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1 Introduction and overview

This specification specifies the operational states, message format and semantics of the AUTOSAR UDP Network Management (UdpNm) protocol.

UdpNm is intended to work together with a TCP/IP Stack, independent of the physical layer of the communication system used.

The AUTOSAR UDP Network Management is a hardware independent protocol that can be used on TCP/IP based systems (for limitations refer to chapter 1.1). Its main purpose is to coordinate the transition between normal operation and bus-sleep mode of the network.

In addition to the core functionality optional features are provided e.g. to implement a service to detect all present nodes or to detect if all other nodes are ready to sleep.

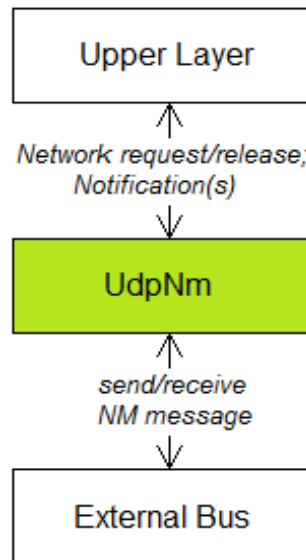


Figure 1.1: UdpNm module location

1.1 Limitations

1. One instance of UdpNm is associated with only one NM-Cluster in one network. One NM-Cluster can have only one instance of UdpNm in one node.
2. UdpNm is only applicable for TCP/IP based systems.

1.2 Dependencies to other protocol layers

UdpNm module uses services of the TCP/IP underlying modules in order to send or receive NM messages.

1.3 Dependencies to the upper layers

Upper layer (e.g. application) uses UdpNm services to request or release a network i.e. to activate or deactivate sending of NM messages.

In addition, upper layers may use the possibility to get informed about changes of the UdpNm operational modes.

2 Use Cases

No use case in UdpNm_PRS document.

3 Requirements Traceability

Requirement	Description	Satisfied by
[RS_Nm_00047]	NM shall provide a service to request to keep the bus awake and a service to cancel this request.	[PRS_UdpNm_00100] [PRS_UdpNm_00103] [PRS_UdpNm_00104] [PRS_UdpNm_00105] [PRS_UdpNm_00106] [PRS_UdpNm_00108] [PRS_UdpNm_00110] [PRS_UdpNm_00111] [PRS_UdpNm_00112] [PRS_UdpNm_00113] [PRS_UdpNm_00116] [PRS_UdpNm_00118] [PRS_UdpNm_00119] [PRS_UdpNm_00120] [PRS_UdpNm_00121] [PRS_UdpNm_00122] [PRS_UdpNm_00123] [PRS_UdpNm_00124] [PRS_UdpNm_00129]
[RS_Nm_00048]	NM shall put the communication controller into sleep mode if there is no bus communication	[PRS_UdpNm_00115]
[RS_Nm_00052]	The NM interface shall signal to the application that all other ECUs are ready to sleep.	[PRS_UdpNm_00150]
[RS_Nm_00054]	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.	[PRS_UdpNm_00115] [PRS_UdpNm_00128]
[RS_Nm_00149]	No description	[PRS_UdpNm_00032] [PRS_UdpNm_00040] [PRS_UdpNm_00051] [PRS_UdpNm_00096] [PRS_UdpNm_00098] [PRS_UdpNm_00099] [PRS_UdpNm_00101] [PRS_UdpNm_00102] [PRS_UdpNm_00109] [PRS_UdpNm_00117] [PRS_UdpNm_00173] [PRS_UdpNm_00174] [PRS_UdpNm_00175] [PRS_UdpNm_00179] [PRS_UdpNm_00180] [PRS_UdpNm_00330] [PRS_UdpNm_00334]
[RS_Nm_00150]	Specific functions of the Network Management shall be configurable	[PRS_UdpNm_00013] [PRS_UdpNm_00045] [PRS_UdpNm_00074] [PRS_UdpNm_00075] [PRS_UdpNm_00107] [PRS_UdpNm_00136] [PRS_UdpNm_00149] [PRS_UdpNm_00158] [PRS_UdpNm_00161] [PRS_UdpNm_00328]
[RS_Nm_00153]	The Network Management shall optionally provide a possibility to detect present nodes	[PRS_UdpNm_00107] [PRS_UdpNm_00135]
[RS_Nm_02505]	The NM shall optionally set the local node identifier to the NM-message	[PRS_UdpNm_00013] [PRS_UdpNm_00074]

Requirement	Description	Satisfied by
[RS_Nm_02509]	The NM interface shall signal to the application that at least one ECU is not ready to sleep anymore.	[PRS_UdpNm_00151] [PRS_UdpNm_00152]
[RS_Nm_02511]	It shall be possible to configure the Network Management of a node in Cluster Shutdown	[PRS_UdpNm_00072] [PRS_UdpNm_00116] [PRS_UdpNm_00128] [PRS_UdpNm_00161] [PRS_UdpNm_00162] [PRS_UdpNm_00163]
[RS_Nm_02517]	<Bus>Nm shall support Partial Networking on CAN, FlexRay and Ethernet	[PRS_UdpNm_00328] [PRS_UdpNm_00332] [PRS_UdpNm_00333]
[RS_Nm_02518]	<Bus>Nm shall be able to distinguish between NM Messages	[PRS_UdpNm_00328] [PRS_UdpNm_00329] [PRS_UdpNm_00331] [PRS_UdpNm_00460] [PRS_UdpNm_00461] [PRS_UdpNm_00462]
[RS_Nm_02520]	<Bus>Nm shall evaluate the PNI bit in the NM message	[PRS_UdpNm_00329] [PRS_UdpNm_00331] [PRS_UdpNm_00335] [PRS_UdpNm_00337] [PRS_UdpNm_00338] [PRS_UdpNm_00460] [PRS_UdpNm_00461] [PRS_UdpNm_00462]
[RS_Nm_02521]	<Bus>Nm shall set the PNI bit for requesting Partial Network functionality	[PRS_UdpNm_00332] [PRS_UdpNm_00333]
[RS_Nm_02536]	NM shall provide an interface which triggers the transition to the Network Mode without keeping the network awake	[PRS_UdpNm_00128]

4 Definition of terms and acronyms

Abbreviation or Acronym:	Description
API	Application Programming Interface
CWU	Car Wakeup
IP	Internet Protocol
NM	Network Management
PN	Partial Network
PNI	Partial Network Information
TCP	Transmission Control Protocol
TCP/IP	A family of communication protocols used in computer networks
UDP	User Datagram Protocol
UDPNM	UDP Network Management

Table 4.1: Abbreviations and Acronyms

Term or Definition	Description
NM transmission ability is disabled	This means that the NM message transmission has been disabled.
Repeat Message Request Bit Indication	Repeat Message Bit set in the Control Bit Vector of a received NM message.
PN-communication	Communication during partial network operation
NM-Cluster	Set of NM nodes coordinated with the use of the NM algorithm.
NM Message	Refers to the payload transmitted in a packet. It contains the NM User Data as well as the Control Bit Vector and the Source Node Identifier.
NM Packet	Refers to an Ethernet Frame containing an IP as well as a UDP header in addition to the data transmitted by the NM in the payload section

Table 4.2: Terms and Definitions

5 Protocol specification

5.1 Network management algorithm

The AUTOSAR UdpNm is based on decentralized direct network management strategy, which means that every network node performs activities self-sufficient depending only on the UDP packets received and/or transmitted within the communication system.

The AUTOSAR UdpNm algorithm is based on periodic NM packets, which are received by all nodes in the cluster via multicast transmission. Reception of NM packets indicates that sending nodes want to keep the NM-cluster awake. If any node is ready to go to sleep mode, it stops sending NM packets, but as long as NM packets from other nodes are received, it postpones transmission to sleep mode. Finally, if a dedicated timer elapses because no NM packets are received anymore, every node initiates transmission to the sleep mode.

If any node in the NM-cluster requires bus-communication, it can keep the NM-cluster awake by transmitting NM packets.

Every network node transmits periodic NM messages as long as it requires bus-communication, otherwise it doesn't transmit NM messages.

5.2 Network states

Two network states of the AUTOSAR UdpNm exist in parallel to the state machine. Network states denote, whether the application needs to communicate on the bus (the network state is then 'requested'); or whether there is currently no demand for active communication on the bus (the bus network state is then 'released').

The ECU needs to continue its communication until the network enters the Bus-Sleep Mode.

Rational: some other ECU may still request network communication.

[PRS_UdpNm_00104] [If the network is requested, the UdpNm module shall change network state to 'requested'.] ([RS_Nm_00047](#))

[PRS_UdpNm_00105] [If the network is released, the UdpNm module shall change network state to 'released'.] ([RS_Nm_00047](#))

5.3 Operational Modes

This chapter describes the operational modes of the AUTOSAR UdpNm.

[PRS_UdpNm_00092] [The AUTOSAR UdpNm shall contain three operational modes visible at the modules interface:

- Network Mode
- Prepare Bus-Sleep Mode
- Bus-Sleep Mode

]()

The following figure shows an UML state diagram. Mode change related transitions are denoted in green, error handling related transmissions in red and optional node detection related transitions in blue.

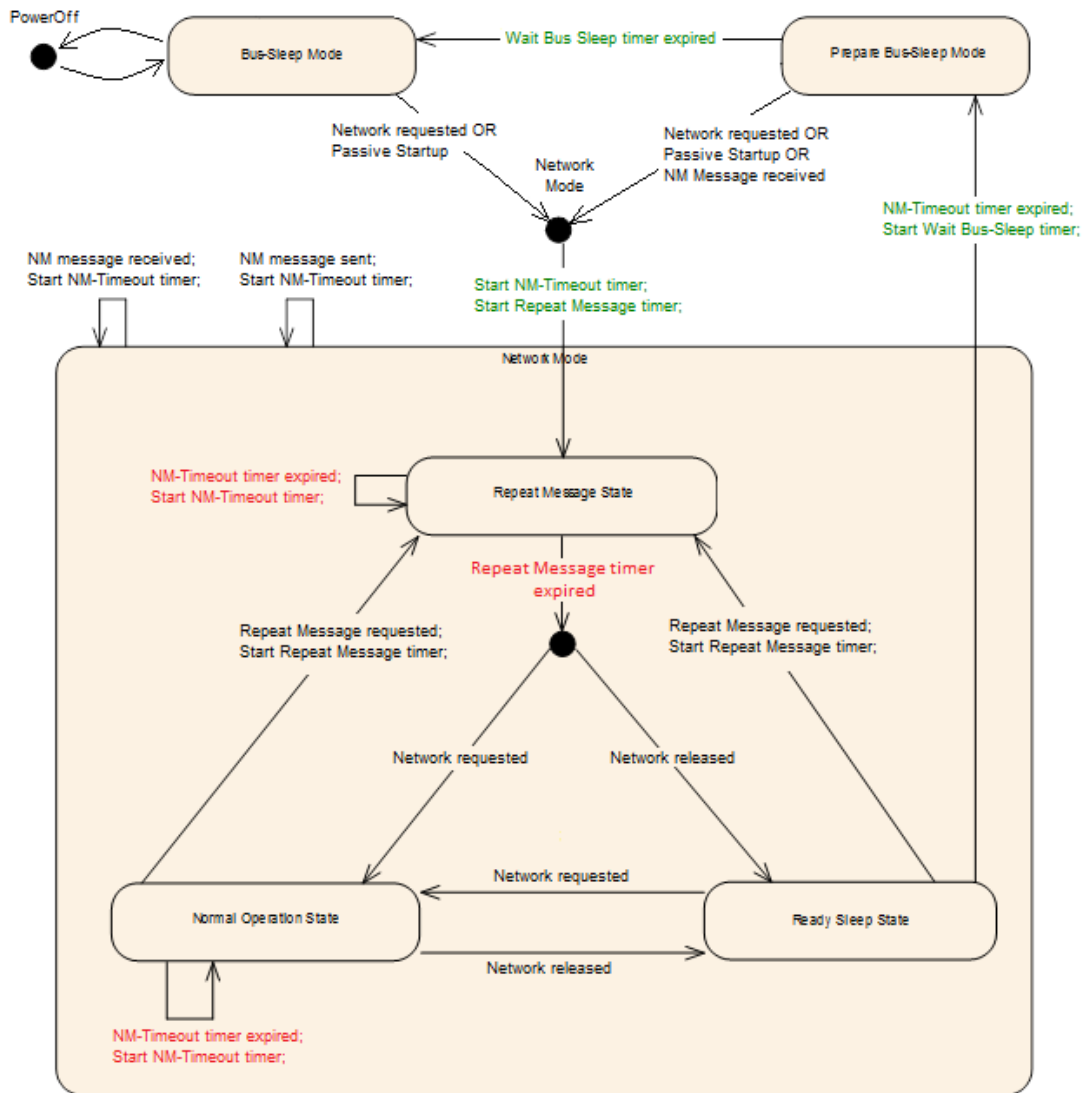


Figure 5.1: State chart diagram

5.3.1 Network Mode

[PRS_UdpNm_00094] [The Network Mode shall consist of three internal states:

- Repeat Message State
- Normal Operation State
- Ready Sleep State

]()

[PRS_UdpNm_00095] [When the Network Mode is entered from Bus-Sleep Mode or Prepare Bus-Sleep Mode, the Repeat Message State shall be entered.]()

[PRS_UdpNm_00096] [When the Network Mode is entered, the NM-Timeout Timer `UdpNmTimeoutTime` shall be started.]([RS_Nm_00149](#))

[PRS_UdpNm_00098] [Upon successful reception of an NM message in Network Mode, the NM-Timeout Timer shall be restarted.]([RS_Nm_00149](#))

[PRS_UdpNm_00099] [Upon transmission of an NM message in Network Mode, the NM-Timeout Timer shall be restarted.]([RS_Nm_00149](#))

5.3.1.1 Repeat Message State

For nodes that are not in passive mode and NM message transmission enabled, the Repeat Message State ensures that any transition from Bus-Sleep or Prepare Bus-Sleep to the Network Mode becomes visible for the other nodes on the network. Additionally, it ensures that any node stays active for a minimum amount of time. Optionally it can be used for detection of present nodes.

[PRS_UdpNm_00100] [When the Repeat Message State is entered from Bus-Sleep Mode, Prepare-Bus-Sleep Mode, Normal Operation State or Ready Sleep State transmission of NM messages shall be (re-) started unless passive mode is enabled.]([RS_Nm_00047](#))

[PRS_UdpNm_00101] [When the NM-Timeout Timer expires in the Repeat Message State, the NM-Timeout Timer shall be restarted.]([RS_Nm_00149](#))

[PRS_UdpNm_00102] [The NM shall stay in the Repeat Message State for a configurable amount of time determined by the `UdpNmRepeatMessageTime`; after that time the Repeat Message State shall be left.]([RS_Nm_00149](#))

[PRS_UdpNm_00103] [When Repeat Message State is left, the Normal Operation State shall be entered, if the network has been requested.]([RS_Nm_00047](#))

[PRS_UdpNm_00106] [When Repeat Message State is left, the Ready Sleep State shall be entered, if the network has been released.]([RS_Nm_00047](#))

[PRS_UdpNm_00107] [When Repeat Message State is left and the Node Detection option is enabled, the Repeat Message Request Bit (see [5.4.2](#)) shall be set to 0.]([RS_Nm_00150](#), [RS_Nm_00153](#))

[PRS_UdpNm_00137] [If the Repeat Message is requested in Repeat Message State, Prepare Bus-Sleep Mode or Bus-Sleep Mode, the UdpNm module shall ignore the repeat message request.]()

5.3.1.2 Normal Operation State

The Normal Operation State ensures that any node can keep the NM-cluster awake as long as the network functionality is required.

[PRS_UdpNm_00116] [When the Normal Operation State is entered from Ready Sleep State, transmission of NM messages shall be started unless passive mode is enabled or the NM message transmission ability has been disabled.]([RS_Nm_00047](#), [RS_Nm_02511](#))

[PRS_UdpNm_00117] [When the NM-Timeout Timer expires in the Normal Operation State, the NM-Timeout Timer shall be restarted with `UdpNmTimeoutTime`.]([RS_Nm_00149](#))

[PRS_UdpNm_00118] [When the network is released and the current state is Normal Operation State, the Normal Operation State shall be left and the Ready Sleep state shall be entered.]([RS_Nm_00047](#))

[PRS_UdpNm_00119] [At Repeat Message Request Bit Indication in the Normal Operation State, the Normal Operation State shall be left and the Repeat Message State shall be entered.]([RS_Nm_00047](#))

[PRS_UdpNm_00120] [If the Repeat Message is requested in the Normal Operation State, the Normal Operation State shall be left and the Repeat Message State shall be entered.]([RS_Nm_00047](#))

[PRS_UdpNm_00121] [If the Repeat Message is requested in Normal Operation State the Repeat Message Bit shall be set to 1 (see [5.4.2](#)).]([RS_Nm_00047](#))

5.3.1.3 Ready Sleep State

The Ready Sleep State ensures that any node in the NM-cluster waits with transition to the Prepare Bus-Sleep Mode as long as any other node keeps the NM-cluster awake.

[PRS_UdpNm_00108] [When the Ready Sleep State is entered from Repeat Message State or Normal Operation State, transmission of NM messages shall be stopped.]([RS_Nm_00047](#))

Note: If passive mode is enabled no NM messages are transmitted, no action is required.

[PRS_UdpNm_00109] [When the NM-Timeout Timer expires in the Ready Sleep State, the Ready Sleep State shall be left and the Prepare Bus-Sleep Mode shall be entered.]([RS_Nm_00149](#))

[PRS_UdpNm_00110] [When the network is requested and the current state is the Ready Sleep State, the Ready Sleep State shall be left and the Normal Operation State shall be entered.]([RS_Nm_00047](#))

[PRS_UdpNm_00111] [At Repeat Message Request Bit Indication in the Ready Sleep State, the Ready Sleep State shall be left and the Repeat Message State shall be entered.]([RS_Nm_00047](#))

[PRS_UdpNm_00112] [If the Repeat Message is requested in the Ready Sleep State, the Ready Sleep State shall be left and the Repeat Message State shall be entered.]([RS_Nm_00047](#))

[PRS_UdpNm_00113] [If the Repeat Message is requested in Ready Sleep State the Repeat Message Bit shall be set to 1 if CBV is available (see [5.4.2](#)).]([RS_Nm_00047](#))

5.3.2 Prepare Bus-Sleep Mode

The purpose of the Prepare Bus Sleep state is to ensure that all nodes have time to stop their network activity before the Bus Sleep state is entered. Bus activity is calmed down (i.e. queued messages are transmitted in order to empty all Tx-buffers) and finally there is no activity on the bus in the Prepare Bus-Sleep Mode.

[PRS_UdpNm_00115] [The NM shall stay in the Prepare Bus-Sleep Mode for an amount of time determined by the `UdpNmWaitBusSleepTime`; after that time, the Prepare Bus-Sleep Mode shall be left and the Bus-Sleep Mode shall be entered.]([RS_Nm_00048](#), [RS_Nm_00054](#))

[PRS_UdpNm_00124] [Upon successful reception of an NM message in the Prepare Bus-Sleep Mode, the Prepare Bus-Sleep Mode shall be left and the Network Mode

shall be entered.]([RS_Nm_00047](#))

[PRS_UdpNm_00123] [When the network is requested in the Prepare Bus-Sleep Mode, the Prepare Bus-Sleep Mode shall be left and the Network Mode shall be entered.]([RS_Nm_00047](#))

[PRS_UdpNm_00122] [When the network has been requested in the Prepare Bus-Sleep Mode and the UdpNm module has entered Network Mode and if the Immediate Restart option is enabled (`UdpNmImmediateRestartEnabled = TRUE`), the UdpNm module shall transmit a NM message.]([RS_Nm_00047](#))

Rationale: Other nodes in the cluster are still in Prepare Bus-Sleep Mode; in the exceptional situation described above, transition into the Bus-Sleep Mode shall be avoided and bus-communication shall be restored as fast as possible.

Caused by the transmission offset for NM messages in UdpNm, the transmission of the first NM message in Repeat Message State can be delayed significantly. In order to avoid a delayed re-start of the network, the transmission of a NM message can be requested immediately.

Note: If the Immediate Restart option is enabled and a wake-up line is used, a burst of NM messages occurs if all network nodes get a network request in Prepare Bus-Sleep Mode.

5.3.3 Bus-Sleep Mode

The purpose of the Bus-Sleep state is to reduce power consumption in the node, when no messages are to be exchanged.

The communication controller is switched to sleep mode, respective wakeup mechanisms are activated and finally power consumption is reduced to the adequate level in the Bus-Sleep Mode.

If a configurable amount of time determined by the (`UdpNmTimeoutTime + UdpNmWaitBusSleepTime`) is identically configured for all nodes in the network management cluster, all nodes in the network management cluster that are coordinated with use of the AUTOSAR NM algorithm perform the transition into the Bus-Sleep Mode at approximately the same time.

Note: The parameters `UdpNmTimeoutTime` and `UdpNmWaitBusSleepTime` should have the same values within all network nodes of the NM-cluster.

Depending on the specific implementation and other factors, transition into the Bus-Sleep Mode takes place approximately at the same time. The time jitter experienced for this transition depends on the following factors:

- internal clock precision (oscillator’s drift),
- NM-task cycle time (if tasks are not synchronized with a global time),
- NM messages waiting time in the Tx-queue (if transmission confirmation is made immediately after transmit request).

[PRS_UdpNm_00128] [If passive start-up is requested in the Bus-Sleep Mode or Prepare Bus Sleep Mode, the UdpNm module shall enter the Network Mode.]
 ([RS_Nm_00054](#), [RS_Nm_02511](#), [RS_Nm_02536](#))

Note: In the Prepare Bus-Sleep Mode and Bus-Sleep Mode is assumed that the network is released, unless bus communication is explicitly requested.

[PRS_UdpNm_00129] [When the network is requested in Bus-Sleep Mode, the UdpNm module shall enter the Network Mode.]([RS_Nm_00047](#))

5.4 Message format

The table below shows an example for n bytes message length:

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Source Node Identifier (default)							
Byte 1	Control Bit Vector (default)							
Byte 2	User data 0							
Byte 3	User data 1							
Byte 4	User data 2							
Byte 5	User data 3							
...	...							
Byte n	User data n-2							

Table 5.1: NM packet payload (NM message) default format.

[PRS_UdpNm_00076] [The length of an NM packet shall not exceed the MTU (Maximum Transmission Unit) of the underlying physical transport layer.]()

Note: as defined in RFC 894, the maximum length of an IP datagram (including header) sent over an Ethernet is 1500 bytes.

5.4.1 Source Node Identifier

[PRS_UdpNm_00074] [The location of the source node identifier shall be configured by `UdpNmPduNidPosition` to position Byte 0 or Byte 1 or Off (default: Byte 0).]([RS_Nm_00150](#), [RS_Nm_02505](#))

[PRS_UdpNm_00013] [The source node identifier shall be set with configuration parameter `UdpNmNodeId` unless the location of the source node identifier is set to Off.]([RS_Nm_00150](#), [RS_Nm_02505](#))

5.4.2 Control Bit Vector

The following table describes the format of the Control Bit Vector.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
CBV	Res	PNI Bit	Res	Active Wakeup Bit	NM Co-ordinator Sleep Ready	Res	Res	Repeat Message Request

Table 5.2: Control Bit Vector.

[PRS_UdpNm_00075] [The location of the Control Bit Vector shall be configurable by `UdpNmPduCbvPosition` to position Byte 0 or Byte 1 or Off (default: Byte 1).]([RS_Nm_00150](#))

[PRS_UdpNm_00045] [The Control Bit Vector shall consist of:

- Bit 0: Repeat Message Request
 - 0: Repeat Message State not requested
 - 1: Repeat Message State requested
- Bit 3: NM Coordinator Sleep Ready Bit
 - 0: Start of synchronized shutdown is not requested by main coordinator
 - 1: Start of synchronized shutdown is requested by main coordinator
- Bit 4: Active Wakeup Bit
 - 0: Node has not woken up the network (passive wakeup)
 - 1: Node has woken up the network (active Wakeup)
- Bit 6: Partial Network Information Bit (PNI)
 - 0: NM message contains no Partial Network request information

1: NM message contains Partial Network request information

- Bits 1,2,5,7 are reserved for future extensions

0: Disabled/Reserved for future usage

]([RS_Nm_00150](#))

[PRS_UdpNm_00135] [It shall be possible to enable or disable the handling of Repeat Message Request Bit and Repeat Message State Request with use of Node Detection Option (configuration parameter).]([RS_Nm_00153](#))

[PRS_UdpNm_00136] [It shall be possible to enable or disable the handling of Active Wakeup Bit.]([RS_Nm_00150](#))

5.4.3 User Data

[PRS_UdpNm_00158] [It shall be possible to enable or disable the support of NM user data using parameter `UdpNmUserDataEnabled`.]([RS_Nm_00150](#))

Note: If either Node Identifier or Control Bit Vector is defined, user data starts from Byte 1. If both Node Identifier and Control Bit Vector are not defined, user data starts from Byte 0.

5.4.3.1 Car Wakeup

The Car Wakeup filter is necessary to realize sub gateways that only consider the Car Wakeup of the central Gateway to avoid wrong wakeups.

[PRS_UdpNm_00373] [The position of the Car Wakeup bit in the NM-message User Data shall be defined by a configurable byte and bit position.]()

5.5 NM Transmission

5.5.1 Transmission Communication Control

[PRS_UdpNm_00168] [It shall be possible to enable or disable the communication control.]()

Note: The NM coordination algorithm cannot work correctly if NM message transmission ability is disabled. Therefore, it has to be ensured that the ECU is not shutdown

as long as the NM message transmission ability is disabled.

If communication release is requested and NM message transmission ability has been disabled, ECU will shut down. This ensures that ECU can shut down also in case of race conditions (e.g. diagnostic session left shortly before enabling communication) or a wrong usage of communication control.

[PRS_UdpNm_00173] [When the NM message transmission ability is disabled, the UdpNm module shall stop the UdpNm Message Cycle Timer in order to stop the transmission of NM messages.]([RS_Nm_00149](#))

[PRS_UdpNm_00174] [When the NM message transmission ability is disabled, the NM-Timeout Timer shall be stopped.]([RS_Nm_00149](#))

[PRS_UdpNm_00175] [When the NM message transmission ability is disabled, the detection of Remote Sleep Indication Timer shall be suspended.]([RS_Nm_00149](#))

[PRS_UdpNm_00178] [When the Network Management message transmission ability is enabled, the transmission of NM messages shall be started latest within the next NM main function.]()

[PRS_UdpNm_00179] [When the Network Management message transmission ability is enabled, the NM-Timeout Timer shall be restarted.]([RS_Nm_00149](#))

[PRS_UdpNm_00180] [When the NM message transmission ability is enabled, the detection of Remote Sleep Indication Timer shall be resumed.]([RS_Nm_00149](#))

5.5.2 Transmission Scheduling

The transmission mechanisms described in this chapter are only relevant if the NM message transmission ability is enabled.

[PRS_UdpNm_00072] [The transmission of NM messages shall be enabled or disabled by means of Passive Mode option (see [5.7.1](#))]([RS_Nm_02511](#))

Note: Passive nodes do not transmit NM messages, i.e. they cannot actively influence the shutdown decision, but they do receive NM message in order to be able to shut down synchronously.

Note: The transmission mechanisms described in this chapter are only relevant if Passive Mode option is disabled.

[PRS_UdpNm_00237] [The UdpNm module shall provide the periodic transmission of NM messages. In "Repeat Message State" and "Normal Operation State" the UdpNm module shall send NM messages periodically.]()

[PRS_UdpNm_00005] [If the Repeat Message State is entered because of an external event (e.g. reception of a NM-message) OR `UdpNmImmediateNmTransmissions` is zero, the transmission of NM message shall be delayed by `UdpNmMsgCycleOffset` after entering the Repeat Message State.]()

Note: requirement PRS_UdpNm_00005 covers also the case if Repeat Message State is entered from Network Operation State or Ready Sleep State due to a Repeat Message Request or Repeat Message Request Bit received (see PRS_UdpNm_00111, PRS_UdpNm_00112, PRS_UdpNm_00119, PRS_UdpNm_00120). This means that in this case the immediate transmission is not used (even if `UdpNmImmediateNmTransmissions > 0`) i.e. `UdpNmMsgCycleOffset` will always be applied. This mechanism prevents bursts of NM messages.

[PRS_UdpNm_00334] [When entering the Repeat Message State from Bus Sleep Mode or Prepare Bus Sleep Mode because of network request (active wakeup) and if `UdpNmImmediateNmTransmissions` is greater zero, the NM messages shall be transmitted using `UdpNmImmediateNmCycleTime` as cycle time. The transmission of the first NM message shall be triggered as soon as possible. After the transmission, the Message Cycle Timer shall be reloaded with `UdpNmImmediateNmCycleTime`. The `UdpNmMsgCycleOffset` shall not be applied in this case.]([RS_Nm_00149](#))

[PRS_UdpNm_00006] [If Normal Operation State is entered from Ready Sleep State the transmission of NM messages shall be started immediately.]()

[PRS_UdpNm_00330] [If NM messages shall be transmitted with `UdpNmImmediateNmCycleTime` (see PRS_UdpNm_00334), UdpNm shall ensure that `UdpNmImmediateNmTransmissions` (including first immediate transmission) with this timing are requested successfully. If a transmission request fails, UdpNm shall retry the transmission request. Afterwards UdpNm shall continue transmitting NM messages using the `UdpNmMsgCycleTime`.]([RS_Nm_00149](#))

Note: While transmitting NM messages using the `UdpNmImmediateNmCycleTime` no other Nm messages shall be transmitted (i.e. the `UdpNmMsgCycleTime` transmission cycle is stopped).

[PRS_UdpNm_00032] [If transmission of NM messages has been started and the UdpNm Message Cycle Timer expires, a NM message shall be transmitted.]
([RS_Nm_00149](#))

[PRS_UdpNm_00040] [If the UdpNm Message Cycle Timer expires it shall be restarted with `UdpNmMsgCycleTime`.]([RS_Nm_00149](#))

[PRS_UdpNm_00051] [If transmission of NM messages has been stopped the UdpNm Message Cycle Timer shall be canceled.]([RS_Nm_00149](#))

5.6 Partial Networking

5.6.1 Rx Handling of NM messages

[PRS_UdpNm_00328] [If the PN support is disabled, the UdpNm shall perform the normal Rx Indication handling and the partial networking extensions shall be disabled.]([RS_Nm_00150](#), [RS_Nm_02517](#), [RS_Nm_02518](#))

[PRS_UdpNm_00460] [If no relevant PN is requested in the received NM message and `UdpNmAllNmMessagesKeepAwake` is `FALSE` the message shall be dropped from further processing.]([RS_Nm_02518](#), [RS_Nm_02520](#))

[PRS_UdpNm_00461] [If no relevant PN is requested in the received NM message and `UdpNmAllNmMessagesKeepAwake` is `TRUE` the message shall not be dropped from further Rx Indication handling.]([RS_Nm_02518](#), [RS_Nm_02520](#))

[PRS_UdpNm_00329] [If the PN support is enabled and the PNI bit in the received NM message is 0 and `UdpNmAllNmMessagesKeepAwake` is `TRUE`, the UdpNm module shall perform the normal Rx Indication handling omitting the extensions for partial networking.]([RS_Nm_02518](#), [RS_Nm_02520](#))

[PRS_UdpNm_00462] [If the PN support is enabled and the PNI bit in the received NM message is 0 and `UdpNmAllNmMessagesKeepAwake` is `FALSE`, the UdpNm module shall ignore the received NM message.]([RS_Nm_02518](#), [RS_Nm_02520](#))

[PRS_UdpNm_00331] [If the PN support is enabled and the PNI bit in the received NM message is 1, UdpNm module shall process the Partial Networking Information of the NM message.]([RS_Nm_02518](#), [RS_Nm_02520](#))

5.6.2 Tx Handling of NM messages

[PRS_UdpNm_00332] [If the PN support is enabled, the UdpNm module shall set the value of the transmitted PNI bit in the CBV to 1.]([RS_Nm_02517](#), [RS_Nm_02521](#))

[PRS_UdpNm_00333] [If the PN support is disabled, the UdpNm module shall set the value of the transmitted PNI bit in the CBV always to 0.]([RS_Nm_02517](#), [RS_Nm_02521](#))

Constraint: The usage of the CBV is mandatory in case Partial Networking is used. This has to be ensured by configuration in the respective platform.

5.6.3 NM message Filter Algorithm

[PRS_UdpNm_00335] [The range (in bytes) that contains the PN request information (PN Info Range) in the received NM message shall be defined by PN Info Offset (in bytes) starting from byte 0 and PN Info Length (in bytes).]([RS_Nm_02520](#))

Example:

PN Info Offset = 3

PN Info Length = 2

Only Byte 3 and Byte 4 of the NM message contain PN request information.

Note: every bit of the PN Info Range represents one Partial Network. If the bit is set to 1 the Partial Network is requested. If the bit is set to 0 there is no request for this PN.

[PRS_UdpNm_00337] [By means of PN Filter Mask Byte the UdpNm shall detect which PN is relevant for the ECU and which not.

Each bit of the PN Filter Mask Byte has the following meaning:

0 The PN request is irrelevant for the ECU

1 The PN request is relevant for the ECU

]([RS_Nm_02520](#))

[PRS_UdpNm_00338] [Each PN Filter Mask Byte shall be mapped (bitwise AND) to the corresponding byte in the PN Info Range of the NM message.]([RS_Nm_02520](#))

Note: If at least one bit within the PN Info Range of the received NM message matches with a bit in the NM filter mask, the PN request information is relevant for the ECU.

5.7 Additional Features

5.7.1 Passive Mode

In Passive Mode the node is only receiving NM messages but not transmitting any NM messages.

[PRS_UdpNm_00161] [It shall be possible to enable or disable the support of the Passive Mode.]([RS_Nm_00150](#), [RS_Nm_02511](#))

[PRS_UdpNm_00162] [Passive Mode shall be configured consistent for all UdpNm instances within one NM node.]([RS_Nm_02511](#))

[PRS_UdpNm_00163] [If Passive Mode is enabled, the following options shall not be used:

- Bus Synchronisation
- Remote Sleep Indication
- Node Detection

]([RS_Nm_02511](#))

5.7.2 Detection of Remote Sleep Indication

The “Remote Sleep Indication” denotes a situation, where a node in Normal Operation State finds all other nodes in the cluster are ready to sleep. The node still in Normal Operation State will still keep the bus awake.

[PRS_UdpNm_00149] [It shall be possible to enable or disable the detection of Remote Sleep Indication.]([RS_Nm_00150](#))

[PRS_UdpNm_00150] [If no NM messages are received in the Normal Operation State for a configurable amount of time determined by `UdpNmRemoteSleepIndTime`, the UdpNm shall detect that all other nodes in the cluster are ready to sleep (the so-called ‘Remote Sleep Indication’).]([RS_Nm_00052](#))

[PRS_UdpNm_00151] [If Remote Sleep Indication has been previously acknowledged and if a NM message is received in the Normal Operation State or Ready Sleep State again, the UdpNm shall detect that some nodes in the cluster are not ready to sleep anymore (the so-called ‘Remote Sleep Cancellation’).]([RS_Nm_02509](#))

[PRS_UdpNm_00152] [If Remote Sleep Indication has been previously acknowledged and if Repeat Message State is entered from Normal Operation State, the UdpNm shall detect that some nodes in the cluster are not ready to sleep anymore (the so-called ‘Remote Sleep Cancellation’).]([RS_Nm_02509](#))

[PRS_UdpNm_00154] [The NM shall reject a check of Remote Sleep Indication in Bus-Sleep Mode, Prepare Bus-Sleep Mode and Repeat Message State.]()

5.7.3 Active Wakeup Bit handling

[PRS_UdpNm_00366] [If the UdpNm performs a state change from BusSleep state or PrepareBusSleep state to NetworkMode due to an internal communication request and support of Active Wakeup Bit is enabled, the UdpNm shall set the Active Wakeup Bit to 1.]()

[PRS_UdpNm_00367] [If the UdpNm module leaves the NetworkMode and support of Active Wakeup Bit is enabled, the UdpNm module shall set the Active Wakeup Bit to 0.]()

6 Configuration parameters

The following chapter summarizes the configuration parameters referred in this specification.

Parameter	Description
UdpNmTimeoutTime	Network Timeout for NM packets. It denotes the time in [s] how long the NM shall stay in the Network Mode before transition into Prepare Bus-Sleep Mode shall take place.
UdpNmMsgCycleTime	Period of a NM-message. It determines the periodic rate and is the basis for transmit scheduling.
UdpNmRepeatMessageTime	Timeout for Repeat Message State. It defines the time in seconds how long the NM shall stay in the Repeat Message State.
UdpNmWaitBusSleepTime	Timeout for bus calm down phase. It denotes the time in [s] how long the NM shall stay in the Prepare Bus-Sleep Mode before transition into Bus-Sleep Mode shall take place.
UdpNmImmediateNmCycleTime	Defines the immediate NM message cycle time in seconds which is used for UdpNmImmediateNmTransmissions NM message transmissions.
UdpNmRemoteSleepIndTime	Timeout for Remote Sleep Indication. It defines the time in [s] how long it shall take to recognize that all other nodes are ready to sleep.
UdpNmMsgCycleOffset	Time offset in the periodic transmission node. It determines the start delay of the transmission.
UdpNmImmediateNmTransmissions	Defines the number of immediate NM message s which shall be transmitted
UdpNmImmediateRestartEnabled	Enables/disables the immediate transmission of a NM message upon bus-communication request in Prepare-Bus-Sleep mode
UdpNmPduNidPosition	Defines the position of the source node identifier within the NM message
UdpNmNodeId	Node identifier of a local node
UdpNmPduCbvPosition	Defines the position of the control bit vector within the NM message
UdpNmUserDataEnabled	Enables/disables user data support
UdpNmAllNmMessagesKeepAwake	Specifies if UdpNm drops irrelevant NM messages

Table 6.1: Configuration parameters