“Global Testbeds for Sensor-networks, including relevant IPv6 aspects”

Sotiris Nikoletseas
University of Patras and CTI, Greece

FIA, Poznan, October 2011
Session 2.3 - International Cooperation on Testbeds
A) The **HOBNET** Project (**IPv6** sensor networking for green buildings) and its collaborations in China

B) Relevant **Test-bed support** in **R@D Projects** in China

C) Relevant **Test-beds** in China

D) A recent, large scale **environmental monitoring system**
Holistic approach addressing critical aspects at 3 different layers:

i) network protocols and architectures, mainly based on IPv6

ii) algorithmic models and solutions for smart buildings

iii) an interface layer for building management systems applications.

=> experimental evaluation within the platform integration at 3 buildings (following a REST architecture).

=> contribution to 6lowapp standardization
Participants

1. Computer Technology Institute (Coordinator), Greece
   Leader: Sotiris Nikoletseas

2. Ericsson Serbia, Serbia
   Leader: Srdjan Krco

3. Mandat International, Switzerland
   Leader: Sebastien Ziegler

4. Sensinode, Finland
   Leader: Zach Shelby

5. University College Dublin, Ireland
   Leader: Antonio Ruzzelli

6. University of Edinburgh, Scotland
   Leader: DK Arvind

7. University of Geneva, Switzerland
   Leader: Jose Rolim
HOBNET Contacts and Cooperation in China

- **industry:** Calven Luo, Beijing Software Enterprise Advisory Center (BSEAC, www.bseac.com). Calven is cooperating with Prof. Yan MA (BUPT, Beijing University of Post and Telecoms)

  Context: **health-related aspects** of wireless networking, test-beds at leading **Chinese hospital buildings**

- **academia:** Prof. Amy Yuexuan Wang and Prof. Qiang-Sheng Hua (Tsinghua University)

  Context: Theoretical and practical aspects of **large scale sensor networking**
B. Testbed support in China projects

Diverse scope of Testbed support:

- Network technologies in Future Internet
- Internet of things
- Optical technology
- Cloud computing etc.

Different features tested:

- Network architecture
- Key functions and algorithms
- New services and applications
- Performances etc.
A (partial) list of relevant test-beds (I)


⇒ performance measurement, verification and fault diagnosis

2. “Integrated testing and validation platform for new generation Internet Architecture”

⇒ testing tools and real network behaviour generator

3. “Structure, modelling and testing for testable, controllable, manageable IP networks”

⇒ testing and validation of IP network functions and algorithms
A (partial) list of relevant test-beds (II)

4. “Basic theory and design methods of Internet of Things”
=> architecture, theory and practice, as well as testing and validation of key technologies of IoT

5. “New generation trustable Internet testbed”
=> emphasis on trust issues

6. “OTN based flexible and reconfigurable optical testbed”
=> testing flexible scheduling of resources, convergence of IP and optical networks
C. Test-beds in China

**VegaNet**
- Supported by National 863 projects
- Developed by Tsinghua University
- Overlay network on top of CERNET2 - real networks
- Provide real network environment for network layer protocol simulation and experiments
- Real user traffics
- Support network layer virtual link and topology configuration and experiment

http://wenku.baidu.com/view/1dea181aff00bed5b9f31d34.html
DragonLab

- Supported by National 973 and National 863 projects
- Developed by Tsinghua University and Ruijie Networks
- Support testing and validation of different types of network technologies, network devices, and application systems
- Support virtual network experiment

http://dragonlab.org/
GreenOrbs

- Developed by The Hong Kong University of Science and Technology, Xi’an Jiaotong University, Illinois Institute of Technology, Zhejiang A&F University, Hangzhou Dianzi University, Tsinghua University
- Provide environment real-time monitoring
- Include more than 1000 wireless sensor nodes
- Provide real testbed for large-scale wireless sensor networks

http://cn.greenorbs.org/
4G testbed

- Developed by Beijing University of Posts and Telecommunications
- Peak rate: up to 122Mbps
- Based on FPGA and DSP
- Support VoIP, steaming, high speed data download, Internet and other services
- Supported by MOST 863 “FuTURRE” project
Optical testbed

- OTN-based flexible and reconfiguration optical testbed
- Developed by Beijing University of Posts and Telecommunications and ZTE
- Support following testing
  - Flexible scheduling of target resources
  - Automatic protection switching
  - Convergence of IP and optical
  - Etc.
D. An environmental monitoring system

PAIMS: Precision Agriculture Information Monitoring System

Institute for Interdisciplinary Information Science (IIIS), Tsinghua University, Beijing
To contribute to lowApp and its standardization towards a new embedded application protocol for building automation. To also develop a multipurpose building automation demonstration integrated into the project website and easily usable as part of demonstration activities and for connecting with external activities through an API.

A broader research goal is to contribute to the vision of the Future Internet and building automation Objective 6.
PAIMS key features

- cluster-based self-organization
- multi-hop joint scheduling for power saving schemes
- distributed load balancing
- open architecture integrating WSN and Internet
Information Platform

- Information platform based on web and Google Earth
  - Data storage, querying, and representation
  - Network topology, node position, map service
FIRE researchers and building management application designers and developers will be able to test their high level algorithms in hardware (not just simulation), at a large scale, in realistic scenarios.

Engineers will benefit from the interaction with rigorous algorithmic methodologies.

The algorithmic and distributed computing community will benefit from the definition of more realistic abstract models and well-motivated problems for sensor networking.

Target Users and Benefits (II)
Some Conclusions

- IPv6 and sensor networking are high on the agenda of both China and the EU

- Current cooperation remains rather sporadic and ad hoc

- Focused initiatives are needed
Relevant events in China


- The 26th IEEE International Parallel & Distributed Processing Symposium (IPDPS), Shanghai, May 21-25, 2012.

Thank you.

Contact: Sotiris Nikoletseas

www.cti.gr/RD1/nikole
nikole@cti.gr