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**Speech and multimedia Transmission Quality (STQ);
Reference benchmarking,
background traffic profiles and KPIs;
Part 2: Reference benchmarking
and KPIs for High speed internet**

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Foreword

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

The present document is part 2 of a multi-part deliverable covering Reference benchmarking, background traffic profiles and KPIs as identified below:

Part 1: "Reference benchmarking, background traffic profiles and KPIs for VoIP and FoIP in fixed networks";

Part 2: "Reference benchmarking and KPIs for High speed internet";

Part 3: "Reference benchmarking, background traffic profiles and KPIs for UMTS and VoLTE";

Part 4: "Reference benchmarking for IPTV, Web TV and RCS-e Video Share".

Modal verbs terminology

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"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Introduction

The present document describes the reference benchmarking, background traffic profiles and key performance indicators for high-speed internet.

1 Scope

The offer of new NGN services requires new KPIs, QoS measurement and benchmarking methods which are needed to ensure the quality of new services. To ensure the comparability of test results, reference benchmarking methods and background traffic load profiles are needed. The present document describes key performance indicators and benchmarking methods for the spectrum of potential applications. All access technologies offered by the operator under test are considered.

The present document is the second part of the multi-part deliverable which consists of four parts. The present document contains the Reference benchmarking and KPIs for High speed internet.

2 References

2.1 Normative 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 referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://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.

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

[1] Recommendation ITU-T E.800 (2008): "Definitions of terms related to quality of service".

[2] ETSI TS 102 250-2: "Speech and multimedia Transmission Quality (STQ); QoS aspects for popular services in mobile networks; Part 2: Definition of Quality of Service parameters and their computation".

[3] Recommendation ITU-T Y.1540: "Internet protocol data communication service - IP packet transfer and availability performance parameters".

2.2 Informative 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 referenced document (including any amendments) applies.

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

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] ETSI TR 101 578: "Speech and multimedia Transmission Quality (STQ); QoS aspects of TCP-based video services like YouTubeTM".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

benchmark: evaluation of performance value/s of a parameter or set of parameters for the purpose of establishing value/s as the norm against which future performance achievements may be compared or assessed

NOTE: The definition is taken from Recommendation ITU-T E.800 [1].

3.2 Symbols

Void.

3.3 Abbreviations

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

ACK	Acknowledgement message
DL	DownLoad
DNS	Domain Name System
E2E	End-to-End
FFS	For Further Study
FIN	FIN message
FTP	File Transfer Protocol
GET	HTTP method GET
HTTP	Hypertext Transfer Protocol
IAD	Integrated Access Device
ICMP	Internet Control Message Protocol
IP	Internet Protocol
IPDV	IP Delay Variation
IPER	IP Packet Error Ratio
IPLR	IP Packet Loss Ratio
IPSBR	IP Packet Sending Bit Rate
IPTD	IP Packet Transfer Delay
IPTV	Internet Protocol Television
KPI	Key Performance Indicator
NGN	Next Generation Networks
PING	Packet INternet Groper (Send a packet to a computer and wait for its return)
POST	HTTP method POST
QoE	Quality of Experience
QoS	Quality of Service
RTP	Real-Time Transport Protocol
RTT	Round-Trip Time
SYN	SYNchronize Message
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
UE	User Equipment
UL	UpLoad
UMTS	Universal Mobile Telecommunications System
URI	Uniform Resource Identifier
VoIP	Voice over IP

4 Quality of service parameter values for High-speed internet

4.0 KPIs overview

To determine the quality of high-speed internet connections, the following measurement and KPI values are determined.

Table 4.0-1: Overview of quality benchmarks for DNS

1.	DNS Lookup Time [ms]; see clause 5.1
2.	DNS Lookup Failure Ratio [%]; see clause 5.10 of [2]
3.	DNS Host Name Resolution Time; see clause 5.11 of [2]

Table 4.0-2: Overview of quality benchmarks for PING

1.	PING Average Time [ms]; is defined in clause 6.3.1 of [2]
2.	PING packets missing [%]; see clause 4.1.1
3.	PING Packets Errors [%]; see clause 4.1.2
4.	PING Failure Ratio; see clause 4.1.3

Table 4.0-3: Overview of quality benchmarks for HTTP

1.	HTTP Service Non-Accessibility [%]; see clause 6.8.1 of [2]
2.	HTTP Setup Time [s]; see clause 6.8.2 of [2]
3.	HTTP IP Service Access Failure Ratio [%]; see clause 6.8.3 of [2]
4.	HTTP IP Service Setup Time [s]; see clause 6.8.4 of [2]
5.	HTTP Session Failure Ratio [%]; see clause 6.8.5 of [2]
6.	HTTP Session Time [s]; see clause 6.8.6 of [2]
7.	HTTP Mean Data Rate [kbit/s]; see clause 6.8.7 of [2]
8.	HTTP Data Transfer Cut-off Ratio [%]; see clause 6.8.8 of [2]
9.	HTTP Content Compression Ratio [%]; see clause 6.8.9 of [2]
10.	HTTP peak download throughput [kbit/s]; see clause 4.2.11
11.	HTTP Response Time; see clause 4.2.1
12.	HTTP Download Throughput; see clause 4.2.2
13.	HTTP Download Throughput < x % of Bandwidth; see clause 4.2.3
14.	HTTP Percentage of invoiced Bandwidth; see clause 4.2.4
15.	HTTP Upload Response Time; see clause 4.5
16.	HTTP Upload Throughput; see clause 4.2.6
17.	HTTP Upload Throughput; see clause 4.2.7
18.	HTTP; Number of HTTP Sessions; see clause 4.2.8
19.	HTTP Dropped Sessions; see clause 4.2.9
22.	Number of HTTP Sessions (Daily number of HTTP sessions); see clause 4.2.9
23.	Traffic Volume DL (Daily total volume in Downlink)
24.	Traffic Volume UL (Daily total volume in Uplink)
25.	Number of active users
26.	Average duration of HTTP sessions [min]

Table 4.0-4: Overview of quality of service parameters for FTP

1.	FTP {Download|Upload} Setup Time [s]; see clause 6.1.2 of [2]
2.	FTP {Download|Upload} IP-Service Access Failure Ratio [%]; see clause 6.1.3 of [2]
3.	FTP {Download|Upload} IP-Service Setup Time [s]; see clause 6.1.4 of [2]
4.	FTP {Download|Upload} Session Failure Ratio [%]; see clause 6.1.5 of [2]
5.	FTP {Download|Upload} Session Time [s]; see clause 6.1.6 of [2]
6.	FTP {Download|Upload} Mean Data Rate [kbit/s]]; see clause 6.1.7 of [2]
7.	FTP {Download|Upload} Data Transfer Cut-off Ratio [%]; see clause 4.3.7
8.	FTP {Download|Upload} Service non - Accessibility [%]; see clause 4.3.8
9.	FTP {Download|Upload} throughput [kbit/s]; defined in clause 4.3.1
10.	FTP Upload/Download Throughput < x % of Bandwidth; defined in clause 4.3.2
11.	FTP Percentage of invoiced Bandwidth; defined in clause 4.3.3
12.	FTP Download Throughput < x % of Bandwidth; defined in clause 4.3.4
13.	File Download/Upload Data Transfer Cut-off; defined in clause 4.3.5
14.	FTP {Download|Upload} Service non - Accessibility [%]; defined in clause 4.3.6
15.	FTP Retransmission Ratio; defined in clause 4.3.9
16.	FTP {Download|Upload} packet loss rate [%]; defined in clause 4.3.8
17.	FTP {Download|Upload} Traffic Volume (Daily total volume in Downlink)
18.	Active Users (Daily number of unique users)
19.	FTP upload with parallel HTTP Download
20.	FTP upload Number of FTP Sessions with parallel HTTP Download
21.	FTP upload Service non - Accessibility with parallel HTTP Download [%]
22.	FTP upload Setup Time with parallel HTTP Download
23.	FTP upload IP service Access Failure Ratio with parallel HTTP Download [%]
24.	FTP upload IP-Service Access Setup Time with parallel HTTP Download [%]
25.	FTP upload Session Time [s] with parallel HTTP Download
26.	FTP upload Mean Data Rate with parallel HTTP Download [kbit/s]
27.	FTP upload Data Transfer Cut-off Ratio with parallel HTTP Download [%]

Table 4.0-5: Overview of TCP quality benchmarks

1.	TCP Round Trip Time (Server side); see clause 4.4.1
2.	TCP Round Trip Time (Client side); see clause 4.4.2
3.	TCP Retransmission Ratio; see clause 4.4.3
4.	TCP Data Call Access Failure Ratio; see clause 4.4.4
5.	TCP Data Call Access Time; see clause 4.4.5
6.	TCP Server Response Time; see clause 4.4.6

Table 4.0-6: Overview of IP/UDP quality benchmarks

1.	IP Sending Rate (Sender side); see clause 4.5.2
2.	Maximum IP Capacity (Receiver side); see clause 4.5.3

Table 4.0-7: Overview of quality benchmarks E-mail

1.	E-Mail {Download|Upload} Service Non-Accessibility [%]; see clause 7.2 of [2]
2.	E-Mail {Download|Upload} Setup Time [s]; see clause 7.2 of [2]
3.	E-Mail {Download|Upload} IP-Service Access Failure Ratio [%]; see clause 7.2 of [2]
4.	E-Mail {Download|Upload} IP-Service Setup Time [s]; see clause 7.2 of [2]
5.	E-mail {Upload|Download} Session Failure Ratio [%]; see clause 7.2 of [2]
6.	E-mail {Upload|Header Download|Download} Session Time [s]; see clause 7.2 of [2]
7.	E-mail {Upload|Header Download|Download} Mean Data Rate [kbit/s]; see clause 7.2 of [2]
8.	E-mail {Upload|Header Download|Download} Data Transfer Cut-off Ratio [%]; see clause 7.2 of [2]
9.	E-mail {Upload|Header Download|Download} Data Transfer Time [s]; see clause 7.2 of [2]
10.	E-mail Login Non-Accessibility [%]; see clause 7.2 of [2]
11.	E-mail Login Access Time [s]; see clause 7.2 of [2]
12.	E-mail Notification Push Failure Ratio [%]; see clause 7.2 of [2]
13.	E-mail Notification Push Transfer Time [s]; see clause 7.2 of [2]
14.	E-mail End-to-End Failure Ratio [%]; see clause 7.2 of [2]

Table 4.0-8: Network Diagnostic parameters

1.	Number of open parallel UDP ports (Default value 11)
2.	Number of open parallel TCP ports (Default value 16)
3.	Reachability of DNS entries (Default value 45)
4.	Reachability of Transparent connections (Default value 2) - for further study
5.	Reachability of Reference Webpage (Default value 1) - for further study
6.	Unchanged content transport (Default value 2) - for further study
7.	Radio level - for further study
8.	Stability of Radio level - for further study

Table 4.0-9: Overview of quality benchmarks for Network performance objectives for IP-based services

1.	Maximal IPDV
2.	Maximal IPTD
3.	Maximal IPLR
4.	Maximal IPER

Table 4.0-10: Overview of quality benchmarks for voice Media RTP

1.	RTP DL Throughput
2.	RTP UL Throughput
3.	RTP Latency
4.	RTP Jitter
5.	RTP Out of sequence
6.	RTP Dropped sequence
7.	RTP duplicate packets

Table 4.0-11: Overview of quality benchmarks for real-time video

1.	DL Throughput
2.	UL Throughput
3.	Latency
4.	Jitter
5.	Out of sequence
6.	Dropped sequence
7.	Duplicate packets

Table 4.0-12: Web Browsing QoS Parameters

1.	Website Response Time; see clause 5.2.3
2.	Website Load Duration Time; see clause 5.2.4
3.	Website Session Duration Time; see clause 5.2.5
4.	Website Download Failure Ratio; see clause 5.2.6
5.	HTTP Service Non-Accessibility; defined in clause 6.8.1 of [2]
6.	Number HTTP Sessions; defined in clause 4.2.8
7.	TCP Round Trip Time (Client side); defined in clause 4.4.1
8.	TCP Round Trip Time (Server side); defined in clause 4.4.2
9.	TCP Retransmission Ratio; defined in clause 4.4.3
10.	HTTP Service Setup Time; defined in clause 6.8.4 of [2]
11.	HTTP IP-Service Setup Time [s]; see clause 6.8.4 of [2]
12.	HTTP Setup Time [s]; see clause 6.8.2 of [2]

Table 4.0-13: Streaming QoS Parameters

1.	Streaming Service Non-Accessibility [%]; see clause 6.5.4 of [2]
2.	Streaming Service Access Time [s]; see clause 6.5.5 of [2]
3.	Streaming Reproduction Cut-off Ratio [%];see clause 6.5.6 of [2]
4.	Streaming Audio Quality; see clause 6.5.7 of [2]
5.	Streaming Video Quality; see clause 6.5.8 of [2]
6.	Streaming Audio/Video De-Synchronization; see clause 6.5.9 of [2]
7.	Streaming Reproduction Start Failure Ratio [%]; see clause 6.5.10 of [2]
8.	Streaming Reproduction Start Delay [s]; see clause 6.5.11 of [2]
9.	Streaming Teardown Failure Ratio [%]; see clause 6.5.12 of [2]
10.	Streaming Teardown Time [s]; see clause 6.5.13 of [2]
11.	Streaming Rebuffering Failure Ratio [%]; see clause 6.5.14 of [2]
12.	Streaming Rebuffering Time [s]; see clause 6.5.15 of [2]
13.	Number Streaming Sessions; see clause 6.12
14.	Streaming Mean Data Rate; see clause 6.9
15.	Streaming Peak Data Rate; see clause 6.10
16.	Effective Reproduction Time; see clause 6.11

Table 4.0-14: File Download/Upload QoS Parameter

1.	TCP Round Trip Time (Server side); see clause 4.4.1
2.	TCP Round Trip Time (Client side); see clause 4.4.2
3.	TCP Retransmission Ratio; see clause 4.4.3
4.	TCP Data Call Access Failure Ratio; see clause 4.4.4
5.	TCP Data Call Access Time; see clause 4.4.5
6.	TCP Server Response Time; see clause 4.4.6
7.	FTP {Download|Upload} Setup Time [s]; see clause 6.1.2 of [2]
8.	FTP {Download|Upload} IP-Service Access Failure Ratio [%]; see clause 6.1.3 of [2]
9.	FTP {Download|Upload} IP-Service Setup Time [s]; see clause 6.1.4 of [2]
10.	FTP {Download|Upload} Session Failure Ratio [%]; see clause 6.1.5 of [2]
11.	FTP {Download|Upload} Session Time [s]; see clause 6.1.6 of [2]
12.	FTP {Download|Upload} Mean Data Rate [kbit/s]]; see clause 6.1.7 of [2]
13.	FTP {Download|Upload} Data Transfer Cut-off Ratio [%]; see clause 4.3.7
14.	FTP {Download|Upload} Service non - Accessibility [%]; see clause 4.3.8
15.	FTP {Download|Upload} throughput [kbit/s]; defined in clause 4.3.1
16.	FTP Upload/Download Throughput < x % of Bandwidth; defined in clause 4.3.2
17.	FTP Percentage of invoiced Bandwidth; defined in clause 4.3.3
18.	FTP Download Throughput < x % of Bandwidth; defined in clause 4.3.4
19.	File Download/Upload Data Transfer Cut-off; defined in clause 4.3.5
20.	FTP {Download|Upload} Service non - Accessibility [%]; defined in clause 4.3.6
21.	FTP {Download|Upload} Retransmission Ratio; defined in clause 4.3.7
22.	FTP {Download|Upload} packet loss rate [%]; defined in clause 4.3.8
23.	FTP {Download|Upload} number of FTP Sessions
24.	FTP {Download|Upload} Traffic Volume (Daily total volume in Downlink)
25.	Active Users (Daily number of unique users)
26.	HTTP Service Non-Accessibility [%]; see clause 6.8.1 of [2]
27.	HTTP Setup Time [s]; see clause 6.8.2 of [2]
28.	HTTP IP-Service Access Failure Ratio [%]; see clause 6.8.3 of [2]
29.	HTTP IP-Service Setup Time [s]; see clause 6.8.4 of [2]
30.	HTTP Session Failure Ratio [%]; see clause 6.8.5 of [2]
31.	HTTP Session Time [s], see clause 6.8.6 of [2]
32.	HTTP Mean Data Rate [kbit/s]; see clause 6.8.7 of [2]
33.	HTTP Data Transfer Cut-off Ratio [%]; see clause 6.8.8 of [2]
34.	HTTP Content Compression Ratio [%]; see clause 6.8.9 of [2]
35.	HTTP peak download throughput [kbit/s]; see clause 4.2.11
36.	HTTP Response Time; see clause 4.2.1
37.	HTTP Download Throughput; see clause 4.2.2
38.	HTTP Download Throughput < x % of Bandwidth; see clause 4.2.3
39.	HTTP Percentage of invoiced Bandwidth; see clause 4.2.4
40.	HTTP Upload Response Time; see clause 4.5
41.	HTTP Upload Throughput; see clause 4.2.6
42.	HTTP Upload Throughput; see clause 4.2.7
43.	HTTP; Number of HTTP Sessions; see clause 4.2.8