FIT/CorteXlab

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Citi, Insa-Lyon, Inria
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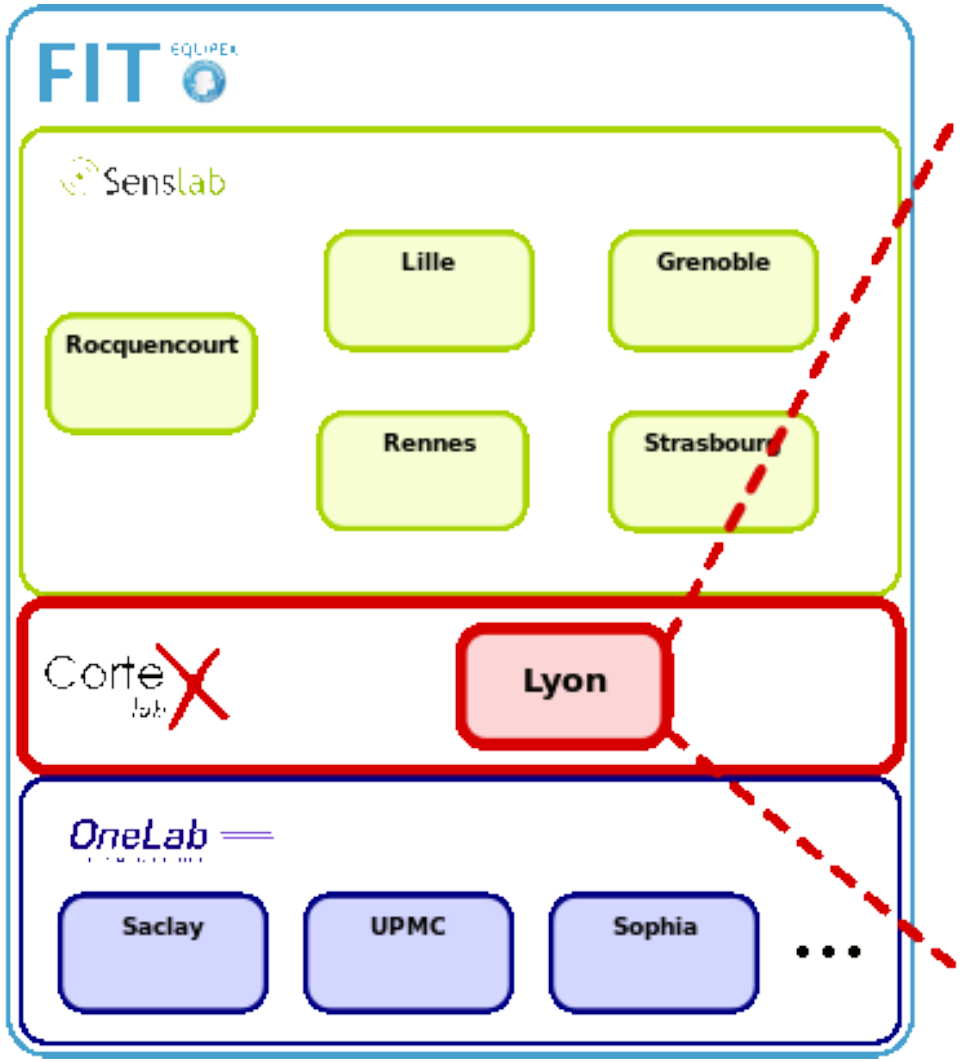
Equipex Fit



Partners:

- UPMC,
- INRIA,
- U strasbourg, Mines-Telecom, CNRS

Scientific goals:

- Physical layer design and testing
- Cognitive radio networks
- Software defined radio
- State-of-the-art wireless techniques

Community goals:

- An open experimentation testbed
- An easy to use engineering tool
- Increase research visibility

0

The Testbed

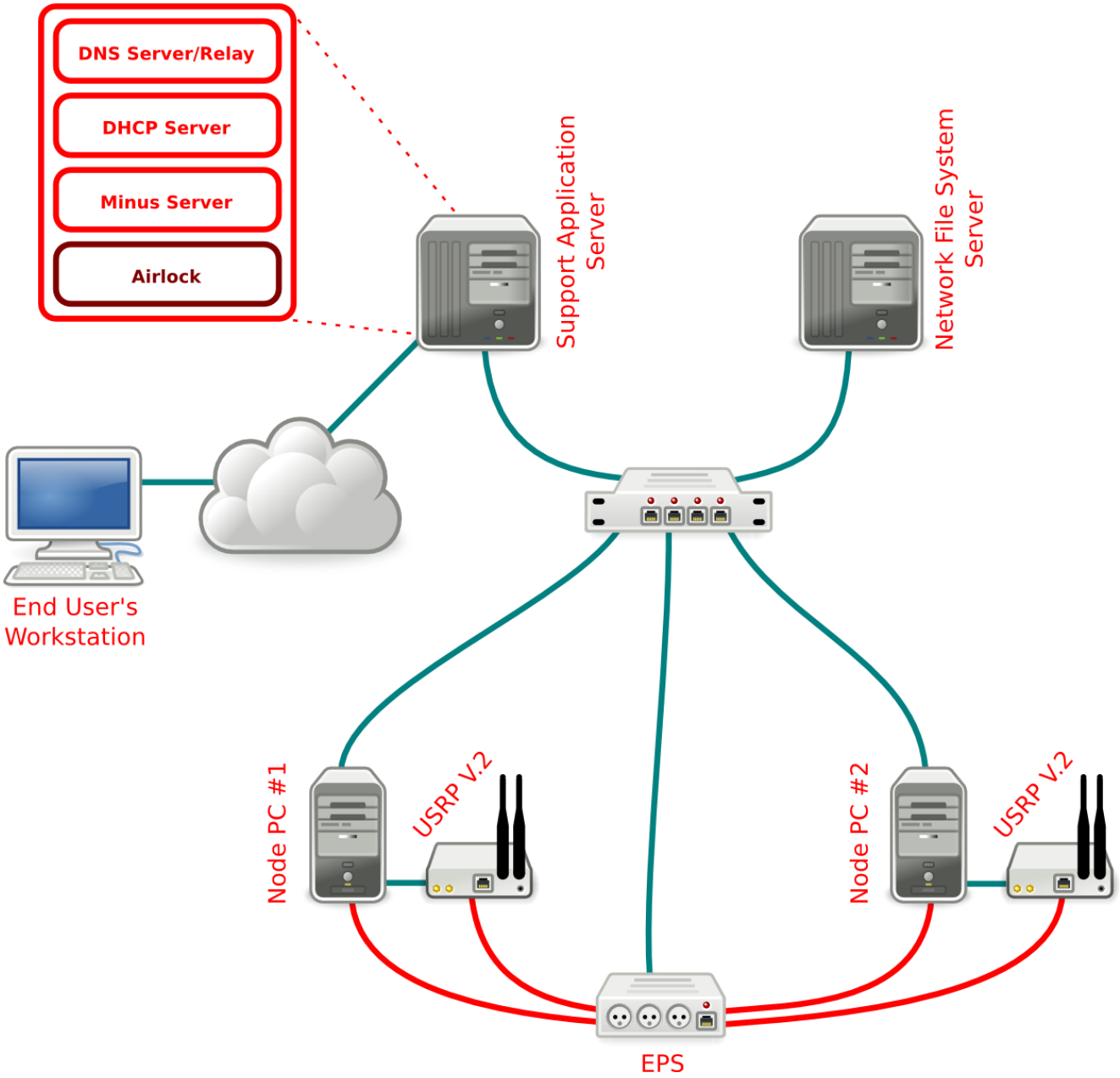
Testbed

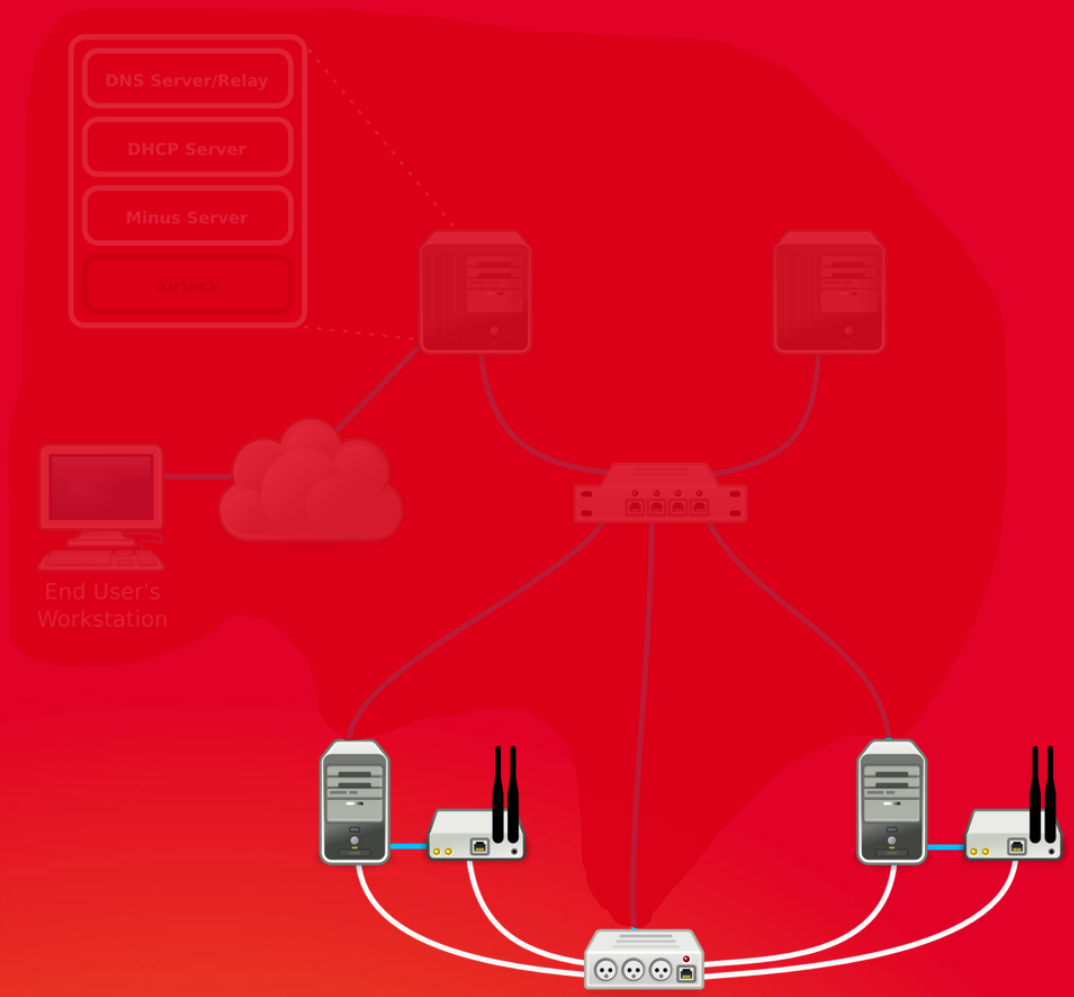
Versions:

- Development (testing and debugging)
  - reduced number of nodes (~ 10)
  - no guarantees of stability nor scheduling (FIFS)
  - bleading edge technology and software
  - installed in the radio room
- Production
  - official version!
  - full number and spectrum of nodes (84 in total)
  - federated access and scheduling
  - better stability and reproducibility of experiments
  - installed in the isolated experimentation room

AVAILABLE FROM JUNE 2013

AVAILABLE FROM FEB 2014


DNS Server/Relay
DHCP Server
Minus Server
Airlock
Support Application Server
Network File System Server
End User's Workstation
Node PC #1
USRP V.2
Node PC #2
USRP V.2
EPS



1

Nodes & related HW

A perfect radio node has to be:

- Flexible
- Agile
- Technology agnostic
- Supportive of new technologies
- Future proof
- Easy to develop for
- Powerful

Target node setup

x21

+ Open, “simple” to develop, cheaper

- Limited FPGA, limited bandwidth

USRPs

+ Powerfull FPGA, big bandwidth

- Expensive, harder to develop

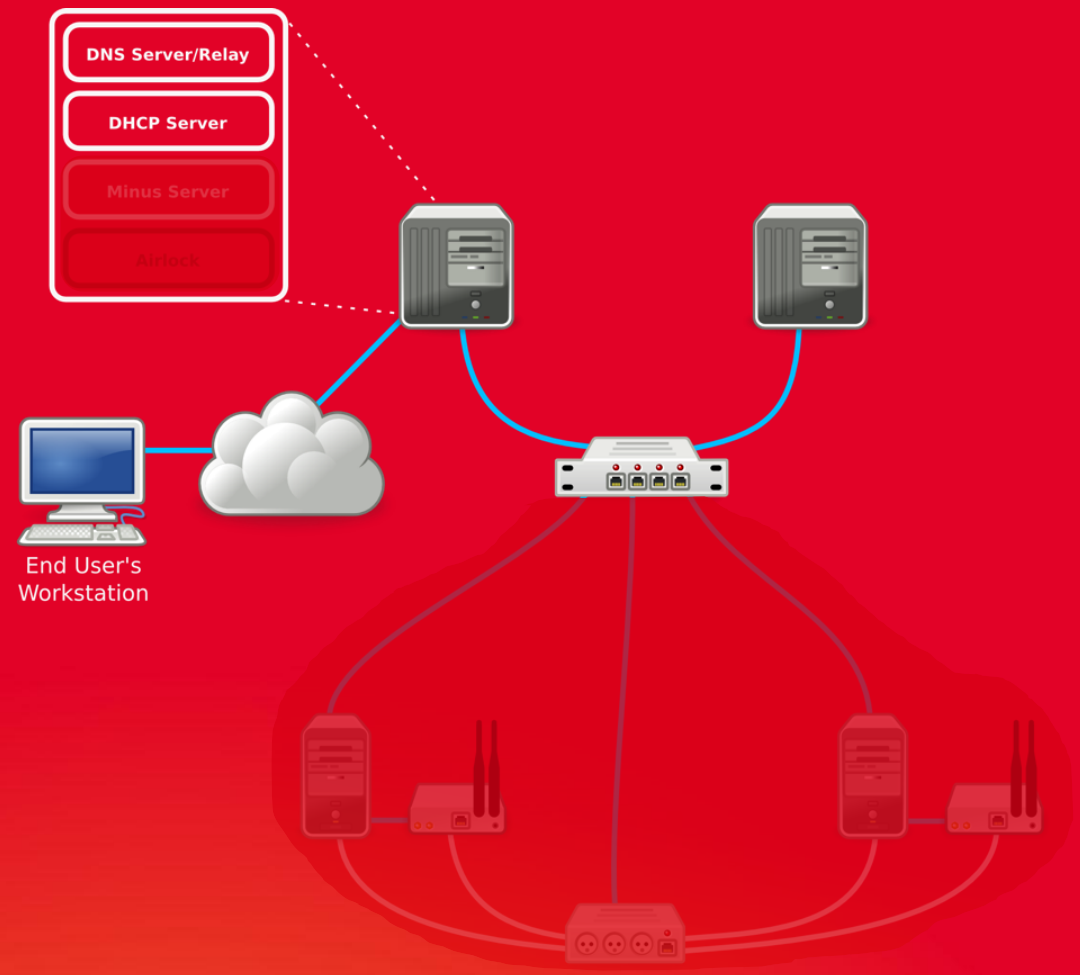
Nutaq (Pico SDR)

x21

+ FIT/IoT-Lab Sensor Nodes

x42

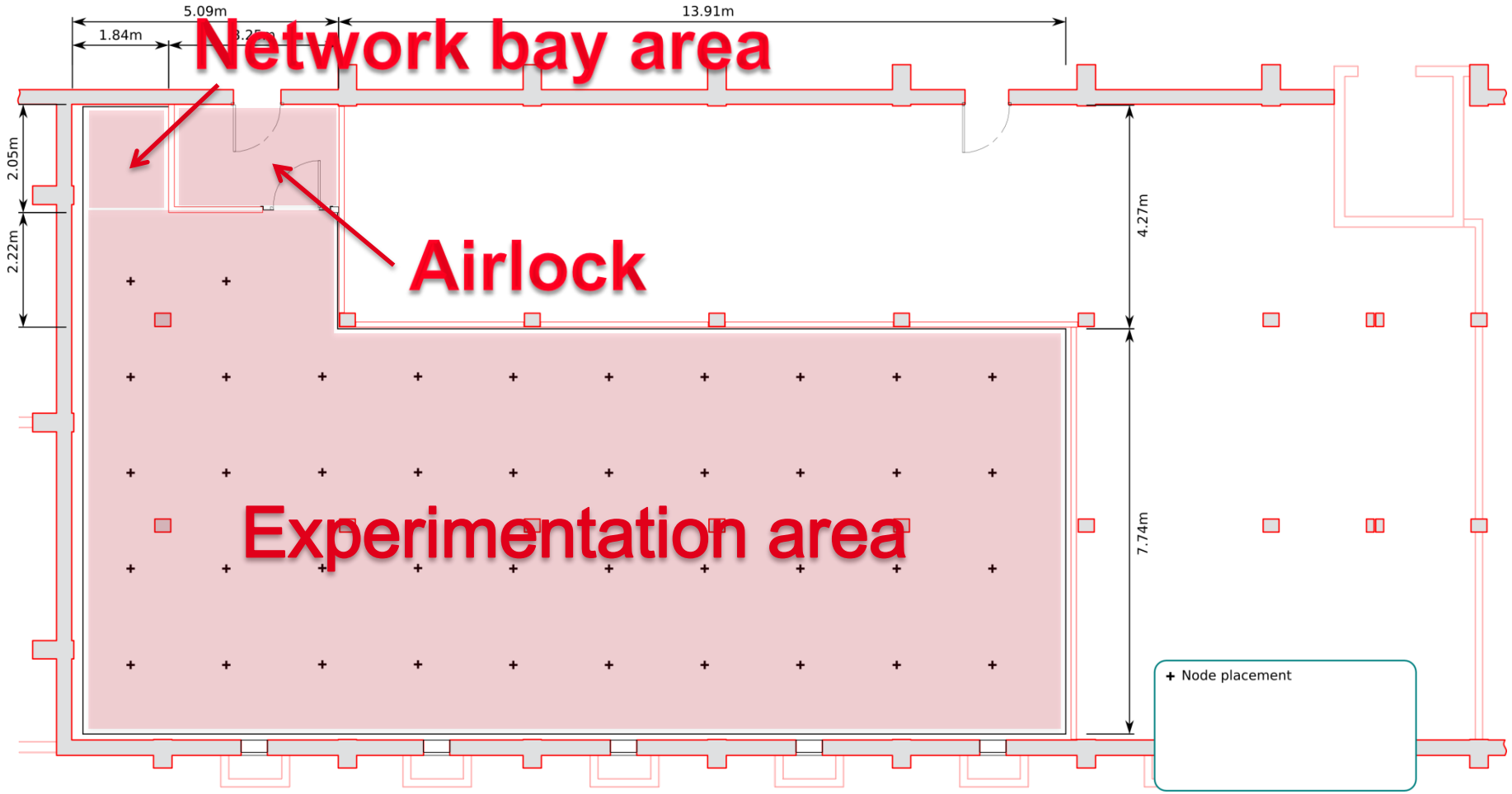
84 Nodes



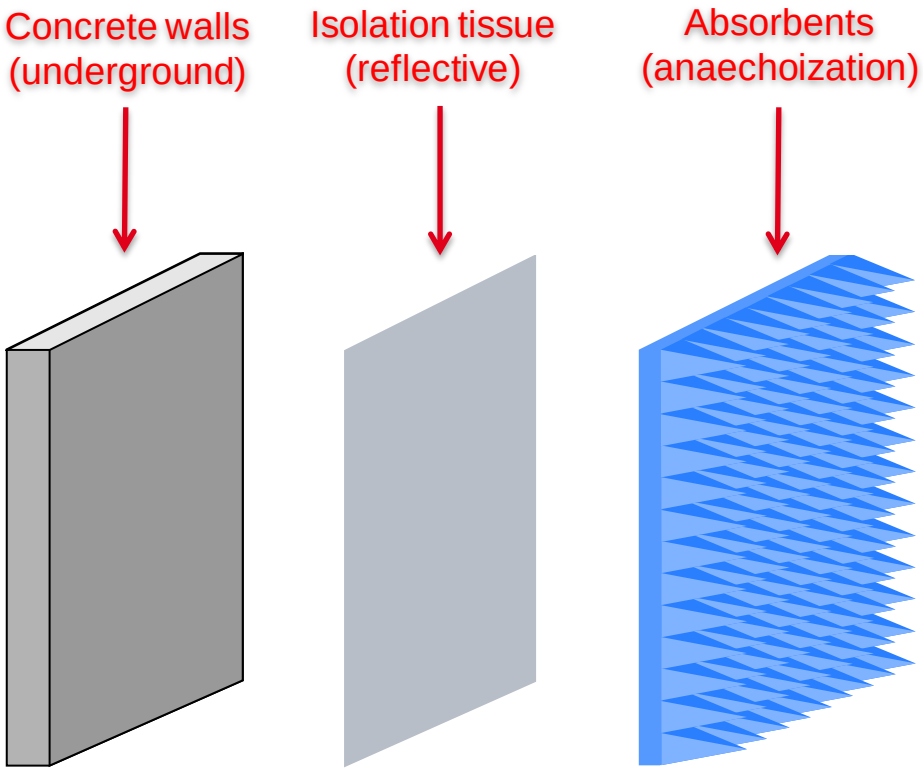
2

Infrastructure & Room

Experimentation Room

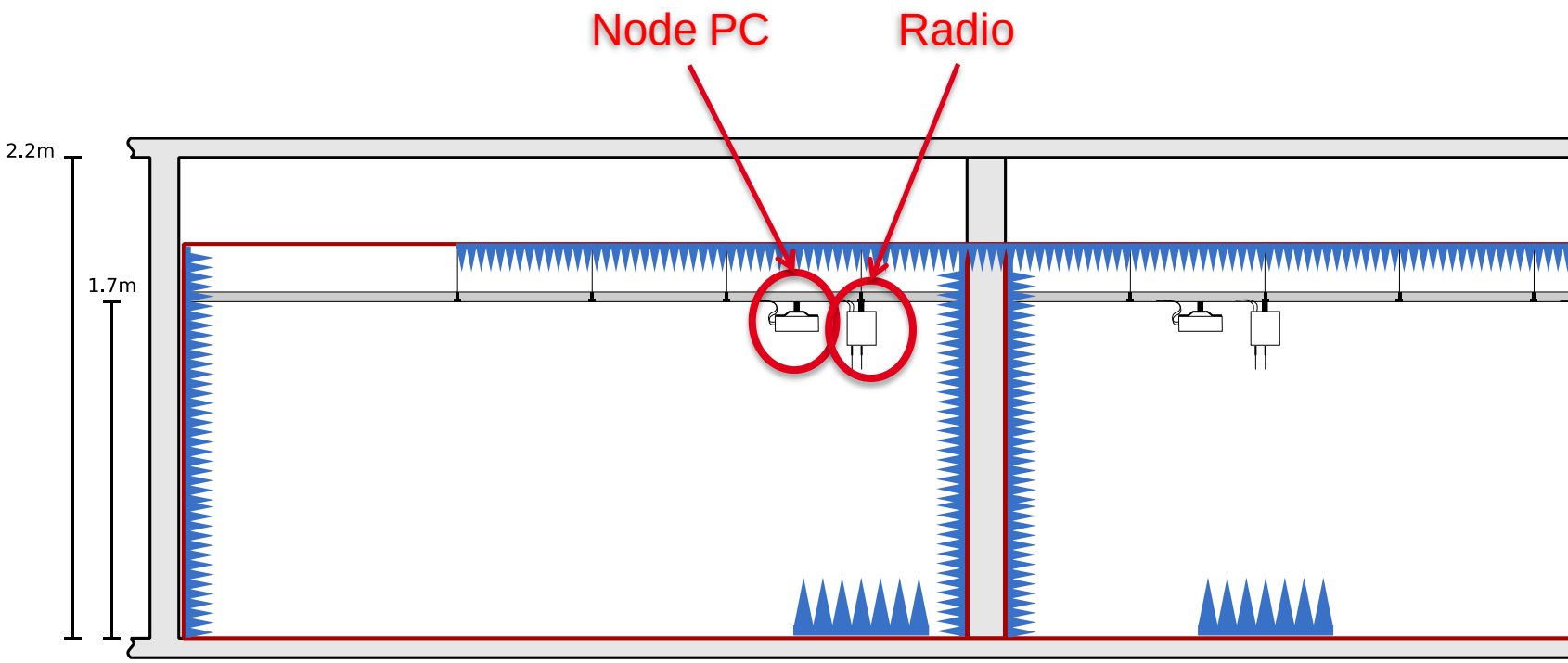


Electromagnetic Conditioning

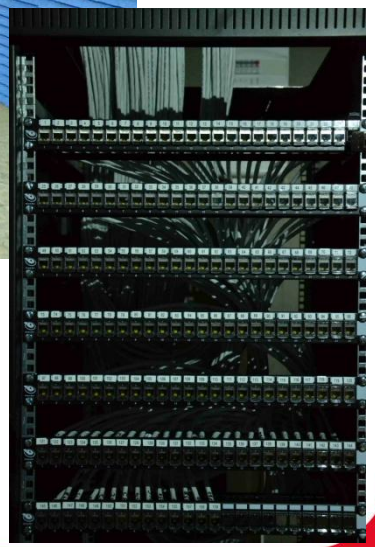


- 50 dB of attenuation w.r.t. outside

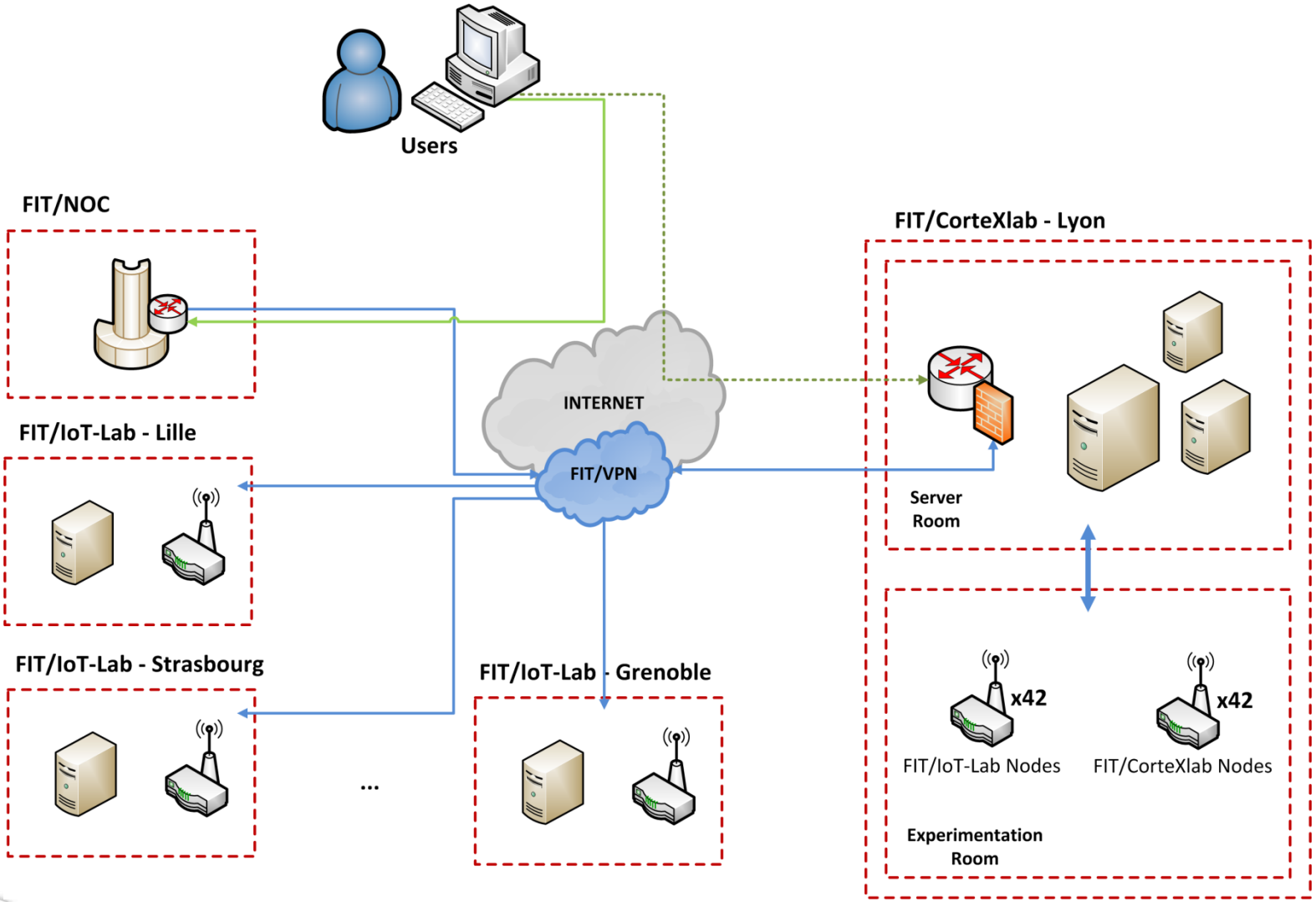
Room



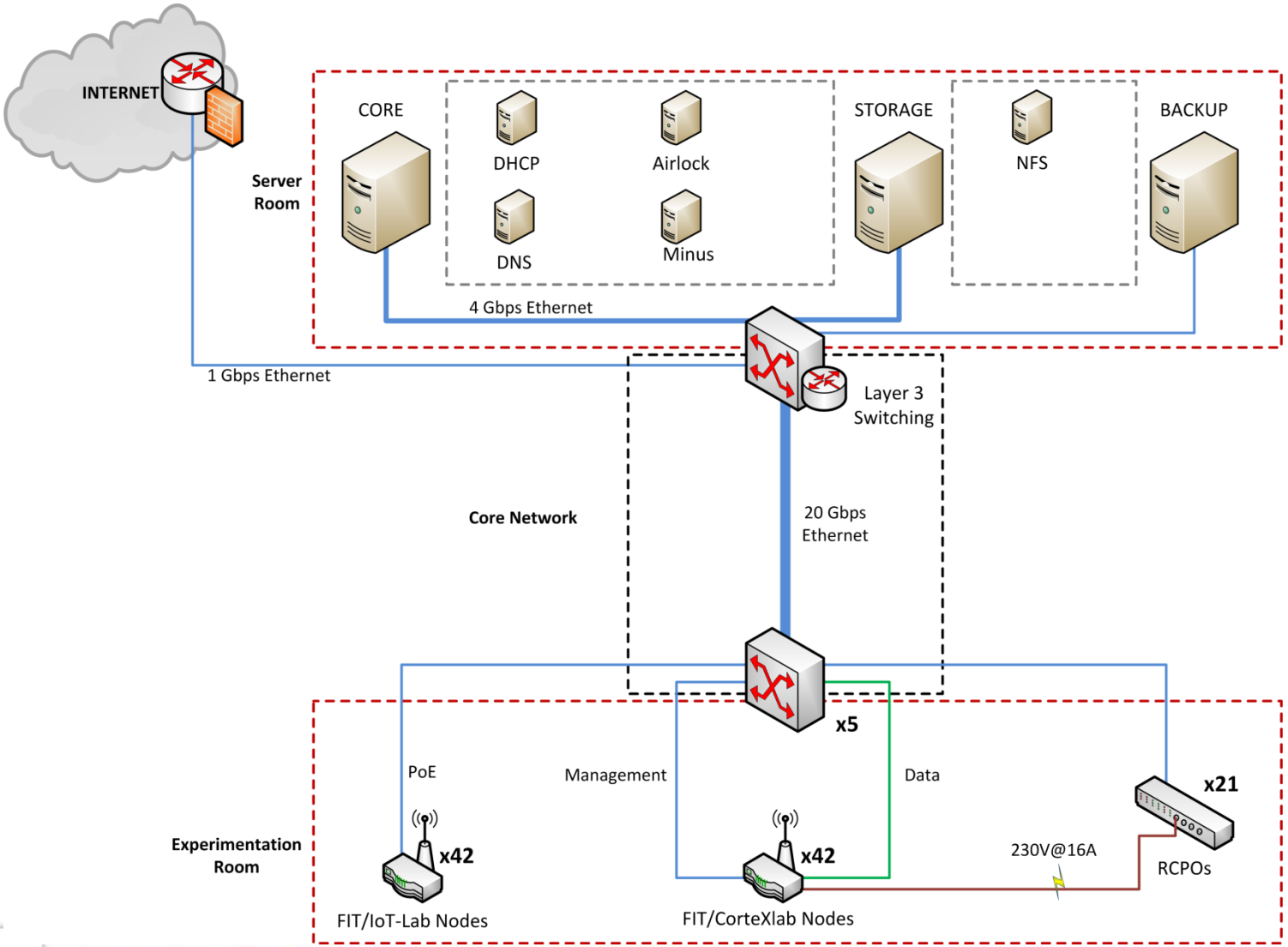
Cortex-Lab Room 26 March 2013



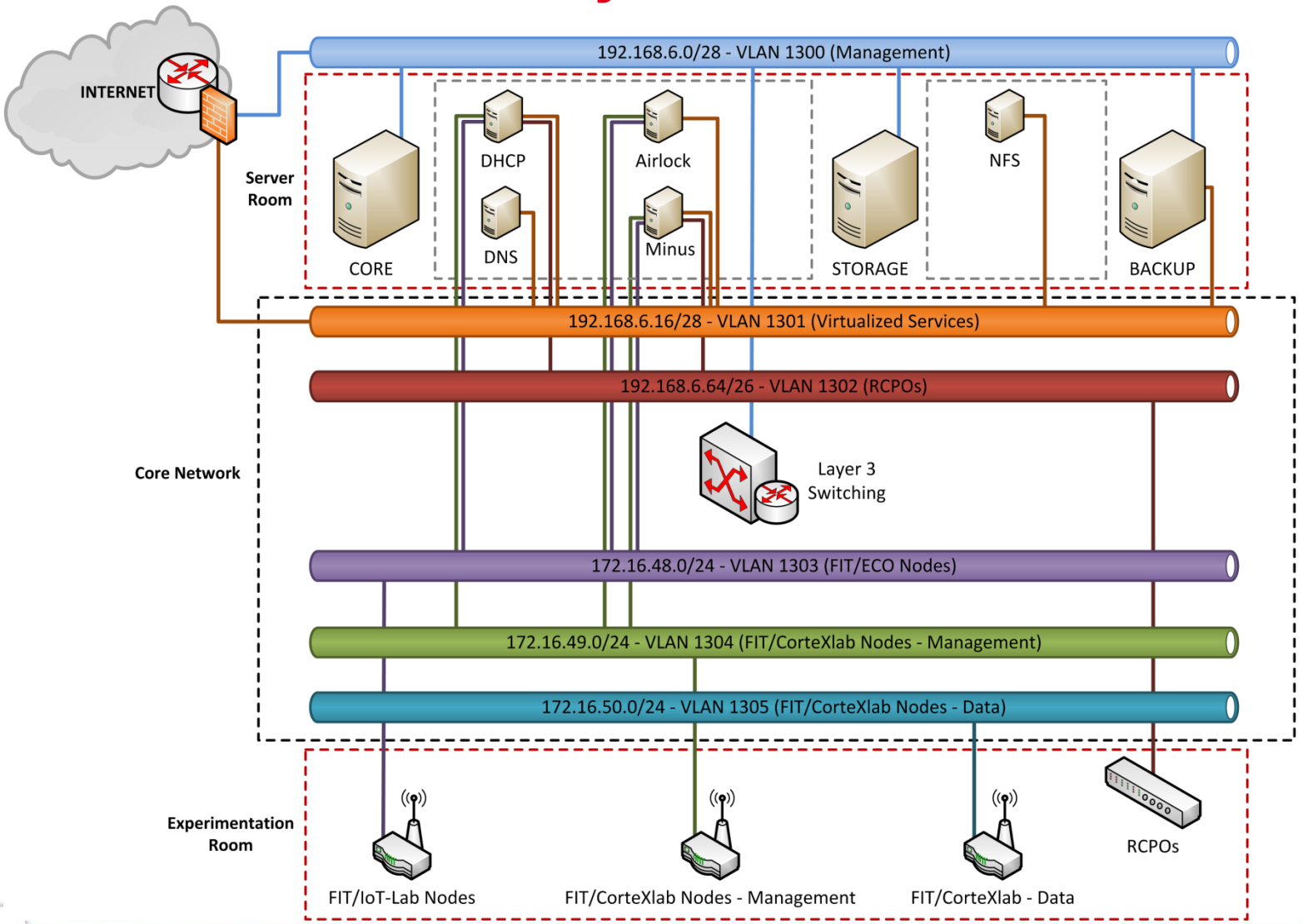
Systems & Network

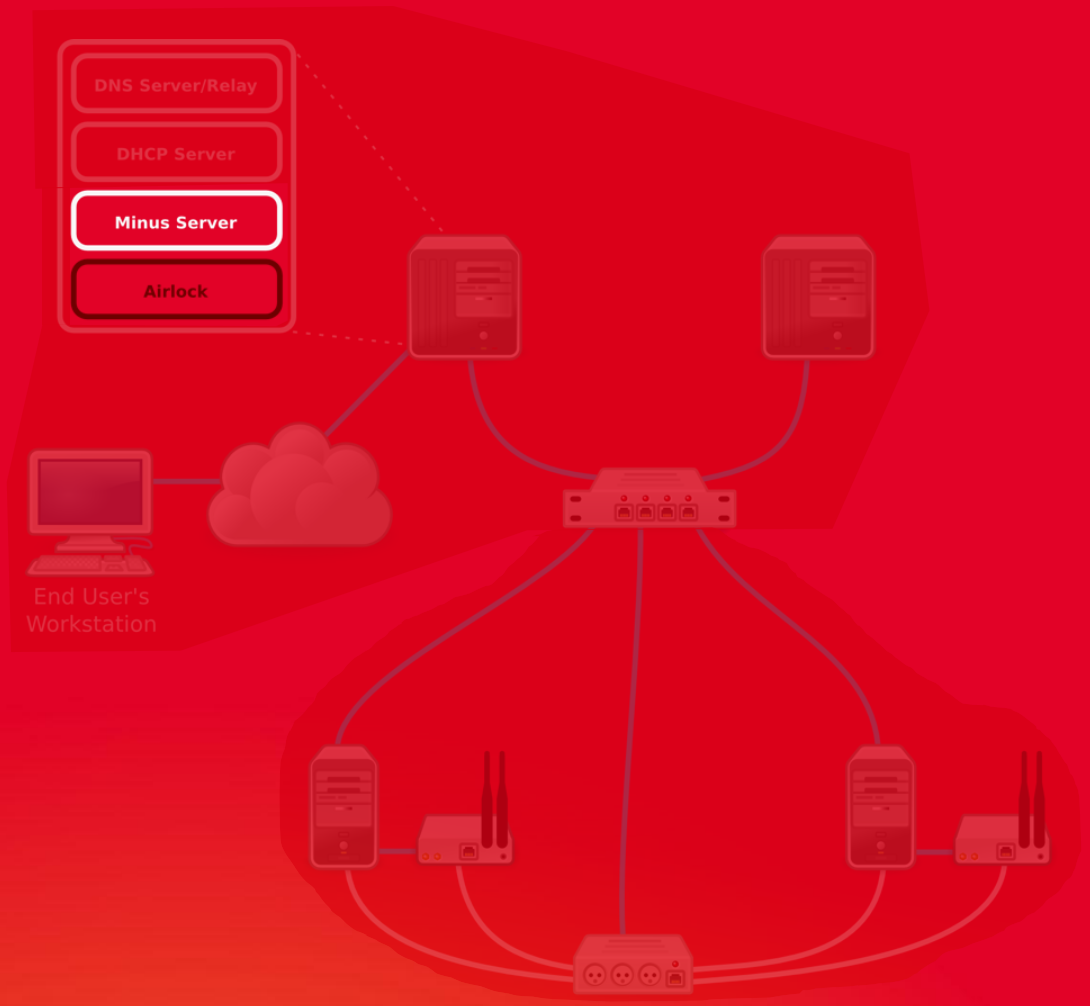


Systems & Network



Services & Security

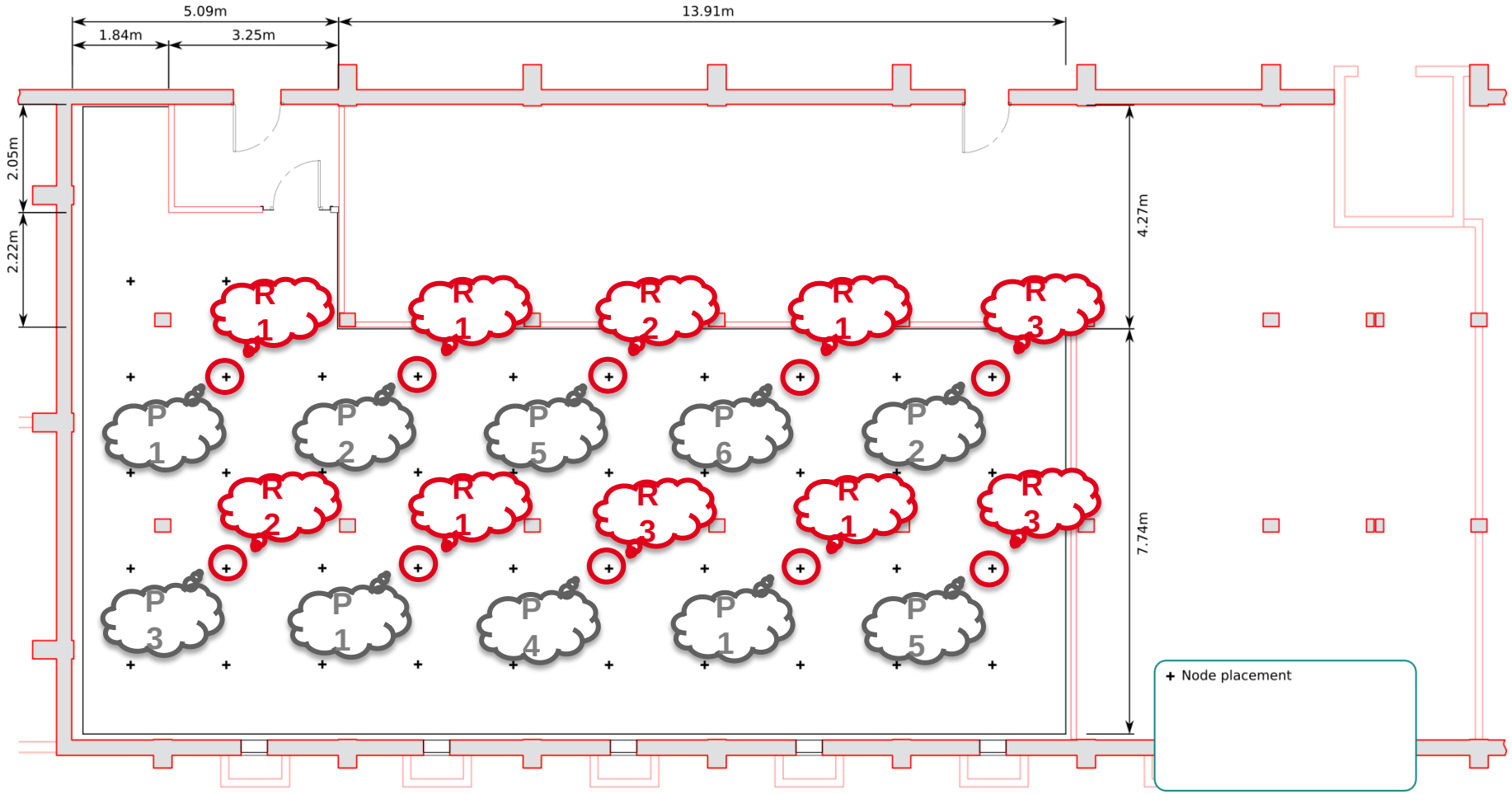




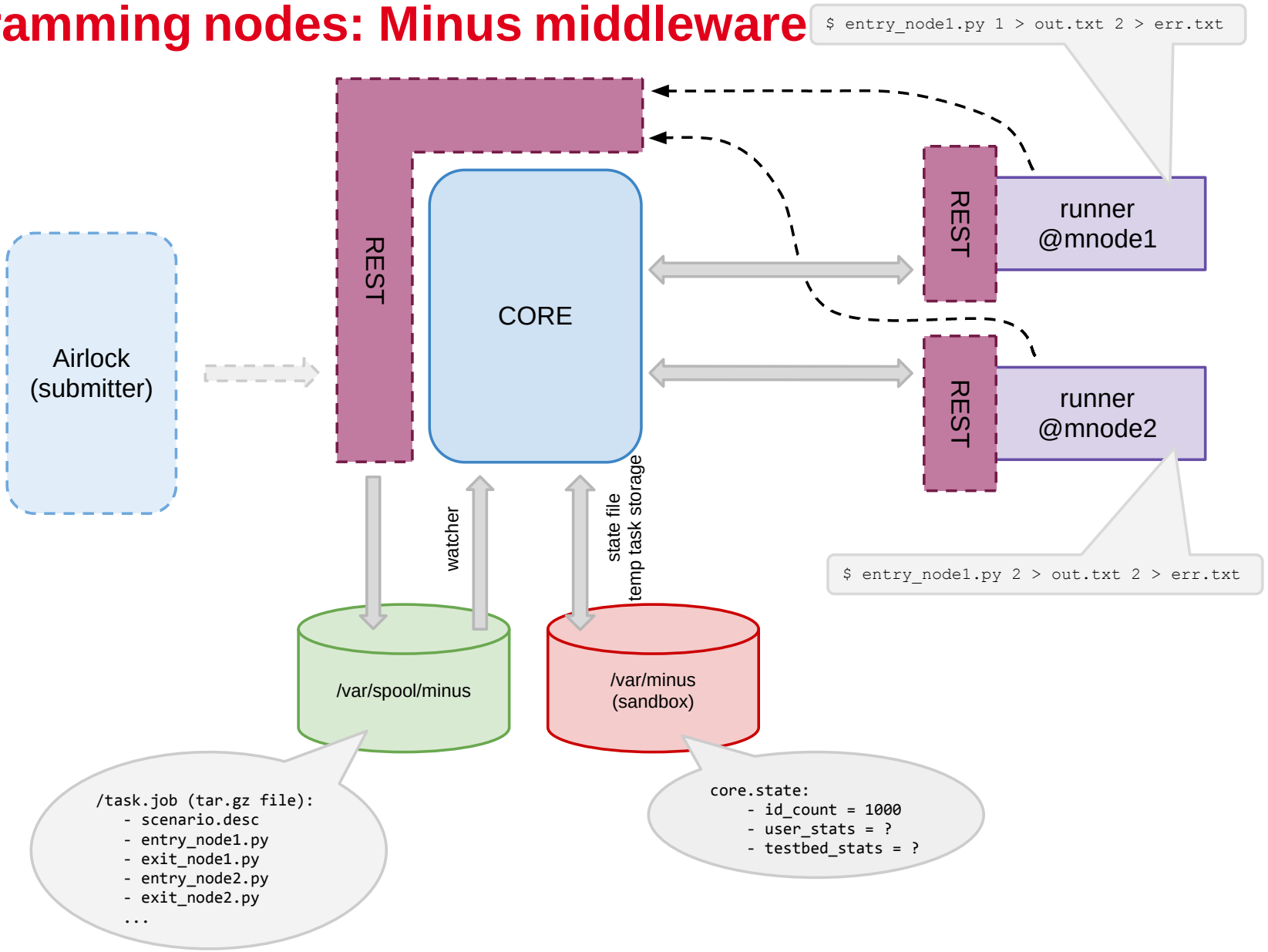
2

Software Tools & Federation

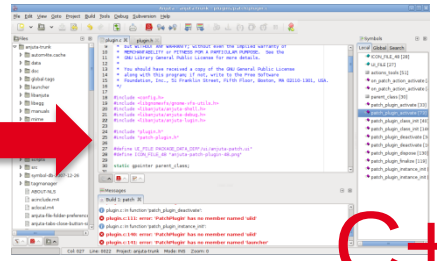
Node selection, role configuration, parameter assignment



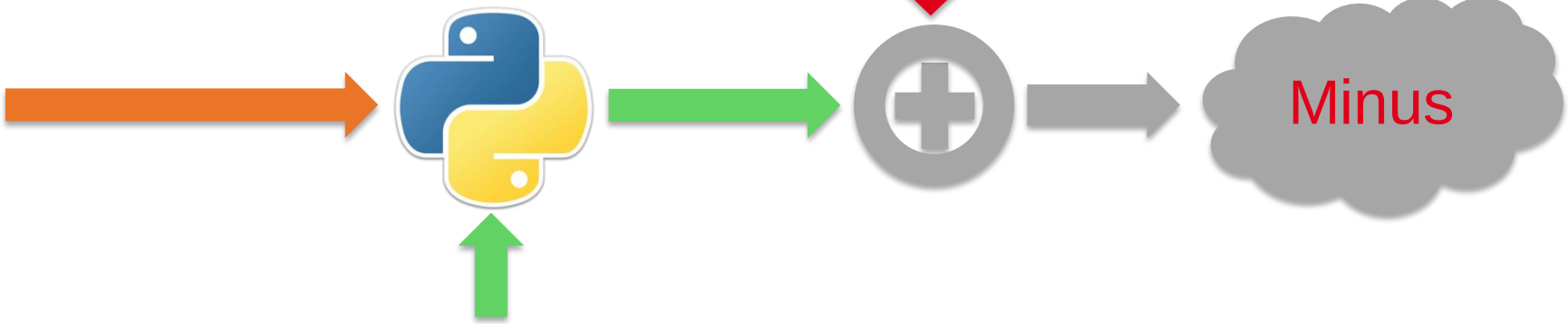
Programming nodes: Minus middleware

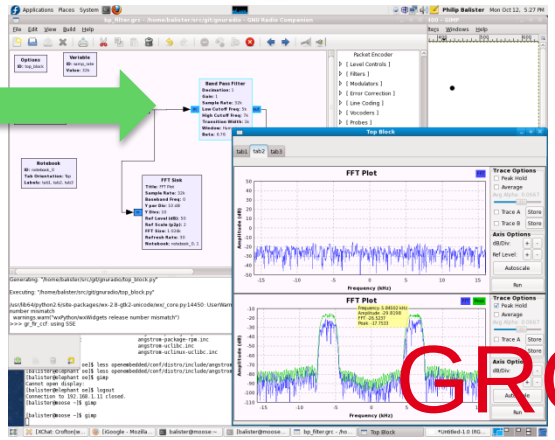


GNU Radio + Minus Workflow



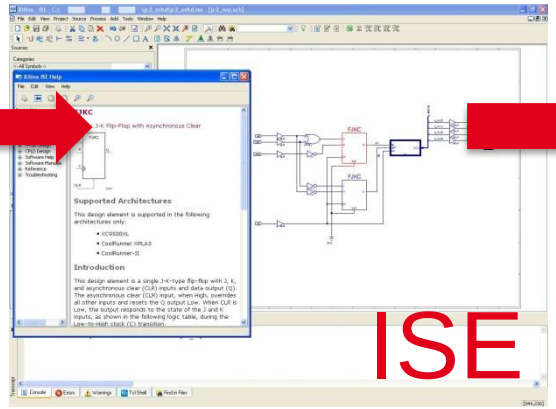
C++

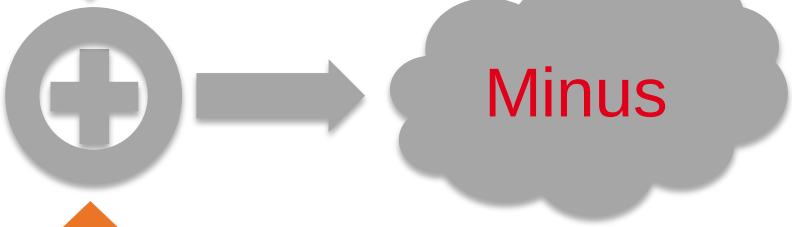


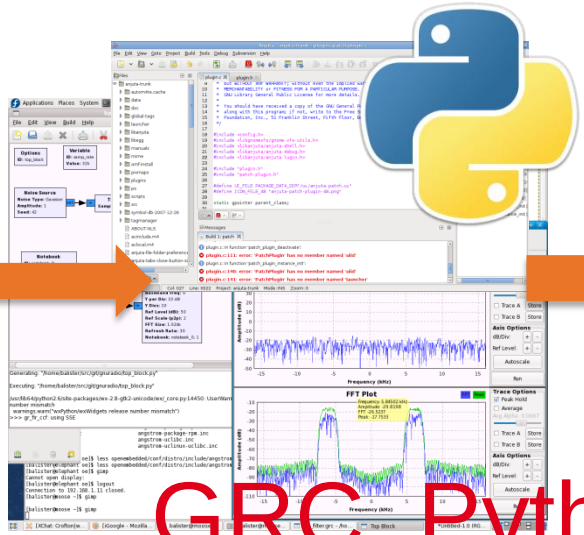


GRC

GNU Radio + Xilinx + Minus Workflow

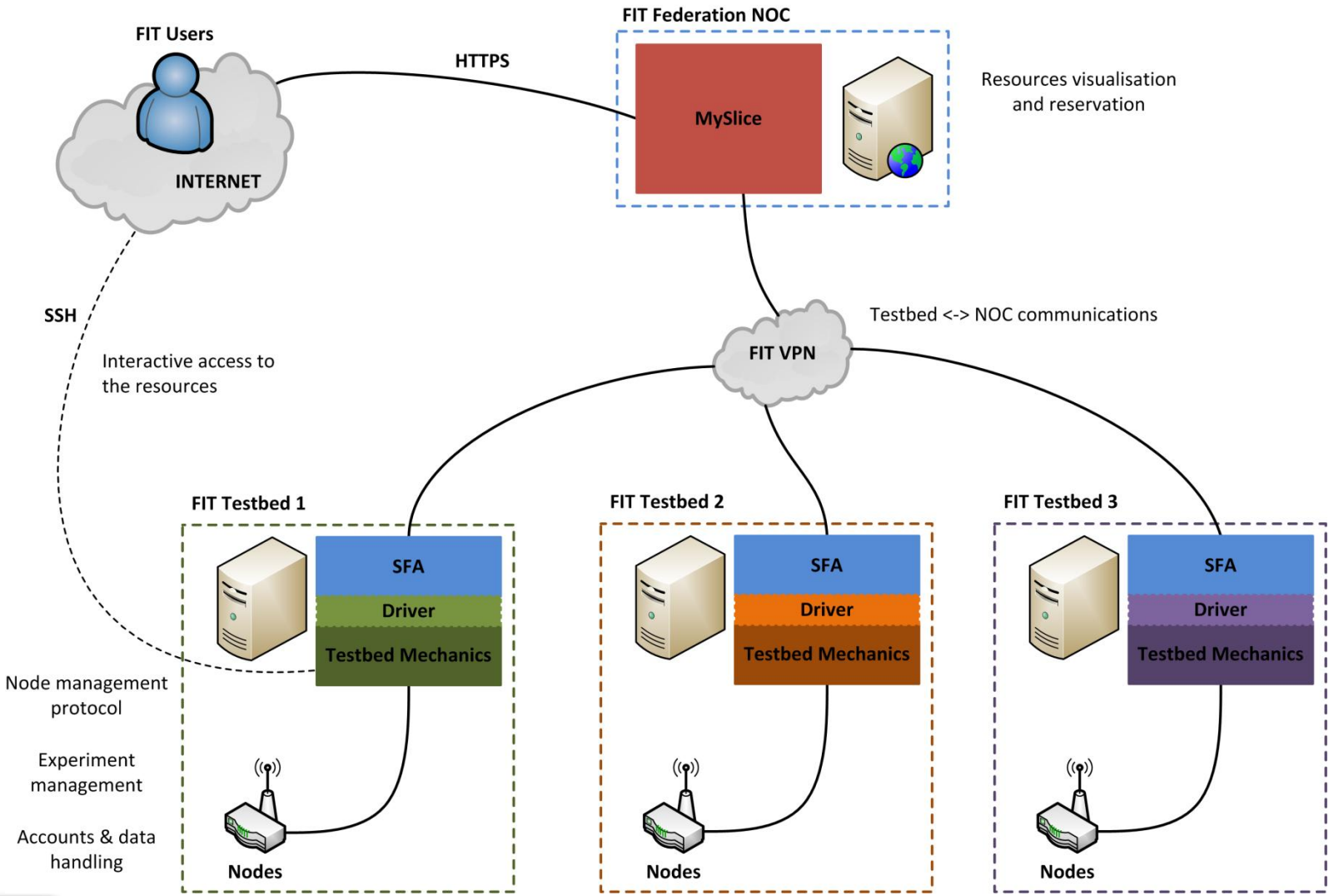






GRC, Python, C++

Federation Tools



Federation Tools

First step:

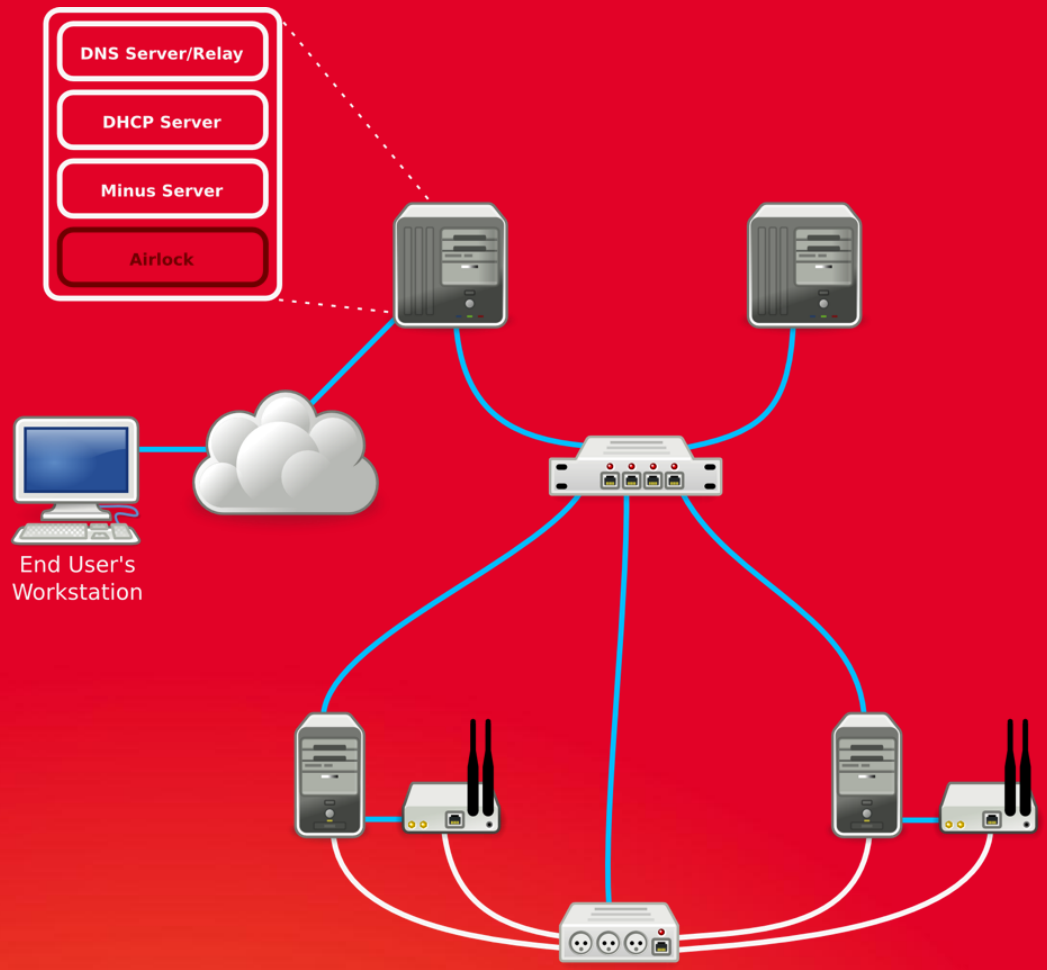
- Connect FIT/CorteXlab to FIT/ECO infrastructure
- Take advantage of their SFA module and driver

Next step:

- Implement OMF when it's deployed in FIT
- Replacement of SFA and its testbed specific driver

Final step:

- All the testbeds are fully MySlice and OMF compliant


DNS Server/Relay
DHCP Server
Minus Server
Airlock
End User's
Workstation

4

Planning

Project Milestones

1. **Room works:**
   - Experimentation room construction
   - Experimentation room faradization and installation

FEB 2013

2. **Alpha version testbed deployment:**
   - "On the shelf" or simulation mode
   - Proof-of-concept
   - Internal usage

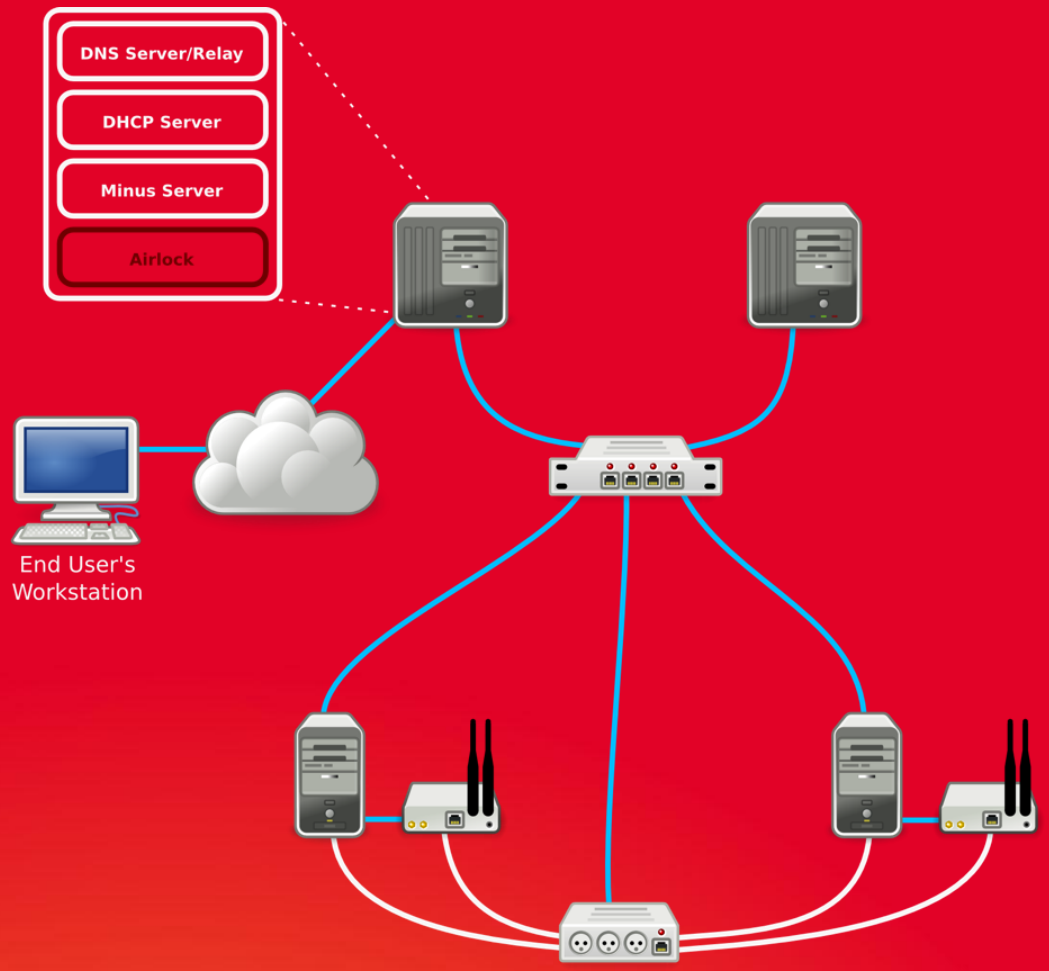
APR 2013

3. **Beta version testbed deployment:**
   - Limited amount and types of nodes
   - In PC only development available (FPGA pass-through)
   - Opened to selected partners

SEP 2013

4. **Public testbed opening:**
   - Opened to everyone
   - Fully available through the FIT federation

FEB 2014



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Example Usecases

Usecase 1: Cooperative nets (Layers 1-2)

Resources:

- Agile PHY layer SDRs RF heads
- Possibility of hard synchronization between nodes (PPS input/output - GPS)
- Lots of processing power (4 core - i7 processors, 8Gb ram, 128 Gb SSD)
- Gb dedicated data network (able to deal with moderate BW base-band)
- Connected VSA and VSG
- Wireless sensor network nodes (helper nodes)
- Energy measurements

Examples of techniques:

- Network-MIMO
- Interference Alignment
- Relay networks

Usecase 2: Routing and transp. (Layers 3-4)

Resources:

- Ready made reference adaptable PHY (OFDM, Zigbee)
- Gb dedicated data network
- GNU Radio for implementation and/or data source
- Use the linux kernel framework as implementation space
- Use standard linux TCP/IP stack (dedicated interface generation)
  - Use standard linux applications as data source
  - Use standard network sniffing tools for results collection/debugging
- Wireless sensor network nodes
- Energy measurements

Examples:

- Emulating cellular network infrastructure for beyond 4G systems
- Link quality aware routing (cross layer)
- High density node deployments/testing

Usecase 3: Application QoS (Layers 5-7)

Resources:

- Ready made reference adaptable PHY (OFDM, Zigbee)
- Gb dedicated data network
- Use standard linux TCP/IP stack (dedicated interface generation)
  - Use standard linux applications as data source
  - Use standard network sniffing tools for results collection/debugging
- Implement data sources in python/C/C++
- Emulate user behavior with audio/video/web browsing input patterns
- Energy measurements

Examples:

- Testing of services in realistic wireless scenarios
  - Controlling the conditions of tests (interference, propagation, errors…)
  - Test concurrent services and service priorities
- Development of services compliant with beyond 4G standards

Thank You!

The FIT-CorteXlab team

- Jean-Marie Gorce
- Florin Hutu
- Tanguy Risset
- Guillaume Vuillemaud
- Leonardo Cardoso
- Benjamin Guillon
- Abdelbasset Massouri
- Hervé Parvey

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