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Table of Contents

1 Introduction

This explanatory provides additional information to Software Clusters of the AUTOSAR Standard.

1.1 Objectives

The goal of this document is to

- provide an overview about the technical approach Software Clusters
- explain the utilization of Software Clusters in AUTOSAR Classic Platform
- lists design and feature restrictions
- provide some examples

1.2 Scope

This document discusses only Software Clusters in the **AUTOSAR Classic Platform**!

2 Acronyms and abbreviations

The glossary below includes acronyms and abbreviations relevant to Requirements on Software Cluster Connection that are not included in the AUTOSAR Glossary [1].

Abbreviation / Acronym:	Description:
SwCluC	Software Cluster Connection

Table 2.1: Acronyms and Abbreviations

Terms:	Description:
Software Cluster	A Software Cluster groups all AUTOSAR artifacts that are relevant to deploy software on a machine. The full definition is given in document [1]

Terms:	Description:
Software Cluster Connection	The Software Cluster Connection is the BSW module that provides the features to • connect the Binary Objects deployed on the same machine • substitute not locally-available BSW modules in an Applicative Software Cluster, whose interfaces are required for the integrated SW, by so called Proxy Modules. • implement the VFB communication features between Software Clusters together with RTE with the means of an RTE Implementation Plug-In
machine	A machine consists of a set of computing resources - such as microcontroller cores, memory or peripheral (e.g. communication) devices - and has the ability to execute software applications. The representation of a machine in the AUTOSAR Classic Platform could be done with an EcuInstance, but note that this semantic is currently in clarification. Further information is given in document [1].
binary-identical	Bit for Bit identical
Binary Object	A set of files, which contains the binary executable code and data. This binary executable code and data will not be modified again, before programming it on the target ECU.
Binary Manifest	The Binary Manifest is the well-defined interface of the Software Cluster's Binary Object, providing the meta information of a resources and information - so called handles - to access such a resource.
Applicative Software Cluster	A Software Cluster that mainly contains software components, and only selected BSW modules (e.g. a Service module, transformers, e.t.c.)
Host Software Cluster	The single Software Cluster that contains the major part of the BSW, and especially the micro controller dependent lower layer BSW Modules, e.g. OS and MCAL.
Substitution Software Cluster	The single Software Cluster that can override the provided resources of other Software Clusters for bug fixing purpose.
Proxy Module	A Proxy Module substitutes a BSW module in an Applicative Software Cluster. A Proxy module itself is split into High Proxy Module and Low Proxy Module. The High Proxy Module provides dedicated interfaces for modules in higher layers or same layer, and the functionality to connect them via the Binary Manifest to the Low Proxy Module in the Host Software Cluster.
High Proxy Module	The part of the Proxy Module residing in an Applicative Software Cluster.
Low Proxy Module	The part of the Proxy Module residing in the Host Software Cluster.
Os High Proxy	A type of Proxy Module implementing Os APIs in the Applicative Software Cluster.
Os Low Proxy	A type of proxy Module implementing an Os abstraction in the Host Software Cluster.
NvM High Proxy	A type of Proxy Module substituting the NVRAM Manager in the Applicative Software Cluster.

Terms:	Description:
NvM Low Proxy	A type of Proxy Module connecting the NvM High Proxy Modules to the NVRAM Manager in the Host Software Cluster.
RTE Implementation Plug-In	A RTE Implementation Plug-In is a part of the overall RTE implementation, which is not provided by the RTE Generator, but from an additional source (e.g. a Plug-In Generator or a manually implemented source code).
Local Software Cluster Communication Plug-In	A Local Software Cluster Communication Plug-In is an RTE Implementation Plug-In, which handles the communication locally inside a Software Cluster. This includes the Transformer handling, if a DataMapping exist for the according Communication Graph
Cross Software Cluster Communication Plug-In	A Cross Software Cluster Communication Plug-In is an RTE Implementation Plug-In that handles the communication towards other Software Clusters. This includes the Transformer handling, if intra ECU transformation is configured.
Communication Graph	The sum of all AbstractAccessPoints to elements of PortInterfaces, instantiated in PortPrototypes which are connected to each other; or the sum of all accesses from BswModuleEntitys to interface elements in a BswModuleDescriptions connected to each other.
Data Communication Graph	The sum of all VariableAccesses to VariableDataPrototypes instantiated in PortPrototypes, which are connected to each other; or the sum of all VariableAccesses to VariableDataPrototypes in the InternalBehavior; or the sum of all BswVariableAccesses to VariableDataPrototypes in BswModuleDescriptions connected to each other.
Parameter Communication Graph	The sum of all ParameterAccesses to ParameterDataPrototypes instantiated in PortPrototypes, which are connected to each other; or the sum of all ParameterAccesses to ParameterDataPrototypes in the InternalBehavior.
Client Server Communication Graph	The sum of all ServerCallPoints to operations instantiated in PortPrototypes, which are connected to each other, including the associated server runnable.
Trigger Communication Graph	The sum of all ExternalTriggeringPoints for triggers instantiated in PortPrototypes, which are connected to each other, including the associated triggered runnable.
Mode Communication Graph	The sum of all ModeAccessPoints and ModeSwitchPoints to ModeDeclarationGroupPrototypes instantiated in PortPrototypes, which are connected to each other; or the sum of all managedModeGroups and accessedModeGroups to ModeDeclarationGroupPrototypes in BswModuleDescriptions connected to each other.
mode manager	Entering and leaving modes is initiated by a *mode manager*. A *mode manager* is either a software component that provides a p-port typed by a ModeSwitchInterface, or a BSW module that defines in its BswModuleDescription a ModeDeclarationGroupPrototype in the role providedModeGroup.
mode switch notification	The communication of a mode switch from the mode manager to the mode user, using either the ModeSwitchInterface or providedModeGroup and requiredModeGroup ModeDeclarationGroupPrototypes.

Terms:	Description:
mode switch port	The port for receiving (or sending) a mode switch notification. For this purpose, a mode switch port is typed by a ModeSwitchInterface.
mode user	An *AUTOSAR SW-C* or *AUTOSAR Basic Software Module* that depends on modes, is called a mode user. The dependency can occur through a SwcModeSwitchEvent/BswModeSwitchEvent, a ModeAccessPoint for a provided/required mode switch port, or a accessedModeGroup for a providedModeGroup/requiredModeGroup ModeDeclarationGroupPrototype.
on-entry ExecutableEntity	A RunnableEntity that is triggered by a SwcModeSwitchEvent with *ModeActivationKind* 'entry'; or a BswSchedulableEntity that is triggered by a BswModeSwitchEvent with *ModeActivationKind* 'entry'.
on-exit ExecutableEntity	A RunnableEntity that is triggered by a SwcModeSwitchEvent with *ModeActivationKind* 'exit'; or a BswSchedulableEntity that is triggered by a BswModeSwitchEvent with *ModeActivationKind* 'exit'.
on-transition ExecutableEntity	A RunnableEntity that is triggered by a SwcModeSwitchEvent with *ModeActivationKind* 'transition'; or a BswSchedulableEntity that is triggered by a BswModeSwitchEvent with *ModeActivationKind* 'transition'.
trigger port	A PortPrototype, which is typed by an TriggerInterface
trigger sink	A *trigger sink* relies on the activation of RunnableEntity or a BswSchedulableEntity, if a particular Trigger is raised. A *trigger sink* has a dedicated require trigger port(s) and / or requiredTrigger Trigger(s) to communicate to the trigger source(s).
trigger source	A *trigger source* administrates the particular Trigger, and informs the RTE or *Basic Software Scheduler* if the Trigger is raised. A *trigger source* has dedicated provide trigger port(s) and / or releasedTrigger Trigger(s) to communicate to the trigger sink(s).
triggered BswSchedulableEntity	A BswSchedulableEntity that is triggered at least by one BswExternalTriggerOccurredEvent or BswInternalTriggerOccurredEvent. In particular cases, the *Trigger Event Communication* or the *Inter Basic Software Schedulable Entity Triggering* is implemented by the *Basic Software Scheduler* as a direct or trusted function call of the triggered ExecutableEntity, by the triggering ExecutableEntity.
triggered ExecutableEntity	A RunnableEntity that is triggered by at least one ExternalTriggerOccurredEvent / InternalTriggerOccurredEvent; or a BswSchedulableEntity that is triggered by at least one BswExternalTriggerOccurredEvent/ BswInternalTriggerOccurredEvent. In particular cases, the Trigger Event Communication or the *Inter Runnable Triggering* is implemented by RTE or *Basic Software Scheduler* as a direct or trusted function call of the triggered ExecutableEntity, by the triggering ExecutableEntity.

Terms:	Description:
triggered runnable	A `RunnableEntity` that is triggered at least by one `ExternalTriggerOccurredEvent` or `InternalTriggerOccurredEvent`. In particular cases, the Trigger Event Communication or the *Inter Runnable Triggering* is implemented by RTE as a direct or trusted function call of the *triggered runnable*, by the triggering runnable.

Table 2.2: Terms

3 Related Documentation

[1] Glossary
AUTOSAR_TR_Glossary

[2] Specification of Memory Mapping
AUTOSAR_SWS_MemoryMapping

[3] ISO 26262:2018 (all parts) – Road vehicles – Functional Safety
http://www.iso.org

[4] Specification of Timing Extensions
AUTOSAR_TPS_TimingExtensions

4 Software Clusters in Classic Platform

4.1 Software Clusters in a nutshell

This section provides a compact overview about the general solution approach. Please apologize that further details are only given in the section where the detailed solutions are elaborated.

The approach of `Software Clusters` in the AUTOSAR Classic Platform, is considering the fact that several ECUs have an inner structure, which is crucial for the SW system. This is illustrated in figure 4.1, which shows the conceptual meta model:

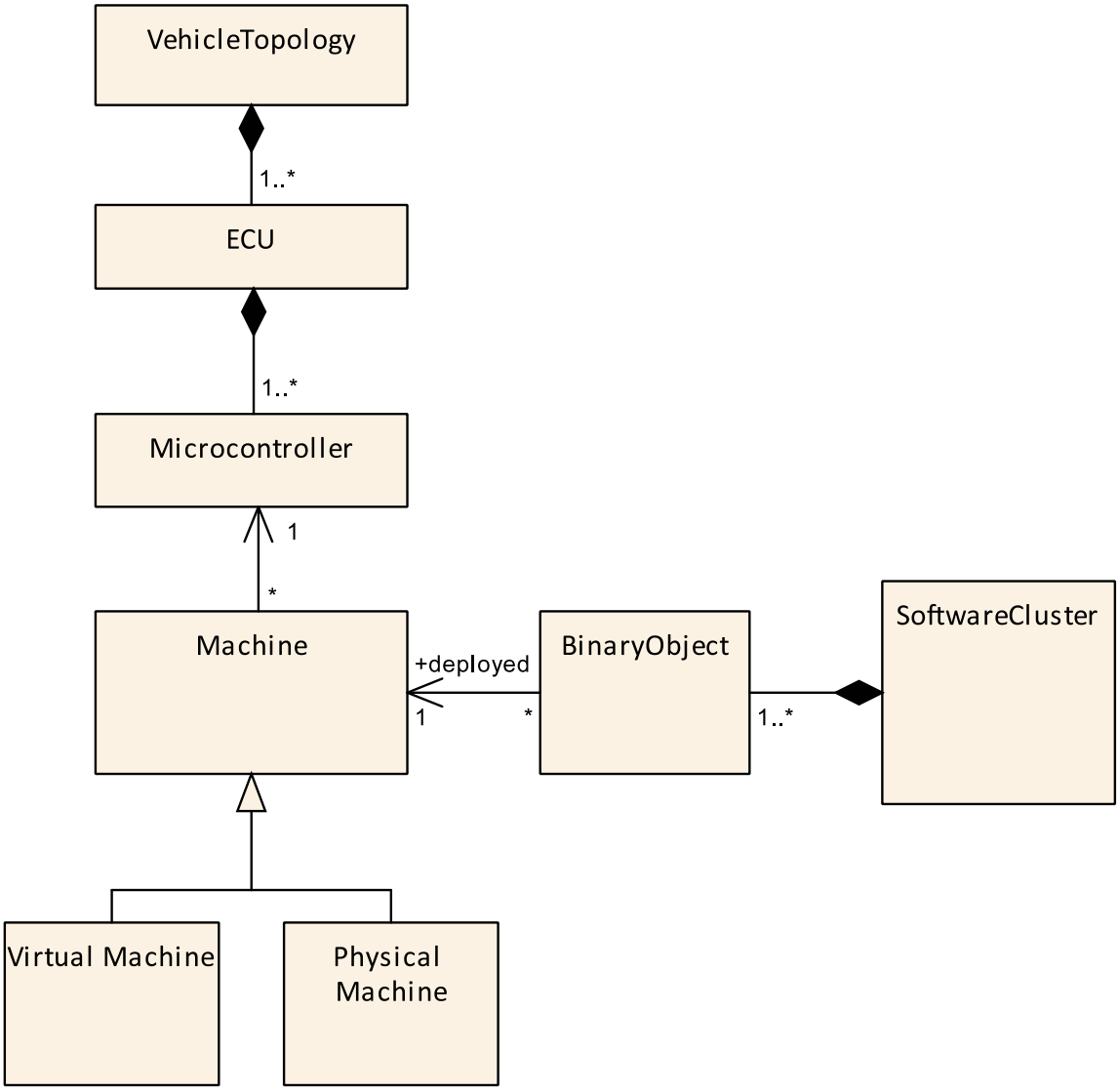

Figure 4.1: Hierarchy of ECUs, Machines and Software Clusters in a vehicle topology

The topology of a vehicle has several ECUs. One ECU can have 1 to N microcontrollers. Since microprocessors are in scope of AUTOSAR Adaptive Platform, they are not considered here. On one micro controller, 1 to N Machines are hosted. In case of N > 1, those are virtual and share the resources of the micro controller. Furthermore, each Machine owns one BSW Stack, e.g. from AUTOSAR perspective it is an instance of a Classic Platform Architecture!

This is considered as state of the art, even if the AUTOSAR Methodology might not be able to describe all details of such setups - not to mention that hypervisors are not standardized by AUTOSAR.

With `Software Clusters`, the overall software of a Classic Platform Architecture is split into independent parts. Each `Software Cluster` is an independent Build Unit, and the result of the cluster specific build processes are the `Binary Objects`.

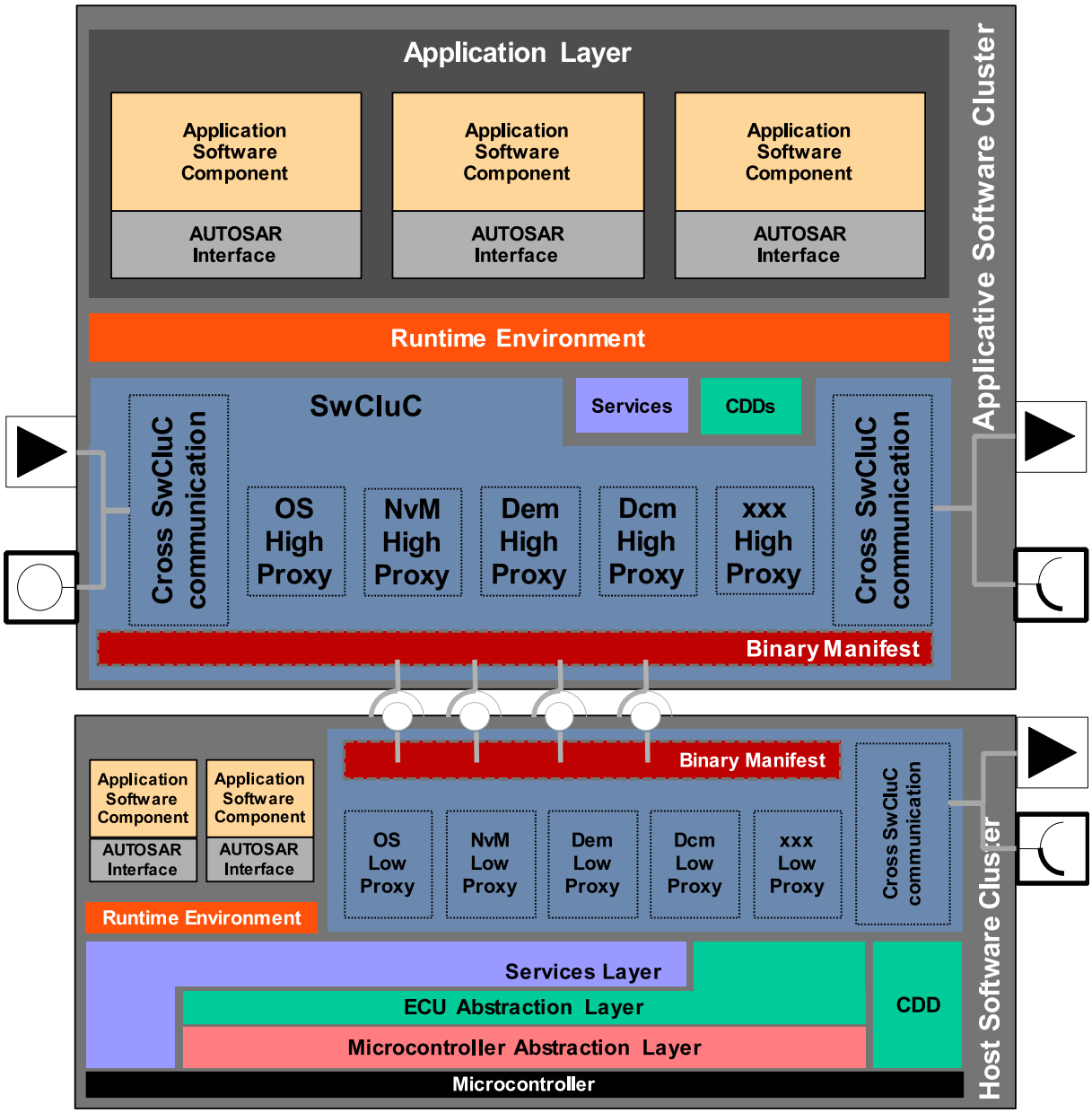

Figure 4.2: Software Cluster Connection in AUTOSAR Layered Software Architecture

As shown in figure 4.2, in a clustered software system the existing Layered Architecture gets extended by one new building block, the `Software Cluster Connection`. This `Software Cluster Connection` in turn has three major sub-blocks:

- The `Binary Manifest`
- The `Cross Cluster Communication`
- The `Proxy Modules`

The `Binary Manifests` provide the means to connect the `Binary Objects` deployed on the same machine.

The Cross Cluster Communication provides the VFB communication features between Software Clusters. Note that service interfaces are out of scope, since the access to BSW modules is provided via the Proxy Modules.

The High Proxy Modules substitute non-local BSW modules in Applicative Software Clusters, and implement the connection to the Low Proxy Modules in the Host Software Cluster, which then connect to the real BSW Modules. The High Proxy Modules exposes the same interface as the real BSW Module.

The Host Software Cluster contains the major part of the BSW Stack, especially micro controller dependent modules, including the Operating System. This implies that the dynamic behavior of the machine is mainly determined by the Host Software Cluster, which implements the scheduling. However, the implementation of the Applicative Software Clusters needs to conform to the scheduling strategy of the Host Software Cluster.

In an Applicative Software Cluster, Application Software Components and BSW modules (with strong limitations) can be integrated. Basic Software Modules that are no available locally in an Applicative Software Cluster, but whose interfaces are required for the integrated software, are substituted by Proxy Modules.

Some RTE features might be restricted, since the implementations of those features do not scale, or may have unintended side effects to other Software Clusters. For instance, synchronous client server calls cross Software Clusters require full context decoupling, where the impact to overall schedule is hard to foresee in a single Software Cluster scope.

The BSW Software is still reachable by synchronous client server calls. The implementation of the Multi Core Basic Software distribution concept is considered as prerequisite for scalability and good performance for SW systems applying Software Clusters.

4.1.1 Design Philosophy, Goals and Non-Goals

The goal of Software Clusters is to provide flexibility for design and implementation of an AUTOSAR system and, by modularization, make it possible to localize the impact of a change in one cluster. Some architectural changes can be introduced step wise, and certain implementation changes no longer require a rebuild of the complete software. It is explicitly not the goal, to support every possible usecase and solve every possible problem, or to reinvent the Adaptive Platform.

While Software Clusters make it possible to reduce the rate of change, it is still possible to rebuild every Software Cluster, including the Host Software Cluster. Some usecases will be solved only partially by this concept (or not at all), and still require a change to the BSW and a rebuild of the Host Software Cluster. The features in this concept will make changes to the BSW easier, so it might even be that the Host Software Cluster is rebuilt more often than before. But instead of rare, large changes to the BSW, the concept enables frequent, smaller changes.

4.2 Relation to EcucPartitions

The Software Cluster concept targets microcontrollers, which typically are very resource constrained. Therefore, it is important that this concept adds as little overhead as possible. Simply put: you only pay for what you use, but you also only get what you pay for. The relation between Software Clusters and EcucPartitions is one area where this is evident.

EcucPartitions offer the possibility to separate functions. Since they are implemented using OSApplications, separation of memory accesses and of runtime behavior can be achieved to a certain degree. On the other hand, the execution of multiple OSApplications also causes a relatively large overhead, requiring task switches (which can take hundreds of processor cycles) and additional administrative overhead (depending on the current and next task, it might be required to change the execution level, reconfigure the MPU, etc.). With a growing number of EcucPartitions, this overhead can become significant. Therefore, it is possible to reuse one EcucPartition in multiple Software Clusters.

At the same time, a system designer wants to combine functions from different EcucPartitions inside one cluster. This might be the case with large features, where some parts carry different ASIL requirements, or if OBD relevant parts should be separated from those that are not OBD relevant. For example, a brake function cluster might contain functions from different ASIL levels. Some actuate the brake and are safety relevant, but others, like a function that evaluates how smooth the ride is, are not safety relevant. Therefore, one Software Cluster can contain multiple EcucPartitions.

To fulfill both of these requirements, it is possible to have multiple EcucPartitions in one Software Cluster and to share an EcucPartitions between several Software Clusters (n:m relation).

If an EcucPartition is shared between Software Clusters, at runtime there is no way to enforce the separation between the Software Components from different Software Clusters it contains. But there is still a slight benefit, because the Software Clusters are separated logically and by memory address regions. Some violations could be detected not at runtime, but by static checks outside the ECU. For a given piece of code, the range of allowed memory regions and used features is much smaller. If static check tools would take this into account, it would make static checks or proofs about the software easier.

If the constrained resources allow, it is preferable not to share EcucPartitions between Software Clusters, since this provides a better separation between Software Clusters. Unfortunately, in practice this often cannot be avoided, so the goal should be to minimize this sharing as much as possible.

4.3 Assumption on the applicable target ECUs

Clustering a Classic Platform architecture shall work with state-of-the-art micro controllers. This means on one hand that enough resources especially w.r.t. RAM, ROM and CPU-Cores and their calculation power exist. This might also imply a 32-bit architecture or higher.

On the other hand, a utilization of the concepts and features on today's existing platforms are in scope, supporting various optimizations. For instance, a general software separation of Software Clusters by hardware features should be avoided since this usually uses rare resources of micro controller.

Targets with Memory Management Units are out of scope or at least are not especially considered by the standardized solution.

4.4 Assumption on safety mechanisms

The AUTOSAR CP Architecture assumes that communication local to an ECU utilizing RAM is safe. Therefore, the communication between Software Clusters on the same machine is also considered as safe. Integrity of machine local communication is ensured by the usage of partitions (with memory protection) and sufficiently reliable hardware (ECC RAM, suitable FID rates, etc.)

This means spatial and temporal separation of software needs to be implemented on the target microcontroller, based on the already introduced concept of partitions in the AUTOSAR Classic Platform architecture. This concept does not introduce additional methods to ensure such separation.

4.5 Assumption on the to-be-clustered SW system

Note: The numbers given in this chapter shall only express the rough magnitude to indicate a certain complexity. This framework was used in the concept development to prioritize sub-features, optimization capabilities, and to discuss acceptable restrictions of the solution. Nevertheless, in case of accepted restrictions, those will be part as constrains to the elaborated specifications.

The Software Components, which are mapped to different Software Clusters, shall aim for loose coupling.

'In computing and systems design, a loosely coupled system is one in which each of its components has, or makes use of, little or no knowledge of the definitions of other separate components. Subareas include the coupling of classes, interfaces, data, and services.' (See Wikipedia 'Loose coupling is the opposite of tight coupling.')

The concept assumes that the number of interfaces across Software Clusters is much smaller than the total number of interfaces between Software Components.

This could be condensed into some rough estimate that the interface data of Software Clusters should be at least a factor of 10 smaller than the internal data flow (approx. 3k/machine). Preferably, interfaces should be well defined and rather stable, nevertheless a change of interfaces during the development time is explicitly supported by this concept.

Beside the static interfaces, the different Software Clusters shall have only have loose timing dependencies. Basically, the same design goals as for the parallelization and multi-core designs apply. E.g.

- avoid strict sequences
- avoid synchronous interactions
- avoid strict executions orders between Software Clusters

In general, a system designer has to keep in mind that any dependency between Software Clusters has to be solved at a higher level. E.g.

- interfaces need to be negotiated
- required execution orders needs to be agreed between Software Cluster providers and ensured during the Software Cluster integration on a machine
- required execution order needs to be ensured by the Software Cluster integration on a machine

But those cross Software Cluster dependencies are contradicting the goals of independent development, test and release of Software Clusters!

The number of Software Clusters on a physical microcontroller shall be in the area of 2 to 20. But with a growing number of Software Clusters - considering the absence of virtual memory (MMU) - the fragmentation of memory will increase. This fragmentation depends only on the number of Software Clusters and their required partitions, regardless of the number of machines. In any case, the precise number needs to be crosschecked with the capabilities of the physical hardware.

The software inside an Applicative Software Cluster does not use or implement interrupts.

It is assumed to be mainly control loop SW - usually time driven, but may also react on a limited number of sporadic events.

4.6 Assigning Memory to Software Clusters

Typically, the overall memory of microcontrollers is composed out of different memory types each serving for a specific purpose (e.g. RAM, FLASH program ROM, FLASH data ROM)). In addition, a specific segment of a memory type may have different performance for different use cases (e.g. access speed might be different for different microcontroller cores.) Splitting a monolithic CP software architecture into individual

buildable units requires that each Software Cluster provider has a clear notion which memory can be used for which purpose. Since microcontrollers typically do not support memory virtualization, it is not only required to agree on the amount of memory, but also on the specific address ranges.

The suggested methodology works as following:

The machine architect splits the overall memory into logical memory slots and belonging directions for which purpose such memory slot can be used. Those directions correspond to the physical properties of such memory slots (e.g. .RAM or FLASH) but also to the software partitioning (e.g. spatial separation by MPU), functional grouping (e.g. memory of calibration data set) and performance goals.

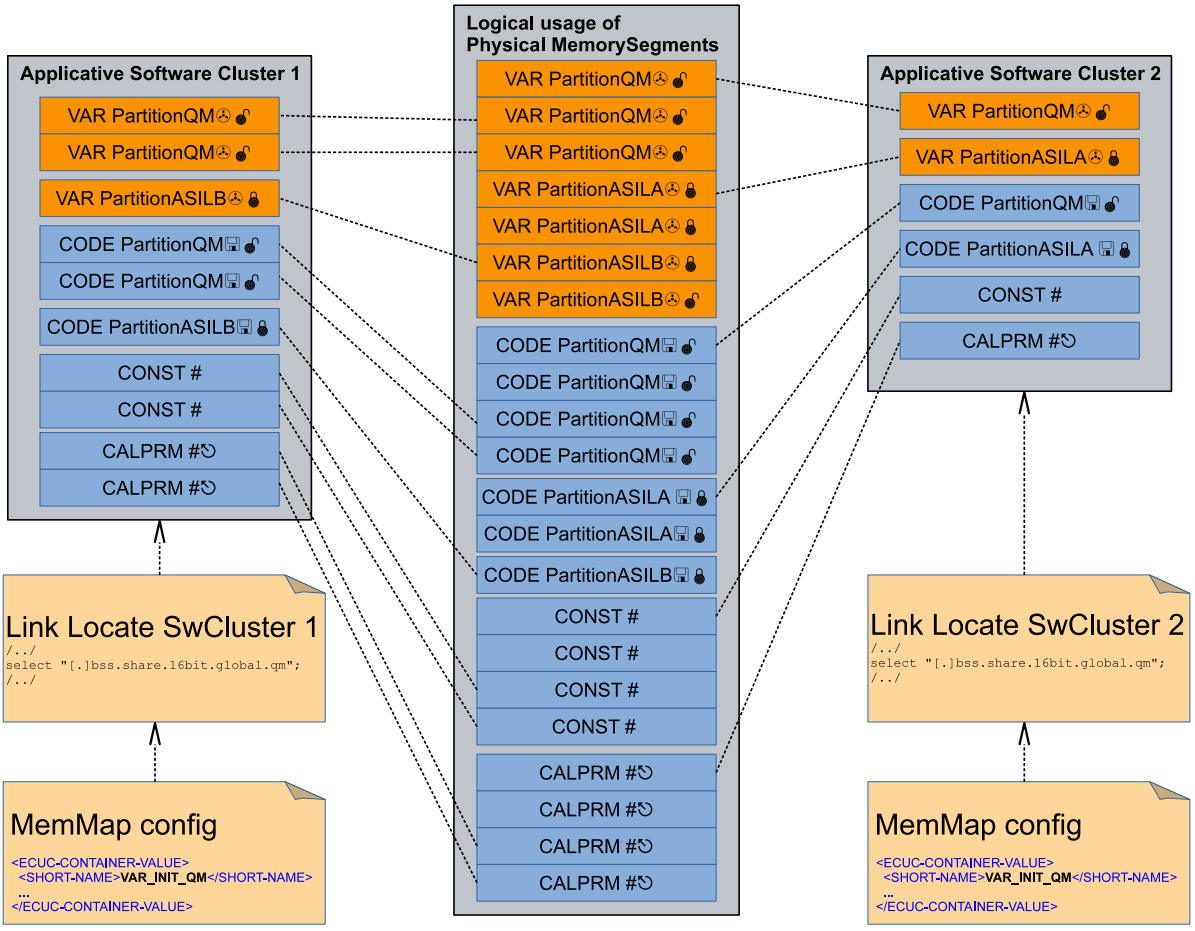

Figure 4.3: Assignment of memory to Software Clusters

The figure 4.3 illustrates the principle how different memory gets assigned to the Software Clusters.

Each Software Clusters gets now different memory slots assigned depending on the predicted memory consumption of the contained functionality and the required type of memories. Such an assignment can be directly transferred to a link-locate file and an initial configuration of the AUTOSAR Memory Mapping. The Software Cluster specific link-locate file ensures, that the Software Cluster specific build only

allocates memory which is reserved for this Software Cluster. The initial configuration of the AUTOSAR Memory Mapping in turn can define the MemMapAddressingModeSets with the configuration of pragmas controlling the assignment of code and variables to linker sections.

Further details can be found in document [2].

In addition to the static memory usage, the stack usage needs to be considered. Please note that a Host Software Cluster calls the 'Proxy' OS Tasks of the Applicative Software Cluster which in turn can invoke functions of BSW in the Host Software Cluster. Due to this common call graph a stack estimation and dimensioning has to consider the software architecture of Host Software Cluster and the individual Applicative Software Clusters in common.

4.7 Assigning Run-time to Software Clusters

First of all, please be aware that the use case 'freedom from unintended side effects' in a clustered system is different from 'freedom from interference' as a safety goal of ISO26262 [3]. The safety considerations usually assume first a design for coexistence and later apply measures to avoid interference, or at least to have a safe detection and failure reaction in case of interference.

With the native means of an AUTOSAR OS, it is almost impossible to create a schedule, which guarantees a complete 'freedom from unintended side effects' between various software sub systems. In a pure priority-based scheduling, it is always possible to occupy more calculation time on a given priority level, than is acceptable for other functionalities on the same or a lower priority. This can only be strictly avoided, by assigning a distinct set of OS Tasks on a dedicated core to each software sub system, which very likely is not affordable in terms of resources.

Consequently, managing a distributed development with Software Clusters requires the upfront design of an overall schedule, and the management of calculation time budgets in such a schedule. In practical use, it is also required to maintain such a design over the development time, in order to react to changing scheduling demands or identified problems.

With the concept of proxy tasks, an Applicative Software Cluster has already well-defined entry points, called dispatch entry points. Those dispatch entry points need to be qualified by timing properties, like trigger conditions (e.g. a periodic occurrence), *jitter*, or *maximum execution time*. Since those dispatch entry points can be described with the AUTOSAR Timing Extensions [4], a formal description of such timing properties is possible.

With this approach, it is possible to give a dynamic framework architecture to the different Software Cluster providers, against which they can prove their integration. This proof can be done by static code analyses, and real runtime measurements. A run-time estimation based on static code analysis has the advantage that a first proof

of dynamic architecture boundaries (e.g. the time budget of proxy task) can be already done without any running software.

The online monitoring of those runtime budgets is currently not standardized in AUTOSAR, but could be implemented as vendor-specific functionality with CDDs.

Nonetheless, if software gets integrated in a common AUTOSAR OS schedule, the software design and implementation need to support this coexistence. For example, the maximum runtime of `RunnableEntity`s shall be smaller than the expected minimum response time in a non-preemptive schedule.

Additionally to the aspect of software scheduling, the functional impact of communication behavior needs to be taken into consideration. Depending on the executed algorithm, it might have severe impact on the output, whether the input signals from the actual calculation (N), or the ones from the previous calculation (N-1) are taken. Worst-case, the behavior even fluctuates between these two cases, which in turn can add jitter to the calculated output.

In a clustered system (assuming that the task system is shared), the total runtime of OS Tasks, and also the exact point of time when a specific Runnable is executed in an OS Task, frequently changes with each integration of new `Software Cluster` versions. This jeopardizes the approach to localize the functional impact to the changed Software Cluster.

The Logical Execution Time (LET) can support to ensure a stable software behavior, by abstracting the physical execution. In brief, the concept of LET splits the overall schedule into so called Logical Execution Time frames. A LET frame starts with its release point, and ends with its termination point. The communication of software located to different LET frames is executed only at the terminate point of the sending LET frame and the release point of the receiving LET frame.

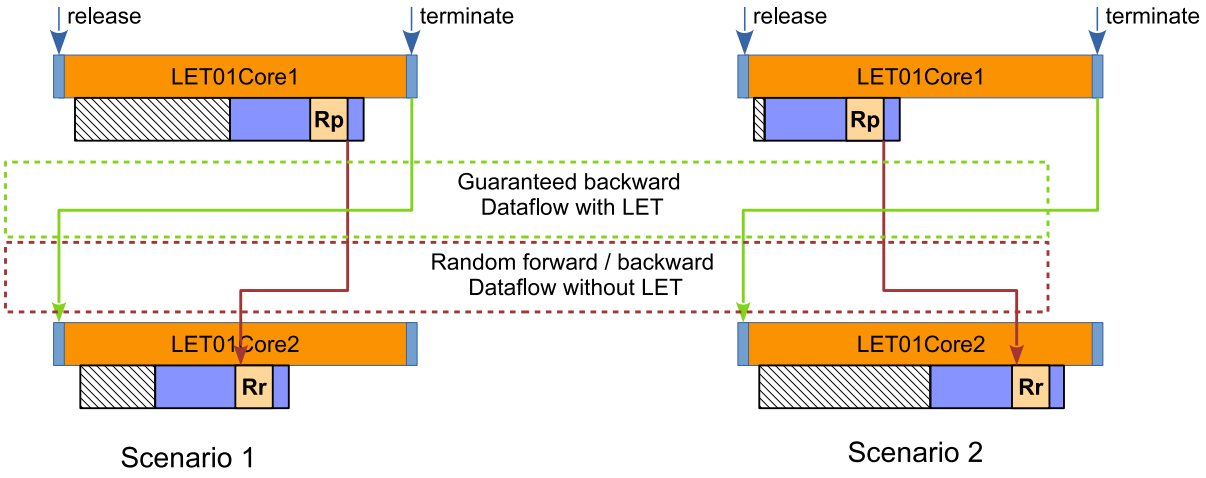

Figure 4.4: LET based communication versus classical communication

Figure 4.4 illustrates a simple data flow between two Runnables `Rp` and `Rr`. For simplicity, it is assumed that both are executed on OS Tasks executed on different cores, but similar situations can also occur in preemptive systems on the same core. The

point in time, at which they finish executing, jitters, which is shown by the hatched area. In Scenario 1, Rp is executed after Rr. Hence, Rc observes the values from Rp's execution N-1 (also called backward data flow). In Scenario 2, Rp is executed before Rr. Hence, Rc observes the values from Rp's actual execution N (also called forward data flow). With the application of LET, for both scenarios a deterministic backward data flow is guaranteed.

4.8 Design hints for clustered systems

Since the Software Cluster concept builds on existing technologies and concepts, introducing them adds only few additional design considerations.

If a cross cluster interface cannot be connected, the RTE method call (for example Rte_IRead) will return RTE_E_UNCONNECTED and the output value will be the ComSpec.initValue (for example NonqueuedSenderComSpec.initValue).

The notion that required ports might not be connected, already exists in systems that do not use Software Clusters. However, in some domains, this behavior is not used and some developers might assume that the interfaces they require are always present. It is therefore important to evaluate the impact of unconnected interfaces on those Software Components, who participate in cross cluster communication.

There are three ways, in which this can affect a Software Component:

1. The SW-C is not affected, if the input value is the init value. In this case, the SW-C can be used as-is. Example: the init value is a reserved value with neutral behavior.
2. The SW-C can function with the input value, but has to distinguish between the init value and other values. In this case, the SW-C should react to the RTE_E_UNCONNECTED return value. Example: the init value is a maximum value and the component should not use this value in its calculations.
3. The SW-C cannot function without the input value. In this case, the attribute CpSoftwareClusterResource.isMandatory should be set for the corresponding resource.

In the last case, [SWS_SwCluC_00050] specifies that, if a single mandatory interface on a Software Component cannot be connected, the whole cluster containing that Software Component will stay unconnected. This avoids situations, in which the Software Components integrated in a Software Cluster work with partly alive interfaces. It also avoids consecutive faults, for example if the reading Software Component calculates a faulty output value that is then read by another Software Component.

The CpSoftwareClusterResource.isMandatory attribute is set at system design time, when assigning Software Components to Clusters. It might also be required

to convey this information at component design or implementation time. To indicate this, VariableAccess.scope can be set to communicationIntraPartition.

It is recommended that architecture tools warn, if VariableAccess.scope is set to communicationIntraPartition, but CpSoftwareClusterResource.isMandatory is not set.

Sidenote: Since Software Clusters can share EcucPartitions, it is possible that some cross cluster communication happens within the same partition (cross-cluser, but intra-partition). Therefore, there is a slight semantic difference between cross partition and cross cluster. However, due to the flexibility introduced by software clusters, it is generally not possible to assure that a cross cluster interface will never cross a partition border. So it should be assumed that cross cluster communication might potentially also be cross partition. Therefore, it was decided to use the existing value communicationIntraPartition, instead of introducing a special value for communication within a cluster.

5 Software Clusters Example

5.1 Overview of the example system

The system model, coresponding to this example, can be found in the supplementary folder of Concept-670.

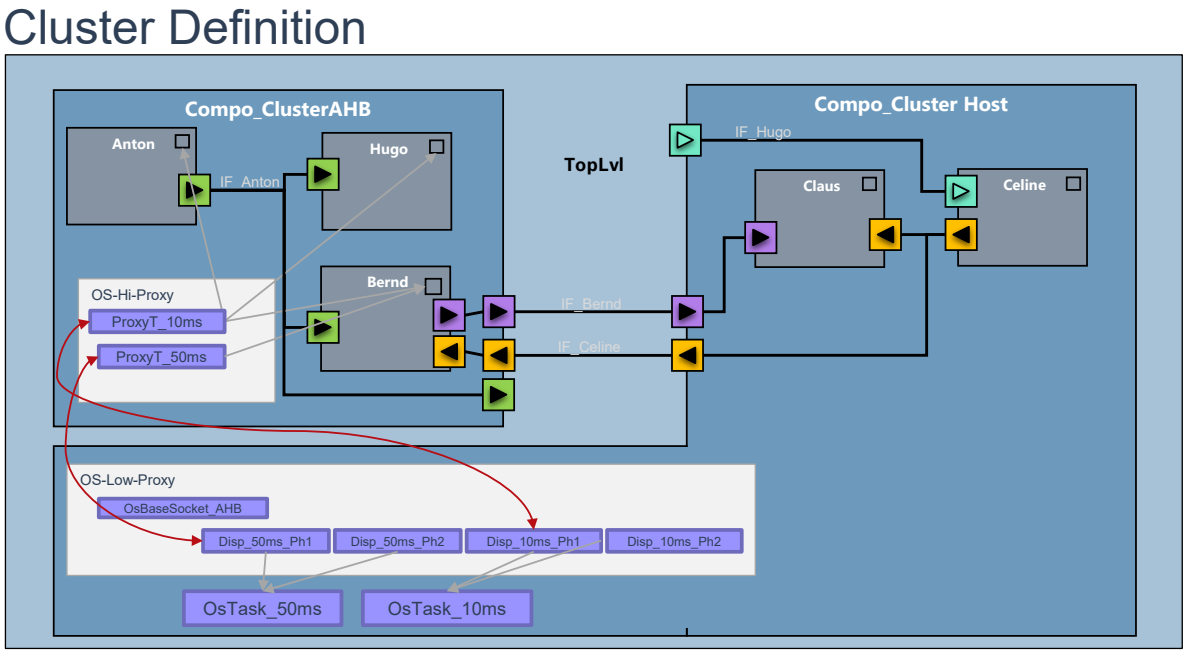

Figure 5.1: Overview of the example model

The example consists of 2 Software Compositions:

- Compo_AHB, with 3 Software Components: Anton, Hugo and Bernd
- Compo_Host, with 2 Software Components: Claus and Celine

Each of them have Providing and Requiring Ports, some of which are connected on Top-Level view.

There are 2 Software Clusters:

- SwClu_AHB, which contains Compo_AHB
- SwClu_Host, which contains Compo_Host

They are described separately, based on the neccessary System Elements. Of course, in a real system, a cluster would usually contain several Software Compositions.

As shown in figure 5.1, the 2 Software Clusters have the following interfaces:

- IF_Celine; ports connected from SwClu_Host to SwClu_AHB
- IF_Bernd; ports connected from SwClu_AHB to SwClu_Host
- IF_Hugo; open requiring port on SwClu_Host
- IF_Anton; open providing port on SwClu_AHB

Figure 5.1 also shows the relevant service dependencies, through which a properly configured Host Software Cluster and its operating system can run the Software Cluster AHB.

For the required Os Services, the proxy pattern for Os is used. In that example, the base configuration consists of 2 OsTasks: OsTask_50ms and OsTask_10ms. Each of the tasks has 2 entry-points for the so called dispatchers in the Applicative Software Clusters:

- OsTask_10ms:
  - Disp_10ms_Ph1 (Dispatcher for 10ms Task, phase 1)
  - Disp_10ms_Ph2 (Dispatcher for 10ms Task, phase 2)
- OsTask_50ms:
  - Disp_50ms_Ph1 (Dispatcher for 50ms Task, phase 1)
  - Disp_50ms_Ph2 (Dispatcher for 50ms Task, phase 2)

In the Software Cluster AHB, there is a local implementation for the Os, following the Os High Proxy pattern, with the 2 proxy tasks: ProxyT_10ms and ProxyT_50ms. The matching timing events, from the Software Component's TimingEvents, are mapped to these 2 proxy tasks.

Not shown in the picture 5.1, is the OsBaseSocket_AHB and BaseConfigCheck_AHB. The OsBaseSocket_AHB is used for initial setup of the Software Cluster's AHB local OsProxy. The BaseConfigCheck_AHB is used to ensure that the configuration,

implemented by the Host Software Cluster, fulfills the needs of the Software Cluster AHB.

All dependencies between the Software Clusters are described in the RessourcePool. In this example, there are Communication-Ressources based on the S/R Ports, Service-Ressources for the Os and configuration dependencies.

With all these settings, the system design for this example is complete. As mentioned in the beginning, the coresponding system model can be found in the supplementary folder of Concept-670.

5.2 Example Extract of Software Clusters

Based on the example system Model, it is possible to generate a cluster extract of the two Software Clusters SwClu_Host and SwClu_AHB. Through this step, the system will be split into two separate parts:

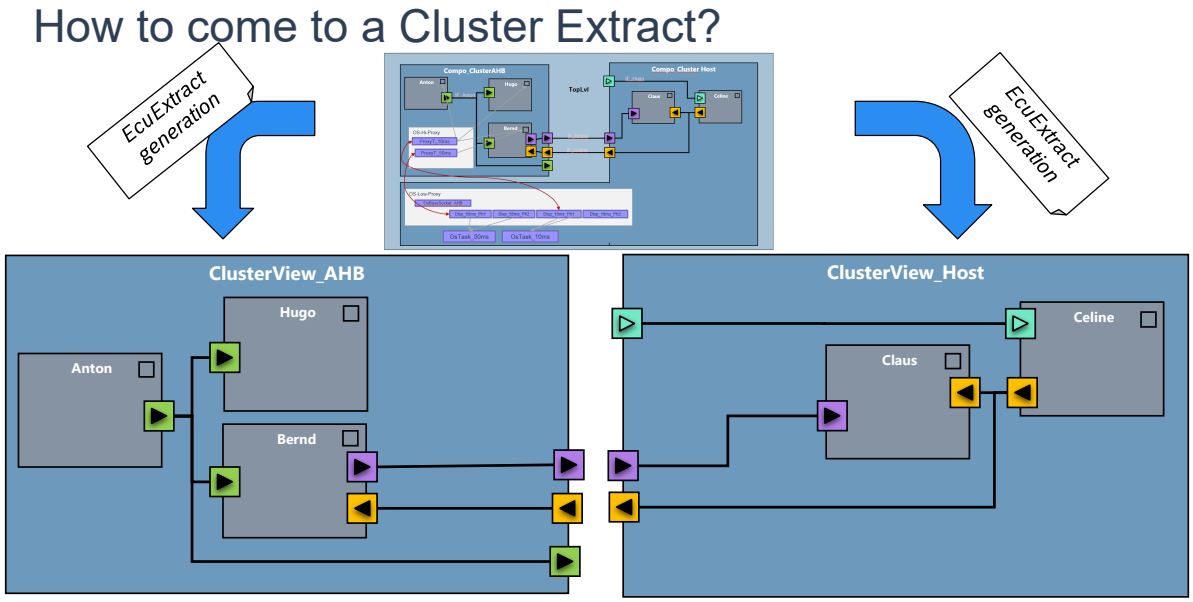

Figure 5.2: Overview of the Software Cluster Extract

Similar to the EcuExtract mechanism, each Software Cluster will be extracted from the system, and described on its own. In addition to that, the dependencies are referenced from the common RessourcePool. The main parts of such an extract are:

- Software Components
- Software Compositions
- Toplevel Root Composition
- Software Clusters

- COM-Ressources
- CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE
- Service-Needs

with their corresponding mappings. The first three items are already present for an EcuExtract, while the rest is specific to `Software Clusters`.

This concept uses the analogy to the EcuExtract mechanism, as the task is basically the same. The aim was that it should be possible to reuse the currently available tools and toolchains for configuration and generation, with only minor changes.

In the example model, you can find ARXML-examples for each `Software Cluster`.

5.3 Example Configuration of ECUC

To enable the generation and implementation of the service layer of a `Software Cluster`, also new ECU Configuration elements (EcuC) are introduced with this concept. In this example, the configuration describes the settings of the `Os High Proxy` and the BinaryManifest, as well as the attributes of the `Software Clusters` itself. Such attributes could be: the type of the `Software Clusters`, its connection settings, or settings needed by the build environment, like compiler flags. It also configures the `Software Cluster Communications` Layer, e.g. whether or not it is implementated via RIPS-plugin.

5.4 ECUC Configuration of Os High Proxy

The example ARXMLs show a basic configuration of the `Os High Proxy`, which consists of the Os Task configuration for the proxy-tasks ProxyT_10ms and ProxyT_50ms, and their settings for Priority, Period, Schedule and Activation. Also, an OsApplication "Core1QM" is configured there, to define the same context for both tasks.

5.5 File overview

To ease the creation and maintenance of the example, the model is split into several files. In addition, this file split is used to compose the mode to the different steps in the methodology. The table describes which files have to be used to get the complete model of a methodology step.

	Component Models	Resource Pool	ECU_SYSTEM_DESCRIPTION	SW_CLUSTER_SYSTEM_DESCRIPTION Host	SW_CLUSTER_SYSTEM_DESCRIPTION AHB	ECU configuration AHB
PlatformBase_Types.arxml	x		x	x	x	
Platform_Types.arxml	x		x	x	x	
DOC_SwCluC_SwcAnton_SWCD.arxml	x		x	x	x	
DOC_SwCluC_SwcBernd_SWCD.arxml	x		x	x	x	
DOC_SwCluC_SwcHugo_SWCD.arxml	x		x	x	x	
DOC_SwCluC_SwcCeline_SWCD.arxml	x		x	x	x	
DOC_SwCluC_SwcClaus_SWCD.arxml	x		x	x	x	
DOC_SwCluC_SwcCompoAHB_SWCD.arxml	x		x	x	x	
DOC_SwCluC_SwcCompoHost_SWCD.arxml	x		x	x	x	
DOC_SwCluC_Sys_TopLvl_SWCD.arxml	x		x	x	x	
DOC_SwCluC_Sys_SwClusters.arxml			x	x	x	
DOC_SwCluC_Sys_Descr_TopLvl.arxml			x			
DOC_SwCluC_Sys_HWT.arxml			x	x	x	
DOC_SwCluC_Sys_ResPoolCommunicationResources.arxml		x	x	x	x	
DOC_SwCluC_Sys_ResPoolServiceResources.arxml		x	x	x	x	
DOC_SwCluC_Sys_ResPoolServiceResourceNeeds.arxml		x	x	x	x	
DOC_SwCluC_Sys_Extr_Host.arxml				x		
DOC_SwCluC_Sys_Extr_TopLvl_SWCD_Host.arxml				x		
DOC_SwCluC_Sys_Extr_AHB.arxml					x	
DOC_SwCluC_Sys_Extr_TopLvl_SWCD_AHB.arxml					x	
DOC_SwCluC_Ecuc_EcuC_AHB.arxml						x
DOC_SwCluC_Ecuc_Os_AHB.arxml						x
DOC_SwCluC_Ecuc_SwCluC_AHB.arxml						x
AUTOSAR_MOD_ECUConfigurationParameters.arxml		x	x	x	x	x

Table 5.1: Mapping of files to methodology steps

5.6 From model to code

This section shall illustrate how the AUTOSAR model of a Software Cluster is handled over the different methodology steps, and finally processed in the code.

As previously described, three Software Components are integrated in the Software Cluster AHB:

- SwcAnton (DOC_SwCluC_SwcAnton_SWCD.arxml)
- SwcBernd (DOC_SwCluC_SwcBernd_SWCD.arxml)
- SwcHugo (DOC_SwCluC_SwcHugo_SWCD.arxml)

All are instantiated in the CompositionSwComponentType SwcCompoAHB (DOC_SwCluC_SwcCompoAHB_SWCD.arxml) that is used to describe the application software of AHB. A CpSoftwareCluster.swComponentAssignment exists for SwClu_AHB (DOC_SwCluC_Sys_SwClusters.arxml).

From these Software Components, three dataElements in the ports

- RP_Celine, dataElement Celine
- PP_Bernd, dataElement Bernd
- PP_Anton, dataElement Anton

are delegated by SwcCompoAHB.

For each dataElement, a CpSoftwareClusterCommunicationResource (DOC_SwCluC_Sys_ResPoolServiceResources.arxml) describes the Software Cluster related properties.

In the ECU_SYSTEM_DESCRIPTION System_TopLvl (DOC_SwCluC_Sys_Descr_TopLvl.arxml), the according dataElement instances are mapped via a PortElementToCommunicationResourceMapping. In the ECU_SYSTEM_DESCRIPTION System_TopLvl, the mapping is consistently defined at the PPortPrototype side, if a PPortPrototype is available in a Data Communication Graph.
Please note dataElement Celine, mapped at PP_Celine of SwcCompoHost.

In the SW_CLUSTER_SYSTEM_DESCRIPTION AHB (DOC_SwCluC_Sys_Extr_Host.arxml) - which is an extract of ECU_SYSTEM_DESCRIPTION System_TopLvl - the mappings are transformed to the PortPrototypes, which are available in the scope of Software Cluster AHB.
Please note dataElement Celine, mapped now at RP_Celine of SwcCompoAHB.

In the ECU configuration phase of Software Cluster AHB, the Data Communication Graphs of the dataElements Celine, Bernd, and Anton are assigned to the Cross Software Cluster Communication Plug-In Gr8Xcc.

Due to this configuration, the according RTE APIs are using the RTE Implementation Plug-In Services, when communication cross Cross Software Clusters.

Example 5.1

Rte_Write in software component SwcAnton:

```
Std_ReturnType Rte_Write_SwcAnton_PP_Anton_Anton(Type_Anton data)
{
    Std_ReturnType status = RTE_E_OK;

    /* write to Software Cluster local communication buffer */
    Rte_Buffer_000000_Anton = data;

    /* write to Xcc Plug-In */
    status = Rte_Rips_Gr8Xcc_Write_SwcAnton_CGI_Anton(data);

    return status;
}
```

or

Example 5.2

Rte_DRead in software component SwcBernd:

```
Type_Celine Rte_DRead_SwcBernd_RP_Celine_Celine(void)
{
        return Rte_Rips_Gr8Xcc_DRead_SwcBernd_CGI_Celine();
}
```

The Gr8Xcc Cross Software Cluster Communication Plug-In can implement the related RTE Implementation Plug-In Services as follows:

Example 5.3

Rte_Rips_Write in Cross Software Cluster Communication Plug-In Gr8Xcc:

```
Std_ReturnType Rte_Rips_Gr8Xcc_Write_SwcAnton_CGI_Anton(
    Rte_Rips_GlobalCopy_CGI_Anton_Type data)
{
        Std_ReturnType status = RTE_E_OK;

        /* sendIndication = none, no indication of send operations */
        SwCluC_Xcc_Buffer_Anton = data;
        /* writing data is always successful */
        return status;


}
```

The Rte_Rips_Write updates the data buffer used for cross cluster communication:

Example 5.4

```
1 Rte_Rips_GlobalCopy_CGI_Bernd_Type SwCluC_Xcc_Buffer_Bernd = 123u;
```

In case of reading the data, the relation to the Binary Manifest becomes also visible in the source code:

Example 5.5

Rte_Rips_DRead in Cross Software Cluster Communication Plug-In Gr8Xcc:

```
1 Rte_Rips_GlobalCopy_CGI_Celine_Type
      Rte_Rips_Gr8Xcc_DRead_SwcBernd_CGI_Celine()
2 {
3         return *((Rte_Rips_GlobalCopy_CGI_Celine_Type *)
              SwCluC_BManif_GetHandle_rXccBasicSR_Celine_dataBuffer());
4 }
```

Please note that Rte_Rips_DRead just takes the data reference from Binary Manifest, without checking if the related Resource Entry in the Binary Manifest is connected to another Software Cluster.

This is possible, since the Cross Software Cluster Communication Plug-In creates a default data instance, and puts this as a default data value into the Binary Manifest.

Example 5.6

Default data instance Cross Software Cluster Communication Plug-In Gr8Xcc:

```
1 const Rte_Rips_GlobalCopy_CGI_Celine_Type SwCluC_Xcc_Default_Celine =
      42;
```

Therefore, the SwCluC_BManif_GetHandle API either returns the reference to the data buffer in the connected Software Cluster, or the reference to the default data instance of the own Software Cluster AHB, in case no connection was possible.

It is the task of the Cross Software Cluster Communication Plug-In functionality, to configure the Resource Entrys needed in the Binary Manifest, so that the Cross Software Cluster Communication works. Such a configuration is shown in DOC_SwCluC_Ecuc_SwCluC_AHB.arxml.

Example 5.7

Interface Descriptor Table for

- Send/Receive Ports Anton, Bernd, Celine,

- OsTasks OsTask_10ms, OsTask_50ms
- dispatchers for OsTask_10ms, OsTask_50ms

```
const SwCluC_BManif_ResourcePropertiesType
    SwCluC_BManif_ResourcePropertiesDescriptorColumn[
    SWCLUC_BMANIF_NO_OF_DESCRIPTORS] =
{
  0x80,  /* PROVIDED (Anton),  N/A, S/R, GID = 0xDA1A0001 */
  0x80,  /* PROVIDED (Bernd),  N/A, S/R, GID = 0xDA1A0002 */
  0x00,  /* REQUIRED (Celine), N/A, S/R, GID = 0xDA1A0003 */
  0x40,  /* REQUIRED (OsTask_10ms), MANDATORY, OsTask, GID = 0x05000004
       */
  0x40,  /* REQUIRED (OsTask_50ms), MANDATORY, OsTask, GID = 0x05000003
       */
  0x40,  /* REQUIRED (Disp_10ms_Ph1), MANDATORY, OsDispatcher, GID = 0
      x0500000a */
  0x40   /* REQUIRED (Disp_50ms_Ph1), MANDATORY, OsDispatcher, GID = 0
      x05000008 */
};

/* descriptor table column for resource type Ids */
const SwCluC_BManif_ResourceTypeIdType
    SwCluC_BManif_ResourceTypeIdDescriptorColumn[
    SWCLUC_BMANIF_NO_OF_DESCRIPTORS] =
{
  0x01u, /* PROVIDED (Anton),  N/A, S/R, GID = 0xDA1A0001 */
  0x01u, /* PROVIDED (Bernd),  N/A, S/R, GID = 0xDA1A0002 */
  0x01u, /* REQUIRED (Celine), N/A, S/R, GID = 0xDA1A0003 */
  0x03u, /* REQUIRED (OsTask_10ms), MANDATORY, OsTask, GID = 0x05000004
       */
  0x03u, /* REQUIRED (OsTask_50ms), MANDATORY, OsTask, GID = 0x05000003
       */
  0x04u, /* REQUIRED (Disp_10ms_Ph1), MANDATORY, OsDispatcher, GID = 0
      x0500000a */
  0x04u  /* REQUIRED (Disp_50ms_Ph1), MANDATORY, OsDispatcher, GID = 0
      x05000008 */
};

const SwCluC_BManif_GlobalResourceIdType
    SwCluC_BManif_GlobalResourceIdDescriptorColumn[
    SWCLUC_BMANIF_NO_OF_DESCRIPTORS] =
{
  0xDA1A0001,  /* PROVIDED (Anton),  N/A, S/R, GID = 0xDA1A0001 */
  0xDA1A0002,  /* PROVIDED (Bernd),  N/A, S/R, GID = 0xDA1A0002 */
  0xDA1A0003,  /* REQUIRED (Celine), N/A, S/R, GID = 0xDA1A0003 */
  0x05000004,  /* REQUIRED (OsTask_10ms), MANDATORY, OsTask, GID = 0
      x05000004 */
  0x05000003,  /* REQUIRED (OsTask_50ms), MANDATORY, OsTask, GID = 0
      x05000003 */
  0x0500000a,  /* REQUIRED (Disp_10ms_Ph1), MANDATORY, OsDispatcher,
      GID = 0x0500000a */
  0x05000008   /* REQUIRED (Disp_50ms_Ph1), MANDATORY, OsDispatcher,
      GID = 0x05000008 */
};

```

```
35 const SwCluC_BManif_ResourceGuardValueType
       SwCluC_BManif_ResourceGuardValueDescriptorColumn[
       SWCLUC_BMANIF_NO_OF_DESCRIPTORS] =
36 {
37   0x0001DD21, /* PROVIDED (Anton),  N/A, S/R, GID = 0xDA1A0001 */
38   0x0001E2FD, /* PROVIDED (Bernd),  N/A, S/R, GID = 0xDA1A0002 */
39   0x19D1C26F, /* REQUIRED (Celine), N/A, S/R, GID = 0xDA1A0003 */
40   0x0006F83F, /* REQUIRED (OsTask_10ms), MANDATORY, OsTask, GID = 0
         x05000004 */
41   0x0006F855, /* REQUIRED (OsTask_50ms), MANDATORY, OsTask, GID = 0
         x05000003 */
42   0x0006F83F, /* REQUIRED (Disp_10ms_Ph1), MANDATORY, OsDispatcher, GID
          = 0x0500000a */
43   0x0006F855  /* REQUIRED (Disp_50ms_Ph1), MANDATORY, OsDispatcher, GID
          = 0x05000008 */
44 };
45
46 const SwCluC_BManif_TableIndexType
       SwCluC_BManif_OfferedInterfaceIndexDescriptorColumn[
       SWCLUC_BMANIF_NO_OF_DESCRIPTORS] =
47 {
48   0,                              /* PROVIDED (Anton),  N/A, S/R, GID = 0
         xDA1A0001 */
49   1,                              /* PROVIDED (Bernd),  N/A, S/R, GID = 0
         xDA1A0002 */
50   SWCLUC_BMANIF_NO_TABLE_ENTRY, /* REQUIRED (Celine), N/A, S/R, GID = 0
         xDA1A0003 */
51   SWCLUC_BMANIF_NO_TABLE_ENTRY, /* REQUIRED (OsTask_10ms), MANDATORY,
         OsTask, GID = 0x05000004 */
52   SWCLUC_BMANIF_NO_TABLE_ENTRY, /* REQUIRED (OsTask_50ms), MANDATORY,
         OsTask, GID = 0x05000003 */
53   2,                              /* REQUIRED (Disp_10ms_Ph1), MANDATORY,
          OsDispatcher, GID = 0x0500000a */
54   3                               /* REQUIRED (Disp_50ms_Ph1), MANDATORY,
          OsDispatcher, GID = 0x05000008 */
55 };
56
57 const SwCluC_BManif_HandleIndexType
       SwCluC_BManif_OfferedInterfaceNoOfHandlesDescriptorColumn[
       SWCLUC_BMANIF_NO_OF_DESCRIPTORS] =
58 {
59   0x01u, /* PROVIDED (Anton),  N/A, S/R, GID = 0xDA1A0001 */
60   0x01u, /* PROVIDED (Bernd),  N/A, S/R, GID = 0xDA1A0002 */
61   0x00u, /* REQUIRED (Celine), N/A, S/R, GID = 0xDA1A0003 */
62   0x00u, /* REQUIRED (OsTask_10ms), MANDATORY, OsTask, GID = 0x05000004
          */
63   0x00u, /* REQUIRED (OsTask_50ms), MANDATORY, OsTask, GID = 0x05000003
          */
64   0x01u, /* REQUIRED (Disp_10ms_Ph1), MANDATORY, OsDispatcher, GID = 0
         x0500000a */
65   0x01u  /* REQUIRED (Disp_50ms_Ph1), MANDATORY, OsDispatcher, GID = 0
         x05000008 */
66 };
67
```

```
68 const SwCluC_BManif_TableIndexType
       SwCluC_BManif_SubscribedInterfaceIndexDescriptorColumn[
       SWCLUC_BMANIF_NO_OF_DESCRIPTORS] =
69 {
70   SWCLUC_BMANIF_NO_TABLE_ENTRY, /* PROVIDED (Anton),  N/A, S/R, GID = 0
         xDA1A0001 */
71   SWCLUC_BMANIF_NO_TABLE_ENTRY, /* PROVIDED (Bernd),  N/A, S/R, GID = 0
         xDA1A0002 */
72   0x00u,                        /* REQUIRED (Celine), N/A, S/R, GID = 0
         xDA1A0003 */
73   0x01u,                        /* REQUIRED (OsTask_10ms), MANDATORY,
         OsTask, GID = 0x05000004 */
74   0x02u,                        /* REQUIRED (OsTask_50ms), MANDATORY,
         OsTask, GID = 0x05000003 */
75   SWCLUC_BMANIF_NO_TABLE_ENTRY, /* REQUIRED (Disp_10ms_Ph1), MANDATORY,
          OsDispatcher, GID = 0x0500000a */
76   SWCLUC_BMANIF_NO_TABLE_ENTRY  /* REQUIRED (Disp_50ms_Ph1), MANDATORY,
          OsDispatcher, GID = 0x05000008 */
77 };
78
79 const SwCluC_BManif_HandleIndexType
       SwCluC_BManif_SubscribedInterfaceNoOfHandlesDescriptorColumn[
       SWCLUC_BMANIF_NO_OF_DESCRIPTORS] =
80 {
81   0x00, /* PROVIDED (Anton),  N/A, S/R, GID = 0xDA1A0001 */
82   0x00, /* PROVIDED (Bernd),  N/A, S/R, GID = 0xDA1A0001 */
83   0x01, /* REQUIRED (Celine), N/A, S/R, GID = 0xDA1A0003 */
84   0x01, /* REQUIRED (OsTask_10ms), MANDATORY, OsTask, GID = 0x05000004
         */
85   0x01, /* REQUIRED (OsTask_50ms), MANDATORY, OsTask, GID = 0x05000003
         */
86   0x00, /* REQUIRED (Disp_10ms_Ph1), MANDATORY, OsDispatcher, GID = 0
         x0500000a */
87   0x00  /* REQUIRED (Disp_50ms_Ph1), MANDATORY, OsDispatcher, GID = 0
         x05000008 */
88 };
89
90 const SwCluC_BManif_HandleIndexType
       SwCluC_BManif_SubscribedInterfaceNoOfHandleSetsDescriptorColumn[
       SWCLUC_BMANIF_NO_OF_DESCRIPTORS] =
91 {
92   0x00, /* PROVIDED (Anton),  N/A, S/R, GID = 0xDA1A0001 */
93   0x00, /* PROVIDED (Bernd),  N/A, S/R, GID = 0xDA1A0002 */
94   0x00, /* REQUIRED (Celine), N/A, S/R, GID = 0xDA1A0003 */
95   0x00, /* REQUIRED (OsTask_10ms), MANDATORY, OsTask, GID = 0x05000004
         */
96   0x00, /* REQUIRED (OsTask_50ms), MANDATORY, OsTask, GID = 0x05000003
         */
97   0x00, /* REQUIRED (Disp_10ms_Ph1), MANDATORY, OsDispatcher, GID = 0
         x0500000a */
98   0x00  /* REQUIRED (Disp_50ms_Ph1), MANDATORY, OsDispatcher, GID = 0
         x05000008 */
99 };
```

Please note the addressing of the Interface Descriptor Table into the related row of the Offered Interface Table and Subscribed Interface Table.

In this example:

- Resource Anton
  - is provided (line 3), and of type Sender/Receiver (line 15)
  - has one handle in the OfferedInterface (line 59), which occupies the first row in the Offered Interface Table (line 48, OfferedInterfaceIndex = 0)
  - has no handle in the Subscribed interface (SubscribedInterfaceNoOfHandles = 0, line 81, and SubscribedInterfaceIndex = SWCLUC_BMANIF_NO_TABLE_ENTRY, line 70).
- Resource Celine
  - is required (line 5), and of type Sender/Receiver (line 17)
  - has no handle in the OfferedInterface (OfferedInterfaceNoOfHandles = 0, line 61, and OfferedInterfaceIndex = SWCLUC_BMANIF_NO_TABLE_ENTRY, line 50)
  - has one handle in the SubscribedInterface (line 83), which occupies the first row in the Subscribed Interface Table (line 72).

Example 5.8

Offered Interface Table for Anton, Bernd, dispatcher for OsTask_10ms, and dispatcher for OsTask_50ms

```
1 const SwCluC_BManif_HandleType
      SwCluC_BManif_OfferedInterfaceHandleColumn[
      SWCLUC_BMANIF_NO_OF_OFFERED_HANDLES] =
2 {
3   { .dptr = (void *) &SwCluC_Xcc_Buffer_Anton },  /* PROVIDED (Anton),
        N/A, S/R, GID = 0xDA1A0001 */
4   { .dptr = (void *) &SwCluC_Xcc_Buffer_Bernd },  /* PROVIDED (Bernd),
        N/A, S/R, GID = 0xDA1A0002 */
5   { .fptr = (SwCluC_BManif_VoidFncPtrType) SwCluC_OsProxy_ProxyT_10ms
       },  /* REQUIRED (Disp_10ms_Ph1), MANDATORY, OsDispatcher, GID = 0
      x0500000a */
6   { .fptr = (SwCluC_BManif_VoidFncPtrType) SwCluC_OsProxy_ProxyT_50ms }
          /* REQUIRED (Disp_50ms_Ph1), MANDATORY, OsDispatcher, GID = 0
      x05000008 */
7 };
```

In the Offered Interface Table, the data buffers for Anton and Bernd are offered for other Software Clusters.

Example 5.9

Subscribed Interface Table for Celine, OsTask_10ms, and OsTask_50ms

```
1  const SwCluC_BManif_HandleType
       SwCluC_BManif_SubscribedInterfaceDefaultHandleColumn[
       SWCLUC_BMANIF_NO_OF_SUBSCRIBED_HANDLES] =
2  {
3    { .dptr = (void *) &SwCluC_Xcc_Default_Celine },  /* REQUIRED (Celine
       ), N/A, S/R, GID = 0xDA1A0003 */
4    { .fptr = (SwCluC_BManif_VoidFncPtrType)
       SwCluC_OsProxy_ActivateTaskDefault },  /* REQUIRED (OsTask_10ms),
        MANDATORY, OsTask, GID = 0x05000004 */
5    { .fptr = (SwCluC_BManif_VoidFncPtrType)
       SwCluC_OsProxy_ActivateTaskDefault }   /* REQUIRED (OsTask_50ms),
        MANDATORY, OsTask, GID = 0x05000003 */
6  };
7
8  const SwCluC_BManif_HandleType
       SwCluC_BManif_SubscribedInterfaceHandleColumn[
       SWCLUC_BMANIF_NO_OF_SUBSCRIBED_HANDLES] =
9  {
10   { .dptr = (void *) &SwCluC_Xcc_Default_Celine },  /* REQUIRED (Celine
       ), N/A, S/R, GID = 0xDA1A0003 */
11   { .fptr = (SwCluC_BManif_VoidFncPtrType)
       SwCluC_OsProxy_ActivateTaskDefault },  /* REQUIRED (OsTask_10ms),
        MANDATORY, OsTask, GID = 0x05000004 */
12   { .fptr = (SwCluC_BManif_VoidFncPtrType)
       SwCluC_OsProxy_ActivateTaskDefault }   /* REQUIRED (OsTask_50ms),
        MANDATORY, OsTask, GID = 0x05000003 */
13 };
14
15 const SwCluC_BManif_SwClusterIdType
       SwCluC_BManif_SubscribedInterfaceConnectedSwClusterIdColumn[
       SWCLUC_BMANIF_NO_OF_SUBSCRIBED_HANDLES] =
16 {
17   SWCLUC_BMANIF_SWCL_ID_UNCONNECTED,  /* REQUIRED (Celine), N/A, S/R,
       GID = 0xDA1A0003 */
18   SWCLUC_BMANIF_SWCL_ID_UNCONNECTED,  /* REQUIRED (OsTask_10ms),
       MANDATORY, OsTask, GID = 0x05000004 */
19   SWCLUC_BMANIF_SWCL_ID_UNCONNECTED   /* REQUIRED (OsTask_50ms),
       MANDATORY, OsTask, GID = 0x05000003 */
20 };
```

In the `Subscribed Interface Table`, the default data instance for `Celine` is set. This ensures that the inital value is read, in case no connection to another `Software Cluster` is possible.

6 Limitations and Restrictions

6.1 Out of scope topics

6.1.1 Securing the Binary Objects

Securing the Binary Objects against unauthorized modification (e.g. signature checks during flash).

Rationale: This is not in scope of CP platform in general.

6.1.2 Standardization of hypervisor solutions

Standardization of hypervisor solutions to implement multiple machines one micro controller.

Rationale: There are already existing solutions on the market.

6.1.3 Mere build time optimization

The concept does not target projects that just want to do build time optimization. While it is possible to use the concept to reuse already built parts and thereby reduce build times, it is not designed with this usecase in mind. The scenario that a local integration just uses Software Clusters as independent build units, but keeps the full static and dynamic dependencies between them, is not considered.

The build time reduction will be accompanied by some overhead in memory consumption and runtime, since the concept has to solve the additional requirements for a distributed and independent development and integration. If the flexibility introduced by Software Clusters is not required, and the goal is just to reuse parts of a build, other solutions can be designed that have less (or maybe even no) overhead at run time.

To summarize: Using the concept in this way is possible, but not recommended.

6.1.4 Easy deactivation of Software Clusters

The solution of AUTOASR to support Software Clusters in the Classic Platform is not designed in a way that clustering can be disabled, or that a clustered system can easily be turned back into a non-clustered system. Simply put: there is no off switch.

Rationale: This is not possible since separate build units support:

- different lib versions
- separate name spaces for compiler / linker

- multi instances of regular BSW modules (e.g. Dem/Dcm/Fim)

If such benefits are used, a simple fall back to a common large-scale integration is technically not possible.

Example: If a project uses different versions of a library in different clusters, the project can no longer be compiled and linked as a single build unit, since the single definition rule is violated. If such a project were to be turned back into an unclustered system, it would first be neccessary to consolidate the different library versions to a single version.

Nonetheless, by setting the bit `SWCLUC_BMANIF_DISABLE_ON_ECU_CONNECTION`, defined in [SWS_SwCluC_00056], on the `Host Software Cluster`, it is possible to freeze the `Software Cluster Connection` for all clusters. After setting the bit, it is no longer possible to flash single clusters. Reprogramming can only be done for the whole ECU.

6.2 Utilization of RTE features

No Blocking APIs of RTE can be used by SWCs in a Software Clusters.

Rationale: Several software clusters share the same Basic Software including the operating system. This requires a 'gentle' behavior of the Software Clusters in order to avoid blocking of the schedule by a single Software Cluster.

No synchronous client server calls between Applicative Software Clusters.

Rationale: Software Clusters are built independently from each other. It is almost impossible to create a software function, which can be called from a completely unknow context. A solution to this problem would involve a complex and blocking RPC mechanism!

6.3 Constraints on feasible decoupling

Please note that Software Clusters in any case do not use run-time measures to enforce a strict separation between different Software Clusters.

This design decision considers the fact that run-time protection requires certain hardware support (for example MPU regions) and CPU performance, whose availability is limited on real existing microcontrollers. To reach specific safety-goals or other separation goals of an ECU, Software Clusters support the existing separation mechanisms, based on Partitions. However, to avoid unnecessary overhead, it is also possible to share partitions between Applicative Software Clusters.

Nevertheless, it is up to the concrete project to decide, where which kind of separation is required, desirable and affordable on the selected target microcontroller for the concrete software.

Very likely, reaching the goal of independent homologation / certification requires the usage of virtual machines.

Rationale: Different Applicative Software Clusters share the same BSW Stack and execution environment. Therefore, it will be hard to formally prove that these Software Clusters are free from unintended side effects!

Virtual machines versus software clusters in classic platform

The decision, whether virtual machines (where each of them contains its own BSW Stack) or software clusters are used to split the overall SW System into independent units, is a trade of between complete independence of the SW units and required resources (RAM, ROM, Runtime, etc.)

The current concept setup focuses on a rather lean approach for software clusters, supporting independent development. Use cases that require hard separation are better suited to virtual machines with independent BSW Stacks.

6.4 Basic Software integration in an Applicative Software Cluster

Even if the solution in AUTOSAR basically supports the integration of BSW modules, it does not provide a generic solution for any flexible BSW module distribution and separation. The standardized solution focuses on the independent usage of RTE, Transformers and Libraries.

The basic motivation for BSW integration in an Applicative Software Cluster is either to localize integration decisions, when integrated software components depend on BSW services, or to improve performance by avoidance of cross cluster interface crossing.

An additional motivation is the possible scenario to put an independent set of Diagnosis Modules (Dcm, Dem, Fim) into an Applicative Software Cluster. In doing so, BSW modules existing in the Host Software Cluster may also exist as an additional instance in one or several Applicative Software Clusters

But adding BSW modules to multiple Software Clusters leads to a significant increases in the overall BSW resource need.

This concept excludes the use case to move any arbitrary BSW module into a software cluster. It also excludes the objective to enable the independent update of single or smaller sets of BSW modules. The BSW module implementation has to support the integration into an Applicative Software Cluster, which provides only a limited environment:

- Hardware interrupts are not available (ISR tables reside in Host Software Cluster)
- Direct HW access is not supported and strongly discouraged. This excludes any driver with hardware access!

- In general, interfaces of other BSW modules will not be available and it will not be possible to call other BSW modules. The only exception are interfaces provided by `Proxy Modules` and other local BSW modules inside the same cluster.
- Usage of BSW Modules inside a `Software Cluster` may not easily be distributable to several cores (or only with some performance penalty), since the low-level mechanisms for partition / core passing are only available in the `Host Software Cluster`!

Rationale: BSW Modules in the AUTOSAR Architecture have strong configuration dependencies, which hard to break up into different SW units.

6.5 Functional restrictions

In the current release of AUTOSAR, the usage of features by Software Clusters in general, but especially by Applicative Software Clusters is restricted to a basic set. This section lists the most prominent not supported functionalities. Nevertheless, it claims not to be complete.

- Postbuild variability for `Software Cluster` interfaces is currently out of scope of this concept and will not be supported.
- intra ECU signal based communciation by an Applicative Software Cluster is not supported
- SOME/IP communciation by an Applicative Software Cluster is not supported
- Access to BSW Services by an Applicative Software Cluster is not supported, with the exception of OS and NvM (e.g. Dem, FiM, Dcm, WdgM, BswM, e.t.c. are not supported)

Some of those restrictions might be removed in furture AUTOSAR releases.

6.6 Flashing and Compatibility

One of the goals of this concept is to allow changing and updating single clusters, without having to rebuild and reflash the complete software. This, of course, has some influence on the flashing process. Since flash programming is usually out of scope of the AUTOSAR Classic Platform, these points are not mentioned in the specification document. Nevertheless, some hints are given in this section.

A typical programming session usually consist of the following steps:

- check readiness
- start flash routine
- check compatibility

- upload new data to the ECU
- write new data to flash
- restart ECU

6.6.1 Severe incompatibilities

In non clustered projects, the compatibility check is required to ensure that the new data fits on a certain ECU. Without this check, it would be possible to flash software that does not run on the given ECU.

Such a check is also required for clustered software. A cluster can be totally incompatible to the rest of the software, especially to the `Host Software Cluster`. For example, if the cluster hex is built for a different memory layout, flashing it might overwrite addresses that are assigned to other clusters, leaving the system in an undefined state. There are many other examples, like using a compiler with a different calling convention.

To handle these severe incompatibilities, the specification document defines the `Software Cluster Base Configuration Check`. This uses a guard value calculated from two parts. One part, `SwCluCAutoBaseConfigDescriptor`, is calculated, and should be implemented to cover incompatibilities that can be detected automatically (e.g. changed memory layout). The other part, `SwCluCUserBaseConfigDescriptor`, is maintained manually. It should be changed, whenever an incompatiblity is introduced that cannot be detected manually (e.g. a new compiler).

In case of a severe incompatiblity, the flash process should be aborted, before the new data is uploaded.

6.6.2 Severe Connection Errors

In case the connection is done on-Board, a new connection phase has to be done after programming. During this phase, incompatibilities can surface. The section 'Errors during software cluster connection' of the specification document lists errors, which cause an abort of the connection phase. In such a case, the newly programmed cluster will not be started. This can lead to knock-on effects on other clusters, and in some cases might lead to a system that can no longer start. In such a case, the system should, if possible, roll back to the previous state, or enter a state that allows diagnosing this problem and flashing a corrected cluster.

A Example listings

A.1 DOC_SwCluC_SwcAnton_SWCD.arxml

Listing A.1: DOC_SwCluC_SwcAnton_SWCD.arxml

```
<AUTOSAR xmlns="http://autosar.org/schema/r4.0" xmlns:xsi="http://www.w3.
    org/2001/XMLSchema-instance" xsi:schemaLocation="http://autosar.org/
    schema/r4.0␣AUTOSAR_00048.xsd">
  <AR-PACKAGES>
    <AR-PACKAGE>
      <SHORT-NAME>AUTOSAR</SHORT-NAME>
      <AR-PACKAGES>
        <AR-PACKAGE>
          <SHORT-NAME>CONC_670</SHORT-NAME>
          <AR-PACKAGES>
            <AR-PACKAGE>
              <SHORT-NAME>SwcAnton</SHORT-NAME>
              <AR-PACKAGES>
                <AR-PACKAGE>
                  <SHORT-NAME>SwComponentTypes</SHORT-NAME>
                  <ELEMENTS>
                    <APPLICATION-SW-COMPONENT-TYPE>
                      <SHORT-NAME>SwcAnton</SHORT-NAME>
                      <PORTS>
                        <P-PORT-PROTOTYPE>
                          <SHORT-NAME>PP_Anton</SHORT-NAME>
                          <PROVIDED-INTERFACE-TREF DEST="SENDER-RECEIVER-
                              INTERFACE">/AUTOSAR/CONC_670/SwcAnton/
                              PortInterfaces/IF_Anton</PROVIDED-INTERFACE-
                              TREF>
                        </P-PORT-PROTOTYPE>
                      </PORTS>
                      <INTERNAL-BEHAVIORS>
                        <SWC-INTERNAL-BEHAVIOR>
                          <SHORT-NAME>IB_SwcAnton</SHORT-NAME>
                          <DATA-TYPE-MAPPING-REFS>
                            <DATA-TYPE-MAPPING-REF DEST="DATA-TYPE-MAPPING-
                                SET">/AUTOSAR/CONC_670/SwcAnton/
                                DataTypeMappingSets/DTMS_SwcAnton</DATA-TYPE
                                -MAPPING-REF>
                          </DATA-TYPE-MAPPING-REFS>
                          <EVENTS>
                            <TIMING-EVENT>
                              <SHORT-NAME>TE_SwcAnton_10ms</SHORT-NAME>
                              <START-ON-EVENT-REF DEST="RUNNABLE-ENTITY">/
                                  AUTOSAR/CONC_670/SwcAnton/SwComponentTypes
                                  /SwcAnton/IB_SwcAnton/RE_SwcAnton_10ms</
                                  START-ON-EVENT-REF>
                              <PERIOD>0.01</PERIOD>
                            </TIMING-EVENT>
                          </EVENTS>
                          <RUNNABLES>
```

```
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                      INVOKED-CONCURRENTLY>
                  <DATA-SEND-POINTS>
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                      <ACCESSED-VARIABLE>
                        <AUTOSAR-VARIABLE-IREF>
                          <PORT-PROTOTYPE-REF DEST="P-PORT-
                              PROTOTYPE">/AUTOSAR/CONC_670/
                              SwcAnton/SwComponentTypes/SwcAnton
                              /PP_Anton</PORT-PROTOTYPE-REF>
                          <TARGET-DATA-PROTOTYPE-REF DEST="
                              VARIABLE-DATA-PROTOTYPE">/AUTOSAR/
                              CONC_670/SwcAnton/PortInterfaces/
                              IF_Anton/Anton</TARGET-DATA-
                              PROTOTYPE-REF>
                        </AUTOSAR-VARIABLE-IREF>
                      </ACCESSED-VARIABLE>
                    </VARIABLE-ACCESS>
                  </DATA-SEND-POINTS>
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              </RUNNABLES>
              <SUPPORTS-MULTIPLE-INSTANTIATION>false</SUPPORTS-
                  MULTIPLE-INSTANTIATION>
            </SWC-INTERNAL-BEHAVIOR>
          </INTERNAL-BEHAVIORS>
        </APPLICATION-SW-COMPONENT-TYPE>
      </ELEMENTS>
    </AR-PACKAGE>
    <AR-PACKAGE>
      <SHORT-NAME>SwcImplementations</SHORT-NAME>
      <ELEMENTS>
        <SWC-IMPLEMENTATION>
          <SHORT-NAME>IMPL_SwcAnton</SHORT-NAME>
          <CODE-DESCRIPTORS>
            <CODE>
              <SHORT-NAME>Code</SHORT-NAME>
              <ARTIFACT-DESCRIPTORS>
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                  <SHORT-LABEL>AutosarEngineeringObject</SHORT-
                      LABEL>
                  <CATEGORY>SWSRC</CATEGORY>
                </AUTOSAR-ENGINEERING-OBJECT>
              </ARTIFACT-DESCRIPTORS>
            </CODE>
          </CODE-DESCRIPTORS>
          <PROGRAMMING-LANGUAGE>C</PROGRAMMING-LANGUAGE>
          <BEHAVIOR-REF DEST="SWC-INTERNAL-BEHAVIOR">/AUTOSAR/
              CONC_670/SwcAnton/SwComponentTypes/SwcAnton/
              IB_SwcAnton</BEHAVIOR-REF>
        </SWC-IMPLEMENTATION>
      </ELEMENTS>
    </AR-PACKAGE>
```

```
<AR-PACKAGE>
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  <ELEMENTS>
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      <SHORT-NAME>Type_Anton</SHORT-NAME>
      <CATEGORY>VALUE</CATEGORY>
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        <SW-DATA-DEF-PROPS-VARIANTS>
          <SW-DATA-DEF-PROPS-CONDITIONAL>
            <SW-CALIBRATION-ACCESS>READ-ONLY</SW-
               CALIBRATION-ACCESS>
            <COMPU-METHOD-REF DEST="COMPU-METHOD">/AUTOSAR/
               CONC_670/SwcAnton/CompuMethods/Identical</
               COMPU-METHOD-REF>
            <SW-IMPL-POLICY>STANDARD</SW-IMPL-POLICY>
          </SW-DATA-DEF-PROPS-CONDITIONAL>
        </SW-DATA-DEF-PROPS-VARIANTS>
      </SW-DATA-DEF-PROPS>
    </APPLICATION-PRIMITIVE-DATA-TYPE>
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<AR-PACKAGE>
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      <IS-SERVICE>false</IS-SERVICE>
      <SERVICE-KIND>VENDOR-SPECIFIC</SERVICE-KIND>
      <DATA-ELEMENTS>
        <VARIABLE-DATA-PROTOTYPE>
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          <CATEGORY>VALUE</CATEGORY>
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                   CALIBRATION-ACCESS>
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            </SW-DATA-DEF-PROPS-VARIANTS>
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             ApplicationDataTypes/Type_Anton</TYPE-TREF>
        </VARIABLE-DATA-PROTOTYPE>
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  </ELEMENTS>
</AR-PACKAGE>
<AR-PACKAGE>
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  <ELEMENTS>
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      <CATEGORY>TYPE_REFERENCE</CATEGORY>
      <SW-DATA-DEF-PROPS>
        <SW-DATA-DEF-PROPS-VARIANTS>
```

```
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                          IMPLEMENTATION-DATA-TYPE">/AUTOSAR_Platform/
                          ImplementationDataTypes/uint16</
                          IMPLEMENTATION-DATA-TYPE-REF>
                    </SW-DATA-DEF-PROPS-CONDITIONAL>
                  </SW-DATA-DEF-PROPS-VARIANTS>
                </SW-DATA-DEF-PROPS>
              </IMPLEMENTATION-DATA-TYPE>
            </ELEMENTS>
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          <AR-PACKAGE>
            <SHORT-NAME>DataTypeMappingSets</SHORT-NAME>
            <ELEMENTS>
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                <SHORT-NAME>DTMS_SwcAnton</SHORT-NAME>
                <DATA-TYPE-MAPS>
                  <DATA-TYPE-MAP>
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                        PRIMITIVE-DATA-TYPE">/AUTOSAR/CONC_670/
                        SwcAnton/ApplicationDataTypes/Type_Anton</
                        APPLICATION-DATA-TYPE-REF>
                    <IMPLEMENTATION-DATA-TYPE-REF DEST="
                        IMPLEMENTATION-DATA-TYPE">/AUTOSAR/CONC_670/
                        SwcAnton/ImplementationDataTypes/Type_Anton</
                        IMPLEMENTATION-DATA-TYPE-REF>
                  </DATA-TYPE-MAP>
                </DATA-TYPE-MAPS>
              </DATA-TYPE-MAPPING-SET>
            </ELEMENTS>
          </AR-PACKAGE>
          <AR-PACKAGE>
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            <ELEMENTS>
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                <SHORT-NAME>No_Unit</SHORT-NAME>
                <FACTOR-SI-TO-UNIT>1.0</FACTOR-SI-TO-UNIT>
                <OFFSET-SI-TO-UNIT>0.0</OFFSET-SI-TO-UNIT>
              </UNIT>
            </ELEMENTS>
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          <AR-PACKAGE>
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                    Units/No_Unit</UNIT-REF>
              </COMPU-METHOD>
            </ELEMENTS>
          </AR-PACKAGE>
        </AR-PACKAGES>
      </AR-PACKAGE>
    </AR-PACKAGES>
  </AR-PACKAGE>
```

```
      </AR-PACKAGES>
    </AR-PACKAGE>
  </AR-PACKAGES>
</AUTOSAR>
```

A.2 DOC_SwCluC_SwcBernd_SWCD.arxml

Listing A.2: DOC_SwCluC_SwcBernd_SWCD.arxml

```
<AUTOSAR xmlns="http://autosar.org/schema/r4.0" xmlns:xsi="http://www.w3.
    org/2001/XMLSchema-instance" xsi:schemaLocation="http://autosar.org/
    schema/r4.0 AUTOSAR_00048.xsd">
  <AR-PACKAGES>
    <AR-PACKAGE>
      <SHORT-NAME>AUTOSAR</SHORT-NAME>
      <AR-PACKAGES>
        <AR-PACKAGE>
          <SHORT-NAME>CONC_670</SHORT-NAME>
          <AR-PACKAGES>
            <AR-PACKAGE>
              <SHORT-NAME>SwcBernd</SHORT-NAME>
              <AR-PACKAGES>
                <AR-PACKAGE>
                  <SHORT-NAME>SwComponentTypes</SHORT-NAME>
                  <ELEMENTS>
                    <APPLICATION-SW-COMPONENT-TYPE>
                      <SHORT-NAME>SwcBernd</SHORT-NAME>
                      <ADMIN-DATA>
                        <SDGS>
                          <SDG GID="Master">
                            <SD>true</SD>
                          </SDG>
                        </SDGS>
                      </ADMIN-DATA>
                      <PORTS>
                        <P-PORT-PROTOTYPE>
                          <SHORT-NAME>PP_Bernd</SHORT-NAME>
                          <PROVIDED-INTERFACE-TREF DEST="SENDER-RECEIVER-
                              INTERFACE">/AUTOSAR/CONC_670/SwcBernd/
                              PortInterfaces/IF_Bernd</PROVIDED-INTERFACE-
                              TREF>
                        </P-PORT-PROTOTYPE>
                        <R-PORT-PROTOTYPE>
                          <SHORT-NAME>RP_Anton</SHORT-NAME>
                          <REQUIRED-INTERFACE-TREF DEST="SENDER-RECEIVER-
                              INTERFACE">/AUTOSAR/CONC_670/SwcBernd/
                              PortInterfaces/IF_Anton</REQUIRED-INTERFACE-
                              TREF>
                        </R-PORT-PROTOTYPE>
                        <R-PORT-PROTOTYPE>
                          <SHORT-NAME>RP_Celine</SHORT-NAME>
```

```
        <REQUIRED-INTERFACE-TREF DEST="SENDER-RECEIVER-
            INTERFACE">/AUTOSAR/CONC_670/SwcBernd/
            PortInterfaces/IF_Celine</REQUIRED-INTERFACE-
            TREF>
      </R-PORT-PROTOTYPE>
    </PORTS>
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              -MAPPING-REF>
        </DATA-TYPE-MAPPING-REFS>
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          <TIMING-EVENT>
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            <START-ON-EVENT-REF DEST="RUNNABLE-ENTITY">/
                AUTOSAR/CONC_670/SwcBernd/SwComponentTypes
                /SwcBernd/IB_SwcBernd/RE_SwcBernd_10ms</
                START-ON-EVENT-REF>
            <PERIOD>0.01</PERIOD>
          </TIMING-EVENT>
          <TIMING-EVENT>
            <SHORT-NAME>TE_SwcBernd_50ms</SHORT-NAME>
            <START-ON-EVENT-REF DEST="RUNNABLE-ENTITY">/
                AUTOSAR/CONC_670/SwcBernd/SwComponentTypes
                /SwcBernd/IB_SwcBernd/RE_SwcBernd_50ms</
                START-ON-EVENT-REF>
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        </EVENTS>
        <RUNNABLES>
          <RUNNABLE-ENTITY>
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                INVOKED-CONCURRENTLY>
            <DATA-SEND-POINTS>
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                <ACCESSED-VARIABLE>
                  <AUTOSAR-VARIABLE-IREF>
                    <PORT-PROTOTYPE-REF DEST="P-PORT-
                        PROTOTYPE">/AUTOSAR/CONC_670/
                        SwcBernd/SwComponentTypes/SwcBernd
                        /PP_Bernd</PORT-PROTOTYPE-REF>
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                        IF_Bernd/Bernd</TARGET-DATA-
                        PROTOTYPE-REF>
                  </AUTOSAR-VARIABLE-IREF>
                </ACCESSED-VARIABLE>
              </VARIABLE-ACCESS>
            </DATA-SEND-POINTS>
```

```
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          </RUNNABLE-ENTITY>
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            <DATA-RECEIVE-POINT-BY-ARGUMENTS>
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                <ACCESSED-VARIABLE>
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                        SwcBernd/SwComponentTypes/SwcBernd
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                        IF_Anton/Anton</TARGET-DATA-
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                </ACCESSED-VARIABLE>
              </VARIABLE-ACCESS>
            </DATA-RECEIVE-POINT-BY-ARGUMENTS>
            <DATA-RECEIVE-POINT-BY-VALUES>
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                <ACCESSED-VARIABLE>
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                        PROTOTYPE">/AUTOSAR/CONC_670/
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                        /RP_Celine</PORT-PROTOTYPE-REF>
                    <TARGET-DATA-PROTOTYPE-REF DEST="
                        VARIABLE-DATA-PROTOTYPE">/AUTOSAR/
                        CONC_670/SwcBernd/PortInterfaces/
                        IF_Celine/Celine</TARGET-DATA-
                        PROTOTYPE-REF>
                  </AUTOSAR-VARIABLE-IREF>
                </ACCESSED-VARIABLE>
              </VARIABLE-ACCESS>
            </DATA-RECEIVE-POINT-BY-VALUES>
            <SYMBOL>RE_SwcBernd_50ms</SYMBOL>
          </RUNNABLE-ENTITY>
        </RUNNABLES>
        <SUPPORTS-MULTIPLE-INSTANTIATION>false</SUPPORTS-
            MULTIPLE-INSTANTIATION>
      </SWC-INTERNAL-BEHAVIOR>
    </INTERNAL-BEHAVIORS>
  </APPLICATION-SW-COMPONENT-TYPE>
 </ELEMENTS>
</AR-PACKAGE>
<AR-PACKAGE>
 <SHORT-NAME>SwcImplementations</SHORT-NAME>
 <ELEMENTS>
  <SWC-IMPLEMENTATION>
   <SHORT-NAME>IMPL_SwcBernd</SHORT-NAME>
   <CODE-DESCRIPTORS>
```

```
            <CODE>
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              <ARTIFACT-DESCRIPTORS>
                <AUTOSAR-ENGINEERING-OBJECT>
                  <SHORT-LABEL>AutosarEngineeringObject</SHORT-
                    LABEL>
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                </AUTOSAR-ENGINEERING-OBJECT>
              </ARTIFACT-DESCRIPTORS>
            </CODE>
          </CODE-DESCRIPTORS>
          <PROGRAMMING-LANGUAGE>C</PROGRAMMING-LANGUAGE>
          <BEHAVIOR-REF DEST="SWC-INTERNAL-BEHAVIOR">/AUTOSAR/
            CONC_670/SwcBernd/SwComponentTypes/SwcBernd/
            IB_SwcBernd</BEHAVIOR-REF>
        </SWC-IMPLEMENTATION>
      </ELEMENTS>
    </AR-PACKAGE>
    <AR-PACKAGE>
      <SHORT-NAME>ApplicationDataTypes</SHORT-NAME>
      <ELEMENTS>
        <APPLICATION-PRIMITIVE-DATA-TYPE>
          <SHORT-NAME>Type_Anton</SHORT-NAME>
          <CATEGORY>VALUE</CATEGORY>
          <SW-DATA-DEF-PROPS>
            <SW-DATA-DEF-PROPS-VARIANTS>
              <SW-DATA-DEF-PROPS-CONDITIONAL>
                <SW-CALIBRATION-ACCESS>READ-ONLY</SW-
                  CALIBRATION-ACCESS>
                <COMPU-METHOD-REF DEST="COMPU-METHOD">/AUTOSAR/
                  CONC_670/SwcBernd/CompuMethods/Identical</
                  COMPU-METHOD-REF>
                <SW-IMPL-POLICY>STANDARD</SW-IMPL-POLICY>
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A.3 DOC_SwCluC_SwcHugo_SWCD.arxml

Listing A.3: DOC_SwCluC_SwcHugo_SWCD.arxml

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A.4 DOC_SwCluC_SwcCeline_SWCD.arxml

Listing A.4: DOC_SwCluC_SwcCeline_SWCD.arxml

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A.5 DOC_SwCluC_SwcClaus_SWCD.arxml

Listing A.5: DOC_SwCluC_SwcClaus_SWCD.arxml

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    schema/r4.0␣AUTOSAR_00046.xsd">
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A.6 DOC_SwCluC_SwcCompoAHB_SWCD.arxml

Listing A.6: DOC_SwCluC_SwcCompoAHB_SWCD.arxml

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A.7 DOC_SwCluC_SwcCompoHost_SWCD.arxml

Listing A.7: DOC_SwCluC_SwcCompoHost_SWCD.arxml

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A.8 DOC_SwCluC_Sys_TopLvl_SWCD.arxml

Listing A.8: DOC_SwCluC_Sys_TopLvl_SWCD.arxml

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              <SHORT-NAME>PCT_TopLvl</SHORT-NAME>
              <AR-PACKAGES>
                <AR-PACKAGE>
                  <SHORT-NAME>SwComponentTypes</SHORT-NAME>
                  <ELEMENTS>
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                      <SHORT-NAME>TopLvl</SHORT-NAME>
                      <COMPONENTS>
                        <SW-COMPONENT-PROTOTYPE>
                          <SHORT-NAME>CPT_SwcCompoAHB</SHORT-NAME>
                          <TYPE-TREF DEST="COMPOSITION-SW-COMPONENT-TYPE">/
                              AUTOSAR/CONC_670/SwcCompoAHB/SwComponentTypes/
                              SwcCompoAHB</TYPE-TREF>
                        </SW-COMPONENT-PROTOTYPE>
                        <SW-COMPONENT-PROTOTYPE>
                          <SHORT-NAME>CPT_SwcCompoHost</SHORT-NAME>
                          <TYPE-TREF DEST="COMPOSITION-SW-COMPONENT-TYPE">/
                              AUTOSAR/CONC_670/SwcCompoHost/SwComponentTypes
                              /SwcCompoHost</TYPE-TREF>
                        </SW-COMPONENT-PROTOTYPE>
                      </COMPONENTS>
                      <CONNECTORS>
                        <ASSEMBLY-SW-CONNECTOR>
                          <SHORT-NAME>ASC_PP_Celine_RP_Celine</SHORT-NAME>
                          <PROVIDER-IREF>
```

```
            <CONTEXT-COMPONENT-REF DEST="SW-COMPONENT-
                PROTOTYPE">/AUTOSAR/CONC_670/PCT_TopLvl/
                SwComponentTypes/TopLvl/CPT_SwcCompoHost</
                CONTEXT-COMPONENT-REF>
            <TARGET-P-PORT-REF DEST="P-PORT-PROTOTYPE">/
                AUTOSAR/CONC_670/SwcCompoHost/
                SwComponentTypes/SwcCompoHost/PP_Celine</
                TARGET-P-PORT-REF>
          </PROVIDER-IREF>
          <REQUESTER-IREF>
            <CONTEXT-COMPONENT-REF DEST="SW-COMPONENT-
                PROTOTYPE">/AUTOSAR/CONC_670/PCT_TopLvl/
                SwComponentTypes/TopLvl/CPT_SwcCompoAHB</
                CONTEXT-COMPONENT-REF>
            <TARGET-R-PORT-REF DEST="R-PORT-PROTOTYPE">/
                AUTOSAR/CONC_670/SwcCompoAHB/
                SwComponentTypes/SwcCompoAHB/RP_Celine</
                TARGET-R-PORT-REF>
          </REQUESTER-IREF>
        </ASSEMBLY-SW-CONNECTOR>
        <ASSEMBLY-SW-CONNECTOR>
          <SHORT-NAME>ASC_PP_Bernd_RP_Bernd</SHORT-NAME>
          <PROVIDER-IREF>
            <CONTEXT-COMPONENT-REF DEST="SW-COMPONENT-
                PROTOTYPE">/AUTOSAR/CONC_670/PCT_TopLvl/
                SwComponentTypes/TopLvl/CPT_SwcCompoAHB</
                CONTEXT-COMPONENT-REF>
            <TARGET-P-PORT-REF DEST="P-PORT-PROTOTYPE">/
                AUTOSAR/CONC_670/SwcCompoAHB/
                SwComponentTypes/SwcCompoAHB/PP_Bernd</
                TARGET-P-PORT-REF>
          </PROVIDER-IREF>
          <REQUESTER-IREF>
            <CONTEXT-COMPONENT-REF DEST="SW-COMPONENT-
                PROTOTYPE">/AUTOSAR/CONC_670/PCT_TopLvl/
                SwComponentTypes/TopLvl/CPT_SwcCompoHost</
                CONTEXT-COMPONENT-REF>
            <TARGET-R-PORT-REF DEST="R-PORT-PROTOTYPE">/
                AUTOSAR/CONC_670/SwcCompoHost/
                SwComponentTypes/SwcCompoHost/RP_Bernd</
                TARGET-R-PORT-REF>
          </REQUESTER-IREF>
        </ASSEMBLY-SW-CONNECTOR>
      </CONNECTORS>
    </COMPOSITION-SW-COMPONENT-TYPE>
  </ELEMENTS>
 </AR-PACKAGE>
 </AR-PACKAGES>
 </AR-PACKAGE>
 </AR-PACKAGES>
 </AR-PACKAGE>
 </AR-PACKAGES>
 </AR-PACKAGE>
 </AR-PACKAGES>
</AUTOSAR>
```

A.9 DOC_SwCluC_Sys_SwClusters.arxml

Listing A.9: DOC_SwCluC_Sys_SwClusters.arxml

```
<AUTOSAR xmlns="http://autosar.org/schema/r4.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation=
      "http://autosar.org/schema/r4.0␣AUTOSAR_00049.xsd">
  <ADMIN-DATA>
    <USED-LANGUAGES></USED-LANGUAGES>
  </ADMIN-DATA>
  <AR-PACKAGES>
    <AR-PACKAGE>
      <SHORT-NAME>AUTOSAR</SHORT-NAME>
      <AR-PACKAGES>
        <AR-PACKAGE>
          <SHORT-NAME>CONC_670</SHORT-NAME>
          <AR-PACKAGES>
            <AR-PACKAGE>
              <SHORT-NAME>PCFG_SYS</SHORT-NAME>
              <AR-PACKAGES>
                <AR-PACKAGE>
                  <SHORT-NAME>CpSoftwareClusters</SHORT-NAME>
                  <ELEMENTS>
                    <CP-SOFTWARE-CLUSTER>
                      <SHORT-NAME>SwClu_Host</SHORT-NAME>
                      <SW-COMPONENT-ASSIGNMENTS>
                        <SW-COMPONENT-PROTOTYPE-ASSIGNMENT>
                          <SW-COMPONENT-IREF>
                            <CONTEXT-COMPOSITION-REF DEST="ROOT-SW-
                                COMPOSITION-PROTOTYPE">/AUTOSAR/CONC_670/
                                PCFG_SYS/Systems/System/CPT_TopLvl</CONTEXT-
                                COMPOSITION-REF>
                            <TARGET-COMPONENT-REF DEST="SW-COMPONENT-
                                PROTOTYPE">/AUTOSAR/CONC_670/PCT_TopLvl/
                                SwComponentTypes/TopLvl/CPT_SwcCompoHost</
                                TARGET-COMPONENT-REF>
                          </SW-COMPONENT-IREF>
                        </SW-COMPONENT-PROTOTYPE-ASSIGNMENT>
                      </SW-COMPONENT-ASSIGNMENTS>
                    </CP-SOFTWARE-CLUSTER>
                    <CP-SOFTWARE-CLUSTER>
                      <SHORT-NAME>SwClu_AHB</SHORT-NAME><SW-COMPONENT-
                          ASSIGNMENTS>
                        <SW-COMPONENT-PROTOTYPE-ASSIGNMENT>
                          <SW-COMPONENT-IREF>
                            <CONTEXT-COMPOSITION-REF DEST="ROOT-SW-
                                COMPOSITION-PROTOTYPE">/AUTOSAR/CONC_670/
                                PCFG_SYS/Systems/System/CPT_TopLvl</CONTEXT-
                                COMPOSITION-REF>
                            <TARGET-COMPONENT-REF DEST="SW-COMPONENT-
                                PROTOTYPE">/AUTOSAR/CONC_670/PCT_TopLvl/
                                SwComponentTypes/TopLvl/CPT_SwcCompoAHB</
                                TARGET-COMPONENT-REF>
                          </SW-COMPONENT-IREF>
```

```
                    </SW-COMPONENT-PROTOTYPE-ASSIGNMENT>
                  </SW-COMPONENT-ASSIGNMENTS>
                </CP-SOFTWARE-CLUSTER>
              </ELEMENTS>
            </AR-PACKAGE>
          </AR-PACKAGES>
        </AR-PACKAGE>
      </AR-PACKAGES>
    </AR-PACKAGE>
  </AR-PACKAGES>
</AUTOSAR>
```

A.10 DOC_SwCluC_Sys_Descr_TopLvl.arxml

Listing A.10: DOC_SwCluC_Sys_Descr_TopLvl.arxml

```
<AUTOSAR xmlns="http://autosar.org/schema/r4.0" xmlns:xsi="http://www.w3.
    org/2001/XMLSchema-instance" xsi:schemaLocation="http://autosar.org/
    schema/r4.0␣AUTOSAR_00044.xsd">
  <AR-PACKAGES>
    <AR-PACKAGE>
      <SHORT-NAME>AUTOSAR</SHORT-NAME>
      <AR-PACKAGES>
        <AR-PACKAGE>
          <SHORT-NAME>CONC_670</SHORT-NAME>
          <AR-PACKAGES>
            <AR-PACKAGE>
              <SHORT-NAME>PCT_TopLvl</SHORT-NAME>
              <AR-PACKAGES>
                <AR-PACKAGE>
                  <SHORT-NAME>Systems</SHORT-NAME>
                  <ELEMENTS>
                    <SYSTEM>
                      <SHORT-NAME>System_TopLvl</SHORT-NAME>
                      <CATEGORY>ECU_SYSTEM_DESCRIPTION</CATEGORY>
                      <MAPPINGS>
                        <SYSTEM-MAPPING>
                          <SHORT-NAME>Sys_TopLvl_Maps</SHORT-NAME>
                          <PORT-ELEMENT-TO-COM-RESOURCE-MAPPINGS>
                            <PORT-ELEMENT-TO-COMMUNICATION-RESOURCE-MAPPING
                                >
                              <SHORT-NAME>Res_Map_DE_Anton</SHORT-NAME>
                              <COMMUNICATION-RESOURCE-REF DEST="CP-SOFTWARE
                                  -CLUSTER-COMMUNICATION-RESOURCE">/AUTOSAR/
                                  CONC_670/SysResPool/
                                  CpSoftwareClusterResourcePools/
                                  ComResourcePool/Anton</COMMUNICATION-
                                  RESOURCE-REF>
                              <VARIABLE-DATA-PROTOTYPE-IREF>
```

```
        <CONTEXT-COMPONENT-REF DEST="SW-COMPONENT-
            PROTOTYPE">/AUTOSAR/CONC_670/PCT_TopLvl/
            SwComponentTypes/TopLvl/CPT_SwcCompoAHB<
            /CONTEXT-COMPONENT-REF>
        <CONTEXT-COMPOSITION-REF DEST="ROOT-SW-
            COMPOSITION-PROTOTYPE">/AUTOSAR/CONC_670
            /PCT_TopLvl/Systems/System_TopLvl/
            Sys_TopLvl</CONTEXT-COMPOSITION-REF>
        <CONTEXT-PORT-REF DEST="P-PORT-PROTOTYPE">/
            AUTOSAR/CONC_670/SwcCompoAHB/
            SwComponentTypes/SwcCompoAHB/PP_Anton</
            CONTEXT-PORT-REF>
        <TARGET-DATA-PROTOTYPE-REF DEST="VARIABLE-
            DATA-PROTOTYPE">/AUTOSAR/CONC_670/
            SwcCompoAHB/PortInterfaces/IF_Anton/
            Anton</TARGET-DATA-PROTOTYPE-REF>
      </VARIABLE-DATA-PROTOTYPE-IREF>
    </PORT-ELEMENT-TO-COMMUNICATION-RESOURCE-
        MAPPING>
    <PORT-ELEMENT-TO-COMMUNICATION-RESOURCE-MAPPING
        >
      <SHORT-NAME>Res_Map_DE_Bernd</SHORT-NAME>
      <COMMUNICATION-RESOURCE-REF DEST="CP-SOFTWARE
          -CLUSTER-COMMUNICATION-RESOURCE">/AUTOSAR/
          CONC_670/SysResPool/
          CpSoftwareClusterResourcePools/
          ComResourcePool/Bernd</COMMUNICATION-
          RESOURCE-REF>
      <VARIABLE-DATA-PROTOTYPE-IREF>
        <CONTEXT-COMPONENT-REF DEST="SW-COMPONENT-
            PROTOTYPE">/AUTOSAR/CONC_670/PCT_TopLvl/
            SwComponentTypes/TopLvl/CPT_SwcCompoAHB<
            /CONTEXT-COMPONENT-REF>
        <CONTEXT-COMPOSITION-REF DEST="ROOT-SW-
            COMPOSITION-PROTOTYPE">/AUTOSAR/CONC_670
            /PCT_TopLvl/Systems/System_TopLvl/
            Sys_TopLvl</CONTEXT-COMPOSITION-REF>
        <CONTEXT-PORT-REF DEST="P-PORT-PROTOTYPE">/
            AUTOSAR/CONC_670/SwcCompoAHB/
            SwComponentTypes/SwcCompoAHB/PP_Bernd</
            CONTEXT-PORT-REF>
        <TARGET-DATA-PROTOTYPE-REF DEST="VARIABLE-
            DATA-PROTOTYPE">/AUTOSAR/CONC_670/
            SwcCompoAHB/PortInterfaces/IF_Bernd/
            Bernd</TARGET-DATA-PROTOTYPE-REF>
      </VARIABLE-DATA-PROTOTYPE-IREF>
    </PORT-ELEMENT-TO-COMMUNICATION-RESOURCE-
        MAPPING>
    <PORT-ELEMENT-TO-COMMUNICATION-RESOURCE-MAPPING
        >
      <SHORT-NAME>Res_Map_DE_Celine</SHORT-NAME>
```

```
        <COMMUNICATION-RESOURCE-REF DEST="CP-SOFTWARE
            -CLUSTER-COMMUNICATION-RESOURCE">/AUTOSAR/
            CONC_670/SysResPool/
            CpSoftwareClusterResourcePools/
            ComResourcePool/Celine</COMMUNICATION-
            RESOURCE-REF>
        <VARIABLE-DATA-PROTOTYPE-IREF>
          <CONTEXT-COMPONENT-REF DEST="SW-COMPONENT-
              PROTOTYPE">/AUTOSAR/CONC_670/PCT_TopLvl/
              SwComponentTypes/TopLvl/CPT_SwcCompoHost
              </CONTEXT-COMPONENT-REF>
          <CONTEXT-COMPOSITION-REF DEST="ROOT-SW-
              COMPOSITION-PROTOTYPE">/AUTOSAR/CONC_670
              /PCT_TopLvl/Systems/System_TopLvl/
              Sys_TopLvl</CONTEXT-COMPOSITION-REF>
          <CONTEXT-PORT-REF DEST="P-PORT-PROTOTYPE">/
              AUTOSAR/CONC_670/SwcCompoHost/
              SwComponentTypes/SwcCompoHost/PP_Celine<
              /CONTEXT-PORT-REF>
          <TARGET-DATA-PROTOTYPE-REF DEST="VARIABLE-
              DATA-PROTOTYPE">/AUTOSAR/CONC_670/
              SwcCompoHost/PortInterfaces/IF_Celine/
              Celine</TARGET-DATA-PROTOTYPE-REF>
        </VARIABLE-DATA-PROTOTYPE-IREF>
      </PORT-ELEMENT-TO-COMMUNICATION-RESOURCE-
          MAPPING>
      <PORT-ELEMENT-TO-COMMUNICATION-RESOURCE-MAPPING
          >
        <SHORT-NAME>Res_Map_DE_Hugo</SHORT-NAME>
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            -CLUSTER-COMMUNICATION-RESOURCE">/AUTOSAR/
            CONC_670/SysResPool/
            CpSoftwareClusterResourcePools/
            ComResourcePool/Celine</COMMUNICATION-
            RESOURCE-REF>
        <VARIABLE-DATA-PROTOTYPE-IREF>
          <CONTEXT-COMPONENT-REF DEST="SW-COMPONENT-
              PROTOTYPE">/AUTOSAR/CONC_670/PCT_TopLvl/
              SwComponentTypes/TopLvl/CPT_SwcCompoHost
              </CONTEXT-COMPONENT-REF>
          <CONTEXT-COMPOSITION-REF DEST="ROOT-SW-
              COMPOSITION-PROTOTYPE">/AUTOSAR/CONC_670
              /PCT_TopLvl/Systems/System_TopLvl/
              Sys_TopLvl</CONTEXT-COMPOSITION-REF>
          <CONTEXT-PORT-REF DEST="R-PORT-PROTOTYPE">/
              AUTOSAR/CONC_670/SwcCompoHost/
              SwComponentTypes/SwcCompoHost/RP_Hugo</
              CONTEXT-PORT-REF>
          <TARGET-DATA-PROTOTYPE-REF DEST="VARIABLE-
              DATA-PROTOTYPE">/AUTOSAR/CONC_670/
              SwcCompoHost/PortInterfaces/IF_Hugo/Hugo
              </TARGET-DATA-PROTOTYPE-REF>
        </VARIABLE-DATA-PROTOTYPE-IREF>
      </PORT-ELEMENT-TO-COMMUNICATION-RESOURCE-
          MAPPING>
    </PORT-ELEMENT-TO-COM-RESOURCE-MAPPINGS>
```

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<SOFTWARE-CLUSTER-TO-RESOURCE-MAPPINGS>
  <CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
    <SHORT-NAME>Res_Map_BaseConfigCheck_AHB</
       SHORT-NAME>
    <DESC>
      <L-2 L="EN">Software Cluster resource
         mapping Base Config Check AHB for the
         complete ECU</L-2>
    </DESC>
    <PROVIDER-REF DEST="CP-SOFTWARE-CLUSTER">/
       AUTOSAR/CONC_670/PCFG_SYS/
       CpSoftwareClusters/SwClu_Host</PROVIDER-
       REF>
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      <REQUESTER-REF DEST="CP-SOFTWARE-CLUSTER">/
         AUTOSAR/CONC_670/PCFG_SYS/
         CpSoftwareClusters/SwClu_AHB</REQUESTER-
         REF>
    </REQUESTER-REFS>
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       CONC_670/SysResPool/
       CpSoftwareClusterResourcePools/
       SwClusCResourcePool/BaseConfigCheck_AHB</
       SERVICE-RESOURCE-REF>
  </CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
  <CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
    <SHORT-NAME>Res_Map_XccBaseSocket_AHB</SHORT-
       NAME>
    <DESC>
      <L-2 L="EN">Software Cluster resource
         mapping Xcc Base Socket AHB for the
         complete ECU</L-2>
    </DESC>
    <PROVIDER-REF DEST="CP-SOFTWARE-CLUSTER">/
       AUTOSAR/CONC_670/PCFG_SYS/
       CpSoftwareClusters/SwClu_Host</PROVIDER-
       REF>
    <REQUESTER-REFS>
      <REQUESTER-REF DEST="CP-SOFTWARE-CLUSTER">/
         AUTOSAR/CONC_670/PCFG_SYS/
         CpSoftwareClusters/SwClu_AHB</REQUESTER-
         REF>
    </REQUESTER-REFS>
    <SERVICE-RESOURCE-REF DEST="CP-SOFTWARE-
       CLUSTER-SERVICE-RESOURCE">/AUTOSAR/
       CONC_670/SysResPool/
       CpSoftwareClusterResourcePools/
       SwClusCResourcePool/XccBaseSocket_AHB</
       SERVICE-RESOURCE-REF>
  </CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>

  <CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
    <SHORT-NAME>Res_Map_OsBaseSocket_AHB</SHORT-
       NAME>
    <DESC>
```

```
      <L-2 L="EN">Software Cluster resource
        mapping Xcc Base Socket AHB for the
        complete ECU</L-2>
    </DESC>
    <PROVIDER-REF DEST="CP-SOFTWARE-CLUSTER">/
      AUTOSAR/CONC_670/PCFG_SYS/
      CpSoftwareClusters/SwClu_Host</PROVIDER-
      REF>
    <REQUESTER-REFS>
      <REQUESTER-REF DEST="CP-SOFTWARE-CLUSTER">/
        AUTOSAR/CONC_670/PCFG_SYS/
        CpSoftwareClusters/SwClu_AHB</REQUESTER-
        REF>
    </REQUESTER-REFS>
    <SERVICE-RESOURCE-REF DEST="CP-SOFTWARE-
      CLUSTER-SERVICE-RESOURCE">/AUTOSAR/
      CONC_670/SysResPool/
      CpSoftwareClusterResourcePools/
      OsResourcePool/OsBaseSocket_AHB</SERVICE-
      RESOURCE-REF>
  </CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>

  <CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
    <SHORT-NAME>Res_Map_OsTask_50ms</SHORT-NAME>
    <DESC>
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        mapping OsTask_50ms for the complete ECU
        </L-2>
    </DESC>
    <PROVIDER-REF DEST="CP-SOFTWARE-CLUSTER">/
      AUTOSAR/CONC_670/PCFG_SYS/
      CpSoftwareClusters/SwClu_Host</PROVIDER-
      REF>
    <REQUESTER-REFS>
      <REQUESTER-REF DEST="CP-SOFTWARE-CLUSTER">/
        AUTOSAR/CONC_670/PCFG_SYS/
        CpSoftwareClusters/SwClu_AHB</REQUESTER-
        REF>
    </REQUESTER-REFS>
    <SERVICE-RESOURCE-REF DEST="CP-SOFTWARE-
      CLUSTER-SERVICE-RESOURCE">/AUTOSAR/
      CONC_670/SysResPool/
      CpSoftwareClusterResourcePools/
      OsResourcePool/OsTask_50ms</SERVICE-
      RESOURCE-REF>
  </CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
  <CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
    <SHORT-NAME>Res_Map_OsTask_10ms</SHORT-NAME>
    <DESC>
      <L-2 L="EN">Software Cluster resource
        mapping OsTask_10ms for the complete ECU
        </L-2>
    </DESC>
```

```
      <PROVIDER-REF DEST="CP-SOFTWARE-CLUSTER">/
        AUTOSAR/CONC_670/PCFG_SYS/
        CpSoftwareClusters/SwClu_Host</PROVIDER-
        REF>
      <REQUESTER-REFS>
        <REQUESTER-REF DEST="CP-SOFTWARE-CLUSTER">/
          AUTOSAR/CONC_670/PCFG_SYS/
          CpSoftwareClusters/SwClu_AHB</REQUESTER-
          REF>
      </REQUESTER-REFS>
      <SERVICE-RESOURCE-REF DEST="CP-SOFTWARE-
        CLUSTER-SERVICE-RESOURCE">/AUTOSAR/
        CONC_670/SysResPool/
        CpSoftwareClusterResourcePools/
        OsResourcePool/OsTask_10ms</SERVICE-
        RESOURCE-REF>
    </CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
    <CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
      <SHORT-NAME>Res_Map_Disp_50ms_Ph1</SHORT-NAME
        >
      <DESC>
        <L-2 L="EN">Software Cluster resource
          mapping Disp_50ms_Ph1 for the complete
          ECU</L-2>
      </DESC>
      <PROVIDER-REF DEST="CP-SOFTWARE-CLUSTER">/
        AUTOSAR/CONC_670/PCFG_SYS/
        CpSoftwareClusters/SwClu_Host</PROVIDER-
        REF>
      <REQUESTER-REFS>
        <REQUESTER-REF DEST="CP-SOFTWARE-CLUSTER">/
          AUTOSAR/CONC_670/PCFG_SYS/
          CpSoftwareClusters/SwClu_AHB</REQUESTER-
          REF>
      </REQUESTER-REFS>
      <SERVICE-RESOURCE-REF DEST="CP-SOFTWARE-
        CLUSTER-SERVICE-RESOURCE">/AUTOSAR/
        CONC_670/SysResPool/
        CpSoftwareClusterResourcePools/
        OsResourcePool/Disp_50ms_Ph1</SERVICE-
        RESOURCE-REF>
    </CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
    <CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
      <SHORT-NAME>Res_Map_Disp_10ms_Ph1</SHORT-NAME
        >
      <DESC>
        <L-2 L="EN">Software Cluster resource
          mapping Disp_50ms_Ph1 for the complete
          ECU</L-2>
      </DESC>
      <PROVIDER-REF DEST="CP-SOFTWARE-CLUSTER">/
        AUTOSAR/CONC_670/PCFG_SYS/
        CpSoftwareClusters/SwClu_Host</PROVIDER-
        REF>
      <REQUESTER-REFS>
```

```
            <REQUESTER-REF DEST="CP-SOFTWARE-CLUSTER">/
              AUTOSAR/CONC_670/PCFG_SYS/
              CpSoftwareClusters/SwClu_AHB</REQUESTER-
              REF>
          </REQUESTER-REFS>
          <SERVICE-RESOURCE-REF DEST="CP-SOFTWARE-
            CLUSTER-SERVICE-RESOURCE">/AUTOSAR/
            CONC_670/SysResPool/
            CpSoftwareClusterResourcePools/
            OsResourcePool/Disp_10ms_Ph1</SERVICE-
            RESOURCE-REF>
        </CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
      </SOFTWARE-CLUSTER-TO-RESOURCE-MAPPINGS>
      <SW-MAPPINGS>
        <SWC-TO-ECU-MAPPING>
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          <COMPONENT-IREFS>
            <COMPONENT-IREF>
              <CONTEXT-COMPOSITION-REF DEST="ROOT-SW-
                COMPOSITION-PROTOTYPE">/AUTOSAR/
                CONC_670/PCT_TopLvl/Systems/
                System_TopLvl/Sys_TopLvl</CONTEXT-
                COMPOSITION-REF>
              <TARGET-COMPONENT-REF DEST="SW-COMPONENT-
                PROTOTYPE">/AUTOSAR/CONC_670/
                PCT_TopLvl/SwComponentTypes/TopLvl/
                CPT_SwcCompoHost</TARGET-COMPONENT-REF
                >
            </COMPONENT-IREF>
            <COMPONENT-IREF>
              <CONTEXT-COMPOSITION-REF DEST="ROOT-SW-
                COMPOSITION-PROTOTYPE">/AUTOSAR/
                CONC_670/PCT_TopLvl/Systems/
                System_TopLvl/Sys_TopLvl</CONTEXT-
                COMPOSITION-REF>
              <TARGET-COMPONENT-REF DEST="SW-COMPONENT-
                PROTOTYPE">/AUTOSAR/CONC_670/
                PCT_TopLvl/SwComponentTypes/TopLvl/
                CPT_SwcCompoAHB</TARGET-COMPONENT-REF>
            </COMPONENT-IREF>
          </COMPONENT-IREFS>
          <ECU-INSTANCE-REF DEST="ECU-INSTANCE">/
            AUTOSAR/CONC_670/PCFG_SYS/EcuInstances/
            Machine_Host_AHB</ECU-INSTANCE-REF>
        </SWC-TO-ECU-MAPPING>
      </SW-MAPPINGS>
    </SYSTEM-MAPPING>
  </MAPPINGS>
  <ROOT-SOFTWARE-COMPOSITIONS>
    <ROOT-SW-COMPOSITION-PROTOTYPE>
      <SHORT-NAME>Sys_TopLvl</SHORT-NAME>
      <SOFTWARE-COMPOSITION-TREF DEST="COMPOSITION-SW-
        COMPONENT-TYPE">/AUTOSAR/CONC_670/PCT_TopLvl/
        SwComponentTypes/TopLvl</SOFTWARE-COMPOSITION-
        TREF>
    </ROOT-SW-COMPOSITION-PROTOTYPE>
```

```
                    </ROOT-SOFTWARE-COMPOSITIONS>
                    <SW-CLUSTERS>
                      <CP-SOFTWARE-CLUSTER-REF-CONDITIONAL>
                        <CP-SOFTWARE-CLUSTER-REF DEST="CP-SOFTWARE-
                            CLUSTER">/AUTOSAR/CONC_670/PCFG_SYS/
                            CpSoftwareClusters/SwClu_Host</CP-SOFTWARE-
                            CLUSTER-REF>
                      </CP-SOFTWARE-CLUSTER-REF-CONDITIONAL>
                      <CP-SOFTWARE-CLUSTER-REF-CONDITIONAL>
                        <CP-SOFTWARE-CLUSTER-REF DEST="CP-SOFTWARE-
                            CLUSTER">/AUTOSAR/CONC_670/PCFG_SYS/
                            CpSoftwareClusters/SwClu_AHB</CP-SOFTWARE-
                            CLUSTER-REF>
                      </CP-SOFTWARE-CLUSTER-REF-CONDITIONAL>
                    </SW-CLUSTERS>
                    <SYSTEM-VERSION>1.0.0</SYSTEM-VERSION>
                  </SYSTEM>
                </ELEMENTS>
              </AR-PACKAGE>
            </AR-PACKAGES>
          </AR-PACKAGE>
        </AR-PACKAGES>
      </AR-PACKAGE>
    </AR-PACKAGES>
  </AR-PACKAGE>
</AUTOSAR>
```

A.11 DOC_SwCluC_Sys_HWT.arxml

Listing A.11: DOC_SwCluC_Sys_HWT.arxml

```
<AUTOSAR xmlns="http://autosar.org/schema/r4.0" xmlns:xsi="http://www.w3.
    org/2001/XMLSchema-instance" xsi:schemaLocation="http://autosar.org/
    schema/r4.0␣AUTOSAR_00046.xsd">
  <AR-PACKAGES>
    <AR-PACKAGE>
      <SHORT-NAME>AUTOSAR</SHORT-NAME>
      <AR-PACKAGES>
        <AR-PACKAGE>
          <SHORT-NAME>CONC_670</SHORT-NAME>
          <AR-PACKAGES>
            <AR-PACKAGE>
              <SHORT-NAME>PCFG_SYS</SHORT-NAME>
              <AR-PACKAGES>
                <AR-PACKAGE>
                  <SHORT-NAME>EcuInstances</SHORT-NAME>
                  <ELEMENTS>
                    <ECU-INSTANCE>
                      <SHORT-NAME>Machine_Host_AHB</SHORT-NAME>
                    </ECU-INSTANCE>
                  </ELEMENTS>
```

```
            </AR-PACKAGE>
          </AR-PACKAGES>
        </AR-PACKAGE>
      </AR-PACKAGES>
    </AR-PACKAGE>
  </AR-PACKAGES>
</AUTOSAR>
```

A.12 DOC_SwCluC_Sys_ResPoolCommunicationResources.arxml

Listing A.12: DOC_SwCluC_Sys_ResPoolCommunicationResources.arxml

```
<AUTOSAR xmlns="http://autosar.org/schema/r4.0" xmlns:xsi="http://www.w3.
    org/2001/XMLSchema-instance" xsi:schemaLocation="http://autosar.org/
    schema/r4.0 AUTOSAR_00049.xsd">
  <AR-PACKAGES>
    <AR-PACKAGE>
      <SHORT-NAME>AUTOSAR</SHORT-NAME>
      <AR-PACKAGES>
        <AR-PACKAGE>
          <SHORT-NAME>CONC_670</SHORT-NAME>
          <AR-PACKAGES>
            <AR-PACKAGE>
              <SHORT-NAME>SysResPool</SHORT-NAME>
              <AR-PACKAGES>
                <AR-PACKAGE>
                  <SHORT-NAME>CpSoftwareClusterResourcePools</SHORT-NAME>
                  <ELEMENTS>
                    <CP-SOFTWARE-CLUSTER-RESOURCE-POOL>
                      <SHORT-NAME>ComResourcePool</SHORT-NAME>
                      <RESOURCES>
                        <CP-SOFTWARE-CLUSTER-COMMUNICATION-RESOURCE>
                          <SHORT-NAME>Anton</SHORT-NAME>
                          <GLOBAL-RESOURCE-ID>0xda1a0001</GLOBAL-RESOURCE-
                              ID>
                          <IS-MANDATORY>false</IS-MANDATORY>
                          <COM-PROPS>
                            <SEND-INDICATION>NONE</SEND-INDICATION>
                          </COM-PROPS>
                        </CP-SOFTWARE-CLUSTER-COMMUNICATION-RESOURCE>
                        <CP-SOFTWARE-CLUSTER-COMMUNICATION-RESOURCE>
                          <SHORT-NAME>Bernd</SHORT-NAME>
                          <GLOBAL-RESOURCE-ID>0xda1a0002</GLOBAL-RESOURCE-
                              ID>
                          <IS-MANDATORY>false</IS-MANDATORY>
                          <COM-PROPS>
                            <SEND-INDICATION>NONE</SEND-INDICATION>
                          </COM-PROPS>
                        </CP-SOFTWARE-CLUSTER-COMMUNICATION-RESOURCE>
                        <CP-SOFTWARE-CLUSTER-COMMUNICATION-RESOURCE>
```

```
                    <SHORT-NAME>Celine</SHORT-NAME>
                    <GLOBAL-RESOURCE-ID>0xda1a0003</GLOBAL-RESOURCE-
                        ID>
                    <IS-MANDATORY>false</IS-MANDATORY>
                    <COM-PROPS>
                      <SEND-INDICATION>NONE</SEND-INDICATION>
                    </COM-PROPS>
                  </CP-SOFTWARE-CLUSTER-COMMUNICATION-RESOURCE>
                  <CP-SOFTWARE-CLUSTER-COMMUNICATION-RESOURCE>
                    <SHORT-NAME>Hugo</SHORT-NAME>
                    <GLOBAL-RESOURCE-ID>0xda1a0004</GLOBAL-RESOURCE-
                        ID>
                    <IS-MANDATORY>false</IS-MANDATORY>
                    <COM-PROPS>
                      <SEND-INDICATION>NONE</SEND-INDICATION>
                    </COM-PROPS>
                  </CP-SOFTWARE-CLUSTER-COMMUNICATION-RESOURCE>
                </RESOURCES>
              </CP-SOFTWARE-CLUSTER-RESOURCE-POOL>
            </ELEMENTS>
          </AR-PACKAGE>
        </AR-PACKAGES>
      </AR-PACKAGE>
    </AR-PACKAGES>
  </AR-PACKAGE>
</AR-PACKAGES>
</AUTOSAR>
```

A.13 DOC_SwCluC_Sys_ResPoolServiceResources.arxml

Listing A.13: DOC_SwCluC_Sys_ResPoolServiceResources.arxml

```
<AUTOSAR xmlns="http://autosar.org/schema/r4.0" xmlns:xsi="http://www.w3.
    org/2001/XMLSchema-instance" xsi:schemaLocation="http://autosar.org/
    schema/r4.0␣AUTOSAR_00049.xsd">
  <AR-PACKAGES>
    <AR-PACKAGE>
      <SHORT-NAME>AUTOSAR</SHORT-NAME>
      <AR-PACKAGES>
        <AR-PACKAGE>
          <SHORT-NAME>CONC_670</SHORT-NAME>
          <AR-PACKAGES>
            <AR-PACKAGE>
              <SHORT-NAME>SysResPool</SHORT-NAME>
              <AR-PACKAGES>
                <AR-PACKAGE>
                  <SHORT-NAME>CpSoftwareClusterResourcePools</SHORT-NAME>
                  <ELEMENTS>
                    <CP-SOFTWARE-CLUSTER-RESOURCE-POOL>
                      <SHORT-NAME>OsResourcePool</SHORT-NAME>
```

```
<RESOURCES>
  <CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
    <SHORT-NAME>OsBaseSocket_AHB</SHORT-NAME>
    <DESC>
      <L-2 L="EN">OsTask resource according
          SWS_SwCluC_90002</L-2>
    </DESC>
    <CATEGORY>SWCLUSTER_RES_OS_BASE_SOCKET</CATEGORY>
    <GLOBAL-RESOURCE-ID>0x05000000</GLOBAL-RESOURCE-
        ID>
    <IS-MANDATORY>true</IS-MANDATORY>
  </CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
  <CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
    <SHORT-NAME>OsTask_1ms</SHORT-NAME>
    <DESC>
      <L-2 L="EN">OsTask resource according
          SWS_SwCluC_90004</L-2>
    </DESC>
    <CATEGORY>SWCLUSTER_RES_OS_TASK</CATEGORY>
    <GLOBAL-RESOURCE-ID>0x05000001</GLOBAL-RESOURCE-
        ID>
    <IS-MANDATORY>true</IS-MANDATORY>
    <RESOURCE-NEEDS-REFS>
      <RESOURCE-NEEDS-REF DEST="ECUC-CONTAINER-VALUE"
          >/AUTOSAR/CONC_670/SysResPool/
          EcucModuleConfigurationValuess/
          OsResourceNeeds/OsTask_1ms</RESOURCE-NEEDS-
          REF>
    </RESOURCE-NEEDS-REFS>
  </CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
  <CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
    <SHORT-NAME>OsTask_5ms</SHORT-NAME>
    <DESC>
      <L-2 L="EN">OsTask resource according
          SWS_SwCluC_90004</L-2>
    </DESC>
    <CATEGORY>SWCLUSTER_RES_OS_TASK</CATEGORY>
    <GLOBAL-RESOURCE-ID>0x05000002</GLOBAL-RESOURCE-
        ID>
    <IS-MANDATORY>true</IS-MANDATORY>
    <RESOURCE-NEEDS-REFS>
      <RESOURCE-NEEDS-REF DEST="ECUC-CONTAINER-VALUE"
          >/AUTOSAR/CONC_670/SysResPool/
          EcucModuleConfigurationValuess/
          OsResourceNeeds/OsTask_5ms</RESOURCE-NEEDS-
          REF>
    </RESOURCE-NEEDS-REFS>
  </CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
  <CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
    <SHORT-NAME>OsTask_50ms</SHORT-NAME>
    <DESC>
      <L-2 L="EN">OsTask resource according
          SWS_SwCluC_90004</L-2>
    </DESC>
    <CATEGORY>SWCLUSTER_RES_OS_TASK</CATEGORY>
```

```
      <GLOBAL-RESOURCE-ID>0x05000003</GLOBAL-RESOURCE-
          ID>
      <IS-MANDATORY>true</IS-MANDATORY>
      <RESOURCE-NEEDS-REFS>
        <RESOURCE-NEEDS-REF DEST="ECUC-CONTAINER-VALUE"
            >/AUTOSAR/CONC_670/SysResPool/
            EcucModuleConfigurationValuess/
            OsResourceNeeds/OsTask_50ms</RESOURCE-NEEDS-
            REF>
      </RESOURCE-NEEDS-REFS>
    </CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
    <CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
      <SHORT-NAME>OsTask_10ms</SHORT-NAME>
      <DESC>
        <L-2 L="EN">OsTask resource according
            SWS_SwCluC_90004</L-2>
      </DESC>
      <CATEGORY>SWCLUSTER_RES_OS_TASK</CATEGORY>
      <GLOBAL-RESOURCE-ID>0x05000004</GLOBAL-RESOURCE-
          ID>
      <IS-MANDATORY>true</IS-MANDATORY>
      <RESOURCE-NEEDS-REFS>
        <RESOURCE-NEEDS-REF DEST="ECUC-CONTAINER-VALUE"
            >/AUTOSAR/CONC_670/SysResPool/
            EcucModuleConfigurationValuess/
            OsResourceNeeds/OsTask_10ms</RESOURCE-NEEDS-
            REF>
      </RESOURCE-NEEDS-REFS>
    </CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
    <CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
      <SHORT-NAME>Disp_1ms_Ph1</SHORT-NAME>
      <DESC>
        <L-2 L="EN">Task dispatcher resource according
            SWS_SwCluC_90007</L-2>
      </DESC>
      <CATEGORY>SWCLUSTER_RES_OS_TASK_DISPATCHER</
          CATEGORY>
      <GLOBAL-RESOURCE-ID>0x05000005</GLOBAL-RESOURCE-
          ID>
      <IS-MANDATORY>true</IS-MANDATORY>
      <RESOURCE-NEEDS-REFS>
        <RESOURCE-NEEDS-REF DEST="ECUC-CONTAINER-VALUE"
            >/AUTOSAR/CONC_670/SysResPool/
            EcucModuleConfigurationValuess/
            OsResourceNeeds/OsTask_1ms</RESOURCE-NEEDS-
            REF>
      </RESOURCE-NEEDS-REFS>
    </CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
    <CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
      <SHORT-NAME>Disp_5ms_Ph1</SHORT-NAME>
      <DESC>
        <L-2 L="EN">Task dispatcher resource according
            SWS_SwCluC_90007</L-2>
      </DESC>
      <CATEGORY>SWCLUSTER_RES_OS_TASK_DISPATCHER</
          CATEGORY>
```

```
    <GLOBAL-RESOURCE-ID>0x05000006</GLOBAL-RESOURCE-
      ID>
    <IS-MANDATORY>true</IS-MANDATORY>
    <RESOURCE-NEEDS-REFS>
      <RESOURCE-NEEDS-REF DEST="ECUC-CONTAINER-VALUE"
        >/AUTOSAR/CONC_670/SysResPool/
        EcucModuleConfigurationValuess/
        OsResourceNeeds/OsTask_5ms</RESOURCE-NEEDS-
        REF>
    </RESOURCE-NEEDS-REFS>
  </CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
  <CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
    <SHORT-NAME>Disp_5ms_Ph2</SHORT-NAME>
    <DESC>
      <L-2 L="EN">Task dispatcher resource according
        SWS_SwCluC_90007</L-2>
    </DESC>
    <CATEGORY>SWCLUSTER_RES_OS_TASK_DISPATCHER</
      CATEGORY>
    <GLOBAL-RESOURCE-ID>0x05000007</GLOBAL-RESOURCE-
      ID>
    <IS-MANDATORY>true</IS-MANDATORY>
    <RESOURCE-NEEDS-REFS>
      <RESOURCE-NEEDS-REF DEST="ECUC-CONTAINER-VALUE"
        >/AUTOSAR/CONC_670/SysResPool/
        EcucModuleConfigurationValuess/
        OsResourceNeeds/OsTask_5ms</RESOURCE-NEEDS-
        REF>
    </RESOURCE-NEEDS-REFS>
  </CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
  <CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
    <SHORT-NAME>Disp_50ms_Ph1</SHORT-NAME>
    <DESC>
      <L-2 L="EN">Task dispatcher resource according
        SWS_SwCluC_90007</L-2>
    </DESC>
    <CATEGORY>SWCLUSTER_RES_OS_TASK_DISPATCHER</
      CATEGORY>
    <GLOBAL-RESOURCE-ID>0x05000008</GLOBAL-RESOURCE-
      ID>
    <IS-MANDATORY>true</IS-MANDATORY>
    <RESOURCE-NEEDS-REFS>
      <RESOURCE-NEEDS-REF DEST="ECUC-CONTAINER-VALUE"
        >/AUTOSAR/CONC_670/SysResPool/
        EcucModuleConfigurationValuess/
        OsResourceNeeds/OsTask_50ms</RESOURCE-NEEDS-
        REF>
    </RESOURCE-NEEDS-REFS>
  </CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
  <CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
    <SHORT-NAME>Disp_50ms_Ph2</SHORT-NAME>
    <DESC>
      <L-2 L="EN">Task dispatcher resource according
        SWS_SwCluC_90007</L-2>
    </DESC>
```

```
        <CATEGORY>SWCLUSTER_RES_OS_TASK_DISPATCHER</
            CATEGORY>
        <GLOBAL-RESOURCE-ID>0x05000009</GLOBAL-RESOURCE-
            ID>
        <IS-MANDATORY>true</IS-MANDATORY>
        <RESOURCE-NEEDS-REFS>
          <RESOURCE-NEEDS-REF DEST="ECUC-CONTAINER-VALUE"
              >/AUTOSAR/CONC_670/SysResPool/
              EcucModuleConfigurationValuess/
              OsResourceNeeds/OsTask_50ms</RESOURCE-NEEDS-
              REF>
        </RESOURCE-NEEDS-REFS>
      </CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
      <CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
        <SHORT-NAME>Disp_10ms_Ph1</SHORT-NAME>
        <DESC>
          <L-2 L="EN">Task dispatcher resource according
              SWS_SwCluC_90007</L-2>
        </DESC>
        <CATEGORY>SWCLUSTER_RES_OS_TASK_DISPATCHER</
            CATEGORY>
        <GLOBAL-RESOURCE-ID>0x0500000a</GLOBAL-RESOURCE-
            ID>
        <IS-MANDATORY>true</IS-MANDATORY>
        <RESOURCE-NEEDS-REFS>
          <RESOURCE-NEEDS-REF DEST="ECUC-CONTAINER-VALUE"
              >/AUTOSAR/CONC_670/SysResPool/
              EcucModuleConfigurationValuess/
              OsResourceNeeds/OsTask_10ms</RESOURCE-NEEDS-
              REF>
        </RESOURCE-NEEDS-REFS>
      </CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
      <CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
        <SHORT-NAME>Disp_10ms_Ph2</SHORT-NAME>
        <DESC>
          <L-2 L="EN">Task dispatcher resource according
              SWS_SwCluC_90007</L-2>
        </DESC>
        <CATEGORY>SWCLUSTER_RES_OS_TASK_DISPATCHER</
            CATEGORY>
        <GLOBAL-RESOURCE-ID>0x0500000b</GLOBAL-RESOURCE-
            ID>
        <IS-MANDATORY>true</IS-MANDATORY>
        <RESOURCE-NEEDS-REFS>
          <RESOURCE-NEEDS-REF DEST="ECUC-CONTAINER-VALUE"
              >/AUTOSAR/CONC_670/SysResPool/
              EcucModuleConfigurationValuess/
              OsResourceNeeds/OsTask_10ms</RESOURCE-NEEDS-
              REF>
        </RESOURCE-NEEDS-REFS>
      </CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
    </RESOURCES>
  </CP-SOFTWARE-CLUSTER-RESOURCE-POOL>
  <CP-SOFTWARE-CLUSTER-RESOURCE-POOL>
    <SHORT-NAME>SwClusCResourcePool</SHORT-NAME>
    <RESOURCES>
```

```
                        <CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
                          <SHORT-NAME>BaseConfigCheck_AHB</SHORT-NAME>
                          <DESC>
                            <L-2 L="EN">Base Configuration Check for AHB
                               according SWS_SwCluC_90000</L-2>
                          </DESC>
                          <CATEGORY>SWCLUSTER_RES_BASE_CNF</CATEGORY>
                          <GLOBAL-RESOURCE-ID>0xba5e0001</GLOBAL-RESOURCE-
                             ID>
                          <IS-MANDATORY>true</IS-MANDATORY>
                        </CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
                        <CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
                          <SHORT-NAME>XccBaseSocket_AHB</SHORT-NAME>
                          <DESC>
                            <L-2 L="EN">Xcc Base Socket for AHB according
                               SWS_SwCluC_90008</L-2>
                          </DESC>
                          <CATEGORY>SWCLUSTER_RES_XCC_BASE_SOCKET</CATEGORY
                             >
                          <GLOBAL-RESOURCE-ID>0xba5e0002</GLOBAL-RESOURCE-
                             ID>
                          <IS-MANDATORY>true</IS-MANDATORY>
                        </CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE>
                      </RESOURCES>
                    </CP-SOFTWARE-CLUSTER-RESOURCE-POOL>
                  </ELEMENTS>
                </AR-PACKAGE>
              </AR-PACKAGES>
            </AR-PACKAGE>
          </AR-PACKAGES>
        </AR-PACKAGE>
      </AR-PACKAGES>
    </AR-PACKAGE>
  </AR-PACKAGES>
</AUTOSAR>
```

A.14 DOC_SwCluC_Sys_ResPoolServiceResourceNeeds.arxml

Listing A.14: DOC_SwCluC_Sys_ResPoolServiceResourceNeeds.arxml

```
<AUTOSAR xmlns="http://autosar.org/schema/r4.0" xmlns:xsi="http://www.w3.
    org/2001/XMLSchema-instance" xsi:schemaLocation="http://autosar.org/
    schema/r4.0␣AUTOSAR_00044.xsd">
  <AR-PACKAGES>
    <AR-PACKAGE>
      <SHORT-NAME>AUTOSAR</SHORT-NAME>
      <AR-PACKAGES>
        <AR-PACKAGE>
          <SHORT-NAME>CONC_670</SHORT-NAME>
          <AR-PACKAGES>
            <AR-PACKAGE>
              <SHORT-NAME>SysResPool</SHORT-NAME>
```

```
<AR-PACKAGES>
  <AR-PACKAGE>
    <SHORT-NAME>EcucModuleConfigurationValuess</SHORT-NAME>
    <ELEMENTS>
      <ECUC-MODULE-CONFIGURATION-VALUES>
        <SHORT-NAME>OsResourceNeeds</SHORT-NAME>
        <DEFINITION-REF DEST="ECUC-MODULE-DEF">/AUTOSAR/
            EcucDefs/Os</DEFINITION-REF>
        <ECUC-DEF-EDITION>1.0.0</ECUC-DEF-EDITION>
        <CONTAINERS>
          <ECUC-CONTAINER-VALUE>
            <SHORT-NAME>OsTask_1ms</SHORT-NAME>
            <DEFINITION-REF DEST="ECUC-PARAM-CONF-CONTAINER-
                DEF">/AUTOSAR/EcucDefs/Os/OsTask</DEFINITION-
                REF>
            <PARAMETER-VALUES>
              <ECUC-NUMERICAL-PARAM-VALUE>
                <DEFINITION-REF DEST="ECUC-INTEGER-PARAM-DEF"
                    >/AUTOSAR/EcucDefs/Os/OsTask/
                    OsTaskPriority</DEFINITION-REF>
                <VALUE>1</VALUE>
              </ECUC-NUMERICAL-PARAM-VALUE>
              <ECUC-TEXTUAL-PARAM-VALUE>
                <DEFINITION-REF DEST="ECUC-ENUMERATION-PARAM-
                    DEF">/AUTOSAR/EcucDefs/Os/OsTask/
                    OsTaskSchedule</DEFINITION-REF>
                <VALUE>NON</VALUE>
              </ECUC-TEXTUAL-PARAM-VALUE>
            </PARAMETER-VALUES>
          </ECUC-CONTAINER-VALUE>
          <ECUC-CONTAINER-VALUE>
            <SHORT-NAME>OsTask_5ms</SHORT-NAME>
            <DEFINITION-REF DEST="ECUC-PARAM-CONF-CONTAINER-
                DEF">/AUTOSAR/EcucDefs/Os/OsTask</DEFINITION-
                REF>
            <PARAMETER-VALUES>
              <ECUC-NUMERICAL-PARAM-VALUE>
                <DEFINITION-REF DEST="ECUC-INTEGER-PARAM-DEF"
                    >/AUTOSAR/EcucDefs/Os/OsTask/
                    OsTaskPriority</DEFINITION-REF>
                <VALUE>5</VALUE>
              </ECUC-NUMERICAL-PARAM-VALUE>
              <ECUC-TEXTUAL-PARAM-VALUE>
                <DEFINITION-REF DEST="ECUC-ENUMERATION-PARAM-
                    DEF">/AUTOSAR/EcucDefs/Os/OsTask/
                    OsTaskSchedule</DEFINITION-REF>
                <VALUE>FULL</VALUE>
              </ECUC-TEXTUAL-PARAM-VALUE>
            </PARAMETER-VALUES>
          </ECUC-CONTAINER-VALUE>
          <ECUC-CONTAINER-VALUE>
            <SHORT-NAME>OsTask_10ms</SHORT-NAME>
            <DEFINITION-REF DEST="ECUC-PARAM-CONF-CONTAINER-
                DEF">/AUTOSAR/EcucDefs/Os/OsTask</DEFINITION-
                REF>
            <PARAMETER-VALUES>
```

```
                    <ECUC-NUMERICAL-PARAM-VALUE>
                      <DEFINITION-REF DEST="ECUC-INTEGER-PARAM-DEF"
                          >/AUTOSAR/EcucDefs/Os/OsTask/
                          OsTaskPriority</DEFINITION-REF>
                      <VALUE>10</VALUE>
                    </ECUC-NUMERICAL-PARAM-VALUE>
                    <ECUC-TEXTUAL-PARAM-VALUE>
                      <DEFINITION-REF DEST="ECUC-ENUMERATION-PARAM-
                          DEF">/AUTOSAR/EcucDefs/Os/OsTask/
                          OsTaskSchedule</DEFINITION-REF>
                      <VALUE>FULL</VALUE>
                    </ECUC-TEXTUAL-PARAM-VALUE>
                  </PARAMETER-VALUES>
                </ECUC-CONTAINER-VALUE>
                <ECUC-CONTAINER-VALUE>
                  <SHORT-NAME>OsTask_50ms</SHORT-NAME>
                  <DEFINITION-REF DEST="ECUC-PARAM-CONF-CONTAINER-
                      DEF">/AUTOSAR/EcucDefs/Os/OsTask</DEFINITION-
                      REF>
                  <PARAMETER-VALUES>
                    <ECUC-NUMERICAL-PARAM-VALUE>
                      <DEFINITION-REF DEST="ECUC-INTEGER-PARAM-DEF"
                          >/AUTOSAR/EcucDefs/Os/OsTask/
                          OsTaskPriority</DEFINITION-REF>
                      <VALUE>50</VALUE>
                    </ECUC-NUMERICAL-PARAM-VALUE>
                    <ECUC-TEXTUAL-PARAM-VALUE>
                      <DEFINITION-REF DEST="ECUC-ENUMERATION-PARAM-
                          DEF">/AUTOSAR/EcucDefs/Os/OsTask/
                          OsTaskSchedule</DEFINITION-REF>
                      <VALUE>FULL</VALUE>
                    </ECUC-TEXTUAL-PARAM-VALUE>
                  </PARAMETER-VALUES>
                </ECUC-CONTAINER-VALUE>
              </CONTAINERS>
            </ECUC-MODULE-CONFIGURATION-VALUES>
          </ELEMENTS>
        </AR-PACKAGE>
      </AR-PACKAGES>
    </AR-PACKAGE>
  </AR-PACKAGES>
</AUTOSAR>
```

A.15 DOC_SwCluC_Sys_Extr_Host.arxml

Listing A.15: DOC_SwCluC_Sys_Extr_Host.arxml

```
<AUTOSAR xmlns="http://autosar.org/schema/r4.0"
```

```
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation=
    "http://autosar.org/schema/r4.0␣AUTOSAR_4-0-1.xsd">
<ADMIN-DATA>
  <USED-LANGUAGES></USED-LANGUAGES>
</ADMIN-DATA>
<AR-PACKAGES>
  <AR-PACKAGE>
    <SHORT-NAME>AUTOSAR</SHORT-NAME>
    <AR-PACKAGES>
      <AR-PACKAGE>
        <SHORT-NAME>CONC_670</SHORT-NAME>
        <AR-PACKAGES>
          <AR-PACKAGE>
            <SHORT-NAME>PCFG_SYS</SHORT-NAME>
            <AR-PACKAGES>
              <AR-PACKAGE>
                <SHORT-NAME>Systems</SHORT-NAME>
                <ELEMENTS>
                  <SYSTEM>
                    <SHORT-NAME>System_Host</SHORT-NAME>
                    <CATEGORY>SW_CLUSTER_SYSTEM_DESCRIPTION</CATEGORY>
                    <MAPPINGS>
                      <SYSTEM-MAPPING>
                        <SHORT-NAME>Sys_Host_Maps</SHORT-NAME>
                        <PORT-ELEMENT-TO-COM-RESOURCE-MAPPINGS>
                          <PORT-ELEMENT-TO-COMMUNICATION-RESOURCE-MAPPING
                              >
                            <SHORT-NAME>Res_Map_DE_Bernd</SHORT-NAME>
                            <COMMUNICATION-RESOURCE-REF DEST="CP-SOFTWARE
                                -CLUSTER-COMMUNICATION-RESOURCE">/AUTOSAR/
                                CONC_670/SysResPool/
                                CpSoftwareClusterResourcePools/
                                ComResourcePool/Bernd</COMMUNICATION-
                                RESOURCE-REF>
                            <VARIABLE-DATA-PROTOTYPE-IREF>
                              <CONTEXT-COMPONENT-REF DEST="SW-COMPONENT-
                                  PROTOTYPE">/AUTOSAR/CONC_670/PCT_TopLvl/
                                  SwComponentTypes/TopLvl/CPT_SwcCompoHost
                                  </CONTEXT-COMPONENT-REF>
                              <CONTEXT-COMPOSITION-REF DEST="ROOT-SW-
                                  COMPOSITION-PROTOTYPE">/AUTOSAR/CONC_670
                                  /PCFG_SYS/Systems/System_Host/
                                  Sys_SWCluster_Host</CONTEXT-COMPOSITION-
                                  REF>
                              <CONTEXT-PORT-REF DEST="R-PORT-PROTOTYPE">/
                                  AUTOSAR/CONC_670/SwcCompoHost/
                                  SwComponentTypes/SwcCompoHost/RP_Bernd</
                                  CONTEXT-PORT-REF>
                              <TARGET-DATA-PROTOTYPE-REF DEST="VARIABLE-
                                  DATA-PROTOTYPE">/AUTOSAR/CONC_670/
                                  SwcCompoHost/PortInterfaces/IF_Bernd/
                                  Bernd</TARGET-DATA-PROTOTYPE-REF>
                            </VARIABLE-DATA-PROTOTYPE-IREF>
                          </PORT-ELEMENT-TO-COMMUNICATION-RESOURCE-
                              MAPPING>
```

```
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    >
  <SHORT-NAME>Res_Map_DE_Celine</SHORT-NAME>
  <COMMUNICATION-RESOURCE-REF DEST="CP-SOFTWARE
      -CLUSTER-COMMUNICATION-RESOURCE">/AUTOSAR/
      CONC_670/SysResPool/
      CpSoftwareClusterResourcePools/
      ComResourcePool/Celine</COMMUNICATION-
      RESOURCE-REF>
  <VARIABLE-DATA-PROTOTYPE-IREF>
    <CONTEXT-COMPONENT-REF DEST="SW-COMPONENT-
        PROTOTYPE">/AUTOSAR/CONC_670/PCT_TopLvl/
        SwComponentTypes/TopLvl/CPT_SwcCompoHost
        </CONTEXT-COMPONENT-REF>
    <CONTEXT-COMPOSITION-REF DEST="ROOT-SW-
        COMPOSITION-PROTOTYPE">/AUTOSAR/CONC_670
        /PCFG_SYS/Systems/System_Host/
        Sys_SWCluster_Host</CONTEXT-COMPOSITION-
        REF>
    <CONTEXT-PORT-REF DEST="P-PORT-PROTOTYPE">/
        AUTOSAR/CONC_670/SwcCompoHost/
        SwComponentTypes/SwcCompoHost/PP_Celine<
        /CONTEXT-PORT-REF>
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        DATA-PROTOTYPE">/AUTOSAR/CONC_670/
        SwcCompoHost/PortInterfaces/IF_Celine/
        Celine</TARGET-DATA-PROTOTYPE-REF>
  </VARIABLE-DATA-PROTOTYPE-IREF>
</PORT-ELEMENT-TO-COMMUNICATION-RESOURCE-
    MAPPING>
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    >
  <SHORT-NAME>Res_Map_DE_Hugo</SHORT-NAME>
  <COMMUNICATION-RESOURCE-REF DEST="CP-SOFTWARE
      -CLUSTER-COMMUNICATION-RESOURCE">/AUTOSAR/
      CONC_670/SysResPool/
      CpSoftwareClusterResourcePools/
      ComResourcePool/Celine</COMMUNICATION-
      RESOURCE-REF>
  <VARIABLE-DATA-PROTOTYPE-IREF>
    <CONTEXT-COMPONENT-REF DEST="SW-COMPONENT-
        PROTOTYPE">/AUTOSAR/CONC_670/PCT_TopLvl/
        SwComponentTypes/TopLvl/CPT_SwcCompoHost
        </CONTEXT-COMPONENT-REF>
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        /PCFG_SYS/Systems/System_Host/
        Sys_SWCluster_Host</CONTEXT-COMPOSITION-
        REF>
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        AUTOSAR/CONC_670/SwcCompoHost/
        SwComponentTypes/SwcCompoHost/RP_Hugo</
        CONTEXT-PORT-REF>
```

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            SwcCompoHost/PortInterfaces/IF_Hugo/Hugo
            </TARGET-DATA-PROTOTYPE-REF>
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         SHORT-NAME>
      <DESC>
        <L-2 L="EN">Software Cluster resource
           mapping Base Config Check AHB for the
           complete ECU</L-2>
      </DESC>
      <PROVIDER-REF DEST="CP-SOFTWARE-CLUSTER">/
         AUTOSAR/CONC_670/PCFG_SYS/
         CpSoftwareClusters/SwClu_Host</PROVIDER-
         REF>
      <SERVICE-RESOURCE-REF DEST="CP-SOFTWARE-
         CLUSTER-SERVICE-RESOURCE">/AUTOSAR/
         CONC_670/SysResPool/
         CpSoftwareClusterResourcePools/
         SwClusCResourcePool/BaseConfigCheck_AHB</
         SERVICE-RESOURCE-REF>
    </CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
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      <SHORT-NAME>Res_Map_XccBaseSocket_AHB</SHORT-
         NAME>
      <DESC>
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           mapping Xcc Base Socket AHB for the
           complete ECU</L-2>
      </DESC>
      <PROVIDER-REF DEST="CP-SOFTWARE-CLUSTER">/
         AUTOSAR/CONC_670/PCFG_SYS/
         CpSoftwareClusters/SwClu_Host</PROVIDER-
         REF>
      <SERVICE-RESOURCE-REF DEST="CP-SOFTWARE-
         CLUSTER-SERVICE-RESOURCE">/AUTOSAR/
         CONC_670/SysResPool/
         CpSoftwareClusterResourcePools/
         SwClusCResourcePool/XccBaseSocket_AHB</
         SERVICE-RESOURCE-REF>
    </CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
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         NAME>
      <DESC>
        <L-2 L="EN">Software Cluster resource
           mapping Xcc Base Socket AHB for the
           complete ECU</L-2>
      </DESC>
```

```
    <PROVIDER-REF DEST="CP-SOFTWARE-CLUSTER">/
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      CpSoftwareClusters/SwClu_Host</PROVIDER-
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      CLUSTER-SERVICE-RESOURCE">/AUTOSAR/
      CONC_670/SysResPool/
      CpSoftwareClusterResourcePools/
      OsResourcePool/OsBaseSocket_AHB</SERVICE-
      RESOURCE-REF>
  </CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>

  <CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
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    <DESC>
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        mapping OsTask_50ms for the complete ECU
        </L-2>
    </DESC>
    <PROVIDER-REF DEST="CP-SOFTWARE-CLUSTER">/
      AUTOSAR/CONC_670/PCFG_SYS/
      CpSoftwareClusters/SwClu_Host</PROVIDER-
      REF>
    <SERVICE-RESOURCE-REF DEST="CP-SOFTWARE-
      CLUSTER-SERVICE-RESOURCE">/AUTOSAR/
      CONC_670/SysResPool/
      CpSoftwareClusterResourcePools/
      OsResourcePool/OsTask_50ms</SERVICE-
      RESOURCE-REF>
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  <CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
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    <DESC>
      <L-2 L="EN">Software Cluster resource
        mapping OsTask_10ms for the complete ECU
        </L-2>
    </DESC>
    <PROVIDER-REF DEST="CP-SOFTWARE-CLUSTER">/
      AUTOSAR/CONC_670/PCFG_SYS/
      CpSoftwareClusters/SwClu_Host</PROVIDER-
      REF>
    <SERVICE-RESOURCE-REF DEST="CP-SOFTWARE-
      CLUSTER-SERVICE-RESOURCE">/AUTOSAR/
      CONC_670/SysResPool/
      CpSoftwareClusterResourcePools/
      OsResourcePool/OsTask_10ms</SERVICE-
      RESOURCE-REF>
  </CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
  <CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
    <SHORT-NAME>Res_Map_Disp_50ms_Ph1</SHORT-NAME
      >
    <DESC>
      <L-2 L="EN">Software Cluster resource
        mapping Disp_50ms_Ph1 for the complete
        ECU</L-2>
    </DESC>
```

```
            <PROVIDER-REF DEST="CP-SOFTWARE-CLUSTER">/
              AUTOSAR/CONC_670/PCFG_SYS/
              CpSoftwareClusters/SwClu_Host</PROVIDER-
              REF>
            <SERVICE-RESOURCE-REF DEST="CP-SOFTWARE-
              CLUSTER-SERVICE-RESOURCE">/AUTOSAR/
              CONC_670/SysResPool/
              CpSoftwareClusterResourcePools/
              OsResourcePool/Disp_50ms_Ph1</SERVICE-
              RESOURCE-REF>
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              >
            <DESC>
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                ECU</L-2>
            </DESC>
            <PROVIDER-REF DEST="CP-SOFTWARE-CLUSTER">/
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              CpSoftwareClusters/SwClu_Host</PROVIDER-
              REF>
            <SERVICE-RESOURCE-REF DEST="CP-SOFTWARE-
              CLUSTER-SERVICE-RESOURCE">/AUTOSAR/
              CONC_670/SysResPool/
              CpSoftwareClusterResourcePools/
              OsResourcePool/Disp_10ms_Ph1</SERVICE-
              RESOURCE-REF>
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        </SOFTWARE-CLUSTER-TO-RESOURCE-MAPPINGS>
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            <COMPONENT-IREFS>
              <COMPONENT-IREF>
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                  CONC_670/PCFG_SYS/Systems/System/
                  CPT_TopLvl</CONTEXT-COMPOSITION-REF>
                <TARGET-COMPONENT-REF DEST="SW-COMPONENT-
                  PROTOTYPE">/AUTOSAR/CONC_670/
                  PCT_TopLvl/SwComponentTypes/TopLvl/
                  CPT_SwcCompoHost</TARGET-COMPONENT-REF
                  >
              </COMPONENT-IREF>
            </COMPONENT-IREFS>
            <ECU-INSTANCE-REF DEST="ECU-INSTANCE">/
              AUTOSAR/CONC_670/PCFG_SYS/EcuInstances/
              Machine_Host_AHB</ECU-INSTANCE-REF>
          </SWC-TO-ECU-MAPPING>
        </SW-MAPPINGS>
      </SYSTEM-MAPPING>
    </MAPPINGS>
    <ROOT-SOFTWARE-COMPOSITIONS>
      <ROOT-SW-COMPOSITION-PROTOTYPE>
```

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                        <SHORT-NAME>Sys_SWCluster_Host</SHORT-NAME>
                        <SOFTWARE-COMPOSITION-TREF DEST="COMPOSITION-SW-
                            COMPONENT-TYPE">/AUTOSAR/CONC_670/PCT_TopLvl/
                            SwComponentTypes/TopLvl</SOFTWARE-COMPOSITION-
                            TREF>
                      </ROOT-SW-COMPOSITION-PROTOTYPE>
                    </ROOT-SOFTWARE-COMPOSITIONS>
                    <SW-CLUSTERS>
                      <CP-SOFTWARE-CLUSTER-REF-CONDITIONAL>
                        <CP-SOFTWARE-CLUSTER-REF DEST="CP-SOFTWARE-
                            CLUSTER">/AUTOSAR/CONC_670/PCFG_SYS/
                            CpSoftwareClusters/SwClu_Host</CP-SOFTWARE-
                            CLUSTER-REF>
                      </CP-SOFTWARE-CLUSTER-REF-CONDITIONAL>
                    </SW-CLUSTERS>
                  </SYSTEM>
                </ELEMENTS>
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            </AR-PACKAGES>
          </AR-PACKAGE>
        </AR-PACKAGES>
      </AR-PACKAGE>
    </AR-PACKAGES>
  </AR-PACKAGE>
</AR-PACKAGES>
</AUTOSAR>
```

A.16 DOC_SwCluC_Sys_Extr_TopLvl_SWCD_Host.arxml

Listing A.16: DOC_SwCluC_Sys_Extr_TopLvl_SWCD_Host.arxml

```
<AUTOSAR xmlns="http://autosar.org/schema/r4.0" xmlns:xsi="http://www.w3.
    org/2001/XMLSchema-instance" xsi:schemaLocation="http://autosar.org/
    schema/r4.0␣AUTOSAR_00044.xsd">
  <AR-PACKAGES>
    <AR-PACKAGE>
      <SHORT-NAME>AUTOSAR</SHORT-NAME>
      <AR-PACKAGES>
        <AR-PACKAGE>
          <SHORT-NAME>CONC_670</SHORT-NAME>
          <AR-PACKAGES>
            <AR-PACKAGE>
              <SHORT-NAME>PCT_TopLvl</SHORT-NAME>
              <AR-PACKAGES>
                <AR-PACKAGE>
                  <SHORT-NAME>SwComponentTypes</SHORT-NAME>
                  <ELEMENTS>
                    <COMPOSITION-SW-COMPONENT-TYPE>
                      <SHORT-NAME>TopLvl</SHORT-NAME>
                      <COMPONENTS>
                        <SW-COMPONENT-PROTOTYPE>
                          <SHORT-NAME>CPT_SwcCompoHost</SHORT-NAME>
```

```
                        <TYPE-TREF DEST="COMPOSITION-SW-COMPONENT-TYPE">/
                            AUTOSAR/CONC_670/SwcCompoHost/SwComponentTypes
                            /SwcCompoHost</TYPE-TREF>
                      </SW-COMPONENT-PROTOTYPE>
                    </COMPONENTS>
                  </COMPOSITION-SW-COMPONENT-TYPE>
                </ELEMENTS>
              </AR-PACKAGE>
            </AR-PACKAGES>
          </AR-PACKAGE>
        </AR-PACKAGES>
      </AR-PACKAGE>
    </AR-PACKAGES>
  </AR-PACKAGES>
</AUTOSAR>
```

A.17 DOC_SwCluC_Sys_Extr_AHB.arxml

Listing A.17: DOC_SwCluC_Sys_Extr_AHB.arxml

```
<AUTOSAR xmlns="http://autosar.org/schema/r4.0" xmlns:xsi="http://www.w3.
    org/2001/XMLSchema-instance" xsi:schemaLocation="http://autosar.org/
    schema/r4.0␣AUTOSAR_4-0-1.xsd">
  <ADMIN-DATA>
    <USED-LANGUAGES/>
  </ADMIN-DATA>
  <AR-PACKAGES>
    <AR-PACKAGE>
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      <AR-PACKAGES>
        <AR-PACKAGE>
          <SHORT-NAME>CONC_670</SHORT-NAME>
          <AR-PACKAGES>
            <AR-PACKAGE>
              <SHORT-NAME>PCFG_SYS</SHORT-NAME>
              <AR-PACKAGES>
                <AR-PACKAGE>
                  <SHORT-NAME>Systems</SHORT-NAME>
                  <ELEMENTS>
                    <SYSTEM>
                      <SHORT-NAME>System_AHB</SHORT-NAME>
                      <CATEGORY>SW_CLUSTER_SYSTEM_DESCRIPTION</CATEGORY>
                      <MAPPINGS>
                        <SYSTEM-MAPPING>
                          <SHORT-NAME>Sys_AHB_Maps</SHORT-NAME>
                          <PORT-ELEMENT-TO-COM-RESOURCE-MAPPINGS>
                            <PORT-ELEMENT-TO-COMMUNICATION-RESOURCE-MAPPING
                                >
                              <SHORT-NAME>Res_Map_DE_Anton</SHORT-NAME>
```

```
<COMMUNICATION-RESOURCE-REF DEST="CP-SOFTWARE
    -CLUSTER-COMMUNICATION-RESOURCE">/AUTOSAR/
    CONC_670/SysResPool/
    CpSoftwareClusterResourcePools/
    ComResourcePool/Anton</COMMUNICATION-
    RESOURCE-REF>
<VARIABLE-DATA-PROTOTYPE-IREF>
  <CONTEXT-COMPONENT-REF DEST="SW-COMPONENT-
      PROTOTYPE">/AUTOSAR/CONC_670/PCT_TopLvl/
      SwComponentTypes/TopLvl/CPT_SwcCompoAHB<
      /CONTEXT-COMPONENT-REF>
  <CONTEXT-COMPOSITION-REF DEST="ROOT-SW-
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      /PCFG_SYS/Systems/System_AHB/
      Sys_SWCluster_AHB</CONTEXT-COMPOSITION-
      REF>
  <CONTEXT-PORT-REF DEST="P-PORT-PROTOTYPE">/
      AUTOSAR/CONC_670/SwcCompoAHB/
      SwComponentTypes/SwcCompoAHB/PP_Anton</
      CONTEXT-PORT-REF>
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      SwcCompoAHB/PortInterfaces/IF_Anton/
      Anton</TARGET-DATA-PROTOTYPE-REF>
</VARIABLE-DATA-PROTOTYPE-IREF>
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<PORT-ELEMENT-TO-COMMUNICATION-RESOURCE-MAPPING
   >
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    CpSoftwareClusterResourcePools/
    ComResourcePool/Bernd</COMMUNICATION-
    RESOURCE-REF>
<VARIABLE-DATA-PROTOTYPE-IREF>
  <CONTEXT-COMPONENT-REF DEST="SW-COMPONENT-
      PROTOTYPE">/AUTOSAR/CONC_670/PCT_TopLvl/
      SwComponentTypes/TopLvl/CPT_SwcCompoAHB<
      /CONTEXT-COMPONENT-REF>
  <CONTEXT-COMPOSITION-REF DEST="ROOT-SW-
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      /PCFG_SYS/Systems/System_AHB/
      Sys_SWCluster_AHB</CONTEXT-COMPOSITION-
      REF>
  <CONTEXT-PORT-REF DEST="P-PORT-PROTOTYPE">/
      AUTOSAR/CONC_670/SwcCompoAHB/
      SwComponentTypes/SwcCompoAHB/PP_Bernd</
      CONTEXT-PORT-REF>
  <TARGET-DATA-PROTOTYPE-REF DEST="VARIABLE-
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      SwcCompoAHB/PortInterfaces/IF_Bernd/
      Bernd</TARGET-DATA-PROTOTYPE-REF>
</VARIABLE-DATA-PROTOTYPE-IREF>
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    MAPPING>
<PORT-ELEMENT-TO-COMMUNICATION-RESOURCE-MAPPING
    >
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      CONC_670/SysResPool/
      CpSoftwareClusterResourcePools/
      ComResourcePool/Celine</COMMUNICATION-
      RESOURCE-REF>
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        SwComponentTypes/TopLvl/CPT_SwcCompoAHB<
        /CONTEXT-COMPONENT-REF>
    <CONTEXT-COMPOSITION-REF DEST="ROOT-SW-
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        /PCFG_SYS/Systems/System_AHB/
        Sys_SWCluster_AHB</CONTEXT-COMPOSITION-
        REF>
    <CONTEXT-PORT-REF DEST="R-PORT-PROTOTYPE">/
        AUTOSAR/CONC_670/SwcCompoAHB/
        SwComponentTypes/SwcCompoAHB/RP_Celine</
        CONTEXT-PORT-REF>
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        Celine</TARGET-DATA-PROTOTYPE-REF>
  </VARIABLE-DATA-PROTOTYPE-IREF>
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</PORT-ELEMENT-TO-COM-RESOURCE-MAPPINGS>
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        SHORT-NAME>
    <DESC>
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          mapping Base Config Check AHB for the
          complete ECU</L-2>
    </DESC>
    <REQUESTER-REFS>
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          CpSoftwareClusters/SwClu_AHB</REQUESTER-
          REF>
    </REQUESTER-REFS>
    <SERVICE-RESOURCE-REF DEST="CP-SOFTWARE-
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        CONC_670/SysResPool/
        CpSoftwareClusterResourcePools/
        SwClusCResourcePool/BaseConfigCheck_AHB</
        SERVICE-RESOURCE-REF>
  </CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
  <CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
```

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    <SHORT-NAME>Res_Map_XccBaseSocket_AHB</SHORT-
      NAME>
    <DESC>
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        complete ECU</L-2>
    </DESC>
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        CpSoftwareClusters/SwClu_AHB</REQUESTER-
        REF>
    </REQUESTER-REFS>
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      CONC_670/SysResPool/
      CpSoftwareClusterResourcePools/
      SwClusCResourcePool/XccBaseSocket_AHB</
      SERVICE-RESOURCE-REF>
  </CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
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    <SHORT-NAME>Res_Map_OsBaseSocket_AHB</SHORT-
      NAME>
    <DESC>
      <L-2 L="EN">Software Cluster resource
        mapping Xcc Base Socket AHB for the
        complete ECU</L-2>
    </DESC>
    <REQUESTER-REFS>
      <REQUESTER-REF DEST="CP-SOFTWARE-CLUSTER">/
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        CpSoftwareClusters/SwClu_AHB</REQUESTER-
        REF>
    </REQUESTER-REFS>
    <SERVICE-RESOURCE-REF DEST="CP-SOFTWARE-
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      CONC_670/SysResPool/
      CpSoftwareClusterResourcePools/
      OsResourcePool/OsBaseSocket_AHB</SERVICE-
      RESOURCE-REF>
  </CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>

  <CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
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    <DESC>
      <L-2 L="EN">Software Cluster resource
        mapping OsTask_50ms for the complete ECU
        </L-2>
    </DESC>
    <REQUESTER-REFS>
      <REQUESTER-REF DEST="CP-SOFTWARE-CLUSTER">/
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        CpSoftwareClusters/SwClu_AHB</REQUESTER-
        REF>
    </REQUESTER-REFS>
```

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         CpSoftwareClusterResourcePools/
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           </L-2>
      </DESC>
      <REQUESTER-REFS>
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           CpSoftwareClusters/SwClu_AHB</REQUESTER-
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      </REQUESTER-REFS>
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         CpSoftwareClusterResourcePools/
         OsResourcePool/OsTask_10ms</SERVICE-
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         >
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           ECU</L-2>
      </DESC>
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           CpSoftwareClusters/SwClu_AHB</REQUESTER-
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         CpSoftwareClusterResourcePools/
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      <SHORT-NAME>Res_Map_Disp_10ms_Ph1</SHORT-NAME
         >
      <DESC>
        <L-2 L="EN">Software Cluster resource
           mapping Disp_50ms_Ph1 for the complete
           ECU</L-2>
      </DESC>
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                    <REQUESTER-REFS>
                      <REQUESTER-REF DEST="CP-SOFTWARE-CLUSTER">/
                          AUTOSAR/CONC_670/PCFG_SYS/
                          CpSoftwareClusters/SwClu_AHB</REQUESTER-
                          REF>
                    </REQUESTER-REFS>
                    <SERVICE-RESOURCE-REF DEST="CP-SOFTWARE-
                        CLUSTER-SERVICE-RESOURCE">/AUTOSAR/
                        CONC_670/SysResPool/
                        CpSoftwareClusterResourcePools/
                        OsResourcePool/Disp_10ms_Ph1</SERVICE-
                        RESOURCE-REF>
                  </CP-SOFTWARE-CLUSTER-TO-RESOURCE-MAPPING>
                </SOFTWARE-CLUSTER-TO-RESOURCE-MAPPINGS>
                <SW-MAPPINGS>
                  <SWC-TO-ECU-MAPPING>
                    <SHORT-NAME>SWC_AHB_Map</SHORT-NAME>
                    <COMPONENT-IREFS>
                      <COMPONENT-IREF>
                        <CONTEXT-COMPOSITION-REF DEST="ROOT-SW-
                            COMPOSITION-PROTOTYPE">/AUTOSAR/
                            CONC_670/PCFG_SYS/Systems/System/
                            CPT_TopLvl</CONTEXT-COMPOSITION-REF>
                        <TARGET-COMPONENT-REF DEST="SW-COMPONENT-
                            PROTOTYPE">/AUTOSAR/CONC_670/
                            PCT_TopLvl/SwComponentTypes/TopLvl/
                            CPT_SwcCompoAHB</TARGET-COMPONENT-REF>
                      </COMPONENT-IREF>
                    </COMPONENT-IREFS>
                    <ECU-INSTANCE-REF DEST="ECU-INSTANCE">/
                        AUTOSAR/CONC_670/PCFG_SYS/EcuInstances/
                        Machine_Host_AHB</ECU-INSTANCE-REF>
                  </SWC-TO-ECU-MAPPING>
                </SW-MAPPINGS>
              </SYSTEM-MAPPING>
            </MAPPINGS>
            <ROOT-SOFTWARE-COMPOSITIONS>
              <ROOT-SW-COMPOSITION-PROTOTYPE>
                <SHORT-NAME>Sys_SWCluster_AHB</SHORT-NAME>
                <SOFTWARE-COMPOSITION-TREF DEST="COMPOSITION-SW-
                    COMPONENT-TYPE">/AUTOSAR/CONC_670/PCT_TopLvl/
                    SwComponentTypes/TopLvl</SOFTWARE-COMPOSITION-
                    TREF>
              </ROOT-SW-COMPOSITION-PROTOTYPE>
            </ROOT-SOFTWARE-COMPOSITIONS>
            <SW-CLUSTERS>
              <CP-SOFTWARE-CLUSTER-REF-CONDITIONAL>
                <CP-SOFTWARE-CLUSTER-REF DEST="CP-SOFTWARE-
                    CLUSTER">/AUTOSAR/CONC_670/PCFG_SYS/
                    CpSoftwareClusters/SwClu_AHB</CP-SOFTWARE-
                    CLUSTER-REF>
              </CP-SOFTWARE-CLUSTER-REF-CONDITIONAL>
            </SW-CLUSTERS>
          </SYSTEM>
        </ELEMENTS>
      </AR-PACKAGE>
```

```
            </AR-PACKAGES>
          </AR-PACKAGE>
        </AR-PACKAGES>
      </AR-PACKAGE>
    </AR-PACKAGES>
  </AR-PACKAGE>
</AR-PACKAGES>
</AUTOSAR>
```

A.18 DOC_SwCluC_Sys_Extr_TopLvl_SWCD_AHB.arxml

Listing A.18: DOC_SwCluC_Sys_Extr_TopLvl_SWCD_AHB.arxml

```
<AUTOSAR xmlns="http://autosar.org/schema/r4.0" xmlns:xsi="http://www.w3.
    org/2001/XMLSchema-instance" xsi:schemaLocation="http://autosar.org/
    schema/r4.0␣AUTOSAR_00044.xsd">
  <AR-PACKAGES>
    <AR-PACKAGE>
      <SHORT-NAME>AUTOSAR</SHORT-NAME>
      <AR-PACKAGES>
        <AR-PACKAGE>
          <SHORT-NAME>CONC_670</SHORT-NAME>
          <AR-PACKAGES>
            <AR-PACKAGE>
              <SHORT-NAME>PCT_TopLvl</SHORT-NAME>
              <AR-PACKAGES>
                <AR-PACKAGE>
                  <SHORT-NAME>SwComponentTypes</SHORT-NAME>
                  <ELEMENTS>
                    <COMPOSITION-SW-COMPONENT-TYPE>
                      <SHORT-NAME>TopLvl</SHORT-NAME>
                      <COMPONENTS>
                        <SW-COMPONENT-PROTOTYPE>
                          <SHORT-NAME>CPT_SwcCompoAHB</SHORT-NAME>
                          <TYPE-TREF DEST="COMPOSITION-SW-COMPONENT-TYPE">/
                              AUTOSAR/CONC_670/SwcCompoAHB/SwComponentTypes/
                              SwcCompoAHB</TYPE-TREF>
                        </SW-COMPONENT-PROTOTYPE>
                      </COMPONENTS>
                    </COMPOSITION-SW-COMPONENT-TYPE>
                  </ELEMENTS>
                </AR-PACKAGE>
              </AR-PACKAGES>
            </AR-PACKAGE>
          </AR-PACKAGES>
        </AR-PACKAGE>
      </AR-PACKAGES>
    </AR-PACKAGE>
  </AR-PACKAGES>
</AUTOSAR>
```

A.19 DOC_SwCluC_Ecuc_EcuC_AHB.arxml

Listing A.19: DOC_SwCluC_Ecuc_EcuC_AHB.arxml

```
<AUTOSAR xmlns="http://autosar.org/schema/r4.0" xmlns:xsi="http://www.w3.
    org/2001/XMLSchema-instance" xsi:schemaLocation="http://autosar.org/
    schema/r4.0␣AUTOSAR_00044.xsd">
  <AR-PACKAGES>
    <AR-PACKAGE>
      <SHORT-NAME>AUTOSAR_EcuC</SHORT-NAME>
      <AR-PACKAGES>
        <AR-PACKAGE>
          <SHORT-NAME>EcucModuleConfigurationValuess</SHORT-NAME>
          <ELEMENTS>
            <ECUC-MODULE-CONFIGURATION-VALUES>
              <SHORT-NAME>EcuC</SHORT-NAME>
              <DEFINITION-REF DEST="ECUC-MODULE-DEF">/AUTOSAR/EcucDefs/EcuC
                  </DEFINITION-REF>
              <ECUC-DEF-EDITION>1.0.0</ECUC-DEF-EDITION>
              <CONTAINERS>
                <ECUC-CONTAINER-VALUE>
                  <SHORT-NAME>EcucPartitionCollection</SHORT-NAME>
                  <DEFINITION-REF DEST="ECUC-PARAM-CONF-CONTAINER-DEF">/
                      AUTOSAR/EcucDefs/EcuC/EcucPartitionCollection</
                      DEFINITION-REF>
                  <SUB-CONTAINERS>
                    <ECUC-CONTAINER-VALUE>
                      <SHORT-NAME>PartitionCore1QM</SHORT-NAME>
                      <DEFINITION-REF DEST="ECUC-PARAM-CONF-CONTAINER-DEF">
                          /AUTOSAR/EcucDefs/EcuC/EcucPartitionCollection/
                          EcucPartition</DEFINITION-REF>
                      <PARAMETER-VALUES>
                        <ECUC-NUMERICAL-PARAM-VALUE>
                          <DEFINITION-REF DEST="ECUC-BOOLEAN-PARAM-DEF">/
                              AUTOSAR/EcucDefs/EcuC/EcucPartitionCollection/
                              EcucPartition/PartitionCanBeRestarted</
                              DEFINITION-REF>
                          <VALUE>false</VALUE>
                        </ECUC-NUMERICAL-PARAM-VALUE>
                        <ECUC-NUMERICAL-PARAM-VALUE>
                          <DEFINITION-REF DEST="ECUC-BOOLEAN-PARAM-DEF">/
                              AUTOSAR/EcucDefs/EcuC/EcucPartitionCollection/
                              EcucPartition/EcucDefaultBswPartition</
                              DEFINITION-REF>
                          <VALUE>true</VALUE>
                        </ECUC-NUMERICAL-PARAM-VALUE>
                      </PARAMETER-VALUES>
                    </ECUC-CONTAINER-VALUE>
                  </SUB-CONTAINERS>
                </ECUC-CONTAINER-VALUE>
              </CONTAINERS>
            </ECUC-MODULE-CONFIGURATION-VALUES>
          </ELEMENTS>
        </AR-PACKAGE>
```

```
      </AR-PACKAGES>
    </AR-PACKAGE>
  </AR-PACKAGES>
</AUTOSAR>
```

A.20 DOC_SwCluC_Ecuc_Os_AHB.arxml

Listing A.20: DOC_SwCluC_Ecuc_Os_AHB.arxml

```
<AUTOSAR xmlns="http://autosar.org/schema/r4.0" xmlns:xsi="http://www.w3.
    org/2001/XMLSchema-instance" xsi:schemaLocation="http://autosar.org/
    schema/r4.0␣AUTOSAR_00044.xsd">
  <AR-PACKAGES>
    <AR-PACKAGE>
      <SHORT-NAME>AUTOSAR_Os</SHORT-NAME>
      <AR-PACKAGES>
        <AR-PACKAGE>
          <SHORT-NAME>EcucModuleConfigurationValuess</SHORT-NAME>
          <ELEMENTS>
            <ECUC-MODULE-CONFIGURATION-VALUES>
              <SHORT-NAME>Os</SHORT-NAME>
              <DEFINITION-REF DEST="ECUC-MODULE-DEF">/AUTOSAR/EcucDefs/Os</
                  DEFINITION-REF>
              <ECUC-DEF-EDITION>1.0.0</ECUC-DEF-EDITION>
              <CONTAINERS>
                <ECUC-CONTAINER-VALUE>
                  <SHORT-NAME>Core1QM</SHORT-NAME>
                  <DEFINITION-REF DEST="ECUC-PARAM-CONF-CONTAINER-DEF">/
                      AUTOSAR/EcucDefs/Os/OsApplication</DEFINITION-REF>
                  <REFERENCE-VALUES>
                    <ECUC-REFERENCE-VALUE>
                      <DEFINITION-REF DEST="ECUC-REFERENCE-DEF">/AUTOSAR/
                          EcucDefs/Os/OsApplication/OsAppTaskRef</DEFINITION
                          -REF>
                      <VALUE-REF DEST="ECUC-CONTAINER-VALUE">/AUTOSAR_Os/
                          EcucModuleConfigurationValuess/Os/ProxyT_10ms</
                          VALUE-REF>
                    </ECUC-REFERENCE-VALUE>
                    <ECUC-REFERENCE-VALUE>
                      <DEFINITION-REF DEST="ECUC-REFERENCE-DEF">/AUTOSAR/
                          EcucDefs/Os/OsApplication/OsAppTaskRef</DEFINITION
                          -REF>
                      <VALUE-REF DEST="ECUC-CONTAINER-VALUE">/AUTOSAR_Os/
                          EcucModuleConfigurationValuess/Os/ProxyT_50ms</
                          VALUE-REF>
                    </ECUC-REFERENCE-VALUE>
                  </REFERENCE-VALUES>
                </ECUC-CONTAINER-VALUE>
                <ECUC-CONTAINER-VALUE>
                  <SHORT-NAME>ProxyT_10ms</SHORT-NAME>
                  <DEFINITION-REF DEST="ECUC-PARAM-CONF-CONTAINER-DEF">/
                      AUTOSAR/EcucDefs/Os/OsTask</DEFINITION-REF>
```

```
      <PARAMETER-VALUES>
        <ECUC-NUMERICAL-PARAM-VALUE>
          <DEFINITION-REF DEST="ECUC-INTEGER-PARAM-DEF">/
              AUTOSAR/EcucDefs/Os/OsTask/OsTaskPriority</
              DEFINITION-REF>
          <VALUE>10</VALUE>
        </ECUC-NUMERICAL-PARAM-VALUE>
        <ECUC-NUMERICAL-PARAM-VALUE>
          <DEFINITION-REF DEST="ECUC-FLOAT-PARAM-DEF">/AUTOSAR/
              EcucDefs/Os/OsTask/OsTaskPeriod</DEFINITION-REF>
          <VALUE>0.01</VALUE>
        </ECUC-NUMERICAL-PARAM-VALUE>
        <ECUC-TEXTUAL-PARAM-VALUE>
          <DEFINITION-REF DEST="ECUC-ENUMERATION-PARAM-DEF">/
              AUTOSAR/EcucDefs/Os/OsTask/OsTaskSchedule</
              DEFINITION-REF>
          <VALUE>FULL</VALUE>
        </ECUC-TEXTUAL-PARAM-VALUE>
        <ECUC-NUMERICAL-PARAM-VALUE>
          <DEFINITION-REF DEST="ECUC-INTEGER-PARAM-DEF">/
              AUTOSAR/EcucDefs/Os/OsTask/OsTaskActivation</
              DEFINITION-REF>
          <VALUE>1</VALUE>
        </ECUC-NUMERICAL-PARAM-VALUE>
      </PARAMETER-VALUES>
    </ECUC-CONTAINER-VALUE>
    <ECUC-CONTAINER-VALUE>
      <SHORT-NAME>ProxyT_50ms</SHORT-NAME>
      <DEFINITION-REF DEST="ECUC-PARAM-CONF-CONTAINER-DEF">/
          AUTOSAR/EcucDefs/Os/OsTask</DEFINITION-REF>
      <PARAMETER-VALUES>
        <ECUC-NUMERICAL-PARAM-VALUE>
          <DEFINITION-REF DEST="ECUC-INTEGER-PARAM-DEF">/
              AUTOSAR/EcucDefs/Os/OsTask/OsTaskPriority</
              DEFINITION-REF>
          <VALUE>50</VALUE>
        </ECUC-NUMERICAL-PARAM-VALUE>
        <ECUC-NUMERICAL-PARAM-VALUE>
          <DEFINITION-REF DEST="ECUC-FLOAT-PARAM-DEF">/AUTOSAR/
              EcucDefs/Os/OsTask/OsTaskPeriod</DEFINITION-REF>
          <VALUE>0.05</VALUE>
        </ECUC-NUMERICAL-PARAM-VALUE>
        <ECUC-TEXTUAL-PARAM-VALUE>
          <DEFINITION-REF DEST="ECUC-ENUMERATION-PARAM-DEF">/
              AUTOSAR/EcucDefs/Os/OsTask/OsTaskSchedule</
              DEFINITION-REF>
          <VALUE>FULL</VALUE>
        </ECUC-TEXTUAL-PARAM-VALUE>
        <ECUC-NUMERICAL-PARAM-VALUE>
          <DEFINITION-REF DEST="ECUC-INTEGER-PARAM-DEF">/
              AUTOSAR/EcucDefs/Os/OsTask/OsTaskActivation</
              DEFINITION-REF>
          <VALUE>1</VALUE>
        </ECUC-NUMERICAL-PARAM-VALUE>
      </PARAMETER-VALUES>
    </ECUC-CONTAINER-VALUE>
```

```
            </CONTAINERS>
          </ECUC-MODULE-CONFIGURATION-VALUES>
        </ELEMENTS>
      </AR-PACKAGE>
    </AR-PACKAGES>
  </AR-PACKAGE>
 </AR-PACKAGES>
</AUTOSAR>
```

A.21 DOC_SwCluC_Ecuc_SwCluC_AHB.arxml

Listing A.21: DOC_SwCluC_Ecuc_SwCluC_AHB.arxml

```
<AUTOSAR xmlns="http://autosar.org/schema/r4.0" xmlns:xsi="http://www.w3.
    org/2001/XMLSchema-instance" xsi:schemaLocation="http://autosar.org/
    schema/r4.0␣AUTOSAR_00044.xsd">
  <AR-PACKAGES>
    <AR-PACKAGE>
      <SHORT-NAME>AUTOSAR_SwCluC</SHORT-NAME>
      <AR-PACKAGES>
        <AR-PACKAGE>
          <SHORT-NAME>EcucModuleConfigurationValuess</SHORT-NAME>
          <ELEMENTS>
            <ECUC-MODULE-CONFIGURATION-VALUES>
              <SHORT-NAME>SwCluC</SHORT-NAME>
              <DEFINITION-REF DEST="ECUC-MODULE-DEF">/AUTOSAR/EcucDefs/
                  SwCluC</DEFINITION-REF>
              <ECUC-DEF-EDITION>1.0.0</ECUC-DEF-EDITION>
              <CONTAINERS>
                <ECUC-CONTAINER-VALUE>
                  <SHORT-NAME>SwCluCDefinitionSet</SHORT-NAME>
                  <DEFINITION-REF DEST="ECUC-PARAM-CONF-CONTAINER-DEF">/
                      AUTOSAR/EcucDefs/SwCluC/SwCluCDefinitionSet</
                      DEFINITION-REF>
                  <SUB-CONTAINERS>
                    <ECUC-CONTAINER-VALUE>
                      <SHORT-NAME>ClusterHost</SHORT-NAME>
                      <DEFINITION-REF DEST="ECUC-PARAM-CONF-CONTAINER-DEF">
                          /AUTOSAR/EcucDefs/SwCluC/SwCluCDefinitionSet/
                          SwCluCDefinition</DEFINITION-REF>
                      <PARAMETER-VALUES>
                        <ECUC-TEXTUAL-PARAM-VALUE>
                          <DEFINITION-REF DEST="ECUC-ENUMERATION-PARAM-DEF"
                              >/AUTOSAR/EcucDefs/SwCluC/SwCluCDefinitionSet/
                              SwCluCDefinition/
                              SwCluCBManifDescriptorTreatment</DEFINITION-
                              REF>
                          <VALUE>EMBED_DESCRIPTORS</VALUE>
                        </ECUC-TEXTUAL-PARAM-VALUE>
                        <ECUC-TEXTUAL-PARAM-VALUE>
```

```
        <DEFINITION-REF DEST="ECUC-ENUMERATION-PARAM-DEF"
            >/AUTOSAR/EcucDefs/SwCluC/SwCluCDefinitionSet/
            SwCluCDefinition/
            SwCluCBManifOnBoardConnectorControl</
            DEFINITION-REF>
        <VALUE>ENABLE_ON_ECU_CONNECTOR</VALUE>
      </ECUC-TEXTUAL-PARAM-VALUE>
      <ECUC-NUMERICAL-PARAM-VALUE>
        <DEFINITION-REF DEST="ECUC-INTEGER-PARAM-DEF">/
            AUTOSAR/EcucDefs/SwCluC/SwCluCDefinitionSet/
            SwCluCDefinition/SwCluCMachineId</DEFINITION-
            REF>
        <VALUE>0</VALUE>
      </ECUC-NUMERICAL-PARAM-VALUE>
      <ECUC-NUMERICAL-PARAM-VALUE>
        <DEFINITION-REF DEST="ECUC-INTEGER-PARAM-DEF">/
            AUTOSAR/EcucDefs/SwCluC/SwCluCDefinitionSet/
            SwCluCDefinition/SwCluCSoftwareClusterId</
            DEFINITION-REF>
        <VALUE>0</VALUE>
      </ECUC-NUMERICAL-PARAM-VALUE>
      <ECUC-TEXTUAL-PARAM-VALUE>
        <DEFINITION-REF DEST="ECUC-ENUMERATION-PARAM-DEF"
            >/AUTOSAR/EcucDefs/SwCluC/SwCluCDefinitionSet/
            SwCluCDefinition/SwCluCSoftwareClusterType</
            DEFINITION-REF>
        <VALUE>HOST_SW_CLUSTER</VALUE>
      </ECUC-TEXTUAL-PARAM-VALUE>
    </PARAMETER-VALUES>
  </ECUC-CONTAINER-VALUE>
  <ECUC-CONTAINER-VALUE>
    <SHORT-NAME>ClusterAHB</SHORT-NAME>
    <DEFINITION-REF DEST="ECUC-PARAM-CONF-CONTAINER-DEF">
        /AUTOSAR/EcucDefs/SwCluC/SwCluCDefinitionSet/
        SwCluCDefinition</DEFINITION-REF>
    <PARAMETER-VALUES>
      <ECUC-TEXTUAL-PARAM-VALUE>
        <DEFINITION-REF DEST="ECUC-ENUMERATION-PARAM-DEF"
            >/AUTOSAR/EcucDefs/SwCluC/SwCluCDefinitionSet/
            SwCluCDefinition/
            SwCluCBManifDescriptorTreatment</DEFINITION-
            REF>
        <VALUE>EMBED_DESCRIPTORS</VALUE>
      </ECUC-TEXTUAL-PARAM-VALUE>
      <ECUC-TEXTUAL-PARAM-VALUE>
        <DEFINITION-REF DEST="ECUC-ENUMERATION-PARAM-DEF"
            >/AUTOSAR/EcucDefs/SwCluC/SwCluCDefinitionSet/
            SwCluCDefinition/
            SwCluCBManifOnBoardConnectorControl</
            DEFINITION-REF>
        <VALUE>ENABLE_ON_ECU_CONNECTOR</VALUE>
      </ECUC-TEXTUAL-PARAM-VALUE>
      <ECUC-NUMERICAL-PARAM-VALUE>
```

```
            <DEFINITION-REF DEST="ECUC-INTEGER-PARAM-DEF">/
              AUTOSAR/EcucDefs/SwCluC/SwCluCDefinitionSet/
              SwCluCDefinition/SwCluCMachineId</DEFINITION-
              REF>
            <VALUE>0</VALUE>
          </ECUC-NUMERICAL-PARAM-VALUE>
          <ECUC-NUMERICAL-PARAM-VALUE>
            <DEFINITION-REF DEST="ECUC-INTEGER-PARAM-DEF">/
              AUTOSAR/EcucDefs/SwCluC/SwCluCDefinitionSet/
              SwCluCDefinition/SwCluCSoftwareClusterId</
              DEFINITION-REF>
            <VALUE>1</VALUE>
          </ECUC-NUMERICAL-PARAM-VALUE>
          <ECUC-TEXTUAL-PARAM-VALUE>
            <DEFINITION-REF DEST="ECUC-ENUMERATION-PARAM-DEF"
              >/AUTOSAR/EcucDefs/SwCluC/SwCluCDefinitionSet/
              SwCluCDefinition/SwCluCSoftwareClusterType</
              DEFINITION-REF>
            <VALUE>APPLICATIVE_SW_CLUSTER</VALUE>
          </ECUC-TEXTUAL-PARAM-VALUE>
        </PARAMETER-VALUES>
      </ECUC-CONTAINER-VALUE>
    </SUB-CONTAINERS>
  </ECUC-CONTAINER-VALUE>
  <ECUC-CONTAINER-VALUE>
    <SHORT-NAME>SwCluCGeneral</SHORT-NAME>
    <DEFINITION-REF DEST="ECUC-PARAM-CONF-CONTAINER-DEF">/
      AUTOSAR/EcucDefs/SwCluC/SwCluCGeneral</DEFINITION-REF>
    <REFERENCE-VALUES>
      <ECUC-REFERENCE-VALUE>
        <DEFINITION-REF DEST="ECUC-REFERENCE-DEF">/AUTOSAR/
          EcucDefs/SwCluC/SwCluCGeneral/
          SwCluCDefinitionSelection</DEFINITION-REF>
        <VALUE-REF DEST="ECUC-CONTAINER-VALUE">/
          AUTOSAR_SwCluC/EcucModuleConfigurationValuess/
          SwCluC/SwCluCDefinitionSet/ClusterAHB</VALUE-REF>
      </ECUC-REFERENCE-VALUE>
    </REFERENCE-VALUES>
  </ECUC-CONTAINER-VALUE>
  <ECUC-CONTAINER-VALUE>
    <SHORT-NAME>SwCluCBaseConfigurationCheck</SHORT-NAME>
    <DEFINITION-REF DEST="ECUC-PARAM-CONF-CONTAINER-DEF">/
      AUTOSAR/EcucDefs/SwCluC/SwCluCBaseConfigurationCheck</
      DEFINITION-REF>
    <PARAMETER-VALUES>
      <ECUC-TEXTUAL-PARAM-VALUE>
        <DEFINITION-REF DEST="ECUC-MULTILINE-STRING-PARAM-DEF
          ">/AUTOSAR/EcucDefs/SwCluC/
          SwCluCBaseConfigurationCheck/
          SwCluCAutoBaseConfigDescriptor</DEFINITION-REF>
        <VALUE>compiler flags= -O3 -w -std=c99</VALUE>
      </ECUC-TEXTUAL-PARAM-VALUE>
      <ECUC-TEXTUAL-PARAM-VALUE>
```

```
        <DEFINITION-REF DEST="ECUC-MULTILINE-STRING-PARAM-DEF
            ">/AUTOSAR/EcucDefs/SwCluC/
            SwCluCBaseConfigurationCheck/
            SwCluCUserBaseConfigDescriptor</DEFINITION-REF>
        <VALUE>Integration according Architecture
            Specification 1.0.2</VALUE>
      </ECUC-TEXTUAL-PARAM-VALUE>
    </PARAMETER-VALUES>
    <REFERENCE-VALUES>
      <ECUC-REFERENCE-VALUE>
        <DEFINITION-REF DEST="ECUC-REFERENCE-DEF">/AUTOSAR/
            EcucDefs/SwCluC/SwCluCBaseConfigurationCheck/
            SwCluCResourceRef</DEFINITION-REF>
        <VALUE-REF DEST="CP-SOFTWARE-CLUSTER-SERVICE-RESOURCE
            ">/AUTOSAR/CONC_670/SysResPool/
            CpSoftwareClusterResourcePools/SwClusCResourcePool
            /BaseConfigCheck_AHB</VALUE-REF>
      </ECUC-REFERENCE-VALUE>
    </REFERENCE-VALUES>
  </ECUC-CONTAINER-VALUE>
  <ECUC-CONTAINER-VALUE>
    <SHORT-NAME>SwCluCXcc</SHORT-NAME>
    <DEFINITION-REF DEST="ECUC-PARAM-CONF-CONTAINER-DEF">/
       AUTOSAR/EcucDefs/SwCluC/SwCluCXcc</DEFINITION-REF>
    <PARAMETER-VALUES>
      <ECUC-TEXTUAL-PARAM-VALUE>
        <DEFINITION-REF DEST="ECUC-ENUMERATION-PARAM-DEF">/
            AUTOSAR/EcucDefs/SwCluC/SwCluCXcc/
            SwCluCXccDefaultDataHandling</DEFINITION-REF>
        <VALUE>DEFAULTS_AS_CALPRMS</VALUE>
      </ECUC-TEXTUAL-PARAM-VALUE>
    </PARAMETER-VALUES>
    <SUB-CONTAINERS>
      <ECUC-CONTAINER-VALUE>
        <SHORT-NAME>Gr8Xcc</SHORT-NAME>
        <DEFINITION-REF DEST="ECUC-PARAM-CONF-CONTAINER-DEF">
            /AUTOSAR/EcucDefs/SwCluC/SwCluCXcc/
            RteRipsPluginProps</DEFINITION-REF>
        <PARAMETER-VALUES>
          <ECUC-NUMERICAL-PARAM-VALUE>
            <DEFINITION-REF DEST="ECUC-BOOLEAN-PARAM-DEF">/
                AUTOSAR/EcucDefs/SwCluC/SwCluCXcc/
                RteRipsPluginProps/
                RtePluginSupportsIReadIWrite</DEFINITION-REF>
            <VALUE>true</VALUE>
          </ECUC-NUMERICAL-PARAM-VALUE>
          <ECUC-TEXTUAL-PARAM-VALUE>
            <DEFINITION-REF DEST="ECUC-ENUMERATION-PARAM-DEF"
                >/AUTOSAR/EcucDefs/SwCluC/SwCluCXcc/
                RteRipsPluginProps/
                RteRipsGlobalCopyInstantiationPolicy</
                DEFINITION-REF>
            <VALUE>RTE_RIPS_INSTANTIATION_BY_PLUGIN</VALUE>
          </ECUC-TEXTUAL-PARAM-VALUE>
          <ECUC-TEXTUAL-PARAM-VALUE>
```

```
            <DEFINITION-REF DEST="ECUC-ENUMERATION-PARAM-DEF"
               >/AUTOSAR/EcucDefs/SwCluC/SwCluCXcc/
               RteRipsPluginProps/
               RteRipsPluginCommunicationScope</DEFINITION-
               REF>
            <VALUE>RTE_RIPS_CROSS_SW_CLUSTER_COM</VALUE>
          </ECUC-TEXTUAL-PARAM-VALUE>
        </PARAMETER-VALUES>
      </ECUC-CONTAINER-VALUE>
      <ECUC-CONTAINER-VALUE>
        <SHORT-NAME>SwCluCXccBaseSocket</SHORT-NAME>
        <DEFINITION-REF DEST="ECUC-PARAM-CONF-CONTAINER-DEF">
           /AUTOSAR/EcucDefs/SwCluC/SwCluCXcc/
           SwCluCXccBaseSocket</DEFINITION-REF>
        <REFERENCE-VALUES>
          <ECUC-REFERENCE-VALUE>
            <DEFINITION-REF DEST="ECUC-REFERENCE-DEF">/
               AUTOSAR/EcucDefs/SwCluC/SwCluCXcc/
               SwCluCXccBaseSocket/SwCluCXccEcucPartitionRef<
               /DEFINITION-REF>
            <VALUE-REF DEST="ECUC-CONTAINER-VALUE">/
               AUTOSAR_EcuC/EcucModuleConfigurationValuess/
               EcuC/EcucPartitionCollection/PartitionCore1QM<
               /VALUE-REF>
          </ECUC-REFERENCE-VALUE>
          <ECUC-REFERENCE-VALUE>
            <DEFINITION-REF DEST="ECUC-REFERENCE-DEF">/
               AUTOSAR/EcucDefs/SwCluC/SwCluCXcc/
               SwCluCXccBaseSocket/SwCluCResourceRef</
               DEFINITION-REF>
            <VALUE-REF DEST="CP-SOFTWARE-CLUSTER-SERVICE-
               RESOURCE">/AUTOSAR/CONC_670/SysResPool/
               CpSoftwareClusterResourcePools/
               SwClusCResourcePool/XccBaseSocket_AHB</VALUE-
               REF>
          </ECUC-REFERENCE-VALUE>
        </REFERENCE-VALUES>
      </ECUC-CONTAINER-VALUE>
    </SUB-CONTAINERS>
  </ECUC-CONTAINER-VALUE>
  <ECUC-CONTAINER-VALUE>
    <SHORT-NAME>SwCluCProxies</SHORT-NAME>
    <DEFINITION-REF DEST="ECUC-PARAM-CONF-CONTAINER-DEF">/
       AUTOSAR/EcucDefs/SwCluC/SwCluCProxies</DEFINITION-REF>
    <PARAMETER-VALUES>
      <ECUC-TEXTUAL-PARAM-VALUE>
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            SwCluCBManifProvideHandle</DEFINITION-REF>
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                /SwCluCBManifResourceType/
                SwCluCBManifProvideHandle/
                SwCluCBManifNativeHandleType</DEFINITION-
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```

```
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               SwCluCBManifResourceType/
               SwCluCBManifResourceId</DEFINITION-REF>
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               SwCluCBManifNotifierHandle</DEFINITION-REF>
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```

```
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```

B Referenced Meta Classes

Class	***AbstractAccessPoint*** (abstract)			
Package	M2::AUTOSARTemplates::SWComponentTemplate::SwcInternalBehavior::AccessCount			
Note	Abstract class indicating an access point from an ExecutableEntity.			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	AsynchronousServerCallResultPoint, ExternalTriggeringPointIdent, InternalTriggeringPoint, ModeAccessPointIdent, ModeSwitchPoint, ParameterAccess, *ServerCallPoint*, VariableAccess			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
returnValue Provision	RteApiReturnValue ProvisionEnum	0..1	attr	This attribute controls the provision of return values for RTE APIs that correspond to the enclosing access point.

Table B.1: AbstractAccessPoint

Class	**BswExternalTriggerOccurredEvent**			
Package	M2::AUTOSARTemplates::BswModuleTemplate::BswBehavior			
Note	A BswEvent resulting from a trigger released by another module or cluster.			
Base	*ARObject*, *AbstractEvent*, *BswEvent*, *BswScheduleEvent*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
trigger	Trigger	1	ref	The trigger associated with this event. The trigger is external to this module.

Table B.2: BswExternalTriggerOccurredEvent

Class	**BswInternalTriggerOccurredEvent**			
Package	M2::AUTOSARTemplates::BswModuleTemplate::BswBehavior			
Note	A BswEvent, which can happen sporadically. The event is activated by explicit calls from the module to the BSW Scheduler. The main purpose for such an event is to cause a context switch, e.g. from an ISR context into a task context. Activation and switching are handled within the same module or cluster only.			
Base	*ARObject*, *AbstractEvent*, *BswEvent*, *BswScheduleEvent*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
eventSource	BswInternalTriggering Point	1	ref	The activation point is the source of this event.

Table B.3: BswInternalTriggerOccurredEvent

Class	**BswModeSwitchEvent**			
Package	M2::AUTOSARTemplates::BswModuleTemplate::BswBehavior			
Note	A BswEvent resulting from a mode switch.			
Base	*ARObject*, *AbstractEvent*, *BswEvent*, *BswScheduleEvent*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
activation	ModeActivationKind	1	attr	Kind of activation w.r.t. to the referred mode.
mode (ordered)	ModeDeclaration	0..2	iref	Reference to one or two Modes that initiate the Mode Switch Event. **InstanceRef implemented by:**ModeInBswModule DescriptionInstanceRef

Table B.4: BswModeSwitchEvent

Class	**BswModuleDescription**			
Package	M2::AUTOSARTemplates::BswModuleTemplate::BswOverview			
Note	Root element for the description of a single BSW module or BSW cluster. In case it describes a BSW module, the short name of this element equals the name of the BSW module. **Tags:**atp.recommendedPackage=BswModuleDescriptions			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
bswModule Dependency	BswModuleDependency	*	aggr	Describes the dependency to another BSW module. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=bswModuleDependency.shortName, bswModuleDependency.variationPoint.shortLabel vh.latestBindingTime=preCompileTime xml.sequenceOffset=20
bswModule Documentation	SwComponent Documentation	0..1	aggr	This adds a documentation to the BSW module. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=bswModuleDocumentation, bswModuleDocumentation.variationPoint.shortLabel vh.latestBindingTime=preCompileTime xml.sequenceOffset=6
expectedEntry	BswModuleEntry	*	ref	Indicates an entry which is required by this module. Replacement of outgoingCallback / requiredEntry. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=expectedEntry.bswModuleEntry, expectedEntry.variationPoint.shortLabel vh.latestBindingTime=preCompileTime
implemented Entry	BswModuleEntry	*	ref	Specifies an entry provided by this module which can be called by other modules. This includes "main" functions, interrupt routines, and callbacks. Replacement of providedEntry / expectedCallback. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=implementedEntry.bswModuleEntry, implementedEntry.variationPoint.shortLabel vh.latestBindingTime=preCompileTime
internalBehavior	BswInternalBehavior	*	aggr	The various BswInternalBehaviors associated with a BswModuleDescription can be distributed over several physical files. Therefore the aggregation is <<atpSplitable>>. **Stereotypes:** atpSplitable **Tags:** atp.Splitkey=internalBehavior.shortName xml.sequenceOffset=65
moduleId	PositiveInteger	0..1	attr	Refers to the BSW Module Identifier defined by the AUTOSAR standard. For non-standardized modules, a proprietary identifier can be optionally chosen. **Tags:**xml.sequenceOffset=5

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Class	**BswModuleDescription**			
providedClient ServerEntry	BswModuleClientServer Entry	*	aggr	Specifies that this module provides a client server entry which can be called from another parition or core.This entry is declared locally to this context and will be connected to the requiredClientServerEntry of another or the same module via the configuration of the BSW Scheduler. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=providedClientServerEntry.shortName, providedClientServerEntry.variationPoint.shortLabel vh.latestBindingTime=preCompileTime xml.sequenceOffset=45
providedData	VariableDataPrototype	*	aggr	Specifies a data prototype provided by this module in order to be read from another partition or core.The providedData is declared locally to this context and will be connected to the requiredData of another or the same module via the configuration of the BSW Scheduler. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=providedData.shortName, provided Data.variationPoint.shortLabel vh.latestBindingTime=preCompileTime xml.sequenceOffset=55
providedMode Group	ModeDeclarationGroup Prototype	*	aggr	A set of modes which is owned and provided by this module or cluster. It can be connected to the required ModeGroups of other modules or clusters via the configuration of the BswScheduler. It can also be synchronized with modes provided via ports by an associated ServiceSwComponentType, EcuAbstraction SwComponentType or ComplexDeviceDriverSw ComponentType. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=providedModeGroup.shortName, provided ModeGroup.variationPoint.shortLabel vh.latestBindingTime=preCompileTime xml.sequenceOffset=25
releasedTrigger	Trigger	*	aggr	A Trigger released by this module or cluster. It can be connected to the requiredTriggers of other modules or clusters via the configuration of the BswScheduler. It can also be synchronized with Triggers provided via ports by an associated ServiceSwComponentType, Ecu AbstractionSwComponentType or ComplexDeviceDriver SwComponentType. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=releasedTrigger.shortName, released Trigger.variationPoint.shortLabel vh.latestBindingTime=preCompileTime xml.sequenceOffset=35
requiredClient ServerEntry	BswModuleClientServer Entry	*	aggr	Specifies that this module requires a client server entry which can be implemented on another parition or core.This entry is declared locally to this context and will be connected to the providedClientServerEntry of another or the same module via the configuration of the BSW Scheduler. ▽

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Class	**BswModuleDescription**			
				△ **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=requiredClientServerEntry.shortName, requiredClientServerEntry.variationPoint.shortLabel vh.latestBindingTime=preCompileTime xml.sequenceOffset=50
requiredData	VariableDataPrototype	*	aggr	Specifies a data prototype required by this module in oder to be provided from another partition or core.The required Data is declared locally to this context and will be connected to the providedData of another or the same module via the configuration of the BswScheduler. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=requiredData.shortName, required Data.variationPoint.shortLabel vh.latestBindingTime=preCompileTime xml.sequenceOffset=60
requiredMode Group	ModeDeclarationGroup Prototype	*	aggr	Specifies that this module or cluster depends on a certain mode group. The requiredModeGroup is local to this context and will be connected to the providedModeGroup of another module or cluster via the configuration of the BswScheduler. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=requiredModeGroup.shortName, required ModeGroup.variationPoint.shortLabel vh.latestBindingTime=preCompileTime xml.sequenceOffset=30
requiredTrigger	Trigger	*	aggr	Specifies that this module or cluster reacts upon an external trigger.This requiredTrigger is declared locally to this context and will be connected to the providedTrigger of another module or cluster via the configuration of the BswScheduler. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=requiredTrigger.shortName, required Trigger.variationPoint.shortLabel vh.latestBindingTime=preCompileTime xml.sequenceOffset=40

Table B.5: BswModuleDescription

Class	***BswModuleEntity*** (abstract)			
Package	M2::AUTOSARTemplates::BswModuleTemplate::BswBehavior			
Note	Specifies the smallest code fragment which can be described for a BSW module or cluster within AUTOSAR.			
Base	*ARObject*, *ExecutableEntity*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	BswCalledEntity, BswInterruptEntity, BswSchedulableEntity			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
accessedMode Group	ModeDeclarationGroup Prototype	*	ref	A mode group which is accessed via API call by this entity. It shall be a ModeDeclarationGroupPrototype required by this module or cluster. **Stereotypes:** atpVariation **Tags:**vh.latestBindingTime=preCompileTime

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Class	***BswModuleEntity*** (abstract)			
activationPoint	BswInternalTriggering Point	*	ref	Activation point used by the module entity to activate one or more internal triggers. **Stereotypes:** atpVariation **Tags:**vh.latestBindingTime=preCompileTime
callPoint	BswModuleCallPoint	*	aggr	A call point used in the code of this entitiy. The variablity of this association is especially targeted at debug scenarios: It is possible to have one variant calling into the AUTOSAR debug module and another one which doesn't. **Stereotypes:** atpVariation **Tags:**vh.latestBindingTime=preCompileTime
dataReceive Point	BswVariableAccess	*	aggr	The data is received via the BSW Scheduler. **Stereotypes:** atpVariation **Tags:**vh.latestBindingTime=preCompileTime
dataSendPoint	BswVariableAccess	*	aggr	The data is sent via the BSW Scheduler. **Stereotypes:** atpVariation **Tags:**vh.latestBindingTime=preCompileTime
implemented Entry	BswModuleEntry	1	ref	The entry which is implemented by this module entity.
issuedTrigger	Trigger	*	ref	A trigger issued by this entity via BSW Scheduler API call. It shall be a BswTrigger released (i.e. owned) by this module or cluster. **Stereotypes:** atpVariation **Tags:**vh.latestBindingTime=preCompileTime
managedMode Group	ModeDeclarationGroup Prototype	*	ref	A mode group which is managed by this entity. It shall be a ModeDeclarationGroupPrototype provided by this module or cluster. **Stereotypes:** atpVariation **Tags:**vh.latestBindingTime=preCompileTime
schedulerName Prefix	BswSchedulerName Prefix	0..1	ref	A prefix to be used in generated names for the Bsw ModuleScheduler in the context of this BswModuleEntity, for example entry point prototypes, macros for dealing with exclusive areas, header file names. Details are defined in the SWS RTE. The prefix supersedes default rules for the prefix of those names.

Table B.6: BswModuleEntity

Class	**BswSchedulableEntity**			
Package	M2::AUTOSARTemplates::BswModuleTemplate::BswBehavior			
Note	BSW module entity, which is designed for control by the BSW Scheduler. It may for example implement a so-called "main" function.			
Base	*ARObject*, *BswModuleEntity*, *ExecutableEntity*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
–	–	–	–	–

Table B.7: BswSchedulableEntity

Class	**BswVariableAccess**			
Package	M2::AUTOSARTemplates::BswModuleTemplate::BswBehavior			
Note	The presence of a BswVariableAccess implies that a BswModuleEntity needs access to a VariableData Prototype via the BSW Scheduler. The kind of access is specified by the role in which the class is used.			
Base	*ARObject*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
accessed Variable	VariableDataPrototype	1	ref	The data accessed via the BSW Scheduler.
context Limitation	BswDistinguished Partition	*	ref	The existence of this reference indicates that the variable is recevied resp. sent only in the context of the referred BswDistinguishedPartitions.

Table B.8: BswVariableAccess

Class	**ClientServerInterface**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::PortInterface			
Note	A client/server interface declares a number of operations that can be invoked on a server by a client. **Tags:**atp.recommendedPackage=PortInterfaces			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *PortInterface*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
operation	ClientServerOperation	*	aggr	ClientServerOperation(s) of this ClientServerInterface. **Stereotypes:** atpVariation **Tags:**vh.latestBindingTime=blueprintDerivationTime
possibleError	ApplicationError	*	aggr	Application errors that are defined as part of this interface.

Table B.9: ClientServerInterface

Class	**CompositionSwComponentType**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Composition			
Note	A CompositionSwComponentType aggregates SwComponentPrototypes (that in turn are typed by Sw ComponentTypes) as well as SwConnectors for primarily connecting SwComponentPrototypes among each others and towards the surface of the CompositionSwComponentType. By this means hierarchical structures of software-components can be created. **Tags:**atp.recommendedPackage=SwComponentTypes			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *SwComponentType*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
component	SwComponent Prototype	*	aggr	The instantiated components that are part of this composition. The aggregation of SwComponentPrototype is subject to variability with the purpose to support the conditional existence of a SwComponentPrototype. Please be aware: if the conditional existence of Sw ComponentPrototypes is resolved post-build the deselected SwComponentPrototypes are still contained in the ECUs build but the instances are inactive in in that they are not scheduled by the RTE. The aggregation is marked as atpSplitable in order to allow the addition of service components to the ECU extract during the ECU integration. ▽

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Class	**CompositionSwComponentType**			
				△ The use case for having 0 components owned by the CompositionSwComponentType could be to deliver an empty CompositionSwComponentType to e.g. a supplier for filling the internal structure. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=component.shortName, component.variation Point.shortLabel vh.latestBindingTime=postBuild
connector	SwConnector	*	aggr	SwConnectors have the principal ability to establish a connection among PortPrototypes. They can have many roles in the context of a CompositionSwComponentType. Details are refined by subclasses. The aggregation of SwConnectors is subject to variability with the purpose to support variant data flow. The aggregation is marked as atpSplitable in order to allow the extension of the ECU extract with AssemblySw Connectors between ApplicationSwComponentTypes and ServiceSwComponentTypes during the ECU integration. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=connector.shortName, connector.variation Point.shortLabel vh.latestBindingTime=postBuild
constantValue Mapping	ConstantSpecification MappingSet	*	ref	Reference to the ConstantSpecificationMapping to be applied for initValues of PPortComSpecs and RPortCom Spec. **Stereotypes:** atpSplitable **Tags:**atp.Splitkey=constantValueMapping
dataType Mapping	DataTypeMappingSet	*	ref	Reference to the DataTypeMapping to be applied for the used ApplicationDataTypes in PortInterfaces. Background: when developing subsystems it may happen that ApplicationDataTypes are used on the surface of CompositionSwComponentTypes. In this case it would be reasonable to be able to also provide the intended mapping to the ImplementationDataTypes. However, this mapping shall be informal and not technically binding for the implementors mainly because the RTE generator is not concerned about the CompositionSwComponent Types. Rationale: if the mapping of ApplicationDataTypes on the delegated and inner PortPrototype matches then the mapping to ImplementationDataTypes is not impacting compatibility. **Stereotypes:** atpSplitable **Tags:**atp.Splitkey=dataTypeMapping
instantiation RTEEventProps	InstantiationRTEEvent Props	*	aggr	This allows to define instantiation specific properties for RTE Events, in particular for instance specific scheduling. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=instantiationRTEEventProps.shortLabel, instantiationRTEEventProps.variationPoint.shortLabel vh.latestBindingTime=codeGenerationTime

Table B.10: CompositionSwComponentType

Class	**CpSoftwareCluster**			
Package	M2::AUTOSARTemplates::SystemTemplate::SoftwareCluster			
Note	This meta class provides the ability to define a CP Software Cluster. Each CP Software Cluster can be integrated and build individually. It defines the sub-set of hierarchical tree(s) of Software Components belonging to this CP Software Cluster. Resources required or provided by this CP Software Cluster are given in the according mappings. **Tags:** atp.Status=draft atp.recommendedPackage=CpSoftwareClusters			
Base	*ARElement*, *ARObject*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
swComponentAssignment	SwComponentPrototypeAssignment	*	aggr	This is the colllection of SwComponentPrototype Assignments **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=swComponentAssignment, swComponentAssignment.variationPoint.shortLabel atp.Status=draft vh.latestBindingTime=postBuild
swComposition	CompositionSwComponentType	*	ref	Software Components in the context of a CompositionSwComponentType belonging to this CP Software Cluster. This reference can be used to describe the belonging SWCs when the CP Software Cluster is described out of the context of a System, e.g. reusable CP Software Cluster. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=swComposition.compositionSwComponentType, swComposition.variationPoint.shortLabel atp.Status=draft vh.latestBindingTime=systemDesignTime

Table B.11: CpSoftwareCluster

Class	**CpSoftwareClusterCommunicationResource**			
Package	M2::AUTOSARTemplates::SystemTemplate::SoftwareCluster			
Note	Represents a single resource required or provided by a CP Software Cluster which relates to the port based communication on VFB level. **Tags:**atp.Status=draft			
Base	*ARObject*, *CpSoftwareClusterResource*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
comProps	CpSoftwareClusterCommunicationResourceProps	0..1	aggr	This aggregation supports the further qualification of the enclosing CpSoftwareClusterCommunicationRecource by means of additional attributes depending on the nature of the CpSoftwareClusterCommunicationRecource.

Table B.12: CpSoftwareClusterCommunicationResource

Class	***CpSoftwareClusterResource*** (abstract)
Package	M2::AUTOSARTemplates::SystemTemplate::SoftwareCluster
Note	Represents a single resource required or provided by a CP Software Cluster. **Tags:** atp.Status=draft atp.recommendedPackage=Resources

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Class	***CpSoftwareClusterResource*** (abstract)			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	CpSoftwareClusterCommunicationResource, CpSoftwareClusterServiceResource			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
dependent Resource	RoleBasedResource Dependency	*	aggr	Link to a resource which depends on this resource to implement them.
globalResource Id	PositiveInteger	0..1	attr	A unique identifiers per resource used for the connection process. The identifier is required to be unique in the scope of a single machine. If software clusters are designed to be reused on multiple machines the uniqueness requirements applies for all the intended machines.
isMandatory	Boolean	0..1	attr	This attribute indicates, that the resource is mandatory to operate the Software Cluster. If the resource is not provided on the machine the connection process of any Software Cluster requiring this resource gets aborted.

Table B.13: CpSoftwareClusterResource

Class	**DataConstr**			
Package	M2::MSR::AsamHdo::Constraints::GlobalConstraints			
Note	This meta-class represents the ability to specify constraints on data. **Tags:**atp.recommendedPackage=DataConstrs			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
dataConstrRule	DataConstrRule	*	aggr	This is one particular rule within the data constraints. **Tags:** xml.roleElement=true xml.roleWrapperElement=true xml.sequenceOffset=30 xml.typeElement=false xml.typeWrapperElement=false

Table B.14: DataConstr

Class	***DataMapping*** (abstract)			
Package	M2::AUTOSARTemplates::SystemTemplate::DataMapping			
Note	Mapping of port elements (data elements and parameters) to frames and signals.			
Base	*ARObject*			
Subclasses	ClientServerToSignalMapping, SenderReceiverCompositeElementToSignalMapping, SenderReceiverToSignalGroupMapping, SenderReceiverToSignalMapping, TriggerToSignalMapping			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
communication Direction	Communication DirectionType	0..1	attr	This attribute controls the direction into which the mapped SystemSignal is communicated with respect to the kind of PortPrototype used as the context element of the Data Mapping.
introduction	DocumentationBlock	0..1	aggr	This represents introductory documentation about the data mapping.

Table B.15: DataMapping

Class	**EcuInstance**			
Package	M2::AUTOSARTemplates::SystemTemplate::Fibex::FibexCore::CoreTopology			
Note	ECUInstances are used to define the ECUs used in the topology. The type of the ECU is defined by a reference to an ECU specified with the ECU resource description. **Tags:**atp.recommendedPackage=EcuInstances			
Base	*ARObject*, *CollectableElement*, *FibexElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
associatedComIPduGroup	ISignalIPduGroup	*	ref	With this reference it is possible to identify which ISignalIPduGroups are applicable for which Communication Connector/ ECU. Only top level ISignalIPduGroups shall be referenced by an EcuInstance. If an ISignalIPduGroup contains other ISignalIPduGroups than these contained ISignalIPduGroups shall not be referenced by the EcuInstance. Contained ISignalIPduGroups are associated to an Ecu Instance via the top level ISignalIPduGroup.
associatedConsumedProvidedServiceInstanceGroup	ConsumedProvidedServiceInstanceGroup	*	ref	With this reference it is possible to identify which ConsumedProvidedServiceInstanceGroups are applicable for which ECUInstance. **Stereotypes:** atpVariation **Tags:**vh.latestBindingTime=postBuild
associatedPdurIPduGroup	PdurIPduGroup	*	ref	With this reference it is possible to identify which PduR IPdu Groups are applicable for which Communication Connector/ ECU.
clientIdRange	ClientIdRange	0..1	aggr	Restriction of the Client Identifier for this Ecu to an allowed range of numerical values. The Client Identifier of the transaction handle is generated by the client RTE for inter-Ecu Client/Server communication.
comConfigurationGwTimeBase	TimeValue	0..1	attr	The period between successive calls to Com_MainFunctionRouteSignals of the AUTOSAR COM module in seconds.
comConfigurationRxTimeBase	TimeValue	0..1	attr	The period between successive calls to Com_MainFunctionRx of the AUTOSAR COM module in seconds.
comConfigurationTxTimeBase	TimeValue	0..1	attr	The period between successive calls to Com_MainFunctionTx of the AUTOSAR COM module in seconds.
comEnableMDTForCyclicTransmission	Boolean	0..1	attr	Enables for the Com module of this EcuInstance the minimum delay time monitoring for cyclic and repeated transmissions (TransmissionModeTiming has cyclic Timing assigned or eventControlledTiming with numberOfRepetitions > 0).
commController	CommunicationController	1..*	aggr	CommunicationControllers of the ECU. **Stereotypes:** atpVariation **Tags:**vh.latestBindingTime=postBuild
connector	CommunicationConnector	*	aggr	All channels controlled by a single controller. **Stereotypes:** atpVariation **Tags:**vh.latestBindingTime=postBuild
dltConfig	DltConfig	0..1	aggr	Describes the Dlt configuration on this EcuInstance.
doIpConfig	DoIpConfig	0..1	aggr	DoIp configuration on this EcuInstance. **Tags:**atp.Status=draft

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Class	EcuInstance			
ethSwitchPort Group Derivation	Boolean	0..1	attr	Defines whether the derivation of SwitchPortGroups based on VLAN and/or CouplingPort.pncMapping shall be performed for this EcuInstance. If not defined the derivation shall not be done.
partition	EcuPartition	*	aggr	Optional definition of Partitions within an Ecu.
pncPrepare SleepTimer	TimeValue	0..1	attr	Time in seconds the PNC state machine shall wait in PNC_PREPARE_SLEEP.
pnc Synchronous Wakeup	Boolean	0..1	attr	If this parameter is available and set to true then all available PNCs will be woken up as soon as a channel wakeup occurs. This is ensured by adding all PNCs to all channel wakeup sources during upstream mapping.
pnResetTime	TimeValue	0..1	attr	Specifies the runtime of the reset timer in seconds. This reset time is valid for the reset of PN requests in the EIRA and in the ERA.
sleepMode Supported	Boolean	1	attr	Specifies whether the ECU instance may be put to a "low power mode" • true: sleep mode is supported • false: sleep mode is not supported Note: This flag may only be set to "true" if the feature is supported by both hardware and basic software.
tcpIpIcmpProps	EthTcpIpIcmpProps	0..1	ref	EcuInstance specific ICMP (Internet Control Message Protocol) attributes
tcpIpProps	EthTcpIpProps	0..1	ref	EcuInstance specific TcpIp Stack attributes.
v2xSupported	V2xSupportEnum	0..1	attr	This attribute is used to control the existence of the V2X stack on the given EcuInstance.
wakeUpOver BusSupported	Boolean	1	attr	Driver support for wakeup over Bus.

Table B.16: EcuInstance

Class	***ExecutableEntity*** (abstract)			
Package	M2::AUTOSARTemplates::CommonStructure::InternalBehavior			
Note	Abstraction of executable code.			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	*BswModuleEntity*, RunnableEntity			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
activation Reason	ExecutableEntity ActivationReason	*	aggr	If the ExecutableEntity provides at least one activation Reason element the RTE resp. BSW Scheduler shall provide means to read the activation vector of this executable entity execution. If no activationReason element is provided the feature of being able to determine the activating RTEEvent is disabled for this ExecutableEntity.
canEnter ExclusiveArea	ExclusiveArea	*	ref	This means that the executable entity can enter/leave the referenced exclusive area through explicit API calls.
exclusiveArea NestingOrder	ExclusiveAreaNesting Order	*	ref	This represents the set of ExclusiveAreaNestingOrders recognized by this ExecutableEntity.
minimumStart Interval	TimeValue	0..1	attr	Specifies the time in seconds by which two consecutive starts of an ExecutableEntity are guaranteed to be separated.

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Class	***ExecutableEntity*** (abstract)			
reentrancyLevel	ReentrancyLevelEnum	0..1	attr	The reentrancy level of this ExecutableEntity. See the documentation of the enumeration type ReentrancyLevel Enum for details. Please note that nonReentrant interfaces can have also reentrant or multicoreReentrant implementations, and reentrant interfaces can also have multicoreReentrant implementations.
runsInside ExclusiveArea	ExclusiveArea	*	ref	The executable entity runs completely inside the referenced exclusive area.
swAddrMethod	SwAddrMethod	0..1	ref	Addressing method related to this code entity. Via an association to the same SwAddrMethod, it can be specified that several code entities (even of different modules or components) shall be located in the same memory without already specifying the memory section itself.

Table B.17: ExecutableEntity

Class	**ExternalTriggerOccurredEvent**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::SwcInternalBehavior::RTEEvents			
Note	The event is raised when the referenced trigger have been occurred.			
Base	*ARObject*, *AbstractEvent*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *Multilanguage Referrable*, *RTEEvent*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
trigger	Trigger	0..1	iref	Reference to the applicable Trigger. **InstanceRef implemented by:**RTriggerInAtomicSwc InstanceRef

Table B.18: ExternalTriggerOccurredEvent

Class	**ExternalTriggeringPoint**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::SwcInternalBehavior::Trigger			
Note	If a RunnableEntity owns an ExternalTriggeringPoint it is entitled to raise an ExternalTriggerOccurred Event.			
Base	*ARObject*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
ident	ExternalTriggeringPoint Ident	0..1	aggr	The aggregation in the role ident provides the ability to make the ExternalTriggeringPoint identifiable. From the semantical point of view, the ExternalTriggering Point is considered a first-class Identifiable and therefore the aggregation in the role ident shall always exist (until it may be possible to let ModeAccessPoint directly inherit from Identifiable). **Stereotypes:** atpIdentityContributor **Tags:** atp.Status=shallBecomeMandatory xml.sequenceOffset=-100
trigger	Trigger	0..1	iref	The trigger taken for the ExternalTriggeringPoint. **Tags:** xml.namePlural=TRIGGER-IREF xml.roleElement=false ▽

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Class	**ExternalTriggeringPoint**			
				△ xml.roleWrapperElement=true xml.typeElement=true xml.typeWrapperElement=false **InstanceRef implemented by:**PTriggerInAtomicSwcType InstanceRef

Table B.19: ExternalTriggeringPoint

Class	**ImplementationDataType**			
Package	M2::AUTOSARTemplates::CommonStructure::ImplementationDataTypes			
Note	Describes a reusable data type on the implementation level. This will typically correspond to a typedef in C-code. **Tags:**atp.recommendedPackage=ImplementationDataTypes			
Base	*ARElement*, *ARObject*, *AbstractImplementationDataType*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *AutosarDataType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *Packageable Element*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
dynamicArray SizeProfile	String	0..1	attr	Specifies the profile which the array will follow in case this data type is a variable size array.
isStructWith Optional Element	Boolean	0..1	attr	This attribute is only valid if the attribute category is set to STRUCTURE. If set to True, this attribute indicates that the ImplementationDataType has been created with the intention to define at least one element of the structure as optional.
subElement (ordered)	ImplementationData TypeElement	*	aggr	Specifies an element of an array, struct, or union data type. The aggregation of ImplementionDataTypeElement is subject to variability with the purpose to support the conditional existence of elements inside a Implementation DataType representing a structure. **Stereotypes:** atpVariation **Tags:**vh.latestBindingTime=preCompileTime
symbolProps	SymbolProps	0..1	aggr	This represents the SymbolProps for the Implementation DataType. **Stereotypes:** atpSplitable **Tags:**atp.Splitkey=symbolProps.shortName
typeEmitter	NameToken	0..1	attr	This attribute is used to control which part of the AUTOSAR toolchain is supposed to trigger data type definitions.

Table B.20: ImplementationDataType

Class	***InternalBehavior*** (abstract)			
Package	M2::AUTOSARTemplates::CommonStructure::InternalBehavior			
Note	Common base class (abstract) for the internal behavior of both software components and basic software modules/clusters.			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	BswInternalBehavior, SwcInternalBehavior			
Attribute	***Type***	***Mult.***	***Kind***	***Note***

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Class	***InternalBehavior*** (abstract)			
constant Memory	ParameterData Prototype	*	aggr	Describes a read only memory object containing characteristic value(s) implemented by this Internal Behavior. The shortName of ParameterDataPrototype has to be equal to the ”C’ identifier of the described constant. The characteristic value(s) might be shared between Sw ComponentPrototypes of the same SwComponentType. The aggregation of constantMemory is subject to variability with the purpose to support variability in the software component or module implementations. Typically different algorithms in the implementation are requiring different number of memory objects. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=constantMemory.shortName, constant Memory.variationPoint.shortLabel vh.latestBindingTime=preCompileTime
constantValue Mapping	ConstantSpecification MappingSet	*	ref	Reference to the ConstanSpecificationMapping to be applied for the particular InternalBehavior **Stereotypes:** atpSplitable **Tags:**atp.Splitkey=constantValueMapping
dataType Mapping	DataTypeMappingSet	*	ref	Reference to the DataTypeMapping to be applied for the particular InternalBehavior **Stereotypes:** atpSplitable **Tags:**atp.Splitkey=dataTypeMapping
exclusiveArea	ExclusiveArea	*	aggr	This specifies an ExclusiveArea for this InternalBehavior. The exclusiveArea is local to the component resp. module. The aggregation of ExclusiveAreas is subject to variability. Note: the number of ExclusiveAreas might vary due to the conditional existence of RunnableEntities or BswModuleEntities. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=exclusiveArea.shortName, exclusive Area.variationPoint.shortLabel vh.latestBindingTime=preCompileTime
exclusiveArea NestingOrder	ExclusiveAreaNesting Order	*	aggr	This represents the set of ExclusiveAreaNestingOrder owned by the InternalBehavior. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=exclusiveAreaNestingOrder.shortName, exclusiveAreaNestingOrder.variationPoint.shortLabel vh.latestBindingTime=preCompileTime
staticMemory	VariableDataPrototype	*	aggr	Describes a read and writeable static memory object representing measurerment variables implemented by this software component. The term "static" is used in the meaning of "non-temporary" and does not necessarily specify a linker encapsulation. This kind of memory is only supported if supportsMultipleInstantiation is FALSE. The shortName of the VariableDataPrototype has to be equal with the ”C’ identifier of the described variable. The aggregation of staticMemory is subject to variability with the purpose to support variability in the software component’s implementations. ▽

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Class	*InternalBehavior* (abstract)			
				△ Typically different algorithms in the implementation are requiring different number of memory objects. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=staticMemory.shortName, staticMemory.variationPoint.shortLabel vh.latestBindingTime=preCompileTime

Table B.21: InternalBehavior

Class	**InternalTriggerOccurredEvent**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::SwcInternalBehavior::RTEEvents			
Note	The event is raised when the referenced internal trigger have been occurred.			
Base	*ARObject*, *AbstractEvent*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *RTEEvent*, *Referrable*			
Attribute	*Type*	*Mult.*	*Kind*	*Note*
eventSource	InternalTriggeringPoint	0..1	ref	Internal Triggering Point that triggers the event.

Table B.22: InternalTriggerOccurredEvent

Class	**ModeAccessPoint**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::SwcInternalBehavior::ModeDeclarationGroup			
Note	A ModeAccessPoint is required by a RunnableEntity owned by a Mode Manager or Mode User. Its semantics implies the ability to access the current mode (provided by the RTE) of a ModeDeclaration GroupPrototype's ModeDeclarationGroup.			
Base	*ARObject*			
Attribute	*Type*	*Mult.*	*Kind*	*Note*
ident	ModeAccessPointIdent	0..1	aggr	The aggregation in the role ident provides the ability to make the ModeAccessPoint identifiable. From the semantical point of view, the ModeAccessPoint is considered a first-class Identifiable and therefore the aggregation in the role ident shall always exist (until it may be possible to let ModeAccessPoint directly inherit from Identifiable). **Stereotypes:** atpIdentityContributor **Tags:** atp.Status=shallBecomeMandatory xml.sequenceOffset=-100
modeGroup	ModeDeclarationGroupPrototype	0..1	iref	The mode declaration group that is accessed by this runnable. **Tags:**xml.typeElement=true **InstanceRef implemented by:**ModeGroupInAtomicSwcInstanceRef

Table B.23: ModeAccessPoint

Class	**ModeDeclarationGroup**
Package	M2::AUTOSARTemplates::CommonStructure::ModeDeclaration
Note	A collection of Mode Declarations. Also, the initial mode is explicitly identified. **Tags:**atp.recommendedPackage=ModeDeclarationGroups

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Class	**ModeDeclarationGroup**			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
initialMode	ModeDeclaration	0..1	ref	The initial mode of the ModeDeclarationGroup. This mode is active before any mode switches occurred.
mode Declaration	ModeDeclaration	*	aggr	The ModeDeclarations collected in this ModeDeclaration Group. **Stereotypes:** atpVariation **Tags:**vh.latestBindingTime=blueprintDerivationTime
modeManager ErrorBehavior	ModeErrorBehavior	0..1	aggr	This represents the ability to define the error behavior expected by the mode manager in case of errors on the mode user side (e.g. terminated mode user).
modeTransition	ModeTransition	*	aggr	This represents the avaliable ModeTransitions of the ModeDeclarationGroup
modeUserError Behavior	ModeErrorBehavior	0..1	aggr	This represents the definition of the error behavior expected by the mode user in case of errors on the mode manager side (e.g. terminated mode manager).
onTransition Value	PositiveInteger	0..1	attr	The value of this attribute shall be taken into account by the RTE generator for programmatically representing a value used for the transition between two statuses.

Table B.24: ModeDeclarationGroup

Class	**ModeDeclarationGroupPrototype**			
Package	M2::AUTOSARTemplates::CommonStructure::ModeDeclaration			
Note	The ModeDeclarationGroupPrototype specifies a set of Modes (ModeDeclarationGroup) which is provided or required in the given context.			
Base	*ARObject*, *AtpFeature*, *AtpPrototype*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
swCalibration Access	SwCalibrationAccess Enum	0..1	attr	This allows for specifying whether or not the enclosing ModeDeclarationGroupPrototype can be measured at run-time.
type	ModeDeclarationGroup	0..1	tref	The "collection of ModeDeclarations" (= ModeDeclaration Group) supported by a component **Stereotypes:** isOfType

Table B.25: ModeDeclarationGroupPrototype

Class	**ModeSwitchInterface**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::PortInterface			
Note	A mode switch interface declares a ModeDeclarationGroupPrototype to be sent and received. **Tags:**atp.recommendedPackage=PortInterfaces			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *PortInterface*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
modeGroup	ModeDeclarationGroup Prototype	0..1	aggr	The ModeDeclarationGroupPrototype of this mode interface.

Table B.26: ModeSwitchInterface

Class	**ModeSwitchPoint**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::SwcInternalBehavior::ModeDeclarationGroup			
Note	A ModeSwitchPoint is required by a RunnableEntity owned a Mode Manager. Its semantics implies the ability to initiate a mode switch.			
Base	*ARObject*, *AbstractAccessPoint*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
modeGroup	ModeDeclarationGroup Prototype	0..1	iref	The mode declaration group that is switched by this runnable. **InstanceRef implemented by:**PModeGroupInAtomic SwcInstanceRef

Table B.27: ModeSwitchPoint

Class	**NonqueuedSenderComSpec**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Communication			
Note	Communication attributes for non-queued sender/receiver communication (sender side)			
Base	*ARObject*, *PPortComSpec*, *SenderComSpec*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
dataFilter	DataFilter	0..1	aggr	The applicable filter algorithm for filtering the value of the corresponding dataElement.
initValue	ValueSpecification	0..1	aggr	Initial value to be sent if sender component is not yet fully initialized, but receiver needs data already.

Table B.28: NonqueuedSenderComSpec

Class	**PPortPrototype**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Components			
Note	Component port providing a certain port interface.			
Base	*ARObject*, *AbstractProvidedPortPrototype*, *AtpBlueprintable*, *AtpFeature*, *AtpPrototype*, *Identifiable*, *MultilanguageReferrable*, *PortPrototype*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
provided Interface	PortInterface	0..1	tref	The interface that this port provides. **Stereotypes:** isOfType

Table B.29: PPortPrototype

Class	**ParameterAccess**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::SwcInternalBehavior::DataElements			
Note	The presence of a ParameterAccess implies that a RunnableEntity needs access to a ParameterData Prototype.			
Base	*ARObject*, *AbstractAccessPoint*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
accessed Parameter	AutosarParameterRef	0..1	aggr	Refernce to the accessed calibration parameter.
swDataDef Props	SwDataDefProps	0..1	aggr	This allows denote instance and access specific properties, mainly input values and common axis.

Table B.30: ParameterAccess

Class	**ParameterDataPrototype**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Datatype::DataPrototypes			
Note	A parameter element used for parameter interface and internal behavior, supporting signal like parameter and characteristic value communication patterns and parameter and characteristic value definition.			
Base	*ARObject*, *AtpFeature*, *AtpPrototype*, *AutosarDataPrototype*, *DataPrototype*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
initValue	ValueSpecification	0..1	aggr	Specifies initial value(s) of the ParameterDataPrototype

Table B.31: ParameterDataPrototype

Class	**PortElementToCommunicationResourceMapping**			
Package	M2::AUTOSARTemplates::SystemTemplate			
Note	This meta class maps a communication resource to CP Software Clusters. In this case the kind of Port Prototype specified whether the Software Cluster has to provide or to require the resource. **Tags:**atp.Status=draft			
Base	*ARObject*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
clientServer Operation	ClientServerOperation	0..1	iref	ClientServerOperation instance qualifying the communication resource **Tags:**atp.Status=draft **InstanceRef implemented by:**OperationInSystem InstanceRef
communication Resource	CpSoftwareCluster Communication Resource	0..1	ref	Communication resource for which the mapping applies. **Tags:**atp.Status=draft
mode Declaration GroupPrototype	ModeDeclarationGroup Prototype	0..1	iref	ModeDeclarationGroupPrototype instance qualifying the communication resource **Tags:**atp.Status=draft **InstanceRef implemented by:**ModeDeclarationGroup PrototypeInSystemInstanceRef
parameterData Prototype	ParameterData Prototype	0..1	iref	ParameterDataPrototype instance qualifying the communication resource. **Tags:**atp.Status=draft **InstanceRef implemented by:**ParameterDataPrototype InSystemInstanceRef
trigger	Trigger	0..1	iref	Trigger instance qualifying the communication resource. **Tags:**atp.Status=draft **InstanceRef implemented by:**TriggerInSystemInstance Ref
variableData Prototype	VariableDataPrototype	0..1	iref	VariableDataPrototype instance qualifying the communication resource **Tags:**atp.Status=draft **InstanceRef implemented by:**VariableDataPrototypeIn SystemInstanceRef

Table B.32: PortElementToCommunicationResourceMapping

Class	***PortInterface*** (abstract)			
Package	M2::AUTOSARTemplates::SWComponentTemplate::PortInterface			
Note	Abstract base class for an interface that is either provided or required by a port of a software component.			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*			
Subclasses	ClientServerInterface, *DataInterface*, ModeSwitchInterface, TriggerInterface			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
isService	Boolean	0..1	attr	This flag is set if the PortInterface is to be used for communication between an • ApplicationSwComponentType or • ServiceProxySwComponentType or • SensorActuatorSwComponentType or • ComplexDeviceDriverSwComponentType • ServiceSwComponentType • EcuAbstractionSwComponentType and a ServiceSwComponentType (namely an AUTOSAR Service) located on the same ECU. Otherwise the flag is not set.
serviceKind	ServiceProviderEnum	0..1	attr	This attribute provides further details about the nature of the applied service.

Table B.33: PortInterface

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.
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.
senderReceiver Annotation	SenderReceiver Annotation	*	aggr	Collection of annotations of this ports sender/receiver communication.
triggerPort Annotation	TriggerPortAnnotation	*	aggr	Annotations on this trigger port.

Table B.34: PortPrototype

Class	**RunnableEntity**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::SwcInternalBehavior			
Note	A RunnableEntity represents the smallest code-fragment that is provided by an AtomicSwComponent Type and are executed under control of the RTE. RunnableEntities are for instance set up to respond to data reception or operation invocation on a server.			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *ExecutableEntity*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
argument (ordered)	RunnableEntity Argument	*	aggr	This represents the formal definition of a an argument to a RunnableEntity.
asynchronous ServerCall ResultPoint	AsynchronousServer CallResultPoint	*	aggr	The server call result point admits a runnable to fetch the result of an asynchronous server call. The aggregation of AsynchronousServerCallResultPoint is subject to variability with the purpose to support the conditional existence of client server PortPrototypes and the variant existence of server call result points in the implementation. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=asynchronousServerCallResultPoint.shortName, asynchronousServerCallResultPoint.variationPoint.shortLabel vh.latestBindingTime=preCompileTime
canBeInvoked Concurrently	Boolean	0..1	attr	If the value of this attribute is set to "true" the enclosing RunnableEntity can be invoked concurrently (even for one instance of the corresponding AtomicSwComponent Type). This implies that it is the responsibility of the implementation of the RunnableEntity to take care of this form of concurrency. Note that the default value of this attribute is set to "false".
dataRead Access	VariableAccess	*	aggr	RunnableEntity has implicit read access to dataElement of a sender-receiver PortPrototype or nv data of a nv data PortPrototype. The aggregation of dataReadAccess is subject to variability with the purpose to support the conditional existence of sender receiver ports or the variant existence of dataReadAccess in the implementation. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=dataReadAccess.shortName, dataReadAccess.variationPoint.shortLabel vh.latestBindingTime=preCompileTime
dataReceive PointBy Argument	VariableAccess	*	aggr	RunnableEntity has explicit read access to dataElement of a sender-receiver PortPrototype or nv data of a nv data PortPrototype. The result is passed back to the application by means of an argument in the function signature. The aggregation of dataReceivePointByArgument is subject to variability with the purpose to support the conditional existence of sender receiver PortPrototype or the variant existence of data receive points in the implementation. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=dataReceivePointByArgument.shortName, dataReceivePointByArgument.variationPoint.shortLabel vh.latestBindingTime=preCompileTime

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Class	**RunnableEntity**			
dataReceive PointByValue	VariableAccess	*	aggr	RunnableEntity has explicit read access to dataElement of a sender-receiver PortPrototype or nv data of a nv data PortPrototype. The result is passed back to the application by means of the return value. The aggregation of dataReceivePointBy Value is subject to variability with the purpose to support the conditional existence of sender receiver ports or the variant existence of data receive points in the implementation. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=dataReceivePointByValue.shortName, data ReceivePointByValue.variationPoint.shortLabel vh.latestBindingTime=preCompileTime
dataSendPoint	VariableAccess	*	aggr	RunnableEntity has explicit write access to dataElement of a sender-receiver PortPrototype or nv data of a nv data PortPrototype. The aggregation of dataSendPoint is subject to variability with the purpose to support the conditional existence of sender receiver PortPrototype or the variant existence of data send points in the implementation. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=dataSendPoint.shortName, dataSend Point.variationPoint.shortLabel vh.latestBindingTime=preCompileTime
dataWrite Access	VariableAccess	*	aggr	RunnableEntity has implicit write access to dataElement of a sender-receiver PortPrototype or nv data of a nv data PortPrototype. The aggregation of dataWriteAccess is subject to variability with the purpose to support the conditional existence of sender receiver ports or the variant existence of dataWriteAccess in the implementation. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=dataWriteAccess.shortName, dataWrite Access.variationPoint.shortLabel vh.latestBindingTime=preCompileTime
external TriggeringPoint	ExternalTriggeringPoint	*	aggr	The aggregation of ExternalTriggeringPoint is subject to variability with the purpose to support the conditional existence of trigger ports or the variant existence of external triggering points in the implementation. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=externalTriggeringPoint.ident.shortName, externalTriggeringPoint.variationPoint.shortLabel vh.latestBindingTime=preCompileTime
internal TriggeringPoint	InternalTriggeringPoint	*	aggr	The aggregation of InternalTriggeringPoint is subject to variability with the purpose to support the variant existence of internal triggering points in the implementation. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=internalTriggeringPoint.shortName, internal TriggeringPoint.variationPoint.shortLabel vh.latestBindingTime=preCompileTime

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Class	**RunnableEntity**			
modeAccess Point	ModeAccessPoint	*	aggr	The runnable has a mode access point. The aggregation of ModeAccessPoint is subject to variability with the purpose to support the conditional existence of mode ports or the variant existence of mode access points in the implementation. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=modeAccessPoint.ident.shortName, mode AccessPoint.variationPoint.shortLabel vh.latestBindingTime=preCompileTime
modeSwitch Point	ModeSwitchPoint	*	aggr	The runnable has a mode switch point. The aggregation of ModeSwitchPoint is subject to variability with the purpose to support the conditional existence of mode ports or the variant existence of mode switch points in the implementation. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=modeSwitchPoint.shortName, modeSwitch Point.variationPoint.shortLabel vh.latestBindingTime=preCompileTime
parameter Access	ParameterAccess	*	aggr	The presence of a ParameterAccess implies that a RunnableEntity needs read only access to a Parameter DataPrototype which may either be local or within a Port Prototype. The aggregation of ParameterAccess is subject to variability with the purpose to support the conditional existence of parameter ports and component local parameters as well as the variant existence of Parameter Access (points) in the implementation. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=parameterAccess.shortName, parameter Access.variationPoint.shortLabel vh.latestBindingTime=preCompileTime
readLocal Variable	VariableAccess	*	aggr	The presence of a readLocalVariable implies that a RunnableEntity needs read access to a VariableData Prototype in the role of implicitInterRunnableVariable or explicitInterRunnableVariable. The aggregation of readLocalVariable is subject to variability with the purpose to support the conditional existence of implicitInterRunnableVariable and explicit InterRunnableVariable or the variant existence of read LocalVariable (points) in the implementation. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=readLocalVariable.shortName, readLocal Variable.variationPoint.shortLabel vh.latestBindingTime=preCompileTime
serverCallPoint	ServerCallPoint	*	aggr	The RunnableEntity has a ServerCallPoint. The aggregation of ServerCallPoint is subject to variability with the purpose to support the conditional existence of client server PortPrototypes or the variant existence of server call points in the implementation. ▽

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Class	**RunnableEntity**			
				△ **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=serverCallPoint.shortName, serverCall Point.variationPoint.shortLabel vh.latestBindingTime=preCompileTime
symbol	CIdentifier	0..1	attr	The symbol describing this RunnableEntity's entry point. This is considered the API of the RunnableEntity and is required during the RTE contract phase.
waitPoint	WaitPoint	*	aggr	The WaitPoint associated with the RunnableEntity.
writtenLocal Variable	VariableAccess	*	aggr	The presence of a writtenLocalVariable implies that a RunnableEntity needs write access to a VariableData Prototype in the role of implicitInterRunnableVariable or explicitInterRunnableVariable. The aggregation of writtenLocalVariable is subject to variability with the purpose to support the conditional existence of implicitInterRunnableVariable and explicit InterRunnableVariable or the variant existence of written LocalVariable (points) in the implementation. **Stereotypes:** atpSplitable; atpVariation **Tags:** atp.Splitkey=writtenLocalVariable.shortName, written LocalVariable.variationPoint.shortLabel vh.latestBindingTime=preCompileTime

Table B.35: RunnableEntity

Class	**SenderReceiverInterface**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::PortInterface			
Note	A sender/receiver interface declares a number of data elements to be sent and received. **Tags:**atp.recommendedPackage=PortInterfaces			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *DataInterface*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *PortInterface*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
dataElement	VariableDataPrototype	*	aggr	The data elements of this SenderReceiverInterface.
invalidation Policy	InvalidationPolicy	*	aggr	InvalidationPolicy for a particular dataElement
metaDataItem Set	MetaDataItemSet	*	aggr	This aggregation defines fixed sets of meta-data items associated with dataElements of the enclosing Sender ReceiverInterface

Table B.36: SenderReceiverInterface

Class	***ServerCallPoint*** (abstract)			
Package	M2::AUTOSARTemplates::SWComponentTemplate::SwcInternalBehavior::ServerCall			
Note	If a RunnableEntity owns a ServerCallPoint it is entitled to invoke a particular ClientServerOperation of a specific RPortPrototype of the corresponding AtomicSwComponentType			
Base	*ARObject*, *AbstractAccessPoint*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Subclasses	AsynchronousServerCallPoint, SynchronousServerCallPoint			
Attribute	***Type***	***Mult.***	***Kind***	***Note***

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Class	***ServerCallPoint*** (abstract)			
operation	ClientServerOperation	0..1	iref	The operation that is called by this runnable. **InstanceRef implemented by:**ROperationInAtomicSwc InstanceRef
timeout	TimeValue	0..1	attr	Time in seconds before the server call times out and returns with an error message. It depends on the call type (synchronous or asynchronous) how this is reported.

Table B.37: ServerCallPoint

Class	**ServiceSwComponentType**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::Components			
Note	ServiceSwComponentType is used for configuring services for a given ECU. Instances of this class are only to be created in ECU Configuration phase for the specific purpose of the service configuration. **Tags:**atp.recommendedPackage=SwComponentTypes			
Base	*ARElement*, *ARObject*, *AtomicSwComponentType*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *Referrable*, *SwComponentType*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
–	–	–	–	–

Table B.38: ServiceSwComponentType

Class	**SwcModeSwitchEvent**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::SwcInternalBehavior::RTEEvents			
Note	This event is raised upon a received mode change.			
Base	*ARObject*, *AbstractEvent*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *RTEEvent*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
activation	ModeActivationKind	0..1	attr	Specifies if the event is activated on entering or exiting the referenced Mode.
mode (ordered)	ModeDeclaration	0..2	iref	Reference to one or two Modes that initiate the SwcModeSwitchEvent. **InstanceRef implemented by:**RModeInAtomicSwc InstanceRef

Table B.39: SwcModeSwitchEvent

Class	**Trigger**			
Package	M2::AUTOSARTemplates::CommonStructure::TriggerDeclaration			
Note	A trigger which is provided (i.e. released) or required (i.e. used to activate something) in the given context.			
Base	*ARObject*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
swImplPolicy	SwImplPolicyEnum	0..1	attr	This attribute, when set to value queued, allows for a queued processing of Triggers.
triggerPeriod	MultidimensionalTime	0..1	aggr	Optional definition of a period in case of a periodically (time or angle) driven external trigger.

Table B.40: Trigger

Class	**TriggerInterface**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::PortInterface			
Note	A trigger interface declares a number of triggers that can be sent by an trigger source. **Tags:**atp.recommendedPackage=PortInterfaces			
Base	*ARElement*, *ARObject*, *AtpBlueprint*, *AtpBlueprintable*, *AtpClassifier*, *AtpType*, *CollectableElement*, *Identifiable*, *MultilanguageReferrable*, *PackageableElement*, *PortInterface*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
trigger	Trigger	*	aggr	The Trigger of this trigger interface.

Table B.41: TriggerInterface

Class	**VariableAccess**			
Package	M2::AUTOSARTemplates::SWComponentTemplate::SwcInternalBehavior::DataElements			
Note	The presence of a VariableAccess implies that a RunnableEntity needs access to a VariableData Prototype. The kind of access is specified by the role in which the class is used.			
Base	*ARObject*, *AbstractAccessPoint*, *AtpClassifier*, *AtpFeature*, *AtpStructureElement*, *Identifiable*, *MultilanguageReferrable*, *Referrable*			
Attribute	***Type***	***Mult.***	***Kind***	***Note***
accessed Variable	AutosarVariableRef	0..1	aggr	This denotes the accessed variable.
scope	VariableAccessScope Enum	0..1	attr	This attribute allows for constraining the scope of the corresponding communication. For example, it possible to express whether the communication is intended to cross the boundary of an ECU or whether it is intended not to cross the boundary of a single partition.

Table B.42: VariableAccess

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

Table B.43: VariableDataPrototype