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

Systèmes intelligents de transport — Accès aux communications des services mobiles terrestres (CALM) — Couche d'interface adaptée au milieu (MAIL)

Reference number
ISO 24103:2009(E)

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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.

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ISO 24103 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 (communication access for land mobiles) which determine a common architecture, network protocols and air interface definitions for wireless communications using cellular second generation, cellular third generation, mobile wireless broadband, microwaves, millimetre waves, infra-red communications, and so on. Other air interfaces may be added at a later date. These air interfaces are designed for providing parameters and protocols for broadcast, point-point, vehicle-vehicle, and vehicle-point communications in the intelligent transport systems (ITS) sector.

This International Standard determines the media adapted interface layer (MAIL), which enables communication media such as dedicated short-range communication (DSRC) compliant with ISO 15628 (DSRC application layer) to be used as CALM media for internet protocol (IP)-based communications.

DSRC media with the following characteristics are available.

— Proven radio communication for ITS:

  1) direct communication based on ISO 15628, e.g. for electronic fee collection (EFC) — in ARIB STD-T75, a 4 MB/s data rate and a communication zone of approximately 30 m, available for response during high-speed driving;

  2) practical experiments for IP communication over the ISO 15628 application layer — a DSRC application sub-layer (ARIB STD-T88) that works on application ID 18 of ISO 15628.

— Communication in a comparatively small communication zone:

  1) easy identification of a communication partner;

  2) reuse frequency in every small zone and effective utilization of frequency resources;

  3) less liable to be affected by shadowing.

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

1 Scope

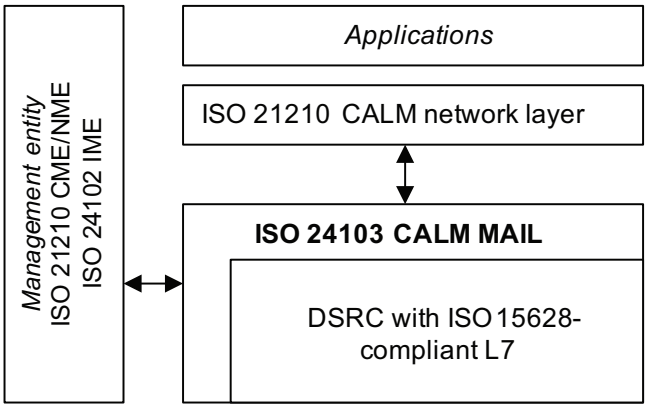
This International Standard determines the logical structure of using dedicated short-range communication (DSRC) with an OSI (open systems interconnection) application layer as a CALM medium for IP communications. DSRC to which MAIL is applicable are those with an application layer compliant with ISO 15628, and the standards of such DSRC include the following:

— ARIB STD-T75 DSRC (Japan);

— TTAS.KO-06.0025 DSRC in the 5,8 GHz band (Korea);

— EN 12253 DSRC physical layer using microwave in the 5,8 GHz band, EN 12795 DSRC data link layer and EN 12834 DSRC application layer (Europe).

Figure 1 shows the architecture of the MAIL, which can be considered as a specific extension of the communication adaptation layer (CAL) specified by ISO 21218.



NOTE In furnishing additional information on CALM MAIL, reference can be made to ARIB STD-T88 (DSRC application sub layer).

Figure 1 — CALM MAIL in CALM architecture

2 Conformance

In order for conformance to be claimed with this International Standard, communication shall be established in full compliance with the procedures and protocols given in ISO 15628, compliant with the appropriate national or regional standards, and shall be in accordance with ISO 21210, ISO 21217 and ISO 21218.

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 15628, *Road transport and traffic telematics — Dedicated short range communication (DSRC) — DSRC application layer*

ISO 21210, *Intelligent transport systems — Communications access for land mobiles (CALM) — Networking protocols*[1)]

ISO 21217, *Intelligent transport systems — Communications access for land mobiles (CALM) — Architecture*[1)]

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) — CALM Management* [2)]

4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.1
ISO 15628 DSRC
dedicated short-range communication system for ITS applications with an application layer as specified in ISO 15628

4.2
base station
fixed DSRC equipment on the roadside, which performs communications with multiple mobile stations

4.3
media adapted interface layer
MAIL
functional structure for using DSRC as a CALM medium

4.4
mobile station
mobile communication facility capable of receiving and transmitting information from/to the base stations

5 Symbols and abbreviated terms

A-PDU	application-layer protocol data unit
ARIB	association of radio industries and businesses
A-SDU	application-layer service data unit
ASN	abstract syntax notation

1) To be published.

2) Under preparation.

CAL	communication adaptation layer
CALM	communications access for land mobiles
CI	communication interface
CIMAE	communication interface management adaptation entity
C-SAP	communication SAP, as offered by the CAL to the CALM network layer
DHCP	dynamic host configuration protocol
DL	data link
DLL	data link layer
DSRC	dedicated short-range communication
EID	element identifier
ELCP	extended link control protocol
I-KE	initialization kernel element
ind	indication (service primitive type)
IP	internet protocol
ITS	intelligent transport systems
L7	layer 7 (application layer)
LAN	local area network
LANCP	LAN control protocol
LID	link identifier
LPCP	local port control protocol
L-PDU	lower layer protocol data unit
MAC	media access control
MAIL	media adapted interface layer
ME	management entity
MIB	management information base
M-PDU	media protocol data unit
MRU	maximum receive unit
NCP	network control protocol
OBU	on-board unit
PDU	protocol data unit
PHY-PDU	physical layer protocol data unit
req	request (service primitive type)
RSU	road side unit
SAP	service access point
SDU	service data unit
TCP	transmission control protocol
T-KE	transfer kernel element
TTAS	telecommunications technology association standard
U-PDU	upper layer protocol data unit

6 Requirements

6.1 Structure and operation

The MAIL interfaces ISO 15628 DSRC application layer protocol stacks and CALM network protocols to provide the DSRC with supplemental communications functions (see Figure 2).

The CALM MAIL communication interface (CI) shall be in accordance with

a) ISO 21218, for lower layer service access points,

b) ISO 24102, for interface management

c) ISO 21217, for global architecture, and

d) ISO 21210, for IP networking,

as restricted and/or amended by this International Standard.

This communication interface is a CALM wireless CI which shall

— support CI class CIC-wl5,

— support at least CI access class CIAC-1,

— provide a C-SAP, and

— provide an M-SAP,

all in accordance with ISO 21218.

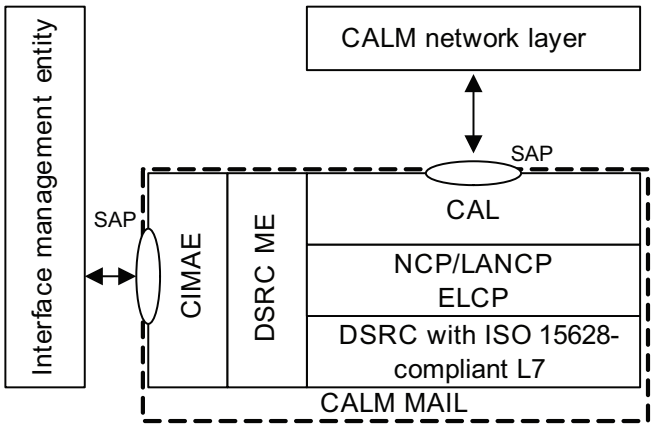


Figure 2 — Medium adaptation

Figure 3 shows the structure of the core part of MAIL. The MAIL provides IP communications via DSRC to CALM without requiring awareness of ISO 15628 protocol stacks. The functions that adapt the application layer of the ISO 15628 DSRC to CALM are defined below.

MAIL consists of the extended link control protocol (ELCP) and the network control protocol (NCP). The ELCP interfaces with the ISO 15628 protocol stacks, complements them, and provides management functions. The NCP provides encapsulation functions for upper layer protocols.

— The ELCP has the following functions:

1) transmission service control;

2) client/server communication control;

3) communication control management.

— The NCP has the following functions:

1) LAN control;

2) local port control (optional).

The NCP may consist of multiple communication control protocols for interfacing with various types of network protocols. The LAN control protocol is a communication control protocol which interfaces with the IP network protocol. The local port control protocol is an optional communication control protocol specified in ISO 29281, and is used for non-IP network applications. The present International Standard focuses on the LAN control protocol used to interface with the IPv6 CALM network layer.

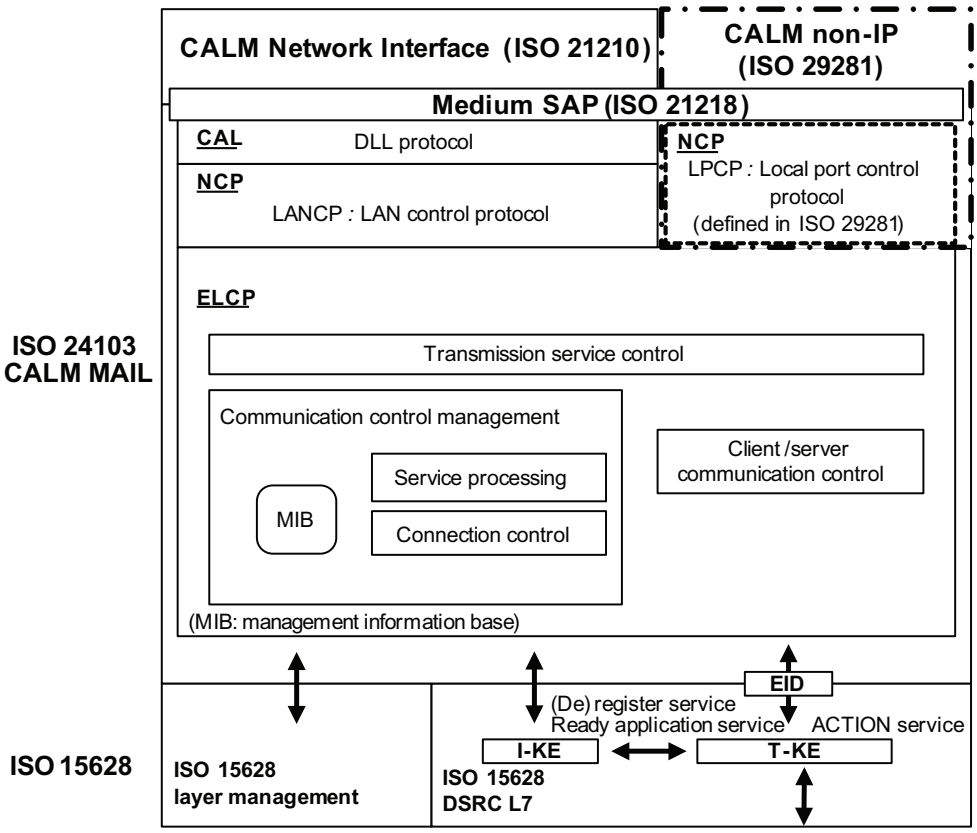


Figure 3 — Structure of MAIL core part

Figure 4 shows an outline of MAIL operation.

DSRC layer 7 establishes an ISO 15628 DSRC communication link. The ELCP shall be activated by a notification of a communication link establishment from DSRC L7. After the activation, the ELCP first shall compare its own MAIL profile with the peer MAIL profile passed through the established communication link and confirm the available functions in the ELCP. During this stage, the ELCP shall not conduct any settings related to the NCP.

After the confirmation of MAIL profiles, when an access management function is usable, a peer authentication may be conducted. In the case of successful authentication, the ELCP may activate the communication control protocol (e.g. LANCP) in the NCP and start the NCP process phase.

The activated NCP shall conduct the initial setting for each communication control protocol in the initial setting phase. Each network protocol shall be activated only after the completion of the initial setting for the corresponding communication control protocol in the NCP.

After completion of the above procedure, the communication phase may start to initiate communication using the network protocol.

Thus, the network protocol, such as IP, is activated.

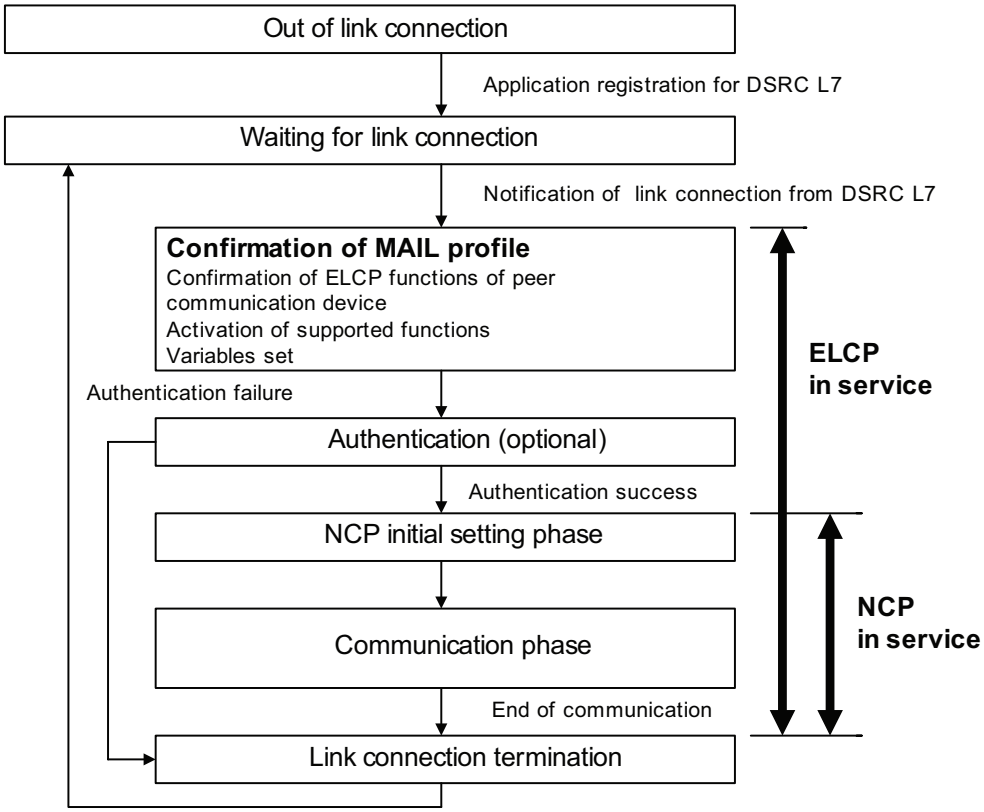


Figure 4 — Outline of MAIL operation

6.2 Communication control method

Figure 5 shows an overview of the service interfaces and the protocol stacks of DSRC and MAIL.

The ELCP exchanges the protocol data units (PDU) with the peer ELCP by using the service interface provided by DRSC L7 and conducts the communication procedures stipulated for the ELCP. The ELCP provides the service interface of the communication service for the data transmission and the management service for the management control to the NCP.

The NCP exchanges the PDU with the peer NCP by using the service interface provided by the ELCP and conducts the communication procedures stipulated for the NCP.

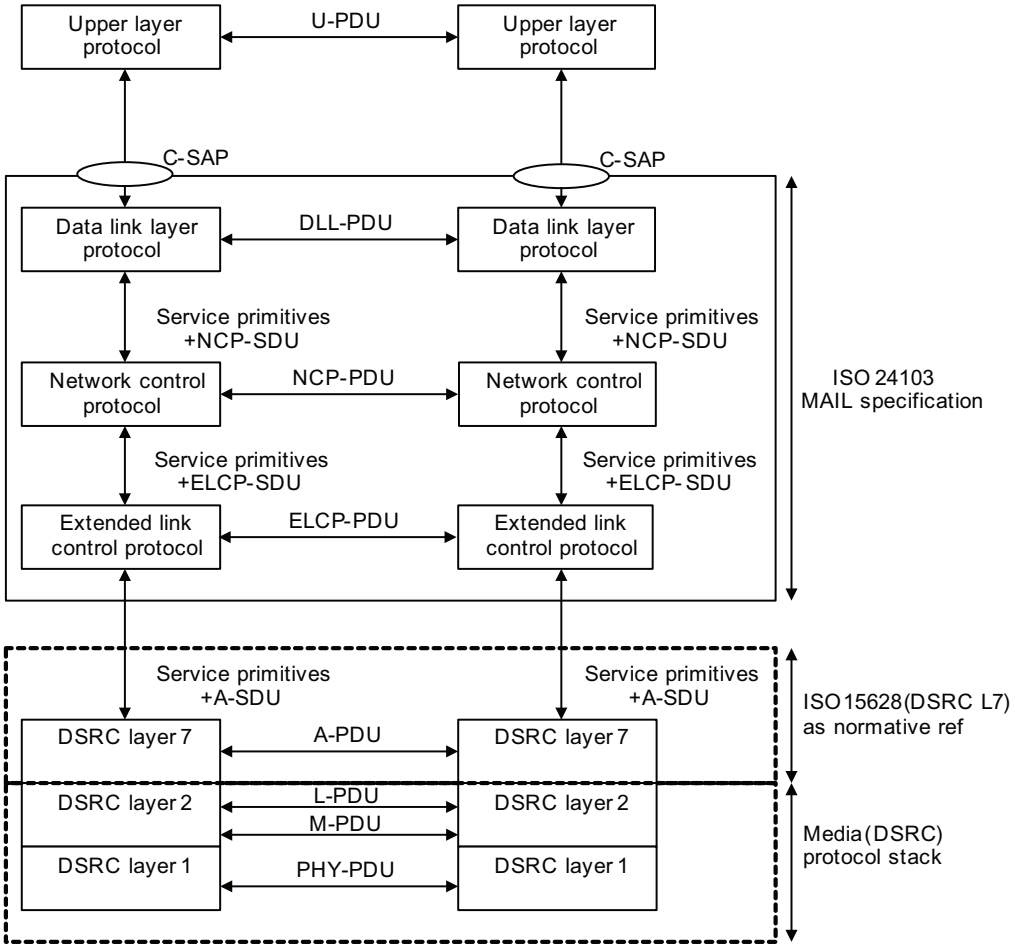


Figure 5 — Overview of DSRC and MAIL service interfaces and protocols

7 Extended link control protocol

7.1 General

The ELCP is composed of

a) transmission service control,

b) client/server communication control, and

c) communication control management.

Each entity has peer protocol with its corresponding entity.

NOTE Figure 3 shows the structure of the MAIL core part.

7.2 Transmission service control

7.2.1 Communication service interface of extended link control

The communication control of the ELCP provides the following primitives as the communication service to the NCP:

```
SendDataUnit.request (linkAddress, networkControlParameter)

SendDataUnit.indication (linkAddress, networkControlParameter)
```

The “SendDataUnit.request” primitive is sent to the ELCP from the NCP to request that the ELCP-SDU passed from the NCP be transmitted to the remote station.

The “SendDataUnit.indication” primitive is sent to the NCP from the ELCP, in order to notify the arrival of the ELCP-SDU.

The logical relationship between communication service primitives provided by the ELCP to the NCP is shown in Figure 6.

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

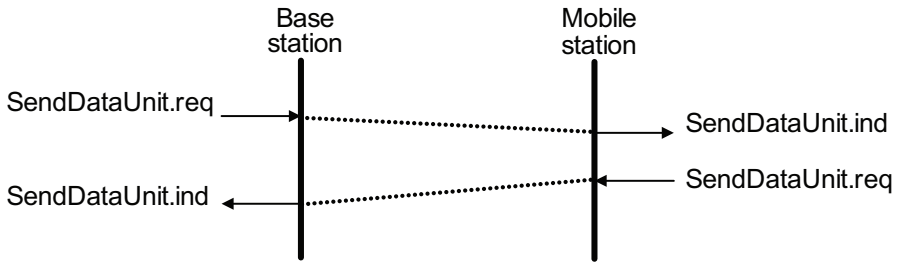


Figure 6 — Logical relationship between communication service primitives

The parameter “linkAddress” indicates the access points of own and remote stations for each NCP communication control protocol.

The “networkControlParameter” can be either actual ELCP-SDU or pointer for the ELCP-SDU.

7.2.2 Communication services from DSRC layer 7 (L7) interface

The ELCP defines and uses the following services and sub-primitives with the ACTION service provided by DSRC L7:

— data transfer service;

— data transfer inquiry service.

The ACTION service is defined in ISO 15628.

a) Data transfer service

In the data transfer service, the following sub-primitives are defined by using the “ACTION.request” and “ACTION.indication” primitives:

```
SendMessage.request (linkAddress, dataPacket)

SendMessage.indication (linkAddress, dataPacket)
```

The “SendMessage.request” primitive is sent to DSRC L7 of the base station from the ELCP of the base station to request that the ELCP-PDU generated by the ELCP of the base station be transmitted to the mobile station.

The “SendMessage.indication” parameter is sent to the ELCP of the mobile station from DSRC L7 of the mobile station to notify the arrival of the ELCP-PDU.

The parameter “linkAddress” indicates the access points of own and remote stations for the NCP communication control protocol.

The parameter “dataPacket” can be either actual ELCP-SDU or pointer for the ELCP-SDU and shall be set in the parameter “actionParameter” of the ACTION primitives.

b) Data transfer inquiry service

In the data transfer inquiry service, the following sub-primitives are defined by using the “ACTION.request”, “ACTION.indication”, “ACTION.response” and “ACTION.confirm” primitives:

```
WaitMessage.request (linkAddress, [dataPacket])

WaitMessage.indication (linkAddress, [dataPacket])

WaitMessage.response (linkAddress, [dataPacket])

WaitMessage.confirm (linkAddress, [dataPacket])
```

The “WaitMessage.request” primitive is sent to DSRC L7 of the base station from the ELCP of the base station to inquire that the existence of the ELCP-PDU be transmitted to the base station at the mobile station.

The “WaitMessage.indication” primitive is sent to the ELCP of the mobile station from DSRC L7 of the mobile station to notify the ELCP of the mobile station of the arrival of the transmission inquiry.

The “WaitMessage.response” primitive is sent to DSRC L7 of the mobile station from the ELCP of the mobile station to request the return of the response to the transmission inquiry.

The “WaitMessage.confirm” primitive is sent to the ELCP of the base station from DSRC L7 of the base station to notify the ELCP of the base station of the arrival of the response to the transmission inquiry.

The parameter “linkAddress” indicates the access points of own and remote stations for the NCP communication control protocol.

The parameter “dataPacket” can be either the actual ELCP-SDU or the pointer for the ELCP-SDU and shall be set in the parameter “actionParameter” or “responseParameter” of the ACTION primitives.

The logical relationships between the sub-primitives defined in the ACTION primitives are shown in Figure 7.

NOTE Service primitive type “confirm” is abbreviated to “cf” and “response” to “res”.

The parameter “actionType” in the data transfer service and those in the data transfer inquiry service are to be set to different values.

The values of “actionType” should be registered in the *DSRC Layer 7 ActionType Register* (see Bibliography).

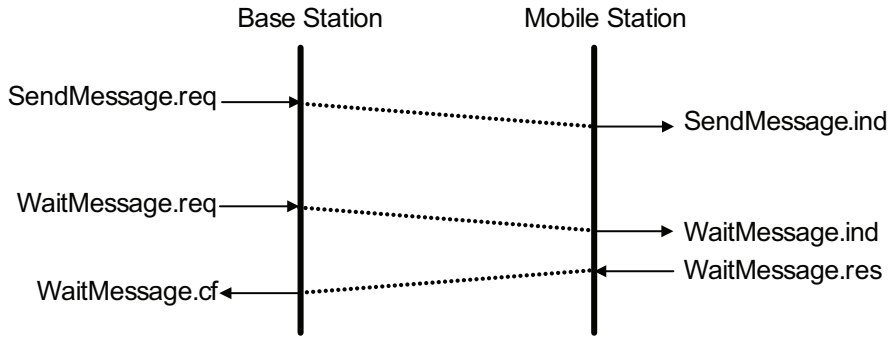


Figure 7 — Logical relationships between sub-primitives defined in ACTION service

7.2.3 Extended link control procedure

7.2.3.1 Base station data transfer service

7.2.3.1.1 Data transmission process

When the primitive requesting the data transmission ("SendDataUnit.request") is invoked by the NCP, the ELCP shall obtain the ELCP-SDU from the parameter "networkControlParameter".

The ELCP-SDU shall be supposed to be invalid in the following two cases:

a) when the size of the ELCP-SDU passed by the parameter "networkControlParameter" exceeds the maximum receive unit (MRU) of the ELCP, in which case the request primitive shall be discarded and the state *the data size exceeded the buffer upper bound* shall be notified by the event notice primitive ("EventInformation.indication") to the NCP that requested the transmission;

b) when the transmission queue is full, in which case the ELCP-SDU shall be discarded and the state *the transmission queue is full and transmission failed* shall be notified to the NCP that requested the transmission by the event notice primitive ("EventInformation.indication").

7.2.3.1.2 Data reception process

When the ELCP-PDU is stored in the receiving queue, the ELCP-SDU shall be sent to the NCP by the data arrival notice primitive ("SendDataUnit.indication"). Under these circumstances, the ELCP-SDU that is passed to the NCP shall be extracted from the ELCP-PDU by deletion of the communication control information and shall be stored in the parameter "networkControlParameter".

The link address of the ELCP-PDU shall be stored in the parameter "linkAddress".

The NCP to which the data arrival notice primitive ("SendDataUnit.indication") is sent shall be identified according to the access point identifier in the access control information field in the ELCP-SDU. Under these circumstances, if there is no relevant NCP to be noticed in the station, the ELCP-SDU shall be discarded.

7.2.3.2 Mobile station data transfer service

7.2.3.2.1 Data transmission process

When the primitive requesting data transmission ("SendDataUnit.request") is invoked by the NCP, the ELCP shall obtain the ELCP-SDU from the parameter "networkControlParameter".

When the content of the parameter "linkAddress" is the private link address, the ELCP shall generate the ELCP-PDU by appending the communication control information to the acquired ELCP-SDU and shall set it to the transmission queue.

However, in the following two cases, the ELCP-SDU shall be supposed to be invalid and shall not be processed:

a) when the ELCP-SDU passed by the parameter “networkControlParameter” exceeds the MRU of the ELCP, in which case the request primitive shall be discarded and the state, *the data size exceeded the buffer upper bound*, shall be notified by the event notice primitive (“EventInformation.indication”) to the NCP that requested the transmission;

b) when the transmission queue is full, in which case the ELCP-SDU shall be discarded and the state, *the transmission queue is full and transmission failed*, shall be notified by the event notice primitive (“EventInformation.indication”) to the NCP that requested the transmission.

7.2.3.2.2 Data reception process

When the ELCP-SDU is obtained, it shall be sent to the NCP in the parameter “networkControlParameter” by the data arrival notice primitive (“SendDataUnit.indication”).

The link address of the ELCP-SDU shall be stored in the parameter “linkAddress”.

The NCP to which the data arrival notice primitive (“SendDataUnit.indication”) is sent shall be identified according to the access point identifier in the access control information field in the ELCP-SDU. Under these circumstances, if there is no relevant NCP to be noticed in the station, the ELCP-SDU shall be discarded.

7.3 Client/server communication control

Extended link control protocol performs the procedure of the client/server communication control shown in Figure 8 in order to enable a transmission from the mobile station. This communication control procedure is described in 7.3.1 and 7.3.2.

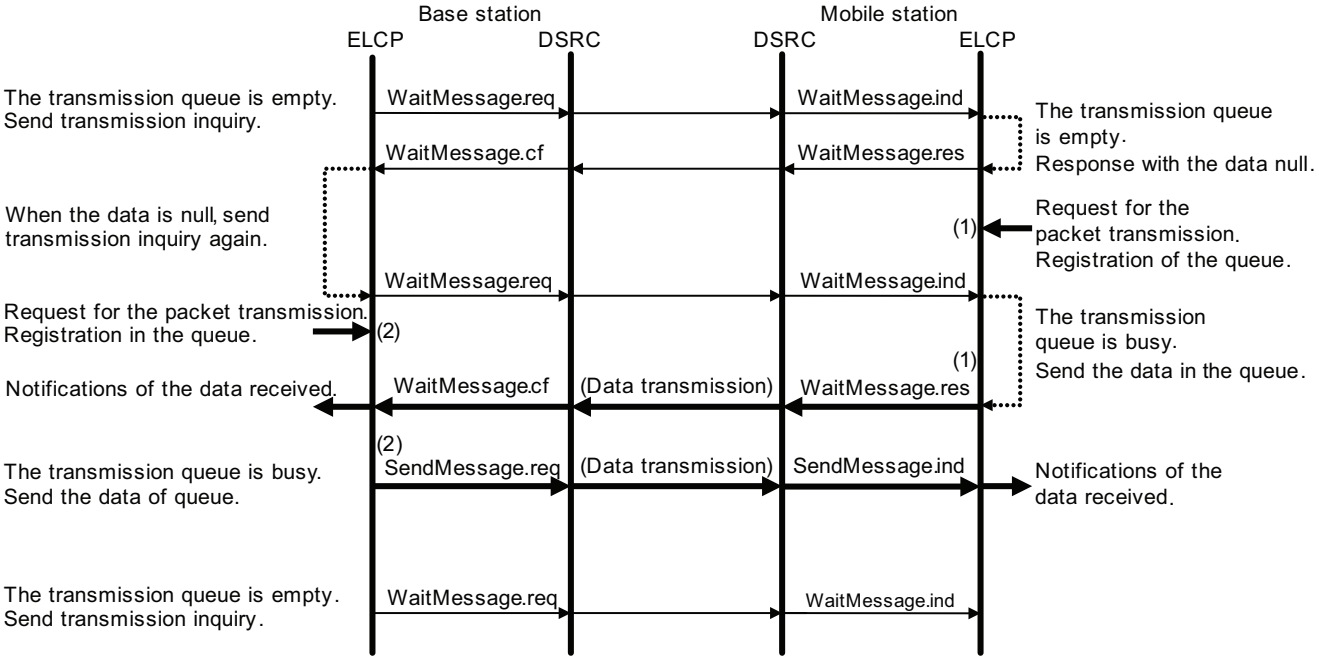


Figure 8 — Example of client/server communication control using ACTION primitives

7.3.1 Base station communication control

7.3.1.1 Transmission of the ELCP-PDU

When there is an ELCP-PDU to be sent to a mobile station in the transmission queue, the base station shall transmit the ELCP-PDU to the mobile station using the data transfer service.

The ELCP shall set the parameter of the “ACTION.request” primitive according to the specification of the “SendMessage.request” sub-primitive and shall transmit the ELCP-PDU using this DSRC L7 ACTION primitive.

On this occasion, if the link address in the ELCP-PDU is a private link address, the value of the parameter EID passed from the DSRC L7 in the “NotifyApplicationRSU” primitive shall be used for the value of EID in the “ACTION.request” primitive.

NOTE “NotificationApplicationRSU” primitive and “ACTION.request” primitive refer to the ISO 15628 DSRC application layer.

7.3.1.2 Reception of the ELCP-PDU (Data transmission inquiry)

Reception of the ELCP-PDU from each mobile station shall be carried out as a transmission inquiry from the base station and a response to inquiry from the mobile station.

The base station shall inquire the data transmission of each mobile station according to the schedule decided beforehand.

The ELCP shall set each parameter of the “ACTION.request” primitive according to the specification of the “WaitMessage.request” sub-primitive and shall perform the transfer inquiry for each mobile station by using the “ACTION.request” primitive of DSRC L7.

The content of the parameter “dataPacket” in the “WaitMessage.request” sub-primitive shall be Null, i.e. the data length is zero.

The base station shall acquire the ELCP-PDU transmitted by the mobile station through the “WaitMessage.confirm” sub-primitive.

When the content of the “ACTION.confirm” primitive passed from DSRC L7 conforms to the “WaitMessage.confirm” sub-primitive specification, the base station shall accept this sub-primitive. Otherwise, the base station shall discard the sub-primitive.

Next, the ELCP shall check the content of the parameter “dataPacket” in the received primitive. As a result of the content check, when the content of the parameter “dataPacket” is not Null and the size of the “dataPacket” does not exceed the summation of the MRU of the ELCP and the size of the communication control information, the content of the parameter “dataPacket” shall be stored in the receiving queue corresponding to the link address.

7.3.2 Mobile station communication control

7.3.2.1 Transmission of the ELCP-PDU (Response to transmission inquiry)

The mobile station shall transmit the ELCP-PDU using the transfer inquiry service.

Upon reception of “WaitMessage.indication”, the mobile station shall conduct the response process.

The ELCP shall set the parameters of the “ACTION.response” primitive according to the specification of the “WaitMessage.response” sub-primitive and shall use the “ACTION.response” primitive of the DSRC L7 to perform the response process.

With this process, the content of the parameter “dataPacket” is usually Null, i.e. the data length is zero. When there are ELCP-PDUs to be sent to the base station in the transmission queue, the content of the parameter shall be the ELCP-PDU.

7.3.2.2 Reception of the ELCP-PDU

The mobile station shall receive the ELCP-PDU from the base station using the data transfer service.

When the content of the “ACTION.indication” primitive passed from DSRC L7 conforms to the “SendMessage.indication” sub-primitive or the “WaitMessage.indication” sub-primitive, the mobile station shall receive this sub-primitive.

Next, the ELCP shall check the content of parameter “dataPacket” in the received primitive. As the result of the content check, when the content of the parameter “dataPacket” is not Null (i.e. data length is not zero), and the size of the “dataPacket” does not exceed the summation of the MRU of the ELCP and the size of the communication control information, the content of the parameter “dataPacket” shall be stored to the receiving queue corresponding to the link address. After the content check, the received sub-primitives shall be discarded.

7.4 Communication control management

The communication control management of the ELCP provides the following management services to the NCP:

a) Event notify service

The event notify service shall provide the following primitive:

```
EventInformation.indication (linkAddress, status, [extensionParameter])
```

To notify the events such as errors, etc., which occurred within the ELCP, the “EventInformation.indication” primitive is passed from the ELCP to the NCP at its own station or at remote station.

The “linkAddress” parameter identifies the service access points of own and remote stations for each NCP.

The “status” parameter indicates the status indicating the events.

The “extensionParameter” parameter is optional and may pass either the actual data or the pointers, or other means may be used to provide the actual data.

b) Echo service

The echo service shall provide the following primitives:

```
Echo.request (linkAddress, [echoParameter])

EchoReply.indication (linkAddress, [echoParameter])
```

The “Echo.request” primitive is passed from the NCP to the ELCP in order to request a loop back communication between MAILs.

The “EchoReply.indication” primitive is passed from the ELCP to the NCP to indicate the response of the loop back communication between MAILs.

The “linkAddress” parameter shall identify the service access points of own and remote stations for each NCP.

The “echoParameter” parameter is optional and may pass either the actual data or the pointers, or other means may be used to provide the actual data.

c) MIB access service

The MIB access service shall provide the following primitives:

```
ElcpmeGet.request (mibIndex)

ElcpmeGet.indication (mibIndex, mibStatus, [mibParameter])

ElcpmeSet.request (mibIndex, [mibParameter])

ElcpmeSet.indication (mibIndex, mibStatus)
```

The “ElcpmeGet.request” primitive is passed from the NCP to the ELCP to request acquisition of the MIB parameters of the ELCP.

The “ElcpmeGet.indication” primitive is passed from the ELCP to the NCP to notify the acquisition of the MIB parameters of the ELCP.

The “ElcpmeSet.request” primitive is passed from the NCP to the ELCP to request the setting of the MIB parameters of the ELCP.

The “ElcpmeSet.indication” primitive is passed from the ELCP to the NCP to notify the setting result of the MIB parameters of the ELCP.

The “mibIndex” parameter passes either the parameter name designating an actual MIB parameter or the pointer.

The “mibStatus” parameter indicates a successful or unsuccessful result for the request.

The “mibParameter” parameter is optional and may pass either the actual data or the pointers, or other means may be used to provide the actual data.

The logical relationship between the management service primitives that the ELCP provides for the NCP is shown in Figure 9.

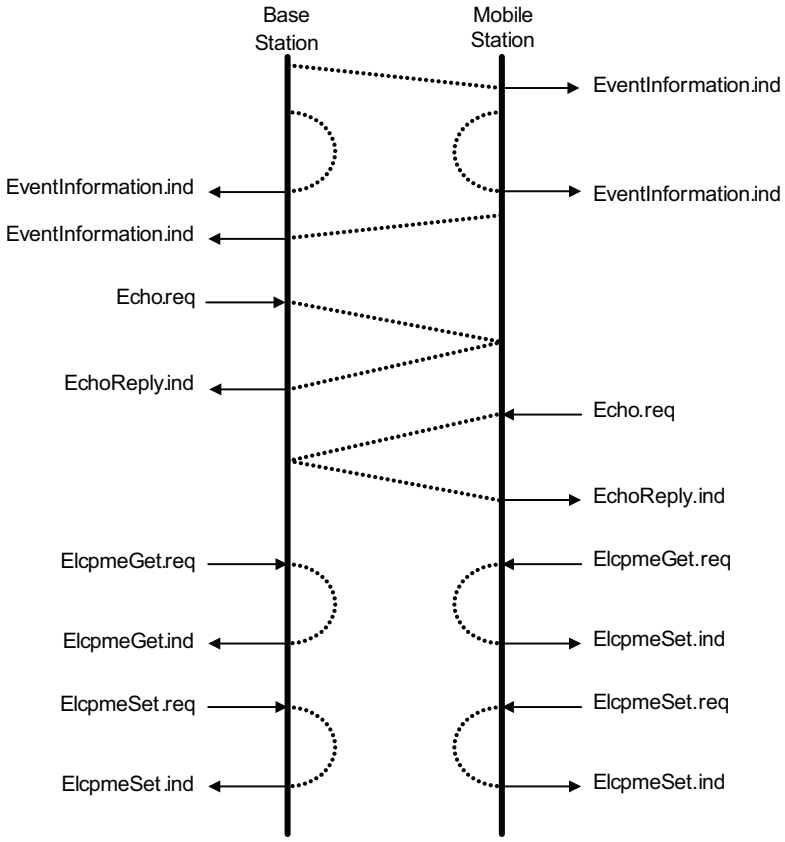


Figure 9 — Logical relationship between management service primitives

8 Network control protocol

8.1 General

The NCP performs encapsulation for LAN control protocol and local port control protocol (optional), establishment of access points and initial setting for the use of the upper layer protocols.

The control protocols of the NCP have the following functions and provide the interface to each upper layer protocol by

— allowing the data unit of the upper layer protocol to pass through,

— conducting initial settings for the use of the upper layer protocols, and

— conducting control management in accordance with the upper layer protocol characteristics.

Figure 10 shows the configuration of the NCP. The basic functions of the NCP are the data transfer process for upper layer protocol encapsulation and the initial settings for the use of the upper layer protocols.

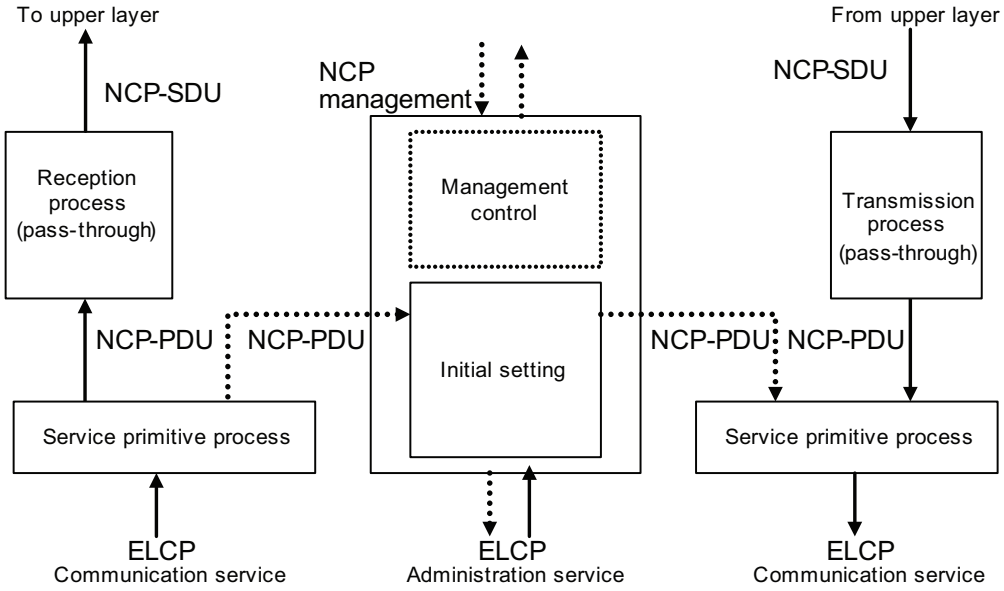


Figure 10 — NCP configuration

8.2 LAN control protocol

8.2.1 General

The LAN control protocol (LANCP) is a control protocol that provides an interface with the data link layer of the ISO/IEC 8802-3 LAN (local area network) in order for MAIL to connect to the CALM IP network layer.

8.2.2 LANCP interface

8.2.2.1 Network configuration update set-up

The LANCP shall generate and provide a start-up trigger to automatically start a network configuration setting protocol such as dynamic host configuration protocol (DHCP).

For that purpose, the mobile station acquires a server MAC address from the base station, which works as a network configuration-setting unit. After comparison between the acquired address and the address held in the mobile station, the LANCP generates the start-up trigger if there is a difference between the two addresses.

8.2.2.2 Communication frame transfer

The LANCP stands between the ELCP and an ISO/IEC 8802-3 LAN data link layer. Communication frames (ISO/IEC 8802-3 frames) exchanged by the data link layers pass through it (see Figure 11).

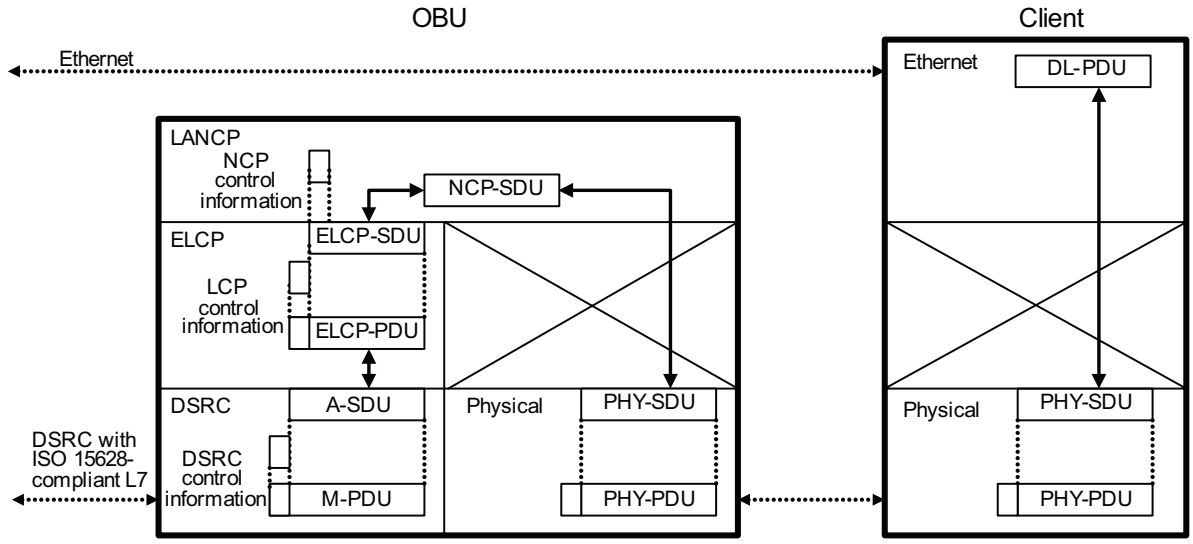


Figure 11 — Example of communication frame transfer

8.2.3 LANCP procedure

8.2.3.1 Connection process procedure

8.2.3.1.1 Initial setting process

8.2.3.1.1.1 Base station initial setting process

The initial setting process at the base station shall be conducted as follows.

Upon reception of a communication connection notification from the base station ELCP by the event notification primitive (“EventInformation.indication”) of the management service, the LANCP starts the initial setting phase and awaits the initial setting message from the LANCP of the mobile station's link address, passed by the event notification primitive. The initial setting message from the mobile station includes the mobile station MAC address.

In the event that the LANCP receives an initial setting message from a mobile station in the initial setting phase, it generates a management table utilizing the mobile station link address passed by the event notification primitive and the mobile station MAC address. The management table stores the correspondence between the link address and the MAC address and is used to determine the transmission link address from the MAC address contained in the NCP-SDU to be transmitted.

Next, the LANCP transmits an initial setting message in order to notify the base station server MAC address to the pertinent mobile station, and shifts to the communication phase to implement the data transfer.

In the initial setting phase, if the LANCP receives a communication disconnection notification from the base station ELCP through the event notification primitive of the management service, the LANCP terminates the initial setting phase.

If the LANCP receives messages other than the mobile station initial setting message in the initial setting phase, these messages shall be discarded.

8.2.3.1.1.2 Mobile station initial setting process

The initial setting process at the mobile station shall be conducted as follows.

When the LANCP receives a communication connection notification from the mobile station ELCP through the event notification primitive ("EventInformation.indication") of the management service, it starts the initial setting phase. The LANCP transmits a mobile station initial setting message to notify the mobile station MAC address to the base station LANCP, and awaits the response from the pertinent base station.

When the LANCP receives a base station initial setting message in the initial setting phase, it compares the base station server MAC address passed by the message and the server MAC address held in the mobile station.

If they do not match in the comparison, the LANCP updates the server MAC address held and issues a start-up trigger to update the network configuration setting to the upper layer protocols. Then the LANCP shifts to the communication phase to implement the data transfer.

If they do match, the LANCP does not issue a start-up trigger, but only implements the transition procedure to move to the communication phase.

In the event that the LANCP receives a communication disconnection notification state from the mobile station ELCP by the event notification primitive ("EventInformation.indication"), it terminates the initial setting phase.

If the LANCP receives messages other than the base station initial setting message in the initial setting phase, these messages are discarded.

8.2.3.1.2 Communication termination process

8.2.3.1.2.1 Base station communication termination process

When the LANCP receives a communication disconnection notification from the base station ELCP through the event notification primitive ("EventInformation.indication") of the management service, it shall abandon the management table with the link address passed by the primitive, terminate the communication phase and change to the idle state.

8.2.3.1.2.2 Mobile station communication termination process

When the LANCP receives a communication disconnection notification from the mobile station ELCP through the event notification primitive ("EventInformaton.indication") of the management service, it shall terminate the communication phase.

8.2.3.2 Data transfer procedure

8.2.3.2.1 Base station data transfer process

8.2.3.2.1.1 Data transmission process

When the LANCP receives the NCP-SDU from the upper layer protocols, it shall transfer the NCP-SDU to the base station ELCP by the data transfer message.

In this process, the LANCP shall obtain the destination link address for mobile station identification from the base station management table by referring to the destination MAC address in the NCP-SDU.

8.2.3.2.1.2 Data reception process

When the LANCP receives a data transfer message from the base station ELCP, it shall extract the NCP-SDU from the message and transfer it to the upper layer protocols.

If the LANCP receives messages from the mobile station other than the data transfer message during the communication phase, those messages shall be discarded.

8.2.3.2.2 Mobile station data transfer process

8.2.3.2.2.1 Data transmission process

When the NCP-SDU is passed from the upper layer protocols, the LANCP shall transfer it to the mobile station ELCP by the data transfer message.

In this process, the LANCP shall obtain the destination link address from the mobile station management table by referring to the MAC address in the NCP-SDU.

8.2.3.2.2.2 Data reception process

When the LANCP receives a data transfer message from the mobile station ELCP, it shall extract the NCP-SDU from the message and transfers it to the upper layer protocols.

If the LANCP receives messages from the mobile station ELCP other than the data transfer message during the communication phase, those messages shall be discarded.

8.3 Local port control protocol

The local port control protocol (LPCP) provides ISO 15628-compliant data transfer service for non-IP networking. The LPCP is defined in ISO 29281.

9 Adaptation

The MAIL shall provide the communication SAP (service access point) to the CALM network layer and the management SAP to the interface management entity.

NOTE The interface adaptation is outlined in Figure 2.

Annex A
(informative)

ASN.1 definitions

A.1 Use of modules

This annex provides an example of the reference data structure defined in Clauses 7 and 8.

This ASN.1 (abstract syntax notation one) module is not complete. Therefore, in referring to this annex the user will need to specify the data structure for the user system.

A.2 ASN.1 module — Example

Parameters relating with MIB access are to be specified as internal specifications.

```
CALMmail
DEFINITIONS ::=
BEGIN

--ELCP PDU

ElcpPDU::= AslUnicastPDU-normalMode

AslUnicastPDU-NormalMode ::= SEQUENCE{
 aslLinkProtocol        AslLinkProtocol,    -- ELCP control data
 aslPduBody             UnicastDataUnit     -- SDU from NCP
 }

AslLinkProtocol ::= SEQUENCE{
 functionEnable         BOOLEAN,
 functionTermination    BOOLEAN,
 pduGroup               INTEGER,
 segmentNumber          INTEGER,
 broadcastParameter     ProfileBroadcast OPTIONAL
 }

ProfileBroadcast ::= SEQUENCE{
 reserve                BIT STRING,
 serviceTime            ServiceTime
 }

ServiceTime ::= INTEGER

UnicastDataUnit ::= NcpPDU

--NCP PDU

NcpPDU::= NetworkControlPDU

NetworkControlPDU ::= SEQUENCE {
 aslAccessProtocol      AslAccessProtocol,  -- Access control information of NCP
 pduBody                OCTET STRING        -- SDU from upper layer
 }
```

```
-- NCP PDU -Access control information

AslAccessProtocol ::= CHOICE {
 linkControlManagement  LinkSubProtocol,
 localPortControl       LocalPortSubProtocol,  -- See ISO 29281
 lanControl             LanSubProtocol,
 ...
 ...
 }

-- NCP PDU -Access control information -Link sub protocol

LinkSubProtocol ::= CHOICE {
 echo                   MsEchoParameter,       -- echo service
 echoReply              MsEchoParameter,       -- echo service
 eventReport            MsEventParameter,      -- event report service
 challenge              MsAuthCodeChallenge,   -- Access control service
                                               -- (random number)
 signature              MsAuthCodeSignature,   -- Access control
                                               -- service (signature)
 ...
 ...
 }

MsEchoParameter ::= SEQUENCE {
 dummy                  BIT STRING,
 source                 AccessControlIndex,
 message                OCTET STRING
 }

AccessControlIndex ::= INTEGER {
 aslControlManagement   (0),                -- Communication Control Management
 localPortControl       (1),                -- Local Port
 lanControl             (2),                -- IEEE 802.3 MAC
 ...
 ...
 }

MsEventParameter ::= SEQUENCE {
 status                 MsStatusCode,
 extentionParameter     OCTET STRING OPTIONAL
 }

MsStatusCode ::= INTEGER {
 Disabled to use                            (0),
 No Access point exist                      (1),   --for opposite station
 Not available this function                (2),   --for own/opposite station
 Not is available this sub-protocol         (3),   --for opposite station
 Data size exceeds upper limit              (4),   --for own station
 No space in own transmit queue and
 Transmission serves is abandoned           (5),   --for own station
 Invalid designated broadcast link address  (6),   --for own station
 Not corresponding designated version       (7),   --for base station
 Access permitted                           (94),  --for mobile station
 Access denied                              (95),  --for mobile station
 Report of Connection                       (96),  --for own station
 Report of Disconnection                    (97)   --for own station
 ...
 ...
 }
```

```
MsAuthCodeChallenge ::= OCTET STRING    -- Challenge Data

MsAuthCodeSignature ::= OCTET STRING    -- Signature Data

-- NCP PDU -Access control information -LAN sub protocol

LanSubProtocol ::= CHOICE {
 message                NULL,           -- transmission data
 obuInitialMessage      InitialData,    -- mobile station initial data
 rsuInitialMessage      InitialData,    -- base station initial data
 ...
 ...
 }

InitialData ::= OCTET STRING            -- MAC Address

--Parameters of primitives

LinkAddress::= DsrcLID

DsrcLID ::= OCTET STRING

NetworkControlParameter::= NetworkControlPDU

DataPacket::= AslUnicastPDU-normalMode

Status::= MsStatusCode

ExtensionParameter::= OCTET STRING

EchoParameter::= MsEchoParameter


END
```

Annex B
(informative)

Relationship of primitives and protocol data units (PDU)

Figure B.1 shows an example of the relationship of primitives and PDU.

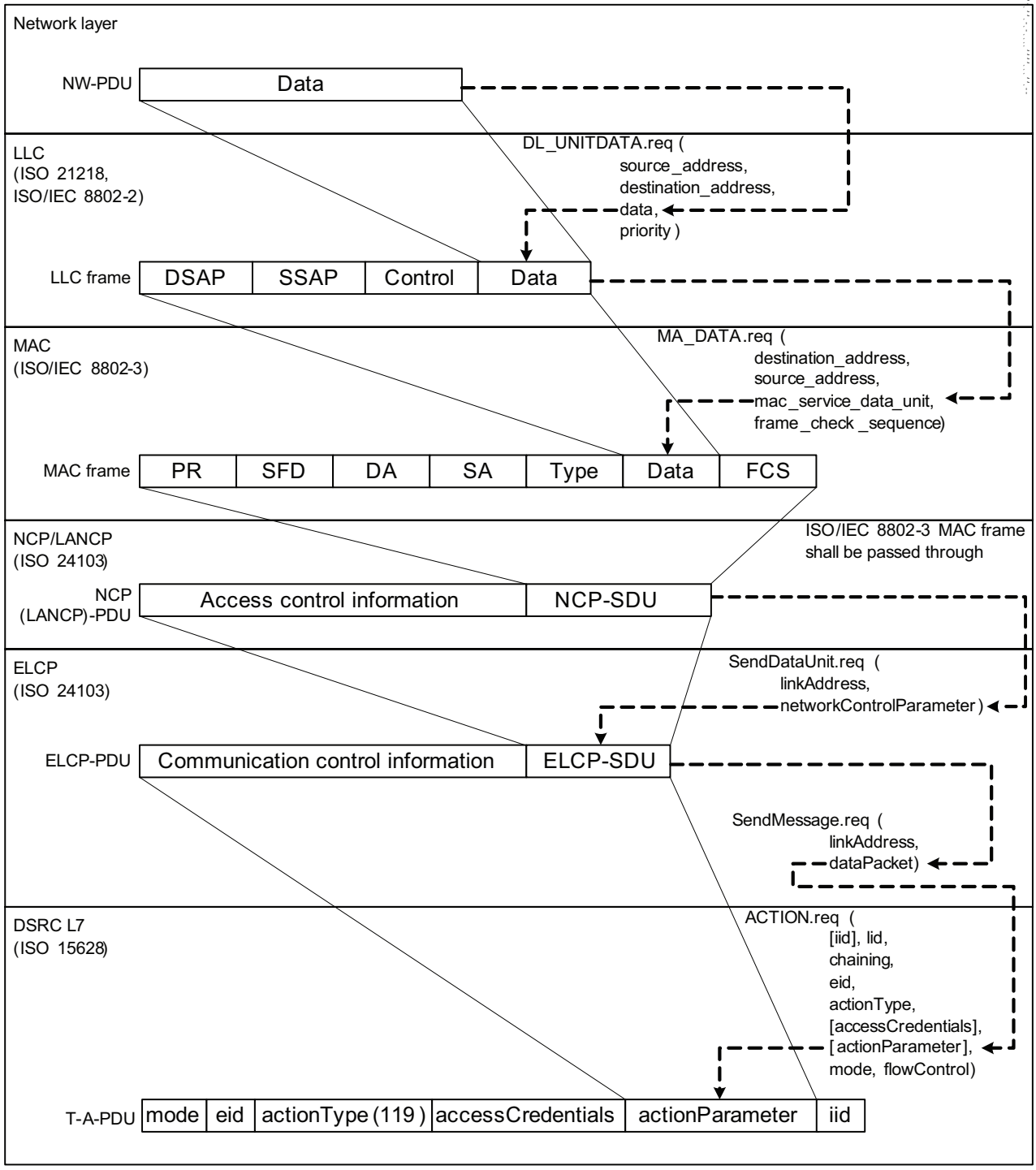


Figure B.1 — Relationship of primitives and PDU — Example

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3) Under preparation.

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