Future Internet testbeds/experimentation between Brazil and Europe - FIBRE

FIBRE-EU and FIBRE-BR

Future Internet Assembly: International Cooperation on Testbeds
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Michael Stanton (michael@rnp.br) on behalf of the FIBRE team:
• Future Internet and Brazil
• FIBRE at a glance
• Project goals and outcomes
• Workplan
• Partners’ roles
• Final Considerations
Objectives of FI work in Brazil

• Participate in and contribute to the growing global community which is developing R,D&I activities in “Future Internet” (FI):
  – Evaluate current FI initiatives
  – Identify and discuss suitable approaches within Brazilian research community
  – Build initial large-scale testbed infrastructure for experimental validation and demonstration, based on existing networks
  – Seek to interoperate (federate) with other international initiatives

• In parallel, look after future funding:
  – Seek to influence adoption of FI-directed policies by government and other funding bodies
Initial FI testbed projects in Brazil

• GIGA Phase 2 (CPqD – telecom R&D centre; RNP – NREN)
  – Phase 1 (2003-2007) built 800 km WDM optical testbed used by users from 50 universities all over Brazil for developing optical technology and high-speed applications
  – Phase 2 (2009 – ) oriented towards FI + SDN R&D.

• WebScience Institute: FI Architecture subproject (RNP + 4 universities)
  – (2010 – ) convergence towards GIGA Phase 2)

• FIBRE: (CPqD, RNP + 7 univs + 6 EU partners)
  – (2011 – ) selected in competitive BR-EU Coordinated Call
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FIBRE and the Brazil-EU Coordinated Call em ICT

• FIBRE is one of 5 projects approved in the September 2010 Brazil-EU Coordinated Call for bilateral cooperation in ICT
  – 30 month projects, average budget of 1 M€ for each side
  – EU side financed through FP7, Brazil side through CNPq
  – Common workplan for the two sides of the project

• FIBRE approved in the area “Future Internet – Experimental Facilities” (10 proposals submitted)


• FIBRE-BR is the first large-scale Future Internet testbed project to be funded in Brazil, building on experience in smaller projects
• FIBRE-EU partners already active in current FP7 FIRE projects OFELIA, CHANGE and OpenLab (successor to OneLab2)
What?
- Main objective is to create a common space between the EU and Brazil for Future Internet (FI) experimental research into network infrastructure and distributed applications, by building and operating a federated EU-Brazil Future Internet experimental facility.

Who?
- 15 partners

How?
Funding of ~1.1M€ (EC) and R$ 2.3M (CNPq) to carry out 6 activities
- WP1: Project management
- WP2, WP3: Building and operating the Brazilian (WP2) and European (WP3) facilities
- WP4: Federation of FIBRE-EU and FIBRE-BR facilities
- WP5: Joint pilot experiments to showcase the potential of the federated FIBRE facility
- WP6: Dissemination and collaboration
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Objective 1: Future Internet Experimental Facility

Build a shared large-scale experimental facility that enables experimentation on network infrastructure and distributed applications, consisting in a new testbed in Brazil and an enhancement of the FP7 OFELIA facility and the basic wireless facility of FP7 OneLab2, the UTH NITOS testbed, both in Europe.

How it will be achieved:

- **i2CAT** and **UEssex** will enhance their local OFELIA testbeds (islands) to provide dedicated services for FI experimentation to the FIBRE users. Focus is on wired experiments.

- **UTH** will enhance its NITOS wireless testbed to provide dedicated services for FI experimentation to the FIBRE users. Focus is on wireless experiments.

- **All the Brazilian partners** will build and operate a Future Internet testbed dedicated to the FIBRE users. Focus on both wired and wireless experiments.

- **i2CAT, UEssex, Nextworks and some Brazilian partners** will enhance the OFELIA Control Framework to serve as the CMF of some islands.

- **UTH, NICTA and some Brazilian partners** will enhance the OMF and OML control and monitoring frameworks to serve as the CMF of some islands.
FIBRE-BR facility: site locations and interconnection

Expected topology of interconnecting private L2 network and alternatives for BR-EU link
FIBRE site in Brazil - site-specific resources and external connectivity

Common nucleus: OpenFlow substrate; programmable network nodes

Site-specific resources: wireless, optical, EmuLab, ...
FIBRE-EU facility

FIBRE island at UEssex (Colchester), collocated with OFELIA island

FIBRE island at i2CAT (Barcelona), collocated with OFELIA island

NITOS testbed at UTH (Volos)
Objective 2: Federation of facilities

Federate the Brazilian and European facilities, to allow researchers to use resources of both FIBRE-EU and FIBER-BR testbeds in the same experiment.

• How it will be achieved:
  – **Federation of control frameworks**
    • **UPMC and UFRJ** will lead the federation WP.
    • The CFs used in the project will be studied and federation requirements extracted.
    • The right solutions for the federation framework will be chosen (for example SFA) and customised to the FIBRE facility
    • Software tools will be developed and/or customized to implement and deploy the federation architecture.
  – **Physical interconnection**
    • FIBRE-EU testbeds will be connected among themselves, probably through GEANT
    • FIBRE-BR testbeds will be connected through RNP, KyaTera and GIGA networks
    • FIBRE-BR and FIBRE-EU will be connected through an intercontinental link between the point of entry (hub) at each side
Objective 3: Pilot experiments and showcases

Showcase the potential of the facility by demonstrating experimental network-enabled applications deployed on top of the federated facilities resources.

• How it will be achieved:
  – **Design and Development of 3 technology pilots**
    • Intelligent mobility management to provide (horizontal and vertical) seamless handover in a multi-technology wireless network in which low-cost laptops tend to transit in groups between dense connectivity and sparse connectivity scenarios
    • Intelligent high-definition content delivery of high-definition media over WDM optical networks
    • Automatic on-demand network connectivity services offered by the GMPLS control plane on top of the programmable optical network substrate controller
  – The technology pilots will be first tried locally and later over the federated facility
  – The technology pilots validate and showcase the power of the federated facility
Technology pilot examples

Seamless mobility testbed
High-definition content delivery
Objective 4: Increased EU-Brazil collaboration

Enhance the collaboration and exchange of knowledge between European and Brazilian researchers in the field of Future Internet.

• How it will be achieved:
  – Joint collaboration between FIBRE partners already in the project (all the WPs include shared activities)
  – Organization of joint EU-Brazil workshops as part of the project activities
  – Joint research publications
  – Testbed user publications
  – Co-orientation of student theses
  – Exchange of students
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Project structure: 6 work packages
Effort distribution per WP

WP2: Building and operating the Brazilian facility (45%)

WP6: Dissemination and collaboration (9%)

WP1: Project management (5%)

WP5: Deployment of technology pilots and showcases (17%)

WP4: Federation of facilities (17%)

WP3: Building and operating the European facility (7%)
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Role of partners
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Expected results

- **Joint EU-Brazil Future Internet facility**, providing intercontinental slices of heterogeneous infrastructure to network researchers. The facility is composed of:
  - Future Internet Testbed in Brazil, consisting in 9 islands providing access to heterogeneous technologies (optical, layer 2, layer 3, wireless) interconnected by high speed links, automatically controlled by one or more CMFs
  - Future Internet Testbed in Europe, consisting in enhanced OFELIA islands at UEssex and i2CAT, and an enhanced wireless testbed at UTH, controlled by OCF and OMF.
  - High speed intercontinental links connecting the European and the Brazilian parts of the joint facility.

- **Enhanced OFELIA Control Framework** software, publicly available
- **Enhanced OMF and OML software**, publicly available
- **Federation software and tools**, publicly available, enable cross-experiments using the joint facility
- **Experimental network application software**: Content delivery controller application software, GMPLS-as-a-service controller application software, Seamless mobility controller application software
- **Network of contacts** between Brazilian and European partners
Expected results for Brazil/LA

- FIBRE is a showcase project in international collaboration in Future Internet
  - Demonstrate local capacity to collaborate with leading European projects in this important area
  - Provide local experimental facilities for validating and demonstrating new FI proposals
  - Provide opportunity for extension to and participation by researchers from other Latin American countries
  - Promote involvement of and technology transfer to the industrial sector, to prepare for Future Internet needs, especially involving OpenFlow and SDN approaches.
Thanks!

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