

Document Title	Requirements on System Template
Document Owner	AUTOSAR GbR
Document Responsibility	AUTOSAR GbR
Document Version	2.0.0
Document Status	Draft
Part of Release	2.1
Revision	0014

Document Change History			
Date	Version	Changed by	Change Description
31.01.2007	2.0.0	AUTOSAR Administration	Release as a separate Document. The Specification of System Template V1.0.0 has been split into independent documents for Release 2.1 <ul style="list-style-type: none"> • Legal disclaimer revised • Release Notes added • “Advice for users” revised • “Revision Information” added
09.05.2005	1.0.0	Initial release	Initial release as part of the Specification of System Template V1.0.0

Release Notes

Errata and known deficiencies

This chapter describes which classes of the System Template are released and which classes are not yet finalized. The classes that are not yet finalized will likely be changed, to some extent, in a future release of the System Template.

Released classes

Classes that are released are listed in the table below.

Class	Description	Defined in chapter
System	System is the main class that aggregates all information relevant to describe a system and its constraints.	4.1
SoftwareComposition	This top-level software composition contains the functionality of the full system and describes the complete application software architecture of this system.	1.3 ¹
SwCompToEcuMapping	With the SwCompToEcuMapping element it is possible to express the mapping of Software components to one ECU instance.	7.1.1
ECUInstance	The software configurable properties of the ECU are described in the ECUInstance.	5.7
SystemTopologyType	The SystemTopologyType may be reused in different systems.	5.2
SystemTopologyInstance	The topology of the system. Since several systems may share the same topology, a reference to a SystemTopologyType is used to define which topology is used in the system.	5.2
TopologyElement	An abstract class that is a generalization of ECUInstance and Hub.	5.2
SenderReceiverToSignalMapping	Mapping of a sender receiver communication data element with a primitive data type to a signal.	7.2.1.1
SenderReceiverToSignalGroupMapping	Mapping of a sender receiver communication data element with a composite data type to a signal group.	7.2.1.2
SenderRecRecordTypeMapping	Used if the compositeType is a Record.	7.2.1.2
SenderRecRecordElementMapping	Mapping of a primitive record element to a SystemSignal.	7.2.1.2
SenderRecCompositeTypeMapping	Abstract class	7.2.1.2
SenderRecArrayTypeMapping	Used if the compositeType is an Array.	7.2.1.2
SenderRecArrayElementMapping	The ArrayElement may be a primitive one or a composite one. A primitive array element is mapped to a SystemSignal.	7.2.1.2

¹ Defined in SW-C Template, used in the context of System Template.

ClientServerToSignalGroupMapping	Mapping of client server operation arguments to signals of a signal group.	7.2.1.3
ClientId	In case of a server on one ECU with multiple clients on other ECUs, the client server communication shall use different unique COM signals and signal groups for each client to allow the identification of the client associated with each system signal.	7.2.1.3
ApplicationError	This is a user-defined error that is associated with an element of an AUTOSAR interface.	7.2.1.3
ClientServerPrimitiveTypeMapping	Mapping of an argument with a primitive data type to a signal.	7.2.1.3
SequenceCounter	The purpose of sequence counters is to map a response to the correct request of a known client.	7.2.1.3
EmptySignal	According to the COM Specification, signal groups without signals are allowed.	7.2.1.3
ClientServerCompositeTypeMapping	An abstract class	7.2.1.3
ClientServerArrayTypeMapping	Used if the compositeType is an array.	7.2.1.3
ClientServerArrayElementMapping	The ArrayElement may be a primitive one or a composite one. If the element is primitive, it will be mapped to a SystemSignal.	7.2.1.3
ClientServerRecordTypeMapping	Used if the compositeType is a Record.	7.2.1.3
ClientServerRecordElementMapping	Mapping of a primitive record element to a SystemSignal.	7.2.1.3
SystemSignal	The system signal represents the communication system's view of data exchanged between SW components which reside on different ECUs.	6.1
SystemSignalGroup	A signal group refers to a set of signals that must always be kept together. A signal group is used to guarantee the atomic transfer of AUTOSAR composite data types.	6.3

Classes aggregated by a released class are not automatically released, if not explicit defined as released classes.

Non-released classes

All classes in System Template not listed in the table are not released and will likely be changed, at some extent, in a future release of the System Template. Backwards compatibility can not be assumed for not released classes.

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1 Scope of Document

2 Conventions to be used

- In requirements, the following specific semantics shall be used (based on the Internet Engineering Task Force IETF).

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as:

- **SHALL**: This word means that the definition is an absolute requirement of the specification.
- **SHALL NOT**: This phrase means that the definition is an absolute prohibition of the specification.
- **MUST**: This word means that the definition is an absolute requirement of the specification due to legal issues.
- **MUST NOT**: This phrase means that the definition is an absolute prohibition of the specification due to legal constraints.
- **SHOULD**: This word, or the adjective "RECOMMENDED", mean that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.
- **SHOULD NOT**: This phrase, or the phrase "NOT RECOMMENDED" mean that there may exist valid reasons in particular circumstances when the particular behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
- **MAY**: This word, or the adjective „OPTIONAL“, means that an item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because the vendor feels that it enhances the product while another vendor may omit the same item. An implementation, which does not include a particular option, **MUST** be prepared to interoperate with another implementation, which does include the option, though perhaps with reduced functionality. In the same vein an implementation, which does include a particular option, **MUST** be prepared to interoperate with another implementation, which does not include the option (except, of course, for the feature the option provides.)

3 Related Documentation

3.1 Input Documents

The following input documents have been used in the development of these requirements:

[1] AUTOSAR Glossary
https://svn.autosar.org/repos/10Releases/AUTOSAR_Glossary.pdf

[2] AUTOSAR Methodology
https://svn.autosar.org/repos/10Releases/AUTOSAR_Methodology.pdf

[3] Technical Overview
https://svn.autosar.org/repos/10Releases/AUTOSAR_TechnicalOverview.pdf

[4] AUTOSAR Main Requirement
https://svn.autosar.org/repos/10Releases/AUTOSAR_MainRequirements.pdf

4 Requirements

This chapter describes all requirements driving the work of WP2.1.1.3. All of them originate from the Main Requirements document from the PL Team (“MainX” requirements [4]). Also, some of them have strong links with the safety requirements defined by the WP1.1.3 (“AR-DS-X”) requirements). These links are given in the “supporting material” field.

4.1 Functional Requirements

4.1.1 [SYSCT0001] Mixed Systems (AUTOSAR/NON-AUTOSAR)

Initiator:	WP2.1.1.3
Date:	30.03.2004
Short Description:	Mixed Systems (AUTOSAR/NON-AUTOSAR)
Type:	new
Importance:	high
Description:	System constraints, which arise through usage of mixed systems, must be treated by WP2.1.1.3.
Rationale:	The transition between non-AUTOSAR systems to full-AUTOSAR systems can only be achieved gradually. Furthermore, interoperability with legacy solutions must be ensured. Thus, it must be possible to have AUTOSAR and non-AUTOSAR ECUs together on the same system (“mixed” systems).
Use Case:	Gradual AUTOSAR introduction into an existing architecture.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	[Main190] AUTOSAR shall provide interoperability with legacy software. [Main210] AUTOSAR shall provide means to integrate AUTOSAR ECUs in non-AUTOSAR networks.

4.1.2 [SYSCT0002] Basic Software Resources and RTE Resources

Initiator:	PL Team (Joint Meeting Open Questions)
Date:	30.03.2004
Short Description:	Basic Software Resources and RTE Resources
Type:	new
Importance:	high
Description:	The System Template has to cover resource requests of the basic SW and the RTE.
Rationale:	Resources of an ECU are, by their own definition, limited (RAM, ROM, CPU time, etc.). Such limitations act as constraints during the mapping process.
Use Case:	Taking into account memory limitations when allocating AUTOSAR services and features on a small ECU.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	[Main90] Tool-chains, which are developed for or adopted to AUTOSAR, must be compatible with the AUTOSAR-process. [Main150] AUTOSAR shall provide mechanisms, methods, processes and tools to encapsulate application software from the infrastructure.

4.1.3 [SYSCT0003] Iterative Development

Initiator:	WP2.1.1.3
Date:	30.03.2004
Short Description:	Iterative Development
Type:	new
Importance:	high
Description:	The System Template has to support an iterative system development.
Rationale:	During the development of an AUTOSAR system, solutions found in former steps of the system design process are themselves system constraints for the next system generation steps.
Use Case:	If new functionalities are added to a vehicle project in a late development phase, the current mapping become itself a constraint for the mapping of the new SW components associated with such new functionalities.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	[Main90] Tool-chains, which are developed for or adopted to AUTOSAR, must be compatible with the AUTOSAR-process. [Main300] AUTOSAR supports work-share in large inter-company development groups.

4.1.4 [SYSCT0004] Variant handling

Initiator:	WP2.1.1.3
Date:	22.10.2004
Short Description:	Variant handling
Type:	new
Importance:	high
Description:	The System Template has to support variant handling.
Rationale:	The use of different combinations of SW-Components and ECUs, in order to reach different specific characteristics/behaviors of the overall system (the vehicle), is meant as "variant". Such variants can result e.g. from different motors, different bodies, optional equipments, country specific equipments, etc.
Use Case:	Right-hand and left-hand drive can lead to different system constraints during the development phase.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	[Main360] Management of vehicle diversity is supported by AUTOSAR.

4.1.5 [SYSCT0005] Timing requirements

Initiator:	WP1.1.3
Date:	22.10.2004
Short Description:	Timing requirements
Type:	new
Importance:	high
Description:	The System Template has to describe timing requirements. Such timing requirements can be applied on frames, on signal paths, on single SW-C or on SW-C execution chains (including more than one ECU).
Rationale:	Response times are one of the main topics during the development of real-time system. The AUTOSAR mapping process must ensure that such timing requirements (e.g. maximum elapsed time in a chain of SW-Cs) can be fulfilled.

Use Case:	To verify requirements on response times from the very beginning of the development process.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	[Main40] AUTOSAR must be compatible with concepts, mechanisms, tools, and processes to handle safety-related systems. [AR-DS-73] Specification of chains of components. [AR-DS-74] Timing requirements involving more than one component (sensors, ECUs, actuators).

4.1.6 [SYSCT0006] Compatibility between the WP2.1.1.x Templates

Initiator:	WP2.1.1.3
Date:	30.03.2004
Short Description:	Compatibility between the WP2.1.1.x Templates
Type:	new
Importance:	high
Description:	The compatibility between the WP2.1.1.x Templates must be guaranteed. In this context, compatibility means that each WP2.1.1.x template can have references to elements of another WP2.1.1.x template.
Rationale:	Ensuring coherence and interoperability between AUTOSAR templates.
Use Case:	Development of an in-vehicle electronic architecture (software modelling, hardware modelling and mapping constraint modelling) using the same tool chain.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	[Main90] Tool-chains, which are developed for or adopted to AUTOSAR, must be compatible with the AUTOSAR-process. [Main300] AUTOSAR supports work-share in large inter-company development groups.

4.1.7 [SYSCT0007] Mapping of Software Components to ECUs

Initiator:	WP2.1.1.3
Date:	30.03.2004
Short Description:	Mapping of Software Components to ECUs
Type:	new
Importance:	high
Description:	The System Template has to describe the mapping of software components to ECUs. However, it doesn't describe the scheduling aspects nor the mapping of software components to individual microcontrollers residing in one ECU.
Rationale:	
Use Case:	For safety reasons (or simply due to the experience) some specific Software Components can run only on some specific ECUs. Such "pre-mapping" is a constraint for the real mapping process.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	[Main40] AUTOSAR must be compatible with concepts, mechanisms, tools, and processes to handle safety-related systems. [Main50] AUTOSAR shall support inter- and intra-ECU-communication mechanisms with high reliability [Main200] AUTOSAR shall imply only small memory and performance impacts when used in today's micro controllers

4.1.8 [SYSCT0008] SWC Cluster

Initiator:	WP2.1.1.3
Date:	30.03.2004
Short Description:	SWC Cluster
Type:	new
Importance:	high
Description:	The System Constraint Description has to cover the clustering of SW Components. SW Component Clustering means that two SW Components cannot be divided and must be mapped to the same ECU.
Rationale:	Due to performance requirements, to safe communication requirements or simply to experience, some communication paths must be prevented to be mapped onto an external bus. Involved SW Components shall then be mapped together onto the same ECU.
Use Case:	Safe communication, which may not be carried out over a communication bus, or very strict timing requirements.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	[Main40] AUTOSAR must be compatible with concepts, mechanisms, tools, and processes to handle safety-related systems. [Main200] AUTOSAR shall imply only small memory and performance impacts when used in today's micro controllers. [AR-DS-78] Mapping rules of SW-Cs to same ECU.

4.1.9 [SYSCT0009] SWC Separation

Initiator:	WP2.1.1.3
Date:	30.03.2004
Short Description:	SWC Separation
Type:	new
Importance:	high
Description:	The System Constraint Description has to cover the separation of SW Components. SW Component Separation means that two SW Components cannot be on the same ECU.
Rationale:	To enhance the independence of redundant SW-C.
Use Case:	Two redundant Software Components, implementing safety critical functions, will not be mapped together on the same ECU because of safety requirements (of course, redundancy does not always imply SWC separation).
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	[Main40] AUTOSAR must be compatible with concepts, mechanisms, tools, and processes to handle safety-related systems. [AR-DS-44] Exclusive mapping of SW-C to ECUs.

4.1.10 [SYSCT0010] Exclusive Mapping of SW-C

Initiator:	WP1.1.3
Date:	22.10.2004
Short Description:	Exclusive Mapping of SW-C
Type:	new
Importance:	high
Description:	The System Constraint Description has to cover the exclusion of SW-Cs from one or more ECUs. "Exclusion" means that the SW-C cannot be

	mapped to the ECUs it is excluded from.
Rationale:	During the mapping process it can be useful to express that a specific SW-C cannot be mapped to one or more ECUs, based on ECU properties.
Use Case:	Exclusion of safety critical functions from crash exposed areas.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	[Main40] AUTOSAR must be compatible with concepts, mechanisms, tools, and processes to handle safety-related systems. [AR-DS-79] Exclusive Mapping of SW-Cs.

4.1.11 [SYSCT0011] Dedicated Mapping of SW-C

Initiator:	WP1.1.3
Date:	22.10.2004
Short Description:	Dedicated Mapping of SW-C
Type:	new
Importance:	high
Description:	The System Constraint Description has to describe dedicated mapping of SW-Cs to one or more ECUs. "Dedicated mapping" means that the SW-C can only be mapped to the ECUs it is dedicated to.
Rationale:	During the mapping process it can be useful to express that a specific SW-C can be only mapped to some ECUs, based on ECU properties.
Use Case:	SW-Cs requiring an ECU that can guarantee full functionality for a specified time period after power down.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	[Main40] AUTOSAR must be compatible with concepts, mechanisms, tools, and processes to handle safety-related systems. [AR-DS-80] Dedicated Mapping of SW-Cs.

4.1.12 [SYSCT0013] Topology

Initiator:	WP2.1.1.3
Date:	30.03.2004
Short Description:	Topology
Type:	new
Importance:	high
Description:	The System Template has to describe the topology of an EE System.
Rationale:	The available communication paths limit the possible distributions of SW Components to some ECUs.
Use Case:	Mapping of SW Components being tightly linked from a functional point of view: the topology must then be known in order to avoid too long data paths.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	[Main230] AUTOSAR shall support networks of networks including sub networks.

4.1.13 [SYSCT0014] Data Segmenting

Initiator:	WP2.1.1.3
Date:	30.03.2004
Short Description:	Data Segmenting

Type:	new
Importance:	medium
Description:	The System Template must provide information, which can be used for the segmenting of (application) data to more than 1 frame.
Rationale:	Data length limitations of the underlying bus technology.
Use Case:	Transmission of diagnostic data, often longer than 8 bytes, by means of 8 byte CAN frames.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	[Main140] AUTOSAR shall provide an independency of application software from in-vehicle communication technologies.

4.1.14 [SYSCT0015] Bus bandwidth

Initiator:	WP2.1.1.3
Date:	22.10.2004
Short Description:	Bus bandwidth
Type:	new
Importance:	high
Description:	The System Template shall support bandwidth calculation as a constraint for the definition of the Communication Matrix.
Rationale:	Bandwidth is a limited resource, acting as a constraint during the definition of the Communication Matrix.
Use Case:	When defining the Communication Matrix for mixed systems (AUTOSAR and non-AUTOSAR ECUs), only one part of the Communication Matrix is freely configurable using the AUTOSAR process. That means that the available bandwidth for the AUTOSAR system generator is limited by the non-AUTOSAR part of the Communication Matrix.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	[Main90] Tool-chains, which are developed for or adapted to AUTOSAR, must be compatible with the AUTOSAR-process. [Main210] AUTOSAR shall provide means to integrate AUTOSAR ECU's in non-AUTOSAR networks. [AR-DS-71] Checking bus bandwidth used.

4.1.15 [SYSCT0016] Dedicated physical connections

Initiator:	WP2.1.1.3
Date:	29.10.2004
Short Description:	Dedicated physical connections
Type:	new
Importance:	medium
Description:	The System Constraint Description shall be able to describe that a signal has to be sent over a dedicated wire, which is only used by two SW-Components (sender and receiver).
Rationale:	This technique is commonly used in current safety concepts.
Use Case:	Communication with the air-bag module.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	[Main20] AUTOSAR shall provide mechanisms to support redundancy paths. [Main40] AUTOSAR must be compatible with concepts, mechanisms, tools, and processes to handle safety-related systems.

	[AR-DS-72] Describing signal paths.
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4.1.16 [SYSCT0017] Mapping of signals to the same physical line

Initiator:	WP2.1.1.3
Date:	29.10.2004
Short Description:	Mapping of signals to the same physical line
Type:	new
Importance:	medium
Description:	The System Constraint Description shall be able to describe that a group of signals has to be sent via the same physical line.
Rationale:	--
Use Case:	--
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	[Main20] AUTOSAR shall provide mechanisms to support redundancy paths.

4.1.17 [SYSCT0018] Mapping of signals to different physical lines

Initiator:	WP1.1.3
Date:	22.10.2004
Short Description:	Mapping of signals to different physical lines
Type:	new
Importance:	medium
Description:	The System Constraint Description shall be able to describe, if needed, that signals between ECUs are sent via different physical lines.
Rationale:	To support hardware and information redundancy (as a mean to support fault detection and fault handling).
Use Case:	A mean to guarantee the transmission of very safety critical data, is to force the sending of redundant copies onto different physical lines.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	[Main20] AUTOSAR shall provide mechanisms to support redundancy paths. [Main40] AUTOSAR must be compatible with concepts, mechanisms, tools, and processes to handle safety-related systems. [Main50] AUTOSAR shall support inter- and intra-ECU-communication mechanisms with high reliability. [AR-DS-46] Mapping of signals to different lines.

4.1.18 [SYSCT0019] Mapping of signals to a specific physical line

Initiator:	WP1.1.3
Date:	29.10.2004
Short Description:	Mapping of signals to a specific physical line
Type:	new
Importance:	medium
Description:	The System Constraint Description shall be able to describe that signals have to be mapped to a specific physical line.
Rationale:	Some signals have to be mapped to specific physical lines due to e.g. special performance and/or safety needs.

Use Case:	Powertrain signals have to be mapped to a high-speed bus, due to their timing requirements.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	[Main20] AUTOSAR shall provide mechanisms to support redundancy paths.

4.1.19 [SYSCT0020] Exclusion of signals from a specific physical line

Initiator:	WP1.1.3
Date:	29.10.2004
Short Description:	Exclusion of signals from a specific physical line
Type:	new
Importance:	medium
Description:	The System Constraint Description shall be able to describe that signals have not to be mapped to a specific physical line.
Rationale:	Some physical lines can result unsuitable (too slow, unsafe communication protocol, etc.) for the transmission of some specific signals.
Use Case:	Most of power train signals cannot be mapped to a low speed CAN bus, due to their timing requirements.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	[Main20] AUTOSAR shall provide mechanisms to support redundancy paths.

4.1.20 [SYSCT0021] ECU Communication via CAN (Controller Area Network)

Initiator:	WP2.1.1.3
Date:	23.02.2005
Short Description:	ECU Communication via CAN
Type:	Change (SYSCT0012)
Importance:	high
Description:	The System Template has to cover the system communication via CAN Bus.
Rationale:	CAN is widely used in the automotive systems.
Use Case:	Development of a complete, multi-networked, in-vehicle electronic architecture.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	[Main60] AUTOSAR shall provide open and standardized software interfaces for intra-ECU and inter-ECU communication. [Main140] AUTOSAR shall provide an independency of application software from in-vehicle communication technologies.

4.1.21 [SYSCT0022] ECU Communication via LIN (Local Interconnect Network)

Initiator:	WP2.1.1.3
Date:	30.03.2004
Short Description:	ECU Communication via LIN
Type:	Change (SYSCT0012)
Importance:	high
Description:	The System Template has to cover the system communication via LIN.
Rationale:	LIN is widely used in the automotive systems.

Use Case:	Development of a complete, multi-networked, in-vehicle electronic architecture.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	<p>[Main60] AUTOSAR shall provide open and standardized software interfaces for intra-ECU and inter-ECU communication.</p> <p>[Main140] AUTOSAR shall provide an independency of application software from in-vehicle communication technologies.</p>

4.1.22 [SYSCT0023] ECU Communication via MOST (Media Oriented Systems Transport)

Initiator:	WP2.1.1.3
Date:	30.03.2004
Short Description:	ECU Communication via MOST
Type:	Change (SYSCT0012)
Importance:	high
Description:	The System Template has to cover the system communication via MOST.
Rationale:	MOST is going to become a standard communication protocol in the automotive industry.
Use Case:	Development of a complete, multi-networked, in-vehicle electronic architecture.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	<p>[Main60] AUTOSAR shall provide open and standardized software interfaces for intra-ECU and inter-ECU communication.</p> <p>[Main140] AUTOSAR shall provide an independency of application software from in-vehicle communication technologies.</p>

4.1.23 [SYSCT0024] ECU Communication via FlexRay

Initiator:	WP2.1.1.3
Date:	30.03.2004
Short Description:	ECU Communication via FlexRay
Type:	Change (SYSCT0012)
Importance:	high
Description:	The System Template has to cover the system communication via FlexRay.
Rationale:	FlexRay is going to become a standard communication protocol in the automotive industry.
Use Case:	Development of a complete, multi-networked, in-vehicle electronic architecture.
Dependencies:	None identified.
Conflicts:	None identified.
Supporting Material:	<p>[Main60] AUTOSAR shall provide open and standardized software interfaces for intra-ECU and inter-ECU communication.</p> <p>[Main140] AUTOSAR shall provide an independency of application software from in-vehicle communication technologies.</p>

5 References

- [1] AUTOSAR Glossary,
https://svn.autosar.org/repos/10Releases/AUTOSAR_Glossary.pdf
- [2] Methodology,
https://svn.autosar.org/repos/10Releases/AUTOSAR_Methodology.pdf
- [3] Technical Overview,
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- [4] AUTOSAR Main Requirements,
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