International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.323

Amendment 1

(01/2005)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

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

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Packet-based multimedia communications systems

Amendment 1: Revised Annex D – Real-time facsimile over H.323 systems: Transport of facsimile signals using RTP

ITU-T Recommendation H.323 (2003) – Amendment 1

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ITU-T Recommendation H.323

Packet-based multimedia communications systems

Amendment 1

Revised Annex D – Real-time facsimile over H.323 systems: Transport of facsimile signals using RTP

Summary

This amendment (previously referred to as "Annex Dv3") adds the support for transport of T.38 over RTP as described in ITU-T Rec. T.38 (2004) to Annex D, as well as incorporating correction of errors discovered since the original approval of the annex.

Source

Amendment 1 to ITU-T Recommendation H.323 (2003) was approved on 8 January 2005 by ITU-T Study Group 16 (2005-2008) under the ITU-T Recommendation A.8 procedure.

FOREWORD

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

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

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

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

NOTE

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

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.

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As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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Amendment 1

Revised Annex D – Real-time facsimile over H.323 systems: Transport of facsimile signals using RTP

Make the following modifications to Annex D as indicated by revision marks:

D.1 Introduction

Currently, facsimile and speech are typically sent using the PSTN with the same calling and addressing infrastructure. It is highly desirable to continue this approach in the context of this Recommendation. From a high level, facsimile can be viewed as another kind of real-time traffic similar to a particular speech coder. This seems appropriate, as facsimile entering the packet world via a gateway from the PSTN should logically be treated in a fashion similar to speech if the customer expects a real-time, assured end-to-end transmission service. The conversion of facsimile to email or other store-and-forward methods represents a new service that is beyond the scope of this Recommendation, which is a real-time protocol. It is recognized that manufacturers may wish to provide a gateway that falls back to a store-and-forward service when the real-time facsimile call fails. It is beyond the scope of this Recommendation when and how this decision is made, or by what means a store-and-forward facsimile service is implemented.

ITU-T Rec. T.38 [56] defines an Internet facsimile protocol consisting of messages and data exchanged between Facsimile Gateways connected via an IP network. This annex uses ITU-T Rec. T.38. Communication between the Gateways and G3/G4 Facsimile terminals is beyond the scope of ITU-T Rec. T.38. The reference model for T.38 is shown in Figure D.1 with three scenarios. In the first scenario, the two traditional Group 3 Facsimile Equipment (G3FE) terminals are virtually connected through the Gateways once the PSTN calls are established. All T.30 [55] session establishment and capabilities negotiation is carried out between the terminals. In the second scenario, the traditional Group 3 Facsimile (IAF) terminal is connected with an Internet Aware Fax terminal (IAF).

The IAF is directly connected to the IP network. In the third scenario, the two IAFs are directly connected to the IP network. In all the scenarios, T.38 packets are used on the IP network to communicate T.4/T.30 facsimile information. The transport of T.38 packets is either on TCP/IP, UDP/IP (UDPTL), or RTP using the H.323 mechanism.

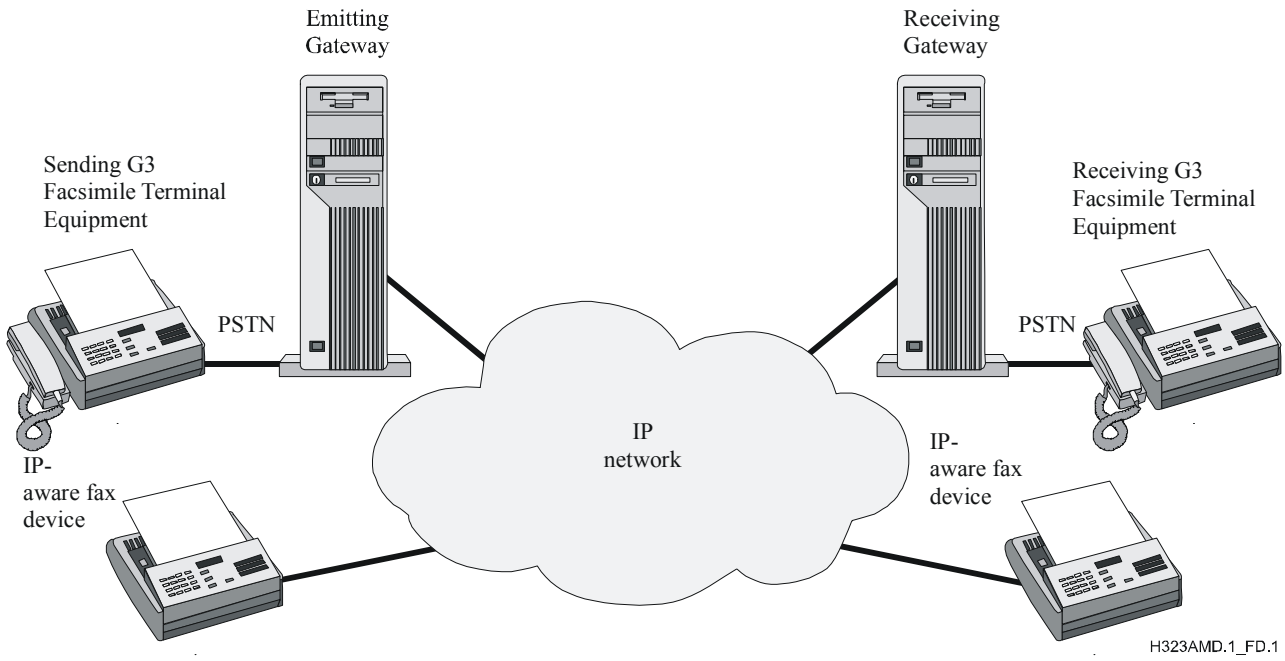

Figure D.1/H.323 – Model for facsimile transmission over IP networks

D.2 Scope

The scope of this annex is to use H.323 procedures to transfer T.38 packets in real time over the IP network. H.323 entities supporting facsimile capabilities shall use T.38 to support real-time facsimile services as described in this annex.

H.323 facsimile capable endpoints shall support the usage of TCP and UDPTL as described in ITU-T Rec. T.38 and may optionally support RTP. Annex B/T.38 describes a T.38-only capable terminal that supports a subset of H.245 messages using H.245 tunnelling. However, the T.38/Annex B terminal can interwork with an H.323/Annex D terminal using 8.1.7/H.323 "Fast Connect Procedure", and 8.2.1/H.323 "Encapsulation of H.245 Messages within H.225.0 call signalling Messages" procedures in this Recommendation. T.38/Annex B terminals interwork with H.323 terminals without being conformant to this Recommendation. An H.323 terminal that supports the procedures of this annex shall interwork with T.38/Annex B terminals.

D.3 Procedures for opening channels to send T.38 packets

Fast Connect is used to describe the H.323 procedures for opening channels for the transportation of T.38 packets. The traditional sequence can also be used, though it is not described here.

D.3.1 Opening the voice channel

Zero, one (sender to receiver channel or receiver to sender channel), or two (sender to receiver channel and receiver to sender channel) logical channels for voice may be opened depending on the capability of the sender and the receiver. If a voice channel is desired, the voice channel shall be opened as specified by the procedures in 8.1.7/H.323 "Fast Connect". Support of voice by facsimile applications is not mandatory in this annex.

D.3.2 Opening the facsimile channels

Two unidirectional reliable or unreliable logical channels (sender to receiver channel and receiver to sender channel) as shown in Figure D.2 or, optionally, one bidirectional reliable channel as shown in Figure D.3 may be opened for the transfer of T.38 packets. T.38 packets can be transferred using TCP, UDPTL, or RTP. In general, the usage of TCP is more effective when the bandwidth for facsimile communication is limited. On the other hand, the usage of UDPTL or RTP may be more effective when the bandwidth for facsimile communication is sufficient.

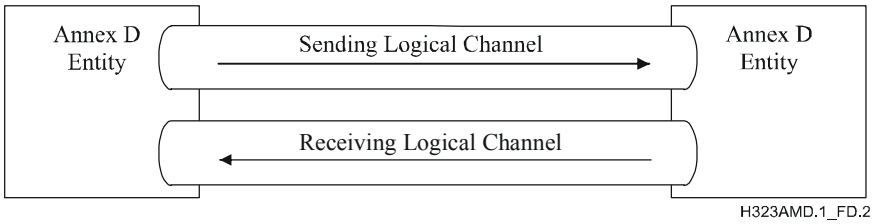

Figure D.2/H.323 – A pair of unidirectional channels

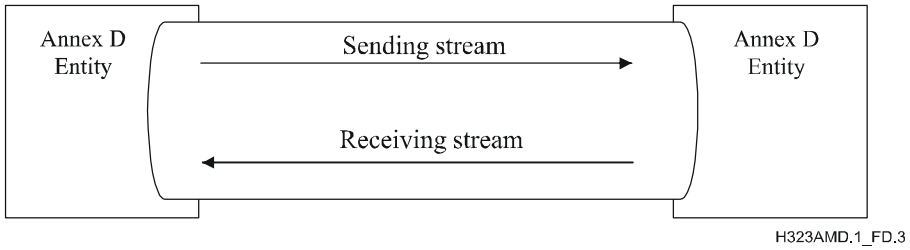

Figure D.3/H.323 – A unit of bidirectional channels

NOTE – In the first version of this annex, it was not possible to use a single bidirectional reliable channel. In order to retain backward compatibility, the endpoint may specify support for bidirectional reliable channels by including the **t38FaxTcpOptions** SEQUENCE and setting the **t38TCPBidirectionalMode** field to TRUE. If the other endpoint does not include the **t38FaxTcpOptions** SEQUENCE, the endpoint shall assume that a single bidirectional reliable channel for T.38 is not supported and shall use either two unidirectional reliable or unreliable channels.

The sender terminal specifies a TCP/UDP port in the **OpenLogicalChannel** in the **fastStart** element of *Setup*. The receiver terminal shall provide its TCP (or UDP) port in the **OpenLogicalChannel** of the **fastStart** element as specified by the procedures in 8.1.7/H.323 "Fast Connect procedure".

The receiver shall open the TCP/UDP port based on the preference of the sender. If the sender terminal has a preference for UDPTL, RTP, or TCP, then it shall indicate its preference by ordering proposals in the **fastStart** sequence according to 8.1.7.1/H.323. The receiving terminal can select the transport, TCP or UDP, by returning the desired proposals in **OpenLogicalChannel** structures in the **fastStart** element of *Connect*.

Figures D.4 and D.5 show the signalling used to open unidirectional and bidirectional channels using Fast Connect.

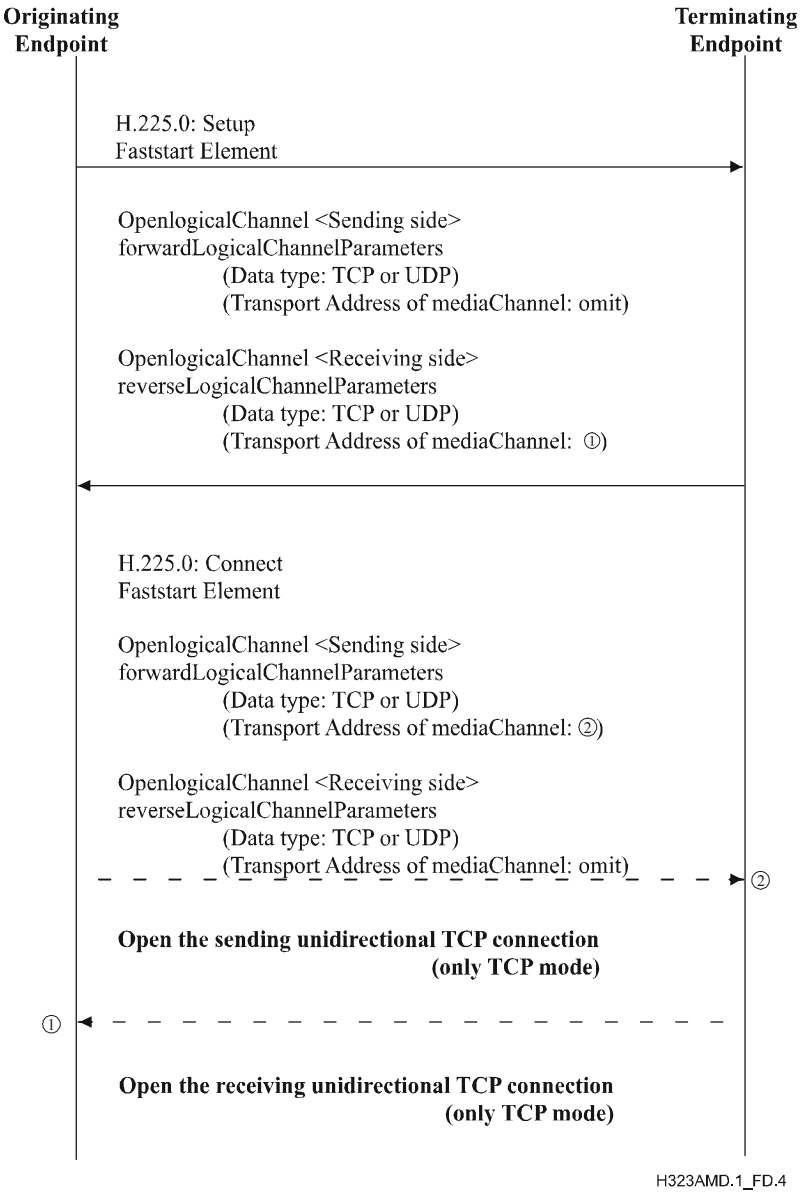

Figure D.4/H.323 – Two unidirectional channels with fast connect

In the above example, T.38 channels are proposed as UDPTL or TCP. To propose a unidirectional logical channel that utilizes RTP for transport of T.38 packets, the Open Logical Channel's **dataType** parameter shall be set to **audioData** and shall include the H.245 Generic Audio Capability for T.38 as specified in Annex G/T.38.

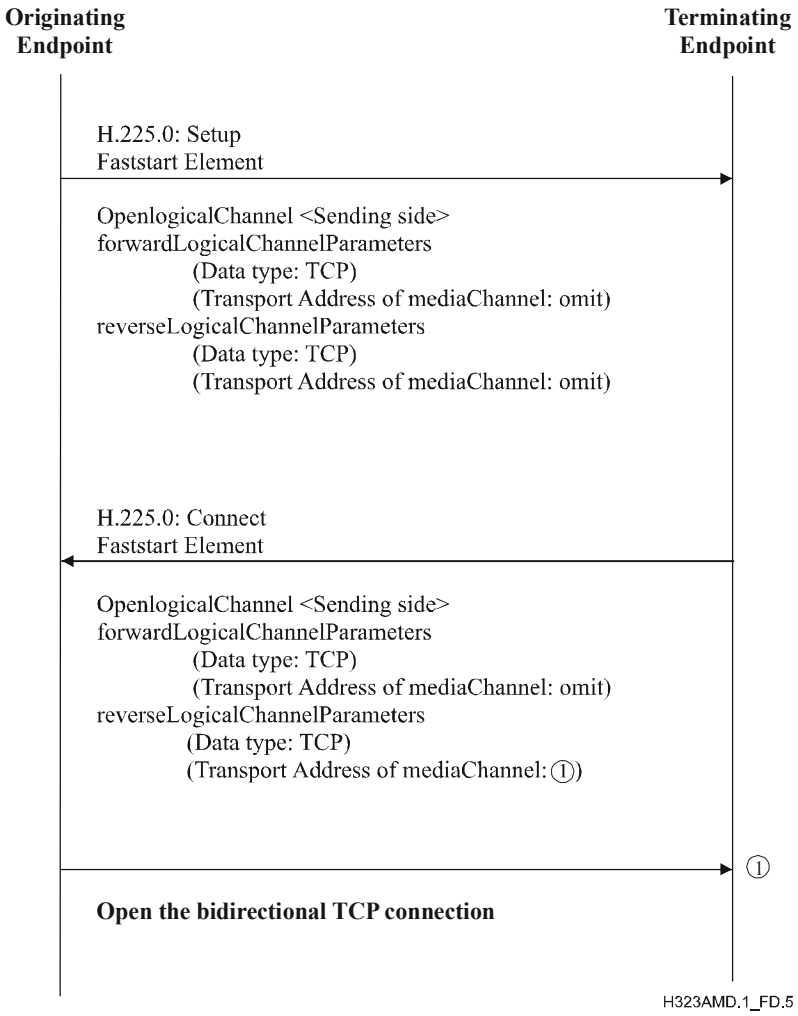

Figure D.5/H.323 – One bidirectional reliable channel with fast connect

D.3.3 DTMF transmission

DTMF tones shall be sent by H.323/Annex D terminals using **UserInputIndication** to interwork with T.38/Annex B terminals. H.323/Annex D terminals may send DTMF tones in-band with the voice or via RFC 2833 when T.38/Annex B terminals are not involved in the call.

D.4 Non-fast connect procedures

It is noted that in Non-Fast Connect, the normal H.245-based **OpenLogicalChannel** procedures can be used to open and close UDPTL, RTP, and TCP fax channels (refer to 6.2.8.2/H.323). Tunnelled H.245 can also be used to open and close channels. It is also noted that non-Fast Connect and non-tunnelled H.245 procedures do not apply to interworking with ITU-T Rec. T.38.

Figures D.6 and D.7 show the signalling used to open unidirectional and bidirectional channels when not using Fast Connect.

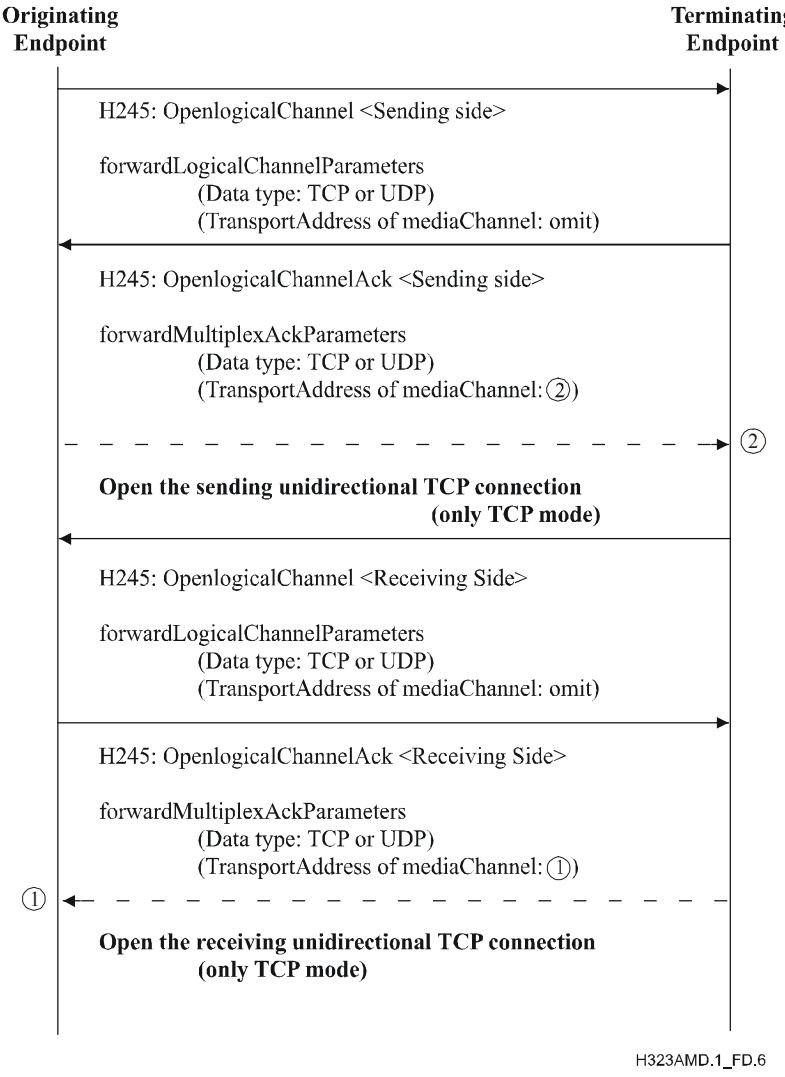

Figure D.6/H.323 – Two unidirectional channels without fast connect

In the above example, T.38 channels are proposed as UDPTL or TCP. To propose a unidirectional logical channel that utilizes RTP for transport of T.38 packets, the Open Logical Channel's **dataType** parameter shall be set to **audioData** and shall include the H.245 Generic Audio Capability for T.38 as specified in Annex G/T.38.

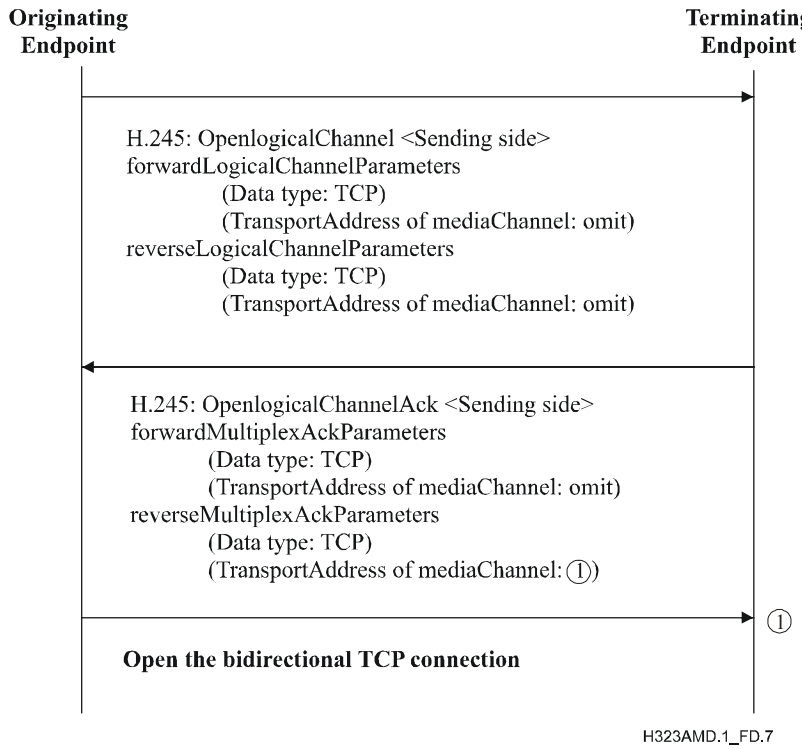

Figure D.7/H.323 – One bidirectional channel without fast connect

D.5 Replacing an existing audio stream with a T.38 fax stream

An endpoint that wishes to replace an existing audio stream with a fax stream shall use the following mechanism to achieve this goal.

Once the audio call has been established – ideally via the use of Fast Connect and prior to the receipt of the CONNECT message – the endpoint that wishes to replace the audio stream with T.38 fax shall initiate H.245 procedures via tunnelling if H.245 has not already been started.

During H.245 capability exchange, each endpoint shall express its capability of receiving and transmitting T.38 fax by including the **t38fax** field of the **DataApplicationCapability** structure and, optionally, including the T38RTP Generic Audio Capability specified in Annex G/T.38. The presence of these capabilities indicates that the remote endpoint is capable of supporting the T.38 Fax Mode.

It should be noted that the Connect message may arrive while H.245 procedures are taking place. After H.245 procedures have completed and the Connect has been received, either endpoint may detect fax tones (i.e., CNG or CED) or the presence of V.21 carrier and HDLC flags. Typical scenarios for facsimile call detection rely on the analysis of CNG calling tone and a response of the CED answer tone and/or the initiation of fax procedures using the V.21 carrier and HDLC flags. Note that in some implementations the presence of either CNG or CED is optional. Therefore, both endpoints should take an active role in order to properly detect fax.

When using two unidirectional fax channels, the endpoint that detected the tone shall initiate the standard H.245 Mode Request procedure by sending a **requestMode** message to its remote counterpart with the **t38fax** data mode or the T38RTP Generic Audio Capability as the requested mode. The endpoint that receives the **RequestMode** message shall return a **requestModeAck** message. On receiving the **requestModeAck** message, the initiating endpoint shall close its audio logical channel and open a T.38 logical channel. Similarly, the remote end shall close its audio logical channel and open a T.38 fax logical channel. After acknowledgments have been received for each of the T.38 open logical channels, fax transmission and reception takes place.

Figure D.8 illustrates a successful switchover from voice to fax when a separate H.245 channel is already open for two unidirectional media channels.

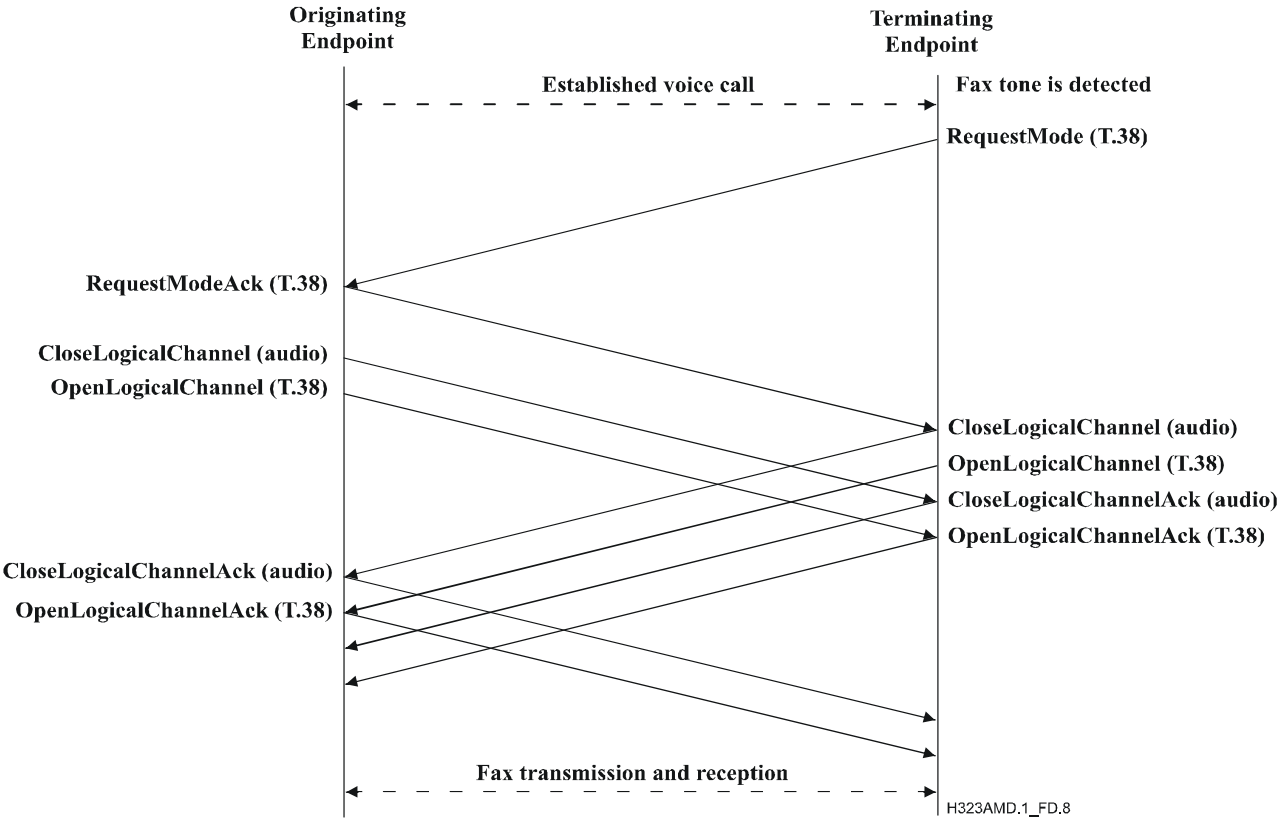

Figure D.8/H.323 – Successful switching of an existing voice call to T.38 using two unidirectional media channels without tunnelling

Figure D.9 illustrates a successful switchover from voice to fax using H.245 tunnelling for two unidirectional media channels.

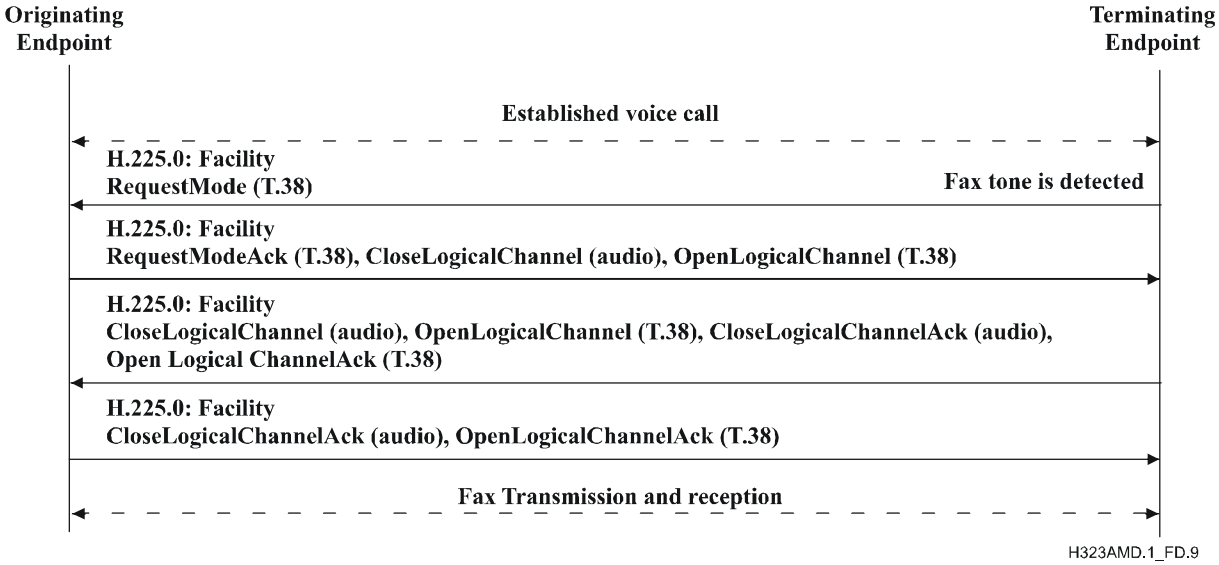

Figure D.9/H.323 – Successful switching of an existing voice call to T.38 using two unidirectional media channels with tunnelling

When using a bidirectional fax channel (for TCP only), the request mode command is not necessary: the endpoint that detected the tone shall close its open channels, request the reverse channels to be closed by the other endpoint, and open a bidirectional T.38 channel. Upon reception of the request channel close command, the remote end shall close its audio channel. After acknowledgements have been received for each of the T.38 open logical channels, fax transmission and reception takes place.

Figure D.10 illustrates a successful switchover from voice to fax when a separate H.245 channel is already open for one bidirectional media channel.

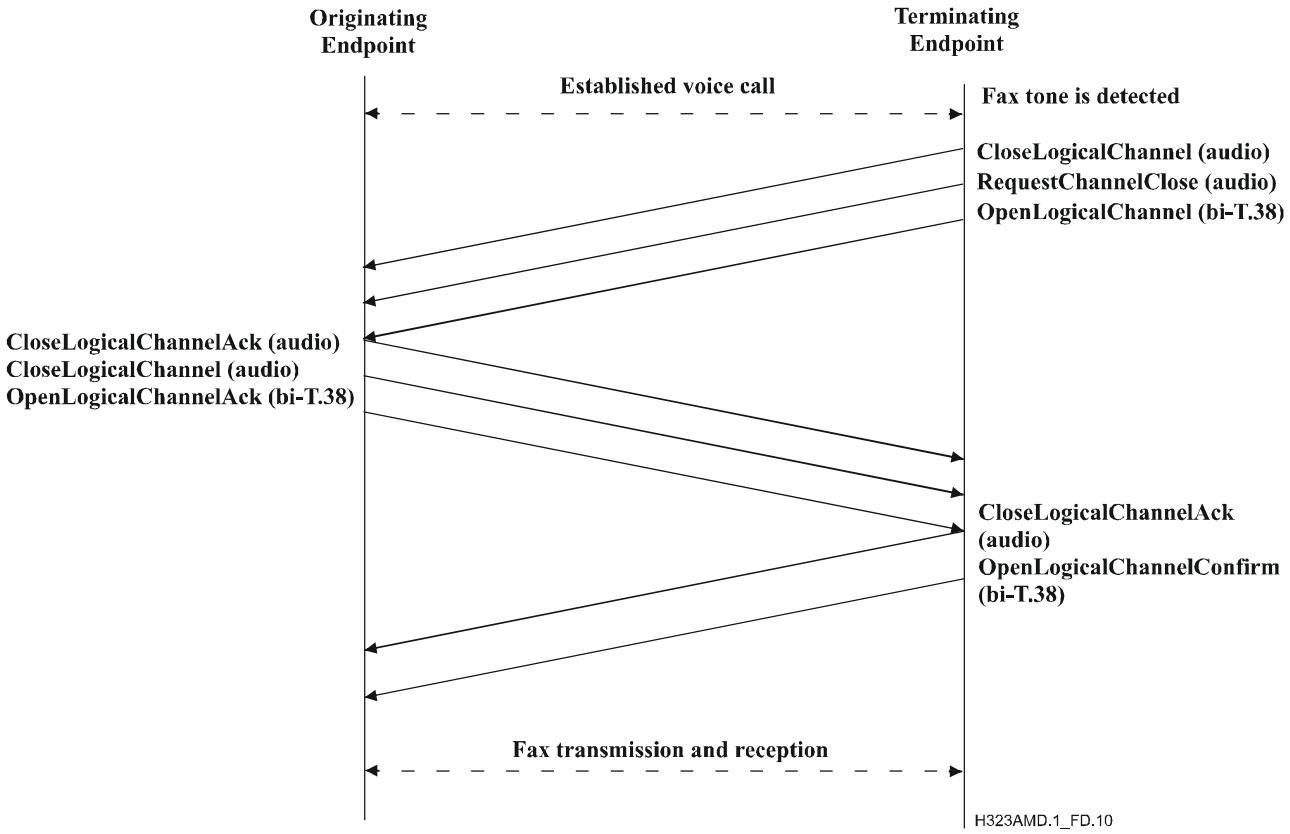

Figure D.10/H.323 – Successful switching of an existing voice call to T.38 using one bidirectional media channel (TCP) without tunnelling

Figure D.11 illustrates a successful switchover from voice to fax using H.245 tunnelling for one bidirectional media channel.

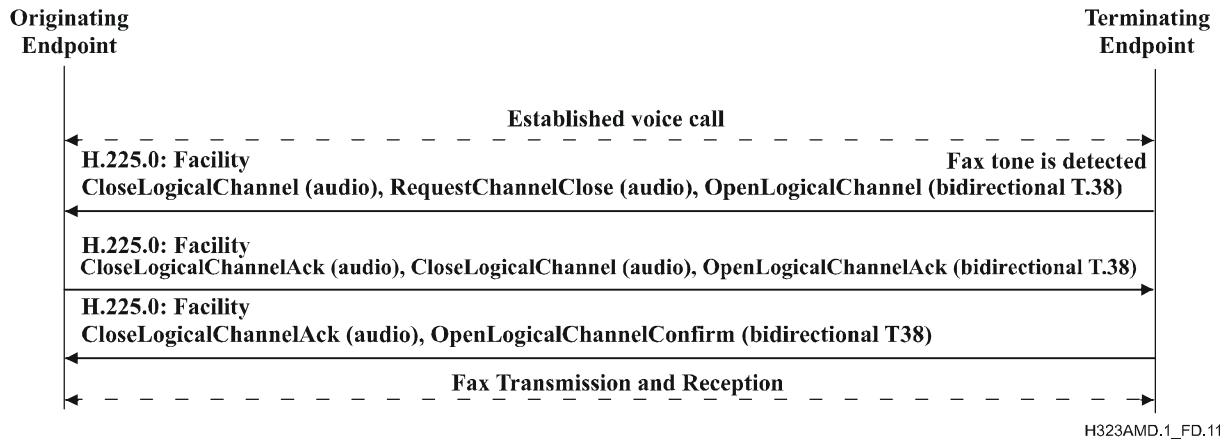

Figure D.11/H.323 – Successful switching of an existing voice call to T.38 using one bidirectional media channel (TCP) with tunnelling

Should either endpoint wish to return to an audio call after the fax transmission has ended, the Mode Request procedure shall be initiated using an audio codec as a parameter. The above procedure also applies to traditional H.245 logical channel signalling cases, in the event that Fast Connect cannot be established between the two endpoints.

D.6 Usage of the maxBitRate/bandWidth in messages

When TCP is used for T.38 fax transmission, **bandWidth** in the ARQ/BRQ does not include the fax data rate, and if a voice link is switched off when the fax session starts, a BRQ shall be used to indicate to the Gatekeeper that the bandwidth has changed. When UDPTL or RTP is used for T.38 fax transmission, **bandWidth** in the ARQ/BRQ does include the bit rate needed for the fax session. The endpoint (terminal, gateway) shall send BRQs to the Gatekeeper as bandwidth needs change during the call. It is noted that the **maxBitRate** in the **OpenLogicalChannel** element in the Setup during Fast Connect is different from the **bandWidth** in ARQ/BRQ, and does refer to the peak bit rate that the fax call will use.

D.7 Interactions with gateways and T.38/Annex B devices

The following case must be considered:

H.323/Annex D device (with voice) <–> T.38/Annex B device (without voice).

Note that these devices may be terminals or gateways; it does not affect the discussion. A fax call arrives from the "voiceless" side, but the voice side must generate an outgoing voice call that is not connected to anything although tones or announcements might be played. In the opposite direction, the H.323/Annex D device cannot offer a voice call to a "voiceless" device, as it cannot receive voice.

The H.323/Annex D gateway may send both a voice and fax **OpenLogicalChannel** element in the Setup message. If it encounters a T.38 device, only the fax channel will be opened if both were proposed. If the call mistakenly encounters a non-fax H.323 device, the fax port will not be opened. This is the equivalent of a fax machine calling a telephone.

An H.323/Annex D device becomes aware that it is talking to a T.38/Annex B device due to the following sequence of events:

1) The T.38/Annex B device does not supply an H.245 port in the Connect or Setup.

2) The H.323/Annex D device uses the Facility message as described in 8.2.3/H.323 and transmits a **FACILITY** message with a **FacilityReason** of **startH245** and provides its H.245 address in the **h245Address** element. The T.38/Annex B endpoint receiving a **FACILITY** message with a **FacilityReason** of **startH245** will respond with a **FACILITY** message having a **FacilityReason** of **noH245**. At this point the H.323/Annex D device should cease all attempts to open the H.245 channel.

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