ETSI TS 186 008-2 V1.1.1 (2007-10)

Technical Specification

Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IMS/NGN Performance Benchmark Part 2: Subsystem Configurations and Benchmarks

Reference

DTS/TISPAN-06024-2-NGN

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

Important notice

Individual copies of the present document can be downloaded from:
http://www.etsi.org

The present document may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the PDF version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at
http://portal.etsi.org/tb/status/status.asp

If you find errors in the present document, please send your comment to one of the following services:
http://portal.etsi.org/chaircor/ETSI_support.asp

Copyright Notification

ETSI

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 2 of a multi-part deliverable covering the IMS/NGN Performance Benchmark, as identified below:

Part 1: "Core Concepts";

Part 2: "Subsystem Configurations and Benchmarks".

Part 3: "Traffic Sets and Traffic Profiles".

Introduction

Part 1 of this technical specification provides a general introduction to the environment in which the benchmark exists.

Part 2 documents the subsystem configurations, use-cases and design objectives corresponding to them.

Part 3 documents the benchmark tests through definitions of traffics sets and traffic profiles.

1 Scope

The present document is for an initial, revision 1.0, release of an IMS/NGN performance benchmark. The metrics measured and reported are for performance of this subsystem under a communications application load.

The benchmark is defined for the IMS/NGN network as a whole, as well as for several subsystems of an IMS/NGN network. The benchmark is designed so that nodes composing a subsystem can also be benchmarked alone.

This multi-part deliverable consists of three parts. TS 186 008-1 [5] contains overall benchmark descriptions, architectures, processes, and information models that are common to all specific benchmarking scenarios.

The present document is Part 2 of the IMS Benchmark definition and contains the IMS and ETSI TISPAN SUT subsystem configurations, the specific benchmarking use-cases and scenarios, along with scenario specific metrics and design objectives. It also defines the SUT configuration parameters. The present document also contains any required extensions to the overall descriptions present in TS 186 008-1 [5], if necessary for the specific scenario. This present document also includes an attachment containing any required data or code files.

TS 186 008-3 [6] defines an initial benchmark test through the specification of a traffic set, traffic-time profile, and benchmark test procedure.

The current architecture and scenarios defined for IMS/NGN Benchmark in the present document include:

- Control plane of the IMS/NGN architecture.

- Registration/De-Registration use-case.

- Session setup/teardown use-case.

- Page mode messaging use-case.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:

  - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;

  - for informative references.

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

For online referenced documents, information sufficient to identify and locate the source shall be provided. Preferably, the primary source of the referenced document should be cited, in order to ensure traceability. Furthermore, the reference should, as far as possible, remain valid for the expected life of the document. The reference shall include the method of access to the referenced document and the full network address, with the same punctuation and use of upper case and lower case letters.

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 indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

[1]   ETSI ES 282 007 (V1.1.1): "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IP Multimedia Subsystem (IMS); Functional architecture".

[2]   IETF RFC 3310: "Hypertext Transfer Protocol (HTTP) Digest Authentication Using Authentication and Key Agreement (AKA)".

[3]   IETF RFC 3840 (August 2004): "Indicating User Agent Capabilities in the Session Initialization Protocol (SIP)".

[4]   ETSI TS 183 041 (V1.1.1): "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Messaging service using the IP Multimedia (IM) Core Network (CN) subsystem; Stage 3: Protocol specifications".

[5]   ETSI TS 186 008-1: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IMS/NGN Performance Benchmark; Part 1: Core Concepts".

[6]   ETSI TS 186 008-3: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IMS/NGN Performance Benchmark; Part 3: Traffic Sets and Traffic Profiles".

2.2   Informative references

[7]   ETSI TS 124 228: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Signalling flows for the IP multimedia call control based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3 (3GPP TS 24.228 version 5.14.0 Release 5)".

[8]   ETSI TS 124 247: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Messaging service using the IP Multimedia (IM) Core Network (CN) subsystem; Stage 3 (3GPP TS 24.247 version 7.2.0 Release 7)".

3   Definitions and abbreviations

3.1   Definitions

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

arrival distribution: function describing the probability distribution of the interarrival time of events (e.g. messages)

attempts per second: rate at which scenarios are executed. Depending on the scenario, the actual implementation might be Registration Attempts Per Second (RAPS), or Call Attempts Per Second CAPS

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 log: data file containing measurements of SUT performance collected during the execution of a test procedure

benchmark report: documented 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 behavior and produce a benchmark report

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

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

Design Objective Capacity (DOC): largest load an SUT can sustain while not exceeding design objectives defined for a use-case

DOC overload: condition or part of a load profile, in which the system load exceeds the DOC

DOC underload: condition or part of a load profile, in which the system load does not exceed the DOC

duration distribution: function (e.g. Poisson) describing the probability distribution of the duration of an event (e.g. a call)

inadequately handled scenario attempt: scenario attempt which either fails or which exceeds the threshold values defined for the use case of which the scenario attempt is an instantiation

maximum capacity: smallest scenario arrival rate at which the successful scenario rate cannot be increased

metric: performance measurement of an SUT reported in a benchmark report

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

percent registered subscribers: parameter specifying the percent of subscribers with records in the HSS/UPSF that are active during the benchmark test

percent roaming subscribers: parameter specifying the percent of active subscribers who are roaming

preamble: phase at the beginning of a test procedure during which initialization of the test system and system under test is performed

protocol diagram: diagram depicting a collection of architectural elements as vertical lines, and protocol interactions between the elements as directed lines between architectural elements, where the vertical order in which the directed lines appear indicate time sequence

Protocol Implementation eXtra Information for Testing (PIXIT): statement made by a supplier or implementor of an IUT (protocol) which contains or references all of the information related to the IUT

recovery capacity: when a traffic-time profile describes a scenario arrival rate starting at a value greater than maximum capacity and monotonically decreasing, the maximum value at which design objectives for the use-case in effect are no longer exceeded

SAPS increase amount: increment by which the average SAPS changes between steps of a profile

NOTE: Equivalent to system load increase amount.

scenario: specific path through a use-case, including the sequence of messages exchanged by all agents, and (when meaningful) a scenario duration distribution (e.g. the duration of a call)

EXAMPLE: An example of a scenario is "simple call - succeeded".

scenario attempt: event of a scenario being initiated by the test system and handled by the SUT

scenario attempts per second: average number of scenarios that are instantiated by the test system per second

scenario arrival distribution: probability distribution that governs the arrival times of scenarios during a test phase

scenario duration distribution: probability distribution that governs the duration of an individual scenario

scenario percent of system load: relative frequency of an individual scenario within a system load

simultaneous scenarios: number of scenarios that the test system may allow a single UE to perform simultaneously

step number: for a profile consisting of a sequence of steps, the number of steps

step time: length of time, in a profile consisting of a sequence of steps, at which the average scenario arrival rate remains at the same value

step transient time: parameter representing the time interval, measured from the beginning of a step, for which counts of scenario attempts and inadequately handled scenario attempts are not kept

stir time: parameter representing a period of time in the preamble of a benchmark test in which a system load is run in order to allow initial transient conditions attenuate to an insignificant level

subscriber base: information elements that describe simulated users

system load: stream of protocol interactions presented to the SUT by the test system

system load increase amount: increment by which the average SAPS changes between steps of a profile

> NOTE: Equivalent to SAPS increase amount.

System Under Test (SUT): collection of hardware and software whose performance is measured by the benchmark test

test parameters: parameters whose values determine the behavior 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

total provisioned subscribers: number of simulated subscribers with records in the HSS/UPSF

traffic-time profile: evolution of the average scenario arrival rate over time

> NOTE: It is specified by a scenario arrival distribution and a function of average scenario arrival rate as a
> function of time.

traffic set: mixture of scenarios whose proportional contributions to traffic are fixed

use-case: specification of a type of interaction between a test system and a system under test, corresponding to a mode of end-user behavior

> NOTE: A use-case is a collection of scenarios.

> EXAMPLE: An example of a use-case is "simple call", which may contain scenarios "simple call - succeeded",
> "simple call - no answer", and others.

user behavioral model: model that defines the number and rate at which an individual user of an IMS system makes scenario attempts

3.2   Abbreviations

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

%IHS	Percent Inadequately Handled Scenarios
3GPP	Third Generation Partnership Project
3GPP2	Third Generation Partnership Project-2
AKA	Authentication and Key Agreement
APS	Attempts Per Second
A-RACF	Access - Resource Access Control Facility
AS	Application Server
ATCA	Advanced Telecom Computing Architecture
BGCF	Border Gateway Control Function
C-BGF	Controlling-Border Gateway Function
CDMA	Code Division Multiple Access
CN	Core Network
CSCF	Call Session Control Function

DNS	Domain Name System
DO	Design Objective
DOC	Design Objective Capacity
DSLAM	Digital Subscriber Line Access Multiplexer
GSM	Global System for Mobile communication
HSS	Home Subscriber Server
IBCF	Interconnection Border Control Function
I-BGF	Interconnect-Border Gateway Function
I-CSCF	Interrogating-CSCF
IHSA	Inadequately Handled Scenario Attempt
IM	IP Multimedia
IMS	IP Multimedia Subsystem
ISDN	Integrated Services Digital Network
IWF	Inter-Working Function
JAIN	Java API for Integrated Networks
LAN	Local Area Network
MGCF	Media Gateway Control Function
MRFC	Media Resource Function Controller
MRFP	Media Resource Function Processor
NGN	Next Generation Networks
OMG	Object Management Group
PCI	Peripheral Component Interconnect
P-CSCF	Proxy-CSCF
PIXIT	Protocol Implementation eXtra Information for Testing
PSTF	Public Switched Telecommunications Network
QoS	Quality of Service
SA	Security Association
SBC	Session Border Control
SCS	Session Control Subsystem
S-CSCF	Serving CSCF
SGF	Serving Gateway Function
SIMS	SIMultaneous Sessions (per user)
SLF	Subscriber Location Function
SPDF	Service Policy Decision Function
SQN	SeQuence Number
SUT	System Under Test
TEM	Telecommunications Equipment Manufacturer
TISPAN	Telecommunications and Internet convergence Services for Advanced Networking
T-MGF	Trunk Media Gateway Function
TRT	Total Round-trip Time
TS	Test System
UE	User Equipment
UPSF	User Profile Server Function

4 System Under Test (SUT) subsystems

An IMS/NGN benchmark is required to allow not only a complete IMS network, as depicted in figure 1 of TS 186 001 [5], to be benchmarked, but also subsystems of a network corresponding to discrete products that may be available from a supplier. To address this requirement in this multi-part deliverable, a series of subsystems are defined, which will serve as a System Under Test (SUT) for a benchmark test. IMS/NGN elements that do not appear in a subsystem are regarded as part of the test environment, which must be present for a subsystem to function, but which is not itself subject to benchmarking.

The focus of Release 1 of this multi-part deliverable is depicted in figure 1 of TS 186 001 [5]. IMS elements not part of this focus are regarded as part of the test environment. In future releases of this multi-part deliverable, more of these elements may be incorporated in subsystems, and additional elements may appear in the reference architecture.

Table 1: Subsystems for which benchmarks are to be specified

IMS/NGN Performance Benchmark Subsystem	Included 3GPP IMS Functionality	Included TISPAN NGN Functionality	Test Environment Functionality
Session Control Subsystem (SCS)	P-CSCF, I/S-CSCF, HSS	P-CSCF, I/S-CSCF, S-CSCF, UPSF	DNS, access network (e.g. SPDF, C-BGF, A-RACF, DSLAM, SBC, switches, routers)
HSS/UPSF Subsystem	HSS	UPSF	
P-CSCF Subsystem	P-CSCF	P-CSCF	DNS, access network (e.g. SPDF, C-BGF, A-RACF, DSLAM, SBC, switches, routers)
I/S-CSCF Subsystem	I-CSCF, S-CSCF	I-S/CSCF	DNS, access network (e.g. SPDF, C-BGF, A-RACF, DSLAM, SBC, switches, routers)
NOTE: The last column of table 1 represents the elements of the test environment. In Release 1, only benchmark configurations with one network are specified; in such a configuration, DNS queries are cached locally, and hence have no significant effect on the measured metrics. Similarly in Release 1, IPv6, network errors, andnetwork delays are not specified in benchmarks, and hence have no impact.			

Figure 1 depicts the IMS Reference Architecture. The components of the architecture are the primary building blocks, which are either defined by the IMS standard, or defined by external standards and referenced by IMS. The links between the primary building block represent reference points over which the building blocks communicate with each other.

The reference architecture is a logical architecture; no mapping of functional elements to hardware or software component is mandated.
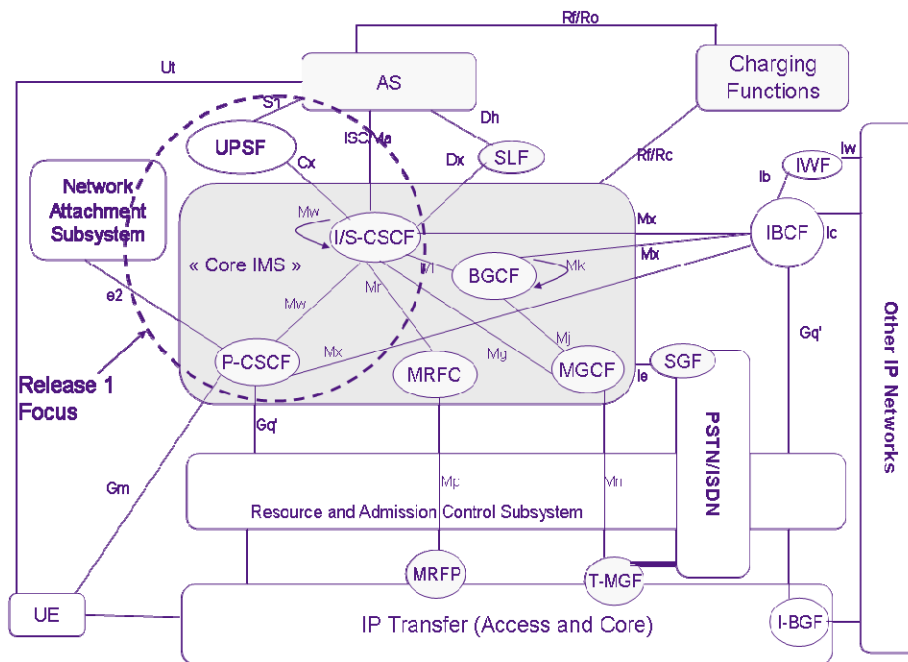

Figure 1: IMS Reference architecture (from ES 282 007 [1])

For the purposes of benchmarking, however, certain rules concerning subsystem configurations are required. These rules that benchmark measurements taken from equivalent subsystems of different vendors are comparable with one another.

The general guidelines for defining an SUT configuration are:

- All of the functional elements of the subsystem must be present in the SUT configuration.

- All hardware elements used in the implementation of the SUT configuration must be completely enumerated.

- All the QoS spec measurements defined at the interfaces to the SUT must be collected as specified in the benchmark test.

- All hardware-specific measurements (e.g. CPU utilization, memory utilization, fabric bandwidth) specified in the benchmark test must be collected for all hardware elements used in the implementation of the SUT configuration.

- SUT interface characteristics must be specified so that they can be emulated by the test system, including:

  - Security (e.g. IPSec, TLS, DTLS, etc.).

  - Interface network characteristics (e.g. up and down bandwidth, up and down latency).

4.1   Session Control Subsystem (SCS)

The Session Control Subsystem (SCS) consists of the P-CSCF, I-CSCF, and S-CSCF, and HSS/UPSF components, as depicted in figure 2.

A valid SCS configuration consists of the set of x-CSCF building blocks, as well as the database functions HSS/UPSF and SLF that support their functionality. The reference points for the SCS are the G_m reference point between the UE traffic generator and the home and visited P-CSCFs, the M_r reference point between the S-CSCF and the Simulated MRFC, the M_j reference point between the S-CSCF and the Simulated BGCF, and the test system management interface to the HSS/UPSF and SLF databases.

A SUT for this subsystem may consist of either one or two SCS configurations, to allow benchmark tests to use a combination of local and roaming simulated subscribers.
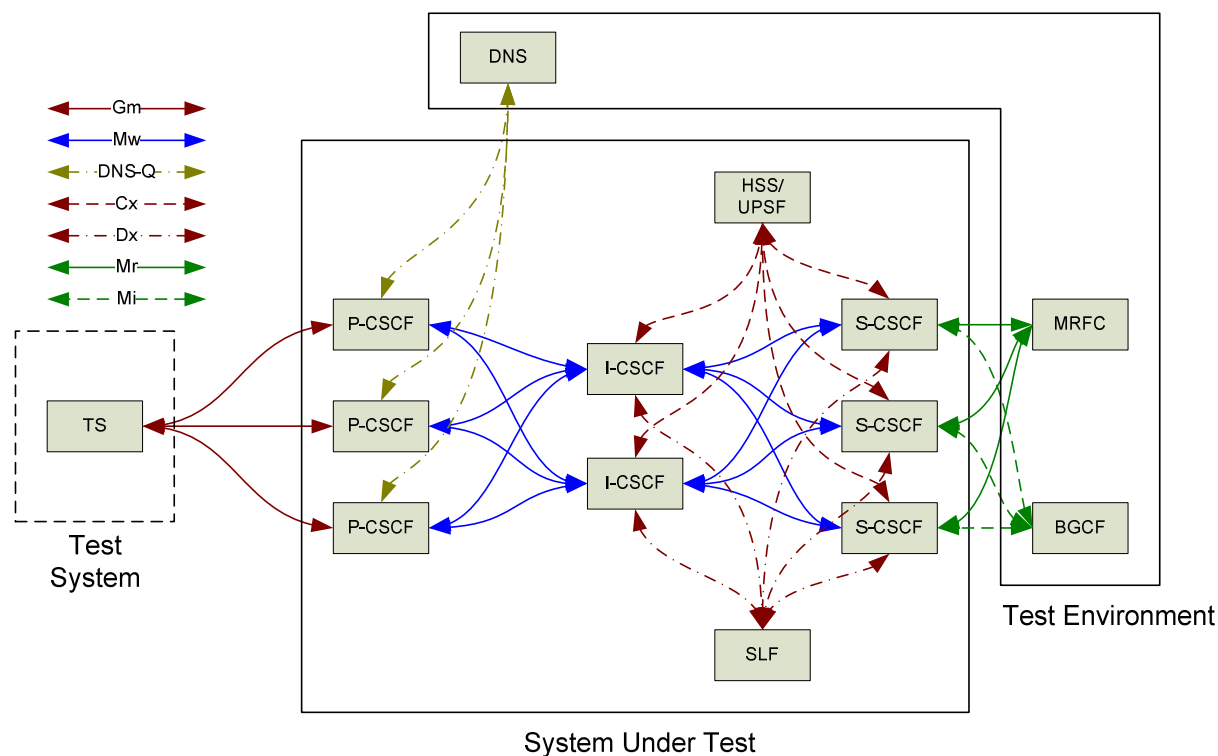
Figure 2: SUT topology for SCS

4.2   HSS/UPSF subsystem

This subsystem refers to the HSS (in 3GPP), and to the UPSF (in TISPAN).

4.3   P-CSCF subsystem

The P-CSCF consists of the P-CSCF component, as depicted in figure 3.

A valid P-CSCF configuration consists of the set of P-CSCF building blocks. The reference points for the subsystem are the G_m reference point between the UE traffic generator and the home and visited P-CSCFs, and the M_w reference points to the other simulated components (which are part of the TS in in this configuration).
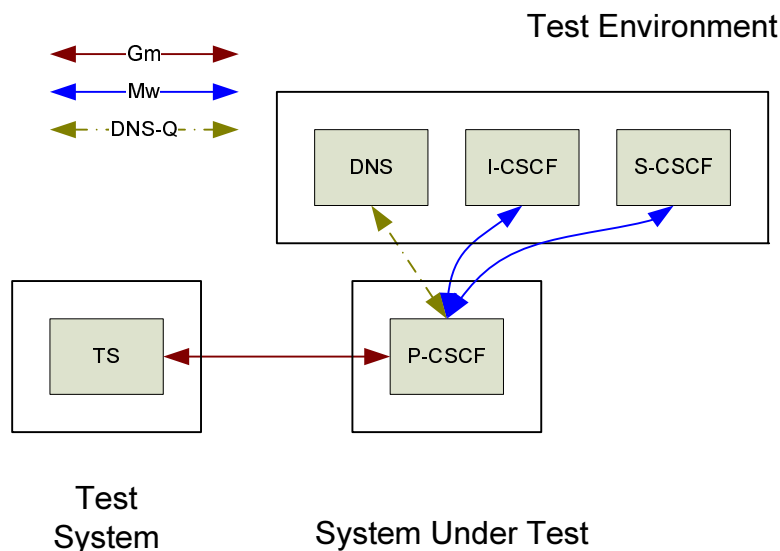
Figure 3: P-CSCF Subsystem

4.4   S/I-CSCF subsystem

The S/I-CSCF Subsystem consists of the S-CSCF, I-CSCF, HSS/UPSF, and SLF components, as depicted in figure 4.

A valid S/I-CSCF configuration consists of the set of S-CSCF and I-CSCF building blocks, as well as the database functions HSS/UPSF and SLF that support their functionality. The reference points for the subsystem are the M_w reference point between the simulated P-CSCF and the S/I-CSCFs.
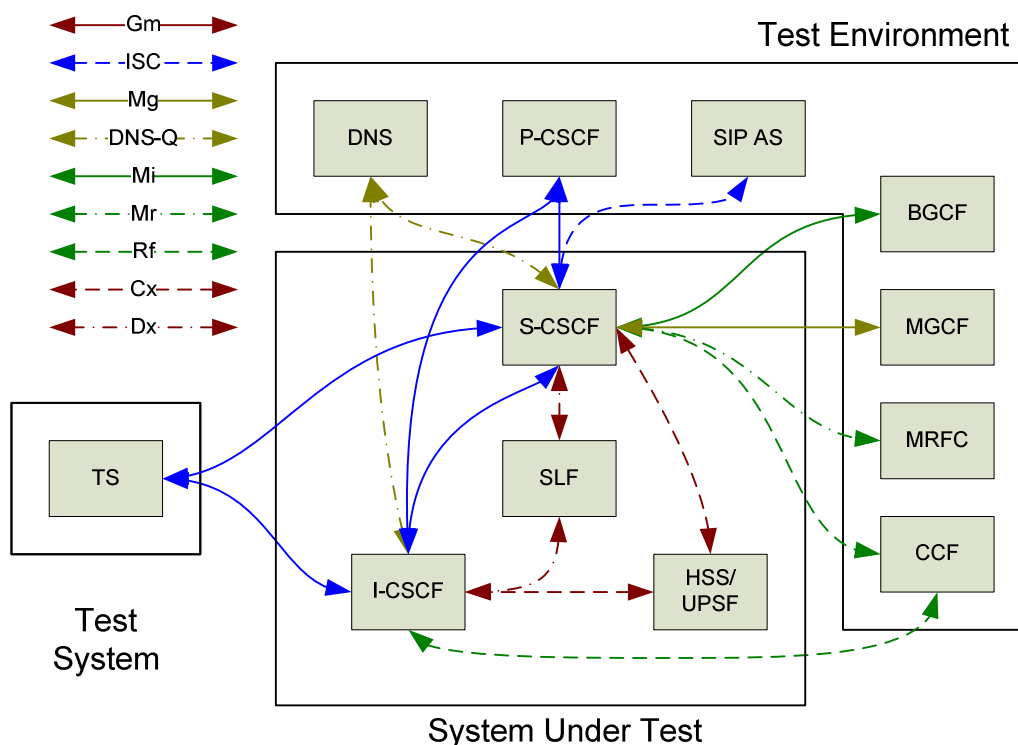
Figure 4: S/I-CSCF subsystem

5 Use cases

The following use cases, and corresponding tests, are currently defined. This section attempts to define a set of basic use-cases and further ones can be defined similarly. These newly defined use-cases, or modifications to the ones presented here, will have to be described in a similar manner in the test report.

The differences in use-cases between 3GPP IMS and TISPAN NGN occur within and between elements that are part of the test environment (outside the Systems Under Test configurations required for this release of the benchmark scenarios), with respect to this release of this multi-part deliverable. They therefore are not documented as part of the following use-cases; in other words, with respect to this release of this multi-part deliverable, there are no differences between 3GPP IMS and TISPAN NGN.

5.1 Registration/de-registration use-case

Registration is the first use-case that must be employed when using an IMS network. During this operation the UE announces its contact location to the home domain registrar in order for the home network to route terminating messages towards it. It is performed by an UE when it is turned on. De-registration is the last operation that an UE performs before it is turned off and it is used to invalidate the registered contact information.

Because of security concerns, this operation has to be authenticated and the assigned S-CSCF challenges the UE using authentication vectors obtained from the HSS/UPSF.

During the initial registration the P-CSCF also negotiates a set of security associations with the UE. Future registration/deregistration operations performed over these secure channels do not need to further be authenticated as the integrity of the messages is protected.

The registration has an attached expiration timer. Depending on the type of the network (fixed or mobile) and the usage patterns, this timer can vary from a few minutes up to one week, and it is negotiated between the UE and the home network. Before this timer expires, or when roaming to a new visited network, the UE has to start re-registration scenarios.

As part of this use-case, after registering, the UE will subscribe to its own registration status at the assigned S-CSCF. This subscription will need to be refreshed periodically, similarly to the registration. Unsubscription is not required, as the S-CSCF will automatically terminate it on de-registration. To avoid congestion, the notification timing is not strictly coupled to events that triggered them, and can have a delay in the order of seconds. The first one is sent shortly after subscription, and as a rule, the UE should be ready to respond to notification at any moment during the subscription period.
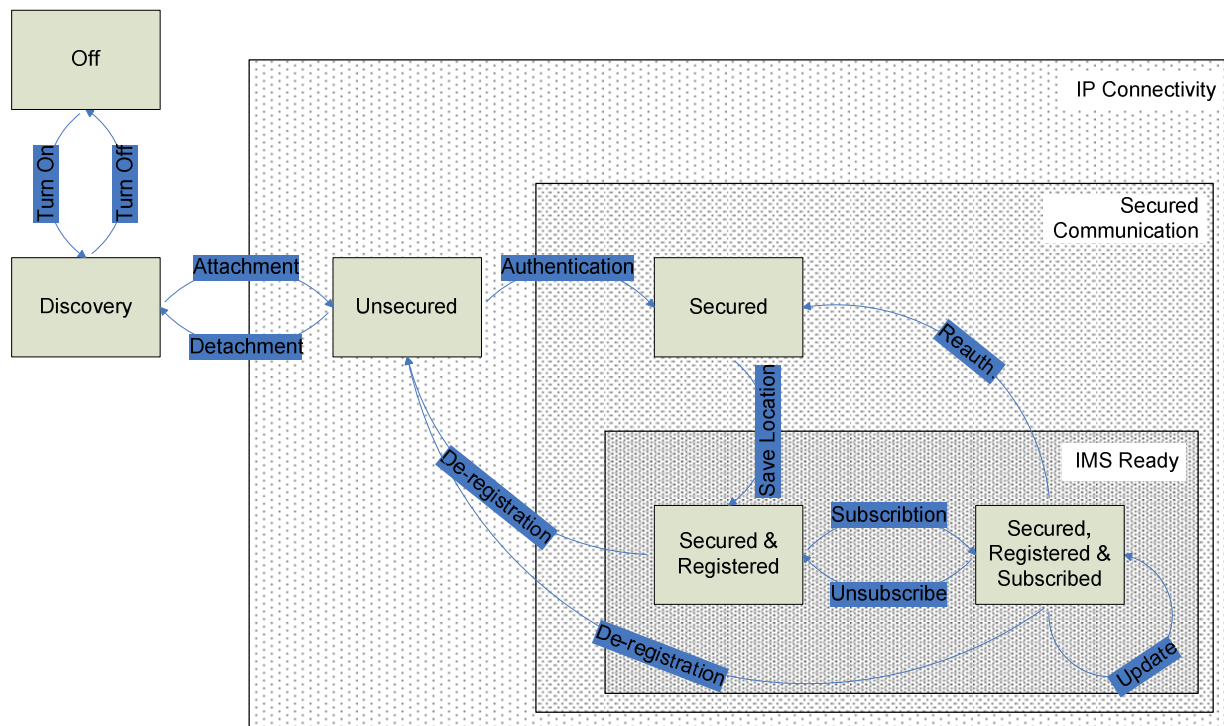
Figure 5: Registration/de-registration state machine

a)   Off - In this state the UE does not have any interaction with the environment.

b)   Discovery - The UE is acquiring an IP address and finds the address of the outbound Proxy-CSCF.

c)   Unsecured - In this state the UE is completely attached to the IP layer and it can fully act at the signaling level. This state is mainly used to send initial registration intentions. No traffic is to be trusted by the network until the UE is authenticated. The UE should not trust incoming signaling until it will attach to a correctly authenticated network.

d)   Secured - the UE begun authentication by requesting an authentication challenge. The UE can verify the authenticity of this challenge and it creates a Security Association (SA) with the Proxy-CSCF

e)   Secured and Registered - the UE sends the authentication challenge response to the network, indicating the location information that it wishes to save. While in this state, as communication is secured, updates can be performed without re-authentication.

f)   Secured, Registered and Subscribed - to react to network initiated events regarding the registration status, the UE subscribes to its own registration event package. The UE will then receive notifications on changes and it can act accordingly.

For simplification, it is considered that the initial state is unsecured: the UE simulated by the test system already has IP connectivity and the Proxy-CSCF addresses are considered as input configuration for the test system.

5.1.1   Definition

The registration/de-registration is the process by which a UE announces, updates or deletes its location information to the home domain"s registrar. This operation is authenticated and a secure communication channel for subsequent signaling is set-up between the UE and the network.

5.1.2   Scenarios

While the scenarios describe actions on the part of the UE, the portion of the signaling path between the UE and the complete IMS system outside the System Under Test configuration (outside the dotted line in Figure 1) are simulated by the test environment with test system characteristics fixed with stated values.

5.1.2.1   Scenario 1 - Successful initial registration without synchronization

In the initial registration Scenario, the UE indicates its contact information to the home domain registrar. To prevent attacks, the home network challenges the UE as part of the Digest AKA (RFC 3310 [2]) process. The AKA authentication also offers keying material for securing the communication channels and provides authentication of the home-network. It is considered that in this scenario the UE is always accepting the SeQuence Number (SQN) provided by the HSS/UPSF and does not trigger synchronization.

After registering, the UE starts a subscription for its own registration status at the assigned S-CSCF.

In the figure below, the scenario for a successful initial registration is presented, without SQN (SeQuence Number) synchronization.
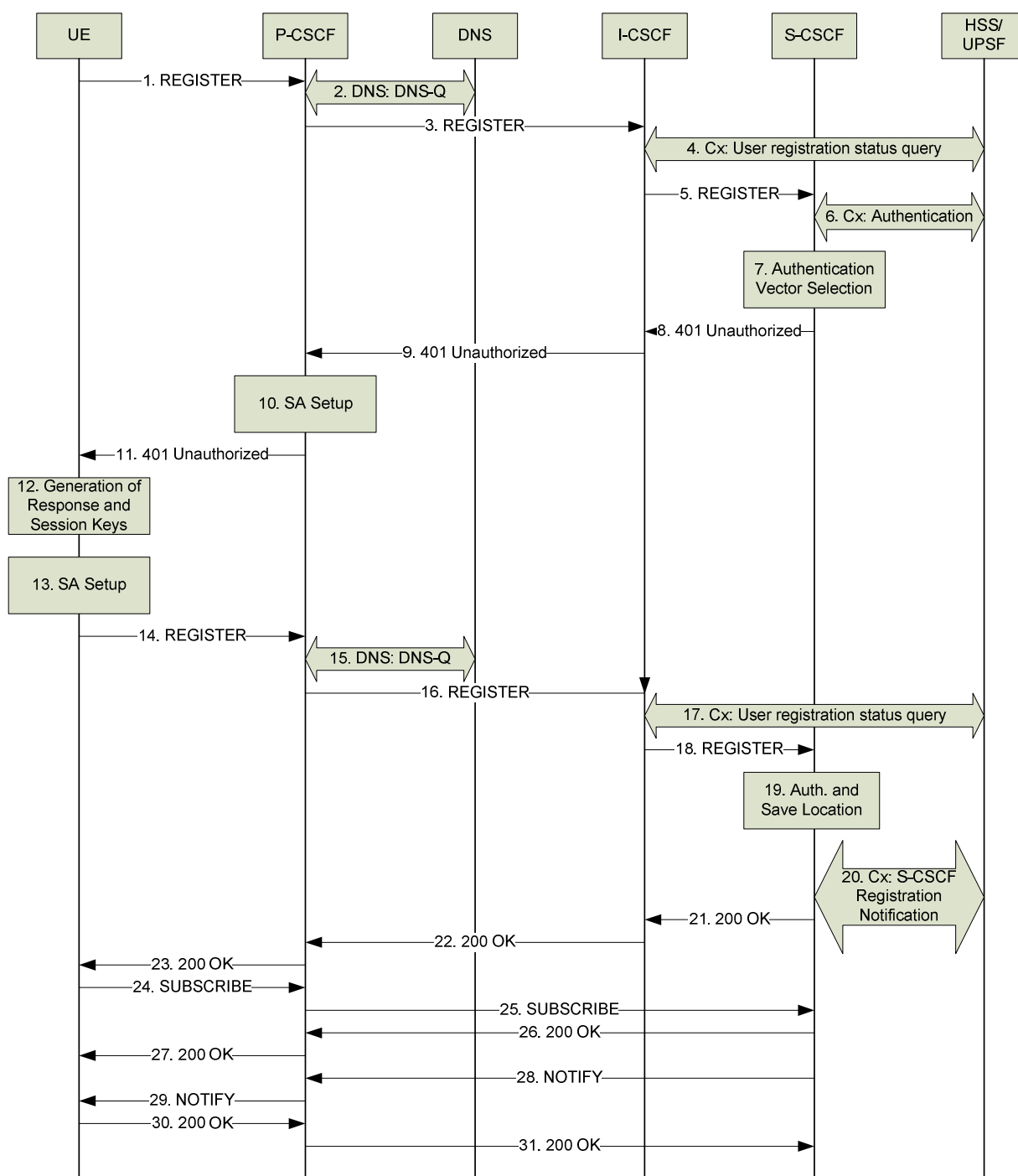
Figure 6: Successful initial registration without synchronization scenario signalling flow

In figure 6, the signalling flow is taken from TS 124 228 [7] (page 33: figure 6.2-1); TISPAN has endorsed this call flow. The discovery and attachment parts have been removed and Security Association has been inserted.

5.1.2.2 Scenario 2 - successful initial registration with synchronization

NOTE: This scenario does not apply to TISPAN networks because of the usage of AKA.

This functionality of this scenario is similar to the one defined in clause 5.1.2, except that the UE is not accepting the SQN provided by the HSS/UPSF and triggers a synchronization. In this process, instead of sending a challenge response in the second REGISTER, the UE sends the authenticated new synchronized SQN towards the HSS/UPSF. The HSS/UPSF should save this value and new authentication vectors are generated. The UE is then challenged again.
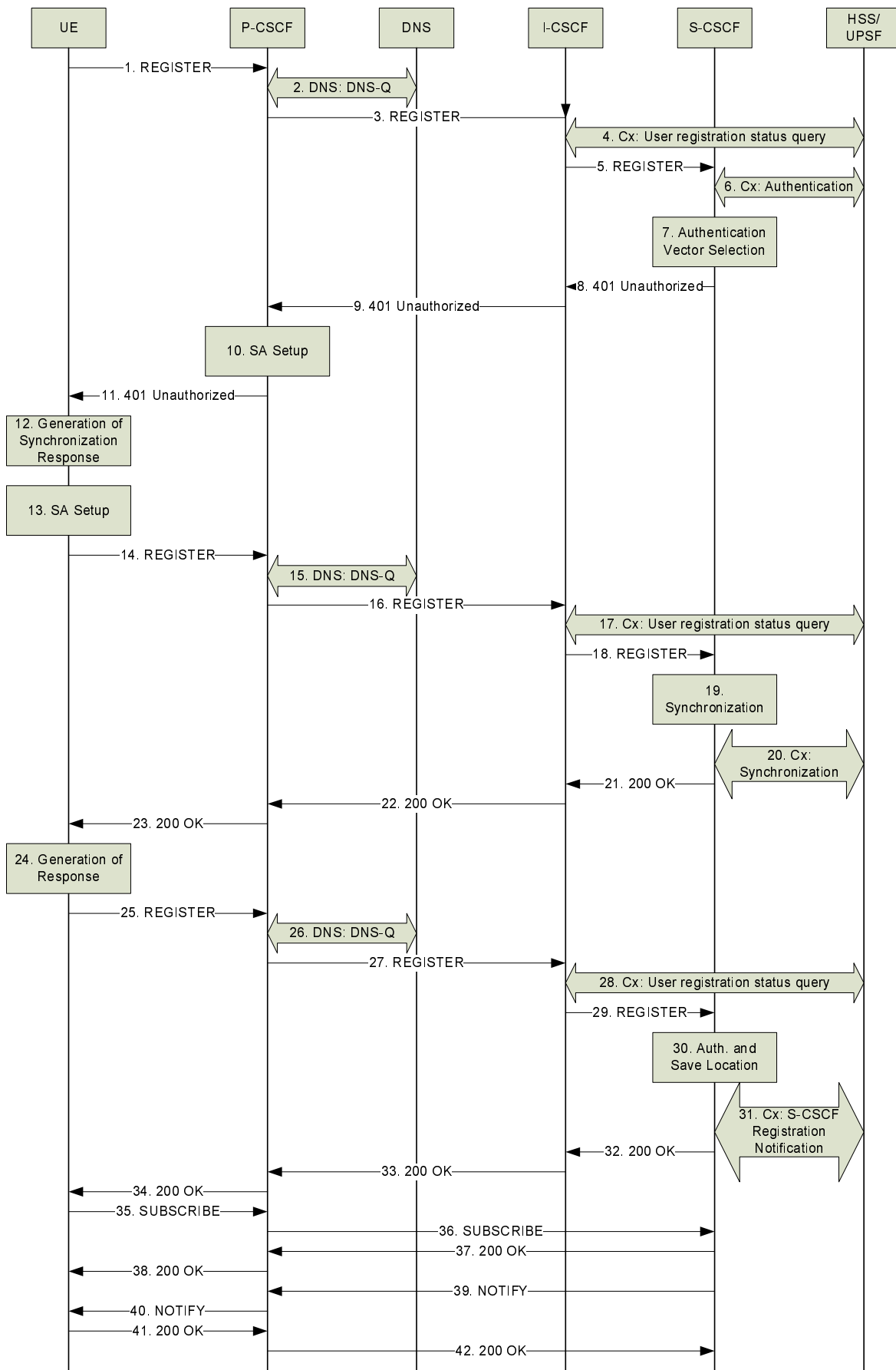
Figure 7: Successful initial registration with synchronization scenario signalling flow

Figure 7 is similar to figure 6. Additionally, one more REGISTER transaction is required to complete the process, as the second REGISTER was used for synchronization and not for authentication.

5.1.2.3 Scenario 3 - Re-registration - user currently registered

To refresh the registration timer the UE must send a re-registration request before the expiration time expires. This should be sent either 600 seconds before the expiration time if the registration time was greater than 1 200 seconds, or when half the registration time has passed when the registration time was under equal or less than 1 200 seconds. This scenario can also be employed at any time during the registration period when the UE intends to update its capabilities according to RFC 3840 [3].

If a secure channel has been set-up and it is used during this procedure, the S-CSCF does not need to authenticate the user and the signalling is presented in figure 8. If the request is not sent through the secure channel then the signalling flow is similar to that of the Initial Registration Scenario.

In figure 8 we have the signaling flow from TS 124 228 [7] (page 33: Figure 6.3-1); TISPAN has endorsed this call flow.
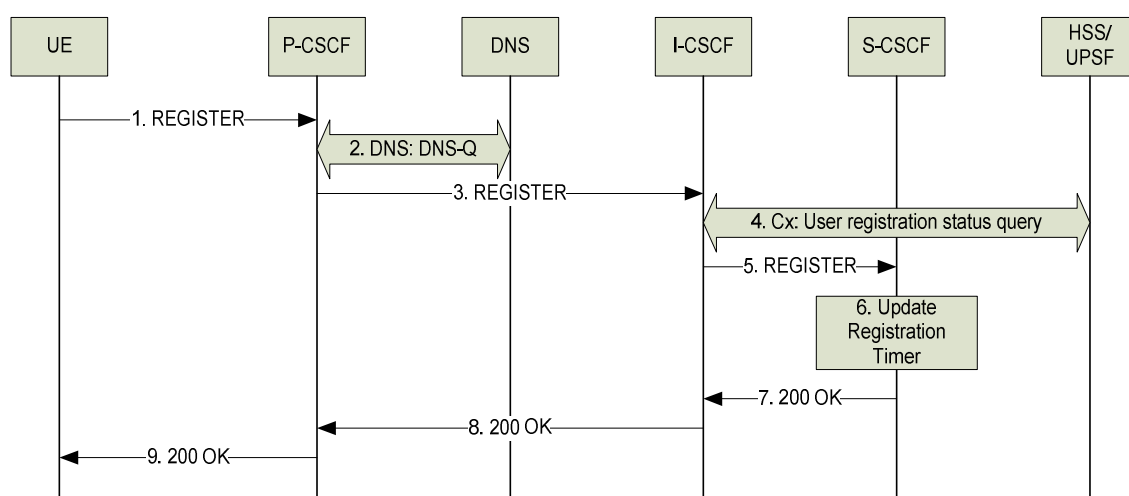
Figure 8: Re-Registration - user currently registered signalling flow

5.1.2.4 Scenario 4 - Re-subscription - user currently registered

As the subscription might have a different expiration timer as the registration, re-subscription is not necessarily linked to re-registration. The process is detailed in figure 9.
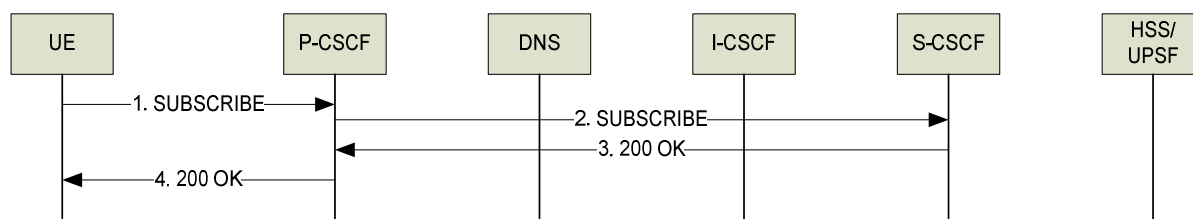
Figure 9: Re-subscription - user currently registered signaling flow

5.1.2.5 Scenario 5 - Re-registration - user roaming

When the UE is roaming to another visited network, the procedures are similar to those of initial registration. As there are no security association set-up with the new P-CSCF, the initial REGISTER request will be authenticated. The network will internally take care of the old registration as specified in clause 5.1.2.8, without any UE interaction.

5.1.2.6 Scenario 6 - UE initiated de-registration

When the UE requires terminating immediately the registration it can do so by issueing a REGISTER request with an expiration timer set to "0". The signalling flow is identical to clause 5.1.2.3.

5.1.2.7 Scenario 7 - Network initiated de-registration

The de-registration process can be triggered also from the network side, as result of an administrative event. To be informed about these changes the UE is required to subscribe to its own registration event package at the S-CSCF. There is no action required for the UE to perform on this scenario.

Based on the place where the administrative de-registration event occurs, there are two signalling flows possible depicted in the following two figures. Figure 10 is taken from TS 124 228 [7] (page 62: Figure 6.7.1-1) and figure 11 is from TS 124 228 [7] (page 66: Figure 6.7.2-1); TISPAN has endorsed this call flow.
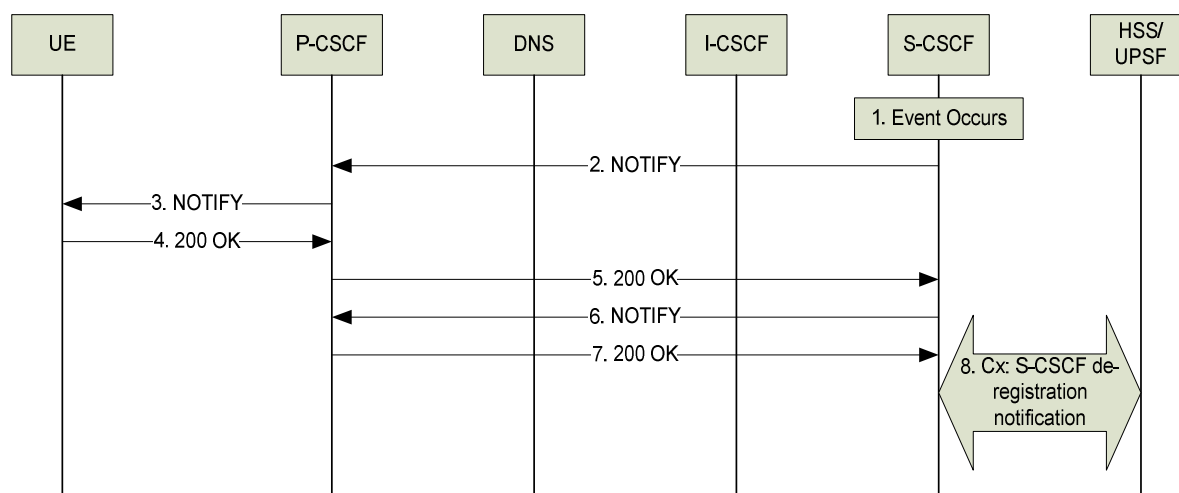
Figure 10: Network initiated de-registration - event at the S-CSCF - signalling flow
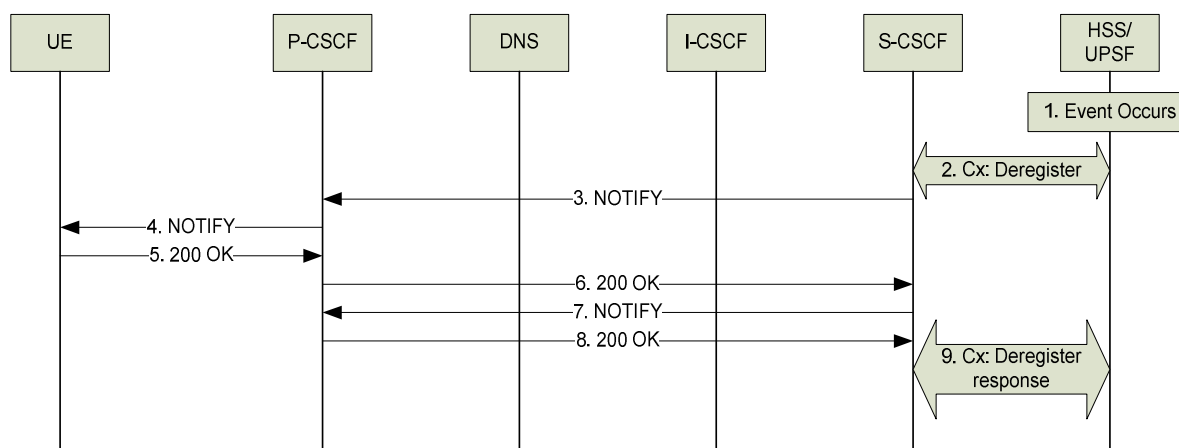
Figure 11: Network initiated de-registration - event at the HSS/UPSF - signalling flow

5.1.2.8 Scenario 8 - Network initiated de-registration upon roaming or expiration

Upon roaming, the S-CSCF should send the notification only to the old visited network P-CSCF and this process requires no interaction with the UE.

Upon expiration, the S-CSCF will send the notification to both the P-CSCF and the UE. Again, no interactions with the UE are required.

This scenario is included for completeness, even though there is no way to devise a benchmark test.

5.1.2.9   Scenario 9 - Network initiated re-authentication

In case that the home network requires a re-authentication of the user before the UE will normally initiate a re-registration as a refresh, it can notify the UE of this. The rest of the process is similar to an initial registration.

In the notification, a new expiration timer is set to a shorter period. If the UE fails to re-authenticate in this interval a normal Scenario 8 for expiration is triggered.

This scenario is included for completeness, even though there is no way to devise a benchmark test.

5.1.3   Scenario failures

Failures to perform these use-case scenarios and failure scenarios (e.g. user unkown, user not allowed to roam, etc.) are not described here and are out of scope for the benchmark. Before running the test, the tester will make sure that there will be no failures of the SUT as result of bad provisioning, Test System generated traffic, Test Environment issues, etc., such that an ideal SUT will always be able to remain in the desired scenario execution path. All failures that will happen during the normal run should be exclusively as the result of SUT malfunctions.

5.1.4   SUT topology

The internal elements of the topology are not mandated and can be freely chosen from the multitude of options for clause 4.1. The only indication is that the entry point in the System Under Test can be represented by one or many P-CSCFs.

5.1.5   Subscriber base

The subscriber base for the SUT is detailed in a separate XML Schema Definition file provided together with the present document (SubscriberBase.xsd). In the following paragraphs, the input parameters for this generator are explained.

As the Successful Initial Registration without Synchronization scenario could be employed to test the maximum number of subscribers accepted by a SUT, it is difficult to indicate a maximum limit for this value. Accordingly, the second choice for provisioning the data is to be employed.

Input parameters for the data generators:

- Realm - All the public and private identities will use the same realm. It must be a correct domain name of length Realm.Length.

- Subscribers.Count - the required subscriber count. This number should be generated from the test procedure indications.

- Subscriber - Each Subscriber contains exactly one private identity and exactly one attached public identity.

    - PrivateID:

        ▪ Identity - A valid user identity composed of the following:

            - Username - a valid username string with a length of PrivateId.Identity.MinLength to PrivateID.Identity.MaxLength characters with an equal distribution. It is acceptable that short usernames will have a limited number of distinct values. In the case that this limit is achieved for several username lengths, the rest of the usernames should have an equal distribution between them.

            - Domain - equal to the Realm value.

        ▪ Algorithm - the authentication algorithm that this user employs.

        ▪ K - the secret key for this user.

        ▪ OP - the operator specific OP value for this subscriber.

- PublicID:

  - Identity - A valid SIP URI composed of the following:

    - Username - a valid username string with a length of PublicId.Identity.MinLength to PublicID.Identity.MaxLength. The same rules apply as on the PrivateId.Identity.

    - Domain - equal to the Realm value.

- IDMapping:

  - PublicID.

  - PrivateID.

In table 2 the recommended values for this test are indicated. Changes to these values should be provided in the Results Report.

Table 2: Recommended values for successful initial registration without synchronization scenario

Name	Value
Realm.Length	16
Realm	imsbenchmark.org
Subscriber.Count	To be determined based on test procedure indications
PrivateID.Identity.MinLength	4
PrivateID.Identity.MaxLength	16
PrivateID.Identity.AcceptableChars	abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
PrivateID.Algorithm	Digest-AKAv1-MD5
PrivateID.K	0x6162636465666768696a6b6c6d6e6f70
PrivateID.OP	0x00000000000000000000000000000000
PublicID.Identity.MinLength	4
PublicID.Identity.MaxLength	16
PublicID.Identity.AcceptableChars	abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789

5.1.6   Metrics and design objectives

The following metrics need to be collected (see TS 186 008-1 [5] for details on the metrics):

Table 3: Metrics and IHS cases specific to Scenarios

Name	Additional note	IHS Case ?	Type	Reason for choice as metric
PX_TRT-REG1	Between message 1 and 11	Yes, if ≥ 2s	float	Processing time of first register transaction must be under 2 seconds
PX_TRT-REG2	Between message 14 and 23	Yes, if ≥ 2s	float	Processing time of second register transaction must be under 2 seconds
PX_TRT-DNS1	DNS query 3	No	float	Account for DNS latency
PX_TRT-DNS2	DNS query 4	No	float	Account for DNS latency
PX_CRT	TRT-REG1 + TRT-REG2	No	float	Total register transaction processing time - without key processing time

Table 4: Metrics and IHS cases specific to clause 5.1.2.2

Name	Additional note	IHS Case ?	Type	Reason for choice
PX_TRT-REG1	Between message 1 and 11	Yes, if ≥ 2 s	float	Processing time of first register transaction must be under 2 seconds
PX_TRT-REG2	Between message 14 and 23	Yes, if ≥ 2 s	float	Processing time of second register transaction must be under 2 seconds
PX_TRT-REG3	Between message 25 and 34	Yes, if ≥ 2 s	float	Processing time of third register transaction must be under 2 seconds
PX_TRT-DNS1	DNS query 2	No	float	Account for DNS latency
PX_TRT-DNS2	DNS query 15	No	float	Account for DNS latency
PX_TRT-DNS3	DNS query 26	No	float	Account for DNS latency
PX_TRT-REG	TRT-REG1 + TRT-REG2 + TRT-REG3	No	float	Total register transaction processing time - without key processing time

Table 5: Metrics and design objectives specific to clause 5.1.2.3

Name	Additional note	IHS Case ?	Type	Reason for choice
PX_TRT-REG1	Between message 1 and 9	Yes, if ≥ 2 s	float	Processing time of register transaction must be under 2 seconds
PX_TRT-DNS1	DNS query 2	No	float	Account for DNS latency

Table 6: Metrics and design objectives specific to clause 5.1.2.4

Name	Additional note	IHS Case ?	Type	Reason for choice
PX_TRT-REG1	Between message 1 and 4	Yes, ≥ 2 s	float	Processing time of register transaction must be under 2 seconds

5.2   Session set-up/tear-down use-case

This use-case corresponds to a normal 2-party call. The "session set-up" part refers to the establishment of the call and the "session tear-down" to its destroyal. Before this scenario is performed, the respective User Endpoints which belong to the particular SUT domain and involved in the communication have to be successfully registered/re-registered. The registration period must not during execution of this use-case (it is acceptable to do a re-registration refreshment during a call scenario).

This version of the document covers several call scenarios that are encountered the most in a real life deployments:

- Call Successful.

- Call Failed (e.g. terminating party not found).

- Call Abandoned (e.g. originating party cancels the call during ringing, before the terminating party answers).

- Call Rejected (e.g. the terminating party rejects the call while busy).

Then several situations for the User Endpoints can been considered, based on the IP-CAN resource reservation status on the two participating sides. For example the originating and/or terminating party might require resource reservation or they could already have the resources preallocated, before the start of the scenario.

In case that the Access Network is not part of the SUT, the IP-CAN reservation steps should be simulated by fixed delays in the Test System and the Test Report must contain this values.

In all successful call scenarios defined in the next subchapters, the signaling flow of the tear-down part is depicted as initiated on the terminating side of the call. When generating traffic, the Test System should also simulate the symmetric case when the originating user initiates the tear-down and the Test System should maintain a 1:1 ratio between the two cases.

During these scenario there are several waiting times during which the Test System must pause, like the ringing time or the call hold time. Distribution of these delays can follow a constant or a Poisson distribution.

5.2.1   Definition

Session set-up/tear-down is the scenario in which a multi-media communication session is set-up is attempted between two users, of which at least one is an IMS one. During the set-up period a "ringing" delay is introduced and if the set-up is successful then the scenario is put on hold for the duration of the call and then it is terminated with a tear-down sequence.

5.2.2   Scenarios

5.2.2.1   Scenario 1 - Successful call - resource reservation on both sides

In this scenario both users are registered. The signaling flow is presented below.

Figure 12: Successful call - resource resevation on both sides

5.2.2.2   Scenario 2 - Successful call - no resource reservation on originating side

In this case only the terminating party needs to reserve resources as the originating one is considered to have them already.

Figure 13: Successful call - no resource reservation on originating side

5.2.2.3   Scenario 3 - Successful call - no resource reservation on the terminating side

The signaling for this case is very similar to the one for a Successful Call with reservation on both sides.

Figure 14: Successful call - no resource reservation on the terminating side

5.2.2.4   Scenario 4 - Successful call - no resource reservation on either side

This is the simplest scenario for a successful call and it is similar to a normal SIP call.
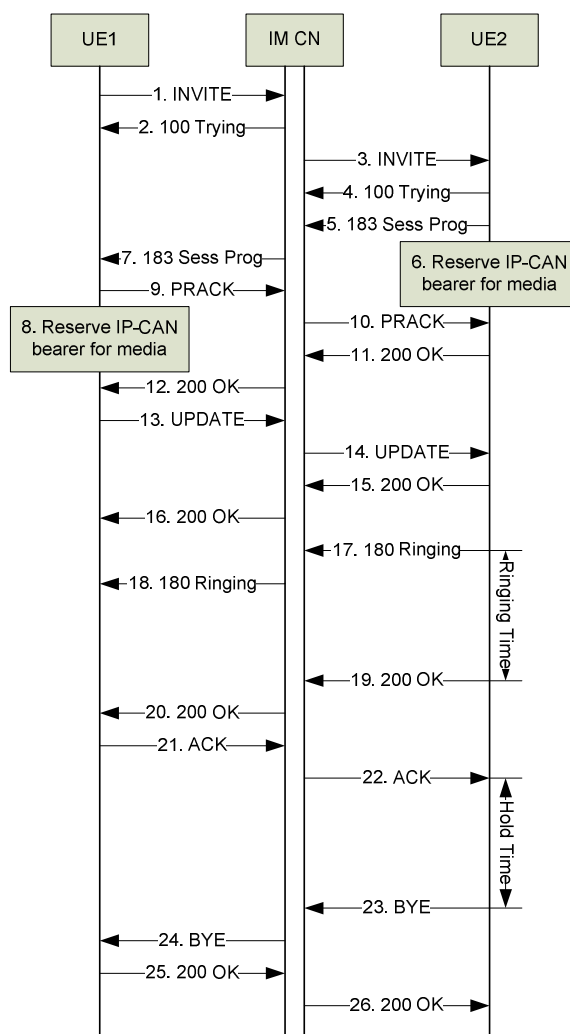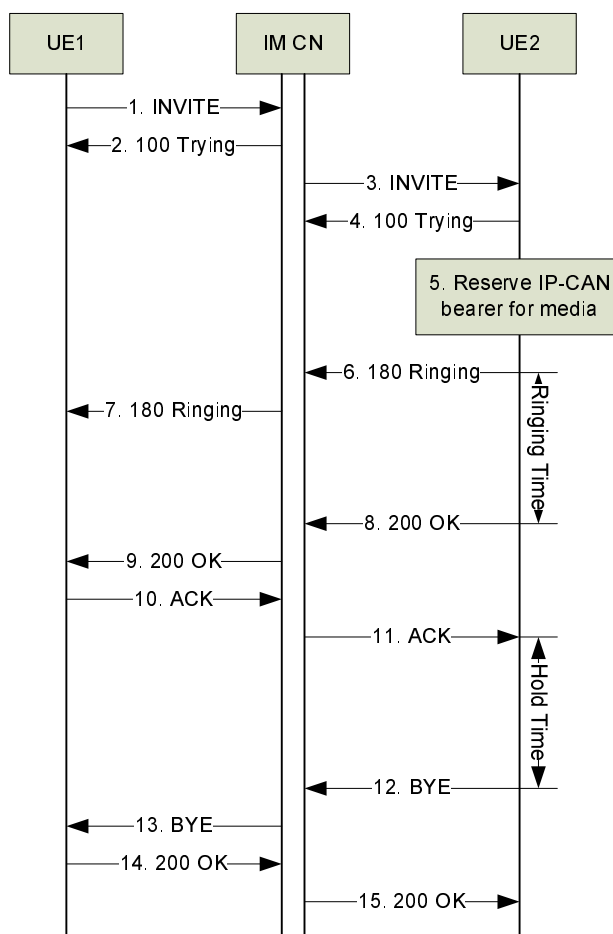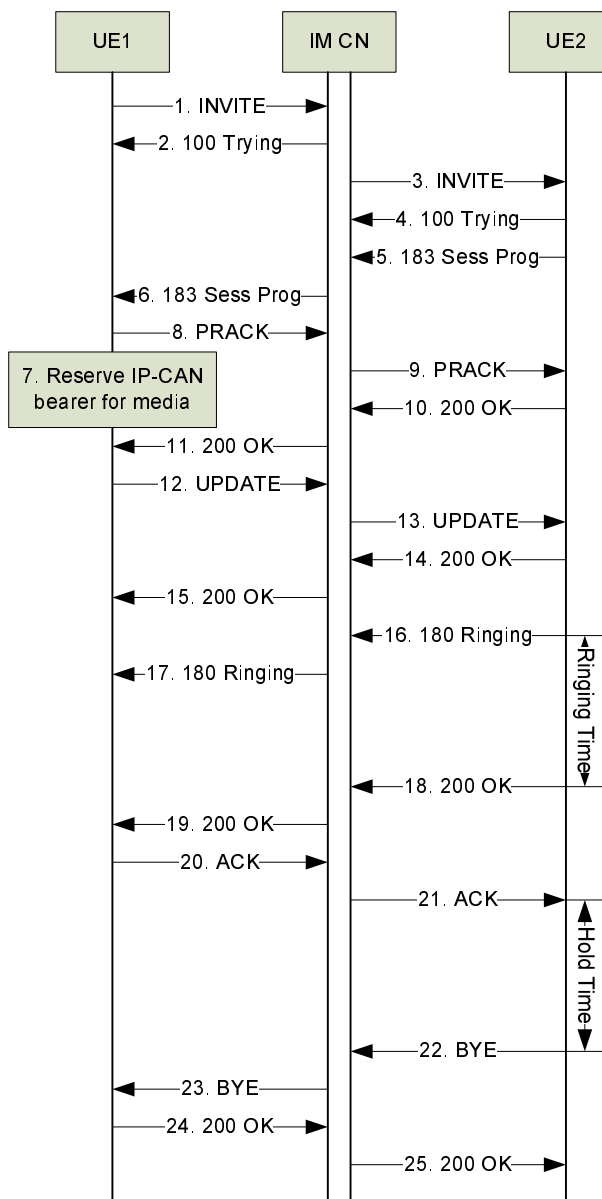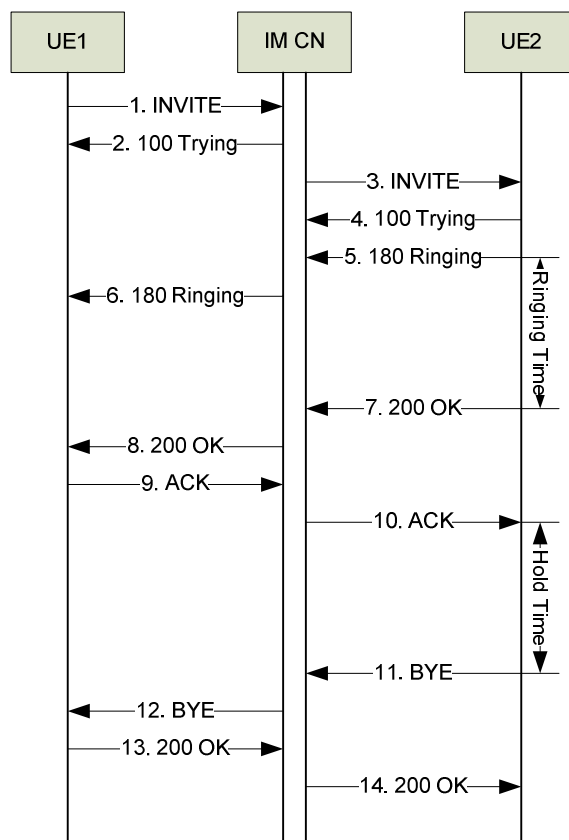

Figure 15: Successful call - no resource reservation on either side

5.2.2.5   Scenario 5 - Successful call - resource reservation on originating side and non-IMS terminating side

In this case the originating user will reserve resources after the call is answered. The terminating user is non-IMS and it is put on hold until a re-INVITE is transmited with indication on the resources reserved.

To simulate the non-IMS user the Test System will initiate a call to an open destination on itself. The Request-URI will be filled with this IP address and port number.

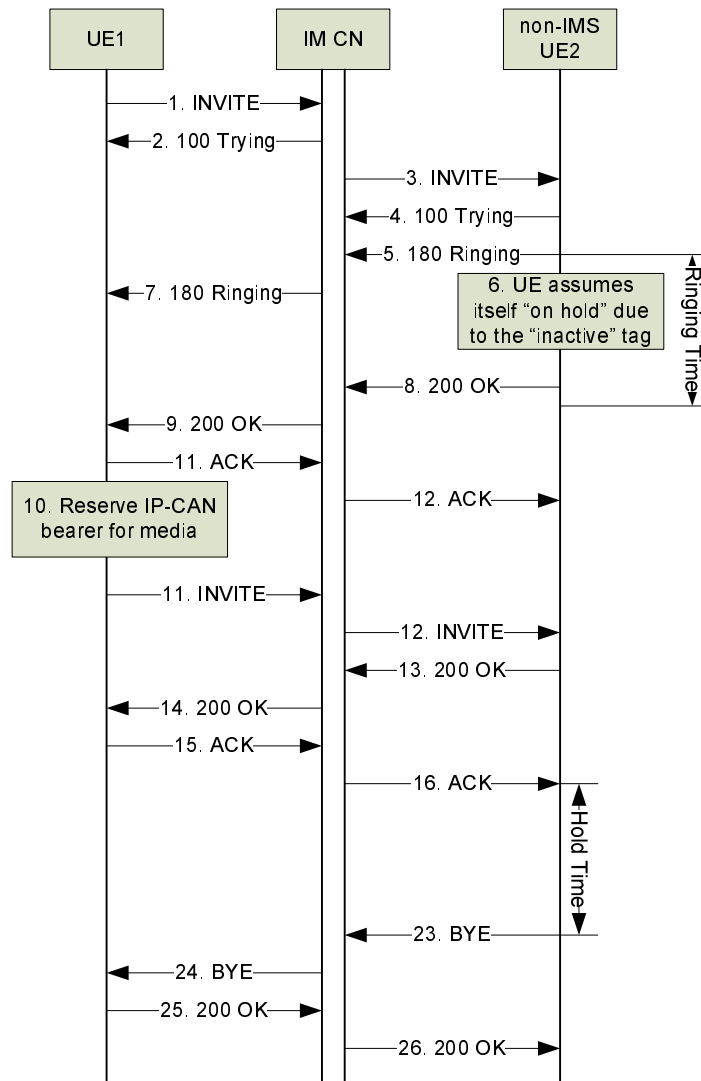**Figure 16: Successful call - originating user reserves resource and non-IMS terminating user**

5.2.2.6   Scenario 6 - Successful call - no resource reservation on originating side and non-IMS terminating side

The signaling for this scenario is similar to the ones in clause 5.2.2.4. The difference is in the non-IMS terminating user and as such the special conditions from clause 5.2.2.5 apply.

5.2.2.7   Scenario 7 - Successful call - originating side non-IMS and resource reservation on terminating side

Here the originating side is non-IMS and the Test System should open separate address and port and should contact the SUT through the I-CSCF entry point.
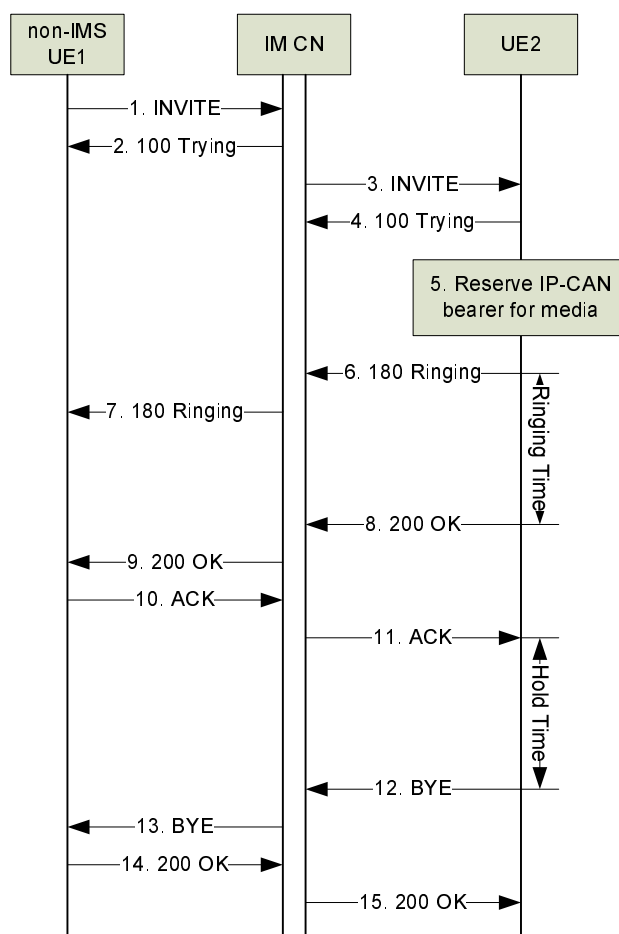
Figure 17: Successful call - Originating user non-IMS and resource reservation on terminating user

5.2.2.8   Scenario 8 - Successful call - originating side non-IMS and no resource reservation on terminating side

The signaling for this scenario is similar to the ones in clause 5.2.2.4. The difference is in the non-IMS terminating user and as such the special conditions from clause 5.2.2.7 apply.

5.2.2.9   Scenario 9 - Abandoned call - resource reservation on both sides

This scenario illustrates the case when the terminating user does not answer the phone in the ringing time and the originating user abandons the call. The first part of the call, including the resource reservation is similar to the successful call scenario.

Figure 18: Scenario 9 - Abandoned Call - Resource reservation on both sides

5.2.2.10   Scenario 10 - Abandoned call - no resource reservation on originating side

This scenario can be derived from clause 5.2.2.9 by applying the similar signaling as in clause 5.2.2.2.

5.2.2.11   Scenario 11 - Abandoned call - no resource reservation on terminating side

This scenario can be derived from clause 5.2.2.9 by applying the similar signaling as in clause 5.2.2.3.

5.2.2.12   Scenario 12 - Abandoned call - no resource reservation on either side

This scenario can be derived from clause 5.2.2.9 by applying the similar signaling as in clause 5.2.2.4.

5.2.2.13   Scenario 13 - Abandoned call - resource reservation on originating side and non-IMS terminating side

This scenario can be derived from clause 5.2.2.9 by applying the similar signaling as in clause 5.2.2.5.

5.2.2.14   Scenario 14 - abandoned call - no resource reservation on originating side and non-IMS terminating side

This scenario can be derived from clause 5.2.2.9 by applying the similar signaling as in clause 5.2.2.6.

5.2.2.15   Scenario 15 - Abandoned call - originating side non-IMS and resource reservation on terminating side

This scenario can be derived from clause 5.2.2.9 by applying the similar signaling as in clause 5.2.2.7.

5.2.2.16   Scenario 16 - Abandoned call - originating side non-IMS and no resource reservation on terminating side

This scenario can be derived from clause 5.2.2.9 by applying the similar signaling as in clause 5.2.2.8.

5.2.2.17   Scenario 17 - Rejected call - resource reservation on both sides

This scenario illustrates the case when the terminating user refuses the call after the ringing time. The first part of the call, including the resource reservation is similar to the successful call scenario.
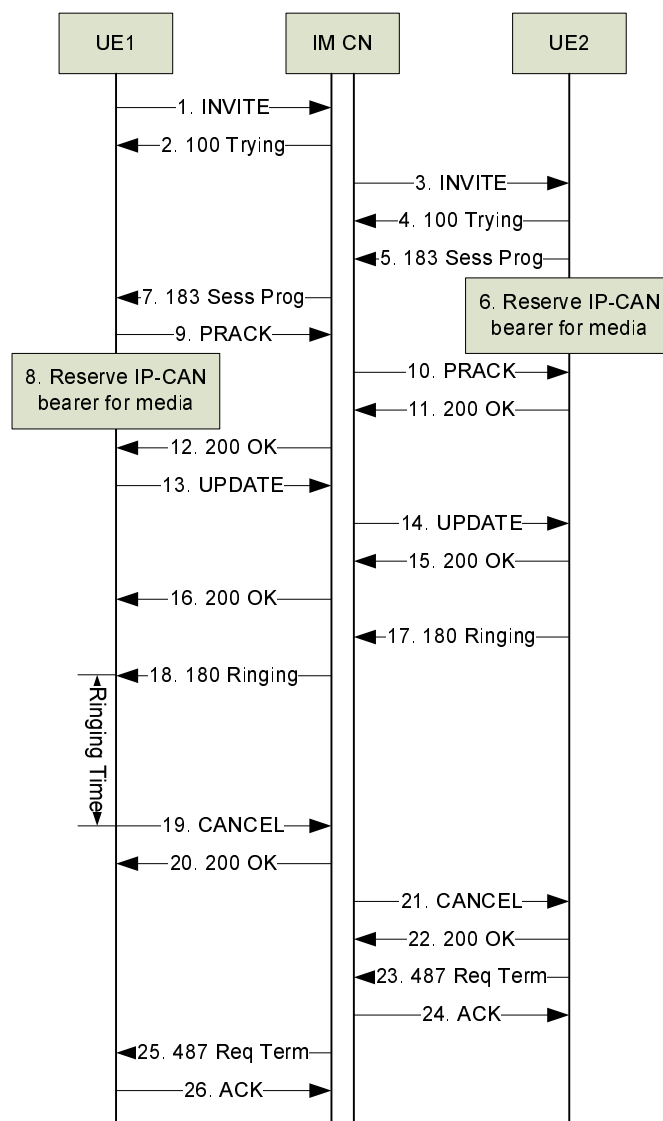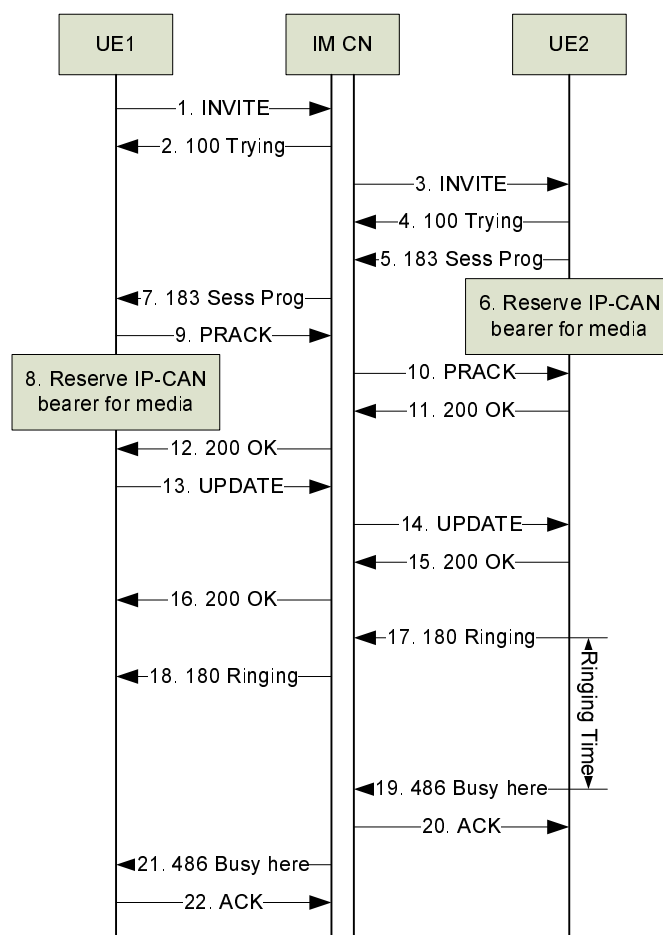
Figure 19: Rejected call - resource reservation on both sides

5.2.2.18   Scenario 18 - Rejected call - no resource reservation on originating side

This scenario can be derived from clause 5.2.2.17 by applying the similar signaling as in clause 5.2.2.2.

5.2.2.19   Scenario 19 - Rejected call - no resource reservation on terminating side

This scenario can be derived from clause 5.2.2.17 by applying the similar signaling as in clause 5.2.2.3.

5.2.2.20   Scenario 20 - Rejected call - no resource reservation on either side

This scenario can be derived from clause 5.2.2.17 by applying the similar signaling as in clause 5.2.2.4.

5.2.2.21   Scenario 21 - Rejected call - resource reservation on originating side and non-IMS terminating user

This scenario can be derived from clause 5.2.2.17 by applying the similar signaling as in clause 5.2.2.5.

5.2.2.22   Scenario 22 - Rejected call - no resource reservation on originating side and non-IMS terminating side

This scenario can be derived from clause 5.2.2.17 by applying the similar signaling as in clause 5.2.2.6.

5.2.2.23   Scenario 23 - Rejected call - originating side non-IMS and resource reservation on terminating side

This scenario can be derived from clause 5.2.2.17 by applying the similar signaling as in clause 5.2.2.7.

5.2.2.24   Scenario 24 - Rejected call - originating side non-IMS and no resource reservation on terminating side

This scenario can be derived from clause 5.2.2.17 by applying the similar signaling as in clause 5.2.2.8.

5.2.2.25   Scenario 25 - Failed call

This scenario represents the case when the call fails based on the situation of the involved parties. For example, the originating party dialed an invalid number or the terminating party is not registered or the terminating party does not exist. Only the case when the terminating party is not found is depicted and similar scenarios can be derived.
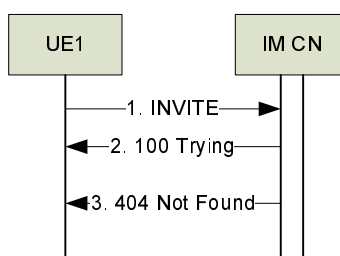
Figure 20: Failed call

As it can be observed, only one registered user is required for this scenario.

5.2.3   Scenario failures

Failures to perform these use-case scenarios and failure scenarios (e.g. user unkown, user not allowed to roam, etc) are not described here and are not in scope for the benchmark. Before running the test, the tester will make sure that there will be no failures of the SUT as result of bad provisioning, Test System generated traffic, Test Environment issues, etc., such that an ideal SUT will always be able to remain in the desired scenario execution path. All failures that will happen during the normal run should be exclusively as result of SUT malfunctions.

5.2.4   SUT topology

The internal elements of the topology are not mandated and can be freely chosen from the multitude of options for clause 4.1. The only indication is that the entry point in the System Under Test can be represented by one or many Proxy-CSCFs plus an Interrogating-CSCF whose IP address is to be determined by DNS queries.

5.2.5   Subscriber base

The subscriber base for the SUT is detailed in a separate XML Schema Definition file provided together with the present document (SubscriberBase.xsd). To generate reference data, a data-generator is also available. In the following paragraphs, the input parameters for this generator are explained.

The data definition for this use-case extends the one of the Registration/De-Registration use-case, as the actors involved usually need to be registered before performing any call scenario.

Additionally, several external URI to be used on scenarios with non-IMS actors are defined here. The host parts should be DNS configured to point towards the Test System.

Additionl input parameters for the data generators:

- ExternalRealm.Length - All the non-IMS actors will have the hostname of this length.

- ExternalRealm.Count - the required realm count. This number should be generated from the test procedure indications.

- ExternalSubscriber - Each subscriber contains exactly one private identity and exactly one attached public identity.

  - PublicID

    - Identity - A valid SIP URI composed of the following:

      - Username - a valid username string with a length of PublicId.Identity.MinLength to PublicID.Identity.MaxLength. The same rules apply as on the PrivateId.Identity.

      - Domain - equal to one of the ExternalRealm value.

In table 7 the recommended values for this test are indicated. Changes to these values should be provided in the Results Report.

Table 7: Recommended values for the session set-up/tear-down use-case

Name	Value
ExternalRealm.Length	16
ExternalRealm.Count	128
ExternalSubscriber.PublicID.Identity.MinLength	4
ExternalSubscriber.PublicID.Identity.MaxLength	16
ExternalSubscriber.PublicID.Identity.AcceptableChars	abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789

5.2.6   Metrics and design objectives

The following metrics need to be collected (see TS 186 008-1 [5] for details on the metrics).

Table 8: Metrics and IHS cases specific scenario 1, 2, 3, 4, 5, 6, 7, 8

Name	Additional note	IHS Case ?	Type	Reason for choice as metric
PX_TRT-SES1	Session setup time (between caller sending INVITE and first callee receiving ACK)	Yes, if ≥ 8 s	float	Session setup time must be under 8 s, **not including** the ringing time
PX_TRT-SES2	Session initiation transversal time (between caller sending INVITE and callee receiving INVITE)	Yes, if ≥ 2 s	float	Called party must get INVITE in less than 2 s
PX_TRT-REL1	Between first BYE sent and corresponding 200 OK	Yes, if ≥ 2 s	float	Time to release the resource must be less than 2 s

Table 9: Metrics and IHS cases specific scenario 5

Name	Additional note	IHS Case ?	Type	Reason for choice
PX_TRT-SES3	INVITE and re-INVITE cost (between caller sending first INVITE and callee receiving the second ACK)	Yes, if ≥ 4 s	float	The global session establishment must be faster than 4 s

Table 10: Metrics and IHS cases specific scenario 9, 10, 11, 12, 13, 14, 15, 16

Name	Additional note	IHS Case ?	Type	Reason for choice
PX_TRT-SES4	Between caller sending INVITE and caller receiving first 200 OK	Yes, if ≥ 8 s	float	Session setup time must be under 8 s, **not including** the ringing time
PX_TRT-SES5	Between caller sending CANCEL and caller receiving corresponding 200 OK	Yes, if ≥ 1 s	float	Call resources must be released in less than 1 s

Table 11: Metrics and IHS cases specific scenario 17, 18, 19, 20, 21, 22, 23, 24

Name	Additional note	IHS Case ?	Type	Reason for choice
PX_TRT-SES6	Between caller sending INVITE and caller receiving 486 Busy Here	Yes, if ≥ 8 s	float	Session abandon time must be under 8 s, **not including** the ringing time

Table 12: Metrics and IHS cases specific scenario 25

Name	Additional note	IHS Case ?	Type	Reason for choice
PX_TRT-SES7	Between caller sending INVITE and caller receiving 404 Not Found	Yes, if ≥ 1s	float	Call resources must be released in less than 1 s

5.3   Page-mode messaging use-case

Page-mode messaging is the simple use-case when a message is exchange between two peers. This simple messaging is often referred as page-mode messaging, as defined in TS 124 247 [8] and TS 183 041 [4]. This kind of communication makes sense when a small number of messages are exchanged between 2 peers.

A normal call setup and tear-down is often too complicated for transmitting small data quantities. It takes a minimum of 5 SIP messages and typically 7 for a normal session setup and tear-down. If the application does not require relating between messages at the protocol level, simple messaging can be more efficient, employing just 2 SIP messages.

Each UE can emit MESSAGE requests towards another UE. To this it can attach data in the form of the Content-Body. This data can be in any arbitrary format, the type can be indicated in the Content-type header and the length in the Content-Length header. If the whole message exceeds the MTU of the transport layer (usually around 1 500 bytes), because of fragmentation, it will be relayed not over UDP, but TCP.

5.3.1   Definition

Message exchange is a scenario in which a message is transmited between two peers over the IMS network.

5.3.2   Scenarios

5.3.2.1   Scenario 1 - Successful message exchange

In this scenario, it is considered that both users are registered and the message will be relayed successfully. The terminating party will always respond with a success response.
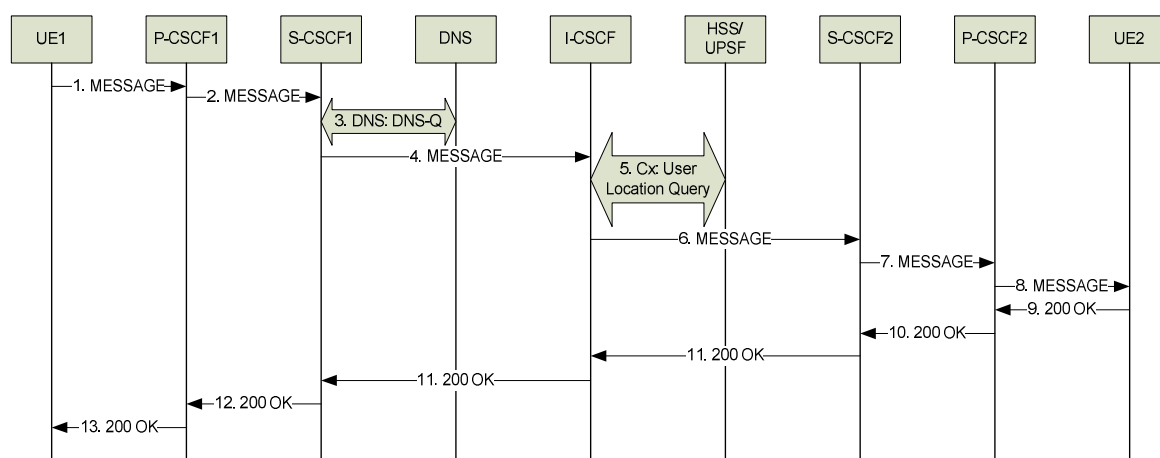

Figure 21: Signaling flow for message exchange (from TS 124 228 [7] page 532: Figure 10.6-1)

5.3.2.2   Scenario 2 - Unsuccessful message exchange - called user not found

In this scenario, it is considered that the destination is either not registered or not existent. In both cases, the signalling flow is the same. Only the originating party of the TS is involved in this scenario.
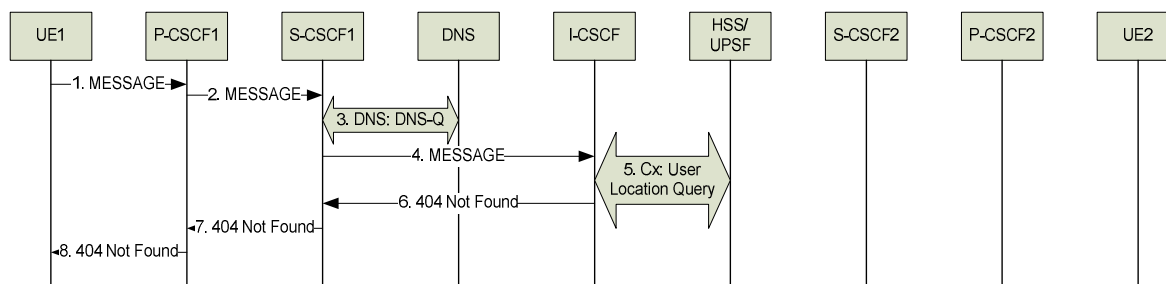

Figure 22: Signaling flow for unsuccessful message exchange

5.3.3   Scenario failures

Failures to perform these use-case scenarios and failure scenarios (e.g. user unkown, user not allowed to roam, etc) are not described here and are not in scope for the benchmark. Before running the test, the tester will make sure that there will be no failures of the SUT as result of bad provisioning, TS generated traffic, Test Environment issues, etc., such that an ideal SUT will always be able to remain in the desired scenario execution path. All failures that will happen during the normal run should be exclusively as result of SUT malfunctions.

5.3.4   SUT topology

The internal elements of the topology are not mandated and can be freely chosen from the multitude of options for clause 4.1. The only indication is that the entry point in the System Under Test can be represented by one or many Proxy-CSCF.

5.3.5   Subscriber base

The subscriber base for the SUT is detailed in a separate XML Schema Definition file provided together with the present document (SubscriberBase.xsd). To generate reference data, a data-generator is also available. In the following paragraphs, the input parameters for this generator are explained.

The data definition for this use-case extends the one of the Registration/De-Registration use-case, as the actors involved need to be registered before performing any messaging scenario.

There is no additional data required.

5.3.6   Metrics and design objectives

The following metrics must be collected (see TS 186 008-1 [5] for details on the metrics).

Table 13: Metrics and IHS Cases for clause 5.3: "Page-mode Messaging Use-Case"

Metric Name	Description of Metric	IHS case ?	Type	Reason for choice as metric
PX_PMM Data Size	Number of characters of text in page mode message	No	integer	Defined in TS 186 008-3 [6] as part of benchmark test traffic set and traffic-time profile

Table 14: Metrics and IHS cases specific to clause 5.3.2.1: "Successful Message Exchange"

Name	Additional note	IHS Case ?	Type	Reason for choice
PX_TRT-PMM1	Between message 1 and 13	Yes, if ≥ 2 s	float	Message transmission latency from UE1 to UE2
PX_TRT-DNS-Q	DNS query 3 for I-CSCF	No	float	Test environment metric for collection
PX_TRT-ULQ	HSS/UPSF query 5 for UE2 Location	No	float	SUT metric for collection

Table 15: Metrics and IHS Cases specific to clause 5.3.2.2:
Scenario 2 - Unsuccessful Message Exchange - Called User Not Found"

Name	Additional note	IHS Case ?	Type	Reason for choice as metric
PX_TRT-PMM2	Between message 1 and 8	Yes, if ≥ 2 s	float	Message transmission latency from UE1 to UE2
PX_TRT-DNS-Q	DNS query 3 for I-CSCF	No	float	Test environment metric for collection
PX_TRT-ULQ	HSS/UPSF query 5 for UE2 Location	No	float	SUT metric for collection

Annex A (informative):
Bibliography

ETSI TR 121 905: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Vocabulary for 3GPP Specifications (3GPP TR 21.905 version 7.0.0 Release 7)".

ETSI TS 123 228: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); IP Multimedia Subsystem (IMS); Stage 2 (3GPP TS 23.228 Release 6)".

ETSI TS 124 247: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Messaging service using the IP Multimedia (IM) Core Network (CN) subsystem; Stage 3 (3GPP TS 24.247)".

History

Document history		
V1.1.1	October 2007	Publication