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BSI Standards Publication

Road vehicles — Media Oriented Systems Transport (MOST)

Part 4: Transport layer and network layer

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National foreword

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Road vehicles — Media Oriented Systems Transport (MOST) —

Part 4: Transport layer and network layer

Véhicules routiers — Système de transport axé sur les médias —

Partie 4: Couche de transport et couche réseau

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Foreword

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This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Data communication*.

A list of all parts in the ISO 21806 series can be found on the ISO website.

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Introduction

The Media Oriented Systems Transport (MOST) communication technology was initially developed at the end of the 1990s in order to support complex audio applications in cars. The MOST Cooperation was founded in 1998 with the goal to develop and enable the technology for the automotive industry. Today, MOST[1)] enables the transport of high quality of service (QoS) audio and video together with packet data and real-time control to support modern automotive multimedia and similar applications. MOST is a function-oriented communication technology to network a variety of multimedia devices comprising one or more MOST nodes.

Figure 1 shows a MOST network example.

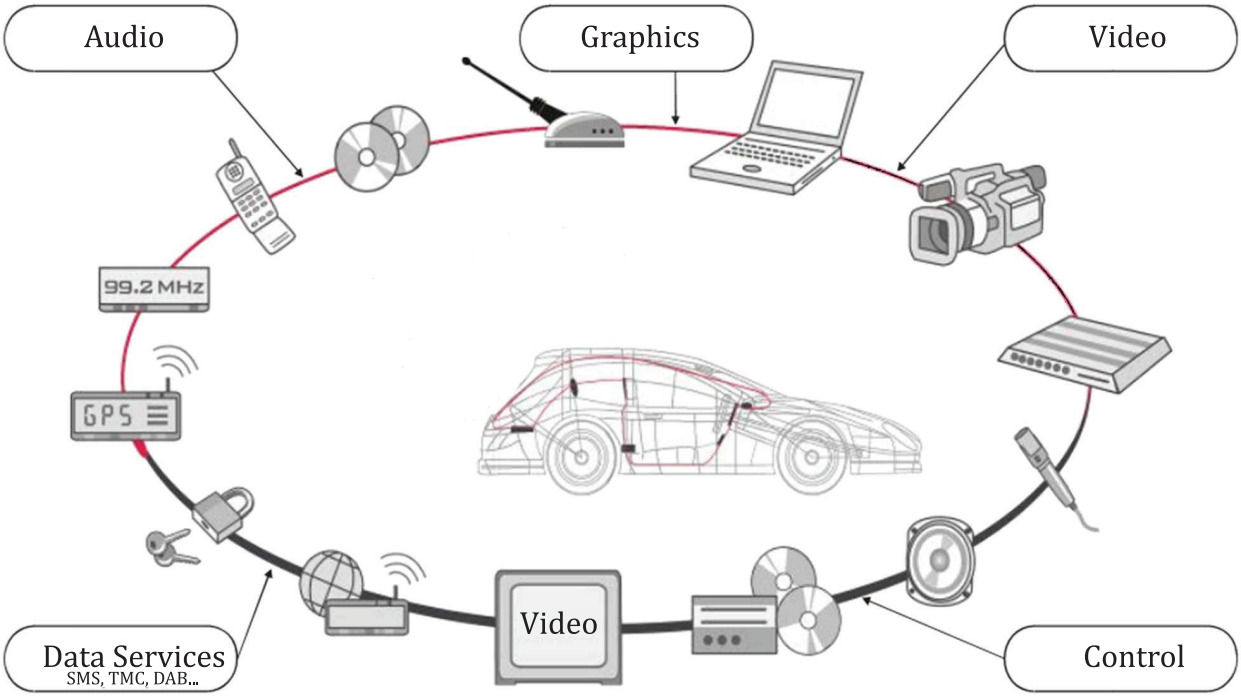

Figure 1 — MOST network example

The MOST communication technology provides:

— synchronous and isochronous streaming,

— small overhead for administrative communication control,

— a functional and hierarchical system model,

— API standardization through a function block (FBlock) framework,

— free partitioning of functionality to real devices,

— service discovery and notification, and

— flexibly scalable automotive-ready Ethernet communication according to ISO/IEC/IEEE 8802-3[6].

MOST is a synchronous time-division-multiplexing (TDM) network that transports different data types on separate channels at low latency. MOST supports different bit rates and physical layers. The network clock is provided with a continuous data signal.

1) MOST® is the registered trademark of Microchip Technology Inc. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO.

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Within the synchronous base data signal, the content of multiple streaming connections and control data is transported. For streaming data connections, bandwidth is reserved to avoid interruptions, collisions, or delays in the transport of the data stream.

MOST specifies mechanisms for sending anisochronous, packet-based data in addition to control data and streaming data. The transmission of packet-based data is separated from the transmission of control data and streaming data. None of them interfere with each other.

A MOST network consists of devices that are connected to one common control channel and packet channel.

In summary, MOST is a network that has mechanisms to transport the various signals and data streams that occur in multimedia and infotainment systems.

The ISO standards maintenance portal (https://standards.iso.org/iso/) provides references to MOST specifications implemented in today's road vehicles because easy access via hyperlinks to these specifications is necessary. It references documents that are normative or informative for the MOST versions 4V0, 3V1, 3V0, and 2V5.

The ISO 21806 series has been established in order to specify requirements and recommendations for implementing the MOST communication technology into multimedia devices and to provide conformance test plans for implementing related test tools and test procedures.

To achieve this, the ISO 21806 series is based on the open systems interconnection (OSI) basic reference model in accordance with ISO/IEC 7498-1[1] and ISO/IEC 10731[4], which structures communication systems into seven layers as shown in Figure 2. Stream transmission applications use a direct stream data interface (transparent) to the data link layer.

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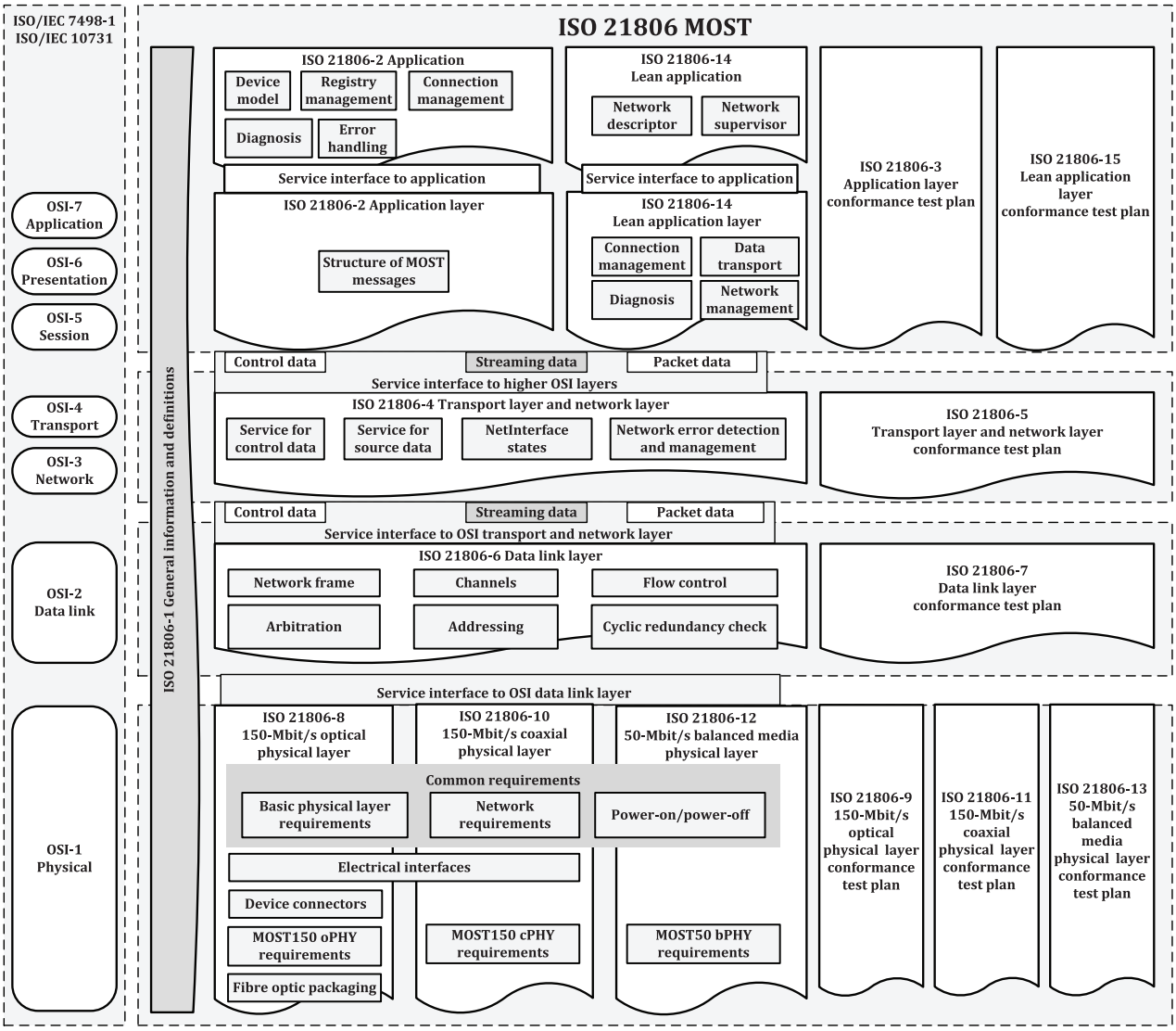

Figure 2 — The ISO 21806 series reference according to the OSI model

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Road vehicles — Media Oriented Systems Transport (MOST) —

Part 4: Transport layer and network layer

1 Scope

This document specifies technical requirements related to the MOST transport layer and network layer functionality:

— the service interface to application layer;

— the network layer services;

— the data transport mechanism;

— the dynamic behaviour of a node;

— the network error management.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 21806-1, *Road vehicles — Media Oriented Systems Transport (MOST) — Part 1: General information and definitions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21806-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
active TimingSlave
TimingSlave that initiates a *network startup* (3.2)

3.2
network startup
network activity that commences so that all nodes in the MOST network change to `s_NetInterface_Normal_Operation`

3.3
network wake-up
process of all nodes in the MOST network exiting `s_NetInterface_Sleep`

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3.4
network wake-up event
network activity or electrical wake-up line activity

3.5
passive TimingSlave
node that participates in a *network startup* (3.2), not initiating it

3.6
qualified local wake-up event
local trigger (one that does not affect all devices) that causes exiting `s_NetInterface_Sleep`

3.7
wake-up event
trigger for exiting `s_NetInterface_Sleep`

4 Symbols and abbreviated terms

4.1 Symbols

---	empty cell/undefined
L_{AMSmax}	maximum payload length for AMS
L_{CMmax}	maximum payload length for control data

4.2 Abbreviated terms

A:	action
AMS	application message service
C:	condition
`ev_`	prefix event name
`MsgID`	message identifier
NL	network layer
RBD	ring break diagnosis
`s_`	prefix state name
`SegCnt`	segment counter
`TelID`	telegram identifier
`TelLen`	telegram length
TL	transport layer

5 Conventions

This document is based on OSI service conventions as specified in ISO/IEC 10731[4].

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6 Transport layer service interface to upper OSI layers

6.1 Overview of services

Figure 3 shows the transport layer (TL) service interface, which specifies the interface to the upper OSI layers, see ISO 21806-2[1].

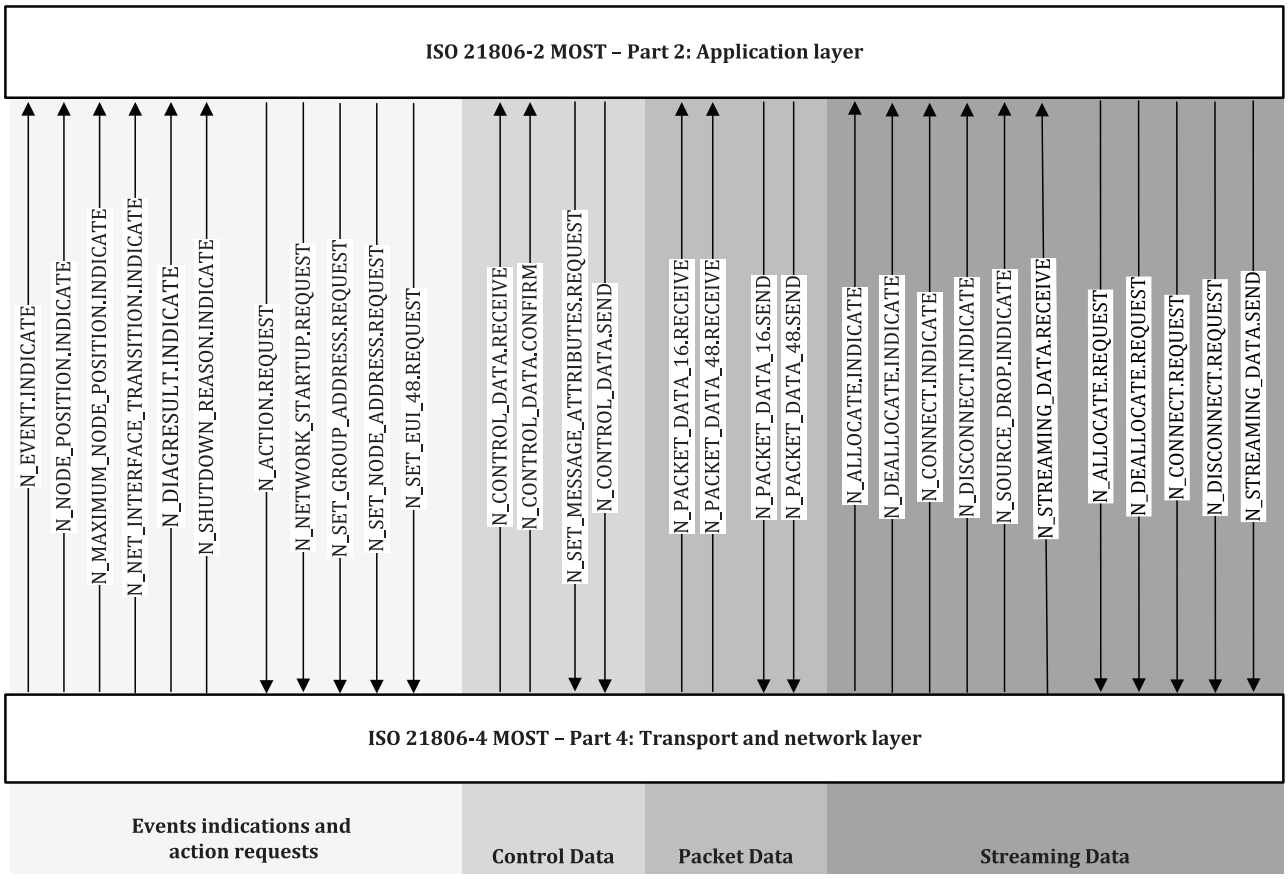

Figure 3 — Service interface to upper OSI layers

6.2 Data type definitions

REQ	4.1 Service interface – Data type definitions
The data types shall be in accordance to: — `Enum`: 8-bit enumeration; — `Unsigned Byte`: 8-bit unsigned numeric value; — `Unsigned Word`: 16-bit unsigned numeric value; — `Unsigned Long`: 32-bit unsigned numeric value; — `EUI-48`: 48-bit address value; — `Byte Array`: sequence of 8-bit aligned data.	

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6.3 Parameters

6.3.1 Parameters — NL/TL to upper layers

6.3.1.1 Overview

Table 1 specifies the parameters that are used in the service interface and passed from NL/TL to upper layers.

Table 1 — Parameters passed from NL/TL to upper layers

Parameter	Data type	Description

`Application_Event`	`Enum {`
	`  Unlock,`
	`  Stable_Lock,`
	`  Lock_Flag,`
	`  Network_Change_Event,`
	`  Shutdown_Flag,`
	`  MOST_Output_Off,`
	`  Network_Activity`
	`}`
		An event that is reported to the application.

`NetInterface_Transition`	`Enum {`
	`  ev_Wake_Up,`
	`  ev_Sleep,`
	`  ev_Start_Up,`
	`  ev_Diagnosis_Start,`
	`  ev_Init_Error_Shutdown,`
	`  ev_Init_Diagnosis_Start,`
	`  ev_Init_Ready,`
	`  ev_Error_Shutdown,`
	`  ev_Normal_Shutdown,`
	`  ev_Diagnosis_Ready,`
	`  ev_Diagnosis_End`
	`}`
		A transition between NetInterface states

`DiagResult`	`Enum {`
	`  No_Error,`
	`  Ring_Break,`
	`  Weak_Signal,`
	`  Diagnosis_Inconclusive`
	`}`
		DiagResult of the ring break diagnosis

`Relative_Position`	`Unsigned Byte`	Relative position of a node to a ring break

`Shutdown_Reason`	`Enum {`
	`  No_Result_Available,`
	`  No_Fault_Saved,`
	`  Sudden_Signal_Off,`
	`  Critical_Unlock`
	`}`
		Shutdown reason

`Node_Position`	`Unsigned Byte`	Position of the node
`Maximum_Position`	`Unsigned Byte`	Maximum position information

`Transmission_Status`	`Enum {`
	`  Success,`
	`  Buffer_Full,`
	`  CRC_Error,`
	`  Wrong_Target`
	`}`
		Transmission status that is reported back to the sender.

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6.3.1.2 Application_Event

`Application_Event` corresponds to events that are used to notify the application about changes in lower layers, which require no additional information.

REQ	4.2 Service interface – Parameters – NL/TL to upper layers – Application_Event
The `Application_Event` parameter shall be of data type `Enum` and shall contain the value specified according to Table 2.	

Table 2 — Application_Event values

Enum value	Description
`Unlock`	Unlock event occurred.
`Stable_Lock`	Stable lock reached.
`Lock_Flag`	Lock flag detected.
`Network_Change_Event`	Network change event (NCE) occurred.
`Shutdown_Flag`	Shutdown flag detected.
`Network_Activity_End`	Network activity ends.
`Network_Activity`	Network activity detected.

6.3.1.3 NetInterface_Transition

`NetInterface_Transition` corresponds to events that are used to notify the application about transitions from one NetInterface state to another.

REQ	4.3 Service interface – Parameters – NL/TL to upper layers – NetInterface_Transition
The `NetInterface_Transition` values shall be of data type `Enum` and shall contain the value specified according to Table 3.	

Table 3 — NetInterface_Transition values

Enum value	Description
`ev_Wake_Up`	The `ev_Wake_Up` transition from `s_NetInterface_Sleep` to `s_NetInterface_Off` is taken.
`ev_Sleep`	The `ev_Sleep` transition from `s_NetInterface_Off` to `s_NetInterface_Sleep` is taken.
`ev_Start_Up`	The `ev_Start_Up` transition from `s_NetInterface_Off` to `s_NetInterface_Init` is taken.
`ev_Diagnosis_Start`	The `ev_Diagnosis_Start` transition from `s_NetInterface_Off` to `s_NetInterface_Diagnosis` is taken.
`ev_Init_Error_Shutdown`	The `ev_Init_Error_Shutdown` transition from `s_NetInterface_Init` to `s_NetInterface_Off` is taken.
`ev_Init_Diagnosis_Start`	The `ev_Init_Diagnosis_Start` transition from `s_NetInterface_Init` to `s_NetInterface_Diagnosis` is taken.
`ev_Init_Ready`	The `ev_Init_Ready` transition from `s_NetInterface_Init` to `s_NetInterface_Normal_Operation` is taken.
`ev_Error_Shutdown`	The `ev_Error_Shutdown` transition from `s_NetInterface_Normal_Operation` to `s_NetInterface_Off` is taken.
`ev_Normal_Shutdown`	The `ev_Normal_Shutdown` transition from `s_NetInterface_Normal_Operation` to `s_NetInterface_Off` is taken.
`ev_Diagnosis_Ready`	The `ev_Diagnosis_Ready` transition from `s_NetInterface_Diagnosis` to `s_NetInterface_Normal_Operation` is taken.

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Table 3 *(continued)*

Enum value	Description
`ev_Diagnosis_End`	The `ev_Diagnosis_End` transition from `s_NetInterface_Diagnosis` to `s_NetInterface_Off is taken`.

6.3.1.4 DiagResult

`DiagResult` corresponds to the possible diagnosis to be provided to the application. The structure of `DiagResult` depends on the kind of diagnosis that is performed and should be adopted from the corresponding specification.

REQ	4.4 Service interface – Parameters – NL/TL to upper layers – DiagResult
The `DiagResult` values for ring break diagnosis, as specified in Annex A (informative), shall be of data type Enum and shall contain the value specified according to Table 4.	

Table 4 — DiagResult values for ring break diagnosis

Enum value	Description
`No_Error`	No error detected.
`Ring_Break`	Ring break detected. The result indicates the relative position of ring break in the Relative_Position parameter.
`Weak_Signal`	Excessive attenuation detected at the input.
`Diagnosis_Inconclusive`	The ring break diagnosis inconclusive.

6.3.1.5 Relative_Position

The content of the `Relative_Position` parameter is relevant if the `DiagResult` parameter contains the value `Ring_Break`.

REQ	4.5 Service interface – Parameters – NL/TL to upper layers – Relative_Position
The `Relative_Position` parameter shall be of data type `Unsigned Byte` and shall contain the relative position of the node to a ring break.	

6.3.1.6 Shutdown_Reason

`Shutdown_Reason` corresponds to the possible causes of a shutdown to be provided to the application.

REQ	4.6 Service interface – Parameters – NL/TL to upper layers – Shutdown_Reason
The `Shutdown_Reason` parameter shall be of data type Enum and shall contain the value specified according to Table 5.	

Table 5 — Shutdown_Reason values

Enum value	Description
`No_Result_Available`	Initial value of the shutdown reason.
`No_Fault_Saved`	Shutdown flag detected before network activity ceased.
`Sudden_Signal_Off`	Shutdown caused by a sudden signal off (SSO).
`Critical_Unlock`	Shutdown caused by a critical unlock.

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6.3.1.7 Node_Position

`Node_Position` provides the current node position to the application.

REQ	4.7 Service interface – Parameters – NL/TL to upper layers – Node_Position
The `Node_Position` parameter shall be of data type `Unsigned Byte` and shall contain the current node position.	

6.3.1.8 Maximum_Position

`Maximum_Position` provides the maximum node position information to the application.

REQ	4.8 Service interface – Parameters – NL/TL to upper layers – Maximum_Position
The `Maximum_Position` parameter shall be of data type `Unsigned Byte` and shall contain the maximum node position information.	

6.3.1.9 Transmission_Status

`Transmission_Status` corresponds to the possible outcomes of a message transmission to be provided to the application.

REQ	4.9 Service interface – Parameters – NL/TL to upper layers – Transmission_Status
The `Transmission_Status` parameter shall be of data type `Enum` and shall contain the value specified according to Table 6.	

Table 6 — Transmission_Status values

Enum value	Description
`Success`	The message is transmitted successfully.
`Buffer_Full`	The receiver buffer is full.
`CRC_Error`	A CRC error occurred.
`Wrong_Target`	There is no such target.
`Segmentation_Error_01`	First segment missing, that is, the first telegram of a segmented transfer is not received.
`Segmentation_Error_02`	Target node does not provide enough buffers to handle a message of this size.
`Segmentation_Error_03`	Unexpected segment number
`Segmentation_Error_04`	Too many unfinished segmentation messages pending.
`Segmentation_Error_05`	Timeout while waiting for next segment.
`Segmentation_Error_06`	Node not capable of handling segmented transfers.
`Segmentation_Error_07`	Segmented transfer has not been finished before the arrival of another message with identical `MsgID` sent by the same node.

6.3.2 Parameters — Upper layers to TL/NL

6.3.2.1 Overview

Table 7 specifies the parameters that are used in the service interface and received from upper layers.

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Table 7 — Parameters received from upper layers to TL/NL

Parameter	Data type	Description

`Application_Request`	`Enum {`
	`  cmd_Network_Startup,`
	`  cmd_Off_Request,`
	`  cmd_Emergency_Shutdown,`
	`  cmd_Start_Diagnosis,`
	`  cmd_DiagResult,`
	`  cmd_Shutdown_Reason`
	`}`
		A request from the application; it is passed from upper layers to NL/TL.

`Network_Startup_Type`	`Enum {`
	`  TimingMaster,`
	`  TimingSlave`
	`}`
		Determines how a node starts up.

`Number_Of_Retries`	`Unsigned Byte`	The number of low-level retries to perform on a control data transmission.
`Priority`	`Unsigned Byte`	The priority for a control data transmission
`Group_Address`	`Unsigned Word`	A group address
`Node_Address`	`Unsigned Word`	A logical node address
`EUI_48`	`EUI-48`	A 48-bit address
`Bandwidth`	`Unsigned Word`	Required bandwidth

6.3.2.2 Application_Request

`Application_Request` corresponds to actions that the application can request from lower layers. These requests require no additional information.

REQ	**4.10 Service interface – Parameters – Upper layers to TL/NL – Application_Request**
The `Application_Request` values shall be of data type `Enum` and shall contain the value specified according to Table 8.	

Table 8 — Application_Request values

Enum value	Description
`cmd_Network_Startup`	Network startup requested.
`cmd_Off_Request`	Off Request issued.
`cmd_Emergency_Shutdown`	Emergency shutdown requested.
`cmd_Start_Diagnosis`	Start of diagnosis requested. The network owner determines how the kind of diagnosis to be performed is selected, for example, through an additional action or by hard coding it.
`cmd_DiagResult`	`DiagResult` of the diagnosis requested.
`cmd_Shutdown_Reason`	Shutdown reason requested.

6.3.2.3 Network_Startup_Type

The `Network_Startup_Type` corresponds to the two different startup types, which can be chosen for the MOST network controller.

REQ	**4.11 Service interface – Parameters – Upper layers to TL/NL – Network_Startup_Type**
The `Network_Startup_Type` parameter shall be of data type `Enum` and shall contain the value specified according to Table 9.	

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Table 9 — Network_Startup_Type values

Enum value	Description
`TimingMaster`	For startup, configure the MOST network controller as TimingMaster.
`TimingSlave`	For startup, configure the MOST network controller as TimingSlave.

6.3.2.4 Number_Of_Retries

`Number_Of_Retries` is used to set the maximum permissible number of low-level retries for a particular message.

REQ	4.12 Service interface – Parameters – Upper layers to TL/NL – Number_Of_Retries
The `Number_Of_Retries` parameter shall be of data type `Unsigned Byte` and shall contain the maximum permissible number of low-level retries for a particular message.	

6.3.2.5 Priority

`Priority` is used by the application to set the priority for a particular message.

REQ	4.13 Service interface – Parameters – Upper layers to TL/NL – Priority
The `Priority` parameter shall be of data type `Unsigned Byte` and shall contain priority for a particular message.	

6.3.2.6 Group_Address

`Group_Address` is an `Unsigned Word` parameter, which is used to set the group address of the node.

REQ	4.14 Service interface – Parameters – Upper layers to TL/NL – Group_Address
The `Group_Address` parameter shall be of data type `Unsigned Word` and shall contain the group address of the node.	

6.3.2.7 Node_Address

`Node_Address` is an `Unsigned Word` parameter, which is used to set the logical node address of the node.

REQ	4.15 Service interface – Parameters – Upper layers to TL/NL – Node_Address
The Node_Address parameter shall be of data type Unsigned Word and shall contain the logical node address of the node.	

6.3.2.8 EUI_48

`EUI_48` is used to set the MAC address of the node.

REQ	4.16 Service interface – Parameters – Upper layers to TL/NL – EUI_48
The `EUI_48` parameter shall be of data type `EUI-48` and shall contain the MAC address of the node.	

6.3.2.9 Bandwidth

`Bandwidth` is used to request the allocation of the corresponding number of bytes in the network frame.

REQ	4.17 Service interface – Parameters – Upper layers to TL/NL – Bandwidth
The `Bandwidth` parameter shall be of data type `Unsigned Word` and shall contain the number of bytes in the network frame that are requested for allocation.	

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6.3.3 Parameters – NL/TL to upper layers and upper layers to TL/NL

6.3.3.1 Overview

Table 10 provides an overview of the parameters that are used in the specified service interface and used in both directions.

Table 10 — Parameters passed from NL/TL to upper layers and upper layers to TL/NL

Parameter	Data type	Description
`Media_Interface_ID`	`Unsigned Word`	An identifier for media data output or input
`Length`	`Unsigned Word`	Length of the data field that is contained in the same service interface.
`Data`	`Byte Array`	A data field, whose length is determined by the `Length` parameter.
`MsgID`	`Unsigned Long`	The MsgID field for control data
`Session_ID`	`Unsigned Word`	A session identifier to correlate confirmations to send-operations.
`Target_Address`	`Unsigned Word`	A 16-bit target address
`Source_Address`	`Unsigned Word`	A 16-bit source address
`Destination_MAC_Address`	`EUI-48`	A 48-bit target address
`Source_MAC_Address`	`EUI-48`	A 48-bit source address

6.3.3.2 Media_Interface_ID

`Media_Interface_ID` is used to unambiguously identify a media interface as source or target of streaming data.

REQ	**4.18 Service interface – Parameters – NL/TL to upper layers and upper layers to TL/NL – Media_Interface_ID**
The `Media_Interface_ID` parameter shall be of data type `Unsigned Word` and shall identify a media interface.	

6.3.3.3 Length

`Length` is used to provide the size of the data field that is contained in the same service interface.

REQ	**4.19 Service interface – Parameters – NL/TL to upper layers and upper layers to TL/NL – Length**
The `Length` parameter shall be of data type `Unsigned Byte` and shall contain the size of the data field that is contained in the same service interface.	

6.3.3.4 Data

`Data` is used as a wrapper for payload that requires no interpretation in the context of the service interface that contains it.

REQ	**4.20 Service interface – Parameters – NL/TL to upper layers and upper layers to TL/NL – Data**
The `Data` parameter shall be of data type `Byte Array`.	

6.3.3.5 MsgID

`MsgID` is used to identify the target of a control frame.

REQ	**4.21 Service interface – Parameters – NL/TL to upper layers and upper layers to TL/NL – MsgID**
The `MsgID` parameter shall be of data type `Unsigned Long` and shall identify the target of a control frame.	

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6.3.3.6 Session_ID

`Session_ID` is an `Unsigned Word` parameter, which is used to unambiguously identify an instance of a control frame that is passed down by the application. The session ID is generated by the application and used when determining the outcome of a transmission attempt.

REQ	4.22 Service interface – Parameters – NL/TL to upper layers and upper layers to TL/NL – Session_ID
The `Session_ID` parameter shall be of data type `Unsigned Word` and shall identify an instance of a control frame.	

6.3.3.7 Target_Address

`Target_Address` is used to fill the target address field for 16-bit addressing for control data and packet data.

REQ	4.23 Service interface – Parameters – NL/TL to upper layers and upper layers to TL/NL – Target_Address
The `Target_Address` parameter shall be of data type `Unsigned Word` and shall contain the target address for 16-bit addressing for control data and packet data.	

6.3.3.8 Source_Address

`Source_Address` is used to fill the source address field for 16-bit addressing for control data and packet data.

REQ	4.24 Service interface – Parameters – NL/TL to upper layers and upper layers to TL/NL – Source_Address
The `Source_Address` parameter shall be of data type `Unsigned Word` and shall contain the source address for 16-bit addressing for control data and packet data.	

6.3.3.9 Destination_MAC_Address

`Destination_MAC_Address` is used to fill the destination address field for 48-bit addressing.

REQ	4.25 Service interface – Parameters – NL/TL to upper layers and upper layers to TL/NL – Destination_MAC_Address
The `Destination_MAC_Address` parameter shall be of data type `EUI-48` and shall contain the destination address for 48-bit addressing.	

6.3.3.10 Source_MAC_Address

`Source_MAC_Address` is used to fill the source address field for 48-bit addressing.

REQ	4.26 Service interface – Parameters – NL/TL to upper layers and upper layers to TL/NL – Source_MAC_Address
The `Source_MAC_Address` parameter shall be of data type `EUI-48` and shall contain the source address for 48-bit addressing.	

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