
**Road vehicles — Automotive multimedia
interface —**

**Part 4:
Network protocol requirements for
vehicle interface access**

Véhicules routiers — Interface multimédia pour l'automobile —

*Partie 4: Exigences du protocole de réseau pour accès à l'interface du
véhicule*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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ISO 22902 consists of the following parts, under the general title *Road vehicles — Automotive multimedia interface*:

- *Part 1: General technical overview*
- *Part 2: Use cases*
- *Part 3: System requirements*
- *Part 4: Network protocol requirements for vehicle interface access*
- *Part 5: Common message set*
- *Part 6: Vehicle interface requirements*
- *Part 7: Physical specification*

Introduction

This part of the standard network architecture provides a set of common interfaces for accessing network-connected devices and vehicle functions through the vehicle interface. This network architecture has two elements:

- network protocol requirements for vehicle interface access;
- Common Message Set (CMS).

The CMS is the companion to the network protocol requirements: in general, the CMS specifies semantic requirements; the network protocol specifies syntactical requirements. It should be recognized that the network protocol requirements are focused on supporting access to vehicle services; the CMS contains – in addition to vehicle services – semantic requirements for audio visual (AV) messages, phone messages, Human Machine Interface (HMI) messages, etc.

As shown in Figure 1, vehicle interface is a component that is a proxy of the vehicle functions: interfacing objects from functional modules may interact with the device it represents. The object abstracts and exposes the services of devices in the vehicle. Objects called doors, windows, lights and vehicle speed, correspond to the devices connected to an automaker's proprietary network.

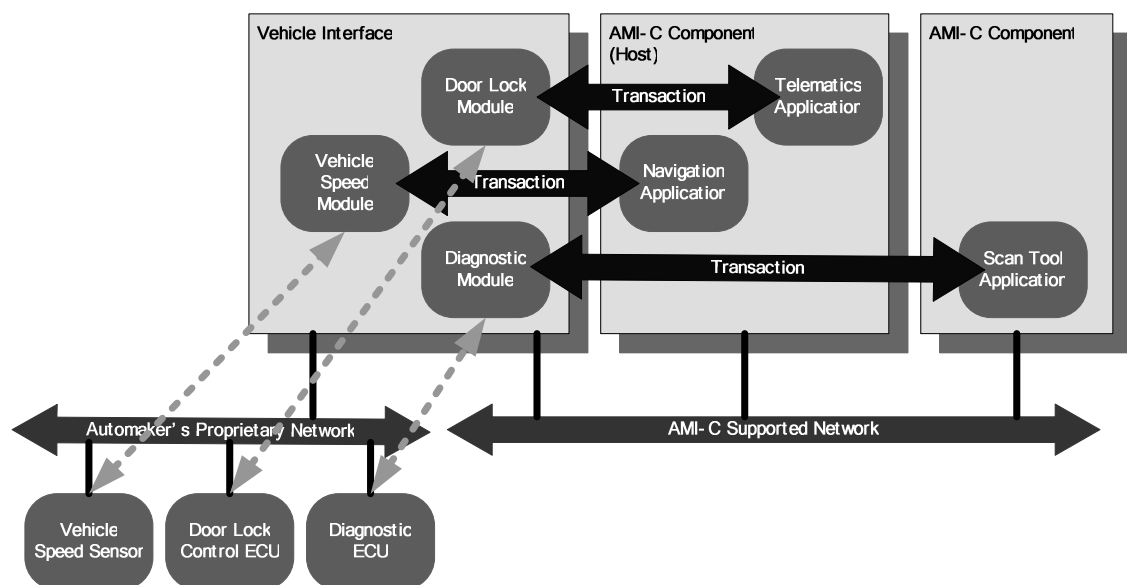


Figure 1 — Vehicle interface (example)

This network protocol requirement for vehicle interface access is a network framework and high-level (meta) protocol that enables the abstraction of devices and thereby facilitates their communication with applications and networks. The AMI-C network protocol requires that each device object consist of a network interface (called its network adaptation layer) to ensure compatibility with different networks and also several functional modules. This requirement makes it possible for network applications to access a vehicle interface independently from specific network technology. Additionally, the network technology must be able to support multiple application level protocols on the network devices.

AMI-C network protocol requirements for vehicle interface access define a Vehicle Interface Protocol (VIP) that can be instantiated on a network technology. A VIP is an application protocol to access a vehicle's devices (functions) via the network transport protocol of AMI-C networks. This, in turn, allows devices on such an AMI-C network to communicate with an automaker's proprietary vehicle network through that vehicle interface.

AMI-C network protocol requirements for vehicle interface access apply to automotive multimedia networks that do NOT have existing protocols for transporting vehicle function messages to and from a vehicle interface. For example, network transport layers are supposed to be general: TCP (UDP)/IP, FCP for 1394 Automotive, or L2CAP for Bluetooth. However, MOST Cooperation has already defined how to transport vehicle functions over the MOST network. Hence, the AMI-C network protocol requirements for vehicle interface access do not apply to the MOST network.

For specific network technologies, the CMS is instantiated into technology-specified message frames. A specific network technology may already include the functionality of some portion of the CMS. In those cases the CMS is not instantiated. Rather, the CMS permits a semantic mapping from AMI-C specifications to the messages of that particular network technology.

Road vehicles — Automotive multimedia interface —

Part 4: Network protocol requirements for vehicle interface access

1 Scope

This document provides a communication model that contains the requirements for a Vehicle Interface Protocol (VIP) to access a vehicle interface over a network transport protocol for AMI-C networks. It does not apply to networks that have pre-existing protocols and messages for transporting vehicle functions.

A VIP defines how an application communicates over a simple network transport mechanism. These requirements can be applied to network technologies that use UDP/IP as the transport method. However, pre-existing systems may have unique protocols and messages for transporting messages about vehicle functions; therefore, this document does not cover such pre-existing technology.

Messages transported are network-specific instantiations of the CMS.

This document addresses the following aspects related to the AMI-C's approach to network communication:

- message frame format;
- application transaction;
- system transaction;
- initialization process;
- address resolution; and
- functional module discovery and removal process.

2 Network architecture

2.1 Outline

The Network protocol requirements for vehicle interface access, which consists of component, functional modules, API, network application layer, and network transport layer. The vehicle interface is considered one of its components.

2.2 Component

A component is a physical entity attached to an AMI-C network (1394 Automotive, Bluetooth, and so on). A component contains one or more functional modules, the network application layer and the network transport layer. A component is identified within a network transport layer with a physical ID, such as node ID, AM address, or IP address.

2.3 Vehicle interface

For those services resident on the automaker's network, the AMI-C vehicle interface (VI) is a component that provides access to vehicle services via an AMI-C-compliant network. It may act as a gateway to a network defined by a vehicle manufacturer or it may implement some or all of the vehicle services directly. Vehicle information and services such as vehicle speed, door lock, windows, and diagnostic services are members of the automaker's proprietary network and a functional module on the VI represents each device. There may be more than one vehicle interface component on a network.

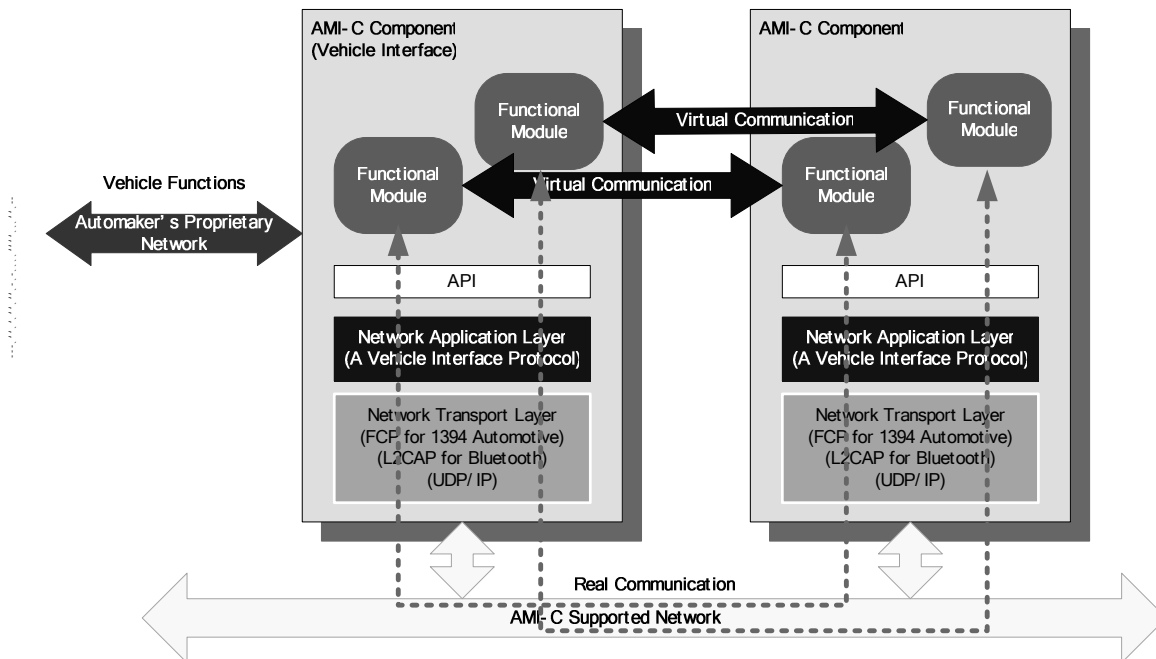


Figure 2 — AMI-C meta protocol conceptual architecture

2.4 Network application layer

A network application layer provides the interface through an API for functional modules to access transport layers (and also, as necessary, lower layers) of network protocol. This document establishes the requirements for the application layer protocol. The instantiation of the application layer requirements into a specific network technology is the vehicle interface protocol for that network.

A VIP allows devices on an AMI-C network to communicate with an automaker's proprietary vehicle network through a vehicle interface.

2.5 Network transport layer

Common network transport layers include TCP(UDP)/IP, FCP for 1394 Automotive, or L2CAP for Bluetooth. MOST has defined a layer for transporting vehicle functions.

2.6 Functional module

Within the AMI-C network architecture, a functional module (FM) is an abstraction of a device. An AMI-C component can have one or more FMs. An FM defines the properties of a device (e.g., the up/down position of a car window). It also defines commands (e.g., set position) that control the properties of a device. An FM is addressed through a logical address, composed of function type (F-Type) and instance number (I-Num).

There can be more than one FM with the same F-Type (4 windows, for example). To distinguish between these identical F-Types, I-Nums are statically or dynamically assigned.

2.7 Component control module (CCM)

Each AMI-C component (including the VI) must have a component control module (CCM). The CCM is the FM that performs initialization, network management, address resolution, service discovery, as well as registry maintenance and update. The I-Num of a CCM serves as the Component ID.

A CCM in each component communicates with other FMs to exchange attributes and status regarding FM installed in its components during initialization or when a component joins the network at the first time or leaves the network. In addition, the CCM is able to reply to service discovery queries from remote functional modules about all FMs inside its own component and component hardware status. The CCM keeps track of the status information in a registry, such as the power status of a remote module, or visibility of a remote module in the network.

2.8 Registry

A Registry is an address-mapping table between the Logical Address of an FM (that is, F-Type and I-Num) and the network-specific ID of the AMI-C component containing this FM (e.g., node number in the case of 1394 Automotive).

The registry contains this matching information about remote and local FMs throughout the AMI-C Network. It is beyond the scope of this specification to define the format of the registry, and how often it should be updated.

3 Addressing

There are three types of addressing: unicast, broadcast and multicast.

3.1 Unicast

Unicast addressing defines a point-to-point transaction.

Unicast is characterized by F-Type values from '00'H to 'EF'H, and I-Num values from '00'H to 'FE'H.

Unicast is the most common type of transaction. For example, an application (hosted by an FM) needs information that can be supplied by a remote FM. It sends an INQUIRE message to that remote FM and waits for the corresponding REPORT message from that remote FM. The logical address (F-Type and I-Num) of the destination FM is specified in the header. The Logical Address of the source FM is also specified in the header so that the destination FM can respond to the source component (See Figure 3), illustrates a unicast transaction.

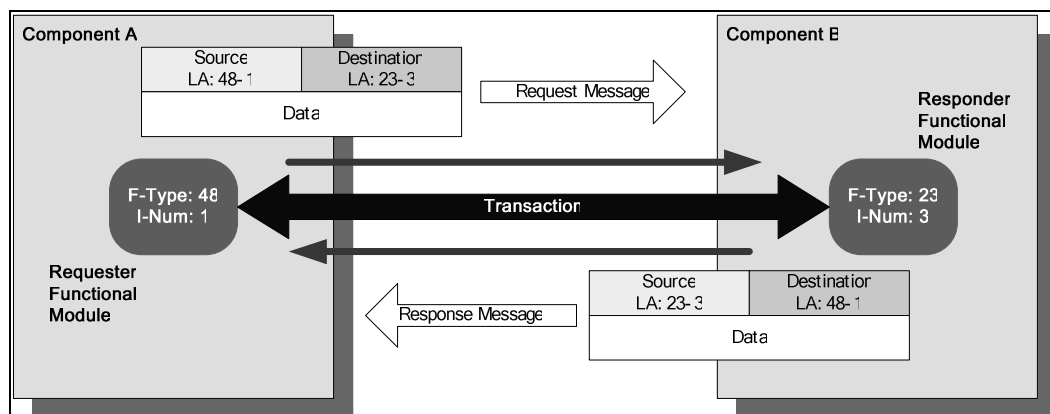


Figure 3 — Unicast transaction mechanism

3.2 Broadcast

The network protocol requirements for vehicle interface access define 3 types of broadcast transactions:

- a broadcast message sent from an FM to all the instances of the same F-Type, e.g. lock all windows. In order to address all the instances of a particular F-Type, the I-Num field is given the maximum value: 'FF'H. F-Type field specifies the Function Type.
- a broadcast message sent from a FM to all the FMs of the AMI-C Network. In order to address all the FMs of the network, the F-Type field is given the maximum value: 'FF'H and I-Num field is 'FF'H.
- a broadcast message for an address request or response (e.g. request to know which component contains a specific FM). When the system field (Sys, see section 4.2) equals 1B, this indicates that the message is a system transaction; therefore, it is always a broadcast message. The subsequent response will also have its Sys field set.

3.3 Multicast

Multicast is used for subscribed information. A component will request information from another component to be sent periodically. The responder component shall then allocate a multicast group ID and start to send the packets with the requested information.

A multicast packet is identified by its F-Type destination field (equal to 'FE'H) and its I-Num field is equal to the multicast group ID ('00'H to 'FE'H).

The message class is used by all the receiving components to indicate the nature of the information being sent (for example the dashboard sends a message containing vehicle speed information at a regular interval. The F-Type indicates that the message comes from the dashboard. The object property indicates that the nature of the information: Vehicle Speed).