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Technical Specification

**Speech and multimedia Transmission Quality (STQ);
End-to-End Jitter Transmission Planning Requirements for
Real Time Services in an NGN context**

Reference

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Speech and multimedia Transmission Quality (STQ).

Introduction

The present document provides end-to-end Jitter transmission requirements for voice, voice band data and conversational video services in a context of a IP Multimedia Core Network Subsystem. The focus is on details of jitter introduced by network elements, jitter caused by access bandwidth limitations and on reference connection scenarios. The objectives provided are a pre-requisite for network operators to be enabled to provide good quality connections as perceived by the user. The present document forms part of the STQ roadmap with respect to Quality aspects of IP Multimedia Subsystem.

1 Scope

The present document provides requirements on the jitter that need to be considered at the Segment-connection of Voice over IP (VoIP) services, voice band data (VBD) services and conversational video service in an IP Multimedia Subsystem. The present document considers only the transport layer.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

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2.1 Normative references

The following referenced documents are necessary for the application of the present document.

Not applicable.

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] Recommendation ITU-T Y.1540 (2007): "Internet protocol data communication service - IP packet transfer and availability performance parameters".

[i.2] Recommendation ITU-T Y.1541 (2006): "Network performance objectives for IP-based services".

[i.3] Recommendation ITU-T Y.1542 (2006): "Framework for achieving end-to-end IP performance objectives".

[i.4] GSMA IR.34-v9.1: "Guidelines for IPX Provider networks" (Previously Inter-Service Provider IP Backbone Guidelines).

NOTE: Available at http://www.gsma.com/newsroom/wp-content/uploads/2013/05/IR.34-v9.1.pdf

[i.5] ETSI ES 282 001: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Functional Architecture".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

access segment: network segment from the customer interface (UNI) to the interface on the customer side of the first Gateway Router

real time service: class of telecommunications service requiring information to be transmitted and delivered within stated limits of time delay and jitter

segment-connection point: point between two segments

NOTE: The terms "interconnection" or "interconnection point" has been used in the NGN standards, e.g. in [i.2], the same terms are generally used for NNIs, not for the connection between access segment and transit segment, they might be misinterpreted. Therefore, throughout the present document, the terms "Segment-connection" or "Segment-connection point" are used.

total transit segment: segment between Gateway routers, including the gateway routers themselves

NOTE: The network segment may include interior routers with various roles.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

DSLAM	Digital Subscriber Line Access Manager
ETH	Ethernet
GSMA	GSM Association
GW	GateWay
IAD	Integrated Access Device
I-BGF	Interconnection Border Control Functions
IMS	IP Multimedia Subsystem
IP	Internet Protocol
IPDV	IP packet Delay Variation
IPX	IP Exchange
ITU	International Telecommunication Union
ITU-T	ITU Telecommunication Standardization Sector
IWF	Interworking Function
MGW	Media Gateway
MSAN	Multi Service Access Node
NGN	Next Generation Network
NNI	Network to Network Interface
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RACS	Resource and Admission Control Subsystem
SBC	Session Border Controller
SIP	Session Initiated Protocol
SoIx	Service-oriented Interconnection
TE	Terminal Equipment
UNI	User Network Interface
UNIA	User Network Interface A
UNIC	User Network Interface C
VBD	voice band data
VoIP	Voice over Internet Protocol
xDSL	x Digital Subscriber Line

4 Reference Configuration

Compared to networks and systems that are circuit-based, those based on IP pose distinctly different challenges for planning and achieving the end-to-end performance levels necessary to adequately support the wide array of user applications (voice, data, fax, video, etc.). The fundamental quality objectives for these applications are well understood and have not changed as perceived by the user; what has changed is the technology (and associated impairments) in the layers below these applications. The very nature of IP-based routers and terminals, with their queuing methods and de-jitter buffers, respectively, makes realizing good end-to-end performance across multiple network operators a very major challenge for applications with stringent performance objectives. Fortunately Recommendations ITU-T Y.1540 [i.1] and Y.1541 [i.2] together provide the parameters needed to capture the performance of IP networks, and specify a set of "network QoS" classes with end-to-end objectives specified. It is widely accepted (i.e. beyond the ITU-T) that the network QoS classes of Recommendation ITU-T Y.1541 [i.2] should be supported by Next Generation Networks, and thus by networks evolving into NGNs. Recommendation ITU-T Y.1542 [i.3] considers various approaches toward achieving end-to-end (UNI-UNI) IP network performance objectives.

The general reference configuration for the present document follows the principles shown in figure 1; the number of concatenated transit providers may vary.

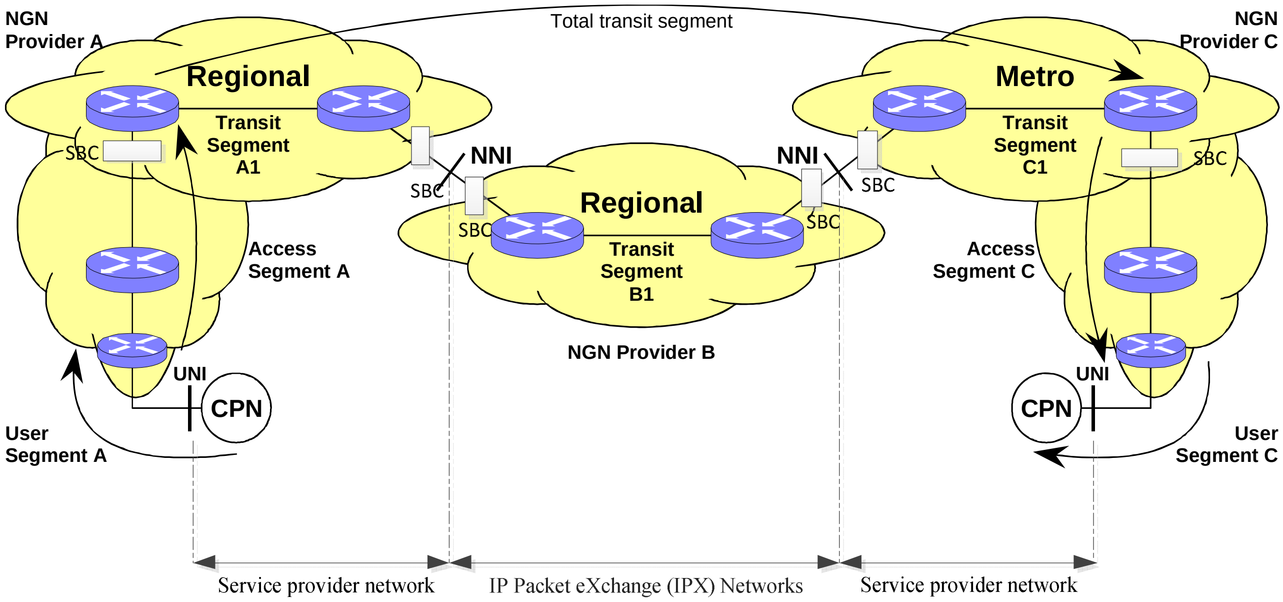

Figure 1: General Reference Configuration

Thus the end-to-end connection can be decomposed into the User segment A:

- UNI_A (sending side).
- Access segment A.
- Segment-connection Point Ain.
- Total transit segment.
- Segment-connection Point Cout.
- Access segment C.
- UNI_C (receiving side).
- User segment C.

The total transit segment can be further decomposed into:

- Transit segment A1.
- Segment-connection point Aout.
- Transit segment A2 (NNI).
- Segment-connection point Bin.
- Transit segment B1.
- Segment-connection point Bout.
- Transmit segment B2 (NNI).
- Segment-connection point Cin.
- Transit segment C1.

4.1 Generic Segment-connection Points

Due to real-world constraints the simplified **static divisor** approach according to Recommendation ITU-T Y.1542 [i.3] has been chosen for the impairment apportionment between access and transit networks.

This approach "divides" the UNI-to-UNI path into three segments and budgets the impairments such that the total objective is met in principle.

The delay values for the total transit segment are in a fixed relation to the distances between different geographical regions. Thus, for the near future dynamic allocation of delay budgets is not expected to be implemented between user segments, access segments and transit segments.

In figure 2 the upper part displays the division of the connection as seen from a QoS point of view whereas the lower part shows this division in terms of the NGN Functional Architecture ES 282 001 [i.5].

NOTE: The reference points Ic, Iw, and Iz are defined in Recommendation ITU-T Y.1541 [i.2], clause 7.2.2.

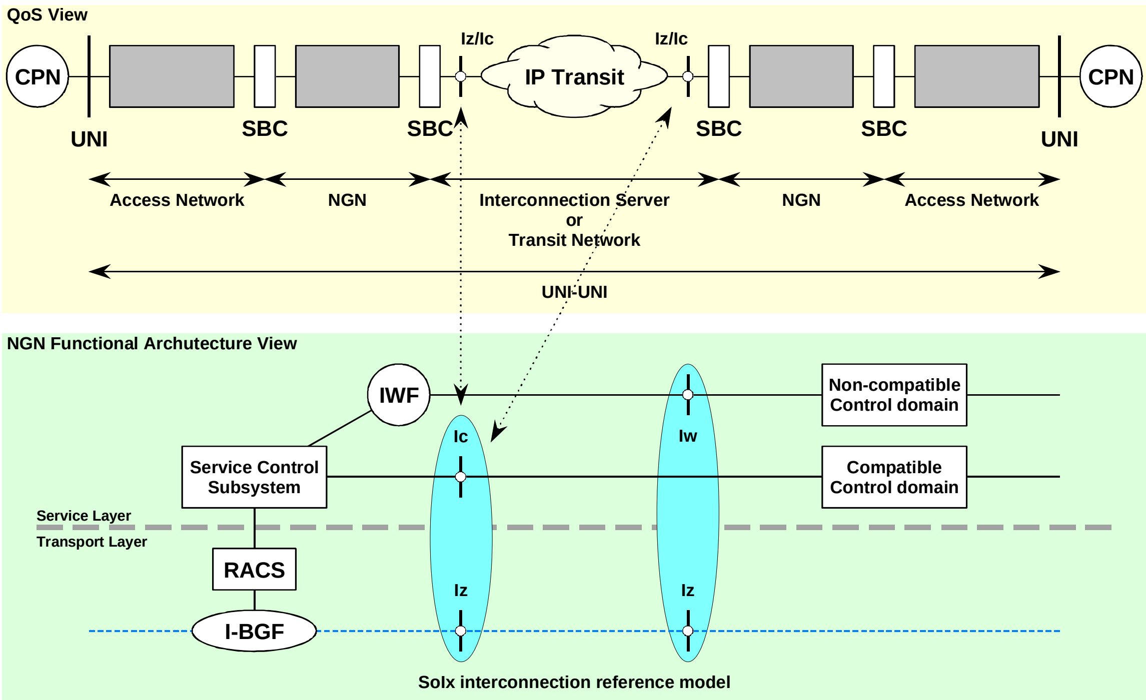

Figure 2: Division of the connection

Hence, there should be objectives for the following portions of the connection:

- UNI (send side) ←→ Segment-connection Point A.
- Segment-connection Point A ←→ Segment-connection Point C.
- Segment-connection Point C ←→ UNI (receive side).

As illustrated in figure 2, SoIx interconnection is typically characterized by the presence of two types of information exchanged between the two interconnected domains:

- Service-related signalling information, that allows to identify the end-to-end service that has been requested. For example, in case of IMS-to-IMS SoIx interconnection, this is mapped to SIP signalling on the Ic reference point.
- Transport information, that carries the bearer traffic.

The presence of the service-related signalling in SoIx interconnection enables the end-to-end service awareness.

An NGN interconnection could be a SoIx even if the transport information is not exchanged between the interconnected domains, as long as service-related signalling is exchanged.

An NGN transport layer interconnection is considered being part of an NGN SoIx interconnection if the transport layer is controlled from the service layer in both of the interconnected domains.

- **SoIx Interconnection interface** includes at least Ic and Iz reference points between two interconnected domains that have same or compatible service control sub systems/domains.
- **SoIx Interconnection interface with Interworking** includes at least the Iw and Iz reference points between two interconnected domains that have non- compatible service control sub systems/domains.

5 Guidance on Segment-connection limits

QoS objectives in Recommendation ITU-T Y.1541 [i.2] are deemed to be applicable when access link speeds are at the T1 or E1 rate and higher. Today many network providers use technologies where they offer access link speeds much smaller then T1or E1. Fortunately, de-jitter buffers in international MGW are often limited to a size of 100 ms, and it is suggested the total jitter should not be exceed 80 ms in order to leave some extra space for clock drift/skew.

5.1 Guidance on Access Segment limits

The following IPDV limits can be applied for access networks (between TE and included SBC). See figure 3 for details.

Table 1: Maximal IPDV values for xDSL and ETH Access Segment

Nature of Network	Application	Jitter Value
Access Network (sending side)	Voice	< 35 ms
	Conversational video	< 5 ms
Access Network (receiving side)	Voice	10 ms (see note 1)
	Conversational video	< 5 ms
NOTE 1: 10 ms are recommended for Voice, the maximum IPDV value is 40 ms for Voice. NOTE 2: Conversational Video, minimal Service Rate 1 Mbps for 720 p Video-Quality.		

Table 2: Maximal IPDV values for MSAN

Nature of Network	Jitter value
Access Network (sending side)	< 5 ms
Access Network (receiving side)	< 5 ms

The target Jitter values are the maximum values occurring during one month. It is recommended to use dynamic Jitter Buffer with a minimum target delay in the Voice GW. Furthermore it is not recommended to use IP - IP GW (e.g. SBC) with Jitter Buffers.

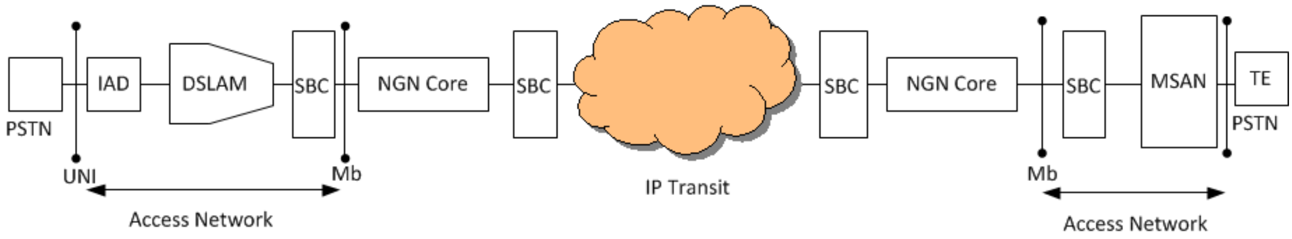

Figure 3: IAD-MSAN Jitter Budget

TE:	Terminal Equipment
IAD:	Integrated Access Device
DSLAM:	Digital Subscriber Line Access Manager
SBC:	Session Border Controller
MSAN/MGW:	Media Gateway

5.2 Guidance on Total Transit Segment Limits

The following limits can be applied between:

- Segment-connection point A ←→ Segment-connection point C.

See figure 1 for details. The maximum IPDV value per service provider transit segment (NGN Core) is 5 ms (included SBC).

Table 3: Guidance on Limits for IP Packet eXchange (IPX) Networks

Nature of Network	Jitter value
IPDV **Intra**-continent Jitter Value - **5 ms** per Provider (maximum of 2 involved in the service delivery chain) (see note)	10 ms
IPDV **Inter**-continent Jitter Value - **10 ms** per Provider (maximum of 2 involved in the service delivery chain) (see note)	20 ms
NOTE: IR34 GSMA Guidelines for IPX Provider networks [i.4].	

The target Jitter values are the maximum values occurring during one month. For being able to deliver higher quality voice connections, the total jitter should be significantly lower.

History

Document history		
V1.1.1	October 2013	Publication as TR 103 210
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