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SERIES Q: SWITCHING AND SIGNALLING

Signalling requirements and protocols for the NGN – Testing for next generation networks

Real-time Internet Protocol based on the ITU-T T.38 supporting facsimile service testing framework at the user-to-network interface of next generation networks

Recommendation ITU-T Q.3951

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Recommendation ITU-T Q.3951

Real-time Internet Protocol based on the ITU-T T.38 supporting facsimile service testing framework at the user-to-network interface of next generation networks

Summary

Recommendation ITU-T Q.3951 describes the real-time Internet Protocol (IP) based on the ITU-T T.38 supporting facsimile service testing framework at the user-to-network interface (UNI) in next generation networks (NGNs). This Recommendation defines the preparation for NGN multimedia service testing, physical configuration, test scenarios and test report production. The real-time IP based on the ITU-T T.38 supporting facsimile service defined in this Recommendation covers services including facsimile (ITU-T T.38) and voice over IP (ITU-T G.711) communication. The test check sheets described in clause 7.1 are useful for NGN operators, service providers and vendors when testing their services or products.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T Q.3951	2015-06-13	11	11.1002/1000/12501

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FOREWORD

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Real-time Internet Protocol based on the ITU-T T.38 supporting facsimile service testing framework at the user-to-network interface of next generation networks

1 Scope

This Recommendation describes the real-time IP based on the ITU-T T.38 supporting facsimile service testing framework at the UNI in NGNs. This Recommendation defines the preparation for NGN multimedia service testing, physical configuration, test scenarios and test report production. The real-time IP based on the ITU-T T.38 supporting facsimile service defined in this Recommendation covers services including facsimile (ITU-T T.38) and voice over IP (ITU-T G.711) communication. The test check sheets described in clause 7.1 are useful for NGN operators, service providers and vendors when testing their services or products.

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.

[ITU-T T.30] Recommendation ITU-T T.30 (2005), *Procedures document facsimile transmission in the general switched telephone network*.

[ITU-T G.711] Recommendation ITU-T G.711 (1984), *Pulse code modulation (PCM) of voice frequencies*.

[ITU-T Q.3402] Recommendation ITU-T Q.3402 (2008), *NGN UNI signalling profile (Protocol set 1)*.

[ITU-T Q.3903] Recommendation ITU-T Q.3903 (2008), *Formalized presentation of testing results*.

[ITU-T Q.3945] Recommendation ITU-T Q.3945 (2011), *Test specifications for next generation network services on model networks – Test set 1*.

[ITU-T T.38] Recommendation ITU-T T.38 (2010), *Procedures for real-time Group 3 facsimile communication over IP networks*.

[ITU-T V.152] Recommendation ITU-T V.152 (2010), *Procedures for supporting voice-band data over IP networks.*

[ITU-T Y.2012] Recommendation ITU-T Y.2012 (2010), *Functional requirements and architecture of next generation networks*.

[IETF RFC 3261] IETF RFC 3261 (2002), *SIP, Session Initiation Protocol*.

[IETF RFC 3262] IETF RFC 3262 (2002), *Reliability of Provisional Responses in Session Initiation Protocol (SIP).*

[IETF RFC 3264] IETF RFC 3264 (2002), *An Offer/Answer Model with Session Description Protocol (SDP).*

[IETF RFC 3311] IETF RFC 3311 (2002), *The Session Initiation Protocol (SIP) UPDATE Method*.

[IEFT RFC 3550] IETF RFC 3550 (2003), RTP, *A Transport Protocol for Real-Time Applications*.

[IETF RFC 3551] IETF RFC 3551 (2003), *RTP Profile for Audio and Video Conferences with Minimal Control*.

[IETF RFC 3362] IETF RFC 3362 (2002), *Real-time Facsimile (T.38) – image/t38 MIME Sub-type Registration*.

[IETF RFC 4028] IETF RFC 4028 (2005), *Session Timers in the Session Initiation Protocol (SIP)*.

[IETF RFC 4145] IETF RFC 4145 (2005), *TCP-Based Media Transport in the Session Description Protocol (SDP).*

[IETF RFC 4245] IETF RFC 4245 (2005), *High-Level Requirements for Tightly Coupled SIP Conferencing*.

[IETF RFC 4566] IETF RFC 4566 (2006), *SDP: Session Description Protocol*.

[IETF RFC 6416] IETF RFC 6416 (2011), *RTP Payload Format for MPEG-4 Audio/Visual Streams*.

[IETF RFC 6466] IETF RFC 6466 (2011), *IANA Registration of the 'image' Media Type for the Session Description Protocol (SDP)*.

3 Definitions

3.1 Terms defined elsewhere

None.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

IAF Internet Aware Facsimile

NGN Next Generation Network

NIT Network Integration Test

NUT Network Under Test

QoS Quality of Service

RTCP RTP Control Protocol

RTP Real-Time Transport Protocol

SDP Session Description Protocol

SIP Session Initiation Protocol

TCP Transmission Control Protocol

UA User Agent

UDP User Datagram Protocol

UNI User-to-Network Interface

5 Conventions

None.

6 Preparation for testing

6.1 Test object

Test objects used in IP based on the facsimile service are specified within multiple ITU-T Recommendations and other standards development organization (SDO) documents, as referenced in this Recommendation.

Figure 6-1 shows the block diagram for an IP based on the facsimile communication terminal. Dual-mode facsimile has capability of facsimile over IP supporting ITU-T T.38, and voice supporting ITU-T G.711 communication.

Figure 6-1 – IP based on the facsimile communication terminal

Test profiles should include a list of Recommendations related to the test object of IP based on the facsimile service testing.

Table 6-1 shows the coding schemes and profiles for an IP based on the facsimile communication terminal.

Table 6-1 – IP based on the facsimile communication terminal coding schemes and profiles

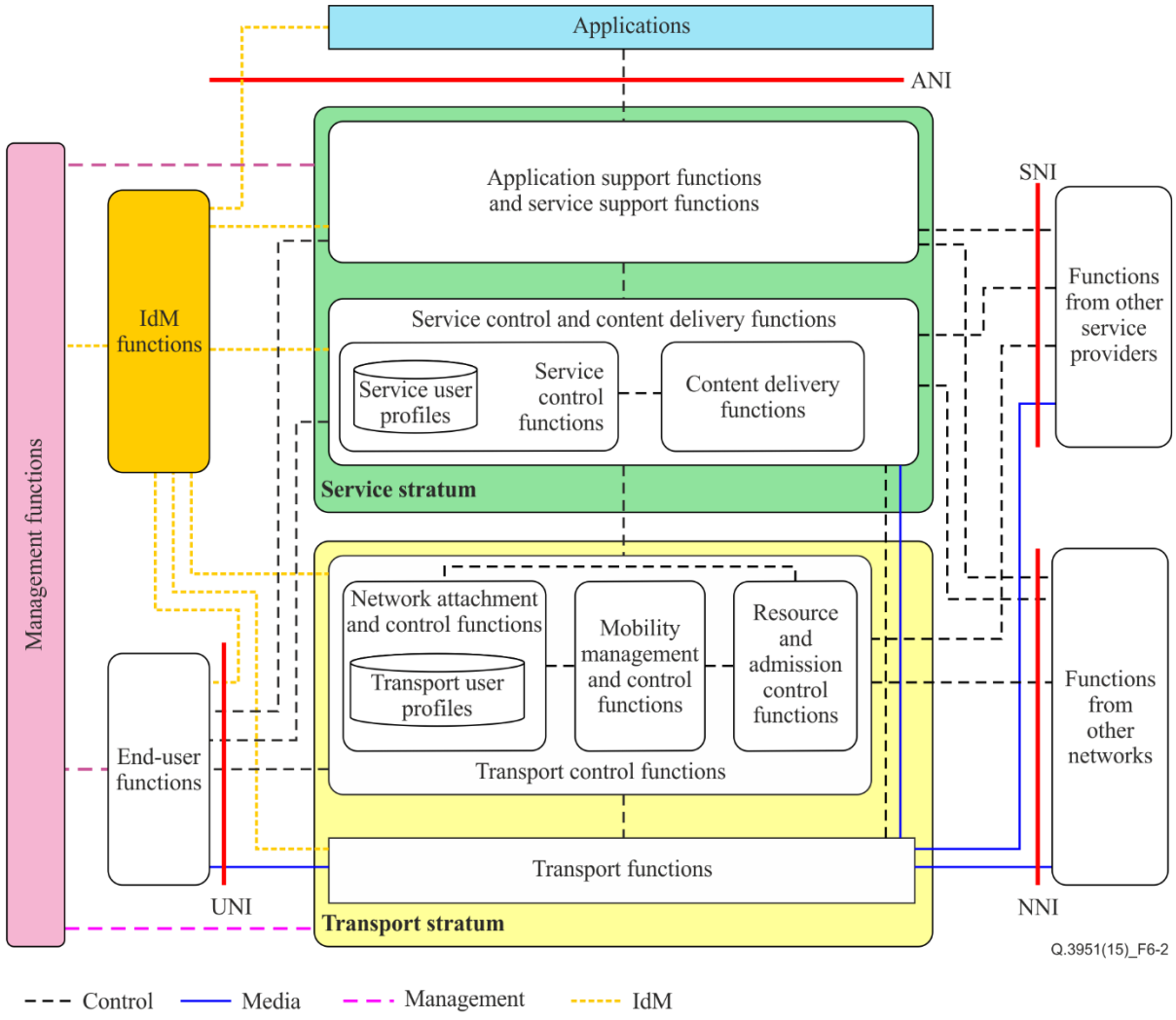
Item	VoIP protocol	Facsimile protocol
Session control	Session initiation protocol (SIP) (RFC 3261), session description protocol (SDP) (RFC 4566)	
Capability exchange	RFC 3264	RFC 3362, RFC 6466
SIP extensions	RFC 3262 (Reliability of provisional responses) RFC 3311 (UPDATE) RFC 4028 (Session timers)	
Media transfer	Real-time transport protocol (RTP) (RFC 3550, RFC 3551), RTCP (RFC 3550 option)	
	RFC 3551	Packetization mode (RFC 6416) Transmission control protocol (TCP) mode (RFC 4145)

Table 6-1 – IP based on the facsimile communication terminal coding schemes and profiles

Item	VoIP protocol	Facsimile protocol
Facsimile	None	ITU-T T.38 (Real-time facsimile)
Audio	ITU-T G.711 μ/a-Law	ITU-T T.38 (Option: ITU-T V.152 VBD)

6.2 Target interface

The UNI, shown in the lower left of Figure 6-2, is the target interface for the IP, based on the facsimile service testing, described in this Recommendation.



NOTE – Figure 6-2 is an exact replica of Figure 7-1 of [ITU-T Y.2012].

Figure 6-2 – UNI as the target interface (ITU-T Y.2012 NGN architecture overview)

6.3 Target Recommendation

[ITU-T Q.3402] defines the NGN UNI signalling profile (protocol set 1) and is the target Recommendation for the multimedia service testing described in this Recommendation. In this Recommendation, the testing terminals are Internet aware facsimiles (IAFs) or ITU-T T.38 supporting terminals connected to IP based network.

6.4 Physical configuration

The physical configuration for multimedia service testing should define the functions needed for service testing. However, the physical configuration may depend on the target protocol. This clause shows the test configuration for two test cases of network under test (NUT): The network integration test (NIT) test case, and the interoperability testing of the end-to-end service test case.

Figure 6-3 shows one case of the general configuration of NIT for the multimedia service testing at UNI. In this figure, the reference machine is similar to the network. Figure 6-4 shows one case of the general configuration of multimedia interoperability testing of the end-to-end service.

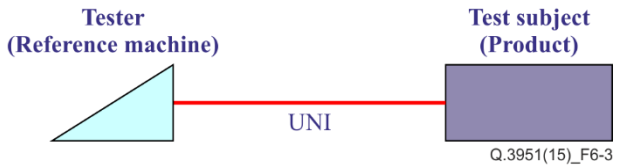


Figure 6-3 – General configuration case of NIT for multimedia service testing

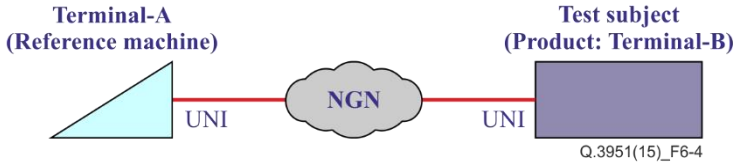


Figure 6-4 – General configuration case of multimedia interoperability testing of the end-to-end service

6.5 Test scenarios of NIT

The following is an example of the NIT for multimedia service testing at UNI.

6.5.1 Test items

The following are several example test items:

a) terminal registration;

b) negotiating SIP capabilities;

c) audio and facsimile data behaviour of the terminal.

Refer to Table 6-2 for details.

Table 6-2 – List of sequences of NIT

No.	Sequence name
1	Terminal registration
2	Call sending and call receiving
3	Audio communication and facsimile communication
4	Update of session timer
5	Call disconnection
6	Deletion of terminal registration

6.5.2 Execution flow

NGN service testing should be conducted in the following steps:

1) set the test object, target interface and target Recommendations;
2) set the physical configuration and target products;
3) define the test scenarios;
4) examine the service testing according to the test scenarios and analyse the test output.

Detail clauses are as follows.

6.5.2.1 Basic connection sequences

The basic sequences of IP based on the facsimile communication service interoperability with NGN protocol are shown in Figures 6-5 and 6-6.

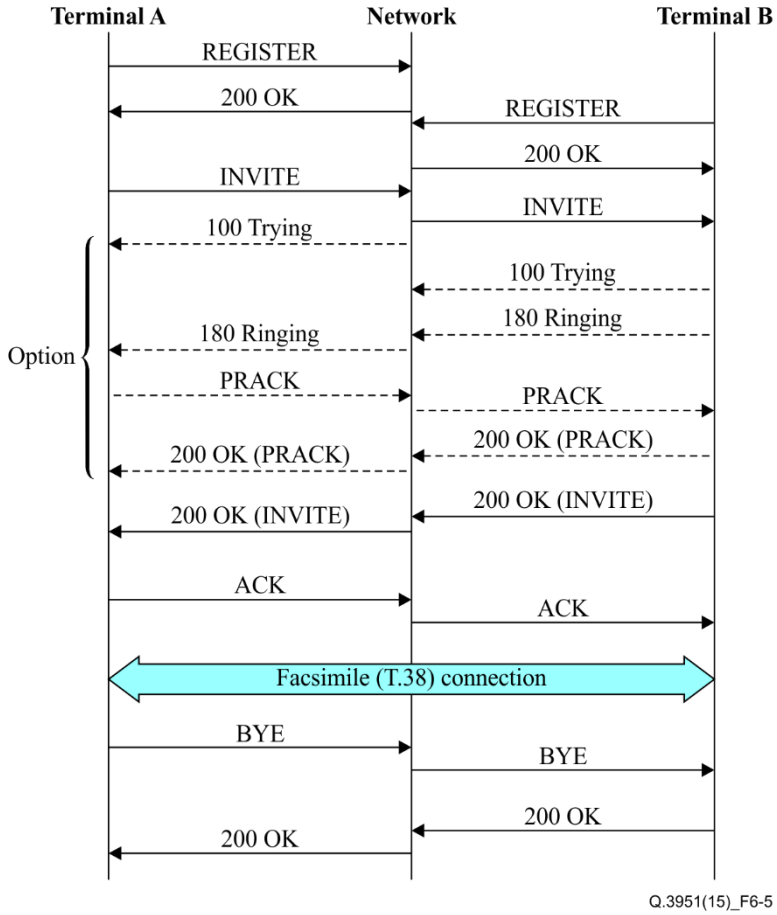


Figure 6-5 – Basic sequence of IP based on the facsimile communications on IAF terminals

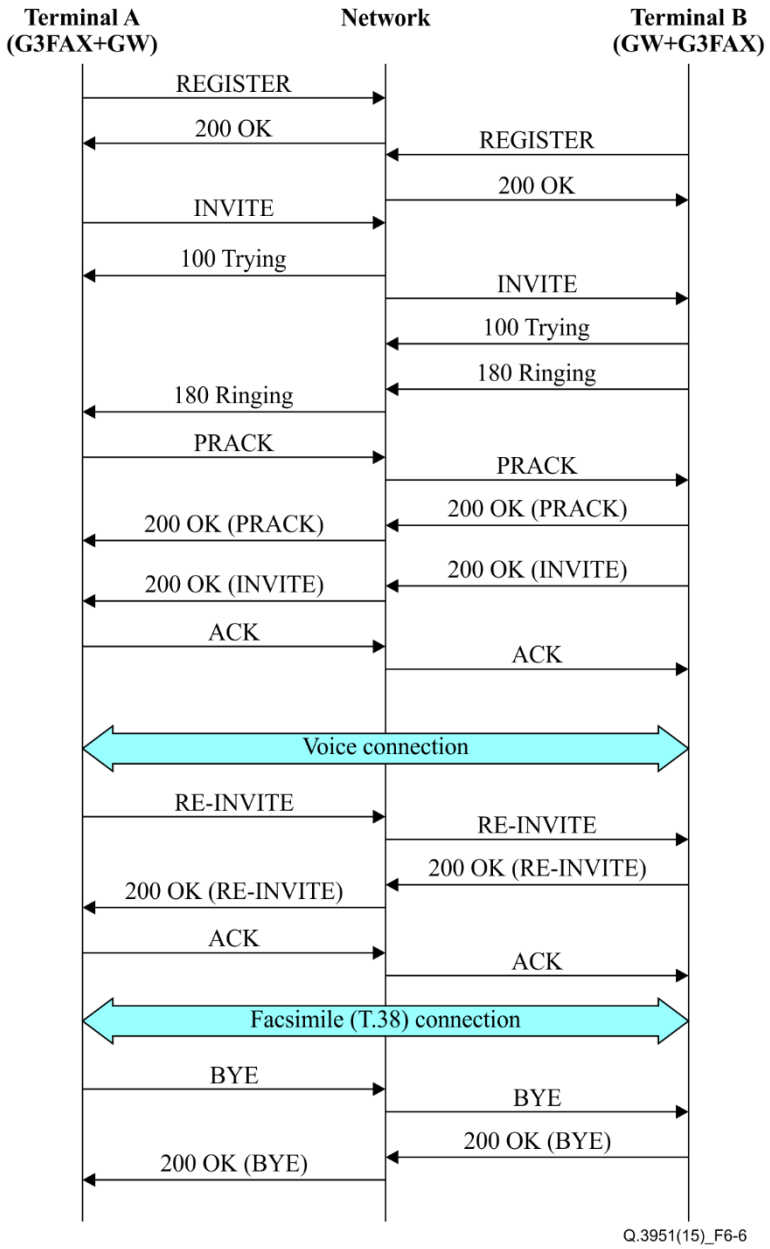


Figure 6-6 – Basic sequence of IP based on the facsimile communications between dual-mode terminals

6.5.2.2 SIP message regulations

Table 6-3 shows the information that should be described in the INVITE request for the NGN multimedia communication negotiation.

Table 6-3 – INVITE request regulations outline

Item	Content	Remarks
Request line	Method (= INVITE)	
	Request-URI	
	SIP-version	
Header field	Via	
	From	

Table 6-3 – INVITE request regulations outline

Item	Content	Remarks
	To	
	Call-ID	
	CSeq	
	Max-forwards	
	Contact	
	Content-type	Necessary when SDP is used
	Content-length	Necessary when SDP is used
	Route	
	P-preferred-identity	
	Privacy	
	Allow	
	Supported	
	Session-expires	

6.5.2.3 SDP parameter regulations

6.5.2.3.1 SDP regulations outline

Table 6-4 is the SDP regulations outline. Only the essential parameters for IP based on the facsimile communication negotiation are shown. Table 6-5 shows the ITU-T T.38 SDP parameters to take into account for SDP regulations outline.

Table 6-4 – SDP regulations outline

Line type, parameter			Regulations	Remarks
m	<media>		Fixed as "image" or "application"	Media type used
	<port>		"9"	
	<transport>		Fixed as "TCP"	
	<fmt list>		"t38"	
b	<bandwidth>		Specify the bandwidth. AS:[kbps]	
a	T38Fax	<T38FaxVersion>	"1" or "0"	
		<T38FaxRateManagement"	"localTCF"	
	RFC4145	<setup>	OFFER as "active" ANSWER as "passive"	According to RFC 4145
		<connection>	Offer and Answer as "new"	According to RFC 4145

Table 6-5 – ITU-T T.38 SDP parameters

No.	Parameter name	Definition
1	T38FaxVersion	This is the version number of ITU-T T.38. New versions shall be compatible with previous versions. Absence of this parameter indicates version 0. The version is expressed as an integer value
2	T38MaxBitRate	Indicates the maximum fax transmission rate supported by the endpoint and shall not be used to negotiate actual transmission speeds
3	T38FaxFillBit	Removal indicates the capability to remove and insert fill bits in phase C (refer to [ITU-T T.30]), non-ECM data to reduce bandwidth. This is a Boolean parameter (inclusion = true, exclusion = false)
4	T38FaxTranscodingMMR	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. This is a Boolean parameter (inclusion = true, exclusion = false)
5	T38FaxTranscodingJBIG	Indicates the ability to convert to/from JBIG to reduce bandwidth. This is a Boolean parameter (inclusion = true, exclusion = false)
6	T38FaxRateManagement	Indicates the fax rate management model as defined values may be "localTCF" or "transferredTCF"
7	T38FaxMaxBuffer	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. Value is an integer
8	T38FaxMaxDatagram	Indicates the maximum size of the payload within an RTP packet that can be accepted by the remote device. This is an integer value
9	T38FaxMaxIFP	This parameter signals the maximum IFP frame size the offering endpoint is capable of accepting
10	T38FaxUdpEC	Indicates any desired error correction scheme, either FEC or redundancy or none. Valid options are "t38UDPFEC", "t38UDPRedundancy" and "t38UDPNoEC". This parameter shall only be present when using UDPTL as the transport for ITU-T T.38
11	T38FaxUdpECDepth	If the parameter is specified, then the 'minred' value indicates that the offering endpoint wishes to receive at least that many redundancy frames per UDPTL datagram (when the answering endpoint chooses to use t38UDPRedundancy as the error correction mode), or that the offering endpoint wishes to receive at least that many FEC frames per UDPTL datagram (when the answering endpoint chooses to use t38UDPFEC as the error correction mode). Additionally, if 'maxred' is specified, it indicates that the offering endpoint wishes to receive no more than that many redundancy frames or FEC frames per UDPTL datagram
12	T38FaxUdpFECMaxSpan	Indicates that offering endpoint may not be able to properly process FEC frames that span more than the specified number of IFP frames
13	T38VendorInfo	Indicates the manufacturer of the endpoint

Table 6-5 – ITU-T T.38 SDP parameters

No.	Parameter name	Definition
14	T38ModemType	Indicates modem capability supported by the ITU-T T.38 endpoint Valid options are: "t38G3FaxOnly" (0) and "t38G3AndV34G3" (1) NOTE – Ff not provided, the implied value of this parameter is "t38G3FaxOnly"

6.5.2.3.2 Details of the SDP regulations

1) m

Specify the attribute of the video media you wish to use.

Description format :

m=<media><port><transport><fmt list>

Example of the setting:

m=image 9 TCP t38

The port example has to be an even number.

<media>

"image" or "application" are allowed.

<port>

Specify the port number is only "9".

Specify the even port number for the IFP reception number.

<transport>

Only "TCP" is allowed. (Specify the transport protocol)

<fmt list>

Only "t38" is allowed.

2) a

Specify the image session information for each media.

Description format:

(In the case of the value attribute)

a=<attribute>:<value>

Example of the setting:

(In the case of the value attribute)

a=rtpmap:<payload type> <encoding name>/<clock rate>
[/<encoding parameter>]

a=fmtp:<payload type> <profile-level-id> <config>

How to handle the value attribute of t38:

– <TBD>

3) T30_INDICATOR

Specify T30_INDICATOR is "preamble flag" is mandatory.

– <TBD>

4) Negotiation of DIS/DCS

– <TBD>

6.5.2.4 SDP negotiation method

When deciding on an image encoding format, it is recommended to use the method specifying the m line and the a line with the image encoding formats on the OFFER side, and choosing only one format on the ANSWER side.

The typical SDP negotiation sequence is shown in Figure 6-7. Figure 6-8 shows an example of the sequence of the SDP negotiation.

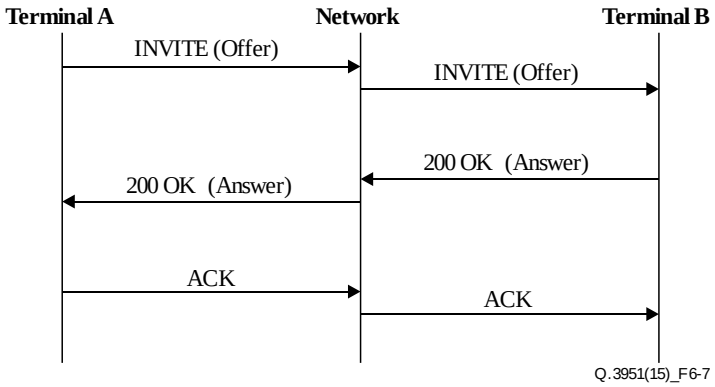


Figure 6-7 – Typical SDP negotiation sequence

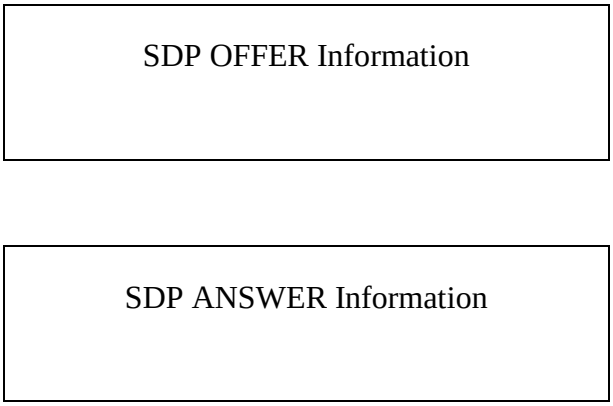
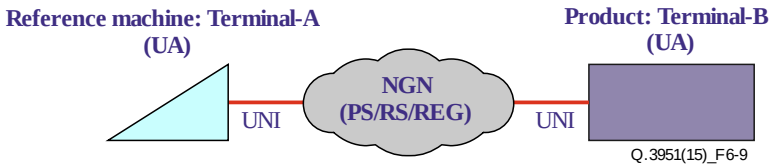


Figure 6-8 – Example of the sequence of the SDP negotiation

6.6 Test scenario of facsimile interoperability testing of the end-to-end service

This clause shows the detailed steps for each test to prevent the omission of facsimile interoperability testing of the end-to-end service. This step should be tested after NIT confirmation in clause 6.5 above.

Figure 6-9 shows a sample of the general configuration of facsimile interoperability testing of the end-to-end service. Following is a sample that shows the testing steps.



UA: User agent, PS: Proxy server, RS: Redirect server, REG: Registration server

Figure 6-9 – General configuration of facsimile interoperability testing of the end-to-end service

6.6.1 Test items

Following is a sample of test items:

1) Case-1 single page test
   - Number of page: one
   - Test chart: ITU-T T.24 No.1 chart
   - Resolution: 8X7.7 or 200X200
   - Codec: MH (option: MR)
   - ECM : OFF (option: ON)
   - Recording length: Fixed
2) Case-2 multiple page test
   - Number of page: two
   - Test chart: ITU-T T.24 No.1 chart
   - Resolution: 8X7.7 or 200X200
   - Codec: MH (option: MR)
   - ECM : OFF (option: ON)
   - Recording length: Fixed
3) Case-3 bandwidth negotiation test
   - Number of page: one
   - Bandwidth(SDP b line): Offer=Answer and Offer>Answer and Offer<Answer
   - Test chart: ITU-T T.24 No.1 chart
   - Resolution : 8X7.7 or 200X200
   - Codec: MH (option: MR)
   - ECM : OFF (option: ON)
   - Recording length: Fixed
4) Case-4 long time communication test
   - Number of page: Can communicate on five minutes.
   - Test chart: ITU-T T.24 No.1 chart
   - Resolution: 8X7.7 or 200X200
   - Codec: MH (option: MR)
   - ECM: OFF (option: ON)
   - Recording length: Fixed

Table 6-6 is a sample of test criteria.

Table 6-6 – Test criteria

No.	Item		Judging standard
1	Sending side (terminal A)	Terminal registration	Confirm receiving the correct response from the network
2		Deletion of terminal registration	Confirm receiving the correct response from the network
3		Confirmation of audio communications	Confirm the communication of audio in each mode for more than 3 minutes
4		Confirmation of image communications	Confirm the communication of image
5		Update of session timer	Confirm the session timer is updated by UPDATE request and OK response at least one time (dual-mode terminal only)
6		Call disconnection	Confirm that the terminal disconnected properly when the terminal disconnected
1	Receiving side (terminal B)	Terminal registration	Confirm receiving the correct response from the network
2		Deletion of terminal registration	Confirm receiving the correct response from the network
3		Confirmation of audio communications	Confirm the communication of audio and video in each mode for more than 3 minutes
4		Confirmation of image communications	Confirm the communication of image
5		Update of session timer	Confirm the session timer is updated by UPDATE request and OK response at least one time (dual-mode terminal only)
6		Call disconnection	Confirm that the terminal disconnected properly when the terminal disconnected.

7 Analysis of test results

Upon completion of testing, test event, examination log, state and other test outputs are produced. The results of the entire test suite performed on the target device are analysed to determine support of, and to confirm interoperability with, the NGN multimedia service. In addition, these results and their analysis should be compared with the specifications of all referenced Recommendations.

7.1 Test report production

This clause shows the methods to make a summary of the examinations for the test result successes and failures and shows the detailed items required for success of the tests in order to illustrate the results of the conformance test.

The test result will show two items about NIT for service testing and multimedia interoperability testing of the end-to-end service.

Sheet 1 provided in clause 7.1.1 shows a sample verification sheet. The results of service testing should be formalized in accordance with [ITU-T Q.3903], which describes the requirements for completion, saving, and analysis of the testing results.

7.1.1 Sheet 1: NGN multimedia service interoperability test check sheet (IP-FAX)

Sheet 1: NGN multimedia service interoperability test check sheet (IP-FAX)

[Filled in by]

Company/Organization	
Person in charge	
TEL	
FAX	

Test date [(year) (month) (date) : ~ :]
Test location [ ]
UA A [Company/Organization: Model type: □IAF □dual-mode]
UA B [Company/Organization: Model type: □IAF □dual-mode]
Network [Company/Organization: Model type:]
Facsimile Test condition1 [□Single-page □Multi-Page □Long Time（> 5 Minutes）]
Facsimile Test condition2 [Bandwidth Negotiation:□Offer=Answer □Offer>Answer □Offer<Answer]

List of test items

No.	Item		Judging standard	Result (yes or no)	Remarks (problems, etc.)
1	Sending side (terminal A)	Terminal registration	Confirm receiving the correct response from the network		
2		Deletion of terminal registration	Confirm receiving the correct response from the network		
3		Confirmation of audio communication	Confirm the communication of audio and the image in each mode. Record the mode used		dual-mode only
4		Confirmation of image communication			
5		Update of session timer	Confirm the session timer is updated by UPDATE request and OK response at least one time		dual-mode only
6		Call disconnection	Confirm that terminal disconnected properly when terminal disconnected		

List of test items

No.	Item		Judging standard	Result (yes or no)	Remarks (problems, etc.)
7	Sending side (terminal B)	Terminal registration	Confirm receiving the correct response from the network		
8		Deletion of terminal registration	Confirm receiving the correct response from the network		
9		Confirmation of the audio communication	Confirm the communication of audio and the image in each mode. Record the mode used		
10		Confirmation of the image communication			
11		Update of Session Timer	Confirm the session timer is updated by UPDATE request and OK response at least one time		dual-mode only
12		Call disconnection	Confirm that Terminal disconnected properly when Terminal disconnected		

Appendix I

The applicable testing items for [ITU-T Q.3945] (The types and list of NGN services testing on the model networks. Test set 1)

(This appendix does not form an integral part of this Recommendation.)

This Recommendation is based on the test items described in [ITU-T Q.3945]. Table I.1 describes the comparison between [ITU-T Q.3945] and the test items described in this Recommendation.

Table I.1 – Comparison between [ITU-T Q.3945] and ITU-T Q.3951

Contents of [ITU-T Q.3945]		ITU-T Q.3951
1	Scope	–
2	References	–
3	Definitions	–
3.1	Terms defined elsewhere	–
4	Abbreviations and acronyms	–
5	Conventions	–
6	NGN services classification for testing (test set 1)	Consistency Described as "facsimile services"
7	Requirements to NGN service testing approach	–
7.1	Model network requirements for providing NGN service testing	Consistency Described in "Figure 6-2 target interface"
7.2	NGN services test programme	–
7.2.1	Common service parameters testing	–
7.2.2	NP and quality of service (QoS) parameters of service testing	FFS
7.3	NGN services test specification	–
7.3.1	Common characteristic of services testing	–
7.3.1.1	Service scenarios and logic of service testing	Consistency Described MM testing as NGN service testing
7.3.1.2	Call flow testing for service realization	Consistency Described in Table 6-2: List of sequences of NIT
7.3.1.3	Emergency accessibility testing	–
7.3.1.4	Customer's terminal identification testing. (This clause should provide the test's specifications for services in case of emergency situation)	Consistency Described in Table 6-5: Test criteria

Table I.1 – Comparison between [ITU-T Q.3945] and ITU-T Q.3951

Contents of [ITU-T Q.3945]		ITU-T Q.3951
7.3.1.5	Coding testing	Consistency Described in Table 6-1: SIP multimedia communication terminal coding schemes and profiles and Table 6-5: Test criteria "confirmation of audio communications" "Confirmation of facsimile communications"
7.3.1.6	Numeration and addressing for providing service	NA The test target is only end-to-end terminal capability testing, not network testing
7.3.1.7	The service statistic testing	NA The test target is only end-to-end terminal capability testing, not network testing
7.3.1.8	Information security testing	NA The test target is only end-to-end terminal capability testing, not network testing
7.3.1.9	Customer profile testing	NA The test target is only end-to-end terminal capability testing, not network testing
7.3.1.10	Service profile testing	NA The test target is only end-to-end terminal capability testing, not network testing
7.3.1.11	QoS and NP testing for a service	NA The test target is only end-to-end terminal capability testing, not network testing
8	Formalization of service testing results	Consistency Described in Sheet 1, Sheet 2, and [ITU-T Q.3903] as recommendation
FFS For further study. NA Not applicable.		

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