International Telecommunication Testing Centre (ITTC)

NGN services testing Global approaches

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TISPAN 06 Chairman

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- NGN testing methods
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TISPAN WG 6 Test activity - Overview

WG 6 produces manual and automatic test suites to ensure the conformance to TISPAN, 3GPP and ITU standardized protocols. These tests ensure the global interoperability of ISDN, PES and IMS Core NGN R1/R2, QoS between networks and Performance Benchmarking for NGN.

TC INT (IMS Network Testing)

- New ETSI technical committee formed in March 2008.
- Initial mandate from 3GPP and TISPAN:
  - Develop IMS Core Network test specifications (interoperability, conformance, network integration etc.) according to 3GPP and TISPAN specifications.
  - Initiate and supervise interoperability events (such as IMS Plugtests).
  - Coordinate IMS interoperability efforts with other organisations such as the IMS/NGN Forum, GSMA, OMA, MSF.
  - Coordination with ETSI TC MTS in order to have the right methodologies and tools to ensure effective test specifications

WG6 Approved NGN documents

- SIP/ ISUP Interworking conformance Tests (based on the EN 383 001/Q.1912.5) (TSS&TP, PICS, ETS)
- SIP/ ISUP Interworking conformance Tests (based on the ES 283 027 / 3GPP TS 29.163 TSS&TP)
- Network Integration Testing (NIT) between SIP and ISDN (TSS&TP, PICS, ETS) Rel 1
- OIP/OIR Conformance Tests (TSS&TP, PICS, ETS) Rel.1
- TIP/TIR Conformance Tests (TSS&TP, PICS, ETS) Rel.1
- TIP/TIR Rel.2 (TSS&TP)
- Communication HOLD Conformance Tests (TSS&TP, PICS, ETS)
- MCID (TSS&TP and PICS)
- SUB (TSS&TP and PICS)
- ACR-CB (TSS&TP and PICS)
- CUG (TSS&TP and PICS)
- Performance Benchmarking for NGN

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Work in progress conformance tests

- SIP/ ISUP Interworking conformance Tests (based on the ES 283 027 / 3GPP TS 29.163 ATS& PIXIT)
- TIP/TIR Rel.2 (ATS&PIXIT)
- OIP/OIR Rel.2 (INT)
- UUS
- CCBS
- CCNR
- ECT
- CONF
- CDIV
- CUG (ATS&PIXIT)
- MCID (ATS&PIXIT)
- ISDN-SIP INTERWORKING
- QoS performance test
- Network Integration Testing (NIT) between SIP and ISDN (TSS&TP, PICS, ETS) Rel 2

Specialist Task Forces (STF) (1)

- Finished STF to realize automatic testing and Interoperability Test Specifications

  - 297 Test SIP-ISUP profiles A&B
  - 301 SIP-ISUP test validation
  - 306 Test & Validation NIT SIP-ISDN
  - 310 Test SIP- ISUP Profile C
  - 334 Test & validation TIP/TIR
  - 335 Test & validation OIP/OIR
  - 336 Test & validation HOLD
  - 348 SIP-ISUP interworking mainten.
  - 328 Interop. IMS-NNI interworking based on 3GPP R6

Specialist Task Forces (STF) (2)

- Current STF to realize automatic testing and Interoperability Test Specifications

  - 346 Conformance tests for IP multimedia call control protocol based on SIP and SDP (based on ES 283 003 / 3GPPTS 24.229)
  - 366 Conformance Test Abstract Test Suite Specification (ATS) for SIP-ISUP Interworking between the IP Multimedia (IM) Core Network (CN) subsystem and Circuit Switched (CS) networks (ES 283-027)
  - 347 Interoperability Test Specifications for IMS NNI interworking for TISPAN Rel.2 (3GPPR7)
  - Conformance Tests (ATS) for the SIP-I/ISUP Interworking (Q.1912.5 Profile C)

NGN testing methods

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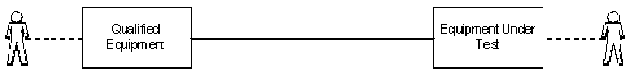
NGN testing methods

- Conformance testing or type testing
  - The purpose of conformance testing is to determine to what extent a single implementation of a particular standard conforms to the individual requirements of that standard.

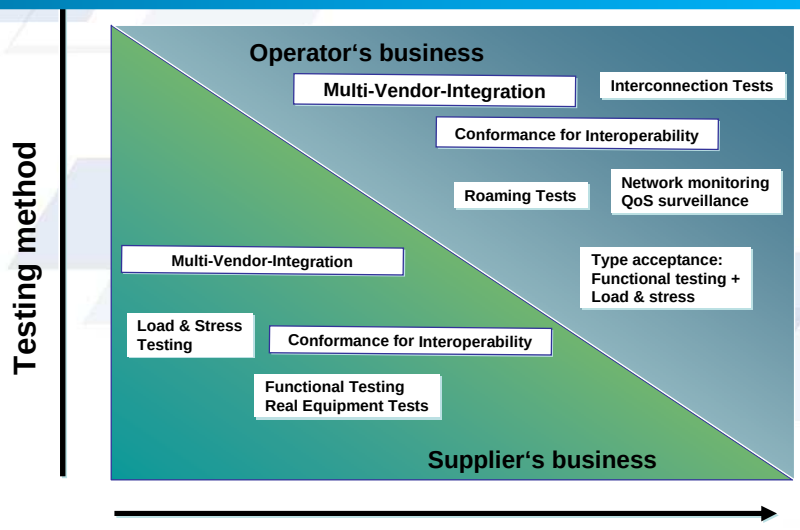
- Interoperability testing
  - Interoperability testing is the activity of proving that end-to-end functionality between (at least) two communicating systems is as required by those base systems' standards.



NGN - Interoperability testing methods

- Network Integration Tests / End-to-End Tests
- Benchmark / Load Tests
- QoS Tests
- Security Tests
- Roaming Tests
- Interconnection Tests
- Functional tests / Real Equipment Tests

Interoperability Testing



Combining Interoperability and Conformance Testing

- Conformance and Interoperability
  - both important and useful approaches to the testing of standardized protocol implementations
  - although it is unlikely that one will ever fully replace the other
- Conformance testing
  - able to show that a particular implementation complies with all of the protocol requirements specified in the associated base standard
  - difficult for such testing to be able to prove that the implementation will interoperate with similar implementations in other products

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Combining Interoperability and Conformance Testing

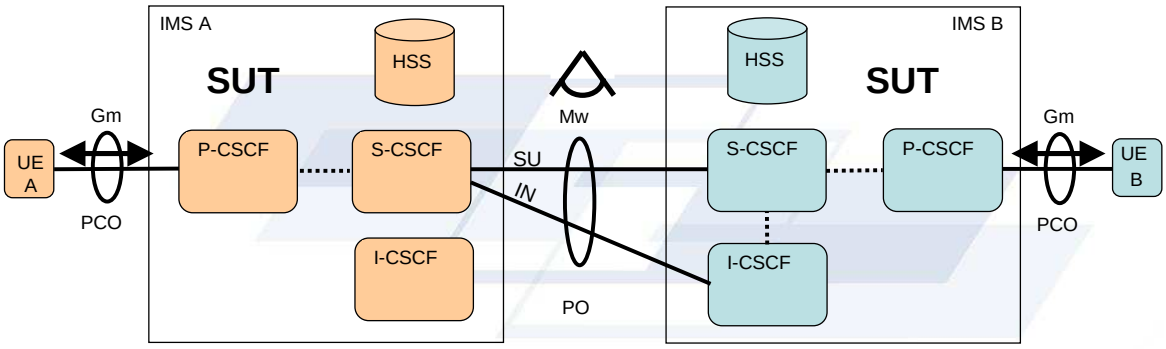
- Interoperability testing

  can clearly demonstrate that two implementations will cooperate to provide the specified end-to-end functions
  cannot easily prove that either of these implementations conforms to the detailed requirements of the protocol specification

Conformance testing for interoperability

- ETSI test specifications are designed to concentrate on areas critical to interoperability, including testing an implementation's reaction to erroneous behaviour. The goal is conformance testing for interoperability.
- This should not be confused with interoperability testing, which is a useful, but different, activity. The two approaches are complementary rather than competitive, which is why ETSI also provides a Plugtests Service for interoperability events for standards and product validation. A focussed set of conformance tests can provide an excellent framework for subsequent interoperability testing.

IMS core network interoperability tests



UE = User Equipment (Terminal)
CSCF = Call Session Control Function (~Proxy)
HSS = Home Subscriber Function (~User Database)

2nd ETSI IMS Interoperability Event in Bled

- Target 3GPP IMS standards Rel-7
- Uses TISPAN WG6 test descriptions TS 186 011-2
- Tested were following services:
  - Charging related aspects and ISC interface
  - HOLD, OIP/OIR
  - ACR-CB, CDIV
  - IMS roaming
  - Border control
  - Interaction with application servers.

End-to-end / Network Integration Tests

- End-to-end NIT (network integration testing) covers all testing activities necessary to assess the correct behaviour of the interconnected network from the point of view of access interfaces and the network side.
- End-to-End tests are based on the emulation of subscriber equipment behaviour on those interfaces where subscriber equipment is connected to the network(s) under test

Examples for Network Integration and Conformance Tests

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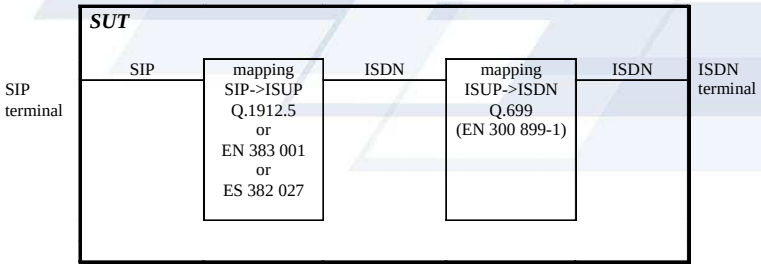
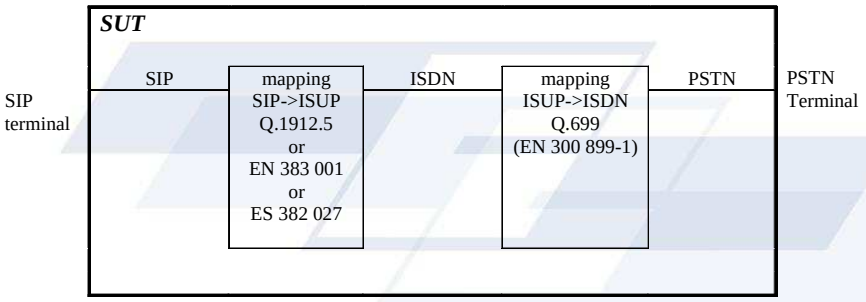
"Network Integration Testing (NIT) between SIP and ISDN, including validation" (1)

- The TS 386 001 contains TSS &TP, ATS & PIXIT for the basic call functionality (SIP- ISDN, ISDN-SIP, SIP-SIP) and supplementary services CLIP/CLIR (OIP/OIR), COLP/COLR (TIP/TIR), Call HOLD, Call Diversion (CFU,CFB, CFNR), 3PTY, CONF



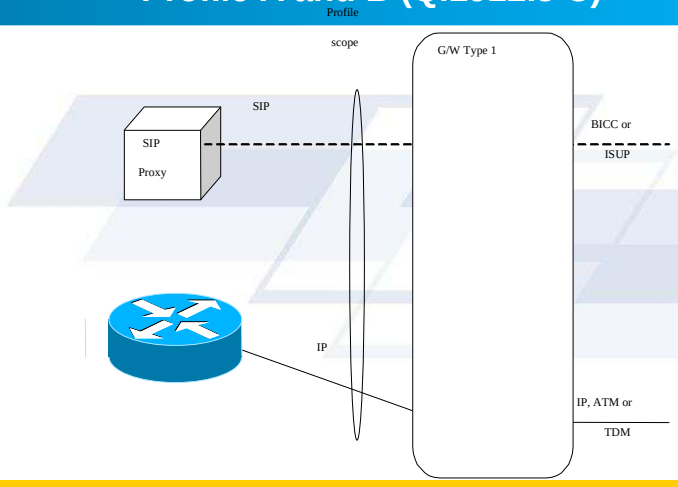
”Network Integration Testing (NIT) between SIP and ISDN, including validation”(2)



Test example

Microsoft
Word-Dokument

Conformance Testing: Interworking between Session Initiation Protocol (SIP) and Bearer Independent Call Control Protocol or ISDN User Part, Profile A and B (Q.1912.5 C)



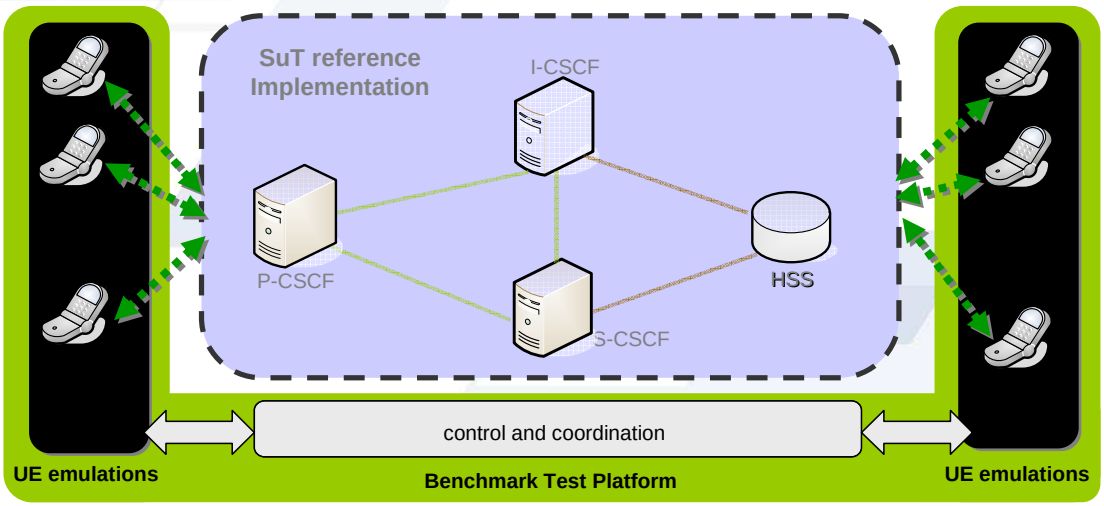
Test example

Microsoft
Word-Dokument

Benchmark / Performance testing

- The purpose of performance testing is to verify that applications fulfil the performance requirements, which have been set in the process definition for the operational context.
- This has the following aspects:
  - Software performs the operations within the requirements of process definitions i.e. response parameters for queries and notifications meet operating agreement limits.
  - Availability of applications is proven both mathematically and empirically.
  - User interfaces allow manual work to be performed as efficiently as expected and planned.

Benchmark Test Platform



MOS - Speech Quality Measure

- **Subjective measurement**
  - Based on subjective experiments
  - Mean opinion score
  - Costly and time consuming
- **Objective measurement**
  - Good correlation with subjective measurement
  - Highly repeatable
  - Real-time

QoS Voice Testing (1)

- **Active voice quality measurement**
  - **Active voice quality measurement techniques, also known as intrusive models, require a test call to be made over the network. A comparison of reference and degraded signals produces a quality score based on MOS. This type of measurement is useful for the preinstallation testing of a system as well as network optimization.**
- **Passive voice quality measurement**
  - **Common to all communication technologies are Passive voice quality measurement. Passive voice quality measurement is also known as a non-intrusive measurement.**
  - **These models monitor live network traffic and again measure the voice quality on the MOS scale. Passive measurement is ideal for the testing of systems already in use**

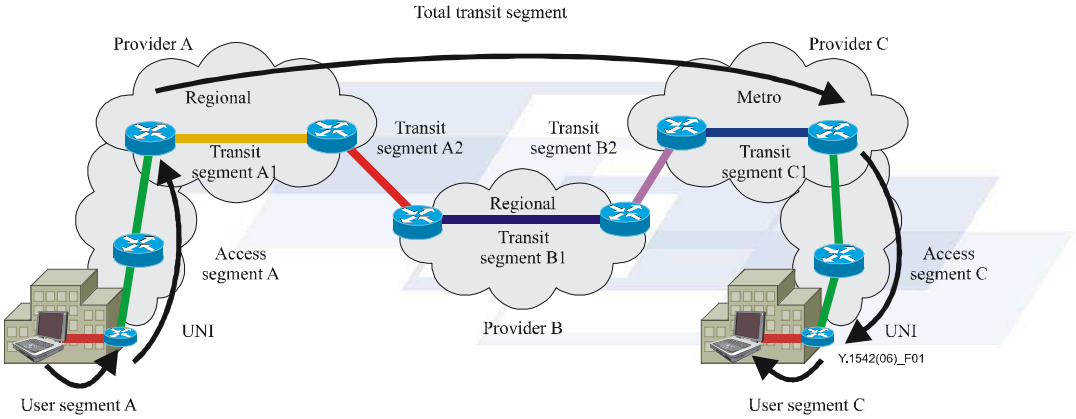
QoS Voice Testing (2)

- **PSQM ITU-T Rec. P.861 - designed for codec evaluation.**
  Assesses error loudness, noise disturbance and asymmetry to predict a PSQM value
  Withdrawn February 2001
- **PAMS - developed for real world networks**
  Assesses time aligned, level aligned, spectrally weighted error surface
- **PESQ© - ITU-T Rec. P.862 Perceptual Evaluation of Speech Quality**
  Designed for network avaluation, using specific scale
- **PESQ© - ITU-T Rec. P862.1 (PESQ extension from Nov.2003)**
  Linear mapping to P.800 MOS scale

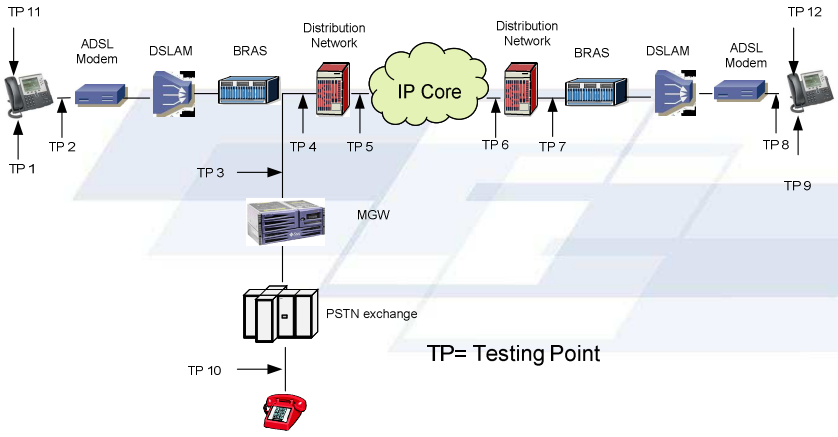
QoS Voice Testing (3)

- **PESQ© - ITU-T Rec. P862.3 [2007] (Implementation guide, Methods for objective and subjective assessment of quality)**
- **3SQM, perceptual single-sided speech quality measure (non-intrusive) according to ITU-T rec. P.563 [2004]**

Objectives for Quality related Parameters at VoIP Interconnection Points ETSI TR 102 775



Objectives for Quality related Parameters at VoIP Interconnection Points ETSI TR 102 775



Objectives for Quality related Parameters at VoIP Interconnection Points - Acess Segment Requirements - According ETSI TR 102 775

Category:	BEST (G.109)	HIGH (G.109)
(T_{SP}) / ms	60	90
(T_A) / ms	20	30
DV / ms (Note 2)	20	20
IPLR	3.0×10^{-4}	3.0×10^{-4}
IPER	$1x\ 10^{-5}$	$1x\ 10^{-5}$
Ie (transmit)	2	12
Ie (receive)	0	0

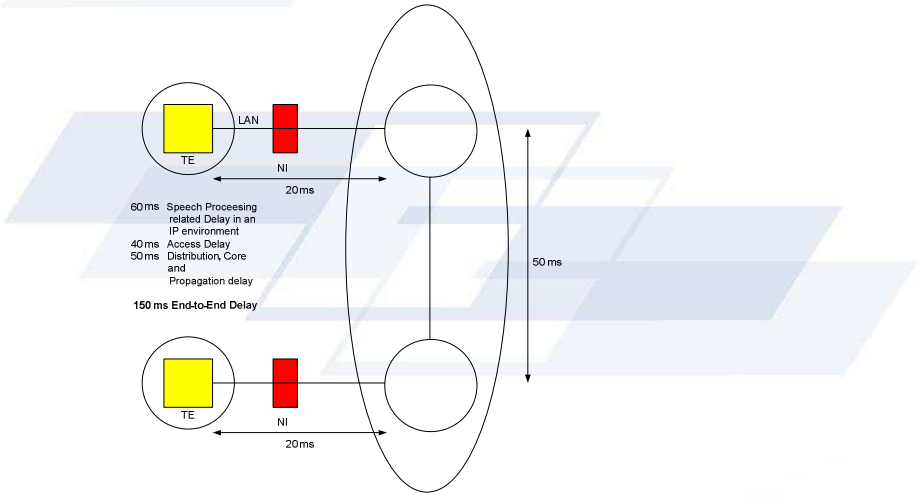
T_{SP} - Speech processing related Delay in an IP environment
T_A - Access delay
DV - Delay Variation
IPLR - Packet Loss

Objectives for Quality related Parameters at VoIP Interconnection Points – Transit Segment Requirements According ETSI TR 102 775

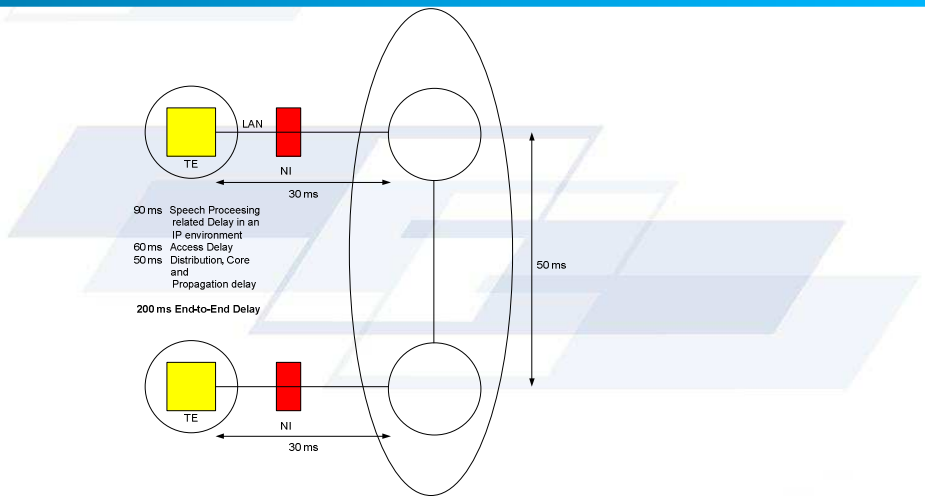
Category:	BEST (G.109)	HIGH (G.109)
(T_T) / ms	50	50
DV / ms (Note 2)	10	10
IPLR	3.0×10^{-4}	3.0×10^{-4}
IPER	$1x\ 10^{-5}$	$1x\ 10^{-5}$
Ie	0	0

T_T - Transit Delay
DV - Delay Variation
IPLR - Packet Loss

Objectives for Quality related Parameters at VoIP Interconnection Points – Delay Objectives for BEST (G.109) voice communication quality (R>90)



Objectives for Quality related Parameters at VoIP Interconnection Points – Delay Objectives for BEST (G.109) voice communication quality (R>80)



Suggested Objectives for support of emulation of ISDN clearmode (UDI) in NGN (ETSI TR 102 775)

Network Performance Parameter	Network Performance Objective for clearmode
IP packet loss ratio for national connections	2.75×10^{-7}
IP packet loss ratio for each operator's network	9.0×10^{-8}
end-to-end probability IP packet loss ratio	1.5×10^{-6}
IP packet error ratio for each operator's network	1.0×10^{-8}

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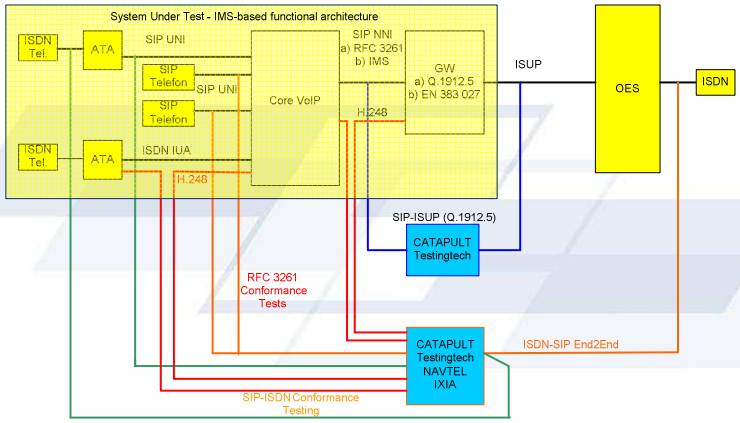
Title

Telekom Austria‘s Test configurations and QoS requirements

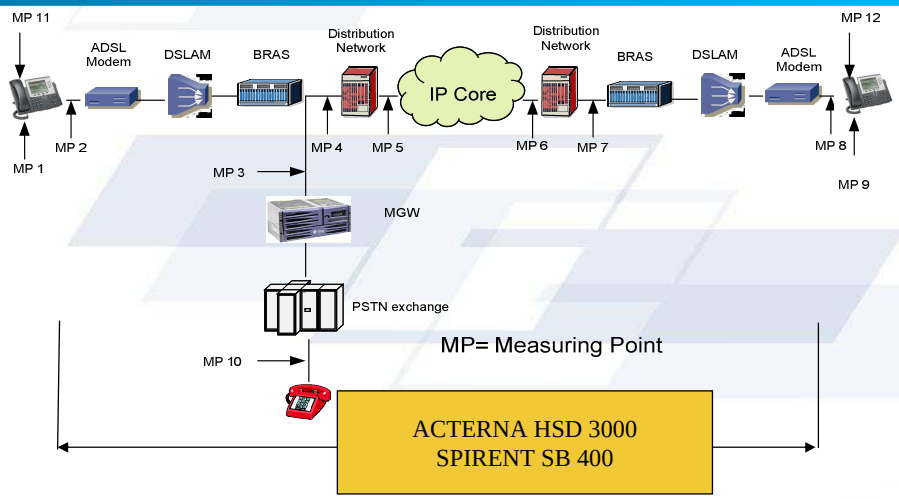
International training seminar «Testing of System and Network Solutions»
ZNIIS, Moscow December 15-17 2008

Telekom Austria protocol Test Configuration



NGN Test - configuration

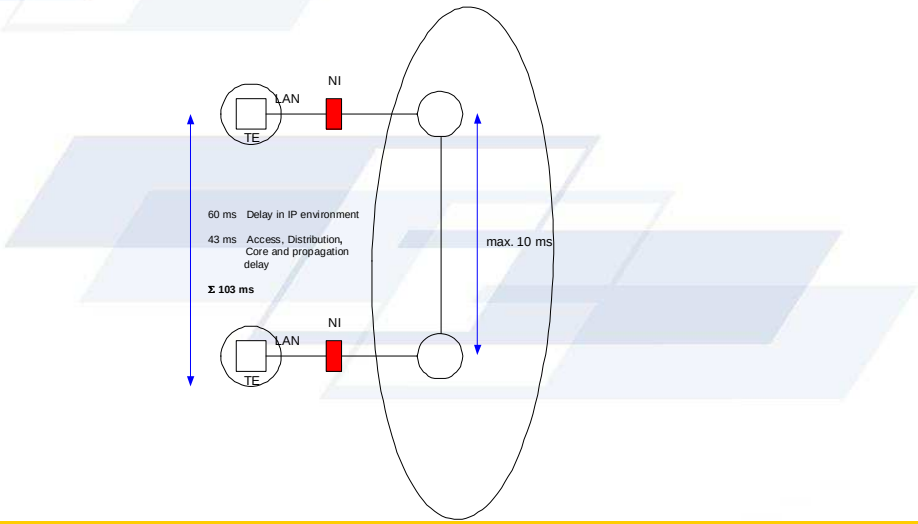
Telekom Austria QoS Test Configuration based on Y.1541



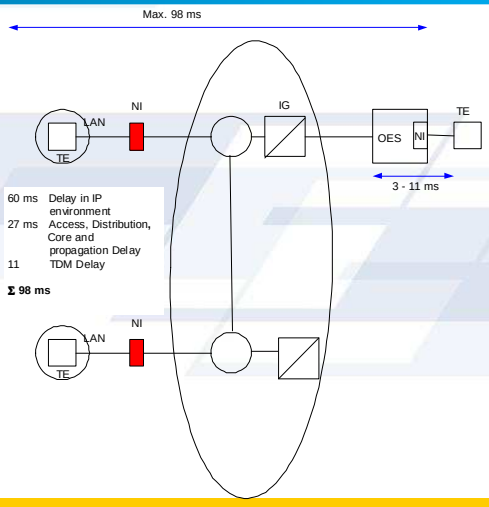
Network performance objectives for the Telekom Austria network based on Y.1541

Parameter Voice Channels with G.711 Packetization 20 ms	IP Packet Transfer Delay (sum of queuing & processing)	IP Packet Delay Variation	IP Packet Loss Ratio	IP Packet Error Ratio	IP Packet Discard Rate
Class 0	Max. 43 ms Max 59 ms with interleaver (incl. BGR) **Core**: 6 ms including propagation delay (ITU 5x2=10 ms) **Propagation delay**: 1000 km x 5 us/km = 5 ms **Distribution:** (2x2) 4ms (ITU 4x3=12 ms) **Access** Serialization & quing Upstream & downstream 1-16,5 (2 x 16,5) 33 ms Interleaver down- stream 8 - 16 ms Interleaver up- stream 0 ms ITU (2x18) = 36 ms	Max. 10 **Core** 0.43 ms **Distribution** 0.5 ms (2ms - ITU Y.1541 distribution & core) **Access** Upstream & downstream 2 – 7 ms	3×10^{-5}	3×10^{-5}	3×10^{-4}

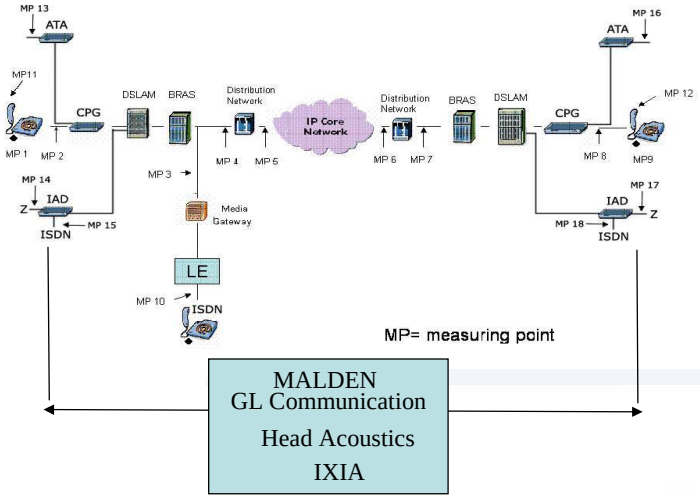
Delay between two VoIP subscribers with 20 ms packetization time



Delay between VoIP and TDM subscriber with 20 ms packetization time



Telekom Austria Voice QoS Test Configuration



MOS Calculation for different Codecs and frame duration

	G.711			G.726				G.729A	
Codec Bit Rate (kb/s)	64	64	64	32	32	40	40	8	8
Ie	0			7		2		11	
Packet Frame Duration (ms)	10	20	30	20	30	20	30	20	30
Delay in IP environment (ms) (2N+1)x frame size + Look ahead Where: N = number of frames per packet; frame size is in ms	30	60	90	60	90	60	90	100	150
MOS without network delay	4.4	4.4	4.4	4.2	4.2	4.3	4.3	4.0	4.0
End to end delay with 40 ms network delay e.g IAD -> IAD	70	100	130	100	130	100	130	140	190
MOS	4.4	4.4	4.3	4.2	4.1	4.3	4.3	4.0	3.9
QoS two wire (PSTN)	4.2	4.2	4.1	4.0	3.9	4.1	4.1	3.8	3.7
End to end delay with 20 ms network delay e.g TDM -> IAD	50	80	110	80	110	80	110	120	170
MOS	4.4	4.4	4.4	4.2	4.2	4.3	4.3	4.0	3.9
QoS two wire (PSTN)	4.2	4.2	4.2	4.0	4.0	4.1	4.1	3.8	3.7

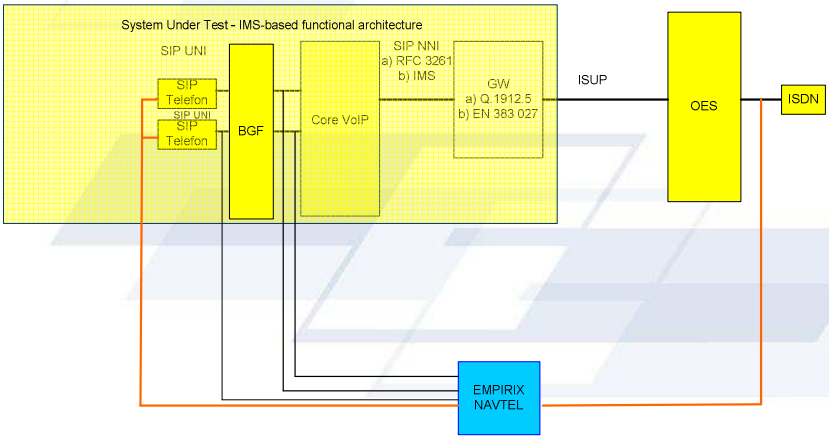
Fax Module Rates

Fax Module Rates	Redundancy
V.27ter 2400 bps	R0
	R1
	R3
V.29/V.17 9600 bps	R0
	R1
	R3
V.17 14 400 bps (G3)	R0
	R1
	R3
V.34 33 600 bps (Super G3)	R0
	R1
	R3

Bandwidth for T.38 with Modul rate V.17 (G3)

CODEC	T.38	T.38
Packet Frame Duration (ms)	20ms (Redundancy 1)	20ms (Redundancy 3)
Payload Size (bytes)	88	172
IP Packet Size (40b header)	130	214
IP Bitrate needed (kbit/s)	52	85,6
ATM Cells Needed IP Packet Size / 47	3	5
ATM Bytes Needed (ATM cells x 53) + 8 Byte Trailer	167	273
ATM Bitrate Needed (kb/s) /channel (ATM Bytes X 8 / duration)	66,8	109,2

Telekom Austria Load Test Configuration



NGN Test - configuration

Thank you for your attention !!!