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[1] Software Component Template
AUTOSAR_TPS_SoftwareComponentTemplate

[2] Layered Software Architecture
AUTOSAR_EXP_LayeredSoftwareArchitecture

[3] Reference Model for Service Oriented Architecture 1.0
https://www.oasis-open.org/committees/download.php/19679/soa-rm-cs.pdf

[4] Standardization Template
AUTOSAR_TPS_StandardizationTemplate

[5] Generic Structure Template
AUTOSAR_TPS_GenericStructureTemplate

[6] ISO/IEC 14882:2011, Information technology – Programming languages – C++
http://www.iso.org

[7] Specification of Communication Management
AUTOSAR_SWS_CommunicationManagement

[8] Specification of Persistency
AUTOSAR_SWS_Persistency

[9] IEEE Standard for Information Technology- Standardized Application Environment Profile (AEP)-POSIX Realtime and Embedded Application Support
https://standards.ieee.org/findstds/standard/1003.13-2003.html

[10] Specification of Time Synchronization for Adaptive Platform
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[11] Explanation of ara::com API
AUTOSAR_EXP_ARAComAPI

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AUTOSAR_SWS_AdaptiveCryptoInterface

[14] System Template
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[19] REST: Architectural Styles and the Design of Network-based Software Architectures

[20] Specification of Execution Management
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AUTOSAR_PRS_SOMEIPServiceDiscoveryProtocol

[22] Data Distribution Service (DDS), Version 1.4
http://www.omg.org/spec/DDS/1.4

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[24] Log and Trace Protocol Specification
AUTOSAR_PRS_LogAndTraceProtocol

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1 Introduction

This document contains the specification of the so-called the *Manifest* on the *AUTOSAR adaptive platform*. A description of the overall modeling approach can be found in section 1.1. A reference to the definition of the term *service* is given in section 1.2.

The term *Manifest* is used in this specification in the meaning of a formal specification of configuration content. Please find a more detailed description of the term and the implications for the *AUTOSAR adaptive platform* in section 2.

Please note that the content of the document (despite the name) extends to the description of design elements necessary to develop software for the *AUTOSAR adaptive platform*.

The design-related modeling mainly is focused on the development of application software on the *AUTOSAR adaptive platform* as well as the connection between application and diagnostics and is described in detail[1] in section 3 and section 4.

Section 5 remains on the design level and describes the modeling of communication with web services following the REST pattern

Section 6 represents that counterpart to section 3 on deployment level, it describes the content of the so-called *application manifest*.

Section 7 provides a detailed description of how service-oriented communication shall be configured on *manifest* level.

Section 8 describes the options for configuring a machine by means of a *manifest*.

Section 9 describes the big picture of *AUTOSAR classic platform* and *AUTOSAR adaptive platform* communicating via service-oriented communication.

Section 10 explains how signal-based communication can be transformed into service-oriented communication and vice versa in order to participate in the communication between ECUs on the *AUTOSAR classic platform*.

Section 11 is the first in a string of sections that explain the manifest content of platform module functionality, in case of section 11 the manifest content for persistency is described.

Section 12 describes the manifest content needed for the configuration of the crypto platform module.

Section 13 describes the manifest content needed for the configuration of the communication platform module with respect to secure communication.

[1] The description of the design elements may be moved to other model-related documents in the future.
But for the time being, there is a coexistence of manifest-related and design-related model elements in this document.

Section 14 lays out the details of the configuration of the platform health management module.

Section 16 describes the idea behind and the configuration of the concept of an uploadable software package.

Section 17 describes the manifest content needed for the configuration of the communication platform module with respect to REST.

1.1 Modeling Approach

The *AUTOSAR adaptive platform* has been introduced when the *AUTOSAR classic platform* was already a stable and well-established standard in the automotive domain.

And yet, the *AUTOSAR adaptive platform* is no successor of the *AUTOSAR classic platform*. Both platforms complement each other for specific use cases that can be better implemented by one or the other platform.

In this situation, two possible approaches for modeling on the *AUTOSAR adaptive platform* could have been taken:

- The *AUTOSAR adaptive platform* is based on different principles than the *AUTOSAR classic platform*, and hence the modeling approach could also **decouple from the canon of the AUTOSAR classic platform as much as possible** to advertise the fact that the two platforms have different purposes.

  Consequentially, even if specific model elements have clear counterparts in the respective other platform, use a different terminology to not confuse the users of both platforms.

- Despite the undeniable differences between the two platforms, there is still a significant number of striking similarities that strongly encourage the **usage of existing modeling concepts** from the *AUTOSAR classic platform*, especially from the specification of the AUTOSAR Software-Component Template [1], as much as possible.

  Consequentially, the conclusion is to use the identical meta-classes for similar purposes on both platforms. It will then be necessary to extend some of the affected meta-classes platform specific where applicable and add constraints that clarify the platform-specific usage of the mentioned extensions.

Without further ado, the modeling approach for the *AUTOSAR adaptive platform* follows the second alternative.

This means, for example, that a piece of application software on the *AUTOSAR adaptive platform* shall be represented by an `SwComponentType`. This includes the definition of `CompositionSwComponentType`s that in turn aggregate `SwComponentPrototype`s typed by e.g. (in case of the *AUTOSAR adaptive platform*) `AdaptiveApplicationSwComponentType`s.

This also means that an AtomicSwComponentType used on the *AUTOSAR adaptive platform* shall **not** aggregate AtomicSwComponentType.internalBehavior because the latter is reserved for usage on the *AUTOSAR classic platform*.

The reuse of existing model-elements for the definition of the meta-model for the *AUTOSAR adaptive platform* has the side effect that the descriptions of existing model elements may contain references to technical details that only make sense on the *AUTOSAR classic platform*.

After all, the model elements were created when only the *AUTOSAR classic platform* existed.

These references shall be taken with a grain of salt. It is expected that readers can abstract from those details and extract the aspects of these model elements that create relevance for the description of the *AUTOSAR adaptive platform*.

1.2 The Term Service

It is essential to keep in mind that the term *service* is frequently used within this document in particular and the *AUTOSAR adaptive platform* in general.

This usage has its reasons despite the fact that the meaning of the term *service* on the *AUTOSAR adaptive platform* collides with other meanings used within AUTOSAR.

In summary, the following meaning of the term *service* exist in the scope of AUTOSAR:

- The Term *service* is used in the layered software architecture [2] to denote the highest layer of the AUTOSAR software architecture that interacts with the application. In this context, model elements like ServiceSwComponentType, SwcServiceDependency, ServiceNeeds, or PortInterface.isService have been created on the *AUTOSAR classic platform*.
- The term *service* is used to express that information is related or required in a workshop where a car is **serviced**. In this context, *service-only diagnostic trouble codes* (DTC) are defined.
- The term *service* is used to describe the handling of **diagnostic services**, e.g. UDS service *ReadDataByIdentifier*, for the communication between a diagnostic tester and a diagnostic stack on an (AUTOSAR) ECU.
- the term *service* is used in the meaning defined by the **service-oriented architecture** (SOA) [3]. This meaning has the strongest relation to the usage of the term *service* on the *AUTOSAR adaptive platform*.

1.3 Abbreviations

The following table contains a list of abbreviations used in the scope of this document along with the spelled-out meaning of each of the abbreviations.

Abbreviation	*Meaning*
AES	Advanced Encryption Standard
API	Application Programming Interface
ATP	AUTOSAR Template Profile
ARXML	AUTOSAR XML
CAN	Controller Area Network
CRC	Cyclic Redundancy Check
CTM	Counter Mode
DDS	Data Distribution Service
DES	Data Encryption Standard
DHCP	Dynamic Host Control Protocol
DoIP	Diagnostics over IP
DM	Diagnostic Manager
DTC	Diagnostic Trouble Code
ECB	Electronic Code Book
ECC	Elliptic Curve Cryptography
ECDSA	Elliptic Curve Digital Signature Algorithm
ECU	Electrical Control Unit
ECIES	Elliptic Curve Integrated Encryption Scheme
EDDSA	Edwards-Curve Digital Signature Algorithm
FQDN	Fully-Qualified Domain Name
GCM	Galios/Counter Mode
HMAC	Hash-based Message Authentication Code
HTTP	Hypertext Transport Protocol
ID	Identifier
IO	Input/Output
IP	Internet Protocol
ISO	International Standardization Organization
JSON	JavScript Object Notation
LAN	Local Area Network
MAC	Media Access Control
MAC	Message Authentication Code
MD	Message Digest
MTU	Maximum Transmission Unit
NM	Network Management

Abbreviation	*Meaning*
NV	Non-Volatile
OEM	Original Equipment Manufacturer
OS	Operating System
PDU	Protocol Data Unit
PHM	Platform Health Management
PKCS	Public Key Cryptography Standards
POSIX	Portable Operating System Interface
PSK	Pre-Shared Key
RAM	Random Access Memory
REST	Representational State Transfer
ROM	Read-Only Memory
RSA	Cryptographic approach according to Rivest, Shamir, and Adleman
SD	Service Discovery
SDG	Special Data Group
SHA	Secure Hash Algorithm
SOME/IP	Scalable service-Oriented MiddlewarE over IP
SWC	Software Component
TCP	Transport Control Protocol
TLS	Transport Layer Security
TLV	Tag Length Value
TTL	Time to Live
UDS	Unified Diagnostic Services
UDP	User datagram Protocol
UML	Unified Modeling Language
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
UUID	Universally Unique Identifier
VFB	Virtual Functional Bus
VLAN	Virtual Local Area Network
VSA	Variable Size Array
XML	Extensible Markup Language
XSD	XML Schema Definition

Table 1.1: Abbreviations used in the scope of this Document

1.4 Document Conventions

Technical terms are typeset in mono spaced font, e.g. `PortPrototype`. As a general rule, plural forms of technical terms are created by adding "s" to the singular form, e.g. `PortPrototype`s. By this means the document resembles terminology used in the AUTOSAR XML Schema.

This document contains constraints in textual form that are distinguished from the rest of the text by a unique numerical constraint ID, a headline, and the actual constraint text starting after the ⌈ character and terminated by the ⌋ character.

The purpose of these constraints is to literally constrain the interpretation of the AUTOSAR meta-model such that it is possible to detect violations of the standardized behavior implemented in an instance of the meta-model (i.e. on M1 level).

Makers of AUTOSAR tools are encouraged to add the numerical ID of a constraint that corresponds to an M1 modeling issue as part of the diagnostic message issued by the tool.

The attributes of the classes introduced in this document are listed in form of class tables. They have the form shown in the example of the top-level element AUTOSAR:

Class	**AUTOSAR**			
Package	M2::AUTOSARTemplates::AutosarTopLevelStructure			
Note	Root element of an AUTOSAR description, also the root element in corresponding XML documents. **Tags:** xml.globalElement=true			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
adminData	AdminData	0..1	aggr	This represents the administrative data of an Autosar file. **Tags:** xml.sequenceOffset=10
arPackage	ARPackage	*	aggr	This is the top level package in an AUTOSAR model. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=shortName, variation Point.shortLabel vh.latestBindingTime=blueprintDerivationTime xml.sequenceOffset=30
fileInfoComment	FileInfoComment	0..1	aggr	This represents a possibility to provide a structured comment in an AUTOSAR file. **Stereotypes:** atpStructuredComment **Tags:** xml.roleElement=true; xml.sequence Offset=-10; xml.typeElement=false

Attribute	*Type*	*Mul.*	*Kind*	*Note*
introduction	Documentation Block	0..1	aggr	This represents an introduction on the Autosar file. It is intended for example to rpresent disclaimers and legal notes. **Tags:** xml.sequenceOffset=20

Table 1.2: AUTOSAR

The first rows in the table have the following meaning:

Class: The name of the class as defined in the UML model.

Package: The UML package the class is defined in. This is only listed to help locating the class in the overall meta model.

Note: The comment the modeler gave for the class (class note). Stereotypes and UML tags of the class are also denoted here.

Base Classes: If applicable, the list of direct base classes.

The headers in the table have the following meaning:

Attribute: The name of an attribute of the class. Note that AUTOSAR does not distinguish between class attributes and owned association ends.

Type: The type of an attribute of the class.

Mul.: The assigned multiplicity of the attribute, i.e. how many instances of the given data type are associated with the attribute.

Kind: Specifies, whether the attribute is aggregated in the class (`aggr` aggregation), an UML attribute in the class (`attr` primitive attribute), or just referenced by it (`ref` reference). Instance references are also indicated (`iref` instance reference) in this field.

Note: The comment the modeler gave for the class attribute (role note). Stereotypes and UML tags of the class are also denoted here.

Please note that the chapters that start with a letter instead of a numerical value represent the appendix of the document. The purpose of the appendix is to support the explanation of certain aspects of the document and does not represent binding conventions of the standard.

The verbal forms for the expression of obligation specified in [TPS_STDT_00053] shall be used to indicate requirements, see Standardization Template, chapter Support for Traceability ([4]).

The representation of requirements in AUTOSAR documents follows the table specified in [TPS_STDT_00078], see Standardization Template, chapter Support for Traceability ([4]).

1.5 Requirements Tracing

Requirements against this document are exclusively stated in the corresponding requirements document.

The following table 1.3 references the requirements specified in the corresponding requirements document and provides information about individual specification items that fulfill a given requirement.

Requirement	Description	Satisfied by
[RS_MANI_00001]	Adaptive AUTOSAR Application	[TPS_MANI_01008] [TPS_MANI_01009]
[RS_MANI_00002]	Declaration of provided and required services in an application	[TPS_MANI_01039] [TPS_MANI_01040] [TPS_MANI_01052] [TPS_MANI_01053] [TPS_MANI_01057]
[RS_MANI_00003]	Specification of service interfaces	[TPS_MANI_01001] [TPS_MANI_01004] [TPS_MANI_01005] [TPS_MANI_01006] [TPS_MANI_01007] [TPS_MANI_01033] [TPS_MANI_01034] [TPS_MANI_01035] [TPS_MANI_01055] [TPS_MANI_01064] [TPS_MANI_03118] [TPS_MANI_03119]
[RS_MANI_00004]	Support of application design	[TPS_MANI_01010]
[RS_MANI_00005]	Configuration of diagnostic capabilities of an application	[TPS_MANI_01037] [TPS_MANI_01038] [TPS_MANI_01048] [TPS_MANI_01049] [TPS_MANI_01050] [TPS_MANI_01051] [TPS_MANI_01060] [TPS_MANI_01181]
[RS_MANI_00006]	Support of application deployment	[TPS_MANI_01011]
[RS_MANI_00007]	Configuration of application startup behavior	[TPS_MANI_01012] [TPS_MANI_01013] [TPS_MANI_01014] [TPS_MANI_01015] [TPS_MANI_01017] [TPS_MANI_01041] [TPS_MANI_01046] [TPS_MANI_01059] [TPS_MANI_01061] [TPS_MANI_03153]
[RS_MANI_00008]	Service interface deployment to a transport layer mechanism	[TPS_MANI_01136] [TPS_MANI_01137] [TPS_MANI_03036] [TPS_MANI_03037] [TPS_MANI_03038] [TPS_MANI_03039] [TPS_MANI_03070] [TPS_MANI_03071] [TPS_MANI_03072] [TPS_MANI_03073] [TPS_MANI_03074] [TPS_MANI_03075] [TPS_MANI_03101] [TPS_MANI_03103] [TPS_MANI_03104] [TPS_MANI_03105] [TPS_MANI_03106] [TPS_MANI_03107] [TPS_MANI_03108] [TPS_MANI_03116] [TPS_MANI_03117]
[RS_MANI_00009]	Service instance configuration on the network-level	[TPS_MANI_03001] [TPS_MANI_03002] [TPS_MANI_03003] [TPS_MANI_03004] [TPS_MANI_03007] [TPS_MANI_03008] [TPS_MANI_03009] [TPS_MANI_03010] [TPS_MANI_03022] [TPS_MANI_03023] [TPS_MANI_03024] [TPS_MANI_03049] [TPS_MANI_03061]
[RS_MANI_00011]	Instantiation of provided and required services in an application	[TPS_MANI_03000]

[RS_MANI_00014]	User defined transport layer mechanisms	[TPS_MANI_01165] [TPS_MANI_03032] [TPS_MANI_03045] [TPS_MANI_03046] [TPS_MANI_03047] [TPS_MANI_03048] [TPS_MANI_03102]
[RS_MANI_00015]	Definition of the nature of a manifest	[TPS_MANI_01000] [TPS_MANI_01019] [TPS_MANI_01020]
[RS_MANI_00016]	Usage of data types specifically on the AUTOSAR adaptive platform	[TPS_MANI_01016] [TPS_MANI_01018] [TPS_MANI_01027] [TPS_MANI_01028] [TPS_MANI_01029] [TPS_MANI_01030] [TPS_MANI_01042] [TPS_MANI_01043] [TPS_MANI_01044] [TPS_MANI_01047] [TPS_MANI_01062] [TPS_MANI_01063] [TPS_MANI_01098] [TPS_MANI_01099] [TPS_MANI_01100] [TPS_MANI_01101] [TPS_MANI_01102] [TPS_MANI_03144]
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[RS_MANI_00018]	Network connections of the machine	[TPS_MANI_03052] [TPS_MANI_03053]
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[RS_MANI_00020]	Hardware resources of the machine	[TPS_MANI_03035] [TPS_MANI_03065]
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[RS_MANI_00031]	Interaction with Crypto Software	[TPS_MANI_01087] [TPS_MANI_01088] [TPS_MANI_01089] [TPS_MANI_01090] [TPS_MANI_01091] [TPS_MANI_01092] [TPS_MANI_01093] [TPS_MANI_01094] [TPS_MANI_01095] [TPS_MANI_01096] [TPS_MANI_03141] [TPS_MANI_03142] [TPS_MANI_03143]
[RS_MANI_00032]	Support for platform health management	[TPS_MANI_03500] [TPS_MANI_03502] [TPS_MANI_03503] [TPS_MANI_03505] [TPS_MANI_03506] [TPS_MANI_03508] [TPS_MANI_03509] [TPS_MANI_03510] [TPS_MANI_03511] [TPS_MANI_03512] [TPS_MANI_03513] [TPS_MANI_03514] [TPS_MANI_03515] [TPS_MANI_03516] [TPS_MANI_03517] [TPS_MANI_03518] [TPS_MANI_03519] [TPS_MANI_03520] [TPS_MANI_03521] [TPS_MANI_03522] [TPS_MANI_03523] [TPS_MANI_03524] [TPS_MANI_03534] [TPS_MANI_03544] [TPS_MANI_03545] [TPS_MANI_03546] [TPS_MANI_03552]
[RS_MANI_00033]	Interaction with web services based on the REST pattern	[TPS_MANI_01103] [TPS_MANI_01105] [TPS_MANI_01120] [TPS_MANI_01121] [TPS_MANI_01122] [TPS_MANI_01123] [TPS_MANI_01124] [TPS_MANI_01125] [TPS_MANI_01126] [TPS_MANI_01127] [TPS_MANI_01128] [TPS_MANI_01129] [TPS_MANI_01130] [TPS_MANI_01131] [TPS_MANI_01178]
[RS_MANI_00034]	Specification of capabilities	[TPS_MANI_01106] [TPS_MANI_01107] [TPS_MANI_01108]

[RS_MANI_00035]	Definition of an uploadable software package	[TPS_MANI_01109] [TPS_MANI_01110] [TPS_MANI_01111] [TPS_MANI_01112] [TPS_MANI_01113] [TPS_MANI_01114] [TPS_MANI_01115] [TPS_MANI_01116] [TPS_MANI_01117] [TPS_MANI_01118] [TPS_MANI_01119] [TPS_MANI_01161] [TPS_MANI_01162] [TPS_MANI_01163] [TPS_MANI_01164]
[RS_MANI_00036]	Configuration of security protection	[TPS_MANI_03133] [TPS_MANI_03134] [TPS_MANI_03135] [TPS_MANI_03136] [TPS_MANI_03137] [TPS_MANI_03138] [TPS_MANI_03139] [TPS_MANI_03140] [TPS_MANI_03141] [TPS_MANI_03142] [TPS_MANI_03143]
[RS_MANI_00037]	Configuration of logging and tracing	[TPS_MANI_03160] [TPS_MANI_03161]
[RS_MANI_00038]	DDS transport layer mechanisms	[TPS_MANI_03525] [TPS_MANI_03526] [TPS_MANI_03527] [TPS_MANI_03528] [TPS_MANI_03529] [TPS_MANI_03530] [TPS_MANI_03531] [TPS_MANI_03532] [TPS_MANI_03533]
[RS_MANI_00039]	Usage of implementation specific data types	[TPS_MANI_01166] [TPS_MANI_01167] [TPS_MANI_01168] [TPS_MANI_01169] [TPS_MANI_01170] [TPS_MANI_01171] [TPS_MANI_01172] [TPS_MANI_01173] [TPS_MANI_01174] [TPS_MANI_01175] [TPS_MANI_01176] [TPS_MANI_01177] [TPS_MANI_03169] [TPS_MANI_03170] [TPS_MANI_03171] [TPS_MANI_03172] [TPS_MANI_03173] [TPS_MANI_03174] [TPS_MANI_03175] [TPS_MANI_03176] [TPS_MANI_03177] [TPS_MANI_03178] [TPS_MANI_03179] [TPS_MANI_03180] [TPS_MANI_03181] [TPS_MANI_03182] [TPS_MANI_03183] [TPS_MANI_03184] [TPS_MANI_03185] [TPS_MANI_03186] [TPS_MANI_03187] [TPS_MANI_03188] [TPS_MANI_03189] [TPS_MANI_03190] [TPS_MANI_03191] [TPS_MANI_03192] [TPS_MANI_03193] [TPS_MANI_03196]
[RS_MANI_00040]	Support for access to synchronized time	[TPS_MANI_03535] [TPS_MANI_03536] [TPS_MANI_03537] [TPS_MANI_03538] [TPS_MANI_03539] [TPS_MANI_03540] [TPS_MANI_03541] [TPS_MANI_03542] [TPS_MANI_03543] [TPS_MANI_03547] [TPS_MANI_03548] [TPS_MANI_03549] [TPS_MANI_03550] [TPS_MANI_03551]
[RS_MANI_00041]	Configuration of function groups	[TPS_MANI_03145] [TPS_MANI_03152] [TPS_MANI_03153] [TPS_MANI_03194] [TPS_MANI_03195]

Table 1.3: RequirementsTracing

1.6 Known Limitations

The description of the meta-model functionality for crypto services is under discussion, i.e. the current content of section 3.10.2 and section 12 is released for documentation only. Changes can be expected for the next release.

2 Big Picture of Manifest Definition

2.1 Design vs. Deployment

Despite the name, this document contains the description of model elements that are clearly bound to a *design* workflow **and** model elements that have a strong relation to the *deployment* aspect.

Model elements discussed in this document are either related to *design* or *deployment*, there is no overlap between the two groups.

Model elements that are related to *deployment* will be used in models that are uploaded to a target platform, see [TPS_MANI_01000]. These model elements are mainly described in sections of this document where the term “Manifest” is part of the section title.

In the absence of a more precise definition, model elements related to *design* can be identified by not being related to *deployment*.

The structure of the document maps to the division between *design* and *deployment* such that the *design* aspect is mostly described in sections 3, 4 and 5.

Chapters 6, 7, 8, 11, 12, 13, and 14 focus on *deployment*-related content.

2.2 About Manifest

This chapter shall clarify the definition of the term `Manifest` in the context of the *AUTOSAR adaptive platform*.

[TPS_MANI_01000] Definition of the term `Manifest` ⌈ A `Manifest` represents a piece of AUTOSAR model description that is created to support the configuration of an *AUTOSAR adaptive platform* product and which is uploaded to the *AUTOSAR adaptive platform* product, potentially in combination with other artifacts (like binary files) that contain executable code to which the `Manifest` applies. ⌋*(RS_MANI_00015)*

It is important to stress the fact that the usage of a `Manifest` is indeed strictly limited to the *AUTOSAR adaptive platform* and that there is no use case to port the concept to the *AUTOSAR classic platform*.

2.3 Serialization Format

One aspect that the definition of a `Manifest` has in common with other AUTOSAR model content is the standardized serialization format.

[TPS_MANI_01020] Serialization format of the `Manifest` in AUTOSAR ⌈ The standardized serialization format of `Manifest` content in AUTOSAR is ARXML.

Consequently, Manifest model content can be validated against the AUTOSAR XML Schema. ⌋(*RS_MANI_00015*)

An important consequence of [TPS_MANI_01020] is that there is no limitation to just one “manifest file” a.k.a. “the manifest”.

Content may be distributed among several physical files according to the rules given in the specification of the AUTOSAR Generic Structure Template [5].

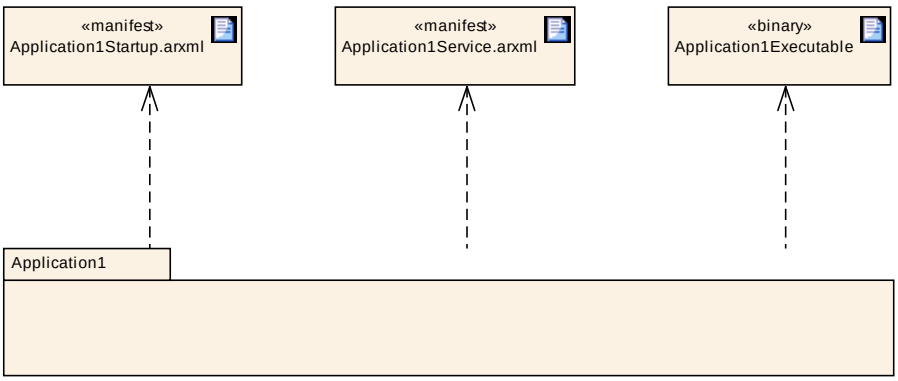


Figure 2.1: Example usage of several manifest files within one software delivery

[TPS_MANI_01021] Serialization format of Manifest content on a machine ⌈ The serialization format used to actually upload a manifest on a machine may be freely chosen by a platform supplier.

However, the content and semantics of the original ARXML Manifest needs to be **fully preserved**. ⌋()

It can be expected that in many cases the best option for the upload of the Manifest will still be ARXML because a custom format obviously has to support the full complexity of the Manifest meta-model.

Please note that the meta-model foresees the existence of references from manifest-related meta-classes to design-related meta-classes.

These references are created for the sake of clarity but it is not mandatory that the content of the reference actually needs to be resolvable.

In terms of the AUTOSAR modeling approach, this translates to a decoration of these references with the stereotype ≪atpUriDef≫. More information can be found in [5].

If the referenced meta-classes contain information that is relevant for the manifest level then this information is replicated on the manifest level (such that the manifest-level model does not have to rely on the availability of design-level information).

2.4 Scope

As mentioned before, the usage of a Manifest is limited to the *AUTOSAR adaptive platform*. This does not mean, however, that all ARXML produced in a develop-

ment project that targets the *AUTOSAR adaptive platform* is automatically considered a `Manifest`.

In fact, the *AUTOSAR adaptive platform* is usually not exclusively used in a vehicle project.

A typical vehicle will most likely be also equipped with a number of ECUs developed on the *AUTOSAR classic platform* and the system design for the entire vehicle will therefore have to cover both ECUs built on top of the *AUTOSAR classic platform* and those created on top of the *AUTOSAR adaptive platform*.

[TPS_MANI_01019] `Manifest` content may apply to different aspects of the *AUTOSAR adaptive platform* ⌈ `Manifest` content can apply to different aspects of the model. At the moment, `Manifest` content can roughly be divided into three focus areas:

- Application-related `Manifest` content describes all aspects of the deployment of an application, including - but not limited to - the startup configuration and the configuration of service-oriented communication endpoints on application level.
- Machine-related `Manifest` content describes the deployment of just a machine, i.e. without any application (including platform modules, see [TPS_MANI_01009]) running on the machine.
- Service instance-related `Manifest` describes how service-oriented communication on transport layer level is bound to endpoints in the application and (in some cases) platform software.

⌋(*RS_MANI_00015*)

2.5 Manifests described in this Document

In principle, the term `Manifest` could be defined such that there is conceptually just one “manifest” and every deployment aspect would be handled in this context.

This does not seem appropriate because it became apparent that manifest-related model-elements exist that are relevant in entirely different phases of a typical development project.

This aspect is taken as the main motivation to subdivide the definition of the term `Manifest` in three different partitions:

Application Manifest This kind of `Manifest` is used to specify the deployment-related information of applications running on the *AUTOSAR adaptive platform*.

An `Application Manifest` is bundled with the actual executable code in order to support the integration of the executable code onto the machine.

Please find more information regarding this topic in section 6.

Service Instance Manifest This kind of `Manifest` is used to specify how service-oriented communication is configured in terms of the requirements of the underlying transport protocols.

A `Service Instance Manifest` is bundled with the actual executable code that implements the respective usage of service-oriented communication.

Please find more information regarding this topic in section 7.

Machine Manifest This kind of `Manifest` is supposed to describe deployment-related content that applies to the configuration of just the underlying machine (i.e. without any applications running on the machine) that runs an *AUTOSAR adaptive platform*.

A `Machine Manifest` is bundled with the software taken to establish an instance of the *AUTOSAR adaptive platform*.

Please find more information regarding this topic in section 8.

The temporal division between the definition (and usage) of different kinds of `Manifest` leads to the conclusion that in most cases different physical files will be used to store the content of the three kinds of `Manifest`.

However, as with all kinds of ARXML content, this is not a binding rule.

3 Application Design

3.1 Overview

This chapter describes all design-related modeling that applies to the creation of application software on the *AUTOSAR adaptive platform*.

This also extends to extensions of existing modeling used on the *AUTOSAR classic platform*, e.g. the introduction of new values of the attribute `category`.

In particular, this section of the document focuses on the following aspects:

- Definition of a dedicated subclass of `SwComponentType` for the *AUTOSAR adaptive platform* (section 3.2)
- Definition of data types specifically for the *AUTOSAR adaptive platform* (section 3.3)
- Service interface as the pivotal element for service-oriented communication (section 3.4)
- Service interface mapping as a mediator between internal and external communication (section 3.5)
- Service interface **element** mapping as a mediator between internal and external communication (section 3.6)
- Persistency interface as the basis for interacting with persistent data storage (section 3.7)
- Aspects of the fine-grained configuration of interaction with the “outside world” from the perspective of the inside of a software-component (section 3.10)
- Adaptive AUTOSAR application as a starting point for the transition towards the deployment (section 3.11)
- Configuration of transformation properties (section 3.13)

3.2 Software Component

In principle, it would be possible to directly take over the definition of e.g. `ApplicationSwComponentType` for the usage on the *AUTOSAR adaptive platform*.

However, this would complicate the formulation of constraints regarding the existence of model elements (for example: data types, as explained in section 3.3) that are exclusive to the *AUTOSAR adaptive platform*.

Therefore, the `AdaptiveApplicationSwComponentType` is defined as a representation of software-components on the *AUTOSAR adaptive platform*.

The Existence of the AdaptiveApplicationSwComponentType allows for a convenient way (see [constr_1492]) to lock out most kinds of software-component defined for the *AUTOSAR classic platform* from the usage on the *AUTOSAR adaptive platform*.

The clarification of the opposite direction (i.e. an erroneous use of an AdaptiveApplicationSwComponentType) is less obvious.

In other words, it may be possible to use a AdaptiveApplicationSwComponentType within a System as some sort of overall design model for software on both the *AUTOSAR classic platform* **and** the *AUTOSAR adaptive platform*.

This aspect, however, is not clarified so far nor is a restriction in place that prohibits AdaptiveApplicationSwComponentType to appear in the context of a System.

Later versions of this specification may fix the missing regulation.

Class	**AdaptiveApplicationSwComponentType**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ApplicationStructure			
Note	This meta-class represents the ability to support the formal modeling of application software on the AUTOSAR adaptive platform. Consequently, it shall only be used on the AUTOSAR adaptive platform. **Tags:** atp.Status=draft; atp.recommendedPackage=AdaptiveApplicationSw ComponentTypes			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *SwComponentType*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
internalBehavior	AdaptiveSwcInternalBehavior	0..1	aggr	This aggregation represents the internal behavior of the AdaptiveApplicationSwComponentType for the AUTOSAR adaptive platform. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=internalBehavior, variation Point.shortLabel; atp.Status=draft vh.latestBindingTime=preCompileTime

Table 3.1: AdaptiveApplicationSwComponentType

Class	**AdaptiveSwcInternalBehavior**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::AdaptiveInternal Behavior			
Note	This meta-class represents the ability to define an internal behavior of an AtomicSwComponentType used on the AUTOSAR adaptive platform. Please note that the model of internal behavior in this case, in stark contrast to the situation of the AUTOSAR classic platform, is very minimal. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

Attribute	Type	Mul.	Kind	Note
serviceDependency	SwcServiceDependency	*	aggr	This represents the collection of SwcServiceDependencys owned by AdaptiveInternalBehavior. **Tags:** atp.Status=draft

Table 3.2: AdaptiveSwcInternalBehavior

3.3 Data Type

3.3.1 Overview

The specification of data types on the *AUTOSAR adaptive platform* follows the same pattern as the counterpart on the *AUTOSAR classic platform*: data types are defined on different levels of abstraction that complement each other.

In the context of this document, the focus is on the discussion of `ApplicationDataType`s and `ImplementationDataType`s.

In general, most of the concepts regarding the definition of data types can be taken over from the existing specifications on the *AUTOSAR classic platform*.

However, some aspects are specific to the *AUTOSAR adaptive platform* and are consequently discussed in the scope of this document rather than the specification of the AUTOSAR Software Component Template [1].

One of the aspects that could be taken over from the *AUTOSAR classic platform* is the definition of initial values.

Although the utility of initial values is certainly limited on the *AUTOSAR adaptive platform*, there is an opportunity to utilize the definition of initial values in the context of the so-called `Field`s (see [TPS_MANI_01034]).

3.3.2 ApplicationDataType

The full range of the modeling of `ApplicationDataType`s that is supported on the *AUTOSAR classic platform* can directly be used on the *AUTOSAR adaptive platform* as well.

In addition to the `ApplicationDataType`s supported on the *AUTOSAR classic platform*, there are further `ApplicationDataType`s that - while in principle also available on the *AUTOSAR classic platform* - are primarily used on and designed for the *AUTOSAR adaptive platform*.

Class	***ApplicationDataType* (abstract)**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Datatype::Datatypes			
Note	ApplicationDataType defines a data type from the application point of view. Especially it should be used whenever something "physical" is at stake. An ApplicationDataType represents a set of values as seen in the application model, such as measurement units. It does not consider implementation details such as bit-size, endianess, etc. It should be possible to model the application level aspects of a VFB system by using ApplicationDataTypes only.			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *AutosarDataType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Subclasses	*ApplicationCompositeDataType*, ApplicationPrimitiveDataType			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 3.3: ApplicationDataType

3.3.2.1 String Data Type

While the handling of data types that represent textual strings is very similar with respect the definition of `ApplicationDataType`s on the *AUTOSAR classic platform* and the *AUTOSAR adaptive platform*, special regulations apply on the level of `ImplementationDataType`s on the *AUTOSAR adaptive platform*.

For more information about the modeling of string data types on the level of `ImplementationDataType` please refer to section 3.3.3.1.

For the sake of consistency, this chapter summarizes the modeling of `ApplicationDataType`s for the modeling of data types that represent textual strings as far as the *AUTOSAR adaptive platform* is concerned.

The meta-classes used to define an `ApplicationPrimitiveDataType` of `category STRING` are summarized in Figure 3.1.

Please note that thanks to the usage of programming languages with richer data types than plain C, the implementation of an `ApplicationPrimitiveDataType` of `category STRING` on the *AUTOSAR adaptive platform* is predefined for a given *language binding*.

[TPS_MANI_01047] Existence of `SwRecordLayout` for an `ApplicationPrimitiveDataType` of `category STRING` ⌈ For the usage of an `ApplicationPrimitiveDataType` of `category STRING` on the *AUTOSAR adaptive platform*, the existence of `ApplicationPrimitiveDataType.swDataDefProps.swRecordLayout` shall be ignored. ⌋*(RS_MANI_00016)*

Please note that [TPS_MANI_01047] intentionally does not forbid the existence of `SwRecordLayout` because the same `ApplicationPrimitiveDataType` of `cat-`

egory STRING could rightfully be used **on both** the *AUTOSAR adaptive platform* and the *AUTOSAR classic platform*.

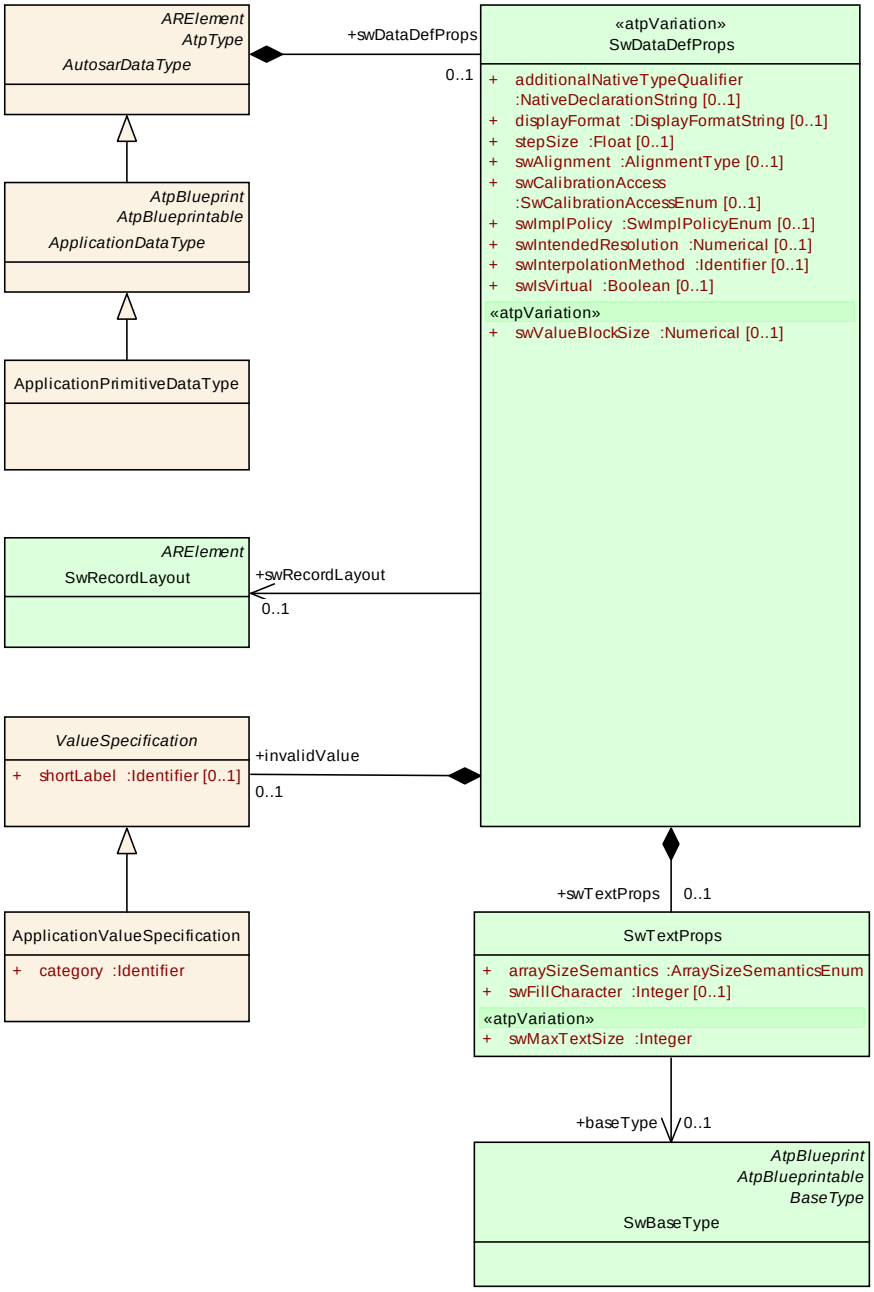


Figure 3.1: Specification of textual strings

Class	**ApplicationPrimitiveDataType**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Datatype::Datatypes			
Note	A primitive data type defines a set of allowed values. **Tags:** atp.recommendedPackage=ApplicationDataTypes			
Base	*ARElement*, *ARObject*, *ApplicationDataType*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *AutosarDataType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 3.4: ApplicationPrimitiveDataType

Class	**SwTextProps**			
Package	M2::MSR::DataDictionary::DataDefProperties			
Note	This meta-class expresses particular properties applicable to strings in variables or calibration parameters.			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
arraySizeSemantics	ArraySizeSemanticsEnum	1	attr	This attribute controls the semantics of the arraysize for the array representing the string in an ImplementationDataType. It is there to support a safe conversion between ApplicationDatatype and ImplementationDatatype, even for variable length strings as required e.g. for Support of SAE J1939.
baseType	SwBaseType	0..1	ref	This is the base type of one character in the string. In particular this baseType denotes the intended encoding of the characters in the string on level of ApplicationDataType. **Tags:** xml.sequenceOffset=30
swFillCharacter	Integer	0..1	attr	Filler character for text parameter to pad up to the maximum length swMaxTextSize. The value will be interpreted according to the encoding specified in the associated base type of the data object, e.g. 0x30 (hex) represents the ASCII character zero as filler character and 0 (dec) represents an end of string as filler character. The usage of the fill character depends on the arraySizeSemantics. **Tags:** xml.sequenceOffset=40

Attribute	Type	Mul.	Kind	Note
swMaxText Size	Integer	1	attr	Specifies the maximum text size in characters. Note the size in bytes depends on the encoding in the corresponding baseType. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=preCompileTime xml.sequenceOffset=20

Table 3.5: SwTextProps

3.3.2.2 Associative Map Data Type

[TPS_MANI_01027] Semantics of `ApplicationAssocMapDataType` ⌈ An `ApplicationAssocMapDataType` represents an associative data structure, i.e. a data structure where so-called *key*s (formalized as `ApplicationAssocMapDataType.key` that are in turn typed by an `ApplicationDataType`) are associated with *value*s (formalized as `ApplicationAssocMapDataType.value` that are also in turn typed by an `ApplicationDataType`). ⌋*(RS_MANI_00016)*

[constr_3349] Usage of `ApplicationAssocMapDataType` is limited ⌈ The usage of an `ApplicationAssocMapDataType` is limited to the context of `AdaptiveApplicationSwComponentType`s and `CompositionSwComponentType`s defined in the context of an `Executable`, i.e. such a data type shall not be used on the *AUTOSAR classic platform*. ⌋*()*

[constr_3349] is a formal approach to express that an `ApplicationAssocMapDataType` shall only be used on the *AUTOSAR adaptive platform*.

[TPS_MANI_01016] Category of `ApplicationAssocMapDataType` ⌈ The value `ApplicationAssocMapDataType.category` shall be set to `ASSOCIATIVE_MAP` for attribute. ⌋*(RS_MANI_00016)*

Figure 3.2 depicts an example of the structure of an `ApplicationAssocMapDataType`.

As can be deduced from looking at Figure 3.2, the concept of an `ApplicationDataType` of `category` `MAP` shall not be confused with an `ApplicationAssocMapDataType`[1].

[1] On the other hand, both concepts of a “map” are justified in their respective “community” and choosing to name one of these very different in order so reduce overall potential confusion would probably not be applicable

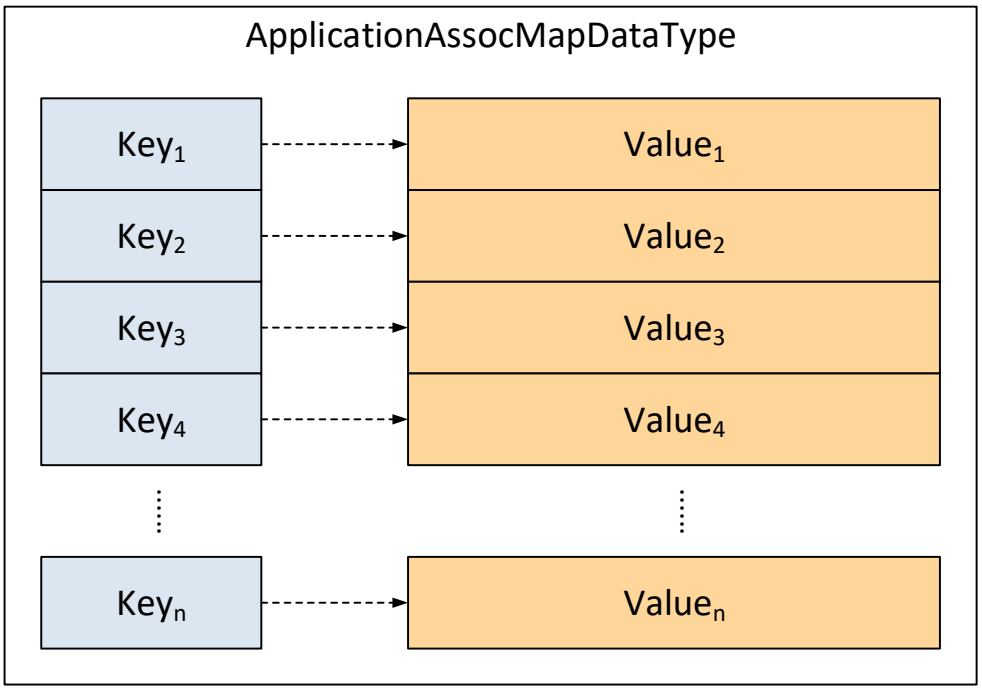


Figure 3.2: Example `ApplicationAssocMapDataType` on the *AUTOSAR adaptive platform*

There are a number of technical implications on the usage of an associative data structure at run-time, e.g. that the content of each *key* shall be unique within the context of the overall data structure.

On the other hand, it is totally no problem if content on the value-side contain duplicates, e.g. two unique `key`s are associated with `value`s that have a completely identical content.

However, these aspects have no implication on the formal model of the `ApplicationAssocMapDataType` and are therefore not considered in this document.

The modeling of the `ApplicationAssocMapDataType` is somewhat minimalistic and motivated mainly be the fact that data types for both key and value need to be defined.

There is no assumption how the structure of an implementation of an associative map may look like. For example, in C++ (which is currently the only supported language binding on the *AUTOSAR adaptive platform*) the straightforward way to use an associative map is to utilize the container `std::map` (where the implementation is opaque to the client programmer).

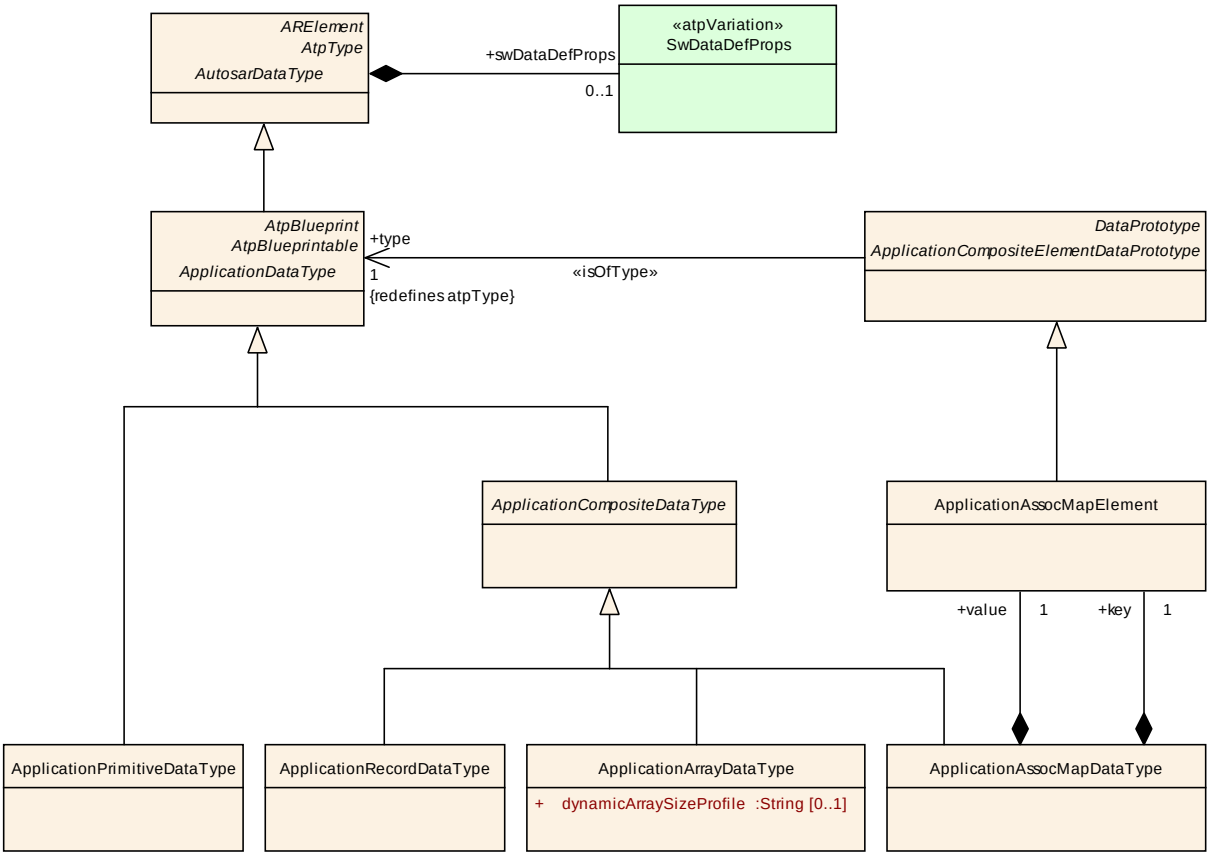


Figure 3.3: Formal model of `ApplicationAssocMapDataType`

Class	**ApplicationAssocMapDataType**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::DataTypes			
Note	An application data type which is a map and consists of a key and a value **Tags:** atp.Status=draft; atp.recommendedPackage=ApplicationDataTypes			
Base	*ARElement*, *ARObject*, *ApplicationCompositeDataType*, *ApplicationDataType*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *AutosarDataType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
key	ApplicationAssocMapElement	1	aggr	Key element of the map that is used to uniquely identify the value of the map. **Tags:** atp.Status=draft
value	ApplicationAssocMapElement	1	aggr	Value element of the map that stores the content associated to a key. **Tags:** atp.Status=draft

Table 3.6: ApplicationAssocMapDataType

Class	**ApplicationAssocMapElement**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::DataTypes			
Note	Describes the properties of the elements of an application map data type. **Tags:** atp.Status=draft			
Base	*ARObject*, *ApplicationCompositeElementDataPrototype*, *AtpFeature*, *AtpPrototype*, *DataPrototype*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 3.7: ApplicationAssocMapElement

Listing 3.1 provides a sketch of the modeling of an example ApplicationAssocMapDataType.

Figure 3.9 contains the corresponding graphical representation of the model.

The corresponding definition of ImplementationDataTypes can be found in Listing 3.4.

Listing 3.1: Example for the definition of an ApplicationAssocMapDataType

```
<APPLICATION-ASSOC-MAP-DATA-TYPE>
  <SHORT-NAME>MyAssociativeMap</SHORT-NAME>
  <KEY>
    <SHORT-NAME>MyKey</SHORT-NAME>
    <TYPE-TREF DEST="APPLICATION-PRIMITIVE-DATA-TYPE">keyType</TYPE-TREF>
  </KEY>
  <VALUE>
    <SHORT-NAME>MyValue</SHORT-NAME>
    <TYPE-TREF DEST="APPLICATION-PRIMITIVE-DATA-TYPE">valueType</TYPE-TREF>
  </VALUE>
</APPLICATION-ASSOC-MAP-DATA-TYPE>

<APPLICATION-PRIMITIVE-DATA-TYPE>
  <SHORT-NAME>keyType</SHORT-NAME>
  <CATEGORY>VALUE</CATEGORY>
</APPLICATION-PRIMITIVE-DATA-TYPE>

<APPLICATION-PRIMITIVE-DATA-TYPE>
  <SHORT-NAME>valueType</SHORT-NAME>
  <CATEGORY>VALUE</CATEGORY>
</APPLICATION-PRIMITIVE-DATA-TYPE>
```

The initialization of an ApplicationAssocMapDataType, however, needs to be clarified because it would (using a combination of RecordValueSpecification and ArrayValueSpecification) in general be technically possible to define a number of differently structured ValueSpecifications that are semantically identical.

In order to keep this element of uncertainty out of the AUTOSAR standard, the initialization of a DataPrototype typed by ApplicationAssocMapDataType is clarified by means of [constr_1488].

[constr_1488] Initialization of a `DataPrototype` typed by an `ApplicationAssocMapDataType` ⌈ A `DataPrototype` typed by an `ApplicationAssocMapDataType` shall only be initialized by an `ApplicationAssocMapValueSpecification`. ⌋*()*

As already mentioned, there is a semantic requirement that the *key* elements of an *associative map* need to the unique in the context of one *associative map* container.

Obviously, the model has no influence on what happens at run-time. On the other hand, there is an implication onto the initialization of an `ApplicationAssocMapDataType`, see [constr_1489].

[constr_1489] Uniqueness of `ApplicationAssocMapValueSpecification.mapElementTuple.key` ⌈ The value of all `mapElementTuple.key` elements in the context of a given `ApplicationAssocMapValueSpecification` shall be unique. ⌋*()*

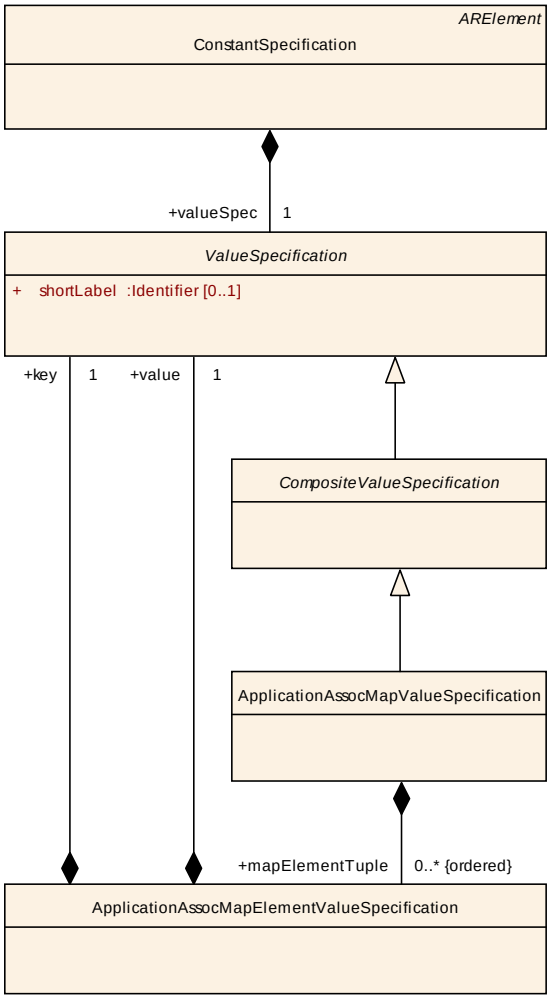


Figure 3.4: Formal model of the initialization of an `ApplicationAssocMapDataType`

Class	**ApplicationAssocMapValueSpecification**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::DataTypes			
Note	This meta-class represents the ability to define the initialization of an ApplicationAssocMapDataType. **Tags:** atp.Status=draft			
Base	*ARObject*, *CompositeValueSpecification*, *ValueSpecification*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
mapElementTuple (ordered)	ApplicationAssocMapElementValueSpecification	*	aggr	This aggregation represents the initial values for the elements of the ApplicationAssocMapValueSpecification. **Tags:** atp.Status=draft

Table 3.8: ApplicationAssocMapValueSpecification

Class	**ApplicationAssocMapElementValueSpecification**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::DataTypes			
Note	This meta-class represents the ability to define the initialization of the elements of an ApplicationAssocMapDataType. **Tags:** atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
key	ValueSpecification	1	aggr	This aggregation represents the initialization of the key part of an AssociativeElementValueSpecification. **Tags:** atp.Status=draft
value	ValueSpecification	1	aggr	This aggregation represents the initialization of the value part of an AssociativeElementValueSpecification. **Tags:** atp.Status=draft

Table 3.9: ApplicationAssocMapElementValueSpecification

3.3.2.3 Attributes of SwDataDefProps

[constr_1478] `SwDataDefProps` applicable to `ApplicationDataType`s exclusive to the *AUTOSAR adaptive platform* ⌈ A complete list of the `SwDataDefProps` and other attributes and their multiplicities which are allowed for a given `category` is shown in table 3.10. ⌋*()*

A consequence of [constr_1478] is that the Table 3.10 shows only the values of `category` that are limited to the *AUTOSAR adaptive platform*. For all other values of `category` that are also supported on the *AUTOSAR classic platform* please refer to a similar table contained in the specification of the Software Component Template [1].

Attributes of SwDataDefProps	Root Elem.		Attribute Existence per Category
	ApplicationAssocMapDataType	ApplicationAssocMapElement	ASSOCIATIVE_MAP
additionalNativeTypeQualifier			
annotation	x	x	*
baseType			
compuMethod			
dataConstr			
displayFormat	x	x	0..1
implementationDataType			
invalidValue			
stepSize			
swAddrMethod			
swAlignment			
swBitRepresentation			
swCalibrationAccess			
swCalprmAxisSet			
swComparisonVariable			
swDataDependency			
swHostVariable			
swImplPolicy			
swIntendedResolution			
swInterpolationMethod			
swIsVirtual			
swPointerTargetProps			
swRecordLayout			
swRefreshTiming			
swTextProps			
swValueBlockSize			
unit			
valueAxisDataType			
Other Attributes below the Root Element			
key: ApplicationAssocMapElement	x		1
value: ApplicationAssocMapElement	x		1

Table 3.10: Allowed Attributes vs. category for ApplicationDataTypes

3.3.3 ImplementationDataType

[TPS_MANI_01029] Usage of `ImplementationDataType` ⌈ A subset of the modeling of `ImplementationDataType`s that is supported on the *AUTOSAR classic platform* can directly be used on the *AUTOSAR adaptive platform* as well.

In addition to the supported values of `category` on the *AUTOSAR classic platform*, it is possible to use further values that are exclusive to the *AUTOSAR adaptive platform*. ⌋*(RS_MANI_00016)*

[constr_1479] No support for certain values of `ImplementationDataType.category` ⌈ On the *AUTOSAR adaptive platform*, the following values of `ImplementationDataType.category` are not supported:

- `DATA_REFERENCE`
- `FUNCTION_REFERENCE`

⌋*()*

For explanation of the existence of [constr_1479], the utilization of formalized data types on the *AUTOSAR adaptive platform* (currently) extends entirely to communication, there is no description of internal values as it is done extensively on the *AUTOSAR classic platform*.

The usage of pointers (which is what the mentioned two values of `category` represent) is not safe for the purpose of communication that extends potentially beyond the scope of a single process or even machine.

It should be noted that the modeling of variable-size arrays on the *AUTOSAR classic platform* has an intrinsic complexity because the programming language C that is used on the *AUTOSAR classic platform* does not provide a **native** support for variable-size arrays.

The *AUTOSAR adaptive platform*, on the other hand, supports the implementation of software using the programming language C++ [6]. This language comes with built-in so-called *container data-types*.

These container data-types are used to type **objects** (as opposed to a plain piece of data, as used in C), and this fact can be taken to significantly simplify the modeling of existing semantics that is more complex on the *AUTOSAR classic platform*, e.g. the already mentioned variable-size array can be much easier modeled with an underlying C++ `vector`.

Class	**ImplementationDataType**			
Package	M2::AUTOSARTemplates::CommonStructure::ImplementationDataTypes			
Note	Describes a reusable data type on the implementation level. This will typically correspond to a typedef in C-code. **Tags:** atp.recommendedPackage=ImplementationDataTypes			
Base	*ARElement*, *ARObject*, *AbstractImplementationDataType*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *AutosarDataType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dynamicArraySizeProfile	String	0..1	attr	Specifies the profile which the array will follow in case this data type is a variable size array.
subElement (ordered)	ImplementationDataTypeElement	*	aggr	Specifies an element of an array, struct, or union data type. The aggregation of ImplementionDataTypeElement is subject to variability with the purpose to support the conditional existence of elements inside a ImplementationDataType representing a structure. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=preCompileTime
symbolProps	SymbolProps	0..1	aggr	This represents the SymbolProps for the ImplementationDataType. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=shortName
typeEmitter	NameToken	0..1	attr	This attribute is used to control which part of the AUTOSAR toolchain is supposed to trigger data type definitions.

Table 3.11: ImplementationDataType

Class	**ImplementationDataTypeElement**			
Package	M2::AUTOSARTemplates::CommonStructure::ImplementationDataTypes			
Note	Declares a data object which is locally aggregated. Such an element can only be used within the scope where it is aggregated. This element either consists of further subElements or it is further defined via its swDataDefProps. There are several use cases within the system of ImplementationDataTypes fur such a local declaration: • It can represent the elements of an array, defining the element type and array size • It can represent an element of a struct, defining its type • It can be the local declaration of a debug element.			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
arraySize	PositiveInteger	0..1	attr	The existence of this attributes (if bigger than 0) defines the size of an array and declares that this ImplementationDataTypeElement represents the type of each single array element. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=preCompileTime
arraySizeHandling	ArraySizeHandlingEnum	0..1	attr	The way how the size of the array is handled in case of a variable size array.
arraySizeSemantics	ArraySizeSemanticsEnum	0..1	attr	This attribute controls the meaning of the value of the array size.
subElement (ordered)	ImplementationDataTypeElement	*	aggr	Element of an array, struct, or union in case of a nested declaration (i.e. without using "typedefs"). The aggregation of ImplementionDataTypeElement is subject to variability with the purpose to support the conditional existence of elements inside a ImplementationDataType representing a structure. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=preCompileTime
swDataDefProps	SwDataDefProps	0..1	aggr	The properties of this ImplementationDataTypeElement.

Table 3.12: ImplementationDataTypeElement

3.3.3.1 String Data Type

The new programming language options for implementing software on the *AUTOSAR adaptive platform* open new ways to define a string data type on the level of `Imple-`

mentationDataType that are less complex than the necessary steps that have to be taken on the *AUTOSAR classic platform*.

For more details about how strings could be used on the *AUTOSAR classic platform*, please refer to the specification of the AUTOSAR Software Component Template [1].

In addition to what is supported on the *AUTOSAR classic platform*, the *AUTOSAR adaptive platform* offers a new value of attribute category of ImplementationDataType: STRING.

[TPS_MANI_01030] ImplementationDataType of category STRING ⌈ An ImplementationDataType of category STRING represents a container data type for a sequence of characters.

AUTOSAR demands that the C++ binding of an ImplementationDataType of category STRING is implemented either by a std::string or by a std::u16string. ⌋*(RS_MANI_00016)*

It is still possible to define an encoding for a string data type according to [TPS_MANI_01030] implemented by a std::string or std::u16string, for any encodings other than ASCII a dedicated library to process the string content would be required.

In other words, these strings should really be thought of as sequences of bytes, where each string type is more suitable for a different Unicode encoding.

[TPS_MANI_03144] C++ language binding of ImplementationDataTypes of category STRING ⌈ The baseTypeSize of the ImplementationDataType that describes the Code Unit size decides about the C++ language binding.

- an ImplementationDataType of category STRING where the baseTypeSize is set to a value of 8 will be implemented as std::string.
- an ImplementationDataType of category STRING where the baseTypeSize is set to a value of 16 will be implemented as std::u16string.

⌋*(RS_MANI_00016)*

[TPS_MANI_03144] means that:

- a String with UTF-8 encoding is always mapped to std::string.
- a String with UTF-16 encoding is always mapped to std::u16string.

[constr_1486] ImplementationDataType of category STRING and SwBaseType ⌈ The ImplementationDataType of category STRING shall aggregate SwDataDefProps in the role swDataDefProps which shall refer to an SwBaseType in the role baseType where the attribute BaseTypeDirectDefinition.baseTypeSize is set to a value of 8 or 16. ⌋*()*

[constr_1475] ImplementationDataType of category STRING is limited ⌈ The usage of an ImplementationDataType of category STRING is limited to the con-

text of AdaptiveApplicationSwComponentTypes and CompositionSwComponentTypes defined in the context of an Executable. ⌋()

[constr_1475] is a formal approach to express that an ImplementationDataType of category STRING shall only be used on the *AUTOSAR adaptive platform*.

The example depicted in Figure 3.5 contains the definition of both an ApplicationDataType as well as the definition of the corresponding ImplementationDataType.

The latter obviously becomes significantly lighter to model thanks to the restriction that, as far as the C++ language binding is concerned, an ImplementationDataType of category STRING shall only be implemented on the basis of a `std::string` or `std::u16string` (as expressed by [TPS_MANI_01030]).

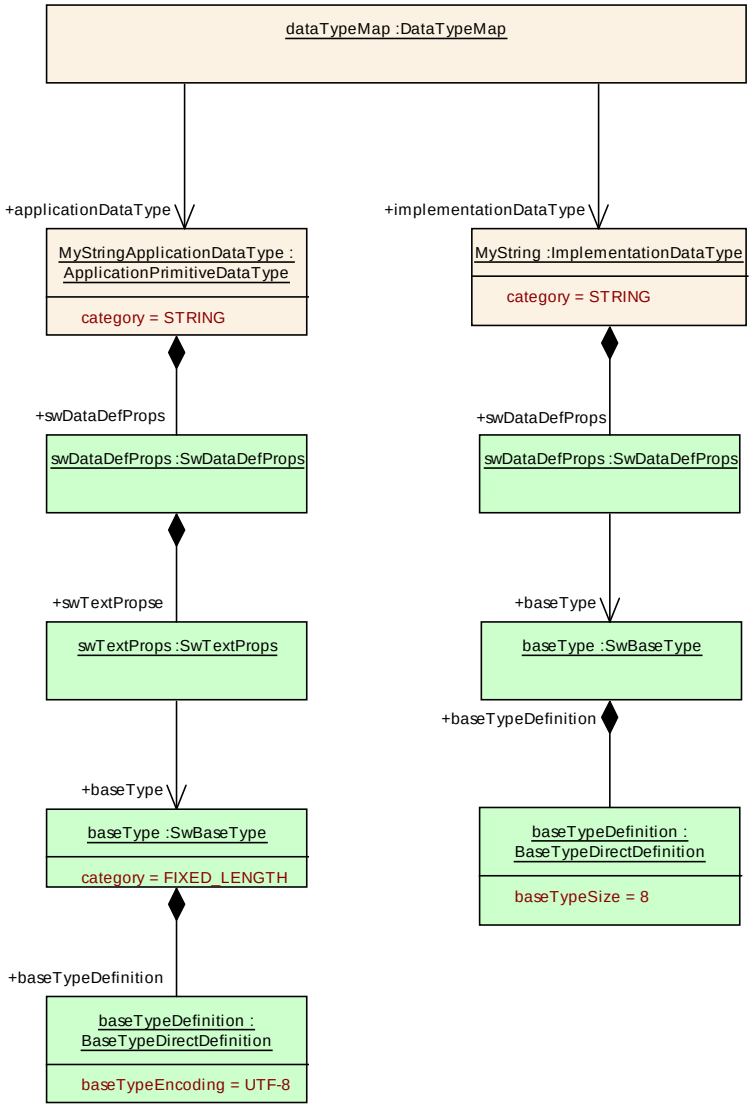


Figure 3.5: Example of the model of a string with UTF-8 encoding

[constr_1485] No `subElement` for `ImplementationDataType` of `category STRING` ⌈ `ImplementationDataType` of `category STRING` shall not aggregate an `ImplementationDataTypeElement` in the role `subElement`. ⌋*()*

Another aspect of the example in Figure 3.5 is that it defines the intended encoding of the modeled data type in the scope of the `ApplicationPrimitiveDataType`.

This reflects the plausible intention of the creator of the `ApplicationPrimitiveDataType` to take control of the underlying encoding and not leave this decision to the corresponding model of an `ImplementationDataType`.

3.3.3.2 Vector Data Type

There is another case where the language binding to C++ offers new ways of implementing semantics that requires significantly more effort on the *AUTOSAR classic platform*: the so-called variable-size array.

This means that an `ImplementationDataType` of `category VECTOR` that holds any data-type other than a further `ImplementationDataType` of `category VECTOR` can be taken as the *AUTOSAR adaptive platform* equivalent of an `ImplementationDataType` of `category STRUCTURE` that has attribute `dynamicArraySizeProfile` set to the value `VSA_LINEAR` (see [1]).

On a related note, the companion to an `ApplicationArrayDataType` that does not define attribute `dynamicArraySizeProfile` (which means that the array data type is supposed to have a fixed size) can still be an `ImplementationDataType` of `category ARRAY` that is implemented by means of either a `std::array` or a C-style array in C++.

Class	**ApplicationArrayDataType**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Datatype::Datatypes			
Note	An application data type which is an array, each element is of the same application data type. **Tags:** atp.recommendedPackage=ApplicationDataTypes			
Base	*ARElement*, *ARObject*, *ApplicationCompositeDataType*, *ApplicationDataType*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *AutosarDataType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dynamicArraySizeProfile	String	0..1	attr	Specifies the profile which the array will follow if it is a variable size array.
element	ApplicationArrayElement	1	aggr	This association implements the concept of an array element. That is, in some cases it is necessary to be able to identify single array elements, e.g. as input values for an interpolation routine.

Table 3.13: ApplicationArrayDataType

[TPS_MANI_01018] `ImplementationDataType` of `category` `VECTOR` ⌈ For a C++ binding, an `ImplementationDataType` of `category` `VECTOR` (which can be taken as the equivalent of a variable-size array) can be implemented as a `std::vector` or as a vector type in a custom namespace (e.g. `my::vector`) (provided that the type in the custom namespace can be configured with the available modeling capabilities). ⌋ *(RS_MANI_00016)*

[TPS_MANI_01098] Constraints on the definition of an `ImplementationDataType` of `category` `VECTOR` ⌈ The idea of a container for data that can grow indefinitely has limited compatibility with the requirements of an embedded system, as there are:

- It shall be possible to limit the size of the `ImplementationDataType` of `category` `VECTOR`.
- It shall be possible to control whether the `ImplementationDataType` of `category` `VECTOR` is allocated on the stack or on the heap. This decision has some implications on the safety domain.
- it shall be possible to define the `ImplementationDataType` of `category` `VECTOR` in its own freely defined namespace.

⌋*(RS_MANI_00016)*

Model elements exist that support the implementation of the topics stated by [TPS_MANI_01098]. The details can be found in Figure 3.6.

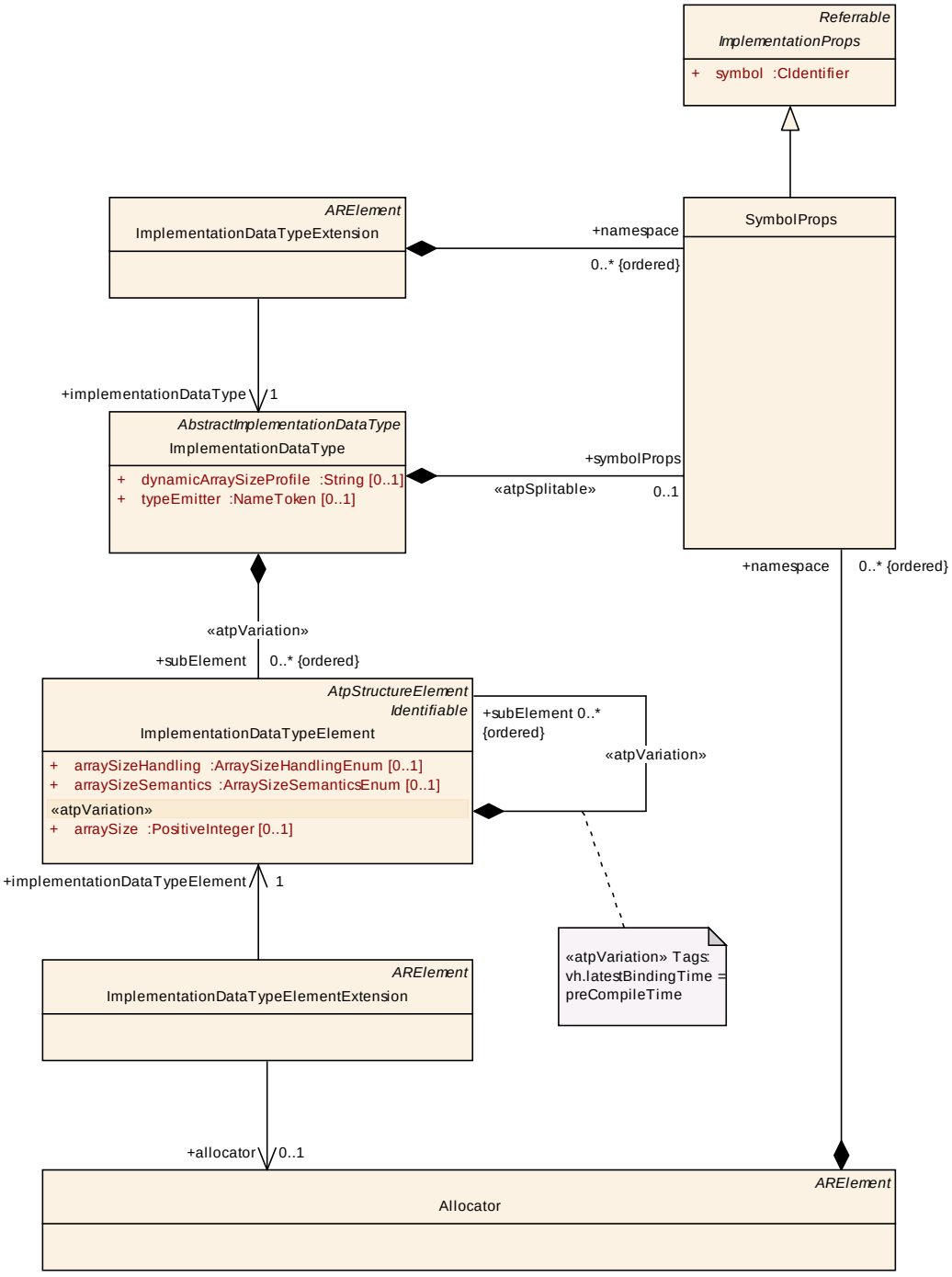


Figure 3.6: C++-specific properties of `ImplementationDataType`

The ability to allocate memory on either stack or heap as well as the assignment of a namespace represent features that are not available on the plain C used on the *AUTOSAR classic platform* for which the `ImplementationDataType` was originally designed.

[TPS_MANI_01099] Semantics of `ImplementationDataTypeElementExtension` ⌈ The meta-class `ImplementationDataTypeElementExtension` has the

ability to add semantics to an ImplementationDataType that goes beyond the capabilities of the plain C data type system.

In a true extension behavior, ImplementationDataTypeElementExtension is not a part of the respective ImplementationDataType but references ImplementationDataTypeElement. This way, the extension semantics can be applied without having to touch the definition of the ImplementationDataType ⌋(*RS_MANI_00016*)

Class	**ImplementationDataTypeElementExtension**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::DataTypes			
Note	This meta-class represents the ability to define an extension to an ImplementationDataTypeElement to express C++-specific properties. **Tags:** atp.Status=draft; atp.recommendedPackage=ImplementationDataTypeElement Extensions			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
allocator	Allocator	0..1	ref	This represents an allocator taken to create the C++ data type. **Tags:** atp.Status=draft
implementationDataTypeElement	ImplementationDataTypeElement	1	ref	This represents the ImplementationDataTypeElement to extend. **Tags:** atp.Status=draft

Table 3.14: ImplementationDataTypeElementExtension

[constr_1547] Reference from ImplementationDataTypeExtension to ImplementationDataType ⌈ Each ImplementationDataType shall only be referenced by a single ImplementationDataTypeExtension, ⌋()

[constr_1548] Reference from ImplementationDataTypeElementExtension to ImplementationDataTypeElement ⌈ Each ImplementationDataTypeElement shall only be referenced by a single ImplementationDataTypeElementExtension, ⌋()

[TPS_MANI_01100] Semantics of Allocator ⌈ Meta-class Allocator carries the ability to define the properties of an allocation of memory. The general approach for memory allocation is expressed by means of the attribute category.

The following values of Allocator.category are standardized by AUTOSAR:

- MAX_SIZE_HEAP: when using this allocator there is the intention to allocate a fixed-size chunk on the heap. This allocator add the ability to define a maximum number of elements to the semantics of the default allocator of std::vector.
- MAX_SIZE_STACK: when using this allocator there is the intention to allocate a fixed-size chunk on the stack. Memory on the stack always needs to be con-

strained in terms of the maximum size. In other words, there is hardly any case where an unbounded amount of memory should be allocated on the stack.

- MAX_SIZE_DATASEGMENT: when using this allocator there is the intention to allocate a fixed-size chunk in the data segment.

⌋(*RS_MANI_00016*)

In principle, it is possible to use a custom value for attribute Allocator.category as long as the custom value is guaranteed to never clash with any future standardization within AUTOSAR. This can be achieved by using a company-specific prefix or suffix for the custom value.

Please note that Allocator is derived from ARElement in order to make it reusable in different contexts.

[TPS_MANI_01101] Size-constrained allocation of memory ⌈ The size of a memory chunk to be used for a given ImplementationDataType or ImplementationDataTypeElement of category VECTOR can be computed out of the information contained in ImplementationDataTypeElement.arraySize and the information about the size of one element of the vector. ⌋(*RS_MANI_00016*)

Class	**Allocator**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::DataTypes			
Note	This meta-class represents the ability to take influence on the way objects are allocated in memory, for example it can be controlled whether an objects is allocated on the heap or on the stack. **Tags:** atp.Status=draft; atp.recommendedPackage=Allocators			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
namespace (ordered)	SymbolProps	*	aggr	This aggregation allows for the definition of a namespace of an Allocator. **Tags:** atp.Status=draft

Table 3.15: Allocator

[TPS_MANI_01102] Specification of a namespace for an ImplementationDataType of category VECTOR ⌈ The ability to define a namespace for a ImplementationDataType of category VECTOR is expressed by means of the aggregation of SymbolProps at ImplementationDataTypeExtension in the role namespace. ⌋(*RS_MANI_00016*)

Class	**ImplementationDataTypeExtension**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::DataTypes			
Note	his meta-class represents the ability to extend the semantics of the ImplementationDataType. **Tags:** atp.Status=draft; atp.recommendedPackage=ImplementationDataType Extensions			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
implementationDataType	ImplementationDataType	1	ref	This represents the ImplementationDataType that this subject to the extension. **Tags:** atp.Status=draft
namespace (ordered)	SymbolProps	*	aggr	This represents the intended namespace of the C++ data type **Tags:** atp.Status=draft

Table 3.16: ImplementationDataTypeExtension

[constr_1476] `ImplementationDataType` of `category VECTOR` is limited ⌈ The usage of an `ImplementationDataType` of `category VECTOR` is limited to the context of `AdaptiveApplicationSwComponentType`s and `CompositionSwComponentType`s defined in the context of an `Executable`. ⌋*()*

[constr_1476] is a formal approach to express that an `ImplementationDataType` of `category VECTOR` shall only be used on the *AUTOSAR adaptive platform*.

An `ImplementationDataType` of `category VECTOR` carries the intrinsic semantics that it (bar any limitations set by the used implementation of the C++ runtime) can grow indefinitely.

This technically corresponds to a setting of attribute `dynamicArraySizeProfile` to the value `VSA_FULLY_FLEXIBLE`. In other words, it would not make sense and only lead to confusion if in a concrete model the value of attribute `dynamicArraySizeProfile` would be set to anything else than the value `VSA_FULLY_FLEXIBLE`.

[constr_1506] `ImplementationDataType` of `category VECTOR` shall not define `dynamicArraySizeProfile` ⌈ An `ImplementationDataType` of `category VECTOR` shall **not define** attribute `dynamicArraySizeProfile`. ⌋*()*

In order to channel the definition of `ImplementationDataType` of `category VECTOR` the following rules shall apply:

[TPS_MANI_01042] Definition of a linear `ImplementationDataType` of `category VECTOR` ⌈ A **linear** `ImplementationDataType` of `category VECTOR` shall aggregate one `ImplementationDataTypeElement` of `category TYPE_REFERENCE` which defines the details of the “payload” of the `ImplementationDataType` of `category VECTOR`. ⌋*(RS_MANI_00016)*

Figure 3.7 contains an example model of a ImplementationDataType of category VECTOR.

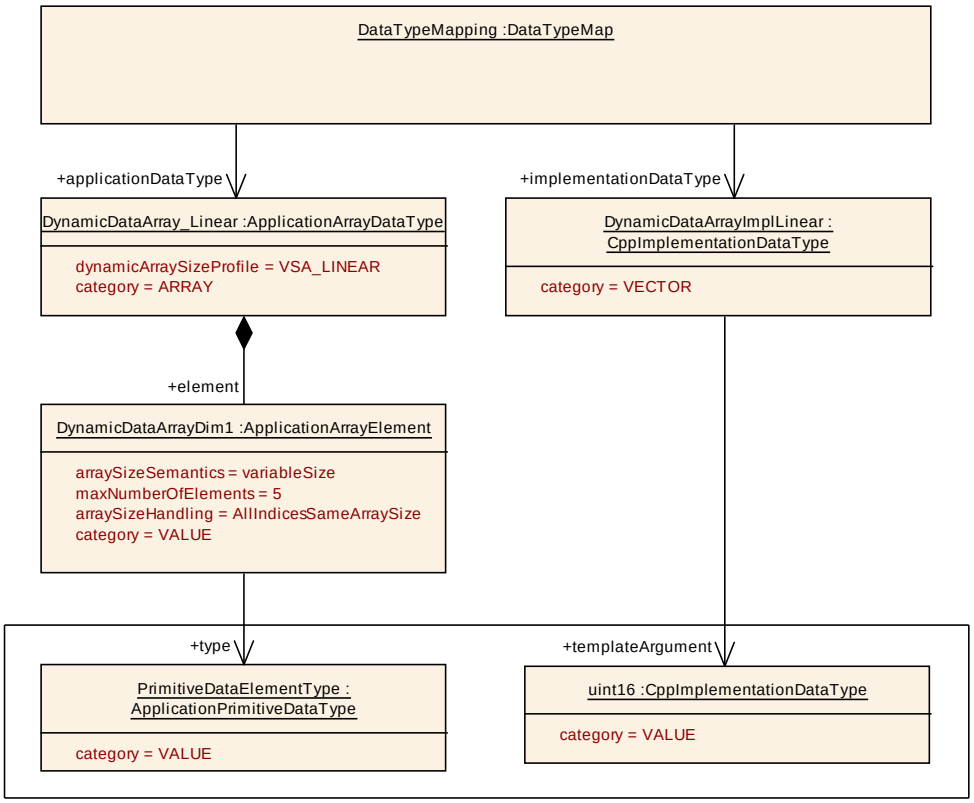


Figure 3.7: A one-dimensional vector

For comparison, the diagram also shows the corresponding ApplicationArrayDataType that has attribute dynamicArraySizeProfile set to the value VSA_LINEAR on the left side.

A corresponding ARXML fragment can be found in Listing 3.2.

Note that the fragment represents only a sketch that concentrates on the most important model elements needed to exemplify the definition of a (semantically) **linear** ImplementationDataType of category VECTOR.

As expected, the usage of an ImplementationDataType of category VECTOR is not limited to one dimension. As a matter of fact, the full range of possible values of attribute dynamicArraySizeProfile (as explained in [TPS_SWCT_01607]) can be used.

Listing 3.2: Example for the definition of a linear ImplementationDataType of category VECTOR

```
<IMPLEMENTATION-DATA-TYPE>
  <SHORT-NAME>DynamicDataArrayImplLinear</SHORT-NAME>
  <CATEGORY>VECTOR</CATEGORY>
  <SUB-ELEMENTS>
    <IMPLEMENTATION-DATA-TYPE-ELEMENT>
      <SHORT-NAME>payloadDim1Element</SHORT-NAME>
      <CATEGORY>TYPE_REFERENCE</CATEGORY>
```

```
      <SW-DATA-DEF-PROPS>
        <SW-DATA-DEF-PROPS-VARIANTS>
          <SW-DATA-DEF-PROPS-CONDITIONAL>
            <IMPLEMENTATION-DATA-TYPE-REF DEST="IMPLEMENTATION-DATA-TYPE">/
                ArrayExamle_VSA_Linear/uint16</IMPLEMENTATION-DATA-TYPE-REF>
          </SW-DATA-DEF-PROPS-CONDITIONAL>
        </SW-DATA-DEF-PROPS-VARIANTS>
      </SW-DATA-DEF-PROPS>
    </IMPLEMENTATION-DATA-TYPE-ELEMENT>
  </SUB-ELEMENTS>
</IMPLEMENTATION-DATA-TYPE>
```

[TPS_MANI_01043] Definition of a rectangular `ImplementationDataType` of `category VECTOR` ⌈ A (semantically) **rectangular** `ImplementationDataType` of `category VECTOR` shall have the following structure:

- The `ImplementationDataType` of `category VECTOR` shall aggregate one `ImplementationDataTypeElement` where attribute `category` is set to the value `VECTOR`.
- The `ImplementationDataTypeElement` of `category VECTOR` shall aggregate one further `ImplementationDataTypeElement` which defines the details of the “payload” of the `ImplementationDataType` of `category VECTOR`.

⌋*(RS_MANI_00016)*

Figure 3.8 contains an example model of an `ImplementationDataType` of `category VECTOR` that corresponds to [TPS_MANI_01043].

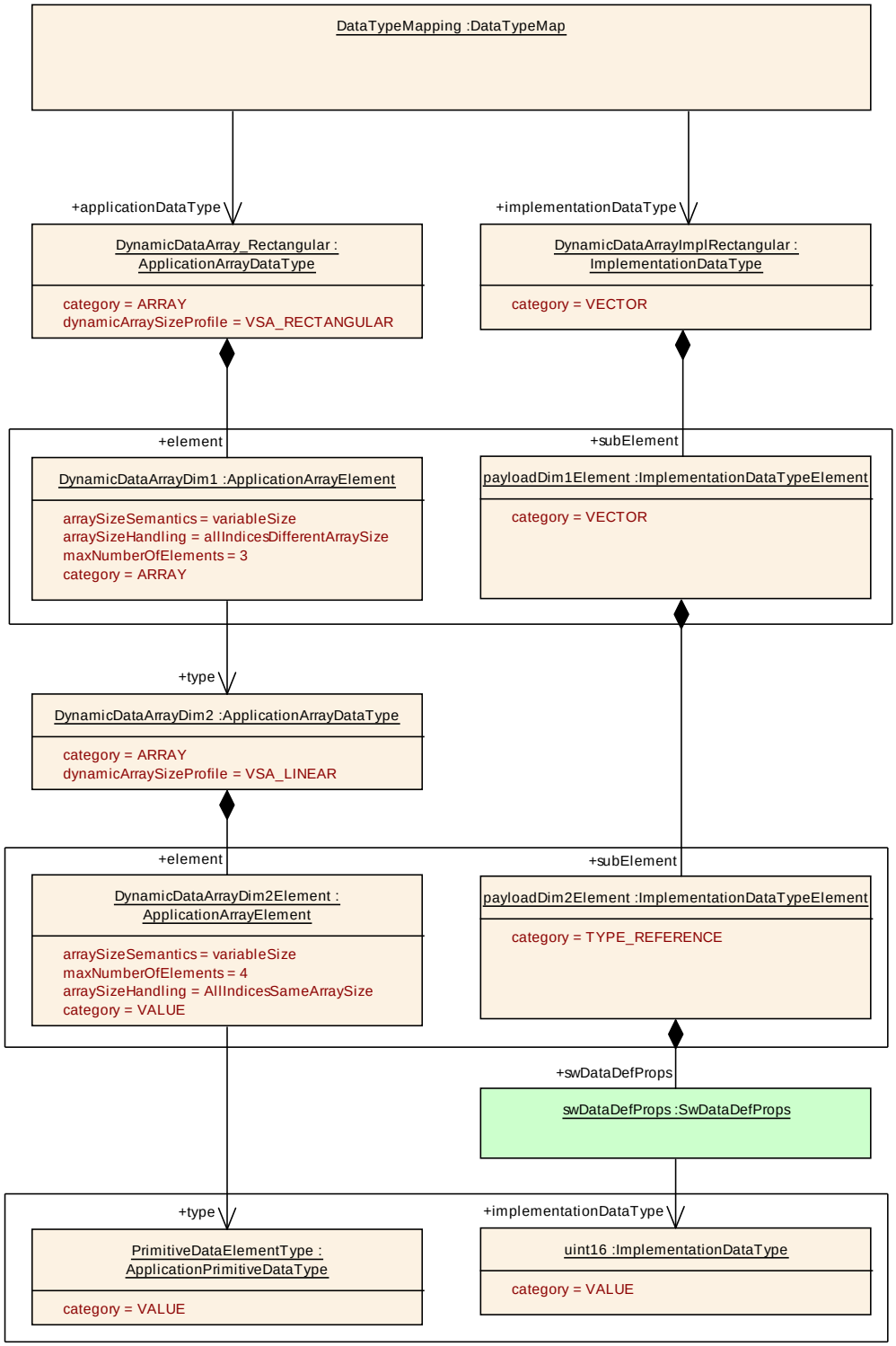


Figure 3.8: A two-dimensional vector with different dimension values

For comparison, the diagram also shows the corresponding `ApplicationArrayDataType` that has attribute `dynamicArraySizeProfile` set to the value `VSA_RECTANGULAR` on the left side.

A corresponding ARXML fragment can be found in Listing 3.3.

Note that the fragment represents only a sketch that concentrates on the most important model elements needed to exemplify the definition of a **rectangular** ImplementationDataType of category VECTOR.

Listing 3.3: Example for the definition of a rectangular ImplementationDataType of category VECTOR

```
<IMPLEMENTATION-DATA-TYPE>
    <SHORT-NAME>DynamicDataArrayImplRectangular</SHORT-NAME>
    <CATEGORY>VECTOR</CATEGORY>
    <SUB-ELEMENTS>
        <IMPLEMENTATION-DATA-TYPE-ELEMENT>
            <SHORT-NAME>payloadDim1Element</SHORT-NAME>
            <CATEGORY>VECTOR</CATEGORY>
            <SUB-ELEMENTS>
                <IMPLEMENTATION-DATA-TYPE-ELEMENT>
                    <SHORT-NAME>payloadDim2Element</SHORT-NAME>
                    <CATEGORY>TYPE_REFERENCE</CATEGORY>
                    <SW-DATA-DEF-PROPS>
                        <SW-DATA-DEF-PROPS-VARIANTS>
                            <SW-DATA-DEF-PROPS-CONDITIONAL>
                                <IMPLEMENTATION-DATA-TYPE-REF DEST="
                                    IMPLEMENTATION-DATA-TYPE">/
                                    ArrayExamle_VSA_Linear/uint16</
                                    IMPLEMENTATION-DATA-TYPE-REF>
                            </SW-DATA-DEF-PROPS-CONDITIONAL>
                        </SW-DATA-DEF-PROPS-VARIANTS>
                    </SW-DATA-DEF-PROPS>
                </IMPLEMENTATION-DATA-TYPE-ELEMENT>
            </SUB-ELEMENTS>
        </IMPLEMENTATION-DATA-TYPE-ELEMENT>
    </SUB-ELEMENTS>
</IMPLEMENTATION-DATA-TYPE>
```

3.3.3.3 Associative Map Data Type

The companion to ApplicationAssocMapDataType on the level of ImplementationDataType could in principle be modeled in various ways.

However, the rules presented in the following paragraphs have been designed to align with an implementation using an `std::map` on C++[2].

To support this approach a new value of category for ImplementationDataType is necessary.

Since the category value MAP is already taken it is consequently necessary to define a new value that represents the nature of an associative map data type appropriately. This value of category is defined in [TPS_MANI_01028], along with its translation into code.

[2] which is currently the only supported language binding on the *AUTOSAR adaptive platform*

[TPS_MANI_01028] `ImplementationDataType` of `category` `ASSOCIATIVE_MAP` ⌈ An `ImplementationDataType` of `category` `ASSOCIATIVE_MAP` (can be taken as the equivalent of an associative container data structure) shall always be implemented as a `std::map` for a C++ binding. ⌋*(RS_MANI_00016)*

[constr_1477] `ImplementationDataType` of `category` `ASSOCIATIVE_MAP` is limited ⌈ The usage of an `ImplementationDataType` of `category` `ASSOCIATIVE_MAP` is limited to the context of `AdaptiveApplicationSwComponentType`s and `CompositionSwComponentType`s defined in the context of an `Executable`, i.e. such data type shall not be used on the *AUTOSAR classic platform*. ⌋*()*

[constr_1477] is a formal approach to express that an `ImplementationDataType` of `category` `ASSOCIATIVE_MAP` shall only be used on the *AUTOSAR adaptive platform*.

The modeling of an `ImplementationDataType` of `category` `ASSOCIATIVE_MAP` needs to be expressive enough to allow for deriving all necessary information for the language binding.

As a design principle, container data types do not reveal their inner structure to the application programmer, and therefore there is no point in trying to regulate the modeling of such an `ImplementationDataType` with the goal to mock a `std::map` as closely as possible.

That said, the conclusion of this observation is that the regulation of the modeling of an `ImplementationDataType` of `category` `ASSOCIATIVE_MAP` can be as simple as possible.

Consequently, [constr_1487] as well as [TPS_MANI_01044] implement this approach.

[constr_1487] Number of `subElement`s of an `ImplementationDataType` of `category` `ASSOCIATIVE_MAP` ⌈ An `ImplementationDataType` of `category` `ASSOCIATIVE_MAP` shall have exactly two `subElement`s. Their semantic meaning is defined by [TPS_MANI_01044]. ⌋*()*

[TPS_MANI_01044] Structure of an `ImplementationDataType` of `category` `ASSOCIATIVE_MAP` ⌈ An `ImplementationDataType` of `category` `ASSOCIATIVE_MAP` shall have the following structure:

- The **first** `ImplementationDataTypeElement` (that shall be of `category` `TYPE_REFERENCE`) aggregated by `ImplementationDataType` of `category` `ASSOCIATIVE_MAP` shall represent the role that corresponds to `ApplicationAssocMapDataType.key` and define the respective data type details.
- The **second** `ImplementationDataTypeElement` (that shall be of `category` `TYPE_REFERENCE`) aggregated by `ImplementationDataType` of `category` `ASSOCIATIVE_MAP` shall represent the role that corresponds to `ApplicationAssocMapDataType.value` and define the respective data type details.

⌋*(RS_MANI_00016)*

The regulations made by [TPS_MANI_01044] are implemented in the example modeling of an `ImplementationDataType` of `category` `ASSOCIATIVE_MAP` that can be found in Figure 3.9.

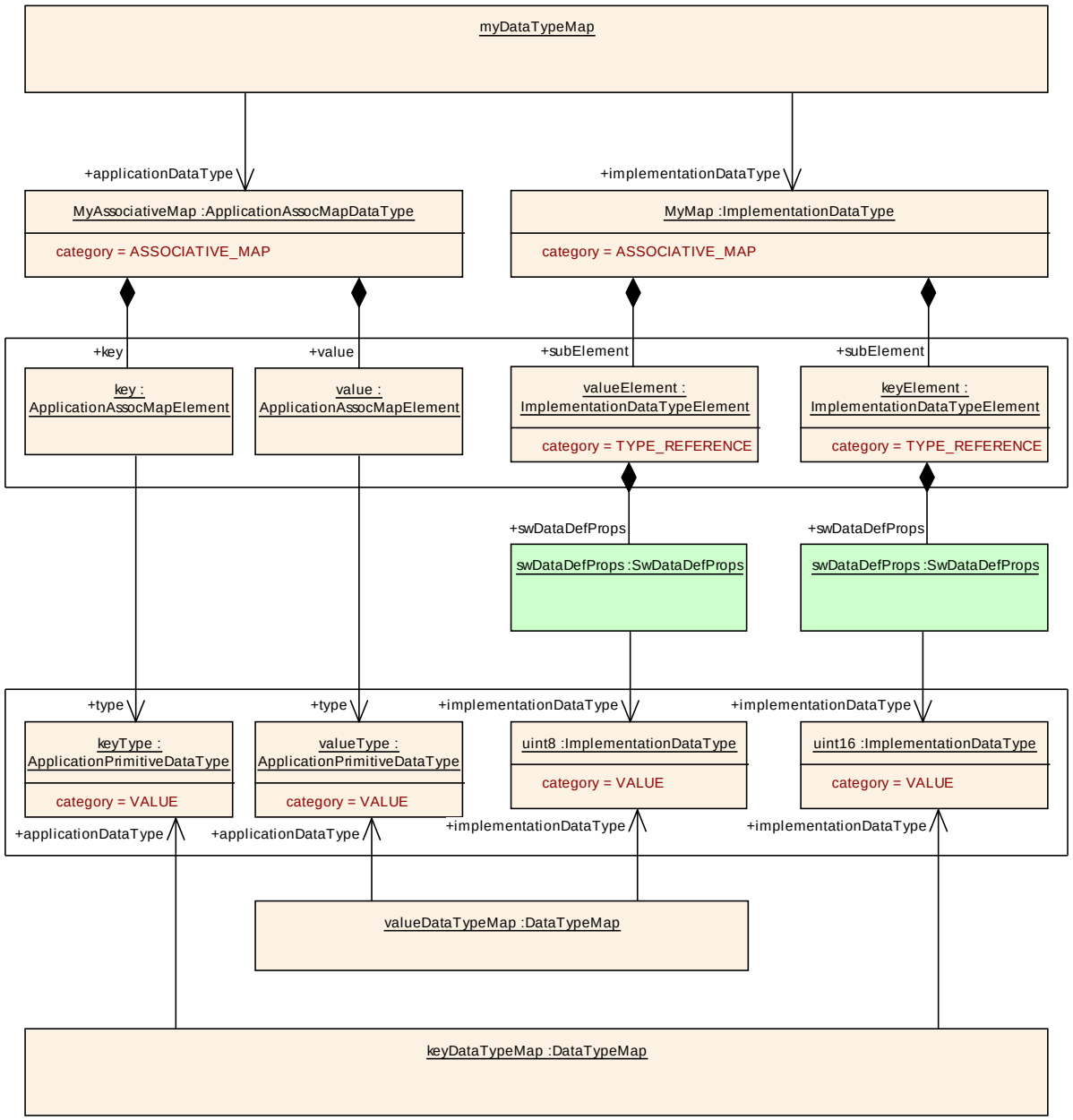


Figure 3.9: Example of the model of an associative map

The ARXML fragment listed in Listing 3.4 corresponds to the model sketched in Figure 3.9. The modeling of the corresponding `ApplicationAssocMapDataType` can be found in Listing 3.1.

Please note the order of definition of `ImplementationDataTypeElement`s in Listing 3.4.

Please note further that the fragments represents only a sketch that concentrates on the most important model elements needed to exemplify the definition of an ImplementationDataType of category ASSOCIATIVE_MAP.

This is significant for the semantics of the overall data type definition, as specified by [TPS_MANI_01044].

Listing 3.4: Example for the definition of an ImplementationDataType of category ASSOCIATIVE_MAP

```
<IMPLEMENTATION-DATA-TYPE>
  <SHORT-NAME>MyMap</SHORT-NAME>
  <CATEGORY>ASSOCIATIVE_MAP</CATEGORY>
  <SUB-ELEMENTS>
    <IMPLEMENTATION-DATA-TYPE-ELEMENT>
      <SHORT-NAME>keyElement</SHORT-NAME>
      <CATEGORY>TYPE_REFERENCE</CATEGORY>
      <SW-DATA-DEF-PROPS>
        <SW-DATA-DEF-PROPS-VARIANTS>
          <SW-DATA-DEF-PROPS-CONDITIONAL>
            <IMPLEMENTATION-DATA-TYPE-REF DEST="IMPLEMENTATION-DATA-TYPE">
              uint16</IMPLEMENTATION-DATA-TYPE-REF>
          </SW-DATA-DEF-PROPS-CONDITIONAL>
        </SW-DATA-DEF-PROPS-VARIANTS>
      </SW-DATA-DEF-PROPS>
    </IMPLEMENTATION-DATA-TYPE-ELEMENT>
    <IMPLEMENTATION-DATA-TYPE-ELEMENT>
      <SHORT-NAME>valueElement</SHORT-NAME>
      <CATEGORY>TYPE_REFERENCE</CATEGORY>
      <SW-DATA-DEF-PROPS>
        <SW-DATA-DEF-PROPS-VARIANTS>
          <SW-DATA-DEF-PROPS-CONDITIONAL>
            <IMPLEMENTATION-DATA-TYPE-REF DEST="IMPLEMENTATION-DATA-TYPE">
              uint8</IMPLEMENTATION-DATA-TYPE-REF>
          </SW-DATA-DEF-PROPS-CONDITIONAL>
        </SW-DATA-DEF-PROPS-VARIANTS>
      </SW-DATA-DEF-PROPS>
    </IMPLEMENTATION-DATA-TYPE-ELEMENT>
  </SUB-ELEMENTS>
</IMPLEMENTATION-DATA-TYPE>

<IMPLEMENTATION-DATA-TYPE>
    <SHORT-NAME>uint16</SHORT-NAME>
    <CATEGORY>VALUE</CATEGORY>
</IMPLEMENTATION-DATA-TYPE>

<IMPLEMENTATION-DATA-TYPE>
  <SHORT-NAME>uint8</SHORT-NAME>
  <CATEGORY>VALUE</CATEGORY>
</IMPLEMENTATION-DATA-TYPE>
```

Admittedly, the simplistic approach to modeling an ImplementationDataType of category ASSOCIATIVE_MAP also has its drawbacks.

In a clear departure from the situation on the *AUTOSAR classic platform*, the structure of such an ImplementationDataType does not reflect the structure of a Value-

Specification needed to initialize a corresponding DataPrototype, as already described in section 3.3.2.2.

Finally, the DataTypeMaps depicted in Figure 3.9 can be found in Listing 3.5.

Listing 3.5: Example for the definition of DataTypeMaps for the definition of an associative map data type

```
<DATA-TYPE-MAPPING-SET>
    <SHORT-NAME>MyDataTypeMappingSet</SHORT-NAME>
    <DATA-TYPE-MAPS>
        <DATA-TYPE-MAP>
            <APPLICATION-DATA-TYPE-REF DEST="APPLICATION-ASSOC-MAP-DATA-
                TYPE">MyAssociativeMap</APPLICATION-DATA-TYPE-REF>
            <IMPLEMENTATION-DATA-TYPE-REF DEST="IMPLEMENTATION-DATA-TYPE">
                MyMap</IMPLEMENTATION-DATA-TYPE-REF>
        </DATA-TYPE-MAP>
        <DATA-TYPE-MAP>
            <APPLICATION-DATA-TYPE-REF DEST="APPLICATION-PRIMITIVE-DATA-
                TYPE">keyType</APPLICATION-DATA-TYPE-REF>
            <IMPLEMENTATION-DATA-TYPE-REF DEST="IMPLEMENTATION-DATA-TYPE">
                uint16</IMPLEMENTATION-DATA-TYPE-REF>
        </DATA-TYPE-MAP>
        <DATA-TYPE-MAP>
            <APPLICATION-DATA-TYPE-REF DEST="APPLICATION-PRIMITIVE-DATA-
                TYPE">valueType</APPLICATION-DATA-TYPE-REF>
            <IMPLEMENTATION-DATA-TYPE-REF DEST="IMPLEMENTATION-DATA-TYPE">
                uint8</IMPLEMENTATION-DATA-TYPE-REF>
        </DATA-TYPE-MAP>
    </DATA-TYPE-MAPS>
</DATA-TYPE-MAPPING-SET>
```

3.3.3.4 Attributes of SwDataDefProps

[constr_1474] SwDataDefProps applicable to ImplementationDataTypes exclusive to the *AUTOSAR adaptive platform* ⌈ A complete list of the SwDataDefProps and other attributes and their multiplicities which are allowed for a given category is shown in table 3.17. ⌋*()*

A consequence of [constr_1474] is that the Table 3.17 shows only the values of category that are limited to the *AUTOSAR adaptive platform*. For all other values of category that are also supported on the *AUTOSAR classic platform* please refer to a similar table contained in the specification of the Software Component Template [1].

Attributes of SwDataDefProps	Root Element		Attribute Existence per Category		
	ImplementationDataType	ImplementationDataTypeElement	STRING	VECTOR	ASSOCIATIVE_MAP
additionalNativeTypeQualifier					
annotation	x	x	*	*	*
baseType	x	x	1		
compuMethod					
dataConstr	x	x		0..1	
displayFormat	x	x	0..1	0..1	0..1
implementationDataType					
invalidValue	x	x	0..1		
stepSize					
swAddrMethod					
swAlignment					
swBitRepresentation					
swCalibrationAccess					
swCalprmAxisSet					
swComparisonVariable					
swDataDependency					
swHostVariable					
swImplPolicy					
swIntendedResolution					
swInterpolationMethod					
swIsVirtual					
swPointerTargetProps					
swPointerTargetProps.swDataDefProps					
swPointerTargetProps.functionPointerSignature					
swRecordLayout					
swRefreshTiming	x	x	0..1	0..1	0..1
swTextProps					
swValueBlockSize					
unit					
valueAxisDataType					
Other Attributes					
subElement: ImplementationDataTypeElement	x	x		1	2
subElement.arraySizeSemantics	x	x			
subElement.arraySize	x	x			

Table 3.17: Allowed Attributes vs. category for ImplementationDataType

3.3.4 CppImplementationDataType

3.3.4.1 Disclaimer

Caution: this chapter has been introduced as a preparation for a later roll-out of the content. The content of this chapter is not binding for AUTOSAR R18-03.

3.3.4.2 Overview

In the AUTOSAR standard, data types represent assets of paramount prominence for the entire development approach.

Therefore[3], AUTOSAR implements a multi-level approach for the modeling of data types. One of the described levels, the so-called *Implementation Data Level* aims at a modeling on a level that could be described as "language binding" in the parlor of the *AUTOSAR adaptive platform*.

For the *AUTOSAR classic platform*, the *Implementation Data Level* has been addressed by the creation of the `ImplementationDataType` that specifically aims at covering the data type behavior of the C programming language.

In contrast to the *AUTOSAR classic platform*, the *AUTOSAR adaptive platform* currently does not foresee the usage of the C language and instead (at least for the foreseeable future) defines language binding to the C++ language.

It is therefore necessary to provide a modeling approach on the *Implementation Data Level* with a proper support for the capabilities of the C++ language.

While it would technically be feasible to extend the semantics of `ImplementationDataType` for a support of a C++ language binding this would significantly water down the clarity and expressiveness of `ImplementationDataType`[4].

It therefore seems reasonable to add an additional system of meta-classes that specifically supports the usage of data types with an intended binding to the C++ language.

[TPS_MANI_01166] Semantics of `CppImplementationDataType` ⌈ Meta-class `CppImplementationDataType` supports the a modeling of data types specifically tailored towards a support for a C++ language binding. ⌋*(RS_MANI_00039)*

[3] As explained in [1]

[4] And even if it were possible to extend `ImplementationDataType` towards a more or less clean support for C++ it may happen that further language bindings are added to the *AUTOSAR adaptive platform* for which further and further extensions of `ImplementationDataType` would be required.

Class	**CppImplementationDataType**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::CppImplementationDataType			
Note	This meta-class represents the way to specify a reusable data type definition taken as a the basis for a C++ language binding **Tags:** atp.Status=draft; atp.recommendedPackage=CppImplementationDataTypes			
Base	*ARElement*, *ARObject*, *AbstractImplementationDataType*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *AutosarDataType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
arraySize	PositiveInteger	0..1	attr	This attribute can be used to specify the array size if the enclosing CppImplementationDataType has array semantics. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=preCompileTime
namespace (ordered)	SymbolProps	*	aggr	This aggregation allows for the definition an own namespace for the enclosing CppImplementationDataType. **Tags:** atp.Status=draft
subElement (ordered)	CppImplementationDataTypeElement	*	aggr	This represents the collection of sub-elements of the enclosing CppImplementationDataType **Tags:** atp.Status=draft
template Argument (ordered)	CppTemplateArgument	*	aggr	This aggreation allows for the specification of properties of template arguments **Tags:** atp.Status=draft
typeEmitter	NameToken	0..1	attr	This attribute can be taken to control how the respective CppImplementationDataType is contributed to the language binding.
typeReference	CppImplementationDataType	0..1	ref	This reference shall be defined to define a type reference (a.k.a. typedef). **Tags:** atp.Status=draft

Table 3.18: CppImplementationDataType

[constr_1571] `CppImplementationDataType` is limited ⌈ The usage of an `CppImplementationDataType` is limited to the context of `AdaptiveApplicationSwComponentType`s and `CompositionSwComponentType`s defined in the context of an `Executable`. ⌋*()*

[TPS_MANI_01167] `AbstractImplementationDataType` ⌈ Meta-class `CppImplementationDataType` inherits from abstract base class `AbstractImplementationDataType` in order to become a valid target for specific references from other meta-classes that want to refer to "`ImplementationDataType` in general". ⌋ *(RS_MANI_00039)*

Class	***AbstractImplementationDataType* (abstract)**			
Package	M2::AUTOSARTemplates::CommonStructure::ImplementationDataTypes			
Note	This meta-class represents an abstract base class for different flavors of ImplementationDataType.			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *AutosarDataType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Subclasses	CppImplementationDataType, ImplementationDataType			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 3.19: AbstractImplementationDataType

A prominent example for the idea of referring to "ImplementationDataType in general" can be found in meta-class DataTypeMap. The intention behind the existence of DataTypeMap is to map an ApplicationDataType to either an ImplementationDataType or CppImplementationDataType.

By means of modeling the reference DataTypeMap.implementationDataType as a reference to AbstractImplementationDataType both options are possible in a single role.

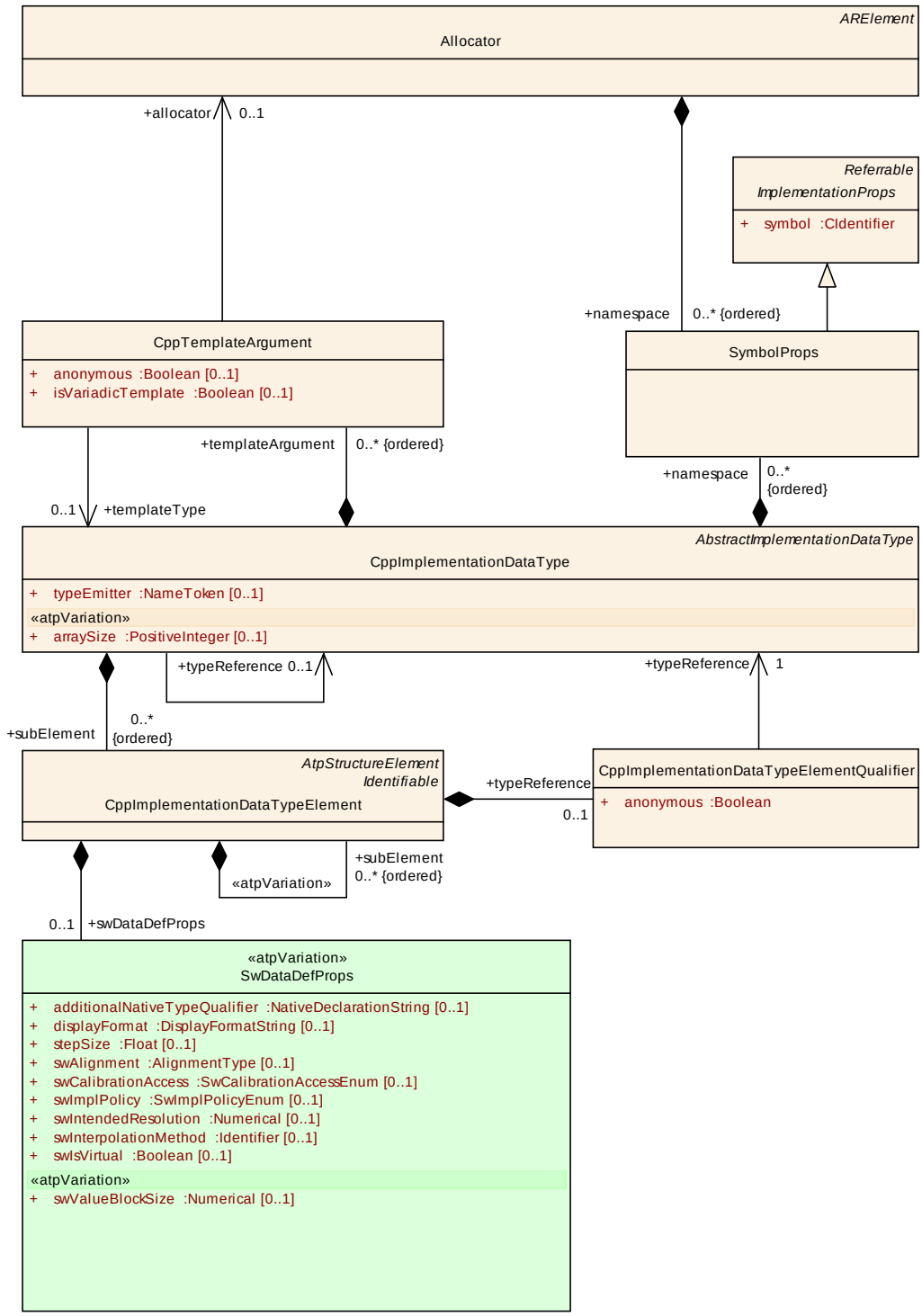


Figure 3.10: Example of the model of a string with UTF-8 encoding

In contrast to the C language, C++ supports the definition of namespaces in programs. This feature is also cleared for development on the *AUTOSAR adaptive platform* and therefore needs to be represented in the modeling approach.

[TPS_MANI_01168] Specification of a namespace for a `CppImplementationDataType` ⌈ The ability to define a namespace for a `CppImplementationDataType`

is expressed by means of the aggregation of SymbolProps at CppImplementationDataType in the role namespace. ⌋(*RS_MANI_00039*)

[TPS_MANI_01176] Standardized value for attribute CppImplementationDataType.typeEmitter ⌈ The AUTOSAR Standard reserves the following value for attribute CppImplementationDataType.typeEmitter:

- TYPE_EMITTER_ARA

⌋(*RS_MANI_00039*)

[TPS_MANI_01177] Semantics of CppImplementationDataType.typeEmitter ⌈ The following set of rules applies for the usage of the attribute CppImplementationDataType.typeEmitter:

- If the value of attribute typeEmitter is NOT defined **and** a nativeDeclaration is provided the ARA generator shall generate the corresponding data type definition[5].
- If the attribute typeEmitter is set to the value TYPE_EMITTER_ARA **and** a nativeDeclaration is provided the ARA generator shall generate the corresponding data type definition.
- If the the attribute typeEmitter is set to the value TYPE_EMITTER_ARA **and** no nativeDeclaration is provided the ARA generator shall issue an error message.
- If the attribute typeEmitter is set to any value other than TYPE_EMITTER_ARA the ARA generator shall silently **not** generate the corresponding data type definition regardless of the existence and value of attribute nativeDeclaration.

⌋(*RS_MANI_00039*)

[constr_1577] Specification of a nativeDeclaration for a CppImplementationDataType ⌈ The specification of a nativeDeclaration shall not be defined for a CppImplementationDataType unless attribute category is set to VALUE. ⌋*()*

The rationale for [constr_1577] is obvious: to keep the role of the nativeDeclaration to the absolute minimum, i.e. the definition of fundamental data types. It is not intended and would be considered a misuse to put complex values of nativeDeclaration that e.g. describe several layers of template arguments.

In other words, there is value in the specification of a complex data type by means of the canonical modeling means and this value could not be utilized if the entire definition is put into a completely non-formal value of nativeDeclaration.

[TPS_MANI_01169] Support for template data types ⌈ Meta-class CppImplementationDataType supports the usage of templates for the definition of data types in C++ programs by means of the reference CppImplementationDataType.templateArgument.

[5] This rule represents the behavior before the attribute typeEmitter was introduced. The rule has specifically been added in order to support a backwards-compatible behavior.

The order of arguments in templates is significant, therefore templateArgument is modeled as an **ordered** collection. ⌋(*RS_MANI_00039*)

[TPS_MANI_01170] Semantics of CppTemplateArgument.isVariadicTemplate ⌈ Attribute isVariadicTemplate can be used to model a template where the definition of the list of template arguments ends in an ellipsis to indicate that further unspecified arguments may be passed to the template. ⌋(*RS_MANI_00039*)

[constr_1573] CppTemplateArgument.isVariadicTemplate is set to True ⌈ If attribute CppTemplateArgument.isVariadicTemplate is set to True then the following attributes shall not exist within the context of the enclosing CppTemplateArgument:

- allocator
- templateType
- anonymous

⌋()

[constr_1574] Number of CppTemplateArguments with isVariadicTemplate set to True ⌈ In any given collection only a single CppImplementationDataType.templateArgument shall exist where attribute isVariadicTemplate is set to True. ⌋()

[constr_1575] Position of CppTemplateArgument with isVariadicTemplate set to True ⌈ In any given collection CppImplementationDataType.templateArgument, a CppTemplateArgument where attribute isVariadicTemplate set to True shall be the last element of the collection templateArgument. ⌋()

[TPS_MANI_01174] Semantics of reference in the role CppTemplateArgument.templateType ⌈ Attribute CppTemplateArgument.templateType specifies the data type to be filled in the respective position of the template in the language binding. ⌋(*RS_MANI_00039*)

[TPS_MANI_01175] Semantics of reference in the role CppTemplateArgument.allocator ⌈ Attribute CppTemplateArgument.allocator specifies the behavior of an allocator class to be filled in the respective position of the template in the language binding. ⌋(*RS_MANI_00039*)

[constr_1576] Existence of CppTemplateArgument.templateType vs. CppTemplateArgument.allocator ⌈ For any given CppTemplateArgument, **at most one of** the references

- CppTemplateArgument.templateType or
- CppTemplateArgument.allocator

may exist. ⌋()

For more background on the formulation of [constr_1576], please refer to [constr_1573].

Class	**CppTemplateArgument**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::CppImplementationDataType			
Note	This meta-class has the ability to define properties for template arguments. **Tags:** atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
allocator	Allocator	0..1	ref	This reference identifies the applicable allocator. **Tags:** atp.Status=draft
anonymous	Boolean	0..1	attr	This attribute specifies whether the template argument shall be translated into the name of the referenced CppImplementationDataType or whether it shall be filled with the data type definition behind the name.
isVariadicTemplate	Boolean	0..1	attr	This attribute indicates that the CppImplementationDataType shall be considered a variadic template.
templateType	CppImplementationDataType	0..1	ref	This reference identifies the data type of the specific template argument required for the language binding. **Tags:** atp.Status=draft

Table 3.20: CppTemplateArgument

[TPS_MANI_01171] Modeling of structured data types ⌈ Meta-class `CppImplementationDataType` supports the creation of nested data types by means of the aggregation of `CppImplementationDataTypeElement` in the role `subElement`.

Because the order of sub-elements in a structured data type is significant the aggregation `subElement` is modeled as an **ordered** collection. ⌋*(RS_MANI_00039)*

Class	**CppImplementationDataTypeElement**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::CppImplementationDataType			
Note	Declares a data object which is locally aggregated. Such an element can only be used within the scope where it is aggregated. This element either consists of further subElements or it is further defined via its swDataDefProps. A CppImplementationDataTypeElement can represent an element of a struct, defining its type. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

subElement (ordered)	CppImplementationDataTypeElement	*	aggr	Element of an array, struct, or union in case of a nested declaration (i.e. without using "typedefs"). The aggregation of ImplementionDataTypeElement is subject to variability with the purpose to support the conditional existence of elements inside a ImplementationDataType representing a structure. **Stereotypes:** atpVariation **Tags:** atp.Status=draft vh.latestBindingTime=preCompileTime
swDataDefProps	SwDataDefProps	0..1	aggr	The properties of this ImplementationDataTypeElement. **Tags:** atp.Status=draft
typeReference	CppImplementationDataTypeElementQualifier	0..1	aggr	This aggregation defines the type of the CppImplementationDataTypeElement and determines whether in C++ the CppImplementationDataTypeElement is defined inside or outside of the enclosing CppImplementationDataType. **Tags:** atp.Status=draft

Table 3.21: CppImplementationDataTypeElement

Please note that there is no intention to support a “mixed” modeling of structured data types such that the resulting data type on C++ level would be composed of data types that are native to C++ and data types from the C subsystem.

While this would technically be possible on code level it would impose a huge effort on modeling level and the general consensus is that there is no real use case for such a "mixed" data type. The C++ data type system can, as far as the implementation of the *AUTOSAR adaptive platform* is concerned, fully replace the “legacy” C data types in C++.

[constr_1572] Usage of `SwDataDefProps.implementationDataType` within a `CppImplementationDataType` ⌈ Within the scope of a `CppImplementationDataType` (which includes aggregated `CppImplementationDataTypeElement`s) the reference `CppImplementationDataType.swDataDefProps.implementationDataType` and `CppImplementationDataTypeElement.swDataDefProps.implementationDataType` shall not exist. ⌋*()*

As a consequence of [constr_1572], type references have to be done differently on the *AUTOSAR adaptive platform*. For this purpose dedicated references are available.

[TPS_MANI_01172] Description of type references in the scope of `CppImplementationDataType` ⌈ The reference `CppImplementationDataType.typeReference` can be used to create a type reference from the enclosing `CppImplementationDataType` to another `CppImplementationDataType`. ⌋*(RS_MANI_00039)*

[TPS_MANI_01173] Description of type references in the scope of CppImplementationDataTypeElement ⌈ CppImplementationDataTypeElement.typeReference can be used to create a reference to the CppImplementationDataType that shall apply for the enclosing CppImplementationDataTypeElement. ⌋*(RS_MANI_00039)*

Please note that the CppImplementationDataTypeElement.typeReference is realized as an Association Class that allows to add the anonymous attribute to the typeReference.

Class	**CppImplementationDataTypeElementQualifier**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::CppImplementationDataType			
Note	This element qualifies the typeReference of the CppImplementationDataTypeElement to the CppImplementationDataType. **Tags:** atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
anonymous	Boolean	1	attr	This attribute defines whether the CppImplementationDataTypeElement in C++ is an embedded type element inside of the enclosing CppImplementationDataType (true) or whether the CppImplementationDataTypeElement is defined outside and referenced by a type reference (false).
typeReference	CppImplementationDataType	1	ref	This reference defines a type reference. **Tags:** atp.Status=draft

Table 3.22: CppImplementationDataTypeElementQualifier

[TPS_MANI_03196] Semantics of CppImplementationDataTypeElementQualifier.anonymous attribute ⌈ The CppImplementationDataTypeElementQualifier.anonymous attribute defines whether the data type of the CppImplementationDataTypeElement in the C++ language binding is derived from the name or the properties of the referenced CppImplementationDataType.

Specifically, the following rules shall apply:

- if CppImplementationDataTypeElement.typeReference.anonymous is set to False then the **shortName** of the CppImplementationDataType referenced in the role CppImplementationDataTypeElement.typeReference.typeReference shall be used in the C++ language binding.
- if CppImplementationDataTypeElement.typeReference.anonymous is set to True then the **properties** of the CppImplementationDataType referenced in the role CppImplementationDataTypeElement.typeReference.typeReference shall be used in the C++ language binding.

⌋*(RS_MANI_00039)*

Please note that Figure 3.16 shows an example of a Structure where the typeReference of the subElements is classified as anonymous.

Class	**Allocator**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::DataTypes			
Note	This meta-class represents the ability to take influence on the way objects are allocated in memory, for example it can be controlled whether an objects is allocated on the heap or on the stack. **Tags:** atp.Status=draft; atp.recommendedPackage=Allocators			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
namespace (ordered)	SymbolProps	*	aggr	This aggregation allows for the definition of a namespace of an Allocator. **Tags:** atp.Status=draft

Table 3.23: Allocator

Please note that a list of standardized values of attribute Allocator.category can be found in [TPS_MANI_01100].

[constr_1578] applicable data categories ⌈ Table 3.24 defines the applicable categorys vs. meta-class. ⌋()

Category	Applicable to ...								Description
	ApplicationArrayDataType	ApplicationRecordDataType	ApplicationPrimitiveDataType	ApplicationRecordElement	ApplicationArrayElement	ApplicationValueSpecification	CppImplementationDataType	CppImplementationDataTypeElement	
VALUE			x	x	x	x	x		Contains a single value. See also [TPS_MANI_03192].
TYPE_REFERENCE							x	x	The element is defined via reference to another data type (via CppImplementationDataType.typeReference resp. CppImplementationDataTypeElement.typeReference).
STRUCTURE		x		x	x		x	x	Holds one or several further elements which can have different AutosarDataTypes. See also [TPS_MANI_03180].
VARIANT							x		Can hold values of different data types. It is similar to STRUCTURE except that all of its members start at the same location in memory. A VARIANT data prototype can contain only one of its elements at a time and represents a type-safe union. The size of the VARIANT is at least the size of the largest member. See also [TPS_MANI_03189].
ARRAY	x			x	x		x		A fixed-sized array of sub-elements of the same type. See also [TPS_MANI_03169].

Category	Applicable to ...								Description
	ApplicationArrayDataType	ApplicationRecordDataType	ApplicationPrimitiveDataType	ApplicationRecordElement	ApplicationArrayElement	ApplicationValueSpecification	CppImplementationDataType	CppImplementationDataTypeElement	
VECTOR							x		An array of elements of the same time that is able to grow at run-time. See also [TPS_MANI_03174].
ASSOCIATIVE_MAP							x		An associative array of key-value pairs. See also [TPS_MANI_03183].
STRING			x	x	x	x	x		Contains a text string. See also [TPS_MANI_03178].
BOOLEAN			x	x	x	x			Contains one boolean state. Depending on the CPU direct addressing of single bits may not be available. So a byte or a word can be used to store only one logical state.

Table 3.24: Usage of category for Data Types

3.3.4.3 Attributes of SwDataDefProps

[constr_1579] SwDataDefProps applicable to CppImplementationDataTypes exclusive to the *AUTOSAR adaptive platform* ⌈ A complete list of the SwDataDefProps and other attributes and their multiplicities which are allowed for a given category is shown in table 3.25. ⌋*()*

A consequence of [constr_1578] is that the Table 3.25 shows only the values of category that are limited to the *AUTOSAR adaptive platform*. For all other values of category that are also supported on the *AUTOSAR classic platform* please refer to a similar table contained in the specification of the Software Component Template [1].

Attributes of SwDataDefProps	Root Element		Attribute Existence per Category							
	CppImplementationDataType	CppImplementationDataTypeElement	VALUE	TYPE_REFERENCE	STRUCTURE	VARIANT	ARRAY	VECTOR	ASSOCIATIVE_MAP	STRING

Attributes of SwDataDefProps	Root Element		Attribute Existence per Category							
	CppImplementationDataType	CppImplementationDataTypeElement	VALUE	TYPE_REFERENCE	STRUCTURE	VARIANT	ARRAY	VECTOR	ASSOCIATIVE_MAP	STRING
additionalNativeTypeQualifier										
annotation	x	x	*	*	*	*	*	*	*	*
baseType	x	x	1							1
compuMethod	x	x	0..1	0..1						
dataConstr.dataConstrRule.physConstrs	x	x	d/c[6]	d/c			d/c	d/c		
dataConstr.dataConstrRule.internalConstrs	x	x	0..1	0..1			0..1	0..1		
displayFormat	x	x	0..1		0..1	0..1	0..1	0..1	0..1	0..1
implementationDataType										
invalidValue	x	x	0..1	0..1	0..1		0..1			
stepSize										
swAddrMethod										
swAlignment										
swBitRepresentation										
swCalibrationAccess										
swCalprmAxisSet										
swComparisonVariable										
swDataDependency										
swHostVariable										
swImplPolicy										
swIntendedResolution										
swInterpolationMethod										
swIsVirtual										
swPointerTargetProps										
swPointerTargetProps.swDataDefProps										
swPointerTargetProps.functionPointerSignature										
swRecordLayout										
swRefreshTiming	x	x	0..1	0..1	0..1	0..1	0..1	0..1	0..1	0..1
swTextProps										
swValueBlockSize										
unit										
valueAxisDataType										
Other Attributes										
subElement: CppImplementationDataTypeElement	x	x			1..*					

[6] don't care

Attributes of SwDataDefProps	Root Element		Attribute Existence per Category							
	CppImplementationDataType	CppImplementationDataTypeElement	VALUE	TYPE_REFERENCE	STRUCTURE	VARIANT	ARRAY	VECTOR	ASSOCIATIVE_MAP	STRING
templateArgument	x					1..*	1..*	1..*	2..*	0..1
typeReference	x	x		1						

Table 3.25: Allowed Attributes vs. `category` for `CppImplementationDataType`

3.3.4.4 Fundamental Data Types

[TPS_MANI_03192] **`CppImplementationDataType` of `category VALUE`** ⌈ The fundamental datatypes like Boolean, fixed width integer types and floating point types are described as `CppImplementationDataType`s of `category VALUE`. ⌋ *(RS_MANI_00039)*

[TPS_MANI_03193] **`CppImplementationDataType` or `CppImplementationDataTypeElement` of `category TYPE_REFERENCE`** ⌈ The `CppImplementationDataType` or `CppImplementationDataTypeElement` of `category TYPE_REFERENCE` defines an alias for another `CppImplementationDataType` that is referenced by the `typeReference`. ⌋ *(RS_MANI_00039)*

3.3.4.5 String Data Type

[TPS_MANI_03178] **`CppImplementationDataType` of `category STRING`** ⌈ A `CppImplementationDataType` of `category STRING` represents a container data type for a sequence of characters.

AUTOSAR demands that the C++ binding of a `CppImplementationDataType` of `category STRING` is implemented either by a `std::string` or by a `std::u16string`. ⌋ *(RS_MANI_00039)*

It is still possible to define an encoding for a string data type according to [TPS_MANI_03177] implemented by a `std::string` or `std::u16string`, for any encodings other than ASCII a dedicated library to process the string content would be required.

In other words, these strings should really be thought of as sequences of bytes, where each string type is more suitable for a different Unicode encoding.

[TPS_MANI_03179] C++ language binding of `CppImplementationDataType`s of `category STRING` ⌈ The `baseTypeSize` of the `CppImplementationDataType` that describes the Code Unit size decides about the C++ language binding.

- a `CppImplementationDataType` of `category STRING` where the `baseTypeSize` is set to a value of 8 will be implemented as `std::string`.
- a `CppImplementationDataType` of `category STRING` where the `baseTypeSize` is set to a value of 16 will be implemented as `std::u16string`.

⌋*(RS_MANI_00039)*

[TPS_MANI_03178] means that:

- a String with UTF-8 encoding is always mapped to std::string.
- a String with UTF-16 encoding is always mapped to std::u16string.

[constr_3422] `CppImplementationDataType` of `category STRING` and `SwBaseType` ⌈ The `CppImplementationDataType` of `category STRING` shall aggregate `SwDataDefProps` in the role `swDataDefProps` which shall refer to an `SwBaseType` in the role `baseType` where the attribute `BaseTypeDirectDefinition.baseTypeSize` is set to a value of 8 or 16. ⌋*()*

The example depicted in Figure 3.11 contains the definition of both an `ApplicationDataType` as well as the definition of the corresponding `CppImplementationDataType`.

The latter obviously becomes significantly lighter to model thanks to the restriction that, as far as the C++ language binding is concerned, a `CppImplementationDataType` of `category STRING` shall only be implemented on the basis of a `std::string` or `std::u16string` (as expressed by [TPS_MANI_01030]).

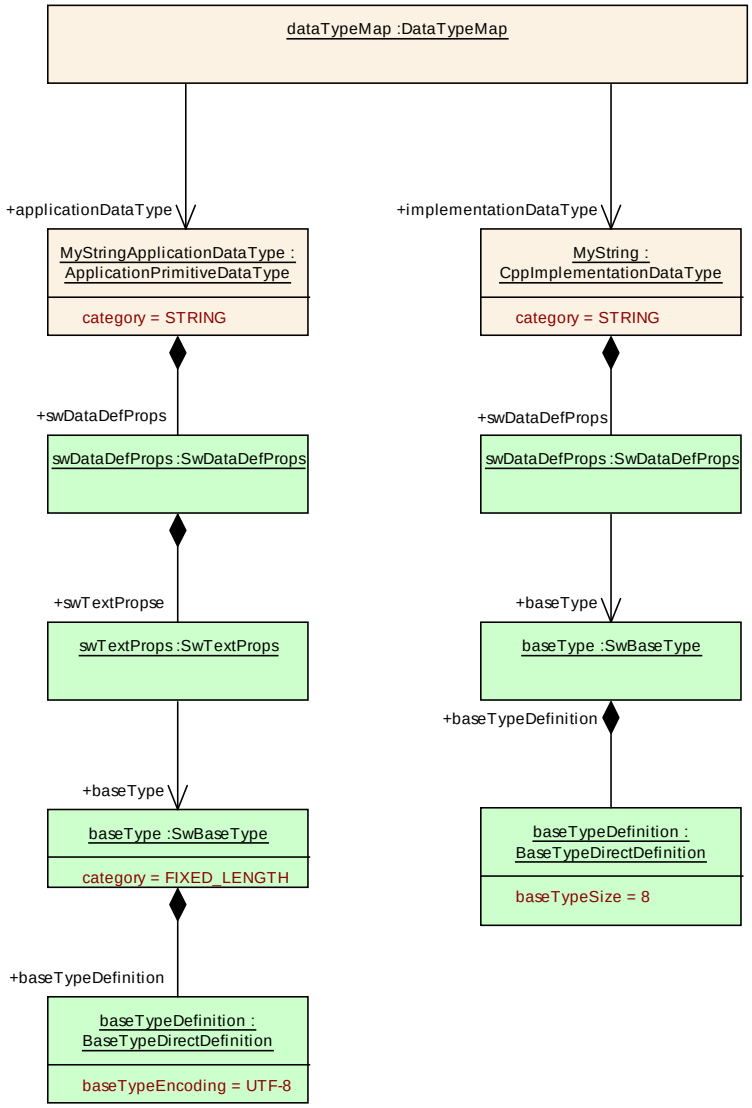


Figure 3.11: Example of the model of a string with UTF-8 encoding

Another aspect of the example in Figure 3.11 is that it defines the intended encoding of the modeled data type in the scope of the `ApplicationPrimitiveDataType`.

[TPS_MANI_03188] Usage of an Allocator for a `CppImplementationDataType` of `category STRING` ⌈ A `CppImplementationDataType` of `category STRING` is allowed to aggregate a `CppTemplateArgument` that refers to an `Allocator` with the `allocator` reference. ⌋*(RS_MANI_00039)*

3.3.4.6 Array Data Type

[TPS_MANI_03169] `CppImplementationDataType` with fixed size array semantics ⌈ A `CppImplementationDataType` of `category ARRAY` represents a container data type that encapsulates fixed size arrays. ⌋*(RS_MANI_00039)*

[TPS_MANI_03170] `CppImplementationDataType` of `category ARRAY` ⌈ For a C++ binding, a `CppImplementationDataType` of `category ARRAY` can be implemented as a std::array or as a array type in a custom namespace (e.g. my::array) (provided that the type in the custom namespace can be configured with the available modeling capabilities). ⌋*(RS_MANI_00039)*

[TPS_MANI_03171] Value type of a `CppImplementationDataType` of `category ARRAY` ⌈ The type of elements contained in a `CppImplementationDataType` of `category ARRAY` is defined by the aggregated `templateArgument` and the corresponding `templateType` that defines the data type of the `CppTemplateArgument`. ⌋*(RS_MANI_00039)*

[constr_3433] Aggregation of `templateArgument`s for a `ARRAY` ⌈ `CppImplementationDataType` of `category ARRAY` that boils down to std::array shall aggregate exactly one `templateArgument` that defines the type of elements contained in the `CppImplementationDataType` of `category ARRAY`. ⌋*()*

[TPS_MANI_03172] Size of a `CppImplementationDataType` of `category ARRAY` ⌈ The primitive attribute `arraySize` of a `CppImplementationDataType` of `category ARRAY` shall be used to define the size of the array. ⌋*(RS_MANI_00039)*

Figure 3.12 shows an example of an one-dimensional array of uint16 elements with `arraySize` = 5.

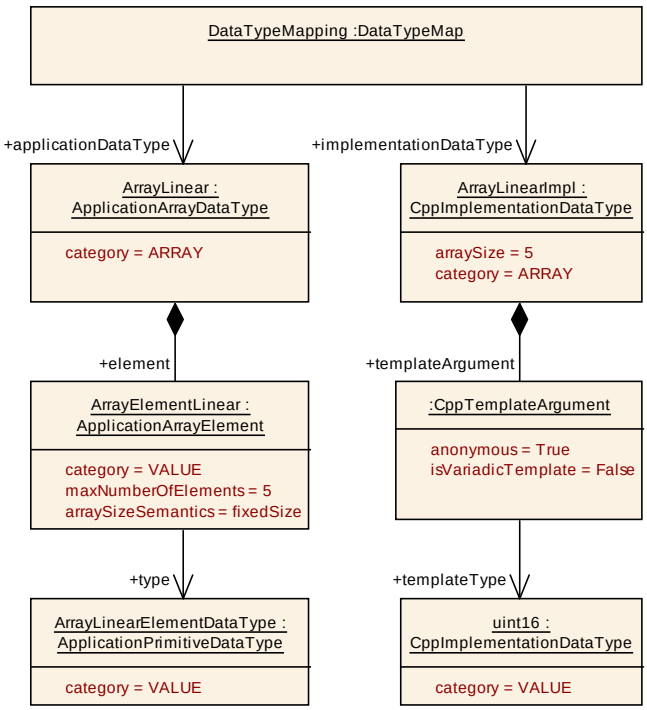


Figure 3.12: Example of the model of a one-dimensional array

[TPS_MANI_03173] multidimensional Array ⌈ A multidimensional `CppImplementationDataType` of `category ARRAY` is described as a list of `CppImplementationDataType`s of `category ARRAY`.

The CppImplementationDataType of category ARRAY that represents the outer array will refer to a CppImplementationDataType of category ARRAY that represents the inner array via the aggregated templateArgument.

The last referenced CppImplementationDataType of category ARRAY in the list of CppImplementationDataTypes of category ARRAY has a reference to the type of elements contained in the array. ⌋(*RS_MANI_00039*)

Figure 3.13 shows an example of a multidimensional array where a CppImplementationDataType of category ARRAY with arraySize = 5 has a templateArgument that points to the inner CppImplementationDataType of category ARRAY in the role templateType. The inner CppImplementationDataType has a templateArgument that finally points with the templateType reference to a fundamental type.

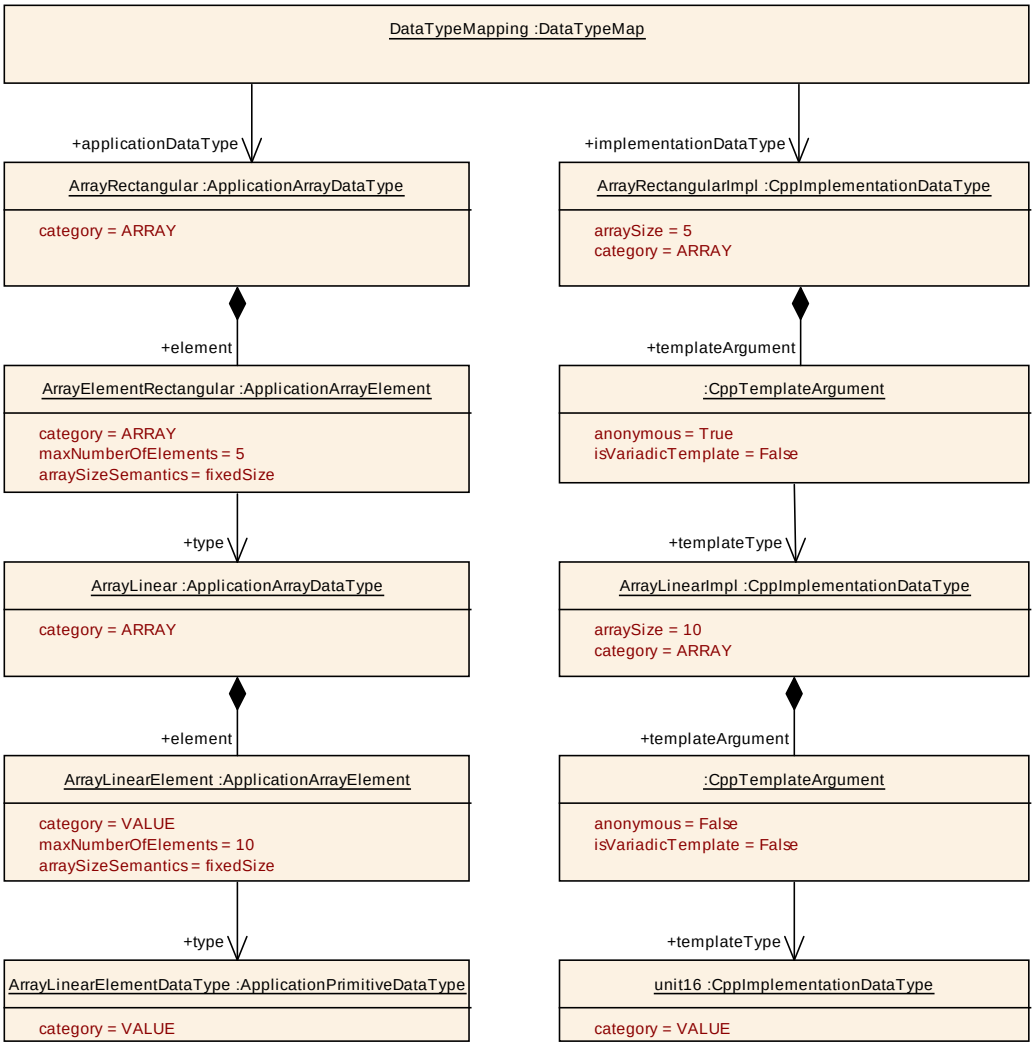


Figure 3.13: Example of the model of a multidimensional array

Such a model will result in the following C++ code since the CppTemplateArgument.anonymous flag is set to true for the inner array:

```
1  using ArrayRectangularImpl = std::array<std::array<uint16_t, 10>, 5>;
```

If the CppTemplateArgument.anonymous flag would be false for the inner array the model results in:

```
1  using ArrayLinearImpl = std::array<uint16_t, 10>;
2  typedef ArrayRectangularImpl = std::array<ArrayLinearImpl, 5>;
```

3.3.4.7 Vector Data Type

[TPS_MANI_03174] CppImplementationDataType with variable size array semantics ⌈ A CppImplementationDataType of category VECTOR represents a container data type that encapsulates variable size arrays. ⌋*(RS_MANI_00039)*

[TPS_MANI_03175] CppImplementationDataType of category VECTOR ⌈ For a C++ binding, a CppImplementationDataType of category VECTOR can be implemented as a std::vector or as a vector type in a custom namespace (e.g. my::vector) (provided that the type in the custom namespace can be configured with the available modeling capabilities). ⌋*(RS_MANI_00039)*

[TPS_MANI_03176] Value type of a CppImplementationDataType of category VECTOR ⌈ The type of elements contained in a CppImplementationDataType of category VECTOR is defined by the aggregated templateArgument and the corresponding templateType that defines the data type of the CppTemplateArgument. ⌋*(RS_MANI_00039)*C

[constr_3434] Aggregation of templateArguments for a VECTOR ⌈ CppImplementationDataType of category VECTOR that boils down to std::vector shall aggregate

- one templateArgument that defines the type of elements contained in the CppImplementationDataType of category VECTOR with the templateType reference.
- optionally one additional templateArgument that defines the Allocator with the allocator reference.

⌋*()*

[TPS_MANI_03186] Usage of arraySize in case of a Vector ⌈ If the CppImplementationDataType of category VECTOR aggregates a templateArgument that defines the Allocator with the allocator reference then the attribute arraySize that defines the maximum size of the vector is allowed to be used. ⌋*(RS_MANI_00039)*

Figure 3.14 shows an example of an one-dimensional vector of uint16 elements.

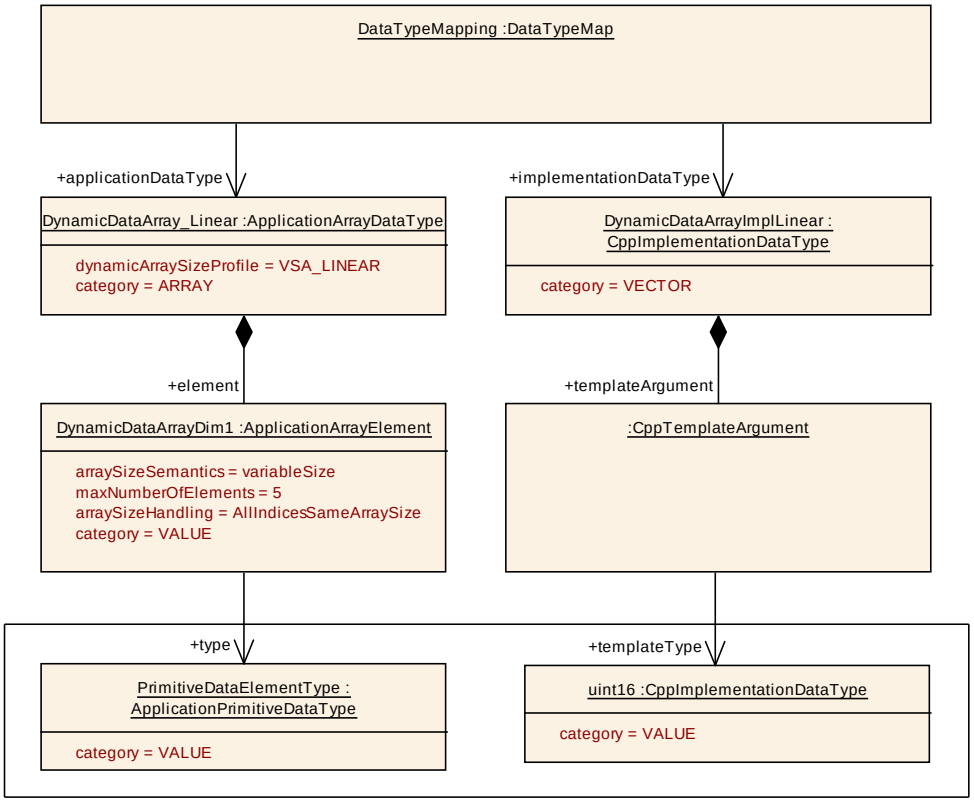


Figure 3.14: Example of the model of a one-dimensional vector

[TPS_MANI_03177] multidimensional Vector ⌈ A multidimensional `CppImplementationDataType` of `category VECTOR` is described as a list of `CppImplementationDataType`s of category `VECTOR`.

The `CppImplementationDataType` of category `VECTOR` that represents the outer vector will refer to a `CppImplementationDataType` of category `VECTOR` that represents the inner vector via the aggregated `templateArgument`.

The last referenced `CppImplementationDataType` of category `VECTOR` in the list of `CppImplementationDataType`s of category `VECTOR` shall have a reference to the type of elements contained in the vector. ⌋*(RS_MANI_00039)*

Figure 3.15 shows an example of a multidimensional vector where a `CppImplementationDataType` of `category VECTOR` has a `templateArgument` that points to the inner `CppImplementationDataType` of `category VECTOR` in the role `templateType`. The inner `CppImplementationDataType` has a `templateArgument` that finally points with the `templateType` reference to a fundamental type.

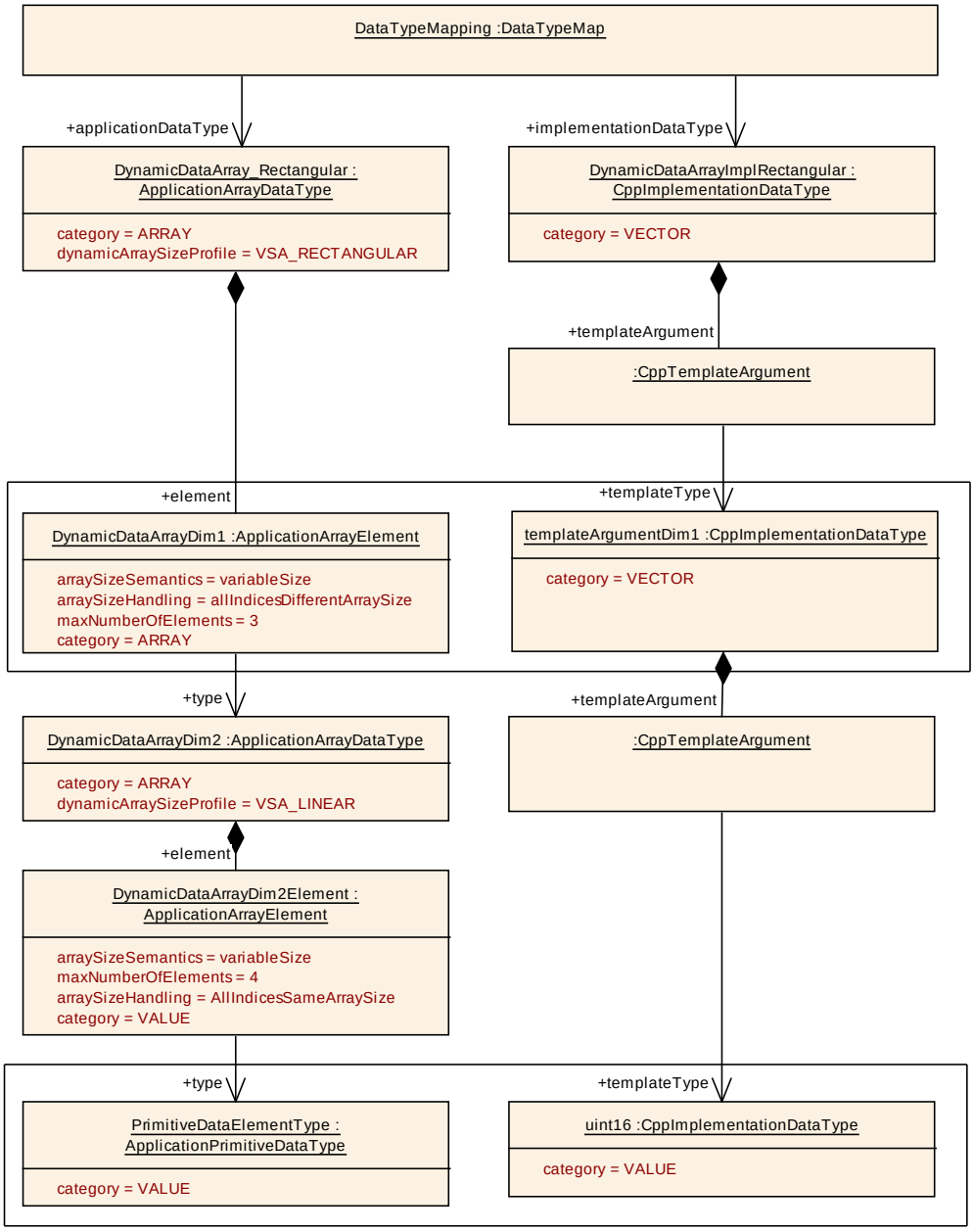


Figure 3.15: Example of the model of a multidimensional vector

Such a model will result in the following C++ code since the `CppTemplateArgument.anonymous` flag is not set for the inner vector:

```
1 using templateArgumentDim1 = std::vector<uint16_t>;
2 using DynamicDataArrayImplRectangular = std::vector<templateArgumentDim1>;
```

If the `CppTemplateArgument.anonymous` flag would be set to true for the inner vector the model results in:

```
1 using DynamicDataArrayImplRectangular = std::vector<std::vector<uint16_t>>;
```

3.3.4.8 Struct Data Type

[TPS_MANI_03180] Definition of Structures ⌈ A CppImplementationDataType or CppImplementationDataTypeElement of category STRUCTURE represents a data type for holding an ordered collection of variables of arbitrary data types. ⌋ *(RS_MANI_00039)*

[TPS_MANI_03181] Definition of members in CppImplementationDataType of category STRUCTURE ⌈ Members in a CppImplementationDataType of category STRUCTURE are defined by the aggregation in the role CppImplementationDataType.subElement. ⌋*(RS_MANI_00039)*

[TPS_MANI_03182] Definition of members in CppImplementationDataTypeElement of category STRUCTURE ⌈ Members of a CppImplementationDataTypeElement of category STRUCTURE are defined by the CppImplementationDataTypeElement.subElement aggregation. ⌋*(RS_MANI_00039)*

[constr_3428] Structure shall own at least one element ⌈ CppImplementationDataType or CppImplementationDataTypeElement of category STRUCTURE shall own at least one CppImplementationDataTypeElement. ⌋*()*

[constr_3432] Allowed subElements for Structures ⌈ CppImplementationDataType and CppImplementationDataTypeElement of category STRUCTURE are allowed to aggregate CppImplementationDataTypeElements of the following categories in the role subElement:

- TYPE_REFERENCE
- STRUCTURE

⌋*()*

The example depicted in Figure 3.16 shows the definition of a Structure, called MyStruct, that has two members. The typeReference of both subElements is classified as anonymous and according to [TPS_MANI_03196] the following data type would be generated in C++ out of the model:

```
struct MyStruct {
    std::uint8_t PrimitiveElement;
    std::array<uint8_t,5> ArrayElement;
};
```

In case that only the anonymous attribute in the typeReference of ArrayElement is set to False the model results in C++ code where the ArrayDataType is defined outside of MyStruct.

```
using ArrayDataType = std::array<uint8_t,5>;

struct MyStruct {
    std::uint8_t PrimitiveElement;
    ArrayDataType ArrayElement;
};
```

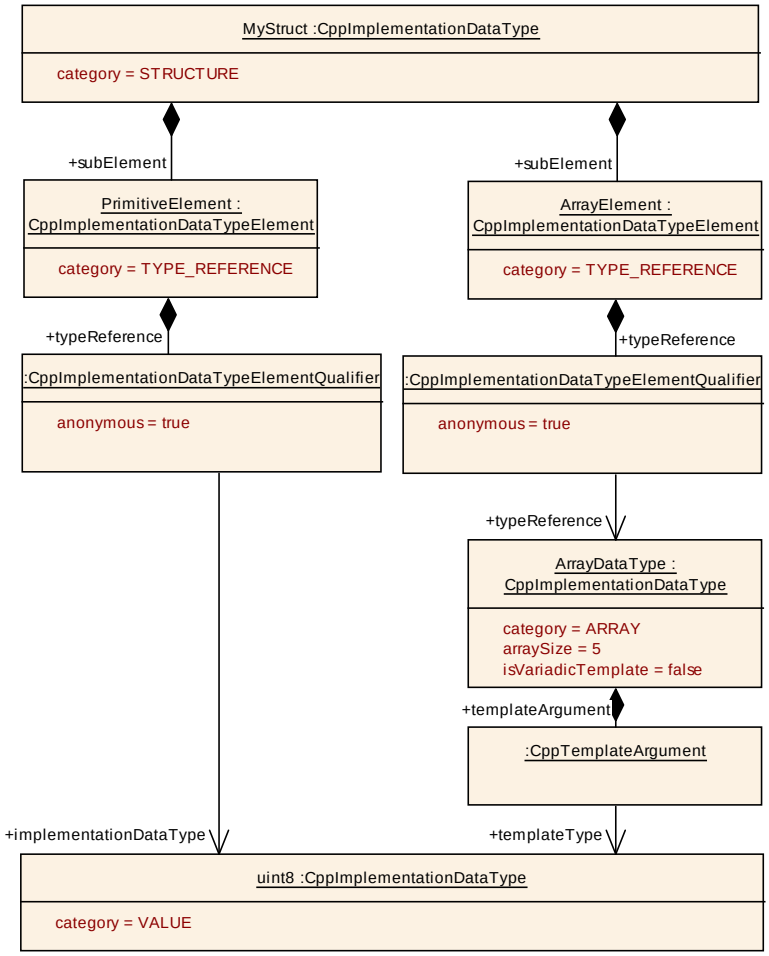


Figure 3.16: Example of the model of a Struct

3.3.4.9 Enumeration Data Type

[TPS_MANI_03187] Definition of enumeration types ⌈ In the AUTOSAR metamodel, an enumeration is not implemented by means of an `CppImplementationDataType` with an own `category`. Instead, a range of integer numbers can be used as a structural description for a single fundamental `CppImplementationDataType` of `category` `VALUE` or `TYPE_REFERENCE` that boils down to a `CppImplementationDataType` of category `VALUE`. The mapping of the integer numbers to labels in the scope of the definition of an enumeration is considered part of the semantical definition via an attached `CompuMethod` with `category` TEXTTABLE rather than part of the structural description. ⌋*(RS_MANI_00039)*

The rules for the usage of a `CompuMethod` with `category` TEXTTABLE are the same as in the AUTOSAR Classic Platform and are described in the Software Component Template [1].

Summarized an enumeration value in the `CompuMethod` with `category` TEXTTABLE can be provided as an text value in the `vt` of the `CompuConst`, in the `shortLabel`

or symbol of the applicable CompuScale of the CompuMethod. Each CompuScale shall be defined as compuInternalToPhys computation in the CompuMethod and shall contain an upperLimit and lowerLimit.

The following example illustrates how an enumeration is specified using CompuMethod.

Listing 3.6: example for enumeration

```
<COMPU-METHOD>
  <SHORT-NAME>cylinders</SHORT-NAME>
  <CATEGORY>TEXTTABLE</CATEGORY>
  <COMPU-INTERNAL-TO-PHYS>
    <COMPU-SCALES>
      <COMPU-SCALE>
        <LOWER-LIMIT INTERVAL-TYPE="CLOSED">0</LOWER-LIMIT>
        <UPPER-LIMIT INTERVAL-TYPE="CLOSED">0</UPPER-LIMIT>
        <COMPU-CONST>
          <VT>Cylinder1</VT>
        </COMPU-CONST>
      </COMPU-SCALE>
      <COMPU-SCALE>
        <LOWER-LIMIT INTERVAL-TYPE="CLOSED">1</LOWER-LIMIT>
        <UPPER-LIMIT INTERVAL-TYPE="CLOSED">1</UPPER-LIMIT>
        <COMPU-CONST>
          <VT>Cylinder2</VT>
        </COMPU-CONST>
      </COMPU-SCALE>
      <COMPU-SCALE>
        <LOWER-LIMIT INTERVAL-TYPE="CLOSED">2</LOWER-LIMIT>
        <UPPER-LIMIT INTERVAL-TYPE="CLOSED">2</UPPER-LIMIT>
        <COMPU-CONST>
          <VT>Cylinder3</VT>
        </COMPU-CONST>
      </COMPU-SCALE>
      <COMPU-SCALE>
        <LOWER-LIMIT INTERVAL-TYPE="CLOSED">3</LOWER-LIMIT>
        <UPPER-LIMIT INTERVAL-TYPE="CLOSED">3</UPPER-LIMIT>
        <COMPU-CONST>
          <VT>Cylinder4</VT>
        </COMPU-CONST>
      </COMPU-SCALE>
    </COMPU-SCALES>
  </COMPU-INTERNAL-TO-PHYS>
</COMPU-METHOD>
```

3.3.4.10 Map Data Type

[TPS_MANI_03183] CppImplementationDataType of category ASSOCIATIVE_MAP ⌈ A CppImplementationDataType of category ASSOCIATIVE_MAP represents a container that contains key-value pairs with unique keys. ⌋ *(RS_MANI_00039)*

[TPS_MANI_03184] **CppImplementationDataType of category ASSOCIATIVE_MAP** ⌈ For a C++ binding, a CppImplementationDataType of category ASSOCIATIVE_MAP can be implemented as a std::map or as a map type in a custom namespace (e.g. my::map) (provided that the type in the custom namespace can be configured with the available modeling capabilities). ⌋*(RS_MANI_00039)*

[TPS_MANI_03185] Structure of an CppImplementationDataType of category ASSOCIATIVE_MAP ⌈ A CppImplementationDataType of category ASSOCIATIVE_MAP that boils down to a std::map shall aggregate the following CppTemplateArguments:

- the **first** CppTemplateArgument shall refer to a CppImplementationDataType with the templateType reference. This CppTemplateArgument represents the role that corresponds to ApplicationAssocMapDataType.key and defines the respective data type details.
- the **second** CppTemplateArgument shall refer a CppImplementationDataType with the templateType reference. This CppTemplateArgument represents the role that corresponds to ApplicationAssocMapDataType.value and defines the respective data type details.
- the optional **third** CppTemplateArgument shall refer to an Allocator with the allocator reference.

⌋*(RS_MANI_00039)*

The example depicted in Figure 3.17 shows the definition of a ASSOCIATIVE_MAP that has two CppTemplateArguments, one for the key and one for the value. Please note that the CppTemplateArguments of a CppImplementationDataType are ordered in ARXML and this order is not visible in the object diagram.

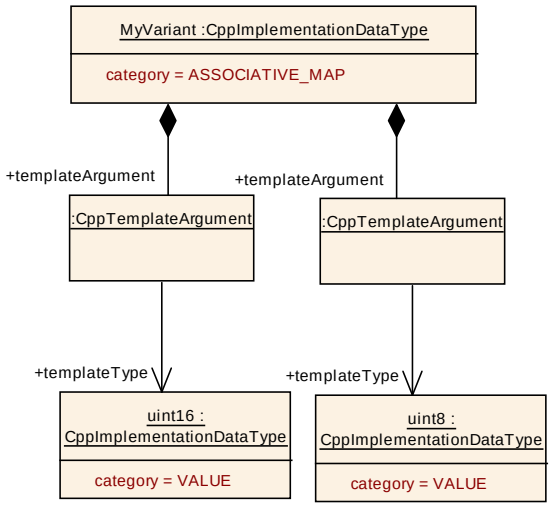


Figure 3.17: Example of the model of an ASSOCIATIVE_MAP

3.3.4.11 Variant Data Type

[TPS_MANI_03189] Definition of `CppImplementationDataType` of `category VARIANT` ⌈ A `CppImplementationDataType` of `category VARIANT` represents a type safe union. ⌋*(RS_MANI_00039)*

[TPS_MANI_03190] `CppImplementationDataType` of `category VARIANT` ⌈ For a C++ binding, a `CppImplementationDataType` of `category VARIANT` can be implemented as a std::variant or as a variant type in a custom namespace (e.g. my::variant) (provided that the type in the custom namespace can be configured with the available modeling capabilities). ⌋*(RS_MANI_00039)*

[TPS_MANI_03191] Definition of type alternatives stored in a `VARIANT` ⌈ A type alternative that is stored in a `CppImplementationDataType` of `category VARIANT` is defined by the aggregated `templateArgument` and the corresponding `templateType` that defines the data type of the `CppTemplateArgument`. ⌋*(RS_MANI_00039)*

[constr_3429] No allocator usage for `CppImplementationDataType`s of `category VARIANT` ⌈ `CppImplementationDataType` of `category VARIANT` is not allowed to aggregate a `templateArgument` that points to an `Allocator` in the role `allocator`. ⌋*()*

The example depicted in Figure 3.18 shows the definition of a `VARIANT` that has two `CppTemplateArgument`s. Each one represents one alternative type. Please note that the `CppTemplateArgument`s of a `CppImplementationDataType` are ordered in ARXML and this order is not visible in the object diagram.

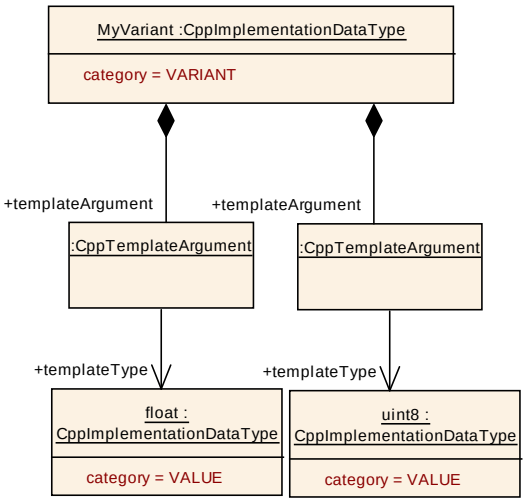


Figure 3.18: Example of the model of an `VARIANT`

3.3.5 BaseType

Some implications on the usage of data types only occur in the context of the `SwBaseType` resp. the `BaseTypeDirectDefinition`.

In other words, there are cases where the data types on the level of `ApplicationDataType` and `ImplementationDataType` are identical on both the *AUTOSAR adaptive platform* and the *AUTOSAR classic platform*.

Nevertheless, a different modeling is indicated on the level of the `SwBaseType`/`BaseTypeDirectDefinition` (i.e. in the binding to the actual programming language used to implement one of the respective platforms).

Class	**SwBaseType**			
Package	M2::MSR::AsamHdo::BaseTypes			
Note	This meta-class represents a base type used within ECU software. **Tags:** atp.recommendedPackage=BaseTypes			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *BaseType*, *Collectable Element*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 3.26: SwBaseType

Class	**BaseTypeDirectDefinition**			
Package	M2::MSR::AsamHdo::BaseTypes			
Note	This BaseType is defined directly (as opposite to a derived BaseType)			
Base	*ARObject*, *BaseTypeDefinition*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
baseTypeEncoding	BaseTypeEncodingString	1	attr	This specifies, how an object of the current BaseType is encoded, e.g. in an ECU within a message sequence. **Tags:** xml.sequenceOffset=90
baseTypeSize	PositiveInteger	0..1	attr	Describes the length of the data type specified in the container in bits. **Tags:** xml.sequenceOffset=70
byteOrder	ByteOrderEnum	0..1	attr	This attribute specifies the byte order of the base type. **Tags:** xml.sequenceOffset=110
maxBaseTypeSize	PositiveInteger	0..1	attr	Describes the maximum length of the BaseType in bits. **Tags:** atp.Status=obsolete xml.sequenceOffset=80
memAlignment	PositiveInteger	0..1	attr	This attribute describes the alignment of the memory object in bits. E.g. "8" specifies, that the object in question is aligned to a byte while "32" specifies that it is aligned four byte. If the value is set to "0" the meaning shall be interpreted as "unspecified". **Tags:** xml.sequenceOffset=100

Attribute	*Type*	*Mul.*	*Kind*	*Note*

nativeDeclaration	NativeDeclarationString	0..1	attr	This attribute describes the declaration of such a base type in the native programming language, primarily in the Programming language C. This can then be used by a code generator to include the necessary declarations into a header file. For example
				
				BaseType with
				`shortName: "MyUnsignedInt"`
				`nativeDeclaration: "unsigned short"`
				
				Results in
				`typedef unsigned short MyUnsignedInt;`
				
				If the attribute is not defined the referring ImplementationDataTypes will not be generated as a typedef by RTE.
				
				If a nativeDeclaration type is given it shall fulfill the characteristic given by basetypeEncoding and baseTypeSize.
				
				This is required to ensure the consistent handling and interpretation by software components, RTE, COM and MCM systems.
				
				Tags: xml.sequenceOffset=120

Table 3.27: BaseTypeDirectDefinition

3.3.5.1 Bitfield

A prominent example for this kind of implication is the definition of a `nativeDeclaration` for a primitive type that implements an enumeration or a bitfield.

On the *AUTOSAR classic platform*, support for bitfields and enumeration is possible by using specific kinds of `CompuMethod`s.

However, the language C does not provide portable implementations enumerations or bitfields and thus any bitfields and enumerations can only be implemented by means of plain integer data objects.

This changes on the *AUTOSAR adaptive platform*, here it is possible to use native ways for the implementation of a bitfield, i.e. it is possible to set the value of `nativeDeclaration` to `std::bitset<8>` for this purpose.

3.3.5.2 Enumeration

[TPS_MANI_01062] `ImplementationDataType` to generate a C++ `enum` ⌈ On the *AUTOSAR adaptive platform*, it is possible to define an `ImplementationDataType` that refers to a `CompuMethod` of `category` `TEXTTABLE` and use this `ImplementationDataType` to generate a native C++ `enum` out of it. ⌋*(RS_MANI_00016)*

[TPS_MANI_01063] Sharing of `ImplementationDataType` with enumeration semantics ⌈ It is possible to share an `ImplementationDataType` according to [TPS_MANI_01062] between the *AUTOSAR classic platform* and the *AUTOSAR adaptive platform* if the `ImplementationDataType` (via `SwDataDefProps`) does not refer to a `SwBaseType` where attribute `nativeDeclaration` exists.

In other words, the `ImplementationDataType` shall be of `category` `TYPE_REFERENCE` and (via `SwDataDefProps`) refer to another `ImplementationDataType` that has a `shortName` that is identical with a `shortName` of a `platform data type`. ⌋*(RS_MANI_00016)*

[constr_1508] `BaseTypeDirectDefinition.nativeDeclaration` shall not be set to the value `enum` ⌈ For any given `ImplementationDataType`, the actual value of the attribute `swDataDefProps.baseType.baseTypeDefinition.nativeDeclaration` shall **not** be set to the value `enum`. ⌋*()*

Rationale for the existence of [constr_1508]: the attribute `nativeDeclaration` is needed for the specification of the integral C++ data type used for the specification of the enumeration.

Note that the usage of attribute `SwDataDefProps.additionalNativeTypeQualifier` is not required for achieving “native” `enum` semantics in the generated data type.

On the contrary, the usage of this attribute may potentially complicate the sharing of `ImplementationDataType`s between the *AUTOSAR classic platform* and the *AUTOSAR adaptive platform*.

Please note further that the definition of an `enum` is only possible for `CompuMethod`s that represent “pure” enumeration semantics. In cased of a “mixed” semantics (e.g. `CompuMethod` of `category` `SCALE_LINEAR_AND_TEXTTABLE`) it will be necessary to fall back to the generation of symbols in the source code that represent the enumerators.

The details of how an `enum` data type shall be generated out of the formal definition of an `ImplementationDataType` are explained in [7].

3.4 Service Interface

3.4.1 Overview

[TPS_MANI_01001] Meaning of `ServiceInterface` ⌈ Meta-class `ServiceInterface` inherits from `PortInterface` and allows for a heterogeneous aggregation of elements, i.e. it is possible to mix

- aggregation of `VariableDataPrototype` in the role `event` with
- aggregation of meta-class `Field` in the role `field` with
- aggregation of `ClientServerOperation` in the role `method` (with
- aggregation of `ApplicationError` in the role `possibleError`)

within the same `ServiceInterface`. ⌋*(RS_MANI_00003)*

The purpose of this modeling is to embrace the concept of service-oriented communication [3] and better support this paradigm for communication on the *AUTOSAR adaptive platform*.

Please note that, in terms of semantics, the `ApplicationError` represents sort of a second-class citizen (that only makes sense in the presence of `ClientServerOperation` in the role `method`) in the scope of the `ServiceInterface`.

More information can be found in section 3.4.7.

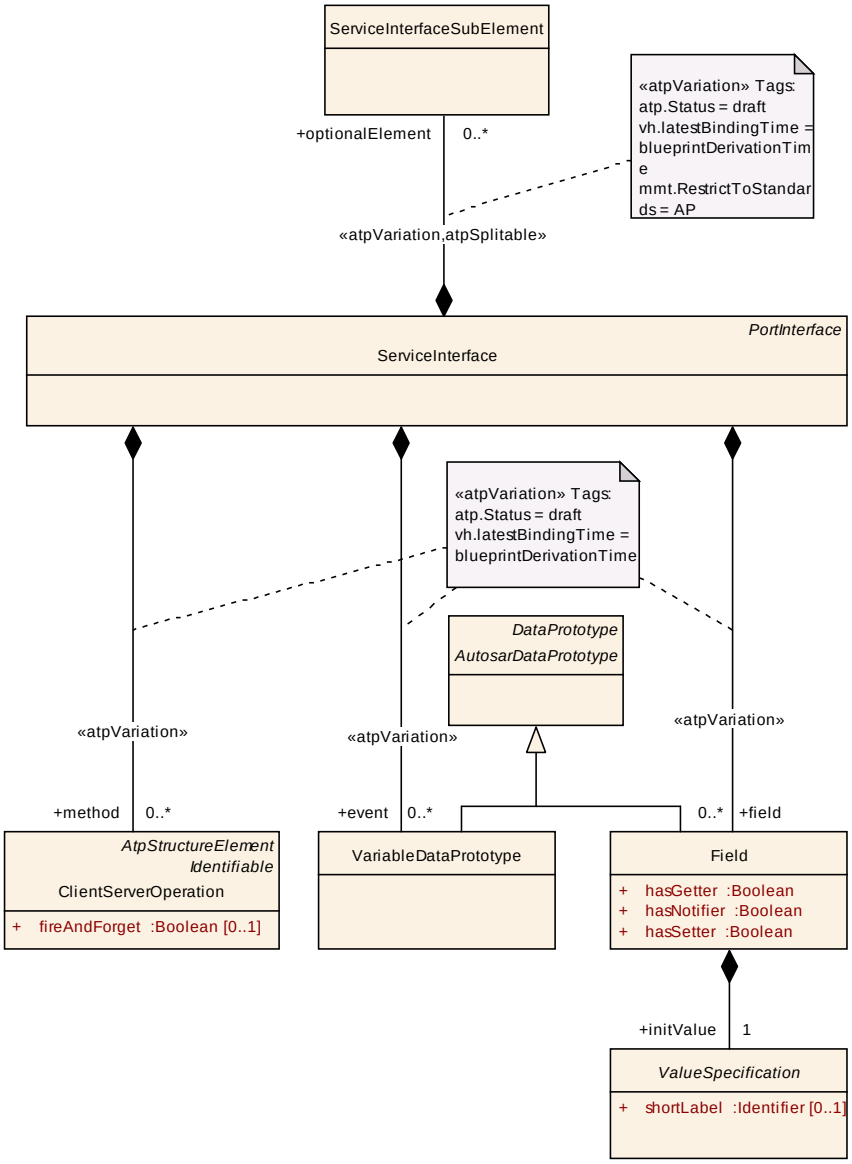


Figure 3.19: Modeling of the `ServiceInterface`

[constr_1483] Applicability of a `ServiceInterface` ⌈ The applicability of a `ServiceInterface` shall be limited to the *AUTOSAR adaptive platform*, i.e. a `ServiceInterface` shall only be taken to type a `PortPrototype` if the latter is aggregated by an `AdaptiveApplicationSwComponentType` or by a `CompositionSwComponentType` defined in the context of an `Executable`. ⌋*()*

Please note that on the *AUTOSAR adaptive platform* there are use-cases for the utilization of a `ServiceInterface` **without** the existence of a corresponding `PortPrototype`. For more explanation, please refer to [TPS_MANI_01032].

Class	**ServiceInterface**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	This represents the ability to define a PortInterface that consists of a heterogeneous collection of methods, events and fields. **Tags:** atp.Status=draft; atp.recommendedPackage=ServiceInterfaces			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *PortInterface*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
event	VariableDataPrototype	*	aggr	This represents the collection of events defined in the context of a ServiceInterface. **Stereotypes:** atpVariation **Tags:** atp.Status=draft vh.latestBindingTime=blueprintDerivationTime
field	Field	*	aggr	This represents the collection of fields defined in the context of a ServiceInterface. **Stereotypes:** atpVariation **Tags:** atp.Status=draft vh.latestBindingTime=blueprintDerivationTime
method	ClientServerOperation	*	aggr	This represents the collection of methods defined in the context of a ServiceInterface. **Stereotypes:** atpVariation **Tags:** atp.Status=draft vh.latestBindingTime=blueprintDerivationTime
optionalElement	ServiceInterfaceSubElement	*	aggr	This aggregation represents the collectionof optional elements within the scope of the enclosing ServiceInterface. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=optionalElement, variationPoint.shortLabel; atp.Status=draft vh.latestBindingTime=blueprintDerivationTime
possibleError	ApplicationError	*	aggr	This represents the collection of ApplicationErrors defined in the context of the enclosing ServiceInterface. **Tags:** atp.Status=draft

Table 3.28: ServiceInterface

[TPS_MANI_01007] Atomic unit of service discovery ⌈ As far as the application level is concerned, the atomic unit for **service discovery** on the *AUTOSAR adaptive platform* is the `ServiceInterface`. ⌋*(RS_MANI_00003)*

Please note that there is no obligation to have any `method`, `event`, or `field` defined in the context of a given `ServiceInterface`. In other words, the existence of a `ServiceInterface` by itself represents a valid semantics that has a value on its own.

For example, a use case could exist where a given service instance that corresponds to such a ServiceInterface is offered with the mere intention to signal that the ECU that provides the service instance is becoming ready for something, e.g. being diagnosed.

A tester could then take the existence of the offer as an indication to initiate a connection to the respective ECU.

3.4.2 Event

[TPS_MANI_01033] Semantics of ServiceInterface.event ⌈ An event represents an update to a piece of data. The server decides when to send this update and makes sure that the event has full control over the value.

The occurrence of an event is transmitted from a server to one or more client(s). ⌋ *(RS_MANI_00003)*

[constr_1494] Initial value for event ⌈ An ServiceInterface.event shall **not** have an initValue. ⌋*()*

For the client, the only way to get access to the value of an event is to receive an update of the event from the server.

As mentioned in [constr_1494], the Server always has full control over the value of the event and when it is sent to clients. Therefore, the definition of an initValue is not necessary.

Class	**VariableDataPrototype**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Datatype::DataPrototypes			
Note	A VariableDataPrototype is used to contain values in an ECU application. This means that most likely a VariableDataPrototype allocates "static" memory on the ECU. In some cases optimization strategies might lead to a situation where the memory allocation can be avoided. In particular, the value of a VariableDataPrototype is likely to change as the ECU on which it is used executes.			
Base	*ARObject*, *AtpFeature*, *AtpPrototype*, *AutosarDataPrototype*, *DataPrototype*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
initValue	ValueSpecification	0..1	aggr	Specifies initial value(s) of the VariableDataPrototype

Table 3.29: VariableDataPrototype

3.4.3 Field

[TPS_MANI_01034] Semantics of `ServiceInterface.field` ⌈ A `field` represents a piece of data hosted by a server that is accessible to one or more client(s) via *get* and/or *set* accessors.

Clients can optionally receive notifications of changes of the `field`'s value. ⌋ *(RS_MANI_00003)*

[constr_1495] Initial value for `field` ⌈ A `field` shall have an `initValue`. ⌋*()*

If a `field` defines `hasGetter` = `True` then the client may access the value of the `Field` at any time and at its own discretion. It is therefore necessary that the `Field` always has a valid value because the client would have no way to distinguish an undefined from a defined value.

Class	**Field**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	This meta-class represents the ability to define a piece of data that can be accessed with read and/or write semantics. It is also possible to generate a notification if the value of the data changes. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpFeature*, *AtpPrototype*, *AutosarDataPrototype*, *DataPrototype*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
hasGetter	Boolean	1	attr	This attribute controls whether read access is foreseen to this field.
hasNotifier	Boolean	1	attr	This attribute controls whether a notification semantics is foreseen to this field.
hasSetter	Boolean	1	attr	This attribute controls whether write access is foreseen to this field.
initValue	ValueSpecification	1	aggr	Specifies initial value(s) of the Field. **Tags:** atp.Status=draft

Table 3.30: Field

3.4.4 Method

[TPS_MANI_01035] Semantics of `ServiceInterface.method` ⌈ A `method` represents a function that is executed by and in the scope of a server on request of one or more client(s). ⌋*(RS_MANI_00003)*

Class	**ClientServerOperation**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::PortInterface			
Note	An operation declared within the scope of a client/server interface.			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
argument (ordered)	ArgumentDataPrototype	*	aggr	An argument of this ClientServerOperation **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=blueprintDerivationTime
fireAndForget	Boolean	0..1	attr	This attribute defines whether this method is a fire&forget method (true) or not (false). **Tags:** atp.Status=draft
possibleError	ApplicationError	*	ref	Possible errors that may by raised by the referring operation.

Table 3.31: ClientServerOperation

3.4.4.1 Fire and Forget Method

A so-called “fire & forget” method represents a special form of a `method` dedicated to the sole purpose of conveying information from a client to a server.

There is no expectation that the implementation of the `method` executes any kind of algorithm other than to merely accept the incoming data.

Spun from this angle, the semantics of a “fire & forget” method is comparable to the semantics of an `event`, only reverse.

In other words, the “fire & forget” method conveys the data and the occurrence of the data **from a client to a server**. For comparison, the `event` is used to convey information in combination with the occurrence of the information from **a server to a client**.

The *occurrence* aspect of this statement has the consequence that e.g. the number of “fire & forget” calls can be counted by the implementation of the server and this meta-information could be taken to convey additional semantics on top of the actual data.

[TPS_MANI_01064] Semantics of attribute `method.fireAndForget` ⌈ The activation of the “fire & forget” semantics of a given `method` is achieved by setting the value of attribute `method.fireAndForget` to value `true`. ⌋*(RS_MANI_00003)*

[TPS_MANI_03118] Semantics of `ServiceInterface.method` with `fireAndForget` set to true ⌈ A `method` with `fireAndForget` set to the value `true` represents a void-return-method where the client is not expecting any kind of acknowledge or handshake from the server side. ⌋*(RS_MANI_00003)*

[constr_3374] `method` with attribute `fireAndForget` set to true shall not have any inout or out arguments ⌈ A `method` that has attribute `fireAndForget` set to the value `true` is not allowed to have any `argument`s with `direction` `inout` or `out`. ⌋*()*

[constr_3375] `method` with attribute `fireAndForget` set to true shall not reference an `ApplicationError` ⌈ A `method` that has attribute `fireAndForget` set to the value `true` is not allowed to reference an `ApplicationError` in role `possibleError`. ⌋*()*

[TPS_MANI_03119] Default value for the attribute `fireAndForget` of meta-class `ClientServerOperation` ⌈ If the attribute `fireAndForget` is not defined then it shall be assumed that no “fire & forget” semantics is intended. ⌋*(RS_MANI_00003)*

3.4.5 Compatibility of Service Interfaces

This chapter defines `ServiceInterface` compatibility rules on the Application Design level that is independent of the later used transport layer.

Each transport layer mechanism (e.g. SOME/IP) may define its own compatibility rules. Therefore for each individual transport layer an own impact assessment on the compatibility needs to be performed whether the changed service interface has an incompatible representation on this transport layer. The compatibility depends on the features that are used on the transport layer. For example, in SOME/IP a length field that is put in front of a struct allows that during deserialization unknown elements at the end of an extensible data struct are skipped. An additional option in SOME/IP is the usage of Data IDs in front of optional struct members. With this approach the receiver can skip unknown members of the struct, i.e. where the Data ID is unknown.

Therefore on the Application Design level all changes of datatypes shall be handled carefully since only the used transport layer and the used features on the transport layer decide whether the change is compatible or not.

[constr_3387] Compatibility of `PortPrototype`s of different `ServiceInterface`s ⌈ `PortPrototype`s of different `ServiceInterface`s are compatible if:

- For each `event` defined in the context of the `ServiceInterface` of the required `PortPrototype` a compatible `event` exists in the `ServiceInterface` of the provided `PortPrototype` according to [constr_3388].
- For each `method` defined in the context of the `ServiceInterface` of the required `PortPrototype` a compatible `method` exists in the `ServiceInterface` of the provided `PortPrototype` according to [constr_3389].
- For each `field` defined in the context of the `ServiceInterface` of the required `PortPrototype` a compatible `field` exists in the `ServiceInterface` of the provided `PortPrototype` according to [constr_3390].

⌋*()*

[constr_3388] Compatibility of `events` ⌈ Two `event`s are assumed as compatible if the following conditions apply:

- the two `event`s have identical `shortName`s.

⌋()

[constr_3389] Compatibility of `methods` ⌈ Two `method`s are assumed as compatible if the following conditions apply:

- the two `method`s have identical `shortName`s.
- the two `method`s have the same number of `ArgumentDataPrototype`s.

⌋()

[constr_3390] Compatibility of `fields` ⌈ Two `field`s are assumed as compatible if the following conditions apply:

- the two `field`s have identical `shortName`s.
- if the attribute `hasNotifier` is set to true for the `field` defined in the context of the `ServiceInterface` of the required `PortPrototype` then the `hasNotifier` attribute in the `field` that is defined in the context of the `ServiceInterface` of the provided `PortPrototype` shall be true as well.
- if the attribute `hasGetter` is set to true for the `field` defined in the context of the `ServiceInterface` of the required `PortPrototype` then the `hasGetter` attribute in the `field` that is defined in the context of the `ServiceInterface` of the provided `PortPrototype` shall be true as well.
- if the attribute `hasSetter` is set to true for the `field` defined in the context of the `ServiceInterface` of the required `PortPrototype` then the `hasSetter` attribute in the `field` that is defined in the context of the `ServiceInterface` of the provided `PortPrototype` shall be true as well.

⌋()

Please note that the constraints [constr_3388], [constr_3389] and [constr_3390] do not make any statements about the compatibility of `AutosarDataType`s of the `AutosarDataPrototype`s. Finally the compatibility rules of the used transport layer will decide whether two `ServiceInterface`s are compatible or not. The constraints defined in this chapter define a basic set of rules that are valid for all supported transport layers. If one wants to make sure that two `AutosarDataPrototype`s inside of a `ServiceInterface` are compatible then both `AutosarDataPrototype`s shall be typed by an identical `AutosarDataType`.

With constraint [constr_3387] a `ServiceInterface` can be updated based on the requirements of one or more consumers, which can start using this new `ServiceInterface` immediately. The other consumers of this service do not need to switch to using the latest version of this `ServiceInterface`, but can continue to use older versions of the `ServiceInterface` they were designed for and tested with.

3.4.6 Namespace

The definition of a ServiceInterface has a direct impact on the code of an application on the *AUTOSAR adaptive platform*.

Without going into too much detail at this point, it is necessary to support the definition of a *namespace* in the context of a ServiceInterface.

The namespace shall be used to encapsulate source code related to the ServiceInterface and thus avoid name clashes with the content of other definitions of ServiceInterfaces.

In principle, the definition of the namespace around a concrete ServiceInterface could be derived from the structure of ARPackages in which the definition of the ServiceInterface is contained. However, this approach puts some constraints of the package structure.

The same ServiceInterface may be used in different projects that may or may not demand the usage of a specific *different* package structure.

This placement of the same ServiceInterface in potentially different package hierarchies would lead to the definition of different namespaces, and thus the necessity to create or generate the code representing the ServiceInterface **plus** the code that uses this definition again and again.

One way to overcome this potential issue is to attach a dedicated namespace definition to the definition of the ServiceInterface itself.

This approach is documented in Figure 3.20.

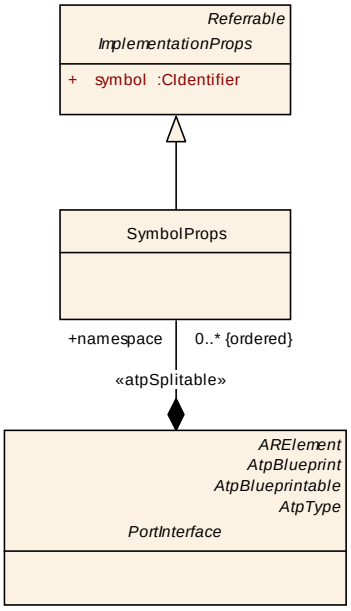


Figure 3.20: Specification of namespaces in PortInterfaces

[TPS_MANI_01004] Semantics of ServiceInterface.namespace ⌈ The aggregation ServiceInterface.namespace shall be used to define the namespace to

be used for the source code that corresponds to the given ServiceInterface. ⌋ *(RS_MANI_00003)*

[TPS_MANI_01005] The definition of the namespace of a ServiceInterface may follow a hierarchical pattern ⌈ The namespace of a ServiceInterface may follow a hierarchical pattern, as supported by many modern programming languages.

The separator between the elements of the hierarchical namespace definition depends on the used programming language and is not explicitly defined in the model.

The model only defines the elements of the hierarchical namespace pattern. ⌋ *(RS_MANI_00003)*

As the consequence of the ability to define a hierarchical namespace, the aggregation ServiceInterface.namespace is qualified as being ordered. This means that the order of individual elements to the collection of namespaces has a semantical relevance[7].

[TPS_MANI_01006] Ordered definition of ServiceInterface.namespace ⌈ In a hierarchical definition of ServiceInterface.namespace the order of namespace fragments shall be maintained in the translation of the namespace to source code.

In other words, the first namespace fragment shall appear first, followed by the second namespace fragment, and so on. ⌋*(RS_MANI_00003)*

Listing 3.7: Example for the definition of a namespace for a given ServiceInterface

```
<SERVICE-INTERFACE>
  <SHORT-NAME>MyServiceInterface</SHORT-NAME>
  <NAMESPACES>
    <SYMBOL-PROPS>
      <SHORT-NAME>first</SHORT-NAME>
      <SYMBOL>com</SYMBOL>
    </SYMBOL-PROPS>
    <SYMBOL-PROPS>
      <SHORT-NAME>second</SHORT-NAME>
      <SYMBOL>myCompany</SYMBOL>
    </SYMBOL-PROPS>
    <SYMBOL-PROPS>
      <SHORT-NAME>third</SHORT-NAME>
      <SYMBOL>software</SYMBOL>
    </SYMBOL-PROPS>
  </NAMESPACES>
</SERVICE-INTERFACE>
```

[7] This means that the definition of a namespace a::b is semantically different from the definition of a namespace b::a.

Class	***PortInterface* (abstract)**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::PortInterface			
Note	Abstract base class for an interface that is either provided or required by a port of a software component.			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Subclasses	ClientServerInterface, *DataInterface*, ModeSwitchInterface, *PersistencyInterface*, *PlatformHealthManagementInterface*, RestServiceInterface, ServiceInterface, *TimeSynchronizationInterface*, TriggerInterface			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
namespace (ordered)	SymbolProps	*	aggr	This represents the SymbolProps used for the definition of a hierarchical namespace applicable for the generation of code artifacts out of the definition of a ServiceInterface. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=shortName; atp.Status=draft

Table 3.32: PortInterface

Class	**SymbolProps**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Components			
Note	This meta-class represents the ability to attach with the symbol attribute a symbolic name that is conform to C language requirements to another meta-class, e.g. AtomicSwComponentType, that is a potential subject to a name clash on the level of RTE source code.			
Base	*ARObject*, *ImplementationProps*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 3.33: SymbolProps

The Listing 3.7 exemplifies the statement made by [TPS_MANI_01006], i.e. the resulting name space in e.g. C++ would look like sketched in Listing 3.8.

```
namespace com {
    namespace myCompany {
        namespace software {

        }
    }
}
```

Listing 3.8: Resulting namespace for the example `ServiceInterface`

3.4.7 Error Handling

[TPS_MANI_01055] Definition of application-level errors ⌈ The ServiceInterface aggregates ApplicationError in the role possibleError in order to allow for the definition of application-level errors. ⌋*(RS_MANI_00003)*

Please note that [constr_1108] specified in AUTOSAR Software Component Template [1] also applies for the possible values of ApplicationError.errorCode on the *AUTOSAR adaptive platform*.

[constr_1491] Semantics of ServiceInterface.possibleError ⌈ A ServiceInterface.possibleError referenced by a given ClientServerOperation shall be owned by the same ServiceInterface that also owns the ClientServerOperation. ⌋*()*

[constr_1522] Semantics of ClientServerOperation.possibleError ⌈ An ApplicationError referenced by a given ClientServerOperation in the role possibleError shall only reference ArgumentDataPrototypes in the role errorContext that are aggregated by the mentioned specific ClientServerOperation. ⌋*()*

One problem that the definition of ApplicationError by itself doesn't really solve is that the information returned back to the caller in case of an error is extremely limited.

By definition, the **caller cannot rely on the value** of out-arguments if an error occurs.

It is, however, considered crucial that the caller has the ability to obtain further information about the nature of an error from the call of a given ClientServerOperation. The existence of ApplicationError.errorContext fixes this problem.

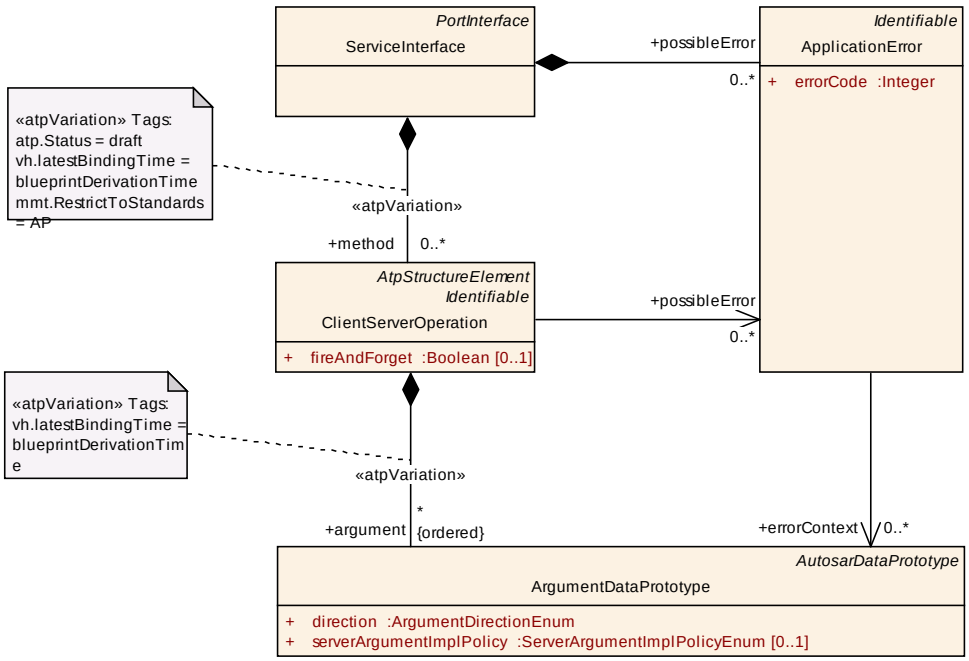


Figure 3.21: Modeling of ApplicationError on the *AUTOSAR adaptive platform*

By this means it is **possible to formally identify operation arguments that will have a valid value** if the call to the respective ClientServerOperation returns with an error indication.

[TPS_MANI_01056] Semantics of ApplicationError.errorContext ⌈ ArgumentDataPrototypes referenced in the role ApplicationError.errorContext are used to convey context information about a given error scenario back to the caller.

Therefore, if an error occurs then ArgumentDataPrototypes referenced in the role ApplicationError.errorContext shall (in contrast to ArgumentDataPrototypes **not** referenced in this role) have a valid value upon termination of the execution of the associated ClientServerOperation. ⌋()

Class	**ApplicationError**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::PortInterface			
Note	This is a user-defined error that is associated with an element of an AUTOSAR interface. It is specific for the particular functionality or service provided by the AUTOSAR software component.			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
errorCode	Integer	1	attr	The RTE generator is forced to assign this value to the corresponding error symbol. Note that for error codes certain ranges are predefined (see RTE specification).
errorContext	ArgumentDataPrototype	*	ref	This reference identifies out arguments that shall have a meaning only if an error occurs. **Tags:** atp.Status=draft; atp.StatusComment=Reserved for AUTOSAR adaptive platform

Table 3.34: ApplicationError

[constr_1493] ArgumentDataPrototype referenced in the role ApplicationError.errorContext ⌈ The reference to ArgumentDataPrototype in the role ApplicationError.errorContext is **only** supported for ArgumentDataPrototypes where attribute direction is set to out. ⌋()

Class	**ArgumentDataPrototype**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::PortInterface			
Note	An argument of an operation, much like a data element, but also carries direction information and is owned by a particular ClientServerOperation.			
Base	*ARObject*, *AtpFeature*, *AtpPrototype*, *AutosarDataPrototype*, *DataPrototype*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
direction	ArgumentDirectionEnum	1	attr	This attribute specifies the direction of the argument prototype.

Attribute	*Type*	*Mul.*	*Kind*	*Note*
serverArgumentImplPolicy	ServerArgumentImplPolicyEnum	0..1	attr	This defines how the argument type of the servers RunnableEntity is implemented. If the attribute is not defined this has the same semantics as if the attribute is set to the value useArgumentType for primitive arguments and structures and to the value useArrayBaseType for arrays.

Table 3.35: ArgumentDataPrototype

Enumeration	**ArgumentDirectionEnum**
Package	M2::AUTOSARTemplates::GenericStructure::GeneralTemplateClasses::PrimitiveTypes
Note	Use cases: • Arguments in ClientServerOperation can have different directions that need to be formally indicated because they have an impact on how the function signature looks like eventually. • Arguments in BswModuleEntry already determine a function signature, but the direction is used to specify the semantics, especially of pointer arguments.
Literal	***Description***
in	The argument value is passed to the callee. **Tags:** atp.EnumerationValue=0
inout	The argument value is passed to the callee but also passed back from the callee to the caller. **Tags:** atp.EnumerationValue=1
out	The argument value is passed from the callee to the caller. **Tags:** atp.EnumerationValue=2

Table 3.36: ArgumentDirectionEnum

3.4.8 Service Interface Data Type Mapping

An important step in the workflow of implementing software on the *AUTOSAR adaptive platform* is the creation of a code-based representation of a `ServiceInterface` to make it accessible for the application code.

This creation of a code-based representation is usually automatized and will be executed by a code generator. This code generator needs an input from the model. The main input for this purpose is obviously the definition of the `ServiceInterface` itself.

However, this is not sufficient. The designer of a ServiceInterface is free to use ApplicationDataTypes for the specification of the details of the ServiceInterface.

It is therefore necessary to provide the definition of an ImplementationDataType for each of the used ApplicationDataType. In the meta-model, this correspondence is implemented by means of the meta-class DataTypeMappingSet[8].

However, from the methodological point of view it is considered inappropriate to let ServiceInterface directly refer to one or more DataTypeMappingSet(s).

For clarification, this would mean that the mapping of ApplicationDataType to ImplementationDataType becomes an integral part of the definition of the ServiceInterface although the mapping itself does not really contribute to the actual semantics of the ServiceInterface.

As a consequence, the ServiceInterface would have to be updated whenever the mapping between data types changes.

But since the definition of ServiceInterfaces are usually considered very stable a frequent update for the mere purpose of acknowledging a change in the data type mapping is not acceptable.

In this concrete case, the described problem can be circumvented by the definition of a mapping class that refers to both a ServiceInterface and a DataTypeMappingSet and therefore create the correspondence without the need to update the ServiceInterface.

Although the prelude into this chapter suggests the existence of a meta-class that maps a ServiceInterface to one or more DataTypeMappingSet(s) the actual meta-model is designed with a broader focus.

In the future, there could be further kinds of PortInterfaces beside the ServiceInterface that need to fulfill the same use case.

Consequently, the name of the meta-class created for this purpose is PortInterfaceToDataTypeMapping.

[8]For more background regarding the definition and use of meta-class DataTypeMappingSet please refer to [1].

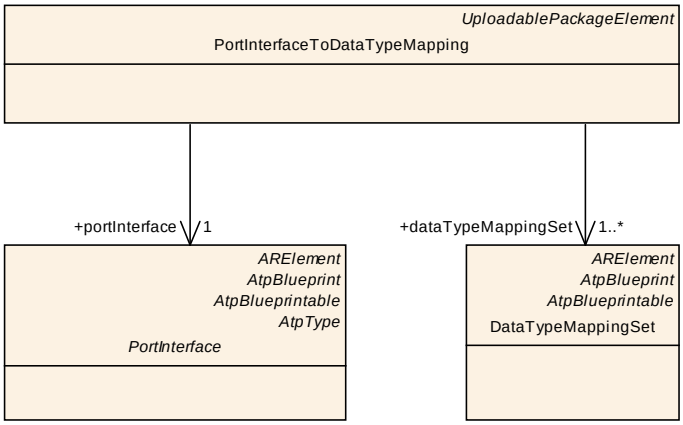


Figure 3.22: Modeling of `PortInterfaceToDataTypeMapping`

[constr_1507] `PortInterfaceToDataTypeMapping` is only applicable to `ServiceInterface` ⌈ `PortInterfaceToDataTypeMapping.portInterface` shall only refer to **either** a `ServiceInterface` **or** a `PersistencyKeyValueDatabaseInterface`. ⌋()

Class	**PortInterfaceToDataTypeMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	This meta-class represents the ability to associate a PortInterface with a DataTypeMappingSet. This association is needed for the generation of header files in the scope of a single PortInterface. The association is intentionally made outside the scope of the PortInterface itself because the designers of a PortInterface most likely will not want to add details about the level of ImplementationDataType. **Tags:** atp.Status=draft; atp.recommendedPackage=ServiceInterfaceToDataType Mappings			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dataTypeMappingSet	DataTypeMappingSet	1..*	ref	This represents the reference to the applicable dataTypemappingSet **Tags:** atp.Status=draft; atp.Status Comment=Reserved for adaptive platform
portInterface	PortInterface	1	ref	This represents the reference to the applicable PortInterface **Tags:** atp.Status=draft; atp.Status Comment=Reserved for adaptive platform

Table 3.37: PortInterfaceToDataTypeMapping

Class	**DataTypeMappingSet**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Datatype::Datatypes			
Note	This class represents a list of mappings between ApplicationDataTypes and ImplementationDataTypes. In addition, it can contain mappings between ImplementationDataTypes and ModeDeclarationGroups. **Tags:** atp.recommendedPackage=DataTypeMappingSets			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dataTypeMap	DataTypeMap	*	aggr	This is one particular association between an ApplicationDataType and its ImplementationDataType.
modeRequestTypeMap	ModeRequestTypeMap	*	aggr	This is one particular association between an ModeDeclarationGroup and its ImplementationDataType.

Table 3.38: DataTypeMappingSet

Class	**DataTypeMap**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Datatype::Datatypes			
Note	This class represents the relationship between ApplicationDataType and its implementing ImplementationDataType.			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
applicationDataType	ApplicationDataType	1	ref	This is the corresponding ApplicationDataType
implementationDataType	AbstractImplementationDataType	1	ref	This is the corresponding ImplementationDataType.

Table 3.39: DataTypeMap

3.5 Service Interface Mapping

Please note that, according to [TPS_MANI_01007], the `ServiceInterface` becomes the single basis for both `VFB`-based and *external* (i.e. using communication networks) communication.

This concept is in stark contrast to the approach on the *AUTOSAR classic platform* where different model elements are used for the `VFB`-level (`PortInterface`) and the network-level (`SystemSignal`, `ISignal`, and `ISignalIPdu`).

The usage of different model elements optimally supports the existence of different granularity for `VFB`-based vs. network-based communication.

In other words, design of communication on the network level may be subject to different design restrictions, e.g. keep the bus load caused by service discovery manageable by defining coarse-grained communication packages.

Opposed to that, designers on the VFB level may want to define interface granularity to achieve maximum reusability.

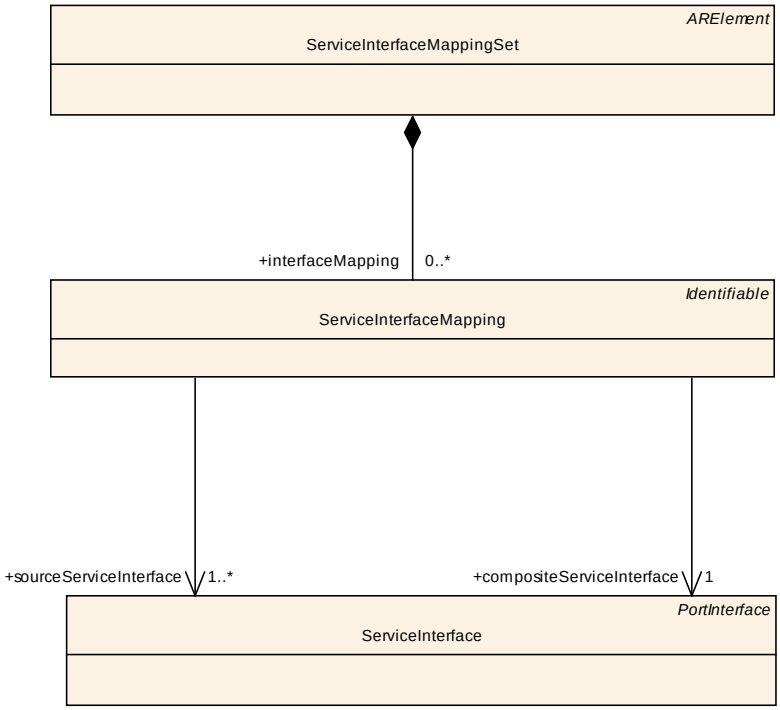


Figure 3.23: Modeling of the ServiceInterfaceMapping

[TPS_MANI_01002] Semantics of meta-class ServiceInterfaceMapping ⌈ In order to sort out a potentially different motivation between the definition of

- ServiceInterfaces explicitly designed for VFB-based communication and
- ServiceInterfaces explicitly designed for network-based communication

meta-class ServiceInterfaceMapping is available to map

- (fine-grained) ServiceInterfaces for the VFB-communication to
- (coarse-grained) ServiceInterfaces for network communication.

⌋*(RS_MANI_00017)*

[TPS_MANI_01032] Usage of ServiceInterfaceMapping ⌈ The ability to apply a ServiceInterfaceMapping can be used in two different ways:

- It is possible to derive a dedicated AdaptiveApplicationSwComponentType that implements the mapping functionality. A SwComponentPrototype derived from this so-called *facade* software-component would expose PortPrototypes for each of the ServiceInterfaces.

  Other SwComponentPrototypes could then “connect” to the PortPrototypes typed by ServiceInterfaces referenced in the role sourceServiceInterface.

The PortPrototype typed by the ServiceInterface referenced in the role compositeServiceInterface is used for external communication.

- It is also possible to configure the communication middleware to offer or require a service typed by the ServiceInterface referenced in the role composite-ServiceInterface.

  A configuration of the relevant ids for this scenario is possible as part of the Application Manifest.

⌋(*RS_MANI_00017*)

Figure 3.24 summarizes the idea behind the creation of a *facade* software-component. The latter is able to "bundle" the communication of different PortPrototypes owned by potentially different SwComponentTypes for external communication.

In other words, elements event1 owned by SWC1 and event2 owned by SWC1 are combined into one ServiceInterface used to type one PortPrototype of the *facade* software-component.

From the communication-related outside point-of-view, SWC3 acts like a facade to the "inner structure" created by SWC1 and SWC2 that is, by way of the existence of SWC3, abstracted away.

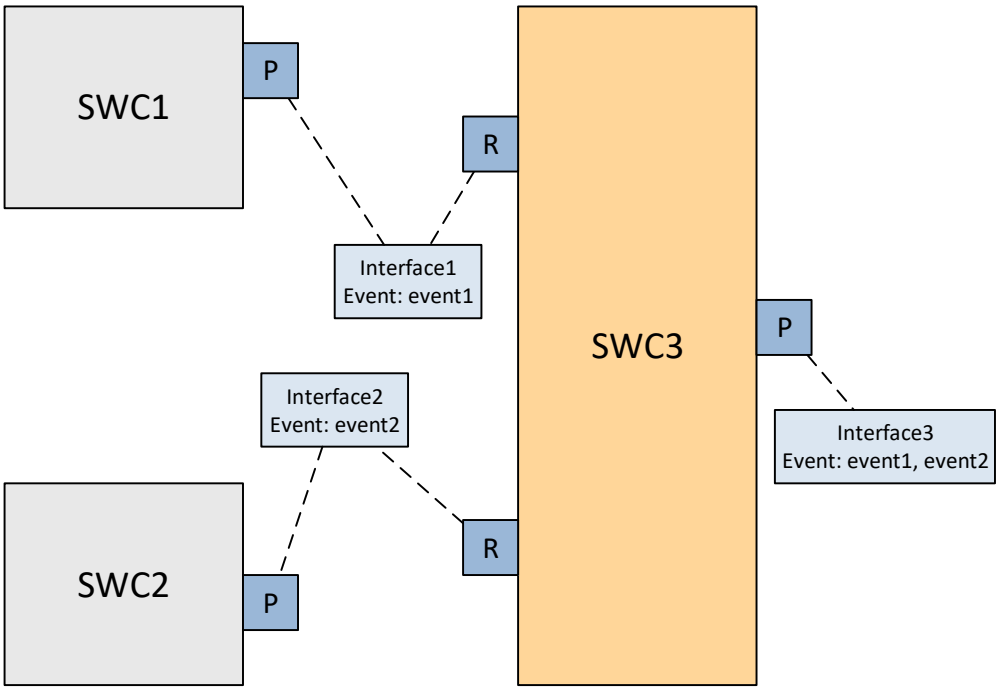


Figure 3.24: Concept of a facade software-component

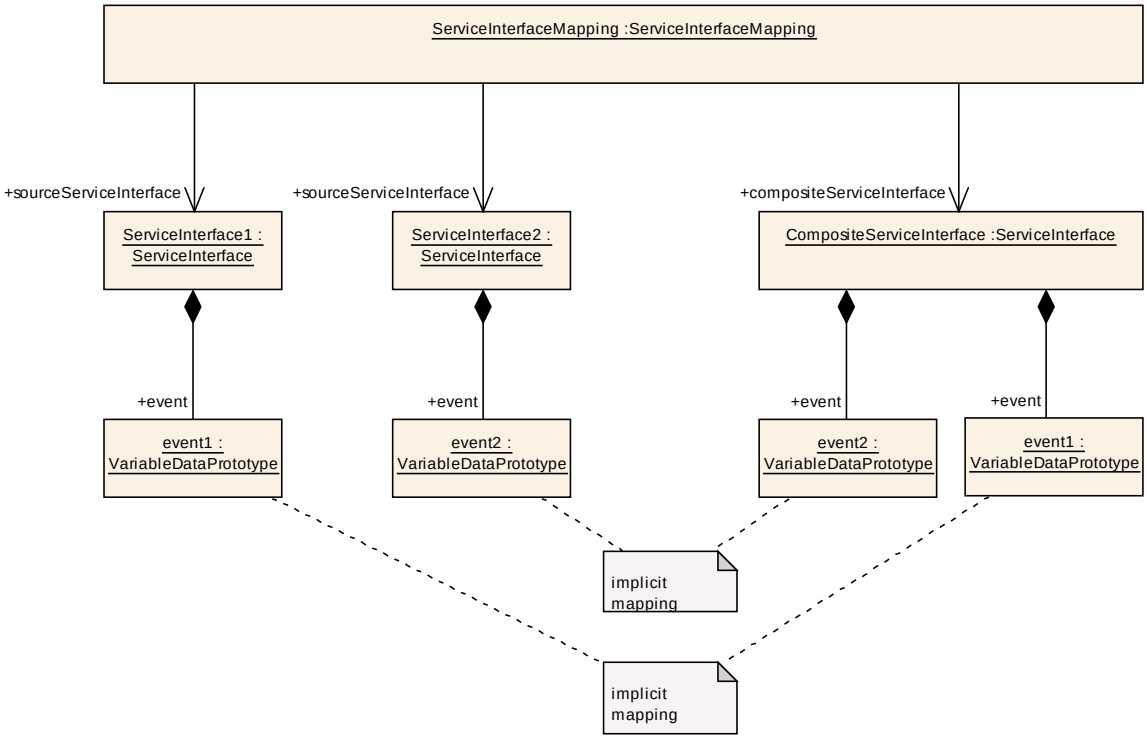


Figure 3.25: Example for the application of a `ServiceInterfaceMapping`

[TPS_MANI_01022] Concept behind `ServiceInterfaceMapping` ⌈ The concept behind the definition of a `ServiceInterfaceMapping` is that **all elements** of the `sourceServiceInterface` are required to have a **counterpart of the same kind** (`ServiceInterface.event`, `ServiceInterface.field`, or `ServiceInterface.method`) and with the identical `shortName`. ⌋*(RS_MANI_00017)*

The regulation stated in [TPS_MANI_01022] is exemplified in Figure 3.25.

Please note that the creation of a `ServiceInterfaceMapping` is considered an atomic step, it is unlikely that such a `ServiceInterfaceMapping` is partially created and then later finished by a different party.

After all, there are mutually exclusive ways to specify the mapping, and any creator of a partial mapping of `ServiceInterface`s could not be sure which of the alternatives apply for a specific pairing of one `ServiceInterface` with another without already knowing the other `ServiceInterface` (in which case the mapping can already be completed).

Therefore, there is no need to set the lower multiplicity of the references to `ServiceInterface` to 0.

Class	**ServiceInterfaceMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ServiceInterface Mapping			
Note	Specifies one ServiceInterfaceMapping that allows to define that a ServiceInterface is composite of several other ServiceInterfaces. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
compositeServiceInterface	ServiceInterface	1	ref	This represents the composite ServiceInterface. **Tags:** atp.Status=draft
sourceServiceInterface	ServiceInterface	1..*	ref	ServiceInterface that is mapped into the composite ServiceInterface. **Tags:** atp.Status=draft

Table 3.40: ServiceInterfaceMapping

Class	**ServiceInterfaceMappingSet**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ServiceInterface Mapping			
Note	This meta-class represents the ability to aggregate a collection of ServiceInterfaceElementMappings. **Tags:** atp.Status=draft; atp.recommendedPackage=ServiceInterfaceMappingSets			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
elementMapping	ServiceInterfaceElementMapping	*	aggr	This represents the collection of ServiceInterfaceElementMappings aggregated at the ServiceInterfaceElementMappingSet **Tags:** atp.Status=draft
interfaceMapping	ServiceInterfaceMapping	*	aggr	This represents the collection of ServiceInterfaceMappings owned by the ServiceInterfaceMappingSet. **Tags:** atp.Status=draft

Table 3.41: ServiceInterfaceMappingSet

[TPS_MANI_01003] Limitation of the applicability of `ServiceInterfaceMapping` ⌈ The applicability of the `ServiceInterfaceMapping` is limited to cases where the `shortName`s of the elements of the `compositeServiceInterface` are **unique** in the context of the `compositeServiceInterface`. ⌋*(RS_MANI_00017)*

As already indicated, the meta-class `ServiceInterfaceMappingSet` has been defined as a container for both `ServiceInterfaceMapping`s as well as the `ServiceInterfaceElementMapping` introduced in section 3.6.

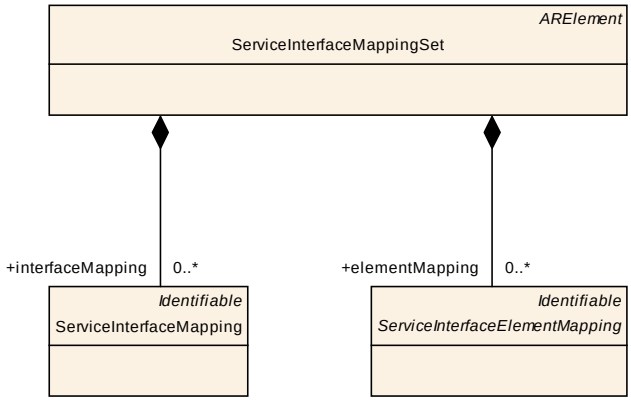


Figure 3.26: Modeling of the `ServiceInterfaceMappingSet`

Note that the `ServiceInterfaceMapping` is not an up-front association (by means of `SwConnector`s) between communication ends in the sense of section 3.4.5.

As stated in [TPS_MANI_01032], the `ServiceInterfaceMapping` allows for the derivation of a facade software-component or a proper configuration of the communication middleware.

The compatibility between the `sourceServiceInterface`s and the `compositeServiceInterface` is achieved by an adequate transformation implemented in the facade software-component or the configuration of the middleware.

Thus, connecting `ServiceInterface`s (or parts of them) via `ServiceInterfaceMapping`s is not constrained by any compatibility rules apart from the ones stated in [TPS_MANI_01022].

3.6 Service Interface Element Mapping

3.6.1 Overview

The existence of the `ServiceInterfaceMapping` leaves the question about how `ServiceInterface`s where elements have non-matching `shortName` can be mapped.

The answer to this question is provided by the ability to create an element-wise mapping of elements of the same kind.

Figure 3.27 provides an example of how such a mapping on element basis looks like. Note that, in this example, both `ServiceInterface1` and `ServiceInterface2` aggregate a `field` with the `shortName` `field1`.

This configurations disqualifies the scenario from the application of the `ServiceInterfaceMapping`, as of [TPS_MANI_01003]. The element-wise mapping, however, is able to work around the existence of the `shortName` `field1` in both “source” `ServiceInterface`s quite nicely:

- `ServiceInterface1.field1` is mapped to `CompositeServiceInterface.leftField`
- `ServiceInterface2.field1` is mapped to `CompositeServiceInterface.rightField`

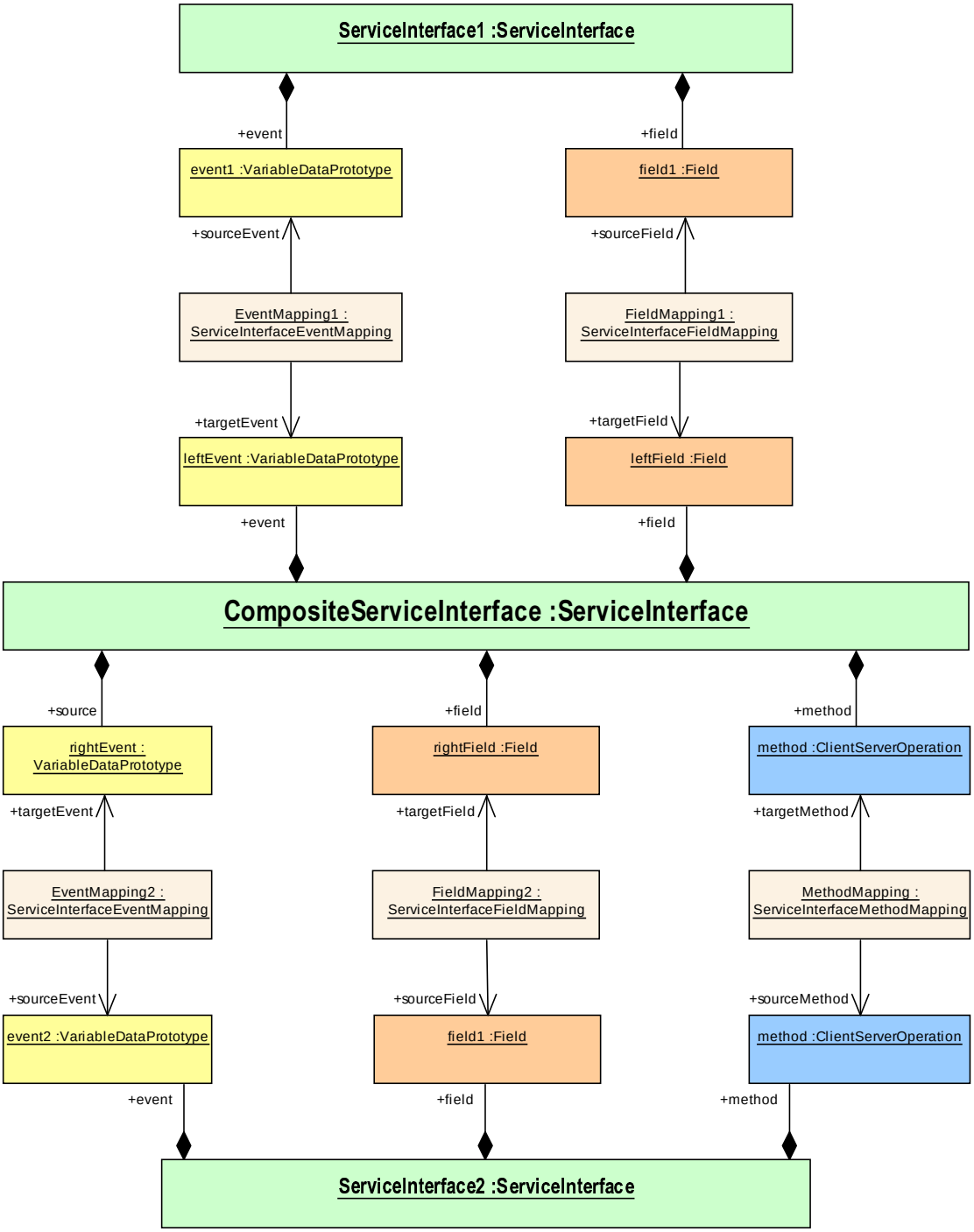


Figure 3.27: Example for a mapping of elements of `ServiceInterface`

The formal modeling of the individual mappings is described in section 3.6.

Please note that it is **not intended** to mix a mapping of ServiceInterfaces with a mapping of elements of a ServiceInterface.

In other words, as soon as a mapping between two ServiceInterfaces exists, it is not supported that a mapping between elements of the same pair of ServiceInterfaces exists. This important restriction is formalized by [constr_1482].

[constr_1482] Mapping of service interfaces vs. mapping of service interface elements ⌈ In order to establish a mapping between a given pair of ServiceInterfaces, at most **one of** the following alternatives can exist:

- the given pair of ServiceInterfaces is referenced by a ServiceInterfaceMapping, where one ServiceInterface is referenced in the role sourceServiceInterface and the other ServiceInterface is referenced in the role compositeServiceInterface.
- an arbitrary mixture of the following options exists:
  - an event aggregated by one of the given ServiceInterfaces is referenced by a ServiceInterfaceEventMapping in the role sourceEvent and one events aggregated by the other given ServiceInterface is referenced by the same ServiceInterfaceEventMapping in the role targetEvent.
  - a field aggregated by one of the given ServiceInterfaces is referenced by a ServiceInterfaceFieldMapping in the role sourceField and one fields aggregated by the other given ServiceInterface is referenced by the same ServiceInterfaceFieldMapping in the role targetField.
  - a method aggregated by one of the given ServiceInterfaces is referenced by a ServiceInterfaceMethodMapping in the role sourceMethod and one methods aggregated by the other given ServiceInterface is referenced by the same ServiceInterfaceMethodMapping in the role targetMethod.

⌋()

Of course, it is possible that the same ServiceInterface is referenced by mappings to elements and mappings to entire ServiceInterfaces. The limitation formalized in [constr_1482] always applies to a **pair** of ServiceInterfaces.

A mapping between elements of ServiceInterfaces is modeled by means of a subclass of the abstract meta-class ServiceInterfaceElementMapping.

Class	***ServiceInterfaceElementMapping* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ServiceInterface Mapping			
Note	This abstract meta-class acts as base class for the mapping of specific elements of a ServiceInterface. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	ServiceInterfaceApplicationErrorMapping, ServiceInterfaceEventMapping, ServiceInterfaceFieldMapping, ServiceInterfaceMethodMapping			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 3.42: ServiceInterfaceElementMapping

`ServiceInterfaceElementMapping`s are aggregated by a `ServiceInterfaceMappingSet` that – in principle – allows for an arbitrary grouping of `ServiceInterfaceElementMapping`s.

Please note that the creation of a `ServiceInterfaceElementMapping` is considered an atomic step, i.e. it is unlikely that such a `ServiceInterfaceElementMapping` is partially created, handed over to a different party and then later finished by that different party.

After all, there are mutually exclusive ways to specify the mapping, and any creator of a partial mapping of `ServiceInterface`s could not be sure which of the alternatives apply for a specific pairing of one `ServiceInterface` with another without already knowing the other `ServiceInterface` (in which case the mapping can already be completed).

Therefore, there is no need to set the lower multiplicity of the references to elements of the `ServiceInterface` to 0.

3.6.2 Service Interface Event Mapping

[TPS_MANI_01024] Semantics of `ServiceInterfaceEventMapping` ⌈ Meta-class `ServiceInterfaceEventMapping` has the ability to map a `ServiceInterface.event` referenced in the role `sourceEvent` explicitly to another `ServiceInterface.event` referenced in the role `targetEvent`. ⌋*(RS_MANI_00017)*

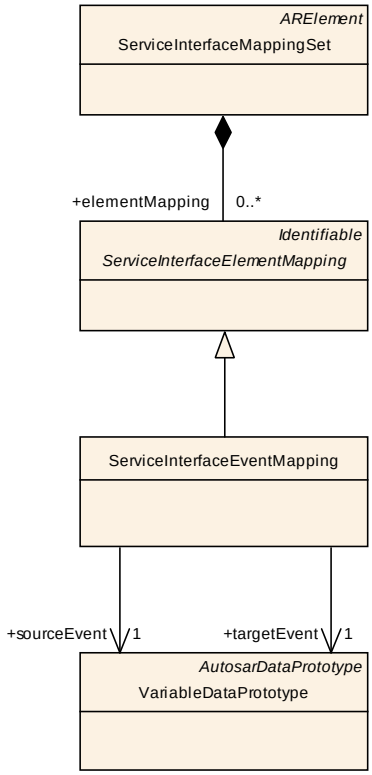


Figure 3.28: Modeling of the `ServiceInterfaceEventMapping`

Class	**ServiceInterfaceEventMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ServiceInterface Mapping			
Note	This meta-class allows to define a mapping between events of ServiceInterfaces that are mapped to each other by the ServiceInterfaceMapping. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *ServiceInterface ElementMapping*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
sourceEvent	VariableDataPrototype	1	ref	Reference to an event that is contained in the source ServiceInterface. **Tags:** atp.Status=draft
targetEvent	VariableDataPrototype	1	ref	Reference to an event that is contained in the composite ServiceInterface. **Tags:** atp.Status=draft

Table 3.43: ServiceInterfaceEventMapping

The explicit mapping implemented by `ServiceInterfaceEventMapping` does **not** require equal `shortName`s on both sides of the mapping.

It is also possible to map a given event of a given ServiceInterface multiple times in different roles to the ServiceInterface that aggregates the targetEvent, as exemplified by Figure 3.29.

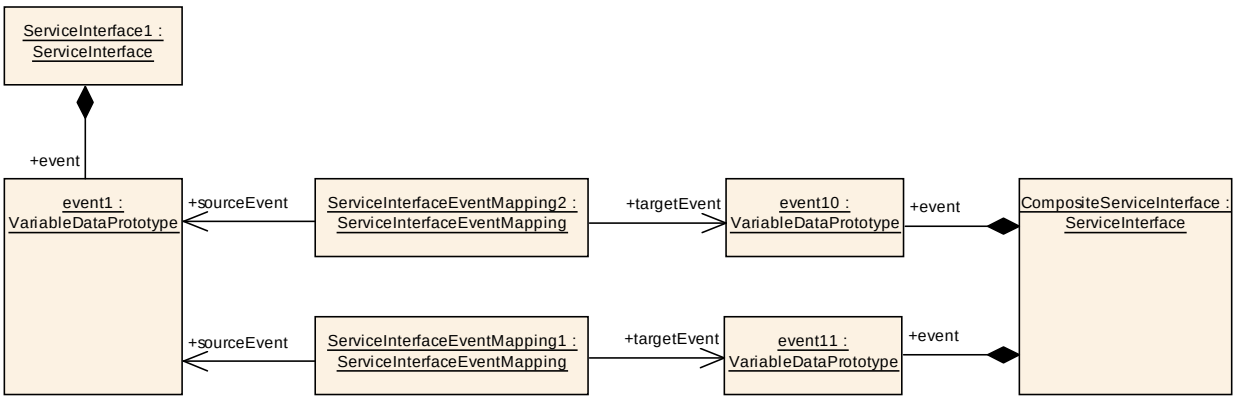


Figure 3.29: Example for the application of a ServiceInterfaceEventMapping

Please note that the mapping of one sourceEvent to different targetEvents does **not** represent a *fan-out* of any kind.

It only means that the sourceEvent will be used in different roles, as specified in the deployment. For more explanation, please find an example of how the role-based mapping of elements of ServiceInterfaces works in Figure A.5.

3.6.3 Service Interface Field Mapping

[TPS_MANI_01025] Semantics of ServiceInterfaceFieldMapping ⌈ Meta-class ServiceInterfaceFieldMapping has the ability to map a ServiceInterface.field referenced in the role sourceField explicitly to another ServiceInterface.field referenced in the role targetField. ⌋*(RS_MANI_00017)*

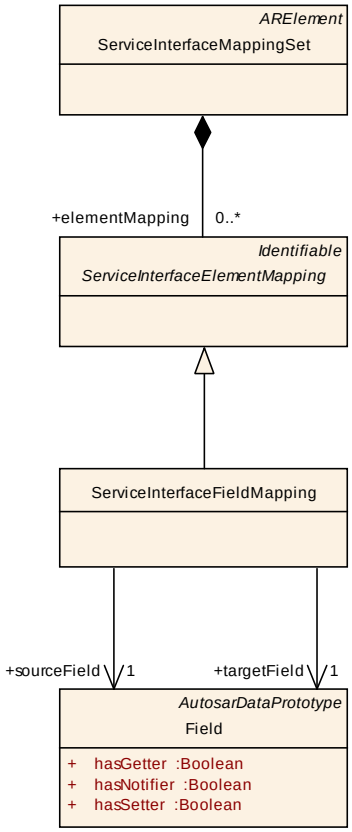


Figure 3.30: Modeling of the `ServiceInterfaceFieldMapping`

Class	**ServiceInterfaceFieldMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ServiceInterface Mapping			
Note	This meta-class allows to define a mapping between fields of ServiceInterfaces that are mapped to each other by the ServiceInterfaceMapping. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *ServiceInterface ElementMapping*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
sourceField	Field	1	ref	Reference to a field that is contained in the source ServiceInterface. **Tags:** atp.Status=draft
targetField	Field	1	ref	Reference to a field that is contained in the composite ServiceInterface. **Tags:** atp.Status=draft

Table 3.44: ServiceInterfaceFieldMapping

The explicit mapping implemented by `ServiceInterfaceFieldMapping` does **not** require equal `shortName`s on both sides of the mapping.

It is also possible to map a given `field` of a given `ServiceInterface` multiple times in different roles to the `ServiceInterface` that aggregates the `targetField`, as exemplified by Figure 3.31.

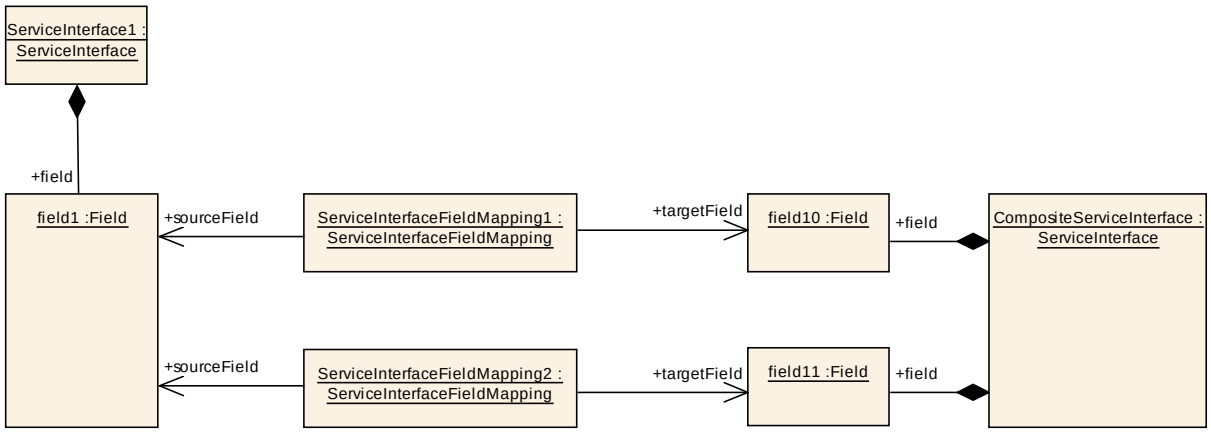


Figure 3.31: Example for the application of a `ServiceInterfaceFieldMapping`

Please note that the mapping of one `sourceField` to different `targetField`s does **not** represent a *fan-out* of any kind.

It only means that the `sourceField` will be used in different roles, as specified in the deployment. For more explanation, please find an example of how the role-based mapping of elements of `ServiceInterface`s works in Figure A.5.

3.6.4 Service Interface Method Mapping

[TPS_MANI_01026] Semantics of `ServiceInterfaceMethodMapping` ⌈ Meta-class `ServiceInterfaceMethodMapping` has the ability to map a `ServiceInterface.method` referenced in the role `sourceMethod` explicitly to another `ServiceInterface.method` referenced in the role `targetMethod`. ⌋*(RS_MANI_00017)*

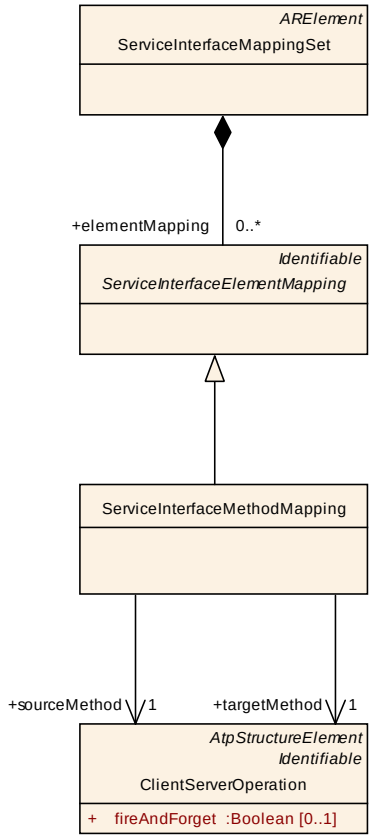


Figure 3.32: Modeling of the `ServiceInterfaceMethodMapping`

Class	**ServiceInterfaceMethodMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ServiceInterface Mapping			
Note	This meta-class allows to define a mapping between methods of ServiceInterfaces that are mapped to each other by the ServiceInterfaceMapping. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *ServiceInterface ElementMapping*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
sourceMethod	ClientServerOperation	1	ref	Reference to a method that is contained in the source ServiceInterface. **Tags:** atp.Status=draft
targetMethod	ClientServerOperation	1	ref	Reference to a method that is contained in the composite ServiceInterface. **Tags:** atp.Status=draft

Table 3.45: ServiceInterfaceMethodMapping

The explicit mapping implemented by `ServiceInterfaceMethodMapping` does **not** require equal `shortName`s on both sides of the mapping.

It is also possible to map a given method of a given ServiceInterface multiple times in different roles to the ServiceInterface that aggregates the targetMethod, as exemplified by Figure 3.33.

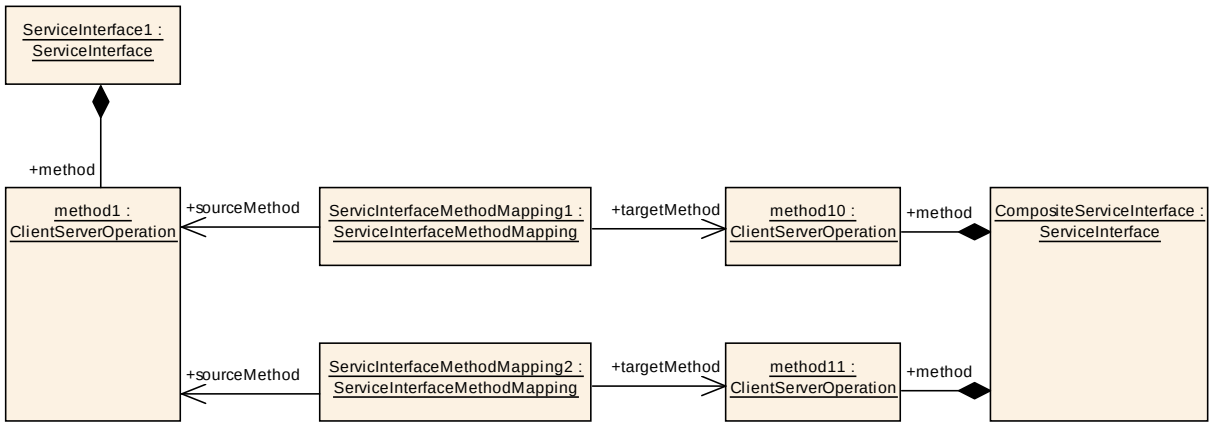


Figure 3.33: Example for the application of a ServiceInterfaceMethodMapping

Please note that the mapping of one sourceMethod to different targetMethods does **not** represent a *fan-out* of any kind.

It only means that the sourceMethod will be used in different roles, as specified in the deployment. For more explanation, please find an example of how the role-based mapping of elements of ServiceInterfaces works in Figure A.5.

3.6.5 Service Interface Application Error Mapping

[TPS_MANI_01058] Ability to create a mapping of ApplicationErrors aggregated in the role possibleError ⌈ Apart from the "first-class citizen" of a ServiceInterface, i.e. event, method, and field, there is also the ability to create a mapping of ApplicationErrors aggregated in the role possibleError. ⌋ *(RS_MANI_00017)*

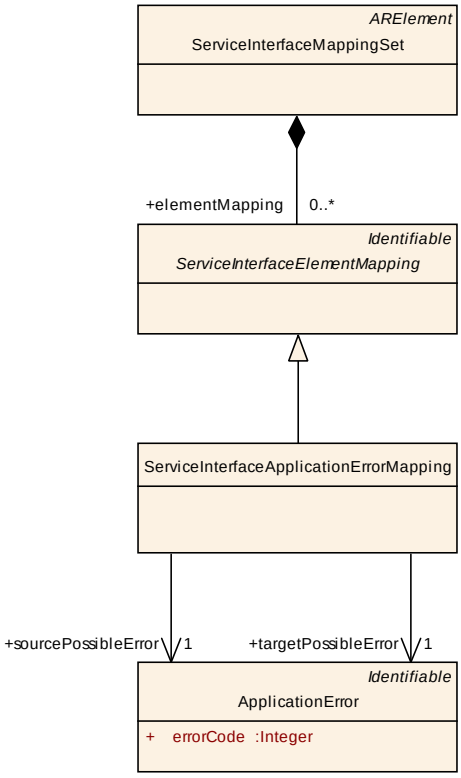


Figure 3.34: Modeling of the `ServiceInterfaceApplicationErrorMapping`

Class	**ServiceInterfaceApplicationErrorMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ServiceInterface Mapping			
Note	This meta-class allows to define a mapping between possibleErrors of ServiceInterfaces that are mapped to each other by the ServiceInterfaceMapping. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *ServiceInterface ElementMapping*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
sourcePossibleError	ApplicationError	1	ref	This reference represents the source end of the ApplicationError mapping. **Tags:** atp.Status=draft; atp.Status Comment=Reserved for adaptive platform
targetPossibleError	ApplicationError	1	ref	This reference represents the target end of the ApplicationError mapping **Tags:** atp.Status=draft; atp.Status Comment=Reserved for adaptive platform

Table 3.46: ServiceInterfaceApplicationErrorMapping

3.7 Persistency Interface

3.7.1 Overview

The *AUTOSAR adaptive platform* foresees a support for access to persistent data by e.g. application software.

There are some similarities to the communication model in terms of the usage of `PortPrototype`s.

In contrast to the configuration of communication, however, the modeling approach is much less detailed (i.e. instead of providing access to individual elements of a database an entire database is accessible on the level of `PortPrototype`).

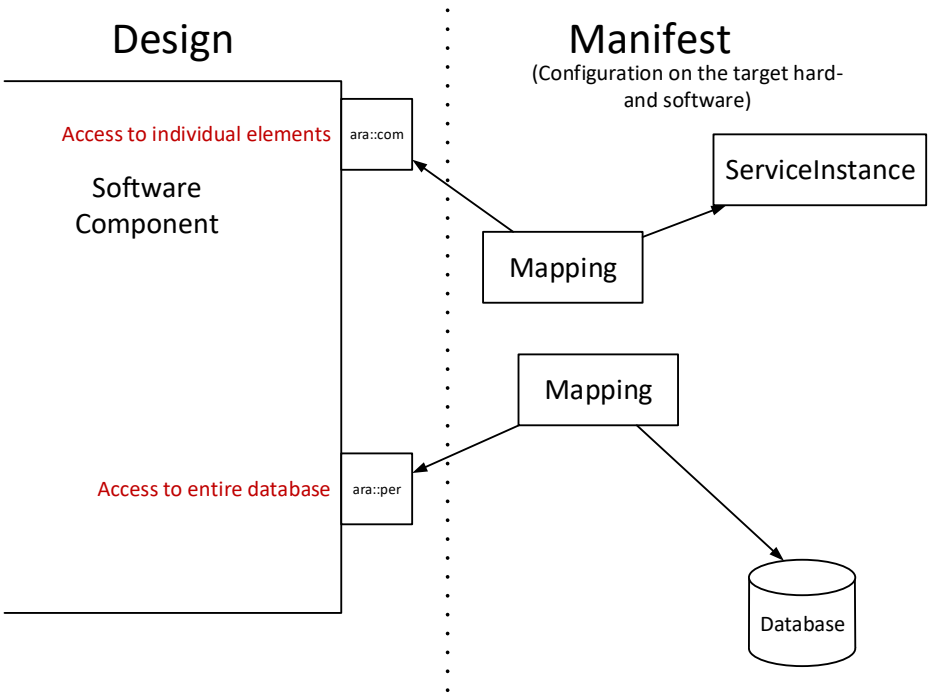


Figure 3.35: General approach for the modeling of persistency

The aspect of deployment for the configuration of persistent data is explained in Figure 3.35.

Please note that the AUTOSAR meta-model actually defines two separate meta-classes (for more details, please refer to Figure 3.36) for the different use cases of access to persistent data (i.e. `PersistencyKeyValueDatabaseInterface`) and access to files on the file system, or maybe an emulation of one (by means of `PersistencyFileProxyInterface`).

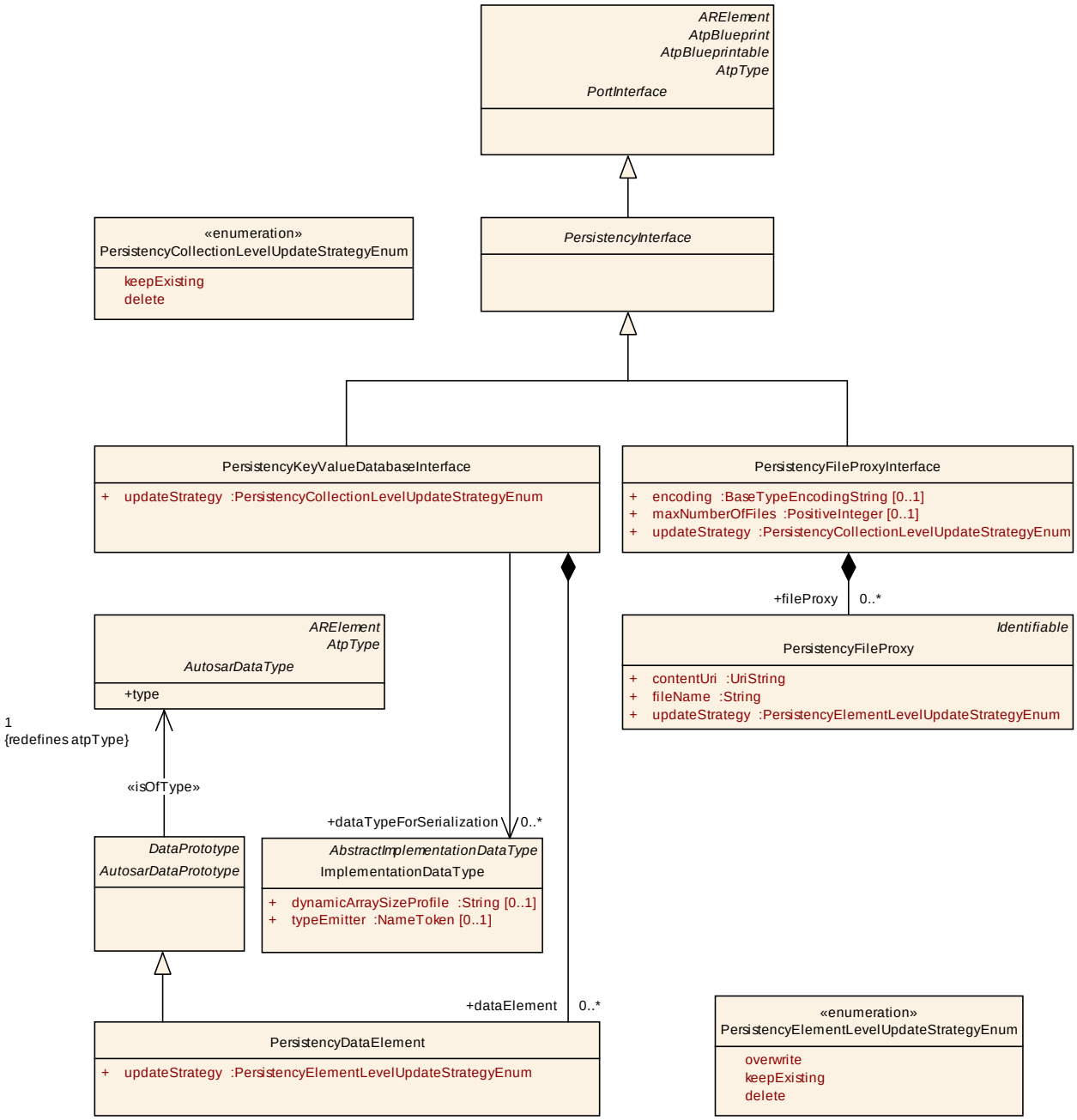


Figure 3.36: Specification of `PortInterface`s for persistency use cases

Abstract meta-class `PersistencyInterface` has been created as a means of categorization, i.e. it allows for easily referring to `PortInterface`s dedicated to persistency in general.

Class	***PersistencyInterface* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	This meta-class provides the abstract ability to define a PortInterface for the support of persistency use cases. **Tags:** atp.Status=draft			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *PortInterface*, *Referrable*			
Subclasses	PersistencyFileProxyInterface, PersistencyKeyValueDatabaseInterface			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 3.47: PersistencyInterface

3.7.2 Persistency Key Value Database Interface

[TPS_MANI_01065] Purpose of `PersistencyKeyValueDatabaseInterface` ⌈ The purpose of the `PersistencyKeyValueDatabaseInterface` is to support the persistent access to data in a key-value database. ⌋*(RS_MANI_00027)*

Class	**PersistencyKeyValueDatabaseInterface**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	This meta-class provides the ability to implement a PortInterface for supporting persistency use cases for data. **Tags:** atp.Status=draft; atp.recommendedPackage=PersistencyKeyValueDatabase Interfaces			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *PersistencyInterface*, *PortInterface*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dataElement	PersistencyDataElement	*	aggr	This aggregation represents the collection of PersistencyDataElements in the context of the enclosing PersistencyKeyValueDatabaseInterface. **Tags:** atp.Status=draft
dataTypeForSerialization	ImplementationDataType	*	ref	This reference identifies ImplementationDataTypes that shall be supported for storing in a key-value data base in addition to the types already referenced as PersistencyDataElement. **Tags:** atp.Status=draft
updateStrategy	PersistencyCollectionLevelUpdateStrategyEnum	1	attr	This attribute shall be used to specify the update strategy of the respective PersistencyKeyValueDatabaseInterface as a whole.

Table 3.48: PersistencyKeyValueDatabaseInterface

[TPS_MANI_01139] Semantics of PersistencyKeyValueDatabaseInterface.updateStrategy ⌈ The attribute PersistencyKeyValueDatabaseInterface.updateStrategy can be used to specify the strategy for updating the actual persistent elements used in the context of the PersistencyKeyValueDatabase that corresponds to PersistencyKeyValueDatabaseInterface.

This update strategy shall be applied to the PersistencyKeyValueDatabaseInterface as a whole except for the explicitly modeled dataElements that define their own updateStrategy. ⌋*(RS_MANI_00027)*

The relation between a PortPrototype typed by a PersistencyKeyValueDatabaseInterface and the corresponding PersistencyKeyValueDatabase is described in section 11.2. The behavior of the software in terms of applying an update strategy is explained in detail in [8].

Enumeration	**PersistencyCollectionLevelUpdateStrategyEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface
Note	This enumeration provides possible values for the update strategy on interface/database level. **Tags:** atp.Status=draft
Literal	***Description***
delete	The update strategy is to delete all values on the level of the respective collection. **Tags:** atp.EnumerationValue=1
keepExisting	The update strategy is to keep the existing values on the level of the respective collection. **Tags:** atp.EnumerationValue=0

Table 3.49: PersistencyCollectionLevelUpdateStrategyEnum

[TPS_MANI_01135] Semantics of PersistencyKeyValueDatabaseInterface.dataTypeForSerialization ⌈ The reference PersistencyKeyValueDatabaseInterface.dataTypeForSerialization can be taken to get information about data types for which a serialization algorithm has to be generated in order to support the persistent storage of objects of such data type. ⌋ *(RS_MANI_00027)*

In contrast to other kinds of PortInterfaces it is **not required** to define elements of a PersistencyKeyValueDatabaseInterface. If this is intended, however, the aggregation PersistencyKeyValueDatabaseInterface.dataElement shall be used for this purpose.

[TPS_MANI_01138] Semantics of PersistencyKeyValueDatabaseInterface.dataElement ⌈ The definition of PersistencyKeyValueDatabaseInterface.dataElement supports the ability to generate transformer code as well as allow for a dedicated deployment of the dataElement to a given PersistencyKeyValueDatabase. ⌋*(RS_MANI_00027)*

[TPS_MANI_01180] Collection of data types that requires serialization support ⌈
The collection of data types that requires serialization support consists of

- `ImplementationDataType`s referenced in the role `PersistencyKeyValueDatabaseInterface.dataTypeForSerialization`
- either
  - `ImplementationDataType`s taken to type a `PersistencyKeyValueDatabaseInterface.dataElement` or
  - `ImplementationDataType`s mapped to `ApplicationDataType`s taken to type a `PersistencyKeyValueDatabaseInterface.dataElement` by means of `PortInterfaceToDataTypeMapping.dataTypeMappingSet` that also refers to the enclosing `PersistencyKeyValueDatabaseInterface`.

⌋(*RS_MANI_00027*)

Class	**PersistencyDataElement**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	This meta-class represents the ability to formally specify a piece of data that is subject to persistency in the context of the enclosing PersistencyKeyValueDatabaseInterface. PersistencyDataElement represents also a key of the deployed PersistencyKeyValueDatabase and provides an initial value. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpFeature*, *AtpPrototype*, *AutosarDataPrototype*, *DataPrototype*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
updateStrategy	PersistencyElementLevelUpdateStrategyEnum	1	attr	This attribute shall be used to specify the update strategy of the respective PersistencyDataElement.

Table 3.50: PersistencyDataElement

[TPS_MANI_01140] Semantics of `PersistencyDataElement.updateStrategy` ⌈ The attribute `PersistencyDataElement.updateStrategy` can be used to specify the strategy for updating the actual persistent element that corresponds to `PersistencyDataElement`. ⌋(*RS_MANI_00027*)

The relation between a `PersistencyDataElement` and the corresponding `PersistencyKeyValuePair` in the scope of a `PersistencyKeyValueDatabase` is described in section 11.2. The behavior of the software in terms of applying an update strategy for specific persistent elements is explained in detail in [8].

Enumeration	**PersistencyElementLevelUpdateStrategyEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface

Note	This enumeration provides possible values for the update strategy on element level. **Tags:** atp.Status=draft
Literal	***Description***
delete	The update strategy is to delete the value of the respective data item. **Tags:** atp.EnumerationValue=2
keepExisting	The update strategy is to keep the existing value of the respective data item. **Tags:** atp.EnumerationValue=1
overwrite	The update strategy is to overwrite the respective data item. **Tags:** atp.EnumerationValue=0

Table 3.51: PersistencyElementLevelUpdateStrategyEnum

3.7.3 Persistency File Proxy Interface

[TPS_MANI_01067] Purpose of `PersistencyFileProxyInterface` ⌈ The purpose of meta-class `PersistencyFileProxyInterface` is to support access to an abstract representation of files. ⌋*(RS_MANI_00027)*

[constr_1524] Standardized values of `PersistencyFileProxyInterface.category` ⌈ The values of `PersistencyFileProxyInterface.category` shall be taken to further qualify the nature of the accessed files. The following values are standardized:

- `TEXT_FILE`
- `BINARY_FILE`

⌋*()*

[TPS_MANI_01068] Semantics of `PersistencyFileProxyInterface.maxNumberOfFiles` ⌈ Any `PortPrototype` typed by a `PersistencyFileProxyInterface` has the ability to access a number of files.

The upper bound of the number of files represented by a given `PortPrototype` typed by a `PersistencyFileProxyInterface` can be configured using the attribute `PersistencyFileProxyInterface.maxNumberOfFiles`.

The value of attribute `PersistencyFileProxyInterface.maxNumberOfFiles` **includes** the explicitly modeled `PersistencyFileProxyInterface.fileProxy`. ⌋*(RS_MANI_00027)*

Please note that the existence of the `PersistencyFileProxyInterface` does not violate the restrictions set by the POSIX subset PSE51 defined in IEEE1003.13 [9].

Class	**PersistencyFileProxyInterface**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	This meta-class provides the ability to implement a PortInterface for supporting persistency use cases for files. **Tags:** atp.Status=draft; atp.recommendedPackage=PersistencyFileProxyInterfaces			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *PersistencyInterface*, *PortInterface*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
encoding	BaseTypeEncodingString	0..1	attr	This attribute supports the definition of an encoding of the corresponding physical files. The possible values of this attribute may be partially standardized by AUTOSAR. But it is also possible to extend the set of values in a custom way (provided that the custom values use a notation that ensures the absence of clashes with further extensions of the standardized values, e.g. by using a company-specific prefix).
fileProxy	PersistencyFileProxy	*	aggr	This aggregation represents the collection of PersistencyFileProxys in the context of the enclosing PersistencyFileProxyInterface. **Tags:** atp.Status=draft
maxNumberOfFiles	PositiveInteger	0..1	attr	This attribute represents the definition of an upper bound for the handling of files at run-time in the context of the enclosing PersistencyFileProxyInterface.
updateStrategy	PersistencyCollectionLevelUpdateStrategyEnum	1	attr	This attribute can be used to specify the update strategy of the respective PersistencyFileProxyInterface as a whole.

Table 3.52: PersistencyFileProxyInterface

A `PortPrototype` typed by a `PersistencyFileProxyInterface` allows for abstracting the actual calls to the operating system away from the scope of the application software and into the modules of the *AUTOSAR adaptive platform*.

[TPS_MANI_01141] Semantics of `PersistencyFileProxyInterface.updateStrategy` ⌈ The attribute `PersistencyFileProxyInterface.updateStrategy` can be used to specify the strategy for updating the actual persistent files used in the context of the `PersistencyFileArray` that corresponds to `PersistencyFileProxyInterface`.

This update strategy shall be applied to the `PersistencyFileProxyInterface` as a whole except for the explicitly modeled `dataElement`s that define their own `updateStrategy`. ⌋*(RS_MANI_00027)*

The relation between a `PortPrototype` typed by a `PersistencyFileProxyInterface` and the corresponding `PersistencyFileArray` is described in sec-

tion 11.2. The behavior of the software in terms of applying an update strategy is explained in detail in [8].

[TPS_MANI_01142] Semantics of `PersistencyFileProxy` ⌈ By aggregating`PersistencyFileProxy` in the role `fileProxy` it is possible to explicitly model files (and some of their properties) accessible to the application software within the context of a `PersistencyFileProxyInterface`. ⌋*(RS_MANI_00027)*

Class	**PersistencyFileProxy**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	This meta-class has the ability to represent a file at design time such that it is possible to configure the behavior for accessing the represented file at run-time. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
contentUri	UriString	1	attr	This attribute represents the URI that identifies the initial content of the PersistencyFile.
fileName	String	1	attr	This attribute holds filename part of the storage location for the PersistencyFileProxy, e.g. file on the file system.
updateStrategy	PersistencyElementLevelUpdateStrategyEnum	1	attr	This attribute can be used to specify the update strategy of the respective PersistencyFileProxy.

Table 3.53: PersistencyFileProxy

[TPS_MANI_01143] Semantics of `PersistencyFileProxy.updateStrategy` ⌈ The attribute `PersistencyFileProxy.updateStrategy` can be used to specify the strategy for updating the actual persistent file that corresponds to `PersistencyFileProxy`. ⌋*(RS_MANI_00027)*

The behavior of the software in terms of applying an update strategy for specific persistent files is explained in detail in [8].

[constr_1581] Value of `fileProxy.fileName` ⌈ Within the scope of any given `PersistencyFileProxyInterface`, the value of all `fileProxy.fileName` shall be unique. ⌋*()*

3.8 Time Synchronization Interface

Time Synchronization functional cluster within the Adaptive Platform is responsible to provide various Time Bases for the application to read from or to write to.

In order to interface with the Time Synchronization foundation software an application developer needs to declare which kind of Time Base this application will interact with.

The interface towards the Time Synchronization follows the generic pattern of PortPrototypes and PortInterfaces which are applied to many use-cases concerning the interaction of application software with platform software.

In contrast to the service based communication, the modeling of platform software interaction using PortPrototypes and PortInterfaces is less detailed. The PortPrototype is a placeholder for the interaction with platform software, it does not model the actually used APIs available for the interaction. The APIs to be used are formally specified in the platform software SWS document, i.e. SWS_TimeSync [10].

[TPS_MANI_03535] Definition of Time Synchronization interaction ⌈ The metaclass TimeSynchronizationInterface together with its sub classes are used to define the interaction of the application software with a Time Synchronization Time Base (see figure 3.37). ⌋*(RS_MANI_00040)*

By defining a RPortPrototype which is typed by one of the TimeSynchronizationInterface sub classes the application indicates that it will access a specific Time Base.

[TPS_MANI_03549] Usage of RPortPrototype for the interaction with Time Synchronization ⌈ When defining a PortPrototype typed by one of the subclasses of TimeSynchronizationInterface an RPortPrototype shall be used. ⌋*(RS_MANI_00040)*

The application software takes the active role in the interaction with foundation platform software thus a RPortPrototype is used to represent this interaction from the application software point of view.

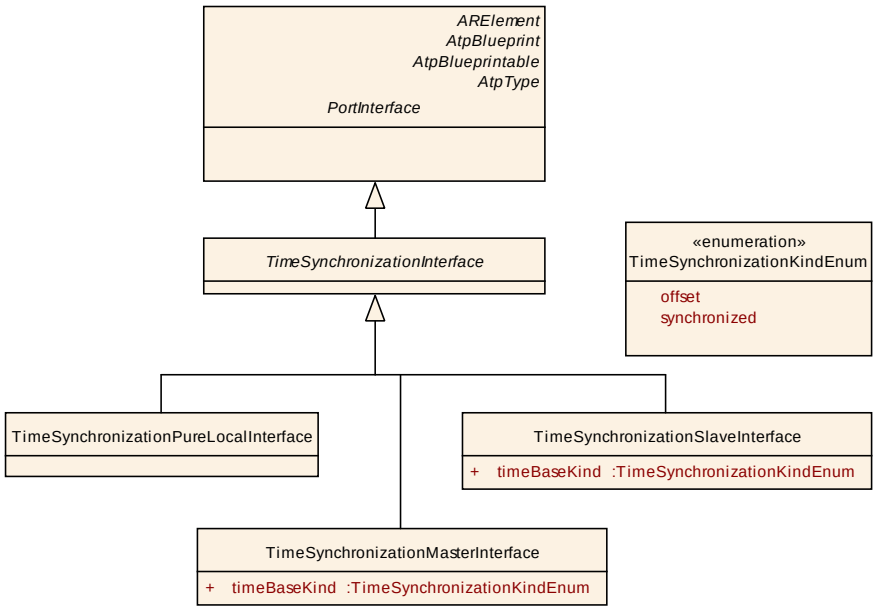


Figure 3.37: Modeling of Time Synch Interfaces

[TPS_MANI_03536] Time Synchronization interaction in a master role ⌈ The metaclass TimeSynchronizationMasterInterface is used to indicate the intended interaction with a synchronized global Time Base in a *master* role. ⌋*(RS_MANI_00040)*

When interacting with a synchronized global Time Base in a *master* role the application is able to *set* (and *get*) the value of the synchronized global Time Base which is then propagated to the time value on the network.

[TPS_MANI_03537] Time Synchronization interaction in a slave role ⌈ The meta-class `TimeSynchronizationSlaveInterface` is used to indicate the intended interaction with a synchronized global Time Base in a *slave* role. ⌋*(RS_MANI_00040)*

When interacting with a synchronized global Time Base in a *slave* role the application is able to only *get* the value of the synchronized global Time Base which is synchronized from a time value coming from the network.

[TPS_MANI_03551] Definition of Time Base kind ⌈ The attributes `TimeSynchronizationMasterInterface.timeBaseKind` and `TimeSynchronizationSlaveInterface.timeBaseKind` define whether the Time Base shall be a `synchronized` or a `offset` Time Base. ⌋*(RS_MANI_00040)*

[TPS_MANI_03538] Time Synchronization interaction with a local Time Base ⌈ The meta-class `TimeSynchronizationPureLocalInterface` is used to indicate the intended interaction with a pure local Time Base. ⌋*(RS_MANI_00040)*

When interacting with a pure local Time Base the application is able to*set* and *get* the value of the Time Base, but the value is considered local to the `Machine`.

Class	**TimeSynchronizationMasterInterface**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	This meta-class provides the ability to define a PortInterface for the interaction with a Time Synchronization Master. **Tags:** atp.Status=draft; atp.recommendedPackage=TimeSynchronizationInterfaces			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *PortInterface*, *Referrable*, *TimeSynchronizationInterface*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
timeBaseKind	TimeSynchronizationKindEnum	1	attr	Defines which kind of time base is requested at this interface. **Tags:** atp.Status=draft

Table 3.54: TimeSynchronizationMasterInterface

Class	**TimeSynchronizationSlaveInterface**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	This meta-class provides the ability to define a PortInterface for the interaction with a Time Synchronization Slave. **Tags:** atp.Status=draft; atp.recommendedPackage=TimeSynchronizationInterfaces			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *PortInterface*, *Referrable*, *TimeSynchronizationInterface*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
timeBaseKind	TimeSynchronizationKindEnum	1	attr	Defines which kind of time base is requested at this interface. **Tags:** atp.Status=draft

Table 3.55: TimeSynchronizationSlaveInterface

Class	**TimeSynchronizationPureLocalInterface**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	This meta-class provides the ability to define a PortInterface for the interaction with a Time Synchronization Pule Local Time Base. **Tags:** atp.Status=draft; atp.recommendedPackage=TimeSynchronizationInterfaces			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *PortInterface*, *Referrable*, *TimeSynchronizationInterface*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 3.56: TimeSynchronizationPureLocalInterface

Enumeration	**TimeSynchronizationKindEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface
Note	Defines the possible kinds of TimeSynchronizationInterfaces. **Tags:** atp.Status=draft
Literal	***Description***
offset	Defines that the requested time base shall be an offset time based. **Tags:** atp.EnumerationValue=1
synchronized	Defines that the requested time base shall be a synchronized time based. **Tags:** atp.EnumerationValue=0

Table 3.57: TimeSynchronizationKindEnum

In the example in figure 3.38 the interaction of one Application with several time sync aspects are illustrated.

The interaction approach is that for each meta-class of `TimeSynchronizationInterface` used in an application's `RPortPrototype` a corresponding *TimeBaseResourceProxy* is generated and the application developer gains access to the time synchronization kind by use of this *TimeBaseResourceProxy*.

In the application code the *TimeBaseResourceProxy* is used to initiate a *find* functionality using *InstanceIdentifier* representing the `RPortPrototype` as defined in [7] and described in [11].

During application deployment those `RPortPrototype`s are mapped to actual *Time Bases* in the Time Sync Management (see figure 15.6).

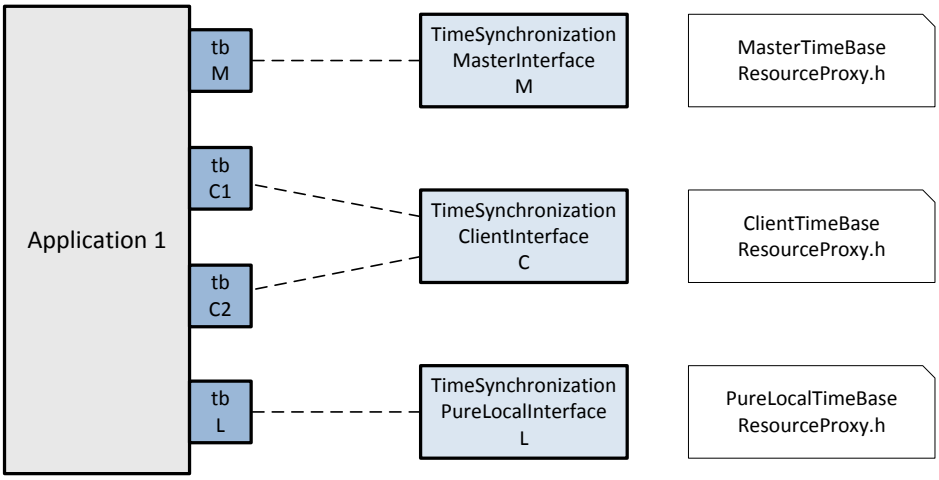


Figure 3.38: Example Application and Time Sync interaction

3.9 Platform Health Management Interface

3.9.1 Overview

Platform Health Management functional cluster within the Adaptive Platform is responsible to supervise the execution of applications, monitor their status, and to provide rule-based evaluation and triggering of respective actions.

In order to interface with the Platform Health Management foundation software an application developer needs to declare which supervisions and status information is provided by the application software and shall be observed by the Platform Health Management.

The interface towards the Platform Health Management follows the generic pattern of `PortPrototype`s and `PortInterface`s which are applied to many use-cases concerning the interaction of application software with platform software.

In contrast to the service based communication, the modeling of platform software interaction using `PortPrototype`s and `PortInterface`s is less detailed.

The PortPrototype is a placeholder for the interaction with platform software, it does not model the actually used APIs available for the interaction. The APIs to be used are formally specified in the platform software SWS document, i.e. SWS_HealthManagement [12].

3.9.2 Supervised Entities and Checkpoints

The interaction of supervision with the Platform Health Management is defined by PhmSupervisedEntityInterface and PhmCheckpoints.

[TPS_MANI_03500] Definition of Platform Health Management Supervision and Checkpoints ⌈ The meta-class PhmSupervisedEntityInterface together with the aggregated PhmCheckpoint are used to define the interaction of one Supervised Entity with the Platform Health Management supervision (see figure 3.39). ⌋ *(RS_MANI_00032)*

By defining a RPortPrototype which is typed by the PhmSupervisedEntityInterface the application indicates that it wants to report the checkpoints of this PhmSupervisedEntityInterface.

[TPS_MANI_03550] Usage of RPortPrototype for the interaction with Platform Health Management ⌈ When defining a PortPrototype typed by one of the subclasses of PlatformHealthManagementInterface an RPortPrototype shall be used. ⌋*(RS_MANI_00040)*

The application software takes the active role in the interaction with foundation platform software thus a RPortPrototype is used to represent this interaction from the application software point of view.

The application code then calls the *CheckpointReached* API (defined in [12]) in the context of the respective RPortPrototype typed by the PhmSupervisedEntityInterface in order to notify the Platform Health Management that a specific PhmCheckpoint has been reached in the program flow.

[constr_3530] Mandatory definition of checkpointId ⌈ The checkpointId shall be defined for every PhmCheckpoint element. ⌋*()*

The checkpointId is used during the call to the *CheckpointReached* API as a representation of the PhmCheckpoint.

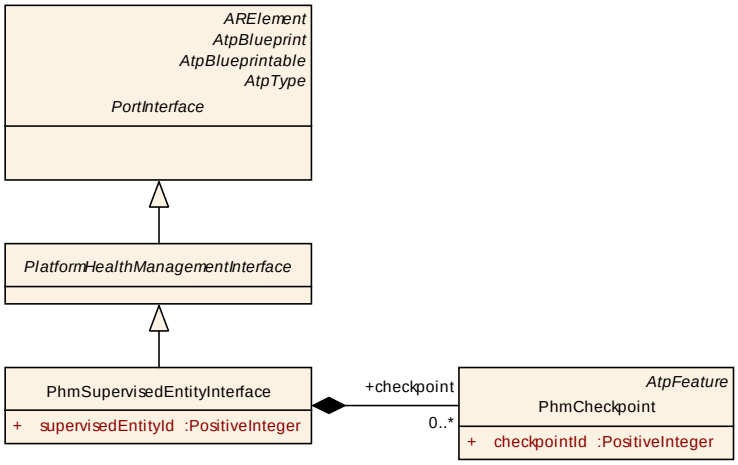


Figure 3.39: Modeling of Supervised Entities and Checkpoints

[constr_3536] Mandatory definition of `supervisedEntityId` ⌈ The `supervisedEntityId` shall be defined for every `PhmSupervisedEntityInterface` element. ⌋*()*

If the application wants to query the status of a Supervised Entity monitored by the Platform Health Management then the application code calls the *GetSupervisionStatus* API (defined in [12]) in the context of the respective `RPortPrototype` typed by the `PhmSupervisedEntityInterface`.

Note that from the application design point of view there are no relations defined between the checkpoints (as to indicate a specific observed order in reporting). The possible transitions between the checkpoints and their timing aspects are defined in the context of the `PlatformHealthManagementContribution` and described in chapter 14.2.

Class	**PhmSupervisedEntityInterface**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	This meta-class provides the ability to implement a PortInterface for interaction with the Platform Health Management Supervised Entity. **Tags:** atp.Status=draft; atp.recommendedPackage=PlatformHealthManagement Interfaces			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *PlatformHealthManagementInterface*, *PortInterface*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
checkpoint	PhmCheckpoint	*	aggr	Defines the set of checkpoints which can be reported on this supervised entity. **Tags:** atp.Status=draft
supervised EntityId	PositiveInteger	1	attr	Defines the numeric value which is used to interact with this Supervised Entity when calling the Phm. **Tags:** atp.Status=draft

Table 3.58: PhmSupervisedEntityInterface

Class	**PhmCheckpoint**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	This meta-class provides the ability to implement a checkpoint for interaction with the Platform Health Management Supervised Entity. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpFeature*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
checkpointId	PositiveInteger	1	attr	Defines the numeric value which is used to indicate the reporting of this Checkpoint to the Phm. **Tags:** atp.Status=draft

Table 3.59: PhmCheckpoint

3.9.3 Health Channels

The interaction of Health Channels with the Platform Health Management is defined by `PhmHealthChannelInterface` and `PhmHealthChannelStatus` states.

[TPS_MANI_03534] Definition of Platform Health Management Health Channel ⌈ The meta-class `PhmHealthChannelInterface` together with the aggregated `PhmHealthChannelStatus` are used to define the interaction of one Health Channel with the Platform Health Management (see figure 3.40). ⌋*(RS_MANI_00032)*

By defining a `RPortPrototype` which is typed by the `PhmHealthChannelInterface` the application indicates that it wants to report the `status` of this `PhmHealthChannelInterface`.

The application code then calls the *SetHealthMode* API (defined in [12]) in the context of the respective `RPortPrototype` typed by the `PhmHealthChannelInterface` in order to notify the Platform Health Management that the Health Channel defined by the `RPortPrototype` has changed its status.

[constr_3531] Mandatory definition of `healthChannelId` ⌈ The `healthChannelId` shall be defined for every `PhmHealthChannelInterface` element. ⌋*()*

[constr_3532] Mandatory definition of `statusId` ⌈ The `statusId` shall be defined for every `PhmHealthChannelStatus` element. ⌋*()*

The `healthChannelId` together with the `statusId` are used during the call to the *SetHealthMode* API as representation of the Health Channel status.

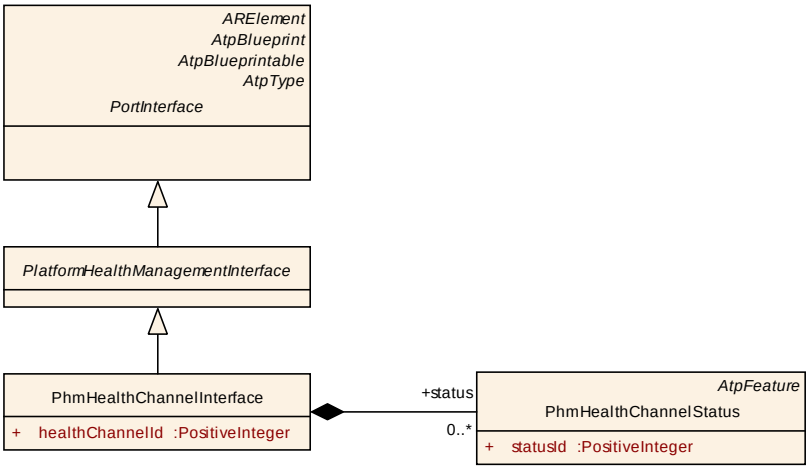


Figure 3.40: Modeling of Health Channel

If the application wants to query the status of a Health Channel monitored by the Platform Health Management then the application code calls the *GetChannelStatus* API (defined in [12]) in the context of the respective `RPortPrototype` typed by the `PhmHealthChannelInterface`.

Class	**PhmHealthChannelInterface**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	This meta-class provides the ability to implement a PortInterface for interaction with the Platform Health Management Health Channel. **Tags:** atp.Status=draft; atp.recommendedPackage=PlatformHealthManagement Interfaces			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *PlatformHealthManagementInterface*, *PortInterface*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
healthChannelId	PositiveInteger	1	attr	Defines the numeric value which is used to indicate the reporting of this Health Channel to the Phm. **Tags:** atp.Status=draft
status	PhmHealthChannelStatus	*	aggr	Defines the possible set of status information available to the health channel. **Tags:** atp.Status=draft

Table 3.60: PhmHealthChannelInterface

Class	**PhmHealthChannelStatus**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	The PhmHealthChannelStatus specifies one possible status of the health channel. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpFeature*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
statusId	PositiveInteger	1	attr	Defines the numeric value which is used to indicate the indication of this status the Phm. **Tags:** atp.Status=draft

Table 3.61: PhmHealthChannelStatus

3.10 Interaction Endpoint for Application

The interaction of software-components with the outside world can take several forms, e.g. service-oriented communication or the interaction with a persistent data storage.

A formal representation of the interaction needs to be described as an anchor point for adding various additional configuration attributes that make sense in this context but would not make sense in the context of a `PortInterface`.

There is a model element that already has a long-standing tradition in the AUTOSAR meta-model for exactly the described purpose: the `PortPrototype`.

The following sub-chapters discuss the interaction by means of `PortPrototype`s with software "outside" a given software-component with the focus on different kinds of interaction that require different ways to further contribute model elements for configuration.

3.10.1 Service-oriented Communication

The service-oriented communication by means of `PortPrototype`s does **not** support the concept of a communication endpoint that is both required and provided **at the same time**. This motivates the existence of [constr_1473].

[constr_1473] No support for `PRPortPrototype` ⌈ A `ServiceInterface` shall not be referenced by a `PRPortPrototype` in the role `providedRequiredInterface`. ⌋*()*

[TPS_MANI_01039] Representation of provided service ⌈ A **provided service** shall be modeled by means of an `PPortPrototype` that is typed by a `ServiceInterface`. ⌋*(RS_MANI_00002)*

[TPS_MANI_01040] Representation of required service ⌈ A **required service** shall be modeled by means of an `RPortPrototype` that is typed by a `ServiceInterface`. ⌋*(RS_MANI_00002)*

For more background regarding the rationale of [constr_1473], please refer to [1].

Please note that the utilization of service discovery on the *AUTOSAR adaptive platform* means that opposite communication ends **are by design not known upfront**.

As a consequence, it is in general not possible to use `AssemblySwConnector`s to model a pre-defined relation between two communication endpoints modeled as `PortPrototype`s.

Independent of the issue described above, it is still necessary to provide means for configuration of a given `PortPrototype` on different levels:

- The `PortPrototype` itself (i.e. as a whole) may need to be customized, independently of the kind or number of elements aggregated by the corresponding `ServiceInterface`. This aspect is discussed in section 3.10.5.
- The usage of elements of the corresponding `ServiceInterface` may need to be configured for a given `PortPrototype`. This aspect is discussed in section 3.10.6.

3.10.2 Interaction with Crypto Software

Disclaimer: the content of this chapter is under discussion. It is released for documentation purposes only. Changes can be expected for the next release.

[TPS_MANI_01087] Interaction with crypto software ⌈ Interaction with crypto software on an instance of the *AUTOSAR adaptive application* shall be modeled on the basis of the existence of `PortPrototype`s typed by `ClientServerInterface`s ⌋ *(RS_MANI_00031)*

The specific shape of the `ClientServerInterface`s used for this purpose is defined in the SWS AdapiveCryptoInterface [13].

[TPS_MANI_01088] Semantics of `CryptoNeed` ⌈ The meta-class `CryptoNeed` allows for the specification of the general strategy (e.g. the nature of the crypto algorithm) for the application of a crypto `API`. ⌋ *(RS_MANI_00031)*

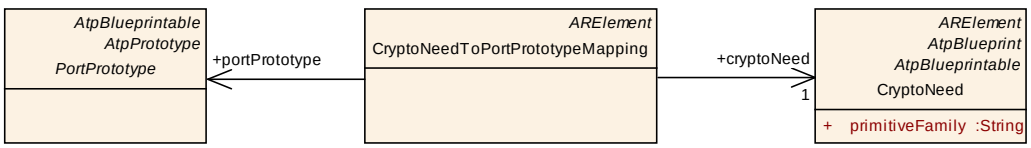


Figure 3.41: Modeling of the relation between `CryptoNeed` and `PortPrototype`

[TPS_MANI_01089] Relation between `CryptoNeed` and `PortPrototype` ⌈ The meta-class `CryptoNeedToPortPrototypeMapping` can be taken to describe a concrete relation between a given `CryptoNeed` and a `PortPrototype` typed by a `ClientServerInterface` that is supposed to provide a crypto `API`. ⌋ *(RS_MANI_00031)*

Please note that the semantics of CryptoNeed in principle could have been modeled by means of a SwcServiceDependency and an aggregated ServiceNeeds.

However, this requires the definition of a software-component. On the other hand, the definition of a CryptoNeed is typically created by an OEM in an early stage of a development project.

Although the individual development approach may vary by OEM, it could easily happen that the design work done by the OEM does not extend to the definition of software-components.

In other words, an OEM that chooses to let the software-component structure be designed by suppliers would not be able to contribute the semantics that is contained in the CryptoNeeds.

[constr_1529] Standardized values of CryptoNeed.category ⌈ The following values of CryptoNeed.category are standardized by AUTOSAR:

- PAYMENT_INFORMATION
- PERSONAL_IDENTIFIABLE_INFORMATION

⌋()

Beyond the regulation made by [constr_1529] it is possible to assign custom values of CryptoNeed.category.

In this case, however, it is mandatory to use a company-specific prefix or suffix to the custom values in order to positively avoid clashes with potential future extensions of the collection of standardized values defined by [constr_1529].

Class	**CryptoNeed**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	This meta-class represents a statement regarding the applicable crypto use case. **Tags:** atp.Status=draft; atp.recommendedPackage=CryptoNeeds			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
primitiveFamily	String	1	attr	This attribute represents the ability to specify the algorithm family of the crypto need. **Tags:** atp.Status=draft

Table 3.62: CryptoNeed

Class	**CryptoNeedToPortPrototypeMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	This meta-class represents the ability to map a crypto need onto a PortPrototype. **Tags:** atp.Status=draft; atp.recommendedPackage=CryptoNeedToPortPrototype Mappings			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
cryptoNeed	CryptoNeed	1	ref	This meta-class represents the crypto need part of the mapping from crypto need to PortPrototype. **Tags:** atp.Status=draft
portPrototype	PortPrototype	1	ref	This meta-class represents the PortPrototype part of the mapping from crypto need to PortPrototype. **Tags:** atp.Status=draft

Table 3.63: CryptoNeedToPortPrototypeMapping

3.10.3 Interaction with Persistent Key-Value Storage

The usage of `PortPrototype`s for the purpose of interacting with *persistent key-value storage* is less restricted than in the case of service-oriented communication. In other words, it is perfectly valid to use a `PRPortPrototype` where applicable.

[TPS_MANI_01073] Semantics of `PortPrototype` typed by `PersistencyKeyValueDatabaseInterface` ⌈ The usage of a specific sub-class of `PortPrototype` typed by `PersistencyKeyValueDatabaseInterface` indicates the intended semantics of interaction:

- The usage of a `RPortPrototype` indicates that the persistent data can only be **read from** the persistent storage.
- The usage of a `PPortPrototype` indicates that the persistent data can only be **written to** the persistent storage.
- The usage of a `PRPortPrototype` indicates that the persistent data can be **read from** as well as **written to** the persistent storage.

⌋*(RS_MANI_00027)*

It is possible to model whether and how the files that correspond to the `PortPrototype` shall be encrypted from the perspective of the designer of the software-component. Details of the approach are further explained in section 3.10.2 as well as Figure 3.41.

[TPS_MANI_01077] Specification of file encryption ⌈ Cryptographic methods can be applied to a `PortPrototype` typed by a `PersistencyFileProxyInterface` by referencing the `PortPrototype` from a `CryptoNeedToPortPrototypeMapping`

that also refers to a CryptoNeed that provides further details about the nature of the applicable cryptographic algorithms. ⌋(*RS_MANI_00027*)

3.10.4 Interaction with Persistent File-Based Storage

Interaction with **persistent file-based storage** can involve the ability to read from and write to a file by the same application. Therefore, the existence of a PRPortPrototype typed by a PersistencyFileProxyInterface shall be supported.

[TPS_MANI_01081] Semantics of PortPrototype typed by PersistencyFileProxyInterface ⌈ The usage of a specific sub-class of PortPrototype typed by PersistencyFileProxyInterface indicates the intended semantics of interaction:

- The usage of a RPortPrototype indicates that the corresponding file(s) can be **opened for read access**.
- The usage of a PPortPrototype indicates that the corresponding file(s) can be **opened resp. created for write access**. Also, there is the ability to **delete** a file.
- The usage of a PRPortPrototype indicates that the corresponding file(s) can be **opened resp. created for read and write access**. Also, there is the ability to **delete** a file.

⌋(*RS_MANI_00027*)

3.10.5 Port Prototype Props

As mentioned before, in some cases a qualification of the semantics of PortPrototypes is necessary. For this purpose, AUTOSAR typically defines a *props* class of some kind. The same approach applies in this situation as well.

In particular, PortPrototype aggregates the abstract meta-class PortPrototypeProps, that in turn starts an inheritance tree of derived meta-classes that have the ability to qualify sub-classes of PortPrototype accordingly.

One example for this approach is the definition of the meta-class RPortPrototypeProps, sketched in Figure 3.42.

[constr_3359] RPortPrototypeProps are related only to RPortPrototypes ⌈ The RPortPrototypeProps shall be aggregated only by a RPortPrototype in the role portPrototypeProps. ⌋()

[TPS_MANI_01052] Semantics of RPortPrototypeProps.portInstantiationBehavior ⌈ The attribute RPortPrototypeProps.portInstantiationBehavior adds the ability to define whether a given RPortPrototype can have a "multiple-instantiation semantics".

This means that the RPortPrototype exists only as a single model-element but can have a collection-semantics in the implementation of the software-component. ⌋ *(RS_MANI_00002)*

[TPS_MANI_01057] Semantics of RPortPrototypeProps.searchBehavior ⌈ The value of the attribute RPortPrototypeProps.searchBehavior clarifies whether the search for a corresponding offer shall be done as a search for “any” or else as a search for a specific ID.

Typically, a search for “any” results in a collection of offers while the search for a given id results in just a single offer. ⌋ *(RS_MANI_00002)*

Please note that a search for “any” does not necessarily mean that [TPS_MANI_01052] applies, i.e. that the RPortPrototype is supposed to assume array semantics.

Even if a search for “any” is executed it may still be intended to select just a **single offer** from the result of the search. Therefore, the simultaneous existence of RPortPrototypeProps.searchBehavior and RPortPrototypeProps.portInstantiationBehavior is warranted.

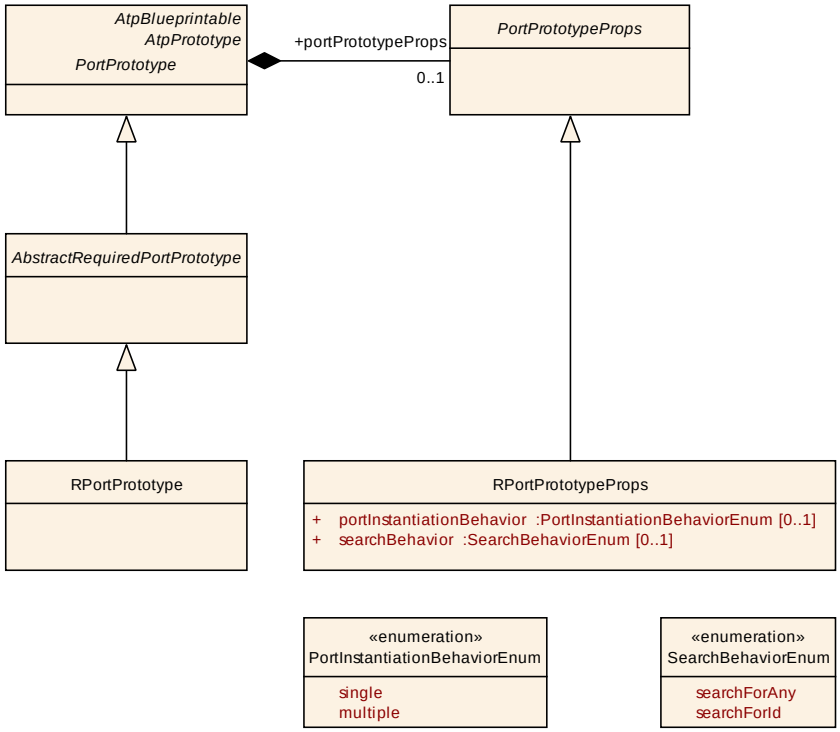


Figure 3.42: Modeling of the RPortPrototypeProps for RPortPrototype

Class	***PortPrototypeProps* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ApplicationStructure			
Note	This meta-class represents the ability to define a further qualification of semantics of sub-classes of PortPrototype. **Tags:** atp.Status=draft			
Base	*ARObject*			
Subclasses	RPortPrototypeProps			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 3.64: PortPrototypeProps

Class	**RPortPrototypeProps**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ApplicationStructure			
Note	PortPrototypeProps for a RPort. **Tags:** atp.Status=draft			
Base	*ARObject*, *PortPrototypeProps*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
portInstantiationBehavior	PortInstantiationBehaviorEnum	0..1	attr	This attribute specifies how many proxy instances may be created at this RPort.
searchBehavior	SearchBehaviorEnum	0..1	attr	This attribute is used to specify the search behavior.

Table 3.65: RPortPrototypeProps

Enumeration	**PortInstantiationBehaviorEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ApplicationStructure
Note	This enumeration describes different option for the instantiation behavior of a PortPrototype. **Tags:** atp.Status=draft
Literal	***Description***
multiple	Multiple proxy instances may be created at this port. **Tags:** atp.EnumerationValue=1
single	A single proxy instance is created at this port **Tags:** atp.EnumerationValue=0

Table 3.66: PortInstantiationBehaviorEnum

Enumeration	**SearchBehaviorEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign

Note	This meta-class allows for the definition of a dedicated search behavior from the application's point of view. **Tags:** atp.Status=draft
Literal	***Description***
searchFor Any	This value represents the intention to search for "any" **Tags:** atp.EnumerationValue=0
searchForId	This value represents the intention to search for a dedicated Id. **Tags:** atp.EnumerationValue=1

Table 3.67: SearchBehaviorEnum

3.10.6 Port Prototype ComSpec

[TPS_MANI_01053] Usage of `ComSpec`s on the *AUTOSAR adaptive platform* ⌈ The aspect of further qualification of elements of the `ServiceInterface` used to type given `PortPrototype` is implemented by means of `ComSpec`s, i.e. specific sub-classes of the abstract meta-classes `RPortComSpec` and `PPortComSpec`.

However, the support for `ComSpec`s on the *AUTOSAR adaptive platform* only covers a **limited selection** of attributes of a specific `ComSpec`. ⌋*(RS_MANI_00002)*

The details about supported attributes of either a `RPortComSpec` or `PPortComSpec` are described in this chapter.

3.10.6.1 Port Prototypes typed by Service Interfaces

3.10.6.1.1 Receiver ComSpec

It is necessary to provide means to configure the queue length of the reception of an `event` on a case-by-case basis. In other words, even two "adjacent" `event`s within the same `RPortPrototype` may need a different handling of the queue length.

[TPS_MANI_01054] Definition of the queue length of an `event` or `field` notifier ⌈ The definition of the queue length of an `event` or `field` notifier shall be modeled by means of the attribute `QueuedReceiverComSpec.queueLength`. ⌋*()*

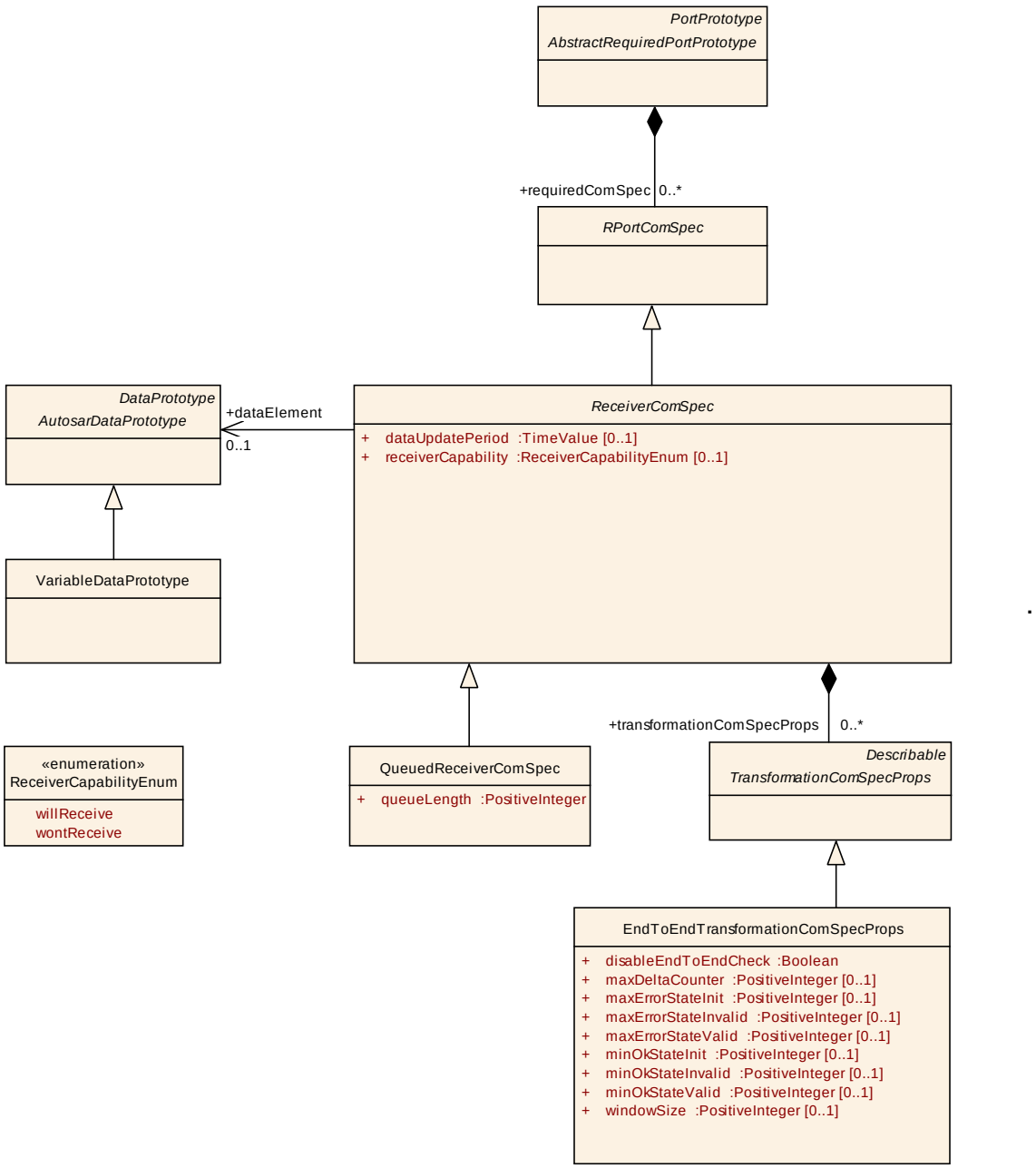


Figure 3.43: Modeling of the `ReceiverComSpec` on the *AUTOSAR adaptive platform*

Class	***ReceiverComSpec* (abstract)**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Communication			
Note	Receiver-specific communication attributes (RPortPrototype typed by SenderReceiverInterface).			
Base	*ARObject*, *RPortComSpec*			
Subclasses	NonqueuedReceiverComSpec, QueuedReceiverComSpec			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dataElement	AutosarDataPrototype	0..1	ref	Data element these attributes belong to.

Attribute	Type	Mul.	Kind	Note
dataUpdatePeriod	TimeValue	0..1	attr	This attribute defines the period in which the application shall check for updated data. This attribute is used for the configuration of the E2E protection. **Tags:** atp.Status=draft
receiverCapability	ReceiverCapabilityEnum	0..1	attr	This attribute represents the expressed capability of the receiver. The receiver may decide to claim that existing resources of a ServiceInterface are expressly not used by this specific receiver. The conceptual background of this claim may be driven by security, safety, etc. **Tags:** atp.Status=draft
transformationComSpecProps	TransformationComSpecProps	*	aggr	This references the TransformationComSpecProps which define port-specific configuration for data transformation.

Table 3.68: ReceiverComSpec

Class	QueuedReceiverComSpec			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Communication			
Note	Communication attributes specific to queued receiving.			
Base	*ARObject*, *RPortComSpec*, *ReceiverComSpec*			
Attribute	**Type**	**Mul.**	**Kind**	**Note**
queueLength	PositiveInteger	1	attr	Length of queue for received events.

Table 3.69: QueuedReceiverComSpec

[TPS_MANI_01106] Specification of capabilities for the receiver of `event`s or `field` notifiers ⌈ The attribute `ReceiverComSpec.receiverCapability` can be used to specify whether the software actually intends to access the referenced `event`s or `field` notifier or whether it explicitly states that it is not interested in the value. ⌋ *(RS_MANI_00034)*

Enumeration	ReceiverCapabilityEnum
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ComSpec
Note	This meta-class represents the ability to specify how a given ServiceInterface is used from the perspective of a given event receiver. **Tags:** atp.Status=draft
Literal	**Description**
willReceive	The receiver will receive the event or field notifier. **Tags:** atp.EnumerationValue=0
wontReceive	The receiver won't receive the event or field notifier. **Tags:** atp.EnumerationValue=1

Table 3.70: ReceiverCapabilityEnum

[TPS_MANI_03132] Semantics of E2E attributes in `ReceiverComSpec` ⌈ The `EndToEndTransformationComSpecProps` shall be used for the specification of `RPortPrototype`-specific configuration options related to end-to-end protection of events or field notifiers. ⌋*(RS_MANI_00028)*

Class	**EndToEndTransformationComSpecProps**			
Package	M2::AUTOSARTemplates::SystemTemplate::Transformer			
Note	The class EndToEndTransformationIComSpecProps specifies port specific configuration properties for EndToEnd transformer attributes.			
Base	*ARObject*, *Describable*, *TransformationComSpecProps*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
disableEndToEndCheck	Boolean	1	attr	Disables/Enables the E2E check. The E2Eheader is removed from the payload independent from the setting of this attribute.
maxDeltaCounter	PositiveInteger	0..1	attr	Maximum allowed difference between two counter values of two consecutively received valid messages. For example, if the receiver gets data with counter 1 and MaxDeltaCounter is 3, then at the next reception the receiver can accept Counters with values 2, 3 or 4.
maxErrorStateInit	PositiveInteger	0..1	attr	Maximal number of checks in which ProfileStatus equal to E2E_P_ERROR was determined, within the last WindowSize checks, for the state E2E_SM_INIT. The minimum value is 0.
maxErrorStateInvalid	PositiveInteger	0..1	attr	Maximal number of checks in which ProfileStatus equal to E2E_P_ERROR was determined, within the last WindowSize checks, for the state E2E_SM_INVALID. The minimum value is 0.
maxErrorStateValid	PositiveInteger	0..1	attr	Maximal number of checks in which ProfileStatus equal to E2E_P_ERROR was determined, within the last WindowSize checks, for the state E2E_SM_VALID. The minimum value is 0.
minOkStateInit	PositiveInteger	0..1	attr	Minimal number of checks in which ProfileStatus equal to E2E_P_OK was determined, within the last WindowSize checks, for the state E2E_SM_INIT. The minimum value is 1.

Attribute	*Type*	*Mul.*	*Kind*	*Note*
minOkState Invalid	PositiveInteger	0..1	attr	Minimal number of checks in which ProfileStatus equal to E2E_P_OK was determined, within the last WindowSize checks, for the state E2E_SM_INVALID. The minimum value is 1.
minOkState Valid	PositiveInteger	0..1	attr	Minimal number of checks in which ProfileStatus equal to E2E_P_OK was determined, within the last WindowSize checks, for the state E2E_SM_VALID. The minimum value is 1.
windowSize	PositiveInteger	0..1	attr	Size of the monitoring window for the E2E state machine. The meaning is the number of correct cycles (E2E_P_OK) that are required in E2E_SM_INITCOM before the transition to E2E_SM_VALID. The minimum allowed value is 1.

Table 3.71: EndToEndTransformationComSpecProps

3.10.6.1.2 Sender ComSpec

The `SenderComSpec` is modeled in the same way as described in the Software Component Template [1]. It has some specific additions, e.g. the introduction of the attribute `dataUpdatePeriod` that defines the frequency with which the data is updated by the application.

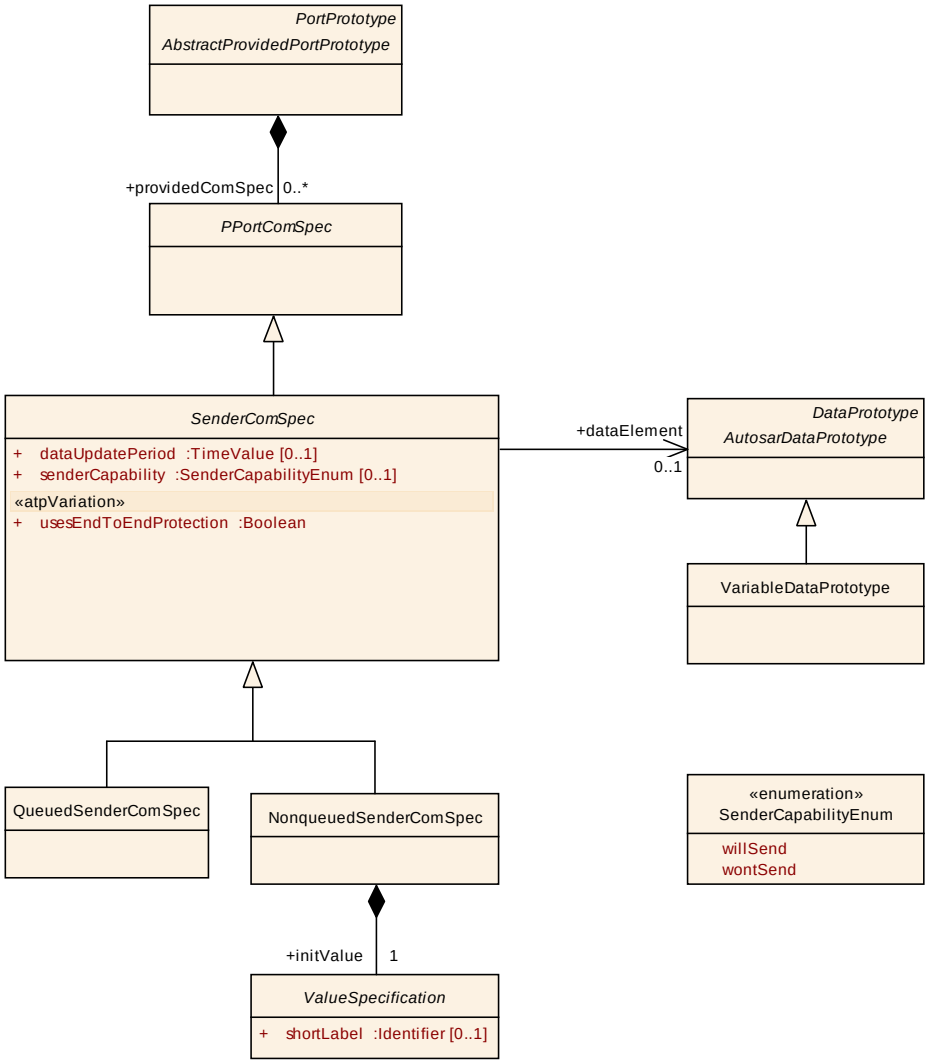


Figure 3.44: Modeling of the `SenderComSpec` on the *AUTOSAR adaptive platform*

Class	***SenderComSpec* (abstract)**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Communication			
Note	Communication attributes for a sender port (PPortPrototype typed by SenderReceiverInterface).			
Base	*ARObject*, *PPortComSpec*			
Subclasses	NonqueuedSenderComSpec, QueuedSenderComSpec			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
compositeNetworkRepresentation	CompositeNetworkRepresentation	*	aggr	This represents a CompositeNetworkRepresentation defined in the context of a SenderComSpec.
dataElement	AutosarDataPrototype	0..1	ref	Data element these quality of service attributes apply to.
dataUpdatePeriod	TimeValue	0..1	attr	This attribute describes the period in which the applications are assumed to transmit E2E-protected messages. The middleware does not use this attribute at all. **Tags:** atp.Status=draft

Attribute	Type	Mul.	Kind	Note
networkRepresentation	SwDataDefProps	0..1	aggr	A networkRepresentation is used to define how the dataElement is mapped to a communication bus.
senderCapability	SenderCapabilityEnum	0..1	attr	This attribute represents the expressed capability of the sender. The sender may decide to claim that existing resources of a ServiceInterface are expressly not used by this specific sender. The conceptual background of this claim may be driven by security, safety, etc. **Tags:** atp.Status=draft
transmissionAcknowledge	TransmissionAcknowledgementRequest	0..1	aggr	Requested transmission acknowledgement for data element.
usesEndToEndProtection	Boolean	1	attr	This indicates whether the corresponding dataElement shall be transmitted using end-to-end protection. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=preCompileTime

Table 3.72: SenderComSpec

[TPS_MANI_01107] Specification of capabilities for the sender of `events` or `field` notifiers ⌈ The attribute `SenderComSpec.senderCapability` can be used to specify whether the software actually intends to send the referenced `event`s or `field` notifier. ⌋*(RS_MANI_00034)*

Enumeration	SenderCapabilityEnum
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ComSpec
Note	This meta-class represents the ability to specify how a given ServiceInterface is used from the perspective of a given event sender. **Tags:** atp.Status=draft
Literal	**Description**
willSend	The sender will send the event or field notifier. **Tags:** atp.EnumerationValue=0
wontSend	The sender won't send the event or field notifier. **Tags:** atp.EnumerationValue=1

Table 3.73: SenderCapabilityEnum

3.10.6.1.3 Client ComSpec

The `ClientComSpec` undergoes extensions for the *AUTOSAR adaptive platform*, namely the ability to refer to the getter and setter method of a `field` and the definition of capabilities.

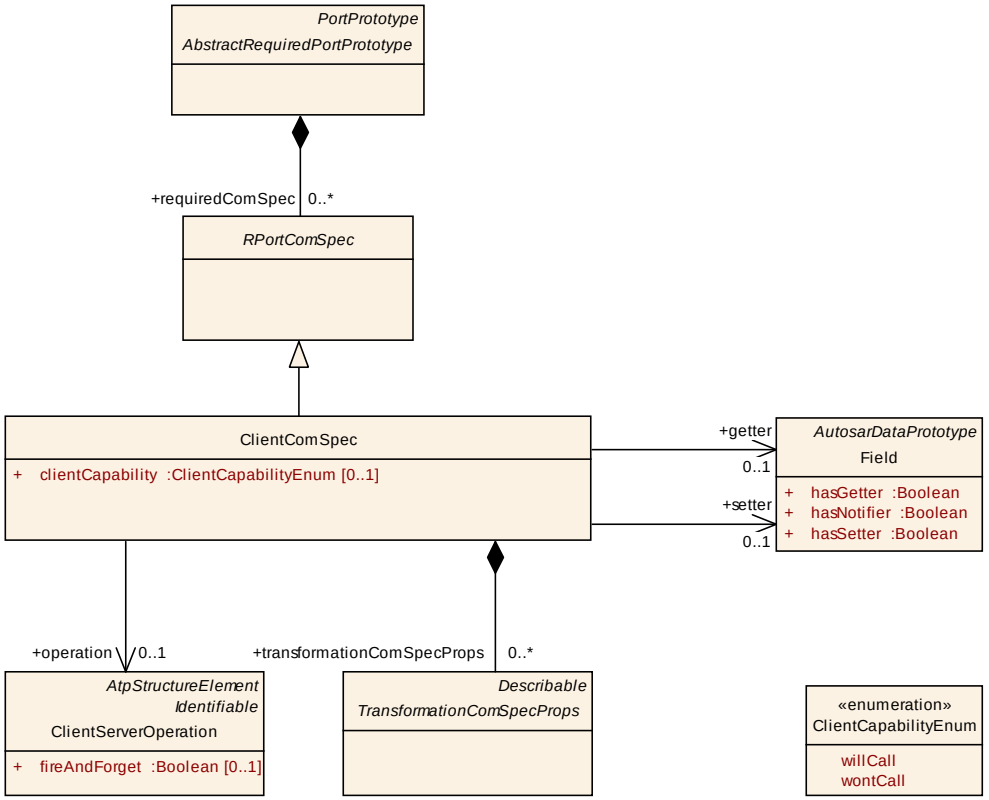


Figure 3.45: Modeling of the `ClientComSpec` on the *AUTOSAR adaptive platform*

Class	**ClientComSpec**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Communication			
Note	Client-specific communication attributes (RPortPrototype typed by ClientServerInterface).			
Base	*ARObject*, *RPortComSpec*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
clientCapability	ClientCapabilityEnum	0..1	attr	This attribute represents the expressed capability of the client. The client may decide to claim that existing resources of a ServiceInterface are expressly not used by this specific client. The conceptual background of this claim may be driven by security, safety, etc. **Tags:** atp.Status=draft
getter	Field	0..1	ref	The existence of this reference indicates that the ClientComSpec refers to the getter of a Field. **Tags:** atp.Status=draft
operation	ClientServerOperation	0..1	ref	This represents the corresponding ClientServerOperation.
setter	Field	0..1	ref	The existence of this reference indicates that the ClientComSpec refers to the setter of a Field. **Tags:** atp.Status=draft

Attribute	Type	Mul.	Kind	Note
transformationComSpecProps	TransformationComSpecProps	*	aggr	This references the TransformationComSpecProps which define port-specific configuration for data transformation.

Table 3.74: ClientComSpec

[TPS_MANI_01108] Specification of capabilities for the caller of a `methods` or `field` setter/getter ⌈ The attribute `ClientComSpec.clientCapability` can be used to specify whether the software actually intends to call the referenced `method`s resp. getter/setter of a referenced `field`. ⌋*(RS_MANI_00034)*

Enumeration	ClientCapabilityEnum
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ComSpec
Note	This meta-class represents the ability to specify how a given ServiceInterface is used from the perspective of a given client. **Tags:** atp.Status=draft
Literal	**Description**
willCall	The client will call this method. **Tags:** atp.EnumerationValue=0
wontCall	The client won't call this method. **Tags:** atp.EnumerationValue=1

Table 3.75: ClientCapabilityEnum

Please note that the existence of the `ServerComSpec` has not explicitly been mentioned in this chapter because there is no extension or additional attribute that needs documentation for the *AUTOSAR adaptive platform*.

3.10.6.2 Port Prototypes typed by Persistency Data Interfaces

[TPS_MANI_01069] Further qualification of properties of `PortPrototype`s typed by `PersistencyKeyValueDatabaseInterface`s ⌈ For `PortPrototype`s typed by `PersistencyKeyValueDatabaseInterface`s it is possible to define further qualifying attributes for the provider side.

For this purpose meta-class `PersistencyDataProvidedComSpec` is provided. ⌋ *(RS_MANI_00027)*

[TPS_MANI_01074] Specification of encryption of persistent data ⌈ The specification that data related to a specific `PortPrototype` typed by a specific `PersistencyKeyValueDatabaseInterface` shall be encrypted can be made by having a `CryptoNeedToPortPrototypeMapping` refer to the mentioned `PortPrototype`. ⌋*(RS_MANI_00027)*

Class	**PersistencyDataProvidedComSpec**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ComSpec			
Note	This meta-class represents the ability to define port-specific attributes for supporting use cases of data persistency on the provided side. **Tags:** atp.Status=draft			
Base	*ARObject*, *PPortComSpec*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dataElement	PersistencyDataElement	1	ref	This refrence represents the PersistencyDataElement for which the PersistencyDataProvidedComSpec applies. **Tags:** atp.Status=draft
initValue	ValueSpecification	0..1	aggr	This aggregation represents the definition of an initial value for the PersistencyDataElement referenced by the enclosing PersistencyDataProvidedComSpec **Tags:** atp.Status=draft
redundancy	PersistencyRedundancyEnum	0..1	attr	This attribute represents a requirement towards the redundancy of storage.

Table 3.76: PersistencyDataProvidedComSpec

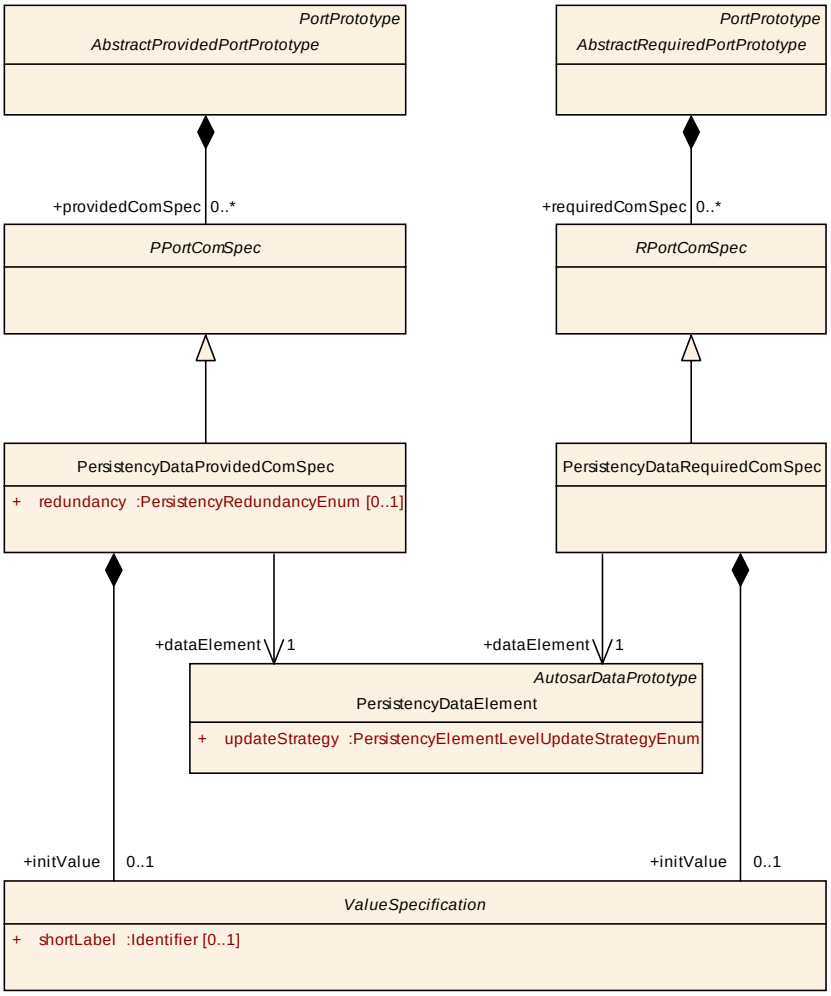


Figure 3.46: Modeling of `ComSpec` for persistency

Note that the specification of encryption as described in [TPS_MANI_01073] does not impose a binding contract. An integrator may reasonably have various reasons to overrule the configuration in the `PersistencyDataProvidedComSpec`.

It would simply not make any sense to statically model the encryption algorithms by means of an enumeration in the AUTOSAR meta-model and consequently require an update of this very enumeration in the AUTOSAR meta-model and XML schema in order to be able to use that hipster encryption algorithm that happens to fulfill ambitious needs in terms of encryption for a specific purpose.

[TPS_MANI_01075] Specification of redundancy of persistent data ⌈ The attribute `PersistencyDataProvidedComSpec.redundancy` can be taken to specify whether the respective key-value database shall store data redundantly from the perspective of the designer of the software-component. ⌋*(RS_MANI_00027)*

In contrast to the definition of encryption the specification of redundancy doesn't leave much freedom for the designer of a software-component. This person may only state that the values in the corresponding key-value database shall be or shall not be stored redundantly.

The details are left to an integrator who may also decide to overrule the value of PersistencyDataProvidedComSpec.redundancy entirely if there is a use case for that.

Enumeration	**PersistencyRedundancyEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ComSpec
Note	This meta-class provides a way to specify the behavior of a given persistent data element with respect to redundancy. **Tags:** atp.Status=draft
Literal	***Description***
none	This value represents the requirement that a piece of data to be stored persistently shall not end up in a redundant persistent storage facility. **Tags:** atp.EnumerationValue=1
redundant	This value represents the requirement that a piece of data to be stored persistently shall end up in a redundant persistent storage facility. The nature of the redundant persistent storage is not further qualified and subject to integrator decisions. **Tags:** atp.EnumerationValue=0

Table 3.77: PersistencyRedundancyEnum

[TPS_MANI_01160] Definition of initial value for PersistencyDataElement ⌈ The definition of an initial value for a PersistencyDataElement can be done on the level of a PortPrototype by means of either PersistencyDataProvidedComSpec.initValue resp. PersistencyDataRequiredComSpec.initValue ⌋ *(RS_MANI_00027)*

Class	**PersistencyDataRequiredComSpec**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ComSpec			
Note	This meta-class represents the ability to define port-specific attributes for supporting use cases of data persistency on the required side. **Tags:** atp.Status=draft			
Base	*ARObject*, *RPortComSpec*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dataElement	PersistencyDataElement	1	ref	This refrence represents the PersistencyDataElement for which the PersistencyDataRequiredComSpec applies. **Tags:** atp.Status=draft
initValue	ValueSpecification	0..1	aggr	This aggregation represents the definition of an initial value for the PersistencyDataElement referenced by the enclosing PersistencyDataRequiredComSpec **Tags:** atp.Status=draft

Table 3.78: PersistencyDataRequiredComSpec

3.11 Executable Group

This section contains the description of the formal modeling of the concept of an "application" itself. For this purpose, the meta-class `ExecutableGroup` has been created.

[TPS_MANI_01008] Semantics of `ExecutableGroup` ⌈ Meta-class `ExecutableGroup` represents the unit of distribution of application software for the adaptive platform towards an integration step, i.e. application software developers shall pass the results of their work in the form of an `ExecutableGroup` to the integration workflow. ⌋*(RS_MANI_00001)*

Class	**ExecutableGroup**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ApplicationStructure			
Note	This element describes a collection of executables. **Tags:** atp.Status=draft; atp.recommendedPackage=ExecutableGroups			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
executable	Executable	1..*	ref	Reference to executables that are contained in the Adaptive Autosar Application. **Tags:** atp.Status=draft
version	String	0..1	attr	Version of the Adaptive Autosar Application

Table 3.79: ExecutableGroup

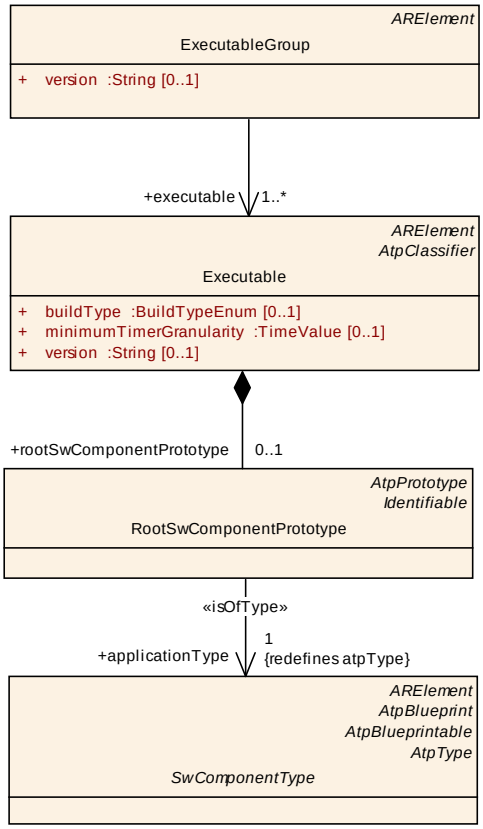


Figure 3.47: Modeling of the `ExecutableGroup` and `Executable`

In general, an `ExecutableGroup` may not be limited to the actual application level (i.e. conceptually located *above* the middleware), it is also supported to define an `ExecutableGroup` that actually represents a part of the concrete implementation of an *AUTOSAR adaptive platform*.

A possible example for this kind of application could be a Diagnostic Manager (DM).

[TPS_MANI_01009] Standardized values of `ExecutableGroup.category` ⌈ The following values of attribute `ExecutableGroup.category` are standardized by AUTOSAR:

- `APPLICATION_LEVEL`: the `ExecutableGroup` represents software on the application level (i.e. conceptually located *above* the middleware).
- `PLATFORM_LEVEL`: the `ExecutableGroup` represents software on the platform level (i.e. conceptually located *on the level of* the middleware).

⌋*(RS_MANI_00001)*

Both the meta-class `ExecutableGroup` and the meta-class `Executable` provide the ability to define a `version`.

The format and content of these version specifications is not constrained by the AUTOSAR standard, i.e the content of attribute `version` can be defined in custom ways and the AUTOSAR standard does **not** make any assumptions on how different values of `version` are compared to each other.

Class	**Executable**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ApplicationStructure			
Note	This meta-class represents an executable program. **Tags:** atp.Status=draft; atp.recommendedPackage=Executables			
Base	*ARElement*, *ARObject*, *AtpClassifier*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
buildType	BuildTypeEnum	0..1	attr	This attribute describes the buildType of a module and/or platform implementation.
minimumTimerGranularity	TimeValue	0..1	attr	This attribute describes the minimum timer resolution (TimeValue of one tick) that is required by the Executable. **Tags:** atp.Status=draft
rootSwComponentPrototype	RootSwComponentPrototype	0..1	aggr	This represents the root SwCompositionPrototype of the Executable. This aggregation is required (in contrast to a direct reference of a SwComponentType) in order to support the definition of instanceRefs in Executable context. **Tags:** atp.Status=draft
transformationPropsMappingSet	TransformationPropsToServiceInterfaceElementMappingSet	0..1	ref	Reference to a set of serialization properties that are defined for ServiceInterfaces of the Executable. **Tags:** atp.Status=draft
version	String	0..1	attr	Version of the executable. **Tags:** atp.Status=draft

Table 3.80: Executable

Enumeration	**BuildTypeEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::AdaptiveModuleImplementation
Note	This enumeration defines the possible buildTypes a software module may be implemented. **Tags:** atp.Status=draft
Literal	***Description***
buildTypeDebug	Used for debugging. **Tags:** atp.EnumerationValue=1
buildTypeRelease	Used for releasing. **Tags:** atp.EnumerationValue=0

Table 3.81: BuildTypeEnum

Each ExecutableGroup can refer to 1..* Executables. For practical purposes, this relation can be translated to "ExecutableGroup consists of 1..* Executables.

In contrast to a potential modeling of this relation as an aggregation, however, the reference-based approach supports the existence of the same Executable in the collection ExecutableGroup.executable of several ExecutableGroups.

[TPS_MANI_01010] Root element for a hierarchical software-component ⌈ Executable aggregates meta-class RootSwComponentPrototype in the role rootSwComponentPrototype to provide a root element for an arbitrarily nested hierarchy of software-components represented by the reference RootSwComponentPrototype.applicationType. ⌋*(RS_MANI_00004)*

Please note that the aggregation of RootSwComponentPrototype by Executable is the basis for the applicability of an ≪instanceRef≫ reference into the hierarchy of software-components that represent the functionality of the Executable.

This modeling approach is similar to the modeling of a System on the *AUTOSAR classic platform*.

[TPS_MANI_03056] Optionality of Executable.rootSwComponentPrototype ⌈ The aggregation Executable.rootSwComponentPrototype has been made optional in order to support the implementation of *platform modules* that do not utilize any service oriented communication and don't require any further formalization. ⌋ *(RS_MANI_00023)*

[constr_1492] SwComponentType referenced as Executable.rootSwComponentPrototype.applicationType ⌈ Any SwComponentType referenced in the role Executable.rootSwComponentPrototype.applicationType, or used to type a SwComponentPrototype nested inside the SwComponentType referenced in the role Executable.rootSwComponentPrototype.applicationType shall **only** be either a CompositionSwComponentType or an AdaptiveApplicationSwComponentType. ⌋*()*

The example depicted in Figure 3.48 exemplifies the statement of [constr_1492]. The example shows a component hierarchy that consists of SwComponentPrototypes that are excursively typed by either a CompositionSwComponentType or an AdaptiveApplicationSwComponentType.

While the left part of Figure 3.48 resembles the modeling in the meta-model, the right part uses a simplified notation to give an idea how the nested definition of software-components could look like.

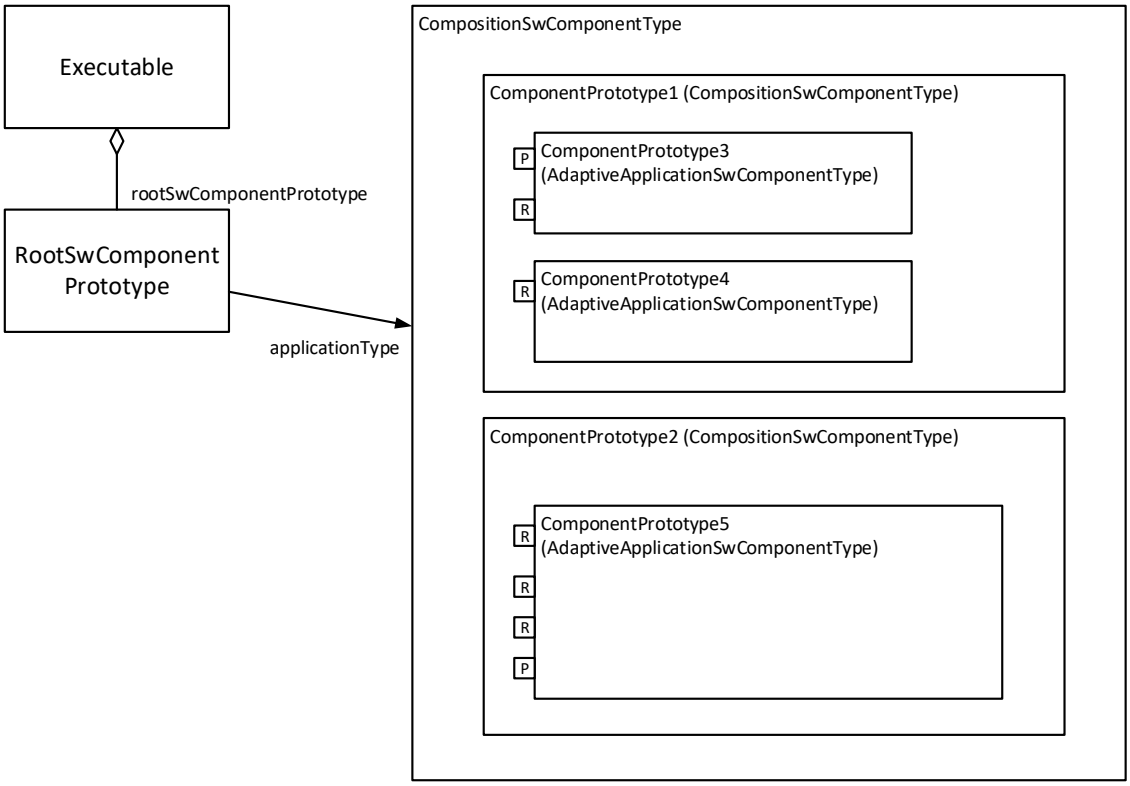


Figure 3.48: Example of the possible structure of an `Executable`

An obvious consequence of [constr_1492] is that no software-component that could be used on the *AUTOSAR classic platform* is allowed on the *AUTOSAR adaptive platform*, i.e. in the context of a `Executable`.`rootSwComponentPrototype`.`applicationType`.

Software-components on the *AUTOSAR adaptive platform* are mainly defined by their interaction with the outside world by means of `PortPrototype`s typed by `ServiceInterface`s. The definition of an internal behavior, with a minor exception, is not foreseen.

This lack of internal structure, in combination with decisions made regarding the scope of the generation of header files, leads to a situation where the implementation of a software component in source code is (in comparison to the situation on the *AUTOSAR classic platform*) way less subject to a strict separation.

In other words, there is no real motivation to implement software-components separately from each other. It would be possible, although not encouraged, to implement all software-components of a given executable program directly within the `Main()` function of the program.

Class	**RootSwComponentPrototype**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ApplicationStructure			
Note	The RootSwCompositionPrototype represents the top-level-composition of software components within an Executable. The contained SwComponentPrototypes are fully specified by their SwComponentTypes (including PortPrototypes, PortInterfaces, VariableDataPrototypes, etc.). **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpFeature*, *AtpPrototype*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
applicationType	SwComponentType	1	tref	This SwComponnetType acts as the Type of the RootSwComponentPrototype. **Stereotypes:** isOfType **Tags:** atp.Status=draft

Table 3.82: RootSwComponentPrototype

Class	***SwComponentType* (abstract)**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Components			
Note	Base class for AUTOSAR software components.			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Subclasses	AdaptiveApplicationSwComponentType, *AtomicSwComponentType*, CompositionSwComponentType, ParameterSwComponentType			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
consistencyNeeds	ConsistencyNeeds	*	aggr	This represents the collection of ConsistencyNeeds owned by the enclosing SwComponentType. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=shortName, variationPoint.shortLabel vh.latestBindingTime=preCompileTime
port	PortPrototype	*	aggr	The PortPrototypes through which this SwComponentType can communicate. The aggregation of PortPrototype is subject to variability with the purpose to support the conditional existence of PortPrototypes. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=shortName, variationPoint.shortLabel vh.latestBindingTime=preCompileTime

Attribute	Type	Mul.	Kind	Note
portGroup	PortGroup	*	aggr	A port group being part of this component. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=preCompileTime
swComponentDocumentation	SwComponentDocumentation	0..1	aggr	This adds a documentation to the SwComponentType. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=swComponentDocumentation, variationPoint.shortLabel vh.latestBindingTime=preCompileTime xml.sequenceOffset=-10
unitGroup	UnitGroup	*	ref	This allows for the specification of which UnitGroups are relevant in the context of referencing SwComponentType.

Table 3.83: SwComponentType

Class	CompositionSwComponentType			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Composition			
Note	A CompositionSwComponentType aggregates SwComponentPrototypes (that in turn are typed by SwComponentTypes) as well as SwConnectors for primarily connecting SwComponentPrototypes among each others and towards the surface of the CompositionSwComponentType. By this means hierarchical structures of software-components can be created. **Tags:** atp.recommendedPackage=SwComponentTypes			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *SwComponentType*			
Attribute	**Type**	**Mul.**	**Kind**	**Note**

Attribute	Type	Mul.	Kind	Note
component	SwComponent Prototype	*	aggr	The instantiated components that are part of this composition. The aggregation of SwComponentPrototype is subject to variability with the purpose to support the conditional existence of a SwComponentPrototype. Please be aware: if the conditional existence of SwComponentPrototypes is resolved post-build the deselected SwComponentPrototypes are still contained in the ECUs build but the instances are inactive in in that they are not scheduled by the RTE. The aggregation is marked as atpSplitable in order to allow the addition of service components to the ECU extract during the ECU integration. The use case for having 0 components owned by the CompositionSwComponentType could be to deliver an empty CompositionSwComponentType to e.g. a supplier for filling the internal structure. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=shortName, variation Point.shortLabel vh.latestBindingTime=postBuild
connector	SwConnector	*	aggr	SwConnectors have the principal ability to establish a connection among PortPrototypes. They can have many roles in the context of a CompositionSwComponentType. Details are refined by subclasses. The aggregation of SwConnectors is subject to variability with the purpose to support variant data flow. The aggregation is marked as atpSplitable in order to allow the extension of the ECU extract with AssemblySwConnectors between ApplicationSwComponentTypes and ServiceSwComponentTypes during the ECU integration. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=shortName, variation Point.shortLabel vh.latestBindingTime=postBuild
constantValueMapping	ConstantSpecificationMappingSet	*	ref	Reference to the ConstantSpecificationMapping to be applied for initValues of PPortComSpecs and RPortComSpec. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=constantValueMapping

Attribute	Type	Mul.	Kind	Note
dataTypeMapping	DataTypeMappingSet	*	ref	Reference to the DataTypeMapping to be applied for the used ApplicationDataTypes in PortInterfaces. Background: when developing subsystems it may happen that ApplicationDataTypes are used on the surface of CompositionSwComponentTypes. In this case it would be reasonable to be able to also provide the intended mapping to the ImplementationDataTypes. However, this mapping shall be informal and not technically binding for the implementers mainly because the RTE generator is not concerned about the CompositionSwComponentTypes. Rationale: if the mapping of ApplicationDataTypes on the delegated and inner PortPrototype matches then the mapping to ImplementationDataTypes is not impacting compatibility. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=dataTypeMapping
instantiationRTEEventProps	InstantiationRTEEventProps	*	aggr	This allows to define instantiation specific properties for RTE Events, in particular for instance specific scheduling. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=shortLabel, variationPoint.shortLabel vh.latestBindingTime=codeGenerationTime

Table 3.84: CompositionSwComponentType

3.12 Optional Members in complex Data Structures

3.12.1 Background

The *AUTOSAR adaptive platform* supports the usage of a TLV[9] data encoding on the SOME/IP transport layer. TLV is typically used where at least a part of the transmitted data is only *optionally* existing and filled with meaningful values.

In other words: an optional part of a data structure may exist and carry meaningful values in one instance of data transmission and be completely missing in another instance of the data transmission.

The receiving software needs to be able to identify whether the optional part exists and read its value accordingly.

[9]This abbreviation stands for tag-length-value

The receiving software also needs to be able to still execute in a meaningful way if the optional part of such a data structure does not exist in the specific communication instance.

Consequently, it is necessary to be able to precisely identify the parts of a data structure that may become optional for specific instances of data transmission.

In terms of the AUTOSAR meta-model, the identification could - in principle - be attached at various levels of abstraction:

AutosarDataType In this case the optionality that is only needed for communication purposes would still be existing in all other usages of data types. This seems unbalanced.

On top of that, the definition of different optionality configurations for the same data type may lead to the existence of a bunch of structurally identical data types that only vary in terms of optionality. The existence of variation points may help to mitigate this effect, though.

ServiceInterface In this case the optionality is defined where it is actually required. However, different optionality could - in principle - be defined for DataPrototypes typed by the same AutosarDataType.

This would lead to an increased effort for the definition of C++ data types in the context of the same ServiceInterface.

ComSpec In this case the definition of optionality would even be more specific in comparison to the definition of optionality on the level of ServiceInterfaces.

On top of that, the task to define optionality in the vast majority of cases is done by an OEM, whereas the model definition on the level of ComSpec requires the existence of SwComponentTypes and this definition is in many cases in the domain of a supplier.

As a result of this consideration, AUTOSAR has opted for implementation the concept of defining the optionality on the level of the ServiceInterface.

3.12.2 Definition of Optionality

As mentioned before, the concrete definition of optionality on the level of a ServiceInterface is done by the indication of individual DataPrototypes that are elements of a composite data structure as optional.

[TPS_MANI_01082] Eligibility of DataPrototypes for the definition of optionality
⌈ DataPrototypes identified as optional can only exist as

- part of a **composite data type** of category STRUCTURE
- arguments of a method within the scope of a ServiceInterface

⌋*(RS_MANI_00030)*

In other words, there is one use case (i.e. optional method argument) to define entire elements of a ServiceInterface as optional.

With respect to the question of eligibility for the definition of optional elements in array data structures: there is already a mechanism in place for the definition of variable-size arrays (VSA) described in the context of AUTOSAR and it would not make sense to add another way to achieve the same semantics.

The details are explained in the specification of the AUTOSAR Software Component Template [1].

The concrete modeling approach for the definition of optionality in the context of a ServiceInterface is sketched in Figure 3.49. The anchor point for this effort is the ServiceInterfaceSubElement.

[TPS_MANI_01083] Optionality is supported for ApplicationDataType as well as ImplementationDataType ⌈ The ServiceInterfaceSubElement supports the definition of optionality for the case the respective DataPrototype is typed by either an ApplicationDataType or an ImplementationDataType. ⌋ *(RS_MANI_00030)*

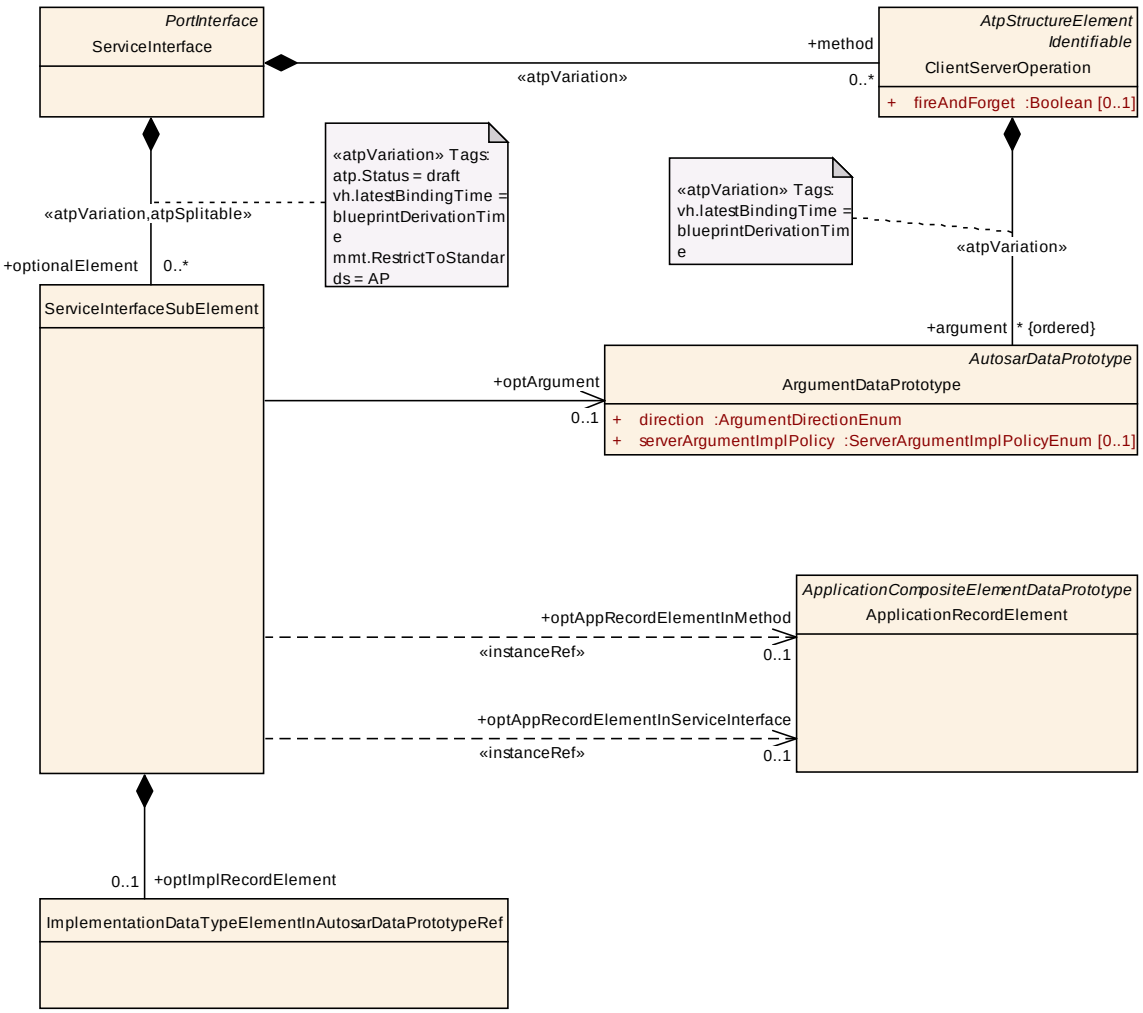


Figure 3.49: Modeling of optional members of `DataPrototype`s in the context of a `ServiceInterface`

[TPS_MANI_01084] Optionality for a `DataPrototype` typed by an `ApplicationDataType` ⌈ A `DataPrototype` typed by an `ApplicationDataType` that is eligible for the definition of optionality can only be an `ApplicationRecordElement` or an entire `ArgumentDataPrototype`. ⌋*(RS_MANI_00030)*

[TPS_MANI_01133] Optional element of an `event` ⌈ An `ApplicationRecordElement` can in principle be used inside the definition of an `event` or `field`. In this case either the reference `ServiceInterfaceSubElement.optAppRecordElementInServiceInterface` or `ServiceInterfaceSubElement.optImplRecordElement` shall exist. ⌋*(RS_MANI_00030)*

[TPS_MANI_01134] Optional element in the context of a `method` ⌈ If optionality occurs in the context of a `ClientServerOperation` then one of the following cases applies:

- An entire `argument` identified as optional shall be referenced in the role `ServiceInterfaceSubElement.optArgument`.

- An element of an argument typed by a composite data type identified as optional shall be referenced in either the role ServiceInterfaceSubElement.optAppRecordElementInMethod or the role ServiceInterfaceSubElement.optImplRecordElement.

⌋(*RS_MANI_00030*)

[constr_1546] Existence of attributes of ServiceInterfaceSubElement ⌈ For any given ServiceInterfaceSubElement, only one of the following attributes shall exist:

- optAppRecordElementInServiceInterface
- optAppRecordElementInMethod
- optArgument
- optImplRecordElement

⌋()

Class	**ApplicationRecordElement**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Datatype::DataPrototypes			
Note	Describes the properties of one particular element of an application record data type.			
Base	*ARObject*, *ApplicationCompositeElementDataPrototype*, *AtpFeature*, *AtpPrototype*, *DataPrototype*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 3.85: ApplicationRecordElement

Please note that the existence of the two different instanceRefs (in the roles optAppRecordElementInServiceInterface and optAppRecordElementInMethod) to ApplicationRecordElement for the same purpose of defining optionality has a purely formal background.

In more technical terms, the first atpContextElement of the reference optAppRecordElementInServiceInterface is the ServiceInterface while in the case of the reference optAppRecordElementInMethod the first atpContextElement is the ClientServerOperation.

For details regarding this formal aspect, please consult the definition of the "abstract structure" in the specification of the AUTOSAR Generic Structure Template [5].

More details about the specific modeling of ServiceInterfaceSubElement.optAppRecordElementInServiceInterface and ServiceInterfaceSubElement.optAppRecordElementInMethod can be found in section B.

Class	**ServiceInterfaceSubElement**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::OptionalElementInServiceInterface			
Note	This meta-class represents the ability to refer to sub-elements of fields, events, and arguments to methods that are typed by a composite data type **Tags:** atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
optAppRecordElementInMethod	ApplicationRecordElement	0..1	iref	This reference identifies an element of an ApplicationRecordDataType as an optional sub-element in the context of an argument to a method defined in the context of an enclosing ServiceInterface. **Tags:** atp.Status=draft
optAppRecordElementInServiceInterface	ApplicationRecordElement	0..1	iref	This reference identifies an element of an ApplicationRecordDataType as an optional sub-element of an event or a field in the context of the enclosing ServiceInterface. **Tags:** atp.Status=draft
optArgument	ArgumentDataPrototype	0..1	ref	This reference identifies optional arguments in the context of a ClientServerOperation. **Tags:** atp.Status=draft
optImplRecordElement	ImplementationDataTypeElementInAutosarDataPrototypeRef	0..1	aggr	This aggregation provides the ability to refer to ImplementationDataTypeElements as optional elements in the context of a ServiceInterface. **Tags:** atp.Status=draft

Table 3.86: ServiceInterfaceSubElement

Please note that the usage of `ApplicationDataType`s for the specification of a `ServiceInterface` for which optionality is defined has the implication that the code generator that creates the `API` towards the application software needs to take the optionality into account in the structurally identical `ImplementationDataType` that is tied to the respective `ApplicationDataType` by means of the applicable `DataTypeMap`.

[TPS_MANI_01085] Definition of optionality for a `DataPrototype` typed by an `ImplementationDataType` ⌈ For the definition of optionality for a `DataPrototype` typed by an `ImplementationDataType` it is necessary to aggregate `ImplementationDataTypeElementInAutosarDataPrototypeRef` in the role `optImplRecordElement` at the `ServiceInterfaceSubElement`. ⌋*(RS_MANI_00030)*

Nevertheless, the `ImplementationDataTypeElement` finally referenced as the target element in the context of an `ImplementationDataTypeElementInAutosarDataPrototypeRef` shall be part of a record data type.

[constr_1527] `ImplementationDataTypeElement` finally referenced as the target element in the context of an `ImplementationDataTypeElementIn-`

AutosarDataPrototypeRef ⌈ An ImplementationDataTypeElement referenced in the role ImplementationDataTypeElementInAutosarDataPrototypeRef.targetDataPrototype shall be aggregated by either of the following options:

1. An ImplementationDataType of category STRUCTURE.
2. An ImplementationDataTypeElement of category STRUCTURE .

⌋()

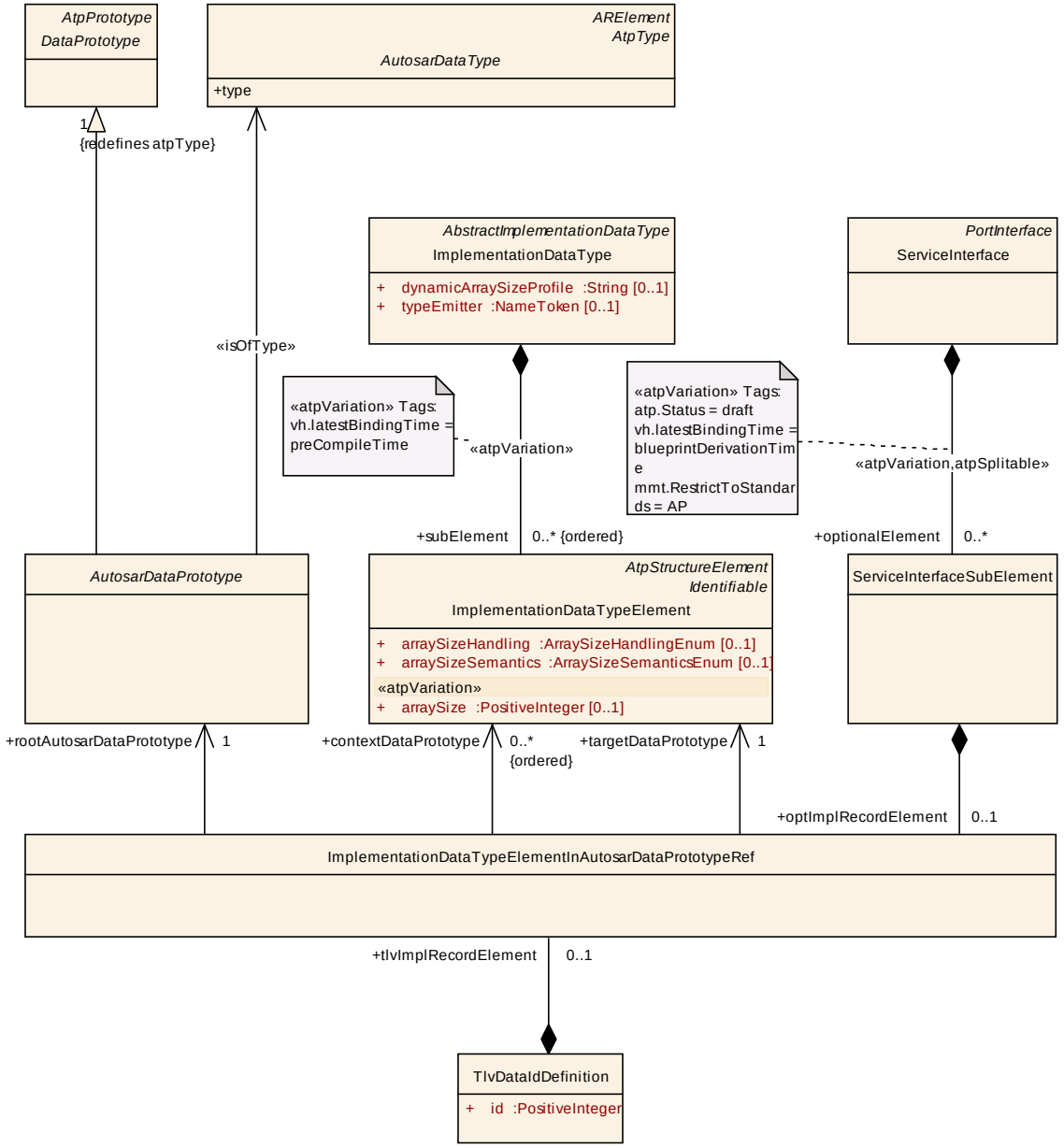


Figure 3.50: Modeling of optional members of DataPrototypes typed by ImplementationDataType in the context of a ServiceInterface

Class	**ImplementationDataTypeElementInAutosarDataPrototypeRef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::OptionalElementInServiceInterface			
Note	This meta-class represents the ability to refer to an ImplementationDataTypeElement in the context of a ServiceInterface. **Tags:** atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
contextDataPrototype (ordered)	ImplementationDataTypeElement	*	ref	This reference goes to context DataPrototypes. It is only required if indirections in the definition of the respective ImplementationDataType exist. **Tags:** atp.Status=draft xml.sequenceOffset=20
rootAutosarDataPrototype	AutosarDataPrototype	1	ref	This reference goes to either the event, field, or method argument in the role of a root element of a composite data structure typed by an ImplementationDataType. **Tags:** atp.Status=draft xml.sequenceOffset=10
targetDataPrototype	ImplementationDataTypeElement	1	ref	This reference points to the target ImplementationDataElement inside a composite ImplementationDataType **Tags:** atp.Status=draft xml.sequenceOffset=30

Table 3.87: ImplementationDataTypeElementInAutosarDataPrototypeRef

As mentioned before, a limitation in terms of data types used for the definition of optionality applies.

The nature of the limitation is that - within the context of one `ServiceInterface` - optionality shall be uniformly defined, i.e. all affected `DataPrototype`s shall not differ in terms of how they are referenced from a `ServiceInterfaceSubElement`.

[constr_1528] Definition of optionality for multiple `DataPrototype`s typed by the same `AutosarDataType` ⌈ Within the context of a given `ServiceInterface`, for each data type that has child elements that are referenced directly (if the `DataPrototype` is typed by an `ApplicationDataType`) or indirectly (if the `DataPrototype` is typed by an `ImplementationDataType`) from a `ServiceInterfaceSubElement` it is required that every `DataPrototype` typed by the respective composite `AutosarDataType` shall have exactly the same (in terms of the target `DataPrototype` within the composite `DataPrototype`) set of references in the role `ServiceInterface.optionalElement`. ⌋*()*

Figure 3.51 contains a simplified sketch of the main statement of [constr_1528]. Of the three `ServiceInterfaceSubElement`, two define a consistent reference to one `DataPrototype` as a sub-element of the composite data type.

The third ServiceInterfaceSubElement refers to a different DataPrototype within the composite data type. In this case a violation of [constr_1528] shall be reported.

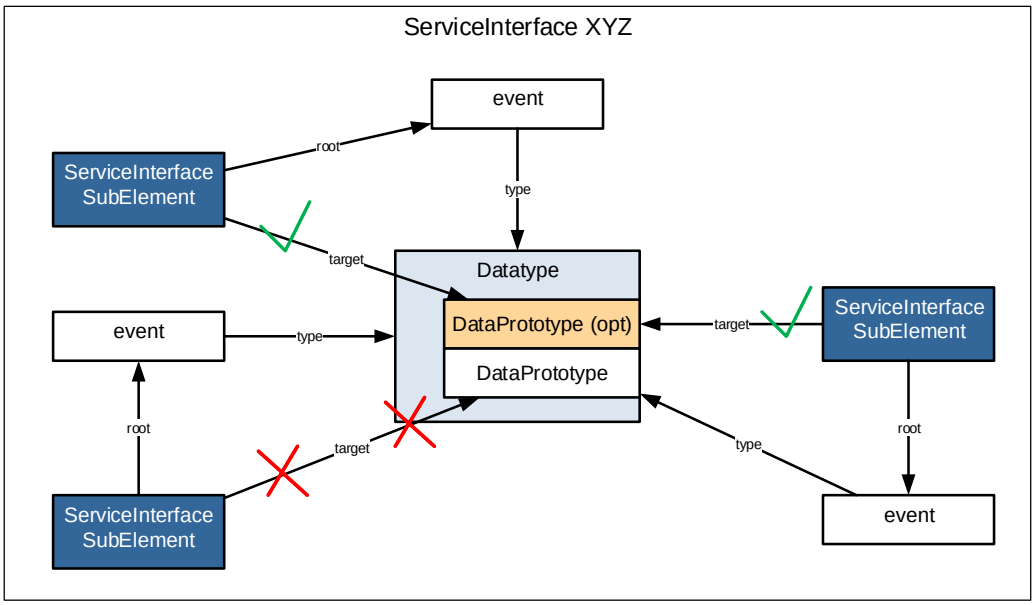


Figure 3.51: Simplified example of the application of ServiceInterfaceSubElement

Please note that the modeling approach for the definition of optionality on the level of a ServiceInterface explicitly leaves out the question of how the necessary tag id is assigned.

It is assumed that the step in the project workflow where ServiceInterfaces and their optional elements are defined is not the step where the assignment of an actual TLV data id (that is not to be confused with the actual tag that is used on the bus to identify the element) is in the focus.

Therefore, the assignment of TLV data ids has intentionally been separated from the rest of the definition of optionality. Details can be found in section 3.13.3.

3.13 Serialization Properties

In Adaptive AUTOSAR, the serialization code is generated out of the service description and is compiled and executed in the application context.

The meta-class TransformationPropsToServiceInterfaceElementMapping defines the serialization for a ServiceInterface element and provides the necessary serialization settings with the TransformationProps element.

The existence of a TransformationPropsToServiceInterfaceElementMapping demands the existence of serialization code that is linked with the application component object file to an application binary.

The serialization of SOME/IP is based on the ServiceInterface specification. If an AutosarDataPrototype that is used within a ServiceInterface is composite like a structure, union or array then SOME/IP supports the configuration of length fields that will be put in front of the serialized data.

AUTOSAR supports the configuration of such serialization settings on two different levels:

- Modeling on ServiceInterface element level in the context of an Executable that is valid for all available occurrences of a DataPrototype in the ServiceInterface element. This case is described in detail in chapter 3.13.1.
- Fine granular modeling on the level of DataPrototypes described in this chapter. This case is described in detail in chapter 3.13.2.

3.13.1 Default Values for Serialization Properties

[TPS_MANI_03101] SOME/IP serialization ⌈ The ApSomeipTransformationProps meta-class that is referenced by the TransformationPropsToServiceInterfaceElementMapping in the role transformationProps provides the ability to define a SOME/IP serialization settings for ServiceInterface elements that are referenced by the TransformationPropsToServiceInterfaceElementMapping in the role event, method or field. ⌋*(RS_MANI_00008, RS_MANI_00025)*

[constr_3395] TransformationPropsToServiceInterfaceElementMapping is restricted to one single ServiceInterface ⌈ All ServiceInterface elements that are referenced by the TransformationPropsToServiceInterfaceElementMapping in the role event, method or field shall be aggregated by the same ServiceInterface in the role event, method or field. ⌋*()*

[TPS_MANI_03103] Default size for all array length fields ⌈ The attribute sizeOfArrayLengthField of ApSomeipTransformationProps referenced by TransformationPropsToServiceInterfaceElementMapping in the role transformationProps defines the size of a length field generated by SOME/IP in front of all available arrays defined in ServiceInterface elements that are referenced by the TransformationPropsToServiceInterfaceElementMapping in the role event, method or field. ⌋*(RS_MANI_00008, RS_MANI_00025)*

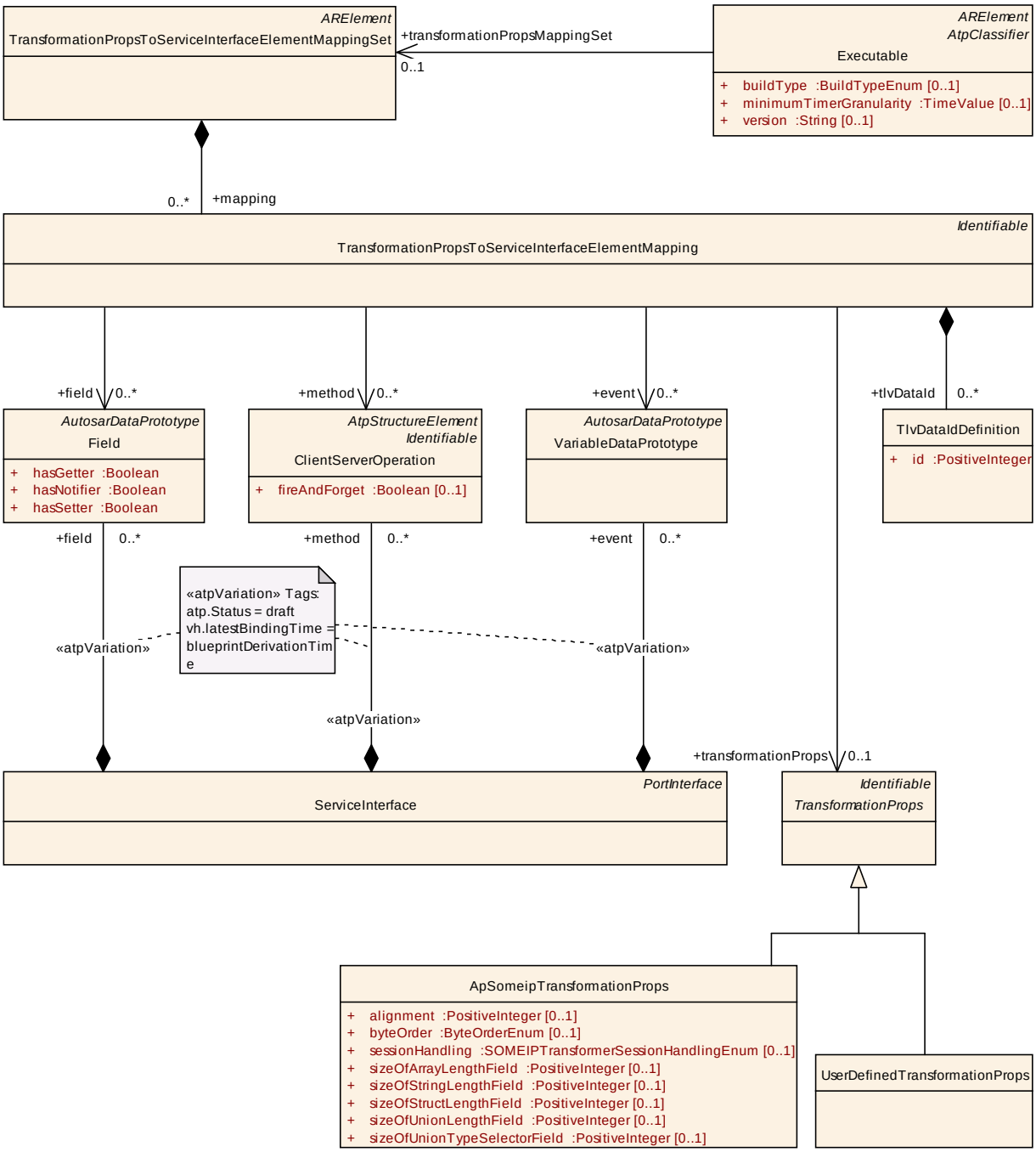


Figure 3.52: Association of serialization properties with a ServiceInterface in the context of an Executable

[TPS_MANI_03104] Default size for all structure length fields ⌈ The attribute `sizeOfStructLengthField` of `ApSomeipTransformationProps` referenced by `TransformationPropsToServiceInterfaceElementMapping` in the role `transformationProps` defines the size of a length field generated by SOME/IP in front of all available structures defined in `ServiceInterface` elements that are referenced by the `TransformationPropsToServiceInterfaceElementMapping` in the role `event`, `method` or `field`. ⌋*(RS_MANI_00008, RS_MANI_00025)*

[TPS_MANI_03117] Default size for all string length fields ⌈ The attribute sizeOfStringLengthField of ApSomeipTransformationProps referenced by TransformationPropsToServiceInterfaceElementMapping in the role transformationProps defines the size of a length field generated by SOME/IP in front of all available strings defined in ServiceInterface elements that are referenced by the TransformationPropsToServiceInterfaceElementMapping in the role event, method or field. ⌋*(RS_MANI_00008, RS_MANI_00025)*

[TPS_MANI_03105] Default size for all union length fields ⌈ The attribute sizeOfUnionLengthField of ApSomeipTransformationProps referenced by TransformationPropsToServiceInterfaceElementMapping in the role transformationProps defines the size of a length field generated by SOME/IP in front of all available unions defined in ServiceInterface elements that are referenced by the TransformationPropsToServiceInterfaceElementMapping in the role event, method or field. ⌋*(RS_MANI_00008, RS_MANI_00025)*

[TPS_MANI_03106] Default size for all union type selector fields ⌈ The attribute sizeOfUnionTypeSelectorField of ApSomeipTransformationProps referenced by TransformationPropsToServiceInterfaceElementMapping in the role transformationProps defines the size of a type field generated by SOME/IP in front of all available unions defined in ServiceInterface elements that are referenced by the TransformationPropsToServiceInterfaceElementMapping in the role event, method or field. ⌋*(RS_MANI_00008, RS_MANI_00025)*

[TPS_MANI_03107] Default alignment for all dynamic DataPrototypes ⌈ The attribute alignment of ApSomeipTransformationProps referenced by TransformationPropsToServiceInterfaceElementMapping in the role transformationProps defines the padding for alignment purposes that will be added by SOME/IP after the serialized data of all variable data length data elements defined in ServiceInterface elements that are referenced by the TransformationPropsToServiceInterfaceElementMapping in the role event, method or field. ⌋ *(RS_MANI_00008, RS_MANI_00025)*

[TPS_MANI_03108] Default Byte Order for all DataPrototypes ⌈ The attribute byteOrder of ApSomeipTransformationProps referenced by TransformationPropsToServiceInterfaceElementMapping in the role transformationProps defines the Byte Order in the serialized data stream resulting from ServiceInterface elements that are referenced by the TransformationPropsToServiceInterfaceElementMapping in the role event, method or field. ⌋ *(RS_MANI_00008, RS_MANI_00025)*

Please note that more details about ApSomeipTransformationProps can be found in chapter 3.13.2.

Class	**ApSomeipTransformationProps**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::TransformationConfiguration			
Note	SOME/IP serialization properties. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *TransformationProps*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
alignment	PositiveInteger	0..1	attr	Specifies the alignment of dynamic data in the serialized data stream. The alignment is specified in Bits.
byteOrder	ByteOrderEnum	0..1	attr	Specifies the byte order of data in the serialized data stream.
sessionHandling	SOMEIPTransformerSessionHandlingEnum	0..1	attr	Defines whether the SOME/IP transformer shall use session handling for Sender/Receiver communication.
sizeOfArrayLengthField	PositiveInteger	0..1	attr	Configures the SOME/IP serialization for the referenced dataPrototype in case of an Array. It describes the size of the length field (in Bytes) that will be put in front of the Array in the SOME/IP message. In contrast to Classic AUTOSAR this attribute defines the value for both, fixed-size and dynamic-size arrays.
sizeOfStringLengthField	PositiveInteger	0..1	attr	Configures the SOME/IP serialization for the referenced dataPrototype in case of a String. It describes the size of the length field (in Bytes) that will be put in front of the String in the SOME/IP message.
sizeOfStructLengthField	PositiveInteger	0..1	attr	Configures the SOME/IP serialization for the referenced dataPrototype in case of an Struct. It describes the size of the length field (in Bytes) that will be put in front of the Struct in the SOME/IP message.
sizeOfUnionLengthField	PositiveInteger	0..1	attr	Configures the SOME/IP serialization for the referenced dataPrototype in case of a Union. It describes the size of the length field (in Bytes) that will be put in front of the Union in the SOME/IP message.
sizeOfUnionTypeSelectorField	PositiveInteger	0..1	attr	Configures the SOME/IP serialization for the referenced dataPrototype in case of a Union. It describes the size of the type selector field (in Bytes) that will be put in front of the Union in the SOME/IP message.

Table 3.88: ApSomeipTransformationProps

[TPS_MANI_03102] UserDefined serialization ⌈ The `UserDefinedTransformationProps` meta-class that is referenced by the `TransformationPropsToServiceInterfaceElementMapping` in the role `transformationProps` provides the ability to define a User defined serialization for `ServiceInterface` elements that are referenced by the `TransformationPropsToServiceInterfaceElementMapping` in the role `event`, `method` or `field`. ⌋*(RS_MANI_00014, RS_MANI_00025)*

Please note that `UserDefinedTransformationProps` is derived from meta-class `Identifiable` and therefore has the ability to describe special data (`sdg`) by which it is possible to define custom structural extensions of an AUTOSAR model in a generic way. For more information about special data please refer to [5].

Class	**TransformationPropsToServiceInterfaceElementMappingSet**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::TransformationConfiguration			
Note	Collection of TransformationPropsToServiceInterfaceElementMappings. **Tags:** atp.Status=draft; atp.recommendedPackage=TransformationPropsToService InterfaceMappingSets			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
mapping	TransformationPropsToServiceInterfaceElementMapping	*	aggr	Mapping that assigns serialization properties to elements of a ServiceInterface. **Tags:** atp.Status=draft

Table 3.89: TransformationPropsToServiceInterfaceElementMappingSet

Class	**TransformationPropsToServiceInterfaceElementMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::ApplicationStructure			
Note	This meta-class represents the ability to associate a ServiceInterface element with TransformationProps. The referenced elements of the Service Interface will be serialized according to the settings defined in the TransformationProps. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
event	VariableDataPrototype	*	ref	This represents the reference to one or several events of one ServiceInterface. **Tags:** atp.Status=draft
field	Field	*	ref	This represents the reference to one or several fields of one ServiceInterface. **Tags:** atp.Status=draft
method	ClientServerOperation	*	ref	This represents the reference to one or several methods of one ServiceInterface. **Tags:** atp.Status=draft
tlvDataId	TlvDataIdDefinition	*	aggr	This aggregation represents the collection of tlvDataIds defined in the enclosing context. **Tags:** atp.Status=draft
transformationProps	TransformationProps	0..1	ref	This represents the reference to the applicable Serialization properties. **Tags:** atp.Status=draft

Table 3.90: TransformationPropsToServiceInterfaceElementMapping

Class	**UserDefinedTransformationProps**			
Package	M2::AUTOSARTemplates::SystemTemplate::Transformer			
Note	The class UserDefinedTransformationProps specifies specific configuration properties of a user defined serializer.			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *TransformationProps*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 3.91: UserDefinedTransformationProps

3.13.2 Individual Definition of Serialization Properties

[TPS_MANI_03109] `TransformationProps` on the level of `DataPrototype`s overwrites `TransformationProps` settings on the level of a `ServiceInterface` ⌈ The fine granular modeling of `TransformationProps` on the level of `DataPrototype`s overwrites the `TransformationProps` settings defined on the level of a `ServiceInterface` described with the `TransformationPropsToServiceInterfaceElementMappingSet`. ⌋*()*

[constr_3361] Selective definition of serialization settings ⌈ If a `SomeipDataPrototypeTransformationProps` is defined for a composite `DataPrototype` of an element of a `ServiceInterface` (`method`, `field`, `event`) and if the reference `someipTransformationProps` exists then `SomeipDataPrototypeTransformationProps` that define the reference `someipTransformationProps` shall be defined for all other composite `DataPrototype`s of the `ServiceInterface` element as well. ⌋*()*

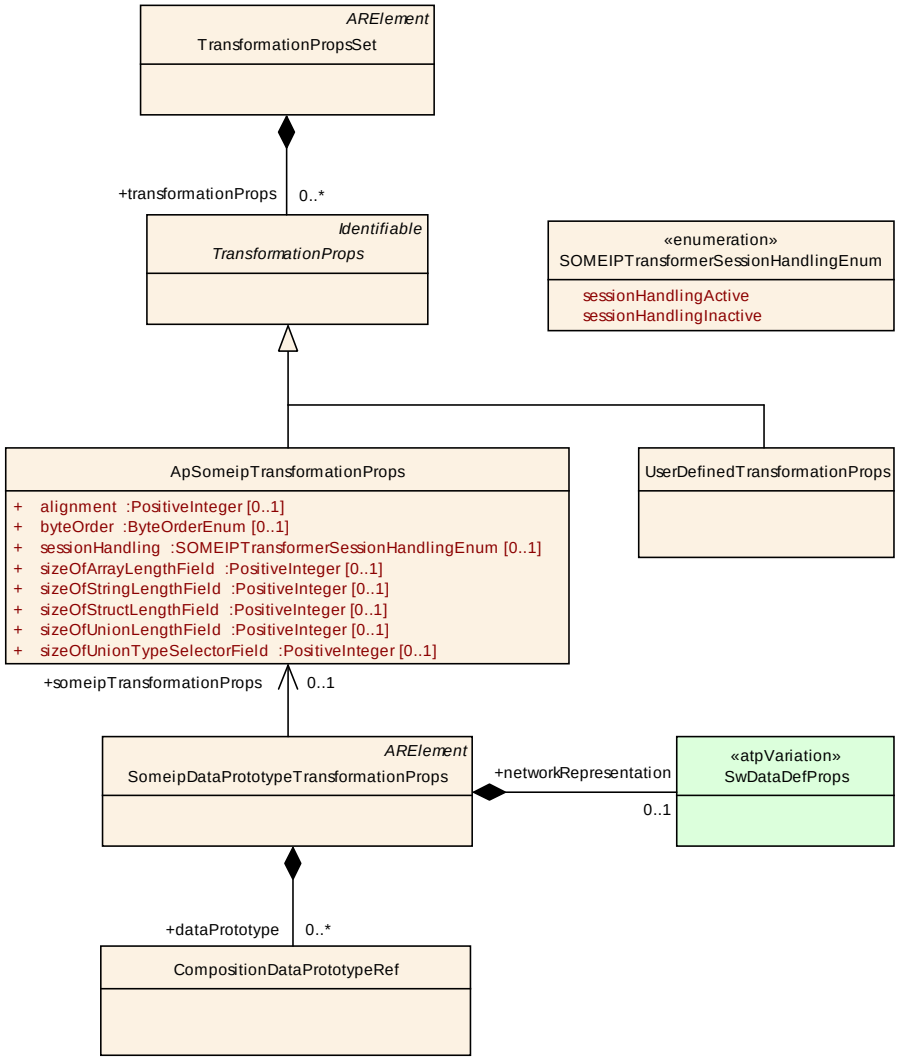


Figure 3.53: Overview about SOME/IP Serialization Properties

Class	**TransformationPropsSet**			
Package	M2::AUTOSARTemplates::SystemTemplate::Transformer			
Note	Collection of TransformationProps. **Tags:** atp.recommendedPackage=TransformationPropsSets			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
transformationProps	TransformationProps	*	aggr	Transformer specific configuration properties.

Table 3.92: TransformationPropsSet

Class	**ApSomeipTransformationProps**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::TransformationConfiguration			
Note	SOME/IP serialization properties. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *TransformationProps*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
alignment	PositiveInteger	0..1	attr	Specifies the alignment of dynamic data in the serialized data stream. The alignment is specified in Bits.
byteOrder	ByteOrderEnum	0..1	attr	Specifies the byte order of data in the serialized data stream.
sessionHandling	SOMEIPTransformerSessionHandlingEnum	0..1	attr	Defines whether the SOME/IP transformer shall use session handling for Sender/Receiver communication.
sizeOfArrayLengthField	PositiveInteger	0..1	attr	Configures the SOME/IP serialization for the referenced dataPrototype in case of an Array. It describes the size of the length field (in Bytes) that will be put in front of the Array in the SOME/IP message. In contrast to Classic AUTOSAR this attribute defines the value for both, fixed-size and dynamic-size arrays.
sizeOfStringLengthField	PositiveInteger	0..1	attr	Configures the SOME/IP serialization for the referenced dataPrototype in case of a String. It describes the size of the length field (in Bytes) that will be put in front of the String in the SOME/IP message.
sizeOfStructLengthField	PositiveInteger	0..1	attr	Configures the SOME/IP serialization for the referenced dataPrototype in case of an Struct. It describes the size of the length field (in Bytes) that will be put in front of the Struct in the SOME/IP message.
sizeOfUnionLengthField	PositiveInteger	0..1	attr	Configures the SOME/IP serialization for the referenced dataPrototype in case of a Union. It describes the size of the length field (in Bytes) that will be put in front of the Union in the SOME/IP message.
sizeOfUnionTypeSelectorField	PositiveInteger	0..1	attr	Configures the SOME/IP serialization for the referenced dataPrototype in case of a Union. It describes the size of the type selector field (in Bytes) that will be put in front of the Union in the SOME/IP message.

Table 3.93: ApSomeipTransformationProps

Enumeration	**SOMEIPTransformerSessionHandlingEnum**
Package	M2::AUTOSARTemplates::SystemTemplate::Transformer
Note	Enables or disable session handling for SOME/IP transformer
Literal	***Description***
sessionHandlingActive	The SOME/IP Transformer shall use session handling **Tags:** atp.EnumerationValue=0

sessionHandlingInactive	The SOME/IP Transformer doesn't use session handling **Tags:** atp.EnumerationValue=1

Table 3.94: SOMEIPTransformerSessionHandlingEnum

[TPS_MANI_03070] Size of a length field for a chosen array ⌈ The attribute `sizeOfArrayLengthField` of `ApSomeipTransformationProps` defines the size of a length field generated by SOME/IP in front of an array for which the `SomeipDataPrototypeTransformationProps` is defined, i.e. the array that is referenced within the aggregated `CompositionDataPrototypeRef`. ⌋*(RS_MANI_00008, RS_MANI_00024)*

[constr_3353] Restriction in usage of `ApSomeipTransformationProps.sizeOfArrayLengthField` ⌈ The value of the attribute `sizeOfArrayLengthField` shall be either 0, 1, 2 or 4. ⌋*()*

[TPS_MANI_03071] Size of a length field for a chosen structure ⌈ The attribute `sizeOfStructLengthField` of `ApSomeipTransformationProps` defines the size of a length field generated by SOME/IP in front of a structure for which the `SomeipDataPrototypeTransformationProps` is defined, i.e. the structure that is referenced within the aggregated `CompositionDataPrototypeRef`. ⌋*(RS_MANI_00008, RS_MANI_00024)*

[constr_3354] Restriction in usage of `ApSomeipTransformationProps.sizeOfStructLengthField` ⌈ The value of the attribute `sizeOfStructLengthField` shall be either 0, 1, 2 or 4. ⌋*()*

[TPS_MANI_03116] Size of a length field for a chosen string ⌈ The attribute `sizeOfStringLengthField` of `ApSomeipTransformationProps` defines the size of a length field generated by SOME/IP in front of a String for which the `SomeipDataPrototypeTransformationProps` is defined, i.e. the String that is referenced within the aggregated `CompositionDataPrototypeRef`. ⌋*(RS_MANI_00008, RS_MANI_00024)*

[constr_3372] Restriction in usage of `ApSomeipTransformationProps.sizeOfStringLengthField` ⌈ The value of the attribute `sizeOfStringLengthField` shall be either 0, 1, 2 or 4. ⌋*()*

[TPS_MANI_03072] Size of a length field for a chosen union ⌈ The attribute `sizeOfUnionLengthField` of `ApSomeipTransformationProps` defines the size of a length field generated by SOME/IP in front of a union for which the `SomeipDataPrototypeTransformationProps` is defined, i.e. the union that is referenced within the aggregated `CompositionDataPrototypeRef`. ⌋*(RS_MANI_00008, RS_MANI_00024)*

[constr_3355] Restriction in usage of `ApSomeipTransformationProps.sizeOfUnionLengthField` ⌈ The value of the attribute `sizeOfUnionLengthField` shall be either 0, 1, 2 or 4. ⌋*()*

[TPS_MANI_03073] Alignment of a dynamic DataPrototype ⌈ The attribute alignment of ApSomeipTransformationProps defines the padding for alignment purposes that will be added by SOME/IP after the serialized data of the variable data length data element for which the SomeipDataPrototypeTransformationProps is defined, i.e. the variable data length DataPrototype that is referenced within the aggregated CompositionDataPrototypeRef. ⌋*(RS_MANI_00008, RS_MANI_00024)*

[constr_3356] Restriction in usage of ApSomeipTransformationProps.alignment ⌈ The value of the attribute alignment shall always be divisible by 8. ⌋*()*

[TPS_MANI_03074] Size of a type selector field for a chosen union ⌈ The attribute sizeOfUnionTypeSelectorField of ApSomeipTransformationProps defines the size of a type selector field generated by SOME/IP in front of a union for which the SomeipDataPrototypeTransformationProps is defined, i.e. the union that is referenced within the aggregated CompositionDataPrototypeRef. ⌋ *(RS_MANI_00008, RS_MANI_00024)*

[constr_3357] Restriction in usage of ApSomeipTransformationProps.sizeOfUnionTypeSelectorField ⌈ The value of the attribute sizeOfUnionTypeSelectorField shall be either 1, 2 or 4. ⌋*()*

[TPS_MANI_03075] Byte Order of chosen DataPrototype in the serialized data stream ⌈ The attribute byteOrder of ApSomeipTransformationProps defines the Byte Order in front of the DataPrototype in the serialized data stream for which the SomeipDataPrototypeTransformationProps is defined, i.e. the DataPrototype that is referenced within the aggregated CompositionDataPrototypeRef. ⌋ *(RS_MANI_00008, RS_MANI_00024)*

Class	**SomeipDataPrototypeTransformationProps**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::TransformationConfiguration			
Note	This meta-class represents the ability to define data transformation props specifically for a SOME/IP serialization for a given DataPrototype. **Tags:** atp.Status=draft; atp.recommendedPackage=SomeipDataPrototype TransformationPropss			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dataPrototype	CompositionDataPrototypeRef	*	aggr	Collection of DataPrototypes for which the settings in SomeipDataPrototypeTransformationProps are valid. For reuse reasons the SomeipDataPrototypeTransformationProps is able to aggregate several DataPrototypes. **Tags:** atp.Status=draft

Attribute	Type	Mul.	Kind	Note
networkRepresentation	SwDataDefProps	0..1	aggr	Optional specification of the actual network representation for the referenced primitive DataPrototype. If a network representation is provided then the baseType available in the SwDataDefProps shall be used as input for the serialization/deserialization. If the networkRepresentation is not provided then the baseType of the ImplementationDataType shall be used for the serialization/deserialization. **Tags:** atp.Status=draft
someipTransformationProps	ApSomeipTransformationProps	0..1	ref	This reference represents the ability to define data transformation props specifically for a SOME/IP serialization. **Tags:** atp.Status=draft

Table 3.95: SomeipDataPrototypeTransformationProps

Class	CompositionDataPrototypeRef			
Package	M2::AUTOSARTemplates::AdaptivePlatform::General			
Note	This meta-class represents the ability to refer to an AUTOSAR DataPrototype in the context of a CompositionSwComponentType. **Tags:** atp.Status=draft			
Base	*ARObject*			
Attribute	**Type**	**Mul.**	**Kind**	**Note**
dataPrototype	DataPrototype	0..1	iref	This attribute shall exist if the InstanceRef points to a DataPrototype typed by an ApplicationDataType. **Tags:** atp.Status=draft
elementInImplDatatype	ElementInImplementationDatatypeInstanceRef	0..1	aggr	This attribute shall exist if the InstanceRef points to a DataPrototype typed by an ImplementationDataType. **Tags:** atp.Status=draft

Table 3.96: CompositionDataPrototypeRef

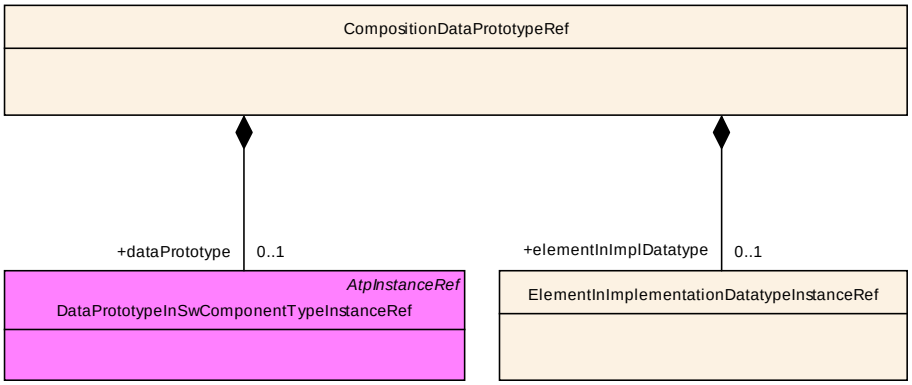


Figure 3.54: Reference to a DataPrototype in the context of a CompositionSwComponentType that is typed by an ApplicationDataType or by an ImplementationDataType

[TPS_MANI_01136] `AutosarDataPrototype` is the target of the `CompositionDataPrototypeRef` ⌈ If the target of an `CompositionDataPrototypeRef` is an `AutosarDataPrototype` the role `CompositionDataPrototypeRef.dataPrototype` shall be used to describe the reference **independently** of whether the `AutosarDataPrototype` is typed by an `ApplicationDataType` or an `ImplementationDataType` and even **independently** of whether the `AutosarDataType` of the `AutosarDataPrototype` represents a composite data type. ⌋*(RS_MANI_00008, RS_MANI_00024)*

[TPS_MANI_01137] Applicable use cases for `CompositionDataPrototypeRef` ⌈ Table 3.97 contains a comprehensive list of use cases for the usage of `CompositionDataPrototypeRef`. ⌋*(RS_MANI_00008, RS_MANI_00024)*

Use case	Role
`AutosarDataPrototype` typed by an `ApplicationDataType`	`dataPrototype`
`DataPrototype` in `AutosarDataPrototype` typed by an `ApplicationCompositeDataType`	`dataPrototype`
`AutosarDataPrototype` typed by an `ImplementationDataType`	`dataPrototype`
`DataPrototype` in `AutosarDataPrototype` typed by an `ImplementationDataType`	`elementInImplDatatype`

Table 3.97: Possible use cases for the usage of `CompositionDataPrototypeRef`

From a careful observation of Table 3.97 it should be clear that there is no valid use case to simultaneously use the two roles `dataPrototype` and `elementInImplDatatype` in the context of the same `CompositionDataPrototypeRef`.

[constr_1551] Existence of `CompositionDataPrototypeRef.dataPrototype` vs. `CompositionDataPrototypeRef.elementInImplDatatype` ⌈ For every given `CompositionDataPrototypeRef`, either the aggregation `CompositionDataPrototypeRef.dataPrototype` or `CompositionDataPrototypeRef.elementInImplDatatype` shall exist. ⌋*()*

The usage of the SomeipDataPrototypeTransformationProps.networkRepresentation is explained in more detail in the System Template [14] in [TPS_SYST_02136] and [TPS_SYST_02137].

3.13.3 Assignment of TLV Data IDs for Data Structures with optional Members

[TPS_MANI_01097] Assignment of TLV data ids for data structures with optional members ⌈ The assignment of TLV data ids for data structures with optional members is done in the context of the specification of TransformationPropsToServiceInterfaceElementMapping, namely by means of the attribute TransformationPropsToServiceInterfaceElementMapping.tlvDataId.id. ⌋ *(RS_MANI_00030)*

This approach takes benefit from the fact that the TlvDataIdDefinition is able to create references into any nested level of data structures.

The assignment of the TLV data id is therefore done by creating such a reference and assigning a TLV data id to it by means of the attribute TlvDataIdDefinition.id.

Please note that the assignment of TLV data ids is compulsory for an entire data structure that has at least one optional member. In a nutshell, this conclusion (that is also backed by [PRS_SOMEIP_00230], see [15]) is the motivation for the existence of [constr_1532].

Please note further that the assignment of TLV data ids is not restricted to data structures with optional members. There is also a use case to support sending the elements of a specific data structure in arbitrary order even if none of the elements is considered optional.

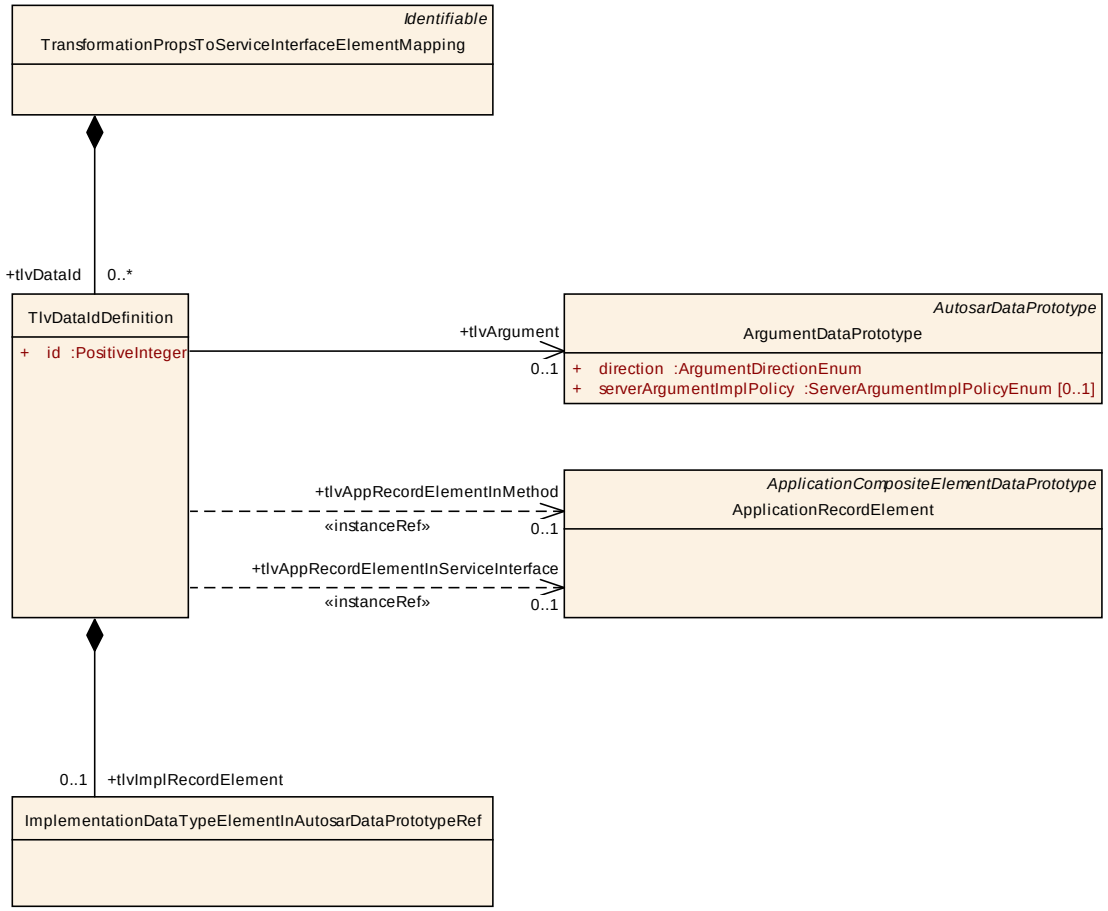


Figure 3.55: Modeling of the TLV data id

[constr_1532] Consistent assignment of TLV data ids to data structures with optional members ⌈ For every `DataPrototype` or `ImplementationDataType` resp. `ImplementationDataTypeElement` of `category` `STRUCTURE` where direct members are the target of either

- `ServiceInterfaceSubElement.optAppRecordElementInMethod`
- `ServiceInterfaceSubElement.optAppRecordElementInServiceInterface`
- `ServiceInterfaceSubElement.optImplRecordElement`

references to **all direct members** of this `DataPrototype` or `ImplementationDataType` resp. `ImplementationDataTypeElement` shall be created on the basis of the definition of `TlvDataIdDefinition` and **within the definition of each** respective `TlvDataIdDefinition` the attribute `TlvDataIdDefinition.id` **shall exist and have a unique value** in the context of respective enclosing `DataPrototype` or `ImplementationDataType` resp. `ImplementationDataTypeElement`. ⌋()

Please note, however, that [constr_1532] only extends to the existence of `TlvDataIdDefinition.id`.

The numerical values of TlvDataIdDefinition.id for eligible DataPrototypes or ImplementationDataTypeElements within the context of the same ApplicationRecordDataType resp. ImplementationDataType of category STRUCTURE don't have to be identical.

In other words, if the ids for the elements of a given structure are set to 1, 2, and 3 for one DataPrototype then it is possible that the ids for another DataPrototype typed by the same ApplicationRecordDataType are set to different values, e.g. 4, 5, and 6.

To bring this example one step further, the definition of values 1, 1, and 3 as tag ids in the context of the enclosing DataPrototype **would have to be rejected** by regulation of [constr_1532].

The important aspect of the definition of tag ids (similar to other serialization-related information) is that the settings need to be shared between sender and receiver.

Obviously, a constraint similar to [constr_1532] (and similarly motivated by the existence of [PRS_SOMEIP_00231], see [15]) needs to exist for the case of optional arguments in a ClientServerOperation.

[constr_1537] Consistent assignment of TLV data ids to arguments of a given ClientServerOperation ⌈ For each ClientServerOperation where at least one argument is the target of a reference in the role ServiceInterfaceSubElement.optArgument references to all arguments shall be created on the basis of the definition of TlvDataIdDefinition and **within the definition of each** respective TlvDataIdDefinition the attribute TlvDataIdDefinition.id **shall exist and have a unique value** in the context of respective enclosing ClientServerOperation. ⌋*()*

Please note that [constr_1532] and [constr_1537] do not exclusively apply, there may be ClientServerOperations that have optional arguments as well as non-optional arguments typed a composite data type for which optional elements have been identified.

A scenario like this would obviously be subject to the application of both [constr_1532] and [constr_1537].

Class	**TlvDataIdDefinition**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::TransformationConfiguration			
Note	This meta-class represents the ability to define the tlvDataId in the context of a TransformationPropsToServiceInterfaceMapping. **Tags:** atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
id	PositiveInteger	1	attr	This attribute represents the definition of the value of the TlvDataId

tlvAppRecordElementInMethod	ApplicationRecordElement	0..1	iref	This reference assigns a TLV data ID to an element of an ApplicationRecordDataType in the context of an argument to a method defined in the context of an enclosing ServiceInterface. **Tags:** atp.Status=draft
tlvAppRecordElementInServiceInterface	ApplicationRecordElement	0..1	iref	This reference assigns a TLV datat ID to an element of an ApplicationRecordDataType of an event or a field in the context of the enclosing ServiceInterface. **Tags:** atp.Status=draft
tlvArgument	ArgumentDataPrototype	0..1	ref	This reference assigns a tlvDataId to a given argument of a ClietServerOperation. **Tags:** atp.Status=draft
tlvImplRecordElement	ImplementationDataTypeElementInAutosarDataPrototypeRef	0..1	aggr	This aggregation provides the ability toassign a TLV data ID to ImplementationDataTypeElements as optional elements in the context of a ServiceInterface. **Tags:** atp.Status=draft

Table 3.98: TlvDataIdDefinition

4 Diagnostic Mapping

4.1 Overview

The configuration of diagnostics on the *AUTOSAR adaptive platform* will typically be done by creating a Diagnostic Extract by means of the Diagnostic Extract Template [16] that is also used on the *AUTOSAR classic platform*.

Therefore, concepts within the Diagnostic Extract should be similarly applicable to models on both platforms in a uniform fashion.

It can even be safely expected that a given Diagnostic Extract can be divided into parts that apply for ECUs build on top of the *AUTOSAR classic platform* and parts that apply to ECUs built on top of the *AUTOSAR adaptive platform* that all belong to the same vehicle.

In terms of applicability to this document, the part of the Diagnostic Extract that is relevant in this context is the mapping between the definition of information related to diagnostic protocol content and the application software.

Following the pattern of communication on the *AUTOSAR adaptive platform*, interaction between the application software and platform modules for diagnostics (the so-called `AUTOSAR Adaptive Diagnostic Management`) is also using service-oriented communication.

This raises the question how the communication ends on both application and platform software get together in the course of a service discovery. This issue can be addressed by utilizing modeling concepts existing in a Diagnostic Extract on the *AUTOSAR adaptive platform*.

Specifically, by formally modeling the relation between the `AUTOSAR Adaptive Diagnostic Management` and specific endpoints in the application software it is possible to configure the service-oriented communication in a way that communication endpoints that are supposed to be connected become actually connected to each other as the service discovery unfolds.

The meta-classes that need to be considered for this purpose are in the following list:

- `DiagnosticServiceDataMapping`
- `DiagnosticServiceSwMapping`
- `DiagnosticEventPortMapping`
- `DiagnosticOperationCyclePortMapping`
- `DiagnosticEnableConditionPortMapping`
- `DiagnosticStorageConditionPortMapping`

In order to exemplify the approach, The diagram depicted in Figure 4.1 describes a very simplistic situation where **one** `event` contained **in one of two** different `PPortPro-`

totypes exposed by an AdaptiveApplicationSwComponentType is accessed by the AUTOSAR Adaptive Diagnostic Management on the *AUTOSAR adaptive platform* with the purpose of adding the value to e.g. a DID response telegram.

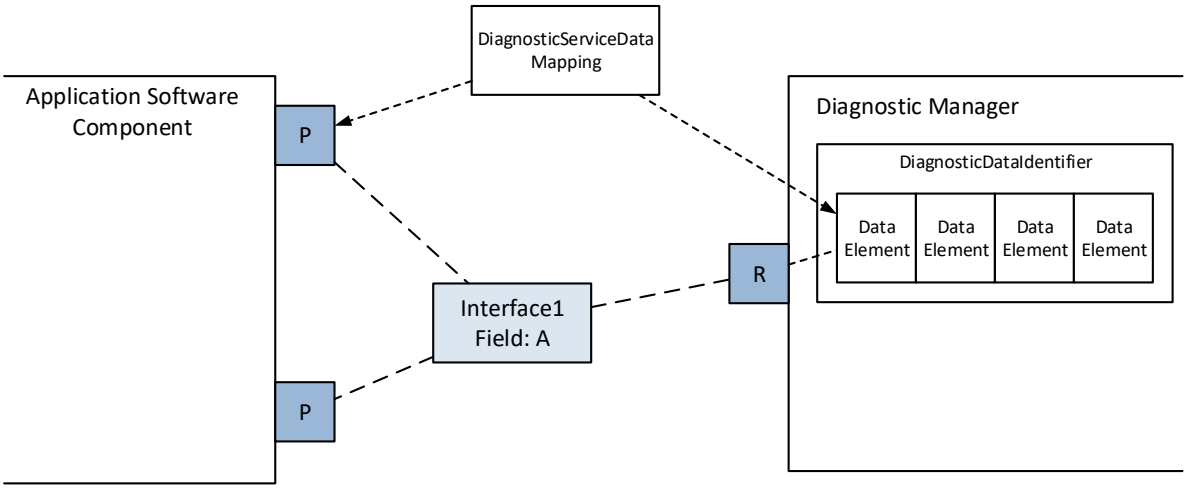


Figure 4.1: Example data exchange for diagnostic purpose

In this situation, the AUTOSAR Adaptive Diagnostic Management obviously needs to be aware which of the two available events has to be accessed in particular.

In other words, the service discovery settings of the AUTOSAR Adaptive Diagnostic Management need to be clear about which of the two available PortPrototypes to connect to.

The process of configuring the AUTOSAR Adaptive Diagnostic Management's service discovery settings accordingly can be assisted by the existence of (in this case) a DiagnosticServiceDataMapping that formally identifies the applicable event in the context of the enclosing PortPrototype.

Of course, the specifics of the PortPrototype on the side of the AUTOSAR Adaptive Diagnostic Management need to be derived from the configuration (in this case, the definition of a DiagnosticDataElement owned by a DiagnosticDataIdentifier) of the external behavior of the diagnostic stack on the *AUTOSAR adaptive platform*, as described by a corresponding Diagnostic Extract [16].

A further kind of mapping that is necessary to enable diagnostics on the *AUTOSAR adaptive platform* comes with slightly more complexity.

In this case use-cases are implemented that may or may not involve several communication ends (in the form of PortPrototypes).

Class	**DiagnosticDataIdentifier**			
Package	M2::AUTOSARTemplates::DiagnosticExtract::CommonDiagnostics			
Note	This meta-class represents the ability to model a diagnostic data identifier (DID) that is fully specified regarding the payload at configuration-time. **Tags:** atp.recommendedPackage=DiagnosticDataIdentifiers			
Base	*ARElement*, *ARObject*, *CollectableElement*, *DiagnosticAbstractDataIdentifier*, *DiagnosticCommonElement*, *Identifiable*, *MultilanguageReferrable*, *Packageable Element*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dataElement	DiagnosticParameter	1..*	aggr	This is the dataElement associated with the DiagnosticDataIdentifier. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=dataElement, variationPoint.shortLabel vh.latestBindingTime=postBuild
didSize	PositiveInteger	0..1	attr	This attribute indicates the size of the DiagnosticDataIdentifier.
representsVin	Boolean	0..1	attr	This attributes indicates whether the specific DiagnosticDataIdentifier represents the vehicle identification.
supportInfoByte	DiagnosticSupportInfoByte	0..1	aggr	This attribute represents the supported information associated with the DiagnosticDataIdentifier.

Table 4.1: DiagnosticDataIdentifier

The response to this situation on the *AUTOSAR classic platform* has been the definition of the `SwcServiceDependency` that allows for associating several `PortPrototype`s in specific roles to a given use-case.

Although (thanks to the existence of the `ServiceInterface`) the need for involving different `PortPrototype`s in the implementation of a given use case has slightly gone down, there is still enough motivation to keep using this pattern on the *AUTOSAR adaptive platform* as well.

For example, one benefit of this approach over a seemingly more straightforward implementation to refer to a `PortPrototype` directly is the ability to let several `PortPrototype`s (where e.g. some may represent server functionality, and the rest could represent client functionality) in concert in order to implement a given use case.

Figure 4.2 provides a visual explanation of how this kind of diagnostic mapping to model elements on the *AUTOSAR adaptive platform* works.

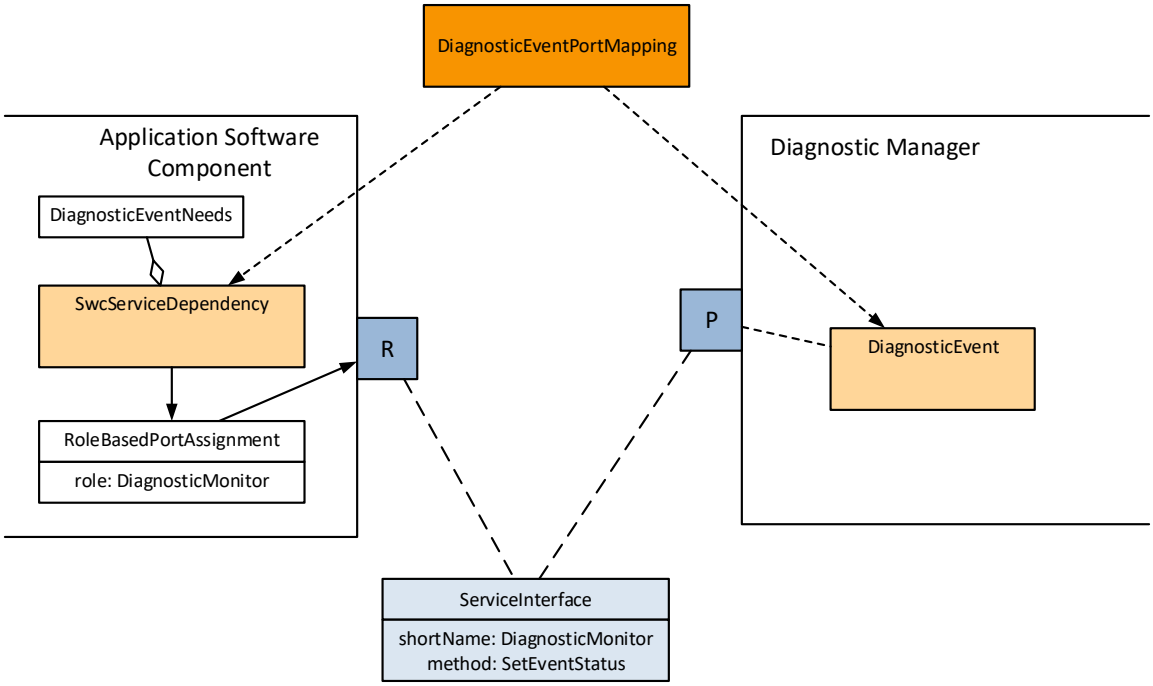


Figure 4.2: Example mapping to associate a `PortPrototype` with a `DiagnosticEvent`

Please note that the mapping targets[1] within a set of diagnostic mappings may exist in several instances at run-time.

This kind of multiple instantiation is formalized by the existence of meta-class `Process`, see chapter 6.

It is very typical that different instances of a piece of application software instances could require a different diagnostic mapping and the modeling needs to accommodate to this requirement, i.e. a relation between a diagnostic mapping and the `Process` needs to be established.

Within the definition of a diagnostic mapping, the assignment to the `Process` is typically done in a methodological step[2] that happens when all the diagnostic mapping[3] is already complete.

Therefore, it would be good to implement a proxy for an actual `Process` that can stand in as the target of the relation to a `Process` at design time. This semantics is realized by meta-class `ProcessDesign`.

The integrator would have to take care that an actual `Process` refers to the corresponding `ProcessDesign` such that by means of this reference an AUTOSAR software tool is able to figure out the relation between a diagnostic mapping and a process, provided that each `ProcessDesign` is **only** referenced by a single `Process`.

[1] on the end of the application software

[2] i.e. during the creation of the application manifest

[3] From the methodological point of view, the creation of the diagnostic mapping is typically considered a design-time activity.

[constr_1550] Reference from `Process` to `ProcessDesign` ⌈ Each `ProcessDesign` shall only be referenced from a single `Process`. ⌋*()*

Note that the reference from the `Process` to the `ProcessDesign` acknowledges the fact that the `Process` is typically created later in time[4].

Class	**ProcessDesign**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::DiagnosticMapping			
Note	This meta-class has the ability to stand in for a Process at the time when the Process does not yet exist. But its future existence already needs to be considered during design phase and for that a dedicated model element is required.. **Tags:** atp.Status=draft; atp.recommendedPackage=ProcessDesigns			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 4.2: ProcessDesign

Conceivably, the association of diagnostic mappings with Meta-class `ProcessDesign` may still happen as a finalizing last step of the activity to create the diagnostic mappings. To accommodate for this potential modeling, the reference from a diagnostic mapping to `ProcessDesign` has been decorated by stereotype ≪`atpSplitable`≫.

For more information concerning the semantics of this stereotype please refer to the specification of the AUTOSAR Generic Structure Template [5].

4.2 Diagnostic Data Mapping

[TPS_MANI_01037] Diagnostic data mapping on the *AUTOSAR adaptive platform* ⌈ The diagnostic data mapping on the *AUTOSAR adaptive platform* is created by means of meta-class `DiagnosticServiceDataMapping` that maps a `DiagnosticDataElement` to a `DataPrototype` referenced in the role `mappedApDataElement`. ⌋*(RS_MANI_00005)*

[TPS_MANI_01060] Use cases for the application of `DiagnosticServiceDataMapping` ⌈ `DiagnosticServiceDataMapping` shall only be used where access to data is free of side-effects. This is the case for the notifier events of `field`s and, at least with respect to the value, `event`s. ⌋*(RS_MANI_00005)*

[4] In other words, if references are needed between design-related and deployment-related meta-classes then the direction of these references shall always point from deployment to design.

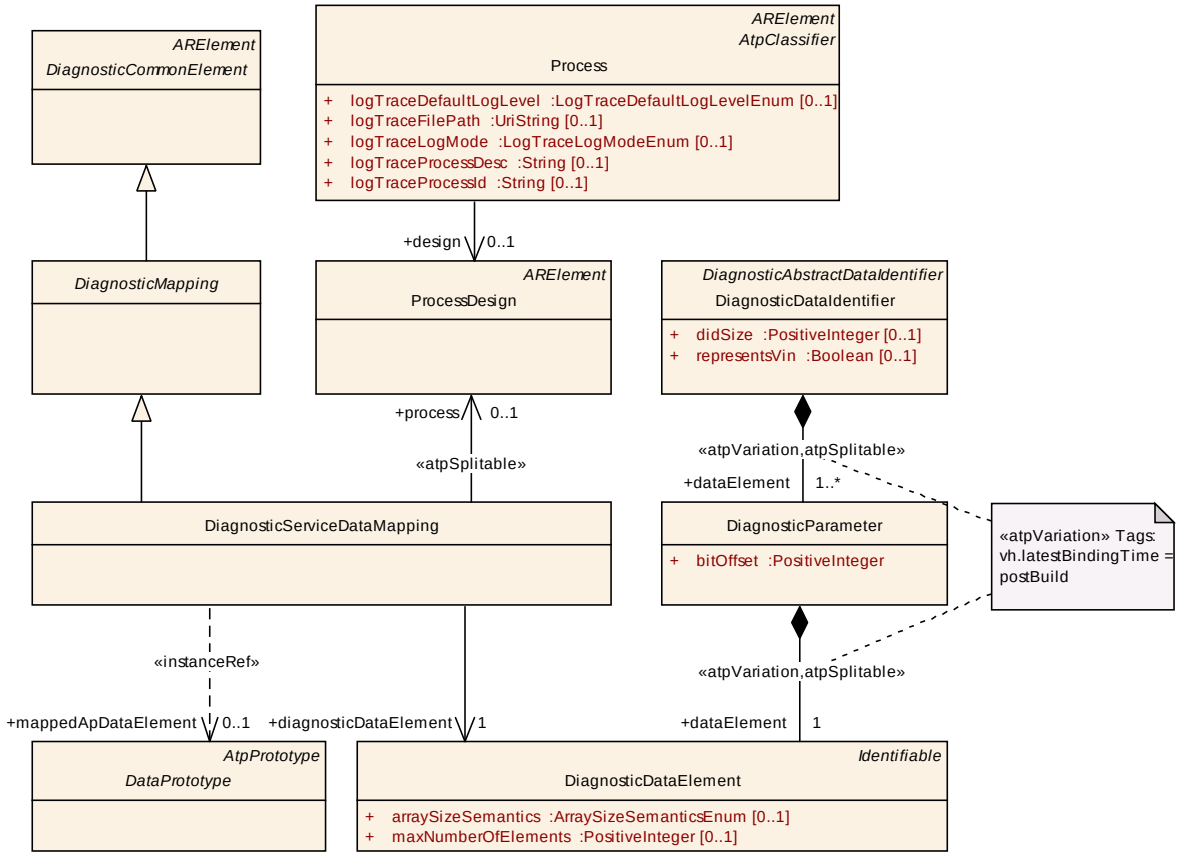


Figure 4.3: Modeling of the diagnostic data mapping

Please note that the `DiagnosticServiceDataMapping` can be applied on models on the *AUTOSAR adaptive platform* because the mapping target is a `DataPrototype` that is aggregated by a `ServiceInterface` in the context of a `PortPrototype`.

In other words, the `DiagnosticServiceDataMapping` applies for the mapping to an `event` or `field`, **or even to an element of** an `event` or `field`.

[constr_1496] `DiagnosticServiceDataMapping.mappedApDataElement` shall only refer to specific sub-classes of `DataPrototype` ⌈ A `DiagnosticServiceDataMapping.mappedApDataElement` shall only refer to an `event` or a `field` or a `DataPrototype` owned by an `event` or a `field`. ⌋*()*

Please note that the existence of [constr_1496] is a direct consequence of the existence of [TPS_MANI_01060].

In particular, [constr_1496] prevents the creation of a `DiagnosticServiceDataMapping` to a `ArgumentDataPrototype`. In the diagnostic context, `ArgumentDataPrototype` are mainly used in the argument list of the sub-functions of diagnostic routines which are rarely free of side-effects.

Class	**DiagnosticServiceDataMapping**			
Package	M2::AUTOSARTemplates::DiagnosticExtract::ServiceMapping			
Note	This represents the ability to define a mapping of a diagnostic service to a software-component. This kind of service mapping is applicable for the usage of SenderReceiverInterfaces resp. event/notifier semantics in ServiceInterfaces on the adaptive platform. **Tags:** atp.recommendedPackage=DiagnosticServiceMappings			
Base	*ARElement*, *ARObject*, *CollectableElement*, *DiagnosticCommonElement*, *DiagnosticMapping*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
diagnosticDataElement	DiagnosticDataElement	1	ref	This represents the applicable payload that corresponds to the referenced DataPrototype in the role mappedDataElement or (in case of a usage on the adaptive platform) mappedApDataElement.
mappedApDataElement	DataPrototype	0..1	iref	This represents the dataElement in the application software of an adaptive AUTOSAR application that is accessed for diagnostic purpose. **Tags:** atp.Status=draft
mappedDataElement	DataPrototype	0..1	iref	This represents the dataElement in the application software that is accessed for diagnostic purpose. This role is applicable on the classic platform.
process	ProcessDesign	0..1	ref	Reference to the representation of a Process that is required because the mapping could be different for different Processes referring to a specific Executable. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=process; atp.Status=draft

Table 4.3: DiagnosticServiceDataMapping

Class	**DiagnosticDataElement**			
Package	M2::AUTOSARTemplates::DiagnosticExtract::CommonDiagnostics			
Note	This meta-class represents the ability to describe a concrete piece of data to be taken into account for diagnostic purposes.			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
arraySizeSemantics	ArraySizeSemanticsEnum	0..1	attr	This attribute controls the meaning of the value of the array size.
maxNumberOfElements	PositiveInteger	0..1	attr	The existence of this attribute turns the data instance into an array of data. The attribute determines the size of the array in terms of how many elements the array can take.
swDataDefProps	SwDataDefProps	0..1	aggr	This property allows to specify data definition properties in order to support the definition of e.g. computation formulae and data constraints.

Table 4.4: DiagnosticDataElement

4.3 Diagnostic Software Mapping

[TPS_MANI_01038] Diagnostic software mapping on the *AUTOSAR adaptive platform* ⌈ The diagnostic software mapping on the *AUTOSAR adaptive platform* is created by means of meta-class `DiagnosticServiceSwMapping` that maps a `DiagnosticServiceInstance` to a `SwcServiceDependency` referenced in the role `mappedSwcServiceDependencyInExecutable` respectively a `DiagnosticDataElement` in the role `diagnosticDataElement`. ⌋*(RS_MANI_00005)*

As depicted by Figure 4.4, the application of a `DiagnosticServiceSwMapping` on the *AUTOSAR adaptive platform* requires the existence of a `SwcServiceDependency`, defined in the context of an `AdaptiveApplicationSwComponentType` (see section 3.2).

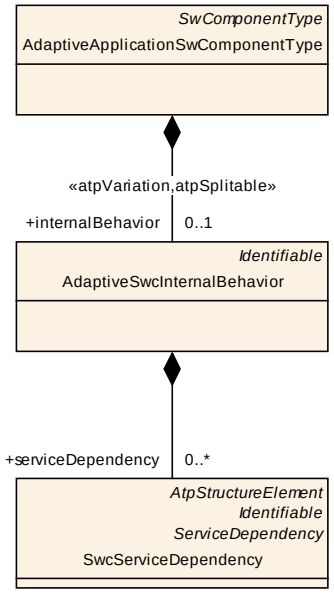


Figure 4.4: Modeling of internal behavior for the modeling of `DiagnosticServiceSwMapping`

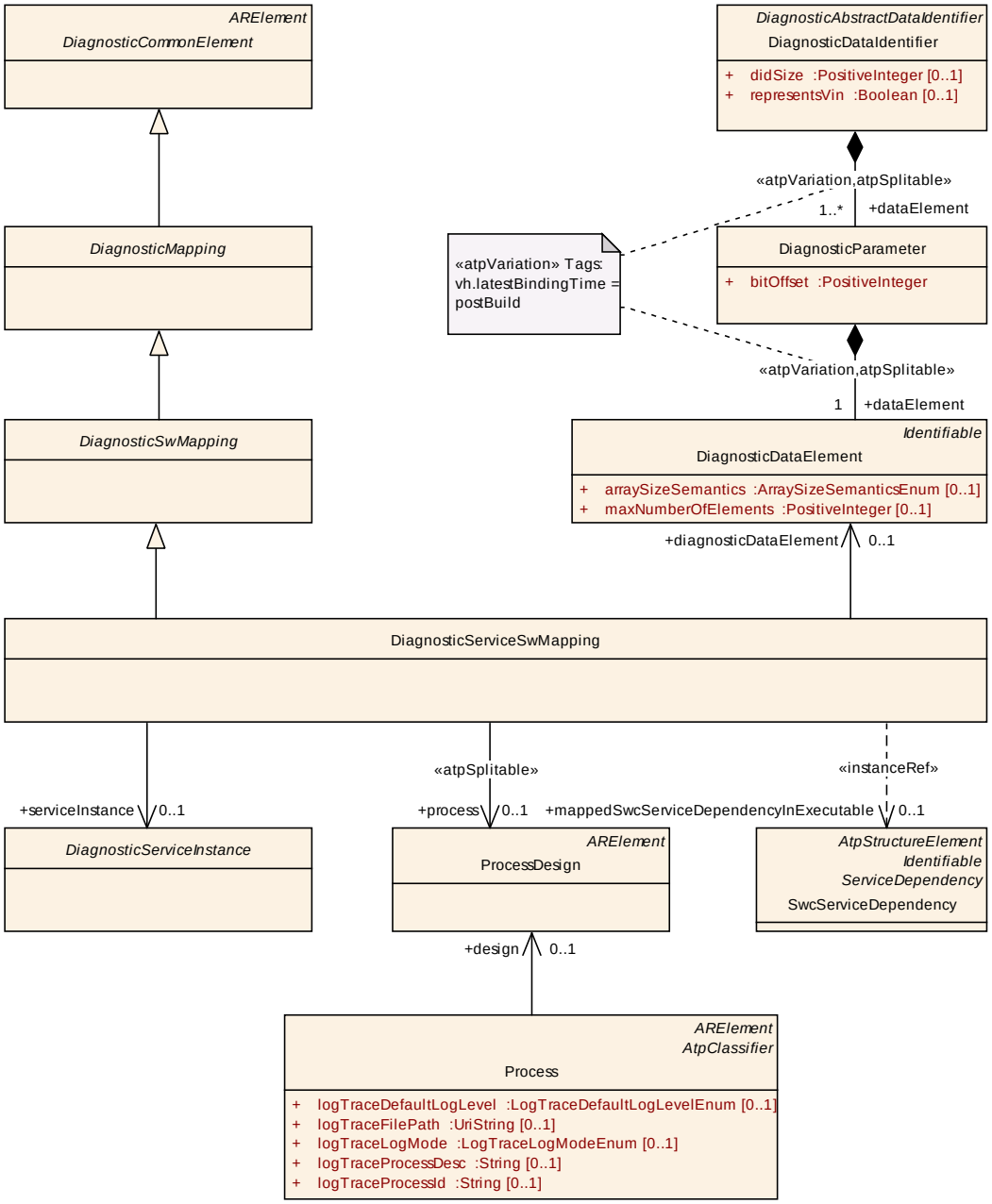


Figure 4.5: Modeling of the diagnostic software mapping

For explanation, meta-class `DiagnosticServiceSwMapping` provides two similar references to refer to a `SwcServiceDependency`.

The existence of two different references is motivated by formal reasons, i.e. the underlying implementations of `AtpInstanceRef` have a different structure.

The reference `mappedSwcServiceDependencyInSystem` is designed for being used on the *AUTOSAR classic platform* while reference `mappedSwcServiceDependencyInExecutable` is reserved for the *AUTOSAR adaptive platform*. This relation is formally expressed by [constr_1499].

[constr_1499] Target SwcServiceDependency of DiagnosticServiceSwMapping.mappedSwcServiceDependencyInExecutable ⌈ Any particular SwcServiceDependency that is referenced in the role DiagnosticServiceSwMapping.mappedSwcServiceDependencyInExecutable shall **only** be aggregated in the role serviceDependency by an AdaptiveSwcInternalBehavior. ⌋*()*

[TPS_MANI_01181] Use cases for the application of DiagnosticServiceSwMapping ⌈ Meta-class DiagnosticServiceSwMapping shall be used for accessing method semantics.

In the case of ServiceInterface, this boils down to the method role and access methods (i.e. getter/setter) for field. ⌋*(RS_MANI_00005)*

[constr_1585] Standardized values of attribute DiagnosticServiceSwMapping.category ⌈ The following list of values of the attribute DiagnosticServiceSwMapping.category is reserved by the AUTOSAR standard:

- DATA_ELEMENT
- DATA_IDENTIFIER
- GENERIC_UDS_SERVICE

⌋*()*

The value of DiagnosticServiceSwMapping.category shall indicate which type of ServiceInterface is associated to this DiagnosticServiceSwMapping.

More precisely, a ServiceInterface is considered associated to a DiagnosticServiceSwMapping, if the instance of the SwcServiceDependency referenced by this DiagnosticServiceSwMapping in the role of mappedSwcServiceDependencyInExecutable aggregates a RoleBasedPortAssignment that references a PPortPrototype in the role of portPrototype typed by the given ServiceInterface.

[constr_1586] DiagnosticServiceSwMapping.category set to DATA_ELEMENT ⌈ If the category of a DiagnosticServiceSwMapping is set to DATA_ELEMENT, then this DiagnosticServiceSwMapping shall reference a DiagnosticDataElement in the role of diagnosticDataElement, and the ServiceInterface given by this DiagnosticDataElement as defined in [17] shall be associated to this DiagnosticServiceSwMapping. ⌋*()*

[constr_1587] DiagnosticServiceSwMapping.category set to DATA_IDENTIFIER ⌈ If the category of a DiagnosticServiceSwMapping is set to DATA_IDENTIFIER, then this DiagnosticServiceSwMapping shall reference either a DiagnosticReadDataByIdentifier or a DiagnosticWriteDataByIdentifier in the role of serviceInstance, and the ServiceInterface (as defined in [17]) defined by the DiagnosticDataIdentifier referenced in the role of dataIdentifier shall be associated to this DiagnosticServiceSwMapping. ⌋*()*

[constr_1588] DiagnosticServiceSwMapping.category set to GENERIC_UDS_SERVICE ⌈ If the category of a DiagnosticServiceSwMapping is set to GENERIC_UDS_SERVICE, then this DiagnosticServiceSwMapping shall reference either a DiagnosticReadDataByIdentifier or a DiagnosticWriteDataByIdentifier in the role of serviceInstance, and the GenericUDSService as defined in [17] shall be associated to this DiagnosticServiceSwMapping. ⌋*()*

Explanatory note: Setting the category of a DiagnosticServiceSwMapping without configuration of SwcServiceDependency meets the concerns of distributed development of the system extract.

As a first step in configuration one might prescribe the type of the ServiceInterface used to handle diagnostic data by setting the category accordingly. As a later step of configuration one then determines the precise AA providing the suitable PPortPrototype by defining the related SwcServiceDependency.

Class	**DiagnosticServiceSwMapping**			
Package	M2::AUTOSARTemplates::DiagnosticExtract::ServiceMapping			
Note	This represents the ability to define a mapping of a diagnostic service to a software-component or a basic-software module. If the former is used then this kind of service mapping is applicable for the usage of ClientServerInterfaces resp. method semantics of ServiceInterface on the adaptive platform. **Tags:** atp.recommendedPackage=DiagnosticServiceMappings			
Base	*ARElement*, *ARObject*, *CollectableElement*, *DiagnosticCommonElement*, *DiagnosticMapping*, *DiagnosticSwMapping*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
diagnosticDataElement	DiagnosticDataElement	0..1	ref	This represents a DiagnosticDataElement required to execute the respective diagnostic service in the context of the diagnostic service mapping,
mappedBswServiceDependency	BswServiceDependencyIdent	0..1	ref	This is supposed to represent a reference to a BswServiceDependency. the latter is not derived from Referrable and therefore this detour needs to be implemented to still let BswServiceDependency become the target of a reference.
mappedFlatSwcServiceDependency	SwcServiceDependency	0..1	ref	This represents the ability to refer to an AtomicSwComponentType that is available without the definition of how it will be emebdded into the component hiearchy.
mappedSwcServiceDependencyInExecutable	SwcServiceDependency	0..1	iref	This represents the ability to point into the component hiearchy of an adaptive AUTOSAR model (under possible consideration of the rootSoftwareComposition) **Tags:** atp.Status=draft

mappedSwcServiceDependencyInSystem	SwcServiceDependency	0..1	iref	This represents the ability to point into the component hiearchy (under possible consideration of the rootSoftwareComposition)
process	ProcessDesign	0..1	ref	Reference to the representation of a Process that is required because the mapping could be different for different Processes referring to a specific Executable. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=process; atp.Status=draft
serviceInstance	DiagnosticServiceInstance	0..1	ref	This represents the service instance that needs to be considered in this diagnostics service mapping.

Table 4.5: DiagnosticServiceSwMapping

Class	**SwcServiceDependency**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::SwcInternalBehavior::ServiceMapping			
Note	Specialization of ServiceDependency in the context of an SwcInternalBehavior. It allows to associate ports, port groups and (in special cases) data defined for an atomic software component to a given ServiceNeeds element.			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *ServiceDependency*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
assignedData	RoleBasedDataAssignment	*	aggr	Defines the role of an associated data object of the same component. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=preCompileTime
assignedPort	RoleBasedPortAssignment	*	aggr	Defines the role of an associated port of the same component. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=assignedPort, variationPoint.shortLabel vh.latestBindingTime=preCompileTime
representedPortGroup	PortGroup	0..1	ref	This reference specifies an association between the ServiceNeeeds and a PortGroup, for example to request a communication mode which applies for communication via these ports. The referred PortGroup shall be local to this atomic SWC, but via the links between the PortGroups, a tool can evaluate this information such that all the ports linked via this port group on the same ECU can be found.
serviceNeeds	ServiceNeeds	1	aggr	The associated ServiceNeeds.

Table 4.6: SwcServiceDependency

4.4 Diagnostic Event to Port Mapping

[TPS_MANI_01048] Mapping of `DiagnosticEvent` to `PortPrototype`(s) on the *AUTOSAR adaptive platform* ⌈ On the *AUTOSAR adaptive platform*, the relation between a `DiagnosticEvent` and one or many `PortPrototype`s is created by using the `DiagnosticEventPortMapping` that refers to a `DiagnosticEvent` in the role `diagnosticEvent` as well as to a `SwcServiceDependency` in the role `swcServiceDependencyInExecutable`. ⌋*(RS_MANI_00005)*

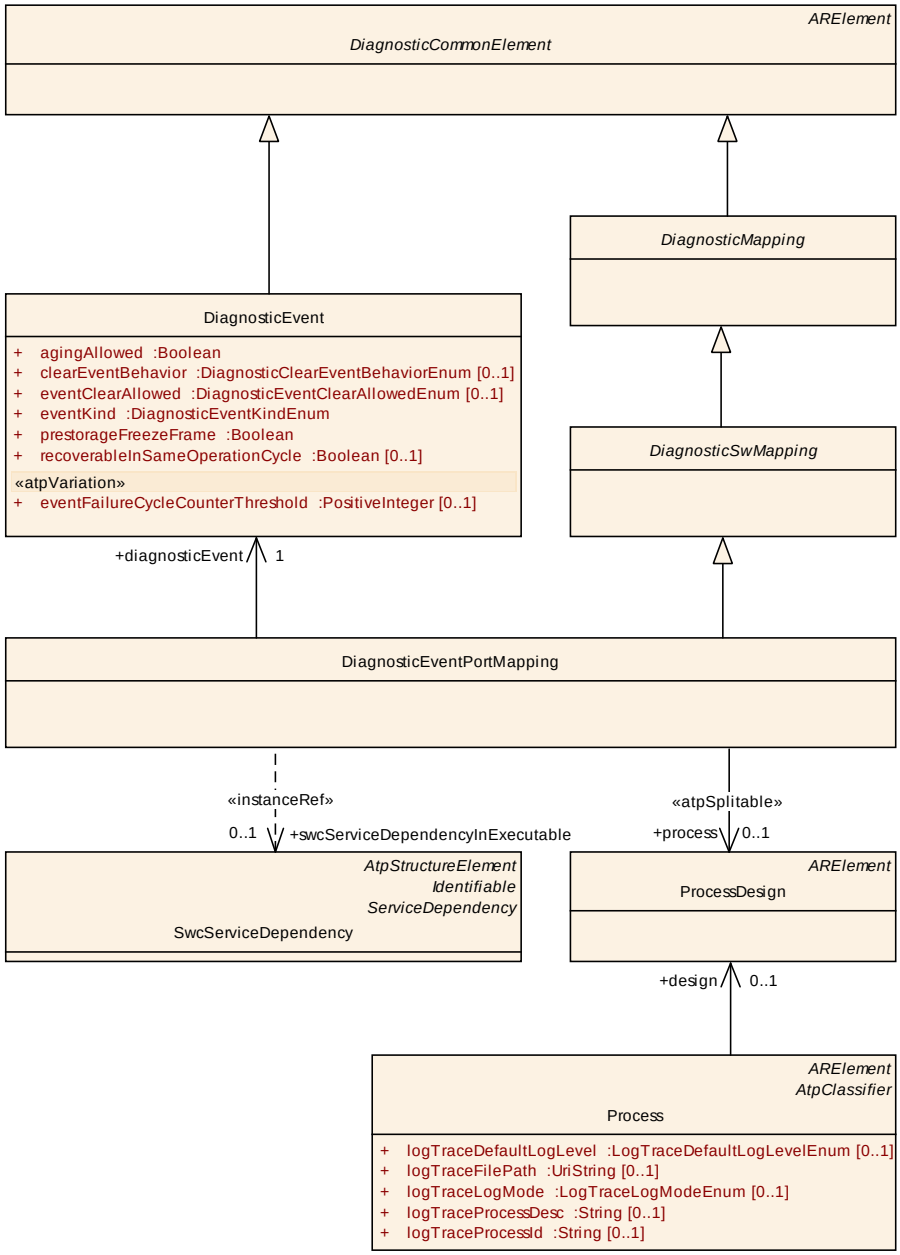


Figure 4.6: Modeling of `DiagnosticEventPortMapping` for the usage on the *AUTOSAR adaptive platform*

[constr_1500] Target `SwcServiceDependency` of `DiagnosticEventPortMapping.swcServiceDependencyInExecutable` ⌈ Any particular `SwcServiceDe-`

pendency that is referenced in the role DiagnosticEventPortMapping.swcServiceDependencyInExecutable shall **only** be aggregated in the role serviceDependency by an AdaptiveSwcInternalBehavior. ⌋()

Class	**DiagnosticEvent**			
Package	M2::AUTOSARTemplates::DiagnosticExtract::Dem::DiagnosticEvent			
Note	This element is used to configure DiagnosticEvents. **Tags:** atp.recommendedPackage=DiagnosticEvents			
Base	*ARElement*, *ARObject*, *CollectableElement*, *DiagnosticCommonElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
agingAllowed	Boolean	1	attr	This represents the decision whether aging is allowed for this DiagnosticEvent.
clearEventBehavior	DiagnosticClearEventBehaviorEnum	0..1	attr	This attribute defines the resulting UDS status byte for the related event, which shall not be cleared according to the ClearEventAllowed callback.
connectedIndicator	DiagnosticConnectedIndicator	*	aggr	Event specific description of Indicators. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=shortName, variationPoint.shortLabel vh.latestBindingTime=postBuild
eventClearAllowed	DiagnosticEventClearAllowedEnum	0..1	attr	This attribute defines whether the Dem has access to a "ClearEventAllowed" callback.
eventFailureCycleCounterThreshold	PositiveInteger	0..1	attr	This attribute defines the number of failure cycles for the event based fault confirmation. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=postBuild
eventKind	DiagnosticEventKindEnum	1	attr	This attribute is used to distinguish between SWC and BSW events.
prestorageFreezeFrame	Boolean	1	attr	This attribute describes whether the Prestorage of FreezeFrames is supported by the assigned event or not. True: Prestorage of FreezeFrames is supported False: Prestorage of FreezeFrames is not supported
recoverableInSameOperationCycle	Boolean	0..1	attr	If the attribute is set to true then reporting PASSED will reset the indication of a failed test in the current operation cycle. If the attribute is set to false then reporting PASSED will be ignored and not lead to a reset of the indication of a failed test.

Table 4.7: DiagnosticEvent

Class	**DiagnosticEventPortMapping**			
Package	M2::AUTOSARTemplates::DiagnosticExtract::Dem::DiagnosticMapping			
Note	Defines to which SWC service ports with DiagnosticEventNeeds the DiagnosticEvent is mapped. **Tags:** atp.recommendedPackage=DiagnosticMappings			
Base	*ARElement*, *ARObject*, *CollectableElement*, *DiagnosticCommonElement*, *DiagnosticMapping*, *DiagnosticSwMapping*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
bswServiceDependency	BswServiceDependencyIdent	0..1	ref	Reference to a BswServiceDependency that links ServiceNeeds to BswModuleEntries.
diagnosticEvent	DiagnosticEvent	1	ref	Reference to the DiagnosticEvent that is assigned to SWC service ports with DiagnosticEventNeeds.
process	ProcessDesign	0..1	ref	Reference to the representation of a Process that is required because the mapping could be different for different Processes referring to a specific Executable. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=process; atp.Status=draft
swcFlatServiceDependency	SwcServiceDependency	0..1	ref	Reference to a SwcServiceDependencyType that links ServiceNeeds to SWC service ports.
swcServiceDependencyInExecutable	SwcServiceDependency	0..1	iref	This aggregation allows for the usage of the DiagnosticEventPortMapping on the AUTOSAR adaptive platform. **Tags:** atp.Status=draft
swcServiceDependencyInSystem	SwcServiceDependency	0..1	iref	Instance reference to a SwcServiceDependency that links ServiceNeeds to SWC service ports.

Table 4.8: DiagnosticEventPortMapping

4.5 Diagnostic Operation Cycle to Port Mapping

[TPS_MANI_01049] Mapping of `DiagnosticOperationCycle` to `PortPrototype`(s) on the *AUTOSAR adaptive platform* ⌈ On the *AUTOSAR adaptive platform*, the relation between a `DiagnosticOperationCycle` and one or many `PortPrototype`s is created by using the `DiagnosticEventPortMapping` that refers to a `DiagnosticOperationCycle` in the role `operationCycle` as well as to a `SwcServiceDependency` in the role `swcServiceDependencyInExecutable`. ⌋ *(RS_MANI_00005)*

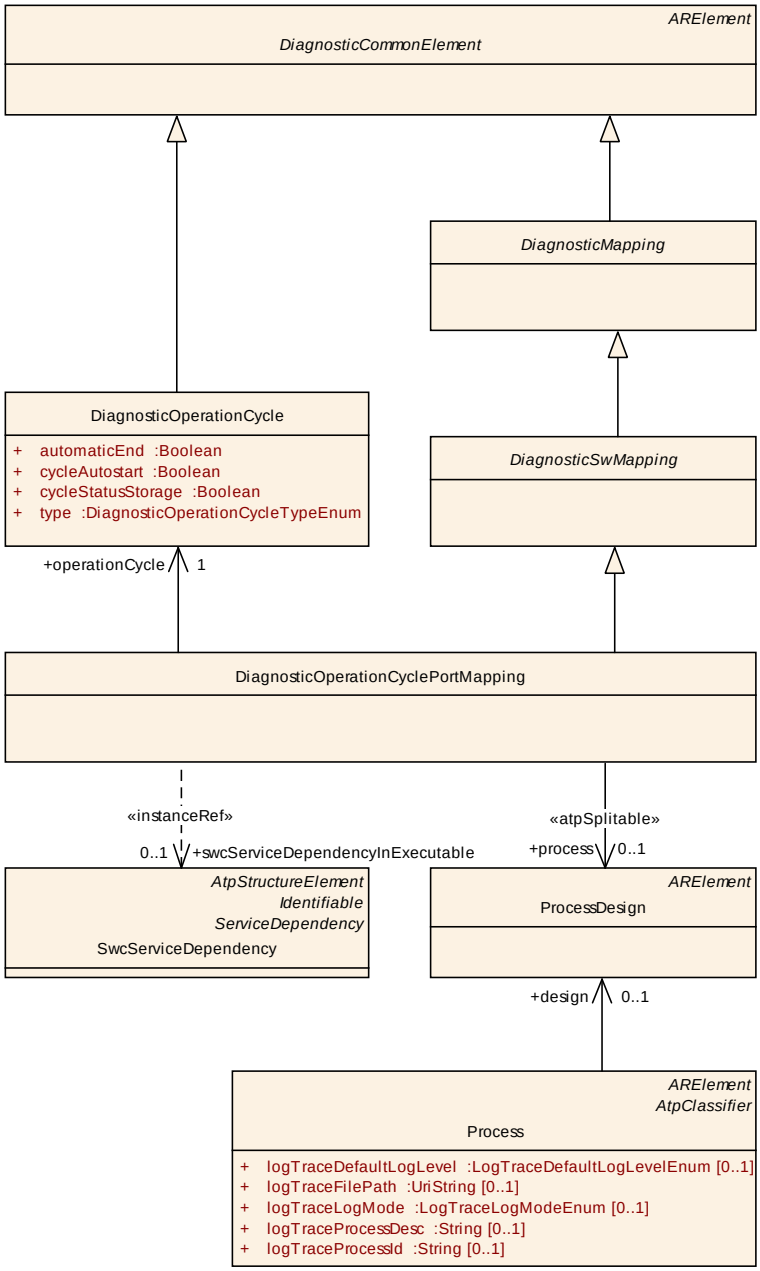


Figure 4.7: Modeling of `DiagnosticOperationCyclePortMapping` for the usage on the *AUTOSAR adaptive platform*

[constr_1501] Target `SwcServiceDependency` of `DiagnosticOperationCyclePortMapping.swcServiceDependencyInExecutable` ⌈ Any particular `SwcServiceDependency` that is referenced in the role `DiagnosticOperationCyclePortMapping.swcServiceDependencyInExecutable` shall **only** be aggregated in the role `serviceDependency` by an `AdaptiveSwcInternalBehavior`. ⌋*()*

Class	**DiagnosticOperationCycle**			
Package	M2::AUTOSARTemplates::DiagnosticExtract::Dem::DiagnosticOperationCycle			
Note	Definition of an operation cycle that is the base of the event qualifying and for Dem scheduling. **Tags:** atp.recommendedPackage=DiagnosticOperationCycles			
Base	*ARElement*, *ARObject*, *CollectableElement*, *DiagnosticCommonElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
automaticEnd	Boolean	1	attr	If set to true the driving cycle shall automatically end at either Dem_Shutdown() or Dem_Init().
cycleAutostart	Boolean	1	attr	This attribute defines if the operation cycles is automatically re-started during Dem_PreInit.
cycleStatusStorage	Boolean	1	attr	Defines if the operation cycle state is available over the power cycle (stored non-volatile) or not. • true: the operation cycle state is stored non-volatile • false: the operation cycle state is only stored volatile
type	DiagnosticOperationCycleTypeEnum	1	attr	Operation cycles types for the Dem.

Table 4.9: DiagnosticOperationCycle

Class	**DiagnosticOperationCyclePortMapping**			
Package	M2::AUTOSARTemplates::DiagnosticExtract::Dem::DiagnosticMapping			
Note	Defines to which SWC service ports with DiagnosticOperationCycleNeeds the DiagnosticOperationCycle is mapped. **Tags:** atp.recommendedPackage=DiagnosticMappings			
Base	*ARElement*, *ARObject*, *CollectableElement*, *DiagnosticCommonElement*, *DiagnosticMapping*, *DiagnosticSwMapping*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
operationCycle	DiagnosticOperationCycle	1	ref	Reference to the DiagnosticOperationCycle that is assigned to SWC service ports with DiagnosticOperationCycleNeeds.
process	ProcessDesign	0..1	ref	Reference to the representation of a Process that is required because the mapping could be different for different Processes referring to a specific Executable. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=process; atp.Status=draft
swcFlatServiceDependency	SwcServiceDependency	0..1	ref	Reference to a SwcServiceDependencyType that links ServiceNeeds to SWC service ports.

swcServiceDependencyInExecutable	SwcServiceDependency	0..1	iref	This aggregation allows for the usage of the DiagnosticOperationCyclePortMapping on the AUTOSAR adaptive platform. **Tags:** atp.Status=draft
swcServiceDependencyInSystem	SwcServiceDependency	0..1	iref	Instance reference to a SwcServiceDependency that links ServiceNeeds to SWC service ports.

Table 4.10: DiagnosticOperationCyclePortMapping

4.6 Diagnostic Enable Condition to Port Mapping

[TPS_MANI_01050] Mapping of `DiagnosticEnableCondition` to `PortPrototype`(s) on the *AUTOSAR adaptive platform* ⌈ On the *AUTOSAR adaptive platform*, the relation between a `DiagnosticEnableCondition` and one or many `PortPrototype`s is created by using the `DiagnosticEventPortMapping` that refers to a `DiagnosticEnableCondition` in the role `enableCondition` as well as to a `SwcServiceDependency` in the role `swcServiceDependencyInExecutable`. ⌋ *(RS_MANI_00005)*

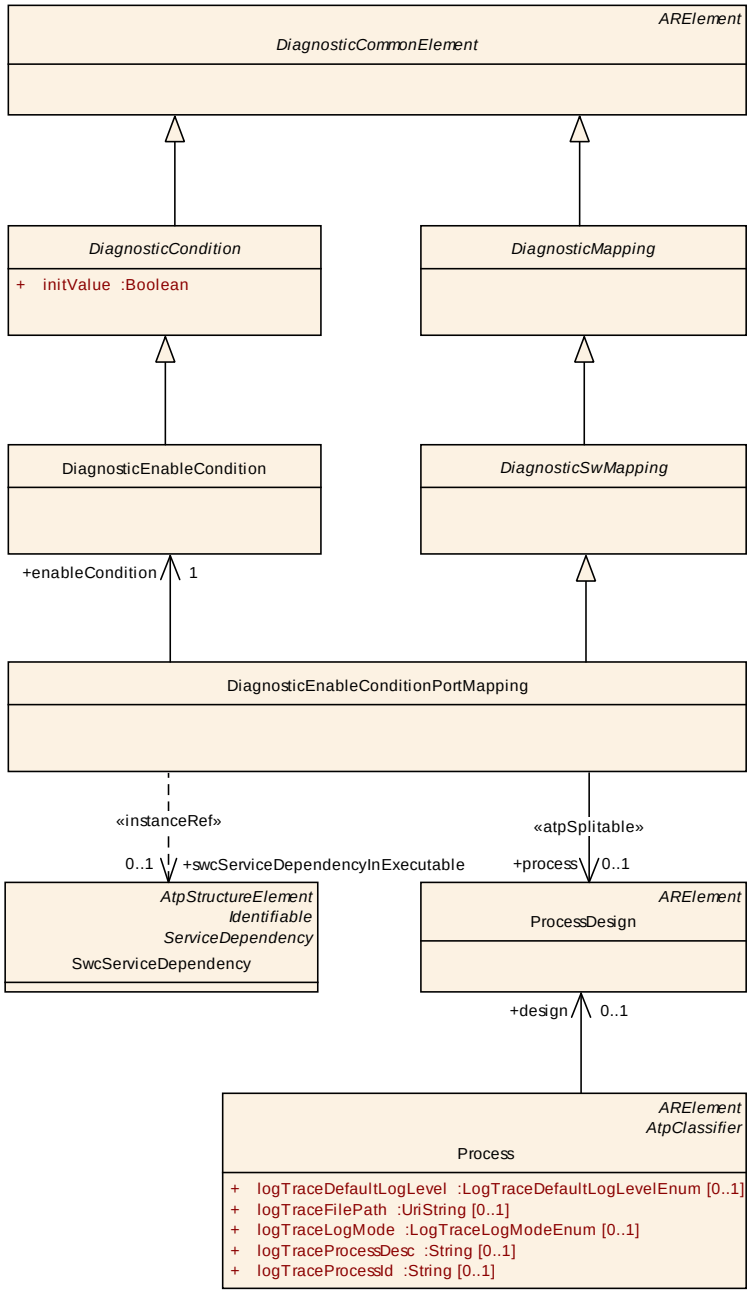


Figure 4.8: Modeling of `DiagnosticEnableConditionPortMapping` for the usage on the *AUTOSAR adaptive platform*

[constr_1502] Target `SwcServiceDependency` of `DiagnosticEnableConditionPortMapping.swcServiceDependencyInExecutable` ⌈ Any particular `SwcServiceDependency` that is referenced in the role `DiagnosticEnableConditionPortMapping.swcServiceDependencyInExecutable` shall **only** be aggregated in the role `serviceDependency` by an `AdaptiveSwcInternalBehavior`. ⌋ *()*

Class	**DiagnosticEnableCondition**			
Package	M2::AUTOSARTemplates::DiagnosticExtract::Dem::DiagnosticCondition			
Note	Specification of an enable condition. **Tags:** atp.recommendedPackage=DiagnosticConditions			
Base	*ARElement*, *ARObject*, *CollectableElement*, *DiagnosticCommonElement*, *DiagnosticCondition*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 4.11: DiagnosticEnableCondition

Class	**DiagnosticEnableConditionPortMapping**			
Package	M2::AUTOSARTemplates::DiagnosticExtract::Dem::DiagnosticMapping			
Note	Defines to which SWC service ports with DiagnosticEnableConditionNeeds the DiagnosticEnableCondition is mapped. **Tags:** atp.recommendedPackage=DiagnosticMappings			
Base	*ARElement*, *ARObject*, *CollectableElement*, *DiagnosticCommonElement*, *DiagnosticMapping*, *DiagnosticSwMapping*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
enableCondition	DiagnosticEnableCondition	1	ref	Reference to the EnableCondition which is mapped to a SWC service port with DiagnosticEnableConditionNeeds.
process	ProcessDesign	0..1	ref	Reference to the representation of a Process that is required because the mapping could be different for different Processes referring to a specific Executable. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=process; atp.Status=draft
swcFlatServiceDependency	SwcServiceDependency	0..1	ref	Reference to a SwcServiceDependencyType that links ServiceNeeds to SWC service ports. This reference can be used in early stages of the development in order to identify the SwcServiceDependency without a full System Context.
swcServiceDependencyInExecutable	SwcServiceDependency	0..1	iref	This aggregation allows for the usage of the DiagnosticEnableConditionPortMapping on the AUTOSAR adaptive platform. **Tags:** atp.Status=draft
swcServiceDependencyInSystem	SwcServiceDependency	0..1	iref	Instance reference to a SwcServiceDependency that links ServiceNeeds to SWC service ports.

Table 4.12: DiagnosticEnableConditionPortMapping

4.7 Diagnostic Storage Condition to Port Mapping

[TPS_MANI_01051] Mapping of `DiagnosticStorageCondition` to `PortPrototype`(s) on the *AUTOSAR adaptive platform* ⌈ On the *AUTOSAR adaptive platform*, the relation between a `DiagnosticStorageCondition` and one or many `PortPrototype`s is created by using the `DiagnosticEventPortMapping` that refers to a `DiagnosticStorageCondition` in the role `diagnosticStorageCondition` as well as to a `SwcServiceDependency` in the role `swcServiceDependencyInExecutable`. ⌋*(RS_MANI_00005)*

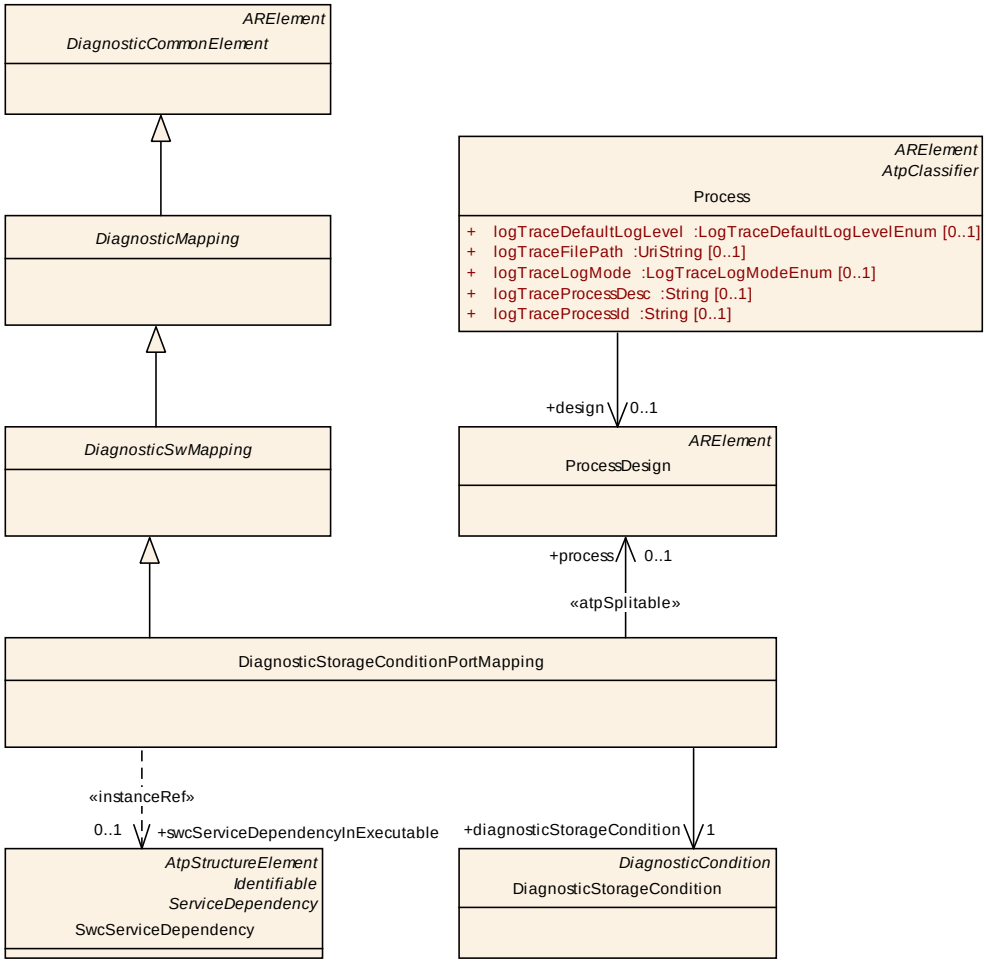


Figure 4.9: Modeling of `DiagnosticStorageConditionPortMapping` for the usage on the *AUTOSAR adaptive platform*

[constr_1503] Target `SwcServiceDependency` of `DiagnosticStorageConditionPortMapping.swcServiceDependencyInExecutable` ⌈ Any particular `SwcServiceDependency` that is referenced in the role `DiagnosticStorageConditionPortMapping.swcServiceDependencyInExecutable` shall **only** be aggregated in the role `serviceDependency` by an `AdaptiveSwcInternalBehavior`. ⌋*()*

Class	**DiagnosticStorageCondition**			
Package	M2::AUTOSARTemplates::DiagnosticExtract::Dem::DiagnosticCondition			
Note	Specification of a storage condition. **Tags:** atp.recommendedPackage=DiagnosticConditions			
Base	*ARElement*, *ARObject*, *CollectableElement*, *DiagnosticCommonElement*, *DiagnosticCondition*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 4.13: DiagnosticStorageCondition

Class	**DiagnosticStorageConditionPortMapping**			
Package	M2::AUTOSARTemplates::DiagnosticExtract::Dem::DiagnosticMapping			
Note	Defines to which SWC service ports with DiagnosticStorageConditionNeeds the DiagnosticStorageCondition is mapped. **Tags:** atp.recommendedPackage=DiagnosticMappings			
Base	*ARElement*, *ARObject*, *CollectableElement*, *DiagnosticCommonElement*, *DiagnosticMapping*, *DiagnosticSwMapping*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
diagnosticStorageCondition	DiagnosticStorageCondition	1	ref	Reference to the StorageCondition which is mapped to a SWC service port with DiagnosticStorageConditionNeeds.
process	ProcessDesign	0..1	ref	Reference to the representation of a Process that is required because the mapping could be different for different Processes referring to a specific Executable. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=process; atp.Status=draft
swcFlatServiceDependency	SwcServiceDependency	0..1	ref	Reference to a SwcServiceDependencyType that links ServiceNeeds to SWC service ports.
swcServiceDependencyInExecutable	SwcServiceDependency	0..1	iref	This aggregation allows for the usage of the DiagnosticStorageConditionPortMapping on the AUTOSAR adaptive platform. **Tags:** atp.Status=draft
swcServiceDependencyInSystem	SwcServiceDependency	0..1	iref	Instance reference to a SwcServiceDependency that links ServiceNeeds to SWC service ports.

Table 4.14: DiagnosticStorageConditionPortMapping

5 REST Design

5.1 Overview

Important note: the AUTOSAR SWS REST [18] defines a low-level API for REST-based communication. The content of this chapter, on the other hand, applies for the configuration of a not-yet standardized API on top of the ara::rest API.

In line with the target application domains of the *AUTOSAR adaptive platform* it can be expected that software will have use case to interact with generic web services inside and outside the vehicle.

Obviously, the communication partners need to agree on the applied communication approach to make this happen.

In other words, while it would be technically feasible to implement web services based on the existence of ServiceInterfaces it is still not very likely to happen for services that are completely outside the typical automotive domain and which have no incentive to embrace the communication approach of the *AUTOSAR adaptive platform*.

Therefore, the only viable option seems to extend the communications capabilities of the adaptive AUTOSAR stack to talk to web services in their “native language”.

The conclusion to adopt web service communication approach does not only extend to the actual communication and transport conventions but also affects the way how information conveyed between a vehicle and a web service is described.

In order to fully implement a communication paradigm for information exchange with web services, the *AUTOSAR adaptive platform* needs to adopt conventions of data description that are typically supported by web services.

As a matter of fact, web services don’t dive into data semantics nearly as deep as this is done in a typical automotive software and therefore seamlessly supported by the AUTOSAR meta-model. Consequently, AUTOSAR needs to define an alternative approach to data definition that matches with the conventions established for web services.

Consequently, the approach to define ApplicationDataTypes and their ImplementationDataType counterparts is not applicable for this case.

But still, the general AUTOSAR approach to structure application software into the definition of ApplicationSwComponentTypes that interact with the outside world via the existence of aggregated PortPrototypes applies also for software that interacts with web services.

In other words, interaction with web services need to be placed on the definition of a specific subclass of PortInterface in order to conform to the above mentioned statement.

The concrete definition of such a subclass of PortInterface requires a more specific understanding of the typical interaction patterns of web services.

While it is safe to conclude that the web breeds new technologies on nearly a weekly basis, there is still some stable core on which the modeling in AUTOSAR can rely on.

This stable core onto which the AUTOSAR modeling approach shall be based has been identified as the so-called "**Representational State Transfer**" [19] (a.k.a. REST) pattern.

Fundamentally, the REST approach requires a stateless communication among server and client, i.e. only data can be communicated.

The call of a method or operation (which is otherwise supported by means of the ServiceInterface or ClientServerInterface) is expressly out of scope.

[TPS_MANI_01103] Three-level approach to REST modeling ⌈ The conversion of the REST pattern, as far as modeling is concerned, into AUTOSAR assumes a three-level structure:

Service This level represents the definition of an entire REST service.

In the AUTOSAR meta-model, this level is represented by meta-class RestServiceInterface.

Resource This level represents a resource in the context of the service. A resource can be used to structure the content of a service according to a given conceptual understanding of the semantics of the service.

For example, if a *sound mixer* were a service then it could make sense to define *audio source*, *output device*, etc as resources of the service. There can still be several sources and several output devices.

In the AUTOSAR meta-model, the resource level is represented by meta-class RestResourceDef.

Element The final level represents the definition of actual data with properties in the context of a resource. In the context of the above mentioned example of a *sound mixer* the element level of the *output device* resource could be populated by *volume*, *volume step-size*, *status*, etc.

In the AUTOSAR meta-model, the element level is represented by meta-class RestElementDef.

⌋(*RS_MANI_00033*)

The three-level approach described in [TPS_MANI_01103] is depicted in Figure 5.1.

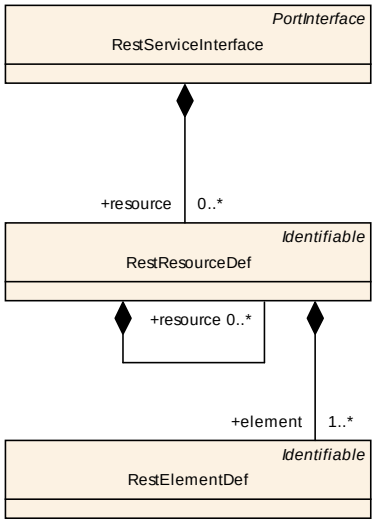


Figure 5.1: Big picture to REST modeling

Rest services are identified by means of a URI. The details of how the URI is created for a specific REST service can (because of the possibility of multiple instantiation of SwComponentTypes that aggregate PortPrototypes typed by a RestServiceInterface) only be resolved in the deployment phase where the specific instances are known.

The details of what makes a URI for a REST service as well as a description of how elements of the URI are sourced can be found in section 17.

Please note that in the domain of web services a service description is often provided in JSON format. The description of REST services in this chapter introduces the description of REST services to AUTOSAR and this has the consequence that ARXML has to be used for this purpose.

However, AUTOSAR does not oblige the usage of ARXML on the target platform, it only says that there shall be a point in time where the final model has to be available as ARXML and that exchange of AUTOSAR models shall only be done in ARXML format.

From the point of finalization going forward, proprietary conversions into whatever format for the sole purpose of uploading to a target platform is permitted.

Conversely, it is totally conceivable to create a conversion tool that takes an existing service description in JSON format and converts it into the ARXML representation described in this chapter.

Please note further that REST typically supports a filtering of information on the server, i.e. the client can apply a filter to only obtain the part of information on the server that passes the filter.

This filtering approach fully happens at run-time, there is no need to configure anything in the model in order to support the filtering of information on the server.

5.2 REST Service Interface

As depicted in Figure 5.2, `RestServiceInterface` is derived from `PortInterface` and can therefore be taken to type a `PortPrototype`.

In other words, the definition of a REST service creates a binding contract for the implementation of the `ApplicationSwComponentType` that aggregates a `PortPrototype` typed by a `RestServiceInterface`.

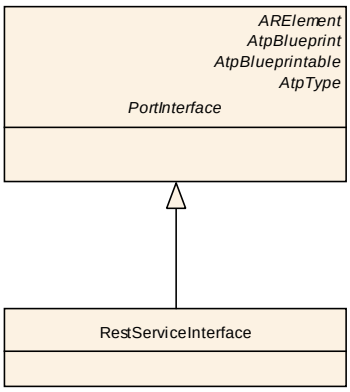


Figure 5.2: Modeling of the REST service

[TPS_MANI_01105] Semantics of `RestServiceInterface` ⌈ A `PortPrototype` used to interact by means of the REST pattern with a web service shall be typed by `RestServiceInterface`. ⌋*(RS_MANI_00033)*

Class	**RestServiceInterface**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface::REST			
Note	This meta-class represents a REST service. **Tags:** atp.Status=draft; atp.recommendedPackage=RestServiceInterfaces			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *PortInterface*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
resource	RestResource Def	*	aggr	This aggregation represents the collectioin of resources owned by the enclosing REST service. **Tags:** atp.Status=draft

Table 5.1: RestServiceInterface

5.3 REST Resource

[TPS_MANI_01120] Recursive definition of `RestResourceDef` ⌈ The definition of `RestResourceDef` supports the aggregation of other `RestResourceDef`. In other words, it is possible to created a nested definition of `RestResourceDef`s. ⌋ *(RS_MANI_00033)*

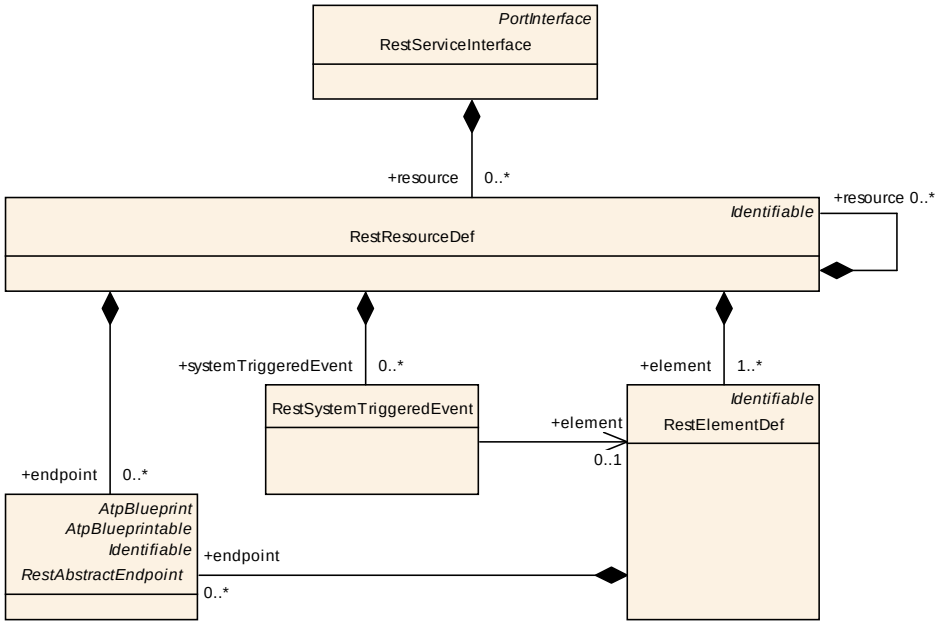


Figure 5.3: Modeling of the REST resource level

Class	**RestResourceDef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface::REST			
Note	This meta-class represents a resource inside a REST service. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
element	RestElementDef	1..*	aggr	This aggregation represents the elements of a resource. **Tags:** atp.Status=draft
endpoint	RestAbstractEndpoint	*	aggr	This aggregation represents the collection of endpoints on the resource level. **Tags:** atp.Status=draft
resource	RestResourceDef	*	aggr	This aggregation represenst the ability to create nested resource levels. **Tags:** atp.Status=draft
systemTriggeredEvent	RestSystemTriggeredEvent	*	aggr	This represents the collection of system triggered events for the enclosing resource. **Tags:** atp.Status=draft

Table 5.2: RestResourceDef

[TPS_MANI_01121] Semantics of `RestResourceDef.endpoint` ⌈ It is possible to define the `API` that shall be available for a specific `RestResourceDef`. For this purpose the aggregation of `RestAbstractEndpoint` in the role `endpoint` shall be used.

In particular the following concrete API elements (that directly correspond to the eponymous HTTP verbs) can be modeled:

GET For this purpose meta-class `RestEndpointGet` shall be used.

PUT For this purpose meta-class `RestEndpointPut` shall be used.

POST For this purpose meta-class `RestEndpointPost` shall be used.

DELETE For this purpose meta-class `RestEndpointDelete` shall be used.

⌋(*RS_MANI_00033*)

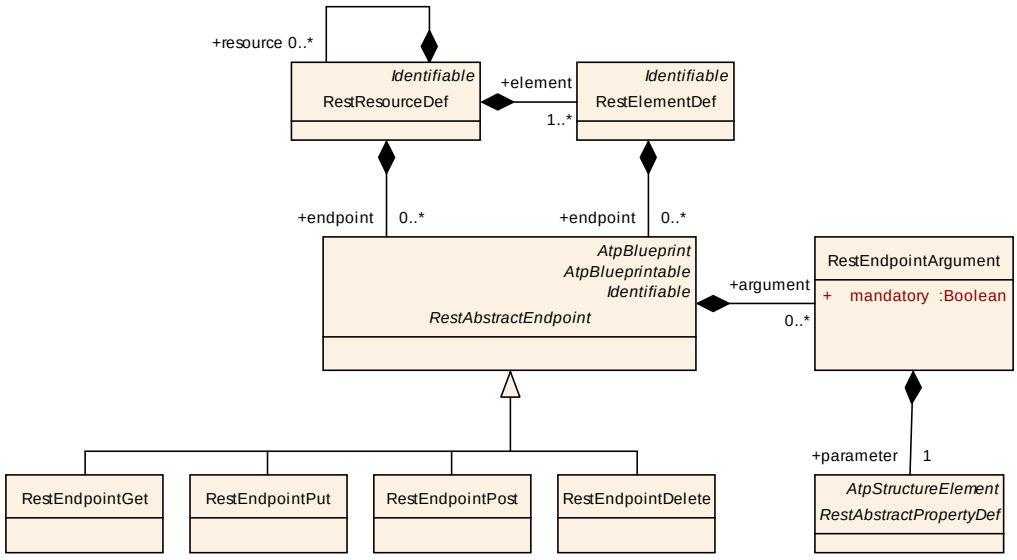


Figure 5.4: Modeling of the REST endpoints

[TPS_MANI_01122] Arguments to endpoints ⌈ In many cases a concrete subclass of `RestAbstractEndpoint` needs arguments to fulfill its intended semantics. An argument to such an endpoint can be defined by means of the aggregation of `RestEndpointArgument` in the role `RestAbstractEndpoint.argument` . Arguments can be required to exist or may be optional. This question is clarified by means of attribute `RestEndpointArgument.mandatory`.

The actual “payload” of the argument is not defined by `RestEndpointArgument` itself, for this the aggregation `RestEndpointArgument.parameter` shall be used. ⌋ (*RS_MANI_00033*)

Class	***RestAbstractEndpoint* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface::REST			
Note	This meta-class acts as a base class for the definition of endpoints within REST services. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	RestEndpointDelete, RestEndpointGet, RestEndpointPost, RestEndpointPut			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
argument	RestEndpointArgument	*	aggr	Some endpoints can require a list of arguments. **Tags:** atp.Status=draft

Table 5.3: RestAbstractEndpoint

Class	**RestEndpointPut**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface::REST			
Note	This meta-class represents the ability to model a REST endpoint with PUT semantics. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *RestAbstractEndpoint*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 5.4: RestEndpointPut

Class	**RestEndpointGet**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface::REST			
Note	This meta-class represents the ability to model a REST endpoint with GET semantics. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *RestAbstractEndpoint*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 5.5: RestEndpointGet

Class	**RestEndpointPost**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface::REST			
Note	This meta-class represents the ability to model a REST endpoint with POST semantics. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *RestAbstractEndpoint*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 5.6: RestEndpointPost

Class	**RestEndpointDelete**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface::REST			
Note	This meta-class represents the ability to model a REST endpoint with DELETE semantics. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *RestAbstractEndpoint*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 5.7: RestEndpointDelete

Class	**RestEndpointArgument**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface::REST			
Note	This meta-class represents the ability to define an argument for a REST endpoint. **Tags:** atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
mandatory	Boolean	1	attr	This attribute defines whether the argument is mandatory or whether it could be left out. **Tags:** atp.Status=draft
parameter	RestAbstractPropertyDef	1	aggr	This aggregation represents the concrete kind of argument to be used. **Tags:** atp.Status=draft

Table 5.8: RestEndpointArgument

[TPS_MANI_01123] System Triggered Event ⌈ A `RestSystemTriggeredEvent` aggregated in the role `RestResourceDef.systemTriggeredEvent` can be modeled to indicate that a notifier for changes of the specific `RestElementDef` referenced in the role `RestSystemTriggeredEvent.element` shall be created.

By this means the server is able to inform any respectively configured client about changes of the referenced element. ⌋(*RS_MANI_00033*)

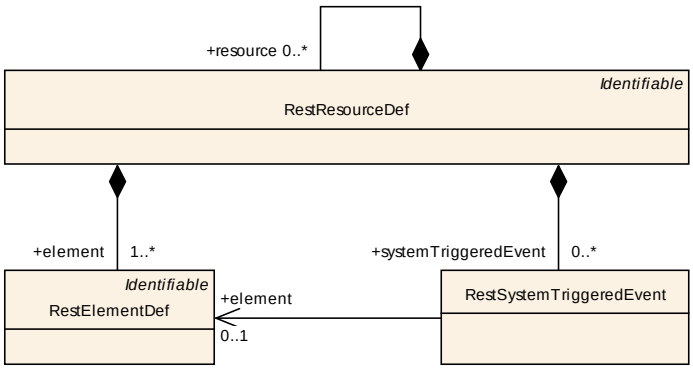


Figure 5.5: Modeling of the REST system triggered event

Class	**RestSystemTriggeredEvent**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface::REST			
Note	This meta-class represents the ability to identify an element such that at runtime an event is generated when the value of the reference element changes. **Tags:** atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
element	RestElementDef	0..1	ref	This reference represent the element that is linked to the system triggered event. **Tags:** atp.Status=draft

Table 5.9: RestSystemTriggeredEvent

5.4 REST Element

[TPS_MANI_01124] Semantics of `RestElementDef` ⌈ Meta-class `RestElementDef` represents the definition of data within a REST service. The specific definition of the data is done by way of aggregating so-called properties, i.e. `RestElementDef` aggregates `RestAbstractPropertyDef` in the role `property`. ⌋(*RS_MANI_00033*)

Class	**RestElementDef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface::REST			
Note	This meta-class represents an element of a resource that in turn is owned by a REST service. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

endpoint	RestAbstractEndpoint	*	aggr	This aggregation represents the definition of endpoints on the object level. **Tags:** atp.Status=draft
property	RestAbstractPropertyDef	1..*	aggr	This aggregation represents the collection of non-obligatory properties of the element level in a REST service. **Tags:** atp.Status=draft

Table 5.10: RestElementDef

Class	***RestAbstractPropertyDef* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface::REST			
Note	This meta-class acts as an abstract subclass for the definition of properties owned by the element level of a REST service definition. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	RestArrayPropertyDef, *RestPrimitivePropertyDef*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 5.11: RestAbstractPropertyDef

As depicted by Figure 5.6, there is a certain variety of ways in which the properties of a REST element can be described.

However, the expressiveness of this description is in no way comparable to the richness of the semantics of an `ApplicationDataType` or an `ImplementationDataType`.

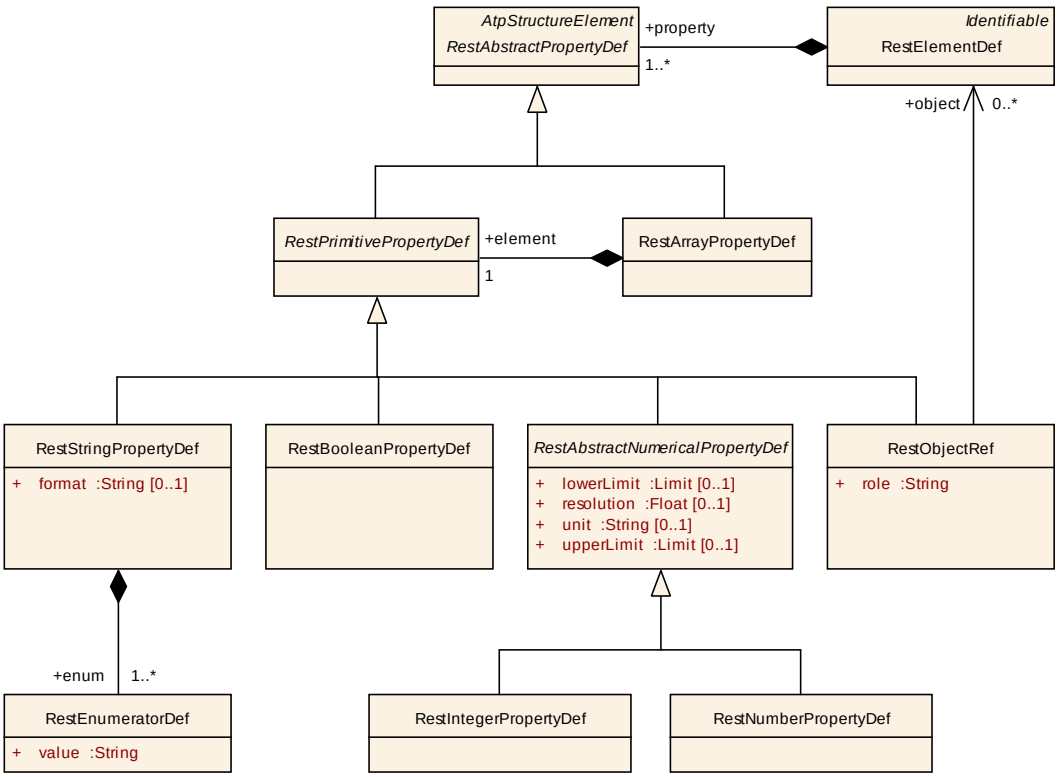


Figure 5.6: Modeling of the REST elements

[TPS_MANI_01125] Properties of REST elements can either be primitive or have array semantics ⌈ The properties of REST elements can either be primitive or have array semantics.

There is no support for the creation of structures nor is the nesting of property definitions with array semantics supported.

This aspect is already clarified by the model (`RestArrayPropertyDef` directly aggregates `RestPrimitivePropertyDef`) and does not need to be expressed by a written constraint. ⌋*(RS_MANI_00033)*

Class	***RestPrimitivePropertyDef* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface::REST			
Note	This meta-class acts as an abstract base class for the definition of primitive properties of elements of a REST service. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *RestAbstractPropertyDef*			
Subclasses	*RestAbstractNumericalPropertyDef*, RestBooleanPropertyDef, RestObjectRef, RestStringPropertyDef			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 5.12: RestPrimitivePropertyDef

Class	**RestArrayPropertyDef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface::REST			
Note	This meta-class represents the ability to define a property of an element of a rest service where the property is supposed to represent an array of other primitive properties. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *RestAbstractPropertyDef*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
element	RestPrimitiveP ropertyDef	1	aggr	This aggregation represents the definition of the base element type of the array property **Tags:** atp.Status=draft

Table 5.13: RestArrayPropertyDef

Class	**RestBooleanPropertyDef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface::REST			
Note	This meta-class represents the ability to define a REST property with boolean semantics. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *RestAbstractPropertyDef*, *RestPrimitive PropertyDef*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 5.14: RestBooleanPropertyDef

[TPS_MANI_01126] Definition of string properties ⌈ Properties with string semantics can be defined by means of `RestStringPropertyDef`.

In many cases, the intention will be to only allow a certain number of values within the string property and define the potential values of the string property directly by the string property itself.

For this purpose, `RestStringPropertyDef` aggregates `RestEnumeratorDef` in the role `enum` that in turn allows for the definition of the predefined value by way of attribute `value`. ⌋*(RS_MANI_00033)*

Class	**RestStringPropertyDef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface::REST			
Note	This meta-class represents the ability to define a REST property with string semantics. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *RestAbstractPropertyDef*, *RestPrimitivePropertyDef*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
enum	RestEnumeratorDef	1..*	aggr	This aggregation represents the collection of enumerators for the enclosing string property. **Tags:** atp.Status=draft
format	String	0..1	attr	This attribute can be used to define a specific format that the value of the string property shall be conform with. **Tags:** atp.Status=draft

Table 5.15: RestStringPropertyDef

Class	**RestEnumeratorDef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface::REST			
Note	This meta-class represents the ability to define enumerator values that can be taken as a the value of the enclosing string property. **Tags:** atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
value	String	1	attr	This attribute represents the ability to assign a value to an enumerator. **Tags:** atp.Status=draft

Table 5.16: RestEnumeratorDef

[TPS_MANI_01127] Limited support for data semantics in `RestAbstractNumericalPropertyDef` ⌈ Meta-class `RestAbstractNumericalPropertyDef` allows for a limited support of data semantics by means of the following attributes:

`lowerLimit` This value represents a definition of the lower boundary of the allowed interval for this property. The value shall always be provided as a physical value.

`upperLimit` This value represents a definition of the upper boundary of the allowed interval for this property. The value shall always be provided as a physical value.

`unit` This value represents the unit of the property. It is only defied as a simple string without further formalization, i.e. it does not make use of `Unit` and/or `PhysicalDimension`.

resolution This attribute defines the resolution of the property. However, this definition should not be confused with a conversion into an internal value domain, comparable to the usage of CompuMethod. It just says that the value of the property shall have a certain resolution.

⌋(*RS_MANI_00033*)

For explanation, the values of a REST properties are typically conveyed from sender to receiver on top of a "JSON transport layer". In other words, the serialization of the values ends up in a string-based format.

There is simply no need to define the conversion into a binary transport format that is used for typical automotive communication buses.

[TPS_MANI_01128] Difference between RestIntegerPropertyDef and RestNumberPropertyDef ⌈ Both RestIntegerPropertyDef and RestNumberPropertyDef can benefit from the limited support for data semantics as described by [TPS_MANI_01127].

However, by design RestIntegerPropertyDef is foreseen to carry integer values while RestNumberPropertyDef is reserved for carrying non-integer[1] numbers. ⌋ (*RS_MANI_00033*)

Class	***RestAbstractNumericalPropertyDef* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface::REST			
Note	This meta-class acts as an abstract base class that contributes attributes for its subclasses that in turn represent a numerical property. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *RestAbstractPropertyDef*, *RestPrimitivePropertyDef*			
Subclasses	RestIntegerPropertyDef, RestNumberPropertyDef			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
lowerLimit	Limit	0..1	attr	This attribute specifies the lower limit of the property value. **Tags:** atp.Status=draft
resolution	Float	0..1	attr	This attribute specifies the resolution of a given value on a physical basis. **Tags:** atp.Status=draft
unit	String	0..1	attr	This attribute describes the lower limit of the property's value. **Tags:** atp.Status=draft

[1] It would be inaccurate to describe these values as "float" because that would imply a certain representation in a binary layout in memory or on a bus. This binary format is not applicable in this case.

upperLimit	Limit	0..1	attr	This attribute describes the upper limit of the property's value. **Tags:** atp.Status=draft

Table 5.17: RestAbstractNumericalPropertyDef

Class	**RestIntegerPropertyDef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface::REST			
Note	This meta-class represents the ability to define a REST property with an integer semantics. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *RestAbstractNumericalPropertyDef*, *RestAbstractPropertyDef*, *RestPrimitivePropertyDef*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 5.18: RestIntegerPropertyDef

Class	**RestNumberPropertyDef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface::REST			
Note	This meta-class represents the ability to define a REST property with a numerical semantics. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *RestAbstractNumericalPropertyDef*, *RestAbstractPropertyDef*, *RestPrimitivePropertyDef*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 5.19: RestNumberPropertyDef

[TPS_MANI_01129] `RestObjectRef` is only needed for specific implementations of REST-based communication ⌈ The existence of a `RestObjectRef` is only required for specific implementations of the REST-based communication approach.

The application of this reference has some pitfalls (it should only refer to elements in the same service, make sure to only reference the intended kind of element) and therefore needs to be applied carefully.

There is no formal support to make sure that only a certain kind of `RestElementDef` can be referenced. As a semi-formal support for the creation of references the attribute `RestObjectRef.role` has been introduced. It allows for the annotation of the kind of target `RestElementDef`. ⌋*(RS_MANI_00033)*

Class	**RestObjectRef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface::REST			
Note	This meta-class represents the ability to define a REST property that defines reference to another REST element. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *RestAbstractPropertyDef*, *RestPrimitive PropertyDef*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
object	RestElementDef	*	ref	This reference represents the ability to define constraints regarding the reference to another element, i.e. the reference identifies the element to which the reference is allowed to refer. **Tags:** atp.Status=draft
role	String	1	attr	This attribute represents the ability to define a role for the reference to another element. **Tags:** atp.Status=draft

Table 5.20: RestObjectRef

The application of the attribute `RestObjectRef.role` is sketched in Figure 5.7. The example shows a REST service that makes heavy use of the referencing ability.

The roles (in *italics*) can be used for checking, i.e. the reference in the role *engine* should not point to e.g. a gastank object.

But again, this semantics - although the strongest that could be supported on M2 modeling level - is rather weak and may be subject to consistency problems.

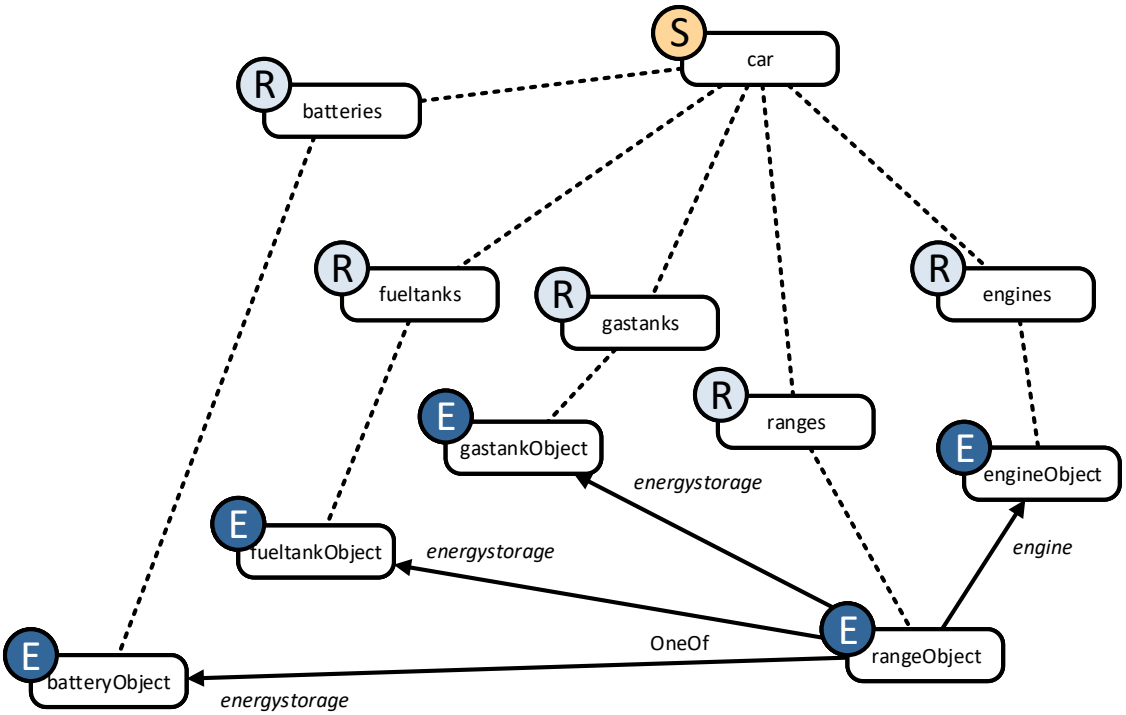


Figure 5.7: Example of the usage of the `role` attribute

6 Application Manifest

6.1 Overview

The purpose of the application manifest is to provide information that is needed for the actual deployment of an application (formally modeled as an SwComponentType) onto the AUTOSAR adaptive platform.

One aspect of the deployment information is the provision of information that could in principle be provided as part of the application software code but which would make the application software code become very much bound to specific usage scenarios.

The general idea is to keep the application software code as independent as possible from the deployment scenario in order to increase the odds that the application software can be reused in different deployment scenarios.

In particular, the usage of PortPrototypes as a means to express communication with the “outside” of the application software allows for abstracting away the details (the concrete service instance identification) of the service configuration. As far as the model is concerned, the API between the application and the middleware is represented by the PortPrototype.

The application code does not use specific service instances but takes the PortPrototype as a symbolic replacement for this information. The specifics of this modeling aspect are described in section 7.

The top-level element of the Application Manifest definition is the Process, in reference to the fact that the unit of deployment on the *AUTOSAR adaptive platform* is a binary that, at runtime, makes a POSIX process.

[TPS_MANI_01011] Connection between application design and application deployment ⌈ The connection between the *application design* and the *application deployment* is implemented by means of a reference from meta-class Process to meta-class Executable in the role executable.

By modeling the reference in this direction it is possible to keep the design level independent of the deployment level and, at the same time, bind the deployment to a specific design. ⌋*(RS_MANI_00006)*

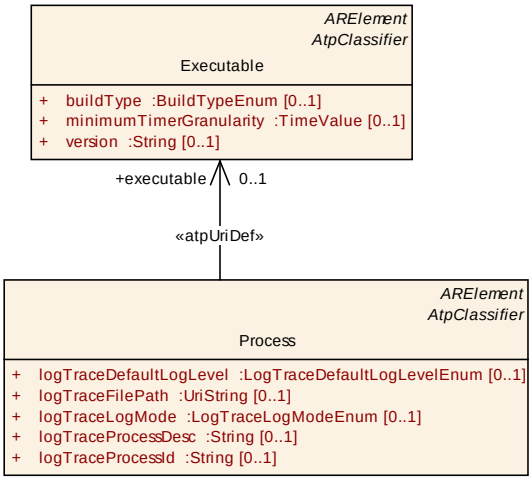


Figure 6.1: Relation of meta-classes `Executable` and `Process`

Class	**Process**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Process			
Note	This meta-class provides information required to execute the referenced executable. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft; atp.recommended Package=Processes			
Base	*ARElement*, *ARObject*, *AtpClassifier*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
applicationModeMachine	ModeDeclarationGroupPrototype	0..1	aggr	Set of ApplicationStates (Modes) that are defined for the process. **Tags:** atp.Status=draft
design	ProcessDesign	0..1	ref	This reference represents the identification of the design-time representation for the Process that owns the reference. **Tags:** atp.Status=draft
executable	Executable	0..1	ref	Reference to executable that is executed in the process. **Stereotypes:** atpUriDef **Tags:** atp.Status=draft
logTraceDefaultLogLevel	LogTraceDefaultLogLevelEnum	0..1	attr	This attribute allows to set the initial log reporting level for a logTraceProcessId (ApplicationId).
logTraceFilePath	UriString	0..1	attr	This attribute defines the destination file to which the logging information is passed.
logTraceLogMode	LogTraceLogModeEnum	0..1	attr	This attribute defines the destination of log messages provided by the process.
logTraceProcessDesc	String	0..1	attr	This attribute can be used to describe the logTraceProcessId that is used in the log and trace message in more detail.
logTraceProcessId	String	0..1	attr	This attribute identifies the process in the log and trace message (ApplicationId).

modeDependentStartupConfig	ModeDependentStartupConfig	*	aggr	Applicable startup configurations. **Tags:** atp.Status=draft

Table 6.1: Process

Please note that the meta-model, as depicted in Figure 6.1 supports the existence of two or more `Process`es that reference the same `Executable`.

This is an indication that the specific `Executable` is supposed to be executed in several instances (i.e. in the form of POSIX processes) on the same platform. Such a situation is sketched in Figure 6.2

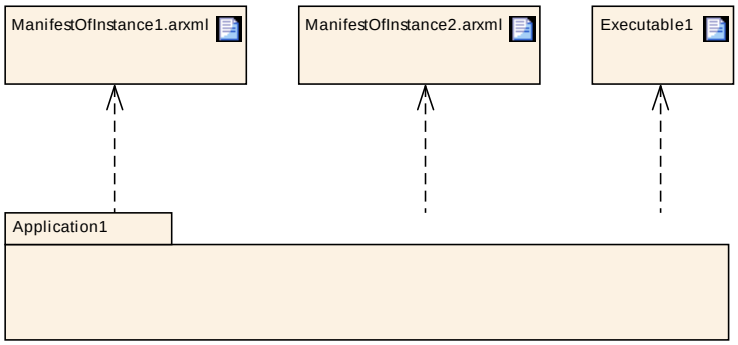


Figure 6.2: Example deployment where one `Executable` is bundled with two ARXML files that each contain the description of one `Process`

It is somehow likely that the startup conditions and startup parameters of different `Process`es may be different (in order to achieve a variation of the functionality of the `Executable`).

Therefore, it is necessary to allow for the definition of startup configurations on a per-`Process`-basis.

This aspect is described in section 6.2.

The supported application states that are defined in the `Process.applicationModeMachine` are described in more detail in [20] by [SWS_EM_01053], [SWS_EM_01055].

6.2 Startup Configuration

The configuration of startup behavior is an essential part of the application manifest.

[TPS_MANI_01012] Formal modeling of application startup behavior ⌈ The formal modeling of application startup behavior is implemented by means of the aggregation of meta-class `ModeDependentStartupConfig` in the role `Process.modeDependentStartupConfig`. ⌋ *(RS_MANI_00007)*

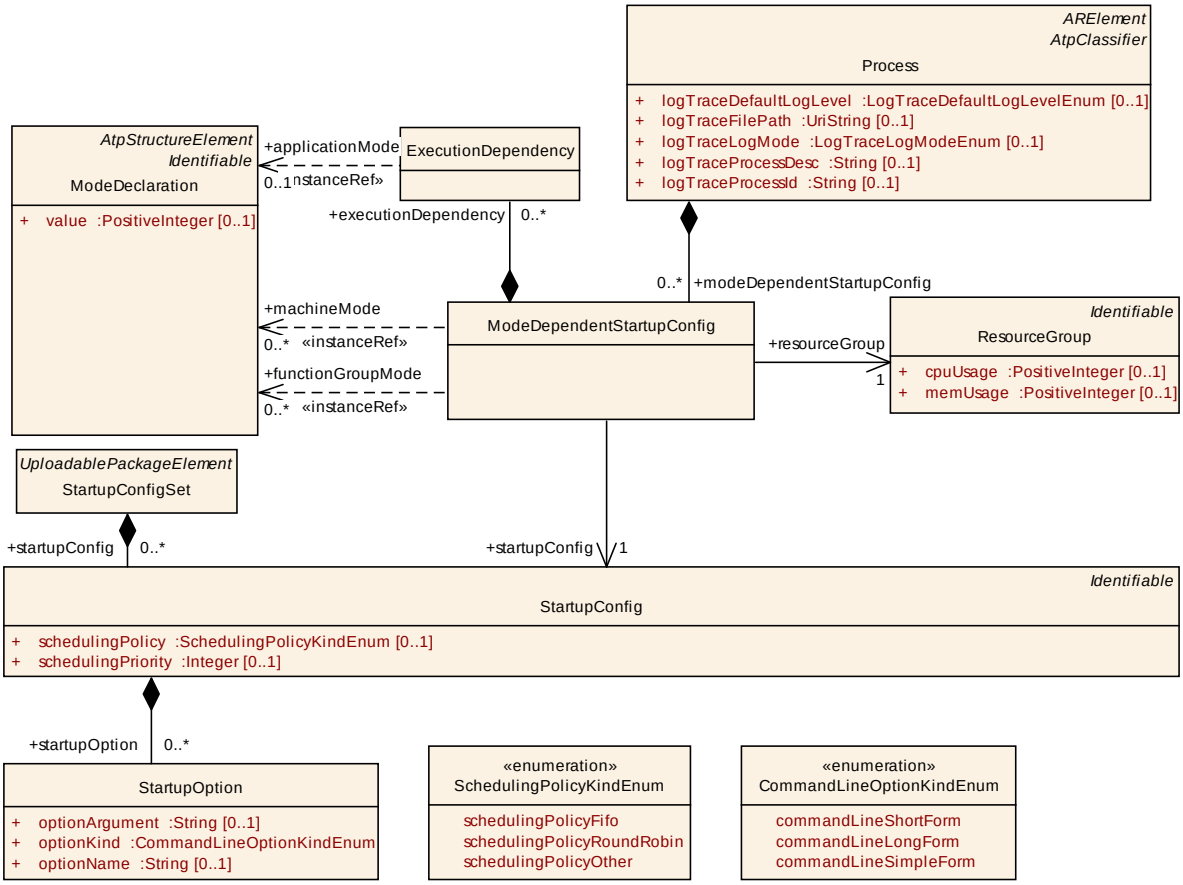


Figure 6.3: Content of a `Process`

6.2.1 Mode-dependent Startup Configuration

[TPS_MANI_01013] Semantics of meta-class `ModeDependentStartupConfig` ⌈
The purpose of meta-class `ModeDependentStartupConfig` is to qualify the startup configuration represented by meta-class `StartupConfig` for specific `ModeDeclaration`s.

In other words, the intention is to express that the `StartupConfig` is applicable if the mode machines that control the startup are in the modes represented by the `ModeDeclaration` referenced in the role `ModeDependentStartupConfig.machineMode` and/or `ModeDependentStartupConfig.functionGroupMode`. ⌋
(RS_MANI_00007)

Please note that the corresponding SWS for the definition of the Execution Manager may refer to *states*. Similar to the situation on the *classic AUTOSAR platform*, the term *mode* used in this document directly corresponds to a *state* on the level of middleware software.

As a consequence of the reference from the `ModeDependentStartupConfig` to `ModeDeclaration` the `Application Manifest` is defined for a specific `Machine` to which the binary and the Manifest is deployed.

[constr_3423] ModeDependentStartupConfig of a Process shall reference a functionGroupMode or machineMode ⌈ Each ModeDependentStartupConfig of a Process shall reference at least one ModeDeclaration in the role functionGroupMode or in the role machineMode. ⌋*()*

[constr_3397] ModeDependentStartupConfig that refers to a functionGroupMode and to a machineMode ⌈ If a Process has **one** modeDependentStartupConfig that does refer to a functionGroupMode and to a machineMode then the Process shall not aggregate **any other** modeDependentStartupConfig. ⌋*()*

[constr_3398] ModeDependentStartupConfig that refers to function group modes of different function groups ⌈ If a Process has **one** modeDependentStartupConfig that refers to ModeDeclarations of different ModeDeclarationGroups in the role functionGroupMode then the Process shall not aggregate **any other** modeDependentStartupConfig. ⌋*()*

In other words, if a Process references functionGroupModes which belong to more than one functionGroup, or if it references both machineModes and functionGroupModes, then only one ModeDependentStartupConfig shall be configured for the Process, which is valid for all referenced states. This restriction prevents undefined behavior, because if a Process would reference states of different Function Groups, which can be active simultaneously, the used ModeDependentStartupConfigs would depend on the sequence of the referenced Function Group States, if different startup configurations were used.

It is necessary to specify constraints [constr_1504] and [constr_3396] to regulate the number of ModeDependentStartupConfigs that refer to the same ModeDeclaration in the context of one Process because the resulting startup configuration would be ambiguous.

[constr_1504] Number of Process.modeDependentStartupConfig that refer to the same machineMode ⌈ Within the context of a given Process, no two ModeDependentStartupConfigs shall refer to the same ModeDeclaration in the role machineMode. ⌋*()*

[constr_3396] Number of Process.modeDependentStartupConfig that refer to the same functionGroupMode ⌈ Within the context of a given Process, no two ModeDependentStartupConfigs shall refer to the same ModeDeclaration in the role functionGroupMode. ⌋*()*

[TPS_MANI_01046] Semantics of ModeDependentStartupConfig.machineMode ⌈ The ModeDeclarations referenced in the role ModeDependentStartupConfig.machineMode shall be considered in a way such that the ModeDependentStartupConfig applies if **any** of the referenced ModeDeclarations is active.

In other words, the ModeDeclarations are or-ed for the determination of whether a ModeDependentStartupConfig is applicable. ⌋*(RS_MANI_00007)*

[TPS_MANI_03153] Semantics of `ModeDependentStartupConfig.functionGroupMode` ⌈ The `ModeDeclaration`s referenced in the role `ModeDependentStartupConfig.functionGroupMode` shall be considered in a way such that the `ModeDependentStartupConfig` applies if **any** of the referenced `ModeDeclaration`s is active.

In other words, the `ModeDeclaration`s are or-ed for the determination of whether a `ModeDependentStartupConfig` is applicable. ⌋*(RS_MANI_00007, RS_MANI_00041)*

[constr_3424] `ModeDependentStartupConfig` shall never reference the `functionGroupMode` `Off` ⌈ A `ModeDependentStartupConfig` shall never reference the `ModeDeclaration` that has the `shortName` `Off` in the role `functionGroupMode`. Please note that the `Off` `ModeDeclaration` is a special state in a Function Group as defined by [TPS_MANI_03195]. ⌋*()*

Class	**ModeDependentStartupConfig**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Process			
Note	This meta-class defines the startup configuration for the process depending on a collection of machine states. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
executionDependency	ExecutionDependency	*	aggr	This attribute defines that all processes that are referenced via the ExecutionDependency shall be launched and shall reach a certain ApplicationState before the referencing process is started. **Tags:** atp.Status=draft
functionGroupMode	ModeDeclaration	*	iref	This represent the applicable functionGroupMode. **Tags:** atp.Status=draft
machineMode	ModeDeclaration	*	iref	This represent the applicable machineMode. **Tags:** atp.Status=draft
resourceGroup	ResourceGroup	1	ref	Reference to an applicable resource group. **Tags:** atp.Status=draft
startupConfig	StartupConfig	1	ref	Reference to a reusable startup configuration with startup parameters. **Tags:** atp.Status=draft

Table 6.2: ModeDependentStartupConfig

Class	**ModeDeclaration**			
Package	M2::AUTOSARTemplates::CommonStructure::ModeDeclaration			
Note	Declaration of one Mode. The name and semantics of a specific mode is not defined in the meta-model. **Tags:** atp.ManifestKind=ApplicationManifest,MachineManifest			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
value	PositiveInteger	0..1	attr	The RTE shall take the value of this attribute for generating the source code representation of this ModeDeclaration.

Table 6.3: ModeDeclaration

Class	**StartupConfig**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Process			
Note	This meta-class represents a reusable startup configuration for processes.. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
schedulingPolicy	SchedulingPolicyKindEnum	0..1	attr	This attribute represents the ability to define the scheduling policy for the initial thread of the application.
schedulingPriority	Integer	0..1	attr	This is the scheduling priority requested by the application itself.
startupOption	StartupOption	*	aggr	Applicable startup options **Tags:** atp.Status=draft

Table 6.4: StartupConfig

6.2.2 Scheduling

[TPS_MANI_01061] Requirements on scheduling ⌈ The attributes `StartupConfig.schedulingPolicy` and `StartupConfig.schedulingPriority` make requirements on the scheduling of the process that is created out of launching the `Executable`, i.e. the “outer” scheduling.

The value of these attributes has no direct impact on the behavior of any “inner” scheduling of threads. ⌋*(RS_MANI_00007)*

Enumeration	**SchedulingPolicyKindEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Process

Note	This meta-class provides a set of settings that allow for the specification of a scheduling policy. For a detailed description of the scheduling policies defined in the context of this meta-class, please refer to The Open Group Base Specifications Issue 7, IEEE Std 1003.1, 2013 Edition. **Tags:** atp.Status=draft
Literal	***Description***
schedulingPolicyFifo	This attribute represents the setting for a FIFO scheduling policy. **Tags:** atp.EnumerationValue=0
schedulingPolicyOther	This attribute represents the setting for a custom scheduling policy. **Tags:** atp.EnumerationValue=2
schedulingPolicyRoundRobin	This attribute represents the setting for a round robin scheduling policy **Tags:** atp.EnumerationValue=1

Table 6.5: SchedulingPolicyKindEnum

6.2.3 Startup Options

[TPS_MANI_01014] Semantics of meta-class `StartupConfigSet` ⌈ The existence of a mode-dependent startup procedure implies the existence of a number of `StartupConfig`s within a given project.

Meta-class `StartupConfigSet` is therefore used as some sort of bucket to collect a number of `StartupConfig`s. ⌋*(RS_MANI_00007)*

Class	**StartupConfigSet**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Process			
Note	Collection of reusable startup configurations for processes. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft; atp.recommendedPackage=StartupConfigSets			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
startupConfig	StartupConfig	*	aggr	Startup configuration that is contained in the StartupConfigSet **Tags:** atp.Status=draft

Table 6.6: StartupConfigSet

A POSIX process is usually started by a parent process, on the *AUTOSAR adaptive platform* this boils down to the `Execution Manager`. It is possible to pass a number of command-line options along with the command to launch the process.

The command-line options are then evaluated and taken into account by the process internally. In principle, command-line options are just a collection of tokens separated by whitespaces.

In most cases, it is not enough to have single tokens passed to the program because then the semantics of an individual token would not be unambiguous.

Therefore, conventions have evolved how to structure the collection of command-line options for launching a program.

In particular, the conventions assume the definition of pairs of command-line tokens where one token takes the role of a qualifier and the other takes the role of the value of that qualifier (example: `-v 1.0` or `--version=1.0`).

Whether or not single tokens can have a meaning depends on the individual program. For the modeling of command-line options this means:

- The model shall be able to describe a pair of command tokens that form a higher semantics in the sense that one qualifies and the other provides a value for that qualifier (example: `-v 1.0` or `--version=1.0`).
- Single tokens may have a fully-specified semantics (example: `-h`).
- It shall also be possible to just pass arguments along without any further markup (example: `../docs/config.txt`)
- Arbitrary number of tokens may appear on the command line of a program

These conclusions, along with the intention of the *AUTOSAR adaptive platform* to model the command line in a detailed way (as opposed to one opaque string), lead to the modeling of meta-class `StartupOption`.

[TPS_MANI_01015] Semantics of meta-class `StartupOption` ⌈ Each `StartupOption` represents a command-line parameter that may (depending on the value of `optionKind`, see [constr_1497] and [constr_1498]) consist of one or two token.

On top of that, it is possible to specify the convention for tokens to be arranged in order to make a valid command-line parameter. The convention is represented by attribute `optionKind`. ⌋*(RS_MANI_00007)*

[TPS_MANI_01059] Different values of `optionKind` within a `StartupConfig.startupOption` ⌈ The attribute `optionKind` may have a different value for each `optionKind` within a given `StartupConfig`. ⌋*(RS_MANI_00007)*

A simpler form of the statement made by [TPS_MANI_01059] is to say that different styles of startup options can be mixed within the context of a `StartupConfig`.

Please note that the usage of the value `commandLineSimpleForm` for attribute `optionKind` implicitly supports the usage of so-called “indirect files” that contain a list of startup options in order to overcome limitations regarding the total length of startup options on the command line.

In this case the typical strategy is to define a lead-in token that signals the nature of the command-line option, e.g. `@config.txt`.

[constr_1497] Attribute `optionKind` set to `commandLineSimpleForm` ⌈ For any `StartupOption` where attribute `optionKind` is set to `CommandLineOptionKindEnum.commandLineSimpleForm` the attribute `optionName` **shall not** and attribute `optionArgument` **shall** exist. ⌋*()*

[constr_1498] Attribute `optionKind` set to `commandLineShortForm` or `commandLineLongForm` ⌈ For any `StartupOption` where attribute `optionKind` is set to value `CommandLineOptionKindEnum.commandLineShortForm` or `CommandLineOptionKindEnum.commandLineLongForm` the attribute `optionName` **shall** exist. ⌋*()*

Class	**StartupOption**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Process			
Note	This meta-class represents a single startup option consisting of option name and an optional argument. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
optionArgument	String	0..1	attr	This attribute defines option value.
optionKind	CommandLineOptionKindEnum	1	attr	This attribute specifies the style how the command line options appear in the command line.
optionName	String	0..1	attr	This attribute defines option name.

Table 6.7: StartupOption

Enumeration	**CommandLineOptionKindEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Process
Note	This enum defines the different styles how the command line option appear in the command line. **Tags:** atp.Status=draft
Literal	***Description***
commandLineLongForm	Long form of command line option. Example: --version=1.0 --help **Tags:** atp.EnumerationValue=1

commandLineShortForm	Short form of command line option. Example: -v 1.0 -h **Tags:** atp.EnumerationValue=0
commandLineSimpleForm	In this case the command line option does not have any formal structure. Just the value is passed to the program. **Tags:** atp.EnumerationValue=2

Table 6.8: CommandLineOptionKindEnum

6.2.4 Resources

Meta-class `ModeDependentStartupConfig` also supports the specification of a relation to a resource group.

[TPS_MANI_01017] Relation of startup configuration to resource group ⌈ The modeling of a resource group is possible by means of meta-class `ResourceGroup` in the `OsModuleInstantiation` of the `Machine` and the assignment of a `Process` to a `ResourceGroup` is supported by the association from `ModeDependentStartupConfig` to `ResourceGroup` in the role `resourceGroup`. ⌋*(RS_MANI_00007)*

[constr_3413] `ModeDependentStartupConfig` of a `Process` is mapped to exactly one `ResourceGroup` ⌈ Each `ModeDependentStartupConfig` of a `Process` shall be assigned to exactly one `ResourceGroup` that is defined in the Machine Manifest. ⌋*()*

Class	**ResourceGroup**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::AdaptiveModuleImplementation			
Note	This meta-class represents a resource group that limits the resource usage of a collection of processes. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
cpuUsage	PositiveInteger	0..1	attr	CPU resource limit in percentage of the total CPU capacity on the machine.
memUsage	PositiveInteger	0..1	attr	Memory limit in bytes.

Table 6.9: ResourceGroup

6.2.5 Execution Dependency

[TPS_MANI_01041] Startup configuration supports the definition of a launch sequence dependency ⌈ The modeling of startup configuration also supports the definition of a launch sequence dependency, formalized by the meta-class `ExecutionDependency` that is aggregated by `ModeDependentStartupConfig` in the role `executionDependency`.

The `ExecutionDependency` allows to define a dependency to a process that needs to be in a specific application state before the process that aggregates the `ExecutionDependency` via `ModeDependentStartupConfig` is launched. ⌋ *(RS_MANI_00007)*

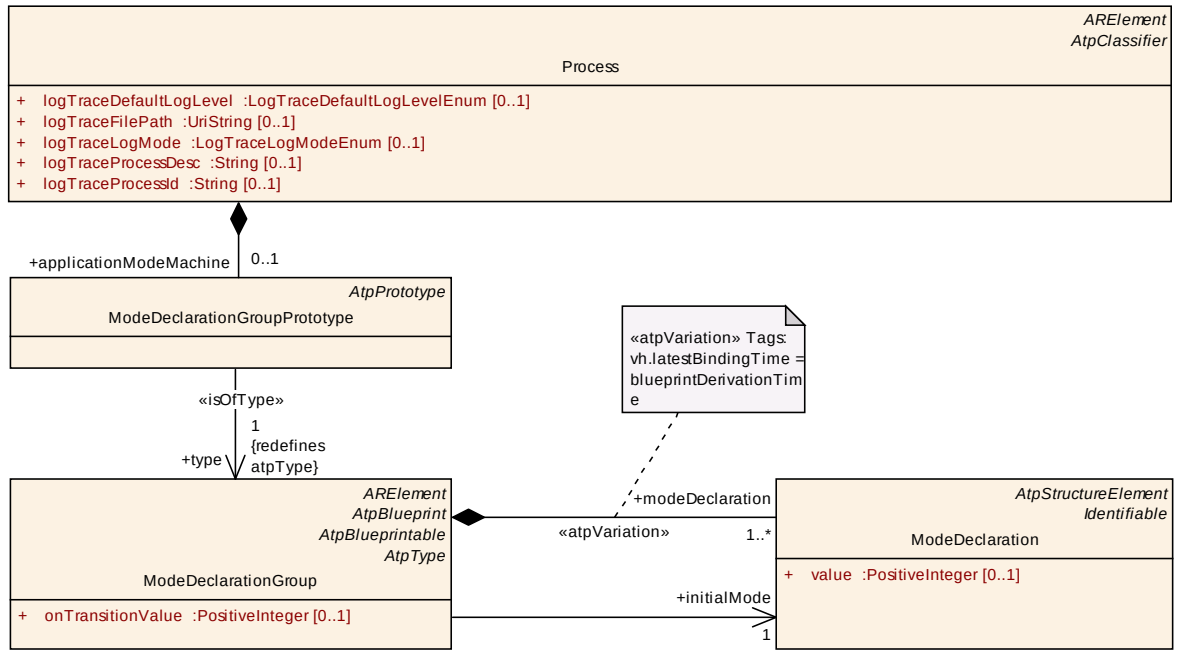


Figure 6.4: Modeling of how `Process` relates to `ModeDeclaration`

Class	**ExecutionDependency**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Process			
Note	This element defines an ApplicationState in which a dependent process needs to be before the process that aggregates the ExecutionDependency element can be started. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
applicationMode	ModeDeclaration	0..1	iref	This represent the applicable modeDeclaration that represents an ApplicationState. **Tags:** atp.Status=draft

Table 6.10: ExecutionDependency

[constr_1484] Applicability of `ModeDependentStartupConfig.executionDependency` ⌈ The following restrictions apply for the existence of `ModeDependentStartupConfig.executionDependency`:

- The `Process` that contains the `applicationMode` that is referenced by the `ExecutionDependency` shall **only** reference an `Executable` that in turn is referenced by an `ExecutableGroup` that has the value of attribute `category` set to `PLATFORM_LEVEL` (see [TPS_MANI_01009]).
- The `Process` that aggregates the `ExecutionDependency` via `ModeDependentStartupConfig` that refers indirectly to another `Process` via the `applicationMode` shall **only** reference an `Executable` that in turn is referenced by an `ExecutableGroup` that has the value of attribute `category` set to `PLATFORM_LEVEL`.

⌋*()*

In other words: the explicit launch dependency is reserved for platform modules that, in all likelihood, do not use service-oriented communication to communicate with each other.

[constr_3350] Consistent value of `category` for `ExecutableGroup`s referencing an `Executable` ⌈ All `ExecutableGroup`s that reference a specific `Executable` shall have the value of attribute `category` set to the same value. ⌋*()*

6.2.6 Assignment of Processes to Function Group states

There are use cases where starting and terminating of individual groups of processes is necessary. This is supported in AUTOSAR by function groups that group processes together. A function group may have a number of function group states, e.g. Running, Idle, Terminating. The`ModeDependentStartupConfig` of a `Process` can be assigned to a function group state and the start-up of the `Process` will then depend on this assignment.

The modeling of function groups and their function group states is described in section 8.3 in more detail. The usage of Function Groups is described in more detail in [20].

[TPS_MANI_03152] Assignment of a `ModeDependentStartupConfig` to a function group state ⌈ The `ModeDependentStartupConfig` is assigned to a function group state with the `functionGroup` reference. ⌋*(RS_MANI_00041)*

7 Service Instance Manifest

7.1 Service Interface Deployment

The different meta-class specializations of `ServiceInterfaceDeployment` define a binding of a `ServiceInterface` to a middleware transport layer.

This chapter describes the usage of the `ServiceInterfaceDeployment` in different bindings that are supported by AUTOSAR.

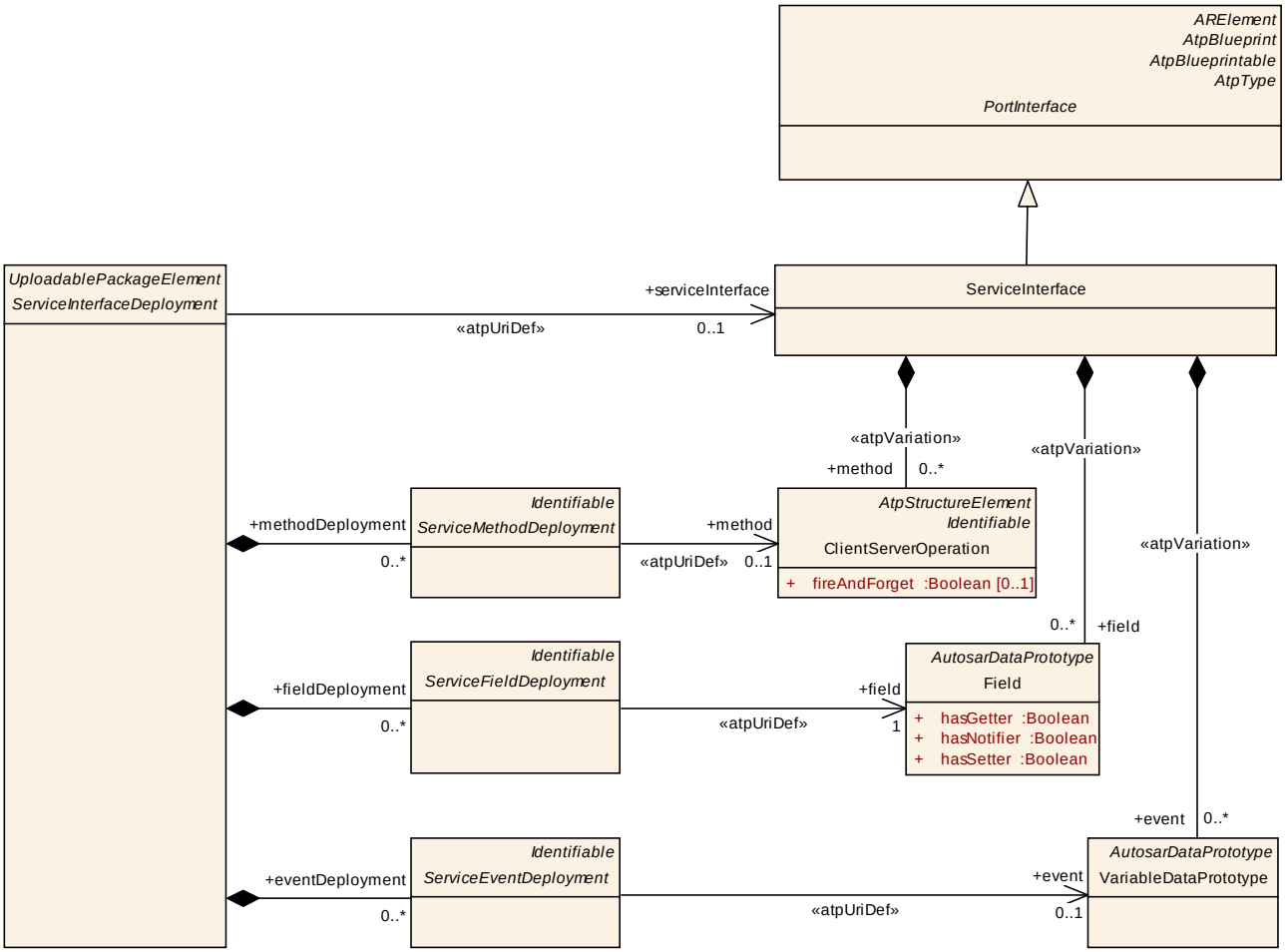


Figure 7.1: Deployment-related modeling of ServiceInterface

[TPS_MANI_03036] `ServiceInterface` deployment to a middleware transport layer ⌈ The `ServiceInterfaceDeployment` meta-class provides the ability to map a `ServiceInterface` to a middleware transport layer that is represented by a concrete class that is derived from the abstract `ServiceInterfaceDeployment` meta-class. ⌋*(RS_MANI_00008)*

Class	***ServiceInterfaceDeployment* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInterface Deployment			
Note	Middleware transport layer specific configuration settings for the ServiceInterface and all contained ServiceInterface elements. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *UploadablePackageElement*			
Subclasses	DdsServiceInterfaceDeployment, SignalBasedServiceInterfaceDeployment, SomeipServiceInterfaceDeployment, UserDefinedServiceInterfaceDeployment			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
eventDeployment	ServiceEventDeployment	*	aggr	Middleware transport layer specific configuration settings for an Event that is defined in the ServiceInterface. **Tags:** atp.Status=draft
fieldDeployment	ServiceFieldDeployment	*	aggr	Middleware transport layer specific configuration settings for a Field that is defined in the ServiceInterface. **Tags:** atp.Status=draft
methodDeployment	ServiceMethodDeployment	*	aggr	Middleware transport layer specific configuration settings for a method that is defined in the ServiceInterface. **Tags:** atp.Status=draft
serviceInterface	ServiceInterface	0..1	ref	Reference to a ServiceInterface that is deployed to a middleware transport layer. **Stereotypes:** atpUriDef **Tags:** atp.Status=draft

Table 7.1: ServiceInterfaceDeployment

[TPS_MANI_03037] Purpose of `ServiceMethodDeployment` ⌈ The `ServiceMethodDeployment` meta-class provides the ability to define middleware transport layer specific configuration settings relevant for a `method` that is defined in the context of a `ServiceInterface`. ⌋*(RS_MANI_00008)*

[constr_3300] Allowed `ServiceMethodDeployment.method` references ⌈ The `ClientServerOperation` that is referenced by `ServiceMethodDeployment` in the role `method` shall be defined in the context of a `ServiceInterface` that is referenced by the `ServiceInterfaceDeployment` in the role `serviceInterface` that contains the `ServiceMethodDeployment`. ⌋*()*

[TPS_MANI_03038] Purpose of `ServiceEventDeployment` ⌈ The `ServiceEventDeployment` meta-class provides the ability to define middleware transport layer specific configuration settings relevant for an `event` that is defined in the context of a `ServiceInterface`. ⌋*(RS_MANI_00008)*

[constr_3301] Allowed `ServiceEventDeployment.event` references ⌈ The `VariableDataPrototype` that is referenced by `ServiceEventDeployment` in the role `event` shall be defined in the context of a `ServiceInterface` that is referenced by the `ServiceInterfaceDeployment` in the role `serviceInterface` that contains the `ServiceEventDeployment`. ⌋*()*

[TPS_MANI_03039] Purpose of `ServiceFieldDeployment` ⌈ The `ServiceFieldDeployment` meta-class provides the ability to define middleware transport layer specific configuration settings relevant for a `field` that is defined in the context of a `ServiceInterface`. ⌋*(RS_MANI_00008)*

[constr_3302] Allowed `ServiceFieldDeployment.field` references ⌈ The `Field` that is referenced by `ServiceFieldDeployment` in the role `field` shall be defined in the context of a `ServiceInterface` that is referenced by the `ServiceInterfaceDeployment` in the role `serviceInterface` that contains the `ServiceFieldDeployment`. ⌋*()*

Class	***ServiceMethodDeployment* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInterface Deployment			
Note	This abstract meta-class represents the ability to specify a deployment of a Method to a middleware transport layer. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	SignalBasedMethodDeployment, SomeipMethodDeployment, UserDefinedMethod Deployment			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
method	ClientServerO peration	0..1	ref	Reference to a method that is deployed to a middleware transport layer. **Stereotypes:** atpUriDef **Tags:** atp.Status=draft

Table 7.2: ServiceMethodDeployment

Class	***ServiceEventDeployment* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInterface Deployment			
Note	This abstract meta-class represents the ability to specify a deployment of an Event to a middleware transport layer. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	DdsEventDeployment, SignalBasedEventDeployment, SomeipEventDeployment, UserDefinedEventDeployment			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

event	VariableDataPrototype	0..1	ref	Reference to an Event that is deployed to a middleware transport layer. **Stereotypes:** atpUriDef **Tags:** atp.Status=draft

Table 7.3: ServiceEventDeployment

Class	***ServiceFieldDeployment* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInterfaceDeployment			
Note	This abstract meta-class represents the ability to specify a deployment of a Field to a middleware transport layer. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	SignalBasedFieldDeployment, SomeipFieldDeployment, UserDefinedFieldDeployment			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
field	Field	1	ref	Reference to a Field that is deployed to a middleware transport layer. **Stereotypes:** atpUriDef **Tags:** atp.Status=draft

Table 7.4: ServiceFieldDeployment

7.1.1 SOME/IP Service Interface Deployment

This chapter describes the SOME/IP deployment of a `ServiceInterface`.

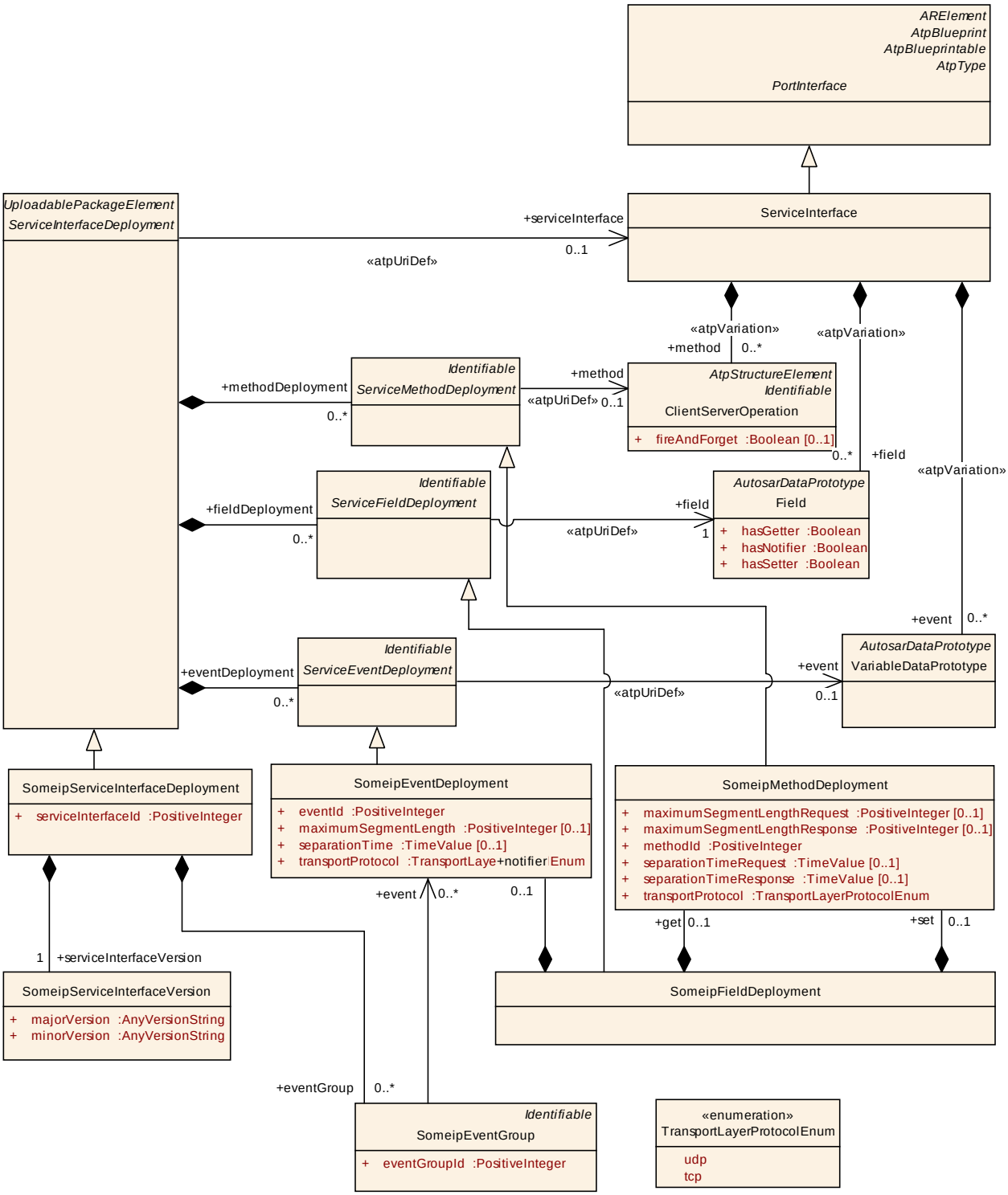


Figure 7.2: SOME/IP deployment of ServiceInterface

[TPS_MANI_03040] SOME/IP ServiceInterface binding ⌈ The `SomeipServiceInterfaceDeployment` meta-class provides the ability to bind a `ServiceInterface` to SOME/IP and to assign a SOME/IP Service identifier to the `ServiceInterface` with the `serviceInterfaceId` attribute. ⌋*(RS_MANI_00024)*

[constr_3410] Value range of SomeipServiceInterfaceDeployment.serviceInterfaceId ⌈ The value of serviceInterfaceId shall be in the range of 0..65535. ⌋*()*

Please note that the SOME/IP MessageId that is 32 Bit long contains a 16 Bit serviceInterfaceId, a single bit that defines whether the message transports a method or an event and a 15 Bit eventId or methodId.

Please also consider [PRS_SOMEIPSD_00515] in [21] that defines special and reserved serviceInterfaceIds for SOME/IP and SOME/IP-SD.

[TPS_MANI_03041] Definition of SOME/IP EventGroups ⌈ The SomeipServiceInterfaceDeployment.eventGroup allows to define SOME/IP *EventGroups* that are included in the SOME/IP Service and provide a logical grouping of events and notification events used for publish/subscribe handling. ⌋*(RS_MANI_00024)*

[constr_3304] Value of attribute SomeipEventGroup.eventGroupId shall be unique ⌈ The value of attribute eventGroupId shall be unique in the context of the enclosing SomeipServiceInterfaceDeployment. ⌋*()*

[TPS_MANI_03042] Definition of SOME/IP Service Version ⌈ The SomeipServiceInterfaceDeployment.serviceInterfaceVersion allows to define a major and a minor version for the SOME/IP Service. ⌋*(RS_MANI_00024)*

[constr_3303] ANY not allowed for SomeipServiceInterfaceDeployment.serviceInterfaceVersion ⌈ The value ANY is not allowed for the majorVersion and minorVersion of the SomeipServiceInterfaceDeployment.serviceInterfaceVersion. ⌋*()*

Class	**SomeipServiceInterfaceDeployment**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInterface Deployment			
Note	SOME/IP configuration settings for a ServiceInterface. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft; atp.recommendedPackage=ServiceInterfaceDeployments			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *ServiceInterfaceDeployment*, *UploadablePackage Element*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
eventGroup	SomeipEventGroup	*	aggr	SOME/IP EventGroups that are defined within the SOME/IP ServiceClass. **Tags:** atp.Status=draft
serviceInterfaceId	PositiveInteger	1	attr	Unique Identifier that identifies the ServiceInterface in SOME/IP. This Identifier is sent as Service ID in SOME/IP Service Discovery messages.
serviceInterfaceVersion	SomeipServiceInterfaceVersion	1	aggr	The SOME/IP major and minor Version of the Service. **Tags:** atp.Status=draft

Table 7.5: SomeipServiceInterfaceDeployment

Class	**SomeipServiceInterfaceVersion**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	This meta-class represents the ability to describe a version of a SOME/IP ServiceInterface. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
majorVersion	AnyVersionString	1	attr	Major Version of the ServiceInterface. Value can be set to a number that represents the Major Version of the searched service or to ANY.
minorVersion	AnyVersionString	1	attr	Minor Version of the ServiceInterface. Value can be set to a number that represents the Minor Version of the searched service or to ANY.

Table 7.6: SomeipServiceInterfaceVersion

Class	**SomeipEventGroup**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInterface Deployment			
Note	Grouping of events and notification events inside a ServiceInterface in order to allow subscriptions. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
event	SomeipEventDeployment	*	ref	Reference to an event that is part of the EventGroup. **Tags:** atp.Status=draft
eventGroupId	PositiveInteger	1	attr	Unique Identifier that identifies the EventGroup in SOME/IP. This Identifier is sent as Eventgroup ID in SOME/IP Service Discovery messages.

Table 7.7: SomeipEventGroup

[TPS_MANI_03043] SOME/IP `VariableDataPrototype` binding ⌈ The `SomeipEventDeployment` meta-class provides the ability to bind a `VariableDataPrototype` to SOME/IP and to assign a SOME/IP Event identifier to the `event` with the `eventId` attribute. ⌋*(RS_MANI_00024)*

[constr_3305] Value of attribute `SomeipEventDeployment.eventId` shall be unique ⌈ The value of `eventId` shall be unique in the in the context of the enclosing `SomeipServiceInterfaceDeployment` and shall also not overlap with any defined

methodId used in the context of the enclosing SomeipServiceInterfaceDeployment. ⌋()

[constr_3408] Value range of SomeipEventDeployment.eventId ⌈ The value of eventId shall be in the range of 0..32767. ⌋()

Please note that [PRS_SOMEIPSD_00517] in [21] defines special and reserved EVENT-IDs for SOME/IP and SOME/IP-SD that result in the eventId values of 0 and 32767.

[TPS_MANI_03050] Usage of SomeipEventDeployment.transportProtocol ⌈ The value of SomeipEventDeployment.transportProtocol defines over which Transport Layer Protocol the SomeipEventDeployment.event is provided. ⌋ *(RS_MANI_00024)*

[constr_3307] SomeipEventDeployment.transportProtocol setting to udp and the impact on ProvidedSomeipServiceInstances ⌈ If SomeipEventDeployment.transportProtocol is set to udp then each ProvidedSomeipServiceInstance that refers the SomeipServiceInterfaceDeployment in the role serviceInterface shall only be mapped to a MachineDesign with a SomeipServiceInstanceToMachineMapping with a configured udpPort. ⌋()

[constr_3308] SomeipEventDeployment.transportProtocol setting to tcp and the impact on ProvidedSomeipServiceInstances ⌈ If SomeipEventDeployment.transportProtocol is set to tcp then each ProvidedSomeipServiceInstance that refers the SomeipServiceInterfaceDeployment in the role serviceInterface shall only be mapped to a MachineDesign with a SomeipServiceInstanceToMachineMapping with a configured tcpPort. ⌋()

[TPS_MANI_03067] SOME/IP segmentation of udp SomeipEventDeployments ⌈ If the maximumSegmentLength is set to a value and the data length is larger than maximumSegmentLength then SOME/IP shall segment the SomeipEventDeployment into several packets and transmit them over the network.

The sender shall wait the separationTime between the transmissions of segments. On the reception side, SOME/IP re-assembles the received SOME/IP segments to the original SomeipEventDeployment. ⌋*(RS_MANI_00024)*

[constr_3351] SOME/IP segmentation allowed for udp SomeipEventDeployments ⌈ Attribute SomeipEventDeployment.maximumSegmentLength shall only be used if the value of attribute SomeipEventDeployment.transportProtocol is set to udp. ⌋()

Class	**SomeipEventDeployment**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInterface Deployment			
Note	SOME/IP configuration settings for an Event. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *ServiceEvent Deployment*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
eventId	PositiveInteger	1	attr	Unique Identifier within a ServiceInterface that identifies the Event in SOME/IP. This Identifier is sent as part of the Message ID in SOME/IP messages.
maximumSegmentLength	PositiveInteger	0..1	attr	This attribute describes the length in bytes of the SOME/IP segment. This includes 8 bytes for the Request ID, Protocol Version, Interface Version, Message Type and Return Code and 4 additional SOME/IP TP bytes. If this attribute is set to a value and the data length is larger than maximumSegmentLength then the corresponding SOME/IP message will be segmented into smaller parts that are transmitted over the network.
separationTime	TimeValue	0..1	attr	Sets the duration of the minimum time in seconds SOME/IP shall wait between the transmissions of segments.
transportProtocol	TransportLayerProtocolEnum	1	attr	This attribute defines over which Transport Layer Protocol this event is intended to be sent.

Table 7.8: SomeipEventDeployment

[TPS_MANI_03044] SOME/IP `ClientServerOperation` binding ⌈ The `SomeipMethodDeployment` meta-class provides the ability to bind a `ClientServerOperation` to SOME/IP and to assign a SOME/IP Method identifier to the `method` with the `methodId` attribute. ⌋*(RS_MANI_00024)*

[constr_3306] Value of attribute `methodId` shall be unique per `SomeipServiceInterfaceDeployment` ⌈ The value of `methodId` shall be unique in the in the context of the enclosing `SomeipServiceInterfaceDeployment` and shall also not overlap with any defined `eventId` used in the context of the enclosing `SomeipServiceInterfaceDeployment`. ⌋*()*

[constr_3409] Value range of `SomeipMethodDeployment.methodId` ⌈ The value of `methodId` shall be in the range of 0..32767. ⌋*()*

Please note that [PRS_SOMEIPSD_00517] in [21] defines special and reserved METHOD-IDs for SOME/IP and SOME/IP-SD that result in the `methodId` values of 0 and 32767.

[TPS_MANI_03051] Usage of SomeipMethodDeployment.transportProtocol ⌈ The value of SomeipMethodDeployment.transportProtocol defines over which Transport Layer Protocol this method is provided. ⌋*(RS_MANI_00024)*

[constr_3309] SomeipMethodDeployment.transportProtocol setting to udp and the impact on ProvidedSomeipServiceInstances ⌈ If SomeipMethodDeployment.transportProtocol is set to udp then each ProvidedSomeipServiceInstance that refers the SomeipServiceInterfaceDeployment in the role serviceInterface shall only be mapped to a MachineDesign with a SomeipServiceInstanceToMachineMapping with a configured udpPort. ⌋*()*

[constr_3310] SomeipMethodDeployment.transportProtocol setting to tcp and the impact on ProvidedSomeipServiceInstances ⌈ If SomeipMethodDeployment.transportProtocol is set to tcp then each ProvidedSomeipServiceInstance that refers the SomeipServiceInterfaceDeployment in the role serviceInterface shall only be mapped to a MachineDesign with a SomeipServiceInstanceToMachineMapping with a configured tcpPort. ⌋*()*

[TPS_MANI_03068] SOME/IP segmentation of SomeipMethodDeployment Calls ⌈ If the maximumSegmentLengthRequest is set to a value and the data length is larger than maximumSegmentLengthRequest then SOME/IP shall segment the SomeipMethodDeployment Call-Message into several packets and transmit them over the network.

The sender shall wait the separationTimeRequest between the transmissions of segments. On the reception side, SOME/IP re-assembles the received SOME/IP segments to the original SomeipMethodDeployment Call-Message. ⌋ *(RS_MANI_00024)*

[TPS_MANI_03069] SOME/IP segmentation of SomeipMethodDeployment Responses ⌈ If the maximumSegmentLengthResponse is set to a value and the data length is larger than maximumSegmentLengthResponse then SOME/IP shall segment the SomeipMethodDeployment Response-Message into several packets and transmit them over the network.

The sender shall wait the separationTimeResponse between the transmissions of segments. On the reception side, SOME/IP re-assembles the received SOME/IP segments to the original SomeipMethodDeployment Response-Message. ⌋*(RS_MANI_00024)*

[constr_3352] SOME/IP segmentation allowed for udp SomeipMethodDeployments ⌈ SomeipMethodDeployment.maximumSegmentLengthRequest and SomeipMethodDeployment.maximumSegmentLengthResponse shall only be used if SomeipMethodDeployment.transportProtocol is set to udp. ⌋*()*

Class	**SomeipMethodDeployment**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInterface Deployment			
Note	SOME/IP configuration settings for a Method. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *ServiceMethod Deployment*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
maximumSegmentLengthRequest	PositiveInteger	0..1	attr	This attribute describes the length in bytes of one SOME/IP segment into which the Method Call Message will be divided. This length field includes 8 bytes for the Request ID, Protocol Version, Interface Version, Message Type and Return Code and 4 additional SOME/IP TP bytes. If this attribute is set to a value and the data length is larger than maximumSegmentLengthRequest then the corresponding SOME/IP message will be segmented into smaller parts that are transmitted over the network.
maximumSegmentLengthResponse	PositiveInteger	0..1	attr	This attribute describes the length in bytes of one SOME/IP segment into which the Method Return Message will be divided. This length field includes 8 bytes for the Request ID, Protocol Version, Interface Version, Message Type and Return Code and 4 additional SOME/IP TP bytes. If this attribute is set to a value and the data length is larger than maximumSegmentLengthResponse then the corresponding SOME/IP message will be segmented into smaller parts that are transmitted over the network.
methodId	PositiveInteger	1	attr	Unique Identifier within a ServiceInterface that identifies the Method in SOME/IP. This Identifier is sent as part of the Message ID in SOME/IP messages.
separationTimeRequest	TimeValue	0..1	attr	Sets the duration of the minimum time in seconds SOME/IP shall wait between the transmissions of segments into which the Method Call Message will be divided.
separationTimeResponse	TimeValue	0..1	attr	Sets the duration of the minimum time in seconds SOME/IP shall wait between the transmissions of segments into which the Method Return Message will be divided.
transportProtocol	TransportLayerProtocolEnum	1	attr	This attribute defines over which Transport Layer Protocol this method is intended to be sent.

Table 7.9: SomeipMethodDeployment

Class	**SomeipServiceInstanceToMachineMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstanceMapping			
Note	This meta-class allows to map SomeipServiceInstances to a CommunicationConnector of a Machine. In this step the network configuration (IP Address, Transport Protocol, Port Number) for the ServiceInstance is defined. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft; atp.recommendedPackage=ServiceInstanceToMachineMappings			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *ServiceInstanceToMachineMapping*, *Uploadable PackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
eventMulticastUdpPort	PositiveInteger	0..1	attr	UdpPort configuration that is used for Event communication in the IP-Multicast case. SOME/IP Service Discovery: Send in the SD-SubscribeEventGroupAck Message to client (answer to SD-SubscribeEventGroup). Event: This is the destination-port where the server sends the multicast event messages if the mulicastThreshold of the corresponding ProvidedEventGroupInSomeipServiceInstance is exceeded.
ipv4MulticastIpAddress	Ip4AddressString	0..1	attr	Multicast IPv4 Address that is transmitted in the EventGroupSubscribeAck message for all available EventGroups that are available in the ProvidedSomeipServiceInstance.
ipv6MulticastIpAddress	Ip6AddressString	0..1	attr	Multicast IPv6 Address that is transmitted in the EventGroupSubscribeAck message for all available EventGroups that are available in the ProvidedSomeipServiceInstance.
tcpPort	PositiveInteger	0..1	attr	TcpPort configuration that is used for Method and Event communication in IP-Unicast case. SOME/IP Service Discovery: PortNumber that is sent in the SD-Offer Message to client (answer on SD-find) or clients (SD-offer). Method: This is the destination-port where the server accepts the method call messages (from the clients). This is the source-port where the server sends the method response messages (to the client). Event: This is the event source-port where the server sends the event messages to the subscribed clients in IP-Unicast case.
udpMinTxBufferSize	PositiveInteger	0..1	attr	Specifies the amount of data in bytes that shall be buffered for data transmission over the udp connection specified by this SomeipServiceInstanceToMachineMapping in case data accumulation is enabled.

udpPort	PositiveInteger	0..1	attr	UdpPort configuration that is used for Method and Event communication in IP-Unicast case. SOME/IP Service Discovery: PortNumber that is sent in the SD-Offer Message to client (answer on SD-find) or clients (SD-offer). Method: This is the destination-port where the server accepts the method call messages (from the clients). This is the source-port where the server sends the method response messages (to the client). Event: This is the event source-port where the server sends the event messages to the subscribed clients in IP-Unicast case.

Table 7.10: SomeipServiceInstanceToMachineMapping

[TPS_MANI_03057] SOME/IP `Field` binding ⌈ The `SomeipFieldDeployment` meta-class provides the ability to bind a `Field` to SOME/IP.

If the `Field` contains a notifier (`hasNotifier` = true) it is possible to assign a SOME/IP notifier identifier to the `field` by setting the value of attribute `SomeipFieldDeployment.notifier.eventId`.

If the `Field` contains a getter method (`hasGetter` = true) it is possible to assign a SOME/IP notifier identifier to the `field` by setting the value of attribute `SomeipFieldDeployment.get.methodId`.

If the `Field` contains a setter method (`hasSetter` = true) it is possible to assign a SOME/IP notifier identifier to the `field` by setting the value of attribute `SomeipFieldDeployment.set.methodId` ⌋*(RS_MANI_00024)*

Please note that each `methodId` and each `eventId` of a `SomeipFieldDeployment` shall be unique in the context of a `ServiceInterface` as defined in [constr_3306] and [constr_3305].

Class	**SomeipFieldDeployment**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInterface Deployment			
Note	SOME/IP configuration settings for a Field. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *ServiceField Deployment*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
get	SomeipMethod Deployment	0..1	aggr	This aggregation represents the setting of the get method. **Tags:** atp.Status=draft

notifier	SomeipEventDeployment	0..1	aggr	This aggregation represents the settings of the notifier. **Tags:** atp.Status=draft
set	SomeipMethodDeployment	0..1	aggr	This aggregation represents the settings of the set method **Tags:** atp.Status=draft

Table 7.11: SomeipFieldDeployment

[constr_3362] `SomeipEventDeployment`s aggregated by a `SomeipFieldDeployment` ⌈ A `SomeipEventDeployment` that is aggregated by a `SomeipFieldDeployment` in the role `notifier` shall not reference a `VariableDataPrototype` in the role `event`. ⌋*()*

[constr_3363] `SomeipMethodDeployment`s aggregated by a `SomeipFieldDeployment` ⌈ A `SomeipMethodDeployment` that is aggregated by a `SomeipFieldDeployment` in the role `get` or `set` shall not reference a `ClientServerOperation` in the role `method`. ⌋*()*

7.1.2 DDS Service Interface Deployment

This chapter describes the DDS [22] deployment of a `ServiceInterface`.

Please note that in the current state there is only support for `ServiceEventDeployment`, the support for `ServiceMethodDeployment` and `ServiceFieldDeployment` will be provided at a later point in time.

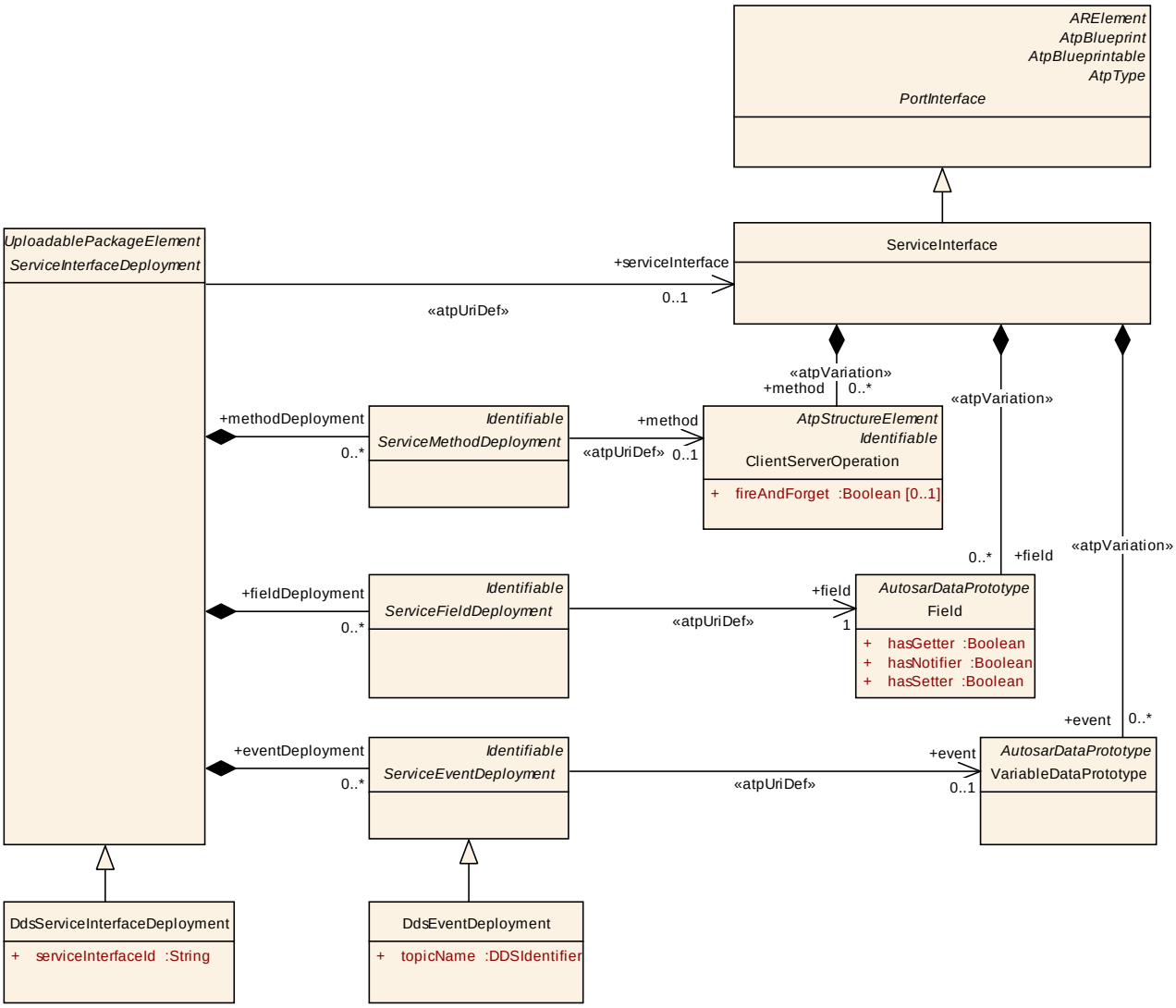


Figure 7.3: DDS deployment of ServiceInterface

[TPS_MANI_03525] DDS ServiceInterface binding ⌈ The `DdsServiceInterfaceDeployment` meta-class provides the ability to bind a `ServiceInterface` to DDS and to assign a DDS Service identifier to the `ServiceInterface` with the `serviceInterfaceId` attribute. ⌋*(RS_MANI_00038)*

Class	**DdsServiceInterfaceDeployment**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInterface Deployment			
Note	DDS configuration settings for a ServiceInterface. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft; atp.recommendedPackage=ServiceInterfaceDeployments			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *ServiceInterfaceDeployment*, *UploadablePackage Element*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

serviceInterfaceId	String	1	attr	Unique Identifier that identifies the ServiceInterface in DDS. This Identifier is encoded in the USER_DATA QoS of the DomainParticipant associated with the Service Instance and its value is propagated by DDS Discovery messages. **Tags:** atp.Status=draft

Table 7.12: DdsServiceInterfaceDeployment

[TPS_MANI_03526] DDS `VariableDataPrototype` binding ⌈ The `DdsEventDeployment` meta-class provides the ability to bind a `VariableDataPrototype` to DDS and to assign a DDS Topic to the `event` with the `topicName` attribute. ⌋ *(RS_MANI_00038)*

Class	**DdsEventDeployment**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInterface Deployment			
Note	DDS configuration settings for an Event. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *ServiceEvent Deployment*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
topicName	DDSIdentifier	1	attr	Name of the DDS Topic associated with the Event. **Tags:** atp.Status=draft

Table 7.13: DdsEventDeployment

7.1.3 User Defined Service Interface

This chapter describes a user defined deployment of a `ServiceInterface` to a middleware technology that is not standardized by AUTOSAR. Such `UserDefinedServiceInterfaceDeployment` can for example also be used to describe a machine local IPC communication.

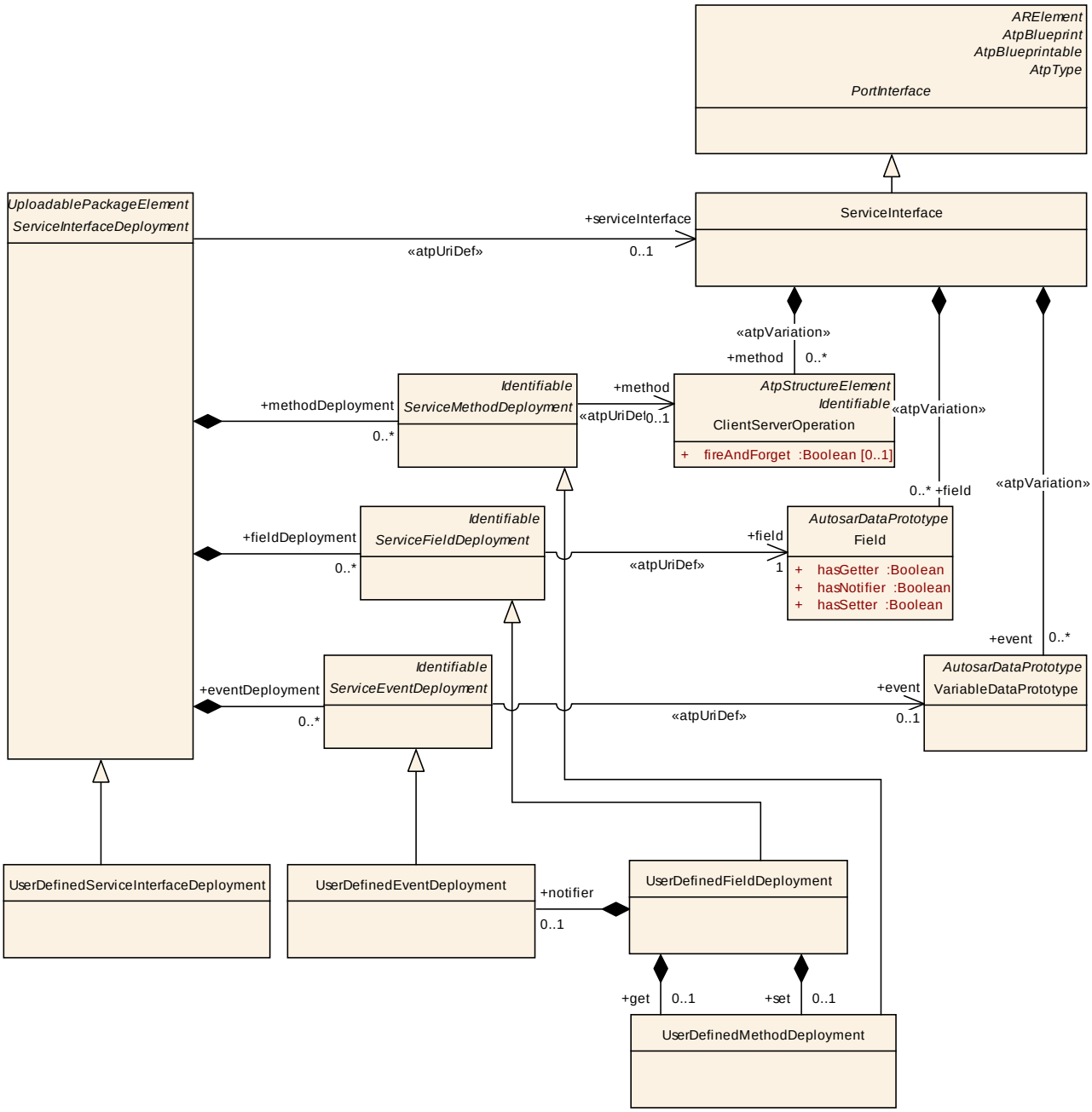


Figure 7.4: User defined deployment of ServiceInterface

[TPS_MANI_03045] UserDefined `ServiceInterface` binding ⌈ The `UserDefinedServiceInterfaceDeployment` meta-class provides the ability to bind a `ServiceInterface` that is referenced in the role `serviceInterface` to a middleware technology that is not standardized by AUTOSAR. ⌋*(RS_MANI_00014)*

Please note that `UserDefinedServiceInterfaceDeployment` is `Identifiable` and therefore is able to describe special data (sdg) which is not represented by the standard model.

Class	**UserDefinedServiceInterfaceDeployment**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInterface Deployment			
Note	UserDefined configuration settings for a ServiceInterface. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft; atp.recommendedPackage=ServiceInterfaceDeployments			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *ServiceInterfaceDeployment*, *UploadablePackage Element*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 7.14: UserDefinedServiceInterfaceDeployment

[TPS_MANI_01165] Standardized value of `UserDefinedServiceInterfaceDeployment.category` ⌈ The AUTOSAR Standard reserves the following value for attribute `UserDefinedServiceInterfaceDeployment.category`:

- `SERVICE_INTERFACE_DEPLOYMENT_IPC`

It is possible to use a custom, non-standardized value for the attribute `UserDefinedServiceInterfaceDeployment.category` but this option comes with the obligation to use a value that is guaranteed to not clash with possible future extensions of the collection of standardized values. ⌋*(RS_MANI_00014)*

[constr_1570] Restriction for `UserDefinedServiceInterfaceDeployment` of `category SERVICE_INTERFACE_DEPLOYMENT_IPC` ⌈ An `AdaptivePlatformServiceInstance` that references a `UserDefinedServiceInterfaceDeployment` of `category SERVICE_INTERFACE_DEPLOYMENT_IPC` shall not be referenced by a `UserDefinedServiceInstanceToMachineMapping` in the role `serviceInstance`. ⌋*()*

Rationale for [constr_1570]: for a local IPC binding it is not necessary to define the relation of the `AdaptivePlatformServiceInstance` to a `CommunicationConnector`.

[TPS_MANI_03046] User defined `VariableDataPrototype` binding ⌈ The `UserDefinedEventDeployment` meta-class provides the ability to bind a `VariableDataPrototype` that is referenced in the role `event` to a middleware technology that is not standardized by AUTOSAR. ⌋*(RS_MANI_00014)*

Please note that `UserDefinedEventDeployment` is `Identifiable` and therefore is able to describe special data (sdg) which is not represented by the standard model.

Class	**UserDefinedEventDeployment**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInterface Deployment			
Note	UserDefined configuration settings for an Event. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *ServiceEvent Deployment*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 7.15: UserDefinedEventDeployment

[TPS_MANI_03047] User defined `ClientServerOperation` binding ⌈ The `UserDefinedMethodDeployment` meta-class provides the ability to bind a `ClientServerOperation` that is referenced in the role `method` to a middleware technology that is not standardized by AUTOSAR. ⌋ *(RS_MANI_00014)*

Please note that `UserDefinedMethodDeployment` is `Identifiable` and therefore is able to describe special data (sdg) which is not represented by the standard model.

Class	**UserDefinedMethodDeployment**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInterface Deployment			
Note	UserDefined configuration settings for a Method. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *ServiceMethod Deployment*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 7.16: UserDefinedMethodDeployment

[TPS_MANI_03048] User defined `Field` binding ⌈ The `UserDefinedFieldDeployment` meta-class provides the ability to bind a `Field` that is referenced in the role `field` to a middleware technology that is not standardized by AUTOSAR. ⌋ *(RS_MANI_00014)*

Please note that `UserDefinedFieldDeployment` is `Identifiable` and therefore is able to describe special data (sdg) which is not represented by the standard model.

Class	**UserDefinedFieldDeployment**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInterface Deployment			
Note	UserDefined configuration settings for a Field. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *ServiceField Deployment*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
get	UserDefinedMethodDeployment	0..1	aggr	This aggregation represents the settings of the get method **Tags:** atp.Status=draft
notifier	UserDefinedEventDeployment	0..1	aggr	This aggregation represents the settings of the notifier. **Tags:** atp.Status=draft
set	UserDefinedMethodDeployment	0..1	aggr	This aggregation represents the settings of the set method **Tags:** atp.Status=draft

Table 7.17: UserDefinedFieldDeployment

[constr_3417] **`UserDefinedEventDeployment`s aggregated by a `UserDefinedFieldDeployment`** ⌈ A `UserDefinedEventDeployment` that is aggregated by a `UserDefinedFieldDeployment` in the role `notifier` shall not reference a `VariableDataPrototype` in the role `event`. ⌋*()*

[constr_3418] **`UserDefinedMethodDeployment`s aggregated by a `UserDefinedFieldDeployment`** ⌈ A `UserDefinedMethodDeployment` that is aggregated by a `UserDefinedFieldDeployment` in the role `get` or `set` shall not reference a `ClientServerOperation` in the role `method`. ⌋*()*

7.2 Service Instance Deployment

An `AdaptivePlatformServiceInstance` makes the functionality of a `ServiceInterface` available on the *AUTOSAR adaptive platform*. Several `AdaptivePlatformServiceInstance`s may be set up for the same `ServiceInterface`. They deliver the same functionality, but for different purposes and/or to different users.

The `ProvidedApServiceInstance` represents a provider that offers the functionality of a `ServiceInterface` with particular properties. Clients that are represented by the `RequiredApServiceInstance` observe offers and choose a provider with respect to service properties.

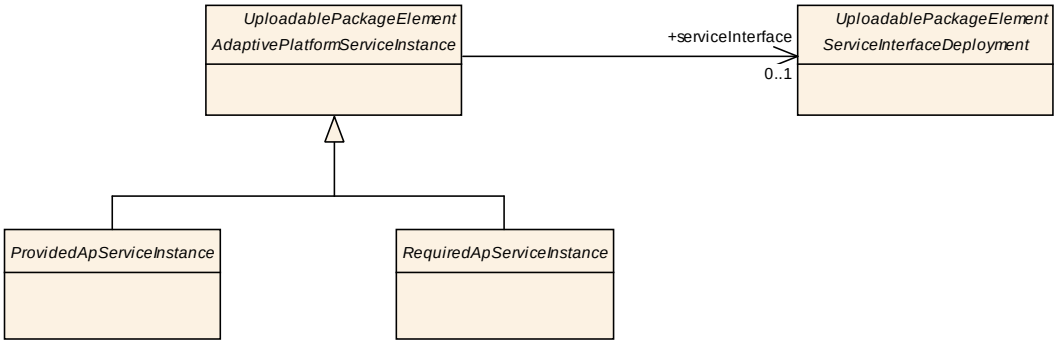


Figure 7.5: Modeling of the `AdaptivePlatformServiceInstance`

Note that the abstract meta-class `AdaptivePlatformServiceInstance` is derived from `ARElement`. This means that all meta-classes derived from `AdaptivePlatformServiceInstance` can be declared on the M1 level as part of an `ARPackage` and thus can be used in several different Manifest descriptions.

Class	***AdaptivePlatformServiceInstance* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	This meta-class represents the ability to describe the existence and configuration of a service instance in an abstract way. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *UploadablePackageElement*			
Subclasses	*ProvidedApServiceInstance*, *RequiredApServiceInstance*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
e2eEventProtectionProps	End2EndEventProtectionProps	*	aggr	This aggregation allows to protect an event or a field notifier that is defined inside of the ServiceInterface that is referenced by the ServiceInstance in the role serviceInterface. **Tags:** atp.Status=draft
secureComConfig	ServiceInterfaceElementSecureComConfig	*	aggr	Configuration settings to secure the communication of ServiceInterface elements. **Tags:** atp.Status=draft
serviceInterface	ServiceInterfaceDeployment	0..1	ref	Reference to a ServiceInterfaceDeployment that identifies the ServiceInterface that is represented by the ServiceInstance. **Tags:** atp.Status=draft

Table 7.18: AdaptivePlatformServiceInstance

Class	***RequiredApServiceInstance* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	This meta-class represents the ability to describe the existence and configuration of a required service instance in an abstract way. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARElement*, *ARObject*, *AdaptivePlatformServiceInstance*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *Uploadable PackageElement*			
Subclasses	RequiredDdsServiceInstance, RequiredSomeipServiceInstance, RequiredUser DefinedServiceInstance			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 7.19: RequiredApServiceInstance

Class	***ProvidedApServiceInstance* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	This meta-class represents the ability to describe the existence and configuration of a provided service instance in an abstract way. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARElement*, *ARObject*, *AdaptivePlatformServiceInstance*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *Uploadable PackageElement*			
Subclasses	ProvidedDdsServiceInstance, ProvidedSomeipServiceInstance, ProvidedUser DefinedServiceInstance			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 7.20: ProvidedApServiceInstance

There are two alternative ways to relate a `AdaptivePlatformServiceInstance` with a `MachineDesign` as described in [TPS_MANI_03000] and [TPS_MANI_03001]. Figure Figure 7.6 shows both approaches in an example.

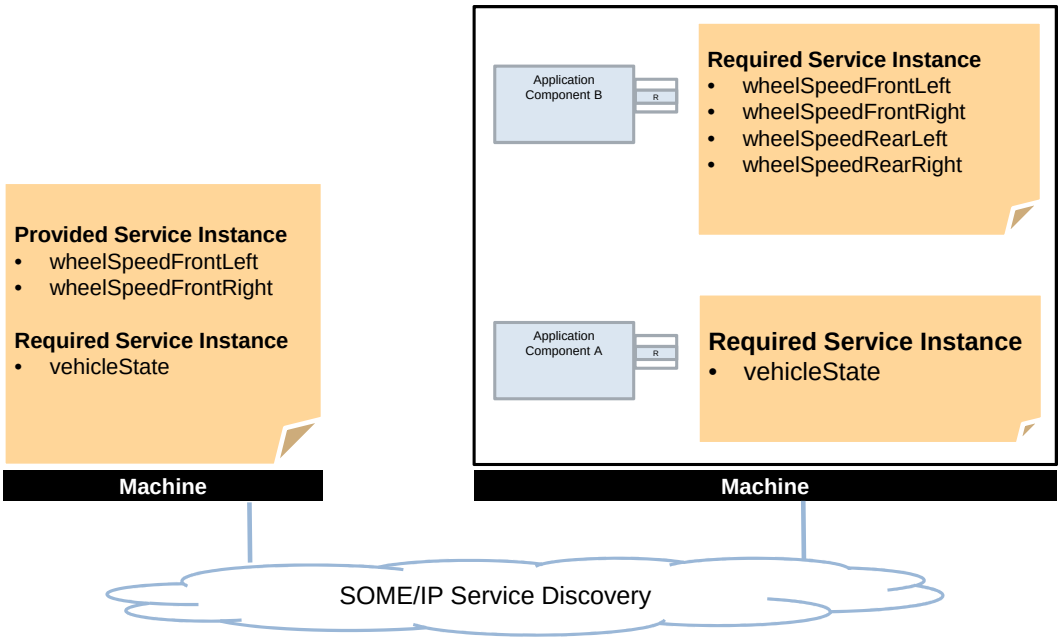


Figure 7.6: Different approaches for ServiceInstanceMapping

[TPS_MANI_03001] Mapping of `AdaptivePlatformServiceInstance` to a `MachineDesign` ⌈ `ServiceInstanceToMachineMapping` is used to assign an `AdaptivePlatformServiceInstance` to (via a `CommunicationConnector`) a `MachineDesign`. This allows to define a "black box" machine view without any assumption on the application software but with all necessary information to configure the communication (e.g. SOME/IP). ⌋*(RS_MANI_00009)*

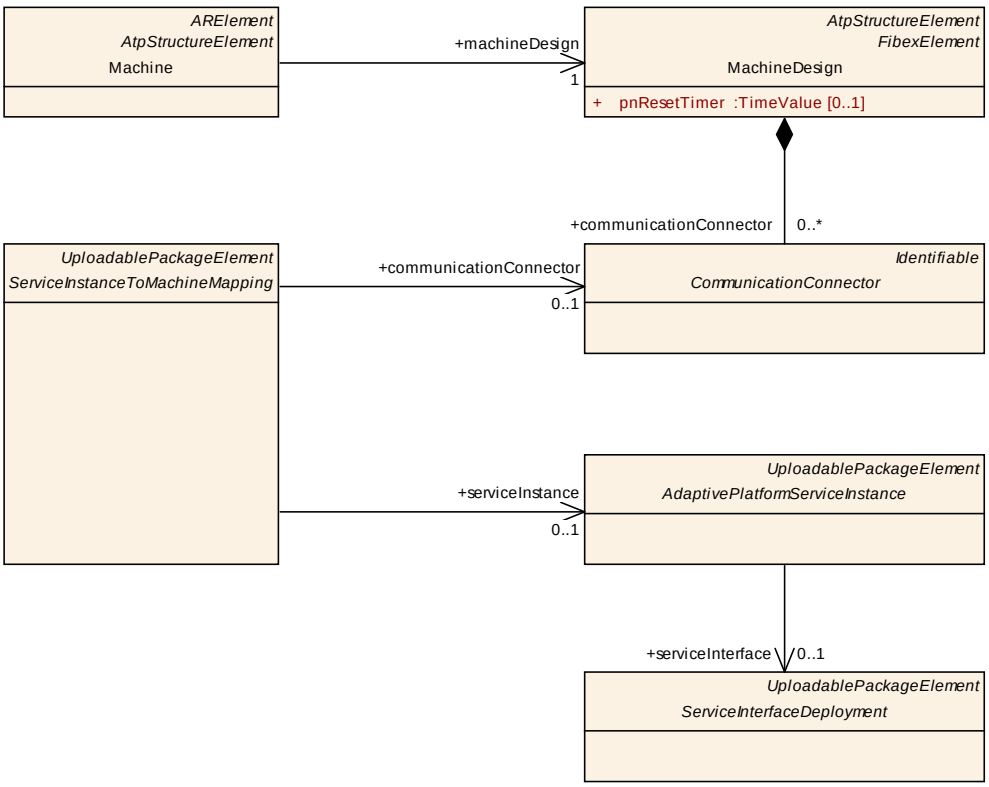


Figure 7.7: ServiceInstanceToMachineMapping

Class	***ServiceInstanceToMachineMapping* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstanceMapping			
Note	This meta-class represents the ability to map a AdaptivePlatformServiceInstance to a CommunicationConnector of a Machine. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *UploadablePackageElement*			
Subclasses	DdsServiceInstanceToMachineMapping, SomeipServiceInstanceToMachineMapping, UserDefinedServiceInstanceToMachineMapping			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
communicationConnector	CommunicationConnector	0..1	ref	Reference to the Machine to which the ServiceInstance is mapped. **Tags:** atp.Status=draft
serviceInstance	AdaptivePlatformServiceInstance	0..1	ref	Reference to a ServiceInstance that is mapped to the Machine. **Tags:** atp.Status=draft

Table 7.21: ServiceInstanceToMachineMapping

[constr_3297] `SomeipServiceInstanceToMachineMapping` **only supports a single Address Family** ⌈ A `SomeipServiceInstanceToMachineMapping` shall only support a single Address Family, i.e. either IPv4 or IPv6. The address fam-

ily shall be consistent with the Ipv4Configuration/Ipv6Configuration of the NetworkEndpoint referenced by the EthernetCommunicationConnector that is referenced by the SomeipServiceInstanceToMachineMapping in the role communicationConnector. ⌋()

[TPS_MANI_03000] Mapping of AdaptivePlatformServiceInstance to PortPrototypes ⌈ ServiceInstanceToPortPrototypeMapping is used to assign an AdaptivePlatformServiceInstance to a PortPrototype of a SwComponentType. This allows to define how specific PortPrototypes of a Software Component are represented in the middleware in terms of the service configuration. ⌋ *(RS_MANI_00011)*

In other words, the "outside" appearance of a PortPrototype from the middleware point of view is the AdaptivePlatformServiceInstance, resp. the concrete subclasses RequiredApServiceInstance and ProvidedApServiceInstance.

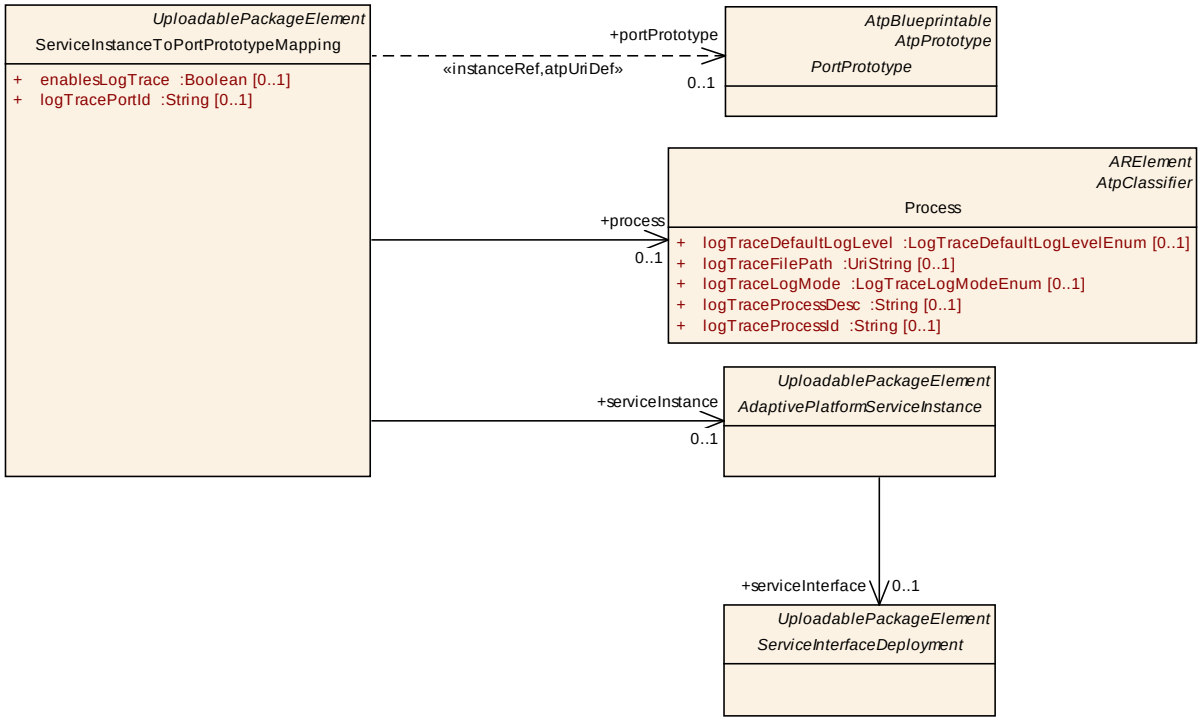


Figure 7.8: ServiceInstanceToPortPrototypeMapping

Class	**ServiceInstanceToPortPrototypeMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstanceMapping			
Note	This meta-class represents the ability to assign a transport layer dependent ServiceInstance to a PortPrototype. With this mapping it is possible to define how specific PortPrototypes are represented in the middleware in terms of service configuration. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft; atp.recommended Package=ServiceInstanceToPortPrototypeMappings			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
enablesLogTrace	Boolean	0..1	attr	This attribute enables/disables Log&Trace for the communication on the referenced Port of the referenced process. True: Log&Trace is enabled. False: Log&Trace is disabled.
logTracePortId	String	0..1	attr	This attribute identifies a Port of an Application executed in a process for tracing (ContextId).
portPrototype	PortPrototype	0..1	iref	Reference to a specific PortPrototypes that represents the ServiceInstance. **Tags:** atp.Status=draft
process	Process	0..1	ref	Reference to the Process in which the Executable that contains the SoftwareComponent and the referenced PortPrototype is executed. **Tags:** atp.Status=draft
serviceInstance	AdaptivePlatformServiceInstance	0..1	ref	Reference to a ServiceInstance that is represented in the Software Component by the mapped group of PortPrototypes. **Tags:** atp.Status=draft

Table 7.22: ServiceInstanceToPortPrototypeMapping

Meta-classes `ProvidedApServiceInstance` and `RequiredApServiceInstance` are abstract and this allows for using specific derived classes that fit the underlying middleware (e.g. SOME/IP). The following sub-chapters will detail the supported specializations.

7.2.1 SOME/IP Service Instance Deployment

In the case of SOME/IP used as the middleware the derived meta-classes are `ProvidedSomeipServiceInstance` resp. `RequiredSomeipServiceInstance`. These meta-classes also carry attributes that apply for the service discovery on SOME/IP.

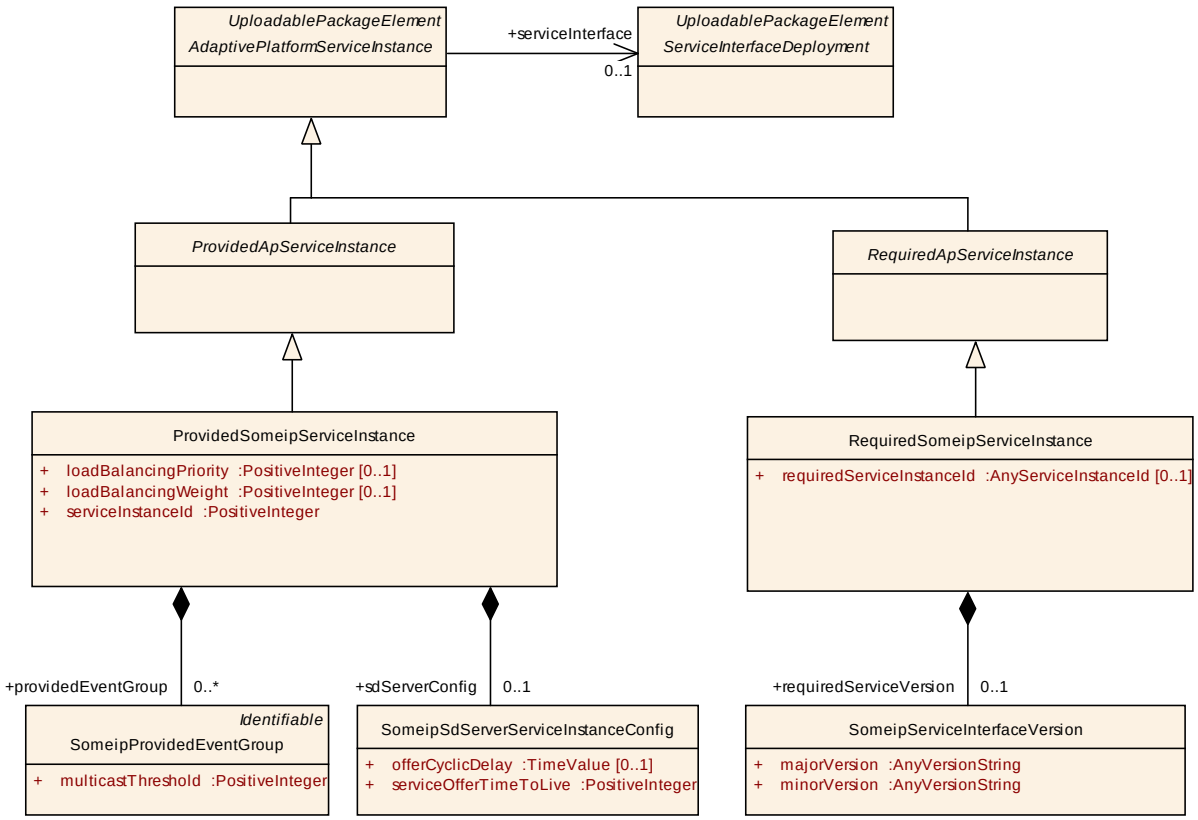


Figure 7.9: SOME/IP Service Instances

Primitive	**AnyServiceInstanceId**
Package	M2::AUTOSARTemplates::GenericStructure::GeneralTemplateClasses::PrimitiveTypes
Note	This is a positive integer or the literal ANY which can be denoted in decimal, octal and hexadecimal. The value is between 0 and 4294967295. **Tags:** atp.Status=draft xml.xsd.customType=ANY-SERVICE-INSTANCE-ID; xml.xsd.pattern=[1-9][0-9]*|0[xX][0-9a-fA-F]+|0[0-7]*|0[bB][0-1]+|ANY; xml.xsd.type=string

Table 7.23: AnyServiceInstanceId

7.2.1.1 Provided Service Instance

The `ProvidedSomeipServiceInstance` defines the `serviceInstanceId` for the Service Instance of the `SomeipServiceInterfaceDeployment` that is referenced with the `serviceInterface` reference.

It means that the Server on which the `ProvidedSomeipServiceInstance` is deployed offers the Service Instance over SOME/IP with the `serviceInstanceId` and `serviceInterfaceId`.

Class	**ProvidedSomeipServiceInstance**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	This meta-class represents the ability to describe the existence and configuration of a provided service instance in a concrete implementation on top of SOME/IP. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft; atp.recommendedPackage=ServiceInstances			
Base	*ARElement*, *ARObject*, *AdaptivePlatformServiceInstance*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *ProvidedApService Instance*, *Referrable*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
eventProps	SomeipEventProps	*	aggr	Configuration settings for individual events that are provided by the ServiceInstance. **Tags:** atp.Status=draft
loadBalancingPriority	PositiveInteger	0..1	attr	This attribute is used to specify the priority in the load balancing option of SOME/IP that is added to the OfferService. When a client searches for all service instances of a service, the client shall choose the service instance with highest priority if one is defined.
loadBalancingWeight	PositiveInteger	0..1	attr	This attribute is used to specify the weight in the load balancing option of SOME/IP that is added to the OfferService. When a client searches for all service instances of a service, the client shall choose the service instance with highest priority if one is defined. If several service instances exist with the highest priority the service instance shall be chosen based on the weights of the service instances.
methodResponseProps	SomeipMethodProps	*	aggr	Configuration settings for individual methods that are provided by the ServiceInstance. **Tags:** atp.Status=draft
providedEventGroup	SomeipProvidedEventGroup	*	aggr	List of EventGroups that are provided by the Service Instance. **Tags:** atp.Status=draft
sdServerConfig	SomeipSdServerServiceInstanceConfig	0..1	aggr	Server specific configuration settings relevant for the SOME/IP service discovery. **Tags:** atp.Status=draft
serviceInstanceId	PositiveInteger	1	attr	Identification number that is used by SOME/IP service discovery to identify the instance of the service.

Table 7.24: ProvidedSomeipServiceInstance

[constr_3287] Mandatory information of a `ProvidedSomeipServiceInstance`
⌈ The `ProvidedSomeipServiceInstance` shall always define the `serviceInstanceId`. ⌋()

In addition to the service identification properties a SOME/IP offer message contains so called endpoint options that define how the service instance is reachable by clients.

[TPS_MANI_03168] Configuration of the SOME/IP load balancing option ⌈ The SOME/IP load balancing option is configurable per ProvidedSomeipServiceInstance with the two attributes loadBalancingPriority and loadBalancingWeight. ⌋*(RS_MANI_00024)*

The SOME/IP load balancing option is used to prioritize different ProvidedSomeipServiceInstances that point to the same SomeipServiceInterfaceDeployment, so that a client chooses the service instance based on these settings. This option is attached to SOME/IP Offer Service entries.

[constr_3415] Value range of loadBalancingPriority ⌈ The value of loadBalancingPriority shall be in the range of 0..65535. ⌋*()*

Please note that according to SOME/IP a lower value means higher priority.

[constr_3416] Value range of loadBalancingWeight ⌈ The value of loadBalancingWeight shall be in the range of 0..65535. ⌋*()*

Please note that according to SOME/IP a higher value means higher probability to be chosen.

7.2.1.1.1 IP Configuration

In SOME/IP the Offer service entry references IPv4 or IPv6 Endpoint options to indicate to the client where the server accepts the method calls and where the server sends the event messages.

Such an Endpoint contains the IP address of the sender. The IP address configuration is described in this chapter.

[TPS_MANI_03002] IP configuration for a ProvidedSomeipServiceInstance ⌈ A ProvidedSomeipServiceInstance can be mapped to a CommunicationConnector of a MachineDesign with the SomeipServiceInstanceToMachineMapping.

With this mapping an assignment of the ProvidedSomeipServiceInstance to a unicast IP Address is established since the EthernetCommunicationConnector refers to a NetworkEndpoint in the role unicastNetworkEndpoint. ⌋ *(RS_MANI_00009, RS_MANI_00024)*

[TPS_MANI_03003] ProvidedSomeipServiceInstance Fanout ⌈ It is allowed to map the same ProvidedSomeipServiceInstance to different CommunicationConnectors of a MachineDesign. In such a case, several SomeipServiceInstanceToMachineMappings shall be defined.

This allows for offering the same `ProvidedSomeipServiceInstance` on different `VLAN`s or even on different `CommunicationCluster`s. ⌋(*RS_MANI_00009*, *RS_MANI_00024*)

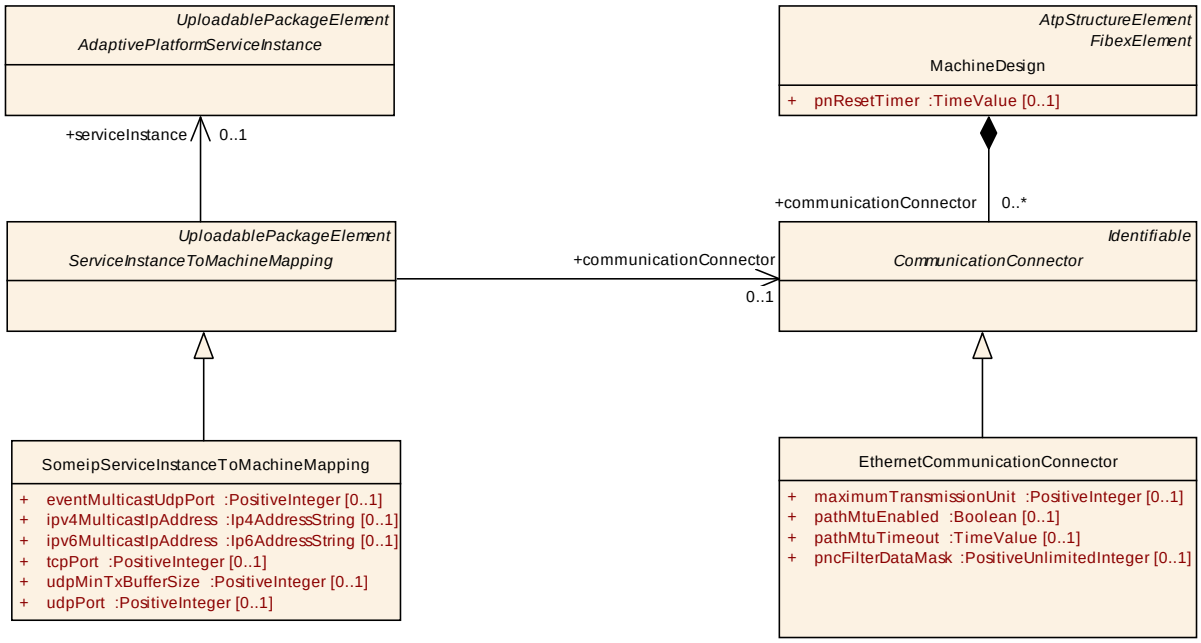


Figure 7.10: `SomeipServiceInstanceToMachineMapping` with TP and IP configuration

Class	≪`atpVariation`≫ ***CommunicationCluster* (abstract)**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::FibexCore::CoreTopology			
Note	The CommunicationCluster is the main element to describe the topological connection of communicating ECUs. A cluster describes the ensemble of ECUs, which are linked by a communication medium of arbitrary topology (bus, star, ring, ...). The nodes within the cluster share the same communication protocol, which may be event-triggered, time-triggered or a combination of both. A CommunicationCluster aggregates one or more physical channels. **Tags:** vh.latestBindingTime=postBuild			
Base	*ARObject*, *CollectableElement*, *FibexElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Subclasses	*AbstractCanCluster*, EthernetCluster, FlexrayCluster, LinCluster, UserDefinedCluster			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
baudrate	PositiveUnlimitedInteger	0..1	attr	Channels speed in bits/s.

physicalChannel	PhysicalChannel	1..*	aggr	This relationship defines which channel element belongs to which cluster. A channel must be assigned to exactly one cluster, whereas a cluster may have one or more channels. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=shortName, variationPoint.shortLabel vh.latestBindingTime=systemDesignTime
protocolName	String	0..1	attr	The name of the protocol used.
protocolVersion	String	0..1	attr	The version of the protocol used.

Table 7.25: CommunicationCluster

Class	***CommunicationConnector* (abstract)**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::FibexCore::CoreTopology			
Note	The connection between the referencing ECU and the referenced channel via the referenced controller. Connectors are used to describe the bus interfaces of the ECUs and to specify the sending/receiving behavior. Each CommunicationConnector has a reference to exactly one communicationController. Note: Several CommunicationConnectors can be assigned to one PhysicalChannel in the scope of one ECU Instance. **Tags:** atp.ManifestKind=MachineManifest			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	*AbstractCanCommunicationConnector*, EthernetCommunicationConnector, FlexrayCommunicationConnector, LinCommunicationConnector, UserDefinedCommunicationConnector			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 7.26: CommunicationConnector

Class	**EthernetCommunicationConnector**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::Fibex4Ethernet::EthernetTopology			
Note	Ethernet specific attributes to the CommunicationConnector. **Tags:** atp.ManifestKind=MachineManifest			
Base	*ARObject*, *CommunicationConnector*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
maximumTransmissionUnit	PositiveInteger	0..1	attr	This attribute specifies the maximum transmission unit in bytes.

networkEndpoint	NetworkEndpoint	*	ref	NetworkEndpoints
pathMtuEnabled	Boolean	0..1	attr	If enabled the IPv4/IPv6 processes incoming ICMP "Packet Too Big" messages and stores a MTU value for each destination address.
pathMtuTimeout	TimeValue	0..1	attr	If this value is >0 the IPv4/IPv6 will reset the MTU value stored for each destination after n seconds.
pncFilterDataMask	PositiveUnlimitedInteger	0..1	attr	Bit mask for Ethernet Payload used to configure the Ethernet Transceiver for partial network wakeup.
unicastNetworkEndpoint	NetworkEndpoint	0..1	ref	Network Endpoint that defines the IPAddress of the machine. **Tags:** atp.Status=draft

Table 7.27: EthernetCommunicationConnector

[constr_3288] IP configuration restriction for `unicastNetworkEndpoint`s ⌈ A `NetworkEndpoint` that is referenced by a `EthernetCommunicationConnector` in the role `unicastNetworkEndpoint` shall have either

- `Ipv4Configuration` or
- `Ipv6Configuration`

as `networkEndpointAddress` that is defined in the unicast IP range according to the rules defined in [TPS_MANI_03005] and [TPS_MANI_03006]. ⌋*()*

In SOME/IP, a server that offers a `ProvidedSomeipServiceInstance` is able to send events and notification events to an IP-Multicast address.

To indicate to the client to which Multicast IP address the event messages are send the Subscribe Eventgroup Acknowledgement entry contains a reference an IPv4 Multicast Option and/or and IPv6 Multicast Option.

[TPS_MANI_03004] IPv4 Multicast event destination address ⌈ Meta-class `SomeipServiceInstanceToMachineMapping` defines the multicast IPv4 address to which the `event`s and notification events are send with the attribute `ipv4MulticastIpAddress`. ⌋*(RS_MANI_00009, RS_MANI_00024)*

[TPS_MANI_03061] IPv6 Multicast event destination address ⌈ Meta-class `SomeipServiceInstanceToMachineMapping` defines the multicast IPv6 address to which the `event`s and notification events are sent with the attribute `ipv6MulticastIpAddress`. ⌋*(RS_MANI_00009, RS_MANI_00024)*

[TPS_MANI_03005] IPv4 Multicast address range ⌈ The IPv4 addresses reserved for multicast communication are in the range 224.0.0.0 through 239.255.255.255. Addresses between 0.0.0.0 and 223.255.255.255 are reserved for unicast communication. ⌋*()*

[TPS_MANI_03006] IPv6 Multicast address range ⌈ IPv6 multicast addresses are distinguished from unicast addresses by the value of the high-order octet of the addresses: a value of 0xFF (binary 11111111) identifies an address as an address reserved for multicast communication; any other value identifies an address as a unicast address. ⌋*()*

Class	**NetworkEndpoint**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::Fibex4Ethernet::EthernetTopology			
Note	The network endpoint defines the network addressing (e.g. IP-Address or MAC multicast address). **Tags:** atp.ManifestKind=MachineManifest			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
fullyQualifiedDomainName	String	0..1	attr	Defines the fully qualified domain name (FQDN) e.g. some.example.host.
infrastructureServices	InfrastructureServices	0..1	aggr	Defines the network infrastructure services provided or consumed.
networkEndpointAddress	NetworkEndpointAddress	1..*	aggr	Definition of a Network Address. **Tags:** xml.namePlural=NETWORK-ENDPOINT-ADDRESSES
priority	PositiveInteger	0..1	attr	Priority of this Network-Endpoint.

Table 7.28: NetworkEndpoint

Class	***NetworkEndpointAddress* (abstract)**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::Fibex4Ethernet::EthernetTopology			
Note	To build a valid network endpoint address there has to be either one MAC multicast group reference or an ipv4 configuration or an ipv6 configuration. **Tags:** atp.ManifestKind=MachineManifest			
Base	*ARObject*			
Subclasses	Ipv4Configuration, Ipv6Configuration, MacMulticastConfiguration			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 7.29: NetworkEndpointAddress

Class	**Ipv4Configuration**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::Fibex4Ethernet::EthernetTopology			
Note	Internet Protocol version 4 (IPv4) configuration.			
Base	*ARObject*, *NetworkEndpointAddress*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

assignment Priority	PositiveInteger	0..1	attr	Priority of assignment (1 is highest). If a new address from an assignment method with a higher priority is available, it overwrites the IP address previously assigned by an assignment method with a lower priority.
defaultGateway	Ip4AddressString	0..1	attr	IP address of the default gateway.
dnsServerAddress	Ip4AddressString	*	attr	IP addresses of preconfigured DNS servers. **Tags:** xml.namePlural=DNS-SERVER-ADDRESSES
ipAddressKeepBehavior	IpAddressKeepEnum	0..1	attr	Defines the lifetime of a dynamically fetched IP address.
ipv4Address	Ip4AddressString	0..1	attr	IPv4 Address. Notation: 255.255.255.255. The IP Address shall be declared in case the ipv4AddressSource is FIXED and thus no auto-configuration mechanism is used.
ipv4AddressSource	Ipv4AddressSourceEnum	0..1	attr	Defines how the node obtains its IP address.
networkMask	Ip4AddressString	0..1	attr	Network mask. Notation 255.255.255.255
ttl	PositiveInteger	0..1	attr	Lifespan of data (0..255). The purpose of the TimeToLive field is to avoid a situation in which an undeliverable datagram keeps circulating on a system.

Table 7.30: Ipv4Configuration

Class	**Ipv6Configuration**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::Fibex4Ethernet::EthernetTopology			
Note	Internet Protocol version 6 (IPv6) configuration.			
Base	*ARObject*, *NetworkEndpointAddress*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
assignment Priority	PositiveInteger	0..1	attr	Priority of assignment (1 is highest). If a new address from an assignment method with a higher priority is available, it overwrites the IP address previously assigned by an assignment method with a lower priority.
defaultRouter	Ip6AddressString	0..1	attr	IP address of the default router.
dnsServerAddress	Ip6AddressString	*	attr	IP addresses of pre configured DNS servers. **Tags:** xml.namePlural=DNS-SERVER-ADDRESSES
enableAnycast	Boolean	0..1	attr	This attribute is used to enable anycast addressing (i.e. to one of multiple receivers).
hopCount	PositiveInteger	0..1	attr	The distance between two hosts. The hop count n means that n gateways separate the source host from the destination host (Range 0..255)

ipAddressKeepBehavior	IpAddressKeepEnum	0..1	attr	Defines the lifetime of a dynamically fetched IP address.
ipAddressPrefixLength	PositiveInteger	0..1	attr	IPv6 prefix length defines the part of the IPv6 address that is the network prefix.
ipv6Address	Ip6AddressString	0..1	attr	IPv6 Address. Notation: FFFF:...:FFFF. The IP Address shall be declared in case the ipv6AddressSource is FIXED and thus no auto-configuration mechanism is used.
ipv6AddressSource	Ipv6AddressSourceEnum	0..1	attr	Defines how the node obtains its IP address.

Table 7.31: Ipv6Configuration

7.2.1.1.2 TP Configuration

The IPv4 or IPv6 Endpoint option that is referenced in the SOME/IP Offer message contains besides the IP address the transport layer protocol (e.g. UDP or TCP), and the port number of the sender.

With the `SomeipServiceInstanceToMachineMapping` the Transport Layer configuration attributes are assigned to the `ProvidedSomeipServiceInstance`.

The same element contains the Transport Layer configuration attributes for the IPv4/IPv6 Multicast Option that may be used in the SOME/IP `SubscribeEventGroupAck` message.

[TPS_MANI_03007] Udp Transport Protocol Configuration for `ProvidedSomeipServiceInstance` ⌈ The attribute `SomeipServiceInstanceToMachineMapping.udpPort` defines the Transport Protocol for a UDP communication.

This setting is used in an IPv4 or IPv6 Endpoint Option that is referenced by an `OfferService` entry. ⌋*(RS_MANI_00009, RS_MANI_00024)*

[TPS_MANI_03008] Tcp Transport Protocol Configuration for `ProvidedSomeipServiceInstance` ⌈ The attribute `SomeipServiceInstanceToMachineMapping.tcpPort` defines the Transport Protocol for a TCP communication.

This setting is used in an IPv4 or IPv6 Endpoint Option that is referenced by an `OfferService` entry. ⌋*(RS_MANI_00009, RS_MANI_00024)*

[TPS_MANI_03009] Tcp and Udp Transport Protocol Configuration for `ProvidedSomeipServiceInstance` ⌈ It is allowed to set `tcpPort` and `udpPort` in the same `SomeipServiceInstanceToMachineMapping`.

Such a setting shall be used to indicate that one UDP endpoint and one TCP endpoint are referenced in the `OfferService` entry. It means that the Server provides the `ProvidedSomeipServiceInstance` over both Transport Protocols. ⌋ *(RS_MANI_00009, RS_MANI_00024)*

If a Tcp and Udp Transport Protocol Configuration is defined for a ProvidedSomeipServiceInstance as described in [TPS_MANI_03009] then the SOME/IP ServiceInterfaceDeployment settings decide which content of the ProvidedSomeipServiceInstance is transported over udp and which content is transported over tcp.

This is described in [TPS_MANI_03050] and [TPS_MANI_03051].

[TPS_MANI_03010] Udp Transport Protocol Configuration in case of IP-Multicast ⌈ The SomeipServiceInstanceToMachineMapping.eventMulticastUdpPort defines the Transport Protocol Port Number for a UDP event communication in case IP-Multicast is used.

This setting is used in an IPv4 or IPv6 Multicast Option that is referenced by a SubscribeEventGroupAck Service entry. ⌋*(RS_MANI_00009, RS_MANI_00024)*

[constr_3290] Transport Protocol attributes defined for a ProvidedSomeipServiceInstance ⌈ Each SomeipServiceInstanceToMachineMapping that is defined for a ProvidedSomeipServiceInstance shall define either

- a udpPort or
- a tcpPort or
- a udpPort and a tcpPort.

⌋*()*

[TPS_MANI_03157] Enabling of data accumulation for upd data transmission ⌈ The setting of the attribute SomeipServiceInstanceToMachineMapping.udpMinTxBufferSize to a value enables the data accumulation for data transmission over the udpPort and unicastNetworkEndpoint defined on the EthernetCommunicationConnector that is referenced by the SomeipServiceInstanceToMachineMapping. In this case all event and method messages that are configured for data accumulation will be agglomerated in the buffer until a transmission trigger arrives and the data transmission starts. ⌋*(RS_MANI_00024)*

For configuration of transmission triggers please see [TPS_MANI_03158] and [TPS_MANI_03159].

7.2.1.1.3 Service Discovery Server Configuration

The multicast messages of the SOME/IP Service Discovery come with the risk of overflowing Machines with too many messages. Therefore, the Service Discovery can be configured with a suitable message sending behavior.

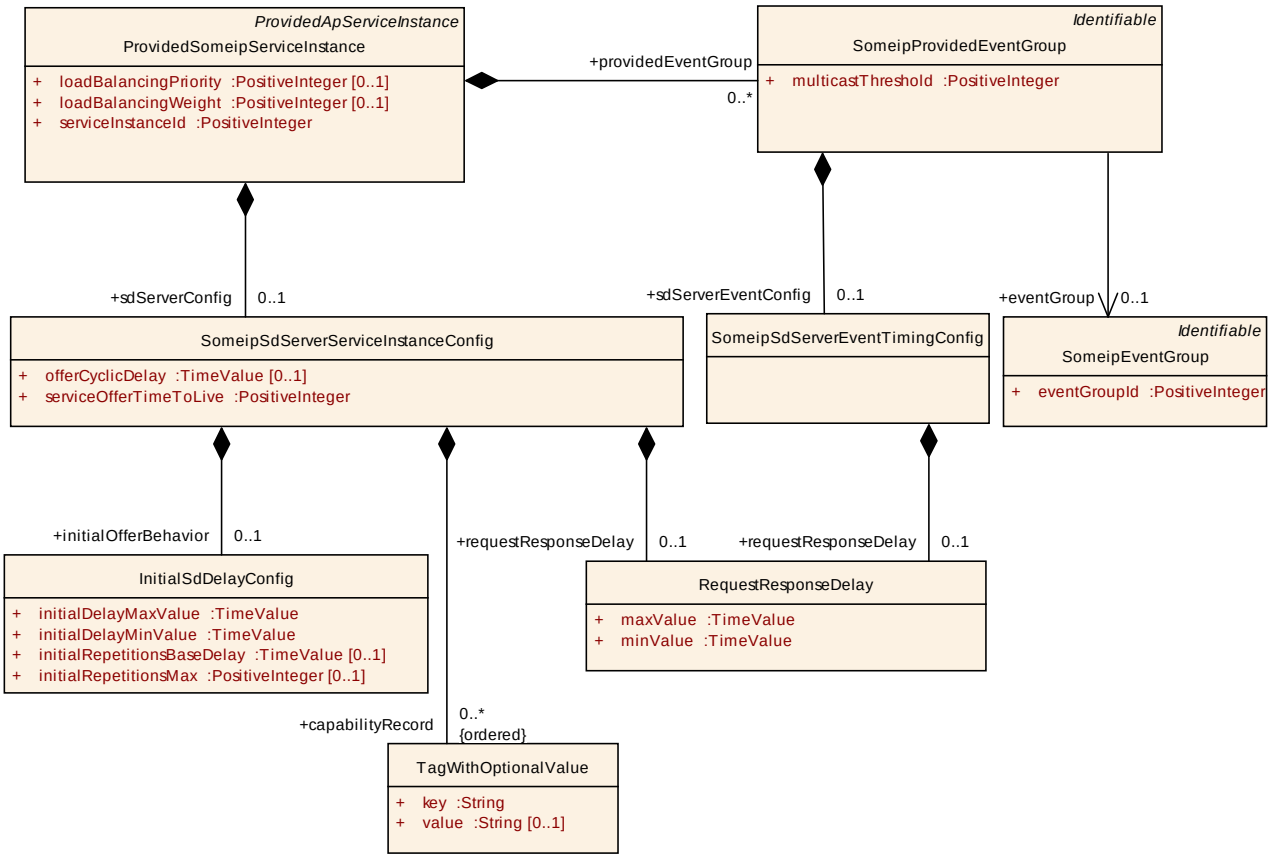


Figure 7.11: SOME/IP Service Discovery Server configuration settings

For every `ProvidedSomeipServiceInstance` on a Server different phases are existing:

- Down
- Available
  - Initial Wait Phase
  - Repetition Phase
  - Main Phase

[TPS_MANI_03011] Server Timing configuration for a `ProvidedSomeipServiceInstance` ⌈ The Server Timing is configurable with `SomeipSdServerServiceInstanceConfig` that is aggregated in the role `sdServerConfig` by the `ProvidedSomeipServiceInstance` for which the Timing is valid. ⌋*(RS_MANI_00024)*

Class	**SomeipSdServerServiceInstanceConfig**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	Server specific settings that are relevant for the configuration of SOME/IP Service-Discovery. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
capabilityRecord (ordered)	TagWithOptionalValue	*	aggr	A sequence of records to store arbitrary name/value pairs conveying additional information about the named service. **Tags:** atp.Status=draft
initialOfferBehavior	InitialSdDelayConfig	0..1	aggr	Controls offer behavior of the server. **Tags:** atp.Status=draft
offerCyclicDelay	TimeValue	0..1	attr	Optional attribute to define cyclic offers. Cyclic offer is active, if the delay is set (in seconds).
requestResponseDelay	RequestResponseDelay	0..1	aggr	Maximum/Minimum allowable response delay to entries received by multicast in seconds. The Service Discovery shall delay answers to entries that were transported in a multicast SOME/IP-SD message (e.g. FindService). **Tags:** atp.Status=draft
serviceOfferTimeToLive	PositiveInteger	1	attr	Defines the time in seconds the service offer is valid.

Table 7.32: SomeipSdServerServiceInstanceConfig

[TPS_MANI_03012] Initial Wait Phase configuration for a `ProvidedSomeipServiceInstance` ⌈ The Initial Wait Phase for a `ProvidedSomeipServiceInstance` is configured with the `initialOfferBehavior` and the two attributes `initialDelayMinValue` and `initialDelayMaxValue`.

When a calculated random timer based on these min and max values expires the first `OfferService` entry will be sent out. ⌋*(RS_MANI_00024)*

When the calculated random timer expires the Repetition Phase will be entered.

[TPS_MANI_03013] Repetition Wait Phase configuration for a `ProvidedSomeipServiceInstance` ⌈ The Repetition Wait Phase for a `ProvidedSomeipServiceInstance` is configured with the `initialOfferBehavior` and the two attributes `initialRepetitionsMax` and `initialRepetitionsBaseDelay`. ⌋*(RS_MANI_00024)*

If the Repetition Phase is entered the Service Discovery waits for the `initialRepetitionsBaseDelay` and then sends an `OfferService` entry. If the amount of sent `OfferService` entries reaches `initialRepetitionsMax` the Main Phase will be entered.

[TPS_MANI_03014] Main Phase configuration for a `ProvidedSomeipServiceInstance` ⌈ The Main Phase for a `ProvidedSomeipServiceInstance` is configured with the `offerCyclicDelay` attribute of `SomeipSdServerServiceInstanceConfig`.

The `OfferService` entry will be sent cyclically with an interval that is defined by the value of attribute `offerCyclicDelay`. ⌋*(RS_MANI_00024)*

Class	**InitialSdDelayConfig**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::Fibex4Ethernet::EthernetTopology			
Note	This element is used to configure the offer behavior of the server and the find behavior on the client. **Tags:** atp.ManifestKind=ServiceInstanceManifest			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
initialDelayMaxValue	TimeValue	1	attr	Max Value in seconds to delay randomly the first offer (if aggregated by SdServerConfig) or the transmission of a find message (if aggregated by SdClientConfig).
initialDelayMinValue	TimeValue	1	attr	Min Value in seconds to delay randomly the first offer (if aggregated by SdServerConfig) or the transmission of a find message (if aggregated by SdClientConfig).
initialRepetitionsBaseDelay	TimeValue	0..1	attr	The base delay for offer repetitions (if aggregated by SdServerConfig) or find repetitions (if aggregated by SdClientConfig. Successive find messages have an exponential back off delay.
initialRepetitionsMax	PositiveInteger	0..1	attr	Describes the maximum amount of offer repetitions (if aggregated by SdServerConfig) or the maximum amount of find repetitions (if aggregated by SdClientConfig).

Table 7.33: InitialSdDelayConfig

[TPS_MANI_03015] TTL for Offer Service Entries ⌈ The lifetime of a `ProvidedSomeipServiceInstance` is configurable with the `serviceOfferTimeToLive` attribute of `SomeipSdServerServiceInstanceConfig`.

If the time that is configured by `serviceOfferTimeToLive` expires the `ProvidedSomeipServiceInstance` is no longer offered. ⌋*(RS_MANI_00024)*

[TPS_MANI_03016] Servers `RequestResponseDelay` for received `FindService` entries ⌈ The Server will delay the `OfferService` answer to a received multicast `FindService` entry by the configured `SomeipSdServerServiceInstanceConfig.requestResponseDelay`.

The actual delay will be randomly chosen between the `maxValue` and `minValue`. ⌋ *(RS_MANI_00024)*

Class	**RequestResponseDelay**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::Fibex4Ethernet::EthernetTopology			
Note	Time to wait before answering the query. **Tags:** atp.ManifestKind=ServiceInstanceManifest			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
maxValue	TimeValue	1	attr	Maximum allowable response delay to entries received by multicast in seconds.
minValue	TimeValue	1	attr	Minimum allowable response delay to entries received by multicast in seconds.

Table 7.34: RequestResponseDelay

Figure 7.12 shows an example of the different SOME/IP phases on the Server side.

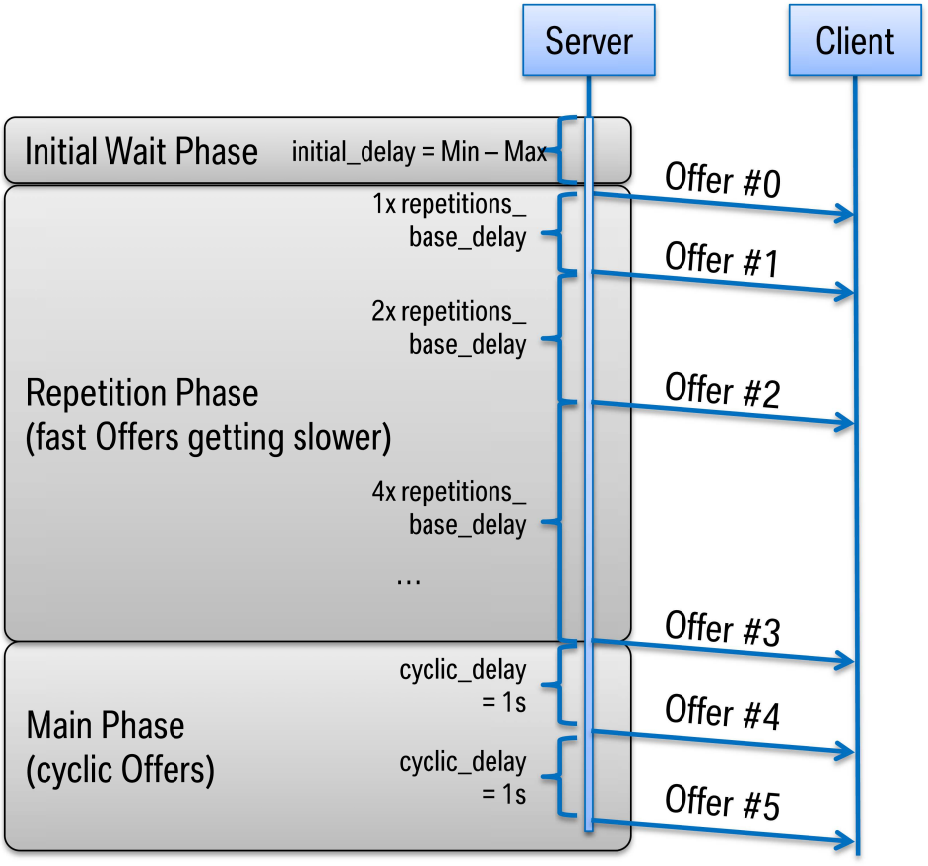


Figure 7.12: SOME/IP Server Timing example

SOME/IP allows for the specification of additional information about the `ProvidedSomeipServiceInstance` with the Capability Record that allows to transport arbitrary configuration strings (key/value pairs). This allows to encode additional information like the name of a service or its configuration.

[TPS_MANI_03017] Server Capability Records ⌈ A Capability Record (key/value pair) on the Server side is configurable with the `capabilityRecord` and the two attributes `key` and `value`. ⌋*(RS_MANI_00024)*

Class	**TagWithOptionalValue**			
Package	M2::AUTOSARTemplates::GenericStructure::GeneralTemplateClasses::TagWithOptionalValue			
Note	A tagged value is a combination of a tag (key) and a value that gives supplementary information that is attached to a model element. Please note that keys without a value are allowed. **Tags:** atp.ManifestKind=ServiceInstanceManifest			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
key	String	1	attr	Defines a key.
value	String	0..1	attr	Defines the corresponding value.

Table 7.35: TagWithOptionalValue

7.2.1.1.4 Provided Event Group

The `ProvidedSomeipServiceInstance` aggregates a `SomeipProvidedEventGroup` in the role `providedEventGroup` that allows to define service instance specific configuration settings for a `SomeipEventGroup`.

Class	**SomeipProvidedEventGroup**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	The meta-class represents the ability to configure ServiceInstance related communication settings on the provided side for each EventGroup separately. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
eventGroup	SomeipEventGroup	0..1	ref	Reference to the SomeipEventGroup in the System Manifest for which the ServiceInstance related EventGroup settings are valid. **Tags:** atp.Status=draft

multicastThreshold	PositiveInteger	1	attr	Specifies the number of subscribed clients that trigger the server to change the transmission of events to multicast. Example: If configured to 0 only unicast will be used. If configured to 1 the first client will be already served by multicast. If configured to 2 the first client will be server with unicast and as soon as the 2nd client arrives both will be served by multicast. This does not influence the handling of initial events, which are served using unicast only.
sdServerEventConfig	SomeipSdServerEventTimingConfig	0..1	aggr	Server Timing configuration settings that are EventGroup specific. **Tags:** atp.Status=draft

Table 7.36: SomeipProvidedEventGroup

[TPS_MANI_03018] Usage of `SomeipProvidedEventGroup.multicastThreshold` ⌈ The switching between IP-Unicast and IP-Multicast is guided by the server with the `SomeipProvidedEventGroup.multicastThreshold` attribute and by the number of subscribed clients to the `SomeipProvidedEventGroup`.

The Server will change the transmission of events to Multicast if the `multicastThreshold` of the corresponding `SomeipProvidedEventGroup` is reached by the number of subscribed clients. If the number of subscribed clients is smaller then the configured `multicastThreshold`, the transmission of events takes place via unicast communication. ⌋*(RS_MANI_00024)*

The following example shows the effect of the `multicastThreshold` in relation to the number of subscribed clients to the transmission of the SOME/IP event to the unicast or multicast destination address:

- If `multicastThreshold` is configured to 0 only the unicast IP address and the port will be used as destination address.
- If `multicastThreshold` is configured to 1 the first client will be served by multicast.
- If `multicastThreshold` is configured to 2 the first client will be served with unicast and as soon as the second client arrives both will be served by multicast, etc.

[TPS_MANI_03020] Servers `RequestResponseDelay` for received `SubscribeEventGroup` entries ⌈ The Server will delay the `SubscribeEventGroupAck` answer to a received `SubscribeEventGroup` message that was triggered by a multicast `ServiceOffer` by the configured `SomeipSdClientEventGroupTimingConfig.requestResponseDelay`.

The actual delay will be randomly chosen between the maxValue and minValue. ⌋ *(RS_MANI_00024)*

Class	**SomeipSdServerEventTimingConfig**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	EventGroup specific timing configuration settings. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
requestResponseDelay	RequestResponseDelay	0..1	aggr	The Service Discovery shall delay answers to unicast messages triggered by multicast messages (e.g. Subscribe Eventgroup after Offer Service). **Tags:** atp.Status=draft

Table 7.37: SomeipSdServerEventTimingConfig

7.2.1.1.5 ProvidedSomeipServiceInstance related event and method properties

[TPS_MANI_03154] ProvidedSomeipServiceInstance related configuration settings for events ⌈ The class SomeipEventProps that is aggregated by the ProvidedSomeipServiceInstance in the role eventProps allows to specify ProvidedSomeipServiceInstance related configuration settings for events that are defined in the SomeipServiceInterfaceDeployment referenced by the ProvidedSomeipServiceInstance in the role serviceInterface. ⌋ *(RS_MANI_00024)*

[TPS_MANI_03155] ProvidedSomeipServiceInstance related configuration settings for methods ⌈ The class SomeipMethodProps that is aggregated by the ProvidedSomeipServiceInstance in the role methodResponseProps allows to specify ProvidedSomeipServiceInstance related configuration settings for a method response message. The method is defined in the SomeipServiceInterfaceDeployment referenced by the ProvidedSomeipServiceInstance in the role serviceInterface. ⌋ *(RS_MANI_00024)*

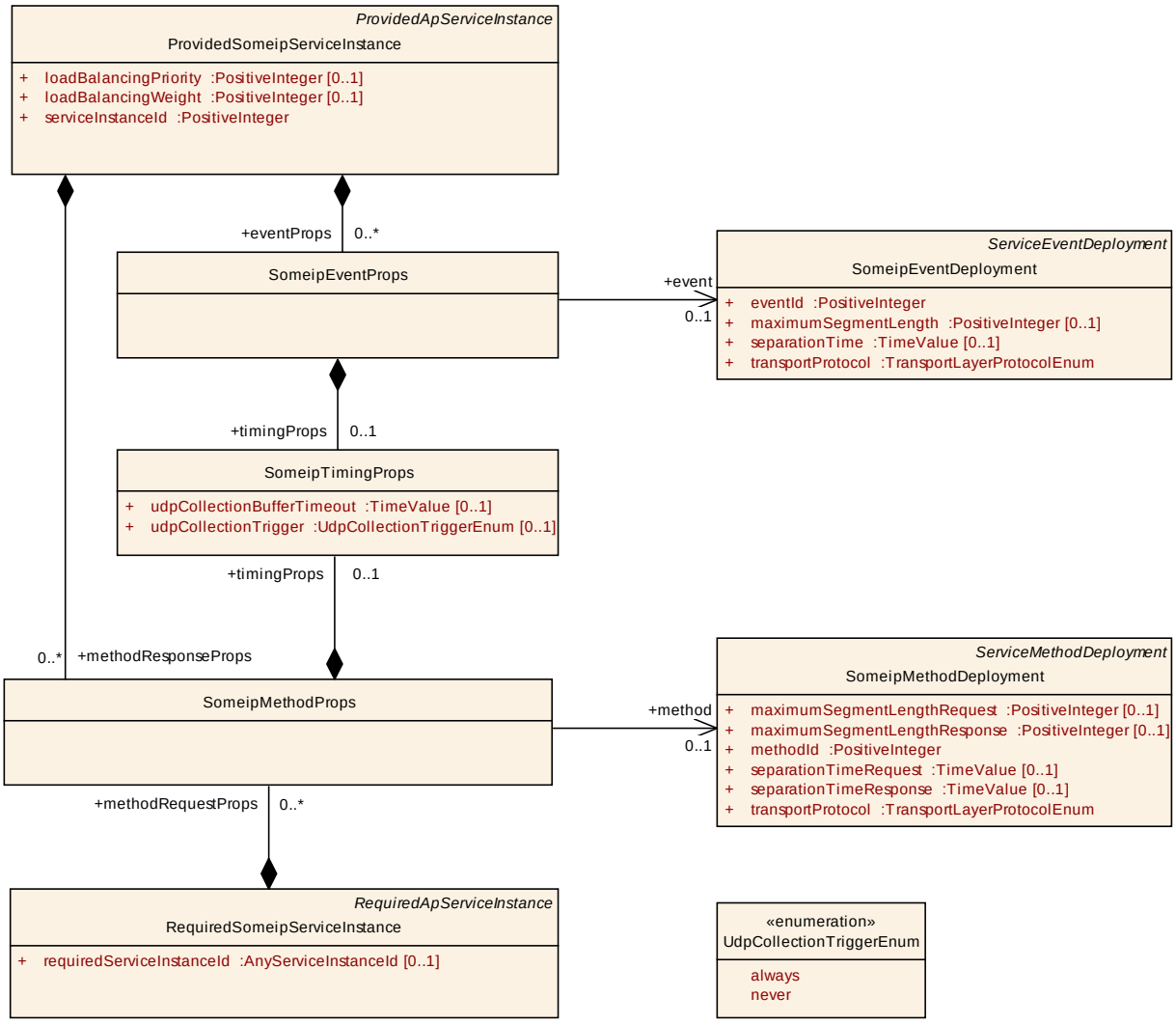


Figure 7.13: `ProvidedSomeipServiceInstance` related event and method properties

Class	**SomeipEventProps**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	This meta-class allows to set configuration options for an event in the provided service instance. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
event	SomeipEventDeployment	0..1	ref	Reference to the event for which the SomeipEventProps are applicable. **Tags:** atp.Status=draft
timingProps	SomeipTimingProps	0..1	aggr	Collection of timing attributes configurable for an event that is provided by a Service Instance. **Tags:** atp.Status=draft

Table 7.38: SomeipEventProps

Class	**SomeipMethodProps**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	This meta-class allows to set configuration options for a method in the service instance. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
method	SomeipMethodDeployment	0..1	ref	Reference to the method for which the SomeipMethodProps are applicable. **Tags:** atp.Status=draft
timingProps	SomeipTimingProps	0..1	aggr	Collection of timing attributes configurable for a method that is provided or requested by a Service Instance. **Tags:** atp.Status=draft

Table 7.39: SomeipMethodProps

Class	**SomeipTimingProps**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	Collection of timing attributes that are configurable for an event that is provided by a ServiceInstance or for a method that is provided or requested by a ServiceInstance. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
udpCollectionBufferTimeout	TimeValue	0..1	attr	Maximum time, an outgoing message (event, method call or method response) may be delayed, due to data accumulation.
udpCollectionTrigger	UdpCollectionTriggerEnum	0..1	attr	Defines whether the ServiceInterface element (event or method) contributes to the triggering of the udp data transmission if data accumulation is enabled.

Table 7.40: SomeipTimingProps

Enumeration	**UdpCollectionTriggerEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance
Note	Defines whether the ServiceInterface element (event or method) contributes to the triggering of the udp data transmission if data accumulation is enabled. **Tags:** atp.Status=draft
Literal	***Description***
always	ServiceInterface element will trigger the transmission of the data. **Tags:** atp.EnumerationValue=0

never	ServiceInterface element will be buffered and will not trigger the transmission of the data. **Tags:** atp.EnumerationValue=1

Table 7.41: UdpCollectionTriggerEnum

[TPS_MANI_03158] Configuration of a data accumulation on a `ProvidedServiceInstance` for transmission over udp ⌈ The attributes `udpCollectionBufferTimeout` and `udpCollectionTrigger` support the configuration of a data accumulation of several messages for transmission over udp. In the `ProvidedServiceInstance` all `method` responses and `event`s for which the `udpCollectionTrigger` is set to `never` will be agglomerated in a buffer until a trigger arrives that starts the data transmission.

The following trigger options are supported:

- a message needs to be transmitted for which the `udpCollectionTrigger` is set to `always`.
- the `udpCollectionBufferTimeout` is reached for a message.
- the buffer size defined by the attribute `udpMinTxBufferSize` is reached.

⌋*(RS_MANI_00024)*

7.2.1.2 Required Service Instance

[TPS_MANI_03059] `RequiredSomeipServiceInstance.requiredServiceInstanceId` ⌈ The `RequiredSomeipServiceInstance` defines the `requiredServiceInstanceId` of a `SomeipServiceInterfaceDeployment` that the client searches.

The client may search for a specific `requiredServiceInstanceId` or for ANY `requiredServiceInstanceId` of the `serviceInterface`. ⌋*(RS_MANI_00024)*

Class	**RequiredSomeipServiceInstance**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	This meta-class represents the ability to describe the existence and configuration of a required service instance in a concrete implementation on top of SOME/IP. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft; atp.recommendedPackage=ServiceInstances			
Base	*ARElement*, *ARObject*, *AdaptivePlatformServiceInstance*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *RequiredApServiceInstance*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

methodRequestProps	SomeipMethodProps	*	aggr	Configuration settings for individual methods that are requested by the ServiceInstance. **Tags:** atp.Status=draft
requiredEventGroup	SomeipRequiredEventGroup	*	aggr	List of EventGroups that are used by the RequiredServiceInstance. **Tags:** atp.Status=draft
requiredServiceInstanceId	AnyServiceInstanceId	0..1	attr	This attribute represents the ability to describe the required service instance ID.
requiredServiceVersion	SomeipServiceInterfaceVersion	0..1	aggr	This element is used to configure for which version (major version/minor version) of the SomeIp Service the Service Discovery will search. **Tags:** atp.Status=draft
sdClientConfig	SomeipSdClientServiceInstanceConfig	0..1	aggr	Client specific configuration settings relevant for the SOME/IP service discovery. **Tags:** atp.Status=draft

Table 7.42: RequiredSomeipServiceInstance

[constr_3293] Mandatory information of a `RequiredSomeipServiceInstance` ⌈ The `RequiredSomeipServiceInstance` shall always define the attributes `requiredServiceInstanceId` and `requiredServiceVersion`. ⌋*()*

[TPS_MANI_03021] Requirements on the service version from the client's point of view ⌈ The meta-class `RequiredSomeipServiceInstance` can also make further specifications regarding the version of the service from the client's point of view.

For this purpose, the attribute `RequiredSomeipServiceInstance.requiredServiceVersion` exists and provides the ability to define the required major version (`SomeipServiceInterfaceVersion.majorVersion`) and the minor version (`SomeipServiceInterfaceVersion.minorVersion`). ⌋*(RS_MANI_00024)*

Class	**SomeipServiceInterfaceVersion**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	This meta-class represents the ability to describe a version of a SOME/IP ServiceInterface. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
majorVersion	AnyVersionString	1	attr	Major Version of the ServiceInterface. Value can be set to a number that represents the Major Version of the searched service or to ANY.
minorVersion	AnyVersionString	1	attr	Minor Version of the ServiceInterface. Value can be set to a number that represents the Minor Version of the searched service or to ANY.

Table 7.43: SomeipServiceInterfaceVersion

7.2.1.2.1 IP Configuration

In SOME/IP, the SubscribeEventGroup entry references IPv4 or IPv6 Endpoint options to indicate to the server where the client wants to receive the events of the SomeipEventGroup. Such an Endpoint contains the IP address of the client.

[TPS_MANI_03022] Context of RequiredSomeipServiceInstance ⌈ A RequiredSomeipServiceInstance can be mapped to a CommunicationConnector of a MachineDesign with the SomeipServiceInstanceToMachineMapping.

With this mapping an assignment of the RequiredSomeipServiceInstance to a unicast IP Address is established since the EthernetCommunicationConnector refers to a NetworkEndpoint in the role unicastNetworkEndpoint. The unicastNetworkEndpoint defines the local IP address of the client. ⌋ *(RS_MANI_00009, RS_MANI_00024)*

[constr_3411] eventMulticastUdpPort, ipv4MulticastIpAddress and ipv6MulticastIpAddress not relevant for RequiredSomeipServiceInstances ⌈ The attributes eventMulticastUdpPort, ipv4MulticastIpAddress and ipv6MulticastIpAddress are not relevant for a ServiceInstanceToMachineMapping that maps a RequiredSomeipServiceInstance to a CommunicationConnector of a MachineDesign. ⌋*()*

The reason for [constr_3411] is that the Server informs the client in the Subscribe Eventgroup Acknowledgement entry to which Multicast IP address the event messages will be send. There is no reason to configure the IPv4 Multicast Option or IPv6 Multicast Option on the client side.

7.2.1.2.2 TP Configuration

The IPv4 or IPv6 Endpoint option that is referenced in the SOME/IP SubscribeEventGroup message contains besides the IP address the transport layer protocol (e.g. UDP or TCP), and the port number of the client.

With the SomeipServiceInstanceToMachineMapping the Transport Layer configuration attributes are assigned to the RequiredSomeipServiceInstance.

The Transport Layer (TCP/UDP) configuration attributes for the SubscribeEventGroup entry are directly available in the SomeipServiceInstanceToMachineMapping element.

The SomeipServiceInstanceToMachineMapping defines also the source-port where the client sends the method call messages to the server and the destination-port where the client receives the method responses from the server.

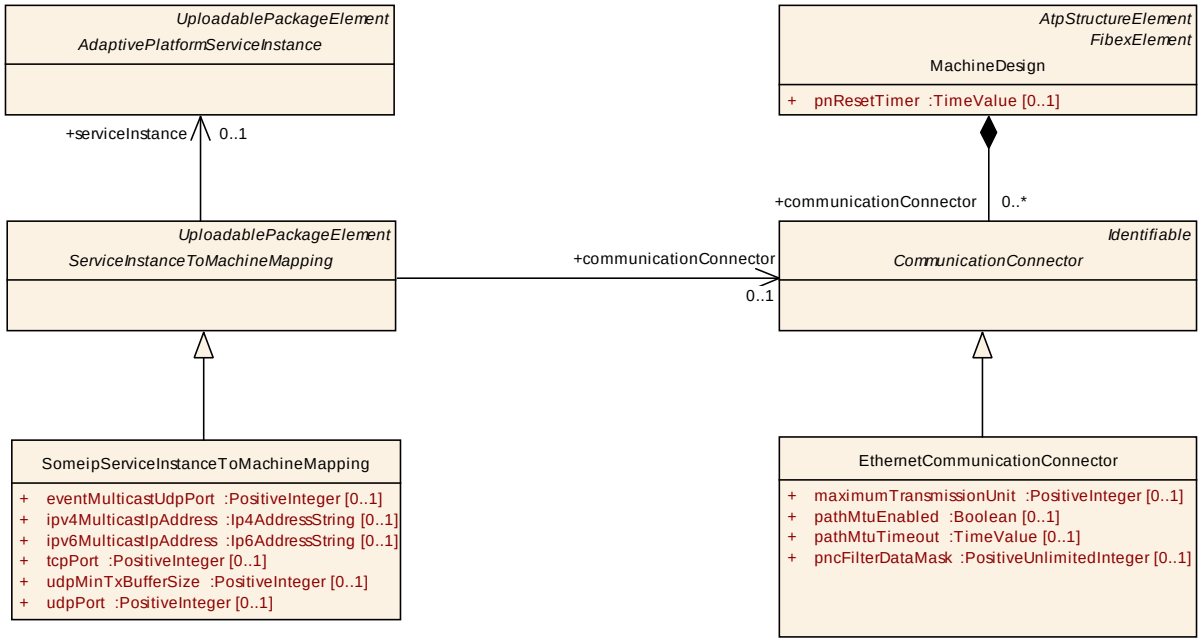


Figure 7.14: SomeipServiceInstanceToMachineMapping with TP and IP configuration

[TPS_MANI_03023] Udp Transport Protocol Configuration for RequiredSomeipServiceInstance ⌈ The SomeipServiceInstanceToMachineMapping.udpPort defines the Transport Protocol for a UDP communication in case that the server provides ServiceInterface content over UDP and the client wants to use it. ⌋*(RS_MANI_00009, RS_MANI_00024)*

[TPS_MANI_03024] Tcp Transport Protocol Configuration for RequiredSomeipServiceInstance ⌈ The SomeipServiceInstanceToMachineMapping.tcpPort defines the Transport Protocol for a TCP communication in case that the server provides ServiceInterface content over TCP and the client wants to use it. ⌋*(RS_MANI_00009, RS_MANI_00024)*

[TPS_MANI_03049] Tcp and Udp Transport Protocol Configuration for RequiredSomeipServiceInstance ⌈ It is allowed to set tcpPort and udpPort in the same SomeipServiceInstanceToMachineMapping. Such a setting shall be used in case that the server provides ServiceInterface content over Udp and Tcp and the client wants to use it. ⌋*(RS_MANI_00009, RS_MANI_00024)*

[constr_3296] Transport Protocol attributes defined for a RequiredSomeipServiceInstance ⌈ Each SomeipServiceInstanceToMachineMapping that is defined for a RequiredSomeipServiceInstance shall define either

- a udpPort or
- a tcpPort or
- a udpPort and a tcpPort.

⌋*()*

If a Tcp and Udp Transport Protocol Configuration is defined for a RequiredSomeipServiceInstance as described in [TPS_MANI_03049] then the SOME/IP ServiceInterfaceDeployment settings decide which content of the ProvidedSomeipServiceInstance is transported over udp and which content is transported over tcp. This is described in [TPS_MANI_03050] and [TPS_MANI_03051].

7.2.1.2.3 Service Discovery Client Configuration

Service Discovery phases on the Client side allow minimizing the number of Service Discovery messages and allow a fast synchronization upon ECU start.

For every RequiredSomeipServiceInstance on a Client different phases are existing:

- Down
- Requested
  - Initial Wait Phase
  - Repetition Phase
  - Main Phase

[TPS_MANI_03025] Client Timing configuration for a RequiredSomeipServiceInstance ⌈ The Client Timing is configurable with SomeipSdClientServiceInstanceConfig that is aggregated in the role sdClientConfig by the RequiredSomeipServiceInstance for which the Timing is valid. ⌋*(RS_MANI_00024)*

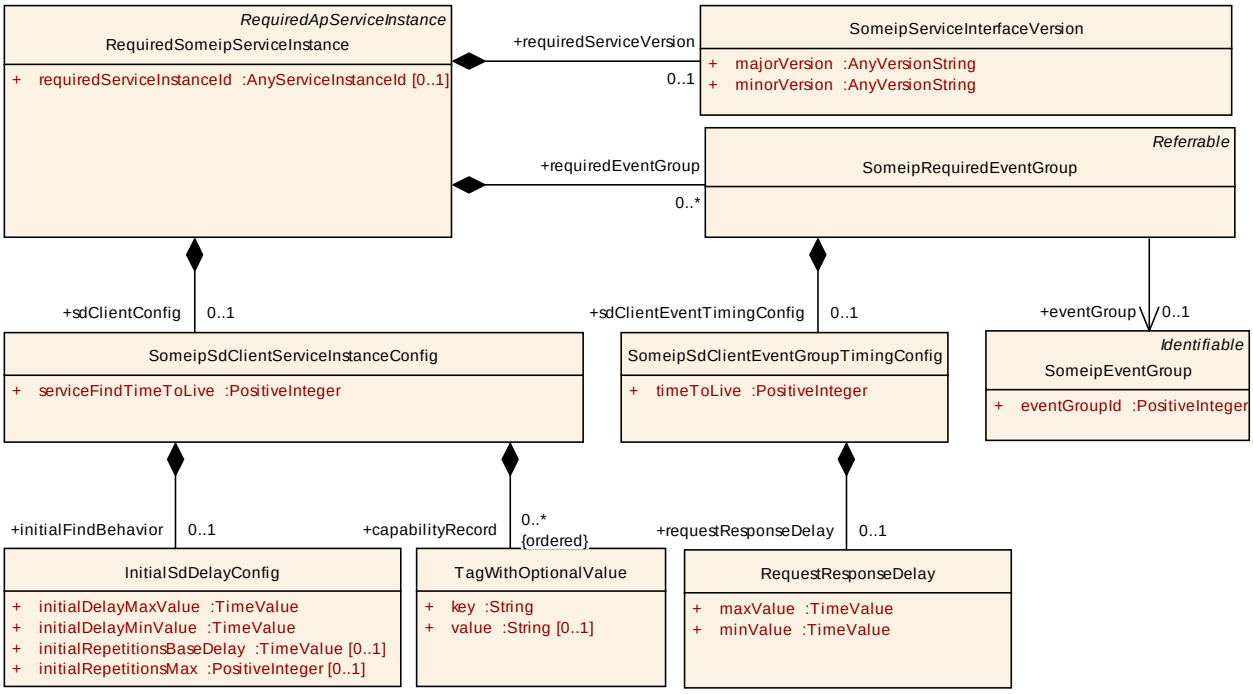


Figure 7.15: SOME/IP Service Discovery Client configuration settings

Class	**SomeipSdClientServiceInstanceConfig**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	Client specific settings that are relevant for the configuration of SOME/IP Service-Discovery. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
capabilityRecord (ordered)	TagWithOptionalValue	*	aggr	A sequence of records to store arbitrary name/value pairs conveying additional information about the named service. **Tags:** atp.Status=draft
initialFindBehavior	InitialSdDelayConfig	0..1	aggr	Controls initial find behavior of clients. **Tags:** atp.Status=draft
serviceFindTimeToLive	PositiveInteger	1	attr	This attribute represents the ability to define the time in seconds the service find is valid.

Table 7.44: SomeipSdClientServiceInstanceConfig

[TPS_MANI_03026] Initial Wait Phase configuration for a `RequiredSomeipServiceInstance` ⌈ The Initial Wait Phase for a `RequiredSomeipServiceInstance` is configured with the `initialFindBehavior` and the two attributes `initialDelayMinValue` and `initialDelayMaxValue`.

If a calculated random timer based on these min and max values expires the first `FindService` entry will be sent out. ⌋*(RS_MANI_00024)*

When the calculated random timer expires and no `OfferService` is received the Repetition Phase will be entered.

[TPS_MANI_03027] Repetition Wait Phase configuration for a `RequiredSomeipServiceInstance` ⌈ The Repetition Wait Phase for a `RequiredSomeipServiceInstance` is configured with the `initialFindBehavior` and the two attributes `initialRepetitionsMax` and `initialRepetitionsBaseDelay`. ⌋*(RS_MANI_00024)*

If the Repetition Phase is entered, the Service Discovery waits the `initialRepetitionsBaseDelay` and sends an `FindService` entry.

If the amount of sent `FindService` entries reaches `initialRepetitionsMax` and no `OfferService` is received the Main Phase will be entered. In the Main Phase no further `FindService` entries are send by the client.

[TPS_MANI_03028] TTL for Find Service Entries ⌈ The lifetime of a `RequiredSomeipServiceInstance` is configurable with the `serviceFindTimeToLive` attribute of `SomeipSdClientServiceInstanceConfig`.

If the time that is configured by `serviceFindTimeToLive` expires the `FindService` entry shall be considered not existing. ⌋*(RS_MANI_00024)*

Figure 7.16 shows an example of the different SOME/IP phases on the Client side.

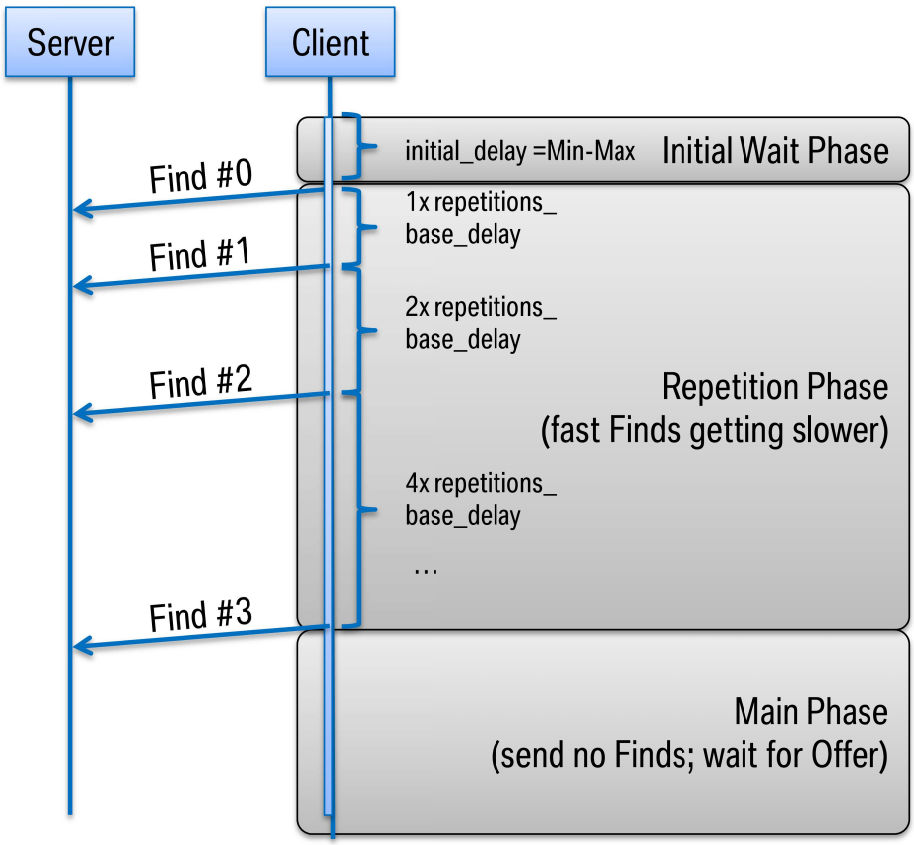


Figure 7.16: SOME/IP Client Timing example

SOME/IP allows to specify additional information about the `RequiredSomeipServiceInstance` with the Capability Record that allows to transport arbitrary configuration strings (key/value pairs).

This allows to encode additional information like the name of a service or its configuration.

[TPS_MANI_03029] Client Capability Records ⌈ A Capability Record (key/value pair) on the Client side is configurable with the `capabilityRecord` and the two attributes `key` and `value`. ⌋*(RS_MANI_00024)*

7.2.1.2.4 Required Event Group

The `RequiredSomeipServiceInstance` aggregates a `SomeipRequiredEventGroup` in the role `requiredEventGroup` that allows to define service instance specific configuration settings for a `SomeipEventGroup`.

Class	**SomeipRequiredEventGroup**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	The meta-class represents the ability to configure ServiceInstance related communication settings on the required side for each EventGroup separately. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
eventGroup	SomeipEventGroup	0..1	ref	Reference to the SomeipEventGroup in the System Manifest for which the ServiceInstance related EventGroup settings are valid. **Tags:** atp.Status=draft
sdClientEventTimingConfig	SomeipSdClientEventGroupTimingConfig	0..1	aggr	Client Timing configuration settings that are EventGroup specific. **Tags:** atp.Status=draft

Table 7.45: SomeipRequiredEventGroup

Class	**SomeipSdClientEventGroupTimingConfig**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	This meta-class is used to specify configuration related to service discovery in the context of an event group on SOME/IP. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
requestResponseDelay	RequestResponseDelay	0..1	aggr	The Service Discovery shall delay answers to unicast messages triggered by multicast messages (e.g. Subscribe Eventgroup after Offer Service). **Tags:** atp.Status=draft
timeToLive	PositiveInteger	1	attr	Defines the time in seconds the subscription of this event is expected by the client. this value is sent from the client to the server in the SD-subscribeEvent message.

Table 7.46: SomeipSdClientEventGroupTimingConfig

[TPS_MANI_03030] **`SomeipSdClientEventGroupTimingConfig.timeToLive` for `SubscribeEventGroup` Entries** ⌈ The lifetime of a event subscription is configurable with the `timeToLive` attribute of `SomeipSdClientEventGroupTimingConfig`.

If the time that is configured by `timeToLive` expires the event subscription is canceled. ⌋*(RS_MANI_00024)*

[TPS_MANI_03031] Clients `RequestResponseDelay` for received `ServiceOffer` entries ⌈ The Client will delay the `SubscribeEventGroup` answer to a re-

ceived ServiceOffer message by the configured SomeipSdClientEventGroup-TimingConfig.requestResponseDelay.

The actual delay will be randomly chosen between the maxValue and minValue. ⌋ *(RS_MANI_00024)*

7.2.1.2.5 RequiredSomeipServiceInstance related method call properties

[TPS_MANI_03156] RequiredSomeipServiceInstance related configuration settings for methods ⌈ The class SomeipMethodProps that is aggregated by the RequiredSomeipServiceInstance in the role methodRequestProps allows to specify RequiredSomeipServiceInstance related configuration settings for a method request message. The method is defined in the SomeipServiceInter-faceDeployment referenced by the RequiredSomeipServiceInstance in the role serviceInterface. ⌋*(RS_MANI_00024)*

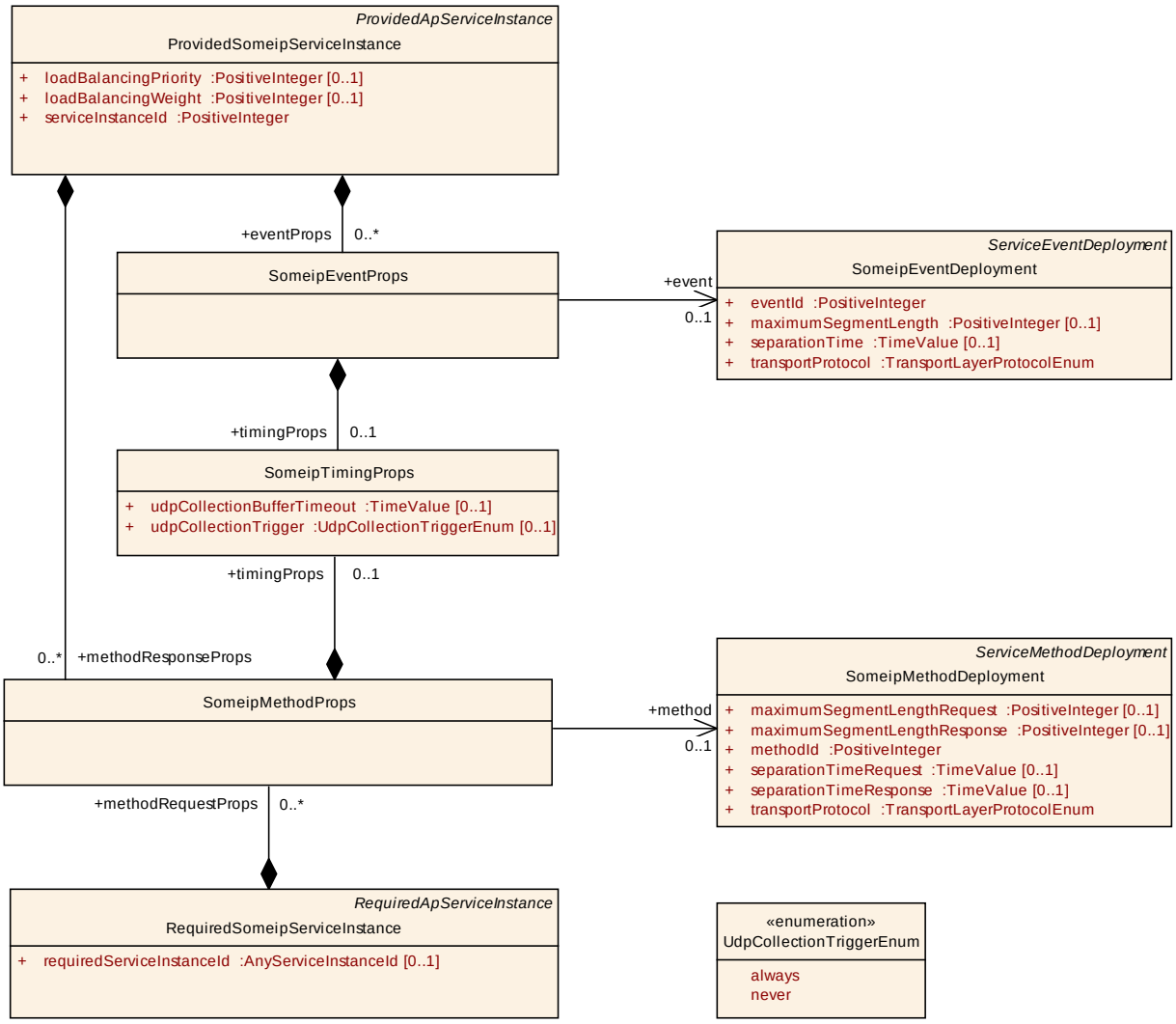


Figure 7.17: RequiredSomeipServiceInstance related event and method properties

Class	**SomeipMethodProps**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	This meta-class allows to set configuration options for a method in the service instance. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
method	SomeipMethodDeployment	0..1	ref	Reference to the method for which the SomeipMethodProps are applicable. **Tags:** atp.Status=draft
timingProps	SomeipTimingProps	0..1	aggr	Collection of timing attributes configurable for a method that is provided or requested by a Service Instance. **Tags:** atp.Status=draft

Table 7.47: SomeipMethodProps

Class	**SomeipTimingProps**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	Collection of timing attributes that are configurable for an event that is provided by a ServiceInstance or for a method that is provided or requested by a ServiceInstance. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
udpCollectionBufferTimeout	TimeValue	0..1	attr	Maximum time, an outgoing message (event, method call or method response) may be delayed, due to data accumulation.
udpCollectionTrigger	UdpCollectionTriggerEnum	0..1	attr	Defines whether the ServiceInterface element (event or method) contributes to the triggering of the udp data transmission if data accumulation is enabled.

Table 7.48: SomeipTimingProps

Enumeration	**UdpCollectionTriggerEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance
Note	Defines whether the ServiceInterface element (event or method) contributes to the triggering of the udp data transmission if data accumulation is enabled. **Tags:** atp.Status=draft
Literal	***Description***
always	ServiceInterface element will trigger the transmission of the data. **Tags:** atp.EnumerationValue=0

never	ServiceInterface element will be buffered and will not trigger the transmission of the data. **Tags:** atp.EnumerationValue=1

Table 7.49: UdpCollectionTriggerEnum

[TPS_MANI_03159] Configuration of a data accumulation on a `RequiredSomeipServiceInstance` for transmission over udp ⌈ The attributes `udpCollectionBufferTimeout` and `udpCollectionTrigger` support the configuration of a data accumulation of several messages for transmission over udp. In the `RequiredSomeipServiceInstance` all `method` requests for which the `udpCollectionTrigger` is set to `never` will be agglomerated in a buffer until a trigger arrives that starts the data transmission.

The following trigger options are supported:

- a message needs to be transmitted for which the `udpCollectionTrigger` is set to `always`.
- the `udpCollectionBufferTimeout` is reached for a message.
- the buffer size defined by the attribute `udpMinTxBufferSize` is reached.

⌋*(RS_MANI_00024)*

7.2.2 DDS Service Instance Deployment

In the case of DDS used as the transport layer the derived meta-classes are `ProvidedDdsServiceInstance` resp. `RequiredDdsServiceInstance`. These meta-classes also carry attributes that apply for the service discovery on DDS.

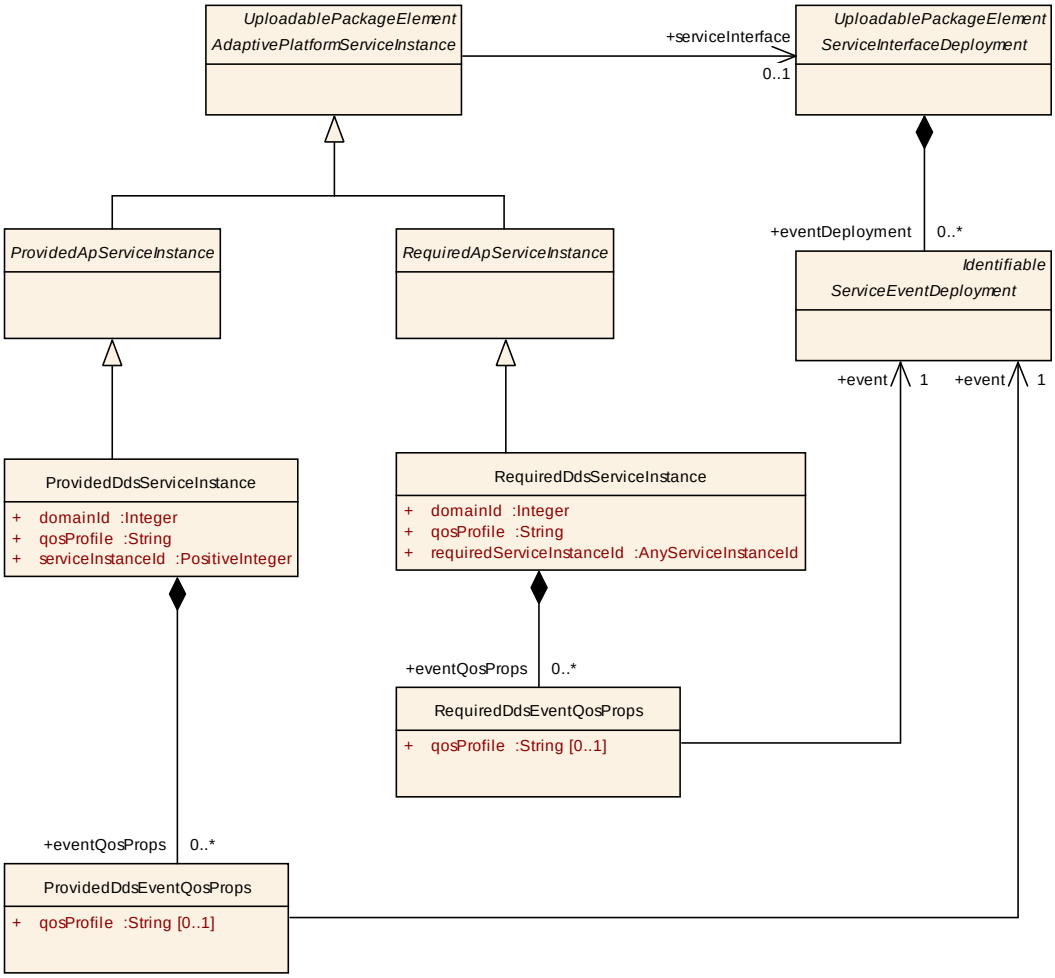


Figure 7.18: Dds Service Instances

7.2.2.1 Provided DDS Service Instance

[TPS_MANI_03527] Definition of `ProvidedDdsServiceInstance` ⌈ The `ProvidedDdsServiceInstance` configures the Service to join a DDS Domain with the `domainId` attribute, and to instantiate the underlying DDS entities according to a QoS Profile with the `qosProfile` attribute. Moreover, it assigns an Instance Id to the Service for deployment with the `serviceInstanceId` attribute. ⌋*(RS_MANI_00038)*

[constr_3528] Value range of `domainId` ⌈ The value of `domainId` shall be in the range of a signed 32 bit integer. ⌋*()*

[constr_3529] Value range of `serviceInstanceId` ⌈ The value of `serviceInstanceId` shall be in the range of 0..65535. ⌋*()*

Class	**ProvidedDdsServiceInstance**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	This meta-class represents the ability to describe the existence and configuration of a provided service instance in a concrete implementation on top of DDS. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft; atp.recommendedPackage=ServiceInstances			
Base	*ARElement*, *ARObject*, *AdaptivePlatformServiceInstance*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *ProvidedApService Instance*, *Referrable*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
domainId	Integer	1	attr	This attribute identifies the DDS Domain the Service Instance shall join. **Tags:** atp.Status=draft
eventQosProps	ProvidedDdsEventQosProps	*	aggr	List of configuration properties for the Events that are provided by the Service Instance. **Tags:** atp.Status=draft
qosProfile	String	1	attr	Identifies a group of QoS Policies that apply to the DDS entities created by the Service Instance. **Tags:** atp.Status=draft
serviceInstanceId	PositiveInteger	1	attr	Identification number that is used by DDS to identify DomainParticipants associated with an instance of the service. **Tags:** atp.Status=draft

Table 7.50: ProvidedDdsServiceInstance

[TPS_MANI_03528] Definition of `ProvidedDdsEventQosProps` ⌈ The `ProvidedDdsEventQosProps` configure the DDS entities associated with each Event according to a QoS Profile specified with the `qosProfile` attribute. ⌋*(RS_MANI_00038)*

[TPS_MANI_03531] `qosProfile` of `ProvidedDdsEventQosProps` is optional ⌈ The attribute `ProvidedDdsEventQosProps.qosProfile` is optional; if `qosProfile` is not defined, the underlying DDS entities shall be configured according to the `qosProfile` attribute of the parent `ProvidedDdsServiceInstance`. ⌋ *(RS_MANI_00038)*

Class	**ProvidedDdsEventQosProps**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	Configuration properties of Events provided by a Service Instance using DDS as the underlying network binding. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

event	ServiceEventDeployment	1	ref	Reference to an event that is provided. **Tags:** atp.Status=draft
qosProfile	String	0..1	attr	Identifies a group of QoS Policies that apply to the DDS entities associated with an Event. **Tags:** atp.Status=draft

Table 7.51: ProvidedDdsEventQosProps

7.2.2.2 Required DDS Service Instance

[TPS_MANI_03529] Definition of `RequiredDdsServiceInstance` ⌈ The `RequiredDdsServiceInstance` configures the Client to join a DDS Domain with the `domainId` attribute, and to instantiate the underlying DDS entities according to a QoS Profile with the `qosProfile` attribute. Optionally, the `requiredServiceInstanceId` attribute allows a Client to search for a specific Instance Id of the serviceInterface. ⌋*(RS_MANI_00038)*

Class	**RequiredDdsServiceInstance**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	This meta-class represents the ability to describe the existence and configuration of a required service instance in a concrete implementation on top of DDS. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft; atp.recommendedPackage=ServiceInstances			
Base	*ARElement*, *ARObject*, *AdaptivePlatformServiceInstance*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *RequiredApServiceInstance*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
domainId	Integer	1	attr	This attribute identifies the DDS Domain the Client application shall join. **Tags:** atp.Status=draft
eventQosProps	RequiredDdsEventQosProps	*	aggr	List of configuration properties for the Events that are requested by the Client. **Tags:** atp.Status=draft
qosProfile	String	1	attr	Identifies a group of QoS Policies that apply to the DDS entities created by the Client. **Tags:** atp.Status=draft
requiredServiceInstanceId	AnyServiceInstanceId	1	attr	This attribute represents the ability to describe the required service instance ID. **Tags:** atp.Status=draft

Table 7.52: RequiredDdsServiceInstance

[TPS_MANI_03530] Definition of `RequiredDdsEventQosProps` ⌈ The `RequiredDdsEventQosProps` configure the DDS entities responsible for subscribing to an Event according to a QoS Profile specified with the `qosProfile` attribute. ⌋ *(RS_MANI_00038)*

[TPS_MANI_03532] `qosProfile` of `RequiredDdsEventQosProps` is optional ⌈ The attribute `RequiredDdsEventQosProps.qosProfile` is optional; if `qosProfile` is not defined, the underlying DDS entities shall be configured according to the `qosProfile` attribute of the parent `RequiredDdsServiceInstance`. ⌋ *(RS_MANI_00038)*

Class	**RequiredDdsEventQosProps**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	Configuration properties of Events requested by a Client using DDS as the underlying network binding. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
event	ServiceEventDeployment	1	ref	Reference to an event that is requested. **Tags:** atp.Status=draft
qosProfile	String	0..1	attr	Identifies a group of QoS Policies that apply to the DDS entities associated with an Event. **Tags:** atp.Status=draft

Table 7.53: RequiredDdsEventQosProps

7.2.2.3 DDS Service Instance to Machine mapping

The `DdsServiceInstanceToMachineMapping` defines on which network / VLAN the DDS communication shall be deployed.

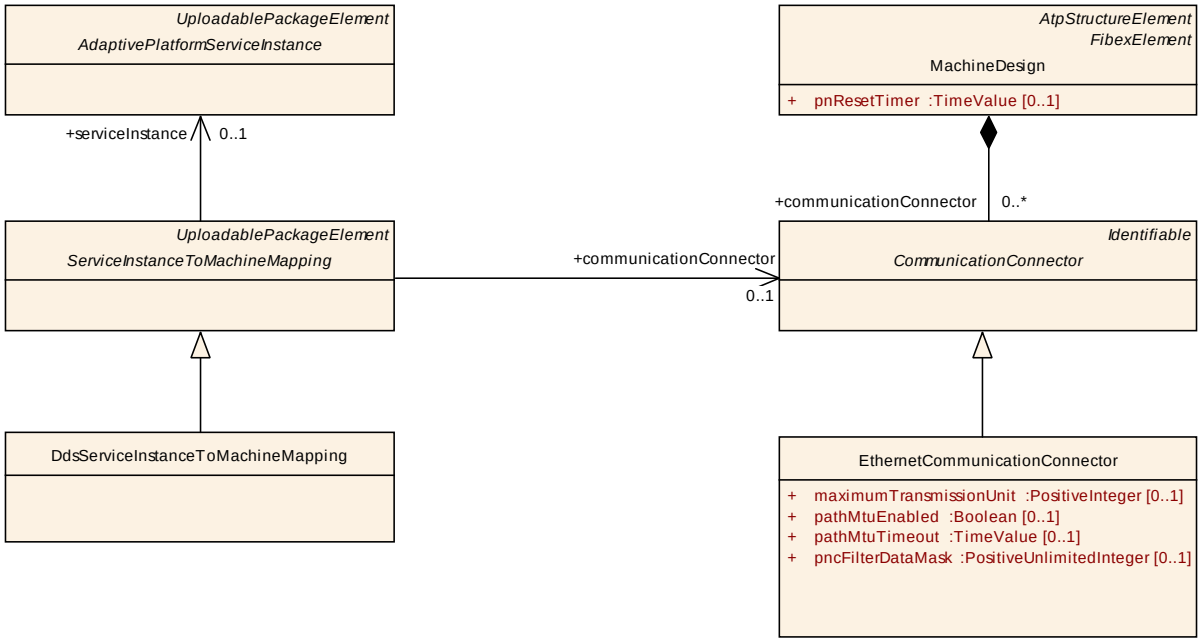


Figure 7.19: Dds Service Instance to Machine mapping

[TPS_MANI_03533] **DdsServiceInstanceToMachineMapping** ⌈ The DdsServiceInstanceToMachineMapping defines for a specific serviceInstance (either ProvidedDdsServiceInstance or RequiredDdsServiceInstance) on which network the communication shall be done using the reference communicationConnector to CommunicationConnector. ⌋*(RS_MANI_00038)*

Class	**DdsServiceInstanceToMachineMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstanceMapping			
Note	This meta-class allows to map DdsServiceInstances to a CommunicationConnector of a Machine. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft; atp.recommendedPackage=ServiceInstanceToMachineMappings			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *ServiceInstanceToMachineMapping*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 7.54: DdsServiceInstanceToMachineMapping

7.2.3 User Defined Service Instance Deployment

[TPS_MANI_03032] Description of middleware technologies not standardized by AUTOSAR ⌈ The elements ProvidedUserDefinedServiceInstance and RequiredUserDefinedServiceInstance can be used to describe alternative middleware technologies that are not standardized by AUTOSAR. ⌋*(RS_MANI_00014)*

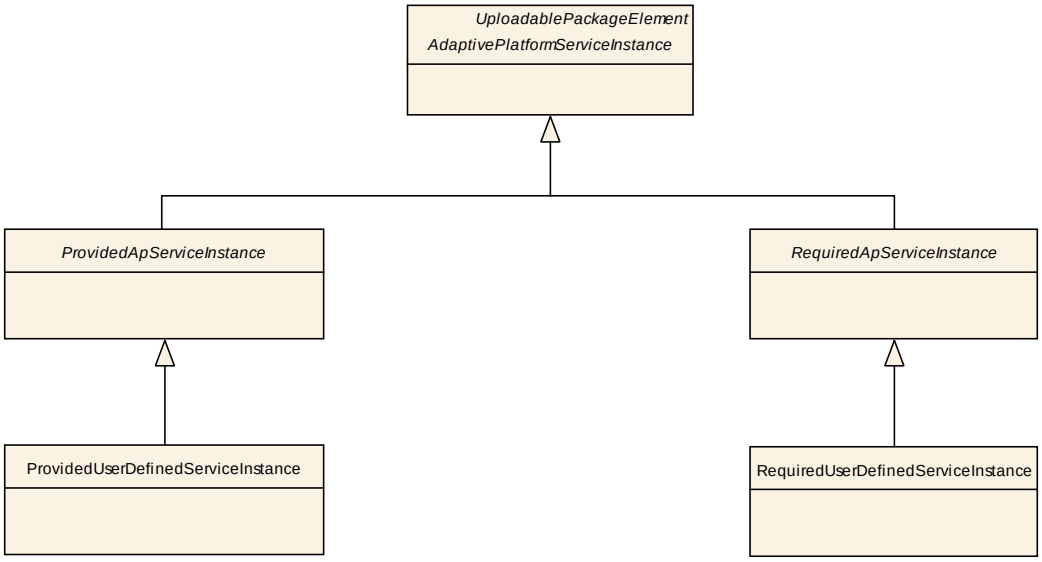


Figure 7.20: User Defined Service Instance Deployment

Class	**ProvidedUserDefinedServiceInstance**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	This meta-class represents the ability to describe the existence and configuration of a provided service instance in a concrete implementation that is not standardized by AUTOSAR. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft; atp.recommendedPackage=ServiceInstances			
Base	*ARElement*, *ARObject*, *AdaptivePlatformServiceInstance*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *ProvidedApService Instance*, *Referrable*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 7.55: ProvidedUserDefinedServiceInstance

Class	**RequiredUserDefinedServiceInstance**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance			
Note	This meta-class represents the ability to describe the existence and configuration of a required service instance in a concrete implementation that is not standardized by AUTOSAR. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft; atp.recommendedPackage=ServiceInstances			
Base	*ARElement*, *ARObject*, *AdaptivePlatformServiceInstance*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *RequiredAp ServiceInstance*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 7.56: RequiredUserDefinedServiceInstance

Please note that both elements ProvidedUserDefinedServiceInstance and RequiredUserDefinedServiceInstance are Identifiable and therefore are able to describe special data (sdg) which is not represented by the standard model.

7.3 EndToEndProtection

AUTOSAR supports the protection of events and Field notifiers with E2E Profiles that are defined in the E2E Communication Protection Library [23].

[TPS_MANI_03127] Usage of End2EndEventProtectionProps ⌈ The End2EndEventProtectionProps element is used to define event or notifier specific E2E configuration settings in the context of an AdaptivePlatformServiceInstance. ⌋*(RS_MANI_00028)*

Since the End2EndEventProtectionProps element is aggregated by the abstract AdaptivePlatformServiceInstance it can be used to describe the End-to-End protection on specific derived classes like ProvidedSomeipServiceInstance or RequiredSomeipServiceInstance that fit the underlying middleware. With this approach it is possible to define different End-to-End protection settings for different used transport layer mechanisms in case of Multi-Binding.

[TPS_MANI_03129] E2E profile ⌈ The E2E profile is defined by E2EProfileConfiguration.profileName. ⌋*(RS_MANI_00028)*

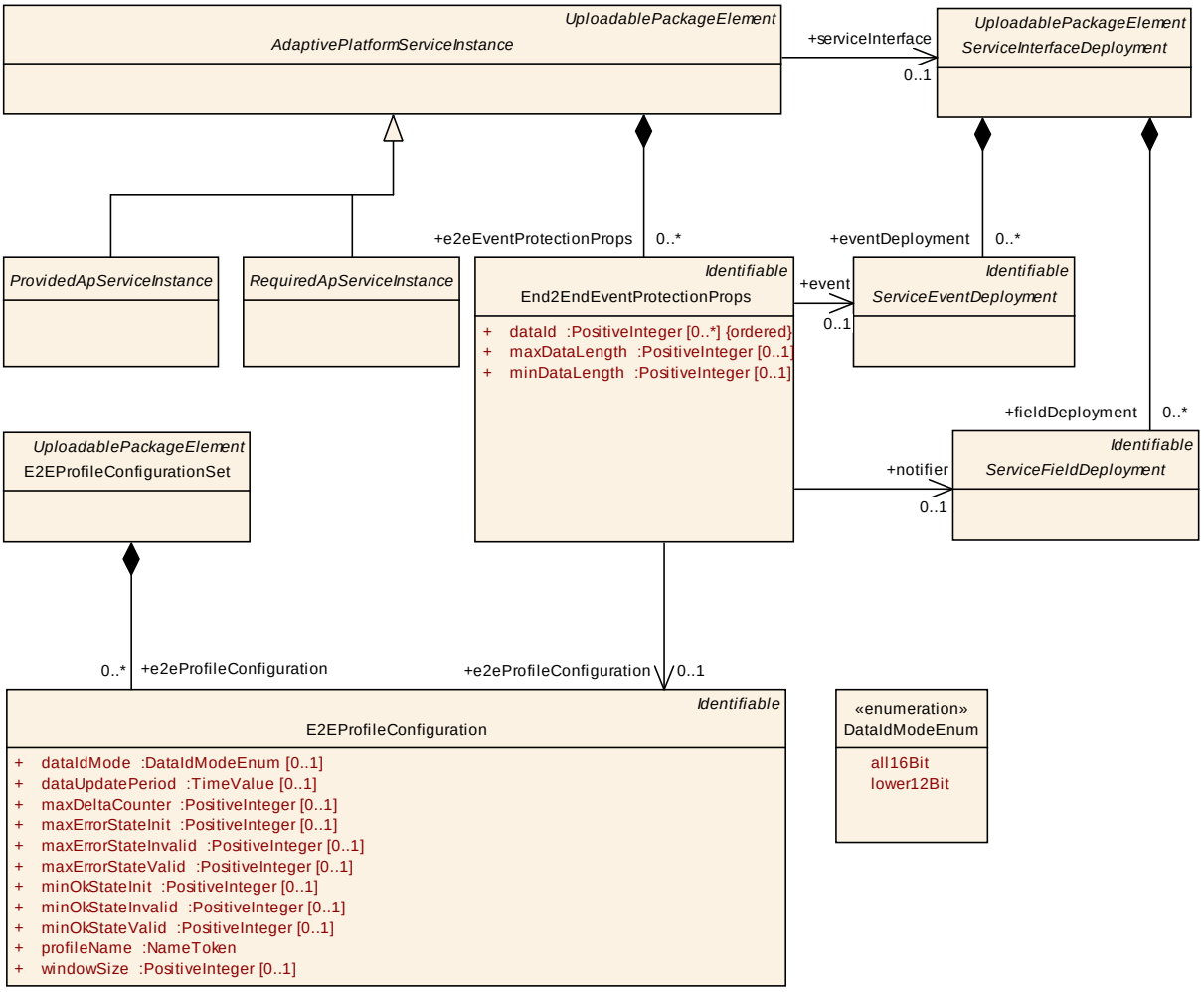


Figure 7.21: E2E EventProtection

[TPS_MANI_03130] Standardized `E2EProfileConfiguration.profileName` values ⌈ The `E2EProfileConfiguration.profileName` that is referenced by an `End2EndEventProtectionProps` can have the following values that are standardized by AUTOSAR: PROFILE_04, PROFILE_05, PROFILE_06, PROFILE_07, PROFILE_11, PROFILE_22. ⌋*(RS_MANI_00028)*

[TPS_MANI_03131] Non-Standardized `E2EProfileConfiguration.profileName` values ⌈ The values for the `profileName` of `E2EProfileConfiguration` mentioned in [TPS_MANI_03130] are standardized and reserved for being used in the way the AUTOSAR standard foresees. PROFILE_01 and PROFILE_02 are also reserved by AUTOSAR but excluded for usage in Adaptive AUTOSAR. In addition, it is positively possible to use other than the standardized values for the `profileName`. ⌋ *(RS_MANI_00028)*

[constr_3380] `End2EndEventProtectionProps` shall not reference an `event` and a `notifier` at the same time ⌈ The `End2EndEventProtectionProps` element shall reference either an `event` or a `notifier`. ⌋*()*

[TPS_MANI_03128] Usage of same `dataId` in case of Multi-Binding ⌈ In case of Multi-Binding, i.e. if different `AdaptivePlatformServiceInstance`s exist that are mapped by `ServiceInstanceToPortPrototypeMapping` to the same `PortPrototype`, the different `AdaptivePlatformServiceInstance`s may contain the same `dataId` for the same `event` or `notifier`. ⌋*(RS_MANI_00028)*

In other words if a `PortPrototype` contains two transport layer bindings, e.g. a `ProvidedSomeipServiceInstance` and a `ProvidedUserDefinedServiceInstance` representing an IPC communication then an `event` is allowed to be protected with the same `dataId` in both `AdaptivePlatformServiceInstance`s.

Class	**End2EndEventProtectionProps**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::E2E			
Note	This element allows to protect an event or a field notifier with an E2E profile. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dataId (ordered)	PositiveInteger	*	attr	This represents a unique numerical identifier for the referenced event or field notifier that is included in the CRC calculation. Note: ID is used for protection against masquerading. The details concerning the maximum number of values (this information is specific for each E2E profile) applicable for this attribute are controlled by a semantic constraint that depends on the category of the EndToEndProtection.
e2eProfileConfiguration	E2EProfileConfiguration	0..1	ref	Reference to E2E profile configuration settings that are valid to protect the referenced event or field notifier. **Tags:** atp.Status=draft
event	ServiceEventDeployment	0..1	ref	Reference to an event that is protected by the E2E profile. **Tags:** atp.Status=draft
maxDataLength	PositiveInteger	0..1	attr	Maximum length of Data in bits.
minDataLength	PositiveInteger	0..1	attr	Minimum length of Data in bits.
notifier	ServiceFieldDeployment	0..1	ref	Reference to a field notifier that is protected by an E2E profile. **Tags:** atp.Status=draft

Table 7.57: End2EndEventProtectionProps

Class	**E2EProfileConfigurationSet**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::E2E			
Note	This meta-class represents the ability to aggregate a collection of E2EProfileConfigurations. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft; atp.recommendedPackage=E2EProfileConfigurationSets			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
e2eProfileConfiguration	E2EProfileConfiguration	*	aggr	This represents the collection of E2EProfileConfigurations aggregated at the E2EProfileConfigurationSet. **Tags:** atp.Status=draft

Table 7.58: E2EProfileConfigurationSet

Class	**E2EProfileConfiguration**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::E2E			
Note	This element holds E2E profile specific configuration settings. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dataIdMode	DataIdModeEnum	0..1	attr	This attribute describes the inclusion mode that is used to include the implicit two-byte Data ID in the one-byte CRC.
dataUpdatePeriod	TimeValue	0..1	attr	This attribute describes the period in which the applications are assumed to process E2E-protected messages. The middleware does not use this attribute at all.
maxDeltaCounter	PositiveInteger	0..1	attr	Maximum allowed difference between two counter values of two consecutively received valid messages. For example, if the receiver gets data with counter 1 and MaxDeltaCounter is 3, then at the next reception the receiver can accept Counters with values 2, 3 or 4.
maxErrorStateInit	PositiveInteger	0..1	attr	Maximal number of checks in which ProfileStatus equal to E2E_P_ERROR was determined, within the last WindowSize checks, for the state E2E_SM_INIT.
maxErrorStateInvalid	PositiveInteger	0..1	attr	Maximal number of checks in which ProfileStatus equal to E2E_P_ERROR was determined, within the last WindowSize checks, for the state E2E_SM_INVALID.
maxErrorStateValid	PositiveInteger	0..1	attr	Maximal number of checks in which ProfileStatus equal to E2E_P_ERROR was determined, within the last WindowSize checks, for the state E2E_SM_VALID.

minOkState Init	PositiveInteger	0..1	attr	Minimal number of checks in which ProfileStatus equal to E2E_P_OK was determined, within the last WindowSize checks, for the state E2E_SM_INIT.
minOkState Invalid	PositiveInteger	0..1	attr	Minimal number of checks in which ProfileStatus equal to E2E_P_OK was determined, within the last WindowSize checks, for the state E2E_SM_INVALID.
minOkState Valid	PositiveInteger	0..1	attr	Minimal number of checks in which ProfileStatus equal to E2E_P_OK was determined, within the last WindowSize checks, for the state E2E_SM_VALID.
profileName	NameToken	1	attr	Definition of the E2E profile.
windowSize	PositiveInteger	0..1	attr	Size of the monitoring window for the E2E state machine.

Table 7.59: E2EProfileConfiguration

Enumeration	**DataIdModeEnum**
Package	M2::AUTOSARTemplates::SystemTemplate::Transformer
Note	Supported inclusion modes to include the implicit two-byte Data ID in the one-byte CRC.
Literal	***Description***
all16Bit	Two bytes are included in the CRC (double ID configuration). **Tags:** atp.EnumerationValue=0
lower12Bit	The low byte is included in the implicit CRC calculation, the low nibble of the high byte is transmitted along with the data (i.e. it is explicitly included), the high nibble of the high byte is not used. This is applicable for the IDs up to 12 bits. **Tags:** atp.EnumerationValue=2

Table 7.60: DataIdModeEnum

Please note that the configuration of the E2E state machines with the configuration attributes available in `E2EProfileConfiguration` is restricted by [constr_3176], [constr_3177], [constr_3178], [constr_3179], [constr_3180], [constr_3181] defined in the System Template [14].

It is possible to overwrite the E2E state machine configuration settings that are defined in `End2EndEventProtectionProps` (`e2eProfileConfiguration`) at the `RPortPrototype` of a `SwComponentType` with settings available in the `ReceiverComSpec` as described in [TPS_MANI_03132]. With this approach it is possible to define individual E2E settings for different receivers of the event or field notifier.

7.4 Secure Communication

AUTOSAR supports different protocols that provide communication security over a network. To configure the secured communication of ServiceInterface elements between a ProvidedApServiceInstance and a RequiredApServiceInstance the ServiceInterfaceElementSecureComConfig meta-class is defined.

[TPS_MANI_03133] Usage of ServiceInterfaceElementSecureComConfig ⌈
The ServiceInterfaceElementSecureComConfig element is used to define ServiceInterface element specific secure communication configuration settings in the context of an AdaptivePlatformServiceInstance. ⌋*(RS_MANI_00036)*

The modeling allows to protect selected elements of a ServiceInterface, like particular events or methods. And it allows to protect different elements of a ServiceInterface with different security protection mechanisms.

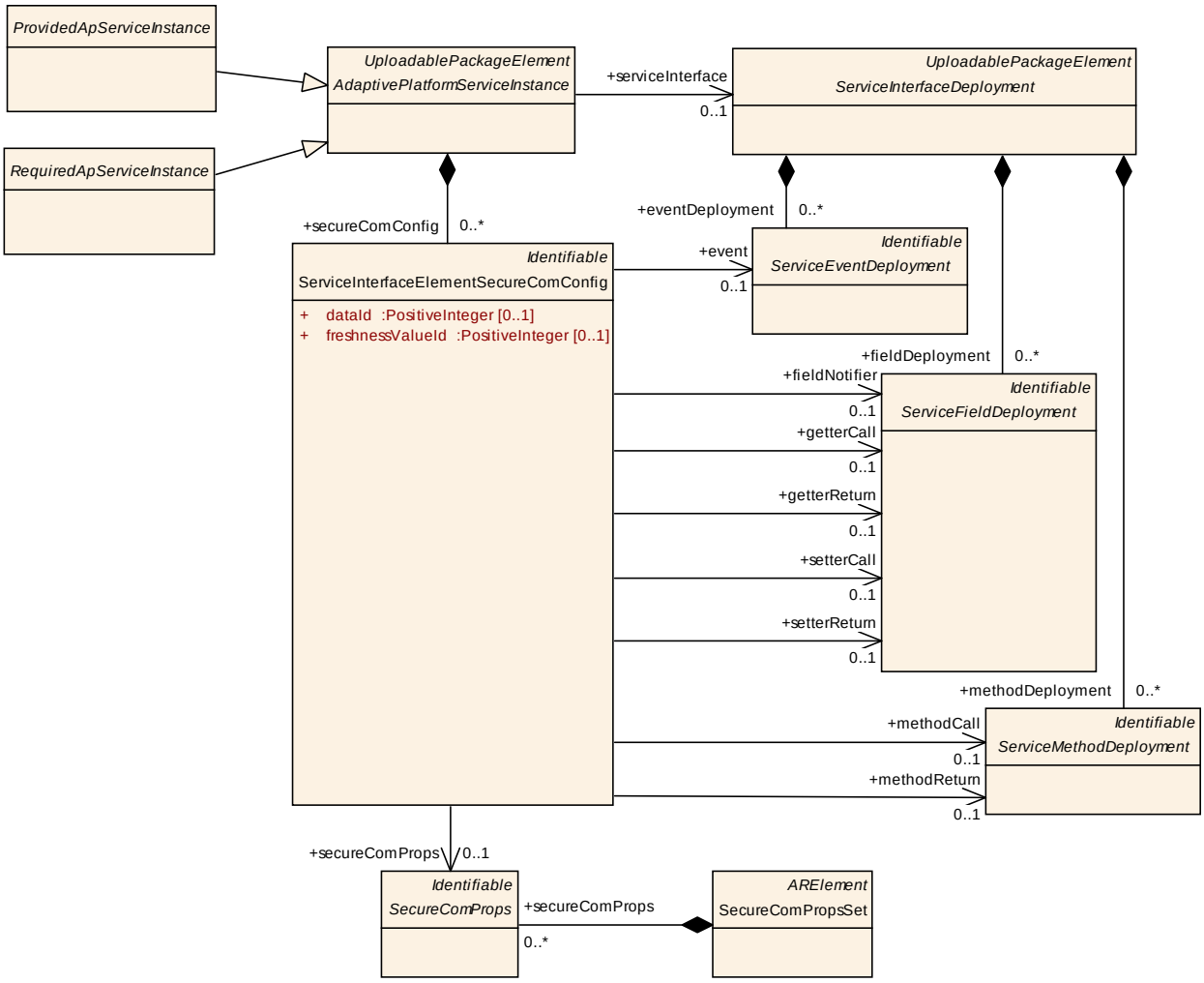


Figure 7.22: Secure Communication

Since the ServiceInterfaceElementSecureComConfig meta-class is aggregated by the abstract AdaptivePlatformServiceInstance it can be used to configure the secure communication on specific derived classes like Provided-

SomeipServiceInstance or RequiredSomeipServiceInstance that fit the underlying middleware. With this approach it is possible to define different communication security protections for different used transport layer mechanisms in case of Multi-Binding.

Class	**ServiceInterfaceElementSecureComConfig**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::SecureCommunication			
Note	This element allows to secure the communication of the referenced ServiceInterface element. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dataId	PositiveInteger	0..1	attr	This attribute defines a unique numerical identifier for the referenced ServiceInterface element.
event	ServiceEventDeployment	0..1	ref	Reference to an event that is protected by a security protocol. **Tags:** atp.Status=draft
fieldNotifier	ServiceFieldDeployment	0..1	ref	Reference to a field notifier that is protected by a security protocol. **Tags:** atp.Status=draft
freshnessValueId	PositiveInteger	0..1	attr	This attribute defines the Id of the Freshness Value.
getterCall	ServiceFieldDeployment	0..1	ref	Reference to a field getter call message that is protected by a security protocol. **Tags:** atp.Status=draft
getterReturn	ServiceFieldDeployment	0..1	ref	Reference to a field getter return message that is protected by a security protocol. **Tags:** atp.Status=draft
methodCall	ServiceMethodDeployment	0..1	ref	Reference to a method call message that is protected by a security protocol. **Tags:** atp.Status=draft
methodReturn	ServiceMethodDeployment	0..1	ref	Reference to a method return message that is protected by a security protocol. **Tags:** atp.Status=draft
secureComProps	SecureComProps	0..1	ref	Reference to the communication security protocol and its configuration settings that will provide communication security for the referenced ServiceInterfaceElement that is exchanged between a ProvidedServiceInstance and one or several RequiredServiceInstances. **Tags:** atp.Status=draft

setterCall	ServiceFieldDeployment	0..1	ref	Reference to a field setter call message that is protected by a security protocol. **Tags:** atp.Status=draft
setterReturn	ServiceFieldDeployment	0..1	ref	Reference to a field setter return message that is protected by a security protocol. **Tags:** atp.Status=draft

Table 7.61: ServiceInterfaceElementSecureComConfig

[constr_3391] `ServiceInterfaceElementSecureComConfig` references to `ServiceInterfaceDeployment` elements ⌈ `ServiceInterfaceElementSecureComConfig` element shall be defined for exactly one `ServiceInterface` element and shall therefore contain only one single reference to an element defined in the scope of a `ServiceInterfaceDeployment`. ⌋*()*

The attributes in the `ServiceInterfaceElementSecureComConfig` meta-class are defining configuration settings that are specific for the referenced `ServiceInterface` element. In addition the `ServiceInterfaceElementSecureComConfig` references the `SecureComProps` meta-class and defines with this reference the security protocol that will be used for the protection. The security protocol configuration settings that are defined in `SecureComProps` are not `ServiceInterface` element specific and may be reused by several `ServiceInterfaceElementSecureComConfig` elements.

Class	**SecureComPropsSet**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::SecureCommunication			
Note	This meta-class represents the ability to aggregate a collection of SecureComProps.. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft; atp.recommendedPackage=SecureComPropsSets			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
secureComProps	SecureComProps	*	aggr	This represents the collection of SecureComProps aggregated at the SecureComPropsSet. **Tags:** atp.Status=draft

Table 7.62: SecureComPropsSet

Class	***SecureComProps* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::SecureCommunication			
Note	This meta-class defines a communication security protocol and its configuration settings. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	SecOcSecureComProps, TlsSecureComProps			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 7.63: SecureComProps

7.4.1 Secure Communication over TLS

The configuration of the Transport Layer Security (TLS) and Datagram Transport Layer Security (DTLS) protocols is supported with the `TlsSecureComProps` meta-class, which is a specialization of `SecureComProps`.

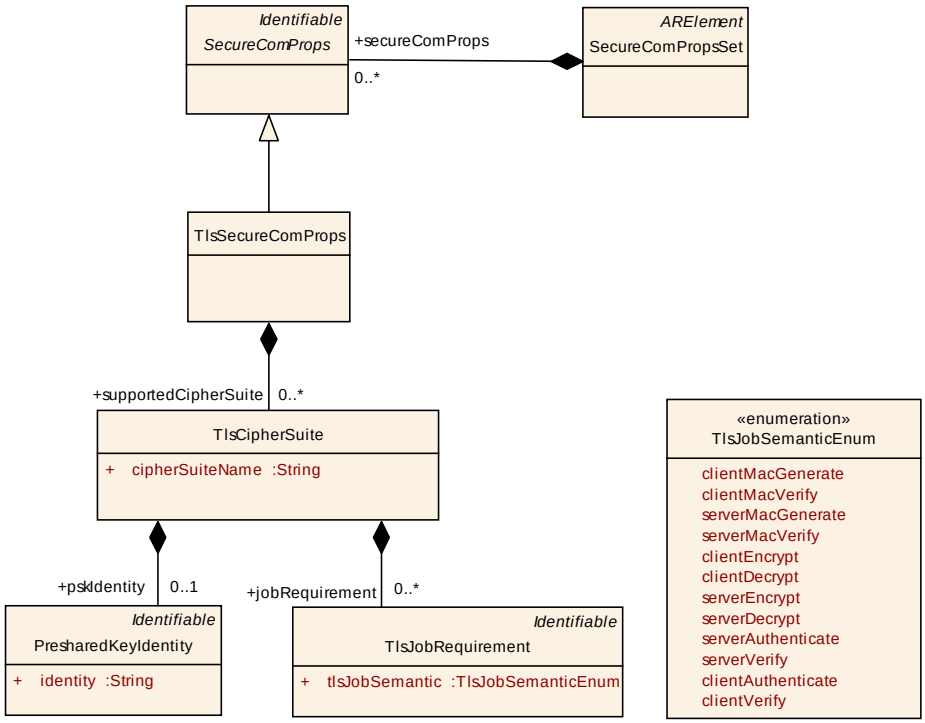


Figure 7.23: Secure Communication over TLS

Class	**TlsSecureComProps**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::SecureCommunication			
Note	Configuration of the Transport Layer Security protocol (TLS). **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *SecureComProps*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
supportedCipherSuite	TlsCipherSuite	*	aggr	Collection of supported cipher suites that are used to negotiate the security settings for a network connection. **Tags:** atp.Status=draft

Table 7.64: TlsSecureComProps

TLS is composed of the TLS Record Protocol and the TLS Handshake Protocol. The Record Protocol provides connection security and encrypts and authenticate packets. The record layer functions can be called at any time after the handshake process is finished, when there is need to receive or send data.

The Handshake Protocol allows the server and client to authenticate each other and to negotiate encryption algorithms and cryptographic keys before any data is exchanged.

In order to establish a cryptographically secure data channel, the communication partners in form of `AdaptivePlatformServiceInstance`s must agree on ciphersuites and on keys that will be used to encrypt the data.

The client sends a list of supported ciphersuites to the server. The server decides on a ciphersuite from the list provided by the client, and continues with the handshake.

[TPS_MANI_03134] Configuration of supported TLS ciphersuites ⌈ The supported TLS ciphersuites are configured on an `AdaptivePlatformServiceInstance` via `ServiceInterfaceElementSecureComConfig` with `TlsCipherSuite` elements that are aggregated by `TlsSecureComProps` in the role `supportedCipherSuite`. Each `TlsCipherSuite` element contains the `cipherSuiteName` attribute that describes the ciphersuite. ⌋*(RS_MANI_00036)*

Class	**TlsCipherSuite**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::SecureCommunication			
Note	This meta-class defines a cipher suite that is supported in TLS. It defines a named combination of authentication and encryption algorithms used to negotiate the security settings for a network connection that uses the Transport Layer Security. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
cipherSuiteName	String	1	attr	This attributes defines the CipherSuite name. e.g. "TLS_RSA_WITH_RC4_128_MD5".
jobRequirement	TlsJobRequirement	*	aggr	Collection of cryptographic job requirements. **Tags:** atp.Status=draft

pskIdentity	PresharedKeyIdentity	0..1	aggr	Configuration of TLS-PSK identity that will be send from the client to the server. **Tags:** atp.Status=draft

Table 7.65: TlsCipherSuite

If the client and the server are able to negotiate a cipher, and the client accepts the certificate provided by the server then the client will initiate the key exchange. The client indicates which key to use by sending a PSK identity to the server.

[TPS_MANI_03135] Configuration of TLS PSK Identity ⌈ The TLS PSK Identity is configured with the `PresharedKeyIdentity.identity` attribute. ⌋ *(RS_MANI_00036)*

Class	**PresharedKeyIdentity**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::SecureCommunication			
Note	TLS-PSK are symmetric keys that are shared in advance among the communicating parties, to establish a TLS connection. The client indicates which key to use by sending a PSK identity to the server. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
identity	String	1	attr	This attribute defines the PSK identity that is sent from the client to the server to indicate which PreSharedKey will be used for the handshake.

Table 7.66: PresharedKeyIdentity

Please note that it is of course allowed that the different `ServiceInterfaceElementSecureComConfig` elements of a `RequiredApServiceInstance` point to the same `TlsSecureComProps` to indicate that the same secure channel is used for the complete outgoing service communication.

After the successful handshake the encryption and/or authentication of the data that is referenced by the `ServiceInterfaceElementSecureComConfig` will be provided. The cryptographic jobs that need to be supported by the communication partners are defined by `TlsJobRequirement`.

[TPS_MANI_03136] Configuration of requirements for the TLS cryptographic job ⌈ The TLS Job requirements are configured with the `TlsJobRequirement.tlsJobSemantic` attribute. ⌋*(RS_MANI_00036)*

Class	**TlsJobRequirement**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::SecureCommunication			
Note	Requirements for the cryptographic job that need to be executed. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
tlsJobSemantic	TlsJobSemanticEnum	1	attr	This attribute defines the cryptographic algorithm that needs to be supported.

Table 7.67: TlsJobRequirement

Enumeration	**TlsJobSemanticEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::SecureCommunication
Note	List of cryptographic routines supported by TLS. **Tags:** atp.Status=draft
Literal	***Description***
clientAuthenticate	Client supports the generation of a Signature. **Tags:** atp.EnumerationValue=10
clientDecrypt	Client supports decryption. **Tags:** atp.EnumerationValue=5
clientEncrypt	Client supports encryption. **Tags:** atp.EnumerationValue=4
clientMacGenerate	Client supports the generation of a Message Authentication Code **Tags:** atp.EnumerationValue=0
clientMacVerify	Client supports the verification of a Message Authentication Code **Tags:** atp.EnumerationValue=1
clientVerify	Client supports the verification of a Signature. **Tags:** atp.EnumerationValue=11
serverAuthenticate	Server supports the generation of a Signature. **Tags:** atp.EnumerationValue=8
serverDecrypt	Server supports decryption. **Tags:** atp.EnumerationValue=7
serverEncrypt	Server supports encryption. **Tags:** atp.EnumerationValue=6
serverMacGenerate	Server supports the generation of a Message Authentication Code **Tags:** atp.EnumerationValue=2
serverMacVerify	Server supports the verification of a Message Authentication Code **Tags:** atp.EnumerationValue=3

serverVerify	Server supports the verification of a Signature. **Tags:** atp.EnumerationValue=9

Table 7.68: TlsJobSemanticEnum

[TPS_MANI_03137] ServiceInterfaceElementSecureComConfig.dataId and ServiceInterfaceElementSecureComConfig.freshnessValueId are not relevant in case of TLS communication ⌈ The attributes ServiceInterfaceElementSecureComConfig.dataId and ServiceInterfaceElementSecureComConfig.freshnessValueId are not relevant in case that the ServiceInterfaceElementSecureComConfig refers to TlsSecureComProps. ⌋ *(RS_MANI_00036)*

7.4.2 Secure Communication over SecOC

AUTOSAR Secure Onboard Communication (SecOC) supports symmetric and asymmetric authentication approaches. To configure the SecOC secure protection of a message by a MAC or Signature the ServiceInterfaceElementSecureComConfig element needs to point to SecOcSecureComProps that contains the relevant configuration settings.

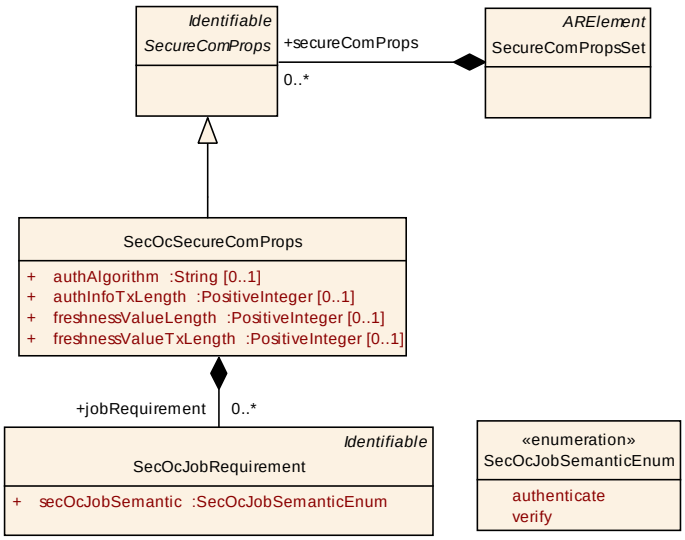


Figure 7.24: Secure Communication over SecOC

[constr_3392] ServiceInterfaceElementSecureComConfig.dataId and ServiceInterfaceElementSecureComConfig.freshnessValueId are mandatory in case of SecOC communication ⌈ The attributes ServiceInterfaceElementSecureComConfig.dataId and ServiceInterfaceElementSecureComConfig.freshnessValueId are mandatory in case that ServiceInterfaceElementSecureComConfig refers to SecOcSecureComProps. ⌋ *()*

[TPS_MANI_03138] SecOC Security Profile ⌈ The SecOC security profile is defined by `SecOcSecureComProps.category`. ⌋*(RS_MANI_00036)*

Class	**SecOcSecureComProps**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::SecureCommunication			
Note	Configuration of AUTOSAR SecOC. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *SecureComProps*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
authAlgorithm	String	0..1	attr	This attribute defines the authentication algorithm used for MAC generation and verification.
authInfoTxLength	PositiveInteger	0..1	attr	This attribute defines the length in bits of the authentication code to be included in the payload of the authenticated Message.
freshnessValueLength	PositiveInteger	0..1	attr	This attribute defines the complete length in bits of the Freshness Value.
freshnessValueTxLength	PositiveInteger	0..1	attr	This attribute defines the length in bits of the Freshness Value to be included in the payload of the secured message. In other words this attribute defines the length of the authenticated Message.
jobRequirement	SecOcJobRequirement	*	aggr	Collection of cryptographic job requirements. **Tags:** atp.Status=draft

Table 7.69: SecOcSecureComProps

[TPS_MANI_03139] Standardized SecOC Security Profiles ⌈ The SecOC security profile that is defined by `SecOcSecureComProps.category` can have the following values that are standardized by AUTOSAR: PROFILE_01, PROFILE_02, PROFILE_03. ⌋*(RS_MANI_00036)*

The attribute values for the predefined categories mentioned in [TPS_MANI_03139] are defined in [constr_3325] in [14].

[TPS_MANI_03140] Non-Standardized SecOC Security Profiles ⌈ The values for the `SecOcSecureComProps.category` mentioned in [TPS_MANI_03139] are standardized and reserved for being used in the way the AUTOSAR standard foresees. In addition, it is positively possible to use other than the standardized values for the `SecOcSecureComProps.category`. ⌋*(RS_MANI_00036)*

With the `SecOcJobRequirement` the cryptographic routines can be selected that need to be supported. In case of SecOC it can be selected whether the symmetric and/or asymmetric authentication approach is needed.

Class	**SecOcJobRequirement**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::SecureCommunication			
Note	Requirements for the cryptographic job that need to be executed. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
secOcJobSemantic	SecOcJobSemanticEnum	1	attr	This attribute defines the cryptographic algorithm that needs to be supported.

Table 7.70: SecOcJobRequirement

Enumeration	**SecOcJobSemanticEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::SecureCommunication
Note	List of cryptographic routines supported by SecOC. **Tags:** atp.Status=draft
Literal	***Description***
authenticate	Authentication algorithm for Authenticator generation/verification. **Tags:** atp.EnumerationValue=0
verify	Asymmetric cryptographic algorithm to generate/verify a signature **Tags:** atp.EnumerationValue=1

Table 7.71: SecOcJobSemanticEnum

7.5 Log and Trace

The Log and Trace functionality in AUTOSAR supports the monitoring of applications and provides means to forward logging information onto the communication bus, the console, or to the file system. The logging information is put into a standardized delivery and presentation format that is described in more detail in the Log and Trace Protocol specification [24]. The format contains meta-data that identifies for example the application that produces the logging information.

This chapter describes settings that are available in the Application Manifest and Service Instance Manifest to configure the logging framework. Some of these settings will be put as meta-data into the Log and Trace messages.

[TPS_MANI_03160] Log and Trace configuration options in the Application Manifest ⌈

- The `logTraceProcessId` in the `Process` identifies the application instance and is put as `ApplicationId` into the log and trace message.
- The `logTraceProcessDesc` in the `Process` is an optional setting that allows to describe the `logTraceProcessId` as descriptive text.

- logTraceLogMode in the Process defines the destination to which the log messages will be forwarded.
- logTraceDefaultLogLevel in the Process defines the initial log reporting level for the application instance. The log level defines the severity grade of the Log Message.
- logTraceFilePath in the Process This attribute defines the destination file to which the logging information is passed.

⌋(*RS_MANI_00037*)

[constr_3426] The logTraceFilePath is mandatory in case that logTraceLogMode is set to file ⌈ In case that the logTraceLogMode is set to file the logTraceFilePath shall be set to a value. ⌋()

[constr_3427] The logTraceFilePath is only relevant if logTraceLogMode is set to file ⌈ The logTraceFilePath shall only be used if logTraceLogMode is set to file. ⌋()

[TPS_MANI_03161] Log and Trace configuration options in the Service Instance Manifest ⌈

- The enablesLogTrace flag in the ServiceInstanceToPortPrototypeMapping enables or disables the tracing of the communication over the referenced PortPrototype of the referenced Process.
- The logTracePortId identifies the communication of the referenced Process and is put as ContextId into the log and trace message.

⌋(*RS_MANI_00037*)

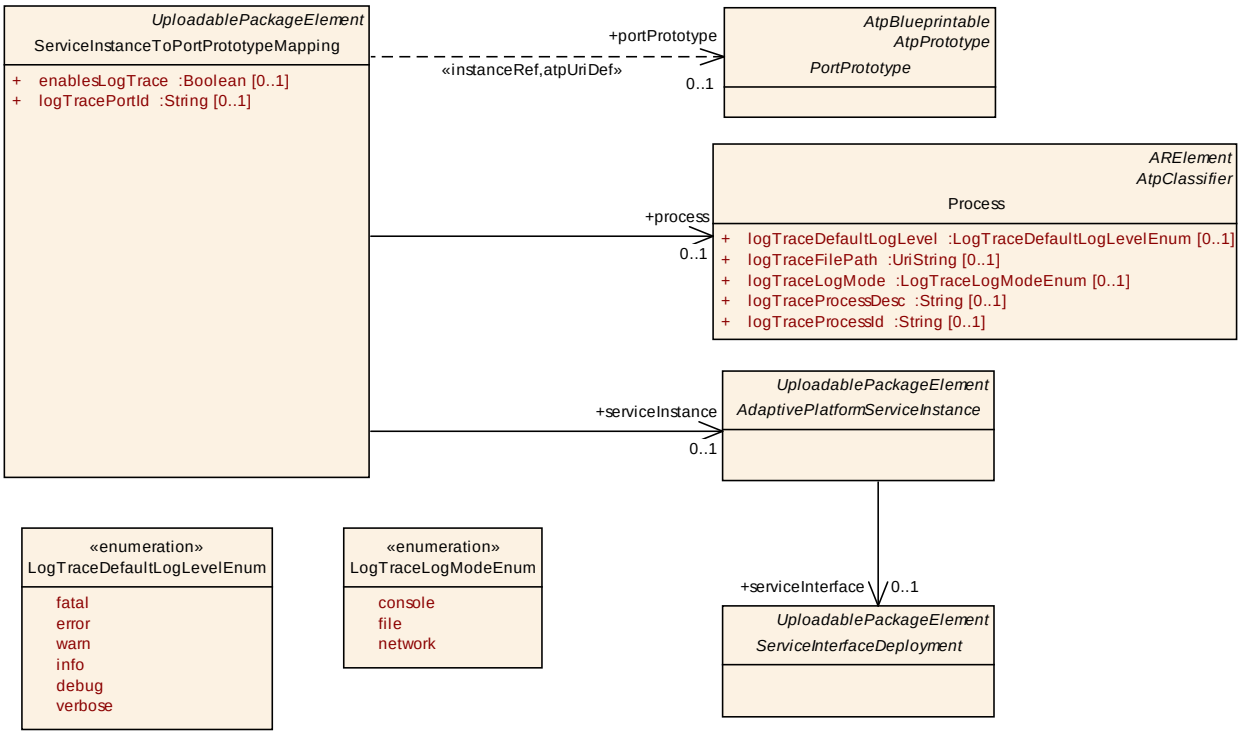


Figure 7.25: Log and Trace configuration in Application- and ServiceInstanceManifest

The output channel on Ethernet for the Log and Trace messages is configured in the Machine Manifest. The `LogAndTraceInstantiation` aggregates a `NetworkConfiguration` in the role `networkConfiguration` that allows to specify over which Transport Protocol (Udp or Tcp), Port and IP Address the messages are transported.

Enumeration	**LogTraceLogModeEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Process
Note	This enum defines the possible destinations of a log&trace message. **Tags:** atp.Status=draft
Literal	***Description***
console	Destination of log message will be the console output. **Tags:** atp.EnumerationValue=0
file	Destination of log message will be a file on the file system. **Tags:** atp.EnumerationValue=1
network	Log message will be transmitted over the communication bus. **Tags:** atp.EnumerationValue=2

Table 7.72: LogTraceLogModeEnum

Enumeration	**LogTraceDefaultLogLevelEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Process

Note	This enum defines available log&trace log levels that may be used to define the severity level of a log message. **Tags:** atp.Status=draft
Literal	***Description***
debug	Detailed information for programmers **Tags:** atp.EnumerationValue=4
error	Error with impact to correct functionality **Tags:** atp.EnumerationValue=1
fatal	Fatal error **Tags:** atp.EnumerationValue=0
info	High level information **Tags:** atp.EnumerationValue=3
verbose	Verbose debug message **Tags:** atp.EnumerationValue=5
warn	Warning if correct behavior cannot be ensured **Tags:** atp.EnumerationValue=2

Table 7.73: LogTraceDefaultLogLevelEnum

8 Machine Manifest

The Machine meta-class defines the entity on which one *Adaptive AUTOSAR Software Stack* is running with an operating system. The Machine may be physical or virtual.

Some aspects of the actual Machine are already available from the System Design (see chapter 9.2) at the MachineDesign. The information defined at the MachineDesign is avaiable to the Machine as well since Machine has a reference to the MachineDesign in the role machineDesign (see figure 9.1).

The Machine is able to aggregate one or several Processors. And each Processor consists of one or several ProcessorCores.

Meta-class ProcessorCore provides attribute coreId that can be used e.g. in a bitmask to better control the utilization of processing resources.

[constr_1549] Value of ProcessorCore.coreId ⌈ The value of ProcessorCore.coreId shall be unique in the context of the enclosing Processor. ⌋*()*

An overview of the Machine meta-class is sketched in Figure 8.1.

[TPS_MANI_03035] Content of the Machine configuration ⌈ The purpose of the Machine is to provide machine specific configuration settings. ⌋*(RS_MANI_00020, RS_MANI_00021, RS_MANI_00022, RS_MANI_00023)*

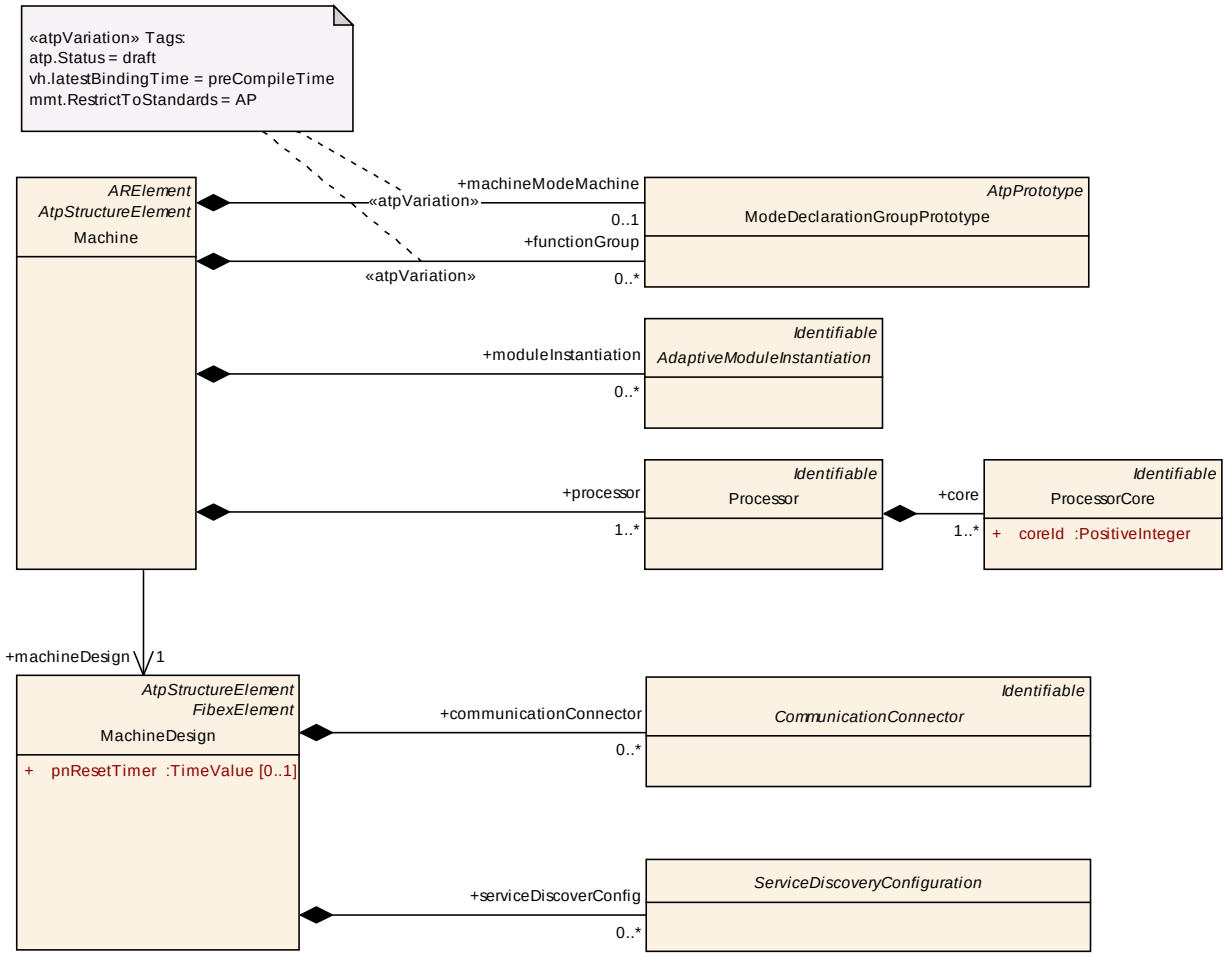


Figure 8.1: Overview about the content of the Machine configuration

Class	**Machine**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Machine			
Note	Machine that represents an Adaptive Autosar Software Stack. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft; atp.recommended Package=Machines			
Base	*ARElement*, *ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Collectable Element*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
defaultApplicationTimeout	EnterExitTimeout	0..1	aggr	This aggration defines a default timeout in the context of a given Machine with respect to the launching and termination of applications. **Tags:** atp.Status=draft
functionGroup	ModeDeclarationGroupPrototype	*	aggr	This aggregation represents the collection of function groups of the enclosing Machine. **Stereotypes:** atpVariation **Tags:** atp.Status=draft vh.latestBindingTime=preCompileTime

hwElement	HwElement	*	ref	This reference is used to describe the hardware resources of the machine. **Stereotypes:** atpUriDef **Tags:** atp.Status=draft
machineDesign	MachineDesign	1	ref	Reference to the MachineDesign this Machine is implementing. **Tags:** atp.Status=draft
machineModeMachine	ModeDeclarationGroupPrototype	0..1	aggr	Set of MachineStates (Modes) that are defined for the machine. **Stereotypes:** atpVariation **Tags:** atp.Status=draft vh.latestBindingTime=preCompileTime
moduleInstantiation	AdaptiveModuleInstantiation	*	aggr	Configuration of Adaptive Autosar module instances that are running on the machine. **Tags:** atp.Status=draft
perStateTimeout	PerStateTimeout	*	aggr	This aggregation represens the definition of per-state-timeouts in the context of the enclosing machine. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=perStateTimeout; atp.Status=draft
processor	Processor	1..*	aggr	This represents the collection of processors owned by the enclosing machine. **Tags:** atp.Status=draft
secureCommunicationDeployment	SecureCommunicationDeployment	*	aggr	Deployment of secure communication protocol configuration settings to crypto module entities. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=shortName, variationPoint.shortLabel; atp.Status=draft

Table 8.1: Machine

Class	**Processor**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Machine			
Note	This represents a processor for the execution of an AUTOSAR adaptive platform **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
core	ProcessorCore	1..*	aggr	This represents the collection of cores onwed by the enclosing processor. **Tags:** atp.Status=draft

Table 8.2: Processor

Class	**ProcessorCore**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Machine			
Note	This meta-class represents the ability to model a processor core for the execution of an AUTOSAR adaptive platform. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
coreId	PositiveInteger	1	attr	This attribute represents a numerical value assigned to the specific core. The value can be taken e.g. for use in a bitmask.

Table 8.3: ProcessorCore

8.1 Hardware Resources

[TPS_MANI_03065] Hardware resources of the machine ⌈ With the `Machine.hwElement` reference it is possible to formally describe the hardware of the machine. ⌋*(RS_MANI_00020)*

The `HwElement` is the main describing element that is used for example to describe Processing units, memory, peripherals and sensors/actuators.

The `HwCategory` that is referenced by the `HwElement` defines the hardware type and the applicable attribute definitions are defined by `HwAttributeDef`. An attribute value can be assigned to `HwAttributeDef` by `hwAttributeValue`.

Predefined categories and corresponding attributes are described in the Ecu Resource Template [25].

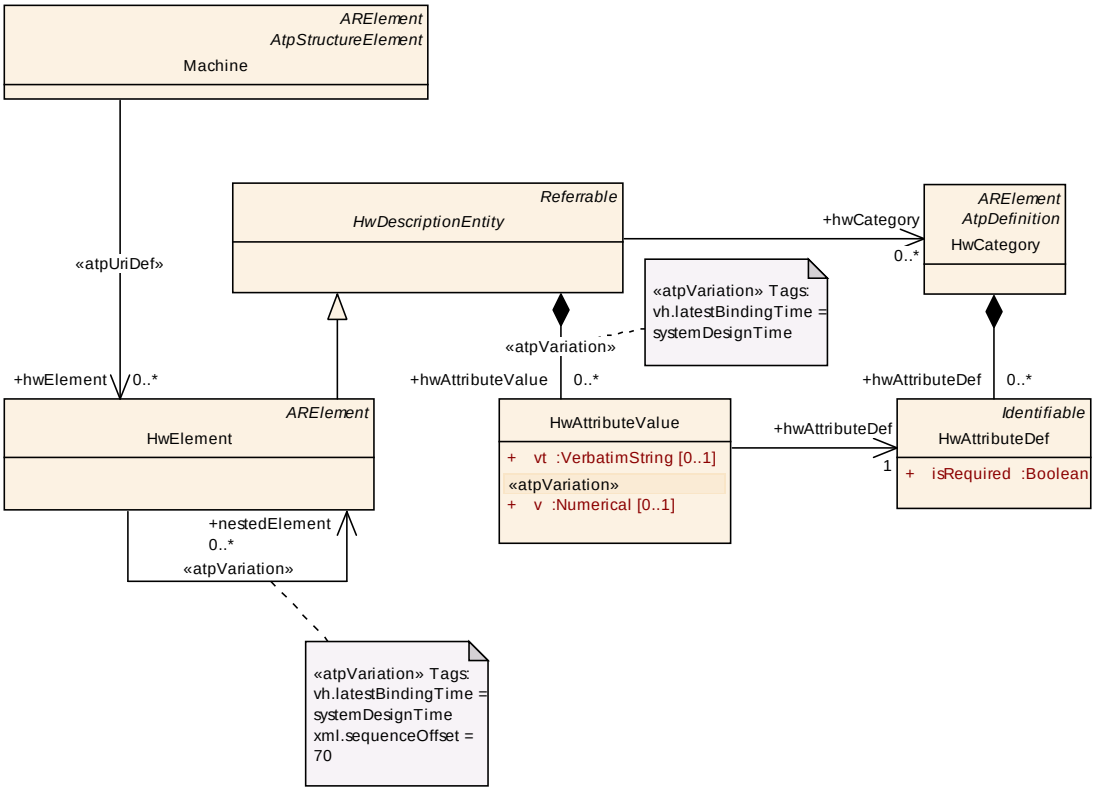


Figure 8.2: Description of hardware resources of the machine

Class	**HwElement**			
Package	M2::AUTOSARTemplates::EcuResourceTemplate			
Note	This represents the ability to describe Hardware Elements on an instance level. The particular types of hardware are distinguished by the category. This category determines the applicable attributes. The possible categories and attributes are defined in HwCategory. **Tags:** atp.recommendedPackage=HwElements			
Base	*ARElement*, *ARObject*, *CollectableElement*, *HwDescriptionEntity*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
hwElement Connection	HwElementConnector	*	aggr	This represents one particular connection between two hardware elements. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=systemDesignTime xml.sequenceOffset=110
hwPinGroup	HwPinGroup	*	aggr	This aggregation is used to describe the connection facilities of a hardware element. Note that hardware element has no pins but only pingroups. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=systemDesignTime xml.sequenceOffset=90

nestedElement	HwElement	*	ref	This association is used to establish hierarchies of hw elements. Note that one particular HwElement can be target of this association only once. I.e. multiple instantiation of the same HwElement is not supported (at any hierarchy level). **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=systemDesignTime xml.sequenceOffset=70

Table 8.4: HwElement

Class	***HwDescriptionEntity* (abstract)**			
Package	M2::AUTOSARTemplates::EcuResourceTemplate			
Note	This meta-class represents the ability to describe a hardware entity.			
Base	*ARObject*, *Referrable*			
Subclasses	HwElement, HwPin, HwPinGroup, HwType			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
hwAttributeValue	HwAttributeValue	*	aggr	This aggregation represents a particular hardware attribute value. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=systemDesignTime xml.sequenceOffset=50
hwCategory	HwCategory	*	ref	One of the associations representing one particular category of the hardware entity. **Tags:** xml.sequenceOffset=30
hwType	HwType	0..1	ref	This association is used to assign an optional HwType which contains the common attribute values for all occurences of this HwDescriptionEntity. Note that HwTypes can not be redefined and therefore shall not have a hwType reference.

Table 8.5: HwDescriptionEntity

Class	**HwAttributeValue**			
Package	M2::AUTOSARTemplates::EcuResourceTemplate::HwElementCategory			
Note	This metaclass represents the ability to assign a hardware attribute value. Note that v and vt are mutually exclusive.			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
annotation	Annotation	0..1	aggr	Optional annotation that can be added to each HwAttributeValue.
hwAttributeDef	HwAttributeDef	1	ref	This association represents the definition of the particular hardware attribute value.

v	Numerical	0..1	attr	This represents a numerical hardware attribute value. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=systemDesignTime
vt	VerbatimString	0..1	attr	This represents a textual hardware attribute value.

Table 8.6: HwAttributeValue

Class	**HwCategory**			
Package	M2::AUTOSARTemplates::EcuResourceTemplate::HwElementCategory			
Note	This metaclass represents the ability to declare hardware categories and its particular attributes. **Tags:** atp.recommendedPackage=HwCategorys			
Base	*ARElement*, *ARObject*, *AtpDefinition*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
hwAttributeDef	HwAttributeDef	*	aggr	This aggregation describes particular hardware attribute definition.

Table 8.7: HwCategory

Class	**HwAttributeDef**			
Package	M2::AUTOSARTemplates::EcuResourceTemplate::HwElementCategory			
Note	This metaclass represents the ability to define a particular hardware attribute. The category of this element defines the type of the attributeValue. If the category is Enumeration the hwAttributeEnumerationLiterals specify the available literals.			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
hwAttributeLiteral	HwAttributeLiteralDef	*	aggr	The available EnumerationLiterals of the Enumeration definition. Only applicable if the category of the HwAttributeDef equals Enumeration.
isRequired	Boolean	1	attr	This attribute specifies if the defined attribute value is required to be provided.
unit	Unit	0..1	ref	This association specifies the physical unit of the defined hardware attribute. This is optional due to the fact that there are textual attributes.

Table 8.8: HwAttributeDef

8.2 Machine States

[TPS_MANI_03066] Description of machine states ⌈ With the machineModeMachine aggregation it is possible to define a set of Modes (States) as ModeDeclarationGroupPrototype in the context of a Machine.

The ModeDeclarationGroupPrototype points to a reusable ModeDeclarationGroup in the role type that contains the different modes as ModeDeclarations and a designated initialMode. ⌋*(RS_MANI_00021)*

Please note that the startup of a Process may depend on Modes that are defined in the context of a Machine. The ModeDependentStartupConfig is described in chapter 6.2.

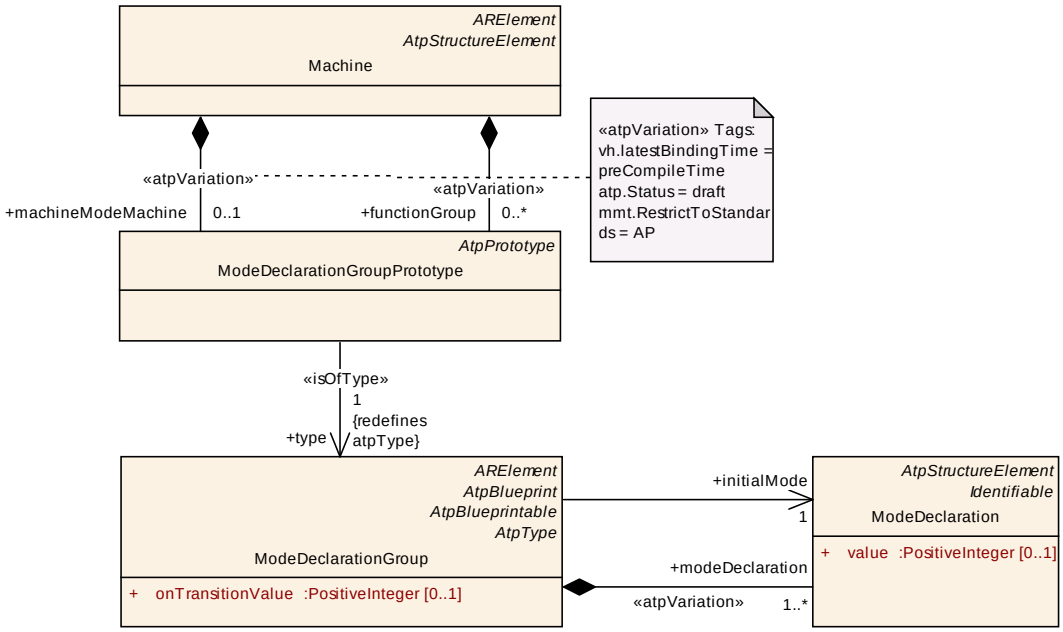


Figure 8.3: Configuration of Machine States

Class	**ModeDeclarationGroupPrototype**			
Package	M2::AUTOSARTemplates::CommonStructure::ModeDeclaration			
Note	The ModeDeclarationGroupPrototype specifies a set of Modes (ModeDeclarationGroup) which is provided or required in the given context. **Tags:** atp.ManifestKind=ApplicationManifest,MachineManifest			
Base	*ARObject*, *AtpFeature*, *AtpPrototype*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
type	ModeDeclarationGroup	1	tref	The "collection of ModeDeclarations" (= ModeDeclarationGroup) supported by a component **Stereotypes:** isOfType

Table 8.9: ModeDeclarationGroupPrototype

Class	**ModeDeclarationGroup**			
Package	M2::AUTOSARTemplates::CommonStructure::ModeDeclaration			
Note	A collection of Mode Declarations. Also, the initial mode is explicitly identified. **Tags:** atp.ManifestKind=ApplicationManifest,MachineManifest; atp.recommended Package=ModeDeclarationGroups			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
initialMode	ModeDeclaration	1	ref	The initial mode of the ModeDeclarationGroup. This mode is active before any mode switches occurred.
modeDeclaration	ModeDeclaration	1..*	aggr	The ModeDeclarations collected in this ModeDeclarationGroup. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=blueprintDerivationTime
modeManagerErrorBehavior	ModeErrorBehavior	0..1	aggr	This represents the ability to define the error behavior expected by the mode manager in case of errors on the mode user side (e.g. terminated mode user).
modeTransition	ModeTransition	*	aggr	This represents the avaliable ModeTransitions of the ModeDeclarationGroup
modeUserErrorBehavior	ModeErrorBehavior	0..1	aggr	This represents the definition of the error behavior expected by the mode user in case of errors on the mode manager side (e.g. terminated mode manager).
onTransitionValue	PositiveInteger	0..1	attr	The value of this attribute shall be taken into account by the RTE generator for programmatically representing a value used for the transition between two statuses.

Table 8.10: ModeDeclarationGroup

Class	**ModeDeclaration**			
Package	M2::AUTOSARTemplates::CommonStructure::ModeDeclaration			
Note	Declaration of one Mode. The name and semantics of a specific mode is not defined in the meta-model. **Tags:** atp.ManifestKind=ApplicationManifest,MachineManifest			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
value	PositiveInteger	0..1	attr	The RTE shall take the value of this attribute for generating the source code representation of this ModeDeclaration.

Table 8.11: ModeDeclaration

8.3 Function Groups

Function groups with function group states individually control groups of functionally coherent Application processes. The `Process` state may depend on a mode that is defined in the function group in case that the `ModeDependentStartupConfig` refers to the function group state with the `functionGroup` reference.

The usage of Function Groups is described in more detail in [20].

[TPS_MANI_03145] Description of a function group ⌈ With the `functionGroup` aggregation it is possible to define a function group that has a `shortName` and a set of Modes (States) as `ModeDeclarationGroupPrototype` in the context of a `Machine`.

The `ModeDeclarationGroupPrototype` points to a reusable `ModeDeclarationGroup` in the role `type` that contains the different modes as `ModeDeclaration`s and a designated `initialMode`. ⌋*(RS_MANI_00041)*

[TPS_MANI_03194] Function Group State ⌈ A function group state is described by a `ModeDeclaration` within a `ModeDeclarationGroup` that is referenced by a `ModeDeclarationGroupPrototype` aggregated as `functionGroup` by a `Machine`. The function group state is identified by its `shortName`. ⌋*(RS_MANI_00041)*

[TPS_MANI_03195] Off state in Function Group ⌈ Each `functionGroup` shall have an `Off` `ModeDeclaration` defined. This `Off` `ModeDeclaration` shall also be the `initialMode` of the `functionGroup`. ⌋*(RS_MANI_00041)*

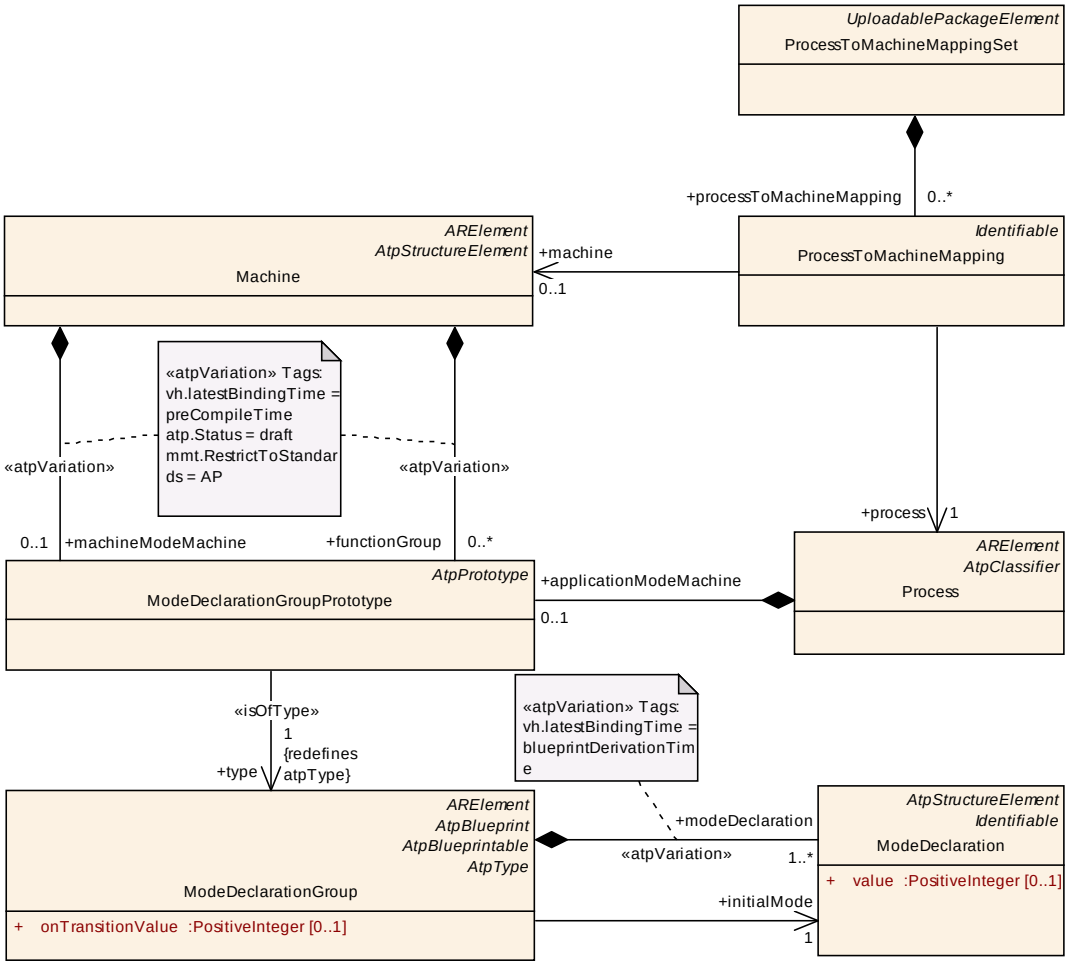


Figure 8.4: Configuration of Function Groups

Class	**ModeDeclarationGroupPrototype**			
Package	M2::AUTOSARTemplates::CommonStructure::ModeDeclaration			
Note	The ModeDeclarationGroupPrototype specifies a set of Modes (ModeDeclarationGroup) which is provided or required in the given context. **Tags:** atp.ManifestKind=ApplicationManifest,MachineManifest			
Base	*ARObject*, *AtpFeature*, *AtpPrototype*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
type	ModeDeclarationGroup	1	tref	The "collection of ModeDeclarations" (= ModeDeclarationGroup) supported by a component **Stereotypes:** isOfType

Table 8.12: ModeDeclarationGroupPrototype

Class	**ModeDeclarationGroup**			
Package	M2::AUTOSARTemplates::CommonStructure::ModeDeclaration			
Note	A collection of Mode Declarations. Also, the initial mode is explicitly identified. **Tags:** atp.ManifestKind=ApplicationManifest,MachineManifest; atp.recommended Package=ModeDeclarationGroups			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
initialMode	ModeDeclaration	1	ref	The initial mode of the ModeDeclarationGroup. This mode is active before any mode switches occurred.
modeDeclaration	ModeDeclaration	1..*	aggr	The ModeDeclarations collected in this ModeDeclarationGroup. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=blueprintDerivationTime
modeManagerErrorBehavior	ModeErrorBehavior	0..1	aggr	This represents the ability to define the error behavior expected by the mode manager in case of errors on the mode user side (e.g. terminated mode user).
modeTransition	ModeTransition	*	aggr	This represents the avaliable ModeTransitions of the ModeDeclarationGroup
modeUserErrorBehavior	ModeErrorBehavior	0..1	aggr	This represents the definition of the error behavior expected by the mode user in case of errors on the mode manager side (e.g. terminated mode manager).
onTransitionValue	PositiveInteger	0..1	attr	The value of this attribute shall be taken into account by the RTE generator for programmatically representing a value used for the transition between two statuses.

Table 8.13: ModeDeclarationGroup

Class	**ModeDeclaration**			
Package	M2::AUTOSARTemplates::CommonStructure::ModeDeclaration			
Note	Declaration of one Mode. The name and semantics of a specific mode is not defined in the meta-model. **Tags:** atp.ManifestKind=ApplicationManifest,MachineManifest			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
value	PositiveInteger	0..1	attr	The RTE shall take the value of this attribute for generating the source code representation of this ModeDeclaration.

Table 8.14: ModeDeclaration

8.4 State Timeouts

[TPS_MANI_03146] Configuration of timeouts for a selected machine state or function group state ⌈ With the PerStateTimeout meta-class that is aggregated by the Machine in the role perStateTimeout it is possible to define EnterExitTimeouts for a selected machine state or function group state. The state for which the timeout is defined is specified by the PerStateTimeout.state reference. ⌋()

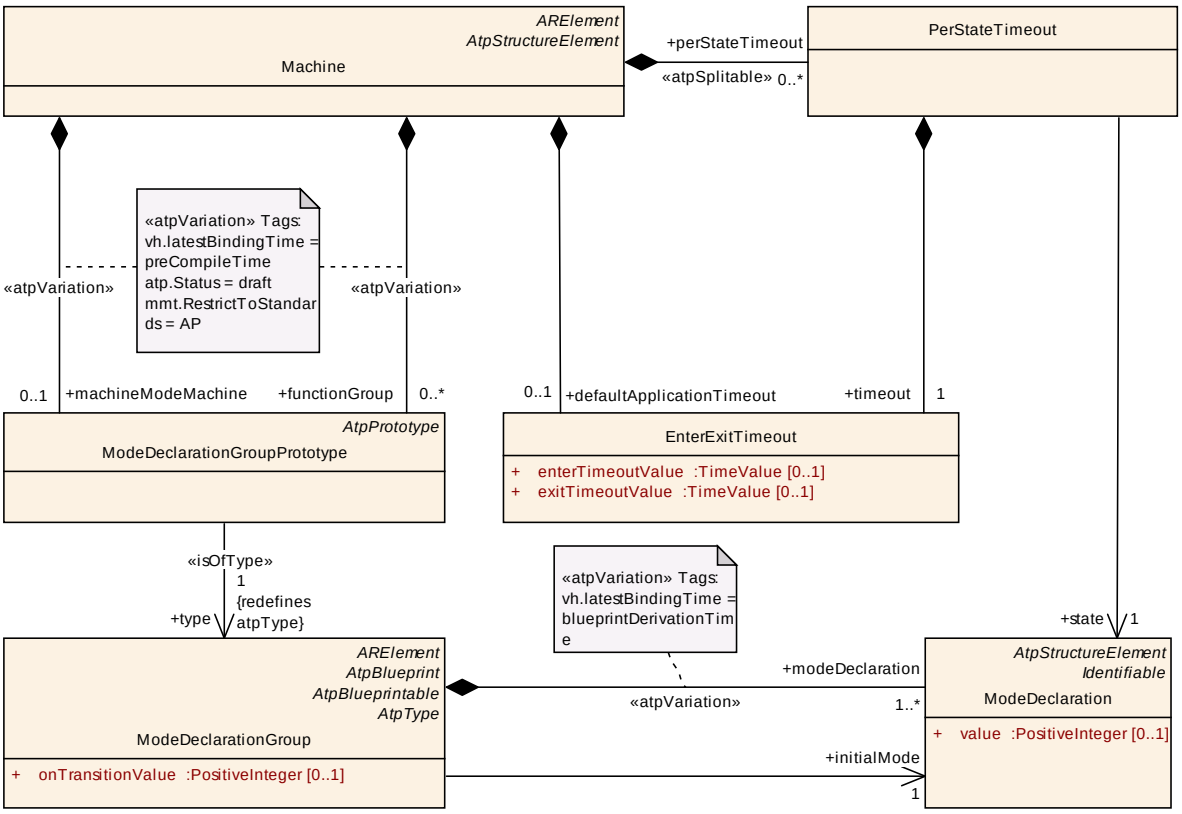


Figure 8.5: Configuration of timeouts for selected machine states and function group states

Class	**PerStateTimeout**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Machine			
Note	This meta-class represents the ability to specify a state-specific timeout. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
state	ModeDeclaration	1	ref	Ths reference represents the respective state for which the PerStateTimeout is defined. **Tags:** atp.Status=draft
timeout	EnterExitTimeout	1	aggr	This aggregation describes the timeout specification with respect to the referenced state. **Tags:** atp.Status=draft

Table 8.15: PerStateTimeout

Class	**EnterExitTimeout**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Machine			
Note	This meta-class represents the ability to specify a pair of timeouts, one for entering, and one for exiting. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
enterTimeoutValue	TimeValue	0..1	attr	This attribute represents the value of the enter timeout in seconds.
exitTimeoutValue	TimeValue	0..1	attr	This attribute represents the value of the exit timeout in seconds.

Table 8.16: EnterExitTimeout

The attribute `enterTimeoutValue` in the `EnterExitTimeout` meta-class defines the maximal time for start-up of all processes that are newly active in the referenced `state`.

The attribute `exitTimeoutValue` in the `EnterExitTimeout` meta-class defines the maximal time for termination of all processes that were active in the referenced `state` and are not assigned to a new `state`.

More details about the state timeouts are described in [20].

8.5 Process To Machine Mapping

[TPS_MANI_03147] Mapping of a `Process` to a `Machine` ⌈ The meta-class `ProcessToMachineMapping` provides the ability to map a `Process` to a `Machine`. ⌋ *()*

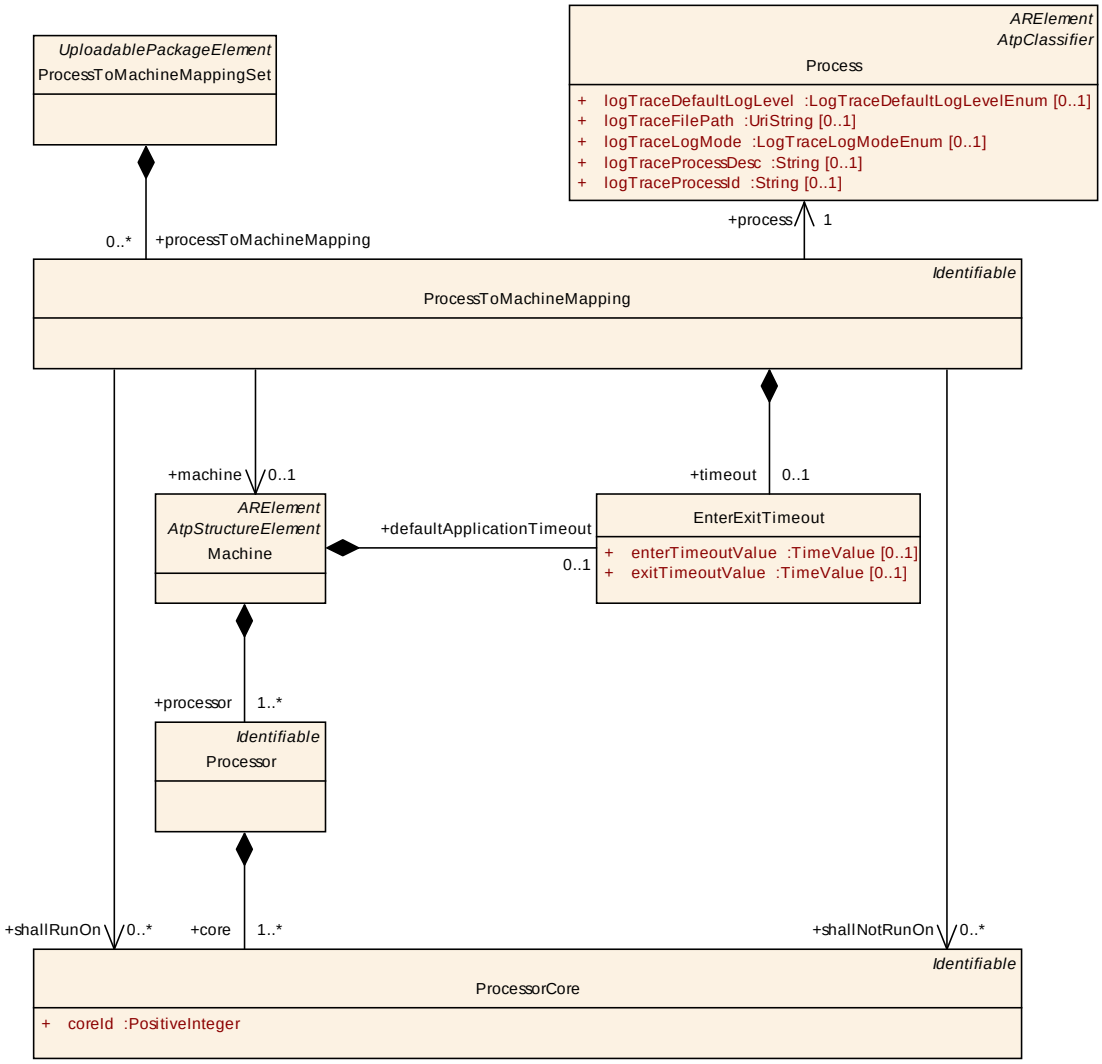


Figure 8.6: Mapping of a `Process` to a `Machine`

[constr_1553] Restriction for `ProcessToMachineMapping` ⌈ The following restrictions apply for the usage of `ProcessToMachineMapping`:

1. Each combination of `Process` and `Machine` shall only be referenced by one `ProcessToMachineMapping` in the role `process` resp. `machine`.
2. Each `Process` shall only be referenced by a single `ProcessToMachineMapping` in the role `process`.

⌋()

Please note that [constr_1553] does not imply that a given `Machine` shall only be referenced by a single `ProcessToMachineMapping`. It only says that one `Process` shall only be mapped once, to exactly one `Machine`.

Class	**ProcessToMachineMappingSet**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Machine			
Note	This meta-class acts as a bucket for collecting ProcessToMachineMappings. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft; atp.recommended Package=ProcessToMachineMappings			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
processToMachineMapping	ProcessToMachineMapping	*	aggr	This represents the collection of ProcessToMachineMappings of the enclosing ProcessToMachineMappingSet. **Tags:** atp.Status=draft

Table 8.17: ProcessToMachineMappingSet

Class	**ProcessToMachineMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Machine			
Note	This meta-class has the ability to associate a Process with a Machine. This relation involves the definition of further properties, e.g. timeouts. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
machine	Machine	0..1	ref	This reference identifies the Machine in the context of the ProcessToMachineMapping. **Tags:** atp.Status=draft
nonOsModuleInstantiation	NonOsModuleInstantiation	0..1	ref	This supports the optional case that the process represents a platform module. **Tags:** atp.Status=draft
process	Process	1	ref	This reference identifies the Process in the context of the ProcessToMachineMapping. **Tags:** atp.Status=draft
shallNotRunOn	ProcessorCore	*	ref	This reference indicates a collection of cores onto which the mapped process shall not be executing. **Tags:** atp.Status=draft
shallRunOn	ProcessorCore	*	ref	This reference indicates a collection of cores onto which the mapped process shall be executing. **Tags:** atp.Status=draft
timeout	EnterExitTimeout	0..1	aggr	This aggregation can be used to specify the timeouts for launching and terminating the process. **Tags:** atp.Status=draft

Table 8.18: ProcessToMachineMapping

[TPS_MANI_03148] Description of Core affinity ⌈ The meta-class ProcessToMachineMapping provides the ability to restrict the assignment of processes to selected ProcessorCores with the two references shallRunOn and shallNotRunOn. ⌋()

[constr_3393] Usage of shallRunOn and shallNotRunOn references ⌈ The ProcessorCore that is referenced by a ProcessToMachineMapping in the role shallRunOn or shallNotRunOn shall be aggregated by the Machine that is referenced in the role machine by the same ProcessToMachineMapping. ⌋()

Class	**EnterExitTimeout**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Machine			
Note	This meta-class represents the ability to specify a pair of timeouts, one for entering, and one for exiting. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
enterTimeoutValue	TimeValue	0..1	attr	This attribute represents the value of the enter timeout in seconds.
exitTimeoutValue	TimeValue	0..1	attr	This attribute represents the value of the exit timeout in seconds.

Table 8.19: EnterExitTimeout

[TPS_MANI_03149] Definition of a start-up timeout for a Process ⌈ The meta-class ProcessToMachineMapping provides the ability to define a start-up timeout for a Process with the attribute enterTimeoutValue that is available in the EnterExitTimeout meta-class that is aggregated by the ProcessToMachineMapping in the role timeout. ⌋()

[TPS_MANI_03150] Definition of a termination timeout for a Process ⌈ The meta-class ProcessToMachineMapping provides the ability to define a termination timeout for a Process with the attribute exitTimeoutValue that is available in the EnterExitTimeout meta-class that is aggregated by the ProcessToMachineMapping in the role timeout. ⌋()

[TPS_MANI_03151] Default value for termination timeout ⌈ The meta-class Machine provides the ability to define a default value for termination timeout of applications in the context of the Machine with the attribute exitTimeoutValue that is available in the EnterExitTimeout meta-class that is aggregated by the Machine in the role defaultApplicationTimeout. ⌋()

[constr_3394] Default value for start-up timeout on the Machine is not configurable ⌈ The attribute enterTimeoutValue that is available in the EnterExitTimeout is not allowed to be used if the EnterExitTimeout is aggregated by the Machine in the role defaultApplicationTimeout. ⌋()

8.6 Adaptive Autosar Module and Platform Configuration

The configuration settings for individual Adaptive Autosar modules are covered by specializations of the abstract class `AdaptiveModuleInstantiation`.

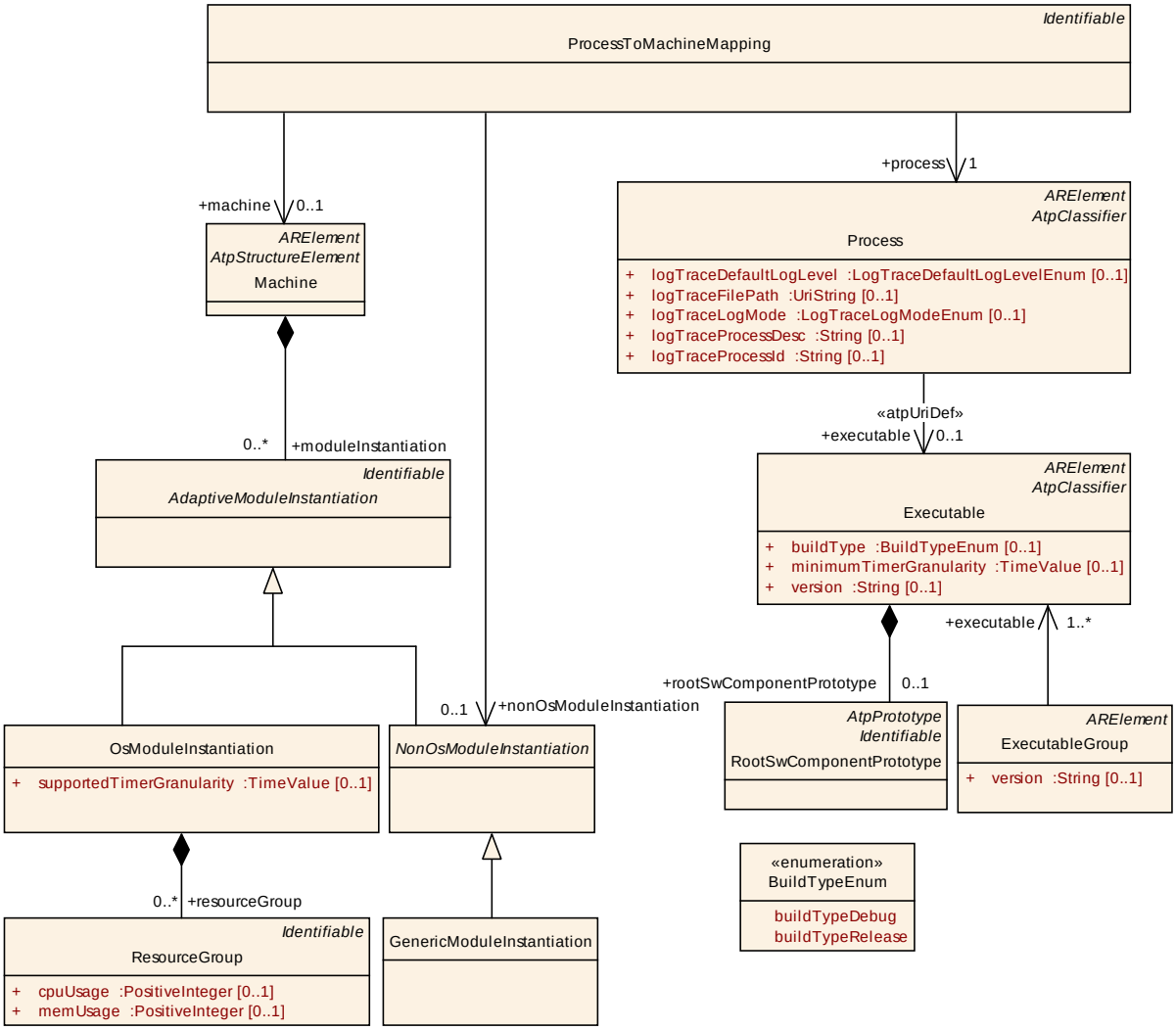


Figure 8.7: Adaptive Autosar Module Configuration

Class	***AdaptiveModuleInstantiation* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::AdaptiveModuleImplementation			
Note	This meta-class defines the abstract attributes for the configuration of an adaptive autosar module instance on a specific machine. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	*NonOsModuleInstantiation*, OsModuleInstantiation			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 8.20: AdaptiveModuleInstantiation

Each Adaptive Autosar module other than OS can be assigned to a Process with the ProcessToMachineMapping.

[constr_1490] Allowed value of category for reference ProcessToMachineMapping.process.executable ⌈ The value of category of an Executable referenced in the role ProcessToMachineMapping.process.executable shall **only** be set to PLATFORM_LEVEL (see [TPS_MANI_01009]). ⌋*()*

The meta-class GenericModuleInstantiation can be used to define configuration settings of generic modules and modules that are not standardized by AUTOSAR. Different modules are distinguishable by the category attribute.

Please note that both elements are Identifiable and therefore are able to describe special data (sdg), by which means it is possible to define generic custom settings that are not represented by the standard model. For more information, please refer to the AUTOSAR Generic Structure Template [5].

[TPS_MANI_03096] Machine-specific configuration settings for a generic module ⌈ The Machine-specific configuration settings for a generic module are collected in GenericModuleInstantiation where the value of attribute category value denotes the module. ⌋*(RS_MANI_00023)*

Class	**GenericModuleInstantiation**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::AdaptiveModuleImplementation			
Note	This meta-class defines the attributes for the generic module configuration on a specific machine. Different modules are distinguishable by the category attribute. This element can also be used to describe modules that are not standardized by AUTOSAR. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *AdaptiveModuleInstantiation*, *Identifiable*, *MultilanguageReferrable*, *NonOsModuleInstantiation*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 8.21: GenericModuleInstantiation

8.6.1 OS Module configuration

[TPS_MANI_03098] Machine-specific configuration settings for the OS module ⌈ The Machine-specific configuration settings for the OS module are collected in OsModuleInstantiation. ⌋*(RS_MANI_00023)*

Class	**OsModuleInstantiation**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::AdaptiveModule Implementation			
Note	This meta-class defines the attributes for the OS configuration on a specific machine. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *AdaptiveModuleInstantiation*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
resourceGroup	ResourceGroup	*	aggr	This represents the collection of ResourceGroups owned by the enclosing OsModuleImplementation. **Tags:** atp.Status=draft
supportedTimerGranularity	TimeValue	0..1	attr	This attribute describes the supported timer granularity (TimeValue of one tick). **Tags:** atp.Status=draft

Table 8.22: OsModuleInstantiation

AUTOSAR supports the configuration of `ResourceGroup`s in the `OsModuleInstantiation` of the `Machine` that correspond for example to cgroups (aka control groups) in Linux. `ResourceGroup`s provide a mechanism to manage system resources by partitioning constraints like `cpuUsage` and `memUsage` into groups that limit the resource usage for a collection of processes (see also [TPS_MANI_01017]).

Class	**ResourceGroup**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::AdaptiveModule Implementation			
Note	This meta-class represents a resource group that limits the resource usage of a collection of processes. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
cpuUsage	PositiveInteger	0..1	attr	CPU resource limit in percentage of the total CPU capacity on the machine.
memUsage	PositiveInteger	0..1	attr	Memory limit in bytes.

Table 8.23: ResourceGroup

[constr_3412] `OsModuleInstantiation` shall have at least one `ResourceGroup`
⌈ An `OsModuleInstantiation` in the `Machine` shall own at least one `ResourceGroup`. ⌋()

8.6.2 Network Management configuration

[TPS_MANI_03166] `Machine`-specific configuration settings for NM module ⌈ The `Machine`-specific configuration settings for Nm are collected in `NmInstantiation`. ⌋*(RS_MANI_00023)*

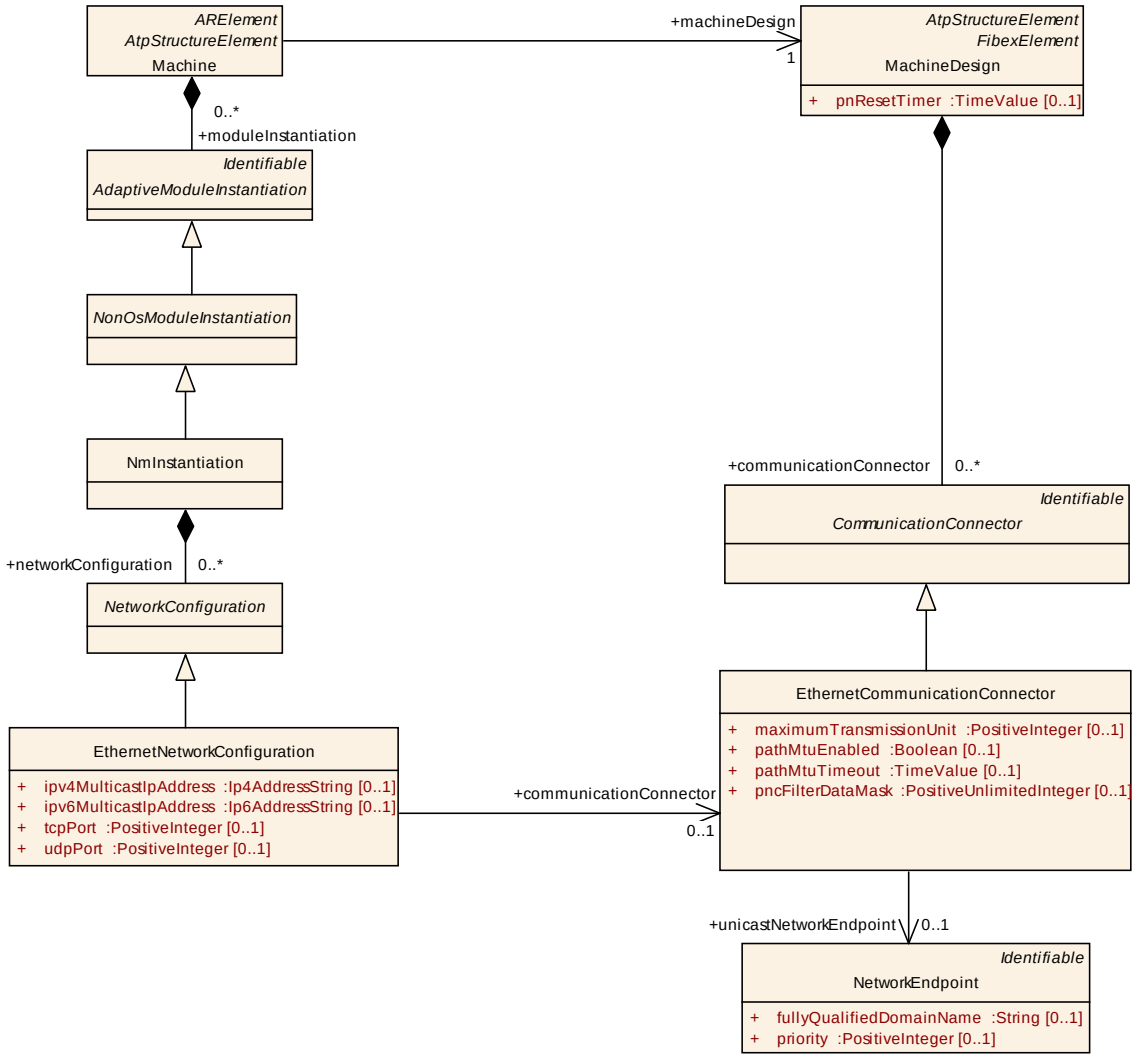


Figure 8.8: Network configuration for Nm

Class	**NmInstantiation**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::AdaptiveModule Implementation			
Note	This meta-class defines the attributes for the Nm configuration on a specific machine. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *AdaptiveModuleInstantiation*, *Identifiable*, *MultilanguageReferrable*, *Non OsModuleInstantiation*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

networkConfiguration	NetworkConfiguration	*	aggr	Network configuration for sending and receiving of Nm messages on the machine. **Tags:** atp.Status=draft

Table 8.24: NmInstantiation

[TPS_MANI_03167] Network configuration for Nm ⌈ The UDP multicast connection over which Network Management messages are transported is configured with the `EthernetNetworkConfiguration` that is aggregated by the `NmInstantiation` in the role `networkConfiguration`. The attribute `udpPort` is used to configure the port number. The IP Address is configured either by `ipv4MulticastIpAddress` or `ipv6MulticastIpAddress`. ⌋*(RS_MANI_00023)*

[constr_3414] Allowed usage of `EthernetNetworkConfiguration` attributes ⌈ Table 8.25 shows `EthernetNetworkConfiguration` attributes that are allowed to be used to configure the network communication in the different platform modules. ⌋*()*

	Element		
EthernetNetworkConfiguration attributes	**Usage in NmInstantiation**	**Usage in DoIpInstantiation**	**Usage in LogAndTraceInstantiation**
`tcpPort`	NA	Optional	Optional
`udpPort`	Mandatory	Optional	Optional
`ipv4MulticastIpAddress`	Optional	NA	NA
`ipv6MulticastIpAddress`	Optional	NA	NA
`communicationConnector`	Mandatory	Mandatory	Mandatory
`udpNmCluster`	Mandatory	NA	NA

Table 8.25: Allowed usage of `EthernetNetworkConfiguration` attributes

[constr_3419] Allowed usage of `EthernetNetworkConfiguration` attributes ⌈ The `EthernetNetworkConfiguration` that is aggregated by `NmInstantiation` in the role `networkConfiguration` shall have either

- `ipv4MulticastIpAddress` or
- `ipv6MulticastIpAddress`.

⌋*()*

The `UdpNmCluster` with all included `UdpNmNode`s is described in the `System` design model. With the reference `NmInstantiation.udpNmCluster` the relation to the `System` design model is established.

Typically the `System` design model is provided by an OEM that defines the network configuration and provides all configuration settings that are relevant for a network management cluster to an integrator. The NM configuration options that will typically be set by an Integrator are collected in the `NmInstantiation` element. The Machine Manifest delivery to configure UdpNm consists of both, the `NmInstantiation` settings together with the referenced `UdpNmCluster` and `UdpNmNode` settings.

The NmConfig element is a wrapper that contains all network management specific configuration settings in the System model.

AUTOSAR Adaptive Network Management is based on periodic NM messages, which are received by all UdpNmNodes in the UdpNmCluster via multicast. Reception of NM packets indicates that sending UdpNmNodes want to keep the UdpNmCluster awake. If any node is ready to go to sleep mode, it stops sending NM messages, but as long as NM packets from other UdpNmNodes are received, it postpones transition to sleep mode.

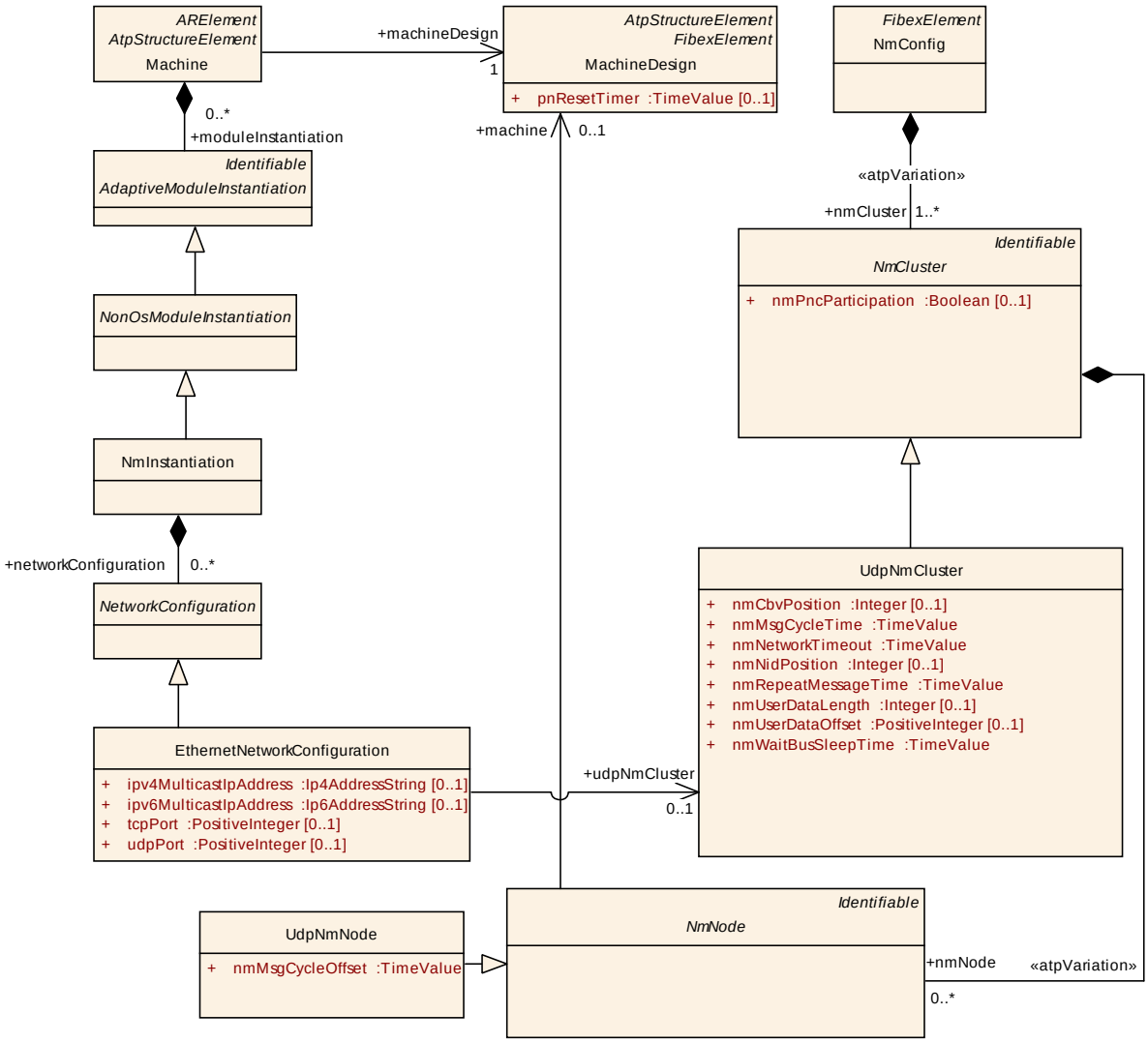


Figure 8.9: NM Cluster configuration

Class	**NmConfig**			
Package	M2::AUTOSARTemplates::SystemTemplate::NetworkManagement			
Note	Contains the all configuration elements for AUTOSAR Nm. **Tags:** atp.ManifestKind=MachineManifest; atp.recommendedPackage=NmConfigs			
Base	*ARObject*, *CollectableElement*, *FibexElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
nmCluster	NmCluster	1..*	aggr	Collection of NM Clusters atpVariation: Derived, because cluster can be variable. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=postBuild

Table 8.26: NmConfig

Class	***NmCluster* (abstract)**			
Package	M2::AUTOSARTemplates::SystemTemplate::NetworkManagement			
Note	Set of NM nodes coordinated with use of the NM algorithm. **Tags:** atp.ManifestKind=MachineManifest			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	CanNmCluster, FlexrayNmCluster, J1939NmCluster, LinNmCluster, UdpNmCluster			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
communicationCluster	CommunicationCluster	1	ref	Asscociation to a CommunicationCluster in the topology description.
nmNode	NmNode	*	aggr	Collection of NmNodes of the NmCluster. atpVariation: Derived, because NmNode can be variable. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=postBuild
nmPncParticipation	Boolean	0..1	attr	Defines whether this NmCluster contributes to the partial network mechanism.

Table 8.27: NmCluster

Class	**UdpNmCluster**			
Package	M2::AUTOSARTemplates::SystemTemplate::NetworkManagement			
Note	Udp specific NmCluster attributes **Tags:** atp.ManifestKind=MachineManifest			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *NmCluster*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
nmCbvPosition	Integer	0..1	attr	Defines the position of the control bit vector within the NmPdu (Byte positon).

nmMsgCycleTime	TimeValue	1	attr	Period of a NmPdu in seconds. It determines the periodic rate in the periodic transmission mode with bus load reduction and is the basis for transmit scheduling in the periodic transmission mode without bus load reduction.
nmNetworkTimeout	TimeValue	1	attr	Network Timeout for NmPdus in seconds. It denotes the time how long the UdpNm shall stay in the Network Mode before transition into Prepare Bus-Sleep Mode shall take place.
nmNidPosition	Integer	0..1	attr	Defines the byte position of the source node identifier within the NmPdu.
nmRepeatMessageTime	TimeValue	1	attr	Timeout for Repeat Message State in seconds. Defines the time how long the NM shall stay in the Repeat Message State.
nmUserDataLength	Integer	0..1	attr	Defines the length in bytes of the user data contained in the Nm message. User data excludes the PN information.
nmUserDataOffset	PositiveInteger	0..1	attr	Specifies the offset (in bytes) of the user data information in the NM message. User data excludes the PN information. **Tags:** atp.Status=draft
nmWaitBusSleepTime	TimeValue	1	attr	Timeout for bus calm down phase in seconds. It denotes the time how long the CanNm shall stay in the Prepare Bus-Sleep Mode before transition into Bus-Sleep Mode shall take place.

Table 8.28: UdpNmCluster

Class	***NmNode* (abstract)**			
Package	M2::AUTOSARTemplates::SystemTemplate::NetworkManagement			
Note	The linking of NmEcus to NmClusters is realized via the NmNodes. **Tags:** atp.ManifestKind=MachineManifest			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	CanNmNode, FlexrayNmNode, J1939NmNode, UdpNmNode			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
machine	MachineDesign	0..1	ref	Reference to the machine that contains the NmNode. **Tags:** atp.Status=draft

Table 8.29: NmNode

Class	**UdpNmNode**			
Package	M2::AUTOSARTemplates::SystemTemplate::NetworkManagement			
Note	Udp specific NM Node attributes. **Tags:** atp.ManifestKind=MachineManifest			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *NmNode*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
communicationConnector	EthernetCommunicationConnector	0..1	ref	Reference to the CommunicationConnector that represents the UdpNmNode in the topology description. **Tags:** atp.Status=draft
nmMsgCycleOffset	TimeValue	1	attr	Node specific time offset in the periodic transmission node. It determines the start delay of the transmission. Specified in seconds.

Table 8.30: UdpNmNode

8.6.3 Log and Trace module configuration

[TPS_MANI_03162] `Machine`-specific configuration settings for the Log and Trace functional cluster ⌈ The `Machine`-specific configuration settings for the Log and Trace functional cluster are collected in `LogAndTraceInstantiation`. ⌋ *(RS_MANI_00023)*

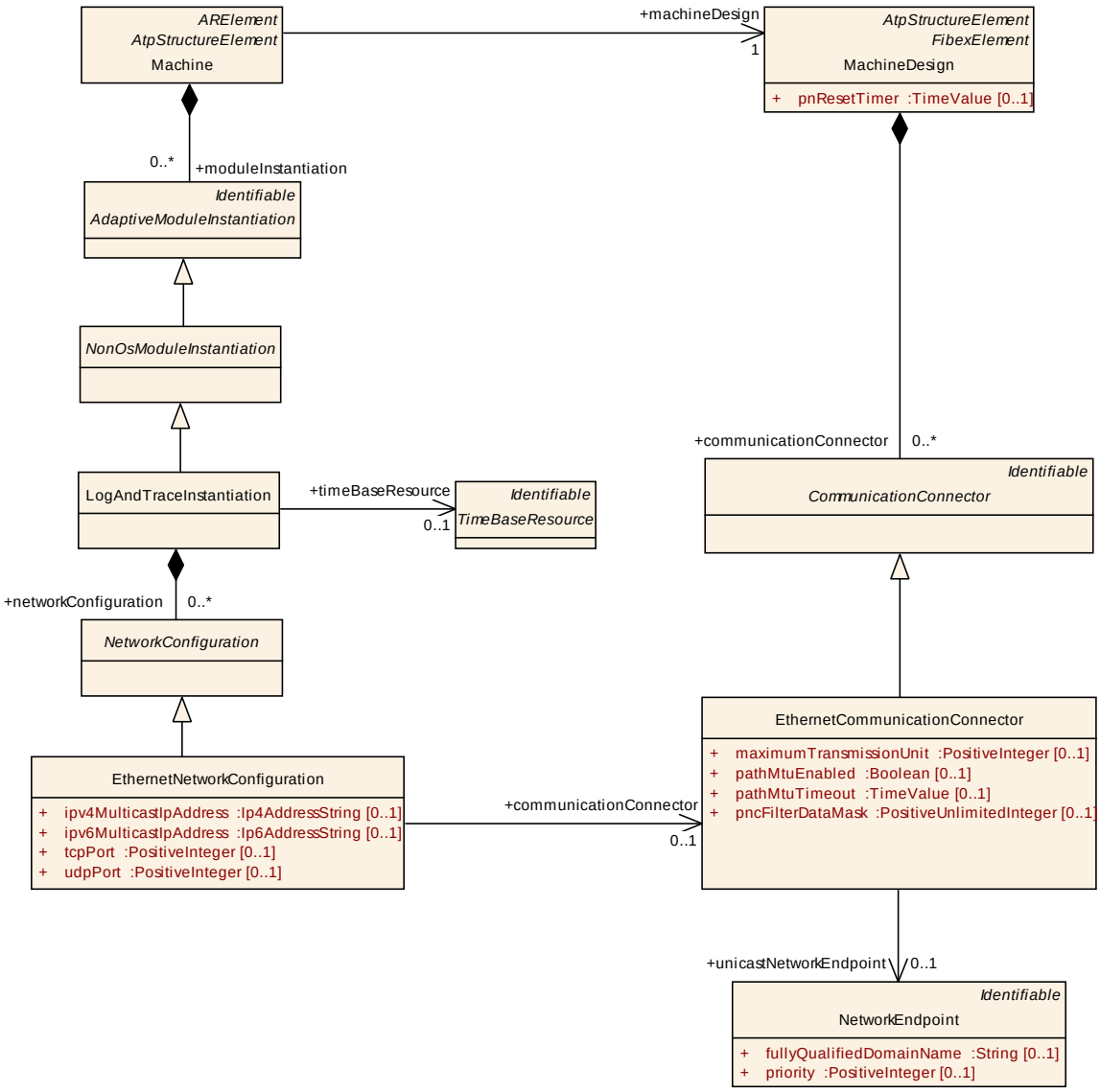


Figure 8.10: Log and Trace module configuration

Class	**LogAndTraceInstantiation**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::AdaptiveModule Implementation			
Note	This meta-class defines the attributes for the Log&Trace configuration on a specific machine. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *AdaptiveModuleInstantiation*, *Identifiable*, *MultilanguageReferrable*, *NonOsModuleInstantiation*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
networkConfiguration	NetworkConfiguration	*	aggr	Network configuration for transmission of log & trace messages. **Tags:** atp.Status=draft

timeBaseResource	TimeBaseResource	0..1	ref	This reference is used to describe to which time base the the Log and Trace module has access. From the Time Base Resource the Log and Trace module gets the needed information to generate the time stamp. **Tags:** atp.Status=draft

Table 8.31: LogAndTraceInstantiation

[TPS_MANI_03163] Network configuration for Log and Trace messages ⌈ The output channel on Ethernet for Log and Trace messages is configured with the `EthernetNetworkConfiguration` that is aggregated by the `LogAndTraceInstantiation` in the role `networkConfiguration`. The attributes `tcpPort` and `udpPort` are used to configure the Transport Protocol (Udp or Tcp) and the used Port number. The IP Address is configured in the `NetworkEndpoint` that is referenced by the `EthernetNetworkConfiguration` via the `EthernetCommunicationConnector`. ⌋ *(RS_MANI_00023)*

8.6.4 DoIP configuration

[TPS_MANI_03164] `Machine`-specific configuration settings for DoIP ⌈ The `Machine`-specific configuration settings for DoIP are collected in `DoIpInstantiation`. ⌋*(RS_MANI_00023)*

[constr_3425] Restriction of `DoIpInstantiation`s on a `Machine` ⌈ Each `Machine` shall aggregate at most one `DoIpInstantiation` in the role `moduleInstantiation`. ⌋*()*

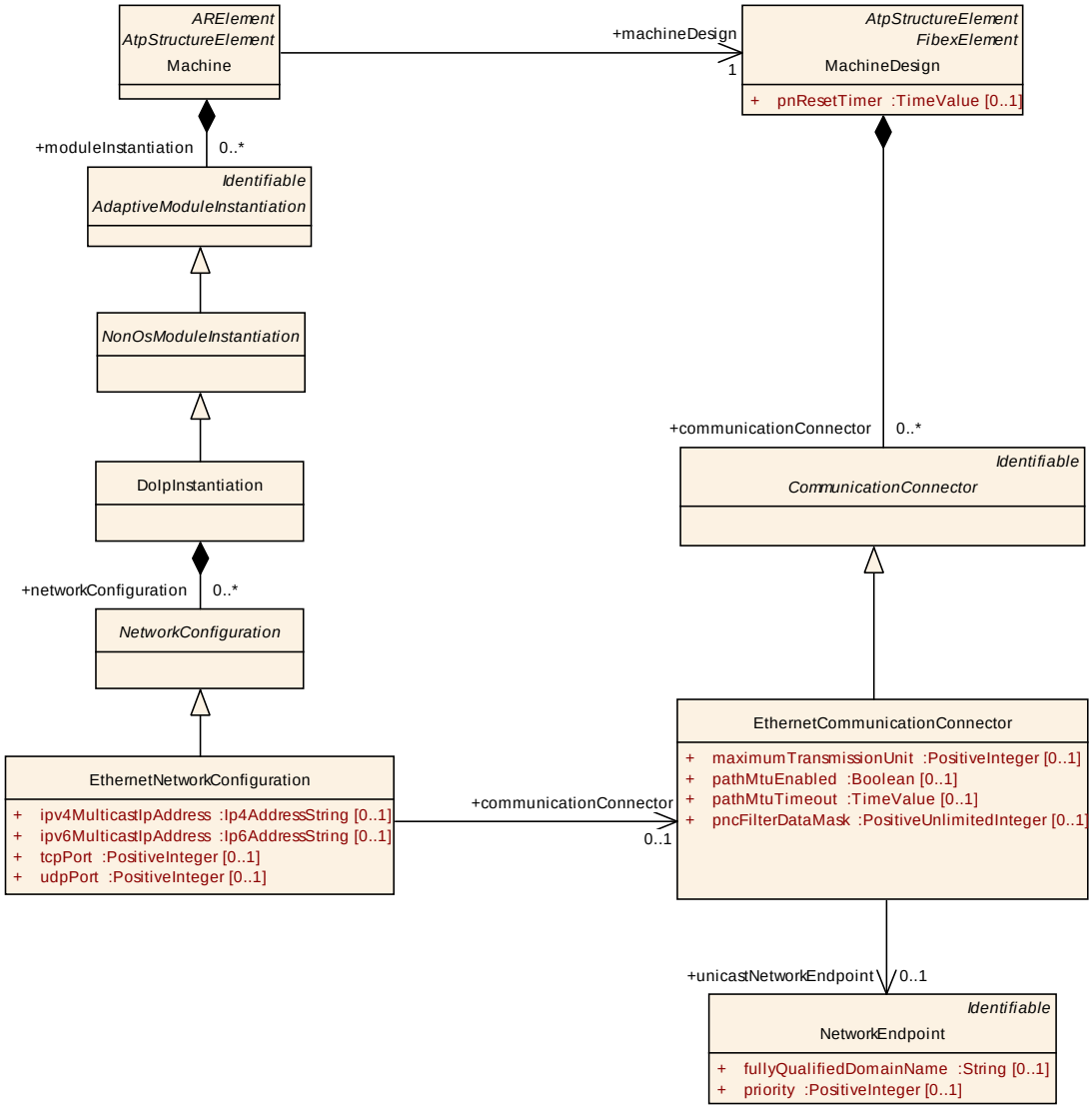


Figure 8.11: DoIP configuration

Class	**DoIpInstantiation**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::AdaptiveModule Implementation			
Note	This meta-class defines the attributes for the DoIP configuration on a specific machine. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *AdaptiveModuleInstantiation*, *Identifiable*, *MultilanguageReferrable*, *Non OsModuleInstantiation*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
networkConfiguration	NetworkConfiguration	*	aggr	Network configuration for transmission of DoIP messages. **Tags:** atp.Status=draft

Table 8.32: DoIpInstantiation

[TPS_MANI_03165] Network configuration for DoIP ⌈ The TCP or UDP connection over which diagnostic messages are transported is configured with the EthernetNetworkConfiguration that is aggregated by the DoIpInstantiation in the role networkConfiguration. The attributes tcpPort and udpPort are used to configure the Transport Protocol (Udp or Tcp) and the used Port number. The IP Address is configured in the NetworkEndpoint that is referenced by the EthernetNetworkConfiguration via the EthernetCommunicationConnector. ⌋ *(RS_MANI_00023)*

Please note that it is possible to define several networkConfigurations in a DoIpInstantiation, one for each VLAN that is represented by the referenced EthernetCommunicationConnector that belongs to the Machine on which the DoIpInstantiation is running.

9 System Design

9.1 Overview

A typical vehicle will most likely be equipped with ECUs developed on the AUTOSAR classic platform and ECUs developed on the AUTOSAR adaptive platform. The system design for the entire vehicle has therefore to cover all these ECUs.

The AUTOSAR model description supports the system design with the possibility to describe Software Components of both AUTOSAR Platforms that will be used in a System and even allows to indicate the service oriented communication between them if possible.

Especially when it come to the description of the communication behavior of AUTOSAR classic and adaptive ECUs in a harmonized way the notion of a System Design becomes a special focus point.

All the system design aspects have in common that they have to cope with both, AUTOSAR classic and adaptive. The basic design aspects of such interdisciplinary systems have to be already available in the AUTOSAR classic modeling approach because otherwise they would not be available to both worlds.

Thus it is straight forward to take the existing meta-class `System` as the starting point for the modeling of such mixed systems.

Class	**System**			
Package	M2::AUTOSARTemplates::SystemTemplate			
Note	The top level element of the System Description. The System description defines five major elements: Topology, Software, Communication, Mapping and Mapping Constraints. The System element directly aggregates the elements describing the Software, Mapping and Mapping Constraints; it contains a reference to an ASAM FIBEX description specifying Communication and Topology. **Tags:** atp.recommendedPackage=Systems			
Base	*ARElement*, *ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
fibexElement	FibexElement	*	ref	Reference to ASAM FIBEX elements specifying Communication and Topology. All Fibex Elements used within a System Description shall be referenced from the System Element. atpVariation: In order to describe a product-line, all FibexElements can be optional. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=postBuild

pncVectorLength	PositiveInteger	0..1	attr	Length of the partial networking request release information vector (in bytes).
pncVectorOffset	PositiveInteger	0..1	attr	Absolute offset (with respect to the NM-PDU) of the partial networking request release information vector that is defined in bytes as an index starting with 0.
rootSoftwareComposition	RootSwCompositionPrototype	0..1	aggr	Aggregation of the root software composition, containing all software components in the System in a hierarchical structure. This element is not required when the System description is used for a network-only use-case. atpVariation: The RootSwCompositionPrototype can vary. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=shortName, variationPoint.shortLabel vh.latestBindingTime=systemDesignTime

Table 9.1: System

[constr_3366] System `category` for a system design description with Adaptive Platform and Classic Platform content ⌈ The `System` element that contains design artifacts that are relevant for the Adaptive Platform and Classic Platform shall have the `category` SYSTEM_DESIGN_DESCRIPTION. ⌋*()*

There are use cases to exchange parts of such a SYSTEM_DESIGN_DESCRIPTION between different developer parties and therefore further system categories are supported by AUTOSAR.

A common approach is for example that the OEM provides a basis for designing an ECU, which is later advanced by the supplier. Therefore Classic AUTOSAR supports `System` categories like ECU_EXTRACT or ECU_SYSTEM_DESCRIPTION that have only a single ECU in scope.

Adaptive AUTOSAR is using the same approach. If an OEM wants to provide design artifacts that are relevant for the configuration of a single `Machine` all unnecessary information is stripped from the `System` with `category` SYSTEM_DESIGN_DESCRIPTION and a definition of the subsystem is provided.

[constr_3420] System `category` for a design description that has one single Adaptive `Machine` in scope ⌈ The `System` element that contains design artifacts that are relevant for a single Adaptive `Machine` shall have the `category` MACHINE_DESIGN_EXTRACT. ⌋*()*

[constr_3421] Fibex elements applicable for a MACHINE_DESIGN_EXTRACT ⌈ A `System` with the `category` MACHINE_DESIGN_EXTRACT is allowed to reference the following `fibexElement`s:

- `CommunicationCluster`

- MachineDesign
- GlobalTimeDomain
- NmConfig

]()

9.2 Specification of Communication System Structure

When the communication interaction is designed for a vehicle system the focus is put on the network and the connected ECUs. Whether a specific ECU connected to the network is implemented using AUTOSAR classic or AUTOSAR adaptive does not influence the major communication design.

But of course it is essential from a car manufacturer point of view whether a specific ECU will be implemented using AUTOSAR classic or adaptive. Thus already on system design level there is a need to specify the AUTOSAR Platform kind which shall be used to implement an ECU.

In AUTOSAR classic the element EcuInstance is used to define one ECU in the system design.

In AUTOSAR adaptive the element Machine is an entity which already represents a specific ECU Implementation with dedicated configurations for e.g. Processors, machineModeMachines, functionGroups. The Machine is a model entity which is not in the focus of communication designers and should not be used during system design.

Therefore the MachineDesign has been introduced in order to allow the communication system designer to define a placeholder for an adaptive ECU in the scope of the System (the MachineDesign corresponds to the EcuInstance of AUTOSAR classic).

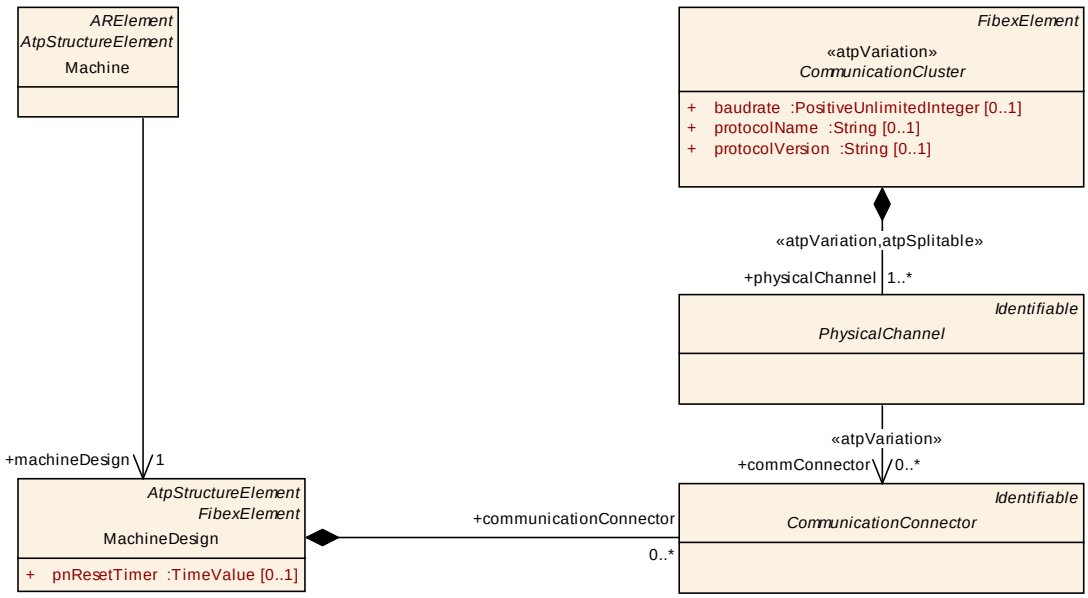


Figure 9.1: MachineDesign

Class	**MachineDesign**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::SystemDesign			
Note	This meta-class represents the ability to define requirements on a Machine in the context of designing a system. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft; atp.recommended Package=MachineDesigns			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *CollectableElement*, *FibexElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
communicationConnector	CommunicationConnector	*	aggr	This aggregation defines the network connection of the machine. **Tags:** atp.Status=draft
pnResetTimer	TimeValue	0..1	attr	Specifies the runtime of the reset timer in seconds. This reset time is valid for the reset of PN requests.
serviceDiscoverConfig	ServiceDiscoveryConfiguration	*	aggr	Set of service discovery configuration settings that are defined on the machine for individual CommunicationConnectors. **Tags:** atp.Status=draft

Table 9.2: MachineDesign

9.2.1 Network connection

One of the most prominent information defined in the context of the MachineDesign is the network connectivity. Since the *AUTOSAR adaptive platform* focuses on the usage of Ethernet for communication, this boils down to the specification of IP addresses.

Specifically, the basic definition of the connectivity of a MachineDesign is created by aggregating the abstract base-class CommunicationConnector in the role communicationConnector. The specific subclass of CommunicationConnector that is used in this context is the EthernetCommunicationConnector.

The EthernetCommunicationConnector is used to connect the MachineDesign with a VLAN that is represented in AUTOSAR by a EthernetPhysicalChannel that is part of an EthernetCluster.

Class	***PhysicalChannel* (abstract)**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::FibexCore::CoreTopology			
Note	A physical channel is the transmission medium that is used to send and receive information between communicating ECUs. Each CommunicationCluster has at least one physical channel. Bus systems like CAN and LIN only have exactly one PhysicalChannel. A FlexRay cluster may have more than one PhysicalChannels that may be used in parallel for redundant communication. An ECU is part of a cluster if it contains at least one controller that is connected to at least one channel of the cluster.			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	*AbstractCanPhysicalChannel*, EthernetPhysicalChannel, FlexrayPhysicalChannel, LinPhysicalChannel, UserDefinedPhysicalChannel			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
commConnector	CommunicationConnector	*	ref	Reference to the ECUInstance via a CommunicationConnector to which the channel is connected. atpVariation: Variable assignment of Physical Channels to different CommunicationConnectors is expressed with this variation. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=postBuild

Table 9.3: PhysicalChannel

Class	≪`atpVariation`≫ **EthernetCluster**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::Fibex4Ethernet::EthernetTopology			
Note	Ethernet-specific cluster attributes. **Tags:** atp.ManifestKind=MachineManifest; atp.recommendedPackage=CommunicationClusters			
Base	*ARObject*, *CollectableElement*, *CommunicationCluster*, *FibexElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
couplingPortConnection	CouplingPortConnection	*	aggr	Specification of connections between CouplingElements and EcuInstances. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=couplingPortConnection, variationPoint.shortLabel vh.latestBindingTime=postBuild
couplingPortSwitchoffDelay	TimeValue	0..1	attr	Switch off delay for CouplingPorts in seconds. It denotes the delay of switching off couplingPorts after the request to switch off a couplingPort was issued. (e.g. switch off of Ethernet switch ports).
macMulticastGroup	MacMulticastGroup	*	aggr	MacMulticastGroup that is defined for the Subnet (EthernetCluster).

Table 9.4: EthernetCluster

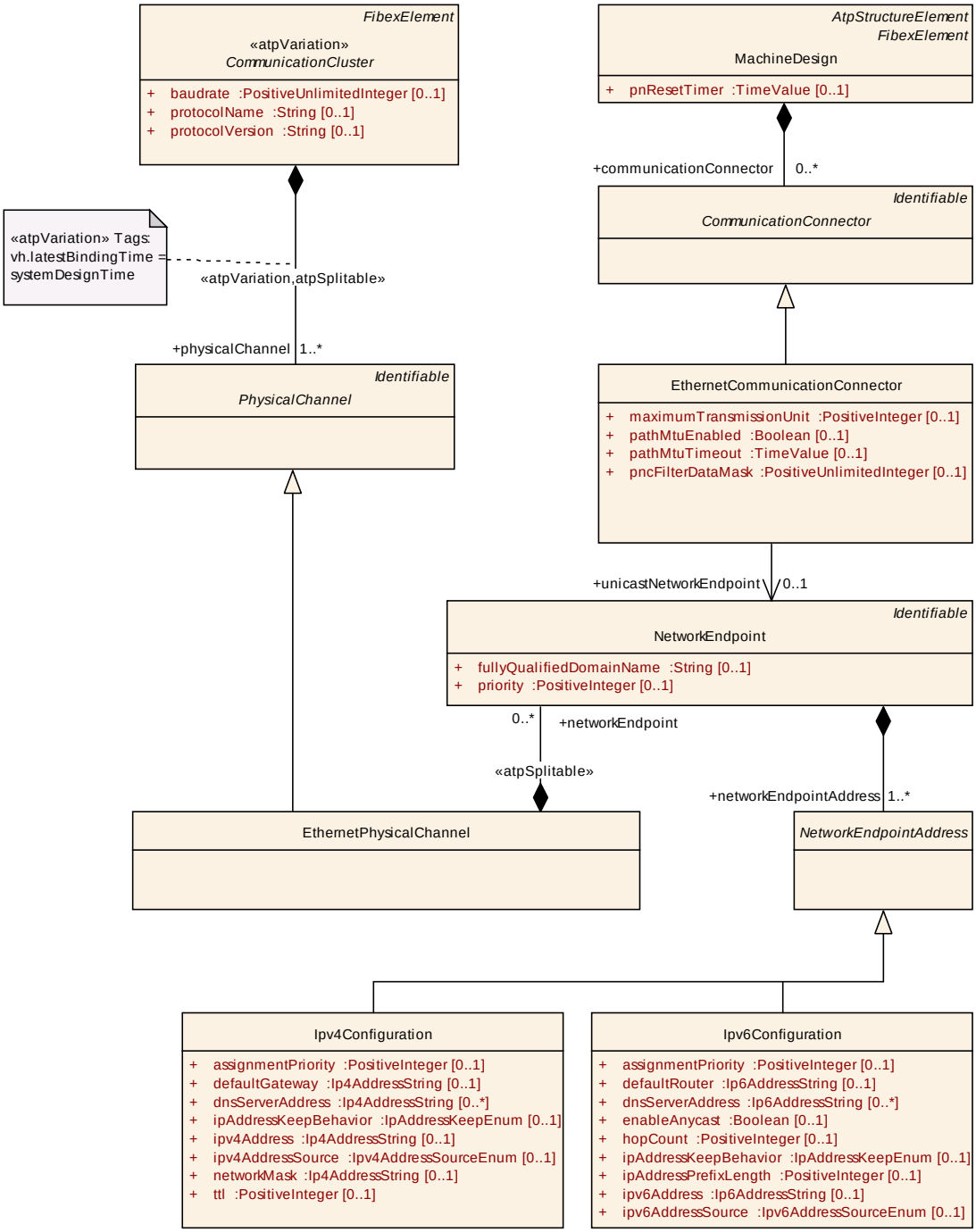


Figure 9.2: Network connection of a MachineDesign

[constr_3320] Aggregation of `CommunicationConnector` by `MachineDesign` ⌈ Meta-Class `MachineDesign` shall only aggregate `EthernetCommunicationConnector`s in the role `communicationConnector`. No other subclass of `CommunicationConnector` shall appear in this aggregation. ⌋()

The canonical way to specify an IP address is the modeling of a `NetworkEndpoint`, referenced from an `EthernetCommunicationConnector` that is aggregated by `MachineDesign` in the role `communicationConnector`.

In addition to the IP address, the NetworkEndpoint may have a *Fully Qualified Domain Name* and a priority.

Class	**NetworkEndpoint**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::Fibex4Ethernet::EthernetTopology			
Note	The network endpoint defines the network addressing (e.g. IP-Address or MAC multicast address). **Tags:** atp.ManifestKind=MachineManifest			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
fullyQualifiedDomainName	String	0..1	attr	Defines the fully qualified domain name (FQDN) e.g. some.example.host.
infrastructureServices	InfrastructureServices	0..1	aggr	Defines the network infrastructure services provided or consumed.
networkEndpointAddress	NetworkEndpointAddress	1..*	aggr	Definition of a Network Address. **Tags:** xml.namePlural=NETWORK-ENDPOINT-ADDRESSES
priority	PositiveInteger	0..1	attr	Priority of this Network-Endpoint.

Table 9.5: NetworkEndpoint

More precisely, the particular IP address is configured by means of the aggregation of Ipv4Configuration resp. Ipv6Configuration in the role networkEndpointAddress.

The NetworkEndpoint is aggregated by the EthernetPhysicalChannel that in turn is aggregated by the EthernetCluster.

Please note that the reference commConnector from the EthernetPhysicalChannel to the CommunicationConnector is optional although the lower multiplicity in the model is 1. The multiplicity of 1 is related to AUTOSAR Classic Platform and will be changed in future.

[TPS_MANI_03052] Static IPv4 configuration ⌈ If the value of attribute ipv4AddressSource of meta-class Ipv4Configuration is set to Ipv4AddressSourceEnum.fixed then the ipv4Address defines the static IPv4 Address. ⌋*(RS_MANI_00018)*

Class	**Ipv4Configuration**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::Fibex4Ethernet::EthernetTopology			
Note	Internet Protocol version 4 (IPv4) configuration.			
Base	*ARObject*, *NetworkEndpointAddress*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

assignment Priority	PositiveInteger	0..1	attr	Priority of assignment (1 is highest). If a new address from an assignment method with a higher priority is available, it overwrites the IP address previously assigned by an assignment method with a lower priority.
defaultGateway	Ip4AddressString	0..1	attr	IP address of the default gateway.
dnsServerAddress	Ip4AddressString	*	attr	IP addresses of preconfigured DNS servers. **Tags:** xml.namePlural=DNS-SERVER-ADDRESSES
ipAddressKeepBehavior	IpAddressKeepEnum	0..1	attr	Defines the lifetime of a dynamically fetched IP address.
ipv4Address	Ip4AddressString	0..1	attr	IPv4 Address. Notation: 255.255.255.255. The IP Address shall be declared in case the ipv4AddressSource is FIXED and thus no auto-configuration mechanism is used.
ipv4AddressSource	Ipv4AddressSourceEnum	0..1	attr	Defines how the node obtains its IP address.
networkMask	Ip4AddressString	0..1	attr	Network mask. Notation 255.255.255.255
ttl	PositiveInteger	0..1	attr	Lifespan of data (0..255). The purpose of the TimeToLive field is to avoid a situation in which an undeliverable datagram keeps circulating on a system.

Table 9.6: Ipv4Configuration

Enumeration	**Ipv4AddressSourceEnum**
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::Fibex4Ethernet::EthernetTopology
Note	Defines how the node obtains its IPv4-Address.
Literal	***Description***
autoIp	AutoIP is used to dynamically assign IP addresses at device startup. **Tags:** atp.EnumerationValue=0
autoIp_doip	Linklocal IPv4 Address Assignment using DoIP Parameters **Tags:** atp.EnumerationValue=2
dhcpv4	DHCP is a service for the automatic IP configuration of a client. **Tags:** atp.EnumerationValue=3
fixed	The IP Address shall be declared manually. **Tags:** atp.EnumerationValue=4

Table 9.7: Ipv4AddressSourceEnum

[TPS_MANI_03053] Static IPv6 configuration ⌈ If the value of attribute `ipv6AddressSource` of meta-class `Ipv6Configuration` is set to `Ipv6AddressSourceEnum.fixed` then the `ipv6Address` defines the static IPv6 Address. ⌋*(RS_MANI_00018)*

Class	**Ipv6Configuration**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::Fibex4Ethernet::EthernetTopology			
Note	Internet Protocol version 6 (IPv6) configuration.			
Base	*ARObject*, *NetworkEndpointAddress*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
assignmentPriority	PositiveInteger	0..1	attr	Priority of assignment (1 is highest). If a new address from an assignment method with a higher priority is available, it overwrites the IP address previously assigned by an assignment method with a lower priority.
defaultRouter	Ip6AddressString	0..1	attr	IP address of the default router.
dnsServerAddress	Ip6AddressString	*	attr	IP addresses of pre configured DNS servers. **Tags:** xml.namePlural=DNS-SERVER-ADDRESSES
enableAnycast	Boolean	0..1	attr	This attribute is used to enable anycast addressing (i.e. to one of multiple receivers).
hopCount	PositiveInteger	0..1	attr	The distance between two hosts. The hop count n means that n gateways separate the source host from the destination host (Range 0..255)
ipAddressKeepBehavior	IpAddressKeepEnum	0..1	attr	Defines the lifetime of a dynamically fetched IP address.
ipAddressPrefixLength	PositiveInteger	0..1	attr	IPv6 prefix length defines the part of the IPv6 address that is the network prefix.
ipv6Address	Ip6AddressString	0..1	attr	IPv6 Address. Notation: FFFF:...:FFFF. The IP Address shall be declared in case the ipv6AddressSource is FIXED and thus no auto-configuration mechanism is used.
ipv6AddressSource	Ipv6AddressSourceEnum	0..1	attr	Defines how the node obtains its IP address.

Table 9.8: Ipv6Configuration

Enumeration	**Ipv6AddressSourceEnum**
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::Fibex4Ethernet::EthernetTopology
Note	Defines how the node obtains its IPv6-Address.
Literal	***Description***
dhcpv6	DHCP is a service for the automatic IP configuration of a client. **Tags:** atp.EnumerationValue=0

fixed	The IP Address shall be declared manually. **Tags:** atp.EnumerationValue=1
linkLocal	LinkLocal is intended only for communications within the segment of a local network (a link) or a point-to-point connection that a host is connected to. **Tags:** atp.EnumerationValue=2
linkLocal _doip	Linklocal IPv6 Address Assignment using DoIP Parameters **Tags:** atp.EnumerationValue=3
routerAdver-tisement	IPv6 Stateless Autoconfiguration. **Tags:** atp.EnumerationValue=4

Table 9.9: Ipv6AddressSourceEnum

Enumeration	**IpAddressKeepEnum**
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::Fibex4Ethernet::Ethernet Topology
Note	Defines the behavior after a dynamic IP address has been assigned.
Literal	***Description***
forget	After a dynamic IP address has been assigned just use it for this session. **Tags:** atp.EnumerationValue=0
storePersis-tently	After a dynamic IP address has been assigned store the address persistently. **Tags:** atp.EnumerationValue=1

Table 9.10: IpAddressKeepEnum

9.2.2 Service Discovery Configuration

Service Discovery messages are exchanged between network nodes to announce and to discover available service instances. This chapter describes the configuration that is necessary to exchange service discovery messages for supported middleware transport layers.

Class	***ServiceDiscoveryConfiguration* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Machine			
Note	Service Discovery configuration settings for the middleware transport layer. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*			
Subclasses	SomeipServiceDiscovery			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 9.11: ServiceDiscoveryConfiguration

9.2.2.1 SOME/IP Service Discovery Configuration

[TPS_MANI_03064] SOME/IP Service Discovery message exchange configuration ⌈ ProvidedServiceInstances are announced in SOME/IP by the server with multicast addressing on a VLAN to a specifically designated IP multicast address (SomeipServiceDiscovery.multicastSdIpAddress) at a specific UDP port number (SomeipServiceDiscovery.someipServiceDiscoveryPort). ⌋ *(RS_MANI_00019)*

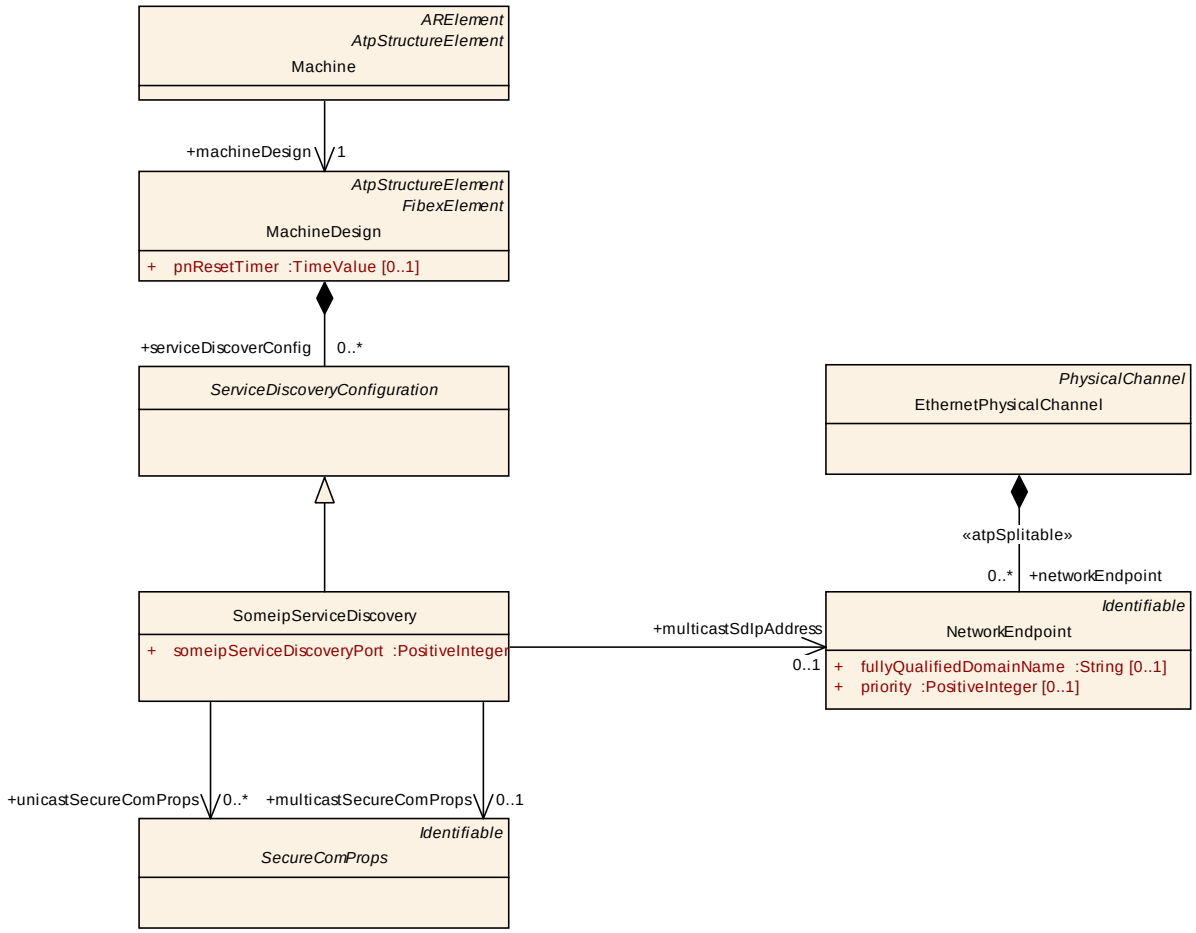


Figure 9.3: SOME/IP Service Discovery Configuration

Class	**SomeipServiceDiscovery**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInterface Deployment			
Note	This meta-class represents a specialization of the generic service discovery for the SOME/IP case. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *ServiceDiscoveryConfiguration*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

multicastSdIpAddress	NetworkEndpoint	0..1	ref	This reference identifies the multicast IP address used for service discovery. **Tags:** atp.Status=draft
multicastSecureComProps	SecureComProps	0..1	ref	Reference to a communication security protocol and its configuration settings that will provide communication security for Service Discovery messages that are transmitted using multicast, e.g. FindService message. **Tags:** atp.Status=draft
someipServiceDiscoveryPort	PositiveInteger	1	attr	This attribute represents the port number reserved for service discovery.
unicastSecureComProps	SecureComProps	*	ref	Reference to a communication security protocol and its configuration settings that will provide communication security for Service Discovery messages that are transmitted using unicast, e.g. OfferService as answer to a FindService message. . **Tags:** atp.Status=draft

Table 9.12: SomeipServiceDiscovery

The SomeipServiceDiscovery is able to reference SecureComProps to define and to configure a security protocol that will be provide communication security for Service Discovery messages. For Service Discovery messages that will be transmitted to a designated multicast IP address the protection is defined by the SecureComProps that is referenced in the role multicastSecureComProps. For unicast Service Discovery messages different credentials may be used for the different ECU pairs. Therefore a list of SecureComProps is aggregated in the role unicastSecureComProps.

9.3 Specification of Application Software System Structure

The root element of a System Design model is the System element that is already known from the AUTOSAR classic platform. The System aggregates the RootSwCompositionPrototype that represents the top-level-composition of all software components that are available in a given system.

[TPS_MANI_03110] Allowed components in system description with category SYSTEM_DESIGN_DESCRIPTION. ⌈ SwComponentPrototypes nested inside the CompositionSwComponentType that is referenced by the RootSwCompositionPrototypeof a System with category SYSTEM_DESIGN_DESCRIPTION are al-

lowed to be of any SwComponentType that is supported by Classic or by Adaptive Autosar. ⌋(*RS_MANI_00026*)

Class	**RootSwCompositionPrototype**			
Package	M2::AUTOSARTemplates::SystemTemplate			
Note	The RootSwCompositionPrototype represents the top-level-composition of software components within a given System. According to the use case of the System, this may for example be the a more or less complete VFB description, the software of a System Extract or the software of a flat ECU Extract with only atomic SWCs. Therefore the RootSwComposition will only occasionally contain all atomic software components that are used in a complete VFB System. The OEM is primarily interested in the required functionality and the interfaces defining the integration of the Software Component into the System. The internal structure of such a component contains often substantial intellectual property of a supplier. Therefore a top-level software composition will often contain empty compositions which represent subsystems. The contained SwComponentPrototypes are fully specified by their SwComponentTypes (including PortPrototypes, PortInterfaces, VariableDataPrototypes, SwcInternalBehavior etc.), and their ports are interconnected using SwConnectorPrototypes.			
Base	*ARObject*, *AtpFeature*, *AtpPrototype*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
softwareComposition	CompositionSwComponentType	1	tref	We assume that there is exactly one top-level composition that includes all Component instances of the system **Stereotypes:** isOfType

Table 9.13: RootSwCompositionPrototype

If a Software Component communicates over the service oriented communication and provides or requires a ServiceInterface the opposite communication end is not always known upfront. In the System with category SYSTEM_DESIGN_DESCRIPTION a System Designer may want to indicate the service oriented communication between endpoints if it is already known at the System Design time.

[TPS_MANI_03114] Usage of AssemblySwConnectors in the System Design model ⌈ In the System with category SYSTEM_DESIGN_DESCRIPTION it is allowed to indicate the service oriented communication between two communication endpoints by AssemblySwConnectors if the required RPortPrototype is searching for a specific service instance, i.e. if the RPortPrototypeProps.searchBehavior is set to searchForId.

If the searchBehavior is set to searchForAny the AssemblySwConnector shall not be used to connect this RPortPrototype. ⌋(*RS_MANI_00026*)

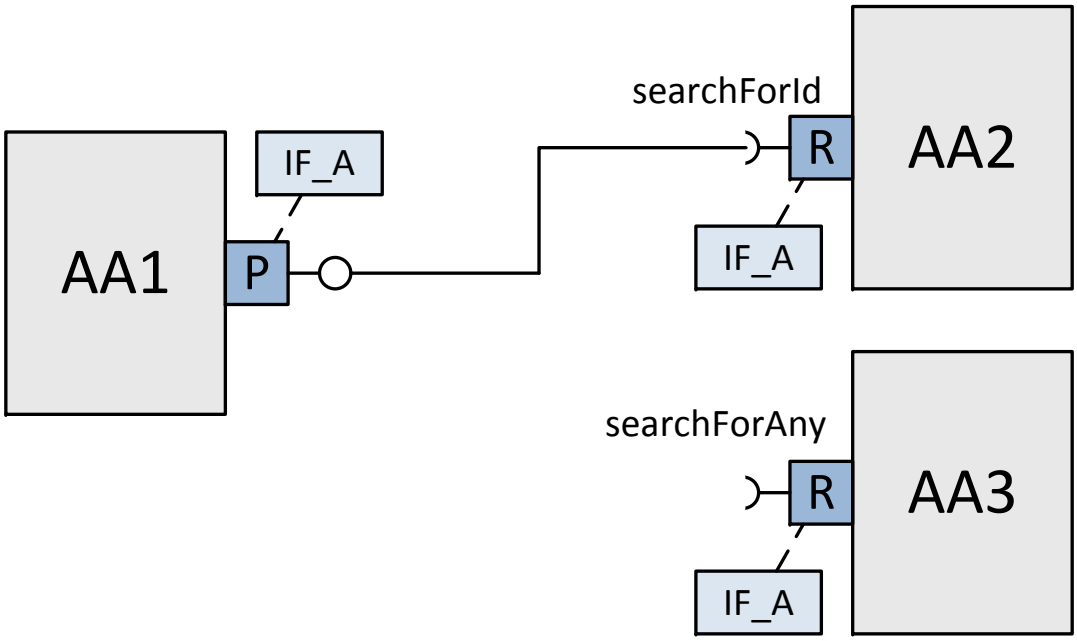


Figure 9.4: Example for Assembly connectors in System Design model

9.4 Modeling of service oriented communication between Classic and Adaptive platform

AUTOSAR classic platform does not support ServiceInterfaces yet but provides the possibility to communicate in a service oriented way over SOME/IP. To mimic a ServiceInterface in the classic platform any combination of ClientServerInterfaces, SenderReceiverInterfaces or TriggerInterfaces may be used to describe a service to which later a SOME/IP Service Id is assigned.

To simplify the description of the service oriented communication between Classic and Adaptive Software components in a System design model the InterfaceMapping was introduced that allows to map elements of PortInterfaces of the Classic Platform to a single ServiceInterface of the Adaptive Platform.

Class	**InterfaceMappingSet**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::SystemDesign			
Note	This meta-class represents the ability to aggregate a collection of InterfaceMappings. **Tags:** atp.Status=draft; atp.recommendedPackage=InterfaceMappingSets			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

interfaceMapping	InterfaceMapping	*	aggr	Mapping of a ServiceInterface of the Adaptive Platform to PortInterface elements of the Classic Platform. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=shortName,variationPoint.shortLabel; atp.Status=draft vh.latestBindingTime=systemDesignTime

Table 9.14: InterfaceMappingSet

Class	**InterfaceMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::SystemDesign			
Note	This meta-class collects the mappings of elements of a single ServiceInterface to PortInterface elements of the AUTOSAR Classic Platform. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
eventMapping	EventMapping	*	aggr	Mapping of a VariableDataPrototype in a SenderReceiverInterface to an Event in a ServiceInterface. **Tags:** atp.Status=draft
fieldMapping	FieldMapping	*	aggr	Mapping of a Field in a ServiceInterface to ClientServerOperations that represent the getter and setter methods and to a VariableDataPrototype that represents the notifier in the Field. **Tags:** atp.Status=draft
fireAndForgetMapping	FireAndForgetMapping	*	aggr	Mapping of a Fire&Forget Method that is located in a ServiceInterface to a VariableDataPrototype in a SenderReceiverInterface or to a Trigger in a TriggerInterface. **Tags:** atp.Status=draft
methodMapping	MethodMapping	*	aggr	Mapping of a ClientServerOperation in a ClientServerInterface to a Method in a ServiceInterface. **Tags:** atp.Status=draft

Table 9.15: InterfaceMapping

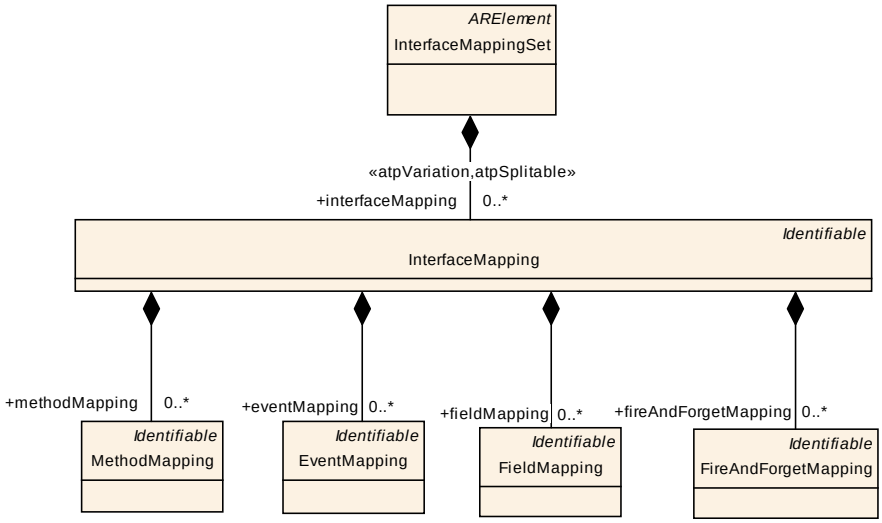


Figure 9.5: InterfaceMapping Overview

[constr_3370] `InterfaceMapping` shall map all elements of a single `ServiceInterface` ⌈ The mappings that are included in an `InterfaceMapping` shall map all elements of a single `ServiceInterface` (i.e. `field`s, `event`s, `method`s) to `PortInterface` elements of the classic platform. ⌋*()*

Figure 9.6 shows a possible System Design modeling approach where Adaptive Applications are communicating in a service oriented way over SOME/IP with classic Software Components. SWC_1 requires a `ClientServerInterface` with a `ClientServerOperation` and a `SenderReceiverInterface` with a `VariableDataPrototype`. SWC_2 requires a `SenderReceiverInterface` with with a `VariableDataPrototype`. The three Interfaces are mapped by a `InterfaceMapping` to a single `ServiceInterface` IF_C. On the other side the Adaptive Applications AA1 and AA2 provide `ServiceInterface`s IF_A and IF_B that are composed by a `ServiceInterfaceMapping` to IF_C.

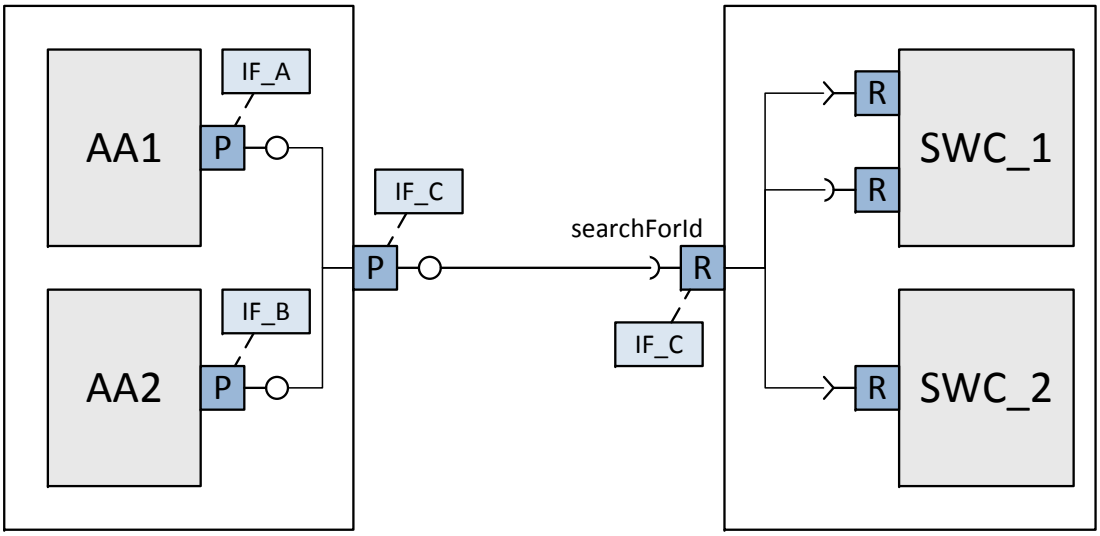


Figure 9.6: Example for a modeling of Service Oriented communication between Adaptive Applications and Software Components of the Classic Platform

9.4.1 MethodMapping

[TPS_MANI_03111] Mapping between `method` and `operation` ⌈ The mapping between a `method` located in a `ServiceInterface` and a `operation` located in a `ClientServerInterface` is provided by the class `MethodMapping`. ⌋ *(RS_MANI_00026)*

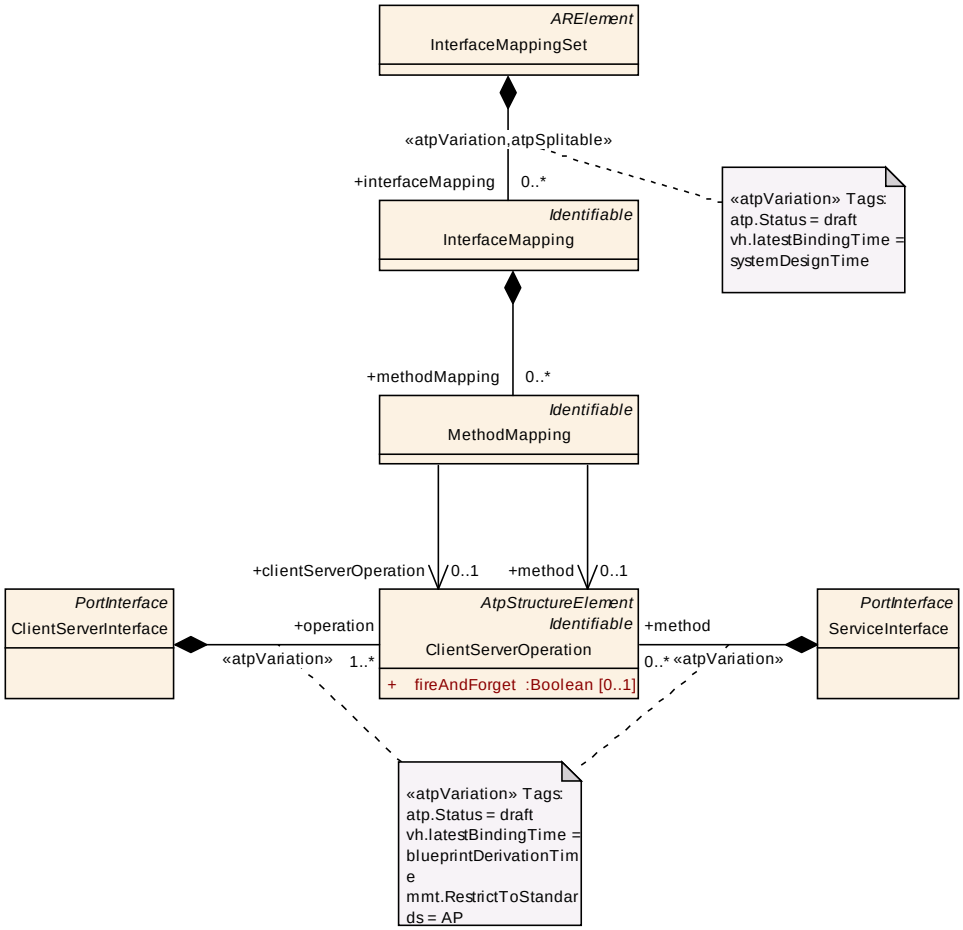


Figure 9.7: Mapping of a Method to a ClientServerOperation

Class	**MethodMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::SystemDesign			
Note	Mapping of a ClientServerOperation that is located in a ClientServerInterface to a Method that is located in a ServiceInterface. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
clientServer Operation	ClientServerO peration	0..1	ref	Reference to a ClientSeverOperation that is located in a ClientSeverInterface. **Tags:** atp.Status=draft
method	ClientServerO peration	0..1	ref	Reference to a Method that is located in a ServiceInterface. **Tags:** atp.Status=draft

Table 9.16: MethodMapping

9.4.2 EventMapping

[TPS_MANI_03112] Mapping between an `event` and a `dataElement` ⌈ The mapping between an `event` located in a `ServiceInterface` and a `dataElement` located in a `SenderReceiverInterface` is provided by the class `EventMapping`. ⌋ *(RS_MANI_00026)*

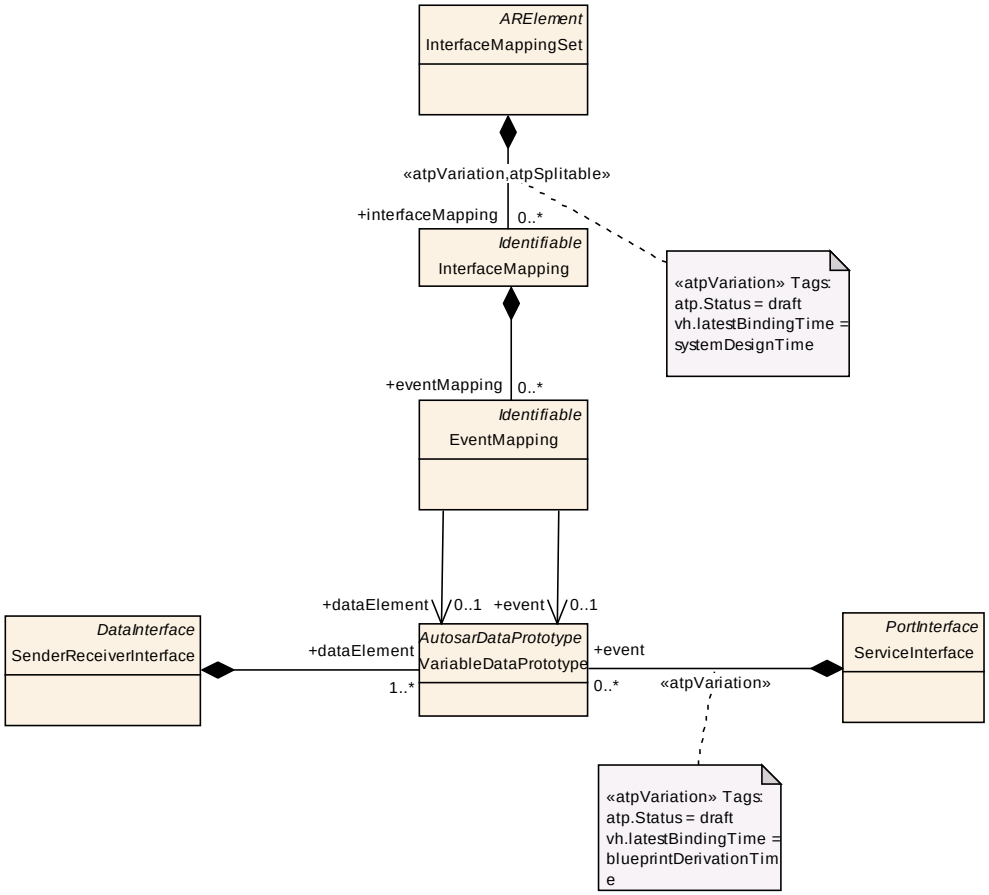


Figure 9.8: Mapping between an `event` and a `dataElement`

Class	**EventMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::SystemDesign			
Note	Mapping of a VariableDataPrototype that is located in a SenderReceiverInterface to an Event that is located in a ServiceInterface. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dataElement	VariableDataPrototype	0..1	ref	Reference to a VariableDataPrototype that is located in a SenderReceiverInterface. **Tags:** atp.Status=draft

event	VariableDataPrototype	0..1	ref	Reference to an Event that is located in a ServiceInterface. **Tags:** atp.Status=draft

Table 9.17: EventMapping

9.4.3 FieldMapping

[TPS_MANI_03113] Mapping between a `field` and elements of Classic Platform `PortInterface`s ⌈ The mapping between a `field` located in a `ServiceInterface` and elements of Classic Platform `PortInterface`s is provided by the class `FieldMapping`. The field notifier in the classic platform is represented by a `dataElement` that is located in a `SenderReceiverInterface`. The getter and setter methods in the classic platform are represented by `operation`s that are located in a `ClientServerInterface`. ⌋*(RS_MANI_00026)*

[constr_3367] `FieldMapping.notifierDataElement` reference ⌈ The `FieldMapping` shall only contain the `notifierDataElement` reference if the `hasNotifier` attribute in the referenced `field` is set to true. ⌋*()*

[constr_3368] `FieldMapping.getterOperation` reference ⌈ The `FieldMapping` shall only contain the `getterOperation` reference if the `hasGetter` attribute in the referenced `field` is set to true. ⌋*()*

[constr_3369] `FieldMapping.setterOperation` reference ⌈ The `FieldMapping` shall only contain the `setterOperation` reference if the `hasSetter` attribute in the referenced `field` is set to true. ⌋*()*

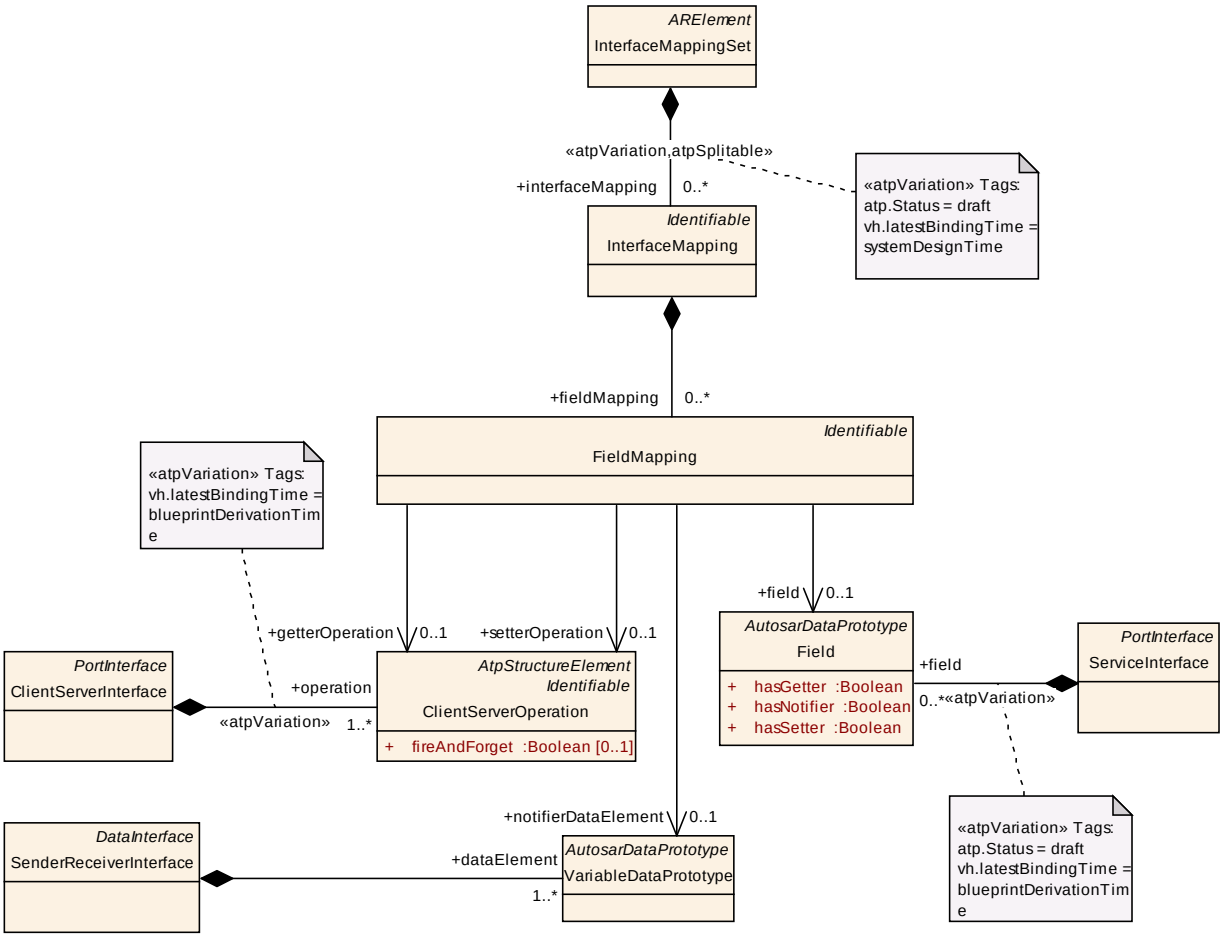


Figure 9.9: Mapping between a `field` and elements of Classic Platform `PortInterfaces`

Class	**FieldMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::SystemDesign			
Note	Mapping of a Field that is located in a ServiceInterface to ClientServerOperations that represent the getter and setter methods and to a VariableDataPrototype that represents the notifier in the Field. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
field	Field	0..1	ref	Reference to a field that is located in a ServiceInterface. **Tags:** atp.Status=draft
getterOperation	ClientServerOperation	0..1	ref	Reference to a ClientServerOperation that represents the getter Method in the Field. **Tags:** atp.Status=draft
notifierDataElement	VariableDataPrototype	0..1	ref	Reference to a VariableDataPrototype that represents the notifier in the Field. **Tags:** atp.Status=draft

setterOperation	ClientServerOperation	0..1	ref	Reference to a ClientServerOperation that represents the setter Method in the Field. **Tags:** atp.Status=draft

Table 9.18: FieldMapping

9.4.4 FireAndForgetMapping

In a fire and forget Message Exchange Pattern the consumer sends a message to a provider with no expectation of a response as described in chapter 3.4.4.1.

In Adaptive Autosar the fire and forget method is described with a `method` where the value of attribute `method.fireAndForget` is set to `true` as defined by [TPS_MANI_01064].

In classic Autosar a fire and forget method can not be described with a `ClientServerOperation` since a client-server call always has a response. Therefore a `VariableDataPrototype` is used if the fire and forget method contains input arguments. If the fire and forget method contains several input arguments then the `VariableDataPrototype` needs to be of type Structure that hosts one element for each argument of the fire and forget method. It is important that the order of elements in the Structure is the same as the order of `ArgumentDataPrototype`s within the `ClientServerOperation`.

This representation ensures that the SOME/IP serialization results in the same byte stream as in the Adaptive Platform where all `argument`s which have the `direction in` are serialized according to the order of the `ArgumentDataPrototype`s within the `ClientServerOperation`.

If the fire and forget method is without any parameters a `Trigger` is used to describe such a method in classic Autosar.

It is important that the SOME/IP MessageType is set to REQUEST_NO_RETURN if a fire and forget method is transmitted over SOME/IP.

[TPS_MANI_03115] Mapping between a fire and forget `method` and elements of Classic Platform `PortInterface`s ⌈ The mapping between a `method` for which the value of attribute `method.fireAndForget` is set to `true` and elements of Classic Platform `PortInterface`s is provided by the class `FireAndForgetMapping`. If the fire and forget method is represented in the classic platform by a `VariableDataPrototype` then this `dataElement` is mapped to a `method` located in a `ServiceInterface`. If the fire and forget method is represented in the classic platform by a `Trigger` then this `trigger` is mapped to a `method` located in a `ServiceInterface`. ⌋*(RS_MANI_00026)*

[constr_3371] Mutually exclusive existence of `FireAndForgetMapping.dataElement` reference and `FireAndForgetMapping.trigger` reference

⌈ A FireAndForgetMapping shall never reference a dataElement and a trigger at the same time. ⌋()

[constr_3376] FireAndForgetMapping shall reference only fire and forget methods ⌈ A FireAndForgetMapping is only allowed to reference a ClientServerOperation in role method for which the value of attribute method.fireAndForget is set to true. ⌋()

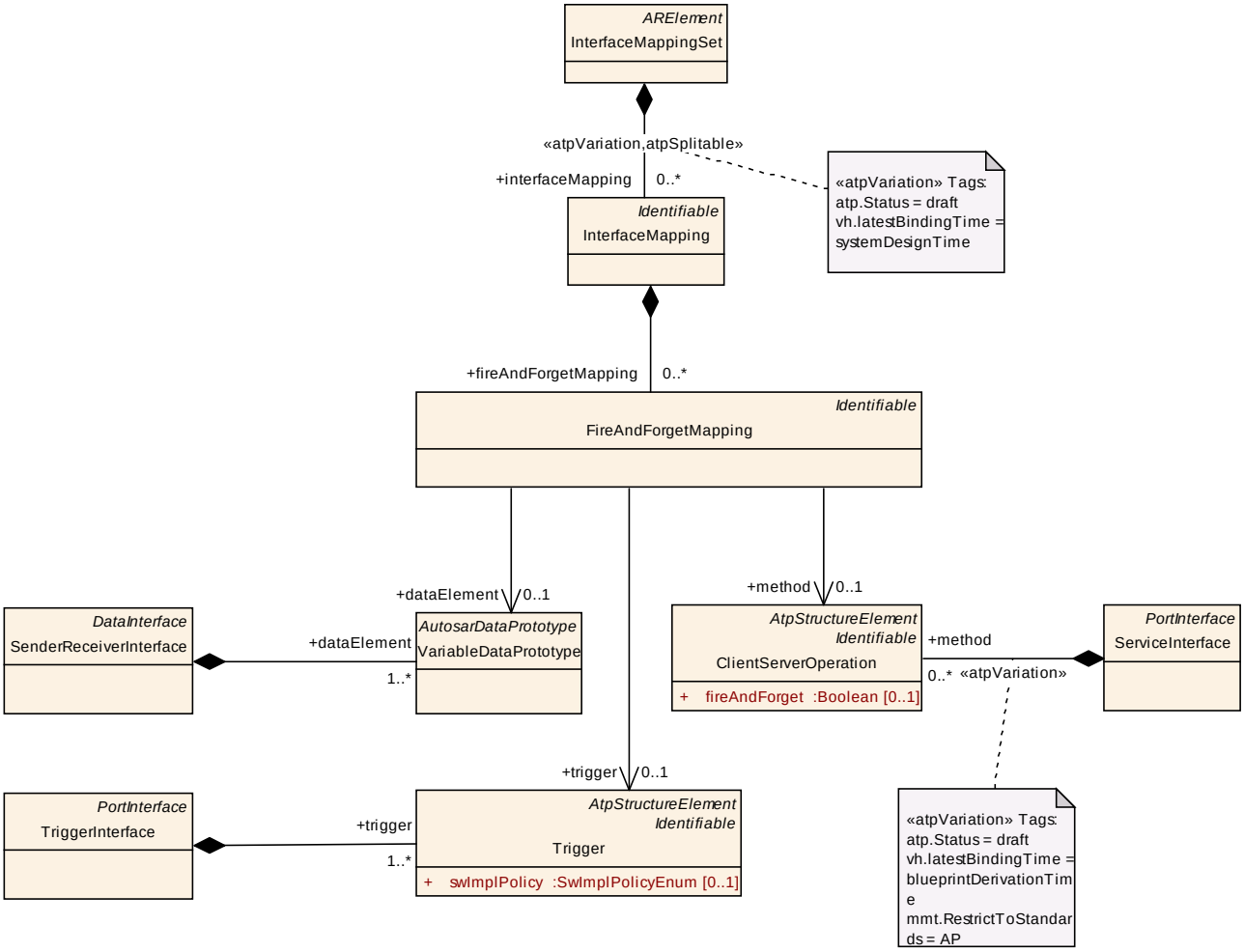


Figure 9.10: Mapping between a fire and forget method and elements of Classic Platform PortInterfaces

Class	**FireAndForgetMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::SystemDesign			
Note	Mapping of a Fire&Forget Method that is located in a ServiceInterface to a VariableDataPrototype in a SenderReceiverInterface or to a Trigger in a TriggerInterface. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

dataElement	VariableDataPrototype	0..1	ref	Reference to a VariableDataPrototype that is located in a SenderReceiverInterface in case that the Fire&Forget Method is represented by this VariableDataPrototype. **Tags:** atp.Status=draft
method	ClientServerOperation	0..1	ref	Reference to a Fire&Forget Method that is located in a ServiceInterface. **Tags:** atp.Status=draft
trigger	Trigger	0..1	ref	Reference to a Trigger that is located in a TriggerInterface in case that the Fire&Forget Method is represented by this Trigger. **Tags:** atp.Status=draft

Table 9.19: FireAndForgetMapping

10 Signal-based communication

10.1 Overview

The applications on the adaptive platform communicate with each other in a service-oriented manner. But there is also a use case where applications on the *AUTOSAR adaptive platform* need to communicate with software-components running on the *AUTOSAR classic platform*.

If the remote ECU on the *AUTOSAR classic platform* communicates via SOME/IP in a service-oriented manner and uses the SOME/IP transformer to serialize its data, then the communication with the `Machine` on the *AUTOSAR adaptive platform* can be established directly without any adaptations of neither the ECU nor the `Machine`.

If the counterpart on the *AUTOSAR classic platform* ECU communicates only using signal-based communication over, e.g., CAN or FlexRay, the translation of the signal-based content into `ServiceInterface`s needs to be established.

Such a Signal-to-Service translation may happen in a Gateway that is implemented on an ECU on the *AUTOSAR classic platform*. Such a solution is out of scope of this document since it is handled using the *AUTOSAR classic platform* configuration means.

Another alternative for this translation is to happen directly on the `Machine` on the *AUTOSAR adaptive platform* by an Application that is running in the Process, as sketched in Figure 10.1.

This Application communicates with other applications on the *AUTOSAR adaptive platform* in the service-oriented way over ara::com; but it is also able to transmit and receive `ISignal`s as well as communicate signal-based with remote ECUs on the *AUTOSAR classic platform*.

In order to make this possible, software that conforms to the specification of the COM stack on the *AUTOSAR classic platform* needs to be executed on the `Machine` on the *AUTOSAR adaptive platform*.

For the configuration of this software, the System Description based on the System Template on the *AUTOSAR classic platform* is used that contains a communication matrix description with `Pdu`s and `ISignal`s.

This chapter introduces a modeling that creates a bridge between the service-oriented communication based on `ServiceInterface`s of the *AUTOSAR adaptive platform* and the signal-based communication involving the definition of `Pdu`s and `ISignal`s that are used on the *AUTOSAR classic platform*.

The Signal-to-Service mapping, together with the *AUTOSAR classic platform* System Description, allows to configure the communication between a `Machine` on the *AUTOSAR adaptive platform* and an ECU on the *AUTOSAR classic platform*. Please note that in a setup like the one sketched in Figure 10.1, the *AUTOSAR classic plat-*

form System Description would also contain a Pdu or Signal Gateway configuration between the Ethernet and the CAN bus.

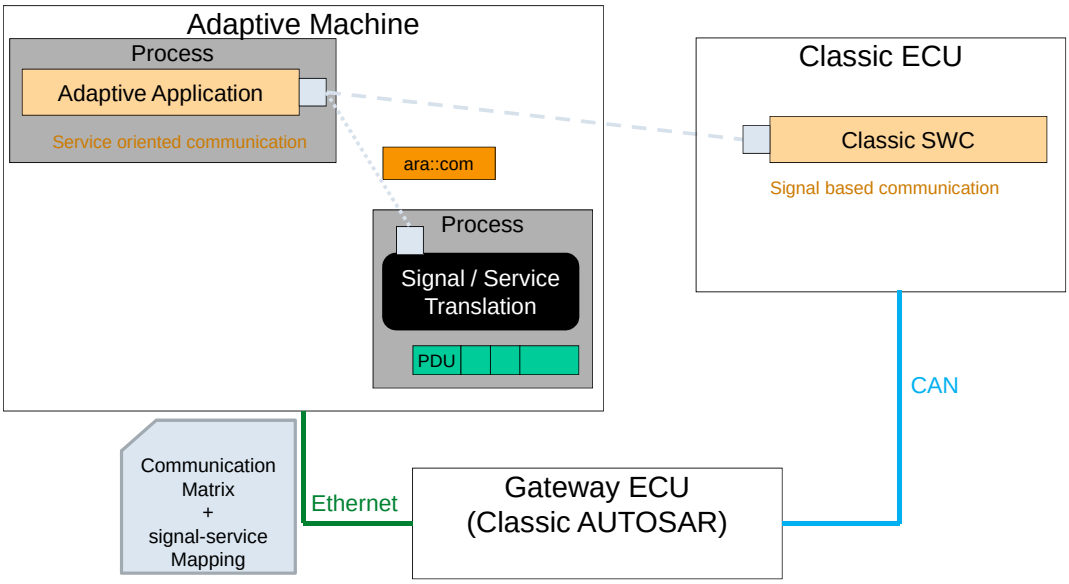


Figure 10.1: SignalToService translation in Application on Adaptive Machine

Please note that the configuration of such signal-based communication on an adaptive machine may be solved in two different ways:

1. The communication matrix definition (ARXML System Description) and the Signal-to-Service mapping is available on the target machine and is interpreted at run-time (like the manifest approach).
2. The communication matrix definition (ARXML System Description) and the Signal-to-Service mapping is built off-board and the application executable gets uploaded to the target `Machine` in response to changes in the communication matrix.

10.2 Signal-based Deployment

The `SignalBasedServiceInterfaceDeployment`, as a specialization of `ServiceInterfaceDeployment`, allows to express that the `ServiceInterface` referenced in the role `serviceInterface` will be transmitted in the signal-based way over a communication medium.

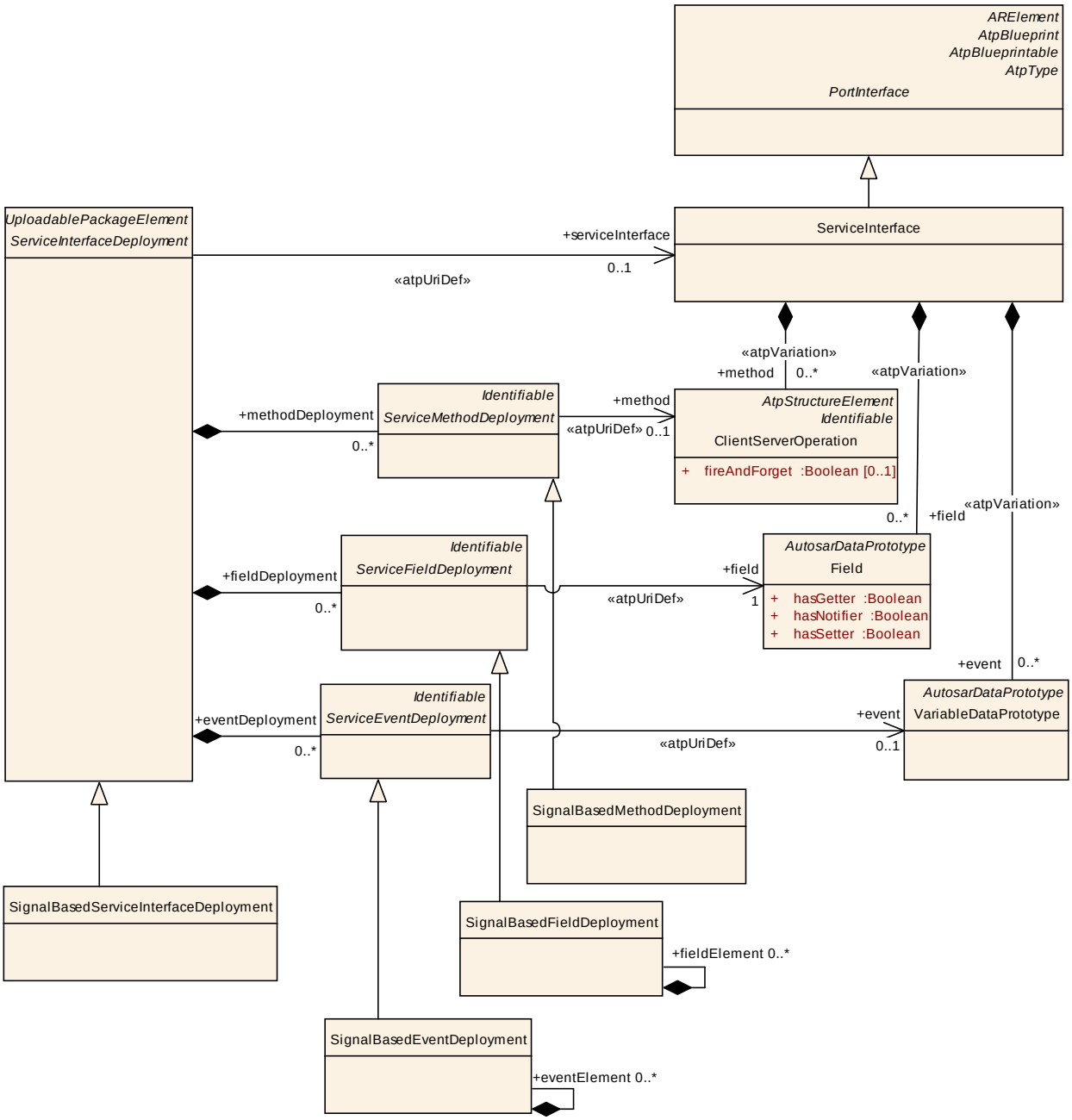


Figure 10.2: Signal-based deployment of ServiceInterface

[TPS_MANI_03120] Signal-based `ServiceInterface` binding ⌈ The `SignalBasedServiceInterfaceDeployment` meta-class provides the ability to bind a `ServiceInterface` that is referenced in the role `serviceInterface` to a signal-based communication protocol like CAN or FlexRay. ⌋*(RS_MANI_00029)*

Please note that in contrast to other `ServiceInterfaceDeployment`s that are described in section 7.1, the communication is not described with `AdaptivePlatformServiceInstance` elements but with a Signal-to-Service Mapping and a classic platform System Description.

Class	**SignalBasedServiceInterfaceDeployment**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInterface Deployment			
Note	Signal-based configuration settings for a ServiceInterface from which the content will be transmitted in the signal-based way over a communication medium. **Tags:** atp.Status=draft; atp.recommendedPackage=ServiceInterfaceDeployments			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *ServiceInterfaceDeployment*, *UploadablePackage Element*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 10.1: SignalBasedServiceInterfaceDeployment

The meta-class `SignalBasedEventDeployment` allows to flatten the structure of the referenced `VariableDataPrototype` with the `eventElement` aggregation, as shown in figure Figure 10.3, where all primitive elements that are defined inside of the Event that is typed by a Structure are modeled as `eventElement`s. This allows for the later mapping of these `eventElement`s to individual signals.

[TPS_MANI_03121] Signal-based `VariableDataPrototype` binding ⌈ The `SignalBasedEventDeployment` meta-class provides the ability to map a `VariableDataPrototype` that is referenced in the role `event` to one or several `ISignal`s. ⌋ *(RS_MANI_00029)*

```
event event1 {
        type: struct1
}

type struct1 {
        a: bool
        b: struct2
}

type struct2 {
        x: uint32
        y: uint32
        z: uint32
}
```

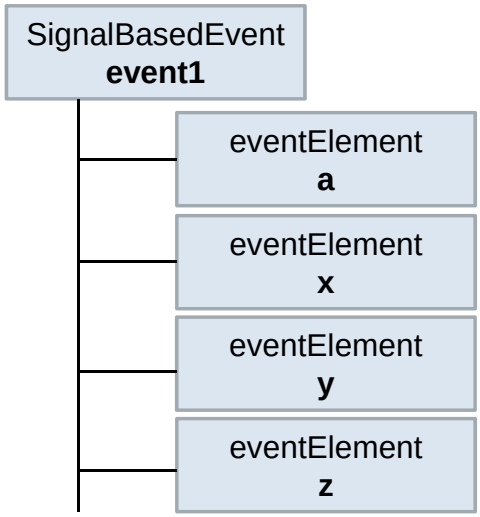


Figure 10.3: Usage of SignalBasedEvent

Class	**SignalBasedEventDeployment**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInterface Deployment			
Note	This element needs to be defined if the event needs to be transported in a signal-based way over a communication channel. If the datatype of the event is composite then the hierarchy and all primitive dataelements need to be described with the aggregated eventElements since every single eventElement will be transported in an individual signal over the communication medium. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *ServiceEvent Deployment*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
eventElement	SignalBasedEventDeployment	*	aggr	In case that the datatype of the event is composite all primitive elements of the datatype need to be described since every single one will be transported in an individual Signal over the communication medium. **Tags:** atp.Status=draft

Table 10.2: SignalBasedEventDeployment

[TPS_MANI_03122] Signal-based `Field` binding ⌈ The `SignalBasedFieldDeployment` meta-class provides the ability to map a `Field` that is referenced in the role `field` to one or several `ISignal`s. ⌋*(RS_MANI_00029)*

Class	**SignalBasedFieldDeployment**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInterface Deployment			
Note	This element needs to be defined if the field needs to be transported in a signal-based way over a communication channel. If the datatype of the field is composite and a notifier is defined in the field then the datatype hierarchy and all primitive dataelements need to be described with the aggregated fieldElements since every single fieldElement will be transported in an individual signal over the communication medium. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *ServiceField Deployment*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
fieldElement	SignalBasedFieldDeployment	*	aggr	In case that the datatype of the field is composite and a notifier is defined for the field all primitive elements of the datatype need to be described since every single one will be transported in an individual Signal over the communication medium. **Tags:** atp.Status=draft

Table 10.3: SignalBasedFieldDeployment

If the attribute hasNotifier in the referenced Field is set to true, the SignalBasedFieldDeployment needs to be handled in the same way as the SignalBasedEventDeployment, i.e. all primitive elements that are defined inside of the Notifier that is typed by a Structure are modeled as fieldElements.

If the attribute hasNotifier in the referenced Field is set to false, no fieldElement need to be defined. The reason is that a ClientServerOperation in *AUTOSAR classic platform* is always mapped to a single Call-Signal and a single Return-Signal, and a mapping of individual arguments to Signals is not supported. If the Field has only the getter and/or setter method, all necessary information to describe the Signal-to-Service mapping is already available with the SignalBasedFieldDeployment .

For the same reason, the SignalBasedMethodDeployment does not contain any aggregations.

[TPS_MANI_03123] Signal-based ClientServerOperation binding ⌈ The SignalBasedMethodDeployment meta-class provides the ability to map a ClientServerOperation that is referenced in the role method to one or several ISignals. ⌋*(RS_MANI_00029)*

Class	**SignalBasedMethodDeployment**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInterface Deployment			
Note	This element needs to be defined if the method needs to be transported in a signal-based way over a communication channel. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *ServiceMethodDeployment*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 10.4: SignalBasedMethodDeployment

10.3 Signal-To-Service Mapping

This chapter describes the mapping of ServiceInterface elements of a specific AdaptivePlatformServiceInstance defined in the context of a Process to ISignalTriggerings. The prerequisite is the definition of the SignalBasedServiceInterfaceDeployment with all necessary Signal-based methodDeployments, fieldDeployments and eventDeployments.

Class	**ServiceInstanceToSignalMappingSet**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ServiceInterfaceElementToSignal Mapping			
Note	This meta-class represents a list of mappings of ServiceInstances to ISignalTriggerings. **Tags:** atp.Status=draft; atp.recommendedPackage=ServiceInstanceToSignalMapping Sets			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
serviceInstanceToSignalMapping	ServiceInstanceToSignalMapping	*	aggr	This is one particular mapping accociation of a ServiceInstance to a number of ISignalTriggerings, **Tags:** atp.Status=draft

Table 10.5: ServiceInstanceToSignalMappingSet

Class	**ServiceInstanceToSignalMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ServiceInterfaceElementToSignal Mapping			
Note	This meta-class is defined for a specific ServiceInstance and contains the mappings of elements of a ServiceInterface for which the ServiceInstance is defined to individual ISignalTriggerings. **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
eventElementMapping	SignalBasedEventElementToISignalTriggeringMapping	*	aggr	Mapping of an event or an element inside of the event to an ISignalTriggering. **Tags:** atp.Status=draft
fieldMapping	SignalBasedFieldToISignalTriggeringMapping	*	aggr	Mapping of a field to ISignalTriggerings. **Tags:** atp.Status=draft
methodMapping	SignalBasedMethodToISignalTriggeringMapping	0..1	aggr	Mapping of a method to ISignalTriggerings. **Tags:** atp.Status=draft
serviceInstance	ServiceInstanceToPortPrototypeMapping	0..1	ref	Reference to a ServiceInstance from which the corresponding ServiceInterface elements will be transported in the signal-based way over a communication medium. **Tags:** atp.Status=draft

Table 10.6: ServiceInstanceToSignalMapping

The `ServiceInstanceToSignalMapping` references a `ServiceInstanceToPortPrototypeMapping` and thereby defines the `AdaptivePlatformService-`

Instance executed in a Process of which serviceInterface elements will be mapped by the aggregated eventElementMapping, methodMapping and/or fieldMapping to ISignalTriggerings. This is described in details in the following chapters.

10.3.1 SignalBasedEvent Mapping

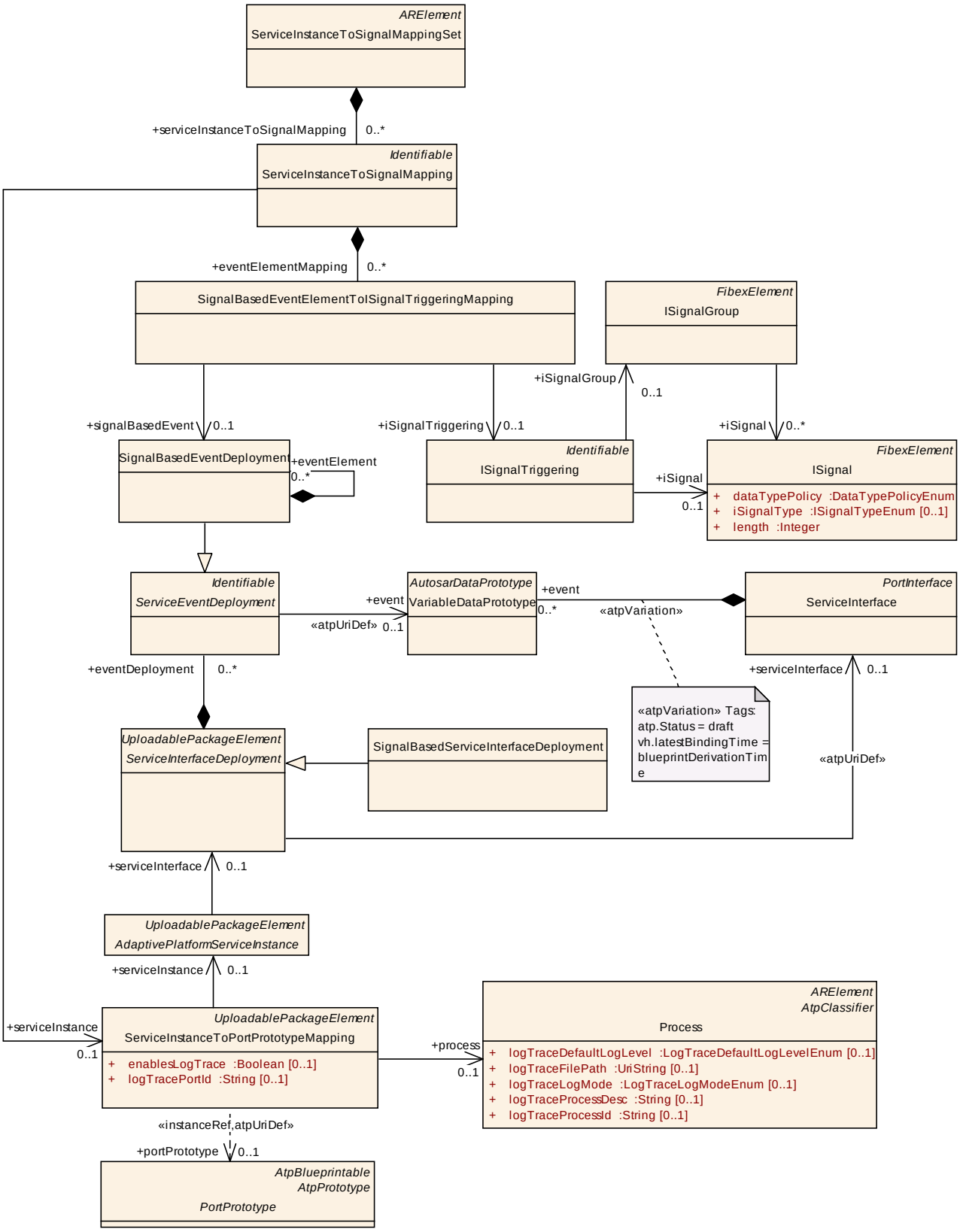


Figure 10.4: Mapping of Event elements to ISignals

[TPS_MANI_03124] `SignalBasedEventDeployment` to `ISignalTriggering` mapping ⌈ The `SignalBasedEventElementToISignalTriggeringMapping` meta-class provides the ability to map a `SignalBasedEventDeployment` that is referenced in the role `signalBasedEvent` to one `ISignalTriggering` of the `ISignal` or `ISignalGroup`. ⌋*(RS_MANI_00029)*

In the example sketched in Figure 10.3, one `SignalBasedEventElementToISignalTriggeringMapping` would map the `SignalBasedEventDeployment` *event1* to an `ISignalTriggering` of an `ISignalGroup`. Another `SignalBasedEventElementToISignalTriggeringMapping` would map the `eventElement` *a* to an `ISignalTriggering` of an `ISignal` contained in the `ISignalGroup`. Finally, one more `SignalBasedEventElementToISignalTriggeringMapping`s would map the `eventElement`s *x*, *y* and *z* to additional `ISignalTriggering`s of individual `ISignal`s located in the same `ISignalGroup`.

Class	**SignalBasedEventElementToISignalTriggeringMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ServiceInterfaceElementToSignalMapping			
Note	This meta-class defines the mapping of a ServiceInterface event or an element that is defined inside of the event in case that the datatype is composite to an ISignalTriggering. **Tags:** atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
iSignalTriggering	ISignalTriggering	0..1	ref	Reference to the ISignalTriggering that is used to transport a piece of data of an event that is defined in a ServiceInterface in a signal-based way over a communication channel. **Tags:** atp.Status=draft
signalBasedEvent	SignalBasedEventDeployment	0..1	ref	Reference to an Event or an element inside of the Event that will be mapped to an ISignalTriggering for signal-based transport over a communication channel. **Tags:** atp.Status=draft

Table 10.7: SignalBasedEventElementToISignalTriggeringMapping

10.3.2 SignalBasedField Mapping

[TPS_MANI_03126] `SignalBasedFieldDeployment` to `ISignalTriggering`s mapping ⌈ The `SignalBasedFieldToISignalTriggeringMapping` meta-class provides the ability to map a `SignalBasedFieldDeployment` that is referenced in the role `signalBasedField`

- to one `ISignalTriggering` for the `ISignalGroup` representing the Notifier or

- to one ISignalTriggering for the ISignal representing the Notifier element (fieldElement) or
- to one ISignalTriggering for the ISignal representing the Getter-Call or
- to one ISignalTriggering for the ISignal representing the Getter-Return or
- to one ISignalTriggering for the ISignal representing the Setter-Call or
- to one ISignalTriggering for the ISignal representing the Setter-Return or

⌋(*RS_MANI_00029*)

It means that several SignalBasedFieldToISignalTriggeringMappings are necessary to map a SignalBasedFieldDeployment to a number of ISignal-Triggerings.

[constr_3377] Restriction of ISignalTriggering references in SignalBased-FieldToISignalTriggeringMapping ⌈ For any given SignalBasedField-ToISignalTriggeringMapping, only a single reference to an ISignalTrigger-ing shall exist. ⌋()

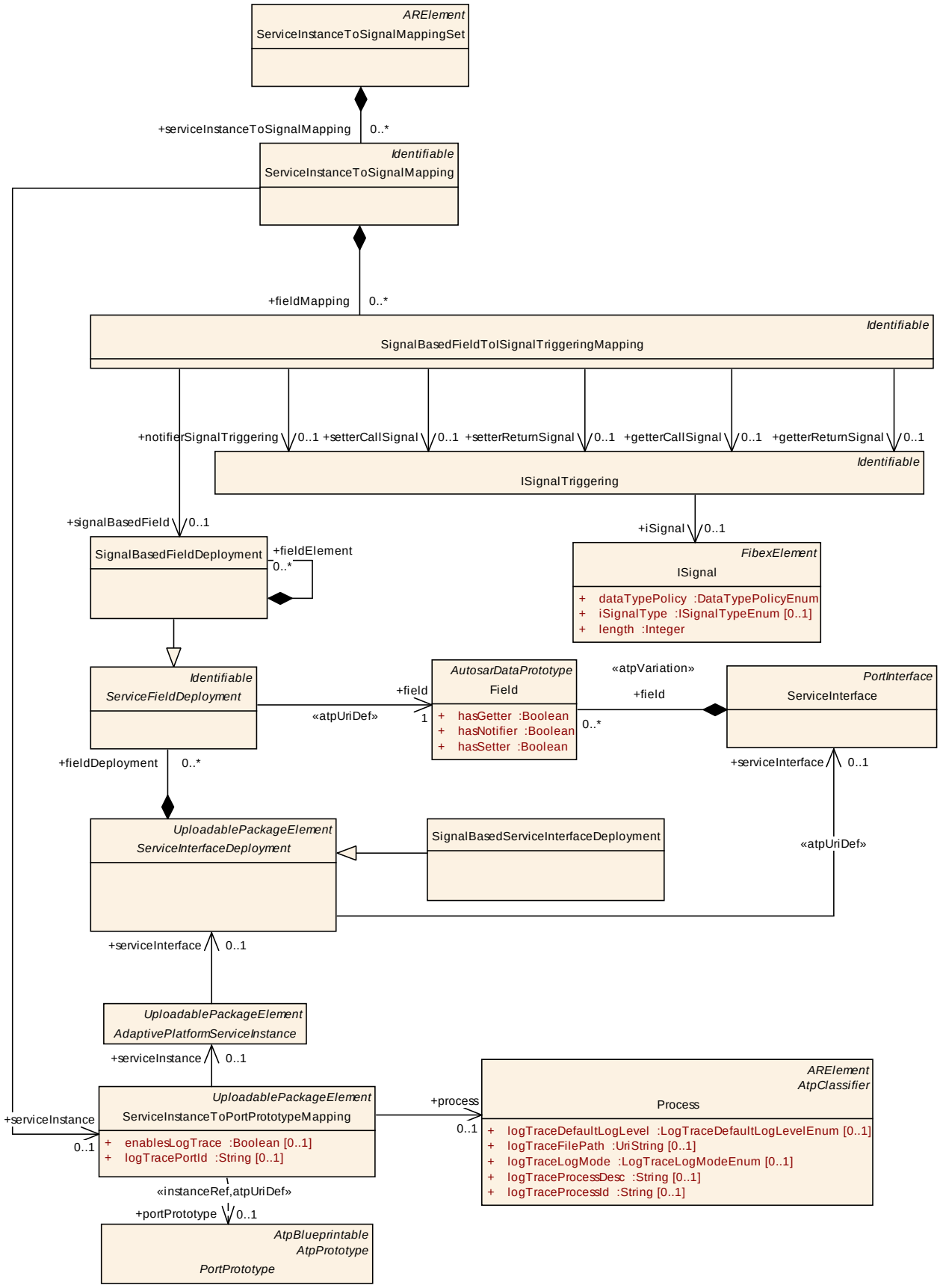


Figure 10.5: Mapping of Fields to ISignals

Class	**SignalBasedFieldToISignalTriggeringMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ServiceInterfaceElementToSignalMapping			
Note	This meta-class defines the mapping of a ServiceInterface field to ISignalTriggerings that represent the notifier elements, the getter call and response, the setter call and response on a signal-based communication channel. . **Tags:** atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
getterCallSignal	ISignalTriggering	0..1	ref	Reference to the ISignalTriggering that is used to transport the getter method call in a signal-based way over a communication channel. **Tags:** atp.Status=draft
getterReturnSignal	ISignalTriggering	0..1	ref	Reference to the ISignalTriggering that is used to transport the getter method response in a signal-based way over a communication channel. **Tags:** atp.Status=draft
notifierSignalTriggering	ISignalTriggering	0..1	ref	Reference to the ISignalTriggering that is used to transport a piece of data of a notifier in a signal-based way over a communication channel. **Tags:** atp.Status=draft
setterCallSignal	ISignalTriggering	0..1	ref	Reference to the ISignalTriggering that is used to transport the setter method call in a signal-based way over a communication channel. **Tags:** atp.Status=draft
setterReturnSignal	ISignalTriggering	0..1	ref	Reference to the ISignalTriggering that is used to transport the setter method response in a signal-based way over a communication channel. **Tags:** atp.Status=draft
signalBasedField	SignalBasedFieldDeployment	0..1	ref	Reference to an field or an element inside of the field that will be mapped to an ISignalTriggering for signal-based transport over a communication channel. **Tags:** atp.Status=draft

Table 10.8: SignalBasedFieldToISignalTriggeringMapping

10.3.3 SignalBasedMethod Mapping

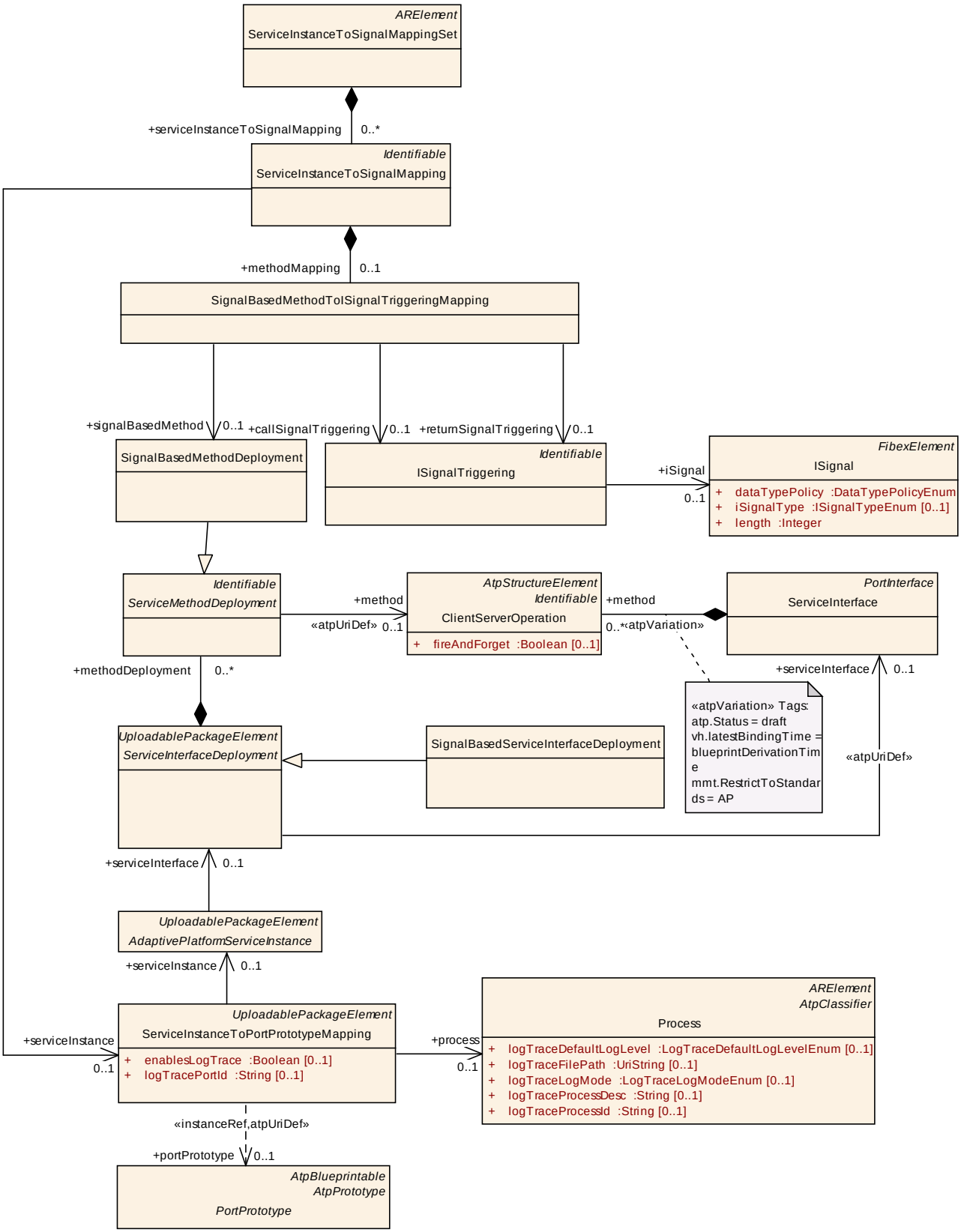


Figure 10.6: Mapping of Methods to ISignals

[TPS_MANI_03125] `SignalBasedMethodDeployment` to `ISignalTriggering`s mapping ⌈ The `SignalBasedMethodToISignalTriggeringMapping` meta-class provides the ability to map a `SignalBasedMethodDeployment` that is referenced in the role `signalBasedMethod` to one `ISignalTriggering` for the `ISignal` representing the Method-Call and one `ISignalTriggering` for the `ISignal` representing the Method-Return. ⌋*(RS_MANI_00029)*

Class	**SignalBasedMethodToISignalTriggeringMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ServiceInterfaceElementToSignalMapping			
Note	This meta-class defines the mapping of a ServiceInterface method to an ISignalTriggering. **Tags:** atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
callSignalTriggering	ISignalTriggering	0..1	ref	Reference to the ISignalTriggering that is used to transport the method call in a signal-based way over a communication channel. **Tags:** atp.Status=draft
returnSignalTriggering	ISignalTriggering	0..1	ref	Reference to the ISignalTriggering that is used to transport the method response in a signal-based way over a communication channel. **Tags:** atp.Status=draft
signalBasedMethod	SignalBasedMethodDeployment	0..1	ref	Reference to the method that will be mapped to an ISignalTriggering for signal-based transport over a communication channel. **Tags:** atp.Status=draft

Table 10.9: SignalBasedMethodToISignalTriggeringMapping

Please note that the `SignalBasedMethodToISignalTriggeringMapping` shall also be used for the mapping of `method`s where the value of attribute `method.fireAndForget` is set to `true`. In this case, only the `callSignalTriggering` shall be used since in the fire and forget Message Exchange Pattern only one message is sent from the service consumer to the service provider.

11 Persistency Deployment

11.1 Overview

This chapter explains the part of the support for persistent storage in terms of mapping of concrete storage models to the corresponding parts of the application software.

11.2 Deployment of Persistent Data

[TPS_MANI_01079] Semantics of `PersistencyKeyValueDatabase` ⌈ Meta-class `PersistencyKeyValueDatabase` represents an actual database or similar entity used for persistently storing data. ⌋*(RS_MANI_00027)*

Class	**PersistencyKeyValueDatabase**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Persistency			
Note	This meta-class represents the ability to model a key/value data base on deployment level. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft; atp.recommendedPackage=PersistencyKeyValueDatabases			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
keyValuePair	PersistencyKeyValuePair	*	aggr	This aggregation represents the key-value-pairs owned by the enclosing PersistencyKeyValueDatabase **Tags:** atp.Status=draft
updateStrategy	PersistencyCollectionLevelUpdateStrategyEnum	1	attr	This attribute can be used to specify the update strategy of the respective PersistencyKeyValueDatabase as a whole.
uri	UriString	0..1	attr	This attribute holds the storage location for the PersistencyKeyValueDatabase / PersistencyFile, e.g. file on the file system.

Table 11.1: PersistencyKeyValueDatabase

[TPS_MANI_01147] Semantics of `PersistencyKeyValueDatabase.updateStrategy` ⌈ The attribute `PersistencyKeyValueDatabase.updateStrategy` can be used to specify the strategy for updating the actual persistent elements.

This update strategy shall be applied to the `PersistencyKeyValueDatabase` as a whole except for the explicitly modeled `keyValuePair`s that define their own `updateStrategy`. ⌋*(RS_MANI_00027)*

[TPS_MANI_01144] Semantics of `PersistencyKeyValuePair` ⌈ Meta-class `PersistencyKeyValuePair` represents an **entry** to an actual database (formalized

by PersistencyKeyValueDatabase) or similar entity used for persistently storing data. ⌋(RS_MANI_00027)

Class	PersistencyKeyValuePair			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Persistency			
Note	This meta-class represents the ability to formally model a key-value pair in the context of the deployment of persistency. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	**Type**	**Mul.**	**Kind**	**Note**
initValue	ValueSpecification	1	aggr	This aggregation represents the ability to define an initial value for the value side of the key-value pair. **Tags:** atp.Status=draft
updateStrategy	PersistencyElementLevelUpdateStrategyEnum	1	attr	This attribute can be used to specify the update strategy of the respective PersistencyKeyValuePair.
valueDataType	ImplementationDataType	1	ref	This reference represents the data type applicable for the value of the key-value pair. **Tags:** atp.Status=draft

Table 11.2: PersistencyKeyValuePair

The modeling of PersistencyKeyValuePair aggregated in the role PersistencyKeyValueDatabase.keyValuePair is optional. It would be possible to use persistency functionality regardless of the existence of keyValuePair.

However, the presence of keyValuePair gives more freedom and ways for the customization of behavior.

[TPS_MANI_01078] Semantics of PersistencyPortPrototypeToKeyValueDatabaseMapping ⌈ Meta-class PersistencyPortPrototypeToKeyValueDatabaseMapping has the ability to map a specific PortPrototype referenced in the role portPrototype to a PersistencyKeyValueDatabase referenced in the role keyValueStorage.

The mapping also comprises a reference to meta-class process in order to accommodate for the fact that identical combinations of keyValueStorage and portPrototype may or may not apply for a given Process that represents the enclosing Executable at runtime. ⌋(RS_MANI_00027)

[constr_1555] Restriction applicable for PersistencyPortPrototypeToKeyValueDatabaseMapping.portPrototype ⌈ The reference PersistencyPortPrototypeToKeyValueDatabaseMapping.portPrototype shall only be used for a PortPrototype typed by a PersistencyKeyValueDatabaseInterface. ⌋()

[TPS_MANI_01155] PersistencyKeyValueDatabase.updateStrategy overrides PersistencyKeyValueDatabaseInterface.updateStrategy ⌈ The

value of attribute PersistencyKeyValueDatabase.updateStrategy shall overrule the value of PersistencyKeyValueDatabaseInterface.updateStrategy for any combination of PersistencyKeyValueDatabaseInterface mapped to a PersistencyKeyValueDatabase by means of a PersistencyPortPrototypeToKeyValueDatabaseMapping. ⌋(*RS_MANI_00027*)

This means that the integrator of the software gets the authority to either agree to the designer's point of view or else overrule the designer's decision based on superior knowledge regarding the integration strategy.

[TPS_MANI_01157] Semantics of updateStrategy on collection level ⌈ The semantics of attribute updateStrategy on collection level is specified in Table 11.3.

The table applies for both the attribute PersistencyKeyValueDatabaseInterface.updateStrategy as well as for attribute PersistencyFileArray.updateStrategy. ⌋(*RS_MANI_00027*)

updateStrategy	Use Case: Installation	Use Case: Update
delete	irrelevant	delete all elements not contained in current manifest
keepExisting	irrelevant	keep all elements not contained in current manifest

Table 11.3: Semantics of updateStrategy on collection level

[TPS_MANI_01159] Semantics of updateStrategy on element level ⌈ The semantics of attribute updateStrategy on element level is specified in Table 11.4.

The table applies for both attribute PersistencyKeyValuePair.updateStrategy as well as for attribute PersistencyFile.updateStrategy. ⌋(*RS_MANI_00027*)

updateStrategy	Use Case: Installation	Use Case: Update
delete	don't create	remove
keepExisting	create	do nothing
overwrite	create	replace

Table 11.4: Semantics of updateStrategy on element level

Class	**PersistencyPortPrototypeToKeyValueDatabaseMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Persistency			
Note	This meta-class represents the ability to define a mapping between a PortPrototype and a key value database used in a persistent storage. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft; atp.recommendedPackage=PersistentPortPrototypeToKeyValueDatabaseMappings			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
keyValueStorage	PersistencyKeyValueDatabase	1	ref	This reference represents the mapped key-value storage. **Tags:** atp.Status=draft

portPrototype	PortPrototype	0..1	iref	This reference represents the affected Persistency PortPrototype **Tags:** atp.Status=draft
process	Process	1	ref	This reference represents the process required for context of the mapping. **Tags:** atp.Status=draft

Table 11.5: PersistencyPortPrototypeToKeyValueDatabaseMapping

Please note that typically the existence of `PersistencyKeyValueDatabase.keyValuePair` depends on the existence of `PersistencyKeyValueDatabaseInterface.dataElement`.

On the other hand, if a `PersistencyKeyValueDatabase` contains `PersistencyKeyValuePair`s that do not correspond to any `dataElement`s of the `PersistencyKeyValueDatabaseInterface` that is mapped (indirectly) via `PersistencyPortPrototypeToKeyValueDatabaseMapping`then those `keyValuePair`s are created within the `PersistencyKeyValueDatabase`.

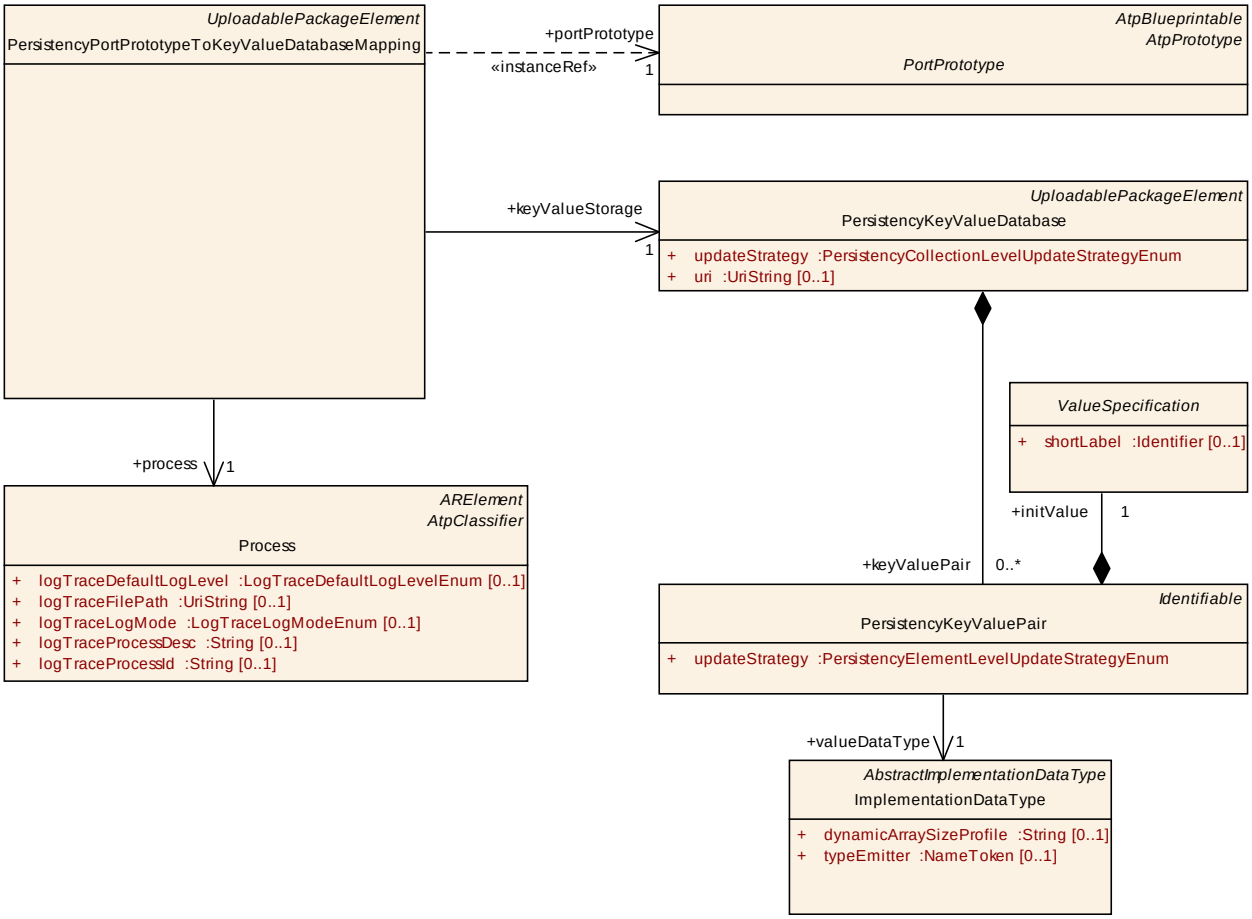


Figure 11.1: Connect a specific `PortPrototype` to a `PersistencyKeyValueDatabase`

[TPS_MANI_01146] Initial value for `PersistencyKeyValuePair` ⌈ It is possible to define an initial value for a given `PersistencyKeyValuePair` by means of the aggregation of `ValueSpecification` in the role `initValue`. ⌋*(RS_MANI_00027)*

[constr_1554] Restriction regarding `PersistencyKeyValuePair.initValue` ⌈ The concrete sub-class of `ValueSpecification` aggregated in the role `PersistencyKeyValuePair.initValue` shall not (after resolving a possible redirection by means of `ConstantReference`) be one of the following:

- `ApplicationValueSpecification`
- `ApplicationRuleBasedValueSpecification`
- `ReferenceValueSpecification`

⌋*()*

[TPS_MANI_01148] Semantics of `PersistencyKeyValuePair.updateStrategy` ⌈ The attribute `PersistencyKeyValuePair.updateStrategy` can be used to specify the strategy for updating the actual persistent element that corresponds to `PersistencyKeyValuePair`. ⌋*(RS_MANI_00027)*

[TPS_MANI_01156] `PersistencyKeyValuePair.updateStrategy` overrides `PersistencyKeyValueDatabase.updateStrategy` ⌈ The value specified for `PersistencyKeyValuePair.updateStrategy` overrides the value of `PersistencyKeyValueDatabase.updateStrategy` for this specific `PersistencyKeyValuePair`. ⌋*(RS_MANI_00027)*

[TPS_MANI_01182] `PersistencyKeyValuePair.updateStrategy` overrides `PersistencyDataElement.updateStrategy` ⌈ The value of attribute `PersistencyKeyValuePair.updateStrategy` overrides the value of attribute `PersistencyDataElement.updateStrategy` ⌋*(RS_MANI_00027)*

This means that the integrator of the software gets the authority to either agree to the designer's point of view or else overrule the designer's decision based on superior knowledge regarding the integration strategy.

[constr_1582] `PersistencyKeyValuePair.valueDataType` shall match to `ImplementationDataType` for the corresponding `PersistencyDataElement` ⌈ Each `PersistencyKeyValuePair.valueDataType` shall match the `ImplementationDataType` that either directly or indirectly (via the applicable `DataTypeMap`) types the corresponding (based on identical values of the respective `shortName`) `PersistencyDataElement`. ⌋*()*

11.3 Deployment of Files

[TPS_MANI_01150] Semantics of `PersistencyFileArray` ⌈ A `PortPrototype` typed by a `PersistencyFileProxyInterface` actually builds an abstraction for an entire array of files.

This abstraction is also visible in the deployment by means of the existence of the companion meta-class PersistencyFileArray.

This approach allows for the dynamic creation and/or deletion of files during runtime while still keeping the structural model of the file interaction static. ⌋(*RS_MANI_00027*)

Class	**PersistencyFileArray**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Persistency			
Note	This meta-class comes with the ability to define an array of single files that creates the deployment-side counterpart to a PortPrototype typed by a PersistencyFileProxyInterface. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft; atp.recommendedPackage=PersistencyFileArrays			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
file	PersistencyFile	*	aggr	This aggregation represents the collection of files aggregated by the PersistencyFileArray. **Tags:** atp.Status=draft
updateStrategy	PersistencyCollectionLevelUpdateStrategyEnum	1	attr	This attribute can be used to specify the update strategy of the respective PersistencyFileArray as a whole.
uri	UriString	1	attr	This attribute holds the storage location for the PersistencyFileArray, e.g. a directory on the file system.

Table 11.6: PersistencyFileArray

[TPS_MANI_01151] Semantics of PersistencyFileArray.updateStrategy ⌈ The attribute PersistencyFileArray.updateStrategy can be used to specify the strategy for updating the actual persistent elements.

This update strategy shall be applied to the PersistencyFileArray as a whole except for the explicitly modeled files that define their own updateStrategy. ⌋ *(RS_MANI_00027)*

At one point, however, it is necessary to boil down the relation of such a PortPrototype typed by a PersistencyFileProxyInterface to individual files and how these individual files are represented on the file system themselves.

This aspect is covered by the modeling of meta-class PersistencyPortPrototypeToFileArrayMapping, as depicted in Figure 11.2.

[TPS_MANI_01080] Semantics of PersistencyPortPrototypeToFileArrayMapping ⌈ Meta-class PersistencyPortPrototypeToFileArrayMapping creates a mapping between a PortPrototype referenced in the role portPrototype to a PersistencyFileArray referenced in the role persistency-

FileArray under consideration of a Process referenced in the role process. ⌋ *(RS_MANI_00027)*

Class	**PersistencyPortPrototypeToFileArrayMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Persistency			
Note	This meta-class represents the ability to define a mapping between an array of files on deployment level to a given PortPrototype. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft; atp.recommended Package=PersistentFileProxyToFileMappings			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
persistencyFileArray	PersistencyFileArray	1	ref	This reference represents the mapped array of files. **Tags:** atp.Status=draft
portPrototype	PortPrototype	0..1	iref	This reference represents the mapped PortPrototype. **Tags:** atp.Status=draft
process	Process	1	ref	This reference represents the process required as context for the mapping. **Tags:** atp.Status=draft

Table 11.7: PersistencyPortPrototypeToFileArrayMapping

[TPS_MANI_01154] PersistencyFileArray.updateStrategy overrides PersistencyFileProxyInterface.updateStrategy ⌈ The value of attribute PersistencyFileArray.updateStrategy shall override the value of PersistencyFileProxyInterface.updateStrategy for any combination of PersistencyFileProxyInterface mapped to a PersistencyFileArray by means of a PersistencyPortPrototypeToFileArrayMapping. ⌋*(RS_MANI_00027)*

This means that the integrator of the software gets the authority to either agree to the designer's point of view or else overrule the designer's decision based on superior knowledge regarding the integration strategy.

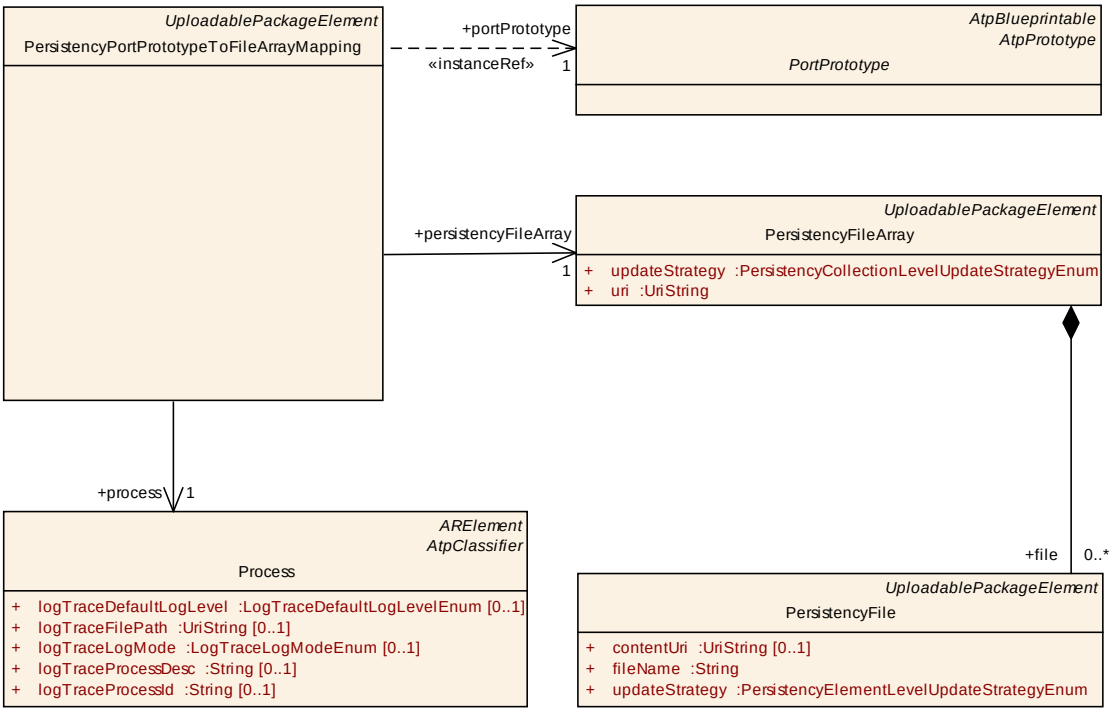


Figure 11.2: Connect a specific `PortPrototype` to a `PersistencyFile`

[TPS_MANI_01149] Semantics of `PersistencyFileArray.file` ⌈ The usage of `PersistencyFileArray.file` allows for the explicit modeling of elements of the `PersistencyFileArray`.

The creation of this aggregation is optional. It can be used to define the update strategy and/or initial content of selected files. ⌋*(RS_MANI_00027)*

[constr_1556] Restriction applicable for `PersistencyPortPrototype-ToFileArrayMapping.portPrototype` ⌈ The reference `PersistencyPort-PrototypeToFileArrayMapping.portPrototype` shall only be used for a `PortPrototype` typed by a `PersistencyFileProxyInterface`. ⌋*()*

Class	**PersistencyFile**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Persistency			
Note	This meta-class represents the model of a file as part of the persistency on deployment level. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft; atp.recommended Package=PersistencyFiles			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
contentUri	UriString	0..1	attr	This attribute represents the URI that identifies the initial content of the PersistencyFile.

fileName	String	1	attr	This attribute holds filename part of the storage location for the PersistencyFile, e.g. file on the file system. **Tags:** atp.Status=draft
updateStrategy	PersistencyElementLevelUpdateStrategyEnum	1	attr	This attribute can be used to specify the update strategy of the respective PersistencyFile.

Table 11.8: PersistencyFile

[TPS_MANI_01152] Semantics of `PersistencyFile.updateStrategy` ⌈ The attribute `PersistencyFile.updateStrategy` can be used to specify the strategy for updating the actual persistent file that corresponds to the model element `PersistencyFile`. ⌋*(RS_MANI_00027)*

[TPS_MANI_01158] `PersistencyFile.updateStrategy` overrides `PersistencyFileArray.updateStrategy` ⌈ The value specified for `PersistencyFile.updateStrategy` overrides the value of `PersistencyFileArray.updateStrategy` for this specific `PersistencyFile`. ⌋*(RS_MANI_00027)*

[TPS_MANI_01183] `PersistencyFile.updateStrategy` overrides `PersistencyFileProxy.updateStrategy` ⌈ The value of attribute `PersistencyFile.updateStrategy` overrides the value of attribute `PersistencyFileProxy.updateStrategy`. ⌋*(RS_MANI_00027)*

This means that the integrator of the software gets the authority to either agree to the designer's point of view or else overrule the designer's decision based on superior knowledge regarding the integration strategy.

[TPS_MANI_01179] Semantics of `PersistencyFileProxy.contentUri`/`PersistencyFile.contentUri` vs. `PersistencyFileArray.uri` and `PersistencyFileProxy.fileName`/`PersistencyFile.fileName` ⌈ Attributes `PersistencyFileProxy.contentUri` and (after deployment) `PersistencyFile.contentUri` describe the URI of the file that is used to initialize the `PersistencyFile` (used during install or update).

On the other hand, the combination of `PersistencyFileArray.uri` and the `PersistencyFileProxy.fileName` or (after deployment) `PersistencyFile.fileName` denote the position of the `PersistencyFile` in the ECU (used at run-time). ⌋ *(RS_MANI_00027)*

[constr_1589] Value of `file.fileName` ⌈ Within the scope of any given `PersistencyFileArray`, the value of all `file.fileName` shall be unique. ⌋*()*

12 Crypto Deployment

Disclaimer: the content of this chapter is under discussion. It is released for documentation purposes only. Changes can be expected for the next release.

12.1 Overview

This chapter explains the part of the support for data encryption etc. in terms of mapping of concrete crypto software to the corresponding parts of the application software.

12.2 Crypto Module Instantiation

[TPS_MANI_01090] Modeling of crypto software as a platform module ⌈ An instance of the *AUTOSAR adaptive platform* hosts the crypto software as a platform module. This aspect is formalized as the definition of meta-class `CryptoModuleInstantiation` that is derived from `NonOsModuleInstantiation`.

The `CryptoModuleInstantiation`, in turn, hosts all formal elements needed to describe the deployment of crypto software and the establishment of a relation between the platform module and application-level software. ⌋*(RS_MANI_00031)*

For more information about the modeling of the `CryptoModuleInstantiation` please refer to Figure 12.1.

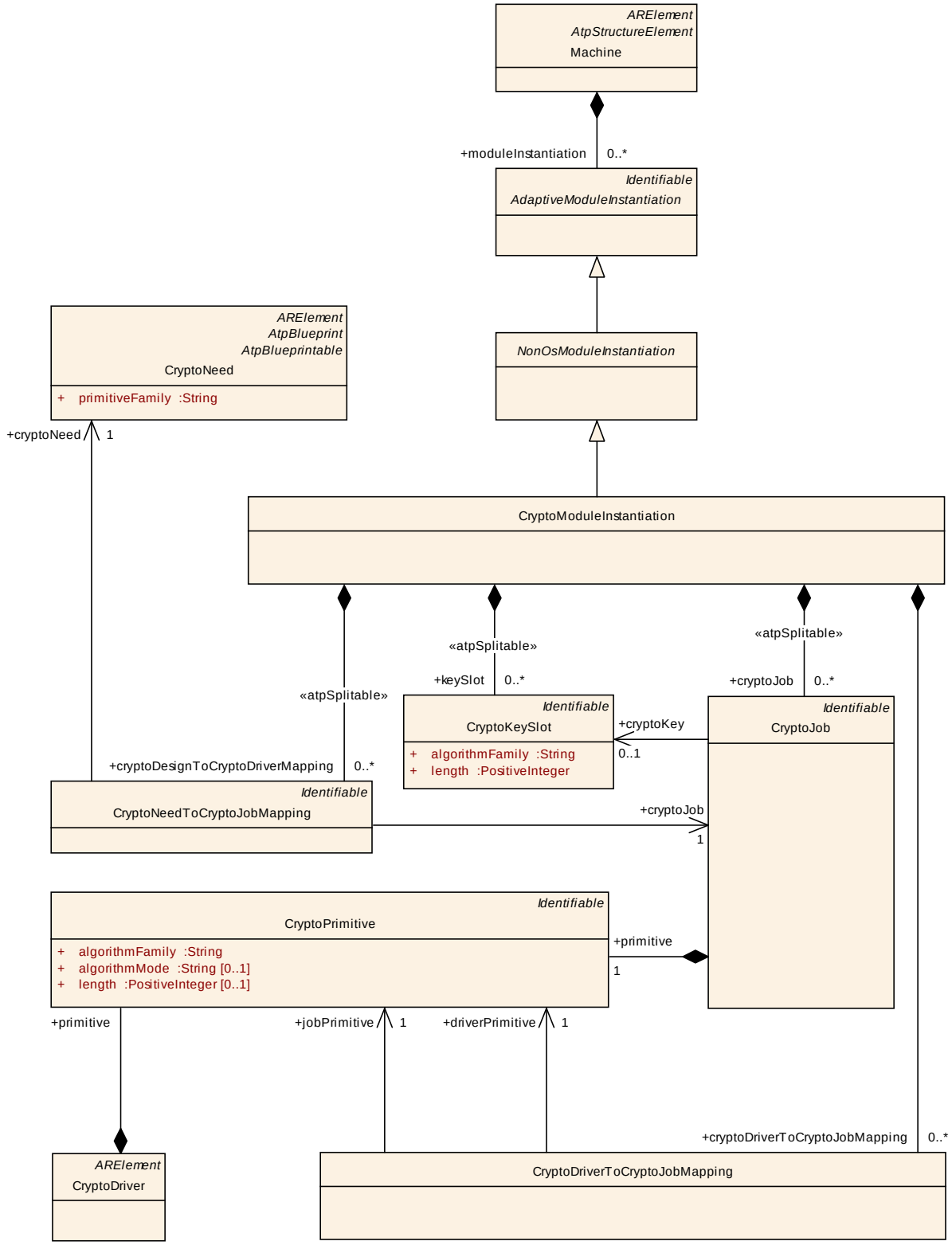


Figure 12.1: Modeling of the crypto deployment

Class	**CryptoModuleInstantiation**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Crypto			
Note	This meta-class represents the ability to define a concerted definition of a crypto module instantiation. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *AdaptiveModuleInstantiation*, *Identifiable*, *MultilanguageReferrable*, *Non OsModuleInstantiation*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
cryptoDesignToCryptoDriverMapping	CryptoNeedToCryptoJobMapping	*	aggr	This aggregation represents the collection of mappings from crypto job to crypto need defined in the context of the enclosing crypto module instantiation. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=shortName; atp.Status=draft
cryptoDriverToCryptoJobMapping	CryptoDriverToCryptoJobMapping	*	aggr	This aggregation represents the collection of mappings from crypto primitive to crypto primitive in the context of the crypto module instantiation. **Tags:** atp.Status=draft
cryptoJob	CryptoJob	*	aggr	This aggregation represents the collection of crypto jobs defined in the context of the enclosing crypto module instantiation. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=shortName; atp.Status=draft
keySlot	CryptoKeySlot	*	aggr	This aggregation represents the collection of crypto key slots defined in the context of the enclosing crypto module instantiation. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=shortName; atp.Status=draft

Table 12.1: CryptoModuleInstantiation

[TPS_MANI_01095] Semantics of `CryptoKeySlot` ⌈ The actual cryptographic keys to be used by the crypto software are introduced at the production line by means of a OEM-specific workflow.

However, it is necessary to define a **representation of a cryptographic key** for the configuration of the crypto software.

This role is taken by the definition of the `CryptoKeySlot`. `CryptoModuleInstantiation` aggregates `CryptoKeySlot` in the role `keySlot`.

The properties of the `CryptoKeySlot` can be further specified by means of attributes `algorithmFamily` ([constr_1530] applies) and `length` (in bits). ⌋*(RS_MANI_00031)*

Class	**CryptoKeySlot**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Crypto			
Note	This meta-class represents the ability to define a concrete key to be used for a crypto operation. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
algorithmFamily	String	1	attr	This attribute represents the ability to specify the algorithm family of the key slot. **Tags:** atp.Status=draft
length	PositiveInteger	1	attr	This attribute represents the ability to specify the length in bits of the key slot. **Tags:** atp.Status=draft

Table 12.2: CryptoKeySlot

[TPS_MANI_01096] Semantics of the `CryptoPrimitive` ⌈ The description of the cryptographic algorithm can be done by means of the `CryptoPrimitive`. The description of the cryptographic algorithm can be further supported by means of the specification of the `algorithmFamily` ([constr_1530] applies), `algorithmMode` ([constr_1531] applies), and `length`. ⌋*(RS_MANI_00031)*

[constr_1530] Standardized values of `CryptoPrimitive.algorithmFamily` and `CryptoKeySlot.algorithmFamily` ⌈ The following values of attributes `CryptoPrimitive.algorithmFamily` and `CryptoKeySlot.algorithmFamily` are standardized by AUTOSAR:

- `CRYPTO_ALGOFAM_AES`
- `CRYPTO_ALGOFAM_3DES`
- `CRYPTO_ALGOFAM_PRESENT`
- `CRYPTO_ALGOFAM_DES`
- `CRYPTO_ALGOFAM_CAMELLIA`
- `CRYPTO_ALGOFAM_SALSA20`
- `CRYPTO_ALGOFAM_CHACHA20`
- `CRYPTO_ALGOFAM_MD5`
- `CRYPTO_ALGOFAM_SHA1`
- `CRYPTO_ALGOFAM_SHA2_256`
- `CRYPTO_ALGOFAM_SHA2_512`
- `CRYPTO_ALGOFAM_WHIRLPOOL`

- CRYPTO_ALGOFAM_SHA3_256
- CRYPTO_ALGOFAM_SHA3_512
- CRYPTO_ALGOFAM_SHAKE_128
- CRYPTO_ALGOFAM_SHAKE_256
- CRYPTO_ALGOFAM_RSA
- CRYPTO_ALGOFAM_ECC

⌋()

[constr_1531] Standardized values of CryptoPrimitive.algorithmMode ⌈ The following values of attribute CryptoPrimitive.algorithmMode are standardized by AUTOSAR:

- CRYPTO_ALGOMODE_ECB
- CRYPTO_ALGOMODE_CRC
- CRYPTO_ALGOMODE_CTR
- CRYPTO_ALGOMODE_GCM
- CRYPTO_ALGOMODE_CCM
- CRYPTO_ALGOMODE_STREAM
- CRYPTO_ALGOMODE_STREAM_POLY1305
- CRYPTO_ALGOMODE_HMAC
- CRYPTO_ALGOMODE_CMAC
- CRYPTO_ALGOMODE_PLOY1305
- CRYPTO_ALGOMODE_MIYAGUCHI_PRENEEL
- CRYPTO_ALGOMODE_HIROSE
- CRYPTO_ALGOMODE_PKCS_V15
- CRYPTO_ALGOMODE_PKCS_V2
- CRYPTO_ALGOMODE_ECDSA
- CRYPTO_ALGOMODE_EDDSA
- CRYPTO_ALGOMODE_ECIES_X963

⌋()

Class	**CryptoPrimitive**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Crypto			
Note	This meta-class represents the ability to describe a crypto algorithm in an abstract form. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
algorithmFamily	String	1	attr	This attribute represents the ability to specify the algorithm family of the crypto primitive. **Tags:** atp.Status=draft
algorithmMode	String	0..1	attr	This attribute represents the ability to specify the algorithm mode of the crypto primitive. **Tags:** atp.Status=draft
length	PositiveInteger	0..1	attr	This attribute represents the ability to specify the length in bits on which the crypto primitive is operating. **Tags:** atp.Status=draft

Table 12.3: CryptoPrimitive

Beyond the regulation made by [constr_1530] and [constr_1531] it is possible to assign custom values to `CryptoPrimitive.algorithmFamily` and `CryptoKeySlot.algorithmFamily` resp. `CryptoPrimitive.algorithmMode`.

In this case, however, it is mandatory to use a company-specific prefix or suffix to the custom values in order to positively avoid clashes with potential future extensions of the collection of standardized values defined by [constr_1530] and [constr_1531].

12.3 Crypto Job

[TPS_MANI_01091] Semantics of `CryptoJob` ⌈ The formal definition of a `CryptoJob` represents a specific usage of (or call to) a cryptographic software function. This software function is part of the `CryptoModuleInstantiation`, hence the aggregation of `CryptoJob` at `CryptoModuleInstantiation` in the role `cryptoJob`. ⌋ *(RS_MANI_00031)*

A `CryptoJob` is defined by the implemented crypto algorithm (modeled as a `CryptoPrimitive`) as well as the used `CryptoKeySlot`. This relation (as depicted in Figure 12.1) is modeled by the aggregation of the `primitive` as well as the reference to the `cryptoKey`.

Class	**CryptoJob**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Crypto			
Note	This meta-class represents the ability to model a crypto job. The latter in turn represents a call to a specific routine that implements a crypto function and that uses a specific key and refers to a specific primitive as a formal representation of the crypto algorithm. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
cryptoKey	CryptoKeySlot	0..1	ref	This represents the key slots to which the referencing crypto job applies. **Tags:** atp.Status=draft
primitive	CryptoPrimitive	1	aggr	This aggregation defines the crypto primitive applicable for the enclosing crypto job. **Tags:** atp.Status=draft

Table 12.4: CryptoJob

[TPS_MANI_01092] Mapping between `CryptoNeed` and `CryptoJob` ⌈ It is necessary to create a formal relation between a `CryptoNeed` formulated by an OEM to a `CryptoJob` (which is typically defined in the domain of a supplier). The formalization of this relation is the `CryptoNeedToCryptoJobMapping`.

By means of this mapping in combination with the `CryptoNeedToPortPrototypeMapping` it is possible to define the relation of a `PortPrototype` in the application software to the corresponding `CryptoJob` in the platform software.

In other words, the `ClientServerOperation`s called by the application software are (typically by means of an IPC mechanism) redirected to the corresponding `CryptoJob`. ⌋*(RS_MANI_00031)*

Class	**CryptoNeedToCryptoJobMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Crypto			
Note	This meta-class represents the ability to define a mapping from crypto need to crypto job. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
cryptoJob	CryptoJob	1	ref	This represents the crypto job part of the mapping from crypto need to crypto job. **Tags:** atp.Status=draft
cryptoNeed	CryptoNeed	1	ref	This represents the crypto need part of the mapping from crypto need to crypto job. **Tags:** atp.Status=draft

Table 12.5: CryptoNeedToCryptoJobMapping

12.4 Crypto Driver

[TPS_MANI_01093] Semantics of `CryptoDriver` ⌈ The `CryptoDriver` represents an abstraction around details of the implementation of crypto routines.

For example, the existence of a `CryptoDriver` is supposed to make the upper layer software independent of the question whether the crypto functionality is implemented by means of pure software or whether some parts are taken over by a hardware component. ⌋*(RS_MANI_00031)*

Of course, the `CryptoDriver` has a strong relation to the underlying crypto algorithm, thus the aggregation the `CryptoPrimitive` in the role `primitive`.

Class	**CryptoDriver**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Crypto			
Note	This meta-class represents the ability to model a crypto driver. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft; atp.recommended Package=CryptoDrivers			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
primitive	CryptoPrimitive	1	aggr	This aggregation represents the collection of crypto primitives in the context of the enclosing crypto driver. **Tags:** atp.Status=draft

Table 12.6: CryptoDriver

[TPS_MANI_01094] Scope of `CryptoDriver` ⌈ The `CryptoDriver` is derived from `ARElement`. It is not part of the `CryptoModuleInstantiation` because the same `CryptoDriver` could be used on different `Machine`s (at the same time).

Consequently, the actual relation between a given `CryptoDriver` and a specific `Machine` is **indirectly** created by means of the `CryptoDriverToCryptoJobMapping`. ⌋*(RS_MANI_00031)*

For clarification, the `CryptoDriverToCryptoJobMapping` references a `CryptoPrimitive` in the role `driverPrimitive` and therefore the specific `CryptoDriver` that aggregates the referenced `driverPrimitive` is also unambiguously identified.

Obviously, the same argumentation applies for the reference `CryptoDriverToCryptoJobMapping.jobPrimitive`. The referenced `CryptoJob` is a member of an aggregation chain the finally ends at the `Machine`. Therefore, by referencing the `CryptoJob` the applicable `Machine` is unambiguously identified.

The actual motivation for the existence of this “indirect” mapping goes down to the fact that the `CryptoDriverToCryptoJobMapping` (that references two `CryptoPrimitive`s) very much facilitates the check for consistency in terms of whether the referenced `CryptoPrimitive`s fit to each other.

Class	**CryptoDriverToCryptoJobMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Crypto			
Note	This meta-class has the ability to map two crypto primitives onto each other. This mapping effectively also maps a crypto driver to a crypto job. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
driverPrimitive	CryptoPrimitive	1	ref	This reference represents the crypto driver in the context of the mapping of two crypto primitives. **Tags:** atp.Status=draft
jobPrimitive	CryptoPrimitive	1	ref	This reference represents the crypto job in the context of the mapping of two crypto primitives. **Tags:** atp.Status=draft

Table 12.7: CryptoDriverToCryptoJobMapping

13 Secure Communication Deployment

13.1 Overview

This chapter explains the part of using concrete crypto software to realize secured communication etc. in terms of mapping of SecureComProps to concrete CryptoJobs and CryptoKeySlots.

For each supported secure communication protocol an own SecureCommunicationDeployment specialization exists that will be explained in the following subchapters.

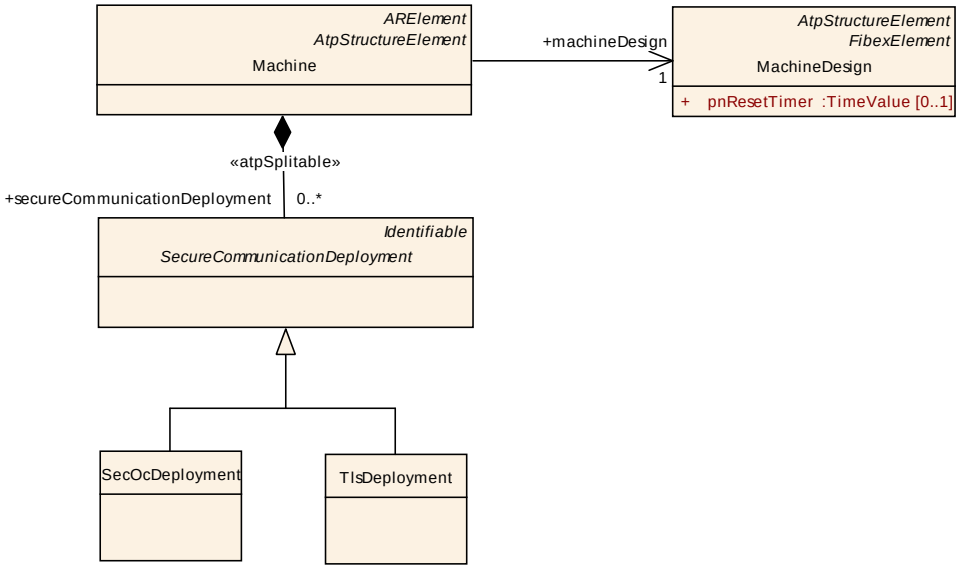


Figure 13.1: Modeling of the secure communication deployment

Class	***SecureCommunicationDeployment* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::SecureCommunication			
Note	The meta-class represents the ability to define a deployment of secure communication protocol configuration settings to crypto module entities. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	SecOcDeployment, TlsDeployment			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 13.1: SecureCommunicationDeployment

13.2 SecOc Deployment

The SecOcDeployment describes the realization of SecOC secured communication by using a crypto platform module that is described as CryptoModuleInstantia-

tion as defined in [TPS_MANI_01090]. In case of SecOC the crypto platform module provides cryptographic algorithms to generate and verify Cryptographic Signatures or Message Authentication Codes.

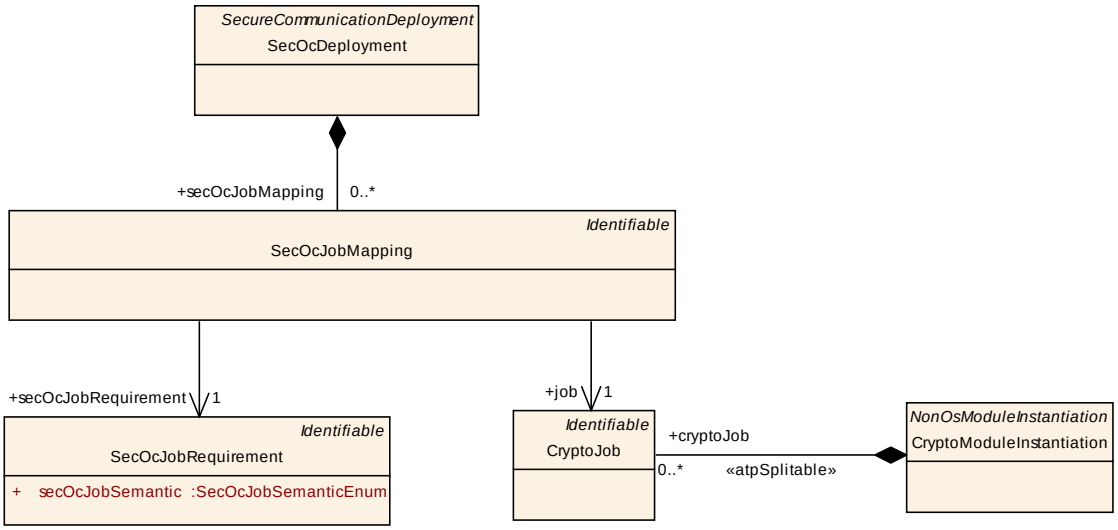


Figure 13.2: Modeling of the SecOC secure communication deployment

Class	**SecOcDeployment**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::SecureCommunication			
Note	The meta-class represents the ability to define a deployment of the SecOc communication protocol configuration settings to crypto module entities. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *SecureCommunication Deployment*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
secOcJobMapping	SecOcJobMapping	*	aggr	Mapping of the JobRequirement to a concrete crypto job. **Tags:** atp.Status=draft

Table 13.2: SecOcDeployment

[TPS_MANI_03141] Mapping between SecOcJobRequirement and CryptoJob ⌈ It is necessary to create a formal relation between a SecOcJobRequirement that is formulated in most cases by an OEM to a CryptoJob (which is typically defined in the domain of a supplier). The formalization of this relation is the SecOcJobMapping. ⌋ *(RS_MANI_00036, RS_MANI_00031)*

Class	**SecOcJobMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::SecureCommunication			
Note	This meta-class allows to map a SecOcJobRequirement to a concrete crypto job that will fulfill the JobRequirement. The crypto job represents a call to a specific routine that implements a crypto function and that uses a specific key and refers to a specific primitive as a formal representation of the crypto algorithm. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
job	CryptoJob	1	ref	Reference to a concrete CryptoJob defined in the CryptoDeployment. **Tags:** atp.Status=draft
secOcJobRequirement	SecOcJobRequirement	1	ref	Reference to a SecOC JobRequirement that defines requirements for the cryptographic job that need to be executed. **Tags:** atp.Status=draft

Table 13.3: SecOcJobMapping

13.3 TLS Deployment

The `TlsDeployment` describes the realization of Tls secured communication by using a crypto platform module that is described as `CryptoModuleInstantiation` as defined in [TPS_MANI_01090]. In case of Tls the crypto platform module provides cryptographic algorithms to generate and verify Cryptographic Signatures or Message Authentication Codes and to encrypt and decrypt the data. In addition a key management is provided.

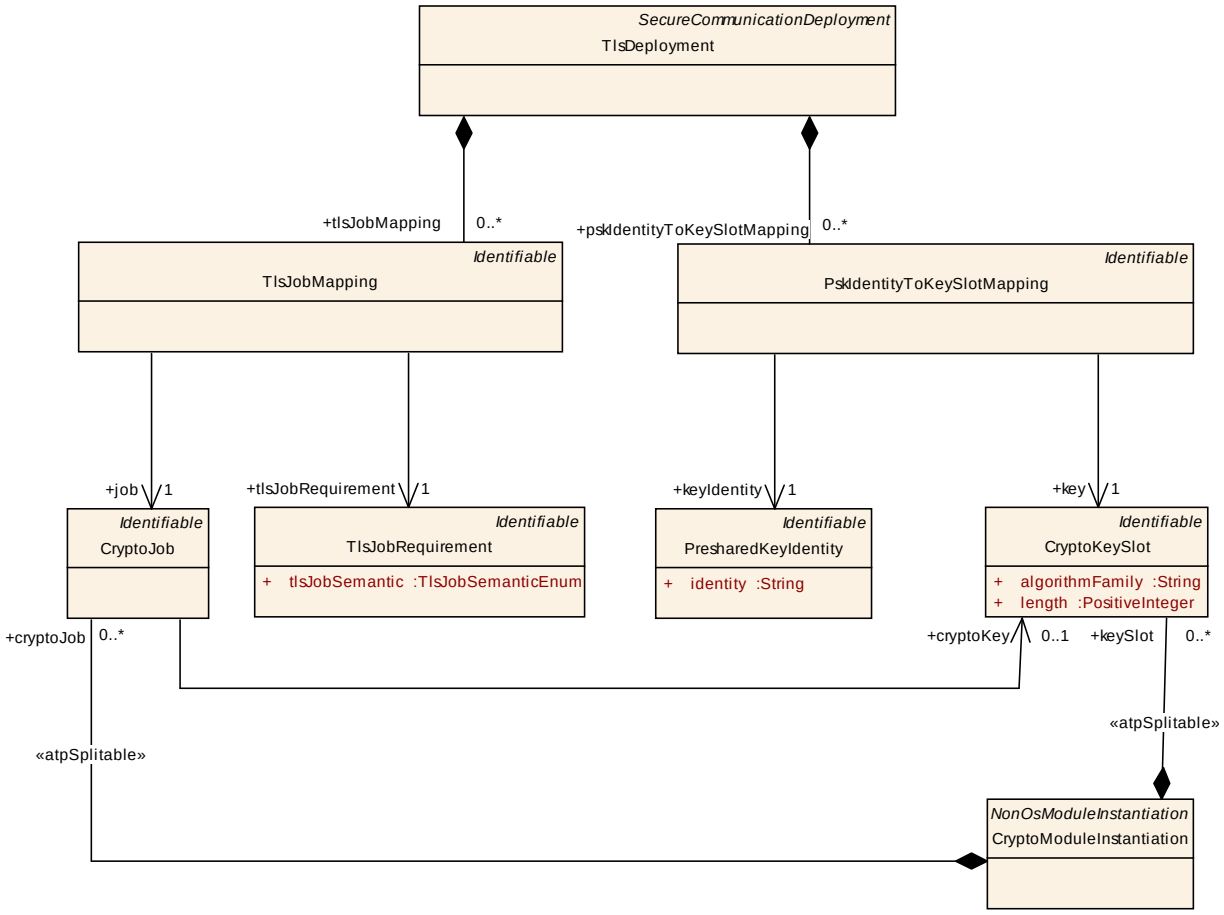


Figure 13.3: Modeling of the TLS secure communication deployment

Class	**TlsDeployment**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::SecureCommunication			
Note	The meta-class represents the ability to define a deployment of the TLS communication protocol configuration settings to crypto module entities. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *SecureCommunicationDeployment*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
pskIdentityToKeySlotMapping	PskIdentityToKeySlotMapping	*	aggr	Mapping of TLS-PSK to a concrety key defined in the CryptoDeployment. **Tags:** atp.Status=draft
tlsJobMapping	TlsJobMapping	*	aggr	Mapping of the JobRequirement to a concrete crypto job. **Tags:** atp.Status=draft

Table 13.4: TlsDeployment

[TPS_MANI_03142] Mapping between `TlsJobRequirement` and `CryptoJob` ⌈ It is necessary to create a formal relation between a `TlsJobRequirement` that is for-

mulated in most cases by an OEM to a CryptoJob (which is typically defined in the domain of a supplier). The formalization of this relation is the TlsJobMapping. ⌋ *(RS_MANI_00031, RS_MANI_00036)*

Class	**TlsJobMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::SecureCommunication			
Note	This meta-class allows to map a TlsJobRequirement to a concrete crypto job that will fulfill the JobRequirement. The crypto job represents a call to a specific routine that implements a crypto function and that uses a specific key and refers to a specific primitive as a formal representation of the crypto algorithm. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
job	CryptoJob	1	ref	Reference to a concrete CryptoJob defined in the CryptoDeployment. **Tags:** atp.Status=draft
tlsJobRequirement	TlsJobRequirement	1	ref	Reference to a TLS JobRequirement that defines requirements for the cryptographic job that need to be executed. **Tags:** atp.Status=draft

Table 13.5: TlsJobMapping

The CryptoKeySlot defines a representation of a cryptographic key in the configuration of the crypto software as defined in [TPS_MANI_01095]. TLS pre-shared keys are shared between the communicating parties to establish a TLS connection. To find the key that corresponds to the PSK identity the PskIdentityToKeySlotMapping is introduced.

[TPS_MANI_03143] Mapping between PresharedKeyIdentity and CryptoKeySlot ⌈ Meta-class PskIdentityToKeySlotMapping has the ability to map a PresharedKeyIdentity defined in TlsSecureComProps to a CryptoKeySlot defined in CryptoModuleInstantiation. ⌋*(RS_MANI_00031, RS_MANI_00036)*

Class	**PskIdentityToKeySlotMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::SecureCommunication			
Note	This meta-class allows to map a PresharedKeyIdentity to a concrete key that will be used for a crypto operation. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
key	CryptoKeySlot	1	ref	Reference to a concrete key defined in the CryptoDeployment. **Tags:** atp.Status=draft

keyIdentity	PresharedKeyIdentity	1	ref	Reference to a Preshared Key Identity. **Tags:** atp.Status=draft

Table 13.6: PskIdentityToKeySlotMapping

14 Platform Health Management Deployment

14.1 Overview

This chapter explains the interaction of application software with the Platform Health Management [12].

The `PlatformHealthManagementContribution` allows to describe aspects for the deployment of configuration how the Platform Health Management shall behave during runtime.

[TPS_MANI_03544] Definition of `PlatformHealthManagementContribution` ⌈ The meta-class `PlatformHealthManagementContribution` allows to define a set of configuration entities for the Platform Health Management. ⌋*(RS_MANI_00023, RS_MANI_00032)*

[TPS_MANI_03503] Applicability of supervision to a specific `Process` ⌈ The reference `PlatformHealthManagementContribution.process` defines to which specific `Process` this `PlatformHealthManagementContribution` definition shall be applied to. ⌋*(RS_MANI_00023, RS_MANI_00032)*

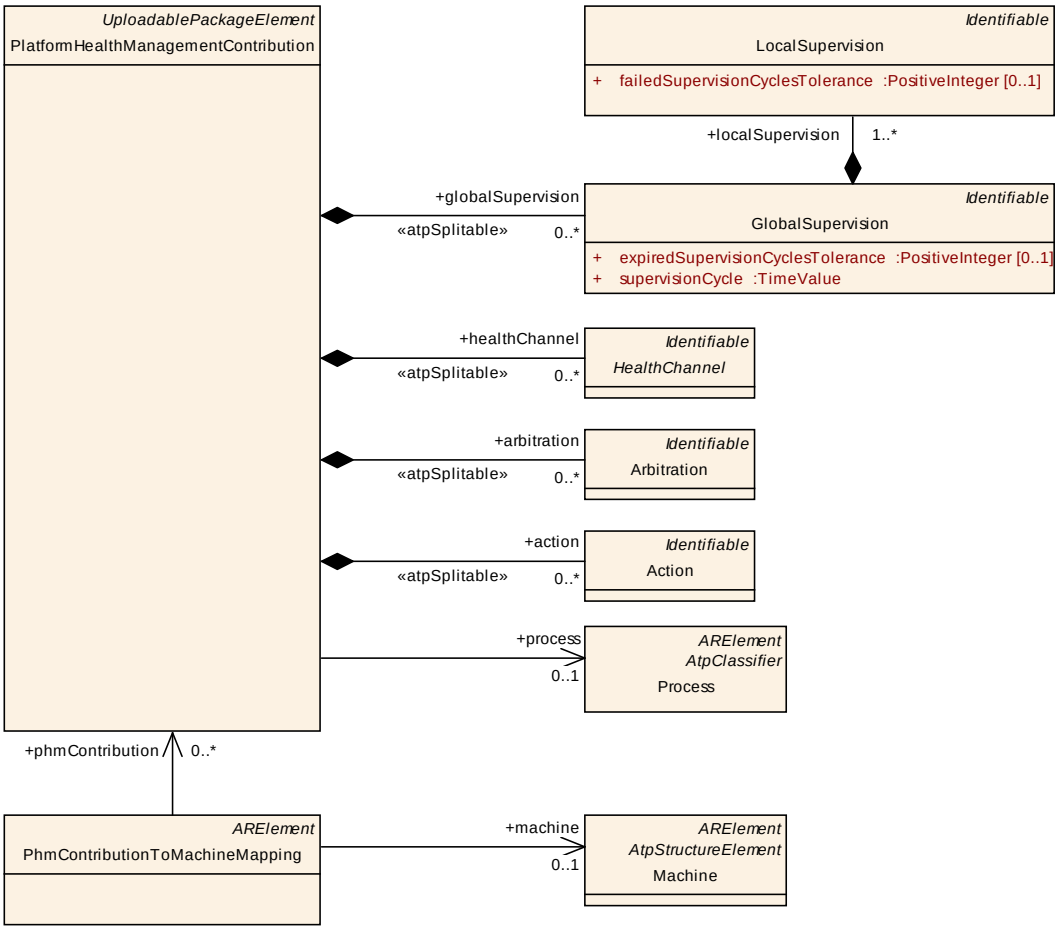


Figure 14.1: Modeling of `PlatformHealthManagementContribution`

The `PlatformHealthManagementContribution` is structured into several aspects which will be described in the following sections:

- Supervision (section 14.2)
- Health channels (section 14.4)
- Arbitration and Rules (section 14.5)
- Actions (section 14.6)

Class	**PlatformHealthManagementContribution**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement			
Note	This element defines a contribution to the Platform Health Management. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft; atp.recommendedPackage=PlatformHealthManagementContributions			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
action	Action	*	aggr	Collection of Actions and ActionLists in the context of a PlatformHealthManagementContribution. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=shortName; atp.Status=draft xml.sequenceOffset=50
arbitration	Arbitration	*	aggr	Collection of Arbitrations in the context of a PlatformHealthManagementContribution. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=shortName; atp.Status=draft xml.sequenceOffset=40
checkpoint	SupervisionCheckpoint	*	aggr	Collection of checkpoints in the context of a PlatformHealthManagementContribution. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=shortName; atp.Status=draft xml.sequenceOffset=10
globalSupervision	GlobalSupervision	*	aggr	Collection of GlobalSupervisions in the context of a PlatformHealthManagementContribution. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=shortName; atp.Status=draft xml.sequenceOffset=30
healthChannel	HealthChannel	*	aggr	Collection of HealthChannels in the context of a PlatformHealthManagementContribution. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=shortName; atp.Status=draft xml.sequenceOffset=30

process	Process	0..1	ref	Reference to the Process this PhmContribution shall be applied to. **Tags:** atp.Status=draft xml.sequenceOffset=90

Table 14.1: PlatformHealthManagementContribution

[TPS_MANI_03502] Enabling of `PlatformHealthManagementContribution` on a `Machine` ⌈ To enable an instance of `PlatformHealthManagementContribution` on a specific `Machine` the `PlatformHealthManagementContribution` shall be mapped to the `Machine` via a `PhmContributionToMachineMapping`. ⌋ *(RS_MANI_00023, RS_MANI_00032)*

Class	**PhmContributionToMachineMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement			
Note	This element associates one or more PlatformHealthManagementContributions with a Machine. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft; atp.recommendedPackage=PhmContributionToMachineMappings			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
machine	Machine	0..1	ref	This reference identifies the Machine in the context of the PhmContributionToMachineMapping. **Tags:** atp.Status=draft
phmContribution	PlatformHealthManagementContribution	*	ref	This reference identifies one or more PlatformHealthManagementContributions in the context of a PhmContributionToMachineMapping. **Tags:** atp.Status=draft

Table 14.2: PhmContributionToMachineMapping

An application software can define the usage of several Platform Health Management supervisions (see chapter 3.9.2) and health channels (see chapter 3.9.3). In order to define the interaction between the application software and the Platform Health Management the `PlatformHealthManagementContribution` creates its own representations of the `RPortPrototype`s typed by the `PhmSupervisedEntityInterface` and `PhmHealthChannelInterface` and creates relations to the application software `RPortPrototype`s (see figure 14.2).

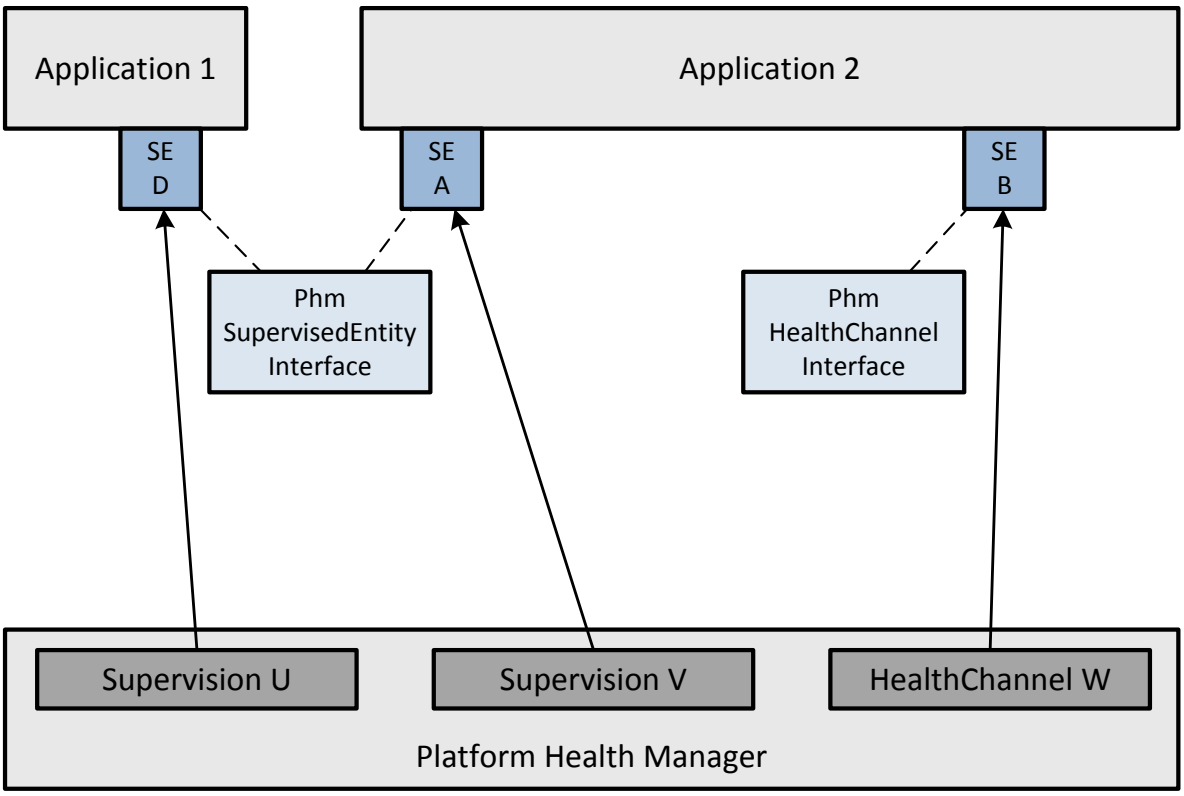


Figure 14.2: Interaction of application software with the platform health manager

In chapter 3.9.2 it is explained that the application software just calls methods in the context of the respective `RPortPrototype`s to interact with the Platform Health Management. From the application developer these methods have no addressing information, because the identity of the `RPortPrototype` is the identification in the scope of the application software.

The deployed structure (according to figure 14.1) however requires more information when an `API` at the Platform Health Manager is called, namely:

- `PhmSupervisedEntityInterface.supervisedEntityId`
- `PhmHealthChannelInterface.healthChannelId`
- `RPortPrototype.shortName`
- `Process` identification during runtime.

These additional arguments have to be injected to the `API` by the implementation of the interaction between the software component and the Platform Health Management (which implements the relations from figure 14.1). The order of this argument injection is determined by the specification of the Platform Health Management APIs.

14.2 Supervision deployment

In the application design chapter of this document the declaration of supervised entities and checkpoints has been described (see section 3.9.2). These declarations provide the view on supervision from the application software code point.

For the configuration of the Platform Health Management the definition of SupervisionCheckpoint is used to stand in for the corresponding PhmCheckpoint used in the context of the application design.

[TPS_MANI_03505] Existence of SupervisionCheckpoint ⌈ For each PhmCheckpoint in the scope of a RPortPrototype typed by a PhmSupervisedEntityInterface in the application definition there may be a SupervisionCheckpoint defined. The correspondence of the two is defined by the instance reference SupervisionCheckpoint.phmCheckpoint ⌋(*RS_MANI_00023*, *RS_MANI_00032*)

[TPS_MANI_03506] Optionality of SupervisionCheckpoint ⌈ It is not required that every PhmSupervisedEntityInterface or PhmCheckpoint used in the context of the application definition eventually has a corresponding SupervisionCheckpoint defined. There may be cases where the application software reports some checkpoints but they are not considered for a specific supervision. ⌋(*RS_MANI_00023*, *RS_MANI_00032*)

Class	**LocalSupervision**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement			
Note	This element defines a LocalSupervision in the context of platform health management contribution. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
aliveSupervision	AliveSupervision	*	aggr	Collection of AliveSupervisions in the context of this LocalSupervision. **Tags:** atp.Status=draft
deadlineSupervision	DeadlineSupervision	*	aggr	Collection of DeadlineSupervisions in the context of this LocalSupervision. **Tags:** atp.Status=draft
failedSupervisionCyclesTolerance	PositiveInteger	0..1	attr	Defines the acceptable amount of cycles with FAILED supervision status of this LocalSupervision before it is considered EXPIRED. **Tags:** atp.Status=draft
logicalSupervision	LogicalSupervision	*	aggr	Collection of LogicalSupervisions in the context of this LocalSupervision. **Tags:** atp.Status=draft

transition	CheckpointTransition	*	aggr	Collection of CheckpointTransitions in the context of this LocalSupervision. **Tags:** atp.Status=draft

Table 14.3: LocalSupervision

Class	**SupervisionCheckpoint**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement			
Note	This element contains an instance reference to a RPortPrototype representing a checkpoint for Platform Health Management. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
phmCheckpoint	PhmCheckpoint	0..1	iref	Instance reference to the PhmCheckpoint defined in the context of a PortInterface. **Tags:** atp.Status=draft

Table 14.4: SupervisionCheckpoint

For the Platform Health Management supervision to take effect it is required to define the instance the application is executed in, thus the reference to a `Process` has to be taken into account. In the model the `Process` also defines under which conditions (`ModeDependentStartupConfig`) and with which arguments (`StartupOption`) the `Executable` will be started.

[TPS_MANI_03515] Expiration tolerance for `LocalSupervision` ⌈ The attribute `LocalSupervision.failedSupervisionCyclesTolerance` defines how many supervision cycles an incorrect supervision is maintained in the state *failed* before it is considered *expired*. ⌋*(RS_MANI_00023, RS_MANI_00032)*

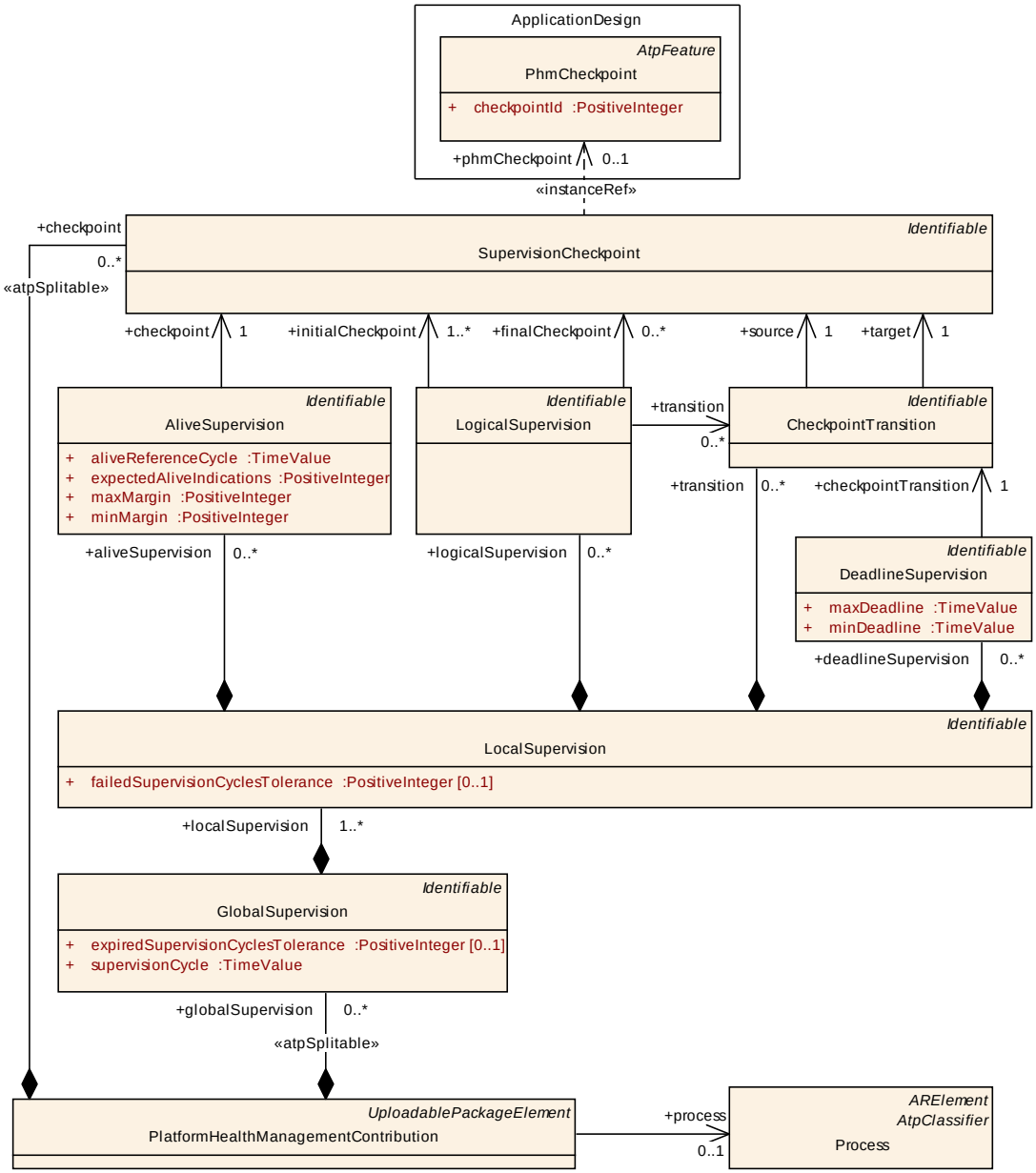


Figure 14.3: Modeling of `LocalSupervision`

14.2.1 `AliveSupervision` definition

In the scope of a `LocalSupervision` an `AliveSupervision` can be defined for a specific `SupervisionCheckpoint`. `LocalSupervision` can be used to define in which timing boundaries one specific checkpoint shall be monitored.

[TPS_MANI_03508] Definition of an `AliveSupervision` for a `SupervisionCheckpoint` ⌈ An `AliveSupervision` definition provides attributes to configure the supervision of the referenced `SupervisionCheckpoint`.

- `aliveReferenceCycle` defines the time base used to monitor the reporting of this specific `SupervisionCheckpoint`
- `expectedAliveIndications` defines the number of indications which shall be observed during the time period defined by `aliveReferenceCycle`
- `minMargin` and `maxMargin` define the acceptable deviation from the `expectedAliveIndications` within the time period defined by `aliveReferenceCycle`

⌋(*RS_MANI_00023*, *RS_MANI_00032*)

Class	**AliveSupervision**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement			
Note	Defines an AliveSupervision for one checkpoint. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
aliveReferenceCycle	TimeValue	1	attr	Time period at which the Alive Supervision mechanism compares the amount of received Alive Indications for the SupervisionCheckpoint against the expectedAliveIndications. **Tags:** atp.Status=draft
checkpoint	SupervisionCheckpoint	1	ref	Reference to a checkpoint in the context of AliveSupervision. **Tags:** atp.Status=draft
expectedAliveIndications	PositiveInteger	1	attr	Defines the amount of expected Alive Indications of the SupervisionCheckpoint within the aliveReferenceCycle. **Tags:** atp.Status=draft
maxMargin	PositiveInteger	1	attr	Defines the amount of Alive Indications of the SupervisionCheckpoint that are acceptable to be additional to the expectedAliveIndications within the aliveReferenceCycle. **Tags:** atp.Status=draft
minMargin	PositiveInteger	1	attr	Defines the amount of Alive Indications of the SupervisionCheckpoint that are acceptable to be missing to the expectedAliveIndications within the aliveReferenceCycle. **Tags:** atp.Status=draft

Table 14.5: AliveSupervision

14.2.2 `CheckpointTransition` definition

For the definition of further supervision strategies the need to first define possible `CheckpointTransition`s between `SupervisionCheckpoint`s arises. Since the application software design does not provide any transition definition between checkpoints it is essential to define possible `CheckpointTransition`s.

The definition of `CheckpointTransition`s is done in the scope of the `LocalSupervision` and can be used by the `LogicalSupervision` and `DeadlineSupervision`.

[TPS_MANI_03509] Definition of a `CheckpointTransition` ⌈ A `CheckpointTransition` defines one possible transition from the `source SupervisionCheckpoint` to the `target SupervisionCheckpoint`. ⌋*(RS_MANI_00023, RS_MANI_00032)*

Class	**CheckpointTransition**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement			
Note	Defines one transition between two checkpoints. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
source	SupervisionCheckpoint	1	ref	Reference to the source checkpoint for this transition. **Tags:** atp.Status=draft
target	SupervisionCheckpoint	1	ref	Reference to the target checkpoint for this transition. **Tags:** atp.Status=draft

Table 14.6: CheckpointTransition

14.2.3 `LogicalSupervision` definition

The `LogicalSupervision` defines a graph of allowed `CheckpointTransition`s which is monitored by the Platform Health Management without any timing considerations, just the order of reported checkpoints is considered for the monitoring.

When a `SupervisionCheckpoint` is reported to the Platform Health Management where there is no `CheckpointTransition` defined from the last reported `SupervisionCheckpoint` as `source` to the current reported `SupervisionCheckpoint` as `target`, this situation violates the `LogicalSupervision`.

[TPS_MANI_03510] Definition of `LogicalSupervision` ⌈ A `LogicalSupervision` defines relations between `SupervisionCheckpoint`s which form a directed graph from one or more `initialCheckpoint SupervisionCheckpoint`s

through a set of CheckpointTransitions defined by collection of transitions to one or more finalCheckpoint SupervisionCheckpoints. ⌋(*RS_MANI_00023*, *RS_MANI_00032*)

Class	**LogicalSupervision**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement			
Note	Defines a LogicalSupervision graph consisting of transitions, initial- and final checkpoints. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
finalCheckpoint	SupervisionCheckpoint	*	ref	Reference to the final Checkpoint(s) for this LogicalSupervision. **Tags:** atp.Status=draft xml.sequenceOffset=20
initialCheckpoint	SupervisionCheckpoint	1..*	ref	Reference to the initial Checkpoint(s) for this LogicalSupervision. **Tags:** atp.Status=draft xml.sequenceOffset=10
transition	CheckpointTransition	*	ref	Reference to the transitions for this LogicalSupervision. **Tags:** atp.Status=draft xml.sequenceOffset=30

Table 14.7: LogicalSupervision

14.2.4 DeadlineSupervision definition

The DeadlineSupervision defines timing attributes for one specific CheckpointTransition.

[TPS_MANI_03511] Definition of DeadlineSupervision ⌈ A DeadlineSupervision defines timing attributes which are monitored by the Platform Health Management for one specific CheckpointTransition. ⌋(*RS_MANI_00023*, *RS_MANI_00032*)

Class	**DeadlineSupervision**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement			
Note	Defines an DeadlineSupervision for one transition. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

checkpointTransition	CheckpointTransition	1	ref	Reference to the transition in the context of a DeadlineSupervision. **Tags:** atp.Status=draft
maxDeadline	TimeValue	1	attr	Defines the longest time span before which the deadline is considered to be met for transition. **Tags:** atp.Status=draft
minDeadline	TimeValue	1	attr	Defines the shortest time span after which the deadline is considered to be met for transition. **Tags:** atp.Status=draft

Table 14.8: DeadlineSupervision

14.3 Global supervision entity deployment

The `GlobalSupervision` definition of supervision for the Platform Health Management is a second level supervision which takes the result of one or several `LocalSupervision`s (with their respective `AliveSupervision`s, `LogicalSupervision`s, and `DeadlineSupervision`s) and aggregates the individual states of these supervisions into one global supervision status (see also figure 14.3).

[TPS_MANI_03513] Collection of `LocalSupervision`s into a global supervision ⌈ All referenced `LocalSupervision`s in the scope of `GlobalSupervision`.`localSupervision` shall be taken into the aggregation of the status of the `GlobalSupervision`. ⌋*(RS_MANI_00023, RS_MANI_00032)*

[TPS_MANI_03512] Applicability of global supervision to a specific `Process` ⌈ The reference `PlatformHealthManagementContribution`.`process` defines to which specific `Process` the included `GlobalSupervision` shall be applied to. ⌋ *(RS_MANI_00023, RS_MANI_00032)*

[TPS_MANI_03514] Expiration tolerance for `GlobalSupervision` ⌈ The attribute `GlobalSupervision`.`expiredSupervisionCyclesTolerance` defines how many supervision cycles this incorrect global supervision is maintained in the state *expired* before it is considered *stopped*. ⌋*(RS_MANI_00023, RS_MANI_00032)*

[TPS_MANI_03552] Supervision cycle for `GlobalSupervision` ⌈ The attribute `GlobalSupervision`.`supervisionCycle` defines at which rate the `GlobalSupervision` and its contained `LocalSupervision`s shall be monitored. ⌋ *(RS_MANI_00023, RS_MANI_00032)*

Class	**GlobalSupervision**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement			
Note	This element defines a collection of LocalSupervisions in order to provide a aggregated supervision state. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
expiredSupervisionCyclesTolerance	PositiveInteger	0..1	attr	Defines the acceptable amount of cycles with EXPIRED supervision status of this GlobalSupervision before it is considered STOPPED. **Tags:** atp.Status=draft
localSupervision	LocalSupervision	1..*	aggr	Collection of LocalSupervisions in the context of a GlobalSupervision. **Tags:** atp.Status=draft
supervisionCycle	TimeValue	1	attr	Defines at which cycle the GlobalSupervision and its contained LocalSupervisions are executed.

Table 14.9: GlobalSupervision

14.4 Health channel deployment

The `HealthChannel` is used as an abstraction to the Platform Health Management input for the arbitration and rule evaluation (see chapter 14.5).

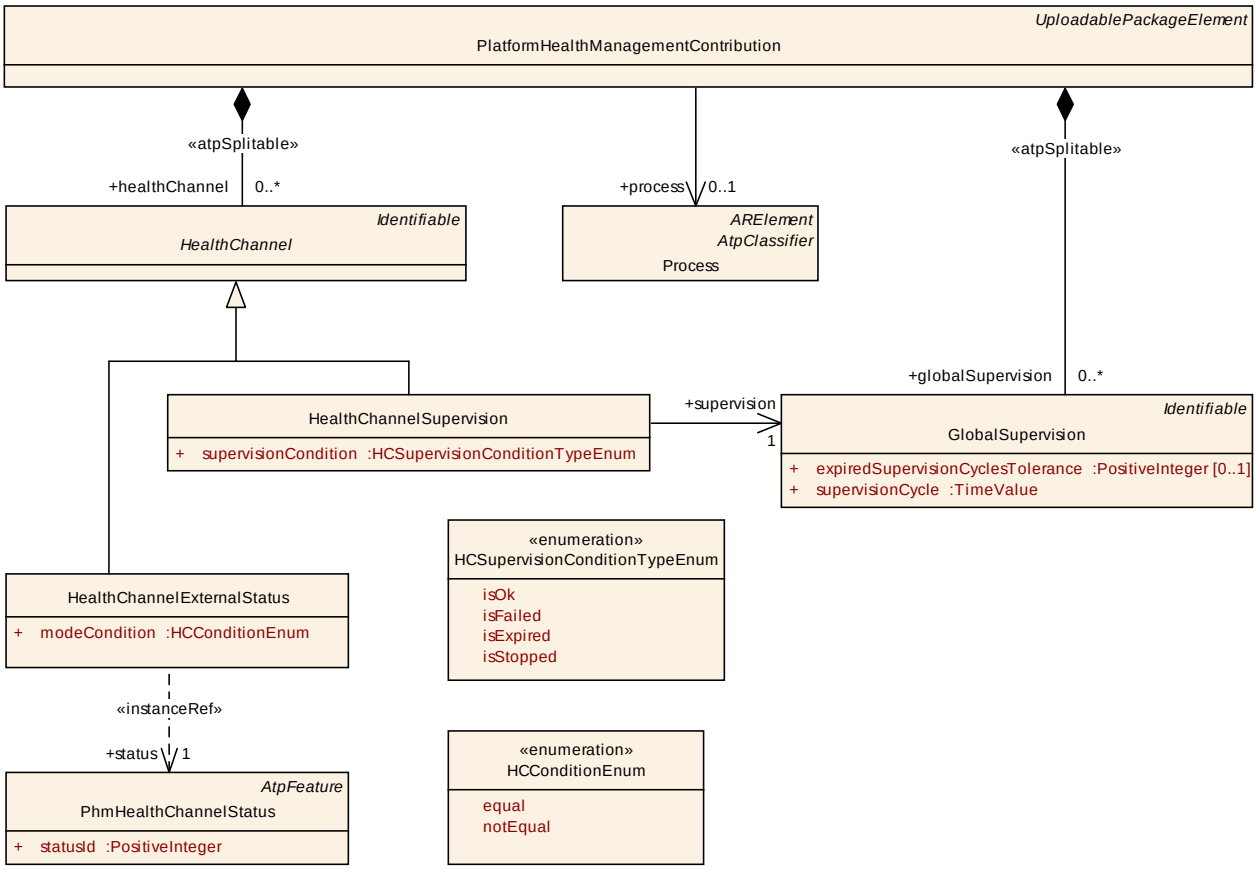


Figure 14.4: Modeling of `HealthChannel`

Class	***HealthChannel* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealth Management			
Note	This element defines the source of a health channel. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	HealthChannelExternalStatus, HealthChannelSupervision			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 14.10: HealthChannel

The specialized use-cases for `HealthChannel`s are describe in the following sections.

14.4.1 Supervision health channel deployment

The `HealthChannelSupervision` is used to compare the status of a `GlobalSupervision` with a constant status definition and provide the result as input to the Platform Health Management arbitration engine.

[TPS_MANI_03516] Condition evaluation for `HealthChannelSupervision` ⌈ The status of the `GlobalSupervision` which is referenced in the role `supervision` will be compared to the constant status provided in `supervisionCondition`. The result of this comparison is then the result of the `HealthChannelSupervision` evaluation. ⌋*(RS_MANI_00023, RS_MANI_00032)*

Class	**HealthChannelSupervision**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement			
Note	This element defines a health channel representing the status of a GlobalSupervision. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *HealthChannel*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
supervision	GlobalSupervision	1	ref	Reference to the GlobalSupervision as source for the health channel. **Tags:** atp.Status=draft
supervisionCondition	HCSupervisionConditionTypeEnum	1	attr	Defines which condition shall trigger this health channel wrt. the referenced GlobalSupervision. **Tags:** atp.Status=draft

Table 14.11: HealthChannelSupervision

Enumeration	**HCSupervisionConditionTypeEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement
Note	Defines the possible conditions which can be evaluated in the scope of a GlobalSupervision. **Tags:** atp.Status=draft
Literal	***Description***
isExpired	**Tags:** atp.EnumerationValue=2
isFailed	**Tags:** atp.EnumerationValue=1
isOk	**Tags:** atp.EnumerationValue=0
isStopped	**Tags:** atp.EnumerationValue=3

Table 14.12: HCSupervisionConditionTypeEnum

14.4.2 External mode health channel deployment

The `HealthChannelExternalStatus` is used to compare a reported status to a constant status declaration and provide the result as input to the Platform Health Management arbitration engine.

[TPS_MANI_03545] Existence of `HealthChannelExternalStatus` ⌈ For each `RPortPrototype` typed by a `PhmHealthChannelInterface` there may be a `HealthChannelExternalStatus` defined. ⌋*(RS_MANI_00023, RS_MANI_00032)*

[TPS_MANI_03546] Definition of reported health status `RPortPrototype` ⌈ The `RPortPrototype` typed by a `PhmHealthChannelInterface` is used to report the status of a health channel by the application software. This specific `RPortPrototype` is defined as the `contextRPortPrototype` of the instance reference `HealthChannelExternalStatus.status`. ⌋*(RS_MANI_00023, RS_MANI_00032)*

[TPS_MANI_03517] Condition evaluation for `HealthChannelExternalStatus` ⌈ The reported value of the `HealthChannelExternalStatus` according to [TPS_MANI_03546] will be compared to the constant status provided in `status`. The `modeCondition` defines whether it shall be compared for equality or non-equality. The result of this comparison is then the result of the `HealthChannelExternalStatus` evaluation. ⌋*(RS_MANI_00023, RS_MANI_00032)*

Class	**HealthChannelExternalStatus**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement			
Note	This element defines a health channel representing the status of an external health channel. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *HealthChannel*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
modeCondition	HCConditionEnum	1	attr	Defines which condition shall trigger this health channel wrt. the referenced mode. **Tags:** atp.Status=draft
status	PhmHealthChannelStatus	1	iref	Defines the status to be compared with for the Health Channel. **Tags:** atp.Status=draft

Table 14.13: HealthChannelExternalStatus

14.5 Arbitration and rule deployment

The `Arbitration` defines the expressions and rules to calculate a logical statement from a set of input `HealthChannel`s. The results of these calculations are used to define the triggering of specific actions by the Platform Health Management (see chapter 14.6).

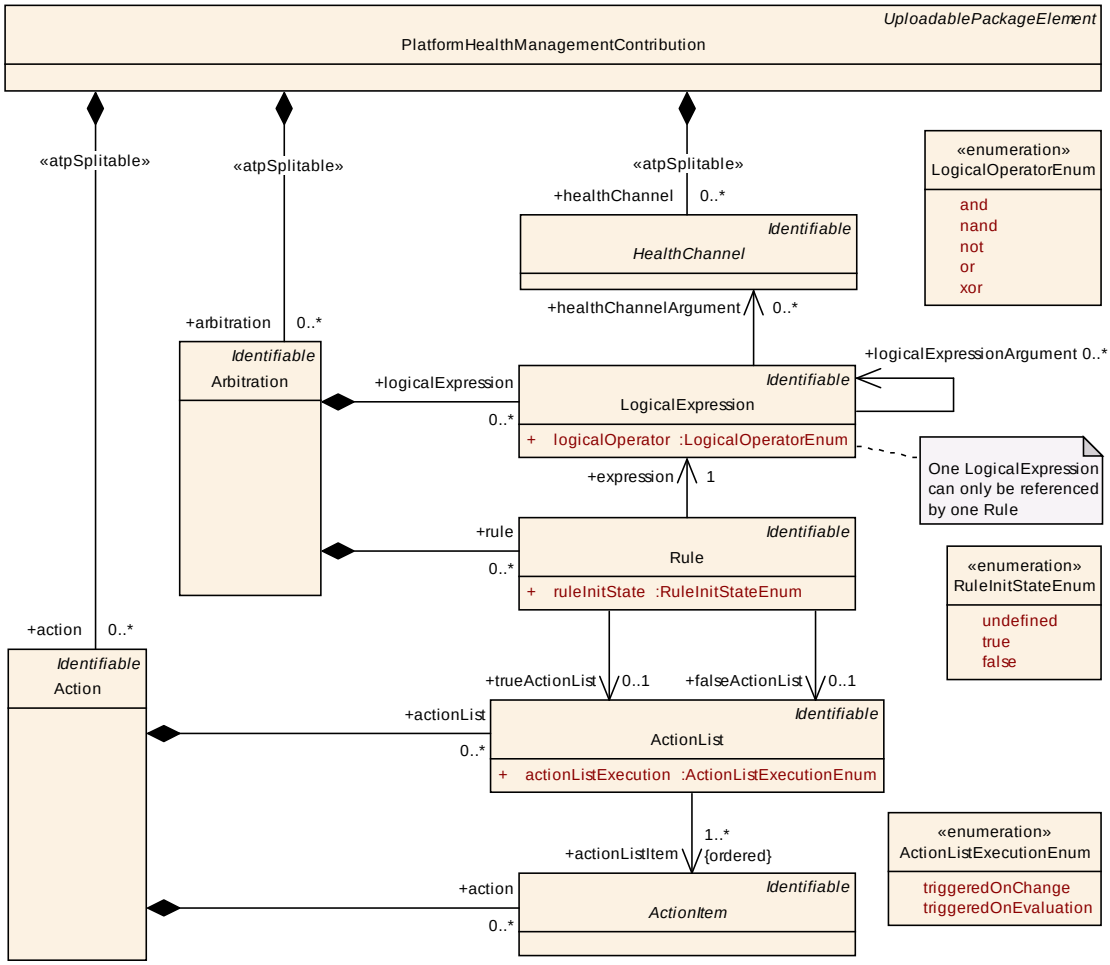


Figure 14.5: Modeling of `Arbitration`

[TPS_MANI_03518] `LogicalExpression` definition ⌈ A `LogicalExpression` defines one `logicalOperator` which will be applied to a set of inputs defined by the `healthChannelArgument` and `logicalExpressionArgument`. ⌋ *(RS_MANI_00023, RS_MANI_00032)*

Thus the result of a `LogicalExpression` can again be used as the input to another `LogicalExpression`.

There are some concerns which need to be formalized at a later point in time to make the definition of `LogicalExpression`s unambiguous:

- using more than 2 inputs for a `LogicalExpression` may lead to ambiguous definitions for some `logicalOperator`s
- the inputs to the `LogicalExpression` are not ordered
- cyclic or recursive definition of `LogicalExpression`s have to be excluded
- ...

Class	**Arbitration**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement			
Note	This element defines logical expressions and rules to be evaluated by the platform health management. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
logicalExpression	LogicalExpression	*	aggr	Collection of LogicalExpressions in the context of an Arbitration. **Tags:** atp.Status=draft
rule	Rule	*	aggr	Collection of rules in the context of an Arbitration. **Tags:** atp.Status=draft

Table 14.14: Arbitration

Class	**LogicalExpression**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement			
Note	This element defines a logical expression with an arbitrary number of arguments. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
healthChannelArgument	HealthChannel	*	ref	Reference to the HealthChannels which shall be considered for the evaluation of the LogicalExpression. **Tags:** atp.Status=draft
logicalExpressionArgument	LogicalExpression	*	ref	Reference to another LogicalExpression which shall be considered in the evaluation of this LogicalExpression. **Tags:** atp.Status=draft
logicalOperator	LogicalOperatorEnum	1	attr	Definition of the operator to be applied to this LogicalExpression. **Tags:** atp.Status=draft

Table 14.15: LogicalExpression

Enumeration	**LogicalOperatorEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement
Note	Definition of logical expression operators. **Tags:** atp.Status=draft

Literal	*Description*
and	**Tags:** atp.EnumerationValue=0
nand	**Tags:** atp.EnumerationValue=1
not	**Tags:** atp.EnumerationValue=2
or	**Tags:** atp.EnumerationValue=3
xor	**Tags:** atp.EnumerationValue=4

Table 14.16: LogicalOperatorEnum

The result of a `LogicalExpression` is taken as input to a `Rule` where it is decided whether and which reaction has to be performed.

[TPS_MANI_03519] `Rule` definition ⌈ A `Rule` takes the result of exactly one `LogicalExpression` and defines the handling of a reaction based on the result of the `LogicalExpression`:

- if the `LogicalExpression` evaluates to *true* the `ActionList` referenced in the role `trueActionList` will be indicated for execution
- if the `LogicalExpression` evaluates to *false* the `ActionList` referenced in the role `falseActionList` will be indicated for execution

Whether an `ActionList` is actually executed is depending on the setting of `actionListExecution` (see [TPS_MANI_03520]). ⌋*(RS_MANI_00023, RS_MANI_00032)*

[constr_3527] `LogicalExpression` referenced by one `Rule` ⌈ Each `LogicalExpression` shall only be referenced by up to one `Rule` in the role `Rule.expression`. ⌋*()*

Class	**Rule**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement			
Note	This element defines a rule for the platform health management. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
expression	LogicalExpression	1	ref	Reference to the logical expression that is evaluated for this rule. **Tags:** atp.Status=draft
falseActionList	ActionList	0..1	ref	Reference to the action list which shall be executed when the rule evaluates to FALSE. **Tags:** atp.Status=draft
ruleInitState	RuleInitStateEnum	1	attr	Defines the initial state of this rule. **Tags:** atp.Status=draft

trueActionList	ActionList	0..1	ref	Reference to the action list which shall be executed when the rule evaluates to TRUE. **Tags:** atp.Status=draft

Table 14.17: Rule

Enumeration	**RuleInitStateEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement
Note	Definition of initial states for rules. **Tags:** atp.Status=draft
Literal	***Description***
false	**Tags:** atp.EnumerationValue=2
true	**Tags:** atp.EnumerationValue=1
undefined	**Tags:** atp.EnumerationValue=0

Table 14.18: RuleInitStateEnum

The ActionList collects an ordered list of ActionItems to be executed when the ActionList is executed. Whether an ActionList is actually executed is defined by the actionListExecution.

[TPS_MANI_03520] Execution of ActionList with actionListExecution=triggeredOnEvaluation ⌈ When a Rule indicates the execution of an ActionList with actionListExecution=triggeredOnEvaluation this ActionList is unconditionally executed every time the Rule is evaluated. ⌋ *(RS_MANI_00023, RS_MANI_00032)*

[TPS_MANI_03521] Execution of ActionList with actionListExecution=triggeredOnChange ⌈ When a Rule indicates the execution of an ActionList with actionListExecution=triggeredOnChange this ActionList is only executed when the previous state of the Rule was different from the current state. ⌋ *(RS_MANI_00023, RS_MANI_00032)*

Class	**ActionList**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement			
Note	This element defines an action list for the platform health management. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
actionListExecution	ActionListExecutionEnum	1	attr	Defines the execution semantics for this action list. **Tags:** atp.Status=draft

actionListItem (ordered)	ActionItem	1..*	ref	Ordered reference to the action items to be executed in the scope of this action list. **Tags:** atp.Status=draft

Table 14.19: ActionList

Enumeration	**ActionListExecutionEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement
Note	Definition of execution semantics for action lists. **Tags:** atp.Status=draft
Literal	***Description***
triggeredOnChange	Actions shall only be executed when the evaluation result of the corresponding rule changes. **Tags:** atp.EnumerationValue=0
triggeredOnEvaluation	Actions shall be executed every time the evaluation of the corresponding rule is done. **Tags:** atp.EnumerationValue=1

Table 14.20: ActionListExecutionEnum

Class	***ActionItem* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement			
Note	This element defines one possible action for the platform health management. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	ApplicationActionItem, PlatformActionItem, WatchdogActionItem			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 14.21: ActionItem

14.6 Action deployment

Actions are executed in the scope of an `ActionList` in a well defined order. The specific subtypes of actions are described below.

14.6.1 Application action deployment

The `ApplicationActionItem` defines an action which is specific to an instance of an application software (represented by a `Process`). The action will be forwarded to the Execution Management [20] by the Platform Health Management.

[TPS_MANI_03522] Definition of actions for application software ⌈ The `ApplicationActionItem` defines an action for a specific `Process`. The action can be either to `terminate` or to `restart` the `Process`. ⌋*(RS_MANI_00023, RS_MANI_00032)*

Class	**ApplicationActionItem**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement			
Note	This element defines the action to be performed for one specific application instance. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *ActionItem*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
actionType	ApplicationActionTypeEnum	1	attr	Defines the action be performed on this application instance. **Tags:** atp.Status=draft
process	Process	0..1	ref	Reference to the process which represents the application instance. **Tags:** atp.Status=draft

Table 14.22: ApplicationActionItem

Enumeration	**ApplicationActionTypeEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement
Note	Definition of available actions to be applied to an application instance. **Tags:** atp.Status=draft
Literal	***Description***
restart	**Tags:** atp.EnumerationValue=1
terminate	**Tags:** atp.EnumerationValue=0

Table 14.23: ApplicationActionTypeEnum

14.6.2 Platform action deployment

The `PlatformActionItem` defines an action which is targeting the whole Platform Instance. The action will be forwarded to the Execution Management [20] by the Platform Health Management.

[TPS_MANI_03523] Definition of actions for Platform Instance ⌈ The `PlatformActionItem` defines an action for the Platform Instance. Different kinds of possible reset strategies are defined in the attribute `PlatformActionItem.actionType`. ⌋ *(RS_MANI_00023, RS_MANI_00032)*

Class	**PlatformActionItem**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement			
Note	This element defines the action to be performed for this platform instance. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *ActionItem*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
actionType	PlatformActionTypeEnum	1	attr	Defines the action be performed on this platform instance. **Tags:** atp.Status=draft

Table 14.24: PlatformActionItem

Enumeration	**PlatformActionTypeEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement
Note	Definition of available actions to be applied to an application instance. **Tags:** atp.Status=draft
Literal	***Description***
resetEcu	**Tags:** atp.EnumerationValue=2
resetMcu	**Tags:** atp.EnumerationValue=1
resetVm	**Tags:** atp.EnumerationValue=0

Table 14.25: PlatformActionTypeEnum

14.6.3 Watchdog action deployment

The `WatchdogActionItem` defines an action which is specific to a Watchdog.

[TPS_MANI_03524] Definition of actions for Watchdog ⌈ The `WatchdogActionItem` defines an action for the Watchdog. Currently only one `WatchdogActionItem.actionType` for the watchdog is defined, namely to stop triggering of the watchdog. ⌋*(RS_MANI_00023, RS_MANI_00032)*

Class	**WatchdogActionItem**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement			
Note	This element defines the action be performed on the watchdog. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *ActionItem*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
actionType	WatchdogActionTypeEnum	1	attr	Defines the action to be performed on the watchdog. **Tags:** atp.Status=draft

Table 14.26: WatchdogActionItem

Enumeration	**WatchdogActionTypeEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement
Note	Definition of available actions to be applied to a watchdog. **Tags:** atp.Status=draft
Literal	***Description***
stopTrigger	**Tags:** atp.EnumerationValue=0

Table 14.27: WatchdogActionTypeEnum

15 Time Synchronization Deployment

15.1 Overview

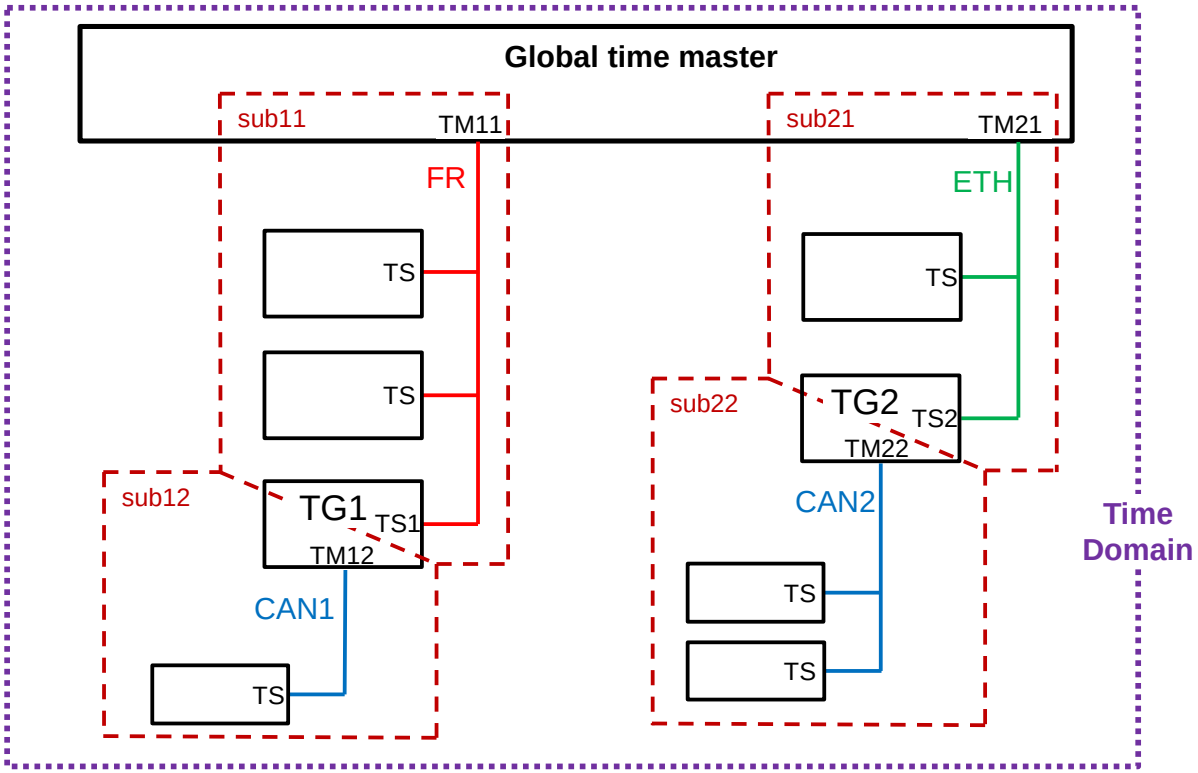
This chapter explains the configuration of the Time Synchronization functional cluster.

An adaptive AUTOSAR application can utilize several (synchronized) time base resources which are provided by the Time Synchronization functional cluster [10]. Time base resources can be *local* to the `Machine` or can be *synchronized* with a network `GlobalTimeDomain`.

The intended interaction of an adaptive AUTOSAR application with Time Synchronization is described in chapter 3.8.

Since an adaptive `Machine` is usually collaborating with other `Machine`s (adaptive) and ECUs (classic), special focus has been put on the vehicle wide definition of synchronized time. For a detailed specification please refer to the *Global Time Synchronization* chapter in the *System Template* [14].

Figure 15.1 provides an example system view on time domains and their transportation over diverse networks. In the scope of the *AUTOSAR adaptive platform* the focus is put on the Ethernet interaction with the rest of the system.



TS: GlobalTime slave
TM: GlobalTime master
TG: GlobalTime gateway

Figure 15.1: Example setup of Synchronized Global Time in AUTOSAR

15.2 Time Synchronization functional cluster configuration

The representation of the Time Synchronization functional cluster [10] within one specific `Machine` is defined by the `TimeSyncModuleInstantiation`. The `Machine` has the ability to define a set of `moduleInstantiation`s, where a specialization can be the `TimeSyncModuleInstantiation`.

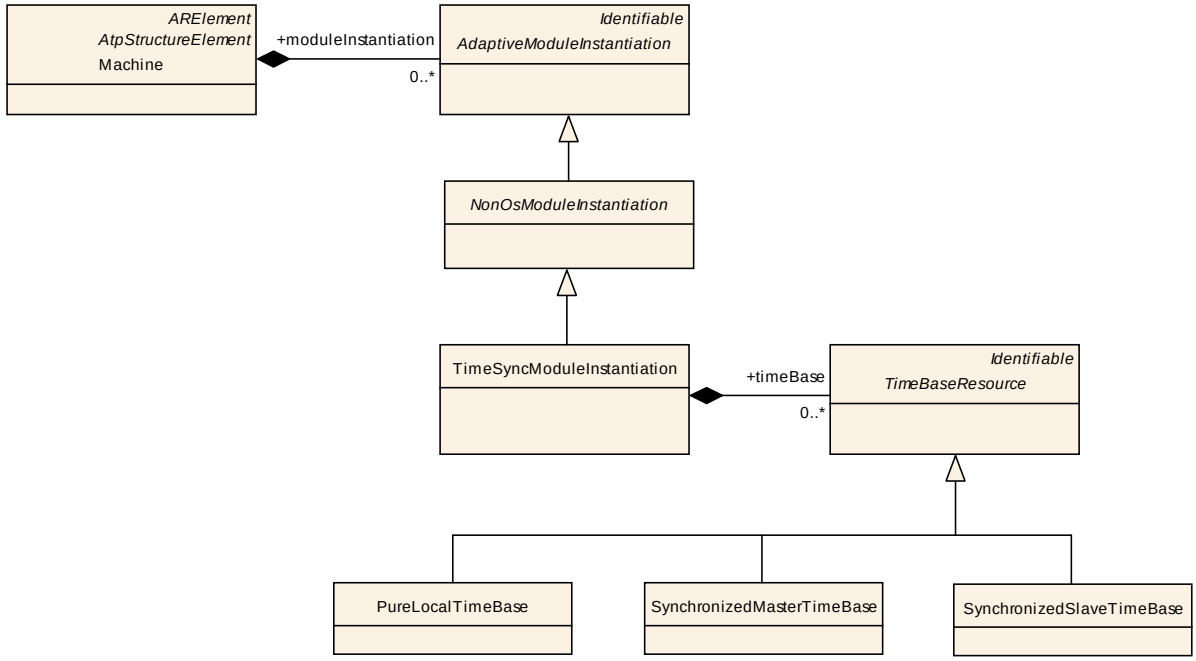


Figure 15.2: Modeling of `TimeSyncModuleInstantiation`

Class	**TimeSyncModuleInstantiation**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::TimeSync			
Note	This meta-class defines the attributes for the Time Synchronization configuration on a specific machine. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *AdaptiveModuleInstantiation*, *Identifiable*, *MultilanguageReferrable*, *NonOsModuleInstantiation*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
timeBase	TimeBaseResource	*	aggr	This aggregation defines the configured Time Bases for Time Synchronization. **Tags:** atp.Status=draft

Table 15.1: TimeSyncModuleInstantiation

15.3 Time Base

The TimeSyncModuleInstantiation represents the actual instance of the Time Synchronization functional cluster executed on a specific Machine. In the scope of the TimeSyncModuleInstantiation the Time Bases are defined.

[TPS_MANI_03539] Definition of Time Bases ⌈ The meta-class TimeSyncModuleInstantiation has the ability to define a set of Time Bases of kind TimeBaseResource in the role timeBase. ⌋*(RS_MANI_00040)*

There are several sub types of TimeBaseResource which will be explained in the following sections.

Class	***TimeBaseResource* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::TimeSync			
Note	This meta-class represents the attributes of one Time Base for Time Synchronization. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	PureLocalTimeBase, SynchronizedMasterTimeBase, SynchronizedSlaveTimeBase			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 15.2: TimeBaseResource

15.3.1 Pure local time base

A PureLocalTimeBase is a specialized TimeBaseResource with a Machine local scope only. So the time is neither received nor propagated over a network.

[TPS_MANI_03540] Definition of PureLocalTimeBase ⌈ The meta-class PureLocalTimeBase defines a Time Base which is only available on the local Machine and is not *synchronized* over the network. ⌋*(RS_MANI_00040)*

Currently no further attributes are defined for the configuration of a PureLocalTimeBase.

Class	**PureLocalTimeBase**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::TimeSync			
Note	This meta-class represents a Time Base which is maintained solely in the context of the local machine. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *TimeBaseResource*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 15.3: PureLocalTimeBase

15.3.2 Synchronized time base

When configuring a synchronized time base many configuration aspects are already provided by the definition of the GlobalTimeDomain and are specified in the *System Template* [14] and associated to MachineDesign.

As for the configuration of the TimeSyncModuleInstantiation the usage of the SynchronizedMasterTimeBase respectively SynchronizedSlaveTimeBase defines the interaction with the GlobalTimeDomain.

[TPS_MANI_03541] Definition of SynchronizedSlaveTimeBase ⌈ The meta-class SynchronizedSlaveTimeBase defines a Time Base which is synchronized with a time coming from the network. With the reference SynchronizedSlaveTimeBase.networkTimeSlave to a GlobalTimeSlave the relation to the system model is established. ⌋*(RS_MANI_00040)*

[TPS_MANI_03542] Definition of SynchronizedMasterTimeBase ⌈ The meta-class SynchronizedMasterTimeBase defines a Time Base which is propagated to a time on the network. With the reference SynchronizedMasterTimeBase.networkTimeMaster to a GlobalTimeMaster the relation to the system model is established. ⌋*(RS_MANI_00040)*

Some aspects of the Synchronized Time Base for the *master* role are not available in the system model, those are provided with the TimeSyncCorrection.

[TPS_MANI_03543] Definition of time sync correction attributes ⌈ The meta-class TimeSyncCorrection defines the attributes required to specify the time sync correction behavior of a SynchronizedMasterTimeBase. The SynchronizedMasterTimeBase aggregates the TimeSyncCorrection in the role timeSyncCorrection. ⌋*(RS_MANI_00040)*

The synchronized global time feature also supports the definition of *offset* time domains.

[TPS_MANI_03547] Definition of *offset* time domains ⌈ A GlobalTimeDomain which has a offsetTimeDomain reference defined is considered an *offset* time domain. The reference source is the *offset* time domain. The reference *target* is the synchronized time domain. ⌋*(RS_MANI_00040)*

The *offset* time domain is applicable to GlobalTimeMaster (therefore also SynchronizedMasterTimeBase) and GlobalTimeSlave (therefore also SynchronizedSlaveTimeBase). *Offset* time domain is not applicable to PureLocalTimeBase.

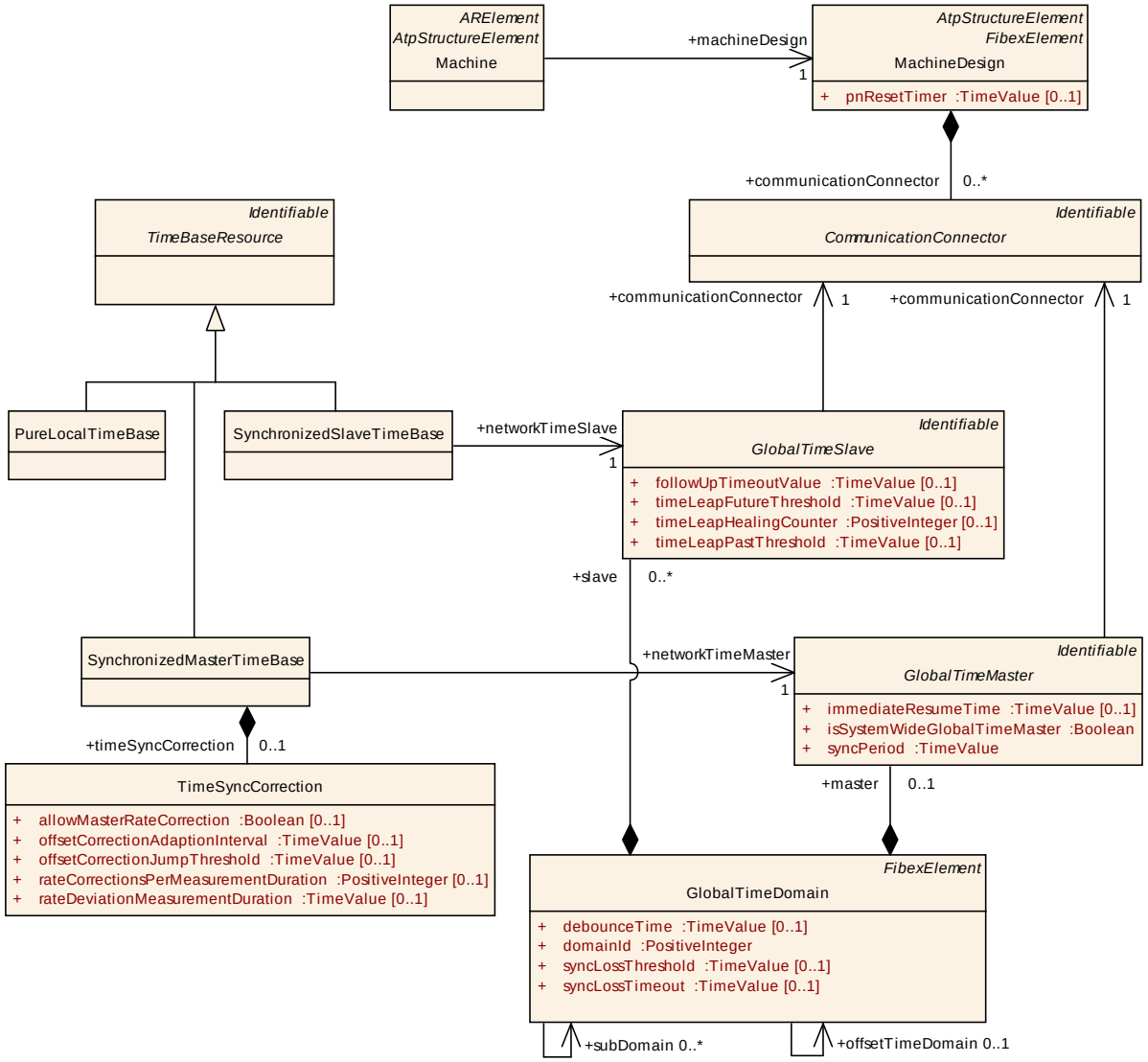


Figure 15.3: Modeling of synchronized time bases

Class	**SynchronizedSlaveTimeBase**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::TimeSync			
Note	This meta-class represents a Synchronized Slave Time Base. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *TimeBaseResource*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
networkTimeSlave	GlobalTimeSlave	1	ref	This reference defines the GlobalTimeSlave which is synchronized with this Time Base. **Tags:** atp.Status=draft

Table 15.4: SynchronizedSlaveTimeBase

Class	**SynchronizedMasterTimeBase**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::TimeSync			
Note	This meta-class represents a Synchronized Master Time Base. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *TimeBaseResource*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
networkTimeMaster	GlobalTimeMaster	1	ref	This reference defines the GlobalTimeMaster which is synchronized with this Time Base. **Tags:** atp.Status=draft
timeSyncCorrection	TimeSyncCorrection	0..1	aggr	This aggregation defines the attributes used for the correction of time synchronization. **Tags:** atp.Status=draft

Table 15.5: SynchronizedMasterTimeBase

Class	**TimeSyncCorrection**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::TimeSync			
Note	This meta-class represents the attributes used for the correction of time synchronization. **Tags:** atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
allowMasterRateCorrection	Boolean	0..1	attr	Defines whether the rate correction value of a Time Base can be set by means of the method setRateCorrection(). false: rate correction cannot be set by method setRateCorrection(). true: rate correction can be set by method setRateCorrection(). **Tags:** atp.Status=draft
offsetCorrectionAdaptionInterval	TimeValue	0..1	attr	Defines the interval during which the adaptive rate correction cancels out the rate and time deviation. Unit: seconds. **Tags:** atp.Status=draft
offsetCorrectionJumpThreshold	TimeValue	0..1	attr	Threshold for the correction method. Deviations below this value will be corrected by a linear reduction over a defined timespan. Values equal and greater than this value will be corrected by immediately setting the correct time and rate in form of a jump. Unit: seconds. **Tags:** atp.Status=draft

rateCorrectionsPerMeasurementDuration	PositiveInteger	0..1	attr	Number of simultaneous rate measurements to determine the current rate deviation. **Tags:** atp.Status=draft
rateDeviationMeasurementDuration	TimeValue	0..1	attr	Time span used to calculate the rate deviation. Unit: seconds. **Tags:** atp.Status=draft

Table 15.6: TimeSyncCorrection

15.3.3 Ethernet synchronized time

As the *AUTOSAR adaptive platform* supports Ethernet as communication network also the time synchronization using Ethernet is supported.

In order to configure the behavior of the Ethernet time synchronization the specific sub-classes are used as shown in figure 15.4.

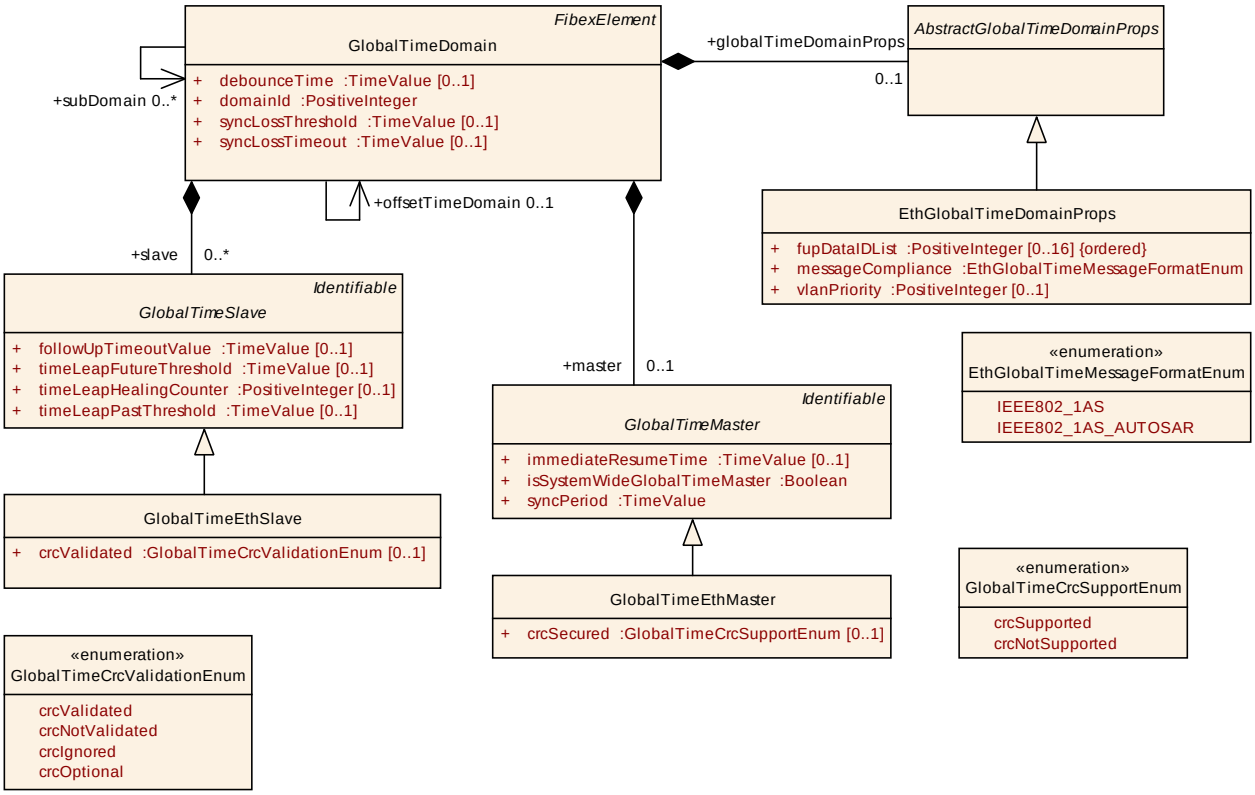


Figure 15.4: Modeling of Ethernet synchronized time

Class	**EthGlobalTimeDomainProps**			
Package	M2::AUTOSARTemplates::SystemTemplate::GlobalTime::ETH			
Note	Enables the definition of Ethernet Global Time specific properties.			
Base	*ARObject*, *AbstractGlobalTimeDomainProps*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
fupDataIDList (ordered)	PositiveInteger	0..16	attr	The DataIDList for FUP messages to calculate CRC.
managedCouplingPort	EthGlobalTimeManagedCouplingPort	*	aggr	Collection of CouplingPorts which are managed in the scope of this Ethernet GlobalTimeDomain.
messageCompliance	EthGlobalTimeMessageFormatEnum	1	attr	Defines the compliance of the Ethernet time sync messages to specific standards.
vlanPriority	PositiveInteger	0..1	attr	Defines which VLAN priority shall be assigned to a time sync message in case the message is sent using a VLAN tag.

Table 15.7: EthGlobalTimeDomainProps

Class	**GlobalTimeEthSlave**			
Package	M2::AUTOSARTemplates::SystemTemplate::GlobalTime::ETH			
Note	This represents the specialization of the GlobalTimeSlave for Ethernet communication.			
Base	*ARObject*, *GlobalTimeSlave*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
crcValidated	GlobalTimeCrcValidationEnum	0..1	attr	Definition of whether or not validation of the CRC is supported.

Table 15.8: GlobalTimeEthSlave

Class	**GlobalTimeEthMaster**			
Package	M2::AUTOSARTemplates::SystemTemplate::GlobalTime::ETH			
Note	This represents the specialization of the GlobalTimeMaster for Ethernet communication.			
Base	*ARObject*, *GlobalTimeMaster*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
crcSecured	GlobalTimeCrcSupportEnum	0..1	attr	Definition of whether or not CRC is supported. This is only relevant for selected bus systems.

Table 15.9: GlobalTimeEthMaster

15.4 Time Base to Port Prototype mapping

The `TimeBaseResource` definition of chapter 15.3 and the `RPortPrototype` typed by a sub-class of `TimeSynchronizationInterface` of chapter 3.8 have to be

mapped to each other in order to define the binding of application software to the platform foundation software implementing the time synchronization.

[TPS_MANI_03548] Definition of TimeSyncPortPrototypeToTimeBaseMapping ⌈ A TimeSyncPortPrototypeToTimeBaseMapping is used to define a mapping between a TimeBaseResource and a RPortPrototype typed by a sub-class of TimeSynchronizationInterface in the context of a Process. ⌋ *(RS_MANI_00040)*

The TimeSyncPortPrototypeToTimeBaseMapping takes the Process into account so that every instantiation of an Executable (and the resulting instantiation of all the RPortPrototypes typed by a sub-class of TimeSynchronizationInterface) can be mapped individually to TimeBaseResources.

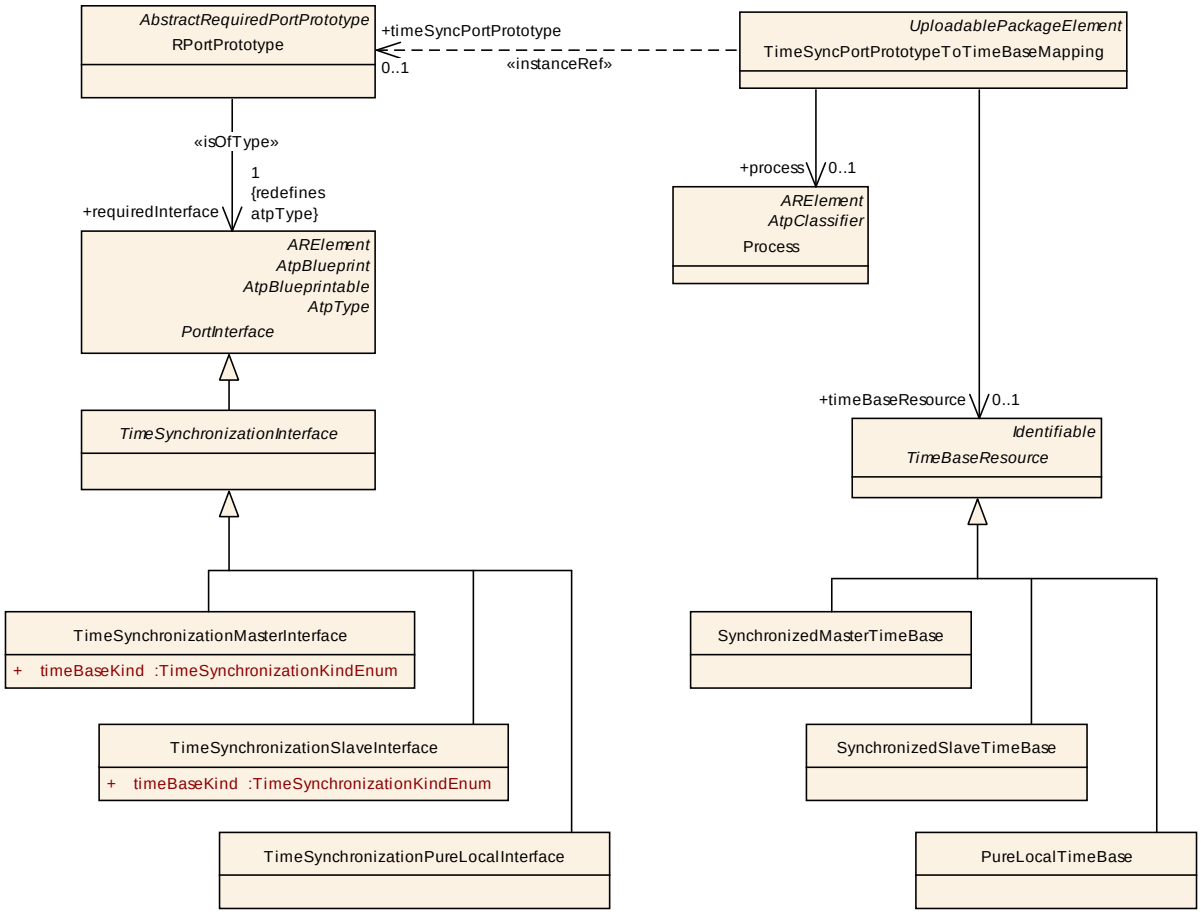


Figure 15.5: Modeling of TimeSyncPortPrototypeToTimeBaseMapping

Class	**TimeSyncPortPrototypeToTimeBaseMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::TimeSync			
Note	This meta-class provides the ability to map a RPortPrototype typed by a TimeSynchronizationInterface to a TimeBaseResource in the context of a Process. **Tags:** atp.Status=draft; atp.recommendedPackage=TimeSyncPortPrototypeToTimeBaseMappings			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
process	Process	0..1	ref	Reference to the context Process this mapping applies to. **Tags:** atp.Status=draft
timeBaseResource	TimeBaseResource	0..1	ref	Reference to the mapped TimeBaseResource. **Tags:** atp.Status=draft
timeSyncPortPrototype	RPortPrototype	0..1	iref	Instance reference to the mapped PortPrototype typed by a TimeSynchronizationInterface. **Tags:** atp.Status=draft

Table 15.10: TimeSyncPortPrototypeToTimeBaseMapping

The example shown in figure 15.6 illustrates the mapping of `RPortPrototype`s typed by one of the sub-classes of `TimeSynchronizationInterface` to actually configured `TimeBaseResource`s at the Time Sync Management.

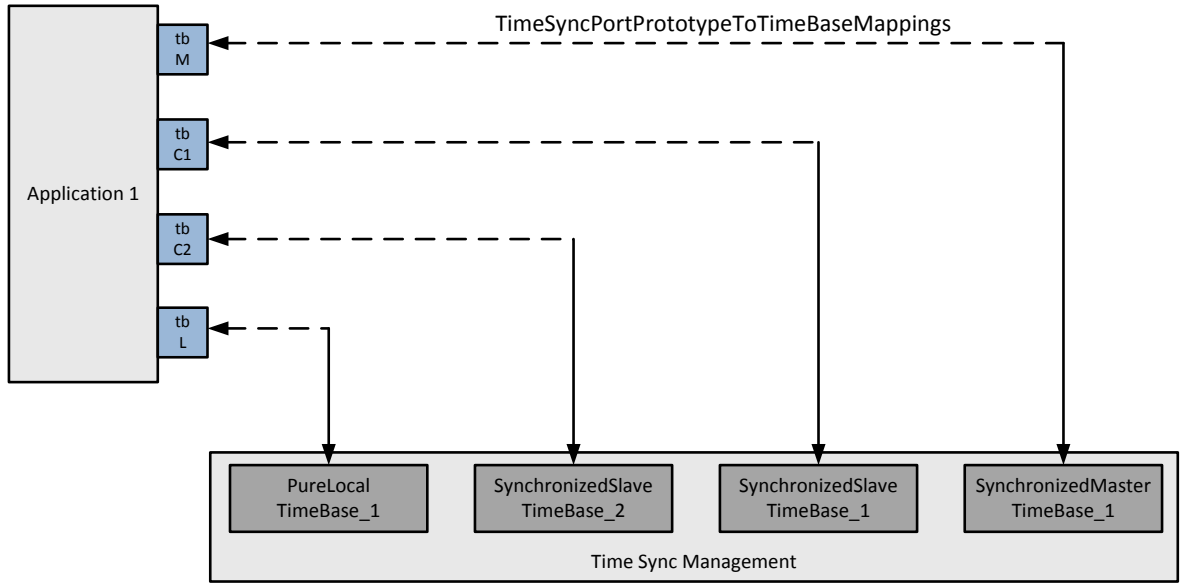


Figure 15.6: Example PortPrototype to TimeBase mapping

16 Uploadable Software Package

16.1 Overview

One of the key features of the *AUTOSAR adaptive platform* is the ability to extend the software on a given ECU without having to reflash the entire ECU. Instead, software packages are uploaded to the ECU where the content is taken care of by responsible platform modules.

The reason why this topic is relevant for the modeling is the fact that an uploadable software package consists not only of software itself but also of manifest content required to support the integration of the uploaded software with the existing platform instance.

As far as the meta-model is concerned, the discussion about manifests and which manifest content needs to go with which other model elements doesn't care about the file granularity. In other words, it would not make sense to formalize the uploadable software package on the basis of references to files that carry model elements.

Instead, the view on the manifest topic from the modeling point of view focuses on model elements that make up manifest content.

Therefore, the modeling of an uploadable software package allows for putting references to all the required model elements that, in their entirety, make up the manifest of the corresponding application software that is also going to end up in the uploadable software package.

From the formal point of view, such an uploadable software package is modeled as a so-called `SoftwareCluster`. This meta-class is the root element that in turn describes all the necessary content of an uploadable software package.

However, the software package obviously isn't created out of thin air. It is the result of a workflow that starts from the formulation of requirements on the content of a `SoftwareCluster`.

These requirements are formalized by means of meta-class `SoftwareClusterDesigns`.

The relation between `SoftwareClusterDesign` and `SoftwareCluster` is depicted in Figure 16.1.

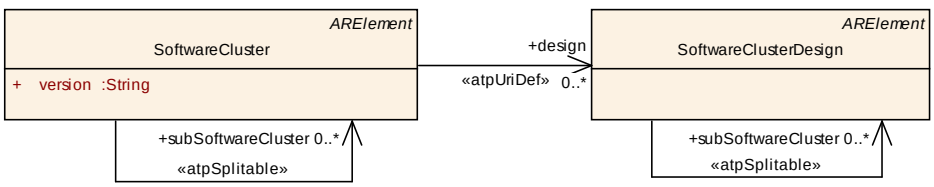


Figure 16.1: Relation of `SoftwareClusterDesign` to `SoftwareCluster`

[TPS_MANI_01109] Semantics of `UploadablePackageElement` ⌈ In order to keep the complexity of the modeling of `SoftwareCluster` as low as possible abstract meta-class `UploadablePackageElement` has been created.

This allows for the referencing of model elements derived from `UploadablePackageElement` that need to be considered in an uploadable software package from within a `SoftwareCluster` with just the reference `containedPackageElement`.

The same applies for `SoftwareClusterDesign` and the respective reference `requiredPackageElement`. ⌋*(RS_MANI_00035)*

Class	***UploadablePackageElement* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::General			
Note	This meta-class acts as an abstract base class for all meta-classes that need to be added to an uploadable software package in order to complete the manifest content. **Tags:** atp.Status=draft			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Subclasses	*AdaptivePlatformServiceInstance*, E2EProfileConfigurationSet, PersistencyFile, PersistencyFileArray, PersistencyKeyValueDatabase, PersistencyPortPrototypeToFileArrayMapping, PersistencyPortPrototypeToKeyValueDatabaseMapping, PlatformHealthManagementContribution, PortInterfaceToDataTypeMapping, ProcessToMachineMappingSet, RestHttpPortPrototypeMapping, *ServiceInstanceToMachineMapping*, ServiceInstanceToPortPrototypeMapping, *ServiceInterfaceDeployment*, StartupConfigSet, TimeSyncPortPrototypeToTimeBaseMapping			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table 16.1: UploadablePackageElement

Please note that this approach to collecting elements is very similar in semantics to `System.fibexElement` or `DiagnosticContributionSet.element`.

16.2 Software Cluster Design

[TPS_MANI_01112] Semantics of `SoftwareClusterDesign` ⌈ The existence of a `SoftwareClusterDesign` represents formalized requirements that have initially been formulated by an OEM and that may be enriched as the development of the software progresses.

Finally, the `SoftwareClusterDesign` shall be taken by the integration as a further input to the definition of the result of the integration step: the definition of the `SoftwareCluster`. ⌋*(RS_MANI_00035)*

Just to be sure, the `SoftwareClusterDesign` is not intended to be uploaded to the target platform. It is just an early form of the final `SoftwareCluster` that indeed gets uploaded. The existence of the `SoftwareClusterDesign` is motivated from the methodological point of view.

[constr_1557] Standardized values of SoftwareClusterDesign.category and SoftwareCluster.category ⌈ The AUTOSAR standard reserves the following values of attribute SoftwareClusterDesign.category and SoftwareCluster.category:

- ROOT_SOFTWARE_CLUSTER
- SUB_SOFTWARE_CLUSTER

⌋*()*

[TPS_MANI_01161] Impact of values of category on the semantics of SoftwareClusterDesign ⌈ A SoftwareClusterDesign of category ROOT_SOFTWARE_CLUSTER may refer to other SoftwareClusterDesigns of category SUB_SOFTWARE_CLUSTER in the role subSoftwareCluster and thereby offer a way to further break down the creation of a SoftwareClusterDesign. ⌋*(RS_MANI_00035)*

[constr_1558] Existence of SoftwareClusterDesign.diagnosticAddress ⌈ The aggregation of SoftwareClusterDiagnosticAddress at SoftwareClusterDesign in the role diagnosticAddress shall only exist if the value of SoftwareClusterDesign.category is set to ROOT_SOFTWARE_CLUSTER. ⌋*()*

[constr_1559] Existence of SoftwareClusterDesign.subSoftwareCluster ⌈ The Reference from SoftwareClusterDesign to itself in the role subSoftwareCluster shall only exist if the value of SoftwareClusterDesign.category is set to ROOT_SOFTWARE_CLUSTER. ⌋*()*

[constr_1560] Usage of SoftwareClusterDesign.requiredARElement ⌈ The reference SoftwareClusterDesign.requiredARElement shall not be used to refer to another SoftwareClusterDesign or even SoftwareCluster. ⌋*()*

Rationale for the existence of [constr_1560]: dedicated references are defined for the purpose of referring to SoftwareClusterDesigns.

[TPS_MANI_01162] Semantics of SoftwareClusterDesign.dependsOn ⌈ A SoftwareClusterDesign has the ability to refer to other SoftwareClusterDesigns in the role dependsOn.dependentSoftwareClusterDesign to express that the functionality of the referenced SoftwareClusterDesign is required to enable the full functionality of the referencing SoftwareClusterDesign.

Attribute SoftwareClusterDesignDependency.dependency allows for the definition of a **non-formal condition**. In other words, the dependency shall be applicable only if the condition is fulfilled. ⌋*(RS_MANI_00035)*

Both the reference in the role SoftwareClusterDesign.dependsOn.dependentSoftwareClusterDesign as well as the reference in the role SoftwareClusterDesign.subSoftwareCluster factually define a dependency between SoftwareClusterDesigns.

However, the difference is that SoftwareClusterDesigns referenced in the role subSoftwareCluster may not have subSoftwareClusters themselves (as explained by [constr_1559]).

Class	**SoftwareClusterDesignDependency**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::SoftwareCluster			
Note	This meta-class has the ability to support the expression of a dependency from one SoftwareCluster to another. **Tags:** atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dependency	String	1	attr	This attribute allows for the definition of a non-formal dependency to the target SoftwareClusterDesign.
dependentSoftwareClusterDesign	SoftwareClusterDesign	0..1	ref	This reference identifies the dependent SoftwareClusterDesign. **Tags:** atp.Status=draft

Table 16.2: SoftwareClusterDesignDependency

[constr_1561] Existence of SoftwareClusterDesign.subSoftwareCluster and SoftwareClusterDesign.dependsOn.dependentSoftwareClusterDesign ⌈ Within the context of a specific SoftwareClusterDesign, the references SoftwareClusterDesign.subSoftwareCluster and SoftwareClusterDesign.dependsOn.dependentSoftwareClusterDesign shall not refer to the same target SoftwareClusterDesign. ⌋*()*

Rationale for the existence of [constr_1561]: the existence of a reference to another SoftwareClusterDesign in two different roles creates ambiguity and also there is no definition for the semantics of such a scenario.

[TPS_MANI_01113] Semantics of SoftwareClusterDesign.diagnosticAddress ⌈ The existence of the attribute SoftwareClusterDesign.diagnosticAddress can be used to express information about the distribution of diagnostic addresses even in a very early stage of development, i.e. this is typically done by an OEM.

This includes the ability to specify multiple (i.e. several functional plus one physical) diagnostic addresses, thus the multiplicity of diagnosticAddress is set to 0..*. ⌋ *(RS_MANI_00035)*

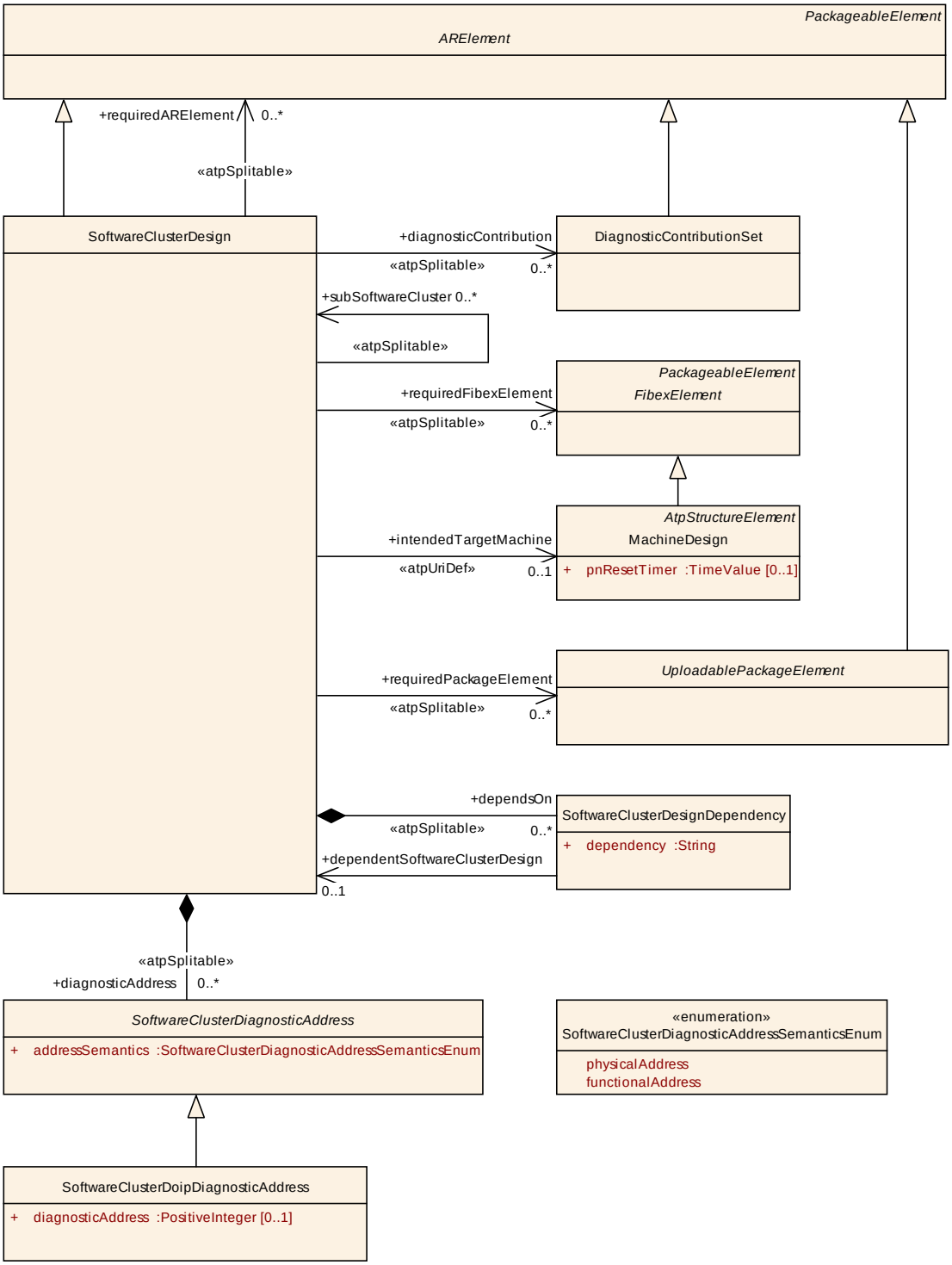


Figure 16.2: Modeling of `SoftwareClusterDesign`

Class	**SoftwareClusterDesign**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::SoftwareCluster			
Note	This meta-class represents the ability for the OEM to design the grouping of software uploadable to a specific target Machine. **Tags:** atp.Status=draft; atp.recommendedPackage=SoftwareClusterDesigns			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dependsOn	SoftwareClusterDesignDependency	*	aggr	This aggregation allows for the specification of a dependency. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=dependsOn; atp.Status=draft
diagnosticAddress	SoftwareClusterDiagnosticAddress	*	aggr	This aggregaton is used to specify the diagnsotic address. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=diagnosticAddress; atp.Status=draft
diagnosticContribution	DiagnosticContributionSet	*	ref	This reference identifes the corresponding collection of DiagnosticContributionSet. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=diagnosticContribution; atp.Status=draft
intendedTargetMachine	MachineDesign	0..1	ref	This reference can be taken to identify the MachineDesign for which the final SoftwareCluster shall be developed. **Stereotypes:** atpUriDef **Tags:** atp.Status=draft
requiredARElement	ARElement	*	ref	This reference represents the collection of ARElements that are required for the completeness of the definition of the SoftwareCluster. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=requiredARElement; atp.Status=draft
requiredFibexElement	FibexElement	*	ref	This reference represents the collection of fibexElements that are required for the completeness of the definition of the SoftwareCluster. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=requiredFibexElement; atp.Status=draft

requiredPackageElement	UploadablePackageElement	*	ref	This reference points to uploadable elements that have been identified as relevant in the context of the enclosing SoftwareClusterDesign. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=requiredPackageElement; atp.Status=draft
subSoftwareCluster	SoftwareClusterDesign	*	ref	This reference is used to identify the sub-SoftwareClusterDesigns of an "umbrella" SoftwareClusterDesign. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=subSoftwareCluster; atp.Status=draft

Table 16.3: SoftwareClusterDesign

[TPS_MANI_01117] Semantics of `SoftwareClusterDesign.intendedTargetMachine` ⌈ The specification of `SoftwareClusterDesign.intendedTargetMachine` allows for focusing the specification of an uploadable software package to a specific `MachineDesign` from early phases of a development project. ⌋ *(RS_MANI_00035)*

Please note that `SoftwareCluster` doesn't have a dedicated reference to the target `Machine`.

This relation is expressed by means of a reference to `Process` that in turn can be mapped to a dedicated `Machine` by means of a `ProcessToMachineMapping`. In this context, [constr_1536] applies.

[TPS_MANI_01118] Relation between `SoftwareClusterDesign` and `DiagnosticContributionSet` ⌈ An important aspect of the definition of a `SoftwareClusterDesign` is the question what diagnostic extract shall be associated with the `SoftwareClusterDesign`.

For this purpose, a reference from `SoftwareClusterDesign` to `DiagnosticContributionSet` in the role `diagnosticContribution` is provided.

In an early stage of the development process, it is intentionally made possible to reference multiple `DiagnosticContributionSet`s in order to support the decentralized (e.g. partly done by OEM and partly done by supplier) configuration of the diagnostics stack. ⌋*(RS_MANI_00035)*

[constr_1562] Existence of `SoftwareClusterDesign.diagnosticContribution` ⌈ The existence of the reference `SoftwareClusterDesign.diagnosticContribution` is limited to `SoftwareClusterDesign`s where attribute `category` is set to the value `ROOT_SOFTWARE_CLUSTER`. ⌋*()*

Rationale for the existence of [constr_1562]: the definition of the diagnostic behavior is limited to the root level of a structure of `SoftwareClusterDesign`s in the same spirit that caused the existence of [constr_1558].

Please mind the intentionally introduced difference between SoftwareCluster and SoftwareClusterDesign in terms of the relation to DiagnosticContributionSet.

In other words, the multiplicity of the references to DiagnosticContributionSet intentionally differ.

As already explained, the SoftwareClusterDesign shall support the decentralized configuration of the DiagnosticContributionSet while the SoftwareCluster requires the existence of a final (merged) DiagnosticContributionSet.

[TPS_MANI_01119] Reference to model elements from SoftwareClusterDesign ⌈ SoftwareClusterDesign has the ability to define the following references to model elements relevant for the definition of an uploadable software package:

- references to meta-classes derived from UploadablePackageElement are formalized by way of SoftwareClusterDesign.requiredPackageElement.
- references to meta-classes derived from ARElement are formalized by way of SoftwareClusterDesign.requiredARElement.
- references to meta-classes derived from FibexElement are formalized by way of SoftwareClusterDesign.requiredFibexElement.

⌋*(RS_MANI_00035)*

Please note that the conversion of a SoftwareClusterDesign to a SoftwareCluster is not formalized by AUTOSAR. This step can be done by a tool at the discretion of the integrator.

In other words, in some cases it may be applicable to do this conversion relatively early in the development project while other projects may require to keep the SoftwareClusterDesign around for a longer period in time.

16.3 Software Cluster

[TPS_MANI_01110] Semantics of SoftwareCluster ⌈ The existence of a SoftwareCluster represents an uploadable software package. ⌋*(RS_MANI_00035)*

[TPS_MANI_01111] Diagnostic Address of a SoftwareCluster ⌈ An uploadable software package formalized as a SoftwareCluster will typically be equipped with a diagnostics management component.

Therefore the definition of the SoftwareCluster needs to provide information about the diagnostic address(es) to which the contained diagnostic management component shall respond.

This information is formalized by means of the attribute SoftwareCluster.diagnosticAddress.

A `SoftwareCluster` may be required to respond to multiple (i.e. several functional plus one physical) diagnostic addresses, thus the multiplicity of `diagnosticAddress` is set to 0..*. ⌋*(RS_MANI_00035)*

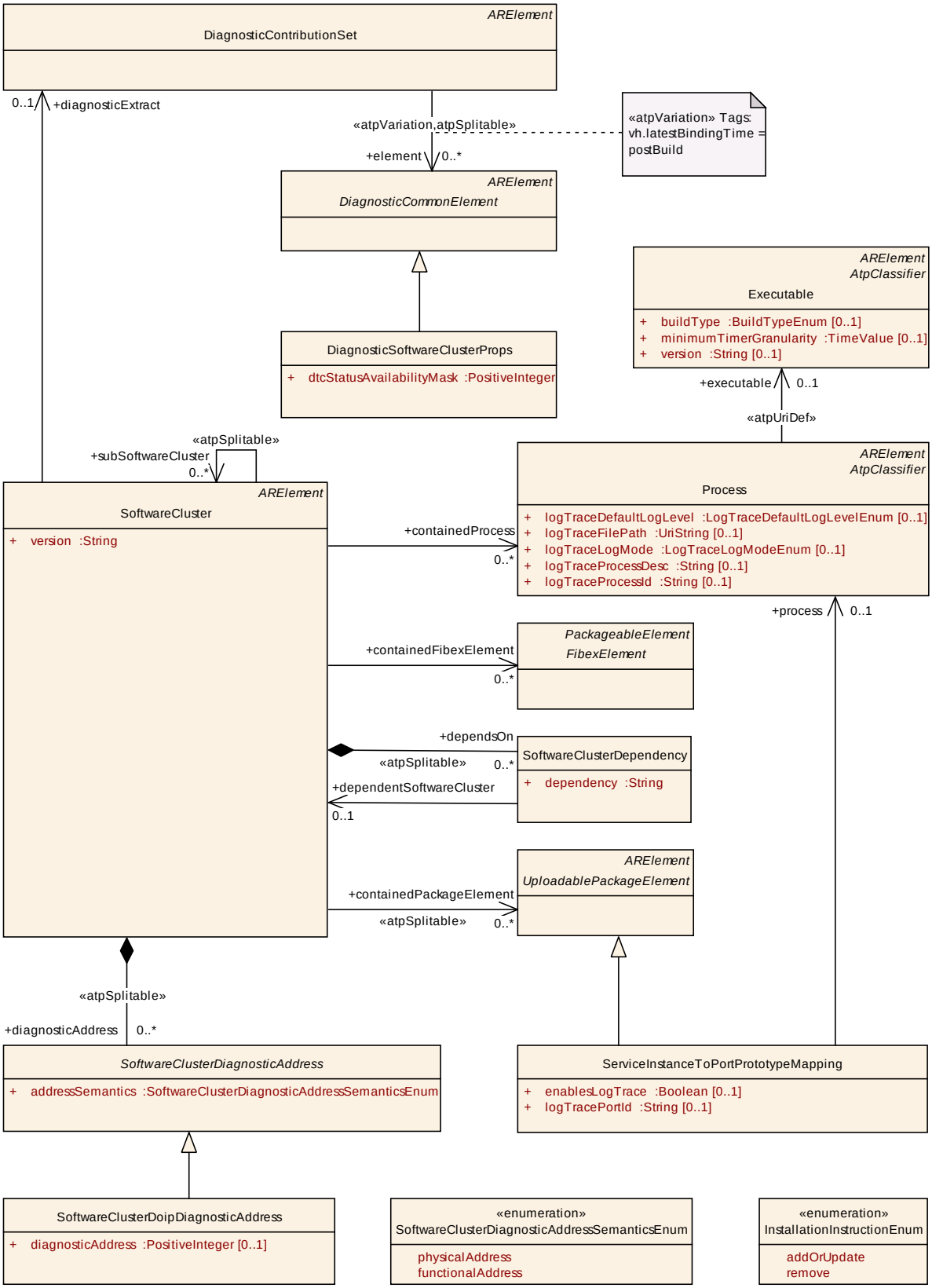


Figure 16.3: Modeling of `SoftwareCluster`

Please note that the modeling of the SoftwareClusterDiagnosticAddress has been created with the primary goal to support the usage of DoIP for diagnostics.

The secondary goal has been to make the modeling of the diagnostic address extensible such that the idiomatic ways in which other transport layers (CAN, LIN, FlexRay, etc.) define diagnostic addresses can also be supported by adding respective subclasses of SoftwareClusterDiagnosticAddress.

[constr_1543] Only one physical address per SoftwareCluster ⌈ Each SoftwareCluster shall only aggregate one SoftwareClusterDiagnosticAddress where the value of attribute addressSemantics is set to SoftwareClusterDiagnosticAddressSemanticsEnum.physicalAddress. ⌋()

Class	**SoftwareCluster**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::SoftwareCluster			
Note	This meta-class represents the ability to define an uploadable software-package, i.e. the SoftwareCluster shall contain all software and configuration for a given purpose. **Tags:** atp.Status=draft; atp.recommendedPackage=SoftwareClusters			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
containedARElement	ARElement	*	ref	This reference represents the collection of model elements that cannot derive from UploadablePackageElement and that contribute to the completeness of the definition of the SoftwareCluster. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=shortName; atp.Status=draft
containedFibexElement	FibexElement	*	ref	This allows for referencing FibexElements that need to be considered in the context of a SoftwareCluster. **Tags:** atp.Status=draft
containedPackageElement	UploadablePackageElement	*	ref	This reference identifies model elements that are required to complete the manifest content. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=shortName; atp.Status=draft
containedProcess	Process	*	ref	This reference represent the processes contained in the enclosing SoftwareCluster. **Tags:** atp.Status=draft
dependsOn	SoftwareClusterDependency	*	aggr	This aggregation can be taken to identify a dependency for the enclosing SoftwareCluster. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=dependsOn; atp.Status=draft

design	SoftwareClusterDesign	*	ref	This reference represents the identification of all SoftwareClusterDesigns applicable for the enclosing SoftwareCluster. **Stereotypes:** atpUriDef **Tags:** atp.Status=draft
diagnosticAddress	SoftwareClusterDiagnosticAddress	*	aggr	This aggregation represents the collection of diagnostic addresses that apply for the SoftwareCluster. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=diagnosticAddress; atp.Status=draft
diagnosticExtract	DiagnosticContributionSet	0..1	ref	This reference represents the definition of the diagnostic extract applicable to the referencing SoftwareCluster **Tags:** atp.Status=draft
subSoftwareCluster	SoftwareCluster	*	ref	This reference is used to identify the sub-SoftwareClusters of an "umbrella" SoftwareCluster. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=subSoftwareCluster; atp.Status=draft
version	String	1	attr	This attribute can be used to describe a version information for the enclosing SoftwareCluster. The format of the version as well as how to tell a lower from a higher version is not prescribed by the AUTOSAR standard.

Table 16.4: SoftwareCluster

Class	***SoftwareClusterDiagnosticAddress* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::SoftwareCluster			
Note	This meta-class represents the ability to define a diagnostic address in an abstract form. Sub-classes are supposed to clarify how the diagnostic address shall be defined according to the applicable addressing scheme (DoIP vs. CAN TP vs. ...). **Tags:** atp.Status=draft			
Base	*ARObject*			
Subclasses	SoftwareClusterDoipDiagnosticAddress			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
addressSemantics	SoftwareClusterDiagnosticAddressSemanticsEnum	1	attr	This attribute clarifies whether the address value shall be interpreted as a physical or a functional address.

Table 16.5: SoftwareClusterDiagnosticAddress

Enumeration	**SoftwareClusterDiagnosticAddressSemanticsEnum**

Package	M2::AUTOSARTemplates::AdaptivePlatform::SoftwareCluster
Note	This meta-class defines a list of semantics for the interpretation of diagnostic addresses in the context of a SoftwareCluster. **Tags:** atp.Status=draft
Literal	***Description***
functional Address	This address represents a functional address. **Tags:** atp.EnumerationValue=1
physical Address	This address represents a physical address. **Tags:** atp.EnumerationValue=0

Table 16.6: SoftwareClusterDiagnosticAddressSemanticsEnum

Class	**SoftwareClusterDoipDiagnosticAddress**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::SoftwareCluster			
Note	This meta-class represents the ability to define a diagnostic address specifically for the DoIP case. **Tags:** atp.Status=draft			
Base	*ARObject*, *SoftwareClusterDiagnosticAddress*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
diagnosticAddress	PositiveInteger	0..1	attr	This attribute represents the collection of diagnostic addresses the SoftwareCluster occupies. **Tags:** atp.Status=draft

Table 16.7: SoftwareClusterDoipDiagnosticAddress

Enumeration	**InstallationInstructionEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::SoftwareCluster
Note	This enumeration class provides the vocabulary for the specification of an installation instruction. **Tags:** atp.Status=draft
Literal	***Description***
addOrUpdate	The SoftwareCluster shall be added (if not already existing on the target) or updated (if already existing on the target). **Tags:** atp.EnumerationValue=0
remove	The SoftwareCluster shall be removed from the target. **Tags:** atp.EnumerationValue=1

Table 16.8: InstallationInstructionEnum

[constr_1563] Standardized values of SoftwareClusterDesign.category and SoftwareCluster.category ⌈ The AUTOSAR standard reserves the following values of attribute SoftwareClusterDesign.category and SoftwareCluster.category:

- ROOT_SOFTWARE_CLUSTER
- SUB_SOFTWARE_CLUSTER

⌋*()*

[TPS_MANI_01163] Impact of values of category on the semantics of SoftwareCluster ⌈ A SoftwareCluster of category ROOT_SOFTWARE_CLUSTER may refer to other SoftwareClusters of category SUB_SOFTWARE_CLUSTER in the role subSoftwareCluster and thereby offer a way to further break down the creation of a SoftwareCluster. ⌋*(RS_MANI_00035)*

[constr_1564] Existence of SoftwareCluster.diagnosticAddress ⌈ The aggregation of SoftwareClusterDiagnosticAddress at SoftwareCluster in the role diagnosticAddress shall only exist if the value of SoftwareCluster.category is set to ROOT_SOFTWARE_CLUSTER. ⌋*()*

[constr_1565] Existence of SoftwareCluster.subSoftwareCluster ⌈ The Reference from meta-class SoftwareCluster to itself in the role subSoftwareCluster shall only exist if the value of attribute SoftwareCluster.category is set to ROOT_SOFTWARE_CLUSTER. ⌋*()*

[constr_1566] Usage of SoftwareCluster.containedARElement ⌈ The reference SoftwareCluster.containedARElement shall not be used to refer to another SoftwareCluster or even SoftwareCluster. ⌋*()*

Rationale for the existence of [constr_1566]: dedicated references are defined for the purpose of referring to SoftwareClusters.

[TPS_MANI_01164] Semantics of SoftwareCluster.dependsOn ⌈ A SoftwareCluster has the ability to refer to other SoftwareClusters in the role dependsOn.dependentSoftwareCluster to express that the functionality of the referenced SoftwareCluster is required to enable the full functionality of the referencing SoftwareCluster.

Attribute SoftwareClusterDependency.dependency allows for the definition of a **non-formal condition**. In other words, the dependency shall be applicable only if the condition is fulfilled. ⌋*(RS_MANI_00035)*

Both the reference in the role SoftwareCluster.dependsOn.dependentSoftwareCluster as well as the reference in the role SoftwareCluster.subSoftwareCluster factually define a dependency between SoftwareClusters.

However, the difference is that SoftwareClusters referenced in the role subSoftwareCluster may not have subSoftwareClusters themselves (as explained by [constr_1559]).

Class	**SoftwareClusterDependency**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::SoftwareCluster			
Note	This meta-class has the ability to define a dependency on another SoftwareCluster **Tags:** atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dependency	String	1	attr	This attribute allows for the description of a non-formal dependency condition.
dependentSoftwareCluster	SoftwareCluster	0..1	ref	This reference identifies the SoftwareCluster to which the dependency applies. **Tags:** atp.Status=draft

Table 16.9: SoftwareClusterDependency

[constr_1567] Existence of `SoftwareCluster.subSoftwareCluster` and `SoftwareCluster.dependsOn.dependentSoftwareCluster` ⌈ Within the context of a specific `SoftwareCluster`, the references from `SoftwareCluster` to itself in the roles `subSoftwareCluster` and `dependsOn.dependentSoftwareCluster` shall not refer to the same target `SoftwareCluster`. ⌋*()*

Rationale for the existence of [constr_1567]: the existence of a reference to another `SoftwareCluster` in two different roles creates ambiguity and also there is no definition for the semantics of such a scenario.

[TPS_MANI_01114] Relation of `DiagnosticContributionSet` to `SoftwareCluster` ⌈ In AUTOSAR, the formalization of the external behavior of the diagnostic stack is rooted in meta-class `DiagnosticContributionSet`.

On the *AUTOSAR classic platform* the scope of the “external behavior of the diagnostic stack” is represented by an entire ECU.

This relation changes on the *AUTOSAR adaptive platform* where each uploadable software package is shipped with the definition of the “external behavior of the diagnostic stack” **as far as the software in the scope of respective uploadable software package is concerned**.

To fully support the different approaches of *AUTOSAR classic platform* and *AUTOSAR adaptive platform* it is necessary to provide means for specifying a `DiagnosticContributionSet` for a given `SoftwareCluster`.

In particular, this relation is created by means of the reference `SoftwareCluster.diagnosticExtract`. ⌋*(RS_MANI_00035)*

In other words, the “external behavior of the diagnostic stack” of each `SoftwareCluster` shall only be described by a single `DiagnosticContributionSet`.

And since the `DiagnosticContributionSet` and all referenced `element`s are subject to the upload on a target platform it only makes sense that the `Soft-`

wareCluster references the DiagnosticContributionSet (instead of the other way round).

[constr_1568] Existence of SoftwareCluster.diagnosticExtract ⌈ The existence of the reference SoftwareCluster.diagnosticExtract is limited to SoftwareClusters where attribute category is set to the value ROOT_SOFTWARE_CLUSTER. ⌋*()*

Rationale for the existence of [constr_1562]: the definition of the diagnostic behavior is limited to the root level of a structure of SoftwareClusters in the same spirit that caused the existence of [constr_1564].

[constr_1534] Existence of DiagnosticSoftwareClusterProps ⌈ Each DiagnosticContributionSet shall only reference one and only one DiagnosticSoftwareClusterProps in the role element. ⌋*()*

Class	**DiagnosticSoftwareClusterProps**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::SoftwareCluster			
Note	This meta-class represents the ability to specify properties for the relation between a DiagnosticContributionSet and a SoftwareCluster. **Tags:** atp.Status=draft; atp.recommendedPackage=DiagnosticSoftwareCluster Propss			
Base	*ARElement*, *ARObject*, *CollectableElement*, *DiagnosticCommonElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dtcStatusAvailabilityMask	PositiveInteger	1	attr	This attribute contains the value of the DTC status availability mask. **Tags:** atp.Status=draft

Table 16.10: DiagnosticSoftwareClusterProps

[constr_1535] Existence of DiagnosticSoftwareClusterProps in the context of a DiagnosticContributionSet ⌈ Each DiagnosticContributionSet shall only reference a single DiagnosticSoftwareClusterProps in the role element. ⌋*()*

[TPS_MANI_01115] Specification of executable software within SoftwareCluster ⌈ One of the most prominent contents of an uploadable software package is the reference to the executable software.

Within the definition of a SoftwareCluster, this reference is implicitly given by means of the reference SoftwareCluster.containedProcess.

The target of SoftwareCluster.containedProcess is a Process that represents an instance of the corresponding executable program (the software image), formalized as Executable ⌋*(RS_MANI_00035)*

The prominence of the dedicated reference to Process is amplified by the fact that it would have been technically possible to let Process inherit from UploadablePackageElement and thus include the referenced Process(es) in the bulk of references to other required model elements.

These references are formalized in two different forms. For technical reasons it is not possible to let all model elements that need to be immediately referenced by a SoftwareCluster inherit from UploadablePackageElement.

The main reason is that further model elements need to be referenced by a SoftwareCluster that are also used on the *AUTOSAR classic platform*.

In other words, it would be very questionable to introduce the “useless” concept of an UploadablePackageElement into the scope of the *AUTOSAR classic platform* as a mere (and unwanted) side effect of providing a definition of the SoftwareCluster on the *AUTOSAR classic platform*.

The scope of a single SoftwareCluster in terms of a relations to a Machine is that all software contained in one SoftwareCluster is supposed to be uploaded to one and only one Machine.

In contrast to the definition of an ExecutableGroup, the definition of SoftwareCluster shall never include multiple Machines. This remarkable difference between SoftwareCluster and ExecutableGroup is expressed in [constr_1536].

[constr_1536] Definition of SoftwareCluster applies for a single Machine ⌈ Within the scope of a SoftwareCluster, each Process referenced in the role containedProcess shall be mapped (e.g. by means of the existence of a ProcessToMachineMapping) to the same Machine. ⌋*()*

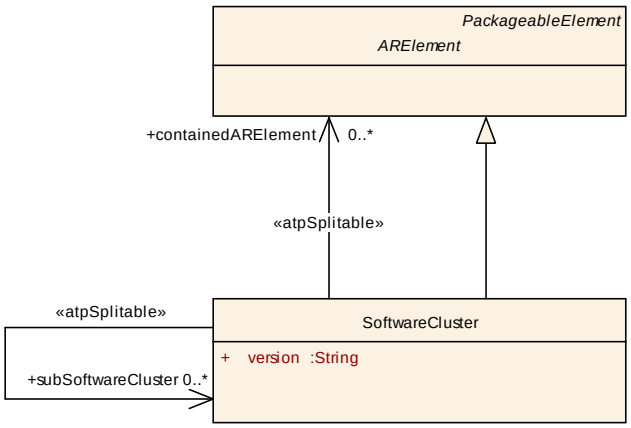


Figure 16.4: SoftwareCluster can reference ARElement

[TPS_MANI_01116] Reference to model elements included in an uploadable software package ⌈ Beside the ability to explicitly reference a Process in the role containedProcess it is possible to define the following references to required model elements:

- references to meta-classes derived from UploadablePackageElement are formalized by way of SoftwareCluster.containedPackageElement.
- references to meta-classes derived from ARElement are formalized by way of SoftwareCluster.containedARElement.
- references to meta-classes derived from FibexElement are formalized by way of SoftwareCluster.containedFibexElement.

Technically, an UploadablePackageElement is also an ARElement, but it is still mandated to use the dedicated reference specifically for UploadablePackageElement. ⌋*(RS_MANI_00035)*

To exemplify the reference to UploadablePackageElement, Figure 16.3 contains a subclass of UploadablePackageElement: ServiceInstanceToPortPrototypeMapping.

It is obvious that the uploaded software needs to integrate with the communication stack and ServiceInstanceToPortPrototypeMapping is a prominent model element for this purpose.

[constr_1542] No nested definition of SoftwareCluster ⌈ A SoftwareCluster shall not reference another SoftwareCluster in the role containedARElement. ⌋ *()*

17 REST Service Deployment

Important note: the AUTOSAR SWS REST [18] defines a low-level API for REST-based communication. The content of this chapter, on the other hand, applies for the configuration of a not-yet standardized API on top of the ara::rest API.

The ara::rest API requires fully-qualified URIs of the *remote communication end* to be passed to the various API elements. This is obviously a bad idea if application software should be kept independent of external resources.

Therefore, an API on top of ara::rest could focus on the path of the URI that is specific to the respective REST service formalized in a RestServiceInterface and inject the "non-portable" part of the URI of the *remote communication end* within an appropriately configured platform module.

Any approach for this purpose needs to take into account that software can be multiply instantiated (on different levels).

For example, the implementation of an Executable shall not make any assumptions about the number and/or behavior of the corresponding Processes launched.

This means that the URI may have elements used for the distinction of instances (created by launching the same Executable multiple times according to the definition of Processes in the application manifest) of the same service.

To further drive this point home, Figure 17.1 has been created as a visualization of how a typical (i.e. it is assumed that RestResourceDef.resource does not exist to keep things simple) REST URI looks like.

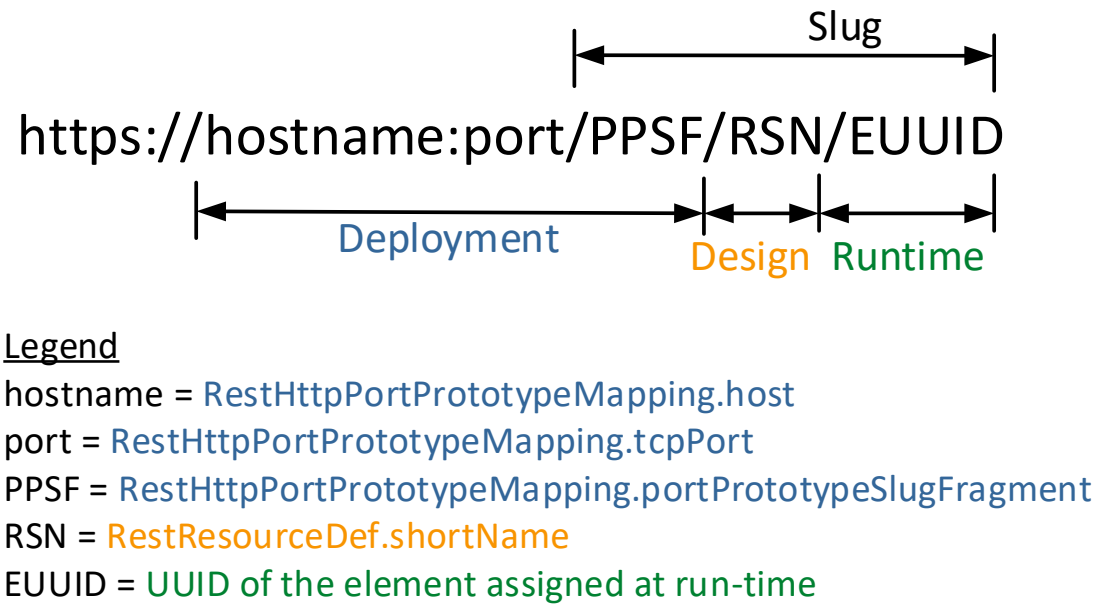


Figure 17.1: Structure of a typical URI for a REST service

As explained by Figure 17.1, the fully-qualified URI should be composed out of several ingredients contributed by different aspects of the configuration process.

The contribution from the design phase is described in section 5. The contribution from the deployment phase is depicted in Figure 17.2.

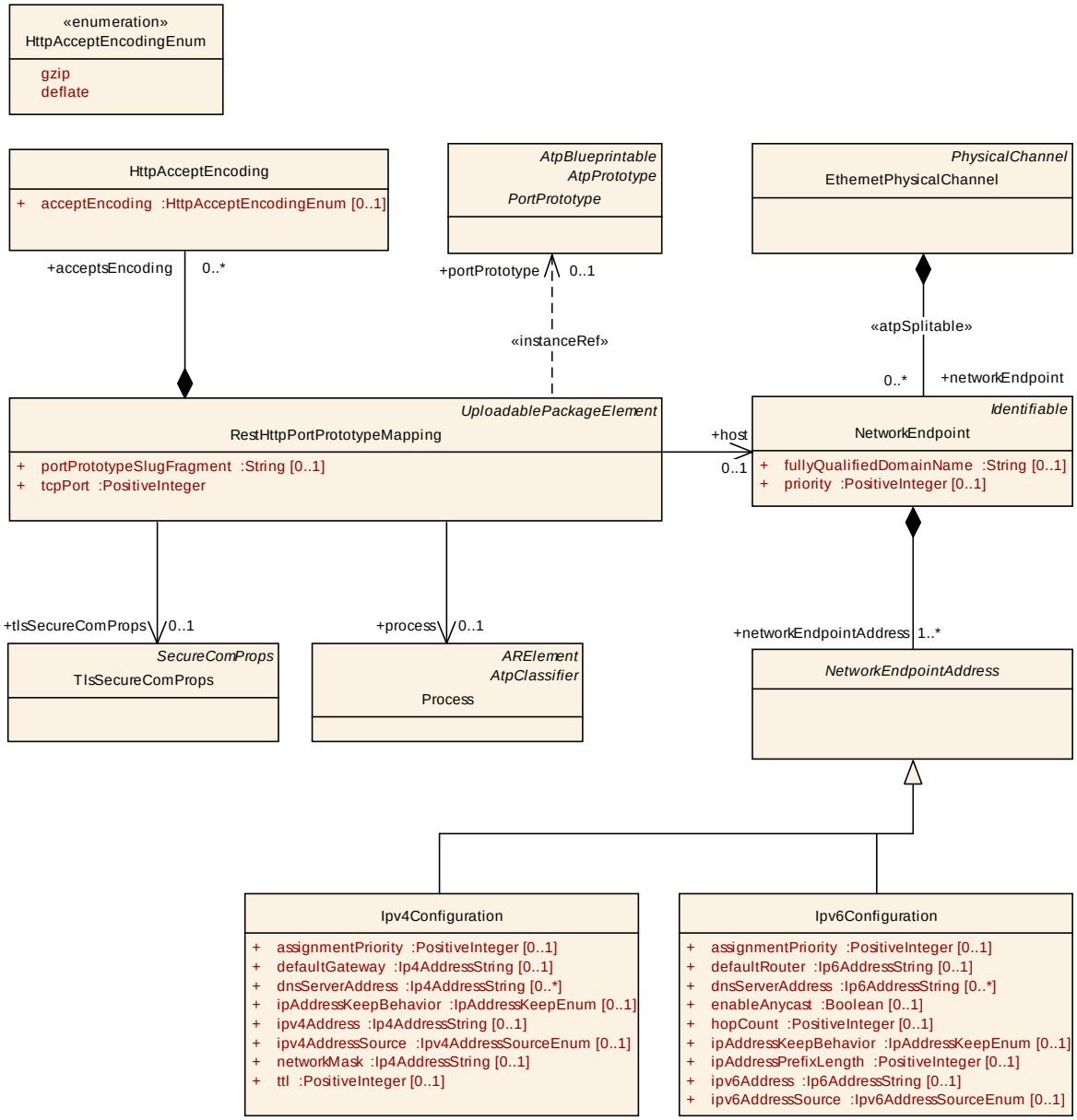


Figure 17.2: Modeling of the REST service deployment

In addition to the contributions from the design and deployment phase, some information that is only available at run-time when the objects that represents the data of a REST service are allocated in memory makes the list of ingredients for the creation of the URI of a REST service complete.

[TPS_MANI_01130] Structure of a typical URI for a REST service ⌈ The part of the URI following the *hostname:port* tuple is usually called the slug.

In the case of a REST service the slug consists of three parts in the order listed below:

1. The representation of the **service instance** (that directly corresponds to the level of a PortPrototype) is contributed by the value of attribute RestHttpPort-PrototypeMapping.portPrototypeSlugFragment. This part is defined on deployment level in order to be sure that it is unique in the context to the *host-name:port* tuple.
2. The **resource** level within the slug is represented by the value of attribute RestResourceDef.shortName. This part is contributed on design level.
3. The identification of the **specific element** (on the level of RestElementDef) is represented by a UUID that is assigned at run-time.

⌋(*RS_MANI_00033*)

In other words, each URI represents a specific path within the tree structure rooted in the service level through levels of resources until finally the element level.

While [TPS_MANI_01130] defines the structure for the simplest and probably most like the most popular case (number of resource levels = 1) it is still necessary to understand the impact of more than one resource level on how the URI looks like.

This conclusion motivates the existence of [TPS_MANI_01131].

[TPS_MANI_01131] Impact of nested REST resources on the structure of REST URI ⌈ The existence of RestResourceDef.resource results in the extension of the design contribution to the URI slug by additional levels consisting of the shortNames of the nested RestResourceDef aggregated in the role resource. ⌋ (*RS_MANI_00033*)

In other words, a specific path through the levels of aggregated RestResourceDefs represented by the respective shortNames, separated by '/' shall be inserted into the "RSN" slot depicted in Figure 17.1.

Please note that the rules for the creation of the slug of a REST URI are more or less arbitrary in terms of the usage of shortName from the model vs. a UUID assigned at run time.

It would technically be possible to use UUIDs instead of shortName on all levels, i.e. also for the "PPSF" and "RSN" slot.

However, this would dramatically decrease the readability of the URI and make it unnecessarily hard for human readers to understand the meaning of a given URI.

Class	**RestHttpPortPrototypeMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::REST			
Note	This meta-class represents the ability to define pieces of a URI for the REST service that cannot be contributed from the design point of view. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft; atp.recommended Package=RestHttpPortPrototypeMappings			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
acceptsEncoding	HttpAcceptEncoding	*	aggr	This aggrgation represents the collection of accepted encodings. **Tags:** atp.Status=draft
host	NetworkEndpoint	0..1	ref	This reference identifies the host configuration of the remote end. **Tags:** atp.Status=draft
portPrototype	PortPrototype	0..1	iref	This reference identifies the instance of the PortPrototype to which the elements of the URI shall be defined. **Tags:** atp.Status=draft
portPrototypeSlugFragment	String	0..1	attr	This attribute contributes a string value to be taken as the slug reference that represents the PortPrototype level of a REST service. **Tags:** atp.Status=draft
process	Process	0..1	ref	This reference represents the process required for context of the mapping. **Tags:** atp.Status=draft
tcpPort	PositiveInteger	1	attr	This attribute represents the value of the TCP port applicable for this mapping. **Tags:** atp.Status=draft
tlsSecureComProps	TlsSecureComProps	0..1	ref	This represents the configuration of TLS applicable for the mapping. **Tags:** atp.Status=draft

Table 17.1: RestHttpPortPrototypeMapping

[TPS_MANI_01178] Semantics of `RestHttpPortPrototypeMapping.acceptsEncoding` ⌈ The aggregation `RestHttpPortPrototypeMapping.acceptsEncoding` allows for a definition of the supported encodings from the client's perspective.

A client may support more than one encoding at the same time. Therefore the multiplicity of the aggregation has been set to 0..*. ⌋*(RS_MANI_00033)*

[constr_1569] Restriction for the scope of `RestHttpPortPrototypeMapping.acceptsEncoding` ⌈ The attribute `RestHttpPortPrototypeMapping.acceptsEncoding` shall only be defined on the client side of a communication. ⌋*()*

[constr_1580] Restriction for the usage of `RestHttpPortPrototypeMapping.acceptsEncoding` ⌈ Each member of `HttpAcceptEncodingEnum` shall only appear **at most** once in a particular `RestHttpPortPrototypeMapping.acceptsEncoding`. ⌋*()*

Please note that a preference rule for one encoding over others in the presence of more than one `RestHttpPortPrototypeMapping.acceptsEncoding` is subject to clarification in the respective SWS [18], see [SWS_REST_01834].

Class	**HttpAcceptEncoding**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::REST			
Note	This meta-class represents the ability to specify the accept-encoding of an exchange using HTTP. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
acceptEncoding	HttpAcceptEncodingEnum	0..1	attr	This attribute is only used on the client side of the configuration for the purpose of stating the accepted compression algorithm.

Table 17.2: HttpAcceptEncoding

Enumeration	**HttpAcceptEncodingEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::REST
Note	This enumeration defines the value for the accept-encoding field of the HTTP header. **Tags:** atp.Status=draft
Literal	***Description***
deflate	Use deflate compression. **Tags:** atp.EnumerationValue=1
gzip	Use gzip pcompression. **Tags:** atp.EnumerationValue=0

Table 17.3: HttpAcceptEncodingEnum

A Examples

This chapter contains a collection of examples that reflect concepts described in different chapters of this document. The content of the chapter provides mere explanation and does not add anything to the model semantics.

A.1 Service Instance Deployment by Service Interface Mapping

The example in Figure A.2 sketches the modeling of a `ProvidedSomeipServiceInstance` in the presence of a `ServiceInterfaceMapping`, that references two `ServiceInterface`s in the role `sourceServiceInterface`.

For support, Figure A.1 contains an excerpt from the meta-model that contains the relevant meta-classes that have been instantiated to create the example sketched in Figure A.2.

Note further that the example depicted in Figure A.2 is not limited to the explanation of the actual `ServiceInterfaceMapping`.

As the main use case for this is the usage of `ServiceInterface`s for the definition of an “outside” communication binding the example also contains the modeling of such a binding, in this case to SOME/IP.

Please note that the modeling of the binding requires the existence of a `PortPrototype`, which in turn is aggregated by an `SwComponentType` (not depicted).

This approach still contains some degrees of freedom with respect to the role of the `SwComponentType` that aggregates the mentioned `PortPrototype`. This document does not go further in discussing the nature of such a configuration.

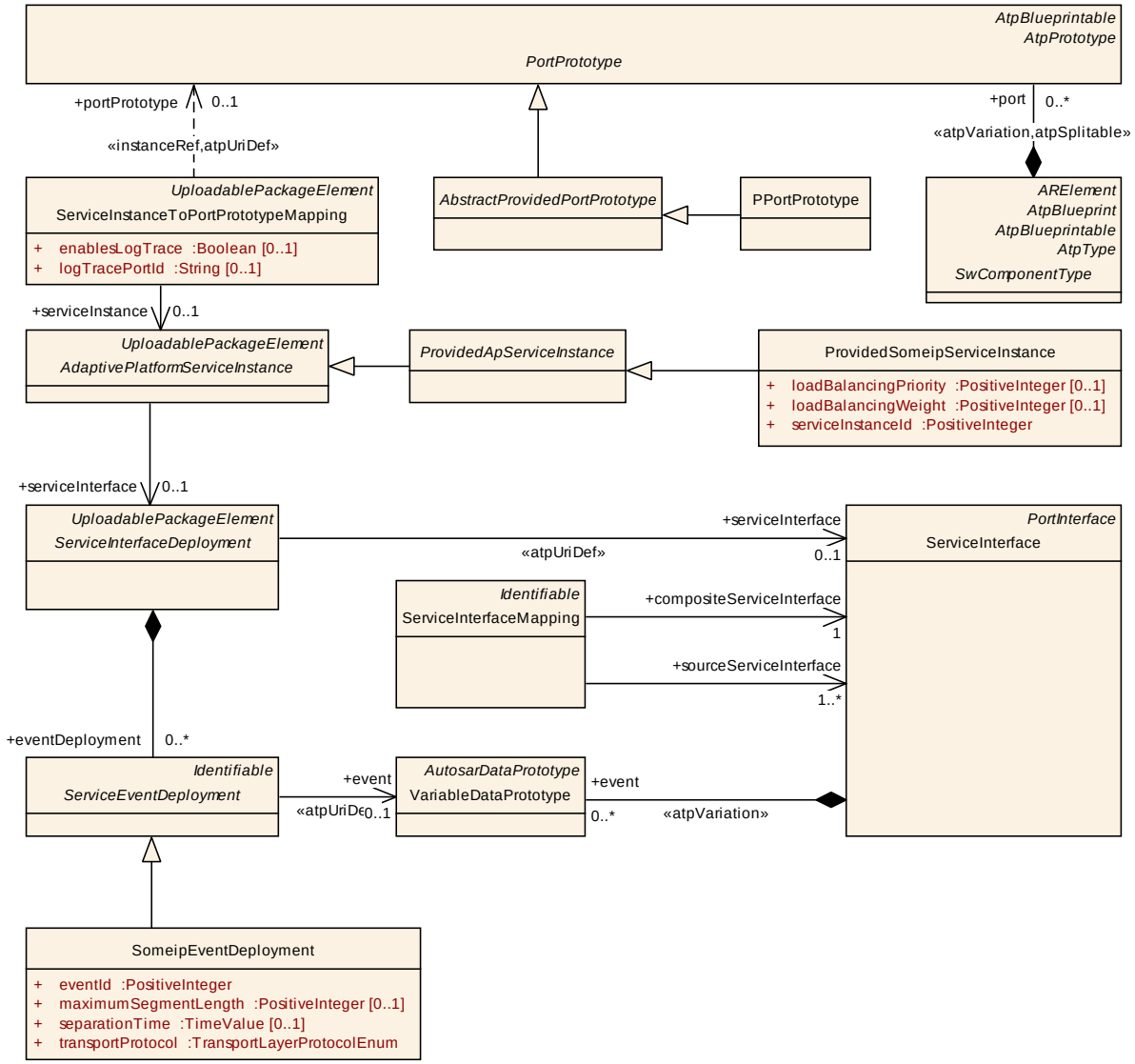


Figure A.1: Meta-model excerpt relevant for the example

For reasons of keeping the example as simple as possible, each of the `ServiceInterfaces` in the role `sourceServiceInterface` aggregate a single `event`.

The `ServiceInterface` referenced in the role `compositeServiceInterface` aggregates two `event` with `shortNames` that match the mentioned `event` of the source `ServiceInterfaces` (see [TPS_MANI_01022]).

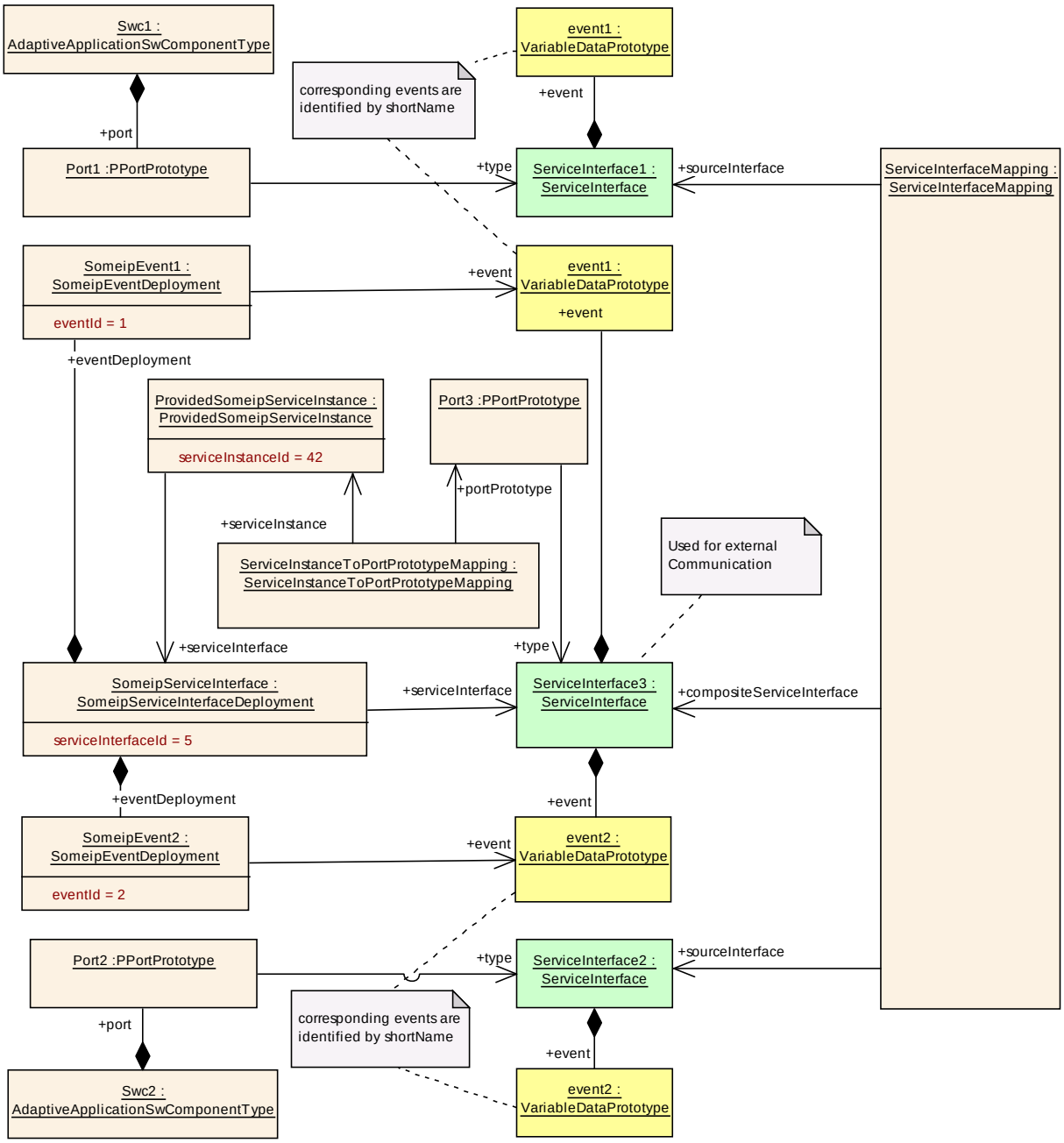


Figure A.2: Example for the deployments of a service in the presence of a `ServiceInterfaceMapping`

A.2 Service Instance Deployment by Service Interface Element Mapping

The example in Figure A.4 sketches the modeling of a `ProvidedSomeipServiceInstance` in the presence of a `ServiceInterfaceEventMapping`s. In principle, this example is very close to the example described in Figure A.2.

In contrast to the example sketched in Figure A.2, the example depicted in Figure A.4 uses a mapping to individual elements of a ServiceInterface instead of the entire ServiceInterface.

Please find the corresponding excerpt of relevant meta-classes for the utilization of ServiceInterfaceEventMapping sketched in Figure A.3.

Note further that the example depicted in Figure A.3 is not limited to the explanation of the actual ServiceInterfaceElementMapping.

As the main use case for this is the usage of ServiceInterfaces for the definition of an “outside” communication binding the example also contains the modeling of such a binding, in this case to SOME/IP.

Please note that the modeling of the binding requires the existence of a PortPrototype, which in turn is aggregated by an SwComponentType (not depicted).

This approach still contains some degrees of freedom with respect to the role of the SwComponentType that aggregates the mentioned PortPrototype. This document does not go further in discussing the nature of such a configuration.

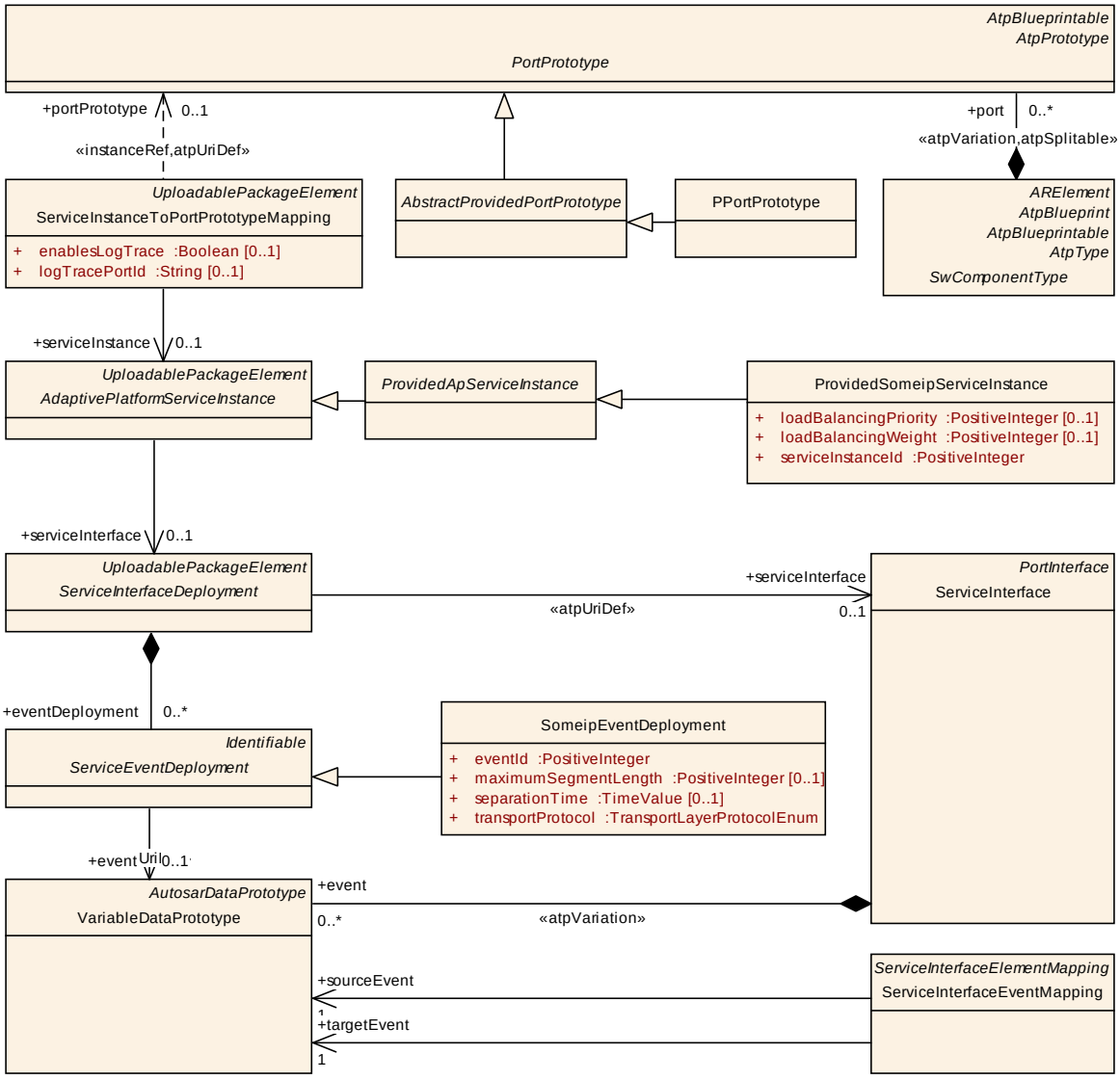


Figure A.3: Excerpt of the relevant meta-classes for the `ServiceInterfaceEventMapping` example

By mapping individual elements of `ServiceInterface`s, it is possible to map element with different `shortName`s to each other. In this example, the `event` with the `shortName` `event1` is mapped to another `event` with the `shortName` `eventLeft`.

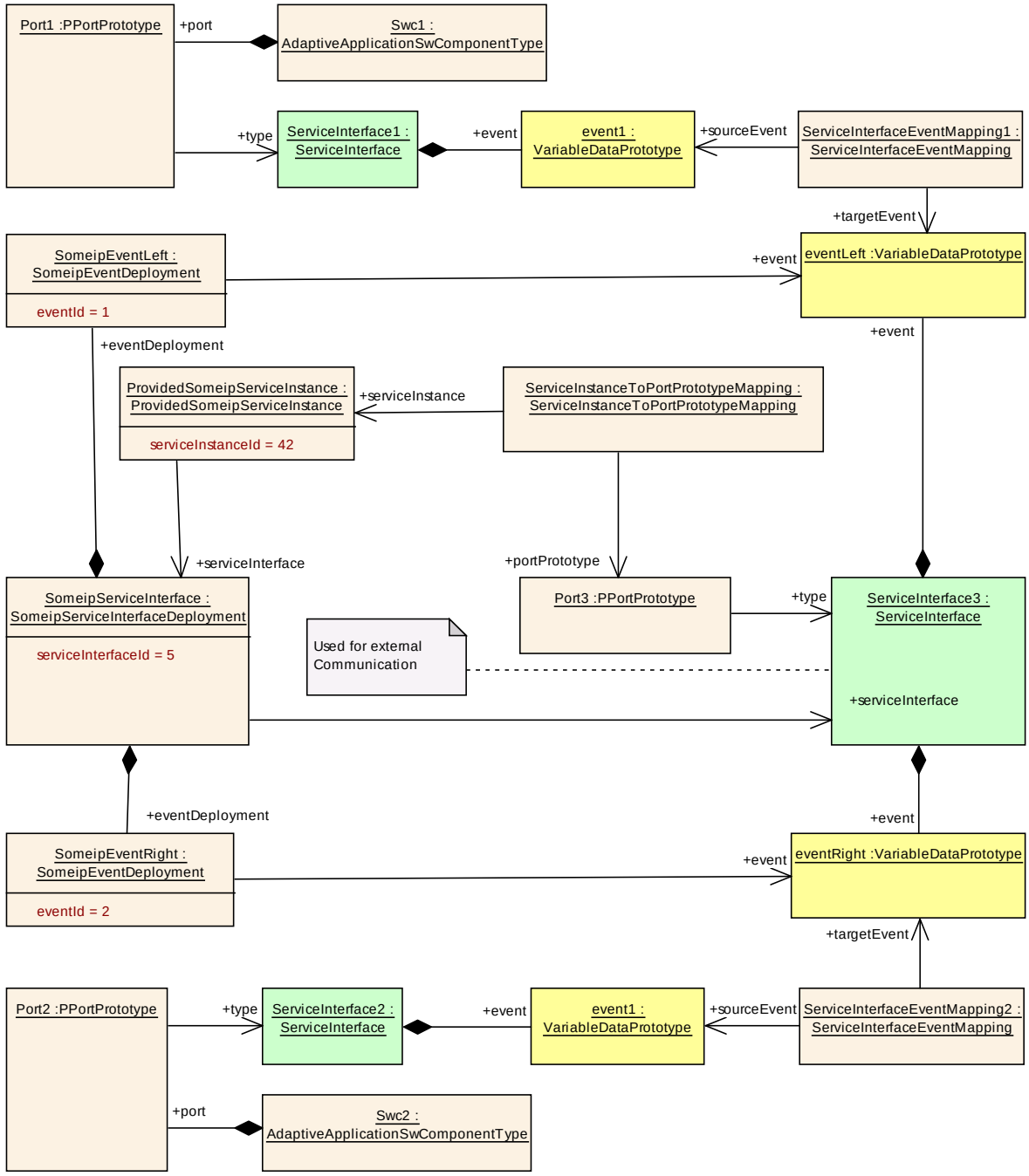


Figure A.4: Example for the deployment of a service in the presence of a `ServiceInterfaceEventMapping`

In Figure A.4, two different `ServiceInterface`s exist that each aggregate an `event` with the identical `shortName`. This scenario **requires** the existence of `ServiceInterfaceElementMapping`s.

As an extension to the scenario depicted in Figure A.4, Figure A.5 describes a model where the **same** `event` of a `ServiceInterface` is used in two different event deployments by means of two `ServiceInterfaceEventMapping`s that each refer to said `event` in the role `ServiceInterfaceEventMapping.sourceEvent`.

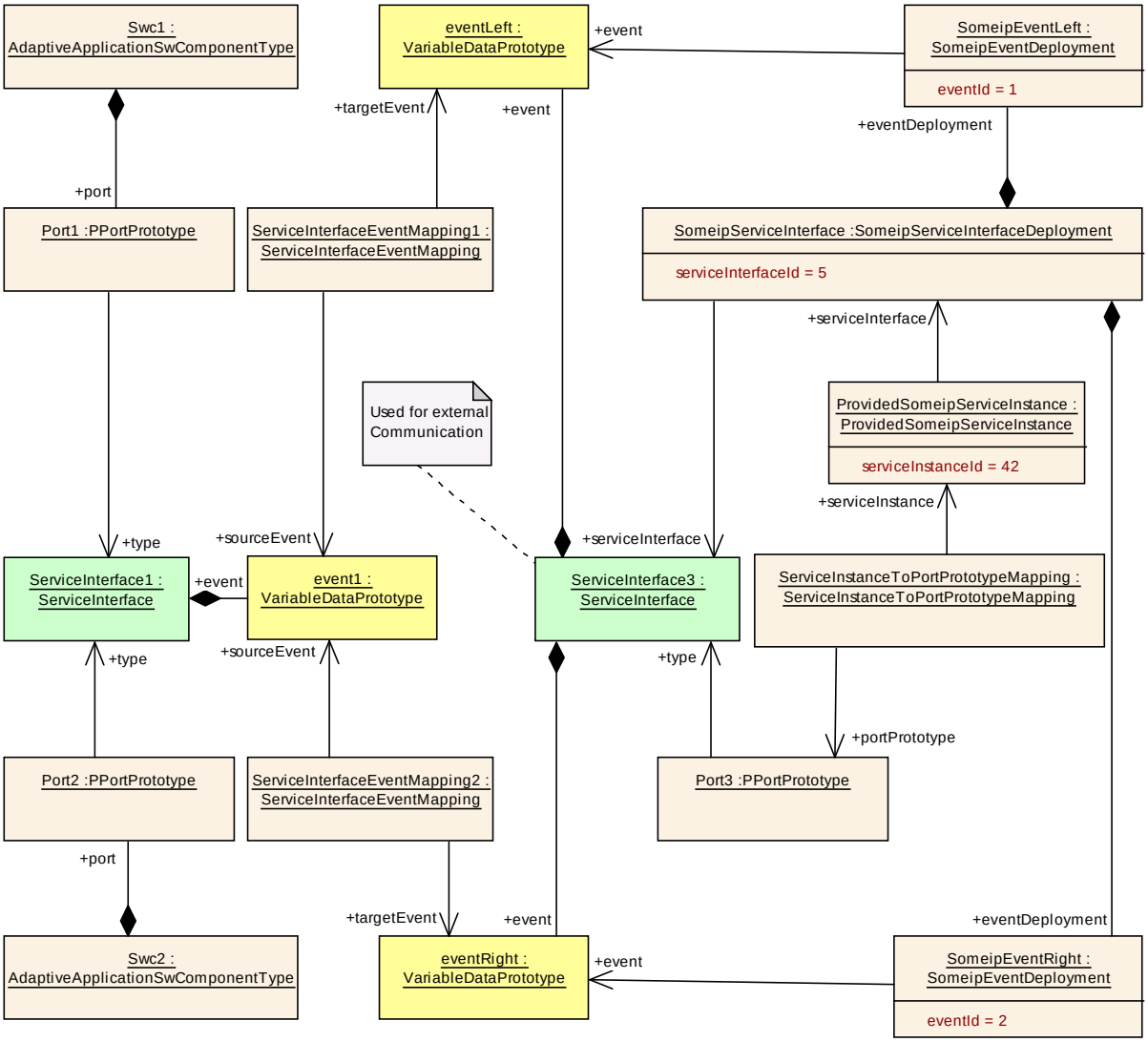


Figure A.5: Example for the deployment of a service in the presence of a `ServiceInterfaceEventMapping` to the same source `ServiceInterface`

Again, this scenario **requires** the existence of appropriately configured `ServiceInterfaceElementMapping`s.

A.3 Definition of Startup Configuration

As already mentioned, the mode-dependent startup configuration is directly aggregated by the definition of a `Process`:

```
<PROCESS>
  <SHORT-NAME>AA1</SHORT-NAME>
  <MODE-DEPENDENT-STARTUP-CONFIGS>
    <MODE-DEPENDENT-STARTUP-CONFIG>
      <EXECUTION-DEPENDENCYS>
        <EXECUTION-DEPENDENCY>
          <APPLICATION-MODE-IREF>
```

```
          <CONTEXT-MODE-DECLARATION-GROUP-PROTOTYPE-REF DEST="MODE-
    DECLARATION-GROUP-PROTOTYPE">/Processes/MWC/ApplicationStateMachine</
    CONTEXT-MODE-DECLARATION-GROUP-PROTOTYPE-REF>
          <TARGET-MODE-DECLARATION-REF DEST="MODE-DECLARATION">/
    ModeDeclarationGroups/ApplicationStateMachine/Running</TARGET-MODE-
    DECLARATION-REF>
        </APPLICATION-MODE-IREF>
      </EXECUTION-DEPENDENCY>
      <EXECUTION-DEPENDENCY>
        <APPLICATION-MODE-IREF>
          <CONTEXT-MODE-DECLARATION-GROUP-PROTOTYPE-REF DEST="MODE-
    DECLARATION-GROUP-PROTOTYPE">/Processes/MSM/ApplicationStateMachine</
    CONTEXT-MODE-DECLARATION-GROUP-PROTOTYPE-REF>
          <TARGET-MODE-DECLARATION-REF DEST="MODE-DECLARATION">/
    ModeDeclarationGroups/ApplicationStateMachine/Running</TARGET-MODE-
    DECLARATION-REF>
        </APPLICATION-MODE-IREF>
      </EXECUTION-DEPENDENCY>
    </EXECUTION-DEPENDENCYS>
    <MACHINE-MODE-IREFS>
      <MACHINE-MODE-IREF>
        <CONTEXT-MODE-DECLARATION-GROUP-PROTOTYPE-REF DEST="MODE-
    DECLARATION-GROUP-PROTOTYPE">/Machines/ExampleMachine/
    ExampleMachine_StateMachine</CONTEXT-MODE-DECLARATION-GROUP-PROTOTYPE-
    REF>
        <TARGET-MODE-DECLARATION-REF DEST="MODE-DECLARATION">/
    ModeDeclarationGroups/VehicleStateMachine/Driving</TARGET-MODE-
    DECLARATION-REF>
      </MACHINE-MODE-IREF>
    </MACHINE-MODE-IREFS>
    <RESOURCE-GROUP-REF DEST="RESOURCE-GROUP">/Machines/ExampleMachine/
    Linux/resourceGroup2</RESOURCE-GROUP-REF>
    <STARTUP-CONFIG-REF DEST="STARTUP-CONFIG">/StartupConfigSets/
    StartupConfigSet_AA/AA1_Startup</STARTUP-CONFIG-REF>
   </MODE-DEPENDENT-STARTUP-CONFIG>
  </MODE-DEPENDENT-STARTUP-CONFIGS>
</PROCESS>
```

Listing A.1: Example for the definition of the `ModeDependentStartupConfig` owned by a `Process`

In this example, launch dependencies exist on two other `Process`es. Both `Process`es MWC and MSM need to be in the ApplicationState “Running” before AA1 is started.

The reference `ModeDependentStartupConfig.machineMode` refers to a `ModeDeclaration` with the `shortName` `Driving` within the state machine of the underlying `Machine`. In other words the referenced `StartupConfig` that is defined in Listing A.2 is valid if the `Machine` is in the machine state `Driving`.

The `ModeDependentStartupConfig` of the `Process` is assigned to the `ResourceGroup` named `ResourceGroup2` that is defined in the Machine Manifest.

```
<STARTUP-CONFIG>
  <SHORT-NAME>AA1_Startup</SHORT-NAME>
  <SCHEDULING-POLICY>SCHEDULING-POLICY-FIFO</SCHEDULING-POLICY>
  <SCHEDULING-PRIORITY>20</SCHEDULING-PRIORITY>
```

```
  <STARTUP-OPTIONS>
    <STARTUP-OPTION>
      <OPTION-ARGUMENT>inputfile_1</OPTION-ARGUMENT>
      <OPTION-KIND>COMMAND-LINE-LONG-FORM</OPTION-KIND>
      <OPTION-NAME>filename</OPTION-NAME>
    </STARTUP-OPTION>
  </STARTUP-OPTIONS>
</STARTUP-CONFIG>
```

Listing A.2: Example for a `StartupConfig`

Please note that the definition of the `StartupOption` in the example yields an actual command-line option that reads `--filename=inputfile_1`.

The corresponding definition of a `Machine` contains a `OsModuleInstantiation` that in turn owns the two `ResourceGroup`s named `ResourceGroup1` and `ResourceGroup2`. This aspect can be found in Listing A.3.

```
<MACHINE>
  <SHORT-NAME>ExampleMachine</SHORT-NAME>
  <MACHINE-MODE-MACHINES>
    <MODE-DECLARATION-GROUP-PROTOTYPE>
      <SHORT-NAME>ExampleMachine_StateMachine</SHORT-NAME>
      <TYPE-TREF DEST="MODE-DECLARATION-GROUP">/ModeDeclarationGroups/
   VehicleStateMachine</TYPE-TREF>
    </MODE-DECLARATION-GROUP-PROTOTYPE>
  </MACHINE-MODE-MACHINES>
  <MODULE-INSTANTIATIONS>
    <OS-MODULE-INSTANTIATION>
      <SHORT-NAME>Linux</SHORT-NAME>
      <RESOURCE-GROUPS>
        <RESOURCE-GROUP>
          <SHORT-NAME>resourceGroup1</SHORT-NAME>
          <CPU-USAGE>60</CPU-USAGE>
          <MEM-USAGE>1000000</MEM-USAGE>
        </RESOURCE-GROUP>
        <RESOURCE-GROUP>
          <SHORT-NAME>resourceGroup2</SHORT-NAME>
          <CPU-USAGE>70</CPU-USAGE>
          <MEM-USAGE>2000000</MEM-USAGE>
        </RESOURCE-GROUP>
      </RESOURCE-GROUPS>
    </OS-MODULE-INSTANTIATION>
  </MODULE-INSTANTIATIONS>
</MACHINE>
```

Listing A.3: Example for the definition of a `Machine`

A.4 Service Instance Mapping

This section contains some examples that explain the modeling of a mapping between a service instance and the application. The examples have been created to show both the “find” and the “offer” side of the service binding.

In the first example, depicted in Figure A.6 shows the binding of PortPrototypes to a SOME/IP-based transport layer. The left part of the diagram contains the modeling of the “find” aspect and the right part contains the modeling of the “offer” aspect.

Please note that the shortNames of the two affected PortPrototypes are different. In other words, the shortNames of the PortPrototypes are not used as a way to identify the opposite end of the service binding.

Instead, the existence of a ServiceInstanceToPortPrototypeMapping that maps a PortPrototype to a ProvidedSomeipServiceInstance resp. RequiredSomeipServiceInstance with the **identical value** of attribute serviceInstanceId creates the actual binding between the “find” and the “offer” end.

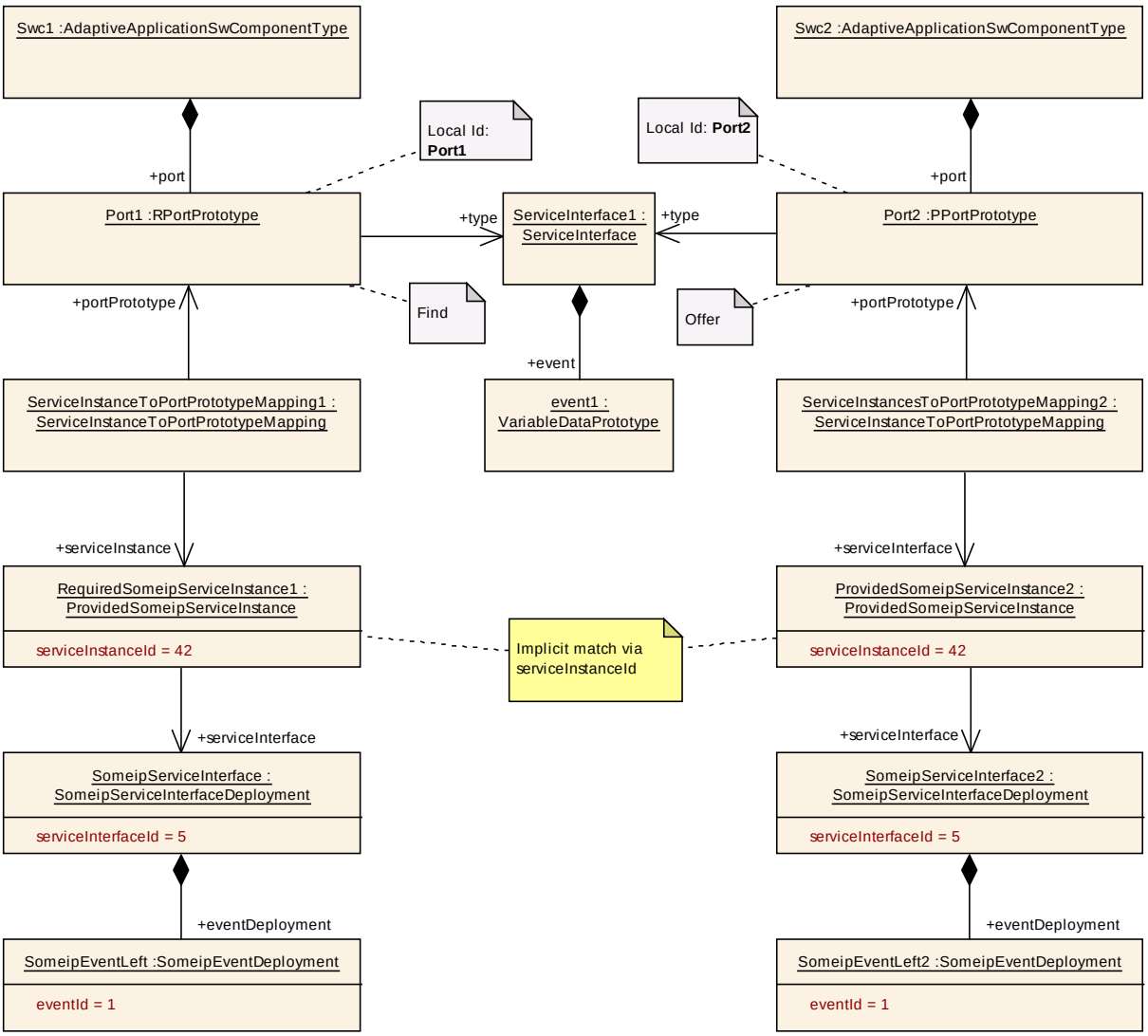


Figure A.6: Port-based binding of a service instance to the application using SOME/IP

The next example (depicted in Figure A.7) shows a binding of PortPrototypes to a user-defined transport layer. The left part of the diagram contains the modeling of the “find” aspect and the right part contains the modeling of the “offer” aspect.

Because the binding is user-defined, there are no attributes modeled on the level of the meta-model available to identify an instance according to the user-defined service implementation. There is just no way to define attributes that are “needed anyway” for a user-defined binding.

Therefore, the only option in this case it the usage of `AdminData`, `Sdg`, and `Sd` to define an identification of the user-defined transport layer.

In order to support the comparison to the example depicted in Figure A.6, the example described in Figure A.7 uses a simple identification based on a numerical value. Again, this is an arbitrary scenario created just for the sake of explanation.

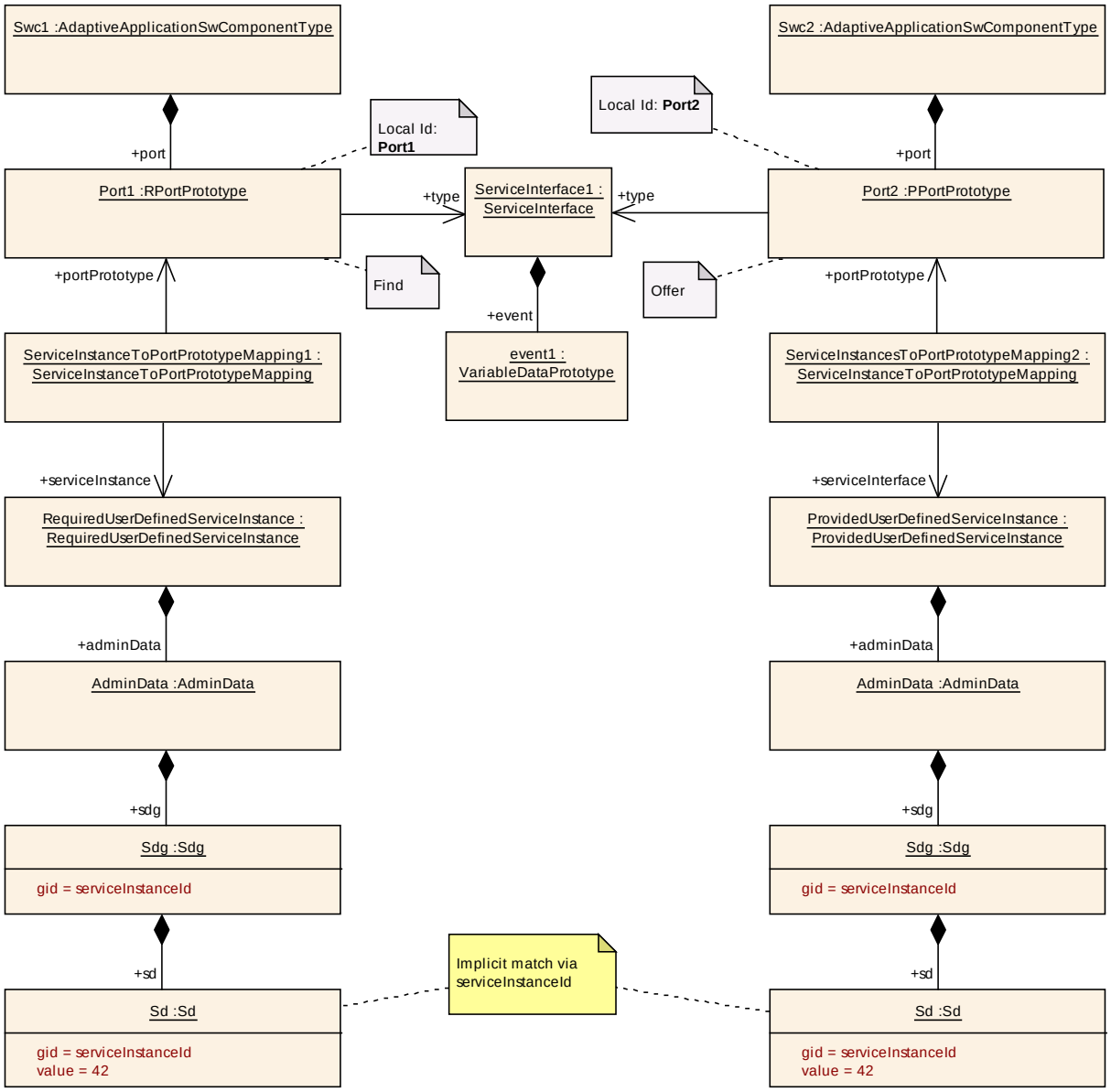


Figure A.7: Port-based binding of a service instance to the application using a user-defined binding

A.5 Radar and Camera ServiceInterface example

The example in figure A.8 shows a *Radar* `ServiceInterface` with a *BrakeEvent* and two `method`s: *Calibrate* and *Adjust*. The *Camera* `ServiceInterface` shown in figure A.9 has two events: *LaneEvent* and *SpeedLimitEvent* and one *Calibrate* `method`.

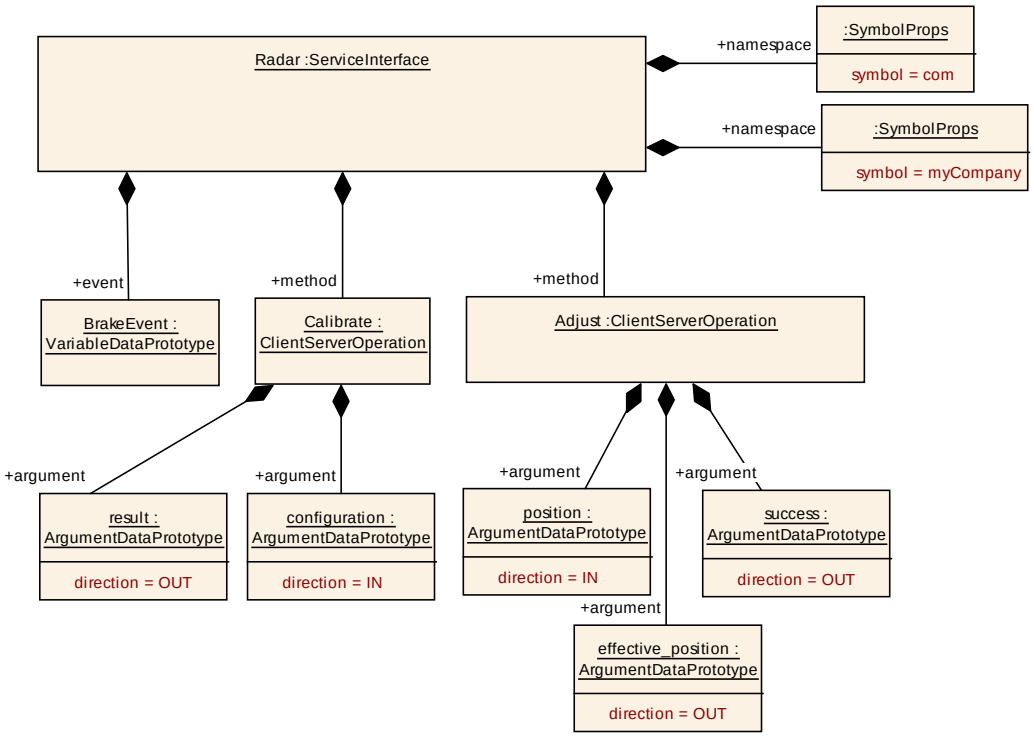


Figure A.8: Radar Service Interface

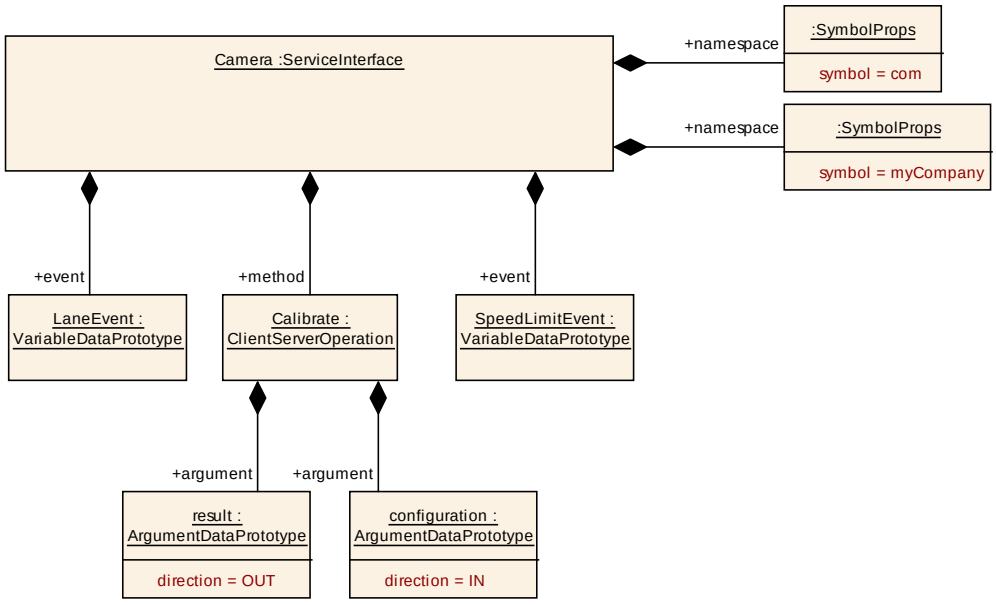


Figure A.9: Camera Service Interface

Both ServiceInterfaces *Radar* and *Camera* are mapped to a combined *RadarAndCamera* ServiceInterface with an Service Interface Element Mapping since both ServiceInterfaces have a method with the same name: *Calibrate*.

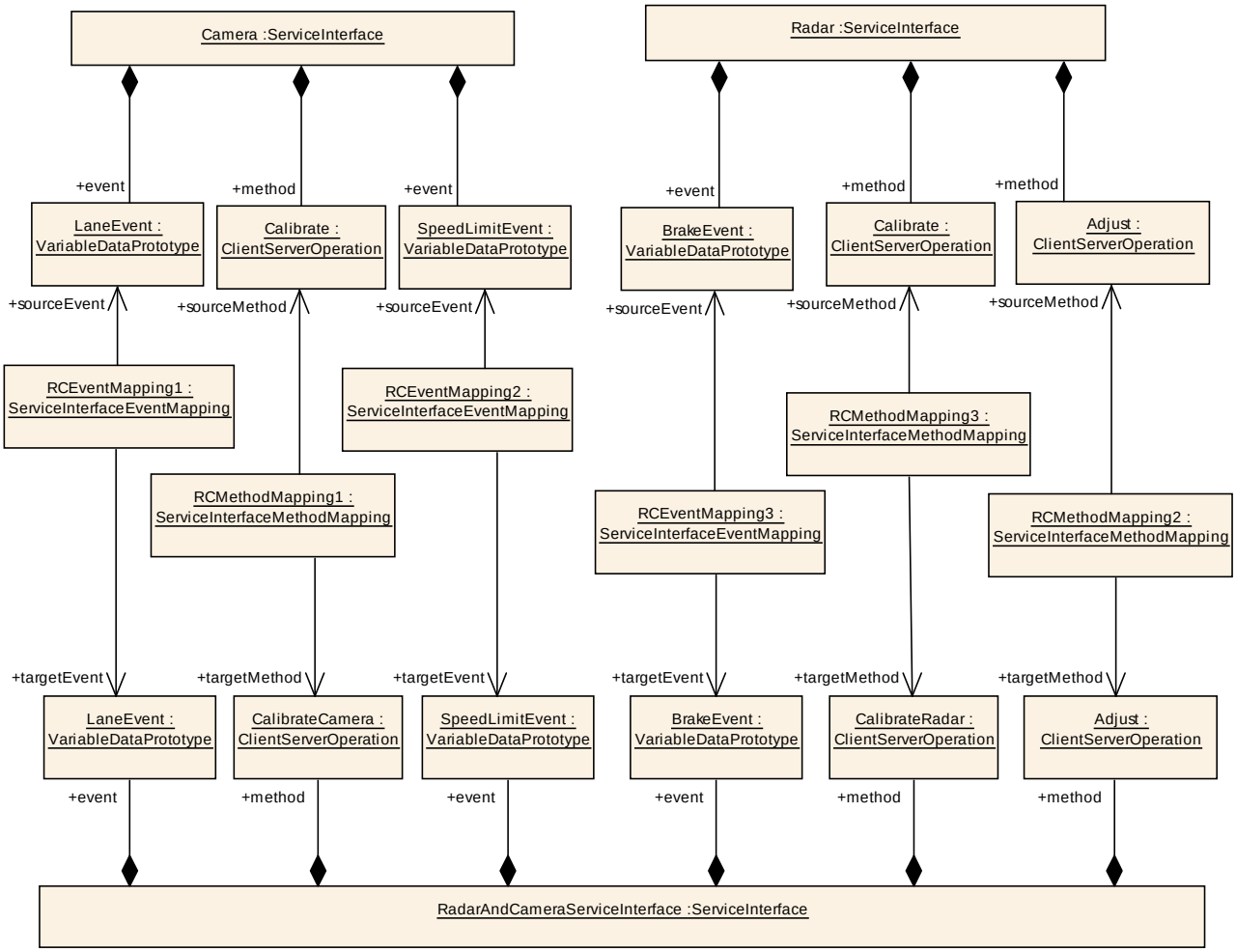


Figure A.10: Service Interface Element Mapping example

The combined ServiceInterface is offered over the network as a SOME/IP Service. Figure A.11 shows the assignment of the SOME/IP serviceInterfaceId to 31.

In addition SOME/IP eventIds are assigned to the events and methodIds are assigned to the methods. Furthermore a single SomeipEventGroup is defined to which all SomeipEventDeployments of the *RadarAndCamera* ServiceInterface are assigned.

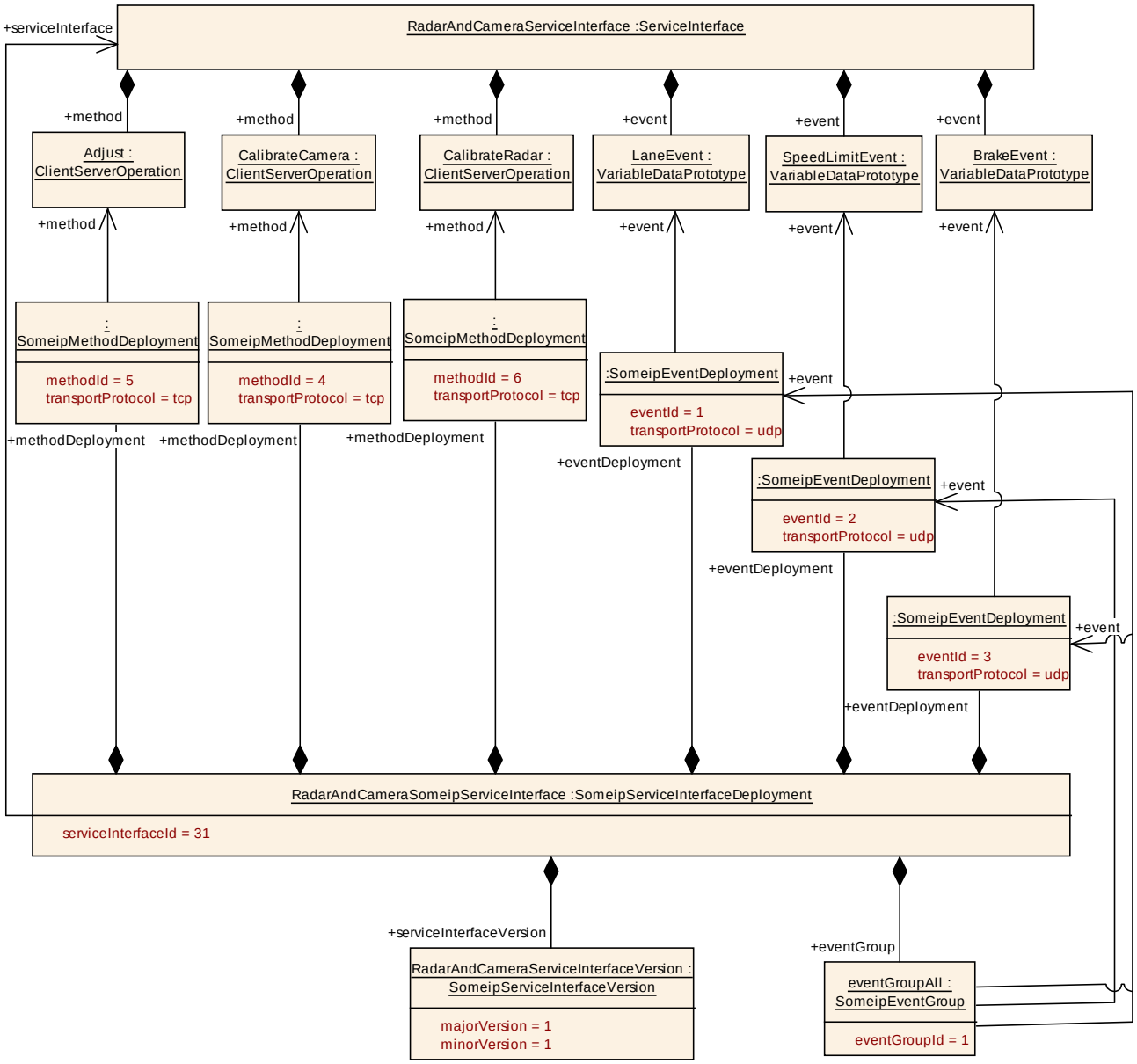


Figure A.11: SOME/IP Deployment

Figure A.12 shows a modeled `ProvidedSomeipServiceInstance` that is mapped to a `Machine`.

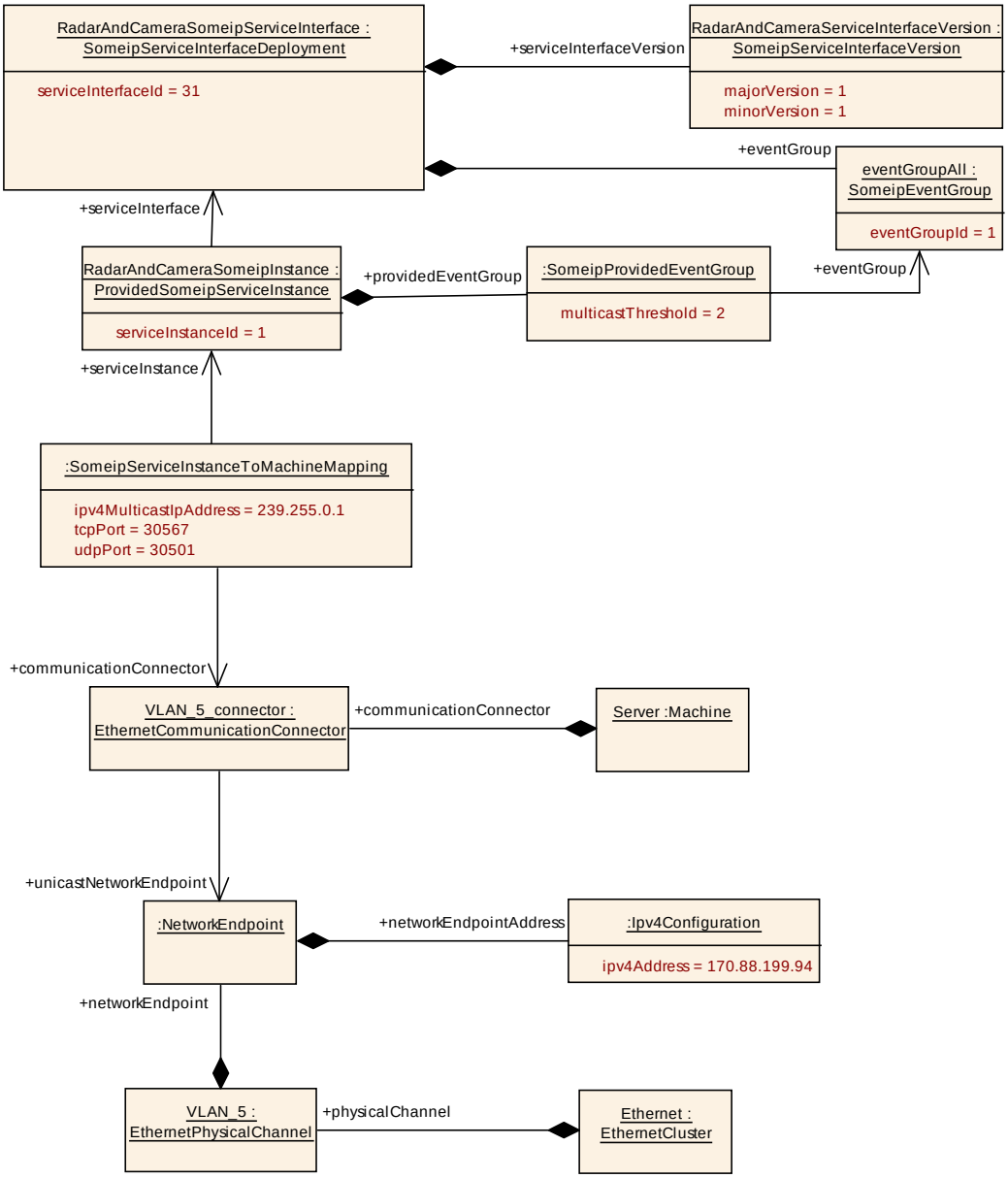


Figure A.12: SOME/IP Provided Service Instance

The displayed configuration in figure A.12 leads to a SOME/IP OfferService Message with the following content:

- ServiceId => `serviceInterfaceId` = 31
- InstanceId => `serviceInstanceId` = 1
- MajorVersion => 1
- MinorVersion => 1
- TTL => 3
- IPv4 Endpoint Option with IPv4 Address (170.88.199.94), Protocol (TCP), Port-Number (30567)

- IPv4 Endpoint Option with IPv4 Address (170.88.199.94), Protocol (UDP), PortNumber (30501)
- IP Multicast Endpoint Option with IPv4 Address (239.255.0.1), Protocol (UDP), PortNumber (30502)

An example of a `RequiredSomeipServiceInstance` is shown in Figure A.13.

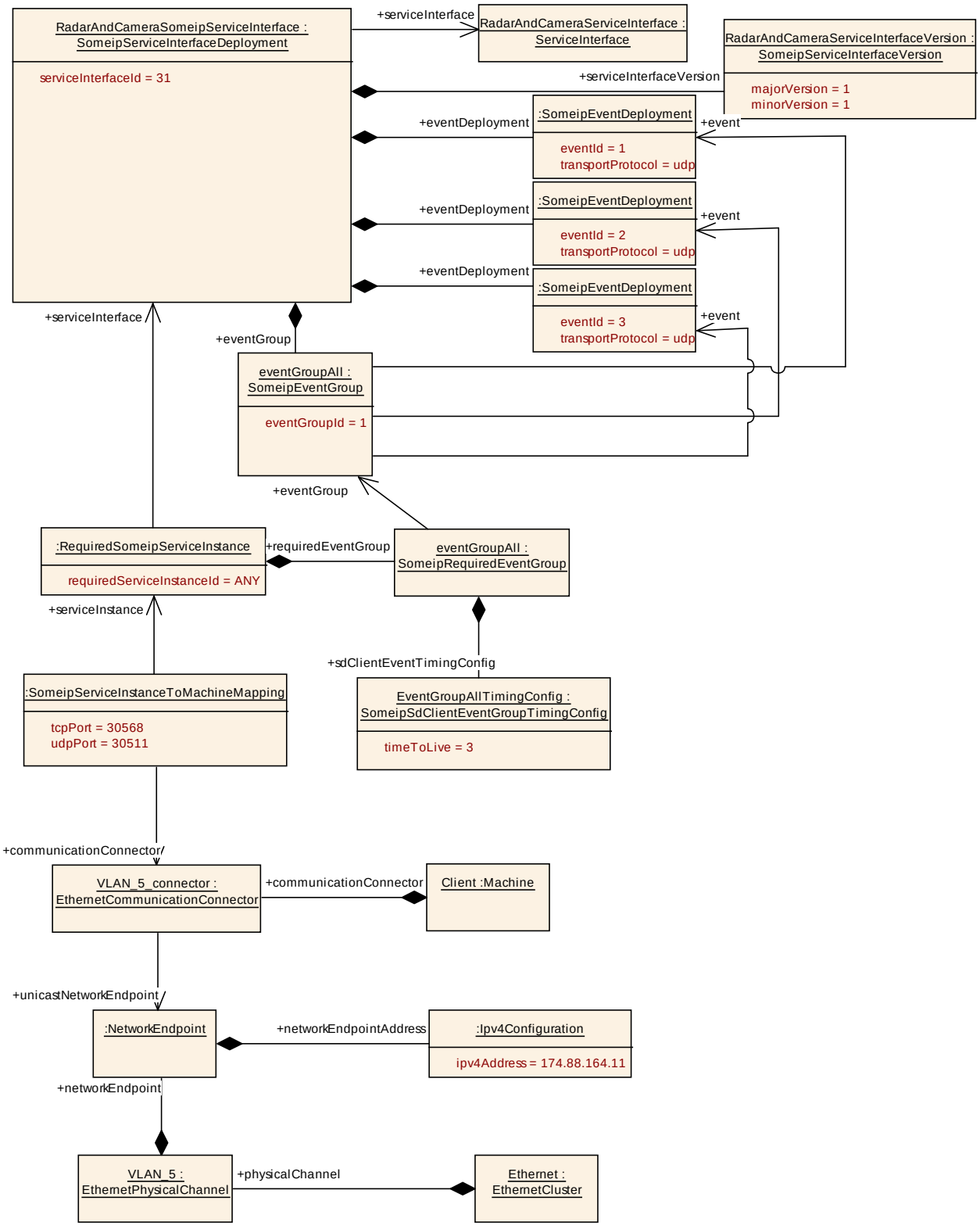


Figure A.13: SOME/IP Required Service Instance

The displayed configuration in figure A.13 leads to a SOME/IP Find Service Message with the following content:

- ServiceId => `serviceInterfaceId` = 31

- InstanceId => RequiredSomeipServiceInstance.requiredServiceInstanceId = ANY
- MajorVersion => majorVersion = 1
- MinorVersion => minorVersion = 1
- TTL => RequiredSomeipServiceInstance.sdClientConfig.serviceFindTimeToLive = 3

The displayed configuration in figure A.12 also leads to a SOME/IP SubscribeEventGroup Message content that is sent from the Service Requester to the Service Provider:

- ServiceId => taken from the OfferMessage
- InstanceId => taken from the OfferMessage
- MajorVersion => taken from the OfferMessage
- MinorVersion => taken from the OfferMessage
- Eventgroup ID => RequiredSomeipServiceInstance.requiredEventGroup.eventGroup.eventGroupId = 1
- TTL => RequiredSomeipServiceInstance.requiredEventGroup.sdClientEventTimingConfig.timeToLive = 3
- IPv4 Endpoint Option with IPv4 Address (170.88.164.11), Protocol (UDP), PortNumber (30511)

A.6 Signal-based communication example

The example in Figure A.14 sketches the modeling of a Signal-to-Service mapping.

In this example, the elements of the ServiceInterface *TestServiceInterface* that is referenced by the ProvidedSomeipServiceInstance are mapped to individual ISignalTriggerings. The *TestServiceInterface* contains only one single event *TestEvent* that is of type Structure and contains three members: x, y and z.

The ServiceInstanceToSignalMapping contains four SignalBasedEventElementToISignalTriggeringMappings. The *SignalBasedTestEvent* is mapped to an ISignalTriggering that is defined for an ISignalGroup. And the three eventElements are mapped to individual ISignalTriggerings for ISignals that will be transported in the enclosing ISignalGroup.

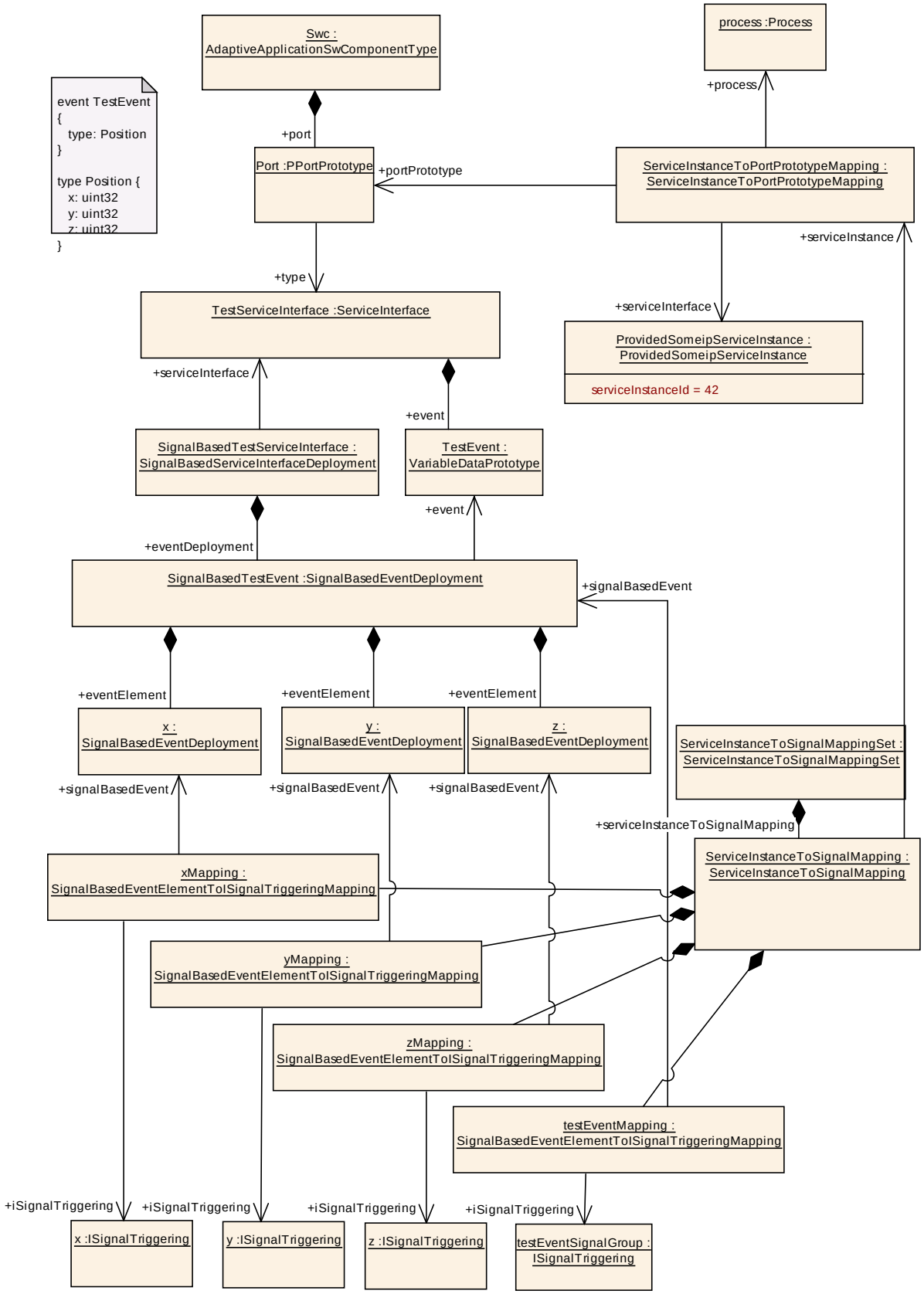


Figure A.14: Example for a Signal-to-Service mapping

A.7 Definition of Persistent Data

This chapter contains examples for the modeling of persistent data and file storage starting form the design aspect down to the definition of the persistent storage and the mapping between design and deployment.

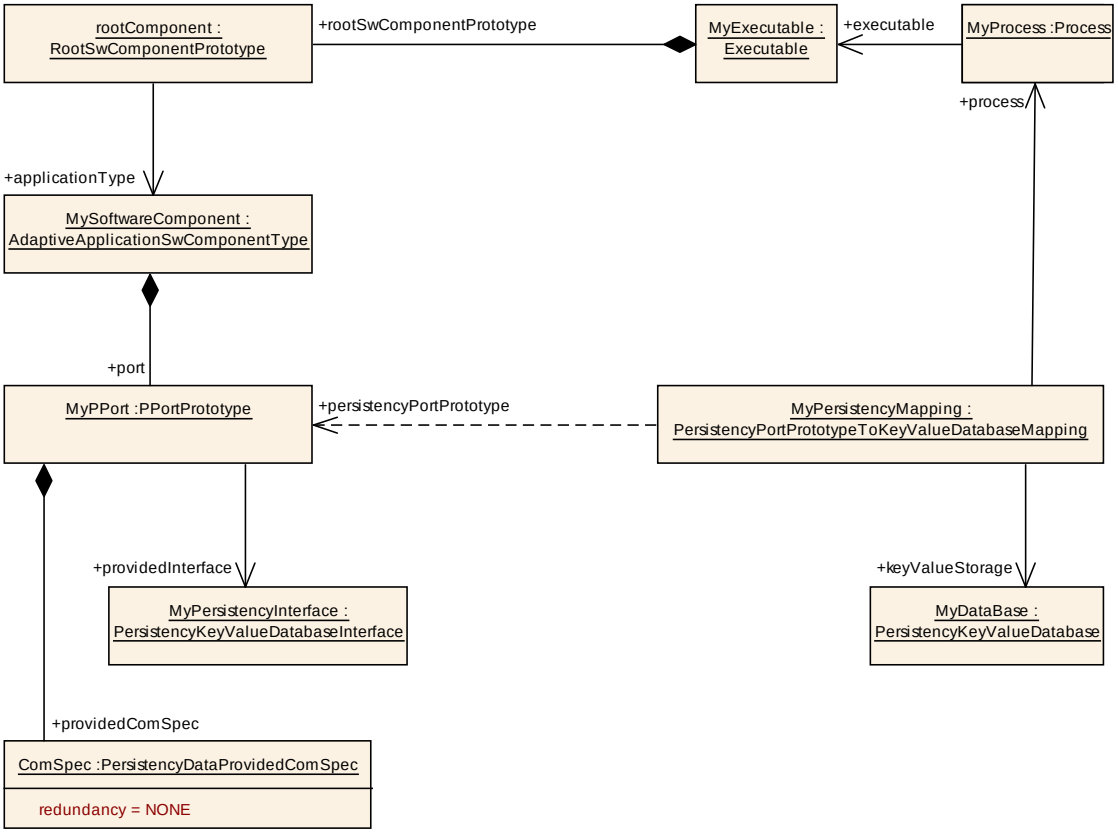


Figure A.15: Simple example modeling of persistent data (design + deployment)

The setup presented in Figure A.15 represents a case with reduced modeling of persistent data.

It is possible to extend the modeling to a deeper level of detail and also formally describe the individual data that is subject to persistency on both design and deployment level, see Figure A.16.

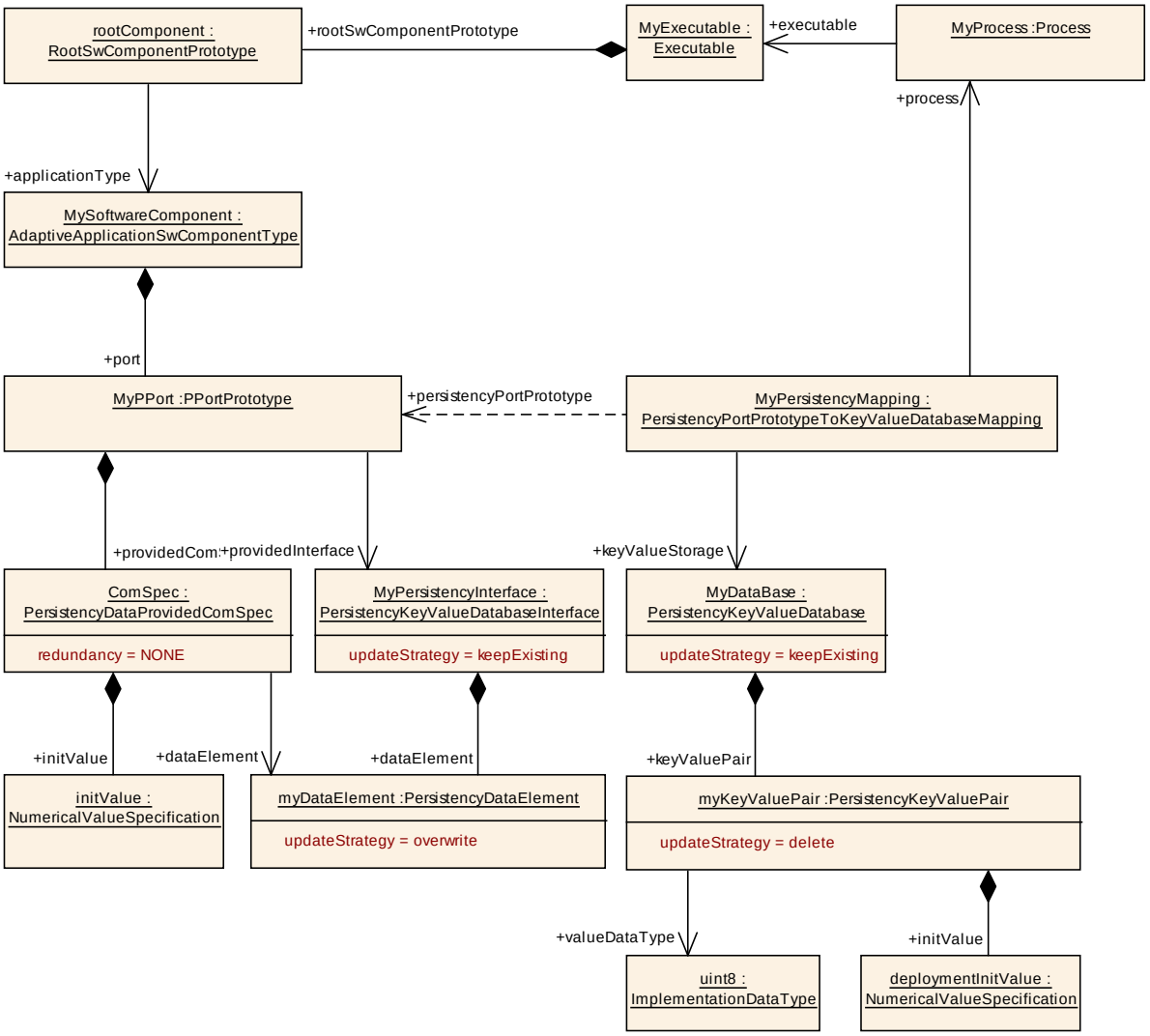


Figure A.16: Advanced example modeling of persistent data (design + deployment)

A.8 Definition of Persistent File

The setup presented in Figure A.17 represents a case with reduced modeling of persistent files.

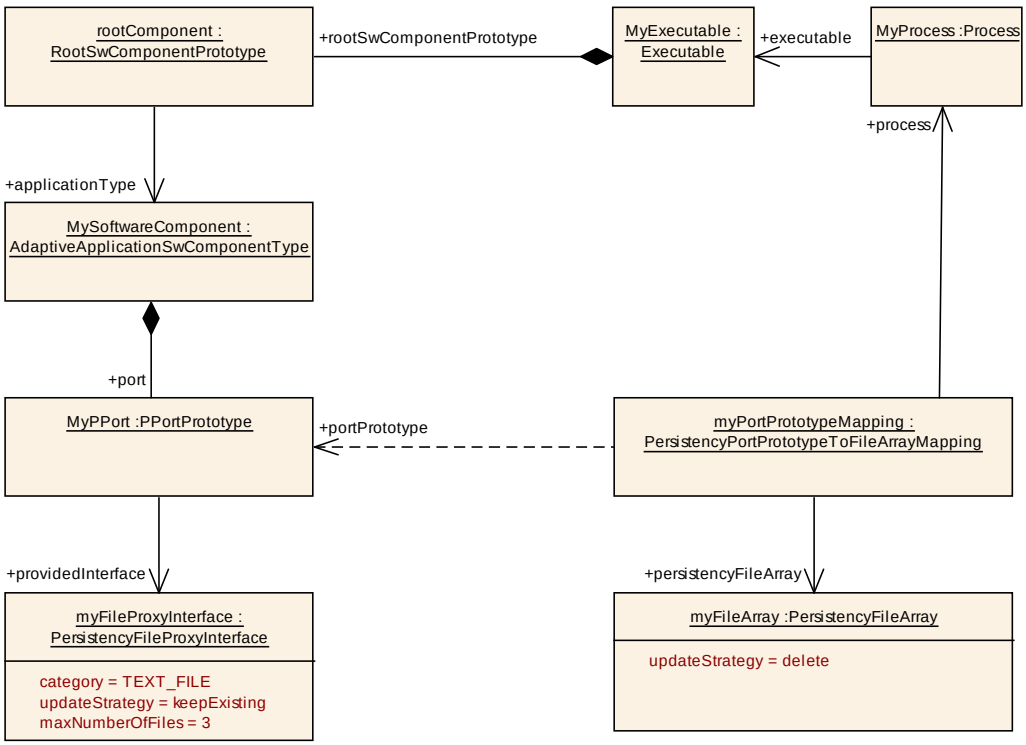


Figure A.17: Simple example modeling of persistent file (design + deployment)

It is possible to extend the modeling to a deeper level of detail and also formally describe the individual file that is subject to persistency on both design and deployment level, see Figure A.18.

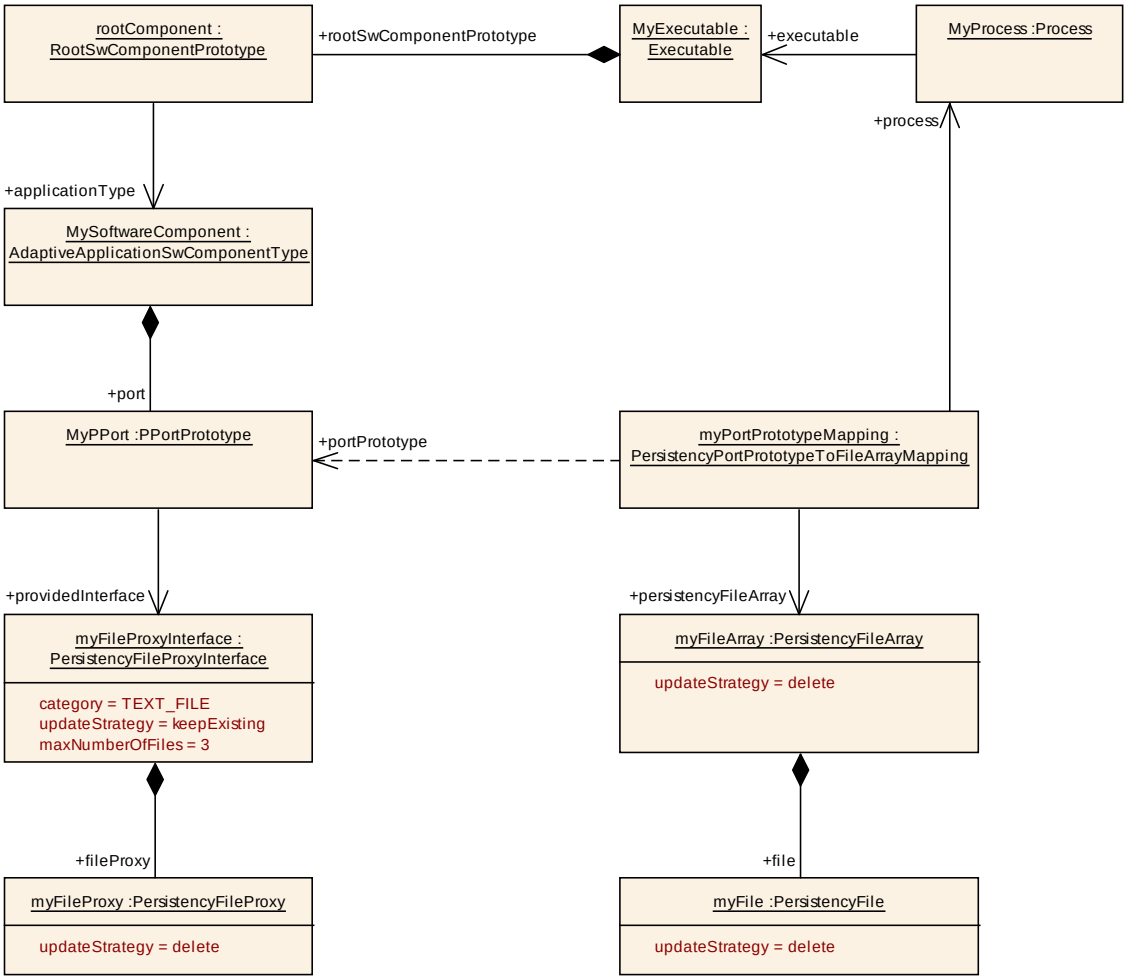


Figure A.18: Advanced example modeling of persistent file (design + deployment)

A.9 Definition of Phm interaction

This chapter contains examples for the modeling of platform health management. The example is structured into Application design and platform health management configuration.

A.9.1 Phm Application Design example

The simple example provided in figure A.19 shows the definition of a `PhmHealthChannelInterface` and a `PhmSupervisedEntityInterface`. This example will also be used in the subsequent section to define the platform health management configuration.

The `PhmHealthChannelInterface` *HealthChannel_A* defines two status attributes:

- *Good*

- *Bad*

The `PhmSupervisedEntityInterface` *SupervisedEntity_B* defines two checkpoints:

- *CP1*
- *CP2*

The `AdaptiveApplicationSwComponentType` *AdaptiveApplication* defines two `RPortPrototype`s

- *Hc_A* typed by *HealthChannel_A*
- *Se_B* typed by *SupervisedEntity_B*

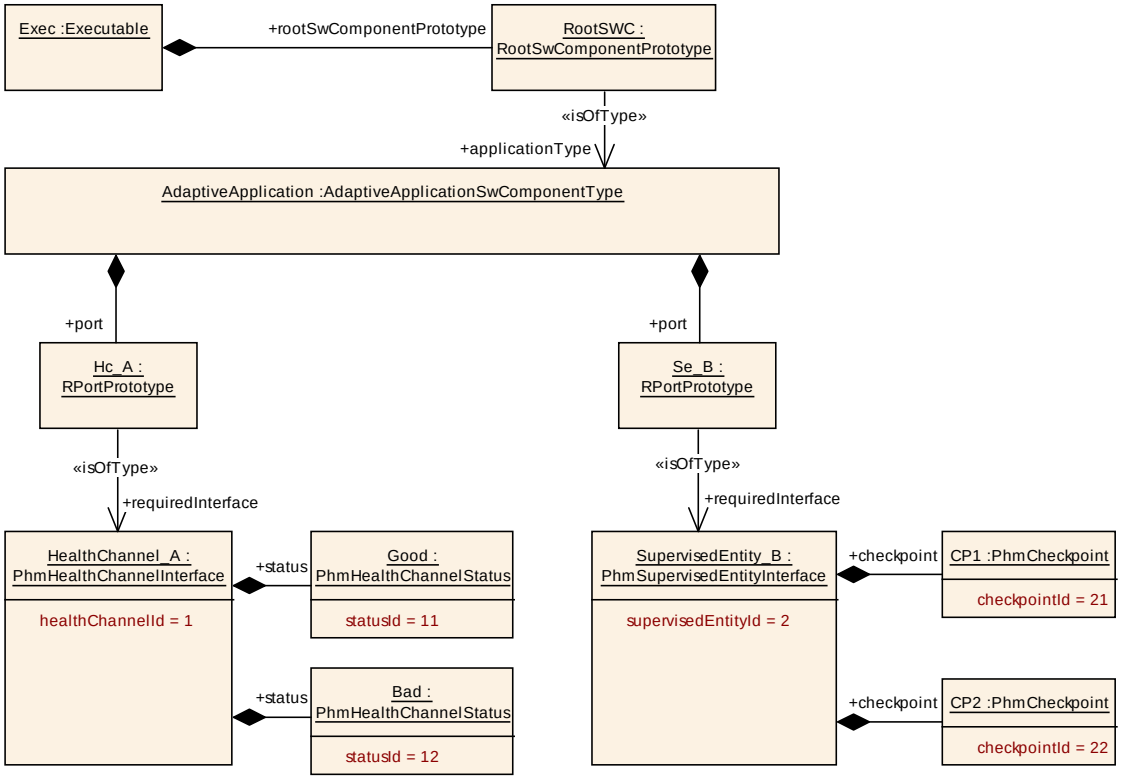


Figure A.19: Example modeling of Health Channel and Supervised Entity

A.9.2 Phm configuration example

When defining the configuration contribution for Phm it is required to first create representatives of the application design model artifacts (health channel status and supervised entity checkpoints) in the Phm configuration context. This is shown in figure A.20.

In this example the *PHM* `PlatformHealthManagementContribution` defines placeholder elements which refer to the respective application design model artifacts:

Example health channel:

- *Hc_Status_Good* refers to the *Good* status of *HealthChannel_A*
- *Hc_Status_Bad* refers to the *Bad* status of *HealthChannel_A*

Example supervision checkpoint:

- *Se_B_Cp1* refers to the *CP1* checkpoint of *SupervisedEntity_B*
- *Se_B_Cp2* refers to the *CP2* checkpoint of *SupervisedEntity_B*

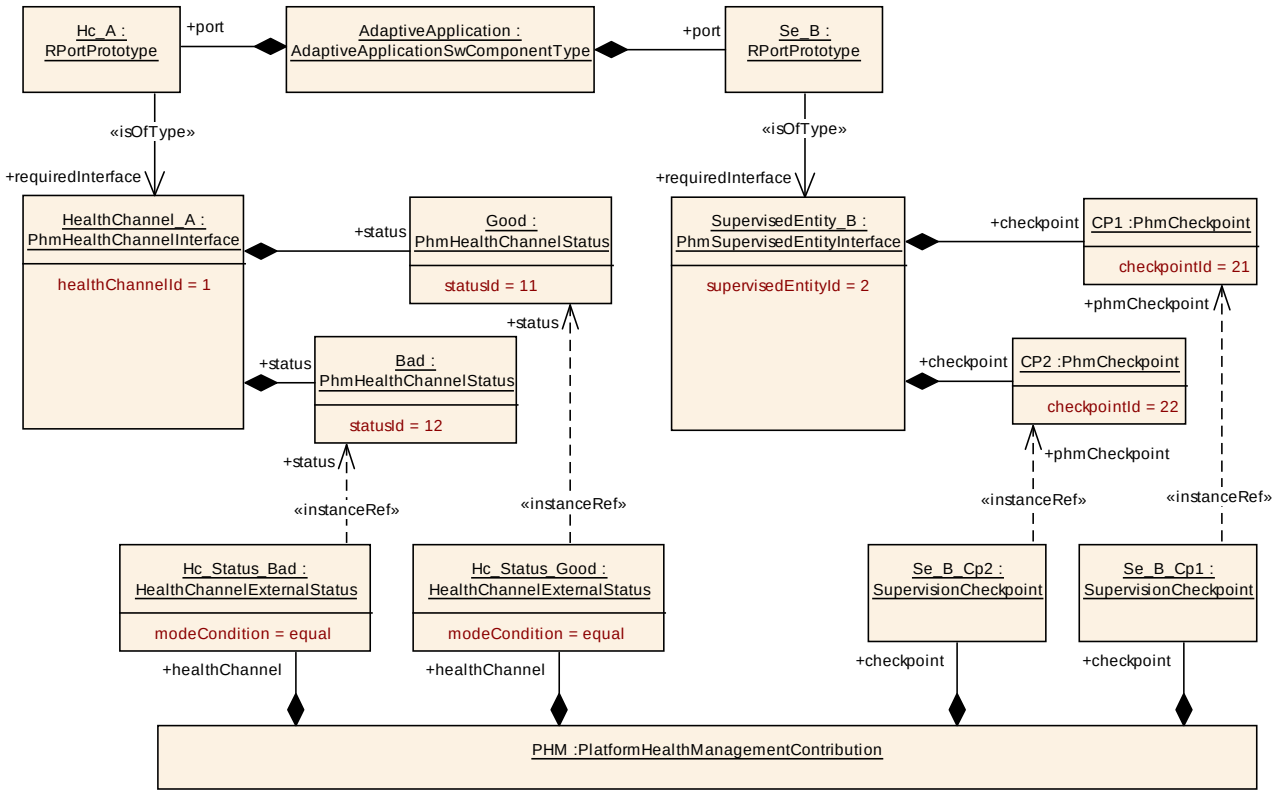


Figure A.20: Example modeling of Phm placeholder definition

Note that these instance references have a composite nature, which is shown in example figure A.21.

Here it is shown that in order to instance reference from the `HealthChannelExternalStatus` *Hc_Status_Bad* to the `PhmHealthChannelStatus` *Bad* there is the structured reference required consisting of

- `contextRootSwComponentPrototype`
- `contextRPortPrototype`
- `targetStatus`

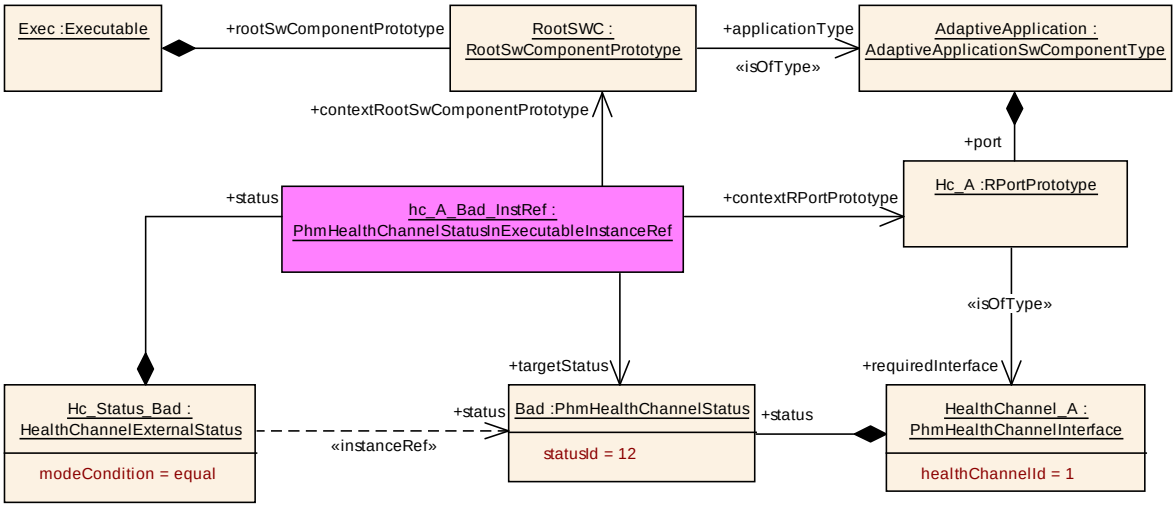


Figure A.21: Example modeling of Phm instance reference

The configuration of expressions is then based on the available placeholders of figure A.20.

One part of the example `LogicalExpression` *Expr_1* is the already defined `HealthChannelExternalStatus` *Good* with the `modeCondition` == `equal`.

The second part of the example `LogicalExpression` *Expr_1* is the evaluation of the supervision status of the `AliveSupervision` *AliveSup_1* which monitors the periodic reporting of the `SupervisionCheckpoint` *Se_B_Cp1*.

The result of *Se_B_Cp1* is taken as input to the `GlobalSupervision` *GlobalSup_1*.

And the `GlobalSupervision` *GlobalSup_1* is taken as input to the `HealthChannelSupervision` *HcSup_1* which in turn is the second input to the `LogicalExpression` *Expr_1*.

The `LogicalExpression` *Expr_1* then takes the two inputs and logically *AND*s them.

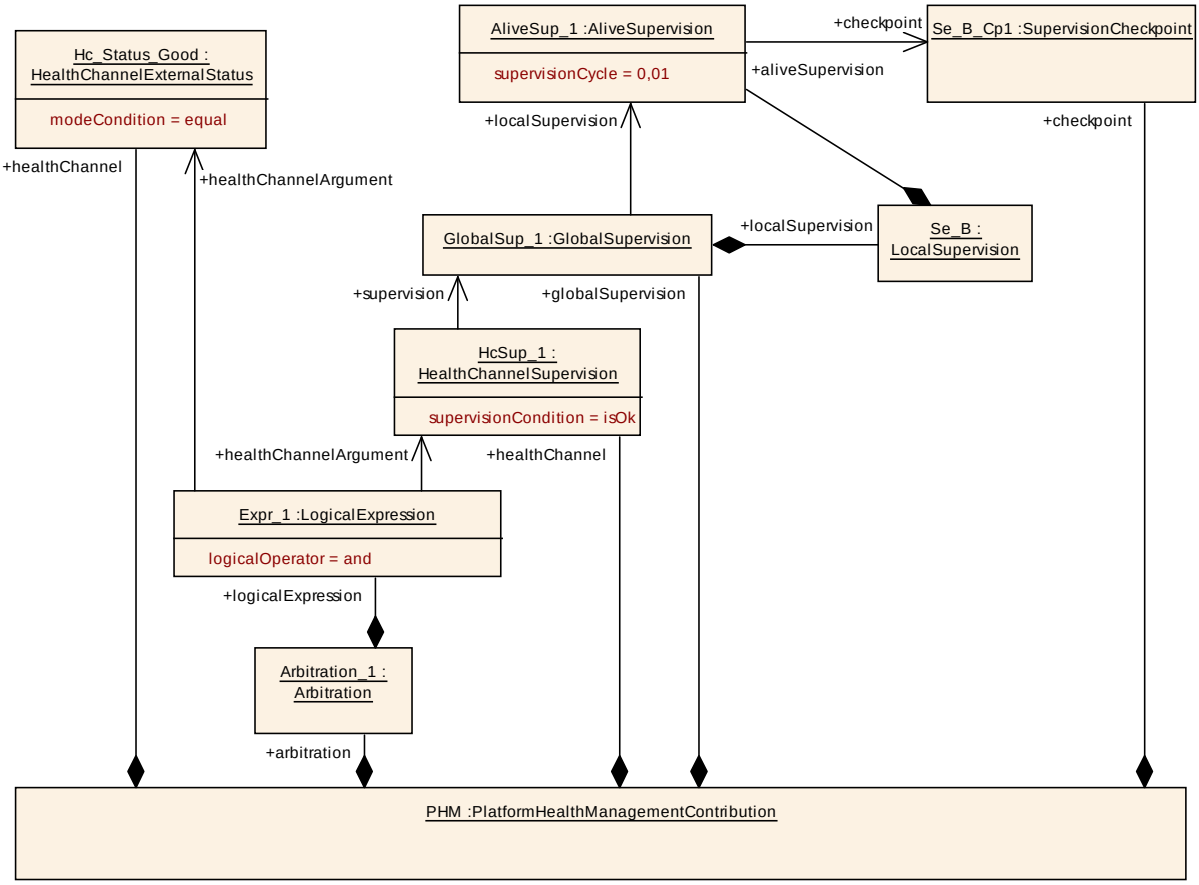


Figure A.22: Example modeling of Phm expression configuration

B General Modeling

This chapter has been created to explain model elements that are not directly related to specific design or deployment usage but have a more general scope. In other words, this chapter describes the structure and usage of some widely reusable modeling content.

B.1 Reference to a DataPrototype in a CompositionSwComponentType

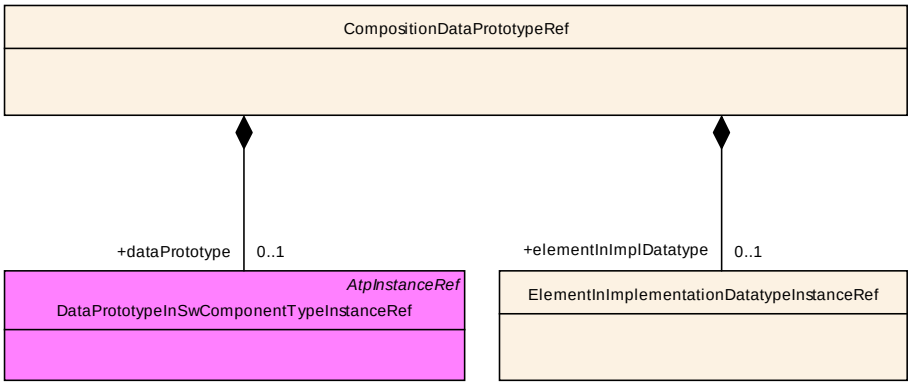


Figure B.1: Modeling of `CompositionDataPrototypeRef`

[constr_1481] Usage of `CompositionDataPrototypeRef` in the *AUTOSAR adaptive platform* ⌈ If `CompositionDataPrototypeRef` is used in the context of the *AUTOSAR adaptive platform* then the actual `DataPrototypeInSwComponentTypeInstanceRef.targetDataPrototype` shall be either a `VariableDataPrototype` or an `ArgumentDataPrototype`. ⌋*()*

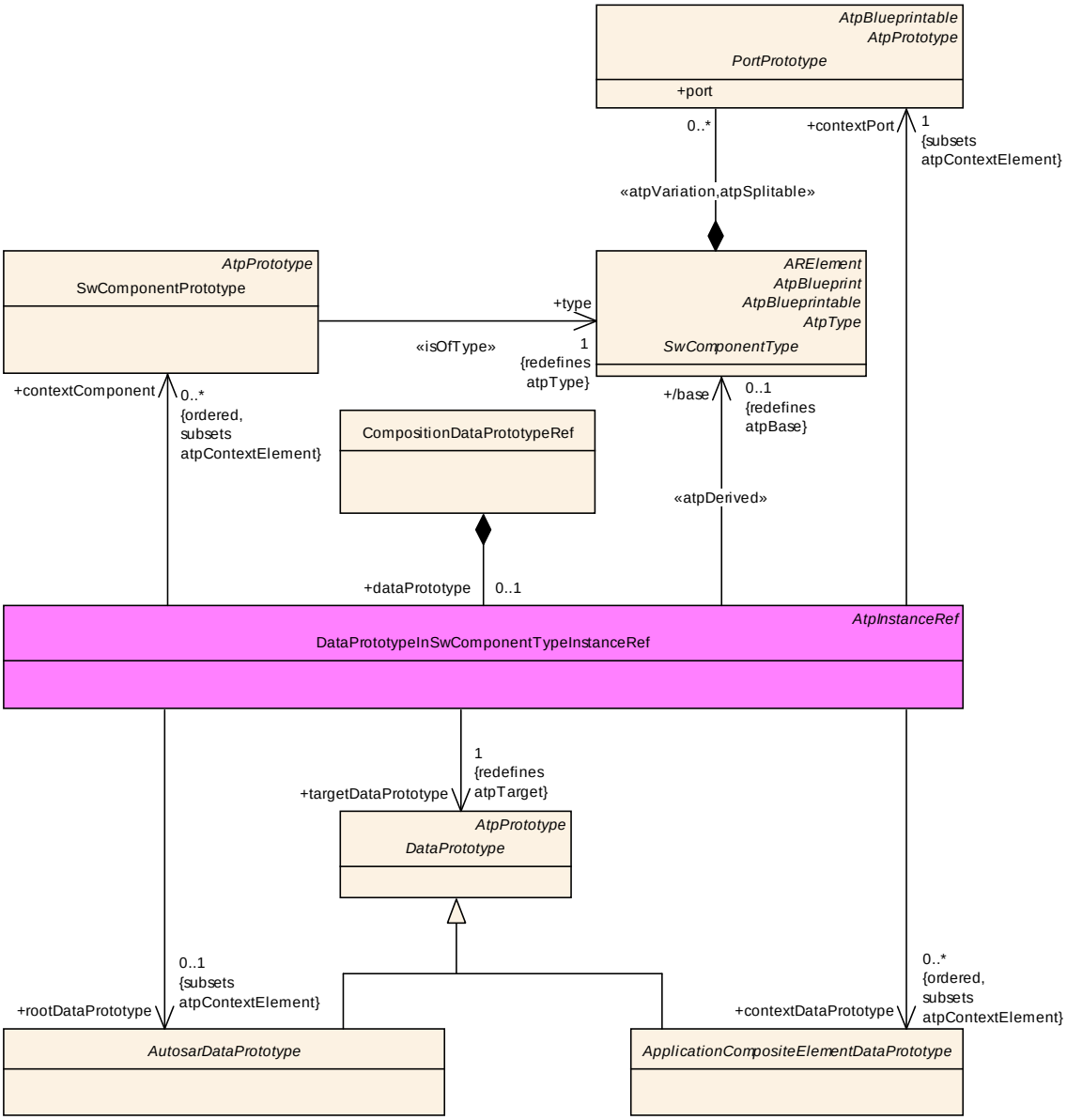


Figure B.2: Modeling of `DataPrototypeInSwComponentTypeInstanceRef`

Class	**CompositionDataPrototypeRef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::General			
Note	This meta-class represents the ability to refer to an AUTOSAR DataPrototype in the context of a CompositionSwComponentType. **Tags:** atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dataPrototype	DataPrototype	0..1	iref	This attribute shall exist if the InstanceRef points to a DataPrototype typed by an ApplicationDataType. **Tags:** atp.Status=draft

elementInImplDatatype	ElementInImplementationDatatypeInstanceRef	0..1	aggr	This attribute shall exist if the InstanceRef points to a DataPrototype typed by an ImplementationDataType. **Tags:** atp.Status=draft

Table B.1: CompositionDataPrototypeRef

Class	**DataPrototypeInSwComponentTypeInstanceRef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::General			
Note	This meta-class represents the ability to: • refer to a DataPrototype in the context of a CompositionSwComponentType. • refer to the internal structure of a DataPrototype in the context of a CompositionSwComponentType. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpInstanceRef*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
base	SwComponentType	0..1	ref	**Stereotypes:** atpDerived **Tags:** atp.Status=draft xml.sequenceOffset=10
contextComponent (ordered)	SwComponentPrototype	*	ref	**Tags:** atp.Status=draft xml.sequenceOffset=20
contextDataPrototype (ordered)	ApplicationCompositeElementDataPrototype	*	ref	**Tags:** atp.Status=draft xml.sequenceOffset=50
contextPort	PortPrototype	1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=30
rootDataPrototype	AutosarDataPrototype	0..1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=40
targetDataPrototype	DataPrototype	1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=60

Table B.2: DataPrototypeInSwComponentTypeInstanceRef

Class	**ArVariableInImplementationDataInstanceRef**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::SwcInternalBehavior::DataElements			
Note	This class represents the ability to navigate into a data element inside of an VariableDataPrototype which is typed by an ImplementationDatatype. Note that it shall not be used if the target is the VariableDataPrototype itself (e.g. if its a primitive). Note that this class follows the pattern of an InstanceRef but is not implemented based on the abstract classes because the ImplementationDataType isn't either, especially because ImplementationDataTypeElement isn't derived from AtpPrototype.			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
contextDataPrototype (ordered)	ImplementationDataTypeElement	*	ref	This is a context in case there are subelements with explicit types. The reference has to be ordered to properly reflect the nested structure. **Tags:** xml.sequenceOffset=30
portPrototype	PortPrototype	0..1	ref	This is the port providing/receiving the root of the variable **Tags:** xml.sequenceOffset=10
rootVariableDataPrototype	VariableDataPrototype	0..1	ref	This refers to the VariableDataPrototype typed by the ImplementationDatatype in which the target can be found. **Tags:** xml.sequenceOffset=20
targetDataPrototype	ImplementationDataTypeElement	1	ref	This reference points to the target ImplementationDataTypeElement. **Tags:** xml.sequenceOffset=40

Table B.3: ArVariableInImplementationDataInstanceRef

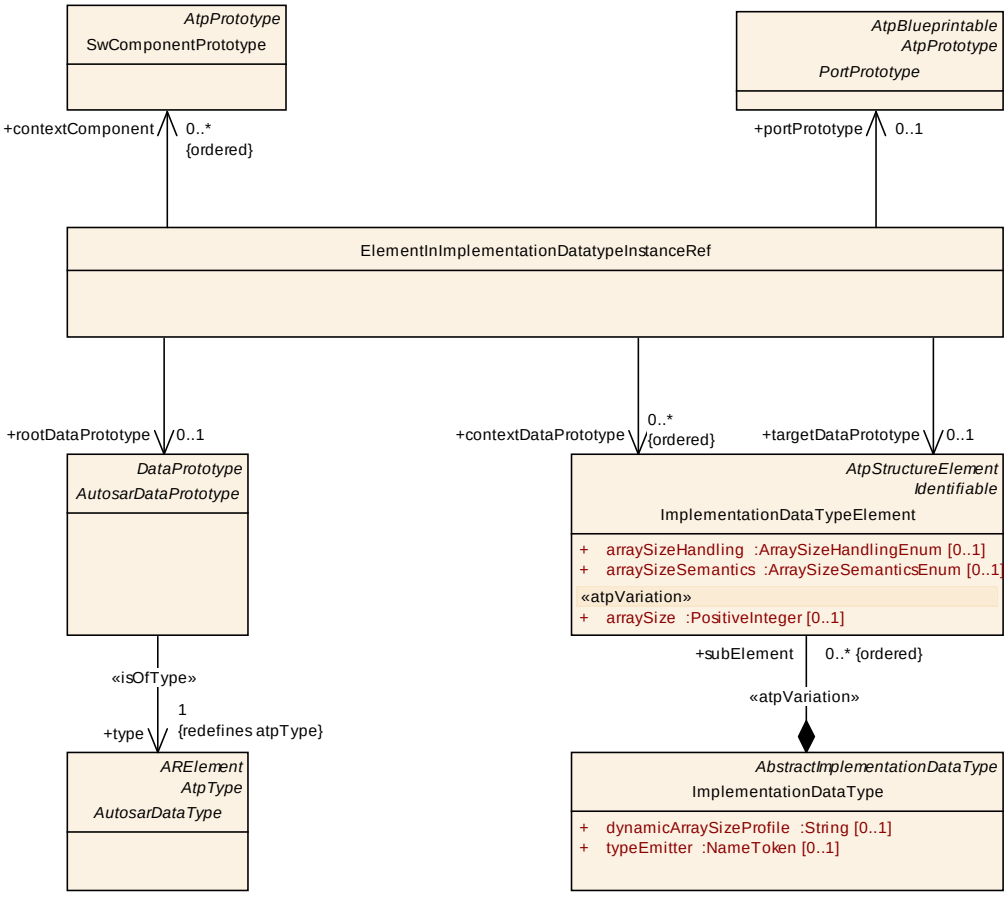


Figure B.3: Modeling of `ElementInImplementationDatatypeInstanceRef`

Class	**ElementInImplementationDatatypeInstanceRef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::General			
Note	This meta-class represents the ability to refer to the internal structure of an AutosarDataPrototype which is typed by an implementationDatatype in the context of a CompositionSwComponentType. In other words, this meta-class shall not be used to model a reference to the **AutosarDataPrototype as a target itself**, **even** if the AutosarDataPrototype is typed by an ImplementationDataType **and even** if that ImplementationDataType represents a composite data type. **Tags:** atp.Status=draft			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
contextComponent (ordered)	SwComponentPrototype	*	ref	This represents the hiearchy of SwComponentPrototypes that creates a context within the instanceRef. **Tags:** atp.Status=draft xml.sequenceOffset=10

contextDataPrototype (ordered)	ImplementationDataTypeElement	*	ref	This is a context in case there are subelements with explicit types. The reference has to be ordered to properly reflect the nested structure. **Tags:** atp.Status=draft xml.sequenceOffset=40
portPrototype	PortPrototype	0..1	ref	This is the port providing/receiving the root of the AutosarDataPrototype. **Tags:** atp.Status=draft xml.sequenceOffset=20
rootDataPrototype	AutosarDataPrototype	0..1	ref	This refers to the AutosarDataPrototype which is typed by the implementationDatatype. This rootDataPrototype represents the target of this InstanceRef if no targetDataPrototype is defined. If a targetDataPrototype is defined this rootDataPrototype defines the AutosarDataPrototype in which the target can be found. **Tags:** atp.Status=draft xml.sequenceOffset=30
targetDataPrototype	ImplementationDataTypeElement	0..1	ref	This is the target reference to a subElement that is defined inside of the rootDataPrototype. **Tags:** atp.Status=draft xml.sequenceOffset=50

Table B.4: ElementInImplementationDatatypeInstanceRef

B.2 Modeling of InstanceRefs

This section illustrates the concrete modeling of the instance references used in the previous parts of this document.

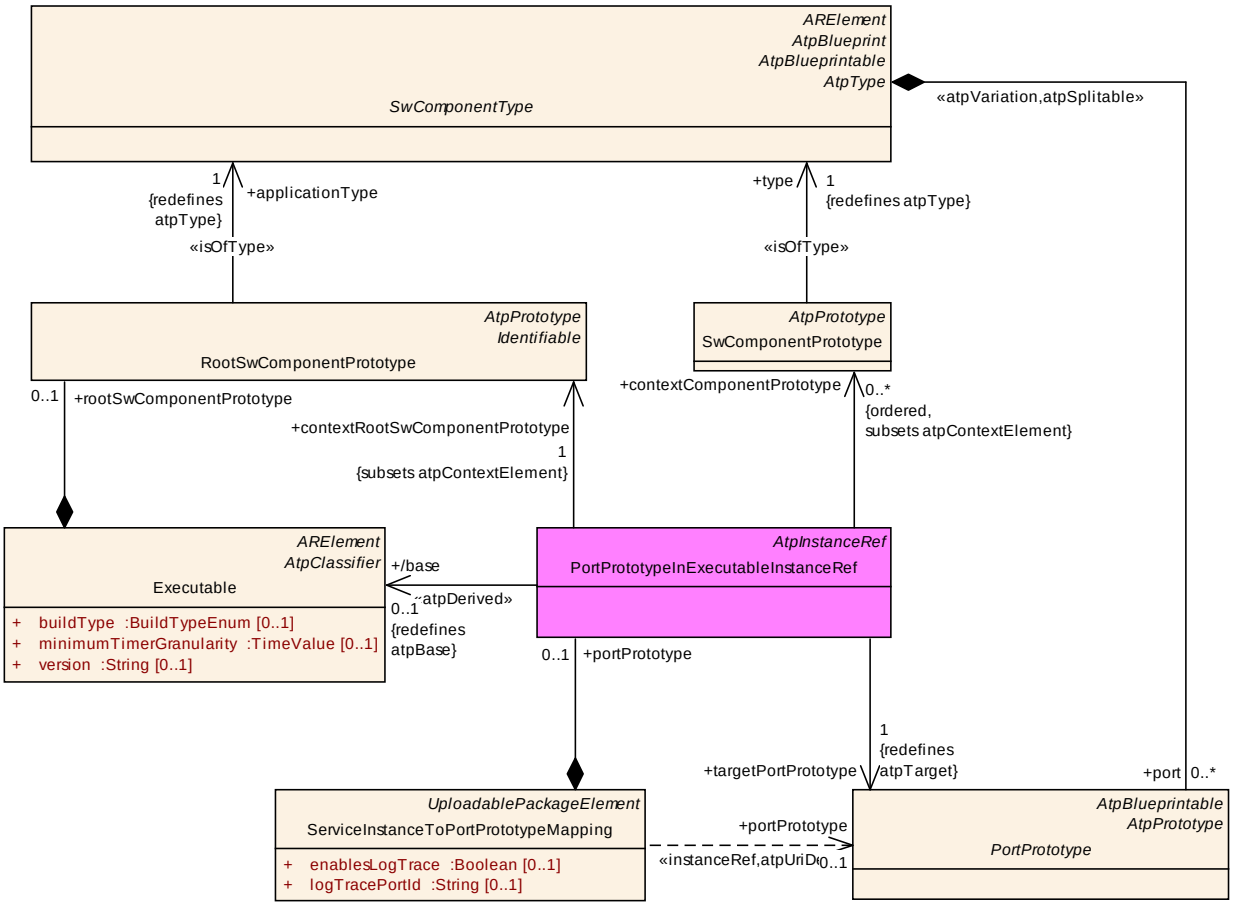


Figure B.4: Modeling of `PortPrototypeInExecutableInstanceRef`

Class	**PortPrototypeInExecutableInstanceRef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Process::InstanceRefs			
Note	**Tags:** atp.Status=draft			
Base	*ARObject*, *AtpInstanceRef*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
base	Executable	0..1	ref	**Stereotypes:** atpDerived **Tags:** atp.Status=draft xml.sequenceOffset=10
contextComponentPrototype (ordered)	SwComponentPrototype	*	ref	**Tags:** atp.Status=draft xml.sequenceOffset=30
contextRootSwComponentPrototype	RootSwComponentPrototype	1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=20
targetPortPrototype	PortPrototype	1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=40

Table B.5: PortPrototypeInExecutableInstanceRef

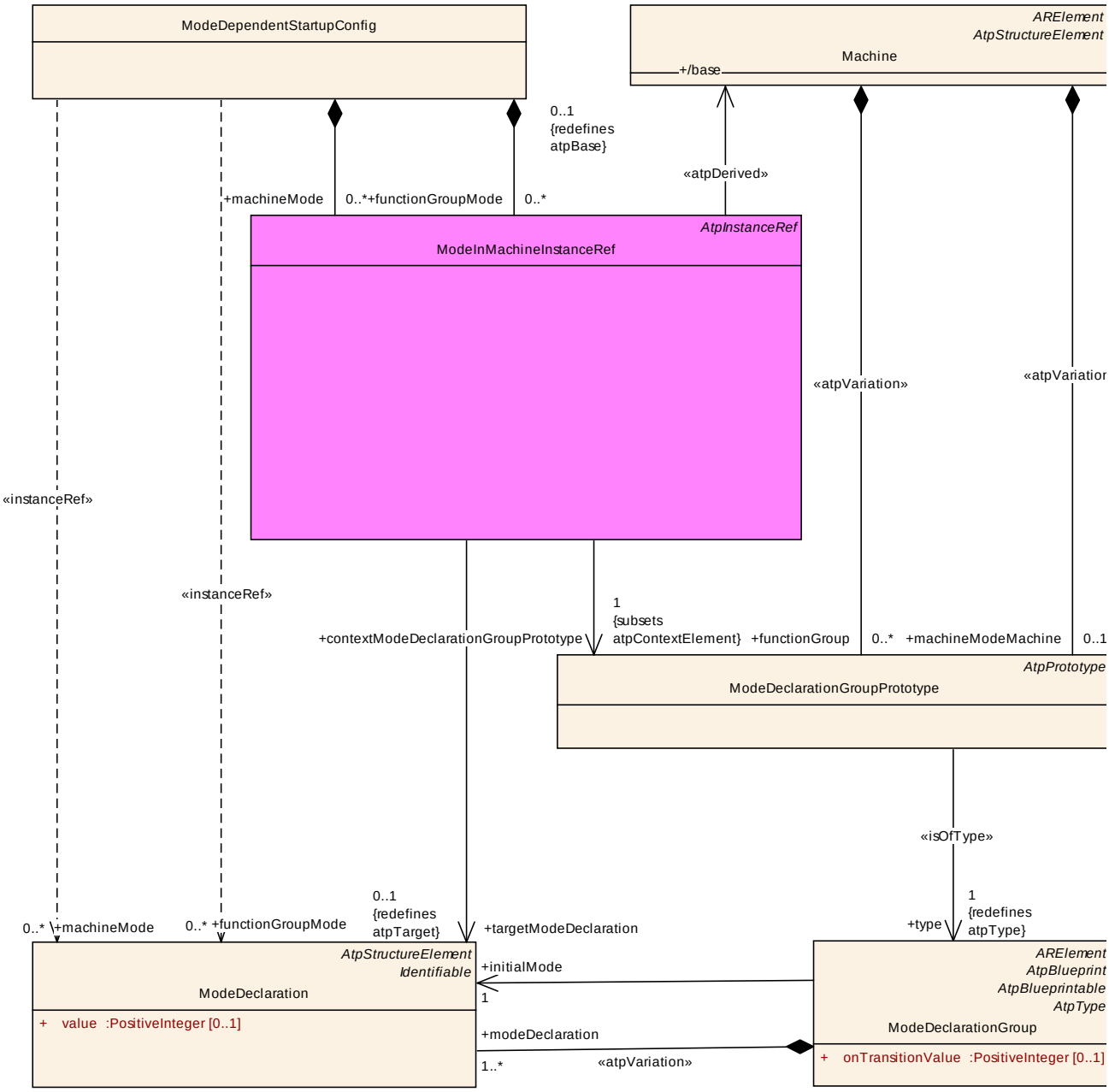


Figure B.5: Modeling of `ModeInMachineInstanceRef`

Class	**ModeInMachineInstanceRef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Process::InstanceRefs			
Note	**Tags:** atp.Status=draft			
Base	*ARObject*, *AtpInstanceRef*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
base	Machine	0..1	ref	**Stereotypes:** atpDerived **Tags:** atp.Status=draft xml.sequenceOffset=10

contextModeDeclarationGroupPrototype	ModeDeclarationGroupPrototype	1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=20
targetModeDeclaration	ModeDeclaration	0..1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=30

Table B.6: ModeInMachineInstanceRef

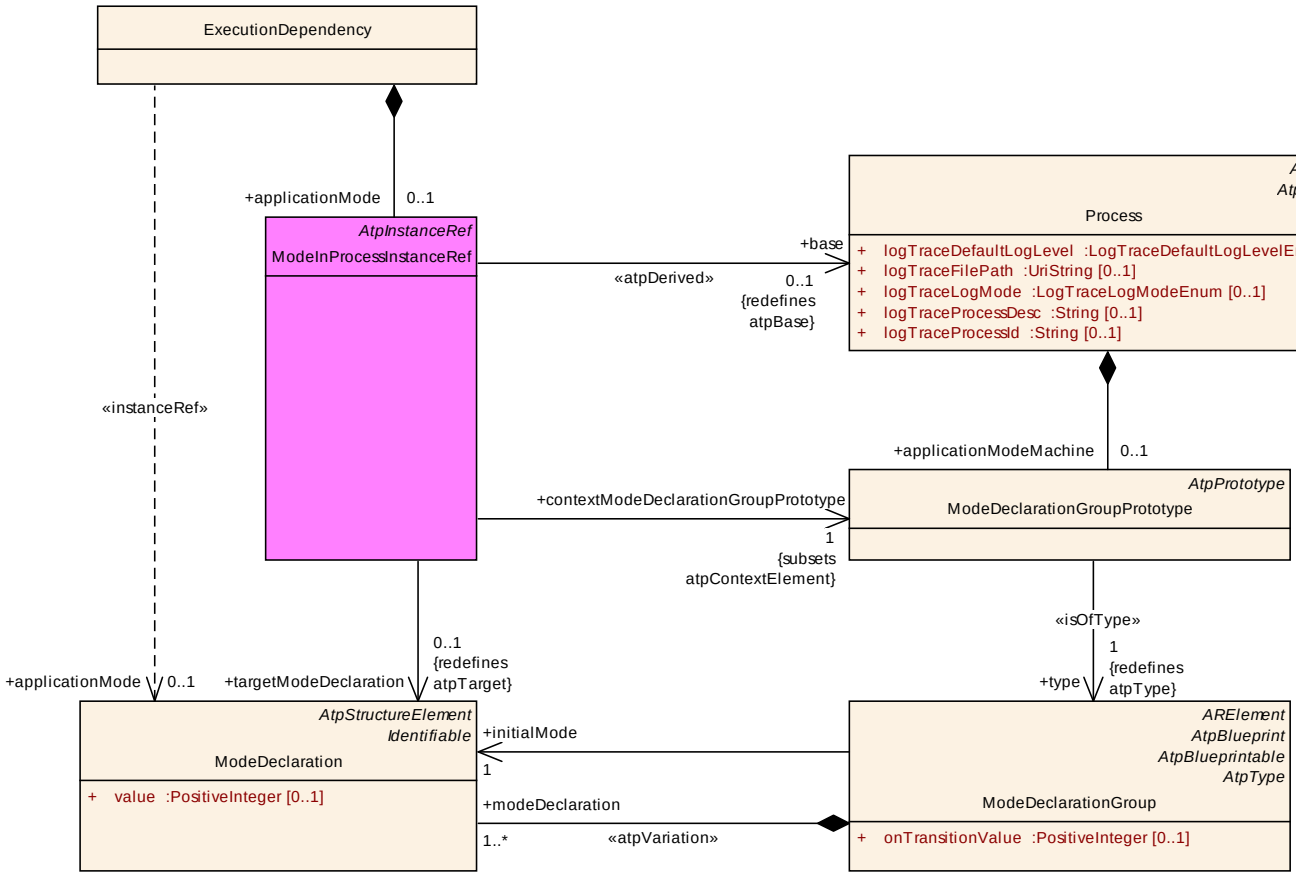


Figure B.6: Modeling of `ModeInProcessInstanceRef`

Class	**ModeInProcessInstanceRef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::Process::InstanceRefs			
Note	**Tags:** atp.Status=draft			
Base	*ARObject*, *AtpInstanceRef*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
base	Process	0..1	ref	**Stereotypes:** atpDerived **Tags:** atp.Status=draft xml.sequenceOffset=10
contextModeDeclarationGroupPrototype	ModeDeclarationGroupPrototype	1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=20

targetMode Declaration	ModeDeclaration	0..1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=30

Table B.7: ModeInProcessInstanceRef

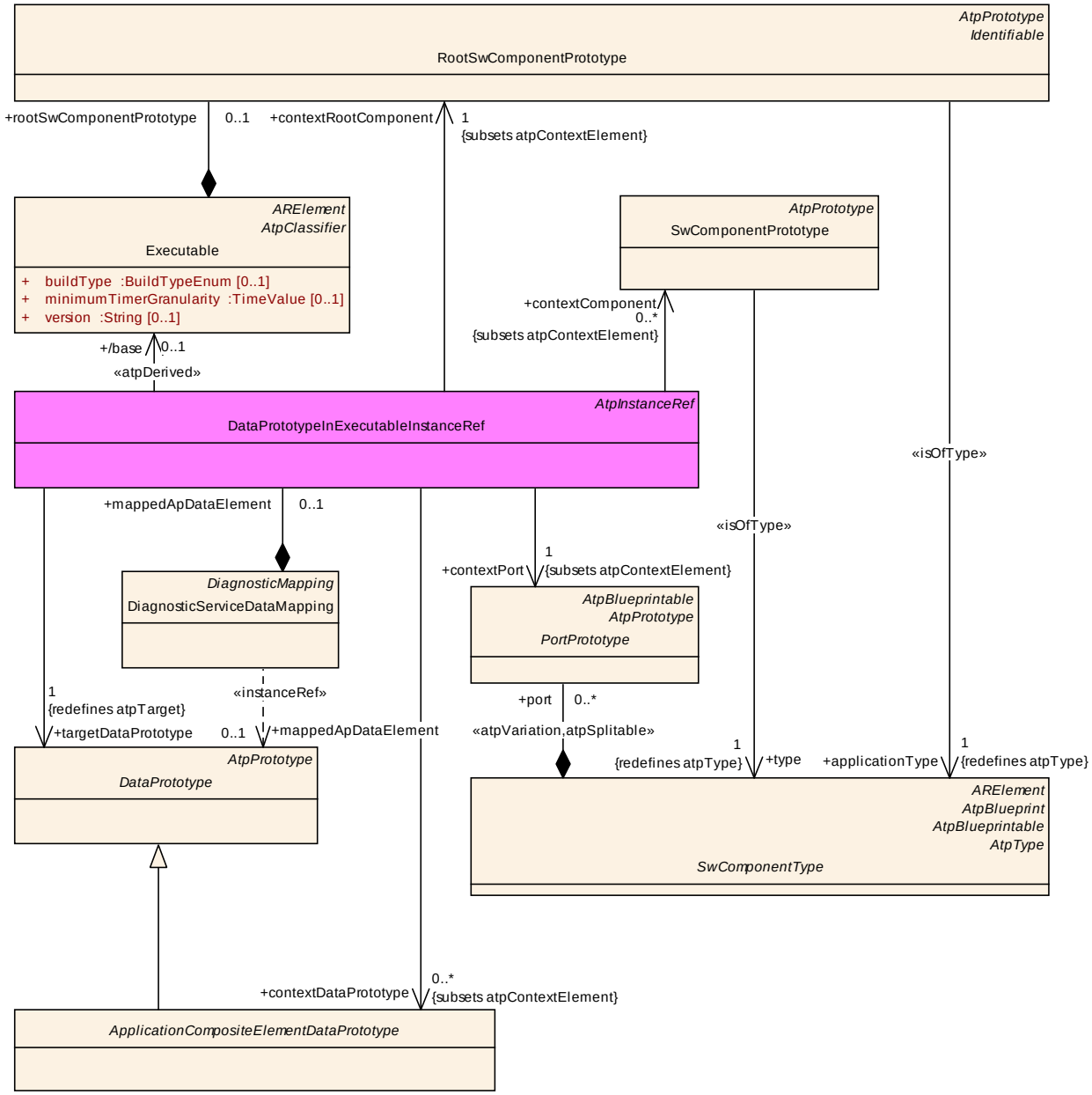


Figure B.7: Modeling of `DiagnosticServiceDataMapping` via `DataPrototypeInExecutableInstanceRef`

Class	**DataPrototypeInExecutableInstanceRef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::DiagnosticMapping			
Note	**Tags:** atp.Status=draft			
Base	*ARObject*, *AtpInstanceRef*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
base	Executable	0..1	ref	**Stereotypes:** atpDerived **Tags:** atp.Status=draft xml.sequenceOffset=10
contextComponent	SwComponentPrototype	*	ref	**Tags:** atp.Status=draft xml.sequenceOffset=30
contextDataPrototype	ApplicationCompositeElementDataPrototype	*	ref	**Tags:** atp.Status=draft xml.sequenceOffset=50
contextPort	PortPrototype	1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=40
contextRootComponent	RootSwComponentPrototype	1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=20
targetDataPrototype	DataPrototype	1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=60

Table B.8: DataPrototypeInExecutableInstanceRef

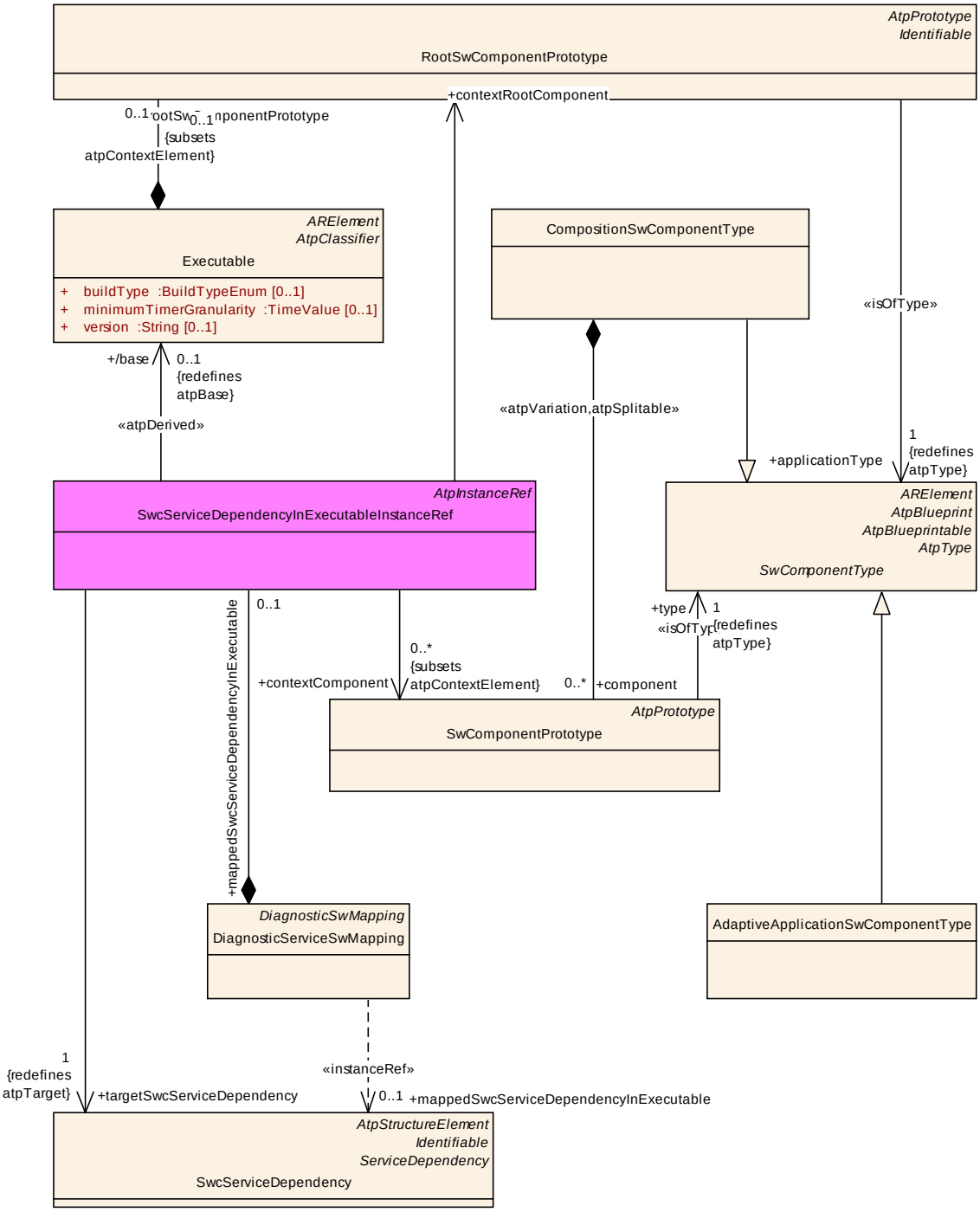


Figure B.8: Modeling of `DiagnosticServiceSwMapping` via `SwcServiceDependencyInExecutableInstanceRef`

Class	**SwcServiceDependencyInExecutableInstanceRef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::DiagnosticMapping			
Note	**Tags:** atp.Status=draft			
Base	*ARObject*, *AtpInstanceRef*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

base	Executable	0..1	ref	**Stereotypes:** atpDerived **Tags:** atp.Status=draft xml.sequenceOffset=10
contextComponent	SwComponentPrototype	*	ref	**Tags:** atp.Status=draft xml.sequenceOffset=30
contextRootComponent	RootSwComponentPrototype	0..1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=20
targetSwcServiceDependency	SwcServiceDependency	1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=40

Table B.9: SwcServiceDependencyInExecutableInstanceRef

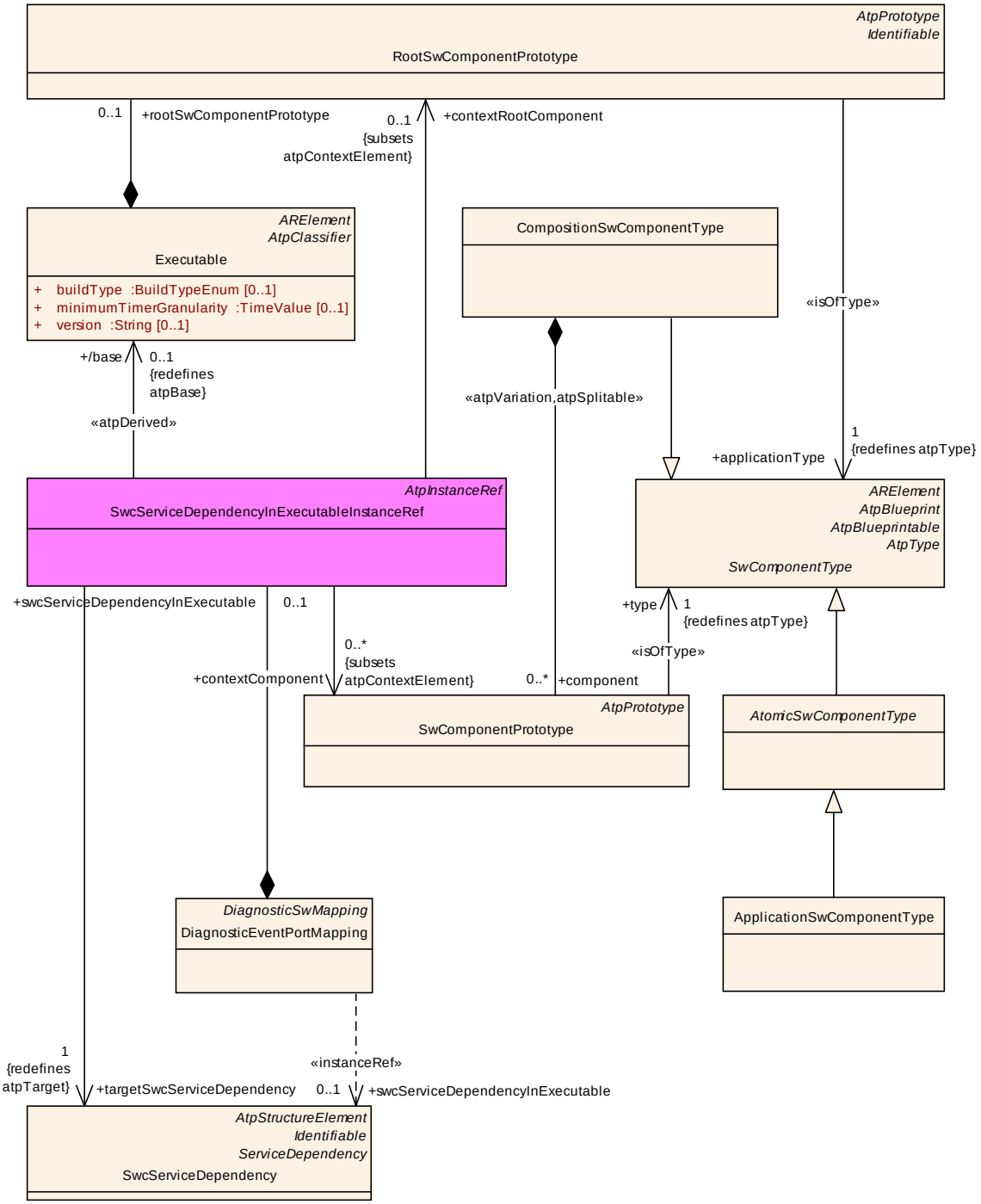


Figure B.9: Modeling of `DiagnosticEventPortMapping` via `SwcServiceDependencyInExecutableInstanceRef`

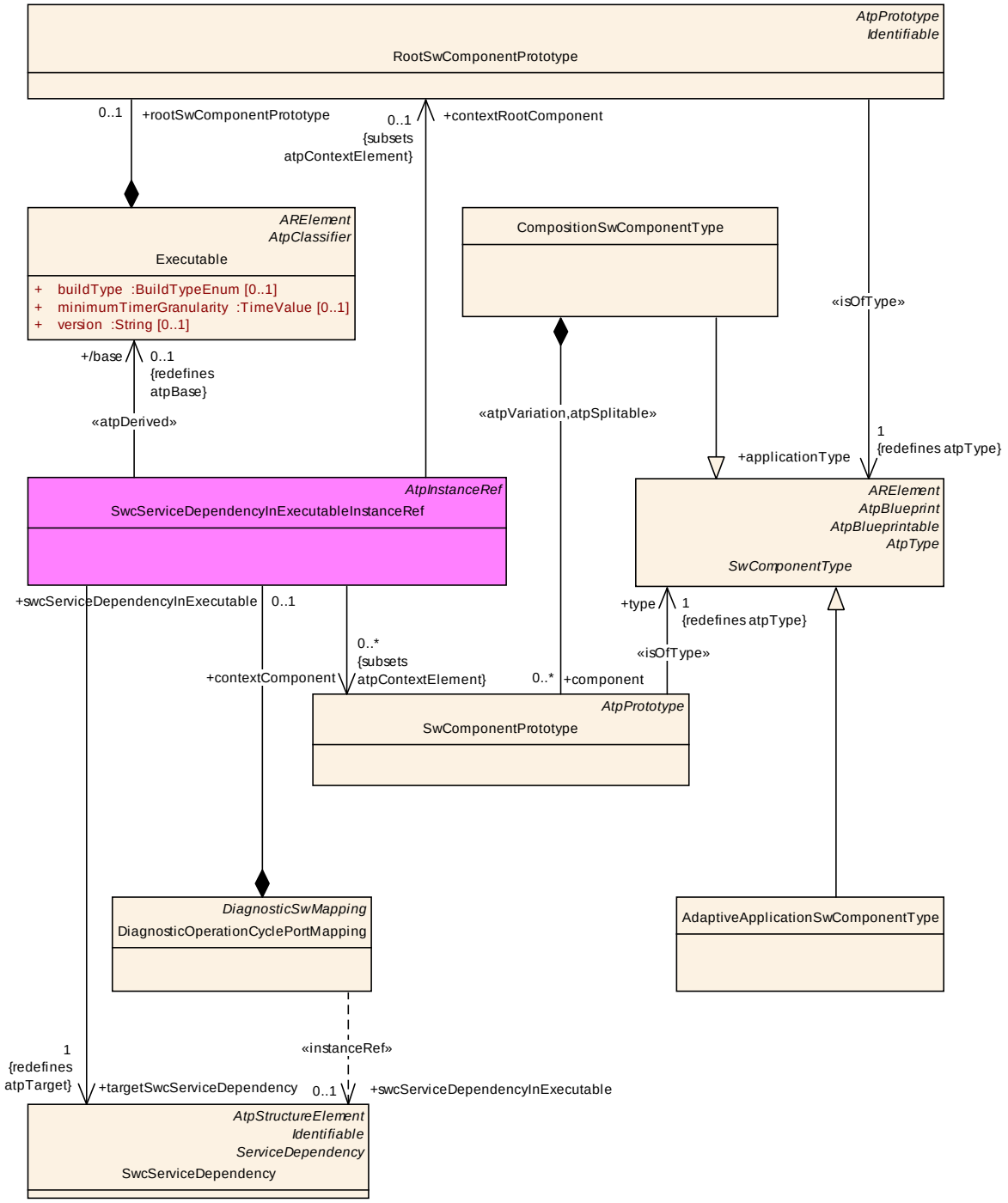


Figure B.10: Modeling of `DiagnosticOperationCyclePortMapping` via `SwcServiceDependencyInExecutableInstanceRef`

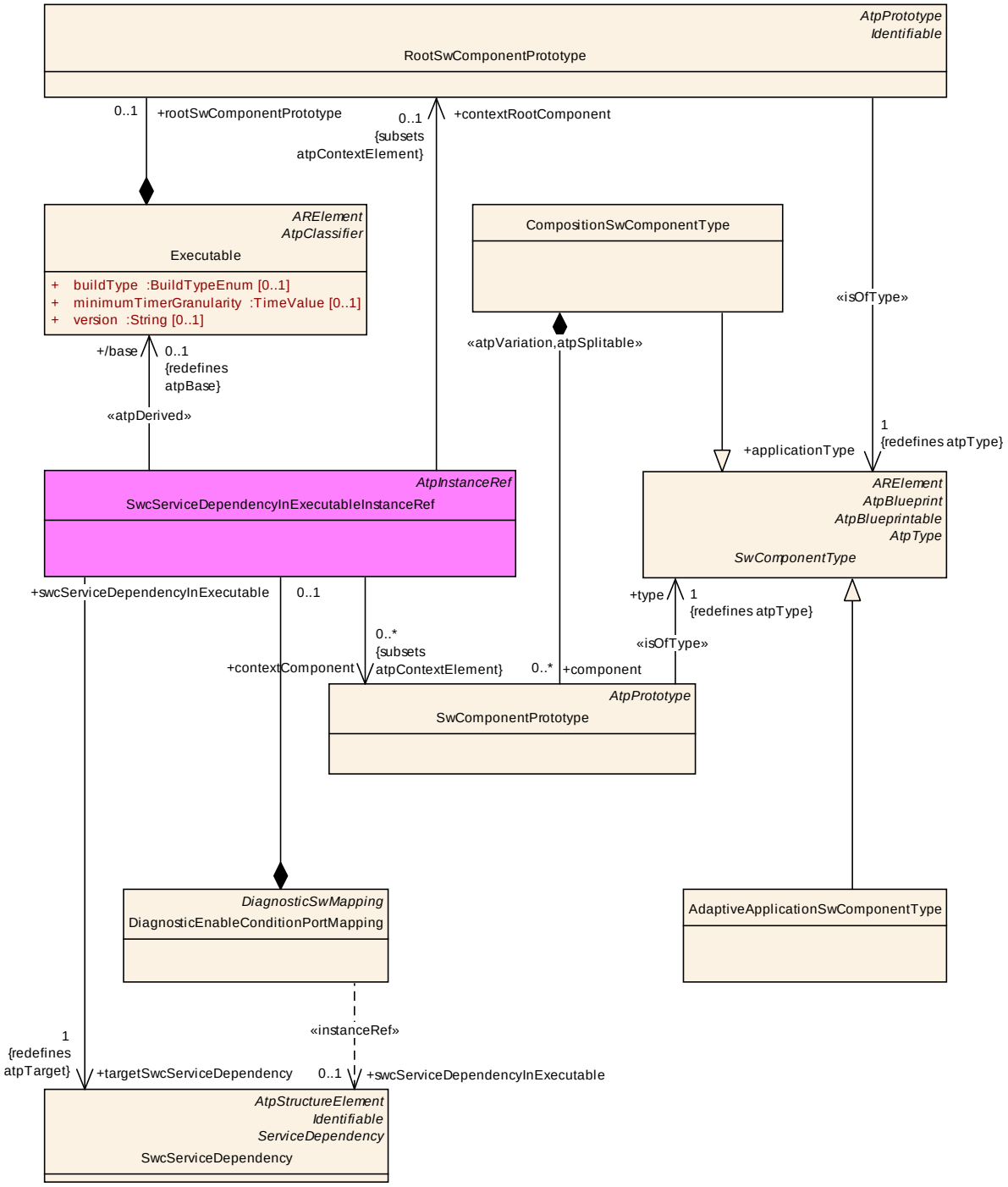


Figure B.11: Modeling of `DiagnosticEnableConditionPortMapping` via `SwcServiceDependencyInExecutableInstanceRef`

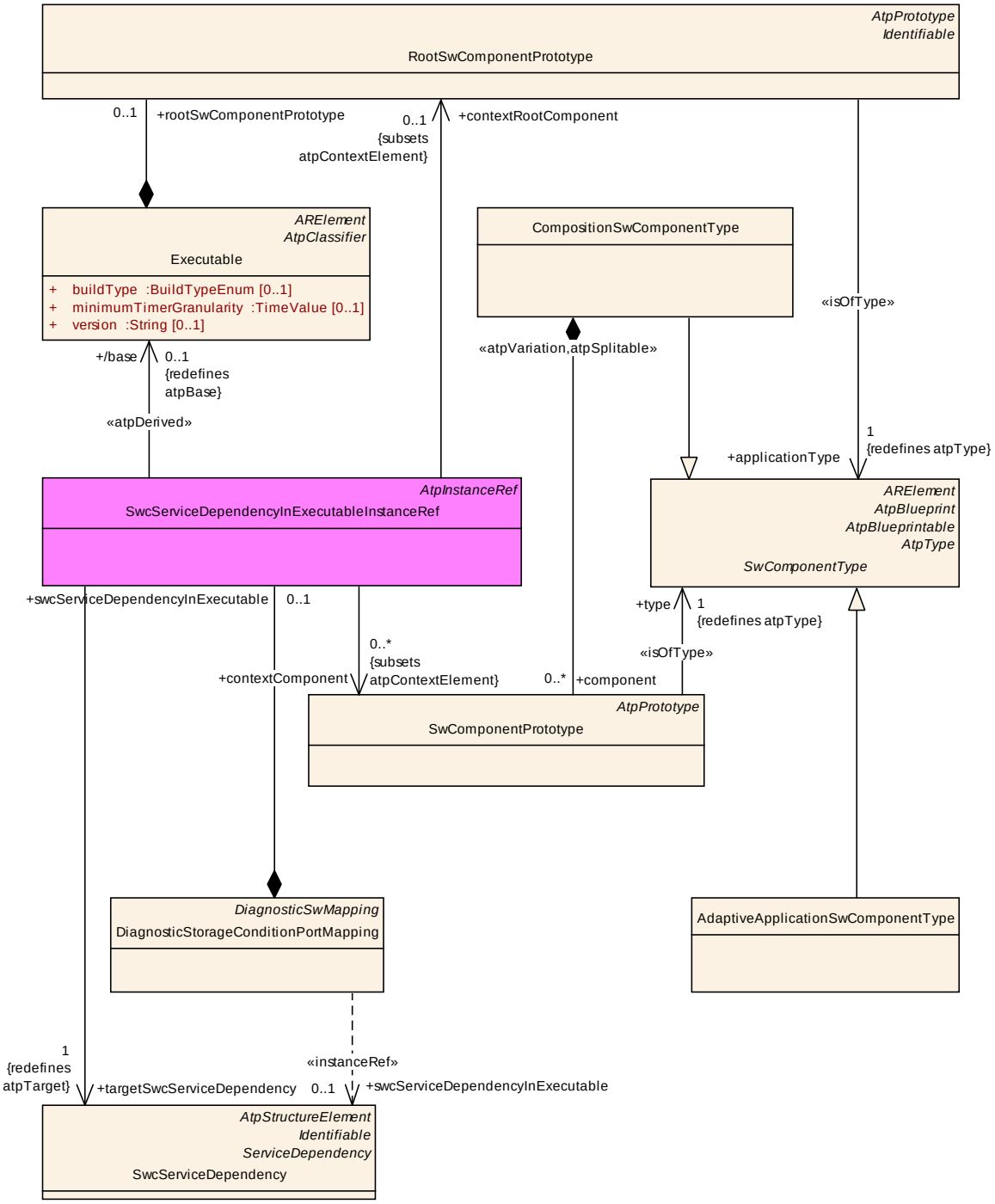


Figure B.12: Modeling of `DiagnosticStorageConditionPortMapping` via `SwcServiceDependencyInExecutableInstanceRef`

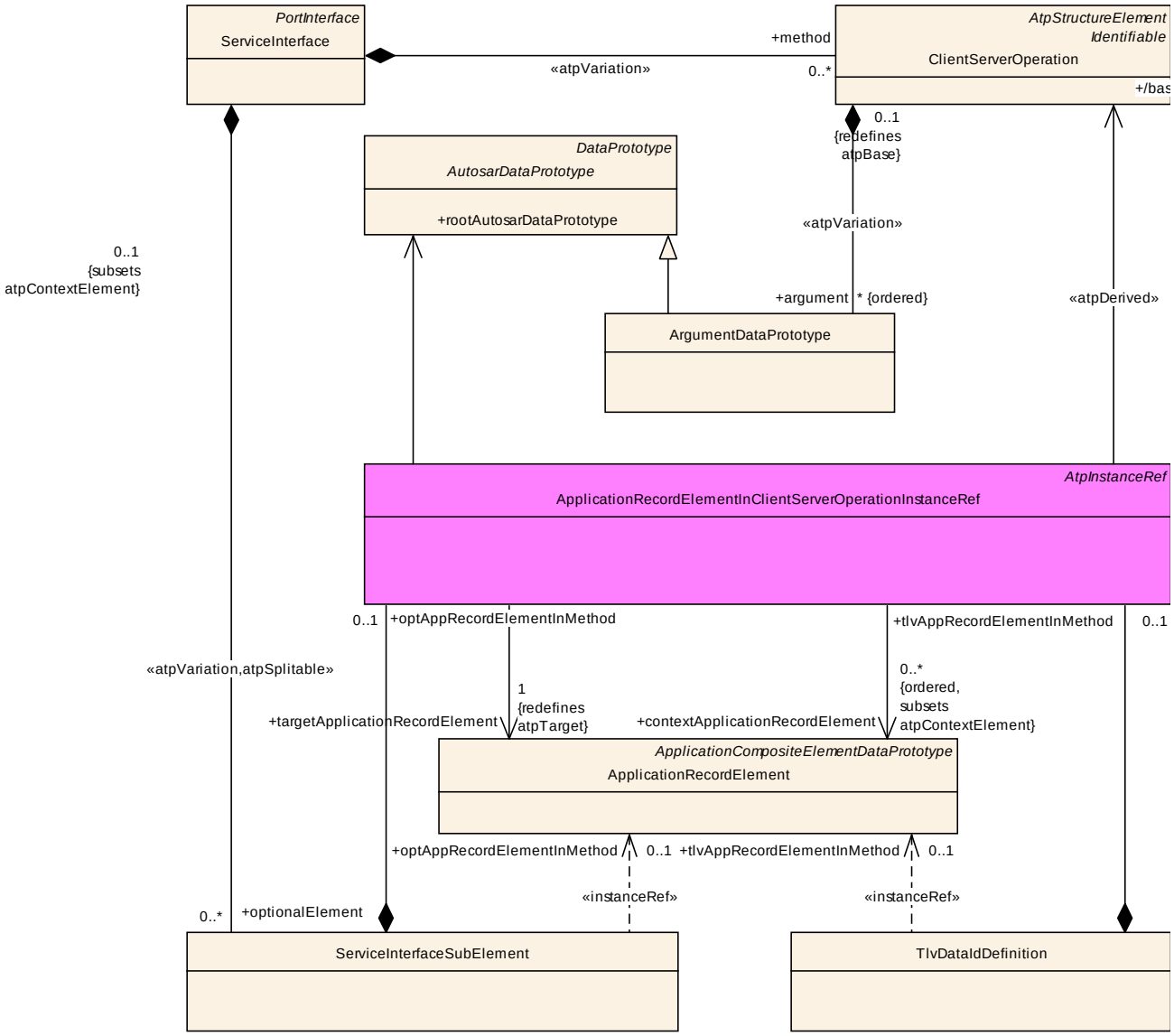


Figure B.13: Modeling of `ApplicationRecordElementInClientServerOperationInstanceRef`

Class	**ApplicationRecordElementInClientServerOperationInstanceRef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::OptionalElementInServiceInterface			
Note	**Tags:** atp.Status=draft			
Base	*ARObject*, *AtpInstanceRef*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
base	ClientServerOperation	0..1	ref	**Stereotypes:** atpDerived **Tags:** atp.Status=draft
contextApplicationRecordElement (ordered)	ApplicationRecordElement	*	ref	**Tags:** atp.Status=draft xml.sequenceOffset=20

rootAutosarDataPrototype	AutosarDataPrototype	0..1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=10
targetApplicationRecordElement	ApplicationRecordElement	1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=30

Table B.10: ApplicationRecordElementInClientServerOperationInstanceRef

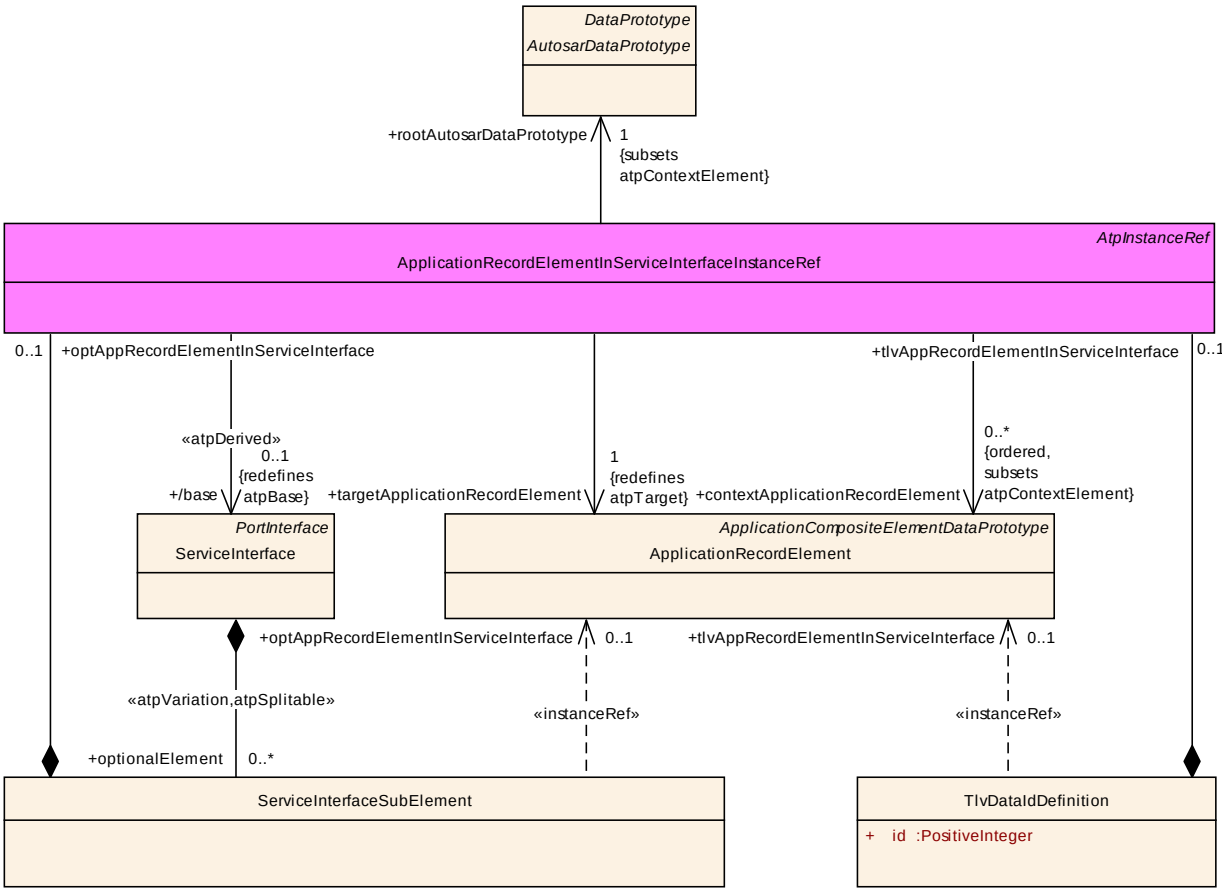


Figure B.14: Modeling of `ApplicationRecordElementInServiceInterfaceInstanceRef`

Class	**ApplicationRecordElementInServiceInterfaceInstanceRef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::OptionalElementInServiceInterface			
Note	This meta-class represents the ability to establish an InstanceRef to an ApplicationRecordElement in the context of an AutosarDataPrototype that is directly or indirectly owned by a ServiceInterface. **Tags:** atp.Status=draft			
Base	*ARObject*, *AtpInstanceRef*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
base	ServiceInterface	0..1	ref	**Stereotypes:** atpDerived **Tags:** atp.Status=draft

contextApplicationRecordElement (ordered)	ApplicationRecordElement	*	ref	This represents the collection of context ApplicationRecordElements. **Tags:** atp.Status=draft xml.sequenceOffset=30
rootAutosarDataPrototype	AutosarDataPrototype	1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=20
targetApplicationRecordElement	ApplicationRecordElement	1	ref	This reference points to the target record element. **Tags:** atp.Status=draft xml.sequenceOffset=40

Table B.11: ApplicationRecordElementInServiceInterfaceInstanceRef

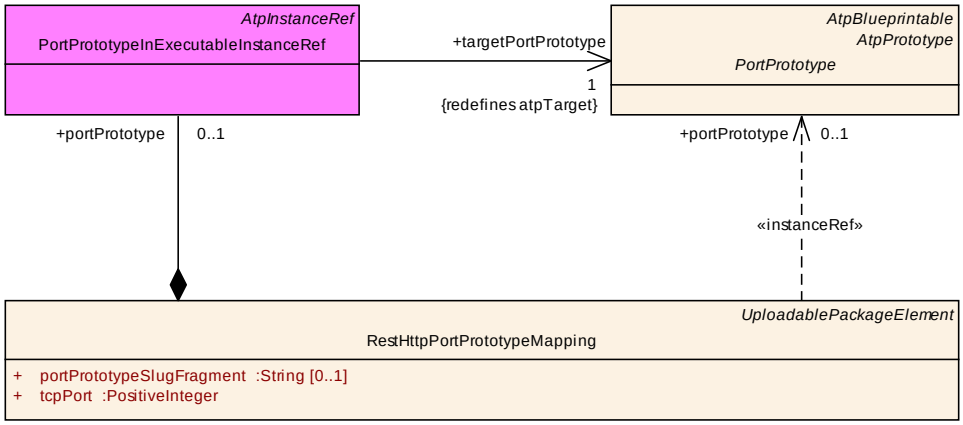


Figure B.15: Modeling of reference `RestHttpPortPrototypeMapping.portPrototype`

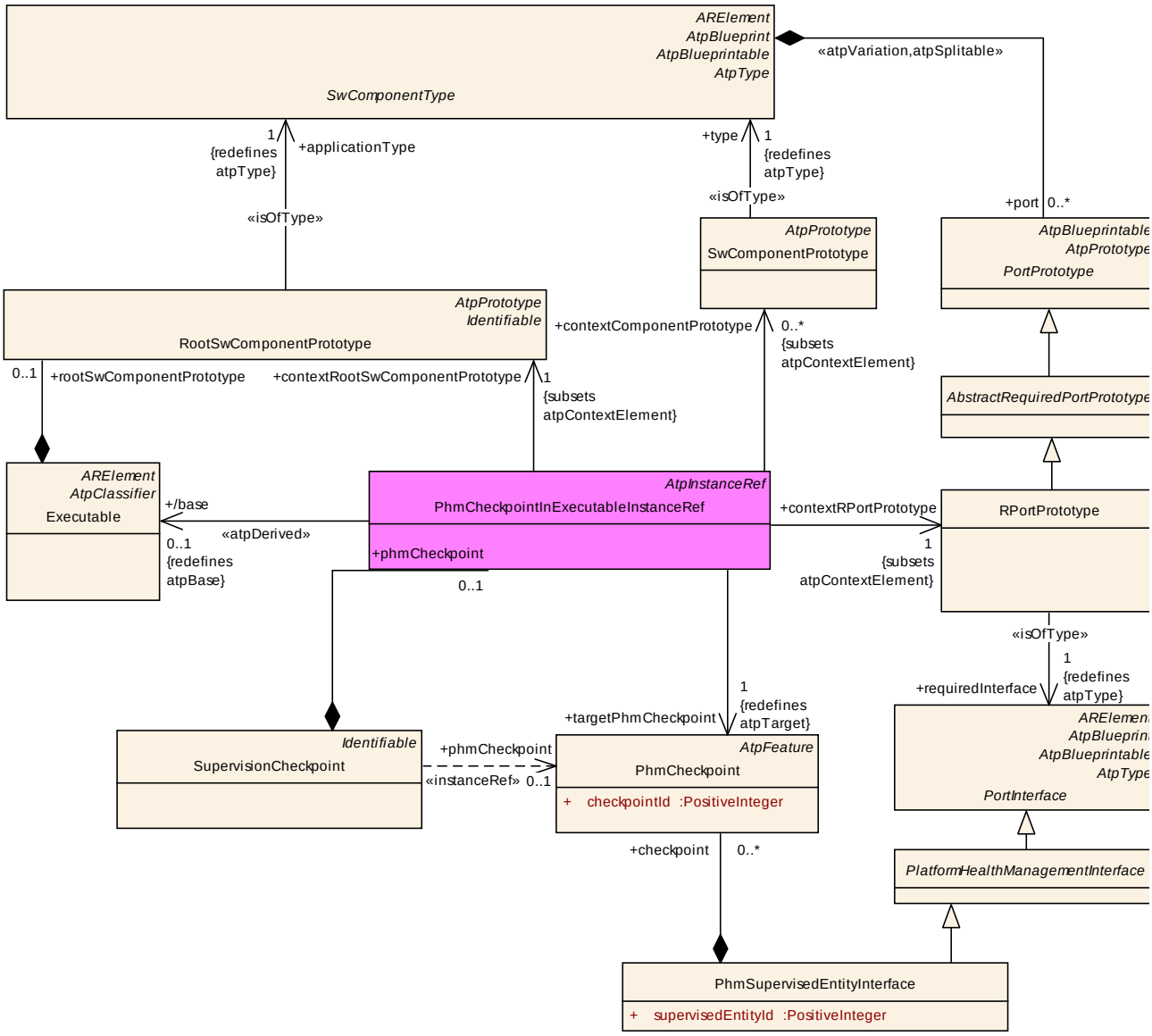


Figure B.16: Modeling of `PhmCheckpointInExecutableInstanceRef`

Class	**PhmCheckpointInExecutableInstanceRef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement::InstanceRefs			
Note	**Tags:** atp.Status=draft			
Base	*ARObject*, *AtpInstanceRef*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
base	Executable	0..1	ref	**Stereotypes:** atpDerived **Tags:** atp.Status=draft xml.sequenceOffset=10
contextComponentPrototype	SwComponentPrototype	*	ref	**Tags:** atp.Status=draft xml.sequenceOffset=30
contextRPortPrototype	RPortPrototype	1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=40

contextRootSwComponentPrototype	RootSwComponentPrototype	1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=20
targetPhmCheckpoint	PhmCheckpoint	1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=50

Table B.12: PhmCheckpointInExecutableInstanceRef

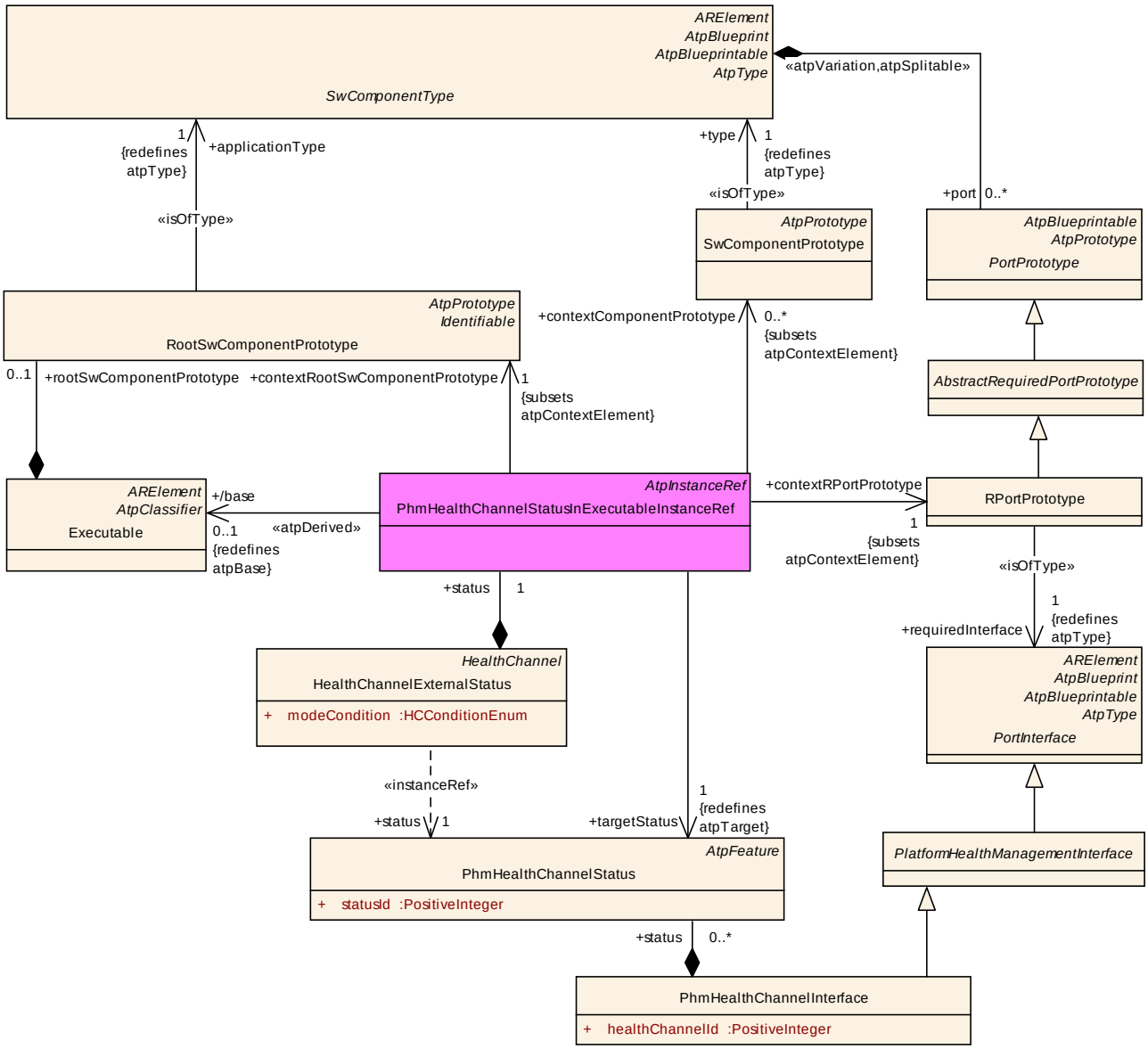


Figure B.17: Modeling of `PhmHealthChannelStatusInExecutableInstanceRef`

Class	**PhmHealthChannelStatusInExecutableInstanceRef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement::InstanceRefs			
Note	**Tags:** atp.Status=draft			
Base	*ARObject*, *AtpInstanceRef*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
base	Executable	0..1	ref	**Stereotypes:** atpDerived **Tags:** atp.Status=draft xml.sequenceOffset=10
contextComponentPrototype	SwComponentPrototype	*	ref	**Tags:** atp.Status=draft xml.sequenceOffset=30
contextRPortPrototype	RPortPrototype	1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=40
contextRootSwComponentPrototype	RootSwComponentPrototype	1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=20
targetStatus	PhmHealthChannelStatus	1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=50

Table B.13: PhmHealthChannelStatusInExecutableInstanceRef

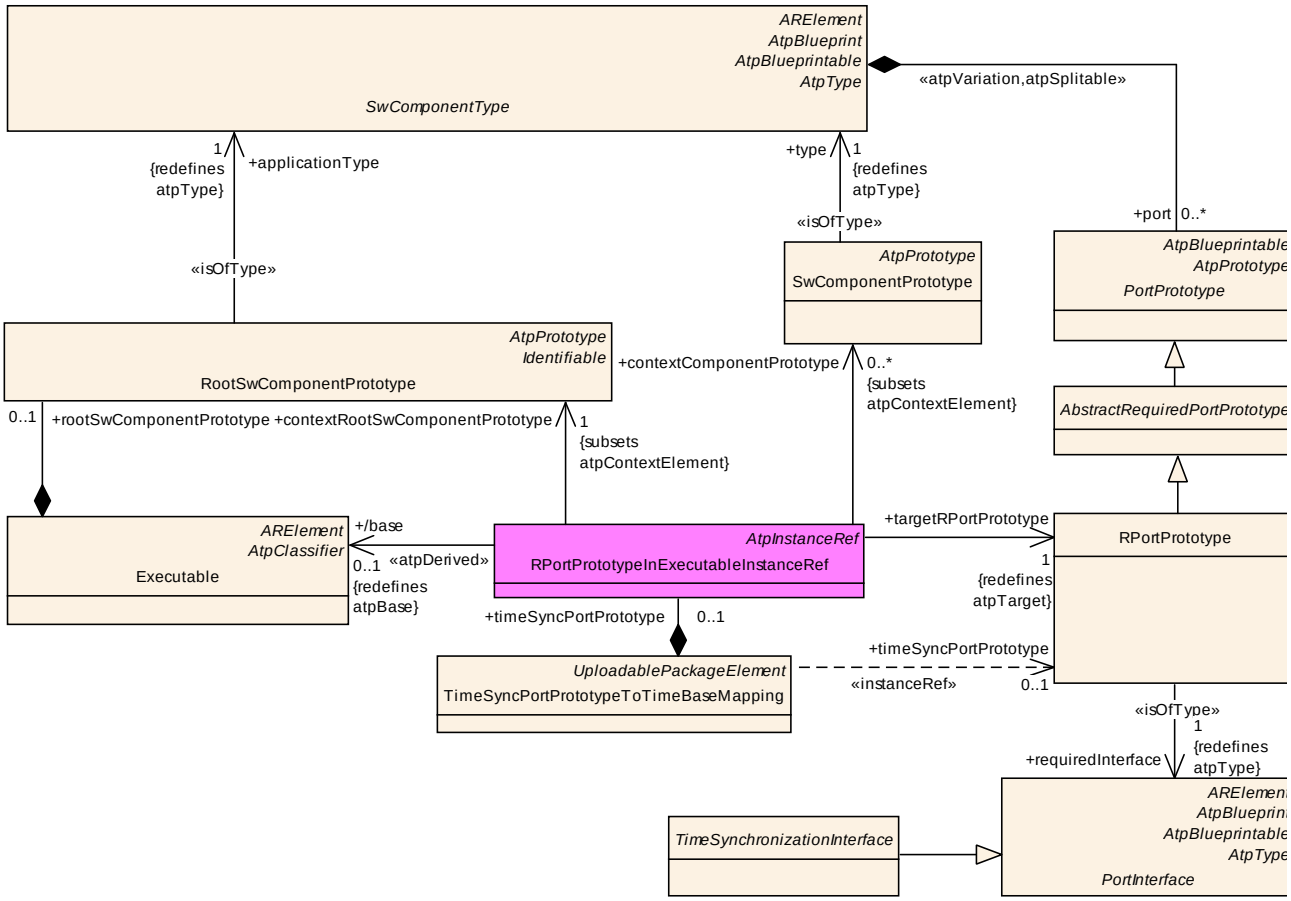


Figure B.18: Modeling of `RPortPrototypeInExecutableInstanceRef`

Class	**RPortPrototypeInExecutableInstanceRef**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::TimeSync::InstanceRefs			
Note	**Tags:** atp.Status=draft			
Base	*ARObject*, *AtpInstanceRef*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
base	Executable	0..1	ref	**Stereotypes:** atpDerived **Tags:** atp.Status=draft xml.sequenceOffset=10
contextComponentPrototype	SwComponentPrototype	*	ref	**Tags:** atp.Status=draft xml.sequenceOffset=30
contextRootSwComponentPrototype	RootSwComponentPrototype	1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=20
targetRPortPrototype	RPortPrototype	1	ref	**Tags:** atp.Status=draft xml.sequenceOffset=40

Table B.14: RPortPrototypeInExecutableInstanceRef

C Mentioned Class Tables

For the sake of completeness, this chapter contains a set of class tables representing meta-classes mentioned in the context of this document but which are not contained directly in the scope of describing specific meta-model semantics.

Class	***ARElement* (abstract)**			
Package	M2::AUTOSARTemplates::GenericStructure::GeneralTemplateClasses::ARPackage			
Note	An element that can be defined stand-alone, i.e. without being part of another element (except for packages of course).			
Base	*ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *Packageable Element*, *Referrable*			
Subclasses	AclObjectSet, AclOperation, AclPermission, AclRole, AliasNameSet, Allocator, ApplicationPartition, *AutosarDataType*, *BaseType*, BlueprintMappingSet, BswEntry RelationshipSet, BswModuleDescription, BswModuleEntry, BuildActionManifest, CalibrationParameterValueSet, ClientIdDefinitionSet, ClientServerInterfaceToBsw ModuleEntryBlueprintMapping, Collection, CompuMethod, ConsistencyNeeds BlueprintSet, ConstantSpecification, ConstantSpecificationMappingSet, CryptoDriver, CryptoNeed, CryptoNeedToPortPrototypeMapping, DataConstr, DataExchangePoint, DataTransformationSet, DataTypeMappingSet, *DiagnosticCommonElement*, DiagnosticConnection, DiagnosticContributionSet, Documentation, EcucDefinition Collection, EcucDestinationUriDefSet, EcucModuleConfigurationValues, EcucModule Def, EcucValueCollection, EndToEndProtectionSet, EvaluatedVariantSet, Executable, ExecutableGroup, FMFeature, FMFeatureMap, FMFeatureModel, FMFeature SelectionSet, FlatMap, GeneralPurposeConnection, HwCategory, HwElement, Hw Type, IPv6ExtHeaderFilterSet, *Implementation*, ImplementationDataTypeElement Extension, ImplementationDataTypeExtension, InterfaceMappingSet, Interpolation RoutineMappingSet, J1939ControllerApplication, KeywordSet, LifeCycleInfoSet, Life CycleStateDefinitionGroup, Machine, McFunction, ModeDeclarationGroup, Mode DeclarationMappingSet, PhmContributionToMachineMapping, PhysicalDimension, PhysicalDimensionMappingSet, *PortInterface*, PortInterfaceMappingSet, Port PrototypeBlueprint, PostBuildVariantCriterion, PostBuildVariantCriterionValueSet, PredefinedVariant, Process, ProcessDesign, RapidPrototypingScenario, SdgDef, SecureComPropsSet, ServiceInstanceToSignalMappingSet, ServiceInterface MappingSet, SoftwareCluster, SoftwareClusterDesign, SomeipDataPrototype TransformationProps, SwAddrMethod, SwAxisType, *SwComponentType*, SwRecord Layout, SwSystemconst, SwSystemconstantValueSet, SwcBswMapping, System, SystemSignal, SystemSignalGroup, TcpOptionFilterSet, *TimingExtension*, TransformationPropsSet, TransformationPropsToServiceInterfaceElementMapping Set, Unit, UnitGroup, *UploadablePackageElement*, ViewMapSet			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table C.1: ARElement

Class	**ARPackage**			
Package	M2::AUTOSARTemplates::GenericStructure::GeneralTemplateClasses::ARPackage			
Note	AUTOSAR package, allowing to create top level packages to structure the contained ARElements. ARPackages are open sets. This means that in a file based description system multiple files can be used to partially describe the contents of a package. This is an extended version of MSR's SW-SYSTEM.			
Base	*ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
arPackage	ARPackage	*	aggr	This represents a sub package within an ARPackage, thus allowing for an unlimited package hierarchy. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=shortName, variationPoint.shortLabel vh.latestBindingTime=blueprintDerivationTime xml.sequenceOffset=30
element	PackageableElement	*	aggr	Elements that are part of this package **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=shortName, variationPoint.shortLabel vh.latestBindingTime=systemDesignTime xml.sequenceOffset=20
referenceBase	ReferenceBase	*	aggr	This denotes the reference bases for the package. This is the basis for all relative references within the package. The base needs to be selected according to the base attribute within the references. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=shortLabel xml.sequenceOffset=10

Table C.2: ARPackage

Class	**Action**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement			
Note	This element defined the Actions and ActionLists for the platform health management. **Tags:** atp.ManifestKind=ApplicationManifest; atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
action	ActionItem	*	aggr	Collection of action items. **Tags:** atp.Status=draft

actionList	ActionList	*	aggr	Collection of action lists. **Tags:** atp.Status=draft

Table C.3: Action

Class	**AdminData**			
Package	M2::MSR::AsamHdo::AdminData			
Note	AdminData represents the ability to express administrative information for an element. This administration information is to be treated as meta-data such as revision id or state of the file. There are basically four kinds of meta-data • The language and/or used languages. • Revision information covering e.g. revision number, state, release date, changes. Note that this information can be given in general as well as related to a particular company. • Document meta-data specific for a company			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
docRevision (ordered)	DocRevision	*	aggr	This allows to denote information about the current revision of the object. Note that information about previous revisions can also be logged here. The entries shall be sorted descendant by date in order to reflect the history. Therefore the most recent entry representing the current version is denoted first. **Tags:** xml.roleElement=true; xml.roleWrapper Element=true; xml.sequenceOffset=50; xml.type Element=false; xml.typeWrapperElement=false
language	LEnum	0..1	attr	This attribute specifies the master language of the document or the document fragment. The master language is the one in which the document is maintained and from which the other languages are derived from. In particular in case of inconsistencies, the information in the master language is priority. **Tags:** xml.sequenceOffset=20
sdg	Sdg	*	aggr	This property allows to keep special data which is not represented by the standard model. It can be utilized to keep e.g. tool specific data. **Tags:** xml.roleElement=true; xml.roleWrapper Element=true; xml.sequenceOffset=60; xml.type Element=false; xml.typeWrapperElement=false

usedLanguages	MultiLanguagePlainText	0..1	aggr	This property specifies the languages which are provided in the document. Therefore it should only be specified in the top level admin data. For each language provided in the document there is one entry in MultilanguagePlainText. The content of each entry can be used for illustration of the language. The used language itself depends on the language attribute in the entry. **Tags:** xml.sequenceOffset=30

Table C.4: AdminData

Class	**ApplicationArrayElement**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Datatype::DataPrototypes			
Note	Describes the properties of the elements of an application array data type.			
Base	*ARObject*, *ApplicationCompositeElementDataPrototype*, *AtpFeature*, *AtpPrototype*, *DataPrototype*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
arraySizeHandling	ArraySizeHandlingEnum	0..1	attr	The way how the size of the array is handled.
arraySizeSemantics	ArraySizeSemanticsEnum	0..1	attr	This attribute controls how the information about the array size shall be interpreted.
indexDataType	ApplicationPrimitiveDataType	0..1	ref	This reference can be taken to assign a CompuMethod of category TEXTTABLE to the array. The texttable entries associate a textual value to an index number such that the element with that index number is represented by a symbolic name.
maxNumberOfElements	PositiveInteger	0..1	attr	The maximum number of elements that the array can contain. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=preCompileTime

Table C.5: ApplicationArrayElement

Class	***ApplicationCompositeDataType*** **(abstract)**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Datatype::Datatypes			
Note	Abstract base class for all application data types composed of other data types.			
Base	*ARElement*, *ARObject*, *ApplicationDataType*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *AutosarDataType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Subclasses	ApplicationArrayDataType, ApplicationAssocMapDataType, ApplicationRecordDataType			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table C.6: ApplicationCompositeDataType

Class	**ApplicationRecordDataType**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Datatype::Datatypes			
Note	An application data type which can be decomposed into prototypes of other application data types. **Tags:** atp.recommendedPackage=ApplicationDataTypes			
Base	*ARElement*, *ARObject*, *ApplicationCompositeDataType*, *ApplicationDataType*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *AutosarDataType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
element (ordered)	ApplicationRecordElement	1..*	aggr	Specifies an element of a record. The aggregation of ApplicationRecordElement is subject to variability with the purpose to support the conditional existence of elements inside a ApplicationrecordDataType. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=preCompileTime

Table C.7: ApplicationRecordDataType

Class	**ApplicationRuleBasedValueSpecification**			
Package	M2::AUTOSARTemplates::CommonStructure::Constants			
Note	This meta-class represents rule based values for DataPrototypes typed by ApplicationDataTypes (ApplicationArrayDataType or a compound ApplicationPrimitiveDataType which also boils down to an array-nature).			
Base	*ARObject*, *AbstractRuleBasedValueSpecification*, *ValueSpecification*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
category	Identifier	1	attr	This represents the category of the RuleBasedValueSpecification **Tags:** xml.sequenceOffset=-20
swAxisCont (ordered)	RuleBasedAxisCont	*	aggr	This represents the axis values of a Compound Primitive Data Type (curve or map). The first swAxisCont describes the x-axis, the second swAxisCont describes the y-axis, the third swAxisCont describes the z-axis. In addition to this, the axis can be denoted in swAxisIndex.
swValueCont	RuleBasedValueCont	0..1	aggr	This represents the values of an array or Compound Primitive Data Type.

Table C.8: ApplicationRuleBasedValueSpecification

Class	**ApplicationSwComponentType**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Components			
Note	The ApplicationSwComponentType is used to represent the application software. **Tags:** atp.recommendedPackage=SwComponentTypes			
Base	*ARElement*, *ARObject*, *AtomicSwComponentType*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *SwComponentType*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table C.9: ApplicationSwComponentType

Class	**ApplicationValueSpecification**			
Package	M2::AUTOSARTemplates::CommonStructure::Constants			
Note	This meta-class represents values for DataPrototypes typed by ApplicationDataTypes (this includes in particular compound primitives). For further details refer to ASAM CDF 2.0. This meta-class corresponds to some extent with SW-INSTANCE in ASAM CDF 2.0.			
Base	*ARObject*, *ValueSpecification*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
category	Identifier	1	attr	Specifies to which category of ApplicationDataType this ApplicationValueSpecification can be applied (e.g. as an initial value), thus imposing constraints on the structure and semantics of the contained values, see [constr_1006] and [constr_2051].
swAxisCont (ordered)	SwAxisCont	*	aggr	This represents the axis values of a Compound Primitive Data Type (curve or map). The first swAxisCont describes the x-axis, the second swAxisCont describes the y-axis, the third swAxisCont describes the z-axis. In addition to this, the axis can be denoted in swAxisIndex.
swValueCont	SwValueCont	0..1	aggr	This represents the values of a Compound Primitive Data Type.

Table C.10: ApplicationValueSpecification

Class	**ArrayValueSpecification**			
Package	M2::AUTOSARTemplates::CommonStructure::Constants			
Note	Specifies the values for an array.			
Base	*ARObject*, *CompositeValueSpecification*, *ValueSpecification*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

element (ordered)	ValueSpecification	1..*	aggr	The value for a single array element. All ValueSpecifications aggregated by ArrayValueSpecification shall have the same structure. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=preCompileTime

Table C.11: ArrayValueSpecification

Class	**AssemblySwConnector**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Composition			
Note	AssemblySwConnectors are exclusively used to connect SwComponentPrototypes in the context of a CompositionSwComponentType.			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*, *SwConnector*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
provider	AbstractProvidedPortPrototype	0..1	iref	Instance of providing port.
requester	AbstractRequiredPortPrototype	0..1	iref	Instance of requiring port.

Table C.12: AssemblySwConnector

Class	***AtomicSwComponentType* (abstract)**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Components			
Note	An atomic software component is atomic in the sense that it cannot be further decomposed and distributed across multiple ECUs.			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *SwComponentType*			
Subclasses	ApplicationSwComponentType, ComplexDeviceDriverSwComponentType, EcuAbstractionSwComponentType, NvBlockSwComponentType, SensorActuatorSwComponentType, ServiceProxySwComponentType, ServiceSwComponentType			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
internalBehavior	SwcInternalBehavior	0..1	aggr	The SwcInternalBehaviors owned by an AtomicSwComponentType can be located in a different physical file. Therefore the aggregation is «atpSplitable». **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=internalBehavior, variationPoint.shortLabel vh.latestBindingTime=preCompileTime

symbolProps	SymbolProps	0..1	aggr	This represents the SymbolProps for the AtomicSwComponentType. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=shortName

Table C.13: AtomicSwComponentType

Class	***AtpInstanceRef* (abstract)**			
Package	M2::AUTOSARTemplates::GenericStructure::AbstractStructure			
Note	An M0 instance of a classifier may be represented as a tree rooted at that instance, where under each node come the sub-trees representing the instances which act as features under that node. An instance ref specifies a navigation path from any M0 tree-instance of the base (which is a classifier) to a leaf (which is an instance of the target).			
Base	*ARObject*			
Subclasses	AnyInstanceRef, ApplicationCompositeElementInPortInterfaceInstanceRef, ApplicationDataPrototypeInSystemInstanceRef, ApplicationRecordElementInClientServerOperationInstanceRef, ApplicationRecordElementInServiceInterfaceInstanceRef, ComponentInCompositionInstanceRef, ComponentInSystemInstanceRef, DataPrototypeInExecutableInstanceRef, DataPrototypeInSwComponentTypeInstanceRef, DataPrototypeInSystemInstanceRef, InnerDataPrototypeGroupInCompositionInstanceRef, InnerPortGroupInCompositionInstanceRef, InnerRunnableEntityGroupInCompositionInstanceRef, InstanceEventInCompositionInstanceRef, *ModeGroupInAtomicSwcInstanceRef*, ModeInBswModuleDescriptionInstanceRef, ModeInMachineInstanceRef, ModeInProcessInstanceRef, ModeInSwcInstanceRef, OperationArgumentInComponentInstanceRef, *OperationInAtomicSwcInstanceRef*, OperationInSystemInstanceRef, PModeInSystemInstanceRef, ParameterInAtomicSWCTypeInstanceRef, PhmCheckpointInExecutableInstanceRef, PhmHealthChannelStatusInExecutableInstanceRef, PortGroupInSystemInstanceRef, *PortInCompositionTypeInstanceRef*, PortPrototypeInExecutableInstanceRef, RModeInAtomicSwcInstanceRef, RPortPrototypeInExecutableInstanceRef, RteEventInEcuInstanceRef, RunnableEntityInCompositionInstanceRef, SwcServiceDependencyInExecutableInstanceRef, SwcServiceDependencyInSystemInstanceRef, *TriggerInAtomicSwcInstanceRef*, TriggerInSystemInstanceRef, VariableAccessInEcuInstanceRef, VariableDataPrototypeInCompositionInstanceRef, VariableDataPrototypeInSystemInstanceRef, VariableInAtomicSWCTypeInstanceRef, *VariableInAtomicSwcInstanceRef*, VariableInComponentInstanceRef			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
atpBase	AtpClassifier	1	ref	This is the base from which the navigaion path starts. **Stereotypes:** atpAbstract; atpDerived
atpContextElement (ordered)	AtpPrototype	*	ref	This is one particular step in the navigation path. **Stereotypes:** atpAbstract
atpTarget	AtpFeature	1	ref	This is the target of the instance ref. In other words it is the terminal of the navigation path. **Stereotypes:** atpAbstract

Table C.14: AtpInstanceRef

Class	***AutosarDataPrototype* (abstract)**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Datatype::DataPrototypes			
Note	Base class for prototypical roles of an AutosarDataType.			
Base	*ARObject*, *AtpFeature*, *AtpPrototype*, *DataPrototype*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	ArgumentDataPrototype, Field, ParameterDataPrototype, PersistencyDataElement, VariableDataPrototype			
Attribute	**Type**	**Mul.**	**Kind**	**Note**
type	AutosarDataType	1	tref	This represents the corresponding data type. **Stereotypes:** isOfType

Table C.15: AutosarDataPrototype

Class	***AutosarDataType* (abstract)**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Datatype::Datatypes			
Note	Abstract base class for user defined AUTOSAR data types for ECU software.			
Base	*ARElement*, *ARObject*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Subclasses	*AbstractImplementationDataType*, *ApplicationDataType*			
Attribute	**Type**	**Mul.**	**Kind**	**Note**
swDataDefProps	SwDataDefProps	0..1	aggr	The properties of this AutosarDataType.

Table C.16: AutosarDataType

Class	***BaseType* (abstract)**			
Package	M2::MSR::AsamHdo::BaseTypes			
Note	This abstract meta-class represents the ability to specify a platform dependant base type.			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Subclasses	SwBaseType			
Attribute	**Type**	**Mul.**	**Kind**	**Note**
baseTypeDefinition	BaseTypeDefinition	1	aggr	This is the actual definition of the base type. **Tags:** xml.roleElement=false; xml.roleWrapperElement=false; xml.sequenceOffset=20; xml.typeElement=false; xml.typeWrapperElement=false

Table C.17: BaseType

Class	**ClientServerInterface**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::PortInterface			
Note	A client/server interface declares a number of operations that can be invoked on a server by a client. **Tags:** atp.recommendedPackage=PortInterfaces			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *PortInterface*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
operation	ClientServerOperation	1..*	aggr	ClientServerOperation(s) of this ClientServerInterface. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=blueprintDerivationTime
possibleError	ApplicationError	*	aggr	Application errors that are defined as part of this interface.

Table C.18: ClientServerInterface

Class	**CompuConst**			
Package	M2::MSR::AsamHdo::ComputationMethod			
Note	This meta-class represents the fact that the value of a computation method scale is constant.			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
compuConstContentType	CompuConstContent	1	aggr	This is the actual content of the constant compu method scale. **Tags:** xml.roleElement=false; xml.roleWrapperElement=false; xml.sequenceOffset=10; xml.typeElement=false; xml.typeWrapperElement=false

Table C.19: CompuConst

Class	**CompuConstTextContent**			
Package	M2::MSR::AsamHdo::ComputationMethod			
Note	This meta-class represents the textual content of a scale.			
Base	*ARObject*, *CompuConstContent*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
vt	VerbatimString	1	attr	This represents a textual constant in the computation method.

Table C.20: CompuConstTextContent

Class	**CompuMethod**			
Package	M2::MSR::AsamHdo::ComputationMethod			
Note	This meta-class represents the ability to express the relationship between a physical value and the mathematical representation. Note that this is still independent of the technical implementation in data types. It only specifies the formula how the internal value corresponds to its physical pendant. **Tags:** atp.recommendedPackage=CompuMethods			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
compuInternalToPhys	Compu	0..1	aggr	This specifies the computation from internal values to physical values. **Tags:** xml.sequenceOffset=80
compuPhysToInternal	Compu	0..1	aggr	This represents the computation from physical values to the internal values. **Tags:** xml.sequenceOffset=90
displayFormat	DisplayFormatString	0..1	attr	This property specifies, how the physical value shall be displayed e.g. in documents or measurement and calibration tools. **Tags:** xml.sequenceOffset=20
unit	Unit	0..1	ref	This is the physical unit of the Physical values for which the CompuMethod applies. **Tags:** xml.sequenceOffset=30

Table C.21: CompuMethod

Class	**CompuScale**			
Package	M2::MSR::AsamHdo::ComputationMethod			
Note	This meta-class represents the ability to specify one segment of a segmented computation method.			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
desc	MultiLanguageOverviewParagraph	0..1	aggr	<desc> represents a general but brief description of the object in question. **Tags:** xml.sequenceOffset=30
compuInverseValue	CompuConst	0..1	aggr	This is the inverse value of the constraint. This supports the case that the scale is not reversible per se. **Tags:** xml.sequenceOffset=60

compuScaleContents	CompuScaleContents	0..1	aggr	This represents the computation details of the scale. **Tags:** xml.roleElement=false; xml.roleWrapperElement=false; xml.sequenceOffset=70; xml.typeElement=false; xml.typeWrapperElement=false
lowerLimit	Limit	0..1	attr	This specifies the lower limit of the scale. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=preCompileTime xml.sequenceOffset=40
mask	PositiveInteger	0..1	attr	In difference to all the other computational methods every COMPU-SCALE will be applied including the bit MASK. Therefore it is allowed for this type of COMPU-METHOD, that COMPU-SCALES overlap. To calculate the string reverse to a value, the string has to be split and the according value for each substring has to be summed up. The sum is finally transmitted. The processing has to be done in order of the COMPU-SCALE elements. **Tags:** xml.sequenceOffset=35
shortLabel	Identifier	0..1	attr	This element specifies a short name for the particular scale. The name can for example be used to derive a programming language identifier. **Tags:** xml.sequenceOffset=20
symbol	CIdentifier	0..1	attr	The symbol, if provided, is used by code generators to get a C identifier for the CompuScale. The name will be used as is for the code generation, therefore it needs to be unique within the generation context. **Tags:** xml.sequenceOffset=25
upperLimit	Limit	0..1	attr	This specifies the upper limit of a of the scale. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=preCompileTime xml.sequenceOffset=50

Table C.22: CompuScale

Class	**ConstantReference**			
Package	M2::AUTOSARTemplates::CommonStructure::Constants			
Note	Instead of defining this value inline, a constant is referenced.			
Base	*ARObject*, *ValueSpecification*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

constant	ConstantSpecification	1	ref	The referenced constant.

Table C.23: ConstantReference

Class	**DataConstr**			
Package	M2::MSR::AsamHdo::Constraints::GlobalConstraints			
Note	This meta-class represents the ability to specify constraints on data. **Tags:** atp.recommendedPackage=DataConstrs			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dataConstrRule	DataConstrRule	*	aggr	This is one particular rule within the data constraints. **Tags:** xml.roleElement=true; xml.roleWrapperElement=true; xml.sequenceOffset=30; xml.typeElement=false; xml.typeWrapperElement=false

Table C.24: DataConstr

Class	**DataConstrRule**			
Package	M2::MSR::AsamHdo::Constraints::GlobalConstraints			
Note	This meta-class represents the ability to express one specific data constraint rule.			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
constrLevel	Integer	0..1	attr	This attribute describes the category of a constraint. One of its functions is in the area of constraint violation, where it can be used from a certain level, to produce error messages. The lower the level, the more stringent the check. Used to distinguish hard or soft limits. **Tags:** xml.sequenceOffset=20
internalConstrs	InternalConstrs	0..1	aggr	Describes the limitations applicable on the internal domain (as opposed to the physical domain). **Tags:** xml.sequenceOffset=40
physConstrs	PhysConstrs	0..1	aggr	Describes the limitations applicable on the physical domain (as opposed to the internal domain). **Tags:** xml.sequenceOffset=30

Table C.25: DataConstrRule

Class	***DataPrototype* (abstract)**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Datatype::DataPrototypes			
Note	Base class for prototypical roles of any data type.			
Base	*ARObject*, *AtpFeature*, *AtpPrototype*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	*ApplicationCompositeElementDataPrototype*, *AutosarDataPrototype*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
swDataDefProps	SwDataDefProps	0..1	aggr	This property allows to specify data definition properties which apply on data prototype level.

Table C.26: DataPrototype

Class	**DiagnosticContributionSet**			
Package	M2::AUTOSARTemplates::DiagnosticExtract::DiagnosticContribution			
Note	This meta-class represents a root node of a diagnostic extract. It bundles a given set of diagnostic model elements. The granularity of the DiagonsticContributionSet is arbitrary in order to support the aspect of decentralized configuration, i.e. different contributors can come up with an own DiagnosticContributionSet. **Tags:** atp.recommendedPackage=DiagnosticContributionSets			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
commonProperties	DiagnosticCommonProps	0..1	aggr	This attribute represents a collection of diagnostic properties that are shared among the entire DiagnosticContributionSet. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=commonProperties
element	DiagnosticCommonElement	*	ref	This represents a DiagnosticCommonElement considered in the context of the DiagnosticContributionSet **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=element, variationPoint.shortLabel vh.latestBindingTime=postBuild
serviceTable	DiagnosticServiceTable	*	ref	This represents the collection of DiagnosticServiceTables to be considered in the scope of this DiagnosticContributionSet. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=serviceTable, variationPoint.shortLabel vh.latestBindingTime=postBuild

Table C.27: DiagnosticContributionSet

Class	***DiagnosticDataByIdentifier* (abstract)**			
Package	M2::AUTOSARTemplates::DiagnosticExtract::Dcm::DiagnosticService::DataBy Identifier			
Note	This represents an abstract base class for all diagnostic services that access data by identifier.			
Base	*ARElement*, *ARObject*, *CollectableElement*, *DiagnosticCommonElement*, *Diagnostic ServiceInstance*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Subclasses	DiagnosticReadDataByIdentifier, DiagnosticWriteDataByIdentifier			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dataIdentifie r	DiagnosticAbst ractDataIdentifi er	1	ref	This represents the linked DiagnosticDataIdentifier.

Table C.28: DiagnosticDataByIdentifier

Class	**DiagnosticReadDataByIdentifier**			
Package	M2::AUTOSARTemplates::DiagnosticExtract::Dcm::DiagnosticService::DataBy Identifier			
Note	This represents an instance of the "Read Data by Identifier" diagnostic service. **Tags:** atp.recommendedPackage=DiagnosticDataByIdentifiers			
Base	*ARElement*, *ARObject*, *CollectableElement*, *DiagnosticCommonElement*, *Diagnostic DataByIdentifier*, *DiagnosticServiceInstance*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
readClass	DiagnosticRea dDataByIdentifi erClass	1	ref	This reference substantiates that abstract reference in the role serviceClass for this specific concrete class. Thereby, the reference represents the ability to access shared attributes among all DiagnosticReadDataByIdentifier in the given context.

Table C.29: DiagnosticReadDataByIdentifier

Class	***DiagnosticServiceInstance* (abstract)**			
Package	M2::AUTOSARTemplates::DiagnosticExtract::Dcm::DiagnosticService::Common Service			
Note	This represents a concrete instance of a diagnostic service.			
Base	*ARElement*, *ARObject*, *CollectableElement*, *DiagnosticCommonElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Subclasses	DiagnosticClearDiagnosticInformation, DiagnosticClearResetEmissionRelatedInfo, DiagnosticComControl, DiagnosticControlDTCSetting, *DiagnosticDataByIdentifier*, DiagnosticDynamicallyDefineDataIdentifier, DiagnosticEcuReset, DiagnosticIO Control, *DiagnosticMemoryByAddress*, DiagnosticReadDTCInformation, Diagnostic ReadDataByPeriodicID, DiagnosticRequestControlOfOnBoardDevice, Diagnostic RequestCurrentPowertrainData, DiagnosticRequestEmissionRelatedDTC, Diagnostic RequestEmissionRelatedDTCPermanentStatus, DiagnosticRequestFileTransfer, DiagnosticRequestOnBoardMonitoringTestResults, DiagnosticRequestPowertrain FreezeFrameData, DiagnosticRequestVehicleInfo, DiagnosticResponseOnEvent, DiagnosticRoutineControl, DiagnosticSecurityAccess, DiagnosticSessionControl			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
accessPermission	DiagnosticAccessPermission	0..1	ref	This represents the collection of DiagnosticAccessPermissions that allow for the execution of the referencing DiagnosticServiceInstance..
serviceClass	DiagnosticServiceClass	0..1	ref	This represents the corresponding "class", i.e. this meta-class provides properties that are shared among all instances of applicable sub-classes of DiagnosticServiceInstance. The subclasses that affected by this pattern implement references to the applicable "class"-role that substantiate this abstract reference. **Stereotypes:** atpAbstract

Table C.30: DiagnosticServiceInstance

Class	**DiagnosticWriteDataByIdentifier**			
Package	M2::AUTOSARTemplates::DiagnosticExtract::Dcm::DiagnosticService::DataBy Identifier			
Note	This represents an instance of the "Write Data by Identifier" diagnostic service. **Tags:** atp.recommendedPackage=DiagnosticDataByIdentifiers			
Base	*ARElement*, *ARObject*, *CollectableElement*, *DiagnosticCommonElement*, *Diagnostic DataByIdentifier*, *DiagnosticServiceInstance*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
writeClass	DiagnosticWriteDataByIdentifierClass	1	ref	This reference substantiates that abstract reference in the role serviceClass for this specific concrete class. Thereby, the reference represents the ability to access shared attributes among all DiagnosticWriteDataByIdentifier in the given context.

Table C.31: DiagnosticWriteDataByIdentifier

Class	**DoIpInstantiation**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::AdaptiveModule Implementation			
Note	This meta-class defines the attributes for the DoIP configuration on a specific machine. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *AdaptiveModuleInstantiation*, *Identifiable*, *MultilanguageReferrable*, *Non OsModuleInstantiation*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
networkConfiguration	NetworkConfiguration	*	aggr	Network configuration for transmission of DoIP messages. **Tags:** atp.Status=draft

Table C.32: DoIpInstantiation

Class	**EcuInstance**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::FibexCore::CoreTopology			
Note	ECUInstances are used to define the ECUs used in the topology. The type of the ECU is defined by a reference to an ECU specified with the ECU resource description. **Tags:** atp.recommendedPackage=EcuInstances			
Base	*ARObject*, *CollectableElement*, *FibexElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
associatedComIPduGroup	ISignalIPduGroup	*	ref	With this reference it is possible to identify which ISignalIPduGroups are applicable for which CommunicationConnector/ ECU. Only top level ISignalIPduGroups shall be referenced by an EcuInstance. If an ISignalIPduGroup contains other ISignalIPduGroups than these contained ISignalIPduGroups shall not be referenced by the EcuInstance. Contained ISignalIPduGroups are associated to an EcuInstance via the top level ISignalIPduGroup.
associatedPdurIPduGroup	PdurIPduGroup	*	ref	With this reference it is possible to identify which PduR IPdu Groups are applicable for which CommunicationConnector/ ECU.
clientIdRange	ClientIdRange	0..1	aggr	Restriction of the Client Identifier for this Ecu to an allowed range of numerical values. The Client Identifier of the transaction handle is generated by the client RTE for inter-Ecu Client/Server communication.

comConfigurationGwTimeBase	TimeValue	0..1	attr	The period between successive calls to Com_MainFunctionRouteSignals of the AUTOSAR COM module in seconds.
comConfigurationRxTimeBase	TimeValue	0..1	attr	The period between successive calls to Com_MainFunctionRx of the AUTOSAR COM module in seconds.
comConfigurationTxTimeBase	TimeValue	0..1	attr	The period between successive calls to Com_MainFunctionTx of the AUTOSAR COM module in seconds.
comEnableMDTForCyclicTransmission	Boolean	0..1	attr	Enables for the Com module of this EcuInstance the minimum delay time monitoring for cyclic and repeated transmissions (TransmissionModeTiming has cyclicTiming assigned or eventControlledTiming with numberOfRepetitions > 0).
commController	CommunicationController	1..*	aggr	CommunicationControllers of the ECU.
connector	CommunicationConnector	*	aggr	All channels controlled by a single controller.
diagnosticAddress	Integer	0..1	attr	An ECU specific ID for responses of diagnostic routines.
diagnosticProps	DiagnosticEcuProps	0..1	aggr	This represents the diagnostic-related properties of an entire ECU. **Tags:** atp.Status=obsolete
ethSwitchPortGroupDerivation	Boolean	0..1	attr	Defines whether the derivation of SwitchPortGroups based on VLAN and/or CouplingPort.pncMapping shall be performed for this EcuInstance. If not defined the derivation shall not be done.
partition	EcuPartition	*	aggr	Optional definition of Partitions within an Ecu.
pnResetTime	TimeValue	0..1	attr	Specifies the runtime of the reset timer in seconds. This reset time is valid for the reset of PN requests in the EIRA and in the ERA.
pncPrepareSleepTimer	TimeValue	0..1	attr	Time in seconds the PNC state machine shall wait in PNC_PREPARE_SLEEP.
sleepModeSupported	Boolean	1	attr	Specifies whether the ECU instance may be put to a "low power mode" • true: sleep mode is supported • false: sleep mode is not supported Note: This flag may only be set to "true" if the feature is supported by both hardware and basic software.
v2xSupported	V2xSupportEnum	0..1	attr	This attribute is used to control the existence of the V2X stack on the given EcuInstance.
wakeUpOverBusSupported	Boolean	1	attr	Driver support for wakeup over Bus.

Table C.33: EcuInstance

Class	**EthernetNetworkConfiguration**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::AdaptiveModule Implementation			
Note	This meta-class defines the attributes for the configuration of a port, protocol type and IP address of the communication on a VLAN. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *NetworkConfiguration*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
communicationConnector	EthernetCommunicationConnector	0..1	ref	Reference to the CommunicationConnector (VLAN) for which the network configuration is defined. **Tags:** atp.Status=draft
ipv4MulticastIpAddress	Ip4AddressString	0..1	attr	Multicast IPv4 Address to which the message will be transmitted.
ipv6MulticastIpAddress	Ip6AddressString	0..1	attr	Multicast IPv6 Address to which the message will be transmitted.
tcpPort	PositiveInteger	0..1	attr	This attribute allows to configure a tcp port number.
udpNmCluster	UdpNmCluster	0..1	ref	Reference to UdpNm cluster specific configuration settings. **Tags:** atp.Status=draft
udpPort	PositiveInteger	0..1	attr	This attribute allows to configure a udp port number.

Table C.34: EthernetNetworkConfiguration

Class	**EthernetPhysicalChannel**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::Fibex4Ethernet::EthernetTopology			
Note	The EthernetPhysicalChannel represents a VLAN or an untagged channel. An untagged channel is modeled as an EthernetPhysicalChannel without an aggregated VLAN. **Tags:** atp.ManifestKind=MachineManifest			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *PhysicalChannel*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
networkEndpoint	NetworkEndpoint	*	aggr	Collection of NetworkEndpoints that are used in the VLan. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=shortName
soAdConfig	SoAdConfig	0..1	aggr	SoAd Configuration for one specific Physical Channel.

vlan	VlanConfig	0..1	aggr	VLAN Configuration.

Table C.35: EthernetPhysicalChannel

Class	***FibexElement* (abstract)**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::FibexCore			
Note	ASAM FIBEX elements specifying Communication and Topology.			
Base	*ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *Packageable Element*, *Referrable*			
Subclasses	*CommunicationCluster*, CouplingElement, EcuInstance, *Frame*, Gateway, Global TimeDomain, ISignal, ISignalGroup, ISignalIPduGroup, MachineDesign, NmConfig, *Pdu*, PdurIPduGroup, SecureCommunicationPropsSet, SoAdRoutingGroup, *Tp Config*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table C.36: FibexElement

Class	**GlobalTimeDomain**			
Package	M2::AUTOSARTemplates::SystemTemplate::GlobalTime			
Note	This represents the ability to define a global time domain. **Tags:** atp.recommendedPackage=GlobalTimeDomains			
Base	*ARObject*, *CollectableElement*, *FibexElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
debounceTime	TimeValue	0..1	attr	Defines the minimum amount of time between two time sync messages are transmitted.
domainId	PositiveInteger	1	attr	This represents the ID of the GlobalTimeDomain used in the network messages sent on behalf of global time management.
gateway	GlobalTimeGateway	*	aggr	A GlobalTimeGateway may exist in the context of a GlobalTimeDomain to actively update the global time information as it is routed from one GlobalTimeDomain to another.
globalTimeDomainProps	AbstractGlobalTimeDomainProps	0..1	aggr	Additional properties of the GlobalTimeDomain
master	GlobalTimeMaster	0..1	aggr	This represents the single master of a GlobalTimeDomain. A GlobalTimeDomain may have no GlobalTimeDomain.master, e.g. when it gets its time from a GPS receiver.
offsetTimeDomain	GlobalTimeDomain	0..1	ref	Reference to a synchronized time domain this offset time domain is based on. The reference source is the offset time domain. The reference target is the synchronized time domain.

slave	GlobalTimeSlave	*	aggr	This represents the collections of slaves of the GlobalTimeDomain. A GlobalTimeDomain may have no GlobalTimeDomain.slaves, e.g. when it propagates its time directly to sub domains.
subDomain	GlobalTimeDomain	*	ref	By this means it is possible to create a hierarchy of subDomains where one global time domain can declare one or more other global time domains as its subDomains.
syncLossThreshold	TimeValue	0..1	attr	This represents the minimum delta between the time value in two sync messages for which the sync loss flag is set. **Tags:** atp.Status=obsolete; atp.StatusRevision Begin=4.3.1
syncLossTimeout	TimeValue	0..1	attr	This attribute describes the timeout for the situation that the time synchronization gets lost in the scope of the time domain.

Table C.37: GlobalTimeDomain

Class	***GlobalTimeMaster* (abstract)**			
Package	M2::AUTOSARTemplates::SystemTemplate::GlobalTime			
Note	This represents the generic concept of a global time master.			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	GlobalTimeCanMaster, GlobalTimeEthMaster, GlobalTimeFrMaster, UserDefined GlobalTimeMaster			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
communicationConnector	CommunicationConnector	1	ref	The GlobalTimeMaster is bound to the CommunicationConnector.
immediateResumeTime	TimeValue	0..1	attr	Defines the minimum time between an "immediate" message and the next periodic message.
isSystemWideGlobalTimeMaster	Boolean	1	attr	If set to TRUE, the GlobalTimeMaster is supposed to act as the root of global time information.
syncPeriod	TimeValue	1	attr	This represents the period. Unit: seconds

Table C.38: GlobalTimeMaster

Class	***GlobalTimeSlave* (abstract)**			
Package	M2::AUTOSARTemplates::SystemTemplate::GlobalTime			
Note	This represents the generic concept of a global time slave.			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	GlobalTimeCanSlave, GlobalTimeEthSlave, GlobalTimeFrSlave, UserDefinedGlobal TimeSlave			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

communicationConnector	CommunicationConnector	1	ref	The GlobalTimeSlave is bound to the CommunicationConnector.
followUpTimeoutValue	TimeValue	0..1	attr	Rx timeout for the follow-up message.
timeLeapFutureThreshold	TimeValue	0..1	attr	Defines the maximum allowed positive difference between the current Local Time Base value and a newly received Global Time Base value.
timeLeapHealingCounter	PositiveInteger	0..1	attr	Defines the required number of updates to the Time Base where the time difference to the previous received value has to remain within the bounds of timeLeapFutureThreshold and timeLeapPastThreshold until that Time Base is considered healed.
timeLeapPastThreshold	TimeValue	0..1	attr	Defines the maximum allowed negative difference between the current Local Time Base value and a newly received Global Time Base value.

Table C.39: GlobalTimeSlave

Enumeration	**HCConditionEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::PlatformHealthManagement
Note	Defines whether the Health Channel status shall match or not. **Tags:** atp.Status=draft
Literal	***Description***
equal	**Tags:** atp.EnumerationValue=0
notEqual	**Tags:** atp.EnumerationValue=1

Table C.40: HCConditionEnum

Class	**ISignal**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::FibexCore::CoreCommunication			
Note	Signal of the Interaction Layer. The RTE supports a "signal fan-out" where the same System Signal is sent in different SignalIPdus to multiple receivers. To support the RTE "signal fan-out" each SignalIPdu contains ISignals. If the same System Signal is to be mapped into several SignalIPdus there is one ISignal needed for each ISignalToIPduMapping. ISignals describe the Interface between the Precompile configured RTE and the potentially Postbuild configured Com Stack (see ECUC Parameter Mapping). In case of the SystemSignalGroup an ISignal must be created for each SystemSignal contained in the SystemSignalGroup. **Tags:** atp.recommendedPackage=ISignals			
Base	*ARObject*, *CollectableElement*, *FibexElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dataTransformation	DataTransformation	0..1	ref	Optional reference to a DataTransformation which represents the transformer chain that is used to transform the data that shall be placed inside this ISignal. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=dataTransformation, variationPoint.shortLabel vh.latestBindingTime=codeGenerationTime
dataTypePolicy	DataTypePolicyEnum	1	attr	With the aggregation of SwDataDefProps an ISignal specifies how it is represented on the network. This representation follows a particular policy. Note that this causes some redundancy which is intended and can be used to support flexible development methodology as well as subsequent integrity checks. If the policy "networkRepresentationFromComSpec" is chosen the network representation from the ComSpec that is aggregated by the PortPrototype shall be used. If the "override" policy is chosen the requirements specified in the PortInterface and in the ComSpec are not fulfilled by the networkRepresentationProps. In case the System Description doesn't use a complete Software Component Description (VFB View) the "legacy" policy can be chosen.
iSignalProps	ISignalProps	0..1	aggr	Additional optional ISignal properties that may be stored in different files. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=iSignalProps

iSignalType	ISignalTypeEnum	0..1	attr	This attribute defines whether this iSignal is an array that results in a UINT8_N / UINT8_DYN ComSignalType in the COM configuration or a primitive type.
initValue	ValueSpecification	0..1	aggr	Optional definition of a ISignal's initValue in case the System Description doesn't use a complete Software Component Description (VFB View). This supports the inclusion of legacy system signals. This value can be used to configure the Signal's "InitValue". If a full DataMapping exist for the SystemSignal this information may be available from a configured SenderComSpec and ReceiverComSpec. In this case the initvalues in SenderComSpec and/or ReceiverComSpec override this optional value specification. Further restrictions apply from the RTE specification.
length	Integer	1	attr	Size of the signal in bits. The size needs to be derived from the mapped VariableDataPrototype according to the mapping of primitive DataTypes to BaseTypes as used in the RTE. Indicates maximum size for dynamic length signals. The ISignal length of zero bits is allowed.
networkRepresentationProps	SwDataDefProps	0..1	aggr	Specification of the actual network representation. The usage of SwDataDefProps for this purpose is restricted to the attributes compuMethod and baseType. The optional baseType attributes "memAllignment" and "byteOrder" shall not be used. The attribute "dataTypePolicy" in the SystemTemplate element defines whether this network representation shall be ignored and the information shall be taken over from the network representation of the ComSpec. If "override" is chosen by the system integrator the network representation can violate against the requirements defined in the PortInterface and in the network representation of the ComSpec. In case that the System Description doesn't use a complete Software Component Description (VFB View) this element is used to configure "ComSignalDataInvalidValue" and the Data Semantics.
systemSignal	SystemSignal	1	ref	Reference to the System Signal that is supposed to be transmitted in the ISignal.

timeoutSubstitutionValue	ValueSpecification	0..1	aggr	Defines and enables the ComTimeoutSubstituition for this ISignal.
transformationISignalProps	TransformationISignalProps	*	aggr	A transformer chain consists of an ordered list of transformers. The ISignal specific configuration properties for each transformer are defined in the TransformationISignalProps class. The transformer configuration properties that are common for all ISignals are described in the TransformationTechnology class.

Table C.41: ISignal

Class	**ISignalGroup**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::FibexCore::CoreCommunication			
Note	SignalGroup of the Interaction Layer. The RTE supports a "signal fan-out" where the same System Signal Group is sent in different SignalIPdus to multiple receivers. An ISignalGroup refers to a set of ISignals that shall always be kept together. A ISignalGroup represents a COM Signal Group. Therefore it is recommended to put the ISignalGroup in the same Package as ISignals (see atp.recommendedPackage) **Tags:** atp.recommendedPackage=ISignalGroup			
Base	*ARObject*, *CollectableElement*, *FibexElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
comBasedSignalGroupTransformation	DataTransformation	0..1	ref	Optional reference to a DataTransformation which represents the transformer chain that is used to transform the data that shall be placed inside this ISignalGroup based on the COMBasedTransformer approach. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=comBasedSignalGroupTransformation, variationPoint.shortLabel vh.latestBindingTime=codeGenerationTime
iSignal	ISignal	*	ref	Reference to a set of ISignals that shall always be kept together.
systemSignalGroup	SystemSignalGroup	1	ref	Reference to the SystemSignalGroup that is defined on VFB level and that is supposed to be transmitted in the ISignalGroup.
transformationISignalProps	TransformationISignalProps	*	aggr	A transformer chain consists of an ordered list of transformers. The ISignalGroup specific configuration properties for each transformer are defined in the TransformationISignalProps class. The transformer configuration properties that are common for all ISignalGroups are described in the TransformationTechnology class.

Table C.42: ISignalGroup

Class	**ISignalIPdu**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::FibexCore::CoreCommunication			
Note	Represents the IPdus handled by Com. The ISignalIPdu assembled and disassembled in AUTOSAR COM consists of one or more signals. In case no multiplexing is performed this IPdu is routed to/from the Interface Layer. A maximum of one dynamic length signal per IPdu is allowed. **Tags:** atp.recommendedPackage=Pdus			
Base	*ARObject*, *CollectableElement*, *FibexElement*, *IPdu*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Pdu*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
iPduTimingSpecification	IPduTiming	0..1	aggr	Timing specification for Com IPdus (Transmission Modes). This information is mandatory for the sender in a System Extract. This information may be omitted on receivers in a System Extract. atpVariation: The timing of a Pdu can vary. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=postBuild
iSignalToPduMapping	ISignalToIPduMapping	*	aggr	Definition of SignalToIPduMappings included in the SignalIPdu. atpVariation: The content of a PDU can be variable. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=postBuild
pduCounter	SignalIPduCounter	0..1	aggr	An included Pdu counter is used to ensure that a sequence of Pdus is maintained. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=preCompileTime
pduReplication	SignalIPduReplication	0..1	aggr	Pdu Replication is a form of redundancy where the data content of one ISignalIPdu (source) is transmitted inside a set of replica ISignalIPdus. These ISignalIPdus (copies) have different Pdu IDs, identical PduCounters, identical data content and are transmitted with the same frequency. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=preCompileTime
unusedBitPattern	Integer	1	attr	AUTOSAR COM and AUTOSAR IPDUM are filling not used areas of an IPDU with this bit-pattern. This attribute is mandatory to avoid undefined behavior. This byte-pattern will be repeated throughout the IPdu.

Table C.43: ISignalIPdu

Class	**ISignalTriggering**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::FibexCore::CoreCommunication			
Note	A ISignalTriggering allows an assignment of ISignals to physical channels.			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
iSignal	ISignal	0..1	ref	This reference shall be used if an ISignal is transported on the PhysicalChannel. This reference forms an XOR relationship with the ISignalTriggering-ISignalGroup reference.
iSignalGroup	ISignalGroup	0..1	ref	This reference shall be used if an ISignalGroup is transported on the PhysicalChannel. This reference forms an XOR relationship with the ISignalTriggering-ISignal reference.
iSignalPort	ISignalPort	*	ref	References to the ISignalPort on every ECU of the system which sends and/or receives the ISignal. References for both the sender and the receiver side shall be included when the system is completely defined.

Table C.44: ISignalTriggering

Class	***Identifiable* (abstract)**
Package	M2::AUTOSARTemplates::GenericStructure::GeneralTemplateClasses::Identifiable
Note	Instances of this class can be referred to by their identifier (within the namespace borders). In addition to this, Identifiables are objects which contribute significantly to the overall structure of an AUTOSAR description. In particular, Identifiables might contain Identifiables.
Base	*ARObject*, *MultilanguageReferrable*, *Referrable*
Subclasses	ARPackage, *AbstractEvent*, *AbstractServiceInstance*, Action, *ActionItem*, ActionList, *AdaptiveModuleInstantiation*, AdaptiveSwcInternalBehavior, AliveSupervision, ApplicationEndpoint, ApplicationError, ApplicationPartitionToEcuPartitionMapping, Arbitration, AsynchronousServerCallResultPoint, *AtpBlueprint*, *AtpBlueprintable*, *Atp Classifier*, *AtpFeature*, AutosarOperationArgumentInstance, AutosarVariableInstance, BswInternalTriggeringPoint, BswModuleDependency, *BuildActionEntity*, BuildAction Environment, CanTpAddress, CanTpChannel, CanTpNode, Chapter, Checkpoint Transition, ClassContentConditional, ClientIdDefinition, ClientServerOperation, Code, *CollectableElement*, *CommConnectorPort*, *CommunicationConnector*, *CommunicationController*, Compiler, ConsistencyNeeds, ConsumedEventGroup, CouplingPort, *CouplingPortStructuralElement*, CppImplementationDataTypeElement, CryptoJob, CryptoKeySlot, CryptoNeedToCryptoJobMapping, CryptoPrimitive, Data PrototypeGroup, DataTransformation, DeadlineSupervision, DependencyOnArtifact, *DiagEventDebounceAlgorithm*, DiagnosticConnectedIndicator, DiagnosticData Element, DiagnosticFunctionInhibitSource, *DiagnosticRoutineSubfunction*, DoIpLogic Address, E2EProfileConfiguration, ECUMapping, *EOCExecutableEntityRefAbstract*, EcuPartition, EcucContainerValue, *EcucDefinitionElement*, EcucDestinationUriDef, EcucEnumerationLiteralDef, EcucQuery, EcucValidationCondition, End2EndEvent ProtectionProps, EndToEndProtection, EventMapping, ExclusiveArea, *Executable Entity*, *ExecutionTime*, FMAttributeDef, FMFeatureMapAssertion, FMFeatureMap Condition, FMFeatureMapElement, FMFeatureRelation, FMFeatureRestriction, FM FeatureSelection, FieldMapping, FireAndForgetMapping, FlatInstanceDescriptor, FlexrayArTpNode, FlexrayTpConnectionControl, FlexrayTpNode, FlexrayTpPduPool, *FrameTriggering*, GeneralParameter, GlobalSupervision, GlobalTimeGateway, *Global TimeMaster*, *GlobalTimeSlave*, *HealthChannel*, *HeapUsage*, HwAttributeDef, Hw AttributeLiteralDef, HwPin, HwPinGroup, IPv6ExtHeaderFilterList, ISignalToIPdu Mapping, ISignalTriggering, *IdentCaption*, ImplementationDataTypeElement, InterfaceMapping, InternalTriggeringPoint, J1939SharedAddressCluster, J1939Tp Node, Keyword, LifeCycleState, LinScheduleTable, LinTpNode, Linker, Local Supervision, LogicalExpression, LogicalSupervision, MacMulticastGroup, McData Instance, MemorySection, MethodMapping, ModeDeclaration, ModeDeclaration Mapping, ModeSwitchPoint, NetworkEndpoint, *NmCluster*, *NmNode*, NvBlock Descriptor, *PackageableElement*, ParameterAccess, PduToFrameMapping, Pdu Triggering, PerInstanceMemory, PersistencyFileProxy, PersistencyKeyValuePair, *PhysicalChannel*, PortGroup, *PortInterfaceMapping*, PossibleErrorReaction, PresharedKeyIdentity, ProcessToMachineMapping, Processor, ProcessorCore, Psk IdentityToKeySlotMapping, ResourceConsumption, ResourceGroup, *RestAbstract Endpoint*, RestElementDef, RestResourceDef, RootSwComponentPrototype, Root SwCompositionPrototype, RptComponent, RptContainer, RptExecutableEntity, Rpt ExecutableEntityEvent, RptExecutionContext, RptProfile, RptServicePoint, Rule, RunnableEntityGroup, *SdgAttribute*, SdgClass, SecOcJobMapping, SecOcJob Requirement, *SecureComProps*, SecureCommunicationAuthenticationProps, *Secure CommunicationDeployment*, SecureCommunicationFreshnessProps, *ServerCall Point*, *ServiceEventDeployment*, *ServiceFieldDeployment*, ServiceInstanceToSignal Mapping, *ServiceInterfaceElementMapping*, ServiceInterfaceElementSecureCom Config, ServiceInterfaceMapping, *ServiceMethodDeployment*, *ServiceNeeds*, Signal BasedFieldToISignalTriggeringMapping, SocketAddress, SomeipEventGroup, Someip ProvidedEventGroup, *SpecElementReference*, *StackUsage*, StartupConfig, StructuredReq, SupervisionCheckpoint, SwGenericAxisParamType, SwServiceArg, SwcServiceDependency, SwcToApplicationPartitionMapping, SwcToEcuMapping, SwcToImplMapping, SystemMapping, TcpOptionFilterList, *TimeBaseResource*, TimingCondition, *TimingConstraint*, *TimingDescription*, TimingExtensionResource, TimingModeInstance, TlsJobMapping, TlsJobRequirement, Topic1, TpAddress,

desc	MultiLanguage OverviewPara graph	0..1	aggr	This represents a general but brief (one paragraph) description what the object in question is about. It is only one paragraph! Desc is intended to be collected into overview tables. This property helps a human reader to identify the object in question. More elaborate documentation, (in particular how the object is built or used) should go to "introduction". **Tags:** xml.sequenceOffset=-60
category	CategoryString	0..1	attr	The category is a keyword that specializes the semantics of the Identifiable. It affects the expected existence of attributes and the applicability of constraints. **Tags:** xml.sequenceOffset=-50
adminData	AdminData	0..1	aggr	This represents the administrative data for the identifiable object. **Tags:** xml.sequenceOffset=-40
annotation	Annotation	*	aggr	Possibility to provide additional notes while defining a model element (e.g. the ECU Configuration Parameter Values). These are not intended as documentation but are mere design notes. **Tags:** xml.sequenceOffset=-25
introduction	Documentation Block	0..1	aggr	This represents more information about how the object in question is built or is used. Therefore it is a DocumentationBlock. **Tags:** xml.sequenceOffset=-30

uuid	String	0..1	attr	The purpose of this attribute is to provide a globally unique identifier for an instance of a meta-class. The values of this attribute should be globally unique strings prefixed by the type of identifier. For example, to include a DCE UUID as defined by The Open Group, the UUID would be preceded by "DCE:". The values of this attribute may be used to support merging of different AUTOSAR models. The form of the UUID (Universally Unique Identifier) is taken from a standard defined by the Open Group (was Open Software Foundation). This standard is widely used, including by Microsoft for COM (GUIDs) and by many companies for DCE, which is based on CORBA. The method for generating these 128-bit IDs is published in the standard and the effectiveness and uniqueness of the IDs is not in practice disputed. If the id namespace is omitted, DCE is assumed. An example is "DCE:2fac1234-31f8-11b4-a222-08002b34c003". The uuid attribute has no semantic meaning for an AUTOSAR model and there is no requirement for AUTOSAR tools to manage the timestamp. **Tags:** xml.attribute=true

Table C.45: Identifiable

Class	**MacMulticastGroup**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::Fibex4Ethernet::EthernetTopology			
Note	Per EthernetCluster globally defined MacMulticastGroup. One sender can handle many receivers simultaneously if the receivers have all the same macMulticastAddress. The addresses need to be unique for the particular EthernetCluster. **Tags:** atp.ManifestKind=MachineManifest			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
macMulticastAddress	MacAddressString	1	attr	A multicast MAC address (Media Access Control address) is a identifier for a group of hosts in a network.

Table C.46: MacMulticastGroup

Class	***NetworkConfiguration* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::AdaptiveModule Implementation			
Note	This meta-class defines the abstract attributes for the configuration of a network for a specific CommunicationConnector. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*			
Subclasses	EthernetNetworkConfiguration			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table C.47: NetworkConfiguration

Class	***NonOsModuleInstantiation* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::AdaptiveModule Implementation			
Note	This meta-class defines the abstract attributes for the configuration of an adaptive autosar module other than the OS module. **Tags:** atp.ManifestKind=MachineManifest; atp.Status=draft			
Base	*ARObject*, *AdaptiveModuleInstantiation*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	CryptoModuleInstantiation, DoIpInstantiation, GenericModuleInstantiation, LogAndTraceInstantiation, NmInstantiation, TimeSyncModuleInstantiation			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table C.48: NonOsModuleInstantiation

Class	***PPortComSpec* (abstract)**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Communication			
Note	Communication attributes of a provided PortPrototype. This class will contain attributes that are valid for all kinds of provide ports, independent of client-server or sender-receiver communication patterns.			
Base	*ARObject*			
Subclasses	ModeSwitchSenderComSpec, NvProvideComSpec, ParameterProvideComSpec, PersistencyDataProvidedComSpec, *SenderComSpec*, ServerComSpec			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table C.49: PPortComSpec

Class	**PPortPrototype**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Components			
Note	Component port providing a certain port interface.			
Base	*ARObject*, *AbstractProvidedPortPrototype*, *AtpBlueprintable*, *AtpFeature*, *AtpPrototype*, *Identifiable*, *MultilanguageReferrable*, *PortPrototype*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
providedInterface	PortInterface	1	tref	The interface that this port provides. **Stereotypes:** isOfType

Table C.50: PPortPrototype

Class	**PRPortPrototype**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Components			
Note	This kind of PortPrototype can take the role of both a required and a provided PortPrototype.			
Base	*ARObject*, *AbstractProvidedPortPrototype*, *AbstractRequiredPortPrototype*, *AtpBlueprintable*, *AtpFeature*, *AtpPrototype*, *Identifiable*, *MultilanguageReferrable*, *PortPrototype*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
providedRequiredInterface	PortInterface	1	tref	This represents the PortInterface used to type the PRPortPrototype **Stereotypes:** isOfType

Table C.51: PRPortPrototype

Class	***PackageableElement* (abstract)**			
Package	M2::AUTOSARTemplates::GenericStructure::GeneralTemplateClasses::ARPackage			
Note	This meta-class specifies the ability to be a member of an AUTOSAR package.			
Base	*ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	*ARElement*, EnumerationMappingTable, *FibexElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table C.52: PackageableElement

Class	***Pdu* (abstract)**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::FibexCore::CoreCommunication			
Note	Collection of all Pdus that can be routed through a bus interface.			
Base	*ARObject*, *CollectableElement*, *FibexElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Subclasses	GeneralPurposePdu, *IPdu*, NmPdu, UserDefinedPdu			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

length	Integer	0..1	attr	Pdu length in bytes. In case of dynamic length IPdus (containing a dynamical length signal), this value indicates the maximum data length. It should be noted that in former AUTOSAR releases (Rel 2.1, Rel 3.0, Rel 3.1, Rel 4.0 Rev. 1) this parameter was defined in bits. The Pdu length of zero bytes is allowed.

Table C.53: Pdu

Class	**PhysicalDimension**			
Package	M2::MSR::AsamHdo::Units			
Note	This class represents a physical dimension. If the physical dimension of two units is identical, then a conversion between them is possible. The conversion between units is related to the definition of the physical dimension. Note that the equivalence of the exponents does not per se define the convertibility. For example Energy and Torque share the same exponents (Nm). Please note further the value of an exponent does not necessarily have to be an integer number. It is also possible that the value yields a rational number, e.g. to compute the square root of a given physical quantity. In this case the exponent value would be a rational number where the numerator value is 1 and the denominator value is 2. **Tags:** atp.recommendedPackage=PhysicalDimensions			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
currentExp	Numerical	0..1	attr	This attribute represents the exponent of the physical dimension "electric current". **Tags:** xml.sequenceOffset=50
lengthExp	Numerical	0..1	attr	The exponent of the physical dimension "length". **Tags:** xml.sequenceOffset=20
luminousIntensityExp	Numerical	0..1	attr	The exponent of the physical dimension "luminous intensity". **Tags:** xml.sequenceOffset=80
massExp	Numerical	0..1	attr	The exponent of the physical dimension "mass". **Tags:** xml.sequenceOffset=30
molarAmountExp	Numerical	0..1	attr	The exponent of the physical dimension "quantity of substance". **Tags:** xml.sequenceOffset=70
temperatureExp	Numerical	0..1	attr	The exponent of the physical dimension "temperature". **Tags:** xml.sequenceOffset=60

timeExp	Numerical	0..1	attr	The exponent of the physical dimension "time". **Tags:** xml.sequenceOffset=40

Table C.54: PhysicalDimension

Class	***PlatformHealthManagementInterface* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	This meta-class provides the abstract ability to define a PortInterface for the interaction with Platform Health Management. **Tags:** atp.Status=draft			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *PortInterface*, *Referrable*			
Subclasses	PhmHealthChannelInterface, PhmSupervisedEntityInterface			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table C.55: PlatformHealthManagementInterface

Class	**PortInterfaceToDataTypeMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	This meta-class represents the ability to associate a PortInterface with a DataTypeMappingSet. This association is needed for the generation of header files in the scope of a single PortInterface. The association is intentionally made outside the scope of the PortInterface itself because the designers of a PortInterface most likely will not want to add details about the level of ImplementationDataType. **Tags:** atp.Status=draft; atp.recommendedPackage=ServiceInterfaceToDataType Mappings			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dataTypeMappingSet	DataTypeMappingSet	1..*	ref	This represents the reference to the applicable dataTypemappingSet **Tags:** atp.Status=draft; atp.Status Comment=Reserved for adaptive platform
portInterface	PortInterface	1	ref	This represents the reference to the applicable PortInterface **Tags:** atp.Status=draft; atp.Status Comment=Reserved for adaptive platform

Table C.56: PortInterfaceToDataTypeMapping

Class	***PortPrototype* (abstract)**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Components			
Note	Base class for the ports of an AUTOSAR software component. The aggregation of PortPrototypes is subject to variability with the purpose to support the conditional existence of ports.			
Base	*ARObject*, *AtpBlueprintable*, *AtpFeature*, *AtpPrototype*, *Identifiable*, *Multilanguage Referrable*, *Referrable*			
Subclasses	*AbstractProvidedPortPrototype*, *AbstractRequiredPortPrototype*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
clientServerAnnotation	ClientServerAnnotation	*	aggr	Annotation of this PortPrototype with respect to client/server communication.
delegatedPortAnnotation	DelegatedPortAnnotation	0..1	aggr	Annotations on this delegated port.
ioHwAbstractionServerAnnotation	IoHwAbstractionServerAnnotation	*	aggr	Annotations on this IO Hardware Abstraction port.
modePortAnnotation	ModePortAnnotation	*	aggr	Annotations on this mode port.
nvDataPortAnnotation	NvDataPortAnnotation	*	aggr	Annotations on this non voilatile data port.
parameterPortAnnotation	ParameterPortAnnotation	*	aggr	Annotations on this parameter port.
portPrototypeProps	PortPrototypeProps	0..1	aggr	This attribute allows for the definition of further qualification of the semantics of a PortPrototype. **Tags:** atp.Status=draft
senderReceiverAnnotation	SenderReceiverAnnotation	*	aggr	Collection of annotations of this ports sender/receiver communication.
triggerPortAnnotation	TriggerPortAnnotation	*	aggr	Annotations on this trigger port.

Table C.57: PortPrototype

Class	**ProvidedServiceInstance**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::Fibex4Ethernet::EthernetTopology			
Note	Service instances that are provided by the ECU that is connected via the ApplicationEndpoint to a CommunicationConnector.			
Base	*ARObject*, *AbstractServiceInstance*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
EventHandler	EventHandler	*	aggr	Collection of event callback configurations.
instanceIdentifier	PositiveInteger	0..1	attr	Instance identifier. Can be used for e.g. service discovery to identify the instance of the service.
priority	PositiveInteger	0..1	attr	Priority defined per provided ServiceInstance.
sdServerConfig	SdServerConfig	0..1	aggr	Service Discovery Server configuration.

serviceIdentifier	PositiveInteger	0..1	attr	Service ID. Shall be unique within one system to allow service discovery.

Table C.58: ProvidedServiceInstance

Class	***RPortComSpec* (abstract)**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Communication			
Note	Communication attributes of a required PortPrototype. This class will contain attributes that are valid for all kinds of require-ports, independent of client-server or sender-receiver communication patterns.			
Base	*ARObject*			
Subclasses	ClientComSpec, ModeSwitchReceiverComSpec, NvRequireComSpec, Parameter RequireComSpec, PersistencyDataRequiredComSpec, *ReceiverComSpec*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table C.59: RPortComSpec

Class	**RPortPrototype**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Components			
Note	Component port requiring a certain port interface.			
Base	*ARObject*, *AbstractRequiredPortPrototype*, *AtpBlueprintable*, *AtpFeature*, *AtpPrototype*, *Identifiable*, *MultilanguageReferrable*, *PortPrototype*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
requiredInterface	PortInterface	1	tref	The interface that this port requires, i.e. the port depends on another port providing the specified interface. **Stereotypes:** isOfType

Table C.60: RPortPrototype

Class	**RecordValueSpecification**			
Package	M2::AUTOSARTemplates::CommonStructure::Constants			
Note	Specifies the values for a record.			
Base	*ARObject*, *CompositeValueSpecification*, *ValueSpecification*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

field (ordered)	ValueSpecification	1..*	aggr	The value for a single record field. This could also be mapped explicitly to a record element of the data type using the shortName of the ValueSpecification. But this would introduce a relationship to the data type that is too strong. As of now, it is only important that the structure of the data type matches the structure of the ValueSpecification indepenently of the shortNames. **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=preCompileTime

Table C.61: RecordValueSpecification

Class	**ReferenceValueSpecification**			
Package	M2::AUTOSARTemplates::CommonStructure::Constants			
Note	Specifies a reference to a data prototype to be used as an initial value for a pointer in the software.			
Base	*ARObject*, *ValueSpecification*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
referenceValue	DataPrototype	1	ref	The referenced data prototype.

Table C.62: ReferenceValueSpecification

Class	***Referrable* (abstract)**			
Package	M2::AUTOSARTemplates::GenericStructure::GeneralTemplateClasses::Identifiable			
Note	Instances of this class can be referred to by their identifier (while adhering to namespace borders).			
Base	*ARObject*			
Subclasses	*AtpDefinition*, BswDistinguishedPartition, *BswModuleCallPoint*, BswModuleClient ServerEntry, BswVariableAccess, CouplingPortTrafficClassAssignment, Diagnostic DebounceAlgorithmProps, *DiagnosticEnvModeElement*, EthernetPriority Regeneration, EventHandler, ExclusiveAreaNestingOrder, *HwDescriptionEntity*, *ImplementationProps*, LinSlaveConfigIdent, ModeTransition, *Multilanguage Referrable*, PncMappingIdent, *SingleLanguageReferrable*, SocketConnectionBundle, SomeipRequiredEventGroup, TimeSyncServerConfiguration, TpConnectionIdent			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
shortName	Identifier	1	attr	This specifies an identifying shortName for the object. It needs to be unique within its context and is intended for humans but even more for technical reference. **Tags:** xml.enforceMinMultiplicity=true; xml.sequenceOffset=-100
shortName Fragment	ShortNameFragment	*	aggr	This specifies how the Referrable.shortName is composed of several shortNameFragments. **Tags:** xml.sequenceOffset=-90

Table C.63: Referrable

Class	**RoleBasedPortAssignment**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::SwcInternalBehavior::ServiceMapping			
Note	This class specifies an assignment of a role to a particular service port (RPortPrototype or PPortPrototype) of an AtomicSwComponentType. With this assignment, the role of the service port can be mapped to a specific ServiceNeeds element, so that a tool is able to create the correct connector.			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
portPrototype	PortPrototype	1	ref	Service PortPrototype used in the assigned role. This PortPrototype shall either belong to the same AtomicSwComponentType as the SwcInternalBehavior which owns the ServiceDependency or to the same NvBlockSwComponentType as the NvBlockDescriptor.
role	Identifier	1	attr	This is the role of the assigned Port in the given context. The value shall be a shortName of the Blueprint of a PortInterface as standardized in the Software Specification of the related AUTOSAR Service.

Table C.64: RoleBasedPortAssignment

Class	**Sd**			
Package	M2::MSR::AsamHdo::SpecialData			
Note	This class represents a primitive element in a special data group.			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
gid	NameToken	1	attr	This attributes specifies an identifier. Gid comes from the SGML/XML-Term "Generic Identifier" which is the element name in XML. The role of this attribute is the same as the name of an XML - element. **Tags:** xml.attribute=true
value	VerbatimStringPlain	1	attr	This is the value of the special data. **Tags:** xml.roleElement=false; xml.roleWrapperElement=false; xml.typeElement=false; xml.typeWrapperElement=false

xmlSpace	XmlSpaceEnum	0..1	attr	This attribute is used to signal an intention that in that element, white space should be preserved by applications. It is defined according to xml:space as declared by W3C. **Tags:** xml.attribute=true; xml.attributeRef=true; xml.enforceMinMultiplicity=true; xml.name=space; xml.nsPrefix=xml

Table C.65: Sd

Class	**Sdg**			
Package	M2::MSR::AsamHdo::SpecialData			
Note	Sdg (SpecialDataGroup) is a generic model which can be used to keep arbitrary information which is not explicitly modeled in the meta-model. Sdg can have various contents as defined by sdgContentsType. Special Data should only be used moderately since all elements should be defined in the meta-model. Thereby SDG should be considered as a temporary solution when no explicit model is available. If an sdgCaption is available, it is possible to establish a reference to the sdg structure.			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
gid	NameToken	1	attr	This attributes specifies an identifier. Gid comes from the SGML/XML-Term "Generic Identifier" which is the element name in XML. The role of this attribute is the same as the name of an XML - element. **Tags:** xml.attribute=true
sdgCaption	SdgCaption	0..1	aggr	This aggregation allows to assign the properties of Identifiable to the sdg. By this, a shortName etc. can be assigned to the Sdg. **Tags:** xml.sequenceOffset=20
sdgCaptionRef	SdgCaption	0..1	ref	This association allows to reuse an already existing caption. **Tags:** xml.name=SDG-CAPTION-REF; xml.sequenceOffset=25
sdgContentsType	SdgContents	0..1	aggr	This is the content of the Sdg. **Tags:** xml.roleElement=false; xml.roleWrapperElement=false; xml.sequenceOffset=30; xml.typeElement=false; xml.typeWrapperElement=false

Table C.66: Sdg

Class	**SenderReceiverInterface**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::PortInterface			
Note	A sender/receiver interface declares a number of data elements to be sent and received. **Tags:** atp.recommendedPackage=PortInterfaces			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *DataInterface*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *PortInterface*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dataElement	VariableDataPrototype	1..*	aggr	The data elements of this SenderReceiverInterface.
invalidationPolicy	InvalidationPolicy	*	aggr	InvalidationPolicy for a particular dataElement

Table C.67: SenderReceiverInterface

Class	**ServerComSpec**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Communication			
Note	Communication attributes for a server port (PPortPrototype and ClientServerInterface).			
Base	*ARObject*, *PPortComSpec*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
operation	ClientServerOperation	0..1	ref	Operation these communication attributes apply to.
queueLength	PositiveInteger	1	attr	Length of call queue on the server side. The queue is implemented by the RTE. The value shall be greater or equal to 1. Setting the value of queueLength to 1 implies that incoming requests are rejected while another request that arrived earlier is being processed.
transformationComSpecProps	TransformationComSpecProps	*	aggr	This references the TransformationComSpecProps which define port-specific configuration for data transformation.

Table C.68: ServerComSpec

Class	***ServiceNeeds* (abstract)**			
Package	M2::AUTOSARTemplates::CommonStructure::ServiceNeeds			
Note	This expresses the abstract needs that a Software Component or Basic Software Module has on the configuration of an AUTOSAR Service to which it will be connected. "Abstract needs" means that the model abstracts from the Configuration Parameters of the underlying Basic Software.			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	BswMgrNeeds, ComMgrUserNeeds, CryptoServiceNeeds, *DiagnosticCapability Element*, DltUserNeeds, *DoIpServiceNeeds*, EcuStateMgrUserNeeds, ErrorTracer Needs, FunctionInhibitionAvailabilityNeeds, FunctionInhibitionNeeds, Global SupervisionNeeds, J1939RmIncomingRequestServiceNeeds, J1939RmOutgoing RequestServiceNeeds, NvBlockNeeds, SecureOnBoardCommunicationNeeds, SupervisedEntityCheckpointNeeds, SupervisedEntityNeeds, SyncTimeBaseMgrUser Needs, V2xFacUserNeeds, V2xMUserNeeds, VendorSpecificServiceNeeds			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table C.69: ServiceNeeds

Class	**ServiceSwComponentType**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Components			
Note	ServiceSwComponentType is used for configuring services for a given ECU. Instances of this class are only to be created in ECU Configuration phase for the specific purpose of the service configuration. **Tags:** atp.recommendedPackage=SwComponentTypes			
Base	*ARElement*, *ARObject*, *AtomicSwComponentType*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *SwComponentType*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table C.70: ServiceSwComponentType

Class	**SwComponentPrototype**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Composition			
Note	Role of a software component within a composition.			
Base	*ARObject*, *AtpFeature*, *AtpPrototype*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
type	SwComponent Type	1	tref	Type of the instance. **Stereotypes:** isOfType

Table C.71: SwComponentPrototype

Class	***SwConnector* (abstract)**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Composition			
Note	The base class for connectors between ports. Connectors have to be identifiable to allow references from the system constraint template.			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	AssemblySwConnector, DelegationSwConnector, PassThroughSwConnector			
Attribute	**Type**	**Mul.**	**Kind**	**Note**
mapping	PortInterfaceMapping	0..1	ref	Reference to a PortInterfaceMapping specifying the mapping of unequal named PortInterface elements of the two different PortInterfaces typing the two PortPrototypes which are referenced by the ConnectorPrototype.

Table C.72: SwConnector

Class	≪`atpVariation`≫ **SwDataDefProps**			
Package	M2::MSR::DataDictionary::DataDefProperties			
Note	This class is a collection of properties relevant for data objects under various aspects. One could consider this class as a "pattern of inheritance by aggregation". The properties can be applied to all objects of all classes in which SwDataDefProps is aggregated. Note that not all of the attributes or associated elements are useful all of the time. Hence, the process definition (e.g. expressed with an OCL or a Document Control Instance MSR-DCI) has the task of implementing limitations. SwDataDefProps covers various aspects: • Structure of the data element for calibration use cases: is it a single value, a curve, or a map, but also the recordLayouts which specify how such elements are mapped/converted to the DataTypes in the programming language (or in AUTOSAR). This is mainly expressed by properties like swRecordLayout and swCalprmAxisSet • Implementation aspects, mainly expressed by swImplPolicy, swVariableAccessImplPolicy, swAddrMethod, swPointerTagetProps, baseType, implementationDataType and additionalNativeTypeQualifier • Access policy for the MCD system, mainly expressed by swCalibrationAccess • Semantics of the data element, mainly expressed by compuMethod and/or unit, dataConstr, invalidValue • Code generation policy provided by swRecordLayout **Tags:** vh.latestBindingTime=codeGenerationTime			
Base	*ARObject*			
Attribute	**Type**	**Mul.**	**Kind**	**Note**

additionalNativeTypeQualifier	NativeDeclarationString	0..1	attr	This attribute is used to declare native qualifiers of the programming language which can neither be deduced from the baseType (e.g. because the data object describes a pointer) nor from other more abstract attributes. Examples are qualifiers like "volatile", "strict" or "enum" of the C-language. All such declarations have to be put into one string. **Tags:** xml.sequenceOffset=235
annotation	Annotation	*	aggr	This aggregation allows to add annotations (yellow pads ...) related to the current data object. **Tags:** xml.roleElement=true; xml.roleWrapperElement=true; xml.sequenceOffset=20; xml.typeElement=false; xml.typeWrapperElement=false
baseType	SwBaseType	0..1	ref	Base type associated with the containing data object. **Tags:** xml.sequenceOffset=50
compuMethod	CompuMethod	0..1	ref	Computation method associated with the semantics of this data object. **Tags:** xml.sequenceOffset=180
dataConstr	DataConstr	0..1	ref	Data constraint for this data object. **Tags:** xml.sequenceOffset=190
displayFormat	DisplayFormatString	0..1	attr	This property describes how a number is to be rendered e.g. in documents or in a measurement and calibration system. **Tags:** xml.sequenceOffset=210
implementationDataType	AbstractImplementationDataType	0..1	ref	This association denotes the ImplementationDataType of a data declaration via its aggregated SwDataDefProps. It is used whenever a data declaration is not directly referring to a base type. Especially • redefinition of an ImplementationDataType via a "typedef" to another ImplementationDatatype • the target type of a pointer (see SwPointerTargetProps), if it does not refer to a base type directly • the data type of an array or record element within an ImplementationDataType, if it does not refer to a base type directly • the data type of an SwServiceArg, if it does not refer to a base type directly **Tags:** xml.sequenceOffset=215

invalidValue	ValueSpecification	0..1	aggr	Optional value to express invalidity of the actual data element. **Tags:** xml.sequenceOffset=255
stepSize	Float	0..1	attr	This attribute can be used to define a value which is added to or subtracted from the value of a DataPrototype when using up/down keys while calibrating.
swAddrMethod	SwAddrMethod	0..1	ref	Addressing method related to this data object. Via an association to the same SwAddrMethod it can be specified that several DataPrototypes shall be located in the same memory without already specifying the memory section itself. **Tags:** xml.sequenceOffset=30
swAlignment	AlignmentType	0..1	attr	The attribute describes the intended alignment of the DataPrototype. If the attribute is not defined the alignment is determined by the swBaseType size and the memoryAllocationKeywordPolicy of the referenced SwAddrMethod. **Tags:** xml.sequenceOffset=33
swBitRepresentation	SwBitRepresentation	0..1	aggr	Description of the binary representation in case of a bit variable. **Tags:** xml.sequenceOffset=60
swCalibrationAccess	SwCalibrationAccessEnum	0..1	attr	Specifies the read or write access by MCD tools for this data object. **Tags:** xml.sequenceOffset=70
swCalprmAxisSet	SwCalprmAxisSet	0..1	aggr	This specifies the properties of the axes in case of a curve or map etc. This is mainly applicable to calibration parameters. **Tags:** xml.sequenceOffset=90
swComparisonVariable	SwVariableRefProxy	*	aggr	Variables used for comparison in an MCD process. **Tags:** xml.sequenceOffset=170; xml.typeElement=false
swDataDependency	SwDataDependency	0..1	aggr	Describes how the value of the data object has to be calculated from the value of another data object (by the MCD system). **Tags:** xml.sequenceOffset=200
swHostVariable	SwVariableRefProxy	0..1	aggr	Contains a reference to a variable which serves as a host-variable for a bit variable. Only applicable to bit objects. **Tags:** xml.sequenceOffset=220; xml.typeElement=false

swImplPolicy	SwImplPolicyEnum	0..1	attr	Implementation policy for this data object. **Tags:** xml.sequenceOffset=230
swIntendedResolution	Numerical	0..1	attr	The purpose of this element is to describe the requested quantization of data objects early on in the design process. The resolution ultimately occurs via the conversion formula present (compuMethod), which specifies the transition from the physical world to the standardized world (and vice-versa) (here, "the slope per bit" is present implicitly in the conversion formula). In the case of a development phase without a fixed conversion formula, a pre-specification can occur through swIntendedResolution. The resolution is specified in the physical domain according to the property "unit". **Tags:** xml.sequenceOffset=240
swInterpolationMethod	Identifier	0..1	attr	This is a keyword identifying the mathematical method to be applied for interpolation. The keyword needs to be related to the interpolation routine which needs to be invoked. **Tags:** xml.sequenceOffset=250
swIsVirtual	Boolean	0..1	attr	This element distinguishes virtual objects. Virtual objects do not appear in the memory, their derivation is much more dependent on other objects and hence they shall have a swDataDependency . **Tags:** xml.sequenceOffset=260
swPointerTargetProps	SwPointerTargetProps	0..1	aggr	Specifies that the containing data object is a pointer to another data object. **Tags:** xml.sequenceOffset=280
swRecordLayout	SwRecordLayout	0..1	ref	Record layout for this data object. **Tags:** xml.sequenceOffset=290
swRefreshTiming	MultidimensionalTime	0..1	aggr	This element specifies the frequency in which the object involved shall be or is called or calculated. This timing can be collected from the task in which write access processes to the variable run. But this cannot be done by the MCD system. So this attribute can be used in an early phase to express the desired refresh timing and later on to specify the real refresh timing. **Tags:** xml.sequenceOffset=300

swTextProps	SwTextProps	0..1	aggr	the specific properties if the data object is a text object. **Tags:** xml.sequenceOffset=120
swValueBlockSize	Numerical	0..1	attr	This represents the size of a Value Block **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=preCompileTime xml.sequenceOffset=80
unit	Unit	0..1	ref	Physical unit associated with the semantics of this data object. This attribute applies if no compuMethod is specified. If both units (this as well as via compuMethod) are specified the units shall be compatible. **Tags:** xml.sequenceOffset=350
valueAxisDataType	ApplicationPrimitiveDataType	0..1	ref	The referenced ApplicationPrimitiveDataType represents the primitive data type of the value axis within a compound primitive (e.g. curve, map). It supersedes CompuMethod, Unit, and BaseType. **Tags:** xml.sequenceOffset=355

Table C.73: SwDataDefProps

Class	**SwPointerTargetProps**			
Package	M2::MSR::DataDictionary::DataDefProperties			
Note	This element defines, that the data object (which is specified by the aggregating element) contains a reference to another data object or to a function in the CPU code. This corresponds to a pointer in the C-language. The attributes of this element describe the category and the detailed properties of the target which is either a data description or a function signature.			
Base	*ARObject*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
functionPointerSignature	BswModuleEntry	0..1	ref	The referenced BswModuleEntry serves as the signature of a function pointer definition. Primary use case: function pointer passed as argument to other function. **Tags:** xml.sequenceOffset=40
swDataDefProps	SwDataDefProps	0..1	aggr	The properties of the target data type. **Tags:** xml.sequenceOffset=30

targetCategory	Identifier	0..1	attr	This specifies the category of the target: • In case of a data pointer, it shall specify the category of the referenced data. • In case of a function pointer, it could be used to denote the category of the referenced BswModuleEntry. Since currently no categories for BswModuleEntry are defined it will be empty. **Tags:** xml.sequenceOffset=5

Table C.74: SwPointerTargetProps

Class	**SwRecordLayout**			
Package	M2::MSR::DataDictionary::RecordLayout			
Note	Defines how the data objects (variables, calibration parameters etc.) are to be stored in the ECU memory. As an example, this definition specifies the sequence of axis points in the ECU memory. Iterations through axis values are stored within the sub-elements swRecordLayoutGroup. **Tags:** atp.recommendedPackage=SwRecordLayouts			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
swRecordLayoutGroup	SwRecordLayoutGroup	1	aggr	This is the top level record layout group. **Tags:** xml.roleElement=true; xml.roleWrapperElement=false; xml.sequenceOffset=20; xml.typeElement=false; xml.typeWrapperElement=false

Table C.75: SwRecordLayout

Class	**SystemSignal**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::FibexCore::CoreCommunication			
Note	The system signal represents the communication system's view of data exchanged between SW components which reside on different ECUs. The system signals allow to represent this communication in a flattened structure, with exactly one system signal defined for each data element prototype sent and received by connected SW component instances. **Tags:** atp.recommendedPackage=SystemSignals			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
dynamicLength	Boolean	1	attr	The length of dynamic length signals is variable in run-time. Only a maximum length of such a signal is specified in the configuration (attribute length in ISignal element).

physicalProps	SwDataDefProps	0..1	aggr	Specification of the physical representation.

Table C.76: SystemSignal

Class	***TimeSynchronizationInterface* (abstract)**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	This meta-class provides the abstract ability to define a PortInterface for the interaction with Time Synchronization. **Tags:** atp.Status=draft			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *PortInterface*, *Referrable*			
Subclasses	TimeSynchronizationMasterInterface, TimeSynchronizationPureLocalInterface, TimeSynchronizationSlaveInterface			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table C.77: TimeSynchronizationInterface

Class	***TransformationProps* (abstract)**			
Package	M2::AUTOSARTemplates::SystemTemplate::Transformer			
Note	This meta-class represents a abstract base class for transformation settings.			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	ApSomeipTransformationProps, SOMEIPTransformationProps, UserDefinedTransformationProps			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table C.78: TransformationProps

Enumeration	**TransportLayerProtocolEnum**
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstance
Note	This enumeration allows to choose a TCP/IP transport layer protocol. **Tags:** atp.Status=draft
Literal	***Description***
tcp	Transmission control protocol **Tags:** atp.EnumerationValue=1
udp	User datagram protocol **Tags:** atp.EnumerationValue=0

Table C.79: TransportLayerProtocolEnum

Class	**Trigger**			
Package	M2::AUTOSARTemplates::CommonStructure::TriggerDeclaration			
Note	A trigger which is provided (i.e. released) or required (i.e. used to activate something) in the given context.			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
swImplPolicy	SwImplPolicyEnum	0..1	attr	This attribute, when set to value queued, allows for a queued processing of Triggers.
triggerPeriod	MultidimensionalTime	0..1	aggr	Optional definition of a period in case of a periodically (time or angle) driven external trigger.

Table C.80: Trigger

Class	**TriggerInterface**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::PortInterface			
Note	A trigger interface declares a number of triggers that can be sent by an trigger source. **Tags:** atp.recommendedPackage=PortInterfaces			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *PortInterface*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
trigger	Trigger	1..*	aggr	The Trigger of this trigger interface.

Table C.81: TriggerInterface

Class	**Unit**			
Package	M2::MSR::AsamHdo::Units			

Note	This is a physical measurement unit. All units that might be defined should stem from SI units. In order to convert one unit into another factor and offset are defined.
	
	For the calculation from SI-unit to the defined unit the factor (factorSiToUnit) and the offset (offsetSiToUnit) are applied as follows:
	`x [{unit}] := y * [{siUnit}] * factorSiToUnit [[unit]/{siUnit}] + offsetSiToUnit [{unit}]`
	
	For the calculation from a unit to SI-unit the reciprocal of the factor (factorSiToUnit) and the negation of the offset (offsetSiToUnit) are applied.
	`y {siUnit} := (x*{unit} - offsetSiToUnit [{unit}]) / (factorSiToUnit [[unit]/{siUnit}]`
	
	Tags: atp.recommendedPackage=Units			

Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***

displayName	SingleLanguageUnitNames	0..1	aggr	This specifies how the unit shall be displayed in documents or in user interfaces of tools.The displayName corresponds to the Unit.Display in an ASAM MCD-2MC file. **Tags:** xml.sequenceOffset=20
factorSiToUnit	Float	0..1	attr	This is the factor for the conversion from SI Units to units. The inverse is used for conversion from units to SI Units. **Tags:** xml.sequenceOffset=30
offsetSiToUnit	Float	0..1	attr	This is the offset for the conversion from and to siUnits. **Tags:** xml.sequenceOffset=40
physicalDimension	PhysicalDimension	0..1	ref	This association represents the physical dimension to which the unit belongs to. Note that only values with units of the same physical dimensions might be converted. **Tags:** xml.sequenceOffset=50

Table C.82: Unit

Class	**UserDefinedServiceInstanceToMachineMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::Deployment::ServiceInstanceMapping			
Note	This meta-class allows to map UserDefinedServiceInstances to a CommunicationConnector of a Machine. **Tags:** atp.ManifestKind=ServiceInstanceManifest; atp.Status=draft; atp.recommendedPackage=ServiceInstanceToMachineMappings			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *ServiceInstanceToMachineMapping*, *UploadablePackageElement*			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
–	–	–	–	–

Table C.83: UserDefinedServiceInstanceToMachineMapping

Class	***ValueSpecification* (abstract)**			
Package	M2::AUTOSARTemplates::CommonStructure::Constants			
Note	Base class for expressions leading to a value which can be used to initialize a data object.			
Base	*ARObject*			
Subclasses	*AbstractRuleBasedValueSpecification*, ApplicationValueSpecification, *Composite ValueSpecification*, ConstantReference, NumericalValueSpecification, Reference ValueSpecification, TextValueSpecification			
Attribute	***Type***	***Mul.***	***Kind***	***Note***
shortLabel	Identifier	0..1	attr	This can be used to identify particular value specifications for human readers, for example elements of a record type.

Table C.84: ValueSpecification

D History of Constraints and Specification Items

Please note that the lists in this chapter also include constraints and specification items that have been removed from the specification in a later version. These constraints and specification items do not appear as hyperlinks in the document.

D.1 Constraint History of this Document according to the original version of the Document

D.1.1 Created Constraints

Number	Heading
[constr_1473]	No support for `PRPortPrototype`
[constr_1474]	`SwDataDefProps` applicable to `ImplementationDataType`s exclusive to the *AUTOSAR adaptive platform*
[constr_1475]	`ImplementationDataType` of `category STRING` is limited
[constr_1476]	`ImplementationDataType` of `category VECTOR` is limited
[constr_1477]	`ImplementationDataType` of `category ASSOCIATIVE_MAP` is limited
[constr_1478]	`SwDataDefProps` applicable to `ApplicationDataType`s exclusive to the *AUTOSAR adaptive platform*
[constr_1479]	No support for certain values of `ImplementationDataType.category`
[constr_1480]	Mutual existence of `CompositionDataPrototypeRef.elementInImplDatatype` vs. attributes of `CompositionDataPrototypeRef.dataPrototype`
[constr_1481]	Usage of `CompositionDataPrototypeRef` in the *AUTOSAR adaptive platform*
[constr_1482]	Mapping of service interfaces vs. mapping of service interface elements
[constr_1483]	Applicability of a `ServiceInterface`
[constr_1484]	Applicability of `ModeDependentStartupConfig.executionDependency`
[constr_1485]	No `subElement` for `ImplementationDataType` of `category STRING`

Number	Heading
[constr_1486]	ImplementationDataType of category STRING and SwBaseType
[constr_1487]	Number of subElements of an ImplementationDataType of category ASSOCIATIVE_MAP
[constr_1488]	Initialization of a DataPrototype typed by an ApplicationAssocMapDataType
[constr_1489]	Uniqueness of ApplicationAssocMapValueSpecification.mapElementTuple.key
[constr_1490]	Allowed value of category for reference AdaptiveModuleInstantiation.process.executable
[constr_1491]	Reference to ApplicationError
[constr_1492]	SwComponentType referenced as Executable.rootSwComponentPrototype.applicationType
[constr_1493]	ArgumentDataPrototype referenced in the role ApplicationError.errorContext
[constr_1494]	Initial value for event
[constr_1495]	Initial value for field
[constr_1496]	DiagnosticServiceDataMapping.mappedApDataElement shall only refer to specific sub-classes of DataPrototype
[constr_1497]	Attribute optionKind set to commandLineSimpleForm
[constr_1498]	Attribute optionKind set to commandLineShortForm or commandLineLongForm
[constr_1499]	Target SwcServiceDependency of DiagnosticServiceSwMapping.mappedSwcServiceDependencyInExecutable
[constr_1500]	Target SwcServiceDependency of DiagnosticEventPortMapping.swcServiceDependencyInExecutable
[constr_1501]	Target SwcServiceDependency of DiagnosticOperationCyclePortMapping.swcServiceDependencyInExecutable
[constr_1502]	Target SwcServiceDependency of DiagnosticEnableConditionPortMapping.swcServiceDependencyInExecutable
[constr_1503]	Target SwcServiceDependency of DiagnosticStorageConditionPortMapping.swcServiceDependencyInExecutable
[constr_1504]	Number of Process.modeDependentStartupConfig that refer to the same ModeDeclaration
[constr_1505]	Number of Process.modeDependentStartupConfig that do not refer to a ModeDeclaration
[constr_1507]	PortInterfaceToDatatypeMapping is only applicable to ServiceInterface
[constr_1508]	BaseTypeDirectDefinition.nativeDeclaration shall not be set to the value enum
[constr_3320]	Aggregation of CommunicationConnector by Machine
[constr_3287]	Mandatory information of a ProvidedSomeipServiceInstance
[constr_3288]	IP configuration restriction for unicastNetworkEndpoints
[constr_3290]	Usage of ServiceInstancePortConfig defined for a ProvidedSomeipServiceInstance
[constr_3291]	SomeipServiceInstanceToMachineMapping.portConfig aggregation restriction
[constr_3293]	Mandatory information of a RequiredSomeipServiceInstance
[constr_3296]	Usage of ServiceInstancePortConfig defined for a RequiredSomeipServiceInstance
[constr_3297]	SomeipServiceInstanceToMachineMapping only supports a single Address Family

Number	Heading
[constr_3300]	Allowed ServiceMethodDeployment.method references
[constr_3301]	Allowed ServiceEventDeployment.event references
[constr_3302]	Allowed ServiceFieldDeployment.field references
[constr_3303]	ANY not allowed for SomeipServiceInterface.serviceInterfaceVersion
[constr_3304]	Value of attribute SomeipEventGroup.eventGroupId shall be unique
[constr_3305]	Value of attribute SomeipEvent.eventId shall be unique
[constr_3306]	Value of attribute SomeipMethod.methodId shall be unique
[constr_3307]	SomeipEvent.transportProtocol setting to udp and the impact on ProvidedSomeipServiceInstances
[constr_3308]	SomeipEvent.transportProtocol setting to tcp and the impact on ProvidedSomeipServiceInstances
[constr_3309]	SomeipMethod.transportProtocol setting to udp and the impact on ProvidedSomeipServiceInstances
[constr_3310]	SomeipMethod.transportProtocol setting to tcp and the impact on ProvidedSomeipServiceInstances
[constr_3320]	Aggregation of CommunicationConnector by Machine
[constr_3349]	Usage of ApplicationAssocMapDataType is limited
[constr_3350]	Consistent value of category for AdaptiveAutosarApplications referencing an Executable
[constr_3351]	SOME/IP segmentation allowed for udp SomeipEvents
[constr_3352]	SOME/IP segmentation allowed for udp SomeipMethods
[constr_3353]	Restriction in usage of ApSomeipTransformationProps.sizeOfArrayLengthField
[constr_3354]	Restriction in usage of ApSomeipTransformationProps.sizeOfStructLengthField
[constr_3355]	Restriction in usage of ApSomeipTransformationProps.sizeOfUnionLengthField
[constr_3356]	Restriction in usage of ApSomeipTransformationProps.alignment
[constr_3357]	Restriction in usage of ApSomeipTransformationProps.sizeOfUnionTypeSelectorField
[constr_3358]	Usage of PortPrototype and TransportLayerIndependentInstanceId to define the same Service Instance is not allowed.
[constr_3359]	RPortPrototypeProps are related only to RPortPrototypes.
[constr_3360]	RPortPrototypeProps are related only to TransportLayerIndependentInstanceIds representing a consumer Service Instance.
[constr_3361]	Selective definition of serialization settings.
[constr_3362]	SomeipEvents aggregated by a SomeipField
[constr_3363]	SomeipMethods aggregated by a SomeipField

Table D.1: Added Constraints in original version

D.1.2 Created Specification Items

Number	Heading
[TPS_MANI_01000]	Definition of the term Manifest

Number	Heading
[TPS_MANI_01001]	Meaning of ServiceInterface
[TPS_MANI_01002]	Semantics of a ServiceInterfaceMapping
[TPS_MANI_01003]	Limitations of the applicability of ServiceInterfaceMapping
[TPS_MANI_01004]	Semantics of ServiceInterface.namespace
[TPS_MANI_01005]	The definition of the namespace of a ServiceInterface may follow a hierarchical pattern
[TPS_MANI_01006]	Ordered definition of ServiceInterface.namespace
[TPS_MANI_01007]	Service-oriented **communication** and service **discovery**
[TPS_MANI_01008]	Semantics of AdaptiveAutosarApplication
[TPS_MANI_01009]	Standardized values of AdaptiveAutosarApplication.category
[TPS_MANI_01010]	Root element for a hierarchical software-component
[TPS_MANI_01011]	Connection between application design and application deployment
[TPS_MANI_01012]	Formal modeling of application startup behavior
[TPS_MANI_01013]	Semantics of meta-class ModeDependentStartupConfig
[TPS_MANI_01014]	Semantics of meta-class StartupConfigSet
[TPS_MANI_01015]	Semantics of meta-class StartupOption
[TPS_MANI_01016]	Category of ApplicationAssocMapDataType
[TPS_MANI_01017]	Relation of startup configuration to resource groups
[TPS_MANI_01018]	ImplementationDataType of category VECTOR
[TPS_MANI_01019]	Manifest content may apply to different aspects of the *AUTOSAR adaptive platform*
[TPS_MANI_01020]	Serialization format of the *Manifest* in AUTOSAR
[TPS_MANI_01021]	Serialization format of *Manifest* content on a machine
[TPS_MANI_01022]	Concept behind ServiceInterfaceMapping
[TPS_MANI_01024]	Semantics of ServiceInterfaceEventMapping
[TPS_MANI_01025]	Semantics of ServiceInterfaceFieldMapping
[TPS_MANI_01026]	Semantics of ServiceInterfaceMethodMapping
[TPS_MANI_01027]	Semantics of ApplicationAssocMapDataType
[TPS_MANI_01028]	ImplementationDataType of category ASSOCIATIVE_MAP
[TPS_MANI_01029]	Usage of ImplementationDataType
[TPS_MANI_01030]	ImplementationDataType of category STRING
[TPS_MANI_01031]	Semantics of CompositionDataPrototypeRef
[TPS_MANI_01032]	Usage of ServiceInterfaceMapping
[TPS_MANI_01033]	Semantics of ServiceInterface.event
[TPS_MANI_01034]	Semantics of ServiceInterface.field
[TPS_MANI_01035]	Semantics of ServiceInterface.method
[TPS_MANI_01037]	Diagnostic data mapping on the *AUTOSAR adaptive platform*
[TPS_MANI_01038]	Diagnostic software mapping on the *AUTOSAR adaptive platform*
[TPS_MANI_01039]	Representation of provided service
[TPS_MANI_01040]	Representation of required service
[TPS_MANI_01041]	Startup configuration supports the definition of a launch dependency

Number	Heading
[TPS_MANI_01042]	Definition of a linear ImplementationDataType of category VECTOR
[TPS_MANI_01043]	Definition of a rectangular ImplementationDataType of category VECTOR
[TPS_MANI_01044]	Structure of an ImplementationDataType of category ASSOCIATIVE_MAP
[TPS_MANI_01045]	Process.modeDependentStartupConfig that does not refer to a ModeDeclaration
[TPS_MANI_01046]	Semantics of ModeDependentStartupConfig.machineMode
[TPS_MANI_01047]	Existence of SwRecordLayout for an ApplicationPrimitiveDataType of category STRING
[TPS_MANI_01048]	Mapping of DiagnosticEvent to PortPrototype(s) on the *AUTOSAR adaptive platform*
[TPS_MANI_01049]	Mapping of DiagnosticOperationCycle to PortPrototype(s) on the *AUTOSAR adaptive platform*
[TPS_MANI_01050]	Mapping of DiagnosticEnableCondition to PortPrototype(s) on the *AUTOSAR adaptive platform*
[TPS_MANI_01051]	Mapping of DiagnosticStorageCondition to PortPrototype(s) on the *AUTOSAR adaptive platform*
[TPS_MANI_01052]	Semantics of RPortPrototypeProps.portInstantiationBehavior
[TPS_MANI_01053]	Usage of ComSpecs on the *AUTOSAR adaptive platform*
[TPS_MANI_01054]	Definition of the queue length of an event
[TPS_MANI_01055]	Semantics of ServiceInterface.possibleError
[TPS_MANI_01056]	Semantics of ApplicationError.errorContext
[TPS_MANI_01057]	Semantics of RPortPrototypeProps.searchBehavior
[TPS_MANI_01058]	Ability to create a mapping of ApplicationErrors aggregated in the role possibleError
[TPS_MANI_01059]	Different values of optionKind within a StartupConfig.startupOption
[TPS_MANI_01060]	Use cases for the application of DiagnosticServiceDataMapping
[TPS_MANI_01061]	Requirements on scheduling
[TPS_MANI_01062]	ImplementationDataType to generate a C++ enum
[TPS_MANI_01063]	Sharing of ImplementationDataType with enumeration semantics
[TPS_MANI_03000]	Mapping of AdaptivePlatformServiceInstance to PortPrototypes
[TPS_MANI_03001]	Mapping of AdaptivePlatformServiceInstance to a Machine
[TPS_MANI_03002]	IP configuration for a ProvidedSomeipServiceInstance
[TPS_MANI_03003]	ProvidedSomeipServiceInstance Fanout
[TPS_MANI_03004]	IPv4 Multicast event destination address
[TPS_MANI_03005]	IPv4 Multicast address range
[TPS_MANI_03006]	IPv6 Multicast address range
[TPS_MANI_03007]	Udp Transport Protocol Configuration for ProvidedSomeipServiceInstance
[TPS_MANI_03008]	Tcp Transport Protocol Configuration for ProvidedSomeipServiceInstance
[TPS_MANI_03009]	Tcp and Udp Transport Protocol Configuration for ProvidedSomeipServiceInstance

Number	Heading
[TPS_MANI_03010]	Udp Transport Protocol Configuration in case of IP-Multicast
[TPS_MANI_03011]	Server Timing configuration for a ProvidedSomeipServiceInstance
[TPS_MANI_03012]	Initial Wait Phase configuration for a ProvidedSomeipServiceInstance
[TPS_MANI_03013]	Repetition Wait Phase configuration for a ProvidedSomeipServiceInstance
[TPS_MANI_03014]	Main Phase configuration for a ProvidedSomeipServiceInstance
[TPS_MANI_03015]	TTL for Offer Service Entries
[TPS_MANI_03016]	Servers RequestResponseDelay for received FindService entries
[TPS_MANI_03017]	Server Capability Records
[TPS_MANI_03018]	Usage of SomeipProvidedEventGroup.multicastThreshold
[TPS_MANI_03019]	TTL for SubscribeEventGroupAck Entries
[TPS_MANI_03020]	Servers RequestResponseDelay for received SubscribeEventGroup entries
[TPS_MANI_03021]	Requirements on the service version from the client's point of view
[TPS_MANI_03022]	Context of RequiredSomeipServiceInstance
[TPS_MANI_03023]	Udp Transport Protocol Configuration for RequiredSomeipServiceInstance
[TPS_MANI_03024]	Tcp Transport Protocol Configuration for RequiredSomeipServiceInstance
[TPS_MANI_03025]	Client Timing configuration for a RequiredSomeipServiceInstance
[TPS_MANI_03026]	Initial Wait Phase configuration for a RequiredSomeipServiceInstance
[TPS_MANI_03027]	Repetition Wait Phase configuration for a RequiredSomeipServiceInstance
[TPS_MANI_03028]	TTL for Find Service Entries
[TPS_MANI_03029]	Client Capability Records
[TPS_MANI_03030]	SomeipSdClientEventGroupTimingConfig.timeToLive for SubscribeEventGroup Entries
[TPS_MANI_03031]	Clients RequestResponseDelay for received ServiceOffer entries
[TPS_MANI_03032]	Description of middleware technologies not standardized by AUTOSAR
[TPS_MANI_03035]	Content of the Machine configuration
[TPS_MANI_03036]	ServiceInterface deployment to a middleware transport layer
[TPS_MANI_03037]	Purpose of ServiceMethodDeployment
[TPS_MANI_03038]	Purpose of ServiceEventDeployment
[TPS_MANI_03039]	Purpose of ServiceFieldDeployment
[TPS_MANI_03040]	SOME/IP ServiceInterface binding
[TPS_MANI_03041]	Definition of SOME/IP EventGroups
[TPS_MANI_03042]	Definition of SOME/IP Service Version
[TPS_MANI_03043]	SOME/IP VariableDataPrototype binding
[TPS_MANI_03044]	SOME/IP ClientServerOperation binding
[TPS_MANI_03045]	UserDefined ServiceInterface binding
[TPS_MANI_03046]	User defined VariableDataPrototype binding
[TPS_MANI_03047]	User defined ClientServerOperation binding
[TPS_MANI_03048]	User defined Field binding

Number	Heading
[TPS_MANI_03049]	Tcp and Udp Transport Protocol Configuration for RequiredSomeipServiceInstance
[TPS_MANI_03050]	Tcp and Udp Transport Protocol Configuration for RequiredSomeipServiceInstance
[TPS_MANI_03051]	Usage of SomeipMethod.transportProtocol
[TPS_MANI_03052]	Static IPv4 configuration
[TPS_MANI_03053]	Static IPv6 configuration
[TPS_MANI_03056]	Usage of SomeipEvent.transportProtocol
[TPS_MANI_03057]	SOME/IP Field binding
[TPS_MANI_03059]	RequiredSomeipServiceInstance.requiredServiceInstanceId
[TPS_MANI_03061]	IPv6 Multicast event destination address
[TPS_MANI_03064]	SOME/IP Service Discovery message exchange configuration
[TPS_MANI_03065]	Hardware resources of the machine
[TPS_MANI_03066]	Description of machine states
[TPS_MANI_03067]	SOME/IP segmentation of udp SomeipEvents
[TPS_MANI_03068]	SOME/IP segmentation of SomeipMethod Calls
[TPS_MANI_03069]	SOME/IP segmentation of SomeipMethod Responses
[TPS_MANI_03070]	Size of a length field for a chosen array
[TPS_MANI_03071]	Size of a length field for a chosen structure
[TPS_MANI_03072]	Size of a length field for a chosen union
[TPS_MANI_03073]	Alignment of a dynamic DataPrototype
[TPS_MANI_03074]	Size of a type selector field for a chosen union
[TPS_MANI_03075]	Byte Order of chosen DataPrototype in the serialized data stream
[TPS_MANI_03094]	Machine-specific platform configuration settings
[TPS_MANI_03095]	Implementation-specific platform configuration settings
[TPS_MANI_03096]	Machine-specific configuration settings for a generic module
[TPS_MANI_03097]	Implementation-specific configuration settings for a generic module
[TPS_MANI_03098]	Machine-specific configuration settings for the OS module
[TPS_MANI_03099]	Implementation-specific configuration settings for the OS module
[TPS_MANI_03100]	Transport layer independent TransportLayerIndependentInstanceIds
[TPS_MANI_03101]	SOME/IP serialization
[TPS_MANI_03102]	UserDefined serialization
[TPS_MANI_03103]	Default size for all array length fields
[TPS_MANI_03104]	Default size for all structure length fields
[TPS_MANI_03105]	Default size for all union length fields
[TPS_MANI_03106]	Default size for all union type selector fields
[TPS_MANI_03107]	Default alignment for all dynamic DataPrototypes
[TPS_MANI_03108]	Default Byte Order for all DataPrototypes
[TPS_MANI_03109]	TransformationProps on the level of DataPrototypes overwrites TransformationProps settings on the level of a ServiceInterface

Table D.2: Added Specification Items in original Version

D.2 Constraint and Specification Item History of this document according to AUTOSAR Release 17-10

D.2.1 Added Traceables in 17-10

Number	Heading
[TPS_MANI_01064]	Semantics of attribute `method.fireAndForget`
[TPS_MANI_01065]	Purpose of `PersistencyKeyValueDatabaseInterface`
[TPS_MANI_01067]	Purpose of `PersistencyFileProxyInterface`
[TPS_MANI_01068]	Semantics of `PersistencyFileProxyInterface.maxNumberOfFiles`
[TPS_MANI_01069]	Further qualification of properties of `PortPrototype`s typed by `PersistencyKeyValueDatabaseInterface`s
[TPS_MANI_01073]	Semantics of `PortPrototype` typed by `PersistencyKeyValueDatabaseInterface`
[TPS_MANI_01074]	Specification of encryption of persistent data
[TPS_MANI_01075]	Specification of redundancy of persistent data
[TPS_MANI_01077]	Specification of file encryption
[TPS_MANI_01078]	Semantics of `PersistencyPortPrototypeToKeyValueDatabaseMapping`
[TPS_MANI_01079]	Semantics of `PersistencyKeyValueDatabase`
[TPS_MANI_01080]	Semantics of `PersistencyFileProxyToFileMapping`
[TPS_MANI_01081]	Semantics of `PortPrototype` typed by `PersistencyFileProxyInterface`
[TPS_MANI_01082]	Eligibility of `DataPrototype`s for the definition of optionality
[TPS_MANI_01083]	Optionality is supported for `ApplicationDataType` as well as `ImplementationDataType`
[TPS_MANI_01084]	Optionality for a `DataPrototype` typed by an `ApplicationDataType`
[TPS_MANI_01085]	Definition of optionality for a `DataPrototype` typed by an `ImplementationDataType`
[TPS_MANI_01087]	Interaction with crypto software
[TPS_MANI_01088]	Semantics of `CryptoNeed`
[TPS_MANI_01089]	Relation between `CryptoNeed` and `PortPrototype`
[TPS_MANI_01090]	Modeling of crypto software as a platform module
[TPS_MANI_01091]	Semantics of `CryptoJob`
[TPS_MANI_01092]	Mapping between `CryptoNeed` and `CryptoJob`
[TPS_MANI_01093]	Semantics of `CryptoDriver`
[TPS_MANI_01094]	Scope of `CryptoDriver`
[TPS_MANI_01095]	Semantics of `CryptoKeySlot`
[TPS_MANI_01096]	Semantics of the `CryptoPrimitive`
[TPS_MANI_01097]	Assignment of TLV data ids for data structures with optional members
[TPS_MANI_01098]	Constraints on the definition of an `ImplementationDataType` of `category` VECTOR
[TPS_MANI_01099]	Semantics of `ImplementationDataTypeElementExtension`
[TPS_MANI_01100]	Semantics of `Allocator`

Number	Heading
[TPS_MANI_01101]	Size-constrained allocation of memory
[TPS_MANI_01102]	Specification of a namespace for an ImplementationDataType of category VECTOR
[TPS_MANI_01103]	Three-level approach to REST modeling
[TPS_MANI_01105]	Semantics of RestServiceInterface
[TPS_MANI_01106]	Specification of capabilities for the receiver of events or field notifiers
[TPS_MANI_01107]	Specification of capabilities for the sender of events or field notifiers
[TPS_MANI_01108]	Specification of capabilities for the caller of a methods or field setter/getter
[TPS_MANI_01109]	Semantics of UploadablePackageElement
[TPS_MANI_01110]	Semantics of SoftwareCluster
[TPS_MANI_01111]	Diagnostic Address of a SoftwareCluster
[TPS_MANI_01112]	Semantics of SoftwareClusterDesign
[TPS_MANI_01113]	Semantics of SoftwareClusterDesign.diagnosticAddress
[TPS_MANI_01114]	Relation of DiagnosticContributionSet to SoftwareCluster
[TPS_MANI_01115]	Specification of executable software within SoftwareCluster
[TPS_MANI_01116]	Reference to model elements included in an uploadable software package
[TPS_MANI_01117]	Semantics of SoftwareClusterDesign.intendedTargetMachine
[TPS_MANI_01118]	Relation between SoftwareClusterDesign and DiagnosticContributionSet
[TPS_MANI_01119]	Reference to model elements from SoftwareClusterDesign
[TPS_MANI_01120]	Recursive definition of RestResourceDef
[TPS_MANI_01121]	Semantics of RestResourceDef.endpoint
[TPS_MANI_01122]	Arguments to endpoints
[TPS_MANI_01123]	System Triggered Event
[TPS_MANI_01124]	Semantics of RestElementDef
[TPS_MANI_01125]	Properties of REST elements can either be primitive or have array semantics
[TPS_MANI_01126]	Definition of string properties
[TPS_MANI_01127]	Limited support for data semantics in RestAbstractNumericalPropertyDef
[TPS_MANI_01128]	Difference between RestIntegerPropertyDef and RestNumberPropertyDef
[TPS_MANI_01129]	RestObjectRef is only needed for specific implementations of REST-based communication
[TPS_MANI_01130]	Structure of a typical URI for a REST service
[TPS_MANI_01131]	Impact of nested REST resources on the structure of REST URI
[TPS_MANI_01132]	Semantics of CompositionDataPrototypeRef
[TPS_MANI_01133]	Optional element of an event
[TPS_MANI_01134]	Optional element in the context of a method
[TPS_MANI_03110]	Allowed components in system description with category category SOFTWARE_COMPONENT_SYSTEM_DESIGN_DESCRIPTION.
[TPS_MANI_03111]	Mapping between method and operation
[TPS_MANI_03112]	Mapping between an event and a dataElement

Number	Heading
[TPS_MANI_03113]	Mapping between a field and elements of Classic Platform PortInterfaces
[TPS_MANI_03114]	Usage of AssemblySwConnectors in the System Design model
[TPS_MANI_03115]	Mapping between a fire and forget method and elements of Classic Platform PortInterfaces
[TPS_MANI_03116]	Size of a length field for a chosen string
[TPS_MANI_03117]	Default size for all string length fields
[TPS_MANI_03118]	Semantics of ServiceInterface.method with fireAndForget set to true
[TPS_MANI_03119]	Default value for the attribute fireAndForget of meta-class ClientServerOperation
[TPS_MANI_03120]	Signal-based ServiceInterface binding
[TPS_MANI_03121]	Signal-based VariableDataPrototype binding
[TPS_MANI_03122]	Signal-based Field binding
[TPS_MANI_03123]	Signal-based ClientServerOperation binding
[TPS_MANI_03124]	SignalBasedEventDeployment to ISignalTriggering mapping
[TPS_MANI_03125]	SignalBasedMethodDeployment to ISignalTriggerings mapping
[TPS_MANI_03126]	SignalBasedFieldDeployment to ISignalTriggerings mapping
[TPS_MANI_03127]	Usage of End2EndEventProtectionProps
[TPS_MANI_03128]	Usage of same dataId in case of Multi-Binding
[TPS_MANI_03129]	E2E profile
[TPS_MANI_03130]	Standardized E2EProfileConfiguration.profileName values
[TPS_MANI_03131]	Non-Standardized E2EProfileConfiguration.profileName values
[TPS_MANI_03132]	Semantics of E2E attributes in ReceiverComSpec
[TPS_MANI_03133]	Usage of ServiceInterfaceElementSecureComConfig
[TPS_MANI_03134]	Configuration of supported TLS ciphersuites
[TPS_MANI_03135]	Configuration of TLS PSK Identity
[TPS_MANI_03136]	Configuration of requirements for the TLS cryptographic job
[TPS_MANI_03137]	ServiceInterfaceElementSecureComConfig.dataId and ServiceInterfaceElementSecureComConfig.freshnessValueId are not relevant in case of TLS communication
[TPS_MANI_03138]	SecOC Security Profile
[TPS_MANI_03139]	Standardized SecOC Security Profiles
[TPS_MANI_03140]	Non-Standardized SecOC Security Profiles
[TPS_MANI_03141]	Mapping between SecOcJobRequirement and CryptoJob
[TPS_MANI_03142]	Mapping between TlsJobRequirement and CryptoJob
[TPS_MANI_03143]	Mapping between PresharedKeyIdentity and CryptoKeySlot
[TPS_MANI_03144]	C++ language binding of ImplementationDataTypes of category STRING
[TPS_MANI_03145]	Description of a function group
[TPS_MANI_03146]	Configuration of timeouts for a selected machine state or function group state
[TPS_MANI_03147]	Mapping of a Process to a Machine
[TPS_MANI_03148]	Description of Core affinity

Number	Heading
[TPS_MANI_03149]	Definition of a start-up timeout for a `Process`
[TPS_MANI_03150]	Definition of a termination timeout for a `Process`
[TPS_MANI_03151]	Default value for termination timeout
[TPS_MANI_03152]	Assignment of a `ModeDependentStartupConfig` to a function group state
[TPS_MANI_03153]	Semantics of `ModeDependentStartupConfig.functionGroup`
[TPS_MANI_03500]	Definition of platform health management checkpoints
[TPS_MANI_03501]	Definition of platform health management supervised entities
[TPS_MANI_03502]	Enabling of `PlatformHealthManagementContribution` on a `Machine`
[TPS_MANI_03503]	Applicability of supervision to a specific `Process`
[TPS_MANI_03504]	Existence of `SupervisionEntity`
[TPS_MANI_03505]	Existence of `PhmCheckpoint`
[TPS_MANI_03506]	Optionality of `SupervisionEntity` and `PhmCheckpoint`
[TPS_MANI_03508]	Definition of an `AliveSupervision` for a `PhmCheckpoint`
[TPS_MANI_03509]	Definition of a `CheckpointTransition`
[TPS_MANI_03510]	Definition of `LogicalSupervision`
[TPS_MANI_03511]	Definition of `DeadlineSupervision`
[TPS_MANI_03512]	Applicability of global supervision to a specific `Process`
[TPS_MANI_03513]	Collection of `SupervisionEntity`s into a global supervision
[TPS_MANI_03514]	Expiration tolerance for `GlobalSupervisionEntity`
[TPS_MANI_03515]	Expiration tolerance for `SupervisionEntity`
[TPS_MANI_03516]	Condition evaluation for `HealthChannelSupervision`
[TPS_MANI_03517]	Condition evaluation for `HealthChannelExternalMode`
[TPS_MANI_03518]	`LogicalExpression` definition
[TPS_MANI_03519]	`Rule` definition
[TPS_MANI_03520]	Execution of `ActionList` with `actionListExecution`=`triggeredOnEvaluation`
[TPS_MANI_03521]	Execution of `ActionList` with `actionListExecution`=`triggeredOnChange`
[TPS_MANI_03522]	Definition of actions for application software
[TPS_MANI_03523]	Definition of actions for Platform Instance
[TPS_MANI_03524]	Definition of actions for Watchdog

Table D.3: Added Traceables in 17-10

D.2.2 Changed Traceables in 17-10

Number	Heading
[TPS_MANI_01004]	Semantics of `ServiceInterface.namespace`
[TPS_MANI_01006]	Ordered definition of `ServiceInterface.namespace`
[TPS_MANI_01017]	Relation of startup configuration to resource group
[TPS_MANI_01018]	`ImplementationDataType` of `category` `VECTOR`
[TPS_MANI_01030]	`ImplementationDataType` of `category` `STRING`

Number	Heading
[TPS_MANI_03000]	Mapping of AdaptivePlatformServiceInstance to PortPrototypes
[TPS_MANI_03007]	Udp Transport Protocol Configuration for ProvidedSomeipServiceInstance
[TPS_MANI_03008]	Tcp Transport Protocol Configuration for ProvidedSomeipServiceInstance
[TPS_MANI_03009]	Tcp and Udp Transport Protocol Configuration for ProvidedSomeipServiceInstance
[TPS_MANI_03010]	Udp Transport Protocol Configuration in case of IP-Multicast
[TPS_MANI_03018]	Usage of SomeipProvidedEventGroup.multicastThreshold
[TPS_MANI_03023]	Udp Transport Protocol Configuration for RequiredSomeipServiceInstance
[TPS_MANI_03024]	Tcp Transport Protocol Configuration for RequiredSomeipServiceInstance
[TPS_MANI_03049]	Tcp and Udp Transport Protocol Configuration for RequiredSomeipServiceInstance
[TPS_MANI_03101]	SOME/IP serialization
[TPS_MANI_03102]	UserDefined serialization
[TPS_MANI_03103]	Default size for all array length fields
[TPS_MANI_03104]	Default size for all structure length fields
[TPS_MANI_03105]	Default size for all union length fields
[TPS_MANI_03106]	Default size for all union type selector fields
[TPS_MANI_03107]	Default alignment for all dynamic DataPrototypes
[TPS_MANI_03108]	Default Byte Order for all DataPrototypes
[TPS_MANI_03109]	TransformationProps on the level of DataPrototypes overwrites TransformationProps settings on the level of a ServiceInterface

Table D.4: Changed Traceables in 17-10

D.2.3 Deleted Traceables in 17-10

Number	Heading
[TPS_MANI_03100]	Transport layer independent TransportLayerIndependentInstanceIds

Table D.5: Deleted Traceables in 17-10

D.2.4 Added Constraints in 17-10

Number	Heading
[constr_1522]	Semantics of ClientServerOperation.possibleError
[constr_1524]	Standardized values of PersistencyFileProxyInterface.category
[constr_1525]	Standardized values of PersistencyFile.category
[constr_1526]	Values of PersistencyFileArray.file.category

Number	Heading
[constr_1527]	ImplementationDataTypeElement finally referenced as the target element in the context of an ImplementationDataTypeElementInAutosarDataPrototypeRef
[constr_1528]	Definition of optionality for multiple DataPrototypes typed by the same AutosarDataType
[constr_1529]	Standardized values of CryptoNeed.category
[constr_1530]	Standardized values of CryptoPrimitive.algorithmFamily and CryptoKeySlot.algorithmFamily
[constr_1531]	Standardized values of CryptoPrimitive.algorithmMode
[constr_1532]	Consistent assignment of TLV data ids to data structures with optional members
[constr_1533]	Applicability of ImplementationDataTypeElementExtension
[constr_1534]	Existence of DiagnosticSoftwareClusterProps
[constr_1535]	Existence of DiagnosticSoftwareClusterProps in the context of a DiagnosticContributionSet
[constr_1536]	Definition of SoftwareCluster applies for a single Machine
[constr_1537]	Consistent assignment of TLV data ids to arguments of a given ClientServerOperation
[constr_1542]	No nested definition of SoftwareCluster
[constr_1543]	Only one physical address per SoftwareCluster
[constr_3366]	System category for a system description with Adaptive Platform components
[constr_3367]	FieldMapping.notifierDataElement reference
[constr_3368]	FieldMapping.getterOperation reference
[constr_3369]	FieldMapping.setterOperation reference
[constr_3370]	InterfaceMapping shall map all elements of a single ServiceInterface
[constr_3371]	Mutually exclusive existence of FireAndForgetMapping.dataElement reference and FireAndForgetMapping.trigger reference
[constr_3372]	Restriction in usage of ApSomeipTransformationProps.sizeOfStringLengthField
[constr_3374]	method with attribute fireAndForget set to true shall not have any inout or out arguments
[constr_3375]	method with attribute fireAndForget set to true shall not reference an ApplicationError
[constr_3376]	FireAndForgetMapping shall reference only fire and forget methods
[constr_3377]	Restriction of ISignalTriggering references in SignalBasedFieldToISignalTriggeringMapping
[constr_3380]	End2EndEventProtectionProps shall not reference an event and a notifier at the same time
[constr_3387]	Compatibility of PortPrototypes of different ServiceInterfaces
[constr_3388]	Compatibility of events
[constr_3389]	Compatibility of methods
[constr_3390]	Compatibility of fields
[constr_3391]	ServiceInterfaceElementSecureComConfig references to ServiceInterfaceDeployment elements

Number	Heading
[constr_3392]	ServiceInterfaceElementSecureComConfig.dataId and ServiceInterfaceElementSecureComConfig.freshnessValueId are mandatory in case of SecOC communication
[constr_3393]	Usage of shallRunOn and shallNotRunOn references
[constr_3394]	Default value for start-up timeout on the Machine is not configurable
[constr_3395]	TransformationPropsToServiceInterfaceElementMapping is restricted to one single ServiceInterface
[constr_3396]	Number of Process.modeDependentStartupConfig that refer to the same functionGroup
[constr_3397]	ModeDependentStartupConfig that refers to a functionGroup and to a machineMode
[constr_3398]	ModeDependentStartupConfig that refers to function group modes of different function groups
[constr_3527]	LogicalExpression referenced by one Rule

Table D.6: Added Constraints in 17-10

D.2.5 Changed Constraints in 17-10

Number	Heading
[constr_1486]	ImplementationDataType of category STRING and SwBaseType
[constr_1490]	Allowed value of category for reference ProcessToMachineMapping.process.executable
[constr_3290]	Transport Protocol attributes defined for a ProvidedSomeipServiceInstance
[constr_3296]	Transport Protocol attributes defined for a RequiredSomeipServiceInstance
[constr_3307]	SomeipEventDeployment.transportProtocol setting to udp and the impact on ProvidedSomeipServiceInstances
[constr_3308]	SomeipEventDeployment.transportProtocol setting to tcp and the impact on ProvidedSomeipServiceInstances
[constr_3309]	SomeipMethodDeployment.transportProtocol setting to udp and the impact on ProvidedSomeipServiceInstances
[constr_3310]	SomeipMethodDeployment.transportProtocol setting to tcp and the impact on ProvidedSomeipServiceInstances
[constr_3361]	Selective definition of serialization settings

Table D.7: Changed Constraints in 17-10

D.2.6 Deleted Constraints in 17-10

Number	Heading
[constr_3291]	SomeipServiceInstanceToMachineMapping.portConfig aggregation restriction
[constr_3358]	Usage of PortPrototype and TransportLayerIndependentInstanceId to define the same Service Instance is not allowed
[constr_3360]	RPortPrototypeProps are related only to TransportLayerIndependentInstanceIds representing a consumer Service Instance

Table D.8: Deleted Constraints in 17-10

D.3 Constraint and Specification Item History of this document according to AUTOSAR Release 18-03

D.3.1 Added Traceables in 18-03

Number	Heading
[TPS_MANI_01135]	Semantics of PersistencyKeyValueDatabaseInterface.dataTypeForSerialization
[TPS_MANI_01136]	AutosarDataPrototype is the target of the CompositionDataPrototypeRef
[TPS_MANI_01137]	Applicable use cases for CompositionDataPrototypeRef
[TPS_MANI_01138]	Semantics of PersistencyKeyValueDatabaseInterface.dataElement
[TPS_MANI_01139]	Semantics of PersistencyKeyValueDatabaseInterface.updateStrategy
[TPS_MANI_01140]	Semantics of PersistencyDataElement.updateStrategy
[TPS_MANI_01141]	Semantics of PersistencyFileProxyInterface.updateStrategy
[TPS_MANI_01142]	Semantics of PersistencyFileProxy
[TPS_MANI_01143]	Semantics of PersistencyFileProxy.updateStrategy
[TPS_MANI_01144]	Semantics of PersistencyKeyValuePair
[TPS_MANI_01146]	Initial value for PersistencyKeyValuePair
[TPS_MANI_01147]	Semantics of PersistencyKeyValueDatabase.updateStrategy
[TPS_MANI_01148]	Semantics of PersistencyKeyValuePair.updateStrategy
[TPS_MANI_01149]	Semantics of PersistencyFileArray.file
[TPS_MANI_01150]	Semantics of PersistencyFileArray
[TPS_MANI_01151]	Semantics of PersistencyFileArray.updateStrategy
[TPS_MANI_01152]	Semantics of PersistencyFile.updateStrategy
[TPS_MANI_01154]	PersistencyFileArray.updateStrategy overrides PersistencyFileProxyInterface.updateStrategy
[TPS_MANI_01155]	PersistencyKeyValueDatabase.updateStrategy overrides PersistencyKeyValueDatabaseInterface.updateStrategy
[TPS_MANI_01156]	PersistencyKeyValuePair.updateStrategy overrides PersistencyKeyValueDatabase.updateStrategy
[TPS_MANI_01157]	Semantics of updateStrategy on collection level
[TPS_MANI_01158]	PersistencyFile.updateStrategy overrides PersistencyFileArray.updateStrategy
[TPS_MANI_01159]	Semantics of updateStrategy on element level
[TPS_MANI_01160]	Definition of initial value for PersistencyDataElement
[TPS_MANI_01161]	Impact of values of category on the semantics of SoftwareClusterDesign
[TPS_MANI_01162]	Semantics of SoftwareClusterDesign.dependsOn
[TPS_MANI_01163]	Impact of values of category on the semantics of SoftwareCluster
[TPS_MANI_01164]	Semantics of SoftwareCluster.dependsOn
[TPS_MANI_01165]	Standardized value of UserDefinedServiceInterfaceDeployment.category

Number	Heading
[TPS_MANI_01166]	Semantics of CppImplementationDataType
[TPS_MANI_01167]	AbstractImplementationDataType
[TPS_MANI_01168]	Specification of a namespace for a CppImplementationDataType
[TPS_MANI_01169]	Support for template data types
[TPS_MANI_01170]	Semantics of CppTemplateArgument.isVariadicTemplate
[TPS_MANI_01171]	Modeling of structured data types
[TPS_MANI_01172]	Description of type references in the scope of CppImplementationDataType
[TPS_MANI_01173]	Description of type references in the scope of CppImplementationDataTypeElement
[TPS_MANI_01174]	Semantics of reference in the role CppTemplateArgument.templateType
[TPS_MANI_01175]	Semantics of reference in the role CppTemplateArgument.allocator
[TPS_MANI_01176]	Standardized value for attribute CppImplementationDataType.typeEmitter
[TPS_MANI_01177]	Semantics of CppImplementationDataType.typeEmitter
[TPS_MANI_01178]	Semantics of RestHttpPortPrototypeMapping.acceptsEncoding
[TPS_MANI_01179]	Semantics of PersistencyFileProxy.contentUri/PersistencyFile.contentUri vs. PersistencyFileArray.uri and PersistencyFileProxy.fileName/PersistencyFile.fileName
[TPS_MANI_01180]	Collection of data types that requires serialization support
[TPS_MANI_01181]	Use cases for the application of DiagnosticServiceSwMapping
[TPS_MANI_01182]	PersistencyKeyValuePair.updateStrategy overrides PersistencyDataElement.updateStrategy
[TPS_MANI_01183]	PersistencyFile.updateStrategy overrides PersistencyFileProxy.updateStrategy
[TPS_MANI_03154]	ProvidedSomeipServiceInstance related configuration settings for events
[TPS_MANI_03155]	ProvidedSomeipServiceInstance related configuration settings for methods
[TPS_MANI_03156]	RequiredSomeipServiceInstance related configuration settings for methods
[TPS_MANI_03157]	Enabling of data accumulation for upd data transmission
[TPS_MANI_03158]	Configuration of a data accumulation on a ProvidedServiceInstance for transmission over udp
[TPS_MANI_03159]	Configuration of a data accumulation on a RequiredSomeipServiceInstance for transmission over udp
[TPS_MANI_03160]	Log and Trace configuration options in the Application Manifest
[TPS_MANI_03161]	Log and Trace configuration options in the Service Instance Manifest
[TPS_MANI_03162]	Machine-specific configuration settings for the Log and Trace functional cluster
[TPS_MANI_03163]	Network configuration for Log and Trace messages
[TPS_MANI_03164]	Machine-specific configuration settings for DoIP
[TPS_MANI_03165]	Network configuration for DoIP
[TPS_MANI_03166]	Machine-specific configuration settings for NM module
[TPS_MANI_03167]	Network configuration for Nm

Number	Heading
[TPS_MANI_03168]	Configuration of the SOME/IP load balancing option
[TPS_MANI_03169]	CppImplementationDataType with fixed size array semantics
[TPS_MANI_03170]	CppImplementationDataType of category ARRAY
[TPS_MANI_03171]	Value type of a CppImplementationDataType of category ARRAY
[TPS_MANI_03172]	Size of a CppImplementationDataType of category ARRAY
[TPS_MANI_03173]	multidimensional Array
[TPS_MANI_03174]	CppImplementationDataType with variable size array semantics
[TPS_MANI_03175]	CppImplementationDataType of category VECTOR
[TPS_MANI_03176]	Value type of a CppImplementationDataType of category VECTOR
[TPS_MANI_03177]	multidimensional Vector
[TPS_MANI_03178]	CppImplementationDataType of category STRING
[TPS_MANI_03179]	C++ language binding of CppImplementationDataTypes of category STRING
[TPS_MANI_03180]	Definition of Structures
[TPS_MANI_03181]	Definition of members in CppImplementationDataType of category STRUCTURE
[TPS_MANI_03182]	Definition of members in CppImplementationDataTypeElement of category STRUCTURE
[TPS_MANI_03183]	CppImplementationDataType of category ASSOCIATIVE_MAP
[TPS_MANI_03184]	CppImplementationDataType of category ASSOCIATIVE_MAP
[TPS_MANI_03185]	Structure of an CppImplementationDataType of category ASSOCIATIVE_MAP
[TPS_MANI_03186]	Usage of arraySize in case of a Vector
[TPS_MANI_03187]	Definition of enumeration types
[TPS_MANI_03188]	Usage of an Allocator for a CppImplementationDataType of category STRING
[TPS_MANI_03189]	Definition of CppImplementationDataType of category VARIANT
[TPS_MANI_03190]	CppImplementationDataType of category VARIANT
[TPS_MANI_03191]	Definition of type alternatives stored in a VARIANT
[TPS_MANI_03192]	CppImplementationDataType of category VALUE
[TPS_MANI_03193]	CppImplementationDataType or CppImplementationDataTypeElement of category TYPE_REFERENCE
[TPS_MANI_03194]	Function Group State
[TPS_MANI_03195]	Off state in Function Group
[TPS_MANI_03196]	Semantics of CppImplementationDataTypeElementQualifier.anonymous attribute
[TPS_MANI_03525]	DDS ServiceInterface binding
[TPS_MANI_03526]	DDS VariableDataPrototype binding
[TPS_MANI_03527]	Definition of ProvidedDdsServiceInstance
[TPS_MANI_03528]	Definition of ProvidedDdsEventQosProps
[TPS_MANI_03529]	Definition of RequiredDdsServiceInstance
[TPS_MANI_03530]	Definition of RequiredDdsEventQosProps
[TPS_MANI_03531]	qosProfile of ProvidedDdsEventQosProps is optional

Number	Heading
[TPS_MANI_03532]	`qosProfile` of `RequiredDdsEventQosProps` is optional
[TPS_MANI_03533]	`DdsServiceInstanceToMachineMapping`
[TPS_MANI_03534]	Definition of Platform Health Management Health Channel
[TPS_MANI_03535]	Definition of Time Synchronization interaction
[TPS_MANI_03536]	Time Synchronization interaction in a master role
[TPS_MANI_03537]	Time Synchronization interaction in a slave role
[TPS_MANI_03538]	Time Synchronization interaction with a local Time Base
[TPS_MANI_03539]	Definition of Time Bases
[TPS_MANI_03540]	Definition of `PureLocalTimeBase`
[TPS_MANI_03541]	Definition of `SynchronizedSlaveTimeBase`
[TPS_MANI_03542]	Definition of `SynchronizedMasterTimeBase`
[TPS_MANI_03543]	Definition of time sync correction attributes
[TPS_MANI_03544]	Definition of `PlatformHealthManagementContribution`
[TPS_MANI_03545]	Existence of `HealthChannelExternalStatus`
[TPS_MANI_03546]	Definition of reported health status `RPortPrototype`
[TPS_MANI_03547]	Definition of *offset* time domains
[TPS_MANI_03548]	Definition of `TimeSyncPortPrototypeToTimeBaseMapping`
[TPS_MANI_03549]	Usage of `RPortPrototype` for the interaction with Time Synchronization
[TPS_MANI_03550]	Usage of `RPortPrototype` for the interaction with Platform Health Management
[TPS_MANI_03551]	Definition of Time Base kind
[TPS_MANI_03552]	Supervision cycle for `GlobalSupervision`

Table D.9: Added Traceables in 18-03

D.3.2 Changed Traceables in 18-03

Number	Heading
[TPS_MANI_01006]	Ordered definition of `ServiceInterface.namespace`
[TPS_MANI_01008]	Semantics of `ExecutableGroup`
[TPS_MANI_01009]	Standardized values of `ExecutableGroup.category`
[TPS_MANI_01013]	Semantics of meta-class `ModeDependentStartupConfig`
[TPS_MANI_01017]	Relation of startup configuration to resource group
[TPS_MANI_01041]	Startup configuration supports the definition of a launch sequence dependency
[TPS_MANI_01042]	Definition of a linear `ImplementationDataType` of `category VECTOR`
[TPS_MANI_01044]	Structure of an `ImplementationDataType` of `category ASSOCIATIVE_MAP`
[TPS_MANI_01060]	Use cases for the application of `DiagnosticServiceDataMapping`
[TPS_MANI_01068]	Semantics of `PersistencyFileProxyInterface.maxNumberOfFiles`
[TPS_MANI_01069]	Further qualification of properties of `PortPrototype`s typed by `PersistencyKeyValueDatabaseInterface`s
[TPS_MANI_01075]	Specification of redundancy of persistent data

Number	Heading
[TPS_MANI_01078]	Semantics of PersistencyPortPrototypeToKeyValueDatabaseMapping
[TPS_MANI_01080]	Semantics of PersistencyPortPrototypeToFileArrayMapping
[TPS_MANI_01097]	Assignment of TLV data ids for data structures with optional members
[TPS_MANI_01100]	Semantics of Allocator
[TPS_MANI_01109]	Semantics of UploadablePackageElement
[TPS_MANI_01112]	Semantics of SoftwareClusterDesign
[TPS_MANI_01113]	Semantics of SoftwareClusterDesign.diagnosticAddress
[TPS_MANI_01116]	Reference to model elements included in an uploadable software package
[TPS_MANI_01117]	Semantics of SoftwareClusterDesign.intendedTargetMachine
[TPS_MANI_01118]	Relation between SoftwareClusterDesign and DiagnosticContributionSet
[TPS_MANI_01119]	Reference to model elements from SoftwareClusterDesign
[TPS_MANI_01133]	Optional element of an event
[TPS_MANI_01134]	Optional element in the context of a method
[TPS_MANI_03001]	Mapping of AdaptivePlatformServiceInstance to a MachineDesign
[TPS_MANI_03002]	IP configuration for a ProvidedSomeipServiceInstance
[TPS_MANI_03003]	ProvidedSomeipServiceInstance Fanout
[TPS_MANI_03022]	Context of RequiredSomeipServiceInstance
[TPS_MANI_03110]	Allowed components in system description with category SYSTEM_DESIGN_DESCRIPTION.
[TPS_MANI_03114]	Usage of AssemblySwConnectors in the System Design model
[TPS_MANI_03145]	Description of a function group
[TPS_MANI_03152]	Assignment of a ModeDependentStartupConfig to a function group state
[TPS_MANI_03153]	Semantics of ModeDependentStartupConfig.functionGroupMode
[TPS_MANI_03500]	Definition of Platform Health Management Supervision and Checkpoints
[TPS_MANI_03503]	Applicability of supervision to a specific Process
[TPS_MANI_03505]	Existence of SupervisionCheckpoint
[TPS_MANI_03506]	Optionality of SupervisionCheckpoint
[TPS_MANI_03508]	Definition of an AliveSupervision for a SupervisionCheckpoint
[TPS_MANI_03509]	Definition of a CheckpointTransition
[TPS_MANI_03510]	Definition of LogicalSupervision
[TPS_MANI_03512]	Applicability of global supervision to a specific Process
[TPS_MANI_03513]	Collection of LocalSupervisions into a global supervision
[TPS_MANI_03514]	Expiration tolerance for GlobalSupervision
[TPS_MANI_03515]	Expiration tolerance for LocalSupervision
[TPS_MANI_03516]	Condition evaluation for HealthChannelSupervision
[TPS_MANI_03517]	Condition evaluation for HealthChannelExternalStatus

Table D.10: Changed Traceables in 18-03

D.3.3 Deleted Traceables in 18-03

Number	Heading
[TPS_MANI_01031]	Semantics of CompositionDataPrototypeRef
[TPS_MANI_01045]	Process.modeDependentStartupConfig that does not refer to a ModeDeclaration
[TPS_MANI_01132]	Semantics of CompositionDataPrototypeRef
[TPS_MANI_03019]	TTL for SubscribeEventGroupAck Entries
[TPS_MANI_03501]	Definition of platform health management supervised entities
[TPS_MANI_03504]	Existence of SupervisionEntity

Table D.11: Deleted Traceables in 18-03

D.3.4 Added Constraints in 18-03

Number	Heading
[constr_1546]	Existence of attributes of ServiceInterfaceSubElement
[constr_1547]	Reference from ImplementationDataTypeExtension to ImplementationDataType
[constr_1548]	Reference from ImplementationDataTypeElementExtension to ImplementationDataTypeElement
[constr_1549]	Value of ProcessorCore.coreId
[constr_1550]	Reference from Process to ProcessDesign
[constr_1551]	Existence of CompositionDataPrototypeRef.dataPrototype vs. CompositionDataPrototypeRef.elementInImplDatatype
[constr_1553]	Restriction for ProcessToMachineMapping
[constr_1554]	Restriction regarding PersistencyKeyValuePair.initValue
[constr_1555]	Restriction applicable for PersistencyPortPrototypeToKeyValueDatabaseMapping.portPrototype
[constr_1556]	Restriction applicable for PersistencyPortPrototypeToFileArrayMapping.portPrototype
[constr_1557]	Standardized values of SoftwareClusterDesign.category and SoftwareCluster.category
[constr_1558]	Existence of SoftwareClusterDesign.diagnosticAddress
[constr_1559]	Existence of SoftwareClusterDesign.subSoftwareCluster
[constr_1560]	Usage of SoftwareClusterDesign.requiredARElement
[constr_1561]	Existence of SoftwareClusterDesign.subSoftwareCluster and SoftwareClusterDesign.dependsOn.dependentSoftwareClusterDesign
[constr_1562]	Existence of SoftwareClusterDesign.diagnosticContribution
[constr_1563]	Standardized values of SoftwareClusterDesign.category and SoftwareCluster.category
[constr_1564]	Existence of SoftwareCluster.diagnosticAddress
[constr_1565]	Existence of SoftwareCluster.subSoftwareCluster
[constr_1566]	Usage of SoftwareCluster.containedARElement
[constr_1567]	Existence of SoftwareCluster.subSoftwareCluster and SoftwareCluster.dependsOn.dependentSoftwareCluster
[constr_1568]	Existence of SoftwareCluster.diagnosticExtract

Number	Heading
[constr_1569]	Restriction for the scope of RestHttpPortPrototypeMapping.acceptsEncoding
[constr_1570]	Restriction for UserDefinedServiceInterfaceDeployment of category SERVICE_INTERFACE_DEPLOYMENT_IPC
[constr_1571]	CppImplementationDataType is limited
[constr_1572]	Usage of SwDataDefProps.implementationDataType within a CppImplementationDataType
[constr_1573]	CppTemplateArgument.isVariadicTemplate is set to True
[constr_1574]	Number of CppTemplateArguments with isVariadicTemplate set to True
[constr_1575]	Position of CppTemplateArgument with isVariadicTemplate set to True
[constr_1576]	Existence of CppTemplateArgument.templateType vs. CppTemplateArgument.allocator
[constr_1577]	Specification of a nativeDeclaration for a CppImplementationDataType
[constr_1578]	applicable data categories
[constr_1579]	SwDataDefProps applicable to CppImplementationDataTypes exclusive to the *AUTOSAR adaptive platform*
[constr_1580]	Restriction for the usage of RestHttpPortPrototypeMapping.acceptsEncoding
[constr_1581]	Value of fileProxy.fileName
[constr_1582]	PersistencyKeyValuePair.valueDataType shall match to ImplementationDataType for the corresponding PersistencyDataElement
[constr_1585]	Standardized values of attribute DiagnosticServiceSwMapping.category
[constr_1586]	DiagnosticServiceSwMapping.category set to DATA_ELEMENT
[constr_1587]	DiagnosticServiceSwMapping.category set to DATA_IDENTIFIER
[constr_1588]	DiagnosticServiceSwMapping.category set to GENERIC_UDS_SERVICE
[constr_1589]	Value of file.fileName
[constr_3408]	Value range of SomeipEventDeployment.eventId
[constr_3409]	Value range of SomeipMethodDeployment.methodId
[constr_3410]	Value range of SomeipServiceInterfaceDeployment.serviceInterfaceId
[constr_3411]	eventMulticastUdpPort, ipv4MulticastIpAddress and ipv6MulticastIpAddress not relevant for RequiredSomeipServiceInstances
[constr_3412]	OsModuleInstantiation shall have at least one ResourceGroup
[constr_3413]	ModeDependentStartupConfig of a Process is mapped to exactly one ResourceGroup
[constr_3414]	Allowed usage of EthernetNetworkConfiguration attributes
[constr_3415]	Value range of loadBalancingPriority
[constr_3416]	Value range of loadBalancingWeight
[constr_3417]	UserDefinedEventDeployments aggregated by a UserDefinedFieldDeployment
[constr_3418]	UserDefinedMethodDeployments aggregated by a UserDefinedFieldDeployment
[constr_3419]	Allowed usage of EthernetNetworkConfiguration attributes
[constr_3420]	System category for a design description that has one single Adaptive Machine in scope

Number	Heading
[constr_3421]	Fibex elements applicable for a MACHINE_DESIGN_EXTRACT
[constr_3422]	CppImplementationDataType of category STRING and SwBaseType
[constr_3423]	ModeDependentStartupConfig of a Process shall reference a functionGroupMode or machineMode
[constr_3424]	ModeDependentStartupConfig shall never reference the functionGroupMode Off
[constr_3425]	Restriction of DoIpInstantiations on a Machine
[constr_3426]	The logTraceFilePath is mandatory in case that logTraceLogMode is set to file
[constr_3427]	The logTraceFilePath is only relevant if logTraceLogMode is set to file
[constr_3428]	Structure shall own at least one element
[constr_3429]	No allocator usage for CppImplementationDataTypes of category VARIANT
[constr_3432]	Allowed subElements for Structures
[constr_3433]	Aggregation of templateArguments for a ARRAY
[constr_3434]	Aggregation of templateArguments for a VECTOR
[constr_3528]	Value range of domainId
[constr_3529]	Value range of serviceInstanceId
[constr_3530]	Mandatory definition of checkpointId
[constr_3531]	Mandatory definition of healthChannelId
[constr_3532]	Mandatory definition of statusId
[constr_3536]	Mandatory definition of supervisedEntityId

Table D.12: Added Constraints in 18-03

D.3.5 Changed Constraints in 18-03

Number	Heading
[constr_1484]	Applicability of ModeDependentStartupConfig.executionDependency
[constr_1507]	PortInterfaceToDataTypeMapping is only applicable to ServiceInterface
[constr_1532]	Consistent assignment of TLV data ids to data structures with optional members
[constr_1537]	Consistent assignment of TLV data ids to arguments of a given ClientServerOperation
[constr_3307]	SomeipEventDeployment.transportProtocol setting to udp and the impact on ProvidedSomeipServiceInstances
[constr_3308]	SomeipEventDeployment.transportProtocol setting to tcp and the impact on ProvidedSomeipServiceInstances
[constr_3309]	SomeipMethodDeployment.transportProtocol setting to udp and the impact on ProvidedSomeipServiceInstances
[constr_3310]	SomeipMethodDeployment.transportProtocol setting to tcp and the impact on ProvidedSomeipServiceInstances
[constr_3320]	Aggregation of CommunicationConnector by MachineDesign
[constr_3350]	Consistent value of category for ExecutableGroups referencing an Executable

Number	Heading
[constr_3366]	System `category` for a system design description with Adaptive Platform and Classic Platform content

Table D.13: Changed Constraints in 18-03

D.3.6 Deleted Constraints in 18-03

Number	Heading
[constr_1480]	Mutual existence of `CompositionDataPrototypeRef.elementInImplDatatype` vs. attributes of `CompositionDataPrototypeRef.dataPrototype`
[constr_1505]	Number of `Process.modeDependentStartupConfig` that do not refer to a `ModeDeclaration`
[constr_1525]	Standardized values of `PersistencyFile.category`
[constr_1526]	Values of `PersistencyFileArray.file.category`
[constr_1533]	Applicability of `ImplementationDataTypeElementExtension`

Table D.14: Deleted Constraints in 18-03

E Splitable Elements in the Scope of this Document

This chapter contains a table of all model elements stereotyped ≪atpSplitable≫ in the scope of this document.

Each entry in the table consists of the identification of the specific model element itself and the applicable value of the tagged value atp.Splitkey.

For more information about the concept of splitable model elements and how these shall be treated please refer to [5].

Name of splitable element	Splitkey
AdaptiveApplicationSwComponentType.internalBehavior	internalBehavior, variationPoint.shortLabel
CryptoModuleInstantiation.cryptoDesignToCryptoDriverMapping	shortName
CryptoModuleInstantiation.cryptoJob	shortName
CryptoModuleInstantiation.keySlot	shortName
InterfaceMappingSet.interfaceMapping	shortName,variationPoint.shortLabel
Machine.perStateTimeout	perStateTimeout
Machine.secureCommunicationDeployment	shortName, variationPoint.shortLabel
PlatformHealthManagementContribution.action	shortName
PlatformHealthManagementContribution.arbitration	shortName
PlatformHealthManagementContribution.checkpoint	shortName
PlatformHealthManagementContribution.globalSupervision	shortName
PlatformHealthManagementContribution.healthChannel	shortName
ServiceInterface.optionalElement	optionalElement, variationPoint.shortLabel
SoftwareCluster.containedARElement	shortName
SoftwareCluster.containedPackageElement	shortName
SoftwareCluster.dependsOn	dependsOn
SoftwareCluster.diagnosticAddress	diagnosticAddress
SoftwareCluster.subSoftwareCluster	subSoftwareCluster
SoftwareClusterDesign.dependsOn	dependsOn
SoftwareClusterDesign.diagnosticAddress	diagnosticAddress
SoftwareClusterDesign.diagnosticContribution	diagnosticContribution
SoftwareClusterDesign.requiredARElement	requiredARElement
SoftwareClusterDesign.requiredFibexElement	requiredFibexElement
SoftwareClusterDesign.requiredPackageElement	requiredPackageElement
SoftwareClusterDesign.subSoftwareCluster	subSoftwareCluster

Table E.1: Usage of splitable elements

F Variation Points in the Scope of this Document

This chapter contains a table of all model elements stereotyped ≪atpVariation≫ in the scope of this document.

Each entry in the table consists of the identification of the model element itself and the applicable value of the tagged value vh.latestBindingTime.

For more information about the concept of variation points and how model elements that contain variation points shall be treated please refer to [5].

Variation Point	Latest Binding Time
AdaptiveApplicationSwComponentType.internalBehavior	preCompileTime
CppImplementationDataType.arraySize	preCompileTime
CppImplementationDataTypeElement.subElement	preCompileTime
InterfaceMappingSet.interfaceMapping	systemDesignTime
Machine.functionGroup	preCompileTime
Machine.machineModeMachine	preCompileTime
ServiceInterface.event	blueprintDerivationTime
ServiceInterface.field	blueprintDerivationTime
ServiceInterface.method	blueprintDerivationTime
ServiceInterface.optionalElement	blueprintDerivationTime

Table F.1: Usage of variation points

G Used classes in Manifest files

G.1 Used classes in Machine Manifest

Used classes	Base
AdaptiveModuleInstantiation	other
CommunicationConnector	other
CryptoDriver	PackageableElement
CryptoDriverToCryptoJobMapping	other
CryptoJob	other
CryptoKeySlot	other
CryptoModuleInstantiation	other
CryptoNeedToCryptoJobMapping	other
CryptoPrimitive	other
DoIpInstantiation	other
EnterExitTimeout	other
EthernetCluster	PackageableElement
EthernetCommunicationConnector	other
EthernetNetworkConfiguration	other
EthernetPhysicalChannel	other
GenericModuleInstantiation	other
LogAndTraceInstantiation	other
MacMulticastGroup	other
Machine	PackageableElement
MachineDesign	PackageableElement
ModeDeclaration	other
ModeDeclarationGroup	PackageableElement
ModeDeclarationGroupPrototype	other
NetworkConfiguration	other
NetworkEndpoint	other
NetworkEndpointAddress	other
NmCluster	other
NmConfig	PackageableElement
NmInstantiation	other
NmNode	other
NonOsModuleInstantiation	other
OsModuleInstantiation	other
PerStateTimeout	other
Processor	other
ProcessorCore	other
PskIdentityToKeySlotMapping	other
PureLocalTimeBase	other
ResourceGroup	other
SecOcDeployment	other
SecOcJobMapping	other
SecureCommunicationDeployment	other
ServiceDiscoveryConfiguration	other
SomeipServiceDiscovery	other
SynchronizedMasterTimeBase	other
SynchronizedSlaveTimeBase	other
TimeBaseResource	other
TimeSyncModuleInstantiation	other

TlsDeployment	other
TlsJobMapping	other
UdpNmCluster	other
UdpNmNode	other

Table G.1: Used classes in MachineManifest

G.2 Used classes in Application Manifest

Used classes	Base
Action	other
ActionItem	other
ActionList	other
AliveSupervision	other
ApplicationActionItem	other
Arbitration	other
CheckpointTransition	other
DeadlineSupervision	other
ExecutionDependency	other
GlobalSupervision	other
HealthChannel	other
HealthChannelExternalStatus	other
HealthChannelSupervision	other
HttpAcceptEncoding	other
LocalSupervision	other
LogicalExpression	other
LogicalSupervision	other
ModeDeclaration	other
ModeDeclarationGroup	PackageableElement
ModeDeclarationGroupPrototype	other
ModeDependentStartupConfig	other
PersistencyFile	PackageableElement
PersistencyFileArray	PackageableElement
PersistencyKeyValueDatabase	PackageableElement
PersistencyKeyValuePair	other
PersistencyPortPrototypeToFileArrayMapping	PackageableElement
PersistencyPortPrototypeToKeyValueDatabaseMapping	PackageableElement
PhmContributionToMachineMapping	PackageableElement
PlatformActionItem	other
PlatformHealthManagementContribution	PackageableElement
Process	PackageableElement
ProcessToMachineMapping	other
ProcessToMachineMappingSet	PackageableElement
RestHttpPortPrototypeMapping	PackageableElement
Rule	other
ServiceInstanceToPortPrototypeMapping	PackageableElement
StartupConfig	other
StartupConfigSet	PackageableElement
StartupOption	other
SupervisionCheckpoint	other
WatchdogActionItem	other

Table G.2: Used classes in ApplicationManifest

G.3 Used classes in Service Instance Manifest

Used classes	Base
AdaptivePlatformServiceInstance	PackageableElement
DdsEventDeployment	other
DdsServiceInstanceToMachineMapping	PackageableElement
DdsServiceInterfaceDeployment	PackageableElement
E2EProfileConfiguration	other
E2EProfileConfigurationSet	PackageableElement
End2EndEventProtectionProps	other
InitialSdDelayConfig	other
PresharedKeyIdentity	other
ProvidedApServiceInstance	PackageableElement
ProvidedDdsEventQosProps	other
ProvidedDdsServiceInstance	PackageableElement
ProvidedSomeipServiceInstance	PackageableElement
ProvidedUserDefinedServiceInstance	PackageableElement
RequestResponseDelay	other
RequiredApServiceInstance	PackageableElement
RequiredDdsEventQosProps	other
RequiredDdsServiceInstance	PackageableElement
RequiredSomeipServiceInstance	PackageableElement
RequiredUserDefinedServiceInstance	PackageableElement
SecOcJobRequirement	other
SecOcSecureComProps	other
SecureComProps	other
SecureComPropsSet	PackageableElement
ServiceEventDeployment	other
ServiceFieldDeployment	other
ServiceInstanceToMachineMapping	PackageableElement
ServiceInterfaceDeployment	PackageableElement
ServiceInterfaceElementSecureComConfig	other
ServiceMethodDeployment	other
SomeipEventDeployment	other
SomeipEventGroup	other
SomeipEventProps	other
SomeipFieldDeployment	other
SomeipMethodDeployment	other
SomeipMethodProps	other
SomeipProvidedEventGroup	other
SomeipRequiredEventGroup	other
SomeipSdClientEventGroupTimingConfig	other
SomeipSdClientServiceInstanceConfig	other
SomeipSdServerEventTimingConfig	other
SomeipSdServerServiceInstanceConfig	other
SomeipServiceInstanceToMachineMapping	PackageableElement
SomeipServiceInterfaceDeployment	PackageableElement
SomeipServiceInterfaceVersion	other
SomeipTimingProps	other
TagWithOptionalValue	other
TlsCipherSuite	other
TlsJobRequirement	other
TlsSecureComProps	other

UserDefinedEventDeployment	other
UserDefinedFieldDeployment	other
UserDefinedMethodDeployment	other
UserDefinedServiceInstanceToMachineMapping	PackageableElement
UserDefinedServiceInterfaceDeployment	PackageableElement

Table G.3: Used classes in ServiceInstanceManifest