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Intelligent transport systems — Wide area communication — Protocol management information

Systèmes de transport intelligents — Communication étendue — Protocole de gestion de l'Information

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15662 was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

Introduction

Most of the application services in the ITS sector use a variety of wide area communication systems in order to connect user terminals and “Service Centres”. In addition, the application services that are currently being provided connect specific user terminals to specific service centres using specific wide area communications systems. In other words, the various conditions that must be established to provide services are fixed. However, when the future modes of service use are considered, it is assumed that a user will utilize the same terminal to access “Service Centre A” in some cases and “Service Centre B” in other cases. It can also be assumed that in some cases the user may be on foot and in others he or she may be travelling in a vehicle. It can also be assumed that some users may access the service centre from “smart phones”, while others may do so from navigation systems, while still others may do so using interactive TVs.

When a variety of user terminals use a variety of wide area communications systems to connect to a variety of service centres in this manner, the type and content of the conditions that must be established will differ for each individual service usage. In order to provide appropriate service based on these conditions, it is crucial to establish a mechanism by which the type of conditions and the content established for them are transmitted to an appropriate entity and interpreted.

This International Standard summarizes information as a checklist to consider internal processing in communication systems, terminals and so forth (“protocol management information”) suitable for providing ITS application services utilizing wide area communication systems.

Intelligent transport systems — Wide area communication — Protocol management information

1 Scope

This International Standard provides information as a checklist to consider handling messages that are defined by the application working groups of ISO/TC 204, installing systems and selecting suitable wide area communication systems for providing ITS application services.

The usages of this information are for frameworks of message headers, pay load items for initializing communication links, checklists for system design and so on. Thus, these information items are not necessarily contained in message instances and/or headers that are actually transmitted.

For example, this information is used to organize the characteristics of messages such as those requesting hand-over based on the relationship between the size of the information service area and the communication range of each communication system (see Figure 1).

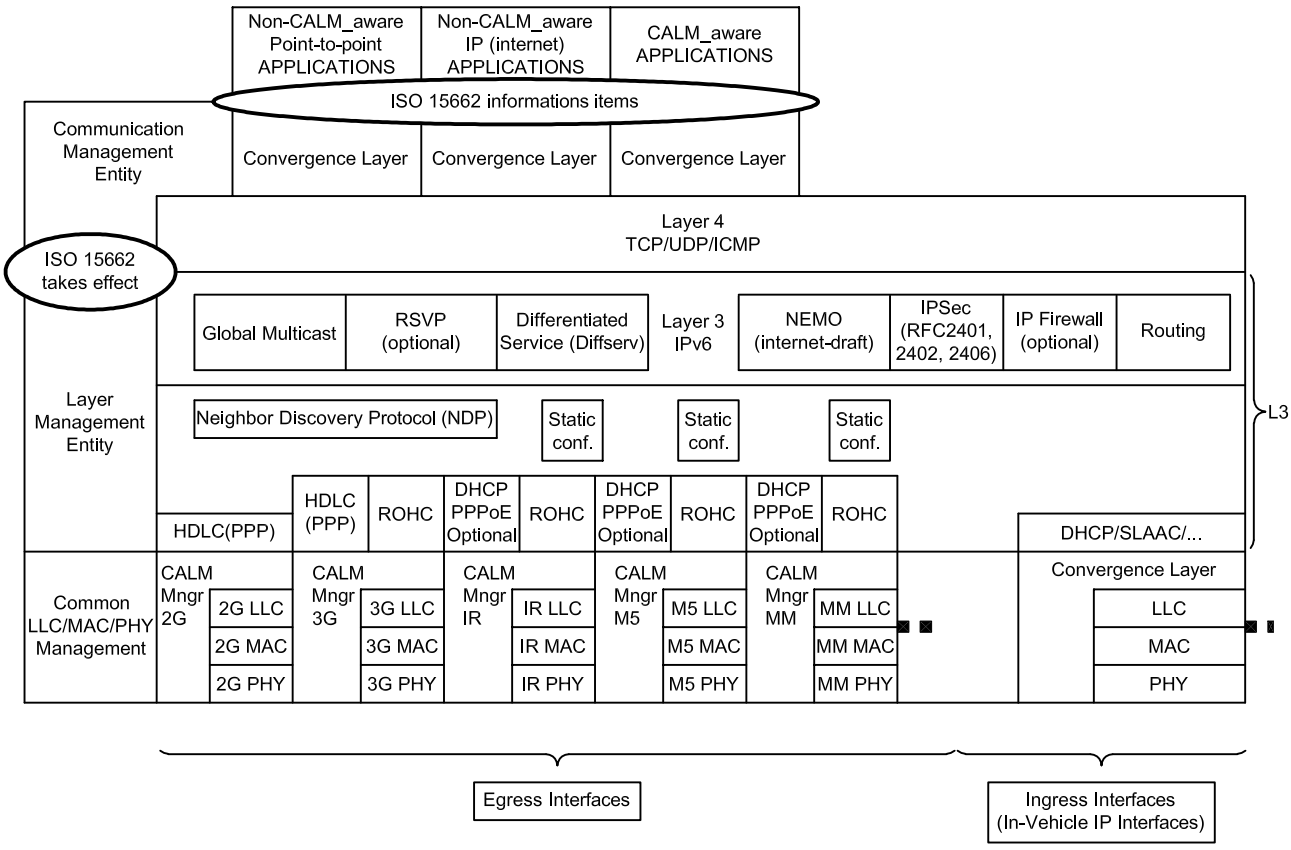


Figure 1 — Scope of 15662 (in the architecture of ISO/TC 204/WG 16)

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 14817, *Transport information and control systems — Requirements for an ITS/TICS central Data Registry and ITS/TICS Data Dictionaries*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14817 and the following apply.

3.1
protocol management information
information as a checklist to consider handling messages that are defined by the application working groups of ISO/TC 204, installing systems and selecting suitable wide area communication systems for providing ITS application services

NOTE Protocol management information items are not necessarily contained in message instances and/or headers that are actually transmitted.

4 Requirements for protocol management information items

Protocol management information is defined as follows and its structure is described in Annex A. Each item is defined in the abstract, so it does not specify location and time reference manner, granularity and so on. If some service providers use them for message headers, they shall define the code strictly.

4.1 Selection of communication system

This information is for selecting the wide area communication system to be used for the response in accordance with the requirements for executing the application service, the usage environment of the service user, the status of the user terminal and so forth.

4.1.1 Responsiveness

4.1.1.1 Descriptive name

```
ProtocolManagementInformation. responsiveness
```

4.1.1.2 ASN.1 object identifier

```
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1)
selectionOfCommunicationSystem(1) responsiveness(1)}
```

4.1.1.3 Definition

This information represents the response speed and allowed delay time while receiving services in terms of whether response will take place in real time and how much delay time will be allowed.

In cases where response time is conditioned for executing application services, the wide area communication system shall be selected in accordance with the required response time, and this information can be used to make such assessment. Furthermore, in case of receiving information in an “on demand” mode, this information indicates the time from request until reception, for emergency bulletins, it indicates the time until the information reaches the other party, and for transportation support and the like, it indicates the time until forward road status, pavement status or other services are completed.

The following depict some examples of categories:

— Within 1 second,

— Within 30 seconds,

— Within 1 minute,

— Within 15 minutes,

— 15 minutes or longer.

In addition, the required response time may be concretely specified as necessary.

4.1.1.4 Descriptive name context

“Protocol management information”.

4.1.1.5 Data concept type

Data element concept.

4.1.2 Directionality

4.1.2.1 Descriptive name

```
ProtocolManagementInformation. directionality
```

4.1.2.2 ASN.1 object identifier

```
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1)
selectionOfCommunicationSystem(1) directionality(2)}
```

4.1.2.3 Definition

This information indicates the combinations of unidirectional or bidirectional and symmetric or asymmetric with respect to transmission and reception of information.

In cases where the directionality of communications (unidirectional, interactive, etc.) is needed to execute application services, the wide area communication system shall be selected in accordance with the type of communication (unidirectional or bidirectional, symmetric or asymmetric), and this information can be used to make such assessment. Furthermore, interactive indicates cases where a response is expected to a given message, while unidirectional indicates cases where a response is not expected to a message.

The following depict combination examples:

— Unidirectional: In the case of an uplink, this corresponds to information provided from the vehicle such as emergency bulletins. In the case of a downlink, it corresponds to cases in which the service user cannot (or does not need to) make a request in order for the service provider to make the decision to start service.

— Interactive-symmetric: When service begins in response to a request from the service user and the amount of data being transmitted and data being received is almost equal.

— Interactive-asymmetric (large uplink): When service begins in response to a request from the service user and when the amount of data being transmitted is greater than the amount of data being received.

— Interactive-asymmetric (large downlink): When service begins in response to a request from the service user and when the amount of data being received is greater than the amount of data being transmitted.

4.1.2.4 Descriptive name context

“Protocol management information”.

4.1.2.5 Data concept type

Data element concept.

4.1.3 Usage environment

4.1.3.1 Descriptive name

```
ProtocolManagementInformation. usageEnvironment
```

4.1.3.2 ASN.1 object identifier

```
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1)
selectionOfCommunicationSystem(1) usageEnvironment(3)}
```

4.1.3.3 Definition

This information represents the combination of the means of transportation when using services and the speed of movement when receiving services.

Depending on the usage environment of the service user, the requirements for responsiveness and directionality may not be met in some cases. For this reason, the wide area communication system shall be selected in accordance with the means of transportation, speed of movement and other usage environment factors, and this information can be used for making such assessment.

The following depict examples of categories by means of transportation:

— Vehicle: In the case of driving a vehicle;

— Public transportation: In the case of riding on public transportation;

— Pedestrians: In the case of being on foot or on a bicycle;

— Other categories: Bicycle, Motorcycle, Moped, Car, Truck, Emergency vehicle, Bus, Tram, Train, Ferry, Taxi, etc.

The following indicate examples of categories by speed of movement:

— Fast: In the case of travelling on expressways, case of travelling on a railroad (60-350 km/h);

— Medium speed: In the case of travelling on ordinary roads (20-60 km/h);

— Slow: In the case of travelling slowly at speeds at which it is possible to stop quickly (less than 20 km/h);

— Stopped: In the case of not being in motion.

In addition, the speed may be more precisely specified as necessary.

4.1.3.4 Descriptive name context

“Protocol Management Information”.

4.1.3.5 Data concept type

Data element concept.

4.1.4 Service (provision) area

4.1.4.1 Descriptive name

`ProtocolManagementInformation. serviceArea`

4.1.4.2 ASN.1 object identifier

```
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1)
selectionOfCommunicationSystem(1) serviceArea(4)}
```

4.1.4.3 Definition

This information represents the range/areas at which users receive services and the need for continuity.

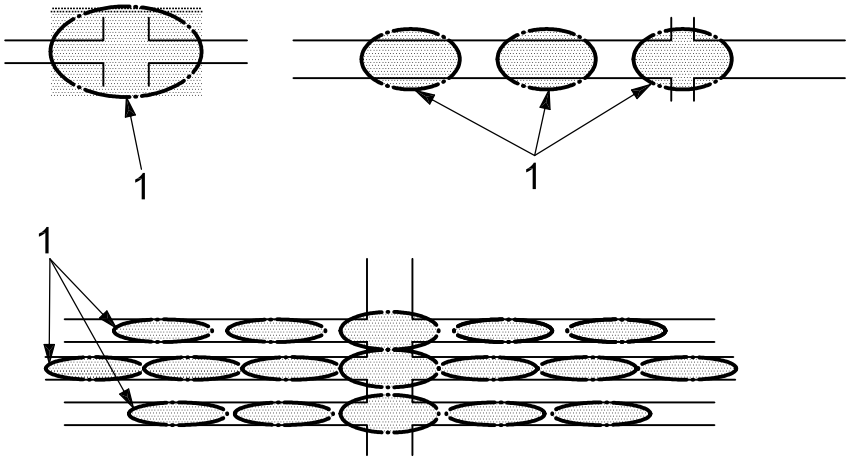
In cases where a service area and the continuity of this area and other conditions are required to use application services, the wide area communication system shall be selected to match the areas in which service can be provided, and this information can be used to make such assessment.

The following depict examples of categories for continuity:

— Continuous area designation: When the area in which service is provided shall be continuous and users shall be able to use the service anywhere (this can be broken down into two types: “area-wide continuity” covering an entire area and “linear continuity” limited to a specific route);

— Non-continuous: When service can only be used in specific non-continuous locations.

In addition, positional information of the range and areas at which services are provided are specified as the range/areas (see Figure 2).



Key

1 area in which service is provided

Figure 2 — Service provision areas

4.1.4.4 Descriptive name context

“Protocol management information”.

4.1.4.5 Data concept type

Data element concept.

4.1.5 Service (provision) time

4.1.5.1 Descriptive name

`ProtocolManagementInformation. serviceTime`

4.1.5.2 ASN.1 object identifier

```
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1)
selectionOfCommunicationSystem(1) serviceTime(5)}
```

4.1.5.3 Definition

This information represents the information service starting time, service ending time and the continuity of service time.

When the conditions relating to communication connection time for use of application services are required, the wide area communication system must be selected to match the service time, and this information can be used to make such assessment.

The following depict examples of categories:

— Start and end times: In the case of specifying the times that information service starts and ends;

— Start time: In the case of specifying the time that information service starts;

— End time: In the case of specifying the time that information service ends;

— Continuous: In the case of specifying that information is provided continuously.

In addition, time is also specified as necessary.

4.1.5.4 Descriptive name context

“Protocol management information”.

4.1.5.5 Data concept type

Data element concept.

4.1.6 Bandwidth

4.1.6.1 Descriptive name

`ProtocolManagementInformation. bandwidth`

4.1.6.2 ASN.1 object identifier

```
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1)
selectionOfCommunicationSystem(1) bandwidth(6)}
```

4.1.6.3 Definition

This information represents the transmission ability in terms of the transmission capacity and format (text, audio, simple graphic, still image, video) required by the information to be provided.

Depending on the amount of information to be transmitted and the format of the data involved in the use of application services, the conditions for responsiveness and data format, etc. may not be satisfied in some cases. Accordingly, the wide area communication system shall be selected to match the transmission capacity, data format and other aspects of transmission ability, and this information can be used to make such assessment.

The following depict examples of describing transmission capacity and data format:

— Transmission capacity: Described according to the required transmission speed (bps);

— Format: Text, audio, simple graphic, still image, video, other special format which can describe the data volume.

4.1.6.4 Descriptive name context

“Protocol management information”.

4.1.6.5 Data concept type

Data element concept.

4.1.7 Connection cost

4.1.7.1 Descriptive name

```
ProtocolManagementInformation. connectionCost
```

4.1.7.2 ASN.1 object identifier

```
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1)
selectionOfCommunicationSystem(1) connectionCost(7)}
```

4.1.7.3 Definition

This information represents the communication cost requirements for providing information.

When conditions relating to communication connection costs (upper limit, etc.) for use of application services are required, the wide area communication system shall be selected to match the cost requirements, and this information can be used to make such assessment.

The following depict examples of categories:

— Upper limit specification: Case of specifying an upper limit price of the total cost value of communication;

— Unit price upper limit specification: Case of specifying the upper limit of the unit price of communication costs (in communication time units or transmitted information volume units).

In addition, the upper limit cost is specified as necessary.

4.1.7.4 Descriptive name context

“Protocol management information”.

4.1.7.5 Data concept type

Data element concept.

4.2 Application identifiers

This information is for identifying requested application services.

4.2.1 Message identifier

4.2.1.1 Descriptive name

```
ProtocolManagementInformation. messageIdentifier
```

4.2.1.2 ASN.1 object identifier

```
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1)
applicationIdentifiers(2) messageIdentifier(1)}
```

4.2.1.3 Definition

This identifies the message belonging to an application or a specific batch.

4.2.1.4 Descriptive name context

“Protocol management information”.

4.2.1.5 Data concept type

Data element concept.

4.2.2 Message number

4.2.2.1 Descriptive name

```
ProtocolManagementInformation. messageNumber
```

4.2.2.2 ASN.1 object identifier

```
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1)
applicationIdentifiers(2) messageNumber(2)}
```

4.2.2.3 Definition

This identifies the order of transmission and reception for a series of messages belonging to an application or a specific batch.

4.2.2.4 Descriptive name context

“Protocol management information”.

4.2.2.5 Data concept type

Data element concept.

4.2.3 Time of message transmission

4.2.3.1 Descriptive name

```
ProtocolManagementInformation. timeOfMessageTransmission
```

4.2.3.2 ASN.1 object identifier

```
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1)
applicationIdentifiers(2) timeOfMessageTransmission(3)}
```

4.2.3.3 Definition

This information represents the time when an individual message transmission was started.

The time is indicated at which an individual message was transmitted from the communication carrier to the user (see Figure 3).

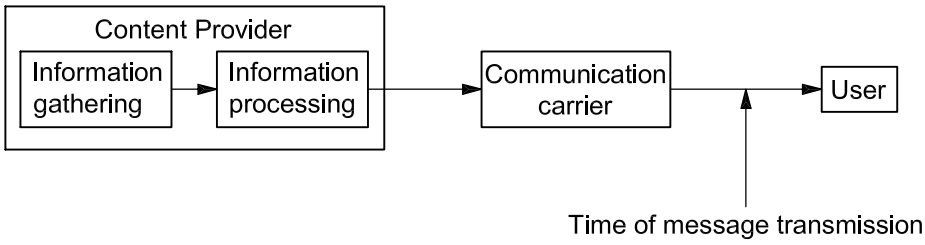


Figure 3 — Time of message transmission

4.2.3.4 Descriptive name context

“Protocol management information”.

4.2.3.5 Data concept type

Data element concept.

4.3 Address

This information is for identifying service users and the internal processing of the service provider.

A wide area communication system shall be selected and routing shall be performed for use of applications services to match the processing of the service provider and the communication system used by the service user, and this information is contained for this reason.

4.3.1 Address of origin (Address of service provider)

4.3.1.1 Descriptive name

```
ProtocolManagementInformation. addressOfOrigin
```

4.3.1.2 ASN.1 object identifier

```
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1) address(3)
 addressOfOrigin(1)}
```

4.3.1.3 Definition

This information represents the service provider or the internal processing of the service provider.

This contains the following data on the presumption of the use of multiple communication systems, IP communication and so forth:

— IP address in an IP network;

— Address information containing data that can be routed;

Example: “Area (Province) Code”, “Service Car type Code”, “Group Code Serial Number”, others which can identify the adequate user terminal;

— Multiple address information in case multiple communication systems can be used.

4.3.1.4 Descriptive name context

“Protocol management information”.

4.3.1.5 Data concept type

Data element concept.

4.3.2 Address of destination (Address of user)

4.3.2.1 Descriptive name

```
ProtocolManagementInformation. addressOfDestination
```

4.3.2.2 ASN.1 object identifier

```
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1) address(3)
 addressOfDestination(2)}
```

4.3.2.3 Definition

This information represents the address of the user terminal and so forth that has requested the service.

It contains the following data on the presumption of the use of multiple communication systems, IP communication and so forth:

— IP address in an IP network;

— Address information containing the data that can be routed;

— Multiple address information in case multiple communication systems can be used;

— Multiple address information in case multiple user terminals can be used.

4.3.2.4 Descriptive name context

“Protocol management information”.

4.3.2.5 Data concept type

Data element concept.

4.4 Priority

This information identifies the priority of application processing on the part of the service provider.

4.4.1 Interrupt handling

4.4.1.1 Descriptive name

```
ProtocolManagementInformation. interruptHandling
```

4.4.1.2 ASN.1 object identifier

```
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1) priority(4)
 interruptHandling(1)}
```

4.4.1.3 Definition

This information represents the priority level in the case of requiring interrupt.

In cases where the provided information is of high urgency, that information must be processed by interrupt processing, and this information can be used to make such assessment.

The priority may have 255 levels and/or the following depict examples of categories:

— Low priority: Case of interrupt having low priority;

— Medium priority: Case of interrupt having medium priority;

— High priority: Case of interrupt having high priority.

4.4.1.4 Descriptive name context

“Protocol management information”.

4.4.1.5 Data concept type

Data element concept.

4.4.2 Queue control

4.4.2.1 Descriptive name

```
ProtocolManagementInformation. queueControl
```

4.4.2.2 ASN.1 object identifier

```
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1) priority(4)
 queueControl(2)}
```

4.4.2.3 Definition

This information indicates the control method in case queuing in line has occurred in message processing.

Although control is typically performed on a first-in first-out (FIFO) basis, since it is also possible to perform processing based on last-in first-out (LIFO), this information can be used to make such assessment. In addition, in the case where transmission has failed due to a collision and so forth, this information also makes it possible to assess whether or not retry is necessary, the need for an error notification and so forth.

The following depict examples of processing categories of queuing lines:

— Undefined: Processing is based on first-in first-out (FIFO);

— LIFO: Processing is based on last-in first-out (LIFO);

— Random: Processing is performed randomly regardless of order.

The following depict processing categories when transmission has failed:

— Re-try: Case of performing resending processing when transmission has failed;

— Error notification: Case of notifying the transmission source of an error when transmission has failed.

4.4.2.4 Descriptive name context

“Protocol management information”.

4.4.2.5 Data concept type

Data element concept.

4.5 Security

This information represents the need for security for receiving and transferring messages.

Since messages may contain confidential or private information, and may not permit impersonation, tampering, disclosure and so forth, this information indicates what type of security is necessary.

4.5.1 Mutual authentication

4.5.1.1 Descriptive name

```
ProtocolManagementInformation. mutualAuthentication
```

4.5.1.2 ASN.1 object identifier

```
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1) security(5)
 mutualAuthentication(1)}
```

4.5.1.3 Definition

This information represents the need for authentication of both persons engaged in the receiving and transferring of data.

It can be used for authentication processing and so forth for preventing impersonation and the like in the transfer of data between service providers and users. In addition, this information identifies whether or not the user or terminal is to be authenticated as necessary based on the contents of the provided data and the conditions of the terminal used by the user.

The following depict examples of mutual authentication categories:

— User authentication: Case of requiring user authentication;

— Terminal authentication: Case of requiring terminal authentication.

4.5.1.4 Descriptive name context

“Protocol management information”.

4.5.1.5 Data concept type

Data element concept.

4.5.2 Data authentication

4.5.2.1 Descriptive name

```
ProtocolManagementInformation. dataAuthentication
```

4.5.2.2 ASN.1 object identifier

```
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1) security(5)
 dataAuthentication(2)}
```

4.5.2.3 Definition

This information represents the need to authenticate the data to be transferred.

This information can be used for processing such as digital signatures in order to ensure reliability by preventing tampering and so forth of data to be transferred.

4.5.2.4 Descriptive name context

“Protocol management information”.

4.5.2.5 Data concept type

Data element concept.

4.5.3 Concealment

4.5.3.1 Descriptive name

```
ProtocolManagementInformation. concealment
```

4.5.3.2 ASN.1 object identifier

```
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1) security(5)
 concealment(3)}
```

4.5.3.3 Definition

This information represents the need to conceal data to be transferred.

This information can be used for processing such as encryption and so forth in order to conceal confidential or private information that is to be transferred.

4.5.3.4 Descriptive name context

“Protocol management information”.

4.5.3.5 Data concept type

Data element concept.

4.6 Application execution

This information identifies the validity of the contents of provided services.

4.6.1 Valid time

4.6.1.1 Descriptive name

```
ProtocolManagementInformation. validTime
```

4.6.1.2 ASN.1 object identifier

```
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1)
applicationExecution(6) validTime(1)}
```

4.6.1.3 Definition

This information represents the valid time of the contents of services provided.

This information indicates the time period during which information contents are valid or that information contents are valid until the next information update. (Example: Distinguishing information used to control an automobile that is only valid for an extremely short period of time or other information for which the time during which effects are demonstrated is set, information that is regularly updated such as road traffic information, information that is valid only until the next update, or information for which these are not set.)

The following depict examples of categories:

— Receiving only: Case of being valid only at the time information is received;

— Time specified: Case of specifying the time at which information is valid.

In addition, the time (interval or end point) is specified as necessary.

4.6.1.4 Descriptive name context

“Protocol management information”.

4.6.1.5 Data concept type

Data element concept.

4.6.2 Time stamp

4.6.2.1 Descriptive name

```
ProtocolManagementInformation. timeStamp
```

4.6.2.2 ASN.1 object identifier

```
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1)
applicationExecution(6) timeStamp(2)}
```

4.6.2.3 Definition

This information represents the time when information processing was started.

This information indicates the times at which the content provider updates information and processes data as well as the times at which messages are generated (see Figure 4).

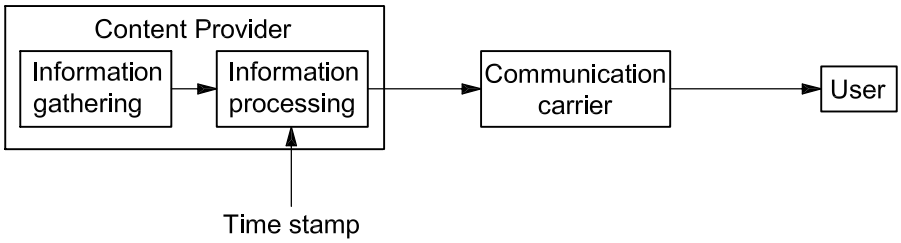


Figure 4 — Time stamp

4.6.2.4 Descriptive name context

“Protocol management information”.

4.6.2.5 Data concept type

Data element concept.

4.6.3 Target area

4.6.3.1 Descriptive name

```
ProtocolManagementInformation. targetArea
```

4.6.3.2 ASN.1 object identifier

```
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1)
applicationExecution(6) targetArea(3)}
```

4.6.3.3 Definition

This information represents the effective area of information in a service.

This information is for identifying the range over which the contents of information provided are indicated when using application services in cases where range is limited.

The following depict examples of categories:

— Spot: Local information such as that of an intersection;

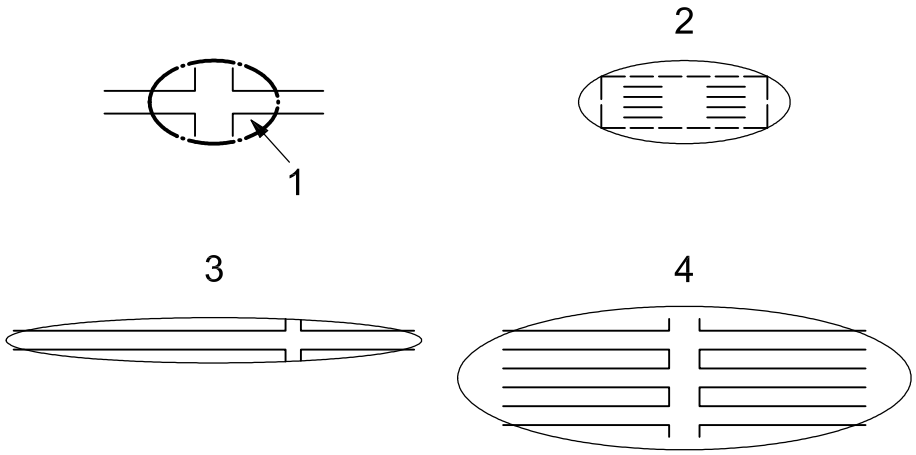
— Zone: Information of a specified narrow region such as a parking lot;

— Interval: Information of a specified route or specified interval of highways (including expressways) and of ordinary roads;

— Region: Information on a specified region;

— Wide area information covering a wide area at the state level or larger.

In addition, location is specified by positional information as necessary (see Figure 5).



Key
1 spot
2 zone (a parking lot, etc.)
3 interval
4 region

Figure 5 — Target Area

4.6.3.4 Descriptive name context

“Protocol management information”.

4.6.3.5 Data concept type

Data element concept.

Annex A
(normative)

Protocol management information structure

Protocol management information structure is as in Figure A.1:

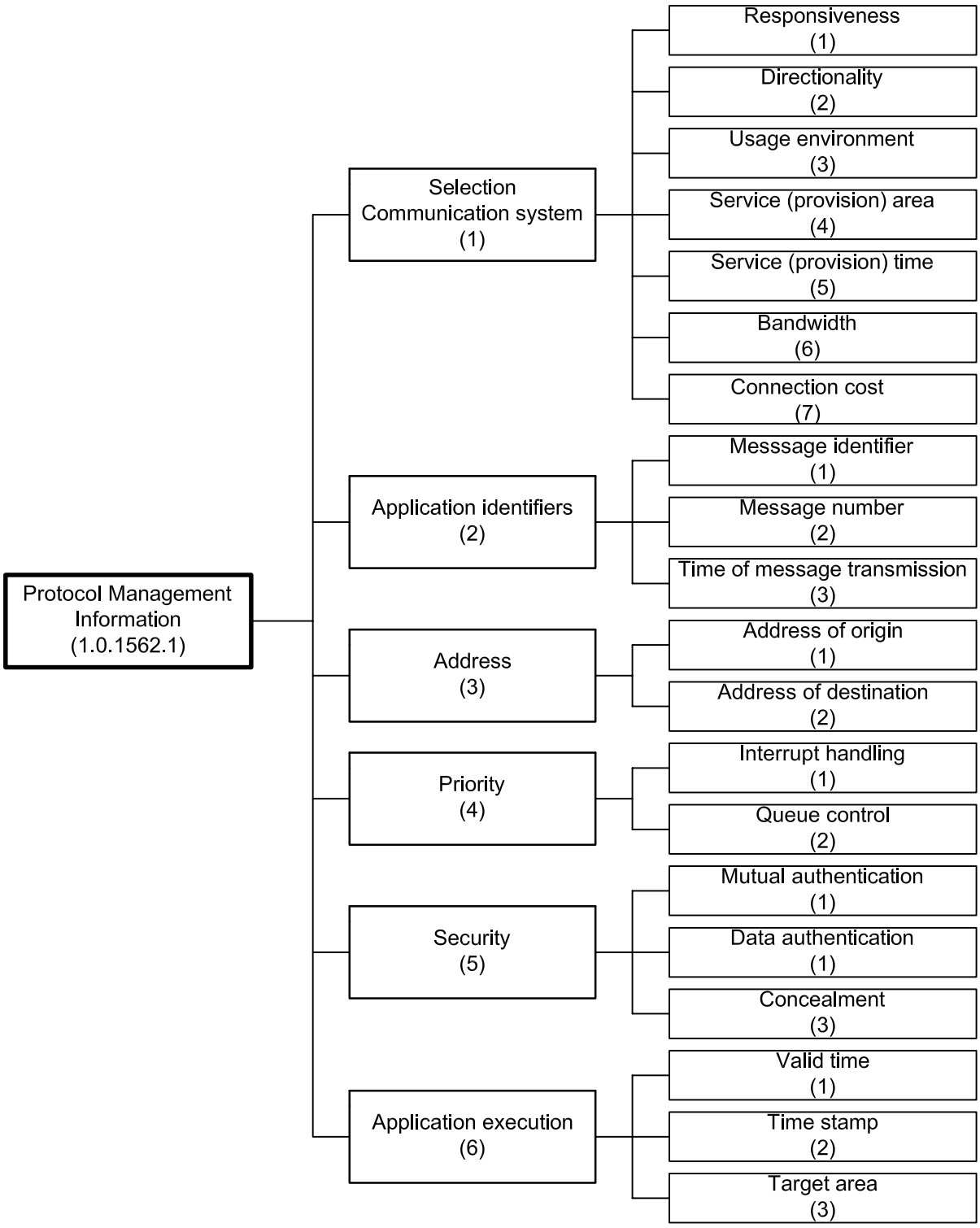


Figure A.1 — Protocol management information structure

Annex B
(normative)

Protocol management information data type definition

Protocol management information is described using the ASN.1 technique according to ISO/IEC 8824-1.

```
ProtocolManagementInformation
{iso(1) standard(0) iso15662(15662) protocolManagementInformation(1)}
DEFINITIONS AUTOMATIC TAGS
::= BEGIN

ProtocolManagementInformation ::= SEQUENCE{
   selectionOfCommunicationSysyem
                    SelectionOfCommunicationSystem    OPTIONAL,
   applicationIdentifiers     ApplicationIdentifiers OPTIONAL,
   address                    Address                OPTIONAL,
   priority                   Priority               OPTIONAL,
   security                   Security               OPTIONAL,
   applicationExecution       ApplicationExecution   OPTIONAL}

SelectionOfCommunicationSystem ::= SEQUENCE{   --see 4.1
   responsiveness             Responsiveness         OPTIONAL,
   directionality             Directionality         OPTIONAL,
   usageEnvironment           UsageEnvironment       OPTIONAL,
   serviceArea                ServiceArea            OPTIONAL,
   serviceTime                ServiceTime            OPTIONAL,
   bandwidth                  Bandwidth              OPTIONAL,
   connectionCost             ConnectionCost         OPTIONAL}

ApplicationIdentifiers ::= SEQUENCE{           --see 4.2
   messageIdentifier          EXTERNAL               OPTIONAL,
   messageNumber              INTEGER                OPTIONAL,
   timeOfMessageTransmission  GeneralizedTime        OPTIONAL}

Address ::= SEQUENCE{                          --see 4.3
   addressOfOrigin            EXTERNAL               OPTIONAL,
   addressOfDestination       EXTERNAL               OPTIONAL}

Priority ::= SEQUENCE{                         --see 4.4
   interruptHandling          INTEGER{
         undefined               (0),
         lowPriority             (1),
         middlePriority          (2),
         highPriority            (3)},
   interruptHandlingLevel     INTEGER   OPTIONAL,
   queueControl               INTEGER{
         undefined-FIFO          (0),
         lIFO                    (1),
         random                  (2),
         re-try                  (3),
         errorNotification       (4)}}

Security ::= BIT STRING {                      --see 4.5
   userAuthentication         (0),
   terminalAuthentication     (1),
```

```
    dataAuthentication            (2),
    concealment                   (3)}

ApplicationExecution ::= SEQUENCE{              --see 4.6
    validTime                 ValidTime,
    timeStamp                 GeneralizedTime,
    targetArea                TargetArea}

Responsiveness ::= SEQUENCE{                    --see 4.1.1
    responsivenessCode        INTEGER{
          undefined               (0),
          within1Sec              (1),
          within30Sec             (2),
          oneMinute               (3),
          fifteenMinute           (4),
          other                   (5),
          error                   (6)},
    responsivenessValue       UTCTime   OPTIONAL}

Directionality ::= INTEGER{                     --see 4.1.2
    undefined                     (0),
    unidirectional                (1),
    bidirectional-Symmetric       (2),
    bidirectional-UpLarger        (3),
    bidirectional-DownLarger      (4)}

UsageEnvironment ::= SEQUENCE {                 --see 4.1.3
    meansOfTransportation     BIT STRING{
          undefined               (0),
          vehicle                 (1),
          publicTransport         (2),
          foot                    (3),
          bicycle                 (4),
          motorCycle              (5),
          moped                   (6),
          car                     (7),
          truck                   (8),
          emergencyVehicle        (9),
          bus                     (10),
          tram                    (11),
          train                   (12),
          ferry                   (13),
          taxi                    (14),
          other                   (15)},
    speed                     INTEGER{
          undefined               (0),
          fast                    (1),
          middle                  (2),
          slow                    (3),
          stopped                 (4),
          other                   (5)},
    speedValue                EXTERNAL  OPTIONAL}

ServiceArea ::= SEQUENCE{                       --see 4.1.4
    serviceAreaCode           INTEGER{
          undefined               (0),
          continuous              (1),
          non-continuous          (2)},
    serviceAreaValue          EXTERNAL  OPTIONAL}
```

```
ServiceTime ::= SEQUENCE{                          --see 4.1.5
   serviceTimeCode            INTEGER{
          undefined               (0),
          start-StopTime          (1),
          startTime               (2),
          stopTime                (3),
          continuous              (4)},
   serviceTimeValue           EXTERNAL  OPTIONAL}

Bandwidth ::= SEQUENCE{                            --see 4.1.6
   capacityOfTransmissionValue   INTEGER   OPTIONAL,
   dataExpressionCode         BIT STRING{
          undefined               (0),
          text                    (1),
          audio                   (2),
          simpleGraphic           (3),
          stillImage              (4),
          video                   (5),
          other                   (6)}}

ConnectionCost ::= SEQUENCE{                       --see 4.1.7
   maximumCostRequirement     INTEGER{
          undefined               (0),
          totalCost               (1),
          timeUnitPrice           (2),
          bitUnitPrice            (3),
          other                   (4)},
   maximumCostValue           EXTERNAL  OPTIONAL}

ValidTime ::= SEQUENCE{                            --see 4.6.1
   validTimeCode              INTEGER{
          undefined               (0),
          duringReceptionOnly     (1),
          timeDesignated          (2),
          untilUpdated            (3),
          other                   (4)},
   validTimeValue             EXTERNAL  OPTIONAL}

TargetArea ::= SEQUENCE{                           --see 4.6.3
   targetAreaCode             INTEGER{
          undefined               (0),
          spot                    (1),
          zone                    (2),
          interval                (3),
          region                  (4),
          wideArea                (5),
          other                   (6)},
   targetAreaValue         EXTERNAL  OPTIONAL}

END
```

Annex C
(informative)

Protocol management information usage

C.1 Protocol management information usage

This indicates usage examples and cautions that apply from the application side to the lower layers of the OSI layer (requesting wide area communication service) in the information (protocol management information) defined in this document by illustrating examples of message attributes and the characteristics of typical communication systems.

C.1.1 Examples of message attributes

The attributes of request messages (Table C.1) and response messages can be postulated in the manner shown below based on the example of emergency vehicle guidance information. Furthermore, request messages refer to messages made from an emergency vehicle to a service center and so forth requesting information such as the shortest route from the current location to the site of an emergency, while response messages are messages that return graphics and other information to the vehicle making such request.

Table C.1 — Example of message attributes

		Attributes of request messages	Attributes of response messages
Selection of communication system	**Responsiveness**	Within 30 seconds	Undefined
	Directionality	Interactive (ascending < descending)	Unidirectional
	Usage environment	Vehicle movement – speed	Vehicle movement – speed
	Service area	Discontinuous	Continuous
	Service time	Continuous	Continuous
	Bandwidth	Text data at about 10 kbps	Text and graphics data at about 100 kbps
	Connection cost	Undefined	Undefined
Application identifiers	**Message identifier**	Specification of emergency vehicle guidance request messages	Specification of emergency vehicle guidance response messages
	Message number	Specification of a sequential number	Specification of a sequential number
	Time of message transmission	Specification of time	Specification of time
Address	**Address of origin**	Compatible with Ipv6	Compatible with IPv6
	Address of destination	Compatible with Ipv6	Compatible with IPv6
Priority	**Interrupt handling**	High priority	High priority
	Queue control	Undefined	Undefined
Security	**Mutual authentication**	Undefined	Undefined
	Data authentication	Undefined	Undefined
	Concealment	Undefined	Undefined
Application execution	**Valid time**	Until time of information updating	Until time of information updating
	Time stamp	Undefined	Specification of time
	Target area	Spot	Interval

C.1.2 Example of organizing communication system characteristics (presumed)

See Table C.2.

Table C.2 — Example of organizing communication systems characteristics

	2GC(PDC/GSM)	3GC(IMT-2000)	Digital broadcast	DSRC (reference)
Responsiveness	Within 1 second	Within 1 second	Real-time within 30 seconds	Within 1 second
Directionality	Interactive (/symmetric)	Interactive (/asymmetric)	Unidirectional	Interactive (/symmetric)
Usage environment	Movement/vehicle speed 100 km/h	Movement/vehicle speed 100 km/h	Home, mobile - vehicle movement	Movement/vehicle speed 100 km/h
Service area	Wide specified area (coverage range)	Wide specified area (coverage range)	State	Spot narrow area
Service time	Irregular, on-demand	Irregular, on-demand	Constant	Irregular, on-demand
Bandwidth	10 kbps	144 kbps	Several 100 kbps	1Mbps
Connection cost	Charged by packets	Charged by packets	None for connection alone	None for connection alone

C.1.3 Usage and caution examples

C.1.3.1 Request messages

See Table C.3.

Table C.3 — Usage and caution example – Request message

		Attributes of request messages	Presumed media				Comments
			2GC	3GC	Digital broad-cast	DSRC	
Selection of communication system	**Responsiveness**	Within 30 seconds	○	○		○	2GC and 3GC are assessed as being suitable for the communication system. DSRC is only possible at locations where beacons are installed.(*)
	Directionality	Interactive (ascending < descending)	○	○		○	
	Usage environment	Vehicle movement – speed	○	○	○	○	
	Service area	Discontinuous	○	○		○*	
	Service time	Continuous	○	○	○	○	
	Bandwidth	Text data at about 10 kbps	○	○	○	○	
	Connection cost	Undefined	○	○	○	○	
Application identifiers	**Message identifier**	Specification of emergency vehicle guidance request message	The receiving side uses information for identifying messages.				
	Message number	Specification of a sequential number					
	Time of message transmission	Specification of time					
Address	**Address of origin**	Compatible with IPv6	Used to confirm the message transmission source and perform routing.				
	Address of destination	Compatible with IPv6					
Priority	**Interrupt handling**	High priority	Requests high-priority interrupt processing.				
	Queue control	Undefined					
Security	**Mutual authentication**	Undefined	Not particularly requested since this is information that gives priority to high-speed processing and has little need as compared with priority.				
	Data authentication	Undefined					
	Concealment	Undefined					
Application execution	**Valid time**	Until time of information updating	Used to assess whether or not the information is valid.				
	Time stamp	Undefined					
	Target area	Region					

C.1.3.2 Response messages

See Table C.4.

Table C.4 — Usage and caution example – Request Message

		Attributes of response messages	Presumed media				Comments
			2GC	3GC	Digital broad-cast	DSRC	
Selection of communication system	**Responsiveness**	Undefined	○	○	○	○	3GC and digital broadcasting are assessed as being suitable for the communications system.
	Directionality	Unidirectional	○	○	○	○	
	Usage environment	Vehicle movement – speed	○	○	○	○	
	Service area	Continuous	○	○	○		
	Service time	Continuous	○	○	○	○	
	Bandwidth	Text and graphics data at about 100 kbps		○	○	○	
	Connection cost	Undefined	○	○	○	○	
Application identifiers	**Message identifier**	Specification of emergency vehicle guidance response messages	Used to identify messages.				
	Message number	Specification of a sequential number					
	Time of message transmission	Specification of time					
Address	**Address of origin**	Compatible with IPv6	Used to confirm the message transmission source and perform routing.				
	Address of destination	Compatible with IPv6					
Priority	**Interrupt handling**	High priority	Requests high-priority interrupt processing.				
	Queue control	Undefined					
Security	**Mutual authentication**	Undefined	Not particularly requested since this is information that gives priority to high-speed processing and has little need as compared with priority.				
	Data authentication	Undefined					
	Concealment	Undefined					
Application execution	**Valid time**	Until time of information updating	Used to assess whether or not the information is valid.				
	Time stamp	Specification of time					
	Target area	Interval					

C.2 Service cases

The use of the information contained in this International Standard ("protocol management information") is premised on its applicability for assessing the internal processing of communication systems, terminals and so forth which is suitable in terms of providing ITS application services based on wide area communication systems. Four cases of connection have been established on the presumption of the forms of service from now to the future:

— Basic case — In this case, the user terminal and content provider are linked directly with one another.

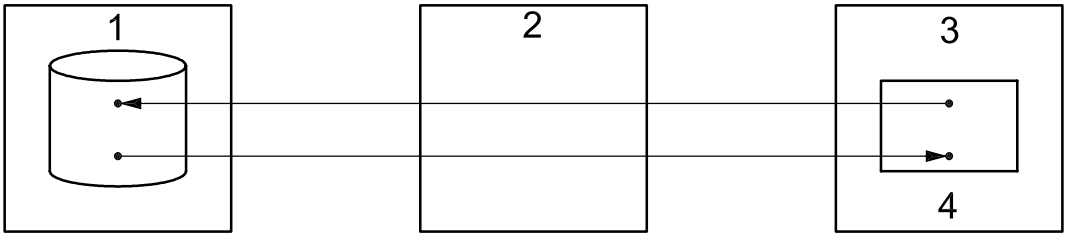
— Mobile Internet case — In this case, the user terminal connects to the content provider via the gateway server of the service provider. This assumes that the service provider and the content provider will be connected to one another via the Internet.

— Multicast case — In this case, the service provider uses a push system to provide content to previously registered user terminals. This assumes that the service provider and the content provider will be connected to one another via some type of network.

— Combined communication systems — In this case, the content request from the user terminal and the content response from the service provider are transmitted using different wide area communications systems. For example, requests might be transmitted by cellular phone and information provided by digital broadcast system.

C.2.1 Basic case

In this case, the service user and content provider are linked directly with one another via the communications carrier (see Figure C.1).



Key

1 content provider
2 communications carrier
3 user
4 terminal

Figure C.1 — Basic service case

C.2.2 Mobile Internet case

In this case, the service user connects to the gateway server of the communications carrier (service provider) and connects to the content provider via the Internet (see Figure C.2).

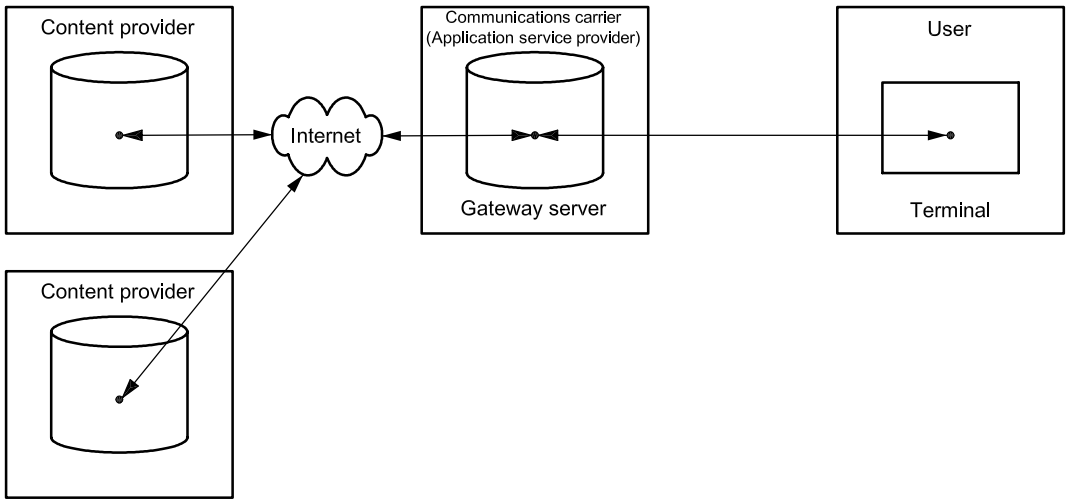


Figure C.2 — Mobile internet case

C.2.3 Multicast case

In this case, data stored by the communications carrier (service provider) is transmitted sequentially (see Figure C.3).

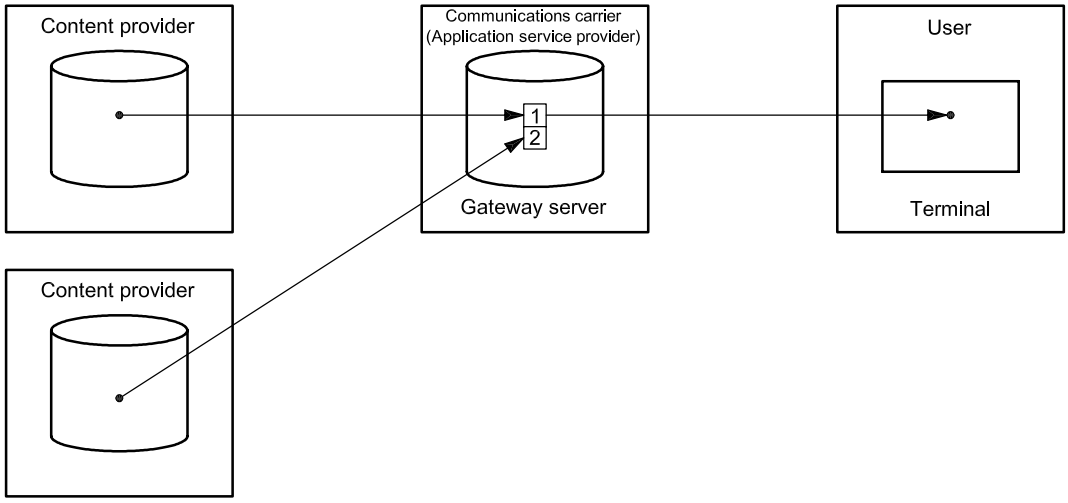


Figure C.3 — Multicast case

C.2.4 Combined communication systems case

In this case, transmission media are used freely in a complex manner. For example, requests might be transmitted by cellular telephone and information provided by broadcasting. A “Response Media” selection will be needed to identify the pattern of multimedia use (see Figure C.4).

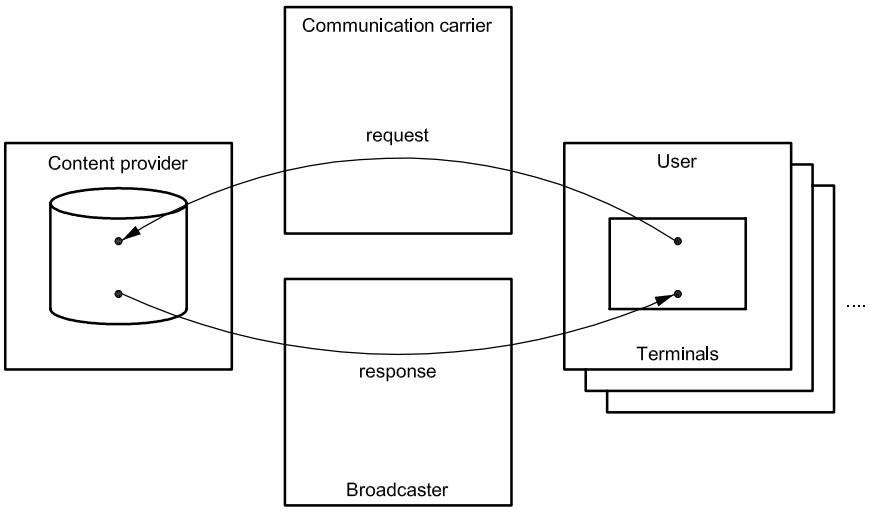


Figure C.4 — Combined communications case

C.3 Usage range of service providers in “protocol management information”

The usage range of service providers for each item in the protocol management information is shown in Table C.5. B-application processing (encircled with a bold line) is treated in this document.

Table C.5 — Usage range of service providers in “protocol management information”

Service format	Protocol management information item									
	A – communication connection					B – application processing				
	(1) Normal connection	(2) Address (routing)	(3) Priority	(4) Security	(5) Communication service format	(1) Selection of communication System	(2) Application ID	(3) Address (internal routing)	(4) Priority	(5) Security	(6) Application execution
1) Basis case	Communication carrier						Content provider				
2) Mobile internet case	Communication carrier						Communication carrier (Application service provider)		Content provider		
3) Multicasting case	Communication carrier						Communication carrier (Application service provider)			Content provider	
4) Combined communication systems case	Communication carrier					Content provider					
5) Other	Communication carrier Content provider										

C.4 Protocol management information usage for each case

C.4.1 Basic case

The usage items of protocol management information for the basic case are shown in Table C.6.

Table C.6 — Protocol management information for basic case

Items required for application processing	Protocol management information items	Communication carrier (Application service provider)	Content provider
		Mandatory/Conditional	Mandatory/Conditional
Selection of communication system	Responsiveness		
	Directionality		
	Usage environment		
	Service (provision) area		
	Service (provision) time		
	Bandwidth		
	Connection cost		
Application identifiers	Message identifier	—	M [a]
	Message number	—	M
	Time of message transmission	—	C [b]
Address (internal routing)	Address of origin	—	C
	Address of destination	—	C
Priority	Interrupt handling	—	C
	Queue control	—	C
Security	Mutual authentication	—	C
	Data authentication	—	C
	Concealment	—	C
Application execution	Valid time	—	C
	Time stamp	—	C
	Target area	—	C

[a] Mandatory.

[b] Conditional.

C.4.2 Mobile internet case

The usage items of protocol management information for the mobile internet case are shown in Table C.7.

Table C.7 — Protocol management information for mobile internet case

Items required for application processing	Protocol management information items	Communications carrier (Application service provider)	Content provider
		Mandatory/Conditional	Mandatory/Conditional
Selection of communication system	Responsiveness		
	Directionality		
	Usage environment		
	Service (provision) area		
	Service (provision) time		
	Bandwidth		
	Connection cost		
Application identifiers	Message identifier	M [a]	–
	Message number	M	–
	Time of message transmission	M	–
Address (internal routing)	Address of origin	M	C [b]
	Address of destination	M	C
Priority	Interrupt handling	—	C
	Queue control	—	C
Security	Mutual authentication	—	C
	Data authentication	—	C
	Concealment	—	C
Application execution	Valid time	—	C
	Time stamp	—	C
	Target area	—	C

[a] Mandatory.

[b] Conditional.

C.4.3 Multicast case

The usage items of the protocol management information for the multi-cast case are shown in Table C.8.

Table C.8 — Protocol management information for the multi-cast case

Items required for application processing	Protocol management information items	Communication carrier (Application service provider)	Content provider
		Mandatory/Conditional	Mandatory/Conditional
Selection of communication system	Responsiveness		
	Directionality		
	Usage environment		
	Service (provision) area		
	Service (provision) time		
	Bandwidth		
	Connection cost		
Application identifiers	Message identifier	M [a]	—
	Message number	M	—
	Time of message transmission	M	—
Address (internal routing)	Address of origin	M	—
	Address of destination	M	—
Priority	Interrupt handling	M	—
	Queue control	M	—
Security	Mutual authentication	—	C [b]
	Data authentication	—	C
	Concealment	—	C
Application execution	Valid time	—	C
	Time stamp	—	C
	Target area	—	C

[a] Mandatory.

[b] Conditional.

C.4.4 Combined communication systems case

The usage items of the protocol management information for the combined media usage case are shown in the table below.

Table C.9 — Protocol management information for combined communications case

Items required for application processing	Protocol management information items	Communications carrier (Application service provider)	Broadcast operator	Content provider
		Mandatory/Conditional	Mandatory/Conditional	Mandatory/Conditional
Selection of communication system	Responsiveness	—	—	M [a]
	Directionality	—	—	M
	Usage environment	—	—	M
	Service (provision) area	—	—	M
	Service (provision) time	—	—	M
	Bandwidth	—	—	M
	Connection cost	—	—	M
Application identifiers	Message identifier	—	M	M
	Message number	—	M	M
	Time of message transmission	—	M	M
Address (internal routing)	Address of origin	—	M	M
	Address of destination	—	—	M
Priority	Interrupt handling	—	—	C [b]
	Queue control	—	—	C
Security	Mutual authentication	—	—	C
	Data authentication	—	—	C
	Concealment	—	—	C
Application execution	Valid time	—	—	C
	Time stamp	—	—	C
	Target area	—	—	C

[a] Mandatory.

[b] Conditional.

Annex D
(informative)

Extracting protocol management information items

D.1 Approach to extracting protocol management information candidate items

A message set is a set of messages processed for the execution of a certain completed operation, function or application. In order to define a finite group as a message set, it shall be specified together with the vocabulary that specifies the set. Accordingly, the features of the operational or functional application being attempted are defined as a finite set S, and by assigning the compositional elements S_{ij} of that set to the message header section and information section, it is possible to define the message set for the execution of the application. When examining protocol management information, information is examined in the form of conceptual header items, including information items that are not treated as header items in terms of mounting.

Based on this concept, the following approach was used to extract information items.

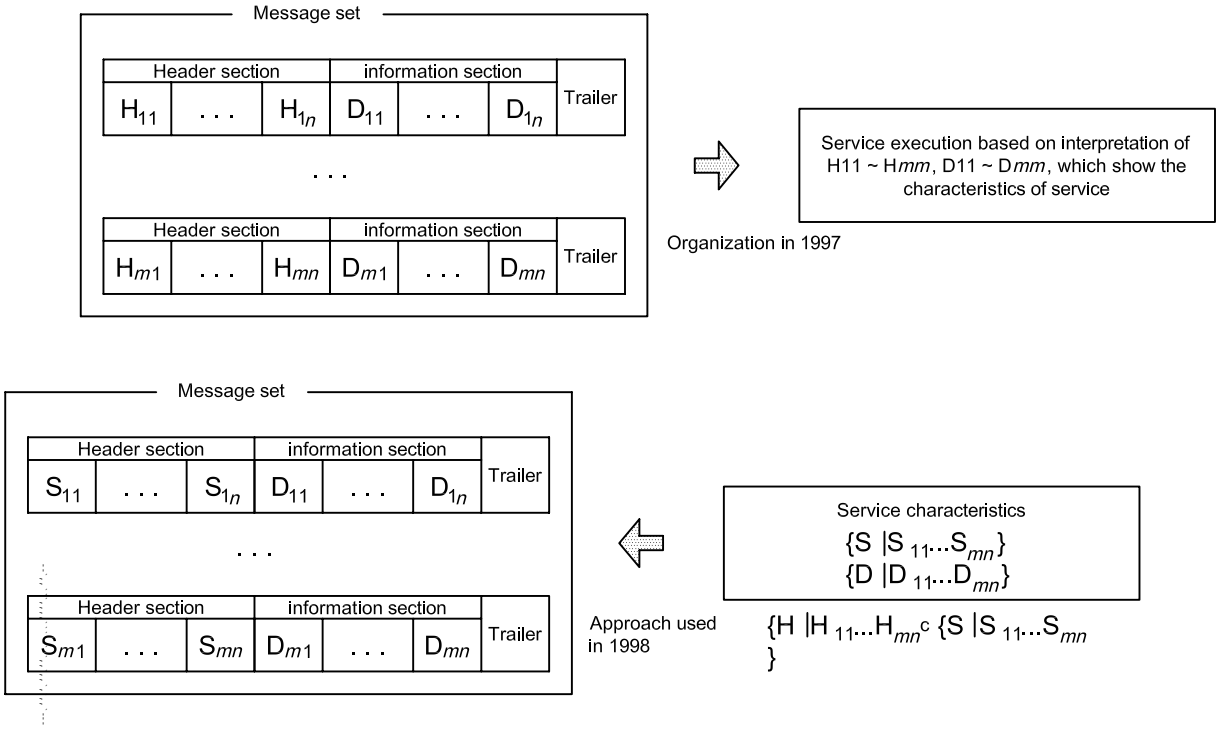


Figure D.1 — Basic approach to message sets

D.2 Process of extracting protocol management information as header candidate items

a) Step 1 — Extract application features.

Of the 172 user services indicated in the Japanese system Architecture engaged in ITS (prepared in 1999 by the five government ministries involved in ITS), extract the services that include interfaces using wide area communication systems.

Define the specific features of the service, from such standpoints as the transmission media used by those services, the method used to provide services and the informational content of the services.

Extract the target wide area communication systems and organize the features for each system.

b) Step 2.

From the table of service features and the table of wide area communication systems features, organize the potential for service application using the corresponding wide area communication systems.

If the following conditions are met, extract the service features organized in “Step 1” as header candidate items:

— When the service can be applied to a single wide area communications system; and

— When the service cannot be realized by a single wide area communications system, consider whether the service can be adapted using a combination of wide area communication systems, and extract those conditions as header items.

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