Using Future Internet testbed as a tool for the practical study of digital networking

Iara Machado, Noemi Rodriguez, Tiago Salmito, Leandro Ciuffo, Gustavo Dias, Antonio Abelém, Michael Stanton

UnbuntuNet Connect 2014 , Zambia, 13 november

Motivation

- **It is widely accepted that the Internet has many limitations and requires changing this architecture through the design called Future Internet (FI)**

  … has resulted in a construction of a number of network testbed

- **Not much attention is given to the development of human resources for this area**

  Undergraduate and graduate students take classical computer network classes that have the same structure for many years …

Motivation

We can enhance the student experience in important ways ！

- Students enjoy seeing their programs running on real world
- Real machines and programs often exhibit behavior that is different in the simulation model

Future Internet testbed can be useful for teaching in conventional classes and on online courses！

Ongoing initiatives related to testbed

- GENI (U.S.) www.geni.net
- FIRE (EU) www.ict-fire.eu/home
- Akari (Japan) http://akari-project.nict.go.jp/eng

FIBRE Testbed

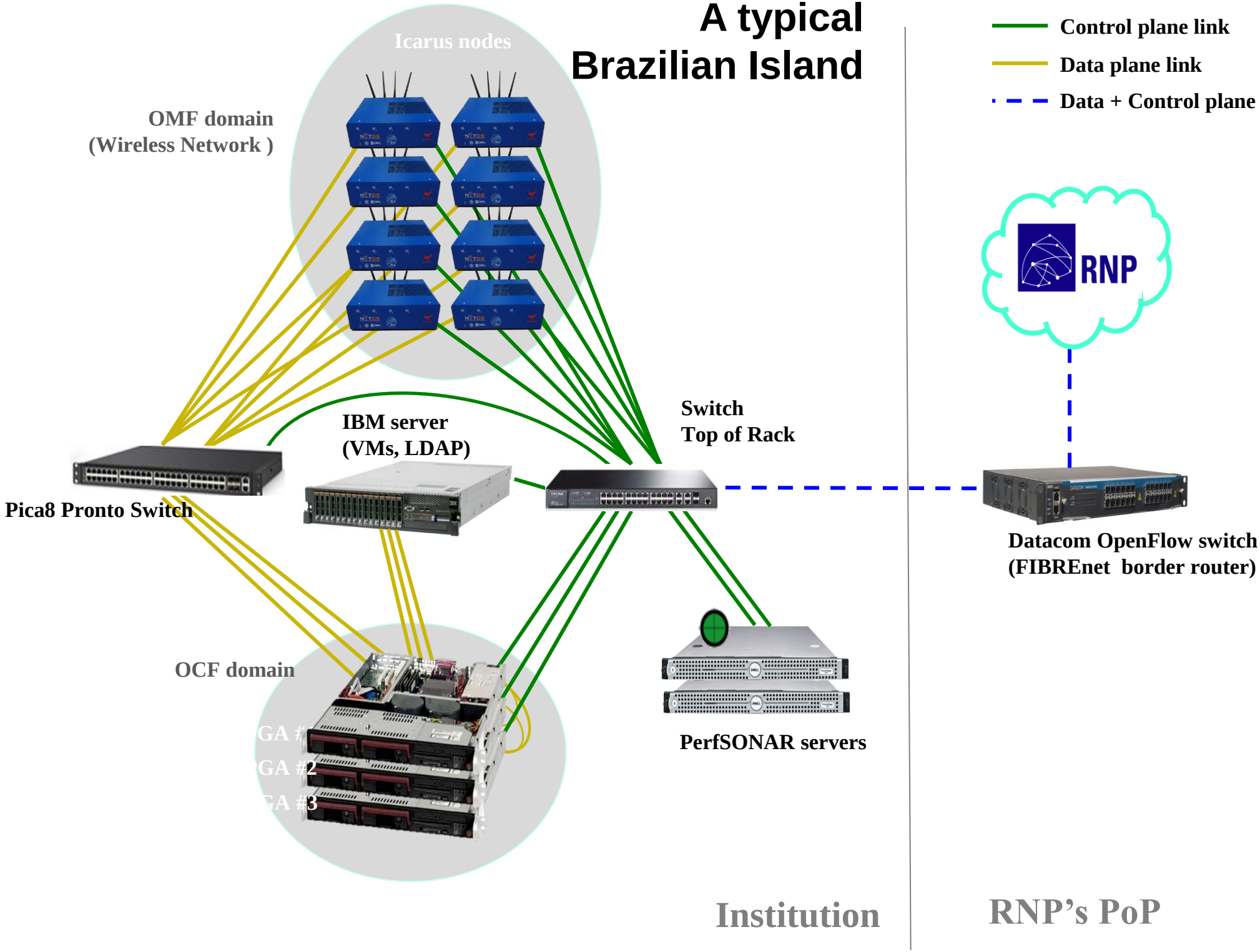
- **Goal:**

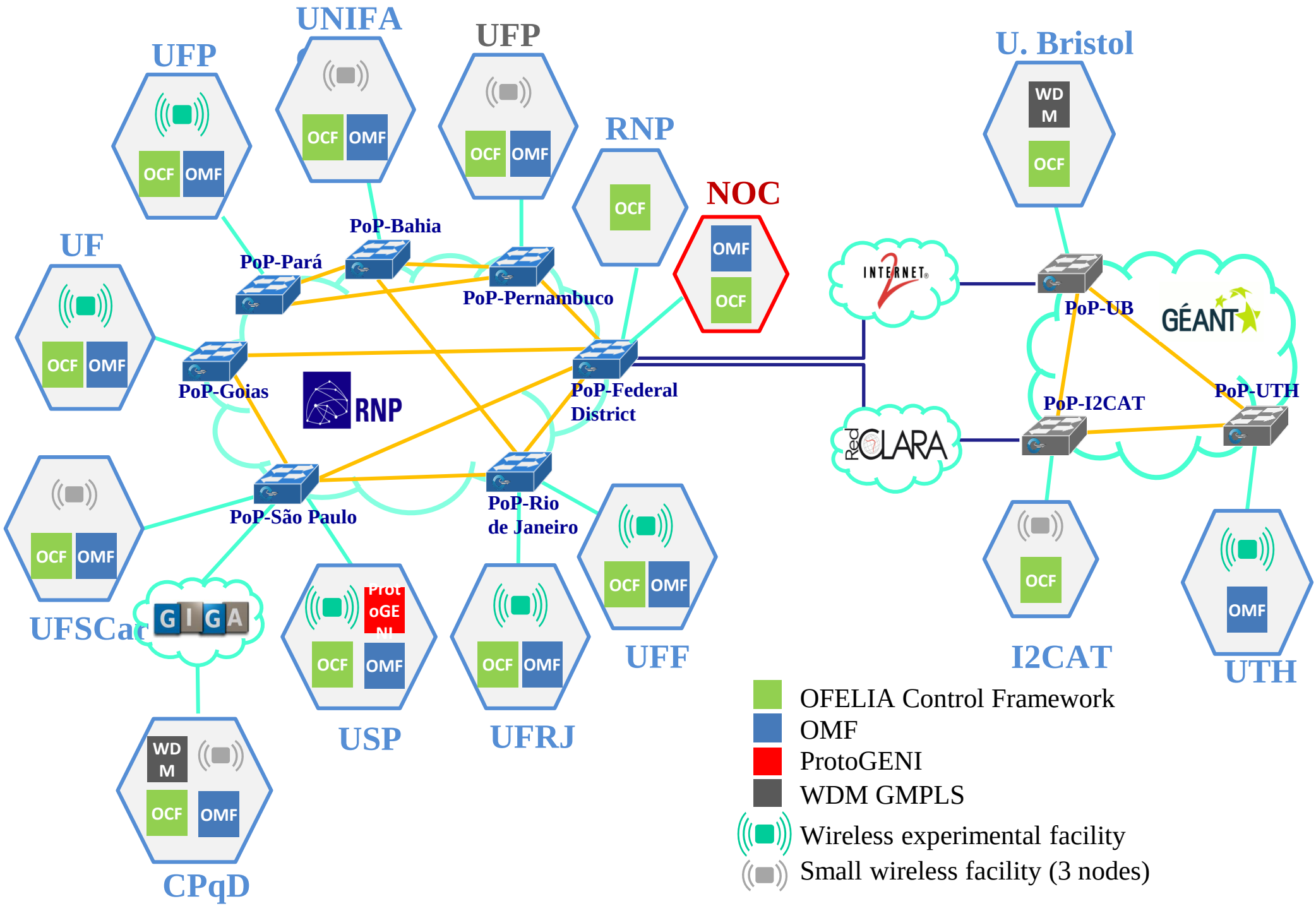
  Experimental Future Internet research facility federated between Brazil and Europe

- Composed by a federation of 13 local testbeds located in different R&E organization in BR and EU

- Funded jointly by CNPq (Brazilian Council for Scientific and Technological Development) and by European Commission within its FP7 Brazil-EU Coordinated Call in ICT in 2010.

A typical Brazilian Island




UNIFA
UFP
UFP
RNP
NOC
U. Bristol
WD M
OCF
OMF
PoP-Bahia
PoP-Pará
PoP-Pernambuco
UF
INTERNET2
PoP-UB
GÉANT
PoP-Goias
RNP
PoP-Federal District
PoP-I2CAT
PoP-UTH
RedCLARA
PoP-São Paulo
PoP-Rio de Janeiro
UFSCar
GIGA
ProtoGENI
UFF
I2CAT
UTH
USP
UFRJ
CPqD
OFELIA Control Framework
OMF
ProtoGENI
WDM GMPLS
Wireless experimental facility
Small wireless facility (3 nodes)

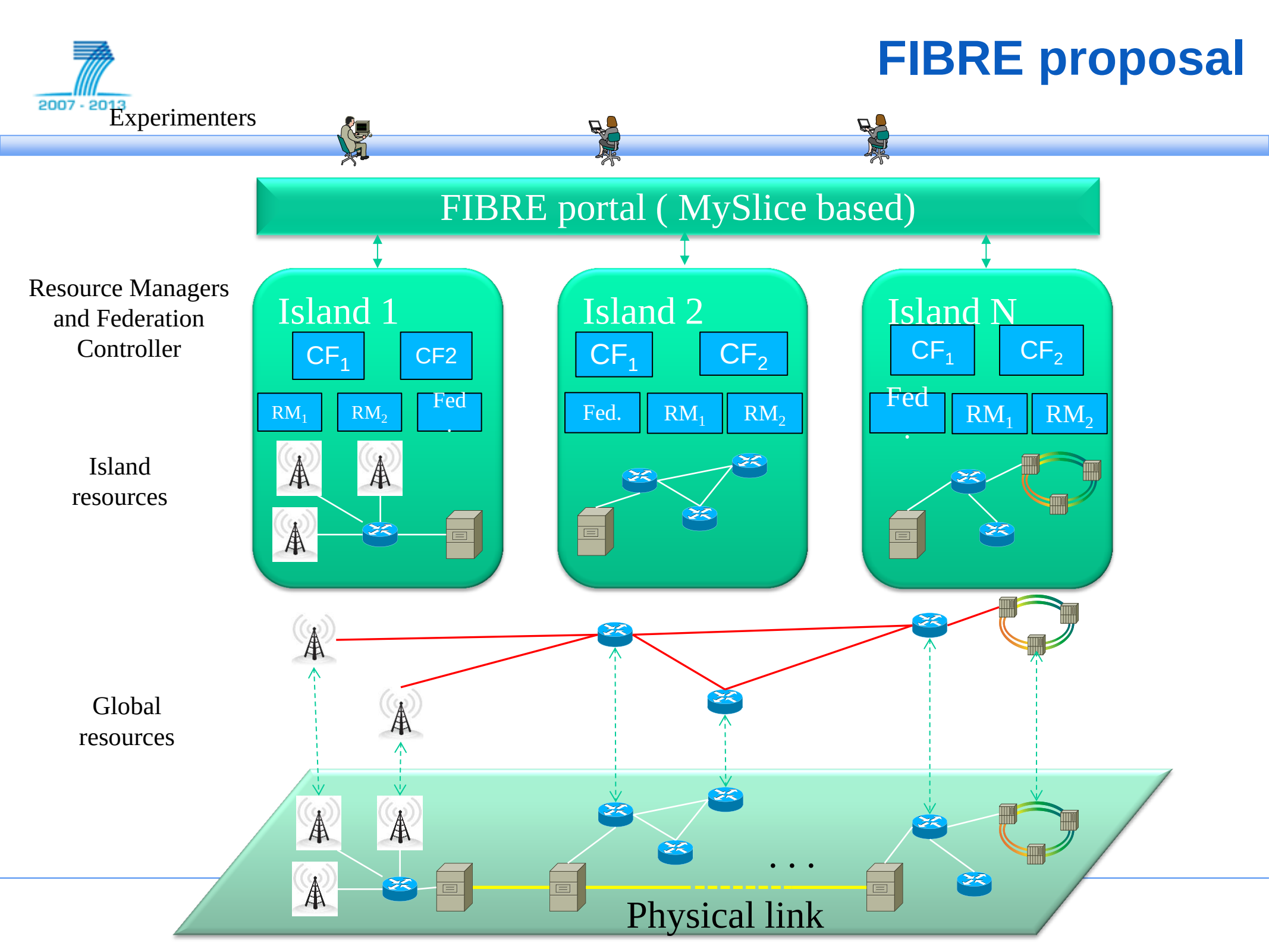
FIBRE – Control and Monitoring Frameworks (CMF)

OFELIA *Control Framework (OCF) - Open Flow controller*

OMF *controlling and managing wireless equipments.*

ProtoGENI *controlling and monitoring Emulab cluster.*

FIBRE proposal



Initiatives in teaching using testbed

GENI project

- Tranning section to TA (teaching assistants)
- Wiki with section devoted to instructors
- Material downloaded for classes

FORGE project

- Linked to FIRE initiative
- Developed widgets and materials that enable instructors and students to easily set experimental for educational proposal
- Raise FIRE awareness in the long term

MOOC (massive open online courses)

- NYU (Polytechnic School of Engineering of Nova York)
- Developed MOOCS modules with hands-on activities using GENI testbed

Using FIBRE in the classroom

Opportunity

- FIBRE was deployed at eight (8) universities
- 25 researchers involved in teaching network classes
- 53 training courses, from undergraduate to doctoral level
- Recent survey revealed that in 2014 only 4 (four) professors uses FIBRE testbed in the classroom
- Great majority plans to do so in the near future

Future plans

- Enhance support to educators
- Dissemination activities target educators
- Provide a repository of practical activities (exercises)
- Build a community of educators

Final Remarks

- Exploring this capacity to enhance education in computer network will help to further comprehension of the field.

- Dissemination of the use of Future Internet experimentation infrastructures is also a way for society to make better use of the large investment involved, often carried out with public resources

- The Future Internet scientist is growing at graduate and undergraduate classes and they really need to know to do research in this new environment

Thank you

twitter.com/FIBRE_project

www.facebook.com/fibre.project

☞www.fibre-ict.eu