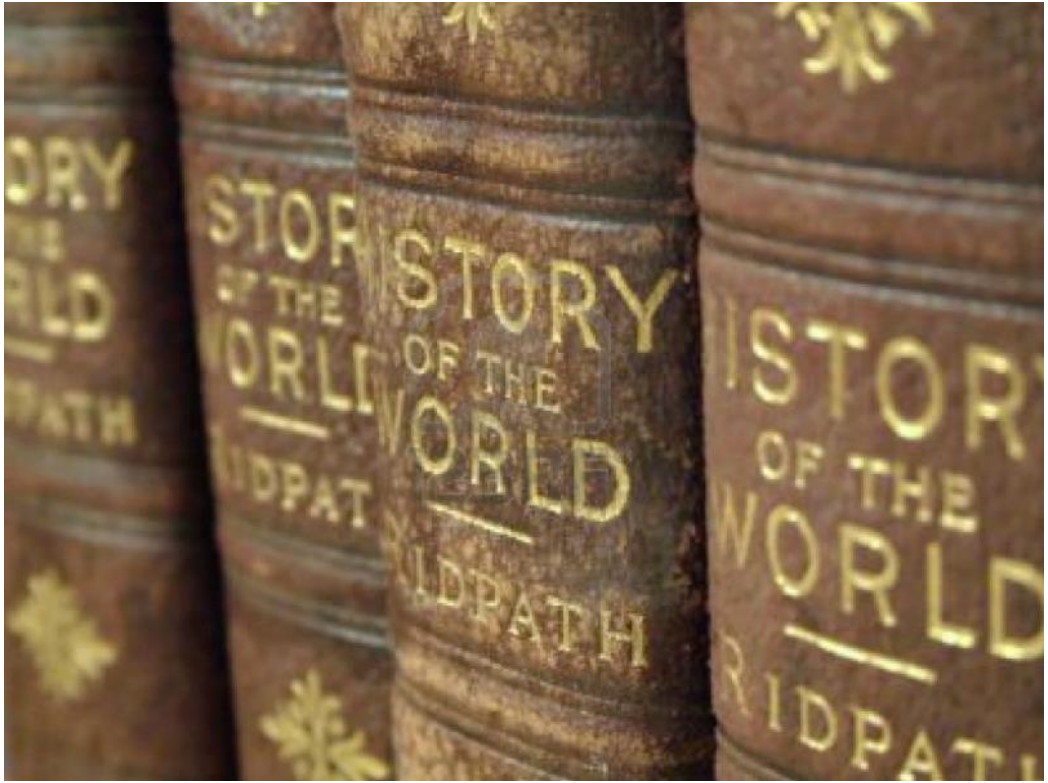
5G experimentation on imec's testbeds and federated testbeds in Fed4FIRE

Brecht Vermeulen

imec, Belgium

VTC2018-Spring

Porto, June 3, 2018



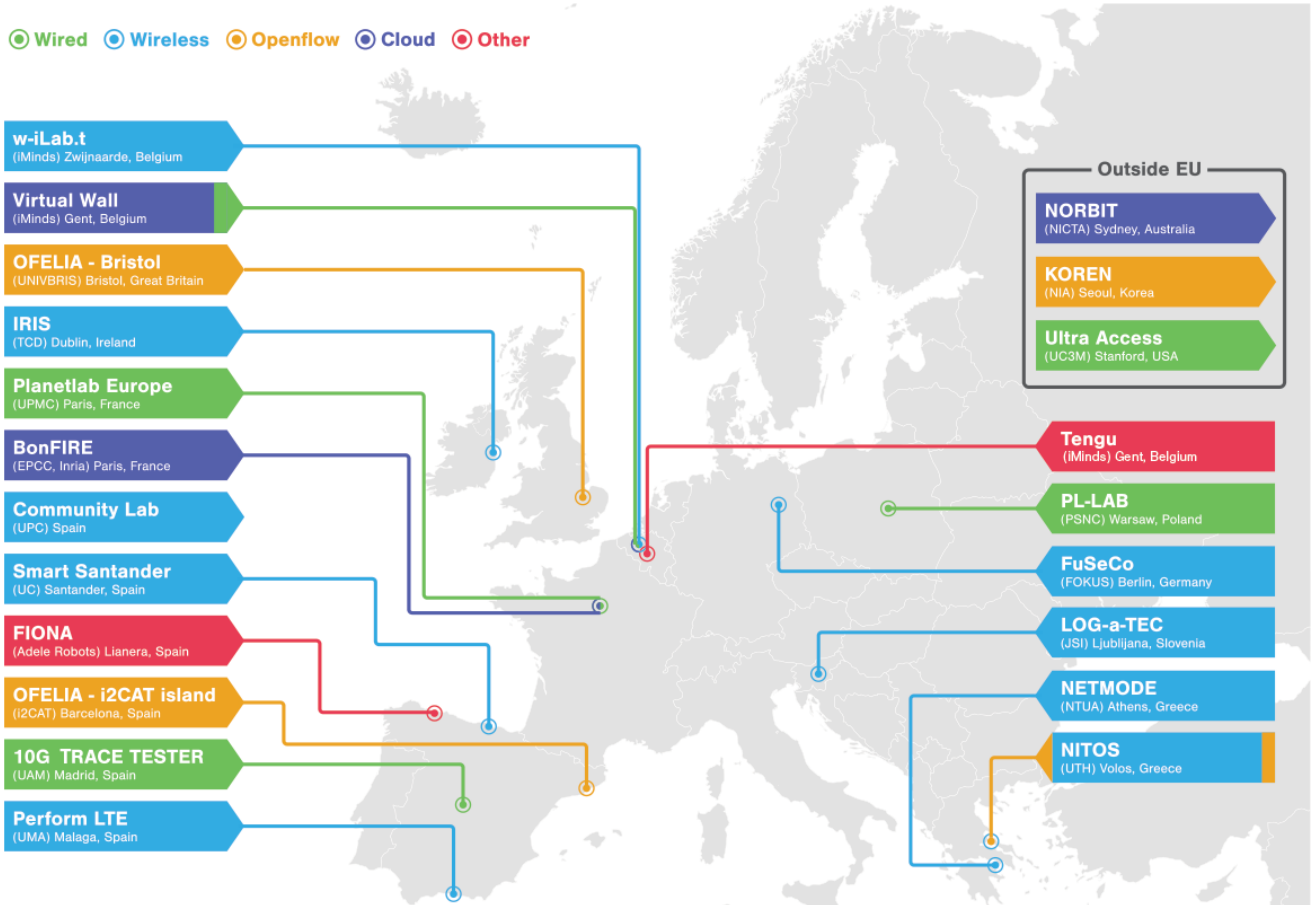
Fed4FIRE
Federation for FIRE

(Future Internet Research & Experimentation)

2012-2016

Fed4FIRE+
2017-2021

Fed4FIRE assets – facilities (doc.fed4fire.eu)



Fed4FIRE assets – tools

FED4FIRE

MySLICE

UPMC SORBONNE UNIVERSITÉS

jFed

iMinds

SFAWRAP

Inria

LabWi

NICTA

aml

NICTA

nepi

Inria

OMF

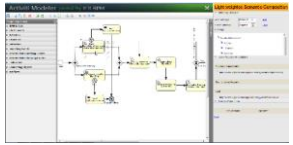
NICTA

geni Exploring Networks of the Future

GCF

Inria

epcc



MULTI-DOMAIN SERVICE DESK

PART OF THE GÉANT SERVICE PORTFOLIO

DANTE

FITeagle

Future Internet Testbed Management Framework

Technische Universität Berlin

YourEPM

Atos

Goals of federation

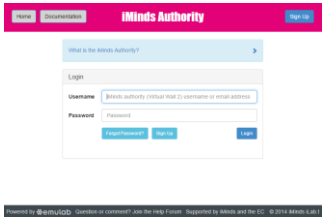
Make it easy for experimenters to use multiple testbeds

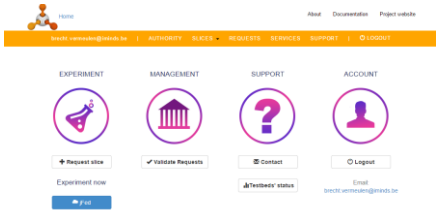
- Single account
- Single (or small number) of tools, choice of tools

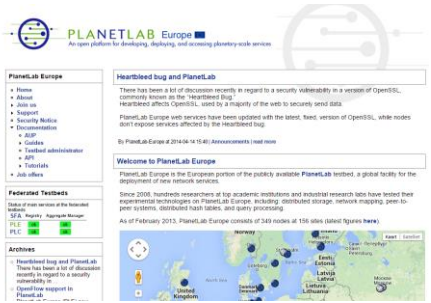
Multiple testbeds

- 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, …)

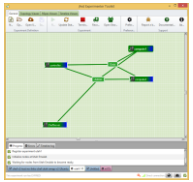
Design principles







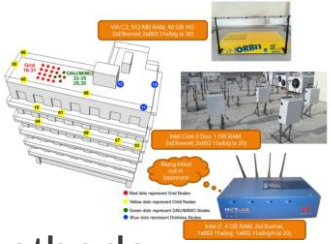
Multiple identity providers



Standardized APIs

Multiple tools

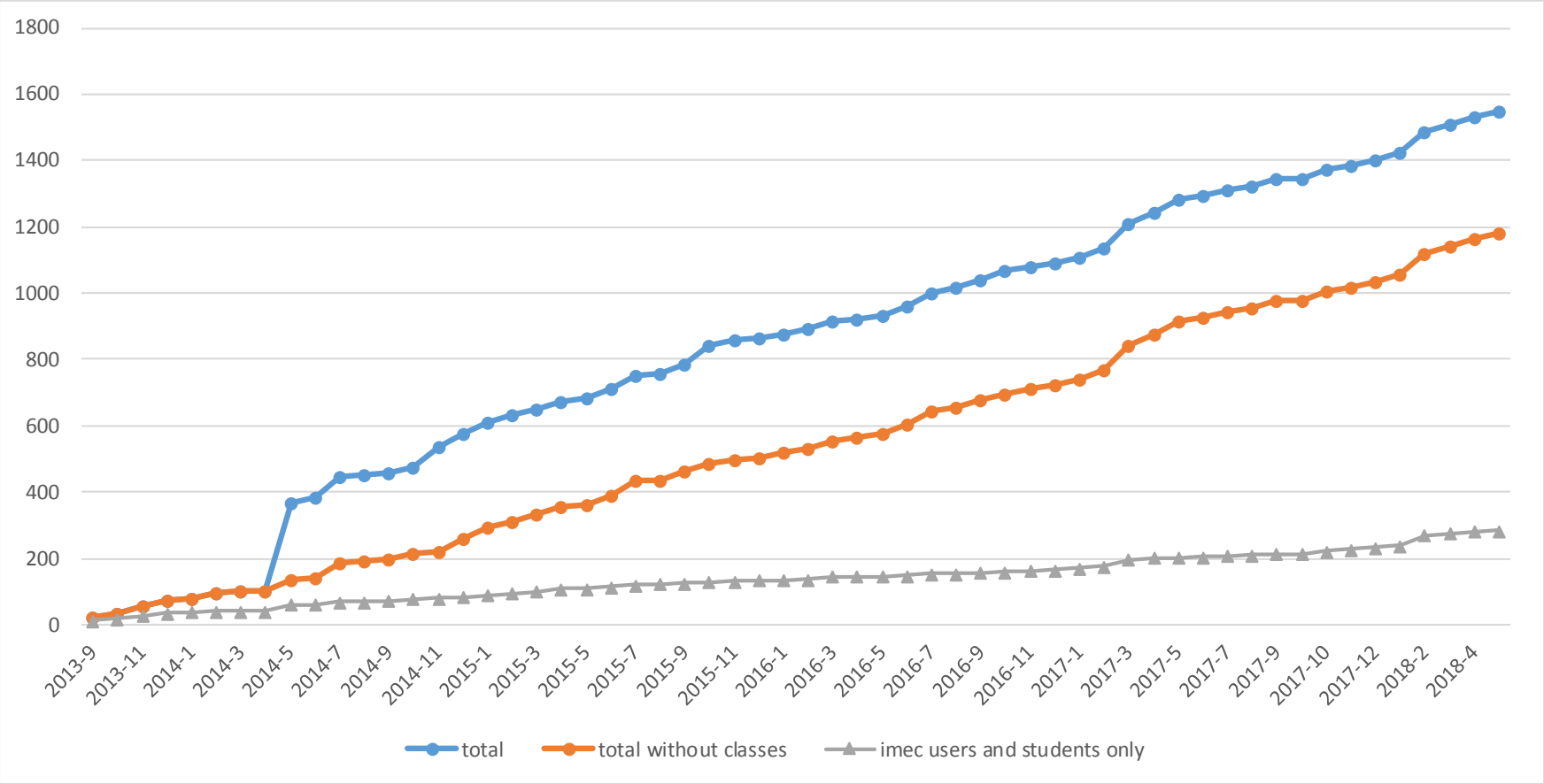
Testbeds
trust IdPs
in federation



Multiple testbeds

All of them can appear and disappear !

Users


1800
1600
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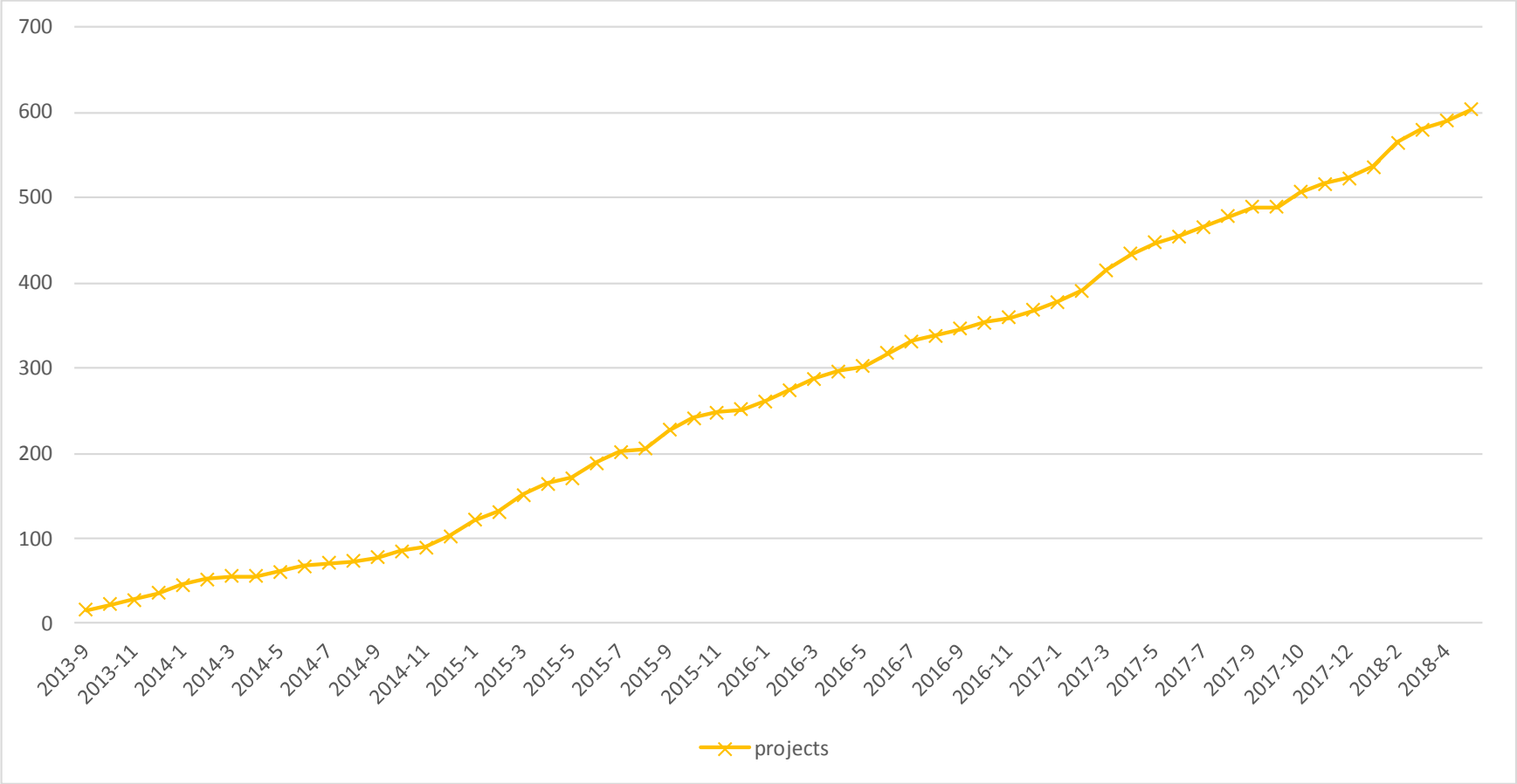
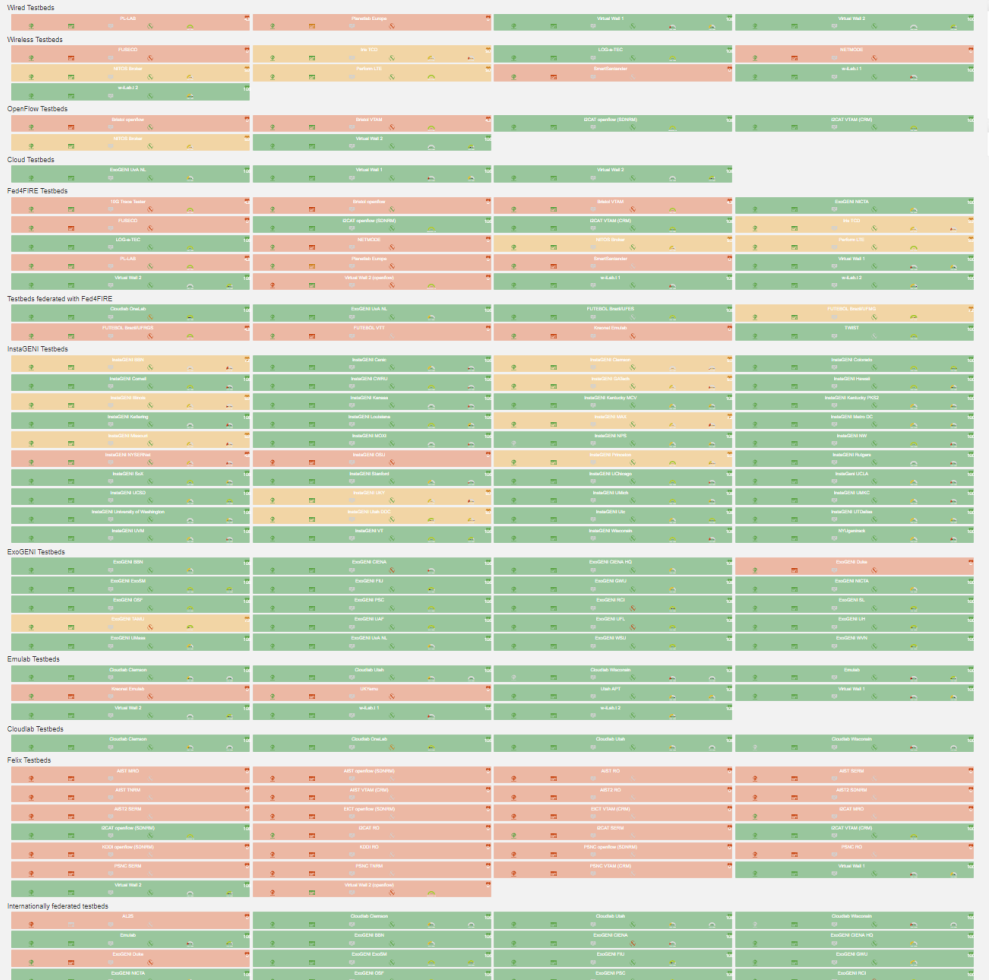
2017-1
2017-3
2017-5
2017-7
2017-9
2017-10
2017-12
2018-2
2018-4
total
total without classes
imec users and students only

Projects (1 project = set of experiment runs)



Monitoring federation is key (https://fedmon.fed4fire.eu)



Try it out

http://doc.fed4fire.eu

Account: https://authority.ilabt.iminds.be

jFed: https://jfed.ilabt.imec.be

Fed4FIRE Engineering Conferences (FEC.FED4FIRE.EU)

- plenary talks
- tutorials
- technical discussion
- demos

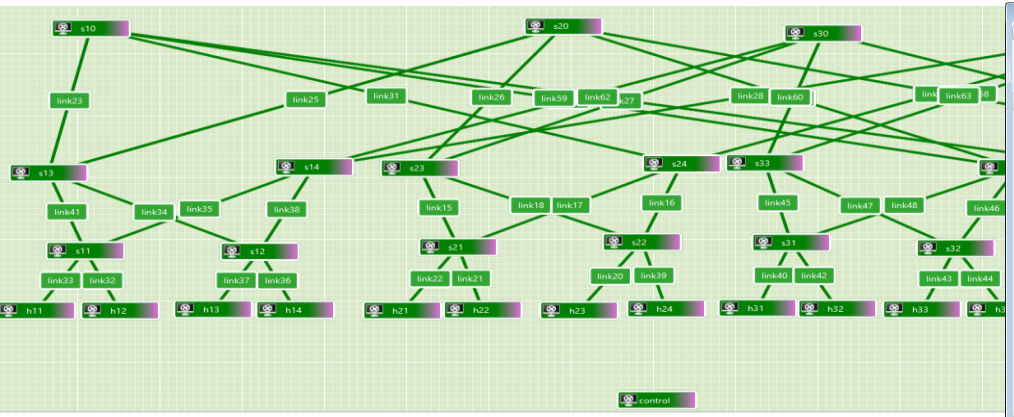
2x per year

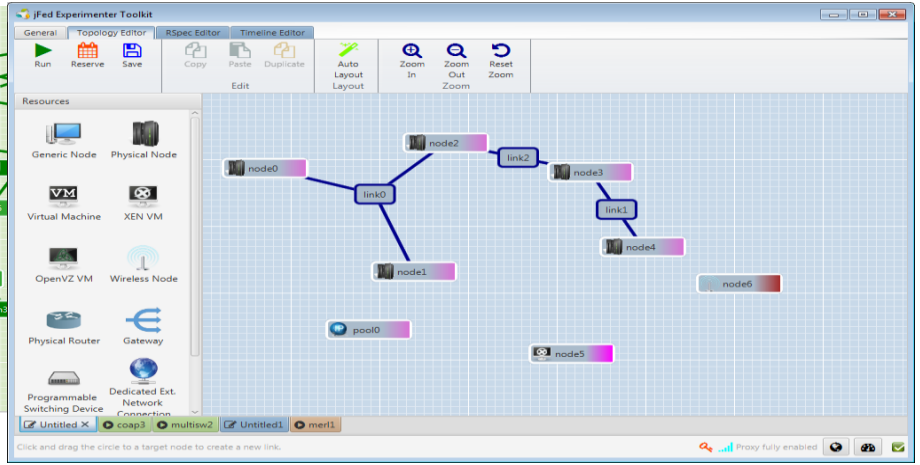
Fed4FIRE as a meta-testbed

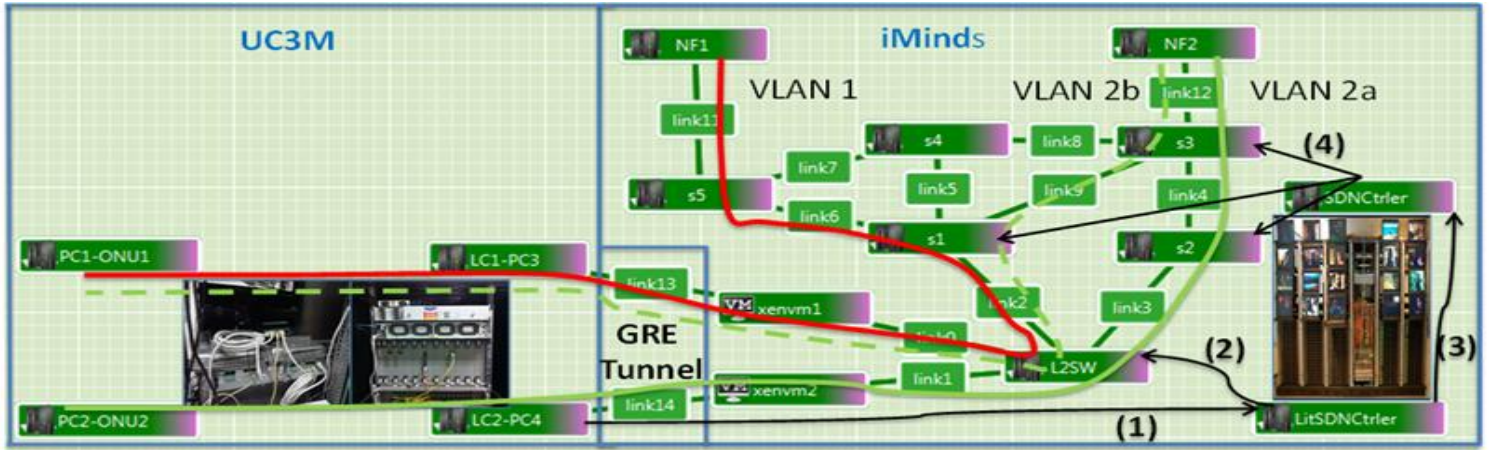
Remotely Experiment with new technologies

jFed tool: easy access for testbeds (jfed.ilabt.imec.be)

FED4FIRE





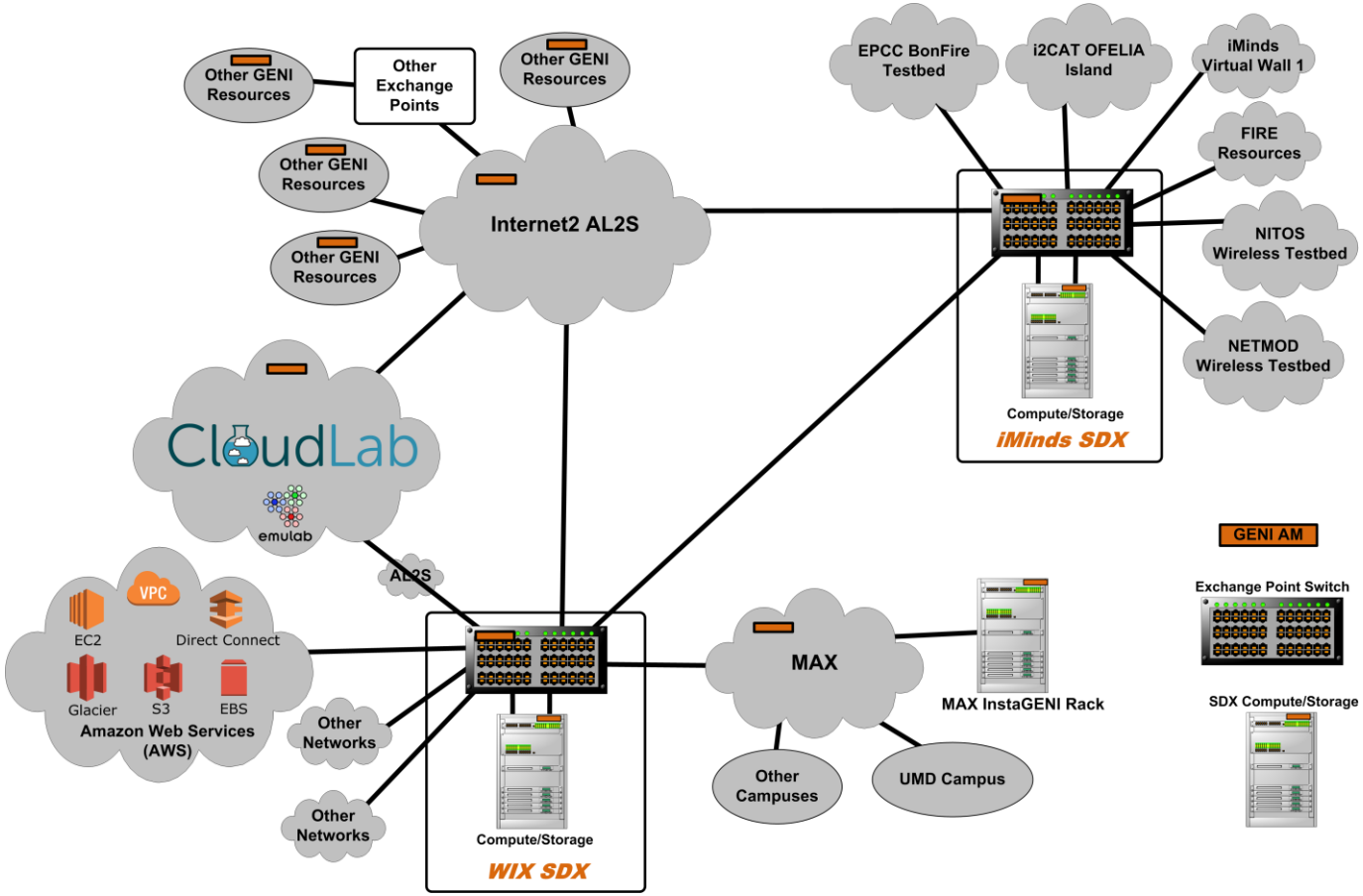


Fed4FIRE as Meta-testbed

Enables all kind of experimentation because of bare metal hardware of all kinds of equipment

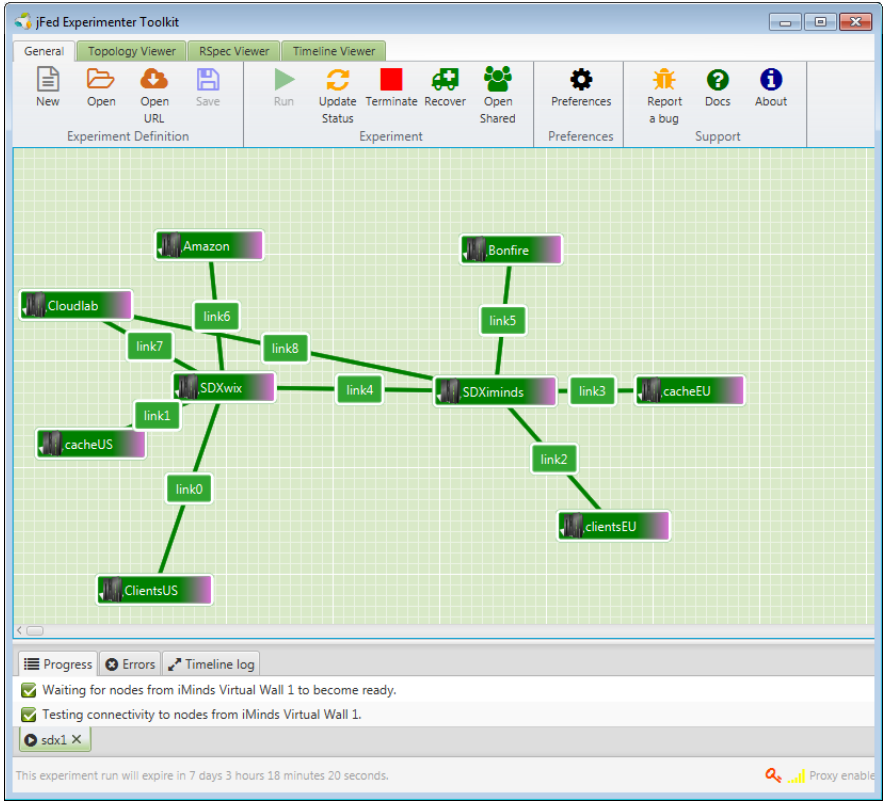
Including creation of new platforms, testbeds, …

SDX Deployed Topology

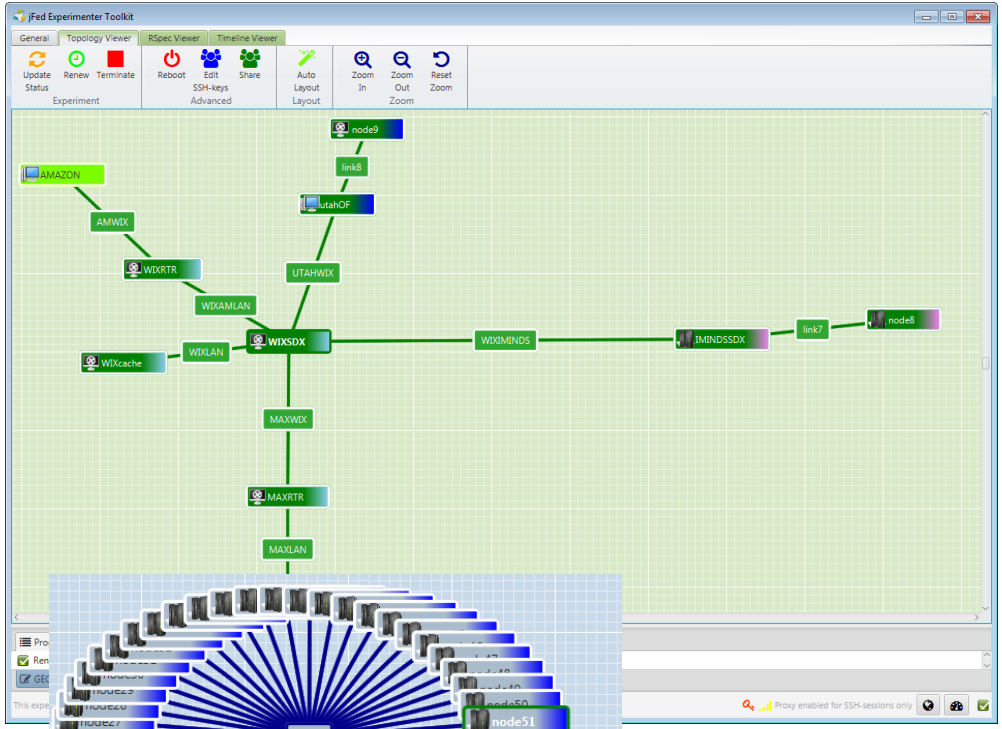


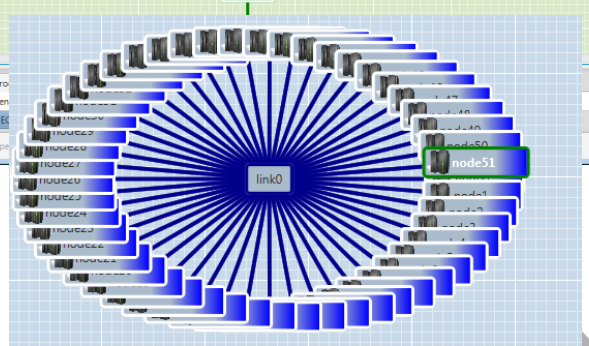
- This topology is based on production networks and GENI resources
- Prototype SDX and SDX enabled services have been deployed

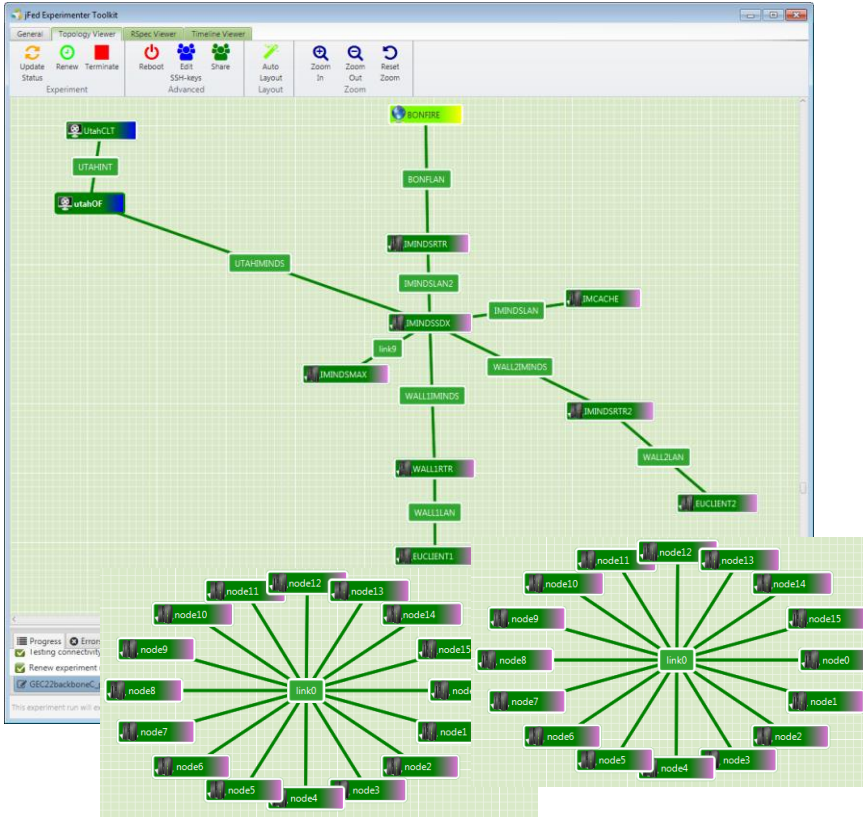
Single testbed prototype



Upscaling


jFed Experimenter Toolkit
General
Topology Viewer
RSpec Viewer
Timeline Viewer
Update Status
Renew
Terminate
Experiment
Reboot
Edit SSH-keys
Share
Advanced
Auto Layout
Layout
Zoom In
Zoom Out
Reset Zoom
Zoom
node9
link8
AMAZON
utahOF
AMWIX
WIXRTR
UTAHWIX
WIXAMLAN
WIXSDX
WIXIMINDS
IMINDSSDX
link7
node8
WIXcache
WIXLAN
MAXWIX
MAXRTR
MAXLAN
Proxy enabled for SSH-sessions only


link0
node51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Zoom Out
Reset Zoom
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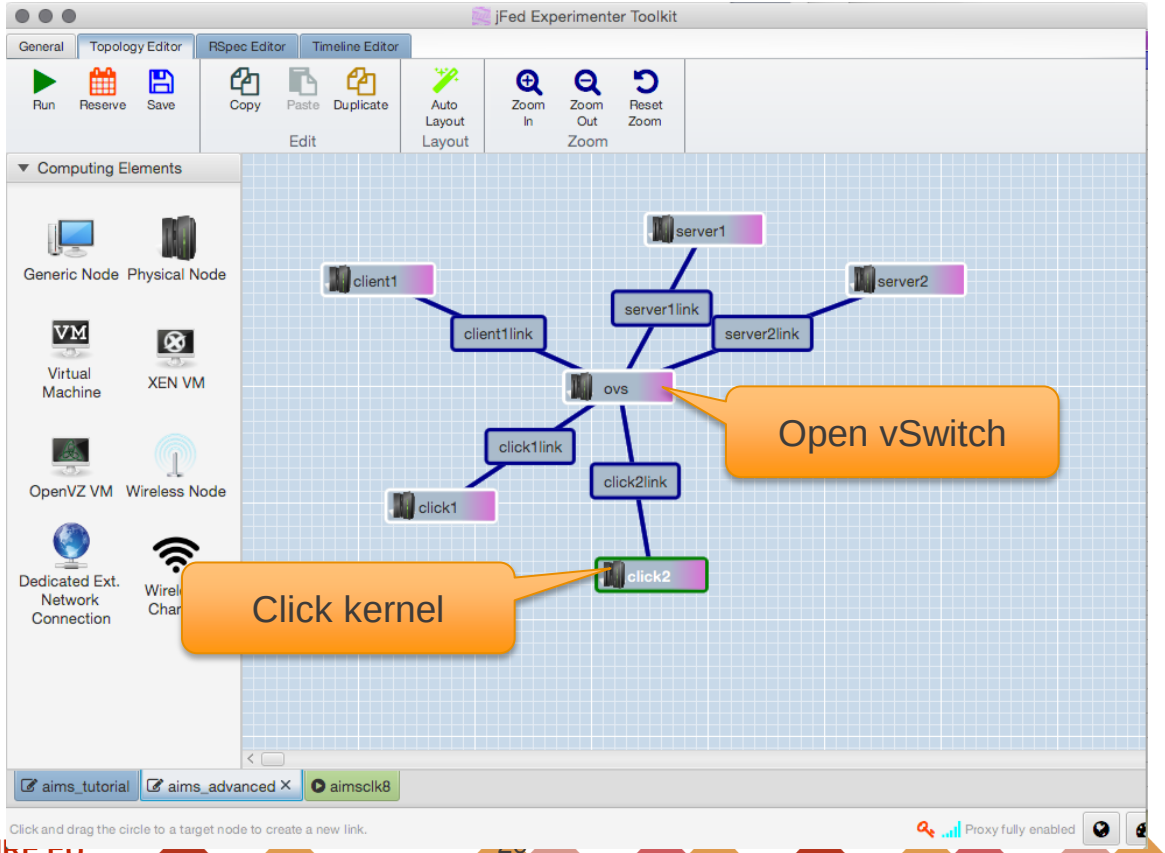
BONFIRE
UtahCLT
UTAHINT
utahOF
BONFLAN
UTAHIMINDS
IMINDSRTR
IMINDSLAN2
IMINDSLAN
IMCACHE
IMINDSSDX
link9
IMINDSMAX
WALL2IMINDS
WALL1IMINDS
IMINDSRTR2
WALL2LAN
WALL1RTR
EUCLIENT2
WALL1LAN
EUCLIENT1
node11
node12
node13
node10
node14
node9
node15
node8
node7
node6
node5
node4
node3
node2
node1
node0
link0

Network Function Virtualization experiments on Fed4FIRE

iMinds

WWW.FED4FIRE.EU

Virtual Network Infrastructure Topology



Automating with Experiment Specification (eSpec)

What is an Experiment Specification?

Espec bundles:

Resource Specification

Files to be uploaded

Commands to be executed

Extras:

Characteristics

Stored in:

- Folder
- Archive (`.zip` / `.tar` / `.tar.gz`)
- Git repository

Contents:

- `experiment-specification.yml`
- RSpec
- Additional files to be uploaded/executed

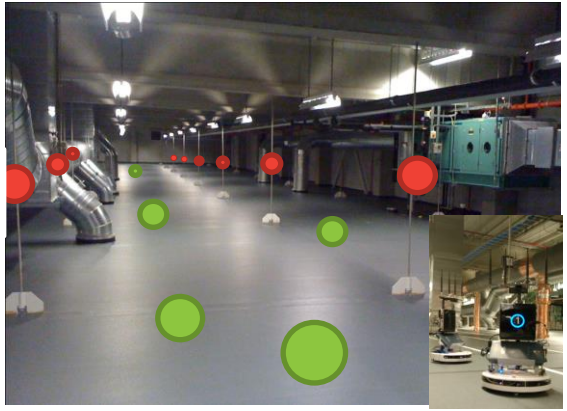
Goal: Everything in one place for a reproducible experiment

Where: now released in jFed 5.8.0, documented at http://jfed.ilabt.imec.be/espec/

imec

IMEC TESTBEDS

Virtual Wall 1 and 2:
400 physical servers
+ virtual machines
for experimenting



w-iLab.t

+150 fixed wireless nodes
15 mobile robots

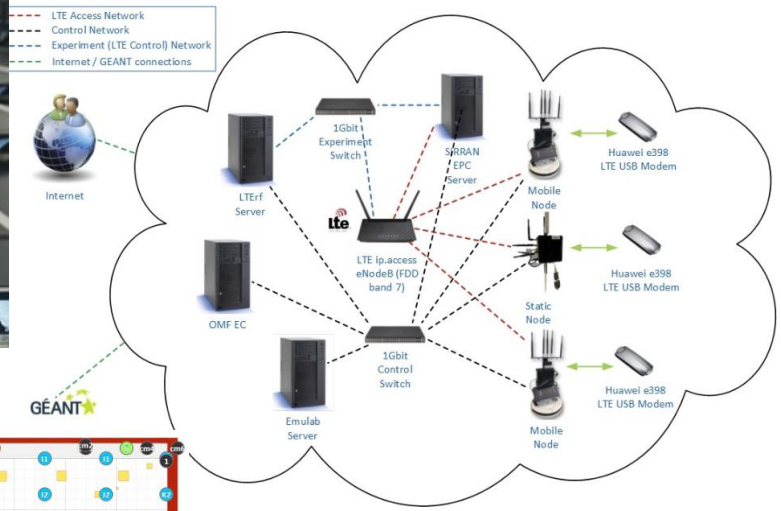
Homelab

City of Things Antwerp

Being rolled out
100 points in city
Sensor + wireless experiments

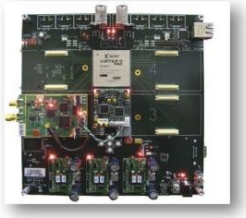
IMEC W-ILAB.T (HTTPS://DOC.ILABT.IMEC.BE)

LTE environment



Shielded environment

WARP MIMO



USRPs

Imec sensing device

Officelab

Being rolled out on 3 floors

Same nodes as City of things


GEFORCE GTX
GEFORCE GTX
GEFORCE GTX
GEFORCE GTX
GEFORCE GTX
GEFORCE GTX
GEFORCE GTX
GEFORCE GTX
GEFORCE GTX

GPU lab

GPU ACCESS in two ways

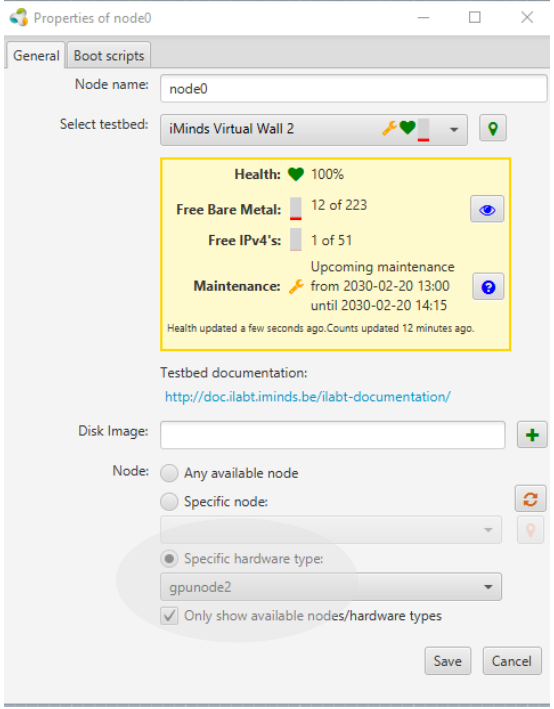
Dedicated machine with root access (use jFed)

- Install your own cuda lib etc

Shared machines with “docker job system” (gpulab)

Currently:

- 37x GTX1080i, 20x GTX1080, 17x GTX980 or older
- 200.000 cuda cores
- One or more cards per machine

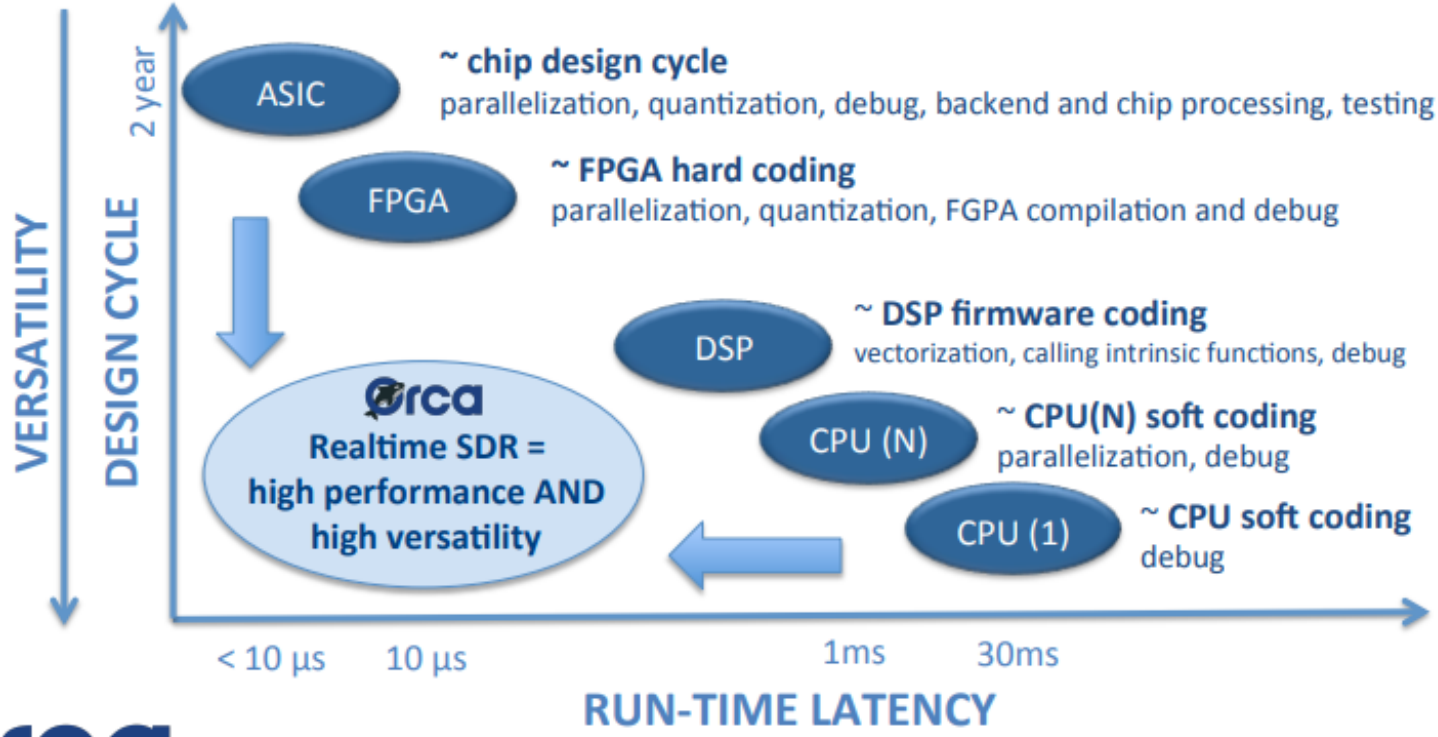


ORCA-PROJECT.EU

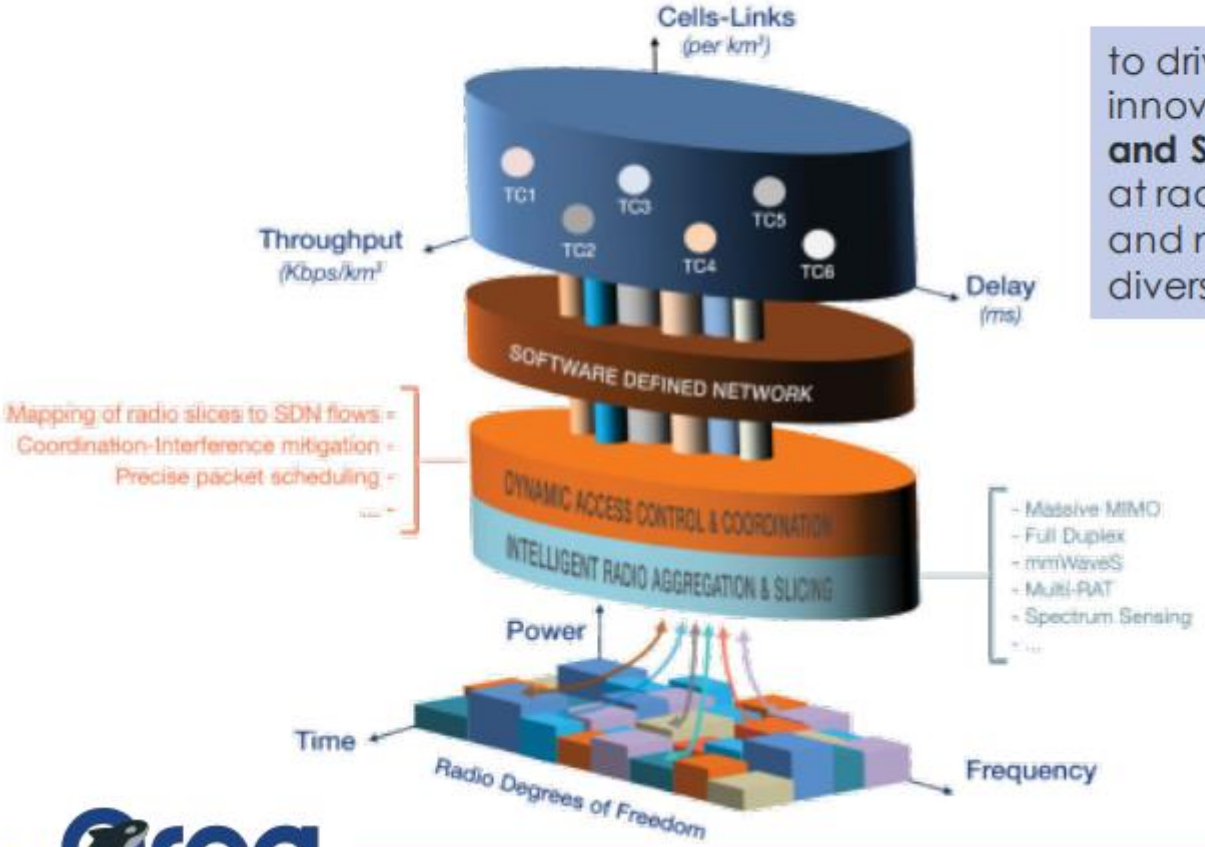
ORCHESTRATION AND RECONFIGURATION CONTROL ARCHITECTURE ORCA A 5G EXPERIMENTAL ENVIRONMENT

ORCA objective: real-time SDR

Real-time SDR: closing the gap between **high versatility** and **low latency**



ORCA objective: bridging SDR and SDN



to drive end-to-end wireless network innovation by **bridging real-time SDR and SDN** exploiting maximum flexibility at radio level, medium access level and network level, to meet very diverse application requirements

wireless SDN
radio & network slicing
Interference mitigation
dynamic MAC mechanisms
multi-RAT aggregation
Full-Duplex
massive MIMO
mmWave technology
…

Fed4FIRE as meta-testbed

Combine computing, networking and storage for all your needs

(SDN/NFV/SDX/5G/machine learning/IoT/cloud)

QUESTIONS ?

WWW.FED4FIRE.EU

Co-funded by the European Union

Co-funded by the Swiss Confederation

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