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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Supplementary services for multimedia

Generic functional protocol for the support of supplementary services in ITU-T H.323 systems

Recommendation ITU-T H.450.1

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Recommendation ITU-T H.450.1

Generic functional protocol for the support of supplementary services in ITU-T H.323 systems

Summary

Recommendation ITU-T H.450.1 describes the procedures and the signalling protocol between ITU-T H.323 entities (packet-based multimedia communications systems) for the control of supplementary services. The signalling protocol which is defined within this Recommendation is common to all ITU-T H.323 supplementary services.

Detailed procedures applicable to individual supplementary services are specified by other Recommendations of the ITU-T H.450.x-series and by individual manufacturers for proprietary services using the capabilities defined in this Recommendation.

The procedures of this Recommendation are derived from the generic functional protocol specified in ISO/IEC 11582 for private integrated services networks (PISN).

The revision approved in May 2011 corrects errors discovered in the initial publication.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T H.450.1	1998-02-06	16
2.0	ITU-T H.450.1	2011-05-14	16

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

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Recommendation ITU-T H.450.1

Generic functional protocol for the support of supplementary services in ITU-T H.323 systems

1 Scope

This Recommendation defines the signalling protocol between ITU-T H.323 entities for the control of supplementary services. Detailed procedures applicable to individual supplementary services are specified by other Recommendations of the ITU-T H.450.x-series and by individual manufacturers for proprietary services using the capabilities defined in this Recommendation.

The procedures of this Recommendation are derived from the generic functional protocol specified in [ISO/IEC 11582] for private integrated services networks (PISN).

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T H.225.0] Recommendation ITU-T H.225.0 (2009), *Call signalling protocols and media stream packetization for packet-based multimedia communication systems.*

[ITU-T H.245] Recommendation ITU-T H.245 (2009), *Control protocol for multimedia communication.*

[ITU-T H.323] Recommendation ITU-T H.323 (2009), *Packet-based multimedia communications systems.*

[ITU-T I.112] Recommendation ITU-T I.112 (1993), *Vocabulary of terms for ISDNs.*

[ITU-T I.210] Recommendation ITU-T I.210 (1993), *Principles of telecommunication services supported by an ISDN and the means to describe them.*

[ITU-T X.680] Recommendation ITU-T X.680 (1994) | ISO/IEC 8824-1:1995, *Information technology – Abstract Syntax Notation One (ASN.1) – Specification of basic notation.*

[ITU-T X.680 Amd.1] Recommendation ITU-T X.680 (1994)/Amd.1 (1995) | ISO/IEC 8824-1:1995/Amd.1:1996, *Information technology – Abstract Syntax Notation One (ASN.1) – Specification of basic notation – Amendment 1: Rules of extensibility.*

[ITU-T X.681 Amd.1] Recommendation ITU-T X.681 (1994)/Amd.1 (1995) | ISO/IEC 8824-2:1995/Amd.1:1996, *Information technology – Abstract Syntax Notation One (ASN.1) – Information object specification – Amendment 1: Rules of extensibility.*

[ITU-T X.691] Recommendation ITU-T X.691 (1995) | ISO/IEC 8825-2:1996, *Information technology – ASN.1 encoding rules – Specification of Packed Encoding Rules (PER).*

[ITU-T X.880] Recommendation ITU-T X.880 (1994) | ISO/IEC 13712-1:1995, *Information technology – Remote Operations: Concepts, model and notation.*

[ISO/IEC 11582] ISO/IEC 11582:2002, *Information technology – Telecommunications and information exchange between systems – Private Integrated Services Network – Generic functional protocol for the support of supplementary services – Inter-exchange signalling procedures and protocol.*

3 Terms and definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 object identifier: [ITU-T X.680].

3.1.2 ITU-T H.323 entity: [ITU-T H.323].

3.1.3 service: [ITU-T I.112].

3.1.4 signalling: [ITU-T I.112].

3.1.5 supplementary service: Clause 2.4 of [ITU-T I.210].

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 application protocol data unit (APDU): A sequence of data elements exchanged between peer application layer entities, e.g., remote operations service (ROS) APDUs.

3.2.2 call independent: A property of information which is conveyed in a message which does not use the call reference of a call.

3.2.3 call independent signalling connection: A signalling connection established between SS-Control entities located in different ITU-T H.323 entities for the exchange of call independent signalling information.

3.2.4 call related: A property of information which is conveyed in a message which uses the call reference of a call.

3.2.5 destination entity: In the context of a single one-way exchange of information between two SS-Control entities, the ITU-T H.323 entity where the receiving SS-Control entity is located.

3.2.6 ITU-T H.450.1 supplement service APDU: A specific APDU defined by Recommendation ITU-T H.450.1.

3.2.7 interpretation APDU: A specific APDU defined by Recommendation ITU-T H.450.1.

3.2.8 invocation: A request by a SS-Control entity to perform an operation in a remote SS-Control entity.

3.2.9 mistyped: A property of an application protocol data unit (APDU) whose structure does not conform to the structure defined in Recommendation ITU-T H.450.1 or the structure defined for a particular supplementary service.

3.2.10 ROS APDU: An APDU defined by the remote operations service (ROS).

3.2.11 source entity: In the context of a single one-way exchange of information between two SS-Control entities, the ITU-T H.323 entity where the sending SS-Control entity is located.

3.2.12 supplementary service control (SS-Control) entity: An entity that exists within an ITU-T H.323 entity and provides the procedures associated with the support of a particular supplementary service.

3.2.13 unrecognized: A property of a message, information element, APDU or operation value whose type identifier is not one supported by the destination entity.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations:

APDU Application Protocol Data Unit

ASN.1 Abstract Syntax Notation One

LAN Local Area Network

MSI Manufacturer-Specific Information

NFE Network Facility Extension

PISN Private Integrated Services Network

RAS Registration, Admission and Status

ROS Remote Operations Service

SS Supplementary Service

5 General principles

The generic functional protocol defined in this Recommendation provides the means to exchange signalling information for the control of supplementary services over a LAN. It does not by itself control any supplementary service but rather provides generic services to specific SS-Control entities. Procedures for individual supplementary services based on these generic procedures are defined in other Recommendations of the ITU-T H.450.x-series or may be manufacturer-specific.

The generic functional protocol operates in conjunction with the call signalling protocol defined in [ITU-T H.225.0].

The generic functional protocol provides mechanisms for the support of supplementary services which relate to existing ITU-T H.323 calls or are entirely independent of any existing ITU-T H.323 calls. In performing a supplementary service, whether call independent or call related, use is made of the information transfer procedures specified below.

Supplementary service operations require an association between the respective peer SS-Control entities. This association is achieved implicitly by the transport connection used for call signalling.

SS-Control entities use the services of the remote operations service (ROS). The remote operations service (ROS) for [ITU-T H.323] is defined in clause 8.3 and based on [ITU-T X.880].

6 Procedures for the transport of APDUs

6.1 Call-related procedures

For the call-related transport of ITU-T H.450.1 supplementary service application protocol data units (APDUs), the call signalling channel and call reference of the call to which the APDU relates shall be used.

APDUs shall be conveyed in the User-user information element which shall be handled according to clauses 6.3 and 6.4.

Gatekeeper procedures and RAS messages, as defined in [ITU-T H.225.0], shall apply to calls that transport ITU-T H.450.1 supplementary service APDUs.

6.2 Call-independent procedures

For the call-independent transport of ITU-T H.450.1 supplementary service APDUs, the call signalling procedures of [ITU-T H.225.0] shall be used to establish a call-independent signalling connection between the peer SS-Control entities. A Bearer capability information element and a conferenceGoal shall be included in the SETUP message as specified in clause 7.2. No ITU-T H.245 control channel and no media channels shall be established in conjunction with a call-independent signalling connection.

APDUs shall be conveyed in the User-user information element which shall be handled according to clauses 6.3 and 6.4.

Gatekeeper procedures and RAS messages, as defined in [ITU-T H.225.0], shall also apply to call-independent procedures.

6.3 Sending the ITU-T H.450.1 supplementary service APDU

The ITU-T H.450.1 supplementary service APDU may be sent on the call signalling channel at any time while a call reference exists, subject to the following conditions:

– if a call establishment or a call clearing message that may contain an ITU-T H.450.1 supplementary service APDU (see clause 7.1 and [ITU-T H.225.0]) is to be sent in the context of a call or a call-independent signalling connection, the ITU-T H.450.1 supplementary service APDU shall be included in that message; otherwise

– the ITU-T H.450.1 supplementary service APDU shall be carried in a FACILITY message;

– a FACILITY message shall not be sent if a SETUP message previously sent or received has not been answered.

The ITU-T H.450.1 supplementary service APDU may be repeated in a given User-user information element.

Sending a FACILITY message shall not cause a change of the ITU-T H.225.0 call state.

6.4 Receiving the ITU-T H.450.1 supplementary service APDU

An entity receiving an ITU-T H.450.1 supplementary service APDU in a valid call clearing or call establishment message (see clause 7.1 and [ITU-T H.225.0]) or a FACILITY message shall determine whether or not it is the destination entity for that ITU-T H.450.1 supplementary service APDU, according to the following rules:

– If no network facility extension (NFE) is present, the entity shall become the destination entity.

– If the NFE is present with destinationEntity = "endpoint", the entity shall become the destination entity if it is endpoint for this call or this call-independent signalling connection. If the destinationEntity = "endpoint", a gatekeeper which is capable of acting as an endpoint for all services indicated in the ITU-T H.450.1 supplementary service APDU may become the destination entity for that ITU-T H.450.1 supplementary service APDU.

– If the NFE is present with destinationEntity = "anyEntity" and with a destinationEntityAddress, the entity shall become the destination entity if the address matches one of its own.

– If the NFE is present with destinationEntity = "anyEntity" and without a destinationEntityAddress, the entity may become the destination entity if it understands the contents of the ITU-T H.450.1 supplementary service APDU.

If the receiving entity is the destination entity, the procedures of clause 6.6 shall be followed.

If the receiving entity is not the destination entity, the ITU-T H.450.1 supplementary service APDU shall be passed on if possible according to the rules of clause 6.3; otherwise, the ITU-T H.450.1 supplementary service APDU shall be discarded.

Receipt of a FACILITY message shall not cause a change of the ITU-T H.225.0 call state.

6.5 Actions at a source entity

APDUs to be sent shall be included in ITU-T H.450.1 supplementary service APDUs as specified in clause 8. An ITU-T H.450.1 supplementary service APDU may contain more than one ROS APDU. All ROS APDUs within a single ITU-T H.450.1 supplementary service APDU shall be for the same destination entity.

If a source entity wishes to include additional information to facilitate handling of unrecognized ROS APDUs of type invoke APDU (see clause 8.3) at a destination entity, it shall include an interpretation APDU (see clause 8.2) as the first APDU in the sequence of APDUs. The interpretation APDU applies to all invoke APDUs included in this ITU-T H.450.1 supplementary service APDU.

An NFE (see clause 8.1) shall be included in the ITU-T H.450.1 supplementary service APDU according to the following rules:

– If the remote endpoint is to be the destination entity of this information element, the NFE shall be included with destinationEntity set to "endpoint" and destinationEntityAddress being omitted.

– If no specific entity is to be the destination entity of this information element, the NFE shall be included with destinationEntity set to "anyEntity" and destinationEntityAddress being omitted.

– If a specific ITU-T H.323 entity on the call signalling path to the remote endpoint is to be the destination entity of this information element, the NFE shall be included with destinationEntity set to "anyEntity" and destinationEntityAddress containing the address of the ITU-T H.323 entity.

– If the next entity (e.g., a gatekeeper) on the call signalling path to the remote endpoint is to be the destination entity of this information element, the NFE may be omitted.

6.6 Actions at a destination entity

APDUs received in an ITU-T H.450.1 supplementary service APDU shall be handled as follows.

ROS APDUs shall be processed in the order in which they were received, following normal ROS rules with the following exception:

• If the first APDU is an interpretation APDU and any of the ROS APDUs is an invoke APDU of an unrecognized operation, then:

  – If the interpretation APDU indicates rejectAnyUnrecognizedInvokePdu, a reject APDU with InvokeProblem = unrecognizedOperation shall be sent to the source entity.

    NOTE – This is the normal ROS procedure which applies also if no interpretation APDU is present.

  – If the interpretation APDU indicates clearCallIfAnyInvokePduNotRecognized, a reject APDU with InvokeProblem = unrecognizedOperation shall be sent to the source entity; and the call or signalling connection to which the invoke APDU was related shall be cleared.

  – If the interpretation APDU indicates discardAnyUnrecognizedInvokePdu, no reject APDU shall be sent to the source entity.

7 Messages

7.1 Overview

Table 1 summarizes the messages that may also be used for the transport of ITU-T H.450.1 supplementary service APDUs, including those already defined in [ITU-T H.225.0].

Table 1 – Messages used for the transport of APDUs

Call establishment messages	*Reference*
ALERTING	[ITU-T H.225.0]
CALL PROCEEDING	[ITU-T H.225.0]
CONNECT	[ITU-T H.225.0]
SETUP	Clause 7.2
Call clearing messages	
RELEASE COMPLETE	[ITU-T H.225.0]
Miscellaneous messages	
FACILITY	[ITU-T H.225.0]
PROGRESS	[ITU-T H.225.0]

7.2 SETUP

[ITU-T H.225.0] shall apply with the following addition.

In the Bearer capability information element, the additional codepoints in Table 2 shall be supported for call-independent procedures (see clause 6.2).

Table 2 – Bearer capability coding for call-independent signalling connections

Coding standard (octet 3)

Bits

7 6

0 1 Other international standard (Note)

Information transfer capability (octet 3) for coding standard "other international standard"

Bits

5 4 3 2 1

0 1 0 0 0 Unrestricted digital information

All other values are reserved

Transfer mode (octet 4) for coding standard "other international standard"

Bits

7 6

0 0 Call-independent signalling connection

All other values are reserved

Information transfer rate (octet 4, bits 5 to 1) for coding standard "other international standard"

Bits

5 4 3 2 1

0 0 0 0 0 Call-independent signalling connection

All other values are reserved

NOTE – When this coding standard is indicated, the coding defined in [b-ITU-T Q.931] shall apply for octets 1 to 2 and bit 8 of octets 3 to 4. Information transfer capability, Transfer mode and Information transfer rate shall be encoded as indicated and no other octets shall be included.

The SETUP message used for call-independent procedures (see clause 6.2) shall include a conferenceGoal within Setup-UUIE set to value "callIndependentSupplementaryService".

8 ITU-T H.450.1 supplementary service APDU

The ITU-T H.450.1 supplementary service APDU shall be included in the User-user information element, as specified in [ITU-T H.225.0].

This clause defines the structure and coding of the ITU-T H.450.1 supplementary service APDU. The purpose of the ITU-T H.450.1 supplementary service APDU is to convey an optional interpretation APDU and one or more ROS APDUs.

All APDUs contained in the ITU-T H.450.1 supplementary service APDU will be delivered to the same entity (as identified by the NFE). If different APDUs are to be processed by different entities, they shall be included in different ITU-T H.450.1 supplementary service APDUs.

The ITU-T H.450.1 supplementary service APDU may be repeated in a given User-user information element.

The maximum length of the ITU-T H.450.1 supplementary service APDU is application dependent, subject to the maximum overall length of the User-user information element (see [ITU-T H.225.0]). The ITU-T H.450.1 supplementary service APDU is defined in Table 3.

Table 3 – ITU-T H.450.1 supplementary service APDU structure

```
H4501-Supplementary-ServiceAPDU-Structure
         {itu-t recommendation h 450 1 version2(1) h4501-facility-
information-structure(2)}
     DEFINITIONS AUTOMATIC TAGS  ::=
     BEGIN
     IMPORTS       AliasAddress
FROM H323-MESSAGES {itu-t(0) recommendation(0) h(8) h225-0(2250) version(0) 7
h323-messages(0)} -- see H.225.0 V7
                   OPERATION, ROS{}, InvokeId
FROM Remote-Operations-Apdus {itu-t recommendation h 450 1 version2(1) remote-
operations-apdus(11)};

H4501SupplementaryService             ::= SEQUENCE
     {    networkFacilityExtension         NetworkFacilityExtension
     OPTIONAL, -- see clause 8.1
          interpretationApdu          InterpretationApdu
     OPTIONAL, -- see clause 8.2
          serviceApdu                 ServiceApdus,          -- ITU-T H.450.x
supplementary services
          ...
     }

NetworkFacilityExtension      ::=     SEQUENCE
          {    sourceEntity            EntityType,
               sourceEntityAddress     AddressInformation    OPTIONAL,
               destinationEntity       EntityType,
               destinationEntityAddress    AddressInformation     OPTIONAL,
               ...
          }
EntityType          ::=  CHOICE
                    {    endpoint      NULL,
                    anyEntity NULL,
                    ...
               }
AddressInformation ::=  AliasAddress

InterpretationApdu ::=  CHOICE
          {    discardAnyUnrecognizedInvokePdu         NULL,
               clearCallIfAnyInvokePduNotRecognized          NULL,
               -- this value also applies to Call independent signalling connections
               rejectAnyUnrecognizedInvokePdu          NULL,
               -- this coding is implied by the absence of an interpretation APDU.
               ...
          }
ServiceApdus  ::=  CHOICE
     {rosApdus SEQUENCE SIZE (1..MAX) OF ROS{{InvokeIdSet}, {OperationSet},
{OperationSet}},
          -- see clause 8.3; other alternatives may be defined in future versions
     ...
     }
InvokeIdSet         INTEGER    ::=      {InvokeIDs,...}
InvokeIDs ::= INTEGER (0..65535)
OperationSet  OPERATION ::=  {...}
-- actual values are defined by individual supplementary service specifications
-- (e.g., ITU-T H.450.x or manufacturer-specific)

END      -- of H4501- Supplementary-ServiceAPDU-Structure
```

8.1 Network facility extension (NFE)

ASN.1 type NetworkFacilityExtension, as defined in Table 3 and encoded in accordance with clause 9, provides a means of routing the contents of the ITU-T H.450.1 supplementary service APDU within the context of a call or a call-independent signalling connection, and a means of identifying the origin and destination of the information, in accordance with the procedures of clauses 6.4 and 6.5.

8.2 Interpretation APDU

ASN.1 type InterpretationAPDU, as defined in Table 3 and encoded in accordance with clause 9, provides a means whereby the originator can include optional instructions to the receiving entity for use in the event that it does not understand the operation value of an invoke APDU contained in element serviceApdu of the ITU-T H.450.1 supplementary service APDU.

8.3 ROS APDUs

ASN.1 type ServiceApdus, as defined in Table 3, shall comprise one or more ROS APDUs, each of which shall be an alternative of ASN.1 type ROS, as defined in Table 4 and encoded in accordance with clause 9.

In accordance with [ITU-T X.880], ROS APDUs are of four types:

– invoke;

– return result;

– return error;

– reject.

Table 5 provides definitions of the problem codes for use in the reject APDUs.

Invoke APDUs, return result APDUs, and return error APDUs used in the context of a supplementary service will be implicitly defined by the operations and errors used by that supplementary service. These operations and errors will be defined using ASN.1 in the relevant supplementary service specifications (standardized or manufacturer-specific).

Certain supplementary services may require the use within ROS APDUs of existing information elements encoded according to the rules of [ITU-T H.225.0] within the argument of an invoke APDU, the result of a return result APDU, or the parameter of a return error APDU (with the exception of the ITU-T H.450.1 supplementary service APDU, which shall not be included in this way). In such a case, these information elements shall be included within an element of type H225InformationElement within the argument or result of the operation concerned or the parameter of the error concerned. In this way, the ITU-T H.225.0 encoding for these information elements can be retained.

If more than one information element is to be included as part of the same argument, result or parameter, all the information elements shall be grouped together within the same element of type H225InformationElement. The type H225InformationElement is defined in clause 10.2.

Table 4 – ROS APDUs

```
Remote-Operations-Apdus
 { itu-t recommendation h 450 1 version2(1) remote-operations-apdus(11) }

DEFINITIONS
AUTOMATIC TAGS ::=
BEGIN
-- exports everything
IMPORTS OPERATION, ERROR FROM Remote-Operations-Information-Objects
     {joint-iso-itu-t remote-operations(4) informationObjects(5) version2(1)};
ROS {InvokeId:InvokeIdSet, OPERATION:Invokable, OPERATION:Returnable} ::=
     CHOICE
{
invoke         [1]  Invoke {{InvokeIdSet}, {Invokable}},
     returnResult   [2]  ReturnResult {{Returnable}},
     returnError    [3]  ReturnError {{Errors{{Returnable}}}},
     reject         [4]  Reject
}
(CONSTRAINED BY { -- must conform to the above definition -- }
! RejectProblem : general-unrecognizedPDU)

Invoke {InvokeId:InvokeIdSet, OPERATION:Operations} ::=     SEQUENCE
{
     invokeId       InvokeId   (InvokeIdSet)
                    (CONSTRAINED BY {-- must be unambiguous --}
                    ! RejectProblem : invoke-duplicateInvocation),
     linkedId       InvokeId
               (CONSTRAINED BY {-- must identify an outstanding operation --}
               ! RejectProblem : invoke-unrecognizedLinkedId)
               (CONSTRAINED BY {-- which has one or more linked operations--}
               ! RejectProblem : invoke-linkedResponseUnexpected)
                    OPTIONAL,
     opcode    OPERATION.&operationCode
               ({Operations}
               ! RejectProblem : invoke-unrecognizedOperation),
     argument  OPERATION.&ArgumentType
               ({Operations} {@opcode}
               ! RejectProblem : invoke-mistypedArgument)
                    OPTIONAL
}
(CONSTRAINED BY { -- must conform to the above definition -- }
! RejectProblem : general-mistypedPDU)
(
     WITH COMPONENTS
     {...,
          linkedId      ABSENT
     }
     |
     WITH COMPONENTS    {...,
          linkedId      PRESENT,
          opcode
          (CONSTRAINED BY {-- must be in the &Linked field of the associated
operation --}
          ! RejectProblem : invoke-unexpectedLinkedOperation)
     }
)
```

Table 4 – ROS APDUs

```
ReturnResult {OPERATION:Operations}::=     SEQUENCE
{
     invokeId       InvokeId
                (CONSTRAINED BY {-- must be that for an outstanding operation --
}
                ! RejectProblem : returnResult-unrecognizedInvocation)
                (CONSTRAINED BY {-- which returns a result --}
                ! RejectProblem : returnResult-resultResponseUnexpected),
     result         SEQUENCE
     {
          opcode    OPERATION.&operationCode
                    ({Operations})(CONSTRAINED BY {-- identified by invokeId --
}
                    ! RejectProblem : returnResult-unrecognizedInvocation),
          result         OPERATION.&ResultType
                    ({Operations} {@.opcode}
                    ! RejectProblem : returnResult-mistypedResult)
     }
     OPTIONAL
}
(CONSTRAINED BY { -- must conform to the above definition -- }
! RejectProblem : general-mistypedPDU)

ReturnError {ERROR:Errors}   ::= SEQUENCE
{
     invokeId  InvokeId
                (CONSTRAINED BY {-- must be that for an outstanding operation --
}
                ! RejectProblem : returnError-unrecognizedInvocation)
                (CONSTRAINED BY {-- which returns an error --}
                ! RejectProblem : returnError-errorResponseUnexpected),
     errcode   ERROR.&errorCode
                ({Errors}
                ! RejectProblem : returnError-unrecognizedError)
                (CONSTRAINED BY
                {--must be in the &Errors field of the associated operation --}
                ! RejectProblem : returnError-unexpectedError),
     parameter  ERROR.&ParameterType
                ({Errors}{@errcode}
                ! RejectProblem : returnError-mistypedParameter) OPTIONAL
}
(CONSTRAINED BY { -- must conform to the above definition -- }
! RejectProblem : general-mistypedPDU)

Reject ::=     SEQUENCE
{
     invokeId  InvokeId,
     problem   CHOICE
                {
                general        GeneralProblem,
                invoke         InvokeProblem,
                returnResult        ReturnResultProblem,
                returnError         ReturnErrorProblem
                }
}
(CONSTRAINED BY { -- must conform to the above definition -- }
! RejectProblem : general-mistypedPDU)
GeneralProblem          ::=  INTEGER
```

Table 4 – ROS APDUs

```
          {
               unrecognizedComponent (0),
               mistypedComponent (1),
               badlyStructuredComponent (2)
          }
InvokeProblem      ::=  INTEGER
          {
               duplicateInvocation (0),
               unrecognizedOperation (1),

               mistypedArgument (2),
               resourceLimitation (3),
               releaseInProgress (4),
               unrecognizedLinkedId (5),
               linkedResponseUnexpected (6),
               unexpectedLinkedOperation (7)
          }
ReturnResultProblem     ::=  INTEGER
          {
               unrecognizedInvocation (0),
               resultResponseUnexpected (1),
               mistypedResult (2)
          }
ReturnErrorProblem  ::= INTEGER
          {
               unrecognizedInvocation (0),
               errorResponseUnexpected (1),
               unrecognizedError (2),
               unexpectedError (3),
               mistypedParameter (4)
          }
RejectProblem       ::= INTEGER
          {
               general-unrecognizedPDU (0),
               general-mistypedPDU (1),
               general-badlyStructuredPDU (2),
               invoke-duplicateInvocation (10),
               invoke-unrecognizedOperation (11),
               invoke-mistypedArgument (12),
               invoke-resourceLimitation (13),
               invoke-releaseInProgress (14),
               invoke-unrecognizedLinkedId (15),
               invoke-linkedResponseUnexpected (16),
               invoke-unexpectedLinkedOperation (17),
               returnResult-unrecognizedInvocation (20),
               returnResult-resultResponseUnexpected (21),
               returnResult-mistypedResult (22),
               returnError-unrecognizedInvocation (30),
               returnError-errorResponseUnexpected (31),
               returnError-unrecognizedError (32),
               returnError-unexpectedError (33),
               returnError-mistypedParameter (34)
          }
InvokeId            ::= INTEGER

Errors {OPERATION:Operations} ERROR ::=    {Operations.&Errors}

END -- end of Remote-Operations-Apdus definitions
```

NOTE – In the *Invoke* APDU, the *invokeID* is an INTEGER constrained by a PER-visible constraint (InvokeIdSet = 0..65535) and is therefore encoded as a constrained INTEGER (16 bits, no length field). In the *ReturnResult* and *ReturnError* APDUs, however, the *invokeID* is encoded as an unconstrained INTEGER (with explicit length field) because the applicable constraint ("must be that for an outstanding operation…") is not PER-visible. In the *Reject* APDU, the *invokeID* is also encoded as an unconstrained INTEGER (with explicit length field) since no constraint applies.

Table 5 – Problem code definitions (informative)

General problem:	
– unrecognizedPDU	Signifies that the type of the APDU as evidenced by its Type identifier, is not defined in clause 8.
– mistypedPDU	Signifies that the structure of the APDU does not conform to that defined in clause 8.
– badlyStructuredPDU	Signifies that the structure of the APDU does not conform to the Standard notation and encoding rules, defined in [ITU-T X.680], etc.
Invoke problem:	
– duplicatedInvocation	Signifies that the Invoked-identifier parameter violates the assignment rules of [ITU-T X.880].
– unrecognizedOperation	Signifies that the type of the operation is not one of those supported.
– mistypedArgument	Signifies that the type of the operation argument supplied is not expected.
– resourceLimitation	Signifies that the performing entity is not able to perform the invoked operation due to resource limitation.
– initiatorReleasing	Signifies that the association initiator is not willing to perform the invoked operation because it is about to attempt to release the application association.
– unrecognizedLinkedId	Signifies that there is no operation in progress with an Invoke identifier equal to the specified Linked identifier.
– linkedResponseUnexpected	Signifies that the invoked operation referred to by the Linked identifier is not a parent operation.
– unexpectedChildOperation	Signifies that the invoked child operation is not one that the invoked parent operation referred to by the Linked identifier allows.
Return result problem:	
– unrecognizedInvocation	Signifies that no operation with the specified invoke identifier is in progress.
– resultResponseUnexpected	Signifies that the invoked operation does not report a result.
– mistypedResult	Signifies that the type of the Result parameter supplied is not expected.
Return error problem:	
– unrecognizedInvocation	Signifies that no operation with the specified invoke identifier is in progress.
– errorResponseUnexpected	Signifies that the invoked operation does not report failure.
– unrecognizedError	Signifies that the reported error is not one expected.
– unexpectedError	Signifies that the reported error is not one that the invoked operation may report.
– mistypedParameter	Signifies that the type of the error parameter supplied is not one that is expected.

9 Encoding of information described using ASN.1

Where the contents of an information element field are defined using ASN.1 notation, the encoding of this field shall be in accordance with the encoding rules that apply to the user information field of the ITU-T H.225.0 User-user information element (i.e., basic aligned variant of the packed encoding rules as specified in [ITU-T X.691]).

10 ASN.1 definitions of generic parameters

10.1 Addressing information

Table 6 contains the definition of ASN.1 types for encoding of alias addressing information in addition to [ITU-T H.225.0].

Table 6 – Addressing information definitions

```
Addressing-Data-Elements
         { itu-t recommendation h 450 1 version2(1) addressing-data-
elements(9)}
     DEFINITIONS AUTOMATIC TAGS ::=
     BEGIN
     IMPORTS   AliasAddress, PartyNumber, PresentationIndicator,
ScreeningIndicator FROM H323-MESSAGES {itu-t(0) recommendation(0) h(8) h225-
0(2250) version(0) 7 h323-messages(0)}; -- see Recommendation ITU-T H.225.0
     PresentedAddressScreened     ::=  CHOICE {
               presentationAllowedAddress        AddressScreened,
               presentationRestricted            NULL,
               numberNotAvailableDueToInterworking          NULL,
               presentationRestrictedAddress          AddressScreened,
               ...            }
     PresentedAddressUnscreened   ::=  CHOICE {
               presentationAllowedAddress        Address,
               presentationRestricted            NULL,
               numberNotAvailableDueToInterworking          NULL,
               presentationRestrictedAddress          Address,
               ...            }
     PresentedNumberScreened ::=  CHOICE {
               presentationAllowedAddress        NumberScreened,
               presentationRestricted            NULL,
               numberNotAvailableDueToInterworking          NULL,
               presentationRestrictedAddress          NumberScreened,
               ...            }
     PresentedNumberUnscreened    ::=  CHOICE {
               presentationAllowedAddress        PartyNumber,
               presentationRestricted            NULL,
               numberNotAvailableDueToInterworking          NULL,
               presentationRestrictedAddress          PartyNumber,
               ...            }
     AddressScreened     ::=  SEQUENCE {
                    partyNumber             PartyNumber,
                    screeningIndicator      ScreeningIndicator,
                    partySubaddress              PartySubaddress OPTIONAL,
                    ...                }
     NumberScreened      ::=  SEQUENCE {
                    partyNumber             PartyNumber,
                    screeningIndicator      ScreeningIndicator,
                    ...                }
     Address        ::=  SEQUENCE {
                    partyNumber             PartyNumber,
                    partySubaddress              PartySubaddress OPTIONAL,
                    ...                }
```

Table 6 – Addressing information definitions

```
     -- PartyNumber defined in Recommendation ITU-T H.225.0
     -- PublicPartyNumber defined in Recommendation ITU-T H.225.0
     -- PrivatePartyNumber defined in Recommendation ITU-T H.225.0
     -- NumberDigits defined in Recommendation ITU-T H.225.0
     -- PublicTypeOfNumber defined in Recommendation ITU-T H.225.0
     -- PrivateTypeOfNumber defined in Recommendation ITU-T H.225.0
     -- PresentationIndicator defined in Recommendation ITU-T H.225.0 (v3 and beyond)
     -- ScreeningIndicator defined in Recommendation ITU-T H.225.0 (v3 and beyond)

     EndpointAddress              ::=  SEQUENCE{
          destinationAddress           SEQUENCE OF AliasAddress,
               -- multiple alias addresses may be used to address the same Recommendation ITU-T H.323
                  endpoint
          remoteExtensionAddress            AliasAddress OPTIONAL,
          ...,
          destinationAddressPresentationIndicator
     PresentationIndicator OPTIONAL,
               -- Note 1, 2
          destinationAddressScreeningIndicator        ScreeningIndicator
OPTIONAL,
          remoteExtensionAddressPresentationIndicator  PresentationIndicator
OPTIONAL,
               -- Note 1, 2
          remoteExtensionAddressScreeningIndicator          ScreeningIndicator
OPTIONAL                                  }
               -- Note 1: If this element is not available, presentation
allowed shall be assumed.
               -- Note 2: If an H.450 APDU that carries this element
EndpointAddress also
               -- contains an element PresentationAllowedIndicator, then the
setting of the
               -- element PresentationAllowedIndicator shall take precedence in
case of
               -- conflicting presentation information.

     PartySubaddress              ::=  CHOICE    {
                    userSpecifiedSubaddress     UserSpecifiedSubaddress,
                    -- not recommended.
                    nsapSubaddress           NSAPSubaddress,
                    -- according to Recommendation ITU-T X.213.
                    ...                      }

     UserSpecifiedSubaddress      ::=  SEQUENCE  {
                    subaddressInformation       SubaddressInformation,
                    oddCountIndicator       BOOLEAN OPTIONAL,
                    -- used when the coding of subaddress is BCD
                    ...                      }

     NSAPSubaddress          ::=  OCTET STRING (SIZE(1..20))
                    -- specified according to Recommendation ITU-T X.213. Some networks may
                    -- limit the subaddress value to some other length
                    -- e.g., 4 octets

     SubaddressInformation        ::=  OCTET STRING (SIZE(1..20))
                    -- coded according to user requirements. Some networks
                    -- may limit the subaddress value to some other length
                    -- e.g., 4 octets

     PresentationAllowedIndicator ::=  BOOLEAN
     END -- of Addressing-Data-Elements
```

10.2 H225InformationElement

Table 7 defines the ASN.1 type H225InformationElement, the use of which is described in clause 8.

Table 7 – ITU-T H.225 information element

```
H225-generic-parameters-definition
          { itu-t recommendation h 450 1 version2(1) h225-generic-
parameters(6) }

     DEFINITIONS AUTOMATIC TAGS            ::=
     BEGIN

     H225InformationElement  ::=  OCTET STRING

     END -- of H225 Generic parameters definition
```

10.3 General error list

Table 8 contains the definitions of general errors that may be used within ITU-T H.450.x Recommendations.

NOTE – Every operation defined in any ITU-T H.450.x Recommendation lists all permitted error values explicitly. This means that the errors defined here are not automatically part of another ITU-T H.450.x Recommendation. An ITU-T H.450.x Recommendation that uses one of the error values below must import it from the module defined below before it can be used for an operation of ITU-T H.450.x.

Table 8 – ITU-T H.450.1 general error list

```
H4501-General-Error-List
     { itu-t recommendation h 450 1 version2(1) general-error-list (1) }

DEFINITIONS AUTOMATIC TAGS    ::=
BEGIN
IMPORTS  ERROR FROM Remote-Operations-Information-Objects
     { joint-iso-itu-t remote-operations(4) informationObjects(5) version2(1)
};

   -- The following errors are based on the error definitions of Recommendation ITU-T Q.950.

userNotSubscribed             ERROR ::=  {CODE   local:0}
 -- is an indication that the user has not subscribed to this service.

rejectedByNetwork       ERROR ::=  {CODE   local:1}
 -- is an indication that the requested service is rejected by the network
 -- (e.g., gatekeeper).

rejectedByUser          ERROR ::=  {CODE   local:2}
 -- is an indication that the remote user has rejected this service request.

notAvailable                  ERROR ::=  {CODE   local:3}
 -- is an indication that the requested service is not available under the specific circumstances

insufficientInformation      ERROR ::=  {CODE   local:5}
 -- is an indication that the content of operation argument is
 -- incomplete, or absent entirely.

invalidServedUserNumber ERROR ::=  {CODE   local:6}
 -- is an indication that the requested service cannot be performed
 -- because of the usage of an invalid served user number.
```

Table 8 – ITU-T H.450.1 general error list

```
invalidCallState                ERROR ::= {CODE   local:7}
 -- is an indication that the service request is
 -- incompatible with the current Recommendation ITU-T H.225.0 call state

basicServiceNotProvided         ERROR ::= {CODE   local:8}
 -- is an indication that the service request refers to an unsupported
 -- terminal capability.


notIncomingCall                 ERROR ::= {CODE   local:9}
 -- is an indication that the service request has been invoked for an
 -- outgoing call, which is not permitted for that service.

supplementaryServiceInteractionNotAllowed       ERROR ::= {CODE   local:10}
 -- is an indication that the service request is not permitted in
 -- combination with either a further requested or active supplementary
 -- service.

resourceUnavailable             ERROR ::= {CODE   local:11}
 -- is an indication that the service provider has temporarily no
 -- resource available for the provision of the requested service.

callFailure                     ERROR ::= {CODE   local:25}
 -- is an indication that the requested supplementary service was not executable by virtue
 -- of a Basic Call Failure.

proceduralError                 ERROR ::= {CODE   local:43}
 -- is an indication that a received operation APDU is incompatible with the procedural
 -- context in which it is received.

END --  of H4501-General-Error-List
```

11 Manufacturer-specific information

This Recommendation permits the inclusion of non-standardized information which is specific to a particular design of equipment or a particular network, etc. This information is known as manufacturer-specific information (MSI).

Manufacturer-specific information may exist as a result of the following:

– manufacturer-specific supplementary services;

– manufacturer-specific extensions to standard supplementary services.

In both cases, any information which is manufacturer specific shall be encoded in such a way that it can be uniquely identified. Any manufacturer-specific information generated by an entity conforming to this Recommendation shall be encoded in conformance with the contents of this clause.

11.1 Manufacturer-specific operations

Manufacturer-specific operations shall conform to the encoding and transport rules defined for standardized operations in other clauses of this Recommendation, but in addition shall make use of operation values which are unique to that manufacturer – i.e., of type OBJECT IDENTIFIER. If any non-standardized error values are to be included in a manufacturer-specific operation, they shall be of type OBJECT IDENTIFIER.

11.2 Manufacturer-specific additions to standardized operations

As an alternative to the definition of a manufacturer-specific operation, a manufacturer may wish to use an enhanced form of a standardized operation.

NOTE – This may be used, for example, to include additional parameters which are manufacturer specific as part of the standard service (e.g., information describing the detailed location of a party involved in the service).

To allow for this possibility, standards for supplementary services will include "placeholders" for manufacturer-specific extensions within the argument, result, or error parameter of an operation. Each placeholder will be an optional element containing a sequence of zero, one or more elements of type Extension (as defined in Table 9). This placeholder may be included in the ROS APDU if MSI is to be conveyed. An element of type Extension shall contain an element of type OBJECT IDENTIFIER to uniquely identify the MSI.

As an alternative to using the type Extension defined here, the placeholder may be coded using the type NonStandardParameter, as defined in [ITU-T H.225.0].

If the destination entity identifies one or more elements of type Extension or NonStandardParameter in a standardized operation, when processing the contents of a received ITU-T H.450.1 supplementary service APDU in accordance with the relevant supplementary service standard, it shall act on such an element only if it recognizes the identifier value contained in the element (see Table 9 for Extension and [ITU-T H.225.0] for NonStandardParameter). Otherwise, the entire element shall be discarded. In the case of several elements of type Extension or NonStandardParameter (i.e., where multiple extensions to the service are defined), the destination entity shall consider each element separately – that is, only those elements containing an unrecognized identifier value shall be discarded.

Table 9 – Manufacturer-specific extension mechanism

```
Manufacturer-specific-service-extension-definition
 { itu-t recommendation h 450 1 version2(1) msi-definition (18) }


DEFINITIONS AUTOMATIC TAGS  ::=
BEGIN

EXTENSION ::= CLASS
{
     &ArgumentType,
     &extensionId            OBJECT IDENTIFIER
```

Table 9 – Manufacturer-specific extension mechanism

```
}
WITH SYNTAX
{
     ARGUMENT       &ArgumentType
     IDENTIFIER          &extensionId
}

Extension {EXTENSION:ExtensionSet} ::= SEQUENCE
     {
          extensionId              EXTENSION.&extensionId
                                                ({ExtensionSet}),
          extensionArgument        EXTENSION.&ArgumentType
                                                ({ExtensionSet}{@extensionId})
     }

-- ExtensionSet is a set of objects of class EXTENSION.
-- Actual values of ExtensionSet are defined by the individual manufacturers.
-- Element extensionId is constrained to be the identifier of an object from that set.
-- Element extensionArgument is constrained to be the argument type for that particular
-- object.

END  -- of Manufacturer-specific-service-extension-definition
```

12 Object identifiers defined in this Recommendation

This clause lists the object identifier values assigned in this Recommendation and data types, values and object classes that are exported from any modules identified by those values. All the object identifiers are defined using the ITU-T object identifier tree. This means that each object identifier value is assigned in the tree:

gfObjectIdTree OBJECT IDENTIFIER ::= { itu-t recommendation h 450 1 version2(1) }

Table 10 lists the module number values and the data types, values and object classes which are exported from these modules.

Table 10 – ASN.1 Module Object identifiers used in Recommendation ITU-T H.450.1

Object Identifier	Reference
{gfObjectIdTree h4501-facility-information-structure(2)}	Table 3
{gfObjectIdTree remote-operations-apdus(11)}	Table 4
{gfObjectIdTree addressing-data-elements(9)}	Table 6
{gfObjectIdTree h225-generic-parameters(6)}	Table 7
{gfObjectIdTree general-error-list(1)}	Table 8
{gfObjectIdTree msi-definition(18)}	Table 9
NOTE – All data types, values and object classes that are defined within this ASN.1 module are exported.	

Bibliography

[b-ITU-T Q.931] Recommendation ITU-T Q.931 (1998), *ISDN user-network interface layer 3 specification for basic call control*.

[b-ITU-T Q.950] Recommendation ITU-T Q.950 (2000), *Supplementary services protocols, structure and general principles*.

[b-ITU-T X.213] Recommendation ITU-T X.213 (2001) | ISO/IEC 8348:2002, *Information technology – Open Systems Interconnection – Network service definition*.

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