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2019-11-28	R19-11	AUTOSAR Release Management	• Added description of startup and shutdown of OSI. • Clarified that `Operating System` must allow calling getenv() from C++ constructors. • Document template upgrade. • Changed Document Status from Final to published.
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2017-10-27	17-10	AUTOSAR Release Management	• Minor changes, document clean up
2017-03-31	17-03	AUTOSAR Release Management	• Initial release

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1 Introduction and Functional Overview

This document is the software specification of the Operating System Interface within the AUTOSAR Adaptive Platform.

AUTOSAR Adaptive Platform does not specify a new Operating System for highly performant microcontrollers. Rather, it defines an execution context and programming interface for use by Adaptive Applications.

The Operating System Interface provides both C and C++ interfaces. In case of a C program, the application's main source code business logic include C function calls defined in the POSIX standard, namely PSE51 defined in IEEE1003.13 [1]. During compilation, the compiler determines which C library from the platform's Operating System provides these C functions and the application's Executable must be linked against at runtime. In case of a C++ program, application software component's source code includes function calls defined in the C++ Standard and its Standard C++ Library.

2 Acronyms and Abbreviations

This document does not define any specific acronyms or abbreviations. A general list of acronyms and abbreviations is available in the AUTOSAR glossary [2].

The table below contains all document-independant acronyms or abbreviations that are defined in the AUTOSAR glossary [2].

Term	Description
Operating System	see [3] Requirements on Operating System Interface
Operating System Interface	see [3] Requirements on Operating System Interface
Execution Management	see [4] Requirements on Execution Management
Adaptive Application	see [2] AUTOSAR Glossary
AUTOSAR Adaptive Platform	see [2] AUTOSAR Glossary
Executable	see [2] AUTOSAR Glossary
Foundation	see [2] AUTOSAR Glossary
Functional Cluster	see [2] AUTOSAR Glossary
Machine	see [2] AUTOSAR Glossary
Process	see [2] AUTOSAR Glossary

Table 2.1: Reference to Technical Terms

3 Related Documentation

3.1 Input Documents & Related Standards and Norms

[1] 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

[2] Glossary
AUTOSAR_FO_TR_Glossary

[3] Requirements on Operating System Interface
AUTOSAR_AP_RS_OperatingSystemInterface

[4] Requirements on Execution Management
AUTOSAR_AP_RS_ExecutionManagement

[5] Explanation of Adaptive Platform Software Architecture
AUTOSAR_AP_EXP_SWArchitecture

[6] ISO/IEC 9899:1999
https://www.iso.org

[7] Specification of Manifest
AUTOSAR_AP_TPS_ManifestSpecification

3.2 Further applicable specification

None.

4 Constraints and assumptions

4.1 Known Limitations

There are no known limitations for this specification.

5 Dependencies to Functional Clusters

This chapter provides an overview of the dependencies to other Functional Clusters in the AUTOSAR Adaptive Platform. Section 5.1 "Provided Interfaces" lists the interfaces provided by Operating System Interface to other Functional Clusters. Section 5.2 "Required Interfaces" lists the interfaces required by Operating System Interface.

A detailed technical architecture documentation of the AUTOSAR Adaptive Platform is provided in [5].

5.1 Provided Interfaces

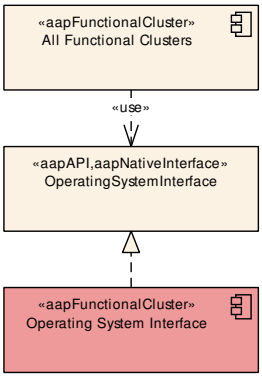


Figure 5.1: Interfaces provided by Operating System Interface to other Functional Clusters

Figure 5.1 shows the interfaces provided by Operating System Interface to other Functional Clusters within the AUTOSAR Adaptive Platform. Table 5.1 provides a complete list of interfaces provided to other Functional Clusters within the AUTOSAR Adaptive Platform.

Interface	*Functional Cluster*	*Purpose*
OperatingSystem Interface	All Functional Clusters	This interface is used to interact with the operating system, e.g., to create and control Threads used by the implementation.

Table 5.1: Interfaces provided to other Functional Clusters

5.2 Required Interfaces

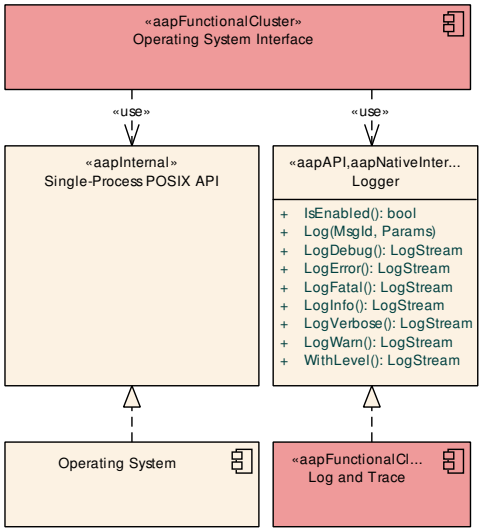


Figure 5.2: Interfaces required by Operating System Interface

Figure 5.2 shows the interfaces required by `Operating System Interface`. Table 5.2 provides a complete list of required interfaces from other `Functional Clusters` within the `AUTOSAR Adaptive Platform`.

Functional Cluster	*Interface*	*Purpose*
Log and Trace	Logger	The `Operating System Interface` uses this interface to log standardized messages.

Table 5.2: Interfaces required from other Functional Clusters

6 Requirements Tracing

The following table references the features specified in [3] and links to the fulfillments of these.

Requirement	Description	Satisfied by
[RS_AP_00111]	Source Code Portability Support	[SWS_OSI_01001] [SWS_OSI_01002]
[RS_AP_00114]	Compatibility with the ISO 14882 C++ standard	[SWS_OSI_01002]
[RS_OSI_00100]	POSIX PSE51 Compliance	[SWS_OSI_01001] [SWS_OSI_01002]
[RS_OSI_00103]	The Operating System Interface shall support C++.	[SWS_OSI_01002]

Table 6.1: Requirements Tracing

7 Functional specification

7.1 Reporting

7.1.1 Security Events

This functional cluster does not define any security events.

7.1.2 Log Messages

This functional cluster does not define any non-verbose log messages (i.e., modelled DLT messages).

7.1.3 Violation Messages

This functional cluster does not define any violation messages (i.e., DLT messages logged for Violations according to [AP_SWS_GENERAL_00021]).
Please note that concrete implementations might implement Non-Standardized Violations (see also [AP_SWS_GENERAL_00003]).

7.1.4 Production Errors

This functional cluster does not define any production errors (i.e., Diagnostic Events).

8 API Specification

This functional cluster does not define any APIs.

The AUTOSAR Adaptive Platform does not specify a new Operating System for highly performant microcontrollers. Rather, it defines an execution context and programming interface for use by Adaptive Applications.

8.1 C++ language binding Operating System

8.1.1 Application Interface C (POSIX PSE51)

[SWS_OSI_01001] POSIX PSE51 Interface

Upstream requirements: RS_OSI_00100, RS_AP_00111

⌈The minimal OS functionality provided by Adaptive AUTOSAR platform shall be as defined by POSIX PSE51 interface, according to the [1, 1003.13-2003] specification.⌋

Note that PSE51 requires [6, C99] as specified in the standard.

There are several Operating Systems on the market, e.g. Linux, that provide POSIX compliant interfaces. However Adaptive Applications are required to use a more restricted API to the Operating Systems as compared to the platform services and Foundation. In particular, the starting assumption is that an Adaptive Application may use PSE51 as OS interface whereas platform-specific applications may use full POSIX.

The implementation of platform Foundation and platform services functionality may use non-PSE51 APIs, even OS specific ones. The use of specific APIs will be left open to the implementer of the AUTOSAR Adaptive Platform and is not standardized.

In case of a C program, the applications main source code business logic includes C function calls defined in the POSIX standard. During compilation, the compiler determines which C library from the platforms Operating System provides these C functions and the applications Executable must be linked against at runtime. This Operating System provided C library can implement the POSIX-compliant C function in two ways:

- The provided C library implements the behavior as part of the library. Then, the execution of this C function causes no further invocation of the Operating System with a system call.
- The provided C library implements the behavior through a suitable system call of the Operating System kernel. In many cases, the function name and behavior of the Operating System kernel system call match very closely to the Operating System provided C library and to the POSIX-specified function definitions. For example, in the case of typical Linux distributions, these functions

are provided by glibc library, and by default, the gcc compiler links the glibc library dynamically.

8.1.2 Application C++ Interface

[SWS_OSI_01002] Use of C++ Language

Upstream requirements: RS_OSI_00100, RS_OSI_00103, RS_AP_00111, RS_AP_00114

⌈The Operating System shall provide implementations of the C++ standard in library and header form - version as per [RS_AP_00114].⌋

In case of a C++ program, application software components source code can include function calls defined in the C++ Standard and its Standard C++ Library. The C++ Standards defines C++ Standard Library, and it includes Thread support library, Input/output library and others that provide most of PSE51 functionalites through these C++ interfaces. Some PSE51 functions, such as setting thread scheduling policies, are not available yet through these C++ Standard Library and Adaptive Applications (implemented in C++) need to use PSE51 C interface in conjunction with these C++ libraries.

In case of Linux and the gcc C++ compiler (g++), the compiler links the libstdc++ library, which provides the defined Standard C++ library functions. The libstdc++ library itself depends on the glibc library, i.e., the libstdc++ implementation includes function calls to the glibc library.

9 Service Interfaces

This functional cluster does not define any provided or required service interfaces.

10 Configuration

The configuration model of this functional cluster is defined in [7]. This chapter defines the default values for attributes and semantic constraints for elements specified in [7] that are part of the configuration model of this functional cluster.

10.1 Default Values

This functional cluster does not define any default values for attributes specified in [7].

10.2 Semantic Constraints

This functional cluster does not define any semantic constraints for elements specified in [7].

A Mentioned Manifest Elements

This chapter contains the remaining set of meta-class tables which are not shown directly in the main body of this document.

This chapter is generated.

B Demands and constraints on Base Software (normative)

This functional cluster defines no demands or constraints for the Base Software on which the AUTOSAR Adaptive Platform is running on (usually a POSIX-compatible operating system).

C Platform Extension Interfaces (normative)

This functional cluster does not specify any Platform Extension Interfaces.

D Not implemented requirements

This chapter lists all functional requirements specified in the corresponding requirement specifications that are not implemented or violated by this specification and provides a rationale.

[SWS_OSI_NA]

Upstream requirements: RS_AP_00115, RS_AP_00116, RS_AP_00119, RS_AP_00120, RS_AP_00121, RS_AP_00122, RS_AP_00124, RS_AP_00125, RS_AP_00127, RS_AP_00128, RS_AP_00129, RS_AP_00130, RS_AP_00134, RS_AP_00135, RS_AP_00136, RS_AP_00137, RS_AP_00138, RS_AP_00139, RS_AP_00140, RS_AP_00141, RS_AP_00142, RS_AP_00143, RS_AP_00144, RS_AP_00145, RS_AP_00146, RS_AP_00147, RS_AP_00148, RS_AP_00149, RS_AP_00150, RS_AP_00151, RS_AP_00153, RS_AP_00154, RS_AP_00155, RS_AP_00156

⌈These requirements are not applicable as they are not within the scope of this release.⌋

E History of Constraints and Specification Items

This chapter provides an overview of the 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.

E.1 Constraint and Specification Item Changes between AUTOSAR Release R25-11 and R26-11

E.1.1 Added Specification Items in R26-11

none

E.1.2 Changed Specification Items in R26-11

Number	Heading
[SWS_OSI_01001]	POSIX PSE51 Interface

Table E.1: Changed Specification Items in R26-11

E.1.3 Deleted Specification Items in R26-11

Number	Heading
[SWS_OSI_01003]	Default Scheduling Policies
[SWS_OSI_01006]	Multi-Threading Support
[SWS_OSI_01008]	Multi-Process Support
[SWS_OSI_01009]	Multi-Process Isolation
[SWS_OSI_01010]	Virtual Memory
[SWS_OSI_01012]	Specification of Core Affinity
[SWS_OSI_01013]	Implicit shared object support
[SWS_OSI_01014]	Multi-Process Creation Capability Restriction
[SWS_OSI_01015]	Availability of environment variables
[SWS_OSI_01040]	Start Execution Management as Initial Process.
[SWS_OSI_02000]	ResourceGroup minimum requirement
[SWS_OSI_02001]	Memory ResourceGroups
[SWS_OSI_02002]	CPU ResourceGroups
[SWS_OSI_02003]	LogMessage OsProcessCreate

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Number	Heading
[SWS_OSI_02004]	LogMessage OsProcessDestroy
[SWS_OSI_02005]	LogMessage OsProcessInfo
[SWS_OSI_02006]	LogMessage OsProcessRename
[SWS_OSI_02007]	LogMessage OsProcessSwitch
[SWS_OSI_02008]	LogMessage OsTaskCreate
[SWS_OSI_02009]	LogMessage OsTaskTerminate
[SWS_OSI_02010]	LogMessage OsTaskInfo
[SWS_OSI_02011]	LogMessage OsTaskPreempt
[SWS_OSI_02012]	LogMessage OsTaskRelease
[SWS_OSI_02013]	LogMessage OsTaskRename
[SWS_OSI_02014]	LogMessage OsTaskSchedule
[SWS_OSI_02015]	LogMessage OsTaskWait
[SWS_OSI_10100]	Log OS tracing started
[SWS_OSI_10102]	Log Task Schedule Notification
[SWS_OSI_10103]	Log Task Wait Notification
[SWS_OSI_10104]	Log Task Release Notification
[SWS_OSI_10105]	Log Task Preempt Notification
[SWS_OSI_10106]	Log Task Exit Notification
[SWS_OSI_10107]	Log Task Creation Notification
[SWS_OSI_10108]	Log Task Renaming Notification
[SWS_OSI_10110]	Log Process Switch Notification
[SWS_OSI_10111]	Log Process Creation Notification
[SWS_OSI_10112]	Log Process Ending Notification
[SWS_OSI_10113]	Log Process Renaming Notification

Table E.2: Deleted Specification Items in R26-11

E.2 Constraint and Specification Item Changes between AUTOSAR Release R24-11 and R25-11

E.2.1 Added Specification Items in R25-11

none

E.2.2 Changed Specification Items in R25-11

Number	Heading
[SWS_OSI_01001]	POSIX PSE51 Interface
[SWS_OSI_01002]	Use of C++ Language
[SWS_OSI_01006]	Multi-Threading Support
[SWS_OSI_01008]	Multi-Process Support
[SWS_OSI_01009]	Multi-Process Isolation
[SWS_OSI_01010]	Virtual Memory
[SWS_OSI_01012]	Specification of Core Affinity
[SWS_OSI_01013]	Implicit shared object support
[SWS_OSI_01014]	Multi-Process Creation Capability Restriction
[SWS_OSI_02000]	ResourceGroup minimum requirement
[SWS_OSI_02001]	Memory ResourceGroups
[SWS_OSI_02002]	CPU ResourceGroups
[SWS_OSI_02003]	LogMessage OsProcessCreate
[SWS_OSI_02004]	LogMessage OsProcessDestroy
[SWS_OSI_02005]	LogMessage OsProcessInfo
[SWS_OSI_02006]	LogMessage OsProcessRename
[SWS_OSI_02007]	LogMessage OsProcessSwitch
[SWS_OSI_02008]	LogMessage OsTaskCreate
[SWS_OSI_02009]	LogMessage OsTaskTerminate
[SWS_OSI_02010]	LogMessage OsTaskInfo
[SWS_OSI_02011]	LogMessage OsTaskPreempt
[SWS_OSI_02012]	LogMessage OsTaskRelease
[SWS_OSI_02013]	LogMessage OsTaskRename
[SWS_OSI_02014]	LogMessage OsTaskSchedule
[SWS_OSI_02015]	LogMessage OsTaskWait
[SWS_OSI_10100]	Log OS tracing started
[SWS_OSI_10102]	Log Task Schedule Notification
[SWS_OSI_10103]	Log Task Wait Notification
[SWS_OSI_10104]	Log Task Release Notification
[SWS_OSI_10105]	Log Task Preempt Notification
[SWS_OSI_10106]	Log Task Exit Notification
[SWS_OSI_10107]	Log Task Creation Notification
[SWS_OSI_10108]	Log Task Renaming Notification
[SWS_OSI_10110]	Log Process Switch Notification
[SWS_OSI_10111]	Log Process Creation Notification
[SWS_OSI_10112]	Log Process Ending Notification



△

Number	Heading
[SWS_OSI_10113]	Log Process Renaming Notification

Table E.3: Changed Specification Items in R25-11

E.2.3 Deleted Specification Items in R25-11

none

E.3 Constraint and Specification Item Changes between AUTOSAR Release R23-11 and R24-11

E.3.1 Added Specification Items in R24-11

none

E.3.2 Changed Specification Items in R24-11

Number	Heading
[SWS_OSI_01001]	POSIX PSE51 Interface
[SWS_OSI_01002]	Use of C++ Language
[SWS_OSI_02003]	LogMessage OsProcessCreate
[SWS_OSI_02004]	LogMessage OsProcessDestroy
[SWS_OSI_02005]	LogMessage OsProcessInfo
[SWS_OSI_02006]	LogMessage OsProcessRename
[SWS_OSI_02007]	LogMessage OsProcessSwitch
[SWS_OSI_02008]	LogMessage OsTaskCreate
[SWS_OSI_02009]	LogMessage OsTaskTerminate
[SWS_OSI_02010]	LogMessage OsTaskInfo
[SWS_OSI_02011]	LogMessage OsTaskPreempt
[SWS_OSI_02012]	LogMessage OsTaskRelease
[SWS_OSI_02013]	LogMessage OsTaskRename
[SWS_OSI_02014]	LogMessage OsTaskSchedule
[SWS_OSI_02015]	LogMessage OsTaskWait
[SWS_OSI_10100]	Log OS tracing started
[SWS_OSI_10102]	Log Task Schedule Notification
[SWS_OSI_10103]	Log Task Wait Notification

▽

△

Number	Heading
[SWS_OSI_10104]	Log Task Release Notification
[SWS_OSI_10105]	Log Task Preempt Notification
[SWS_OSI_10106]	Log Task Exit Notification
[SWS_OSI_10107]	Log Task Creation Notification
[SWS_OSI_10108]	Log Task Renaming Notification
[SWS_OSI_10110]	Log Process Switch Notification
[SWS_OSI_10111]	Log Process Creation Notification
[SWS_OSI_10112]	Log Process Ending Notification
[SWS_OSI_10113]	Log Process Renaming Notification

Table E.4: Changed Specification Items in R24-11

E.3.3 Deleted Specification Items in R24-11

none

E.4 Constraint and Specification Item Changes between AUTOSAR Release R22-11 and R23-11

E.4.1 Added Specification Items in R23-11

Number	Heading
[SWS_OSI_02003]	LogMessage OsProcessCreate
[SWS_OSI_02004]	LogMessage OsProcessDestroy
[SWS_OSI_02005]	LogMessage OsProcessInfo
[SWS_OSI_02006]	LogMessage OsProcessRename
[SWS_OSI_02007]	LogMessage OsProcessSwitch
[SWS_OSI_02008]	LogMessage OsTaskCreate
[SWS_OSI_02009]	LogMessage OsTaskTerminate
[SWS_OSI_02010]	LogMessage OsTaskInfo
[SWS_OSI_02011]	LogMessage OsTaskPreempt
[SWS_OSI_02012]	LogMessage OsTaskRelease
[SWS_OSI_02013]	LogMessage OsTaskRename
[SWS_OSI_02014]	LogMessage OsTaskSchedule
[SWS_OSI_02015]	LogMessage OsTaskWait
[SWS_OSI_10100]	Log OS tracing started

▽

△

Number	Heading
[SWS_OSI_10102]	Log Task Schedule Notification
[SWS_OSI_10103]	Log Task Wait Notification
[SWS_OSI_10104]	Log Task Release Notification
[SWS_OSI_10105]	Log Task Preempt Notification
[SWS_OSI_10106]	Log Task Exit Notification
[SWS_OSI_10107]	Log Task Creation Notification
[SWS_OSI_10108]	Log Task Renaming Notification
[SWS_OSI_10110]	Log Process Switch Notification
[SWS_OSI_10111]	Log Process Creation Notification
[SWS_OSI_10112]	Log Process Ending Notification
[SWS_OSI_10113]	Log Process Renaming Notification

Table E.5: Added Specification Items in R23-11

E.4.2 Changed Specification Items in R23-11

none

E.4.3 Deleted Specification Items in R23-11

none

E.5 Constraint and Specification Item Changes between AUTOSAR Release R21-11 and R22-11

E.5.1 Added Advisories in R22-11

none

E.5.2 Changed Advisories in R22-11

none

E.5.3 Deleted Advisories in R22-11

none

E.5.4 Added Specification Items in R22-11

none

E.5.5 Changed Specification Items in R22-11

none

E.5.6 Deleted Specification Items in R22-11

none

E.5.7 Added Constraints in R22-11

none

E.5.8 Changed Constraints in R22-11

none

E.5.9 Deleted Constraints in R22-11

none

E.6 Constraint and Specification Item Changes between AUTOSAR Release R19-03 and R19-11

E.6.1 Added Specification Items in R19-11

none

E.6.2 Changed Specification Items in R19-11

none

E.6.3 Deleted Specification Items in R19-11

none

E.6.4 Added Constraints in R19-11

none

E.6.5 Changed Constraints in R19-11

none

E.6.6 Deleted Constraints in R19-11

none