Information in the Internet of Things: From Sensing to Meaning
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Moderator
Jaime Lloret Mauri, Polytechnic University of Valencia, Spain

Panelists
- David Musliner, Smart Information Flow Technologies (SIFT), USA
- Svetlana Boudko, Norsk Regnesentral, Norway
- Mike Johnstone, Edith Cowan University, Australia
- Ben Lee, Oregon State University, USA
IoT allows devices to be accessed and controlled remotely through Internet and enables advanced services by interconnecting devices using existing communication technologies.

IoT concept has been defined in Recommendation ITU-T Y.2060 (06/2012):

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Jaime Lloret, Elsa Macías, Alvaro Suárez and Raquel Lacuesta,
Ubiquitous Monitoring of Electrical Household Appliances,
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IoT Panel

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For other staff and projects, please see
www.sift.net
Not about Things, It’s about Data

• John Fruehe, Moor Assoc:
  • If you can’t measure it accurately, you can’t control it.
    • Single source bias.
  • Data chain security.
  • Data must be actionable - analysis, not storage.
  • Data as a liability.

• Big data. Big big big data.
• Analytics: where will the analysts come from?
• Security and vulnerability: making ourselves even more dependent, more vulnerable.
Security

- One weak link.
- Embedded systems.
  - Outside firewalls.
  - Supply chain security.

- Parallels to the PC/internet explosion.
  - Security lessons not learned.
  - Deployment leads research.
  - Vulnerabilities flourish unknown.
CATS: ALL YOUR BASE ARE BELONG TO US.
Multimedia Streaming in the IoT World

Prof. Ben Lee
School of Electrical Engineering and Computer Science
Oregon State University
Streaming HD video is an important enabling technology:
- Home-entertainment
- N-screens
- On-line games
- Context & location aware Digital Sinage
- Wearable cameras
- Media-centric IoT
  - Motion/object detection & classification
  - Cooperation with other IoT devices.
- ...

Increasing number of devices using this technology will cause packet loss and delay degrading visual quality.
Motivation

- Challenges of video streaming:
  - Requires a certain degree of data integrity and has to meet playout deadlines.
  - Packet loss reduces visual quality, while delay induces re-buffering.

- Most of existing streaming methods use either TCP or UDP.
TCP vs. UDP

Pure-TCP vs. Pure-UDP

Bunny video vs. FDSP with Adaptive-BP

Multimedia Streaming in the IoT World
Panel Discussion

• Despite the explosion in Internet traffic, how can provide good QoE for users?
  ◦ Efficient video codecs - H.264/5
  ◦ Network QoS
  ◦ CDN architecture and Management.
  ◦ Better streaming protocols
    • Reliability, flow control, ordered delivery, congestion control, etc.
  ◦ Network condition estimation
  ◦ QoE metrics:
    • Rebuffering vs. packet loss
  ◦ Multimedia adoption:
    • e.g., SVC (used by MPEG DASH and Apple HLS)
  ◦ Loss resilience and error concealment:
    • FMO, Redundant Slices, DP, etc.
  ◦ Transmission over LoWPANs
  ◦ …
“Artificial intelligence bears the same relationship to intelligence as artificial flowers do to flowers. From a distance they appear similar, but up-close they are quite different”
Sensors everywhere

• Sensing
• We can do this now
• Cars, traffic lights, roadways
• For example, the Libelium Waspmote
  – 100 sensors
  – 2/16 wireless protocols
The IoE

- How many sensors?
- Cisco’s vision of IoE (28B devices by 2020)
- IPv6
- A “big data” problem
- A security problem
• But what does it all mean (and how do we know)?
• Ontology -> semantics
• Mass-customisation
• Home automation
• Cloud services
• The technological singularity
  – Remember Asimov’s Laws
Information in the Internet of Things: From Sensing to Meaning

Svetlana Boudko
Norsk Regnesentral
Sensing

► Raw data
  ▪ acquisition and analysis of extremely large data sets
  ▪ IoT needs Big Data

► What is this data?
  ▪ data sets from different locations
  ▪ do we need all these data?
  ▪ select the right subset
  ▪ when and how often to sample?

► Where to process?
  ▪ sensors have limitations
  ▪ IoT needs cloud
System Architecture of MOSKUS

- **Subjective Data Questionnaire**
- **Smartphone App (Android)**
- **Sensor**

**Information System**
- **Health Cloud**
- **API to HIS**
- **HIS Database**

**Objective Assessment**
- **Sensor**
- **App**

**Self management for patient at home**
(main focus area of MOSKUS)

**Increase quality and effectiveness of clinical assessment**

**Communication patient-health professional**
+ treat to target
From Sensing To Meaning To Action

- Cloud
- Internet Of Things
- Internet Of People
- Big Data