



# **PSTN/ISDN emulation and IMS/NGN Reference Benchmarking**

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# Presentation Outline

- Why is IMS Benchmarking needed
- History
- Benchmark Development Process
- Benchmark Information Model
- Use-case
- Call flow
- Load profile
- Metrics and design objectives
- Benchmark Test
- Benchmark report
- Q.3933 “Reference benchmarking, background traffic profiles and KPIs for VoIP and FoIP in fixed networks”

# Why is IMS Benchmarking Needed?

- Goal - performance benchmark for IMS/LTE components
  - Performance and scalability testing of all PSTN and IMS and related components
  - Measurement and analysis of important QoS parameters
  - Regression Tests with applications after Release Change
- Why
  - Creation of objective means to compare overall IMS of different systems by performance (and price)
  - Check ability of hardware/software to run the IMS
- 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

# History

- March 2011 - Q.3931.1: Performance benchmark for the PSTN/ISDN emulation subsystem of an IP multimedia system - Part 1: Core concepts
- March 2011 Q.3931.2: Performance benchmark for the PSTN/ISDN emulation subsystem of an IP multimedia system - Part 2: Subsystem
- June 2015 Q.3931.3: Performance benchmark for the PSTN/ISDN emulation subsystem of an IP multimedia system - Part 3: Traffic sets and traffic profiles
- June 2015 Q.3931.4: Performance benchmark for the PSTN/ISDN emulation subsystem of an IP multimedia system - Part 4: Reference load network

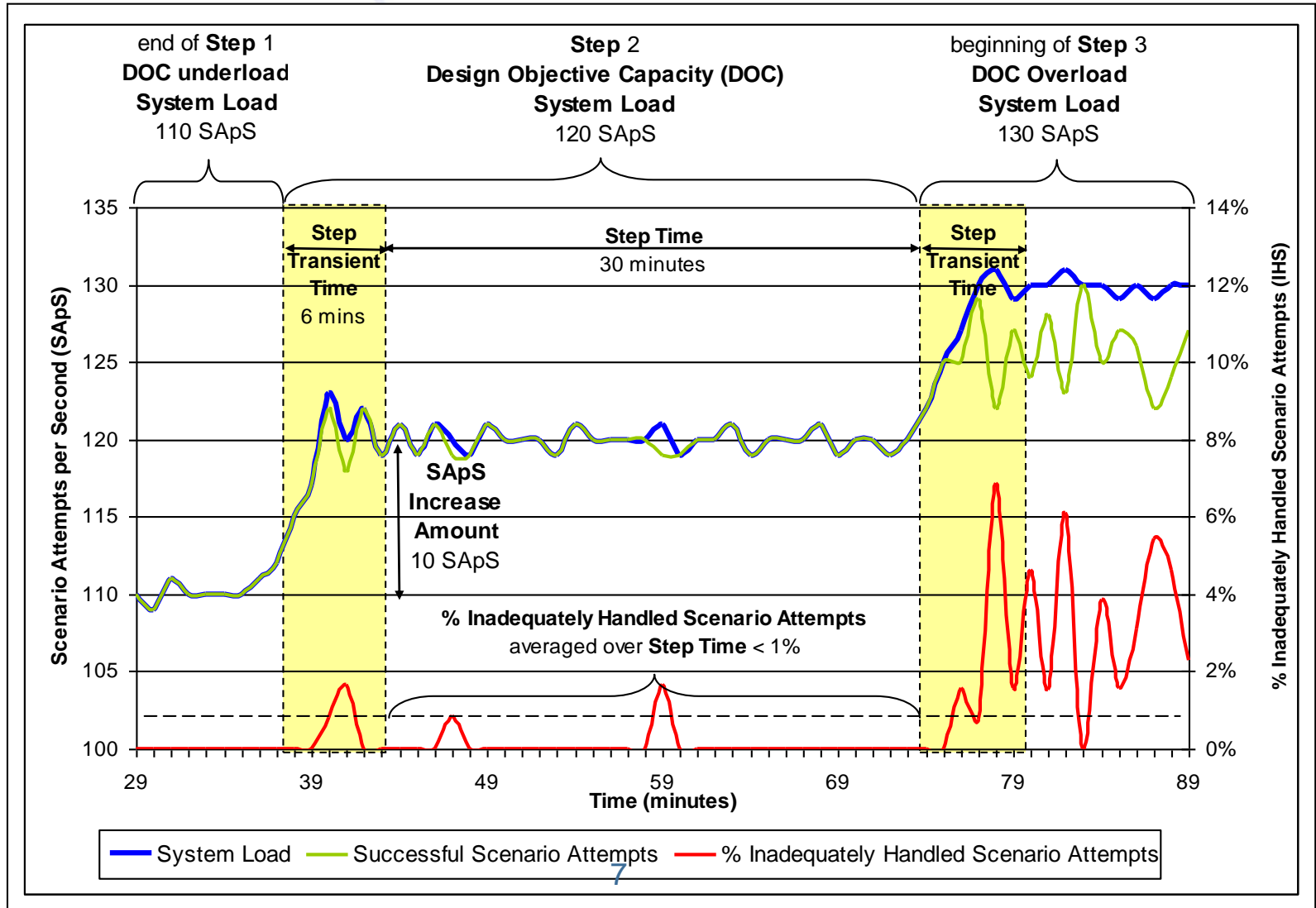
# History

- June 2015 – Q.3932.1: IMS/NGN performance benchmark Part 1: Core concept
- June 2015 - Q.3932.2: IMS/NGN performance benchmark Part 2: Subsystem configurations and benchmarks
- June 2015- Q.3932.3: IMS/NGN performance benchmark – Part 3: Traffic sets and traffic profiles
- June 2015- Q.3933 “Reference benchmarking, background traffic profiles and KPIs for VoIP and FoIP in fixed networks”
- Mai 2016- Q.3932.4: IMS/NGN performance benchmark - Part 4: Testing of the performance design objectives

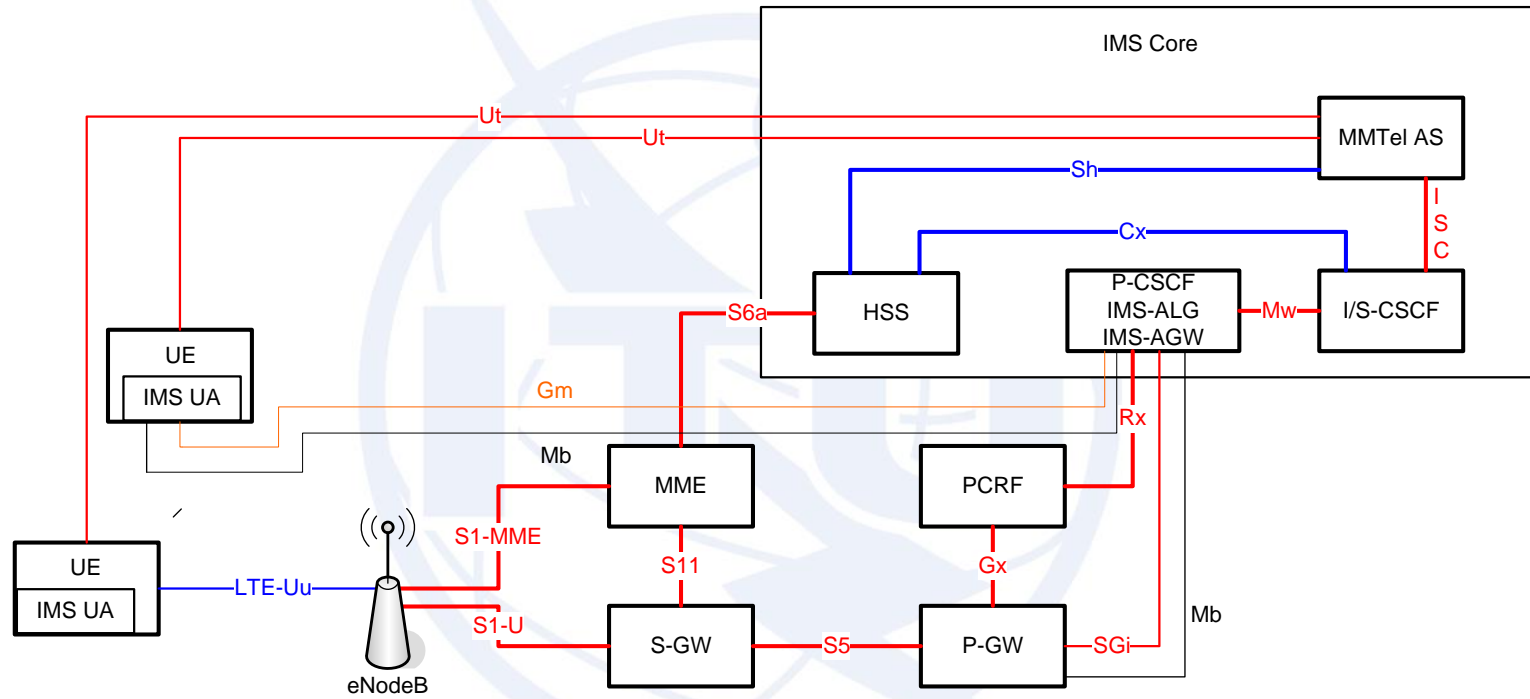
# Involved Bodies

- **ETSI TC MTS**
  - Testing framework and description
- **ETSI TC TISPAN**
  - standardization of PSTN/ISDN Emulation Sub-system (PES) benchmark
- **ETSI TC INT**
  - Benchmark IMS
- **ETSI TC STQ**
  - Benchmark IMS
- **ITU-T**
  - SG11

# Motivating Example

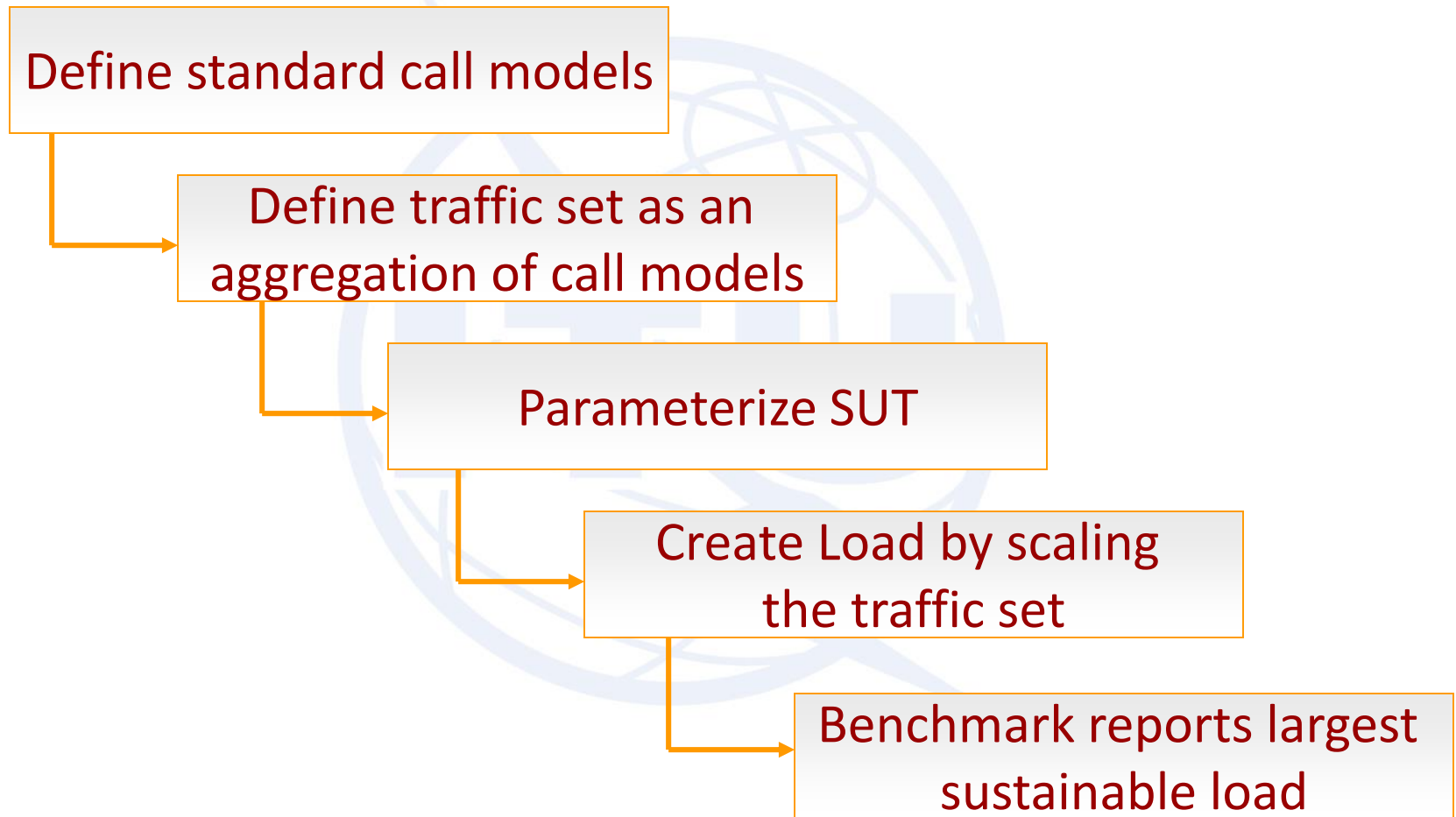


# Scope of IMS/LTE Performance Benchmarking





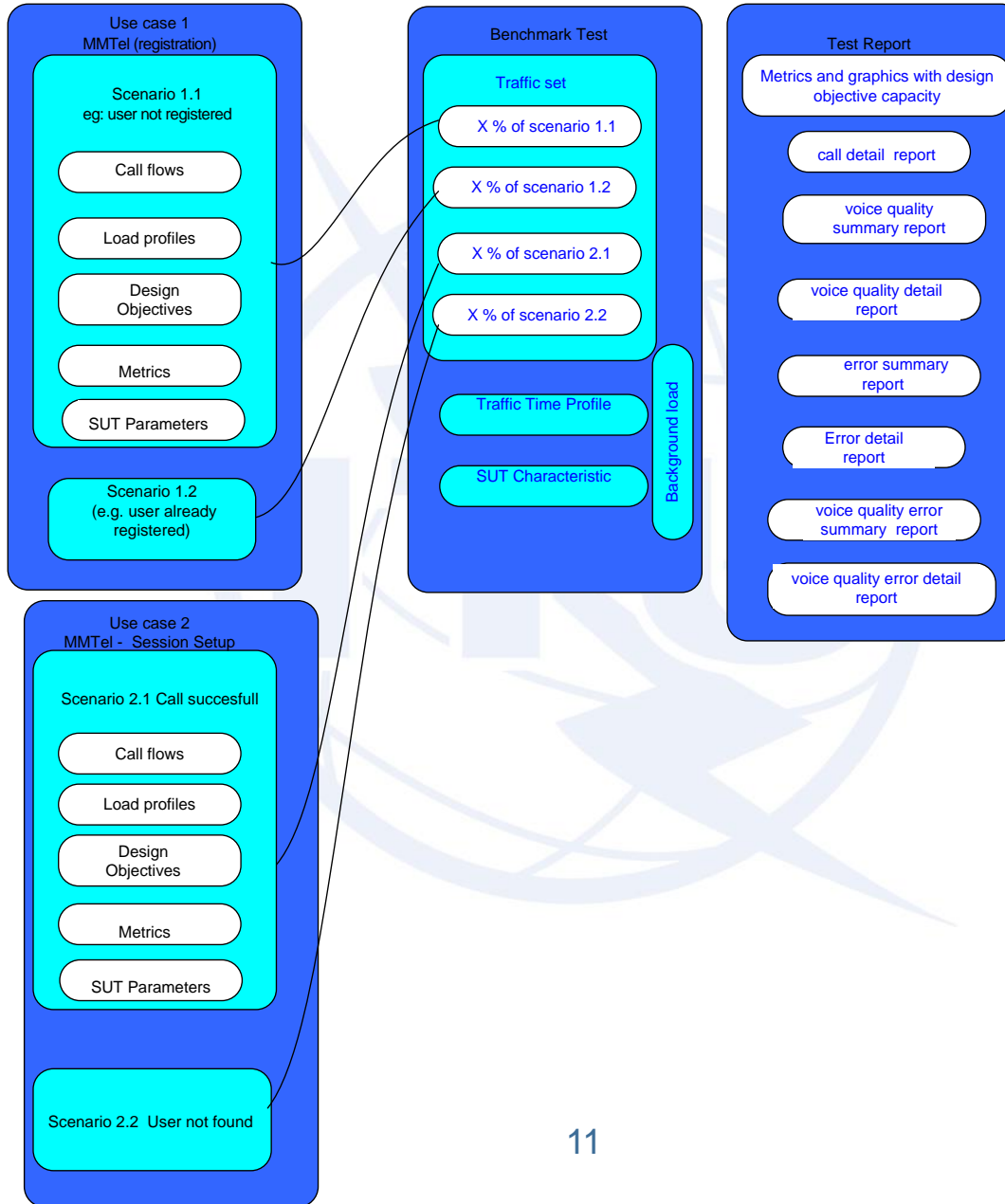
# Benchmark Development Process



# 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

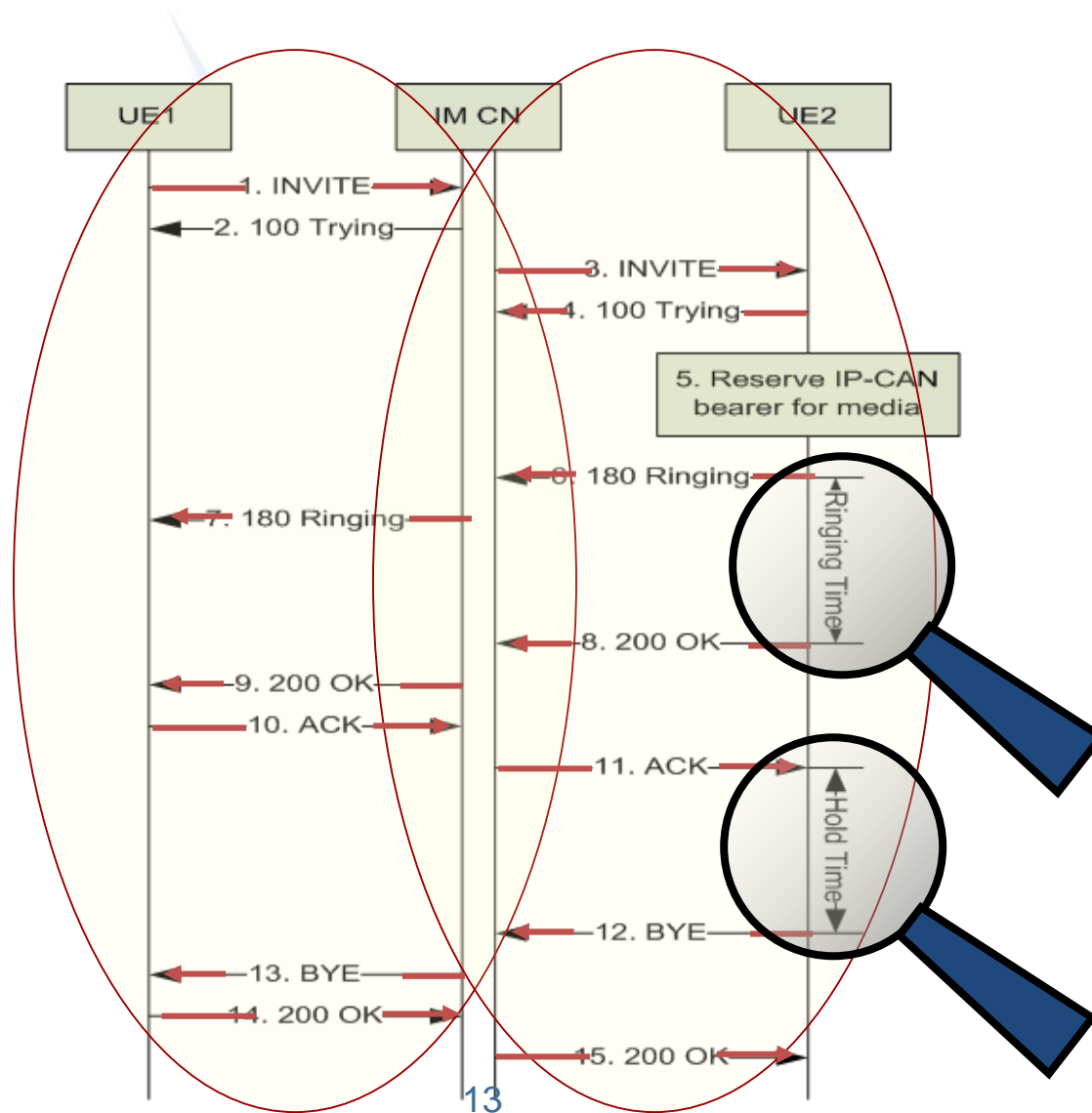
# Benchmark Information Model



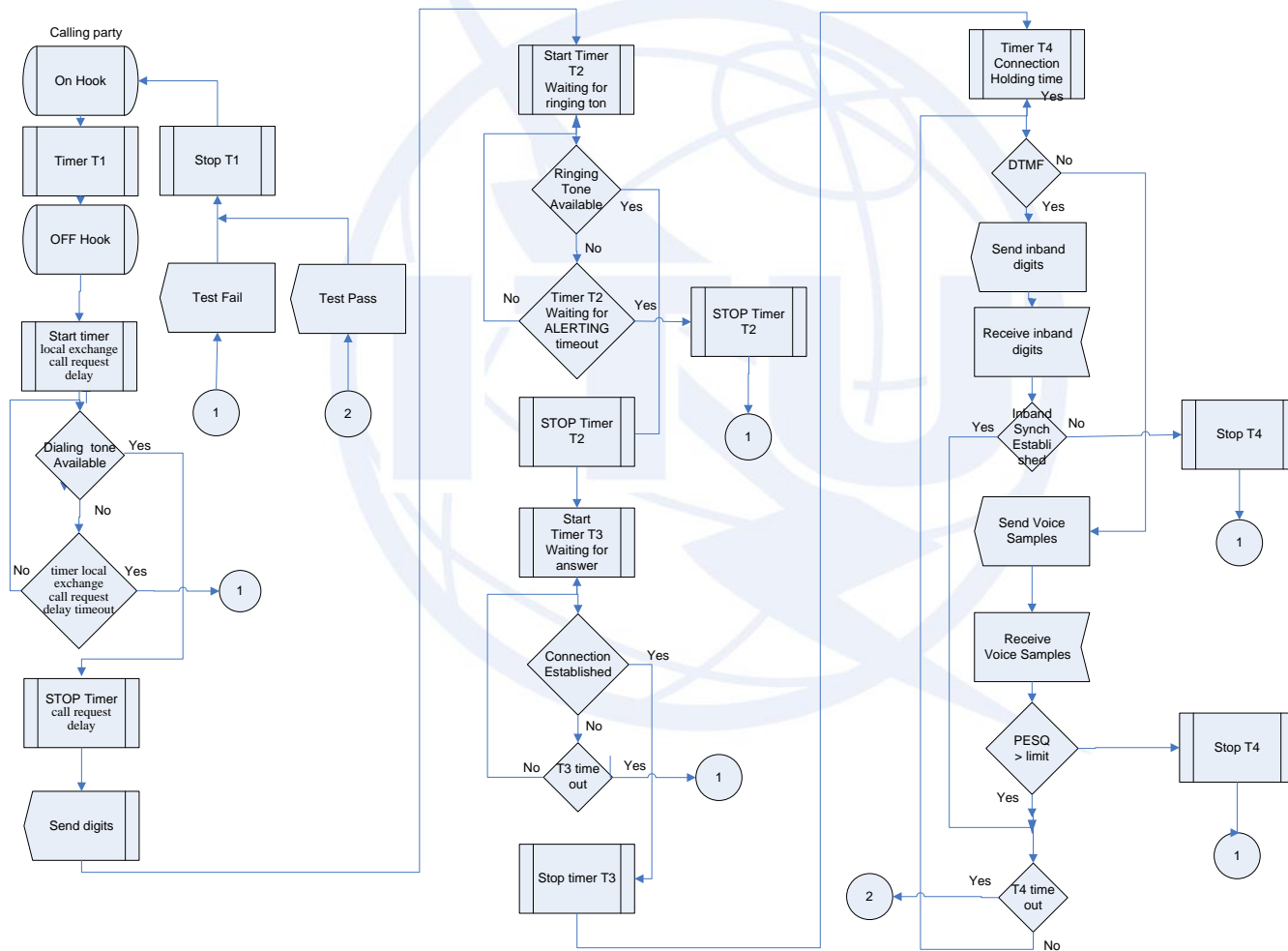
# IMS/LTE Use Cases

- IMS/PES to IMS/PES
- Registration/de-registration use-case
- MMTel to MMTel Use case
- ISDN to MMTel Use case
- MMTel to ISDN Use case
- MMTel to PSTN Use case
- PSTN to MMTel Use case
- ISDN to VoLTE Use case
- VoLTE to ISDN Use case
- VoLTE – PSTN Use case
- PSTN to VoLTE Use case
- VoLTE to VoLTE Use case
- VoLTE to MMTel Use case
- MMTel to VoLTE Use case

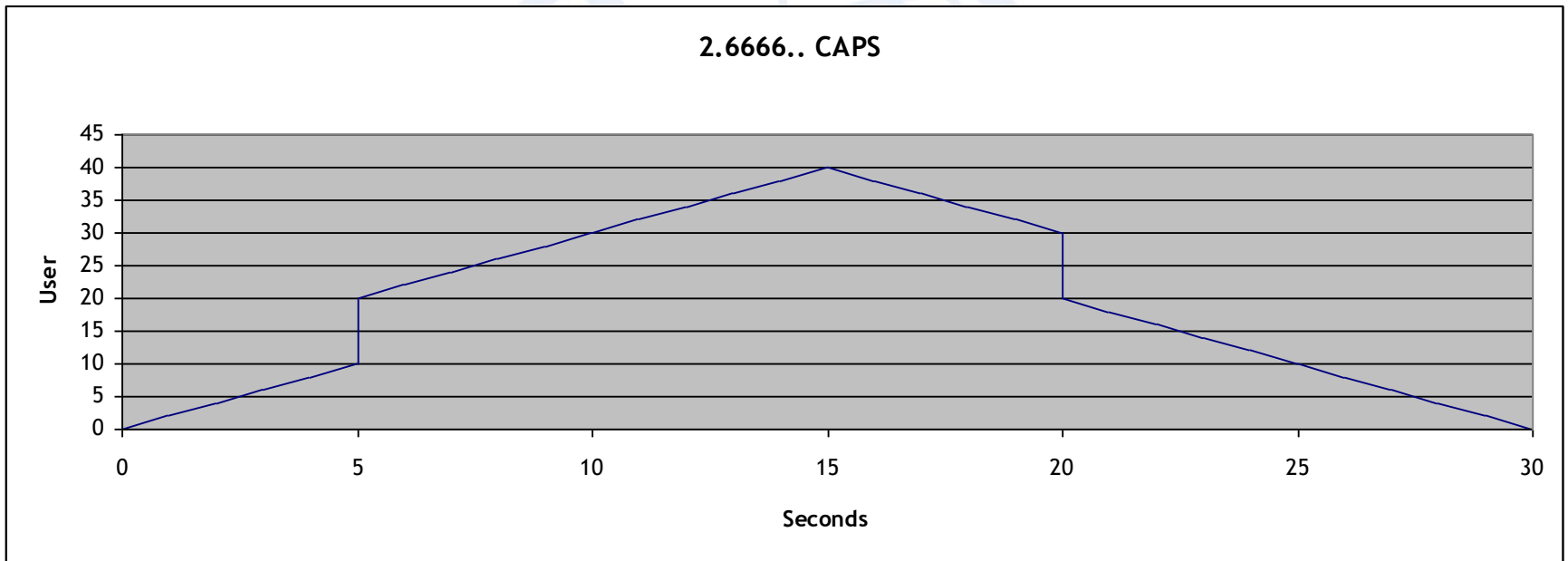
# IMS/LTE Scenario Example: IMS Call



# Call flow example IMS/PES environment calling side



# Load profiles example



# Metrics and design objectives

## Delay probability (1)

Meaning of timers	Parameter Q.543 [2] Detailed description	IMS, PES equivalent	Reference Load A		Reference Load B	
			Mean Value	95 % probability of not exceeding	Mean Value	95 % probability of not exceeding
Call set up delay: en Block sending is used						
ISDN SUBSCRIBER LINES Call set up delay using en-block signalling.	<p>clause 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 setup is complete and ends when the call setup is sent on the outgoing signalling system.</p>	<p>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 interface.</p>	≤ 450 ms	≤ 650 ms	≤ 800 ms	≤ 950 ms
		<p>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 terminating Gm interface.</p>	≤ 350 ms  VGW ≤ 400 ms	≤ 550 ms  VGW ≤ 600 ms	≤ 700 ms  VGW ≤ 800 ms	≤ 850 ms  VGW ≤ 1 000 ms
		<p>ISDN [3] Call set-up delay for Internal traffic 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 (see note).</p>	≤ 350 ms  VGW ≤ 500 ms	≤ 550 ms  VGW ≤ 750 ms	≤ 700 ms  VGW ≤ 1 000 ms	≤ 850 ms  VGW ≤ 1 200 ms
IMS SUBSCRIBER Call set up delay using for Internal traffic.		<p>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.</p>	≤ 300 ms	≤ 450 ms	≤ 600 ms	≤ 750 ms
		<p>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 Ic interface to the called user (without preconditions).</p>	≤ 350 ms	≤ 550 ms	≤ 700 ms	≤ 850 ms

NOTE: If SC (#) is not included the setup delay may increase up to the digit collection timer (15 s).



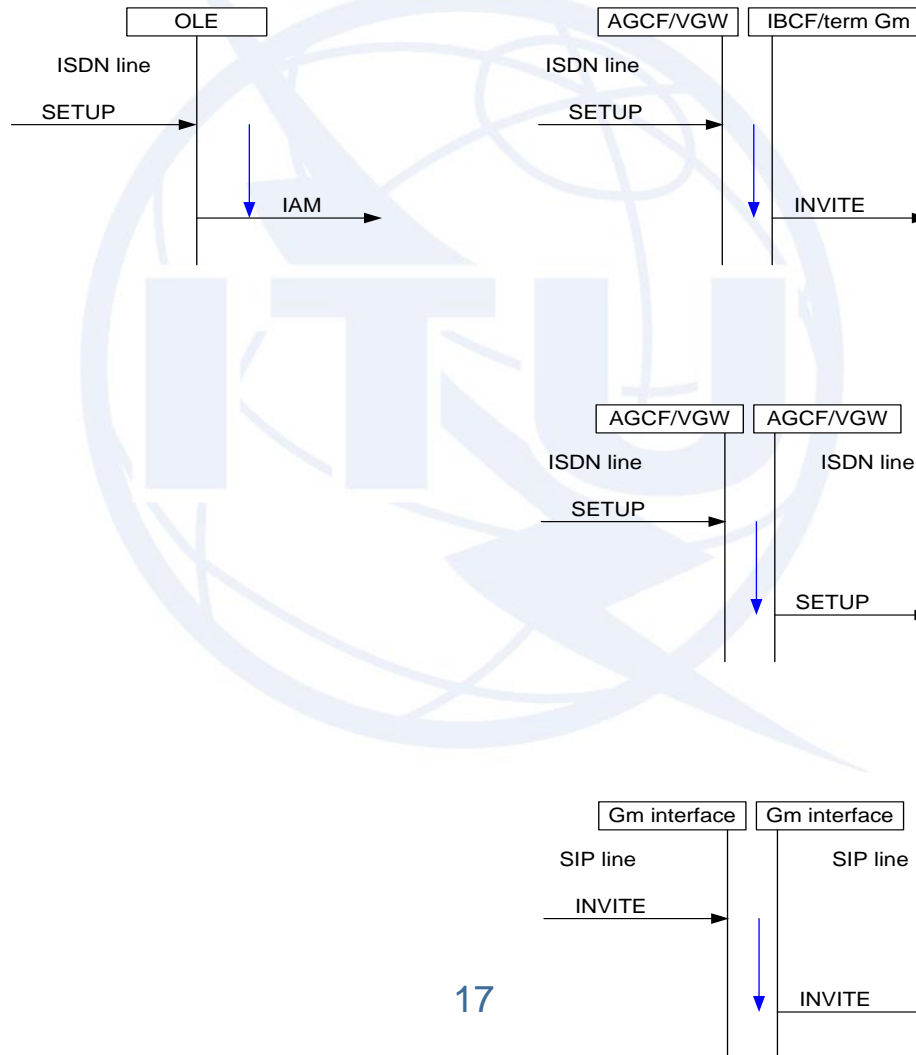


# Metrics and design objectives

## Delay probability (2)

Q.543

IMS



# 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
Use case 1	Scenario 1.1	20 %	Poisson	Mean = 110 sec
	Scenario 1.2	20 %	Poisson	Mean = 110 sec
Use case 2	Scenario 2.1	15 %	Poisson	Mean = 90 sec
	Scenario 2.2	15 %	Poisson	Mean = 90 sec
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 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.

# Report in the reality – Implementation Arcatech

## Implementation Arcatech

The screenshot displays the Arcatech web application interface. At the top, the browser address bar shows the URL `http://localhost/Reports/controller.php?function=report_home`. The application header features the Arcatech logo and navigation links for Home, Call Reports, Voice Reports, Fax Reports, and Logout. The main content area is titled 'Report Summary' and contains two tables: 'Database Information' and 'Test Information'. Below these tables are two line graphs: 'Make Call Graph' and 'Answer Call Graph'. A callout box points to the 'Test Information' table, containing the following text:

General report on run script. Information included, Start and End times along with duration. Call Attempts and Call Errors.

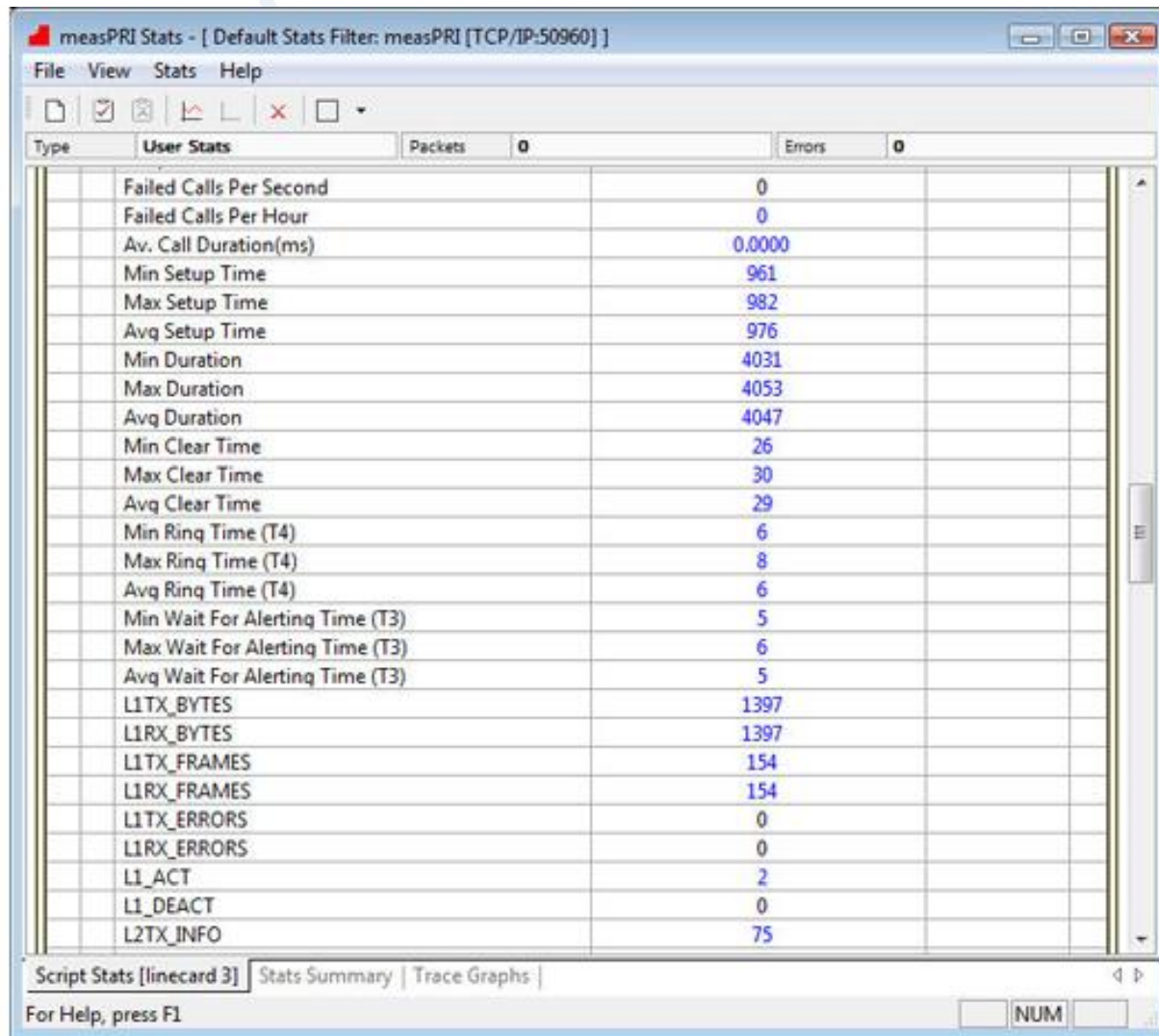
Database Information	
Active Database	ISDN_Mixed_Case
Database Date	November 8, 2011, 4:16 pm
Database File	/database/ISDN_Mixed_Case/ISDN_Mixed_Case.mdb
Script Folder	C:/Documents and Settings/arcatech/My Documents/emutellHarmony/administrator/Tests/ISDN

Test Information	
Test Name	ISDN_Mixed_Case
Start Time	16:14:52
End Time	16:15:38
Duration	01:00:46
Call Attempts	93
Call Errors	0

The 'Make Call Graph' shows three data series: MC Average (blue), MC Active (yellow), and MC Rate (red). The 'Answer Call Graph' shows three data series: AC Average (blue), AC Active (yellow), and AC Rate (red).



# Metrics and design objectives in the reality – statistic Implementation Arcatech



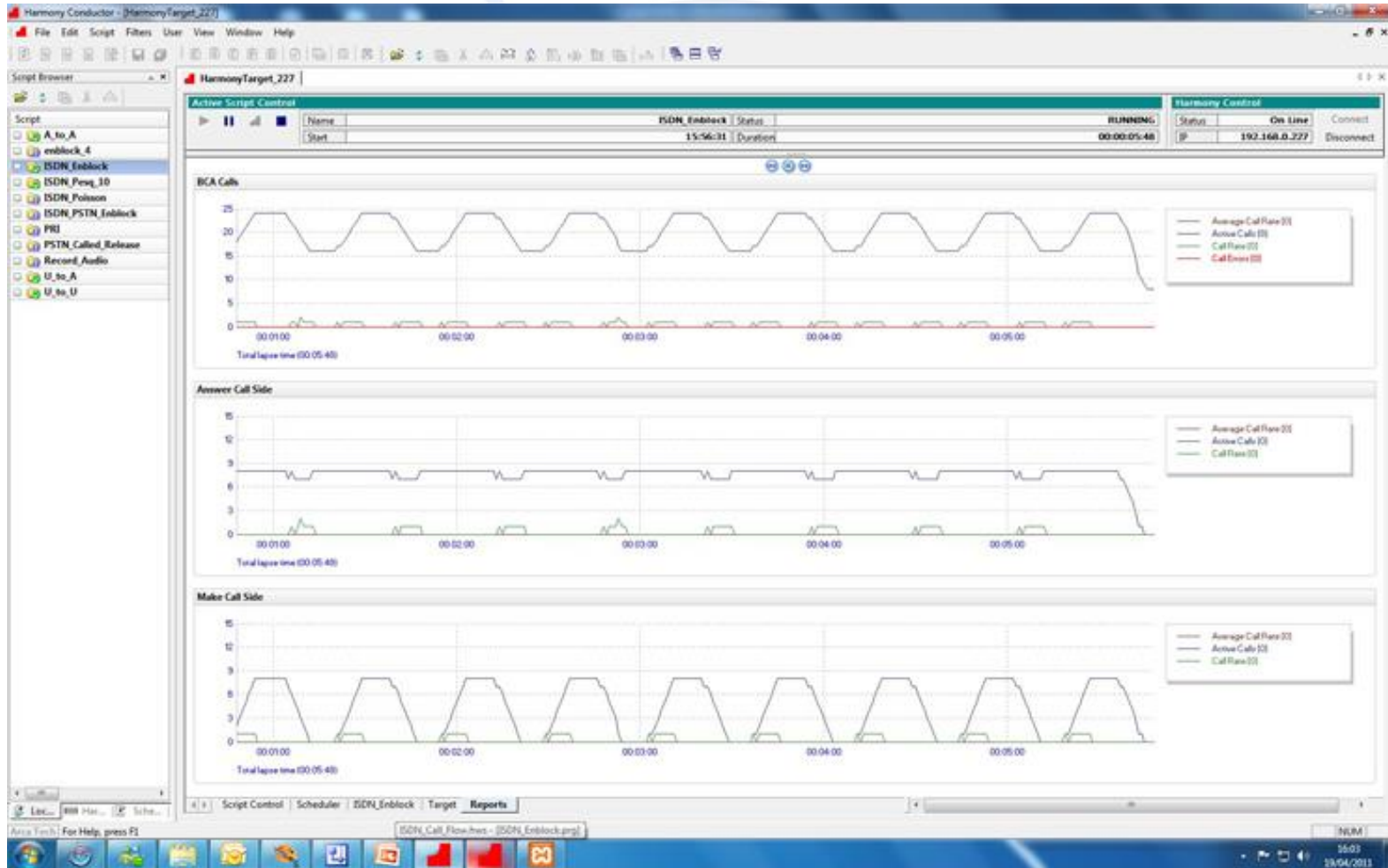
The screenshot shows a window titled "measPRI Stats - [ Default Stats Filter: measPRI [TCP/IP:50960] ]". The window contains a table with columns for "Type", "User Stats", "Packets", and "Errors". The "Packets" and "Errors" columns both show a value of 0. The "User Stats" column lists various performance metrics and their corresponding values.

Type	User Stats	Packets	Errors
	Failed Calls Per Second	0	
	Failed Calls Per Hour	0	
	Av. Call Duration(ms)	0.0000	
	Min Setup Time	961	
	Max Setup Time	982	
	Avq Setup Time	976	
	Min Duration	4031	
	Max Duration	4053	
	Avq Duration	4047	
	Min Clear Time	26	
	Max Clear Time	30	
	Avq Clear Time	29	
	Min Ring Time (T4)	6	
	Max Ring Time (T4)	8	
	Avq Ring Time (T4)	6	
	Min Wait For Alerting Time (T3)	5	
	Max Wait For Alerting Time (T3)	6	
	Avq Wait For Alerting Time (T3)	5	
	L1TX_BYTES	1397	
	L1RX_BYTES	1397	
	L1TX_FRAMES	154	
	L1RX_FRAMES	154	
	L1TX_ERRORS	0	
	L1RX_ERRORS	0	
	L1_ACT	2	
	L1_DEACT	0	
	L2TX_INFO	75	

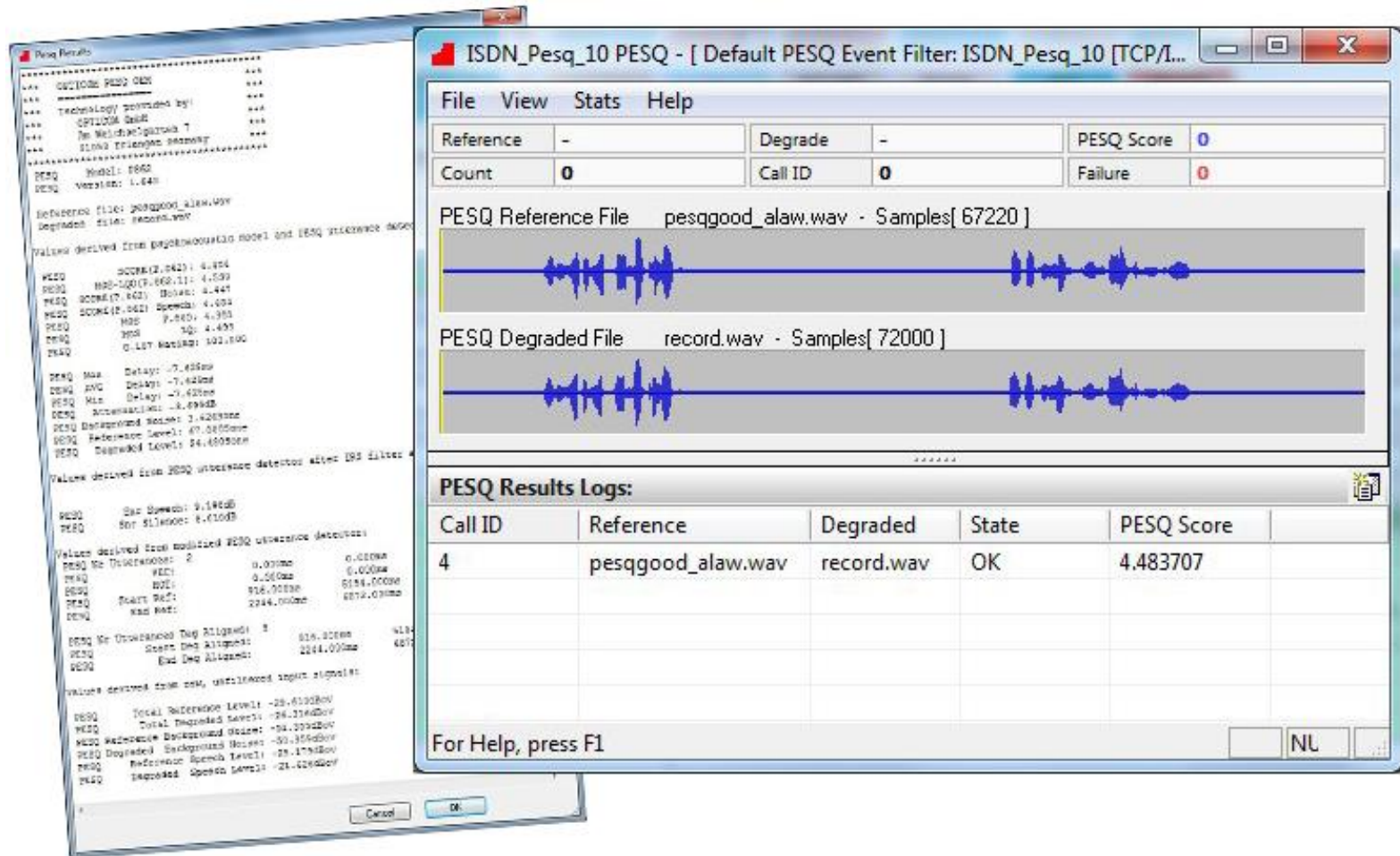
Script Stats [linecard 3] | Stats Summary | Trace Graphs |

For Help, press F1

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



# Example of a call detail report in the reality Implementation Arcatech



# Example of a V.34 FAX detail report in the reality Implementation Arcatech

The screenshot shows a web browser window displaying a report from Arcatech Limited. The browser address bar shows the URL: `http://localhost/Reports/controller.php?function=report_fax_detail`. The page title is "FAX Report". The Arcatech Limited logo is visible at the top. The navigation menu includes "Home", "Call Reports", "Voice Reports", "Fax Reports", and "Logout".

The main content area is divided into several sections:

- Test Information:** A table with columns for Test Name, Start Time, End Time, Duration, Call Attempts, and Call Errors.
- FAX Summary Report:** A section titled "Number of Faxes" with a table.
- FAX Detail Report:** A table with columns for Index, Conn Index, and Ca.

The "FAX Detail Report" table contains the following data:

Index	Conn Index	Ca
1	0	2
2	3	2

The "FAX Details" window is open, showing a log file with the following content:

```
Log File  Tiff File
cur_page_resol      :
                    CF_PR_0200_0200    200 ppi * 200 lpi
cur_max_page_width  : CF_PW_215_MM      215 mm (A4, Letter,
Legal)
cur_max_page_length : CF_PL_A4          A4, 297 mm
cur_encoding         : CF_PENC_T4_1D_MH  T.4 monodimensional
cur_s_ecm_frame_size : CF_ECM_256        ECM, 256 byte-frames
cur_scan_time       : CF_ST_0000        0 ms, 0 ms
rem_pref_resol_unit : CF_RU_METRIC

-----
Na: 0 FAX_AUTO_EVT_TX_RX_FAX_PG (receive fax page data)
    Open new received TIFF file  R0002_14:13:47_rec.tiff

-----
Na: 0 FAX_AUTO_EVT_TX_RX_FAX_PG (receive fax page data)

-----
Na: 0 FAX_AUTO_EVT_EOF_RCV_FAX_PG (CF_MAJOR_SYNC_IN - End of rcv
page)
Cf_sync_processing  : FAX_STOP          end of communication
Cf_sync_quality     : FAX_QUAL_OK       good quality (MCP)
Cf_sync_n_lines     : 0
Cf_sync_n_err_lines : 0
Cf_sync_n_err_consec : 0
Nb lines            : 2284
Nb error T.4        : 0

-----
Na: 0 FAX_AUTO_EVT_IDLE (End of session)
```

A callout box points to the entry "Na: 0 FAX\_AUTO\_EVT\_EOF\_RCV\_FAX\_PG (CF\_MAJOR\_SYNC\_IN - End of rcv page)" in the log file, with the text "Next page FAX V.34".



**Q.3933**

**Reference benchmarking,  
background traffic profiles and KPIs  
for VoIP and FoIP in fixed networks**

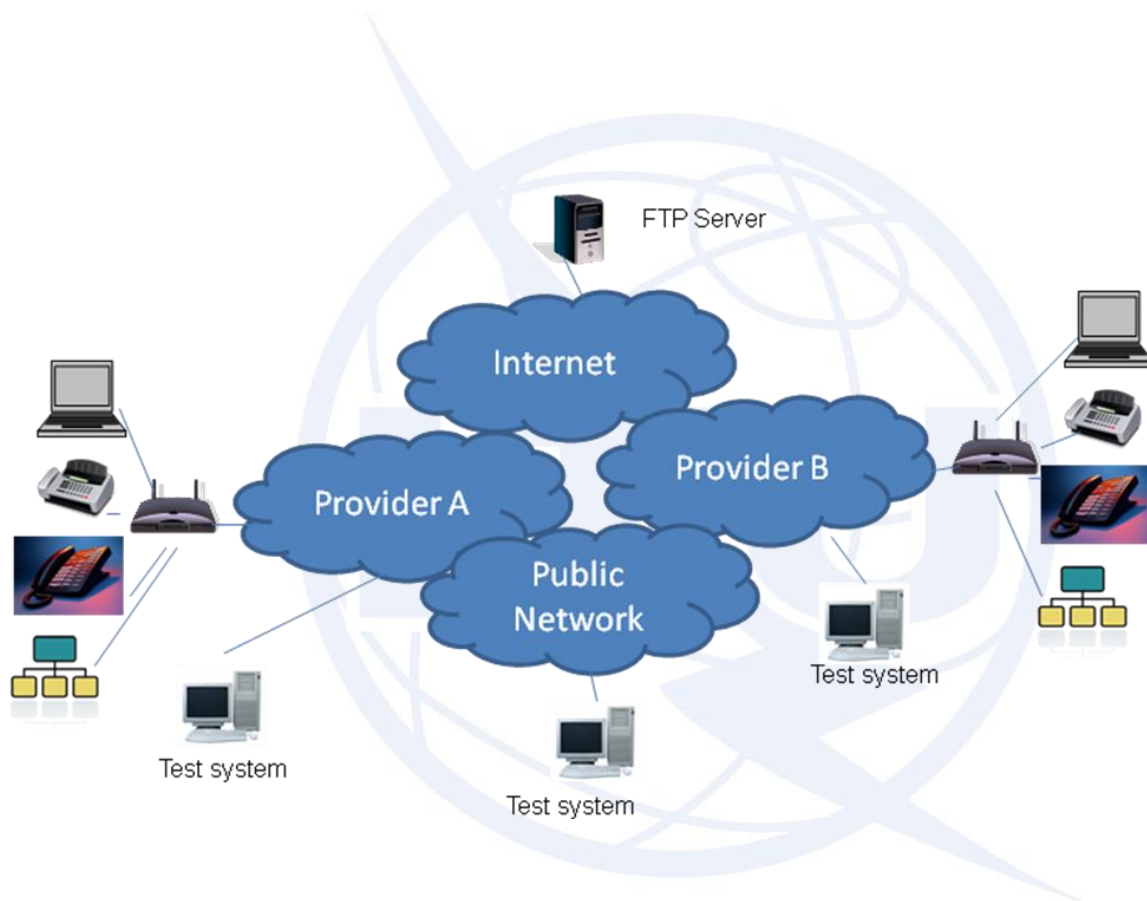
# Scope

The Recommendation Q.3933 describes Key Performance Indicators and benchmarking methods for the spectrum of potential applications. Access technologies considered are all technologies offered by the operator.

# Scope of Functionality (1)

- The benchmarking platform can be distributed across a larger region or an entire country. In this case, several server systems should be also part of the set-up, including a system for evaluating media (e.g., video, audio, and voice) quality.

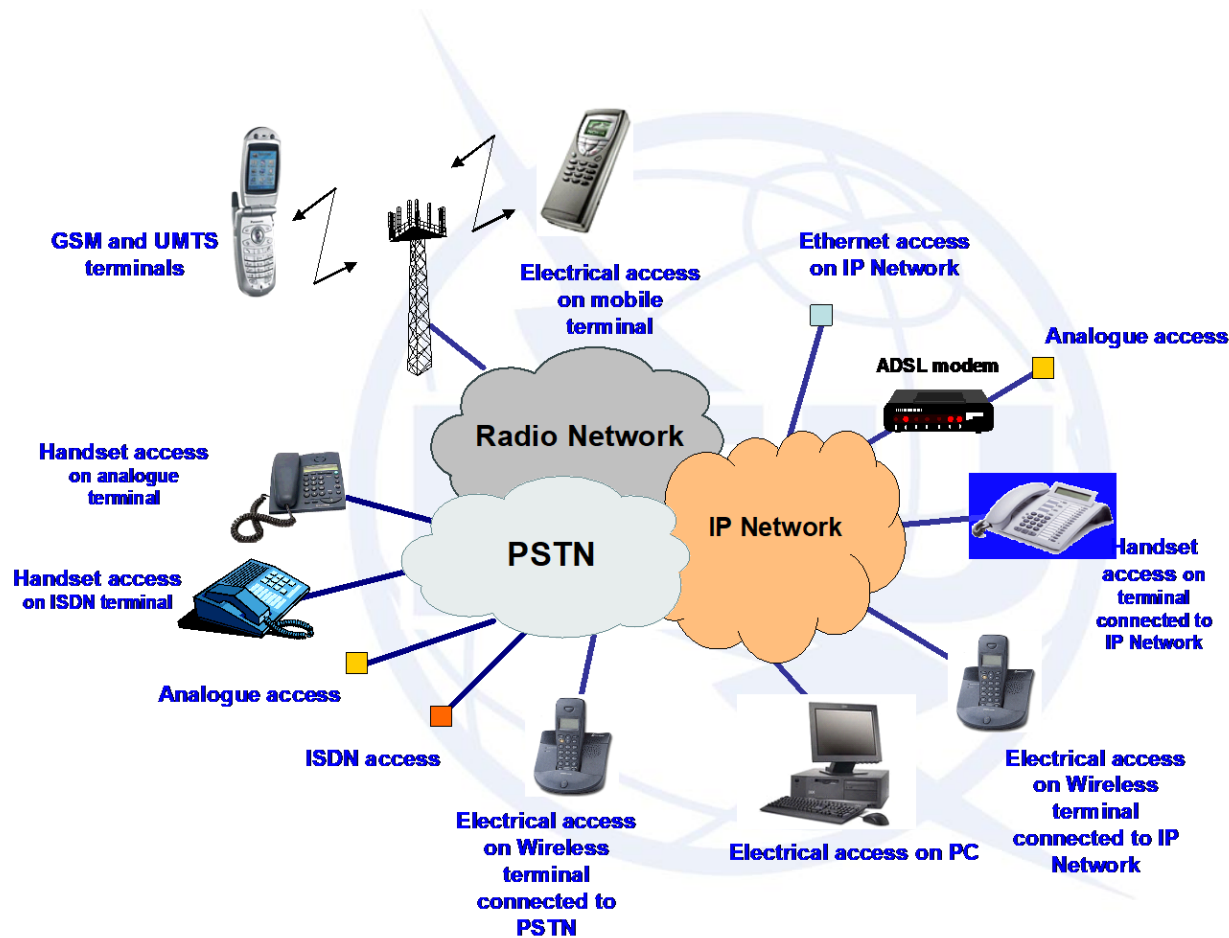
# Setup of the multiplay and benchmarking platform



# Scope of Functionality (2)

- The measurement systems at the user premises can be connected with IP, FXS or ISDN ports via a voice gateway (VGW), integrated access device (IAD), or directly to a CPE or Ethernet port (e.g., multimedia telephony service (MMTel) fixed access).

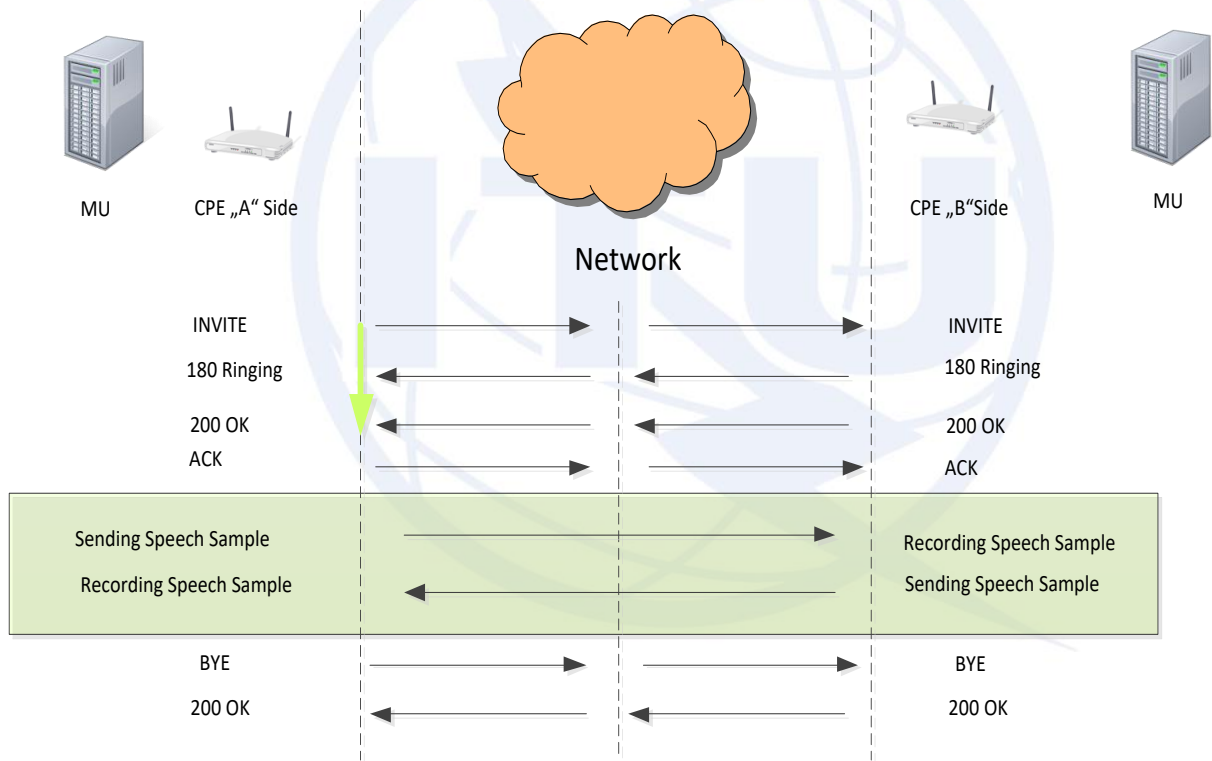
# Possible configurations and interfaces in context of user characterization



# Overview of Quality characteristics for voice quality measurements

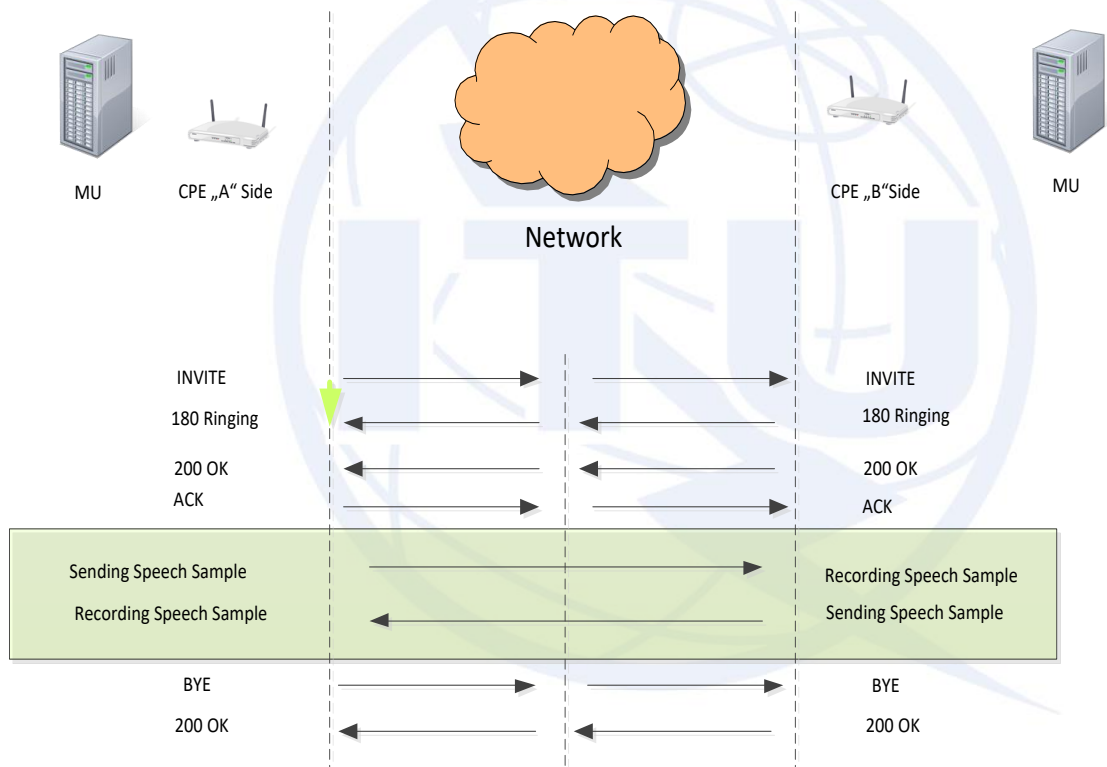
1.	call set up delay
2.	call set-up time (Post Dialling Delay)
3.	Call Setup Time Standard Deviation
4.	Premature release probability (Call Failure Rate)
5.	Call Drop Rate
6.	Unsuccessful call ratio
7.	Media establishment delay
8.	Level of active speech signal
9.	Noise level
10.	Noise to signal ratio
11.	Speech signal attenuation
12.	Talker echo delay
13.	Listening speech quality
14.	Listening speech quality stability
15.	End-to-End audio delay
16.	End-to-End audio delay standard deviation
17.	End -to-End audio delay variation
18.	Frequency response
19.	Fax transmission T.30 (Fax, bit rate $\leq 14,4$ kbit/s and Fax, bit rate $\geq 14,4$ kbit/s)

# Example: Call set-up time (1)





# Example: Call set-up time (2)





**Thank you!**

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