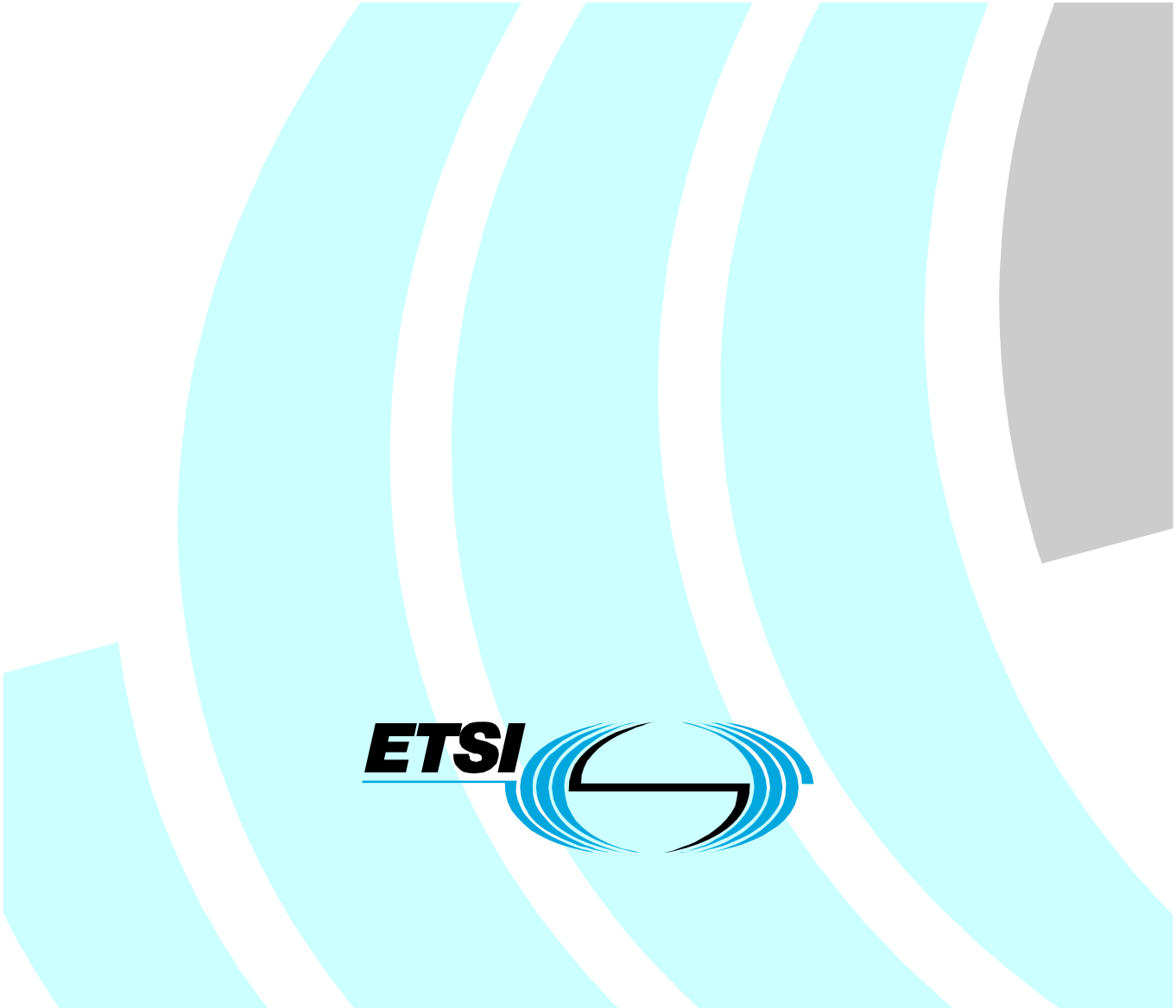
ETSI TS 186 025-1 V2.1.1 (2011-01)

Technical Specification

Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IMS/PES Performance Benchmark; Part 1: Core Concepts



Reference
DTS/TISPAN-06053-1-NGN-R2

Keywords
IMS, performance, service

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://webapp.etsi.org/IPR/home.asp).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN).

The present document is part 1 of a multi-part deliverable covering the IMS/PES Performance Benchmark, as identified below:

Part 1: "Core Concepts";

Part 2: "Subsystem Configurations and Benchmarks";

Part 3: "Traffic Sets and Traffic Profiles";

Part 4: "Reference Load network quality parameters".

1 Scope

The present document is for an initial release of a PSTN/ISDN Emulation Sub-system (PES) performance benchmark. The same tests can be used also for legacy PSTN/ISDN networks or for inter-working tests between PSTN/ISDN emulation subsystem and legacy PSTN and ISDN. The metrics measured and reported are for performance of this subsystem under a communications application load. The present document is the first part of the multi-part deliverable which consists of four parts.

The present document contains the overall benchmark descriptions, architectures, processes, and information models that are common to all specific benchmarking scenarios.

TS 186 025-2 [1] contains the specific benchmarking use-cases and scenarios, along with scenario specific metrics and design objectives. It also defines the SUT configuration parameters. This part also contains any required extensions to the overall descriptions present in the present document, if necessary for the specific scenario.

TS 186 025-3 [i.1] defines an initial benchmark test through the specification of a traffic set, traffic-time profile and benchmark test procedure.

TS 186 025-4 [i.2] defines Reference Load network quality parameters for the use cases defined in TS 186 025-2 [1].

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.

[1] ETSI TS 186 025-2: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IMS/PES Performance Benchmark Part 2: Subsystem Configurations and Benchmarks".

[2] ITU-T Recommendation Q.543: "Digital exchange performance design objective".

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] ETSI TS 186 025-3: "Telecommunications and Internet Converged Services and Protocols for Advanced Networking (TISPAN); IMS/PES Performance Benchmark; Part 3: Traffic Sets and Traffic Profiles".

[i.2] ETSI TS 186 025-4: "Telecommunications and Internet Converged Services and Protocols for Advanced Networking (TISPAN); IMS/PES Performance Benchmark; Part 4: Reference Load network quality parameters".

[i.3] ITU-T Recommendation P.862: "Perceptual evaluation of speech quality (PESQ): An objective method for end-to-end speech quality assessment of narrow-band telephone networks and speech codecs".

[i.4] ITU-T Recommendation P.862.1: "Mapping function for transforming P.862 raw result scores to MOS-LQO".

[i.5] ITU-T Recommendation P.56: "Objective measurement of active speech level".

3 Definitions and abbreviations

3.1 Definitions

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

background load: workload applied to an SUT during a benchmark test, for the purpose of consuming SUT resources during a benchmark test and changing the traffic intensity at which the capacity of the SUT is reached

benchmark report: document generated at the conclusion of a test procedure containing the metrics measured during the execution of the test and/or computed from the data collected in the benchmark log

benchmark test: procedure by which a test system interacts with a System Under Test to measure its behaviour and produce a benchmark report

configuration: specification of a subset of IMS/PES architectural elements and metrics for which collection of benchmark tests can be defined

design objective: probabilistic model of delay and failure requirements for SUT, associated with a use-case, specified by threshold values and probabilities for delay and scenario failure

idle load: load that is not dependent on the traffic or other external activities

maximum capacity: maximum processor load that a processor can handle without rejecting new calls

metric: performance measurement of SUT reported in a benchmark report

parameter: attribute of a SUT, test system, system load, or traffic set whose value is set externally and prior to a benchmark test, and whose value affects the behaviour of the benchmark test

processor load: part of time the processor executes work, normally expressed in percent

NOTE: The processor load consists of Idle load, Traffic load and Usage load.

Reference Call (RC): basic ISUP to ISUP call connected through two MGW in the same MGC domain

test parameters: parameters whose values determine the behaviour of a benchmark test

test procedure: specification of the steps to be performed by a benchmark test

test scenario: specific path through a use-case, whose implementation by a test system creates a system load

test system: collection of hardware and software which presents a system load to a system under test and collects data on the system under test's performance, from which metrics can be computed

traffic load: load that results from handling traffic events that are directly related to calls

NOTE: This load varies with the traffic intensity.

traffic-time profile: evolution of the average scenario over a time interval

traffic set: mixture of traffic scenarios

usage load: load that is reserved for the administrations operation and maintenance activities during busy hour

workload: number of reference calls per second (RC/s)

NOTE: It is calculated by multiplying calls per second by its corresponding WLF**.**

workload factor (WLF): traffic load for different types of calls in relation to the traffic load of the reference call (ISUP call)

3.2 Abbreviations

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

%IHS	Percent Inadequately Handled Scenarios
A-BGF	Access Border Gateway Function
AGCF	Access Gateway Control Function
APS	Attempts per Second
BC	Bearer Capability
CLIP	Calling Line Identification Presentation
CW	Communication Waiting
DO	Design Objective
IMS	IP Multimedia Subsystem
ISDN	Integrated Service Digital Network
ISUP	ISDN User Part
MCID	Malicious Communication IDentification
MGW	Media Gateway
MHT	Mean Holding Time
NGN	Next Generation Networks
PIXIT	Protocol Implementation eXtra Information for Testing
PSTN	Public Switched Telecommunications Network
RC	Reference Call
SAPS	Session Attempts Per Second
SUT	System Under Test
TA	Tones and Announcement
TSS	Telephony Softswitch Solution
UDI	Unrestricted Digital Information
WLF	WorkLoad Factor

4 Benchmark information model

In this clause, "benchmark information model" refers to the structure of the information elements that define the benchmark. This information model is depicted in figure 1.

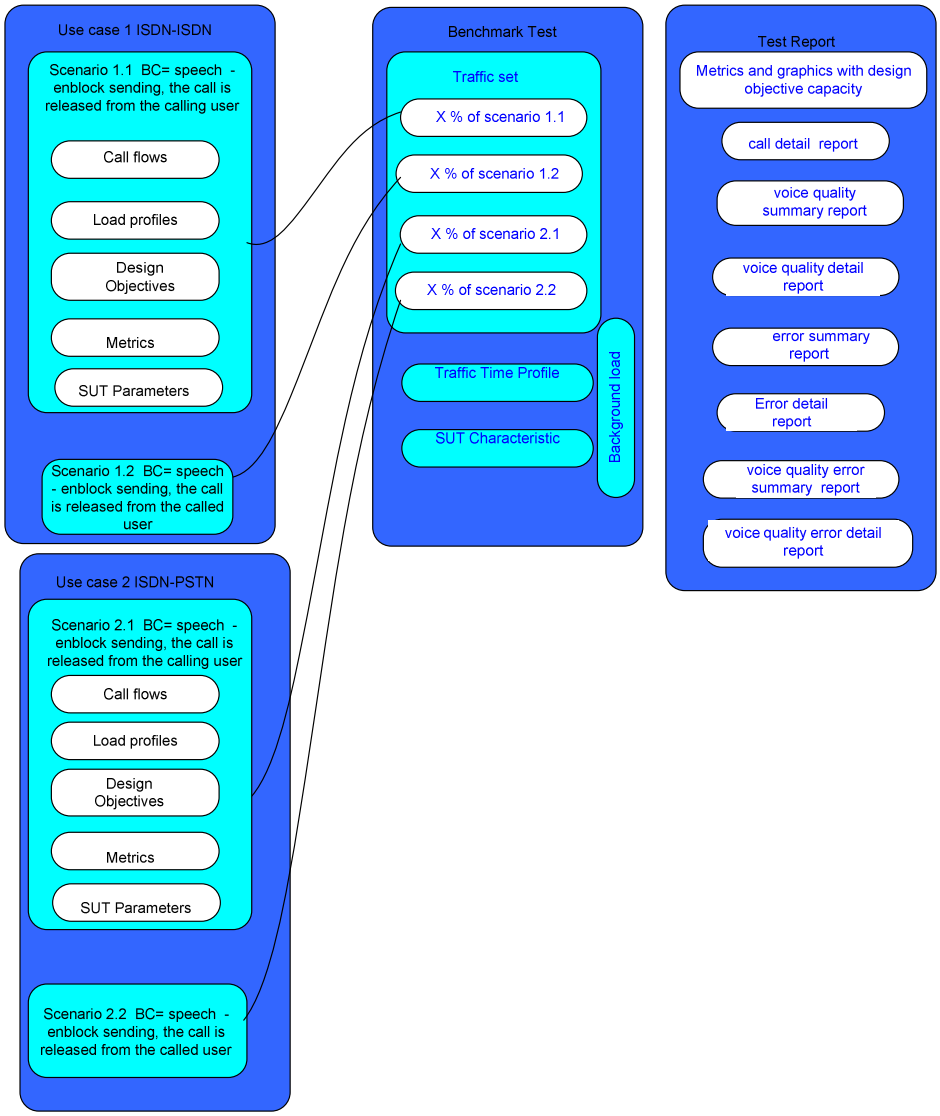


Figure 1: IMS/PES benchmark information model

The information model consists of three primary elements: **use-cases**, which describe the behaviour of an individual user, and which in turn define scenarios; **benchmark tests**, which generate a workload by aggregating the behaviour of individual scenarios in a controlled manner, and collect log files of measurements during the test; and **benchmark test reports**, which report metrics interpreted from the benchmark test log files.

4.1 Use-case

The top level of the individual behavioural model is the *use-case*. A use-case describes the goal that a user has in interacting with a system, the various actors (e.g. other users, network elements) that participate in the use-case, the basic course of events that are carried out by the user and the SUT, the design objective of the use-case, the possible outcomes that apply to the use-case, and the metrics to be collected. The goal and actors of a use-case are documented in narrative text and diagrams; the other elements are complex information elements, which are described in their respective clauses.

4.1.1 Call Flow

The calls flows define the characteristic message flows, the tones and announcement for a specific interface.

4.1.2 Load Profile

To facilitate the calculation of processing capacity and the appropriate load profile the concept of workload factor has been defined based on the reference call for each combination of traffic case and traffic signalling interface. The reference call (RC) is defined as a basic ISUP to ISUP call connected through two MGW in the same domain.

Based on the workload factors for all different types of calls, the call intensities and the services used, one can express the total traffic load in an equivalent number of reference calls per second.

The dimensioning of any type of network depends on a number of different parameters such as utilization per channel, calls per second, mean holding time, type of accesses being involved, and type of services being requested.

4.1.3 Metrics

The metrics of a use-case describe the measurements collected from the execution of a scenario attempt. Typical metrics include response times and message rates. If a scenario is selected for execution in a benchmark test, its metrics are collected. See clause 7 for more detail.

4.1.4 Use-case outcomes

A use-case outcome is a set of possible outcomes of the scenarios of a use-case. An outcome may be simply "correct", it may reflect an error or failure condition; or it may reflect a correct behaviour that took an excessive amount of time to occur. An instance of a scenario that experiences an error, failure, or timeout outcome is referred to as an inadequately handled scenario attempt.

4.1.5 Scenarios and scenario attempts

A scenario is a trace of a path through a use-case. It is analogous to "call attempt", but applies to all interactions within an IMS/PES network, different Bearer, and application interactions.

A scenario may succeed, fail, or succeed functionally.

The terms "scenario attempt" and "scenario attempts per second" are used in this standard in place of "call attempt" and "call attempts per second" because IMS/PES is a transaction-oriented system with transactions of a variety of types (e.g. speech calls, 3,1 kHz calls, modem calls, Fax calls, etc.). Traffic sets, and indeed the real world, do not operate according to only one transaction type, so the more generalized term is necessary. It would be incorrect and misleading to attempt to report the capacity of a system in "call attempts per second", "registration attempts per second", etc., for system loads that were other than purely call attempts, registration attempts, etc.

4.1.6 Design Objective (DO)

The Design Objective (DO) describes the maximal acceptable rate handled scenario attempts for a use-case.

4.1.7 Scenario

A scenario describes a single interaction sequence among the actors of a use-case. It is documented by a set of preconditions on its actors (typically specified by parameter values). In case of IMS/PES the scenario is defined as a set of different Bearer Capabilities (e.g. speech , 3,1 kHz audio, UDI, UDI/TA), services (fax, modem) or dial mode.

4.2 Benchmark test

A benchmark by definition measures the behaviour of a population of users. To accomplish this, the behaviours of individual users must be aggregated into input traffic to the SUT. The input traffic must be realistic, in the sense that a population of users would perform such actions in the real world, and in the sense that statistical variation in user behaviour is similar to statistical variation that would occur in the real world.

4.2.1 Traffic set

The traffic set is a collection of scenarios which are determined to be likely to co-occur in a real-world scenario. The scenarios do not need to come from the same use-case. Within a traffic set, each scenario has an associated relative occurrence frequency, interpreted as the probability with which it would occur in the course of the test procedure.

4.2.2 Background load

Background load is a workload presented to the SUT in order to consume its resources. It may consist of a stream of traffic presented to the SUT by an external system apart from the test system; or it may be a workload presented to the processing elements, network, or storage subsystem of the SUT.

The purpose of background traffic is to make possible the measurement of a design objective capacity in SUT when the capacity of the test system is insufficient to reach the design objective capacity.

If a benchmark test is published in which background load is used, then the following requirements apply:

- The hardware used to generate the background load must be fully specified. If the background load is generated by software running directly on the SUT, then the components of the SUT on which the background load is executed must be fully specified.
- The software used to generate the background load must be provided in source form, including make files and any other configuration files required to compile the software.

4.2.3 Traffic-time profile

The traffic-time profile is a function describing the average scenario attempt arrival rate as a function of elapsed time during a benchmark test. A traffic-time profile should be chosen in such a manner that, for a given scenario attempt arrival rate, sufficient samples are generated that metrics can be collected with an appropriate confidence bound. Following Call Profiler Traffic Patterns are used today: Saw Tooth Blast Ramp Steady Call Rate Rolling Blast Poisson Distribution. To get a realistic scenario a combination of at least two scenarios is needed.

4.2.4 Test parameters

The benchmark test parameters are used to control the behaviour of the test script. The data elements required to configure the test system are listed in table 1.

Table 1 is a non-exhaustive list of test parameters defined for the benchmark standard. The list is expected to grow over time, as additional subsystems and system configurations are developed.

Table 1: Test parameters

Parameter	Description
Start time	Amount of time that a system load is presented to a SUT at the start of a test
Stop time	Amount of time that a system load is presented to a SUT at the end of a test
TotalProvisionedSubscribers	The number of simulated subscribers provisioned in the network
PercentSimulatedSubscriber	The average percentage of simulated subscribers
Simulated Maximum simultaneous call legs	The number of simulated Maximum simultaneous call legs
Traffic per subscriber	Traffic per subscriber; default value 0,1 Erlang
MHT	Mean Holding Time of a call ; default value 120 seconds
Ringing time	Duration between (180 ringing and 200 OK INVITE) Default value 1 to 5 s
NoS	number of subscribers originating traffic per subscriber
CAPS/BHCA	Call attempts per second / busy hour call attempts
WLF for Call Controller	The workload factor for Call Controller for specific configuration. Default value 1 to 3
WLF for Gateway Controller	The workload factor for Gateway Controller for specific configuration. Default value 1 to 3
WLF for MGW	The workload factor for Media Gateways for specific configuration. Default value 1 to 3
TDM Trunks	Number of TDM trunks
ETH	Number of ETH Connections
Type of call	Calls requesting DTMF receiver POTS calls with CLIP POTS calls with CW POTS calls with Call diversion POTS calls with MCID POTS calls with Fax POTS calls with Modem IN calls using GS devices Calls with tone sending for Continuity Check Calls requesting a loop for Continuity Check ISDN calls with CLIP ISDN calls with CW ISDN calls with Call diversion ISDN Call with MCID ISDN calls with Fax ISDN calls with Modem ISDN with BC=3.1 kHz ISDN with BC= speech ISDN with BC= UDI
Protocol call type	SIP-I Basic PRACK PRAC & PREC
	SIP Basic PRACK PRAC & PREC
Protocol call type	H.323 Fast connect Tunnelling Separate H.245
	SIGTRAN M3UA (ISUP) IUA/DUA M2PA
	DNS/ENUM
ISUP routes utilization usually	ISUP routes utilization usually, Default value 0,8

Parameter	Description
Traffic Case	MGW (ISUP) - MGW (ISUP) ● inter-MGW MGW (POTS) - MGW (POTS) ● inter-MGW MGW (BA/PRA) - MGW (BA/PRA) ● inter-MGW MGW (PRA - MGW (PRA) ● inter-MGW MGW (POTS) - MGW (BA/PRA) ● inter-MGW MGW (V5.2 POTS) - MGW (V5.2 POTS) ● inter-MGW MGW (ISUP) - MGW (ISUP) ● intra-MGW MGW (POTS) - MGW (POTS) ● intra-MGW MGW (BA/PRA) - MGW (BA/PRA) ● intra-MGW MGW (PRA) - MGW (PRA) ● intra-MGW MGW (V5.2 POTS) - MGW (V5.2 POTS) ● intra-MGW MGW (ISUP) - AGW (POTS) MGW (ISUP) - AGW (ISDN) MGW (ISUP) - SIP-I MGW (POTS) - SIP-I MGW (ISDN) - SIP-I MGW (PRA) - SIP-I MGW (V5.2 POTS) - SIP-I SIP - SIP Transit H.323 - H.323 SIP - H.323

4.3 Benchmark report

A test report is a document, with accompanying data files, that provides a full description of an execution of a benchmark test on a test system. The SUT and test system, as well as their parameters, are described in sufficient detail that an independent test site can replicate the test. The results of the test include data, represented as charts and data sets, depicting the behaviour of the SUT over the elapsed time of the test; reports of the relevant metrics that are conventionally used to compare benchmark results of differing SUTs; and a full description of other observations and exceptions noted during the test.

5 System Under Test (SUT)

The IMS/PES performance benchmark covers benchmark tests for the PSTN/ISDN Emulation Sub-system (PES), The same tests can be used also for legacy PSTN/ISDN networks or for inter-working tests between PSTN/ISDN emulation subsystem and legacy PSTN and ISDN.

The following functional entities appear to be necessary from the perspective of specifying information flows and ensuring the interoperability of services:

- Access Gateway Analogue line function
- Access Gateway BRI function
- Access Gateway PRI function
- Residential Gateway Analogue line function
- Residential Gateway BRI function
- Trunk Gateway function
- Access Call Server function
- Transit Call Server function
- Packet Handler Gateway function
- Media Gateway Controller function
- Media Server Control Function

- Customer Location function
- IN Access Subsystem
- SIP Server Access Function
- Trunk Signalling Gateway

The Functional Architecture is shown in figure 2 in such a way that it can be seen that multiple implementation architectures are possible. There are some fundamental points that should not be missed however. The first of these is that we have gateways that convert legacy interfaces such as national analogue PSTN Z reference points and ISDN S or T reference points into NGN interfaces. These are usually thought of as being H.248 interfaces but that is not the only interface that can be used. Depending on the service set MGCP or interfaces carrying suitable information in SIP can be used. The key point is that the information flow can carry the stimulus information traditionally needed in national PSTNs to carry both line and register signalling from customers as well as specialised service signalling.

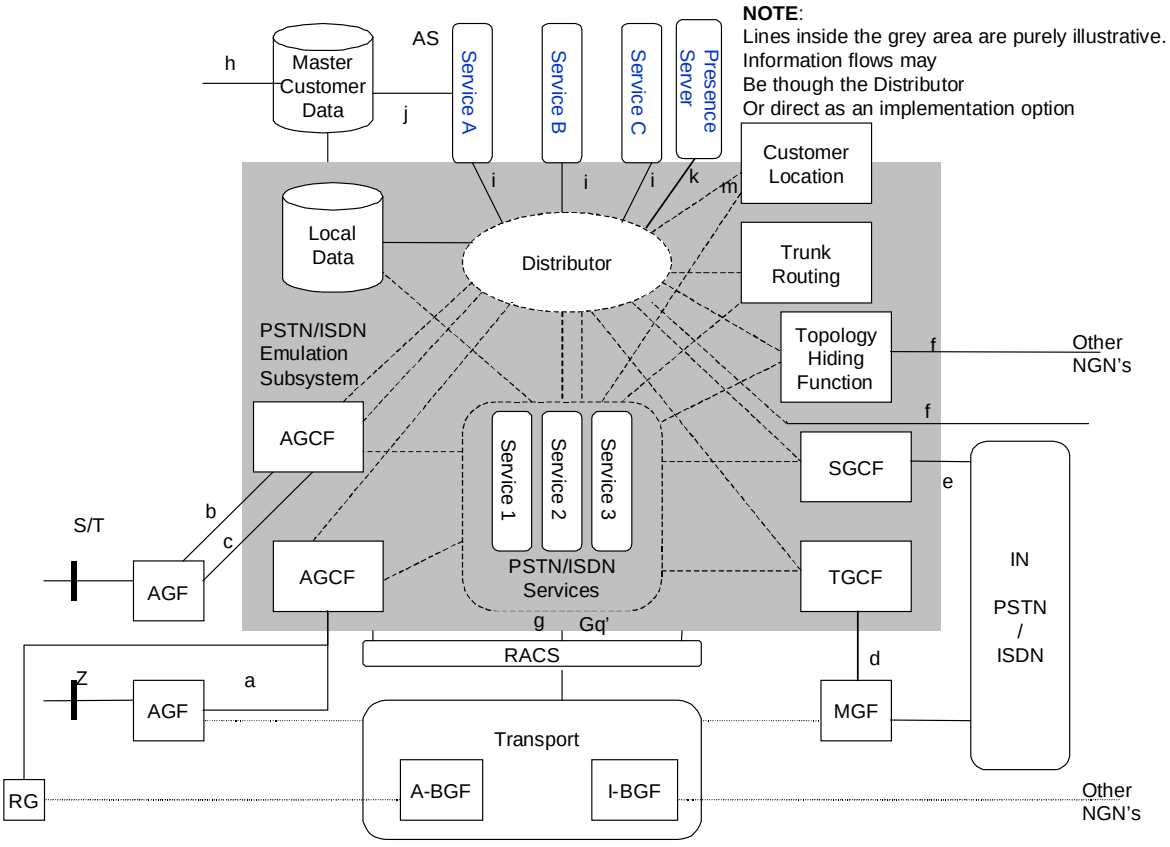


Figure 2: Overview of Functional Entities

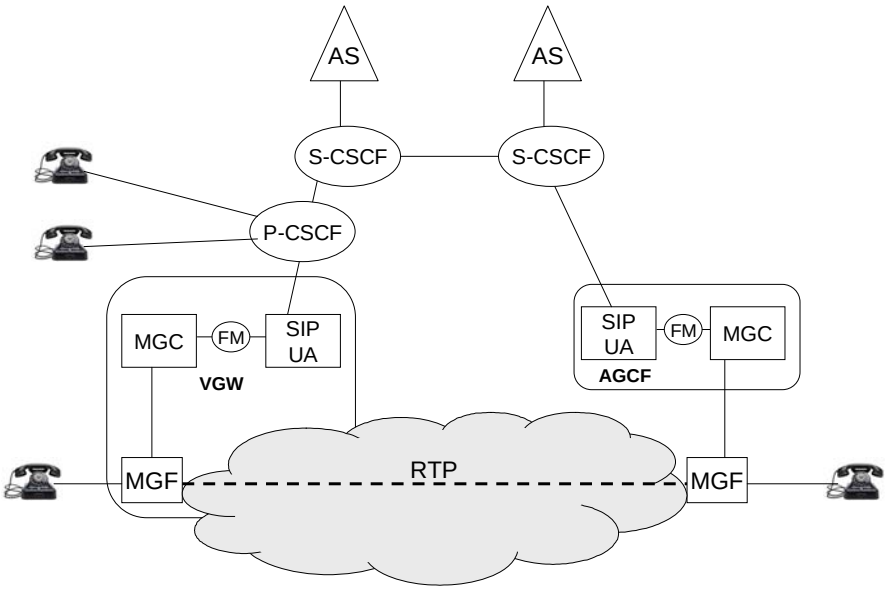


Figure 3: AGCF/VGW session processing model

5.1 Creation of subscriber data base

The subscriber data base is the data-set required to configure the SUT in order to execute a benchmark test. Using the same data, the test system should be able to generate correct traffic.

The present document does not try to specify a complete set, but rather just the subset that will ensure comparable results. All other provisioning information required for correct configuration of a SUT is to be set at the discretion of the SUT provider.

One requirement for a fair benchmark is that the input data is similar for all test-runs. In order for this to happen we have two choices:

a) Provide data base for the subscriber base. However, because we have to ensure scalability for the benchmark, this solution is not feasible.

b) Provide rules to generate this data and data generators. Algorithms using random generators will be avoided for data that could possibly influence the results.

6 Test system

The test system is used to generate the appropriate load on the SUT. The present document does not mandate any specific test system to be used, although the details of the test system must be reported in the benchmark report.

The test system should have two main functions:

- Traffic generation: the test system must be able to execute use-cases' scenarios following the traffic-time profile. It must also be able to reproduce the appropriate traffic set (a mix of scenarios with a weight for each of them).
- Network emulation: optionally, network characteristics on the different interfaces should be emulated by the test system.

7 Benchmark metrics examples

The metrics reported by a benchmark test is measured in real time during the execution of the test, or may be computed after completion of the test from event logs collected during the execution. Enclosed is a benchmark matrix based on the ITU-T Recommendation Q.543 [2].

Table 2: Benchmark metrics examples

delay parameters	**Description**
call request delay	For ANALOGUE SUBSCRIBER LINES, call request delay is defined as the interval from the instant when the off-hook condition is recognizable at the subscriber line interface of the exchange until the exchange begins to apply dial tone to the line. The call request delay interval is assumed to correspond to the period at the beginning of a call attempt during which the exchange is unable to receive any call address information from the subscriber.
Alerting sending	For calls terminating on ANALOGUE SUBSCRIBER LINES, alerting sending delay is defined as the interval from the instant when the last digit is available for processing in the exchange until the ringing tone is sent backwards toward the calling user.
Call set up delay	Call set-up delay is defined as the interval from the instant when the signalling information required for routing is received from the incoming signalling system until the instant when the corresponding signalling information is passed to the outgoing signalling system.
Through-connection delay	Through-connection delay.
Connection release delay	Connection release delay is defined as the interval from the instant when DISCONNECT or RELEASE message is received from a signalling system until the instant when the connection is no longer available for use on the call (and is available for use on another call) and a corresponding RELEASE or DISCONNECT message is passed to the other signalling system involved in the connection.
Speech quality analysis	
Speech Quality - PESQ	PESQ (ITU-T Rec. P.862 [i.3]) and ITU-T Rec. P.862.1 [i.4].
Speech Level - Active Level	ITU-T Rec. P.56 [i.5] method B.
Speech Level - Peak	
Speech Level - Noise	
Speech Level - Signal to Interval Noise	

Annex A (informative): Bibliography

ETSI ES 282 002 (V1.1.1): "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); PSTN/ISDN Emulation Sub-system (PES); Functional architecture".

History

Document history		
V2.1.1	January 2011	Publication