

ITU Telecommunication Standardization Sector

Document AVC-758

Study Group 15

Experts Group for Video Coding and Systems in

May 15-18, 1995

ATM and Other Network Environments

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TITLE :Draft Recommendation H.323: VISUAL TELEPHONE SYSTEMS AND
TERMINAL EQUIPMENT FOR LOCAL AREA NETWORKS WHICH PROVIDE A
NON-GUARANTEED QUALITY OF SERVICE

PURPOSE: Discussion

DRAFT RECOMMENDATION H.323
VISUAL TELEPHONE SYSTEMS AND TERMINAL EQUIPMENT
FOR LOCAL AREA NETWORKS WHICH PROVIDE A NON-
GUARANTEED QUALITY OF SERVICE

Revised May 12, 1995

Note: *[[This document contains editors notes in double brackets. These notes contain questions and open issues that need to be resolved.]]*

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1 Scope

This Recommendation H.323 covers the technical requirements for narrow-band visual telephone services defined in H.200/AV.120-Series Recommendations, in those situations where the transmission path includes one or more Local Area Networks (LAN), which may not provide a guaranteed Quality of Service (QoS) equivalent to that of N-ISDN. Examples of this type of LAN are:

- Ethernet (IEEE 802.3)
- Fast Ethernet (IEEE 802.12 ??)
- FDDI (non-guaranteed quality of service mode)
- Token Ring (IEEE 802.4/5 ??)

Recommendation H.322.1 covers the case of visual telephone services in those situations where the transmission path includes one or more Local Area Networks (LAN), which are configured and managed to provide a guaranteed Quality of Service (QoS) equivalent to that of N-ISDN such that no additional protection or recovery mechanisms beyond those mandated by Rec. H.320 need be provided in the terminals. Pertinent parameters are the data error and loss properties and variation of transit delay. An example of a suitable LAN is: Integrated Services (IS) LAN: IEEE 802.9 Isochronous services with Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Media access control (MAC) service.

1.1 Visual Telephone Terminals

A visual telephone system enables real-time, 2-way communications between two visual telephone terminals. This communications consists of control, indications, voice, moving color pictures, and data between two locations on a local area network. Multipoint communication among more than two visual telephone terminals is also supported (with and without using an MCU).

The visual telephone terminals defined in this Recommendation can be integrated into PCs or workstations, or be stand-alone units.

1.2 Gateway Unit

Systems and terminal equipment complying with Recommendations H.323 are able to interwork with each other and with those complying with Recommendations H.320 (ISDN), H.322.1 (GQOS-LAN), and H.32Y (ATM). The concept is shown in Figure 1/H.323 in which any terminal can be connected to any other. The H.323 Gateway Unit provides an interconnection between the LAN and the Wide Area Network (WAN) which may be N-ISDN or B-ISDN or both. A Gateway can be used to connect a single H.320 terminal to a H.323 LAN.

The Gateway may be connected via N-ISDN or B-ISDN to other Gateways and LANs to provide communication between H.323 terminals which are not on the same LAN. *[[What about dedicated lines?]]*

An H.323 terminal communicates with another H.323 terminal on the same LAN directly and without involving the Gateway. The Gateway may be omitted if communication with terminals not on the same LAN is not required.

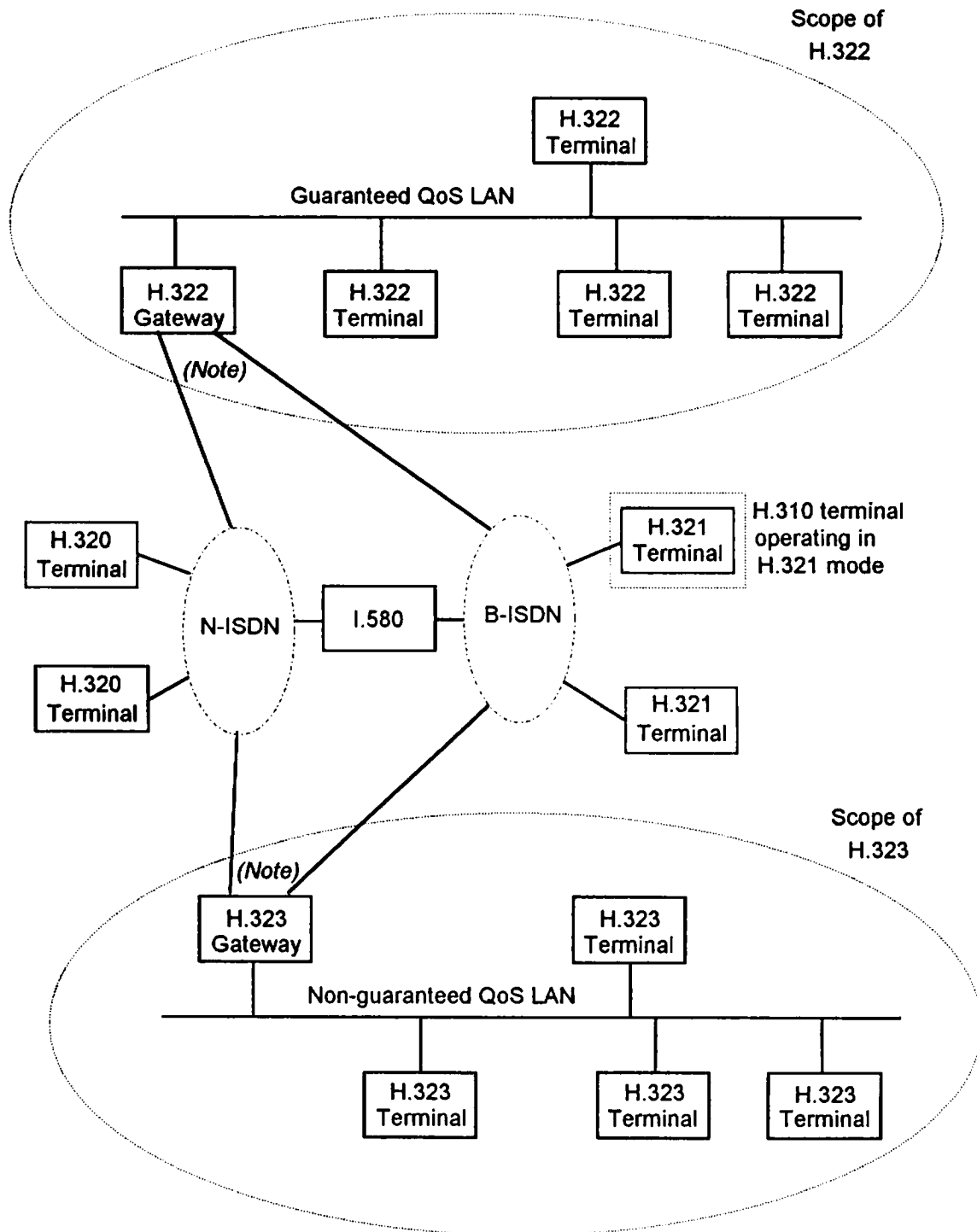
Interworking with visual telephone systems on General Switched Telephone Networks (GSTN) (H.324 series of Recommendation), and mobile radio networks (H.324/M series Recommendations) is also possible. The Gateway Unit may provide a direct connection between the LAN and the GSTN. Alternatively, the Gateway Unit can provide translation to N-ISDN and an H.324 Interworking Unit can provide connection to the GSTN.

The Gateway Unit provides the appropriate translation between multiplex formats (for example H.222 to/from H.221) and between communications procedures (for example H.245 to/from H.242). Translation of video, audio, and data signals is for future study. The functions of the Gateway Unit can be combined with the functions of the Multipoint Control Unit, see 1.3.

1.3 Multipoint Control Unit

The Multipoint Control Unit (MCU) provides for communications between three or more terminals that are not on the same LAN. The MCU shall comply with Recommendations H.231 and H.243. The functions of the MCU can be combined with the functions of the Gateway Unit. The MCU is not required when all communicating terminals are on the same LAN. The MCU is required if one or more communicating terminals are on a LAN and they are communicating with two or more terminals outside the LAN.

[[The issue of terminal capability in a multipoint conference without an MCU needs further consideration.]]



Note. A gateway may support only the N-ISDN or B-ISDN connection.

Figure 1/H.323
Interoperability of H.323 Terminals

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.

[[need to review this list, update reference numbers]]

- [1] ITU-T Recommendation H.22Z (199X): "Multiplexing protocol Visual Telephone Systems and Terminal Equipment on Non-Guaranteed Bandwidth LANs".
- [2] ITU-T Recommendation H.245 (199X): "Control of communications between Visual Telephone Systems and Terminal Equipment on Non-Guaranteed Bandwidth LANs".
- [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 (1995): "Dual Rate Speech coder 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.xxx (1995): [[reserved for low complexity algorithm]] "Speech coder for multimedia telecommunications transmitting at *** 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 (1993): "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 (1993): "Narrow-band ISDN visual telephone systems and terminal equipment".
- [12] Draft ITU-T T.84 | ISO/IEC 10918-3 (1996): "Digital Compression and Coding of Continuous Tone Still Images - Extensions"
- [13] ITU-T Recommendation T.434 (1992): "Binary File Transfer Format for the Telematic Services"

3 Definitions

For the purposes of this Recommendation the definitions given in Clause 3 of both H.22Z [1] and H.245 [2] apply along with the following.

[[need to review this list]]

Audio mute: muting the loudspeaker of a terminal.

Basic Videophone: A videophone containing mandatory features and conforming to performance parameters contained in the Recommendation.

Channel: a unidirectional link between two users.

Connection: a bi-directional link between two users.

Control and Indication (C&I): end-to-end signaling between terminals, consisting of Control, which causes a state change in the receiver, and Indication which provides for information as to the state or functioning of the system (see also H.245 [2] for additional information and abbreviations).

Data: refer to information signals other than audio/speech and video, carried in the logical data channel (see H.22Z [1]).

Enhanced Videophone: A videophone containing enhanced operational features and conforming with performance parameters defined as "optional" in the Recommendation.

Fall-back: A procedure initiated by either the videophone or the network that reduces the bitrate of the voice band connection.

In-band Signaling: Signaling between videophone units that supports user control functions, monitoring functions, user alerts or advisory information about the status of the videophone units or the network connection.

In-band signaling: signaling via Control Channel (see H.245 [2]).

Lip synchronization: operation to provide the feeling that speaking motion of the displayed person is synchronized with his speech.

Man-machine interface: interface between human user and terminal/system, consisting of a physical section (electro-acoustic, electro-optic transducer, keys, etc.) and a logical section dealing with functional operation states.

Out-of-band Signaling: Signaling between the videophone and the network supporting call setup and cleardown.

Videophone System: Two or more videophone units capable of interoperating with the LAN, and each other.

Videophone Unit: A unit of terminal equipment capable of sending and receiving speech and moving picture information simultaneously. Alternatively, a videophone equivalent may be implemented on a general purpose micro-computer equipped with application specific hardware and software capable of performing the functions of a videophone.

4 Symbols and abbreviations

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

[[need to review this list]]

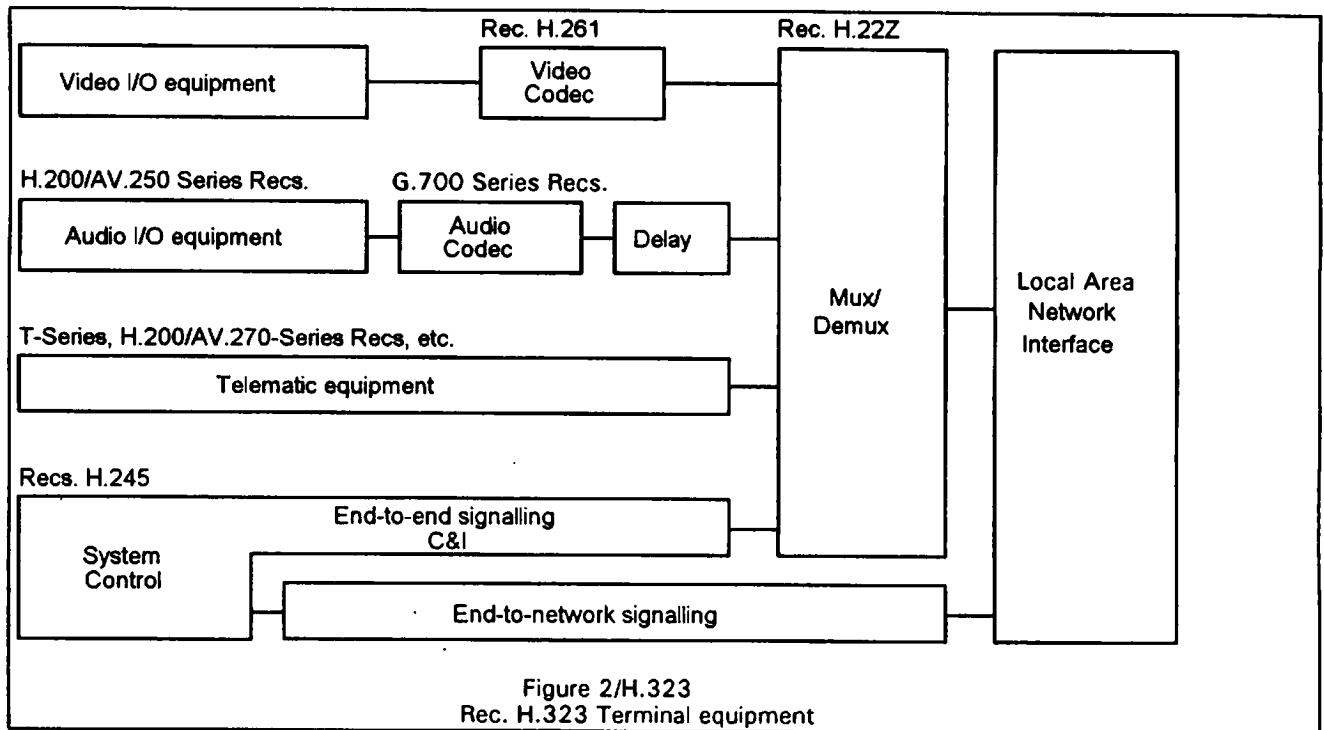
ACE

Audio Command Equalize

AIA	Audio Indicate Active
AIM	Audio Indicate Mute
ANS	Answer Tone
*ANSam	AM Modulated ANS
CI	Call Indication Signal
C&I	Control and Indication
CIF	Common Intermediate Format
CR	Capabilities Request
DCE	Data Communication Equipment
DEMUX	Demultiplex
DTE	Data Terminal Equipment
*DTMF	Dual Tone Multi-Frequency
*ES	Escape Signal
GSTN	General Switched Telephone Network
ISDN	Integrated Services Digital Network
ITU-T	International Telecommunications - Telecommunications Standardization Sector
*IWA	InterWorking Adaptor
LCA	Loopback Command Audio
LCD	Loopback Command Digital
LCO	Loopback Command OFF
LCV	Loopback Command Video
MCC	Multipoint Command Conference
MCU	Multipoint Control Unit
MIS	Multipoint Indicate Secondary-status
MIZ	Multipoint Indicate Zero-communication
MR	Mode Request
MSB	Most Significant Bit
QCIF	Quarter CIF
SQCIF	Sub QCIF
*SPIFF	Still Picture Interchange File Format (ITU-T T.83)
TEA	Terminal Equipment Alarm
VCF	Video Command Freeze
VCU	Video Command Update
VIA	Video Indicate Active
VIR	Video Indicate Ready-to-activate
VIS	Video Indicate Supressed

*[[Delete items marked with *.]]*

5 System description



5.1 Example block diagram and functional elements

An example of an H.323 terminal is shown in Figure 2/H.323. The diagram shows the user equipment interfaces, video coder, audio coder, telematic equipment, mux/demux, system control functions, and the interface to the LAN. All H.323 terminals shall have a System Control Unit, Mux/Demux *[[Pack/Unpack]]* Unit, Network Interface, and an Audio Codec Unit. The Video Codec Unit and Telematic Unit are optional.

5.1.1 System elements outside the scope of H.323

The following elements are not within the scope of H.323, and are therefore not defined within this Recommendation:

Attached audio devices providing, voice activation sensing, microphone and loudspeaker, telephone instrument or equivalent, multiple microphones mixers, and acoustic echo cancellation.

Attached video equipment providing cameras and monitors, and their control and selection, video processing to improve compression or provide split screen functions.

Data applications and associated user interfaces which use T.120 or other data services over the data channel.

Attached Network Interface, which provides the interface to the LAN, supporting appropriate signaling, and voltage levels, in accordance with national standards.

5.1.2 System elements covered by H.323

The following elements are within the scope of H.323, and are therefore subject to standardization and are defined within this Recommendation:

The Speech Codec (G.711, etc.) encodes the speech signal from the microphone for transmission, and decodes the speech code which is output to the loudspeaker. Optional delay may compensate for the video delay, so as to maintain speech and video synchronization.

The Video Codec (H.261, etc.) carries out redundancy reduction coding and decoding for video signals.

The System Control unit (H.245) controls all other system functions including the speech channel and supports such functions as network access, end-to-end control to establish a common mode of operation, and signaling for proper operation of the visual telephone through end-to-end signaling.

The Telematic Data Unit provides an interface for data applications, such as T.120, to access the H.323 data channel.

The Mux/Demux and Error Control (H.22Z). To be supplied by H.22Z editor. *[[Is this a mux/demux function, or is it more properly called a packetizer/depacketizer?]]*

5.2 Signals

Visual telephone signals are classified into video, speech, data, and control as follows:

Audio signals are isochronous and may be delayed to maintain synchronization with the video signals. In order to reduce the average bitrate of audio signals, voice activation may be provided.

Video signals are also isochronous. *[[A mechanism must be identified to control the video data rate.]]*

Data signals include still pictures, facsimile, documents, computer files, and other data streams.

Control signals pass control data between remote like functional elements.

5.3 Network Interface

The network interface is implementation specific and is out side the scope of this recommendation. However, the network interface shall provide the services described in Recommendation H.22Z. This includes the following: Duplex reliable end-to-end service is mandatory for the Supervision and Control Channel. Dulpex, simplex, or multicast unreliable end-to end service may be used for the audio, video and data channels depending on the application.

[[Is simplex service desirable? In multicast applications is there a capability exchange or do receivers take what they can understand? There may be simplex transmission of content (audio, video, data) but may need duplex transmission of supervision and control.]]

[[Congestion detection, packet loss, packet delay, packet jitter]]

5.4 Video Coding

The video coder is optional. If used, the video signal shall be encoded by means of H.261 or H.263. All H.323 terminals shall be capable of encoding and decoding video according to H.261 QCIF. Optionally, a terminal may also be capable of encoding and decoding video according H.261 CIF or H.263 SQCIF. Gateway Units may have to convert the video format between SQCIF and QCIF or CIF. For the H.261 algorithm, SQCIF can be any active picture size less than QCIF, filled out by a black border, and coded in the QCIF format. For all formats, the pixel aspect ratio is the same as the CIF format.

[[This section provides for the optional use of H.263 for coding video. This may provide improved video quality at lower bit rates. This section also indicates that video is optional.]]

Table 1 shows which bitstream formats are required (M), and which are optional (O). *[[Is this table necessary?]]*

Table 1: Video Formats

BITSTREAM FORMAT	LUMINANCE PIXELS	ENCODER		DECODER	
		H.261	H.263	H.261	H.263
CIF	352 x 288	O	O	O	O
QCIF	176 x 144	M	O	M	O
SQCIF	128 x 96	(1)	O	(1)	O

(1) Not part of this recommendation.

The picture format and algorithm options that are used by the encoder are defined during the capability exchange using H.245. After that, the encoder is free to transmit anything that is in line with the capability exchange. In the picture header is indicated which mode is actually used. The decoder should have the possibility to generate non-required requests for a certain mode, but the encoder is allowed to simply ignore these requests.

5.5 Speech Coding

All H.323 terminals shall have an audio coder. It is mandatory that all H.323 terminals be capable of encoding and decoding speech according Recommendation G.711. Terminals intended for interregional operation should be capable of transmitting and receiving A-law and μ -law. A terminal may optionally be capable of encoding and decoding speech using Recommendations G.722, G.728, and G.723. When available, the low complexity algorithm will be an option.

[[This section provides for the optional use of G.723. This may provide acceptable audio at a very low bit rate. G.723 is very low bit rate but high complexity. G.728 is a low bitrate (16kbps) but high complexity algorithm. These high complexity algorithms may not lend themselves to software only codecs. Algorithms such G.711 and G.722 may offer lower complexity. There is also works in SG8 on a low complexity coder, we should provide a placeholder for it.]]

5.5.1 Delay compensation

The video codecs require some processing delay, while the speech codec involves much less delay. Lip synchronization shall not be mandatory, but if it is to be maintained, additional delay must be added in the speech path to compensate.

An H.323 terminal shall not add delay for this purpose in its transmitting speech path. Instead, since video and speech coder delays may vary according to implementation, H.323 terminals shall signal, via indications in the H.245 control channel, the average skew by which their transmitted video signal trails the speech signal.

Intermediate processing points such as MCUs or Gateway Units may alter the video/speech skew, and shall transmit appropriately modified video/speech skew indications, reflecting their transmitted signals. Video signals shall not precede speech signals; if necessary, video path delay shall be added to prevent this.

Receiving terminals may optionally use this information to add appropriate delay in the speech path to achieve lip synchronization.

[[This is the H.324 approach which minimizes audio delay if desired by the receiving terminal. This is because a large video delay is expected because of the complex encoding and low video bitrate. H.320 requires that a delay is added, then encoder delay must be compensated for in the encoder and decoder delay must be compensated for in the decoder. The LAN environment may not have a large delay so the H.320 approach may be more suitable.]]

5.6 Data Channel

The data channel is optional. If available, the data channel shall be capable of supporting Multipoint Audiographic Teleconferencing, as defined in the T.120 series of Recommendations. Other data channel services may also be used.

5.7 Supervision and Control

All H.323 terminals shall provide a supervision and control channel. This channel shall be considered to be permanently open from the establishment of the call until termination of the call. The supervision and control channel supports the necessary control and indications between terminals as per Recommendations H.230 and H.245. This includes capability exchange, mode change commands, escape to proprietary modes, and status.

5.8 Multiplex

[[to be edited by the H.22Z experts]]

As per Recommendation H.22Z

6 Control and Indication (C&I)

C&I shall be chosen from the general audiovisual set contained in H.245 [2]. For videotelephone systems, relevant values are listed in Table 2 giving their source, sink, synchronization with picture, transmission channel and reference for code word definition. They are mandatory where so indicated.

All videotelephone terminals have a video source providing a picture of participants, and some terminals may have optional additional video sources: the participant-picture source is designated #1, having the associated symbol VIA. When incoming video is ON and VIA, VIA2, VIA3 have not been transmitted, source #1 is assumed.

Table 2: C&I signals for videotelephone

	C&I signal	C/I	Source	Sink	Sync. with picture	Transmission channel	Code word definition source	Mandatory (see NOTES)	
								RX (1)	TX (1)
	End_Session	C	sending terminal	receiving terminal	no	Control Channel	H.245	M	M
Audio	audio active/muted indication, AIA/AIM	I	sending terminal	receiving terminal	no	Control Channel	H.245	CM (2)	CM (2)
	audio command equalize, ACE cancel	C	calling terminal	called terminal	no	Control Channel	H.245	M	
Video	Picture format	I	decoder	coder	no	Control Channel	H.245 or H.261		M
	Picture format	C	coder	decoder	yes	embedded in video	H.263 or H.261	M	M
	minimum decodable picture interval	I	decoder	coder	no	Control Channel	H.245		M
	freeze picture request, VCF	C	coder or MCU	decoder	no	Control Channel	H.245	M	
	fast update request control, VCU	C	decoder or MCU	coder	no	Control Channel	H.245	M	CM (3)
	freeze picture release control	C	coder	decoder	yes	embedded in video	H.263 or H.261	M	M
	document camera indication	I	sending terminal	receiving terminal	yes	embedded in video	H.261		M
	video active /suppressed indication VIA, VIA2, VIA3, VIS	I	sending terminal	receiving terminal	no	Control Channel	H.245	CM (2)	CM (2)
	video ready to activate indication, VIR	I	sending terminal	receiving terminal	no	Control Channel	H.245	CM (4)	CM (4)
	split-screen indication	I	sending terminal	receiving terminal	yes	embedded in video	H.261		M (5)
MCU	multipoint, MCC/cancel-MCC	C	MCU, etc.	terminal	no	Control Channel	H.245	M	
	MCU related message	C	terminal or MCU	terminal or MCU	no	Data Channel	ITU-TS T.120series		
	MIZ and MIS	C	MCU	terminal	no	Control Channel	H.245		
Main-ten-ance	audio loop request control, LCA	C	terminal	terminal	no	Control Channel	H.245		
	video loop request control, LCV	C	terminal	terminal	no	Control Channel	H.245		
	digital loop request control, LCD	C	terminal	terminal	no	Control Channel	H.245	M	M
	loop off request, LCO	C	terminal	terminal	no	Control Channel	H.245	M	M

NOTE 1:	RX - mandatory (M) or conditionally mandatory (CM) to recognize and act upon: TX - mandatory (M) or conditionally mandatory (CM) to send when/if relevant conditions occur.
NOTE 2:	Mandatory for a terminal which has user controls to mute audio or cut the video without also switching off the audio/video channel within the transmitted frame.
NOTE 3:	Mandatory if the terminal cannot decode high or low video rates.
NOTE 4:	Mandatory if the terminal itself does not turn video on until it receives this code from the remote terminal.
NOTE 5:	For H.261 only.

[[This table needs to be reviewed and updated. Is it necessary?]]

7 Terminal procedures

[[This section needs to be improved. (H.245 expert)]]

The provision of the communication is made in the following steps:

- phase A: Call set-up (subclause 7.1);
- phase B: Initial communication and capability exchange (subclause 7.2);
- phase C: Establishment of audio visual communication (subclause 7.3);
- phase D: Call termination (subclause 7.4)

7.1 Phases A - Call set-up

The calling terminal shall request the connection according to procedures for the specific network type. The connection shall be *[[connection type and service, ie reliable, acknowledged, datagram]]*.

[[Need H.245 call connection procedure here. What is the method of specifying the ISDN or PSTN phone number to the Gateway Unit? What is the method of specifying the called terminal on the LAN?]]

7.2 Phase B - Initial communication and capability exchange

When the connection has been acknowledged, Phase B begins, which is the capability exchange. Speech may optionally be exchanged during this phase providing the opportunity to speak before proceeding to visual telephony.

During Phase B the terminals may exchange operating mode capability information using the procedures defined in Recommendation H.245. Following this exchange of capabilities, the terminals may proceed directly to the desired operating mode i.e. Phase C.

[[Call answer indication, Capability exchange, Immediately available audio channel.]]

7.3 Phase C - Establishment of audiovisual communication

7.3.1 Procedure at answering terminal

The answering terminal may immediately activate the audio channel to facilitate voice communication. After the completion of the capability exchange, the answering terminal may activate the video and data channels within the capability of the calling terminal.

7.3.2 Procedure at calling terminal

After completion of the capability exchange, the calling terminal may activate the video and data channels within the capability of the calling terminal.

7.3.3 Mode changes

During a session the procedures for changing channel structure, capability, receive mode etc. shall be carried out as defined in Recommendations H.22Z and H.245.

7.3.4 Exchange of video by mutual agreement

The symbol VIR, "Video Indicate Ready-to-activate", is defined in H.245 [2]. Its use is optional, but when used the procedure shall be as follows.

Terminal X has been set so that video is not transmitted unless, and until, the remote terminal has also indicated readiness to transmit video. Terminal X shall send the indication VIR when the initial capability exchange has been completed, but shall not transmit a video signal until it has received either VIR or incoming video.

A terminal which has not been set in this optional way is not obliged to wait until receipt of VIR or video before initiating its video transmission.

7.4 Phase D: Call termination

Either terminal may terminate a call by the following procedure:

- 1) It shall transmit the C&I message VCF (see H.245 [2]) and then discontinue transmission of video packets at the end of a complete picture.
- 2) It shall discontinue transmission of data.
- 3) It shall discontinue transmission of speech
- 4) It shall transmit a final message "End_Session" (see H.245 [2]) in the control channel, and then discontinue all packet transmission within the protocol H.22Z [1].

A terminal receiving "End_Session", without first having transmitted it, shall carry out 1) to 4) above.

8 Interoperation with other terminals

8.1 Speech only terminals

Interoperation with speech only terminals shall be supported.

[[There is an issue concerning the ability of a speech only terminal to participate effectively if it does not have echo cancellation.]]

8.2 Visual telephone terminals over the ISDN (H.320)

Interoperation with visual telephone terminals over the ISDN (H.320) can be provided by:

- 1) using a LAN-ISDN Gateway Unit.

The Gateway Unit must consider the following issues:

- Video format conversion. (if desired, H.261 is mandatory for both terminal types.)
- Audio code conversion. (if desired, G.711 is mandatory for both terminal types.)
- Multiplex scheme conversion. (H.22Z to/from H.221)
- Call Control Conversion. (H.245 to/from H.242)

In order to ease interworking from the H.323 point of view the following requirements shall be met:

- Multiplex related requirements are defined in H.22Z.

8.3 Visual telephone terminals over GSTN (H.324)

Interoperation with visual telephone terminals over the GSTN (H.324) can be provided by two methods:

- 1) using a LAN-GSTN Gateway Unit.
- 2) using a LAN-ISDN Gateway Unit assuming that there exists an ISDN/GSTN Interworking Unit in the network.

The Gateway Unit must consider the following issues:

- Video format conversion. (if desired, H.261 is mandatory for both terminal types.)
- Audio code conversion. (G.711 is mandatory for H.323 terminal, G.723 is mandatory for H.324 terminal.)
- Multiplex scheme conversion. (H.22Z to/from H.223)

In order to ease interworking from the H.323 point of view the following requirements shall be met:

- Video requirements to ease interworking are defined in H.263.
- Multiplex related requirements are defined in H.22Z.

8.4 Visual telephone terminals over Mobile Radio (H.324/M)

For further study

8.5 Visual telephone terminals over ATM (H.321)

Interoperation with visual telephone terminals over ATM networks (H.321) can be provided by two methods:

- 1) using a LAN-ATM Gateway Unit.
- 2) using a LAN-ISDN Gateway Unit assuming that there exists an I.580 ISDN/ATM Interworking Unit in the network.

The Gateway Unit must consider the following issues:

- Video format conversion. (if desired, H.261 is mandatory for both terminal types.)
- Audio code conversion. (if desired, G.711 is mandatory for both terminal types.)
- Multiplex scheme conversion. (H.22Z to/from H.221)
- Call Control Conversion. (H.245 to/from H.242)

In order to ease interworking from the H.323 point of view the following requirements shall be met:

- Multiplex related requirements are defined in H.22Z.

8.6 Visual telephone terminals over Guaranteed Quality of Service LANs (H.322)

Interoperation with visual telephone terminals over Guaranteed Quality of Service LANs (H.322) can be provided by two methods:

- 1) using a NGQOSLAN-GQOSLAN Gateway Unit.
- 2) using a NGQOSLAN-ISDN Gateway Unit assuming that there exists a GQOSLAN-ISDN Gateway Unit in the network.

The Gateway Unit must consider the following issues:

- Video format conversion. (if desired, H.261 is mandatory for both terminal types.)
- Audio code conversion. (if desired, G.711 is mandatory for both terminal types)
- Multiplex scheme conversion. (H.22Z to/from H.221)
- Call Control Conversion. (H.245 to/from H.242)

9 Optional enhancements

9.1 Data facilities

T.120

H.224 (Real-time Data Link Protocol)

H.280 (Far End Camera Control)

9.2 Encryption

H.233 (Confidentiality system)

H.234 (Key Management and authentication)

[[How is this done for multiple signals? Is each packet type encrypted separately? Decryption and re-encryption in the Gateway Unit? Is there an encryption control channel or is it part of the Supervision and Control Channel? Does H.233/234 apply to the LAN or is there a more appropriate LAN encryption procedure?]]

10 Multipoint considerations

H.323 terminals communicating with H.323 terminals on the same LAN may perform multipoint functions internally. These functions include:

- Video selection
- Video mixing
- Audio mixing

[[Are there MCV, VCS, and Chair control functions?]]

A Multipoint Control Unit (MCU) may also be used to perform multipoint functions on the LAN. This unit would at a minimum provide audio mixing and output a composite audio channel for the terminals in the conference to use. This would allow a terminal to receive a mixed audio channel while selecting the desired video channel(s). The MCU may also provide video mixing functions, outputting a composite video channel for the terminals to use.

[[How is channel association performed? How is communications between multiple terminals established? How is the LAN tested for a conference in-progress, so that a terminal may join?]]

12 Maintenance

12.1 Loopbacks for maintenance purposes

Some loopback functions are defined in H.245 [2] to allow verification of some functional aspects of the terminal, to ensure correct operation of the system and satisfactory quality of the service to the remote party. The digital loopback (LCD) command may also be used during actual conversations, for example to measure the network delay.

- a) Loop at terminal-network interface (towards network). Upon receiving the LCD command as defined in H.245, loopback toward the network side shall be made, as indicated in Figure 3/H.323. The ability to respond to this loopback command is mandatory for all terminals.
- b) Loop at analog I/O interface (optional): Upon receiving the LCV or LCA command as defined in H.245, loopback should, where possible, be activated at the analog interface of the video/speech codec towards the video/speech codec, as indicated in Figure 3/H.323. These loopbacks are optional.

The command loopback off (LCO) requires that all loopbacks currently in effect be turned off.

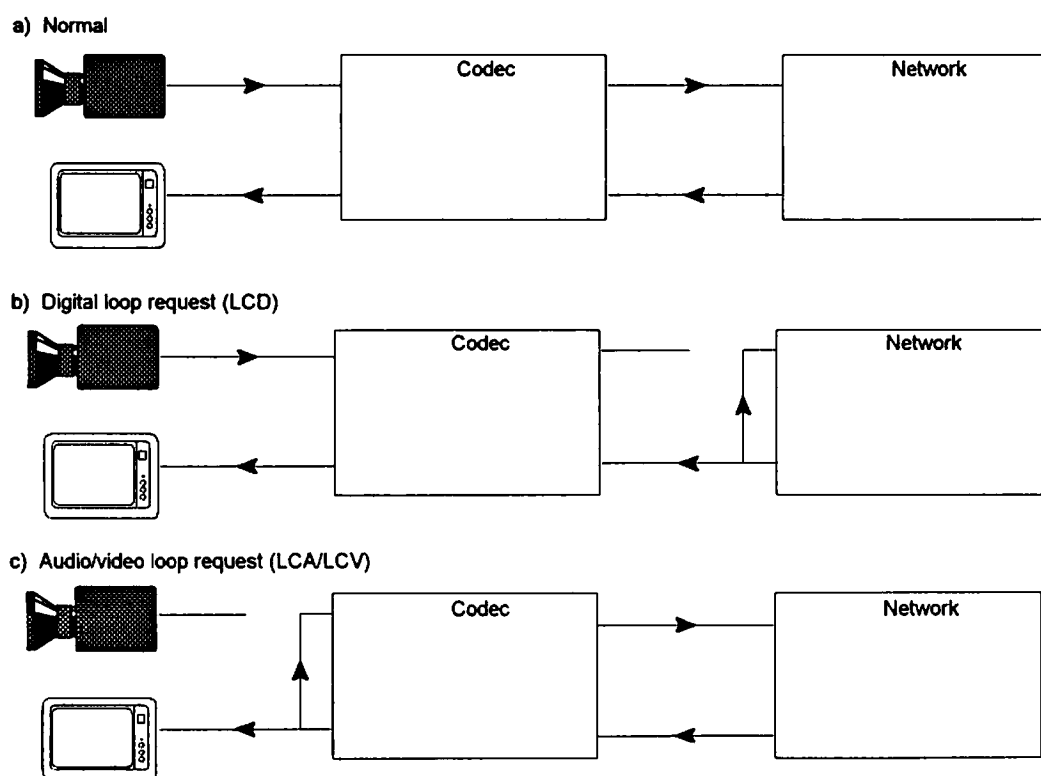


FIGURE 3/H.323
LOOP BACK