# Presentation title : IMS/PES Platform Performance Benchmark

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**Workshop**

**IMPLEMENTATION EXPERIENCE OF NETWORK PERFORMANCE PARAMETERS CONTROL SYSTEMS AND GRANTING REQUIRED LEVEL OF SERVICES QUALITY ON THE OPERATOR NETWORKS. SENSOR NETWORKS – AS OPTIMIZATION TOOL FOR VEHICULAR TRAFFIC FLOW**

**Moscow**

**27-29 April 2011**

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# Why is IMS Benchmarking needed?

- Goal - performance benchmark for PSTN/ISDN Emulation Sub-system (PES) components
  - Performance and scalability testing of all PSTN/ISDN Emulation Sub-system (PES) and related components with simulated real-world traffic
  - Measurement and analysis of important QoS parameters
  - Regression Tests with applications after Release Change
- Why
  - Creation of objective means to compare overall PSTN/ISDN Emulation Sub-system (PES) of different systems by performance (and price)
  - Check ability of hardware/software to run the PSTN/ISDN Emulation Sub-system (PES)
- How
  - Define standard scenarios and traffic models for the work load
  - Define the metrics to be measured
  - Standardize the test procedure, the test parameters and the Benchmark test report
- Where
  - Standardization of IMS benchmarking at ETSI TISPAN WG6; ETSI TC INT
  - Version 2.0 of PSTN/ISDN Emulation Sub-system (PES) benchmarking available

# History

- June 2005 - FOKUS and INTEL demonstrated a proof of concept for IMS Benchmark at VON
- March 2007 - IMS Benchmark published as TS 186008: parts 1-3
- January 2011 - PSTN/ISDN Emulation Sub-system (PES) published as TS 186025: parts 1-2

# Standard Specification Parts

- Specification Parts

1. Core Concepts: Benchmark descriptions, architectures, processes, and information models
   TS 186 025-1 V.2.1.1

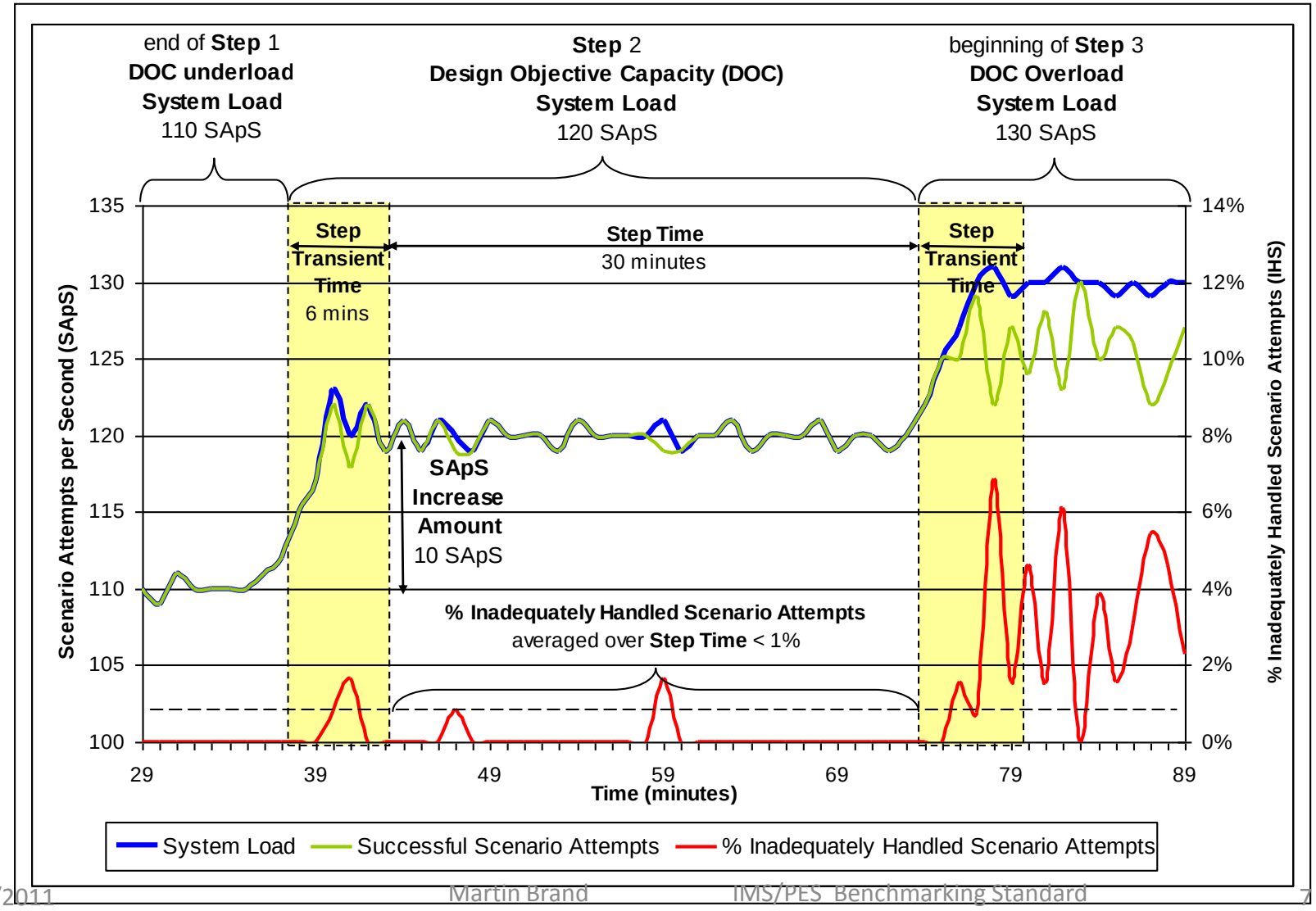
2. Subsystem Configurations and Benchmarks: The document contains the specific benchmarking use-cases and scenarios, along with scenario specific metrics and design objectives.
   TS 186 025-2 V.2.2.1

3. Traffic Sets and Traffic Profiles: defines an initial benchmark test through the specification of a traffic set, traffic-time profile and benchmark test procedure.

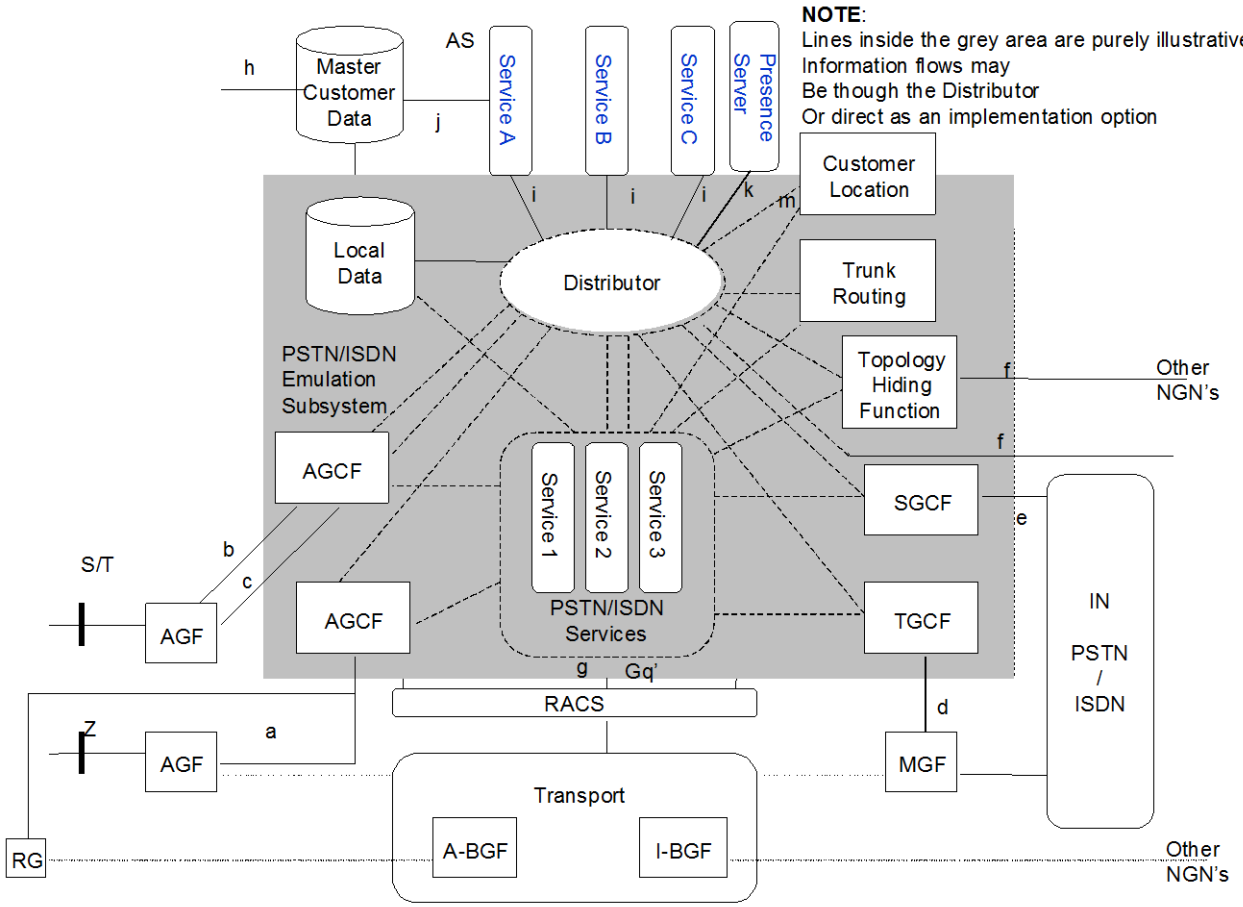
4. Reference Load network quality parameters : defines Reference Load network quality parameters for the use cases.

   TS 186 025-4 Available Juli 2011

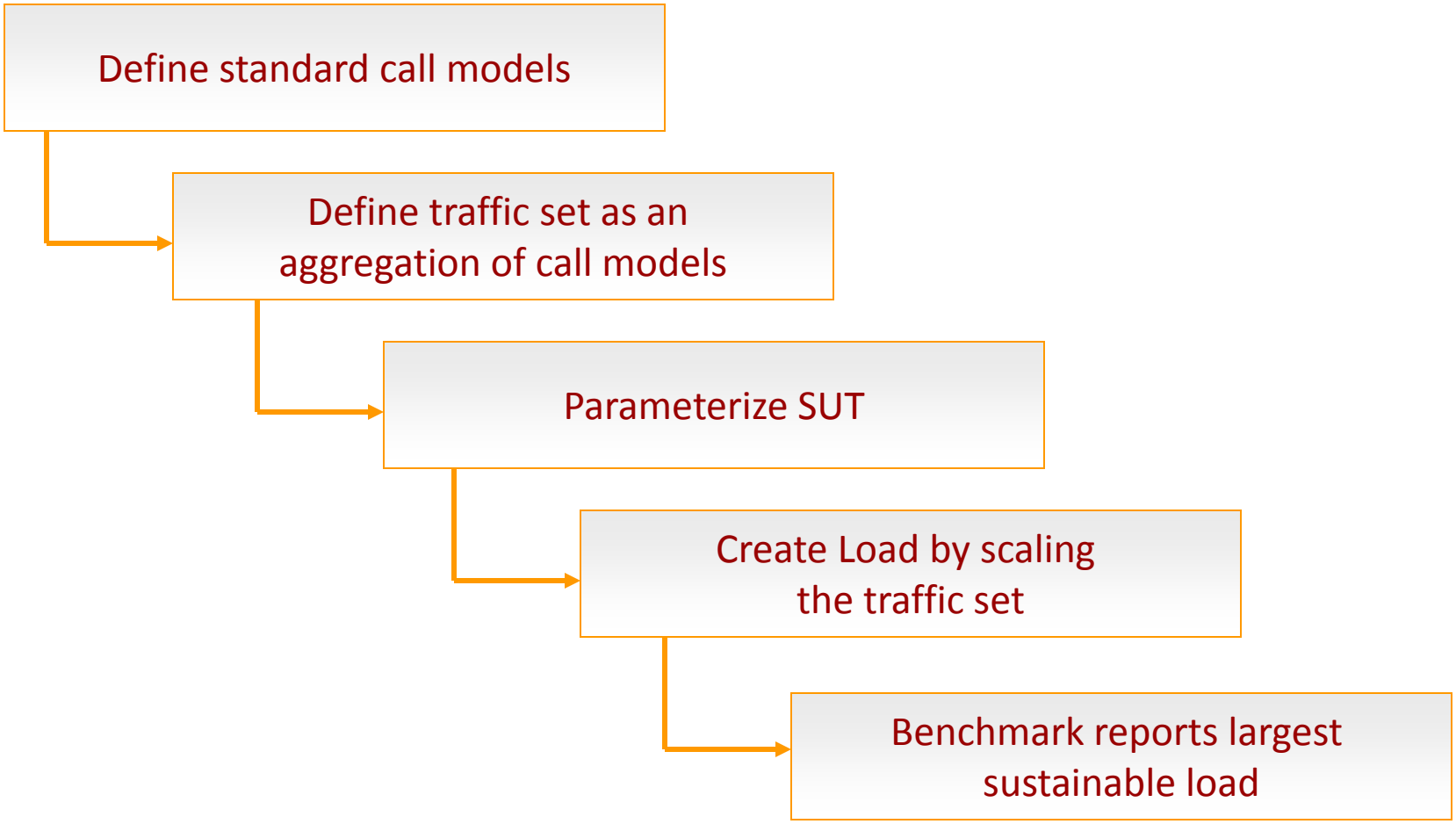
# Motivating Example



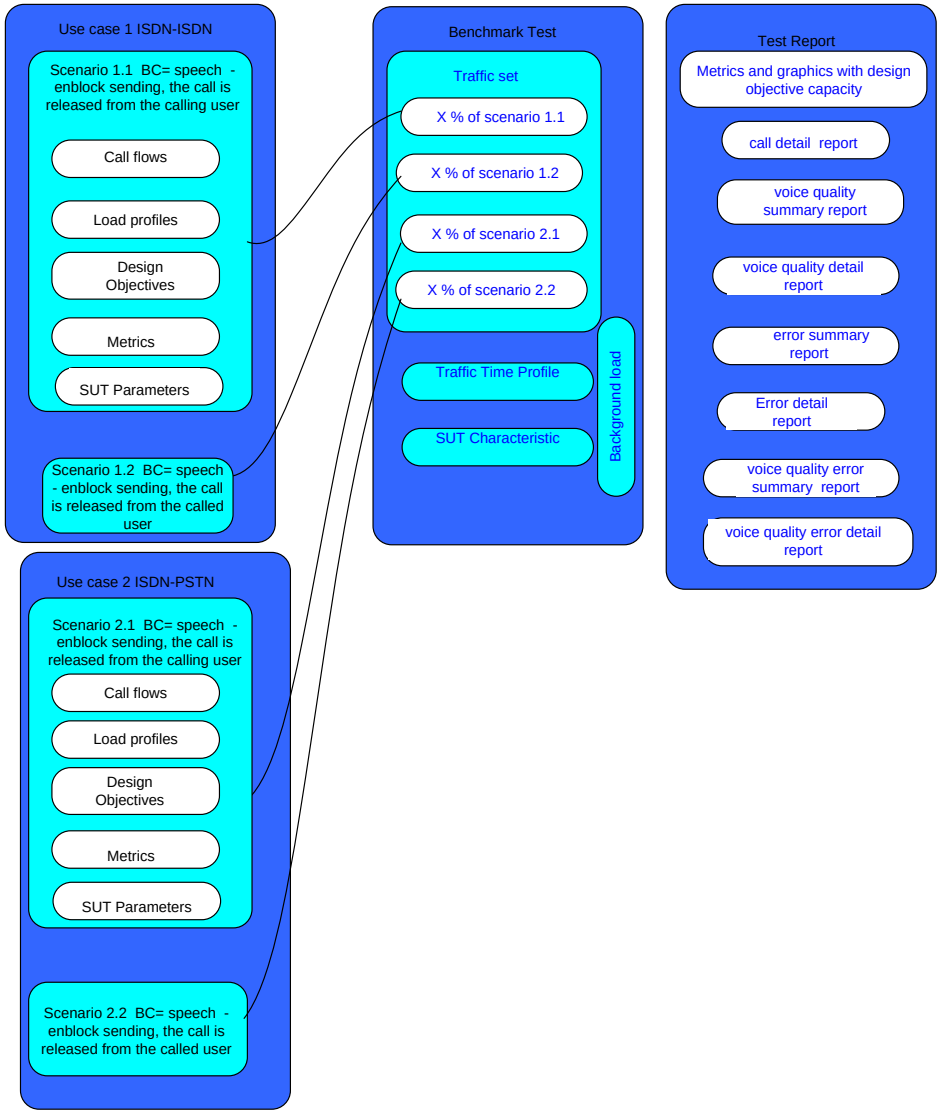
# Scope of the IMS/PES Performance Benchmark Part 1, Section 5



# Benchmark Development Process



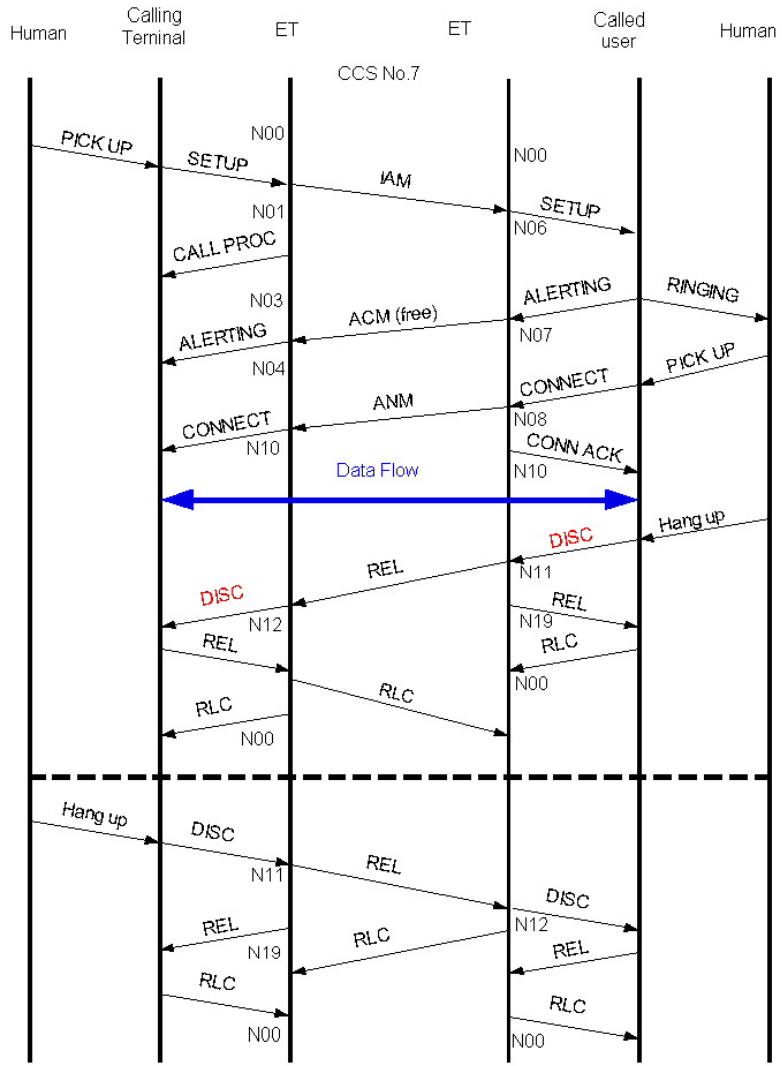
# Benchmark Information Model
# Part 1, Section 4



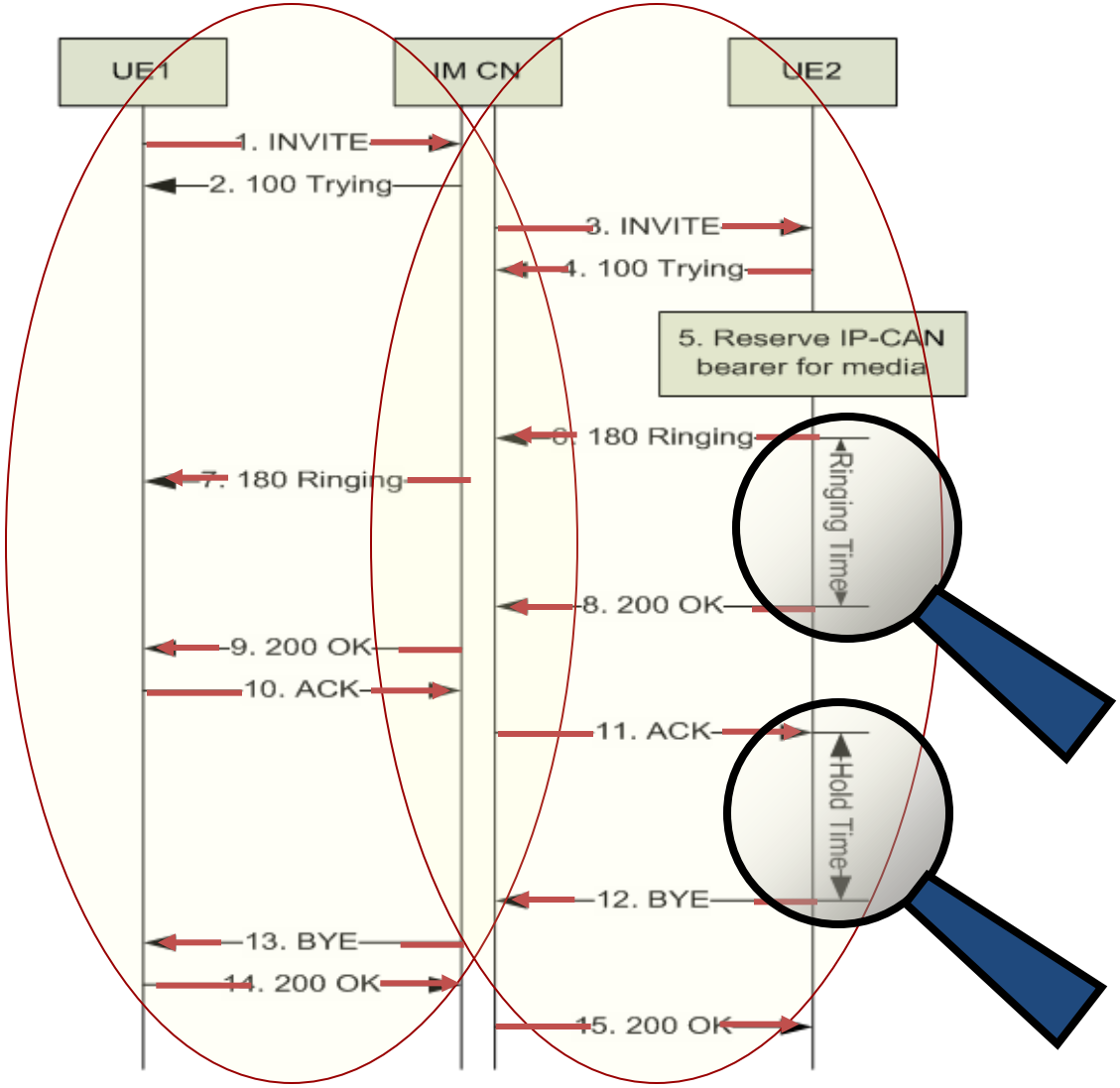
# Use-case

- 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.

# Scenario Example: ISDN Call



# Scenario Example: IMS Call



# Call Scenarios (1)

**Successful Call**

- ISDN - ISDN Scenario 1.1 Basic call with BC= speech - enblock sending; The call is released from the calling user
- ISDN - ISDN Scenario 1.2 Basic call with BC= speech - enblock sending; The call is released from the called user
- ISDN - ISDN Scenario 1.3 Basic call - overlap sending with BC= speech ;: The call is released from the calling user
- ISDN - ISDN Scenario 1.4 Basic call with BC= 3,1 KHz audio - Fax with 33,6 kbit/s ; The call is released from the calling user
- ISDN - ISDN Scenario 1.5 Basic call with BC= 3,1 KHz audio - Fax with 14,4 kbit/s; The call is released from the calling user
- ISDN - ISDN Scenario 1.6 Basic call with BC= 3,1 kHz with PI#3 The call is released from the calling user
- ISDN - ISDN Scenario 1.7 Basic call with BC= 3,1 kHz with PI#3The call is released from the called user
- ISDN - ISDN Scenario 1.8 Basic call with BC= 3,1 kHz - Modem V.32 bis (4,8 kbit/s, 9,6 kbit/s , 14,4 kbit/s); The call is released from the calling user
- ISDN - ISDN Scenario 1.9 Basic call with BC= 3,1 kHz - Modem V.34 (up to 33,6 kbit/s) The call is released from the calling userISDN - ISDN Scenario 1.10 Basic call with BC= UDI - enblock sending
- ISDN - ISDN Scenario 1.11 Basic call with BC= UDI - enblock sending .The call is released from the calling user

**Failed Call**

- ISDN - ISDN Scenario 1.12 - called user is user determined user busy
- ISDN - ISDN Scenario 1.13 - no answer from the called user
- ISDN - PSTN Scenario 2.8 - called user is user determined user busy
- ISDN - PSTN Scenario 2.9- no answer from the called user
- PSTN - ISDN Scenario 3.6 - called user is user determined user busy
- PSTN - ISDN Scenario 3.7 - no answer from the called user
- PSTN - PSTN Scenario 4.7 - called user is user busy
- PSTN - PSTN Scenario 4.8 - no answer from the called user

# Call Scenarios (2)

**Successful Call**

- ISDN - PSTN Scenario 2.1 Basic call with BC= speech - enblock sending. The call is released from the called user
- ISDN - PSTN Scenario 2.2 Basic call with BC= speech - enblock sending . The call is released from the calling user. The call is released from the callied user
- ISDN - PSTN Scenario 2.3 Basic call - overlap sending with BC= speech ; The call is released from the calling user
- ISDN - PSTN Scenario 2.4 Basic call with BC= 3,1 KHz audio - Fax with 33,6 kbit/s; The call is released from the calling user
- ISDN - PSTN Scenario 2.5 Basic call with BC= 3,1 KHz audio - Fax with 14,4 kbit/s; The call is released from the calling user
- ISDN - PSTN Scenario 2.6 Basic call with BC= 3,1 kHz - Modem V.32 bis (4,8 kbit/s, 9,6 kbit/s 14,4 kbit/s); The call is released from the calling user
- ISDN - PSTN Scenario 2.7 Basic call with BC= 3,1 kHz - Modem V.34 (up to 33,6 kbit/s); The call is released from the calling user
- PSTN - ISDN Scenario 3.1 Basic call. The call is released from the calling user
- PSTN - ISDN Scenario 3.2 Basic call The call is released from the called user
- PSTN - ISDN Scenario 3.3 Basic call with BC= 3,1 KHz audio - Fax with 33,6 kbit/s
- PSTN - ISDN Scenario 3.4 Basic call with BC= 3,1 KHz audio - Fax with 14,4 kbit/s
- PSTN - ISDN Scenario 3.5 Basic call with BC= 3,1 KHz audio - Modem V.90
- PSTN - PSTN Scenario 4.1 Basic call. The call is released from the calling user

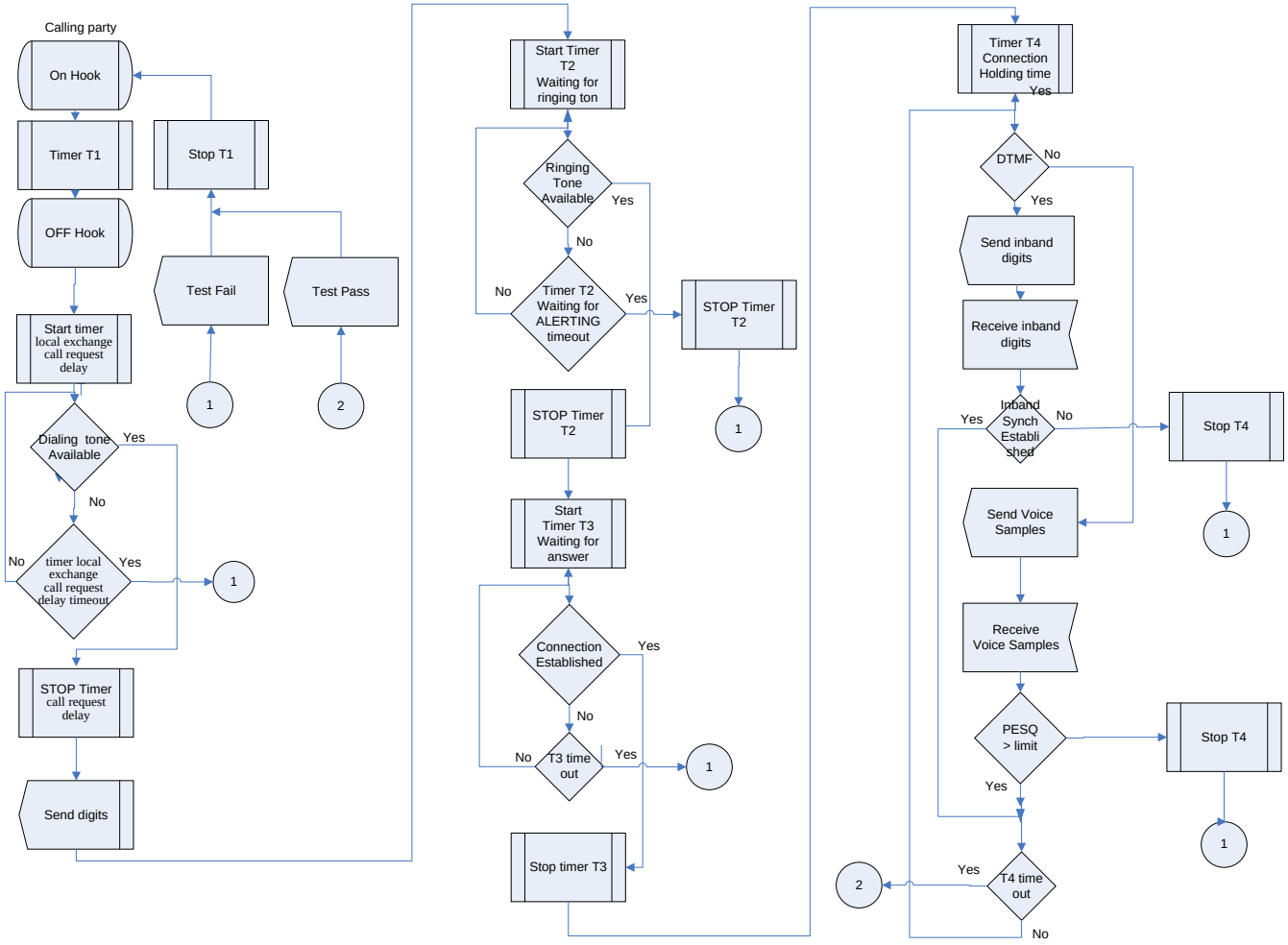
- **Successful Call**

- PSTN - PSTN Scenario 4.2 Basic call The call is released from the called user.
- PSTN - PSTN Scenario 4.3 Basic call with Fax with 33,6 kBit/s (Super G3 Fax)
- PSTN - PSTN Scenario 4.4 Basic call with Fax with 14,4 kBit/s
- PSTN - PSTN Scenario 4.5 Basic call with BC= 3,1 KHz audio - Modem V.34 (up to 33,6 kbit/s)
- PSTN - PSTN Scenario 4.6 Basic call with BC= 3,1 KHz audio - Modem V.32 bis (4,8 kbit/s, 9,6 kbit/s 14,4 kbit/s)

# Call Flow

- The calls flows defines the characteristic message flows, the tones and announcement for a specific interface

# Call flow example
# PTSN environment calling side



# Load profile (1)

- To facilitate the calculation of processing capacity and the appropriate load profile the concept workload factor has been defined based on the reference call for each combination of traffic case and traffic signaling 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.

# Load profile (2)

- The workload factor is implementation dependent. Following values for MGW are examples:

  - MGW (ISUP) - AGW (ISDN) = 1
  - MGW (ISUP) - SIP-I= 1,6
  - SIP - SIP Transit= 2,1

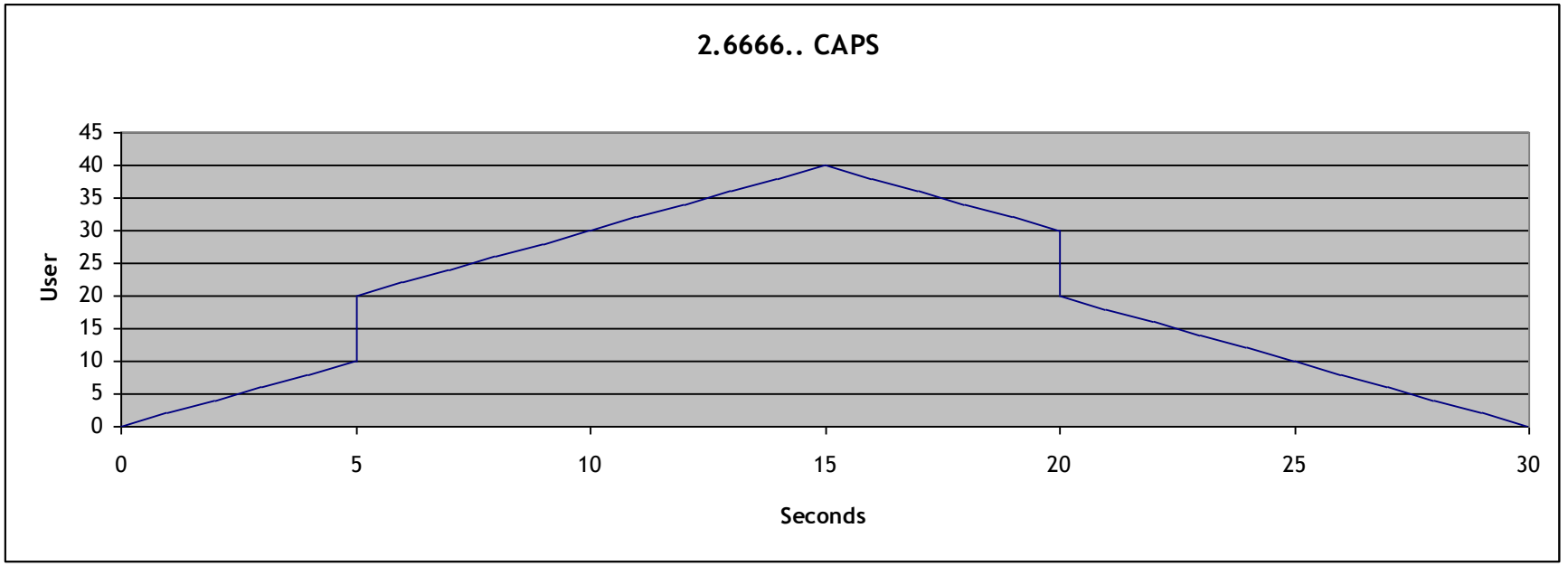
# Examples of signalling terminal capacities for different Protocols in %

| Protocol | Call type | Capacity at 80 % load |
|---|---|---|
| SIP-I | Basic | 26 % call legs/s |
| | PRACK | 25 % call legs/s |
| | PRAC & PREC | 13 % call legs/s |
| SIP | Basic | 35 % call legs/s |
| | PRACK | 32 % call legs/s |
| | PRAC & PREC | 16 % call legs/s |
| H.323 | Fast connect | 43 % call legs/s |
| | Tunnelling | 22 % call legs/s |
| | Separate H.245 | 17 % call legs/s |
| SIGTRAN | M3UA (ISUP) | 73 % call legs/s |
| | IUA/DUA | 100 % call legs/s |
| DNS/ENUM | | 100 % requests/s |

# Load profiles examples (1)

- The load simulates 2,66 CAPS, call duration 15 s, number of simulated users 30. The number of calls increases each 500 ms. After a call duration of 15 s the calls will be released. In the time interval of 5 s are tested simultaneous ISDN call setups using five channels. In order to simulate a load of 2,0 CAPS, the increase of number of calls is changed to 1,5 per second.

# Load profiles example (2)



# Metrics

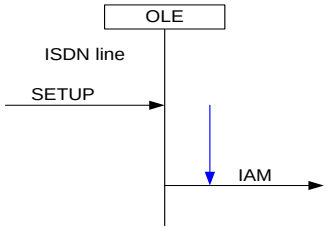
- The metrics of a use-case describe the measurements collected from the execution of a scenario attempt. Typical metrics include response times and message rates. If a scenario is selected for execution in a benchmark test, its metrics are collected.

# Metrics and design objectives
# Delay probability (1)

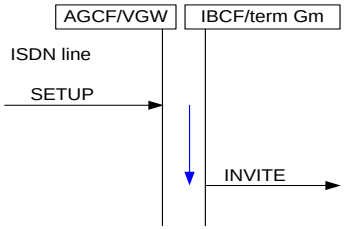
| Meaning of timers | Parameter Q.543 | IMS, PES equivalent | Reference Load A | | Reference Load B | |
|---|---|---|---|---|---|---|
| | Detailed description | | Mean Value | 95% probability of not exceeding | Mean Value | 95% probability of not exceeding |
| **Call set up delay** | | | | | | |
| ISDN SUBSCRIBER LINES call set up delay using enblock signalling | § 2.4.3.1 [2] Exchange call setup delay for originating outgoing traffic connections For call attempts using en-bloc sending 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 The time interval starts when the SETUP message received contains a “sending complete indication” or when the address information necessary for call set-up is complete and ends when the call setup is sent on the outgoing signalling system | ISDN [3] Call set-up delay is defined as the interval from the instant when the signalling information including Sending Complete (#) is received from the incoming signalling system until the instant when the corresponding INVITE signalling information is passed to the Ic or terminating Gm interface or Call set-up delay is defined as the interval from the instant when the SETUP including Sending Complete (#) is received from the incoming signalling system until the instant when the corresponding SETUP signalling information is passed to the called line signalling system Note: if SC (#) is not icluded the setup delay may increase up to the digit collection timer (15 s) IMS [4] Session initiation delay is defined as the interval from the instant when the INVITE signalling information is received from the calling user on the originating Gm interface until the instant when the corresponding INVITE signalling information is passed on the terminating Gm interface to the called user | ≤ 600 ms | 800 ms | ≤ 800 ms | ≤ 1200 ms |

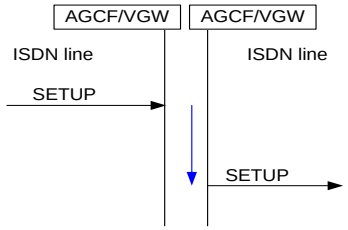
# Metrics and design objectives
# Delay probability (2)

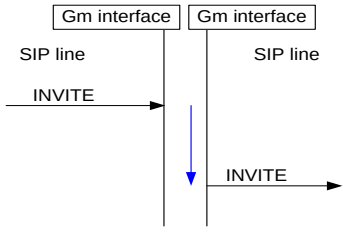
Q.543




IMS



# Design Objective (DO)

- The Design Objective (DO) describes the acceptable rate of inadequately handled scenario attempts for a use-case. When a benchmark test is executed, scenarios from various use-cases are selected and executed, thereby becoming "scenario attempts".
- If the frequency of inadequately handled scenario attempts (IHSAs) exceeds the design objective, then the Design Objective Capacity (DOC) has been exceeded.

# SUT configuration and parameters

- This element describes the exact inventory of hardware and software of which the SUT is constructed, a complete description of its configuration and parameter settings as well as characteristics of the interfaces that connect to the test system (like interface bandwidth and latency, interface security characteristics).

# 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.

# 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 need not 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.

# Traffic Set Example

- Traffic mixture: a combination of percentages of all scenarios

| Use Case Section | Test Scenario | Scenario % of System Load | Scenario Arrival Distribution | Scenario Duration Distribution |
|---|---|---|---|---|
| ISDN – ISDN Use case 1 | Scenario1.1 | 20 % | Poisson | Mean = 110 sec |
| | Scenario 1.2 | 20 % | Poisson | Mean = 110 sec |
| ISDN- PSTN Use case 2 | Scenario 2.1 | 15 % | Poisson | Mean = 90 sec |
| | Scenario 2.2 | 15 % | Poisson | Mean = 90 sec |
| PSTN – ISDN Use case 3 | Scenario 3.1 | 15% | Poisson | Mean = 90 sec |
| | Scenario 3.2 | 15 % | Poisson | Mean = 90 sec |

# 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; of other observations and exceptions noted during the test.

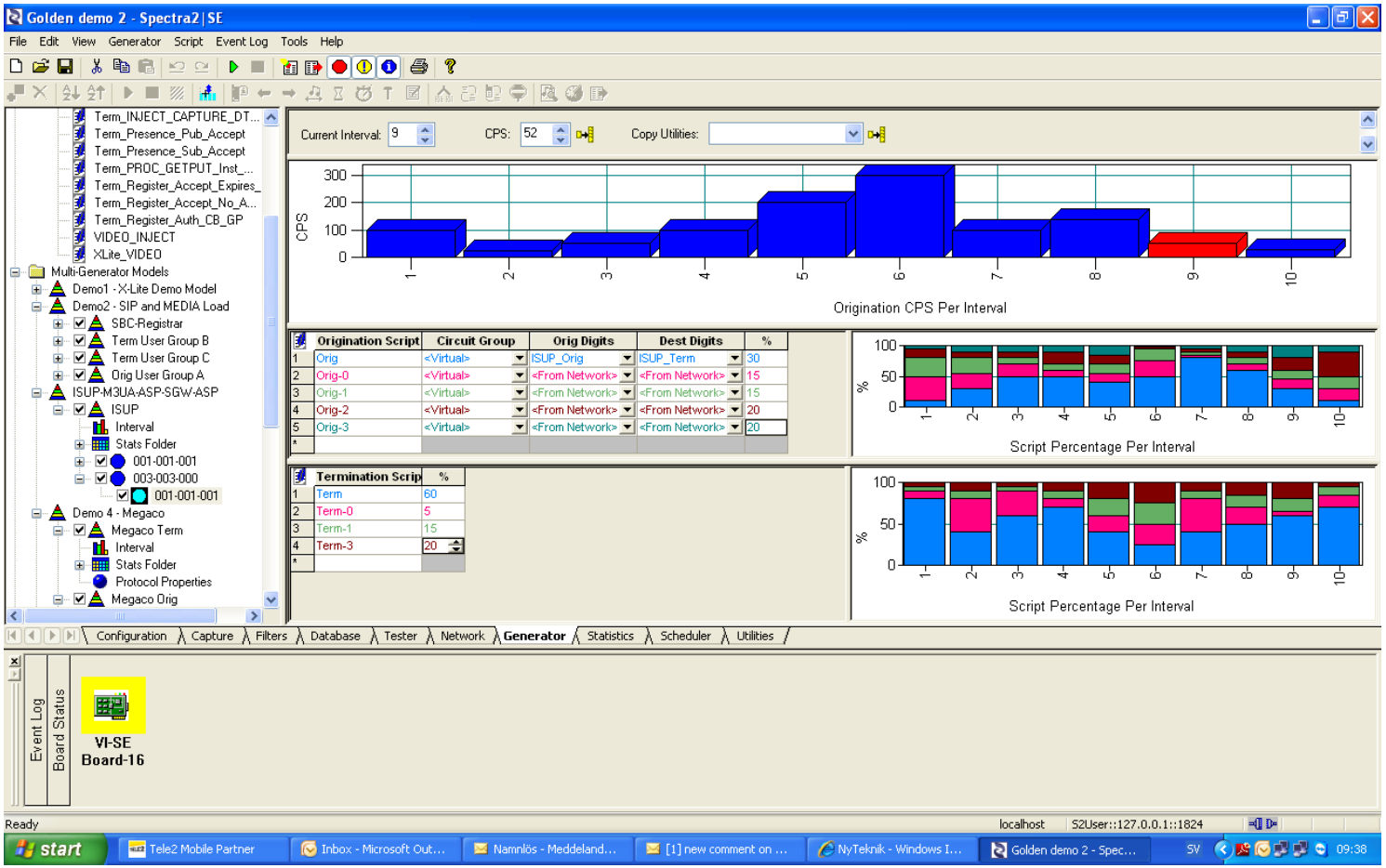
# Example of a call detail report

- **CALL DETAIL REPORT**
- Test Name: Basic Call
- Start Time:
- Stop Time:

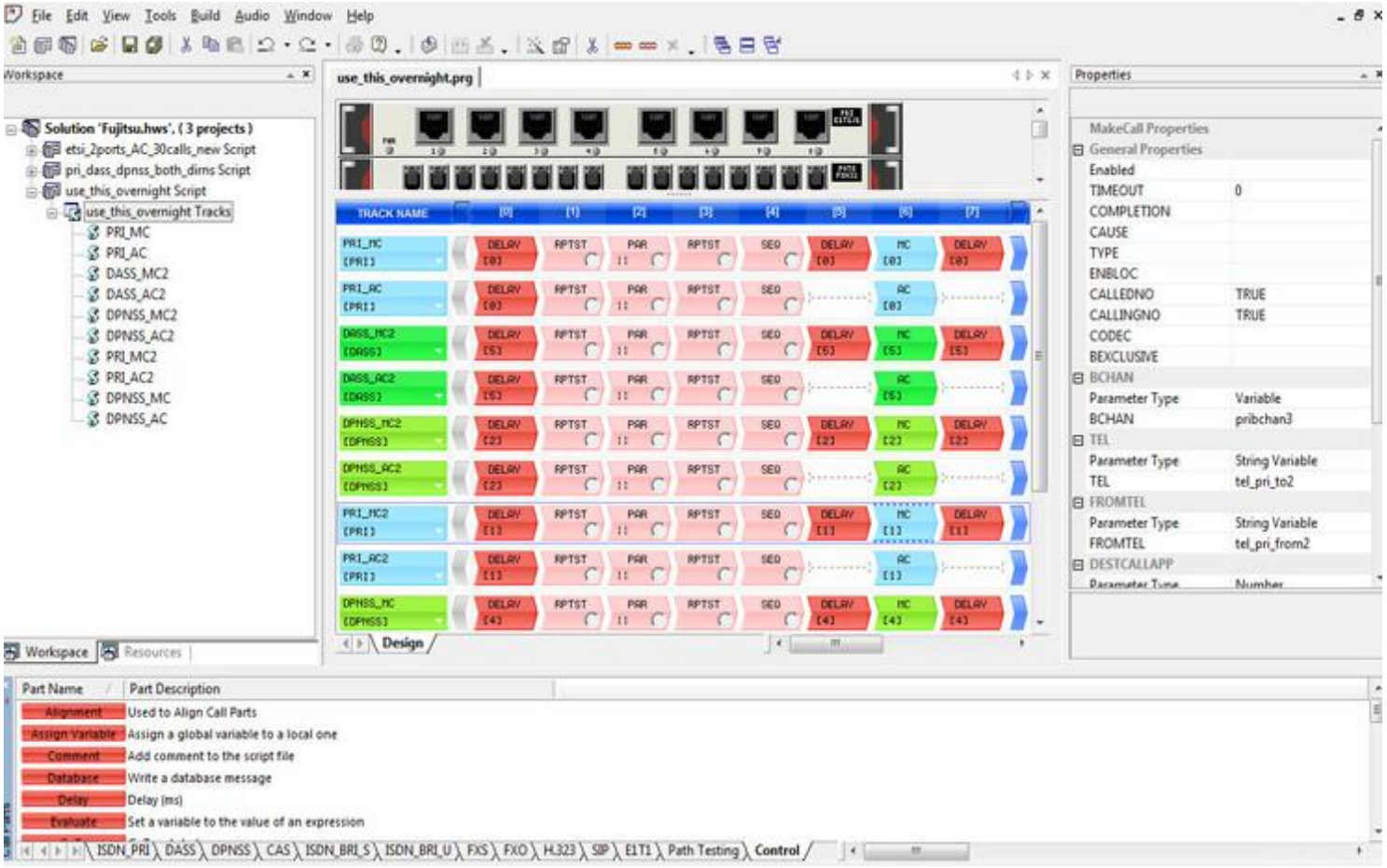
| Date | Time | Call ID | Server | Chan | Status | Called Number | Len | Lat ms | T1 | T2 | T3 | T4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

| AVERAGE | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Date | Time | Calls Successful | Calls Failed : | Call Length | Latency ms | T1 | T2 | T3 | T4 |
| | | | | | | | | | |

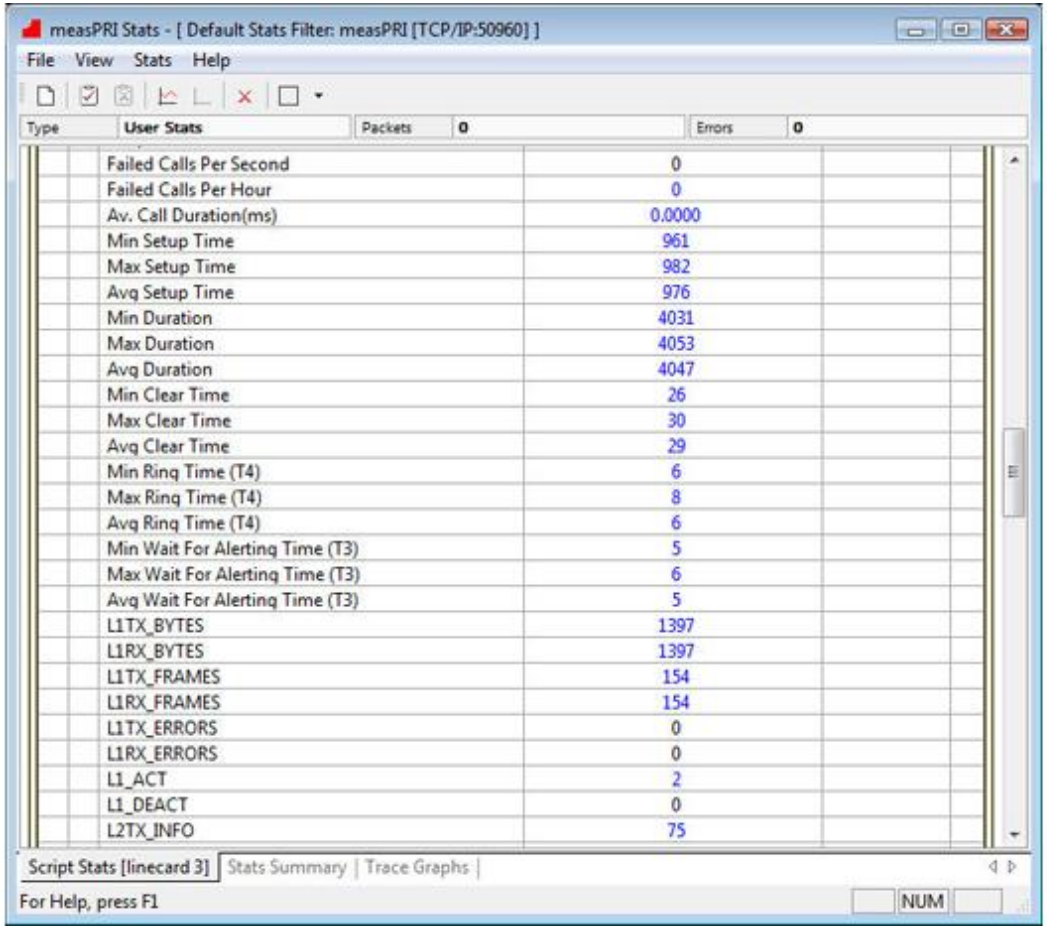
# Benchmark Information Model in the reality



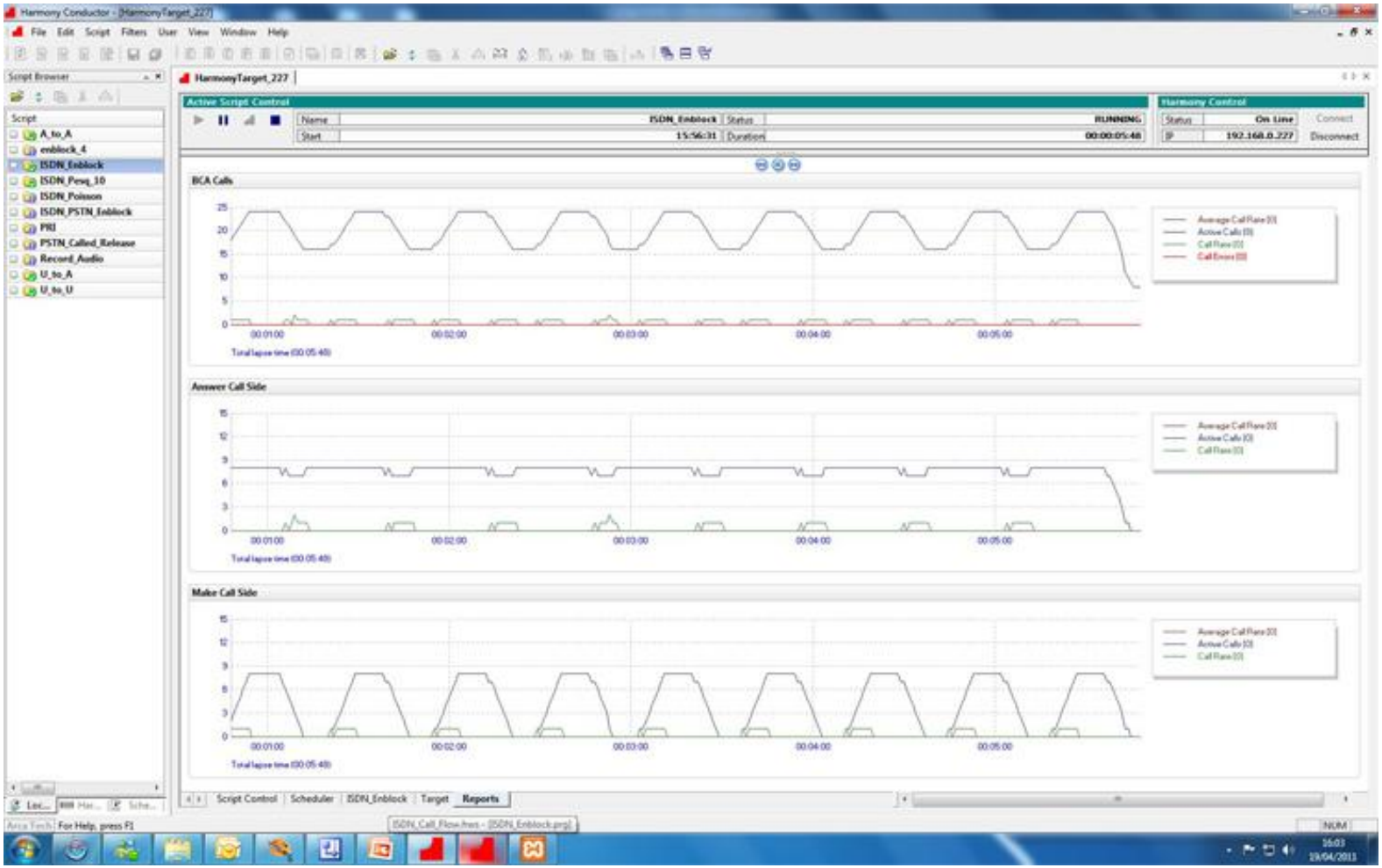
# Call flow example in the reality



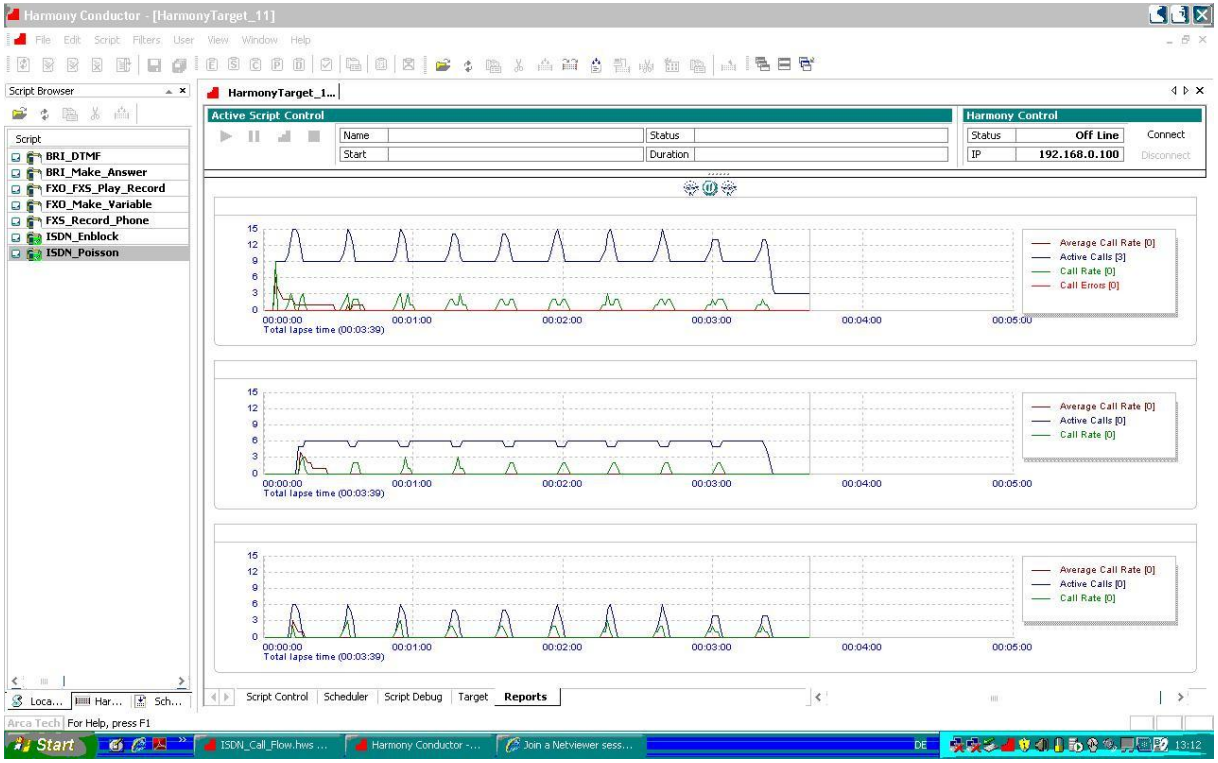
# Metrics and design objectives in the reality – statistic



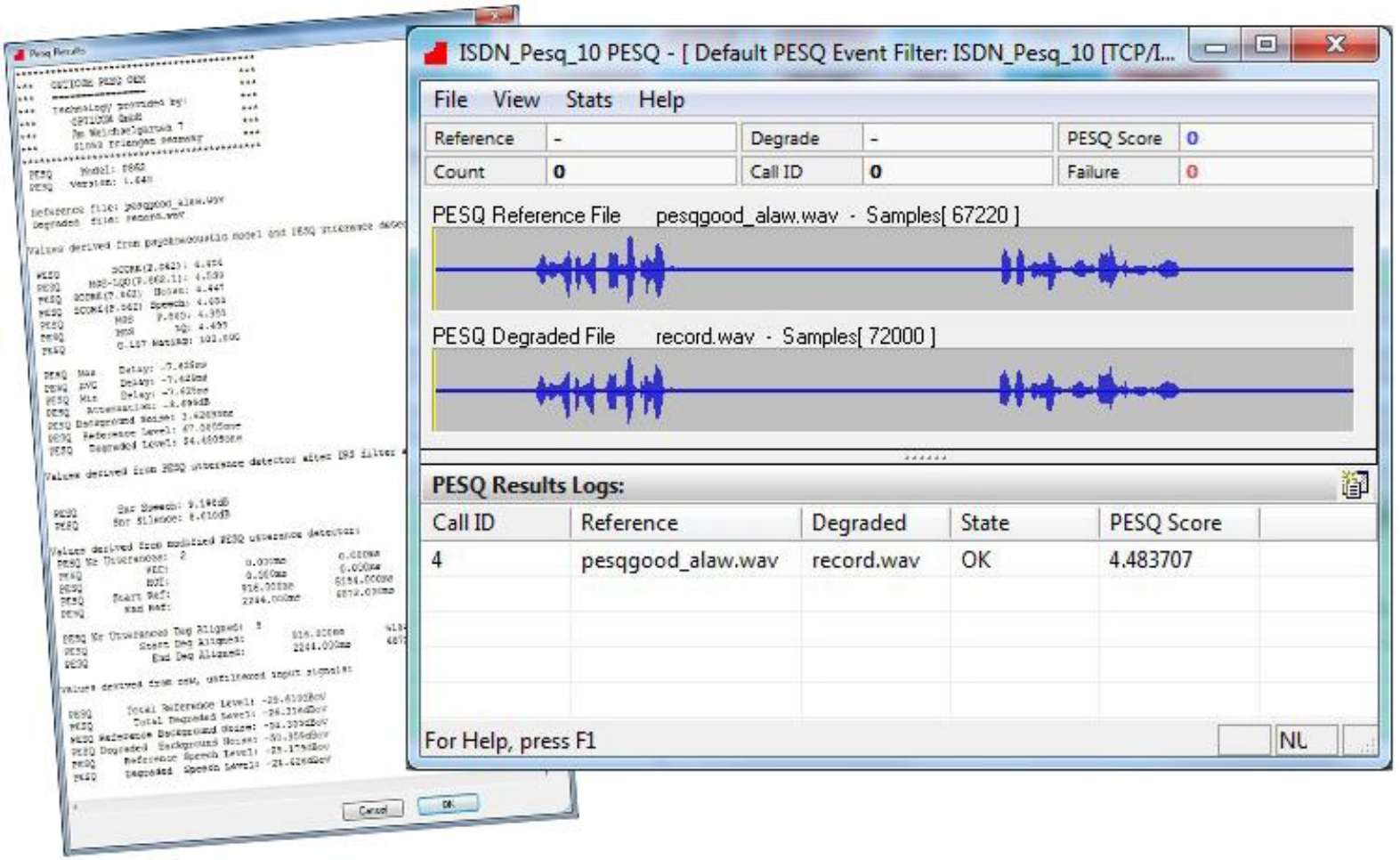
# Metrics and design objectives in the reality - charts for ramp traffic



# Metrics and design objectives in the reality - charts based on Poisson traffic



# Example of a call detail report in the reality



# Questions ?

# Thank you for your attention