Document Title	Specification of Network Management for SAE J1939
Document Owner	AUTOSAR
Document Responsibility	AUTOSAR
Document Identification No	612

Document Status	published
Part of AUTOSAR Standard	Classic Platform
Part of Standard Release	R22-11

Document Change History

Date	Release	Changed by	Description
2022-11-24	R22-11	AUTOSAR Release Management	• Converted to LaTeX • Fixed generic component names
2021-11-25	R21-11	AUTOSAR Release Management	• No content changes
2020-11-30	R20-11	AUTOSAR Release Management	• Improved structure of error sections • Replaced error descriptions with generated tables
2019-11-28	R19-11	AUTOSAR Release Management	• Clarification of AC transmission • Constraint regarding detection of address conflicts • Changed Document Status from Final to published
2018-10-31	4.4.0	AUTOSAR Release Management	• Changed header file structure • Harmonized J1939NM_E_UNINIT
2017-12-08	4.3.1	AUTOSAR Release Management	• Fixed include hierarchy • Removed multiple configuration container
2016-11-30	4.3.0	AUTOSAR Release Management	• Address coordination for gateways • Improved handling of meta data • Reliable TxConfirmation replaces timeout • SetEventStatus replaces ReportErrorStatus

2015-07-31	4.2.2	AUTOSAR Release Management	• Support for networks without address claiming • Fixed state notifications to BswM • Introduction of further error classes
2014-10-31	4.2.1	AUTOSAR Release Management	• Enhanced description of extended production error J1939NM_E_ADDRESS_LOST • Fixed usage of ‘const’ in NM APIs • Harmonized with SWS BSW General
2014-03-31	4.1.3	AUTOSAR Release Management	• Introduction of random delays • Fixed state diagram • Removed configurable dummy APIs
2013-10-31	4.1.2	AUTOSAR Release Management	• Additional development errors for function parameter checks • Removed change documentation
2013-03-15	4.1.1	AUTOSAR Administration	• Initial release

Disclaimer

Contents

1 Introduction and Functional Overview

This specification specifies the functionality, API and the configuration of the AUTOSAR Basic Software module J1939 Network Management.

1.1 Network Management According to SAE J1939

In contrast to other AUTOSAR network management approaches, the task of J1939 network management is not to handle sleep and wake-up of ECUs, but to assign a unique address to each ECU.

This is achieved by sending the AddressClaimed (AC, 0x0EE00) parameter group (PG) at start-up, which announces the desired address. If another ECU claims the same address, and has higher priority, the ECU has to go silent after sending the CannotClaimAddress parameter group (AC with null address 0xFE as source address). The AddressClaimed PG must also be sent upon request.

1.2 J1939 Network Management BSW Module

The J1939 Network Management module (J1939Nm) handles received and transmitted AddressClaimed (AC) PGs. It supports transmission of AC on start-up, after a contending AC received from another node, and on request (triggered by the J1939 Request Manager).

Besides this, the J1939 Network Management module also ensures that the ECU does not send any messages during startup or after address loss.

2 Acronyms and Abbreviations

The glossary below includes acronyms and abbreviations relevant to the SAE J1939 Network Management module that are not included in the [1, AUTOSAR Glossary].

Abbreviation / Acronym	Description
AC	J1939 AddressClaimed PG (PGN = 0x0EE00), CannotClaimAddress when SA = 0xFE
BSW	Basic Software (module)
BswM	Basic Software Mode Manager
CanIf	CAN Interface
CDD	Complex Driver, any software that interfaces directly with AUTOSAR BSW, but is not defined by AUTOSAR
ComM	Communication Manager
DA	Destination Address
DET	Default Error Tracer, supports development and run-time error reporting
DEM	Diagnostic Event Manager, stores diagnostic events, including extended production errors
DP	Data Page, the most significant bit (MSB) of the 18 bit PGN
EDP	Extended Data Page, the second bit (after MSB) of the 18 bit PGN
J1939Nm	SAE J1939 Network Management
J1939Rm	SAE J1939 Request Manager
NAME	The 64 bit NAME of a Node
Node	J1939 node - can be attached to more than one channel
NodeChannel	The connection of a node to one channel
Nm	Network Management Interface
PDUF	PDU Format, the middle byte of the 18 bit PGN
PDUS	PDU Specific, the lower byte of the 18 bit PGN
PG	Parameter Group
PGN	Parameter Group Number (18 bits, contains EDP, DP, PDUF, PDUS)
RQST	J1939 Request PG (PGN = 0x0EA00)
RTE	AUTOSAR Runtime Environment
SA	Source Address
SchM	Basic Software Schedule Manager, part of the RTE

3 Related Documentation

3.1 Input Documents & Related Standards and Norms

[1] Glossary
AUTOSAR_TR_Glossary

[2] General Specification of Basic Software Modules
AUTOSAR_SWS_BSWGeneral

[3] SAE J1939-81 Network Management

[4] Layered Software Architecture
AUTOSAR_EXP_LayeredSoftwareArchitecture

[5] Specification of CAN Interface
AUTOSAR_SWS_CANInterface

[6] Specification of a Request Manager for SAE J1939
AUTOSAR_SWS_SAEJ1939RequestManager

[7] Specification of Network Management
AUTOSAR_SWS_NetworkManagement

[8] Specification of Basic Software Mode Manager
AUTOSAR_SWS_BSWModeManager

[9] Specification of Diagnostic Event Manager
AUTOSAR_SWS_DiagnosticEventManager

[10] Specification of Default Error Tracer
AUTOSAR_SWS_DefaultErrorTracer

[11] Complex Driver design and integration guideline
AUTOSAR_EXP_CDDDesignAndIntegrationGuideline

[12] Specification of ECU Configuration
AUTOSAR_TPS_ECUConfiguration

[13] Specification of Communication Manager
AUTOSAR_SWS_COMManager

[14] Requirements on BSW Modules for SAE J1939
AUTOSAR_SRS_SAEJ1939

[15] General Requirements on Basic Software Modules
AUTOSAR_SRS_BSWGeneral

[16] Specification of Communication Stack Types
AUTOSAR_SWS_CommunicationStackTypes

[17] Specification of Standard Types
AUTOSAR_SWS_StandardTypes

[18] List of Basic Software Modules
AUTOSAR_TR_BSWModuleList

[19] Specification of RTE Software
AUTOSAR_SWS_RTE

[20] System Template
AUTOSAR_TPS_SystemTemplate

3.2 Related Specifications

AUTOSAR provides a General Specification on Basic Software modules [2, SWS BSW General], which is also valid for SAE J1939 Network Management.

Thus, the specification [2, SWS BSW General] shall be considered as additional and required specification for SAE J1939 Network Management.

4 Constraints and assumptions

4.1 Limitations

The J1939 Network Management module does not support all features defined in [3, SAE J1939-81], especially:

- Changing the address of a node after reception of CommandedAddress or after an address loss.
- Changing the NAME of a node using the Name Management protocol.
- Detection of address violations by messages other than AddressClaimed.

4.2 Applicability to Car Domains

J1939 is developed by the SAE as a standard for heavy-duty on-highway, farming, and construction vehicles. It is not applicable to passenger cars or light trucks.

5 Dependencies to Other Modules

The [4, EXP Layered Software Architecture] shows an overview of the neighboring modules of the J1939 Network Management.

The J1939 Network Management module (J1939Nm) has direct interfaces and/or configuration dependencies towards the CAN Interface (CanIf, [5, SWS CAN Interface]), the J1939 Request Manager (J1939Rm, [6, SWS SAE J1939 Request Manager]), the Network Management Interface (Nm, [7, SWS Network Management]), the Basic Software Mode Manager (BswM, see [8, SWS Basic Software Mode Manager]), the Diagnostic Event Manager (DEM, [9, SWS Diagnostic Event Manager]), and the Default Error Tracer (DET, [10, SWS Default Error Tracer]), and also to Complex Drivers (CDD, see [11, CDD Design And Integration Guideline] and [12, TPS ECU Configuration]). Besides these, there are also indirect dependencies towards the Communication Manager (ComM, [13, SWS Communication Manager]).

The J1939 Network Management module includes header files of the CAN Interface, the Network Management Interface, the J1939 Request Manager, the Diagnostic Event Manager, and the Default Error Tracer.

5.1 File Structure

5.1.1 Code File Structure

For details, refer to the subsection 5.1.6 “Code file structure” of the [2, SWS BSW General].

5.1.2 Header File Structure

For details, refer to the subsection 5.1.7 “Header file structure” of the [2, SWS BSW General].

6 Requirements Tracing

The following tables reference the requirements specified in [14, SRS SAE J1939] (Requirements on BSW Modules for SAE J1939) and [15, SRS BSW General] and links to the fulfillment of these.

Requirement	Description	Satisfied by
[SRS_BSW_00005]	Modules of the μC Abstraction Layer (MCAL) may not have hard coded horizontal interfaces	[SWS_J1939Nm_NA]
[SRS_BSW_00161]	The AUTOSAR Basic Software shall provide a microcontroller abstraction layer which provides a standardized interface to higher software layers	[SWS_J1939Nm_NA]
[SRS_BSW_00162]	The AUTOSAR Basic Software shall provide a hardware abstraction layer	[SWS_J1939Nm_NA]
[SRS_BSW_00168]	SW components shall be tested by a function defined in a common API in the Basis-SW	[SWS_J1939Nm_NA]
[SRS_BSW_00171]	Optional functionality of a Basic-SW component that is not required in the ECU shall be configurable at pre-compile-time	[SWS_J1939Nm_00059] [SWS_J1939Nm_00060]
[SRS_BSW_00330]	It shall be allowed to use macros instead of functions where source code is used and runtime is critical	[SWS_J1939Nm_NA]
[SRS_BSW_00343]	The unit of time for specification and configuration of Basic SW modules shall be preferably in physical time unit	[SWS_J1939Nm_NA]
[SRS_BSW_00350]	All AUTOSAR Basic Software Modules shall allow the enabling/disabling of detection and reporting of development errors.	[SWS_J1939Nm_00005]
[SRS_BSW_00351]	Encapsulation of compiler specific methods to map objects	[SWS_J1939Nm_NA]
[SRS_BSW_00375]	Basic Software Modules shall report wake-up reasons	[SWS_J1939Nm_NA]
[SRS_BSW_00377]	A Basic Software Module can return a module specific types	[SWS_J1939Nm_NA]
[SRS_BSW_00385]	List possible error notifications	[SWS_J1939Nm_00012]
[SRS_BSW_00386]	The BSW shall specify the configuration and conditions for detecting an error	[SWS_J1939Nm_00005] [SWS_J1939Nm_00025] [SWS_J1939Nm_00026] [SWS_J1939Nm_00067]
[SRS_BSW_00399]	Parameter-sets shall be located in a separate segment and shall be loaded after the code	[SWS_J1939Nm_NA]

Requirement	Description	Satisfied by
[SRS_BSW_00406]	A static status variable denoting if a BSW module is initialized shall be initialized with value 0 before any APIs of the BSW module is called	[SWS_J1939Nm_00002]
[SRS_BSW_00407]	Each BSW module shall provide a function to read out the version information of a dedicated module implementation	[SWS_J1939Nm_00033]
[SRS_BSW_00413]	An index-based accessing of the instances of BSW modules shall be done	[SWS_J1939Nm_NA]
[SRS_BSW_00416]	The sequence of modules to be initialized shall be configurable	[SWS_J1939Nm_NA]
[SRS_BSW_00417]	Software which is not part of the SW-C shall report error events only after the Dem is fully operational.	[SWS_J1939Nm_NA]
[SRS_BSW_00419]	If a pre-compile time configuration parameter is implemented as `const` it should be placed into a separate c-file	[SWS_J1939Nm_NA]
[SRS_BSW_00422]	Pre-de-bouncing of error status information is done within the Dem	[SWS_J1939Nm_NA]
[SRS_BSW_00425]	The BSW module description template shall provide means to model the defined trigger conditions of schedulable objects	[SWS_J1939Nm_NA]
[SRS_BSW_00449]	BSW Service APIs used by Autosar Application Software shall return a Std_ReturnType	[SWS_J1939Nm_NA]
[SRS_BSW_00453]	BSW Modules shall be harmonized	[SWS_J1939Nm_NA]
[SRS_BSW_00456]	A Header file shall be defined in order to harmonize BSW Modules	[SWS_J1939Nm_NA]
[SRS_BSW_00458]	Classification of production errors	[SWS_J1939Nm_NA]
[SRS_BSW_00466]	Classification of extended production errors	[SWS_J1939Nm_00012]
[SRS_BSW_00469]	Fault detection and healing of production errors and extended production errors	[SWS_J1939Nm_00012]
[SRS_BSW_00470]	Execution frequency of production error detection	[SWS_J1939Nm_00012]
[SRS_BSW_00471]	Do not cause dead-locks on detection of production errors - the ability to heal from previously detected production errors	[SWS_J1939Nm_00012]
[SRS_BSW_00472]	Avoid detection of two production errors with the same root cause.	[SWS_J1939Nm_00012]

Requirement	Description	Satisfied by
[SRS_BSW_00473]	Classification of transient faults	[SWS_J1939Nm_NA]
[SRS_BSW_00478]	Timing limits of main functions	[SWS_J1939Nm_00006] [SWS_J1939Nm_00039]
[SRS_BSW_00479]	Interfaces for handling request from external devices	[SWS_J1939Nm_NA]
[SRS_BSW_00490]	List possible security events	[SWS_J1939Nm_NA]
[SRS_BSW_00492]	Reporting of security events during startup	[SWS_J1939Nm_NA]
[SRS_BSW_00494]	ServiceInterface argument with a pointer datatype	[SWS_J1939Nm_NA]
[SRS_BSW_00495]	If tracing is enabled, all AUTOSAR Basic Software Modules should allow tracing its entry and exit points.	[SWS_J1939Nm_NA]
[SRS_J1939_-00001]	The J1939 Transport Layer module shall be configurable to support only transport protocol variant BAM	[SWS_J1939Nm_NA]
[SRS_J1939_-00002]	The J1939 Transport Layer module shall identify each N-SDU with a unique identifier	[SWS_J1939Nm_NA]
[SRS_J1939_-00003]	The N-PDUs used to transport a J1939Tp N-SDUs shall be statically configured	[SWS_J1939Nm_NA]
[SRS_J1939_-00004]	The J1939 Transport Layer module shall identify each N-PDU with a unique identifier	[SWS_J1939Nm_NA]
[SRS_J1939_-00005]	The local addresses of the ECU shall be configurable	[SWS_J1939Nm_NA]
[SRS_J1939_-00006]	The properties of a J1939Tp N-SDU shall be statically configured	[SWS_J1939Nm_NA]
[SRS_J1939_-00007]	The queue size for transmitted PGs shall be configurable	[SWS_J1939Nm_NA]
[SRS_J1939_-00008]	Requestable PGNs shall be configurable	[SWS_J1939Nm_NA]
[SRS_J1939_-00009]	The upper layers using J1939 Request Manager services shall be configurable	[SWS_J1939Nm_NA]
[SRS_J1939_-00010]	The J1939 Transport Layer module shall implement an interface for initialization	[SWS_J1939Nm_NA]
[SRS_J1939_-00011]	The J1939 Transport Layer services shall not be operational before initializing the module	[SWS_J1939Nm_NA]
[SRS_J1939_-00012]	The J1939 Request Manager shall provide an interface for module initialization	[SWS_J1939Nm_NA]
[SRS_J1939_-00013]	The J1939 Request Manager shall provide an interface for module shutdown	[SWS_J1939Nm_NA]
[SRS_J1939_-00014]	The J1939 Request Manager shall forward incoming requests to configured destinations	[SWS_J1939Nm_NA]

Requirement	Description	Satisfied by
[SRS_J1939_-00015]	The J1939 Request Manager shall forward incoming acknowledgements to configured destinations	[SWS_J1939Nm_NA]
[SRS_J1939_-00016]	The J1939 Request Manager shall provide an interface for transmission of request messages	[SWS_J1939Nm_NA]
[SRS_J1939_-00017]	The J1939 Request Manager shall provide an interface for transmission of acknowledgement messages	[SWS_J1939Nm_NA]
[SRS_J1939_-00018]	The AUTOSAR J1939 Transport Layer module shall support concurrent connections	[SWS_J1939Nm_NA]
[SRS_J1939_-00019]	The J1939 Transport Layer module shall support the transport protocol variant BAM	[SWS_J1939Nm_NA]
[SRS_J1939_-00020]	The AUTOSAR J1939 Transport Layer module shall support the transport protocol variant CMDT	[SWS_J1939Nm_NA]
[SRS_J1939_-00021]	The J1939 Transport Layer module shall be compliant with the CAN Interface module notifications	[SWS_J1939Nm_NA]
[SRS_J1939_-00022]	The timeout values of the J1939 transport protocol variants shall be supervised	[SWS_J1939Nm_NA]
[SRS_J1939_-00023]	The J1939 Transport Layer module shall handle unexpected PDUs according to the SAE J1939 specification	[SWS_J1939Nm_NA]
[SRS_J1939_-00024]	Unused Bytes in N-PDUs shall be padded	[SWS_J1939Nm_NA]
[SRS_J1939_-00025]	The J1939 Transport Layer module shall be able to manage connections via BAM and CMDT in parallel	[SWS_J1939Nm_NA]
[SRS_J1939_-00026]	The J1939 Request Manager shall support timeout supervision for outgoing requests	[SWS_J1939Nm_NA]
[SRS_J1939_-00030]	The J1939 Network Management module shall provide an interface for module initialization	[SWS_J1939Nm_00002] [SWS_J1939Nm_00007] [SWS_J1939Nm_00031]
[SRS_J1939_-00031]	The J1939 Network Management module shall provide an interface for module shutdown	[SWS_J1939Nm_00003] [SWS_J1939Nm_00032]
[SRS_J1939_-00032]	The J1939 Network Management module shall report a failed address claim to the Diagnostic Event Manager	[SWS_J1939Nm_00012]

Requirement	Description	Satisfied by
[SRS_J1939_-00033]	The J1939 Network Management module shall perform an initial address claim at startup	[SWS_J1939Nm_00009] [SWS_J1939Nm_00016] [SWS_J1939Nm_00017] [SWS_J1939Nm_00019] [SWS_J1939Nm_00062] [SWS_J1939Nm_00073]
[SRS_J1939_-00034]	The J1939 Network Management module shall react correctly to contending address claims	[SWS_J1939Nm_00014] [SWS_J1939Nm_00016] [SWS_J1939Nm_00017] [SWS_J1939Nm_00018] [SWS_J1939Nm_00019] [SWS_J1939Nm_00020] [SWS_J1939Nm_00021] [SWS_J1939Nm_00062] [SWS_J1939Nm_00068] [SWS_J1939Nm_00069] [SWS_J1939Nm_00073] [SWS_J1939Nm_00074]
[SRS_J1939_-00035]	The J1939 Network Management module shall react to requests for the Address Claimed PG	[SWS_J1939Nm_00016] [SWS_J1939Nm_00017] [SWS_J1939Nm_00018] [SWS_J1939Nm_00019] [SWS_J1939Nm_00022] [SWS_J1939Nm_00023] [SWS_J1939Nm_00043] [SWS_J1939Nm_00062] [SWS_J1939Nm_00073]
[SRS_J1939_-00036]	The J1939 Network Management module shall only allow communication after a successful address claim	[SWS_J1939Nm_00010] [SWS_J1939Nm_00011] [SWS_J1939Nm_00015] [SWS_J1939Nm_00021] [SWS_J1939Nm_00044] [SWS_J1939Nm_00045] [SWS_J1939Nm_00063] [SWS_J1939Nm_00064] [SWS_J1939Nm_00065] [SWS_J1939Nm_00066]
[SRS_J1939_-00037]	The J1939 Network Management module shall delay communication after initial address claim	[SWS_J1939Nm_00010] [SWS_J1939Nm_00013] [SWS_J1939Nm_00061] [SWS_J1939Nm_00063]
[SRS_J1939_-00038]	The J1939 Transport Layer module shall provide an API to shut down operation of the module	[SWS_J1939Nm_NA]
[SRS_J1939_-00039]	The J1939 Transport Layer module shall be able to cope with invalid values in received TP frames	[SWS_J1939Nm_NA]
[SRS_J1939_-00040]	The AUTOSAR J1939 Transport Layer module shall be based on SAE J1939 specifications	[SWS_J1939Nm_NA]

Requirement	Description	Satisfied by
[SRS_J1939_-00041]	The J1939 Transport Layer module shall implement transport protocol functionalities in the layered software architecture	[SWS_J1939Nm_NA]
[SRS_J1939_-00042]	The J1939 Transport Layer interface shall be independent of its internal configuration	[SWS_J1939Nm_NA]
[SRS_J1939_-00043]	The J1939 Transport Layer module shall support generic channels	[SWS_J1939Nm_NA]
[SRS_J1939_-00044]	The J1939 Transport Layer module shall support generic N-SDUs	[SWS_J1939Nm_NA]
[SRS_J1939_-00045]	The J1939 Transport Layer module shall handle protocol timeout	[SWS_J1939Nm_NA]
[SRS_J1939_-00046]	The J1939 Transport Layer module shall support automatic calculation of block sizes	[SWS_J1939Nm_NA]
[SRS_J1939_-00047]	The J1939 Transport Layer module shall support retransmission of lost TP.DT frames	[SWS_J1939Nm_NA]
[SRS_J1939_-00048]	The J1939 Transport Layer module shall support cancellation of ongoing reception and transmission	[SWS_J1939Nm_NA]
[SRS_J1939_-00049]	J1939 Modules shall support MetaData	[SWS_J1939Nm_00073] [SWS_J1939Nm_00074]
[SRS_J1939_-00050]	The J1939 Request Manager shall route incoming requests and acknowledgements to connected channels	[SWS_J1939Nm_NA]
[SRS_J1939_-00051]	The J1939 Network Management module shall route received address claims to connected channels	[SWS_J1939Nm_00071] [SWS_J1939Nm_00072]
[SRS_J1939_NA]		[SWS_J1939Nm_NA]

7 Functional Specification

This chapter defines the behavior of the J1939 Network Management module. The API of the module is defined in chapter 8, while the configuration is defined in chapter chapter 10.

7.1 Overview

The J1939 Network Management module supports transmission and reception of AddressClaimed PGs, and handling of requests for the AddressClaimed PG. It also ensures that the ECU does not send messages during the initial address claiming phase or after the ECU sent a CannotClaimAddress PG because it lost its address to a contending address claim.

7.2 Module Handling

This section contains description of auxiliary functionality of the J1939 Network Management module.

7.2.1 Initialization

The J1939 Network Management module is initialized via J1939Nm_Init, and de-initialized via J1939Nm_DeInit. Except for J1939Nm_GetVersionInfo and J1939Nm_Init, the API functions of the J1939 Network Management module may only be called after the module has been properly initialized.

[SWS_J1939Nm_00002] ⌈A call to J1939Nm_Init initializes all internal variables and sets the J1939 Network Management module to the initialized state.⌋*(SRS_J1939_00030, SRS_BSW_00406)*

[SWS_J1939Nm_00003] ⌈A call to J1939Nm_DeInit sets the J1939 Network Management module back to the uninitialized state.⌋*(SRS_J1939_00031)*

[SWS_J1939Nm_00005] ⌈When J1939Nm_Init is called in initialized state, the J1939 Network Management module shall not re-initialize its internal variables. It shall instead call Det_ReportError with the error code J1939NM_E_REINIT if development error detection is enabled via J1939NmDevErrorDetect.⌋*(SRS_BSW_00350, SRS_BSW_00386)*

7.2.2 Timing Related Functionality

To be able to measure times, the J1939 Network Management module is triggered cyclically via the J1939Nm_MainFunction.

[SWS_J1939Nm_00006] ⌈The J1939 Network Management module shall use the J1939Nm_MainFunction for timing related purposes.⌋ *(SRS_BSW_00478)*

The recovery after a bus off must be delayed by a random time to avoid repeating bus offs when two nodes try to claim the same address. This random delay is also required when sending a CannotClaimAddress PG after a contending address claim or after a request for the AddressClaimed PG.

[SWS_J1939Nm_00068] ⌈The J1939Nm shall calculate a random number for delaying bus off recovery and transmission of a CannotClaimAddress PG. The calculation shall use the NAME of a node as seed.⌋ *(SRS_J1939_00034)*

[SWS_J1939Nm_00069] ⌈When J1939Nm_GetBusOffDelay is called, J1939Nm shall return a random number based on the NAMEs of all nodes attached to the reported channel. This random number gives the delay time, based on the tick time configured via J1939NmBusOffDelayTickPeriod.⌋ *(SRS_J1939_00034)*

7.3 Network Management States of the J1939Nm

While the NM Interface handles network management states on channel level, the J1939 Network Management module needs a finer granularity, because several nodes can be attached to each channel. The connection of a node to one channel is called NodeChannel hereafter.

The following picture shows the internal NM related states of the J1939 Network Management module for one of its NodeChannels (i.e. one channel of a single node), and the transitions between these states:

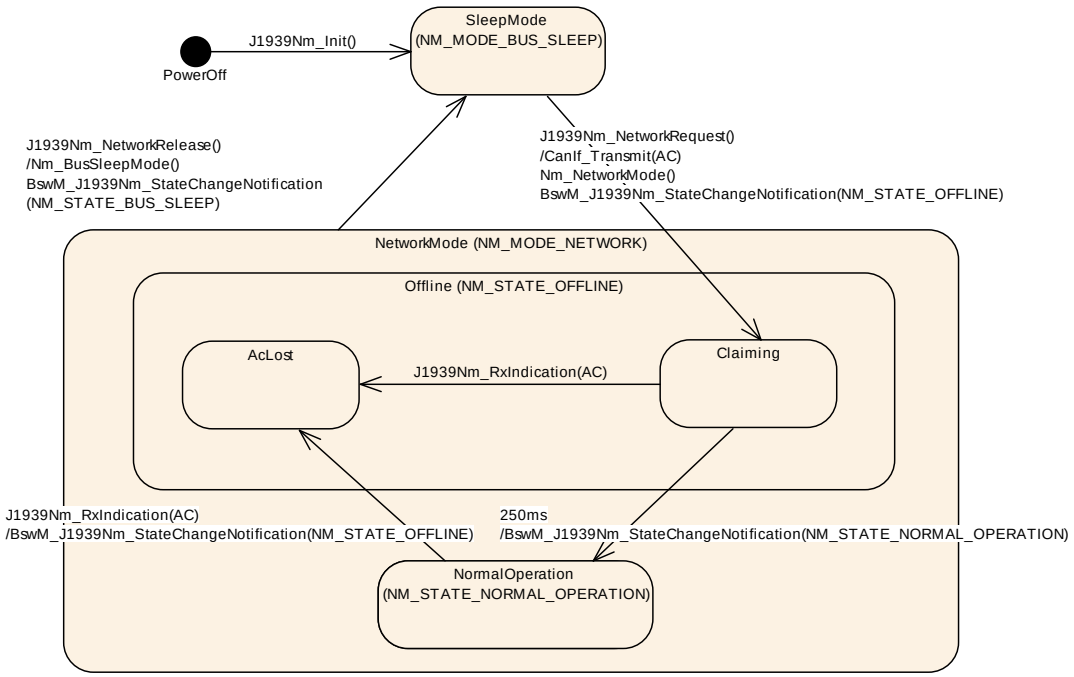

Figure 7.1: Internal states of J1939Nm with startup delay

The J1939 Network Management module reports state changes to the NM Interface and to the Basic Software Mode Manager.

While the states reported to the NM Interface are accumulated states of all NodeChannels of a CAN channel, the J1939 Network Management module reports states to the BswM separately for each NodeChannel.

7.3.1 ECU Startup

The J1939 Network Management module starts all NodeChannels in 'SleepMode' (corresponding to NM_MODE_BUS_SLEEP). The CAN channels will be switched to 'NetworkMode' (corresponding to NM_MODE_NETWORK) immediately afterwards by a network request issued from the ComM via NM Interface.

[SWS_J1939Nm_00007] ⌈During initialization via J1939Nm_Init, the J1939 Network Management module shall silently assume the 'SleepMode' for all NodeChannels.⌋*(SRS_J1939_00030)*

[SWS_J1939Nm_00009] ⌈A call to J1939Nm_NetworkRequest shall set all NodeChannels of the reported channel to 'NetworkMode'. The J1939 Network Management module shall notify this mode change to the NM Interface via Nm_NetworkMode, and shall trigger transmission of an AddressClaimed PG for each NodeChannel where J1939NmChannelUsesAddressArbitration is enabled.⌋*(SRS_J1939_00033)*

The transmission of the AddressClaimed PG is described in detail in section 7.4.

When entering the network mode, the behavior of the J1939 Network Management module depends on the configuration parameter J1939NmNodeStartUpDelay. Controlled by this parameter, the J1939 Network Management module switches the state of the affected NodeChannels either to the sub state 'Claiming' of the state 'Offline' (corresponding to NM_STATE_OFFLINE), or to the state 'NormalOperation' (corresponding to NM_STATE_NORMAL_OPERATION).

[SWS_J1939Nm_00010] ⌈If a node of the J1939 Network Management module is configured for deferred online state (J1939NmNodeStartUpDelay enabled), its NodeChannels shall enter the sub state 'Claiming' of the state 'Offline' immediately after the switch from 'SleepMode' to 'NetworkMode'. The J1939 Network Management module shall report this state change to the Basic Software Mode Manager via BswM_J1939Nm_StateChangeNotification(NM_STATE_OFFLINE).⌋*(SRS_J1939_00036, SRS_J1939_00037)*

[SWS_J1939Nm_00011] ⌈If a node of the J1939 Network Management module is configured for immediate online state (J1939NmNodeStartUpDelay disabled), its NodeChannels shall enter the state 'NormalOperation' immediately after the switch from 'SleepMode' to 'NetworkMode'. The J1939 Network Management module shall report this state change to the Basic Software Mode Manager via BswM_J1939Nm_StateChangeNotification(NM_STATE_NORMAL_OPERATION).⌋*(SRS_J1939_00036)*

The NM Interface expects an accumulated channel state.

[SWS_J1939Nm_00063] ⌈When all NodeChannels of a channel are configured for deferred online state (J1939NmNodeStartUpDelay enabled), the J1939 Network Management module shall report the state change of these NodeChannels to the 'Offline' state immediately to the NM Interface via Nm_StateChangeNotification(NM_STATE_OFFLINE).⌋*(SRS_J1939_00036, SRS_J1939_00037)*

[SWS_J1939Nm_00064] ⌈When the first NodeChannel of a channel changes its state to 'NormalOperation', the J1939 Network Management module shall report this state change immediately to the NM Interface via Nm_StateChangeNotification(NM_STATE_NORMAL_OPERATION).⌋*(SRS_J1939_00036)*

When a NodeChannel has stayed for 250ms in state 'Claiming' after transmission of the initial AddressClaimed PG, it will switch to state 'NormalOperation'.

[SWS_J1939Nm_00061] ⌈When J1939Nm_TxConfirmation is called with result E_OK for the initial AddressClaimed PG of a NodeChannel (transmitted during the transition to the 'Claiming' sub state), the J1939 Network Management module shall start the delay timer for this NodeChannel.⌋*(SRS_J1939_00037)*

[SWS_J1939Nm_00013] ⌈When the delay timer of a NodeChannel expires in sub state 'Claiming', the J1939 Network Management module shall switch that NodeChannel to state 'NormalOperation' and shall report this state change to the Basic Software Mode Manager via

BswM_J1939Nm_StateChangeNotification(NM_STATE_NORMAL_OPERATION) .⌋(*SRS_J1939_00037*)

7.3.2 Address Loss

When a node of the J1939 Network Management module loses its claimed address on one of its channels (see section 7.5), it will switch that NodeChannel to the sub state 'AcLost' of state 'Offline', notifying the NM Interface and the BswM of this state change and sending a CannotClaimAddress PG for the losing node on that channel (see section 7.4).

[SWS_J1939Nm_00014] ⌈When a NodeChannel loses its address in 'NetworkMode', it shall switch to the sub state 'AcLost' of state 'Offline' and, after a delay calculated according to [SWS_J1939Nm_00068], trigger transmission of a CannotClaimAddress PG.⌋(*SRS_J1939_00034*)

[SWS_J1939Nm_00065] ⌈When a NodeChannel switches from state 'NormalOperation' to the sub state 'AcLost' of state 'Offline', the J1939 Network Management module shall notify the Basic Software Mode Manager via BswM_J1939Nm_StateChangeNotification(NM_STATE_OFFLINE).⌋(*SRS_J1939_00036*)

[SWS_J1939Nm_00066] ⌈When the last NodeChannel of a channel changes its state to 'Offline', the J1939 Network Management module shall report this state change immediately to the NM Interface via Nm_StateChangeNotification (NM_STATE_OFFLINE).⌋(*SRS_J1939_00036*)

7.3.3 ECU Shutdown

To shut down the network, ComM calls the Nm_NetworkRelease API of the NM Interface, which in turn calls J1939Nm_NetworkRelease. The J1939 Network Management module will then switch to 'SleepMode', and notify this to the NM Interface.

[SWS_J1939Nm_00015] ⌈A call to J1939Nm_NetworkRelease shall set all NodeChannels of the reported channel to 'SleepMode'. The J1939 Network Management module shall notify this mode change to the NM Interface via Nm_BusSleepMode, and shall report a state change to 'SleepMode' to the NM Interface via Nm_StateChangeNotification(NM_STATE_BUS_SLEEP) and to BswM via BswM_J1939Nm_StateChangeNotification(NM_STATE_BUS_SLEEP) .⌋(*SRS_J1939_00036*)

7.4 Transmission of AddressClaimed

For each NodeChannel, the J1939 Network Management module needs to ensure that a contending AddressClaimed PG or a request for AddressClaimed is answered by at least one AddressClaimed PG. If an AddressClaimed PG is still pending for that NodeChannel, but now a CannotClaimAddress PG must be sent, it suffices to send the CannotClaimAddress. Therefore, a single buffer per NodeChannel that stores only the last transmission request is sufficient.

For the transmission of both the AddressClaimed and the CannotClaimAddress PG, the J1939 Network Management module uses just one PDU per channel with variable source address contained in the meta data of the PDU.

[SWS_J1939Nm_00016] ⌈When the J1939 Network Management module needs to send an AddressClaimed (or CannotClaimAddress) PG, and no previous transmission is pending, it shall directly forward the corresponding PDU to the CAN Interface via CanIf_Transmit.⌋*(SRS_J1939_00033, SRS_J1939_00034, SRS_J1939_00035)*

[SWS_J1939Nm_00073] ⌈The J1939 Network Management module shall use a meta data item of type CAN_ID_32 to provide the source address of transmitted AddressClaimed and CannotClaimAddress PGs. The source address resides in the last (least significant) byte of the meta data item.⌋*(SRS_J1939_00033, SRS_J1939_00034, SRS_J1939_00035, SRS_J1939_00049)*

[SWS_J1939Nm_00017] ⌈When the J1939 Network Management module needs to send an AddressClaimed (or CannotClaimAddress) PG, and the CAN Interface has not yet called J1939Nm_TxConfirmation for the previous transmission, the J1939 Network Management module shall buffer this PG for later transmission.⌋*(SRS_J1939_00033, SRS_J1939_00034, SRS_J1939_00035)*

[SWS_J1939Nm_00018] ⌈Apart from the initial AddressClaimed PG, the J1939 Network Management module shall buffer only the latest AddressClaimed or CannotClaimAddress PG.⌋*(SRS_J1939_00034, SRS_J1939_00035)*

Rationale: The initial AddressClaimed PG must be transmitted before any CannotClaimAddress PG according to [3, SAE J1939-81]. Otherwise, the J1939 Network Management module should report current state even if the original request preceded a state change.

[SWS_J1939Nm_00019] ⌈A call to J1939Nm_TxConfirmation with result E_OK shall trigger transmission of a buffered AddressClaimed or CannotClaimAddress PG via CanIf_Transmit.⌋*(SRS_J1939_00033, SRS_J1939_00034, SRS_J1939_00035)*

[SWS_J1939Nm_00062] ⌈When CanIf_Transmit returns with E_NOT_OK or when J1939Nm_TxConfirmation is called with result E_NOT_OK, the transmission of that PG shall be triggered again.⌋*(SRS_J1939_00033, SRS_J1939_00034, SRS_J1939_00035)*

7.5 Reception of AddressClaimed

The source address of received AddressClaimed PGs must be immediately compared to the source addresses of all NodeChannels attached to the same channel (see J1939NmNodePreferredAddress). If any of these matches, the payload of the received PG must be compared to the configured NAME for the matching source address (see J1939NmNodeNameXxx), and depending on the relative priority, the J1939 Network Management module must send an AddressClaimed or a CannotClaimAddress PG. The priority is determined by the numerical value of the NAME.

To be able to identify the source address, the PDU associated with the AddressClaimed PG shall have a variable source address contained in the meta data of the PDU. In addition, the priority needs to be ignored for this PDU.

[SWS_J1939Nm_00074] ⌈The J1939 Network Management module shall use a meta data item of type CAN_ID_32 to determine the source address of received AddressClaimed and CannotClaimAddress PGs. The source address resides in the last (least significant) byte of the meta data item.⌋ *(SRS_J1939_00034, SRS_J1939_00049)*

[SWS_J1939Nm_00020] ⌈If J1939NmChannelUsesAddressArbitration is enabled, a call to J1939Nm_RxIndication indicating reception of an AddressClaimed PG with one of the source addresses configured via J1939NmNodePreferredAddress and a payload that has a higher numerical value than the NAME for this source address configured via J1939NmNodeNameXxx shall trigger transmission of an AddressClaimed PG for the according NodeChannel.⌋ *(SRS_J1939_00034)*

See also section 7.4.

[SWS_J1939Nm_00021] ⌈If J1939NmChannelUsesAddressArbitration is enabled, a call to J1939Nm_RxIndication indicating reception of an AddressClaimed PG with one of the source addresses configured via J1939NmNodePreferredAddress and a payload that has a lower numerical value than the NAME for this source address configured via J1939NmNodeNameXxx shall induce a state change of the according NodeChannel to the sub state 'AcLost' of state 'Offline'.⌋ *(SRS_J1939_00034, SRS_J1939_00036)*

The state change to 'Offline' will be notified to the NM Interface and the Basic Software Mode Manager and will trigger transmission of a CannotClaimAddress PG (see section 7.4).

Sometimes, the application needs to know the content of all AddressClaimed messages on the bus, e.g. to build up a table that maps functions to addresses. The J1939 Network Management module shall support this use case via a generic callout function (see section 7.5).

[SWS_J1939Nm_00060] ⌈If enabled via J1939NmUserCallout, the J1939Nm shall forward the source address and the content of each AddressClaimed PG to the call-out function <User_AddressClaimedIndication> (see [SWS_J1939Nm_00028]).⌋ *(SRS_BSW_00171)*

7.6 Request for AddressClaimed

When the J1939 Network Management module receives a request for the AddressClaimed PGN from the J1939 Request Manager, it will answer either with an AddressClaimed or with a CannotClaimAddress PG, depending on the current state (see below).

Independent of the request being global or specific, the transmitted PG is always global.

[SWS_J1939Nm_00022] ⌈A call to J1939Nm_RequestIndication shall trigger transmission of an AddressClaimed PG when the addressed NodeChannel is in state 'NormalOperation' or sub state 'Claiming' of state 'Offline'.⌋ *(SRS_J1939_00035)*

[SWS_J1939Nm_00023] ⌈A call to J1939Nm_RequestIndication shall trigger transmission of a CannotClaimAddress PG after a delay calculated according to [SWS_J1939Nm_00068] when the addressed NodeChannel is in sub state 'AcLost' of state 'Offline'.⌋ *(SRS_J1939_00035)*

The J1939Nm_RequestIndication will never be triggered in state 'SleepMode', because then no CAN messages can be received.

7.7 Address Coordination

The J1939 Network Management module is able to coordinate the addresses of different J1939 channels connected to a gateway, so that routed messages have valid addresses on every bus on which they appear.

There are two basic strategies:

1. Several J1939 channels form one common address space. In this scenario, the J1939 Network Management module replicates all AddressClaimed messages appearing on one of the networks on all other networks of the same address space. Nodes connected via the gateway perform a direct arbitration of addresses.
2. Selected nodes of one channel appear also on one or more other channels. In this scenario, the J1939 Network Management module claims the addresses of configured external nodes. Address arbitration is performed between the gateway and the nodes on one channel.

A single gateway can combine both strategies for different sets of channels. The main difference of the strategies is that addresses are not shared in the second strategy, and therefore more than 254 nodes can be present within one system.

[SWS_J1939Nm_00071] ⌈If gateway support is enabled via J1939NmGatewaySupport, and the configuration contains a J1939NmSharedAddressSpace, the J1939Nm shall transmit all AddressClaimed messages received on one of the channels referenced by J1939NmSharedAddressSpace on all other channels referenced by the same J1939NmSharedAddressSpace.⌋ *(SRS_J1939_00051)*

[SWS_J1939Nm_00072] ⌈If gateway support is enabled via J1939NmGatewaySupport, and the configuration contains a J1939NmExternalNode, the channels referenced by J1939NmExternalNodeGatewayedChannelRef shall be treated like internal NodeChannels, with the difference that the state transition from 'SleepMode' to 'NetworkMode' is triggered by the reception of an AddressClaimed message from the external node and enters 'NormalOperation' immediately, and the transition to 'SleepMode' is triggered by the reception of a CannotClaimAddress message from the same node.⌋ *(SRS_J1939_00051)*

7.8 Error Classification

Section 7.2 "Error Handling" of the document [2, SWS BSW General] describes the error handling of the Basic Software in detail. Above all, it constitutes a classification scheme consisting of five error types which may occur in BSW modules.

Based on this foundation, this section specifies particular errors arranged in the respective subsections below.

7.8.1 Development Errors

[SWS_J1939Nm_00024] ⌈

Type of error	*Related error code*	*Error value*
An API was called while the module was uninitialized	J1939NM_E_UNINIT	0x01
The Init API was called twice	J1939NM_E_REINIT	0x02
J1939Nm_Init was called with an invalid configuration pointer	J1939NM_E_INIT_FAILED	0x03
An API service was called with a NULL pointer	J1939NM_E_PARAM_POINTER	0x10
An API service was called with a wrong ID	J1939NM_E_INVALID_PDU_SDU_ID	0x11
An API service was called with wrong network handle	J1939NM_E_INVALID_NETWORK_ID	0x12
An API was called with an unsupported PGN	J1939NM_E_INVALID_PGN	0x13

▽

△

Type of error	*Related error code*	*Error value*
An API was called with an illegal priority	J1939NM_E_INVALID_PRIO	0x14
An API was called with an illegal node address	J1939NM_E_INVALID_ADDRESS	0x15
An API was called with an illegal node ID	J1939NM_E_INVALID_NODE	0x16

⌋()

7.8.2 Runtime Errors

Runtime errors have not yet been classified.

7.8.3 Transient Faults

There are no transient faults.

7.8.4 Production Errors

There are no production errors.

7.8.5 Extended Production Errors

Extended production errors are handled as events of the Diagnostic Event Manager. The event IDs are defined in the following tables, while the actual values are assigned externally by the configuration of the Diagnostic Event Manager, and are included in the J1939 Network Management module via Dem.h.

[SWS_J1939Nm_00012] ⌈

Error Name:	J1939NM_E_ADDRESS_LOST
Short Description:	The desired address could not be claimed.
Long Description:	During start-up of the ECU, all J1939Nm nodes need to send an address claim to the bus and wait for acceptance of the claimed address. If another ECU claims the same address and has a higher priority, the ECU loses its address and stops communication. This is a critical problem, because J1939Nm was not specified for networks where this can happen.

▽

△

Detection Criteria:	Fail	When address claiming failed, because an AddressClaimed message with higher priority was received (see [SWS_J1939Nm_00021]), the J1939 Network Management module shall report the extended production error J1939NM_E_ADDRESS_LOST with event status DEM_EVENT_STATUS_PREFAILED to DEM.
	Pass	When address claiming succeeded, because the J1939 Network Management entered the state 'NormalOperation' (see [SWS_J1939Nm_00011] and [SWS_J1939Nm_00013]), the J1939 Network Management module shall report the extended production error J1939NM_E_ADDRESS_LOST with event status DEM_EVENT_STATUS_PREPASSED to DEM.
Secondary Parameters:	Address claiming is started when a node enters NetworkMode for a channel.	
Time Required:	Typically 250ms after changing to NetworkMode, but possible during entire run time when addresses can change at run time or ECUs are attached later (or wake up later).	
Monitor Frequency	The bus is continuously monitored for AddressClaimed messages.	

⌋(*SRS_J1939_00032*, *SRS_BSW_00385*, *SRS_BSW_00466*, *SRS_BSW_00469*, *SRS_BSW_00470*, *SRS_BSW_00471*, *SRS_BSW_00472*)

8 API Specification

8.1 API Parameter Checking

The J1939 Network Management module performs parameter checks for all called APIs. It reports the development error J1939NM_E_INVALID_PDU_SDU_ID when a check of a PDU/SDU ID fails, J1939NM_E_INVALID_NETWORK_ID when a check of a network handle fails, and J1939NM_E_PARAM_POINTER when a call provides a NULL pointer.

[SWS_J1939Nm_00025] ⌈If development error detection is enabled via J1939NmDevErrorDetect, the J1939 Network Management module shall check PduIdType parameters (SDU/PDU IDs) of its API functions against the configured IDs, and shall report the development error J1939NM_E_INVALID_PDU_SDU_ID when an unknown ID is provided by the call.⌋ *(SRS_BSW_00386)*

[SWS_J1939Nm_00026] ⌈If development error detection is enabled via J1939NmDevErrorDetect, the J1939 Network Management module shall check NetworkHandleType parameters (network handles) of its API functions against the referenced network handles of ComM, and shall report the development error J1939NM_E_INVALID_NETWORK_ID when an unknown handle is provided by the call.⌋ *(SRS_BSW_00386)*

J1939NM_E_PARAM_POINTER shall be reported as specified in [2, SWS BSW General] by [SWS_BSW_00212].

8.2 Imported Types

In this section, all types used by the J1939 Network Management module are listed together with the defining module:

[SWS_J1939Nm_00029] ⌈

Module	*Header File*	*Imported Type*
ComStack_Types	ComStack_Types.h	NetworkHandleType
	ComStack_Types.h	PduIdType
	ComStack_Types.h	PduInfoType
	ComStack_Types.h	PduLengthType
Dem	Rte_Dem_Type.h	Dem_EventIdType
	Rte_Dem_Type.h	Dem_EventStatusType
J1939Rm	Rte_J1939Rm_Type.h	J1939Rm_ExtIdInfoType
	Rte_J1939Rm_Type.h	J1939Rm_ExtIdType
Nm	NmStack_types.h	Nm_ModeType
	NmStack_types.h	Nm_StateType

▽

△

Module	Header File	Imported Type
Std	Std_Types.h	Std_ReturnType
	Std_Types.h	Std_VersionInfoType

⌋()

The types that are declared in `ComStack_Types.h` are defined in [16, SWS Communication Stack Types], while the types declared in `Std_Types.h` are defined in [17, SWS Standard Types].

8.3 Type Definitions

8.3.1 J1939Nm_ConfigType

[SWS_J1939Nm_00030] ⌈

Name	J1939Nm_ConfigType	
Kind	Structure	
Elements	implementation specific	
	Type	–
	Comment	–
Description	This is the base type for the configuration of the J1939 Network Management module. A pointer to an instance of this structure will be used in the initialization of the J1939 Network Management module. The content of this structure is defined in chapter 10 Configuration specification.	
Available via	J1939Nm.h	

⌋()

8.4 Function Definitions

This is a list of functions provided for upper layer modules.

8.4.1 J1939Nm_Init

[SWS_J1939Nm_00031] ⌈

Service Name	J1939Nm_Init

Syntax	`void J1939Nm_Init (`
	`  const J1939Nm_ConfigType* configPtr`
	`)`

Service ID [hex]	0x01

▽

△

Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	configPtr	Pointer to selected configuration structure
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	This function initializes the J1939 Network Management module.	
Available via	J1939Nm.h	

⌋(*SRS_J1939_00030*)

See subsection 7.2.1 for details.

See section 8.1 for parameter checks.

`J1939NM_E_INIT_FAILED` shall be reported as specified in [2, SWS BSW General] by [SWS_BSW_00050].

8.4.2 J1939Nm_DeInit

[SWS_J1939Nm_00032] ⌈

Service Name	J1939Nm_DeInit
Syntax	`void J1939Nm_DeInit ( void )`
Service ID [hex]	0x02
Sync/Async	Synchronous
Reentrancy	Non Reentrant
Parameters (in)	None
Parameters (inout)	None
Parameters (out)	None
Return value	None
Description	This function resets the J1939 Network Management module to the uninitialized state.
Available via	J1939Nm.h

⌋(*SRS_J1939_00031*)

See subsection 7.2.1 for details.

8.4.3 J1939Nm_GetVersionInfo

[SWS_J1939Nm_00033] ⌈

Service Name	J1939Nm_GetVersionInfo	
Syntax	`void J1939Nm_GetVersionInfo ( Std_VersionInfoType* versionInfo )`	
Service ID [hex]	0x03	
Sync/Async	Synchronous	
Reentrancy	Non Reentrant	
Parameters (in)	None	
Parameters (inout)	None	
Parameters (out)	versionInfo	Pointer to where to store the version information of this module.
Return value	None	
Description	Returns the version information of this module.	
Available via	J1939Nm.h	

⌋(*SRS_BSW_00407*)

See subsection 8.3.4 "Get Version Information" of [2, SWS BSW General] for details. The module ID of the `J1939 Network Management` is defined in [18, TR BSW Module List].

See section 8.1 for parameter checks.

8.4.4 J1939Nm_NetworkRequest

[SWS_J1939Nm_00044] ⌈

Service Name	J1939Nm_NetworkRequest	
Syntax	`Std_ReturnType J1939Nm_NetworkRequest ( NetworkHandleType nmChannelHandle )`	
Service ID [hex]	0x05	
Sync/Async	Synchronous	
Reentrancy	Reentrant (but not for the same NM-Channel)	
Parameters (in)	nmChannelHandle	Identification of the NM-channel
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	E_OK: No error E_NOT_OK: Requesting of network has failed
Description	Request the network, since ECU needs to communicate on the bus.	
Available via	J1939Nm.h	

⌋(*SRS_J1939_00036*)

See subsection 7.3.1 for details.

See subsection 7.2.1 for error handling and section 8.1 for parameter checks.

8.4.5 J1939Nm_NetworkRelease

[SWS_J1939Nm_00045] ⌈

Service Name	J1939Nm_NetworkRelease	
Syntax	`Std_ReturnType J1939Nm_NetworkRelease ( NetworkHandleType nmChannelHandle )`	
Service ID [hex]	0x06	
Sync/Async	Asynchronous	
Reentrancy	Reentrant (but not for the same NM-Channel)	
Parameters (in)	nmChannelHandle	Identification of the NM-channel
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	E_OK: No error E_NOT_OK: Releasing of network has failed
Description	Release the network, since ECU doesn't have to communicate on the bus.	
Available via	J1939Nm.h	

⌋*(SRS_J1939_00036)*

See subsection 7.3.3 for details.

See subsection 7.2.1 for error handling and section 8.1 for parameter checks.

8.4.6 J1939Nm_GetState

[SWS_J1939Nm_00052] ⌈

Service Name	J1939Nm_GetState	
Syntax	`Std_ReturnType J1939Nm_GetState ( NetworkHandleType NetworkHandle, Nm_StateType* nmStatePtr, Nm_ModeType* nmModePtr )`	
Service ID [hex]	0x0d	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	NetworkHandle	Identification of the NM-channel
Parameters (inout)	None	
Parameters (out)	nmStatePtr	Pointer where state of the network management shall be copied to.
	nmModePtr	Pointer where the mode of the network management shall be copied to.
Return value	Std_ReturnType	E_OK: No error E_NOT_OK: Getting of NM state has failed
Description	Returns the state and the mode of the network management.	
Available via	J1939Nm.h	

⌋*()*

See subsection 7.2.1 for error handling and section 8.1 for parameter checks.

8.4.7 J1939Nm_GetBusOffDelay

[SWS_J1939Nm_00070] ⌈

Service Name	J1939Nm_GetBusOffDelay	
Syntax	`void J1939Nm_GetBusOffDelay ( NetworkHandleType network, uint8* delayCyclesPtr )`	
Service ID [hex]	0x10	
Sync/Async	Synchronous	
Reentrancy	Reentrant for different networks	
Parameters (in)	network	CAN network where a BusOff occurred.
Parameters (inout)	None	
Parameters (out)	delayCyclesPtr	Number of CanSM base cycles to wait additionally to L1/L2 after a BusOff occurred.
Return value	None	
Description	This callout function returns the number of CanSM base cycles to wait additionally to L1/L2 after a BusOff occurred.	
Available via	J1939Nm.h	

⌋()

See subsection 7.2.1 for error handling and section 8.1 for parameter checks.

8.4.8 J1939Nm_PassiveStartUp

[SWS_J1939Nm_00054] ⌈

Service Name	J1939Nm_PassiveStartUp	
Syntax	`Std_ReturnType J1939Nm_PassiveStartUp ( NetworkHandleType nmChannelHandle )`	
Service ID [hex]	0x0f	
Sync/Async	Synchronous	
Reentrancy	Reentrant (but not for the same NM-Channel)	
Parameters (in)	nmChannelHandle	Identification of the NM-channel
Parameters (inout)	None	
Parameters (out)	None	
Return value	Std_ReturnType	E_OK: No error E_NOT_OK: Passive startup of network management has failed
Description	Passive startup of the NM. It triggers the transition from Bus-Sleep Mode to the Network Mode without requesting the network.	
Available via	J1939Nm.h	

⌋()

This API is just a dummy to satisfy `NM Interface` linkage. It shall always return `E_NOT_OK`.

See subsection 7.2.1 for error handling and section 8.1 for parameter checks.

8.5 Callback Notifications

This is a list of functions provided for other modules.

8.5.1 J1939Nm_RxIndication

[SWS_J1939Nm_00036] ⌈

Service Name	J1939Nm_RxIndication	
Syntax	`void J1939Nm_RxIndication ( PduIdType RxPduId, const PduInfoType* PduInfoPtr )`	
Service ID [hex]	0x42	
Sync/Async	Synchronous	
Reentrancy	Reentrant for different PduIds. Non reentrant for the same PduId.	
Parameters (in)	RxPduId	ID of the received PDU.
	PduInfoPtr	Contains the length (SduLength) of the received PDU, a pointer to a buffer (SduDataPtr) containing the PDU, and the MetaData related to this PDU.
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	Indication of a received PDU from a lower layer communication interface module.	
Available via	J1939Nm.h	

⌋()

See section 7.5 for details.

See subsection 7.2.1 for error handling and section 8.1 for parameter checks.

8.5.2 J1939Nm_TxConfirmation

[SWS_J1939Nm_00037] ⌈

Service Name	J1939Nm_TxConfirmation	
Syntax	`void J1939Nm_TxConfirmation ( PduIdType TxPduId, Std_ReturnType result )`	
Service ID [hex]	0x40	
Sync/Async	Synchronous	
Reentrancy	Reentrant for different PduIds. Non reentrant for the same PduId.	
Parameters (in)	TxPduId	ID of the PDU that has been transmitted.
	result	E_OK: The PDU was transmitted. E_NOT_OK: Transmission of the PDU failed.
Parameters (inout)	None	

▽

△

Parameters (out)	None
Return value	None
Description	The lower layer communication interface module confirms the transmission of a PDU, or the failure to transmit a PDU.
Available via	J1939Nm.h

⌋()

See section 7.4 for details.

See subsection 7.2.1 for error handling and section 8.1 for parameter checks.

8.5.3 J1939Nm_RequestIndication

[SWS_J1939Nm_00043] ⌈

Service Name	J1939Nm_RequestIndication	
Syntax	`void J1939Nm_RequestIndication ( uint8 node, NetworkHandleType channel, uint32 requestedPgn, const J1939Rm_ExtIdInfoType* extIdInfo, uint8 sourceAddress, uint8 destAddress, uint8 priority )`	
Service ID [hex]	0x47	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	node	Node by which the request was received.
	channel	Channel on which the request was received.
	requestedPgn	PGN of the requested PG.
	extIdInfo	Extended identifier bytes.
	sourceAddress	Address of the node that sent the Request PG.
	destAddress	Address of this node or 0xFF for broadcast.
	priority	Priority of the Request PG.
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	Indicates reception of a Request or Request2 PG.	
Available via	J1939Nm.h	

⌋(*SRS_J1939_00035*)

See section 7.6 for details.

[SWS_J1939Nm_00067] ⌈The `J1939 Network Management` module shall ignore the call to `J1939Nm_RequestIndication` when the `sourceAddress` or the `priority` are not in the valid range, or when `node` is not one of the configured `node` IDs (see `J1939NmNodeId`), or when `requestedPgn` is not the `PGN` of `AC`, or when

destAddress is not 0xFF or the address of the reported node. If development error detection is enabled via J1939NmDevErrorDetect, the J1939 Network Management module shall report the corresponding development error: J1939NM_E_INVALID_NODE for node, J1939NM_E_INVALID_PGN for requestedPgn, J1939NM_E_INVALID_ADDRESS for sourceAddress or destAddress, and J1939NM_E_INVALID_PRIO for priority.⌋(*SRS_BSW_00386*)

See subsection 7.2.1 for further error handling and section 8.1 for further parameter checks.

8.6 Scheduled Functions

This function is directly called by the Basic Software Scheduler (SchM, see [19, SWS RTE]).

8.6.1 J1939Nm_MainFunction

[SWS_J1939Nm_00038] ⌈

Service Name	J1939Nm_MainFunction

Syntax	`void J1939Nm_MainFunction (`
	`  void`
	`)`

Service ID [hex]	0x04
Description	Main function of the J1939 Network Management module. Used for scheduling purposes and timeout supervision.
Available via	SchM_J1939Nm.h

⌋()

[SWS_J1939Nm_00039] ⌈The frequency of invocations of J1939Nm_MainFunction is determined by the configuration parameter J1939NmMainFunctionPeriod.⌋ (*SRS_BSW_00478*)

8.7 Expected Interfaces

In this section all interfaces required from other modules are listed.

8.7.1 Mandatory Interfaces

This subsection defines all interfaces that are required to fulfill the core functionality of the module.

[SWS_J1939Nm_00040] ⌈

API Function	*Header File*	*Description*
BswM_J1939Nm_StateChange Notification	BswM_J1939Nm.h	Notification of current J1939Nm state after state changes.
CanIf_Transmit	CanIf.h	Requests transmission of a PDU.
Dem_SetEventStatus	Dem.h	Called by SW-Cs or BSW modules to report monitor status information to the Dem. BSW modules calling Dem_SetEventStatus can safely ignore the return value. This API will be available only if ({Dem/Dem ConfigSet/DemEventParameter/DemEvent ReportingType} == STANDARD_REPORTING)
Nm_BusSleepMode	Nm.h	Notification that the network management has entered Bus-Sleep Mode.
Nm_NetworkMode	Nm.h	Notification that the network management has entered Network Mode.
Nm_StateChangeNotification	Nm.h	Notification that the state of the lower layer <Bus>Nm has changed.

⌋()

8.7.2 Optional Interfaces

This subsection defines all interfaces that are required to fulfill an optional functionality of the module.

[SWS_J1939Nm_00041] ⌈

API Function	*Header File*	*Description*
Det_ReportError	Det.h	Service to report development errors.

⌋()

8.7.3 Configurable Interfaces

In this subsection, all interfaces are listed where the target function could be configured. The target function is usually a call-back function. The name of this kind of interfaces is not fixed because they are configurable.

8.7.3.1 <User_AddressClaimedIndication>

[SWS_J1939Nm_00028] ⌈

Service Name	< User_AddressClaimedIndication >	
Syntax	`void < User_AddressClaimedIndication > ( NetworkHandleType channel, uint8 sourceAddress, const uint8* name )`	
Service ID [hex]	0x20	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	channel	Channel on which the AC was received.
	sourceAddress	Address of the node that sent the AC or NULL address (0xFE).
	name	Pointer to the byte array containing the 64bit NAME.
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	Provides the content of received AddressClaimed (AC) PGs.	
Available via	J1939Nm_Externals.h	

⌋*()*

[SWS_J1939Nm_00059] ⌈The <User_AddressClaimedIndication> function shall only be available if J1939NmUserCallout is configured.⌋*(SRS_BSW_00171)*

See section 7.5 for details.

9 Sequence Diagrams

The following sequence diagrams shall give an impression of the way the J1939 Network Management module shall behave and interoperate with other BSW modules. They are not complete and not binding for the implementation.

9.1 Transmission of AddressClaimed

The following diagram shows the interaction with CanIf when an AddressClaimed is transmitted.

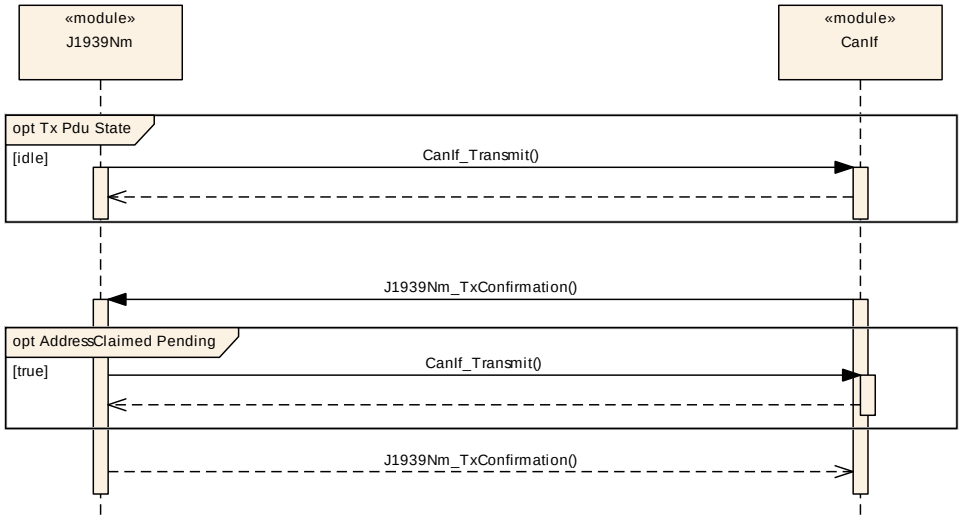

Figure 9.1: Transmission of AddressClaimed PG

9.2 Reception of AddressClaimed

The following diagram shows the interaction with CanIf when an AddressClaimed is received.

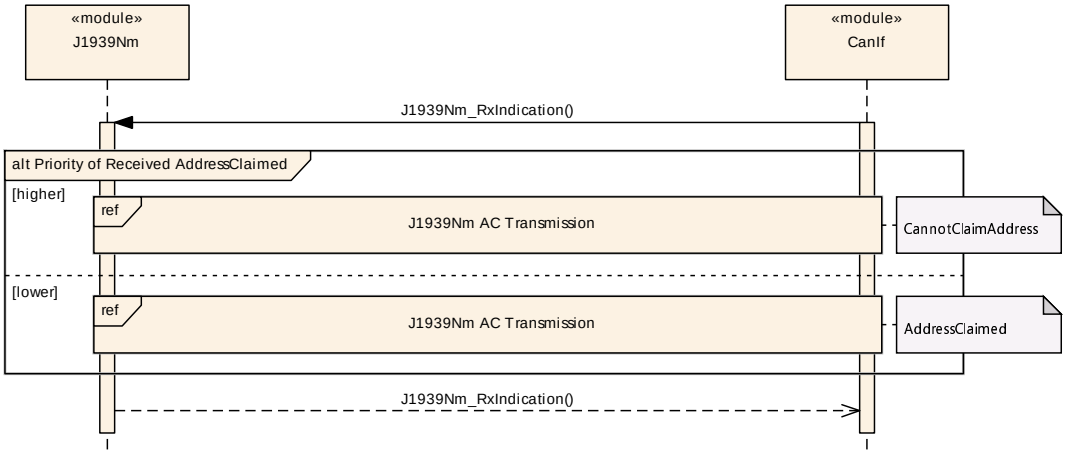

Figure 9.2: Reception of AddressClaimed PG

9.3 Request for AddressClaimed

The following diagram shows the interaction with `J1939Rm` and `CanIf` when a request for `AddressClaimed` is handled.

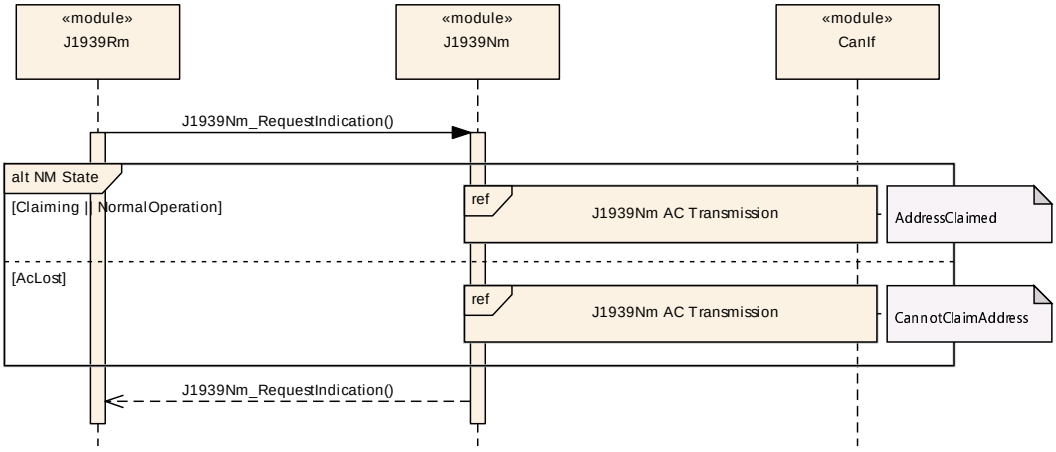

Figure 9.3: Request for the AddressClaimed PG

10 Configuration Specification

In general, this chapter defines configuration parameters and their clustering into containers. For general information about the definition of containers and parameters, refer to the section 10.1 “Introduction to configuration specification” in [2, SWS BSW General]. For details about published information of the J1939 Network Management module, refer to the section 10.3 “Published Information” in [15, SRS BSW General].

Section 10.1 specifies the structure (containers) and the parameters of the J1939 Network Management module.

Section 10.2 gives hints on how to configure the NM Interface to support J1939Nm.

10.1 Containers and Configuration Parameters

The following subsections summarize all configuration parameters of the J1939 Network Management. The detailed meaning of the parameters is described in chapters 7 and 8.

Some of these containers and parameters are derived from classes and attributes of the [20, TPS System Template], which also contains the rules for these derivations.

The following pictures show an overview of the configuration parameters available for J1939Nm:

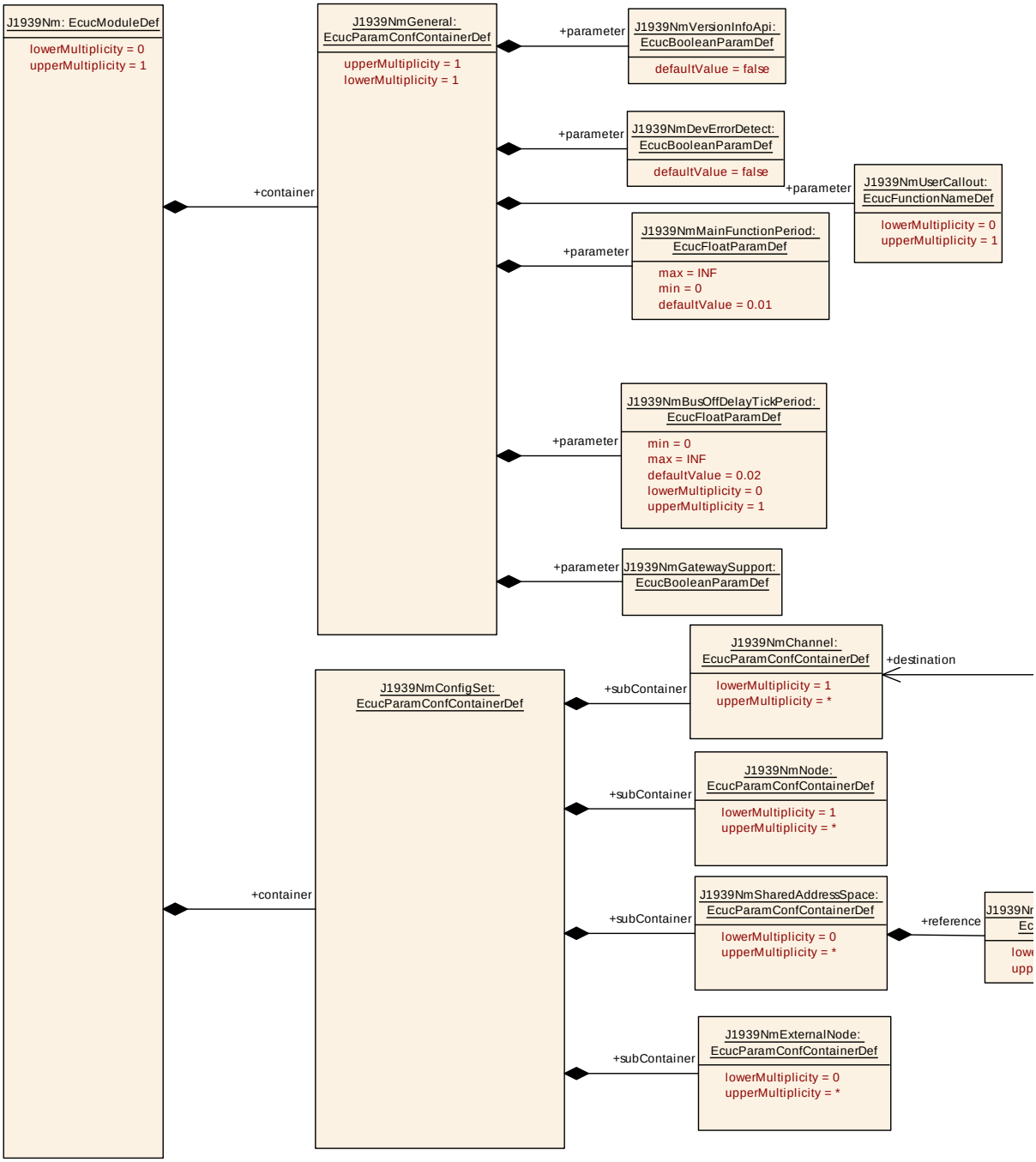

Figure 10.1: Configuration container J1939Nm

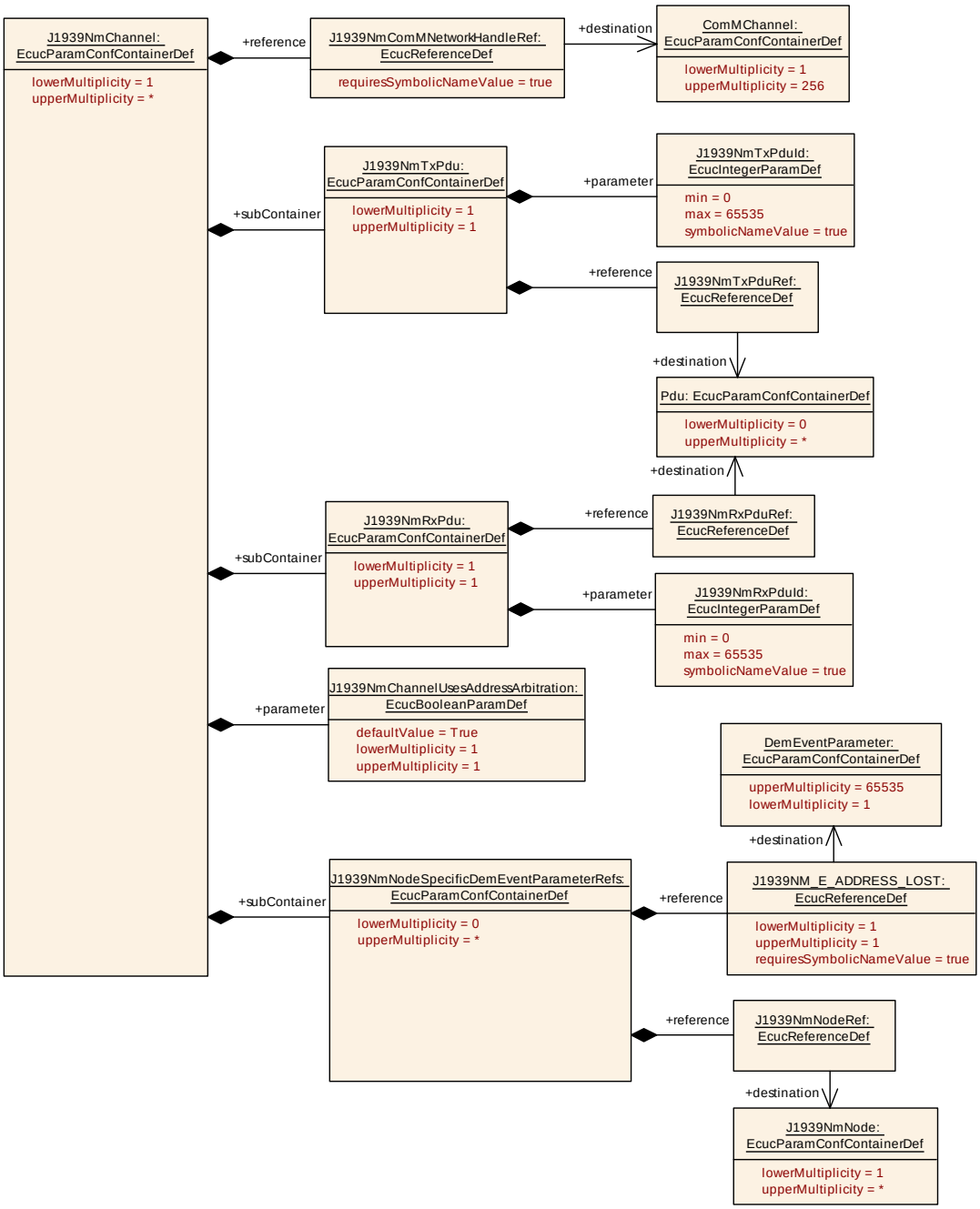

Figure 10.2: Configuration container J1939NmChannel

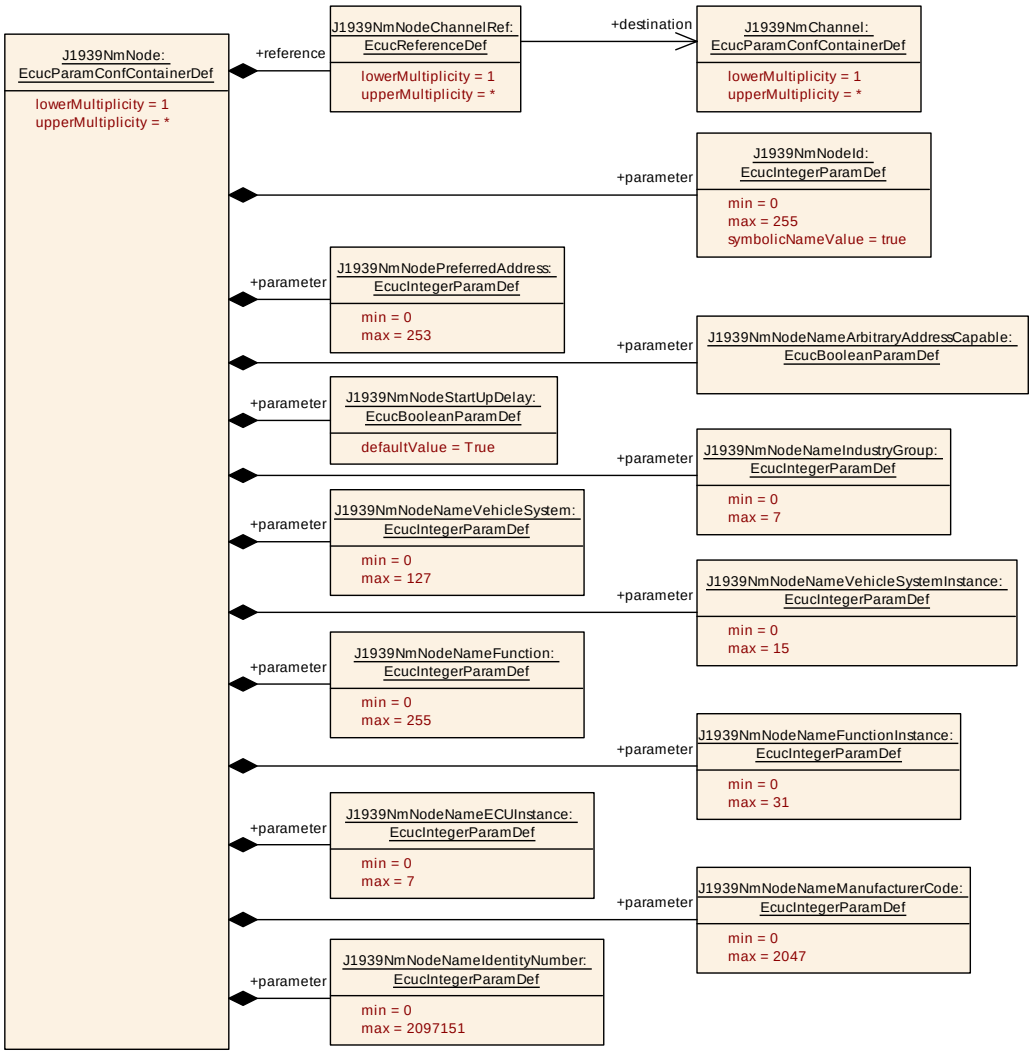

Figure 10.3: Configuration container J1939NmNode

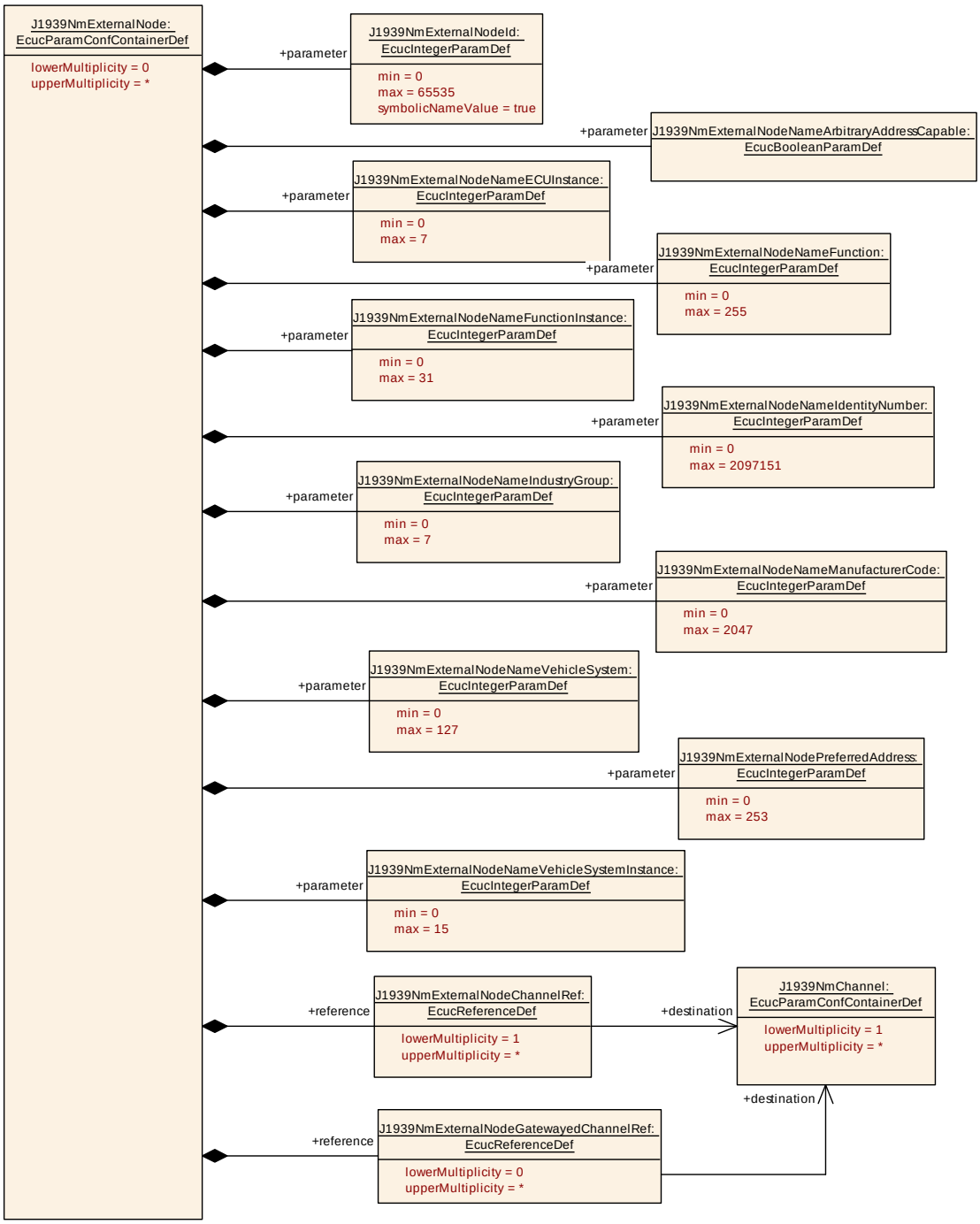

Figure 10.4: Configuration container J1939NmExternalNode

10.1.1 J1939Nm

SWS Item	[ECUC_J1939Nm_00028]
Module Name	J1939Nm
Description	Configuration of the J1939 Network Management module.
Post-Build Variant Support	true
Supported Config Variants	VARIANT-LINK-TIME, VARIANT-POST-BUILD, VARIANT-PRE-COMPILE

Included Containers		
Container Name	Multiplicity	Scope / Dependency
J1939NmConfigSet	1	This container contains the configuration parameters and sub containers of the AUTOSAR J1939Nm module.
J1939NmGeneral	1	Contains the general configuration parameters of the module.

10.1.2 J1939NmGeneral

SWS Item	[ECUC_J1939Nm_00001]
Container Name	J1939NmGeneral
Parent Container	J1939Nm
Description	Contains the general configuration parameters of the module.
Configuration Parameters	

SWS Item	[ECUC_J1939Nm_00034]		
Parameter Name	J1939NmBusOffDelayTickPeriod		
Parent Container	J1939NmGeneral		
Description	Duration of ticks that are used to time BusOff delays after conflicting address claims. This parameter must be synchronized with the main function period of the CAN State Manager.		
Multiplicity	0..1		
Type	EcucFloatParamDef		
Range	]0 .. INF[		
Default value	0.02		
Post-Build Variant Multiplicity	false		
Post-Build Variant Value	false		
Multiplicity Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME, VARIANT-POST-BUILD
	Post-build time	–	
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME, VARIANT-POST-BUILD
	Post-build time	–	
Scope / Dependency	scope: local		

SWS Item	[ECUC_J1939Nm_00003]		
Parameter Name	J1939NmDevErrorDetect		
Parent Container	J1939NmGeneral		
Description	Switches the development error detection and notification on or off. • true: detection and notification is enabled. • false: detection and notification is disabled.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	false		
Post-Build Variant Value	false		
Value Configuration Class	Pre-compile time	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: local		

SWS Item	[ECUC_J1939Nm_00036]		
Parameter Name	J1939NmGatewaySupport		
Parent Container	J1939NmGeneral		
Description	Enables/disables support for claiming the addresses of routed messages.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	–		
Post-Build Variant Value	false		
Value Configuration Class	Pre-compile time	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: local		

SWS Item	[ECUC_J1939Nm_00004]		
Parameter Name	J1939NmMainFunctionPeriod		
Parent Container	J1939NmGeneral		
Description	Call cycle in seconds of J1939Nm_MainFunction.		
Multiplicity	1		
Type	EcucFloatParamDef		
Range	]0 .. INF[		
Default value	0.01		
Post-Build Variant Value	false		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME, VARIANT-POST-BUILD
	Post-build time	–	
Scope / Dependency	scope: ECU		

SWS Item	[ECUC_J1939Nm_00032]
Parameter Name	J1939NmUserCallout
Parent Container	J1939NmGeneral
Description	Pre-processor switch for enabling the <User_AddressClaimedIndication> and defining the name of the callout function.

▽

△

Multiplicity	0..1		
Type	EcucFunctionNameDef		
Default value	–		
Regular Expression	–		
Post-Build Variant Multiplicity	false		
Post-Build Variant Value	false		
Multiplicity Configuration Class	**Pre-compile time**	X	All Variants
	Link time	–	
	Post-build time	–	
Value Configuration Class	**Pre-compile time**	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: local		

SWS Item	**[ECUC_J1939Nm_00002]**		
Parameter Name	J1939NmVersionInfoApi		
Parent Container	J1939NmGeneral		
Description	Pre-processor switch for enabling version info API support.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	false		
Post-Build Variant Value	false		
Value Configuration Class	**Pre-compile time**	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: local		

No Included Containers

10.1.3 J1939NmConfigSet

SWS Item	**[ECUC_J1939Nm_00027]**
Container Name	J1939NmConfigSet
Parent Container	J1939Nm
Description	This container contains the configuration parameters and sub containers of the AUTOSAR J1939Nm module.
Configuration Parameters	

Included Containers		
Container Name	**Multiplicity**	**Scope / Dependency**
J1939NmChannel	1..*	Physical CAN channel handled by J1939Nm.
J1939NmExternalNode	0..*	Logical node implemented in another ECU. Configures potential communication partners. If this container is connected to more than one channel, the external ECU is linked to the local ECU by each of these channels.

▽

△

Included Containers		
Container Name	**Multiplicity**	**Scope / Dependency**
J1939NmNode	1..*	Logical node representing one function handled by J1939Nm.
J1939NmSharedAddressSpace	0..*	Set of J1939NmChannels that share a common address space. Address claims will be routed between these channels.

10.1.4 J1939NmSharedAddressSpace

SWS Item	[ECUC_J1939Nm_00037]		
Container Name	J1939NmSharedAddressSpace		
Parent Container	J1939NmConfigSet		
Description	Set of J1939NmChannels that share a common address space. Address claims will be routed between these channels.		
Post-Build Variant Multiplicity	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Configuration Parameters			

SWS Item	[ECUC_J1939Nm_00038]		
Parameter Name	J1939NmSharedChannelRef		
Parent Container	J1939NmSharedAddressSpace		
Description	Reference to a channel that belongs to the shared address space.		
Multiplicity	2..*		
Type	Reference to J1939NmChannel		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

No Included Containers

10.1.5 J1939NmChannel

SWS Item	[ECUC_J1939Nm_00005]
Container Name	J1939NmChannel
Parent Container	J1939NmConfigSet

▽

△

Description	Physical CAN channel handled by J1939Nm.		
Post-Build Variant Multiplicity	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Configuration Parameters			

SWS Item	**[ECUC_J1939Nm_00035]**		
Parameter Name	J1939NmChannelUsesAddressArbitration		
Parent Container	J1939NmChannel		
Description	Defines whether the nodes attached to this channel use an initial address claim, and whether they react to contending address claims of other nodes. True: The initial address claim is sent, and the node reacts to address claims of other nodes. False: The node only sends an address claim upon request, and does not react to other address claims.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	true		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_J1939Nm_00008]**		
Parameter Name	J1939NmComMNetworkHandleRef		
Parent Container	J1939NmChannel		
Description	Reference to the channel defined by the ComMChannel providing access to the unique channel index ComMChannelId.		
Multiplicity	1		
Type	Symbolic name reference to ComMChannel		
Post-Build Variant Value	false		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME, VARIANT-POST-BUILD
	Post-build time	–	
Scope / Dependency	scope: local		

Included Containers		
Container Name	**Multiplicity**	**Scope / Dependency**
J1939NmNodeSpecificDemEvent ParameterRefs	0..*	Container for the references to DemEventParameter elements related to one J1939NmNode which shall be invoked using the API Dem_SetEventStatus in case the corresponding error occurs. The EventId is taken from the referenced DemEvent Parameter's DemEventId symbolic value. The standardized errors are provided in this container and can be extended by vendor-specific error references.
J1939NmRxPdu	1	Contains the configuration of the PDU used to receive the AddressClaimed PG. This PDU consumes a meta data item of type CAN_ID_32.

▽

△

Included Containers		
Container Name	**Multiplicity**	**Scope / Dependency**
J1939NmTxPdu	1	Contains the configuration of the PDU used to transmit the AddressClaimed PG. This PDU produces a meta data item of type CAN_ID_32.

10.1.6 J1939NmTxPdu

SWS Item	[ECUC_J1939Nm_00009]
Container Name	J1939NmTxPdu
Parent Container	J1939NmChannel
Description	Contains the configuration of the PDU used to transmit the AddressClaimed PG. This PDU produces a meta data item of type CAN_ID_32.
Configuration Parameters	

SWS Item	[ECUC_J1939Nm_00011]		
Parameter Name	J1939NmTxPduId		
Parent Container	J1939NmTxPdu		
Description	The PDU identifier used for TxConfirmation from CanIf.		
Multiplicity	1		
Type	EcucIntegerParamDef (Symbolic Name generated for this parameter)		
Range	0 .. 65535		
Default value	–		
Post-Build Variant Value	false		
Value Configuration Class	**Pre-compile time**	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: ECU		

SWS Item	[ECUC_J1939Nm_00012]		
Parameter Name	J1939NmTxPduRef		
Parent Container	J1939NmTxPdu		
Description	Reference to the Pdu object representing the PDU.		
Multiplicity	1		
Type	Reference to Pdu		
Post-Build Variant Value	false		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME, VARIANT-POST-BUILD
	Post-build time	–	
Scope / Dependency	scope: local		

No Included Containers

10.1.7 J1939NmRxPdu

SWS Item	[ECUC_J1939Nm_00010]
Container Name	J1939NmRxPdu
Parent Container	J1939NmChannel
Description	Contains the configuration of the PDU used to receive the AddressClaimed PG. This PDU consumes a meta data item of type CAN_ID_32.
Configuration Parameters	

SWS Item	[ECUC_J1939Nm_00014]		
Parameter Name	J1939NmRxPduId		
Parent Container	J1939NmRxPdu		
Description	The PDU identifier used for RxIndication from CanIf.		
Multiplicity	1		
Type	EcucIntegerParamDef (Symbolic Name generated for this parameter)		
Range	0 .. 65535		
Default value	–		
Post-Build Variant Value	false		
Value Configuration Class	Pre-compile time	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: ECU		

SWS Item	[ECUC_J1939Nm_00013]		
Parameter Name	J1939NmRxPduRef		
Parent Container	J1939NmRxPdu		
Description	Reference to the Pdu object representing the PDU.		
Multiplicity	1		
Type	Reference to Pdu		
Post-Build Variant Value	false		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME, VARIANT-POST-BUILD
	Post-build time	–	
Scope / Dependency	scope: local		

No Included Containers

10.1.8 J1939NmNodeSpecificDemEventParameterRefs

SWS Item	[ECUC_J1939Nm_00006]
Container Name	J1939NmNodeSpecificDemEventParameterRefs
Parent Container	J1939NmChannel

▽

△

Description	Container for the references to DemEventParameter elements related to one J1939Nm Node which shall be invoked using the API Dem_SetEventStatus in case the corresponding error occurs. The EventId is taken from the referenced DemEvent Parameter's DemEventId symbolic value. The standardized errors are provided in this container and can be extended by vendor-specific error references.		
Post-Build Variant Multiplicity	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Configuration Parameters			

SWS Item	**[ECUC_J1939Nm_00007]**		
Parameter Name	J1939NM_E_ADDRESS_LOST		
Parent Container	J1939NmNodeSpecificDemEventParameterRefs		
Description	Reference to the DemEventParameter which shall be issued when the ECU failed to claim one of its addresses.		
Multiplicity	1		
Type	Symbolic name reference to DemEventParameter		
Post-Build Variant Value	false		
Value Configuration Class	**Pre-compile time**	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: local		

SWS Item	**[ECUC_J1939Nm_00053]**		
Parameter Name	J1939NmNodeRef		
Parent Container	J1939NmNodeSpecificDemEventParameterRefs		
Description	Reference to J1939NmNode.		
Multiplicity	1		
Type	Reference to J1939NmNode		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

No Included Containers

10.1.9 J1939NmNode

SWS Item	**[ECUC_J1939Nm_00015]**
Container Name	J1939NmNode
Parent Container	J1939NmConfigSet
Description	Logical node representing one function handled by J1939Nm.
Post-Build Variant Multiplicity	true

▽

△

Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Configuration Parameters			

SWS Item	**[ECUC_J1939Nm_00030]**		
Parameter Name	J1939NmNodeId		
Parent Container	J1939NmNode		
Description	Unique identifier of this node.		
Multiplicity	1		
Type	EcucIntegerParamDef (Symbolic Name generated for this parameter)		
Range	0 .. 255		
Default value	–		
Post-Build Variant Value	false		
Value Configuration Class	**Pre-compile time**	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: ECU		

SWS Item	**[ECUC_J1939Nm_00018]**		
Parameter Name	J1939NmNodeNameArbitraryAddressCapable		
Parent Container	J1939NmNode		
Description	Arbitrary Address Capable field of the NAME of this node.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	–		
Post-Build Variant Value	false		
Value Configuration Class	**Pre-compile time**	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: local		

SWS Item	**[ECUC_J1939Nm_00024]**		
Parameter Name	J1939NmNodeNameECUInstance		
Parent Container	J1939NmNode		
Description	ECU Instance field of the NAME of this node.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 7		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	[ECUC_J1939Nm_00022]		
Parameter Name	J1939NmNodeNameFunction		
Parent Container	J1939NmNode		
Description	Function field of the NAME of this node.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 255		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	[ECUC_J1939Nm_00023]		
Parameter Name	J1939NmNodeNameFunctionInstance		
Parent Container	J1939NmNode		
Description	Function Instance field of the NAME of this node.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 31		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	[ECUC_J1939Nm_00026]		
Parameter Name	J1939NmNodeNameIdentityNumber		
Parent Container	J1939NmNode		
Description	Identity Number field of the NAME of this node.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 2097151		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	Pre-compile time	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	[ECUC_J1939Nm_00019]
Parameter Name	J1939NmNodeNameIndustryGroup
Parent Container	J1939NmNode
Description	Industry Group field of the NAME of this node.
Multiplicity	1

▽

△

Type	EcucIntegerParamDef		
Range	0 .. 7		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_J1939Nm_00025]**		
Parameter Name	J1939NmNodeNameManufacturerCode		
Parent Container	J1939NmNode		
Description	Manufacturer Code field of the NAME of this node.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 2047		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_J1939Nm_00021]**		
Parameter Name	J1939NmNodeNameVehicleSystem		
Parent Container	J1939NmNode		
Description	Vehicle System field of the NAME of this node.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 127		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_J1939Nm_00020]**		
Parameter Name	J1939NmNodeNameVehicleSystemInstance		
Parent Container	J1939NmNode		
Description	Vehicle System Instance field of the NAME of this node.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 15		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE

▽

△

	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_J1939Nm_00016]**		
Parameter Name	J1939NmNodePreferredAddress		
Parent Container	J1939NmNode		
Description	Source address of this node used for address claiming.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 253		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: ECU		

SWS Item	**[ECUC_J1939Nm_00017]**		
Parameter Name	J1939NmNodeStartUpDelay		
Parent Container	J1939NmNode		
Description	If enabled, the node will start communication after a delay of 250ms after transmission of the initial AddressClaimed, depending on the configured J1939NmNodePreferred Address. If disabled, the node will start communication immediately at network start-up. Please note: According to J1939/81, the 250ms delay is not required for single address CAs with desired source addresses in the ranges 0..127 or 248..253.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	true		
Post-Build Variant Value	false		
Value Configuration Class	**Pre-compile time**	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: local		

SWS Item	**[ECUC_J1939Nm_00029]**		
Parameter Name	J1939NmNodeChannelRef		
Parent Container	J1939NmNode		
Description	Reference to the channels this node has access to.		
Multiplicity	1..*		
Type	Reference to J1939NmChannel		
Post-Build Variant Multiplicity	false		
Post-Build Variant Value	false		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME, VARIANT-POST-BUILD
	Post-build time	–	
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE

▽

△

	Link time	X	VARIANT-LINK-TIME, VARIANT-POST-BUILD
	Post-build time	–	
Scope / Dependency	scope: local		

No Included Containers

10.1.10 J1939NmExternalNode

SWS Item	**[ECUC_J1939Nm_00039]**		
Container Name	J1939NmExternalNode		
Parent Container	J1939NmConfigSet		
Description	Logical node implemented in another ECU. Configures potential communication partners. If this container is connected to more than one channel, the external ECU is linked to the local ECU by each of these channels.		
Post-Build Variant Multiplicity	false		
Multiplicity Configuration Class	**Pre-compile time**	X	All Variants
	Link time	–	
	Post-build time	–	
Configuration Parameters			

SWS Item	**[ECUC_J1939Nm_00040]**		
Parameter Name	J1939NmExternalNodeId		
Parent Container	J1939NmExternalNode		
Description	Unique identifier of this external node.		
Multiplicity	1		
Type	EcucIntegerParamDef (Symbolic Name generated for this parameter)		
Range	0 .. 65535		
Default value	–		
Post-Build Variant Value	false		
Value Configuration Class	**Pre-compile time**	X	All Variants
	Link time	–	
	Post-build time	–	
Scope / Dependency	scope: ECU		

SWS Item	**[ECUC_J1939Nm_00041]**		
Parameter Name	J1939NmExternalNodeNameArbitraryAddressCapable		
Parent Container	J1939NmExternalNode		
Description	Arbitrary Address Capable field of the NAME of this external node.		
Multiplicity	1		
Type	EcucBooleanParamDef		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME

▽

△

	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_J1939Nm_00042]**		
Parameter Name	J1939NmExternalNodeNameECUInstance		
Parent Container	J1939NmExternalNode		
Description	ECU Instance field of the NAME of this external node.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 7		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_J1939Nm_00043]**		
Parameter Name	J1939NmExternalNodeNameFunction		
Parent Container	J1939NmExternalNode		
Description	Function field of the NAME of this external node.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 255		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_J1939Nm_00044]**		
Parameter Name	J1939NmExternalNodeNameFunctionInstance		
Parent Container	J1939NmExternalNode		
Description	Function Instance field of the NAME of this external node.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 31		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	[ECUC_J1939Nm_00045]		
Parameter Name	J1939NmExternalNodeNameIdentityNumber		
Parent Container	J1939NmExternalNode		
Description	Identity Number field of the NAME of this external node.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 2097151		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	[ECUC_J1939Nm_00046]		
Parameter Name	J1939NmExternalNodeNameIndustryGroup		
Parent Container	J1939NmExternalNode		
Description	Industry Group field of the NAME of this external node.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 7		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	[ECUC_J1939Nm_00047]		
Parameter Name	J1939NmExternalNodeNameManufacturerCode		
Parent Container	J1939NmExternalNode		
Description	Manufacturer Code field of the NAME of this external node.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 2047		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	[ECUC_J1939Nm_00048]
Parameter Name	J1939NmExternalNodeNameVehicleSystem
Parent Container	J1939NmExternalNode
Description	Vehicle System field of the NAME of this external node.
Multiplicity	1

▽

△

Type	EcucIntegerParamDef		
Range	0 .. 127		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_J1939Nm_00050]**		
Parameter Name	J1939NmExternalNodeNameVehicleSystemInstance		
Parent Container	J1939NmExternalNode		
Description	Vehicle System Instance field of the NAME of this external node.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 15		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_J1939Nm_00049]**		
Parameter Name	J1939NmExternalNodePreferredAddress		
Parent Container	J1939NmExternalNode		
Description	Source address of this external node.		
Multiplicity	1		
Type	EcucIntegerParamDef		
Range	0 .. 253		
Default value	–		
Post-Build Variant Value	true		
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: ECU		

SWS Item	**[ECUC_J1939Nm_00051]**		
Parameter Name	J1939NmExternalNodeChannelRef		
Parent Container	J1939NmExternalNode		
Description	Reference to the channels of the local ECU this external node has access to.		
Multiplicity	1..*		
Type	Reference to J1939NmChannel		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME

▽

△

	Post-build time	X	VARIANT-POST-BUILD
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

SWS Item	**[ECUC_J1939Nm_00052]**		
Parameter Name	J1939NmExternalNodeGatewayedChannelRef		
Parent Container	J1939NmExternalNode		
Description	Reference to the channels on which messages to/from this external node shall be gatewayed. The address claim from the external node will be replicated on these channels.		
Multiplicity	0..*		
Type	Reference to J1939NmChannel		
Post-Build Variant Multiplicity	true		
Post-Build Variant Value	true		
Multiplicity Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Value Configuration Class	**Pre-compile time**	X	VARIANT-PRE-COMPILE
	Link time	X	VARIANT-LINK-TIME
	Post-build time	X	VARIANT-POST-BUILD
Scope / Dependency	scope: local		

No Included Containers

10.2 Configuration of NM Interface

The J1939 Network Management module relies on the following channel configuration in the NM Interface to be operational:

- NmActiveCoordinator: False
- NmBusSynchronizationEnabled: False
- NmChannelSleepMaster: True
- NmComControlEnabled: False
- NmCoordClusterIndex: <undefined>
- NmCoordinatorSyncSupport: False
- NmNodeDetectionEnabled: False
- NmNodeIdEnabled: False
- NmPassiveModeEnabled: False
- NmRemoteSleepIndEnabled: False
- NmShutdownDelayTimer: 0.0
- NmStateReportEnabled: False
- NmStateReportSignalRef: <undefined>
- NmSynchronizingNetwork: False
- NmUserDataEnabled: False

A Not Applicable Requirements

[SWS_J1939Nm_NA] ⌈These requirements are not applicable to this specification.⌋*(SRS_J1939_00001, SRS_J1939_00002, SRS_J1939_00003, SRS_J1939_00004, SRS_J1939_00005, SRS_J1939_00006, SRS_J1939_00007, SRS_J1939_00008, SRS_J1939_00009, SRS_J1939_00010, SRS_J1939_00011, SRS_J1939_00012, SRS_J1939_00013, SRS_J1939_00014, SRS_J1939_00015, SRS_J1939_00016, SRS_J1939_00017, SRS_J1939_00018, SRS_J1939_00019, SRS_J1939_00020, SRS_J1939_00021, SRS_J1939_00022, SRS_J1939_00023, SRS_J1939_00024, SRS_J1939_00025, SRS_J1939_00026, SRS_J1939_00038, SRS_J1939_00039, SRS_J1939_00040, SRS_J1939_00041, SRS_J1939_00042, SRS_J1939_00043, SRS_J1939_00044, SRS_J1939_00045, SRS_J1939_00046, SRS_J1939_00047, SRS_J1939_00048, SRS_J1939_00050, SRS_J1939_NA, SRS_BSW_00005, SRS_BSW_00161, SRS_BSW_00162, SRS_BSW_00168, SRS_BSW_00330, SRS_BSW_00343, SRS_BSW_00351, SRS_BSW_00375, SRS_BSW_00377, SRS_BSW_00399, SRS_BSW_00413, SRS_BSW_00416, SRS_BSW_00417, SRS_BSW_00419, SRS_BSW_00422, SRS_BSW_00425, SRS_BSW_00449, SRS_BSW_00453, SRS_BSW_00456, SRS_BSW_00458, SRS_BSW_00473, SRS_BSW_00479, SRS_BSW_00490, SRS_BSW_00492, SRS_BSW_00494, SRS_BSW_00495)*