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Date	Version	Changed by	Change Description
28.02.2014	3.0.2	AUTOSAR Release Management	• Replaced CRI with PNI (Partial Network information).
17.05.2012	3.0.1	AUTOSAR Administration	• Added support for NM Co-ordination on Nested Sub-buses
07.04.2011	2.1.0	AUTOSAR Administration	• Added Partial Networking requirements (BSW02513 to BSW02530) • Legal disclaimer revised
23.06.2008	2.0.3	AUTOSAR Administration	Legal disclaimer revised
12.11.2007	2.0.2	AUTOSAR Administration	• Document meta information extended • Small layout adaptations made
24.01.2007	2.0.1	AUTOSAR Administration	• “Advice for users” revised • “Revision Information” added
01.12.2006	2.0.0	AUTOSAR Administration	New requirements regarding: • Immediate Transmission Confirmation • Configurable Role In Cluster Shutdown (Passive Node) • ISO 14229 CommunicationControl (28 hex) service support Removed requirements regarding: • Bus independency • Number of FlexRay hardware send/receive buffers • Reading the local NM Identifier Legal disclaimer revised
30.06.2005	1.0.0	AUTOSAR Administration	Initial Release

Disclaimer

Advice for users

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1 Scope of this Document, Goals

The goal of this document is to define the functional and non-functional requirements on the AUTOSAR Network Management.

Requirements Guidelines

Existing specifications shall be referenced (in form of a single requirement).
Differences to these specifications are specified as additional requirements.

All Requirements shall have the following properties:

- Redundancy
  Requirements shall not be repeated within one requirement or in other requirements
- Clearness
  All requirements shall allow one possibility of interpretation only. Only technical terms of the glossary may be used.
- Atomicity
  Each Requirement shall only contain one requirement. A Requirement is atomic if it cannot be split up in further requirements.
- Testability
  Requirements shall be testable by analysis, review or test.
- Traceability
  The source and status of a requirement shall be visible at all times.

Constraints

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

2 Related Documentation

2.1 Deliverables of AUTOSAR

[1] Layered Software Architecture
AUTOSAR_LayeredSoftwareArchitecture.pdf

[2] General Requirements on Basic Software Modules
AUTOSAR_SRS_General.pdf

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

2.2 Related standards and norms

2.2.1 OSEK

[4] [STD_OSEK_NM]
OSEK/VDX NM Specification (ISO 17356-5), Version 2.5.3

2.2.2 HIS

[5] [HIS_NM_RQMT]
HIS NM Requirements

3 How To read this document

Each requirement has its unique identifier starting with the prefix “BSW” (for “Basic Software”). For any review annotations, remarks or questions, please refer to this unique ID rather than chapter or page numbers!

Each module specific chapter contains a short functional description of the Basic Software Module. Requirements of the same kind within each chapter are grouped under the following headlines (where applicable):

Functional Requirements:

- Configuration (which elements of the module need to be configurable)
- Initialization
- Normal Operation
- Shutdown Operation
- Fault Operation
- ...

Non-Functional Requirements:

- Timing Requirements
- Resource Usage
- Usability
- Output for other WPs (e.g. Description Templates, Tooling,...)
- ...

4 Requirement Specification

4.1 Network Management

4.1.1 Functional Overview

The functionality of the currently used NM based on OSEK NM 2.53 is no longer sufficient. This is partly due to the fact that the original concept based on single CAN.

Examples are:
- the time until a state change takes place depends on the number of ECUs on a bus
- the complexity of the algorithm is high (large number of different states etc.)
- error response is slow
- the specification is not precise/complete
- there is too much functionality besides the core functionality (sleep/wakeup) of a NM

The following SRS covers requirements on following functional entities:

- Network Management coordinating a particular NM-cluster.
- Network Management bus specifics for a particular bus.
- Gateway and Interoperability of Network Management between NM-clusters.

The communication system where NM is applicable has to support a “bus sleep” mode. That means that the transceiver of the communication system can switch to a low power mode and can be switched again to full power mode by (specific) bus traffic and/or application

4.1.2 Functional Requirements

4.1.2.1 [BSW02530] Partial Networking

Initiator:	All
Date:	15.03.2011
Short Description:	Partial Networking
Type:	New
Importance:	High
Description:	<Bus>Nm shall support Partial Networking on CAN, FlexRay and Ethernet.
Rationale:	It is necessary to implement complete partial network support on the bus protocol <Bus>, to reduce the power consumption of <Bus> communication domains.
Use Case:	The power consumption can be reduced by e.g • Shutting down of seat control functions • Shutting down of park assistant functions • Hazard flashers • Shutting down of Electric Park Brake (EPB)
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.2 Configuration

4.1.2.2.1 [BSW150] Configuration of functionality

Initiator:	BMW
Date:	11.02.2004
Short Description:	Configuration of functionality
Type:	New
Importance:	High
Description:	The following functions of the Network Management shall be statically configurable at pre-compile time: – Detection of present nodes (on/off) – BSW153 – Notification that all other ECUs are (no more) ready to sleep (i.e. Remote Sleep Indication (Cancellation)) (on/off) – BSW052, BSW02509 – NM Gateway support (on/off) – BSW136 – User data support (on/off) – BSW02503, BSW02504 – Bus load reduction (on/off) – BSW142 – Channel multiplicity (on/off) – BSW045 – Sending node identifier (on/off) – BSW02505 – Receiving node identifier (on/off) – BSW02506 – Immediate Transmission Confirmation (on/off) - BSW02510 – Configurable Role In Cluster Shutdown (on/off) - BSW02511 – Bus Keep Awake Services (on/off) – BSW047 – Partial Networking extensions (on/off) – BSW02530 – EIRA (External and Internal Requests Aggregated) reset timer timeout – BSW02520 and BSW02521
Rationale:	Scalability
Use Case:	Configuration of ECU SW
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.3 Initialization

4.1.2.3.1 [BSW151] Integration into running NM cluster

Initiator:	BMW
Date:	11.02.2004
Short Description:	Integration into running NM cluster
Type:	New
Importance:	High
Description:	The Network Management algorithm shall allow any node that can integrate into a running cluster to integrate into a running NM cluster.
Rationale:	Integration of a) late nodes b) nodes that have recovered from fault state c) nodes that have been connected to a running vehicle network (e.g. by service)
Use Case:	See rationale
Dependencies:	--
Conflicts:	--

Supporting Material:	--

4.1.2.3.2 [BSW043] Bus Traffic without NM Initialization

Initiator:	DC
Date:	09.01.2004
Short Description:	NM shall not prohibit bus traffic with NM not being initialized
Type:	Changed after review in VCC (06.05.2004)
Importance:	High
Description:	It shall be possible that software modules are enabled to access the communication system, independent of the presence of NM (NM initialized or not).
Rationale:	Initialization delays or errors of NM shall not prohibit the communication of application software.
Use Case:	ECU without NM or NM starts later (see rationale)
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.4 Normal Operation

4.1.2.4.1 [BSW044] Applicability to different types of communication systems

Initiator:	DC
Date:	09.01.2004
Short Description:	The NM shall be applicable to different types of communication systems which are in the scope of Autosar and support a bus sleep mode.
Type:	New
Importance:	High
Description:	Network management mechanisms for each supported protocol shall be realized using a limited number of predefined NM states and NM transitions. The events triggering the transitions between states and the actions taken on these transitions may be protocol specific. A bus sleep mode shall be supported for each protocol. NM shall be executable on asynchronous communication systems (e.g. CAN) as well as on synchronous communication systems (e.g. FlexRay), and also on any other types of communication systems which are in the scope of Autosar.
Rationale:	In today's cars, multiple different communication systems are implemented. For energy consumption, all ECUs have to be able to switch into a low power mode. Therefore, network management is necessary for all communication systems. To facilitate understanding, NM shall be constructed from a common set of state definitions.
Use Case:	ECU with CAN and FlexRay
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.4.2 [BSW045] NM-cluster Independent Shutdown Coordination

Initiator:	DC

Date:	09.01.2004
Short Description:	NM has to provide services to coordinate shutdown of NM-clusters independently of each other.
Type:	New
Importance:	High
Description:	NM has to provide services to coordinate shutdown of NM-clusters independently of each other. Implementation hint: Instantiate NM multiple times and provide a coordinating module (e.g. ECU state manager).
Rationale:	In today's cars, multiple different communication systems are implemented. Therefore, ECUs might be connected to multiple communication channels (e.g. 2 CAN clusters, 1 FlexRay cluster, etc.). Not in all cases all channels have to be in full power mode. Because of that, each channel has to be able to be started up or shut down separately.
Use Case:	Gateways with more than one bus
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.4.3 [BSW046] Trigger of startup of all Nodes at any Point in Time

Initiator:	DC
Date:	09.01.2004
Short Description:	NM has to provide services to trigger a NM-startup of all nodes connected to a NM-cluster at any point in time.
Type:	New
Importance:	High
Description:	At a specific point in time all nodes connected to NM-cluster have to be started-up (e.g. if the car is started). Because of that NM has to provide services to start up NM of all nodes connected to a NM-cluster at any point in time. The point in time can not be calculated offline, therefore this service has to be accessible at any time. Note regarding FlexRay networks: Under certain circumstances, a shutdown may be required before a startup can occur. In this situation substantial delays may occur.
Rationale:	All nodes means all nodes connected to clamp 30 (nodes permanently connected to power supply). ECUs connected to clamp 15 (nodes power supplied through some power relay) have to be treated separately, due to the fact that they cannot be started-up at any point in time. Note: "Passive Nodes" are not able to initiate a start-up of a NM-cluster, but they are able to be woken up if any other node initiates a start-up. Please refer BSW02511.
Use Case:	Driver enters the car and wants to start the engine.
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.4.4 [BSW047] Bus Keep Awake Services

Initiator:	DC
Date:	09.01.2004
Short Description:	NM shall provide a service to request to keep the bus awake and a service

	to cancel this request.
Type:	New
Importance:	High
Description:	The application implemented on one ECU must be enabled to signal at any point in time after the NM has been initialized, that it requests to keep the bus awake and at any other point in time want to cancel this request. These bus keep awake services shall not be available for nodes configured to not contribute to the cluster shutdown decision, refer BSW02511
Rationale:	Basic NM functionality
Use Case:	See Rationale
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.4.5 [BSW048] Bus Sleep Mode

Initiator:	DC
Date:	09.01.2004
Short Description:	Bus Sleep Mode
Type:	New
Importance:	High
Description:	If no Application/ECU connected to a NM-cluster requires bus communication, NM shall indicate to put the communication controller into sleep mode.
Rationale:	Basic functionality
Use Case:	See Rationale
Dependencies:	[BSW047]
Conflicts:	--
Supporting Material:	--

4.1.2.4.6 [BSW050] NM State Information

Initiator:	DC
Date:	12.01.2004
Short Description:	NM State Information
Type:	New
Importance:	High
Description:	The NM shall provide an interface to retrieve information about the current state of NM.
Rationale:	The application shall be able to get NM state information by accessing specific interfaces of NM. Basic functionality. The NM state reflects the state of the bus.
Use Case:	See Rationale
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.4.7 [BSW051] NM State Change Indication

Initiator:	DC
Date:	12.01.2004

Short Description:	NM shall inform application when NM state changes occur.
Type:	New
Importance:	High
Description:	NM shall provide an interface, which can be used by applications to get informed when specific NM state changes occur.
Rationale:	Applications shall be enabled to react on state changes.
Use Case:	Especially the transition to sleep state to switch off transceiver is interesting.
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.4.8 [BSW052] Notification that all other ECUs are ready to sleep.

Initiator:	DC
Date:	12.01.2004
Short Description:	The NM interface shall signal to the application that all other ECUs are ready to sleep.
Type:	New
Importance:	Medium
Description:	NM shall provide an interface, which signals to an application that all other applications/ECUs are ready for sleep.
Rationale:	Prohibition of unintentional keep awake.
Use Case:	Internal check in the application if ECU unintentionally keeps the bus awake. External network management gateway coordination.
Dependencies:	[BSW02509]
Conflicts:	--
Supporting Material:	--

4.1.2.4.9 [BSW02509] Notification that at least one other node is not ready to sleep anymore

Initiator:	WP4.2.2.1.2
Date:	15.11.2004
Short Description:	The NM interface shall signal to the application that at least one other ECUs is not ready to sleep anymore.
Type:	New
Importance:	Medium
Description:	NM shall provide an interface, which signals to an application that at least one other applications/ECUs is not ready for sleep anymore.
Rationale:	Notification that a bus is kept awake if necessary.
Use Case:	Identification of the last node that keeps the bus awake. External network management gateway coordination.
Dependencies:	[BSW052]
Conflicts:	--
Supporting Material:	--

4.1.2.4.10 [BSW02503] Sending user data

Initiator:	WP4.2.2.1.2
Date:	15.11.2004

Short Description:	Sending user data
Type:	New
Importance:	High
Description:	The NM API shall optionally give the possibility to set the user data that may be attached to every NM message sent on the bus. NM shall guarantee data consistency for the write operation.
Rationale:	Exchange of system relevant information within the network.
Use Case:	Distribution of wakeup-reason in the network.
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.4.11 [BSW02504] Receiving user data

Initiator:	WP4.2.2.1.2
Date:	15.11.2004
Short Description:	Receiving user data
Type:	New
Importance:	High
Description:	The NM API shall optionally give the possibility to get the user data that may be attached to every NM message received from the bus. NM shall guarantee data consistency for the read operation.
Rationale:	Exchange of system relevant information within the network.
Use Case:	Distribution of wakeup-reason in the network.
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.4.12 [BSW153] Detection of present nodes

Initiator:	BMW
Date:	11.02.2004
Short Description:	Detection of present nodes
Type:	New
Importance:	Medium
Description:	The Network Management shall optionally provide a possibility to detect nodes that are currently present on the bus. It shall be possible that nodes, on request, send their NM-related data. This feature is statically configurable (available or not) (see BSW150). Comment: This function is only needed in master ECUs (e.g. head unit, central body controller, ...)
Rationale:	For diagnostics purposes and configuration checks.
Use Case:	The Vehicle State Management can use this information to check the completeness of the network.
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.4.13 [BSW02508] Unambiguous node identification per bus

Initiator:	WP4.2.2.1.2
Date:	15.11.2004
Short Description:	Unique node identification per NM-cluster.
Type:	New
Importance:	High
Description:	Every node shall have associated with it a node identifier that is unique in the NM-cluster.
Rationale:	Avoidance of node misidentification.
Use Case:	Identification of the last node that keeps the bus awake. Detection of present nodes.
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.4.14 [BSW02505] Sending node identifier

Initiator:	WP4.2.2.1.2
Date:	15.11.2004
Short Description:	Sending node identifier
Type:	New
Importance:	High
Description:	The NM shall optionally set the local node identifier to the NM-message..
Rationale:	Exchange of system relevant information within the network.
Use Case:	Identification of the last node that keeps the bus awake. Detection of present nodes.
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.4.15 [BSW02506] Receiving node identifier

Initiator:	WP4.2.2.1.2
Date:	15.11.2004
Short Description:	Receiving node identifier
Type:	New
Importance:	High
Description:	The NM API shall give the possibility to read the source node identifier of the sender from the most recently received NM message. NM shall guarantee data consistency for the read operation. Note: This NM API is optional, since it is optional to send the source node identifier.
Rationale:	Exchange of system relevant information within the network.
Use Case:	Identification of the last node that keeps the bus awake. Detection of present nodes.
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.4.16 [BSW02511] Configurable Role in Cluster Shutdown

Initiator:	GM
Date:	03.05.2006
Short Description:	Configurable Role In Cluster Shutdown
Type:	New
Importance:	Medium
Description:	It shall be possible to configure the Network Management of a node so that it cannot contribute to the cluster shutdown decision. Specifically, it shall be possible to configure some nodes of a cluster so that they are not able to broadcast the information used by other nodes to trigger shutdown, i.e., they have no NM-related communication defined for the node. Such nodes shall not be capable of keeping the bus awake, but they are required to shut down in a manner consistent with the others.
Rationale:	Eliminating unnecessary communication reduces bus and buffer overhead. Allowing shutdown to be controlled by a subset of the cluster's nodes enables the possibility that only fault tolerant nodes control shutdown. However, these nodes shall be otherwise capable of normal communication.
Use Case:	In a dual channel FlexRay cluster with some single channel nodes, the cluster can be configured so that only dual channel nodes influence the shutdown. This ensures that all shutdown votes are replicated on across channels even though some nodes are only connected to one channel, thus making the decision process robust against the loss of a channel.
Dependencies:	In order to avoid inconsistencies between and NM and the COM Manager, the COM Manager is not allowed to request keeping the bus awake.
Conflicts:	--
Supporting Material:	--

4.1.2.5 Fault Operation

4.1.2.5.1 [BSW053] Deterministic Behavior in Case of Bus Unavailability

Initiator:	DC
Date:	09.01.2004
Short Description:	Deterministic Behavior in Case of Bus Unavailability
Type:	New
Importance:	High
Description:	NM on a node which is or become bus unavailable shall react such that: • If a bus becomes unavailable and the node is not ready to sleep, the NM shall not enter bus sleep mode by itself. • If a bus becomes unavailable and the node is ready to sleep, the NM shall enter bus sleep mode by itself. • If a bus is unavailable and the node changes its state to ready to sleep, the NM shall enter bus sleep mode by itself. • If a bus is unavailable and the node changes its state to not ready to sleep, the NM shall not enter bus sleep mode by itself.
Rationale:	Faults (transient and/or permanent) shall not cause non deterministic behavior.
Use Case:	Bus unavailability (Bus Off), Loss of NM messages
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.5.2 [BSW137] Communication system error handling

Initiator:	DC
Date:	20.01.2004
Short Description:	NM shall perform communication system error handling for errors that have impact on the NM behavior.
Type:	New
Importance:	High
Description:	If bus errors of a specific bus on which NM is running have impact on the NM behavior, the error handling must be performed by NM. Focus: bus errors, not protocol errors. Example: loss of NM message is handled.
Rationale:	Error handling
Use Case:	Communication loss
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.6 Gateway Operation

4.1.2.6.1 [BSW136] Coordination of coupled networks

Initiator:	DC
Date:	20.01.2004
Short Description:	NM shall provide functionality, which enables additional software to co-ordinate sleep mode for heterogeneous networks.
Type:	New
Importance:	High
Description:	NM shall provide an interface, which enables a different software module to co-ordinate the different NM modes (especially sleep and wake-up/keep awake). This shall enable the synchronous sleep and/or wake-up of different clusters.
Rationale:	Different networks shall be able to shut down (wake-up) synchronously.
Use Case:	NM Gateway
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.6.2 [BSW140] Compliance with OSEK NM on a gateway

Initiator:	DC
Date:	20.01.2004
Short Description:	The AUTOSAR NM shall be able to run in parallel on a different cluster as the OSEK NM, but shall be able to sleep/wake-up synchronously.
Type:	New
Importance:	High
Description:	A gateway must be able to co-ordinate if OSEK NM runs on one network and AUTOSAR NM on another network, which have to get to sleep/wake-up synchronously.
Rationale:	Enable migration

Use Case:	Reused clusters (taken over).
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.2.6.3 [BSW02531] NM coordination on Nested Sub-Buses

Initiator:	DC
Date:	14.12.2011
Short Description:	Supported of NM coordination on nested sub-busses with synchronous shutdown
Type:	New
Importance:	High
Description:	Extent the existing algorithm in a way that it allows to synchronize the shutdown of all connected Gateways.
Rationale:	The network management stack allows to have a coordinated shutdown of more than one bus if an ECU exists which is connected to the busses which are to be coordinated. The functionality is included in the NmIf module. However, there are currently two limitations 1. Currently a coordinator with lower priority does not know if the coordinator with higher priority has started shutdown or if he failed. If the coordinator with lower priority now claims it is the backup coordinator it will take over the lead. This will prevent shutdown as both coordinators toggle to take over the lead. 2. Currently a coordinator with lower priority can shut down its actively handled networks only when detecting that his passively handled network performed a transition to Wait Bus Sleep. This means the passively handled network is already in Wait Bus Sleep while the actively handled networks then just have entered Ready Sleep. This concept intents to fix both shortcomings.
Use Case:	Nested Gateways
Dependencies:	--
Conflicts:	--
Supporting Material:	

4.1.2.7 Partial Networking

4.1.2.7.1 [BSW02513] Distinguish between NM Message

Initiator:	All
Date:	15.03.2011
Short Description:	<Bus>Nm shall be able to distinguish between an NM message without PN request information (PNI = Partial Network Information) and an NM message with PN PNI contained in the NM user data.
Type:	New
Importance:	High
Description:	If Partial Networking is supported, NM shall distinguish between NM message without PN request information and NM message with PN PNI.
Rationale:	This is required to assure the compatibility between carry over parts from current vehicle platforms and new ECUs with Partial Networking. Current ECUs may not send NM messages with PN request information
Use Case:	--
Dependencies:	BSW02530
Conflicts:	--

Supporting Material:	--

4.1.2.7.2 [BSW02514] Partial Network Information Bit

Initiator:	All
Date:	15.03.2011
Short Description:	The NM Control Bit Vector shall contain a PNI (Partial Network Information) bit.
Type:	New
Importance:	High
Description:	The NM Control Bit Vector shall contain a PNI (Partial Network Information) bit with the following meaning: 0: NM message does not contain PN request information 1: NM message contains PN request information (PNI)
Rationale:	--
Use Case:	--
Dependencies:	BSW02530
Conflicts:	--
Supporting Material:	--

4.1.2.7.3 [BSW02515] Evaluate PNI bit

Initiator:	All
Date:	15.03.2011
Short Description:	<Bus>Nm shall evaluate the PNI bit in the NM message
Type:	New
Importance:	High
Description:	NM shall evaluate the PNI bit in the NM message; If PNI bit is Set, the partial networking information shall be evaluated from the message.
Rationale:	--
Use Case:	--
Dependencies:	BSW02530
Conflicts:	--
Supporting Material:	--

4.1.2.7.4 [BSW02516] Request for Partial Networking functionality

Initiator:	All
Date:	15.03.2011
Short Description:	<Bus>Nm shall set the PNI bit for requesting Partial Network functionality
Type:	New
Importance:	High
Description:	While sending NM message, NM will set the PNI bit to request partial networking functionality.
Rationale:	--
Use Case:	--
Dependencies:	BSW02530
Conflicts:	--
Supporting Material:	--

4.1.2.7.5 [BSW02517] Calculate the combined partial network request status EIRA

Initiator:	All
Date:	15.03.2011
Short Description:	<Bus>Nm shall calculate the combined partial network request status EIRA
Type:	New
Importance:	High
Description:	NM shall calculate the combined partial network request status EIRA (External and Internal Requests Aggregated) for each partial network relevant to the ECU. The calculation shall use a configurable time constant for resetting EIRA requests.
Rationale:	--
Use Case:	--
Dependencies:	BSW02530
Conflicts:	--
Supporting Material:	--

4.1.2.7.6 [BSW02518] Calculate the status of the external partial network requests ERA

Initiator:	All
Date:	15.03.2011
Short Description:	<Bus>Nm shall calculate the status of the external partial network requests ERA
Type:	New
Importance:	High
Description:	<Bus>Nm shall calculate the status of the external partial network requests ERA (External Requests Aggregated) for each partial network relevant to the ECU. The calculation shall use a configurable time constant for resetting ERA requests.
Rationale:	--
Use Case:	--
Dependencies:	BSW02530
Conflicts:	--
Supporting Material:	--

4.1.2.7.7 [BSW02519] Communicate EIRA and ERA requests to the upper layers

Initiator:	All
Date:	15.03.2011
Short Description:	<Bus>Nm shall communicate EIRA and ERA requests to the upper layers using virtual PDUs
Type:	New
Importance:	High
Description:	NM shall communicate EIRA and ERA requests to the upper layers using virtual PDUs (not contained in the System Description but generated during Ecu configuration)
Rationale:	--
Use Case:	--
Dependencies:	BSW02530
Conflicts:	--
Supporting Material:	--

4.1.2.7.8 [BSW02520] Configuration for ERA

Initiator:	All
Date:	15.03.2011
Short Description:	<Bus>Nm shall support channel-specific configuration for ERA
Type:	New
Importance:	High
Description:	<Bus>Nm shall support channel-specific configuration for ERA
Rationale:	--
Use Case:	--
Dependencies:	BSW02530
Conflicts:	--
Supporting Material:	--

4.1.2.7.9 [BSW02521] Configuration for EIRA

Initiator:	All
Date:	15.03.2011
Short Description:	<Bus>Nm shall support a global configuration for EIRA over all channels
Type:	New
Importance:	High
Description:	<Bus>Nm shall support a global configuration for EIRA over all channels
Rationale:	--
Use Case:	--
Dependencies:	BSW02530
Conflicts:	--
Supporting Material:	--

4.1.3 Non-Functional Requirements (Qualities)

4.1.3.1 Timing Requirements

4.1.3.1.1 [BSW054] Deterministic Time for Bus Sleep

Initiator:	DC
Date:	09.01.2004
Short Description:	There shall be a deterministic time from the point where all nodes agree to go to bus sleep to the point where bus is switched off.
Type:	New
Importance:	High
Description:	The time required from the point in time when the NM of each ECU agree on shutting down a communication system and the point in time when the communication system is really shutting down, has to be deterministic (guarantee of min time and max time). This time must be statically configurable cluster.
Rationale:	Determinism of network behavior, guarantee of synchronized sleep-mode
Use Case:	See Rationale
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.3.2 Resource Usage

4.1.3.2.1 [BSW142] Limitation of NM bus load

Initiator:	DC
Date:	05.02.2004
Short Description:	NM shall guarantee an upper limit for the bus load generated by NM itself.
Type:	New
Importance:	High
Description:	NM shall not exceed a specified upper limit of bus load. This bus load has to be specified. Example: 3% in normal operation, 6% Bus load peak.
Rationale:	Determinism
Use Case:	Avoid solution like in OSEK NM 2.5.3: alive messages after bus wakeup
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.3.2.2 [BSW143] Predictable NM bus load

Initiator:	DC
Date:	05.02.2004
Short Description:	The bus load caused by NM shall be predictable.
Type:	New
Importance:	High
Description:	The bus load caused by NM shall be predictable. The bus load for normal operation (no error occurred) has to be specified or calculable (dependent on the timing).
Rationale:	Predictability
Use Case:	Prediction of bus load for NM on the specific bus
Dependencies:	[BSW149]
Conflicts:	--
Supporting Material:	--

4.1.3.2.3 [BSW144] ECU cluster size

Initiator:	DC
Date:	05.02.2004
Short Description:	ECU cluster size
Type:	New
Importance:	High
Description:	Communication clusters of up to 64 ECUs / controllers shall be supported by NM.
Rationale:	Flexibility
Use Case:	See Rationale
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.3.2.4 [BSW145] Robustness against NM message losses

Initiator:	DC
Date:	05.02.2004
Short Description:	Robustness against NM message losses.
Type:	New
Importance:	High
Description:	On a properly configured node, NM shall tolerate a loss of a predefined number of NM messages. The limitations of the number of message losses have to be described in the specification.
Rationale:	Robustness: There shall be no need for NM to receive every NM message. A loss of one message (in case of bursts) shall have no impact on the NM behaviour.
Use Case:	Loss of NM-message(s) must be tolerated
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.3.2.5 [BSW146] Robustness against NM message jitter

Initiator:	DC
Date:	05.02.2004
Short Description:	Robustness against NM message jitter.
Type:	New
Importance:	High
Description:	The NM shall tolerate a time jitter of NM messages in one or more ECUs. The limitations of the jitter have to be described in the specification.
Rationale:	Robustness
Use Case:	Jitter of NM-message(s) must be tolerated
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.3.2.6 [BSW147] Processor independent algorithm

Initiator:	DC
Date:	05.02.2004
Short Description:	The NM algorithm shall be processor independent.
Type:	New
Importance:	High
Description:	The algorithm of NM shall not rely on processor specific mechanisms. It shall be realizable on every processor architecture.
Rationale:	Re-use
Use Case:	Usage of NM on different processor architectures
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.3.2.7 [BSW149] Configurable Timing

Initiator:	DC
Date:	05.02.2004
Short Description:	The timing of NM shall be configurable.
Type:	New
Importance:	High
Description:	All timing parameters of the NM (e.g., the cycle timing of message sent on the communication media) shall be configurable. NM Implementation shall support at least one of the following strategies: - pre-compile or - post-compile or - post build. SWS shall define which of parameters are cluster specific and which are node specific.
Rationale:	Flexibility
Use Case:	1. Time until network is shut down after all nodes have indicated that they are ready to sleep. 2. Time interval between two consecutive status indications of a node, whether it is ready to sleep or not. 3. Determination of timing depending on the configurable number of nodes.
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.3.3 Hardware independency

4.1.3.3.1 [BSW154] Bus independency of API

Initiator:	BMW
Date:	11.02.2004
Short Description:	Bus independency of API.
Type:	New
Importance:	High
Description:	The Network Management API shall be independent from the communication bus i.e. equal for CAN and FlexRay.
Rationale:	Common, standardized interface to application and ECU state manager.
Use Case:	Usage of NM on different types of bus; only one interface independent of the underlying bus architecture.
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.4 CAN Specific Requirements

4.1.4.1 Resource Usage

4.1.4.1.1 [BSW148] Separation of Communication system dependent parts

Initiator:	DC
Date:	05.02.2004
Short Description:	Separation of Communication system dependent parts.
Type:	New
Importance:	High

Description:	The specification and implementation shall be split-up into a communication system independent and communication system dependent parts (the communication system dependent parts shall be based on the communication system abstraction).
Rationale:	Re-use
Use Case:	CAN NM Software Architecture (AUTOSAR SC decision from Apr 25th, 2006).
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.4.2 Gateway Operation

4.1.4.2.1 [BSW139] Compliance with OSEK NM on one cluster

Initiator:	DC
Date:	20.01.2004
Short Description:	The AUTOSAR NM shall be able to run in parallel on the same cluster as the OSEK NM.
Type:	New
Importance:	High
Description:	It must be possible to co-ordinate OSEK NM and AUTOSAR NM which run on the same ECU and the same bus. A solution where this works for exactly one ECU on the bus in question is acceptable.
Rationale:	Enable migration
Use Case:	Clusters with reused ECUs (taken over). Example: a cluster of 5 ECUs, two ECUs are using OSEK NM 2.5.3, two ECUs are using AUTOSAR NM and one ECU has to support both for coordination reasons.
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.4.3 Transmission Confirmation

4.1.4.3.1 [BSW02510] Immediate Transmission Confirmation

Initiator:	FMC (WP4.2.2.1.2)
Date:	16.03.2006
Short Description:	Immediate Transmission Confirmation
Type:	New
Importance:	High
Description:	For CAN NM it shall be optionally possible that the NM message transmission confirmation is generated at the transmission request to the CAN Interface layer.
Rationale:	If the bus access is completely regulated through an offline system design tool, the actual transmit confirmation to inform the Nm about a successful transmission can be regarded as redundant. Since the maximum arbitration time is known it is acceptable to immediately raise the confirmation at the transmission request time. Moreover, implementation of superfluous actual transmission confirmation in such a system only for one NM message would mean a significant performance loss regarding the execution time of the overall CAN Interface/Driver layer making the calculated time schedule inefficient.
Use Case:	Usage of CAN NM in a deterministic bus system.
Dependencies:	--
Conflicts:	--
Supporting Material:	--

4.1.4.4 Diagnostic Service

4.1.4.4.1 [BSW02512] CommunicationControl (28 hex) service support

Initiator:	WP4.2.2.1.2
Date:	04.09.2006
Short Description:	CommunicationControl (28 hex) service support
Type:	New
Importance:	High
Description:	The NM shall give the possibility to enable or disable the network management related communication configured for an active NM node. By default network management related communication shall be enabled.
Rationale:	Conformance to ISO 14229 CommunicationControl (28 hex) service
Use Case:	Diagnostics
Dependencies:	BSW02511
Conflicts:	--
Supporting Material:	--

4.1.4.5 Partial Networking

4.1.4.5.1 [BSW02522] Filter Algorithm

Initiator:	All
Date:	15.03.2011
Short Description:	CanNm shall implement a filter algorithm dropping all NM messages that are not relevant for the ECU
Type:	New
Importance:	High
Description:	CanNm shall implement a filter algorithm dropping all NM messages that are not relevant for the ECU. The algorithm uses the Partial Network request information included with CAN NM.

Rationale:	--
Use Case:	--
Dependencies:	BSW02530
Conflicts:	--
Supporting Material:	--

4.1.4.5.2 [BSW02523] Service for spontaneous sending of NM messages

Initiator:	All
Date:	15.03.2011
Short Description:	CanNm shall provide a service which allows for spontaneous sending of NM messages.
Type:	New
Importance:	High
Description:	CanNm shall provide a service which allows for spontaneous sending of NM messages.
Rationale:	A PN request originating from the ECU needs to be sent out as fast as possible to avoid long latency
Use Case:	--
Dependencies:	BSW02530
Conflicts:	--
Supporting Material:	--

4.1.4.5.3 [BSW02524] ECU sends Wakeup Frame as first message

Initiator:	All
Date:	15.03.2011
Short Description:	If partial networking is used, the ECU shall secure that the first message on the bus is the wakeup frame.
Type:	New
Importance:	High
Description:	If partial networking is used, the ECU shall secure that the first message on the bus is the wakeup frame. This requirement will be implemented in CanIf.
Rationale:	If all ECUs on the bus use partial networking, they use the CAN transceiver with the partial networking extensions. These transceivers only wake up after receiving the Wakeup Frame.
Use Case:	--
Dependencies:	BSW02530
Conflicts:	--
Supporting Material:	--

4.1.4.5.4 [BSW02525] Optional channel-specific TX filter

Initiator:	All
Date:	15.03.2011
Short Description:	CanIf shall provide an optional channel-specific TX filter
Type:	New
Importance:	High
Description:	CanIf shall provide an optional channel-specific TX filter. In blocking mode, the filter shall only pass transmission of wakeup frames. In pass mode the filter shall pass every PDU transmitted by an upper layer.
Rationale:	--

Use Case:	--
Dependencies:	BSW02530
Conflicts:	--
Supporting Material:	--

4.1.4.5.5 [BSW02526] CanIf initiates clear and check wake-up flags in the transceiver

Initiator:	All
Date:	15.03.2011
Short Description:	CanIf shall provide the possibility to initiate clear and check wake-up flags in the transceiver
Type:	New
Importance:	High
Description:	CanIf shall provide the possibility to initiate clear and check wake-up flags in the transceiver
Rationale:	--
Use Case:	--
Dependencies:	BSW02530
Conflicts:	--
Supporting Material:	--

4.1.4.5.6 [BSW02527] Enable Pass Mode on the CanIf TX filter

Initiator:	All
Date:	15.03.2011
Short Description:	When full communication is requested, CanSm shall enable pass mode on the CanIf TX filter
Type:	New
Importance:	High
Description:	When full communication is requested, CanSm shall enable pass mode on the CanIf TX filter
Rationale:	--
Use Case:	--
Dependencies:	BSW02530
Conflicts:	--
Supporting Material:	--

4.1.4.5.7 [BSW02528] CanSm initiates clear and check wake-up flags in the transceiver

Initiator:	All
Date:	15.03.2011
Short Description:	CanSm shall provide the possibility to initiate clear and check wake-up flags in the transceiver
Type:	New
Importance:	High
Description:	CanSm shall provide the possibility to initiate clear and check wake-up flags in the transceiver
Rationale:	--
Use Case:	--
Dependencies:	BSW02530

Conflicts:	--
Supporting Material:	--

4.1.4.5.8 [BSW02529] PN Shutdown Sequence

Initiator:	All
Date:	15.03.2011
Short Description:	CanSm shall support a new PN shutdown sequence
Type:	New
Importance:	High
Description:	CanSm shall support a new PN shutdown sequence (CAN CC STOP -> CAN TRCV STANBY -> CAN CC SLEEP)
Rationale:	--
Use Case:	--
Dependencies:	BSW02530
Conflicts:	--
Supporting Material:	--

4.1.5 FlexRay Specific Requirements

None.

5 Links to related documentation

Layered Software Architecture
AUTOSAR_LayeredSoftwareArchitecture.pdf

Requirements on Basic Software Modules
AUTOSAR_SRS_General.pdf

Specification of the Virtual Functional Bus
AUTOSAR_VirualFunctionBus.pdf

[STD_OSEK_NM] OSEK/VDX NM Specification (ISO 17356-5), V2.5.3
http://www.osek-vdx.org/

[HIS_NM_RQMT] HIS NM Requirements
http://www.automotive-his.de/