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1   Scope of Document

This document is intended to list the general requirements resulting from concept UID 387 TCP/IP CommStack Extensions (TCP/IP).
These will need to be implemented by the following software specifications:

- 414 UDP Network Management (UdpNm)
- 415 Ethernet State Manager (EthSM)
- 416 Socket Adaptor (SoAd)
- 417 Ethernet Interface (EthIf)
- 418 Diagnostics over IP (DoIP)
- 430 Ethernert Driver (Eth)
- 431 Ethernet Transciever Driver (Eth Trcv)
- 616 Service Discovery (Sd)
- 617 Tcp/Ip Stack (TcpIp)

2   Conventions to be used

- The representation of requirements in AUTOSAR documents follows the table specified in [7].

- 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.)

2.1 Acronyms and abbreviations

Abbreviation / Acronym:	Description:
ARP	Address Resolution Protocol
COTS	Commercial Of The Shelf
DEM	Diagnostic Event Manager
DET	Development Error Tracer
DHCP	Dynamic Host Configuration Protocol
DoIP	Diagnostics over IP
HTTP	HyperText Transfer Protocol
IANA	Internet Assigned Numbers Authority
ICMP	Internet Control Message Protocol
IP	Internet Protocol
SoAd	AUTOSAR Socket Adaptor Module
TCP	Transmission Control Protocol
TCP/IP	A family of communication protocols used in computer networks
UDP	User Datagram Protocol
UdpNm	AUTOSAR UDP Network Management Module
XCP	eXtended Calibration Protocol

3 Functional Overview

3.1 TCP/IP Protocol Stack (TCPIP)

The TCP/IP protocol stack (TCP/IP stack) is intended to handle layers 2 through 4 of the ISO/OSI layer model. This includes, but is not limited to protocols like `IP`, `DHCP`, `ARP`, `TCP`, `UDP`, `ICMP` and others.
In Terms of this model the SoAd and therefore the whole AUTOSAR COM stack above represent the application at layer 7.

3.2 SWS Socket Adaptor (SoAd)

The SoAd is an adaptor layer, not only matching the AUTOSAR APIs to standard socket APIs [9], but also mapping PDU IDs to socket connections.

3.3 SWS Diagnostics over IP (DoIP)

The DoIP part of the SoAd implements the functionality required by [10].

3.4 SWS Ethernet Interface (EthIf)

The Ethernet Interface provides standardized interfaces to provide the communication with the Ethernet bus system of an ECU. The APIs are independent from the specific Ethernet Controllers and Transceivers and their access through the responsible Driver layer. The Ethernet Interface is conceptually able to access one or more Ethernet Drivers and Ethernet Transceiver Drivers via one uniform interface.

3.5 SWS Ethernet Driver (Eth)

The Ethernet Driver offers uniform interfaces for the Ethernet Interface. The Ethernet Driver hides hardware specific details of the used Ethernet controller.

3.6 SWS Ethernet Transceiver Driver (EthTrcv)

The Ethernet Transceiver Driver offers uniform interfaces for the Ethernet Interface. The Ethernet Transceiver Driver hides hardware specific details of the used Ethernet transceiver.

3.7 SWS Ethernet State Manager (EthSM)

The Ethernet State Manager offers uniform interfaces for the Communication Manager (ComM). The Ethernet State Manager hides network specific details.

3.8 SWS UDP Network Management (UdpNm)

The UDP Network Management offers uniform interfaces for the Network Management Interface (NmIf). The UDP Network Management hides network specific details.

3.9 SWS Service Discovery (Sd)

Service Discovery serves primarily to determine the operational status of a service. A service may be comprised of any combination of SW-Cs and/or BSWs in an ECU. The BswM is used to aggregate the SW-Cs and BSWs status and trigger Sd when the required combination is available. Secondly Sd can also be used as a registration protocol for publish/subscribe communication paterns. In both cases Sd can transport addressing information in addition to the registration and avaialability information.

4 Requirements traceability

Document: Requirements on AUTOSAR Features[1].

Requirement	Satisfied by
[RS_BRF_00286]	OK, see Chapter 5
[RS_BRF_00283]	OK, see Chapter 5

5 Requirements Specification

5.1 General Requirements

5.1.1 Configuration

5.1.1.1 [SRS_Eth_00053] SWS shall specify configuration

⌈

Type:	New
Description:	The SWS documents shall include a configuration section to allow adaption of the functionality.
Rationale:	The functionality needs to be adapted to different use-cases and environments.
Use Case:	--
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01056)

5.1.2 AUTOSAR Interfaces

5.1.2.1 [SRS_Eth_00055] SoAd shall support UDP NM

⌈

Type:	New
Description:	The SoAd shall offer an interface API for UDP NM to send network management messages. This interface shall mimic the API of interfaces in Autosar.
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01784)

5.1.2.2 [SRS_Eth_00056] SoAd shall support XCP

⌈

Type:	Valid
Description:	The SoAd module shall offer a data path to the AUTOSAR XCP module.
Rationale:	Exchange XCP frames between master and client
Use Case:	Calibration and Measurement
Dependencies:	--
Supporting Material:	ASAM XCP

⌋(RS_BRF_01656)

5.1.2.3 [SRS_Eth_00058] SoAd shall support generic upper layer

⌈

Type:	Valid
Description:	The SoAd shall offer an interface API for a generic upper layer to send and receive PDUs via socket connections, to control socket connections and to provide notification of socket connection and IP address assignment state changes.
Rationale:	Simplifies adding of additional upper layers
Use Case:	DoIP, V2G, DNS-SD
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_1056)

5.2 Functional Requirement

5.2.1 SWS TCP/IP Protocol Stack

5.2.1.1 TCP/IP General Requirements

5.2.1.1.1 [SRS_Eth_00054] TCPIP minimum functionality
⌈

Type:	Valid
Description:	If DoIP is not implemented, the minimum requirements on the functionality of the TCP/IP stack shall be determined by the configuration of the Socket Adaptor.
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_1784)

5.2.1.1.2 [SRS_Eth_00019] TCP and UDP related requirement specified in IETF RFC 1122 shall be implemented
⌈

Type:	Valid
Description:	TCP and UDP related requirements specified in IETF RFC 1122 shall be implement in the TCP/IP stack
Rationale:	--
Use Case:	IETF RFC 768, IETF RFC 793
Dependencies:	--
Supporting Material:	[10]; IETF RFC 1122

⌋(RS_BRF_1784)

5.2.2 TCP/IP Internet Protocol

5.2.2.1 [SRS_Eth_00045] TCPIP automatic IP address assignment
⌈

Type:	Valid
Description:	The TCP/IP stack shall implement a mechanism to automatically configure an IP addresses..
Rationale:	This is necessary when no static IP-addresses are assigned to still allow for plug and play configuration of the TCP/IP stack.
Use Case:	--
Dependencies:	[SRS_Eth_00002]
Supporting Material:	[10]

⌋(RS_BRF_1784)

5.2.3 TCP/IP Sub Module: IPv4

5.2.3.1 [SRS_Eth_00014] IPv4 shall be implemented according to IETF RFC 791

⌈

Type:	Valid
Description:	The Internet Protocol (IPv4) shall at least be implemented in the TCP/IP stack as stated in IETF RFC 791
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	[10]; IETF RFC 791;

⌋(RS_BRF_1784)

5.2.3.2 [SRS_Eth_00015] ARP shall be implemented according to IETF RFC 826

⌈

Type:	Valid
Description:	For DoIP the Address Resolution Protocol (ARP) shall at least be implemented in the TCP/IP stack as stated in IETF RFC 826
Rationale:	--
Use Case:	--
Dependencies:	[SRS_Eth_00014]
Supporting Material:	[10]; IETF RFC 826

⌋(RS_BRF_1784)

5.2.3.3 [SRS_Eth_00022] The dynamic configuration of IPv4 link-local addresses as specified in IETF RFC 3927 shall be implemented

⌈

Type:	Valid
Description:	For DoIP the dynamic configuration of IPv4 link-local addresses as specified in IETF RFC 3927 shall be implemented in the TCP/IP stack
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	[10]; IETF RFC 3927

⌋(RS_BRF_1784)

5.2.4 TCP/IP Sub Module: IPv6

5.2.4.1 [SRS_Eth_00059] IPv6 shall be implemented according to IETF RFC 2460

[

Type:	Valid
Description:	Internet Protocol Version 6 (IPv6) shall at least be implemented in the TCP/IP stack as stated in IETF RFC 2460. Limitation: the Authentication and Encapsulating Security Payload extension headers and other IPsec functionalities may not be supported. The handling of IPsec headers shall be tolerated
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	[10]

⌋(RS_BRF_1784)

5.2.4.2 [SRS_Eth_00060] IPv6 shall be implemented according to IETF RFC 2461

[

Type:	Valid
Description:	Neighbour Discovery Protocol shall at least be implemented in the TCP/IP stack as stated in IETF RFC 2461
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_1784)

5.2.5 TCP/IP ICMP

5.2.5.1 [SRS_Eth_00016] ICMP shall be implemented according to IETF RFC 792

[

Type:	Valid
Description:	For DoIP the Internet Control Message Protocol (ICMP) shall at least be implemented in the TCP/IP stack as stated in IETF RFC 792
Rationale:	
Use Case:	--
Dependencies:	[SRS_Eth_00014]
Supporting Material:	[10]; IETF RFC 792

⌋(RS_BRF_1784)

5.2.5.2 [SRS_Eth_00061]An API shall be available to generate any ICMP message

[

Type:	Valid
Description:	An API Shall be available to generate any ICMP message
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01784)

5.2.5.3 [SRS_Eth_00062]A call-back function shall be configurable for any received ICMP message type

⌈

Type:	Valid
Description:	A call-back function shall be configurable for any received ICMP message type
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01784)

5.2.5.4 [SRS_Eth_00017] TCP shall be implemented according to IETF RFC 793

⌈

Type:	Valid
Description:	The Transmission Control Protocol (TCP) shall at least be implemented in the TCP/IP stack as stated in IETF RFC 793
Rationale:	
Use Case:	--
Dependencies:	--
Supporting Material:	[10]; IETF RFC 793

⌋(RS_BRF_01784)

5.2.5.5 [SRS_Eth_00063]TCP shall be independent of IP-Version

⌈

Type:	Valid
Description:	TCP shall be independent of any IP-Version
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01784)

5.2.6 TCP/IP UDP

5.2.6.1 [SRS_Eth_00018] UDP shall be implemented according to IETF RFC 768

⌈

Type:	Valid
Description:	The User Datagram Protocol (UDP) shall at least be implemented in the TCP/IP stack as stated in IETF RFC 768
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	[10], IETF RFC 768

⌋(RS_BRF_01784)

5.2.6.2 [SRS_Eth_00064]TCP shall be independent of IP-Version

⌈

Type:	Valid
Description:	TCP shall be independent of any IP-Version
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01784)

5.2.7 TCP/IP DHCP

5.2.7.1 [SRS_Eth_00065]An API shall be available to fill DHCP field

⌈

Type:	Valid
Description:	An API shall be available to fill any DHCP options field
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01784)

5.2.7.2 [SRS_Eth_00066]An API shall be available to read any received DHCP field

⌈

Type:	Valid
Description:	An API shall be available to read any received DHCP options field
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01784)

5.2.7.3 [SRS_Eth_00020] DHCP shall be implemented according to IETF RFC 2131

⌈

Type:	Valid
Description:	The Dynamic Host Configuration Protocol (DHCP) shall at least be implemented in the TCP/IP stack as stated in IETF RFC 2131
Rationale:	--
Use Case:	--
Dependencies:	
Supporting Material:	[10]; IETF RFC 2131

⌋(RS_BRF_01784)

5.2.7.4 [SRS_Eth_00021] The DHCP host name option shall be implemented according to IETF RFC 2132

⌈

Type:	Valid
Description:	For DoIP DHCP host name option shall at least be implemented in the TCP/IP stack as stated in IETF RFC 2132
Rationale:	--
Use Case:	--
Dependencies:	[SRS_Eth_00047]; SRS_Eth_00020
Supporting Material:	[10]; IETF RFC 2132

⌋(RS_BRF_01784)

5.2.8 TCP/IP Sub-Module: DHCPv6

5.2.8.1 [SRS_Eth_00067]The IPv6 stack shall implement DHCP as a DHCP client according to IETF RFC 3315

⌈

Type:	Valid
Description:	The IPv6 stack shall implement the Dynamic Host Configuration Protocol for IPv6 as a DHCP client.
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	IETF RFC 3315

⌋(RS_BRF_01784)

5.2.8.2 [SRS_Eth_00068]The DNS configuration options for DHCP for IPv6 shall be supported by IETF RFC 3646

⌈

Type:	Valid
Description:	The DNS Configuration Options for Dynamic Host Configuration Protocol for IPv6 shall be supported by IETF RFC 3646.
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	IETF RFC 3646

⌋(RS_BRF_01784)

5.3 SWS Socket Adaptor (SoAd)

5.3.1.1 [SRS_Eth_00004] The SoAd shall support a local multi-homed host

[

Type:	Valid
Description:	The SoAd shall support a local multi-homed host.
Rationale:	An ECU might be connected to multiple IP networks for different use-cases
Use Case:	--
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776)

5.3.1.2 [SRS_Eth_00002] The IP addresses as well as the method of acquisition shall be a configurable item.

[

Type:	Valid
Description:	The IP addresses as well as the method of acquisition shall be a configurable item.
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776)

5.3.1.3 [SRS_Eth_00001] The initialisation the SoAd shall be able to establish all TCP connections

[

Type:	Valid
Description:	The initialisation the SoAd shall be able to establish all TCP connections as described in the configuration.
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776)

5.3.1.4 [SRS_Eth_00005] Both UDP or TCP shall be usable

[

Type:	Valid
Description:	Both UDP or TCP shall be usable.
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776)

5.3.1.5 [SRS_Eth_00009] Upon Shutdown the Socket Adaptor shall close all open TCP connections

[

Type:	Valid
Description:	Upon Shutdown the Socket Adaptor shall close all open TCP connections.
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01776)

5.3.1.6 [SRS_Eth_00008] The Socket Adaptor shall immediately try to re-establish any TCP connection if it is lost

[

Type:	Valid
Description:	The Socket Adaptor shall immediately try to re-establish any TCP connection if it is lost. 'never give up' strategy
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01776)

5.3.1.7 [SRS_Eth_00010] The SoAd shall implement a mechanism by which resources can be shared among multiple socket connections

[

Type:	Valid
Description:	The SoAd shall implement a mechanism by which resources can be shared among multiple socket connections.
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01776)

5.3.1.8 [SRS_Eth_00011] The resources required for the socket connections shall be predictable by analyzing the configuration information

[

Type:	Valid
Description:	The resources required for the socket connections shall be predictable by analyzing the configuration information.
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01776)

5.3.1.9 [SRS_Eth_00012] An API shall be offered where buffer memory is required

[

Type:	Valid
Description:	The Socket Adaptor, TcpIp,EthIf and Eth shall offer an API where buffer memory for transmission and reception of AUTOSAR PDUs via Ethernet is required
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	AUTOSAR API will be able to satisfy this requirement!

⌋(RS_BRF_01776)

5.3.1.10 [SRS_Eth_00013] An API shall be offered for reduced copy operation

⌈

Type:	Valid
Description:	The Socket Adaptor, TcpIp, EthIf and Eth shall offer an API where the number of copy operations for transmission and reception of AUTOSAR PDUs via Ethernet is optimized (i.e. reduced to a minimum)
Rationale:	--
Use Case:	AUTOSAR API
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01776)

5.3.1.11 [SRS_Eth_00006] The Socket Adaptor shall be able to transfer data using TCP/IP without the introduction of additional protocol overhead

⌈

Type:	Valid
Description:	The Socket Adaptor shall be able to transfer data using TCP/IP without the introduction of additional protocol overhead.
Rationale:	The protocol overhead introduced by Ethernet and TCP/IP is so large, that additional overhead is considered harmful.
Use Case:	--
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01776)

5.3.1.12 [SRS_Eth_00048] SoAd shall implement a mechanism to bi-directionally route PDUs between an AUTOSAR connector and the TCP/IP stack

⌈

Type:	Valid
Description:	SoAd shall implement a mechanism to bi-directionally route PDUs between an AUTOSAR connector and the TCP/IP stack.
Rationale:	This is necessary to allow communication
Use Case:	--
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01776)

5.3.1.13 [SRS_Eth_00049] SoAd shall implement an API towards higher layers, which is equivalent to the API provided by interface modules

[

Type:	Valid
Description:	SoAd shall implement an API towards higher layers, which is equivalent to the API provided by interface modules like FrIf, CanIf and LinIf.
Rationale:	Higher layers shall not be aware of the underlining communication stack.
Use Case:	--
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776)

5.3.1.14 [SRS_Eth_00050] SoAd shall implement an API towards higher layers, which is equivalent to the API provided by transport layer

[

Type:	Valid
Description:	SoAd shall implement an API towards higher layers, which is equivalent to the API provided by transport layer modules like FrTP and CanTP.
Rationale:	Higher layers shall not be aware of the underlining communication stack.
Use Case:	--
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776)

5.3.1.15 [SRS_Eth_00051] The Socket Adapter shall specify and be able to use a call-back interface towards the TCP/IP stack

[

Type:	Valid
Description	The Socket Adapter shall specify and be able to use a call-back interface towards the TCP/IP stack.
Rationale	the SoAd shall specify and be able to make use of a call-back interface, that reduces the number of required copy actions to and from the TCP/IP stack (optimized parameter) and reduces the latency (call-back functions).
Use Case	Instead of a commercial of the shelf TCP/IP stack an optimized automotive TCP/IP stack shall be usable.
Dependencies:	--
Supporting Material:	

](RS_BRF_01776)

5.3.1.16 [SRS_Eth_00069]The Socket Adapter shall implement a mechanism to share multiple PDUs from/to the same or different upper modules

[

Type:	Valid
Description:	The SoAd shall implement a mechanism by which a socket connection can be shared among multiple PDUs from/to the same or different upper layer modules.
Rationale:	Minimize resource consumption
Use Case:	Transmission of multiple COM-PDUs to the same remote node.
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01776)

5.3.1.17 [SRS_Eth_00070]The Socket Adapter shall implement a mechanism to transmit PDUs to more than one receiver

⌈

Type:	Valid
Description:	The SoAd shall implement a mechanism by which a PDU shall be transmitted to more than one receiver using the same or a different socket connection and by which a received PDU shall be forwarded to more than one upper layer PDU using the same or a different socket connection to the same or a different upper layer module. (i.e. fan out to lower and upper layer, fan in from mulitple connections)
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01776)

5.3.1.18 [SRS_Eth_00071]The Socket Adapter shall implement a mechanism to activate or deactivate an upper layer using a routing group

⌈

Type:	Valid
Description:	The SoAd shall implement a mechanism by which a routing group can be activated or deactivated by an upper layer during runtime. A routing group consist of a number of PDUs from the same or different socket connections which shall be blocked (i.e. not routed to or from the upper layer). A PDU may only be part of a single routing group.
Rationale:	Blocking of undesired messages
Use Case:	Blocking of undesired notifications from a Publish/Subscribe Server
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01776)

5.4 SWS Diagnostics over IP (DoIP)

5.4.1.1 [SRS_Eth_00047] DoIP shall be able to access the DHCP host name option.

⌈

Type:	Valid
Description:	The value used in the DHCP host name option shall be accessable and changeable by DoIP.
Rationale:	--
Use Case:	--
Dependencies:	[SRS_Eth_00021]
Supporting Material:	[10]

⌋(RS_BRF_01440)

5.4.1.2 [SRS_Eth_00024] DoIP messages shall be bi-directionally routed

⌈

Type:	Valid
Description:	DoIP shall implement a mechanism to bi-directionally route DoIP messages between the vehicle networks and TCP sockets.
Rationale:	This is necessary to allow DoIP communication
Use Case:	--
Dependencies:	--
Supporting Material:	[10]

⌋(RS_BRF_01440)

5.4.1.3 [SRS_Eth_00025] Valid DoIP messages shall be recognized

Type:	Valid
Description:	DoIP shall provide a mechanism to recognize valid DoIP Messages
Rationale:	This is necessary to ensure correct DoIP communication
Use Case:	--
Dependencies:	--
Supporting Material:	[10]

⌋(RS_BRF_01440)

5.4.1.4 [SRS_Eth_00026] DoIP Vehicle Identification shall be provided

⌈

Type:	Valid
Description:	DoIP shall provide a mechanism to identify a vehicle respective its DoIP entity in a network
Rationale:	This is necessary to determine the IP addresses of the DoIP entity
Use Case:	--
Dependencies:	--
Supporting Material:	[10]

⌋(RS_BRF_01440)

5.4.1.5 [SRS_Eth_00027] DoIP diagnostic message shall have a format

⌈

Type:	Valid
Description:	DoIP shall implement a message format to allow the routing of diagnostic messages
Rationale:	This is necessary to allow DoIP
Use Case:	--
Dependencies:	--
Supporting Material:	[10]

⌋(RS_BRF_01440)

5.4.1.6 [SRS_Eth_00028] Multiple DoIP sockets shall be allowed on a single port

[

Type:	Valid
Description:	DoIP shall implement a mechanism to allow the use and assignment of multiple sockets on a single port, while ensuring that no active communication is disturbed
Rationale:	This is necessary for the efficient use of socket communication
Use Case:	--
Dependencies:	--
Supporting Material:	[10]

](RS_BRF_01440)

5.4.1.7 [SRS_Eth_00080] DoIP shall implement a mechanism to retrieve diagnostic power mode

[

Type:	Valid
Description:	DoIP shall implement a mechanism to retrieve the diagnostic power mode of a DoIP Entity via a diagnostic power mode request as described in ISO 134000-2:2012. The service is needed to provide the tester with the diagnostic capability information.
Rationale:	This is necessary to allow DoIP
Use Case:	--
Dependencies:	--
Supporting Material:	[10]

](RS_BRF_01440)

5.4.1.8 [SRS_Eth_00081]DoIP shall be able to dynamically maintain connection to different testers

[

Type:	Valid
Description:	DoIP shall be able to dynamically maintain the connection to different testers as described in ISO 134000-2:2012
Rationale:	This is necessary to allow DoIP
Use Case:	--
Dependencies:	--
Supporting Material:	[10]

](RS_BRF_01440)

5.4.1.9 [SRS_Eth_00082]DoIP shall implement a mechanism to retrieve Entity Status

Type:	Valid
Description:	DoIP shall implement a mechanism to retrieve the entity status information of a DoIP Entity via an Entity status request as described in ISO 134000-2:2012. The service is needed to provide the tester with the diagnostic capability information
Rationale:	This is necessary to allow DoIP
Use Case:	--
Dependencies:	--
Supporting Material:	[10]

⌋(RS_BRF_01440)

5.4.1.10 [SRS_Eth_00083]DoIP shall implement a mechanism to check if diagnostic testers are alive

Type:	Valid
Description:	DoIP shall implement a mechanism to check if the connected testers are still available to allow an efficient management of connections for diagnostics from the DoIP entity point of view. The alive check mechanism shall be according to 13400-2:2012.
Rationale:	This is necessary to allow DoIP
Use Case:	--
Dependencies:	--
Supporting Material:	[10]

⌋(RS_BRF_01440)

5.4.1.11 [SRS_Eth_00084]DoIP shall implement routing activation mechanism

Type:	Valid
Description:	DoIP shall implement a mechanism to allow the selective activation of diagnostics on all supported socket connections with the Routing activation mechanisms described in ISO 13400-2:2012
Rationale:	This is necessary to allow DoIP
Use Case:	--
Dependencies:	--
Supporting Material:	[10]

⌋(RS_BRF_01440)

5.5 SWS Ethernet Interface (EthIf)

5.5.1.1 [SRS_Eth_00031] The Ethernet Interface shall be pre-compile time configurable for interrupt or polling.

⌈

Type:	Valid
Description:	The Ethernet Interface shall provide configuration for interrupt and polling mode. In interrupt mode received frames shall be reported from the driver. In polling mode the main function shall check for received frames.
Rationale	Interface and interaction
Use Case	For low latency interrupt mode is crucial. On systems with high system load the polling mode reduces the system load
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776)

5.5.1.2 [SRS_Eth_00032] The Ethernet Interface shall provide hardware configuration and intitialization.

[

Type:	Valid
Description:	The Ethernet Interface shall provide hardware independent configuration and initialization interface.
Rationale	Hardware abstraction
Use Case	Exchanging the used Ethernet controller and transceiver shall be transparent and only be reflected by replacing the used driver.
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776)

5.5.1.3 [SRS_Eth_00033] The Ethernet Interface shall provide indication for link state change.

[

Type:	Valid
Description:	The Ethernet Interface shall provide indication for link state change of connected transceivers.
Rationale	Interface and interaction
Use Case	Disconnection of the cable results in invalid IP address. Thus a valid IP assignment cycle has to be started.
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776)

5.5.1.4 [SRS_Eth_00072]The Ethernet Interface shall provide VLAN support

[

Type:	Valid
Description:	The Ethernet Interface shall support VLAN tagging of Ethernet frames according to IEEE 802.1Q, i.e. add/remove VLAN tag at transmission/reception of Ethernet frames. A VLAN shall appear as a separate EthIf controller to the upper layer. The VLAN identifier shall be specified via EthIf configuration; the VLAN priority shall be specified by the upper layer as part of the transmission request and ignored at reception.
Rationale	Separation of logical networks
Use Case	Separation of internal and external vehicle communication
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776)

5.6 SWS Ethernet Driver (Eth)

5.6.1.1 [SRS_Eth_00035] The Ethernet Driver shall be pre-compile time configurable for interrupt or polling.

[

Type:	Valid
Description:	The Ethernet Driver shall provide configuration for interrupt and polling mode. In interrupt mode received frames shall be reported from the driver.
Use Case	For low latency interrupt mode is crucial. On systems with high system load the polling mode reduces the system load
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776)

5.6.1.2 [SRS_Eth_00036] The Ethernet Driver shall provide hardware configuration and intitialization.

[

Type:	Valid
Description:	The Ethernet Driver shall provide hardware independent configuration and initialization interface.
Rationale	Hardware abstraction
Use Case	Exchanging the used Ethernet controller shall be transparent and only be reflected by replacing the used driver.
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776)

5.6.1.3 [SRS_Eth_00073]The Ethernet Driver shall support to receive MAC broadcast frames

[

Type:	Valid
Description:	The Ethernet driver shall support the configuration of the Ethernet controller to receive MAC broadcast frames.
Rationale	Reception of frames by all nodes
Use Case	ARP Request
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776)

5.6.1.4 [SRS_Eth_00074]The Ethernet Driver shall support to receive MAC groupcast frames

[

Type:	Valid
Description:	The Ethernet driver shall support the configuration of the Ethernet controller to receive MAC multicast frames.
Rationale	Reception of frames by multiple nodes
Use Case	Notification messages
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776)

5.7 SWS Ethernet Transceiver Driver (EthTrcv)

5.7.1.1 [SRS_Eth_00039] The Ethernet Transceiver Driver shall provide hardware configuration and intitialization.

[

Type:	Valid
Description:	The Ethernet Transceiver Driver shall provide hardware independent configuration and initialization interface.
Rationale	Hardware abstraction
Use Case	Exchanging the used Ethernet transceiver shall be transparent and only be reflected by replacing the used driver.
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776)

5.7.1.2 [SRS_Eth_00040] The Ethernet Transceiver Driver shall provide access to the link state.

[

Type:	Valid
Description:	The Ethernet Transceiver Driver shall provide access to the link state of connected transceivers.
Rationale	Interface and interaction
Use Case	Disconnection of the cable results in invalid IP address. Thus a valid IP assignment cycle has to be started.
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776)

5.8 SWS Ethernet State Manager (EthSM)

5.8.1.1 [SRS_Eth_00043] The Ethernet State Manager shall provide network configuration and intitialization.

[

Type:	Valid
Description:	The Ethernet State Manager shall provide network independent configuration and initialization interface.
Rationale	Hardware abstraction
Use Case	Exchanging the used network shall be transparent and only be reflected by replacing the used State Manager.
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776,RS_BRF_01664)

5.9 SWS UDP Network Management (UdpNm)

5.9.1.1 [SRS_Eth_00037] The UDP Network Management shall provide an interface for transmission of network management information.

[

Type:	Valid
Description:	The UDP Network Management shall provide an interface to send and receive network management information over UDP.
Rationale	Hardware abstraction
Use Case	Exchanging the used network shall be transparent and only be reflected by replacing the used Network Management.
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776,RS_BRF_01680)

5.9.1.2 [SRS_Eth_00075]The UDP Network Management shall atleast provide the functionality of CAN NM.

Type:	Valid
Description:	The UDP Network Management shall match the functionality of CAN NM. (i.e Including optional services such as Partial Networking)
Rationale	Bus independence
Use Case	Replacement of CAN by Ethernet and IP
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776,RS_BRF_01680)

5.10 SWS Service Discovery (Sd)

5.10.1.1 [SRS_Eth_00076]The APIs of the Service Discovery module shall support any protocol

Type:	Valid
Description:	The APIs of the Sd module shall encapsulate the use of any protocol on the wire.
Rationale	The Sd functionality may be achieved with any number of different wire protocols.
Use Case	--
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776)

5.11 Non-Functional Requirements

5.11.1 SWS TCP/IP Protocol Stack

5.11.1.1 [SRS_Eth_00077]The TCP/IP stack shall be implemented as independent sub-modules.

[

Type:	Valid
Description:	The TCP/IP stack shall be implemented as independent sub-modules.
Rationale:	The TCP/IP protocol suite is too large to be implemented in a monolithic block.
Use Case:	--
Dependencies:	--
Supporting Material:	--

](RS_BRF_01784)

[]

5.11.2 SWS Socket Adaptor (SoAd)

5.11.2.1   [SRS_Eth_00078]The SoAd module shall be the sole interface to the TCP/IP stack

[

Type:	Valid
Description:	SoAd module shall be the single interface to the TCP/IP stack for AUTOSAR modules.
Rationale:	Modular design Single implementations of PDU to socket transformation
Use Case:	PDU communication via Ethernet used by multiple AUTOSAR modules.
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776)

[]

5.11.3 SWS Ethernet Interface (EthIf)

5.11.3.1   [SRS_Eth_00029] Ethernet Interface shall be the single interface of all Ethernet modules to the Ethernet hardware drivers.

[

Type:	Valid
Description:	The Ethernet Interface shall be the single interface for all upper modules (i.e. TCP/IP module and Ethernet State Manager) to the lower layer Ethernet hardware drivers for each Ethernet controller (Ethernet Driver) and Ethernet transceiver (Ethernet Transceiver Driver).
Rationale:	Interface and interaction
Use Case:	Multiple software modules shall transmit and receive data through multiple Ethernet connections in a uniform way.
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776)

5.11.3.2   [SRS_Eth_00030] The Ethernet Interface shall be independent of the actual hardware.

[

Type:	Valid
Description:	The Ethernet Interface shall provide a hardware independent interface to its upper layer modules (i.e. TCP/IP module and Ethernet State Manager).
Rationale	Portability and reusability
Use Case	Exchanging the used Ethernet controller and transceiver shall be transparent and only be reflected by replacing the used driver.
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01776)

5.11.4 SWS Ethernet Driver (Eth)

5.11.4.1 [SRS_Eth_00034] An Ethernet Driver shall offer a hardware independent interface.

⌈

Type:	Valid
Description:	An Ethernet Driver shall offer a hardware independent interface for all Ethernet controllers of the same type
Rationale	Hardware abstraction
Use Case	Exchanging the used Ethernet controller shall be transparent and only be reflected by replacing the used driver.
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01776)

5.11.5 SWS Ethernet Transceiver Driver (EthTrcv)

5.11.5.1 [SRS_Eth_00038] An Ethernet Transceiver Driver shall offer a hardware independent interface.

⌈

Type:	Valid
Description:	An Ethernet Transceiver Driver shall offer a hardware independent interface for all Ethernet transceivers of the same type
Rationale	Hardware abstraction
Use Case	Exchanging the used Ethernet transceiver shall be transparent and only be reflected by replacing the used driver.
Dependencies:	--
Supporting Material:	--

⌋(RS_BRF_01776)

5.11.6 SWS Ethernet State Manager (EthSM)

5.11.6.1 [SRS_Eth_00041] An Ethernet State Manager shall offer network independent state handling

⌈

Type:	Valid
Description:	An Ethernet State Manager shall offer network independent state handling. - Uninitialized - No Communication - Full Communication
Rationale	Hardware abstraction
Use Case	Exchanging the used network shall be transparent and only be reflected by replacing the used State Manager.
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776,RS_BRF_01664)

5.11.7 SWS UDP Network Management (UdpNm)

5.11.7.1 [SRS_Eth_00042] A UDP Network Management shall offer network independent interface.

[

Type:	Valid
Description:	A UDP Network Management shall offer network independent interface
Rationale	Hardware abstraction
Use Case	Exchanging the used network shall be transparent and only be reflected by replacing the used Network Management.
Dependencies:	--
Supporting Material:	--

](RS_BRF_01776,RS_BRF_01680)

6 References

[1]   Requirements on AUTOSAR Features
       AUTOSAR_RS_Features.pdf
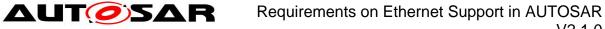
6.1 Deliverables of AUTOSAR

[2]   AUTOSAR Layered Architecture
       AUTOSAR_EXP_LayeredSoftwareArchitecture.pdf

[3]   AUTOSAR UDP Network Management
       AUTOSAR_SWS_UDPNetworkManagement.pdf

[4]   AUTOSAR Ethernet State Manager
       AUTOSAR_SWS_EthernetStateManager.pdf

[5]   AUTOSAR Socket Adaptor
       AUTOSAR_SWS_SocketAdaptor.pdf

[6]   AUTOSAR Ethernet Interface
       AUTOSAR_SWS_EthernetInterface.pdf

[7]   SoftwareComponentTemplate
       AUTOSAR_TPS_SoftwareComponentTemplate.pdf

6.2 Related standards and norms

[8]   IEC 7498-1, "The Basic Model", IEC Norm, 1994

[9]   IEEE Std. 1003.1™, 2004 Edition, "POSIX"
       http://www.opengroup.org/onlinepubs/000095399/

[10]   ISO 13400-2 Diagnostic communication over Internet Protocol (DoIP)

       June 2012

[11]   XCP, The Universal Measurement and Calibration Protocol Family, ASAM
       e.V., 2003

6.2.1 IETF Requests For Comments (RFCs)

[12]   IETF RFC 791   Internet Protocol - DARPA Internet Program – Protocol
       Specification (September 1981)

[13]   IETF RFC 793   Transmission Control Protocol - DARPA Internet Program
       - Protocol Specification (September 1981)

[14]   IETF RFC 768   User Datagram Protocol (August 1980)

[15]   IETF RFC 1122   Requirements for Internet Hosts - Communication Layers
       (October 1989)

[16]   RFC 896, "Congestion Control in IP/TCP Internetworks", (Nagle algorithm)

[17]   IETF RFC 2131   Dynamic Host Configuration Protocol (March 1997)

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[18]   IETF RFC 826   An Ethernet Address Resolution Protocol (November 1982)

[19]   IETF RFC 792   Internet Control Message Protocol DARPA Internet Program - Protocol Specification (September 1981)

[20]   IETF RFC 2132   DHCP Options and BOOTP Vendor Extensions (March 1997)

[21]   IETF RFC 3927   Dynamic Configuration of IPv4 Link-Local Addresses (May 2005)

[22]   IETF RFC 2460   Internet Protocol, Version 6 (IPv6) (December 1998)