INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.246

(02/98)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Communication procedures

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Interworking of H-Series multimedia terminals with H-Series multimedia terminals and voice/voiceband terminals on GSTN and ISDN

ITU-T Recommendation H.246

(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

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

ITU-T RECOMMENDATION H.246

INTERWORKING OF H-SERIES MULTIMEDIA TERMINALS WITH H-SERIES MULTIMEDIA TERMINALS AND VOICE/VOICEBAND TERMINALS ON GSTN AND ISDN

Summary

This Recommendation describes Gateways which provide protocol interworking between H-Series multimedia terminals and other H-Series multimedia terminals, voice/voiceband terminals on GSTN or ISDN, V.70 terminals on the GSTN, and multi-call applications on the GSTN. H.246 Gateways provide the required translation of control and media streams to allow interworking between terminals running different protocols.

Source

ITU-T Recommendation H.246 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.

CONTENTS

Recommendation H.246

INTERWORKING OF H-SERIES MULTIMEDIA TERMINALS WITH H-SERIES MULTIMEDIA TERMINALS AND VOICE/VOICEBAND TERMINALS ON GSTN AND ISDN

(Geneva, 1998)

1 Scope

This Recommendation describes Gateways which provide protocol interworking between H-Series multimedia terminals and other H-Series multimedia terminals, voice/voiceband terminals on GSTN or ISDN, V.70 terminals on the GSTN, and multi-call applications on the GSTN. H.246 Gateways provide the required translation of control and media streams to allow interworking between terminals running different protocols.

The interworking of the H-Series protocols H.323, H.320, H.324, H.324 Mobile, and H.310 with the network acting transparently are covered in this Recommendation as shown in Figures 1 to 3. The interworking of H-Series protocols with voice/voiceband GSTN or ISDN terminals is covered in this Recommendation and involves the interconnection of regular telephone equipment with H-Series protocols in both the call originate and call answer applications. This includes interaction with IP-based telephony which is H.323-based. The interworking of H-Series protocols and multi-call applications on the GSTN is covered in this Recommendation and involves an H-Series protocol interacting with several calls simultaneously on a single GSTN line.

This Recommendation specifies interworking requirements with respect to call control, system control, and media flow between multimedia and voice/voiceband terminals.

The body of this Recommendation document provides a general overview of the Recommendation and specifies any mappings which are applicable to more than one interworking scenario. Specifications of specific interworking scenarios such as H.323 to H.320 are covered in individual Annexes.

The H-Series interworking scenarios which are planned to be part of this Recommendation are summarized in Table 1. Additional interworking scenarios are described in Table 2.

Table 1/H.246 – Annex name of H-Series interworking

	H.320[a)]	**H.324**	**H.310**[b)]	**H.324 Mobile**
H.323	A	TBA	TBA	TBA
H.320[a)]	NA	TBA	TBA	TBA
H.324	NA	NA	TBA	TBA
H.310[b)]	NA	NA	NA	TBA

NA Not Applicable
TBA Annex designator To Be Assigned

a) H.321 and H.322 will be covered in the H.320 Annexes.
b) H.310 RAST-1 and RAST-5 terminals will be covered in the H.310 Annexes.

Table 2/H.246 – Annex name of H-Series interworking with Voice/Voiceband terminals on GSTN and ISDN

	Voice/Voiceband terminal on GSTN	Voice/Voiceband only terminal on ISDN
H.323	B	TBA
H.320[a)]	TBA	TBA
H.324	TBA	TBA
H.310[b)]	TBA	TBA
H.324 Mobile	TBA	TBA

TBA Annex designator To Be Assigned

a) H.321 and H.322 will be covered in the H.320 Annexes.

b) H.310 RAST-1 and RAST-5 terminals will be covered in the H.310 Annexes.

Figures 1 through 3 show the H-Series call control, system control, and media flow interworking which is specified in this Recommendation.

Voice/Voiceband terminals on GSTN use the appropriate national standards for call control and G.711 or analogue signals for voice. Voice/Voiceband terminals on ISDN use the appropriate national variant of Q.931 for call control and G.711 for voice.

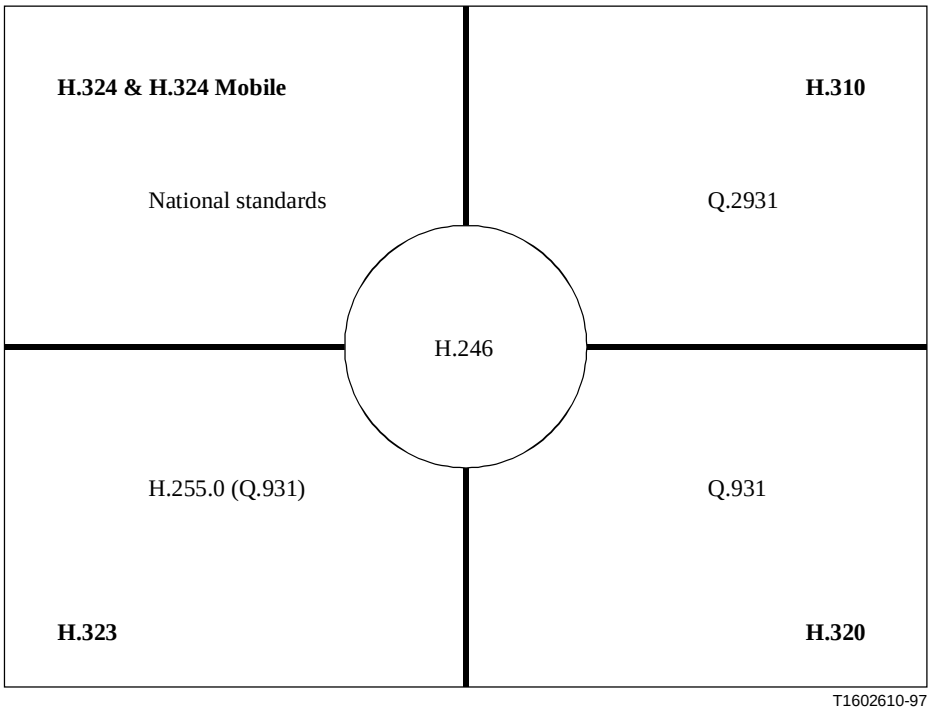

Figure 1/H.246 – H-Series call control interoperability

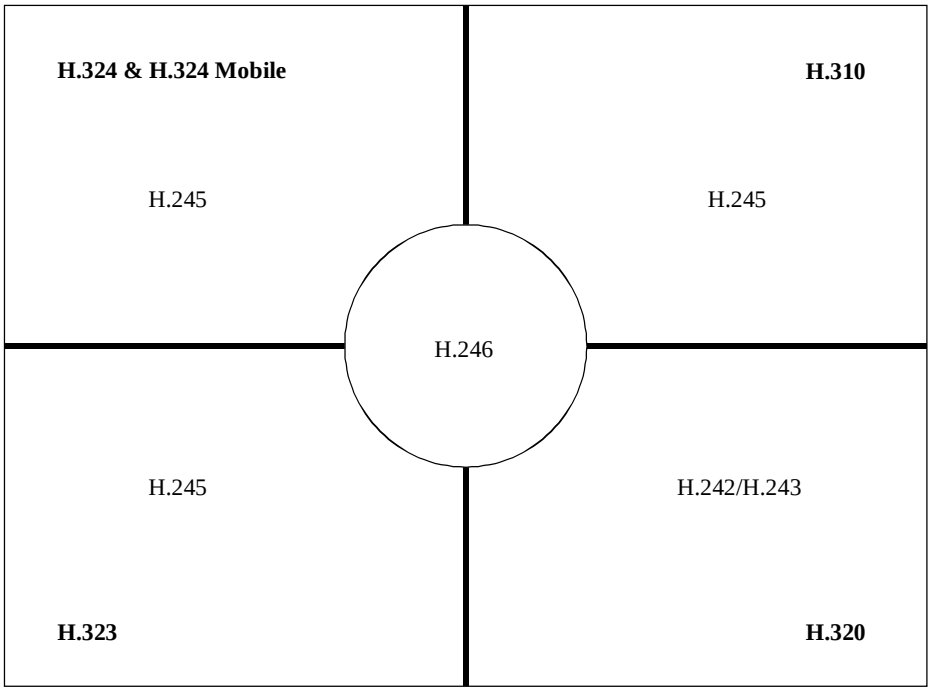

Figure 2/H.246 – H-Series system control interoperability

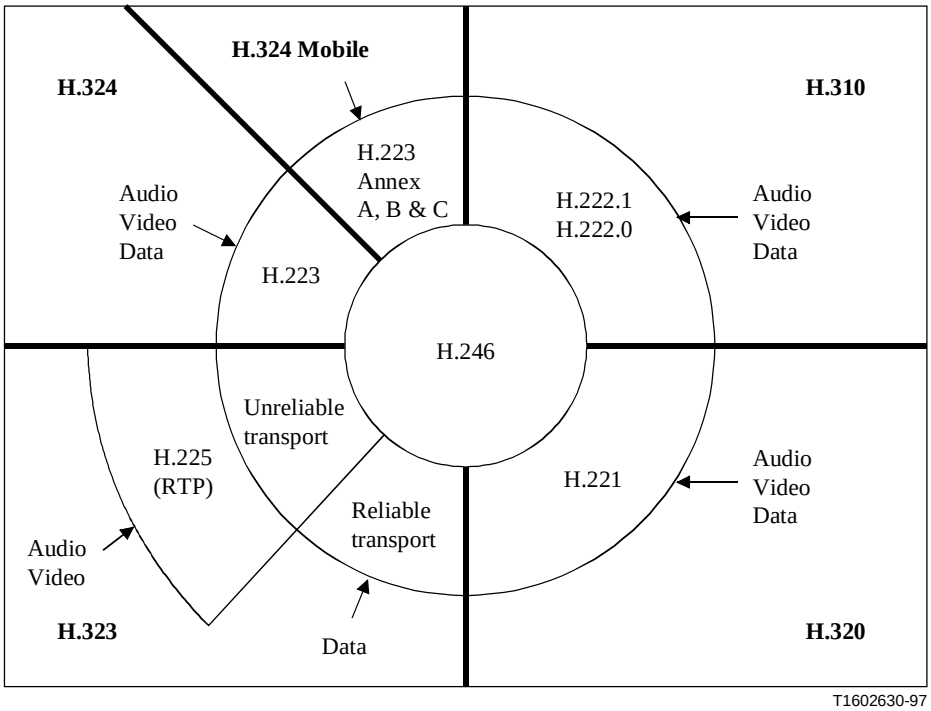

Figure 3/H.246 – H-Series media interoperability

2 Normative 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; 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 E.164 (1997) *The international public telecommunication numbering plan*.

– CCITT Recommendation G.711 (1988), *Pulse Code Modulation (PCM) of voice frequencies*.

– CCITT Recommendation G.722 (1988), *7 kHz audio-coding within 64 kbit/s*.

– ITU-T Recommendation G.723.1 (1996), *Speech coders: Dual rate speech coder for multimedia telecommunications transmitting at 5.3 and 6.3 kbit/s*.

– CCITT Recommendation G.728 (1992), *Coding of speech at 16 kbit/s using low-delay code excited linear prediction.*

– ITU-T Recommendation G.729 (1996), *Coding of speech at 8 kbit/s using Conjugate Structure Algebraic-Code Excited Linear-Prediction (CS-ACELP).*

– ITU-T Recommendation H.221 (1997), *Frame structure for a 64 to 1920 kbit/s channel in audiovisual teleservices.*

– ITU-T Recommendation H.225.0 (1998), *Call signalling protocols and media stream packetization for packet based multimedia communication systems.*

– ITU-T Recommendation H.230 (1997), *Frame-synchronous control and indication signals for audiovisual systems*.

– ITU-T Recommendation H.242 (1997), *System for establishing communication between two audiovisual terminals using digital channels up to 2 Mbit/s*.

– ITU-T Recommendation H.243 (1997), *Procedures for establishing communication between three or more audiovisual terminals using digital channels up to 1920 kbit/s*.

– ITU-T Recommendation H.245 (1998), *Control protocol for multimedia communication*.

– ITU-T Recommendation H.261 (1993), *Video codec for audiovisual services at* $p \times 64$ *kbit/s*.

– ITU-T Recommendation H.262 (1995) | ISO/IEC 13818-2:1996, *Information Technology – Generic coding of moving pictures and associated audio information: video.*

– ITU-T Recommendation H.263 (1998), *Video coding for low bit bit rate communication*.

– ITU-T Recommendation H.310 (1996), *Broadband audiovisual communication systems and terminals*.

– ITU-T Recommendation H.320 (1997), *Narrow-band visual telephone systems and terminal equipment.*

– ITU-T Recommendation H.321 (1998), *Adaptation of H.320 visual telephone terminals to B-ISDN environments*.

– ITU-T Recommendation H.322 (1996), *Visual telephone systems and terminal equipment for local area networks which provide a guaranteed quality of service.*

– ITU-T Recommendation H.323 (1998), *Packet based multimedia communications sytems.*

– ITU-T Recommendation H.324 (1998), *Terminal for low bit-rate multimedia communications*.

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

– ITU-T Recommendation Q.932 (1998), *Digital Subscriber Signalling System No. 1 – Generic procedures for the control of ISDN supplementary services.*

– ITU-T Recommendation Q.950 (1997), *Supplementary services protocols, structure and general principles*.

– ITU-T Recommendation T.120 (1996), *Data protocols for multimedia conferencing*.

– ISO/IEC 10646-1:1993, *Information technology – Universal Multiple-Octet Coded Character Set (USC) – Part I: Architecture and Basic Multilingual Plane.*

3 Definitions

This Recommendation defines the following terms:

3.1 terminal: A terminal is any endpoint and may be a user's terminal or some other communication system such as an MCU or an information server.

3.2 multipoint control unit: The Multipoint Control Unit (MCU) is an endpoint which provides the capability for three or more terminals and Gateways to participate in a multipoint conference.

3.3 multipoint controller: The Multipoint Controller (MC) is an H.323 entity on the local area network which provides for the control of three or more terminals participating in a multipoint conference. It may also connect two terminals in a point-to-point conference which may later develop into a multipoint conference. The MC provides for capability negotiation with all terminals to achieve common levels of communications. It also may control conference resources such as who is multicasting video. The MC does not perform mixing or switching of audio, video and data.

4 Symbols and abbreviations

This Recommendation uses the following abbreviations:

CAPS H.245 or H.242 Capabilities

DTMF Dual Tone Multi-Frequency

FFS For Further Study

GSTN General Switched Telephone Network

ISDN Integrated Services Digital Network

LAN Local Area Network

MC Multipoint Controller

MCU Multipoint Control Unit

MSN Multiple Subscriber Number

SCN Switched Circuit Network

SPID Service Provider ID

TE Terminal Equipment

5 Conventions

In this Recommendation the following conventions are used:

"Shall" indicates a mandatory requirement.

"Should" indicates a suggested but optional course of action.

"May" indicates an optional course of action rather than a recommendation that something take place.

6 General H-Series interworking definitions

The following definitions define mappings which are applicable to more than one interworking scenario.

This clause is for further study.

ANNEX A

H.323-H.320 interworking

A.1 Summary

This annex specifies the interworking requirements of a H.323 to H.320 protocol conversion device called a H.323 to H.320 Gateway.

A H.323 to H.320 Gateway provides interworking by providing conversion of the audio, video, data, and control protocols as specified in the H.323 and H.320 system specifications.

H.321 and H.322 specifics are for further study in this annex.

A.2 Definitions

In addition to the definitions listed in clause 3, this annex uses the following definitions:

A.2.1 capability: A terminal has a particular capability if it is able to encode and transmit or receive and decode that particular signal.

A.2.2 logical channel: A logical channel is a unidirectional path or bi-directional path for the transmission of information.

A.2.3 mode: A mode is a set of elementary streams that a terminal is transmitting, intends to transmit, or would like to receive.

A.2.4 multimedia communication: Multimedia communication refers to the transmission and/or reception of signals of two or more Medium Types simultaneously.

A.2.5 non-standard: Not conforming to a national or international standard referenced in this Recommendation.

A.2.6 session: A session is a period of communication between two terminals which may be conversational or non-conversational (for example retrieval from a database).

A.3 Abbreviations

In addition to the abbreviations listed in clause 4, this annex uses the following abbreviations:

MC H.323 Multipoint Control Entity

QCIF Quarter CIF

RTP Real-time Transport Protocol

RTCP Real-time Transport Control Protocol

A.4 Overview

A H.323 to H.320 Gateway shall support the mandatory functionality as specified for a H.320 terminal in the H.320 system specification on the SCN and the mandatory functionality as specified for a H.323 endpoint in the H.323 system specification on the LAN.

The following table summarizes the minimum protocol requirements for a H.323 to H.320 Gateway.

Component	H.323	H.320
Call Control	H.225.0	Q.931
System Control	H.245	H.242
Multiplex	H.225.0	H.221
Audio	G.711	G.711
Video (If video supported)	H.261 QCIF	H.261 QCIF
Data (If data supported)	T.120	T.120

The following subclauses define the mapping between a H.323 terminal on the LAN side of a Gateway to a H.320 terminal or H.231 MCU on the SCN side of a Gateway.

A.5 Mapping H.323 System Control (H.245) to H.320 System Control (H.242)

The following tables focus on the action required in H.245 based on the receipt of a H.242 (H.221 or H.230) command. The action in the reverse case may be produced by consideration of the following tables.

For mandatory terminal or endpoint capabilities or commands, the Gateway shall respond according to the following table mappings. For option terminal or endpoint capabilities or commands, the Gateway shall respond according to the following table mappings if the option is supported. In cases where the Gateway is transcoding audio or video, flow control or channel opening or closing as specified in the tables may not be necessary (e.g. the Gateway may match bit rates via transcoding, mode switches, or flow control).

A.5.1 H.221 commands/CAPS

Generally H.221/H.230 commands are continuously repeated in the unreliable H.221 BAS channel. As the control channel on the LAN is reliable, only new or changed commands should be passed on by the H.323 Gateway to the LAN side.

When a version two H.323 endpoint receives a H.245 empty capability set (i.e. a terminalCapability set that indicates that the endpoint sending the message has no receive capabilities), the endpoint shall close all open logical channels using the standard H.245 procedures and enter a paused state.

Gateway vendors should note that experience has shown when translating a H.245 empty capability set to a H.320 empty cap set, called Mode 0 in H.320, call termination may occur. Many H.320 endpoints forced into Mode 0 after exchanging a non-empty cap set and/or exchanging media will view a subsequent transition to Mode 0 as a signal that the remote terminal is ending the call and initiate a disconnect themselves. Therefore, vendors are recommended to implement this translation by other means such as using mutes in the H.323 to H.320 direction and not sending media packets in the H.320 to H.323 direction.

A.5.1.1 Subclause A.1/H.221 – Commands

In this table it has been assumed that if the audio operates at a well known rate, e.g. 16 kbit/s for G.728, the rate can be inferred from the logical channel open.

In cases where there are matching audio and video capabilities, it is strongly recommended that Gateways avoid transcoding. However it is up to an individual manufacturer to determine how to resolve conference capabilities in which there are no algorithms in common.

H.221 command	H.245 equivalent
Neutral	• Close the logical channel or use flow control for any logical channel being used for audio. • Close any logical data channels that exist only in the I-channel on the SCN side. • Send **FlowControlCommand** to limit the video rate to be equivalent to the additional channels on the SCN side. • Send **FlowControlCommand** to limit the HSD data rate to be equivalent to the additional channels on the SCN side if needed. NOTE – The neutral command does not necessarily indicate a long-term bandwidth change.
Capex	The Gateway should send **SendTerminalCapabilitySet** using **genericRequest** to the H.323 terminal and then pass the resulting capability to the SCN augmented with its own capabilities to account for its transcoding and translation properties.
Au-off, U	Close the logical channel being used for audio.
Au-off, F	Close the logical channel being used for audio.
A-law, 0U	Open a logical channel with **AudioCapability** of **g711Alaw64k or other algorithm if the Gateway is transcoding**.
A-law, 0F	Open a logical channel with **AudioCapability** of **g711Alaw64k or other algorithm if the Gateway is transcoding**. Note that the Gateway pads the 56 kbit/s SCN G.711 to put it on the LAN and truncates the 64 kbit/s LAN audio to put it on the SCN as described in Recommendation H.225.0.
μ-law, 0U	Open a logical channel with **AudioCapability** of **g711Ulaw64k or other algorithm if the Gateway is transcoding**.
μ-law, 0F	Open a logical channel with **AudioCapability** of **g711Ulaw64k or other algorithm if the Gateway is transcoding**. Note that the Gateway pads the 56 kbit/s SCN G.711 to put it on the LAN and truncates the 64 kbit/s LAN audio to put it on the SCN as described in Recommendation H.225.0.

H.221 command	H.245 equivalent
A-law, F6	Open a logical channel with **AudioCapability** of **g711Alaw64k or other algorithm if the Gateway is transcoding**. Note that the Gateway pads the 48 kbit/s SCN G.711 to put it on the LAN and truncates the 64 kbit/s LAN audio to put it on the SCN as described in Recommendation H.225.0.
μ-law, F6	Open a logical channel with **AudioCapability** of **g711Ulaw64k or other algorithm if the Gateway is transcoding**. Note that the Gateway pads the 48 kbit/s SCN G.711 to put it on the LAN and truncates the 64 kbit/s LAN audio to put it on the SCN as described in Recommendation H.225.0.
G.722-64	Open a logical channel with **AudioCapability** of **g722-64k or other algorithm if the Gateway is transcoding** – use payload type 15 (G.722) in RTP.
G.722-56	Open a logical channel with **AudioCapability** of **g722-56k or other algorithm if the Gateway is transcoding**. Signal the **dynamicRTPPayloadType** option of the **H2250LogicalChannelParameter**s in the **OpenLogicalChannel** command.
G.722-48	Open a logical channel with **AudioCapability** of **g722-48k or other algorithm if the Gateway is transcoding**. Signal the **dynamicRTPPayloadType** option of the **H2250LogicalChannelParameters** in the **OpenLogicalChannel** command.
Au-40k	FFS
Au-32k	FFS
Au-24k	FFS
G.723.1	Open a logical channel with **AudioCapability of g7231 or other algorithm if the Gateway is transcoding**.
G.728	Open a logical channel with **AudioCapability** of **g728 or other algorithm if the Gateway is transcoding**.
G.729	Open a logical channel with **AudioCapability** of **g729 or other algorithm if the Gateway is transcoding**.
Au4k	FFS

A.5.1.2 Sublclause A.2/H.221 – Commands

In general, SCN transfer rates are translated into H.245 maximum bit rate capabilities that apply to the audio and video logical channels on the LAN. The following table illustrates the Gateway requirements.

NOTE – When the Gateway is transcoding media, the LAN and SCN media rates may not be equal.

Media	LAN Side	SCN Side
Audio	max bit rate is implied by the algorithm chosen; the LAN transmitter shall not exceed the negotiated rate. The Gateway should use **FlowControlMessages** to correct for clock synchronization issues	max bit rate is implied by algorithm.
Video	max bit rate is taken from **H261VideoCapability**'s **maxBitRate** field. Endpoint procedures are the same as for audio. The Gateway should use **FlowControlMessages** to correct for clock synchronization issues or fluctuations in bandwidth due to dynamic data channels	If the Gateway is not transcoding, the max bit rate should be is at least the transfer rate minus the audio minus the FAS/BAS minus the data bandwidth. The Gateway must compute this value dynamically and close/open the video logical channel or use flow control when it changes. The Gateway may set the max bit rate higher and then use flow control to adapt the rate based on data or audio channel bandwidth changes. If the Gateway contains a rate reducer, the LAN max bit rate does not need to match the SCN max bit rate.
Data	max bit rate is taken from **DataApplicationCapability**'s **maxBitRate** field. Flow control is provided by the underlying data protocol.	max bit rate is implied by the data rate in use. Changes in max bit rate on the SCN side result in a close/re-open sequence or flow control for the associated LAN logical channel for data.

The LAN side is unaware of the differences between SCN multilink or single channels. The total bandwidth on the LAN and SCN link may be unequal since control on the LAN side is essentially unconstrained, and the audio or video may be transcoded in the Gateway.

If an "Initial Channel Lost" (loss-ic) is received by the Gateway, it should translate into a lower LAN bit rate for the appropriate media channels via closing and reopening the logical channels or via the use of flow control commands.

A.5.1.3 Sublclause A.3/H.221 – Commands

H.221 command	H.245 equivalent
Video-off	Close the video logical channel.
H.261_on	Open a logical channel with **VideoCapability** of **H261VideoCapability** and a **maxBitRate** to force a match to the SCN side video rate unless transcoding to another algorithm or bit rate.
H.262S_on (Simple Profile)	Open a logical channel with **VideoCapability** of **H262VideoCapability** and a **maxBitRate** to force a match to the SCN side video rate unless transcoding to another algorithm or bit rate. Use the Simple Profile at the Main Level.
H.262M_on (Main Profile)	Open a logical channel with **VideoCapability** of **H262VideoCapability** and a **maxBitRate** to force a match to the SCN side video rate unless transcoding to another algorithm or bit rate. Use the Main Profile at the Main Level.

H.221 command	H.245 equivalent
H.263_on	Open a logical channel with **VideoCapability** of **H263VideoCapability** and a **maxBitRate** to force a match to the SCN side video rate unless transcoding to another algorithm or bit rate.
Video-MPEG-1_on	FFS
Freeze-pic (H.230 VCF)	Send **videoFreezePicture**
Fast-update (H.230 VCU)	Send **videoFastUpdatePicture**
Encrpt-on (ECS channel active)	FFS NOTE – Although the ECS channel is in effect always open on the LAN link, receiving this command from the SCN may require a close/re-open logical channel command to correct for changes in the data rates of the media.
Encrpt-off (ECS channel inactive)	See Encrpt-on.
Au-loop	Send **mediaLoop** on the logical channel carrying audio.
Vid-loop	Send **mediaLoop** on the logical channel carrying video.
Dig-loop	A Gateway shall implement this on the SCN side, looping the H.320 stream back to the SCN side. The Gateway should continue to pass the stream onto the LAN side. Any input from the LAN side maybe lost while this loop is in effect.
Loop-off	Send the **MaintenanceLoopOffCommand**.
SM-comp	Close/re-open logical channels affected by video, audio, or data max bit rate changes.
Cancel-SM-comp	Close/re-open logical channels affected by video, audio, or data max bit rate changes.
6B-H0-comp	Close/re-open logical channels affected by video, audio, or data max bit rate changes.
Not-6B-H0-comp	Close/re-open logical channels affected by video, audio, or data max bit rate changes.
Restrict	Close/re-open logical channels affected by video, audio, or data max bit rate changes.
Derestrict	Close/re-open logical channels affected by video, audio, or data max bit rate changes.

A.5.1.4 Subclause A.4/H.221 – Commands

The Gateway, upon receipt of a LSD/HSD/MLP command, should not seek to open a logical channel until an application command is received. At that time, the Gateway should open a logical channel with the appropriate application and a maxBitRate derived from the LSD/HSD/MLP rate in effect.

In the reverse direction, once the Gateway receives an open logical channel, it should seek to open the appropriate LSD/HSD/MLP channel and turn on the requested application. When the far end SCN terminal responds with both the rate and the application command, the Gateway should send **OpenLogicalChannelAck** to the LAN side.

In either direction, the Gateway will require buffering to ensure that data is not lost.

A.5.1.5 Subclauses A.5/A.6/A.7/A.8/A.10/H.221 – Capabilities

Audio, video, and encryption capabilities map one to one with H.245 capabilities. MBE, HSD, LSD, MLP, and transfer rate capabilities are not applicable on the LAN.

LSD and HSD channels on the LAN are differentiated by logical channel number.

NOTE – **temporalSpatialTradeOffCapability** should be terminated at a H.245 device and not passed to H.242 as there is no equivalent command.

A.5.1.6 Subclause A.9/H.221 – Escape Table Values

H.221 command	H.245 equivalent
Table A.6	The transfer rates (commands & caps) should be translated into **maxBitRates** for logical channels.
Table A.2	**The Au-ISO related caps/cmds shall be ignored; their translation is FFS**. The HSD/MLP transfer rate commands result in the opening of a logical channel. See the section on A.4 for a discussion of the issues.
H.230	See H.230 section.
SBE numbers	The values 0-9, #, and * shall be sent using **UserInputIndication**. Other values may be optionally forwarded by a Gateway in either direction.
SBE characters	The characters are always embedded in other messages so there is no direct translation (e.g. they are associated with MLP or H.230 commands).
Start-MBE	No translation is needed as all existing MBEs are translated into LAN messages.
NS-cap	If the Gateway does not understand the non-standard capability, it should send the **Capability** with **nonStandard** set to the appropriate **NonStandardParameter**. The Gateway should map the H.221 country code and manufacturer code into the **h221NonStandard field** of **NonStandardIdentifier** and place the actual non-standard H.221 cap in **NonStandardParameter.data**.
NS-comm	Send **NonStandardMessage** with **nonStandardIdentifier** set to **h221NonStandard**. The Gateway should map the H.221 country code and manufacturer code into the **h221NonStandard field** of **NonStandardIdentifier**, and place the actual non-standard H.221 cap in **NonStandardParameter.data**.
Cap-mark	When H.320 cap set ends, the H.245 cap set should be sent.
Table A.4	See Section on Table A.4.

A.5.1.7 Table A.4/H.221 – Data applications

Reserved code points are ignored in this table. Note that on the SCN (H.221) side, the data channel is opened, and then various applications are turned on and off. On the H.245 side, the application is specified when the logical channel is opened. Thus, opening logical data channels on the LAN side are deferred until it is clear what application is to be used.

H.221 command	H.245 equivalent
V.120 LSD	Open a logical channel with **DataApplicationCapability** of **userData** and **DataModeProtocol** of **v120**. Set **maxBitRate** using LSD rate in effect.
V.120 HSD	Open a logical channel with **DataApplicationCapability** of **userData** and **DataModeProtocol** of **v120**. Set **maxBitRate** using HSD rate in effect.
V.14 LSD	FFS
V.14 HSD	FFS
H.224_MLP_on/off	FFS
H.224_LSD_on/off	FFS
H.224_HSD_on/off	FFS
T.120_on/off	Open a logical channel with **DataApplicationCapability** of **t120** and **DataModeProtocol** of **separateStack**. Set **maxBitRate** using MLP rate in effect.

The following table shows application capability mappings within LSD and HSD channels. Note that there is no differentiation of HSD from LSD except for logical channel number on the LAN side.

H.221 capability	H.245 equivalent
Still Image (Annex D/H.261)	Use **H261VideoCapability stillImageTransmission** field.
V.120 LSD	Use **DataApplicationCapability** of **userData** and **DataProtocolCapability** of **v120**.
V.120 HSD	Use **DataApplicationCapability** of **userData** and **DataProtocolCapability** of **v120**.
V.14 LSD	FFS
V.14 HSD	FFS
H.224_MLP	FFS
H.224_LSD	FFS
H.224_HSD	FFS
T.120	**DataApplicationCapability** of **t120** on **DataProtocolCapability** of **SeparateStack**.
H.224_sim	Not applicable
Nil_data	Not applicable

A.5.1.8 Subclause A.11/H.221 – HSD/H-MLP commands

HSD/H-MLP commands are translated into open logical channel requests. Flow control commands and the maxBitRate are in general used to match the SCN side rate. The channel should not be opened until the data application code is sent by the SCN side.

A.5.1.9 Subclauses A.12/A.13/H.221 – Au-ISO commands and capabilities

These command are not applicable to H.245 conversion.

A.5.1.10 Subclauses A.14/A.15/H.221 – Data application commands and capabilities

See Table A.4/H.221 above.

A.5.1.11 Subclause A.16/H.221 – Transfer rate commands and capabilities used in channel aggregation

Transfer rate changes on the SCN may require the close and re-open of LAN logical channels to account for bit rate changes.

A.5.2 H.230 commands

H.245 equivalents for H.230 commands and indications are for the most part defined in the H.245 commands **ConferenceCommand** and **ConferenceIndication**.

A.5.2.1 Video Commands and Indications (C&I)

H.230 command/indication	H.245 equivalent
VIS	Send **logicalChannelInactive** for the video channel.
VIA	Send **logicalChannelActive** for the video channel.
VIA2	Same as VIA for video source number 2.
VIA3	Same as VIA for video source number 3.
VIR	Send **videoIndicateReadyToActivate**.
VCF	Send **videoFreezePicture**.
VCU	Send **VideoFastUpdatePicture**.

A.5.2.2 Audio C&I

H.230 command/indication	H.245 equivalent
AIM	Send **logicalChannelInactive** for the audio channel.
AIA	Send **logicalChannelActive** for the audio channel.
ACE	Not applicable on LAN as audio and video are time-stamped independently by the transmitter.
ACZ	Not applicable on LAN as audio and video are time-stamped independently by the transmitter.

A.5.2.3 Maintenance C&I

H.230 command/indication	H.245 equivalent
LCV	Send **mediaLoop** on the logical channel carrying video.
LCD	Not applicable on LAN.
LCA	Send **mediaLoop** on the logical channel carrying audio. A Gateway should implement this on the SCN side, looping the H.320 stream back to the SCN side, while continuing to pass the stream onto the LAN side. Any input from the LAN side may be lost while this loop is in effect.
LCO	Send the **MaintenanceLoopOffCommand**.

A.5.2.4 Multipoint C&I

A.5.2.4.1 Multipoint Control C&I

H.230 command/indication	H.245 equivalent
MCC	Send **multipointConference** indication to indicate the presence of an H.231 MCU. The Gateway may have to adapt the **maxBitRate** on the LAN media channels to match the SCN transfer and audio rate as required by MCC.
MMS	Send **multipointModeCommand**. Once in receipt of this command, the LAN endpoint is required to follow all mode requests from the sender of MMS.
Cancel-MCC	Send **cancelMultipointConference**.
Cancel-MMS	Send **cancelMultipointModeCommand**.
MIZ	Send **multipointZeroComm**.
Cancel-MIZ	Send **cancelMultipointZeroComm**.
MIS	Send **multipointSecondaryStatus**.
Cancel-MIS	Send **cancelMultipointSecondaryStatus**.
MIM	FFS
MCV	Send **broadcastMe**.
Cancel-MCV	Send **cancelBroadcastMe**.
MIV	Send **seenByAtLeastOneOther**.
Cancel-MIV	Send **cancelSeenByAtLeastOneOther**.
MCS/MCN	Send **multipointConference** indication to indicate the presence of an H.231 MCU. The Gateway may have to adapt the **maxBitRate** on the LAN media channels to match the SCN transfer and audio rate as required by MCC.
MIL	FFS
MIH	FFS
MIJ	FFS
RAN	FFS

A.5.2.4.2 Terminal Numbering C&I

H.230 command/indication	H.245 equivalent
TCI	Send **enterH243TerminalID**.
TII	Send **terminalIDResponse**.
TIS	Not applicable
TIC(cap)	Not applicable
TIX	Not applicable
TIA	Send **terminalNumberAssign**.
TIN	Send **terminalJoinedConference**.
TID	Send **terminalLeftConference**.
TCU	Send **terminalListRequest**.
TCA	Send **requestChairTokenOwner**.
TIL	Send **terminalListResponse**.
TIR	Send **chairTokenOwnerResponse**.
TIE	Not applicable
TIP	Send **terminalIDResponse**.
TCP	Send **requestTerminalID**.

A.5.2.4.3 Conference Query C&I

H.230 command/indication	H.245 equivalent
TCS1	Send **enterH.243Password**.
TCS2	Send **enterH243TerminalID**.
TCS3	Send **enterH.243ConferenceID**.
TCS4	Gateway should return desired H.323 extension if known via IIS; otherwise, send **enterExtensionAddress** to the LAN and upon receiving **extensionAddressResponse**, send the extension via IIS.
IIS	Send **terminalIDResponse** or **passwordResponse** depending on the IIS value as defined in Recommendation H.230.

A.5.2.4.4 Video Selection and Notification C&I

H.230 command/indication	H.245 equivalent
VIN	Send **terminalYouAreSeeing**.
VCB/Cancel-VCB	Send **makeTerminalBroadcaster/cancelMakeTerminalBroadcaster**.
VCS/Cancel-VCS	Send **sendThisSource/cancelSendThisSource**.
VCR	Send **videoCommandReject**.
VIN2	FFS
VIC	FFS
VIM	FFS

A.5.2.4.5 Chair Control C&I

H.230 command/indication	H.245 equivalent
CCA	Send **makeMeChair**.
CIS	Send **cancelMakeMeChair**.
CIT	Send **grantedChairToken** from **makeMeChairResponse**.
CCR	Send **deniedChairToken** from **makeMeChairResponse** if in response to **makeMeChairRequest**, otherwise send **withdrawChairToken**.
CCD	Send **dropTerminal**.
CCK	Send **dropConference**.
CIR	Send **terminalDropReject**.
CIC (cap)	Send **chairControlCapability** from **MiscellaneousCapability**.
TIF	Send **requestForFloor**. In reverse direction **floorRequested** or **requestForFloor** should cause a TIF to be sent to the SCN.

A.5.2.4.6 Data Channel Related C&I

H.230 command/indication	H.245 equivalent
DCA-L,DIT-L,DCR-L,DIS-L,DCC-L	FFS
DCA-H,DIT-H,DCR-H,DIS-H,DCC-H	FFS
DCM (sent by Gateway to SCN)	The H.323 terminal sends a **RequestMode** with a **dataMode** of **t120** and a **DataModeProtocol** of **SeparateStack** to the Gateway. The H.323 Gateway sends a DCM to the attached MCU or terminal. When the MLP rate command and T120_on have been received by the Gateway, it sends **OpenLogicalChannel** to the H.323 terminal to open a t120 channel and uses the channel **maxBitRate** to constrain the LAN to SCN data flow to match the signalled MLP channel rate.
DCM (received by Gateway from SCN)	This implies that the H.323 Gateway is acting as an MCU; the Gateway sends **RequestMode** with **dataMode** of **t120** and a **DataModeProtocol** of **SeparateStack**. Since it is in receipt of **multipointModeCommand** the H.323 endpoint responds with an **OpenLogicalChannel to the Gateway**. At the same time, the Gateway sends an MLP rate command and T120_on to the H.320 SCN side endpoint to open the MLP channel and turn on T.120. Alternatively, the GW/MCU could send **OpenLogicalChannel** to the H.323 endpoint.

A.5.2.5 Channel Aggregation C&I

Table A.1 H.230 command/indication	H.245 equivalent
AggIN	FFS
NII	FFS
RIR	Received if H.323 Gateway is acting as a master MCU on the SCN; an H.245 equivalent is FFS.
RID	Not applicable
RIU	Received if H.323 Gateway is acting as a master MCU on the SCN; an H.245 equivalent is FFS.

A.5.2.6 Transfer of Network Address C&I

Table A.1 H.230 command/indication	H.245 equivalent
MIL	Not applicable
NCA-i, NCA-a, NIS, NIC, NID, NIR	Not applicable
NIA-s, NIQ-s, NIQ-m	Not applicable
NIA-m	Not applicable
NIAP	Not applicable
AU_MAP	Not applicable
AU_COM	Not applicable

A.6 Mapping H.323 Call Control (H.225.0) to H.320 Call Control on N-ISDN (Q.931)

The Gateway shall terminate the Q.931 Call Signalling Channel between an H.323 endpoint and the Gateway on one hand and the call signalling channel (if any) between the Gateway and the SCN endpoint on the other. The following applies only if the SCN side supports a call signalling protocol such as Q.931 or Q.2931.

The Gateway shall conform to the call signalling procedures recommended for the SCN side independent from the LAN side. The Gateway shall conform to the call signalling procedures of this Recommendation for the LAN side independent from the SCN side.

In addition, call signalling messages received from one side (LAN/SCN) may require forwarding to the other side (SCN/LAN). Some forwarded messages may contain information elements or parts of information elements which are unmodified or uninterpreted by the Gateway. Other forwarded messages may contain modified information elements or parts of information elements which may be added or removed by the Gateway, as required.

In the following, an overview of the actions to be taken by the Gateway in response to Q.931 messages and the information elements, is provided. Messages and information elements that are forbidden in H.225.0 are not considered.

Q.931 messages originating on the H.323 side:

- A SETUP message side shall lead to initiation of call setup procedure for the SCN side contingent upon proper endpoint authorization to use the Gateway and the approval of a Gatekeeper via the ARQ/ACF sequence if the Gateway is registered to one.
- A RELEASE COMPLETE shall lead to initiation of the call disconnect as defined for the SCN side.
- A CALL PROCEEDING message shall be forwarded to the SCN side. This shall not be done if a CALL PROCEEDING has been sent before to the SCN in compliance to the respective SCN specification (Q.931 in the ISDN case).
- A CONNECT message shall be forwarded to the SCN side upon receipt from an H.323 endpoint if it has not already been sent.
- The Gateway is required to respond to a calling H.323 endpoint in either CONNECT, RELEASE COMPLETE, CALL PROCEEDING or ALERTING. Hence, if the connection on the SCN takes longer than the H.225.0 specified time-out, CALL PROCEEDING shall be sent to the calling H.323 endpoint.

- A CONNECT ACKNOWLEDGE message shall be sent to the SCN in compliance with the respective SCN specification. CONNECT ACKNOWLEDGE is forbidden on the LAN.
- Messages for supplementary services (FACILITY, NOTIFY, and the INFORMATION messages) that are not processed by the Gateway, should be forwarded to the SCN side.
- All messages forbidden to be originated from an H.323 endpoint shall be generated by the Gateway autonomously as required by the SCN protocol.

The information elements of the respective messages are to be converted as follows:

- The contents of connection specific information elements (such as Call Reference Value) shall be adapted as required by the SCN protocol.
- Information elements that are not in use on the H.323 side shall be generated by the Gateway as required by the SCN protocol.
- Translation of other information elements shall be done as required by the SCN protocols and procedures. Where interoperability is not an issue, conversion is left to the discretion of the manufacturer.
- Only the user-data part of the user-user information element shall be forwarded to the SCN side. It shall be re-encoded following Figure 4-36/Q.931 and Table 4-26/Q.931.

All call signalling messages originating on the SCN side should be forwarded to the H.323 endpoint without modification except for the following:

- Messages forbidden by Table 4/H.225.0 shall not be passed to the H.323 side.
- The call reference value shall be mapped to the appropriate value for the H.323 side.
- The user data field is copied into the corresponding ASN.1 user-user information element structure.
- The user-user information element structure shall be generated according to the specification in Recommendation H.225.0.

A.7 Inward and outward calling

A.7.1 Inward calling

There are many strategies for accepting a H.320 call from the SCN, determining the H.323 endpoint which is being dialled, and routing a call to the desired destination. Some example methods include H.320 BAS code processing, Direct Inward Dialling (DID), Multiple Subscriber Number (MSN), and ISDN sub-addressing.

A.7.1.1 H.320 BAS Code processing

When accepting a call from the SCN and using the H.320 BAS Code method for extracting the destination location, the Gateway should have multiple strategies for querying the calling endpoint for an extension. Although H.230 includes TCS-4 (Request Remote Extension) and its associated response, many existing H.320 systems do not support this optional H.320 request. To account for this, a Gateway should have the capability to prompt for an extension via an audio prompt and then collect the extension via DTMF signalling.

To accomplish this, a Gateway may request a remote extension from a caller via the TCS-4 command at the same time it plays an audio prompt requesting the extension information. The Gateway should then be prepared to retrieve the intended destination by either DTMF tone detection or by the reception of an IIS message indicating the desired H.323 endpoint. If the endpoint does not provide the intended location by either method, the Gateway should route the call to an operator or have some other means to deal with the inbound call.

NOTE – TCS-4/IIS support is mandatory for a H.323 to H.320 Gateway. DTMF support is optional for a H.323 to H.320 Gateway.

A.7.1.2 Calling an H.323 MC

If a H.323 Gateway connects an inbound H.320 call to a H.323 endpoint that has an active MC, the Gateway should act as an MCU to its attached H.320 endpoint.

H.323 Gateways should pass the H.245 multipointConference command from the H.323 link to the H.320 link as a H.230 MCC command when it is received. Failure to do so could lead to interoperability problems for H.320 endpoints participating in a H.323 multipoint call.

A.7.2 Outward calling

A.7.2.1 Calling an H.320 MCU

A H.323 Gateway should determine the type of H-Series device it is connecting with before it responds to a H.323 setup message. If the H-Series device is a MCU, then the Gateway should indicate that it is a H.323 MCU in its H.245 Master/Slave terminal type. In this situation, the T.120 top provider will either be in the H-Series MCU, or be in an MCU which is cascaded to it. If the H-series device is not an MCU, then the Gateway should signal that it has no MC. If the H.323 endpoint has an active MC, then the Gateway should act as an MCU to its attached H-Series endpoint.

Failing to alter the device type in the H.245 Master/Slave negotiation, can lead to a situation where a H.323 terminal becomes the MC of a conference in which it is attached to a H.320 MCU through a Gateway. While this call can operate if the Gateway shields the two sides of the call from each other, it cannot handle requested mode changes by the MCU like switching from CIF to QCIF unless the Gateway can transcode or the terminal, which could think it is a MC, has advertised transmit capabilities and is willing to accept a request mode command.

H.323 Gateways should pass the H.230 MCC command from the H.320 link to the H.323 link as a H.245 multipointConference command when it is received. Failure to do so will could lead to interoperability problems for H.323 endpoints participating in a H.320 multipoint call.

A.7.2.2 Calling another Gateway

To allow for the case of a H.323 endpoint dialing through two Gateways and then back to another H.323 terminal, a H.320 to H.323 Gateway shall support the TCS4/IIS H.230 BAS commands so that the remote extension can be passed between the Gateways.

A.8 Securing encrypted connections between H.320 and H.323 terminals

For further study.

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