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Road vehicles — Interchange of digital information on electrical connections between towing and towed vehicles —

Part 4: Diagnostics

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Véhicules routiers — Échange d'informations numériques sur les connexions électriques entre véhicules tracteurs et véhicules tractés — Partie 4: Diagnostics

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 11992-4 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

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ISO 11992 consists of the following parts, under the general title *Road vehicles — Interchange of digital information on electrical connections between towing and towed vehicles*:

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— *Part 1: Physical and data-link layers*

— *Part 2: Application layer for brakes and running gear*

— *Part 3: Application layer for equipment other than brakes and running gear*

— *Part 4: Diagnostics*

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Introduction

ISO 11992 has been established in order to define the data interchange between road vehicles and their towed vehicles using a Controller Area Network (CAN) serial data link as specified in ISO 11898[4].

The description of this part of ISO 11992 is based on the Open Systems Interconnection (OSI) Basic Reference Model in accordance with ISO/IEC 7498[2] (and ISO/IEC 10731[3]), which structures communication systems into seven layers.

When mapped on this model, the communication system specified by ISO 11992 is broken down into:

Layer 7
Application layer for brakes and running gear.
Application layer for equipment other than brakes and running gear.
Application layer for diagnostics.

Layer 3
Network layer for diagnostics.

Layer 2
Data link layer for all communication types.

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Layer 1
Physical layer for all communication types.

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Table 1 — Applicability and relationship between International Standards

Applicability	Normal communication		Diagnostic communication
	Brakes and running gear	Equipment other than brakes and running gear	All applications
Layer 7: Application layer	**ISO 11992-2**	**ISO 11992-3**	**ISO 11992-4** ISO 14229-1
Layer 6: Presentation layer	No functions specified for this layer.		
Layer 5: Session layer	No functions specified for this layer.		
Layer 4: Transport layer	No functions specified for this layer.		
Layer 3: Network layer	No functions specified for this layer.		**ISO 11992-4** ISO 15765-2
Layer 2: Data link layer	**ISO 11992-1**		
Layer 1: Physical layer	**ISO 11992-1**		

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Road vehicles — Interchange of digital information on electrical connections between towing and towed vehicles —

Part 4: Diagnostics

1 Scope

This part of ISO 11992 specifies the data communication for diagnostic purposes on a serial data link between a road vehicle and its towed vehicle(s).

This part of ISO 11992 is applicable to road vehicles of a maximum authorized total mass greater than 3 500 kg.

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2 Normative references

The following referenced documents are indispensable for the application 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.

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ISO 11898-1, *Road vehicles — Controller area network (CAN) — Part 1: Data link layer and physical signalling*

ISO 11992-1, *Road vehicles — Interchange of digital information on electrical connections between towing and towed vehicles — Part 1: Physical and data-link layers*

ISO 11992-2, *Road vehicles — Interchange of digital information on electrical connections between towing and towed vehicles — Part 2: Application layer for brakes and running gear*

ISO 11992-3, *Road vehicles — Interchange of digital information on electrical connections between towing and towed vehicles — Part 3: Application layer for equipment other than brakes and running gear*

ISO 14229-1, *Road vehicles — Unified diagnostic services (UDS) — Part 1: Specification and requirements*

ISO 15765-2, *Road vehicles — Diagnostics on Controller Area Networks (CAN) — Part 2: Network layer services*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11992-1, ISO 14229-1 and ISO 15765-2 apply.

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4 Syntax applied

For the description of services and service parameters of this part of ISO 11992, the following syntax is used:

Name: Type	Parameter name and type specification
Name	Mandatory parameter value
<Name>	Parameter name representing a set of mandatory parameter values
[Name]	Optional parameter value
[<Name>]	Parameter name representing a set of optional parameter values
{Name 1;Name 2}	List of mandatory parameter values
{<Name 1>;<Name 2>}	List of parameter names representing sets of mandatory parameter values
[<Name 1>;<Name 2>]	List of parameter names representing sets of optional parameter values
{<Name 1>|<Name 2>}	Parameter names selection list representing sets of mandatory parameter values
[<Name 1>|<Name 2>]	Parameter names selection list representing sets of optional parameter values
Name.req	Service request primitive
Name.ind	Service indication primitive
Name.rsp	Service response primitive
Name.rsp-	Service negative response primitive
Name.rsp+	Service positive response primitive
Name.con	Service confirmation primitive
Name.con-	Service negative confirmation primitive
Name.con+	Service positive confirmation primitive

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5 Diagnostic application specification

5.1 General

The diagnostic applications are divided into basic diagnostic applications and enhanced diagnostic applications.

Functions, services and protocols of the layers 1 to 4 shall be identical for basic diagnostics and enhanced diagnostics.

5.2 Basic diagnostics

The purpose of the basic diagnostics is to provide vehicle-independent identification and diagnostic information.

All basic diagnostic functions and services shall be provided under all operation conditions in the default diagnostic session without the need for specific access rights.

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5.3 Enhanced diagnostics

The support and the conditions under which enhanced diagnostic functions and services are provided are manufacturer-specific. It is the responsibility of the manufacturer to secure a server against unauthorized access and to guarantee performance and safe operation in all operation modes allowing enhanced diagnostics.

5.4 Client and server state diagrams

5.4.1 General

The client and server state diagrams describe the diagnostic service processing of the client and server application entity.

5.4.2 Client service primitives handling

The client service primitives handling shall be as specified in Figure 1 and Figure 2.

Client states while processing a diagnostic service shall be as specified in Table 2, events resulting in a client state change shall be as specified in Table 3.

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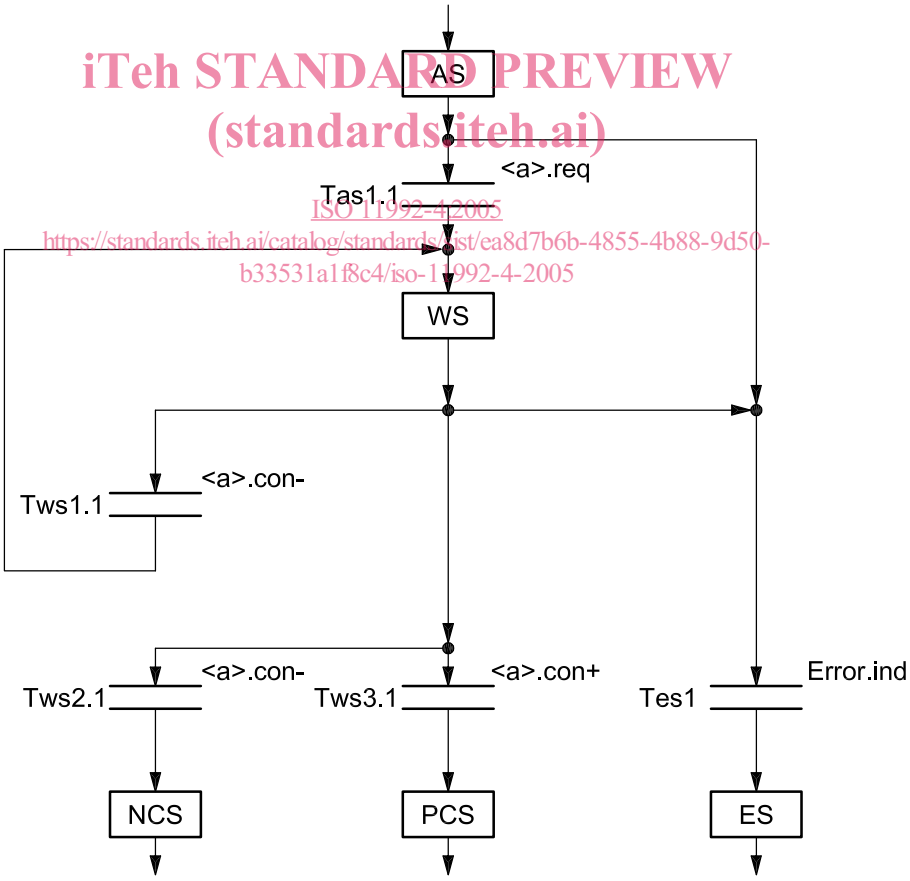

Figure 1 — Client service state diagram — Service request with physical server target address

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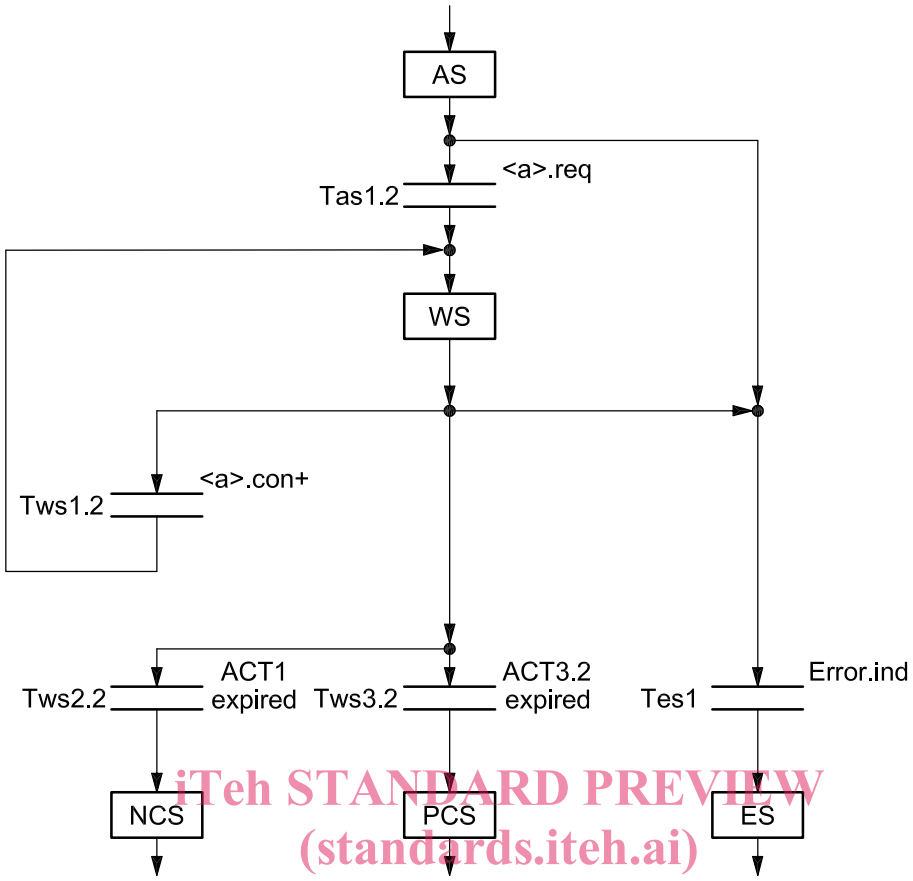

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Figure 2 — Client service state diagram — Service request with functional server target address

Table 2 — Client state description

Client state	Description
AS	Any client state in which a service request can take place.
WS	Client state while waiting for a confirmation from the server.
NCS	a) Following a service request with a physical server target address: client state after the reception of a negative confirmation from the server. b) Following a service request with a functional server target address: client state if no positive service confirmation has been received.
PCS	Client state after the reception of a positive confirmation from a server.
ES	Client state for error handling, e.g. in case of a time out condition.

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Table 3 — Client event description

Client event		Description
Tas1.1	Transmit <a.>.req	The client transmits an <a> service request with a physical server target address.
Tas1.2	Transmit <a.>.req	The client transmits an <a> service request with a functional server target address.
Tws1.1	Receive <a>.con-	Following a service request with a physical server target address: the client receives a negative <a> service confirmation with the response code 'Request correctly received - response pending'. The client shall then reset the time outs and enter the WS state again.
Tws1.2	Receive <a>.con+	Following a service request with a functional server target address: the client receives a positive <a> service confirmation. The client shall then process the positive service confirmation and enter the WS state again.
Tws2.1	Receive <a>.con-	Following a service request with a physical server target address: the <a> service request has been rejected, a corresponding negative <a> service confirmation with a response code has been received. The client shall then change to the NCS state.
Tws2.2	ACT1 expired	Following a service request with a functional server target address: the time ACT1 for the reception of the first service confirmation has expired and no positive service confirmation has been received. The client shall then change to the NCS state.
Tws3.1	Receive <a>.con+	Following a service request with a physical server target address: the <a> service has been executed, a positive <a> service confirmation, i.e. the result of the service, has been received. The client shall then change to the PCS state.
Tws3.2	ACT3.2 expired	Following a service request with a functional server target address the time ACT3.2 for the reception of consecutive service confirmations has expired and at least one positive service confirmation has been received. The client shall then change to the PCS state.
Tes1	Error.ind	An error condition, e.g. a time out condition, is signalled to the client. The client shall then change to the ES state for error handling.
NOTE Negative service responses with a response code 10_{16}, 11_{16} or 12_{16} shall not be sent by a server in case of a service request with a functional server target address.		
<a> Any diagnostic service.		

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5.4.3 Server service primitives handling

The server diagnostic service primitives handling shall be as specified in Figure 3.

Server states while processing a diagnostic service shall be as specified in Table 4, events resulting in a server state change shall be as specified in Table 5.

Table 4 — Server state description

Server state	Description
AS	Any server state in which the reception of a service indication can take place.
PS	Server state while processing a service.
PCS	Server state after the diagnostic service has been executed.
ES	Server state error handling, e.g. after reaching a time out condition.

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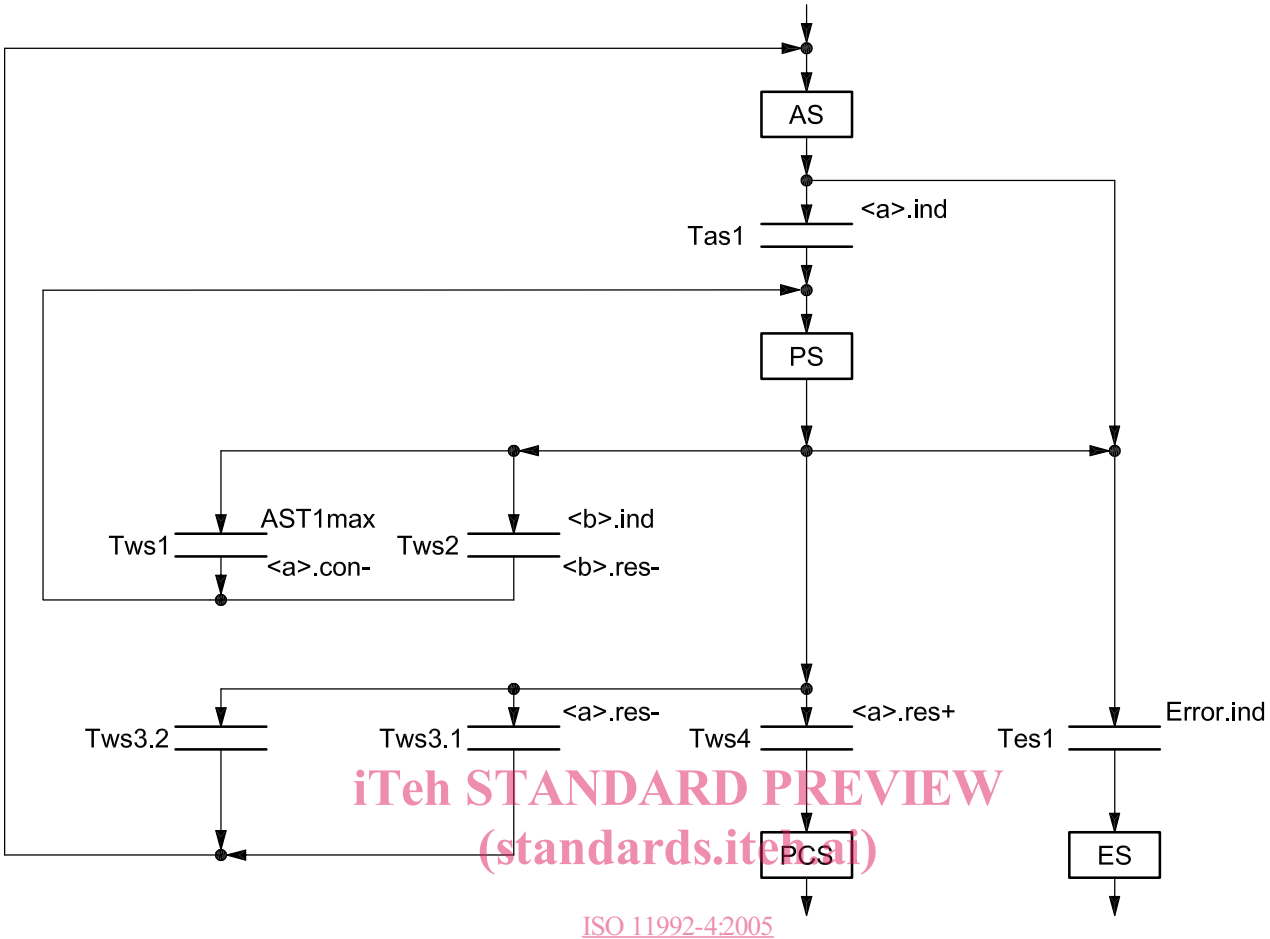

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Figure 3 — Server state diagram

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Table 5 — Server event description

Event		Description
Tas1	Receive <a.>.ind	The server receives any <a> service.indication.
Tws1	AST1max expired Transmit <a>.res-	The service execution time AST1max has expired. the server shall then send a negative service response with the response code 'Request correctly received - response pending' and change back to the PS state to proceed the service execution.
Tws2	Received <b>.ind Respond <b>.res±	The server receives a <b> service indication, while service <a> is in progress. the server shall reject the service <b> if service <b> ≠ service <a> and send a negative response with response code "Busy - Repeat Request". If service <b> = service <a>, the server shall send a negative service response with response code "Request Correctly Received - Response Pending". The server shall then enter again the PS state to proceed the service execution.
Tws3.1	Service execution not completed Respond <a>.res-	Following a service request with a physical server target address: the server rejects the service request. The server shall then send a negative <a> service response with a corresponding response code and change to the AS state.
Tws3.2	Service execution not completed No response	Following a service request with a functional server target address: the server rejects the service request. The server shall then send no response code and change to the AS state.
Tws4	Service execution completed Respond <a>.res+	The server sends a positive <a> service response. the service has been executed. The server shall then transmit a positive <a> service response, i.e. the service results, and shall change again to the PCS state.
Tes1	Error.ind	An error condition is indicated to the server, e.g. a time out condition. The server changes to the ES state for error handling.
NOTE Negative service responses with a response code 10_{16}, 11_{16} or 12_{16} shall not be sent by a server in case of a service request with a functional server target address.		
<a> Any first diagnostic service. <b> Any second diagnostic service.		

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6 Application layer specification

6.1 General

The application layer function, service and protocol specifications comply with ISO 14229-1. In case of differences, the specifications of this part of ISO 11992 shall have precedence.

For the diagnostic communication between road vehicles and their towed vehicles, the restrictions described in this clause apply additionally.

6.2 Application layer functions

6.2.1 General

The application layer provides functions for the execution of the vehicle diagnostics. These functions are used by client and server applications requesting the respective application layer services.

6.2.2 Processing of diagnostic services requests and responses

Diagnostic service requests from the client application and diagnostic service responses from the server application shall be processed according to the service identifier. The diagnostic data shall be encoded as an application layer protocol data unit (A_PDU). The A_PDU shall be transmitted to the respective application layer peer entity by requesting services of the layers beneath the application layer.

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6.2.3 Processing of diagnostic service indications and confirmations

Diagnostic data shall be received as an A_PDU from the layers beneath the application layer. If the received A_PDU is addressed to one of the local server or client application, the received A_PDU shall be decoded and processed according to the diagnostic service identifier and delivered to the server or client application as a service indication or confirmation.

6.2.4 Determination of network layer service parameters

Network layer service parameters are determined by the application layer service type, i.e. ClientIdentifier, ServerIdentifier, ServiceIdentifier and ServiceParameter. In addition the specified parameters Priority and ReservedBit shall be used.

NOTE As no specific functions have been specified for the presentation, session and transport layer, the PDUs of these layers are identical to the respective application layer PDUs.

6.2.5 Application layer protocol timing supervision

The peer application layer entities communicating shall supervise the specified timing and shall take the respective actions in case a specified time out expires.

6.2.6 Server and client addressing

6.2.6.1 Vehicle network architecture

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Towed vehicle server and client applications shall be addressed and identified by means of remote network addressing. The physical sub-networks between towing and towed vehicles are part of the local motor vehicle network and share the same address range. The address type of the target address (TA) and of the remote address (RA) in the case of encoding a remote target address shall be identified by the target address type (TA_Type).

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Figure 4 shows an example of the vehicle network architecture.

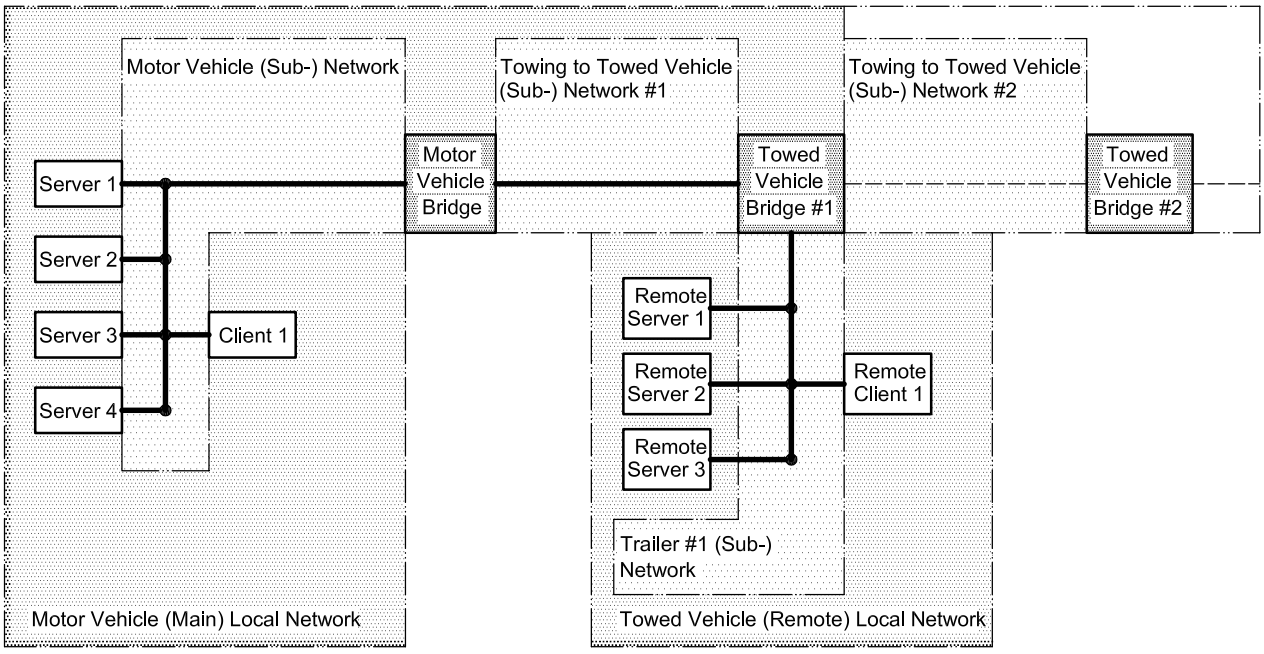

Figure 4 — Vehicle network architecture example

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6.2.6.2 Towing to towed vehicle <Service>.Request and <Service>.Indication

For a diagnostic service request transmitted from a towing vehicle to a towed vehicle, the address parameters of the service primitives have the following meaning:

SA = <Towing vehicle client source address>

TA = <Towed vehicle target address>

RA = <Towed vehicle remote server target address>

TA_type = {
<Physical target addresses>|
<Functional target addresses>
}

See Annex A.

NOTE TA_type identifies the TA and the RA target address type.

6.2.6.3 Towed to towing vehicle <Service>.Response and <Service>.Confirmation

For a diagnostic service response transmitted from a towed vehicle to a towing vehicle, the address parameters of the service primitives have the following meaning:

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SA = <Towed vehicle source address>

TA = <Towing vehicle client target address>

RA = <Towed vehicle remote server source address>

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TA_type = <Physical target addresses>

NOTE TA_type identifies only the TA target address type.

6.2.6.4 Towed to towing vehicle <Service>.Request and <Service>.Indication

For a diagnostic service request transmitted from a towed vehicle to a towing vehicle, the address parameters of the service primitives have the following meaning:

SA = <Towed vehicle source address>

TA = <Towing vehicle server target address>

RA = <Towed vehicle remote client source address>

TA_type = {
<Physical target addresses>|
<Functional target addresses>
}

NOTE TA_type identifies only the TA target address type.

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