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Table of Contents

1	Scope of Document	6
2	Conventions To Be Used	7
2.1	Requirements Guidelines	7
3	Glossary, Acronyms, and Abbreviations	8
4	Requirements Specification	10
4.1	General Requirements	10
4.1.1	Functional Requirements	10
4.1.1.1	MetaData Handling	10
4.2	Requirements for the SAE J1939 Transport Layer module	11
4.2.1	Functional Overview	11
4.2.2	Functional Requirements	12
4.2.2.1	Configuration	12
4.2.2.2	Initialization	14
4.2.2.3	Normal Operation	15
4.2.2.4	Shutdown Operation	20
4.2.2.5	Fault Operation	20
4.2.3	Non-Functional Requirements (Qualities)	22
4.3	Requirements for the SAE J1939 Request Manager	24
4.3.1	Functional Overview	24
4.3.2	Functional Requirements	25
4.3.2.1	Configuration	25
4.3.2.2	Initialization	26
4.3.2.3	Normal Operation	26
4.3.2.4	Shutdown Operation	29
4.4	Requirements for the SAE J1939 Network Management	30
4.4.1	Functional Overview	30
4.4.2	Functional Requirements	31
4.4.2.1	Configuration	31
4.4.2.2	Initialization	32
4.4.2.3	Normal Operation	33
4.4.2.4	Shutdown Operation	35
4.4.2.5	Fault Operation	35
4.5	Requirements for the SAE J1939 Functional Safety Communication Protocol	36
4.5.1	Functional Overview	36
4.5.2	Functional Requirements	37
4.5.2.1	Configuration	37
4.5.2.2	Normal Operation	37
4.5.2.3	Fault Operation	39

5	References	40
A	Trace Groups	41
B	History of Requirements	42
B.1	Requirement History of this Document According to AUTOSAR Release R25-11	42
B.1.1	Added Requirements in R25-11	42
B.1.2	Changed Requirements in R25-11	42
B.1.3	Deleted Requirements in R25-11	42
B.2	Requirement History of this Document According to AUTOSAR Release R24-11	42
B.2.1	Added Requirements in R24-11	42
B.2.2	Changed Requirements in R24-11	42
B.2.3	Deleted Requirements in R24-11	42
B.3	Requirement History of this Document According to AUTOSAR Release R23-11	43
B.3.1	Added Requirements in R23-11	43
B.3.2	Changed Requirements in R23-11	43
B.3.3	Deleted Requirements in R23-11	43
B.4	Requirement History of this Document According to AUTOSAR Release R22-11	43
B.4.1	Added Requirements in R22-11	43
B.4.2	Changed Requirements in R22-11	43
B.4.3	Deleted Requirements in R22-11	43
B.5	Requirement History of this Document According to AUTOSAR Release R21-11	43
B.5.1	Added Requirements in R21-11	43
B.5.2	Changed Requirements in R21-11	44
B.5.3	Deleted Requirements in R21-11	44

1 Scope of Document

This document specifies the requirements for the following BSW modules:

- [SAE J1939 Transport Layer](#) module ([J1939Tp](#), see [\[1\]](#), SWS SAE J1939 Transport Layer])
- [SAE J1939 Request Manager](#) ([J1939Rm](#), see [\[2\]](#), SWS J1939 SAE Request Manager])
- [SAE J1939 Network Management](#) module ([J1939Nm](#), see [\[3\]](#), SWS SAE J1939 Network Management])

The requirements for the [SAE J1939 Diagnostic Communication Manager](#) ([J1939Dcm](#), see [\[4\]](#), SWS SAE J1939 Diagnostic Communication Manager]) are contained in the [\[5\]](#), RS Diagnostics].

2 Conventions To Be Used

The representation of requirements in AUTOSAR documents follows the table specified in [TPS_STDT_00078], see [6, Standardization Template].

The verbal forms for the expression of obligation specified in [TPS_STDT_00053] shall be used to indicate requirements, see [6, Standardization Template].

2.1 Requirements Guidelines

There are no special guidelines for requirements for the Bus Mirroring.

3 Glossary, Acronyms, and Abbreviations

The glossary below includes acronyms and abbreviations relevant to [SAE J1939](#) requirements specification that are not included in the [7, AUTOSAR Glossary].

Acronym / Abbreviation	Description
AC	SAE J1939 AddressClaimed PG
BSW	Basic Software (module) of AUTOSAR
CA	Controller Application
DA	Destination Address
DET	Default Error Tracer
DP	Data Page
EDP	Extended Data Page
J1939Dcm	SAE J1939 Diagnostic Communication Manager
J1939Fscp	SAE J1939 Functional Safety Communication Protocol
J1939Nm	SAE J1939 Network Management
J1939Rm	SAE J1939 Request Manager
J1939Tp	SAE J1939 Transport Layer
MetaData	PDU Meta Data
PDU	Protocol Data Unit
PDU1	PDU Type 1s
PDU2	PDU Type 2s
PDUF	PDU Format
PDUS	PDU Specific
PG	Parameter Group
PGN	Parameter Group Number
SA	Source Address
SDG	Safety Data Group
SDM	Safety Data Message
SHM	Safety Header Message
SRVT	Safety-Relevant Validation Time

Table 3.1: Acronyms and Abbreviations

Glossary Term	Explanation
AddressClaimed	Used to claim an address on an SAE J1939 bus (PGN = 0x0EE00).
Acknowledgement	Used to acknowledge a Request on an SAE J1939 bus (PGN = 0x0E800).
Controller Application	The role of an ECU that is tied to one source address .
Destination Address	The address of the receiver of a PG .
Default Error Tracer	Supports reporting of development errors and runtime errors .
Development Error	An error that is surely detected during development time. This class of errors typically stops the ECU.
Data Page	The most significant bit (MSB) of the 18 bit PGN .
Extended Data Page	The second bit (after MSB) of the 18 bit PGN .
Local Address	Refers to the source address of a transmitted PG and the destination address of a received PG .
PDU Meta Data	Meta data transferred alongside a PDU . For SAE J1939 , this can be the CAN ID, the SA , the DA , or the Priority of a PGN .





Glossary Term	Explanation
N-PDU	PDU of the SAE J1939 Transport Layer, exchanged with the CAN Interface.
N-SDU	SDU of the SAE J1939 Transport Layer, exchanged with the PDU Router.
Parameter Group	A message on an SAE J1939 bus.
Parameter Group Number	Identifier of a Parameter Group (18 bits, contains EDP, DP, PDUF, PDUS)
PDU Type 1	This kind of PGs can be sent to a specific destination address.
PDU Type 2	This kind of PGs is always broadcast to the whole network.
PDU Format	The middle byte of the 18 bit PGN.
PDU Specific	The lower byte of the 18 bit PGN.
Protocol Data Unit	A message transferred between the layers of the AUTOSAR stack, also known as I-PDU.
Remote Address	Refers to the destination address of a transmitted PG and the source address of a received PG.
Request / Request2	SAE J1939 PGs used to request information from another ECU (Request PGN = 0x0EA00, Request2 PGN = 0x0C900).
Runtime Error	An error that is only detected during run-time of an ECU.
SAE J1939	A standard published by the SAE that describes the communication of ECUs of commercial vehicles (on-road and off-road). See also [8, SAE J1939].
SAE J1939 Diagnostic Communication Manager	The SAE J1939 Diagnostic Communication Manager handles the diagnostic messages of the SAE J1939 Controller Applications implemented by an ECU. See also [9, SAE J1939 73].
SAE J1939 Functional Safety Communication Protocol	The SAE J1939 Functional Safety Communication Protocol module handles the SHM and the SDM of the SAE J1939 Controller Applications implemented by an ECU. See also [10, SAE J1939 76].
SAE J1939 Network Management	The SAE J1939 Network Management module handles the address arbitration of the SAE J1939 Controller Applications implemented by an ECU. See also [11, SAE J1939 81].
SAE J1939 Request Manager	The SAE J1939 Request Manager handles the requests and acknowledgements of the SAE J1939 Controller Applications implemented by an ECU. See also [12, SAE J1939 21].
SAE J1939 Transport Layer	The SAE J1939 Transport Layer module handles the SAE J1939 transport protocols for the Controller Applications implemented by an ECU. See also [12, SAE J1939 21].
Safety Data Group	The Safety Data Group represents the combination of the SHM and the SDM, and therewith a protected PG that is handled by the SAE J1939 Functional Safety Communication Protocol.
Safety Data Message	The Safety Data Message is a protected PG that is handled by the SAE J1939 Functional Safety Communication Protocol.
Safety Header Message	The Safety Header Message contains the protection information for a PG that is handled by the SAE J1939 Functional Safety Communication Protocol.
Safety-Relevant Validation Time	The Safety-Relevant Validation Time is the time that passes between the transfer of the SHM and the SDM.
Source Address	The address of the transmitter of a PG.
TP.CM	SAE J1939 Transport Protocol Connection Management message.
TP.DT	SAE J1939 Transport Protocol Data Transfer message.

Table 3.2: Glossary Terms

4 Requirements Specification

4.1 General Requirements

4.1.1 Functional Requirements

4.1.1.1 MetaData Handling

[SRS_J1939_00049] J1939 Modules shall support MetaData [

Description:	The AUTOSAR BSW modules that support the J1939 standard shall support PDUs with MetaData.
Rationale:	J1939 requires a flexible approach to CAN IDs that must be reflected by all BSW modules supporting J1939 features.
Use Case:	<ul style="list-style-type: none"> • Request from arbitrary address. • Answer to request via TP. • Request for AddressClaimed.
Dependencies:	–
Supporting Material:	–

]

4.2 Requirements for the SAE J1939 Transport Layer module

4.2.1 Functional Overview

This chapter describes the requirements that shall be fulfilled by the AUTOSAR [J1939 Transport Layer](#) module, which implements the transport protocol defined by [12, SAE J1939-21] with the variants BAM (Broadcast Announce Message) for broadcast mode and CMDT (Connection Mode Data Transfer, also known as RTS/CTS) for point to point communication.

The following pictures show the parts of the complete AUTOSAR system and in particular the Communication Services in which the [J1939 Transport Layer](#) module is situated.

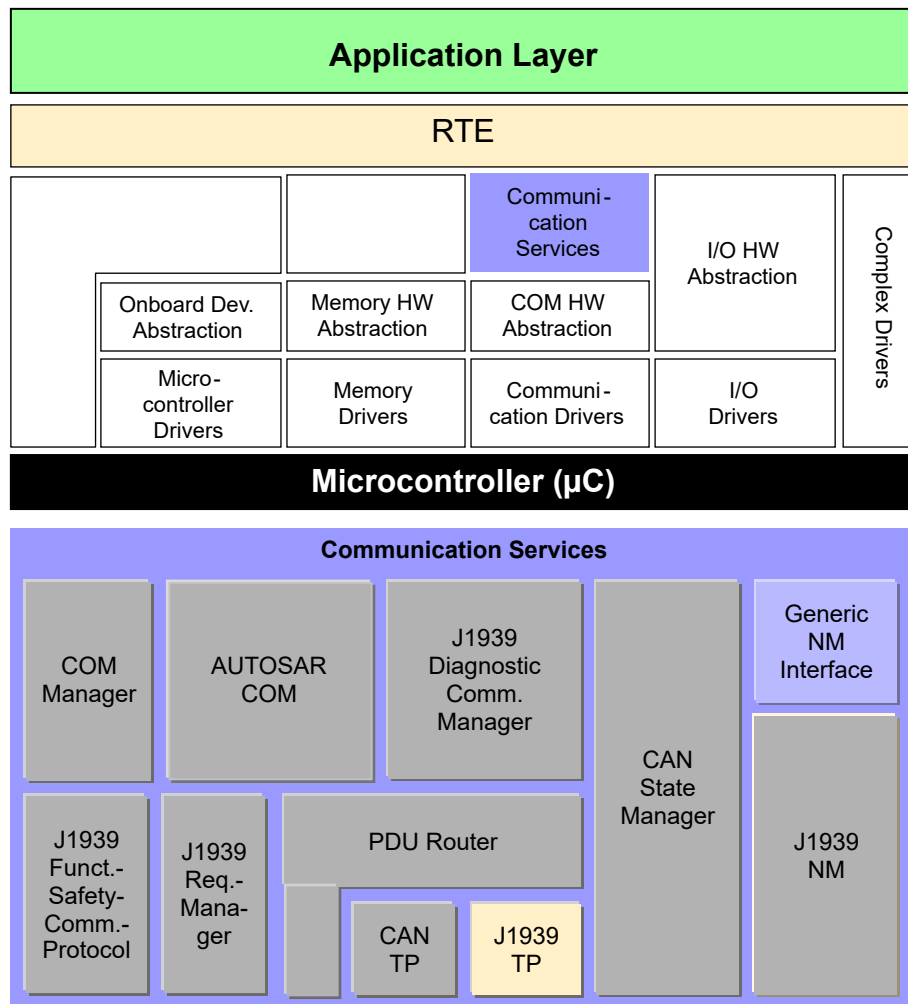


Figure 4.1: Position of the [J1939TP](#) in the AUTOSAR architecture

4.2.2 Functional Requirements

4.2.2.1 Configuration

This section describes the requirements on configurability of the module [J1939 Transport Layer](#).

[SRS_J1939_00001] The J1939 Transport Layer module shall be configurable to support only transport protocol variant BAM [

Description:	The J1939 Transport Layer module shall be configurable to support either both the transport protocol variants BAM and CMTD or only the transport protocol variant BAM.
Rationale:	Some networks do not use CMTD. In these cases, the CMTD protocol shall be omitted completely to save resources.
Use Case:	ECUs that only support cyclic transmission of DM1 and no other large message.
Dependencies:	–
Supporting Material:	–

]

[SRS_J1939_00002] The J1939 Transport Layer module shall identify each N-SDU with a unique identifier [

Description:	The J1939 Transport Layer module shall identify each N-SDU with a unique identifier, so that the upper layer can address an N-SDU without any assumption on the addressing mode configuration of the J1939Tp. Furthermore, a symbolic name shall be assigned for each N-SDU identifier value to simplify the API usage.
Rationale:	Independence of upper layer from the J1939Tp configuration.
Use Case:	The PDU-Router can handle all N-SDUs (FlexRay, CAN and LIN) regardless of addressing mode particularity of its underlying protocols.
Dependencies:	–
Supporting Material:	–

]

[SRS_J1939_00043] The J1939 Transport Layer module shall support generic channels [

Description:	A channel with fixed DA/SA (either because no MetaData is used by the N-PDUs, or because DA and SA are defined by the channel) is called a specific channel, a channel with variable SA/DA is called a generic channel. The N-PDUs of a generic channel either represent specific PGs (TP.CM, TP.DT, or direct frames with fixed PGN), or are completely generic (direct frames without configured CAN ID, only for transmission).
---------------------	--



△

Rationale:	Save configuration effort and resources by using N-PDUs for more than one channel and a channel for different connections (SA-DA-relations).
Use Case:	The SA of received frames and the DA of transmitted frames are usually very dynamic in J1939 networks.
Dependencies:	[SRS_J1939_00049]
Supporting Material:	Concept 579 "Support for Heavy Duty Vehicles"

]

[SRS_J1939_00044] The J1939 Transport Layer module shall support generic N-SDUs [

Description:	All N-SDUs of J1939 Transport Layer module shall have a fixed PGN, but DA and SA can either be handled dynamically, or be statically configured. The N-SDUs of a generic channel may carry MetaData which transfers the actual SA/DA at runtime. These N-SDUs are called generic N-SDUs.
Rationale:	Save configuration effort and resources by using N-SDUs for more than one connection (SA-DA-relation).
Use Case:	The SA of received frames and the DA of transmitted frames are usually very dynamic in J1939 networks.
Dependencies:	[SRS_J1939_00049]
Supporting Material:	Concept 579 "Support for Heavy Duty Vehicles"

]

[SRS_J1939_00003] The N-PDUs used to transport a J1939Tp N-SDUs shall be statically configured [

Description:	<p>Each N-SDU shall have a 1:n statically configured association to N-PDUs, where:</p> <ul style="list-style-type: none"> • n=1 if the N-SDU Data Length <= 8 Bytes (not handled by J1939Tp), • n=2 for BAM with fixed length - TP.CM / TP.DT, • n=3 for BAM with dynamic length - TP.CM / TP.DT / direct, • n=3 for CMDT with fixed length - TP.CM (Tx) / TP.CM (Rx) / TP.DT, and • n=4 for CMDT with dynamic length - TP.CM (Tx) / TP.CM (Rx) / TP.DT / direct. <p>Each N-PDU shall have a 1:m statically configured association to N-SDUs, where m=number of different N-SDUs (generic or specific) that use that N-PDU.</p>
Rationale:	Simplification of configuration.
Use Case:	A channel that only supports BAM does not need TP.CM in reverse direction.
Dependencies:	–
Supporting Material:	[SAE J1939-21]

]

[SRS_J1939_00004] The J1939 Transport Layer module shall identify each N-PDU with a unique identifier [

Description:	The J1939 Transport Layer module shall identify each N-PDU with a unique identifier. Furthermore, a symbolic name may be assigned for each identifier value to simplify the implementation.
Rationale:	Independence of upper layer from the J1939Tp configuration.
Use Case:	The CanIf can handle all N-PDUs regardless of actual upper layer module.
Dependencies:	–
Supporting Material:	–

]

[SRS_J1939_00006] The properties of a J1939Tp N-SDU shall be statically configured [

Description:	The configuration shall statically assign the following properties to each J1939Tp N-SDU: <ul style="list-style-type: none"> • unique N-SDU identifier • Communication direction: sender or receiver • Maximum N-SDU length • N-SDU Length Type: Variable/Fixed • J1939 Parameter Group Number (PGN) • Associated N-PDU identifiers • Optionally: SA and/or DA for generic channels • Optionally: Transport protocol variant
Rationale:	At runtime the J1939 Transport Layer module must have all the needed information to manage a transport connection.
Use Case:	The properties are required for the runtime decision which N-PDU identifiers have to be used for the N-SDU. The effective length of the transmitted data determines whether a transport protocol is required. For generic N-SDUs, the destination address determines the used protocol variant.
Dependencies:	[SRS_J1939_00002], [SRS_J1939_00003]
Supporting Material:	–

]

4.2.2.2 Initialization

This section describes the requirements on the initialization phase of the module [J1939 Transport Layer](#).

[SRS_J1939_00010] The J1939 Transport Layer module shall implement an interface for initialization [

Description:	The J1939 Transport Layer module implements an interface for initialization. This service shall initialize all global variables of the module and set all transport protocol connections in a default state (Idle).
Rationale:	Basic functionality.
Use Case:	Set Transport Layer module to a defined state.
Dependencies:	–
Supporting Material:	–

]

[SRS_J1939_00011] The J1939 Transport Layer services shall not be operational before initializing the module [

Description:	Before using the transmission capabilities of the J1939 Transport Layer module, it shall be initialized. If it is not initialized, the services of J1939Tp have to return an error and a development error shall be reported.
Rationale:	Basic functionality.
Use Case:	To avoid usage of the module without a complete initialization - this could cause the transmission of corrupted frames.
Dependencies:	[SRS_J1939_00010]
Supporting Material:	–

]

4.2.2.3 Normal Operation

This section describes the requirements on the “normal” functionality of the module [J1939 Transport Layer](#).

[SRS_J1939_00018] The AUTOSAR J1939 Transport Layer module shall support concurrent connections [

Description:	<p>The number of concurrent connections supported by the AUTOSAR J1939 Transport Layer module depends on the used transport protocol and the transmitting direction.</p> <p>In the sending direction:</p> <ul style="list-style-type: none"> • If BAM is used: Only one connection shall be possible per local address (SA). • If CMDT is used: Parallel connections from all local addresses (SA) to all remote nodes (DA) shall be possible. <p>In the receiving direction:</p> <ul style="list-style-type: none"> • If BAM has been used: One connection per remote node (SA) shall be possible. • If CMDT has been used: Parallel connections from all remote nodes (SA) to all local addresses (DA) are possible. <p>These restrictions are imposed by the way J1939 models multi packet communication via TP.CM and TP.DT.</p>
Rationale:	An ECU must support parallel reception of N-SDUs that are issued either from different ECUs or shall be sent to different ECUs. So the AUTOSAR J1939 Transport Layer module shall allow concurrent connections.
Use Case:	Communication with more than one remote node at the same time.
Dependencies:	–
Supporting Material:	[SAE J1939-21]

]

[SRS_J1939_00019] The J1939 Transport Layer module shall support the transport protocol variant BAM [

Description:	<p>The J1939 Transport Layer module shall support the transport protocol variant BAM for I-PDUs with large payload (length > 8 Bytes) or variable length according to [SAE J1939-21].</p> <p>Depending on the length and the N-SDU identifier (specific N-SDU) or the provided DA (generic N-SDU), the J1939 Transport Layer module shall decide whether BAM must be used for transmission.</p> <p>During reception, the transport protocol variant is determined by the type of the initial TP.CM frame: BAM is used when a TP.CM_BAM is received.</p>
Rationale:	The transport protocol variant BAM is specified in [SAE J1939-21].
Use Case:	Transmission of DM1.
Dependencies:	[SRS_J1939_00002], [SRS_J1939_00006], [SRS_J1939_00044]
Supporting Material:	[SAE J1939-21]

]

[SRS_J1939_00020] The AUTOSAR J1939 Transport Layer module shall support the transport protocol variant CMDT [

Description:	The AUTOSAR J1939 Transport Layer module shall support the transport protocol variant CMDT for I-PDUs with large payload (length > 8 Bytes) or variable length according to [SAE J1939-21]. Depending on the length and the N-SDU identifier (specific N-SDU) or the provided DA (generic N-SDU), the J1939 Transport Layer module shall decide whether CMDT must be used for transmission. During reception, the transport protocol variant is determined by the type of the initial TP.CM frame: CMDT is used when a TP.CM_RTS is received.
Rationale:	The transport protocol variant CMDT is specified in [SAE J1939-21].
Use Case:	Transmission of DM2 after request.
Dependencies:	[SRS_J1939_00002], [SRS_J1939_00006], [SRS_J1939_00044]
Supporting Material:	[SAE J1939-21]

]

[SRS_J1939_00021] The J1939 Transport Layer module shall be compliant with the CAN Interface module notifications [

Description:	The J1939 Transport Layer module shall use the CAN Interface notification services reception notification and transmission confirmation.
Rationale:	In AUTOSAR architecture, the J1939 Transport Layer module is placed between the PDU Router and the CAN Interface.
Use Case:	The J1939 Transport Layer module has to support the notification services called by the CAN Interface.
Dependencies:	[SRS_Can_01003], [SRS_Can_01009]
Supporting Material:	–

]

[SRS_J1939_00022] The timeout values of the J1939 transport protocol variants shall be supervised [

Description:	All the timeout values of the J1939 transport protocols specified in [SAE J1939-21] shall be supervised by the J1939 Transport Layer module.
Rationale:	Timeout supervision is required by [SAE J1939-21].
Use Case:	The J1939 Transport Layer module shall be able to abort when a timeout occurs.
Dependencies:	[SRS_J1939_00045]
Supporting Material:	[SAE J1939-21]

]

[SRS_J1939_00024] Unused Bytes in N-PDUs shall be padded [

Description:	All unused bytes must be initialized to the value specified in [SAE J1939-21] for TP.DT PGN (0xFF).
Rationale:	TP.DT shall always be transmitted with 8 bytes of data.
Use Case:	–
Dependencies:	–
Supporting Material:	[SAE J1939-21]

]

[SRS_J1939_00025] The J1939 Transport Layer module shall be able to manage connections via BAM and CMDT in parallel [

Description:	The J1939 Transport Layer module shall be able to support more than one connection. Therefore it shall deal with BAM and CMDT connections in parallel. The J1939 transport protocol variant that must be used is determined as described in [SRS_J1939_00019] and [SRS_J1939_00020].
Rationale:	Even though BAM and CMDT share the same TP frames, they are clearly discernible by the TP.CM frame types and the DA (always 0xFF for BAM).
Use Case:	A J1939 network supports the parallel transport of BAM and CMDT frames.
Dependencies:	[SRS_J1939_00019], [SRS_J1939_00020]
Supporting Material:	[SAE J1939-21]

]

[SRS_J1939_00046] The J1939 Transport Layer module shall support automatic calculation of block sizes [

Description:	The block size values transmitted in TP.CM_RTS and TP.CM_CTS shall be calculated automatically. Configured values shall be interpreted as maximum values.
Rationale:	The J1939 transport protocol supports completely dynamic block sizes.
Use Case:	Use actually available buffer to reduce protocol overhead.
Dependencies:	–
Supporting Material:	–

]

[SRS_J1939_00047] The J1939 Transport Layer module shall support retransmission of lost TP.DT frames [

Description:	When the receiver of a CMTD connection has a timeout after transmission of TP.CM_CTS or reception of previous TP.DT, or when a sequence error is encountered in a TP.DT, the J1939 Transport Layer module shall initiate retransmission of the failed block.
Rationale:	To avoid loss of a complete message after protocol errors.
Use Case:	When a TP.DT frame is lost, it shall be retransmitted instead of terminating the connection.
Dependencies:	–
Supporting Material:	[SAE J1939-21]

]

[SRS_J1939_00048] The J1939 Transport Layer module shall support cancellation of ongoing reception and transmission [

Description:	When triggered by the PduR, the J1939 Transport Layer module shall cancel an ongoing reception or transmission. In case of CMTD, an abort message shall be sent.
Rationale:	Support complete API presented to PduR.
Use Case:	Connections may be cancelled because of changed vehicle states.
Dependencies:	–
Supporting Material:	–

]

[SRS_J1939_00067] The J1939 Transport Layer module shall support buffering transmission requests for N-SDUs that share resources with an ongoing transmission [

Description:	When transmission of an N-SDU is requested, but another communication using the same addresses and protocol is already ongoing, the J1939 Transport Layer module shall accept the new connection and set it on hold until the resources are available again.
Rationale:	Improved reaction to transmission requests.
Use Case:	Back-to-back routing with TP.CM directly following the last TP.DT.
Dependencies:	–
Supporting Material:	–

]

4.2.2.4 Shutdown Operation

[SRS_J1939_00038] The J1939 Transport Layer module shall provide an API to shut down operation of the module [

Description:	When the J1939 Transport Layer module needs to be re-initialized, the system is already running. It would lead to severe problems if a state variable is initialized in the same moment in which it is updated e.g. by a callback function. And it would lead to severe overhead, if the system must be protected against these problems. A safe workaround is to de-initialize the module first, then wait for any callback function to terminate, and finally initialize the module again.
Rationale:	Clean handling of initialized state.
Use Case:	Before re-initialization, the J1939 Transport Layer module should be de-initialized so that no operation is ongoing during initialization.
Dependencies:	–
Supporting Material:	–

]

4.2.2.5 Fault Operation

[SRS_J1939_00023] The J1939 Transport Layer module shall handle unexpected PDUs according to the SAE J1939 specification [

Description:	The handling of an unexpected received N-PDU by the J1939 Transport Layer module depends on the configured N-PDU type: <ul style="list-style-type: none"> • Unexpected TP.DT frames shall be ignored. • Unexpected TP.CM_BAM frames shall terminate an active connection and start a new one. • Unexpected TP.CM_RTS frames shall terminate an active connection and start a new one if the PGN is the same. Otherwise they shall be answered by a TP.Conn_Abort frame. • Unexpected TP.CM_CTS and TP.CM_EndOfMsgACK frames shall be ignored. • Unexpected TP.Conn_Abort frames for a different PGN shall be ignored.
Rationale:	Protocol behavior on error.
Use Case:	A TP.CM_CTS is received while the receiver still waits for data.
Dependencies:	–
Supporting Material:	[SAE J1939-21]

]

[SRS_J1939_00039] The J1939 Transport Layer module shall be able to cope with invalid values in received TP frames [

Description:	<p>The J1939 Transport Layer module shall be able to cope with invalid values in received TP frames (TP.CM, TP.DT). There are different possibilities of invalid values in TP frames.</p> <p>TP.DT:</p> <ul style="list-style-type: none"> • Wrong sequence value: Abort connection (BAM) or retry transmission (CMDT). <p>TP.CM:</p> <ul style="list-style-type: none"> • Contradicting number of frames and total size in TP.CM_RTS or TP.CM_BAM: Ignore this frame. • DA in contained PDU1 PGN set: Ignore. • Wrong number of next block or wrong number of frames to transmit in TP.CM_CTS: Abort connection. • Wrong PGN in any TP.CM: Ignore. • Different values in TP.CM_EndOfMsgACK from initial TP.CM_RTS: Ignore.
Rationale:	Defined behavior when invalid values are received in TP frames.
Use Case:	When a TP.CM_BAM is received indicating a total length of 22 bytes in two packets or 17 bytes in 5 packets, the J1939 Transport Layer module should not crash, independent of the actual number of received packets.
Dependencies:	[SRS_J1939_00047]
Supporting Material:	[SAE J1939-21]

]

[SRS_J1939_00045] The J1939 Transport Layer module shall handle protocol timeout [

Description:	<p>When a timeout occurs, the J1939 Transport Layer module shall abort the connection or retry transmission:</p> <p>When BAM is used, the connection is always silently aborted.</p> <p>When CMDT is used, the sender shall always send a TP.Conn_Abort frame with abort reason 3, while the receiver shall initiate retransmission of expected packets if possible.</p>
Rationale:	Defined behavior after timeout.
Use Case:	Timeout after reception of TP.CM_BAM or TP.DT, or timeout after transmission of TP.CM_RTS, TP.CM_CTS, TP.CM_EndOfMsgACK or TP.DT.
Dependencies:	[SRS_J1939_00022], [SRS_J1939_00047]
Supporting Material:	[SAE J1939-21]

]

4.2.3 Non-Functional Requirements (Qualities)

[SRS_J1939_00040] The AUTOSAR J1939 Transport Layer module shall be based on SAE J1939 specifications [

Description:	If no requirement is explicitly added or excluded, the implementation of the AUTOSAR J1939 Transport Layer module shall follow the [SAE J1939-21] specification for the transport protocol (section 5.10 and appendix C of SAE J1939-21 of December 2010).
Rationale:	Reuse of existing standards for AUTOSAR BSW. The SAE J1939-21 specifications is the most used CAN related Transport Layer in Trucks.
Use Case:	Transport protocol on CAN according to SAE J1939: <ul style="list-style-type: none"> • Segmentation of data in transmit direction • Collection of data in receive direction • Control of data flow • Detection of errors (message loss/doubling/sequence)
Dependencies:	–
Supporting Material:	[SAE J1939-21]

]

[SRS_J1939_00041] The J1939 Transport Layer module shall implement transport protocol functionalities in the layered software architecture [

Description:	The J1939 Transport Layer module shall handle segmentation and reassembling of large PDUs. For this task, it shall have interfaces to the PDU Router and the CAN Interface.
Rationale:	Interfaces and interaction
Use Case:	–
Dependencies:	–
Supporting Material:	–

]

[SRS_J1939_00042] The J1939 Transport Layer interface shall be independent of its internal configuration [

Description:	The J1939 Transport Layer module shall offer the PDU Router an interface that is independent from its internal communication configuration and implementation. The only exception shall be the cancellation API which is configurable.
Rationale:	Layered Software Architecture. Information hiding. Common interface for all applications
Use Case:	–



△

Dependencies:	[SRS_J1939_00048]
Supporting Material:	–

」

4.3 Requirements for the SAE J1939 Request Manager

4.3.1 Functional Overview

This chapter describes the requirements that shall be fulfilled by the AUTOSAR [J1939 Request Manager](#), which implements the request management protocol defined by [12, SAE J1939-21] using the [Request](#), the [Request2](#), and the [Acknowledgement](#) PG.

The following pictures show the parts of the complete AUTOSAR system and in particular the Communication Services in which the [J1939 Request Manager](#) is situated.

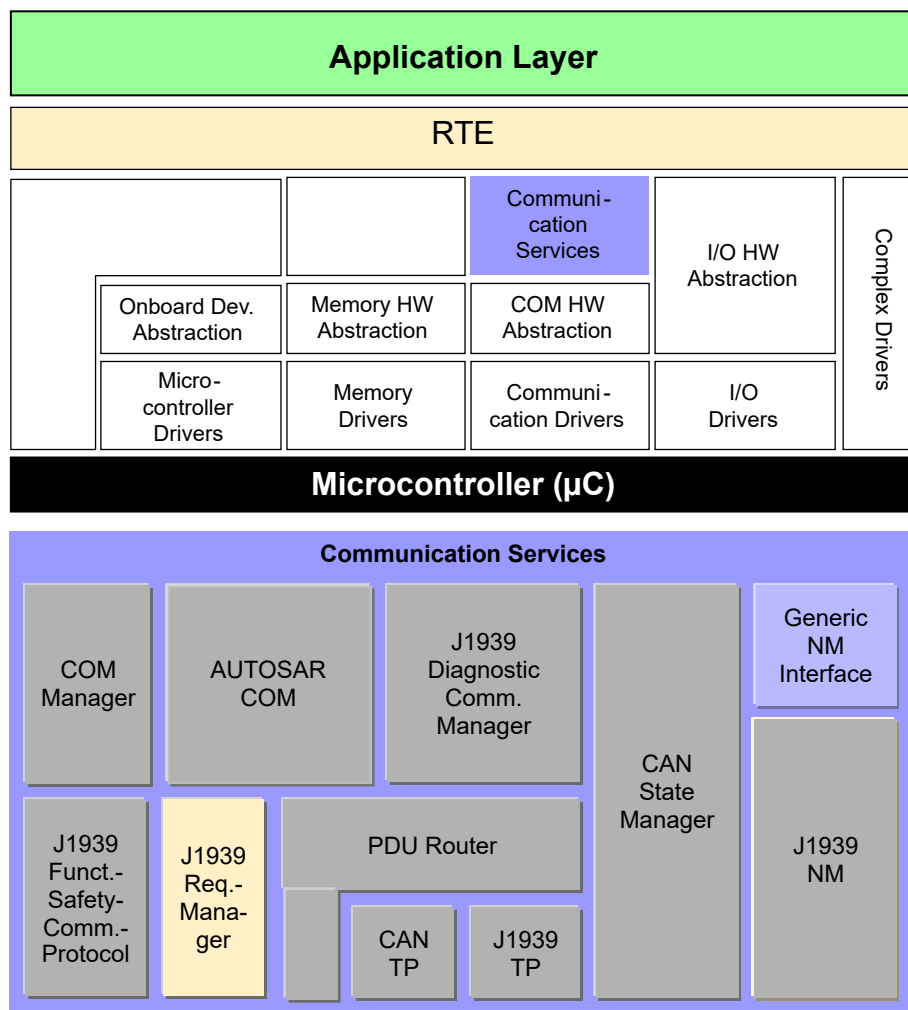


Figure 4.2: Position of the [J1939Rm](#) in the AUTOSAR architecture

4.3.2 Functional Requirements

4.3.2.1 Configuration

[SRS_J1939_00005] The local addresses of the ECU shall be configurable [

Description:	The addresses which are accepted by the J1939 Request Manager when used as destination address of received messages or as source addresses of transmitted messages shall be configurable.
Rationale:	The ECU needs to be able to support more than one function.
Use Case:	An engine ECU might also control the retarder.
Dependencies:	–
Supporting Material:	Concept 579 “Support for Heavy Duty Vehicles”

[SRS_J1939_00007] The queue size for transmitted PGs shall be configurable [

Description:	The size of the queues for the transmitted PGs Request and Acknowledgment shall be configurable separately.
Rationale:	The number of outgoing Request or Acknowledgement PGs strongly depends on the use case.
Use Case:	Adaptation to actual use case.
Dependencies:	–
Supporting Material:	Concept 579 “Support for Heavy Duty Vehicles”

[SRS_J1939_00008] Requestable PGNs shall be configurable [

Description:	The J1939 Request Manager shall support configuration of the PGNs for which a request shall be accepted.
Rationale:	The set of PGNs that need to be requested is strongly use case dependent.
Use Case:	Adaptation to actual use case.
Dependencies:	–
Supporting Material:	Concept 579 “Support for Heavy Duty Vehicles”

[SRS_J1939_00009] The upper layers using J1939 Request Manager services shall be configurable [

Description:	The J1939 Request Manager shall be able to configure used APIs and callbacks/callouts for arbitrary upper layer modules.
Rationale:	The J1939 Request Manager needs to support requests for AddressClaimed, diagnostic messages, and application messages. Not all upper layer modules need all features of J1939 Request Manager.
Use Case:	The J1939 Network Management module and J1939 Diagnostic Communication Manager will not always be present, and the PGNs supported by J1939 Diagnostic Communication Manager or the application are also use case dependent.
Dependencies:	–
Supporting Material:	Concept 579 “Support for Heavy Duty Vehicles”

]

4.3.2.2 Initialization

[SRS_J1939_00012] The J1939 Request Manager shall provide an interface for module initialization [

Description:	The J1939 Request Manager shall provide and implement an interface for initialization of all states and all global variables of the module.
Rationale:	Basic functionality
Use Case:	ECU initialization
Dependencies:	–
Supporting Material:	Concept 579 “Support for Heavy Duty Vehicles”

]

4.3.2.3 Normal Operation

[SRS_J1939_00014] The J1939 Request Manager shall forward incoming requests to configured destinations [

Description:	The J1939 Request Manager shall filter incoming Request and Request2 PGs (destination address, PGN) and call the request indication of the modules configured for that PGN.
Rationale:	Request handling
Use Case:	Dispatching of received requests to the correct destination module.

▽



Dependencies:	Configuration of request destinations, see [SRS_J1939_00005], [SRS_J1939_00008], and [SRS_J1939_00009]
Supporting Material:	Concept 579 "Support for Heavy Duty Vehicles"

]

[SRS_J1939_00015] The J1939 Request Manager shall forward incoming acknowledgements to configured destinations [

Description:	The J1939 Request Manager shall filter incoming Acknowledgement PGs (acknowledged address, PGN) and call the acknowledgement indication of the modules configured for that PGN.
Rationale:	Acknowledgement handling
Use Case:	Dispatching of received acknowledgements to the correct destination module.
Dependencies:	Configuration of acknowledgement destinations, see [SRS_J1939_00005], [SRS_J1939_00008], and [SRS_J1939_00009]
Supporting Material:	Concept 579 "Support for Heavy Duty Vehicles"

]

[SRS_J1939_00016] The J1939 Request Manager shall provide an interface for transmission of request messages [

Description:	The J1939 Request Manager shall provide and implement an interface for transmission of requests for arbitrary PGNS from a configured set of source addresses to arbitrary destination addresses.
Rationale:	Request handling
Use Case:	Transmission of requests
Dependencies:	Configuration of source addresses and request functionality, see [SRS_J1939_00005] and [SRS_J1939_00009]
Supporting Material:	Concept 579 "Support for Heavy Duty Vehicles"

]

[SRS_J1939_00017] The J1939 Request Manager shall provide an interface for transmission of acknowledgement messages [

Description:	The J1939 Request Manager shall provide and implement an interface for transmission of acknowledgements for arbitrary PGNS from a configured set of source addresses for arbitrary acknowledged addresses.
Rationale:	Acknowledgement handling
Use Case:	Transmission of acknowledgements



△

Dependencies:	Configuration of source addresses and acknowledgement functionality, see [SRS_J1939_00005] and [SRS_J1939_00009]
Supporting Material:	Concept 579 "Support for Heavy Duty Vehicles"

]

[SRS_J1939_00026] The J1939 Request Manager shall support timeout supervision for outgoing requests [

Description:	The J1939 Request Manager shall be configurable to supervise timeout of outgoing requests. The timeout shall be stopped when a suitable acknowledgement was received, when the requested PGN was received by COM, or when a dedicated interface of the J1939 Request Manager is called. When not stopped, a configurable callback function shall be invoked.
Rationale:	Request handling
Use Case:	Monitor timeout of the response to a transmitted request message.
Dependencies:	Configuration of timeout supervision functionality, see [SRS_J1939_00009]
Supporting Material:	Concept 579 "Support for Heavy Duty Vehicles"

]

[SRS_J1939_00050] The J1939 Request Manager shall route incoming requests and acknowledgements to connected channels [

Description:	The J1939 Request Manager shall be able to forward received requests and acknowledgements to connected channels, such that a request for a node that is connected to another channel can be correctly processed, and the acknowledgement is visible to the originator of the request.
Rationale:	Request and acknowledgement routing
Use Case:	When a gateway routes J1939 messages, a request for such a message must also be routed, as well as an acknowledgement to that request.
Dependencies:	–
Supporting Material:	Concept 579 "Support for Heavy Duty Vehicles"

]

4.3.2.4 Shutdown Operation

[SRS_J1939_00013] The J1939 Request Manager shall provide an interface for module shutdown [

Description:	The J1939 Request Manager shall provide and implement an interface for de-initialization of the module.
Rationale:	Basic functionality
Use Case:	ECU shutdown, ECU degradation
Dependencies:	–
Supporting Material:	Concept 579 “Support for Heavy Duty Vehicles”

]

4.4 Requirements for the SAE J1939 Network Management

4.4.1 Functional Overview

This chapter describes the requirements that shall be fulfilled by the AUTOSAR [J1939 Network Management](#), which implements the network management protocol defined by [11, SAE J1939-81].

The following pictures show the parts of the complete AUTOSAR system and in particular the Communication Services in which the [J1939 Network Management](#) module is situated.

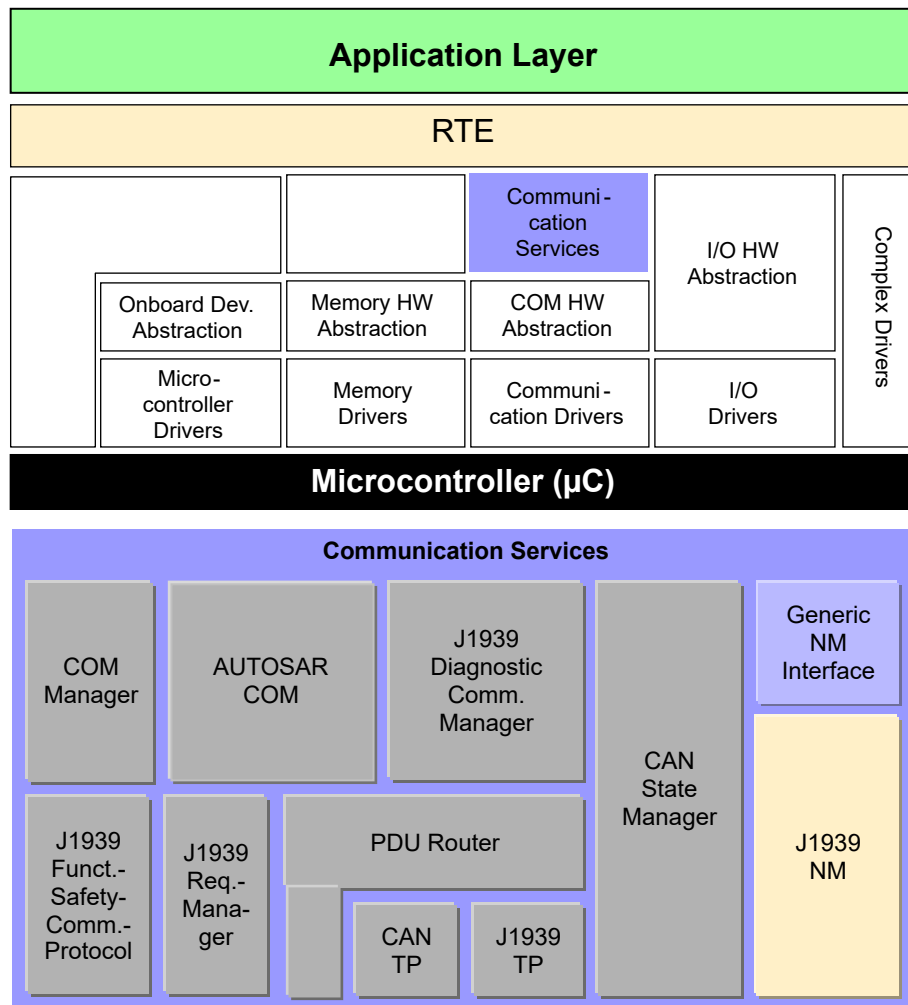


Figure 4.3: Position of the [J1939Nm](#) in the AUTOSAR architecture

4.4.2 Functional Requirements

4.4.2.1 Configuration

[SRS_J1939_00027] The channels on which the J1939 Network Management module is active shall be configurable [

Description:	The channels on which the J1939 Network Management module performs address claiming shall be configurable.
Rationale:	Address claiming is not required for all channels.
Use Case:	Gateway ECU with J1939 and proprietary channels.
Dependencies:	–
Supporting Material:	Concept 579 “Support for Heavy Duty Vehicles”

]

[SRS_J1939_00028] The local addresses of the ECU shall be configurable [

Description:	The addresses which are claimed by the J1939 Network Management module shall be configurable.
Rationale:	The ECU needs to be able to support more than one function.
Use Case:	An engine ECU might also control the retarder.
Dependencies:	–
Supporting Material:	Concept 579 “Support for Heavy Duty Vehicles”

]

[SRS_J1939_00029] The NAMES used for claiming of each configured address shall be configurable [

Description:	For each address that is configured to be claimed a separate NAME is required. All fields of the NAME shall be configurable.
Rationale:	NAMES must be unique for each network.
Use Case:	An engine ECU might also control the retarder.
Dependencies:	–
Supporting Material:	Concept 579 “Support for Heavy Duty Vehicles”

]

[SRS_J1939_00052] Address claiming behavior of J1939 networks [

Description:	The address claiming behavior shall be configurable for J1939 networks. Additional Information: SAE J1939 networks can support dynamic re-allocation of addresses of (some of the) connected nodes. In this case, all connected nodes need to be able to cope with addresses that change at run-time.
Supporting Material:	SAE J1939-81

]

[SRS_J1939_00053] Address claiming behavior of J1939 nodes [

Description:	The address claiming behavior shall be configurable for J1939 nodes. Additional Information: SAE J1939 nodes (called <i>Controller Applications</i> or <i>CA</i> for short) can support different modes of address allocation, from a fixed address to fully dynamic assignment.
Supporting Material:	SAE J1939-81

]

4.4.2.2 Initialization

[SRS_J1939_00030] The J1939 Network Management module shall provide an interface for module initialization [

Description:	The J1939 Network Management module shall provide and implement an interface for initialization of all states and all global variables of the module.
Rationale:	Basic functionality
Use Case:	ECU initialization
Dependencies:	–
Supporting Material:	Concept 579 “Support for Heavy Duty Vehicles”

]

4.4.2.3 Normal Operation

[SRS_J1939_00033] The J1939 Network Management module shall perform an initial address claim at startup [

Description:	For configured channels and ECU addresses, the J1939 Network Management module shall perform an initial address claim at startup.
Rationale:	Address claim is required before communication is allowed on J1939 networks.
Use Case:	Startup behavior of fully J1939 compliant ECUs.
Dependencies:	–
Supporting Material:	Concept 579 “Support for Heavy Duty Vehicles”

]

[SRS_J1939_00034] The J1939 Network Management module shall react correctly to contending address claims [

Description:	When a contending address claim is received, the J1939 Network Management module shall answer with an AddressClaimed or with a CannotClaimAddress PG, depending on the relative priority of the NAMES.
Rationale:	Duplicate addresses in the initial network setup shall not lead to undefined communication states.
Use Case:	Two ECUs might claim the same addresses, either because of an invalid network setup, or because one of the ECUs chooses its address at runtime.
Dependencies:	–
Supporting Material:	Concept 579 “Support for Heavy Duty Vehicles”

]

[SRS_J1939_00035] The J1939 Network Management module shall react to requests for the AddressClaimed PG [

Description:	When a request for the AddressClaimed PG arrives, the J1939 Network Management module shall answer by transmission of AddressClaimed or CannotClaimAddress PGs for all configured addresses.
Rationale:	Correct answer to Request PG.
Use Case:	A tester sends a request for AddressClaimed to the whole network, or an ECU wants to check whether its desired address is available.
Dependencies:	–
Supporting Material:	Concept 579 “Support for Heavy Duty Vehicles”

]

[SRS_J1939_00036] The J1939 Network Management module shall only allow communication after a successful address claim [

Description:	The J1939 Network Management module shall start communication for one of its configured addresses when the address claim succeeded, and stop communication when the address was lost due to a contending address claim.
Rationale:	A J1939 ECU may only use its address for communication after this was successfully claimed.
Use Case:	Correct start-up behavior of a J1939 ECU, and correct reaction to contending address claims.
Dependencies:	–
Supporting Material:	Concept 579 “Support for Heavy Duty Vehicles”

]

[SRS_J1939_00037] The J1939 Network Management module shall delay communication after initial address claim [

Description:	The J1939 Network Management module shall delay communication for 250ms to wait for contending address claims. This delay shall be configurable.
Rationale:	The start-up delay may be skipped for single address CAs with addresses in the ranges 0..127 and 248..253.
Use Case:	Correct start-up behavior of J1939 ECUs.
Dependencies:	–
Supporting Material:	Concept 579 “Support for Heavy Duty Vehicles”

]

[SRS_J1939_00051] The J1939 Network Management module shall route received address claims to connected channels [

Description:	The J1939 Network Management module shall be able to forward received address claims to connected channels, such that the addresses of nodes that are involved in message routing become visible on all relevant channels.
Rationale:	Address claim routing
Use Case:	When a gateway routes J1939 messages, the addresses used by these messages must be known on all involved channels.
Dependencies:	–
Supporting Material:	Concept 579 “Support for Heavy Duty Vehicles”

]

4.4.2.4 Shutdown Operation

[SRS_J1939_00031] The J1939 Network Management module shall provide an interface for module shutdown [

Description:	The J1939 Network Management module shall provide and implement an interface for de-initialization of the module.
Rationale:	Basic functionality
Use Case:	ECU shutdown, ECU degradation
Dependencies:	–
Supporting Material:	Concept 579 “Support for Heavy Duty Vehicles”

]

4.4.2.5 Fault Operation

[SRS_J1939_00032] The J1939 Network Management module shall report a failed address claim to the Diagnostic Event Manager [

Description:	The J1939 Network Management module shall report to the Diagnostic Event Manager (DEM) when the address claim for one of the configured addresses fails.
Rationale:	Loss of address is critical, because some functionality will then not be available.
Use Case:	Due to invalid network setup, it can happen that one of the configured addresses cannot be claimed.
Dependencies:	–
Supporting Material:	Concept 579 “Support for Heavy Duty Vehicles”

]

4.5 Requirements for the SAE J1939 Functional Safety Communication Protocol

4.5.1 Functional Overview

This chapter describes the requirements that shall be fulfilled by the AUTOSAR [J1939 Functional Safety Communication Protocol](#), which implements the functional safety communication protocol defined by [10, SAE J1939-76].

The following pictures show the parts of the complete AUTOSAR system and in particular the Communication Services in which the [J1939 Network Management](#) module is situated.

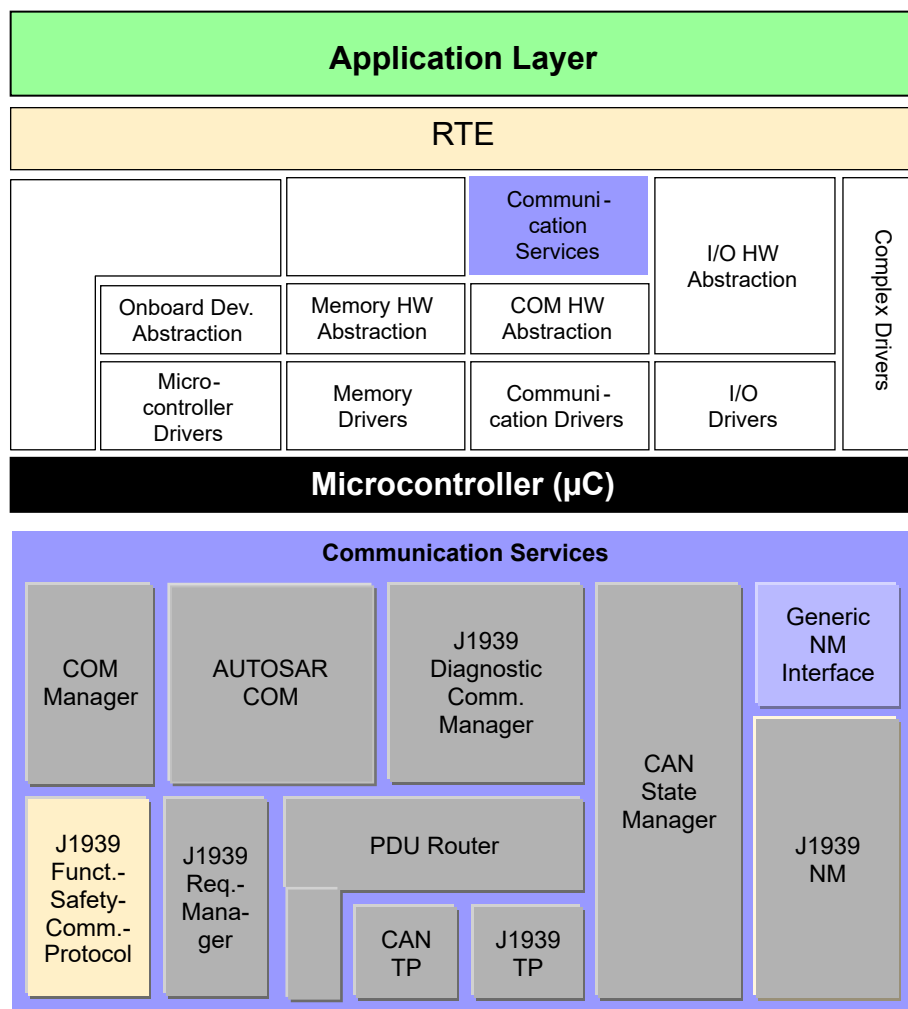


Figure 4.4: Position of the [J1939Fscp](#) in the AUTOSAR architecture

4.5.2 Functional Requirements

4.5.2.1 Configuration

[SRS_J1939_00054] Configurable PDUs

Status: DRAFT

[

Description:	<p>The J1939 Functional Safety Communication Protocol shall support the configuration of the relevant PDUs for the SDG as upper layer PDU and for the SHM and SDM as lower layer PDUs.</p> <p>Additional Information:</p> <ul style="list-style-type: none"> • Only configured Tx/Rx SDGs shall be processed by J1939Fscp. • Reception of SDGs from multiple sources shall be processed by J1939Fscp.
---------------------	--

]

[SRS_J1939_00055] Configurable SRVT between SHM and SDM for Tx SDGs

Status: DRAFT

[

Description:	<p>The J1939 Functional Safety Communication Protocol shall support configuration of the maximum SRVT between SHM and SDM for transmitted SDGs.</p>
---------------------	---

]

[SRS_J1939_00056] Configurable SRVT between SHM and SDM for Rx SDGs

Status: DRAFT

[

Description:	<p>The J1939 Functional Safety Communication Protocol shall support configuration of the maximum SRVT between SHM and SDM for received SDGs</p>
---------------------	---

]

4.5.2.2 Normal Operation

[SRS_J1939_00057] SDG Transmission

Status: DRAFT

[

Description:	<p>The J1939 Functional Safety Communication Protocol shall split the PDU from the upper layers into SHM and SDM, and request the lower layers to transmit both PDUs as described in [10, SAE J1939-76].</p>
---------------------	--

]

[SRS_J1939_00058] SDG Reception

Status: DRAFT

[

Description:	Upon reception of SHMs and SDMs, the J1939 Functional Safety Communication Protocol shall check both PDUs as described in [10, SAE J1939-76] and report the combined PDU to the upper layers.
---------------------	---

]

[SRS_J1939_00059] Transmission Timeout Monitoring

Status: DRAFT

[

Description:	The J1939 Functional Safety Communication Protocol shall ensure that the SDM is transmitted after the SHM as soon as possible but no later than the configured maximum SRVT.
---------------------	--

]

[SRS_J1939_00060] Reception Timeout Monitoring

Status: DRAFT

[

Description:	The J1939 Functional Safety Communication Protocol shall monitor that the SDM is received after the SHM within the configured maximum SRVT.
---------------------	---

]

[SRS_J1939_00061] Ignoring unknown SHMs

Status: DRAFT

[

Description:	The J1939 Functional Safety Communication Protocol shall ignore SHMs with PGNs that have not been configured for the J1939 Functional Safety Communication Protocol.
---------------------	--

]

4.5.2.3 Fault Operation

[SRS_J1939_00062] SDG with Invalid Length

Status: DRAFT

[

Description:	The J1939 Functional Safety Communication Protocol shall report an error if the length of a transmitted upper layer PDU (representing an SDG) is incorrect.
---------------------	---

]

[SRS_J1939_00063] SRVT Timeout during Transmission

Status: DRAFT

[

Description:	The J1939 Functional Safety Communication Protocol shall report an error if the SDM was not transmitted within the configured SRVT.
---------------------	---

]

[SRS_J1939_00064] SRVT Timeout during Reception

Status: DRAFT

[

Description:	The J1939 Functional Safety Communication Protocol shall report an error if the SDM was not received within the configured SRVT.
---------------------	--

]

[SRS_J1939_00065] Reception of Consecutive SHMs

Status: DRAFT

[

Description:	The J1939 Functional Safety Communication Protocol shall report an error if two consecutive SHMs were received, indicating that the SDM expected after the first SHM is missing.
---------------------	--

]

[SRS_J1939_00066] Reception of Consecutive SDMs

Status: DRAFT

[

Description:	The J1939 Functional Safety Communication Protocol shall report an error if two consecutive SDMs were received, indicating that the SHM expected before the second SDM is missing.
---------------------	--

]

5 References

- [1] Specification of a Transport Layer for SAE J1939
AUTOSAR_CP_SWS_SAEJ1939TransportLayer
- [2] Specification of a Request Manager for SAE J1939
AUTOSAR_CP_SWS_SAEJ1939RequestManager
- [3] Specification of Network Management for SAE J1939
AUTOSAR_CP_SWS_SAEJ1939NetworkManagement
- [4] Specification of a Diagnostic Communication Manager for SAE J1939
AUTOSAR_CP_SWS_SAEJ1939DiagnosticCommunicationManager
- [5] Requirements on Diagnostics
AUTOSAR_FO_RS_Diagnostics
- [6] Standardization Template
AUTOSAR_FO_TPS_StandardizationTemplate
- [7] Glossary
AUTOSAR_FO_TR_Glossary
- [8] SAE J1939 – Serial Control and Communications Heavy Duty Vehicle Network
- [9] SAE J1939-73 Application Layer – Diagnostics
- [10] SAE J1939-76 Functional Safety Communications Protocol
- [11] SAE J1939-81 Network Management
- [12] SAE J1939-21 Data Link Layer

A Trace Groups

The requirements in this document are divided into trace groups according to the following table.

Defined Trace Groups	
Identifier	Included Requirements
TG_J1939Fscp_Functional	[SRS_J1939_00049] [SRS_J1939_00054] [SRS_J1939_00055] [SRS_J1939_00056] [SRS_J1939_00057] [SRS_J1939_00058] [SRS_J1939_00059] [SRS_J1939_00060] [SRS_J1939_00061] [SRS_J1939_00062] [SRS_J1939_00063] [SRS_J1939_00064] [SRS_J1939_00065] [SRS_J1939_00066]
TG_J1939Nm_Functional	[SRS_J1939_00027] [SRS_J1939_00028] [SRS_J1939_00029] [SRS_J1939_00030] [SRS_J1939_00031] [SRS_J1939_00032] [SRS_J1939_00033] [SRS_J1939_00034] [SRS_J1939_00035] [SRS_J1939_00036] [SRS_J1939_00037] [SRS_J1939_00049] [SRS_J1939_00051] [SRS_J1939_00052] [SRS_J1939_00053]
TG_J1939Rm_Functional	[SRS_J1939_00005] [SRS_J1939_00007] [SRS_J1939_00008] [SRS_J1939_00009] [SRS_J1939_00012] [SRS_J1939_00013] [SRS_J1939_00014] [SRS_J1939_00015] [SRS_J1939_00016] [SRS_J1939_00017] [SRS_J1939_00026] [SRS_J1939_00049] [SRS_J1939_00050]
TG_J1939Tp_Functional	[SRS_J1939_00001] [SRS_J1939_00002] [SRS_J1939_00003] [SRS_J1939_00004] [SRS_J1939_00006] [SRS_J1939_00010] [SRS_J1939_00011] [SRS_J1939_00018] [SRS_J1939_00019] [SRS_J1939_00020] [SRS_J1939_00021] [SRS_J1939_00022] [SRS_J1939_00023] [SRS_J1939_00024] [SRS_J1939_00025] [SRS_J1939_00038] [SRS_J1939_00039] [SRS_J1939_00043] [SRS_J1939_00044] [SRS_J1939_00045] [SRS_J1939_00046] [SRS_J1939_00047] [SRS_J1939_00048] [SRS_J1939_00049] [SRS_J1939_00067]
TG_J1939Tp_Non_Functional	[SRS_J1939_00040] [SRS_J1939_00041] [SRS_J1939_00042]

Table A.1: Trace Groups of this document

B History of Requirements

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

B.1 Requirement History of this Document According to AUTOSAR Release R25-11

B.1.1 Added Requirements in R25-11

[\[SRS_J1939_00067\]](#)

B.1.2 Changed Requirements in R25-11

none

B.1.3 Deleted Requirements in R25-11

none

B.2 Requirement History of this Document According to AUTOSAR Release R24-11

B.2.1 Added Requirements in R24-11

[\[SRS_J1939_00054\]](#) [\[SRS_J1939_00055\]](#) [\[SRS_J1939_00056\]](#) [\[SRS_J1939_00057\]](#)
[\[SRS_J1939_00058\]](#) [\[SRS_J1939_00059\]](#) [\[SRS_J1939_00060\]](#) [\[SRS_J1939_00061\]](#)
[\[SRS_J1939_00062\]](#) [\[SRS_J1939_00063\]](#) [\[SRS_J1939_00064\]](#) [\[SRS_J1939_00065\]](#)
[\[SRS_J1939_00066\]](#)

B.2.2 Changed Requirements in R24-11

none

B.2.3 Deleted Requirements in R24-11

none

B.3 Requirement History of this Document According to AUTOSAR Release R23-11

B.3.1 Added Requirements in R23-11

[\[SRS_J1939_00052\]](#) [\[SRS_J1939_00053\]](#)

B.3.2 Changed Requirements in R23-11

none

B.3.3 Deleted Requirements in R23-11

none

B.4 Requirement History of this Document According to AUTOSAR Release R22-11

B.4.1 Added Requirements in R22-11

[\[SRS_J1939_NA\]](#)

B.4.2 Changed Requirements in R22-11

none

B.4.3 Deleted Requirements in R22-11

none

B.5 Requirement History of this Document According to AUTOSAR Release R21-11

B.5.1 Added Requirements in R21-11

none

B.5.2 Changed Requirements in R21-11

none

B.5.3 Deleted Requirements in R21-11

none