

I n t e r n a t i o n a l T e l e c o m m u n i c a t i o n U n i o n

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.225.0

(12/2009)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Transmission
multiplexing and synchronization

Call signalling protocols and media stream packetization for packet-based multimedia communication systems

Recommendation ITU-T H.225.0

ITU-T H-SERIES RECOMMENDATIONS
AUDIOVISUAL AND MULTIMEDIA SYSTEMS

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.349
Directory services architecture for audiovisual and multimedia services	H.350–H.359
Quality of service architecture for audiovisual and multimedia services	H.360–H.369
Supplementary services for multimedia	H.450–H.499
MOBILITY AND COLLABORATION PROCEDURES	
Overview of Mobility and Collaboration, definitions, protocols and procedures	H.500–H.509
Mobility for H-Series multimedia systems and services	H.510–H.519
Mobile multimedia collaboration applications and services	H.520–H.529
Security for mobile multimedia systems and services	H.530–H.539
Security for mobile multimedia collaboration applications and services	H.540–H.549
Mobility interworking procedures	H.550–H.559
Mobile multimedia collaboration inter-working procedures	H.560–H.569
BROADBAND, TRIPLE-PLAY AND ADVANCED MULTIMEDIA SERVICES	
Broadband multimedia services over VIDAL	H.610–H.619
Advanced multimedia services and applications	H.620–H.629
PIT MULTIMEDIA SERVICES AND APPLICATIONS FOR PIT	
General aspects	H.700–H.719
PIT terminal devices	H.720–H.729
PIT middleware	H.730–H.739
PIT application event handling	H.740–H.749
IPTV metadata	H.750–H.759
IPTV multimedia application frameworks	H.760–H.769
IPTV service discovery up to consumption	H.770–H.779

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

Recommendation ITU-T H.225.0

Call signalling protocols and media stream packetization for packet-based multimedia communication systems

Summary

This Recommendation covers the technical requirements for narrow-band visual telephone services defined in H.200 and F.720-series Recommendations, in those situations where the transmission path includes one or more packet-based networks, each of which is configured and managed to provide a non-guaranteed Quality of Service (QoS) which is not equivalent to that of N-ISDN, such that additional protection or recovery mechanisms beyond those mandated by ITU-T Rec. H.320 need be provided in the terminals. It is noted that ITU-T Rec. H.322 addresses the use of some other LANs which are able to provide the underlying performance not assumed by the ITU-T Recs H.323 and H.225.0.

This Recommendation describes how audio, video, data, and control information on a packet-based network can be managed to provide conversational services in H.323 equipment.

Products claiming compliance with Version 7 of H.225.0 (this version) shall comply with all of the mandatory requirements of this Recommendation. Version 7 products can be identified by H.225.0 messages containing a **protocolIdentifier** value of {itu-t (0) recommendation (0) h (8) 2250 version (0) 7}.

This revision incorporates the following changes:

- 1) Correction of defects identified in the H.323-Series Implementor's Guide which include:
 - a) Editing corrections.
 - b) Clarification to the length of information element, where "*" denotes an undefined maximum length.
 - b) Clarification to User-user information element in Setup acknowledge, Status and Status inquiry messages.
 - c) Addition of destinationInfo field to H.225.0 ReleaseComplete and Notify messages.
- 2) Incorporation of multi-language caller and called party identification.
- 3) Clarifications to the processing of H.225.0 Call Signalling messages errors in clause 7.1.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T H.225.0	1996-11-11	16
2.0	ITU-T H.225.0	1998-02-06	16
2.1	ITU-T H.225.0 Annex I	1998-09-25	16
2.2	ITU-T H.225.0 Annex G	1999-05-27	16
3.0	ITU-T H.225.0	1999-09-30	16
4.0	ITU-T H.225.0	2000-11-17	16
4.1	ITU-T H.225.0 (2000) Amend. 1	2002-11-29	16
5.0	ITU-T H.225.0	2003-07-14	16
6.0	ITU-T H.225.0	2006-05-29	16
6.1	ITU-T H.225.0 (2006) Amend. 1	2007-01-13	16
7.0	ITU-T H.225.0 v7	2009-12-14	16

FOREWORD

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

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. 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, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at <http://www.itu.int/ITU-T/ipr/>.

© ITU 2010

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

CONTENTS

Page

1	Scope	1
2	References.....	3
3	Definitions	5
4	Abbreviations.....	5
4.1	General abbreviations	5
4.2	RAS message abbreviations	6
5	Conventions	7
6	Packetization and synchronization mechanism	8
6.1	General approach.....	8
6.2	Use of RTP/RTCP	11
7	H.225.0 message definitions.....	14
7.1	Use of Q.931 messages.....	14
7.2	Common Q.931 information elements	17
7.3	Q.931 based H.225.0 call signalling message details.....	27
7.4	Q.932-based H.225.0 call signalling message details	41
7.5	H.225.0 call signalling timer values	46
7.6	H.225.0 common message elements	47
7.7	Required support of RAS messages	60
7.8	Terminal and gateway discovery messages.....	61
7.9	Terminal and gateway registration messages	63
7.10	Terminal/gatekeeper unregistration messages.....	69
7.11	Terminal to gatekeeper admission messages.....	71
7.12	Terminal to gatekeeper requests for changes in bandwidth	76
7.13	Location request messages	78
7.14	Disengage messages	82
7.15	Status request messages.....	84
7.16	Non-standard message.....	88
7.17	Message not understood	88
7.18	Gateway resource availability messages	89
7.19	RAS timers and Request in Progress (RIP).....	90
7.20	Service control messages.....	92
7.21	AdmissionConfirmSequence	93
7.22	Error Code Mapping.....	93
8	Mechanisms for maintaining QoS	95
8.1	General approach and assumptions	95
8.2	Use of RTCP in measuring QoS.....	95
8.3	Audio/Video jitter procedures	96



Documents

Document Sharing Hub

Rec. ITU-T H.225.0 (12/2009)

iii

	Page
8.4 Audio/Video skew procedures	96
8.5 Procedures for maintaining QoS	96
8.6 Echo control.....	97
Annex A – RTP/RTCP.....	98
Annex B – RTP profile	99
Annex C – RTP payload format for H.261 video streams	99
Annex D – RTP payload format for H.261A video streams	100
D.1 Introduction	100
D.2 H.261A RTP packetization.....	100
Annex E – Video packetization	102
E.1 H.263	102
Annex F – Audio and multiplexed packetization.....	103
F.1 G.723.1	103
F.2 G.728	104
F.3 G.729	104
F.4 Silence suppression	107
F.5 GSM codecs.....	108
F.6 G.722.1	109
F.7 TIA/EIA-136 ACELP.....	110
F.8 TIA/EIA-136 US1	111
F.9 IS-127 EVRC.....	113
F.10 H.223 MUX-PDU packetization	115
Annex G – Communication between and within administrative domains.....	116
G.1 Scope	116
G.2 Definitions	117
G.3 Abbreviations	118
G.4 Normative references.....	118
G.5 System models.....	118
G.6 Operation	121
G.7 Signalling examples.....	127
G.8 Annex G profiles	136
Annex H – H.225.0 message syntax (ASN.1)	141
Annex I – H.263+ video packetization	178
Appendix I – RTP/RTCP algorithms	178
Appendix II – RTP profile	179
Appendix III – H.261 packetization.....	179

	Page
Appendix IV – H.225.0 operation on different packet-based network protocol stacks.....	180
IV.1 TCP/IP/UDP	180
IV.2 SPX/IPX	183
IV.3 SCTP.....	184
Appendix V – ASN.1 usage in this Recommendation.....	185
V.1 Tagging.....	185
V.2 Types	185
V.3 Constraints and ranges.....	185
V.4 Extensibility.....	185
Appendix VI – H.225.0 identifiers of tunnelled signalling protocols.....	185

Copyright © 2009 ITU-T. All rights reserved.

Downloaded from https://www.ava.com

Recommendation ITU-T H.225.0

Call signalling protocols and media stream packetization for packet-based multimedia communication systems

1 Scope

This Recommendation describes the means by which audio, video, data, and control are associated, coded, and packetized for transport between H.323 equipment on a packet-based network. This includes the use of an H.323 gateway, which in turn may be connected to H.320, H.324, or H.310/H.321 terminals on N-ISDN, GSTN, or B-ISDN respectively. The equipment descriptions and procedures are described in ITU-T Rec. H.323 while this Recommendation covers protocols and message formats. Communication via an H.323 gateway to an H.322 gateway for guaranteed Quality of Service (QoS) LANs and thus to H.322 endpoints is also possible.

This Recommendation is intended to operate over a variety of different packet-based networks, including IEEE 802.3, Token Ring, etc. Thus, this Recommendation is defined as being above the Transport layer such as TCP/IP/UDP, SPX/IPX, etc. Specific profiles for particular transport protocol suites are included in Appendix IV. ***Thus, the scope of H.225.0 communication is between H.323 entities on the same packet-based network, using the same transport protocol.*** This packet-based network may be a single segment or ring, or it logically could be an enterprise data network comprising multiple packet-based networks bridged or routed to create one interconnected network. It should be emphasized that operation of H.323 terminals over the entire Internet, or even several connected packet-based networks may result in poor performance. The possible means by which quality of service might be assured on this packet-based network, or on the Internet in general is beyond the scope of this Recommendation. However, this Recommendation provides a means for the user of H.323 equipment to determine that quality problems are the result of packet-based network congestion, as well as procedures for corrective actions. It is also noted that the use of multiple H.323 gateways connected over the public ISDN network is a straightforward method for increasing quality of service.

ITU-T Rec. H.323 and this Recommendation are intended to extend H.320 and H.221 connections onto the non-guaranteed QoS packet-based network environment conferences. As such the primary conference model¹ is one with size in the range of a few participants to a few thousand, as opposed to large-scale broadcast operations, with strong admission control, and tight conference control.

This Recommendation makes use of (RTP/RTCP) Real-time Transport Protocol/Real-Time Transport Control Protocol for media stream packetization and synchronization for all underlying packet-based networks (see Annexes A, B and C). Please note that the usage of RTP/RTCP as specified in this Recommendation is not tied in any way to the usage of TCP/IP/UDP. This Recommendation assumes a call model where initial signalling on a non-RTP transport address is used for call establishment and capability negotiation (see ITU-T Recs H.323 and H.245), followed by the establishment of one or more RTP/RTCP connections. This Recommendation contains details on the usage of RTP/RTCP.

In ITU-T Rec. H.221, audio, video, data, and control are multiplexed into one or more synchronized physical SCN calls. On the packet-based network side of an H.323 call, none of these concepts apply. There is no need to carry from the SCN side the H.221 concept of a $P \times 64$ kbit/s call, e.g., 2 by 64 kbit/s, 3 by 64 kbit/s, etc. Thus, on the packet-based network side, for example, there are only single "connection" calls with a maximum rate limited to 128 kbit/s, not 2×64 kbit/s fixed

¹ An optional broadcast-only conference model is under consideration; of necessity the broadcast model does not provide tight admissions or conference control.

rate calls. Another example has single "connection" packet-based network calls with a maximum rate limited to 384 kbit/s interworking with 6×64 kbit/s on the SCN side². The primary rationale of this approach is to put complexity in the gateway rather than the terminal and to avoid extending onto the packet-based network features of H.320 that are tightly tied to ISDN unless this is necessary.

In general, H.323 terminals are not aware directly of the H.320 transfer rate while interworking through an H.323 gateway; instead, the gateway uses H.245 **FlowControlCommand** messages to limit the media rate on each logical channel in use to that allowed by the H.221 multiplex. The gateway may allow the packet-based network side video rates to substantially underrun the SCN side rates (or the reverse) though the usage of a rate reducing function and H.261 fill frames; the details of such operations are beyond the scope of ITU-T Rec. H.323 and this Recommendation. Note that the H.323 terminal is indirectly aware of the H.320 transfer rates via the video maximum bit rate fields in ITU-T Rec. H.245 and shall not transmit at rates that exceed these rates.

This Recommendation is designed so that, with an H.323 gateway, interoperability with H.320 (1990), H.320 (1993), and H.320 (1996) terminals is possible. However, some features of this Recommendation may be directed toward allowing enhanced operations with future versions of ITU-T Rec. H.320. It is also possible that the quality of service on the H.320 side may vary based on the features and capabilities of the H.323 gateway (see Figure 1).

The general approach of this Recommendation is to provide a means of synchronizing packets that make use of the underlying packet-based network/transport facilities. This Recommendation does not require all media and control to be mixed into a single stream, which is then packetized. The framing mechanisms of ITU-T Rec. H.221 are not utilized for the following reasons:

- Not using H.221 allows each media to receive different error treatment as appropriate.
- H.221 is relatively sensitive to the loss of random groups of bits; packetization allows greater robustness in the packet-based network environment.
- H.245 and H.225.0 call signalling messages can be sent over reliable links provided by the packet-based network.
- The flexibility and power of H.245 as compared to H.242.

² Note that video and data rates on the LAN side must match the video and data rates in the SCN side H.320 multiplex; the audio and control rates are not required to match. Stated another way one would normally expect that, using H.245 flow control, the LAN/SCN gateway will force the video and data rates to fit into the H.221 SCN multiplex. However, since audio may be transcoded in the gateway often, one will frequently find that the LAN audio rate and the SCN rate do not match. Also there should be no expectation that the H.221 bit rate for control (800 bit/s) will generally match the H.245 bit rate on the LAN side. Also note that the LAN rate may under-run the SCN rate for either/both video or/and data, but it cannot exceed the maximum amount that fits into the SCN side multiplex.

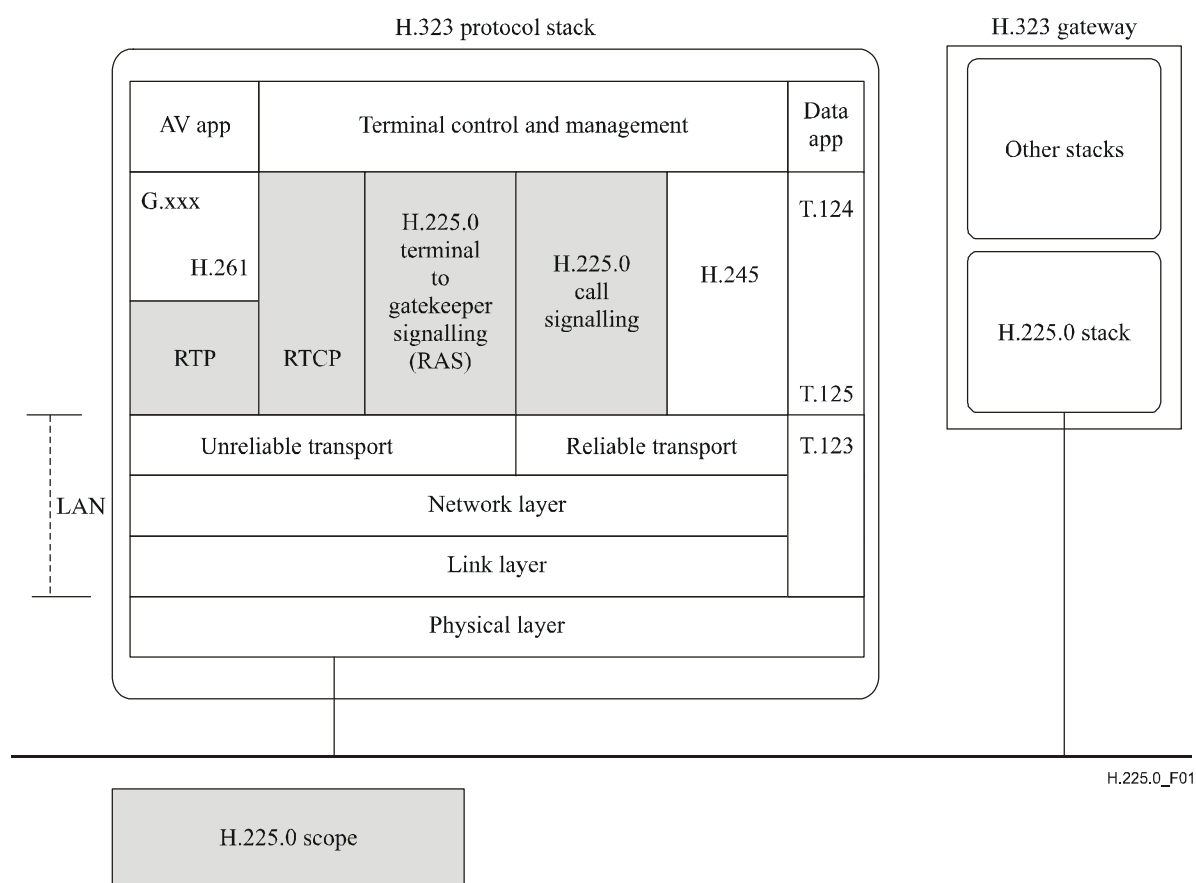


Figure 1 – H.225.0 scope

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [1] ITU-T Recommendation G.711 (1988), *Pulse code modulation (PCM) of voice frequencies*.
- [2] ITU-T Recommendation G.722 (1988), *7 kHz audio-coding within 64 kbit/s*.
- [3] ITU-T Recommendation G.728 (1992), *Coding of speech at 16 kbit/s using low-delay code excited linear prediction*.
- [4] ITU-T Recommendation G.723.1 (2006), *Dual rate speech coder for multimedia communications transmitting at 5.3 and 6.3 kbit/s*.
- [5] ITU-T Recommendation G.729 (1996), *Coding of speech at 8 kbit/s using conjugate-structure algebraic-code-excited linear prediction (CS-ACELP)*.
- [6] ITU-T Recommendation H.221 (2004), *Frame structure for a 64 to 1920 kbit/s channel in audiovisual teleservices*.
- [7] ITU-T Recommendation H.230 (2004), *Frame-synchronous control and indication signals for audiovisual systems*.
- [8] ITU-T Recommendation H.233 (2002), *Confidentiality system for audiovisual services*.

- [9] ITU-T Recommendation H.242 (2004), *System for establishing communication between audiovisual terminals using digital channels up to 2 Mbit/s.*
- [10] ITU-T Recommendation H.243 (2005), *Procedures for establishing communication between three or more audiovisual terminals using digital channels up to 1920 kbit/s.*
- [11] ITU-T Recommendation H.245 (2006), *Control protocol for multimedia communication.*
- [12] ITU-T Recommendation H.261 (1993), *Video codec for audiovisual services at $p \times 64$ kbit/s.*
- [13] ITU-T Recommendation H.263 (2005), *Video coding for low bit rate communication.*
- [14] ITU-T Recommendation H.320 (2004), *Narrow-band visual telephone systems and terminal equipment.*
- [15] ITU-T Recommendation T.122 (1998), *Multipoint communication service – Service definition.*
- [16] ITU-T Recommendation T.123 (1999), *Network-specific data protocol stacks for multimedia conferencing.*
- [17] ITU-T Recommendation T.125 (1998), *Multipoint communication service protocol specification.*
- [18] ITU-T Recommendation H.321 (1998), *Adaptation of H.320 visual telephone terminals to B-ISDN environments.*
- [19] ITU-T Recommendation H.322 (1996), *Visual telephone systems and terminal equipment for local area networks which provide a guaranteed quality of service.*
- [20] ITU-T Recommendation H.324 (2005), *Terminal for low bit-rate multimedia communication.*
- [21] ITU-T Recommendation H.310 (1998), *Broadband audiovisual communication systems and terminals.*
- [22] ITU-T Recommendation Q.931 (1998), *ISDN user-network interface layer 3 specification for basic call control.*
- [23] ITU-T Recommendation Q.932 (1998), *Digital subscriber signalling system No. 1 – Generic procedures for the control of ISDN supplementary services.*
- [24] ITU-T Recommendation X.680 (2008) | ISO/IEC 8824-1:2008, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation.*
- [25] ITU-T Recommendation X.681 (2008) | ISO/IEC 8824-2:2008, *Information technology – Abstract Syntax Notation One (ASN.1): Information object specification.*
- [26] ITU-T Recommendation X.691 (2008) | ISO/IEC 8825-2:2008, *Information technology – ASN.1 encoding rules – Specification of Packed Encoding Rules (PER).*
- [27] ITU-T Recommendation E.164 (2005), *The international public telecommunication numbering plan.*
- [28] ISO/IEC 10646:2003, *Information technology – Universal Multiple-Octet Coded Character Set (UCS).*
- [29] ITU-T Recommendation Q.850 (1998), *Usage of cause and location in the Digital Subscriber Signalling System No. 1 and the Signalling System No. 7 ISDN user part.*
- [30] ITU-T Recommendation Q.950 (2000), *Supplementary services protocols, structure and general principles.*
- [31] ITU-T Recommendation H.235.0 (2005), *H.323 security: Framework for security in H-series (H.323 and other H.245-based) multimedia systems.*

- [32] ISO/IEC 11571:1998, *Information technology – Telecommunications and information exchange between systems – Private Integrated Services Networks – Addressing*.
- [33] IETF RFC 1738 (1994), *Uniform Resource Locators (URL)*.
- [34] IETF RFC 2068 (1997), *Hypertext Transfer Protocol – HTTP/1.1*.
- [35] IETF RFC 1766 (1995), *Tags for the Identification of Languages*.
- [36] ITU-T Recommendation H.248.1 (2005), *Gateway control protocol: Version 3*.
- [37] IETF RFC 3550 (2003), *RTP: A Transport Protocol for Real-Time Applications*.
- [38] IETF RFC 3551 (2003), *RTP Profile for Audio and Video Conferences with Minimal Control*.
- [39] IETF RFC 2032 (1996), *RTP Payload Format for H.261 Video Streams*.
- [40] ITU-T Recommendation X.690 (2008) | ISO/IEC 8825-1:2008, *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*.
- [41] ITU-T Recommendation Q.115.1 (2002), *Logic for the control of echo control devices and functions*.

3 Definitions

See definitions in ITU-T Rec. H.323. In ITU-T Rec. H.323 the term "endpoint" is used to refer to terminals, gateways, and MCUs as elements that are capable of receiving or initiating calls. In this Recommendation the term "terminal" is often used in a general way in descriptions of call setup, and should be understood as referring to an element that can take part in call setup, including a gateway or MCU.

4 Abbreviations

This Recommendation uses the following abbreviations:

4.1 General abbreviations

BAS	Bit rate Allocation Signal
CIF	Common Intermediate Format
CRV	Call Reference Value
ECS	Encryption Control Signal
FFS	For Further Study
GOB	Group of Blocks
H-MLP	High speed Multi-Layer Protocol
HSD	High Speed Data
IA5	International Alphabet No. 5
IE	Information Element
IETF	Internet Engineering Task Force
IP	Internet Protocol
LAN	Local Area Network
LD-CELP	Low Delay – Code Excited Linear Prediction



LSB	Least Significant Bit
LSD	Low Speed Data
MB	Macro Block (see ITU-T Rec. H.261)
MBE	Multi-Byte Extension
MCC	Multipoint Command Conference
MCN	Multipoint Command Negating
MCS	Multipoint Command Symmetrical data transmission
MCS	Multipoint Communication Service
MCU	Multipoint Control Unit
MF	MultiFrame
MLP	Multi-Layer Protocol
MPI	Minimum Picture Interval
MSB	Most Significant Bit
NA	Not Applicable
NS	Non-Standard
NSAP	Network Service Access Point
PCM	Pulse Code Modulation
PDU	Protocol Data Unit
QCIF	Quarter Common Intermediate Format
QoS	Quality of Service
RAS	Registration, Admission and Status
RTCP	Real-time Transport Control Protocol
RTP	Real-time Transport Protocol
SBE	Single Byte Extension
SC	Service Channel
SCM	Selected Communications Mode
SCN	Switched Circuit Network
TCP	Transport Control Protocol
TSAP	Transport Service Access Point
UDP	User Datagram Protocol
URL	Uniform Resource Locator
VCF	Video Command "Freeze picture Request"
VCU	Video Command "Fast Update Request"

4.2 RAS message abbreviations

ACF	Admissions Confirm
ARJ	Admissions Reject

ARQ	Admissions Request
BCF	Bandwidth Confirm
BRJ	Bandwidth Reject
BRQ	Bandwidth Request
DCF	Disengage Confirm
DRJ	Disengage Reject
DRQ	Disengage Request
GCF	Gatekeeper Confirm
GRJ	Gatekeeper Reject
GRQ	Gatekeeper Request
IACK	Information request Acknowledgement
INAK	Information request Negative Acknowledgement
IRQ	Information Request
IRR	Information Request Response
LCF	Location Confirm
LRJ	Location Reject
LRQ	Location Request
RAC	Resource Availability Confirmation
RAI	Resource Availability Indication
RCF	Registration Confirm
RIP	Request In Progress
RRJ	Registration Reject
RRQ	Registration Request
SCI	Service Control Indication
SCR	Service Control Response
UCF	Unregistration Confirm
URJ	Unregistration Reject
URQ	Unregistration Request

5 Conventions

In this Recommendation, "shall" refers to a mandatory requirement, while "should" refers to a suggested but optional feature or procedure. The term "may" refers to an optional course of action without expressing a preference.

When a term such as "MCU" is used, an H.323 MCU is referred to. If an H.231 MCU is intended, this will be explicitly noted.

In this Recommendation kilobits/second is abbreviated kbit/s and is measured in units of 1000. Thus, 64 kbit/s is exactly 64 000 bits per second.

Unless otherwise specified, the aligned variant PER encoding of ASN.1 shall be used for all ASN.1 specified in this Recommendation.

Q.931 message names are Capitalized. ASN.1 names are indicated in **bold**.

NOTE – More recent Recommendations normally represent ASN.1 names using *courier* font. For consistency of presentation with other Recommendations of the H.323 system, ASN.1 names in this text are kept in **bold** typeface.

6 Packetization and synchronization mechanism

6.1 General approach

Before any calls are made, an endpoint may discover/register with a gatekeeper. If this is the case, it is desirable for the endpoint to know the vintage of the gatekeeper it is registering with. It is also desirable for the gatekeeper to know the vintage of endpoints that register with it. For these reasons, both the *discovery* and registration sequences contain an H.245 style OBJECT IDENTIFIER that allows the vintage to be determined in terms of the version of ITU-T Rec. H.323 implemented. This sequence also may contain optional non-standard message parts to allow endpoints to establish non-standard relationships. At the end of this sequence, both gatekeepers and endpoints are aware of the version numbers and the non-standard status of each other.

The version number is mandatory and non-standard information is optional in the Setup/Connect sequence described below to allow two endpoints to inform each other of their vintage and non-standard status. Note, however, that all H.225.0 call signalling messages have a field for an optional non-standard message in the User-user information element, and that all RAS channel messages have an optional field for non-standard information. In addition, a non-standard RAS message has been defined that can be sent at any time.

The unreliable channel for registration, admissions, and status messaging is called the RAS channel. The general approach to starting a call is to send a mandatory admission request on the RAS channel³, followed by an initial Setup message on a reliable channel transport address (this address may have been returned in the admission confirmation message, or may have been known to the calling terminal). As a result of this initial message, a call setup sequence commences based on H.225.0 call signalling operations with enhancements described below. The sequence is complete when the terminal receives in the Connect message a reliable transport address on which to send H.245 control messages⁴.

When messages are sent on the reliable H.225.0 call signalling channel, only one whole message shall be sent within the boundaries defined by the reliable transport; there shall be no fragmentation of H.225.0 messages across transport PDUs. (In IP implementations as outlined in Appendix IV, this PDU is defined by TPKT.)

Once the reliable H.245 control channel has been established, additional channels for audio, video, and data may be established based on the outcome of the capability exchange using H.245 logical channel procedures. Also, the nature of the packet-based network-side multimedia conference (centralized vs. distributed/multicast) is negotiated on a per connection basis⁵. This negotiation is

³ A terminal that is not registered with a gatekeeper is not required to send an admissions request.

⁴ Note that the H.245 address may be sent in the Alerting or Call Proceeding message to shorten call setup time. Note that the H.245 channel may be opened immediately after the receipt of the H.245 address in the Setup message.

⁵ The LAN side conference may be part centralized and part distributed, as decided by the MC controlling the conference. However, the terminal is not aware of this fact. Generally, of course, all terminals will see the same Selected Communications Mode (SCM) (see ITU-T Rec. H.243 for a definition).

performed per media, in the sense that, for example, audio/video may be distributed, while data and control are centralized.

When messages are sent on the reliable H.245 control channel, more than one message may be sent within the boundaries defined by the reliable transport PDU as long as whole messages are sent; there shall be no fragmentation of H.245 messages across transport PDUs. (In IP implementations as outlined in Appendix IV, this PDU is defined by TPKT.)

H.225.0 terminals shall be capable of sending audio and video using RTP via unreliable channels to minimize delay. Error concealment or other recovery action may be applied to overcome lost packets; in general audio/video packets are not re-transmitted since this would result in excessive delay in the packet-based network environment⁶. It is assumed that bit errors are detected in the lower layers, and errored packets are not sent up to H.225.0. Note that audio/video and call signalling/H.245 control are never sent on the same channel, and do not share a common message structure. H.225.0 terminals shall be capable of sending and receiving audio and video on separate transport addresses using separate instances of RTP to allow for media-specific frame sequence numbers and separate quality of service treatment for each media. However, an optional mode where audio and video packets are mixed in a single frame which is sent to a single transport address is for further study.

T.120 capabilities are negotiated using H.245, and upon receipt of appropriate messages, T.120 conferences are established using the transport/packet-based network stacks of T.123 as appropriate. T.120 shall be conveyed over the packet-based network between endpoints on another transport address. Table 1 shows the number of TSAP identifiers used for each media on a point-to-point call. It is also true that a given H.323 terminal may be able to participate in more than one conference at a time, resulting in the use of additional TSAP identifiers. All H.245 logical channels used are unidirectional except for those associated with T.120, which are bidirectional.

Table 1 – TSAP IDs used by H.225.0 per point-to-point unicast call

Usage of TSAP IDs	Reliable or unreliable	Well known or dynamic
Audio/RTP	Unreliable	Dynamic
Audio/RTCP	Unreliable	Dynamic
Video/RTP	Unreliable	Dynamic
Video/RTCP	Unreliable	Dynamic
Call Signalling	Reliable	Well known or dynamic
H.245	Reliable	Dynamic
Data (T.120)	Reliable	Well known or dynamic
RAS	Unreliable	Well known or dynamic
NOTE – If well known TSAP identifiers are used, there can only be a single endpoint per network address. Also, in the direct call model the caller requires a well known TSAP identifier for the Call Signalling channel to start the call.		

Although the transport address for, say, audio and video, may share the same packet-based network address and differ only by TSAP identifier, some manufacturers may choose to use different packet-based network addresses for audio and video. The only requirement is that the convention of Annexes A and B should be followed in the numbering of TSAP identifiers in the RTP session⁷.

⁶ Fast Update of full frames, MBs, or GOBs may be requested via H.245 signalling.

⁷ Note that any TSAP ID can be used for the initial RTP session; the major reason to follow the RTP convention is for possible IETF RTP interoperability.

Table 1 describes the basic case of point-to-point unicast operations between two terminals. To facilitate the construction of gateways, MCUs, and gatekeepers, dynamic TSAP IDs may be used instead of well known TSAP IDs. Tables 2 and 3 illustrate an example of TSAP ID usage for the gateway/MCU case, and for the gatekeeper case.

Table 2 – TSAP IDs used on one MCU/gateway port (Unicast example)

Usage of TSAP IDs	Reliable or unreliable	Well known or dynamic
Audio/RTP	Unreliable	Dynamic
Audio/RTCP	Unreliable	Dynamic
Video/RTP	Unreliable	Dynamic
Video/RTCP	Unreliable	Dynamic
Call Signalling	Reliable	Dynamic (Note)
H.245	Reliable	Dynamic
Data (T.120)	Reliable	Dynamic
RAS	Unreliable	Dynamic (Note)
NOTE – See Note 1 of Table 3.		

Table 3 – Example of TSAP IDs usage by H.225.0 gatekeeper supporting the gatekeeper mediated call model of Figure 28/H.323 for a point-to-point call

Usage of TSAP IDs	Reliable or unreliable	Well known or dynamic	Number of channels
Call Signalling	Reliable	Dynamic or well known (Note 1)	2 per call (Note 2)
H.245	Reliable	Dynamic	2 per call (Note 2)
RAS	Unreliable	Well known	1
NOTE 1 – If the well known TSAP ID is used, the gatekeeper may be limited to a single endpoint per device; therefore, dynamic TSAP IDs should be used.			
NOTE 2 – 0 for direct call model; 2 for gatekeeper-mediated call model.			

Note that a reliable transport address is used for call setup for the terminal to terminal case, and also for the gatekeeper-mediated case. The reliable call signalling connection shall be kept active until a Release Complete message is received for all active calls signalled over the call signalling channel.

Note that more than one H.245 channel may be open at a given time, i.e., an endpoint may be in more than one call/conference at the same time. Note also that within a specific call, a terminal may have more than one channel of the same type open, e.g., two audio channels for stereo audio. The only limitation is that there shall be one and only one H.245 control channel per point-to-point call.

H.245 logical channel signalling is used to start and stop video, audio, and data protocol usage. This process calls for closing the open channel, and then reopening with a new mode of operation. As part of the process of opening the channel, before sending the open logical channel acknowledgment, the endpoint uses the ARQ/ACF or BRQ/BCF sequence to ensure that sufficient bandwidth is available for the new channel (unless sufficient bandwidth is available from a previous ARQ/ACF or BRQ/BCF sequence). In some cases, the gateway may find that the SCN side mode change occurs more quickly than the packet-based network side mode change, resulting in the possibility of the loss of audio information. The gateway may adopt several approaches at the discretion of the manufacturer:

- a) the gateway may transcode audio, thus hiding the SCN mode changes;

- b) the gateway may simply throw away audio information; or
- c) the gateway may operate as an H.231 MCU, thus gaining control over all SCN side mode changes.

No general rule exists concerning whether H.245 or RTP procedures (see Annexes A, B and C) take precedence; each conflict and its resolution is specifically mentioned in this Recommendation.

Note also that there is no fixed association between SSRCs and logical channels; ITU-T Rec. H.245 provides this association which may be used for audio/video synchronization.

In general, two types of conference modes of operation on the packet-based network side are possible: distributed and centralized. It is also possible that different choices may be made for different media, e.g., distributed audio/video and centralized data. Procedures for determining what sort of conference to establish are in ITU-T Rec. H.323; the messages of this Recommendation are intended to support all allowed combinations, noting that distributed control and data are for further study although supported by the H.245 capability signalling.

6.2 Use of RTP/RTCP

The H.225.0 endpoint shall be capable of using separate TSAP IDs for audio and video and the associated RTCP channels as described in Annexes A and B. Optionally, endpoints may choose to use different packet-based network addresses for audio and video, but for each packet-based network address the convention of Annexes A and B should be followed in the use of TSAP IDs. Using H.245 signalling, additional audio and video channels may be established if the terminal supports this capability.

An optional capability to use a single transport address for both audio and video is for further study.

Unless an exception is specifically mentioned here, implementations shall follow those of RTP as contained in Annex A unless modified by text in this Recommendation. Implementations shall follow the RTP profile (see Annex B) only as specifically mentioned in this Recommendation.

RTP translators and mixers are not elements of the H.323 system, and any information about them in Annexes A and B shall be regarded as informative. Note that both gateways and MCUs have some aspects of both mixers and translators, and the information in Annexes A and B may be helpful in the implementation of gateways and MCUs. However, MCUs are not mixers, and mixers are not MCUs. Note that gateways, for example, on a packet-based network-to-packet-based network call via the gateway may act as translators.

Version (V): Version 2 of RTP shall be used.

CSRC Count (CC): Use of the CSRC count in this Recommendation is optional. When not in use, the value of CC shall be zero (0). The CSRC may be used by MCUs to provide information on contributors to the audio sum when distributed audio processing is occurring. Note that there are no capabilities associated with the ability to understand the CSRC count so the MCU/MC has no way of knowing whether and how the terminal in the conference makes use of the information.

CNAME: In the simplest case of a point-to-point connection on the packet-based network, the SSRC is used to identify an audio/video source from a terminal, and the streams are associated by a CNAME as being supplied by the same endpoint as specified in Annex A.

When using RTCP, either RR or SR packets shall be sent periodically as described in Annex A. The CNAME SDES message shall be used. Other SDES messages (see Annex A) are optional, but shall not be used for conference control or conference information when either H.245 and/or T.120 control functions are in use. Information provided by ITU-T Rec. H.245 and/or ITU-T Rec. T.120 shall be regarded as the correct information.

The RTCP BYE message shall not be relied on for RTP session termination. The H.323 terminal determines when a call is disconnected via the procedures of ITU-T Rec. H.323. The only mandatory use of the RTCP BYE packet is for SSRC collision resolution.

The H.323 terminal, when engaged in any conference, whether point-to-point or multipoint, shall restrict the logical channel bit rate averaged over a period as defined in ITU-T Rec. H.245 to that signalled in the H.245 **FlowControlCommands**, H.245 logical channel commands, and the T.120 flow control mechanism.

When the H.323 terminal is connected to an H.323 gateway, the gateway shall use the means of ITU-T Recs H.245 and T.120 to force the H.323 terminal to transmit at a rate less than or equal to the SCN side media rates and receive at a rate equal or higher than the SCN rate, with the following exceptions:

- Control bandwidth on the packet-based network need not match that in ITU-T Rec. H.221.
- Audio bandwidth on the packet-based network may match that in ITU-T Rec. H.221 on the SCN, but with gateway transcoding a match is not required.
- In the case where the gateway is using a rate reducer: the packet-based network-side H.323 terminal shall not exceed the H.245 signalled rate, which will probably be less than the rate being sent over the SCN.

Encryption for H.323 endpoints is for further study.

6.2.1 Audio

Before considering how audio is packetized using RTP, attention must be directed toward how it is signalled via H.245, and the relationship of this signalling to RTP. In general, when the audio channel is opened, an H.245 logical channel is opened. H.245 signalling in the **AudioCapability** structure is given in terms of the maximum number of frames per packet. The frame size for this Recommendation varies with the audio coding in use.

All H.323 terminals offering audio communication shall support G.711. For all frame-oriented audio codecs, receivers shall signal the maximum number of audio frames they are capable of accepting in a single audio packet. Transmitters may send any whole number of audio frames in each packet, up to the maximum stated by the receiver. Transmitters shall not split audio frames across packets, and shall send whole numbers of octets in each audio packet.

Sample-based codecs, such as G.711 and G.722, shall be considered to be frame-oriented, with a frame size of eight samples. (See Annex B for additional information regarding guidelines for sample-based audio encoding.) For audio algorithms such as G.723.1 which use more than one size of audio frame, audio frame boundaries within each packet shall be signalled in-band to the audio channel.

For audio algorithms which use a fixed frame size (see ITU-T Recs G.728 and G.729 for the frame size used by each) audio frame boundaries shall be implied by the ratio of packet size to audio frame size; in other words only whole audio frames shall be put in the RTP packet.

Payload Type (PT): Only ITU-T payload types such as (0)[PCMU], (8)[PCMA], (9)[G722], and (15)[G728] shall be used for ITU-T codecs signalled in ITU-T Rec. H.245. Dynamic payload types exchanged using H.245 signalling shall be used for any ITU-T payload types not listed in Annex B.

It is recommended that if an interruption in sequence numbers is observed, the receiver may repeat the most recent received sounds such that the amplitude of the repeated sound decays to silence; other similar procedures may be used at the discretion of the manufacturer.

Each G.711 octet shall be octet aligned in an RTP packet. The sign bit of each G.711 octet shall correspond to the most significant bit of the octet in the RTP packet (i.e., assuming the G.711

samples are handled as octets on the host machine, the sign bit shall be the most significant bit of the octet as defined by the host machine format).

When sending 48/56 kbit/s PCM toward the packet-based network, the H.323 gateway shall pad the extra 1 or 2 bits in each octet in accordance with Note 2 in Table 1b/G.711, and use the RTP values for PCMA or PCMU(8 or 0). For μ -law the padding consists of "1" in both the 7th and 8th bit. For A-law the 7th bit shall be 0 and the 8th bit 1. In the reverse direction the H.323 gateway shall truncate 64 kbit/s G.711 on the packet-based network side to fit the G.711 rate being used in H.320. Thus, on the packet-based network side only 64 kbit/s G.711 shall be used.

When sending 48/56 kbit/s G.722 toward the packet-based network, the H.323 gateway shall pad the extra 1 or 2 bits in each octet, and use dynamic RTP payload types as signalled by ITU-T Rec. H.245 to differentiate between 64 kbit/s (which uses PT = 9) and the reduced rate cases. In the reverse direction the H.323 gateway shall truncate 64 kbit/s G.722 on the packet-based network side to fit the G.711 rate being used in H.320. Thus, on the packet-based network side only 64 kbit/s G.722 shall be used.

If possible, the H.323 terminal should make use of the silence suppression feature of RTP, especially when the conference is multicast. The H.323 terminal shall be able to receive silence compressed RTP streams. Coders may omit sending audio signals during silent periods after sending a single frame of silence, or may send silence background fill frames if such techniques are specified by the audio codec Recommendation in use.

6.2.2 Video messages

Payload Type (PT): Only ITU-T payload types such as that for ITU-T Rec. H.261 or ITU-T Rec. H.263 shall be used for ITU codecs signalled in ITU-T Rec. H.245. Dynamic payload types may be used for codecs which can be signalled via H.245 and for which packetization formats have not been defined.

Marker (M): The marker bit should be set according to the procedures described in Annex A except in cases where it would increase end-to-end delay.

In order to recover from the loss of video packets, H.245 **VideoFastUpdatePicture**, **VideoFastUpdateMB**, and **VideoFastUpdateGOB** shall be supported. Use of the RTCP control packets Full Intra Request (FIR) [send me a full frame] and Negative Acknowledgment (NACK) [Send me certain packets] is optional, and signalled in H.245 capabilities.

Error recovery method 3) as described in Section 5 of RFC 2032 [39] may be impractical if the NACK does not arrive within one frame time.

H.261 is packetized on the packet-based network side as per Annex C. As long as sufficiently large RTP packets are available, fragmentation on MB boundaries by the transmitter is not required. However, if the H.323 terminal fragments H.261 packets on the RTP level, this fragmentation shall occur on MB boundaries. All H.323 terminals shall be able to receive MB fragmented packets as well as GOB fragmented packets, or packets with a mix of MBs and GOBs. Note that failure to support MB fragmentation in the transmitter may result in the loss of an entire GOB, and may also lower the packet rate. RTP packets used shall not exceed the size of the Maximum Transfer Unit (MTU) on a given packet-based network to maximize robustness of operation, but if the smallest independently coded element of the coding scheme (e.g., a macroblock) is larger than the MTU size it is not required to break up the packet over MTUs. MBs shall not be split across packets; all packets shall end on a GOB or MB boundary. The H.323 transmitter may choose to fill out a packet containing a small GOB with additional MBs, but this is not required.

To preclude the possibility of corruption in multiple pictures caused by the loss of an RTP packet, the RTP packetizer in an H.323 endpoint shall not include video from more than one picture in an RTP packet.

The SBIT is the number of most significant bits that shall be ignored in the first data octet. EBIT is the number of least significant bits that shall be ignored in the last data octet.

The RTP packetizer shall not intentionally octet align video at the start of RTP packets. In other words, if $EBIT = n$ in an RTP packet, SBIT in the next RTP packet shall equal $8 - n$, $0 < n < 8$, and if $EBIT = 0$ in an RTP packet, SBIT in the next RTP packet shall equal 0. This requirement avoids possible additional end-to-end delay caused by bit-shifting. This requirement shall apply across picture boundaries.

Annex D specifies an H.323 extension to the video packet header that contains an optional octet count. The use of this optional extension is described in Annex D.

See Appendix IV for packet-based network-specific advice on video packetization.

6.2.3 Data messages

There are no special data messages or formats; T.120 is used on the packet-based network as per ITU-T Rec. T.123. Centralized vs. distributed data conferencing on the packet-based network is described in ITU-T Rec. H.323, and is negotiated via H.245.

T.120 flow control on the packet-based network is managed using packet-based network protocols when requested by H.245 **FlowControlCommand** and **maxBitRate** limits.

See ITU-T Rec. H.323 for the procedures used to connect a running T.120 conference to an H.323 conference, or to add an H.323 call to a T.120 conference.

The protocol to be used by H.224 on the packet-based network is for further study.

7 H.225.0 message definitions

This clause concerns the definition of messages for call setup, call control, and communications between terminals, gateways, gatekeepers, and MCUs.

The ASN.1 definitions for all H.225.0 messages appear in Annex H.

7.1 Use of Q.931 messages

Implementations shall follow ITU-T Rec. Q.931 as specified in this Recommendation. Terminals may also support optional H.450 APDUs in the User-User IE. The messages shall contain all of the mandatory information elements and may contain any of the optional information elements as defined in ITU-T Rec. Q.931 as described in this Recommendation. The H.225.0 endpoint may, according to ITU-T Rec. Q.931, ignore all optional messages it does not support without harming interoperability, but shall respond with a Status message that should contain Cause No. 95 "Invalid message, unspecified" to an H.225.0 message it cannot understand or decode due to a Q.931 or ASN.1 encoding error.

Error handling procedures defined in clause 5.8 and associated sub-clauses of ITU-T Rec. Q.931 do not apply to H.225.0 endpoints.

Each H.225.0 endpoint shall be able to receive and identify an incoming H.225.0 call signalling message including one containing an H.450 APDU in the User-user IE. It shall be capable of processing the mandatory H.225.0 call signalling messages; it may be capable of processing the optional H.225.0 call signalling messages. In any case, each H.225.0 endpoint shall be able to ignore messages unknown to it without disturbing operation.

Each H.225.0 endpoint shall be able to interpret and generate the information elements mandated in the following for the respective H.225.0 call signalling messages and H.450 APDU in User-user IE. It may interpret and generate the optional information elements as defined below as well. It may also interpret other information elements of Q.931, or other Q-series or H.450 protocols. The endpoints shall be able to ignore unknown information elements contained in an H.225.0 call

signalling message or H.450 APDU without disturbing operation. H.225.0 endpoints shall not send multiple information elements of the same type in the same message; for example, they shall not send multiple Calling Party Number information elements as described in Annex A/Q.931.

Information Elements shall be encoded according to ITU-T Rec. Q.931, except where modified in this Recommendation. However, ITU-T Rec. Q.931 shall always dictate the proper ordering of information elements within a message, regardless of the order of elements listed within this Recommendation.

Intermediate systems (gateways and gatekeepers) shall follow the rules below with regard to H.225.0 call signalling optional messages and information elements:

- 1) The gateway should and the gatekeeper shall, after appropriate modification, forward all information elements (optional or mandatory) associated with mandatory H.225.0 call signalling messages either from the terminal to the gateway/terminal or in the reverse direction. This includes such information elements as User-user information and the Display information.
- 2) A gateway should forward all H.225.0 call signalling messages including those containing H.450 APDUs and information elements in both directions.
- 3) A gatekeeper shall forward all H.225.0 call signalling messages including those containing H.450 APDUs and information elements in both directions after appropriate modification. Note that the gatekeeper may act as a signalling element that can provide features (such as supplementary service features) and may therefore modify, terminate, or originate H.225.0 call signalling messages.

H.323 gateways may be capable of converting H.450-series supplementary services and H.225.0 messages to the corresponding supplementary services and messages of ISO/IEC 11582, ISUP and other SCN signalling standards. Details are the scope of ITU-T Rec. H.246 and its annexes.

H.323 gateways may be capable of passing on unmodified signalling messages of ISO/IEC 11582, ISUP and other SCN signalling standards using tunnelling of non-H.323 signalling in H.225.0. Details are in Annex M/H.323 (see M.1/H.323, M.2/H.323, etc.).

In this version of this Recommendation, all references are to the 1998 version of ITU-T Rec. Q.931. The procedures of 3.1/Q.931 for circuit mode connection setup are followed. However, the implementer is reminded that although "bearer" is being signalled for, no actual "B-channels" of the ISDN type exist on the packet-based network side. Successful completion of the "call" results in an end-to-end reliable channel supporting H.245 messaging. Actually "bearer" setup is done using H.245. However, the use of Q.931 on the packet-based network side enables interworking with Q.931 on the SCN side as well as providing a well-tested framework for general connection oriented calling features.

In general, the symmetric procedures of Annex D/Q.931 are used. This implies that the Q.931 state machine is followed as per Annex D/Q.931 with the exception that the procedure of D.3/Q.931 (Call collisions) shall not be followed; recovery from this glare condition is left to the application layer.

Endpoints not supporting Q.931 shifted code sets shall ignore all Q.931 messages using such methods.

Table 4 shows what messages are mandatory and optional for H.323 and H.225.0 call setup using Q.931 on the packet-based network.

Table 4 – H.225.0 usage of Q.931/Q.932 messages

	Transmit (M, F, O, CM) (Note 1)	Receive and act on (M, F, O (Note 2), CM)
Call establishment messages		
Alerting	M	M
Call Proceeding	O	CM (Notes 3 and 6)
Connect	M	M
Connect Acknowledge	F	F
Progress	O	CM (Note 6)
Setup	M	M
Setup Acknowledge	O	O
Call Clearing messages		
Disconnect	F	F
Release	F	F
Release Complete	M (Note 4)	M
Call Information Phase messages		
Resume	F	F
Resume Acknowledge	F	F
Resume Reject	F	F
Suspend	F	F
Suspend Acknowledge	F	F
Suspend Reject	F	F
User Information	O	O
Miscellaneous messages		
Congestion Control	F	F
Information	O	CM (Note 6)
Notify	O	O
Status	M (Note 5)	M
Status Inquiry	O	M
Q.932/H.450 messages		
Facility	M	M
Hold	F	F
Hold Acknowledge	F	F
Hold Reject	F	F

Table 4 – H.225.0 usage of Q.931/Q.932 messages

	Transmit (M, F, O, CM) (Note 1)	Receive and act on (M, F, O (Note 2), CM)
Retrieve	F	F
Retrieve Acknowledge	F	F
Retrieve Reject	F	F
NOTE 1 – M: Mandatory, F: Forbidden, O: Optional, CM: Conditionally Mandatory. Something is CM if it is required once an option is supported. NOTE 2 – Note that Status shall not be sent in response to a message listed here as "O"; the receiver shall simply ignore the message if it does not support it. NOTE 3 – Terminals intended to use gateways shall receive and act on Call Proceeding. NOTE 4 – Release Complete is required to close the H.225.0 reliable call signalling channel. However, the call signalling channel shall remain open if other calls using the same call signalling channel are still in progress. Additionally, the Gatekeeper may set the maintainConnection flag to TRUE to prevent the closure of the call signalling channel. NOTE 5 – The endpoint shall respond to an unknown message with a Status message; response to Status Inquiry is also mandatory. However, an endpoint is not required to send Status Inquiry. As a practical matter, the endpoint should be able to understand a Status message received in response to a message sent that was not known to the receiver. NOTE 6 – Endpoints that support optional features that use these messages (such as H.245 tunnelling, H.450 supplementary services, tunnelling of signalling protocols, or features that use genericData) shall process these messages.		

7.2 Common Q.931 information elements

7.2.1 Header information elements

For all H.225.0 call signalling messages, there are three common fields that are mandatory in addition to the message type that are described in this clause.

7.2.1.1 Protocol discriminator

As defined in 4.2/Q.931.

Shall be set to 08H – this identifies the message as Q.931/I.451 user-network message (encoded following Figure 4-2/Q.931). If a gatekeeper is acting as a network to supply supplementary services, it may be appropriate to use another value. This is for further study.

7.2.1.2 Call reference

As defined in 4.3/Q.931.

A call reference value length of two octets shall be supported by any H.323 endpoint.

The call reference value is chosen at the side originating the call and has to be locally unique. For subsequent communication, the calling and the called side shall use this call reference value in all the messages belonging to this particular call.

The value is encoded following Figure 4-5/Q.931 for a two-octet call reference value. The most significant octet of the reference value is always encoded in octet No. 2.

Note that the CRV is only unique on a particular part of a call, e.g., between two terminals, or between a terminal and a gatekeeper. If a given terminal has two calls in the same conference, each shall have the same conference ID but different CRVs.

The call reference flag shall be set according to the procedures described in ITU-T Rec. Q.931.

Note that the CRV values passed in RAS messages shall conform to the structure as specified in ITU-T Rec. Q.931. Specifically, the call reference flag shall be included as the most significant bit of the Call ReferenceValue. This restricts the actual CRV to the range of 0 through 32 767, inclusive.

The Global Call Reference, as shown in Figure 4-5/Q.931 and having the numeric value 0, is used to refer to all calls on the Call Signalling Channel or the RAS channel.

7.2.1.3 Message type

The message type is encoded according to Figure 4-6/Q.931 using the values specified in Table 4-2/Q.931. H.225.0 specific extensions are for further study.

7.2.2 Message-specific information elements

The general encoding rules for the following information elements are defined in 4.5.1/Q.931 and Table 4-3/Q.931. These rules shall be followed. The escape mechanism (see Figure 4-8/Q.931) is optional.

7.2.2.1 Bearer capability

This information element is encoded according to Figure 4-11/Q.931 and Table 4-6/Q.931. If this information element is received in a packet-based network-to-packet-based network call, it may be ignored by the receiver. If this information element appears in a Setup message for a call-independent signalling connection as defined in ITU-T Rec. H.450.1, the coding shall follow 7.2.2.1.2. In all other cases, coding shall follow 7.2.2.1.1. The octet number references refer to Figure 4-11/Q.931.

7.2.2.1.1 Bearer capability default encoding

H.323 entities shall encode the Bearer capability IE as follows unless indicated otherwise in subsequent clauses.

Extension bit for octet No. 3 (bit 8)

- Shall be set to "1".

Coding Standard (octet No. 3, bits 6-7)

- Shall be set to "00" indicating "ITU-T".

Information transfer capability (octet No. 3, bits 1-5)

- For calls originating from an ISDN endpoint, the information indicated to the gateway shall be forwarded.

NOTE – This is to allow some advance information about the nature of the connection to be forwarded to the H.323 endpoint, e.g., voice only vs. data vs. video; this would have an impact on the bandwidth required as well as on the ability/willingness to accept the call or not.

- Calls that originate from an H.323 endpoint shall use this field to indicate their wish to place an audiovisual call. Therefore, the field shall be set either to "unrestricted digital information", i.e., "01000" or to "restricted digital information", i.e., "01001". If a speech only call is to be placed, the H.323 terminal shall set the information transfer capability to either "speech" (i.e., "00000") or to "3.1 kHz audio" (i.e., "10000").

Extension bit for octet No. 4 (bit 8)

- Shall be set to "0" if the information transfer rate is set to "multirate"; shall be set to "1" otherwise.

Transfer Mode (octet No. 4, bits 6, 7)

- Shall specify "circuit mode", value "00".

Information transfer rate (octet No. 4, bits 1-5)

- Shall be encoded following Table 4-6/Q.931 except that the value "00000" (for packet mode) is not permitted unless the gateway is connected to a packet network.

Rate multiplier (octet No. 4.1)

- Shall be present if information transfer rate is set to "multirate".
- The extension bit (bit 8) shall be set to "1".
- The bits 1 through 7 shall indicate the bandwidth needed for the call as defined in the following (note, that in contrast to ITU-T Rec. Q.931, a value of "0000001" is allowed here).
- For a call originating from an ISDN endpoint, the gateway shall simply pass on the information that it receives from the ISDN.
- For a call incoming from an H.324 endpoint, the gateway shall set the rate multiplier to 01H.
- For a call incoming from B-ISDN, some translation from ITU-T Rec. Q.2931 to ITU-T Rec. Q.931 needs to be performed. This is for further study.
- For a call originated from an H.323 endpoint, this shall be used to indicate the bandwidth to be used for this call. If the called system is another H.323 endpoint, this value may reflect the bandwidth to be used on the packet-based network but the receiving terminal is not required to follow this information. If a gateway is involved, then this value shall reflect the number of external connections to be set up. The bandwidth needed for the call is the bandwidth needed on the SCN side, and may or may not match the bandwidth allowed on the packet-based network by the ACF/BCF messages.

Layer 1 protocol (Octet No. 5)

- The extension bit (bit 8) shall be set to "1".
- Bits 6 and 7 shall indicate the layer one identifier, i.e., "01".
- Bits 1 through 5 shall indicate the layer one protocol.
- The allowed values are G.711 (A-law "00011" and μ -law "00010") to indicate a voice-only call and H.221 and H.242 ("00101") to indicate an H.323 videophone call.

Octets Nos. 5a, 5b, 5c, 5d, 6 and 7 shall not be present.

7.2.2.1.2 Bearer capability encoding for H.450.1 call-independent signalling connections

H.323 entities shall encode the Bearer capability IE as follows for call-independent signalling connections as defined in ITU-T Rec. H.450.1.

Extension bit for octet No. 3 (bit 8)

- Shall be set to "1".

Coding standard (octet No. 3, bits 6-7)

- Shall be set to "01" indicating "Other international standard". Note that when this coding standard is indicated, the coding defined in ITU-T Rec. Q.931 shall apply for octets 1 to 2 and bit 8 of octets 3 to 4. Information transfer capability, Transfer mode and Information transfer rate shall be encoded as indicated and no other octets shall be included.

Information transfer capability (octet No. 3, bits 1-5)

- Shall be set to "01000", indicating "Unrestricted digital information".

Extension bit for octet No. 4 (bit 8)

- Shall be set to "1".

Transfer mode (octet No. 4, bits 6, 7)

- Shall be set to "00", indicating "Call-independent signalling connection".

Information transfer rate (octet No. 4, bits 1-5)

- Shall be set to "00000", indicating "Call-independent signalling connection".

Octets 4.1 and higher shall not be included.

7.2.2.2 Call identity

The possible use of the Call identity IE is for further study. This study should consider multi-stage dialling, including terminal-to-gatekeeper-to-terminal and terminal-to-gateway-to-terminal, and loose source routing.

7.2.2.3 Call state

This information element is encoded following Figure 4-13/Q.931.

Octet No. 3 coding standard (bits 8-7)

- Set to "00" to indicate ITU-T standardized coding.

Call state value (octet No. 3, bits 1-6)

- Set as per Table 4-8/Q.931 but do not use the global interface state values. Values are interpreted as User State as per use of Annex D/Q.931. Note that most of the listed codes will not be generated by an H.323 terminal.

7.2.2.4 Called party number

This information element is encoded following Figure 4-14/Q.931 and Table 4-9/Q.931.

Octet No. 3 extension (bit 8)

- Set to "1".

Type of number (octet No. 3, bits 5-7)

- Encoded following the values and rules of Table 4-9/Q.931.

Numbering plan identification (octet No. 3, bits 1-4)

- Encoded following the values and rules of Table 4-9/Q.931. A number in the form of a dialled digit string should be coded as "0000" (Unknown). If set to "1001" (Private Numbering Plan) in a packet-based network originated call, this indicates that:
 - 1) the dialled digit string is not present in Setup; and
 - 2) the call will be routed via an alias address in the User-user information.

Type of number (octet No. 3, bits 5-7)

- Encoded following the values and rules of Table 4-9/Q.931. A number with the Numbering plan identification coded as "0000" (Unknown) shall be coded as "000" (Unknown). A number with the Numbering plan identification coded as "0001" (ISDN/Telephony Numbering Plan, ITU-T Rec. E.164) with the Type of number coded as "000" (Unknown) may be used for backward compatibility.

Number "digits"

- Any number of IA5 characters, according to the formats specified in the appropriate numbering/dialling plan.

NOTE – An E.164 number shall only consist of IA5 characters "0", "1", "2", "3", "4", "5", "6", "7", "8" and "9".

7.2.2.5 Called party subaddress

Use as per ITU-T Rec. Q.931.

7.2.2.6 Calling party number

This information element is encoded following Figure 4-16/Q.931 and Table 4-11/Q.931.

Type of number (octet No. 3, bits 5-7)

- Encoded following the values and rules of Table 4-11/Q.931. A number with the Numbering plan identification coded as "0000" (Unknown) shall be coded as "000" (Unknown). A number with the Numbering plan identification coded as "0001" (ISDN/Telephony Numbering Plan, ITU-T Rec. E.164) with the Type of number coded as "000" (Unknown) may be used for backward compatibility.

Numbering plan identification (octet No. 3, bits 1-4)

- Encoded following the values and rules of Table 4-11/Q.931. A number in the form of a dialled digit string should be coded as "0000" Unknown. If set to "1001" (Private Numbering Plan) in a packet-based network originated call, this indicates that:
 - 1) the dialled digit string is not present in Setup; and
 - 2) the call will be routed via an alias address in the User-user information.

Octet No. 3a

- Encoded following the values and rules of Table 4-11/Q.931.

Number "digits"

- Any number of IA5 characters, according to the formats specified in the appropriate numbering/dialling plan.

NOTE – An E.164 number shall only consist of IA5 characters "0", "1", "2", "3", "4", "5", "6", "7", "8" and "9".

H.323 endpoints shall not send multiple Calling Party Number IEs in the same message. Gateways may provide support for interworking with Q.931 SETUP messages that contain multiple Calling Party Number IEs. Gateways that provide such support shall map the first Q.931 Calling Party Number IE to the Calling Party Number IE of the H.225.0 Setup message, and map subsequent Q.931 Calling Party Number IEs to the **additionalSourceAddresses** field of the H.225.0 Setup message. Gatekeepers that route H.225.0 Setup messages initiated by an H.323 endpoint may insert a number in the **additionalSourceAddresses** field before forwarding it to its next recipient.

7.2.2.7 Calling party subaddress

Use as per ITU-T Rec. Q.931.

7.2.2.8 Cause

If received, the rules defined in ITU-T Rec. Q.850 apply. Note that either Cause or **ReleaseCompleteReason** is mandatory for Release Complete; the Cause IE is optional elsewhere. The Cause IE and the **ReleaseCompleteReason** (a part of the Release Complete message) are mutually exclusive. Gateways shall map from a **ReleaseCompleteReason** to the Cause IE when sending a Release Complete message to the circuit-switched side from the packet-based network side (see Table 5). (The reverse mapping is not required as packet-based network entities are required to decode the Cause IE.)

Gateways shall also map from **AdmissionRejectReason** and **LocationRejectReason** to the Cause IE when sending a Release Complete message to the circuit-switched side after receiving an **AdmissionReject** or a **LocationReject** (see Table 6).

Document Sharing Hub



Documents

Document Sharing Hub

Rec. ITU-T H.225.0 (12/2009)

21

Table 5 – ReleaseCompleteReason to Cause IE mapping

ReleaseCompleteReason code	Corresponding Q.931/Q.850 cause value
noBandwidth	34 – No circuit/channel available
gatekeeperResources	47 – Resource unavailable, unspecified
unreachableDestination	3 – No route to destination
destinationRejection	16 – Normal call clearing
invalidRevision	88 – Incompatible destination
noPermission	127 – Interworking, unspecified
unreachableGatekeeper	38 – Network out of order
gatewayResources	42 – Switching equipment congestion
badFormatAddress	28 – Invalid number format (address incomplete)
adaptiveBusy	41 – Temporary Failure
inConf	17 – User busy
undefinedReason	31 – Normal, unspecified
facilityCallDeflection	16 – Normal call clearing
securityDenied	31 – Normal, unspecified
securityWrongSyncTime	31 – Normal, unspecified
securityReplay	31 – Normal, unspecified
securityWrongGeneralID	31 – Normal, unspecified
securityWrongSendersID	31 – Normal, unspecified
securityMessageIntegrityFailed	31 – Normal, unspecified
securityWrongOID	31 – Normal, unspecified
securityDHmismatch	31 – Normal, unspecified
securityCertificateExpired	31 – Normal, unspecified
securityCertificateDateInvalid	31 – Normal, unspecified
securityCertificateRevoked	31 – Normal, unspecified
securityCertificateNotReadable	31 – Normal, unspecified
securityCertificateSignatureInvalid	31 – Normal, unspecified
securityCertificateMissing	31 – Normal, unspecified
securityCertificateIncomplete	31 – Normal, unspecified
securityUnsupportedCertificateAlgOID	31 – Normal, unspecified
securityUnknownCA	31 – Normal, unspecified
calledPartyNotRegistered	20 – Subscriber absent
callerNotRegistered	31 – Normal, unspecified
newConnectionNeeded	47 – Resource unavailable, unspecified
nonStandardReason	127 – Interworking, unspecified
replaceWithConferenceInvite	31 – Normal, unspecified
genericDataReason	31 – Normal, unspecified
neededFeatureNotSupported	31 – Normal, unspecified
tunnelledSignallingRejected	127 – Interworking, unspecified
InvalidCID	3 – No route to destination
hopCountExceeded	3 – No route to destination

Copyright © 2009 ITU-T. All rights reserved.

Table 6 – AdmissionRejectReason/LocationRejectReason to Cause IE mapping

AdmissionRejectReason or LocationRejectReason code	Corresponding Q.931/Q.850 cause value
calledPartyNotRegistered	20 – Subscriber absent
invalidPermission	127 – Interworking, unspecified
requestDenied	31 – Normal, unspecified
undefinedReason	31 – Normal, unspecified
callerNotRegistered	31 – Normal, unspecified
routeCallToGatekeeper	Not applicable
invalidEndpointIdentifier	127 – Interworking, unspecified
resourceUnavailable	47 – Resource unavailable
securityDenial	31 – Normal, unspecified
qosControlNotSupported	63 – Service or option not available, unspecified
incompleteAddress	28 – Invalid number format
aliasesInconsistent	31 – Normal, unspecified
routeCallToSCN	3 – No route to destination
exceedsCallCapacity	41 – Temporary Failure
collectDestination	31 – Normal, unspecified
collectPIN	31 – Normal, unspecified
genericDataReason	31 – Normal, unspecified
neededFeatureNotSupported	31 – Normal, unspecified
securityWrongSyncTime	31 – Normal, unspecified
securityReplay	31 – Normal, unspecified
securityWrongGeneralID	31 – Normal, unspecified
securityWrongSendersID	31 – Normal, unspecified
securityIntegrityFailed	31 – Normal, unspecified
securityWrongOID	31 – Normal, unspecified
securirtyDHMismatch	31 – Normal, unspecified
noRouteToDestination	3 – No route to destination
unallocatedNumber	1 – Unallocated number
noBandwidthAvailable	34 – No circuit/channel available

7.2.2.9 Channel identification

Use is for further study; may be used to provide feedback on multiple call attempts.

7.2.2.10 Connected number

Encoded following 5.4.1/Q.951.

7.2.2.11 Connected sub-address

Encoded following 5.4.2/Q.951.

7.2.2.12 Congestion level

Shall not be used.

7.2.2.13 Date/time

Encoded following Figure 4-21/Q.931.

7.2.2.14 Display

Encoded following Figure 4-22/Q.931. The maximum length of the entire information element is 82 octets.

7.2.2.15 Extended facility information element

Any Extended Facility IE that is used to indicate unmodified semantics as defined in Q.95x-series Recommendations shall be encoded following 8.2.4/Q.932. In this case, the Service ADUs shall be formed according to ROSE (uses ITU-T Rec. X.680 (Specification of ASN.1) and ITU-T Rec. X.690 (Specification of basic encoding rules for ASN.1)) as defined in ITU-T Rec. X.229.

7.2.2.16 Facility

In order to signal call redirection specific to H.323 procedures (call forwarding, redirecting a call to the MC, or forcing a call to be routed to the gatekeeper) or in case of supplementary service signalling according to ITU-T Rec. H.450, the User-user information element of the Facility message is used. This particular case shall be indicated by coding a Facility IE of length zero; i.e., the Facility information element shall consist of exactly 2 octets as follows:

- Octet No. 1 (information element identifier) shall be set to "00011100" ("1C'H) to indicate the Facility IE.
- Octet No. 2 (information element length) shall be set to "0" to indicate that no further octets belonging to this information element follow.

In order to indicate call forwarding, the Facility IE shall be empty and the **Facility-UUIE** shall indicate in the **alternativeAddress** or the **alternativeAliasAddress** the terminal to which the call is to be redirected. In this case, the **facilityReason** shall be set to **callForwarded**.

To instruct an endpoint to call a different endpoint because the calling endpoint wishes to join a conference and the called endpoint does not have the MC, the Facility IE would be left empty as well. The **conferenceID** shall indicate the conference to join and the reason in the **Facility-UUIE** shall be **routeCallToMC**.

Also, to instruct the calling endpoint to signal the called endpoint through the called endpoint's gatekeeper, the Facility IE is left empty. The **conferenceID** in the **Facility-UUIE** shall indicate the conference to join and the reason in the **Facility-UUIE** shall be **routeCallToGatekeeper**.

Any Facility IE that is used to indicate unmodified semantics as defined in Q.95x-series Recommendations shall be encoded following 8.2.3/Q.932. In this case, the Service ADUs shall be formed according to ROSE (uses ITU-T Rec. X.680 (Specification of ASN.1) and ITU-T Rec. X.690 (Specification of basic encoding rules for ASN.1)) as defined in ITU-T Rec. X.229.

7.2.2.17 High layer compatibility

FFS.

7.2.2.18 Keypad facility

Encoded following Figure 4-24/Q.931. The use of the exclamation point character "!" shall represent a hookflash indication. Endpoints not supporting reception of the hookflash indication shall ignore the "!" if received.

7.2.2.19 Low layer compatibility

FFS.

7.2.2.20 More data

Shall not be used.

7.2.2.21 Network-specific facilities

Shall not be used.

7.2.2.22 Notification indicator

Encoded following 4.5.22/Q.931.

7.2.2.23 Progress indicator

Encoded following Figure 4-29/Q.931 and Table 4-20/Q.931.

This information element is only required for interfacing an H.323 terminal to an ISDN- and ATM-based terminal where detailed call proceeding information is available. In this case, the gateway shall forward this information to the H.323 terminal. The H.323 end system need not interpret this information element.

If this information element is generated by an H.323 terminal, the following restrictions apply:

Coding standard (octet No. 3, bit 6,7)

- Shall indicate "ITU-T" ("00").

Location

- Following Table 4-20/Q.931.
- The values "user" ("0000"), "private network serving the local user" ("0001"), and "private network serving the remote user" ("0101") are permitted.

Progress description

- Following Table 4-20/Q.931.

7.2.2.24 Redirecting number

Encoded following 4.6.7/Q.931. Note that this IE is provided only to facilitate interworking with the SCN, and not to provide a mechanism for H.323-based call diversion services. Call diversion services in H.323 are defined by ITU-T Rec. H.450.3.

7.2.2.25 Repeat indicator

Shall not be used.

7.2.2.26 Restart indicator

Shall not be used.

7.2.2.27 Segmented message

Shall not be used. Note that there is no critical upper limit on the message size in ITU-T Rec. H.323 and this Recommendation.

7.2.2.28 Sending complete

Encoded following Figure 4-33/Q.931.

No restrictions apply.

7.2.2.29 Signal

Encoded following Figure 4-34/Q.931 and Table 4-24/Q.931.

No restrictions apply.

7.2.2.30 Transit network selection

Shall not be used.

7.2.2.31 User-user

Encoded following Figure 4-36/Q.931 and Table 4-26/Q.931, as modified here.

The User-user information element shall be used by all H.323 entities to convey H.323-related information. Actual user-user information to be exchanged only between the involved terminals is nested in the **user-data** field of the **H323-UserInformation** PDU (to which no restrictions apply).

The following restrictions apply:

Length of user-user contents

- Shall be 2 octets instead of 1 (as in Figure 4-36/Q.931).

Protocol discriminator

- Shall indicate ITU-T Recs X.680 and X.690 (ASN.1) coded user information ("00000101").
NOTE – This is taken from the 1998 revision of ITU-T Rec. Q.931 that references the earlier revisions of ASN.1. The correct references to ASN.1 are ITU-T Recs X.680 (syntax) and X.691 (PER).

User information

- Shall contain an ASN.1 structure (H323-UserInformation) that, besides the H.323 relevant information, includes the actual user data as follows. The ASN.1 is encoded using the aligned variant of the packed encoding rules as specified in ITU-T Rec. X.691.

The **H323-UserInformation** structure contains the **h323-uu-pdu** and **user-data** fields.

The **h323-uu-pdu** field of the **H323-UserInformation** structure contains the following fields. Note that not all fields in **h323-uu-pdu** are permitted in every message. See the description of each individual message for restrictions.

- **h323-message-body** – This field contains information specific to a particular H.225.0 signalling message, as described in 7.3 and 7.4. A sender may select a choice of **empty** if there is no need to send the UUIE field (**Facility-UUIE**, etc.) in a particular message, such as when a Facility message is used to transport non-call associated information. Note that beginning with version 4 of this Recommendation, if a message is associated with a particular call, then the sender shall include the UUIE field. This is necessary in order to provide the **callIdentifier** field.
- **nonStandardData** – This field carries information not defined in this Recommendation (for example, proprietary data).
- **h4501SupplementaryService** – This field carries a sequence of H4501SupplementaryService APDUs as defined in Table 3/H.450.1.
- **h245Tunnelling** – This element is set to TRUE if tunnelling of H.245 messages is enabled. Systems compliant with H.225.0 version 4 or higher shall set this element to TRUE if the Fast Connect procedure is used to establish the call.
- **h245Control** – This field carries a sequence of tunnelled H.245 PDUs. Each octet string shall contain exactly one H.245 PDU.
- **nonStandardControl** – This field contains control information not defined in this Recommendation (for example, proprietary control information).

- **callLinkage** – The contents of this field are typically controlled by a call linkage service. For the procedures and semantics of this field refer to ITU-T Rec. H.323.
- **tunnelledSignallingMessage** – A tunnelled entire signalling message in its native format to support additional end-to-end call control signalling. The **tunnelledProtocolID** field identifies the protocol being tunnelled. The **messageContent** field is a sequence of actual entire tunnelled messages in their native binary format; this allows aggregation of tunnelled messages in one H.225.0 message. If the **tunnellingRequired** field is present, the call shall only proceed if tunnelling is supported.
- **provisionalRespToH245Tunnelling** – This flag is used to signal that the called entity has not yet decided whether H.245 tunnelling is applicable for this call. If present, the **h245Tunnelling** flag shall be ignored by the receiving entity.
- **stimulusControl** – This field is reserved for future use by the ITU-T for a stimulus-based protocol.
- **genericData** – This field is a list of generic elements related to features that are defined outside of the base H.225.0 specification. These parameters may be used, for example, for tunnelling information transparently through H.225.0.

The **user-data** field of the **H323-UserInformation** structure contains the following fields:

- protocol-discriminator – This field is encoded following Table 4-26/Q.931.
- user-information – This field is encoded following 4.5.30/Q.931.

7.3 Q.931 based H.225.0 call signalling message details

Note that the lengths of the information elements specified in the tables below, where "*" denotes an undefined maximum length, refer to messages that are generated by H.323 terminals only. The size of the User-user information element, not explicitly shown, is understood as the size of the PER encoded **H323-UserInformation** sequence. The total size of **H323-UserInformation** is limited to 65 536 octets. Regardless of the specified sizes, messages forwarded from the SCN side may have different (larger) sizes.

Also note that an information element specified below as mandatory, optional, or forbidden refers only to whether or not H.323 terminals may originate such information elements.

7.3.1 Alerting

This message may be sent by the called user to indicate that called user alerting has been initiated. In everyday terms, the "phone is ringing".

Follow Table 3-2/Q.931 (1998 version) as modified below in Table 7.

Table 7 – Alerting

Information element	H.225.0 status (M/F/O)	Length in H.225.0
Protocol discriminator	M	1
Call reference	M	3
Message type	M	1
Bearer capability	O	5-6
Extended facility	O	8-*
Channel identification	FFS	NA
Facility	O	8-*
Progress indicator	O	2-4

Table 7 – Alerting

Information element	H.225.0 status (M/F/O)	Length in H.225.0
Notification indicator	O	2-*
Display	O	2-82
Signal	O	2-3
High layer compatibility	FFS	NA
User-user	M	*

The User-user information element contains the Alerting-UUIE defined in the H.225.0 Message Syntax. The **Alerting-UUIE** includes the following:

protocolIdentifier – Set to the version of H.225.0 supported.

destinationInfo – Contains an **EndpointType** to allow the caller to determine whether the call involves a gateway or not.

h245Address – This is a specific transport address on which the called endpoint or gatekeeper handling the call would like to establish H.245 signalling. This address may also be sent in Call Proceeding, Progress, Connect, or Facility.

callIdentifier – A globally unique call identifier set by the originating endpoint which can be used to associate RAS signalling with the modified Q.931 signalling used in this Recommendation.

h245SecurityMode – An H.323 entity that receives a Setup message with the **h245SecurityCapability** set shall respond with the corresponding, acceptable **h245SecurityMode** in the Call Proceeding, Alerting, Progress, or Connect.

tokens – This is some data which may be required to allow the operation. The data shall be inserted into the message if available.

cryptoTokens – Encrypted **tokens**.

fastStart – Used only in the fast connect procedure, **fastStart** supports the signalling needed to open a logical channel. This uses the **OpenLogicalChannel** structure defined in ITU-T Rec. H.245, but the sender of this indicates the modes it prefers to receive and transmit, and the transport addresses where it expects to receive media streams.

multipleCalls – If TRUE, this indicates that the sender of the message is capable of signalling multiple calls over a single call signalling connection.

maintainConnection – If TRUE, this indicates that the sender of the message is capable of supporting a signalling connection when no calls are currently signalled over the connection.

alertingAddress – Contains the alias addresses for the alerting party.

presentationIndicator – Indicates whether presentation of the **alertingAddress** should be allowed or restricted.

screeningIndicator – Indicates whether the **alertingAddress** was provided by the endpoint or network (gatekeeper), and whether the **alertingAddress** was screened by a gatekeeper.

fastConnectRefused – A called endpoint should return this element in any message up to and including the Connect message when establishing a call to indicate that it refuses the Fast Connect procedure.

serviceControl – Contains service-specific data, or references to it, that may be used as part of the setup procedure by the calling endpoint (e.g., a menu of options for call diversion) as described, for example, in Annex K/H.323.

capacity – This field indicates the sending endpoint's available call capacity at this point in time, assuming that this Alerting message represents an active call. When sending this field, the endpoint shall include the **currentCallCapacity** element.

featureSet – This field specifies a set of generic features that relate to this call.

displayName – Provides an ordered list of names, along with language tags, that identify the called or calling user. The user's most preferred name and language should be indicated first, followed by alternative representations using the same or different language tags. The receiving user may select any of the offered names for display according to local preference. When the displayName field is present, it shall take precedence over the Display IE. However, the Display IE should still be provided for interworking with legacy systems.

7.3.2 Call proceeding

This message may be sent by the called user to indicate that requested call establishment has been initiated and no more call establishment information will be accepted. See Table 8.

Table 8 – Call proceeding

Information element	H.225.0 status (M/F/O)	Length in H.225.0
Protocol discriminator	M	1
Call reference	M	3
Message type	M	1
Bearer capability	O	5-6
Extended facility	O	8-*
Channel identification	FFS	NA
Facility	O	8-*
Progress indicator	O	2-4
Notification indicator	O	2-*
Display	O	2-82
High layer compatibility	FFS	NA
User-user	M	*

The User-user information element contains the **CallProceeding-UIIE** defined in the H.225.0 Message Syntax. The **CallProceeding-UIIE** includes the following:

protocolIdentifier – Set to the version of H.225.0 supported.

destinationInfo – Contains an **EndpointType** to allow the caller to determine whether the call involves a gateway or not.

h245Address – This is a specific transport address on which the called endpoint or gatekeeper handling the call would like to establish H.245 signalling.

callIdentifier – A globally unique call identifier set by the originating endpoint which can be used to associate RAS signalling with the modified Q.931 signalling used in this Recommendation.

h245SecurityMode – An H.323 entity that receives a Setup message with the **h245SecurityCapability** set shall respond with the corresponding, acceptable **h245SecurityMode** in the Call Proceeding, Alerting, Progress, or Connect.

tokens – This is some data which may be required to allow the operation. The data shall be inserted into the message if available.

cryptoTokens – Encrypted **tokens**.

fastStart – Used only in the fast connect procedure, **fastStart** supports the signalling needed to open a logical channel. This uses the **OpenLogicalChannel** structure defined in ITU-T Rec. H.245, but the sender of this indicates the modes it prefers to receive and transmit, and the transport addresses where it expects to receive media streams.

multipleCalls – If TRUE, this indicates that the sender of the message is capable of signalling multiple calls over a single call signalling connection.

maintainConnection – If TRUE, this indicates that the sender of the message is capable of supporting a signalling connection when no calls are currently signalled over the connection.

fastConnectRefused – A called endpoint should return this element in any message up to and including the Connect message when establishing a call to indicate that it refuses the Fast Connect procedure.

featureSet – This field specifies a set of generic features that relate to this call.

7.3.3 Connect

This message shall be sent by the called entity to the calling entity (gatekeeper, gateway, or calling terminal) to indicate acceptance of the call by the called entity. Follow Table 3-4/Q.931, as modified in Table 9 below.

Table 9 – Connect

Information element	H.225.0 status (M/F/O)	Length in H.225.0
Protocol discriminator	M	1
Call reference	M	3
Message type	M	1
Bearer capability	O	5-6
Extended facility	O	8-*
Channel identification	FFS	NA
Facility	O	8-*
Progress indicator	O	2-4
Notification indicator	O	2-*
Display	O	2-82
Date/Time	O	8
Connected Number	O	2-*
Connected Subaddress	O	2-23
Low layer compatibility	FFS	NA
High layer compatibility	FFS	NA
User-user	M	*

The User-user information element contains the **Connect-UUIE** defined in the H.225.0 Message Syntax. The **Connect-UUIE** includes the following:

protocolIdentifier – Set by the called endpoint to the version of H.225.0 supported.

h245Address – This is a specific transport address on which the called endpoint or gatekeeper handling the call would like to establish H.245 signalling. This address shall be sent if sent earlier in Alerting, Progress, Call Proceeding, or Facility.

destinationInfo – Contains an **EndpointType** to allow the caller to determine whether the call involves a gateway or not.

conferenceID – Will contain a unique number to allow the conference to be uniquely identified from all others as received in the Setup.

callIdentifier – A globally unique call identifier set by the originating endpoint which can be used to associate RAS signalling with the modified Q.931 signalling used in this Recommendation.

h245SecurityMode – An H.323 entity that receives a Setup message with the **h245SecurityCapability** set shall respond with the corresponding, acceptable **h245SecurityMode** in the Call Proceeding, Alerting, Progress, or Connect.

tokens – This is some data which may be required to allow the operation. The data shall be inserted into the message if available.

cryptoTokens – Encrypted **tokens**.

fastStart – Used only in the fast connect procedure, **fastStart** supports the signalling needed to open a logical channel. This uses the **OpenLogicalChannel** structure defined in ITU-T Rec. H.245, but the sender of this indicates the modes it prefers to receive and transmit, and the transport addresses where it expects to receive media streams.

multipleCalls – If TRUE, this indicates that the sender of the message is capable of signalling multiple calls over a single call signalling connection.

maintainConnection – If TRUE, this indicates that the sender of the message is capable of supporting a signalling connection when no calls are currently signalled over the connection.

language – Indicates the language(s) in which the user would prefer to receive announcements and prompts. The field contains one or more RFC 1766 compliant language tags.

connectedAddress – Contains the alias addresses for the connected (answering) party; the dialled digit string of the connected party is in the Connected Number IE.

presentationIndicator – Indicates whether presentation of the **connectedAddress** should be allowed or restricted. If both **presentationIndicator** and the presentation indicator of the Connected Number IE are present and are in conflict, the presentation indicator of the Connected Number IE shall be used.

screeningIndicator – Indicates whether the **connectedAddress** was provided by the endpoint or network (gatekeeper), and whether the **connectedAddress** was screened by a gatekeeper. If both **screeningIndicator** and the screening indicator of the Connected Number IE are present and are in conflict, the screening indicator of the Connected Number IE shall be used.

fastConnectRefused – A called endpoint should return this element in any message up to and including the Connect message when establishing a call to indicate that it refuses the Fast Connect procedure.

serviceControl – Contains service-specific data, or references to it, that could be used by an endpoint or gateway (e.g., for displaying a menu of options to a caller) as described, for example, in Annex K/H.323.

capacity – This field indicates the sending endpoint's available call capacity at this point in time, assuming that this Connect message represents an active call. When sending this field, the endpoint shall include the **currentCallCapacity** element.

featureSet – This field specifies a set of generic features that relate to this call.

displayName – Provides an ordered list of names, along with language tags, that identify the called or calling user. The user's most preferred name and language should be indicated first, followed by alternative representations using the same or different language tags. The receiving user may select

any of the offered names for display according to local preference. When the displayName field is present, it shall take precedence over the Display IE. However, the Display IE should still be provided for interworking with legacy systems.

7.3.4 Connect acknowledge

This message shall not be sent.

7.3.5 Disconnect

This message shall not be sent by an H.323 entity.

The contents and semantics of a Disconnect message received from the network are defined in Table 3-6/Q.931 and in 10.5 of ISO/IEC 11582.

7.3.6 Information

This message may be sent to provide additional information. It may be used to provide information for call establishment (e.g., overlap sending) or miscellaneous call-related information. It may be used to deliver proprietary features.

This message may be sent by an H.323 entity.

This message follows Table 3-7/Q.931 with the following modifications (see Table 10).

Table 10 – Information message content

Information element	H.225.0 status (M/F/O)	Length in H.225.0
Protocol discriminator	M	1
Call reference	M	3
Message type	M	1
Sending complete	O	1
Display	O	2-82
Keypad facility	O	2-34
Signal	O	2-3
Called party number	O (Note)	2-35
User-user	M	*
NOTE – The Called Party Number IE will be used to carry numbers from a Private Numbering Plan when performing overlapped sending according to 8.1.12/H.323.		

The User-user information element contains the **Information-UUIE** defined in the H.225.0 Message Syntax. The **Information-UUIE** includes the following:

protocolIdentifier – Set to the version of H.225.0 supported.

callIdentifier – A globally unique call identifier set by the originating endpoint which can be used to associate RAS signalling with the modified Q.931 signalling used in this Recommendation.

tokens – This is some data which may be required to allow the operation. The data shall be inserted into the message if available.

cryptoTokens – Encrypted **tokens**.

fastStart – This field shall not be included, and shall be ignored upon receipt.

fastConnectRefused – This field shall not be included, and shall be ignored upon receipt.

circuitInfo – This field provides information about the SCN circuit or circuits used for this call.

7.3.7 Progress

This message may be sent by an H.323 gateway to indicate the progress of a call in the event of interworking with SCN. This message may also be sent by an H.323 endpoint before the Connect message, depending on supplementary service interaction.

Follow Table 3-9/Q.931 and 10.10 of ISO/IEC 11582 as modified in Table 11.

Table 11 – Progress

Information element	H.225.0 status (M/F/O)	Length in H.225.0
Protocol discriminator	M	1
Call reference	M	3
Message type	M	1
Bearer capability	O	5-6
Cause	O	2-32
Extended facility	O	8-*
Channel identification	FFS	NA
Facility	O	8-*
Progress indicator	M	2-4
Notification indicator	O	2-*
Display	O	2-82
High layer compatibility	FFS	NA
User-user	M	*

The User-user information element contains the **Progress-UUIE** defined in the H.225.0 Message Syntax. The **Progress-UUIE** includes the following:

protocolIdentifier – Set to the version of H.225.0 supported.

destinationInfo – Contains an **EndpointType** to allow the caller to determine whether the call involves a gateway or not.

h245Address – This is a specific transport address on which the called endpoint or gatekeeper handling the call would like to establish H.245 signalling. This address shall be sent if sent earlier in Call Proceeding, Alerting, Connect, or Facility.

callIdentifier – A globally unique call identifier set by the originating endpoint which can be used to associate RAS signalling with the modified Q.931 signalling used in this Recommendation.

h245SecurityMode – An H.323 entity that receives a Setup message with the **h245SecurityCapability** set shall respond with the corresponding, acceptable **h245SecurityMode** in the Call Proceeding, Alerting, Progress, or Connect.

tokens – This is some data which may be required to allow the operation. The data shall be inserted into the message if available.

cryptoTokens – Encrypted **tokens**.

fastStart – Used only in the fast connect procedure, **fastStart** supports the signalling needed to open a logical channel. This uses the **OpenLogicalChannel** structure defined in ITU-T Rec. H.245, but the sender of this indicates the modes it prefers to receive and transmit, and the transport addresses where it expects to receive media streams.

multipleCalls – If TRUE, this indicates that the sender of the message is capable of signalling multiple calls over a single call signalling connection.

maintainConnection – If TRUE, this indicates that the sender of the message is capable of supporting a signalling connection when no calls are currently signalled over the connection.

fastConnectRefused – A called endpoint should return this element in any message up to and including the Connect message when establishing a call to indicate that it refuses the Fast Connect procedure.

7.3.8 Release

This message shall not be sent by an H.323 entity.

The contents and semantics of a Release message received are defined in Table 3-10/Q.931 and in 10.5 of ISO/IEC 11582.

7.3.9 Release complete

This message shall be sent by a terminal to indicate release of the call. Afterwards, the Call Reference Value (CRV) is available for reuse.

The disconnect/release/release complete sequence is not used since its primary purpose is to indicate the completion of release of circuit-switched resources. As this does not apply to the packet-based network environment, the single step method of sending only Release Complete is used.

Follow Table 3-11/Q.931. Table 12 modifications apply.

Table 12 – Release complete

Information element	H.225.0 status (M/F/O)	Length in H.225.0
Protocol discriminator	M	1
Call reference	M	3
Message type	M	1
Cause	CM (Note)	2-32
Facility	O	8-*
Notification indicator	O	2-*
Display	O	2-82
Signal	O	2-3
User-user	M	*
NOTE – Either the Cause IE or the ReleaseCompleteReason shall be present.		

If this message is sent in response to a Facility message with an empty Facility IE, the **ReleaseCompleteReason** shall be set to **facilityCallDeflection**.

If this message is forwarded from a SCN by a gateway, the cause value shall be set as specified in ITU-T Rec. Q.931.

The User-user information element contains the **ReleaseComplete-UUIE** defined in the H.225.0 Message Syntax. The **ReleaseComplete-UUIE** includes the following:

protocolIdentifier – Set to the version of H.225.0 supported.

reason – More information on why the call was released. A reason of **genericDataReason** indicates that the call was cleared as a result of a generic element or feature; in this case, additional information may be specified in the **genericData** field of the **h323-uu-pdu** of this message. A

reason of **neededFeatureNotSupported** indicates that a feature required by one entity is not supported by another. A reason of **tunnelledSignallingRejected** is sent if the call is cleared because the sender does not allow tunnelled non-H.323 signalling and tunnelling is required in order for the call to succeed. A reason of **hopCountExceeded** indicates that the call was rejected because the **hopCount** value reached 0 and hence the call cannot proceed further.

callIdentifier – A globally unique call identifier set by the originating endpoint which can be used to associate RAS signalling with the modified Q.931 signalling used in this Recommendation.

tokens – This is some data which may be required to allow the operation. The data shall be inserted into the message if available.

cryptoTokens – Encrypted **tokens**.

busyAddress – Contains the alias addresses for the busy party.

presentationIndicator – Indicates whether presentation of the **busyAddress** should be allowed or restricted.

screeningIndicator – Indicates whether the **busyAddress** was provided by the endpoint or network (gatekeeper), and whether the **busyAddress** was screened by a gatekeeper.

capacity – Indicates the sending endpoint's available call capacity after the call referenced in this Release Complete message has been released. When sending this field, the endpoint shall include the **currentCallCapacity** element.

serviceControl – Contains service-specific data, or references to it, for post-call services (e.g., an error message or announcement) as described, for example, in Annex K/H.323.

featureSet – This field specifies a set of generic features that relate to this call.

destinationInfo – Contains an **EndpointType** to allow the caller to determine whether the call involves a gateway or not.

displayName – Provides an ordered list of names, along with language tags, that identify the called or calling user. The user's most preferred name and language should be indicated first, followed by alternative representations using the same or different language tags. The receiving user may select any of the offered names for display according to local preference. When the displayName field is present, it shall take precedence over the Display IE. However, the Display IE should still be provided for interworking with legacy systems.

7.3.10 Setup

This message shall be sent by a calling H.323 entity to indicate its desire to set up a connection to the called entity.

Follow Table 3-15/Q.931 as modified in Table 13.

Table 13 – Setup

Information element	H.225.0 status (M/F/O/CM)	Length in H.225.0
Protocol discriminator	M	1
Call reference	M (Note 2)	3
Message type	M	1
Sending complete	O	1
Repeat indicator	F	NA
Bearer capability	M	5-6
Extended facility	O	8-*
Channel identification	FFS	NA
Facility	O	8-*
Progress indicator	O	2-4
Network specific facilities	F	NA
Notification indicator	O	2-*
Display	O	2-82
Keypad facility	O	2-34
Signal	O	2-3
Calling party number	O	2-131
Calling party subaddress	CM (Note 1)	NA
Called party number	O	2-131
Called party subaddress	CM (Note 1)	NA
Redirecting Number	O	2-*
Transit network selection	F	NA
Low layer compatibility	FFS	NA
High layer compatibility	FFS	NA
User-user	M	*
NOTE 1 – Subaddresses are needed for some SCN call scenarios; they should not be used for packet-based network side only calls.		
NOTE 2 – If an ARQ was previously sent, the CRV used here shall be the same.		

The User-user information element contains the **Setup-UUIE** defined in the H.225.0 Message Syntax. The **Setup-UUIE** includes the following:

protocolIdentifier – Set to the version of H.225.0 supported.

h245Address – This is a specific transport address on which the calling endpoint or gatekeeper handling the call would like to establish the H.245 signalling. This should only be provided by the sender if it is capable of handling H.245 procedures before receiving a Connect on the Call Signalling channel.

sourceAddress – Contains the alias addresses of the source. The primary address shall be first. Note that the E.164 number of the source, if any, shall be contained within the Calling Party Number information element.

sourceInfo – Contains an **EndpointType** to allow the called party to determine whether the call involves a gateway or not.

destinationAddress – This is the address to which the endpoint wishes to be connected. The primary address shall be first. When calling an endpoint using only a dialled digit string, this address shall be placed in the H.225.0 call signalling message Called Party Number IE. The **destinationAddress**, if available, shall be included in the Setup message by terminals compliant with version 2 or higher of this Recommendation.

destCallSignalAddress – Needed to inform the gatekeeper of the destination terminal's call signalling transport address; redundant in the direct terminal-to-terminal case. In all cases where the information is available to the sender of the Setup message, this field shall be filled in.

destExtraCallInfo – Needed to make possible additional channel calls, i.e., for a 2×64 kbit/s call on the SCN side. Shall only contain dialled digit strings, E.164 numbers, or Private numbers and shall not contain the number of the initial channel. (See Note.)

destExtraCRV – CRVs for the additional SCN calls specified by **destExtraCallInfo**. Their use is for further study. They can be used to associate RAS signalling with the modified Q.931 signalling used in this Recommendation.

activeMC – Indicates that the calling endpoint is under the influence of an active MC.

conferenceID – Unique conference identifier.

conferenceGoal:

- **create** – Start a new conference.
- **invite** – Invite a party into an existing conference.
- **join** – Join an existing conference.
- **capability-negotiation** – Negotiate capabilities for a later loosely coupled conference.
- **callIndependentSupplementaryService** – Transport of supplementary services APDUs in a non-call related manner.

callServices – Provides information on support of optional Q-series protocols to gatekeeper and called terminal.

callType – Using this value, called party's gatekeeper can attempt to determine "real" bandwidth usage. The default value is **pointToPoint** for all calls; it should be recognized that the call type may change dynamically during the call and that the final call type may not be known when the Setup is sent.

sourceCallSignalAddress – Contains the transport address for the source; this value shall be used in the ARQ message by the receiver of the Setup. In all cases where the information is available to the sender of the Setup message, this field shall be filled in. The value of **sourceCallSignalAddress** shall be equal to the value that was used in the ARQ by the sender of the Setup, and shall be echoed by the endpoint receiving the Setup in its ARQ.

remoteExtensionAddress – Contains the alias address of a called endpoint in cases where this information is needed to traverse multiple Gateways. In all cases where the information is available to the sender of the Setup message, this field shall be filled in.

callIdentifier – A globally unique call identifier set by the originating endpoint which can be used to associate RAS signalling with the modified Q.931 signalling used in this Recommendation.

h245SecurityCapability – A set of capabilities the sender can use to secure the H.245 channel.

tokens – This is some data which may be required to allow the operation. The data shall be inserted into the message if available.

cryptoTokens – Encrypted **tokens**.

fastStart – Used only in the fast connect procedure, **fastStart** supports the signalling needed to open a logical channel. This uses the **OpenLogicalChannel** structure defined in ITU-T Rec. H.245, but the sender of this indicates the modes it prefers to receive and transmit, and the transport addresses where it expects to receive media streams.

mediaWaitForConnect – If TRUE, indicates that the recipient of the Setup message shall not transmit media until sending the Connect message.

canOverlapSend – If TRUE, indicates that the sender of Setup shall support overlap sending.

endpointIdentifier – This is an endpoint identifier that was assigned to the terminal in the RCF message. This field shall be present when the Setup is sent towards the gatekeeper where the endpoint is registered, and shall not be present when the Setup is sent to any other entity.

multipleCalls – If TRUE, this indicates that the sender of the message is capable of signalling multiple calls over a single call signalling connection.

maintainConnection – If TRUE, this indicates that the sender of the message is capable of supporting a signalling connection when no calls are currently signalled over the connection.

ConnectionParameters – Allow specification of parameters needed by gateways that provide multiple connection types and/or aggregation (for example, an H.323/H.320 gateway):

- **scnConnectionType** – Provides information to a gateway on the type of individual connection used to produce the entire SCN call. Endpoints or gatekeepers should fill in this field if the information is available to them. If the option "multirate" is indicated, then the information transfer rate octet in the bearer capability shall also indicate "multirate" and the rate multiplier octet shall indicate the number of connections. In all other cases, if the **scnConnectionType** field is present, it overrides any indication about the individual connection type contained in the transfer rate (octet #4) and rate multiplier (octet #4.1) of the bearer capability IE.
- **numberOfSCNConnections** – Indicates the number of connections of type **scnConnectionType** which are aggregated together to produce the SCN call. This field, when multiplied by the bandwidth of the individual connection specified in **scnConnectionType**, denotes the bandwidth for the entire call on the SCN. Endpoints or gatekeepers should fill in this field if the information is available to them. Note that if the **scnConnectionType** is set to unknown, then a unit of bandwidth of 64 kbit/s is assumed. If both this field and the **scnConnectionType** fields are present, then the total bandwidth indicated shall agree with the total SCN bandwidth indicated by the transfer rate (octet #4) and rate multiplier (octet #4.1) of the Bearer capability IE.
- **scnConnectionAggregation** – Indicates how the individual connections are aggregated together to produce the complete SCN call. Endpoints or gatekeepers should fill in this field if the information is available to them. The default option, to be used when the actual aggregation mechanism is unknown, is "auto". Where bonding is known to be used, but the precise bonding mode is unknown, then the option "bonded-mode1" should be used.

language – Indicates the language(s) in which the user would prefer to receive announcements and prompts. The field contains one or more RFC 1766 compliant language tags.

presentationIndicator – Indicates whether presentation of the **sourceAddress** should be allowed or restricted. If both **presentationIndicator** and the presentation indicator of the Calling Party Number IE are present and are in conflict, the presentation indicator of the Calling Party Number IE shall be used.

screeningIndicator – Indicates whether the **sourceAddress** was provided by the endpoint or network (gatekeeper), and whether the sourceAddress was screened by a gatekeeper. If both

screeningIndicator and the screening indicator of the Calling Party Number IE are present and are in conflict, the screening indicator of the Calling Party Number IE shall be used.

serviceControl – Contains service-specific data, or references to it, that may be used as part of the setup procedure at the called endpoint (e.g., an image or icon to be displayed while alerting) as described, for example, in Annex K/H.323.

symmetricOperationRequired – If present, indicates that the called endpoint must select identical transmit and receive audio capabilities. This element shall not be included unless the **fastStart** element is also included.

capacity – This field indicates the sending endpoint's available call capacity at this point in time, assuming that this Setup message represents an active call. When sending this field, the endpoint shall include the **currentCallCapacity** element.

circuitInfo – This field provides information about the SCN circuit or circuits used for this call.

desiredProtocols – Identifies the type of protocols, in order of preference, the originating endpoint desires for its call (e.g., voice or fax). A resolving entity may use this field to locate an endpoint that also supports the protocol, giving consideration to the order of preference.

neededFeatures – This field specifies a list of generic features that are required in order for the call to succeed.

desiredFeatures – This field specifies a list of generic features that are preferred for the call, but are not required in order for it to succeed.

supportedFeatures – This field specifies a list of generic features that the sender support and has chosen to declare.

parallelH245Control – This field carries a sequence of tunnelled H.245 Terminal Capability Set PDUs and optionally Master Slave Determination PDUs. Each octet string shall contain exactly one H.245 PDU.

additionalSourceAddresses – This field carries a sequence of alias addresses that correspond to the second and subsequent Calling Party Number IEs in non-H.323 networks. For example, in ISDN, multiple calling party numbers may be present to support the "Two Calling party number information elements delivery option" defined in Annex A/Q.951.

hopCount – This field specifies an integer value to indicate the number of hops the call signalling can traverse further.

displayName – Provides an ordered list of names, along with language tags, that identify the called or calling user. The user's most preferred name and language should be indicated first, followed by alternative representations using the same or different language tags. The receiving user may select any of the offered names for display according to local preference. When the displayName field is present, it shall take precedence over the Display IE. However, the Display IE should still be provided for interworking with legacy systems.

NOTE – If the **destExtraCallInfo** is present, a CRV for each call to be made may be supplied in **destExtraCRV**. These CRVs will be used to identify any response to each call launched. These procedures are for further study. If the **destExtraCRV** field is not present, a gateway shall aggregate all call information into a single response, with the effect that if one call fails on the SCN side, the entire call is treated as a failure.

7.3.11 Setup acknowledge

This message may be sent by an H.323 entity. However, it may be forwarded from the network via a gateway. Processing on receipt is optional, but an entity that indicates **canOverlapSend** in Setup shall support Setup Acknowledge.

The contents and semantics of a Setup Acknowledge message received from the network are defined in Table 3-16/Q.931, as modified in Table 14.

Table 14 – Setup acknowledge

Information element	H.225.0 status (M/F/O)	Length in H.225.0
Protocol discriminator	M	1
Call reference	M	3
Message type	M	1
Channel identification	FFS	NA
Display	O	2-82
User-user	M (Note)	*
NOTE – This element was not present in H.225.0 prior to H.225.0 (2000).		

For backward compatibility with systems prior to H.225.0 version 4, the sender of this message shall not include the **h4501SupplementaryService** or the **h245Control** field in the **h323-message-body** field of the User-user information element.

The User-user information element contains the **SetupAcknowledge-UUIE** defined in the H.225.0 Message Syntax. The **SetupAcknowledge-UUIE** includes the following:

protocolIdentifier – Set to the version of H.225.0 supported.

callIdentifier – A globally unique call identifier set by the originating endpoint, which can be used to associate RAS signalling with the modified Q.931 signalling used in this Recommendation.

tokens – This is some data which may be required to allow the operation. The data shall be inserted into the message if available.

cryptoTokens – Encrypted **tokens**.

7.3.12 Status

The Status message shall be used to respond to an unknown call signalling message or to a Status Inquiry message.

Follow Table 3-17/Q.931 as modified in Table 15.

Table 15 – Status

Information element	H.225.0 status (M/F/O)	Length in H.225.0
Protocol discriminator	M	1
Call reference (Note 1)	M	3
Message type	M	1
Cause	M	4-32
Call State	M	3
Display	O	2-82
User-user	M (Note 2)	*
NOTE 1 – This message may carry the global call reference if the message applies to all calls on a connection carrying multiple calls.		
NOTE 2 – This element was not present in H.225.0 prior to H.225.0 (2000).		

For backward compatibility with systems prior to H.225.0 version 4, the sender of this message shall not include the **h4501SupplementaryService** or the **h245Control** field in the **h323-message-body** field of the User-user information element.

The User-user information element contains the **Status-UUIE** defined in the H.225.0 Message Syntax. The **Status-UUIE** includes the following:

protocolIdentifier – Set to the version of H.225.0 supported.

callIdentifier – A globally unique call identifier set by the originating endpoint, which can be used to associate RAS signalling with the modified Q.931 signalling used in this Recommendation.

tokens – This is some data which may be required to allow the operation. The data shall be inserted into the message if available.

cryptoTokens – Encrypted **tokens**.

7.3.13 Status inquiry

The Status Inquiry message may be used to request call status as described in 8.4.2/H.323.

Follow Table 3-18/Q.931 as modified by Table 16.

Table 16 – Status inquiry

Information element	H.225.0 status (M/F/O)	Length in H.225.0
Protocol discriminator	M	1
Call reference (Note 1)	M	3
Message type	M	1
Display	O	2-82
User-user	M (Note 2)	*
NOTE 1 – This message may carry the global call reference if the message applies to all calls on a connection carrying multiple calls.		
NOTE 2 – This element was not present in H.225.0 prior to H.225.0 (2000).		

For backward compatibility with systems prior to H.225.0 version 4, the sender of this message shall not include the **h4501SupplementaryService** or the **h245Control** field in the **h323-message-body** field of the User-user information element.

The User-user information element contains the **StatusInquiry-UUIE** defined in the H.225.0 Message Syntax. The **StatusInquiry-UUIE** includes the following:

protocolIdentifier – Set to the version of H.225.0 supported.

callIdentifier – A globally unique call identifier set by the originating endpoint which can be used to associate RAS signalling with the modified Q.931 signalling used in this Recommendation.

tokens – This is some data which may be required to allow the operation. The data shall be inserted into the message if available.

cryptoTokens – Encrypted **tokens**.

7.4 Q.932-based H.225.0 call signalling message details

The messages defined in the following are derived from ITU-T Recs Q.932 and H.450. Refer to ITU-T Recs Q.932 and H.450 for further details.

Note that the lengths of the information elements specified in the tables below, where "*" denotes an undefined maximum length, refer to messages that are generated by H.323 terminals only. The size of the User-user information element, not explicitly shown, is understood as the size of the PER-encoded H323-UserInfo sequence. The total size of H323-UserInfo is limited to 65 536 octets. Regardless of the specified sizes, messages forwarded from the SCN side may have different (larger) sizes.

Also note that an information element specified below as mandatory, optional or forbidden refers only to whether or not H.323 terminals may originate such information elements.

7.4.1 Facility

The Facility message shall be used to provide information on where a call should be directed (**FacilityReason** = **routeCallToMC**), or for an endpoint to indicate that the incoming call must go through a gatekeeper (**FacilityReason** = **routeCallToGatekeeper**).

In order to signal call redirection specific to H.323 procedures, the User-user information element of the Facility message is used. This particular case shall be indicated by coding a Facility IE of length zero. In this case, the Facility information element shall consist of exactly 2 octets. An H.323 entity shall handle the empty (H.323-specific) Facility IE properly and shall be capable of skipping other Facility IEs that it does not understand.

The Facility message may be used to request or acknowledge a supplementary service according to H.450.x-series Recommendations. For that reason, one or more H.450 Supplementary Service APDUs shall be carried within the User-user information element of the Facility message. The H.450 Supplementary Service APDUs shall be coded according to clause 8/H.450.1. The Facility information element shall be contained with length zero. Note that a Facility message of H.225.0 version 2 or version 3 that carries only H.450 Supplementary Service APDUs might choose not to include the Facility-UIIE, but instead use the "empty" **h323-message-body** choice. In this case, a Facility message would not have a **callIdentifier** field in it. In H.225.0 version 4 and higher, a sender shall include a Facility-UIIE carrying a **callIdentifier** field in every call-associated Facility message, and shall set the **reason** field value to **transportedInformation**.

If a Facility IE carrying semantics of ITU-T Rec. Q.932 and encoded as defined in ITU-T Rec. Q.932 and ITU-T Rec. Q.95x is present, it shall consist of at least 8 octets as required by Table 7-2/Q.932. The use of Facility IEs of that type is for further study.

The Facility message may be used by an endpoint or gatekeeper to request the recipient to establish an H.245 channel between the two entities (**FacilityReason** = **startH245**).

The Facility message may be used by an endpoint or gatekeeper to send a new set of tokens in the **tokens** and/or **cryptoTokens** field of the Facility message (**FacilityReason** = **newTokens**). This may be useful, for example, for applications in which tokens are used to allow some action to take place only for a limited amount of time.

Follow 7.1.1/Q.932 and 10.8 of ISO/IEC 11582, as modified in Table 17.