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Technical Report

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

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Foreword

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

Introduction

The present document provides end-to-end Jitter transmission planning objectives for voice and voice band data services in an NGN context. 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 NGN.

1 Scope

The present document provides guidance on the jitter that need to be considered at the Segment-connection of Voice over IP (VoIP) services and voice band data (VBD) services in an NGN. Inside the TISPAN based NGN and 3GPP including LTE™ overall architecture (see figure 1), 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.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

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

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:

ADM Add-Dropp-Multiplexer
AGW Access GateWay
BRAS Broadband Remote Access Server
DSL Digital Subscriber Line
DSLAM Digital Subscriber Line Access Multiplexer
EFM Ethernet Fiber Multiplexer
eNode B element in E-UTRA of LTE that is the evolution of the element Node B
ETH Ethernet

NOTE: http://www.ad-net.com.tw/index.php?id=281

EPC Evolved Packet Core
GSMA Global System for Mobile communications 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
ISDN Integrated Services Digital Network
ITU International Telecommunication Union
ITU-T ITU Telecommunication Standardization Sector
IWF Interworking Funktion
MGW Media Gateway
MSAN Multi Service Access Node
NGN Next Generation Network
NNI Network to Network Interface
PSTN Public Switched Telephone Network
RACS Resource and Admission Control Subsystem
QoS Quality of Service
SBC Session Border Controller
SIP Session Initiated Protocol
SoIx Service-oriented Interconnection
TrGW Trunking GW
UNI User Network Interface
UNIA User Network Interface A
UNIC User Network Interface C
VBD voice band data
VoIP Voice over Internet Protocol
VoNGN Voice over NGN

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.

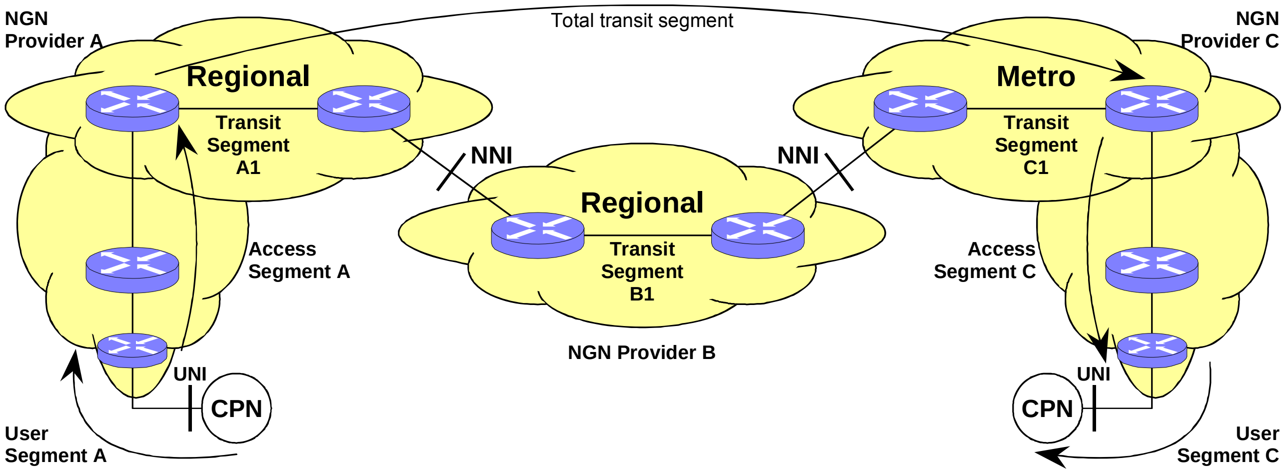

Figure 1: General Reference Configuration

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.

As outlined in [i.5] 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 3, 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 [i.2].

NOTE: The reference points Ic, Iw, and Iz are defined in [i.2] in clause 7.2.2.

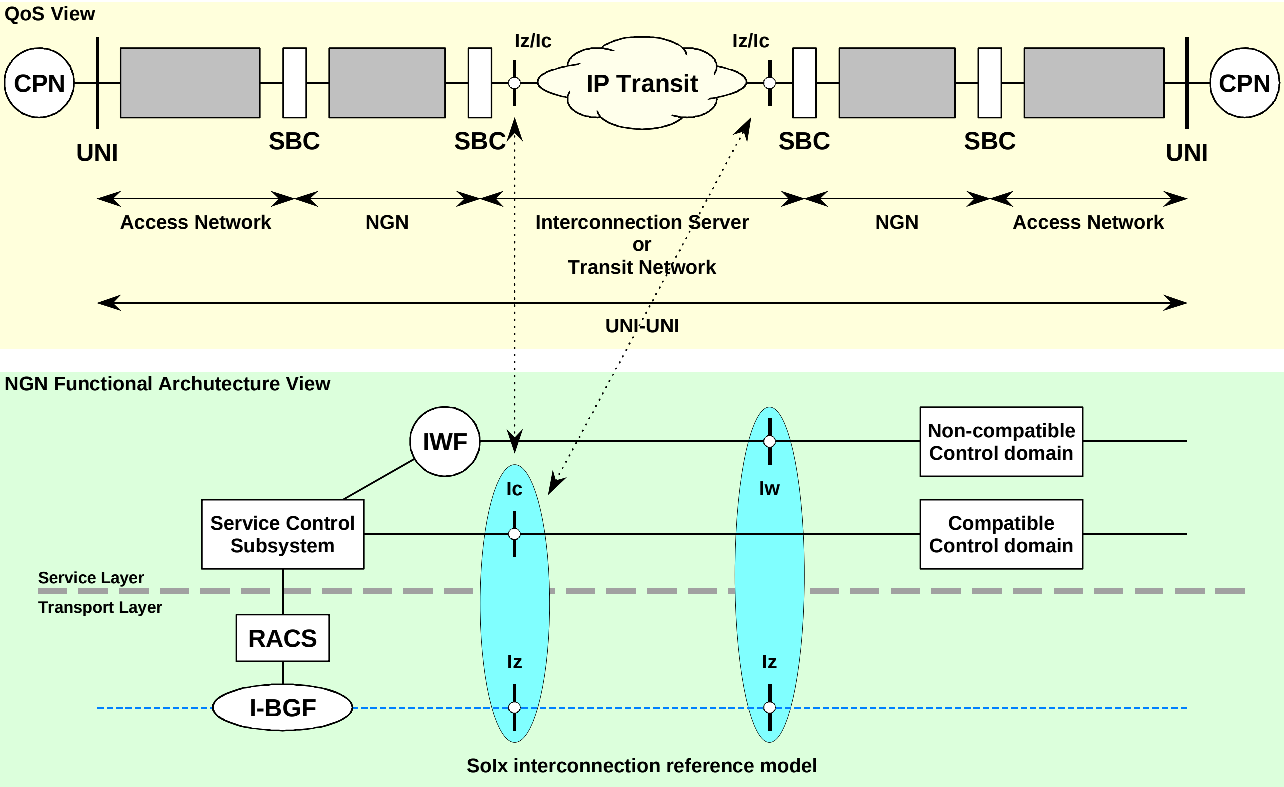

Figure 2: Division of the connection

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).

The guidance on respective objectives is given in clause 5.

As illustrated in figure 3, 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.

4.2 Transport Reference Parameters and Configurations

At the Segment-connection Points (figure 3) different access networks can be connected. Following access networks can be considered:

- PSTN/ISDN classic access Configuration.
- NGN PSTN/ISDN access Configuration.
- Access DSL Configuration.
- LTE.

4.2.1 Reference Configurations

The following clauses describe the Backbone and access reference configuration. In the calculation is at the Segment-connection point taken into account only one SBC.

4.2.1.1 NGN PSTN/ISDN access Configuration

Figure 3 shows the NGN PSTN/ISDN classic access configuration.

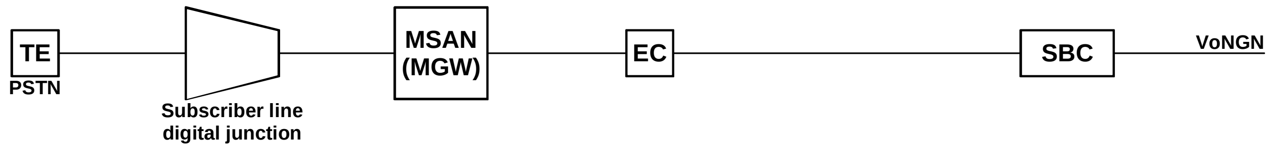

Figure 3: Reference configuration for NGN with PSTN/ISDN access

4.2.1.2 Access DSL/Ethernet Configuration

Figures 4 and 5 shows the xDSL access configuration.

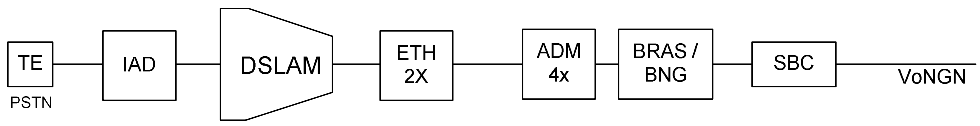

Figure 4: Reference configuration for DSL access

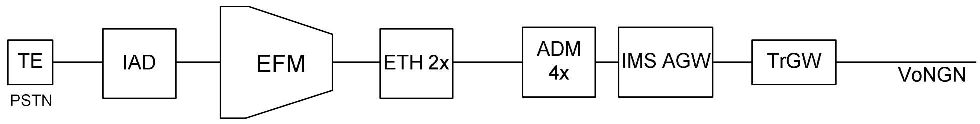

Figure 5: Reference configuration for Ethernet access

4.2.1.3 Access configuration from LTE

Figure 6 shows the LTE access configuration

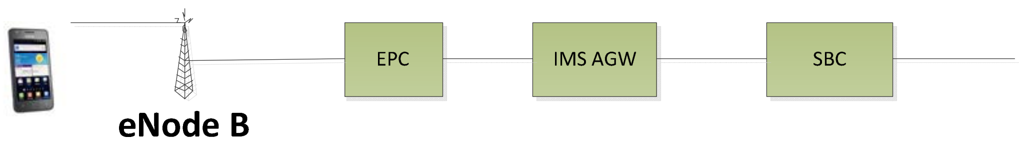

Figure 6: Reference configuration from LTE

5 Guidance on Segment-connection limits

5.1 Guidance on Access Segment limits

The following limits can be applied between the following points, it should be noted that these parameters may vary between both directions of transmission:

- UNI_A (sending side) → Segment-connection point A (receiving side);
- Segment-connection point A (sending side) → UNI_C (receiving side);
- UNI_A (sending side) → Segment-connection point C (receiving side); and
- Segment-connection point C (sending side) → UNI_C (receiving side).

See figure 1 for details.

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

Parameter	Value
UNI_A (sending side)	< 40 ms
UNI_C (receiving side);	10 ms (see note)
NOTE: 10 ms are recommended, the maximum IPDV value is 40 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.

Table 2: Guidance on limits for Access Segment for conversational video (live streaming / TelePresence)

Parameter	Value
UNI_A (sending side)	5 ms
UNI_C (receiving side)	5 ms

TelePresence has a peak-to-peak jitter target of 10 ms. Jitter is defined as the variance in network latency. Thus, if the average latency is 100 ms and packets are arriving between 95 ms and 105 ms, the peak-to-peak jitter is defined as 10 ms.

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 limits are based on the application of Class 0 of Recommendation ITU-T Y.1541 [i.2]. The determination of cases where Class 1 of Recommendation ITU-T Y.1541 [i.2] should be applied and the associated limits are for further study.

Table 3: Guidance on Limits for Total Transit Segments

Parameter	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. As the Jitter Buffers in the international MGW are often limited to 100 ms, the total Jitter should not be higher than 80 ms (to leave some extra space for clock drift/skew). For being able to deliver higher quality voice connections, the total jitter should be significantly lower.

Figures 7, 8, 9 and 10 depict a summary of the proposed Jitter objectives and the end-to-end jitter targets that can be achieved between two xDSL or Ethernet lines.

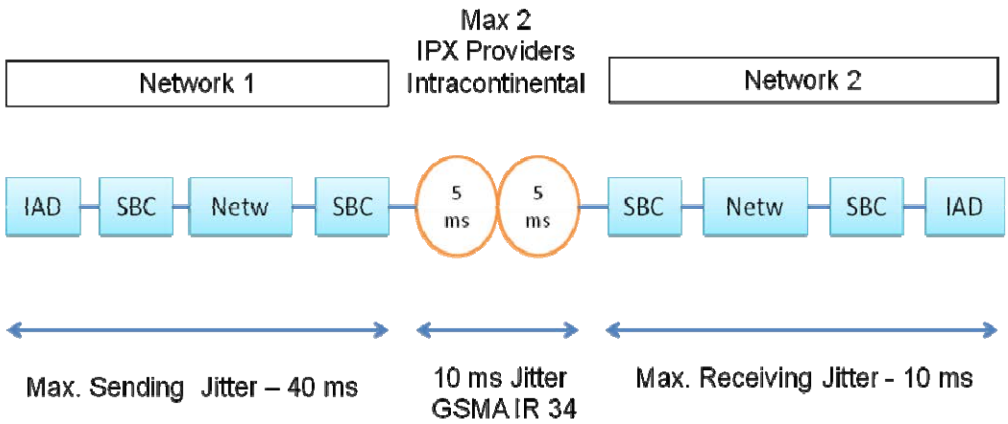

Figure 7: IAD-IAD Jitter Budget Intracontinental

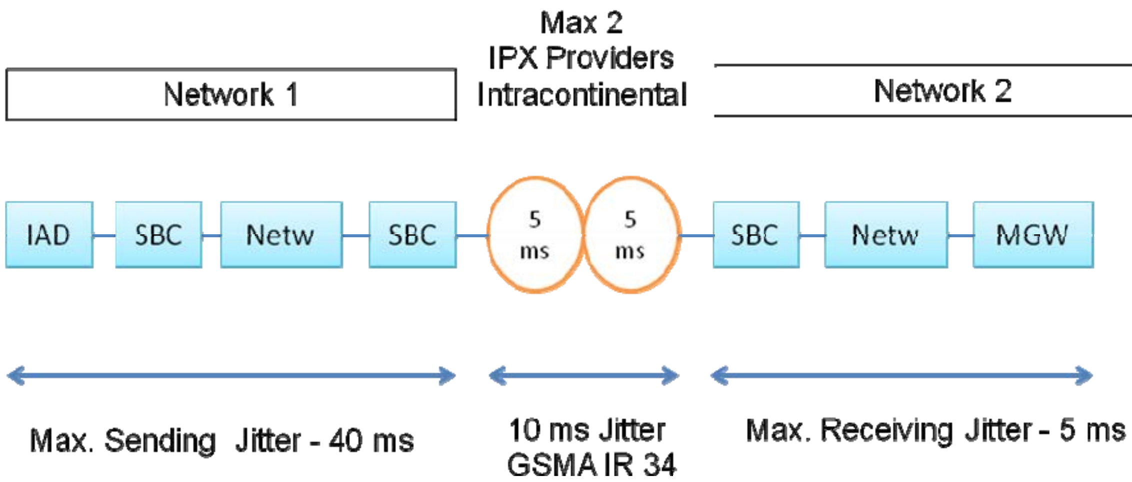

Figure 8: IAD-MSAN Jitter Budget Intracontinental

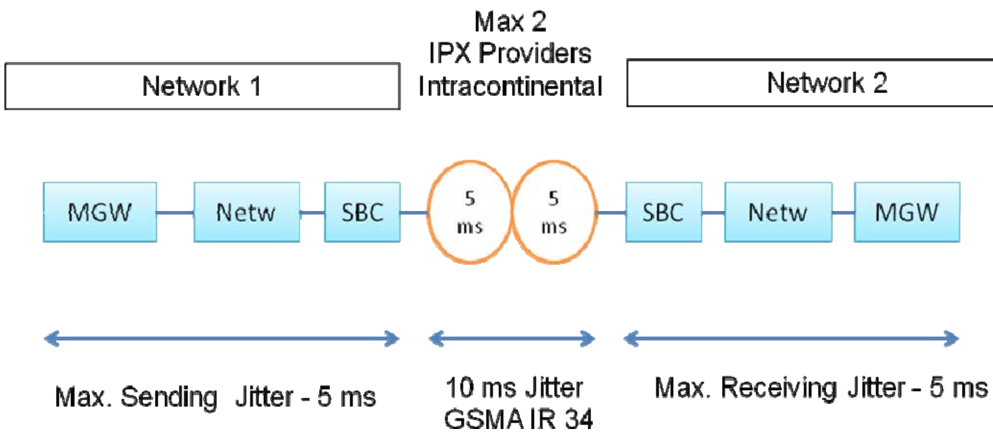

Figure 9: MSAN -MSAN Jitter Budget Intracontinental

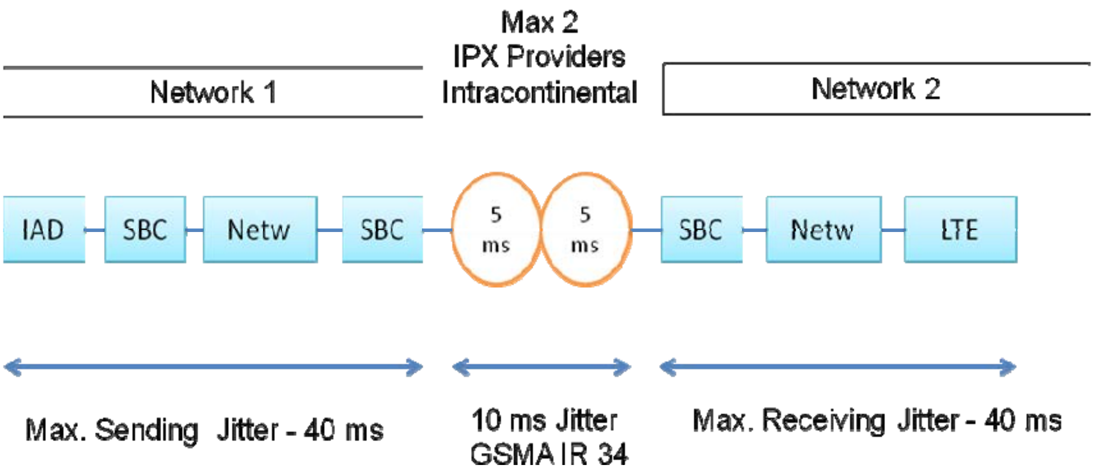

Figure 10: IAD-LTE Jitter Budget Intra- and Intercontinental

Annex A: Bibliography

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

History

Document history		
V1.1.1	October 2013	Publication