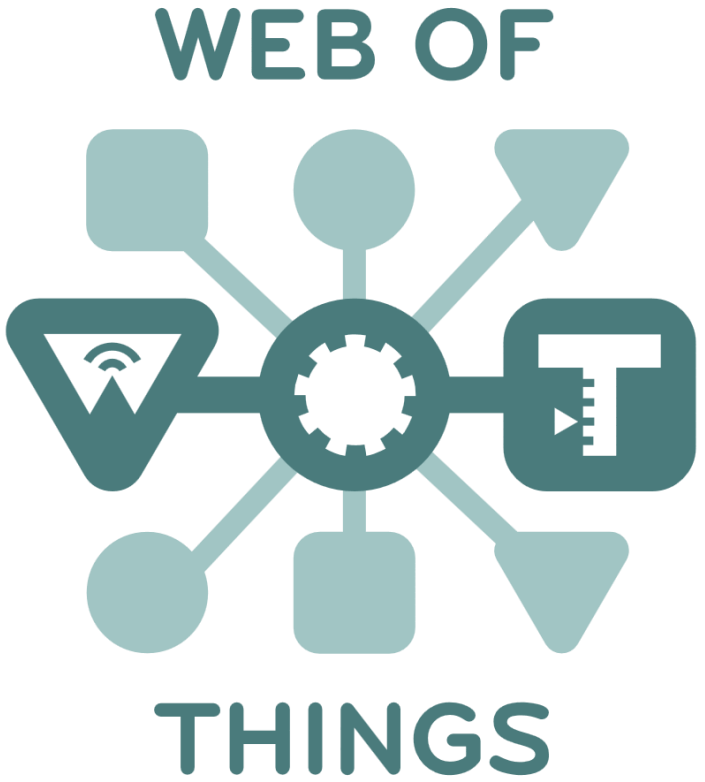


W3C Web of Things
Summary, Status, and Next Steps

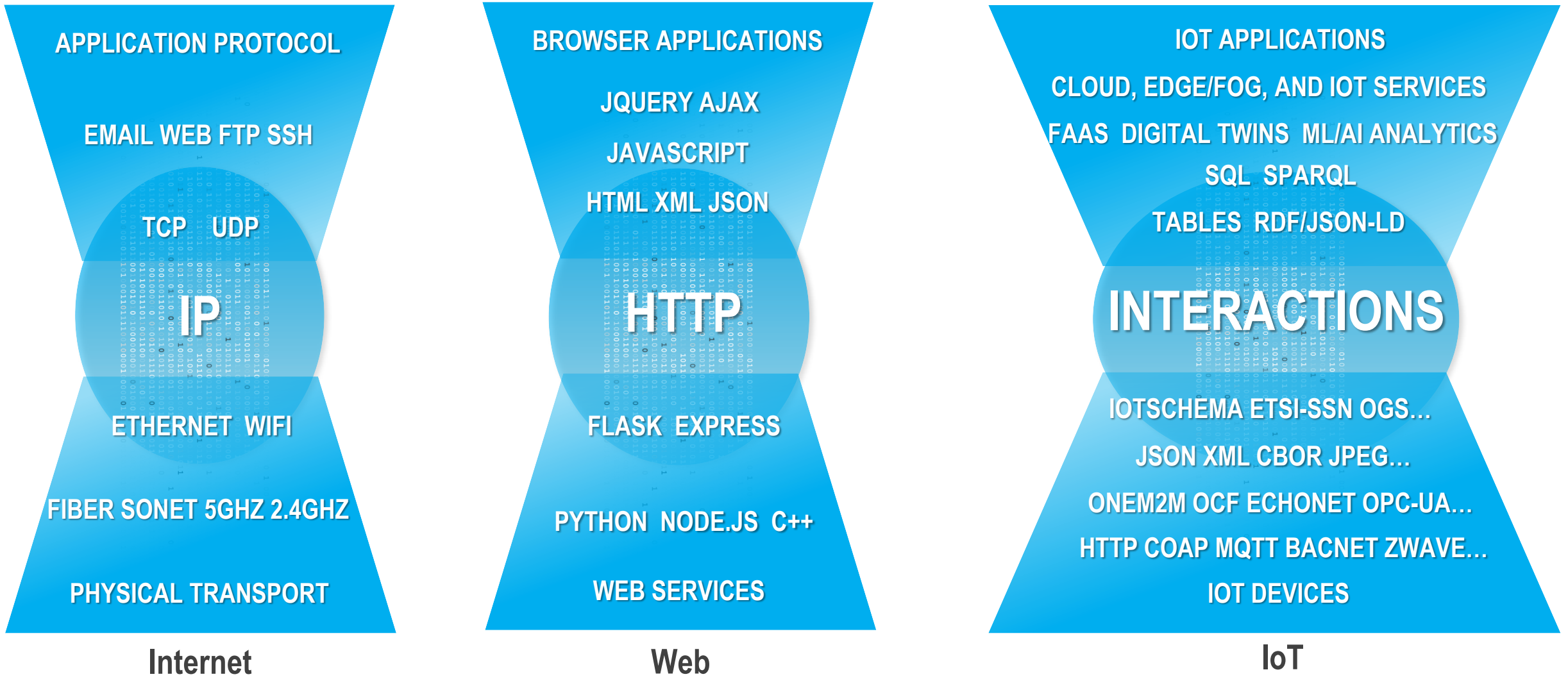
8 April 2019

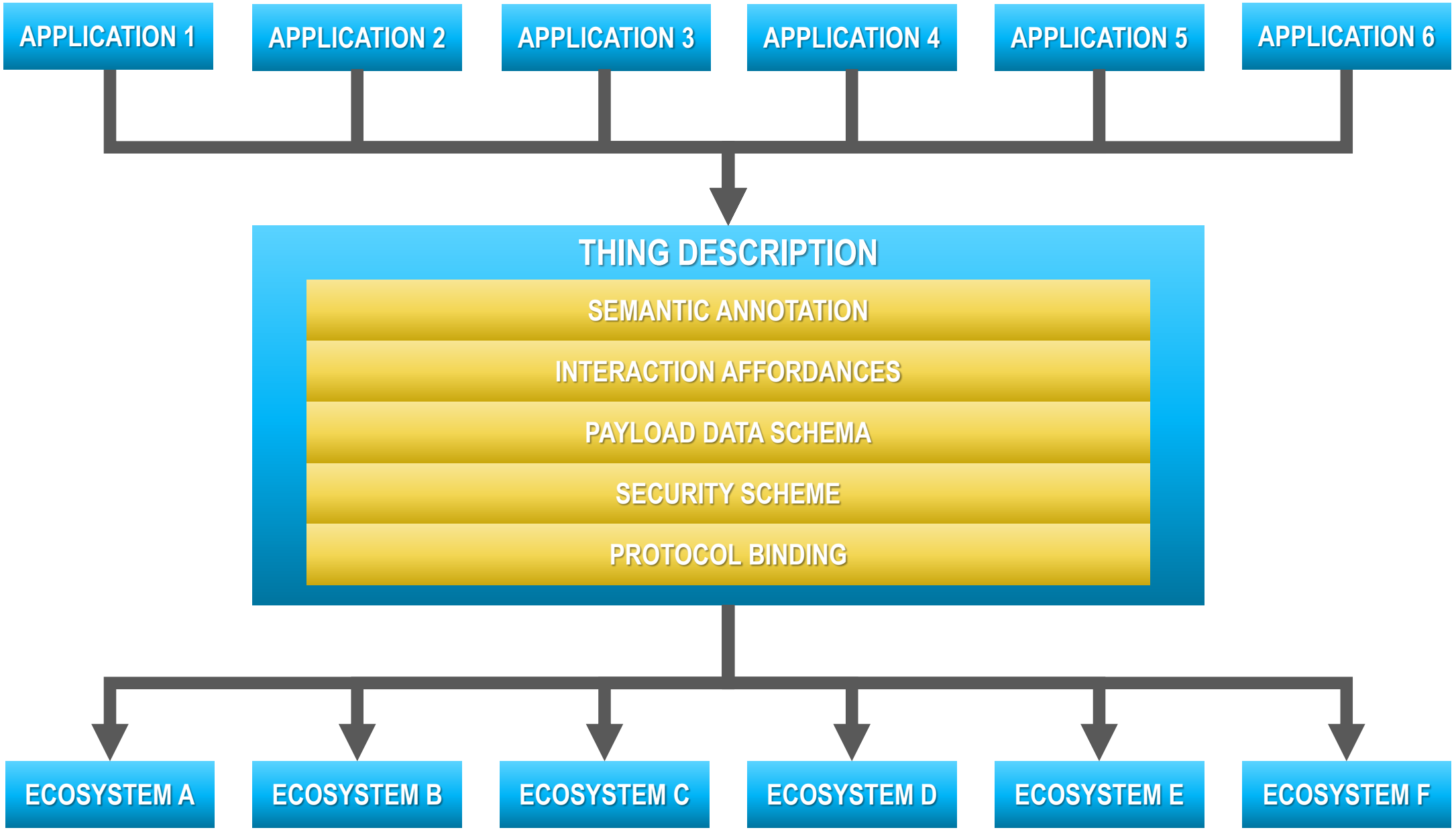
W3C Web of Things

Goal: Support IoT Interoperability via Open Standards

- **W3C WoT Interest Group (IG)**
  https://www.w3.org/2016/07/wot-ig-charter.html
  - Started spring 2015
  - ~200 participants
  - Informal work and outreach
  - "PlugFest" validation with running code
  - Exploration of new building blocks
  - "OpenDays" with external speakers
  - Liaisons and collaborations with other organizations and SDOs
  - ***Second Workshop on Web of Things planned for 3-5 June 2019 in Munich***

- **W3C WoT Working Group (WG)**
  https://www.w3.org/2016/12/wot-wg-2016.html
  - Started end of 2016 (effectively Feb 2017)
  - ~100 participants
  - Normative work on specific deliverables
  - W3C Patent Policy for royalty-free standards
  - Only W3C Members and Invited Experts
  - ***Notes published on Protocol Bindings, Security, and Scripting API***
  - ***Architecture and Thing Description submitted to TAG Review 26 March 2019***

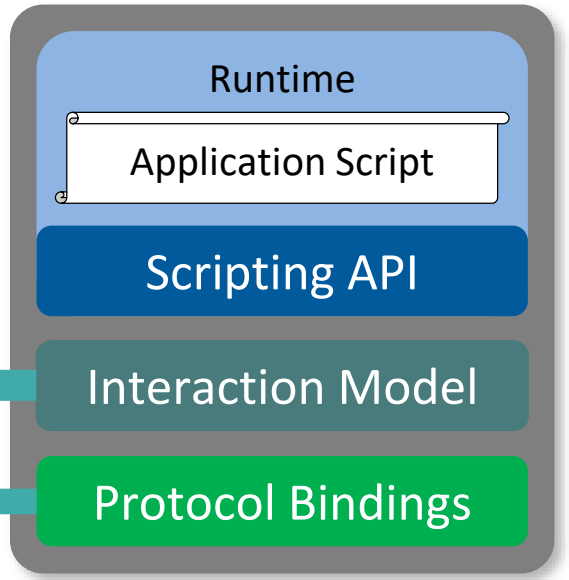

APPLICATION PROTOCOL
EMAIL WEB FTP SSH
TCP UDP
IP
ETHERNET WIFI
FIBER SONET 5GHZ 2.4GHZ
PHYSICAL TRANSPORT
Internet
BROWSER APPLICATIONS
JQUERY AJAX
JAVASCRIPT
HTML XML JSON
HTTP
FLASK EXPRESS
PYTHON NODE.JS C++
WEB SERVICES
Web
IOT APPLICATIONS
CLOUD, EDGE/FOG, AND IOT SERVICES
FAAS DIGITAL TWINS ML/AI ANALYTICS
SQL SPARQL
TABLES RDF/JSON-LD
INTERACTIONS
IOTSCHEMA ETSI-SSN OGS...
JSON XML CBOR JPEG...
ONEM2M OCF ECHONET OPC-UA...
HTTP COAP MQTT BACNET ZWAVE...
IOT DEVICES
IoT

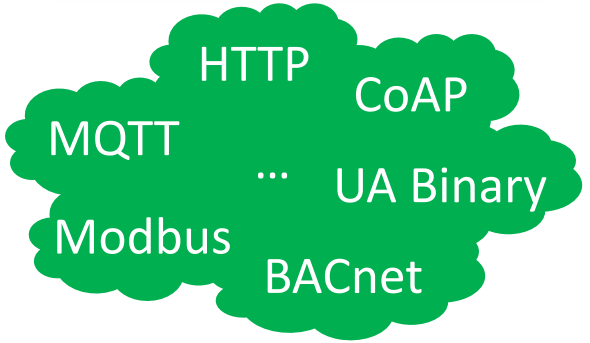

APPLICATION 1
APPLICATION 2
APPLICATION 3
APPLICATION 4
APPLICATION 5
APPLICATION 6
THING DESCRIPTION
SEMANTIC ANNOTATION
INTERACTION AFFORDANCES
PAYLOAD DATA SCHEMA
SECURITY SCHEME
PROTOCOL BINDING
ECOSYSTEM A
ECOSYSTEM B
ECOSYSTEM C
ECOSYSTEM D
ECOSYSTEM E
ECOSYSTEM F

W3C WoT WG Deliverables

WoT Thing Description (TD)

Information model and **JSON-LD 1.1** serialization to describe Thing *instances* with **metadata**. Uses **formal interaction model** and **domain-specific vocabularies** to uniformly describe Thing interaction affordances, which enables semantic interoperability.





JavaScript

WoT Scripting API

Standardized **JavaScript** API for an IoT runtime system **similar to the Web browser**. Provides an interface between applications and Things to simplify IoT application development and enable **portable apps** across vendors, devices, edge, and cloud.

WoT Binding Templates

Capture how the **formal Interaction Model** is mapped to concrete protocol operations (e.g., CoAP) and platform features (e.g., OCF). These templates are re-used by concrete TDs.

WoT Security and Privacy

Cross-cutting support and guidance to support appropriate security and privacy mechanisms and considerations.

WoT Thing Description (TD) – JSON-LD 1.1

WoT Binding Templates – Instantiated in TDs

Basics to build the request

Deviation from defaults

```
...
"properties": {
  "brightness": {
    ...
    "forms": [
      {                                          // Defaults: GET to read, PUT to write
        "href": "https://myled.example.com:8080/pwr",
        "contentType": "application/json"
      }
    ]
  }
},
"actions": {
  "fadeIn": {
    ...
    "forms": [
      {
        "href": "coaps://myled.example.com:5684/pwr",
        "contentType": "application/ocf+cbor",
        "coap:methodCode": 3,                    // PUT instead of POST to invoke
        "coap:options": [ {
          "coap:optionNumber": 2053,             // OCF-Content-Format-Version
          "coap:optionValue": "1.1.0"
        } ]
      }
```

Status and Recent Developments

- Decision to adopt JSON-LD 1.1 proposed features to allow:
  - Default values
  - Object name:value notation
  - More similarity to standard JSON practices
- Security metadata
  - Focus on HTTP(S), CoAP(S), and MQTT(S)
- Protocol Bindings
  - Focus on HTTP, CoAP, and MQTT and structured payloads compatible with JSON
  - Support for Observe, using subProtocols (eg long polling in HTTP) when appropriate
- ***Architecture and Thing Description submitted to TAG Review 26 March 2019***
- ***Notes published on Protocol Bindings, Security, and Scripting API***

https://www.w3.org/WoT/ws-2019/cfp.html

Express your interest or address some new topics or challenges in a position paper

Application deadline: **15th April**

W3C WoT Summary

- Counter fragmentation in the IoT
  - Web of Things to Internet of Things is similar to the Web to Internet relation
  - Narrow waist: common interaction model and metadata description
  - Take patterns from the World Wide Web and adapt and apply them to the IoT
    - JSON Schema and Linked Data
    - URIs and Media Types
    - JavaScript runtime
- By describing and complementing
  - Not competing with existing IoT standards, as not prescribing a full-stack solution
  - Instead, *describes* existing solutions so they can work with each other (interoperate)
  - W3C WoT defines common building blocks to enable semantic interoperability
    - WoT Thing Description (TD)
    - WoT Binding Templates
    - WoT Scripting API

W3C WoT Resources

- W3C WoT Wiki
  - https://www.w3.org/WoT/IG/wiki
    (IG/WG organizational information)
- W3C WoT Interest Group
  - https://www.w3.org/2016/07/wot-ig-charter.html
    (charter)
  - https://lists.w3.org/Archives/Public/public-wot-ig/
    (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 Working Drafts
  - https://www.w3.org/TR/wot-architecture/
  - https://www.w3.org/TR/wot-thing-description/
  - https://www.w3.org/TR/wot-binding-templates/
  - https://www.w3.org/TR/wot-scripting-api/
  - https://www.w3.org/TR/wot-security/
- W3C WoT Editors' Drafts and Issue Tracker
  - https://github.com/w3c/wot-architecture/
  - https://github.com/w3c/wot-thing-description/
  - https://github.com/w3c/wot-binding-templates/
  - https://github.com/w3c/wot-scripting-api/
  - https://github.com/w3c/wot-security/
- Reference Implementation: node-wot
  - https://github.com/eclipse/thingweb.node-wot
- TAG Design Reviews
  - https://github.com/w3ctag/design-reviews/issues/355
  - https://github.com/w3ctag/design-reviews/issues/357

Contacts

Dr. Michael McCool

Intel

michael.mccool@intel.com

Dr. Matthias Kovatsch

Huawei

matthias.kovatsch@huawei.com