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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  
[https://svn2.autosar.org/repos2/22\\_Releases](https://svn2.autosar.org/repos2/22_Releases)  
AUTOSAR\_LayeredSoftwareArchitecture.pdf
- [2] General Requirements on Basic Software Modules  
[https://svn2.autosar.org/repos2/22\\_Releases](https://svn2.autosar.org/repos2/22_Releases)  
AUTOSAR\_SRS\_General.pdf
- [3] Specification of the Virtual Functional Bus  
[https://svn2.autosar.org/repos2/22\\_Releases](https://svn2.autosar.org/repos2/22_Releases)  
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 Configuration

##### 4.1.2.1.1 [BSW150] Configuration of functionality

<b>Initiator:</b>	BMW
<b>Date:</b>	11.02.2004
<b>Short Description:</b>	Configuration of functionality
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	<p>The following functions of the Network Management shall be statically configurable at pre-compile time:</p> <ul style="list-style-type: none"> <li>- Detection of present nodes (on/off) – <a href="#">BSW153</a></li> <li>- Notification that all other ECUs are (no more) ready to sleep (i.e. Remote Sleep Indication (Cancellation)) (on/off) – <a href="#">BSW052</a>, <a href="#">BSW02509</a></li> <li>- NM Gateway support (on/off) – <a href="#">BSW136</a></li> <li>- User data support (on/off) – <a href="#">BSW02503</a>, <a href="#">BSW02504</a></li> <li>- Bus load reduction (on/off) – <a href="#">BSW142</a></li> <li>- Channel multiplicity (on/off) – <a href="#">BSW045</a></li> <li>- Sending node identifier (on/off) – <a href="#">BSW02505</a></li> <li>- Receiving node identifier (on/off) – <a href="#">BSW02506</a></li> <li>- Immediate Transmission Confirmation (on/off) - <a href="#">BSW02510</a></li> </ul>

	<ul style="list-style-type: none"> <li>– Configurable Role In Cluster Shutdown (on/off) - <a href="#">BSW02511</a></li> <li>– Bus Keep Awake Services (on/off) – <a href="#">BSW047</a></li> </ul>
<b>Rationale:</b>	Scalability
<b>Use Case:</b>	Configuration of ECU SW
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

## 4.1.2.2 Initialization

### 4.1.2.2.1 [BSW151] Integration into running NM cluster

<b>Initiator:</b>	BMW
<b>Date:</b>	11.02.2004
<b>Short Description:</b>	Integration into running NM cluster
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	The Network Management algorithm shall allow any node that can integrate into a running cluster to integrate into a running NM cluster.
<b>Rationale:</b>	Integration of <ul style="list-style-type: none"> <li>a) late nodes</li> <li>b) nodes that have recovered from fault state</li> <li>c) nodes that have been connected to a running vehicle network (e.g. by service)</li> </ul>
<b>Use Case:</b>	See rationale
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

### 4.1.2.2.2 [BSW043] Bus Traffic without NM Initialization

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

### 4.1.2.3 Normal Operation

#### 4.1.2.3.1 [BSW044] Applicability to different types of communication systems

<b>Initiator:</b>	DC
<b>Date:</b>	09.01.2004
<b>Short Description:</b>	The NM shall be applicable to different types of communication systems which are in the scope of Autosar and support a bus sleep mode.
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	<p>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.</p> <p>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.</p>
<b>Rationale:</b>	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.
<b>Use Case:</b>	ECU with CAN and FlexRay
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.2.3.2 [BSW045] NM-cluster Independent Shutdown Coordination

<b>Initiator:</b>	DC
<b>Date:</b>	09.01.2004
<b>Short Description:</b>	NM has to provide services to coordinate shutdown of NM-clusters independently of each other.
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	<p>NM has to provide services to coordinate shutdown of NM-clusters independently of each other.</p> <p>Implementation hint: Instantiate NM multiple times and provide a coordinating module (e.g. ECU state manager).</p>
<b>Rationale:</b>	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.
<b>Use Case:</b>	Gateways with more than one bus
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

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

<b>Initiator:</b>	DC
<b>Date:</b>	09.01.2004
<b>Short Description:</b>	NM has to provide services to trigger a NM-startup of all nodes connected to a NM-cluster at any point in time.
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	<p>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.</p> <p>Note regarding FlexRay networks: Under certain circumstances, a shutdown may be required before a startup can occur. In this situation substantial delays may occur.</p>
<b>Rationale:</b>	<p>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.</p> <p>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 <a href="#">BSW02511</a>.</p>
<b>Use Case:</b>	Driver enters the car and wants to start the engine.
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.2.3.4 [BSW047] Bus Keep Awake Services

<b>Initiator:</b>	DC
<b>Date:</b>	09.01.2004
<b>Short Description:</b>	NM shall provide a service to request to keep the bus awake and a service to cancel this request.
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	<p>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.</p> <p>These bus keep awake services shall not be available for nodes configured to not contribute to the cluster shutdown decision, refer <a href="#">BSW02511</a></p>
<b>Rationale:</b>	Basic NM functionality
<b>Use Case:</b>	See Rationale
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.2.3.5 [BSW048] Bus Sleep Mode

<b>Initiator:</b>	DC
<b>Date:</b>	09.01.2004
<b>Short Description:</b>	Bus Sleep Mode
<b>Type:</b>	New

<b>Importance:</b>	High
<b>Description:</b>	If no Application/ECU connected to a NM-cluster requires bus communication, NM shall indicate to put the communication controller into sleep mode.
<b>Rationale:</b>	Basic functionality
<b>Use Case:</b>	See Rationale
<b>Dependencies:</b>	<a href="#">[BSW047]</a>
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.2.3.6 [BSW050] NM State Information

<b>Initiator:</b>	DC
<b>Date:</b>	12.01.2004
<b>Short Description:</b>	NM State Information
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	The NM shall provide an interface to retrieve information about the current state of NM.
<b>Rationale:</b>	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.
<b>Use Case:</b>	See Rationale
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.2.3.7 [BSW051] NM State Change Indication

<b>Initiator:</b>	DC
<b>Date:</b>	12.01.2004
<b>Short Description:</b>	NM shall inform application when NM state changes occur.
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	NM shall provide an interface, which can be used by applications to get informed when specific NM state changes occur.
<b>Rationale:</b>	Applications shall be enabled to react on state changes.
<b>Use Case:</b>	Especially the transition to sleep state to switch off transceiver is interesting.
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

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

<b>Initiator:</b>	DC
<b>Date:</b>	12.01.2004
<b>Short Description:</b>	The NM interface shall signal to the application that all other ECUs are ready to sleep.
<b>Type:</b>	New
<b>Importance:</b>	Medium
<b>Description:</b>	NM shall provide an interface, which signals to an application that all other

	applications/ECUs are ready for sleep.
<b>Rationale:</b>	Prohibition of unintentional keep awake.
<b>Use Case:</b>	Internal check in the application if ECU unintentionally keeps the bus awake. External network management gateway coordination.
<b>Dependencies:</b>	<a href="#">[BSW02509]</a>
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

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

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

#### 4.1.2.3.10 [BSW02503] Sending user data

<b>Initiator:</b>	WP4.2.2.1.2
<b>Date:</b>	15.11.2004
<b>Short Description:</b>	Sending user data
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	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.
<b>Rationale:</b>	Exchange of system relevant information within the network.
<b>Use Case:</b>	Distribution of wakeup-reason in the network.
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.2.3.11 [BSW02504] Receiving user data

<b>Initiator:</b>	WP4.2.2.1.2
<b>Date:</b>	15.11.2004
<b>Short Description:</b>	Receiving user data
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	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.
<b>Rationale:</b>	Exchange of system relevant information within the network.
<b>Use Case:</b>	Distribution of wakeup-reason in the network.
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.2.3.12 [BSW153] Detection of present nodes

<b>Initiator:</b>	BMW
<b>Date:</b>	11.02.2004
<b>Short Description:</b>	Detection of present nodes
<b>Type:</b>	New
<b>Importance:</b>	Medium
<b>Description:</b>	<p>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.</p> <p>This feature is statically configurable (available or not) (see <a href="#">BSW150</a>).</p> <p>Comment: This function is only needed in master ECUs (e.g. head unit, central body controller, ...)</p>
<b>Rationale:</b>	For diagnostics purposes and configuration checks.
<b>Use Case:</b>	The Vehicle State Management can use this information to check the completeness of the network.
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.2.3.13 [BSW02508] Unambiguous node identification per bus

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

#### 4.1.2.3.14 [BSW02505] Sending node identifier

<b>Initiator:</b>	WP4.2.2.1.2
<b>Date:</b>	15.11.2004
<b>Short Description:</b>	Sending node identifier

<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	The NM shall optionally set the local node identifier to the NM-message..
<b>Rationale:</b>	Exchange of system relevant information within the network.
<b>Use Case:</b>	Identification of the last node that keeps the bus awake. Detection of present nodes.
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.2.3.15 [BSW02506] Receiving node identifier

<b>Initiator:</b>	WP4.2.2.1.2
<b>Date:</b>	15.11.2004
<b>Short Description:</b>	Receiving node identifier
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	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.
<b>Rationale:</b>	Exchange of system relevant information within the network.
<b>Use Case:</b>	Identification of the last node that keeps the bus awake. Detection of present nodes.
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.2.3.16 [BSW02511] Configurable Role in Cluster Shutdown

<b>Initiator:</b>	GM
<b>Date:</b>	03.05.2006
<b>Short Description:</b>	Configurable Role In Cluster Shutdown
<b>Type:</b>	New
<b>Importance:</b>	Medium
<b>Description:</b>	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.
<b>Rationale:</b>	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.
<b>Use Case:</b>	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.



<b>Dependencies:</b>	In order to avoid inconsistencies between and NM and the COM Manager, the COM Manager is not allowed to request keeping the bus awake.
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.2.4 Fault Operation

##### 4.1.2.4.1 [BSW053] Deterministic Behavior in Case of Bus Unavailability

<b>Initiator:</b>	DC
<b>Date:</b>	09.01.2004
<b>Short Description:</b>	Deterministic Behavior in Case of Bus Unavailability
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	<p>NM on a node which is or become bus unavailable shall react such that:</p> <ul style="list-style-type: none"> <li>• If a bus becomes unavailable and the node is not ready to sleep, the NM shall not enter bus sleep mode by itself.</li> <li>• If a bus becomes unavailable and the node is ready to sleep, the NM shall enter bus sleep mode by itself.</li> <li>• If a bus is unavailable and the node changes its state to ready to sleep, the NM shall enter bus sleep mode by itself.</li> <li>• 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.</li> </ul>
<b>Rationale:</b>	Faults (transient and/or permanent) shall not cause non deterministic behavior.
<b>Use Case:</b>	Bus unavailability (Bus Off), Loss of NM messages
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

##### 4.1.2.4.2 [BSW137] Communication system error handling

<b>Initiator:</b>	DC
<b>Date:</b>	20.01.2004
<b>Short Description:</b>	NM shall perform communication system error handling for errors that have impact on the NM behavior.
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	<p>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.</p> <p>Focus: bus errors, not protocol errors. Example: loss of NM message is handled.</p>
<b>Rationale:</b>	Error handling
<b>Use Case:</b>	Communication loss
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.2.5 Gateway Operation

##### 4.1.2.5.1 [BSW136] Coordination of coupled networks

<b>Initiator:</b>	DC
<b>Date:</b>	20.01.2004
<b>Short Description:</b>	NM shall provide functionality, which enables additional software to co-ordinate sleep mode for heterogeneous networks.
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	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.
<b>Rationale:</b>	Different networks shall be able to shut down (wake-up) synchronously.
<b>Use Case:</b>	NM Gateway
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

##### 4.1.2.5.2 [BSW140] Compliance with OSEK NM on a gateway

<b>Initiator:</b>	DC
<b>Date:</b>	20.01.2004
<b>Short Description:</b>	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.
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	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.
<b>Rationale:</b>	Enable migration
<b>Use Case:</b>	Reused clusters (taken over).
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.3 Non-Functional Requirements (Qualities)

##### 4.1.3.1 Timing Requirements

##### 4.1.3.1.1 [BSW054] Deterministic Time for Bus Sleep

<b>Initiator:</b>	DC
<b>Date:</b>	09.01.2004
<b>Short Description:</b>	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.
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	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.
<b>Rationale:</b>	Determinism of network behavior, guarantee of synchronized sleep-mode
<b>Use Case:</b>	See Rationale
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.3.2 Resource Usage

##### 4.1.3.2.1 [BSW142] Limitation of NM bus load

<b>Initiator:</b>	DC
<b>Date:</b>	05.02.2004
<b>Short Description:</b>	NM shall guarantee an upper limit for the bus load generated by NM itself.
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	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.
<b>Rationale:</b>	Determinism
<b>Use Case:</b>	Avoid solution like in OSEK NM 2.5.3: alive messages after bus wakeup
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

##### 4.1.3.2.2 [BSW143] Predictable NM bus load

<b>Initiator:</b>	DC
<b>Date:</b>	05.02.2004
<b>Short Description:</b>	The bus load caused by NM shall be predictable.
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	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).
<b>Rationale:</b>	Predictability
<b>Use Case:</b>	Prediction of bus load for NM on the specific bus
<b>Dependencies:</b>	<a href="#">[BSW149]</a>
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

##### 4.1.3.2.3 [BSW144] ECU cluster size

<b>Initiator:</b>	DC
<b>Date:</b>	05.02.2004
<b>Short Description:</b>	ECU cluster size
<b>Type:</b>	New
<b>Importance:</b>	High

<b>Description:</b>	Communication clusters of up to 64 ECUs / controllers shall be supported by NM.
<b>Rationale:</b>	Flexibility
<b>Use Case:</b>	See Rationale
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.3.2.4 [BSW145] Robustness against NM message losses

<b>Initiator:</b>	DC
<b>Date:</b>	05.02.2004
<b>Short Description:</b>	Robustness against NM message losses.
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	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.
<b>Rationale:</b>	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.
<b>Use Case:</b>	Loss of NM-message(s) must be tolerated
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.3.2.5 [BSW146] Robustness against NM message jitter

<b>Initiator:</b>	DC
<b>Date:</b>	05.02.2004
<b>Short Description:</b>	Robustness against NM message jitter.
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	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.
<b>Rationale:</b>	Robustness
<b>Use Case:</b>	Jitter of NM-message(s) must be tolerated
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.3.2.6 [BSW147] Processor independent algorithm

<b>Initiator:</b>	DC
<b>Date:</b>	05.02.2004
<b>Short Description:</b>	The NM algorithm shall be processor independent.
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	The algorithm of NM shall not rely on processor specific mechanisms. It shall be realizable on every processor architecture.
<b>Rationale:</b>	Re-use

<b>Use Case:</b>	Usage of NM on different processor architectures
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.3.2.7 [BSW149] Configurable Timing

<b>Initiator:</b>	DC
<b>Date:</b>	05.02.2004
<b>Short Description:</b>	The timing of NM shall be configurable.
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	<p>All timing parameters of the NM (e.g., the cycle timing of message sent on the communication media) shall be configurable.</p> <p>NM Implementation shall support at least one of the following strategies:</p> <ul style="list-style-type: none"> <li>- pre-compile or</li> <li>- post-compile or</li> <li>- post build.</li> </ul> <p>SWS shall define which of parameters are cluster specific and which are node specific.</p>
<b>Rationale:</b>	Flexibility
<b>Use Case:</b>	<ol style="list-style-type: none"> <li>1. Time until network is shut down after all nodes have indicated that they are ready to sleep.</li> <li>2. Time interval between two consecutive status indications of a node, whether it is ready to sleep or not.</li> <li>3. Determination of timing depending on the configurable number of nodes.</li> </ol>
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.3.3 Hardware independency

##### 4.1.3.3.1 [BSW154] Bus independency of API

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

#### 4.1.4 CAN Specific Requirements

##### 4.1.4.1 Resource Usage

##### 4.1.4.1.1 [BSW148] Separation of Communication system dependent parts

<b>Initiator:</b>	DC
<b>Date:</b>	05.02.2004
<b>Short Description:</b>	Separation of Communication system dependent parts.
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	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).
<b>Rationale:</b>	Re-use
<b>Use Case:</b>	CAN NM Software Architecture (AUTOSAR SC decision from Apr 25th, 2006).
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

##### 4.1.4.2 Gateway Operation

##### 4.1.4.2.1 [BSW139] Compliance with OSEK NM on one cluster

<b>Initiator:</b>	DC
<b>Date:</b>	20.01.2004
<b>Short Description:</b>	The AUTOSAR NM shall be able to run in parallel on the same cluster as the OSEK NM.
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	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.
<b>Rationale:</b>	Enable migration
<b>Use Case:</b>	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.
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.4.3 Transmission Confirmation

##### 4.1.4.3.1 [BSW02510] Immediate Transmission Confirmation

<b>Initiator:</b>	FMC (WP4.2.2.1.2)
<b>Date:</b>	16.03.2006
<b>Short Description:</b>	Immediate Transmission Confirmation
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	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.
<b>Rationale:</b>	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.
<b>Use Case:</b>	Usage of CAN NM in a deterministic bus system.
<b>Dependencies:</b>	--
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.4.4 Diagnostic Service

##### 4.1.4.4.1 [BSW02512] CommunicationControl (28 hex) service support

<b>Initiator:</b>	WP4.2.2.1.2
<b>Date:</b>	04.09.2006
<b>Short Description:</b>	CommunicationControl (28 hex) service support
<b>Type:</b>	New
<b>Importance:</b>	High
<b>Description:</b>	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.
<b>Rationale:</b>	Conformance to ISO 14229 CommunicationControl (28 hex) service
<b>Use Case:</b>	Diagnostics
<b>Dependencies:</b>	BSW02511
<b>Conflicts:</b>	--
<b>Supporting Material:</b>	--

#### 4.1.5 FlexRay Specific Requirements

None.

## 5 Links to related documentation

Layered Software Architecture

[https://svn2.autosar.org/repos2/22\\_Releases](https://svn2.autosar.org/repos2/22_Releases)

AUTOSAR\_LayeredSoftwareArchitecture.pdf

Requirements on Basic Software Modules

[https://svn2.autosar.org/repos2/22\\_Releases](https://svn2.autosar.org/repos2/22_Releases)

AUTOSAR\_SRS\_General.pdf

Specification of the Virtual Functional Bus

[https://svn2.autosar.org/repos2/22\\_Releases](https://svn2.autosar.org/repos2/22_Releases)

AUTOSAR\_VirtualFunctionBus.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/>