

# **Web Standards for the IoT**

IRTF T2TRG WISHI

Prague, Czech Republic, July 2017

# W3C WoT Mission

**Not to be yet another standard**



# W3C WoT Mission

**Not to be yet another standard**



Web of Things



...

Be descriptive instead of prescriptive  
and complement existing standards

plantronics



inswave  
Technology and Inspiration

TOSHIBA

ACCESS



Australian  
National  
University

UNIVERSITY OF  
Southampton



SONY

# W3C WoT Scope



AVAYA

CableLabs

HITACHI  
Inspire the Next



SIEMENS



Inria  
INVENTORS FOR THE DIGITAL WORLD



Panasonic

ITMO UNIVERSITY

China  
unicom 中国联通

OCF



Fairhair  
Alliance

RWE



Insight

cross-platform, cross-domain

Pacific  
Northwest  
NATIONAL  
LABORATORY



FUJITSU

...

TNO

EURECOM  
Sophia Antipolis



at&t



HUAWEI



CHINA MOBILE

NOKIA



ERICSSON

KDDI

JS Foundation

ETRI  
Electronics and Telecommunications  
Research Institute



Blockstream

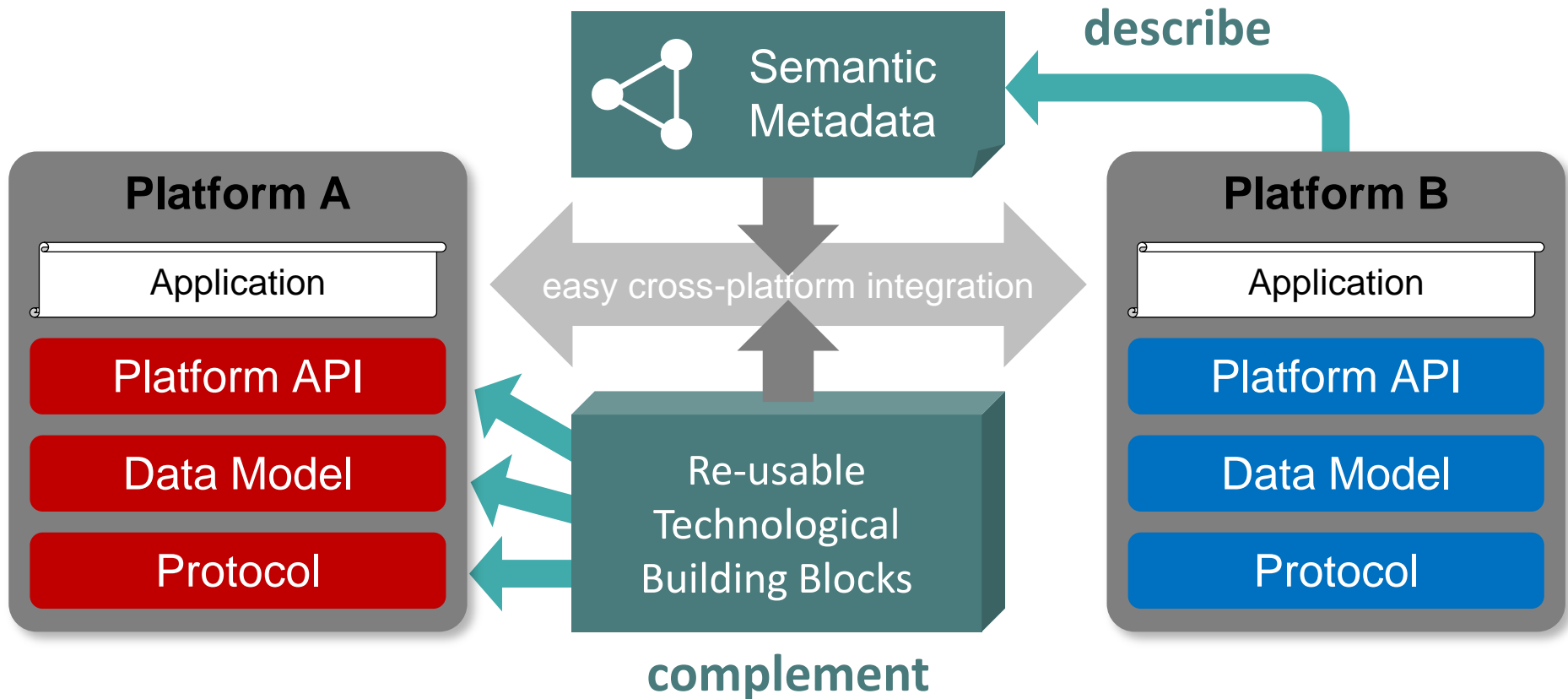
SoftBank



ORACLE

Alibaba Group

# W3C WoT Approach



# Describe



- Formal model around simple interactions
  - Linked Data vocabulary
  - Semantic Web ontology
- Multiple serializations
  - JSON-LD (first CR release)
  - JSON (future versions)  
application/wot-td+json
  - CBOR, EXI, ...
- Domain-specific extensions

JSON-LD  
(Linked Data)

# JSON-LD Serialization

W3C WoT TD  
vocabulary

```
{
  "@context": [
    "http://w3c.github.io/wot/w3c-wot-td-context.jsonld",
    { "domain": "http://example.org/actuator#" },
  ],
  "@type": "Thing",
  "name": "MyLEDThing",
  "base": "coaps://myled.example.com:5683/",
  "security": {
    "cat": "token:jwt",
    "alg": "HS256",
    "as": "https://authority-issuing.example.org"
  },
  "interaction": [
    {
      "@type": ["Property", "domain:onOffStatus"],
      "name": "status",
      "outputData": {
        "type": "boolean",
        "@type": "domain:operationstate"
      },
      "writable": true
    }
  ]
}
```

domain-specific  
vocabulary

JSON Schema  
vocabulary with  
annotations

# Complement

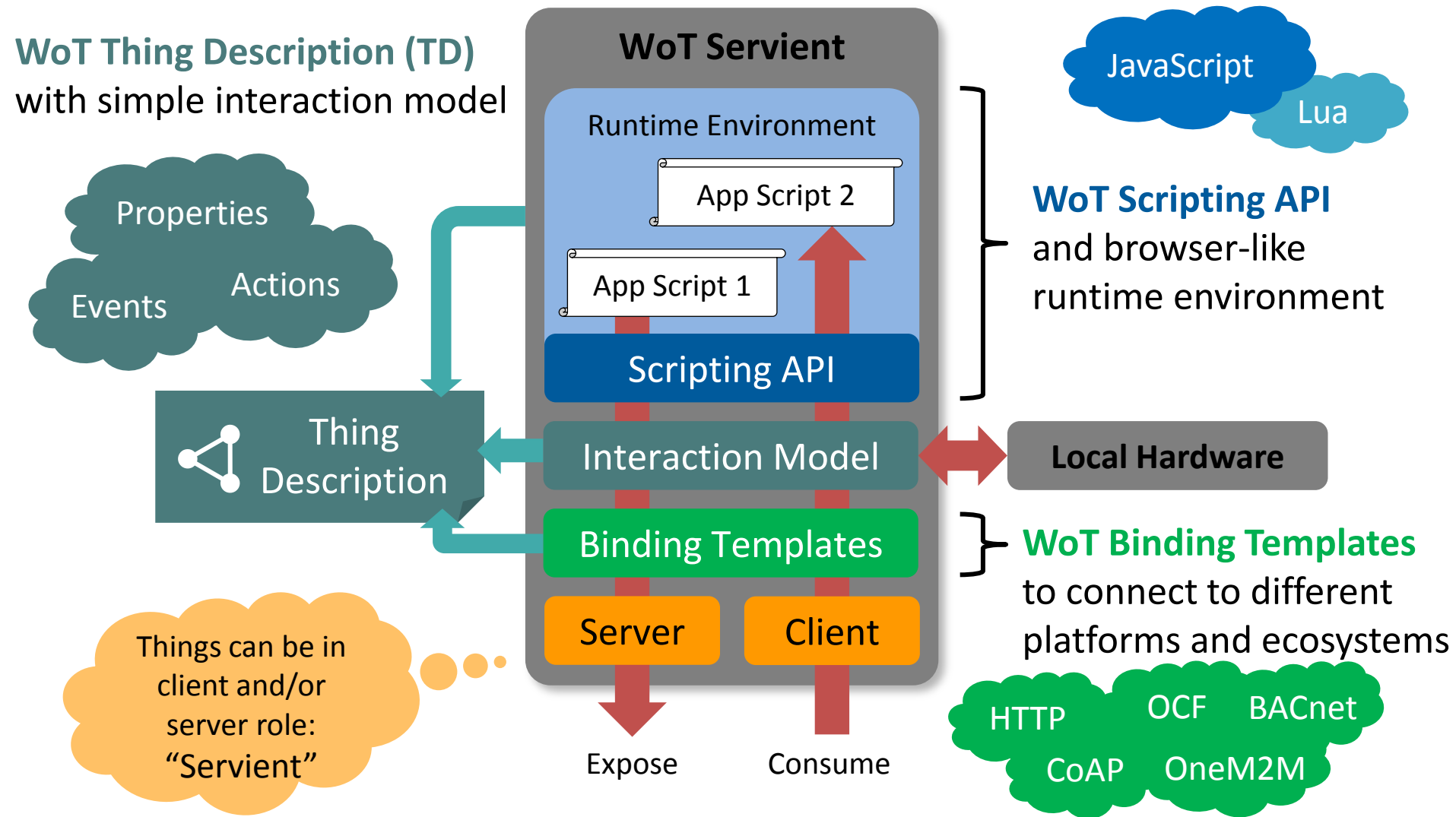
- WoT Thing Description
  - See “Describe” slide
- WoT Binding Templates
  - Descriptions for specific protocols and platforms
  - Binding implementations as (open-source) drivers
- WoT Scripting API
  - Platform-independent application logic



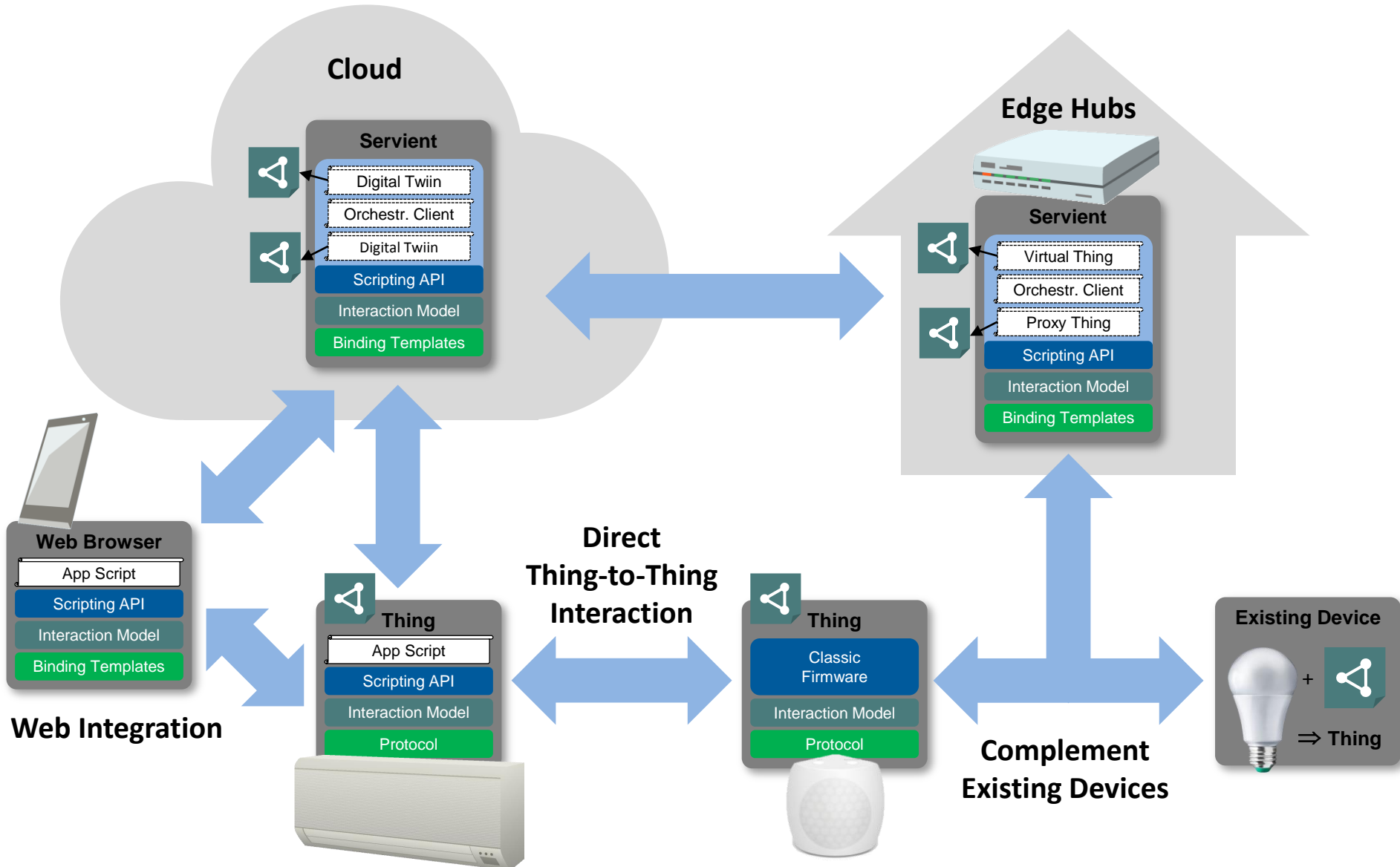
Re-usable  
Technological  
Building Blocks



# W3C WoT Building Blocks



# W3C WoT Architecture



# W3C WoT Process

## Interest Group (IG)

<https://www.w3.org/2016/07/wot-ig-charter.html>

- Started spring 2015
- 220 participants
- Informal work, outreach
- Explorative work, validation
- PlugFests with running code
- Liaisons and collaborations with other organizations and SDOs (+ “OpenDays”)

## Working Group (WG)

<https://www.w3.org/2016/12/wot-wg-2016.html>

- Started December 2016
- 92 participants
- Normative standardization
- Work on deliverables
- W3C Patent Policy for royalty-free standards
- Member organizations and Invited Experts

# W3C WoT Process



# GitHub

- IG: <https://github.com/w3c/wot/>
- WG:
  - <https://github.com/w3c/wot-architecture>
  - <https://github.com/w3c/wot-thing-description>
  - <https://github.com/w3c/wot-scripting-api/>
  - <https://github.com/w3c/wot-binding-templates>
- Open Issues to comment, Pull Requests to contribute

# W3C WoT Progress

- IG started 2015 to identify initial building blocks
  - Current Practices documented
  - Practical evaluation in “PlugFests”
- WG chartered end of 2016 until end of 2018
  - Editor’s Drafts available
  - First Public Working Drafts expected August 2017
  - Candidate Recommendations end of 2018...
- WG re-chartering for 2019+

# Opportunities for Reuse/Integration

- Royalty-free Web standards
- Technological building blocks
  - Non-prescriptive: take what you need
  - Open source reference implementation  
<https://github.com/thingweb/node-wot>
- Extension points like in the Web
  - Semantic vocabulary → [iot.schema.org](http://iot.schema.org), oneM2M
  - Binding Templates → OCF, oneM2M, other liaisons
  - Libraries on top of Scripting API → individual Members

# Opportunities for Collaboration

1. OpenDay at W3C WoT Face-to-Face
  - Proposed and invited talks for awareness
2. W3C WoT Call invites
  - Opportunity for more detailed discussions
3. Liaisons as formal collaboration
  - Chance for mutual alignment
  - Liaison inputs taken into account for WoT design
4. W3C WoT Group Member
  - Organization needs to be W3C Member
  - Invited Expert status
  - Note W3C Patent Policy for WG contributions  
(<https://www.w3.org/Consortium/Patent-Policy-20040205/>)

# Opportunities for Research

- Machine-understandable interaction models
  - Hypermedia controls
  - Programming abstractions for goal definition
  - Recovery from errors
- Semantic Web beyond knowledge management
  - Dynamic graphs
  - Privacy preservation
  - Reasoning in constrained environments
- Security in loosely-coupled systems



# W3C WoT Online Resources

- W3C WoT Interest Group
  - <https://www.w3.org/WoT/IG/> (blog)
  - <https://www.w3.org/2016/07/wot-ig-charter.html> (charter)
  - <https://lists.w3.org/Archives/Public/public-wot-ig/> (subscribe to mailing list)
- W3C WoT Working Group
  - <https://www.w3.org/WoT/WG/> (dashboard)
  - <https://www.w3.org/2016/12/wot-wg-2016.html> (charter)
- W3C WoT Wiki (IG+WG organizational information)
  - [https://www.w3.org/WoT/IG/wiki/Main\\_Page](https://www.w3.org/WoT/IG/wiki/Main_Page)
- W3C WoT GitHub (IG technical proposals)
  - <https://github.com/w3c/wot>
- W3C WoT WG Documents
  - <https://w3c.github.io/wot-architecture/>
  - <https://w3c.github.io/wot-thing-description/>
  - <https://w3c.github.io/wot-scripting-api/>
  - <https://w3c.github.io/wot-binding-templates/>