INTERNATIONAL STANDARD

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Intelligent transport systems — Communications access for land mobiles (CALM) — Using broadcast communications

Systèmes intelligents de transport — Accès aux communications des services mobiles terrestres (CALM) — CALM utilisant les communications de diffusion générale

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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 13183 was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

Introduction

This International Standard is part of a family of International Standards for CALM ("Communications Access for Land Mobiles") which specify a common architecture, network protocols and communications interface definitions for wireless communications using different bearer technologies, e.g. 2nd generation cellular, cellular 3rd generation, 5 GHz microwave, 60 GHz millimetre-wave, mobile wireless broadband, infra-red communications, and satellite. These wireless communications interfaces are designed to provide parameters and protocols for broadcast, point-to-point, vehicle-vehicle, and vehicle-point communications in the ITS sector.

This International Standard provides definitions and procedures for the establishment, maintenance and termination of an ITS communications session within a CALM system environment using received public network broadcast communications messages. Such broadcast communications can be delivered by a variety of media that could include satellite, digital audio broadcast (e.g. $ISDB_{ss}$ and DAB), digital video broadcast (e.g. DVB and ISDB) or any other public communications broadcast service.

Some of the media developed explicitly for CALM include a fully defined broadcast capability, but this International Standard covers only those media that have not been developed specifically for CALM. Protocols for broadcasts that use new dedicated private ITS communications are fully defined in the standards developed for these new communications media.

CALM standards are explicitly designed to enable quasi-continuous communications as well as communications of protracted duration between vehicles and service providers, and between vehicles.

The fundamental advantage of the CALM concept over traditional systems is the ability to support media-independent handover (MIH), also referred to as heterogeneous or vertical handover, between the various media supported by CALM (e.g., cellular, microwave, mobile wireless broadband, infra-red, DSRC, and satellite). Selection policies are supported that include user preferences and media capabilities in making decisions as to which medium to use for a particular session, and when to hand over between media or between service providers on the same medium. These handover mechanisms are defined within the CALM architecture International Standard, ISO 21217, the CALM IPv6 networking protocols International Standard, ISO 21210, the CALM medium service access points International Standard, ISO 21218, and the CALM station management International Standard, ISO 24102. Handovers between access points using the same technology and service provider use mechanisms that are defined within the particular medium-specific CALM standard.

Broadcast communications using public networks will typically be used where large numbers of users are running applications intended to receive the same information. Examples of broadcast information include incremental map-update information, ephemeral information on road conditions including traffic and weather conditions, and the current road use charge that is applied to specific sections of road. Furthermore, GNSS location information can be routed to relevant applications using this protocol.

Broadcasting this information is very efficient spectrally, rather than sending the same information individually to thousands of vehicles via point-to-point communications: the transmission costs could be shared between all the users.

The broadcast medium can also be used to carry paging messages. Strictly speaking, these are unicast, but take advantage of the wide geographical coverage of the broadcast system at the physical layer.

There is no embedded means for the individual receivers to acknowledge correct receipt of broadcast transmissions in real time, and the intended recipient system could be powered down at the time of transmission.

This International Standard identifies techniques that can be used to overcome these limitations.

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The time of transmission is determined by the information supplier and is not under the control of the recipient. Therefore it is possible that the ITS station could be powered down at the time of the transmission, in which case the information will not be received. For example, it is conceivable that there might be overnight transmission of map updates. This International Standard defines a "sleep mode", which would be appropriate for a parked car which would normally require the ITS system to be powered down. However, the (very low power consumption) broadcast receiver and its associated "Medium Management Adaptation Entity" (MMAE) would remain powered to listen for, and store, relevant information transmissions. Any relevant information could be passed to the appropriate applications within the ITS station when the ITS station is next powered up. The following three possible methods have been identified to allow this operation:

a) The MMAE provides storage for all information received over the logical ITS channel, whilst the ITS is in sleep mode, for subsequent transfer to the relevant application via intermediate CALM protocols.

b) The MMAE uses selective storage of information received, following a filtering process. The filtering would be achieved by the application alerting the MMAE on the types of application that are of interest. The application type information will be included within the information header. The MMAE reads the application type information in the header, and stores only the selected information.

c) Filtering and buffering of information, whilst a wake-up message is sent to the rest of the ITS station so that the information being received can be passed to the application for immediate processing. The application would instruct the ITS station to return to sleep mode, once all the information has been received and processed.

The wake-up process in a) above is not currently supported by the relevant CALM standards, so this mode is not currently supported.

The inclusion of this function in the MMAE is not mandated. However, each of these arrangements would greatly increase the probability that broadcast information will be received by a large proportion of the users. As noted above, the broadcast medium does not include a return path. However, reliable information transfer can be supported by using an alternative medium for the return channel. This can be a very sensible approach where there is significant asymmetry, with large amounts of information downloaded with very simple acknowledgement messages to be returned.

Bi-directional satellite communications in the CALM environment are specified in ISO 29282.

Intelligent transport systems — Communications access for land mobiles (CALM) — Using broadcast communications

1 Scope

This International Standard specifies the architectural communications framework of intelligent transport systems (ITS) for the family of communications access for land mobiles (CALM) related International Standards. The architecture is described in an abstract way with several graphical views and examples. The graphical representations partly follow the ISO open systems interconnection (OSI) principles. In addition to the requirements specified within this International Standard, a number of notes and examples are provided to illustrate the CALM concept.

Wherever practicable, this International Standard has been developed by reference to suitable extant International Standards, adopted by selection. The architecture provides for regional variations where regulations differ in different countries and regions.

2 Conformance

2.1 General

Conformance declarations for the various parts of a CALM-compliant system shall be based on the appropriate CALM related International Standards as listed in Clause 3: ISO 21210, ISO 21217, ISO 21218, ISO 24102, ISO 25111, ISO 29281.

2.2 Public telecoms network conformance

Broadcast communications media are defined in various standards set by a variety of standardization fora. This International Standard does not require conformance to any specific broadcast standard, but in order to claim compliance with this International Standard, a system shall declare with which broadcast standards it complies.

The following are examples of systems that are already used, or can be used, for ITS solutions in certain regions:

— ITU-R BS.1194-2, *Systems for multiplexing frequency modulation (FM) sound broadcasts with a sub-carrier data channel having a relatively large transmission capacity for stationary and mobile reception*

— ITU-R BO.1408-1, *Transmission system for advanced multimedia services provided by integrated services digital broadcasting in a broadcasting-satellite channel*

— ITU-R BO.1516 System D, *Digital multiprogramme television systems for use by satellites operating in the 11/12 GHz frequency range*

— ITU-R BT.1306-4 System C, *Error correction, data framing modulation and emission methods for digital terrestrial television broadcasting*

— ITU-R BT.1833, *Multimedia System C, Broadcasting of multimedia and data applications for mobile reception by handheld receivers*

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— ITU-R BT.1833, *Multimedia System F, Broadcasting of multimedia and data applications for mobile reception by handheld receivers*

— ITU-R BT.1833, *Multimedia system M, Broadcasting of multimedia and data applications for mobile reception by handheld receivers*

— ITU-R BS.1114-6, *System F, Systems for terrestrial digital sound broadcasting to vehicular, portable and fixed receivers in the frequency range 30-3,000 MHz*

3 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 21210, *Intelligent transport systems — Communications access for land mobiles (CALM) — IPv6 Networking*

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

ISO 21218, *Intelligent transport systems — Communications access for land mobiles (CALM) — Medium service access points*

ISO 24102, *Intelligent transport systems — Communications access for land mobiles (CALM) — Management*

ISO 25111, *Intelligent transport systems — Communications access for land mobiles (CALM) — General requirements for using public networks*

ISO 29281, *Intelligent transport systems — Communications access for land mobiles (CALM) — Non-IP networking*

4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21217 and the following apply.

4.1
broadcast
some form of digitally coded information being transmitted to a significant percentage of users within the intended area of coverage which could extend to a continent in the case of a satellite broadcast system

4.2
paging
broadcast medium that can be used to carry unicast messages intended for a single recipient, typically in order to request the mobile ITS station to establish a call back to the ITS station that initiated the paging, using the most cost-effective routing

NOTE 1   A specific ITS station could be paged with the instruction to connect to the calling ITS station.

NOTE 2   The calling ITS station can include its identity and current connectivity, so that the paged ITS station knows how to connect to the calling ITS station.

NOTE 3   Paging is an important concept because the CALM architecture does not provide an efficient method for one ITS station to contact a specific mobile ITS station unless these two already have an established communications routing.

4.3
sleep mode
power saving mode of the ITS station when most of the system is powered down, but one or more broadcast radio communications receivers and their associated MMAEs remain powered so that the system can receive and store relevant broadcast information

5   Symbols and abbreviated terms

5.1
CALM
communications access for land mobiles

5.2
CI
communication interface

5.3
DVB
digital video broadcast

5.4
FEC
forward error control

5.5
FLO
forward link only

5.6
GNSS
global navigation satellite systems

5.7
ISDB
integrated services digital broadcasting

5.8
MMAE
medium management adaptation entity

5.9
S-DAB
satellite digital audio broadcast

5.10
S-DMB
satellite digital multimedia broadcast

5.11
UDLR
uni-directional link routing

6 Background

6.1 Proprietary and standardized connectivity protocols

There are many terrestrial broadcast transmitters and satellites that provide broadcast services.

Typically these are primarily for entertainment and carry either video or audio but can also provide digital information broadcast services. Additionally global navigation satellite systems (GNSS) broadcast their location and time in order that the receiver can determine its location and the time. The interface to these systems is the subject of this CALM broadcast International Standard.

Terrestrial services include:

a) Sub carrier services carried on FM broadcast entertainment systems
- 1)　　RDS (Radio Data Service)
- 2)　　DARC (Data Radio Channel) ITU-R BS 1194-2.

b) Digital coded audio

- 1)　　DAB – 'Digital Audio Broadcasting' in Europe
- 2)　　$ISDB_{ss}$ (ITU-R BS.1114-6 System F) / (ITU-R BT.1833.multimedia system F)
- 3)　　'Digital Multimedia Broadcasting' (DMB)
- 4)　　ISDB-T (ITU-R BT.1306-3 System C)/(ITU-R BT.1833 multimedia system C)
- 5)　　SDB-Tmm(ITU-R BS.1114-6 System F)/(ITU-R BT.1306-3 System C)/
　　　　(ITU-R BT.1833 multimedia system F)
- 6)　　FLO (ITU-R BT. 1833 multimedia system M)

c) Digital terrestrial TV
- 1)　　DVB as defined by ETSI
- 2)　　DVB-H
- 3)　　ISDB_Tmm
- 4)　　FLO

Satellite services include:

a) S-DAB (Digital Audio Broadcast)
- 1)　　ONDAS
- 2)　　SIRIUS
- 3)　　Worldspace
- 4)　　XM Radio

b) Digital Satellite Television
- 1)　　 ISDB-S (ITU-R BO.1408-1) / (ITU-R BO.1516 System D)

c) S-DMB (Satellite Digital Multimedia Broadcast)
- 1)　　Solaris (Eutelsat / SES Astra)
- 2)　　Mobile Broadcasting Corporation

d) GNSS
- 1)　　COMPASS
- 2)　　GALILEO
- 3)　　'Global Positioning System' (GPS)4) GLONASS
- 4)　　Correction information from reference stations – including networked real time kinematics

NOTE　　　　The satellite systems identified above are illustrative. These are proprietary systems and not normative.

New systems are in development and this International Standard has been developed to be able to make full use of those new services.

7 Requirements of the MMAE

7.1 General

The efficient connection of a CALM broadcast receiver requires compliance with a number of related standards. The overall CALM architecture is defined in ISO 21217, which defines how the individual standards operate together to deliver the total functionality. An abstraction of the total architecture is shown in Figure 1 below. The satellite 'Medium Management Adaptation Entity' is an adaptation layer between the broadcast communication system and the 'ITS station management', it uses the generic protocol defined in ISO 25111 and ISO 21218 and in this International Standard. Figure 1 shows only the modules that the broadcast communications system has direct interaction with, and identifies the relevant standards. The requirements from each of these standards will be considered in the following sections, together with consideration of the need to interface to a diverse range of proprietary broadcast technologies.

Figure 1 — Interdependency of CALM standards

7.2 Adoption of broadcast standards and internationally adopted practices

Equipment and systems complying with this International Standard shall operate in the environment, regulations and parameters defined for broadcast systems in internationally adopted practices and within the limits and parameters defined in regional and national regulations.

7.3 CALM architecture

Equipment and systems complying with this International Standard shall operate in the environment of, and to the parameters defined within ISO 21217.

Broadcast communications can be used by CALM-aware and non-CALM-aware applications.

Applications are grouped below according to common communications requirements:

a) Broadcast applications (e.g. map updates, road use charging fee tables, and traffic information) where it is acceptable that there is no guarantee that the information will be received correctly by all users.

    1) Includes communication classes 1 and 9 as defined in ISO 21217.

b) Broadcast with a return link (e.g. for message acknowledgement / retransmission request) – the return link can use a return path using another medium.

    1) Includes communications classes 1 to 4 and 9 to 12 as defined in ISO 21217.

    2) Broadcast mode is not applicable to internet browsing.

c) Broadcast communications of management information (e.g. paging of the vehicle).

    1) Supports the establishment of all communication classes 1 to 16, as defined in ISO 21217.

7.4 CALM networking protocols

Equipment and systems complying with this International Standard shall operate in the environment of, and to the parameters defined within, ISO 29281, or to ISO 21210 for IPv6 Networking, e.g. when used to achieve reliable broadcast and multicast (see 7.9.6).

7.5 CALM medium service access points

Equipment and systems complying with this International Standard shall operate in the environment of, and to the parameters defined within, ISO 21218.

This interface is used to provide information on the status of the relevant communications medium. Whilst the ITS station management is unable to take any action when there is no reception of a broadcast signal, it can be useful for some applications to know that the communications link is not available, particularly if the application is expecting to receive some information at a particular time.

The interface is also used to flag up instances when broadcast information is being received, so that the ITS station management can manage the forwarding of this information to the relevant application.

If an application requires information to be received whilst the host of the CALM system is powered down (e.g. a car parked overnight) the ITS station can operate in a "sleep mode" where the ITS station management can instruct the broadcast receiver to monitor, recognise and store information intended for applications that are used within that vehicle. The information can be transferred to the application the next time that the system is powered up.

7.6 ITS station management

Equipment and systems complying to this International Standard shall operate in the environment of, and to the parameters defined within, ISO 24102.

Because there is, normally, no backward signalling on a broadcast channel, there will be no acknowledgement of correctly received information, and no possibility to request retransmission of lost information. However, reliable broadcast techniques allow for a reverse channel to be implemented using an alternative medium. CALM management can assist by selecting the most appropriate channel for the return signalling. The generation of an acknowledgement or a request for retransmission will be handled within the application rather

than within the MMAE. The request to establish a reverse channel will therefore be managed by the application.

A sleep mode has been defined in order to minimise the chances of loss of broadcast data whilst the vehicle is not in use. When not in use the ITS station would normally be powered down except for the broadcast receiver and its associated MMAE. In the sleep mode, any relevant information received will be stored in the MMAE until the next time that ITS station becomes operational.

The ITS station management has limited ability to control the interface to the broadcast receiver. There are three possible states:

a) Ready to receive – information can arrive at any time – this is the continuous connection mode.

b) Sleep mode – a low power mode, where the information from the broadcast receiver can be stored within the MMAE, for later transfer to the application when the ITS station is fully powered.

c) Off – any information received by the broadcast receiver will be ignored and lost.

7.7 CALM using public wireless networks

Equipment and systems complying to this International Standard shall operate in the environment of, and to the parameters defined within ISO 25111.

7.8 Interface medium management

Interface medium management shall be conducted in accordance with the specifications of ISO 25111, 6.5 – 6.7.

7.9 Establishment of a medium specific session by the MMAE

7.9.1 Establishment and termination of a 'Continuous' session

Equipment and systems complying with this International Standard shall utilise procedures determined in ISO 25111, 6.1.4.

7.9.2 Basic operation

The basic operation will support both CALM–aware and non-CALM-aware applications. However more advanced functionality will be enabled only for CALM aware applications, as described, see 7.9.3 to 7.9.6.

The MMAE shall maintain a list of the broadcast services that it is equipped to receive.

The MMAE shall inform the 'ITS station management' of the list of broadcast services that it is equipped to receive. This will be achieved using a GetParam.request / GetParam.confrim interchange.

Similarly any applications installed at the ITS station will identify to the ITS station management details of any information sources that they wish to receive. The ITS station management can then instruct the receiver's MMAE as to which information sources are to be monitored, using a SetParam.request command.

On receipt of the connect instruction from the ITS station management the MMAE shall cause the broadcast receiver to be power up, and to monitor the channels defined by the ITS station management. In general a single broadcast channel can contain information intended for a wide range of applications. A basic MMAE shall simply forward all information detected by the broadcast receiver that has been set to listen to the selected channel. In this mode the MMAE provides an interface for the receiver, but adds no additional value.

7.9.3 Intelligent (filtered) operation

CALM aware applications will be able to include additional information that will enable ITS station management to set parameters that will enable the communications system to operate more efficiently and effectively.
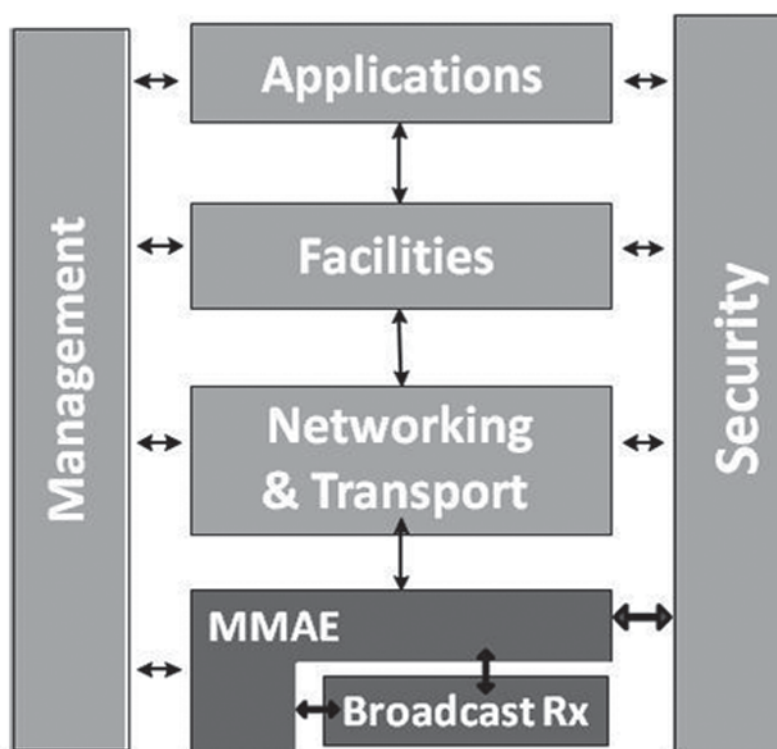
Additionally, a more advanced MMAE could examine the received information to identify when relevant information is received and will then filter out any information that is outside the defined set of applications that are operational at the ITS station. The filtering shall be in accordance to criteria forwarded from the ITS station management and shall use application information in the information header.

This filtering action will reduce the amount of traffic to be handled by the ITS station management and application software. When the broadcast receiver MMAE detects information addressed to a relevant application it alerts the ITS station management using an MMAE-Notify.indication so that the ITS station management can arrange for the information to be delivered to the appropriate application.

The filtering mode shall be selected or deselected using the MMAE-SetParam.request.

7.9.4 Establishment of "sleep mode"

Figure 2 — ITS station reference architecture showing elements that remain powered in sleep mode

Broadcast distribution of information to all users of an application (such as map updates) presents a challenge where ITS stations are typically installed within vehicles. The normal situation would be that an ITS station will be turned off when the vehicle is not being used. Consequently these ITS stations will not receive any broadcast information whilst the engine is not running, and applications in that vehicle will not have the benefit of any information that was transmitted whilst the vehicle was not used. This could be a significant problem for some applications and the following protocol has been defined to reduce the probability that such broadcast information will be lost. This International Standard defines how such a system should operate, if the functionality is provided at that ITS station. Figure 2 shows the elements that remain active during the sleep mode.

The ITS station management can also instruct the MMAE (and hence the broadcast receiver) to remain powered-up whilst the rest of the ITS station is powered down. This will allow the reception of information which would otherwise be lost. This information can be handled in a number of ways.

a) All information that is received could be stored

b) Information can be filtered in accordance with the criteria described in 7.9.3 and only the filtered information would be stored

The MMAE shall notify the ITS station management of the stored information as soon the ITS station is next powered-up, using the MMAE-Notify.indication .

The sleep mode shall be selected and deselected using the MMAE-SetParam.request.

NOTE   There is the possibility that the MMAE temporary information storage resource could be exhausted, if the ITS station remains powered down for a long period. One solution would be for the MMAE to send a "wake-up" request to the ITS station. However, this would have to be implemented as an extension to the current ITS station management International Standard, ISO 24102.
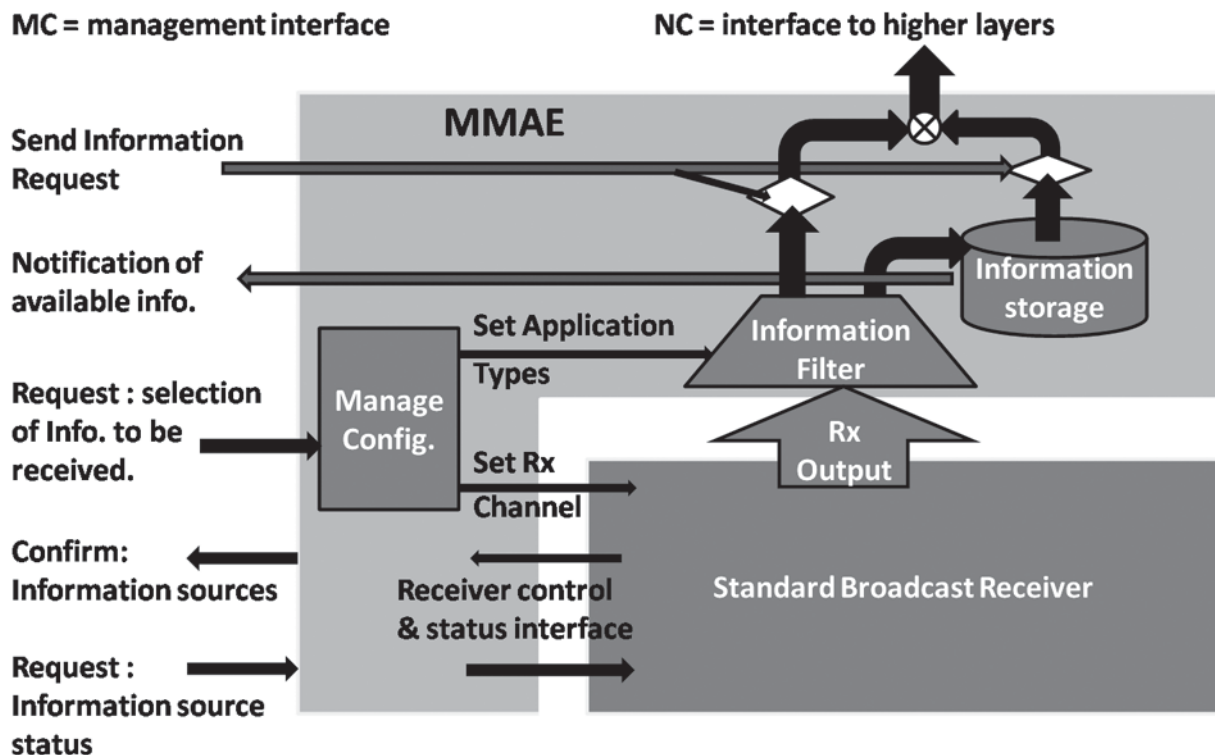

Figure 3 — Functionality provided by the broadcast MMAE

Figure 3 shows the interaction between the MMAE and the ITS station management which is located to the left of the diagram.

a) Starting at the bottom left hand corner of Figure 3 we see that the ITS station management can request information about the status of the broadcast receiver and will receive a confirmation of status.

b) The request can also be used to change the status of the receiver, for instance to power this up or down, or to select the specific information sources to be monitored.

c) The MMAE can translate this request into the selection of specific channels / frequencies to be monitored. The request to monitor information for selected applications can also be used in the MMAE to set an information filter, such that only relevant information is forwarded to the applications via the CALM communication protocol stack, or is stored if the system is in sleep mode.

d) Figure 3 also shows that the information storage device has the capability to notify the ITS station management that it has information to be transferred – this will become available following a return to full power once the system is powered-up from sleep mode.

e) Finally, the ITS station management is able to regulate the flow of information from the filter and the information storage.

7.9.5 Paging

The broadcast medium can be used to carry unicast messages intended for a single recipient, typically in order to request a call-back. The calling ITS station can include its identity and current connectivity, so that the paged ITS station knows how to connect to the calling ITS station. Paging is an important technique to be used when contacting a specific mobile ITS. It reduces the signalling overhead that would be needed to update the IPv6 home agent, if the home agent is to be able to indicate the most appropriate routing to connect to the meeting.

The CALM architecture (ISO 21217) and ITS station management (ISO 24102) International Standards explain how an application running in an ITS station is able to make use of the most suitable communications medium, in terms of cost and performance, where a mobile ITS station needs to connect to the infrastructure. However, when an application needs to connect to a mobile ITS terminal via the most suitable network it needs to have knowledge of the communications connections that are possible at the mobile station. In IPv6 this can be obtained from the "home agent". However, the number of control messages needed to update the information stored by the agent could prove to be an unacceptable overhead for systems such as CALM M5, with very frequent changes of the access node that could be used to make contact with the mobile ITS station.

One solution is for the calling ITS station to send a paging message via a broadcast network with sufficiently extensive geographic coverage. The paging message should contain the following information:

a) Called ITS station unique identification
b) Calling ITS station unique identification
c) Calling station application
d) Identification of network connection options available at the calling ITS station

The called ITS station can then use the information about local and distant communication options in order to determine and establish the optimum routing between the two ITS stations.

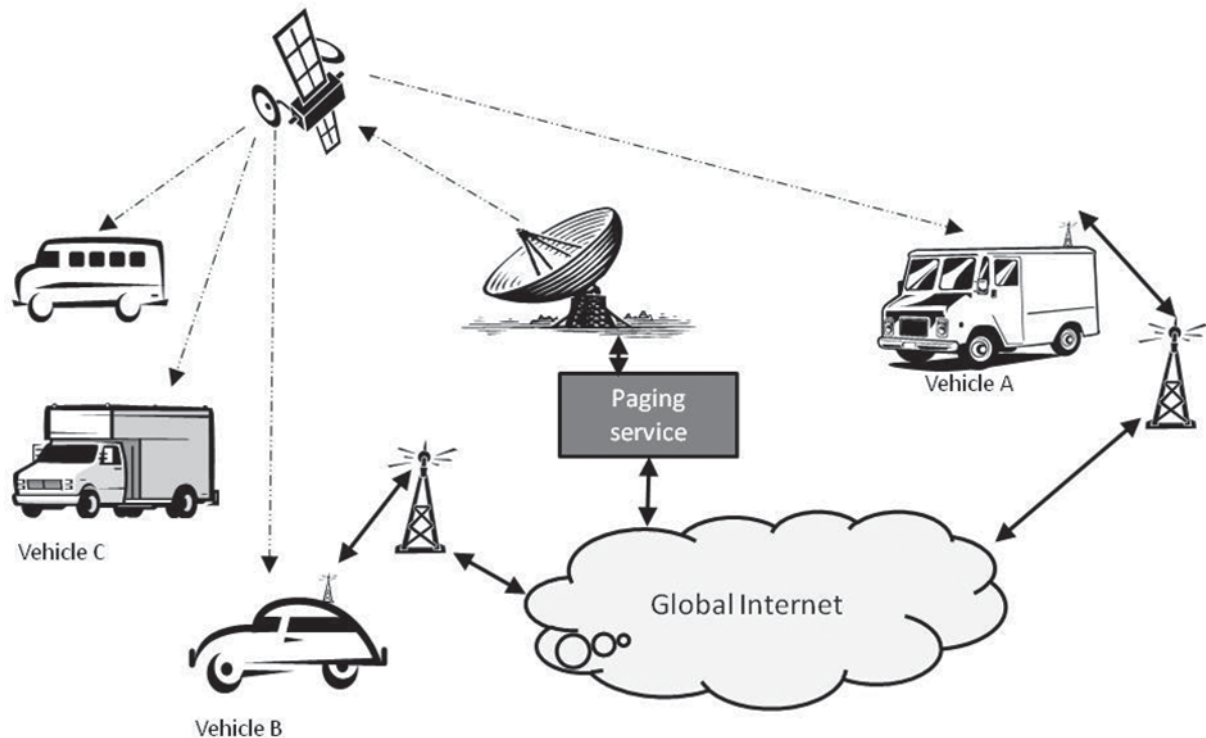## Paging to connect a remote mobile ITS station

Figure 4 — Use of paging to allow connection to a remote ITS station

Figure 4 shows vehicle A setting up a call to vehicle B. Vehicle A first establishes a link to the paging server, by the most appropriate of the media available at vehicle A. The paging message is sent over a broadcast medium with the address of Vehicle B and the routing options available at vehicle A. Vehicles A, B, C, D, etc. all receive the paging message, but only vehicle B responds. Vehicle A can also receive and use the paging message for confirmation that the paging message has been sent. Vehicle B then uses the knowledge of network routing options available at vehicle A and its local network availability in order to make the most appropriate link to Vehicle A.

7.9.6   Reliable broadcast operation

Most broadcast media make use of unidirectional communications. Consequently there is no possibility for these media to support the return of an acknowledgement message. Reliability of information transfer can be improved by techniques such as forward error correction and retransmission of the information, probably after a delay using a carousel approach. However, absolute certainty of correct reception can only be assured if there is positive confirmation of correct reception, typically supported by an indication of which parts of the information need to be retransmitted if there is an error. This International Standard supports the adoption of reliable broadcast protocols that have been defined by other standardization groups.

Several techniques have been standardized to provide reliable broadcast, and this International Standard is intended to accommodate any of these standards. Examples include

a)   the IETF defined UDLR (UniDirectional link routing) within RFC 3077,

b)   ESA has defined satellite communication using IPv6 multicast capabilities, and

c)   IP Datacast has been standardized within ETSI.

The application that is receiving the information can create suitable acknowledgements and retransmission requests. The ITS station management will then be able to determine the most appropriate way to deliver this retransmission request (or acknowledgement) back to the ITS station that is broadcasting the information. The missing information can then be supplied directly to the mobile ITS station, using the comms medium that was employed for the retransmission request. The designer of the application does not need to have any knowledge of the media used for this acknowledgement / retransmission request. However, it must be noted that the standard TCP protocol is unlikely to be suitable because of the round the loop delay in returning acknowledgements. New protocols have are being developed to overcome these delay and uplink bandwidth limitation problems.
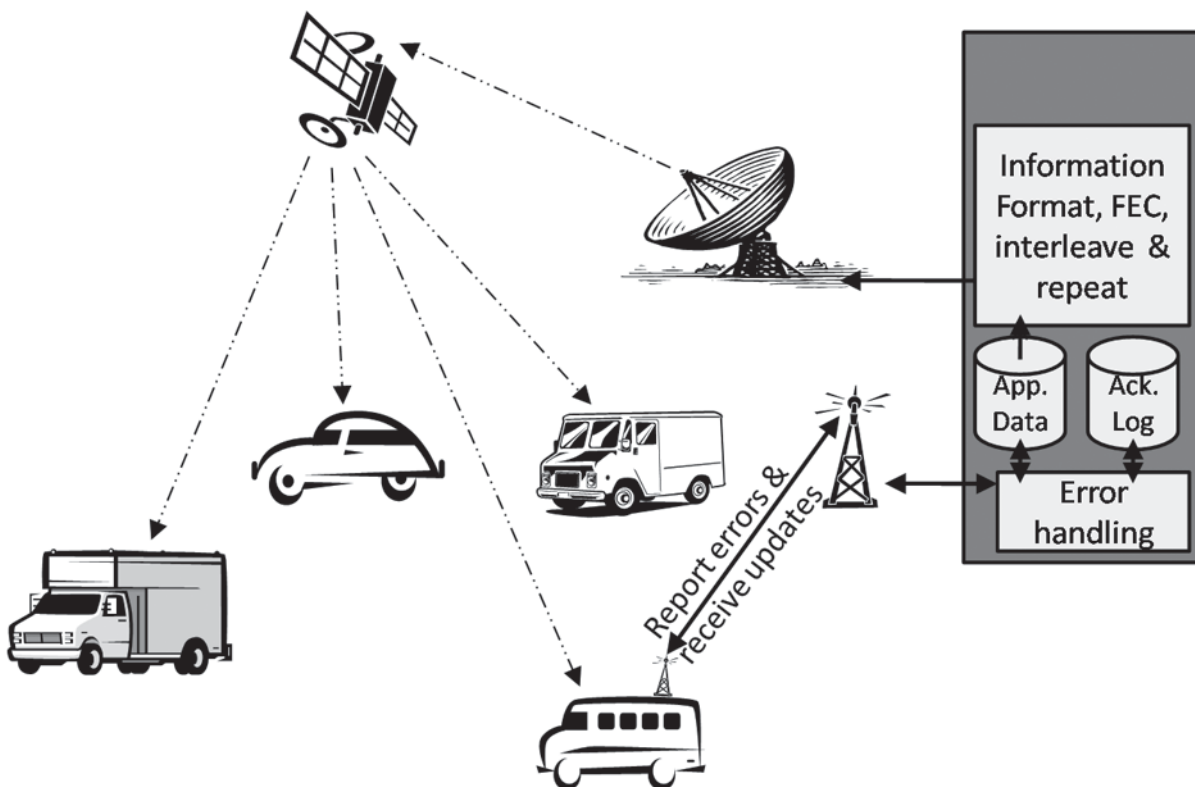
Figure 5 — Achieving reliable broadcasting through the use of an auxiliary channel

Figure 5 shows many vehicles receiving a set of broadcast information. One of the vehicles has errors in the information that it has received. These errors cannot be corrected using the built in FEC. The information can be transmitted many times, but one or more blocks of data can still have not been received correctly. The application in the vehicle then establishes a link to the information server and requests a download of that block of information over the medium that is being used to request the repeating of the missing information.

8 Medium access control (MAC)

MAC shall be conducted in accordance within the specifications of ISO 25111. See Clause 7.

8.1 CALM broadcast communications MMAE service primitives

The CALM system needs to be able to control and monitor the communications systems that are available. A common set of service primitives, have been defined which the IME will used to interact with each communications medium. CALM compliant broadcast communications MMAE shall support the following service primitives:

8.1.1 MMAE-SetParam.request

The MMAE-SetParam.request service primitive is used to set a parameter.

- MMAE-SetParam.request
  - int interfaceId,
  - uchar paramNumber,   // 128
  - uchar paramValue;   // 1: connect, 2: disconnect

8.1.2 MMAE-SetParam.confirm

The MMAE-SetParam.confirm service primitive is a confirmation that the SetParam request has been processed. It indicates whether the request has been performed.

- MMAE-SetParam.confirm
  - int interfaceId,
  - uchar paramNumber,
  - uchar paramValue,
  - uchar result;

8.1.3 MMAE-GetParam.request

The MMAE-GetParam.request service primitive is a request to return the status of the specific parameter.

- MMAE-GetParam.request
  - int interfaceId,
  - uchar paramNumber;

8.1.4 MMAE-GetParam.confirm

The MMAE-GetParam.confirm service primitive is a confirmation that the GetParam request has been processed, and includes the requested information. Alternatively it indicates that the request has not been performed.

- MMAE-GetParam.confirm
  - int interfaceId,
  - uchar paramNumber,
  - uchar ifStatus,
  - struct ifChar,
  - uchar result;

8.1.5 MMAE-Notify.indication

The MMAE-Notify.indication service primitive is a status indication that is created at the initiative of the broadcast receive subsystem rather than in response to a request from the CALM management entity.

- MMAE-Notify.indication
    - int interfaceId
    - uchar status,   // 1: disconnected, 2: connected

8.2   Identification of the broadcast communication MMAE

The sequence of session initiation shall be as determined, see 7.9.

In order to establish a session CALM broadcast communications interface (CI) MMAE shall perform the following procedures to enable the CALM management entity to turn the broadcast receiver on or off, to request status information and to receive confirmation that requests have been acted up on.

8.2.1   MMAE-SetParam.request

On receipt of *MMAE-SetParam.request* the broadcast communications MMAE on the ITS station shall attempt to connect to the broadcast communications system.

- MMAE-SetParam.request
    - int interfaceId,
    - uchar paramNumber   // 128,
    - uchar paramValue   // 1: connect, 2: disconnect

8.2.2   MMAE-SetParam.confirm

Once the parameter value is received, the broadcast MMAE shall send to the ITS station management the MMAE-GetParam.confirm primitive.

- MMAE-SetParam.confirm
    - int interfaceId,
    - uchar paramNumber,
    - uchar paramValue,
    - uchar result;

8.2.3   MMAE-GetParam.request

On receipt of *MMAE-GetParam.request* (int interfaceId, uchar paramNumber = 2), the broadcast MMAE on ITS station shall inquire to MAC on MS the interface characteristics.

- MMAE-GetParam.req
    - int interfaceId;
    - uchar paramNumber
            // 1: Request for interface status
            // 2: Request for interface characteristics

8.2.4   MMAE-GetParam.confirm

Once the parameter value is received, the broadcast MMAE shall send to the ITS station management the MMAE-GetParam.confirm primitive.

- MMAE-GetParam.confirm
    - int interfaceId;
    - uchar paramNumber,
    - uchar ifStatus
        - valid if ParameterNumber is 1   //1: Connected, 2: Disconnected,
    - struct ifChar
        - valid if ParameterNumber is 2
    - int DataRate,
    - int Cost,

- uchar ServiceType,
- uchar Security
- uchar result

8.2.5 Result

The parameter "result" in MMAE-GetParam.confirm represents the processing result of request service.

1: OK   - successful reply
2: Error   - no such media
3: Unknown Error.

8.2.6 Additional procedures

In "sleep mode" broadcast receivers can continue to operate whilst the rest of the ITS station is turned off. The ITS station management shall inform the MMAE about the specific application information types that should be recorded. In turn the MMAE shall notify the ITS station management when it receives any such information. However, if the ITS station is in sleep mode the MMAE shall store the information until the ITS station is once more fully operational – at which time it will send a notification to the ITS station management, which will normally be followed by a request from the ITS station management to forward the relevant information, after which the MMAE should forward the relevant information that has been stored. The stored information should be deleted once the application confirms (via the ITS station management) that this has been correctly received.

8.3 CALM session connection

8.3.1 General

The sequence of session initiation shall be as determined in 7.9.

In order to establish a session CALM broadcast CI MMAE shall perform the following procedure:

On receipt of *MMAE-SetParam.request* (int interfaceId, uchar paramNumber = 128, uchar paramValue = 1) service, the broadcast MMAE on the mobile station side shall attempt to receive the required communications channel

Subsequently, CALM broadcast MMAE shall send to the ITS station management the broadcast *MMAE-SetParam.confirm* (ok) primitive.

The parameter "result" in *MMAE-SetParam.confirm* represents the processing result of connection request service and shall be as follows:

1: OK,   - the broadcast CI MMAE shall attempt to connect
2: Fail   - try later
3: System error

8.3.2 Successful CALM session establishment

Once the broadcast connection is established, the broadcast CI MMAE shall notify to the ITS station management of any changed status of the medium using *MMAE-Notify.indication* service.

The *MMAE-Notify.indication* will also be used each time relevant new information is received, so that this can be forwarded to the application in a controlled way.

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8.4   CALM session disconnection

On receipt of *MMAE-SetParam.request* (int interfaceId, uchar paramNumber = 128, uchar paramValue = **2**) service, the broadcast receiver shall be switched off. The broadcast CI MMAE shall then send to IME the *MMAE-SetParam.confirm* primitive.

The parameter "result" in *MMAE-SetParam.confirm* represents the processing result of connection request service:

- 1: OK   - the broadcast CI MMAE has completed disconnection
- 2: Fail   - try later
- 3: System error

8.5   Change of broadcast communications connection state

If the broadcast communications connection state changes during the session (loses or regains reception of the transmitted information), the broadcast communications MMAE in the mobile station shall immediately notify this to the IME using *MMAE-Notify.indication* primitive.

8.6   Retrieval of the medium status

The ITS station management can check the status of the specific medium. On receipt of *MMAE-GetParam.request* (int interfaceId, uchar paramNumber), the broadcast receiver MMAE on the ITS station side shall report on the status of the medium.

8.6.1   MMAE GetParam.req

The ITS station management can request information about the status of broadcast communications receiver using the *MMAE-getParam.request*.

- MMAE-GetParam.req
     - int interfaceId;
     - uchar paramNumber
         // 1: Request for interface status
         // 2: Request for interface characteristics

8.6.2   MMAE GetParam.confirm

On receipt of an *MMAE-getParam.request* the broadcast communications MMAE on the ITS station shall return the information requested about the status of broadcast communications receiver.

- MMAE-GetParam.confirm
     - int interfaceId;
     - uchar paramNumber
     - uchar ifStatus
     - struct ifChar
     - uchar result

The parameter "result" in MMAE-GetParam.confirm represents the processing result of request service.

- 1: OK   - successful reply
- 2: Error   - no such media
- 3: Unknown error.

8.7 Broadcast communications specific connection aspects

The sequence of session initiation shall be as determined in 7.9 above.

Once the receiver has been instructed to forward information received, it shall acknowledge correct operation, and will also send warnings of loss of signal (if specifically requested).

When the ITS station is powered up from sleep mode it shall inform the MMAE. The MMAE shall then use a notify indication to alert the ITS station management that there is application information stored within the MMAE. The ITS station management shall then request the MMAE to transfer that information to the relevant applications.

8.8 Broadcast communications session disconnection

The broadcast communications connection shall be closed by instructing the receiver to power down.

9   Test methods

Test and conformance requirements in respect of networking protocols shall be defined in accordance with ISO 21210 (CALM IPv6 networking) and ISO 21217 (CALM architecture).

10 Declaration of patents and intellectual property

This International Standard has no specific provisions that are known to be the subject of any patent rights.

The use of any specific communications media may involve the use of patent protected technology, however no such specifications are defined within this International Standard and the reader is directed to the provider of its telecommunications system in respect of any IPR issues involved in aspects of that technical solution.

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Bibliography

[1]   ISO 7498-1:1994, *Information technology — Open Systems Interconnection — Basic Reference Model: The Basic Model*

[2]   ETSI TS 102.470, *IP Datacast over DVB-H: PSI/SI*

[3]   ETSI A096, *IP Datacast over DVB-H: Set of Specifications for Phase 1*

[4]   ETSI TR 102, 473 v1.1.1, *IP Datacast over DVB-H: Use Cases and Services*

[5]   ETSI TR 102, 469 v1.1.1, *IP Datacast over DVB-H: Architecture*

[6]   ETSI TS 102, 471 v1.2.1, *IP Datacast over DVB-H: Electronic Service Guide (ESG)*

[7]   ETSI A112, *Electronic Service Guide (ESG) Implementation Guidelines*

[8]   ETSI A100, *IP Datacast over DVB-H: Service Purchase and Protection (SPP)*

[9]   ETSI TS 102.472, *IP Datacast over DVB-H: Content Delivery Protocols (CDP)*

[10]   ETSI A113, *Content Delivery Protocols (CDP) Implementation Guidelines*

[11]   ISO 15628:2007, *Road transport and traffic telematics — Dedicated short range communication (DSRC) — DSRC application layer*

[12]   ISO 24103, *Intelligent transport systems — Communications access for land mobiles (CALM) — Media adapted interface layer (MAIL)*

[13]   ISO 29282, *Intelligent transport systems — Communications access for land mobiles (CALM) — Satellite networks*

[14]   ISO 8802 (all parts), *Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Specific requirements*

[15]   ISO/IEC 8802-2:1998, *Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Specific requirements — Part 2: Logical link control*

[16]   IEEE 802.15.2:2003, *IEEE recommended practice for information technology — Local and metropolitan area networks — Specific requirements — Part 15.2: Coexistence of wireless personal area networks with other wireless devices operating in unlicensed frequency bands*

[17]   IEEE 802.15.4:2006, *IEEE Standard for Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Specific requirements — Part 15.4: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (WPANs)*

[18]   RFC 3077, *A Link-Layer Tunneling Mechanism for Unidirectional Links*

ISO 13183:2012(E)

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