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Summary: This document is the second draft of H.24i. This version started from Dale Skran's draft which was submitted for discussion at the June 1996 ITU meeting in Geneva.

Notes on reading: {***Editors notes are generally in braces and italics***} New text is indicated in blue. ~~The deleted text has strikethrough font.~~

INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

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DRAFT H.24

(September 1996

LINE TRANSMISSION OF NON-TELEPHONE SIGNALS

Interworking adaptors for H.series multimedia terminal on diverse networks

DRAFT ITU-T Recommendation H.24i

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. 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, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation H.24I was prepared by the ITU-T Study Group 15 (199x-199x) and was approved by the WTSC (Place, Month xx-xx, 199x).

SUMMARY

Recommendation H.24i describes multimedia adaptors which provide protocol interworking between H.series multimedia terminals. Interworking units, which are protocol gateways, not network gateways in the traditional sense, provide the required translation of control and media streams to allow interworking between terminals running different H.series protocols on diverse networks.

This recommendation concentrates on the interworking between the H.323 and other H-series protocols such as H.320, H.324 and H.310. It is expected that other H.series terminal interactions will be added to this document during further study.

H.323 interworking units (H.323 gateways) may be integrated into personal computers or implemented in stand-alone devices. Support for voice is mandatory, while data and video are optional, but if supported, the ability to use a specified common mode of operation is required, so that all terminals supporting that media type can interwork. H.323 allows more than one channel of each type to be in use. Other Recommendations in the H.323 series include H.225.0 packet and synchronization, H.245 control, H.261 and H.263 video codecs, G.711, G.722, G.728, G.729, and G.723 audio codecs, and the T.120 series of multimedia communications protocols. A gateway which supports interworking between H.323 and H.320 is required to support the common mode of operation in H.323 as well as H.320 on the appropriate side of its interfaces.

H.323 makes use of the logical channel signalling procedures of Recommendation H.245, in which the content of each logical channel is described when the channel is opened. Procedures are provided for expression of receiver and transmitter capabilities, so transmissions are limited to what receivers can decode, and so that receivers may request a particular desired mode from transmitters. Since the procedures of H.245 are also used by Recommendation H.310 for ATM networks, Recommendation H.324 for GSTN, and V.70, interworking with these systems should not require H.242 to H.245 translation as would be the case for H.320 systems.

H.323 terminals may be used in multipoint configurations, and may interwork with H.310 terminals on B-ISDN, H.320 terminals on N-ISDN, H.321 terminals on B-ISDN, H.322 terminals on Guaranteed Quality of Service LANs, H.324 terminals on GSTN and wireless networks, and V.70 terminals on GSTN.

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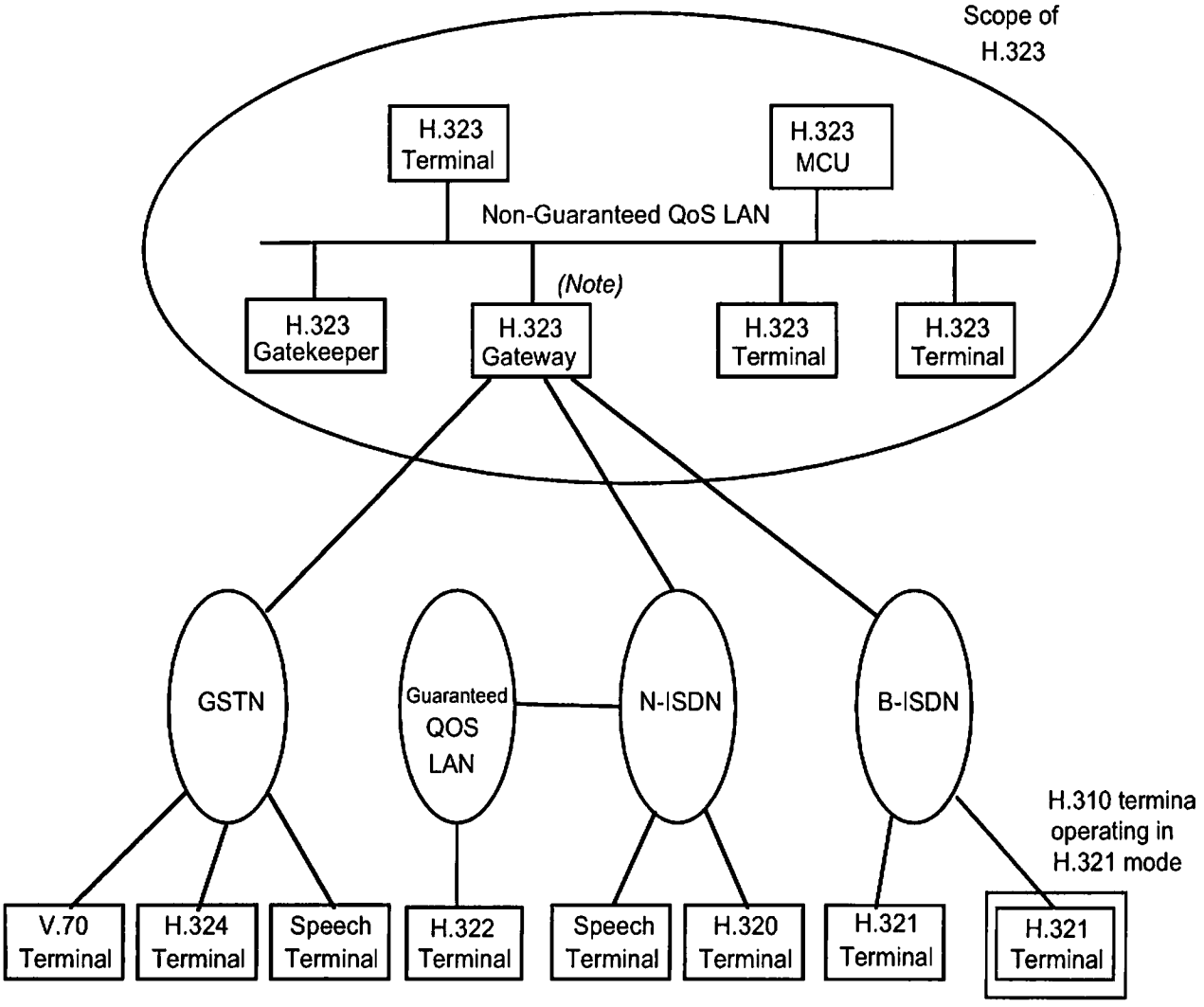
1 SCOPE

This Recommendation, H.24I, covers {to be written}

H.323 terminals may be used in multipoint configurations, and may interwork via an H.323 Gateway with H.310 terminals on B-ISDN, H.320 terminals on N-ISDN, H.321 terminals on B-ISDN, H.322 terminals on Guaranteed Quality of Service LANs, H.324 terminals on GSTN and wireless networks, and V.70 terminals on GSTN. See Figure 1/H.24I.



Note: A gateway may support one or more of the GSTN, N-ISDN and/or B-ISDN connections.

Figure 1/H.323 Gateway 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.

[1] ITU-T Recommendation H.225.0 (1996): " Media Stream Packetization and Synchronization for Visual Telephone Systems on Non-Guaranteed Quality of Service LANs ".
[2] ITU-T Recommendation H.245 (1996): "Control of communications between Visual Telephone Systems and Terminal Equipment".
[3] ITU-T Recommendation G.711 (1988): "Pulse Code Modulation (PCM) of Voice Frequencies".
[4] ITU-T Recommendation G.722 (1988): "7 kHz Audio-coding within 64 kbit/s".
[5] ITU-T Recommendation G.723.1 (1995): "Dual Rate Speech codec for multimedia telecommunications transmitting at 6.4 and 5.3 kbit/s".
[6] ITU-T Recommendation G.728 (1992): "Speech Coding at 16 kbit/s".
[7] ITU-T Recommendation G.729 (1995): "Speech codec for multimedia telecommunications transmitting at 8/13 kbit/s".
[8] ITU-T Recommendation H.261 (1993): "Video CODEC for audiovisual services at p X 64 kbit/s"
[9] ITU-T Recommendation H.263 (1995): "Video CODEC for narrow telecommunications channels at < 64 kbit/s"
[10] ITU-T Recommendation T.120 (1994): "Transmission protocols for multimedia data"
[11] ITU-T Recommendation H.320 (1995): "Narrow-band ISDN visual telephone systems and terminal equipment".
[12] ITU-T Recommendation H.321 (1995): "Adaptation of H.320 Visual Telephone Terminals to B-ISDN Environments".
[13] ITU-T Recommendation H.322 (1995): "Visual Telephone Systems and Terminal Equipment for Local Area Networks which Provide a Guaranteed Quality of Service".
[14] ITU-T Recommendation H.324 (1995): Terminal for Low Bitrate Multimedia Communications".
[15] ITU-T Recommendation H.310 (1996): "Broadband audio-visual communications systems and terminal equipment".
[16] ITU-T Recommendation Q.931 (1993): "Digital Subscriber Signalling System No. 1 (DSS 1) - ISDN User-Network Interface Layer 3 Specification for Basic Call Control".
[17] ITU-T Recommendation Q.932 (1993): "Digital Subscriber Signalling System No. 1 (DSS 1) - Generic Procedures for the Control of ISDN Supplementary Services".
[18] ITU-T Recommendation Q.950 (1993): "Digital Subscriber Signalling System No. 1 (DSS 1) - Supplementary Services Protocols, Structure, and General Principles".
[19] ISO/IEC 10646-1 (1993): "Information Technology - Universal Multiple-Octet Coded Character Set (USC) -- Part I: Architecture and Basic Multilingual Plane".
[20] ITU-T Recommendation E.164 (1991) "Numbering Plan for the ISDN Era".
[21] ITU-T Recommendation H.323 (1996): "Visual Telephony Systems and Equipment for Local Area Networks which provide a non-guaranteed Quality of Service"

3 DEFINITIONS

For the purposes of this Recommendation the definitions given in Clause 3 of both H.225.0 [1] and H.245 [2] apply along with those in this section. These definitions

apply to the LAN side only. Other terms may be appropriate when referring to the Switched Circuit Network (SCN) side.

TBA: To be added.

4 SYMBOLS AND ABBREVIATIONS

For the purposes of this Recommendation, the following symbols and abbreviations apply.

TBA To be added

5 CONVENTIONS

In this document 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.

References to Sections, Paragraphs, Annexes, and Appendices refer to those items within this Recommendation unless another document is explicitly listed. For example, Section 1.4 refers to section 1.4 of this Recommendation; H.245 Section 6.4 refers to section 6.4 in H.245.

Where items exist on both the LAN and on the SCN, references to the SCN item will be explicit. For example, an MCU is an H.323 MCU on the LAN, an SCN MCU is an MCU on the SCN.

{ To be refined for this recommendation - This Recommendation describes the use of "n" different message types: H.245, RAS, Q.931, etc. To distinguish between the different message types the following convention is followed. H.245 message and parameter names consist of multiple concatenated words highlighted in bold typeface (**maximumDelayJitter**). RAS message names are represented by three letter abbreviations (ARQ). Q.931 message names consist of one or two words with the first letters capitalized (Call Proceeding).}

6. INTRODUCTION

H.24I is understood as a document that specifies how an H.245 to H.242 gateway shall operate. {This introduction needs to be expanded to include the new sections and scope}

In the approved version of H.245, the mapping between H.221/H.230 commands and the equivalent H.245 structures is not always clear. Also, unless these mappings are defined, a strong risk of varying implementations leading to interoperability problems exists. Such mappings need to exist for both H.324 and H.323. They are not required for H.310 terminals since these terminals will operate in an H.320 mode, thus there is no requirement for an H.230/H.221 command to H.245 command mapping.

However, an AAL1/AAL5 LAN gateway might make use of such procedures to convert ATM LAN H.310 using H.222.1/H.245 to H.320/H.242.

This document takes the viewpoint of the H.323 gateway attempting to interface an H.323 terminal using H.245 on the LAN side to an H.320 terminal or an H.231 MCU on the SCN side. The particular cases focus(mainly) on the receipt of an H.221 or H.230 command by the H.323/H.320 gateway, and its response or action on the LAN side. The action in the reverse case is easily produced by consideration of this table. Much of this discussion will apply to H.324, but this requires additional work.

The current hope is to agree to stable text at the first meeting of the new study period in 1997.

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

This paper is based on the idea that H.323 terminals should be able to participate in H.243 conferences without handicap, e.g. receive TIN, TID, VIN, send TIF, MCV, etc. and further that MCU-type multipoint operation is mandatory on H.323 and H.324 terminals.

7. H.323 TO H.320

7.1 Mapping H.245 Messages (of H.323) to H.242 Messages

7.1.1 H.221 Commands/CAPS

7.1.1.1 _____A.1 Commands

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

H.221 command	H.245 equivalent
Neutral	Close the 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 that equivalent to whatever is on in the additional channels on the SCN side. Send **FlowControlCommand** to limit the HSD data rate to be equivalent to whatever is on in the additional channels on the SCN side(if needed). *Questions: Should it be assumed that neutral command indicates a long term bandwidth change, requiring the use of **BRQs**, or is this not the case?{No - provides no long term indication}*

Capex	The gateway shouldshall send **SendTerminalCapabilitySet** using **genericRequest** to the H.323 terminal, and then pass the resulting capability set on to the H.320 terminal (or H.244 device) that sent Capex.{If the Gateway can transcode from 711 to 728 and the terminal only supports 711; the Gateway should answer the request with its own capability set for that interface}
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**.
A-law, 0F	Open a logical channel with **AudioCapability** of **g711Alaw64k**. Note that the GW pads the 56Kbps SCN G.711 to put it on the LAN and truncates the 64 Kbps LAN audio to put it on the SCN as described in H.225.0.
u-law, 0U	Open a logical channel with **AudioCapability** of **g711Ulaw64k**
u-law,0F	Open a logical channel with **AudioCapability** of **g711Ulaw64k**. Note that the GW pads the 56Kbps SCN G.711 to put it on the LAN and truncates the 64 Kbps LAN audio to put it on the SCN as described in H.225.0.
A-law,F6	Open a logical channel with **AudioCapability** of **g711Alaw64k**. Note that the GW pads the 48Kbps SCN G.711 to put it on the LAN and truncates the 64 Kbps LAN audio to put it on the SCN as described in H.225.0.
u-law,F6	Open a logical channel with **AudioCapability** of **g711Ulaw64k**. Note that the GW pads the 48Kbps SCN G.711 to put it on the LAN and truncates the 64 Kbps LAN audio to put it on the SCN as described in H.225.0.
G.722-64	Open a logical channel with **AudioCapability** of **g722-64k** - use payload type 15(G722) in RTP.
G.722-56	Open a logical channel with **AudioCapability** of **g722-56k**- signal a dynamic payload type using H.245 Set **dynamicRtpPayloadType** to an allowed value and send as part of **H225LogicalChannelParameters** in **OpenLogicalChannel.**
G.722-48	Open a logical channel with AudioCapability of g722-48k- **see above for G.722-56.**
Au-40k	not needed yet
Au-32k	not needed yet
Au-24k	not needed yet
G.723	Open a logical channel with **AudioCapability** of **g7231**
G.728	Open a logical channel with **AudioCapability** of **g728**
Au<16k(G.729?)	Open a logical channel with **AudioCapability** of **g729**

7.1.1.2 _____A.2 Commands

In general, transfer rates get translated into maximum bit rate capabilities that apply to the audio and video logical channels. The following table will illustrate what the GW must do:

Media	LAN Side	SCN Side
Audio	max bit rate is implied by the algorithm chosen; the LAN transmitter shall not exceed these rates. The gateway uses **FlowControlMessages** to even out any problems	max bit rate is also implied by algorithm. If the gateway transcodes, the rates may not match.
Video	max bit rate is taken from **H261VideoCapability**'s **maxBitRate field**. Procedures are the same as for audio	max bit rate is 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 when it 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. Change in max bit rate on the SCN side result in a close/re-open sequence for the LAN logical channel for data.
Control	No need to match H.221 BAS rate to H.245 message bit rate	Not applicable.

Thus, the LAN side is unaware at the media level (it is aware at the call signaling level) of the differences between multi-link channels and single link channels, nor must the total bandwidth on each side be exactly equal, since control on the LAN side is essentially unconstrained, and the audio may be transcoded in the gateway.

A loss-ic received by the gateway is translated into a lower LAN bit rate for the appropriate media, probably video, via closing and re-opening the video logical channel.

7.1.1.3 A.3 Commands

H.221 command	**H.245 equivalent**
Video-off	Close the logical channel using video
H.261	Open a logical channel with **VideoCapability** of **H261VideoCapability** and a **maxBitRate** to force a match to the SCN side video rate.
H.263	Open a logical channel with VideoCapability of **H263VideoCapability** and a **maxBitRate** to force a match to the SCN side video rate
Vid-imp	Not yet needed

Video-ISO	open logical channel with **IS11172VideoCapability.** Unfortunately, procedures on the H.320 side are unclear, so it is not clear how fields like **pictureRate** are filled in.
Freeze-pic(VCF)	Send **videoFreezePicture**
Fast-update(VCU)	Send **videoFastUpdatePicture**
ECS on	There is no equivalent, but none is needed. In effect, on the LAN side the ECS channel is always open. However, a close/re-open logical channel command must be issued to correct the video and possibly the data rates for appropriate logical channels. Use is for further study in revision 1.
ECS off	See ECS-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, while continuing to pass the stream onto the LAN side. Any input from the LAN side is lost while this loop is in effect.
Loop-off	Send the **MaintenanceLoopOffCommand**
SM-comp	Close/re-open all logical channels affected by video, audio, or data max bit rate changes.
Cancel-SM-comp	Close/re-open all logical channels affected by video, audio, or data max bit rate changes.
6B-H0-comp	Close/re-open all logical channels affected by video, audio, or data max bit rate changes.
Not-6B-H0comp	Close/re-open all logical channels affected by video, audio, or data max bit rate changes.
Restrict	Close/re-open all logical channels affected by video, audio, or data max bit rate changes.
Derestrict	Close/re-open all logical channels affected by video, audio, or data max bit rate changes.

7.1.1.4 _____A.4 Commands

The gateway, upon receipt of an LSD/HSD/MLP command, would not seek to open a logical channel until an application command is received. At that time, the gateway would 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 received an open logical channel it would seek to open an appropriate LSD/HSD/MLP channel and turn on the requested application. When the far end SCN terminal responded with both the rate and the application command, the gateway would send **OpenLogicalChannelAck** toward the LAN side.

In both cases, the gateway will be required to do some buffering to ensure that data is not lost.

7.1.1.5 A.6/A.7/A.8/A.10 Capabilities

In most case the translation of capabilities is clear. The following questions exist:

1. How are LSD/HSD channels differentiated (probably via logical channel number)? Is there any need to do so on the LAN side (probably not; comments?)?

2. How is **temporalSpatialTradeOffCapability** set? This appears to have no H.242/H.221 equivalent.

7.1.1.6 A.9 Escape Table Values

H.221 command	H.245 equivalent
Table A.5	The transfer rates (commands & caps) translate 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	They 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 - all existing MBEs are translated into LAN messages.
NS-cap	Send **Capability** with **nonStandard** set to the appropriate **NonStandardParameter**. The gateway maps the H.221 country code and manufacturer code into the **h221NonStandard field** of **NonStandardIdentifier**, and the actual non-standard H.221 cap is placed in **NonStandardParameter.data**.

NS-comm	Send **NonStandardMessage** with **nonStandardIdentifier** set to **h221NonStandard**. The gateway maps the H.221 country code and manufacturer code into the **h221NonStandard field** of **NonStandardIdentifier**, and the actual non-standard H.221 cap is placed in **NonStandardParameter.data**.
Cap-mark	When H.320 cap set ends, the H.245 cap set can be sent.
Table A.3	See section on Table A.3

7.1.1.7 Table A.3 Data Applications

Reserved codepoints are ignored in this table. Note that on the H.221 side, the data channel is opened, and then various applications are turned on/off. On the H.245 side, the application is specified when the logical channel is opened. Thus, we must defer opening logical data channels on the LAN side until it is clear what application is to be used.

Table A.3 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**. Note that HSD and LSD can simply map into different logical data channels on the H.245 side. Set **maxBitRate** using HSD rate in effect
V.14 LSD	Open a logical channel with **DataApplicationCapability** of **userData** and **DataModeProtocol** of **v14buffered**. Set **maxBitRate** using LSD rate in effect.
V.14 HSD	Open a logical channel with **DataApplicationCapability** of **userData** and **DataModeProtocol** of **v14buffered**. Note that HSD and LSD can simply map into different logical data channels on the H.245 side. Set **maxBitRate** using HSD rate in effect.
H.224_MLP_on/off	Open a logical channel with **DataApplicationCapability** of **h224** and **DataModeProtocol** of **??????** (or close as appropriate). Set **maxBitRate** using MLP rate in effect.
H.224_LSD_on/off	Open a logical channel with **DataApplicationCapability** of **h224** and **DataModeProtocol** of **??????** (or close as appropriate). Set **maxBitRate** using LSD rate in effect.
H.224_HSD_on/off	Open a logical channel with **DataApplicationCapability** of **h224** and **DataModeProtocol** of **??????** (or close as appropriate). Set **maxBitRate** using HSD rate in effect.
T.120_on/off	Open a logical channel with **DataApplicationCapability** of **t120** and **DataModeProtocol** of **t123LANStack** (or close as appropriate). Set **maxBitRate** using MLP rate in effect.

Here we covered the caps since they raise some interesting questions. Note that there is no differentiation of HSD from LSD except via logical channel number on the LAN side.

Table A.3 H.221 capability	H.245 equivalent
Still Image(H.261 Annex D)	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	**DataApplicationCapability** of **userData** and **DataProtocolCapability** of **v14buffered**; unclear this is correct on LAN
V.14 LSD	**DataApplicationCapability** of **userData** and **DataProtocolCapability** of **v14buffered**; unclear this is correct on LAN
H.224_MLP	**DataApplicationCapability** of **h224** on a **DataProtocolCapability** of something, but definitely NOT **hdlcFrameTunneling** {It would seem that H.224 MLP/LSD/HSD all could be running the same LAN selection - currently for further study?}
H.224_LSD	**DataApplicationCapability** of **h224** on a **DataProtocolCapability** of **unreliableLanStack?**
H.224_HSD	**DataApplicationCapability** of **h224** on a **DataProtocolCapability** of **unreliableLanStack**
T.120	**DataApplicationCapability** of **t120** on **DataProtocolCapability** of **T123LanStack**
H.224_sim	Not needed; use simultaneous cap sets.
Nil_data	Not needed; has no meaning on LAN side; gateway should always present Nil_data cap to SCN side.

7.1.1.8 A.11 HSD/H-MLP Commands

These commands are translated into open logical channel requests. Flow control commands and the maxBitRate are used to match the SCN side rate. The channel is not opened until the data application code is sent on the SCN side.

7.1.1.9 A.12/A.13 Au-ISO Commands & Capabilities

It appears that no H.245 equivalent is needed.

7.1.1.10 A.14/A.15 Data Application Commands & Capabilities

See Table A.3/H.221 above.

7.1.1.11 A.16 Transfer Rate Commands and Caps used in Channel Aggregation

All general issues raised about transfer rates apply here as well.

7.1.2 H.230 commands

{I plan to reorganize and split this table to match the sections of H.230 - Comments?}

{We need to be determine if we add: VCF, LCV, LCD, LCA, LC0, VIN2, VIC, NIR }

Table A.1 H.230 command/indication	**H.245 equivalent** (in **ConferenceCommand** and **ConferenceIndication** mainly)
AIM	Send **logicalChannelInactive** for the audio channel
AIA	Send **logicalChannelActive** for the audio channel
ACE	Send **equalizeDelay** on the audio logical channel
ACZ	Send **zeroDelay** on the audio logical channel
TCI	Send **enterH243TerminalID.**
TII*	Send **terminalIdResponse**
TIS	None needed, when it is received the H.245 command to extract the terminal id string is sent.
VIS	Send **logicalChannelInactive** for the video channel
VIA	Send **logicalChannelActive** for the video channel with **logicalChannelNumber** set
VIA2	Same as VIA
VIA3	Same as VIA
VIR	send **videoIndicateReadyToActivate**
MCC	send **multipointConference** indication to indicate the presence of an H.231 MCU, but use **maxBitRate** to control the bit rate on each audio/video logical channel.
MMS	send **multipointModeCommand**. Once in receipt of this command, the terminal is required to follow all mode requests from the sender of MMS. Note that MMS is proposed in association with the H.262/3 changes.
Cancel-MCC	send **cancelMultipointConference**.
Cancel-MMS	send **cancelMultipointModeCommand**
MIZ	Send **multipointZeroComm**
Cancel-MIZ	Send **cancelMultipointZeroComm**
MIS	Send **multipointSecondaryStatus**
Cancel-MIS	Send **cancelMultipointSecondaryStatus**
MIM	***Unclear; procedures are FFS.***
TIC(cap)	Gateway may support, but no need for H.245 equivalent.

TIX	Gateway may support, but no need for H.245 equivalent.
RAN	***Unclear; procedures seem unsettled***
TIA*	send **terminalNumberAssign**
TIN*	send **terminalJoinedConference**
TID*	send **terminalLeftConference**
TCU	send **terminalListRequest**
TCA	Probably not needed in H.245; this allows a requestor to find out who has the chair, HSD, and LSD tokens.
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, but use **maxBitRate** to control the bit rate on each data logical channel.
VIN*	send **terminalYouAreSeeing**
VCB/Cancel-VCB	send **makeTerminalBroadcaster** and **cancelMakeTerminalBroadcaster**
VCS/Cancel-VCS	send **sendThisSource** and **cancelSendThisSource**
VCR	send **videoCommandReject**
MIL*	***Probably not needed in H.245; gateway would perform loop test between itself and the MCU/terminal sending MIL, if it supported MIL, which is optional.***
CCA	send **makeMeChair**
CIS	send **cancelMakeMeChair**
CIT	send **grantedChairToken** from **makeMeChairResponse.**
CCR	send **deniedChairToken** from **makeMeChairResponse**
CCD*	send **dropTerminal** (move to **ConferenceRequest** from **ConferenceCommand**)
CCK	send **dropConference**
CIR	send **terminalDropReject** in **ConferenceResponse**
CIC	send **chairControlCapability** from **MiscellaneousCapability**
TIF*	send **requestForFloor**
DCA-L,DIT-L,DCR-L,DIS-L,DCC-L	Assuming we agree on how(what protocol on the LAN) LSD gets to the H.323 endpoint, the terminal would attempt to open a logical channel for data to the gateway, and the gateway would perform all required H.243 token related signaling on its behalf. When the token was granted or after a timeout, the gateway would send **OpenLogicalChannelAck** or **OpenLogicalChannelReject** as appropriate

DCA-H,DIT-H,DCR-H,DIS-H,DCC-H	Assuming we agree on how(what protocol) HSD gets to the H.323 endpoint, the terminal would attempt to open a logical channel for data to the gateway, and the gateway would perform all required H.243 token related signaling on its behalf. When the token was granted or after a timeout, the gateway would send **OpenLogicalChannelAck** or **OpenLogicalChannelReject** as appropriate
DCM (sent by GW to SCN)	The H.323 terminal sends a **RequestMode** with a **dataMode** of **t120** and a **DataModeProtocol** of **t123LanStack** 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->SCN data flow to match the signaled MLP channel rate.
DCM (received by GW 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 **t123LanStack**. Since it is in receipt of **multipointModeCommand** the H.323 endpoint responds with an **OpenLogicalChannel to the GW**. 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.
TCS1	send **enterH.243Password**
TCS2	Send **enterH243TerminalId** from **ConferenceRequest**. Note that this field is incorrectly in **ConferenceCommand** at this time. Note also that **enterH243TerminalID** is used for both TCI and TCS2; there is no need for **terminalIDRequest**, which is also too similar to **requestTerminalID!**
TCS3	send **enterH.243ConferenceId**
TCS4	Gateway should return desired H.323 extension to requesting H.320 device
TCP	send **ConferenceRequest.requestTerminalID**
AggIN*	Probably not needed
NCA-i, NCA-a, NIS, NIC, NID	Terminated at the H.323 gateway; no need for H.245 equivalent

NII	Probably not needed
NIA-s, NIQ-s, NIQ-m	Terminated at the H.323 gateway; no need for H.245 equivalent
RIR	Received if H.323 gateway is acting as a master MCU; response is either RID(no H.245 equivalent needed), or close/open sequences are sent to reduce the logical channels to appropriate rates.
RID	None needed; generated by gateway toward SCN side only.
RIU	Received if H.323 gateway is acting as a master MCU; either there is no response needed if no action is to be taken, or close/open logical channel messages are sent to increase the logical channels to appropriate rates.

Table A.2 H.230 MBE command/indication	**H.245 equivalent**
TIL	send **terminalListResponse**
IIS	send **terminalIdResponse** Addition of M/T pair in current text makes this confusing since this is sent in resposnse to TCS-1 and TCS-3; best to add two new responses for passwords and conference identity to avoid confusion
TIR	Probably not needed in H.245
TIP	send **terminalIDResponse. from ConferenceResponse.**
NIA	Not needed; gateway responds for H.323 terminal
NIAP	Not needed; gateway responds for H.323 terminal
AU_MAP	Probably not needed
AU_COM	Probably not needed

7.2 Mapping H.323 Call Control ("Q.931") to N-ISDN

PROCESSING OF Q.931 MESSAGES IN GATEWAYS

The Gateway shall terminate the Q.931 Call Signalling Channel between an H.323 endpoint and the Gateway on one hand and the call signaling 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 information elements or parts of information elements may be added or removed by the Gateway, as needed.

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.
- 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 timeout, CALL PROCEEDING shall be sent to the calling H.323 endpoint.~~
- 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 timeout, CALL PROCEEDING shall be sent to the calling H.323 endpoint.
- A CONNECT ACKNOWLEDGE message shall be forwarded to the SCN side upon receipt. This shall not be done if CONNECT ACKNOWLEDGE has been sent before to the SCN in compliance to the respective SCN specification. If the gateway has sent a CONNECT to an H.323 endpoint and has not received the corresponding CONNECT ACKNOWLEDGE from the H.323 endpoint within the time frame required for successful completion of the call, it shall generate the

CONNECT ACKNOWLEDGE to the SCN side as appropriate to comply to the SCN call setup procedures.

- Messages for supplementary services (FACILITY, HOLD, HOLD ACKNOWLEDGE, HOLD REJECT, RETRIEVE, RETRIEVE ACKNOWLEDGE, RETRIEVE REJECT and the INFORMATION messages) that are not processed by the Gateway, shall 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 Q.931 messages originating on the SCN side are forwarded to the H.323 endpoint without modification except for the following:

- Messages forbidden by H.225.0 shall not be passed to the H.323 side.
- The call reference value is 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 H.225.0.

7.4 Inward and outward Calling

7.5 Securing Encrypted connections between H.320 and H.323 Terminals

7.6 Interactions with H.224/H.281

8.0 H.323 TO H.324

8.1 Mapping H.245 Messages between H.323 and H.324 Endpoints

8.2 Mapping H.323 Call Control to H.324 Call Control

8.3 Inward and outward Calling

8.4 Securing Encrypted connections between H.320 and H.323 Terminals

8.5 Rate Adjustments, Multiple GSTN channel, H.223 interworking issues

8.5.1 Rate Adjustments

8.5.2 Multiple GSTN channel

For further study.

8.5.3 H.223 interworking issues

9.0 H.323 TO H.324M

For further study.

10.0 H.323 TO H.310

For further study.

11.0 H.323 TO V.70

For further study.

12.0 H.320 TO H.324

For further study.