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# 1 Introduction

This document defines requirements on tool interoperability and compliance.

## 1.1 Terminology

- The **AUTOSAR metamodel** is a UML2.0 model that defines the language for describing AUTOSAR systems. The AUTOSAR metamodel is a graphical representation of a template. UML2.0 class diagrams are used to describe the attributes and their interrelationships. Stereotypes and OCL (object constraint language) are used for defining specific semantics and constraints.
- An **AUTOSAR model** is an instance of the AUTOSAR metamodel. The information contained in the AUTOSAR model can be anything that is representable according to the AUTOSAR metamodel. The AUTOSAR model can be stored in many different ways: it might be a set of files in a file system, an XML stream, a database or memory used by some running software tools, etc.
- The **AUTOSAR XML Schema** is a W3C XML schema that defines the language for exchanging AUTOSAR models. This Schema is derived from the AUTOSAR metamodel and defines the **AUTOSAR data exchange format**.
- An **AUTOSAR XML description** describes the XML representation of an AUTOSAR model. The AUTOSAR XML description can consist of several fragments (e.g. files). Each individual fragment must validate successfully against the AUTOSAR XML schema.

## 1.2 About Requirements

Each requirement has its unique identifier starting with the prefix "AR\_CONTENT\_" (meaning AUTOSAR Software Component Template Content).

### 1.2.1 Structure

Each requirement is defined as a table. The structure of the tables is as follows:

<b>Initiator:</b>	< number of originating work package, company, etc >
<b>Date:</b>	< date of last change >
<b>Requirement:</b>	< the normative text of the requirement >
<b>Description:</b>	< detailed description of the requirement >
<b>Rationale:</b>	< why is this necessary, what its omission could cause >
<b>Use Case:</b>	< example to a scenario that makes the requirement necessary or useful >
<b>Dependencies:</b>	< reference to depending and depended-on requirements >
<b>Conflicts:</b>	< reference to conflicting requirement >
<b>Supporting Material:</b>	< links to other documents >
<b>Comment:</b>	< additional remarks >

### 1.2.2 Conventions used

In requirements, the following specific semantics are used (taken from Request for Comment RFC 2119 from 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 described in RFC 2119. Note that the requirement level of the document in which they are used modifies the force of these words.

- **MUST:** This word, or the terms "REQUIRED" or "SHALL", mean that the definition is an absolute requirement of the specification.
- **MUST NOT:** This phrase, or the phrase "SHALL NOT", means that the definition is an absolute prohibition of the specification.
- **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.)

### 1.2.3 Guidelines

Existing specifications shall be referenced (in form of a single requirement). Differences to these specifications are specified as additional requirements.

All requirements shall have the following properties:

- **Redundancy**  
Requirements shall not be repeated within one requirement or in other requirements
- **Cleanness**  
All requirements shall allow one possibility of interpretation only. Used technical terms that are not in the glossary must be defined.
- **Atomicity**  
Each requirement shall only contain one requirement. A Requirement is atomic if it cannot be split up in further requirements.
- **Testability**  
Requirements shall be testable by analysis, review or test.
- **Traceability**  
The source and status of a requirement shall be visible at all times.



## 2 Requirements

This chapter provides a definition of the relevant requirements

### 2.1 Requirements that will be taken into account

#### 2.1.1 [AR\_CONTENT\_0010] Compositions

<b>Initiator:</b>	WP 2.1.1.1
<b>Date:</b>	14.05.2004
<b>Requirement:</b>	Compositions
<b>Description:</b>	The SW-Component template must allow the aggregation of existing SW-Component(s) as a component, which may also be aggregated.
<b>Rationale:</b>	--
<b>Use Case:</b>	--
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--
<b>Comment:</b>	--

#### 2.1.2 [AR\_CONTENT\_0020] Interfaces

<b>Initiator:</b>	WP 1.1.1
<b>Date:</b>	06.08.2003
<b>Requirement:</b>	Interfaces
<b>Description:</b>	The SW-Component template must allow specifying interfaces independently from the SW Components (a definition might exist even if no component uses it)
<b>Rationale:</b>	Reuse of interface description WP 10.x
<b>Use Case:</b>	<ul style="list-style-type: none"> <li>• Variables to observe</li> <li>• Parameters/ maps to calibrate</li> <li>• Error-Handling</li> </ul>
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--
<b>Comment:</b>	--

### 2.1.3 [AR\_CONTENT\_0030] Libraries

<b>Initiator:</b>	WP 2.1.1.1
<b>Date:</b>	14.05.2004
<b>Requirement:</b>	Needed libraries
<b>Description:</b>	The SW-Component Template must allow specifying the libraries used by the SW-Component.
<b>Rationale:</b>	--
<b>Use Case:</b>	--
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--
<b>Comment:</b>	--

### 2.1.4 [AR\_CONTENT\_0035] Integration on object code level

<b>Initiator:</b>	Martin Lunt
<b>Date:</b>	03.08.2004
<b>Requirement:</b>	Integration on object code level
<b>Description:</b>	The Software Component Template must contain the right information to allow the integration of the corresponding runnable entity on object code level.
<b>Rationale:</b>	This requirement is important for all Autosar members providing code to others, which shall be protected against unauthorized modification.
<b>Use Case:</b>	--
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--
<b>Comment:</b>	--

### 2.1.5 [AR\_CONTENT\_0040] Behaviour

<b>Initiator:</b>	WP 2.1.1.1
<b>Date:</b>	14.05.2004
<b>Requirement:</b>	Behaviour
<b>Description:</b>	The SW-Component Template must allow linking of the SWComponent to a formal description of its behavior.
<b>Rationale:</b>	"...components are in theory exchangeable as long as they implement the same logic and provide the same public communication..." Thus the functionality / logic of a SW-Component should be describable..
<b>Use Case:</b>	Exchange / compatibility of SW-components
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--
<b>Comment:</b>	--

### 2.1.6 [AR\_CONTENT\_0050] Schedulability

<b>Initiator:</b>	WP 2.1.1.1
<b>Date:</b>	14.05.2004
<b>Requirement:</b>	Schedulability
<b>Description:</b>	The SW-Component Template must content enough information, as far as the component can provide, for generating the runtime environment and integrating multiple SW-Component(s) on one ECU or networked ECUs.
<b>Rationale:</b>	The information needs to be sufficient to enable/support scheduling of components
<b>Use Case:</b>	--
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--
<b>Comment:</b>	--

### 2.1.7 [AR\_CONTENT\_0060] Ordering

<b>Initiator:</b>	WP 1.1.1 (1 <sup>st</sup> Workshop)
<b>Date:</b>	03.06.2003
<b>Requirement:</b>	Sequence of execution of runnable entities
<b>Description:</b>	The template must allow specifying: Constraint on the order of execution of different runnables entities
<b>Rationale:</b>	--
<b>Use Case:</b>	--
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--
<b>Comment:</b>	--

### 2.1.8 [AR\_CONTENT\_0070] Resource

<b>Initiator:</b>	WP2.1.1.1
<b>Date:</b>	13.05.2004
<b>Requirement:</b>	Needed resource for SW Components
<b>Description:</b>	The SW-Component template must provide mechanisms to describe the complete resource requirements of an AUTOSAR SWcomponent
<b>Rationale:</b>	The AUTOSAR Software-Components ("above" the RTE) will be described in such detail that it is possible to analyze whether the software-component can run on a given ECU (for example: the software-component description specifies how many "resources" the component requires)

<b>Use Case:</b>	The SW-Component template must allow specifying the memoryconsumption of a SW Component: <ul style="list-style-type: none"> <li>• ROM</li> <li>• NVRAM</li> <li>• RAM</li> <li>• Stack</li> <li>• Heap</li> </ul> The SW-Component template must allow describing its executiontime (time during which the CPU is executing its instructions)
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--
<b>Comment:</b>	--

### 2.1.9 [AR\_CONTENT\_0080] Timing

<b>Initiator:</b>	WP 1.1.1 (1 <sup>st</sup> Workshop)
<b>Date:</b>	03.06.2003
<b>Requirement:</b>	Timing-requirements of SW-Components
<b>Description:</b>	The SW-Component template must allow specifying the timing requirements of each runnable entity of a SW-Component (eg.): <ul style="list-style-type: none"> <li>• Period</li> <li>• Reaction time</li> </ul>
<b>Rationale:</b>	The SW-Component template must allow describing: <ul style="list-style-type: none"> <li>• how often it has to be run</li> <li>• the time between a stimulus like e.g. the state change of a hardware or software entity and the expected reaction of the system (e.g. response, actuator activation)</li> </ul>
<b>Use Case:</b>	--
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--
<b>Comment:</b>	--

### 2.1.10 [AR\_CONTENT\_0090] Sensors / Actuators

<b>Initiator:</b>	WP2.1.1.1
<b>Date:</b>	14.05.2004
<b>Requirement:</b>	Needed and usable sensors and actuators
<b>Description:</b>	The SW-Component Template must allow: <ul style="list-style-type: none"> <li>• listing the required sensors / actuators</li> <li>• enumerating the sensors / actuators that can be used</li> <li>• referencing external descriptions of sensors / actuators for a SW-Component</li> </ul>
<b>Rationale:</b>	--
<b>Use Case:</b>	--
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--
<b>Comment:</b>	--

### 2.1.11 [AR\_CONTENT\_0100] Variant

<b>Initiator:</b>	WP 1.1.1 (1 <sup>st</sup> Workshop)
<b>Date:</b>	20.08.2003
<b>Requirement:</b>	Variant
<b>Description:</b>	The SW-Component template must allow specifying the different variants of a SW-Component e.g.: <ul style="list-style-type: none"> <li>• SW Configuration</li> </ul>
<b>Rationale:</b>	--
<b>Use Case:</b>	--
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--
<b>Comment:</b>	--

### 2.1.12 [AR\_CONTENT\_0110] Modes

<b>Initiator:</b>	WP 1.1.1 (1 <sup>st</sup> Workshop)
<b>Date:</b>	16.06.2004
<b>Requirement:</b>	Modes
<b>Description:</b>	The SW-Component template must provide some simple means to define modes. The name of the mode is the most important attribute that has to be provided.
<b>Rationale:</b>	The assumption from the SW-Component point of view is that State Managers are using a Standardized AUTOSAR Interface to influence the SW-Component and also provide an interface to get requests and confirmations from the SW-Component.
<b>Use Case:</b>	Each SW-Component can be relying on some modes that have to be provided on the ECU it will run later on.
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--
<b>Comment:</b>	--

### 2.1.13 [AR\_CONTENT\_0120] Dependency on Modes

<b>Initiator:</b>	WP2.1.1.1
<b>Date:</b>	16.06.2004
<b>Requirement:</b>	Dependency on Modes
<b>Description:</b>	SW-Component must provide a matrix where the runnable entities and ports are enabled or disabled depending on the modes coming from the State Managers.
<b>Rationale:</b>	A SW-Component can change its active interface due to the different modes provided by the State Managers.
<b>Use Case:</b>	There could be a different communication behavior in the diagnostic mode than in the normal operational mode.
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--
<b>Comment:</b>	--

### 3 References

In this section the reference used in this specification are listed

#### 3.1 References to AUTOSAR documents

- [1] Glossary  
[https://svn2.autosar.org/repos2/22\\_Releases/AUTOSAR\\_Glossary.pdf](https://svn2.autosar.org/repos2/22_Releases/AUTOSAR_Glossary.pdf)
- [2] Metamodel  
[https://svn2.autosar.org/repos2/22\\_Releases/AUTOSAR\\_Metamodel.eap](https://svn2.autosar.org/repos2/22_Releases/AUTOSAR_Metamodel.eap)
- [3] Template Modeling Patterns  
[https://svn2.autosar.org/repos2/22\\_Releases/AUTOSAR\\_TemplateModelingPatterns.pdf](https://svn2.autosar.org/repos2/22_Releases/AUTOSAR_TemplateModelingPatterns.pdf)
- [4] Template UML Profile and Modeling Guide  
[https://svn2.autosar.org/repos2/22\\_Releases/AUTOSAR\\_TemplateModelingGuide.pdf](https://svn2.autosar.org/repos2/22_Releases/AUTOSAR_TemplateModelingGuide.pdf)

#### 3.2 References to external documents

- [5] Key words for use in RFCs to Indicate Requirement Levels. Network Working Group, S. Brandner, Harvard University, 1997. (<http://www.ietf.org/rfc/rfc2119.txt>).