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Intelligent transport systems — Communications access for land mobiles (CALM) — Medium service access points

Systèmes de transport intelligents — Accès de communication pour services mobiles terrestres (CALM) — Points d'accès au service moyen

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Foreword

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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.

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ISO 21218 was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

Introduction

This International Standard is part of a family of standards for communications access for land mobiles (CALM) which determine a common architecture, network protocols and air interface definitions for wireless communications using media such as cellular 2nd generation, cellular 3rd generation, microwaves, millimetre waves, and infrared light. Further air interfaces, referred to as communication modules, may be added at a later date. These air interfaces are designed to support point-to-multipoint and point-to-point communications for roadside-to-roadside, vehicle-to-vehicle and vehicle-to-roadside links in the ITS sector.

This International Standard determines the service access points for the OSI (see Clause 4) layers below the network layer, i.e.

— the M-SAP (see Clause 4) offered to the IME for management purposes, and

— the C-SAP (see Clause 4) offered to the CALM network layer for communication purposes.

Intelligent transport systems — Communications access for land mobiles (CALM) — Medium service access points

1 Scope

This International Standard determines the service access points (SAPs) of a communication interface (CI) as provided by the communication adaptation layer (CAL) for communication, and as provided by the CI management adaptation entity (CIMAE) for management of the communication interface.

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.

ISO/IEC TR 8802-1 *Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Specific requirements — Part 1: Overview of Local Area Network Standards*

ISO/IEC 8802-2, *Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Specific requirements — Part 2: Logical link control*

ISO/IEC 8802-11:2005, *Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Specific requirements — Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications*

ISO/IEC 8825-2, *Information technology — ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)*

ISO 21217, *Intelligent transport systems — Communications access for land mobiles (CALM) — Architecture*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 8802-2, ISO/IEC 8802-11, ISO 21217 and the following apply.

3.1
CI Identifier
unique identifier of a (virtual) **CI**

3.2
CM Protocol Layers
all **OSI** communication protocol layers of a CALM **CI** that are below the CALM network layer except the **CAL**

3.3
COMMAND
command sent to the **CIMAE** using the **M-SAP** service primitive **COMMAND**.request

3.4
Communication Interface
CI
all parts of the **OSI** communication protocol stack below the network layer, including the related management functions, for a specific type of communication protocol

EXAMPLE An example of communication protocol is CALM IR (ISO 21214), others are shown in Figure 1.

3.5
Communication Module
CM
all parts of the **OSI** communication protocol stack below the network layer, including the related management functions comprising the blocks **CMME** and **CMPL**

NOTE CMME and CMPL are shown in Figure 1.

3.6
Interface Management Entity
part of the CALM management which is horizontally connected to the **CIMAE**

3.7
Medium
physical properties of a **CI** used to transmit a modulated signal, e.g. wireless or on a wire

3.8
REQUEST
command sent to the **IME** using the **M-SAP** service primitive **REQUEST**.request

3.9
Virtual Communication Interface
logical entity in a **CI** that is associated with a peer station

3.10
CI Priority Manager
logical entity in a **CI** that is managing priority queues

4 Abbreviated terms

NOTE See also: ISO/IEC 8802-2, ISO/IEC 8802-11, ISO 21210, ISO 21214, ISO 21217.

APN	Access Point Name
BC-VCI	VCI for transmission to the broadcast MAC address
CAL	Communication Adaptation Layer
CEN	European Committee for Standardization
CI	Communication Interface
CIC	Communication interface class
CI-ID	CI Identifier
CIMAE	CI Management Adaptation Entity
CIME	CI Management Entity
CIPL	Interface Protocol Layers
CM	Communication Module

CMME	CM Management Entity
CMPL	CM Protocol Layers
C-SAP	Communication SAP as offered by the CAL to the CALM network layer
DLL	Data Link Layer
DSRC	Dedicated Short Range Communication
ETSI	European Telecommunications Standards Institute
GC-VCI	VCI for transmission to a groupcast MAC address
IME	Interface Management Entity
LSB	Least Significant Bit
MC-VCI	VCI for transmission to a multicast (group) MAC address
ME	Management Entity
MedID	Medium identifier, part of CI-ID
MIB	Management Information Base
M-SAP	Management SAP as offered by the CIMAE towards the IME
MSB	Most Significant Bit
OBU	On-Board Unit
OSI	Open System Interconnection
PIN	Personal Identification Number
RX/TX-CI	CI capable of operating in receive and transmit mode
RX-only-CI	CI capable of operating in receive mode only
RX-VCI	VCI for reception
SerialNumber	Serial Number, part of CI-ID
SIM	Subscriber Identity Module
SNAP	Sub-Network Access Protocol
TDMA	Time Division Multiple Access
TX-only-CI	CI capable of operating in transmit mode only, either broadcast or multicast
TX-VCI	VCI for unicast transmission
UC-VCI	VCI for reception from and transmission to a unicast MAC address (It consists of a TX-VCI and the shared RX-VCI.)
VCI	Virtual Communication Interface
WAVE	Wireless Access in Vehicular Environments (IEEE work item related to CALM M5)

5 Requirements

5.1 Communication Module Adaptation

5.1.1 General

As CALM is open for existing communication modules (CM), i.e. CMs that are not aware of CALM, and CALM-specific CMs, there is a need to adapt the interfaces of such existing CMs to those expected by the CALM network layer and the CALM management. The task is to adapt

— the CM Protocol Layers (CMPL) of the OSI protocol stack of a CM to the common CALM network layer by means of a Communication Adaptation Layer (CAL), and

— the CM Management Entity (CMME) of the CM to the Interface Management Entity (IME) by means of a CI Management Adaptation Entity (CIMAE).

The sum of CMPL and CMME in Figure 1 is entitled Communication Module (CM).

The sum of CM and CAL and CIMAE in Figure 1 is entitled Communication Interface (CI).

CMME and CIMAE constitute the Communication Interface Management Entity (CIME).

CAL and CMPL constitute the Communication Interface Protocol Layers (CIPL).

The CM Protocol Layers shall include at a minimum a physical layer (PHY), a medium access control sub-layer (MAC), and optionally a logical link control sub-layer (LLC). In the communication path, the CAL shall offer an LLC SAP (C-SAP) towards the CALM network layer, and shall serve the underlying protocol layer.

In a specific implementation, the CM may include higher layers of the OSI communication protocol stack including the related management.

The previously stated inclusion of higher protocol layers shall be restricted to those communication technologies already existing and not being aware of CALM, e.g. the cellular media ISO 21212 and ISO 21213.

In the management path, the CIMAE shall provide a Management SAP (M-SAP) towards the IME, and shall serve the CM and the CAL.

The CI adaptation is outlined in Figure 1.

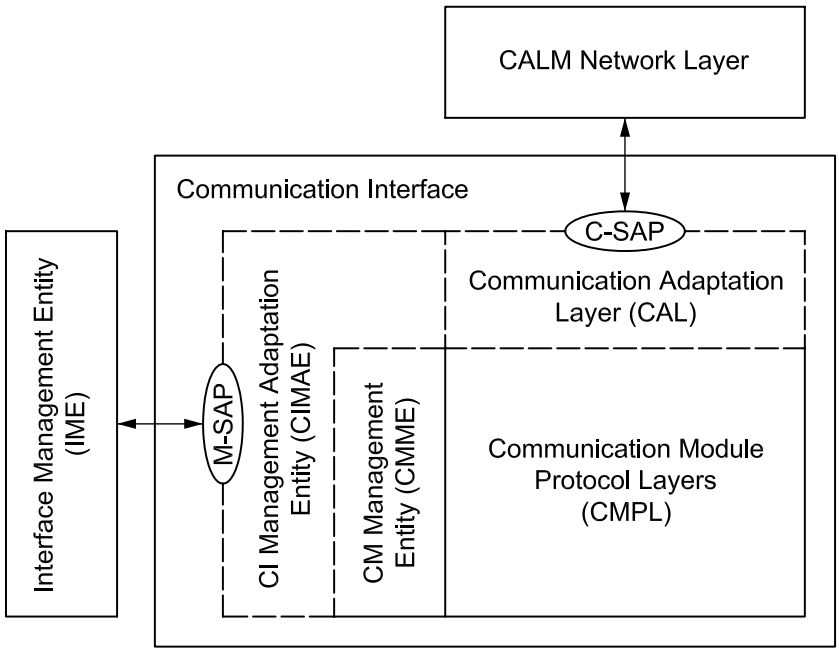

Figure 1 — Architecture

This International Standard provides common basic functional specifications for the Communication Adaptation Layer and for the CI Management Adaptation Entity. It specifies both the Communication SAP (C-SAP) and the Management SAP (M-SAP). Further information may be found in the related standards for the media, e.g. ISO 21212, ISO 21213, ISO 21214.

5.1.2 Communication Adaptation Layer

The CIs built on different media of CALM are using the same CALM network layer. All CIs shall use the same type of C-SAP between the CALM network layer and the CAL.

The medium-specific CAL provides a C-SAP to the CALM network layer following the same principles as outlined in ISO/IEC 8802-2. The supported types of LLC operation and LLC services may depend on the CALM networking protocol selected.

— For CALM FAST communications, Type I. operation is mandatory, with the LLC service XID being prohibited.

— The other types of LLC operation, i.e. Type II. and Type III., are optional.

The CAL can be considered as a medium-specific LLC or as an extension of an existing LLC providing the adaptation of the specific needs of a medium to the common communication C-SAP.

5.1.3 CI Management Adaptation Entity

The CIs built on different media of CALM are using the same IME, i.e. the same CALM management. All CIs shall use the same type of M-SAP between the CALM management and the CIMAE.

The CIMAE provides the M-SAP to the IME following the same principles as outlined in ISO/IEC 8802-11 with respect to the Station Management Entity.

Explicit implementation of the SAP between the CMME and the CIMAE is not required. Thus this SAP is outside the scope of this International Standard.

The CIMAE can be considered as medium-specific management entity providing the adaptation of the specific needs of a medium to the common M-SAP.

5.2 Communication Interface

5.2.1 Classes

Table 1 identifies and distinguishes the classes of CIs.

Table 1 — CI classes

Communication interface class	Definition and explanations
CIC-wl1	Wireless CI that is capable of establishing simultaneous associations with different peer stations for MAC unicast communication, and of receiving from and transmitting to MAC broadcast and multicast (group) addresses. Examples: CALM IR, CALM M5, CALM-MM, …
CIC-wl2	Wireless CI that is capable of establishing a session with a single peer station. Handover between different peer stations may be possible, but not visible to the CALM upper layers and management entities. Examples: CALM-G2, CALM-G3, …
CIC-wl3	Wireless CI that is capable to transmitting only on the basis of MAC broadcast/multicast (group) addresses. Examples: CALM broadcast stations based on CALM-IR, CALM-M5, CALM-MM, …
CIC-wl4	Wireless CI that is capable only of receiving frames from a broadcast station. Examples: Satellite navigation receiver, satellite broadcast receiver, …
CIC-wl5	Wireless CI that is capable only of performing communications between a car and a roadside station based on the master-slave principle with the roadside station being the master. Communication session establishment is done inside the CI. Examples: Japanese DSRC, CEN DSRC, …
CIC-wr1	Wired CI for local area network in a CALM installation. Non-deterministic.
CIC-wr2	Wired CI for local area network in a CALM installation. Deterministic.

5.2.2 Access classes

Access to a remote station may require authentication, for example:

— PIN for a SIM card;

— operator data:

  — provider name;

— APN;

— user name;

— password.

This is identified by means of the CI access class presented in Table 2.

Table 2 — CI access classes

CI access class	Definition and explanations
CIAC-1	No user authentication required. Usage of CI is free of any charge.
CIAC-2	CI requires access credentials, e.g. PIN and operator data. Usage of CI is subject of a service charge, e.g. price per time unit/per data amount unit/flat-rate.
CIAC-3	CI requires access credentials, e.g. PIN and operator data. However, usage of CI is free of any charge.

5.2.3 CI Identifier

CIs shall be referenced/addressed by a unique CI-ID.

The CI-ID shall be constructed according to Figure 2.

CI-ID				
CtrlCI	**SerialNumber**		**MedID**	**CCK-ID**
C7 C6 C5 C4 C3 C2 C1 G/U reserved	Two octet unsigned Integer MSB... LSB		One octet unsigned Integer MSB... LSB	One octet unsigned Integer MSB... LSB
MS Byte	Byte 3	Byte 2	Byte 1	LS Byte

Figure 2 — CI-ID

The **CCK-ID** field identifies a CALM Communication Kernel (CCK) in a CALM installation with several routers and hosts, see ISO 21217. The CCK-ID shall be unique in a CALM installation. The CCK-ID field shall constitute the least significant byte of the CI-ID.

The **MedID** field identifies a CALM CI. The MedID shall be unique within a CCK. The value zero shall be used by the CI during registration at the IME. Assignment of values larger than zero shall be done by the IME. The MedID field shall constitute the second byte of the CI-ID.

NOTE MedID=0 may also indicate "unknown" or "not existent".

The **SerialNumber** field identifies the CI or a VCI of this CI; see clause 5.3.2. The SerialNumber shall constitute the third and fourth byte of the CI-ID. The value zero shall point to the MAC address of the local station and by this to the CI.

NOTE The management of the situation in which a CI may have to maintain more VCIs than addressable with the available SerialNumber address space may be possible and is implementation dependent.

The usage of the **G/U** bit is specified in 5.3.2.

5.2.4 Procedures

5.2.4.1 General

The procedures, as specified here, use management services of the M-SAP, as specified in 5.5.

5.2.4.2 Registration

Registration of a CI at the IME is the process of making the CI known at the IME, and of making it addressable via a unique MedID. See the state machine in Figure 3.

The status of the CI before successful registration shall be CIstatus equal to "not existent".

Upon power-up of the CALM system, or upon physical insertion/activation of a CI, a CI shall request registration of itself at the IME. The following procedure shall apply [steps 1) to 11)].

1) Set SerialNumber (see Figure 2) to a randomly selected number from an equal distribution process, with the seed value derived from the unique MAC address of the CI.

2) Set CCK-ID (see Figure 2) to the value zero.

3) Set MedID (see Figure 2) to the value zero.

4) Set all CtrlCI bits (see Figure 2) to zero.

5) Construct the preliminary CI-ID (see Figure 2).

6) Send **REQUEST** 0 "RegReq" indicating parameter 22 "MedType" and parameter 34 "MAC address" of this CI.

7) Set timer T_register to the value given in parameter 36 "TimeoutRegister".

8) Await **COMMAND** 0 "RegCmd" providing true values of "CCK-ID" and "MedID", and confirming the MAC address as long as T_register has not expired.

9) If the command in the previous step was successfully received, stop T_register and continue with the next step. If T_register had expired, start again with step 1).

10) If MACaddrTemp matches the confirmed MACaddr, registration was successful. Continue with the next step. Otherwise start again with step 1).

11) Upon successful registration, set the SerialNumber to the value zero, which together with the CCK-ID and the MedID as assigned by the IME constitutes the CI-ID of the registered CI. Set parameter 45 "CCK-ID" and parameter 37 "MedID" as received in **COMMAND** 0. Set parameter 42 "CIstatus" to the value "registered", and notify this value to the IME. This setting shall trigger creation of VCIs as specified in 5.3.

In order to register a device with CI class CIC-wl5, set all the CtrlCI bits in step 4) to one.

5.2.4.3 Deregistration

Deregistration of a CI at the IME is the reversal of the registration process of the CI. See the state machine in Figure 3.

Deregistration may be performed by the CIMAE or may be requested by the IME by sending the **COMMAND** 1 "CIstateChng" with the value "deregister".

Deregistration shall result in setting the MedID to the value zero, deletion of all VCIs and setting of parameter 42 "CIstatus" to the value "not existent".

Upon successful deregistration, the CI may be physically removed from the system.

5.2.4.4 Inactivation

Inactivation of a CI is the process to reset the CI and to block all subsequent communications. See the state machine in Figure 3.

Inactivation may be performed by the CIMAE or may be requested by the IME by sending the **COMMAND** 1 "CIstateChng" with the value "inactivate".

Inactivation shall result in resetting the CI. As a consequence, all VCIs shall be deleted and no more pending data packets shall be existent in the CI.

NOTE In a CI of class "CIC-wl2" and access class "CIAC-2" such as specified in ISO 21212 or ISO 21213, inactivation will result in disconnecting from the wireless service, i.e. ringing off.

The CIMEA shall set parameter 42 "CIstatus" to the value "inactive" and shall notify the IME.

5.2.4.5 Activation

Activation of a CI is the process to enable communications in an inactive CI. See the state machine in Figure 3.

Activation may be performed by the CIMAE or may be requested by the IME by sending the **COMMAND** 1 "CIstateChng" with the value "activate".

This command shall trigger creation of VCIs as specified below in this document.

NOTE In a CI of class "CIC-wl2" and access class "CIAC-2" such as specified in ISO 21212 or ISO 21213, the state "active" indicates that the CI is within the communication zone of a base station and thus might connect to the service.

5.2.4.6 Suspension

Suspension of a CI is the process to put all communications of a CI on hold, without deleting any packets or state variables. See the state machine in Figure 3.

Suspension may be performed by the CIMAE or may be requested by the IME by sending the **COMMAND** 1 "CIstateChng" with the value "suspend".

All VCIs shall be maintained. No pending data packets shall be lost. An ongoing frame transmission shall be stopped as quickly as possible.

The CIMEA shall set parameter 42 "CIstatus" to the value "suspended" and shall notify it to the IME.

5.2.4.7 Reactivation

Reactivation of a CI is the process to resume communications in a suspended CI. See the state machine in Figure 3.

Reactivation may be performed by the CIMAE or may be requested by the IME by sending the **COMMAND** 1 "CIstateChng" with the value "reactivate".

The CIMEA shall set parameter 42 "CIstatus" to the value "connected" and shall notify it to the IME. Pending packets shall be processed after activation, if possible, otherwise pending packets may be deleted without notification to the IME.