

Welcome @ FGRE
July 6th – July 10th

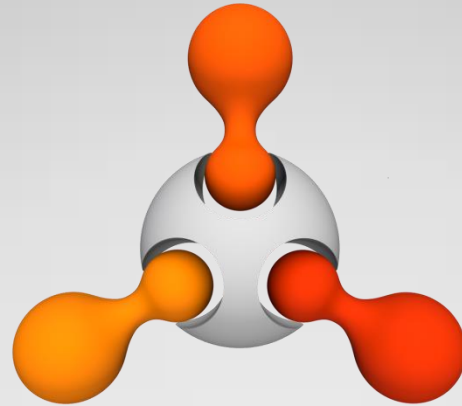
Wifi: WelcomeATiMindS
<http://doc.ilabt.iminds.be/fgre>

	Monday	Tuesday	Wednesday			Thursday	Friday	
Block I (8:30-10)	Welcome Intro to Fed4FIRE Intro To GENI	Emulation, Scale Up, stitching, cloud 11:30-12:30 Labwiki presentation		LabWiki hands-on	Wireless Sensors	Team Project	Team Project	
Block II (10:30 – 12:30)	Getting started tutorial (Lab zero) Introduction to APIs			Wireless & Mobile robots	Big data analysis			Ansible
Block III (1:30 – 3:30)	More advanced tutorial (Lab one)	Smartcity Smart- santander	Open- flow	Team Project			Team Project	Team project presentations, and evaluation
Project (4-5.30)	OpenFlow introduction Use case presentation of openflow Introduction to team projects and team formation	Smart- Fire tutorial .	Open- flow 1.3 and NFV	Team Project			Team Project	
Evening		Social event (19:00)		Lab visit (17:30 – 18:00)				

Main organizers

With support of





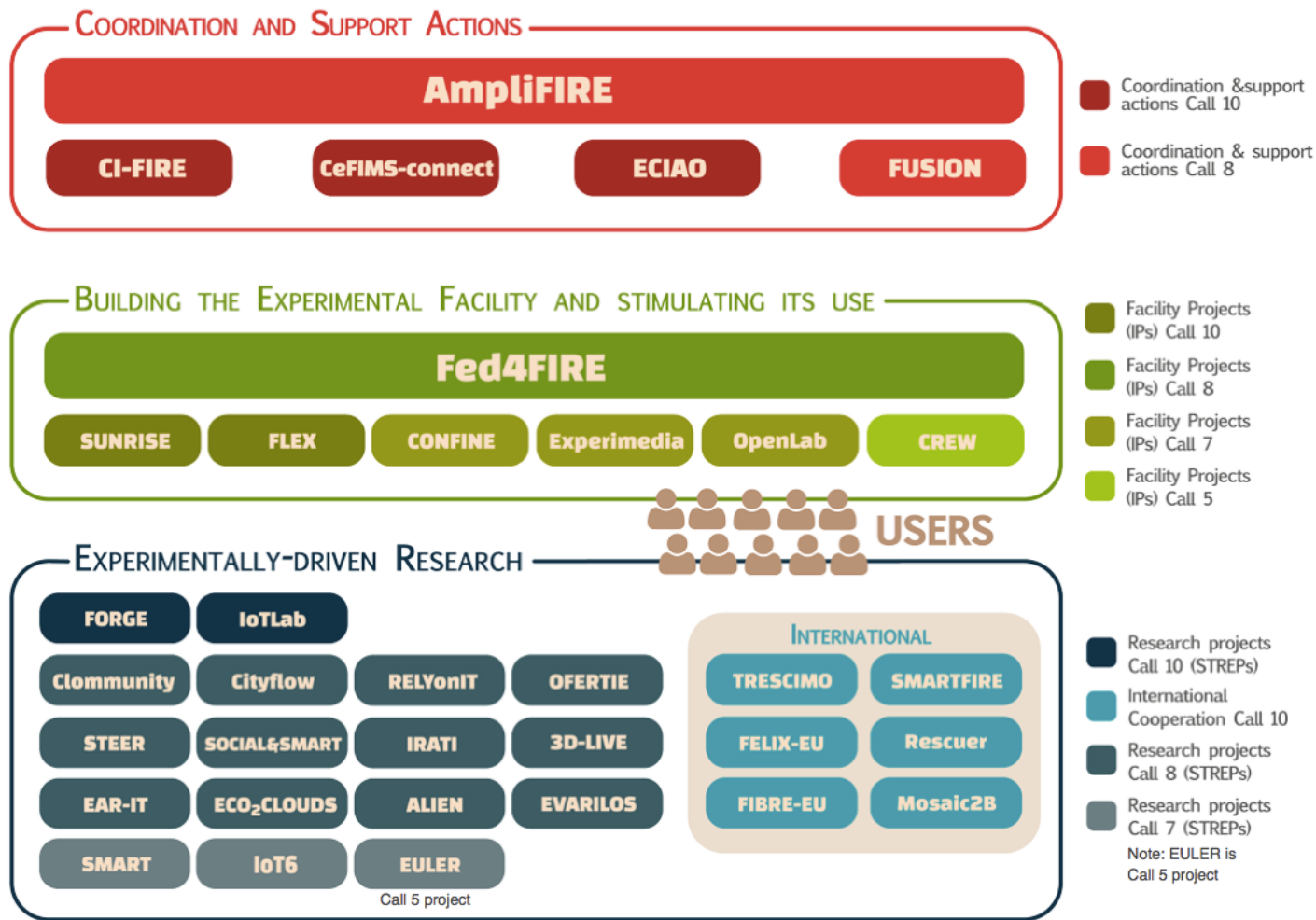
FED4FIRE

FGRE: Fed4FIRE resources



July 6th, Gent
Brecht Vermeulen, iMinds

Fed4FIRE's role in European FIRE framework



Fed4FIRE – general info

- IP project coordinated by iMinds
- Total budget: 7.75 MEUR
- 10/2012 - 9/2016
- 42 partners



Fed4FIRE assets - facilities

- Wired
- Wireless
- Open Flow
- Cloud
- Other



Fed4FIRE assets – tools



UPMC
SORBONNE UNIVERSITÉS



jFed

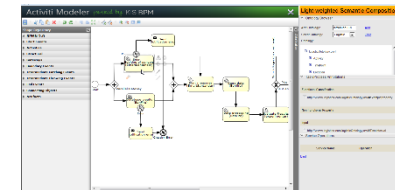


LabWiki



MULTI-DOMAIN
SERVICE DESK

PART OF THE GÉANT SERVICE PORTFOLIO



YourEPM



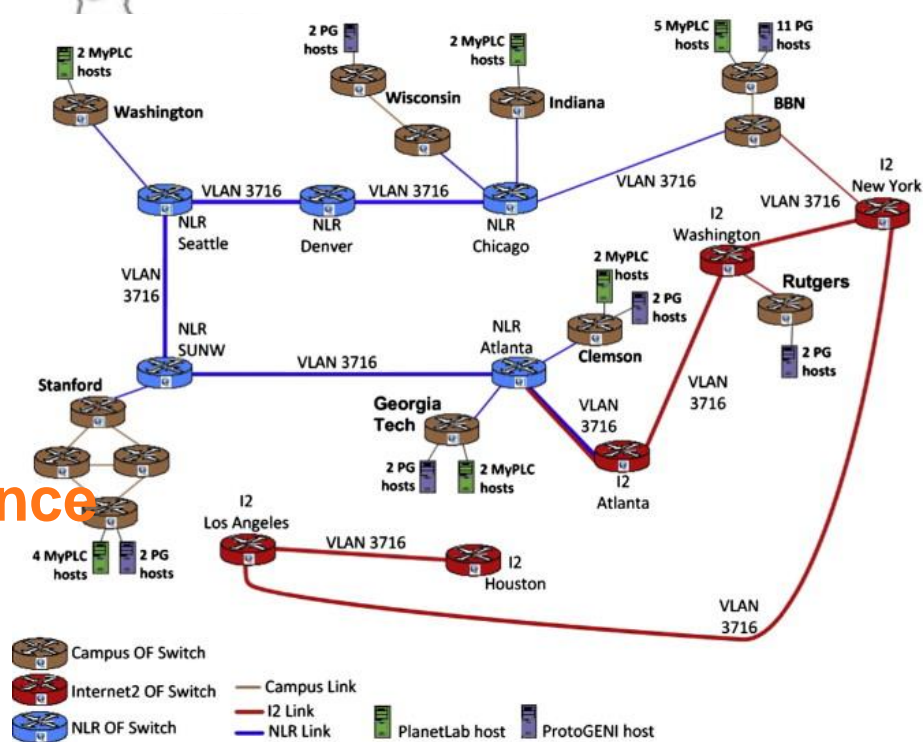
Fed4FIRE facilities

- Diverse technologies
- Diverse implementation stacks

US GENI federation



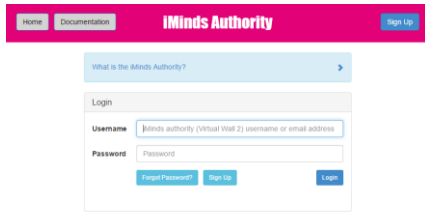
More testbeds
 More uniformity of testbeds
 Designed GENI AM API
 (instageni rack, exogeni rack,
 Openflow, Wimax)
 GEC = Geni Engineering Conference



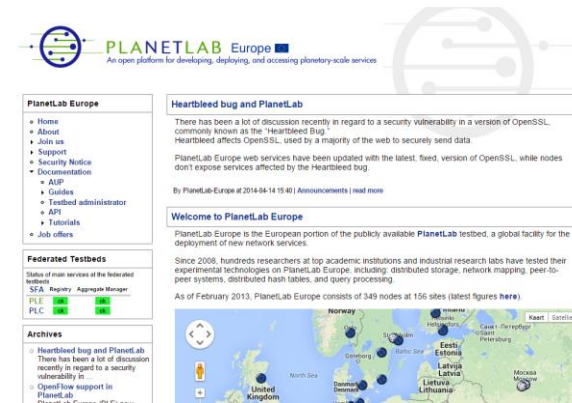
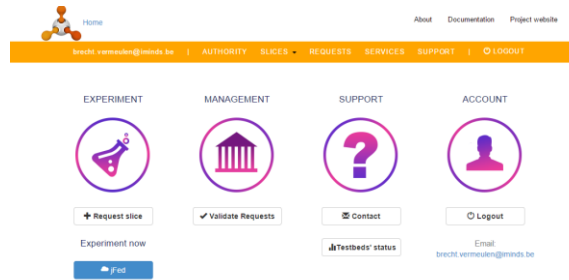
Goals of federation

- Make it easy for experimenters to use multiple testbeds
 - Single account
 - Single (or small number) of tools, choice of tools
- Multiple testbeds
 - To scale up
 - To use/combine special resources (e.g. wireless robots)
 - Redundancy (e.g. testbed in maintenance)
 - To re-use experiments (class exercises, scientifically, ...)
 - To compare environments (e.g. wireless, openflow hardware, ...)

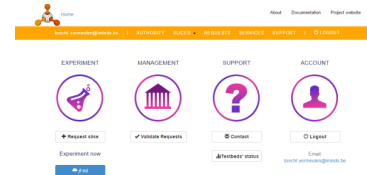
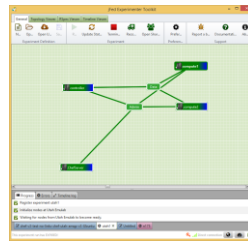
Design principles



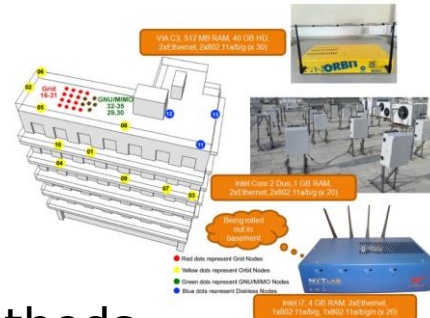
Powered by Question or comment? Join the Help Forum Supported by iMinds and the EC © 2014 iMinds 4 lab



Multiple identity provider



Multiple tools

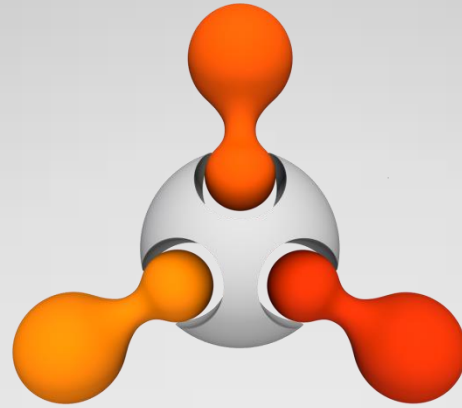


Multiple testbeds

All of them can appear and disappear!

Testbeds trust IdPs in federation



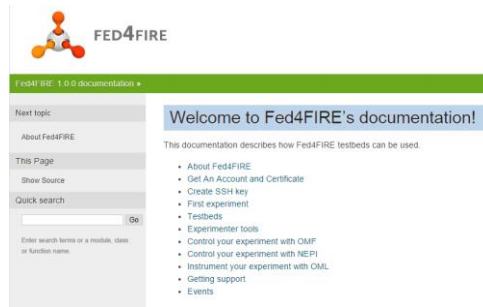


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Experiment workflow



Experiment workflow

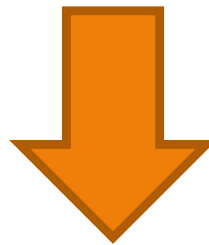


Create Account

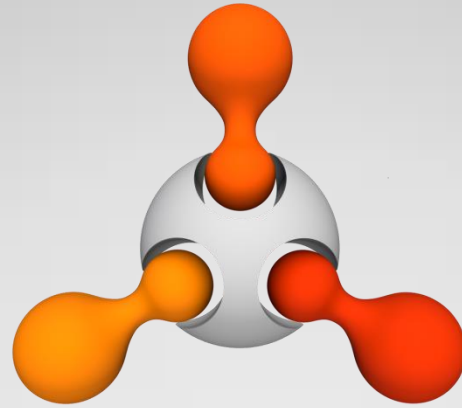


Documentation
<http://doc.fed4fire.eu>

Federation policy:
experimenter can run
tutorial experiments
to learn testbeds



Do more experiments and tutorials:
Provision resources, control resources
(ask more quota to testbeds if needed as testbeds
can have different policies)

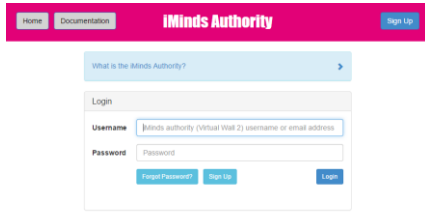


FED4FIRE

Technical workflow between components



Workflow (protocol: XMLRPC over SSL)



Slice Authority API

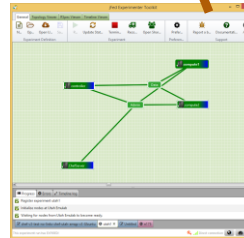
Member Authority API

3. Create slice/get credential (signed XML)

2. Get credential (signed XML)

Create Account and get certificate

1. Use signed certificate in tool

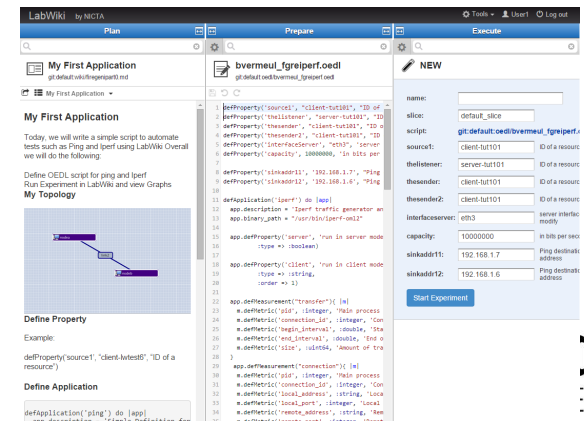


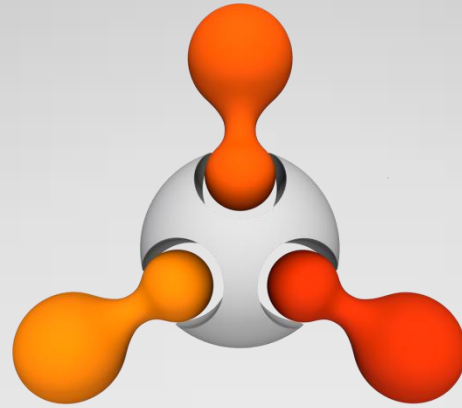
4. Provision resources

Aggregate Manager API



5. Control resources





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Monitoring



jFed testing and monitoring

<https://flsmonitor.fed4fire.eu>

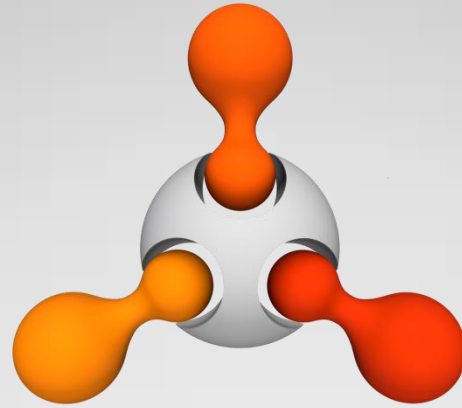
<http://monitor.ilabt.iminds.be>

API testing

Testbed Name	Ping latency (ms)	GetVersion Status	Free Resources	Internal testbed monitoring status	Last chec
BonFIRE	31.17	N/A	N/A	ok	2014-12-0
C-Lab	52.15	ok	113	ok	2014-12-0
FUSECO	15.77	ok	19	ok	2014-12-0
Koren	280.88	ok	3	N/A	N/A
NETMODE	61.02	ok	20	ok	2014-12-0
NITOS Broker	68.11	ok	38	ok	2014-12-0
NITOS SFAWrap	30.34	ok	111	ok	2014-12-0
Norbit	N/A	N/A	N/A	ok	2014-12-0
Ofelia (Bristol openflow)	16.94	ok	48	ok	2014-12-0
Ofelia (Bristol vtam)	16.92	ok	2	ok	2014-12-0
Ofelia (i2CAT openflow)	16.92	ok	5	ok	2014-12-0
Ofelia (i2CAT vtam)	16.98	ok	6	ok	2014-12-0
Planetlab Europe	30.36	ok	273	ok	2014-12-0
SmartSantander	58.9	ok	0	ok	2014-12-0
Virtual Wall 1	0.1	ok	70	N/A	N/A
Virtual Wall 2	0.12	ok	64	ok	2014-12-0
Virtual Wall 2 (openflow)	0.55	ok	2	ok	2014-12-0
w-iLab.t 2	4.71	ok	61	ok	2014-12-0

- ✓ setUp
- ✓ getVersion
- ✓ getTestUserCredential
- ✓ getTestUserInfo
- ✓ retrieveCredentialSomehow
- ✗ createProject
- ✓ createSlice
- ✗ lookupProjectsByUrnNoFilter
- ✗ lookupProjectsByNameNoFilter
- ✓ getSliceCredentials
- ✗ updateProject
- ✓ lookupSlicesNoFilter
- ✗ lookupProjectsNoFilterAfterUpdate
- ✓ updateSlice
- ✗ lookupProjectMembers
- ✗ lookupProjectsForMember
- ✓ lookupSlicesNoFilterAfterUpdate
- ✓ lookupSliceMembers

Test Name	Last Test Start Time (CET)	Last Test Duration	Last Partial Success	Last Full Success	Time since last Failure	Last Log	History
Confine	2014-12-01 21:05:03	10 minutes and 38 seconds	SUCCESS	SUCCESS	4 days and 11 hours	log	history
Fuseco	2014-12-01 21:27:02	27 seconds	FAILURE	FAILURE		log	history
NETMODE	2014-12-01 22:36:37	1 minute and 40 seconds	SUCCESS	FAILURE		log	history
Nitos Broker	2014-12-01 22:38:18	1 minute and 18 seconds	SUCCESS	FAILURE		log	history
Nitos SFAWrap	2014-12-01 22:39:37	14 seconds	FAILURE	FAILURE		log	history
Planetlab Europe	2014-12-02 03:43:26	10 minutes and 49 seconds	SUCCESS	SUCCESS	6 days and 21 hours	log	history
Virtual Wall	2014-12-02 03:39:06	2 minutes and 51 seconds	SUCCESS	SUCCESS	3 days and 22 hours	log	history
Virtual Wall	2014-12-02 03:36:25	2 minutes and 40 seconds	SUCCESS	SUCCESS	3 days and 22 hours	log	history
Virtual Wall 1	2014-12-02 03:32:11	4 minutes and 12 seconds	SUCCESS	SUCCESS	3 days and 22 hours	log	history
Virtual Wall 1	2014-12-02 03:29:14	2 minutes and 56 seconds	SUCCESS	SUCCESS	3 days and 22 hours	log	history
Wilab.t	2014-12-02 03:42:42	44 seconds	WARN	WARN		log	history
Wilab.t	2014-12-02 03:41:58	44 seconds	WARN	WARN		log	history



FED4FIRE

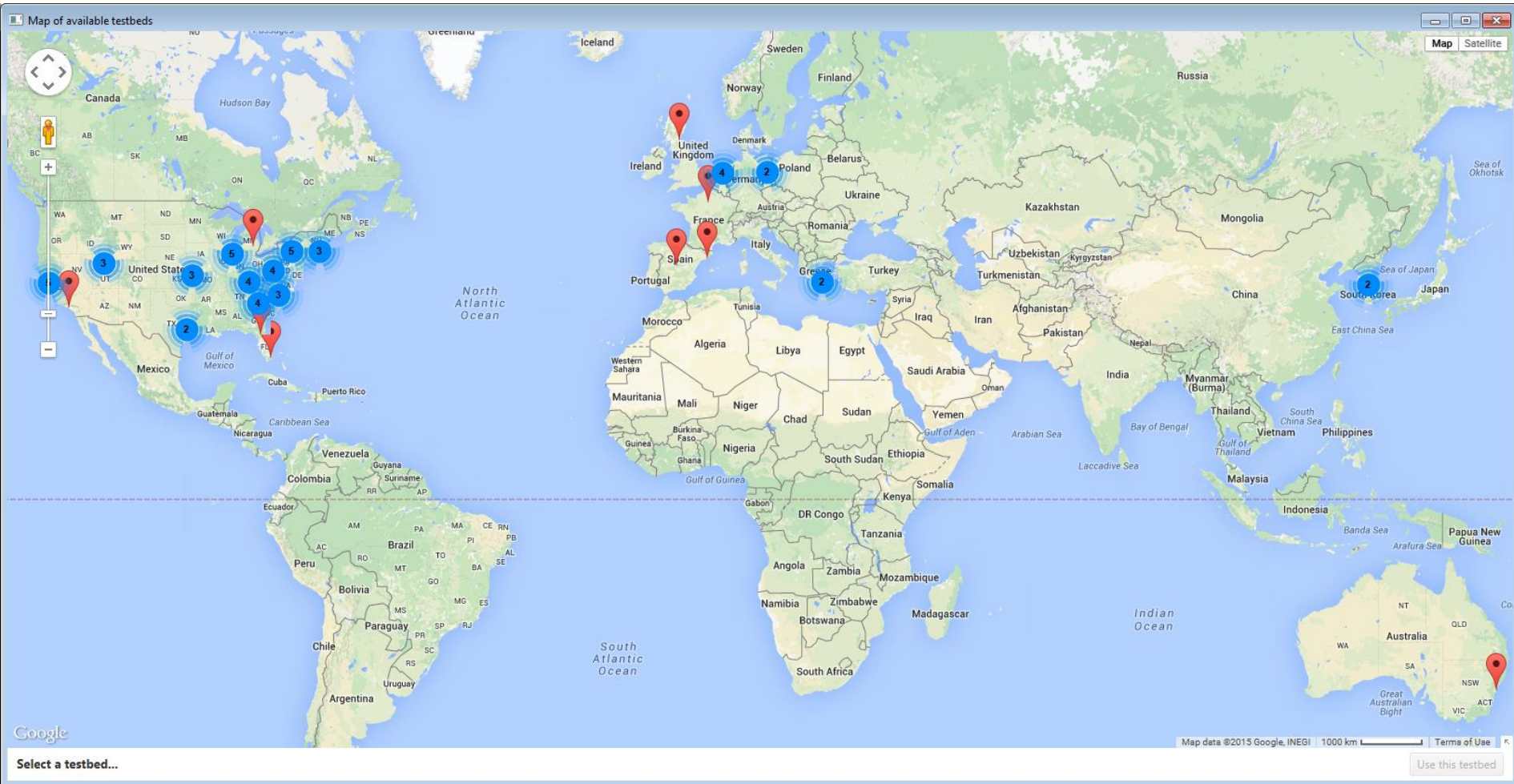
International federation and connectivity



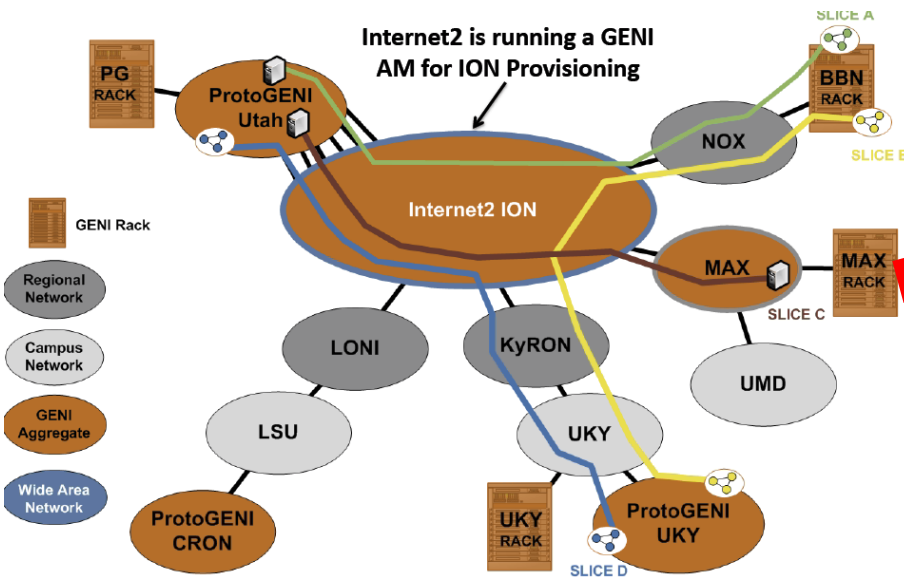
Other compatible initiatives

- South-Korea
- Canada
- Japan
- Brazil
- China
- Russia

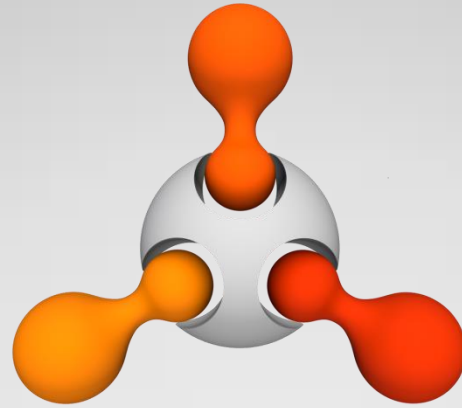
Accessible testbeds: single tool and account



Layer 2 connectivity = stitching VLANs



Meshed L2 connections possible
SDX = software defined exchange
eases connectivity (=exchange)
VLAN translation needed + SDN functionality



FED4FIRE

**Tools beyond provisioning:
experiment control**



jFed: timebased experiment control

The screenshot displays the jFed Experimenter Toolkit interface. The window title is "jFed Experimenter Toolkit". The interface is divided into several sections:

- General Viewers:** Includes tabs for "General", "Topology Viewer", "RSpec Viewer", and "Timeline Viewer".
- Control Panel:** Contains buttons for "Update Status", "Renew", "Terminate", "Start", "Pause", "Stop", "Time", "Instant", "Save results", "Add Command", "Add barrier", "Zoom In", "Zoom Out", and "Reset Zoom".
- Timeline View:** Shows a horizontal timeline from 0:00 to 00:05:00. The left side shows the "Definition" of the experiment, and the right side shows the "Zoom" view. The timeline is divided into segments for "server", "client", "Bonfire", and "node3". A red dot on the timeline indicates a specific event or command execution.
- Terminal:** Displays the output of the experiment. The output shows a successful connection between a client and a server, followed by a bandwidth measurement. The output is as follows:

```
mmand 1 X node3@urn:publicid:IDN+wall2.ilabt.iminds.be+ authority+ cm: Instant command 1 X >_ client@urn:publicid:IDN+wall1.ilabt.iminds.be+ authority+ cm: Command 2 X
09:32:27: Your command has started.
09:32:27: -----
09:32:27: Client connecting to server, TCP port 5001
09:32:27: TCP window size: 23.5 KByte (default)
09:32:27: -----
09:32:27: --
09:32:27: [ 3] local 192.168.0.2 port 48699 connected with 192.168.0.1 port 5001
09:32:37: [ID] Interval Transfer Bandwidth
09:32:37: [ 3] 0.0-10.0 sec 1.10 GBytes 944 Mbits/sec
09:32:37: Your command has finished.
```
- Taskbar:** Shows the system tray with icons for "Proxy fully enabled" and other system utilities.

Labwiki experiment control (OMF/OML)

LabWiki by NICTA

Tools User1 Log out

Plan Prepare Execute

My First Application
git:default:wiki/firegenpart0.md

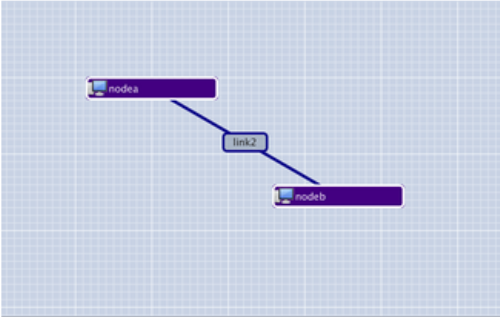
My First Application

My First Application

Today, we will write a simple script to automate tests such as Ping and Iperf using LabWiki Overall we will do the following:

Define OEDL script for ping and Iperf
Run Experiment in LabWiki and view Graphs

My Topology



```
graph LR; nodea --- link2; link2 --- nodeb;
```

Define Property

Example:

```
defProperty('source1', "client-lwtest6", "ID of a resource")
```

Define Application

```
defApplication('ping') do |app|
  app.description = 'Simple Definition for
```

bvermeul_fgriperf.oedl
git:default:oedl/bvermeul_fgriperf.oedl

```
1 defProperty('source1', "client-tut101", "ID of
2 defProperty('thelister', "server-tut101", "ID
3 defProperty('thesender', "client-tut101", "ID o
4 defProperty('thesender2', "client-tut101", "ID
5 defProperty('interfaceServer', "eth3", 'server
6 defProperty('capacity', 10000000, 'in bits per
7
8 defProperty('sinkaddr11', '192.168.1.7', "Ping
9 defProperty('sinkaddr12', '192.168.1.6', "Ping
10
11 defApplication('iperf') do |app|
12   app.description = 'Iperf traffic generator an
13   app.binary_path = "/usr/bin/iperf-om12"
14
15   app.defProperty('server', 'run in server mode
16     :type => :boolean)
17
18   app.defProperty('client', 'run in client mode
19     :type => :string,
20     :order => 1)
21
22   app.defMeasurement("transfer"){ |m|
23     m.defMetric('pid', :integer, 'Main process
24     m.defMetric('connection_id', :integer, 'Con
25     m.defMetric('begin_interval', :double, 'Sta
26     m.defMetric('end_interval', :double, 'End o
27     m.defMetric('size', :uint64, 'Amount of tra
28   }
29   app.defMeasurement("connection"){ |m|
30     m.defMetric('pid', :integer, 'Main process
31     m.defMetric('connection_id', :integer, 'Con
32     m.defMetric('local_address', :string, 'Loca
33     m.defMetric('local_port', :integer, 'Local
34     m.defMetric('remote_address', :string, 'Rem
35     m.defMetric('remote port', :integer, 'Remot
```

NEW

name:

slice:

script: git:default:oedl/bvermeul_fgriperf.oedl

source1: ID of a resource

thelister: ID of a resource

thesender: ID of a resource

thesender2: ID of a resource

interfaceserver: server interface modify

capacity: in bits per second

sinkaddr11: Ping destination address

sinkaddr12: Ping destination address

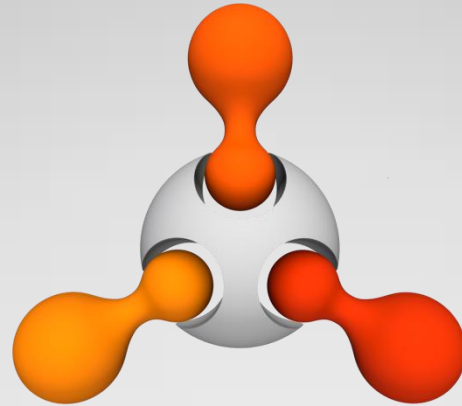
Start Experiment

NEPI experiment control

- <http://doc.fed4fire.eu/nepi.html>

```
n096-09b.wall2.ilabt.iminds.be - PuTTY
ec:~# pico -w ping.py
ec:~# python ping.py
2014-02-25 19:23:39,989 LinuxNode INFO   guid 1 - host n095-26.wall2.ilabt.iminds.be - Deploying node
2014-02-25 19:23:42,070 LinuxNode INFO   guid 1 - host n095-26.wall2.ilabt.iminds.be - Cleaning up processes
2014-02-25 19:23:42,085 LinuxNode INFO   guid 1 - host n095-26.wall2.ilabt.iminds.be - Cleaning up home
2014-02-25 19:23:42,991 LinuxApplication INFO  guid 2 - host n095-26.wall2.ilabt.iminds.be - Deploying command 'ping -c3 node2'
2014-02-25 19:23:43,007 LinuxApplication INFO  guid 2 - host n095-26.wall2.ilabt.iminds.be - Uploading command 'ping -c3 node2'
2014-02-25 19:23:44,246 LinuxApplication INFO  guid 2 - host n095-26.wall2.ilabt.iminds.be - Provisioning finished
2014-02-25 19:23:44,992 LinuxApplication INFO  guid 2 - host n095-26.wall2.ilabt.iminds.be - Starting command 'ping -c3 node2'
2014-02-25 19:23:47,152 LinuxApplication INFO  guid 2 - host n095-26.wall2.ilabt.iminds.be - Retrieving 'stdout' trace all
PING node2-link3 (10.10.1.1) 56(84) bytes of data:
64 bytes from node2-link3 (10.10.1.1): icmp_req=1 ttl=64 time=0.574 ms
64 bytes from node2-link3 (10.10.1.1): icmp_req=2 ttl=64 time=0.207 ms
64 bytes from node2-link3 (10.10.1.1): icmp_req=3 ttl=64 time=0.214 ms

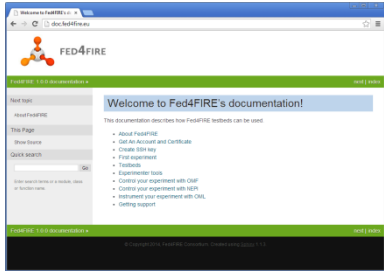
--- node2-link3 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 1998ms
rtt min/avg/max/mdev = 0.207/0.331/0.574/0.172 ms
2014-02-25 19:23:47,186 LinuxApplication INFO  guid 2 - host n095-26.wall2.ilabt.iminds.be - Releasing resource
ec:~#
```



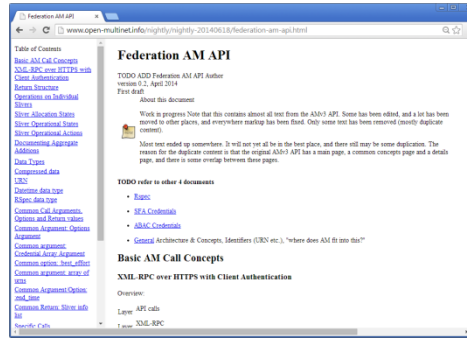
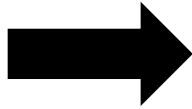
FED4FIRE

**Workflow adding a testbed
to the federation**

Adding a testbed to the federation



doc.fed4fire.eu



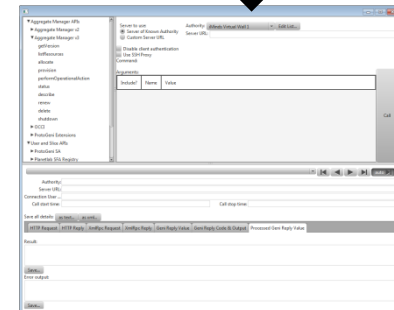
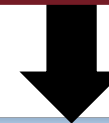
AM API doc



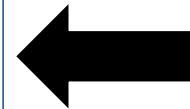
Design RSpecs



Implement AM API on top of testbed



Test with jFed probe



Testbed Name	Ping	latency (ms)	GetVersion	Status	Free Resources	Internal testbed monitoring status	Last check	Internal status
doc4fire	OK	100	OK	OK			2014-04-10 10:00:00	OK
CC-EP	OK	100	OK	OK			2014-04-10 10:00:00	OK
FUTURECO	OK	100	OK	OK			2014-04-10 10:00:00	OK
EPN	OK	100	OK	OK			2014-04-10 10:00:00	OK
NETWORKE	OK	100	OK	OK			2014-04-10 10:00:00	OK
NETOX SPARKING	OK	100	OK	OK			2014-04-10 10:00:00	OK
Open (Biosys openflow)	OK	100	OK	OK			2014-04-10 10:00:00	OK
Open (Biosys openflow)	OK	100	OK	OK			2014-04-10 10:00:00	OK
Open (CCAT openflow)	OK	100	OK	OK			2014-04-10 10:00:00	OK
Open (CCAT openflow)	OK	100	OK	OK			2014-04-10 10:00:00	OK
Planets Energy	OK	100	OK	OK			2014-04-10 10:00:00	OK
Virtual Host 1	OK	100	OK	OK			2014-04-10 10:00:00	OK
Virtual Host 2	OK	100	OK	OK			2014-04-10 10:00:00	OK
Virtual Host 2 openflow	OK	100	OK	OK			2014-04-10 10:00:00	OK
Virtual Host 2	OK	100	OK	OK			2014-04-10 10:00:00	OK

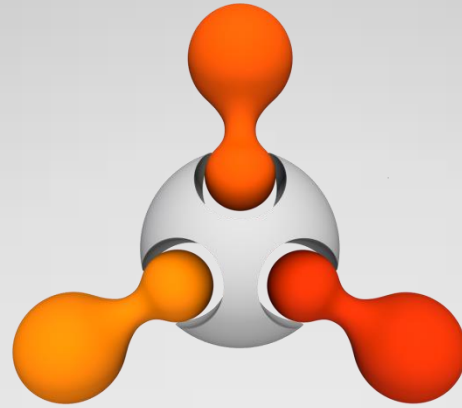
Dashboard and nightly testing (+internal testbed monitoring)



Document testbed



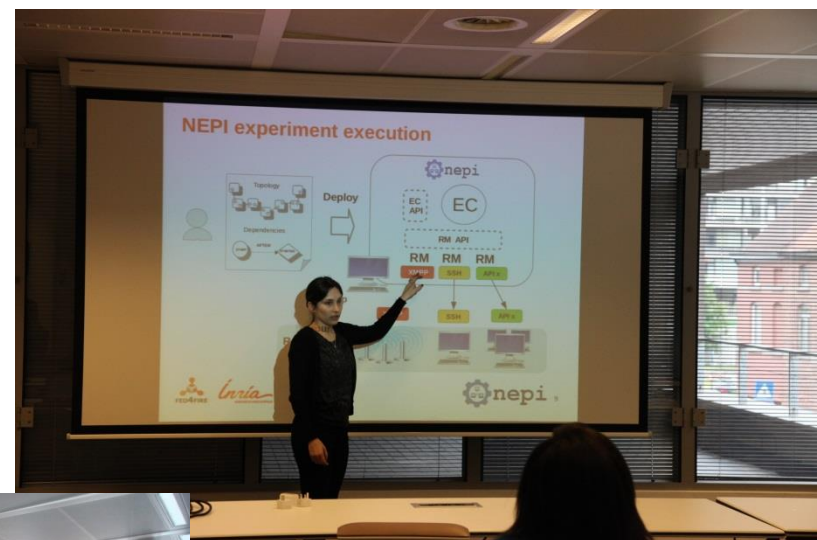
Add testbed in Experimenter tools



FED4FIRE

Use cases





FIRE-GENI Summer school 2014 - 2015



From account creation to first experiment (tutorial with client-server & emulated link)

The screenshot displays the jFed Experimenter Toolkit interface. The main window is titled "jFed Experimenter Toolkit" and features a toolbar with various controls. The toolbar is divided into sections: "Experiment" (Update Status, Renew, Terminate), "Advanced" (Reboot, Edit ssh-keys, Share), "Layout" (Auto Layout), and "Zoom" (Zoom In, Zoom Out, Reset Zoom). Below the toolbar, a network topology is shown on a green grid background. The topology consists of three nodes: "server", "link0", and "client", connected in a line. Below the topology, there are two additional nodes: "VM Bonfire" and "node3".

The bottom section of the interface shows a "Progress" tab with a list of tasks:

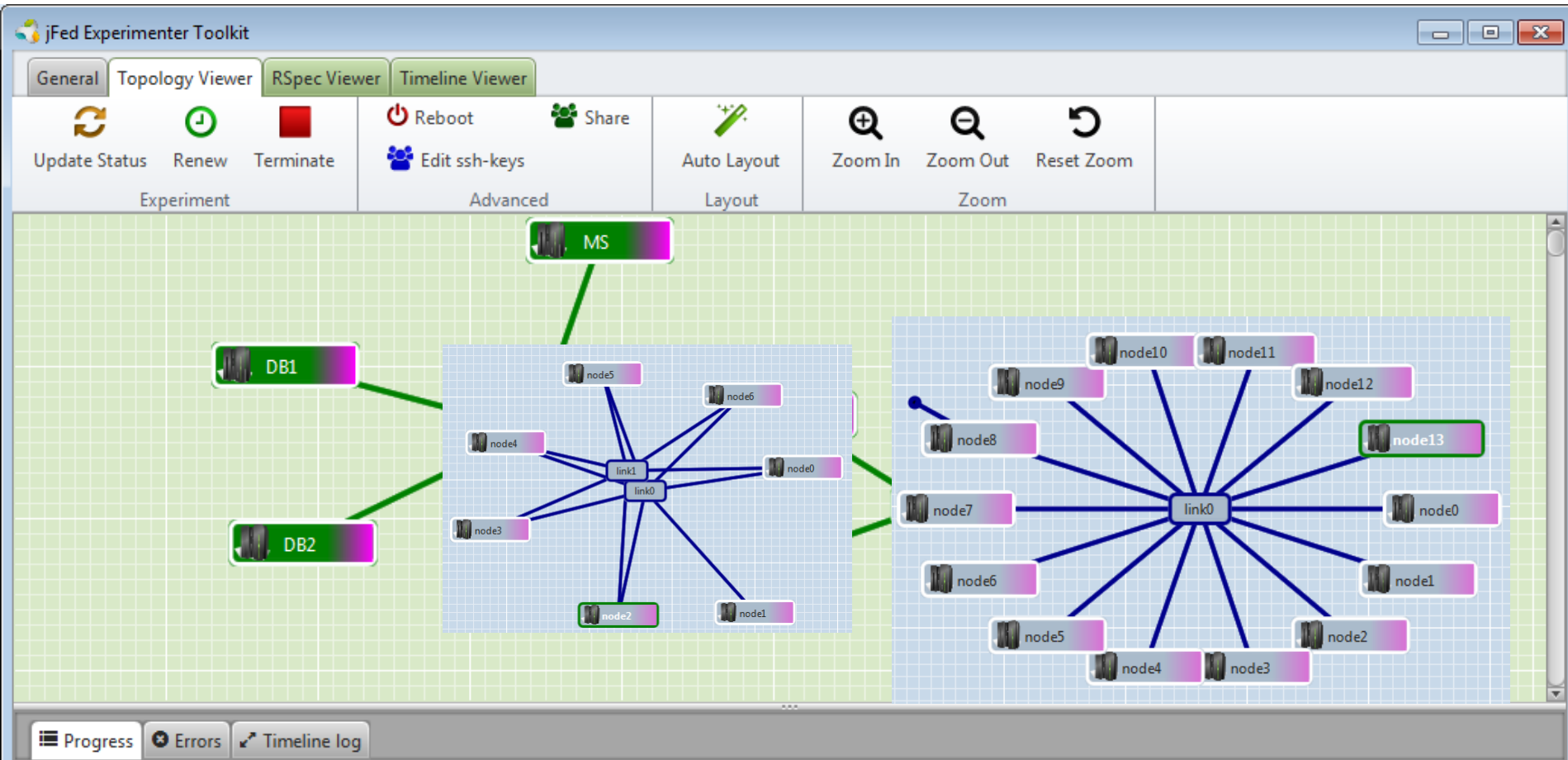
- Initialize nodes at iMinds Virtual Wall 2
- Waiting for nodes from BonFire to become ready.
- Waiting for nodes from iMinds Virtual Wall 2 to become ready.
- Waiting for nodes from iMinds Virtual Wall 1 to become ready.
- Testing connectivity to nodes from BonFire.
- Testing connectivity to nodes from iMinds Virtual Wall 2.
- Testing connectivity to nodes from iMinds Virtual Wall 1.

At the bottom of the interface, there is a status bar that reads: "This experiment run will expire in 1 hour, 41 minutes and 39 seconds."

In the bottom right corner, a terminal window titled "n143-01b.wall1.ilabt.iminds.be - PuTTY" is open. The terminal shows the following output:

```
bvermeul@server:~$ ping client
PING client-link0 (192.168.0.2) 56(84) bytes of data:
64 bytes from client-link0 (192.168.0.2): icmp_req=1 ttl=64 time=200 ms
64 bytes from client-link0 (192.168.0.2): icmp_req=2 ttl=64 time=200 ms
64 bytes from client-link0 (192.168.0.2): icmp_req=3 ttl=64 time=200 ms
64 bytes from client-link0 (192.168.0.2): icmp_req=4 ttl=64 time=200 ms
64 bytes from client-link0 (192.168.0.2): icmp_req=5 ttl=64 time=200 ms
^C
--- client-link0 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4005ms
rtt min/avg/max/mdev = 200.259/200.271/200.276/0.400 ms
bvermeul@server:~$
```

Example: SME does scalability testing



**Experimenters can use exactly the same for private clouds
“cloud-on-demand” service (with size as they want)
Including all other testbeds and connectivity**

Forge: lab in Greece using iMinds testbed

- 200 students in 4 sessions



FORGE

Wireless LAN throughput

In this lab session we'll investigate the different Wi-Fi settings and features which impact the throughput in a WLAN hotspot network. This course is provided by Ghent University and iMinds as part of the FORGE project, Forging Online Education through FIRE.

[Learn more about FORGE »](#)

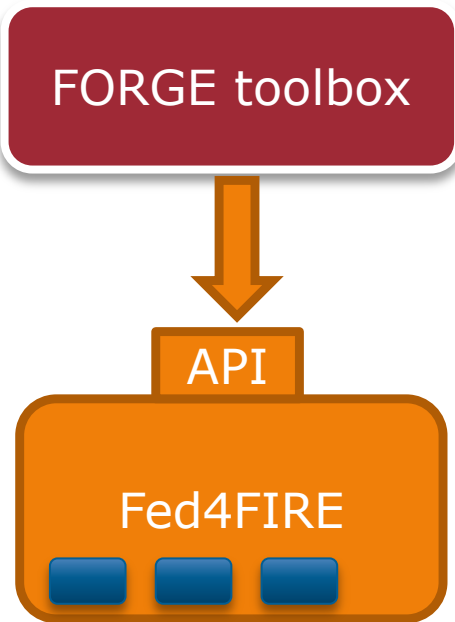
Introduction

You will be using actual hardware (and no simulations) to experiment with different settings and features of Wi-Fi (Wireless Fidelity, based on IEEE 802.11 standards) when deploying a WLAN (Wireless Local Area Network) hotspot network. By using this hardware to solve multiple questions in a set of well-thought-out exercise scenarios, you will gain a better insight in the different aspects which impact the achievable throughput in your WLAN.

Live experimentation

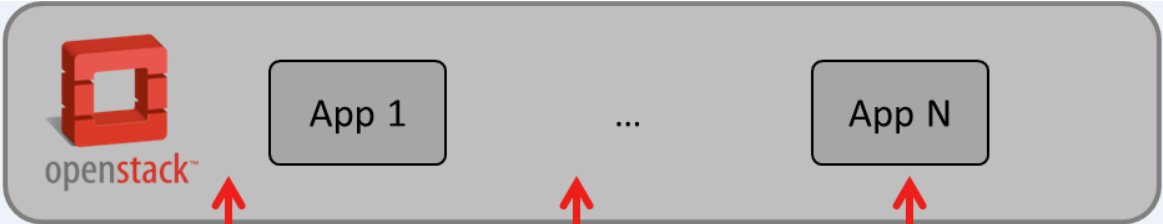
The wireless nodes you will be using are part of the **iMinds w-iLab.t Zwijnaarde** testbed (a.k.a. "wilab2"), which is *physically located at the Zwijnaarde campus in Belgium* but can be configured, managed and tested completely from within the web interface you are currently using. This web interface itself is controlling the wireless nodes and is also dynamically created and hosted at the **iMinds Virtual Wall** testbed, which is *physically located at the Zuiderpoort offices (Ghent) in Belgium*.

These so called **FIRE (Future Internet Research and Experimentation)** testbeds can also be used in research projects to collaborate with industry partners to e.g. study and improve WLAN functionality. However, the configuration and experiments that you will perform during this lab session do not differ from the ones that are also applicable within your own WLAN at home.

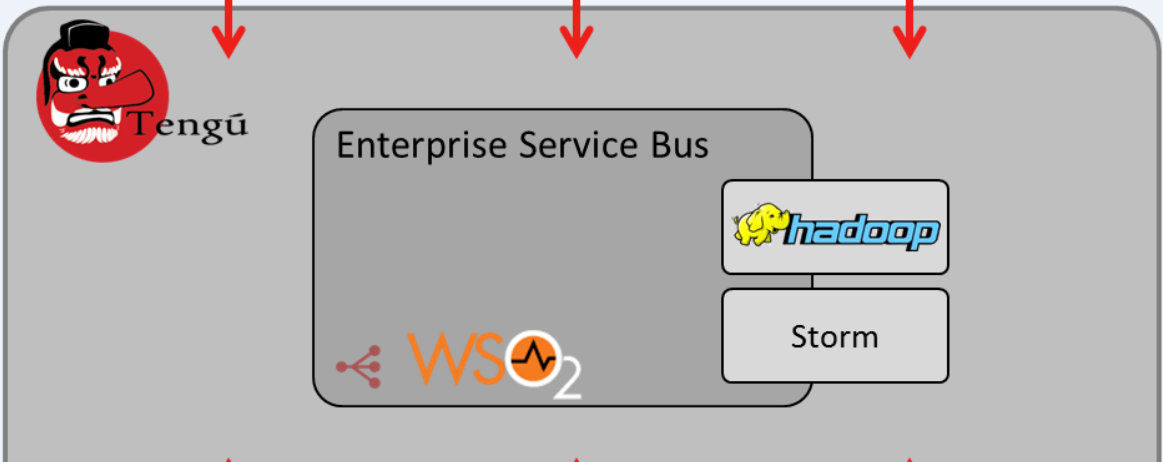


Tengu service platform

Cloud-on-demand



Hadoop/Storm/Lambda-on-demand

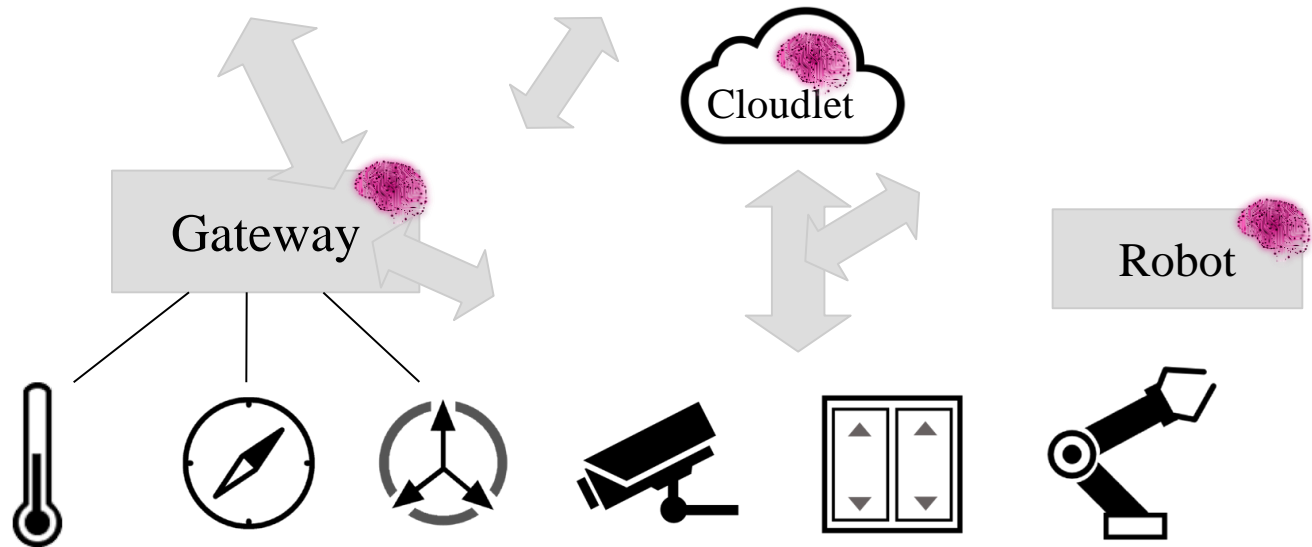


```
POST /tengu/{type}?nodes={nr}&testbed={urn}&project{str}
```

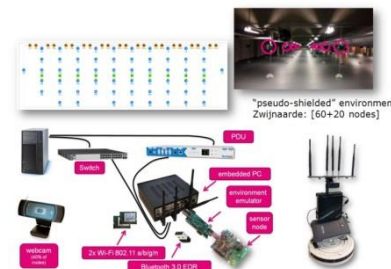
Powered by RSpec and Chef



IOT EXAMPLE



sensors/
actuators



Use multiple testbeds/technologies with single account and tool

Extend your experimental research to other testbeds: upscale, other hardware

Re-use front-end tools / control tools / tutorials / classes

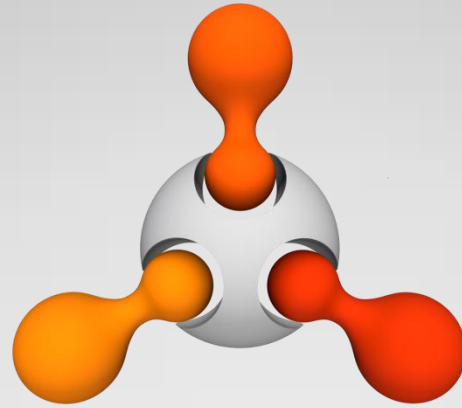
Easy use through federations

<http://www.geni.net>

<http://doc.fed4fire.eu>

<http://www.fed4fire.eu>

Combine and test on all layers



FED4FIRE

Thank you

brecht.vermeulen@iminds.be

www.fed4fire.eu

