FIT IoT-lab

www.iot-lab.info

Experimenting with FIT IoT-LAB Open Access Testbed

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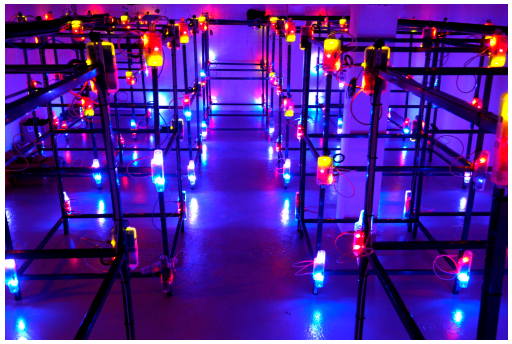
RIOT Summit, July 15-16, 2016, Berlin, Germany

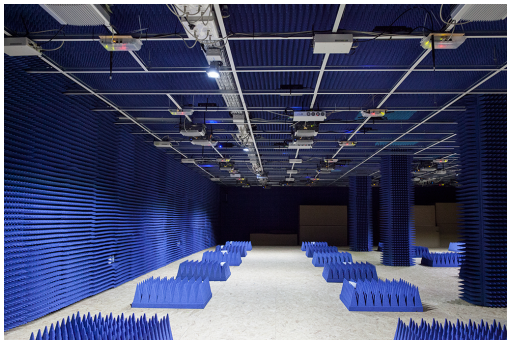
IoT-LAB - testbeds of Equipex FIT

- **Funded project: Equipex FIT (https://fit-equipex.fr/)**

FIT EQUIPEX
Future Internet (of Things) - FRANCE

- **FIT: a initial set of testbeds (IoT, Wi-Fi, SDN, SDR, …)**

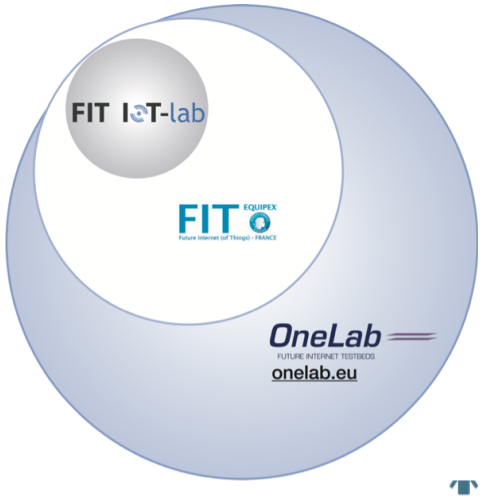


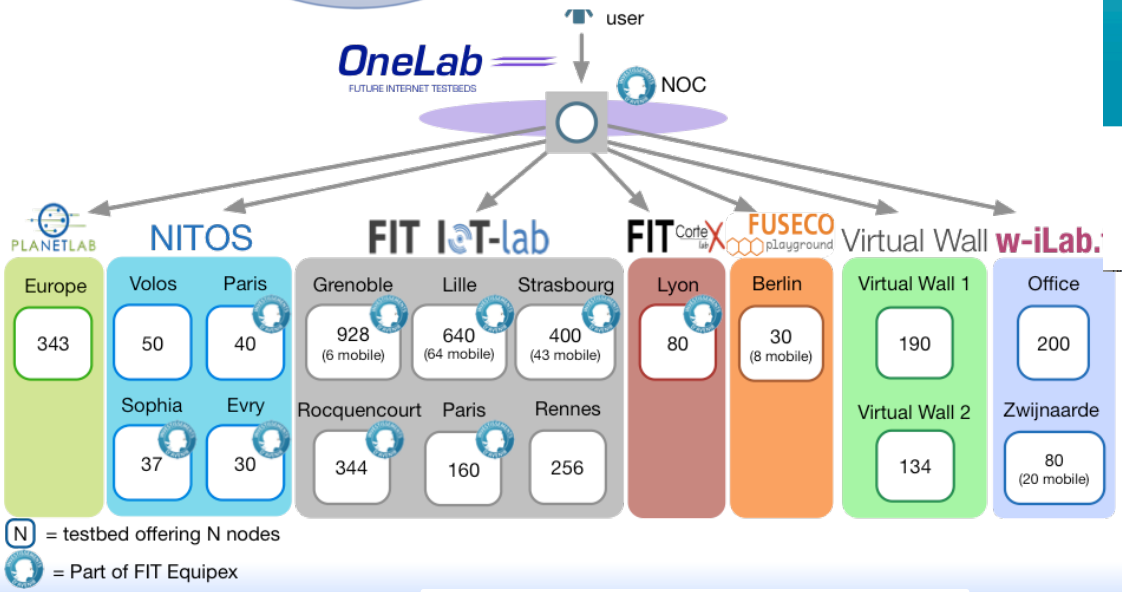


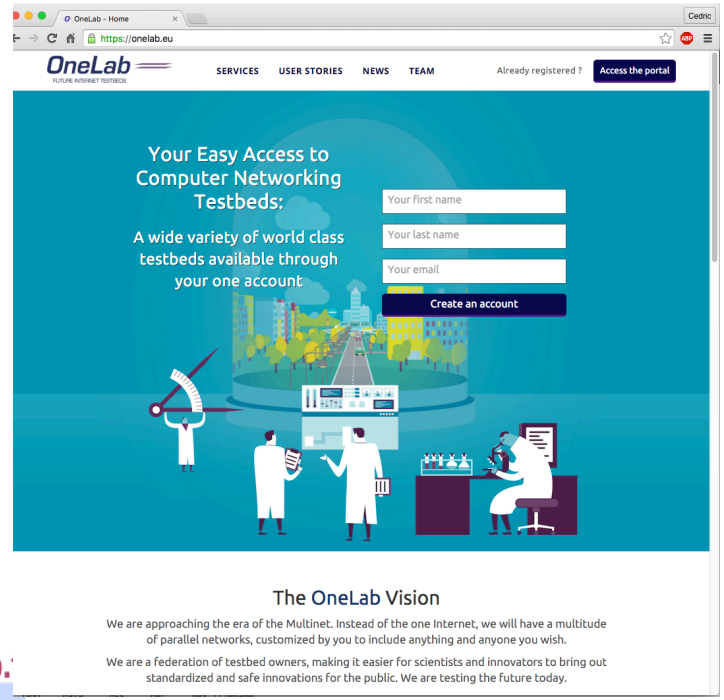
- **Partners**

UPMC SORBONNE UNIVERSITÉS
Inria INVENTEURS DU MONDE NUMÉRIQUE
UNIVERSITÉ DE STRASBOURG
INSTITUT TELECOM
cnrs dépasser les frontières

FIT: part of the OneLab Federation







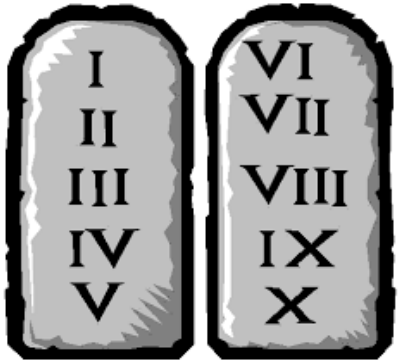
OneLAB.eu

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

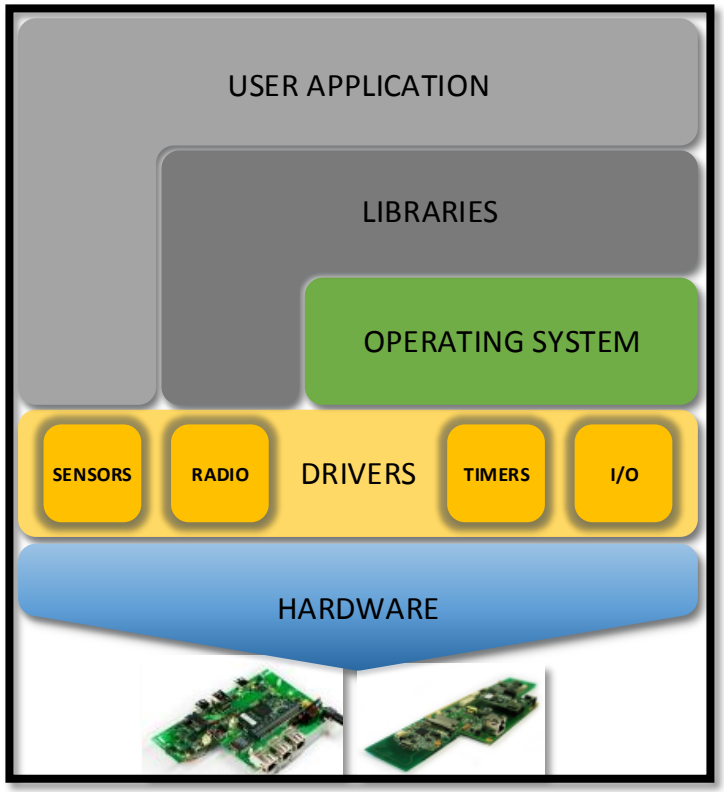
V. Packet sniffer
VI. Precise end-to-end synchronisation (GPS)
VII. Accurate power consumption

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)



RIOT

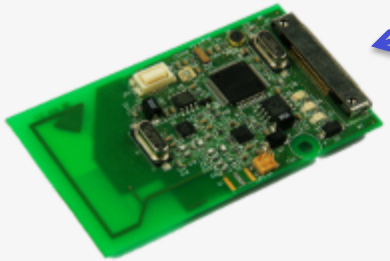
freeRTOS

California OPENWSN BERKELEY

Contiki TinyOS

Initial IoT-LAB Hardware

- WSN430 node : TI MSP430
  - Radio TI CC1101 / CC2420
  - Ambiant 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

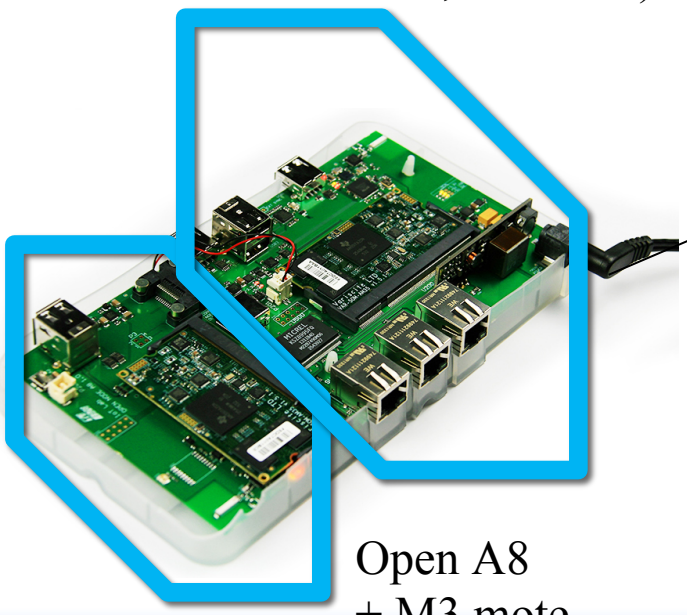
based on TI SITARA AM3505 (Arm Cortex A8) allows to run Linux. This node embeds also a M3 Node with 802.15.4 comm.

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

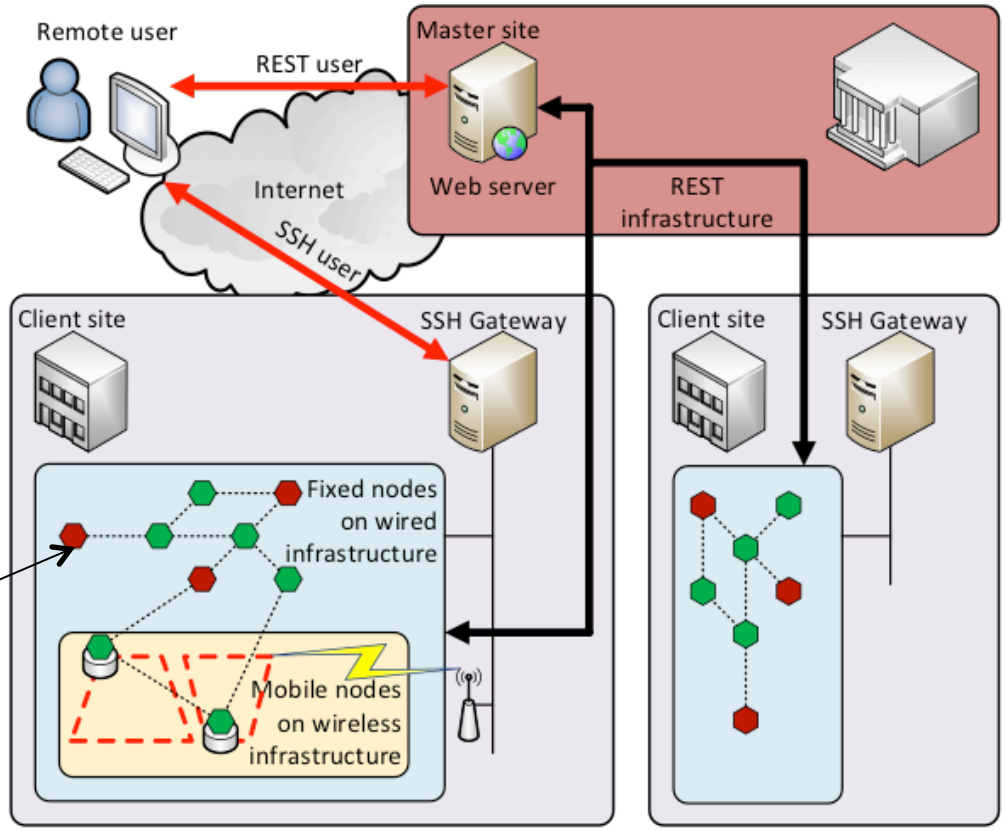
- A8 node : TI-SITARA AM3505
  - Ethernet, USB
  - Linux
  - Indoor GPS for highly accurate synchronisation

IoT-LAB Backend

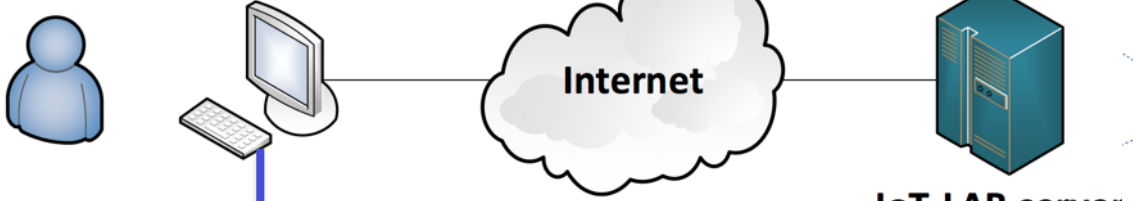
Management
(Linux + mote
802.15.4, sniffer…)

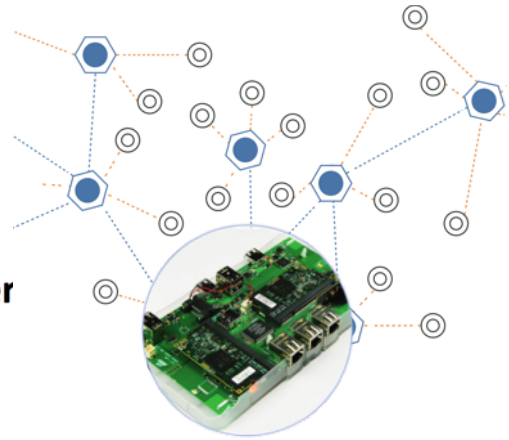


Open A8
+ M3 mote

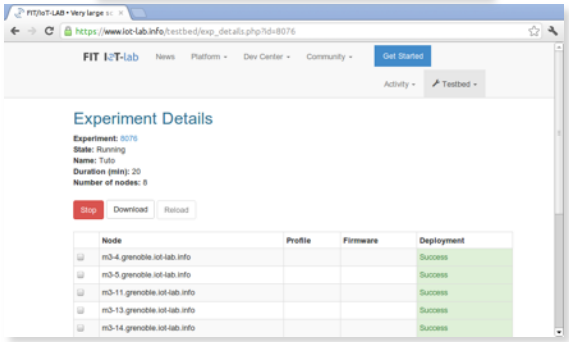


How to run an experiment

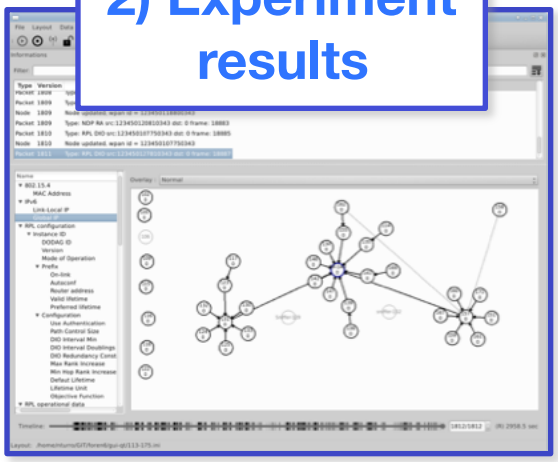




1) Experiment configuration



2) Experiment results



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

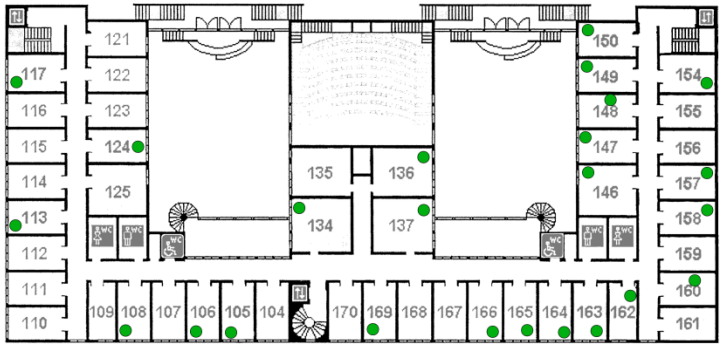
Freie Universität Berlin joins IoT-LAB !

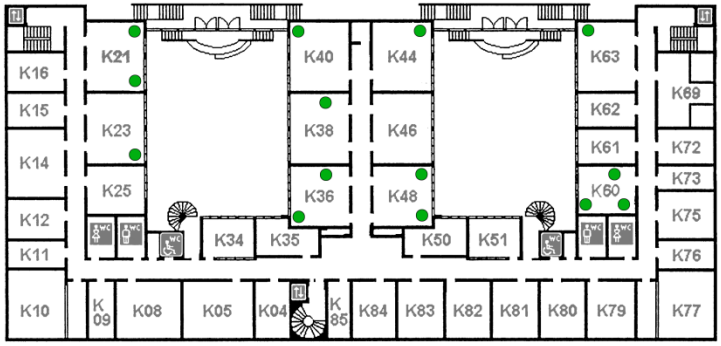
- **IoT-LAB Berlin nodes:**

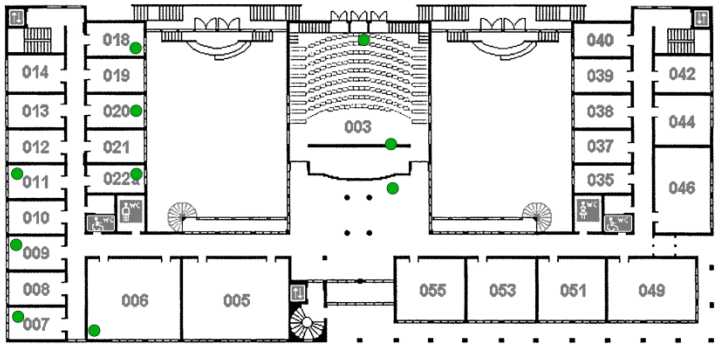
•50 running dual nodes
- Wireless Mesh Node
- MSBA-A2 Wireless Sensor Node

•Spread over 3 floors and 42 rooms

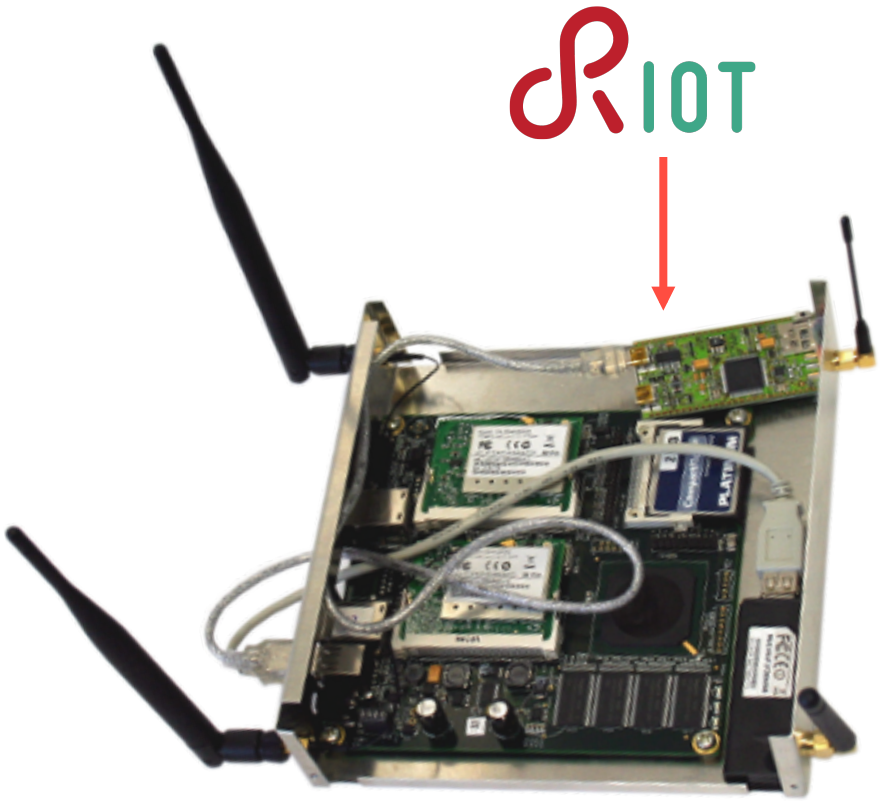
•Integrated in present architecture of the building







IoT-Lab Berlin Nodes

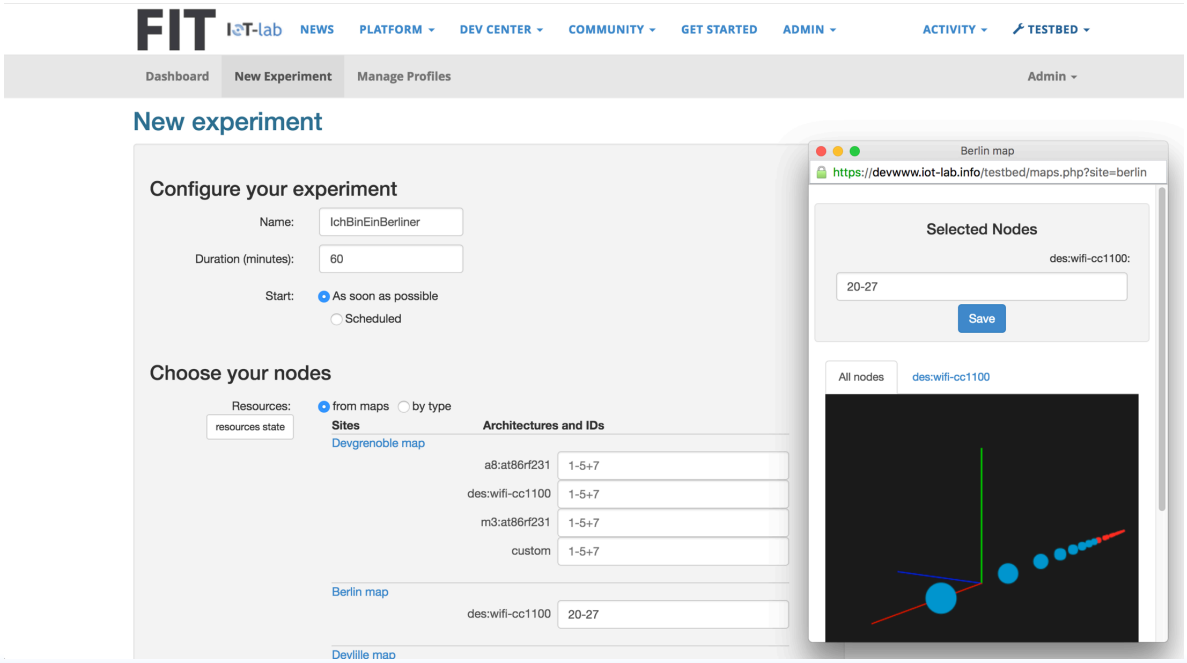


Wireless mesh node
- **PC Engines Alix2c2**
- **500 MHz AMD Geode LX800**
- **256 MB DDR DRAM**
- **2 Ethernet Ports**
  - Via VT6105M
- **2 miniPCI slots and dual USB 2.0 port**
- **CompactFlash socket**
- **Customized enclosure**
- **Debian Linux**
- **3 wireless interfaces, IEEE 802.11a,b,g**

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/

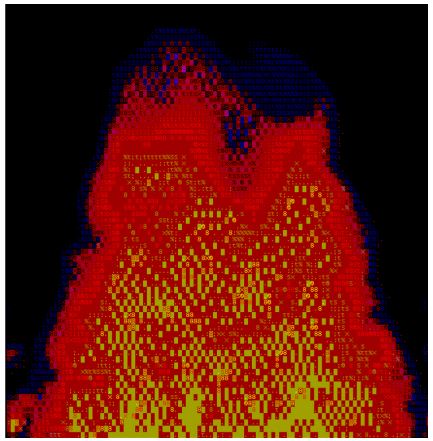


Hands On Tutorial: RIOT on IoT-LAB

- **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 !

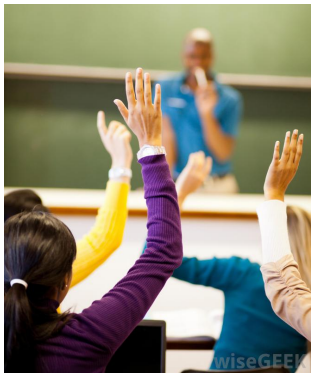
more than 1000 users registered in more than 45 countries

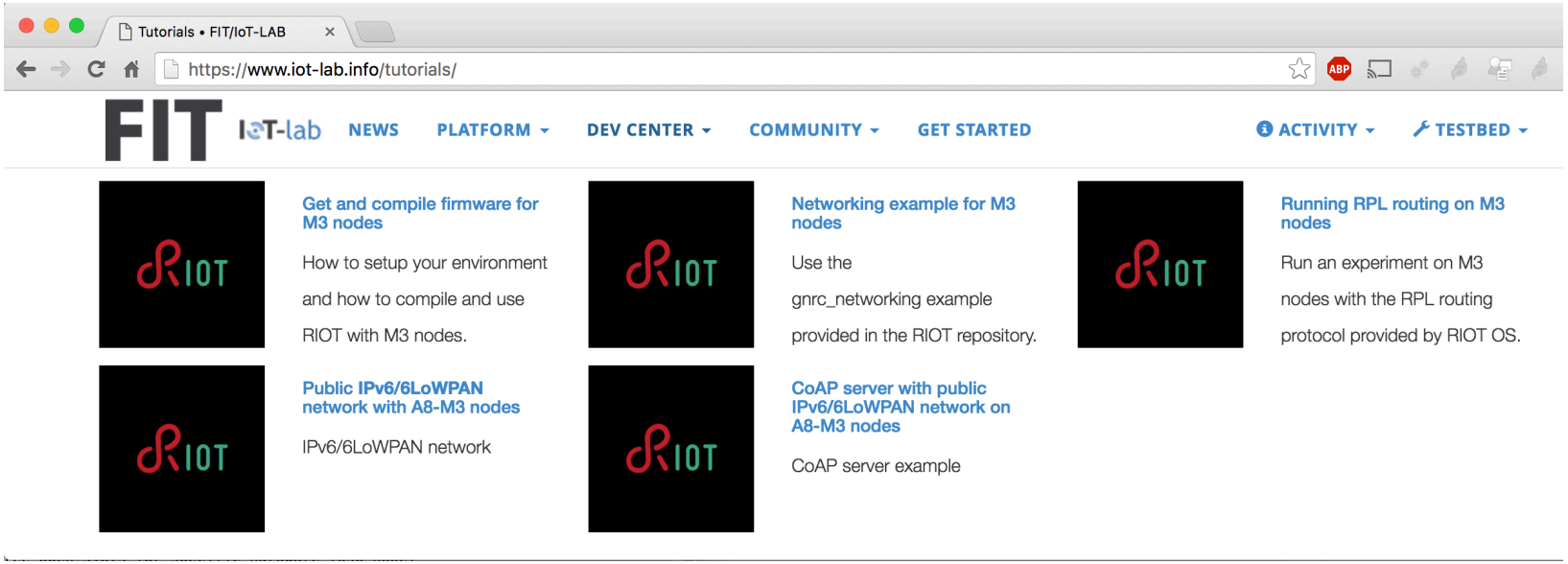
https://www.iot-lab.info

Videos, YouTube channel ”FIT IoT-LAB”

Contact: admin@iot-lab.info

Thank you!
Danke schön!
Questions?




Tutorials • FIT/IoT-LAB
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

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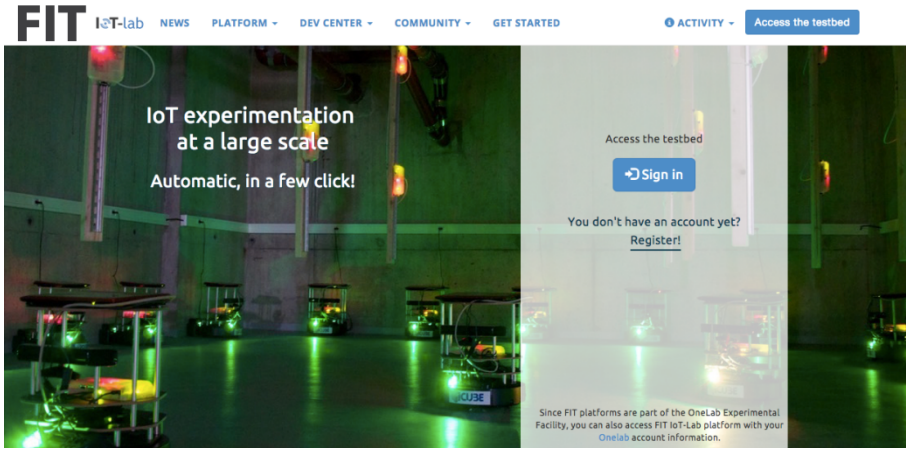
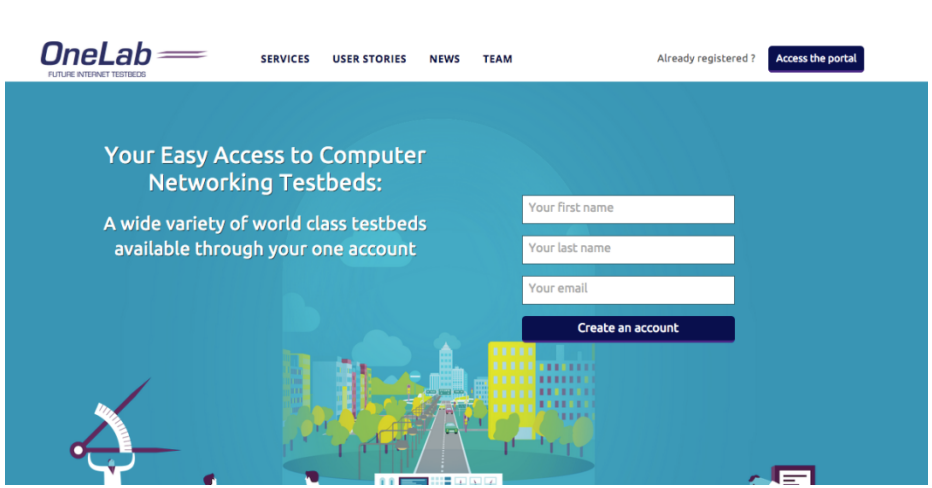
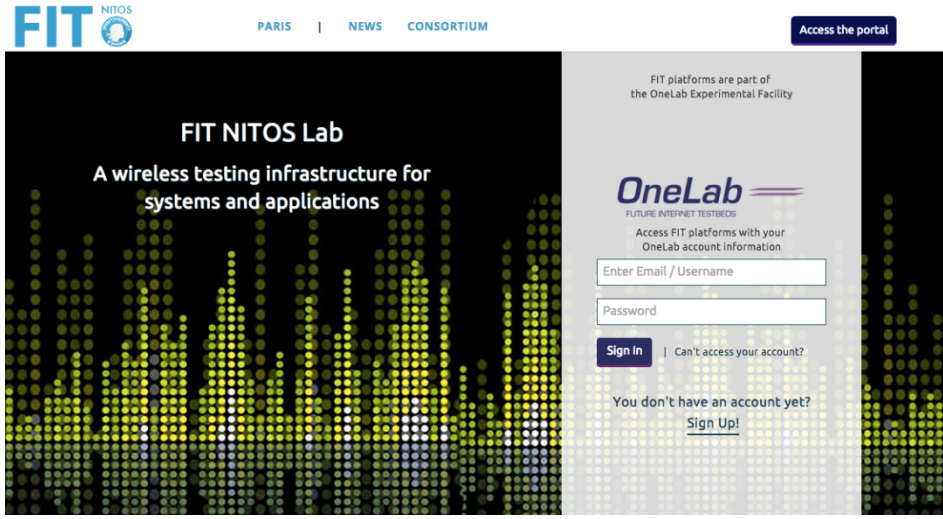


FIT IoT-Lab

FIT CorteXlab



OneLab



FIT NITOS-Lab

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**