INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.323

Annex P

(01/2003)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Systems and terminal equipment for audiovisual services

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Packet-based multimedia communications systems

Annex P: Transfer of modem signals over H.323

ITU-T Recommendation H.323 – Annex P

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ITU-T Recommendation H.323

Packet-based multimedia communications systems

Annex P

Transfer of modem signals over H.323

Summary

This annex defines the signalling procedures to facilitate the transfer of modem signals over H.323-based networks, including the advertisement of capabilities and specific procedures for opening and closing channels that support the transport of modem signals over IP networks. Modem signals may be carried over a packet-based network using either a voice-band data channel or a modem relay channel.

Source

Annex P to ITU-T Recommendation H.323 was prepared by ITU-T Study Group 16 (2001-2004) and approved under the WTSA Resolution 1 procedure on 13 January 2003.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. 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 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.

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As of the date of approval of this Recommendation, ITU had 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.

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Transfer of modem signals over H.323

P.1 Scope

The purpose of this annex is to describe the procedures for transferring modem signalling over an H.323-based network. The signalling procedures describe the use of H.245 (including Fast Connect and Extended Fast Connect), State Signalling Events (SSEs) to signal endpoint capabilities, to open and close logical channels, and to signal state changes. H.323 entities that support the carriage of modem signals of IP networks shall provide that functionality in accordance with this Annex.

P.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.

[1] ITU-T Recommendation V.150.1 (2003), *Modem-over IP networks: Procedures for the end-to-end connection of V-series DCEs*.

[2] ITU-T Recommendation H.460.6 (2002), *Extended Fast Connect feature*.

[3] ISOC/IETF RFC 2198:1997, *RTP Payload for Redundant Audio Data*.

P.3 Definitions

This Recommendation defines the following terms:

P.3.1 modem over IP: The transport of modem signals over an IP network as described in ITU-T Rec. V.150.1.

P.3.2 modem relay: The transportation of modem data across a packet network using modem termination at the network access points.

P.3.3 state signalling event: RTP-encoded event messages that coordinate switching between different media states as defined in Annex C/V.150.1.

P.3.4 voice band data: The transport of modem signals over an audio channel of a packet network with the encoding appropriate for modem signals.

P.4 Abbreviations

This Recommendation uses the following abbreviations:

FEC Forward Error Correction

MoIP Modem over IP

MPS Multiple Payload Stream

OLC Open Logical Channel

RTP Real Time Protocol

SPRT Simple Packet Relay Transport

SSE State Signalling Event

VBD Voice Band Data

P.5 Introduction

H.323 systems have been widely deployed throughout the world for the carriage of audio, video, and data traffic over packet-based networks, including IP networks. One of the applications of H.323 has been for transiting audio calls between two disjoint circuit-switched networks or two points on the same circuit-switched network. In such an application, the call is originated in a circuit-switched network and delivered to an H.323 Gateway. This Gateway then establishes communication with a remote Gateway that, in turn, delivers the call to a circuit-switched network.

In such applications, it is desirable to also allow calls between Gateways to be data calls, rather than audio or video calls only. Annex D/H.323 introduced the signalling procedures necessary to facilitate the transport of facsimile data over an IP-based network between Gateways and other devices. The focus of this annex is to specify the procedures for transporting modem data over an IP-based network between two Gateways.

Figure P.1 graphically depicts H.323 Gateways that carry modem signals between modems over an IP network.

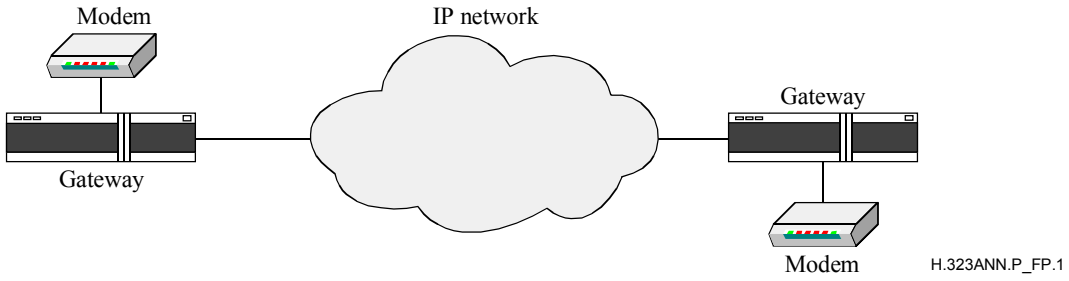

Figure P.1/H.323 – Typical modem over IP application

ITU-T Rec. V.150.1 defines the general procedures for carrying modem signals over IP-based networks between two Gateways and should be read in conjunction with this annex. Whereas ITU-T Rec. V.150.1 does not define the carriage of modem signals within the context of any particular call control protocol, this annex defines the procedures that are necessary and particular to H.323.

Unless explicitly stated otherwise, references to H.323 endpoints throughout the remainder of this annex are to endpoints that are capable of carrying modem signals over an IP network.

P.6 Capability advertisement

As usual, endpoints advertise their capabilities using the **terminalCapabilitySet** message in H.245. The capabilities that are of particular importance and required for the application of modem over IP are the MoIP and SSE data application capabilities (defined in Annex F/V.150.1), RTP audio telephony events (see B.2.2.13/H.245), and the **vbd** audio capability. The **fecCapability** and/or **redundancyEncodingCapability** capabilities may be supported in order to improve the reliability of Voice Band Data (VBD) channel.

Endpoints shall also advertise support for the **multiplePayloadStream** (MPS) in the capability set transmitted to the other endpoint.

The MoIP and SSE capability definitions are in Annex F/V.150.1.

In accordance with ITU-T Rec. V.150.1, the list of codecs supported as VBD codecs shall include G.711 μ-law and A-law. Further, H.323 endpoints shall support G.711 for VBD at 64 kbit/s and, optionally, at 56 kbit/s.

P.7 Call establishment

Because of the time-critical nature of modem signalling, the calling endpoint should use the Fast Connect procedure to offer one or more channels suitable for MoIP operation. The calling endpoint should also include its terminal capabilities in the **parallelH245Control** field in order to facilitate the rapid negotiation of MoIP-related channels.

Likewise, the called endpoint should return a Fast Connect reply as quickly as possible. This reply may be an acceptance or a refusal of the offered channels. Additionally, if the **parallelH245Control** field is present in the Setup message, the called endpoint should acknowledge the receipt of that information as specified in 8.2.4/H.323.

In the case that media cannot be negotiated through Fast Connect for any reason, the endpoints shall begin logical channel signalling via the H.245 Control Channel as quickly as possible. Again, the implementor is cautioned about the time critical nature of MoIP and is encouraged to initiate this signalling well before the transmission of the Connect message.

P.8 Logical channel signalling

There are five types of streams of particular importance to an endpoint that supports MoIP. Those streams are: an audio stream, a VBD stream, RTP audio telephony events, State Signalling Events (SSEs), and an SPRT stream. An endpoint shall logically group streams necessary for MoIP together via an MPS channel. One exception to this requirement is that the SPRT stream may be signalled as a separate channel and associated to the audio/VBD channel using the **associatedSessionID** field.

Within the context of a MoIP session, the MPS channel that contains the audio and/or VBD streams and other streams for MoIP should be considered the primary audio session. As such, the H.245 **sessionID** should be set to 1. However, endpoints are at liberty to use dynamic session ID values, as prescribed by ITU-T Rec. H.245.

While there are no strict limitations on the number of streams that may be contained within any MPS channel, the MPS channel used for MoIP shall contain no more than one audio stream, no more than one VBD stream, no more than one SSE stream, and no more than one SPRT stream. If the SPRT stream is opened as a separate channel, the MPS channel shall not also include an SPRT stream. In addition, there may be one payload type for normal audio, one for the VBD stream, one for the SSE stream, and one for the SPRT stream. It is possible that more than four payload types may be utilized for those four streams. For example, if the VBD stream is protected with Forward Error Correction (FEC), and if those FEC packets are contained within a Redundancy Encoding packet, there may be not just one payload type value for the VBD stream, but three: one used in the RTP header to signify that the packet contains a redundantly encoded payload, one for the primary payload (the VBD data), and one for the FEC data carried as the secondary encoding.

To optionally protect the VBD stream, an endpoint may utilize forward error correction and/or redundancy encoding. A stream that utilizes forward error correction shall be signalled via the **fec** field of the **DataType** structure within the **MultiplePayloadStreamElement** structure. A stream that utilizes redundancy encoding shall be signalled via the **redundancyEncoding** field in the **DataType** structure within the **MultiplePayloadStreamElement** structure.

To illustrate the usage of the MPS for MoIP, consider an OLC that has a G.729 audio stream, a G.711 A-law VBD stream that is protected with redundancy encoding, an SSE stream, and an SPRT stream. The **OpenLogicalChannel** would essentially have a composition similar to that shown in this abbreviated example:

```
{
  forwardLogicalChannelNumber 1,
  forwardLogicalChannelParameters {
     dataType : multiplePayloadStream {
         element {
            dataType : audioData : g729 2
         },
         element {
            dataType : redundancyEncoding {
              primary {
                   dataType : audioData : vbd : g711Alaw64k 160
              },
              secondary {
                   dataType : audioData : vbd : g711Alaw64k 160
                   payloadType 97 -- The PT for the redundant encoding
              }
            },
            payloadType 101 -- The PT for the RFC 2198 packet
         },
         element {
            dataType : data {
              application : genericDataCapability {
                   -- SSE capability
                   capabilityIdentifier : standard {
                        itu-t(0) recommendation(0) v(22) 150 sse(1)
                   },
                   nonCollapsing {
                        {
                             parameterIdentifier : standard 0,
                             parameterValue : octetString "3,5"
                                  -- A comma-separated string
                                  -- of supported events (this string
                                  -- illustration of syntax and is not
                                  -- necessarily an appropriate list)
                        },
                        {
                             parameterIdentifier : standard 1,
                             parameterValue : logical
                   }
              }
            }
         },
         payloadType 102      -- The PT for the SSE packets
     },
     element {
         dataType : data {
            application : genericDataCapability {
              -- MoIP capability
              capabilityIdentifier : standard {
                   itu-t(0) recommendation(0) v(22) 150 moip(0)
                   major-version-one(1) minor-version-one(1)
              },
              nonCollapsingRaw '0000'H
                   -- This value shown is only presented
                   -- for illustration and is not
                   -- a valid value
            }
         },
```

```
            payloadType 103      -- The PT for the MoIP packets
          }
        }
      },
      multiplexParameters : h2250LogicalChannelParameters {
        sessionID 1
      }
  }
```

P.8.1 Extended fast connect

Extended Fast Connect [2] should be used in order to reconfigure logical channels, as it is much faster than exchanging a series of H.245 messages. If an endpoint needs to transition from audio operation to MoIP operation and does not presently have an open channel suitable for usage with MoIP, it should first attempt to reconfigure channels using Extended Fast Connect.

Extended Fast Connect should also be the first preference for logical channel signalling even when existing channels do support MoIP. For example, if the endpoint wishes to exchange the G.729 audio codec within an MPS with the G.723.1 audio codec, it should attempt to reconfigure the logical channels via Extended Fast Connect, as opposed to using H.245 signalling.

P.8.2 H.245 signalling

H.245 logical channel signalling via the H.245 Control Channel may be employed to configure or reconfigure media streams as necessary. MoIP-capable endpoints shall support H.245 Tunnelling when there is a need to utilize an H.245 Control Channel. However, it should be understood that support for H.245 Tunnelling does not guarantee that it will be utilized and that a separate connection may be necessary, though discouraged.

While signalling the opening of new channels is typically not an issue for H.323 endpoints, the possibility does exist that two endpoints may attempt to open channels independently which results in an incompatible configuration. To resolve such issues, the master shall reject the OLC proposals from the slave device with the reason **masterSlaveConflict**. The master should then send a **RequestMode** message to the slave device to propose a compatible mode of operation.

If an endpoint determines that it is necessary to switch modes of operation, for example, to switch from audio-only mode to a mode that supports MoIP, the endpoint shall send a **RequestMode** message to the other endpoint. For example, assume that two endpoints open G.729 audio in each direction and, then one endpoint determines a need to change the mode of operation from audio to MoIP. The endpoint shall send a **RequestMode** message over the H.245 Control Channel indicating the desired mode of operation. The receiving endpoint shall respond with an acknowledgement or a rejection message, as appropriate, but it should make every effort to accept the requested mode of operation. The endpoints should exchange messages in a manner similar to that shown in Figure P.2. As much as possible, messages should be exchanged in parallel to reduce mode transition delays.

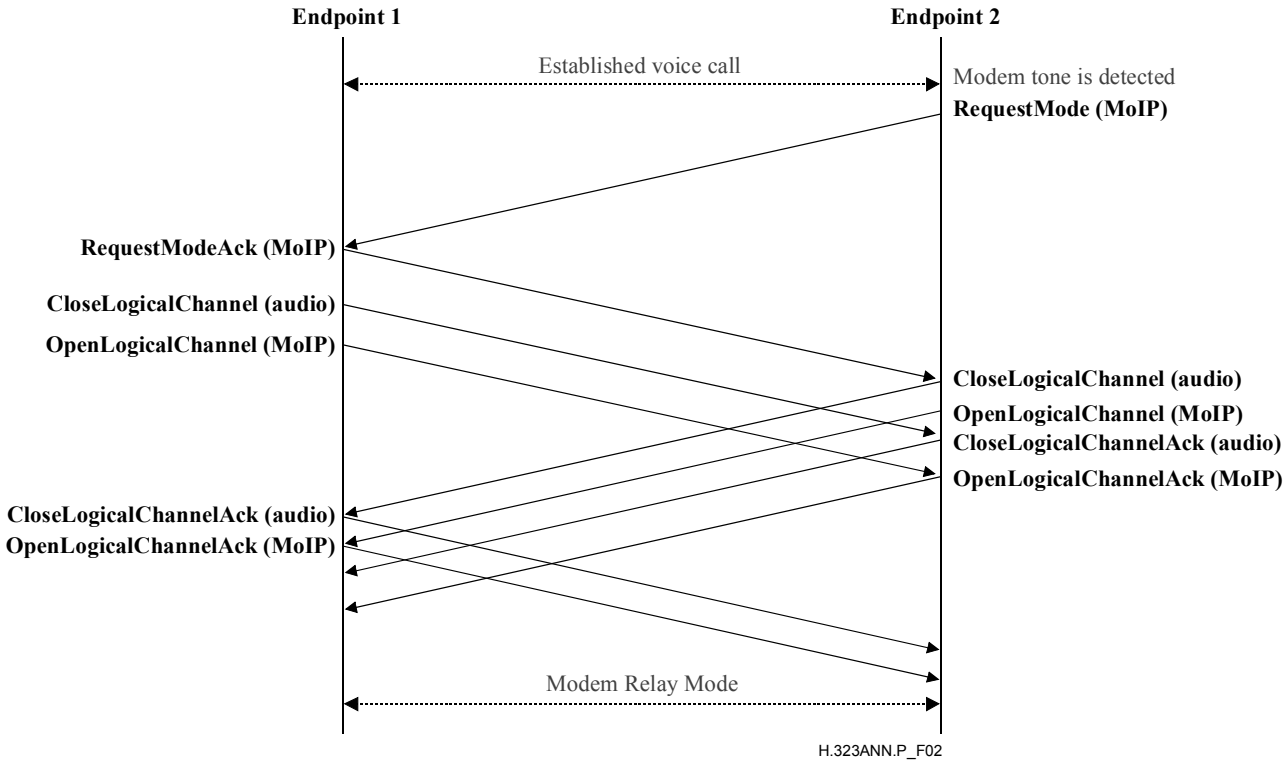

Figure P.2/H.323 – Successful switch between audio and MoIP modes

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