



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.450.1

(02/98)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Supplementary services for multimedia

**Generic functional protocol for the support of
supplementary services in H.323**

ITU-T Recommendation H.450.1

(Previously CCITT Recommendation)

ITU-T H-SERIES RECOMMENDATIONS
AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Characteristics of transmission channels used for other than telephone purposes	H.10–H.19
Use of telephone-type circuits for voice-frequency telegraphy	H.20–H.29
Telephone circuits or cables used for various types of telegraph transmission or simultaneous transmission	H.30–H.39
Telephone-type circuits used for facsimile telegraphy	H.40–H.49
Characteristics of data signals	H.50–H.99
CHARACTERISTICS OF VISUAL TELEPHONE SYSTEMS	H.100–H.199
INFRASTRUCTURE OF AUDIOVISUAL SERVICES	
General	H.200–H.219
Transmission multiplexing and synchronization	H.220–H.229
Systems aspects	H.230–H.239
Communication procedures	H.240–H.259
Coding of moving video	H.260–H.279
Related systems aspects	H.280–H.299
Systems and terminal equipment for audiovisual services	H.300–H.399
Supplementary services for multimedia	H.450–H.499

For further details, please refer to ITU-T List of Recommendations.

ITU-T RECOMMENDATION H.450.1

GENERIC FUNCTIONAL PROTOCOL FOR THE SUPPORT OF SUPPLEMENTARY SERVICES IN H.323

Summary

This Recommendation describes the procedures and the signalling protocol between 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 H.323 supplementary services.

Detailed procedures applicable to individual supplementary services are specified by other Recommendations of the 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).

Source

ITU-T Recommendation H.450.1 was prepared by ITU-T Study Group 16 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 6th of February 1998.

FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 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.

INTELLECTUAL PROPERTY RIGHTS

The ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. The ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, the ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

© ITU 1998

All rights reserved. No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the ITU.

CONTENTS

	Page
1	Scope 1
2	References 1
3	Terms and definitions 2
4	Abbreviations and acronyms 2
5	General principles 3
6	Procedures for the transport of APDUs 3
6.1	Call related procedures 3
6.2	Call independent procedures 3
6.3	Sending the H.450.1 Supplementary Service APDU 4
6.4	Receiving the H.450.1 Supplementary Service APDU 4
6.5	Actions at a source entity 5
6.6	Actions at a destination entity 5
7	Messages 6
7.1	Overview 6
7.2	SETUP 6
8	H.450.1 Supplementary Service APDU 7
8.1	Network Facility Extension (NFE) 8
8.2	Interpretation APDU 9
8.3	ROS APDUs 9
9	Encoding of information described using ASN.1 14
10	ASN.1 definitions of generic parameters 14
10.1	Addressing information 14
10.2	H225InformationElement 16
10.3	General error list 16
11	Manufacturer specific information 17
11.1	Manufacturer specific operations 18
11.2	Manufacturer specific additions to standardized operations 18
12	Object identifiers defined in this Recommendation 19

Recommendation H.450.1

GENERIC FUNCTIONAL PROTOCOL FOR THE SUPPORT OF SUPPLEMENTARY SERVICES IN H.323

(Geneva, 1998)

1 Scope

This Recommendation defines the signalling protocol between H.323 entities for the control of supplementary services. Detailed procedures applicable to individual supplementary services are specified by other Recommendations of the 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 the Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all 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.

- ITU-T Recommendation H.225.0 (1998), *Call signalling protocols and media stream packetization for packet-based multimedia communications systems*.
- ITU-T Recommendation H.245 (1998), *Control protocol for multimedia communication*.
- ITU-T Recommendation H.323 (1998), *Packet-based multimedia communications systems*.
- CCITT Recommendation I.112 (1998), *Vocabulary of terms for ISDNs*.
- ITU-T Recommendation I.210 (1993), *Principles of telecommunication services supported by an ISDN and the means to describe them*.
- ITU-T Recommendation X.680 (1994) | ISO/IEC 8824-1:1996, *Information technology – Abstract Syntax Notation One (ASN.1) – Specification of basic notation*.
- ITU-T Recommendation X.680/Amd.1 (1995) | ISO/IEC 8824-1/Amd.1:1995, *Information technology – Abstract Syntax Notation One (ASN.1) – Specification of basic notation – Amendment 1: Rules of extensibility*.
- ITU-T Recommendation X.681/Amd.1 (1995) | ISO/IEC 8824-2/Amd.1:1995, *Information technology – Abstract Syntax Notation One (ASN.1) – Information Object Specification – Amendment 1: Rules of extensibility*.
- ITU-T Recommendation X.691 (1995) | ISO/IEC 8825-2:1995, *Information technology – ASN.1 encoding rules – Specification of Packed Encoding Rules (PER)*.
- ITU-T Recommendation X.880 (1994) | ISO/IEC 13712-1:1995, *Information technology – Remote Operations: Concepts, model and notation*.

- ISO/IEC 11582:1995, *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

This Recommendation defines the following terms:

- 3.1 Application Protocol Data Unit (APDU):** A sequence of data elements exchanged between peer application layer entities, e.g. ROS APDUs.
- 3.2 call independent:** A property of information which is conveyed in a message which does not use the call reference of a call.
- 3.3 call independent signalling connection:** A signalling connection established between SS-Control entities located in different H.323 entities for the exchange of call independent signalling information.
- 3.4 call related:** A property of information which is conveyed in a message which uses the call reference of a call.
- 3.5 destination entity:** In the context of a single one-way exchange of information between two SS-Control entities, the H.323 entity where the receiving SS-Control entity is located.
- 3.6 H.323 entity:** See Recommendation H.323.
- 3.7 H.450.1 supplement service APDU:** A specific APDU defined by this Recommendation.
- 3.8 interpretation APDU:** A specific APDU defined by this Recommendation.
- 3.9 invocation:** A request by a SS-Control entity to perform an operation in a remote SS-Control entity.
- 3.10 mistyped:** A property of an APDU whose structure does not conform to the structure defined in this Recommendation or the structure defined for a particular supplementary service.
- 3.11 object identifier:** See Recommendation X.680.
- 3.12 ROS APDU:** An APDU defined by the Remote Operations Service (ROS).
- 3.13 service:** See Recommendation I.112.
- 3.14 signalling:** See Recommendation I.112.
- 3.15 source entity:** In the context of a single one-way exchange of information between two SS-Control entities, the H.323 entity where the sending SS-Control entity is located.
- 3.16 supplementary service:** Subclause 2.4/I.210 shall apply.
- 3.17 Supplementary Service Control (SS-Control) entity:** An entity that exists within an H.323 entity and provides the procedures associated with the support of a particular supplementary service.
- 3.18 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
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 H.450.x-Series or may be manufacturer-specific.

The generic functional protocol operates in conjunction with the call signalling protocol defined in Recommendation H.225.0.

The generic functional protocol provides mechanisms for the support of supplementary services which relate to existing H.323 calls or are entirely independent of any existing 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 Recommendation H.323 is defined in 8.3 and based on Recommendation X.880.

6 Procedures for the transport of APDUs

6.1 Call related procedures

For the call related transport of H.450.1 Supplementary Service 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 6.3 and 6.4.

Gatekeeper procedures and RAS messages as defined in Recommendation H.225.0 shall apply to calls that transport H.450.1 Supplementary Service APDUs.

6.2 Call independent procedures

For the call independent transport of H.450.1 Supplementary Service APDUs, the call signalling procedures of 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 7.2 below. No 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 6.3 and 6.4.

Gatekeeper procedures and RAS messages as defined in Recommendation H.225.0 shall also apply to call independent procedures.

6.3 Sending the H.450.1 Supplementary Service APDU

The 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 H.450.1 Supplementary Service APDU (see 7.1 and Recommendation H.225.0) is to be sent in the context of a call or a call independent signalling connection, the H.450.1 Supplementary Service APDU shall be included in that message;
- otherwise, the 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 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 H.225.0 call state.

6.4 Receiving the H.450.1 Supplementary Service APDU

An entity receiving an H.450.1 Supplementary Service APDU in a valid call clearing or call establishment message (see 7.1 and Recommendation H.225.0) or a FACILITY message shall determine whether or not it is the destination entity for that H.450.1 Supplementary Service APDU, according to the following rules:

- If no 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 H.450.1 Supplementary Service APDU may become the destination entity for that 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 H.450.1 Supplementary Service APDU.

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

If the receiving entity is not the destination entity, the H.450.1 Supplementary Service APDU shall be passed on if possible according to the rules of 6.3; otherwise, the H.450.1 Supplementary Service APDU shall be discarded.

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

6.5 Actions at a source entity

APDUs to be sent shall be included in H.450.1 Supplementary Service APDUs as specified in clause 8. An H.450.1 Supplementary Service APDU may contain more than one ROS APDU. All ROS APDUs within a single 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 8.3) at a destination entity, it shall include an Interpretation APDU (see 8.2) as the first APDU in the sequence of APDUs. The Interpretation APDU applies to all invoke APDUs included in this H.450.1 Supplementary Service APDU.

An NFE (see 8.1) shall be included in the 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 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 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 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 rejectUnrecognizedInvokePdu 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 H.450.1 Supplementary Service APDUs, including those already defined in Recommendation H.225.0.

Table 1/H.450.1 – Messages used for the transport of APDUs

<i>Call establishment messages</i>	<i>Reference</i>
ALERTING	H.225.0
CALL PROCEEDING	H.225.0
CONNECT	H.225.0
SETUP	Subclause 7.2
<i>Call clearing messages</i>	
RELEASE COMPLETE	H.225.0
<i>Miscellaneous messages</i>	
FACILITY	H.225.0
PROGRESS	H.225.0

7.2 SETUP

Recommendation 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 6.2).

Table 2/H.450.1 – Bearer capability coding for call independent signalling connections

<i>Coding standard (octet 3)</i>	
Bit	
s	
<u>7 6</u>	
0 1	Other international standard (Note)
<i>Information transfer capability (octet 3) for coding standard "other international standard"</i>	
Bit	
s	
<u>5 4 3 2 1</u>	
0 1 0 0 0	Unrestricted digital information
All other values are reserved	
<i>Transfer mode (octet 4) for coding standard "other international standard"</i>	
Bit	
s	
<u>7 6</u>	
0 0	Call independent signalling connection
All other values are reserved	

Table 2/H.450.1 – Bearer capability coding for call independent signalling connections (concluded)

<i>Information transfer rate (octet 4, bits 5 to 1) for coding standard "other international standard"</i>	
Bit	
s	
<u>5 4 3 2 1</u>	
0 0 0 0	Call independent signalling connection
All other values are reserved	
NOTE – When this coding standard is indicated, the coding defined in Recommendation 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 6.2) shall include a conferenceGoal within Setup-UUIE set to value "callIndependentSupplementaryService".

8 H.450.1 Supplementary Service APDU

The H.450.1 Supplementary Service APDU shall be included in the User-user information element, as specified in Recommendation H.225.0.

This clause defines the structure and coding of the H.450.1 Supplementary Service APDU. The purpose of the H.450.1 Supplementary Service APDU is to convey an optional Interpretation APDU and one or more ROS APDUs.

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

The H.450.1 Supplementary Service APDU may be repeated in a given User-user information element.

The maximum length of the H.450.1 Supplementary Service APDU is application dependent, subject to the maximum overall length of the User-user information element (see Recommendation H.225.0). The H.450.1 Supplementary Service APDU is defined in Table 3.

Table 3/H.450.1 – H.450.1-Supplementary Service APDU Structure

```

H4501-Supplementary-ServiceAPDU-Structure
  {itu-t recommendation h 450 1 version1(0) h4501-facility-information-structure(2)}
  DEFINITIONS AUTOMATIC TAGS ::=
  BEGIN
  IMPORTS
    AliasAddress FROM H323-MESSAGES -- see H.225.0 V2
    OPERATION, ROS{}, InvokeId FROM Remote-Operations-APDUs
    {itu-t recommendation h 450 1 version1(0) remote-operations-apdus(11)};

  H4501SupplementaryService ::= SEQUENCE
    {
      networkFacilityExtension NetworkFacilityExtension OPTIONAL, -- see 8.1
      interpretationAdu InterpretationAdu OPTIONAL, -- see 8.2
      serviceAdu ServiceAdu, -- 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

  InterpretationAdu ::= 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.
      ...
    }

  ServiceAdu ::= CHOICE
    {
      rosAdu SEQUENCE SIZE (1..MAX) OF ROS{{InvokeIdSet}, {OperationSet}, {OperationSet}},
      -- see 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. 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 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 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 serviceA pdu of the H.450.1 Supplementary Service APDU.

8.3 ROS APDUs

ASN.1 type ServiceA pdus, 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 Recommendation 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 Recommendation 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 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 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 10.2.

Table 4/H.450.1 – ROS APDUs

```

Remote-Operations-APDUs
{ itu-t recommendation h 450 1 version1(0) 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) version1(0)};
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-unrecognizedLinkId)
                        (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-unexpectedLinkIdOperation)
    }
)

```


Table 4/H.450.1 – ROS APDUs (continued)

```

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/H.450.1 – ROS APDUs (*concluded*)

	{	unrecognizedComponent (0), mistypedComponent (1), badlyStructuredComponent (2)	
	}		
InvokeProblem	::=	INTEGER	
	{	duplicateInvocation (0), unrecognizedOperation (1), mistypedArgument (2), resourceLimitation (3), releaseInProgress (4), unrecognizedLinkId (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-unrecognizedLinkId (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			

Table 5/H.450.1 – 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 Recommendation X.680, etc.
Invoke problem:	
– duplicatedInvocation	signifies that the Invoked-identifier parameter violates the assignment rules of Recommendation 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.
– unrecognizedLinkId	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 H.225.0 User-user information element (i.e. basic aligned variant of the packed encoding rules as specified in Recommendation 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 Recommendation H.225.0.

Table 6/H.450.1 – Addressing information definitions

Addressing-Data-Elements	
{ itu-t recommendation h 450 1 version1(0) addressing-data-elements(9)}	
DEFINITIONS AUTOMATIC TAGS ::=	
BEGIN	
IMPORTS AliasAddress, PartyNumber FROM H323-MESSAGES; -- see 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/H.450.1 – Addressing information definitions (concluded)

```

-- PartyNumber defined in Recommendation H.225.0
-- PublicPartyNumber defined in Recommendation H.225.0
-- PrivatePartyNumber defined in Recommendation H.225.0
-- NumberDigits defined in Recommendation H.225.0
-- PublicTypeOfNumber defined in Recommendation H.225.0
-- PrivateTypeOfNumber defined in Recommendation H.225.0

EndpointAddress ::= SEQUENCE{
  destinationAddress SEQUENCE OF AliasAddress,
    -- multiple alias addresses may be used to address the same H.323 endpoint
  remoteExtensionAddress AliasAddress OPTIONAL,
  ...
}

PartySubaddress ::= CHOICE {
  userSpecifiedSubaddress UserSpecifiedSubaddress,
    -- not recommended.
  nsapSubaddress NSAPSubaddress,
    -- according to Recommendation 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 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

ScreeningIndicator ::= ENUMERATED {
  userProvidedNotScreened (0),
    -- number was provided by a remote user
    -- , and has not been screened by a gatekeeper
  userProvidedVerifiedAndPassed (1),
    -- number was provided by a user
    -- equipment (or by a remote network), and has
    -- been screened by a gatekeeper
  userProvidedVerifiedAndFailed (2),
    -- not used, value reserved.
  networkProvided (3),
    -- number was provided by a gatekeeper
  ...
}

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/H.450.1 – H.225 information element

<pre>H225-generic-parameters-definition { itu-t recommendation h 450 1 version1(0) h225-generic-parameters(6) } DEFINITIONS AUTOMATIC TAGS ::= BEGIN H225InformationElement ::= OCTET STRING END -- of H225 Generic parameters definition</pre>
--

10.3 General error list

Table 8 contains the definitions of Errors used within H.450.x Recommendations.

Table 8/H.450.1 – H.450.1 General Error List

<pre>H4501-General-Error-List { itu-t recommendation h 450 1 version1(0) general-error-list (1) } DEFINITIONS AUTOMATIC TAGS ::= BEGIN IMPORTS ERROR FROM Remote-Operations-Information-Objects { joint-iso-itu-t remote-operations(4) informationObjects(5) version1(0) }; -- The following errors are based on the error definitions of Recommendation 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 requested service is provided by the -- network but that the remote user has rejected this service request. NotAvailable ERROR ::= {CODE local:3} -- is an indication that the user has subscribed to this service but the -- requested service is not available combined with the basic service or -- the other services (e.g. operation). 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.</pre>

Table 8/H.450.1 – H.450.1 General Error List (concluded)

InvalidCallState	ERROR ::= {CODE local:7} <i>-- is an indication that no match exists between the service request and -- the valid H.225.0 call state, this applies also to invalid -- auxiliary states or an invalid combination of H.225.0 call states and -- auxiliary states.</i>
BasicServiceNotProvided	ERROR ::= {CODE local:8} <i>-- is an indication that the service request is directed to a Basic -- Service which is not provided (e.g. this return error value is used -- in cases where a supplementary service is to be invoked with a SETUP -- message but indicating the wrong Basic Service).</i>
NotIncomingCall	ERROR ::= {CODE local:9} <i>-- is an indication that the service request has been invoked for an -- outgoing call, which is not permitted for that service.</i>
SupplementaryServiceInteractionNotAllowed	ERROR ::= {CODE local:10} <i>-- is an indication that the Service request is not permitted in -- combination with either a further requested or active supplementary -- service.</i>
ResourceUnavailable	ERROR ::= {CODE local:11} <i>-- is an indication that the service provider has temporarily no -- resource available for the provision of the requested service.</i>
CallFailure	ERROR ::= {CODE local:25} <i>-- is an indication that the requested supplementary service was not executable by virtue -- of a Basic Call Failure. The parameter is included under circumstances where the -- call failure was remote from the local gatekeeper interface over which the error is to -- be sent. For example when: -- a) no H.225.0 RELEASE COMPLETE message is provided locally, or -- b) the cause information element included in the RELEASE COMPLETE -- message represents only the reason for local basic call clearing. -- In these cases the parameter value represents the clearing cause included in the -- remote clearing procedure.</i>
ProceduralError	ERROR ::= {CODE local:43} <i>-- is an indication that a transport message (e.g. SETUP) -- is received which has one or more operation APDUs which have a valid -- content but which are not specified as valid information content of -- the transport message used.</i>
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 Recommendation 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 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 Recommendation 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/H.450.1 – Manufacturer specific extension mechanism

<pre>Manufacturer-specific-service-extension-definition { itu-t recommendation h 450 1 version1(0) msi-definition (18) } DEFINITIONS AUTOMATIC TAGS ::= BEGIN EXTENSION ::= CLASS { &ArgumentType, &extensionId OBJECT IDENTIFIER</pre>
--

Table 9/H.450.1 – Manufacturer specific extension mechanism (concluded)

```

}
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 version1(0) }

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

Table 10/H.450.1 – ASN.1 Module Object identifiers used in Recommendation 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.	

ITU-T RECOMMENDATIONS SERIES

Series A	Organization of the work of the ITU-T
Series B	Means of expression: definitions, symbols, classification
Series C	General telecommunication statistics
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	Transmission systems and media, digital systems and networks
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	Transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	Construction, installation and protection of cables and other elements of outside plant
Series M	TMN and network maintenance: international transmission systems, telephone circuits, telegraphy, facsimile and leased circuits
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Telephone transmission quality, telephone installations, local line networks
Series Q	Switching and signalling
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	Data networks and open system communications
Series Y	Global information infrastructure
Series Z	Programming languages