

IBBT w-iLab.t

Using the w-iLab.t testbed for
cognitive networking and cognitive
radio research



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outline

- w-iLab.t general info
 - background
 - what is available
 - w-iLab.t possibilities
- w-iLab.t hands-on
 - access policy & accounts
 - getting started

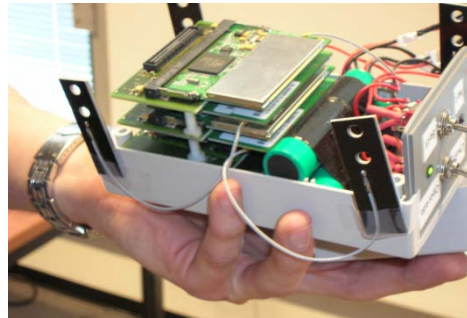


<http://ilabt.ibbt.be>



w-iLab.t background

- interdisciplinary projects @ IBBT
 - some involve wireless networks
 - real-life demonstrators
 - many different test set-ups



w-iLab.t background

- individual set-ups: difficult to...
 - compare results
 - reproduce tests
- small-scale test vs. large-scale evaluation
- how to...
 - enable large-scale wireless experiments?
 - ... in an organized way?
- the answer: a large scale wireless testbed
 - 2007: w-iLab.t

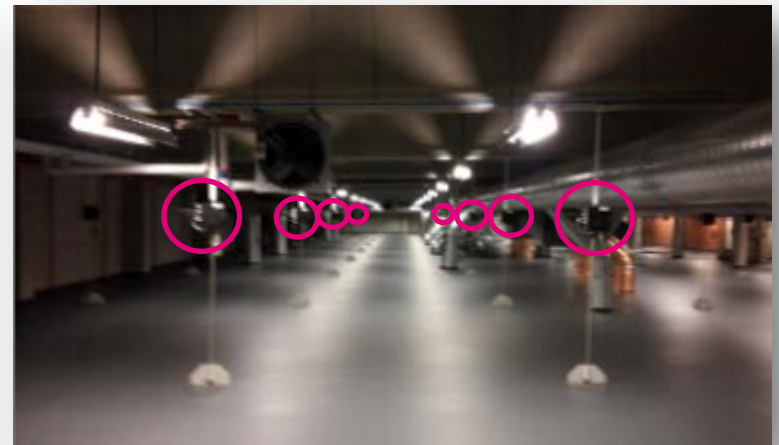
facts and figures

- **generic testbed for wireless networks**

- sensor networks (ZigBee 802.15.4)
- Ad-Hoc, mesh (Wi-Fi 802.11a/b/g/n)
- Bluetooth

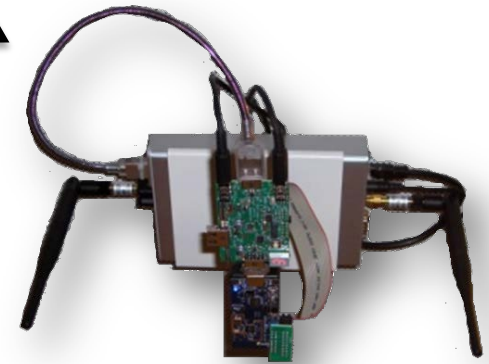
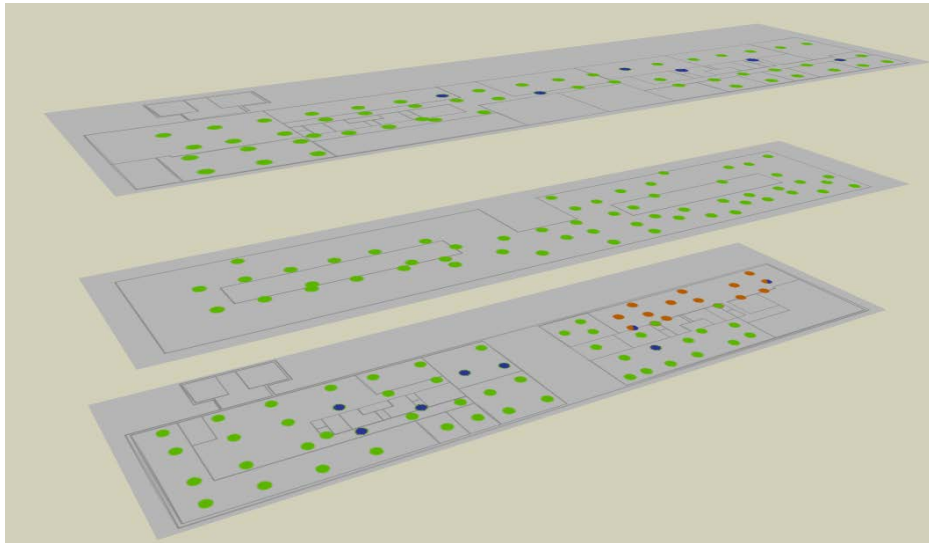
- **2 testbed locations**

- IBBT office: three office floors of 90m x 18m [200 nodes]
- “pseudo-shielded” environment, Zwijnaarde: [60+20 nodes]



facts and figures – node locations

- w-iLab.t testbed

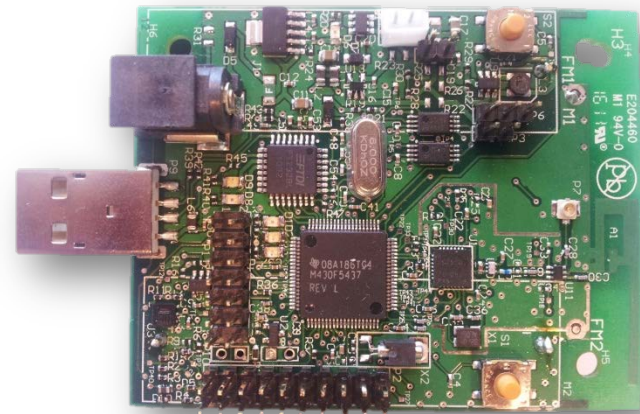


w-iLab.t Zwijnaarde



Hardware – sensor nodes

- Sensor devices
 - TI MSP430 processor
 - Flash memory
 - Chipcon CC2420 radio
 - Sensors for (light), temperature, and humidity



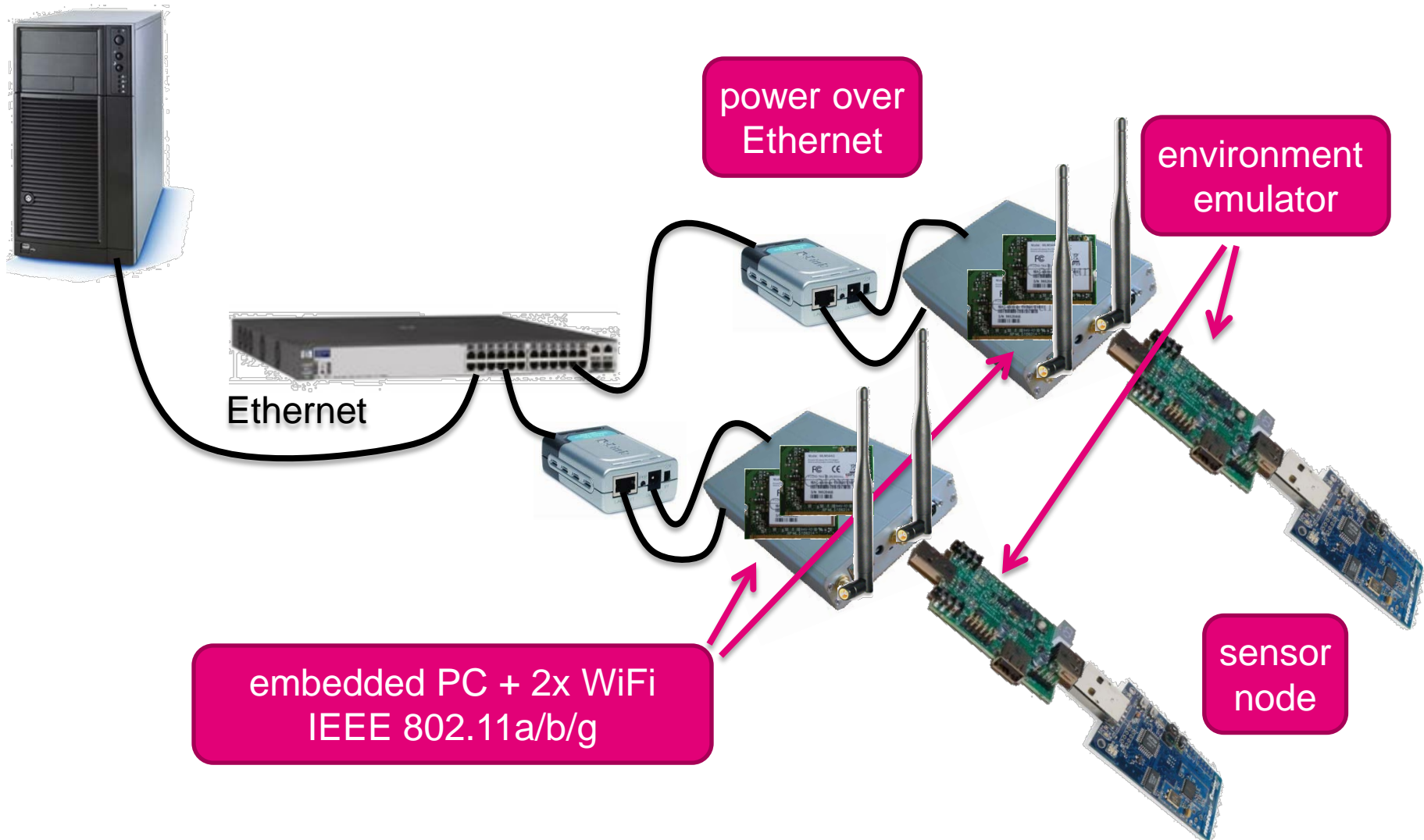
IBBT – Rmoni node

Hardware – embedded PCs

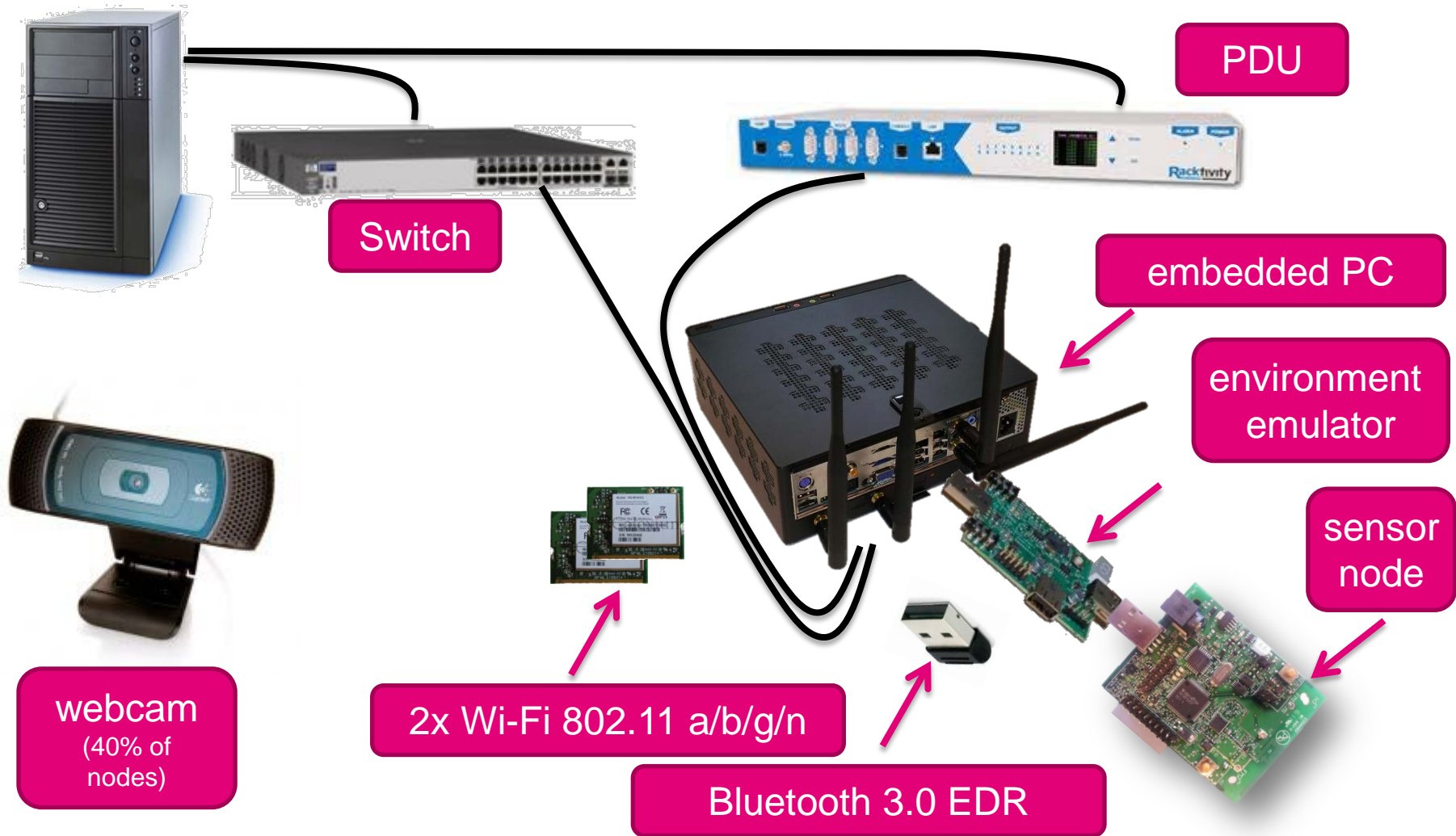


details: www.crew-project.eu/portal/wilabdoc

Hardware: office testbed architecture



Hardware: Zwijnaarde testbed architecture



How can w-iLab.t be used?

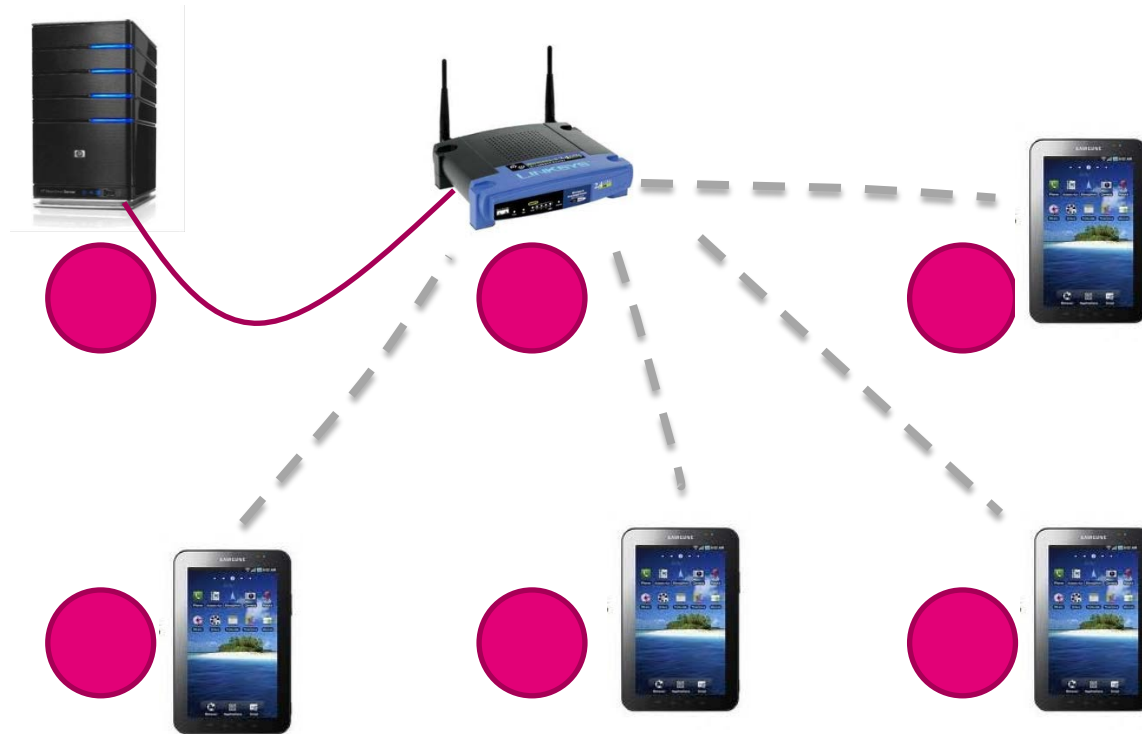
All devices can be used **as if they were on your own desktop**.

But: **w-iLab.t provides tools and the management** for:

- mass-installing nodes
- configuring nodes
- interacting with nodes
- collecting data from nodes
- collecting information on nodes (e.g. power consumption)
- controlling wireless environment
- monitoring the wireless environment
- processing data
- visualizing data
- storing data
- ...

Obtain **more reliable** developments and results, only
in a **faster and more easy** way.

Example configuration



Example configuration (2)



Example configuration (2)



Controlled mobility



based on vacuum cleaning robot



OpenLab



Emulated mobility



- shielded from outside interference
- variable attenuators
- emulate mobility

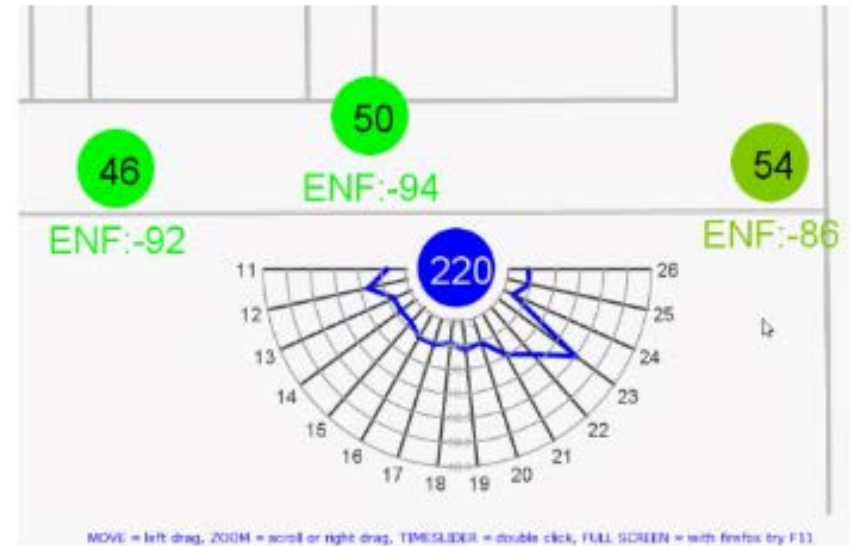




IBBT w-iLab.t

Cognitive radio and cognitive networking components

Cognitive components



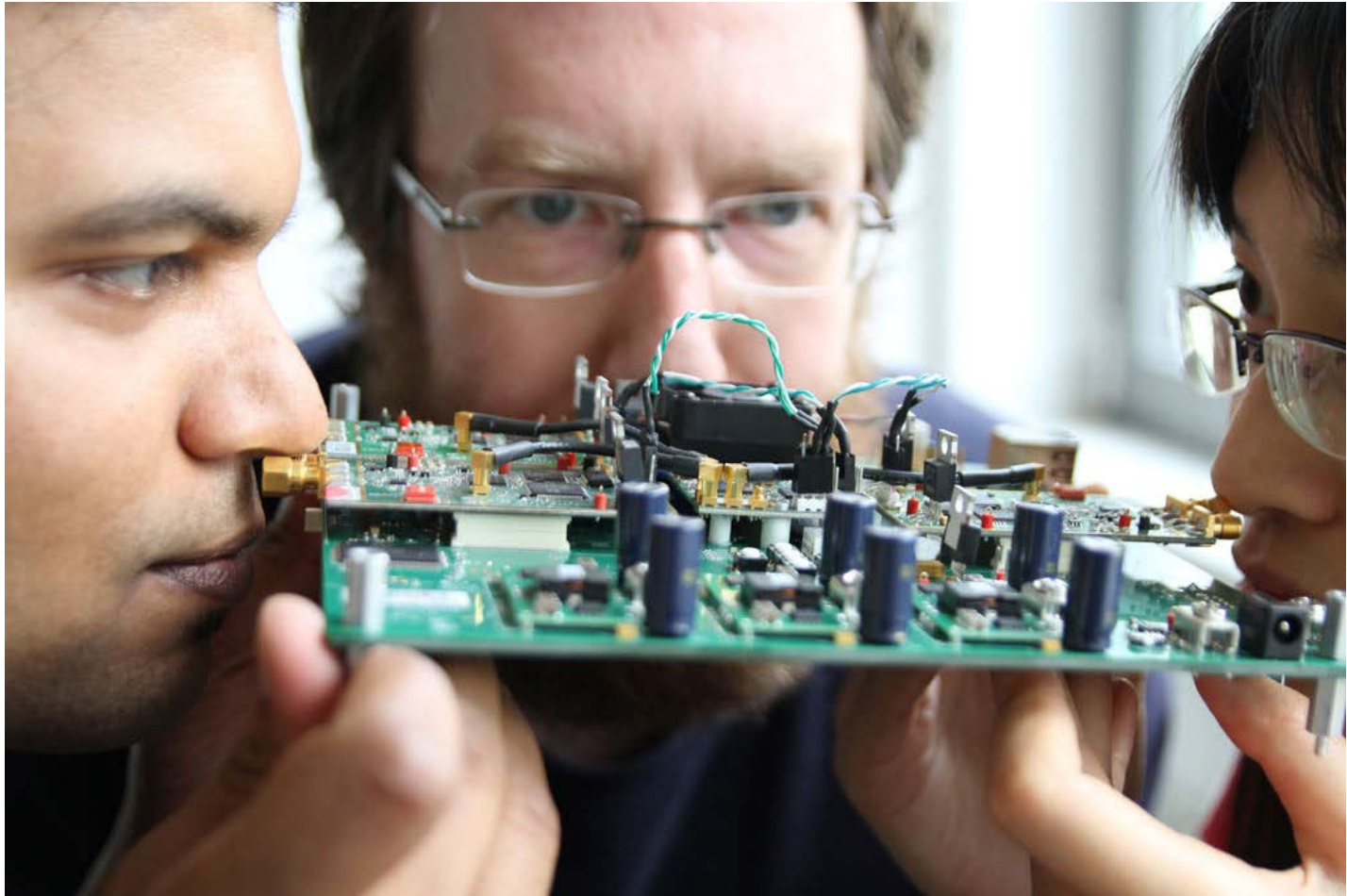
- real-time and post experiment spectrum information
- 10 scanning engines, distributed at the Zwijnaarde location

Cognitive components: USRP2



- USRP2 / USRP N210 devices (facilitate SDR radios)
- dual band 2.4 GHz / 5 GHz ISM daughter boards

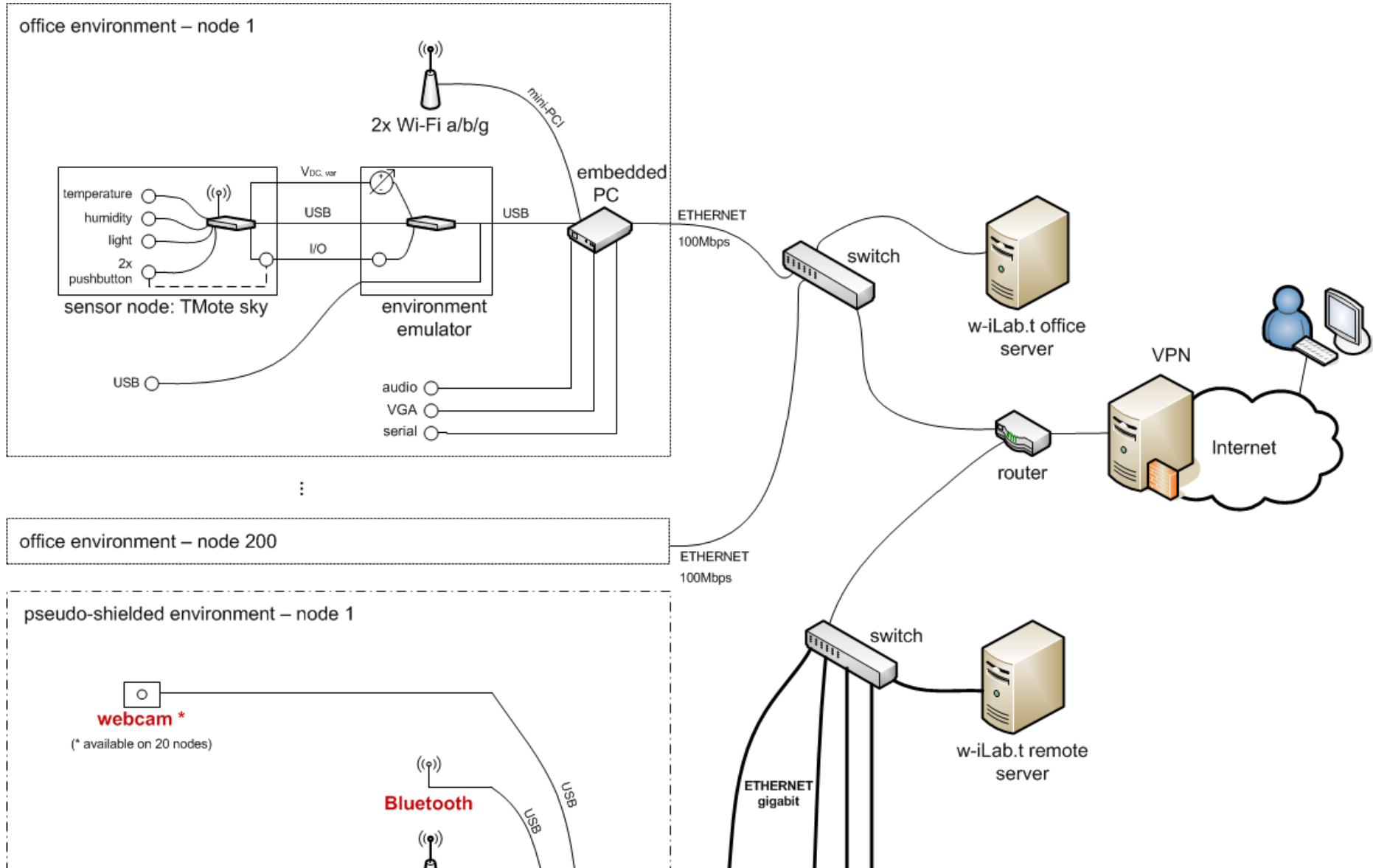
Cognitive components: WARP



Cognitive networking

- cognitive (sensor) networks
 - local scan performed by sensor nodes
 - using information from sensing engines
- example use case: ISM networks in home

Component interconnection



w-iLab.t

Hands-on: controlling the testbed

Connecting to the testbed

- w-iLab.t can be controlled fully remotely
- who can use the testbed?
 - “w-iLab.t classic” (=non-CREW components)
 - best effort access typically free for non-commercial use
 - terms apply
 - see ilabt.ibbt.be (or contact stefan.bouckaert@intec.ugent.be)
 - w-iLab.t CREW components
 - for approved experiments: free or even funded (open call!)
 - availability not guaranteed



Connecting to the testbed

- OpenVPN connection is needed
 - details + apply for an account: see CREW portal



The screenshot shows the top section of the CREW project website. At the top left, the text "CREW project" is displayed in a large, white, sans-serif font, with "Cognitive Radio Experimentation World" in a smaller font below it. To the right of the text is a row of stylized human figures in various colors (green, red, white, blue, yellow) with curved lines behind them suggesting movement or connectivity. Below this is a horizontal navigation bar with ten tabs: "Project", "Consortium - People", "Testbeds", "Events", "Documents", "Publications", "Newsletter", "Links", "Contact", and "Portal". The "Portal" tab is highlighted. Below the navigation bar is a dark blue banner. On the left side of the banner, the text "Open call: CREW portal online!" is followed by a paragraph explaining that the CREW portal is now publicly accessible and providing information on how to use it. On the right side of the banner, there is a yellow-bordered box containing the text "CREW PORTAL: access the CREW facilities" and a list of links: "[Start here] - [Browse by name] - [Overview images] - [Advanced info].".

CREW project
Cognitive Radio Experimentation World

Project Consortium - People Testbeds Events Documents Publications Newsletter Links Contact Portal

Open call: CREW portal online!

The **CREW portal**, holding detailed information on how to use the CREW facilities is now publicly accessible. Use the navigation block next to this text to access the portal. Moreover, updated information on the CREW open call is available in the **Open Call section**.

CREW PORTAL: access the CREW facilities

Interested in using the CREW facilities?
[Start here] - [Browse by name] - [Overview images] - [Advanced info].

www.crew-project.eu/portal

Connecting to the testbed

- Once the openVPN is active:
 - w-iLab.t Office: <http://wilab.atlantis.ugent.be>
 - w-iLab.t Zwijnaarde: OMF-based deployment
 - provisioning of testbed nodes
 - experiment control

w-iLab.t office - user interface

The screenshot shows a web browser window with the address bar displaying `http://www.wilab.test/jobs-create.php?jobid=460`. The browser's menu bar includes 'Bestand', 'Bewerken', 'Beeld', 'Geschiedenis', 'Bladwijzers', 'Extra', and 'Help'. The toolbar contains various icons for navigation and search. The page title is 'www.wilab.test/jobs-create.php'.

The main content area features the 'ibbt w-iLab.t' logo on the left and a navigation menu on the right with links: [user info](#), [schedule](#), [job](#), [scenario](#), [iPlatform](#), [toolbox](#), [status](#), [about](#), [logout](#), and [home](#).

Below the navigation menu, there are tabs for 'description', 'files', 'notes', 'scenario', and 'platform'. The 'files' tab is currently selected.

The 'files' tab content includes the text: 'You can edit the files present in the job below.'

Under the heading 'Program Files', there are two lists of files. The left list contains: '[w-iLab.t]-RadioPerf-Image_021208', 'wilabdemo_v0_10_1', 'Sniffer', and 'wilabdemo_V0_2_0'. The right list contains: 'wilabdemo_V0_2_4'. Below these lists are buttons for 'Delete', 'Add >>', and '<< Remove'.

Under the heading 'Class Files', there are two lists of files. The left list contains: '[w-iLab.t]-sniffer-msg-class-June26', '[w-iLab.t]-RadioPerf-ReportMsg', '[w-iLab.t]-EEMsgEventReport', and '[w-iLab.t]-PrintMsg'. The right list contains: '[w-iLab.t]-EEMsgSamplerReport', 'ChannelScanInfoMsg', 'LinkQualityMessage', and 'PrintMsg'. Below these lists are buttons for 'Delete', 'Add >>', and 'Remove <<'.

At the bottom of the 'files' tab, there is a 'Next' button.

Below the 'files' tab, there is a section for uploading a file. It includes the text 'Select a file to upload:' followed by a text input field and a 'Bladeren...' button. Below this, there is the text 'Provide a reference name:' followed by a text input field. At the bottom, there is the text 'Provide any comments or other information:' followed by a text area.

The browser's status bar at the bottom shows the text 'Klaar' and the system clock displaying '21:18' and '28/09/2010'.

w-iLab.t office - user interface

The screenshot shows a web browser window with the address bar displaying `http://www.wilab.test/view-schedule.php?programJob=&numHours=6&startHour=21&startDay=1285624800&resolution=5&jobID=460&zoneID=29&...`. The page title is `www.wilab.test/view-schedule.php`.

The main content area includes a control bar with the following elements:

- Show hours starting at on in minute chunks.
-
-

Below the control bar, a status message reads: "You have a quota of 3600 minutes. You have 240 minutes of pending jobs. You have 3360 minutes available."

The interface also features a configuration section:

- Run with on [Zone Info](#)

Instructions for using the interface are provided:

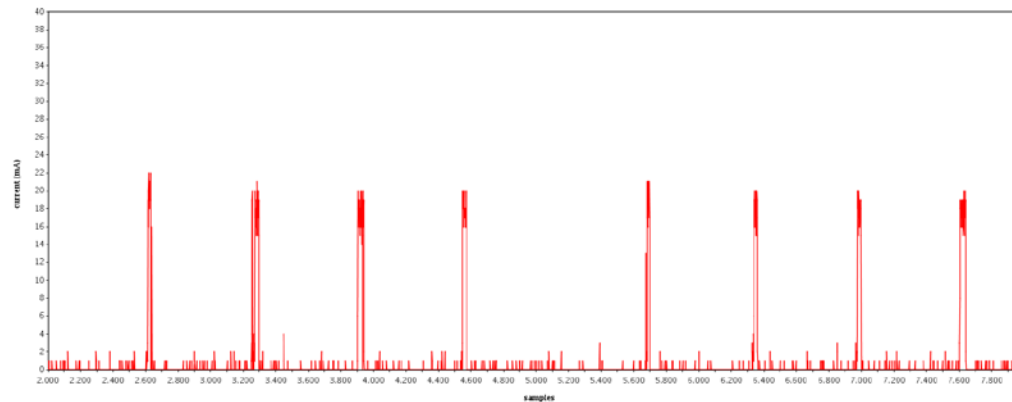
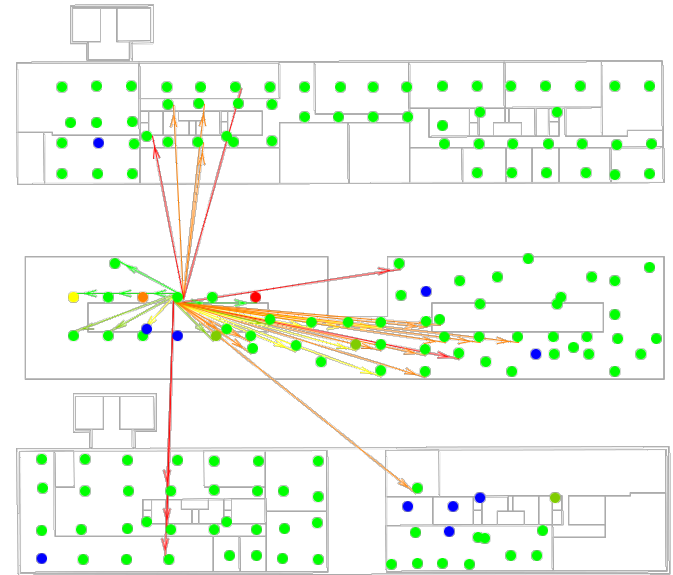
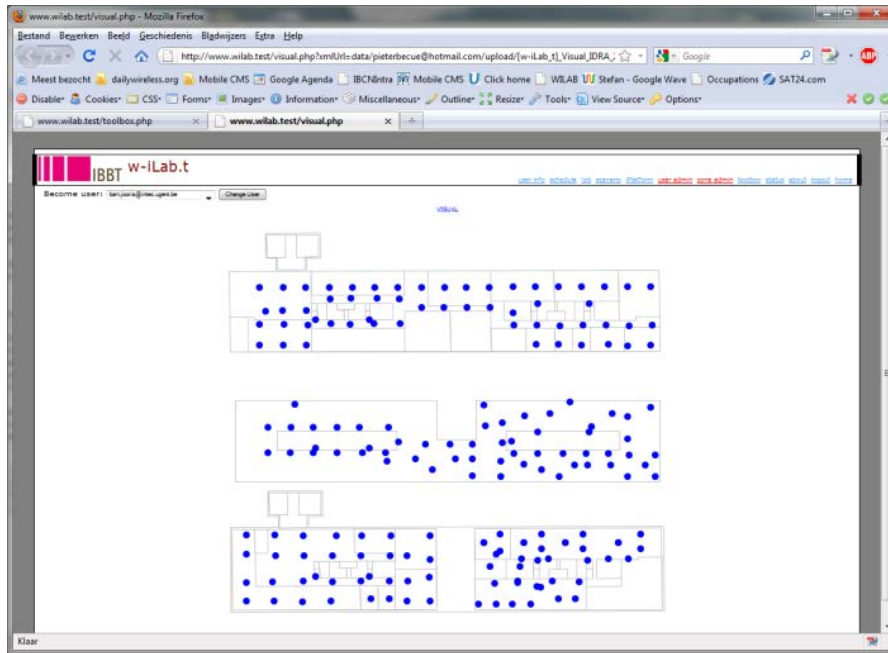
- To begin selecting, double click on an available slot.
- To continue selecting, single click on an adjacent slot.
- To cancel your selection, double click again anywhere inside your selection.

The main display area shows a table of time slots. The first column contains time values from 21:00 to 22:10 in 5-minute increments. The second column contains a list of jobs, each with a unique ID and a "Delete" button. The jobs are as follows:

Time	Job
21:00	
21:05	
21:10	
21:15	[wilab.demo@intec.ugent.be 13709 InterferenceAvoidance (zuiderpoort + sandbox) {=}Delete]
21:20	[wilab.demo@intec.ugent.be 13709 InterferenceAvoidance (zuiderpoort + sandbox) {=}Delete]
21:25	[wilab.demo@intec.ugent.be 13709 InterferenceAvoidance (zuiderpoort + sandbox) {=}Delete]
21:30	[wilab.demo@intec.ugent.be 13709 InterferenceAvoidance (zuiderpoort + sandbox) {=}Delete]
21:35	[wilab.demo@intec.ugent.be 13709 InterferenceAvoidance (zuiderpoort + sandbox) {=}Delete]
21:40	[wilab.demo@intec.ugent.be 13709 InterferenceAvoidance (zuiderpoort + sandbox) {=}Delete]
21:45	[wilab.demo@intec.ugent.be 13709 InterferenceAvoidance (zuiderpoort + sandbox) {=}Delete]
21:50	[wilab.demo@intec.ugent.be 13709 InterferenceAvoidance (zuiderpoort + sandbox) {=}Delete]
21:55	[wilab.demo@intec.ugent.be 13709 InterferenceAvoidance (zuiderpoort + sandbox) {=}Delete]
22:00	
22:05	
22:10	

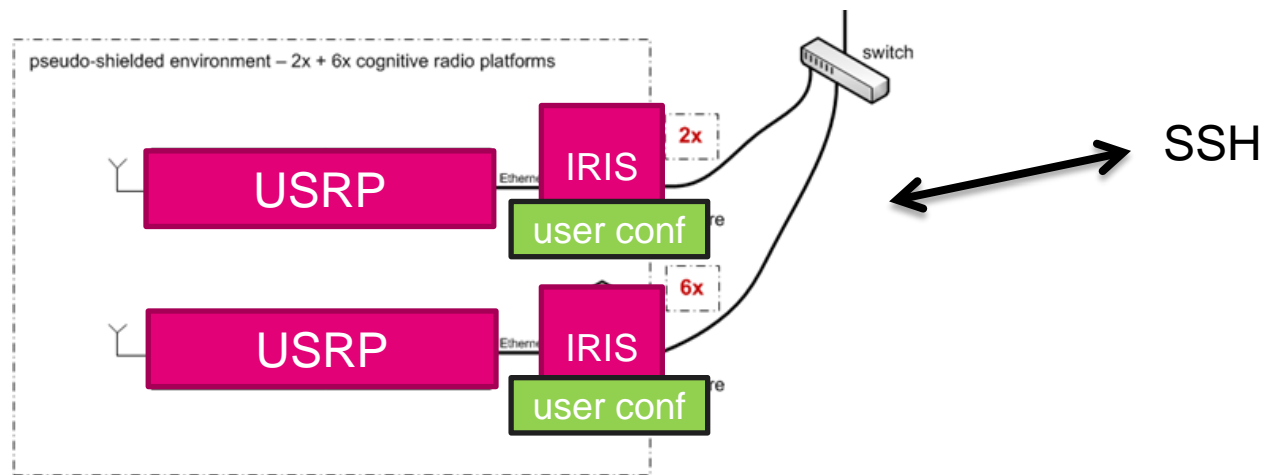
The browser's taskbar at the bottom shows the system clock as 21:26 on 28/09/2010.

w-iLab.t office - user interface



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Video demo

- Spectrum sensing with USRPs
- Benchmarking

Summary: the w-iLab.t

- generic wireless testbed
- heterogeneous wireless nodes
- software defined radios / spectrum sensing engines
- supports full experiment lifecycle
 - easy deployment of code across a wide selection of nodes
 - analysis of results
- enabler for experimentally-driven research

The w-iLab.t testbed



Questions?



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<http://ilabt.ibbt.be>

<http://www.crew-project.eu/portal/wilabdoc>