International Telecommunication Union
Telecommunication Development Bureau

Central Science Research Telecommunication Institute (ZNIIS), Russian Federation.

Project Closure Report

International Telecommunication Union - Central Science Research Telecommunication Institute: International Telecommunication Testing Centre

Moscow
2011

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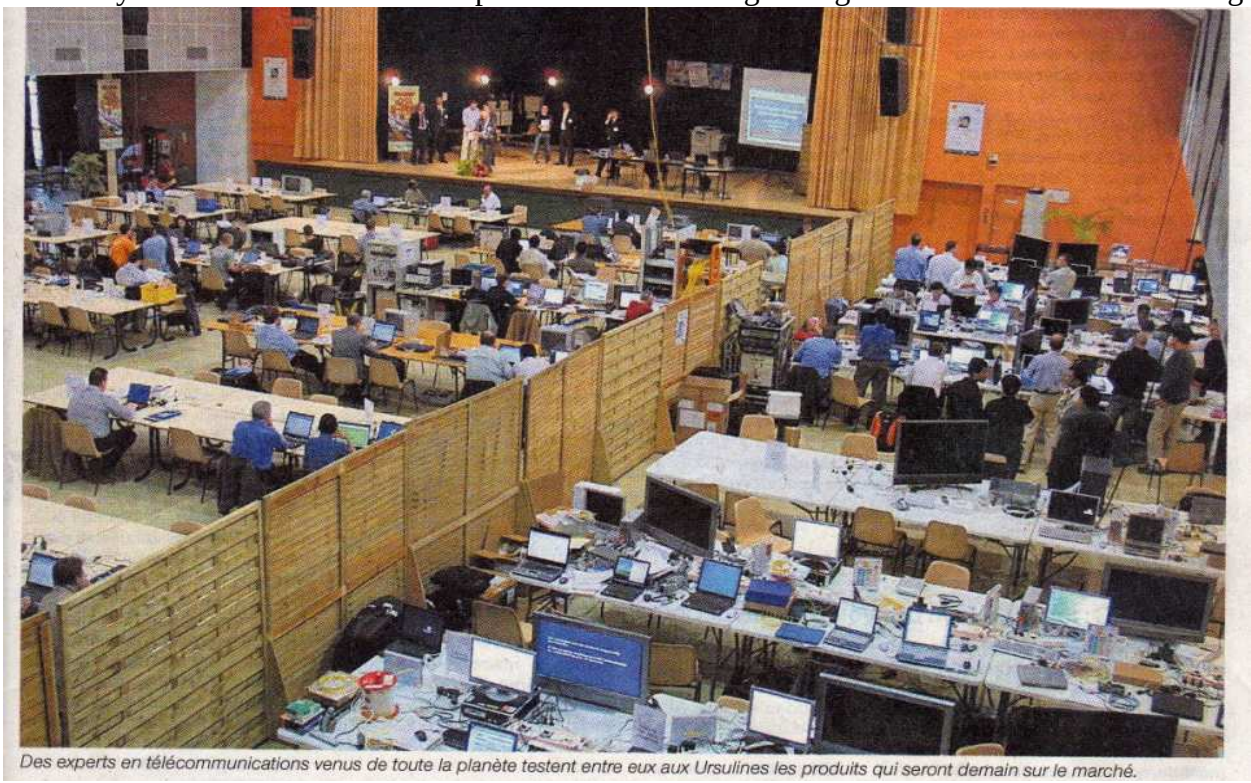
General Information

Project title:	International Telecommunication Union – Central Science Research Telecommunication Institute International Telecommunication Testing Centre
Project number:	7RER07820
Project Time Frame:	From 1/3/2008 To 31/8/2011
Implementing Agency:	International Telecommunication Union
Beneficiary country:	CIS and other developing countries
Prepared by:	Andrei Untila, Program Officer ITU Area Office for the CIS Countries

Background and context

As broadband access and internet-based services continue to expand, Next Generation Networks (NGN) is becoming more important in the development of telecommunication networks. To minimize the risks of network migration or updating of core networks, testing of NGN equipment is vital for those involved in network construction. Prior to full-scale network deployment, vendor equipment should be methodically tested to detect any hardware and/or software defects and to determine the possibilities of multi-vendor equipment interoperability and network integration. This is particularly the case for operators, where testing is key in order to construct high quality and efficient telecommunication networks.

All these factors as well as the rapid development of innovative telecommunication technologies inevitably indicate the importance and growing demand for testing.



Des experts en télécommunications venus de toute la planète testent entre eux aux Ursulines les produits qui seront demain sur le marché.

The transition of telecommunication networks to packet switching demands different testing methods. Currently, stand-alone equipment is tested on the conformance of network protocols against existing standards and on equipment interoperability testing.

Network architecture has evolved, namely, network horizontal planning, considering the NGN architecture and its differing functions at different layers. Therefore, the basic approaches to testing procedures need to also change accordingly.

Testing of NGN networks should be based on a Model Network, which duplicates the architecture of an appropriate network and simulates the network load for each operator. In this case, testing can confirm the conformity of the network under construction with the client requirements and with international telecommunication standards.

The above-described method is quite relevant, as it allows the testing of parameters that were not previously tested. These parameters include the network itself and the functionality of the network elements, Quality of Service, e2e communication scenarios, services functioning, roaming etc.

Therefore the use of the model network adapted to test different equipment and scenario will provide better knowledge for NGN deployment.

ITU-ZNIIS-Partners Collaboration

In accordance with the Resolution No. 17 SG11 ITU-T adopted at WTCA in Brazil 2004, within the framework of Q.8/11, NGN testing standards should be developed.

During the research period within the framework of Q.8/11, active work has been performed to promote the set of Recommendations offered by the Administration of Russia; these Recommendations dealt with the issue of NGN testing. As a result, by the end of the research period, significant results were achieved. Recommendation Q.3900 has been approved - it dealt with the basic approaches to NGN testing. Two Recommendations, which deal with testing methods as well as with NGN testing and monitoring equipment requirements, were submitted for approval.

Based on the results achieved, the World Telecommunication Development Conference (WTDC) 2006 in Qatar has adopted the Doha Action Plan Part 3.1, Part 3.5.2, Resolution 17 that include the recommendation to develop International Centres for testing new generation telecommunication networks.

Resolution 17 therefore supports the initiative of the Regional Commonwealth in the field of Communications (RCC) in creating an International Centre for testing and introducing new telecommunication technologies. During the joint 18/14-th Assembly of RCC Telecommunication Operators Council and Telecommunication RCC Committee which took place in Moscow (26-29 March 2006), the ZNIIS Report, which contained the detailed suggestions on the development of the International Centre was approved.

ZNIIS currently possesses a highly developed technological site, which fulfills the requirements for model networks (Q.3900). The site is quite capable in serving as a technical base for testing NGN and technical solutions in accordance with the methods that are currently being standardized.

Project objectives and expected outputs

Project objectives

The main objective of the Project was to establish an International Telecommunication Testing Centre (ITTC) to:

- reduction of the digital gap in the developing countries of the Region;
- test new telecommunication equipment and services;
- harmonize methods for the provision of new services within a region;
- harmonize the introduction of telecommunication standards issued by different international organizations in one or more regions;
- resolve system/network issues associated with the modernization of communication networks, taking into account previous communication network development experience within a given region;
- train specialists from developing countries.

Expected outputs

The Project should have the following outputs:

- An ITTC will be established with adequate space for classrooms, laboratories, conference hall, administration and management and etc.;
- A model network for practical NGN testing and for lab exercises during training;
- Effective testing strategies (methodologies) on the model networks;
- Training programs and training material;
- Access to the Knowledge Database of NGN tests results.

Work Plan

№	Activities/Milestone	2007				2008												2009												2010												2011							
		9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8
1	Preparation of the project proposal with basic requirements and estimation of the project costs																																															
2	Seeking funds from external Partners and other sources																																															
3	Setup of the System Network sub-centre and installation of equipment to create a Model Network																																															
4	Developing effective testing strategies and training material on the Model network at the System Network sub-centre																																															
5	Testing on the Model Network at the System Centre Network sub-centre and Reporting																																															
6	Installation of equipment to create the Conformance Testing sub-centre																																															
7	Developing effective test strategies and training on the Model network at the Conformance Testing sub-centre																																															
8	Conformance Testing and Reporting																																															
9	Workshop on Conformance Testing																																															
10	Installation of equipment to create the QoS testing sub-centre																																															
11	Testing and training on the Model network using QoS testing sub-centre. Workshop on the result of testing																																															
12	Creation Knowledge centre and preparation knowledge database																																															
13	Workshop of Results Testing																																															
14	Identification of further needs and requirements																																															
15	Project assessment and conclusion																																															

Project activities

According to the Work Plan ITTC Project has been started from preparation of the project proposals with basic requirements and estimation of the project costs. Next step was to seek funds from external Partners and other sources.
After preparation of the project contract and establishment of agreements with Partners all tasks of the Work Plan were combined in 5 stages: initial, system-network testing, conformance testing, QoS testing and final stage. The detailed description of tasks under each stage is provided below.
All results of the ITTC Project for CIS Region have been uploaded into the Knowledge Database which was specially created for the Project tasks and to share its successful experience all over the world. The Knowledge Database is accessible via the following link on ITU-D website http://www.itu.int/ITU-D/tech/NGN/ConformanceInterop/indexProject.html and direct link on the ZNIIS website http://zniis.ru/ITTC.html. All results of the Project are distributed over special folders in the Knowledge Database which are also provided below using abbreviation *KB/* (these are just paths to the documents in the Knowledge Database and not working as web-links).

Initial stage:

- Development of general documentation on ITTC functional processes and ITTC Workflow system which cover System Network, Conformance and QoS sub-centres creation under clauses 3, 6, 10 of ITTC project work plan (*Annex 1*);
- Creation of Model Network for ITTC based on ITU-T Recommendation Q.3900 and common for all ITTC sub-centers (*'Results and impacts' clause*).

System-network testing stage:

- Creation of experts group for the System Network sub-centre;
- Developing effective NGN system-network solutions test strategies for CIS Region (*KB/Testing on the MN/Testing system-network solutions/Interoperability testing/Company/Project/Testing documents/PMT*);
- Developing training materials on NGN system-network solutions testing (http://www.itu.int/ITU-D/tech/OLD_TND_WEBSITE/network-infrastructure_OLD/Moscow_ZNIIS_Dec08/ZNIISSeminar_Moscow_Dec2008_TrainingMethodologicalGuide.pdf);
- Organization and carrying out Training seminar on NGN system-network solutions testing (*Annex 2*);
- Carrying out testing of NGN system-network solutions on the Model network at the System Network sub-centre and development of the corresponding reports (*KB/Testing on the MN/Testing system-network solutions/Interoperability testing/Company/Project/Testing results/Tests protocol*);

Conformance testing stage:

- Creation of experts group for the Conformance sub-centre;
- Developing effective Conformance test strategies for CIS Region (*KB/Testing on the MN/Testing system-network solutions/Conformance testing/Company/Project/Testing documents/PMT*);
- Developing training materials on Conformance testing (http://www.itu.int/ITU-D/tech/OLD_TND_WEBSITE/network-infrastructure_OLD/Moscow_ZNIIS_Dec09/Methodological_Guidance.pdf);
- Organization and carrying out Training seminar on Conformance testing (*Annex 3*);
- Carrying out conformance testing of NGN protocols on the Model network at the Conformance sub-centre and development of the corresponding reports (*KB/Testing on the*

MN/Testing system-network solutions/Conformance testing/Company/Project/Testing results/Tests protocol);

- Carrying out Workshop on Conformance Testing (*Annex 4*).

QoS testing stage:

- Creation of experts group for the QoS sub-centre;
- Developing methodological materials (handbook) on QoS testing (*KB/Testing on the MN/Testing of operators networks, services, QoS/Company/Project/Testing documents/PMT*);
- Organization and carrying out Training seminar on QoS testing (*Annex 5*);
- Carrying out QoS and Network Performance (NP) parameters testing on the Model network at the QoS sub-centre and development of the corresponding reports (*KB/Testing on the MN/Testing of operators networks, services, QoS/Company/Project/ Testing results/Tests protocol*);
- Carrying out Workshop on QoS Testing (*Annex 6*).

Final stage:

- Development concept on Knowledge Database (*Annex 7*);
- Creation of ITTC Knowledge Database (http://zniis.ru/ITTC.html);
- Development Knowledge Database User Manual (*KB/Methodical page*);
- Carrying out Final Workshop on the ITTC Project results (*Annex 8*);
- Project assessment and conclusion, development of Project Closure Report.

The summary results of the Project activities are provided in the ‘Results and impacts’ clause of the current Report.

Project budget

Project Budget	
Description	**US$**
Project Personnel	267 500
Evaluation	7 500
Training	60 000
Miscellaneous	10 000
ITU Admin Support Cost (7.5%)	25 875
SUB-TOTAL:	**370 875**
Cost Sharing	
Description	**US$**
ITU	370 875
ZNIIS in-kind contribution (described below)	399 125
TOTAL:	**770 000**

In-kind contribution fully provided by ZNIIS:

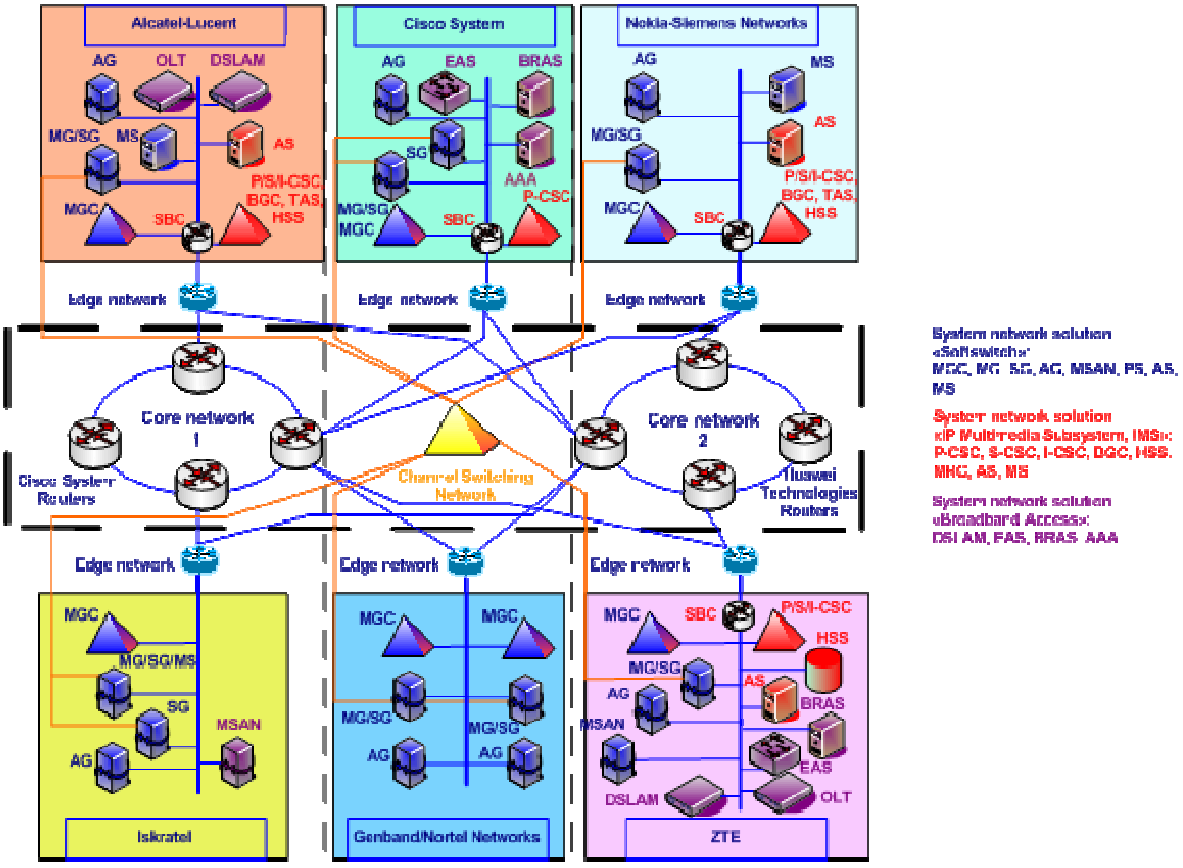
- provide equipment for building part of Model Network;
- provide test equipment for this part;
- laboratory zone for Model Network building (800 – 1000 m^2)
- office space – 3 rooms (20 m^2)
- training centre (170 $m^{2)}$
- provide laboratory facilities such as: electricity, Internet access, phone connection, stationery and etc.
- office space for project manager and project staff, with utilities and communication facilities free of charge;
- supporting documentation and detailed information, necessary to implement the Project;
- organization of workshops, seminars and training courses within the Project framework and provide the facilities (rooms, equipment and etc.);
- Legal and administrative support required during the Project implementation;
- Any other assistance to the Project that may be required by ITU Project staff including subcontractors engaged under this project.

Results and impact

This clause of the report contains summary results of the Project activities and their impact for the CIS Region.

An ITTC was established with adequate space for classrooms, laboratories, conference hall, administration and management rooms which provided in ZNIIS headquarter (Moscow) as in-kind contribution.

Also ITTC Model network was built in full conformance with ITU-T Recommendation Q.3900 on the basis of Technopark ZNIIS model network. The scheme of the ITTC Model network is provided below.



ITTC Model Network scheme

This Model network consist of 2 Core networks (IP), 1 Channel switching network (TDM) and 6 edge networks which are built using solutions/equipment from different manufacturers. The main NGN solutions provided are Softswitches, IMS and different types of Broadband Access systems. Additionally ITTC Model network includes all required cross-connection equipment, power supply systems, cables and etc.

For the purposes of ITTC Project there was created special Knowledge Database, developed in full conformance with ITU-T Recommendation Q.3903. Currently this Knowledge Database contains all results and documents of the ITTC Project activities. The Knowledge Database is accessible via the following link: http://zniis.ru/ITTC.html.

Under the ITTC Project there were conducted 3 events on developing NGN testing methodologies which resulted in 6 methodological documents (*KB/Testing on the MN/-/Company/Project/Testing documents/PMT*).

For the whole life period of ITTC Project there were carried out 3 testing events which were supervised by experts from developing countries (Azerbaijan, Kyrgyzstan, Kazakhstan, Moldova). As the result of these events there were developed 6 testing reports (*KB/Testing on the MN/-/Company/Project/ Testing results/Tests protocol*).

There overall amount of training seminars and Workshops organized within the framework of ITTC Project equals to 6, including:

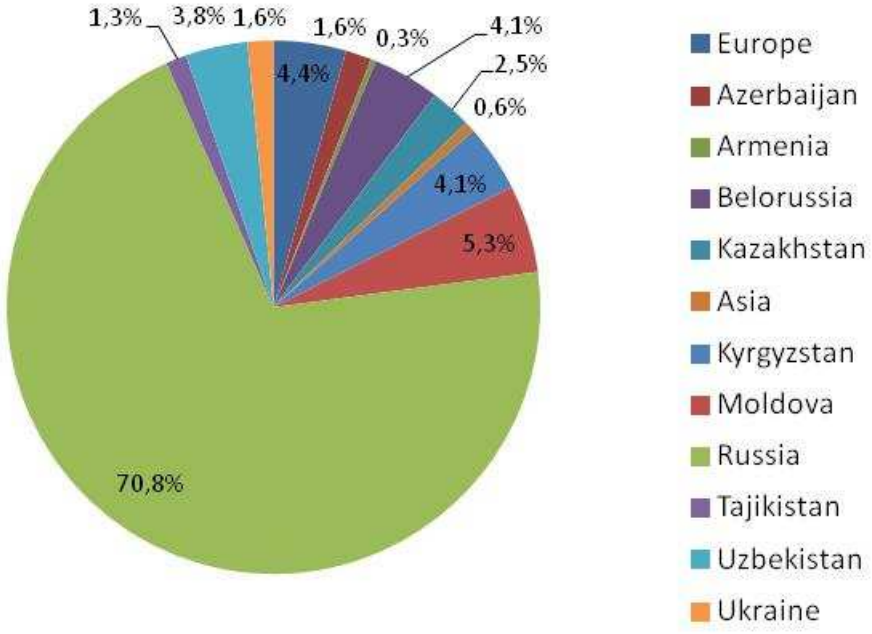
- System-network solutions training «Testing of system and network solutions», 15-17 December 2008 Moscow (http://www.itu.int/ITU-D/tech/OLD_TND_WEBSITE/network-infrastructure_OLD/Moscow_ZNIIS_Dec08/ZNIISFinalPresentations.html)
- Conformance training «Conformance testing», 10-11 December 2009 Moscow (http://www.itu.int/ITU-D/tech/OLD_TND_WEBSITE/network-infrastructure_OLD/Moscow_ZNIIS_Dec09/ZNIISFinalPresentations_2009.html)
- Conformance Workshop «Experience of testing and introduction of NGN», 8-9 July 2010 Moscow (http://www.itu.int/ITU-D/tech/OLD_TND_WEBSITE/network-infrastructure_OLD/Moscow_ZNIIS_Jul10/ZNIISFinalPresentations_2010.html)
- QoS training «Approaches on network performance parameters testing to ensure services quality», 17-18 March 2011 Moscow (http://www.itu.int/ITU-D/tech/events/2011/Moscow_ZNIIS_March11/ZNIIS_March11_FinalPresentations.html)
- QoS 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», 27-29 April 2011 Moscow (http://www.itu.int/ITU-D/tech/events/2011/Moscow_ZNIIS_April11/ZNIIS_April11_FinalPresentations.html)
- Final Workshop «Innovative research directions in the field of telecommunications in the World», 21-22 July 2011 Moscow (http://www.itu.int/ITU-D/tech/events/2011/Moscow_ZNIIS_July11/ZNIIS_July11_FinalPresentations.html)

There was also developed a Handbook on QoS and Network Performance parameters testing (*KB/Testing on the MN/Testing of operators networks, services, QoS/Company/Project/Testing documents/PMT*). This handbook has been contributed to the ITU-T SG11 Meeting (17-21 November 2011).

The overall number of participants attended the ITTC Project events is 318 specialists from 19 countries what. In particular, specialists from 10 CIS countries have participated in ITTC Project events, including Armenia, Azerbaijan, Kyrgyzstan, Kazakhstan, Moldova, Tajikistan, Russia, Ukraine, Uzbekistan, Belorussia (figure below). These are the visible evidences of the digital gap reduction in the developing countries of the Region

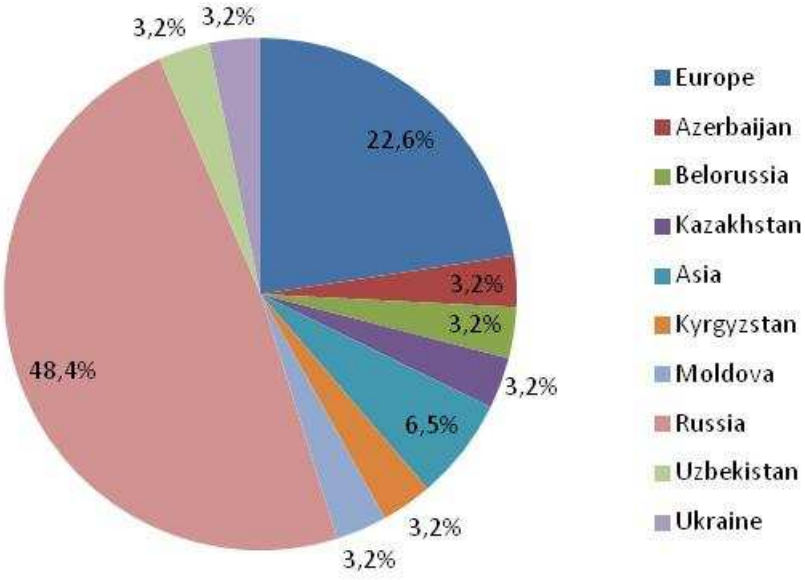
ITTC Project coverage of CIS Region developing countries

Below there is a statistical diagram on ITTC events participation activity from different countries.



Percentage of participants from different countries

The overall number of experts participated in the ITTC Project events is 31 specialists from 15 countries. Below there is a corresponding statistical diagram.



Percentage of experts from different countries

Partners/Sponsors of the ITTC Project were the following telecom operators:

- JSC «Svyazinvest»;
- JSC «Rostelecom»;
- JSC «Mobile TeleSystems»;

and manufacturers:

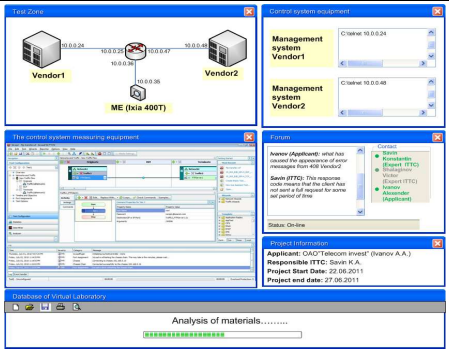
- Alcatel-Lucent;
- Huawei;
- Iskratel;
- Netris;
- Nokia-Siemens;
- Syrus/IXIA;
- ZTE.

Additionally to the ITTC results in the field of specialists from developing countries education/training the ITTC Project has the following main outputs:

1. Practical experience of specialists from developing countries of CIS Region on NGN testing using Model networks and corresponding methodological base;

2. Professional Social Network based on Facebook 'groups' facilities which is used for communication between colleagues, uploading/downloading photos, posting links to presentations under Project events and other tasks. This open group is accessible via the following link: http://www.facebook.com/groups/ittc.cis.

3. Created a draft new Project under CIS Regional Initiatives (WTDC-10, India, 23rd May – 4th June 2010) with the following name «Creation virtual laboratories for remote equipment, technologies and services testing under Resolution 76 WTDC-08, ITU database filling and providing remote experts of development countries training». This project is the continuation of ITTC successful experience.



Conclusions

1. Work Plan of the Project has been completed successfully and more than 300 specialists from 10 countries of the CIS Region were trained on aspects of NGN testing and introduction. This Project definitely resulted in the reduction of the digital gap in the developing countries of the Region.

2. All the Project objectives and all the expected outputs have been achieved:
   - An ITTC for CIS Region have been created with adequate space for classrooms, laboratories, conference hall, administration and management rooms;
   - A model network for practical NGN testing and for lab exercises during training has been built in full conformance with ITU-T Recommendation Q.3900;
   - Effective testing strategies (methodologies) on the model networks for conformance, interoperability and QoS/NP testing have been developed;
   - Training programs and training material on NGN testing aspects have been developed and uploaded on the ITU-D website;
   - Public access to the Knowledge Database of NGN tests results have been provided from the ITU-D website.

3. Cooperation of the Mass communications and telecommunication administration of the Russian Federation, Central Science Research Telecommunication Institute (ZNIIS) and the ITU has been successful.

4. At the output of the Project specialists from CIS countries got the following ITTC products: Model Network, Knowledge Database, Professional Social Network – which could accelerate process of new technologies introduction within the Region.

5. ITTC has mandatory strategy significance for Region and ITU as a whole. The creation centre like ITTC will raise quality and speed of implementation equipment and services on the Region's ISP networks.

6. Project operation was successfully closed.

We express gratitude to the Mass communications and telecommunication administration of the Russian Federation, personally to Minister Shegolev I.O., Central Science Research Telecommunication Institute (ZNIIS), personally to Director General Adjemov A.S. and to all our partners during the project.

Recommendations

Such projects are useful for developing countries and could be replicated for other Regions with developing countries (Africa, Arab, Asia and Pacific).

New Project on creation of Virtual Lab should continue success experience achieved from the ITTC Project.

Project manager: **Andrei Untila** ITU Area Office for the CIS Countries	Project Partners Acceptance: **Alexander Adjemov** Central Science Research Telecommunication Institute (ZNIIS)
Signature _____	Signature _____
Date « »_____2011	Date « »_____2011