
**Intelligent transport systems —
Communication access for land mobiles
(CALM) — Non-IP networking —**

Part 2:
Legacy system support

*Systèmes intelligents de transport — Accès aux communications des
services mobiles terrestres (CALM) — Réseautique non-IP —*

Partie 2: Support pour systèmes hérités



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Foreword

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

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

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The committee responsible for this document is ISO/TC 204, *Intelligent transport systems*.

This first edition of ISO 29281-2, together with ISO 29281-1, cancels and replaces ISO 29281:2011.

ISO 29281 consists of the following parts, under the general title *Intelligent transport systems — Communication access for land mobiles (CALM) — Non-IP networking*:

- *Part 1: Fast networking & transport layer protocol (FNTP)*
- *Part 2: Legacy system support*

Introduction

This part of ISO 29281 is part of a family of International Standards for communications access for land mobiles (CALM). An introduction to the whole set of International Standards is provided in ISO 21217.

This part of ISO 29281 is the second part of a multi-part series which determines intelligent transport systems (ITS) communication functionalities which are different to functionalities from the set of Internet protocols.

These functionalities are protocols and procedures located in the various layers and entities of the ITS station.

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Intelligent transport systems — Communication access for land mobiles (CALM) — Non-IP networking —

Part 2: Legacy system support

1 Scope

This part of ISO 29281 specifies elements of communications for cooperative ITS which are not based on the Internet protocol.

The following architectures, procedures and protocols are specified:

- Support of communication interfaces (DSRC-CI) using ISO 15628;
- Support of ISO 15628 DSRC applications via an ITS ad-hoc access technology.

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

ISO 15628, *Intelligent transport systems — Dedicated short range communication (DSRC) — DSRC application layer*

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

ISO 21218, *Intelligent transport systems — Communications access for land mobiles (CALM) — Access technology support*

ISO 24102-1, *Intelligent transport systems — Communications access for land mobiles (CALM) — ITS station management — Part 1: Local management*

ISO 24102-3, *Intelligent transport systems — Communications access for land mobiles (CALM) — ITS station management — Part 3: Service access points*

ISO 24102-4, *Intelligent transport systems — Communications access for land mobiles (CALM) — ITS station management — Part 4: Station-internal management communications.*

ISO 24102-5, *Intelligent transport systems — Communications access for land mobiles (CALM) — ITS station management — Part 5: Fast service advertisement protocol (FSAP)*

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

ISO 29281-1, *Intelligent transport systems — Communication access for land mobiles (CALM) — Non-IP networking — Part 1: Fast networking & transport layer protocol (FNTP)*

ETSI TS 102 985-1, *Intelligent transport systems (ITS) — Communications Access for Land Mobiles (CALM) — Test specifications for non-IP networking (ISO 29281) — Part 1: Protocol implementation conformance “statement (PICS) proforma*

ETSI TS 102 985-2, *Intelligent transport systems (ITS) — Communications Access for Land Mobiles (CALM) — Test specifications for non-IP networking (ISO 29281) — Part 2: Test suite structure & test purposes (TSS&TP)*

ETSI TS 102 985-3, *Intelligent transport systems (ITS) — Communications Access for Land Mobiles (CALM) — Test specifications for non-IP networking (ISO 29281) — Part 3: Abstract test suite and partial PIXIT (ATS) specification*

3 Requirements

Communication functionality, which is different to the functionality out of the set of Internet protocols (IP), is referred to as non-IP functionality in this multi-part series.

The functionality to support legacy systems, especially those related to ISO 15628 “DSRC application layer” shall be as specified in this part of ISO 29281.

Detailed requirements are specified in the following clauses of this part of ISO 29281:

- [Clause 4](#) specifies architectural elements;
- [Clause 5](#) specifies facility layer protocols;
- [Clause 6](#) specifies conformance declaration;
- [Clause 7](#) specifies test methods;
- [Annexes A](#) and [B](#) provide further mandatory requirements;
- The informative [Annex C](#) provides 15628 legacy service guidelines.

4 Architecture

4.1 ITS station

The specifications given in this part of ISO 29281 shall comply with the ITS station architecture and with the concept of an ITS station communication unit (ITS-SCU) as specified in ISO 21217 and ISO 24102-4.

4.2 Communication scenarios

Communication scenarios are specified in ISO 24102-1 and in ISO 21217.

4.3 Implementation scenarios

The protocols specified in this part of ISO 29281 may support the implementation architectures introduced in ISO 21217 and illustrated in [Figures 1](#) and [2](#) with an ITS station and a peer DSRC station.

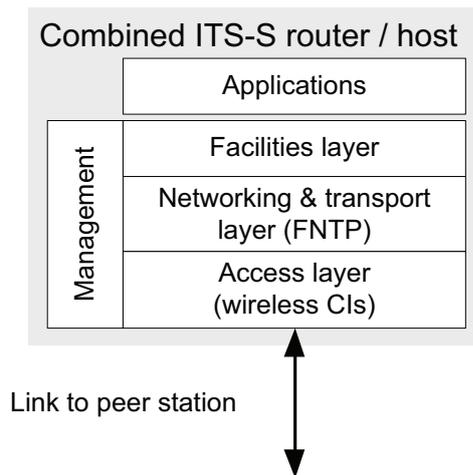


Figure 1 — Combined ITS-S host/router

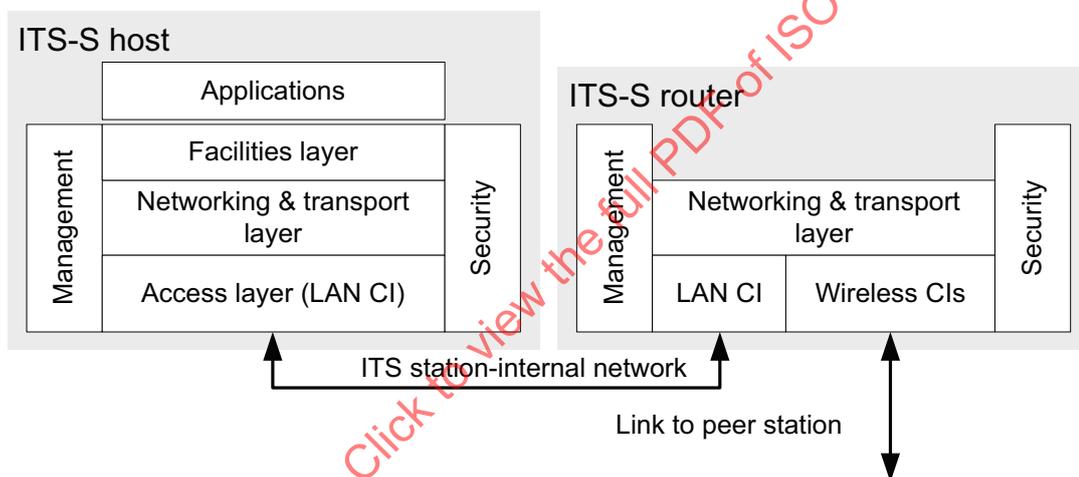


Figure 2 — ITS-S host and ITS-S router separated in different ITS-SCUs

4.4 Legacy CIs

An existing ITS-S access layer technology may be implemented in an ITS station as a “Legacy CI”, as presented in Figure 3, such that it can communicate with peer stations that are not necessarily aware of any ITS-S context, and where none of the networking protocols specified for ITS-S are used in the wireless link.

Types of CIs are specified in ISO 21218 in I-parameter 22 “Medium”. The only legacy CI medium identified so far in ISO 21218 is “DSRC” with an application layer specified in ISO 15628. Further types may be added.

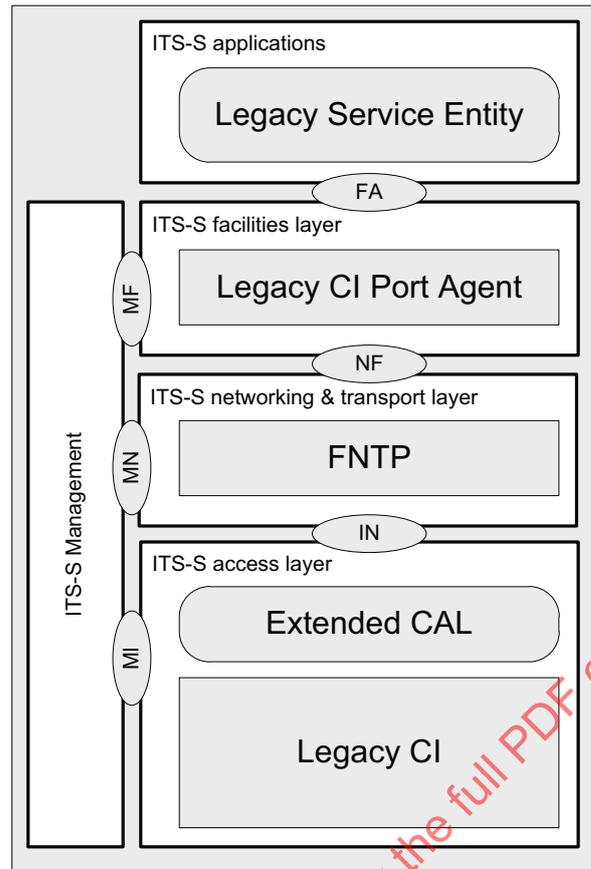


Figure 3 — Legacy CI

Inside the ITS station, the Fast networking & transport layer protocol (FNTTP) specified in ISO 29281-1 shall be used for the forwarding of packets between the ITS-S access layer and the ITS-S facilities layer.

This requires:

- implementing a CALM adaptation layer (CAL) as specified in ISO 21218, extended with the additional functionality for FNTTP support as specified in this part of ISO 29281, which optionally may also include parts of the service processing functionality;
- making use of the “Legacy CI Port Agent” as specified in this part of ISO 29281 and in ISO 24102-1.

Legacy CIs shall specify the medium specific parameters presented in Table 1 (see ISO 21218 for the I-parameter 254 “MediumParameter”).

Table 1 — Legacy CI parameters

MediumParam.mediumPar.no	MediumParam.detail	Description
0	LegacyOption	Optional classification of different options of the same legacy CI.
1	PortPA	Port number of the “Legacy CI Port Agent” connecting to the applicable “Legacy Service Entity”.

The “Legacy Service Entity” shall register at the “Legacy CI Port Agent” indicating the CI class and legacy option of the required legacy CI.

Further details depend on the existing communication interface technology. Normative examples for legacy systems compliant with ISO 15628 are provided in Annex B.

4.5 15628 applications

Applications built on top of the DSRC application layer as specified in ISO 15628 may be operated over an ITS CI of CI class CIC-w1 specified in ISO 21218. The services shall interface with the FNETP via the “15628 Kernel Emulator”, see [Figure 4](#).

NOTE In the given context, 15628 applications are also referred to as 15628 legacy applications.

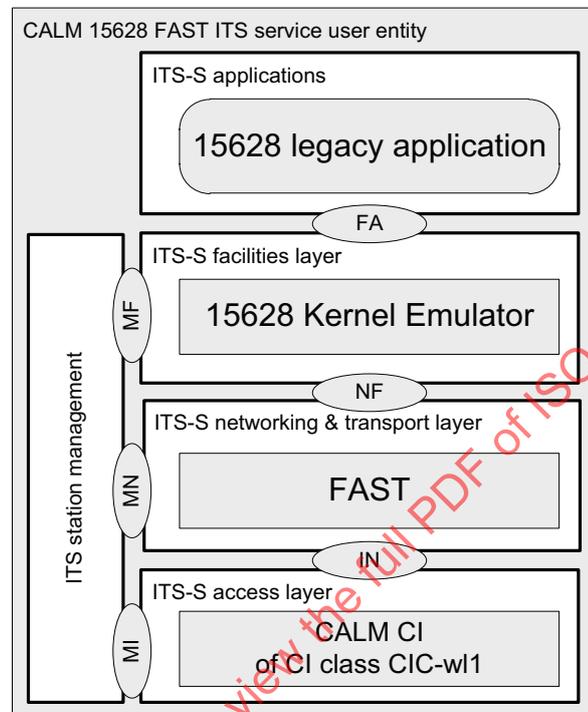


Figure 4 — 15628 legacy service

The 15628 initialization phase shall be implemented with the groupcast functionality specified in ISO 24102-1 and in ISO 24102-5.

The “15628 Kernel Emulator” shall perform the following tasks:

- Register at server groupcast manager for periodic transmission of BST, if applicable;
- Register at client groupcast manager for transmission of VST, if applicable;
- Emulate the 15628 T-Kernel interface for usage by applications;
- Map the 15628 “FlowControl” on BC-VCI and UC-VCI.

The purpose of 15628 LID shall be served by Link-ID specified in ISO 21218.

Detailed procedures are specified in [Clause 5](#).

5 Facilities layer protocols

5.1 General

The ITS-S facilities layer comprises the OSI layers five, six and seven as specified in ISO 21217.

The ITS-S facilities layer shall use the service primitives provided by the ITS management entity in the MF-SAP for management purposes as specified in ISO 24102-3.

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The ITS-S facilities layer shall be connected to services via an API. Details of the API are outside the scope of this part of ISO 29281.

The ITS-S facilities layer shall use the services provided in the NF-SAP by the ITS-S networking & transport layer.

5.2 Groupcast registration handler

The groupcast registration handler shall be as specified in ISO 24102-5.

5.3 Repetitive packet transmission handler

The ITS-S facilities layer shall be responsible for repetitive transmission of data packets, as requested by the service.

5.4 Legacy CI Port Agent

Upon registration of a legacy CI at the ITS station management entity as specified in ISO 24102-1, the ITS station management entity notifies the "Legacy CI Port Agent" about the presence of this legacy CI, indicating the Link-ID and the type of legacy CI as specified in ISO 21218.

The "Legacy CI Port Agent" shall:

- use the NF-SAP service NF-FNTP-PORT of the FNTP to get a host port number from the port number manager assigned as specified in ISO 29281-1;
- notify the port number to the ITS station management entity, indicating also the Link-ID of the related legacy CI.

The "Legacy CI Port Agent" shall maintain a separate host port number for each legacy CI registered in the ITS station.

Details on ISO 15628 legacy CIs are provided in B.1.

5.5 15628 kernel emulator

5.5.1 15628 legacy applications

15628 legacy applications "option 3" shall be treated in the same way as ITS-S applications designed for the FNTP.

NOTE The functionality of ACn commands specified in EN 12795:2003 is not supported.

5.5.2 CI classes

The 15628 kernel emulator enables ITS applications built on ISO 15628 to be operated over a CALM wireless CI of CI class CIC-w1 specified in ISO 21218, based on the FNTP. Usage of CIs of CI class CIC-w15 specified in ISO 21218 shall be prohibited.

5.5.3 Registration of 15628 applications

In a server station the 15628 kernel emulator shall register available 15628 applications at the groupcast manager using MF-REQUEST 1 "GcRegServer" specified in ISO 24102-5 with parameters as specified in [Table 2](#).

Table 2 — Registration of 15628 server application at groupcast manager

Parameter Name	Value
GProgServer. applicationID	As specified in ISO 24102-1
GProgServer. gCschedule	As specified in ISO 24102-5
GProgServer. priority	As specified in ISO 24102-5
GProgServer. serviceDataReg	As specified in ISO 24102-5
ServiceDataReg.nonipData. serviceID	“aid” as contained in “ApplicationList” specified in ISO 15628
ServiceDataReg.nonipData. timeout	defined by implementation
ServiceDataReg.nonipData. Data	not present
ServiceDataReg.nonipData. Port	Port number as specified in ISO 29281-1

The purpose of “BeaconID” specified in ISO 15628 shall be given by the “serverID” contained in “SAM” specified in ISO 24102-5.

In a client station the 15628 kernel emulator shall register available 15628 applications at the groupcast manager using MF-REQUEST 4 “GProgClient” with parameters as specified in [Table 3](#).

Table 3 — Registration of 15628 server application at groupcast manager

Parameter Name	Value
GProgClient. applicationID	As specified in ISO 24102-1
GProgClient. priority	As specified in ISO 24102-5
GProgClient. serviceID	“aid” as contained in “ApplicationList” specified in ISO 15628
GProgClient. contextData	“eid” and “parameter” as contained in “ApplicationList” and “obeConfiguration” as contained in “VST”; “eid”, “parameter” and “VST” as specified in ISO 15628.

5.5.4 Service operation phase

In the service operation phase the PDUs of the 15628 services GET, SET, ACTION and EVENT-REPORT as specified in ISO 15628 shall be exchanged.

For the purpose of this part of ISO 29281, the ITS-FPDU contained in an FNTP NPDU as specified in ISO 29281-1 shall contain the T-APDU as specified in ISO 15628.

The “15628 Kernel Emulator” shall support concatenation and chaining as specified in ISO 15628.

The “FMT-ID” element shall be as specified in [Table 4](#).

Table 4 — Selection of “messageType”

15628 service primitive	15628 parameter “mode”	FMT-ID
SET.request, ACTION.request, EVENT-REPORT.request	0	5
GET.request	-	6
SET.request, ACTION.request, EVENT-REPORT.request	1	6
GET.response, SET.response, ACTION.response, EVENT-REPORT.response	-	7

The 15628 parameters “FlowControl” and “LID” are not supported explicitly. “FlowControl” and “LID” shall be considered in the operation phase as specified in [Table 5](#).

Table 5 — 15628 “FlowControl” and “LID”

15628				CALM	
FlowControl	LID	Mode	Purpose	FMT-ID	VCI
1	broadcast	0	Broadcast transmission	5	TX via BC-VCI
1, 4	private	0	Data transmission	5	TX via UC-VCI
7	private	1	Data exchange - Request	6	TX via UC-VCI
10	private	-	Data exchange - Response	7	TX via UC-VCI
2, 3, 5, 6, 8, 9, 11	-	-	-	-	-

The purpose of 15628 “LID” shall be served by Link-ID.

5.6 Basic primitive application functions

Basic primitive application functions are an essential element of legacy CIs according to option 2 specified in [Annex B](#). They are related to on-board unit’s resources such as human-machine interface, IC card interface and so on. Each basic primitive application function is uniquely addressed by a port number. A roadside station selects and combines basic primitive application functions, see [Figure B.2](#), in order to realize a specific service.

Examples of the basic primitive application functions are shown in [Annex C](#).

NOTE Basic primitive application functions are executed on LPP.

6 Conformance

The “Protocol Implementation Conformance Statements” (PICS) proforma is specified in ETSI TS 102 985-1.

7 Test methods

The “Test Suite Structure & Test Purposes” (TSS&TP) for conformance testing are specified in ETSI TS 102 985-2.

The “Abstract Test Suite” (ATS) for conformance testing is specified in ETSI TS 102 985-3.

Annex A (normative)

ASN.1

A.1 Use of modules

The following ASN.1 module is specified in this Annex:

- **CALMlegacySupport** { iso (1) standard (0) calm-nonip(29281) legacy (2) version1 (1)}

A.2 Module CALMnonip

This module specifies ASN.1 type definitions together with useful ASN.1 value definitions.

It imports ASN.1 definitions from a module specified in ISO 29281-1.

Unaligned packed encoding rules (PER) as specified in ISO/IEC 8825-2 shall be applied for this ASN.1 module.

In order to achieve octet alignment enabling cheap implementations, "fill" bits were defined. All fill bits shall be set to the value '0'b.

```

CALMlegacySupport { iso (1) standard (0) calm-nonip(29281) legacy (2) version1 (1)}

DEFINITIONS AUTOMATIC TAGS ::= BEGIN

IMPORTS

PortNumber FROM CALMfntp { iso (1) standard (0) calm-nonip(29281) fntp(1) version1 (1)}

;

-- End of IMPORTS

-- General types --

Param15628 ::= SEQUENCE {
    fill BIT STRING (SIZE(7)),
    params CHOICE {
        legacyOption INTEGER(0..255),
        portPA PortNumber -- Port number of 15628 Port
    }
}

Manager
}

FNTPlpp ::= OCTET STRING (SIZE(0..65535))

-- Values

-- Dummy values not defined here which cannot be imported. To be replaced by proper type.

/*
The ASN.1 specification has been checked for conformance to the ASN.1
standards by OSS ASN.1 Syntax Checker, and by OSS ASN-1STEP
*/

END

```

Annex B (normative)

15628 legacy CI

B.1 15628 legacy CIs

This Annex presents normative details for legacy CIs being compliant with ISO 15628.

Two options of handling 15628 legacy CIs are specified. Distinction is made by the way in which the 15628 services are implemented.

Option 1: Restricted to CI class CIC-wl5 specified in ISO 21218. Adaptation to CALM performed by means of a “15628 Agent Application” below the IN-SAP being responsible for the quick parts of the service, a “15628 Principal Application” above the NF-SAP being responsible for the slow parts of the service and for global control of the service, and the “15628 Port Manager”, see [Figures 3](#) and [B.1](#).

Option 2: Restricted to CI class CIC-wl5 specified in ISO 21218. Adaptation to CALM performed by means of the LPCP below the IN-SAP, the FNTTP extension LPP, and the “15628 Port Manager”, see [Figures 3](#) and [B.2](#).

The “Agent Application” and the LPCP shall provide the functionality of the CALM adaptation layer (CAL) specified in ISO 21218.

The purpose of LID specified in ISO 15628 shall be achieved by means of the CI-ID of a UC-VCI.

B.2 Option 1

[Figure B.1](#) shows the architecture for option 1. Two communication entities are distinguished in [Figure B.1](#):

- a) 15628 FAST ITS service provider entity (communication master) typically implemented as 15628 DSRC roadside unit (RSU), and not being aware of CALM;
- b) CALM 15628 FAST ITS service user entity (communication slave) with a functionality normally available in a 15628 DSRC on-board unit (OBU), implemented in a CALM mobile unit.

NOTE 1 The communication master may also be implemented as presented for the communication slave.

NOTE 2 The term “DSRC” used above does not refer to IEEE DSRC, but to ISO 15623.

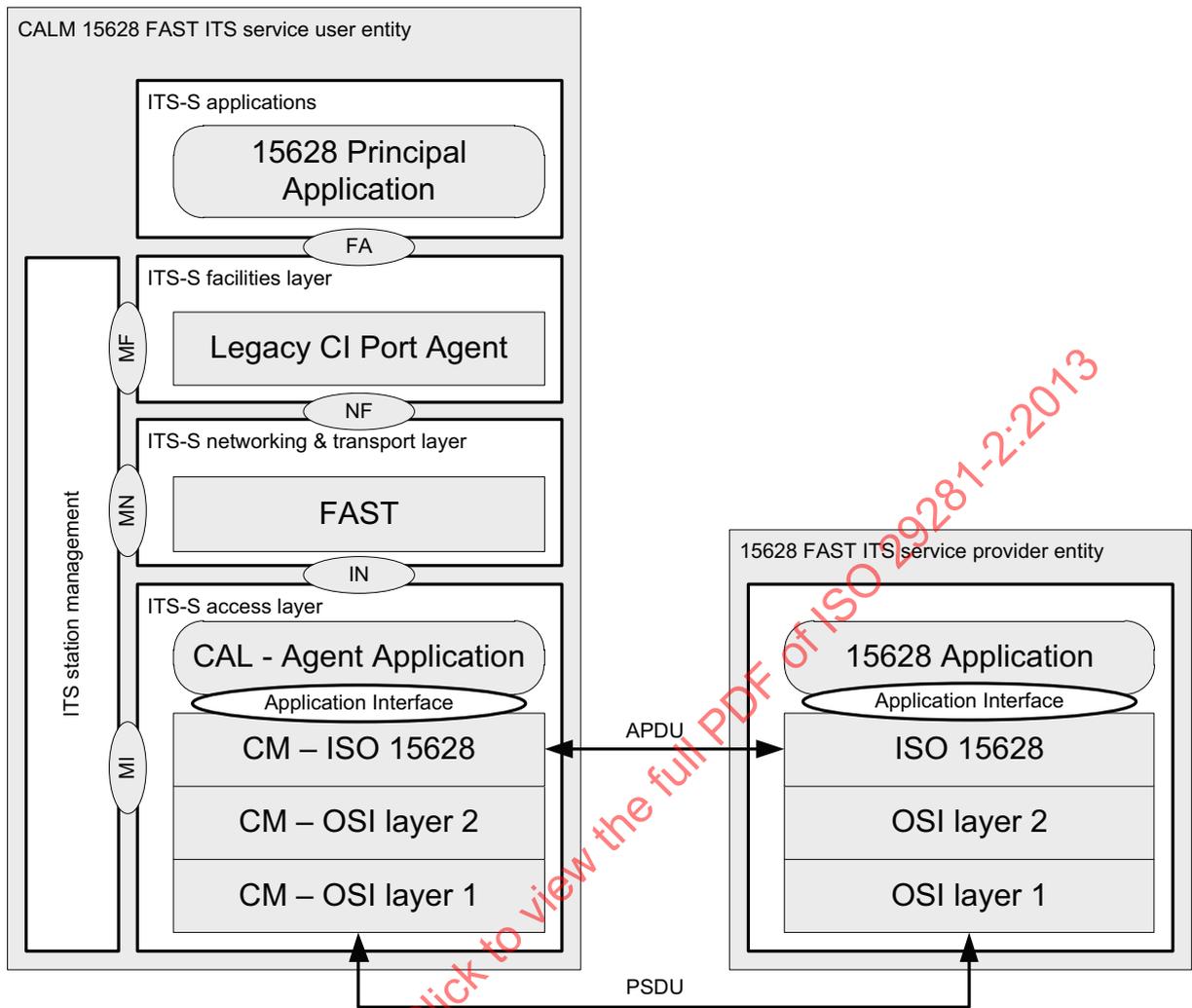


Figure B.1 — CALM 15628 architecture with “Agent Application”

The complete 15628 legacy ITS service is arranged in an “Agent Application” and a “15628 Principal Application”. The “Agent Application” shall autonomously handle time-critical packets received via the “Application Interface”, i.e. packets received from the FAST ITS service provider application in the RSU. Other packets may be forwarded to the “15628 Principal Application” without execution by the “Agent Application”, e.g. packets addressed to the HMI interface or to an OBU component.

The 15628 FAST ITS service user entity contains a CALM 15628 communication module (CM), the “Application Interface”, the CALM adaptation layer (CAL) contained in the “Agent Application”, the “Legacy CI Port Agent” interfacing to the MF-SAP, the NF-SAP and to the API, and the “CALM 15628 Principal Application”.

The “Agent Application” shall interface the communication stack of the CM compliant with ISO 15628 via the “Application Interface”. Examples of an “Application Interface” are given in [1, 2].

The “Agent Application” shall interface the ITS-S networking & transport layer via the IN-SAP, providing the functionality of the CALM adaptation layer (CAL) specified in ISO 21218. The networking protocol used to connect the “Agent Application” to the “15628 Port Manager” shall be FAST. The value of “PortNumber” selecting the “Legacy CI Port Agent” shall be assigned by the ITS station management entity upon activation of the “CALM 15628 CI”.

In case service data units (SDUs) are simultaneously received via the “Application Interface” and via the IN-SAP, priority shall be given to the SDUs received via the “Application Interface”.

The CALM 15628 CI shall provide an MI-SAP compliant with ISO 24102-3 and ISO 21218 with restrictions and amendments as specified in this part of ISO 29281. The CALM 15628 CI shall be of CI class “CIC-w15” and of CI access class “CIAC-1” according to ISO 21218.

In order to register the CI, REQUEST “RegReq” specified in ISO 24102-3 shall be used with:

- parameter “medType” set to “iso15628”;
- parameter “macAddress” set to the all-zero locally administered individual address 02-00-00-00-00-00 to indicate a CI without MAC address.

The “G/U” bit in the CI-ID shall always be set to zero. There shall always be only a single UC-VCI. There shall be no BC-VCI and no MC-VCI which does not preclude reception of groupcast frames.

Every BST received shall be forwarded to the “Legacy CI Port Agent”.

B.3 Option 2

Figure B.2 shows the architecture for option 2 which consists of equal peer stations.

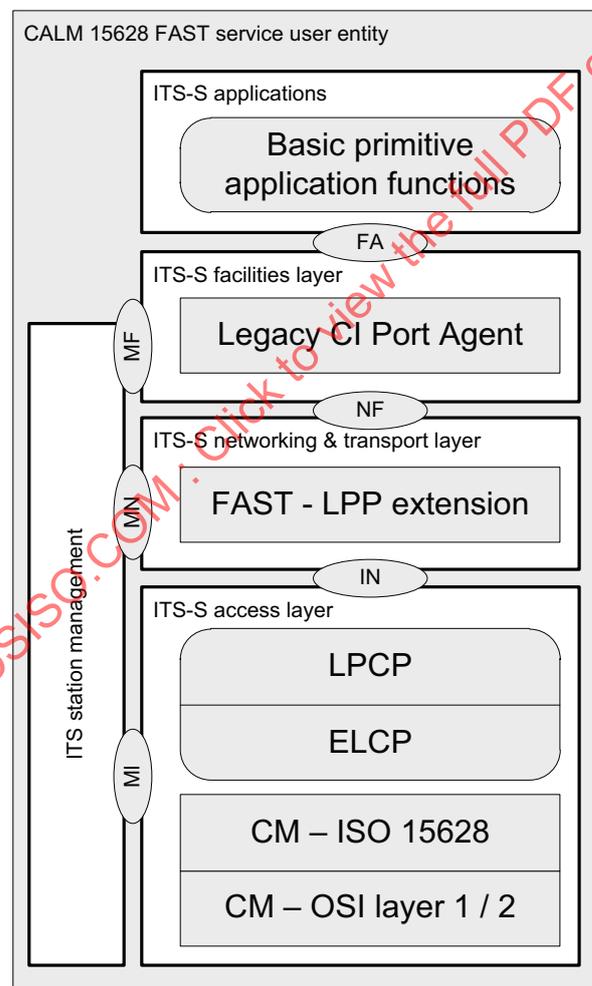


Figure B.2 — Option 2

The “Local Port Control Protocol” (LPCP) performs as an adaptation layer for ISO 15628 type DSRC. It shall be built on top of the “Extended Link Control Protocol” (ELCP) specified in ISO 24103. The ELCP shall be addressed in the BST and VST with the application Id “aid”=18 specified in ISO 15628.

NOTE The ELCP is designed to support IP communications and non-IP communications.

The complete 15628 legacy service is implemented above the ITS-S facilities layer by means of “Basic primitive application functions”.

The networking protocol used to connect the “Basic primitive application functions” to the LPCP shall be FNTF with extension LPP. The value of “PortNumber” selecting the “Basic primitive application functions” via the “Legacy CI Port Agent” may be assigned dynamically by the ITS station management entity upon activation of the “CALM 15628 CI” or may be set by implementation.

B.4 Common procedures

B.4.1 Link management

Upon reception of a BST which shall result in creation of a new LID in a DSRC OBU as specified in ISO 15628, the “CALM 15628 CI” shall:

- delete the existing UC-VCI;
- create a new UC-VCI;
- associate the CI-ID of this new UC-VCI with the BeaconID contained in the BST;
- acknowledge the BST by transmission of a VST, if appropriate according to the rules specified in ISO 15628.

Upon reception of a RELEASE command specified in ISO 15628, the “CALM 15628 CI” shall:

- forward the RELEASE command to the “Legacy CI Port Agent”;
- delete the related UC-VCI.

Upon timeout of the validity of a BeaconID specified in ISO 15628, the “CALM Legacy CI” shall delete the related UC-VCI.

B.4.2 CI states

Possible states of a CALM CI are specified in ISO 21218.

The states “suspended” and “inactive” shall not apply for “CALM Legacy CIs” implemented as backscatter devices specified in [3].

All state changes are notified to the “Legacy CI Port Agent” as specified in ISO 24102-1.

B.5 15628 I-parameters

B.5.1 Applicable parameters

[Table B.1](#) specifies the details of I-parameters specific to a 15628 “CALM Legacy CI”, and 15628-parameters. I-parameters specified in ISO 21218 but not contained in [Table B.1](#) are not mandatory for a 15628 “CALM Legacy CI”.

NOTE I-Param.No equal to 254.128.x identifies 15628-parameter number x.

Table B.1 — 15628 I-parameters

15628 parameter No	Parameter Name	Range/values	Description	Owner
	Medium	128	Indicating CALM 15628	See ISO 21218
	ManufacturerDeviceID	same as ISO 21218	Concatenation of ObeConfiguration.equipmentClass and ObeConfiguration.manufacturerID	See ISO 21218
0	LegacyOption	0, 1-255	0: The CI is not a legacy CI Sequential option number	
1	PortPA	0 - 255	Port number of FNTTP pointing to the "Legacy CI Port Agent".	
2 - 255			Reserved for future use.	

B.5.2 Description

B.5.2.1 ManufacturerDeviceID

[Table B.2](#) specifies details of parameter "ManufacturerDeviceID".

Table B.2 — 15628-parameter Type

ASN.1 Type	Valid Range	Description
MI-Param. manufacturerDeviceID	Text string "eeeeemmm", where "eeee" presents the hexadecimal equivalent of the equipment class, and "mmm" presents the hexadecimal equivalent of the manufacturer ID	Length of eight characters. Equipment class and manufacturer ID used in VST as specified in ISO 15628.

B.5.2.2 PortPA

[Table B.3](#) specifies details of 15628 parameter 1 "Port15628PM".

Table B.3 — Parameter Port15628PM

ASN.1 Type	Valid Range	Description
Param15628. PortPA	As specified in Annex A	Port number of FNTTP pointing to the "15628 Port Manager"

Annex C (informative)

15628 legacy service guidelines

C.1 Option 1

The “Agent Application” can be implemented as a smart cache memory which provides specific real-time functionality, e.g. security related functionality. The “Agent Application” mainly responds to the APDUs with time-critical constraints from the FAST ITS service provider application as specified in ISO 15628. Other APDUs, i.e. without time-critical constraints, mainly the ACTION APDU may be directly handled in the “CALM 15628 Principal Application” without involvement of the “Agent Application”. Details on how to use the ACTION ADPU by an application are specified in the “Application Interface” standards [1] and [2]. A time-critical example to be handled in the “Agent Application” is the GET_STAMPED command carried in the ACTION APDU, which retrieves information with an authenticator appended to it. An example for handling in the “CALM 15628 Principal Application” is the TRANSFER_CHANNEL command carried in the ACTION APDU, which connects to any OBU component, e.g. smart-card.

The required setting of CI access class in no way indicates the type of security applied in the 15628 service.

C.2 Option 2

C.2.1 Introduction

ITS communication media that have the application layer standardized in ISO 15628 (DSRC application layer) has been used by many ITS application such as EFC. In CALM standards series, ISO 24103 (CALM MAIL) enables to use ISO 15628 media for IP communication. On the other hand, for non-IP communication type application, various applications will be executed without requesting the large over-head for communication between roadside equipment-vehicle and vehicle-vehicle.

In this mechanism, vehicle on-board equipment has the basic primitive application functions that are considered to be needed for vehicle on-board equipment as general function.

Road-side applications operate those basic primitive application functions via media which have an application layer compliant with ISO 15628, the extended link control protocol (ELCP) defined in ISO 24103 and the local port control protocol (LPCP). So, those basic primitive application functions will be used by various services commonly.

C.2.2 Application ID

At first, VST-BST will be exchanged between RSU and OBU, identifying “aid” specified in ISO 15628. The value “aid”=18 (multi purpose application) is used to point to the implementation option 2.

C.2.3 Architecture

[Figure C.1](#) presents the OSI structure for using 15628 legacy CIs according to option 2.

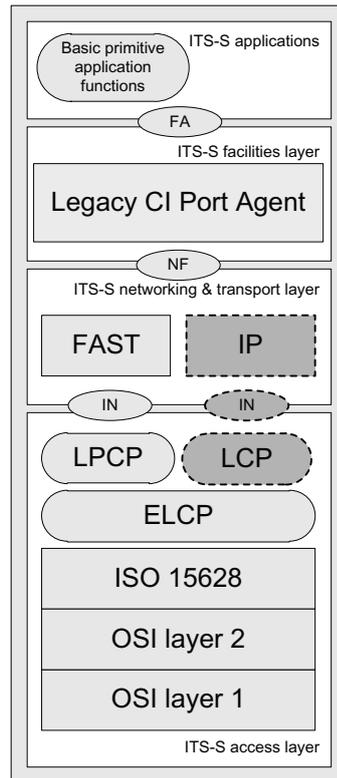


Figure C.1 — Protocol structure of layer 1 and layer 2 for option 2

NOTE [Table C.2](#) shows examples of the basic primitive applications functions and usage.

The “Extended Link Control Protocol” (ELCP) and the “LAN Control Protocol” (LCP) are specified in ISO 24103. ELCP and LCP connect the 15628 legacy CI to the IPv6 networking protocol. ELCP and the “Local Port Control Protocol” (LPCP) connect the 15628 legacy CI to the FNTF.

C.2.4 Extended link control protocol

ELCP is needed for FNTF and for IP networking via a 15628 CI according to option 2.

ELCP has the following functions in order to complement the communication facility of the ISO 15628 type DSRC and provides the communication services for data transmission and the management service to control the network control protocol.

- a) Multi-protocol correspondence;
- b) Client/Server type communication control;
- c) Bulk transmission control;
- d) Broadcast transmission mode control;
- e) Access control;
- f) Communication connection management.

ELCP can provide various transmission modes such as bulk transmission and broadcast transmission; however, some of the functions above are used for IP communication and not for non-IP communication.

C.2.5 Local port control protocol

C.2.5.1 Functionality

LPCP is the adaptation layer to connect ELCP to IN-SAP for FNTF. LPCP is in charge to insert/remove the FNTF header. These headers will not be used in the wireless legacy link, but only inside the ITS station for local processing.

LPCP will provide the data transfer service for non-network type applications.

The LPCP that works as an adaptation layer for ISO 15628 is not a network or transport protocol, but it provides IN-SAP to the FNTF (especially to the local port protocol) located upper layer. It is a control protocol for data transfer service and communication control and management service for upper layer protocol. It provides communication session based on not only a client/server model but also a peer to peer model.

C.2.5.2 Procedure

The LPCP shall be selected with IN-SAP address as specified in ISO 21218.

In order to execute multiple non-network type applications, the LPCP defines the identification information (local port) to identify connection for the upper layer protocol.

In order to send data correctly from a sending source application to a destination application, the LPCP identifies connection of each application using local ports that identify the sending destination application and sending source application and a link address that identifies the counterpart station.

C.2.5.3 Header

The DL-SAP `source_address` and `destination_address` as used in the LLC services shall be concatenation of a CI-ID and IN-SAP address.

In case of using a particular media and when upper protocols are known in priori, `source_address` and `destination_address` may be indicated by other methods on implementation.

NOTE `LinkAddress` and `PortNo` may indicate the address.

C.2.5.4 Data transfer service interface

The LPCP provides the following data transfer service primitives to the LPP:

- `TransferData.request` (`linkAddress`, `sourcePort`, `destinationPort`, `userData`);
- `TransferData.indication` (`linkAddress`, `sourcePort`, `destinationPort`, `userData`).

The “`TransferData.request`” service primitive is passed from the upper layer protocol to the LPCP to request to transfer the NCP-SDU passed from the upper layer protocol to the remote station.

The “`TransferData.indication`” service primitive is passed from the LPCP to the upper layer protocol to indicate arrival of the NCP-SDU.

The parameter “`linkAddress`” indicates the link address used in the DSRC.

The parameter “`sourcePort`” indicates the local port number (application) that is the data sending source. When a response from the sending destination is required, it is used as the default access point for giving the response.

The parameter “`destinationPort`” indicates the local port number (application), which is the data sending destination, and together with the parameter “`linkAddress`” identifies the access point of the local port control protocol.

The parameter “userData” is provided by the actual NCP-SDU itself or by passing a pointer to the NCP-SDU or by other means.

The logical relationship between data transfer service primitives the LPCP to the LPP is shown in [Figure C.2](#).

NOTE Service primitive type “request” is abbreviated to “req” and “indication” to “ind”.

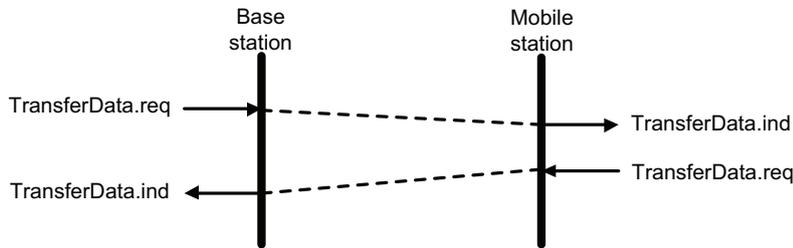


Figure C.2 — Logical relationship between data transfer service primitives

C.2.5.5 Management service interface

The LPCP provides the following management services to the LPP:

a) Event notification service

The LPCP provides the following service primitive as the event notification service to the LPP.

— EventReport.indication (linkAddress, destinationPort, eventCode, [extensionParameter])

The “EventReport.indication” primitive is passed from the LPCP to the upper layer protocol in the local station to notify of an event notified by the event notification service of the ELCP, or passed from the LPCP to the upper layer protocol in the remote station or local station to provide notification that an event such as error occurred in the LPCP.

The parameter “linkAddress” indicates the link address used in the DSRC.

The parameter “destinationPort” indicates the local port number (application) that is the data sending destination, and identifies the access point of the LPCP together with the parameter “linkAddress”.

The parameter “eventCode” indicates the type of event that occurred.

The parameter “extensionParameter” indicates the additional event information corresponding to each event code, and may be provided by the actual data itself or by passing pointer to the data or by other means.

b) Local port management service

The LPCP provides the following primitives as the local port management service to the LPP.

— OpenPort.request ([openPort], [primitiveType], [recvEventCode])

— OpenPort.confirm ([openPort])

— ClosePort.request (closePort)

The “OpenPort.request” primitive is passed from the upper layer protocol to the LPCP to request the opening of a local port.

The “OpenPort.confirm” primitive is passed from the LPCP to the upper layer protocol to provide notification of the opened local port number.

The “ClosePort.request” primitive is passed from the upper layer protocol to the LPCP to request the closing of a local port.

The parameter “openPort” indicates the number of an opened local port.

The parameter “primitiveType” indicates the type of the indication primitive received by the opened local port.

The parameter “recvEventCode” indicates the type of event received by the opened local port.

The parameter “closePort” sets the local port number to be closed.

The logical relationship between management service primitives the LPCP to the LPP is shown in [Figure C.3](#).

NOTE Service primitive type “request” is abbreviated to “req”, “indication” to “ind” and “confirm” to “conf”.

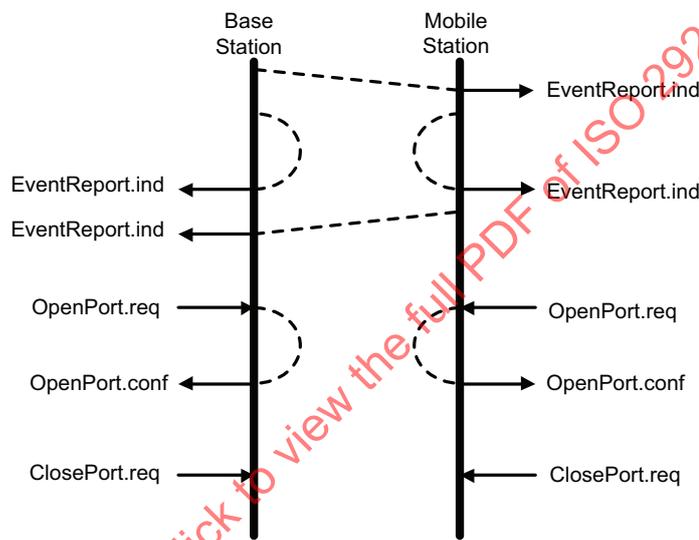


Figure C.3 — Logical relationship between management service primitives

C.2.5.6 Local port management procedure

C.2.5.6.1 Local port open process

When the “OpenPort.request” primitive in which the “openPort” parameter is specified is received from the LPP, the LPCP shall register the local port number (openPort), notification primitive type (primitiveType) and notification event type (recvEventCode) in the acceptable local port list. And then notifies the upper layer protocol of the opened local port number through the “OpenPort.confirm” primitive.

If the specified local port (openPort) does overlap an existing port, the LPCP does not register the contents above, and notifies the upper layer protocol that opening of the local port has failed through the “OpenPort.confirm” primitive without the “openPort” parameter.

When receiving the “OpenPort.request” primitive without the “openPort” parameter, the LPCP shall assign a local port number to the requested process and register the assignment result, notification primitive type (primitiveType) and notification event type (recvEventCode) in the acceptable local port list. And then notify the upper layer protocol of the opened local port number through the “OpenPort.confirm” primitive.