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30.09.2011	3.1.0	AUTOSAR Administration	• several minor changes and bug-fixes • clarification and minor extensions of transmission mode usage and activation • clarification and extension of transfer properties • added retry mechanism for failed transmission requests
30.11.2009	3.0.0	AUTOSAR Administration	• Added support for large data types • Added support for communication protection • Revised mode management interface • Legal disclaimer revised
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01.04.2006	2.0.0	AUTOSAR Administration	Requirements for Transmission Modes changed, nearly all requirements slightly changed
09.05.2005	1.0.0	AUTOSAR Administration	Initial release

Disclaimer

Advice for users

AUTOSAR specifications may contain exemplary items (exemplary reference models, "use cases", and/or references to exemplary technical solutions, devices, processes or software).

Any such exemplary items are contained in the specifications for illustration purposes only, and they themselves are not part of the AUTOSAR Standard. Neither their presence in such specifications, nor any later documentation of AUTOSAR conformance of products actually implementing such exemplary items, imply that intellectual property rights covering such exemplary items are licensed under the same rules as applicable to the AUTOSAR Standard.

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1 Scope of Document

The following specification is to define the functional and non-functional requirements on the AUTOSAR Communication Layer (AUTOSAR COM).

This Software Requirement Specification (SRS) of AUTOSAR COM is based on the OSEK[1] COM 3.0.3 specification [10] and only defines add-ons to this OSEK specification or different behavior.

The location of the AUTOSAR COM Layer within the whole AUTOSAR ECU SW Architecture is defined in [1].

The focus of this document is to specify:

- the behavior of the AUTOSAR COM Layer
- the interfaces of the AUTOSAR COM Layer
- the input of the generator and its configuration input
- the rules to check the consistency of the configuration input

The focus is NOT to specify:

- The editor and the rule checker for the input of the AUTSAR COM Layer module implementation. However the rule checker must use the rules for the configuration in/out defined by [6].

Constraints

First scope for specification of requirements on basic software modules is systems which are not safety relevant. For this reason safety requirements are assigned to medium priority.

[1] OSEK is a registered trademark of Siemens AG.

2 Acronyms and Abbreviations

AUTOSAR data type	See [8], section 6.4
I-PDU	Interaction Layer Protocol Data Unit (assembled and disassembled in AUTOSAR COM), consists of one or more signals (see below and [1]).
I-PDU group	An I-PDU Group is an arbitrary collection of I-PDUs in COM
LOM	Listen Only Mode
L-PDU	Data Link Layer Protocol Data Unit (assembled and disassembled in AUTOSAR Hardware Abstraction layer, see [1]).
signal	A signal in the AUTOSAR COM context is equal to a message in OSEK COM. An AUTOSAR signal is carried by one or more signals in COM. The transformation from an AUTOSAR signal to a signal in COM is carried out by the RTE. Typically the transformation preserves the syntax of the data. However, in the case of complex data types the transformation may change the syntax of the signal. Therefore a signal in AUTOSAR COM is not always the same as an AUTOSAR signal.
signal group	A signal group refers to a set of signals that must always be kept together in a common I-PDU. A Signal group is used to guarantee the consistent transfer of AUTOSAR composite data types. A signal group has the following properties: • A signal can belong to at most one signal group • A signal group can not belong to more than exactly one I-PDU • Signal groups do not overlap each other within an I-PDU • Signal groups are a contiguous set of signals which belong to this group, however it is possible to have unused bits (“holes”) within a group. • Signal groups may contain no signals (“may be empty”). The grouping of signals to signal groups is assumed to be provided as an input for the COM generation process.

3 Conventions to be used

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

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

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

4 Functional Overview

The AUTOSAR COM Layer is the layer between RTE and the PDU Router.

Main-Features of AUTOSAR COM are:

- provision of signal oriented data interface for the RTE
- communication transmission control (start/stop of I-PDU groups)
- sending of signals according to transmission type as specified in the VFB specification
- guarantee of minimum distances between transmission requests
- monitoring of receive signals (signals timeout)
- monitoring of transmit confirmations
- filter mechanisms for incoming signals
- different notification mechanisms
- provision of Init-Values and Update-Indications
- endianness conversion + sign extension
- packing and unpacking of AUTOSAR signals to I-PDUs to be transmitted
- supporting large and dynamical length data types
- supporting I-PDU counter and replication mechanisms

5 Requirement Specification

5.1 Functional Requirements

5.1.1 General requirements

5.1.1.1 [BSW02037] AUTOSAR COM shall be based on the functionality and APIs of OSEK COM 3.0.3

ID:	BSW02037
Initiator:	COM WP
Date:	07.02.2005
Short Description:	AUTOSAR COM shall be based on the functionality and APIs of OSEK COM 3.0.3.
Type:	new
Importance:	high
Description:	AUTOSAR COM shall be based on the functionality and APIs specified in OSEK COM 3.0.3. Specifications not done there, respectively specifications of functionality different from that specified in the above mentioned document shall be defined in the AUTOSAR COM SRS and SWS specifications. Features of OSEK COM 3.0.3 which are not provided by AUTOSAR COM shall be defined in the SWS [6].
Rationale:	This SRS is only an add-on to OSEK COM 3.0.3 as an existing standard.
Use Case:	--
Dependencies:	--
Conflicts:	--
Supporting Material:	specification of OSEK COM 3.0.3, 2004-07-20, [10]
Contributes to:	--

5.1.1.2 [BSW02078] Support of endianness conversion

ID:	BSW02078
Initiator:	COM WP
Date:	03.03.2005
Short Description:	Support of endianness conversion
Type:	changed for release 4.0
Importance:	high
Description:	AUTOSAR COM shall support endianness conversion for the following data types defined in [5] Table “C/C++ mapping from primitive” AUTOSAR data-types” uint16 uint32 sint16 sint32 float32 float64
Rationale:	ensure end to end data consistency
Use Case:	--
Dependencies:	--
Conflicts:	--
Supporting Material:	AUTOSAR_SoftwareComponentTemplate [8] AUTOSAR SWS RTE [5]
Contributes to:	--

5.1.1.3 [BSW02086] Support of Sign-Extension for received signals

ID:	BSW02086
Initiator:	COM WP
Date:	03.03.2005
Short Description:	Support of Sign-Extension for received signals
Type:	new
Importance:	high
Description:	Sign-Extension means, to map negative values of signed signals correctly, if the bit-size of the signal in an I-PDU received and the bit-size of the signal used in the interface of the receiving software component differ from each other. In this case, the size of the signal received shall be extended to the size of the receiver interface. AUTOSAR COM shall support Sign-Extension for the following data types defined in [5] Table “C/C++ mapping from primitive”: sint8 sint16 sint32
Rationale:	ensure end to end data consistency
Use Case:	--
Dependencies:	--
Conflicts:	--
Supporting Material:	AUTOSAR_SoftwareComponentTemplate [8] AUTOSAR SWS RTE [5]
Contributes to:	--

5.1.2 Initialization

5.1.2.1 [BSW02042] Initialization of unused areas/ bits of an I-PDU

ID:	BSW02042
Initiator:	BMW
Date:	01.02.2005
Short Description:	Initialization of unused areas/ bits of an I-PDU
Type:	new
Importance:	high
Description:	AUTOSAR COM shall fill unused areas/ bits within an I-PDU with a configurable value (e.g. 0xFF). This value shall be configurable per I-PDU.
Rationale:	Limit impact of a wrong configuration, if a not used area of an I-PDU is wrongly assigned to a signal this can be detected by the application SW component.
Use Case:	For error detection purposes, all data values must be filled with a defined value.
Dependencies:	--
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.3 Configuration

The chapter Configuration deals with the configurable parameters/ functionalities of the AUTOSAR COM Layer.
This chapter deals only with general configuration requirements, the requirements for configuration of a single feature are defined within the requirement of the feature itself.

5.1.3.1 [BSW02040] AUTOSAR COM configuration language

ID:	BSW02040
Initiator:	BMW
Date:	17.02.2005
Short Description:	AUTOSAR COM Configuration Language shall be XML
Type:	changed
Importance:	high
Description:	AUTOSAR COM shall be configured by using XML as configuration language as defined by ECU Configuration Template. It is up to the SWS [6] to define the configuration parameters themselves.
Rationale:	Having a unique configuration language within AUTOSAR.
Use Case:	Configuration of AUTOSAR COM
Dependencies:	--
Conflicts:	--
Supporting Material:	[4]
Contributes to:	--

5.1.3.2 [BSW177] Configuration of communication parameters

ID:	BSW177
Initiator:	BMW
Date:	27.02.2005
Short Description:	Configuration of communication parameters
Type:	new
Importance:	high

Description:	The AUTOSAR COM Layer shall allow the configuration of communication at the following different stages:
	
	• Pre-Compile-Time
	• Link Time
	• Post-build-Time
	  o Load-able Configuration
	  o Multiple configuration sets
	
	The configuration parameters must be organized in a way to be able to be changed in all the different stages, e.g. one OEM might select to configure pre-compile time while another will configure post-build time.
	
	The concrete set of parameters which are configurable in which state shall be defined in [6].

Rationale:	Guarantee flexibility of using the AUTOSAR COM Layer.
Use Case:	It must be possible to configure the handled bus frames after compile- or build-time, particularly for future concepts running at BMW (reuse an ECU within another vehicle product line with different and incompatible communication layouts).
Dependencies:	The configuration of all communication parameters must be consistent with the parameters in the PDU-router, interfaces and drivers for CAN, LIN and FlexRay.
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.3.3 [BSW02067] Rules for checking the consistency of configuration input

ID:	BSW02067
Initiator:	LiveDevices
Date:	03.03.2005
Short Description:	Rules for checking of the consistency of configuration input

Type:	new
Importance:	high
Description:	A set of rules needs to be specified that enable the Configuration Editor to reject inconsistent configurations or configurations that can not be implemented. These rules shall be defined in the SWS and shall be implemented by the Configuration Editor.
Rationale:	Needed to make sure that the generator only works with correct configuration files.
Use Case:	The configuration must not contain overlapping signals within one I-PDU. The period of I-PDUs must not be negative.
Dependencies:	--
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.3.4 [BSW02046] Configuration of signal notification

ID:	BSW02046
Initiator:	COM WP
Date:	15.02.2005
Short Description:	Configuration of signal notification
Type:	new
Importance:	high
Description:	It shall be configurable whether the signal based notification to the RTE is done either immediately within the I-PDU RxIndication/ TxConfirmation made by the PduRouter or is deferred to the COM main function context.
Rationale:	To allow unpacking of signals in interrupt and polled modes
Use Case:	Unpacking of signals out of an I-PDU
Dependencies:	--
Conflicts:	--
Supporting Material:	UML diagram: - Polling Mode only in Com (R3b-R1a-R1a) and - Interrupt mode (R1b-R1a-R1a) (For decryption of the codes in brackets refer to UML Model)
Contributes to:	--

5.1.3.5 [BSW02089] Timeout indication mechanism on receiver-side

ID:	BSW02089
Initiator:	DC
Date:	11.11.2005
Short Description:	Timeout indication mechanism on receiver-side
Type:	new
Importance:	high
Description:	Receiver-side COM layer shall provide two (configurable) options if a signal timeout is detected • Indication to the RTE → AUTOSAR Software Component can use “spare values” • No indication to the RTE
Rationale:	The RTE shall have the opportunity to notify its environment about timeouts or the application shall be provided with a default value to avoid using outdated values.
Use Case:	see rationale
Dependencies:	--
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.3.6 [BSW02088] Value substitution in case of a signal timeout

ID:	BSW02088
Initiator:	DC
Date:	11.11.2005
Short Description:	Substitution of the last received value by configurable data value in case of a signal timeout
Type:	new
Importance:	high
Description:	In case a signal timeout is configured in that way, that no indication is given to the upper layer, AUTOSAR COM shall substitute the last received value by the init value. Whether this substitution takes place shall be configurable.
Rationale:	It shall be possible to provide the application with a configurable value in case of a signal timeout and no indication is given up to the upper layer.
Use Case:	see rationale
Dependencies:	--
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4 Normal Operation

5.1.4.1 Signal and I-PDU Transmission

This chapter deals with the add-ons to the OSEK COM specification related to signal and I-PDU transmission.

5.1.4.1.1 [BSW02083] Transmission Modes

ID:	BSW02083
Initiator:	BMW
Date:	09.08.2005
Short Description:	Transmission Modes
Type:	new
Importance:	high
Description:	AUTOSAR COM shall provide the Transmission Modes given in the following tabular for each I-PDU. It shows the Transmission Modes available and a short description of those Transmission Modes.

Transmission Modes	***Description***
Periodic	Transmissions occur indefinitely with a fixed period between them.
Direct / n-times	Event driven transmission with n-1 repetitions
Mixed	Periodic transmission with direct/n-times transmissions in between
None	No transmission

Rationale:	These modes are commonly used by all existing automotive bus systems.
Use Case:	--
Dependencies:	BSW02082, BSW02084, BSW02080
Conflicts:	--
Supporting Material:	Transmission Modes “periodic”, “mixed” are the same as already defined in the OSEK COM 3.0.3 Specification [6]. See also Use Cases in [10].
Contributes to:	--

5.1.4.1.2 [BSW02082] Two different Transmission Modes

ID:	BSW02082
Initiator:	BMW
Date:	09.08.2005
Short Description:	Two different Transmission Modes
Type:	new
Importance:	high
Description:	AUTOSAR COM shall provide the possibility to define two different Transmission Modes for each I-PDU. This shall also include the situation where only the parameters of a transmission mode are changed, e.g. different cycle times. It shall be possible to switch between both Transmission Modes during runtime.
Rationale:	This is commonly used by many existing automotive bus systems.
Use Case:	--
Dependencies:	BSW02083, BSW02084, BSW02080
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.1.3 [BSW02084] Transmission Mode selection

ID:	BSW02084
Initiator:	BMW
Date:	09.08.2005
Short Description:	Transmission Mode selection
Type:	new
Importance:	high
Description:	To select one of the two Transmission Modes, AUTOSAR COM shall provide the possibility to attach a condition to each signal within an I-PDU separately. The possibilities to define those conditions shall be the same as defined in OSEK COM 3.0.3 reception filter algorithms (see [10], Section 2.2.2). If all conditions defined for signals within one specific I-PDU evaluate to TRUE, one Transmission Mode shall be used for this I-PDU. In all other cases, the other Transmission Mode shall be used. The conditions shall be evaluated immediately every time a related signal or signal group is sent by RTE and the new transmission request shall be sent using the new Transmission Mode already.
Rationale:	These modes are commonly used by many existing automotive bus systems.
Use Case:	--
Dependencies:	BSW02082, BSW02083, BSW02080
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.1.4 [BSW02080] Re-Triggering of repetitions of I-PDUs

ID:	BSW02080

Initiator:	COM WP
Date:	09.03.2005
Short Description:	Re-Triggering of repetitions of I-PDUs
Type:	new
Importance:	high
Description:	A new send request called while existing repetitions are in progress shall cancel those outstanding repetitions and the transmission shall be started with the new signal/signal group.
Rationale:	These modes are commonly used by many existing automotive bus systems.
Use Case:	--
Dependencies:	BSW02082, BSW02083, BSW02084
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.2 Signal invalidation

5.1.4.2.1 [BSW02077] Signal invalidation mechanism on sender-side

ID:	BSW02077
Initiator:	COM WP
Date:	10.03.2005
Short Description:	Signal invalidation mechanism on sender side
Type:	changed 05.04.2005 during meeting
Importance:	high
Description:	It shall be possible for the sender side RTE to indicate that it is not able to provide a valid value (e.g. sensor is faulty). This shall be done by writing a per signal configurable invalid value (outside of the range of the valid values) into the I-PDU which is handled like a valid value in the further processing. Therefore a special API shall be provided on the sender side COM layer.
Rationale:	The AUTOSAR Software Component shall have (via the RTE) the opportunity to notify its environment about reduced functionality (e.g. sensor is faulty)
Use Case:	See rationale, Starting a fail safe routine if a sensor is broken.
Dependencies:	BSW02079
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.2.2 [BSW02079] Signal invalidation mechanism on receiver-side

ID:	BSW02079
Initiator:	COM WP
Date:	04.04.2005
Short Description:	Signal invalidation mechanism on receiver-side
Type:	new
Importance:	high
Description:	Receiver-side COM layer shall provide two (configurable) options if a sender indicates that it is not able to provide a valid value • Indication to the RTE → AUTOSAR Software Component can use "spare values" • No indication to the RTE

Rationale:	The RTE shall have the opportunity to notify its environment about reduced functionality (e.g. sensor is faulty)
Use Case:	See rationale, Starting a fail safe routine if a sensor is broken.
Dependencies:	BSW02077, BSW02087
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.2.3 [BSW02087] Substitution of invalid value by configurable data value

ID:	BSW02087
Initiator:	COM WP
Date:	09.09.2005
Short Description:	Substitution of invalid value by configurable data value
Type:	new
Importance:	high
Description:	In case a signal is invalidated on sender-side and the receiver-side is configured in that way, that no indication is given to the upper layer, AUTOSAR COM shall substitute the invalid value by the init value. Whether this substitution takes place shall be configurable.
Rationale:	It shall be possible to provide the application with a configurable value in case the signal value received is invalid and no indication is given up to the upper layer.
Use Case:	See rationale
Dependencies:	BSW02077, BSW02079
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.3 I-PDU Groups and Mode Changes

This chapter collects the requirements for the definition and starting/ stopping of I-PDU groups.

5.1.4.3.1 [BSW02090] I-PDU group vector

ID:	BSW02090
Initiator:	COM WP
Date:	07.11.2008
Short Description:	I-PDU group vector
Type:	new
Importance:	high
Description:	AUTOSAR COM shall define a data-structure that allows efficiently • starting and stopping of transmission and reception of multiple I-PDU groups • enabling or disabling the reception deadline monitoring of multiple I-PDU groups The maximum number of I-PDU groups within one ECU shall be compile time configurable. Conceptually and per configuration it shall be allowed that one I-PDU group contains arbitrary other I-PDU groups.

Rationale:	To allow efficient mode changes, especially with respect to the AMM/ VMM concept, it is required to change the state of multiple I-PDU groups within one function call to COM. The arbitrary nesting of I-PDU groups is no problem, since this can be resolved by the configuration tool, thus that each I-PDU only has to store an I-PDU group vector that declares to which I-PDU group it belongs.
Use Case:	AMM/ VMM
Dependencies:	BSW218, BSW192
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.3.2 [BSW218] Starting/ Stopping communication of I-PDU groups

ID:	BSW218
Initiator:	PSA
Date:	04.09.2004
Short Description:	Start/stop communication services for offline configurable groups of I-PDUs.
Type:	changed for release 4.0
Importance:	medium
Description:	The AUTOSAR COM Layer shall be able to start and to stop sending and receiving for multiple I-PDU groups during runtime. The corresponding API to this service shall take an I-PDU group vector reflecting the new state as input parameter. The minimum delay time and deadline monitoring shall be respected for started groups of I-PDUs. It shall be parameter driver if the corresponding timers of the I-PDUs shall be reset or not. After a reset of the COM Layer (normally reset of the ECU) all I-PDUs are stopped per default.
Rationale:	OSEK COM can only start/ stop communication (StartCOM and StopCOM services) as a whole. Such a limitation is too restrictive.
Use Case:	Such configurable groups of I-PDUs provide for example the possibility to disable the transmission of all I-PDUs on a single channel, and enable only their reception (Silent Mode). Such configurable groups of I-PDUs provide for example the possibility to start/ stop communication per logical channel of a single channel (e.g. FlexRay applications). Start sending and receiving on the body domain (e.g. use of the radio and multi-function screen), while powertrain is not still powered on. Stop the transmission of I-PDUs but not the reception when bus load is too high. This feature is also needed for Bus Off handling.
Dependencies:	BSW192, BSW02090
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.3.3 [BSW192] Enabling/ disabling reception deadline monitoring of I-PDU groups

ID:	BSW192
Initiator:	BMW
Date:	21.05.2005
Short Description:	Enabling/ Disabling reception deadline monitoring

Type	changed for release 4.0
Importance:	high
Description:	The AUTOSAR COM Layer shall provide the functionality to enable and disable reception deadline monitoring for multiple configurable I-PDU groups. The corresponding API to this service shall take an I-PDU group vector reflecting the new state as input parameter. After a reset of the COM Layer (normally reset of the ECU), the configured state (enabled/ disabled) shall be active.
Rationale:	This is needed to suppress wrong error handling in Listen Only Mode (LOM, see use case). It is assumed that at least a second ECU on the same channel is also in LOM and does not provide the expected signals to the first one.
Use Case:	For the LOM the transmission of all I-PDU groups is switched off, reception (maybe of only one I-PDU group) is still active but without supervision of the reception timeouts (reception deadline monitoring). For example all ECUs on one channel (e.g. on CAN network) are in LOM, so there are no more periodic send signals on this channel, but the ECU has to be able to receive changes of the ECU state management.
Dependencies:	BSW218, BSW02090
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.4 Packing signals into I-PDUs

5.1.4.4.1 [BSW02041] Consistent transfer of complex data types

ID:	BSW02041
Initiator:	Vector
Date:	01.02.2005
Short Description:	Consistent transfer of all data elements of a complex AUTOSAR data type by network signals in an I-PDU shall be supported.
Type:	new
Importance:	high
Description:	It is required by AUTOSAR to handle complex data types as a consistent set of data. Therefore, it is necessary to pass the data elements from the RTE to the AUTOSAR COM layer consistently.
Rationale:	AUTOSAR provides complex data types; those have to be sent and received atomically via RTE, COM, etc.
Use Case:	Complex AUTOSAR data types, data consistency of signal groups.
Dependencies:	--
Conflicts:	--
Supporting Material:	For guarantee data consistency of complex AUTOSAR data types, signal groups are introduced. For definition of signal group see [7].
Contributes to:	--

5.1.4.5 Interface between COM and the lower layer (PDU-Router)

OSEK COM leaves the interface between COM and the lower layers undefined. In AUTOSAR the only lower layer that COM interfaces to is the PDU Router. The interfaces refer to the definitions in [2]. The requirements are derived from [2] .

5.1.4.5.1 [BSW02043] Indication service Com_RxIndication

ID:	BSW02043
Initiator:	BMS/BMW
Date:	07.02.2005
Short Description:	AUTOSAR COM shall provide a callback function called Com_RxIndication
Type:	new
Importance:	high
Description:	AUTOSAR COM shall provide a function that is called by the lower layer (PDU-Router) after an I-PDU has been received. The name of the function has to be Com_RxIndication. Parameter values of the function are the ID of the I-PDU and a pointer to the received data buffer. The function has no return value.
Rationale:	Basic functionality of a communication layer
Use Case:	Receiving a PDU by the lower layer
Dependencies:	--
Conflicts:	--
Supporting Material:	[2]
Contributes to:	--

5.1.4.5.2 [BSW02044] Confirmation service Com_TxConfirmation

ID:	BSW02044
Initiator:	BMS/BMW
Date:	07.02.2005
Short Description:	AUTOSAR COM shall provide a callback function called Com_TxConfirmation
Type:	new
Importance:	high
Description:	AUTOSAR COM shall provide a function that is called by the lower layer (PDU-Router) after an I-PDU has been transmitted on the network. The name of the function has to be Com_TxConfirmation. The parameter value of the function is the ID of the transmitted I-PDU. It is selectable via configuration whether the TxConfirmation for an I-PDU is active or not. The function has no return value.
Rationale:	Basic functionality of a communication layer
Use Case:	Transmitting a PDU on the network.
Dependencies:	--
Conflicts:	--
Supporting Material:	[2]
Contributes to:	--

5.1.4.5.3 [BSW02045] Function Com_TriggerTransmit

ID:	BSW02045
Initiator:	BMS/ BMW
Date:	07.02.2005
Short Description:	AUTOSAR COM shall provide a function called Com_TriggerTransmit
Type:	new
Importance:	high
Description:	AUTOSAR COM shall provide a function that is called by the lower layer (PDU-Router) when an I-PDU shall be transmitted. Within this function, AUTOSAR COM shall copy the contents of its I-PDU transmit buffer to the L-PDU buffer given by the calling layer. The name of the function has to be Com_TriggerTransmit. The parameter values of the function are the ID I-PDU that is requested to be transmitted by COM and a pointer to the transmit buffer of the L-PDU.

	The function has no return value.
Rationale:	Basic functionality of a communication layer
Use Case:	This function is used e.g. by the LIN Master for sending out a LIN frame. In this case, the trigger transmit can be initiated by the Master schedule table it self or a received LIN header. This function is also used by the FlexRay Interface for requesting PDUs to be sent in the static part (synchronous to the FlexRay global time).
Dependencies:	--
Conflicts:	--
Supporting Material:	[2]
Contributes to:	--

5.1.4.5.4 [BSW02107] Transmit Cancellation

ID:	BSW02107
Initiator:	Toyota/ Bosch (FlexRay WP)
Date:	03.10.2008
Short Description:	Cancellation of transmitting outdated I-PDUs
Importance:	high
Description:	COM shall cancel the transmission request of an I-PDU in case a violation of the transmission deadline monitoring of an I-PDU is detected.
Rationale:	Needed to free buffers in the FlexRay interface.
Use Case:	Cancellation of outdated I-PDU
Dependencies:	BRF00303 see [9]
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.6 Support of Large Data Types

AUTOSAR COM shall support signals larger than the N-PDUs of the underlying busses. For these large signals also a dynamic length shall be supported. The requirements of this chapter define the support of these data types.

5.1.4.6.1 [BSW02091] Placement of large or dynamical length signals

ID:	BSW02091
Initiator:	COM WP
Date:	21.02.2008
Short Description:	A large signal or a dynamic length signal shall only be placed in one I-PDU
Type:	new
Importance:	high
Description:	Large signals supported by AUTOSAR COM shall never be split into different I-PDUs, but it shall be supported that an I-PDU can be split into different N-PDUs
Rationale:	The I-PDU shall be transported by the TP. The TP will work on N-PDU level, and therefore can fragment the I-DPU into a number of N-PDUs
Use Case:	There is no use-case to have fragmentation on I-PDU level.
Dependencies:	BRF00004 see [9], BSW02092, BSW02093
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.6.2 [BSW02092] Support only one dynamic length signal per I-PDU

ID:	BSW02092
Initiator:	COM WP
Date:	21.02.2008
Short Description:	Support only one dynamic length signal per I-PDU
Type:	new
Importance:	high
Description:	At most one dynamic length signal shall be supported per I-PDU.
Rationale:	If only one signal per I-PDU is allowed then the dynamical length does not have to be coded into the I-PDU. The receiver will calculate the length of the signal from the length of the IPDU. This is the same approach as in [10].
Use Case:	Sending textual messages e.g. SMS.
Dependencies:	BRF00004 see [9], BSW02091, BSW02093
Conflicts:	This puts additional restrictions on signal groups since only one dynamic length signal is allowed per signal group
Supporting Material:	[10]
Contributes to:	--

5.1.4.6.3 [BSW02093] Dynamic length signal must be placed last in I PDU

ID:	BSW02093
Initiator:	COM WP
Date:	21.02.2008
Short Description:	Dynamic length signal must be placed last in I-PDU
Type:	new
Importance:	high
Description:	The dynamic length signal must be placed last in the dynamic length I-PDU. This is the same approach as in [10]. All other signals and update-bits must be packed in front of the dynamical length signal.
Rationale:	Placing the signal last in the frame removes the need of coding the dynamical length into the IPDU. The receiving COM can directly derive the length of the dynamic length signal from the length of the IPDU Signal groups may still be used to contain (one) dynamic length signal and other signals.
Use Case:	see Rationale
Dependencies:	BRF00004 see [9], BSW02091, BSW02092
Conflicts:	--
Supporting Material:	[10]
Contributes to:	--

5.1.4.6.4 [BSW02094] Dynamic length signals must be of type UINT8[n]

ID:	BSW02094
Initiator:	COM WP
Date:	2008-02-21
Short Description:	Dynamic length signals must be of type UINT8[n]
Type:	new
Importance:	high
Description:	AUTOSAR COM shall only support dynamic length signals of type UINT[8].
Rationale:	It would be possible to also add support for Bit length dynamical length signals, but this will introduce unnecessary complexity
Use Case:	This restriction is made because actually there is no strong use-case that requires non byte-array data for large signals.
Dependencies:	BRF00004 see [9], BSW02091, BSW02092, BSW02093

Conflicts:	--
Supporting Material:	[10]
Contributes to:	--

5.1.4.6.5 [BSW02095] TP shall be used to fragment and reassemble large signals and dynamical signals

ID:	BSW02095
Initiator:	COM WP
Date:	21.02.2008
Short Description:	TP shall be used to fragment and reassemble large signals and dynamical signals
Type:	new
Importance:	high
Description:	All large signals and dynamic length signals must be transported using the TP. Note that large signals does not mean “normal signals” (e.g. UINT8[n] type). Therefore AUTOSAR COM shall route all large signals and dynamic length signals via the PduR to the underlying TPs using the PduR’s TP-APIs. Note: Signals with static length and equal or less length than 8 bytes are transported in L-PDUs on CAN and LIN. On FlexRay this is valid for signals with length equal to or less than 254 bytes.
Rationale:	There is no need to reinvent fragmentation since TP already supports this It is inconvenient to have dynamic length signals directly packed into L-PDUs (without using TP); this will require dynamical length L-PDUs (e.g. dynamic length CAN frames).
Use Case:	For CAN TP it is no problem to have multiple users (DCM and COM) of the TP. On LIN TP there will be a problem sharing the TP since all TP communication is done through two specific (specified by LIN) frames. A workaround may be to use a specific NAD to differ between diagnostic communication and normal signal communication (containing large signal or dynamic length signal). For FlexRay TP it is no problem to have multiple users (DCM and COM) of the TP.
Dependencies:	BRF00004 see [9], BRF00005 see [9], BSW02096
Conflicts:	LIN TP sharing
Supporting Material:	--
Contributes to:	--

5.1.4.6.6 [BSW02096] No fragmentation above TP

ID:	BSW02096
Initiator:	COM WP
Date:	21.02.2008
Short Description:	No fragmentation above TP
Type:	new
Importance:	high
Description:	Com will always send and receive a complete signal (no fragmentation supported above TP) The COM/RTE/application will always receive/transmit complete large signals and dynamic length signals. Modules above TP are not involved in

	the fragmentation process.
Rationale:	Fragmentation should be hidden in the BSW architecture and should not be put to the application
Use Case:	It was discussed to have fragmentation for transmit/receive on application level to be able to find a more efficient implementation. This was however not approved since it would make the port-concept complex and bus-aware (it is not required for intra-ECU communication)
Dependencies:	BRF00004 see [9], BRF00005 see [9], BSW02095
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.6.7 [BSW02097] Maximum length of dynamic signals must be statically set

ID:	BSW02097
Initiator:	COM WP
Date:	21.02.2008
Short Description:	Maximum length of dynamic signals must be statically set
Type:	new
Importance:	high
Description:	The maximum length of this type of signal must be set in the configuration
Rationale:	If not given all dynamic length signals can only be considered to be maximum length supported by the used TP and therefore buffers cannot be handled efficient.
Use Case:	If LIN is used and if not maximum length is given, it must be assumed that the dynamical length signal is 4095 bytes.
Dependencies:	BRF00004 see [9], BSW02098
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.6.8 [BSW02098] Dynamic length type configuration parameter

ID:	BSW02098
Initiator:	COM WP
Date:	21.02.2008
Short Description:	Dynamic length type configuration parameter
Type:	new
Importance:	high
Description:	There must be a configuration parameter that states if the signal has dynamic length or predefined length (i.e. a “normal” signal or a large signal)
Rationale:	There is no use-case where a fixed length signal becomes a dynamic length signal in run-time
Use Case:	see Rationale
Dependencies:	BRF00005 see [9], BSW02097
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.7 Signal status information

5.1.4.7.1 [BSW02030] Identify if a signal/signal group is updated by the sender

ID:	BSW02030
Initiator:	COM WP
Date:	02.12.2004
Short Description:	It shall be possible to identify at receiver side if a signal/ signal group has been up dated by the sender.
Type:	new
Importance:	high
Description:	It shall be possible for the receiver to identify and indicate to the upper layer if a signal/ signal group has been up dated by the sender. Whether this feature is provided shall be configurable per signal.
Rationale:	When multiple signals /signal groups are placed in the same I-PDU, and that I-PDU is sent more frequently than a signal/ signal group is update, the update bit provides a mechanism to detect only those signals/ signal groups that have changed values.
Use Case:	--
Dependencies:	BSW02058
Conflicts:	--
Supporting Material:	Implementation proposal: An update bit is optionally attached to a signal/ signal group and can only be attached at configuration time. When COM is started all up date bits in all I-PDUs are cleared. In the sending ECU, when a signal/ signal group is sent by the application, the update bit is set automatically by COM as part of the SendMessage() call. In the sending ECU, once the call to the lower layers to transmit the ECU has completed, all update bits in the recently sent I-PDU are cleared. In the receiving ECU, when an I-PDU is received, a signal/signal group with an associated update bit is only processed by COM if its update bit is set. Therefore filtering and informing the RTE etc. will only take place if the update bit is set. In the receiving ECU, for a signal/signal group with an update bit, the reception deadline monitor for that signal/signal group (if configured) is only reset if the update bit is set. Update bits do not have to reside in the I-PDU in a fixed relationship to the signal/signal group with which they are associated. The update bits could reside anywhere in the I-PDU subject to the same restrictions as any other signal/signal group.
Contributes to:	--

5.1.4.7.2 [BSW02058] Deadline monitoring of receiving updated signals/signal groups

ID:	BSW02058
Initiator:	COM WP
Date:	21.02.2005
Short Description:	Deadline monitoring of receiving updated signals/ signal groups
Type:	new
Importance:	high
Description:	The AUTOSAR COM layer shall monitor on receiver-side, if an updated value for a specific signal/signal group has been received within a configurable, signal/signal group specific deadline, i.e. the AUTOSAR COM layer shall check, whether the sender-side upper layers have explicitly sent the signal/signal group. If a deadline violation of a specific signal/signal group is detected, AUTOSAR COM shall notify the upper receiving layers (the SWC via the RTE) about that fact. This information given to the upper receiving layers shall be signal/signal group specific. AUTOSAR COM shall not do any substitution of signal/signal group values. If upper layers read signals/signal groups that have violated their deadline AUTOSAR COM shall return the last value received.
Rationale:	Due to latency times of communication systems or interrupts data might be not received in a pre-defined time (e.g. jitter of period to big, older than max age).
Use Case:	Detect delays in communication system to make sure the application works on up-to-date data.
Dependencies:	BSW02030
Conflicts:	--
Supporting Material:	If no update bits are used, AUTOSAR COM provides the deadline monitoring defined in OSEK COM 3.0.3 [11] (Section 2.5.1). Here, deadline monitoring is done on the reception of I-PDUs but deadline violations are notified per signal to the upper layer.
Contributes to:	--

5.1.4.8 I-PDU Counter

5.1.4.8.1 [BSW02099] I-PDU Counter mechanism

ID:	BSW02099
Initiator:	Safety Team
Date:	30.07.2008
Short Description:	I-PDU Counter mechanism
Type:	new
Importance:	high
Description:	AUTOSAR COM shall provide a mechanism to detect out of sequence received I-PDUs. This mechanism shall be a configurable option of AUTOSAR COM module.
Rationale:	Out of sequence I-PDUs is a communication failure mode which is not already covered by existing mechanisms.
Use Case:	Detection of communication failure modes is needed for safety-related applications. The order I-PDUs are sent is important e.g. ordered information that logically is one unit but does not have to, or cannot, be transferred atomically.
Dependencies:	BRF00111 see [9]
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.8.2 [BSW02100] I-PDU Counter configuration

ID:	BSW02100
Initiator:	Safety Team
Date:	01.02.2008
Short Description:	I-PDU Counter configuration
Type:	new
Importance:	high
Description:	It shall be possible to configure: • If I-PDU Counter mechanism is enabled or not • The I-PDUs to include I-PDU Counter, • The properties of the included I-PDU Counter (number of bits and position in I-PDU)
Rationale:	Configuration is needed so that the mechanism can be adapted to the I-PDU content and characteristics of the physical link.
Use Case:	Configuration of communication of safety related information when including I-PDU Counter.
Dependencies:	BRF00111 see [9]
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.8.3 [BSW02101] Transmission and reception using I-PDU Counter

ID:	BSW02101
Initiator:	Safety Team
Date:	01.02.2008
Short Description:	Transmission and reception using I-PDU Counter
Type:	new
Importance:	high
Description:	The I-PDU Counter shall be a counter that is stored in the I-PDU and incremented at each I-PDU transmission. The I-PDU Counter mechanism shall perform a check for correct I-PDU Counter of received I-PDUs. The I-PDU Counter shall be set up by the I-PDU transmitter and checked by the I-PDU receiver.
Rationale:	Including an I-PDU Counter in an I-PDU makes it possible to keep track of received I-PDUS i.e. that they arrive in the expected order and are not repeated. This will improve error detection capability.
Use Case:	Normal operation for communication of safety related information when including I-PDU Counter.
Dependencies:	BRF00111 see [9]
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.8.4 [BSW02102] I-PDU Counter error handling

ID:	BSW02102
Initiator:	Safety Team
Date:	01.02.2008
Short Description:	I-PDU Counter error handling
Type:	new
Importance:	high
Description:	Detected out of sequence I-PDUs shall be discarded.
Rationale:	The I-PDU Counter shall be able to detect the following failure modes related to communication (where one I-PDU is related to one frame):

	• one repeated I-PDU • one spurious I-PDU
Use Case:	Error handling for communication of safety related information when including I-PDU Counter.
Dependencies:	BRF00111 see [9]
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.9 I-PDU replication

5.1.4.9.1 [BSW02103] I-PDU Replication mechanism

ID:	BSW02103
Initiator:	Safety Team
Date:	30.07.2008
Short Description:	I-PDU Replication mechanism
Type:	New
Importance:	high
Description:	AUTOSAR COM shall provide a mechanism to detect corrupted received I-PDUs and to recover from this failure mode. This mechanism shall be a configurable option of AUTOSAR COM module.
Rationale:	Corrupted and repeated I-PDUs are communication failure modes which are not already covered by existing mechanisms.
Use Case:	Detection of communication failure modes is needed for safety-related applications. It is important not to repeat an I-PDU e.g. an event in I-PDU causing a state transition.
Dependencies:	BRF00110, BRF00241 see [9]
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.9.2 [BSW02104] I-PDU replication configuration

ID:	BSW02104
Initiator:	Safety Team
Date:	01.02.2008
Short Description:	I-PDU replication configuration
Type:	new
Importance:	high
Description:	It shall be possible to configure: • If I-PDU Replication mechanism is enabled or not • The I-PDUs to replicate, • The number of replicas per I-PDU • The voting properties (K out of N) • The properties of the included I-PDU counter (number of bits and position in I-PDU) Details about the supported replication mechanisms, that is the supported K and N shall be defined in [6].
Rationale:	Configuration is needed per I-PDU so that the mechanism can be adapted to the I-PDU content, I-PDU period and characteristics of the physical link.
Use Case:	Communication of safety related information where existing communication

	does not provide adequate integrity.
Dependencies:	BRF00110, BRF00241 see [9]
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.9.3 [BSW02105] Transmission and reception using I-PDU Replication

ID:	BSW02105
Initiator:	Safety Team
Date:	01.02.2008
Short Description:	Transmission and reception using I-PDU Replication
Type:	new
Importance:	high
Description:	The I-PDU Replication mechanism shall, on the transmitting side, replicate a set of I-PDUs, which are statically defined to be replicated, into several (N) I-PDU instances with different I-PDU IDs and communicate them on the bus. The I-PDU Replication mechanism shall, on the receiving side, receive replicated I-PDU instances, evaluate and reconstruct the original I-PDU using voting. The I-PDU Replication mechanism shall include an I-PDU counter mechanism and use it to synchronize the voting and to detect repeated, spurious and missing replicas.
Rationale:	The I-PDU Replication mechanism is needed in order to support that periodic safety related signals can be packed into an I-PDU and communicated with increased protection against communication errors.
Use Case:	Communication of safety related information where existing communication does not provide adequate integrity.
Dependencies:	BRF00110, BRF00241 see [9]
Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.1.4.9.4 [BSW02106] I-PDU Replication error handling

ID:	BSW02106
Initiator:	Safety Team
Date:	01.02.2008
Short Description:	I-PDU Replication error handling
Type:	new
Importance:	high
Description:	The I-PDU Replication shall be able to detect the following failure modes related to communication (where one I-PDU is related to one frame): • loss of all I-PDUs with a specific ID • one repeated I-PDU • one spurious I-PDU • one corrupted I-PDU Detected errors shall be corrected if possible e.g. using voting.
Rationale:	The I-PDU Replication is required as a complement to existing mechanisms in order to detect and if possible recover from a set of failure modes.
Use Case:	Communication of safety related information where existing communication do not provide adequate integrity.
Dependencies:	BRF00110, BRF00241 see [9]

Conflicts:	--
Supporting Material:	--
Contributes to:	--

5.2 Non-Functional Requirements (Qualities)

None

6 References

6.1 Deliverables of AUTOSAR

[1] Layered Sofware Architecture
AUTOSAR_EXP_LayeredSoftwareArchitecture.pdf

[2] Specification of Communication Stack Types
AUTOSAR_SWS_CommunicationStackTypes.pdf

[3] Specification of the Virtual Functional Bus
AUTOSAR_EXP_VFB.pdf

[4] Specification of ECU Configuration
AUTOSAR_TPS_ECUConfiguration.pdf

[5] Specification of RTE Software
AUTOSAR_SWS_RTE.pdf

[6] Specification of Communication
AUTOSAR_SWS_COM.pdf

[7] Glossary
AUTOSAR_TR_Glossary.pdf

[8] Software Component Template
AUTOSAR_TPS_SoftwareComponentTemplate.pdf

[9] Feature Specification of the BSW Architecture and the RTE
AUTOSAR_TR_BSWAndRTEFeatures.pdf

6.2 OSEK

[10] Glossary OSEK/VDX Communication Version 3.0.3 July 20, 2004

[11] OSEK/VDX Communication Version 3.0.3 July 20, 2004

6.3 ISO

No references at the moment

6.4 HIS

[12] Requirements for Protected Applications under OSEK, Version 1, 25.09.2002