



Towards a Reference Architecture for the Internet of Things

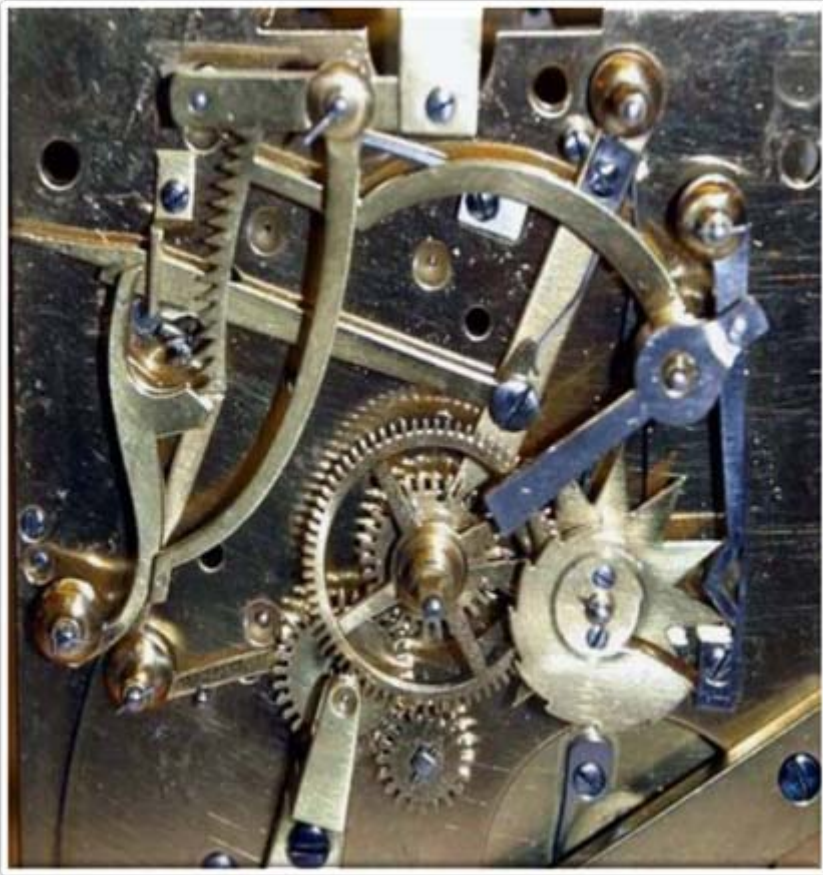
Stephan Haller, SAP Research

Internet of Things 2010 Conference 29-1 Nov/Dec 2010, Tokyo

Workshop Session:

**From the INTRAnet of Things to the INTERnet of Things –
Establishing a common architecture for the IoT**

The IoT Today...

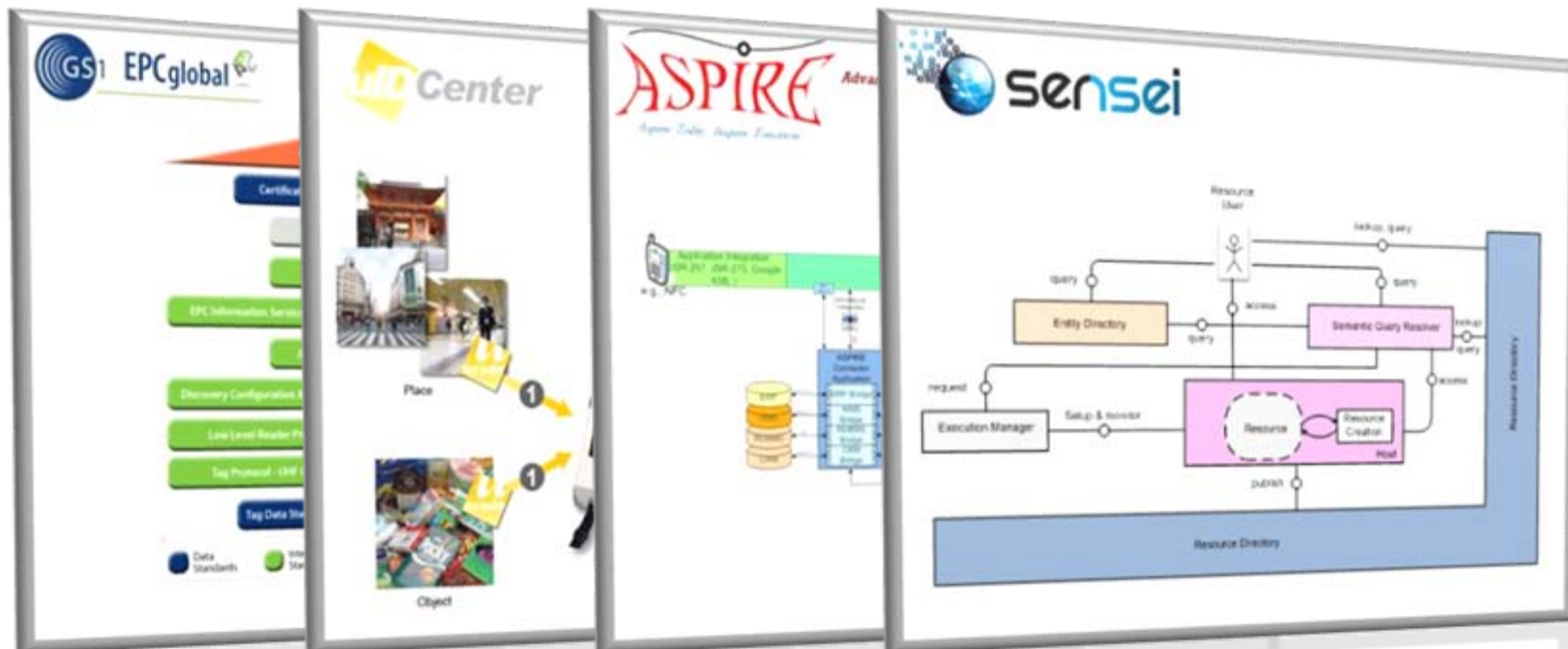


A lot of technology around, but...

- Handicraft, Art...
- Vertical Silos
- No Interoperability

Currently, many IoT Architectures

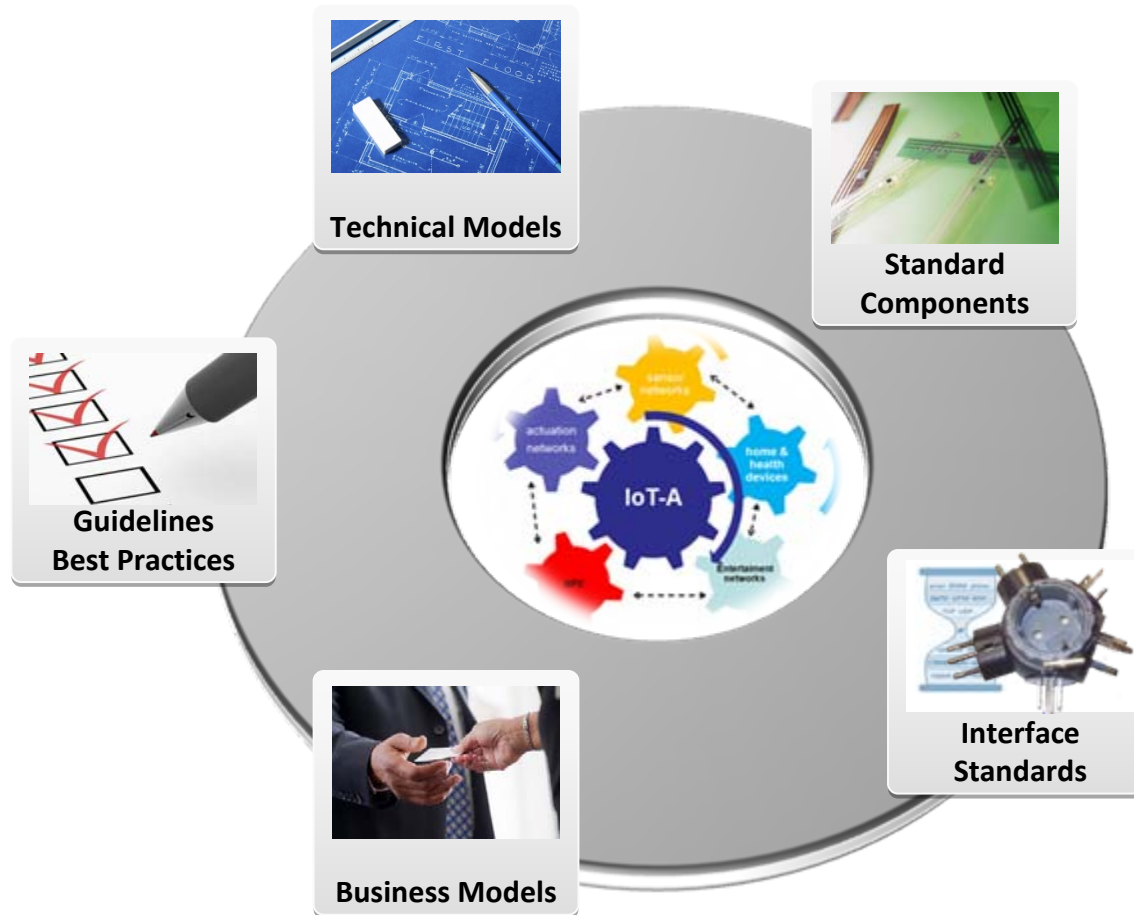
- All were developed in a specific context
- Hard to use in other contexts



Picture Sources: EPCglobal, uID Center, ASPIRE & SENSEI projects

And IoT-A?

- Not yet another architecture, but a **Reference Architecture**

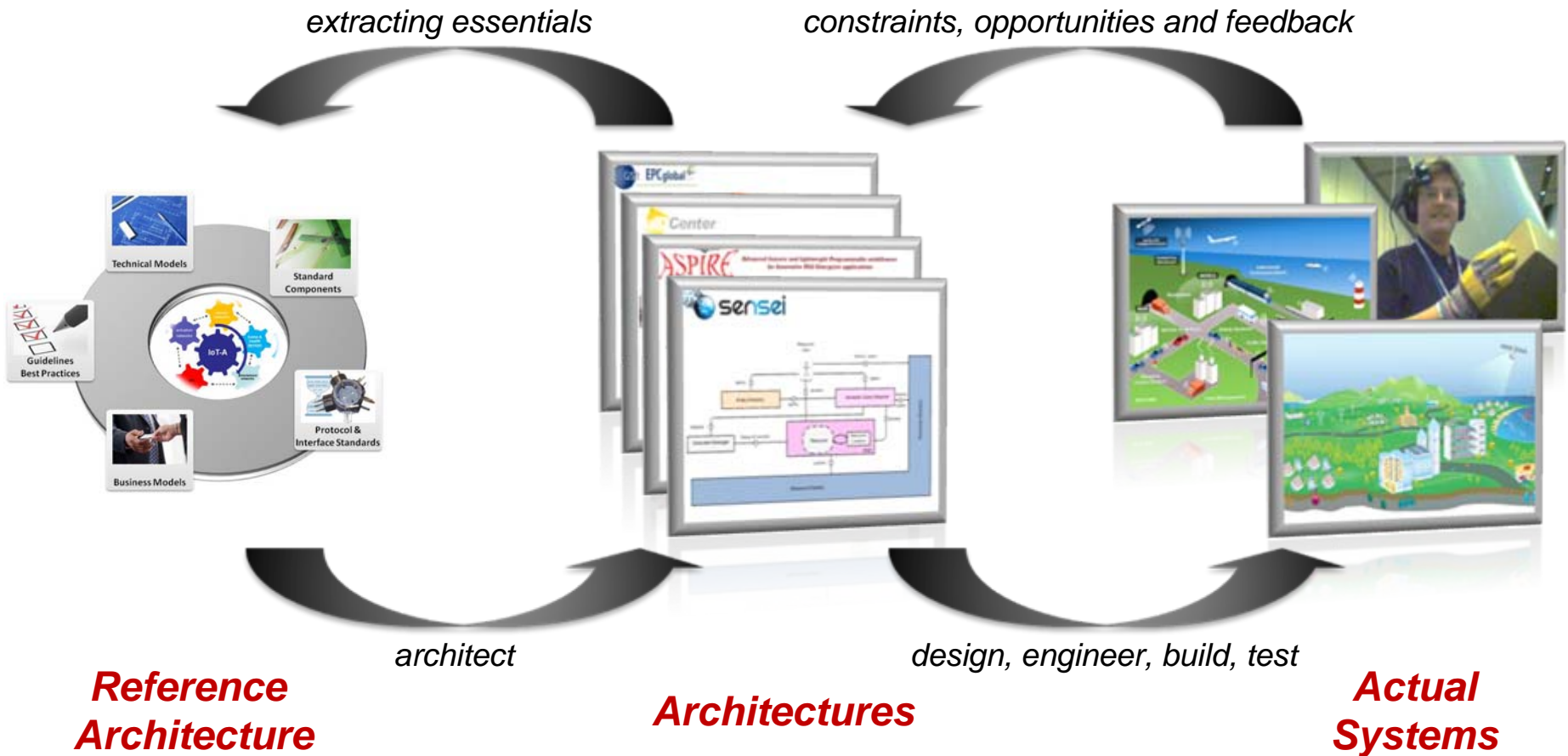


What is a Reference Architecture? [Muller:2008]

- 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



Adapted from: G.Muller, "A Reference Architecture Primer", 2008
 Picture Sources: ETSI, SmartGrids ETP

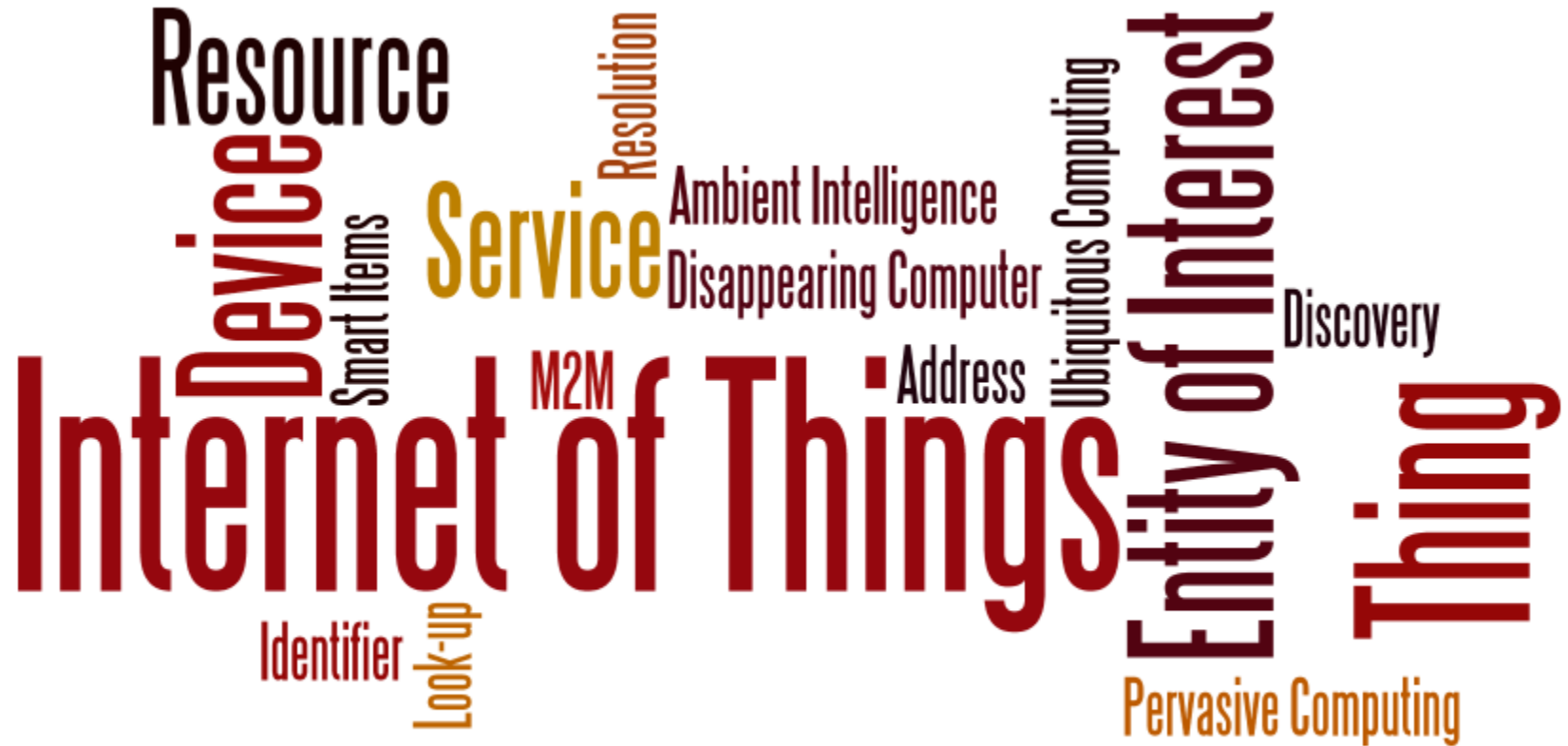
Step 1: A Domain Model for the IoT

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: - G.Muller, "A Reference Architecture Primer", 2008
- P. Oldfield, "Domain Modelling", 2002
- Wikipedia

Terminology Babel



What is a „Thing“ ?

This...

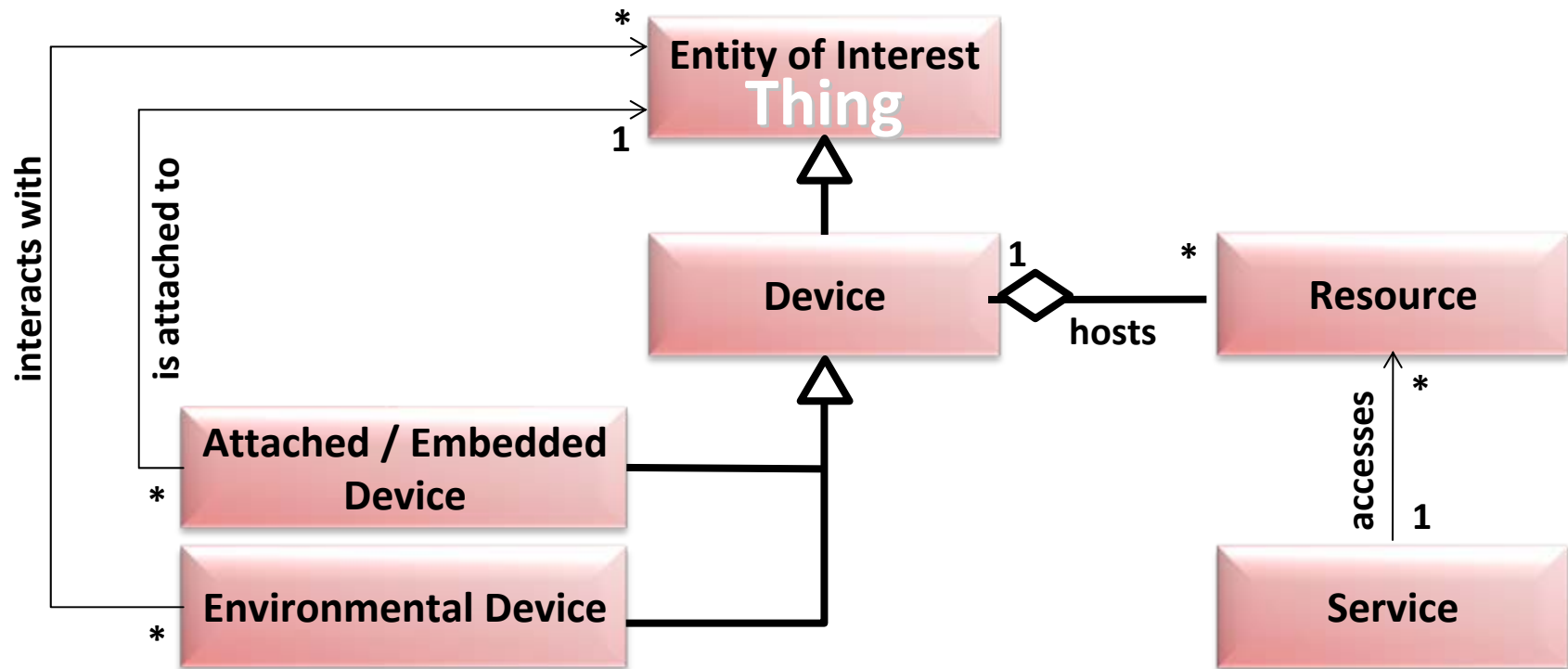


OR

...That?



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

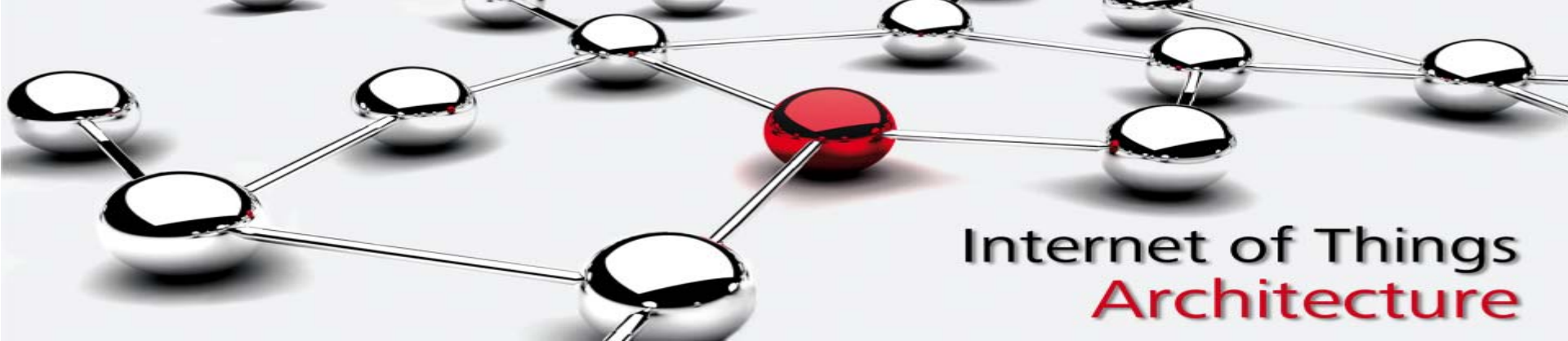
- Technical term used to locate and possibly „talk to“ a thing, a resource, a device or a service
- E.g., IPv6 address, URL, ...
- Sometimes the address can be used as an ID as well

Resolution

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

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



Internet of Things Architecture

Thank you!

Danke ありがとう Merci आभारी 謝謝 Obrigado
Ευχαριστώ Tack 감사합니다 Dankie شكرًا Xin cảm ơn благодаря
Köszí Terima kasih спасибо Mahalo ආචාර්ය Ngiyabona நன்றி
תודה Teşekkürler Muğumesc مرسى Ndiyabulela Dzięki Grazcha

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