Towards a Reference Architecture for the Internet of Things

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Workshop Session:
From the INTRAnet of Things to the INTERnet of Things – Establishing a common architecture for the IoT
The IoT Today…

A lot of technology around, but…

- Handicraft, Art…
- Vertical Silos
- No Interoperability
Currently, many IoT Architectures

- All were developed in a specific context
- Hard to use in other contexts

Picture Sources: EPCglobal, uID Center, ASPIRE & SENSEI projects
And IoT-A?

- Not yet another architecture, but a Reference Architecture
What is a Reference Architecture? [Muller:2008]

- A Reference Architecture captures the **essence of the architecture** of a collection of systems. The purpose of a Reference Architecture is to **provide guidance** for the development of architectures for new versions of the system or extended systems and product families.
  - The description of Reference Architectures must be **accessible** for a broad and rather heterogeneous group of stakeholders
  - A Reference Architecture **captures previous experience**, for instance by mining, or by generalizing existing architectures.
    - Note that IoT-A will extend beyond current systems by capturing new **business needs**

- The Reference Architecture provides:
  - a common lexicon and taxonomy, for example by a **domain model**
  - a common (architectural) **vision**
  - **modularization** and the complementary **context**

- Reflection of experiences can be captured in **architecture principles** and **best practices**

*Source: G.Muller, “A Reference Architecture Primer”, 2008*
Reference Architecture vs. Architecture

extracting essentials

Reference Architecture

architect

Architectures

design, engineer, build, test

Actual Systems

constraints, opportunities and feedback

Adapted from: G. Muller, “A Reference Architecture Primer”, 2008
Picture Sources: ETSI, SmartGrids ETP
Step 1: A Domain Model for the IoT

What is a **Domain Model**?

- Conceptual model of the domain of interest
- Separate out *what doesn’t vary* much from what does
- Common **lexicon** and **taxonomy**
  - Definition of abstract concepts for main entities in the domain
  - Responsibilities and relationships
  - Integrity constraints

**Sources:**
- P. Oldfield, “Domain Modelling”, 2002
- Wikipedia
Terminology Babel
What is a „Thing“?

This… OR …That?

Device

Entity of Interest

Entity of Interest
Basis for a Domain Model of the Internet of Things
**More Terminology**

**Identity**
- Philosophical concept, *whatever makes an entity definable and recognizable*

**Identifier (ID)**
- Used to disambiguate two things
- Possibly several ID's per thing
- Assigned numbers (e.g., EPC) as well as natural feature set (biometrics)

**Address**
- Technical term used to locate and possibly „talk to“ a thing, a resource, a device or a service
- E.g., IPv6 address, URL, …
- Sometimes the address can be used as an ID as well

**Resolution**
- Resolving an ID leads to a set of addresses
  - Information services, interaction services, …
- Based on a priori knowledge (in contrast to **Discovery**)

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Summary and Outlook

- IoT-A is delivering a **Reference Architecture** and a **Domain Model** for the IoT
  - Not just another architecture!
  - Well-founded, both theoretically as well as from previous experience

- **The reference architecture** is the basis for **concrete implementations** and **validation** in specific domains
Thank you!

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