

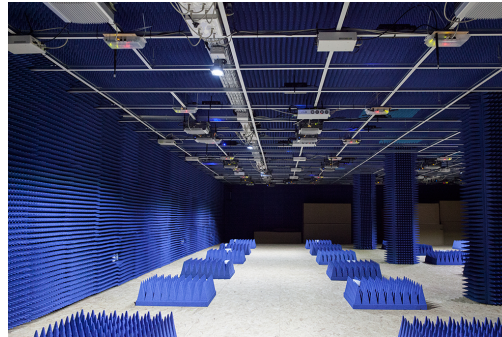
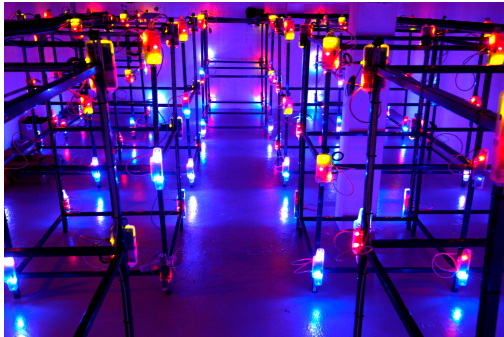
Experimenting with FIT IoT-LAB Open Access Testbed

**Cedric Adjih (Inria), Niels Groth (FUB),
Alexandre Abadie (Inria)**

**RIOT Summit, July 15-16, 2016,
Berlin, Germany**

IoT-LAB - testbeds of Equipex FIT

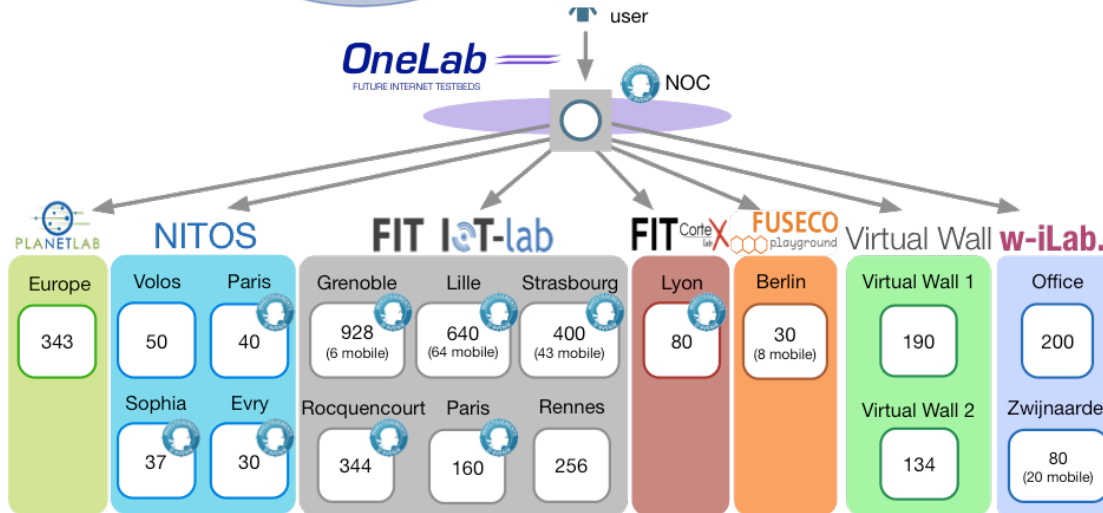
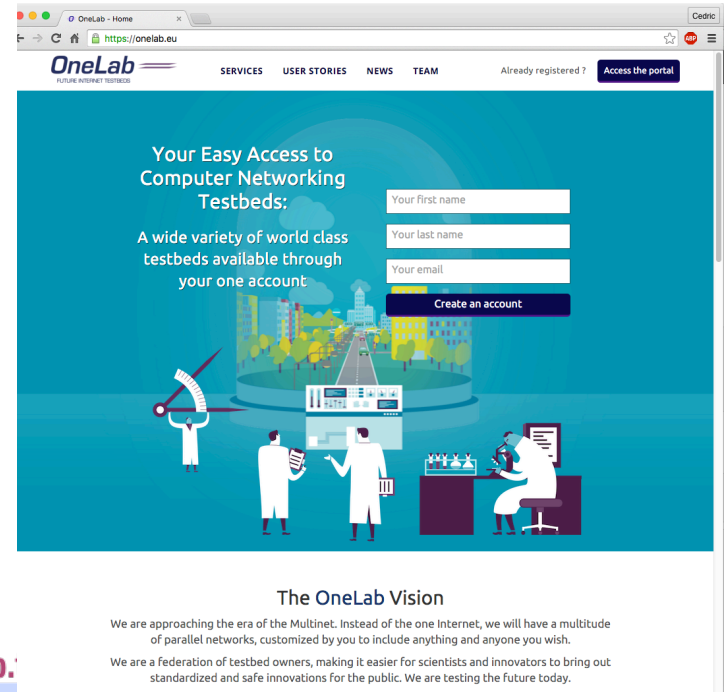
- **Funded project: Equipex FIT**
(<https://fit-equipex.fr/>)
- **FIT: a initial set of testbeds (IoT, Wi-Fi, SDN, SDR, ...)**



- **Partners**



FIT: part of the OneLab Federation



N = testbed offering N nodes

= Part of FIT Equipex

OneLAB.eu

FIT IOT-lab

www.iot-lab.info

RIOT Summit - July 15-16, 2016

FIT IoT-lab

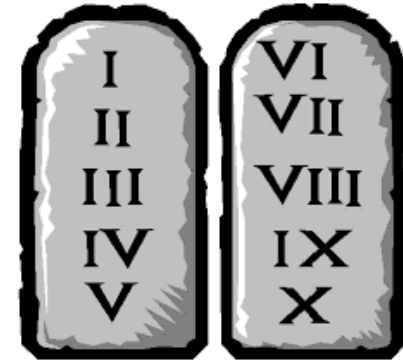
- ▶ Testbed(s) for large scale experimentation
- ▶ More than 2700+ IoT wireless nodes
 - ▶ IEEE 802.15.4 or (sub-1 GHz)
- ▶ Several IoT-LAB testbeds
 - ▶ In 7+1 sites
- ▶ **Total Remote Access**
- ▶ **Total Open Access**



Ten Rules of IoT-LAB

OPEN Nodes == NO CONSTRAINTS AT ALL

- I. Total remote access to open nodes
- II. Direct access to debugger
- III. Access to serial port / aggregator
- IV. On the global Internet (IPv6 end-to-end)



External Monitoring == NO APP MODIFICATION

- v. Packet sniffer
- vi. Precise end-to-end synchronisation (GPS)
- vii. Accurate power consumption



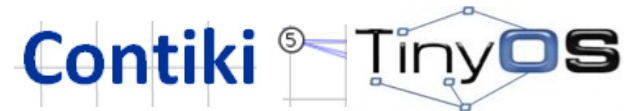
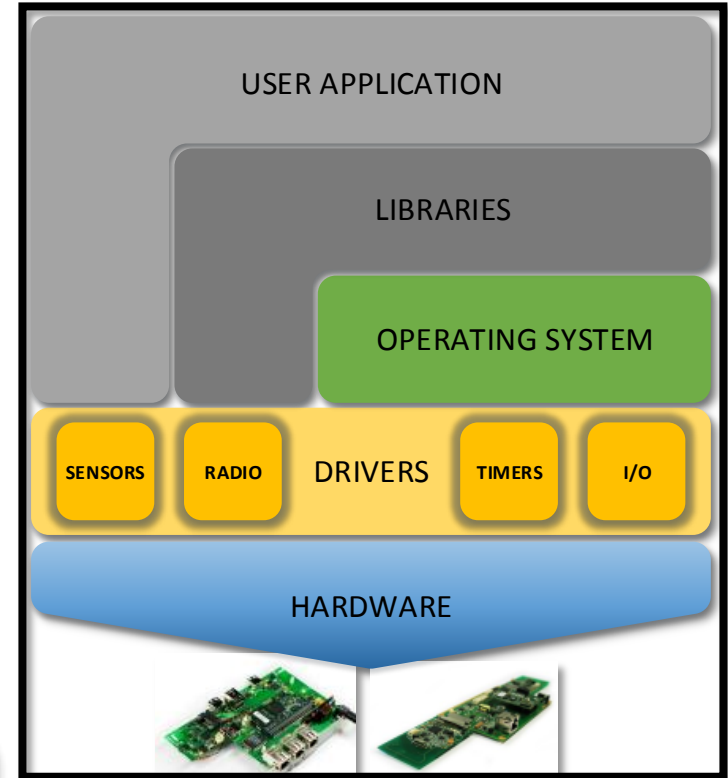
Easy to use / Advance features

- viii. OS support, tutorials, Open-source (OpenWSN,...)
- ix. Fleet of robots (40 + 60 + 10)
- x. Free open slots for specific hardware (usb node)



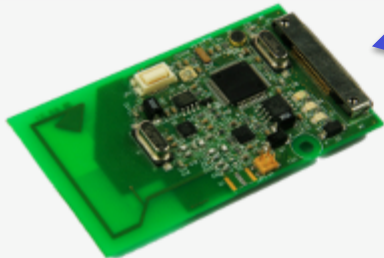
IoT-LAB Software Support

- **Bare metal access**
- **Additional software**
 - Low level drivers
 - Operating systems
 - Libraries (communication)



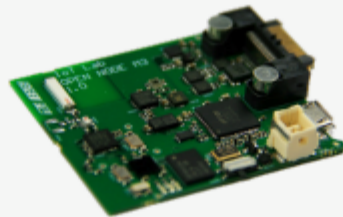
Initial IoT-LAB Hardware

- ▶ WSN430 node : TI **MSP430**
 - ▶ Radio TI CC1101 / CC2420
 - ▶ Ambient light, Temp



WSN430 Node

based on MSP430F1611 MCU and communication with 802.15.4 PHY Layer (800 MHz or 2.4 GHz)



M3 Node

based on STM32F103REY MCU and communication with 802.15.4 PHY Layer (2.4 GHz)



A8 Node

based on TI SITARA AM3505 (Arm Cortex A8) allows to run Linux. This node embeds also a M3 Node with 802.15.4 comm.

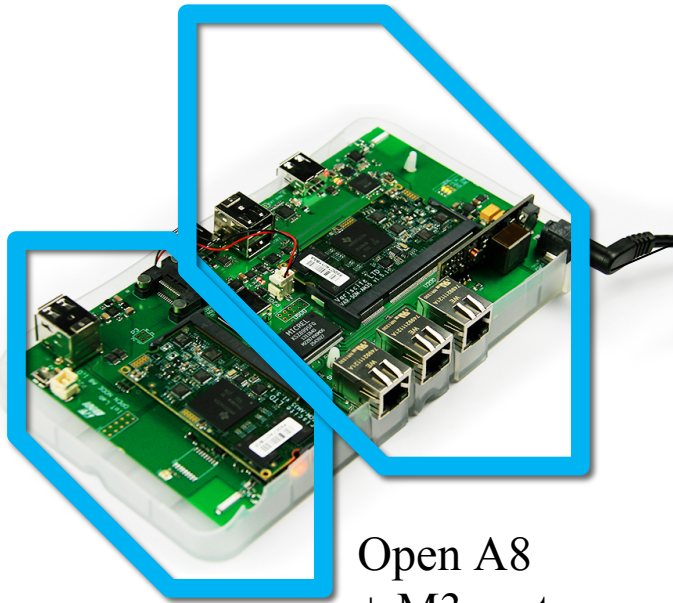


- ▶ M3 node : STM32 (**Cortex-M3**)
 - ▶ Radio Atmel AT86RF231
 - ▶ Ambient light, Temp, IMU, Pressure

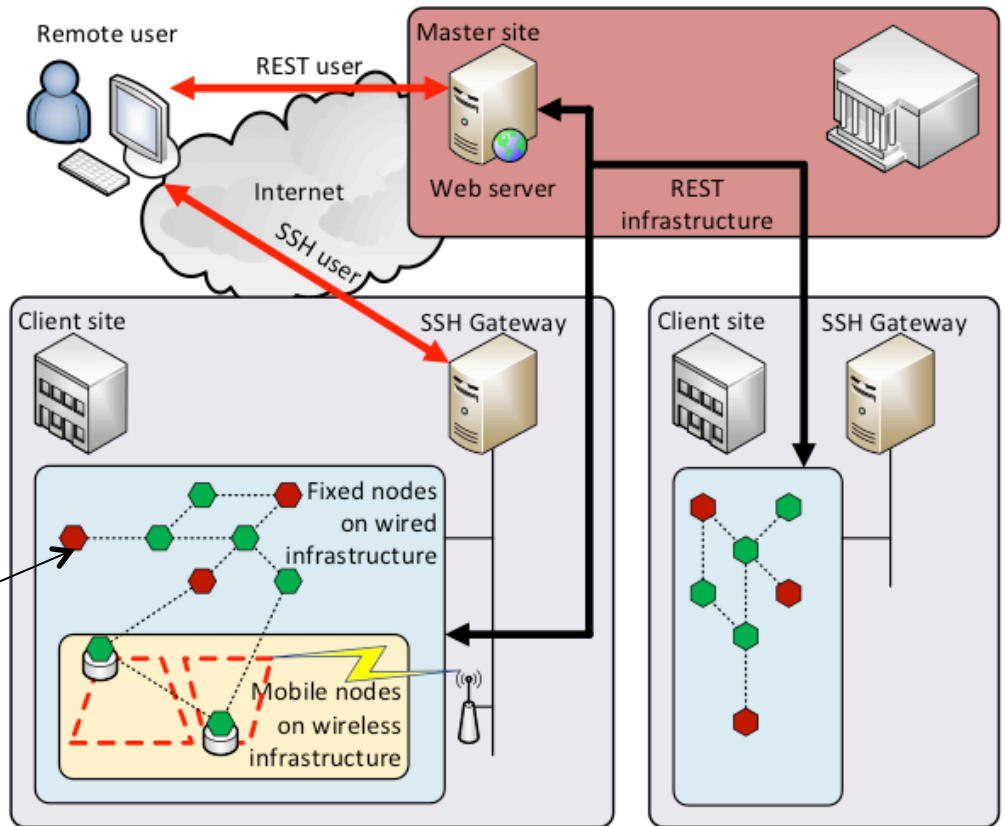
- ▶ **A8** node : TI-SITARA AM3505
 - ▶ Ethernet, USB
 - ▶ Linux
 - ▶ Indoor GPS for highly accurate synchronisation

IoT-LAB Backend

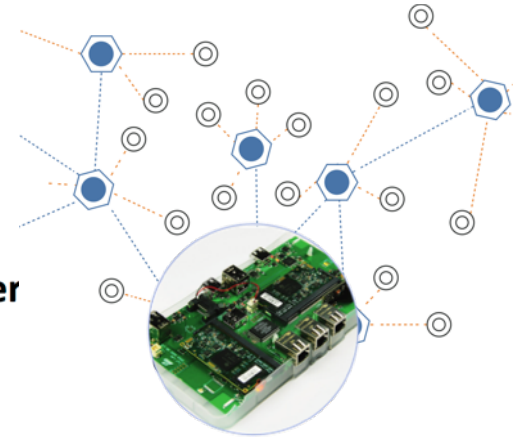
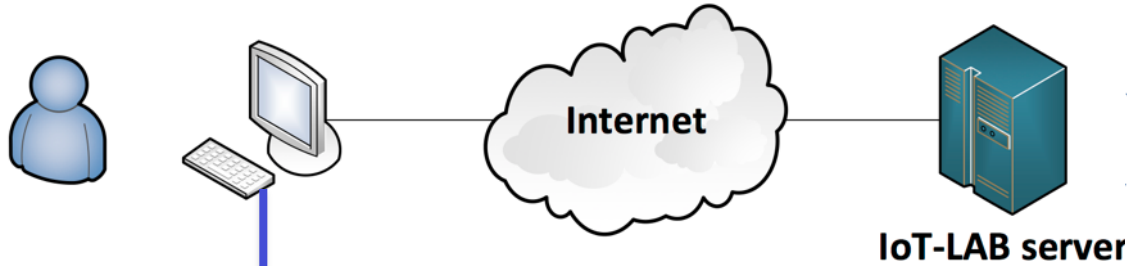
Management
(Linux + mote
802.15.4, sniffer...)



Open A8
+ M3 mote



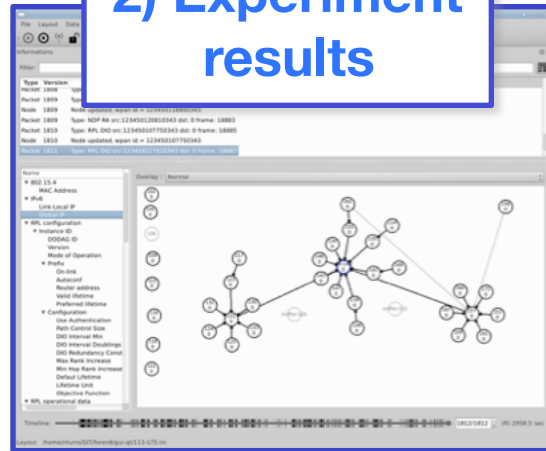
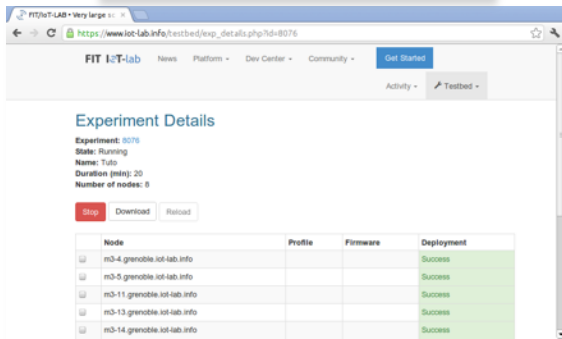
How to run an experiment



Open systems
with IETF protocols
(RPL/COAP/6TiSCH/...

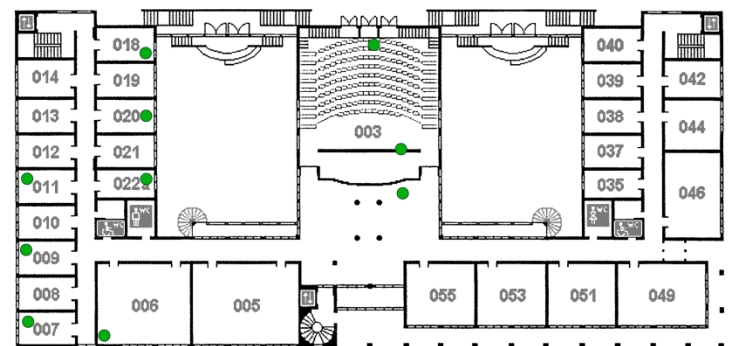
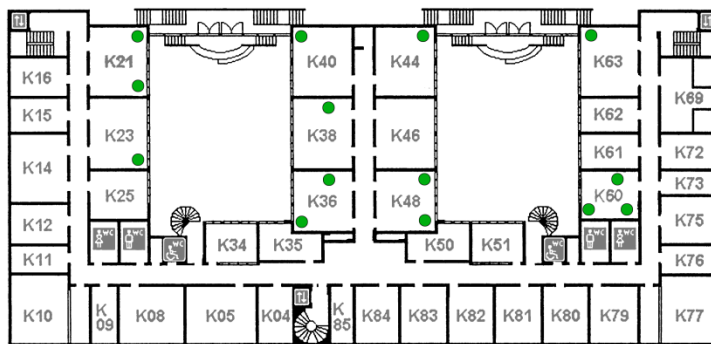
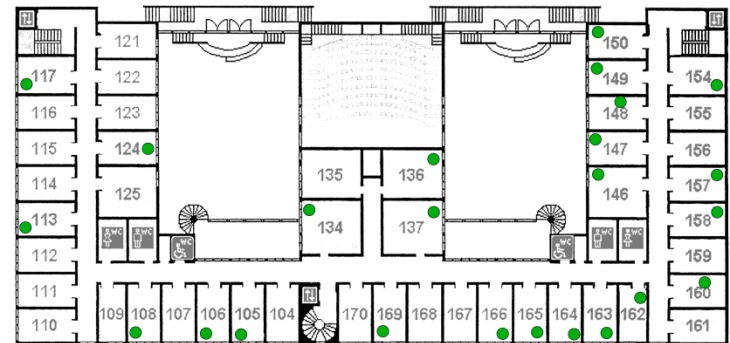
1) Experiment configuration

2) Experiment results

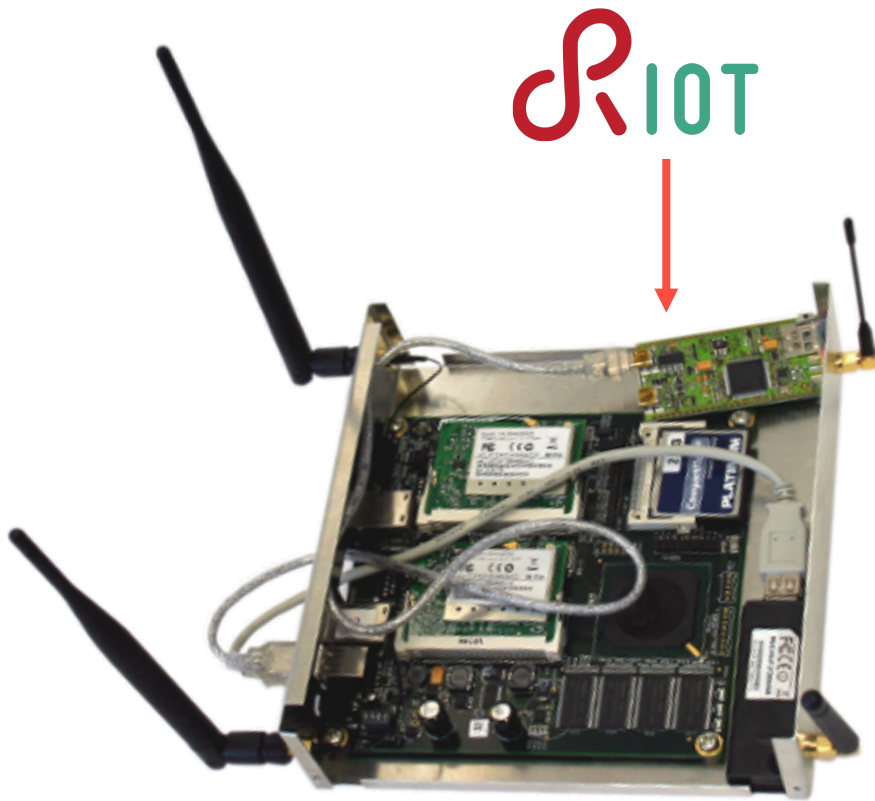


Freie Universität Berlin joins IoT-LAB !

- **IoT-LAB Berlin nodes:**
 - **50 running dual nodes**
 - Wireless Mesh Node
 - MSBA-A2 Wireless Sensor Node
 - **Spread over 3 floors and 42 rooms**
 - **Integrated in present architecture of the building**



IoT-Lab Berlin Nodes



Wireless mesh node

- PC Engines Alix2c2
- 500 MHz AMD Geode LX800
- 256 MB DDR DRAM
- 2 Ethernet Ports
 - Via VT6105M
- 2 miniPCI slots and dual USB 2.0 port
- CompactFlash socket
- Customized enclosure
- Debian Linux
- 3 wireless interfaces, IEEE 802.11a,b,g

MSB-A2 wireless sensor node

- LPC-2387 ARM7
 - 98 kB RAM, 512 kB Flash
- Chipcon CC1100
 - 10dBm, ISM band at, 868-870 MHz, Data rate ≤500kbps
- Coulomb counter for battery depletion measurement
- GPIO pins
- mini USB 2.0 port and microSD-card socket
- Micro kernel (RIOT) operating system

FIT IoT-Lab Berlin opening

- We migrated to IoT-Lab production testbed
- Sign up and use the FIT IoT-Lab Berlin!
 - Official website: <https://www.iot-lab.info/>

The screenshot displays the FIT IoT-Lab Berlin web interface. The top navigation bar includes links for NEWS, PLATFORM, DEV CENTER, COMMUNITY, GET STARTED, ADMIN, ACTIVITY, and TESTBED. Below this is a secondary navigation bar with Dashboard, New Experiment, Manage Profiles, and Admin. The main content area is titled 'New experiment' and contains two sections: 'Configure your experiment' and 'Choose your nodes'.

Configure your experiment

Name: IchBinEinBerliner
Duration (minutes): 60
Start: As soon as possible Scheduled

Choose your nodes

Resources: from maps by type
resources state

Sites	Architectures and IDs
Devgrenoble map	a8:at86rf231 1-5+7
	des:wifi-cc1100 1-5+7
	m3:at86rf231 1-5+7
	custom 1-5+7
Berlin map	des:wifi-cc1100 20-27
Deville map	

The 'Berlin map' window shows a 'Selected Nodes' section with a search box containing '20-27' and a 'Save' button. Below this is a map view showing a network topology with nodes and connections.

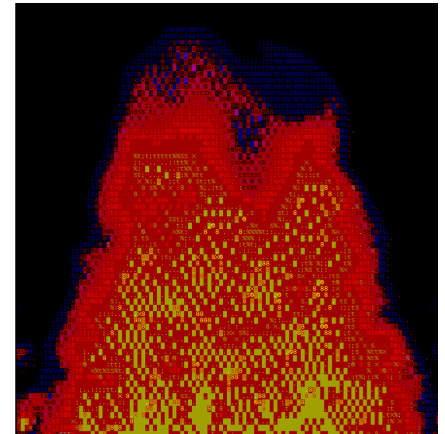
Hands On Tutorial: RIOT on IoT-LAB

- **FiT IoT-LAB Hands-on Tutorial:**

- Tomorrow (17 july) 1:00pm - 7:00pm
- Chairs: Alexandre Abadie, Gaetan Harter
- “How to deploy and test your RIOT application in the open FIT IoT-LAB.”

You will:

- **Discover the basics of IoT-LAB:**
 - Submit an experiment with the web interface
 - Submit an experiment with the CLI tools
- **Play with A8-M3 and M3 nodes**
- **Configure a public IPv6 network with RIOT**
- **Interact with the nodes using CoAP**



Time to use it !

more than 1000 users registered in more than 45 countries

<https://www.iot-lab.info>

Videos, YouTube channel "FIT IoT-LAB"

Contact: admin@iot-lab.info


Thank you!
Danke schön!
Questions?



Tutorials • FIT/IoT-LAB x

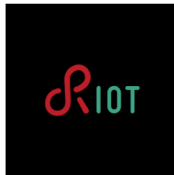
https://www.iot-lab.info/tutorials/

FIT IoT-lab [NEWS](#) [PLATFORM](#) [DEV CENTER](#) [COMMUNITY](#) [GET STARTED](#) [ACTIVITY](#) [TESTBED](#)



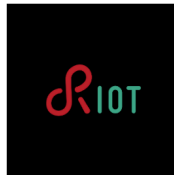
Get and compile firmware for M3 nodes

How to setup your environment and how to compile and use RIOT with M3 nodes.



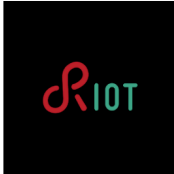
Networking example for M3 nodes

Use the gnrc_networking example provided in the RIOT repository.



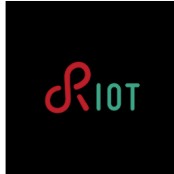
Running RPL routing on M3 nodes

Run an experiment on M3 nodes with the RPL routing protocol provided by RIOT OS.



Public IPv6/6LoWPAN network with A8-M3 nodes

IPv6/6LoWPAN network



CoAP server with public IPv6/6LoWPAN network on A8-M3 nodes

CoAP server example



FIT IOT-lab

www.iot-lab.info

A very large
scale open testbed
for the Internet
of things

very large scale
open testbed
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FIT IoT-Lab NEWS PLATFORM DEV CENTER COMMUNITY GET STARTED **ACTIVITY** Access the testbed

IoT experimentation at a large scale
Automatic, in a few click!

Access the testbed
[Sign in](#)

You don't have an account yet?
[Register!](#)

Since FIT platforms are part of the OneLab Experimental Facility, you can also access FIT IoT-Lab platform with your OneLab account information.

FIT IoT-Lab

FIT CorteXlab NEWS ABOUT PRESS & PAPERS EXPERIMENT SUPPORT ADMIN & RSS FEEDS

CorteXlab

Everything about CorteXlab, the Cognitive Radio Testbed of the FIT Project, located at INSA Lyon, France.

Future Internet of Things (FIT)

- The FIT Initiative: The Future Internet of Things initiative, an open large-scale testing infrastructure
- EquipEx Program: The French government funding program for scientific facilities

Other OneLab Platforms

- OneLab Official website of the OneLab Federation
- IoT-Lab: A very large scale small wireless sensor devices and heterogeneous communicating objects open testbed
- FIT-NITOS: A wireless testing infrastructure for systems and applications

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FIT CorteXlab

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FIT IoT-lab

www.iot-lab.info

RIOT Summit - July 15-16, 2016

Outline

- **Open Access Testbed**
 - FIT and OneLAB federations
 - FIT IoT-LAB
- **FIT IoT-LAB in Berlin**
- **Teaser: tutorial tomorrow**