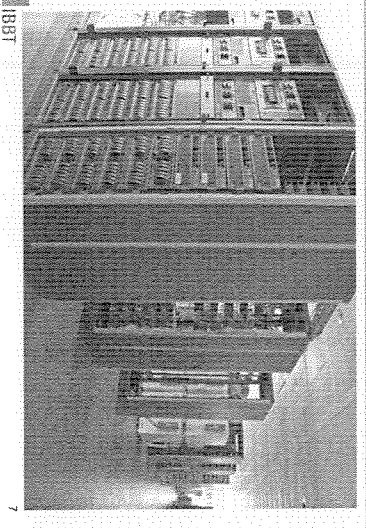
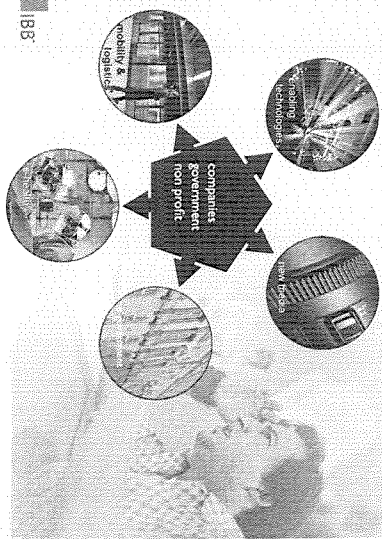


ilab.t : Overview

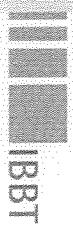


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Demand driven research



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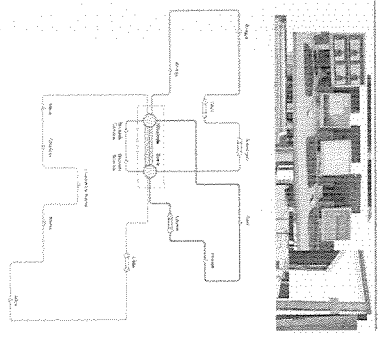
Experimentation at IBBT

Ingrid Moerman & Bart De Vrieschauer
IBBT – Ghent University

3874
new/m 3

Experimental facilities

- Fixed Access & Aggregation
- Wireless Access
- Media Production
- Grid Computing
- Test Equipment
- Connectivity (>20 Gbit/s)



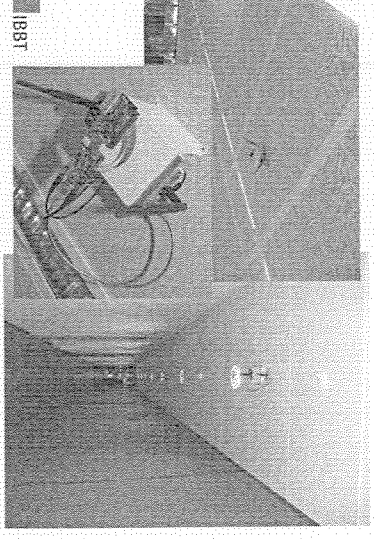
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Interdisciplinary research

- INTERDISCIPLINARY approach**
 - technological clusters
 - networks of the future
 - advanced software technology
 - multimedia & interfaces
- non-technological clusters**
 - policy & market
 - Usability
- Virtual Institute**
 - 16 academic research groups in 5 universities in Flanders (Belgium) with 600+ researchers
 - Total +/- 150 projects in the last 5 years
 - 50% input by companies
 - over 300 research partners

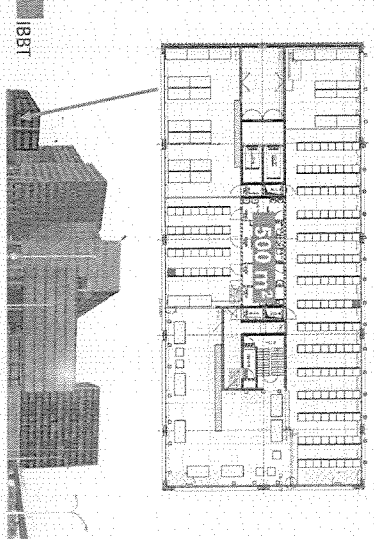
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ilab.t : Wireless Lab



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ilab.t – Technology center @ IBBT



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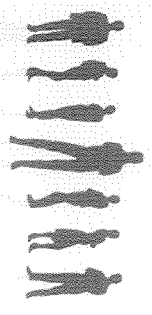
Experimentation at IBBT

- Who is IBBT?
 - IBBT ilab.t: Wireless Lab
 - IBBT ilab.t: Virtual Wall

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Mission of IBBT

The creation of highly competent human capital through interdisciplinary demand driven basic research, aimed at ICT and broad band services in collaboration with companies and government



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A few realistic use cases*

WBA: Wireless Building Automation

DEUS: Deployment and Easy Use of wireless Services

- * Senior mobility support
- * Cultural events
- * Inheritance

* Taken from IBBT cooperative research projects

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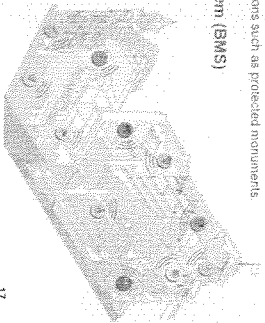
WBA: Wireless Building Automation

Target

- * to develop advanced building automation techniques in order to deploy building management systems, hereby:
 - * avoiding as much as possible costly and inflexible cable infrastructures
 - * covering hard to reach locations such as protected monuments

Building Management System (BMS)

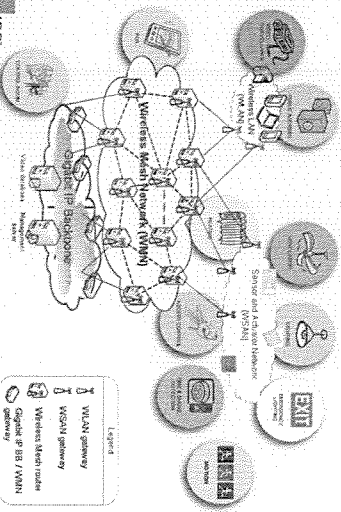
- * monitor & control of
 - HVAC control
 - (emergency) lighting
 - access control
 - fire detection
 - motion detection
 - positioning
- * High data rate applications
 - camera surveillance
 - public address (video display, stereo)



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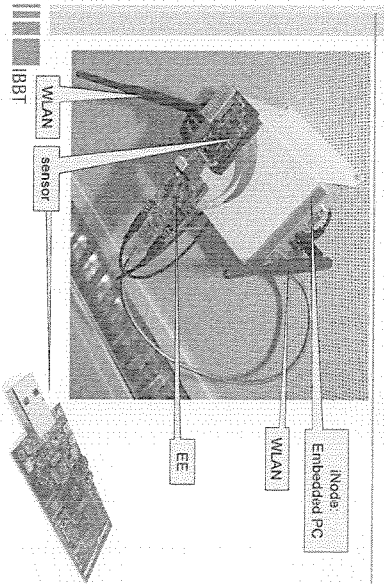
WBA: Wireless Building Automation



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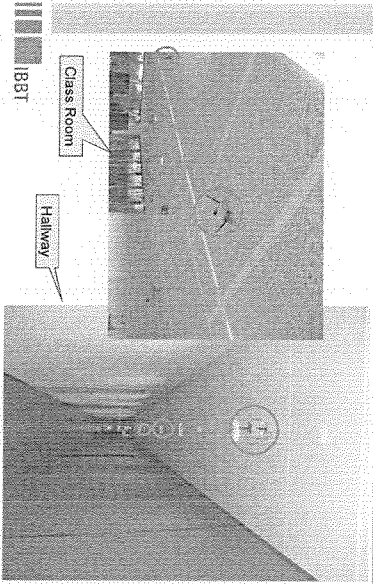
ilab.t: Wireless Lab Hardware



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Wilab deployment @ IBBT building



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IBBT ilab.t - Wireless Lab

Feature set

- * # nodes: 200 fixed locations, 3 floors @ Zuidpoort
- * Every node is generic and is equipped with
 - 1 USB RS485, VGA interfaces
 - 2 USB RS232, VGA interfaces
 - 1 or 2 sensor nodes IEEE802.15.4 (+ embedded sensors: Temperature, Light, Humidity)
 - 2 WiFi IEEE 802.11 radios (active)
- * Every node is powered via PoE and can be disabled
- * Environment emulator (EE)
 - EE can emulate battery voltage of the sensor nodes and can measure the consumed electrical power (real time)
 - EE can log the events of the sensor nodes
 - EE can log the events of the sensor nodes
- * Sensor nodes can measure and react on real and emulated environmental variables
 - Temperature
 - Humidity
 - Light (nodes)
 - Click (nodes)
- * Remote access

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IBBT ilab.t: Wireless Lab

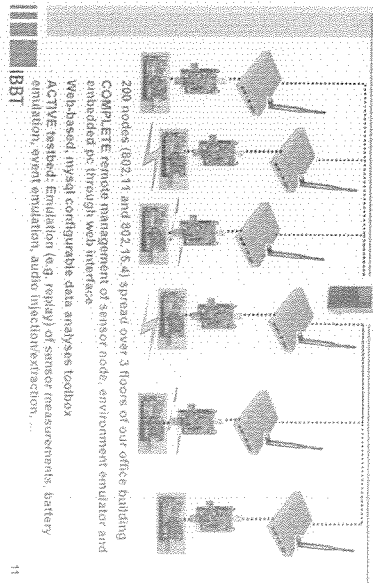
Wireless Lab setup

- * Use cases
- * Practical usage
- * Next steps

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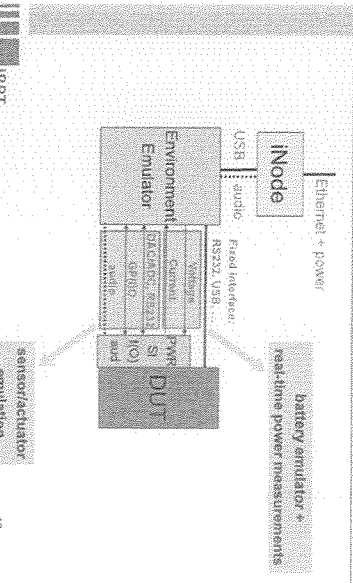
IBBT Wireless Lab - architecture



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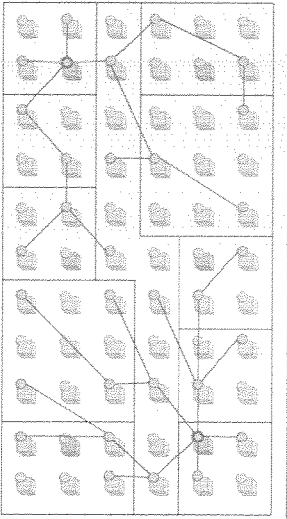
IBBT Wireless Lab: Environment Emulator



IBBT

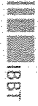
12

WBA @ Wireless Lab

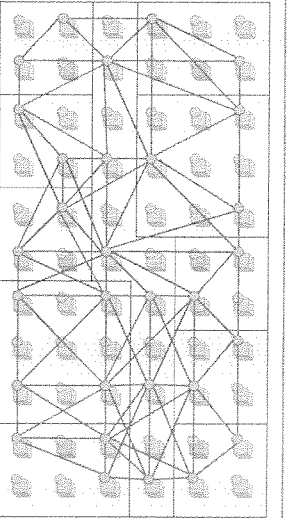


Set up wireless sensor network (WSN)
Sink advertisement + set up (tree) topology

Sensor node 25
Mesh node



WBA @ Wireless Lab

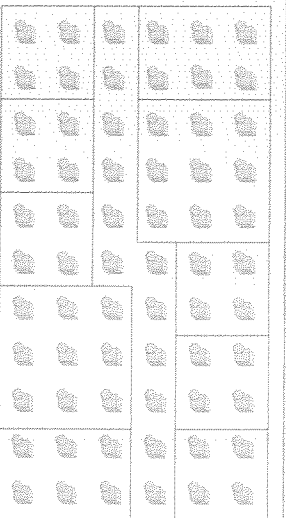


Set up wireless sensor network (WSN)

Sensor node 22
Mesh node



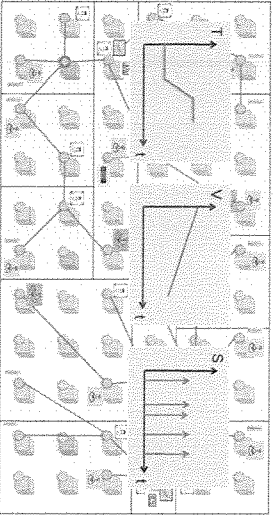
WBA @ Wireless Lab



Sensor node 19
Mesh node



WBA @ Wireless Lab

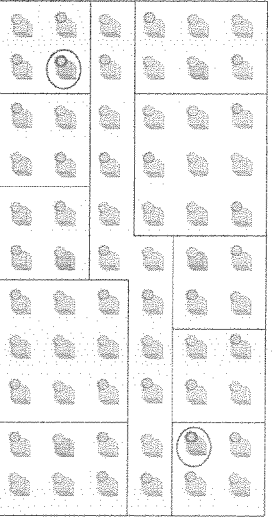


Set up wireless sensor network (WSN)
Sink advertisement + set up (tree) topology
Emulate sensor & actuator events

Sensor node 26
Mesh node



WBA @ Wireless Lab

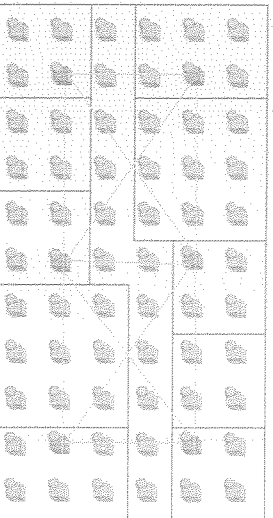


Set up wireless sensor network (WSN)
+ define WSN gateways

Sensor node 23
Mesh node



WBA @ Wireless Lab

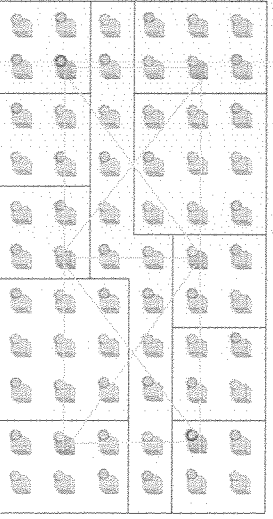


Set up wireless mesh network (WMN)

Sensor node 20
Mesh node



WBA @ Wireless Lab

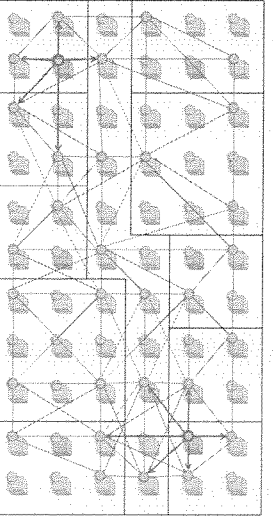


Test robustness upon WMN and/or WSN node failure

Sensor node 27
Mesh node



WBA @ Wireless Lab

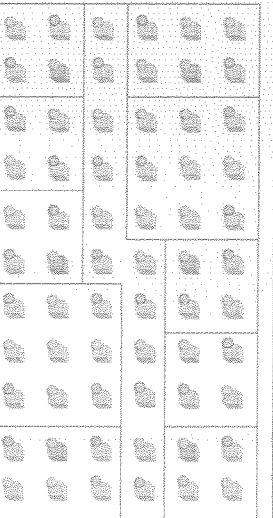


Set up wireless sensor network (WSN)
Sink advertisement + set up topology

Sensor node 24
Mesh node



WBA @ Wireless Lab

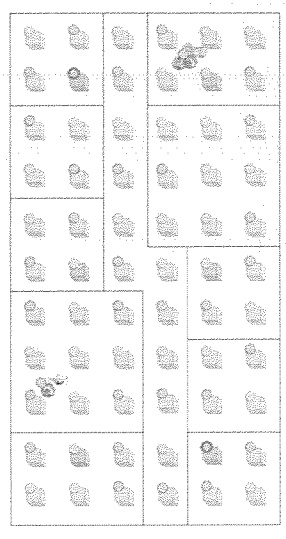


Set up wireless sensor network (WSN)

Sensor node 21
Mesh node



DEUS @ Wireless Lab



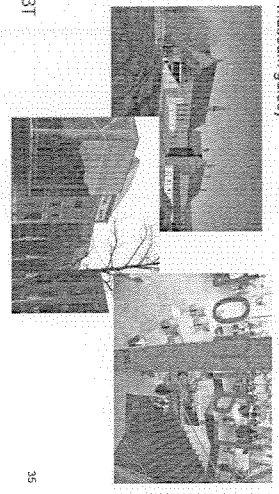
emergency call & voice call
(through environment emulator)

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Sensor node 34
Mesh node

DEUS: Deployment and Easy Use of wireless Services

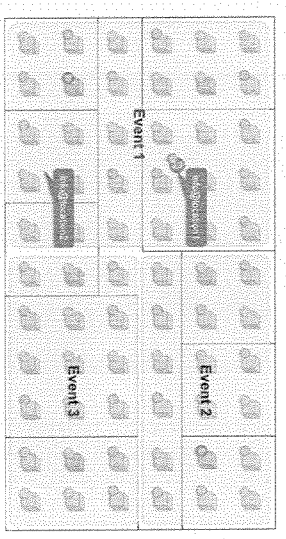
- Use case 3: inheritance ('erfgood')
- support of multiple events taking place at the same location, while settings may change from day-to-day
- offering location-aware and profile-based services (e.g. interactive museum guide)



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DEUS @ Wireless Lab

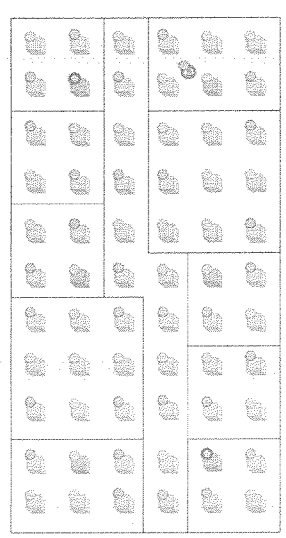


multiple events
Location-based services

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Sensor node 35
Mesh node

DEUS @ Wireless Lab



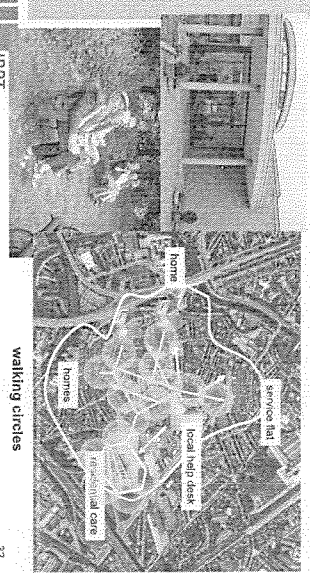
Indoor positioning / tracking / guiding

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Sensor node 31
Mesh node

DEUS: Deployment and Easy Use of wireless Services

Use case 2: senior mobility support

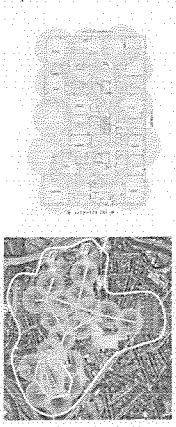


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DEUS: Deployment and Easy Use of wireless Services

- Use case 2: senior mobility support
 - Tracking and identification of persons
 - follow up of people with dementia
 - low cost indoor and outdoor positioning
 - Emergency call
 - Voice call
- Portable device with emergency button and voice connectivity (same low cost device & same technology for indoor and outdoor).



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WBA @ Wireless Lab



Testing of large scale sensor network

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Sensor node 28
Mesh node

WBA @ Wireless Lab



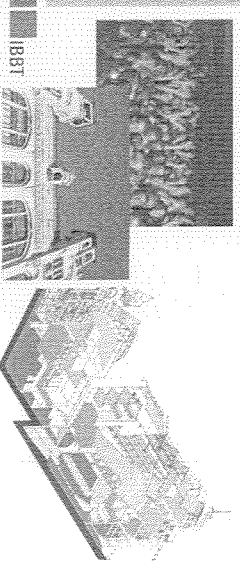
Testing of large scale sensor network

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Sensor node 29
Mesh node

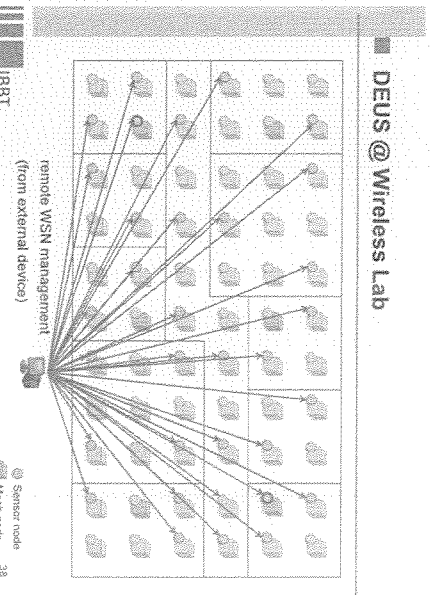
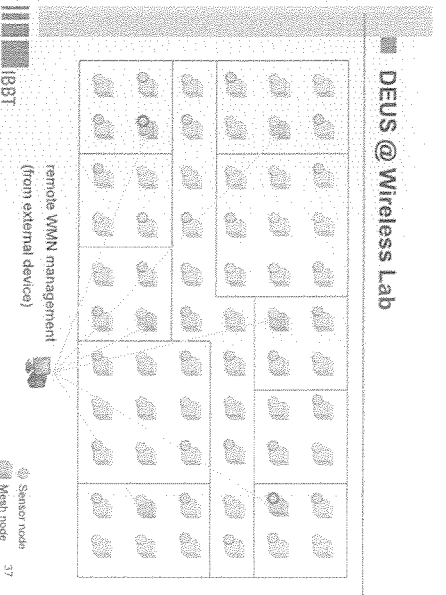
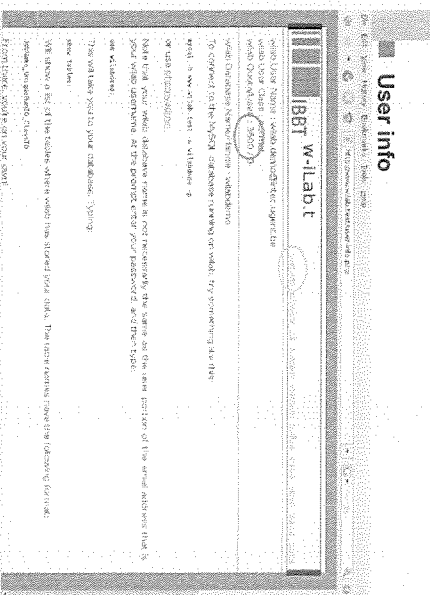
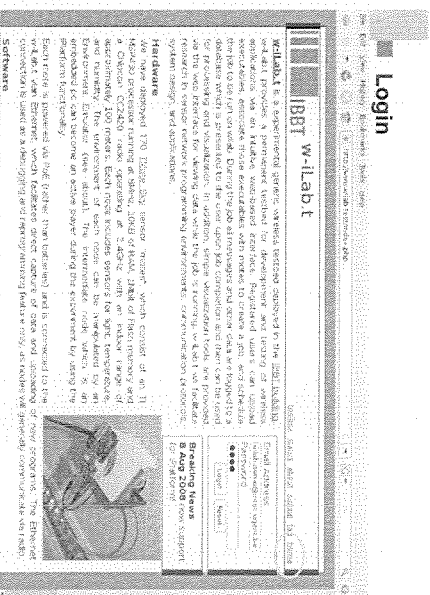
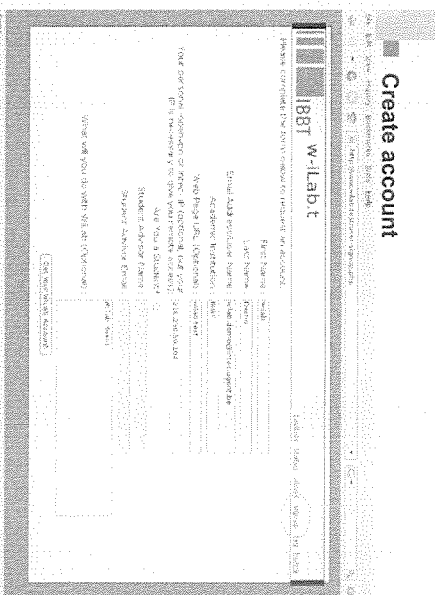
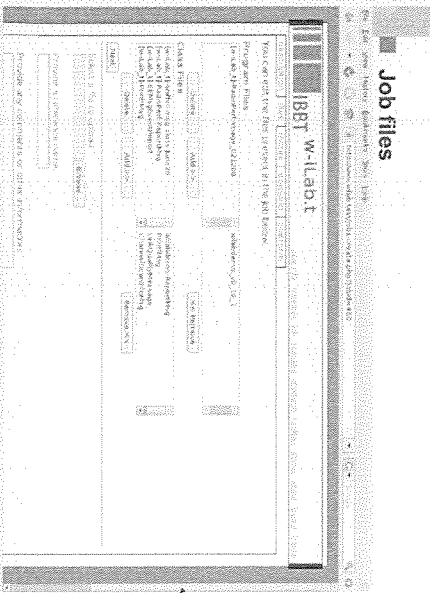
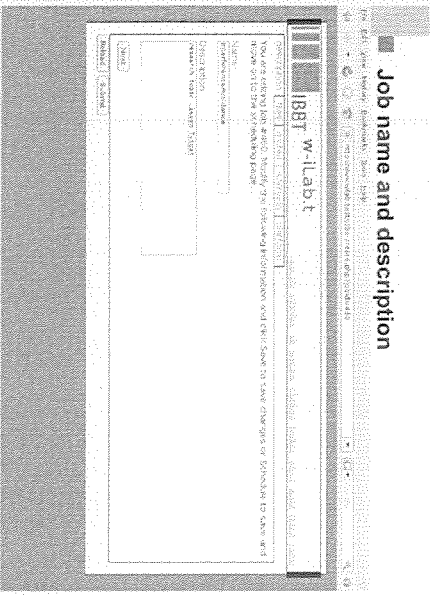
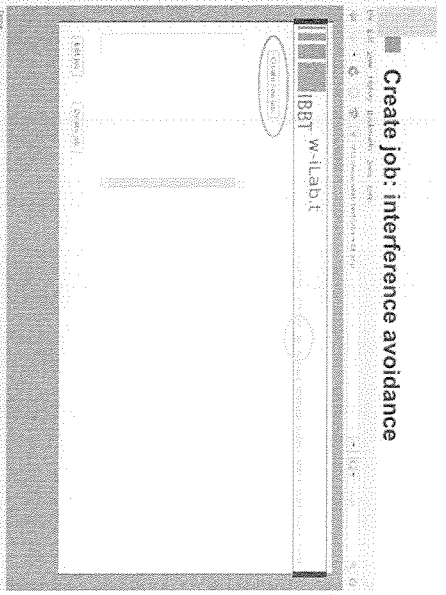
DEUS: Deployment and Easy Use of wireless Services

- Use case 1: cultural events
- Guiding of persons in and around public areas
 - wireless location-based / personalized applications for indoor guiding
 - combination with outdoor guiding with GPS
- Tracking of person/assists



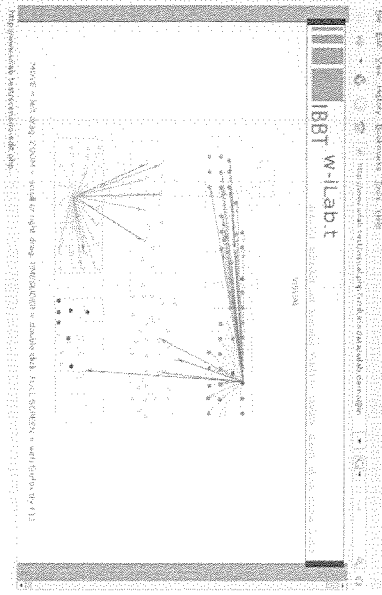
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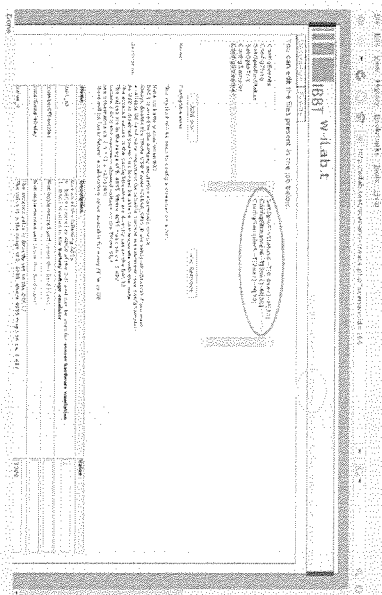


- ### Setting up an experiment
- Create account
 - View user info (quota)
 - Create a job
 - Upload tinyos firmware and message class files
 - Select/exclude the nodes
 - Prepare scenarios
 - Eg. list of events for battery depletion
 - Schedule the job
 - Execute scenarios while job is running
 - Watch experiments results real time or off line
 - Analyzer
 - Visualizer

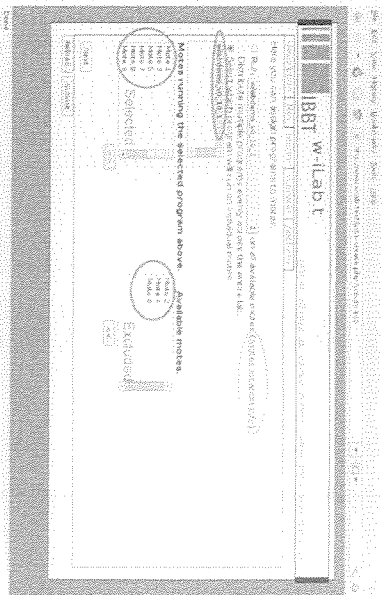
Real time visualization of the experiment: links



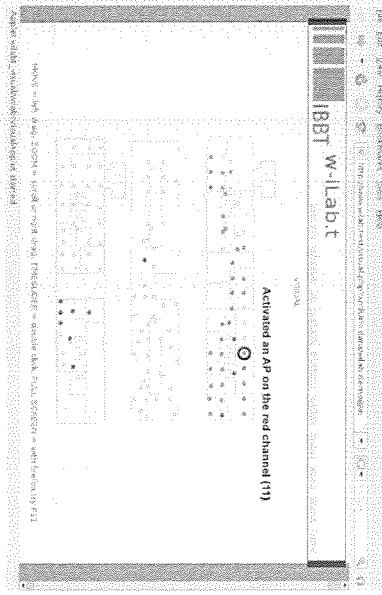
Scenario = list of the presented events



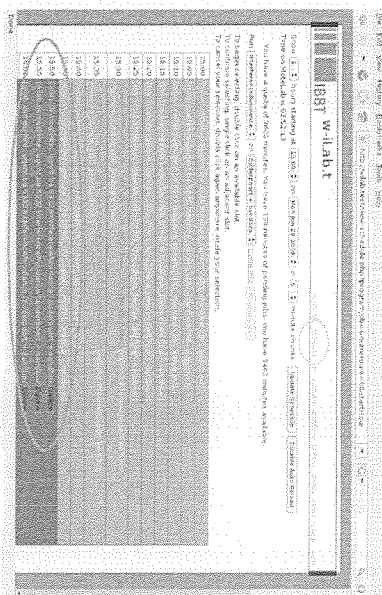
Job sensornodes



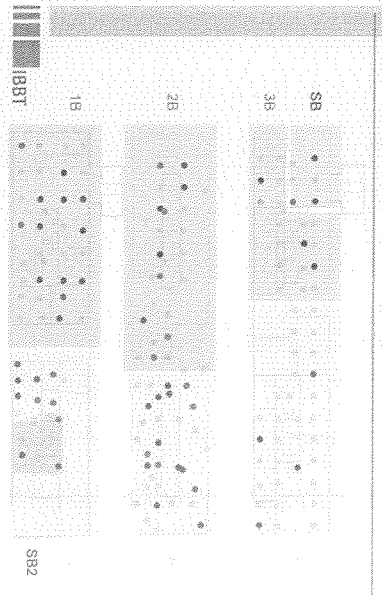
Real time visualization of the experiment: +AP



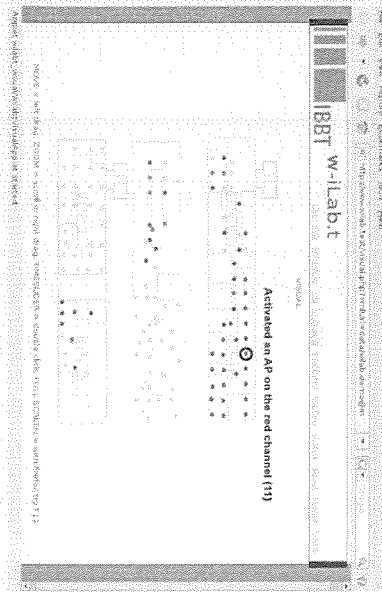
Schedule the job



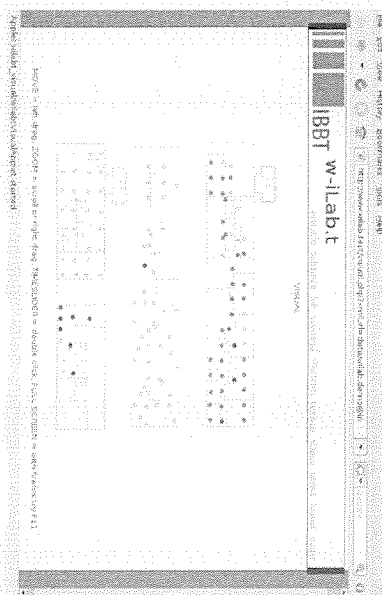
Sensornode location info



Real time visualization of the experiment: +AP



Real time visualization of the experiment: boot



Prepare simple battery depletion scenario

EE Implements

- * Coulombs law $Q = I \cdot t = C \cdot V \rightarrow V = f(I, t, C)$
- * Virtual capacity (CV)

Depleting battery events

- * Configure a streamer
 - Full capacitor with voltage between 0 and 3.6V
- * Disable USB power
- * Configure a sampler
 - Every 12.5 ms the consumed current is measured and the voltage over the capacity is adapted

Emulab – Network Emulation Tested

- Time and space shared network emulator
- Originated at Utah university
- Several sites worldwide
 - More than two dozen sites across the globe
 - Two sites in Europe ([Ghent](#), [Stuttgart](#))

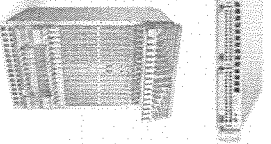


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Physical components

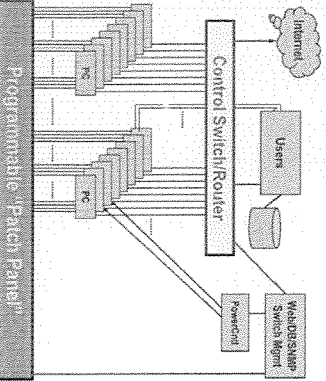
- Server nodes (100x)
 - Dual CPU, dual core
 - 4GB RAM
 - 4x 80GB harddisk
 - 60x 6 and 40x 4 network interfaces
- Central switch: Force 10 network
 - 576x Gb/s port
 - 8x 10 Gb/s port
 - 1.6Tb/s backplane
- Displays



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Emulab: architecture



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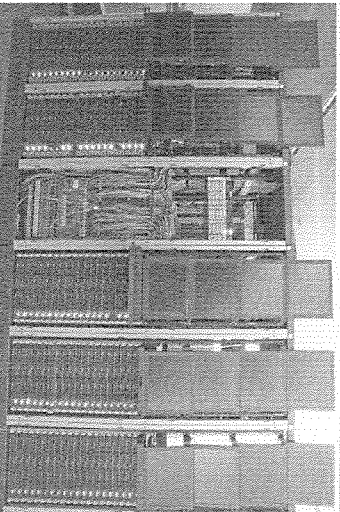
Acknowledgement

- IBBT GBO projects
 - WBA, <https://projects.ibbt.be/wba/>
 - DEUS, <https://projects.ibbt.be/deus/>
- The Wireless Lab team @IBBT

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lLab.t : Virtual Wall



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Outline

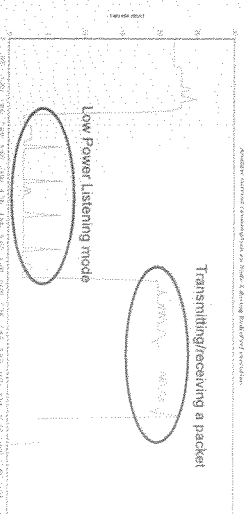
- Virtual wall overview
- Use cases
- Demo and practical usage
- Virtual wall research and next steps

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Wilibox toolbox: analyser

- Real-time / non-real-time analyser of information
- Eg: Current measurement of an LPL enabled node

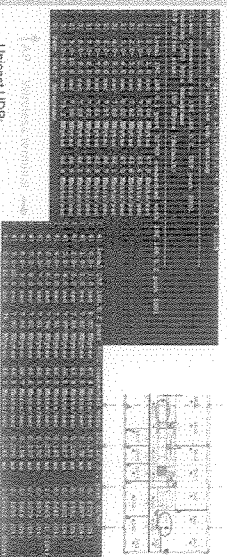


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Experiment 2: WiFi (dist ca 30m)

- Max throughput on Turbo Channel parameters using 1 wireless interface per INode:



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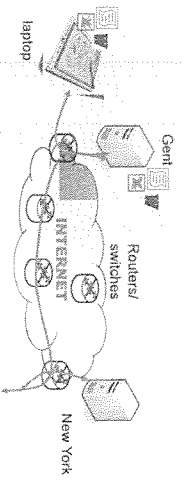
Next steps

- Envisaged extensions
 - Isolated sandbox (not in office area)
 - Outdoor nodes
 - Mobile nodes (robots)
 - Software Defined Radio / Cognitive Radio (collaboration with IMEC)
 - Topology control
- Throughput measurement emulator over full testbed through FPON-based Wireless Link Emulator on 18 sensor nodes
- Support for other (other than tinyos) OS like Contiki...
- Access to the Wireless Lab
 - Today:
 - IBBT research partners and industry in IBBT projects
 - Students
 - Future
 - External partners

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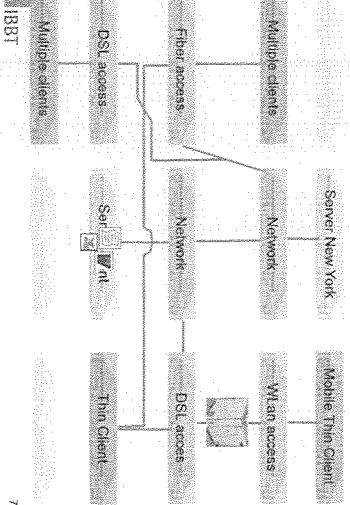
Use case 1: Thin Client



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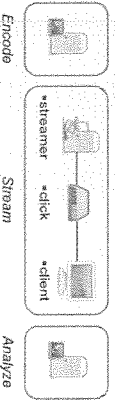
Use case 1: Thin Client



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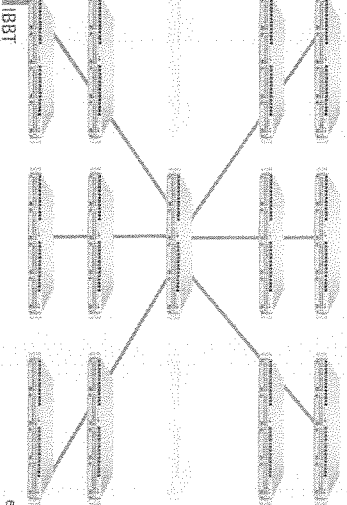
Use case 2: Video quality evaluation



- Example experiment:
 - 8 different types of content
 - 26 different encoding settings
 - 27 different streaming cases
 - 8 * 26 * 27 => 5616 test cases
 - 10 / test case => 39 days

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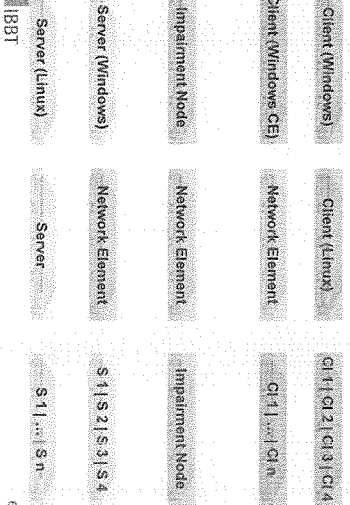
Virtual Wall: Topology Control



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Virtual Wall: Node Functionality



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Outline

- Virtual wall overview
- Use cases
- Demo and practical usage
- Virtual wall research and next steps

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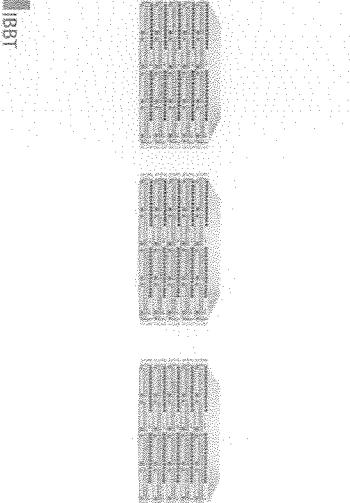
Emulab software

- Management of users, groups and experiments
- Management of nodes
 - Hardware used for a node
 - Image loaded on node
- Setup of network topologies (NS-2 tcl file)
 - Nodes connected via VLANs
 - Possibility to limit bandwidth and configure delay/loss

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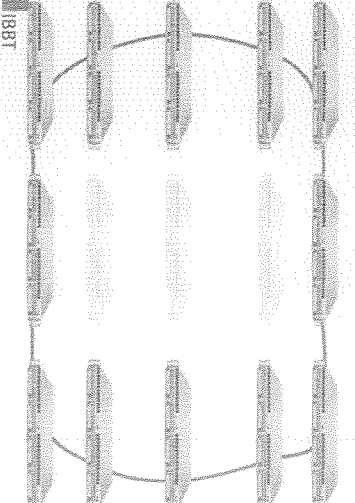
Virtual Wall: Concept



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Virtual Wall: Topology Control



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■ Outline

- Virtual wall overview
- Use cases
- Demo and practical usage
- Virtual wall research and next steps



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■ Virtual wall : Next Steps

- Integrate reservation system with wall
- Possible international connection
 - Emulab Utah: 360 nodes
 - Twisc Taiwan: 155 nodes
 - Our virtual wall: 100 nodes
 - Extension 50
- Virtualization
- Automated testing and experiment management



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■ More info ...

▫ Website

- <http://labr.ibbt.be/>

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- Wireless Lab

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Bart.Joons@ibbt.be

▫ Virtual Wall


- Bart.DeVrieschauer@intec.ugent.be
- Brecht.Vermeyden@ibbt.be



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FIREweek 2009:
FIRE AND LIVING LABS
 FUTURE INTERNET BY THE PEOPLE | LULEÅ, SWEDEN JULY 1-2 2009



Home About Program Registration Dates About Luleå Contact Venue Reviews and other meetings Press Brainlap Presentations

Fire and Living Labs - Future internet by the people

The conference "FIRE and Living Labs - Future Internet by the people" was held in association with the Swedish EU presidency on July 1-2 in Luleå. The conference was a meeting-place of two strong communities: The FIRE community focusing on Future Internet Research and Experimentation and the Living Labs community with the mission to engage people, users as co-creators in the development of new successful products and services. The conference and the workshops were open to everybody interested in research on Future Internet in the world, and in particular to SAC, FIRE and FIA (Future Internet Assembly) members.

More than 300 delegates of experts mainly European, academics, industry from ongoing projects and authorities, European Commission and international organisations joined the conference.

NEWS

FIRE and Living Labs on You Tube

[2009-09-21]

See video »

It is not the technologies that will make a difference to society, it is the users that will make a difference.

[2009-07-07]

These are the words of the swedish minister for communications Åsa Torstensson, in the closing session of FIREweek 2009: FIRE and Living Labs. She also extended an invitation to participate in the debate on the future ICT policy in the EU. See the full presentation and speech here.

FUTURE INTERNET BY THE PEOPLE

[2009-07-07]

Deputy Director-General of DG INFOSO Antti Peltomäki closed the FIREweek 2009: FIRE and Living Labs 2-day conference in Luleå by concluding that the title of the conference was fully appropriate. Please find Mr. Peltomäki's speech here.

FIREweek 2009: FIRE and Living Labs is closed.

[2009-07-03]



With the concluding remarks from conference-general Michael Nilsson:

We have been a "family" for two days, but actually the whole week, 7 days here in Luleå, have been busy days.

Do you know what this is:

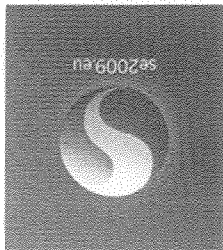
- 330 participants
- 30 nationalities
- 70 speakers
- 22 parallel sessions
- 9 review meetings
- 8 project meetings
- 1 assembly meeting
- 11 preparation meetings
- xx number of new friends,
- yy number of proposal discussions
- a lot of good laughs and enjoyment
- too few sleeping hours BUT + 30 degrees and nightless nights
- a moment of good life!

Dear friends, THAT is FIREweek 2009: FIRE & LivingLabs in Luleå! FANTASTIC!

Share these moments with us | PHOTO GALLERY

Submit your presentations to: martin.valimark[at]cdt.ltu.se

ENJOY YOUR SUMMER HOLIDAYS



Creativity
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