



W3C Web of Things

W3C Auto WG F2F Meeting April 2016



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Internet of Things - Landscape

City/Infrastructure (46 Companies)



Home (145 Companies)



Toys (25 Companies)



Platform (112 Companies)



Automotive (43 Companies)



Internet of Things

Contact
info@venturescanner.com to
 see all 812 companies

Lifestyle/Entertainment (98 Companies)



User Interface (40 Companies)



Tags/Trackers (24 Companies)



Healthcare (110 Companies)



Fitness (99 Companies)



Smartwatch/Jewelry (44 Companies)



Agriculture (38 Companies)

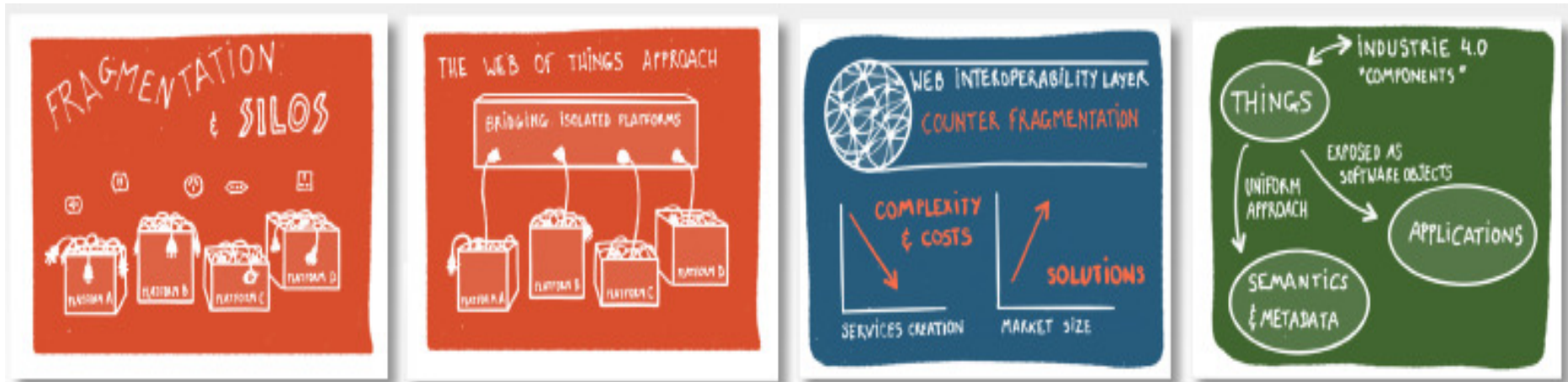


Venture Scanner

IoT Challenges

- **Fragmentation**
 - Incompatible platforms and data silos
- **Wide range of technologies**
 - Generic connectivity
- **Vertical domains**
- **Uniform data representation and processing**
 - No uniform nomenclature for sensors, domains, measurements, units
- **Hard task for application developers**
 - Learn the technologies
 - Making interoperable solutions
 - Address the fragmentation in the market
 - Create cross domain applications

Web of Things



The Web is fuelling a transition from costly monolithic software to open markets of apps

Source: Building the Web of Things, Dave Ragget in W3C Track, WWW 2016

Web of Things - Motivation

- **Web of Things (WoT) concept is becoming more popular**
 - Leverage web standards and technologies to interconnect all types of devices.
 - Expose functionalities using RESTful APIs making them easier to access and use.
 - Provide truly open, flexible, scalable and interoperable services.

Problem to be Addressed

- **Fragmentation in IoT platforms and technologies**
- **High cost of integration into an existing solution**
- **Barriers for semantic interoperability**
- **Security, privacy and trust**

How to Solve

- **Open standards for Web based abstraction layer**
 - Complement existing platforms and standards
 - Enable platforms to interoperate securely

WoT – Clean Separation of Concerns

Application Developer (WoT focus)	Application	Scripts that define thing behaviour in terms of their properties, actions and events, using APIs for control of sensor and actuator hardware <i>Focus on data types and APIs</i>
	Things	Software objects that hold their state Abstract thing to thing messages Semantics and Metadata, Data models and Data
Platform Developer (IoT focus)	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

Source: Building the Web of Things, Dave Ragget in W3C Track, WWW 2016

W3C WoT Interest Group

- **Workshop in Berlin (June 2014)**
- **Launch of WoT IG in early 2015**
 - Chaired by Joerg Heuer, Siemens
 - First F2F Meeting in April 2015, hosted by Siemens
 - Wiki - https://www.w3.org/WoT/IG/wiki/Main_Page
- **Task forces**
 - Thing descriptions and metadata
 - Scripting APIs and protocols
 - Discovery and provisioning
 - Security, privacy and resilience
 - Communications and collaboration
- **WG Charter is under preparation**
 - Will start from late 2016

W3C WoT Interest Group

- **Strong emphasis on practical implementation**
 - Organizing demonstrations of WoT and plugfests in F2F meetings
 - Exploring interoperability among implementations
 - Arrive at a shared understanding
- **Compiled a document on current practices for WoT**
 - Available at - <http://w3c.github.io/wot/current-practices/wot-practices.html>

Thing Description and Metadata

What kind of data do you serve?

Who are you?

How can I access the data/function?



What kind of function do you have?

What kind of protocols/encodings do you support?

Are there some security constrains?

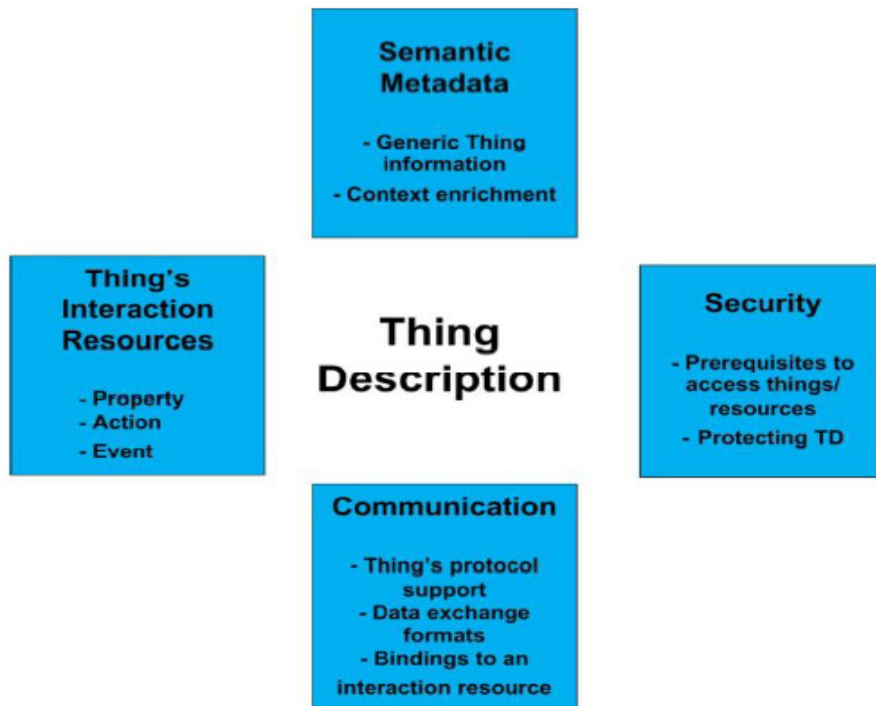
Source: Building Blocks for an Interoperable Web of Things – W3C WoT and BIG IoT, Sebastian Kaebisch in W3C Track, WWW 2016

Thing Description Overview

■ Three fold objectives

- Minimal vocabulary set to describe Things' capabilities and how to access/use them
- Extensible in order to add domain specific and unspecific context
- Optimized representation to describe resource constrained Things

Current Working Model



JSON-LD Example

```
{
  "@context": ["http://w3c.github.io/wot/w3c-wot-td-context.jsonld"],
  "@type": "Thing",
  "name": "MyTemperatureThing",
  "uris": "coap://www.mytemp.com:5683/",
  "encodings": ["JSON"],
  "properties": [
    {
      "name": "temperature",
      "valueType": "xsd:float",
      "writable": false,
      "hrefs": ["temp"]
    }
  ]
}
```

Scripting APIs and Binding to Protocols

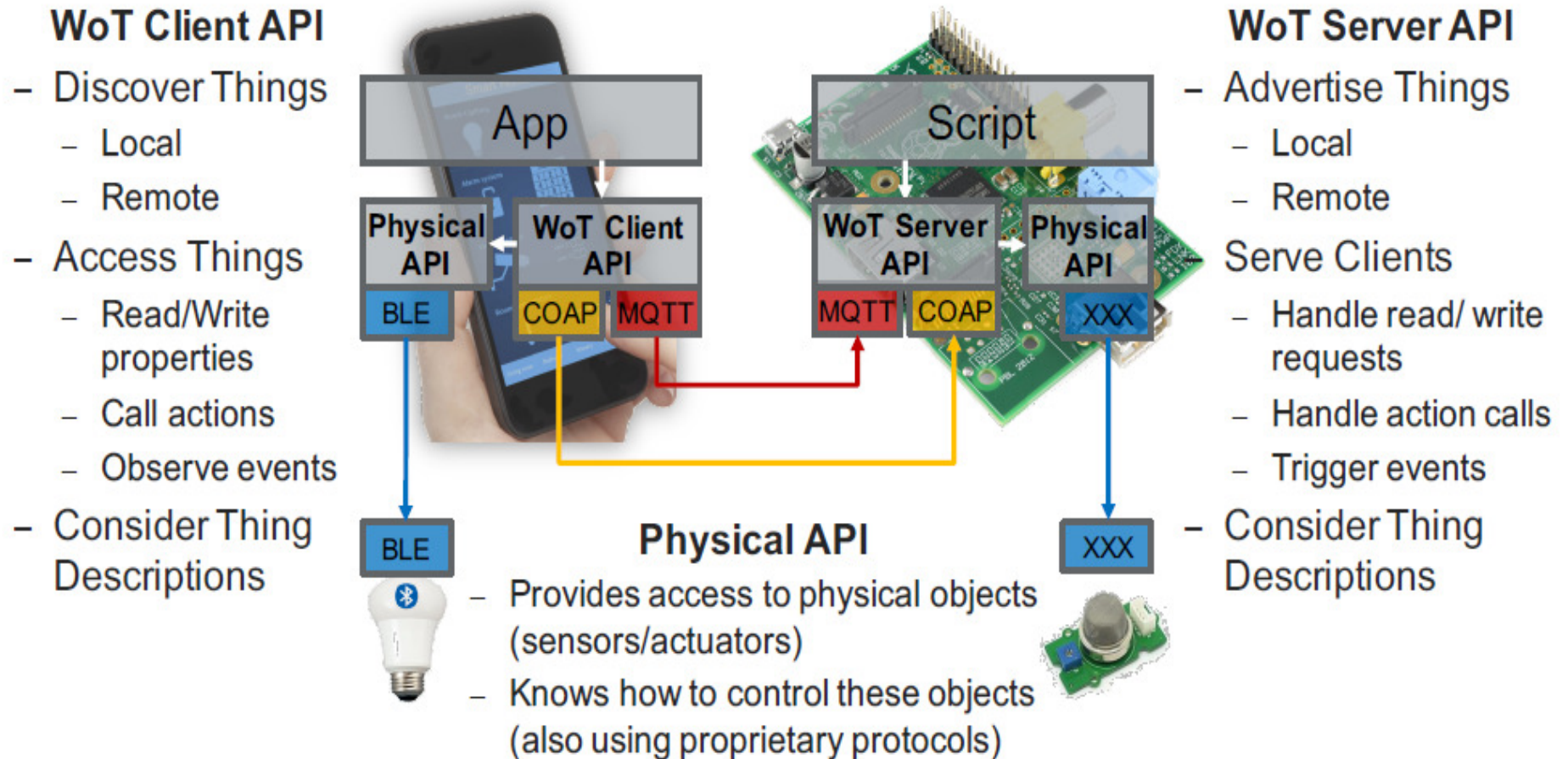
- **What is Scripting API**

- Programming interface that allows scripts to discover things through a Discovery API, issue requests through a Client API, provide resources through a Server API, and access directly attached hardware through a Physical API.

- **Protocol binding**

- Exploring binding to HTTP, CoAP and MQTT

Scripting APIs for WoT



Source: Scripting APIs for the Web of Things, Louay Bassbous in W3C Track, WWW 2016

Resource Discovery

- **Discovery things and their metadata**
- **Six mechanisms**
 - Search around ME (e.g. UriBeacon, iBeacon)
 - Search on a network (e.g. SSDP, mDNS)
 - Search in a directory (e.g. CoAP)
 - Search across Peers (e.g. CoAP RELOAD)
 - Search for metadata (e.g. CoRE Link Format)
 - Search using semantics

Provisioning

- **It includes several aspects**
 - Initial setting up of IoT devices and services
 - Binding to network and security attributes
 - Process of applying security
 - Configuration management and other updates
- **E.g. – OMA LwM2M**

Security, Privacy and Resilience

- **Working towards**

- Security and privacy (SP) challenges
- SP requirements
- SP landscape and advanced concepts

- **Wiki -**

<https://www.w3.org/WoT/IG/wiki/Security, Privacy and Resilience>

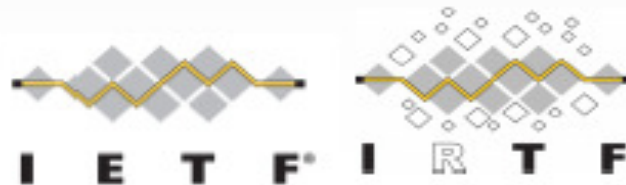
Communications and collaboration

Reaching out to industry alliances and SDO's to drive convergence to unleash the potential

- Plattform Industrie 4.0
 - Especially the “semantics” subgroup
- Industrial Internet Consortium
- Open Connectivity Foundation
- OPC Foundation
- IETF/IRTF
- oneM2M
- AIOTI



OPEN
CONNECTIVITY
FOUNDATION™



Source: Building the Web of Things, Dave Ragget in W3C Track, WWW 2016

Deliverables

- **Current practices document**
 - Compilation of experimental specifications being used in WoT
- **Architecture**
 - Underlying architectural concepts of WoT
- **Uses cases and requirements**
 - Atomic use cases
- **Survey of current technology landscape**
- **Available at**
 - <http://w3c.github.io/wot/>

Thank you!



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- Twitter: [@skdatta2010](https://twitter.com/skdatta2010)