Introduction to W3C Web of Things

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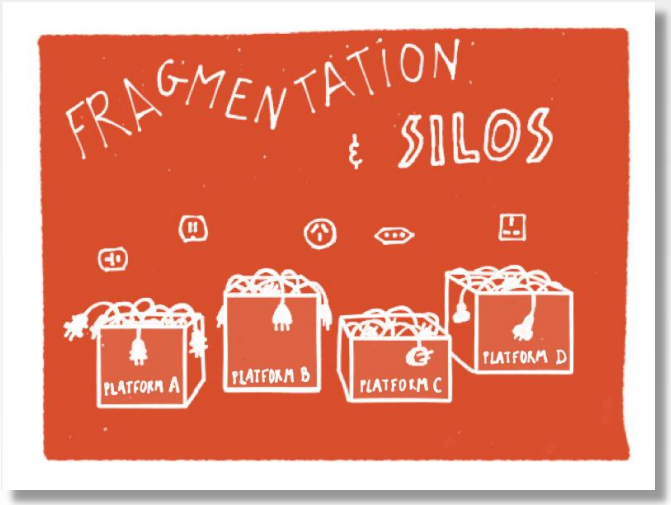
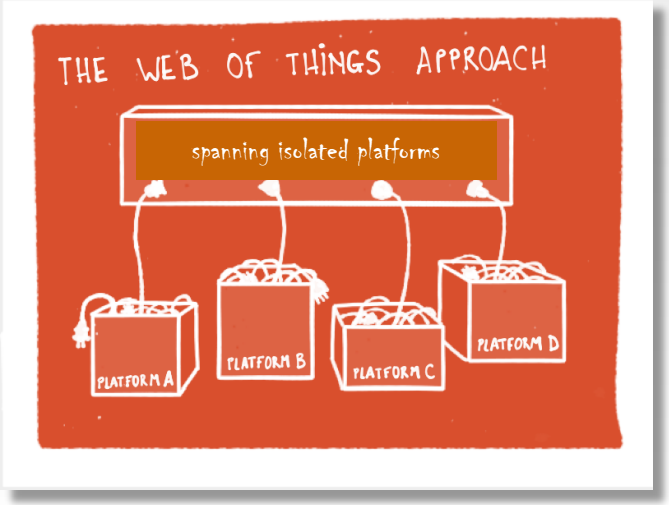
W3C and the Web of Things – resources and links

- W3C: World Wide Web Consortium: https://www.w3.org
- Web of Things Interest Group: https://www.w3.org/WoT/IG/
  - Charter: Leverage web standards and technology to enable IoT applications
  - Web architecture: https://www.w3.org/standards/webarch/
- Proposal to charter a Working Group in the W3C to develop standards for WoT:
  - https://www.w3.org/2016/09/wot-wg-charter.html
  - Proposed co-chairs: Matthias Kovatsch (Siemens), Kazuo Kajimoto (Panasonic), Michael McCool (Intel)
  - White paper on WoT architecture: http://w3c.github.io/wot/charters/wot-white-paper-2016.html
- WoT current practices: http://w3c.github.io/wot/current-practices/wot-practices.html

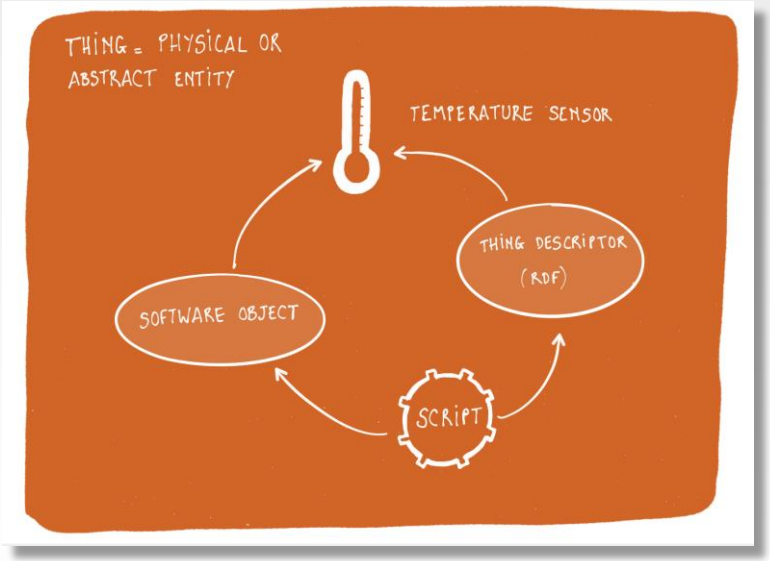
Goal: enabling interoperability across platforms





Rather than defining a new platform → focus on *metadata* and *spanning* existing standards

Thing abstraction



Applications act on "Things"

- Things are *software objects*
- Digital avatars representing physical or abstract entities
- Have properties, support actions and events
- Can be local or remote

Rich metadata descriptions for every "Thing"

- Each Thing has a URI for its name
- URI provides access to its description
- Ontologies describe "things" and their relationships
- Using W3C's Linked Data semantic framework

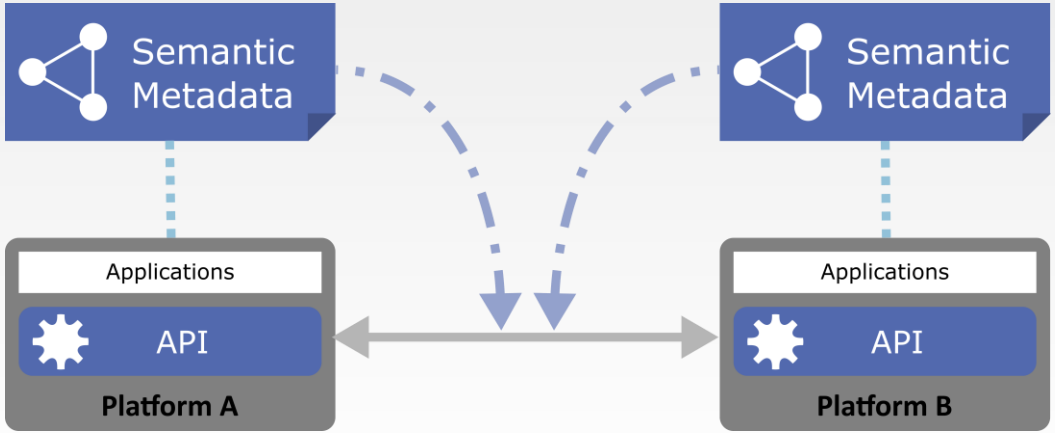
Benefits of standardised metadata

Metadata simplifies application development

- Decouples underlying protocols
- Enables automated tooling

Metadata enables interoperability

- Describe the interfaces exposed to applications
- Describe the communication and security requirements for accessing things
- Describe the data models, semantics, and domain constraints



Linked Data and semantic models

Well-defined semantics ensure that platforms share the same meaning for the data they exchange

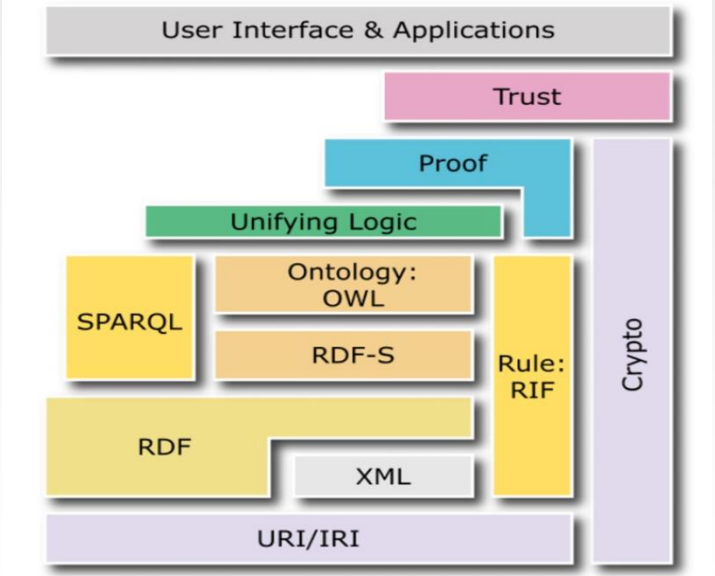
→ Discovery based upon properties and relationships

- Search engines that can index the Web of Things

→ Verify that a thing is consistent with given models

→ Design service compositions based upon knowledge of which services are compatible

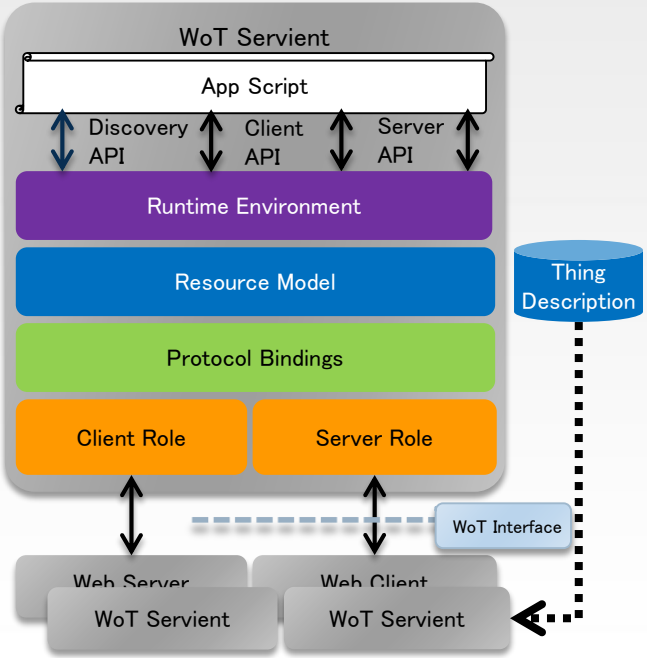
→ Reuse existing domain knowledge (eg schema.org)



RDF = semantic network with nodes connected by labelled arcs

W3C has a rich suite of related standards

Web of Things – current reference architecture



Things can simultaneously be both clients and servers

- "Servients"
- Use plugin "connectors" to specific protocols
- Can be different protocols on different connectors

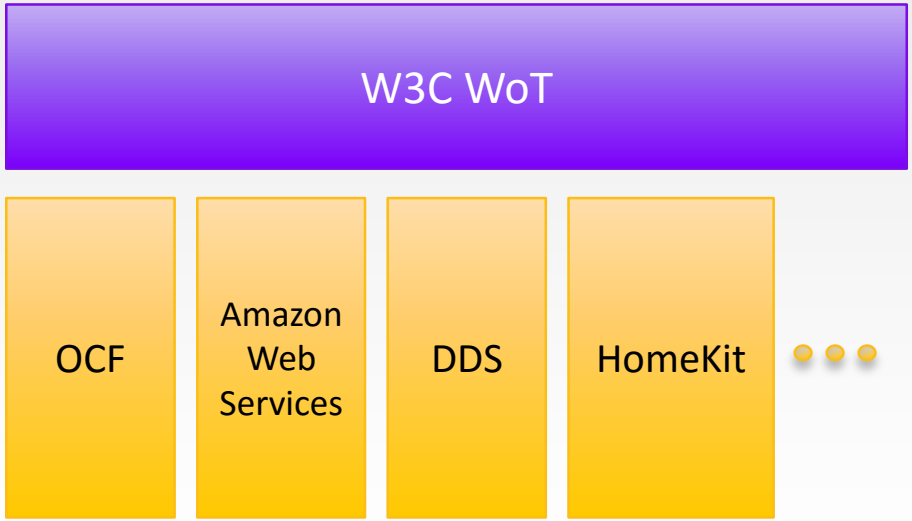
Proposed WG deliverables to include

- **Thing Description** (TD) metadata format
- Language-independent API
- Protocol binding
  - Map from abstract "interaction model" to concrete protocol
- Security management

Relationship of W3C WoT to OCF

W3C can provide community-based…

- Uniform Thing Description for all ecosystems
  - Explicit support for IoT services and devices
    - But still support web service ecosystem
  - In contrast with RAML/Swagger:
    - Only designed for server-based web services
- Connect existing Web community to the IoT
  - Semantic web (RDF, schema.org, …)
  - Browsers
  - Search engines
  - Web services



Summary

- W3C WoT WG to target applying web technologies to the Internet of Things
  - Develop “Web of Things” standards
- Based on several years of work in the W3C WoT Interest Group
- Aiming at an abstraction layer above individual protocols
  - Focus on *metadata* describing internet of things services, protocols, and resources
  - Leverage existing web technologies and standards, in particular, the semantic web

➔ **Enable (1) scalable tooling ecosystem for bridging, validation, and search, among others; and (2) a vendor and platform independent open market for services.**

Backup

Tooling for Bridging

Levels of Abstraction – separation of concerns

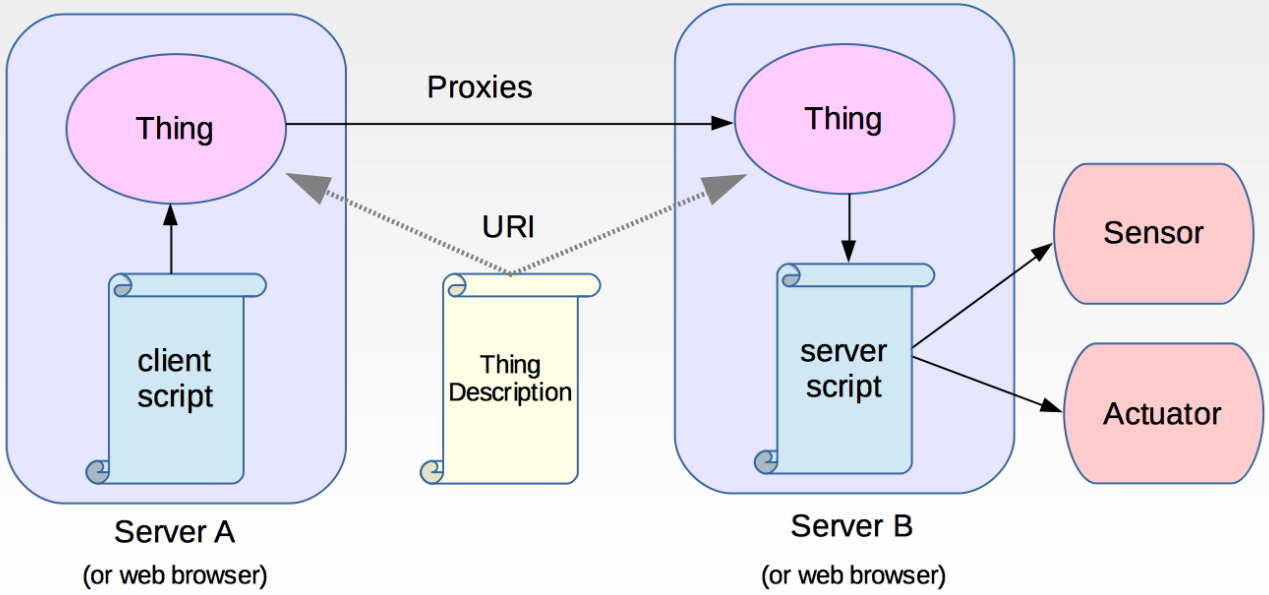
Application Developer
(WoT focus)

Platform Developer
(IoT focus)

Application	Define thing behaviour in terms of their properties, actions and events, using APIs for control of sensor and actuator hardware
Things	Software objects representing abstract or physical devices and state Abstract thing to thing interaction Semantics and Metadata, Data models and Data
Transfer	Bindings of abstract messages to mechanisms provided by each protocol, including choice of communication pattern, e.g. pull, push, pub-sub, peer to peer, etc.
Transport	REST based protocols, e.g. HTTP, CoAP Pub-Sub protocols, e.g. MQTT, XMPP Others, including non IP transports, e.g. Bluetooth
Network	Underlying communication technology with support for exchange of simple messages (packets) Many technologies designed for different requirements

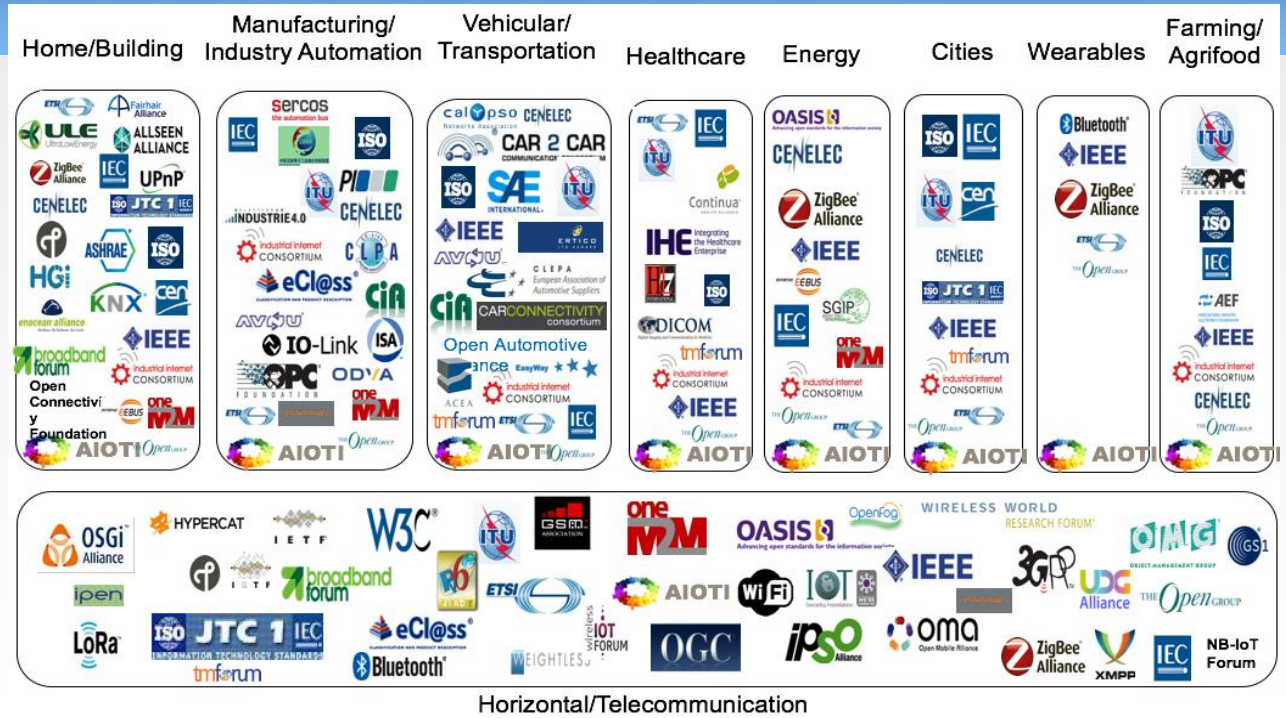
Distributed Web of Things

- Thing descriptions can be used to create proxies for a thing, allowing scripts to interact with a local proxy for a remote entity
- Scripts can run on servers or as part of Web pages in Web browser for human machine interface
- Thing topologies
  - Peer to Peer, Peer to Peer via Cloud, Star, Device to Cloud, Star to Cloud
  - Proxy chains from the edge through the cloud to the browser



Members of the Web of Things Interest Group

IoT Alliances and Standards Development Organisations



Source: AIOTI IoT Standardisation report release 2.6

Liaisons and Collaborations

Reaching out to industry alliances and SDO's:

- Plattform Industrie 4.0 (especially the "semantics" subgroup)
- Proposed German Smart Home Initiative
- Industrial Internet Consortium
- OPC Foundation
- IETF/IRTF
- IoT-SF
- BSI & Hypercat
- oneM2M
- GSMA
- AIOTI
- Open Geospatial Consortium (OGC)
- *OCF*

AIOTI

Work with us to build the Web of Things!

For more information on W3C see:

www.w3.org