Future Internet experimentation in BRIC regions and perspectives in international testbed standardization

International Cooperation for Experimental Research and Testbed Interconnection

Poznan, 25 October 2011
Identity card of project

- **FP7 project:** FP7-ICT-2009-5
- **Start date:** 01/06/2010
- **Budget (EC contribution):** 700K euro
- **Duration:** 24 months
- **Target countries:** EU and BRICs
- **Target groups:** research testbeds users and beneficiaries
Project objectives: overview

**Research and technology:**
- the real needs for test beds

**Innovation and impacts:**
- commercial exploitation strategies, impact evaluation of testbed utilisation

**Standardisation:**
- define the necessary standardised methodologies
• Identify national and International events organised in BRIC countries, so as to use the opportunity to initiate collaboration
  – Target high participation from the stakeholders beyond national participation
  – Collect information and develop personal contact with high number of stakeholders
  – Liaise with BRIC researchers on the FIRE calls
  – Motivate to participate in future EU projects
  – Build close collaboration across experimental researchers
1. INDIA: December 2010, Pune
   – Success story with 136 participants
   – Colocation with ITU, plenary meeting

2. China: April 2011, Beijing
   – Colocation with IPv6 summit
   – 100 Participants

3. Brazil: September 2011, Sao Paolo
   – Colocation with FutureCom conference

4. Russia: May 2012, St. Petersburg
   – Colocation with ExpoCom

5. Europe:
   FIA; Budapest, 16-19 May 2011, FISA session; mini workshop
   FIA, Poznan, 25 Oct 2011, Internal collaboration workshop
   27 Oct Standardisation workshop
• BRIC country reports are available

• FIRE related activities in BRIC is also made available

• The activities are followed up and would be part of Roadmap
BRIC counties has achieved significant advancements in Science, Technology and Innovations in recent years.

BRICs Have a Larger US$GDP Than the G6 in Less Than 40 Years

- By 2040: BRICS overtake the G6
- 2025: BRICs economies over half as large as the G6

National context
BRIC counties
• Total R&Ds in Brazil are estimated to reach \textbf{19 billion EUR} in 2010, representing 1.3\% from Gross National Product

• In 2010 there were granted \textbf{80 thousand research scholarships} and financed \textbf{35 thousand research projects}

• \textbf{FINEP} organization (Research and Project Financing) financed more than \textbf{3 thousand projects in 84 calls for proposals}, mostly granted to universities and research centers
Brazilian workshop

FUTURE INTERNET RESEARCH AND EXPERIMENTATION:
EURO-BRAZILIA WORKSHOP
Transamerica Expo Center, Sao Paulo
September 13th, 2011
Website & register: www.my-fire.eu/brazilian-workshop

To what extent does experimentation and testing support the definition of the Future Internet?

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What are the ideal test-beds in future Internet research & experiment?

How should their exploitation be optimised?

Discussion, debate, opportunity, challenge, cooperation...
We are looking forward to hearing your strong voice!

THE PROGRAMME HIGHLIGHTS
An introduction to Future Internet initiatives in Europe
- Jacques Babot, Future Internet Research and Experiment, DG INFSO, EU

A presentation of collaborative projects between Brazilia and Europe
- Jose Roberto, TEFIS Project - University of Sao Paulo
- Moacyr Martucci, FIRST Project - University of Sao Paulo
- Antonio Abelem, FIBRE Project - Federal University of Para

A taxonomy of technologies and testing approaches in Future internet
- Alain Vouffo, Fraunhofer

Panels discussions:
1. Impact and sustainability of initiatives in Future Internet
2. Strategies and opportunities of cooperation between Brazil and Europe

Call for proposal: win a trip to participate of the future Internet week held in Poznan (Poland) in October!
- Proposal presentation of 3 best proposals selected by contest committee
- Results from contest: premium to winner of call

To submit a proposal:
www.my-fire.eu/brazilian-workshop/call-for-proposal

A workshop organized by BII, partner of the MyFIRE project
MyFIRE is a project co-funded by the European Commission under the 7th Framework Programme

More leading representants from Brazil and Europe will be here! Join us and share your vision with top ICT experts!
1st collaboration requested

- **What is RouteFlow?**
  - Innovating on IP routing with software-defined networks
- Limitations of current evaluation work
- The EU Ofelia testbed opportunity
  - Project proposal: Reality check at Euro scale

from Experiment to the Future Internet
The Project

RouteFlow is an open-source project to provide IP routing & forwarding services in OpenFlow networks

Virtual Routers as a Service: The RouteFlow Approach Leveraging Software-Defined Networks

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from Experiment to the future internet
2nd collaboration requested

IFS – Intrusion Forecasting System Based on Collaborative Architecture

Distributed IFS Architecture (DIFSA) as Early Warning Systems in Cyber Defense

- 2011

- MSc Elvis Pontes (USP)
- MSc Anderson A. A. Silva (IPT)
- Prof. Dr. Sérgio Takeo Kofuji (USP)
- Prof. Dr. Adilson Eduardo Guelfi (USP)
Proposal - First Prototype - Validation

Analysis of three sites with normal network traffic, cyber attacks, simulated cyber attacks and simulated normal network traffic.

We employed two forecasting models:
- Fibonacci sequence
- EWMA

Next step:
- Spread more sensors;
- Employ other forecasting models (stochastic processes, fractals, etc)
Using **FEDERICA** to try out the DIFSA in a real life environment:

A **versatile, scalable**, European wide, technology agnostic infrastructure, **with the possibility to interconnect with the general Internet and other infrastructures**

Allow **extending the employment of our models**, in a testbed environment, being also possible to develop the multicorrelation and the collaborative aspects among agents and sensors widely implemented;

In our **previous work**, we have achieved **preliminary validation**, as our prototypes, experiments and tests were done in **small size environment** (in three sites geographically divided);

During our tests we **simulated real network traffic** and malicious traffic (**cyber** attacks) for the first, second and third level of the Distributed Intrusion Forecasting System (DIFSA).
Experimenting Domain Title Service to Meet Mobility and Multicast Aggregation by using OpenFlow

Prof. Flávio de Oliveira Silva – UFU/USP
In Russia starting from 1999, R&D funding has been growing permanently, facilitated by the constant Gross Domestic Product growth (6-7% per year).

The major pan Russia networks connecting academic, research organizations and Govt. institutions include RUNNET, RBnet, RASNet and RSSI.

Russia is one of the most active participants of European Framework Programs 6/7 among the third countries.
Networking opportunities

• Russian initiatives related to Future Internet
  – The program "University Cluster"
  – Joint Supercomputer Center of the Russian Academy of Sciences
  – Russian Data Intensive Grid
  – NG1 mobile broadband standard

• European Projects with Russian partners in FI
  – MyFire, OpenCirrus, PlanetLab, 6REN, IPv6 Forum, Gloriad, EGEE (Enabling Grids for E-science)
More to come: WS May 2012
In Jan 2011, the total internet/broadband subscriptions in India is at **18 millions**

The **wireless mobile services** is set to dominate future Indian broadband as the primary means of access for most people considering 3G and Broadband Wireless Access

The major networks connecting academic, research organizations and Govt. institutions include **ERNET, NICNET** and **NKN**. ERNET also connects international network such **GEANT2** under the Trans Eurasia Information Network Network 3 (TEIN3) at the speed of **2.5 Gbps**
Research and experimentation testbeds

India

• **RURAL WIRELESS NETWORKS**
  - Long-distance (up to several tens of kms) 802.11 links connected to landline node formed using high-gain directional antennas
  - Digital Gangetic Plains project
    - Providing **VoIP telephony** to the rural communities
  - Ashwini project
    - Two way **video communication** service for healthcare, agriculture and education

• **MOBILE WIRELESS NETWORKS**
  - India-UK Advanced Technology Centre
    - Joint research initiative that focuses on **next generation networks** systems and services
  - Transnational Wireless Testbed
    - End to end research on **all-IP 4G mobile networks**
  - WiMAX Campus Area Testbed
    - The various **WiMAX** deployment issues are researched such as distance, line of sight conditions, data types (video/audio streaming and general TCP packets) and traffic load on the throughput
  - Mobile IPv6 Testbed (about to be deployed)
    - The testbed comprising **WiMAX, WiFi and 3G** networks for mobility scenarios to be tested on real testbed. Considering the IPv6 support, the mobility demonstration between **IPv4** and **IPv6** networks will also be carried out

• **WIRELESS SENSOR NETWORKS**
  - SmartDetect, SmartConnect, 6LoWPAN testbed

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Areas of collaborations under discussion

1. **Nation-wide Quality of Service (QoS) Test Bed** is a DIT funded project for establishing a nationwide IPv6 based QoS network.
2. **Omnipresent Ethernet (OEthernet)**[12] test bed project proposes an end-to-end communication system without need for TCP/IP stack.
3. The **Digital Gangetic Plains (DGP)** and **Ashwini** projects were initiated to explore the technical feasibility of establishing long-distance 802.11 links.
4. **End-to-End UK-India Transnational Wireless Testbed** that aims at an experimental based approach for advanced end to end research on all-IP 4G mobile networks
5. **Mobile IPv6 Test bed** for Mobility management over heterogeneous access networks is the DIT funded joint project between ERNET India and Indian Institute of Science.
6. **6LoWPAN** test bed for Management and Monitoring of Wireless Sensor Network is a joint project between ERNET India and IISc, funded by DIT
7. The **SmartConnect** is a joint project between IISc and C-DAC for *Industrial Sensor Networking* and it is funded by DIT.
While China has the **biggest population of internet users** the internet penetration rate merely reaches **30%**

It is assured that China has huge potentials to increase the internet penetration rate

8 government departments fund **China Next Generation Internet (CNGI)** project
Research and experimentation testbeds

China

- China Next generation Internet (CNGI)
  - 6 backbone networks (covering 22 cities, connecting 59 core nodes), 2 switching centers (Beijing and Shanghai) and 273 residence networks were constructed and deployed. Since the end of 2008, CNGI trial commercial and educational and industrialization projects were implemented

- China Education & Research Network 2 (Cernet2)
  - Pure IPv6 Internet backbone network connected to Internet 2 and GEANT2
  - more than 200 universities and research institutes, supporting many works on next generation internet

- High Performance Broadband information Network (3TNet)
  - Demonstration network supporting large-scale and concurrent streaming services and interactive multi-media service in Shanghai and Changjiang area

- Multiple Space and Time Remote Laboratory DRAGONLab
  - Remote experiment and testing platform, collecting a large amount of network equipment, testing instruments, servers and mass storage system. Its main technical features include multiple space and time, visualization, remote operation and programmable experiment

- There also are some ongoing Next generation Internet projects funded by MOST
Workshop Beijing April 2011

Future Internet Research and Experimentation: EUROMYFIRE Workshop
Hotel Nikko New Century Beijing
April 8th, 2011
Website & register: www.my-fire.eu/chinese-workshop

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The Programme Highlights

- An introduction to Future Internet initiatives in Europe
  - Jacques Babot, Future Internet Research and Experimentation, DG INFSO, EU

- Standardisation to Promote Exploitation of Research Results
  - Jorgen Friis, Vice President, Standards Enabling Services, ETSI

- Update on Future Internet Innovation Platform
  - Li Xing, Professor, Tsinghua University/CTO, Cernet

- The Importance of Test Bed Technology in Future Network Development
  - Zhang Hongke, Professor, Beijing Jiaotong University/Director, National Engineering Laboratory for Next Generation Internet

- The Status of Experiment Facilities in China
  - Ma Yan, Professor, Beijing University of Posts and Telecommunications (BUPT)

- Test Bed for Internet of Things
  - China Telecommunication Technology Labs, China Academy of Telecommunication Research of MIIT

Panels:
1. Testing Environment for Development of Future Internet: Activities Landscape
2. Need of International Collaboration in ICT testbeds and experiments

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China : FIRE networking opportunities

- Follow up Cooperation with CERNET in IPv6 test bed and IoT (Hobnet, Smart Santander). Involvement of BUPT
- cooperation between OneLab and Dragonlab (Tsinghua university)
- Coordination of FI (Fire activities, www.f3i-eu-cn.org) under supervision of CATR (participation 3 delegates at FI Budapest)
- Cooperation with IoT test beds in Wuxi
- cooperation to be followed up between PEARL and Ofelia on openflow test beds
• **Information collection**

→ **Activity:** conduct a mass consultation - MyFIRE web-survey

- Questionnaire prepared and distributed to more than 5500 persons
- More than 300 exploitable responses
- Analysis of web survey results and preliminary conclusion
  - PPT presentation in PUNE
  - D4.1: landscape report
More than half of users and providers of EF are not involved in standardisation activities.

22% of providers of EF are users of the recent standards.

IEEE is the standard bodies more used by users and providers of EF.
Standardisation aspects:

Standardisation of research results?

– Regarding the production of standards, users are aware and understand the benefits of standardising their research results, but 60% do not participate in standardisation activities.

– 63% of users declare themselves to be interested in getting more support to make use of the standardization process as a path to exploit their research. Users need technical support to understand standard development processes and participate in standardisation activities.

What kind of support?

- Support to understand the standardisation processes
  - 57.1%
- Support to get access to standardisation work
  - 55.6%
- Support to attend standardisation committee
  - 52.4%
- Support to identify the right organisation and committee
  - 44.4%
- Support to understand the benefit of standardisation
  - 30.2%
- Support to use standardisation as a tool to promote...
Other feedbacks on standardisation aspects from Survey

• Lack of formal methods standardisation is a manifestation of lack of external focus

• Formal Methods Standardisation:
  – Helps users outsource testing
  – Helps operators of research facilities offer a service to external users

• Need for training in use of formal testing methodologies
Overall approach in helping further in standardisation

- on FIRE setting up and exploitation we have found three interesting cases which are:
  1. standardisation for benchmarking activities (thanks to CREW)
  2. Standardisation for operating activities such as testing, using or federating
     a) Methods for testing
        - Testing suite as a service (PII case); formal methods
        - Description language to describe experiment
     b) Open API to access resource (eg Tefis)
     c) Common language to describe results (eg wisebed)
     d) Authorization and access control (eg PII)
     e) Standardisation for test beds federation and access to resources
  3. Other cases will be on results of research which can be promoted and be further exploited if the results can be part of a standardisation activity. Also in this part we can consider new standards on base technology or standards for testing or testing methodologies (e.g. language, DEN-ng)
From Experiment to the Future Internet

POZNAŃ standardisation workshop

FUTURE INTERNET RESEARCH AND EXPERIMENTATION

FIRE EVENT POZNAŃ
Standardization Workshop

Poznan University of Technology - POLAND
October 27th, 2011

Website & registration: http://www.week.fir-poznan.eu

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THE WORKSHOP TOPICS

Within the Future Internet Week in Poznan, the FIRE initiative supported by the FIRESTATION support action organises an event to discuss the latest developments and findings in FIRE.

Within this event, the MYFIRE support action organises a workshop focused on standardization in FIRE.

The workshop will seek answers to two main questions:

- How can Future Internet experimentation benefit from formal methodologies for testing?
- How can Future Internet experimentation, as a test platform, contribute to the standardization processes?

After a presentation of the main findings from the MYFIRE project, two sessions will foster debate on these questions:

- Session 1: The use of formal testing methods in FIRE
  ETSI will first give an overview of the use of interoperability best practices in test activities related to research. It will be followed by a vision from a living lab and a review of benchmarking needs

- Session 2: The role of FIRE facilities as reference implementations for standards validation and testing
  Presentations of the possibilities and limits of FIRE to interact with the international standardization processes will be offered. Positive interactions contributing to the experimental facilities sustainability will be discussed

Open debates will permit to identify next steps for standardization related activities in FIRE...

A workshop organized by ETSI and INNO, partners of the MyFIRE project in cooperation with the FIRESTATION project.

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Many leading researchers and facilities operators will be here! Join us and share your visions with top ICT experts!
Thank you!

Philippe Cousin
WP2 leader, ETSI Expert

from Experiment to the Future Internet