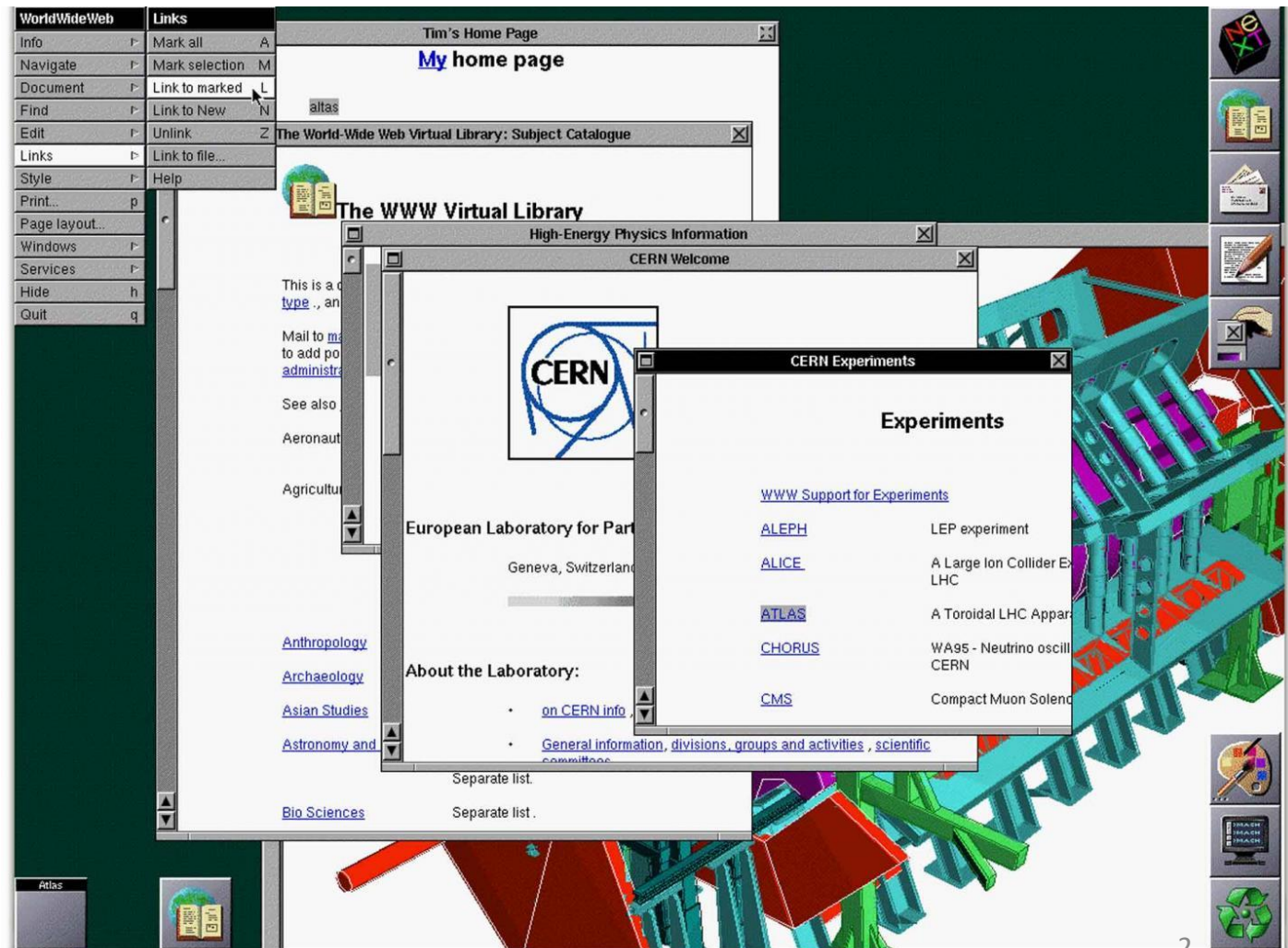# IoT Standards Ecosystem, What's new?

Dave Raggett <dsr@w3.org>, W3C

IoT Week 2017, Geneva

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

W3C Staff

The Internet of Things is Fragmented*
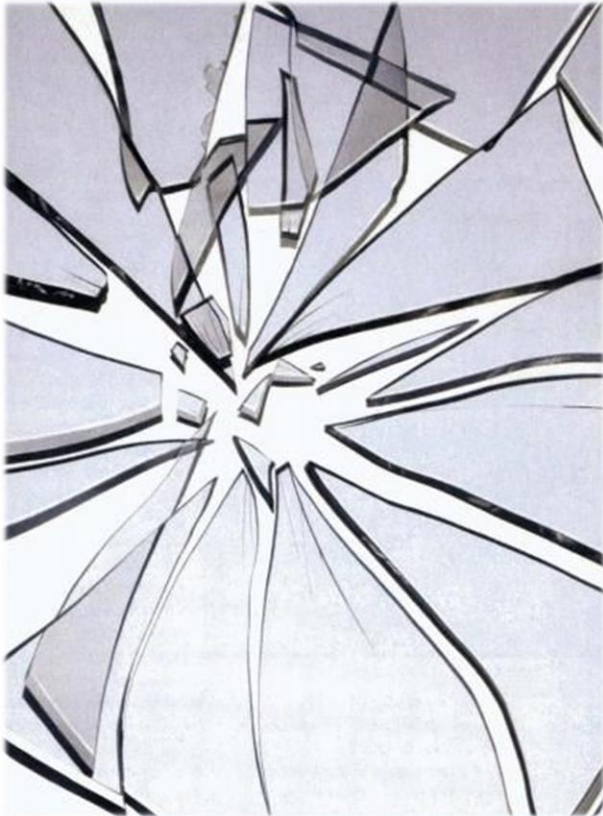
- Lots of incompatible platforms, standards and technologies
  - Even when using the same protocols
    - E.g. OCF and oneM2M both use CoAP, yet are not directly compatible
- This is holding back the market potential by
  - Increasing the costs and complexity for developers
  - Increasing the risks for 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
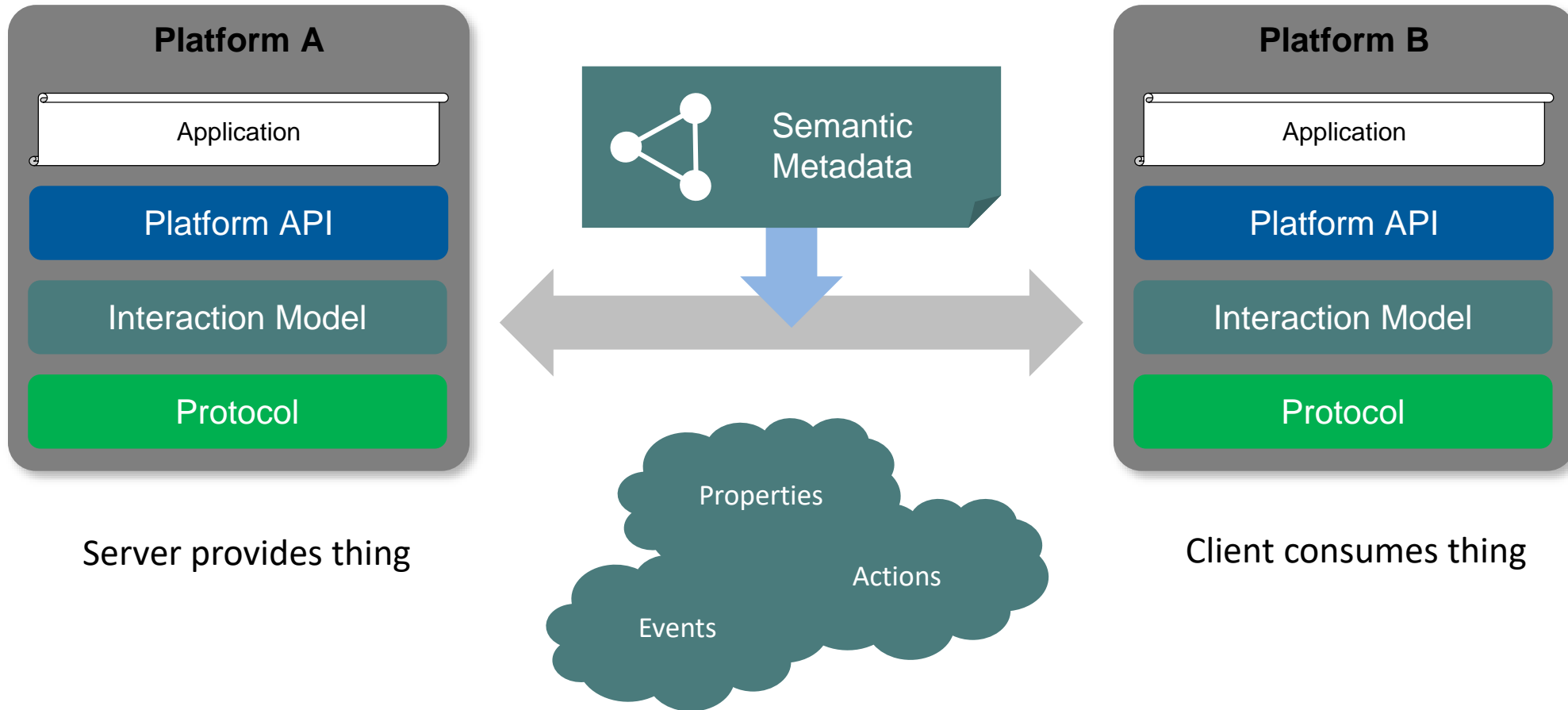
Living with Heterogeneous Standards

- 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
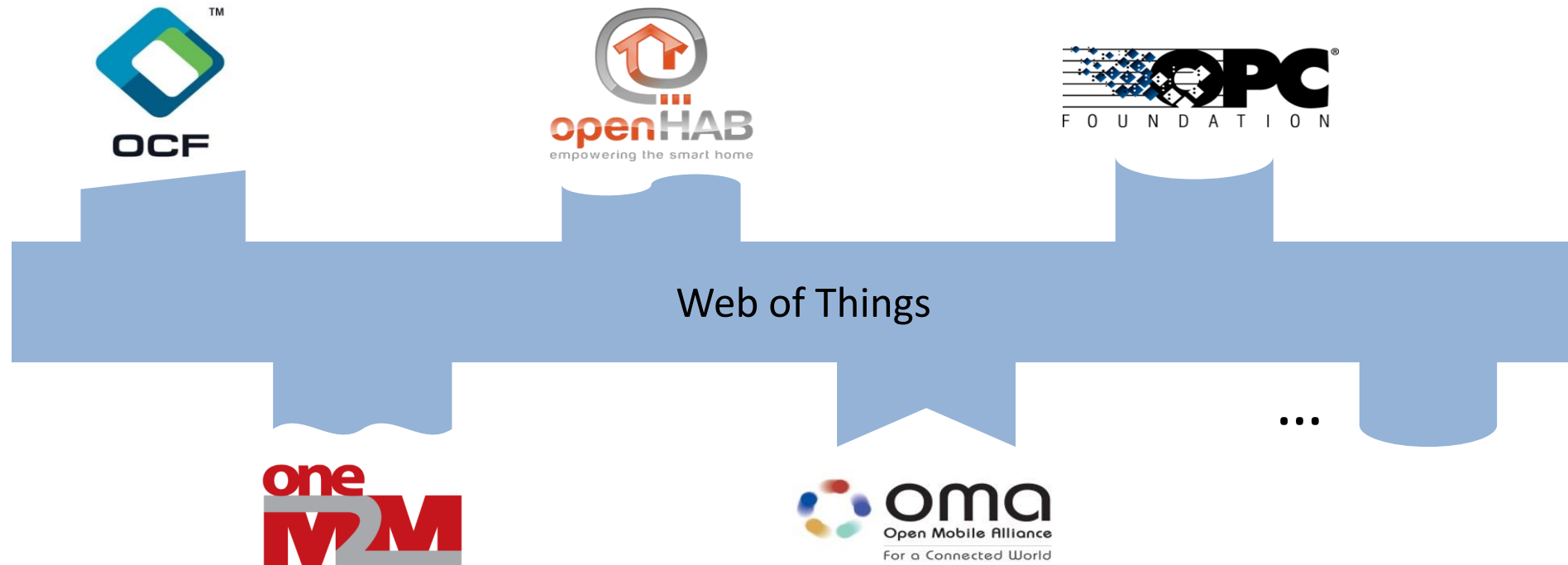 - Including edge, fog, cloud and federated peer to peer approaches

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**
- **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

W3C®

Platform A

Application

Platform API

Interaction Model

Protocol

Semantic Metadata

Platform B

Application

Platform API

Interaction Model

Protocol

Server provides thing

Client consumes thing

Properties

Actions

Events

Based upon Linked Data, available in JSON

Web of Things for Interoperability

W3C®

Web of Things

...

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

W3C Web of Things Activity

- Web of things Interest Group
  - Launched early 2015
  - Pre-standardization actvities
    - 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