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Disclaimer

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1 Introduction and functional overview

This specification specifies the functionality of the AUTOSAR Adaptive Platform Log and Trace.

The Log and Trace provides interfaces for Adaptive Applications to forward logging information onto the communication bus, the console, or to the file system. Each of the provided logging information has its own severity level. For each severity level, a separate method is provided to be used by applications or Adaptive Platform Services, e.g. ara::com. In addition, utility methods are provided to convert decimal values into the hexadecimal numeral system, or into the binary numeral system.

To pack the provided logging information into a standardized delivery and presentation format, a protocol is needed. For this purpose, the LT protocol can be used, which is standardized within the AUTOSAR consortium.

The LT protocol can add additional information to the provided logging information. This information can be used by a Logging client to relate, sort or filter the received logging frames.

Detailed information regarding the use cases and the LT protocol itself are provided by the PRS Log and Trace protocol specification. For more information regarding the LT protocol refer to [1].

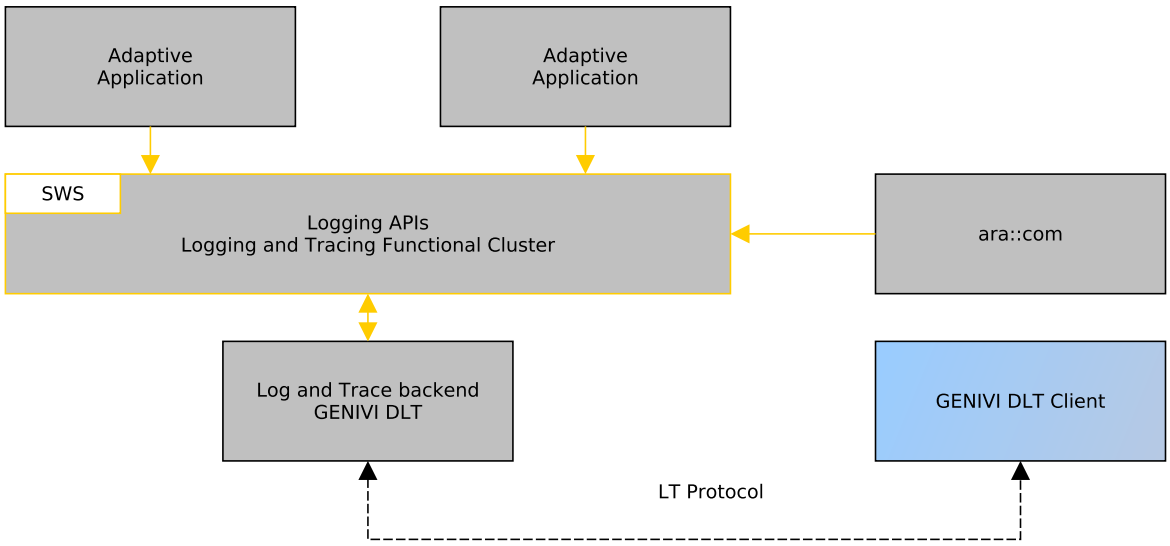

Figure 1.1: Architecture overview

Furthermore, this document introduces additional specification extensions for the AUTOSAR Adaptive Platform Log and Trace.

2 Acronyms and Abbreviations

The glossary below includes acronyms and abbreviations relevant to the Log and Trace module that are not included in the [2, AUTOSAR glossary].

Abbreviation / Acronym:	Description:
Log and Trace	The official `Functional Cluster` name that manages the logging
L&T	Acronym for `Log and Trace`
LT protocol	Original name of the protocol itself (Log and Trace), specified in the PRS document [1]
Logging API	The main logging interface towards user applications as a library
Logging back-end	Implementation of the `LT protocol`, e.g. `DLT`
Logging Client	An external tool which can remotely interact with the `Logging framework`
Logging framework	Implementation of the software solution used for logging purposes
Logging instance	The class that enables the logging functionality and handles a single logging context
Log message	Log message, including message header(s)
Log severity level	Meta information about the severity of a passed logging information
DLT	Diagnostics Log and Trace - a GENIVI Log and Trace daemon implementation of the `LT protocol`
Application process	An executable instance (process) that is running on a `Machine`

The following technical terms used throughout this document are defined in the official [2] AUTOSAR Glossary or [3] TPS Manifest Specification – they are repeated here for tracing purposes.

Term	Description
Adaptive Application	see [2] AUTOSAR Glossary
Application	see [2] AUTOSAR Glossary
AUTOSAR Adaptive Platform	see [2] AUTOSAR Glossary
Adaptive Platform Foundation	see [2] AUTOSAR Glossary
Manifest	see [2] AUTOSAR Glossary
Executable	see [2] AUTOSAR Glossary
Functional Cluster	see [2] AUTOSAR Glossary
Adaptive Platform Service	see [2] AUTOSAR Glossary
Machine	see [2] AUTOSAR Glossary
Service	see [2] AUTOSAR Glossary
Service Interface	see [2] AUTOSAR Glossary
Service Discovery	see [2] AUTOSAR Glossary

Table 2.1: Glossary-defined Technical Terms

3 Input documents & related standards and norms

3.1 Input documents

[1] Log and Trace Protocol Specification
AUTOSAR_PRS_LogAndTraceProtocol

[2] Glossary
AUTOSAR_TR_Glossary

[3] Specification of Manifest
AUTOSAR_TPS_ManifestSpecification

[4] General Requirements specific to Adaptive Platform
AUTOSAR_RS_General

[5] Specification of Adaptive Platform Core
AUTOSAR_SWS_AdaptivePlatformCore

[6] Log and Trace Protocol Specification with protocol version "2"
AUTOSAR_PRS_LogAndTraceProtocol from Release R21-11

[7] Log and Trace Protocol Specification with protocol version "1"
AUTOSAR_PRS_LogAndTraceProtocol from Release R20-11

[8] Requirements on Log and Trace
AUTOSAR_RS_LogAndTrace

[9] Specification of Time Synchronization
AUTOSAR_SWS_TimeSynchronization

NOTE: [4, RS-RSGeneral] is listed here as an input document because it applies to SWS LogAndTrace as well as to all SWS documents of the Adaptive Platform. Since it includes only non-functional requirements the tracing is not necessary.

3.2 Further applicable specification

AUTOSAR provides a core specification [5, SWS AdaptivePlatformCore] which is also applicable for `Log and Trace`. The chapter "General requirements for all Functional Clusters" of this specification shall be considered as an additional and required specification for implementation of `Log and Trace`.

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4 Constraints and assumptions

4.1 Known limitations

The provided `Logging framework` API is designed to be independent from the underlying `Logging back-end` implementation and as such doesn't impose limitations.

Although Log and Trace Protocol version "2" (compare [6]) is already available, Log and Trace currently only supports version "1" of the Log and Trace Protocol [7].

4.2 Applicability to car domains

No restrictions to applicability.

5 Dependencies to other Functional Clusters

There are no dependencies to other Functional Clusters.

5.1 Platform dependencies

This specification is part of the AUTOSAR AUTOSAR Adaptive Platform and therefore depends on it.

6 Requirements Tracing

The following table references the requirements specified in RS Log And Trace [8] and links to the fulfillment of these. Please note that if column “Satisfied by” is empty for a specific requirement this means that this requirement is not fulfilled by this document.

Requirement	Description	Satisfied by
[RS_AP_00155]	Avoidance of cluster-specific initialization functions.	[SWS_LOG_00122] [SWS_LOG_00123]
[RS_LT_00003]	Applications shall have the possibility to send log or trace messages to the LT module.	[SWS_LOG_00001] [SWS_LOG_00002] [SWS_LOG_00004] [SWS_LOG_00005] [SWS_LOG_00006] [SWS_LOG_00007] [SWS_LOG_00008] [SWS_LOG_00009] [SWS_LOG_00010] [SWS_LOG_00011] [SWS_LOG_00012] [SWS_LOG_00013] [SWS_LOG_00015] [SWS_LOG_00016] [SWS_LOG_00017] [SWS_LOG_00018] [SWS_LOG_00019] [SWS_LOG_00021] [SWS_LOG_00022] [SWS_LOG_00023] [SWS_LOG_00024] [SWS_LOG_00025] [SWS_LOG_00026] [SWS_LOG_00027] [SWS_LOG_00028] [SWS_LOG_00029] [SWS_LOG_00030] [SWS_LOG_00031] [SWS_LOG_00032] [SWS_LOG_00033] [SWS_LOG_00034] [SWS_LOG_00035] [SWS_LOG_00036] [SWS_LOG_00037] [SWS_LOG_00039] [SWS_LOG_00040] [SWS_LOG_00041] [SWS_LOG_00042] [SWS_LOG_00043] [SWS_LOG_00044] [SWS_LOG_00045] [SWS_LOG_00046] [SWS_LOG_00047] [SWS_LOG_00048] [SWS_LOG_00049] [SWS_LOG_00050] [SWS_LOG_00051] [SWS_LOG_00053] [SWS_LOG_00054] [SWS_LOG_00055] [SWS_LOG_00056] [SWS_LOG_00057] [SWS_LOG_00058] [SWS_LOG_00059] [SWS_LOG_00060] [SWS_LOG_00062] [SWS_LOG_00063] [SWS_LOG_00064] [SWS_LOG_00065] [SWS_LOG_00066] [SWS_LOG_00067] [SWS_LOG_00068] [SWS_LOG_00069] [SWS_LOG_00070] [SWS_LOG_00082] [SWS_LOG_00083] [SWS_LOG_00091] [SWS_LOG_00095] [SWS_LOG_00098] [SWS_LOG_00108] [SWS_LOG_00109] [SWS_LOG_00110]

Requirement	Description	Satisfied by
		[SWS_LOG_00111] [SWS_LOG_00112] [SWS_LOG_00113] [SWS_LOG_00114] [SWS_LOG_00115] [SWS_LOG_00120] [SWS_LOG_00122] [SWS_LOG_00123] [SWS_LOG_00124] [SWS_LOG_00128] [SWS_LOG_00129] [SWS_LOG_00130] [SWS_LOG_00131] [SWS_LOG_00173] [SWS_LOG_00201] [SWS_LOG_00203] [SWS_LOG_00204] [SWS_LOG_00205]
[RS_LT_00017]	Each log and trace message shall contain a timestamp, which will be added to the message during reception of the message in the LT module.	[SWS_LOG_00083]
[RS_LT_00030]	Logging shall be able to monitor and shape the amount of LT log and trace events.	[SWS_LOG_00095]
[RS_LT_00045]	Logging shall enable applications to check the current severity level.	[SWS_LOG_00007]
[RS_LT_00046]	Logging shall provide conversion functions for hexadecimal and binary values.	[SWS_LOG_00015] [SWS_LOG_00016] [SWS_LOG_00017] [SWS_LOG_00120] [SWS_LOG_00206] [SWS_LOG_00207] [SWS_LOG_00208] [SWS_LOG_00209] [SWS_LOG_00210] [SWS_LOG_00211] [SWS_LOG_00212] [SWS_LOG_00213] [SWS_LOG_00214] [SWS_LOG_00215] [SWS_LOG_00216] [SWS_LOG_00217] [SWS_LOG_00218] [SWS_LOG_00219] [SWS_LOG_00220] [SWS_LOG_00221] [SWS_LOG_00222] [SWS_LOG_00223] [SWS_LOG_00224] [SWS_LOG_00225] [SWS_LOG_00226]
[RS_LT_00047]	Logging shall support initialization and registration.	[SWS_LOG_00004]
[RS_LT_00048]	Logging shall enable applications to provide meta information.	[SWS_LOG_00004]
[RS_LT_00049]	Logging shall enable applications to provide Logging Information.	[SWS_LOG_00008] [SWS_LOG_00009] [SWS_LOG_00010] [SWS_LOG_00011] [SWS_LOG_00012] [SWS_LOG_00013] [SWS_LOG_00125] [SWS_LOG_00126] [SWS_LOG_00127] [SWS_LOG_00130]
[RS_LT_00050]	Logging shall support grouping of Logging Information.	[SWS_LOG_00005] [SWS_LOG_00006]

Requirement	Description	Satisfied by
[RS_LT_00052]	Logging shall provide early logging capabilities.	[SWS_LOG_00001]

7 Functional specification

This specification defines the usage of the defined C++ Logging API for the Log and Trace. Adaptive Applications can use these functions to forward Log messages to various sinks, for example the network, a serial bus, the console or the file system.

The following functionalities are provided:

1) Methods for initializing the Logging framework (see 7.3)
2) Utility methods to convert decimal values into hexadecimal or binary values (see 7.4)
3) Automatic timestamping of Log messages (see 7.5)
4) Log and trace network bandwith limitation (see chapter 7.6)

Adaptive Applications and Functional Clusters can startup (see 7.1.1) and shutdown (see 7.1.2) all Functional Clusters with direct ARA interfaces (e.g. the Logging framework), by calling `ara::core::Initialize()` or `ara::core::Deinitialize()`.

7.1 Functional Cluster Lifecyle

7.1.1 Startup

In order to initialize the Logging framework, mandatory information needs to be provided to the Logging framework. These information are extracted from the application execution manifest and the AUTOSAR Meta-Model. The execution manifest parameter `Executable.loggingBehavior` defines if the logging functionality should be initialized. Initialization of the Logging framework (via `ara::core::Initialize`) is mandatory before usage of any `ara::log` API. Failure to do so will result in undefined behavior.

[SWS_LOG_00001] ⌈Log message logged before the Logging framework is able to process them (e.g. daemon communication is not established) shall be queued. The queue size is defined by LogAndTraceInstantiation.queueSize. If this size is exceeded the oldest entries shall be discarded.⌋ *(RS_LT_00003, RS_LT_00052)*

7.1.2 Shutdown

[SWS_LOG_00122]{DRAFT} ⌈When ara::core::Deinitialize() is called, the Logging framework shall make sure, that no new client connections can be established.⌋ *(RS_LT_00003, RS_AP_00155)*

[SWS_LOG_00123]{DRAFT} ⌈When ara::core::Deinitialize() is called, the Logging framework shall take care that all remaining messages in the buffer can be collected, if a client is connected.⌋(*RS_LT_00003, RS_AP_00155*)

7.2 Necessary Parameters and Initialization

The concept of identifying the user application:
To be able to distinguish the logs of different application instances within a system (e.g. an ECU or even the whole vehicle), every Application process, in that system, has to get a particular ID and a description.

The concept of log contexts:
In order to be able to distinguish the logs from different logical groups within an Application process, for every context within an Application process a particular ID and a description has to be assigned. Every Application process can have an arbitrary amount of contexts, but at least one – the default context.

Machine-specific configuration settings for the Log and Trace functional cluster are collected in LogAndTraceInstantiation. The Application processes using the Logging framework need to supply the following configuration through the application execution manifest:

- Application ID
- Application description
- The default log level, if not set through the manifest a default predefined value is set
- The log mode
- The log file path, in case of a specific log mode that indicates logging to a file

The Application process using the Logging framework creates a Logging instance per context. The context is defined at creation of the Logging instance and the following information should be provided:

- Context ID
- Context description
- The default log level, if not set through the manifest a default predefined value is set

7.2.1 Application ID

The Application ID is an identifier that allows to associate generated logging information with its user application. The Application ID is passed as a string value. Depending on the Logging framework actual implementation, i.e. Logging back-end,

the length of the Application ID might be limited. To be able to unambiguously associate the received logging information to the origin, it is recommended to assign unique Application IDs within one ECU. There is no need for uniqueness of Application IDs across ECUs as the ECU ID will be the differentiator. The system integrator has the overall responsibility to ensure that each Application process instance has a unique Application ID. By having this value defined in the manifest the integrator is able to perform consistency checks. The applicationId in the DltApplication identifies the application instance and is put as ApplicationId into the log and trace message.

Note:
The Application IDs are unique IDs per Application process, meaning if the same Application process is started multiple times it shall have an own ID per instance.

The length limits of the Application ID apply only to version-1 of the PRS LogAndTraceProtocol.

7.2.1.1 Application Description

Since the length of the Application ID can be quite short, an additional descriptive text can be provided. This description is passed as a string and the maximum length is implementation dependent. The applicationDescription in the DltApplication is an optional setting that allows to describe the applicationId as descriptive text.

7.2.2 Default Log Level

The Log severity level represents the severity of the log messages. Severity levels are defined in chapter 7.3. defaultLogThreshold in the DltLogSink defines the initial log reporting level for the application instance.

Each initiated log message is qualified with such a severity level. The default Log severity level is set through the application configuration per Application process. The Log severity level acts as a reporting filter. Only log messages having a higher or the same severity will be processed by the Logging framework, while the others are ignored.

The default Log severity level is the initially configured log reporting level for a certain Application process, though it can be overriden per context.

The Application process wide log reporting level shall be adjustable during runtime. The realization is an implementation detail of the underlying back-end. E.g. remotely via a Logging client for example DLT Viewer. The same applies for the context reporting level.

The design rationale for providing an initial default Log severity level application wide against having per context default Log severity levels is the following:

- It simplifies the API usage. Otherwise the user will have to define a context default `Log severity level` for each group before using the API.
- The context separation of `Log message`s is possible during runtime.

7.2.3 Log Mode

Depending on the `Logging framework` implementation, the passed logging information can be processed in different ways. The destination (the `Log message` sink) can be the console output, a file on the file system or the communication bus. The system integrator is responsible to populate this information in the machine manifest. A direct API for dynamically changing this value for development purposes is provided. In the AUTOSAR Meta-Model the `category` of `DltLogSink` is equivalent to the log mode described here, for more information see [3]. The `category` of `DltLogSink` defines the destination to which the log messages will be forwarded.

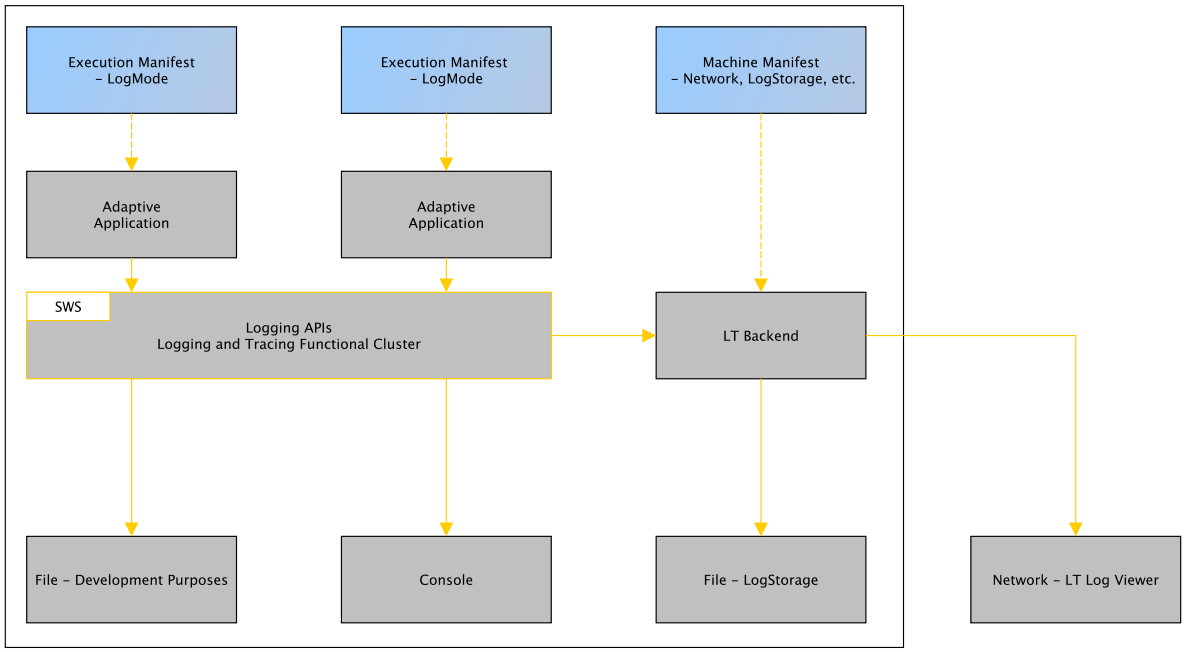

Figure 7.1: Log mode

As shown in the diagram, once the log mode is set to use the `Logging back-end` the configuration is of that back-end is centralized in the `Machine` manifest configuration. For example, the `Logging back-end` can be configured to store the logging information locally and that configuration would be kept in the `Machine`-specific manifest. Furthermore, the output channel on Ethernet for `Log message`s is configured with the `PlatformModuleEthernetEndpointConfiguration` that is referenced by `DltLogSink` in the role `endpointConfiguration`.

7.2.3.1 Log File Path

In case the log mode is set to log to a file, a destination directory path needs to be provided. `path` in the `DltLogSink` defines the destination file to which the logging information is passed. This option is provided for development, integration and prototyping purposes and is not suitable for production.

7.2.4 Context ID

The Context ID is an identifier that is used to logically group logging information within the scope of an `Application process`. The Context ID is passed as a string value. Depending on the actual implementation of the `Logging back-end`, the length of the Context ID might be limited. Context ID is unique in the scope of an `Application process` and as such the developer is responsible for assigning it and this information is not modeled in the manifest. There is no need for uniqueness of Context IDs across multiple different `Application process`es as the Application ID will be the differentiator.

Note:
Special attention should be paid to library components. The libraries are meant to be used by `Application process`es and therefore are running within the `Application process`' scope. Logging executed from those libraries will end up inside the scope of the parent `Application process`. In order to distinguish the internal library logs from the `Application process` logs or from other library logs within same process, each library might need to reserve its own Context IDs system wide – at least when it shall be used by more than one `Application process`.

The length limits of the Cotext ID apply only to version-1 of the PRS LogAndTraceProtocol.

7.2.5 Context Description

Since the length of the Context ID can be quite short, an additional descriptive text must be provided. This Context description is passed as a string. The maximum length of the Context description is implementation dependent.

7.2.6 Initialization of the Logging framework

The Application ID and description are used to identify and to associate the provided logging information with the exact process. The log mode and sink information defines where the logging information is routed. Possible destinations are the console, the file system or the communication bus.

From the Application process' perspective, the Logging framework is initialized and a logger instance is created when an Application process decides to register a logging context. These contexts are used to logically cluster logging information.

[SWS_LOG_00002]{DRAFT} ⌈In case of any errors occurring inside the Logging framework or underlying system, it is intended to not bother the Application process and silently discard the function calls. For this purpose, the relevant interfaces neither specify return values nor throw exceptions.⌋*(RS_LT_00003)*

[SWS_LOG_00004]{DRAFT} ⌈Logging framework shall be initialized if the execution manifest provides the following information for the Logging framework :

- An application ID (Mandatory; if missing, a *Violation* shall be issued)
- An application description (if missing, it can be filled with string with no characters or default values)
- The default Log severity level (default value: kWarn)
- The log mode (default value: kConsole)
- The directory path (only necessary if LogMode::kFile is given as log mode)

⌋*(RS_LT_00003, RS_LT_00047, RS_LT_00048)*

[SWS_LOG_00005] ⌈The function ara::log::CreateLogger shall create a logger context instance internally inside the Logging framework and return it as reference to the using application. Before a Log message can be processed, at least one logger context shall be available.⌋*(RS_LT_00003, RS_LT_00050)*

Note:
This strong ownership relationship of contexts to the Logging framework ensure correct housekeeping of the involved resources. The design rationale is, once a context is registered against the Logging back-end, its lifetime must be ensured until the end of the Application process.

[SWS_LOG_00006] ⌈By calling CreateLogger(), the following parameters need to be provided:

- The context ID
- The context description
- The Log severity level (as an optional parameter, defaults to LogLevel::kWarn)

⌋*(RS_LT_00003, RS_LT_00050)*

[SWS_LOG_00007] ⌈Application processes should be able to check if a desired Log severity level is configured through the function ara::log::Logger::IsEnabled. This mechanism conserves CPU and memory resources that are used

during preparation of logging information, as this logging information is filtered by the `Logging framework` later on.⌋*(RS_LT_00003, RS_LT_00045)*

7.3 Log Messages

Log messages can generally be output to different targets. The Log and Trace Functional Cluster supports these logging targets:

- the console
- a file on a local file system
- a network

Most of the discussion in this section assumes that messages are being output to a network, as this use case requires the additional consideration of minimizing network load.

The Log And Trace Functional Cluster offers two principal “classes” of log messages: *Modeled* and *Non-Modeled* messages. Both these support adding one or more “arguments” to a log message. A log message without any arguments serves no purpose and is discarded.

Non-Modeled messages are the traditional way of composing log messages: All arguments of the message are added to an internal message buffer and then eventually serialized for output, either to a console/file, or via network. All parts of the messages will be sent via network. In the DLT protocol, these messages are called “verbose” messages.

Modeled messages are designed to reduce traffic on the network, by omitting certain static (i.e. unchanging) parts of a message from the network. As the name suggests, these parts are instead added to the application ARXML model. In the DLT protocol, these messages are called “non-verbose” messages. A log message viewer application is able to display the full message by combining the static parts from the model with the dynamic parts from the received message.

Non-modeled messages are mainly used during development, as the information required for the modeled messages may not be available at that time. However, non-modeled messages can impose a high load on the network, making modeled messages usually the preferred choice in production systems.

The `ara::log` Functional Cluster supports defining and using both modeled and non-modeled messages in a single application at the same time.

7.3.1 Non-modeled messages

The `ara::log` Functional Cluster defines a “Builder”-pattern inspired set of APIs for constructing non-modeled messages. The `ara::log::Logger::WithLevel` member function is used for creating a `ara::log::LogStream` object which is then subsequently filled with message content (i.e. message arguments). Alternatively to `ara::log::Logger::WithLevel`, there are also separate member functions for creating a `ara::log::LogStream` object, one per supported log level.

Arguments are added to a verbose message by calling an appropriate `operator<<` overload for the desired argument:

```
logger.WithLevel(LogLevel::kInfo) << "text" << 4.2;
```

The `ara::log` Functional Cluster defines such `operator<<` overloads for all C++ arithmetic types, for bool, for string types, and for a number of `ara::core` types. Application-defined data types can be logged as well, by providing suitable `operator<<` overloads for them.

As the application model allows "annotating" arguments with attributes, the `ara::log` API for non-modeled messages also supports this. Arguments of certain types can be annotated with a "name" and possibly also a "unit" attribute. For instance:

```
1 logger.WithLevel(LogLevel::kInfo)
2     << Arg("text", "identifier")
3     << Arg(4.2, "velocity", "m/s");
```

The string argument "text" is annotated with a "name" attribute called "identifier". The double argument 4.2 is annotated with a "name" attribute "velocity" and a "unit" of "m/s". These attributes can only be set for some of the built-in types that the `ara::log` API supports, i.e. all arithmetic types, bool, strings, and raw data blobs.

Non-modeled messages can also contain information about the location of the log message call in source code. For this purpose, the member function `ara::log::LogStream::WithLocation` is called with the filename and line number of the call site. These should usually come from the compiler-defined `__FILE__` and `__LINE__` symbols:

```
1 logger
2     .WithLevel(LogLevel::kInfo)
3     .WithLocation(__FILE__, __LINE__) << ...;
```

These are easiest set via a macro-based frontend for `ara::log`, but no such macro has yet been defined in the Adaptive Platform.

7.3.2 Modeled messages

7.3.2.1 API principles

The `ara::log` Functional Cluster defines a single member function `ara::log::Logger::Log` for sending modeled messages. Unlike the non-modeled message APIs, it represents a single-call interface, i.e. a single function call passes all arguments to the `Logger` instance and performs all necessary actions to generate and send the message.

This has the advantage that the runtime cost for a modeled message that is eventually not being output (because the message's log level does not reach the configured log level threshold) can be made very small: after parameter passing and function call, a single `if` clause checks the log level threshold and immediately returns if the threshold

is not reached. This contrasts with the non-modeled message APIs, where multiple function calls are performed for constructing a message object, even if that is then eventually discarded.

7.3.2.2 Log message model

All modeled messages are defined as DltMessages, which are aggregated by a LogAndTraceMessageCollectionSet. Each DltMessage contains a messageId, which needs to be unique within an ECU, and the messageTypeInfo denoting the log level, and optionally the messageSourceFile and messageLineNumber. The DltMessage aggregates an ordered list of DltArguments, which in turn aggregate SwDataDefProps in the role networkRepresentation. The name of a log message argument is taken from the shortName of the DltArgument, while the type and unit are taken from the SwDataDefProps.

At design time it is possible to define an Executable with a SwComponentPrototype that has a PortPrototype typed by an LogAndTraceInterface. Such a PortPrototype is used to describe that the SwComponentPrototype is able to forward logging information onto the external Dlt Log Viewer. The DltMessages that are used by the SwComponentPrototype are collected in the LogAndTraceMessageCollectionSet that is referenced from the PortPrototype.

At deployment time a mapping of the PortPrototype typed by a LogAndTraceInterface to a DltLogSink is described with the DltLogSinkToPortPrototypeMapping that takes a Process of the Executable as context into account.

The DltLogSink is referenced by the LogAndTraceInstantiation that in turn is associated with the DltEcu that carries the ecuId. The LogAndTraceInstantiation itself defines with sessionIdSupport whether session IDs are used or not. The DltLogSinkToPortPrototypeMapping defines the dltSessionId and contains a reference to DltContext that defines the contextId and the corresponding contextDescription. The Process in which the Executable is executed is assigned with the DltApplication that defines the applicationId and the corresponding applicationDescription.

The DltLogSink defines with the category the type of the output sink: DltLogSinkRemote, DltLogSinkDlt, DltLogSinkFile, DltLogSinkConsole.

In case the DltLogSink has the category DltLogSinkRemote to provide means to forward logging information to a Dlt log channel the logChannelId is defined. In case the DltLogSink has the category DltLogSinkDlt to provide means to forward logging information onto on a specific VLAN the endpointConfiguration is defined in addition to logChannelId. The nonVerboseMode describes whether the modeled messages will be sent as verbose messages as if they were non-modeled messages. In case the DltLogSink has the category DltLogSinkFile to provide means to forward logging information to a file in path of a file system a path is defined. In case the DltLogSink has the category DltLogSinkConsole to provide means to forward

logging information the console the `bufferOutput` attribute defines whether a buffer is used or not.

7.3.2.3 Usage

The C++ API assumes the existence of a tool that scans source code for modeled log message call sites and generates the expected symbols with unique IDs on-demand.

The framework is required to scan all source code for invocations of the `ara::log::Logger::Log` member function, and generate a symbol that matches the first argument of that member function call.

For instance, if the ARXML representation of the manifest contains the following:

```
<LOG-AND-TRACE-COLLECTION-SET>
  <SHORT-NAME>DltMessages</SHORT-NAME>
  <DLT-MESSAGES>
    <DLT-MESSAGE>
      <SHORT-NAME>SpeedMsg</SHORT-NAME>
      ...
    </DLT-MESSAGE>
  </DLT-MESSAGES>
</LOG-AND-TRACE-COLLECTION-SET>
```

and the source code contains this code sequence:

```
1 Logger& logger = ...
2 logger.Log(SpeedMsg, 4.2);
```

then the framework will define a global constexpr variable called `SpeedMsg` of an implementation-defined type. This variable contains knowledge about the message's modeled aspects, such as parameter types and log level, allowing the `ara::log` implementation to verify that the number of types of parameters given to `ara::log::Logger::Log` matches the model of the particular message.

The message variable definitions will be made available via `ara/log/logger.h`.

Store LogStream objects in a variable:
It is also possible to use the `Logging API` in an alternative way by storing a `ara::log::LogStream` object locally in some named variable. The difference to the temporary object is that it won't go out of scope already at the end of the statement, but stays valid and re-usable as long as the variable exists. Hence, it can be fed with data distributed over multiple lines of code. To get the message buffer processed by the `Logging framework`, the `ara::log::LogStream::Flush` method needs to be called, otherwise the buffer will be processed when the object dies, i.e. when the variable goes out of scope, at the end of the function block.

Performance remark:
Due to the fact that a `ara::log::LogStream` is no longer created per message but rather could be re-used for multiple messages, the costs for this object creation is paid only once – per log level. How much this really influences the actual performance

depends on the Logging framework implementation. However the main goal of this alternative usage of the Logging API is to get the multi-line builder functionality.

Note:
It is highly advised NOT to hold global ara::log::LogStream objects in multi-threaded Applications, because then concurrent access protection will no longer be covered by the Logging API.

Usage examples:

```
Logger& ctx0 = CreateLogger("CTX0", "Context Description CTX0");
ctx0.LogInfo() << "Some log information" << 123;
```

```
// Locally stored LogStream object will process the arguments
// until either Flush() is called or it goes out of scope from
// the block is was created
Logger& ctx1 = CreateLogger("CTX1", "Context Description CTX1");
LogStream localLogInfo = ctx1.LogInfo();
localLogInfo << "Some log information" << 123;
localLogInfo << "Some other information";
localLogInfo.Flush();
localLogInfo << "a new message..." << 456;
```

Exception safety: All Log*() interfaces are designed to guarantee no-throw behavior. This applies for the whole Logging API.

New line: Because of convenience purposes the Logging framework automatically appends a newline to the Log message.

Multiple payload arguments: When one message consists of more than one payload argument, payload arguments are separated by single whitespaces for console output.

[SWS_LOG_00008]{DRAFT} ⌈To initiate a Log message with the Log level Fatal, the API ara::log::Logger::LogFatal shall be called. This API returns a ara::log::LogStream object that has to be used by passing arguments via the insert stream operator<<.⌋*(RS_LT_00003, RS_LT_00049)*

[SWS_LOG_00009]{DRAFT} ⌈To initiate a Log message with the Log level Error, the API ara::log::Logger::LogError shall be called. This API returns a ara::log::LogStream object that has to be used by passing arguments via the insert stream operator<<.⌋*(RS_LT_00003, RS_LT_00049)*

[SWS_LOG_00010]{DRAFT} ⌈To initiate a Log message with the Log level Warning, the API ara::log::Logger::LogWarn shall be called. This API returns a ara::log::LogStream object that has to be used by passing arguments via the insert stream operator<<.⌋*(RS_LT_00003, RS_LT_00049)*

[SWS_LOG_00011]{DRAFT} ⌈To initiate a Log message with the Log level Info, the API ara::log::Logger::LogInfo shall be called. This API returns a ara::log::LogStream object that has to be used by passing arguments via the insert stream operator<<.⌋*(RS_LT_00003, RS_LT_00049)*

[SWS_LOG_00012]{DRAFT} ⌈To initiate a `Log message` with the Log level `Debug`, the API `ara::log::Logger::LogDebug` shall be called. This API returns a `ara::log::LogStream` object that has to be used by passing arguments via the insert stream operator<<.⌋*(RS_LT_00003, RS_LT_00049)*

[SWS_LOG_00013]{DRAFT} ⌈To initiate a `Log message` with the Log level `Verbose`, the API `ara::log::Logger::LogVerbose` shall be called. This API returns a `ara::log::LogStream` object that has to be used by passing arguments via the insert stream operator<<.⌋*(RS_LT_00003, RS_LT_00049)*

[SWS_LOG_00130]{DRAFT} ⌈To write a Log message with a programmatically determined log level, the API `ara::log::Logger::WithLevel` shall be called.⌋*(RS_LT_00003, RS_LT_00049)*

7.4 Conversion Functions

Sometimes it makes sense to represent integer numbers in hexadecimal or binary format instead of decimal format.
For this purpose, the following functions are defined to convert provided decimal numbers into the hexadecimal or binary system.

[SWS_LOG_00120]{DRAFT} ⌈Dedicated conversion functions are provided for conversion of positive decimal numbers into a string with hexadecimal or binary representation.⌋*(RS_LT_00003, RS_LT_00046)*

[SWS_LOG_00015]{DRAFT} ⌈Dedicated conversion functions are provided for conversion of decimal numbers into a string with hexadecimal or binary representation, where the most significant bit shall be set to '1' for negative numbers.⌋*(RS_LT_00003, RS_LT_00046)*

[SWS_LOG_00016]{DRAFT} ⌈Function `ara::log::HexFormat` shall provide functionality to convert an integer decimal number into a string with hexadecimal representation.⌋*(RS_LT_00003, RS_LT_00046)*

[SWS_LOG_00017]{DRAFT} ⌈Function `ara::log::BinFormat` shall provide functionality to convert an integer decimal number into a string with binary representation.⌋*(RS_LT_00003, RS_LT_00046)*

7.5 Log and Trace Timestamp

The Log and Trace information is transmitted by means of the LT protocol which is bus agnostic.
This protocol offers the possibility to include a timestamp in each sent message, as long as such messages are sent with an extended header (refer to [8] for more information).

The synchronized time base is supplied by the Time Synchronization Functional Cluster. The now() method is used by the Adaptive Applications in order to retrieve the current time from the TS (refer to [9] for more information).

According to the requirement [TPS_MANI_03162], the reference time base is derived from the machine manifest timeBaseResource.

[SWS_LOG_00082] ⌈Log and Trace should have accesss to a synchronized time base. The attribute timeBaseResource in LogAndTraceInstantiation shall be used to identify the time base.⌋*(RS_LT_00003)*

[SWS_LOG_00083] ⌈If the time base resource is referenced by the Log and Trace module in the manifest configuration LogAndTraceInstantiation.timeBaseResource, the current timestamp information shall be included in each DLT message, otherwise not In case there is no time base resource referenced by the Log and Trace module in the manifest configuration, no timestamp information shall be transmitted.⌋*(RS_LT_00003, RS_LT_00017)*

[SWS_LOG_00091]{DRAFT} ⌈When the CreateLogger() function is called, Log and Trace shall send a message, "local time base used" in case the used time base is a local time base or "global time base used" in case the used time base is a globally synchronized time base.

⌋*(RS_LT_00003)*

7.6 Log and Trace data loss prevention

[SWS_LOG_00095]{DRAFT} ⌈When `Log and Trace` receives simultaneously a high load of trace information generated by multiple `Adaptive Application`s, it shall buffer this data internally to prevent the data loss during its continuous transmission.⌋ *(RS_LT_00003, RS_LT_00030)*

8 API specification

8.1 API Common Data Types

8.1.1 LogLevel

[SWS_LOG_00018]{DRAFT} ⌈

Kind:	enumeration	
Symbol:	LogLevel	
Scope:	namespace ara::log	
Underlying type:	std::uint8_t	
Syntax:	`enum class LogLevel : std::uint8_t {...};`	
Values:	kOff= 0x00	No logging.
	kFatal= 0x01	Fatal error, not recoverable.
	kError= 0x02	Error with impact to correct functionality.
	kWarn= 0x03	Warning if correct behavior cannot be ensured.
	kInfo= 0x04	Informational, providing high level understanding.
	kDebug= 0x05	Detailed information for programmers.
	kVerbose= 0x06	Extra-verbose debug messages (highest grade of information)
Header file:	#include "ara/log/common.h"	
Description:	List of possible severity levels .	

⌋(*RS_LT_00003*)

8.1.2 LogMode

[SWS_LOG_00019]{DRAFT} ⌈

Kind:	enumeration	
Symbol:	LogMode	
Scope:	namespace ara::log	
Underlying type:	std::uint8_t	
Syntax:	`enum class LogMode : std::uint8_t {...};`	
Values:	kRemote= 0x01	Send remotely.
	kFile= 0x02	Save to file.
	kConsole= 0x04	Forward to console.
Header file:	#include "ara/log/common.h"	
Description:	Log mode. Flags, used to configure the sink for log messages.	
Notes:	In order to combine flags, at least the OR and AND operators needs to be provided for this type.	

⌋(*RS_LT_00003*)

8.1.3 Format specifier

[SWS_LOG_00206]{DRAFT} ⌈

Kind:	enumeration	
Symbol:	Fmt	
Scope:	namespace ara::log	
Underlying type:	std::uint16_t	
Syntax:	`enum class Fmt : std::uint16_t {...};`	
Values:	kDefault= 0	implementation-defined formatting
	kDec= 1	decimal (signed/unsigned)
	kOct= 2	octal
	kHex= 3	hexadecimal
	kBin= 4	binary
	kDecFloat= 5	decimal float (like printf "%f")
	kEngFloat= 6	engineering float (like printf "%e")
	kHexFloat= 7	hex float (like printf "%a")
	kAutoFloat= 8	automatic "shortest" float (like printf "%g")
Header file:	#include "ara/log/logger.h"	
Description:	Format specifiers for log message arguments .	

⌋(*RS_LT_00046*)

[SWS_LOG_00207]{DRAFT} ⌈

Kind:	struct
Symbol:	Format
Scope:	namespace ara::log
Syntax:	`struct Format final {...};`
Header file:	#include "ara/log/logger.h"
Description:	A type holding a formatting hint. The interpretation of precision depends on fmt: For integral types (i.e. Fmt::kDec, Fmt::kOct, Fmt::kHex, Fmt::kBin), precision is interpreted as the minimum number of digits to output, similar to e.g. std::printf("%.7d"). For the floating-point specifiers Fmt::kDecFloat, Fmt::kEng Float and Fmt::kHexFloat, precision denotes the exact number of digits to be shown after the decimal point; for Fmt::kAutoFloat, precision denotes the number of significant digits to be shown according to the rules of the std::printf "%g" specifier. If fmt is Fmt::kDefault, the precision field is ignored, and an implementation-defined formatting is applied. For integral types, if @precision is 0, it is interpreted the same as if it was 1.

⌋(*RS_LT_00046*)

[SWS_LOG_00225]{DRAFT} ⌈

Kind:	variable
Symbol:	fmt
Scope:	struct ara::log::Format
Type:	Fmt

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Syntax:	`Fmt fmt;`
Header file:	#include "ara/log/logger.h"
Description:	the format specifier

⌋(*RS_LT_00046*)

[SWS_LOG_00226]{DRAFT} ⌈

Kind:	variable
Symbol:	precision
Scope:	struct ara::log::Format
Type:	std::uint16_t
Syntax:	`std::uint16_t precision;`
Header file:	#include "ara/log/logger.h"
Description:	the precision to use

⌋(*RS_LT_00046*)

For convenience, there are helper functions to create specific instances of `struct Format`; these should generally be used instead of creating `Format` instances manually.

[SWS_LOG_00208]{DRAFT} ⌈

Kind:	function	
Symbol:	Dflt()	
Scope:	namespace ara::log	
Syntax:	`constexpr Format Dflt () noexcept;`	
Return value:	Format	a Format instance
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Create a Format instance with Fmt::kDefault formatting hint.	

⌋(*RS_LT_00046*)

[SWS_LOG_00211]{DRAFT} ⌈

Kind:	function	
Symbol:	Dec()	
Scope:	namespace ara::log	
Syntax:	`constexpr Format Dec () noexcept;`	
Return value:	Format	a Format instance
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Create a Format instance with Fmt::kDec formatting hint and default precision.	

⌋(*RS_LT_00046*)

[SWS_LOG_00212]{DRAFT} ⌈

Kind:	function	
Symbol:	Dec(std::uint16_t precision)	
Scope:	namespace ara::log	
Syntax:	`constexpr Format Dec (std::uint16_t precision) noexcept;`	
Parameters (in):	precision	the precision to use
Return value:	Format	a Format instance
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Create a Format instance with Fmt::kDec formatting hint and given precision.	

⌋(*RS_LT_00046*)

[SWS_LOG_00213]{DRAFT} ⌈

Kind:	function	
Symbol:	Oct()	
Scope:	namespace ara::log	
Syntax:	`constexpr Format Oct () noexcept;`	
Return value:	Format	a Format instance
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Create a Format instance with Fmt::kOct formatting hint and default precision.	

⌋(*RS_LT_00046*)

[SWS_LOG_00214]{DRAFT} ⌈

Kind:	function	
Symbol:	Oct(std::uint16_t precision)	
Scope:	namespace ara::log	
Syntax:	`constexpr Format Oct (std::uint16_t precision) noexcept;`	
Parameters (in):	precision	the precision to use
Return value:	Format	a Format instance
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Create a Format instance with Fmt::kOct formatting hint and given precision.	

⌋(*RS_LT_00046*)

[SWS_LOG_00209]{DRAFT} ⌈

Kind:	function	
Symbol:	Hex()	
Scope:	namespace ara::log	
Syntax:	`constexpr Format Hex () noexcept;`	
Return value:	Format	a Format instance
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Create a Format instance with Fmt::kHex formatting hint and default precision.	

⌋(*RS_LT_00046*)

[SWS_LOG_00210]{DRAFT} ⌈

Kind:	function	
Symbol:	Hex(std::uint16_t precision)	
Scope:	namespace ara::log	
Syntax:	`constexpr Format Hex (std::uint16_t precision) noexcept;`	
Parameters (in):	precision	the precision to use
Return value:	Format	a Format instance
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Create a Format instance with Fmt::kHex formatting hint and given precision.	

⌋(*RS_LT_00046*)

[SWS_LOG_00215]{DRAFT} ⌈

Kind:	function	
Symbol:	Bin()	
Scope:	namespace ara::log	
Syntax:	`constexpr Format Bin () noexcept;`	
Return value:	Format	a Format instance
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Create a Format instance with Fmt::kBin formatting hint and default precision.	

⌋(*RS_LT_00046*)

[SWS_LOG_00216]{DRAFT} ⌈

Kind:	function	
Symbol:	Bin(std::uint16_t precision)	
Scope:	namespace ara::log	
Syntax:	`constexpr Format Bin (std::uint16_t precision) noexcept;`	
Parameters (in):	precision	the precision to use

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Return value:	Format	a Format instance
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Create a Format instance with Fmt::kBin formatting hint and given precision.	

⌋(*RS_LT_00046*)

[SWS_LOG_00217]{DRAFT} ⌈

Kind:	function	
Symbol:	DecFloat(std::uint16_t precision=6)	
Scope:	namespace ara::log	
Syntax:	`constexpr Format DecFloat (std::uint16_t precision=6) noexcept;`	
Parameters (in):	precision	the precision to use
Return value:	Format	a Format instance
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Create a Format instance with Fmt::kDecFloat formatting hint and given precision.	

⌋(*RS_LT_00046*)

[SWS_LOG_00218]{DRAFT} ⌈

Kind:	function	
Symbol:	DecFloatMax()	
Scope:	namespace ara::log	
Syntax:	`constexpr Format DecFloatMax () noexcept;`	
Return value:	Format	a Format instance
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Create a Format instance with Fmt::kDecFloat formatting hint and a precision that is sufficient for full round-trip safety.	

⌋(*RS_LT_00046*)

[SWS_LOG_00219]{DRAFT} ⌈

Kind:	function	
Symbol:	EngFloat(std::uint16_t precision=6)	
Scope:	namespace ara::log	
Syntax:	`constexpr Format EngFloat (std::uint16_t precision=6) noexcept;`	
Parameters (in):	precision	the precision to use
Return value:	Format	a Format instance
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	

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Description:	Create a Format instance with Fmt::kEngFloat formatting hint and given precision.

⌋(*RS_LT_00046*)

[SWS_LOG_00220]{DRAFT} ⌈

Kind:	function	
Symbol:	EngFloatMax()	
Scope:	namespace ara::log	
Syntax:	`constexpr Format EngFloatMax () noexcept;`	
Return value:	Format	a Format instance
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Create a Format instance with Fmt::kEngFloat formatting hint and a precision that is sufficient for full round-trip safety.	

⌋(*RS_LT_00046*)

[SWS_LOG_00221]{DRAFT} ⌈

Kind:	function	
Symbol:	HexFloat(std::uint16_t precision)	
Scope:	namespace ara::log	
Syntax:	`constexpr Format HexFloat (std::uint16_t precision) noexcept;`	
Parameters (in):	precision	the precision to use
Return value:	Format	a Format instance
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Create a Format instance with Fmt::kHexFloat formatting hint and given precision.	

⌋(*RS_LT_00046*)

[SWS_LOG_00222]{DRAFT} ⌈

Kind:	function	
Symbol:	HexFloatMax()	
Scope:	namespace ara::log	
Syntax:	`constexpr Format HexFloatMax () noexcept;`	
Return value:	Format	a Format instance
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Create a Format instance with Fmt::kHexFloat formatting hint and a precision that is sufficient for full round-trip safety.	

⌋(*RS_LT_00046*)

[SWS_LOG_00223]{DRAFT} ⌈

Kind:	function	
Symbol:	AutoFloat(std::uint16_t precision=6)	
Scope:	namespace ara::log	
Syntax:	`constexpr Format AutoFloat (std::uint16_t precision=6) noexcept;`	
Parameters (in):	precision	the precision to use
Return value:	Format	a Format instance
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Create a Format instance with Fmt::kAutoFloat formatting hint and given precision.	

⌋(*RS_LT_00046*)

[SWS_LOG_00224]{DRAFT} ⌈

Kind:	function	
Symbol:	AutoFloatMax()	
Scope:	namespace ara::log	
Syntax:	`constexpr Format AutoFloatMax () noexcept;`	
Return value:	Format	a Format instance
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Create a Format instance with Fmt::kAutoFloat formatting hint and a precision that is sufficient for full round-trip safety.	

⌋(*RS_LT_00046*)

8.1.4 LogHex8

[SWS_LOG_00108]{DRAFT} ⌈

Kind:	struct
Symbol:	LogHex8
Scope:	namespace ara::log
Syntax:	`struct LogHex8 {...};`
Header file:	#include "ara/log/log_stream.h"
Description:	Represents a 8 bit hexadecimal value data type . Helper struct that is utilized as custom type. Holds an integer value that will be logged with a special format.

⌋(*RS_LT_00003*)

8.1.5 LogHex16

[SWS_LOG_00109]{DRAFT} ⌈

Kind:	struct
Symbol:	LogHex16
Scope:	namespace ara::log
Syntax:	`struct LogHex16 {...};`
Header file:	#include "ara/log/log_stream.h"
Description:	Represents a 16 bit hexadecimal value data type .

⌋(*RS_LT_00003*)

8.1.6 LogHex32

[SWS_LOG_00110]{DRAFT} ⌈

Kind:	struct
Symbol:	LogHex32
Scope:	namespace ara::log
Syntax:	`struct LogHex32 {...};`
Header file:	#include "ara/log/log_stream.h"
Description:	Represents a 32 bit hexadecimal value data type .

⌋(*RS_LT_00003*)

8.1.7 LogHex64

[SWS_LOG_00111]{DRAFT} ⌈

Kind:	struct
Symbol:	LogHex64
Scope:	namespace ara::log
Syntax:	`struct LogHex64 {...};`
Header file:	#include "ara/log/log_stream.h"
Description:	Represents a 64 bit hexadecimal value data type .

⌋(*RS_LT_00003*)

8.1.8 LogBin8

[SWS_LOG_00112]{DRAFT} ⌈

Kind:	struct
Symbol:	LogBin8
Scope:	namespace ara::log
Syntax:	`struct LogBin8 {...};`
Header file:	#include "ara/log/log_stream.h"
Description:	Represents a 8 bit binary data type .

⌋(*RS_LT_00003*)

8.1.9 LogBin16

[SWS_LOG_00113]{DRAFT} ⌈

Kind:	struct
Symbol:	LogBin16
Scope:	namespace ara::log
Syntax:	`struct LogBin16 {...};`
Header file:	#include "ara/log/log_stream.h"
Description:	Represents a 16 bit binary data type .

⌋(*RS_LT_00003*)

8.1.10 LogBin32

[SWS_LOG_00114]{DRAFT} ⌈

Kind:	struct
Symbol:	LogBin32
Scope:	namespace ara::log
Syntax:	`struct LogBin32 {...};`
Header file:	#include "ara/log/log_stream.h"
Description:	Represents a 32 bit binary data type .

⌋(*RS_LT_00003*)

8.1.11 LogBin64

[SWS_LOG_00115]{DRAFT} ⌈

Kind:	struct
Symbol:	LogBin64
Scope:	namespace ara::log
Syntax:	`struct LogBin64 {...};`
Header file:	#include "ara/log/log_stream.h"
Description:	Represents a 64 bit binary data type .

⌋(*RS_LT_00003*)

8.1.12 ClientState

[SWS_LOG_00098]{DRAFT} ⌈

Kind:	enumeration	
Symbol:	ClientState	
Scope:	namespace ara::log	
Underlying type:	std::int8_t	
Syntax:	`enum class ClientState : std::int8_t {...};`	
Values:	kUnknown= -1	–
	kNotConnected	–
	kConnected	–
Header file:	#include "ara/log/common.h"	
Description:	Client state representing the connection state of an external client. .	

⌋(*RS_LT_00003*)

8.2 Function definitions

8.2.1 CreateLogger

[SWS_LOG_00021]{DRAFT} ⌈

Kind:	function	
Symbol:	CreateLogger(ara::core::StringView ctxId, ara::core::StringView ctxDescription, LogLevel ctxDef LogLevel=LogLevel::kWarn)	
Scope:	namespace ara::log	
Syntax:	`Logger& CreateLogger (ara::core::StringView ctxId, ara::core::String View ctxDescription, LogLevel ctxDefLogLevel=LogLevel::kWarn) noexcept;`	
Parameters (in):	ctxId	The context ID.
	ctxDescription	The description of the provided context ID.
	ctxDefLogLevel	The default log level, set to Warning severity if not explicitly specified.
Return value:	Logger &	Reference to the internal managed instance of a Logger object. Ownership stays within the Logging framework
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/logger.h"	
Description:	Creates a Logger object, holding the context which is registered in the Logging framework.	

⌋(*RS_LT_00003*)

8.2.2 HexFormat (uint8)

[SWS_LOG_00022]{DRAFT} ⌈

Kind:	function	
Symbol:	HexFormat(std::uint8_t value)	
Scope:	namespace ara::log	
Syntax:	`constexpr LogHex8 HexFormat (std::uint8_t value) noexcept;`	
Parameters (in):	value	Decimal number to be converted into hexadecimal number system.
Return value:	LogHex8	LogHex8 type that has a built-in stream handler.
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Conversion of a uint8 into a hexadecimal value. Negatives are represented in 2's complement. The number of represented digits depends on the overloaded parameter type length.	
Notes:	Logs decimal numbers in hexadecimal format.	

⌋(*RS_LT_00003*)

8.2.3 HexFormat (int8)

[SWS_LOG_00023]{DRAFT} ⌈

Kind:	function	
Symbol:	HexFormat(std::int8_t value)	
Scope:	namespace ara::log	
Syntax:	`constexpr LogHex8 HexFormat (std::int8_t value) noexcept;`	
Parameters (in):	value	Decimal number to be converted into hexadecimal number system.
Return value:	LogHex8	LogHex8 type that has a built-in stream handler.
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/logger.h"	
Description:	Conversion of a int8 into a hexadecimal value.	
Notes:	Logs decimal numbers in hexadecimal format. Negatives are represented in 2's complement.	

⌋*(RS_LT_00003)*

8.2.4 HexFormat (uint16)

[SWS_LOG_00024]{DRAFT} ⌈

Kind:	function	
Symbol:	HexFormat(std::uint16_t value)	
Scope:	namespace ara::log	
Syntax:	`constexpr LogHex16 HexFormat (std::uint16_t value) noexcept;`	
Parameters (in):	value	Decimal number to be converted into hexadecimal number system.
Return value:	LogHex16	LogHex16 type that has a built-in stream handler.
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/logger.h"	
Description:	Conversion of a uint16 into a hexadecimal value.	
Notes:	Logs decimal numbers in hexadecimal format.	

⌋*(RS_LT_00003)*

8.2.5 HexFormat (int16)

[SWS_LOG_00025]{DRAFT} ⌈

Kind:	function	
Symbol:	HexFormat(std::int16_t value)	
Scope:	namespace ara::log	
Syntax:	`constexpr LogHex16 HexFormat (std::int16_t value) noexcept;`	
Parameters (in):	value	Decimal number to be converted into hexadecimal number system.
Return value:	LogHex16	LogHex16 type that has a built-in stream handler.
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/logger.h"	
Description:	Conversion of a int16 into a hexadecimal value.	
Notes:	Logs decimal numbers in hexadecimal format. Negatives are represented in 2's complement.	

⌋(*RS_LT_00003*)

8.2.6 HexFormat (uint32)

[SWS_LOG_00026]{DRAFT} ⌈

Kind:	function	
Symbol:	HexFormat(std::uint32_t value)	
Scope:	namespace ara::log	
Syntax:	`constexpr LogHex32 HexFormat (std::uint32_t value) noexcept;`	
Parameters (in):	value	Decimal number to be converted into hexadecimal number system.
Return value:	LogHex32	LogHex32 type that has a built-in stream handler.
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/logger.h"	
Description:	Conversion of a uint32 into a hexadecimal value.	
Notes:	Logs decimal numbers in hexadecimal format.	

⌋(*RS_LT_00003*)

8.2.7 HexFormat (int32)

[SWS_LOG_00027]{DRAFT} ⌈

Kind:	function
Symbol:	HexFormat(std::int32_t value)
Scope:	namespace ara::log
Syntax:	`constexpr LogHex32 HexFormat (std::int32_t value) noexcept;`

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Parameters (in):	value	Decimal number to be converted into hexadecimal number system.
Return value:	LogHex32	LogHex32 type that has a built-in stream handler.
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/logger.h"	
Description:	Conversion of a int32 into a hexadecimal value.	
Notes:	Logs decimal numbers in hexadecimal format. Negatives are represented in 2's complement.	

⌋(*RS_LT_00003*)

8.2.8 HexFormat (uint64)

[SWS_LOG_00028]{DRAFT} ⌈

Kind:	function	
Symbol:	HexFormat(std::uint64_t value)	
Scope:	namespace ara::log	
Syntax:	`constexpr LogHex64 HexFormat (std::uint64_t value) noexcept;`	
Parameters (in):	value	Decimal number to be converted into hexadecimal number system.
Return value:	LogHex64	LogHex64 type that has a built-in stream handler.
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/logger.h"	
Description:	Conversion of a uint64 into a hexadecimal value.	
Notes:	Logs decimal numbers in hexadecimal format.	

⌋(*RS_LT_00003*)

8.2.9 HexFormat (int64)

[SWS_LOG_00029]{DRAFT} ⌈

Kind:	function	
Symbol:	HexFormat(std::int64_t value)	
Scope:	namespace ara::log	
Syntax:	`constexpr LogHex64 HexFormat (std::int64_t value) noexcept;`	
Parameters (in):	value	Decimal number to be converted into hexadecimal number system.
Return value:	LogHex64	LogHex64 type that has a built-in stream handler.
Exception Safety:	noexcept	

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Thread Safety:	reentrant
Header file:	#include "ara/log/logger.h"
Description:	Conversion of a int64 into a hexadecimal value.
Notes:	Logs decimal numbers in hexadecimal format. Negatives are represented in 2's complement.

⌋(*RS_LT_00003*)

8.2.10 BinFormat (uint8)

[SWS_LOG_00030]{DRAFT} ⌈

Kind:	function	
Symbol:	BinFormat(std::uint8_t value)	
Scope:	namespace ara::log	
Syntax:	`constexpr LogBin8 BinFormat (std::uint8_t value) noexcept;`	
Parameters (in):	value	Decimal number to be converted into a binary value.
Return value:	LogBin8	LogBin8 type that has a built-in stream handler.
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/logger.h"	
Description:	Conversion of a uint8 into a binary value.	
Notes:	Logs decimal numbers in binary format.	

⌋(*RS_LT_00003*)

8.2.11 BinFormat (int8)

[SWS_LOG_00031]{DRAFT} ⌈

Kind:	function	
Symbol:	BinFormat(std::int8_t value)	
Scope:	namespace ara::log	
Syntax:	`constexpr LogBin8 BinFormat (std::int8_t value) noexcept;`	
Parameters (in):	value	Decimal number to be converted into a binary value.
Return value:	LogBin8	LogBin8 type that has a built-in stream handler.
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/logger.h"	
Description:	Conversion of a int8 into a binary value.	
Notes:	Logs decimal numbers in binary format. Negatives are represented in 2's complement.	

⌋(*RS_LT_00003*)

8.2.12 BinFormat (uint16)

[SWS_LOG_00032]{DRAFT} ⌈

Kind:	function	
Symbol:	BinFormat(std::uint16_t value)	
Scope:	namespace ara::log	
Syntax:	`constexpr LogBin16 BinFormat (std::uint16_t value) noexcept;`	
Parameters (in):	value	Decimal number to be converted into a binary value.
Return value:	LogBin16	LogBin8 type that has a built-in stream handler.
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/logger.h"	
Description:	Conversion of a uint16 into a binary value.	
Notes:	Logs decimal numbers in binary format.	

⌋(*RS_LT_00003*)

8.2.13 BinFormat (int16)

[SWS_LOG_00033]{DRAFT} ⌈

Kind:	function	
Symbol:	BinFormat(std::int16_t value)	
Scope:	namespace ara::log	
Syntax:	`constexpr LogBin16 BinFormat (std::int16_t value) noexcept;`	
Parameters (in):	value	Decimal number to be converted into a binary value.
Return value:	LogBin16	LogBin8 type that has a built-in stream handler.
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/logger.h"	
Description:	Conversion of a int16 into a binary value.	
Notes:	Logs decimal numbers in binary format. Negatives are represented in 2's complement.	

⌋(*RS_LT_00003*)

8.2.14 BinFormat (uint32)

[SWS_LOG_00034]{DRAFT} ⌈

Kind:	function
Symbol:	BinFormat(std::uint32_t value)

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Scope:	namespace ara::log	
Syntax:	`constexpr LogBin32 BinFormat (std::uint32_t value) noexcept;`	
Parameters (in):	value	Decimal number to be converted into a binary value.
Return value:	LogBin32	LogBin8 type that has a built-in stream handler.
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/logger.h"	
Description:	Conversion of a uint32 into a binary value.	
Notes:	Logs decimal numbers in binary format.	

⌋(*RS_LT_00003*)

8.2.15 BinFormat (int32)

[SWS_LOG_00035]{DRAFT} ⌈

Kind:	function	
Symbol:	BinFormat(std::int32_t value)	
Scope:	namespace ara::log	
Syntax:	`constexpr LogBin32 BinFormat (std::int32_t value) noexcept;`	
Parameters (in):	value	Decimal number to be converted into a binary value.
Return value:	LogBin32	LogBin8 type that has a built-in stream handler.
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/logger.h"	
Description:	Conversion of a int32 into a binary value.	
Notes:	Logs decimal numbers in binary format. Negatives are represented in 2's complement.	

⌋(*RS_LT_00003*)

8.2.16 BinFormat (uint64)

[SWS_LOG_00036]{DRAFT} ⌈

Kind:	function	
Symbol:	BinFormat(std::uint64_t value)	
Scope:	namespace ara::log	
Syntax:	`constexpr LogBin64 BinFormat (std::uint64_t value) noexcept;`	
Parameters (in):	value	Decimal number to be converted into a binary value.
Return value:	LogBin64	LogBin8 type that has a built-in stream handler.
Exception Safety:	noexcept	

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Thread Safety:	reentrant
Header file:	#include "ara/log/logger.h"
Description:	Conversion of a uint64 into a binary value.
Notes:	Logs decimal numbers in binary format.

⌋(*RS_LT_00003*)

8.2.17 BinFormat (int64)

[SWS_LOG_00037]{DRAFT} ⌈

Kind:	function	
Symbol:	BinFormat(std::int64_t value)	
Scope:	namespace ara::log	
Syntax:	`constexpr LogBin64 BinFormat (std::int64_t value) noexcept;`	
Parameters (in):	value	Decimal number to be converted into a binary value.
Return value:	LogBin64	LogBin8 type that has a built-in stream handler.
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/logger.h"	
Description:	Conversion of a int64 into a binary value.	
Notes:	Logs decimal numbers in binary format. Negatives are represented in 2's complement.	

⌋(*RS_LT_00003*)

8.2.18 RegisterConnectionStateHandler

[SWS_LOG_00205]{DRAFT} ⌈

Kind:	function	
Symbol:	RegisterConnectionStateHandler(std::function< void(ClientState)> callback)	
Scope:	namespace ara::log	
Syntax:	`void RegisterConnectionStateHandler (std::function< void(ClientState)> callback) noexcept;`	
Parameters (in):	callback	a callback that is invoked whenever the connection state has changed
Return value:	None	
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Register a callback to be invoked whenever the connection state changes. Only a single function can be installed this way; if a callback was already registered before, only the newly registered one is used henceforth.	

⌋(*RS_LT_00003*)

8.2.19 Wrapper object creator

[SWS_LOG_00201]{DRAFT} ⌈

Kind:	function	
Symbol:	Arg(T &&arg, const char *name=nullptr, const char *unit=nullptr, Format format=Dflt())	
Scope:	namespace ara::log	
Syntax:	`template <typename T>` `Argument<T> Arg (T &&arg, const char *name=nullptr, const char *unit=nullptr, Format format=Dflt()) noexcept;`	
Parameters (in):	arg	an argument payload object
	name	an optional "name" attribute for arg
	unit	an optional "unit" attribute for arg
	format	an optional formatting hint for integral or floating-point arguments; the default is to use the implementation's standard formatting
Return value:	Argument< T >	a wrapper object holding the supplied arguments
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Create a wrapper object for the given arguments. Calling this function shall be ill-formed if any of these conditions are met: T is not an arithmetic type and not "bool" and not convertible to "ara::core::StringView" and not convertible to "ara::core::Span<const ara::core::Byte>" T is convertible to "ara::core::StringView" or convertible to "ara::core::Span<const ara::core::Byte>" or "bool", and "unit" is not "nullptr"	

⌋(*RS_LT_00003*)

8.2.20 Logger of an argument with attributes

[SWS_LOG_00203]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(const Argument< T > &arg)	
Scope:	class ara::log::LogStream	
Syntax:	`template <typename T>` `LogStream& operator<< (const Argument< T > &arg) noexcept;`	
Template param:	T	the argument payload type
Parameters (in):	arg	the argument wrapper object
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Header file:	#include "ara/log/log_stream.h"	
Description:	Log an argument with attributes. When output to the console, the value and all its attributes shall be shown as a single argument.	

⌋(*RS_LT_00003*)

8.2.21 Logger of modeled message

[SWS_LOG_00204]{DRAFT} ⌈

Kind:	function	
Symbol:	Log(const MsgId &id, const Params &... args)	
Scope:	class ara::log::Logger	
Syntax:	`template <typename MsgId, typename... Params>` `void Log (const MsgId &id, const Params &... args) noexcept;`	
Template param:	MsgId	the type of the id parameter
	Args	the types of the args parameters
Parameters (in):	id	an implementation-defined type identifying the message object
	args	the arguments to add to the message
Return value:	None	
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Log a modeled message. If this function is called with an argument list that does not match the modeled message, the program is ill-formed.	

⌋(*RS_LT_00003*)

8.3 Class definitions

8.3.1 Class LogStream

The class ara::log::LogStream represents a Log message, allowing stream operators to be used for appending data.

[SWS_LOG_00173]{DRAFT} ⌈

Kind:	class
Symbol:	LogStream
Scope:	namespace ara::log
Syntax:	`class LogStream final {...};`
Header file:	#include "ara/log/log_stream.h"
Description:	Class LogStream Initiates it with the given log level directly on the back-end. .

⌋(*RS_LT_00003*)

Note:
Normally Application processes would not use this class directly. Instead one of the log methods provided in the main Logging API shall be used. Those methods automatically setup a temporary object of this class with the given log severity level. The only reason to use this class directly is, if the user wants to hold a ara::log::LogStream object longer than the default one-statement scope. This is useful in order to create log messages that are distributed over multiple code lines. See the ara::log::LogStream::Flush method for further information. Once this temporary object gets out of scope, its destructor takes care that the message buffer is ready to be processed by the Logging framework.

8.3.1.1 Extending the Logging API to understand custom types

The ara::log::LogStream class supports natively the formats stated in chapter 8.2, it can be easily extended for other derived types by providing a stream operator that makes use of already supported types.

Example:

```
struct MyCustomType {
  int8_t foo;
  ara::core::String bar;
};

LogStream& operator<<(LogStream& out, const MyCustomType& value) {
  return (out << value.foo << value.bar);
}

// Producing the output "42 the answer is."
Logger& ctx0 = CreateLogger("CTX0", "Context Description CTX0");
```

```
12 ctx0.LogDebug () << MyCustomType{42, " the answer is."};
```

8.3.1.2 LogStream::Flush

[SWS_LOG_00039]{DRAFT} ⌈

Kind:	function
Symbol:	Flush()
Scope:	class ara::log::LogStream
Syntax:	`void Flush () noexcept;`
Return value:	None
Exception Safety:	noexcept
Thread Safety:	reentrant
Header file:	#include "ara/log/log_stream.h"
Description:	Sends out the current log buffer and initiates a new message stream.

⌋(*RS_LT_00003*)

Note:
Calling `ara::log::LogStream::Flush` is only necessary if the `ara::log::LogStream` object is going to be re-used within the same scope. Otherwise, if the object goes out of scope (e.g. end of function block) then the flushing operation will be done internally by the destructor. It is important to note that the `ara::log::LogStream::Flush` command does not empty the buffer, but it forwards the buffer's current contents to the `Logging framework`.

8.3.1.3 Built-in operators for natively supported types

[SWS_LOG_00040]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(bool value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (bool value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	
Description:	Appends given value to the internal message buffer.	

⌋(*RS_LT_00003*)

[SWS_LOG_00041]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(std::uint8_t value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (std::uint8_t value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	
Description:	Writes unsigned int 8 bit parameter into message.	

⌋(*RS_LT_00003*)

[SWS_LOG_00042]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(std::uint16_t value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (std::uint16_t value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	
Description:	Writes unsigned int 16 bit parameter into message.	

⌋(*RS_LT_00003*)

[SWS_LOG_00043]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(std::uint32_t value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (std::uint32_t value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	
Description:	Writes unsigned int 32 bit parameter into message.	

⌋(*RS_LT_00003*)

[SWS_LOG_00044]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(std::uint64_t value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (std::uint64_t value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	
Description:	Writes unsigned int 64 bit parameter into message.	

⌋(*RS_LT_00003*)

[SWS_LOG_00045]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(std::int8_t value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (std::int8_t value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	
Description:	Writes signed int 8 bit parameter into message.	

⌋(*RS_LT_00003*)

[SWS_LOG_00046]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(std::int16_t value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (std::int16_t value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	
Description:	Writes signed int 16 bit parameter into message.	

⌋(*RS_LT_00003*)

[SWS_LOG_00047]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(std::int32_t value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (std::int32_t value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	
Description:	Writes signed int 32 bit parameter into message.	

⌋(*RS_LT_00003*)

[SWS_LOG_00048]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(std::int64_t value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (std::int64_t value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	
Description:	Writes signed int 64 bit parameter into message.	

⌋(*RS_LT_00003*)

[SWS_LOG_00049]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(float value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (float value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	
Description:	Writes float 32 bit parameter into message.	

⌋(*RS_LT_00003*)

[SWS_LOG_00050]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(double value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (double value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	
Description:	Writes float 64 bit parameter into message.	

⌋(*RS_LT_00003*)

8.3.1.4 Built-in operators for conversion types

[SWS_LOG_00053]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(const LogHex8 &value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (const LogHex8 &value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	
Description:	Writes unsigned int parameter into message, formatted as hexadecimal 8 digits.	

⌋(*RS_LT_00003*)

[SWS_LOG_00054]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(const LogHex16 &value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (const LogHex16 &value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	

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Description:	Writes unsigned int parameter into message, formatted as hexadecimal 16 digits.

⌋(*RS_LT_00003*)

[SWS_LOG_00055]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(const LogHex32 &value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (const LogHex32 &value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	
Description:	Writes unsigned int parameter into message, formatted as hexadecimal 32 digits.	

⌋(*RS_LT_00003*)

[SWS_LOG_00056]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(const LogHex64 &value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (const LogHex64 &value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	
Description:	Writes unsigned int parameter into message, formatted as hexadecimal 64 digits.	

⌋(*RS_LT_00003*)

[SWS_LOG_00057]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(const LogBin8 &value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (const LogBin8 &value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	

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Thread Safety:	reentrant
Header file:	#include "ara/log/log_stream.h"
Description:	Writes unsigned int parameter into message, formatted as binary 8 digits.

⌋(*RS_LT_00003*)

[SWS_LOG_00058]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(const LogBin16 &value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (const LogBin16 &value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	
Description:	Writes unsigned int parameter into message, formatted as binary 16 digits.	

⌋(*RS_LT_00003*)

[SWS_LOG_00059]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(const LogBin32 &value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (const LogBin32 &value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	
Description:	Writes unsigned int parameter into message, formatted as binary 32 digits.	

⌋(*RS_LT_00003*)

[SWS_LOG_00060]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(const LogBin64 &value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (const LogBin64 &value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.

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Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	
Description:	Writes unsigned int parameter into message, formatted as binary 64 digits.	

⌋(*RS_LT_00003*)

8.3.1.5 Built-in operators for extra types

[SWS_LOG_00062]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(const ara::core::StringView value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (const ara::core::StringView value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	
Description:	Writes ara::core::StringView into message.	

⌋(*RS_LT_00003*)

[SWS_LOG_00051]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(const char *const value)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (const char *const value) noexcept;`	
Parameters (in):	value	Value to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	
Description:	Writes null terminated UTF8 string into message. (NOT sPECIFIED. WILL BE REMOVED IN FUTURE!)	

⌋(*RS_LT_00003*)

[SWS_LOG_00063]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(LogStream &out, LogLevel value)	
Scope:	namespace ara::log	
Syntax:	`LogStream& operator<< (LogStream &out, LogLevel value) noexcept;`	
Parameters (in):	out	LogStream Object which is used to append the logged LogLevel (value) to
	value	LogLevel enum parameter as text to be appended to the internal message buffer.
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Thread Safety:	reentrant	
Header file:	#include "ara/log/log_stream.h"	
Description:	Appends LogLevel enum parameter as text into message.	

⌋(*RS_LT_00003*)

[SWS_LOG_00124]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(LogStream &out, const core::ErrorCode &ec)	
Scope:	namespace ara::log	
Syntax:	`LogStream& operator<< (LogStream &out, const core::ErrorCode &ec) noexcept;`	
Parameters (in):	out	the LogStream object into which to add the value
	ec	the ErrorCode instance to log
Return value:	LogStream &	out
Exception Safety:	noexcept	
Header file:	#include "ara/log/log_stream.h"	
Description:	Write a core::ErrorCode instance into the message. When output to the console, the ErrorCode shall be shown in an implementation-defined way as a String holding the result of ErrorCode:Domain().Name() (i.e. the ErrorDomain's Shortname), and the integral error code number.	

⌋(*RS_LT_00003*)

[SWS_LOG_00125]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(LogStream &out, const std::chrono::duration< Rep, Period > &value)	
Scope:	namespace ara::log	
Syntax:	`template <typename Rep, typename Period>` `LogStream& operator<< (LogStream &out, const std::chrono::duration< Rep, Period > &value) noexcept;`	
Template param:	Rep	arithmetic type representing the number of ticks in this duration
	Period	a std::ratio type representing the tick period of the clock, in seconds
Parameters (in):	out	the LogStream object into which to add the value

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	value	the duration instance to log
Return value:	LogStream &	out
Exception Safety:	noexcept	
Header file:	#include "ara/log/log_stream.h"	
Description:	Write a std::chrono::duration instance into the message. When output to the console, the duration shall be shown as a decimal integer value, together with the duration's unit in SI notation, for at least all units in [std::nano, std::micro, std::milli, std::centi, std::deci, std::ratio<1>].	

⌋(*RS_LT_00049*)

[SWS_LOG_00126]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(LogStream &out, const ara::core::InstanceSpecifier &value)	
Scope:	namespace ara::log	
Syntax:	`LogStream& operator<< (LogStream &out, const ara::core::InstanceSpecifier &value) noexcept;`	
Parameters (in):	out	the LogStream object into which to add the value
	value	the InstanceSpecifier to log
Return value:	LogStream &	out
Exception Safety:	noexcept	
Header file:	#include "ara/log/log_stream.h"	
Description:	Write a core::InstanceSpecifier into the message. The InstanceSpecifier shall be shown as the result of calling InstanceSpecifier::ToString.	

⌋(*RS_LT_00049*)

[SWS_LOG_00127]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(LogStream &out, const void *const value)	
Scope:	namespace ara::log	
Syntax:	`LogStream & operator<< (LogStream &out, const void *const value) noexcept;`	
Parameters (in):	out	the LogStream object into which to add the value
	value	to log
Return value:	LogStream &	out
Exception Safety:	noexcept	
Header file:	#include "ara/log/log_stream.h"	
Description:	Writes pointer address into message, formatted as hexadecimal.	

⌋(*RS_LT_00049*)

[SWS_LOG_00128]{DRAFT} ⌈

Kind:	function	
Symbol:	operator<<(core::Span< const core::Byte > data)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& operator<< (core::Span< const core::Byte > data) noexcept;`	
Parameters (in):	data	a Span<const Byte> covering the range to be logged
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Header file:	#include "ara/log/log_stream.h"	
Description:	Write a byte sequence into message. This call shall copy the sequence of core::Byte objects as-is into the message. When output to the console, this byte sequence shall be shown as a sequence of apostrophe-separated list of hexadecimal octet-pairs, for instance: "48'65'6c'6c'6f"	

⌋(*RS_LT_00003*)

[SWS_LOG_00129]{DRAFT} ⌈

Kind:	function	
Symbol:	WithLocation(core::StringView file, int line)	
Scope:	class ara::log::LogStream	
Syntax:	`LogStream& WithLocation (core::StringView file, int line) noexcept;`	
Parameters (in):	file	the source file identifier
	line	the source file line number
Return value:	LogStream &	*this
Exception Safety:	noexcept	
Header file:	#include "ara/log/log_stream.h"	
Description:	Add source file location into the message. This function has no effect if another member function that adds content to the current message has already been called.	

⌋(*RS_LT_00003*)

8.3.2 Class Logger

The class `Logger` represents a logger context. The `Logging framework` defines contexts which can be seen as logger instances within one `Application process` or process scope.

The contexts have the following properties:

1) Context ID
2) Description of the Context ID
3) Default log level

A context will be automatically registered against the `Logging back-end` during creation phase, as well as automatically deregistered during process shutdown phase. So the end user does not care for the objects life time. To ensure such housekeeping functionality, a strong ownership of the logger instances needs to be ensured towards the `Logging framework`. This means that the `Application process` are not supposed to call the Logger constructor themselves.

The user is not allowed to create a Logger object by himself. Logger context needs to be created by the provided API call `CreateLogger()`.

8.3.2.1 Logger::LogFatal

[SWS_LOG_00064]{DRAFT} ⌈

Kind:	function	
Symbol:	LogFatal()	
Scope:	class ara::log::Logger	
Syntax:	`LogStream LogFatal () const noexcept;`	
Return value:	LogStream	LogStream object of Fatal severity.
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Creates a LogStream object. Returned object will accept arguments via the insert stream operator "@c <<".	
Notes:	In the normal usage scenario, the object's life time of the created LogStream is scoped within one statement (ends with ; after last passed argument). If one wants to extend the LogStream object's life time, the object might be assigned to a named variable.	

⌋*(RS_LT_00003)*

8.3.2.2 Logger::LogError

[SWS_LOG_00065]{DRAFT} ⌈

Kind:	function	
Symbol:	LogError()	
Scope:	class ara::log::Logger	
Syntax:	`LogStream LogError () const noexcept;`	
Return value:	LogStream	LogStream object of Error severity.
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Same as Logger::LogFatal().	

⌋(*RS_LT_00003*)

8.3.2.3 Logger::LogWarn

[SWS_LOG_00066]{DRAFT} ⌈

Kind:	function	
Symbol:	LogWarn()	
Scope:	class ara::log::Logger	
Syntax:	`LogStream LogWarn () const noexcept;`	
Return value:	LogStream	LogStream object of Warn severity.
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Same as Logger::LogFatal().	

⌋(*RS_LT_00003*)

8.3.2.4 Logger::LogInfo

[SWS_LOG_00067]{DRAFT} ⌈

Kind:	function	
Symbol:	LogInfo()	
Scope:	class ara::log::Logger	
Syntax:	`LogStream LogInfo () const noexcept;`	
Return value:	LogStream	LogStream object of Info severity.
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Same as Logger::LogFatal().	

⌋(*RS_LT_00003*)

8.3.2.5 Logger::LogDebug

[SWS_LOG_00068]{DRAFT} ⌈

Kind:	function	
Symbol:	LogDebug()	
Scope:	class ara::log::Logger	
Syntax:	`LogStream LogDebug () const noexcept;`	
Return value:	LogStream	LogStream object of Debug severity.
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Same as Logger::LogFatal().	

⌋(*RS_LT_00003*)

8.3.2.6 Logger::LogVerbose

[SWS_LOG_00069]{DRAFT} ⌈

Kind:	function	
Symbol:	LogVerbose()	
Scope:	class ara::log::Logger	
Syntax:	`LogStream LogVerbose () const noexcept;`	
Return value:	LogStream	LogStream object of Verbose severity.
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Same as Logger::LogFatal().	

⌋(*RS_LT_00003*)

8.3.2.7 Logger::IsEnabled

[SWS_LOG_00070]{DRAFT} ⌈

Kind:	function	
Symbol:	IsEnabled(LogLevel logLevel)	
Scope:	class ara::log::Logger	
Syntax:	`bool IsEnabled (LogLevel logLevel) const noexcept;`	
Parameters (in):	logLevel	The to be checked log level.
Return value:	bool	True if desired log level satisfies the configured reporting level.
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	

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Description:	Check current configured log reporting level. Applications may want to check the actual configured reporting log level of certain loggers before doing log data preparation that is runtime intensive.

⌋(*RS_LT_00003*)

8.3.2.8 Logger::WithLevel

[SWS_LOG_00131]{DRAFT} ⌈

Kind:	function	
Symbol:	WithLevel(LogLevel logLevel)	
Scope:	class ara::log::Logger	
Syntax:	`LogStream WithLevel (LogLevel logLevel) const noexcept;`	
Parameters (in):	logLevel	the log level to use for this LogStream instance
Return value:	LogStream	a new LogStream instance with the given log level
Exception Safety:	noexcept	
Header file:	#include "ara/log/logger.h"	
Description:	Log message with a programmatically determined log level can be written.	

⌋(*RS_LT_00003*)

A Mentioned Manifest Elements

For the sake of completeness, this chapter contains a set of class tables representing meta-classes mentioned in the context of this document.

Class	**DltApplication**			
Package	M2::AUTOSARTemplates::LogAndTraceExtract			
Note	This meta-class represents the application from which the log and trace message originates.			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
applicationDescription	String	0..1	attr	This attribute can be used to describe the applicationId that is used in the log and trace message in more detail.
applicationId	String	0..1	attr	This attribute identifies the SW-C/BSW module in the log and trace message.
context	DltContext	*	ref	Definition of ContextIds for the Application. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=context.dltContext, context.variationPoint.shortLabel vh.latestBindingTime=systemDesignTime

Table A.1: DltApplication

Class	**DltArgument**			
Package	M2::AUTOSARTemplates::LogAndTraceExtract			
Note	This element defines an Argument in a DltMessage.			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
dltArgumentEntry	DltArgument	*	aggr	This aggregation is used to describe subElements of a Dlt Argument that defines a Structure.
length	PositiveInteger	0..1	attr	Describes the DltArgument length in case of Arrays and Strings in number of BaseTypes.
networkRepresentation	SwDataDefProps	0..1	aggr	Definition of the networkRepresentation of the Dlt Argument.
optional	Boolean	0..1	attr	This attribute defines whether the argument is optional or not. If set to True, the argument can be omitted from the payload of a DLT message.
predefinedText	Boolean	0..1	attr	This attribute defines whether the DltArgument is a predefinedText (Static Data).
variableLength	Boolean	0..1	attr	This attribute defines whether the length of the Dlt Argument is variable (determined at runtime) or not.

Table A.2: DltArgument

Class	**DltContext**
Package	M2::AUTOSARTemplates::LogAndTraceExtract
Note	This meta-class represents the Context that groups Log and Trace Messages that are generated by an application. **Tags:**atp.recommendedPackage=DltContexts

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Class	DltContext			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *Packageable Element*, *Referrable*			
Attribute	**Type**	**Mult.**	**Kind**	**Note**
context Description	String	0..1	attr	This attribute can be used to describe the contextId that is used in the log and trace message in more detail.
contextId	String	0..1	attr	This attribute is used to group log and trace messages produced by an application to distinguish functionality.
dltMessage	DltMessage	*	ref	Group of Log and Trace Messages assigned to the Dlt Context **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=dltMessage.dltMessage, dlt Message.variationPoint.shortLabel vh.latestBindingTime=systemDesignTime

Table A.3: DltContext

Class	DltEcu			
Package	M2::AUTOSARTemplates::LogAndTraceExtract			
Note	This element represents an Ecu or Machine that produces logging and tracing information. **Tags:**atp.recommendedPackage=DltEcus			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *Packageable Element*, *Referrable*			
Attribute	**Type**	**Mult.**	**Kind**	**Note**
application	DltApplication	*	aggr	Application on DltEcu that provides log or trace data. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=application.shortName, application.variation Point.shortLabel vh.latestBindingTime=systemDesignTime
ecuId	String	0..1	attr	This attribute defines the name of the ECU for use within the Dlt protocol.

Table A.4: DltEcu

Class	DltLogSink			
Package	M2::AUTOSARTemplates::AdaptivePlatform::PlatformModuleDeployment::LogAndTrace			
Note	The meta-class defines the output sink for DltLogMessages **Tags:** atp.Status=draft atp.recommendedPackage=DltLogSinks			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *Packageable Element*, *Referrable*, *UploadablePackageElement*			
Attribute	**Type**	**Mult.**	**Kind**	**Note**
bufferOutput	Boolean	0..1	attr	This attribute defines whether a buffer is used in case that the output sink is the console. **Tags:**atp.Status=draft
defaultLog Threshold	LogTraceDefaultLog LevelEnum	0..1	attr	This attribute allows to set a log level Threshold for Log Level filtering. **Tags:**atp.Status=draft

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Class	**DltLogSink**			
defaultTrace State	Boolean	0..1	attr	This attributes defines the default trace status. **Tags:**atp.Status=draft
endpoint Configuration	PlatformModule EthernetEndpoint Configuration	0..1	ref	Network configuration (Protocol, Port, IP Address) for transmission of dlt messages on a specific VLAN. **Tags:**atp.Status=draft
logChannelId	String	0..1	attr	This attribute identifies the LogChannel for usage within the Log And Trace protocol. **Tags:**atp.Status=draft
nonVerbose Mode	Boolean	0..1	attr	This attribute defines whether this DltLogSink supports non-Verbose Dlt messages. If disabled only verbose mode messages shall be used. **Tags:**atp.Status=draft
path	UriString	0..1	attr	This attribute defines the path to the file that is used as output sink. **Tags:**atp.Status=draft
queueSize	PositiveInteger	0..1	attr	Length of the queue (in which messages can be stored before processing) in the unit "Log message". **Tags:**atp.Status=draft

Table A.5: DltLogSink

Class	**DltLogSinkToPortPrototypeMapping**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::PlatformModuleDeployment::LogAndTrace			
Note	This meta-class maps a PortPrototype to an output sink of a log and trace message. **Tags:** atp.Status=draft atp.recommendedPackage=DltLogSinkToPortPrototypeMappings			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *Packageable Element*, *Referrable*, *UploadablePackageElement*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
dltContext	DltContext	0..1	ref	Assignement of the DltContext that groups log and trace messages that will be transmitted to the DltLogSink. **Tags:**atp.Status=draft
dltLogSink	DltLogSink	*	ref	Reference to the output sink to which the log or trace message will be transmitted, **Tags:**atp.Status=draft
dltSessionId	PositiveInteger	0..1	attr	This attribute allows distinguishing log/trace messages from different instances of the same SW-C. **Tags:**atp.Status=draft
pPortPrototype	PPortPrototype	0..1	iref	Reference to PPortPrototype that is mapped to the DltLog Sink. **Tags:**atp.Status=draft **InstanceRef implemented by:**PPortPrototypeIn ExecutableInstanceRef
process	Process	0..1	ref	This reference represents the process required as context for the mapping. **Tags:**atp.Status=draft

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Class	**DltLogSinkToPortPrototypeMapping**			
rPortPrototype	RPortPrototype	0..1	iref	Reference to RPortPrototype that is mapped to a DltLog Sink **Tags:**atp.Status=draft **InstanceRef implemented by:**RPortPrototypeIn ExecutableInstanceRef

Table A.6: DltLogSinkToPortPrototypeMapping

Class	**DltMessage**			
Package	M2::AUTOSARTemplates::LogAndTraceExtract			
Note	This element defines a DltMessage.			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
dltArgument (ordered)	DltArgument	*	aggr	Ordered collection of DltArguments in the DltMessage.
messageId	PositiveInteger	0..1	attr	This attribute defines the unique Id for the DltMessage.
messageLine Number	PositiveInteger	0..1	attr	This attribute describes the position in the source file in which this log message was called.
messageSource File	String	0..1	attr	This attribute describes the source file in which this log message was called.
messageType Info	String	0..1	attr	This attribute describes the message Type

Table A.7: DltMessage

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***	***Mult.***	***Kind***	***Note***
buildType	BuildTypeEnum	0..1	attr	This attribute describes the buildType of a module and/or platform implementation. **Tags:**atp.Status=draft
loggingBehavior	LoggingBehaviorEnum	0..1	attr	This attribute indicates the intended logging behavior of the enclosing Executable. **Tags:**atp.Status=draft
minimumTimer Granularity	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
reporting Behavior	ExecutionState ReportingBehavior Enum	0..1	attr	this attribute controls the execution state reporting behavior of the enclosing Executable. **Tags:**atp.Status=draft

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Class	**Executable**			
rootSw Component Prototype	RootSwComponent Prototype	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
version	StrongRevisionLabel String	0..1	attr	Version of the executable. **Tags:**atp.Status=draft

Table A.8: Executable

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*

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Class	**Identifiable** (abstract)			
Subclasses	ARPackage, *AbstractDoIpLogicAddressProps*, *AbstractEvent*, *AbstractImplementationDataTypeElement*, *AbstractSecurityEventFilter*, *AbstractSecurityIdsmInstanceFilter*, *AbstractServiceInstance*, *AbstractSignalBasedToISignalTriggeringMapping*, *AdaptiveModuleInstantiation*, AdaptiveSwcInternalBehavior, ApApplicationEndpoint, ApplicationEndpoint, ApplicationError, ArtifactChecksum, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpFeature*, AutosarOperationArgumentInstance, AutosarVariableInstance, *BuildActionEntity*, BuildActionEnvironment, Chapter, CheckpointTransition, ClassContentConditional, ClientIdDefinition, ClientServerOperation, Code, *CollectableElement*, ComManagementMapping, *CommConnectorPort*, *CommunicationConnector*, *CommunicationController*, Compiler, ConsistencyNeeds, ConsumedEventGroup, CouplingPort, *CouplingPortStructuralElement*, CryptoCertificate, CryptoKeySlot, CryptoProvider, *CryptoServiceMapping*, DataPrototypeGroup, DataTransformation, DdsDomainRange, DependencyOnArtifact, DeterministicClientResourceNeeds, *DiagEventDebounceAlgorithm*, DiagnosticConnectedIndicator, DiagnosticDataElement, DiagnosticDebounceAlgorithmProps, DiagnosticFunctionInhibitSource, *DiagnosticRoutineSubfunction*, DltApplication, DltArgument, DltMessage, DoIpInterface, DoIpLogicAddress, DoIpRoutingActivation, E2EProfileConfiguration, End2EndEventProtectionProps, End2EndMethodProtectionProps, EndToEndProtection, EthernetWakeupSleepOnDatalineConfig, EventHandler, EventMapping, ExclusiveArea, *ExecutableEntity*, *ExecutionTime*, FMAttributeDef, FMFeatureMapAssertion, FMFeatureMapCondition, FMFeatureMapElement, FMFeatureRelation, FMFeatureRestriction, FMFeatureSelection, FieldMapping, FireAndForgetMapping, FlexrayArTpNode, FlexrayTpPduPool, *FrameTriggering*, GeneralParameter, GlobalSupervision, GlobalTimeGateway, *GlobalTimeMaster*, *GlobalTimeSlave*, *HealthChannel*, *HeapUsage*, HwAttributeDef, HwAttributeLiteralDef, HwPin, HwPinGroup, IPSecRule, IPv6ExtHeaderFilterList, ISignalToIPduMapping, ISignalTriggering, *IdentCaption*, InternalTriggeringPoint, Keyword, LifeCycleState, Linker, MacMulticastGroup, McDataInstance, MemorySection, MethodMapping, ModeDeclaration, ModeDeclarationMapping, ModeSwitchPoint, NetworkEndpoint, *NmCluster*, *NmNode*, *PackageableElement*, ParameterAccess, PduActivationRoutingGroup, PduToFrameMapping, PduTriggering, PerInstanceMemory, *PersistencyDeploymentElement*, *PersistencyInterfaceElement*, *PhmSupervision*, *PhysicalChannel*, PortGroup, *PortInterfaceMapping*, PossibleErrorReaction, ProcessToMachineMapping, Processor, ProcessorCore, PskIdentityToKeySlotMapping, RecoveryNotification, ResourceConsumption, ResourceGroup, RootSwClusterDesignComponentPrototype, RootSwComponentPrototype, RootSwCompositionPrototype, RptComponent, RptContainer, RptExecutableEntity, RptExecutableEntityEvent, RptExecutionContext, RptProfile, RptServicePoint, RunnableEntityGroup, *SdgAttribute*, SdgClass, SecOcJobMapping, SecOcJobRequirement, SecureCommunicationAuthenticationProps, *SecureCommunicationDeployment*, SecureCommunicationFreshnessProps, SecurityEventContextProps, *ServiceEventDeployment*, *ServiceFieldDeployment*, ServiceInterfaceElementSecureComConfig, *ServiceMethodDeployment*, *ServiceNeeds*, SignalServiceTranslationEventProps, SignalServiceTranslationProps, SocketAddress, SoftwarePackageStep, SomeipEventGroup, SomeipProvidedEventGroup, SomeipTpChannel, *SpecElementReference*, *StackUsage*, StaticSocketConnection, StructuredReq, SupervisionCheckpoint, SupervisionMode, SupervisionModeCondition, SwGenericAxisParamType, SwServiceArg, SwcServiceDependency, SystemMapping, SystemMemoryUsage, *TimeBaseResource*, TimingCondition, *TimingConstraint*, *TimingDescription*, TimingExtensionResource, TimingModeInstance, TlsCryptoCipherSuite, TlsCryptoCipherSuiteProps, TlsJobMapping, Topic1, TpAddress, TraceableTable, TraceableText, *TracedFailure*, *TransformationProps*, TransformationTechnology, Trigger, UcmDescription, UcmStep, VariableAccess, VariationPointProxy, VehicleRolloutStep, ViewMap, VlanConfig, WaitPoint			
Attribute	**Type**	**Mult.**	**Kind**	**Note**
adminData	AdminData	0..1	aggr	This represents the administrative data for the identifiable object. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=adminData 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
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

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Class	***Identifiable*** (abstract)			
desc	MultiLanguageOverview Paragraph	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
introduction	DocumentationBlock	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 A.9: Identifiable

Class	**LogAndTraceInstantiation**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::PlatformModuleDeployment::LogAndTrace			
Note	This meta-class defines the attributes for the Log&Trace configuration on a specific machine. **Tags:**atp.Status=draft			
Base	*ARObject*, *AdaptiveModuleInstantiation*, *Identifiable*, *MultilanguageReferrable*, *NonOsModule Instantiation*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
dltEcu	DltEcu	0..1	ref	Reference to the Ecu representation in the Log And Trace Extract. **Tags:**atp.Status=draft
logSink	DltLogSink	*	ref	Reference to output sinks for log or trace messages that are produced on the Machine. **Tags:**atp.Status=draft
sessionId Support	Boolean	0..1	attr	This attribute defines whether the sessionId is used or not. **Tags:**atp.Status=draft

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Class	**LogAndTraceInstantiation**			
timeBase Resource	TimeBaseResource	0..1	ref	This reference is used to describe to which time base 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 A.10: LogAndTraceInstantiation

Class	**LogAndTraceInterface**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ApplicationDesign::PortInterface			
Note	This meta-class provides the ability to implement a PortInterface for support of Logging or Tracing. **Tags:** atp.Status=draft atp.recommendedPackage=PortInterfaces			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *PortInterface*, *Referrable*			
Attribute	*Type*	*Mult.*	*Kind*	*Note*
–	–	–	–	–

Table A.11: LogAndTraceInterface

Class	**LogAndTraceMessageCollectionSet**			
Package	M2::AUTOSARTemplates::LogAndTraceExtract			
Note	Collection of DltMessages **Tags:**atp.recommendedPackage=LogAndTraceMessageCollectionSets			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *Packageable Element*, *Referrable*			
Attribute	*Type*	*Mult.*	*Kind*	*Note*
dltMessage	DltMessage	*	aggr	Collection of DltMessages in the DltMessageCollection Set. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=dltMessage.shortName, dlt Message.variationPoint.shortLabel vh.latestBindingTime=systemDesignTime

Table A.12: LogAndTraceMessageCollectionSet

Class	**Machine**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::MachineManifest			
Note	Machine that represents an Adaptive Autosar Software Stack. **Tags:** atp.Status=draft atp.recommendedPackage=Machines			
Base	*ARElement*, *ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	*Type*	*Mult.*	*Kind*	*Note*

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Class	**Machine**			
default Application Timeout	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
environment Variable	TagWithOptionalValue	*	aggr	This aggregation represents the collection of environment variables that shall be added to the environment defined on the level of the enclosing Machine. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=environmentVariable, environment Variable.variationPoint.shortLabel atp.Status=draft
machineDesign	MachineDesign	1	ref	Reference to the MachineDesign this Machine is implementing. **Tags:**atp.Status=draft
module Instantiation	AdaptiveModule Instantiation	*	aggr	Configuration of Adaptive Autosar module instances that are running on the machine. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=moduleInstantiation.shortName atp.Status=draft
processor	Processor	1..*	aggr	This represents the collection of processors owned by the enclosing machine. **Tags:**atp.Status=draft
secure Communication Deployment	SecureCommunication Deployment	*	aggr	Deployment of secure communication protocol configuration settings to crypto module entities. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=secureCommunicationDeployment.short Name atp.Status=draft
trustedPlatform Executable LaunchBehavior	TrustedPlatform ExecutableLaunch BehaviorEnum	1	attr	This attribute controls the behavior of how authentication affects the ability to launch for each Executable. **Tags:**atp.Status=draft

Table A.13: Machine

Class	**PlatformModuleEthernetEndpointConfiguration**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::PlatformModuleDeployment::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.Status=draft atp.recommendedPackage=PlatformModuleEndpointConfigurations			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *Packageable Element*, *PlatformModuleEndpointConfiguration*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
communication Connector	EthernetCommunication Connector	0..1	ref	Reference to the CommunicationConnector (VLAN) for which the network configuration is defined. **Tags:**atp.Status=draft

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Class	**PlatformModuleEthernetEndpointConfiguration**			
ipv4MulticastIp Address	Ip4AddressString	0..1	attr	Multicast IPv4 Address to which the message will be transmitted. **Tags:**atp.Status=draft
ipv6MulticastIp Address	Ip6AddressString	0..1	attr	Multicast IPv6 Address to which the message will be transmitted. **Tags:**atp.Status=draft
tcpPort	ApApplicationEndpoint	0..1	ref	This reference allows to configure a tcp port number. **Tags:**atp.Status=draft
udpPort	ApApplicationEndpoint	0..1	ref	This reference allows to configure a udp port number. **Tags:**atp.Status=draft

Table A.14: PlatformModuleEthernetEndpointConfiguration

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*, *MultilanguageReferrable*, *Referrable*			
Subclasses	*AbstractProvidedPortPrototype*, *AbstractRequiredPortPrototype*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
clientServer Annotation	ClientServerAnnotation	*	aggr	Annotation of this PortPrototype with respect to client/ server communication.
delegatedPort Annotation	DelegatedPort Annotation	0..1	aggr	Annotations on this delegated port.
ioHwAbstraction Server Annotation	IoHwAbstractionServer Annotation	*	aggr	Annotations on this IO Hardware Abstraction port.
logAndTrace Message CollectionSet	LogAndTraceMessage CollectionSet	0..1	ref	Reference to a collection of Log or Trace messages that will be used by the application. **Tags:**atp.Status=draft
modePort Annotation	ModePortAnnotation	*	aggr	Annotations on this mode port.
nvDataPort Annotation	NvDataPortAnnotation	*	aggr	Annotations on this non voilatile data port.
parameterPort Annotation	ParameterPort Annotation	*	aggr	Annotations on this parameter port.
portPrototype Props	PortPrototypeProps	0..1	aggr	This attribute allows for the definition of further qualification of the semantics of a PortPrototype. **Tags:**atp.Status=draft
senderReceiver Annotation	SenderReceiver Annotation	*	aggr	Collection of annotations of this ports sender/receiver communication.
triggerPort Annotation	TriggerPortAnnotation	*	aggr	Annotations on this trigger port.

Table A.15: PortPrototype

Class	**Process**			
Package	M2::AUTOSARTemplates::AdaptivePlatform::ExecutionManifest			
Note	This meta-class provides information required to execute the referenced executable. **Tags:** atp.Status=draft atp.recommendedPackage=Processes			
Base	*ARElement*, *ARObject*, *AbstractExecutionContext*, *AtpClassifier*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *UploadablePackageElement*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
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
deterministic Client	DeterministicClient	0..1	ref	This reference adds further execution characteristics for deterministic clients. **Tags:**atp.Status=draft
executable	Executable	0..1	ref	Reference to executable that is executed in the process. **Stereotypes:** atpUriDef **Tags:**atp.Status=draft
functionCluster Affiliation	String	0..1	attr	This attribute specifies which functional cluster the process is affiliated with. **Tags:**atp.Status=draft
numberOf RestartAttempts	PositiveInteger	0..1	attr	This attribute defines how often a process shall be restarted if the start fails. numberOfRestartAttempts = "0" OR Attribute not existing, start once numberOfRestartAttempts = "1", start a second time **Tags:**atp.Status=draft
preMapping	Boolean	0..1	attr	This attribute describes whether the executable is preloaded into the memory. **Tags:**atp.Status=draft
processState Machine	ModeDeclarationGroup Prototype	0..1	aggr	Set of Process States that are defined for the process. **Tags:**atp.Status=draft
securityEvent	SecurityEventDefinition	*	ref	The reference identifies the collection of SecurityEvents that can be reported by the enclosing SoftwareCluster. **Stereotypes:** atpSplitable; atpUriDef **Tags:** atp.Splitkey=securityEvent atp.Status=draft
stateDependent StartupConfig	StateDependentStartup Config	*	aggr	Applicable startup configurations. **Tags:**atp.Status=draft

Table A.16: Process

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*

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Class	***Referrable*** (abstract)			
Subclasses	*AtpDefinition*, BswDistinguishedPartition, *BswModuleCallPoint*, BswModuleClientServerEntry, BswVariableAccess, CouplingPortTrafficClassAssignment, *CppImplementationDataTypeContextTarget*, *DiagnosticEnvModeElement*, EthernetPriorityRegeneration, ExclusiveAreaNestingOrder, *HwDescriptionEntity*, *ImplementationProps*, ModeTransition, *MultilanguageReferrable*, NmNetworkHandle, PncMappingIdent, *SingleLanguageReferrable*, SoConIPduIdentifier, SocketConnectionBundle, SomeipRequiredEventGroup, TimeSyncServerConfiguration, TpConnectionIdent			
Attribute	***Type***	***Mult.***	***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. **Stereotypes:** atpIdentityContributor **Tags:** xml.enforceMinMultiplicity=true xml.sequenceOffset=-100
shortNameFragment	ShortNameFragment	*	aggr	This specifies how the Referrable.shortName is composed of several shortNameFragments. **Tags:**xml.sequenceOffset=-90

Table A.17: Referrable

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***	***Mult.***	***Kind***	***Note***
type	SwComponentType	0..1	tref	Type of the instance. **Stereotypes:** isOfType

Table A.18: SwComponentPrototype

Class	<<atpVariation>> **SwDataDefProps**
Package	M2::MSR::DataDictionary::DataDefProperties

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Class	<<atpVariation>> **SwDataDefProps**			
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 Data Types in the programming language (or in AUTOSAR). This is mainly expressed by properties like swRecordLayout and swCalprmAxisSet • Implementation aspects, mainly expressed by swImplPolicy, swVariableAccessImplPolicy, sw AddrMethod, swPointerTagetProps, baseType, implementationDataType and additionalNative TypeQualifier • 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***	***Mult.***	***Kind***	***Note***
additionalNative TypeQualifier	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
display Presentation	DisplayPresentation Enum	0..1	attr	This attribute controls the presentation of the related data for measurement and calibration tools.

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Class	<<atpVariation>> **SwDataDefProps**			
implementation DataType	AbstractImplementation DataType	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 SwPointerTarget Props), 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 typical alignment of the DataPrototype. If the attribute is not defined the alignment is determined by the swBaseType size and the memoryAllocationKeywordPolicy of the referenced Sw AddrMethod. **Tags:**xml.sequenceOffset=33
swBit Representation	SwBitRepresentation	0..1	aggr	Description of the binary representation in case of a bit variable. **Tags:**xml.sequenceOffset=60
swCalibration Access	SwCalibrationAccess Enum	0..1	attr	Specifies the read or write access by MCD tools for this data object. **Tags:**xml.sequenceOffset=70
swCalprmAxis Set	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
swComparison Variable	SwVariableRefProxy	*	aggr	Variables used for comparison in an MCD process. **Tags:** xml.sequenceOffset=170 xml.typeElement=false
swData Dependency	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

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Class	<<atpVariation>> **SwDataDefProps**			
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
swIntended Resolution	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
swInterpolation Method	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
swPointerTarget Props	SwPointerTargetProps	0..1	aggr	Specifies that the containing data object is a pointer to another data object. **Tags:**xml.sequenceOffset=280
swRecord Layout	SwRecordLayout	0..1	ref	Record layout for this data object. **Tags:**xml.sequenceOffset=290
swRefresh Timing	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
swValueBlock Size	Numerical	0..1	attr	This represents the size of a Value Block **Stereotypes:** atpVariation **Tags:** vh.latestBindingTime=preCompileTime xml.sequenceOffset=80

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Class	<<atpVariation>> **SwDataDefProps**			
swValueBlock SizeMult (ordered)	Numerical	*	attr	This attribute is used to specify the dimensions of a value block (VAL_BLK) for the case that that value block has more than one dimension. The dimensions given in this attribute are ordered such that the first entry represents the first dimension, the second entry represents the second dimension, and so on. For one-dimensional value blocks the attribute swValue BlockSize shall be used and this attribute shall not exist. **Stereotypes:** atpVariation **Tags:**vh.latestBindingTime=preCompileTime
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
valueAxisData Type	ApplicationPrimitive DataType	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 A.19: SwDataDefProps