ETSI TS 103 697 V2.1.1 (2022-11)

Intelligent Transport Systems (ITS);
Architecture;
Multi-Channel Operation (MCO)
for Cooperative ITS (C-ITS);
Release 2

Reference
DTS/ITS-002202

Keywords
architecture, ITS

ETSI

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Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Intelligent Transport Systems (ITS).

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Introduction

The present document specifies the cross layer Multi-Channel Operations (MCO) functional architecture to be used in Cooperative Intelligent Transport Systems (C-ITS).

The MCO functionality is realized by entities at different layers of a C-ITS-S and can therefore be seen as a cross layer functionality. While the present document specifies the architecture, the layer specific MCO functionalities are specified in layer specific specifications. The present document specifies the Release 2 MCO concept for direct Vehicular Ad-hoc communication.

The present set of MCO documents are intended to be used for evaluation.

NOTE: C-ITS Release 1 set of specifications includes all specification for a single channel system, while the Release 2 specifications and beyond are multi-channel oriented.

1 Scope

The present document provides the C-ITS Multi-Channel Operations functional architectural of the C-ITS architecture including the definition of requirements to the MCO entities, MCO mechanisms, MCO interfaces and MCO related application requirements.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference.

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The following referenced documents are necessary for the application of the present document.

[1] ETSI TS 103 141 (V2.2.1): "Intelligent Transport Systems (ITS); Facilities layer function; Multi-Channel Operation (MCO) for Cooperative ITS (C-ITS); Release 2".

[2] ETSI TS 103 836-4-1 (V2.1.1): "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 4: Geographical addressing and forwarding for point-to-point and point-to-multipoint communications; Sub-part 1: Media-Independent Functionality; Release 2".

[3] ETSI TS 103 695 (V2.1.1): "Intelligent Transport Systems (ITS); Access layer specification in the 5 GHz frequency band; Multi-Channel Operation (MCO) for Cooperative ITS (C-ITS); Release 2".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents are not necessary for the application of the present document, but they assist the user with regard to a particular subject area.

[i.1] ETSI TR 103 439: "Intelligent Transport Systems (ITS); Multi-Channel Operation Study; Release 2".

[i.2] ETSI TS 103 696: "Intelligent Transport Systems (ITS); Communication Architecture for Multi-Channel Operation (MCO); Release 2".

[i.3] C2C-CC BSP: "C2C-CC Basic System Profile".

NOTE: Available at https://www.car-2-car.org/documents/basic-system-profile/.

[i.4] ETSI TS 103 900: "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Specification of Cooperative Awareness Basic Service; Release 2".

[i.5] ECC Decision (08)01: "The harmonised use of Safety-Related Intelligent Transport Systems (ITS) in the 5875-5935 MHz frequency band", approved 14 March 2008, Amended 6 March 2020.

NOTE: Available at https://docdb.cept.org/download/b470d271-048b/ECCDEC0801.PDF.

[i.6] ECC/REC/(08)01: "ECC Recommendation (08)01 on the use of the band 5855-5875 MHz for Intelligent Transport Systems (ITS)".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the following terms apply:

access layer instance: fully parametrized (service channel, technology, TX power, etc.) transceiver entity in the access layer

access layer instance ID: unique identifier for an access layer instance

access layer instance group: set of access layer instances using the same service channel and access layer technology

access layer instance Group ID: unique identifier for an access layer instance group

access layer technology: consistent set of protocols covering the physical layer and link layer functionalities defined in an independent specification or set of specifications

C-ITS Application: single or set of functionalities realizing a single or multiple C-ITS use cases useful to a traffic user being a person or a technical system

NOTE: This task is different from a task related to the operation of the technical environment. Results of the application may trigger technical functionalities at other layers.

backward compatibility: ability of an ITS functionality to interoperate with previous ITS functionalities

Cooperative-Intelligent Transport Systems (C-ITS): intelligent transport systems that enable ITS users to cooperate by exchanging secured and trusted messages; These applications form a subset of ITS applications

C-ITS-Station (C-ITS-S): ITS station which is part of the C-ITS and the related C-ITS Domain trust model

entity: singular, identifiable, and separate object realizing a function or set of functions

NOTE: It refers to individuals, organizations, systems, bits of data, or even distinct system components that are considered significant in and of themselves.

function: self-contained module that accomplishes a specific task. Functions usually "take in" data, process it, and "return" a result

header: part of a package going from one layer to one other layer including layer specific control information

Intelligent Transport Systems (ITS): systems which aim to provide innovative services relating to different modes of transport and traffic management and enable users to be better informed and make safer, more coordinated, and "smarter" use of transport networks

layering: organization of functions that interact in some sequential and hierarchical way, with each layer usually providing a service for the layer above

MCO capable C-ITS-S: C-ITS station which includes MCO functionality

message service: ITS-S facilities layer type of technical service generating messages

plane: logical grouping of communication functions over different layers

NOTE: The main planes recognized are the management or control plane, the data plane, and the security plane.

public user services: services that are available for all users without restrictions such as a business

private user services: services that are restricted for users under a specific business case or used by a selective user group

user service: service provided by an application to a user being a person or a technical system

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

A-PDU	Application-Protocol Data Unit
AF_SAP	Application-Facilities Service Access Point
ALI	Access Layer Instance
AliID	Access layer instance Identifier
AliGroupID	Access Layer Instance Group Identifier

NOTE: The abbreviations AliID and AliGroupID are compliant with an ASN.1 representation of an identifier.

AL-PDU	Access Layer-Protocol Data Unit
ARH	ALI Request Handler
BME	Bandwidth Management Entity
CAM	Cooperative Awareness Message
CAS	Cooperative Awareness Service
C-ITS	Cooperative-Intelligent Transport Systems
C-ITS-S	Cooperative-Intelligent Transport Systems-Station
CLR	Channel Load Ratio
CPS	Collective Perception Service
DENM	Decentralized Environmental Notification Message
ECC	Electronic Communications Committee
EU	European Union
FCL	Functional Configuration Limits
FCP	Functional Configuration Profiles
FcpID	Application Configuration Profile identifier
FH	Facilities layer Header
FL-PDU	Facilities Layer- Protocol Data Unit
FN_SAP	Facilities-Networking Service Access Point
GAGH	GeoNetworking ALI Group Handler
GN	GeoNetworking
GN6ASL	GN IPv6 Adaptation Sub-Layer
ID	Identifier
ITS	Intelligent Transport Systems
ITS-S	Intelligent Transportation Systems Station
LTE	Long-Term Evolution
MCE	Message Collecting Entity
MCO	Multi-Channel Operation
MCO_ACC	MCO Access
MCO_FAC	MCO Facilities
MCO_NET	MCO Networking & transport
MGE	Message Generating Entities
MGS	Message Generating Service
MHE	Message Handling Entity
MPU	MCO Parameter Update
MRE	Message Receiving Entity
MTE	Message Triggering Entity
NA_SAP	Networking-Access Service Access Point
NH	Networking Header

NL-PDU	Networking Layer-Protocol Data Unit
NU	Network Updates
PDU	Protocol Control Unit
QoS	Quality of Service
REQ	Requirement
SA	Service Announcement
SAEM	Service Announcement Essential Message
SAM	Service Announcement Message
SAS	Service Announcement Service
SCH	Service Channel
TR	Technical Report
TRX	Transceiver
TS	Technical Specification
TX	Transmit
V2X	Vehicle to Any

4 Overview

Cooperative-Intelligent Transport Systems (C-ITS) applications require the exchange of information between C-ITS stations (C-ITS-Ss), see ETSI TR 103 439 [i.1], therefore they need to provide their information to the lower layers for dissemination to other C-ITS-Ss. In C-ITS Release 1 the number of use cases to be supported by the station is limited and the information shared occupies a single channel, see ETSI TR 103 439 [i.1]. Release 2 supports a much larger number of use cases, applications, and therefore there is a need to disseminate the information over multiple channels.

Active C-ITS applications may compete for the communication resources while having no knowledge about the dissemination needs of other applications (in the MCO documents the awareness services e.g. CAS and CPS are not mentioned anymore but their application entity (generation rules) are here with represented), as well as not being aware of the capabilities of the underlaying communication resources. A Multi-Channel Operation (MCO) functionality is a C-ITS functionality which is aware of the communication needs of all the C-ITS applications and knows the capabilities of all the communication resources statically and dynamically available in an C-ITS-S. MCO may be the central point in the C-ITS-S where decisions can be made about how to handle application data over the appropriate communication means and keep the applications aware of the allocated resources and consequent communication possibilities.

MCO is a cross-layer C-ITS functionality with sub functionalities at different layers and therefore can be seen as a cross layer functionality. The present document specifies the general MCO architecture with its management flows, data flows, and its system requirements. The various layer specific MCO functionalities for the Facilities layer are detailed in the ETSI TS 103 141 [1], those for the Networking & Transport layer in the ETSI TS 103 836-4-1 [2] and those for the Access layer in the ETSI TS 103 695 [3]. MCO system requirements are specified in clause 7.

5 MCO architecture

5.1 Introduction

The C-ITS MCO architecture is depicted in Figure 1. MCO is a cross layer functionality realized by entities at different layers. The MCO functionalities are C-ITS station internal functionalities. In fact it can be recognized that at all layers functionalities involved in the MCO process exist: at the Application layer there exist the activated and deactivated data disseminating applications with their communication requirements; at the Access layer and Networking and Transport layer there exist the radio channels with their communication capabilities; and at the Facilities layer there exist the main MCO data dissemination coordinating functionalities and message handling services.

In a general-purpose telecom network, the mobile station is centrally controlled by an access point or base station. The mobile station supports this control by providing information about the link quality to the central station. In decentralized systems no centralized communication management exists. As C-ITS is a decentralized system where nodes directly exchange data, the corresponding functionality split between management and data provisioning is performed by the same station.

To allow, mostly intended to increase transport safety, C-ITS applications to realize their functionalities predictively they need to know the communication capabilities at any time. As in a bandwidth limited environment where the information routing is handled by the Networking & Transport layer applications cannot be aware of the communication capabilities. In C-ITS, this Networking & Transport layer routing is therefore limited to forwarding of messages at the and no real routing is executed at this layer. How information is disseminated is fully controlled by the entities active at the application and facilities layer of C-ITS. The MCO architecture covers these aspects.

C-ITS applications provide their dissemination requirements to the MCO functionalities complying to the MCO requirements as specified in clause 7.2, MCO_FAC, at the Facilities layer. MCO_FAC may decide to disseminate a message on a channel different from the preferred one, depending on the physical limitations and possibilities allowed as provided by the application. Although lower layer parameters set by the application may be technology specific, the decision criteria such as the congestion level are technology independent to allow the use of various technologies and the extension into channels beyond today's scope. For these reasons, as other services, the MCO_FAC is technology independent while the MCO specific functionalities at the technology layers, i.e. MCO_NET and MCO_ACC, can be communication technology specific and therefore may include communication technology specific functionalities.

Figure 1 shows in green the MCO specific functionalities residing at the Facilities, Networking & Transport and Access layers. MCO_FAC interfaces directly with the Applications.

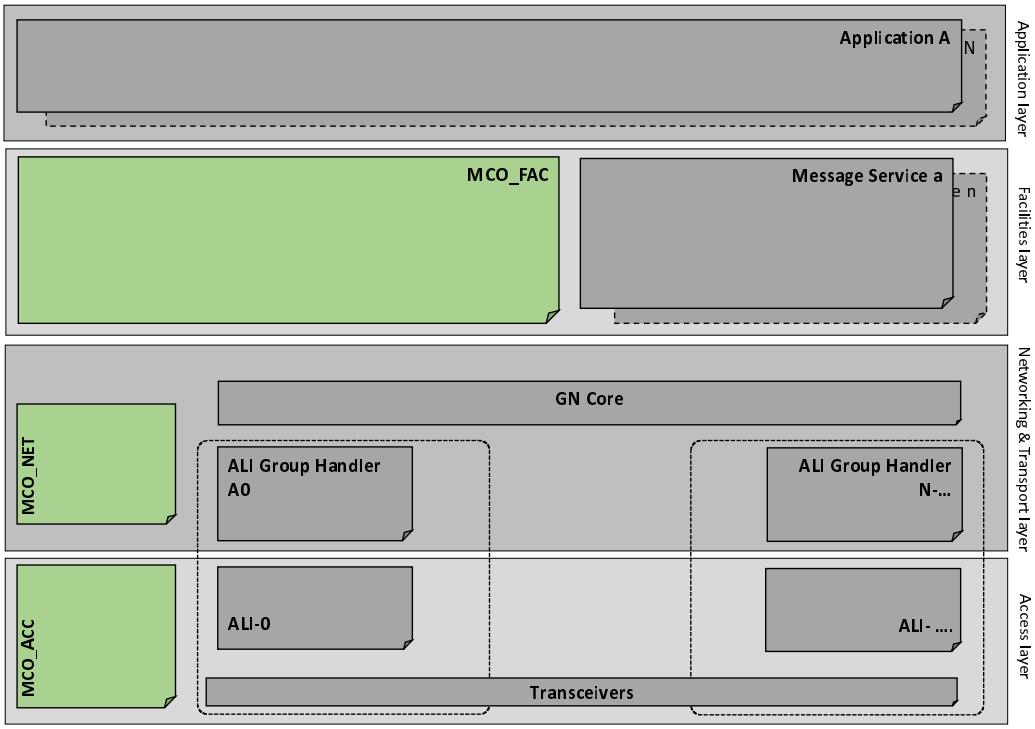

Figure 1: The C-ITS MCO general architecture

NOTE 1: For the data unit terminology at the data plane see Annex A.

NOTE 2: Figure 1 does not visualize the planes identified in ETSI TS 103 696 [i.2].

Applications expect a predictable behavior of the system they have to operate in, and therefore expect to operate based on a predictable MCO functionality. To allow the MCO functionality to operate predictably, MCO expects the applications to operate predictable. As applications are not aware of the existence of other applications, the MCO functionality may only provide predictability when applications comply with the MCO related requirements specified in clause 7.

5.2 Facilities Layer MCO functionalities

The Facilities layer MCO functionalities are all part of the MCO_FAC, which is realized by a set of entities located at the Facilities layer. MCO_FAC manages the dissemination of messages to lower layers when triggered by applications with their Message Generating Services (MGSs). MCO_FAC interacts with the Message Triggering Entities (MTE) at the Application layer and MGSs at the Facilities layer, in order to receive the dissemination needs. MCO_FAC compares the application needs with the capabilities of the lower layers globally through the management plane and or on a message-by-message basis. MCO_FAC may adapt the dissemination of messages depending on the needs provided by the triggering entities. MCO_FAC is responsible for deciding what lower layer parameters are used. The entities part of MCO_FAC shall provide the following functionalities:

- Bandwidth Management Entity (BME): shall collect application requirements, capabilities of the available radio interfaces and channels, shall send feedback to applications to adapt the amount of information they generate based on collected information, status, and notifications, and configuring the lower layers to use the most adequate channels and radio access technologies considering the information collected.
- Message Handling Entity (MHE): shall transmit messages towards the Networking & Transport layer and configure their parameters on a per-message basis considering the capabilities of the available radio interfaces and channels.
- Message Collecting Entity (MCE): shall collect received messages and forward them towards the corresponding Message Receiving Entity (MRE).

Figure 2 shows MCO_FAC, its 3 entities and the other entities at Facilities and Application Layers which are involved in the dissemination process. The management interface at the management plane from MCO_FAC to the applications (triggering entities) is the MCO_APP_FAC_MMT going through the AF_SAP. The data interface at the data plane from MCO_FAC to the applications are going via the message services is the MCO_FAC_MS_DATA interface. While an introduction to the Functional Configuration Profiling (FCP) mechanism use for the communication through the MCO_APP_FAC_MMT and MCO_FAC_MS_DATA interfaces is provided in clause 6.2, all MCO Functionalities, mechanisms and above mentioned interfaces shall comply with ETSI TS 103 141 [1].

Figure 2 also shows the MCO_FAC_NET_MMT and MCO_FAC_NET_DATA interfaces to the lower layers through the FN_SAP. These interfaces are used by MCO_FAC and shall comply with ETSI TS 103 836-4-1 [2] and ETSI TS 103 695 [3].

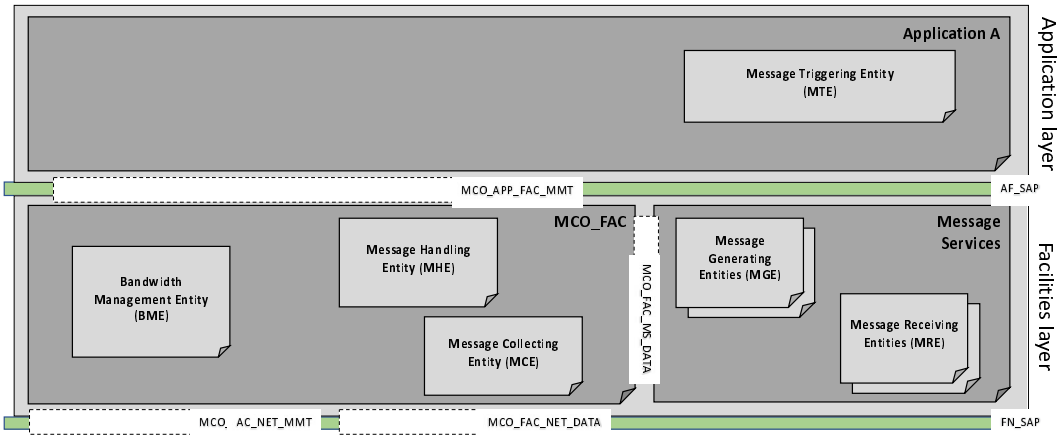

Figure 2: MCO functionalities in the functional layers

NOTE 1: In Release 1 system profiles, message triggering applications such as the C2C-CC Triggering Conditions [i.3] have been defined at the applications layer. These triggering conditions trigger event driven message generation at the facilities layer such as DENM dissemination. As only application entities e.g. triggering conditions and generation rules are aware of possible communication needs, MCO communicates to the application layer entities directly. Considering CAS for Release 2, CAS should be addressed as application by MCO for identification of the dissemination needs from CAS, but MCO should also interface to CAS at the data plane at the Facilities layer for the actual message dissemination requests. Therefore, as identified in the ETSI TR 103 439 [i.1] that CAS resides partly at the application layer and partly at the facilities or service layer. Its MTE exists at the application layer and its MGE at the Facilities layer.

NOTE 2: Example for CAS: In Release 1 the CAS (see ETSI TS 103 900 [i.4]) disseminates its messages in a single channel and in case this channel is congested, the CAMs are not transmitted. In Release 2 the CAM service (CAS) could be extended enabling the non-transmitted messages to be provided to another channel. In that case, CAS requests should include information about a primary channel and a secondary channel on which the CAMs can be shared. Then, the MHE may handle the offloading and inform the BME.

5.3 Networking & Transport Layer MCO functionalities

The Networking & Transport layer MCO functionalities are all part of the MCO_NET service. MCO_NET has interfaces with the GN Core, GN ALI group handlers, and the Facilities and Access layer functionalities. At the Networking & Transport Layer there is an entity called GN Core and entities called GN Access Layer Instance Group Handlers (GAGHs). Each GAGH is associated to an Access Layer Instance (ALI) group at the access layer, which is an entity defined in clause 6.3.

The GN Core realizes channel and technology independent functionalities of the GN protocol. At the Networking and Transport layer a GAGH is associated with each ALI group at the Access layer. A GAGH handles GN protocol operations (media-dependent and-independent) for its associated ALI group.

The entities part of MCO_NET shall provide the following functionalities (see Figure 3):

1) The MCO Parameter Update (MPU) entity shall handle MCO parameters configuration requests received from the Facilities layer via the MCO_FAC_NET_MMT interface through the FN_SAP and the MCO parameters updates from the Access layer via the MCO_NET_ACC_MMT interface through the NA_SAP. In case of MCO configuration request from the Facilities layer, the MPU shall forward the request to the Access layer. When receiving an update from the Access layer, the MPU shall forward the update to the Facilities layer and in accordance updates the states of the GAGHs.

2) The Network Updates (NU) entity shall provide network updates to the Facilities layer via the MCO_FAC_NET_MMT interface through the FN_SAP to enable efficient resource allocation by the MCO_FAC. The network updates are based on information collected from the Access layer such as the ALI group related CLRs and updates from the GAGHs to obtain knowledge about the network state for neighboring stations. The parameters part of a network update provided to the Facilities layer shall be technology independent.

3) The ALI Request Handler (ARH) entity shall handle packets without assigned ALI. In fact, transport layer protocols may not have the opportunity to assign an ALI e.g. the GN IPv6 Adaptation Sub-Layer (GN6ASL). In this scenario, the GN Core shall request an ALI to the Facilities layer via MCO_NET and the MCO_FAC_NET_MMT interface as specified in the ETSI TS 103 836-4-1 [2]. MCO_NET manages the request with the Facilities layer and provides the ALI selected by the Facilities layer to GN Core.

NOTE: To provide media-independent network updates to the Facilities layer, scaling functions as identified in the ETSI TS 103 836-4-1 [2], may be used to align for example the CLR perceived by LTE-V2X to ITS-G5.

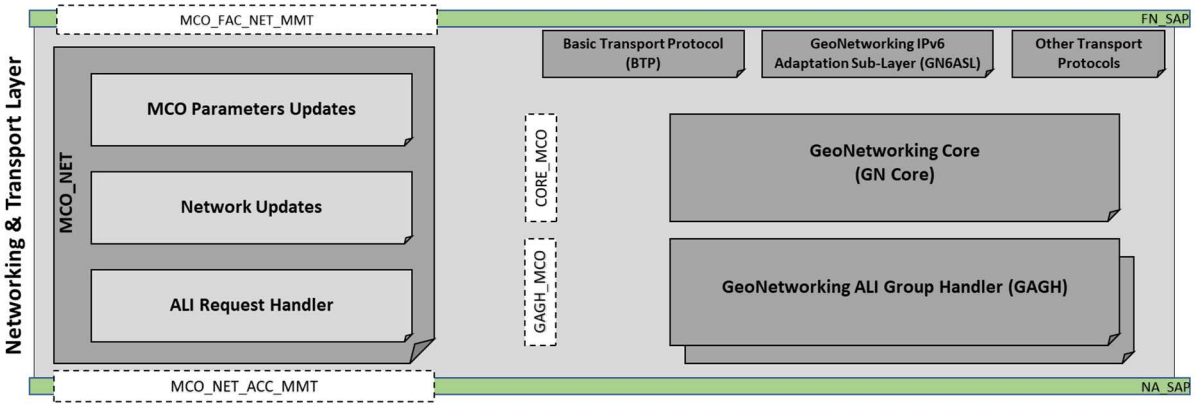

Figure 3: MCO entities at the Networking and Transport layer

5.4 Access layer MCO functionalities

The access layer of an MCO capable C-ITS-S will operate a set of more than one transceiver simultaneously. Such set of transceivers may be capable of implementing different access layer technologies (e.g. ITS-G5, LTE-V2X, etc.), each of which may be parameterized to allow adaptation to the requirements of the applications. A single transceiver may be instantiated using a set of different access layer parameters as identified and specified in the ETSI TS 103 695 [3].
A transceiver parametrization method called "Access Layer Instance" (ALI) represents a specific access layer instantiation of a transceiver and is specified in clause 6.3. The ALI_Group (see ETSI TS 103 695 [3]) is selected at the Facilities layer message by message as part of FL-PDU in the FH via the MCO_NET_ACC_DATA interface or selected for groups of messages and set via the management plane through the MCO_NET_ACC_MNT interface. Both interfaces communicate through the NA_SAP.

The MCO Access layer functionality is realized by the ALI Operations and TRX info Collection entities (see Figure 4):

1) The ALI Operations is a management functionality which is aware of the static and dynamic capabilities of the active transceivers. It shall collect the capabilities of the different transceivers and provide this information to the upper layers as specified in ETSI TS 103 695 [3]. It shall receive information from higher layers r for setting up the different transceivers as specified in ETSI TS 103 695 [3]. When received, it shall configure the transceiver(s) as requested.

2) The Transceiver (TRX) information is collected by the TRX info Collection entity and relevant information is provided to the higher layers.

NOTE: At the Access layer the channel load is measured and captured as a ratio (CLR). This functionality is not specific for MCO and therefore not an MCO entity. This information however is an important parameter which is provided to the higher layers by the TRX info Collecting entity.

The Access layer MCO functionalities and their interfaces shall comply with ETSI TS 103 695 [3].

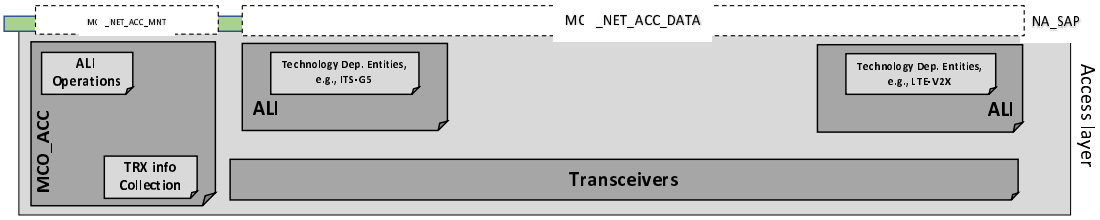

Figure 4: The Access layer MCO functionalities and their interfaces to other entities

6 MCO Mechanisms

6.1 Introduction

To facilitate an MCO approach that takes into account the application requirements and support their fulfilment through various channels and technologies independently, two specific mechanisms are defined. The first mechanism involves the Applications and Facilities layer through the definition of Functional Configuration Profiles (FCPs). The second one involves the Facilities, Networking & Transport, and Access layers through the definition of Access Layer Instances (ALIs). Both mechanisms are clarified in the following clauses.

6.2 The Functional Configuration mechanism

In principle, for each message to be disseminated, communication configurations could be selected flexible for any specific use case by use case or application by application. In Release 1 the dissemination configurations are statically defined, CAS for example makes use of a fixed channel and fixed priority level. In case the channel is congested the CAMs may not be transmitted. As Release 2 includes many new use cases, applications, flexible use of the channels can be enabled by making MCO functionalities responsible for the dissemination decisions in line with applications requirements which allows the MCO functionalities to make decisions about using one or other channel with varying other parameters. As each application has specific configuration needs, each application can be characterized by its own specific Functional Configuration Profile (FCP) which is further detail in the ETSI TS 103 141 [1].

Such profiles may be fixed but may also depend on specific road scenarios e.g. urban or highway and dynamically change. Each configuration profile is identified with an Id, denoted as FcpID. An application selects the FCP by selecting the appropriate FcpID and provides this message by message through the data plane or fixed per message type through the management plane to the lower layer.

The FCPs shall be provided by the MTE to the BME. The BME shall evaluate the FCP parameters and set Functional Configuration Limits (FCL) for these parameters and returns these limits liked to the corresponding FcpID back to the application based on the evaluation of information received from all active applications as well as the information received from the lower layers about their capabilities. The BME shall also provide the FCL with corresponding FcpID to the MHE. When an application initiates the dissemination of messages, it shall provide the appropriate FcpID as part of the application header in the A-PDU to the MHE at the data plane. The Functional Configuration mechanism is further detailed in the ETSI TS 103 141 [1].

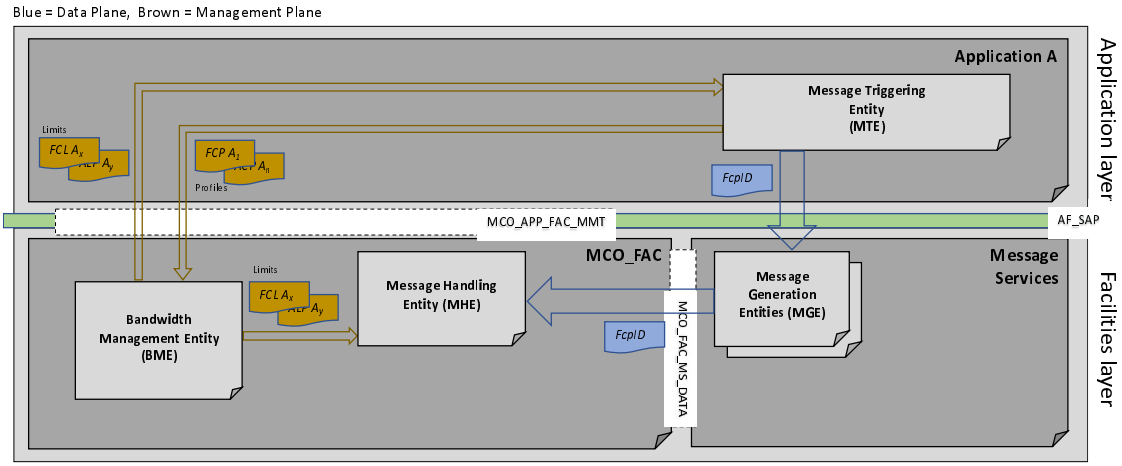

Figure 5: The Functional Configuration

6.3 The Access Layer Instance mechanism

Although the applications may provide several dissemination possibilities to the MHE by suggesting FCPs, the MHE at the Facilities layer shall decide which Access Layer Instance (ALI) is to be used. As identified in clause 5.4, the "Access Layer Instance" (ALI) represents a specific access layer instantiation of a transceiver (i.e. using a given set of access layer parameters). A specific set of parameters are identified by a unique identifier, the AliID. The MCO functionalities at the Networking & Transport layer forward the AliID to the Access layer. By associating such set of specific parameters to an ID, the complete set of parameters is represented by a unique ID. The association of a specific access layer technology with a physical channel is seen as an Access Layer Instance Group. A specific ALI group is identified by a unique access layer instance group identifier, AliGroupID. As the access layer parameters are defined in access layer specifications, the AliID and AliGroupID are further described and specified in the access layer specification ETSI TS 103 695 [3].

As illustrated in Figure 6 the AliID may be provided dynamically by upper layers via the header(s) as part of the NL-PDU at the data plane. Higher layer entities shall at least provide the static AliID via the management plane as specified in ETSI TS 103 695 [3].

Messages received shall be associated with the settings of the receiver with which they are received and associated with the appropriate AliID which shall be provided to the higher layers as part of the received frame as specified in ETSI TS 103 695 [3].

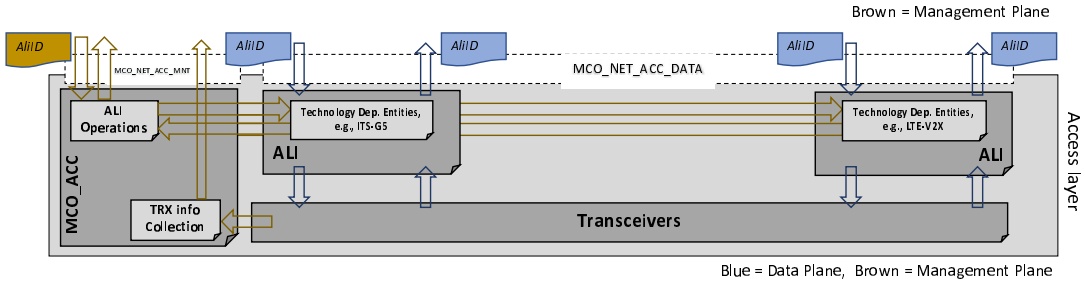

Figure 6: The Access Layer Instance

7 MCO application requirements

7.1 Introduction

C-ITS applications are expected to provide end user services with well-defined Quality of Services. QoS is very important since many of these end-user services are safety related and therefore a service degradation would not be acceptable. In this regard MCO plays a key role since it will be up to the MCO functionalities to manage the sharing of the available radio resources among all the active applications taking also into account the overall capabilities of the C-ITS-S. In Release 1, where there is no MCO concept and only one channel is used, the communication needs of the applications are aligned with the available channel capacity and therefore the end user services are quite limited. In Release 2, where multiple channels is used at the same time and there will be applications providing more advanced services to the end users, it will be necessary to define a set of "requirements" for the applications themselves so that all the available resources will be used in the most efficient way. Clause 7.2 defines these requirements.

7.2 MCO related application requirements

In order to make sure MCO will operate in the most efficient way so as to guarantee the required QoS, the application shall fulfil the following requirements:

REQ_APP_001: A Release 2 application being an extension of the same already deployed Release 1 application, shall provide the Release 1 functionalities in such a way that users have the same or similar experience whether they are making use of the user service based on a Release 1 or Release 2 implementation.

REQ_APP_002: Any Release 2 application (not considering error handling) intended to use a channel configuration which is used by Release 1 shall ensure backward compatibility.

REQ_APP_003: Release specific applications that operate simultaneously in the same communication environment with previous releases shall not interfere with applications from previous releases and shall not interfere with the operation of those previous applications in order to not interfere with operations of earlier releases.

REQ_APP_004: With regards to bandwidth usage each set of applications shall consider its bandwidth usage in relation to the usage of other applications from the same release and from previous releases. A release may provide flexibility by providing optional bandwidth resource allocations to the MCO functionality such that MCO can make choices based on congestion status of the available channels.

REQ_APP_005: When MCO functionality is used, C-ITS applications shall trigger message generation in accordance with MCO interface and MCO operational requirements as specified in the MCO set of specifications in the present document and support the MCO interfaces specified in ETSI TS 103 141 [1], ETSI TS 103 836-4-1 [2] and ETSI TS 103 695 [3].

As identified in ETSI TR 103 439 [i.1], the Service Announcement (SA) Service is not use case specific and may be used for any purpose. Cooperative ITS and ITS applications may use the SAS services. To allow an ITS-S to know that a specific safety or non-safety related C-ITS user service is available a common agreement is required how SAMs are exchanged. In a Cooperative environment a common way to allow the exchange the cooperative messages shall be agreed.

REQ_APP_006: To allow ITS-Ss to be notified about new or updated services, service providers may use the SAS to do so. In order to ensure that all ITS-Ss can be notified to be notified in a C-ITS environment ITS-Ss should be informed about where such information can be found; therefore, the information needs it be exchanged over a predefined channel. As safety relevant and non-safety channels are reginal defined, the channels shall be selected according to reginal spectrum requirements. For Europe these are specified in the EU spectrum regulations ECC/DEC/(08)01 [i.5] and ECC/REC/(08)01 [i.6] and based on Release 1 usage therefore SCH4 shall be used for non-safety and SCH1 shall be used for safety related SAM dissemination.

REQ_APP_007: ITS applications, shall not use the C-ITS channels for SAEM dissemination and shall not influence the operation of any C-ITS application.

Annex A (informative): Data Flow through the layers

When the data is moving from layer to layer a header with layer specific information is added.

Application data and control information are included in the A-PDU.

At the Facilities layer about the message. There the A-PDU and the Facilities layer Header (FH) forms the Facilities Layer (FL) PDU or FL-PDU. When the data goes to the Networking & Transport layer, Transport and Networking Headers (NHs) are added such that a NL-PDU goes to the Access Layer where transmission frames are created which at the AL-PDU in which all headers from all layers are included as reflected in Figure A.1.

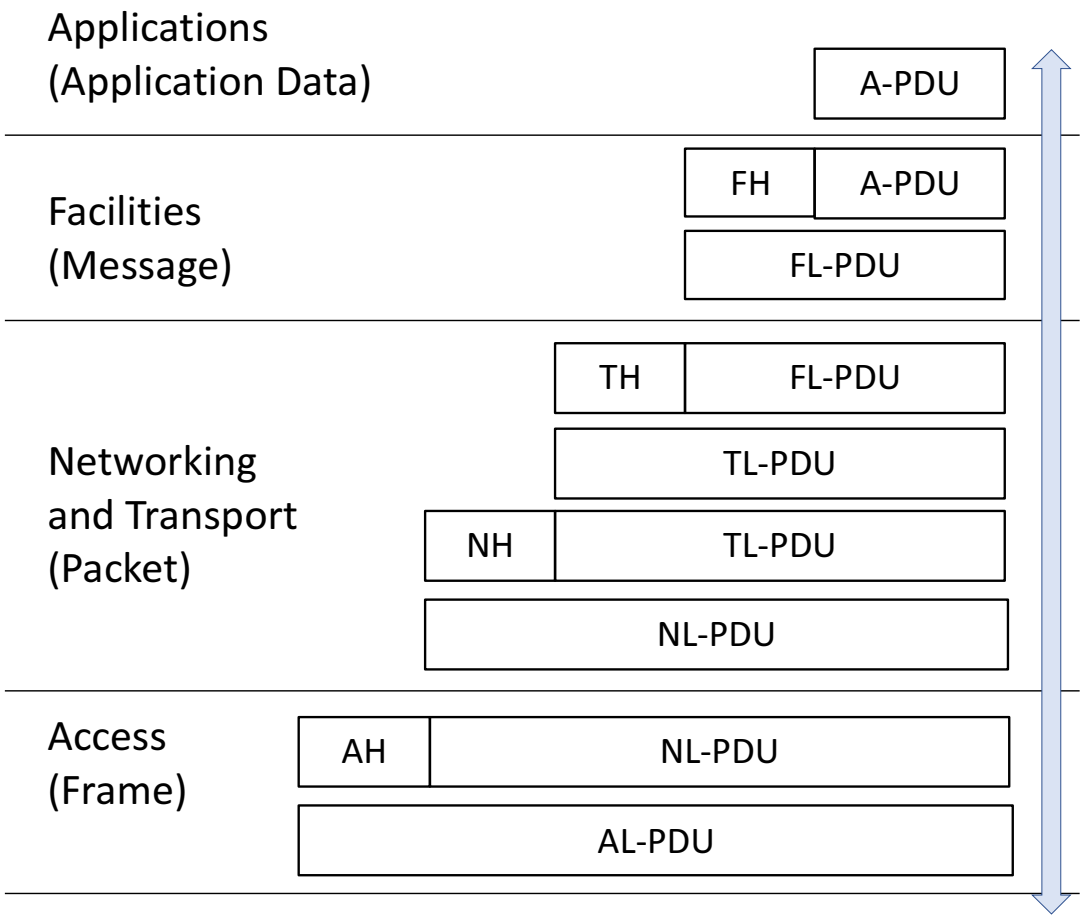

Figure A.1: Layer Header relation overview

History

Document history		
V2.1.1	November 2022	Publication