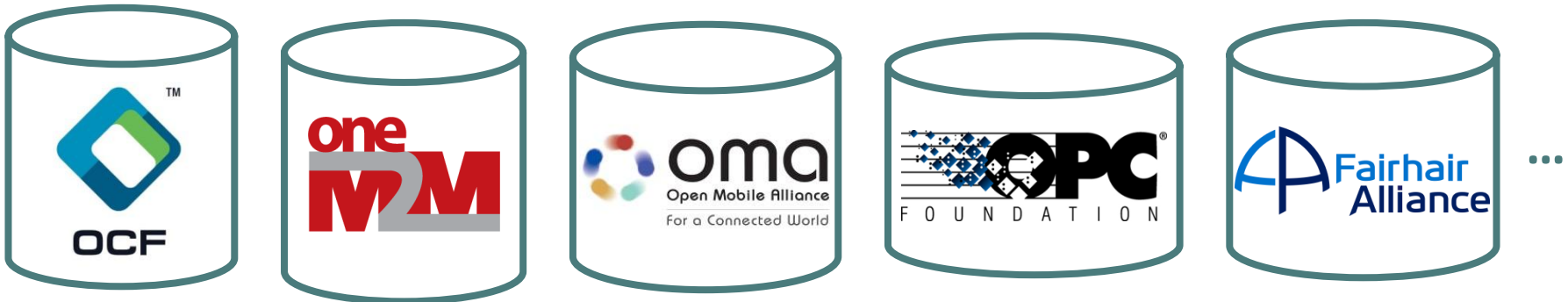


Web Standards for the IoT

IRTF T2TRG WISHI

Prague, Czech Republic, July 2017

Problem: Application/Platform Silos



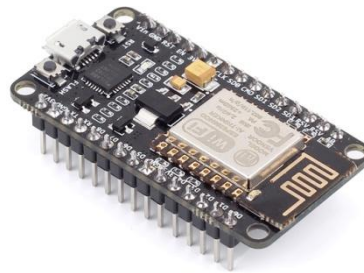
Internet of Things: Connectivity



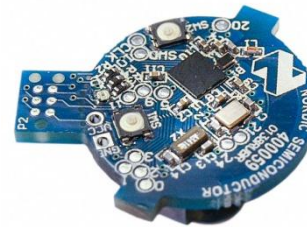
IEEE 802.15.4



Ethernet



Wi-Fi



Bluetooth



LoRa

...

W3C WoT Mission

Not to be yet another standard



W3C WoT Mission

Not to be yet another standard



Web of Things: “glue in-between”



...

Extend Web technologies to the IoT to complement IoT standards
by being *descriptive* instead of prescriptive

plantronics.



inswave
Technology and Inspiration

TOSHIBA

ACCESS



UNIVERSITY OF
Southampton



SONY

W3C WoT Scope



AVAYA

CableLabs

HITACHI
Inspire the Next



Inria
INVENTORS FOR THE DIGITAL WORLD



SIEMENS

Panasonic



Fairhair
Alliance

RWE



OCF



WoT: cross-platform, cross-domain



FUJITSU



TNO



NOKIA



KDDI



Google



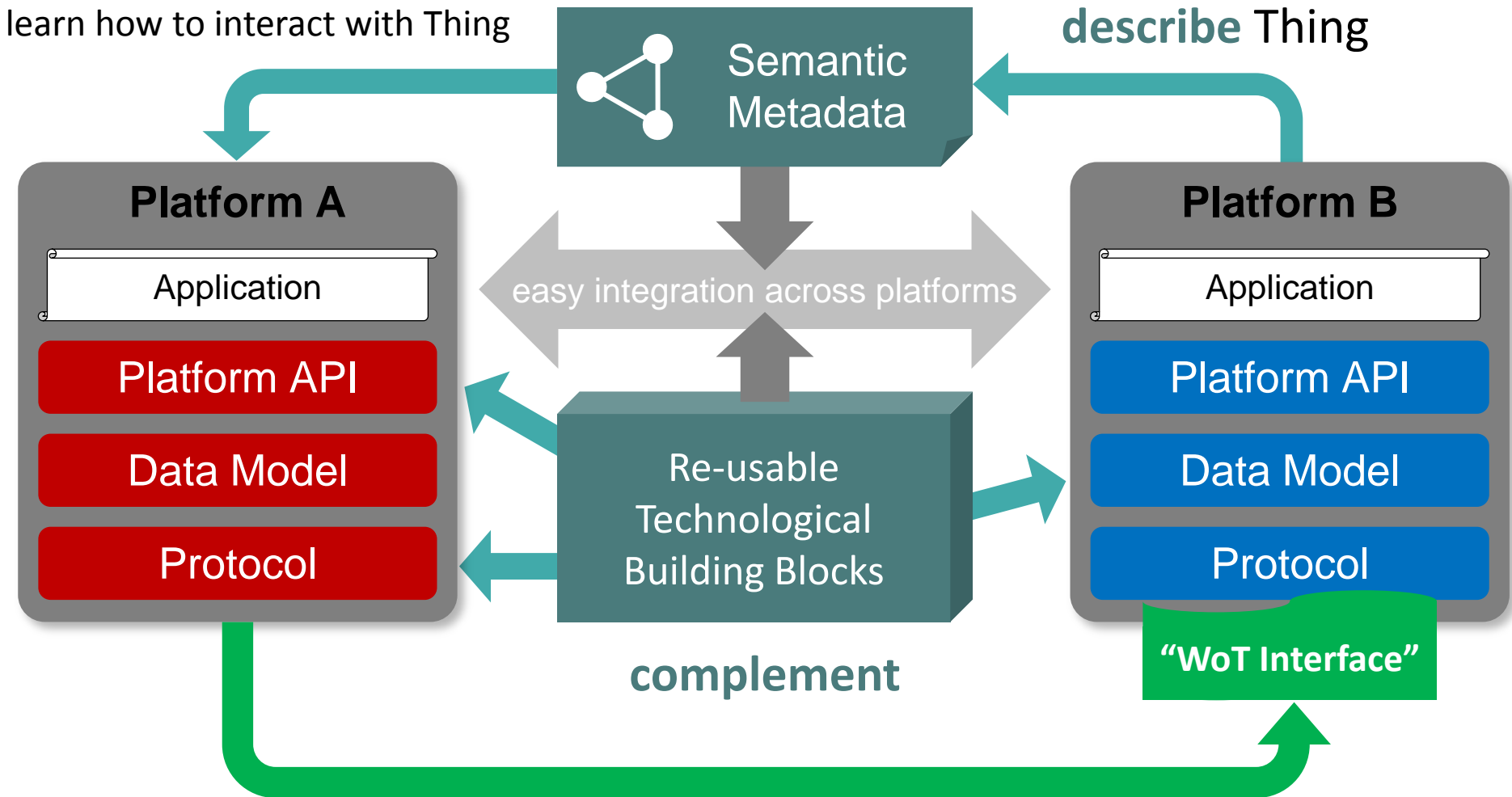
SoftBank



ORACLE



W3C WoT Approach



Describe: Machine-understandable Model



Start with
versatile core and
evolve like the Web

- Linked Data vocabularies
 - Simple interaction model
 - Generic data model (JSON-like)
 - Semantic Web ontology
- Extension points
 - Domain-specific vocabularies
 - New interaction patterns
- Multiple serializations
 - JSON-LD (first CR release)
 - JSON, CBOR, EXI, ...

*CR: W3C Candidate Recommendation

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",
  "security": {
    "cat": "token:jwt",
    "alg": "HS256",
    "as": "https://authority-issuing.example.org"
  },
  "interaction": [
    {
      "@type": ["Action", "domain:fadeIn"],
      "name": "fadeIn",
      "inputData": {
        "type": "integer",
        "minimum": "0",
        "domain:unit": "domain:ms"
      },
      "link": [
        {
          "href": "coaps://myled.example.com:5684/in",
```

domain-specific
vocabulary

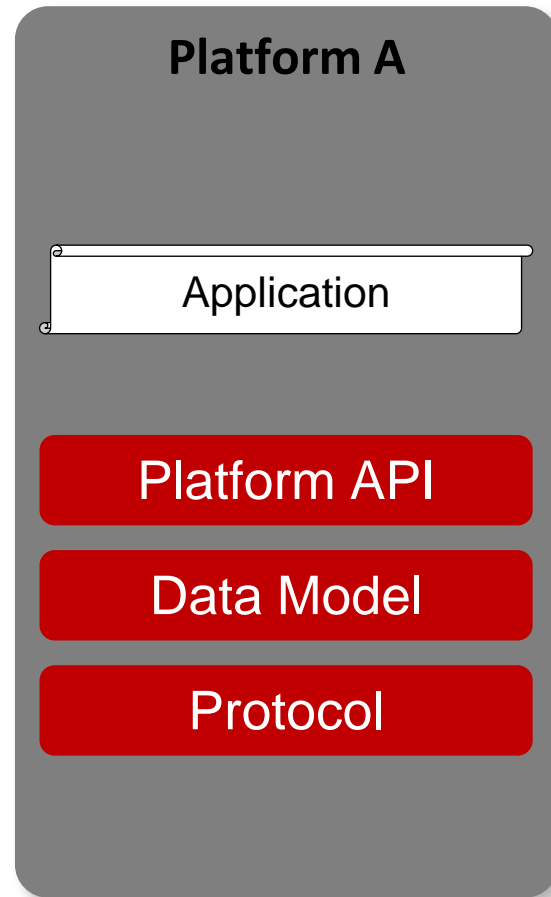
JSON Schema
base types plus
semantics

Complement: Building Blocks

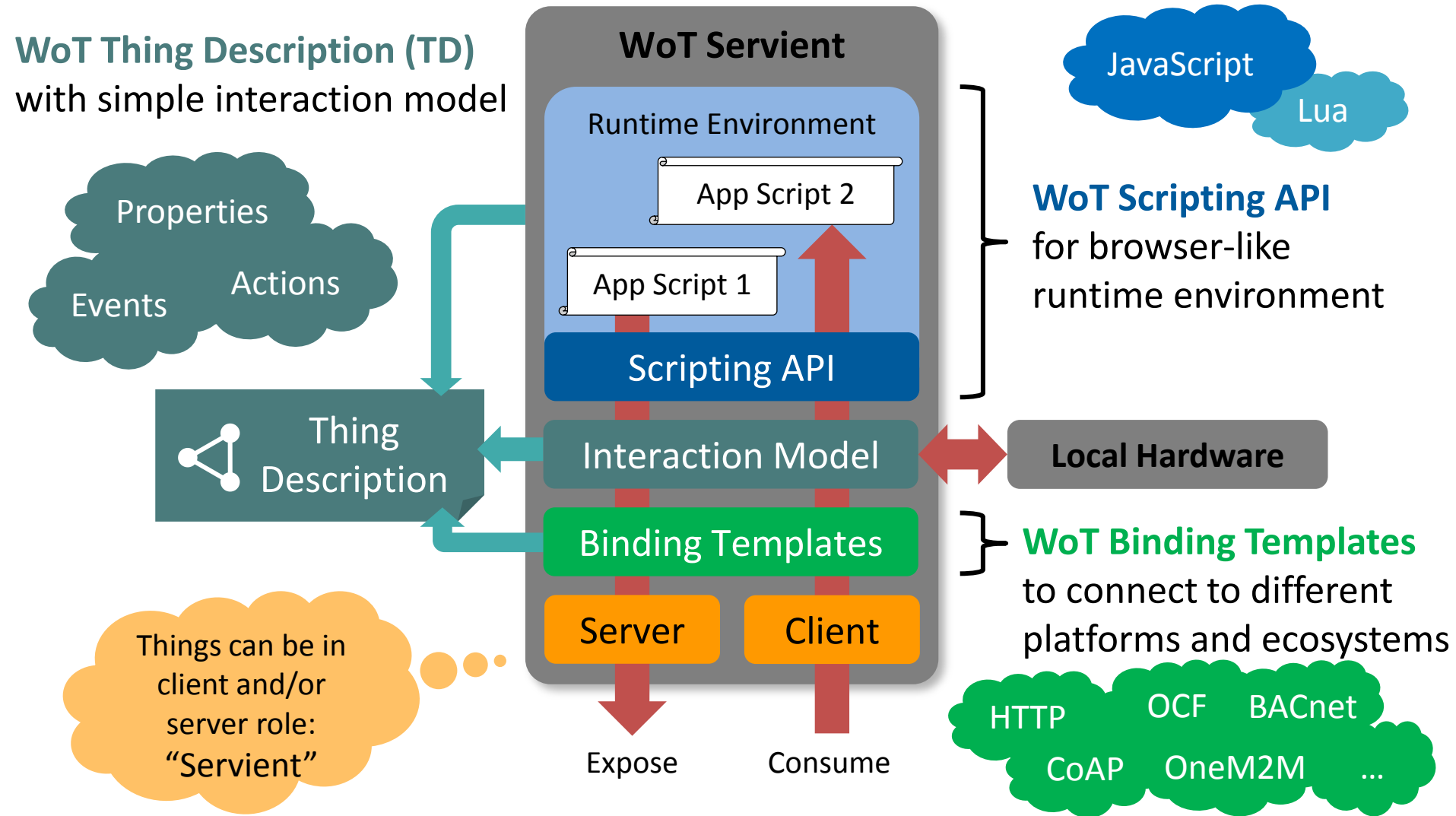
- WoT Thing Description (TD)
 - Machine-understandable format
 - Uniform documentation
- WoT Binding Templates
 - Descriptions for specific protocols and platforms
 - Used in Thing Description
 - Re-usable binding “drivers”
- WoT Scripting API
 - Browser-like runtime for platform-independent IoT applications



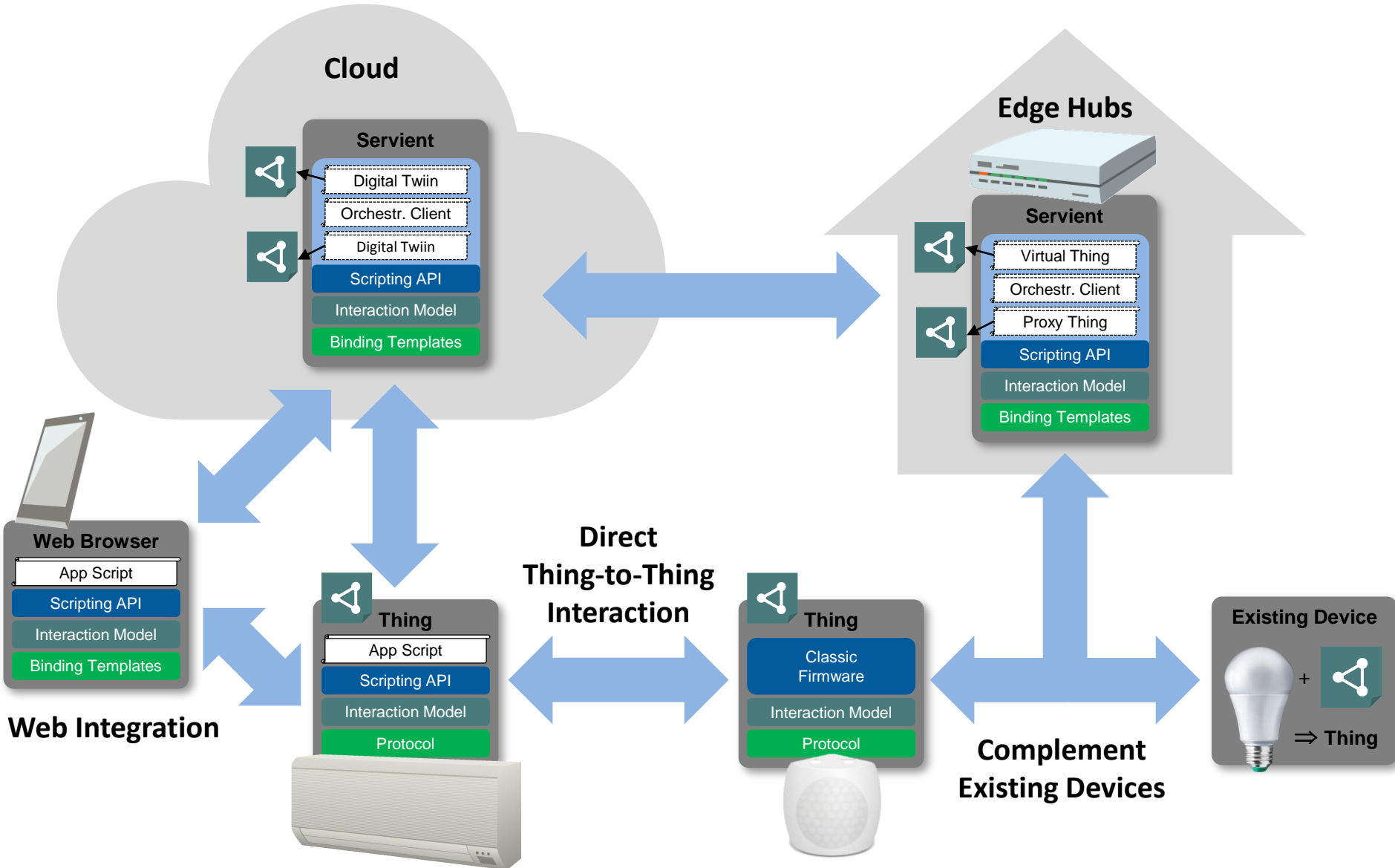
W3C WoT Building Blocks



W3C WoT Building Blocks



W3C WoT Architecture Patterns



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

- 2014: Stakeholders identified at W3C Workshop
- 2015: IG started to identify initial building blocks
 - Current Practices documented
(<http://w3c.github.io/wot/current-practices/wot-practices.html>)
 - Practical evaluation in “PlugFests”
- 2016/17: WG chartered until end of 2018
 - Editor’s Drafts available
 - First Public Working Drafts expected August 2017
 - Candidate Recommendations end of 2018...
- 2019: WG re-chartering for next building blocks
 - IG is continuously exploring and identifying

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
 - Semantic vocabulary → iot.schema.org, oneM2M, ...
 - Binding Templates → Web, CoRE, OCF, oneM2M, ...
 - 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 → IRTF T2TRG
 - Programming abstractions for orchestration
 - Recovery from errors
- Semantic Web beyond knowledge management
 - Dynamic graphs
 - Privacy preservation
 - Reasoning in constrained environments
- Security in loosely-coupled systems
 - Object signing and encryption

W3C WoT Online Resources

- W3C WoT Wiki (IG+WG organizational information)
 - https://www.w3.org/WoT/IG/wiki/Main_Page
- W3C WoT Interest Group
 - <https://www.w3.org/2016/07/wot-ig-charter.html> (charter)
 - <https://lists.w3.org/Archives/Public/public-wot-ig/> (subscribe to mailing list)
 - <https://github.com/w3c/wot> (technical proposals)
- W3C WoT Working Group
 - <https://www.w3.org/2016/12/wot-wg-2016.html> (charter)
 - <https://www.w3.org/WoT/WG/> (dashboard)
- W3C WoT Editor's Drafts
 - <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/>