Fed4FIRE WP2: info for new testbeds

Brecht Vermeulen, Fed4FIRE WP2 lead

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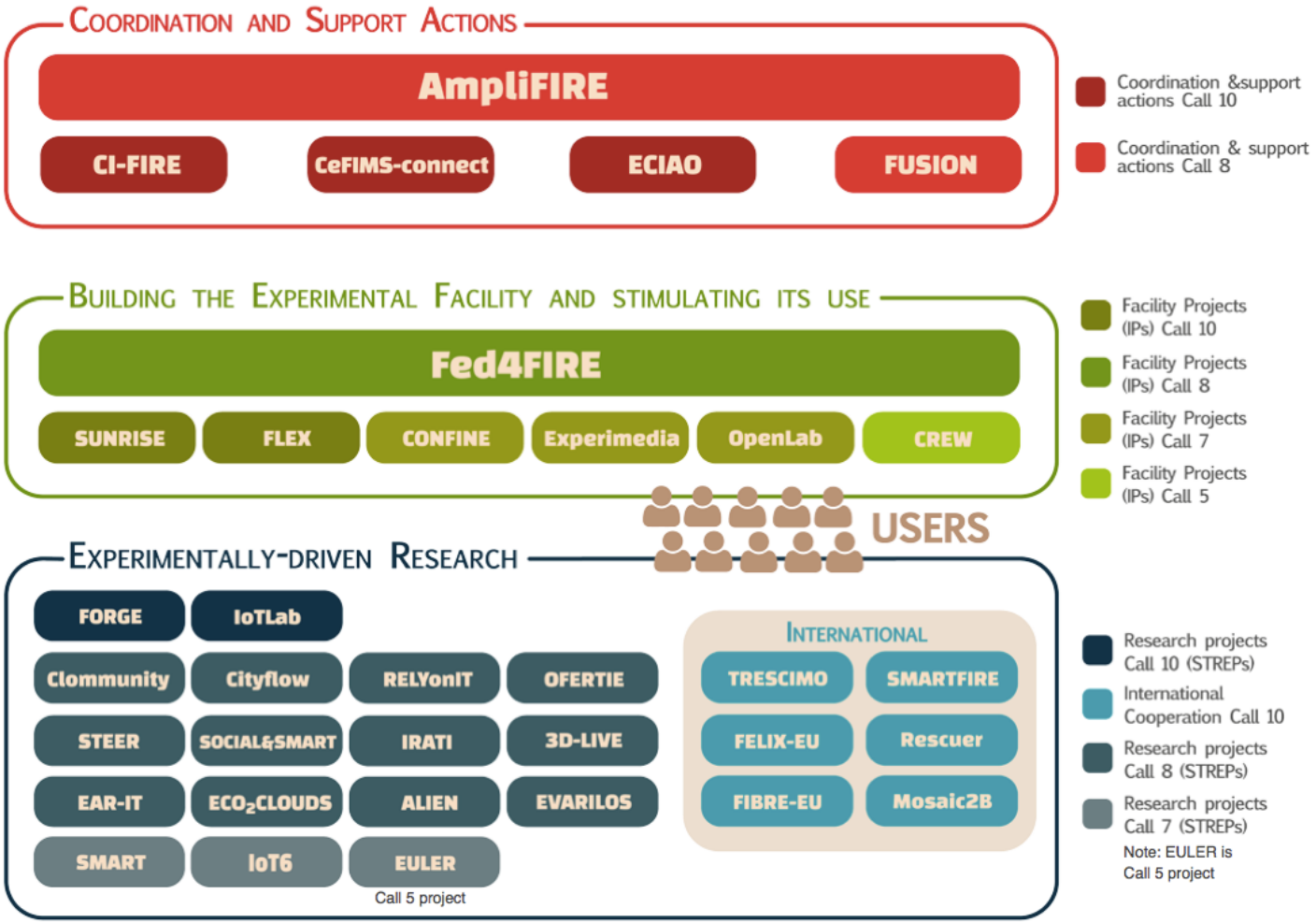
Fed4FIRE – general info

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

Fed4FIRE's role in FIRE



Source figure: FIRE Brochure 2014 (AmpliFIRE)

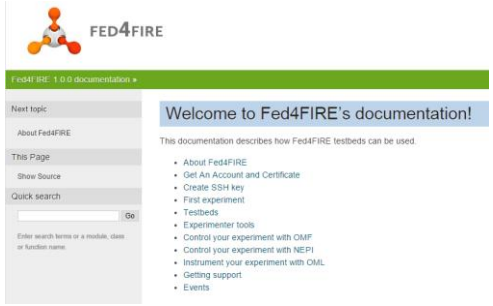
Current testbeds

Agenda

- Experiment workflow
  - Overview Fed4FIRE (http://doc.fed4fire.eu)
  - Technical workflow between components
  - Monitoring
  - Connectivity
    - Proxy
    - International federation and connectivity
  - Tools beyond resource provisioning
- Federation membership models
- Workflow adding testbed to the federation
  - Documentation and tutorials
  - jFed toolkit for testing and monitoring federation
  - How does the Aggregate Manager API look like
  - How to implement the Aggregate Manager

Experiment workflow

Experiment workflow



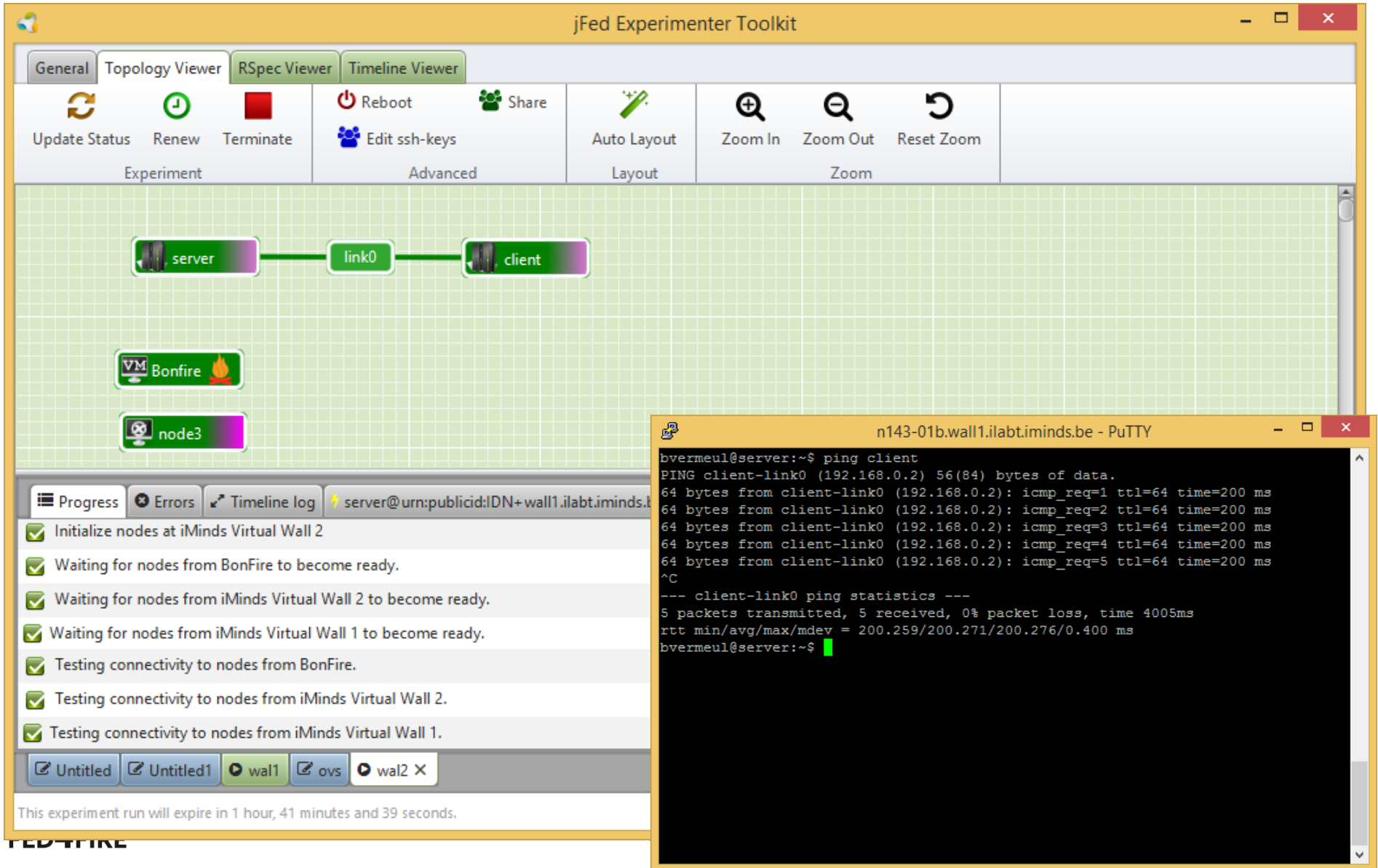
Documentation
http://doc.fed4fire.eu

Create Account

Federation policy: experimenter can run tutorial experiments to learn testbeds

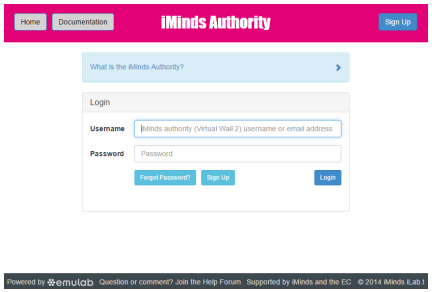
Do more experiments and tutorials:
Provision resources, control resources
(ask more quota to testbeds if needed as testbeds can have different policies)

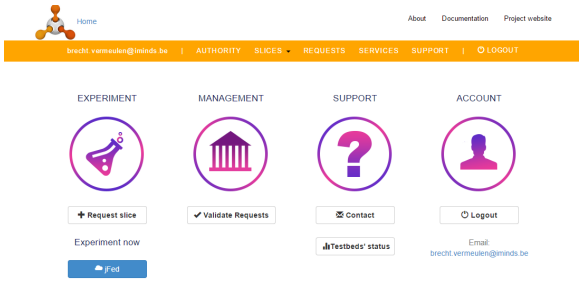
From account creation to first experiment (tutorial with client-server & emulated link)

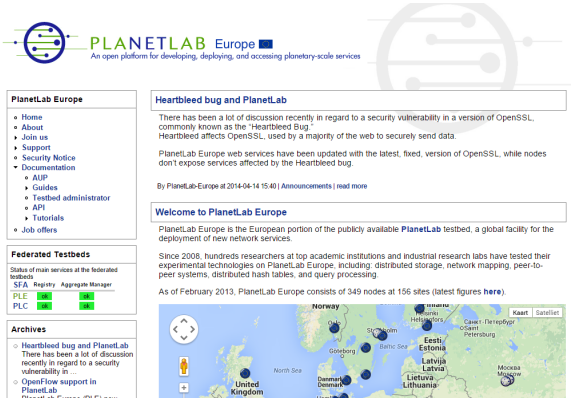


Technical workflow between components

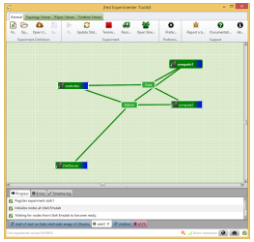
Workflow

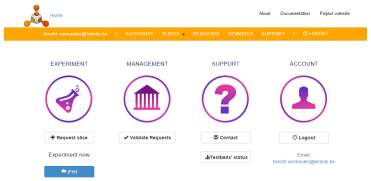






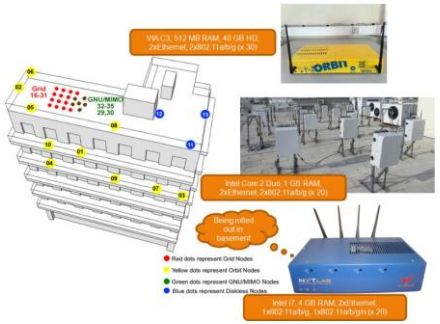
Signed X.509 certificate of **an** identity provider





Use **a** tool

Testbeds trust IdPs in federation

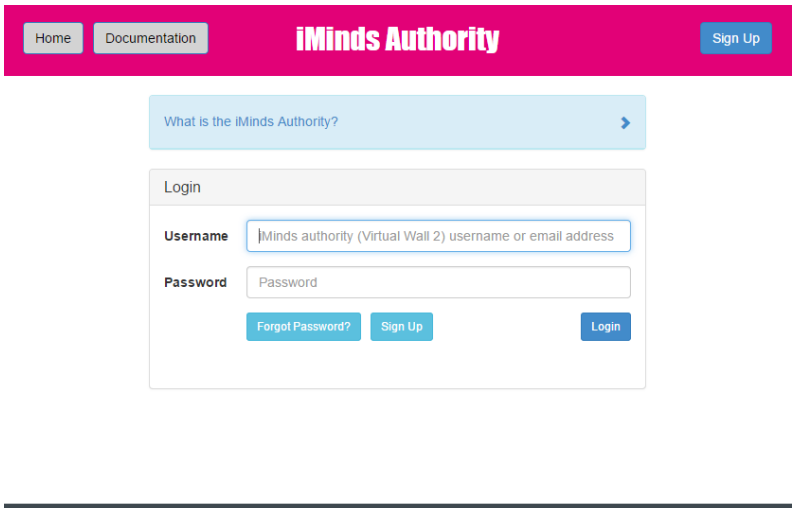


Use **one or more** testbeds

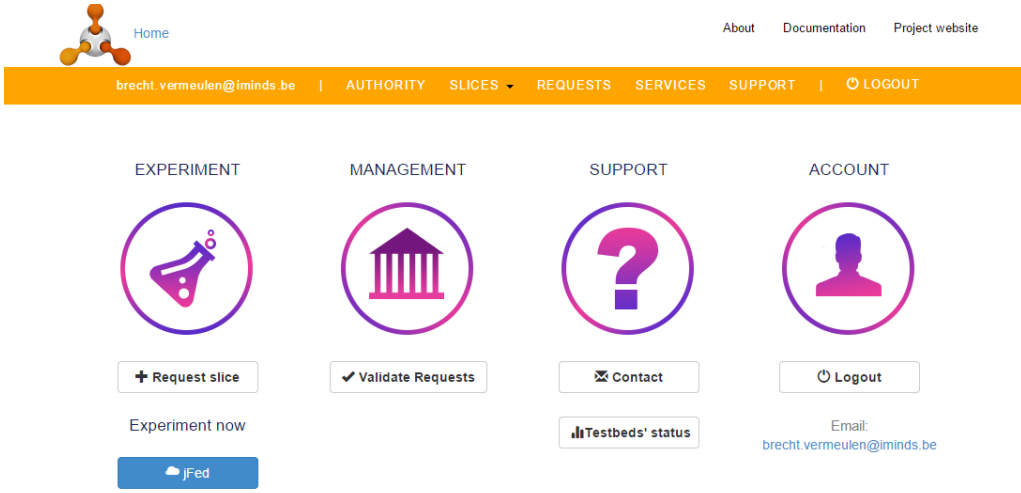
FED4FIRE

iMinds
CONNECT.INNOVATE.CREATE

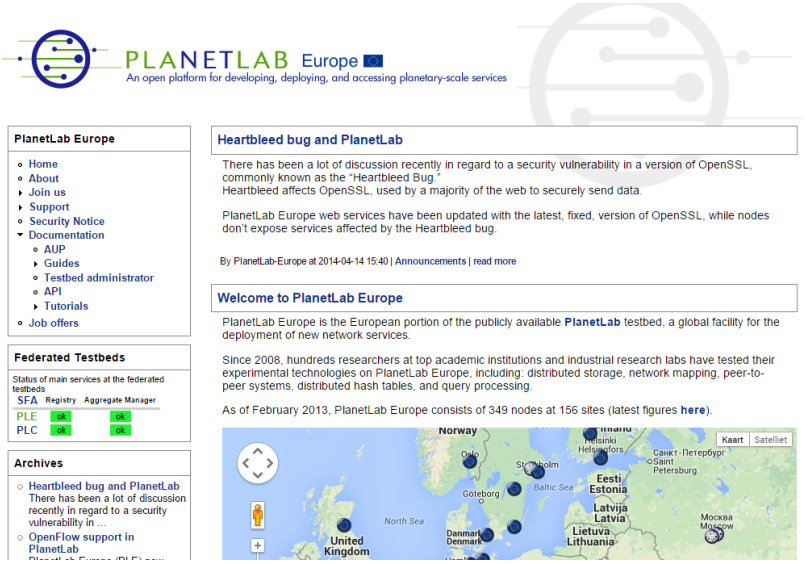
Fed4FIRE Identity providers



https://authority.ilabt.iminds.be

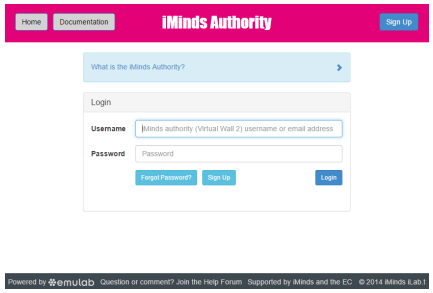


Portal: https://portal.fed4fire.eu



Planetlab Europe: http://www.planet-lab.eu/

Workflow (protocol: XMLRPC over SSL)



Create Account and get certificate

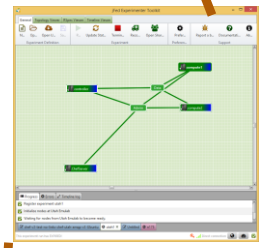
Slice Authority API

Member Authority API

3. Create slice/get credential (signed XML)

2. Get credential (signed XML)

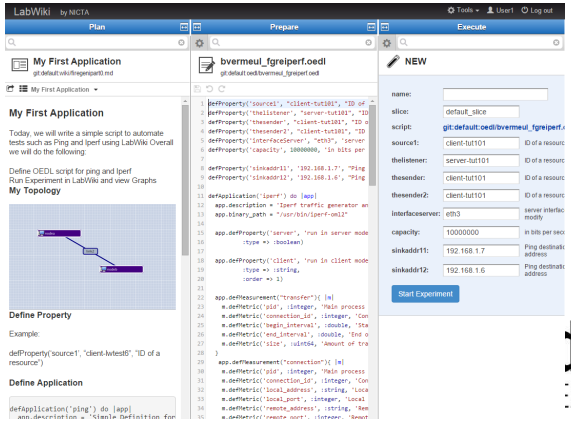
1. Use signed certificate in tool



4. Provision resources

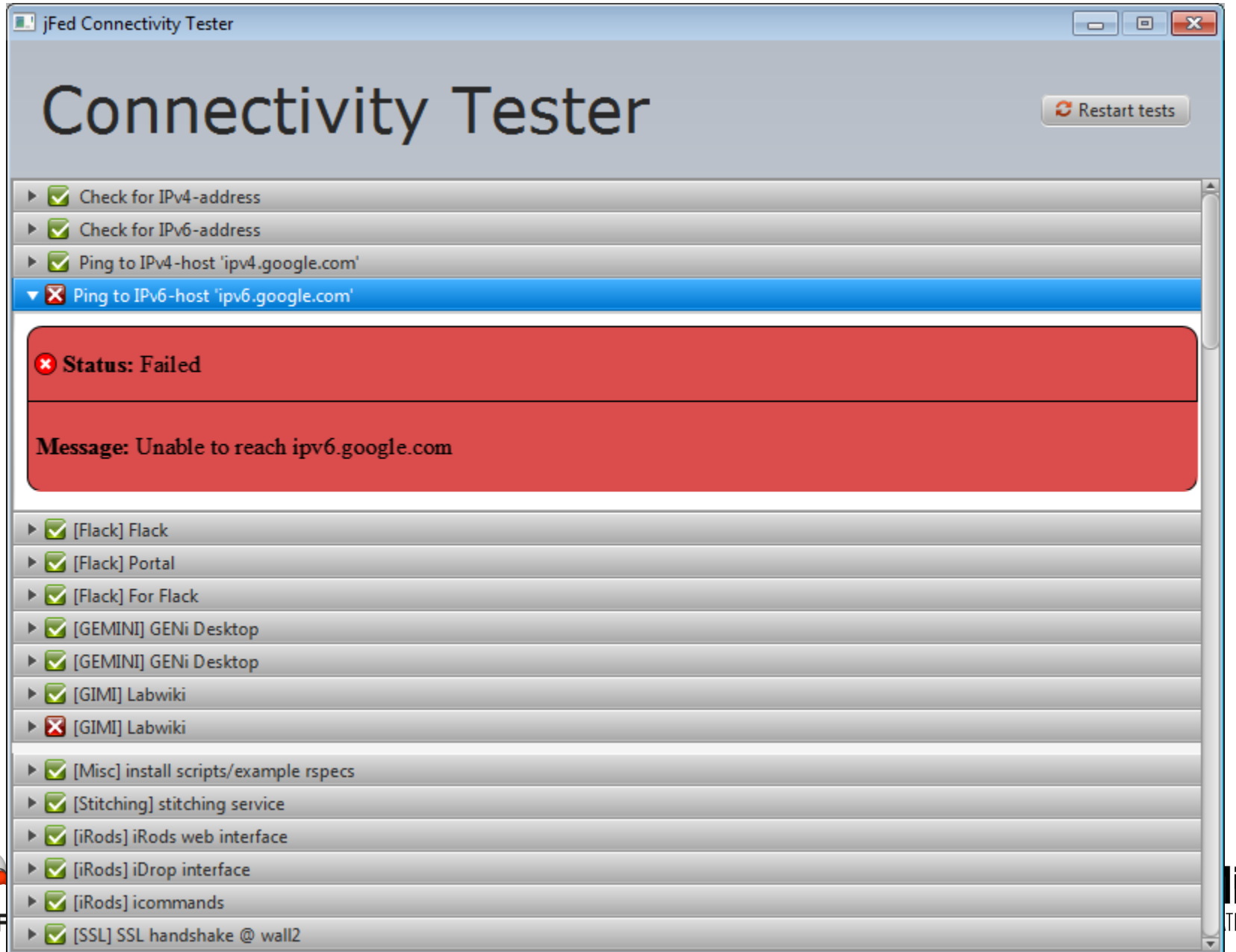
Aggregate Manager API

5. Control resources



Connectivity: proxy

Connectivity test (also in bug report)



TCP ports and firewalls

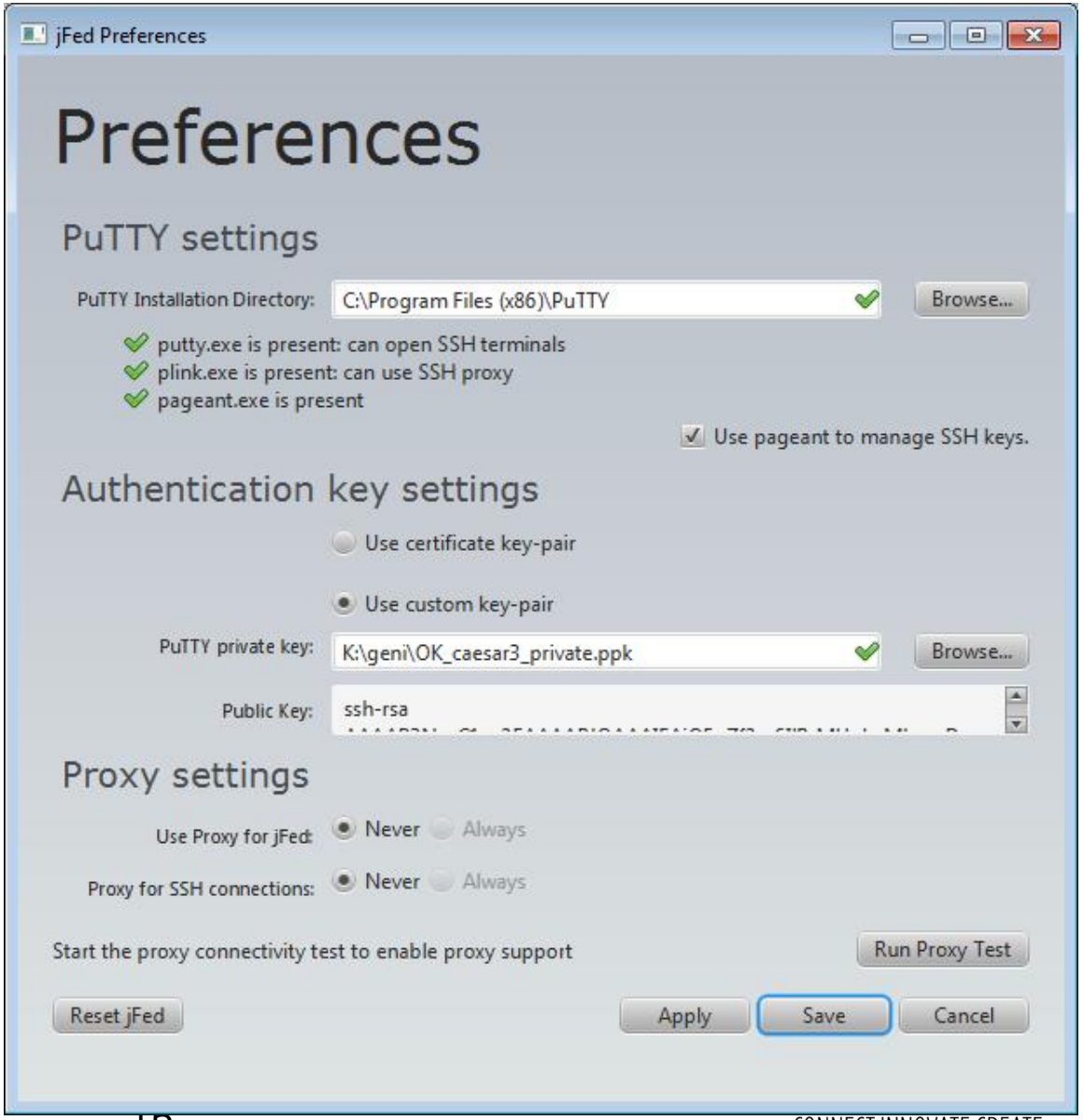
- 12369, 12346, 11443, 8081, …
- IPv6 for node access

= problems

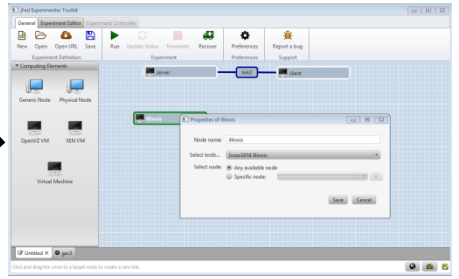
- First step: Detection (connectivity tester)
- Second step: work around -> SSH proxy

SSH proxy (optional !)

- For API calls
- For SSH login
- Automatic SSH agent for extra comfort



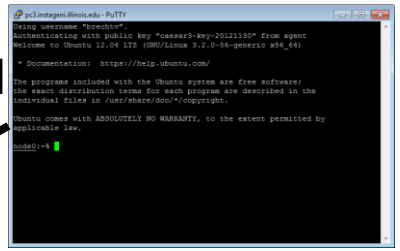
SSH proxy: only TCP 22



Virtual Wall Authority

IPv4
API calls
TCP 22

IPv4 SSH
TCP 22



Public SSH keys
of PEM cert

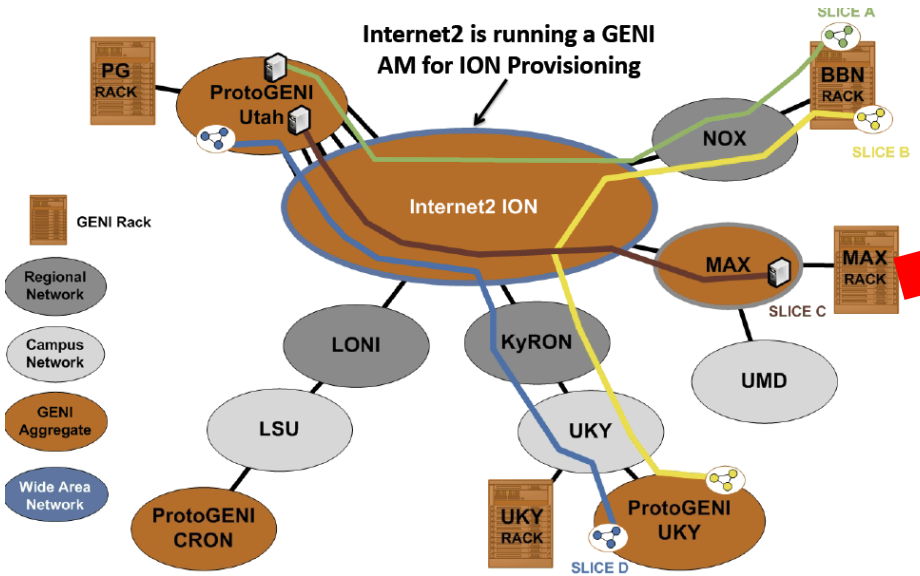
SSH gateway server

AMs, nodes, …

IPv4/IPv6
API calls
SSH login
Even private vpns connected to SSH gateway

International federation and connectivity

Layer 2 connectivity = stitching VLANs



Meshed L2 connections possible

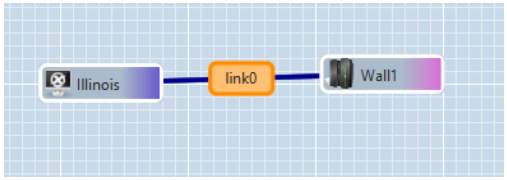
SDX = software defined exchange

eases connectivity (=exchange)

VLAN translation needed + SDN functionality

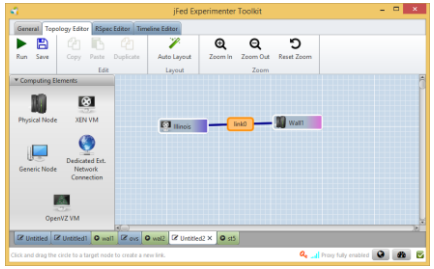
Stitching workflow: iMinds to Illinois

1. Experimenter draws layer 2 link



Stitching Computation Service (SCS)

2. and starts provisioning

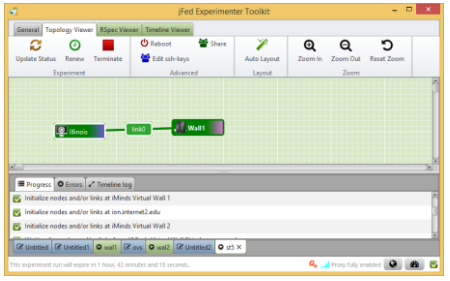


3. Tool contacts SCS
to know the path
and SCS sends back the path and workflow
(e.g. some networks can do VLAN translation)

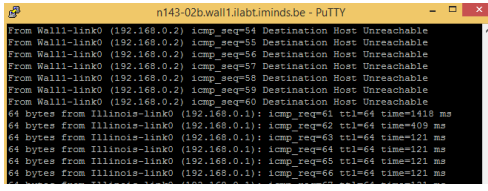
Wall1 | Wall2 | Geant | Inter net2 | Illinois

4. Tool provisions at all testbeds and networks
through the aggregate manager API
and negotiates the VLAN IDs

Wall1 | Wall2 | Geant | Inter net2 | Illinois

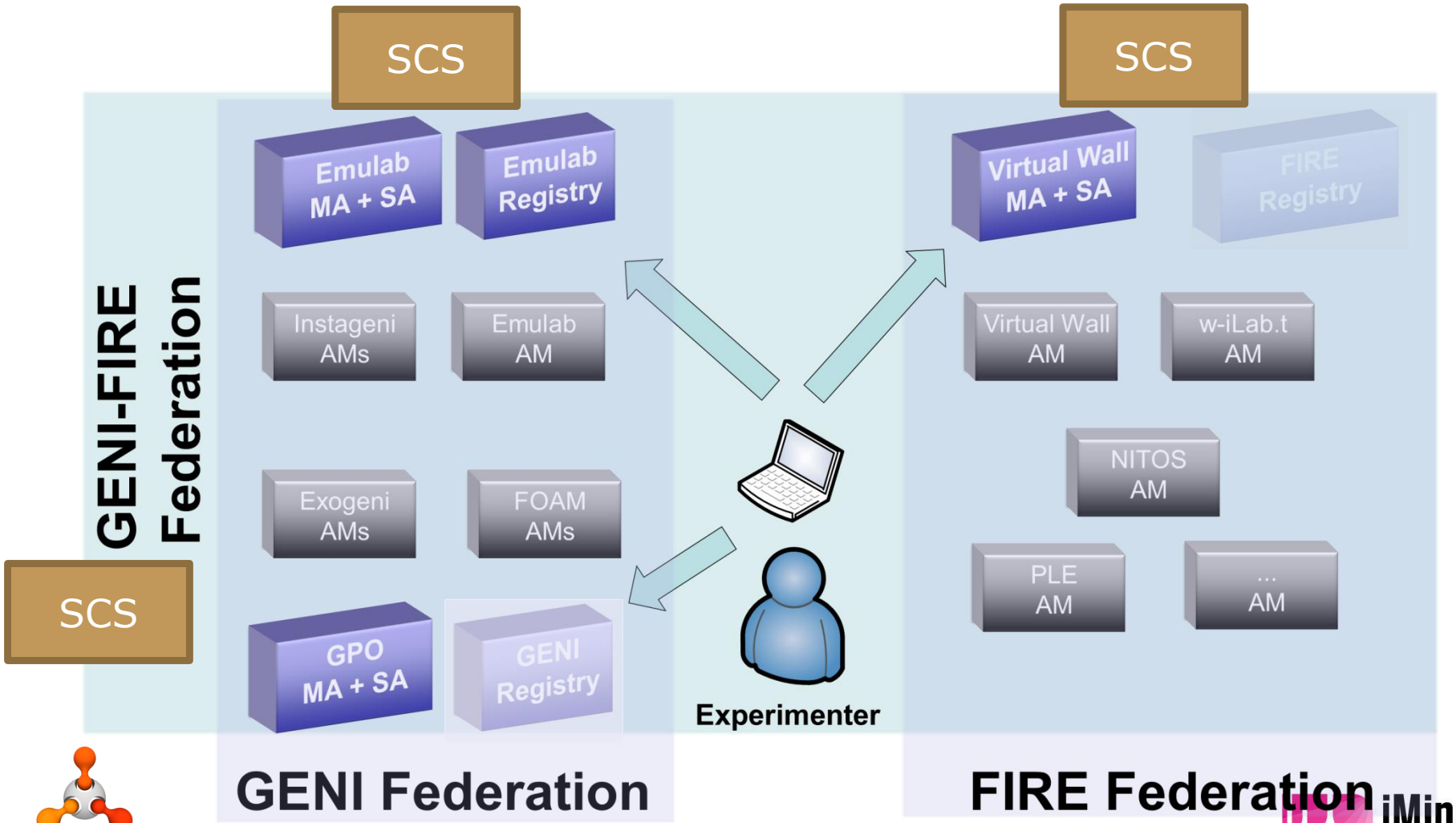


5. User logs in
and can ping



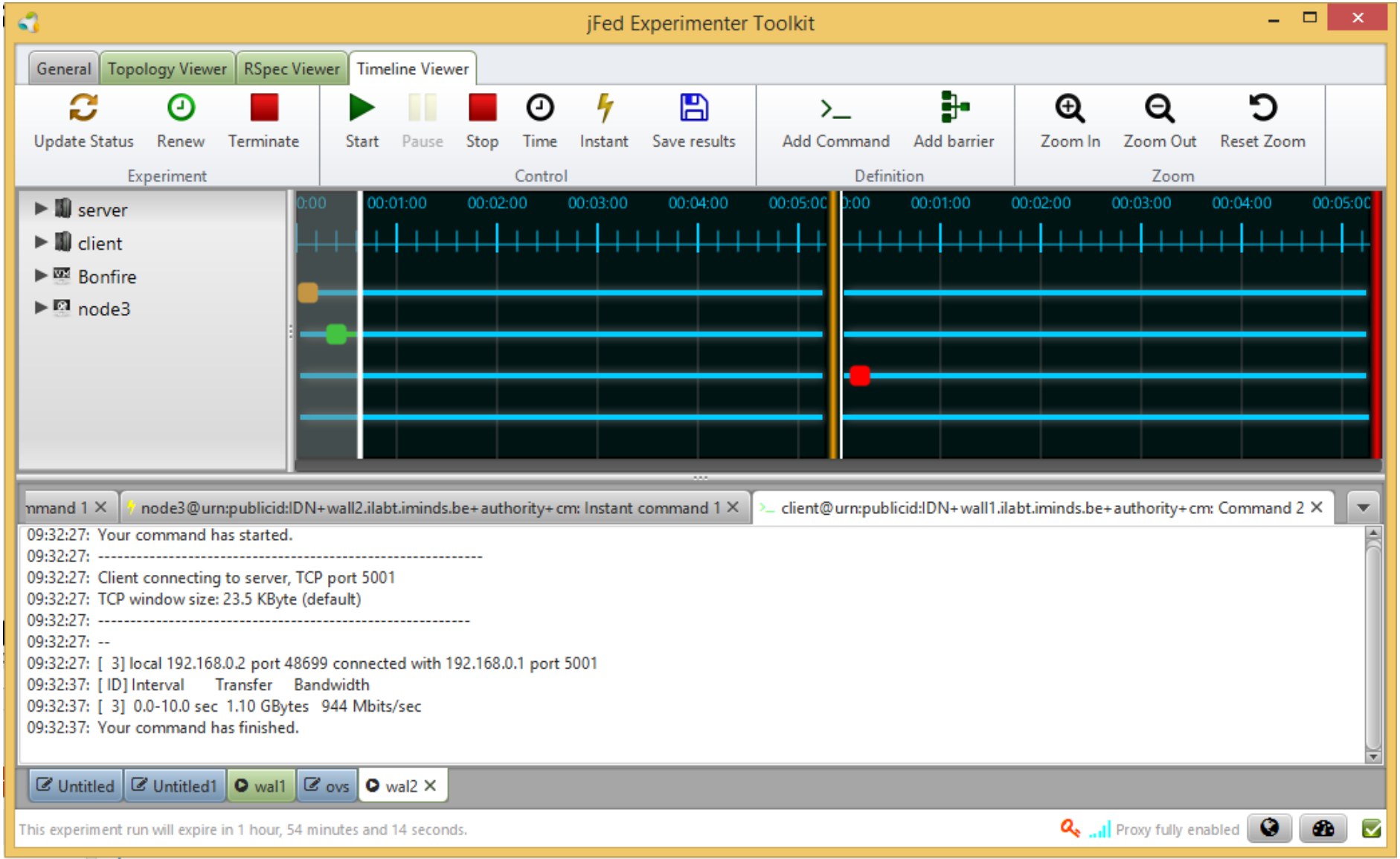
FED4FIRE

SCS per federation

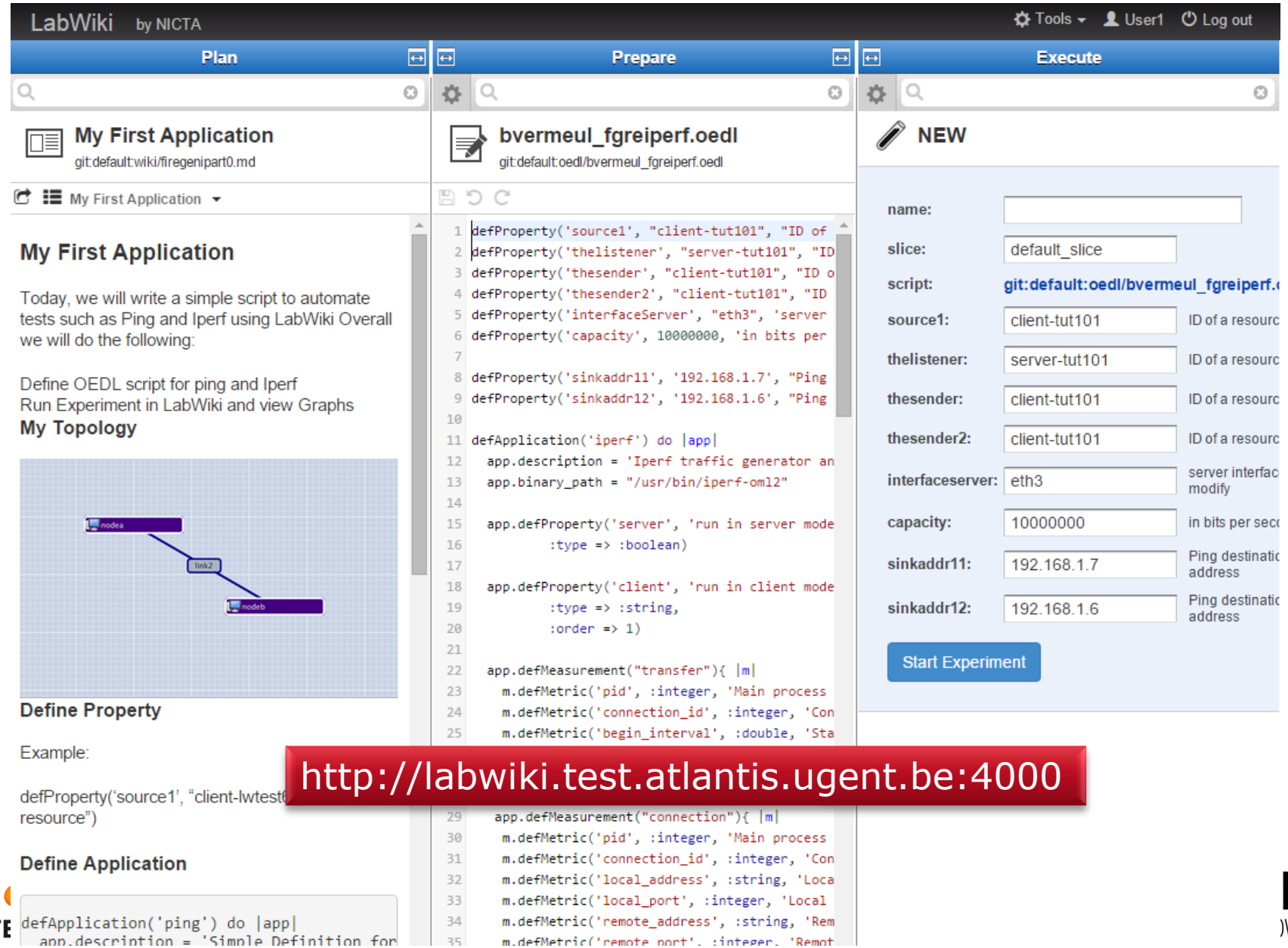


Tools beyond provisioning: experiment control

jFed: timebased experiment control

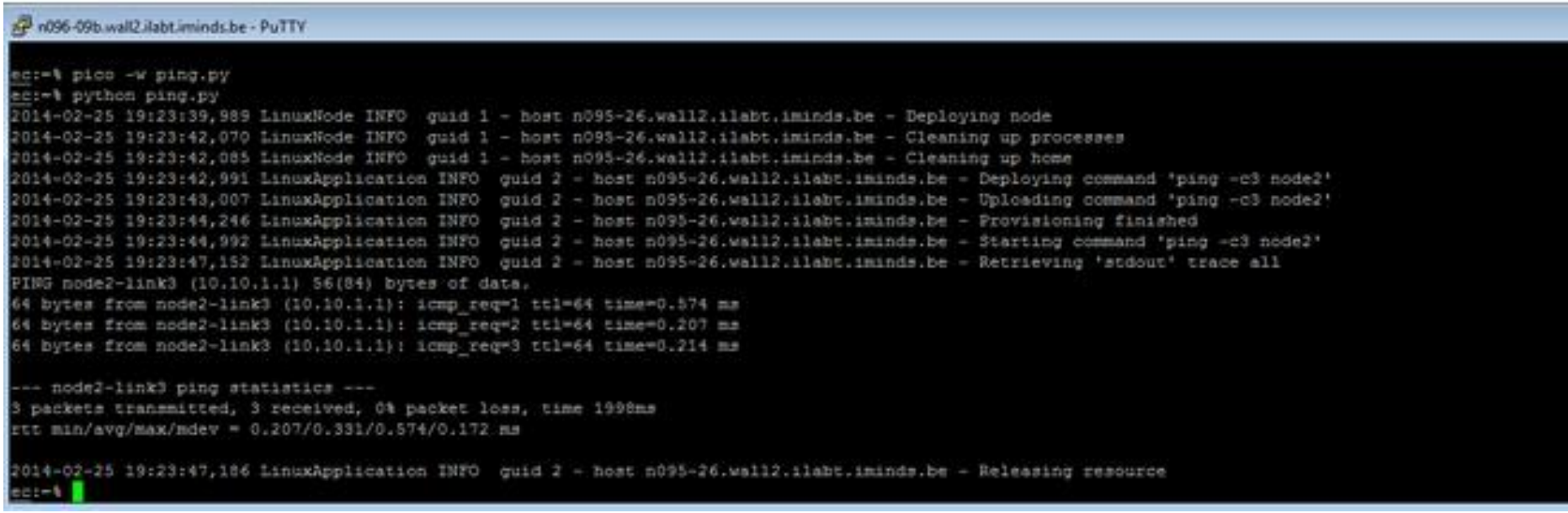


Labwiki experiment control (OMF/OML)



NEPI experiment control

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



Federation membership

technical requirements

Note

- This is about technical requirements
- There is also need for policy decisions (can a testbed join or not) – to be discussed in the sustainability task/federator (board) work
  - Although a testbed joining the federation is different from their users joining (their authority is not automatically allowed on existing testbeds, only vice versa: F4F experimenters can use the new testbed)

What is a testbed (that can be federated)?

- Testbed = hardware + management software
- ‘Ssh/FRCP controlled resource’ testbeds
  - Ability to share resources between different users
    - Shared over time or in parallel (multiplexing, slicing)
    - Concept of credentials and dedicated access (e.g. ssh)
- ‘API only’ testbeds
  - A service with an API (proprietary or standard)
  - Concept of credentials

- *** better naming for these types needed, but the idea should be clear (infrastructure versus service is confusing)

What types of federation

- Light federation
- Tight federation
- Associated testbeds

Tight federation: min. requirements

- Support for AMv2 or AMv3 (or later versions)
  - Authentication, authorization: X.509 certificates, slice and user credentials, accepting root certificates of the main F4F authorities
  - Resource description and discovery: RSpec definition
  - Provisioning (instant): through the AM API
  - Control: through SSH with ssh public/private keys put in the API calls, FRCP control or openflow: point a controller for a switch
- Documentation (on a webpage maintained by the testbed)
  - Testbed description
  - RSpec description
  - URLs of the AM API
  - A basic experiment showing the testbed (and with a F4F tool), described as a tutorial
- Policies: everyone with a valid F4F certificate can execute the basic experiment without extra approval
- Facility monitoring
  - AM API tested from central location, if testbed has internal monitoring, send a summary through OML to the central OML server
- Connectivity: public IPv4 for AM, public IPv4 or IPv6 for ssh login (exceptions for VPN can be granted, but then the ssh gateway of the F4F federation will be a permanent client of the VPN)
- Testbed has to provide basic support on the testbed functionalities towards experimenters

Tight federation: options

- Infrastructure monitoring
- Advanced reservation
- SLA
- Reputation
- Permanent storage
- Experiment control
  - FRCP enabled images
  - AMQP server
  - PDP
- Layer 2 connectivity between testbeds
  - VLAN stitching (federation runs stitching computation engine)
  - Tunnels (egre or gre option in RSpec link)

Tight federation: what does the federation offer ?

- Testing tools for the AM API, test credentials, ...
- Nightly testing when federated
- Central monitor dashboard
- Min. 1 client tool having support for all federated infrastructure testbeds
- At least 1 authority to provide credentials
- Ssh gateway (to bridge e.g. to IPv6, VPNs, ...)
- Central documentation linking to all testbeds
- Central support (google group, NOC) for first help and single point of contact

Light integration: min. requirement

- Support for Fed4FIRE credentials in client based SSL API
  - X.509 certificates, e.g. derived PKCS12 version which can be loaded in a webbrowser or other HTTPS tool
  - API is not the AM API
- Documentation (on a webpage maintained by the testbed)
  - Testbed description
  - Documentation on the specific API
  - URLs of the API
  - A basic experiment showing the testbed, in a tutorial format
- Policies: everyone with a valid F4F certificate can execute the basic experiment without extra approval
- Facility monitoring
  - API tested from central location, if testbed has internal monitoring, send a summary through OML to the central OML server
- Connectivity: public IPv4 for the API server

Light federation: what does the federation offer ?

- Test credentials
- Information on enabling PKCS12 authentication
- Central monitor dashboard
- Min. 1 client tool exporting PKCS12 credentials from the X.509 certificate
- At least 1 authority to provide credentials
- Central documentation linking to all testbeds
- Central support (google group, NOC) for first help and single point of contact

Associated testbeds

- No real federation (e.g. no credential exchange, no testing, …)
- Only mentioning the testbed and linking to the testbed specific documentation
- Testbed has to organise its own support

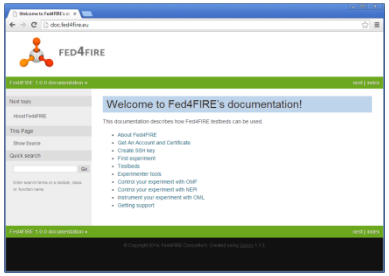
Matrix of possibilities

- ‘SSH/FRCP/openflow controllable testbeds’
  - Light federation (e.g. use Bonfire API with F4F credentials)
  - Tight federation (e.g. Bonfire with an AM, use F4F tool)
  - Associated tested
- ‘API only testbed’
  - Only Light federation possible (e.g. hadoop on demand service with F4F credentials)
  - Associated testbed

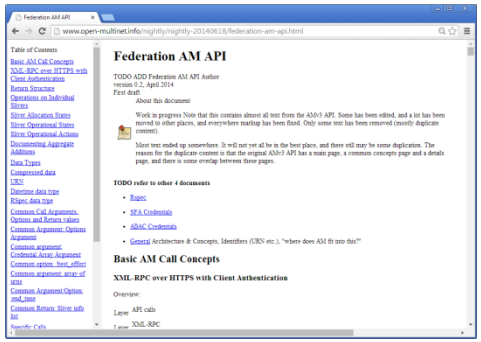
- Reason to make this clear: an ‘API only testbed’ can never do Tight federation, so it is not federated ‘less’, just at the moment, this is the maximum federation that is possible. (and that is demanded from experimenter view as far as we see)

Workflow adding a testbed to the federation

Adding a testbed to the federation



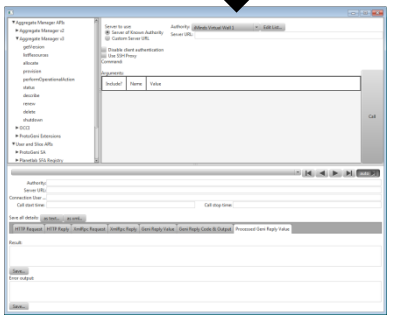
doc.fed4fire.eu



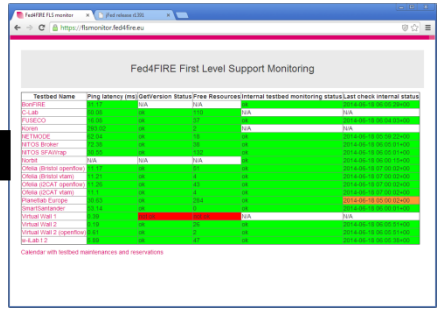
AM API doc

Design RSpecs

Implement AM API on top of testbed



Test with jFed probe



Dashboard and nightly testing (+internal testbed monitoring)

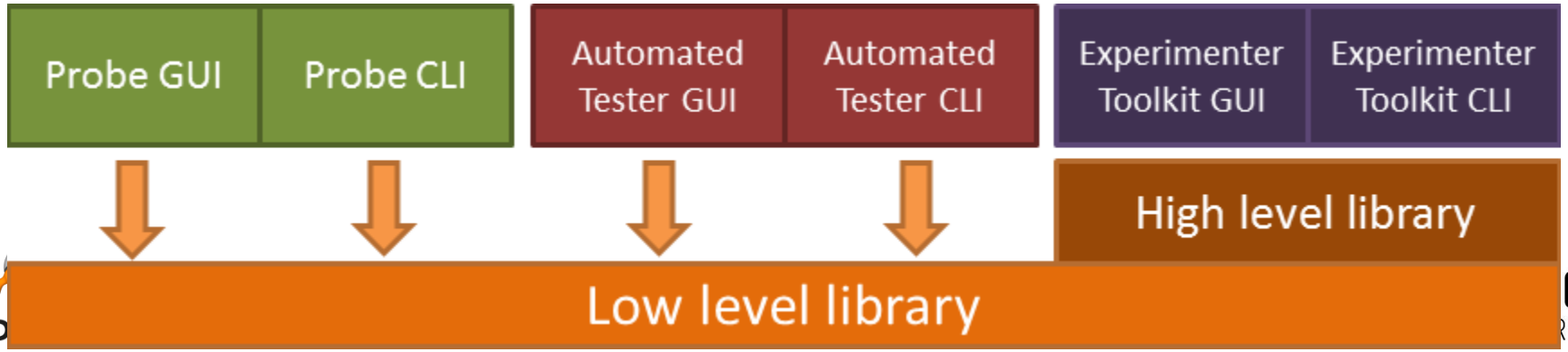
Document testbed

Add testbed in Experimenter tools

jFed toolkit for federation testing and monitoring

jFed toolkit

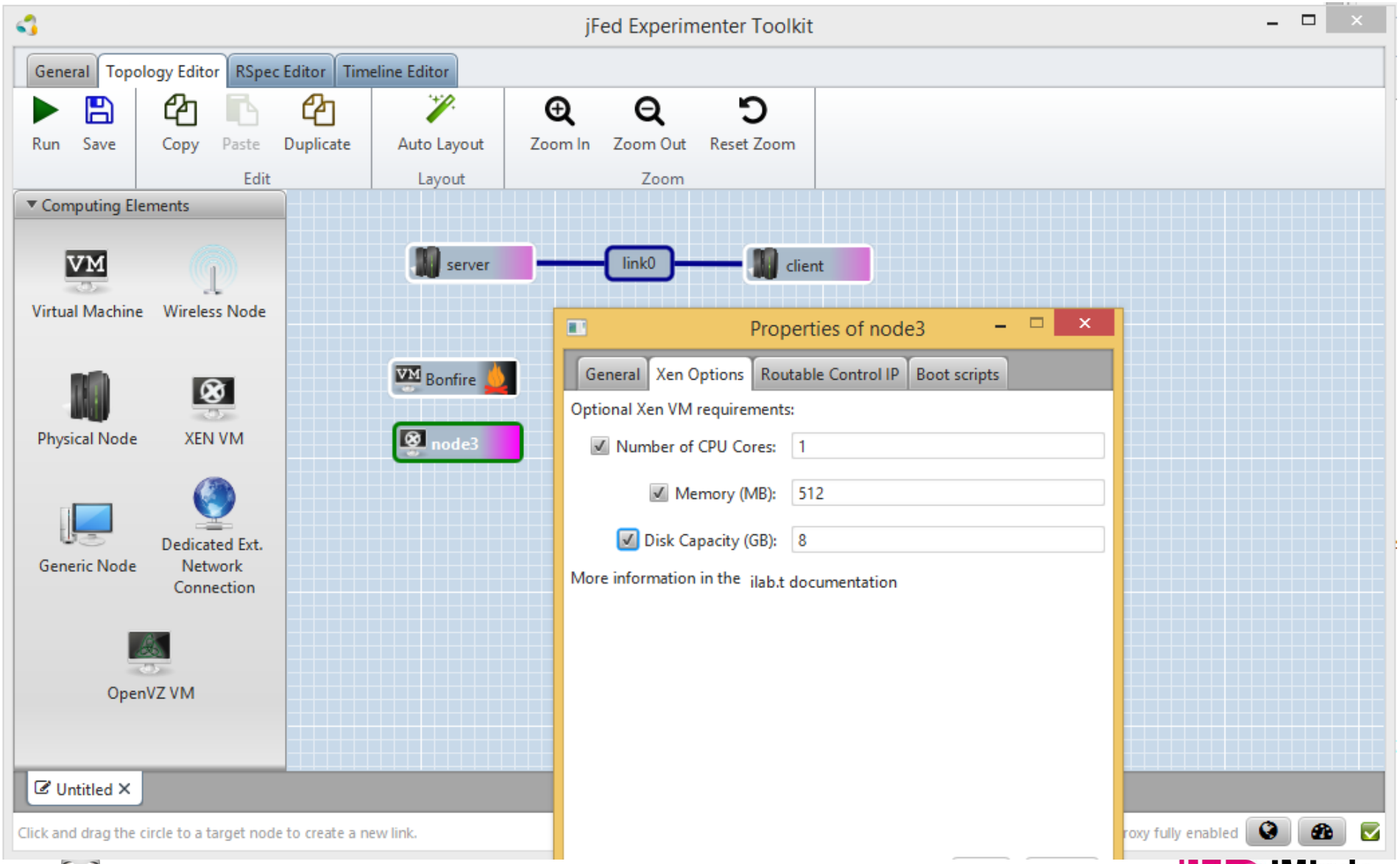
- http://jfed.iminds.be, current release 5.4.0
- Speaks AM API, Federation (CH) APIs, SCS, …
- Written in Java(FX)
- MIT license
- Experimenter tool, test and monitor federation



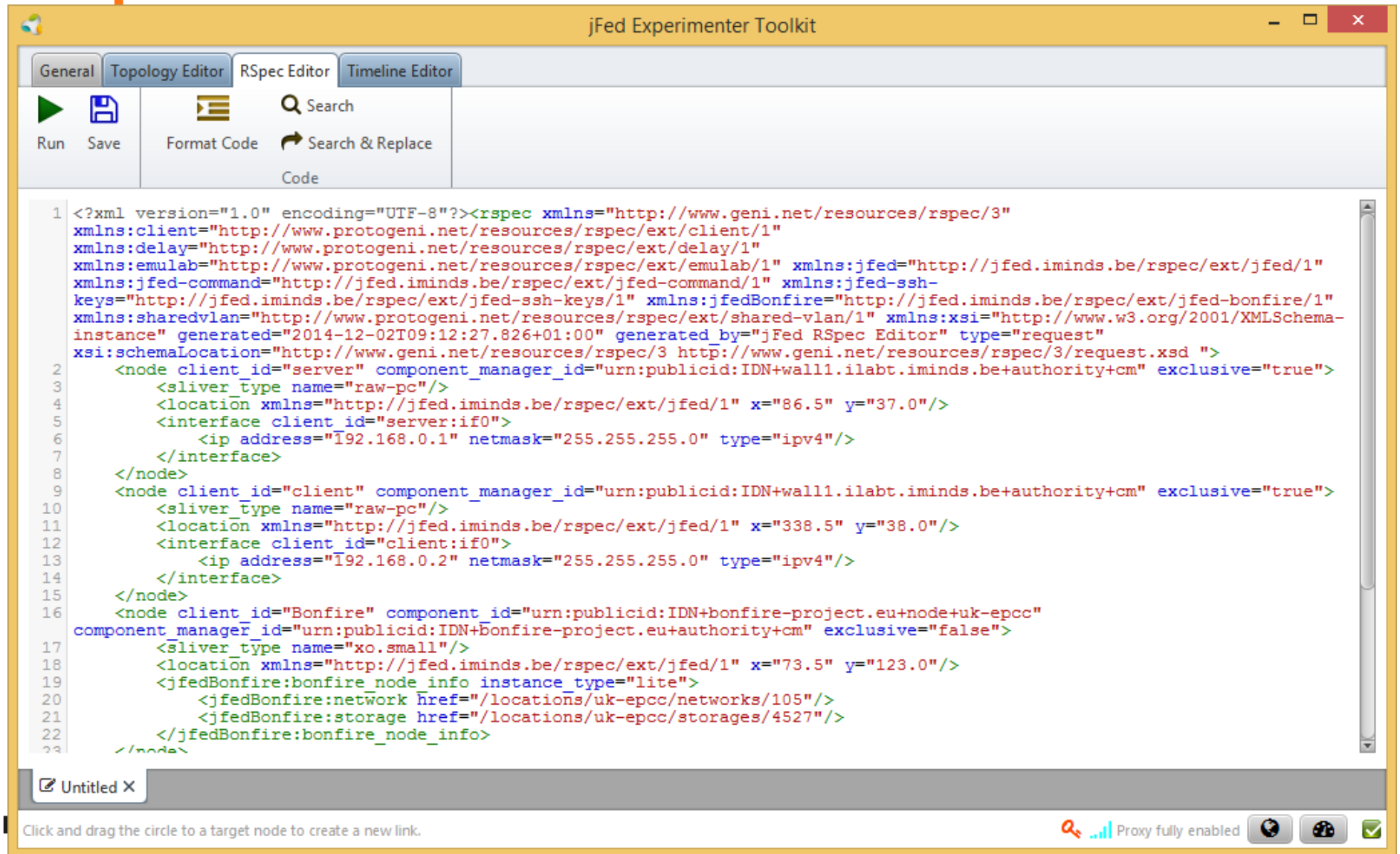
Philosophy: jFed experimenter GUI

- Leverages APIs from jFed Probe testing
- Can be used by a new experimenter (abstract things !)
- Full power when needed
  - raw Rspec
  - API call insight
- Debug and support
  - Leverage API call analysis from jFed probe
  - For support: send all those calls to support !
- Can work around firewall port blocking stuff through SSH proxy
- Cross platform: Windows, OS X, Linux
- Saves and reads RSpecs

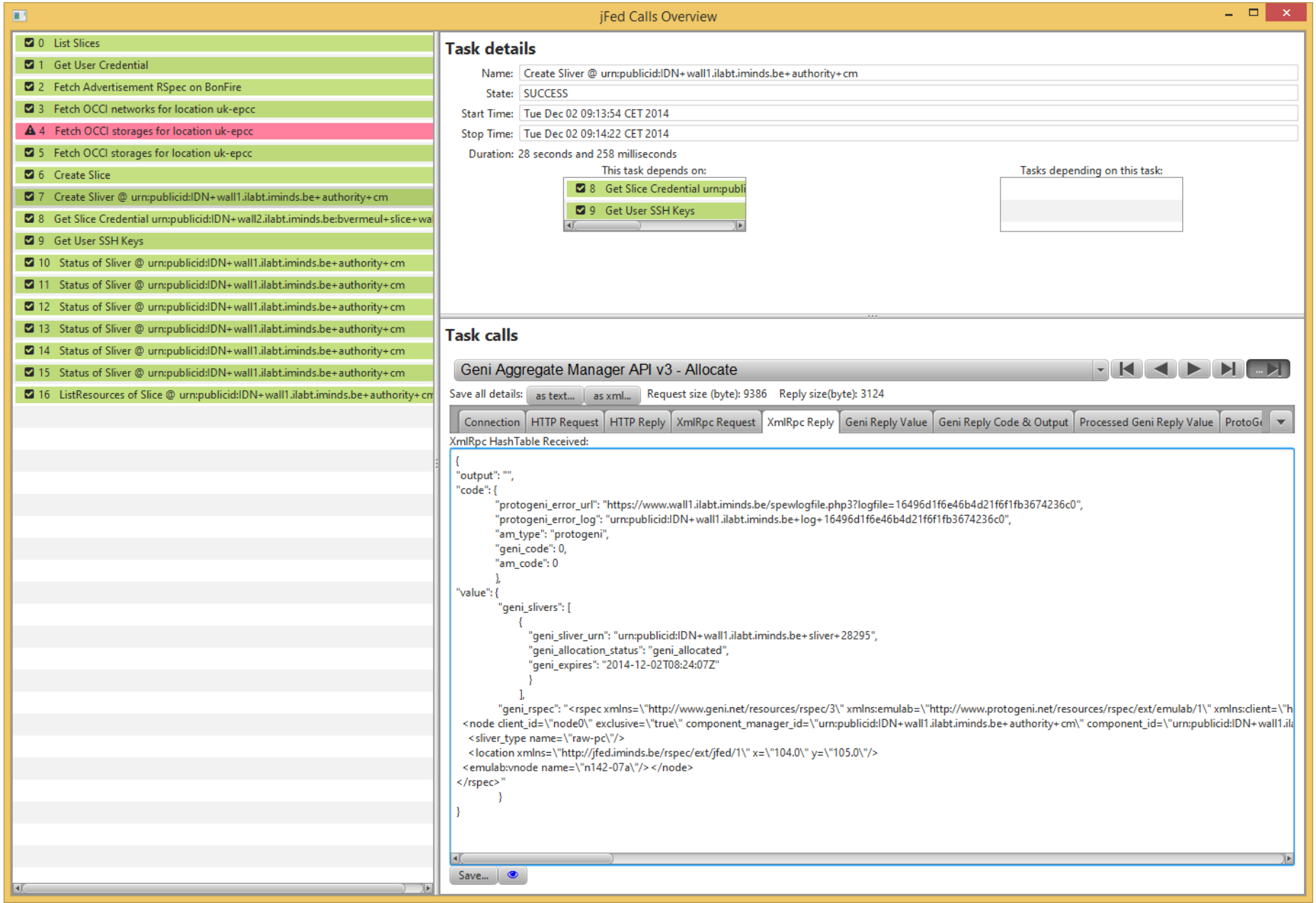
Abstract resources



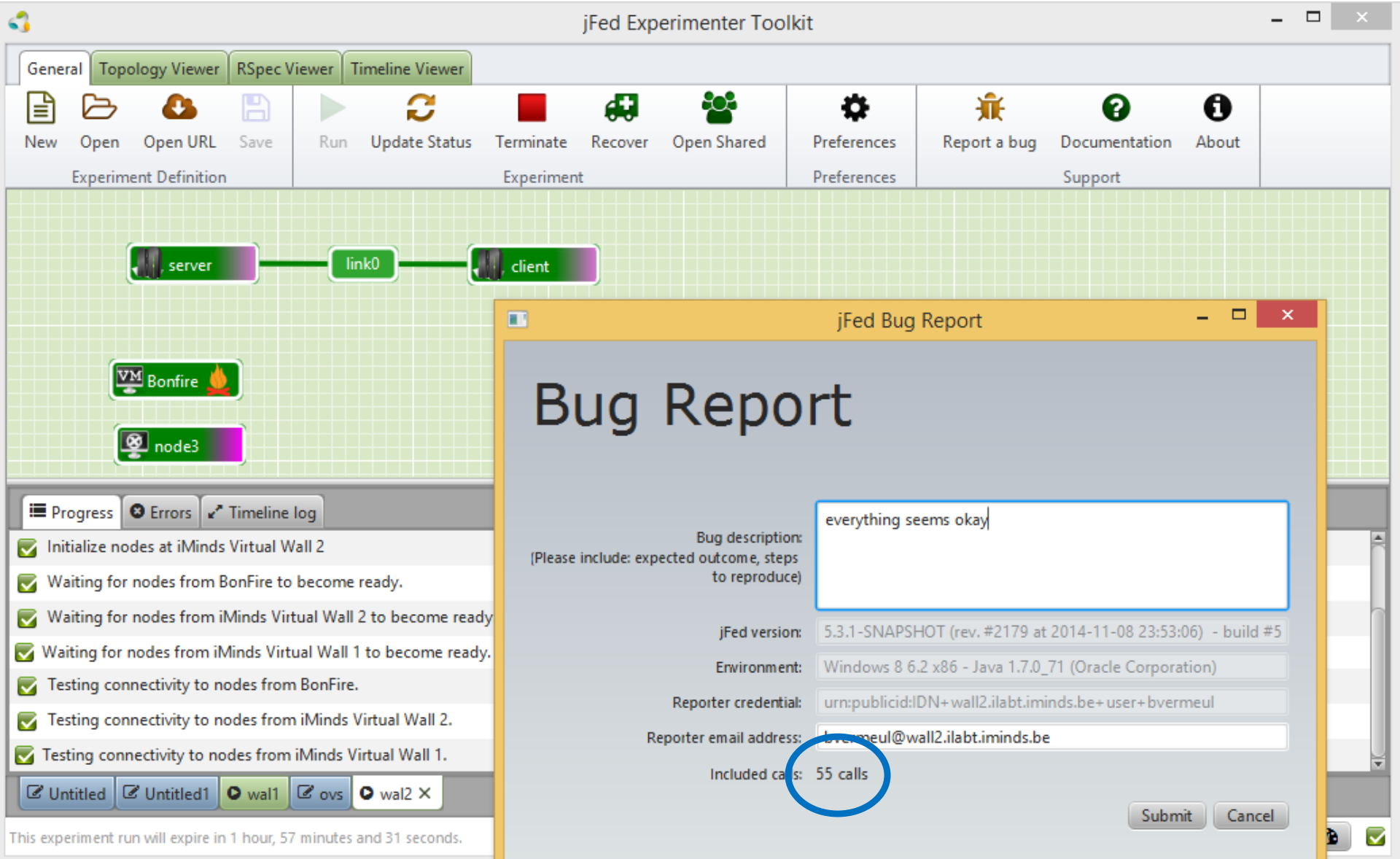
Raw RSpec editing: “support everything”
RSpec = Resource Specification: describes experiment



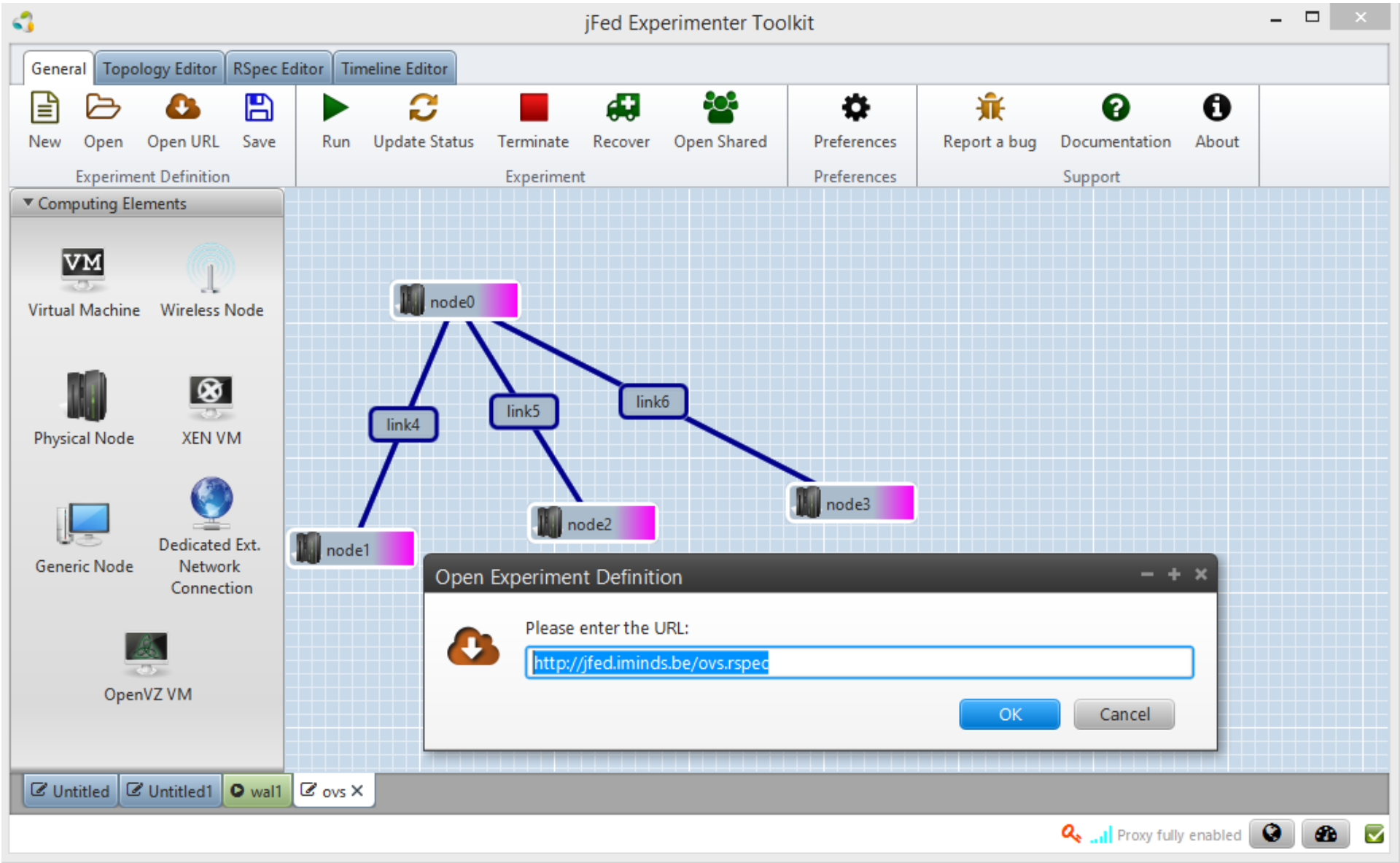
Debug by looking into API calls



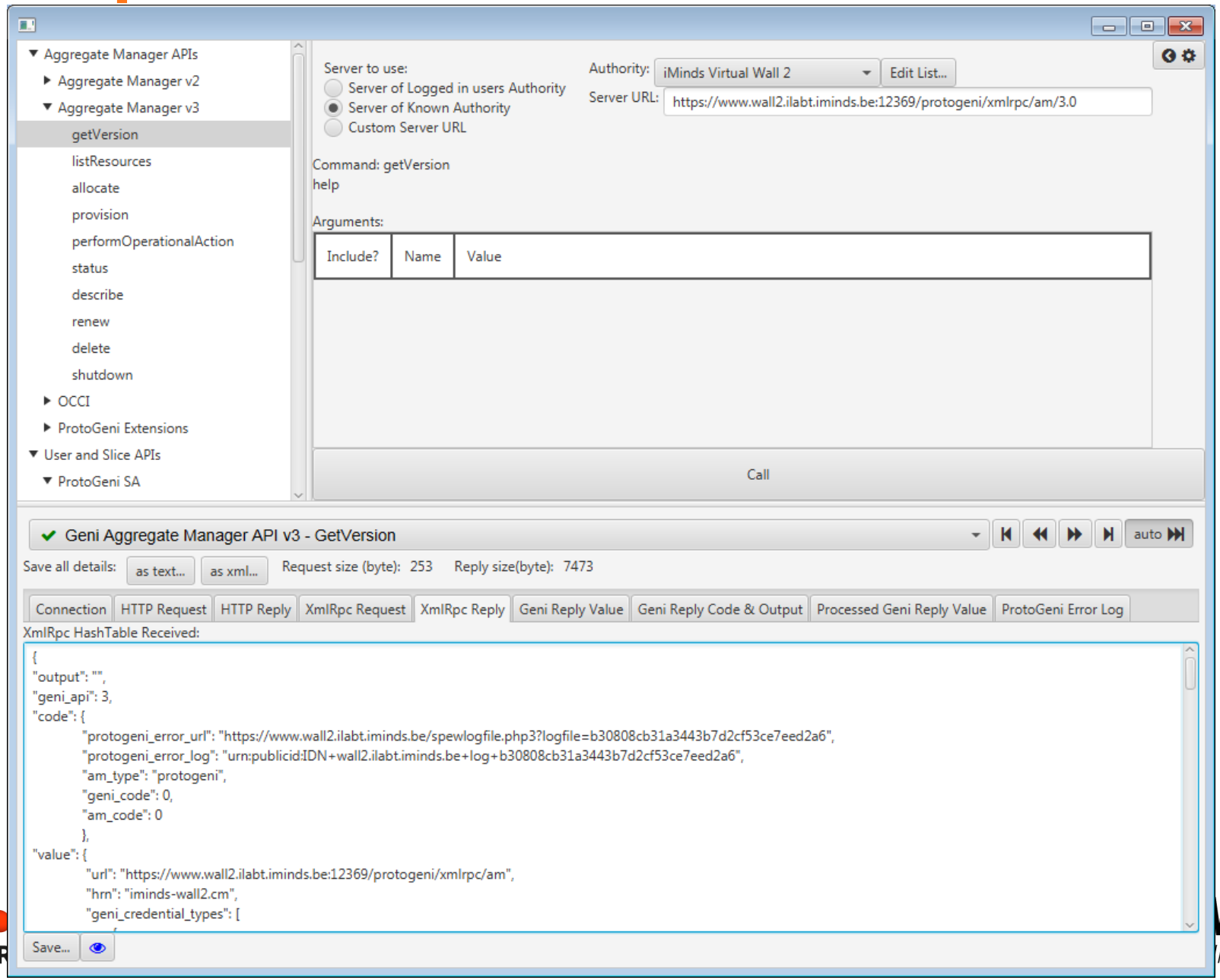
Bug reports and support



RSpec and tutorial/classes world



jFed probe


Aggregate Manager APIs
Aggregate Manager v2
Aggregate Manager v3
getVersion
listResources
allocate
provision
performOperationalAction
status
describe
renew
delete
shutdown
OCCI
ProtoGeni Extensions
User and Slice APIs
ProtoGeni SA
Server to use:
Server of Logged in users Authority
Server of Known Authority
Custom Server URL
Authority:
iMinds Virtual Wall 2
Edit List...
Server URL:
https://www.wall2.ilabt.iminds.be:12369/protogeni/xmlrpc/am/3.0
Command: getVersion
help
Arguments:
Include?
Name
Value
Call
Geni Aggregate Manager API v3 - GetVersion
auto
Save all details:
as text...
as xml...
Request size (byte): 253
Reply size(byte): 7473
Connection
HTTP Request
HTTP Reply
XmlRpc Request
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"protogeni_error_url": "https://www.wall2.ilabt.iminds.be/spewlogfile.php3?logfile=b30808cb31a3443b7d2cf53ce7eed2a6",
"protogeni_error_log": "urn:publicid:IDN+wall2.ilabt.iminds.be+log+b30808cb31a3443b7d2cf53ce7eed2a6",
"am_type": "protogeni",
"geni_code": 0,
"am_code": 0
},
"value": {
"url": "https://www.wall2.ilabt.iminds.be:12369/protogeni/xmlrpc/am",
"hrn": "iminds-wall2.cm",
"geni_credential_types": [
Save...

jFed testing and monitoring

https://flsmonitor.fed4fire.eu

http://monitor.ilabt.iminds.be

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

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

API testing

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

How does the AM work

AM

- AM v2
  - http://groups.geni.net/geni/wiki/GAPI_AM_API_V2
- AM v3
  - http://groups.geni.net/geni/wiki/GAPI_AM_API_V3
- Upcoming AM, but can help in understanding it better (does not differ much from AM v3):
  - https://fed4fire-testbeds.ilabt.iminds.be/asciidoc/federation-am-api.html
  - https://github.com/open-multinet/federation-am-api
  - (on github you can request for clarifications, report problems on the standard API description)

Workflow

- 3 types of Rspecs: advertisement, request, manifest
- Getversion: informative
- Listresources: advertisement RSpec
- Createsliver (v2) vs allocate/provision/performoperationalaction (v3): send request, receive manifest
- SliverStatus (v2) vs Status (v3): check
- Listresources (v2) vs Describe (v3): get overview
- Renew: to extend duration
- DeleteSliver (v2) vs Delete (v3)

How to implement the AM

Possibilities for AM implementation

- If you have only hardware, no mgmt software for your testbed, pick testbed software which has an AM implementation and which is closest to your HW
  - Emulab (contact iMinds for more information)
  - Nitos Broker with OMF (contact University of Thessaly for more information)
  - Foam (openflow + flowvisor) (contact iMinds for more information)
  - GRAM (works with Openstack) (contact Inria Grid 5000 if you want more information)
- If you have software for managing your testbed, you can wrap it with the AM API:
  - SFAwrap (python) – contact UPMC/Inria Sophia Antipolis
  - Fiteagle (java) – contact TU Berlin
  - Geni Control Framework (GCF) – GENI BBN - http://trac.gpolab.bbn.com/gcf
- Implement yourself the AM API on top of an existing testbed
- Choice depends on what you have and what you want