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T.38
Amendment 1
(04/99)

SERIES T: TERMINALS FOR TELEMATIC SERVICES

Procedures for real-time Group 3 facsimile
communication over IP networks

Amendment 1

ITU-T Recommendation T.38 – Amendment 1

ITU-T T-SERIES RECOMMENDATIONS

TERMINALS FOR TELEMATIC SERVICES

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ITU-T RECOMMENDATION T.38

PROCEDURES FOR REAL-TIME GROUP 3
FACSIMILE COMMUNICATION OVER IP NETWORKS

AMENDMENT 1

Summary

Amendment 1 to Recommendation T.38 provides the text for Annex B which documents the call establishment procedures for facsimile communication over IP networks.

FOREWORD

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

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

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

NOTE

In this Recommendation the term *recognized operating agency (ROA)* includes any individual, company, corporation or governmental organization that operates a public correspondence service. The terms *Administration, ROA* and *public correspondence* are defined in the *Constitution of the ITU (Geneva, 1992)*.

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As of the date of approval of this Recommendation, the 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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FACSIMILE COMMUNICATION OVER IP NETWORKS

AMENDMENT 1

(Geneva, 1999)

1)   Clause 2

Insert the following references:

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

– ITU-T Recommendation Q.850 (1993), *Usage of Cause and Location in the Digital Subscriber Signalling System No. 1 and the Signalling System No. 7 ISDN User Part.*

2)   Revised Annex B

Replace Annex B of Recommendation T.38, version 06/98, with the following new text of Annex B:

Annex B

Call establishment procedures

B.1   Introduction

This annex describes system level requirements and procedures for Internet-aware facsimile implementations and Internet-aware facsimile gateways conforming to Recommendation T.38 to establish calls with other T.38 implementations including those using the procedure defined in this annex as well as Recommendation H.323 Annex D.

B.2   Communication between facsimile terminal and gateway

Communication between a sending Group 3 facsimile terminal and the incoming gateway is generally effected using dial-up procedures over the PSTN. Basic and optional T.30 procedures are supported. The support for V.34 is for further study.

The gateway may receive the facsimile transmission from the calling terminal as a modem signal on the PSTN if the gateway supports a direct dial-in procedure. Where the gateway is located within the network, it may receive the transmission in the form of a PCM encoded digital channel. Internet-aware facsimile (IAF) implementations are connected directly to the IP network and act as a gateway for call establishment.

B.2.1   Transfer of addressing information

The conveyance of the E.164 address of the called terminal from the calling terminal to the emitting gateway may be by manual procedures using prompts; by means of double dialling; or by any other suitable means.

B.3 Communication between gateways

B.3.1 Overview

B.3.1.1 Call setup

Call setup for Recommendation T.38 Annex B compliant implementations is based on the Fast Connect Procedure defined in Recommendation H.323. Recommendation T.38 implementations may operate in two distinct H.323 compatible environments.

1) A facsimile-only over IP environment. In this environment, no voice support is provided. The procedures and requirements of this annex shall apply to implementations operating in this environment unless they are superseded by a Recommendation H.323 Annex D implementation.

2) A facsimile and voice over IP environment. Implementations in this environment shall use the methods described in Recommendation H.323 Annex D.

Recommendation T.38 Annex B implementations use only the Fast Connect Procedure for call setup and do not support H.245 negotiation. Recommendation H.323 Annex D implementations, on the other hand, support both the Fast Connect Procedure and the normal H.323 procedure for call setup. Most H.323 implementations also support H.245 negotiation.

B.3.1.2 Media channels

Recommendation H.225.0 requires that T.38 facsimile packets are sent on a separate TCP/UDP port from H.225.0 call signalling (TCP). All required ports are established during the initial **fastStart** exchange. A minimal T.38 Annex B implementation requires a TCP port for call signalling and either a UDP port or a TCP port for T.38 facsimile information.

B.3.1.3 Usage of Recommendation H.245

Endpoints conforming to this annex are not required to support Recommendation H.245, except as required in this annex to support **fastStart** signalling. As described in B.3.9 below, a Recommendation H.323 endpoint can use the *Facility* message to determine that the Recommendation T.38 Annex B endpoint does not support Recommendation H.245.

B.3.2 Basic call setup

H.323 implementations have a multi-phase call setup procedure, which includes:

– RAS (Registration, Admissions and Status) signalling using UDP between the endpoint and the gatekeeper.

– Q.931-based call signalling either directly between endpoints, or between endpoints and gatekeeper depending on the call model in use, using TCP/IP.

– H.245 capability negotiation and logical channel management using TCP/IP.

Although support for RAS is mandatory, it is not mandatory to use RAS. Thus, an Annex B implementation could be used with or without a gatekeeper. It could obtain its IP addresses in any fashion desired, such as LDAP or a personal directory. However, if placed in a gatekeeper environment, it would register and operate as per Recommendation H.323

Implementations conforming to this annex shall conform to H.323 RAS signalling. RAS signalling allows a T.38 implementation to initiate a call, using the H.323 well-known TCP port, and provides dynamic assignment of the port to use for the T.38 messages.

Implementations conforming to this annex utilize Recommendation H.323 call setup messages as described in 8.1.1/H.323: "Basic Call Setup – Neither Endpoint Registered" assuming this to be the case. The initial text of 8.1/H.323: "Phase A – Call Setup" is also relevant to T.38 implementations. The rest of 8.1/H.323 applies if one or both endpoints are registered with a gatekeeper.

Implementations conforming to this annex shall initially start calls by opening a TCP/IP session and sending an H.225.0 SETUP message with the fast connect fields filled in as described in 8.1.7/H.323.

The receiving terminal replies with an H.225.0 ALERTING, CALL PROCEEDING, PROGRESS, or CONNECT message as per the procedures of Recommendation H.323 "fast connect". The Annex B implementation shall not include any video, voice, or data OLC elements in the "fastStart" structure. Instead it includes OLC elements pertinent to facsimile as described in the next subclause.

B.3.3   Capabilities negotiation

There are several options that need to be negotiated to determine which options the gateways support and use. See Table B.1.

Table B.1/T.38 – Gateway option capability support indications

Option	Description
Data rate management method	Method 1, local generation of TCF is required for use with TCP. Method 2, transfer of TCF is required for use with UDP. Method 2 is not recommended for use with TCP.
Data transport protocol	The emitting gateway may indicate a preference for either UDP or TCP for transport of T.38 RTF-Packets. The receiving device selects the transport protocol.
Fill bit removal	Indicates the capability to remove and insert fill bits in Phase C, non-ECM data to reduce bandwidth in the packet network. Optional. See Note.
MMR transcoding	Indicates the ability to convert to/from MMR from/to the line format for increasing the compression of the data and reducing the bandwidth in the packet network. Optional. See Note.
JBIG transcoding	Indicates the ability to convert to/from JBIG to reduce bandwidth. Optional. See Note.
Maximum buffer size	For UDP mode, this option indicates the maximum number of octets that can be stored on the remote device before an overflow condition occurs. It is the responsibility of the transmitting application to limit the transfer rate to prevent an overflow. The negotiated data rate should be used to determine the rate at which data is being removed from the buffer.
Maximum datagram size	This option indicates the maximum size of a UDPTL packet that can be accepted by the remote device.
Version	This is the version number of Recommendation T.38. New versions shall be compatible with previous versions.
NOTE – Bandwidth reduction shall only be done on suitable Phase C data, i.e. MH, MR and – in the case of transcoding to JBIG – €MMR. MMR and JBIG require reliable data transport such as that provided by TCP. When transcoding is selected, it shall be applied to every suitable page in a call.	

These capabilities are negotiated using the OLC elements as defined in H.245 V5 with the following T.38 extensions.

NOTE – A portion of the OLC of H.245 V5 elements are shown below in italics and the T.38 Annex B elements are shown in roman to indicate where these T.38 Annex B elements fit into the H.245 procedure.

T38faxProfile   ::= SEQUENCE
{
        fillBitRemoval   BOOLEAN,
        transcodingJBIG BOOLEAN,
        transcodingMMR   BOOLEAN,
        ....
        version   INTEGER (O..255),   -- Version 0, the default, refers to T.38 (1998)
        t38FaxRateManagement   T38FaxRateManagement,
                     -- The default Data Rate Management is determined by the choice of Data Protocol Capability
        t38FaxUdpOptions   t38FaxUdpOptions OPTIONAL
                     -- For UDP, t38UDPRedundancy is the default.
}

```
DataMode                    ::= SEQUENCE
{
        application                 CHOICE
        {
            nonStandard         NonStandardParameter,
...
            t38fax              SEQUENCE
            {
                t38FaxProtocol  DataProtocolCapability,
                t38FaxProfile   T38FaxProfile
            },
            genericDataMode     GenericCapability
        },
        bitRate    INTEGER (0..4294967295),        -- units 100 bit/s
        ...
}
```

T38FaxRateManagement   ::= CHOICE
{
        localTCF   NULL,
        transferredTCF   NULL
        ...
}

T38FaxUdpOptions   ::= SEQUENCE
{
        t38FaxMaxBuffer   INTEGER OPTIONAL,
        t38FaxMaxDatagram   INTEGER OPTIONAL,
        t38FaxUdpEC   ::= CHOICE
        {
                t38UDPFEC   NULL,
                t38UDPRedundancy   NULL,
        ...
        }
}


```
DataMode    ::= SEQUENCE
{
        application         ::= CHOICE
        {
            nonStandard                 NonStandardParameter,
            t120 DataProtocolCapability,
```

Two logical channels (sender to receiver channel and receiver to sender channel) shall be opened for the transfer of T.38 packets. T.38 packets can be transferred using either TCP or UDP. In general, the usage of TCP is more effective when the bandwidth for facsimile communication is limited, or for IAF to IAF transfers since TCP provides flow control. On the other hand, the usage of UDP may be more effective when the bandwidth for facsimile communication is sufficient.

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".

The receiver should open the TCP/UDP port based on the preference of the sender. If the sender terminal has a preference for UDP or TCP, then it shall provide its preference in the **OpenLogicalChannel** with the appropriate port in the **fastStart** sequence. The receiving terminal can select the transport, TCP or UDP, by specifying one of the two in **OpenLogicalChannel** structures in the **fastStart** element of *Connect*.

All T.38 Annex B implementations shall include a T38facsimile OLC with **udp** and **transferredTCF** set in the **fastStart** structure. Note that all Recommendation H.323 Annex D devices also are required to include this structure. In addition, Recommendation T.38 Annex B devices shall include an OLC with **tcp** and **localTCF** set. As described in 8.1.7/H.323, the order in which OLCs are included in the **fastStart** element indicates preference on the part of the sender. The receiver only includes the OLCs that it wishes to use in the **fastStart** element of the *Connect*.

B.3.4 Examples of call setup OLCs

The examples in this subclause illustrate the OLC elements that are sent in various cases. The rules of 8.1.7/H.323 are followed using OLC definitions in Recommendation H.245. Refer to Recommendation H.245 for the relevant ASN.1.

B.3.4.1 TCP, UDP support

The default case requires support for both TCP and UDP. In this case, the sender shall send OLCs for **T38/TCP&localTCF** and **T38/UDP&transferredTCF**. If the receiver wishes to use UDP, an OLC for **T38/UDP&transferredTCF** is returned; otherwise, the OLC for **T38/TCP&localTCF** is returned.

B.3.4.2 UDP with data rate management method 1 support

For the case where the sender wishes to use data rate management method 1 and UDP for data transport, it shall send OLCs for **T38/UDP&transferredTCF**, **T38/UDP&localTCF**, **T38/TCP&localTCF**. If the receiver agrees to use **UDP&localTCF**, an OLC for **T38/UDP&localTCF** is returned.

B.3.5 Mandatory call setup messages

The Annex B implementation shall support the following clauses of H.225.0 for call setup:

– Mandatory elements in Table 4/H.225.0, i.e. ALERTING, CONNECT, CALL PROCEEDING, SETUP, RELEASE COMPLETE, etc. shall be supported by T.38 endpoints conforming to Annex B. Note that there is no requirement to send ALERTING if CONNECT, CALL PROCEEDING, or RELEASE COMPLETE is sent within 4 seconds of the receipt of SETUP, as described in Recommendation H.323. Note also that gateways shall send CALL PROCEEDING.

– The Information elements of FACILITY as described in 7.4.1/H.225.0.

– The Information elements of ALERTING as described in 7.3.1/H.225.0.

– The Information elements of CALL PROCEEDING as described in 7.3.2/H.225.0.

– The Information elements of CONNECT as described in 7.3.3/H.225.0

– The information elements of PROGRESS as described in 7.3.8/H.225.0.

– The Information elements of RELEASE COMPLETE as described in 7.3.10/H.225.0.

– The Information elements of SETUP as described in 7.3.11/H.225.0.

– The ASN.1 of H.225.0 as described in Recommendation H.225.0.

NOTE – H.225.0 ASN.1 supports a large number of optional features. Recommendation T.38 Annex B implementations may implement the full range of optional H.225.0 features, including authentication features that are potentially available. They may also implement H.450.x supplementary services. H.225.0 options are outside (i.e. prior) to the OLC negotiations. If a real time fax endpoint (H.323 Annex D or T.38 Annex B) makes use of H.450.x supplementary services, it must take into account that the remote endpoint may or may not support them. In the worst case, the supplementary service is ignored by the receiver. Thus the requesting endpoint must handle this condition, with, for example, a timeout mechanism.

B.3.6 Mapping of call progress signals

For call setup and call progress, the return signals can be simplified to the following set. These are all returned prior to or instead of a connect message.

The CONNECT message is returned when the gateway, *by some means*, determines that a connection to the terminal G3FE has been established. If CED or FSK flags are detected, the appropriate T.38 messages can be sent. This level of call setup and progress works in both H.323 as well as non-H.323 environments.

B.3.7   Usage of the MaxBitRate in messages

When TCP is used for T.38 fax transmission, **maxBitRate** in the ARQ/BRQ does not include the fax data rate. When UDP is used for T.38 fax transmission, **maxBitRate** 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 start is different from the **maxBitRate** in ARQ/BRQ, and does refer to the peak bit rate that the fax call will use.

B.3.8   DTMF transmission

For further study. Note that UserInputIndication as described in H.323 Annex D is an H.245 signal. H.245 is not required for T.38 Annex B devices.

Meaning	Mapping/Comments
Busy1. Subscriber busy tone as defined in Recommendation Q.35.	Q.850 cause value 17.
Busy2. Sometimes referred to as "Distinctive Busy" on some PABX models.	Q.850 cause value 17.
Congestion busy as defined in Recommendation Q.35.	Q.850 cause value 34.
Ring1. Ringing tone as defined in Recommendation Q.35. This is an intermediate call progress indicator. It can be used to generate a ringback signal to the originating G3FE as if it were an end-to-end PSTN connection.	ALERTING
Ring2. Ringing tone similar to Ring1 where two short rings are generated instead of one long ring. This is an intermediate call progress result.	ALERTING
SIT Intercept. Special Information Tones are defined in Recommendation Q.35. Intercept Tone is one combination of tones – frequency and duration.	Q.850 cause value 4. NOTE – SIT tones are not distinguished because they generally indicate a problem with the number to dial.
SIT Vacant. Special Information Tones are defined in Recommendation Q.35. Circuit Vacant Tone is one combination of tones – frequency and duration.	Q.850 cause value 4.
SIT Reorder. Special Information Tones are defined in Recommendation Q.35. Reorder Tone is one combination of tones – frequency and duration.	Q.850 cause value 4.
SIT No Circuit. Special Information Tones are defined in Recommendation Q.35. No Circuit Tone is one combination of tones – frequency and duration.	Q.850 cause value 4.

B.3.9   Interoperability

Both H.323 direct call model and T.38 Annex B require a well-known port to initiate call signalling. As described in Recommendation H.323, the H.323 well-known port is 1720. Recommendation T.38 Annex B endpoints shall use the H.323 well-known port. In order for a single implementation (such as a gateway) to support multiple endpoints, dynamic ports must be used. A facsimile gateway conforming to this annex shall support H.323 RAS. Also, note that when the gatekeeper-routed call model is used, a well-known port is not needed.

A Recommendation H.323 Annex D implementation becomes aware that it is communicating with a Recommendation T.38 Annex B implementation due to the following sequence of events:

– The Recommendation T.38 Annex B implementation does not supply an H.245 port in the *connect* or *setup*.

– The Recommendation H.323 Annex D transmits a **FACILITY** message with a **FacilityReason** of **startH245** and provides its H.245 address in the **h245Address** element, as described in 8.2.3/H.323. The Recommendation T.38 Annex B implementation receiving a **FACILITY** message with a **FacilityReason** of **startH245** shall respond with a **FACILITY** message having a **FacilityReason** of **noH245.** At this point, the Recommendation H.323 Annex D implementation should cease all attempts to open the H.245 channel.

If the Annex B implementation connects with an H.323 non-facsimile capable implementation, it shall disconnect after noting the lack of facsimile OLCs in the **fastStart** elements in the responding messaging such as ALERTING, CALL PROCEEDING, PROGRESS, or CONNECT. If it notes the facsimile start procedure initiation in the responding message, it proceeds according to the fast connect procedures, with the exception that as an Annex B implementation, it need not support any H.323 video, voice, or data feature or H.245 messaging. Thus, the Recommendation T.38 Annex B implementation will disconnect from any Recommendation H.323 (1996) implementation as it will not find the fast connect OLCs in the messages from those implementations. The T.38 implementation may also disconnect on seeing the H.323 version number 1.

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