IoT Standards Ecosystem, What’s new?

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It all began here at CERN

- Tim Berners-Lee’s 1989/1990 proposal for the Web, and the first Web browser
- Explosive growth in interest
World Wide Web Consortium (W3C)

Mission: lead the Web to its full potential
- The Web is the world's largest vendor-neutral distributed application platform

Founded by Sir Tim Berners-Lee, inventor of the Web
- 400+ Members
- Member-funded international organisation
- Hosts: USA, Europe, China, Japan

Develops standards for Web and semantic technologies
- HTML, CSS, scripting APIs, XML, SVG, VoiceXML, Semantic Web and Linked Data etc.
- Developer oriented, enabling cooperation between organisations with very different backgrounds
- W3C patent policy for royalty free standards
- W3C staff of engineers actively participating in standardisation
- Increasingly involved in verticals: Mobile, TV, Automotive, Digital publishing
The Internet of Things is Fragmented*

- Lots of incompatible platforms, standards and technologies
  - Even when using the same protocols
    - E.g. OCF and oneM2M both use CoAP, yet are not directly compatible
- This is holding back the market potential by
  - Increasing the costs and complexity for developers
  - Increasing the risks for both investors and customers
  - Making it harder to realize the value of your data

* CES 2017 – large number of incompatible smart home offerings with little chance of commercial success
Living with Heterogeneous Standards

• Disparate requirements across use cases from different domains
• This has resulted in the existence of heterogeneous standards
• W3C is focusing on how to simplify applications and decouple them from the IoT standards suites, underlying protocols, data formats and communication patterns
• Analogous to the Internet as an abstraction layer for networks and networking technologies
• The Internet and the Web have stimulated exponential growth in hardware, software and services, so now it’s time to unleash the IoT
• We need to abstract over existing IoT standards and proprietary solutions
  • Including edge, fog, cloud and federated peer to peer approaches
Web of Things

- **Semantic interoperability** layer for the Internet of Things
- Things as local or remote, physical or abstract entities
- **Interaction model** in terms of a thing’s properties, actions and events
  - Programming language agnostic representation based upon [Linked Data](https://www.w3.org/2001/sw/wiki/Linked_Data)
- **Semantic model** in terms of what kind a thing it is, and its relationships to other things
  - Support for rich models of the context
  - Enabling discovery, composition, and adaptation to variations
- **End to end security** across heterogeneous IoT platforms
- Aim is to enable **open markets of services** on the scale of the Web
Simple, Common Interaction Model

Server provides thing

Based upon Linked Data, available in JSON

Client consumes thing
Web of Things for Interoperability

interconnecting existing Internet of Things platforms and complementing available standards, to reduce costs, reduce risks and boost market opportunities
W3C Web of Things Activity

https://www.w3.org/WoT/

- Web of things Interest Group
  - Launched early 2015
  - Pre-standardization activities
    - Use cases and requirements
    - Experimental specs & Plugfests
    - Liaisons with external groups
    - Test frameworks

- Web of things Working Group
  - Launched early 2017
  - Cross domain vocabulary for thing descriptions
  - Serialization as JSON
  - Application APIs
  - Security review with help from other groups
    - Security metadata and cross platform approaches building on top of IoT platform security

Osaka F2F, 2017
Looking further out ...

- **Cognitive Web** as a synthesis of Linked Data, AI, Cognitive Science and Computational Linguistics
  - Cognition as the reasoning processes between sensing and actuation
  - Focus of interest given recent progress on deep learning
- Extending Linked Data to become more like human memory
  - Transient activation levels and persistent link strengths
  - Reasoning based upon statistics of past experience
  - Declarative memory (episodic + semantic) and Procedural memory (rules)
- Cognitive agents for the Web of things – taught like a child through a sequence of lessons and through self-guided exploration

* Inspired by John R. Anderson’s pioneering work on ACT-R
Questions?

W3C – World Wide Web Consortium

Defining Web technology standards

Web of pages, Web of data, Web of things, Web for all

http://www.w3.org