ITU WORKSHOP ON NGN CONFORMITY AND INTEROPERABILITY TESTING CENTRE (S) FOR THE AFRICA REGION

Nairobi, Kenya
August 2 - 4, 2010

ITTC Testing Experience

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Content 1/2

1. **Experiences of testing**

✓ *Experience and main projects of Technopark ZNIIS*

✓ *Preparation of ITTC project*

✓ *Possibilities of the ITTC Model network*

✓ *ZNIIS projects statistics*

2. **NGN Conformance and Interoperability testing**

✓ *Concepts of Conformance and Interoperability testing (incl. Compatibility)*

3. **European operators services conformance testing experience (ETSI approach)**
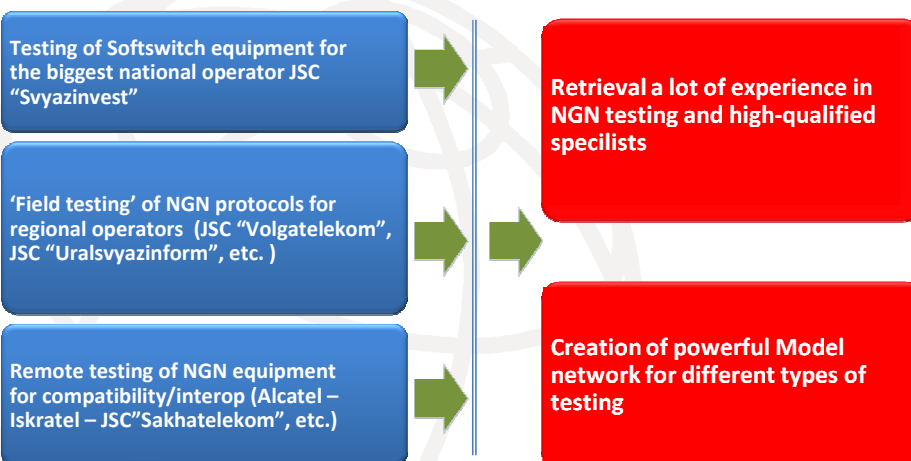
4. **Conformance testing of IP/MPLS**

✓ *ITTC experience on IP/MPLS testing*

Content 2/2

5. **Key features of SIP protocol Conformance testing/Problems detected during protocol Conformance testing**

6. **Key features of MEGACO protocol Conformance testing/Problems detected during protocol Conformance testing**

7. **ETSI experiences on Interoperability testing**

✓ *Experience from SIGTRAN ETSI Plugtests event*

✓ *Plans of participation in 4th IMS ETSI Plugtests event*

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Technopark NGN testing experience

Testing of Softswitch equipment for the biggest national operator JSC "Svyazinvest"	→	**Retrieval a lot of experience in NGN testing and high-qualified specilists**
'Field testing' of NGN protocols for regional operators (JSC "Volgatelekom", JSC "Uralsvyazinform", etc.)	→ →	
Remote testing of NGN equipment for compatibility/interop (Alcatel – Iskratel – JSC"Sakhatelekom", etc.)	→	**Creation of powerful Model network for different types of testing**

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ITTC title

International Telecommunication Union
Telecommunication Standardization Bureau

Central Science Research Telecommunications Institute (ZNIIS), Russian Federation

Project name:	International Telecommunication Testing Center (ITTC) established under auspices of ITU-ZNIIS
Project abbreviated name:	ITU-ZNIIS ITTC
Starting date:	January 2008
Date of term:	June 2011
State agencies engaged in cooperation	Administration and Ministry of Communication
Project implementing Agency:	International Telecommunication Union
Project implementing place:	Regional representation of ITU in Moscow
Project is implemented for benefit of the following countries :	PCC member-countries and developing countries

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ZNIIS projects statistics 1/3

Tested solutions:

o Softswitch

o Fixed/Wireless Broadband access

o IMS

o DWDM

o PON

o IP/MPLS

o IPTV

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ZNIIS projects statistics 2/3

- Alcatel
- Siemens
- Huawei
- Ericsson
- Lucent
- Nortel
- Marconi
- Mera Networks

- Cisco Systems
- Sentito
- ZTE
- ECI Telecom
- Italtel
- Iskratel
- Tekelec

- MFI Soft
- Informtechnika
- NEC Neva
- Sitronics
- Nateks
- ALSiTek
- Eltex
- ZyXel

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ZNIIS projects statistics 3/3

Amount of tests performed- 6973

6657

316

- Amount of successful tests - 6657
- Amount of problems - 316
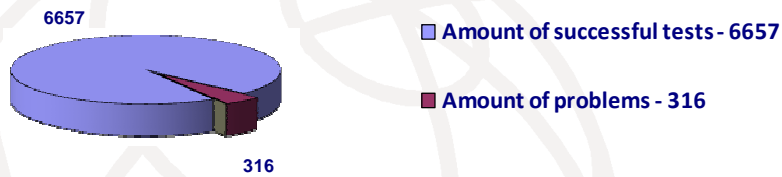
Overall amount of problems- 316

175

141

- Amount of repaired problems - 141
- Amount of unsolved problems - 175
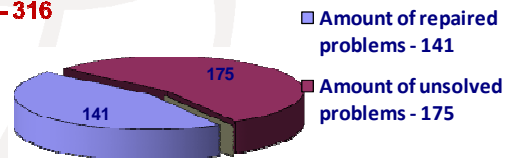
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NGN Testing stages

- conformance,
- compatibility,
- interworking $\Bigg\}$ **interoperability**

Conformance testing

1995: ITU-T   X.290
      ETSI   300406

Base: ISO/IEC 9646 considering telecommunication specifics

Types of conformance specifications

- PICS – Protocol Implementation Conformance Statement. Protocol PICS defines the testing procedure for base specification.
- PIXIT - Protocol Implementation eXtra Information for Testing. Protocol PIXIT defines the testing procedure for additional (optional) specifications. The both protocols – PICS и PIXIT – are presented in formalized form using ATS (Abstract Test Suite), which will allow for the TTCN language application for specifications testing.
- TSS & TP – Test Suite Structure & Test Purposes.

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Why do we need interop testing?

➤ Interoperability of operators for composing their networks on equipment of various manufacturers

➤ Interworking of single operator's network components based on equipment of various manufacturers

➤ Complementation of a segment composed on equipment of one manufacturer by equipment of another manufacturer

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Interop basic example
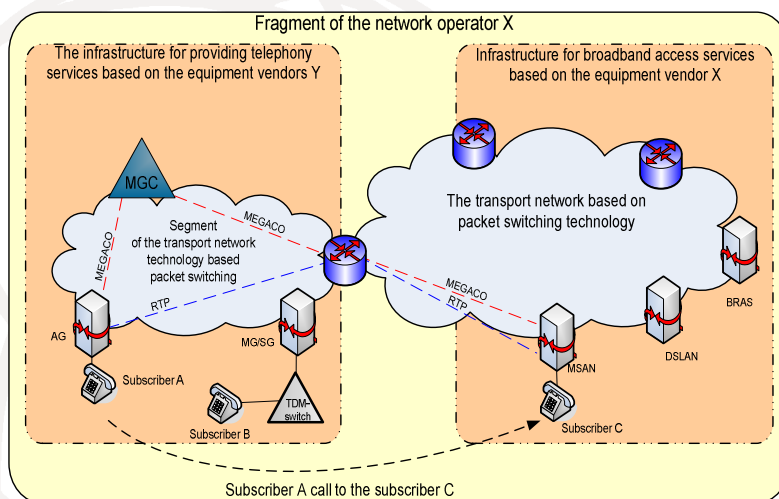
Concepts of interop testing

- **Interworking testing** – checking correctness of interworking of two network solutions
- **Compatibility testing** – checking correctness of a network solution when this solution is incorporated into components of another network solution

Typical reasons of interoperability absence

✓ Fuzzy requirements to parameters' format or values

✓ Failure of equipment manufacturers to implement all functionalities as prescribed by protocol specification

✓ Capability as prescribed by protocol specification to apply different procedures for one functionality implementation

✓ Errors made in protocols implementation

✓ Other reasons

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European operators services conformance testing experience/DT
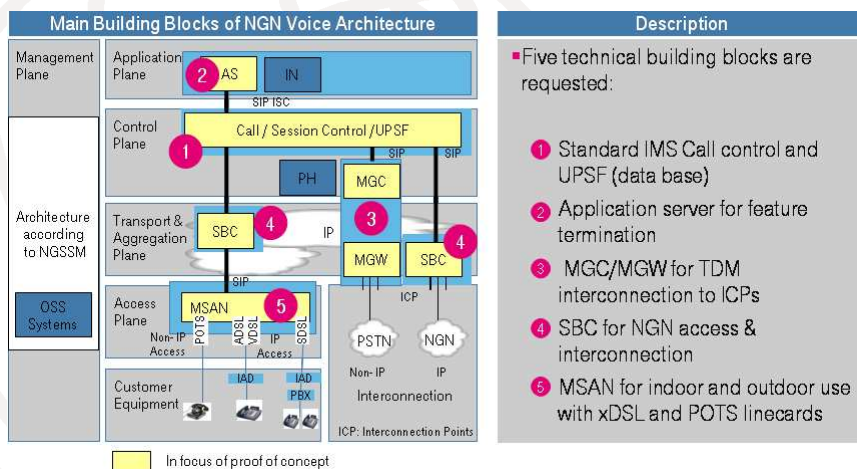
General and functional targets of the project
Targets 1/2

General targets

- Running testbed for network, operation and IT components
- Safeguarding of vendor selection
- Compression of short list
- Analysis of investment and production costs for the offered components

Functional targets

- Compatibility of the call-control with the available terminals (for example TOI-Client, Speedport…)
- Interconnection with PSTN/ISDN through MGC/MG
- Compliancy to regulatory requirements (LI, emergency call,…)
- End-to-end quality assessment from the customer view [1]
- Proof of general component interoperability in a multivendor environment

General and functional targets of the project
Targets 2/2

IT-Integration

- Ende-to-end assessment of network management functions and IT integration [1]
- Proof of functional and non functional interfaces to OSS

Migration proficiency

- Rating of the migration proficiency of the vendor
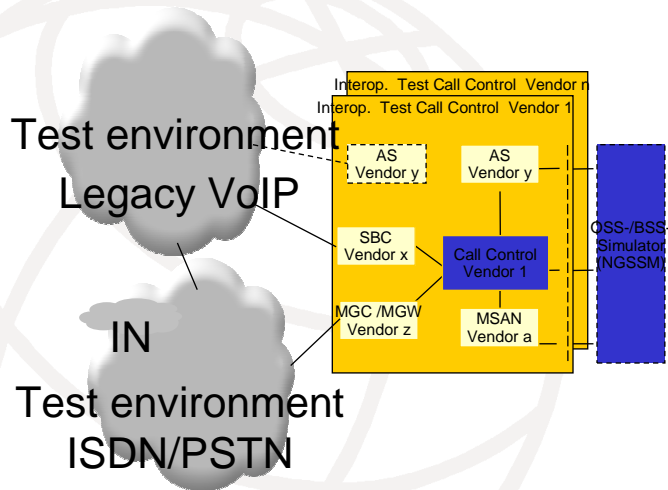
Integration proficiency

- Rating of the integration proficiency of the vendor

Assessment of the development proficiency

- Assessment of the vendors capability to realise new requirements in-time and in-quality

Proof of concept PSTN Migration Testbed architecture

Interop. Test Call Control Vendor n
Interop. Test Call Control Vendor 1

Test environment
Legacy VoIP

IN

Test environment
ISDN/PSTN

AS
Vendor y

AS
Vendor y

SBC
Vendor x

Call Control
Vendor 1

MGC /MGW
Vendor z

MSAN
Vendor a

OSS-/BSS-
Simulator
(NGSSM)

Proof of concept PSTN Migration Test matrix

Testbed	CallControl	AS	MSAN	MGC/MG	SBC
#1	Vendor 5	Vendor 3	Vendor 2	Vendor 4	Vendor 3
#2	Vendor 1	Vendor 5	Vendor 4	Vendor 1	Vendor 2
#3	Vendor 3	Vendor 1	Vendor 3	Vendor 5	Vendor 1
#4	Vendor 4	Vendor 3	Vendor 1	Vendor 3	Vendor 4

Test matrix explanation:
- 5 network elements
- 5 vendor
- <u>Not every network element is provided by every vendor</u>

Proof of concept PSTN Migration
Specific project targets 1/2

- **Standardised features from ETSI TISPAN Release I, i.e OIP, OIR, etc.**
- **Overlap Dialling, DDI**
- **SIP-ISC interface – multivendor interoperability with AS-Supl.Serv.**
- **SIP-ISC interface – telephone number handling at external AS-IN (i.e. RNPS)**
- **IN-Call over MGC/MG and PSTN**
- **Interconnection with PSTN over existing MGC/MG**
- **Interconnection with other IP-IMS domain, legacy VoIP and IP-Interconnection**
- **Multivendor interoperability for MSAN and SBC**
- **Provisioning of subscribers, record of call records**
- **Administration of supplementary services**
- **Security check including scan over the network elements**
- **Speech quality, connection stability**
- **Test of remote configuration**

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Proof of concept PSTN Migration
Specific project targets 2/2

- Proof of element stability, system monitoring, performance management, (overload control, alarm management, redundancy, …)
- Verification of diagnostic capabilities for fault-clearance and monitoring
- Test of recovery ability in case of fault, or backup restore
- Verification of break-in, break-out, on-net and emergency call functions
- Interoperability of CDRs
- Usability from the customer point of view
- Support of the business processes
- Comparison of production cost factors (for example based on business/test case)

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Proof of concept PSTN Migration
Results of PoC

Result of technical evaluation

	V1	V2	V3	V4	V5
AS	● short listed	● not considered	● not considered	● not considered	● not short listed
Call Control	● short listed	● not considered	● not considered	● not considered	● not short listed
SBC	● not considered	○ with constraints	● not considered	● short listed	○ with constraints
MGC/ MGW	● short listed	● not considered	○ with constraints	● not considered	○ with constraints
MSAN	○ with constraints	● short listed	● short listed	● short listed	● not short listed

- short listed
- not short listed
- with constraints
- not considered

+ System integration and processing of test steps from the requirements catalogue was performed by all vendors in time.

+ Proof of concept project brought the general evidence of multivendor capability of the IMS NGN concept.

+ Based on the PoC results the deployment project with short listed vendors was initiated.

- None of the short listed vendors covered the requested functions and features completely.
- Detailed requirements of the deployment project are much harder to meet for the vendors as compared to the PoC results.

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ITTC experience on IP/MPLS testing

AS XXXX
P-L1 Core Network
10Gb 10Gb 10Gb 10Gb
P-L2 Regional
1Gb
P-L2 Regional
10Gb
10Gb 10Gb
ASBR – L2 Regional
1Gb
ASBR – L2 Regional
AS ZZZZ
AS YYYY
10Gb
10Gb 10Gb
P/PE L2 Regional
1Gb
P/PE L2 Regional
10Gb
10Gb 10Gb
P/PE
P/PE
10Gb
10Gb

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Testing program

- ✓ **Testing of interfaces and protocols;**
- ✓ **Testing of dynamic inta-domain routing**
- ✓ **Testing of inter-domain routing**
- ✓ **MPLS specifics**
- ✓ **Testing of RSVP and L2 VPN**
- ✓ **Testing of Multicast**
- ✓ **Testing of QoS**
- ✓ **Testing of Security**
- ✓ **Stress testing**
- ✓ **Load testing**
- ✓ **Testing of monitoring and statistics features**

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Testing results – typical problems

- ■ Functionalities of DHCP and DNS in double stack of protocols IPv4/IPv6 are not router's function

- ■ Technology of transmission of client routing information IPv4/IPv6 and traffic IPv4/IPv6 VPRN via IPv6 MPLS network is not supported

- ■ Function of bidirectional detection of BFD data feed for IS-ISv6 and OSPFv3 is not realized

- ■ Function of bidirectional detection of BFD data feed for LDP MPLS forLDP protocol is not realized

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Testing results – conclusions

- Testing methods make it possible to evaluate functional and quantitative characteristics of routers incorporated in IP/MPLS solution

- As a result of tests certain corrections are introduced into testing methods and into the standard as for supported functionality

- It is necessary to perform testing for compatibility of routers of IP/MPLS solution

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Key features of SIP protocol Conformance testing/Program

№	Check group	Functional element CCP	Checked functions	NGN function as per Y.2012	Test numbers
1	Registration procedures	Terminal equipment	Procedures on terminal	EU-FE	SIP_001– SIP_020
		Proxy/Registar	Procedures on registration server	S-2/S-1	SIP_021– SIP_045
2	Call control procedures	Terminal equipment	Outgoing calls including creation, change and completion of connections	EU-FE	SIP_046– SIP_060
		Terminal equipment	Incoming calls including creation, change and completion of connections	EU-FE	SIP_061– SIP_080
		Proxy	Procedures on proxy server including processing of requests and replies and different types of transactions	S-2/S-1	SIP_081– SIP_123

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Example of test suit form

Test number	SIP_001
Test name	**REGISTER request realization check**
Test jbjective	Register request realization check for compliance to Item 10.2, RFC 3261 [1]
Initial state	Tests are effected in compliance with Scheme in Fig/ 1
Test procedure	Make sure that IUT for purpose of registering sends REGISTER request to registration server given in adjustment specifications without user's name in Request-URI field and with SIP-URI address as a URI request
Expected result	Tested protocol realization complies with Item 10.2, RFC 3261 [1]requirements

Problems detected during protocol Conformance testing

1. The test of AG gateways interworking has revealed a non-conformance of Via field value in BYE request to the value which was earlier transmitted in the INVITE request. Gateways controller transmits surplus symbol «=», which is absent in INVITE request;

2. During call ring off up to reply of a called subscriber the UA sends ACK message with incorrect parameter c CSeq, method=INVITE (while it should be method=ACK)

3. The To field value inBYE request differs from the value transmitted in the final reply (another port is indicated)

4. Some others.

Problem description example (№3)

```
Тестер  ←— SIP —→  UA
```

Test number	SIP_096
Test name	Request formation and session completion (RFC 3261 [1] Items 12.2.1.1 и 15)
Test objective	Checking protocol realization conformance to Items of RFC 3261 Items 12.2.1.1 и 15
Initial state	Tests are effected in compliance with the scheme in Fig. 2
Test procedure	Make sure the IUT for dialog completion sends the BYE with the To field equal to the value as received in the last final reply
Expected result	Test procedure is a success
Obtained result	**The BYE message contains incorrect data**

Key features of MEGACO protocol Conformance testing 1/2

№	Check group	CCP function element	Checked functions	NGN function as per Y.2012	Test numbers
1	Checking of control signaling protocol realization on gateway equipment	MG	Procedures using the Add instruction	T–7, T–8, T–9	H248_001–007
			Procedures using the Modify instruction		H248_008–014
			Procedures using the Subtract instruction		H248_015–020
			Procedures using the Move instruction		H248_021–024
			Procedures using the Audit Value instruction		H248_025–032
			Procedures using the Audit Capabilities instruction		H248_033–040
			Procedures using the Notify instruction		H248_041–043
			Procedures using theService Changeinstruction		H248_044–057
			Administration and maintenance procedures		H248_058–069
			Messaging procedures		H248_070–074

Key features of MEGACO protocol Conformance testing 2/2

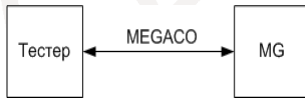| №	Check group	CCP function element	Checked functions	NGN function as per Y.2012	Test numbers
2	Checking of control signaling protocol realization on gateway controller equipment	MGC	Procedures using the Add instruction	S−8	H248_075−081
			Procedures using the Modify instruction		H248_082−088
			Procedures using the Subtract instruction		H248_089−093
			Procedures using the Move instruction		H248_094−097
			Procedures using the Audit Value instruction		H248_098−105
			Procedures using the Audit Capabilities instruction		H248_106−113
			Procedures using the Notify instruction		H248_114−116
			Procedures using theService Changeinstruction		H248_117−131
			Administration and maintenance procedures		H248_132−139
			Messaging procedures		H248_140

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Problems detected during protocol Conformance testing

1. The MGC software employs the mode of sending several instructions in one transaction of protocol H.248. The MG software supports the receive mode for only one instruction in one transaction of protocol H.248. As a result, not all of the instructions received by MG are executed and correct interoperability is impossible;

2. After the receiver is taken on the terminal connected to the communication facility (access gateway) the gateway in reply to the Modify message transmits a message with the error code 519 Out of space to store digit map (insufficient storage for saving the numbering plan). In this case, it is impossible to transmit the number digits when the terminal is operated in pulse mode..

3. In reply to the AuditValue instruction requesting the information as per identification of ports being in the zero context the error message is received. This occurs during sequential transmission of several AuditValue instructions

4. Some others

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Problem description example (№3)

Test number	H248_030
Name	AuditValue instruction (Recommendation ITU H.248.1, Item 7.2.5)
Test objective	AuditValue instruction realization conformance checking
Initial state	Tests are performed according to scheme in Fig. 2 2 ports TID1 and TID2 (in zero context).

Test procedure	Make sure the gateway during receiving Transaction Request message :
	Action request with parameters:
	  CID set to NULL;
	AUDIT VALUE instruction with parameters :
	    TID set to ALL(p12);
	    acceptable replying descriptor.
	The Transaction Reply message is transmitted containing: Reply to actions with parameters :
	  CID set to NULL;
	Reply to the AUDIT VALUE instruction with parameters:
	    TID set toTID1.
	Reply to the AUDIT VALUE instruction with parameters :
	    TID set to TID2.

Expected result	The AuditValue instruction realization complies with the test procedure descriptions
Obtained result	**Message processing error data**

Тестер ←→ MEGACO ←→ MG

Plugtests?

ETSI

PLUGTESTS™
THE INTEROPERABILITY SERVICE

Plugtests – a special unit of ETSI, dealing with organization of international events on interoperability testing of equipment of various manufacturers on the basis of state-of-the art technologies.

Plugtests Advantages

For vendors which realize a new technology in programs and equipment the plugtests make it possible:

- at a comparatively small price (or free of charge) to perform testing of products in various situations and to check for compatibility with competitors' products before entering the market;

- to perform conformance testing so as to obtain immediate clarification of test results from the test creators who often attend such tests

- to discuss vague points of standards with the standard creators or with colleagues from other companies

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Plugtests Advantages (cont..)

For creators of test sets the Plugtests make it possible:

- To perform checkout of test sets during realization of new technologies.

- To clarify vague points or revealed errors of standards jointly with standard creators.

For standard/specification creators the Plugtests make it possible:

- To get reports from experienced experts on standard quality and revealed defects, inaccuracies and errors

- To discuss new possibilities and enhancements which were additionally by standard creators for the purpose of standardization.
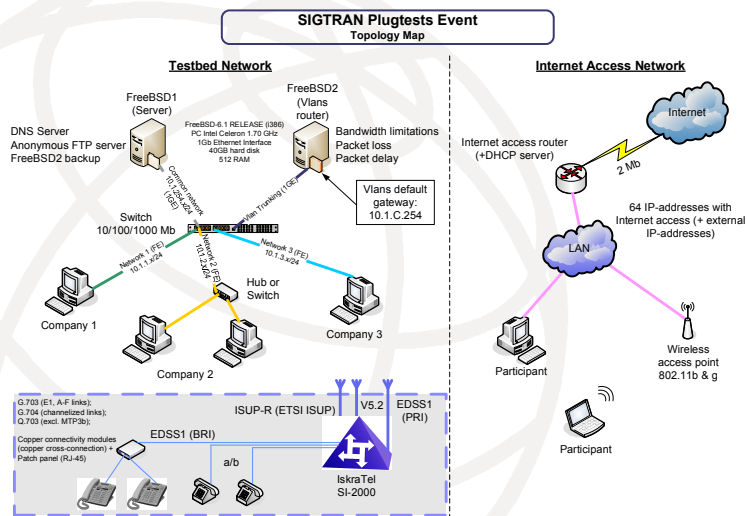
Plugtests in ZNIIS

In the period from April 16 to April 20, 2007 the ZNIIS Technopark has arranged for testing of SIGTRAN protocols, realized by various equipment manufacturers.

A special testing scheme of SIGTRAN protocols has been made on the basis of the Technopark model network

Testing scheme

Event participants

The testing participants included many leading companies engaged in development and standardization of NGN technologies, such as:

- **Tekelec**
- **Nortel**
- **Cisco**
- **Adax**
- **Sitronics**

- **Ulticom**
- **Dialogic**
- **Linkbit**
- **Aricent**
- **Emerson**

Testing results

The testing has revealed a number of problematic points in SIGTRAN specifications. Besides, the software creators of different companies could compare their own realizations of protocols with realizations of other companies.

For more detailed information about the testing results refer to the ETSI Plugtests website address:

http://etsi.org/WebSite/OurServices/Plugtests/2007SIGTRAN.aspx

ZNIIS-Plugtests next step

ZNIIS is taking active part in work of WG4 of SG11 ITU-T engaged in elaboration of Recommendations on NGN technical means testing

During NGN GSI event (May 2010) **the ITU-T Recommendation Q3904** which describes the IMS solutions testing principles elaborated by ZNIIS experts **has approved**

Due to close cooperation between **ETSI – ZNIIS in the NGN testing field** the ETSI TC INT working group has invited ZNIIS experts to perform works under **STF394** which describes IMS Network-to-Network Interface (NNI) testing methods

As a result of this cooperation the ZNIIS experts have acquired experience and qualification in the field of **IMS solutions testing within the ETSI activity framework**

Due to employment of **IMS equipment of different manufacturers on the ZNIIS model network** the ETSI has proposed to ZNIIS to take part in the annual interoperability testing event **"4th IMS Plugtest"** as a remote site. This event will be held in France in November 2010

In its turn **ZNIIS is ready to supply the model network** resources to provide for manufacturers' connection to the Plugtests network during tests

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4th IMS Plugtest event

❑ Assessment of a possibility of interoperability of the IMS network cores of various manufacturers and the application servers of outside participants due to commercial use of IMS user terminals

❑ Further testing of base calls, multimedia possibilities, Supplementary services, "hidden layout" and roaming issues in IMS networks

❑ Greater number of tests of services (RCS, Rich Communication Suits)

✓ "Presence" service

✓ Instantaneous messaging/chat

✓ File transmission

✓ Others

❑ Testing of IMS core on different application servers (including RCS services)

❑ Checks will be effected for compliance with Specification 3GPP Release v8.10

❑ As a methodology use will be made of the following specifications elaborated within STF 394 framework:

✓ ETSI TS 186 011-2 (Test descriptions for IMS NNI Interoperability)

✓ ETSI TS 102 901 (IMS NNI interoperability test descriptions for RCS)

Testing scheme/ZNIIS remote connection

Thank you for attention

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