Versatile Sensor Node

A Platform for the Sensor as a Service Concept

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Outline

- SensorLab
- Wireless Sensor Networks
- Versatile Sensor Node
- Vertical Integration
- Applications

SensorLab

- Department of Communication Systems @ JSI
  Department of Knowledge Technologies @ JSI
  ISOtel d.o.o.

- Coordinated activities on the development of custom WSN solution started in May 2009

- Key words: Versatile Sensor Node, Vertical Integration, Sensor as a Service (IP connectivity, WEB access), Deliberate/Participatory Sensing, Semantics

Wireless Sensor Networks

General characteristics and requirements:

- adaptable (diverse application requirements)
- periodical, external event triggered and/or on request measurements
- asymetric & directional information flow (centralized, distributed, hybrid data aggregation and network control)
- energy efficient (long lifetime, all layers)
- scalable (huge number of nodes)
- robust (long runtime)
- secure (data confidentiality)

Current state in WSN

- Research
  - Well developed field with many degrees of freedom
  - Complex, large-scale, resource constrained systems
  - Focus is on intra network communications
- Development
  - Solutions are tailored to specific application requirements
  - Standard compliance (interoperability)
  - Focus is on communication between WSN and Internet, to facilitate IoT/WoT
- Business
  - Slowly taking off (evolving standards, endless proprietary solutions multi-vendor interoperability)
  - Interference and congestion in ISM bands
  - Huge savings are promised (e.g. smart grids)

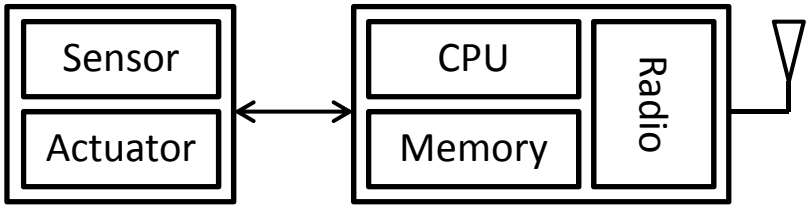
WSN Technologies

- Traditionally: low complexity, low power, small size and weight, long life, autonomous, short range, low cost …

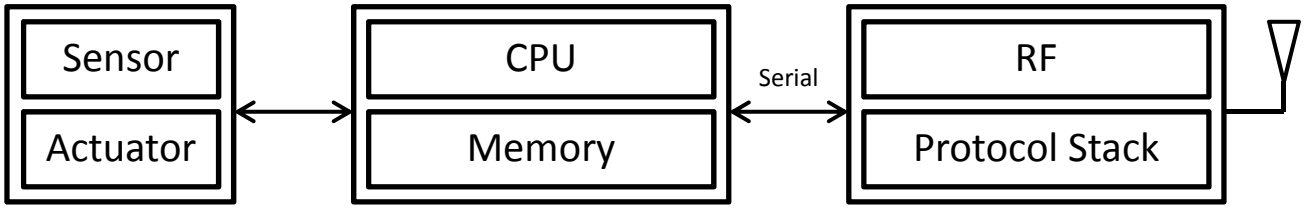
- Standardised
  - IEEE 802.15.4 - Low Rate WPAN (PHY & MAC)
  - ZigBee, 6LoWPAN, WirelessHART, Dash7, Wavenis …
  - IEEE 802.15.1 – Bluetooth (BT 3.0 Low Energy Mode)
  - IEEE 802.11x – Wi-Fi
  - Other dedicated communication technologies (Ethernet, GPRS, …) in WSN concept – gateways
- Proprietary
  - Z-Wave, ANT, MiWi, SimpliciTI, DigiMesh …

WSN Implementation

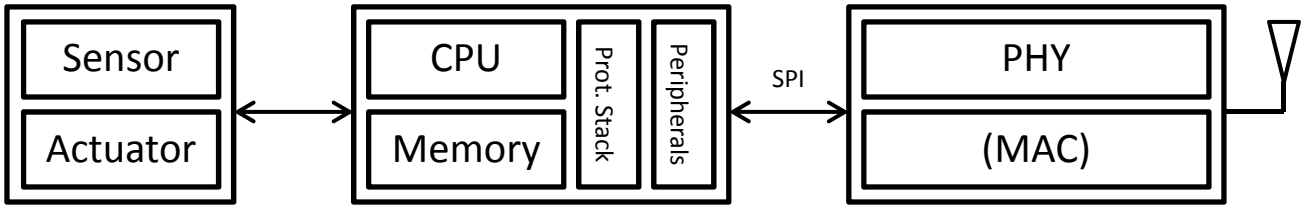
- Node structure
  - System on Chip (SoC)



  - CPU + OEM Radio



  - Microcontroller + PHY/MAC Radio



Versatile Sensor Node

IJS

ISOtel
Isotropic Telecommunications

Processing platforms

- ST ARM Cortex-M3

Comm. tech.

- ZigBee, 6LoWPAN, IEEE 802.15.4
- Bluetooth
- Wi-Fi
- GSM/GPRS
- Ethernet
- Sensor Network Protocol (SNP)
- Satellite

Sensors

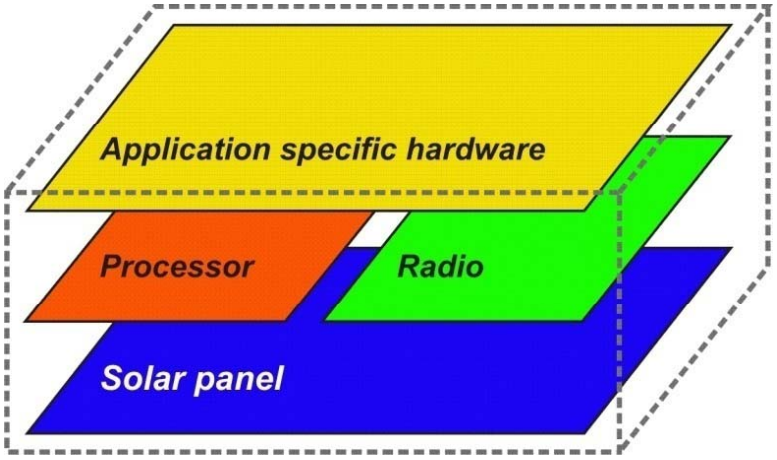
- Temperature
- Humidity
- Luminance
- Color
- Reflectance
- Pressure/Force
- Camera
- Optical Detector
- GPS
- Sound
- Accelerometer
- Gas (O_2, CO_2, CO)
- Hall effect
- Motion, presence, range (IR, ultrasonic)
- Capacitive/inductive touch
- Gyroscope
- Compass
- …

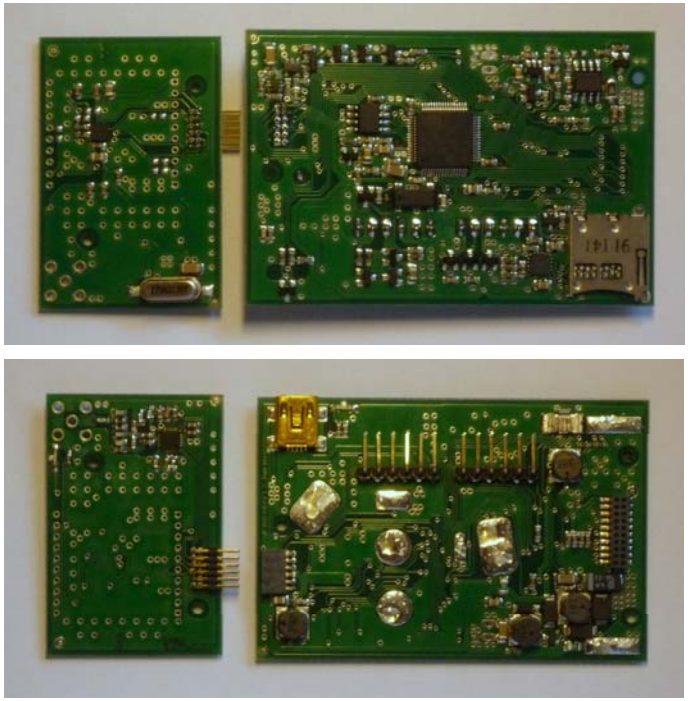
Actuators

- Pulse Width Modulation (Light, Motor)
- Switch, Relay
- Servo
- Alarm

Versatile Sensor Node

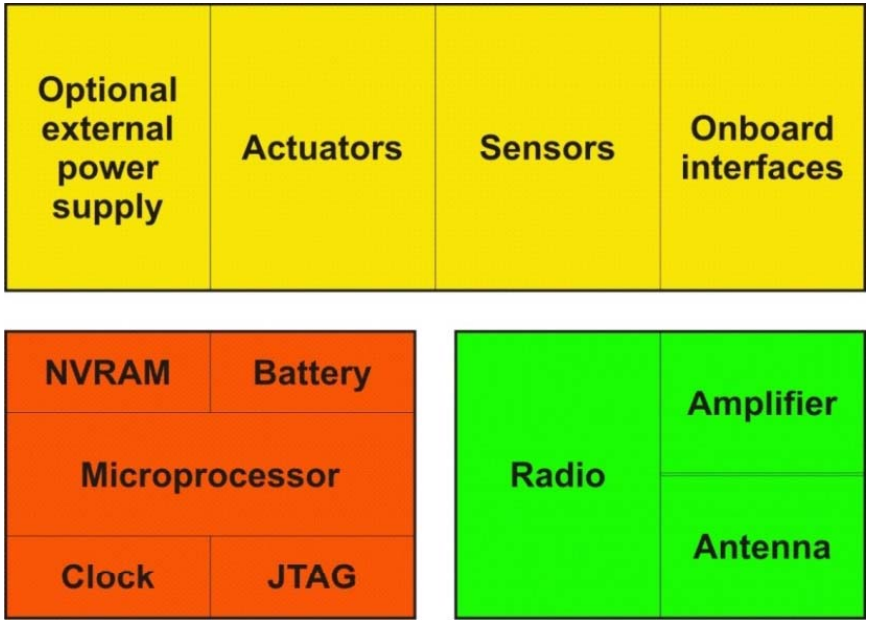
- Modular platform for WSN (VSN=VSC+VSR+VSA+VSP)
  - High processing power and low energy consumption
  - Sensor node & gateway (multi-tier / IP) capability
  - Battery, solar or external power supply
  - Re-configurable radio



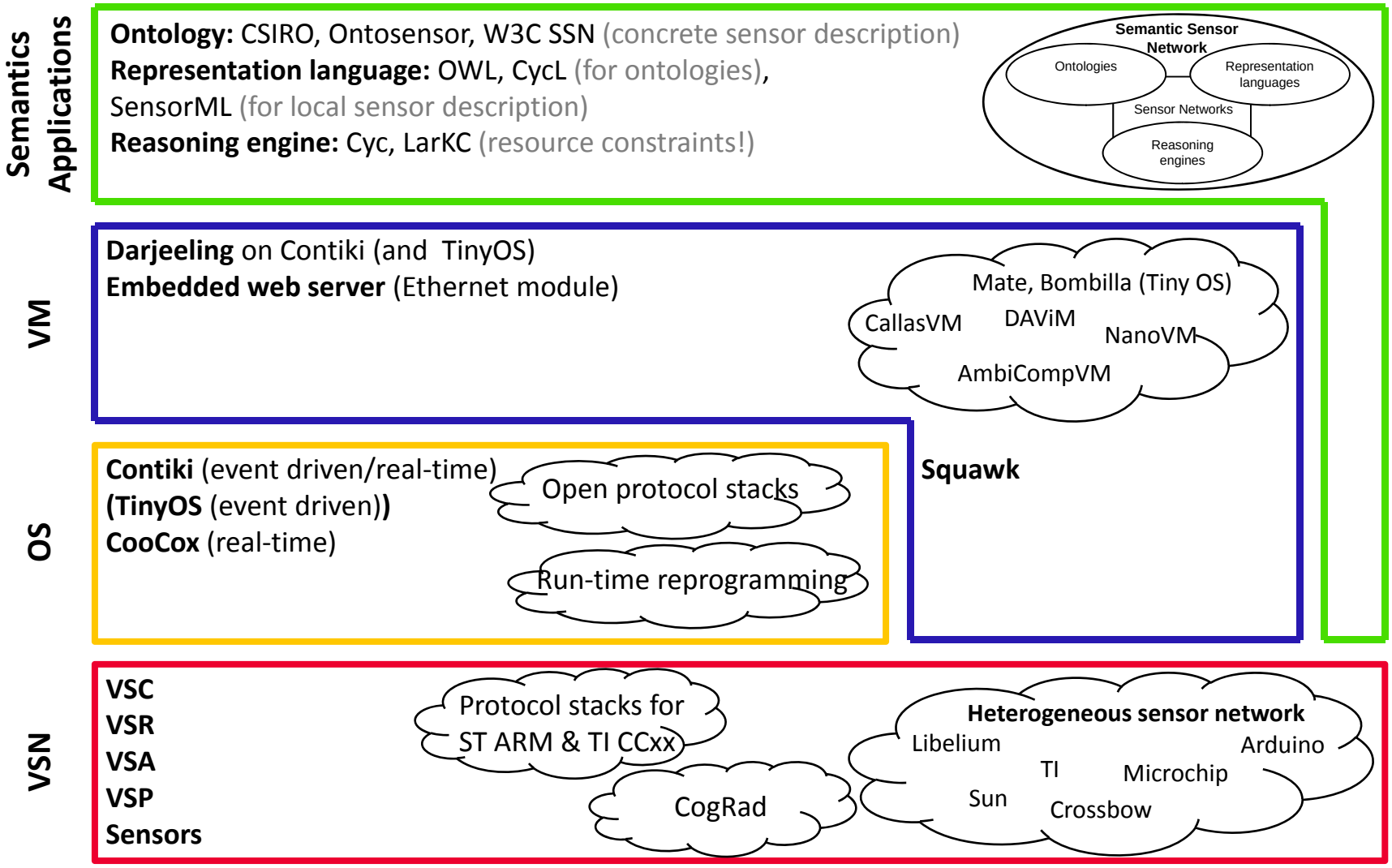


Versatile Sensor Node

- VSC
  - Analog and digital sensor/actuator interfaces
  - Possibility to use operating system (real-time, event-driven)
  - Multiple expansion options
  - Open C/C++ code libraries
  - Onboard memory
- VSR
  - 300-900 MHz, 2.4 GHz radio interface (all ISM bands)
  - ZigBee, 6LoWPAN and other IEEE 802.15.4 based solutions
- VSA
  - Bluetooth, Wi-Fi, Ethernet, GSM/GPRS
  - Sensors/actuators
  - PoE

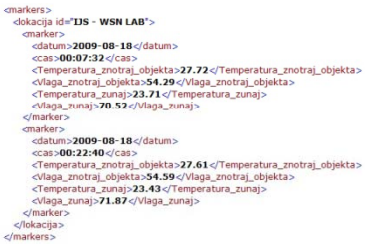


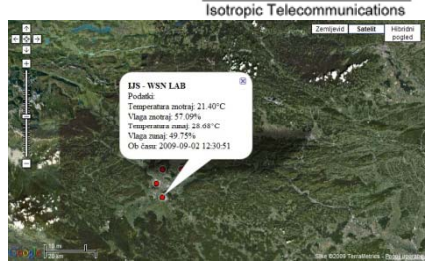
Vertical Integration

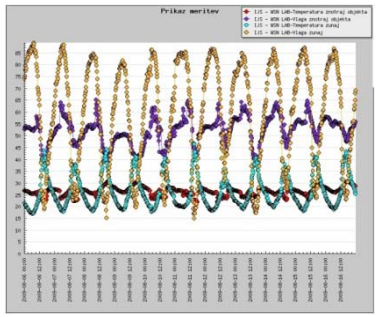


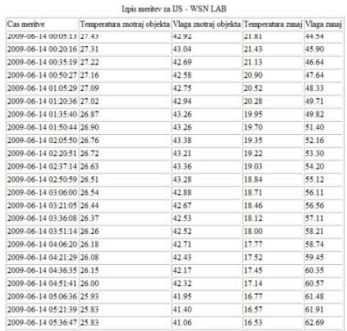
VSN in multi-tier WSN

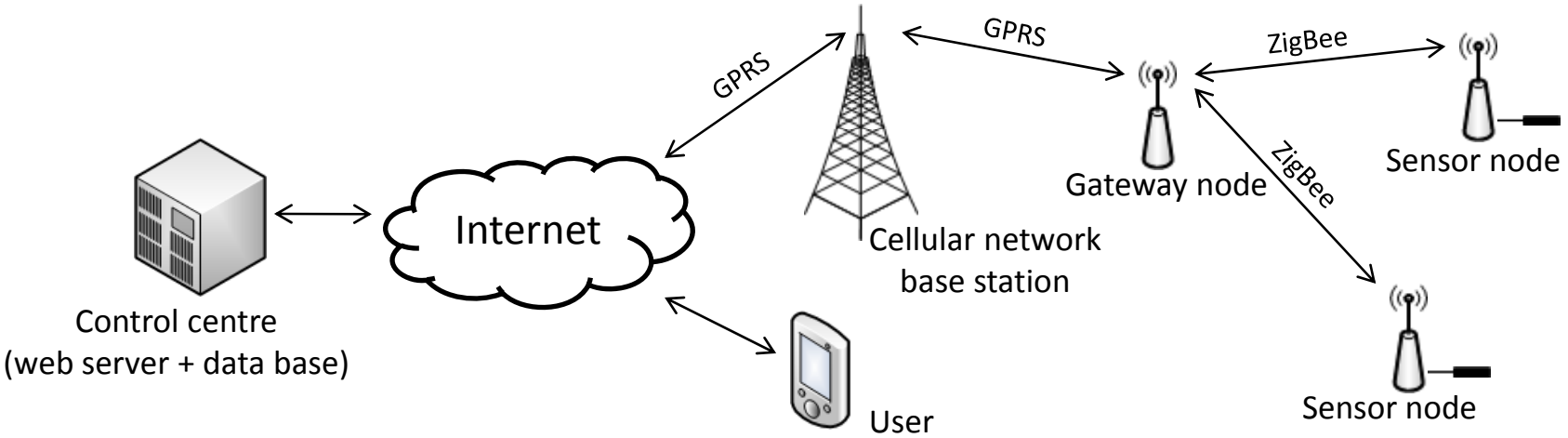
- Temperature and humidity monitoring for environmental applications
- ZigBee based local sensor networks
- GSM/GPRS interconnection with control center
- Joomla extension WEB interface
  - Coustomised data export (Chart, Table, GoogleMaps, XML, Database)
  - http://diploma.idealna.si/ (U:gost, P:gost)





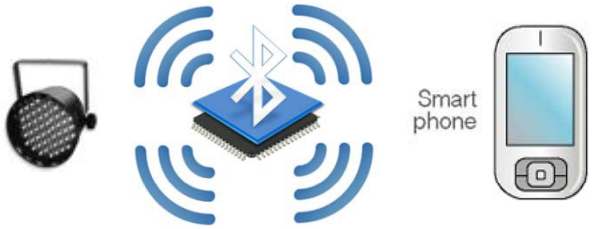


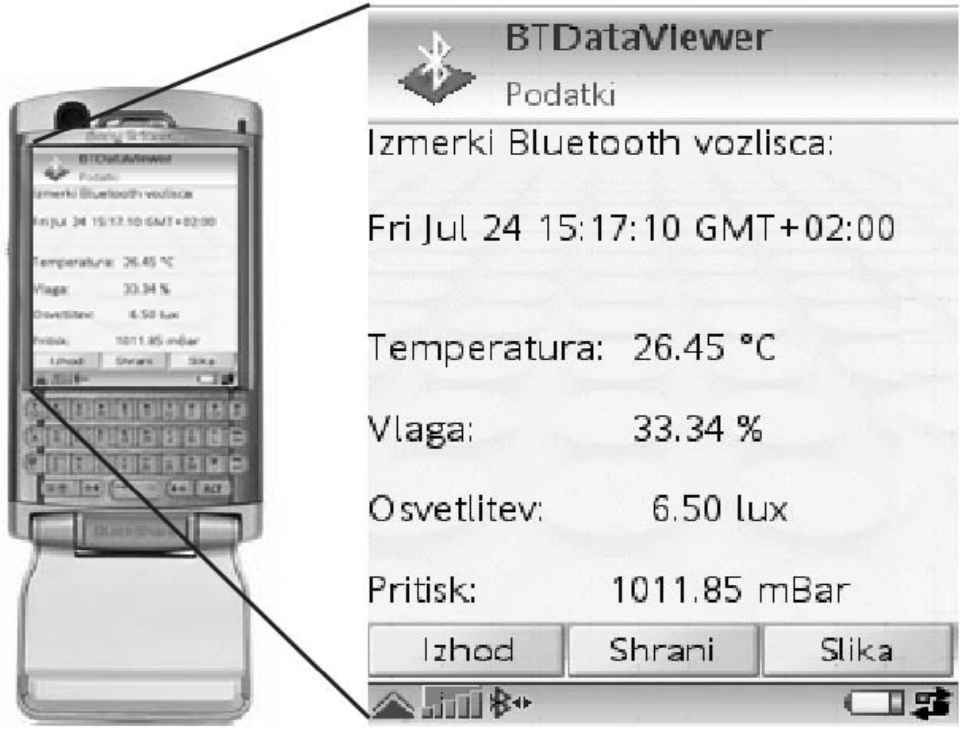




Bluetooth equiped VSN

- Bluetooth link between sensor node and smart phone
- Video and voice capturing
- Temperature, humidity, pressure, light monitoring
- Java test application





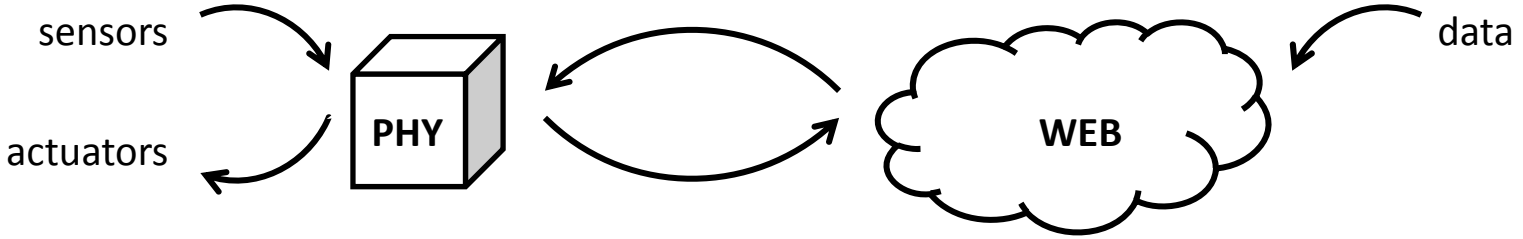
VSN for IoT & WoT

Internet of Things - IoT: world-wide network of heterogeneous smart objects (sensors, actuators, RFID, MEMS …) based on standard communication protocols

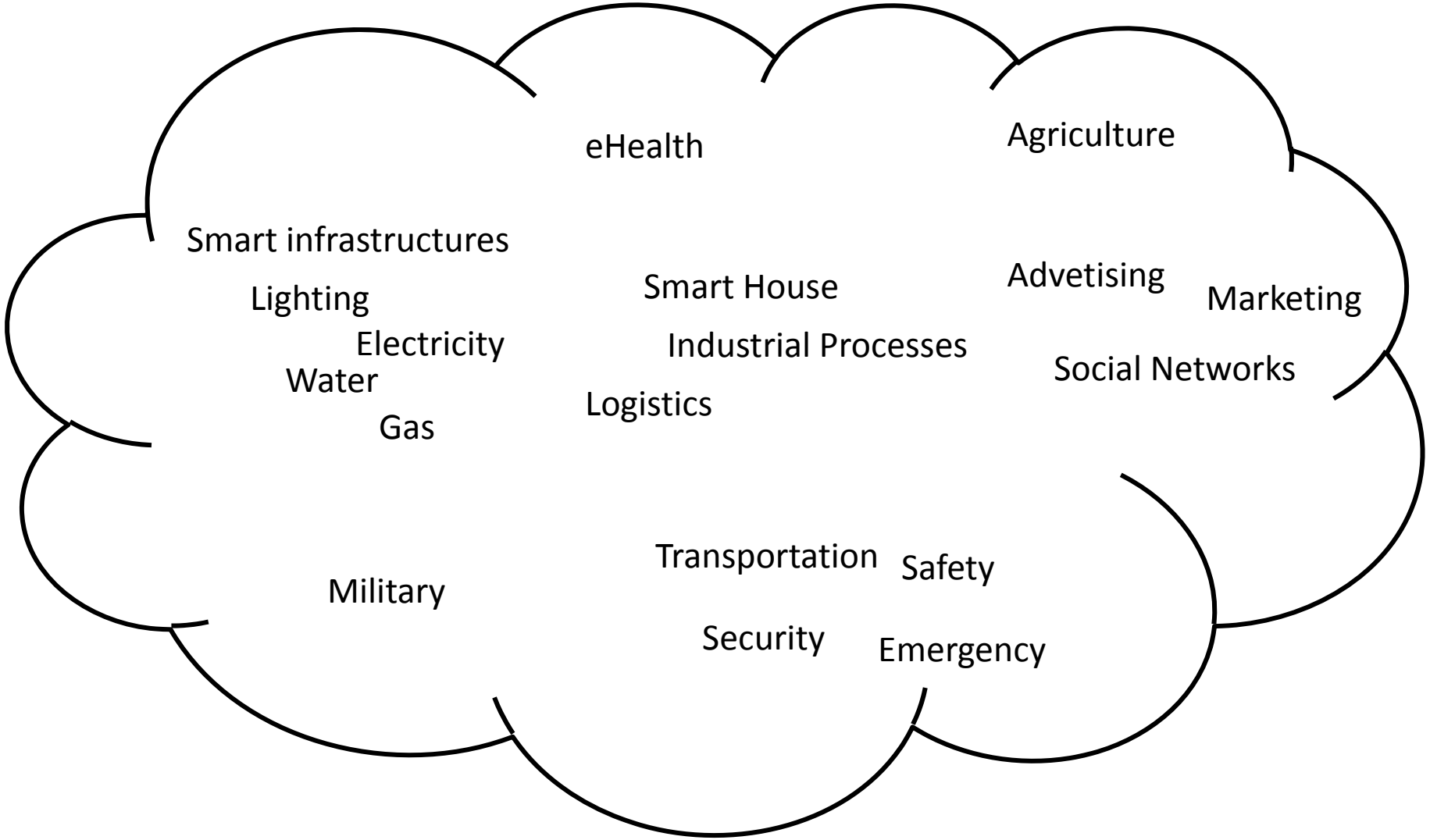
Web of Things - WoT (also **SensorWeb** or **The Physical Web**): integrating embedded devices to the Web using standards like HTML, XML, RSS …

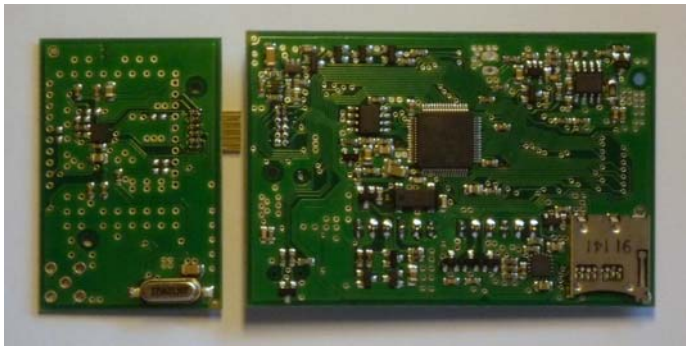
Pachube

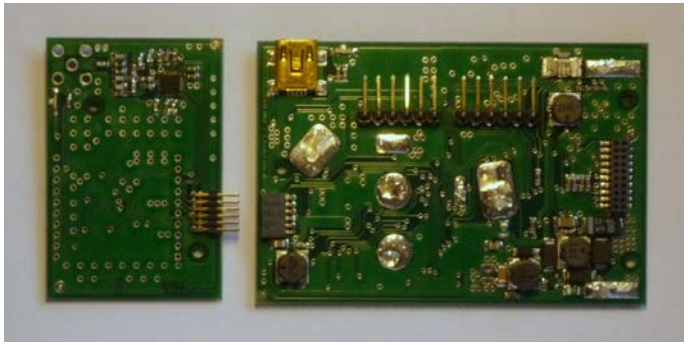
- Web service that enables storing, sharing & discovering of real-time sensor, energy and environment data from objects, devices & buildings around the world.
- Captures input data (from remote sensors) and serves output data (to remote actuators)
- http://www.pachube.com/feeds/6894



VSN Application Areas







Thank you and welcome at the exhibition desk!

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SensorLab – The Team