

OpenFlow in Europe - Linking Infrastructure and Applications

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ICT 2010

Networking Session #3348

Brussels, Sept.28, 2010



OpenFlow

More than the latest hype in networking?

- What is Europe doing in the field of OpenFlow?
- Selected Projects in FP7
 - SPARC
 - OFELIA
 - CHANGE
 - FEDERICA
- Regional activities
 - SEROFON
 - I2T (Basque) testbed

Speakers

- **Felipe Huici**, NEC Labs Heidelberg – Germany:
 - Overview of the **CHANGE FP7** project
- **Luca Giraud**, Politecnico di Torino – Italy:
 - OpenFlow testing in the **FEDERICA** project
- **Elio Salvadori**, Create-Net, Trento - Italy:
 - **SEROFON** (advanced **SER**vices on Open-**FI**ow enabled Networks)
- **Eduardo Jacob**, I2T, University of the Basque Country, Bilbao - Spain:
 - OpenFlow testbeds and activities at I2T



What is OpenFlow?

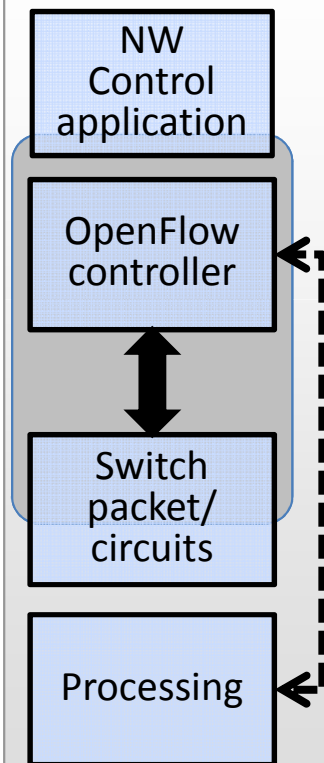
Providing the tools for software defined networks

What is OpenFlow

- OpenFlow is a standardized interface between switch controller and hardware.
 - Plus some protocol that transports the frames over ssl/tcp
 - Allows flexible control down to individual flows
 - Is protocol agnostic, programmable, scalable
 - Allows deployment & test of new controllers & control apps
- OpenFlow testbeds are underway in the US (GENI) & Japan

Advances beyond state of the art. Priorities w.r.t. scientific challenges.

- OF extensions needed for multi-layer, multi-domain
Any domain or layer borders require flow processing; Interface between controller and processing plug-ins needs to be developed & tested
- Extend filter format description to generic labels (CarrierEther, IPv6, opt. circuits, so-called OF v2.0 (?))
 - non-IP experiments such as content-based addressing
 - Multi-domain OpenFlow requires controller/controller communication



European activities in OpenFlow.

Multi-technology, multi-layer, carrier-grade extensions

SPARC

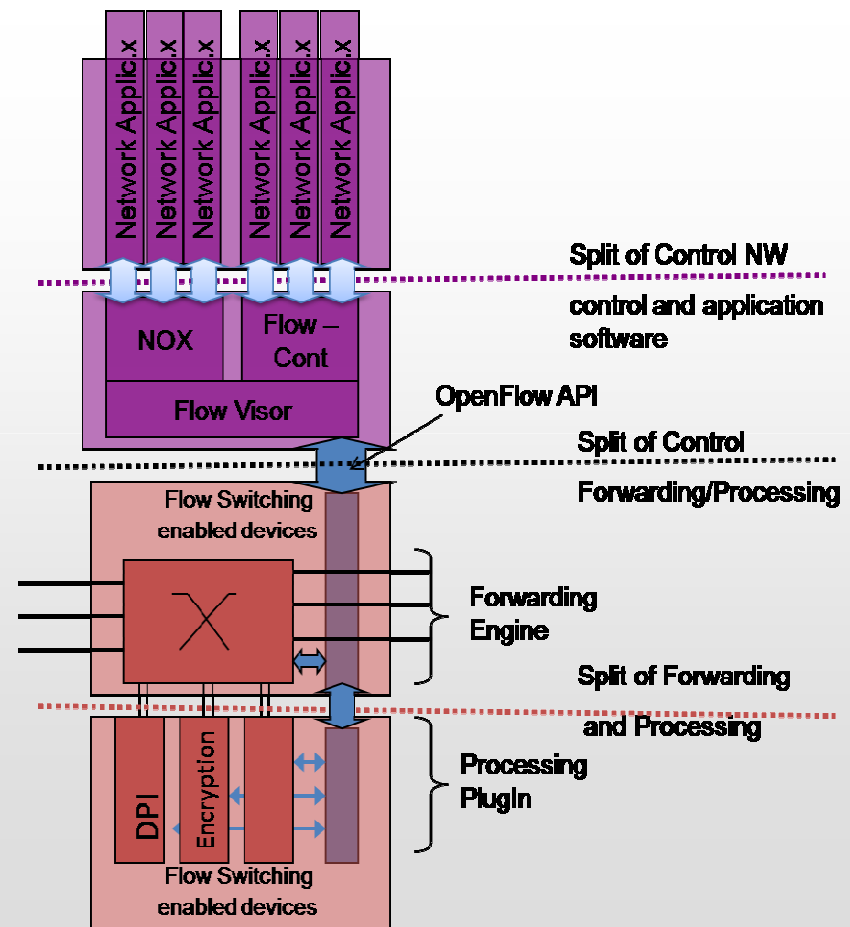
Split Architecture for Carrier grade networks

- 2 years FP7 Objective 1.1 STREP, started July 2010
- Study carrier grade extensions to OpenFlow and prototyping
- Architectural study including APIs towards OF network applications, study of federation of multiple OF enabled domains, OAM
- Use cases: access aggregation for virtualization, provider cooperation and isolation, application requirements (IP-TV)
- Prototyping of a controller architecture for single and multi domain operation
- Performance validation based on massive computer based emulation facility to impact of various architectural options
- Dissemination with focus on driving standardization

CHANGE

Enabling Innovation in the Internet Architecture through flexible flow-processing Extensions

- 3 years FP7 Objective 1.1 STREP, starting Oct. 2010
- Other projects (**STRONGEST**, **SAIL**) look into OF as well.



Traditional European strengths like wireless and optics are brought in.

OFELIA - Aim and Partners.

Build first OpenFlow test environment in Europe.

Complimentary strength & representation of most important research communities.

Federation of five islands

- Three years project, starting Oct 2010
- 5 OpenFlow-enabled islands at academic institutions:
 - Berlin (TUB) – partial replacement of existing campus network with OF-switches
 - Gent (IBBT) – central hub, large-scale emulation
 - Zürich (ETH) – connection to OneLab and GpENI
 - Barcelona (i2CAT) – experience with facility projects (IaaS, DRAGON)
 - Essex (UEssex) – national hub for UK optical community; L2 (Extreme) switches, FPGA testbed
- NEC provides homogeneous L2 hardware platform (OF-enabled Ethernet switches)
- ADVA as major vendor of optical access and data center equipment
- Different external vendors (Juniper, Extreme)
- Explore extensions of OpenFlow towards wireless and optical transmission

Partners with complementary technological strengths and user groups from five countries with strong research communities in networking.



partner	L2	L1/optics	L3	Wireless	emulation	Control SW	processing	US connections	MM source
iBBT	X				X		X		X
TUB	X			X					
I2cat	X		X			X			
UEssex	X	X				X	X		X
ETH	X							X	

Additional partners and European manufacturers will be involved through Open Calls

OFELIA - Operation and extension of the facility.

From isolated islands to centralized resource management — two phases of open calls.

Timeframe of project phases

Operation of the individual islands, one partner per island has the lead

- Phase i: OF controllers and switches in place, first local experiments concluded
- Phase ii: Connect islands and extend OF experimentation to wireless and optics
- Phase iii: Automate resource assignment and provide connections to other FIRE and non-European research facilities

Gradual expansion of early operative facility

Open Calls to extend facility & consortium will be published after M6 & M18

- Total budget €830,000 max. 200 K€ funding per experiment

Promotion/ implementation of open calls

Open Calls will be promoted through www.fp7-ofelia.eu and

- FIRE Station
- Standard communication channels (mailing lists, IEEE ComMag)
- Industry fora: Metro Ethernet Forum, Optical Internetworking Forum, Open Grid Forum

i: Create islands on L2

ii: Connect islands and extend to wireless/optics

iii: Ressource assignment automatization and connection to other facilities

▲ M6

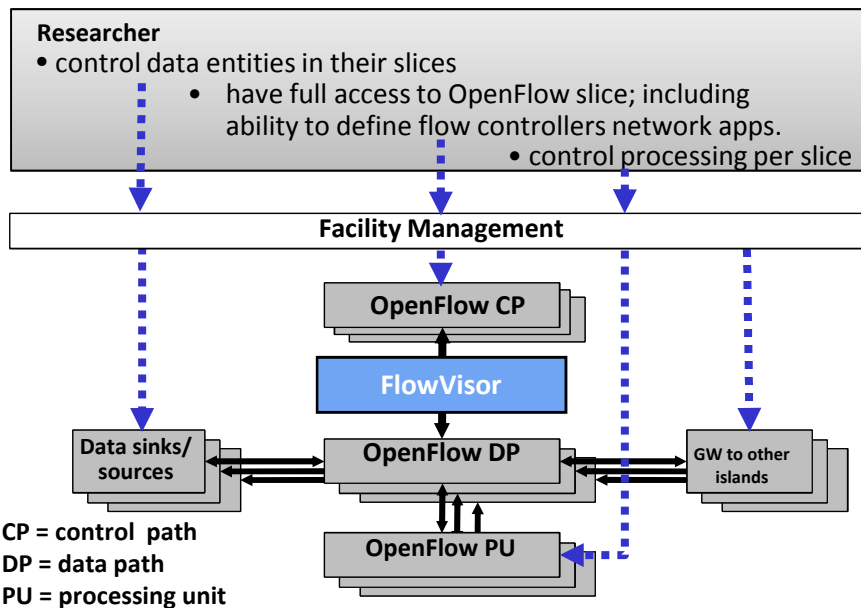
▲ M18

OFELIA - Organizational & technical aspects of cooperation with other FIRE facilities.

Cooperation is key for success. Broad experience within consortium.

Administrative aspects

- FIRE STATION aims at creation of a forum that facilitates cooperation – Architecture board
- Control meta-framework will be required, and we consider favorably adoption of existing projects' results



Software tools to implement the experimental facility

- Decide during first 6 months which of candidate software solutions will be chosen or adapted
 - Describing and reserving resources
- We build upon OpenFlow Software tools, e.g., NOX and FlowVisor
 - Necessary(?) to add inter-controller communication to NOX and FlowVisor