

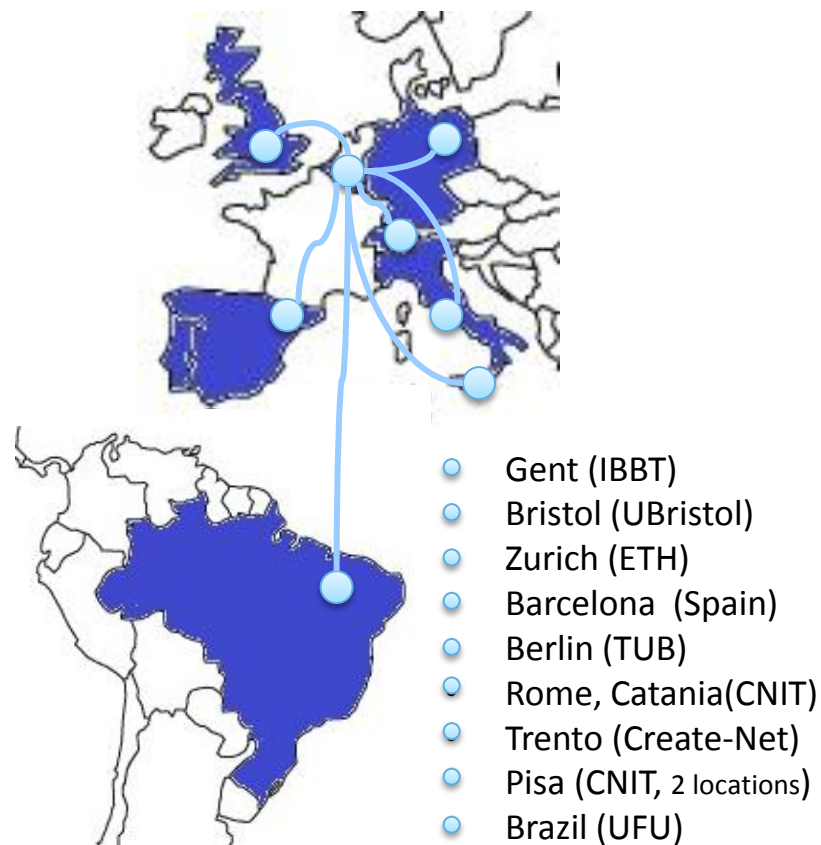
OFELIA

The EU FP7 Project
and
The European OpenFlow Experimental Facility

- OFELIA – the EU FP7 project
- OFELIA – the European OpenFlow experimental facility
- How to experiment on OFELIA

- EU FP7 project
- Started September 2010
Duration: 3 years
- Total budget 6.3M€, funding 4.45M€
- 10 partners
 - + 2 after the first Open Call
 - + 6 after the second Open Call
 - Academic institutions
 - Industry partners:
 - Deutsche Telekom, NEC, ADVA Optical
 - Stanford university official partner
 - Nick McKeown, Guru Parulkar
 - Control framework, architecture, experience

- 10 OpenFlow-enabled islands at academic institutions



What is OpenFlow and why experimental facility?

Future Internet research needs large-scale flexible environments supporting virtualization, allowing new control and routing algorithms

- Poor support for experiments in today's routers & switches
- Large OpenFlow testbeds in the US (GENI) & Japan

OFELIA creates real-world experimental networking substrate

- Allows flexible control down to individual flows
- Is protocol agnostic, programmable, scalable
- Allows deployment & test of new controllers & control apps

Main objective is the creation of a research facility including

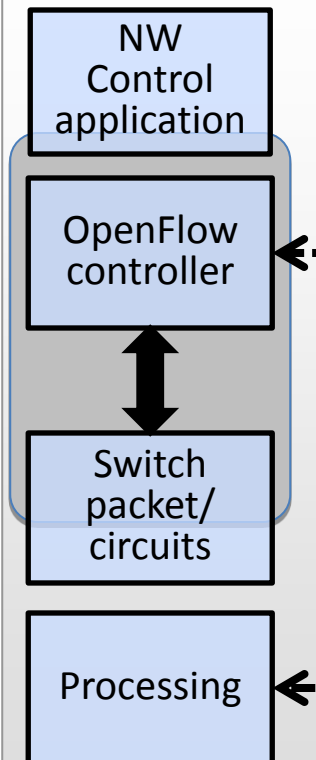
- Virtualization: automatic creation of slices
- Multi-domain extensions of controllers (for federation of islands)
- Extension into optical and wireless technologies

OF extensions needed for multi-layer, multi-domain experiments

- 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)
- non-IP experiments such as content-based addressing

Scientific challenges? Open issues?

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



Three project phases to set-up and extend the facility

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 M5 & M17

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

- First call closed end of March 2011
- Second call closed end of March 2012
- Open Calls were promoted through www.fp7-ofelia.eu and
 - FIRE Station
 - Standard communication channels (mailing lists, IEEE ComMag)
 - Industry fora: Optical Internetworking Forum, Open Grid Forum

Open Calls

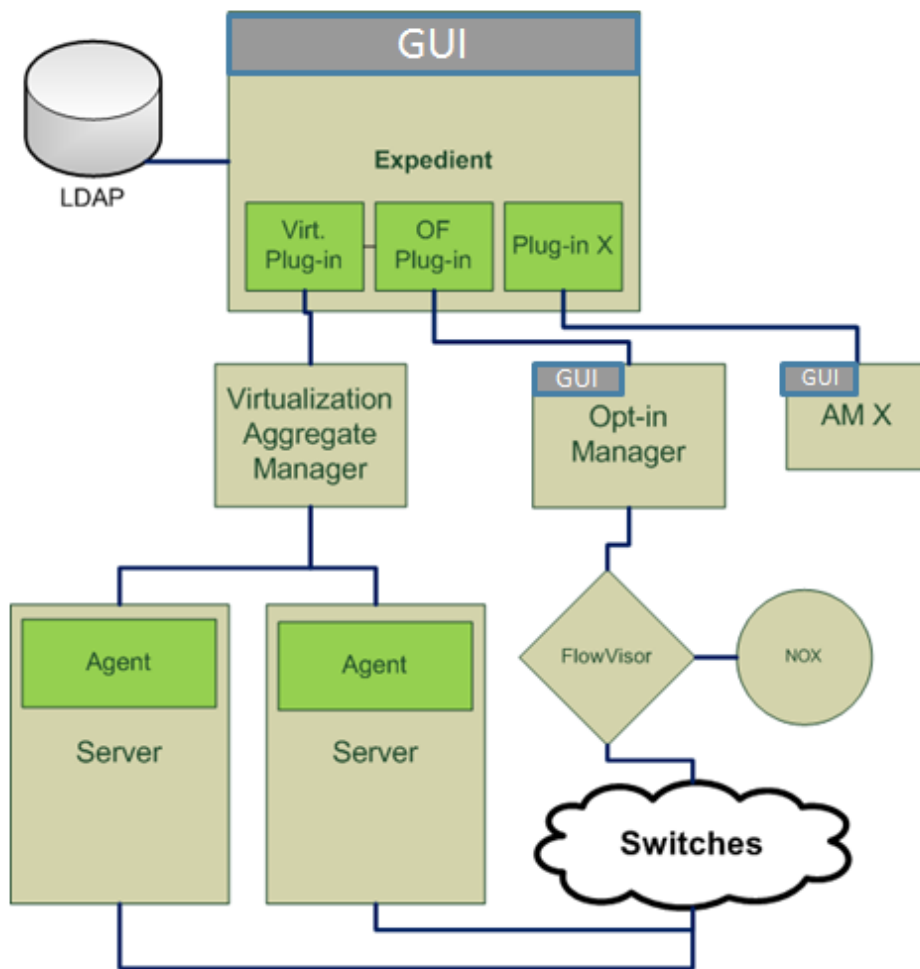
i: Create islands on L2

ii: Connect islands and extend to wireless/optics

iii: Ressource assignment automization and connection to other facilities

M7

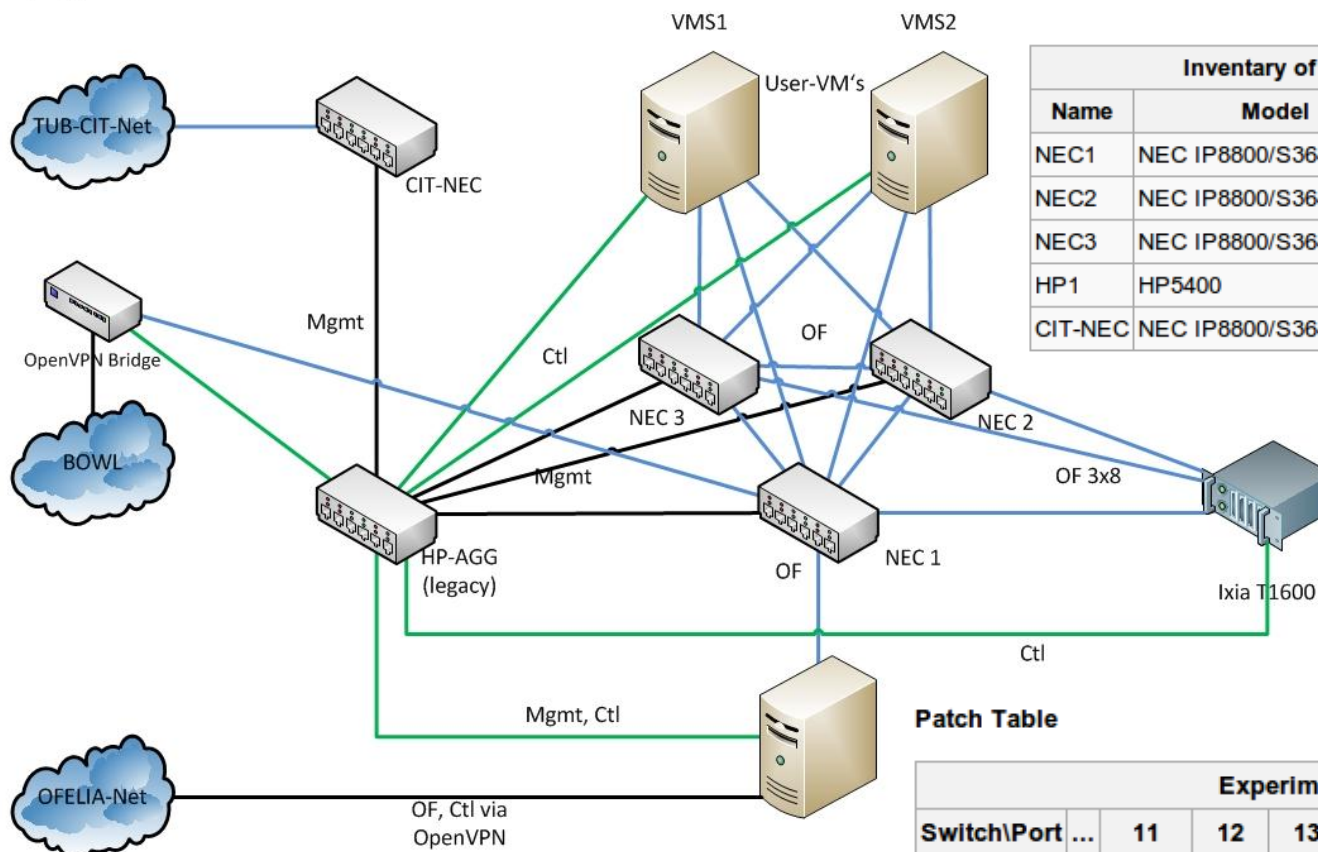
M19



- Control Framework based on eGENI's *expedient*
 - SFA-based (SFA-inspired...)
 - **Expedient** is a web interface
 - VT Plug-in: Expedient's logic to communicate with VT AM.
 - OF Plug-in: Expedient's logic to communicate with Opt-in
- VT AM: Manage Virt. Servers
- Opt-in: Manage OpenFlow resources
- Agent: controls virtualization servers

island	OF-capable Ethernet Switches	Servers	NetFPGA cards, optics, wireless
i2CAT	5x NEC IP8800/S3640-24T2XW, 3x HP E3500-48G-PoE+yl	5x SuperMicro SYS-6010T-T	
IBBT	1 NEC IP8800 /S3640-48T2XVV-LW w/ XFP	Virtual Wall (100 server emulab instance)	WiLab facility, 10 NetFPGA cards
UBristol	4x NEC, 3x Extreme Networks, 3 ADVA FSP 3000 ROADMs, Calient optical switch	5x Dell PowerEdge servers	ultra HD video streaming, 10TB storage 2x Virtex-4 FPGA boards
ETHZ	3x OpenFlow switches NEC IP8800/S3640-24T2XW with two optical 10GBase interfaces	3 servers w/ 36 GByte RAM	
TUB	5x NEC IP8800/S3640-48TWLW	3 servers	2 NetFPGA, BOWL testbed
Create-Net	3xNEC, 2xHP ProCurve 3500	5 servers (2 control framework, 3 exper.)	4 NetFPGA cards

Topology

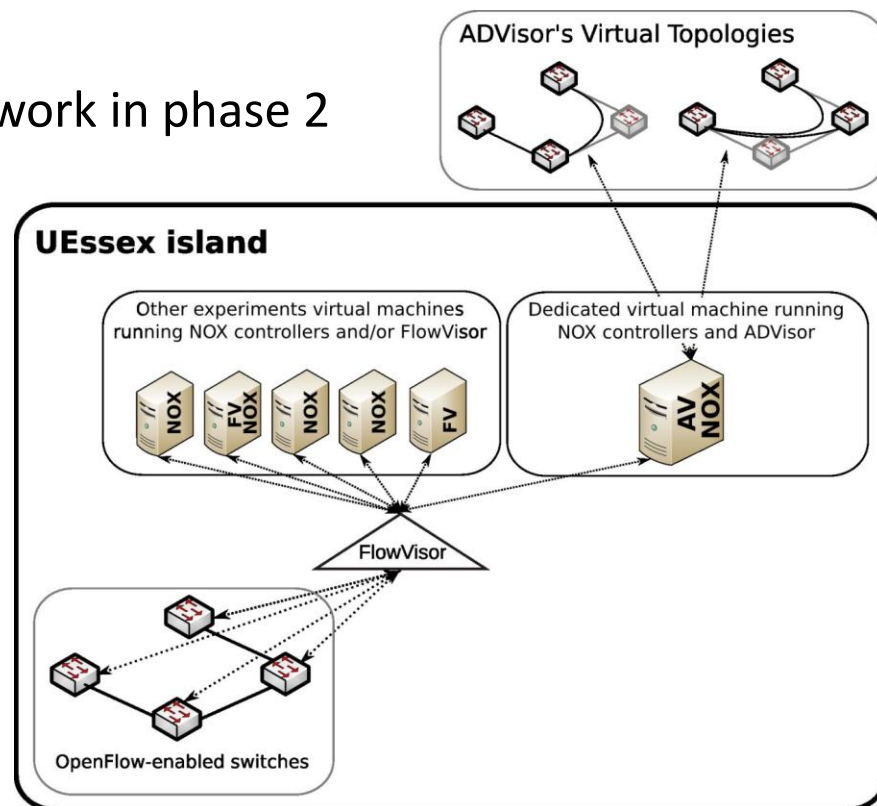
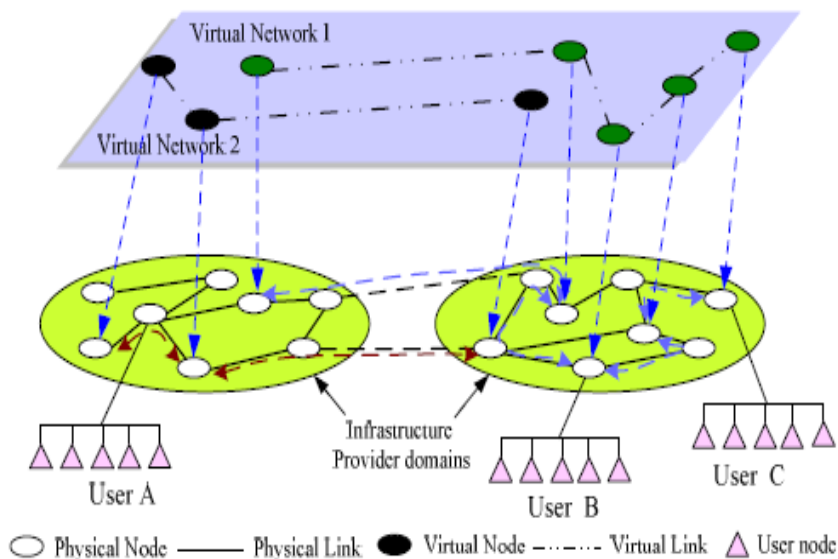


Inventory of OpenFlow switches in the testbed			
Name	Model	Datapath ID	Status
NEC1	NEC IP8800/S3640-48TW	00:00:00:00:00:00:04:01	Up and running
NEC2	NEC IP8800/S3640-48TW	00:00:00:00:00:00:04:02	Up and running
NEC3	NEC IP8800/S3640-48TW	00:00:00:00:00:00:04:03	Up and running
HP1	HP5400	00:00:00:00:00:00:04:04	Not deployed
CIT-NEC	NEC IP8800/S3640-48TW	00:00:00:00:00:00:04:05	Only productive

Patch Table

Experimental Network (OF)								
Switch\Port ...	11	12	13	...	17	18	...	21 - 28
NEC1	VPN-br	NEC2	NEC3		VMS1(eth1)	VMS2(eth1)		Ixia(S2) 1-8
NEC2	NEC1		NEC3		VMS1(eth2)	VMS2(eth2)		Ixia(S3) 1-8
NEC3	NEC1	NEC2			VMS1(eth3)	VMS2(eth3)		Ixia(S4) 1-8

- AdVisor: extension to FlowVisor, introduces topology virtualisation layer
- Developed by Create-Net, Trento
- Integrated into OFELIA Control Framework in phase 2



- The OFELIA facility is open as a best-effort service
 - Any user accepting the usage policy is welcome
 - Connection to the facility through OpenVPN via the central hub at IBBT in Ghent
 - Through a graphical user interface, a user can create and run experiments
- An experiment/slice consists of
 - A number of end points (Xen-based virtual machines, currently)
 - OpenFlow access to a set of switches that connect the end points
 - The user's OpenFlow controller can be deployed on one of the VMs
 - Links between end points and switch ports
 - Best effort (shared), mostly
 - Dedicated capacity will be available at least on some lines
- Instructions, Wiki, Videos, Open Calls, press releases, contact

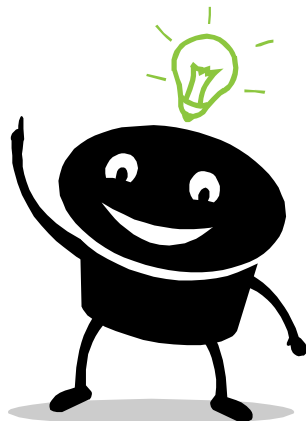
<http://fp7-ofelia.eu>

Facility is publicly available for experiments

Feedback is very much appreciated

The control framework software is free
Build your own OFELIA islands,
connect over to us, develop further

1



Have an idea!

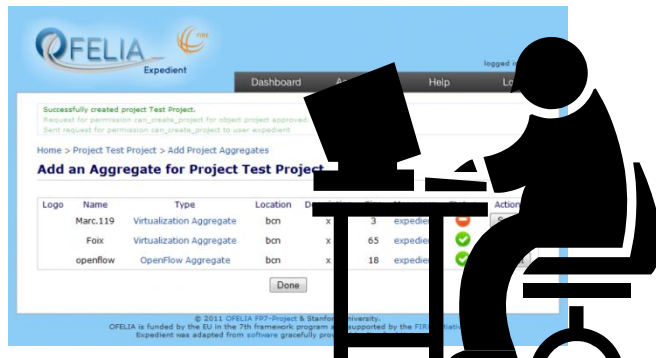
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Log on to OFELIA!

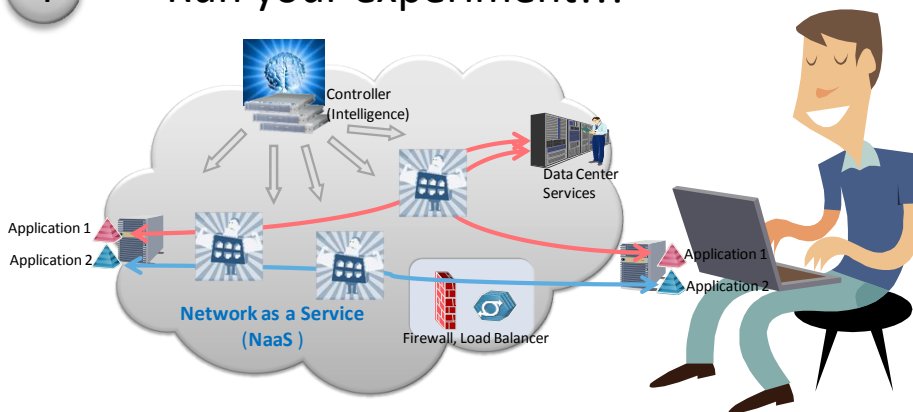
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Configure your network slice!



4

Run your experiment!!!



- Use the facility and provide feedback
 - Be gentle, this facility is a free offer to be used by researchers all over the world, accept our usage policy (similar to PlanetLab)
 - After you have gain hands-on experience with our facility, we would appreciate you filling out the questionnaire:
<https://www.surveymonkey.com/s/3KRW8FM>
- The control framework software is free
 - Build your own OFELIA islands, connect over to us, develop further
- Instructions, Wiki, Videos, Open Calls, press releases, contact

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