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2017-10-27	17-10	AUTOSAR Release Management	<ul style="list-style-type: none"> Minor changes, document clean up
2017-03-31	17-03	AUTOSAR Release Management	<ul style="list-style-type: none"> Initial release

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1 Scope of This Document

This document specifies the requirements of [AUTOSAR Adaptive Platform](#) on the [Operating System](#) that is part of the Foundation in the [AUTOSAR Adaptive Platform](#).

2 Conventions to be Used

The representation of requirements in AUTOSAR documents follows the table specified in [TPS_STDT_00078], see Standardization Template [3], chapter Support for Traceability.

The verbal forms for the expression of obligation specified in [TPS_STDT_00053] shall be used to indicate requirements, see Standardization Template [3], chapter Support for Traceability.

2.1 Requirements Guidelines

2.1.1 Requirements Quality

[RS_OSI_NA]{DRAFT} [These requirements are not applicable as they are not within the scope of this release.] (*RS_Main_00026, RS_Main_00030, RS_Main_00080, RS_Main_00180, RS_Main_00190, RS_Main_00230, RS_Main_00250, RS_Main_00260, RS_Main_00261, RS_Main_00270, RS_Main_00280, RS_Main_00300, RS_Main_00301, RS_Main_00310, RS_Main_00320, RS_Main_00340, RS_Main_00350, RS_Main_00360, RS_Main_00440, RS_Main_00445, RS_Main_00490, RS_Main_00491, RS_Main_00500, RS_Main_00501, RS_Main_00507, RS_Main_00510, RS_Main_00511, RS_Main_00650, RS_Main_00653, RS_Main_01001, RS_Main_01002, RS_Main_01003, RS_Main_01004, RS_Main_01005, RS_Main_01007, RS_Main_01008, RS_Main_01025*)

2.1.2 Requirements Identification

2.1.3 Requirements Status

The following requirements are described within this document but not otherwise considered in this release:

- [\[RS_OSI_00204\]](#)
- [\[RS_OSI_00208\]](#)
- [\[RS_OSI_00209\]](#)

The functionality described above is subject to modification and will be considered for inclusion in a future release of this document.

3 Acronyms and Abbreviations

Abbreviation / Acronym:	Description:
Operating System Interface	A Functional Cluster within the Adaptive Platform Foundation .
AUTOSAR Adaptive Platform	see [4] AUTOSAR Glossary
Adaptive Platform Foundation	see [4] AUTOSAR Glossary
Adaptive Application	see [4] AUTOSAR Glossary
Execution Management	The element of the AUTOSAR Adaptive Platform responsible for the ordered startup and shutdown of the AUTOSAR Adaptive Platform and Adaptive Applications .
Application	see [4] AUTOSAR Glossary
Operating System	Software responsible for managing Processes on a Machine and for providing an interface to hardware resources.
Machine	see [4] AUTOSAR Glossary
Process	see [4] AUTOSAR Glossary
Functional Cluster	see [4] AUTOSAR Glossary
Task	In case of POSIX a Task is called thread or pthread. see [4] AUTOSAR Glossary
ARTI	see [4] AUTOSAR Glossary

4 Requirements Specification

4.1 Functional Overview

The [Operating System](#) is responsible for run-time resource management (including time) for all [Applications](#) on and within the [AUTOSAR Adaptive Platform](#). This includes not only the [Adaptive Applications](#) that run on top of ARA provided by [AUTOSAR Adaptive Platform](#), but also the [Functional Clusters](#) that constitute the platform, which are also implemented as [Applications](#). The OS functions in cooperation with [Execution Management](#) which is responsible for platform initialization and the start-up / shut-down of [Applications](#).

Note that this [Operating System Interface](#) (OSI) requirement specification contains two different categories. The first category contains the requirements that are directly needed by the [Adaptive Applications](#). The other category contains the ones that are needed by the [AUTOSAR Adaptive Platform](#) to realize implementation of [Functional Clusters](#), especially the required mechanisms are difficult or inefficient to be implemented by other software entity than the OS. The most notable such [Functional Cluster](#) requiring the various OS mechanisms is [Execution Management](#).

4.2 Functional Requirements

This chapter describes all requirements driving the work to define the [Operating Systems](#) functionality.

4.2.1 Assumption of Use

This section describes execution environment of the [AUTOSAR Adaptive Platform](#) that is directly or indirectly used to run the [Applications](#). This execution environment is not requirements to the [AUTOSAR Adaptive Platform](#) in the strict sense, but rather assumptions on properties of [Application](#) running on the [AUTOSAR Adaptive Platform](#). These assumptions are used to motivate the further requirements, and provide hints for [Application](#) developers to check if their use cases are covered in this specification document and which specific requirements are derived from those use cases.

The [Operating System](#) section defines requirements on the [Operating System](#) that processes can consider fulfilled in order to achieve their function.

4.2.2 General Requirements

This section describes APIs that should be exposed to processes on the [AUTOSAR Adaptive Platform](#) that closely relates to the [Operating System](#) functionality. Some libraries in the system may be considered by a Developer to be part of the [Operating System](#) without strictly-speaking belonging to it, for example the C++ runtime libraries. For the purpose of this section, the [Operating System](#) kernel and its libraries are considered to be a single entity.

[RS_OSI_00100] The Operating System Interface provided to processes shall provide a PSE51-compliant API. [

Description:	The foundation of the Operating System provided to the process shall be POSIX-compliant as defined by PSE51.
Rationale:	The defined functionality of the POSIX profile PSE51 defined by IEEE1003.13 [5] is provided by various off-the-shelf operating systems. The PSE51 profile is intended for embedded systems, with a single multi-threaded process, no file system, no user and group support and only selected options from more general IEEE1003.1 [6], which is the well-known POSIX standard. PSE51 offers functions for basic synchronized I/O, high-resolution timer, signals, semaphores, shared memory and threads. As the envisioned Application software components will not require to fork new processes themselves, and only need limited direct access to files, the PSE51 profile is thought to be sufficient.
Dependencies:	–
Use Case:	Application portability.
Supporting Material:	IEEE1003.13 [5] and IEEE1003.1 [6]

]([RS_Main_00002](#), [RS_Main_00050](#), [RS_Main_00150](#), [RS_Main_00420](#))

[RS_OSI_00103] The Operating System Interface shall support C++. [

Description:	The Operating System interface shall support C++11.
Rationale:	Processes are written in C++ and interfaces are expected to conform to C++11. Note that the POSIX API consists of C functions which can be invoked from a C++ program.
Dependencies:	–
Use Case:	–
Supporting Material:	–

]([RS_Main_00060](#))

[RS_OSI_00104] The Operating System Interface shall support the reaction on process-external stimuli from devices. [

Description:	The Operating System shall enable processes to react on external stimuli from devices.
Rationale:	Application will react on reception of functional data, signals and timers from the platform. Certain computations shall be executed in reaction on these application-external stimuli.
Dependencies:	–
Use Case:	–
Supporting Material:	–

] ([RS_Main_00050](#), [RS_Main_00060](#), [RS_Main_00460](#))

[RS_OSI_00105] The Operating System Interface shall support the start of [Execution Management](#). [

Description:	The Operating System shall provide means to start the Execution Management functional cluster as first process.
Rationale:	Execution Management is responsible for startup and shutdown of all processes of the AUTOSAR Adaptive Platform .
Dependencies:	–
Use Case:	–
Supporting Material:	–

] ([RS_Main_00049](#), [RS_Main_00460](#))

4.2.3 Operating System Requirements

[RS_OSI_00201] The Operating System shall provide mechanisms for system memory budgeting. [

Description:	The Operating System shall provide mechanisms to configure memory budgeting for each process or for groups of processes.
Rationale:	In order to ensure resource availability in the context of a multi-process system, the system integrator/architect may require a set of tools to configure memory budgeting for each process or for groups of process.
Dependencies:	–
Use Case:	security - protection against DoS attacks - resource starvation types.
Supporting Material:	–

] ([RS_Main_00002](#), [RS_Main_00010](#), [RS_Main_00011](#), [RS_Main_00012](#), [RS_Main_00106](#), [RS_Main_00150](#), [RS_Main_00514](#), [RS_SAF_10008](#))

[RS_OSI_00202] The Operating System shall provide mechanisms for CPU time budgeting. [

Description:	The Operating System shall provide mechanisms to configure resource budgeting in terms of CPU time for each process or group of processes.
Rationale:	In order to ensure schedulability in the context of a multi-process system, the system integrator/architect may require a set of tools to configure CPU time allocated for each process or for groups of processes.
Dependencies:	–
Use Case:	security - protection against DoS attacks - resource starvation types.
Supporting Material:	–

] ([RS_Main_00002](#), [RS_Main_00010](#), [RS_Main_00011](#), [RS_Main_00012](#), [RS_Main_00106](#), [RS_Main_00150](#), [RS_Main_00514](#), [RS_SAF_10008](#))

[RS_OSI_00203] The Operating System should provide mechanisms for binding processes to CPU cores. [

Description:	The Operating System should provide mechanisms for binding individual processes or groups of processes to CPU cores.
Rationale:	In order to ensure correct task schedulability, the system integrator may require a set of tools to configure the CPU affinity of processes. In a multi-core system, it may be relevant to ensure some process can only run on some CPU cores, to allow other less- or differently-restricted processes to concurrently progress.
Dependencies:	–
Use Case:	–
Supporting Material:	–

] ([RS_Main_00002](#), [RS_Main_00010](#), [RS_Main_00011](#), [RS_Main_00012](#), [RS_Main_00050](#), [RS_Main_00106](#), [RS_Main_00514](#), [RS_SAF_10008](#))

[RS_OSI_00204]{DRAFT} The Operating System shall support authorized operating system object access for the software entities which are allowed to do so. [

Description:	The Operating System shall provide access rights and permissions mechanisms to achieve secure data access and data exchange.
Rationale:	The Operating System consists of a collection of hardware and software objects, e.g. pipes, files. Safety or/and Security related requirements may be imposed to grant special access rights and permissions in order to avoid unauthorized access to communication channels or to ensure exclusive access to the process-specific data stored persistently.
Dependencies:	–
Use Case:	–
Supporting Material:	–

] ([RS_Main_00010](#), [RS_Main_00170](#), [RS_Main_00514](#))

[RS_OSI_00206] The Operating System shall provide multi-process support for isolation of applications. [

Description:	The Operating System shall provide mechanisms to let multiple processes run isolated from each other.
Rationale:	Each process may have a different robustness, safety and security level. As a consequence, an incorrect memory access from one process execution shall not result in a corruption of memory in another process, unless the data area is explicitly shared. In addition, a process may not access or read data from another process without explicit data sharing.
Dependencies:	–
Use Case:	–
Supporting Material:	–

] ([RS_Main_00010](#), [RS_Main_00049](#), [RS_Main_00106](#), [RS_SAF_10008](#), [RS_SAF_10037](#))

[RS_OSI_00207] The [Operating System](#) shall provide the capability to share code and data in an implicit manner. [

Description:	The Operating System shall provide mechanisms to run the same code and associated data copy in multiple processes by using a shared object mechanism, where data is either read-only or a process-private copy.
Rationale:	To allow more efficient memory usage both in runtime memory and non-volatile storage, as well as making platform updates faster, applications may be linked against shared code and data objects. Using shared objects is not intended however to be mandatory for use by the AUTOSAR Adaptive Platform , as security, safety or other constraints may require not to use this feature.
Dependencies:	–
Use Case:	–
Supporting Material:	–

] ([RS_Main_00410](#), [RS_Main_00150](#), [RS_Main_00503](#))

[RS_OSI_00208]{DRAFT} The [Operating System](#) shall only allow processes to access required functionality. [

Description:	The Operating System shall ensure that either a process does not access operating system functionality via a system call at all, or the system call has to be authorized.
Rationale:	A process with full access to the Platform could cause significant damage.
Dependencies:	–
Use Case:	–
Supporting Material:	This requirement was visible before 18-10 Specification Release as RS_SEC_05009.

] ([RS_Main_00010](#), [RS_Main_00514](#))

[RS_OSI_00209]{DRAFT} The Operating System shall support error handling including unrecoverable errors. [

Description:	The Operating System shall support error handling including unrecoverable errors.
Rationale:	The operating system may face conditions where has no mechanism to recover the system. These situations are typically expected to result from a misconfigured system and therefore a suitable response might be to halt startup so that the misconfiguration can be resolved outside of the OS context.
Dependencies:	–
Use Case:	The Operating System can not start EM and hence the platform as a whole cannot be started - it is not possible to recover from this situation hence The OS shall halt startup.
Supporting Material:	This requirement was visible before 18-10 Specification Release as RS_SEC_05009.

]([RS_Main_00010](#), [RS_Main_00514](#))

[RS_OSI_00210]{DRAFT} The Operating System shall provide a mechanism to observe scheduling of CPU time to tasks, processes. [

Description:	The Operating System shall provide a mechanism to observe scheduling of CPU time to tasks, processes, etc.
Rationale:	It is mandatory to detect shortage in CPU resources and identify causing tasks and processes. For this the CPU load has to be observable. To identify tasks and processes that influences this CPU load the start, stop and switching of tasks and processes shall be observable, typically through additional ARTI -hooks.
Dependencies:	–
Use Case:	In order to support operating system awareness of tracing solutions, they require an interface to receive this information from the operating system.

]([RS_Main_01026](#))

[RS_OSI_00211]{DRAFT} The Operating System shall provide a mechanism to export low-level scheduling and trace information to applications. [

Description:	The Operating System shall provide a mechanism to export low-level scheduling and trace information to applications.
Rationale:	Similar to observing the scheduling of CPU time and its exporting through hooks, the same type of information can be provided to <code>ara::log</code> , if exported by the operating system.
Dependencies:	–
Use Case:	Provide additional operating system information in <code>ara::log</code> .

]([RS_Main_01026](#))

4.3 Non-Functional Requirements

No content.

5 Requirements Tracing

The following tables reference the requirements specified in [7] and links to the fulfillment of these. Please note that if column “Satisfied by” is empty for a specific requirement this means that this requirement is not fulfilled by this document.

Requirement	Description	Satisfied by
[RS_Main_00002]	AUTOSAR shall provide a software platform for high performance computing platforms	[RS_OSI_00100] [RS_OSI_00201] [RS_OSI_00202] [RS_OSI_00203]
[RS_Main_00010]	Safety Mechanisms	[RS_OSI_00201] [RS_OSI_00202] [RS_OSI_00203] [RS_OSI_00204] [RS_OSI_00206] [RS_OSI_00208] [RS_OSI_00209]
[RS_Main_00011]	Mechanisms for Reliable Systems	[RS_OSI_00201] [RS_OSI_00202] [RS_OSI_00203]
[RS_Main_00012]	Highly Available Systems Support	[RS_OSI_00201] [RS_OSI_00202] [RS_OSI_00203]
[RS_Main_00049]	AUTOSAR shall provide an Execution Management for running multiple applications	[RS_OSI_00105] [RS_OSI_00206]
[RS_Main_00050]	AUTOSAR shall provide an Execution Framework towards applications to implement concurrent application internal control flows	[RS_OSI_00100] [RS_OSI_00104] [RS_OSI_00203]
[RS_Main_00060]	Standardized Application Communication Interface	[RS_OSI_00103] [RS_OSI_00104]
[RS_Main_00106]	AUTOSAR shall provide the possibility to extend the software with new SWCs without recompiling the platform foundation	[RS_OSI_00201] [RS_OSI_00202] [RS_OSI_00203] [RS_OSI_00206]
[RS_Main_00150]	AUTOSAR shall support the deployment and reallocation of AUTOSAR Application Software	[RS_OSI_00100] [RS_OSI_00201] [RS_OSI_00202] [RS_OSI_00207]
[RS_Main_00170]	AUTOSAR shall provide secure access to ECU data and services	[RS_OSI_00204]
[RS_Main_00410]	AUTOSAR shall provide specifications for routines commonly used by Application Software to support sharing and optimization	[RS_OSI_00207]
[RS_Main_00420]	AUTOSAR shall use established software standards and consolidate de-facto standards for basic software functionality	[RS_OSI_00100]
[RS_Main_00460]	AUTOSAR shall standardize methods to organize mode management on Application, ECU and System level	[RS_OSI_00104] [RS_OSI_00105]
[RS_Main_00503]	AUTOSAR shall support change of communication and application software at runtime.	[RS_OSI_00207]
[RS_Main_00514]	System Security Support	[RS_OSI_00201] [RS_OSI_00202] [RS_OSI_00203] [RS_OSI_00204] [RS_OSI_00208] [RS_OSI_00209]
[RS_Main_01026]	AUTOSAR shall support tracing and profiling on the target and onboard	[RS_OSI_00210] [RS_OSI_00211]





Requirement	Description	Satisfied by
[RS_SAF_10008]	AUTOSAR shall provide mechanisms to support safe resource management for the AUTOSAR Adaptive Platform functional-clusters, applications and services and AUTOSAR Classic Platform basic software modules and software components.	[RS_OSI_00201] [RS_OSI_00202] [RS_OSI_00203] [RS_OSI_00206]
[RS_SAF_10037]	AUTOSAR shall provide mechanisms to prevent unintended alteration of data.	[RS_OSI_00206]

Table 5.1: RequirementsTracing

6 References

- [1] Safety Requirements for AUTOSAR Adaptive Platform and AUTOSAR Classic Platform
AUTOSAR_FO_RS_Safety
- [2] Requirements on Execution Management
AUTOSAR_AP_RS_ExecutionManagement
- [3] Standardization Template
AUTOSAR_FO_TPS_StandardizationTemplate
- [4] Glossary
AUTOSAR_FO_TR_Glossary
- [5] IEEE Standard for Information Technology- Standardized Application Environment Profile (AEP)-POSIX Realtime and Embedded Application Support
<https://standards.ieee.org/findstds/standard/1003.13-2003.html>
- [6] Standard for Information Technology–Portable Operating System Interface (POSIX(R)) Base Specifications, Issue 7
<http://pubs.opengroup.org/onlinepubs/9699919799/>
- [7] Main Requirements
AUTOSAR_FO_RS_Main

A History of Constraints and Specification Items

Please note that the lists in this chapter also include constraints and specification items that have been removed from the specification in a later version. These constraints and specification items do not appear as hyperlinks in the document.

A.1 Constraint and Specification Item History of this document according to AUTOSAR Release R22-11

A.1.1 Added Advisories in R22-11

none

A.1.2 Changed Advisories in R22-11

none

A.1.3 Deleted Advisories in R22-11

none

A.1.4 Added Constraints in R22-11

none

A.1.5 Changed Constraints in R22-11

none

A.1.6 Deleted Constraints in R22-11

none

A.1.7 Added Requirements in R22-11

none

A.1.8 Changed Requirements in R22-11

Number	Heading
[RS_OSI_00103]	The Operating System Interface shall support C++.
[RS_OSI_00104]	The Operating System Interface shall support the reaction on process-external stimuli from devices.
[RS_OSI_NA]	

Table A.1: Changed Requirements in R22-11

A.1.9 Deleted Requirements in R22-11

none

A.2 Constraint and Specification Item History of this document according to AUTOSAR Release R23-11

A.2.1 Added Requirements in R23-11

Number	Heading
[RS_OSI_00210]	The <i>Operating System</i> shall provide a mechanism to observe scheduling of CPU time to tasks, processes.
[RS_OSI_00211]	The <i>Operating System</i> shall provide a mechanism to export low-level scheduling and trace information to applications.

Table A.2: Added Requirements in R23-11

A.2.2 Changed Requirements in R23-11

Number	Heading
[RS_OSI_00201]	The Operating System shall provide mechanisms for system memory budgeting.
[RS_OSI_00202]	The Operating System shall provide mechanisms for CPU time budgeting.
[RS_OSI_00203]	The Operating System should provide mechanisms for binding processes to CPU cores.
[RS_OSI_00206]	The Operating System shall provide multi-process support for isolation of applications.

Table A.3: Changed Requirements in R23-11

A.2.3 Deleted Requirements in R23-11

none