Tampereen yliopisto
Tampere University

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Software Hardware Combination for Data Gathering

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Tampere University, Information Technology and Communication Sciences (Pori)
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Tampere University

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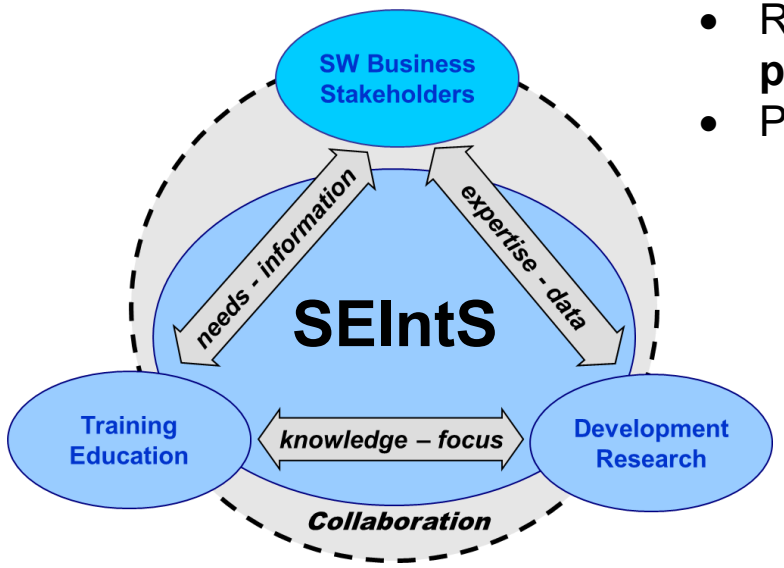


- Research staff: **15 persons**
- Project volume: **1 M€**

- Global software engineering
- Software business
- Software engineering management
- Software and **application architectures**
- Web services and user interface techniques
- Mobile and web applications
- **Smart systems and intelligent spaces**
- **Sensors and sensor networks**
- Embedded systems and **IoT**
- Green ICT

* Sami Hyrynsalmi moved to LUT School of Engineering Science 1.1.2020

Our study – The software/Hardware Framework

In this study the focus was to generalize the guidelines for IoT prototyping with the lessons learned from previous experiments.

The motivation

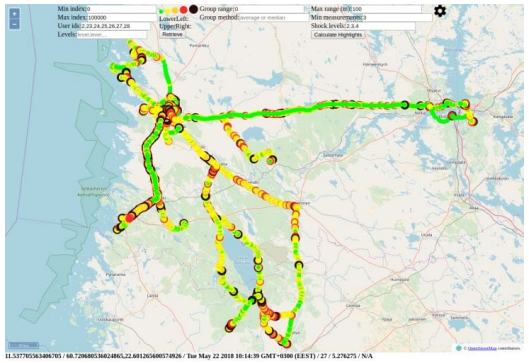
We have done **Prototype development**

- Software orientation
- Utilization of **off-the-shelf devices**
  - smartphones and tablets
  - Arduino, Raspberry Pi, Beagle Bone, Intel Galileo, etc.
  - Sensors (heat, humidity, pressure, movement, position, etc.)
- Communication technologies (Ethernet, WiFi, ZigBEE, LoRa, etc.)
- Cloud-based services and data analysis

Related Research - Prototypes

The motivations

- Reducing energy consumption with IoT prototyping
  - Several IoT data gathering prototypes
- People Counting in a Public Event
  - Autonomous Rasberry Pi based system
- Road Condition Analysis and visualization
  - Smartphone (accelerometer, gyroscope, GPS) data collection, cloud
- Approach (Image) Data Collection (Bus, Garbage Truck)
  - Autonomous Rasberry Pi based system



The software/Hardware Framework

We set **The research questions:**

1. Is it possible to do rapid sensing prototype development with cost efficiency?
2. How can this prototype system be modeled?

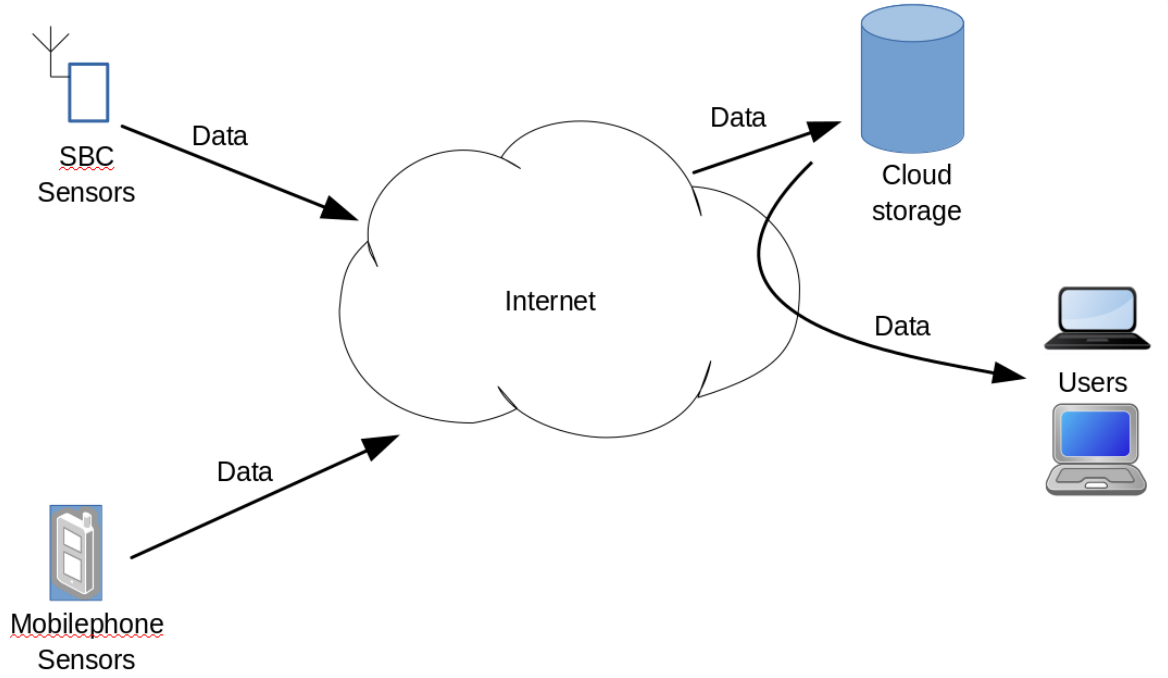
We get **The results**

- The study introduces a special software/hardware (SW/HW) framework for data gathering systems to be used in IoT related systems.
- Furthermore this study introduces the usability of a certain software hardware combination in prototype development.

The software/Hardware Framework

Consists of Hardware components:

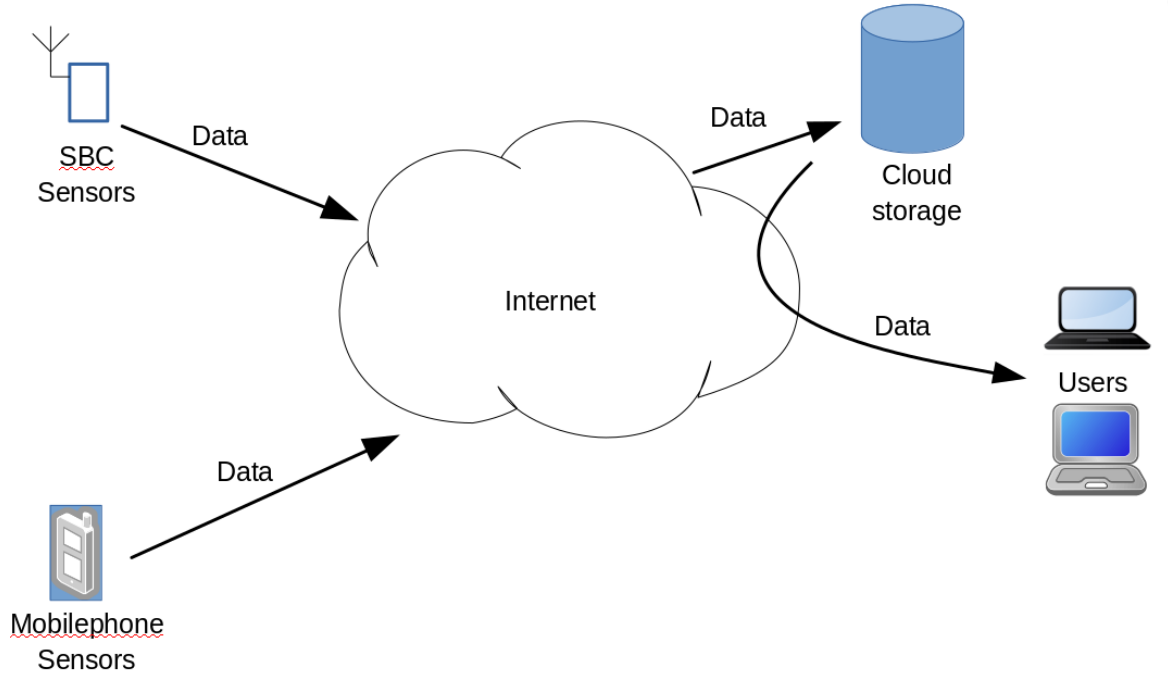
- Sensor hardware
  - Could be simple data such as temperature and humidity
- Data gathering devices
  - SBC such as Raspberry Pi
- Data storage devices
  - cloud servers with a database or dedicated Open source Linux servers for saving data



The software/Hardware Framework

Consists of Software components:

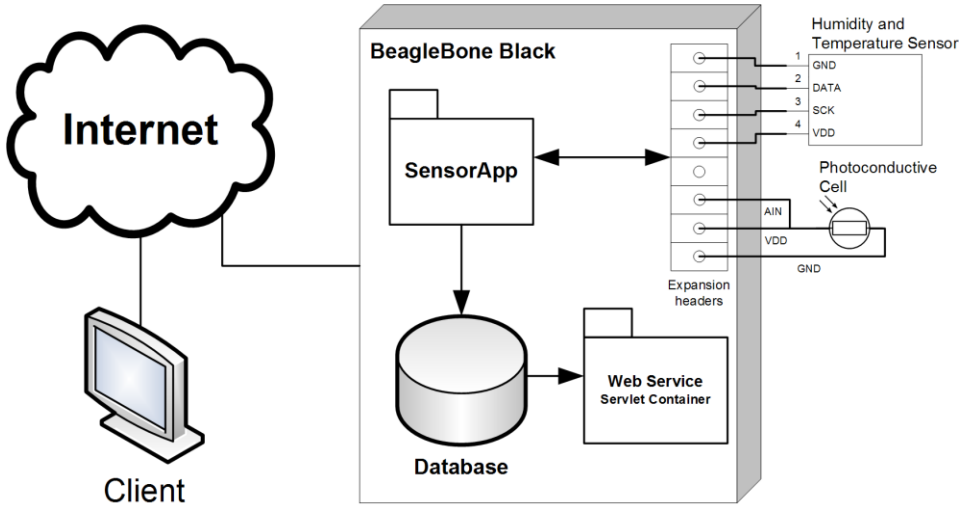
- Sensor Software
  - Low-level programming with C++, Python, or Perl scripts.
  - Micro-controller board with dedicated program
- Data gathering and preprocessing
  - SBC operating system
  - Services(database, remote control software, etc.)
  - Preprocessing(e. g. image recognition)
- Data storage
  - In a device – database software
  - cloud service

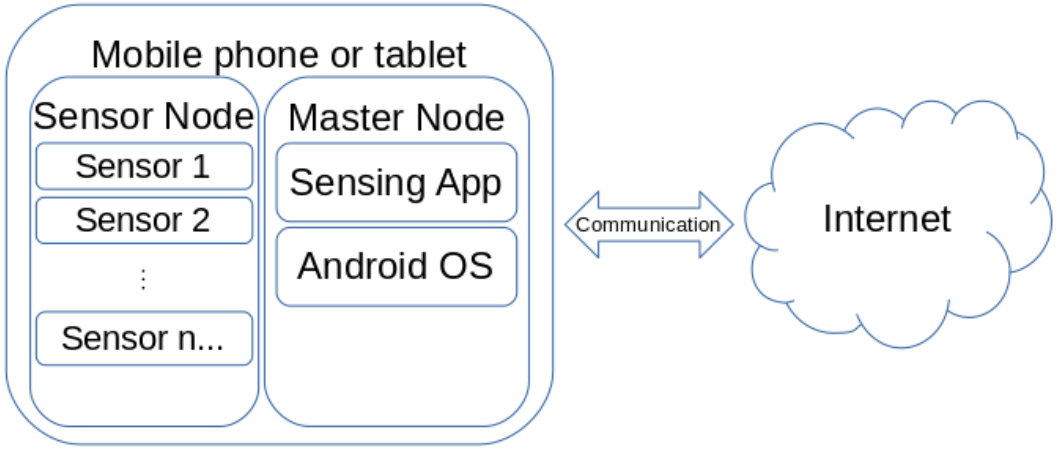


The software/Hardware Framework

Testing the system were done with several prototypes:

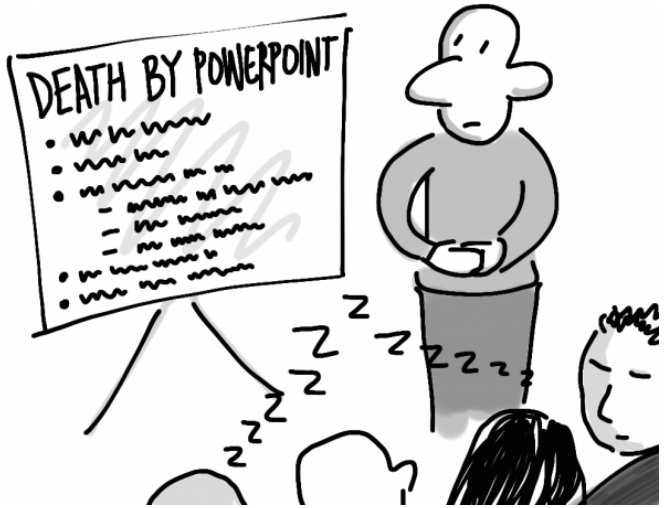
- SBC related systems
  - With Raspberry Pi, Beagle Bone Black and Intel Galileo
- Mobile phone related systems
  - Android smartphone with the sensor application
- Models and methodologies
  - WSN sensor node architecture model for data gathering.





Summary and the next step(s)

- The paper presented a SW/HW framework for data gathering systems to be used in IoT related systems.
- The study supports our approach focus – software, interoperability, cheap off-the-shelf devices.
- What next?
  - Data processing and data mining => How to store and use data?
  - Security issues => how to prevent Security vulnerabilities
  - Modeling the prototyping process
  - Interconnections of components



More information

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