# T2TRG: Thing-to-Thing Research Group

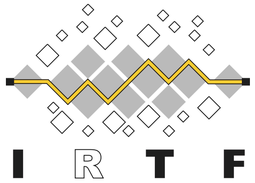
Summary meeting before IETF 108, online, 2020-07-16

Chairs: Carsten Bormann & Ari Keränen

# Note Well

- You may be recorded
- Be nice
- The IPR guidelines of the IETF apply:
  see **http://irtf.org/ipr** for details.

# Note Well – Intellectual Property

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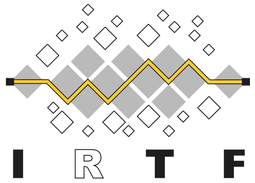


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- See RFC 7154 (Code of Conduct) and RFC 7776 (Anti-Harassment Procedures), which also apply to IRTF

# Goals of the IRTF

- The Internet Research Task Force (IRTF) focuses on longer term research issues related to the Internet while the parallel organisation, the IETF, focuses on shorter term issues of engineering and standards making

- **The IRTF conducts research; it is not a standards development organisation**

- While the IRTF can publish informational or experimental documents in the RFC series, its primary goal is to promote development of research collaboration and teamwork in exploring research issues related to Internet protocols, applications, architecture, and technology
- See “An IRTF Primer for IETF Participants” – RFC 7418

# Administrivia (I)

- Blue sheet (sign your name in the CodiMD notes)
- Note-takers
- Off-site (Jabber)
  - **xmpp:t2trg@jabber.ietf.org?join**
- Mailing List: **t2trg@irtf.org** — subscribe at: **https://www.ietf.org/mailman/listinfo/t2trg**
- Repo: **https://github.com/t2trg/2020-07-summary**

# Agenda

| Time (UTC) | Who | Subject |
|---|---|---|
| 14:00 | Chairs | Intro, RG status, upcoming meetings and activities |
| 14:10 | Chairs | Reports from WISHI, WoT Helsinki |
| 14:20 | Matthias Kovatsch | OPC UA NETCONF binding experiment notes |
| 14:35 | Carsten Bormann | Intro: Industry Updates (focus for this meeting) |
| 14:40 | Michael Richardson | IoTSF update |
| 14:50 | Michael Koster | ZigBee/CHIP update |
| 14:55 | Michael Koster | OneDM update |
| 15:05 | Travis Shanahan | OMA DMSE/IPSO update |
| 15:15 | Wouter van der Beek | OCF update |
| 15:20 | Michael McCool | W3C update for new charter period |
| 15:35 | Carsten Bormann | ASDF BOF |
| 15:45 | Xavier Foy | IoT Edge Challenges and Functions |
| 15:55 | Chairs | Wrap-up |

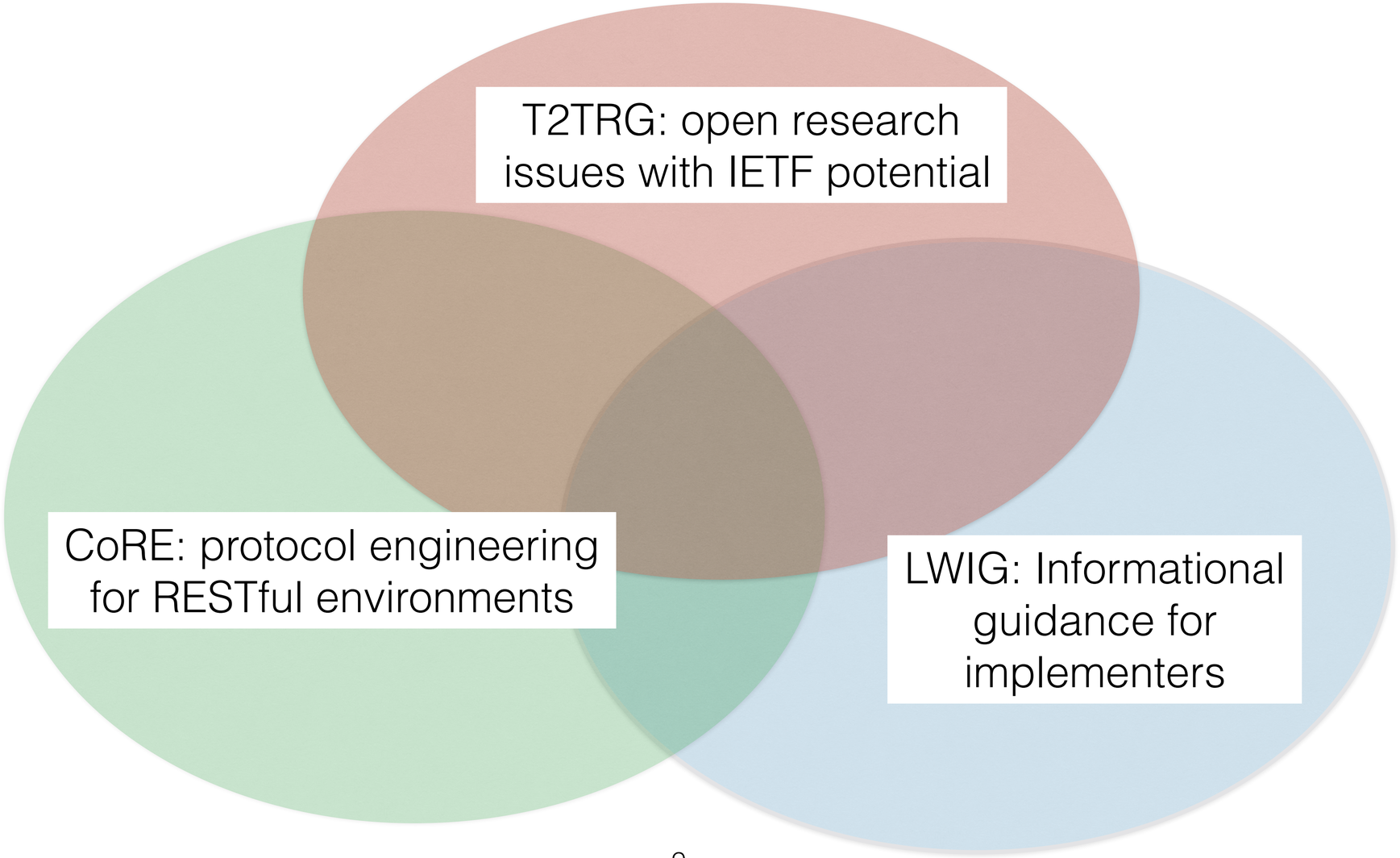
# T2TRG scope & goals

- Open research issues in turning a true "Internet of Things" into reality
  - Internet where low-resource nodes ("things", "constrained nodes") can communicate among themselves and with the wider Internet
- Focus on issues with opportunities for IETF standardization
  - Start at the IP adaptation layer
  - End at the application layer with architectures and APIs for communicating and making data and management functions, including security

# IRTF and IETF

IRTF
(Research)

IETF
(Engineering)



# Next meetings

- Regular WISHI calls
  - E.g., Azure DTDL discussion 2020-07-30
  - Probably pausing in August, picking up in September again

- Online meetings with OCF / OMA SpecWorks (LwM2M&IPSO)/W3C WoT?
- Topic-based meetings on selected OneDM- and ASDF related issues?
- IETF 109 (TBD, decision in August)
- Really co-locating with academic conferences again from 2021?

# RG Doc Status

- "RESTful Design for IoT": TBD affordances & discovery, more terms, re-scoping?
- "IoT Edge Challenges and Functions": short update today, in RG adoption call. Need more reviewers!
- Not today:
  - Secure Bootstrapping for IoT
  - YOUPI (describing binary data in legacy formats)
  - CoRE apps, collections part from CoRE interfaces
  - Layer 3 considerations?
- Ramping up: WISHI notes (see WISHI wiki, e.g. terminology rosetta stone)

# Work on IoT Semantic/Hypermedia Interoperability (WISHI)

- Four online meetings with variety of topics
  - Semantics technology landscape
  - OpenAPI/AsyncAPI and CoRE/WoT technologies
  - SDF standardization & ASDF BOF
  - W3C WoT TD templates & OneDM SDF
  - WoT Discovery
  - Identifiers, References, Paths, and Pointers (& JSON Path standardization)

# WoT "Helsinki" meeting

- Half-day online meeting with the W3C Web of Things (WoT)
  - originally planned f2f in Helsinki
- Topics: use cases, lifecycle, discovery, PoCs, OneDM/TD integration, hypermedia controls in TDs

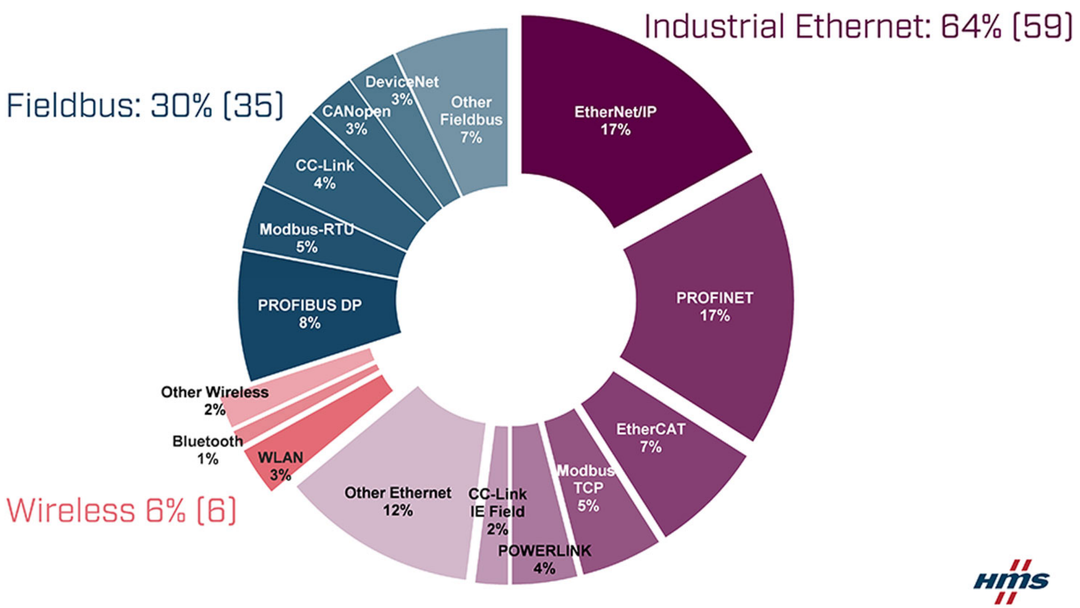
Preview of Our IoT 2020 Conference Paper:

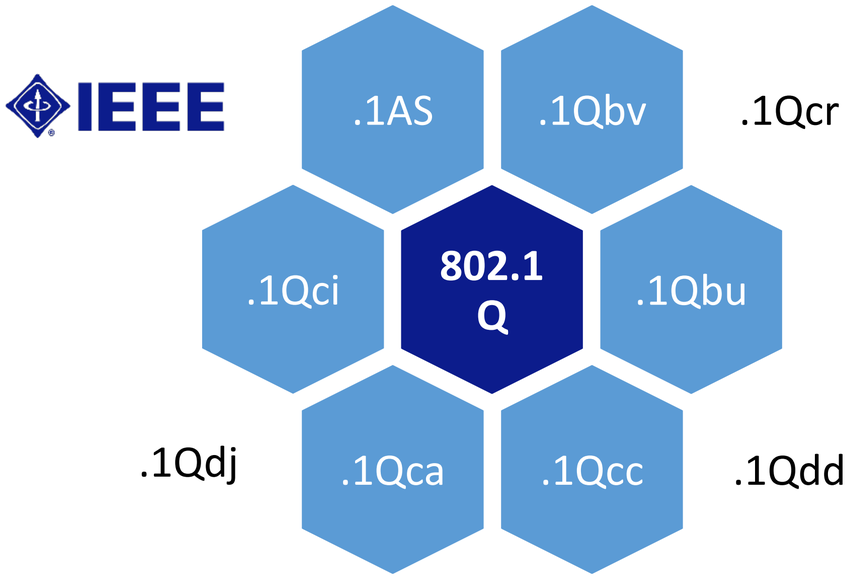
# Bringing Deterministic Industrial Networking to the W3C Web of Things with TSN and OPC UA

Luca Sciullo, Sushmit Bhattacharjee, and Matthias Kovatsch

T2TRG Meeting, virtual, 16 Jul 2020

# Deterministic Industrial Networking

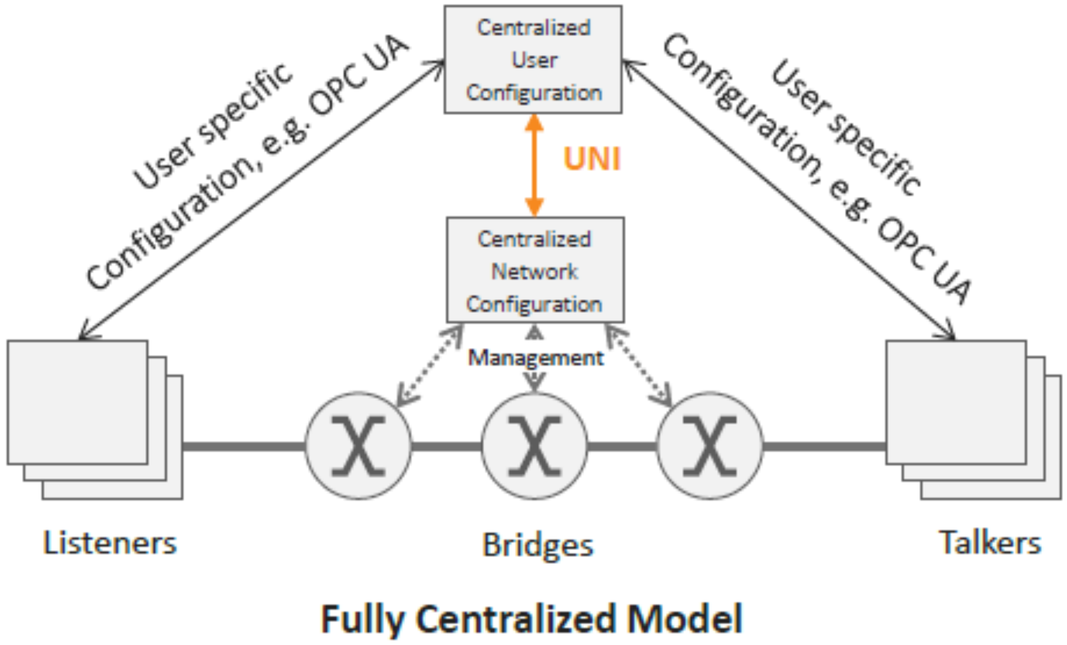



- **Industrial IoT** often requires determenistic networking
  - Provides QoS guarantees
  - Plethora of field buses
- **Time-Sensitive Networking (TSN)** IEEE specification family
  - Based on standard Ethernet (managed VLANs)
  - Enables a converged network

→ **Requires network configuration** ←

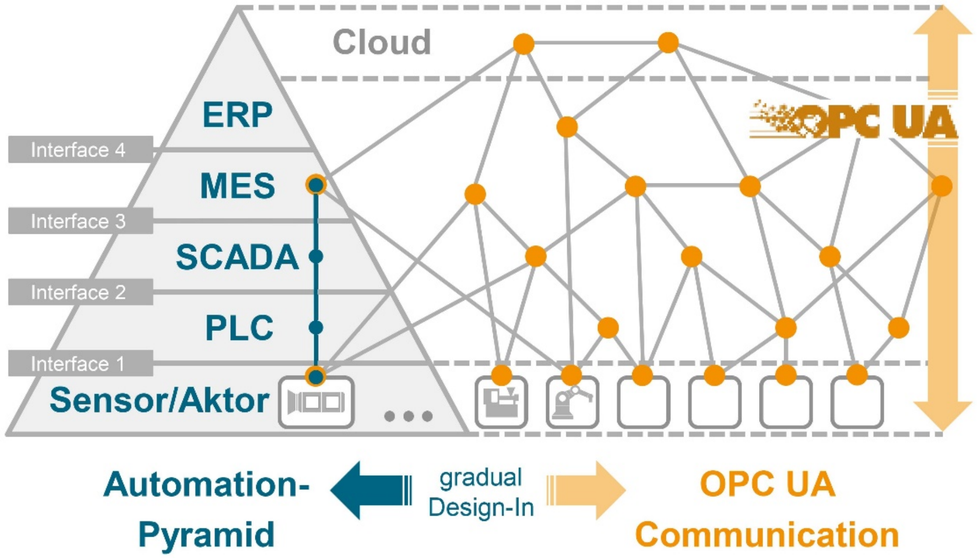
# TSN Network Configuration (Centralized Model)

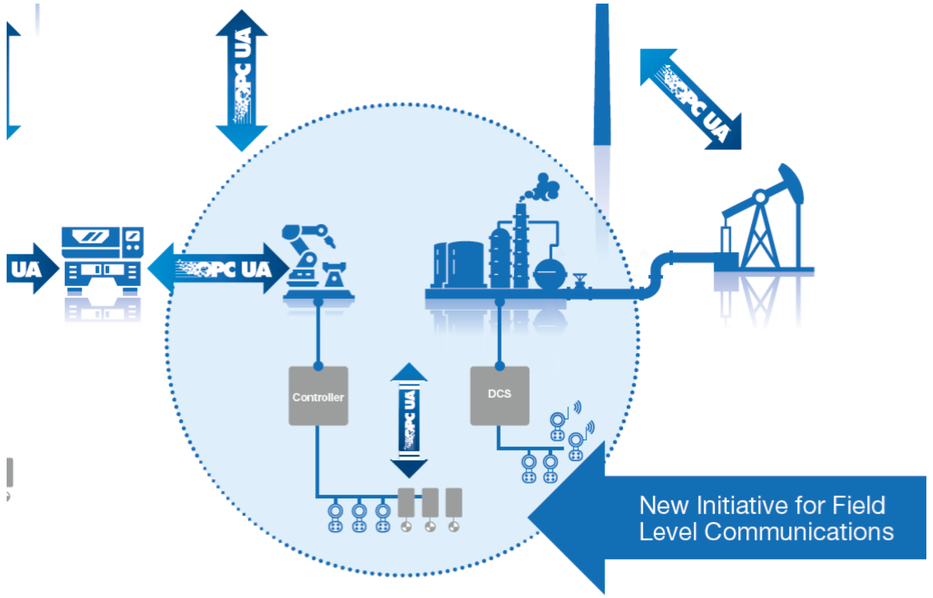



**Fully Centralized Model**

- Network configuration usually done via YANG modules (cf. CoRECONF for LP-WAN work)
- Multiple protocol choices
  - NETCONF
  - RESTCONF
  - CoRECONF
- However, network equipment mainly has NETCONF interfaces

# Cross-Vendor Industrial Applications




## OPC Unified Automation (UA)

- Graph-based information model
- Communication protocols
  (UA-Binary as Client-Server or PubSub)

→ For management/monitoring

## OPC UA Field-Level Communications (FLC)

- Extension to cover field controllers and devices
- Integrates TSN (IEC/IEEE 60802 Profile)

→ For real-time applications

# OPC UA Information Model

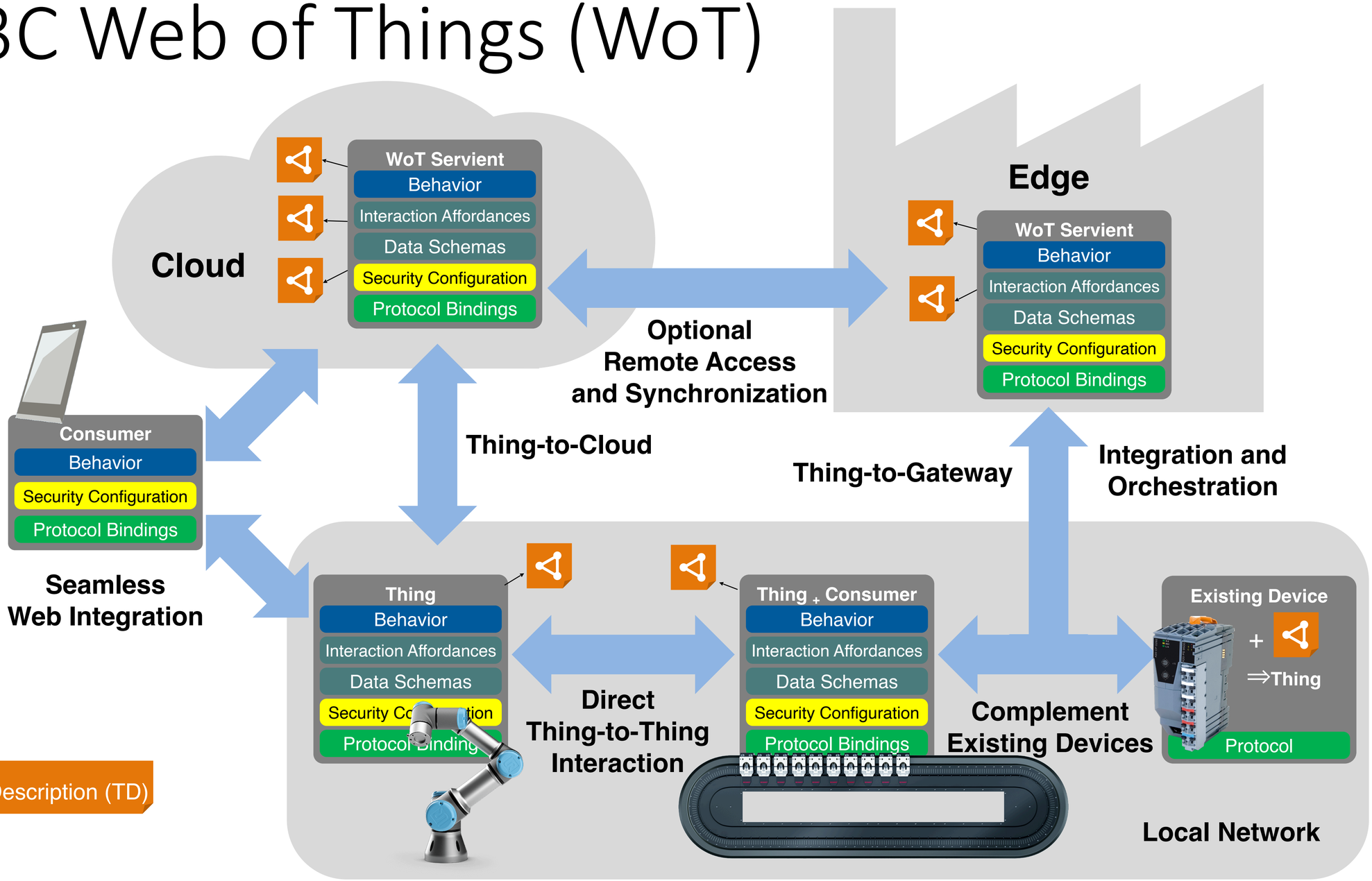
| Attribute | Value |
|---|---|
| NodeId | ns=2;s=HelloWorld/MyObject.Foo |
| NamespaceIndex | 2 |
| IdentifierType | String |
| Identifier | HelloWorld/MyObject.Foo |
| NodeClass | Variable |
| BrowseName | 2, "Foo" |
| DisplayName | "en", "Foo" |
| Description | "", "" |
| WriteMask | 0 |
| UserWriteMask | 0 |
| RolePermissions | BadAttributeIdInvalid (0x80350000) |
| UserRolePermissions | BadAttributeIdInvalid (0x80350000) |
| AccessRestrictions | BadAttributeIdInvalid (0x80350000) |
| Value | |
| SourceTimestamp | 11/12/2018 10:43:20.031 AM |
| SourcePicoseconds | 0 |
| ServerTimestamp | 11/12/2018 10:44:54.931 AM |
| ServerPicoseconds | 0 |
| StatusCode | Good (0x00000000) |
| Value | 0 |
| DataType | Int16 |
| NamespaceIndex | 0 |
| IdentifierType | Numeric |
| Identifier | 4 [Int16] |

**Roughly similar to the Web**

- Graph-based and browsable
- Nodes similar to resources
  - Namespace (URI mapped to integer)
  - Identifier (Integer, string, binary, GUID)
  - Node classes
    - Object
    - Variable
    - Method
    - Reference
    - Various type classes

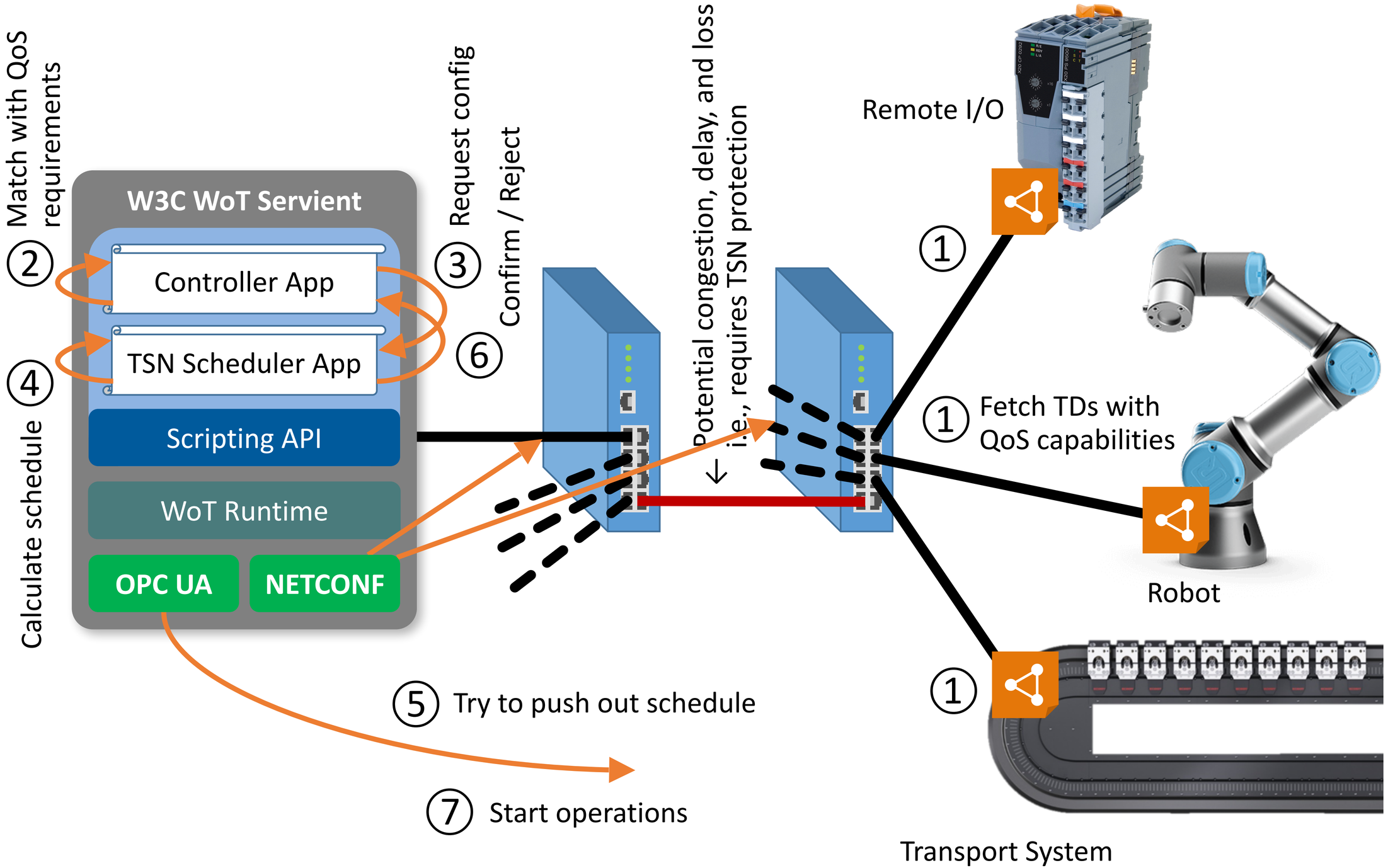
- Bidirectional references, bitmaps, **word sizes**, ...

# W3C Web of Things (WoT)



# Goal

Extend W3C WoT ecosystem to deterministic industrial networking


W3C WoT Servient
Controller App
TSN Scheduler App
Scripting API
WoT Runtime
OPC UA
NETCONF
② Match with QoS requirements
④ Calculate schedule
③ Request config
⑥ Confirm / Reject
Potential congestion, delay, and loss
i.e., requires TSN protection
Remote I/O
① Fetch TDs with QoS capabilities
Robot
①
①
⑤ Try to push out schedule
⑦ Start operations
Transport System

# W3C WoT Vocabulary for QoS

Initial proposal based on proof of concept – more discussion needed

# QoS Vocabulary: Requirement Terms

| Term (`qos:`) | Description | Type |
|---|---|---|
| `flowName` | Unique name for data flow (unique within QoS domain, e.g., TSN domain) | string |
| `talker` | Source of the data flow (e.g., interface MAC address) | string |
| `listener` | Destination of the data flow (e.g., interface MAC address) | string |
| `trafficClass` | Traffic class for the data flow (Literal, one of `deadline`, `latency`, `bandwidth`) | string |
| `cycleTime` | Interval between messages (or message bursts) or for bandwidth definition in nanoseconds | integer |
| `maxBytes` | Maximum message size or for bandwidth definition in bytes (same as QoS capability) | integer |
| `msgCount` | Number of messages within one cycle | integer |
| `deadline` | Relative time within cycle by when the message must be received in nanoseconds | integer |
| `offset` | Relative time within cycle after which the message is sent | integer |
| `lossLimit` | Number of acceptable message losses in a row | integer |

# QoS Vocabulary: Capability Terms

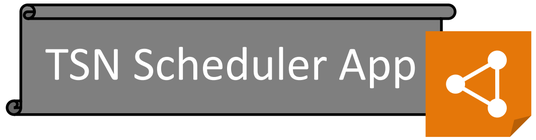
| Term (qos:) | Description | Class | Type |
|---|---|---|---|
| capabilities | Container for the QoS capabilities | Thing | string |
| minCycle | Fastest supported cycle time in nanoseconds | Capabilities | string |
| maxCycle | Slowest supported cycle time in nanoseconds | Capabilities | string |
| workingClock | Whether the Thing is synchronized to a working clock (e.g., 802.1AS) | Capabilities | string |
| maxBytes | Maximum message size in bytes above Layer 2 (i.e., including IP headers if any) | Form | integer |

# QoS Vocabulary: Usage


**App Requirements**
(internal data)

- `trafficClass`
- `cycleTime`
- `deadline`
- `offset`
- `lossLimit`

- `flowName`
  - Generated




**Schedule Action**
(input DataSchema)

- `flowName`
- `talker`
- `listener`
- `trafficClass`
- `cycleTime`
- `maxBytes`
- `(msgCount)`
- `(deadline)`
- `(offset)`
- `(lossLimit)`

`@type: qos:Flow`


**QoS Capability**
(in qos:capabilities)

- `minCycle`
- `maxCycle`
- `workingClock`


**QoS Parameter**
(per affordance form)

- `maxBytes`
- `listener`
  - Action
- `talker`
  - Event/Obs.Property

# W3C WoT Protocol Bindings

For NETCONF and OPC UA

node-opcua limitation

# OPC UA Binding – for now Client/Server only

- Mapping to Properties, Actions, and Events (with `opc:methodName` field in from)
  - Variable nodes → Properties
  - Method nodes → Actions
  - Nodes alerts → Events
- DataSchema
  - OPC UA uses binary data types, hence JSON Schema must be further annotated
  - Would be binding-specific, ergo form field, but form metadata not available to ContentSerdes

  → `opc:dataType` annotation in DataSchema
- Form href URI
  - Adopt opc.tcp schema, but extend with `;`-separated query similar to OPC UA tooling

  → `opc.tcp://localhost:5050/server-path?ns=1;s=mynode`
- Form contentType
  - UA-Binary has no registered mediatype (similar to URI schema, needs a push within OPCF)

  → `application/x.opcua`

# NETCONF Binding

- Mapping to Properties, Actions, and Events (built on RESTCONF)
  - Leaf-nodes → Properties
  - RPCs → Actions
  - Notifications → Events
- DataSchema
  - Mostly works, as YANG is XML-based
  - Must add mechanism for XML node attributes (e.g., )

  → `nc:container` and `nc:attribute` annotations – should become general XML mechanism
- Form href URI (SSH transport)
  - Similar to RESTCONF URIs, but with support for datastores (RESTCONF has implicit rules)

  → `netconf://localhost:830/running/ietf-interfaces:interfaces/interface=eth0/type`
- Form contentType (from RESTCONF)
  - `application/yang-data+xml`

# Examples

## OPC UA

```
"properties": {
  "Velocity": {
    "type": "number",
    "observable": true,
    "opc:dataType": "Double",
    "forms": [{
      "href": "opc.tcp://xts.local:5050/ns=1;\\
          s=GVL.OPC_Interface.MOVER[1].Input.Velocity",
      "contentType": "application/x.opcua-binary" }] },
  ... },
"actions": {
  "Execute": {
    "input": {
      "type": "boolean", "opc:dataType": "Boolean" },
    "output": {
      "type": "boolean", "opc:dataType": "Boolean" },
    "forms": [{
      "href": "opc.tcp://xts.local:5050/ns=1;\\
          s=GVL.OPC_Interface.XTS.Input.Execute",
      "contentType": "application/x.opcua-binary",
      "opc:method": "Call" }] } }
```

## NETCONF

```
"properties": {
  "admin-control-list": {
    "type": "array",
    "items": {
      "type": "object",
      "properties": {
        "index": {
          "type": "number",
          "minimum": 0, "maximum": 127 },
        "time-interval": {
          "type": "number",
          "minimum": 0, "maximum": 4294967295 },
        "gate-state": {
          "type": "number",
          "minimum": 0, "maximum": 255 } } },
    "uriVariables": {
      "datastore": {
        "@type": "nc:Target",
        "type": "string",
        "enum": ["candidate", "running", "startup"] },
      "interface": {
        "type": "integer",
        "minimum": 0, "maximum": 7 } },
    "forms": [{
      "href": "netconf://172.17.0.2:830/{datastore}/huawei:tsn-configuration\\
          /interface={interface}/gate-parameters/admin-control-list",
      "contentType": "application/yang-data+xml",
      "nc:curies": { "huawei": "urn:ietf:params:xml:ns:yang:huawei-tsn" } }] },
  ...
```

# Proof of Concept

# Open-source Implementation

- Merged into Eclipse Thingweb node-wot
  - https://github.com/eclipse/thingweb.node-wot
  - See examples here
    - https://github.com/eclipse/thingweb.node-wot/tree/master/examples/servients/opcua-cli
    - https://github.com/eclipse/thingweb.node-wot/tree/master/examples/servients/netconf-cli
  - Updates from paper publication version pending
- TSN Scheduler App not included – implementation proprietary
  - Open-source scheduler for potential future work: https://github.com/ACassimiro/TSNsched

# Contact

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(Note that this is a research view)

# Industry Updates

Carsten Bormann

# This is a Research Group!
# Why Industry Updates?

- To stay relevant, we need to understand what is going on in industry and other (non-IETF) Standards Development Organizations (SDOs).
- Those developments are often hard to understand for an engineer, when all one has is the marketing speak from the press release.
- Hidden behind that may be interesting technical innovations, which pose research questions that are worthy of being investigated.
- So we'll have short segments (usually 5–10 min) that highlight those technical nuggets, but also organizational news that we can use.

# IoTSF

# Industry Updates

## Zigbee/CHIP
## One Data Model

T2TRG Summary Meeting

July 16, 2020

# Project Connected Home over IP

- Google, Apple, Samsung, Amazon, Comcast, many others in Zigbee Alliance
- New specification for Smart Home interoperability on IP networks: WiFi, Thread, IP-over-BLE
- Open source stack (Apache 2.0) based on contributions of working code
- Open source data models based on ZCL (BSD)
- Simple demo operational 2Q 2020
- Target for device certification 2021

# One Data Model (OneDM)

- Liaison organization of SDOs, vendors, and experts
- Initiated by Zigbee in the fall of 2018
- Zigbee, OCF, OMA, Bluetooth mesh, and associated vendors, energy and microgrid verticals
- Phase 1 - Federated data model language (DSL) and meta-model, based on features that can express all other IoT data models
- Common classes of affordances with semantic type definitions

# OneDM (2)

- Playground repository with contributions and examples of definitions from OMA, OCF, Zigbee, and Bluetooth mesh
- All definitions are contributed under the BSD 3-Clause license
- Phase 2 - Data Model consolidation from diverse SDOs and using diverse transfer layer protocols
- Opening of the liaison group to broad participation based on open source – language and models
- Public-facing website and content

oma SpecWorks

For a Connected World

# LwM2M Status Update

# LwM2M v1.2 will be released this summer

- New transports for LwM2M;
  - this allows LwM2M messaging to be conveyed over MQTT and over HTTP.
- Optimizations for
  - bootstrapping interface; this reduces the amount of data and the number of messages transmitted during the bootstrapping exchange.
  - registration interface; this reduces the amount of data transmitted during registration exchanges.
  - information reporting interface; observation attributes may now be included in an Observe operation.
- Support for LwM2M gateway functionality;
  - this allows non-LwM2M IoT devices as well as LwM2M devices behind a gateway to be connected to the LwM2M ecosystem and to manage those devices remotely.
- New, highly optimized encoding format based on CBOR called LwM2M CBOR.

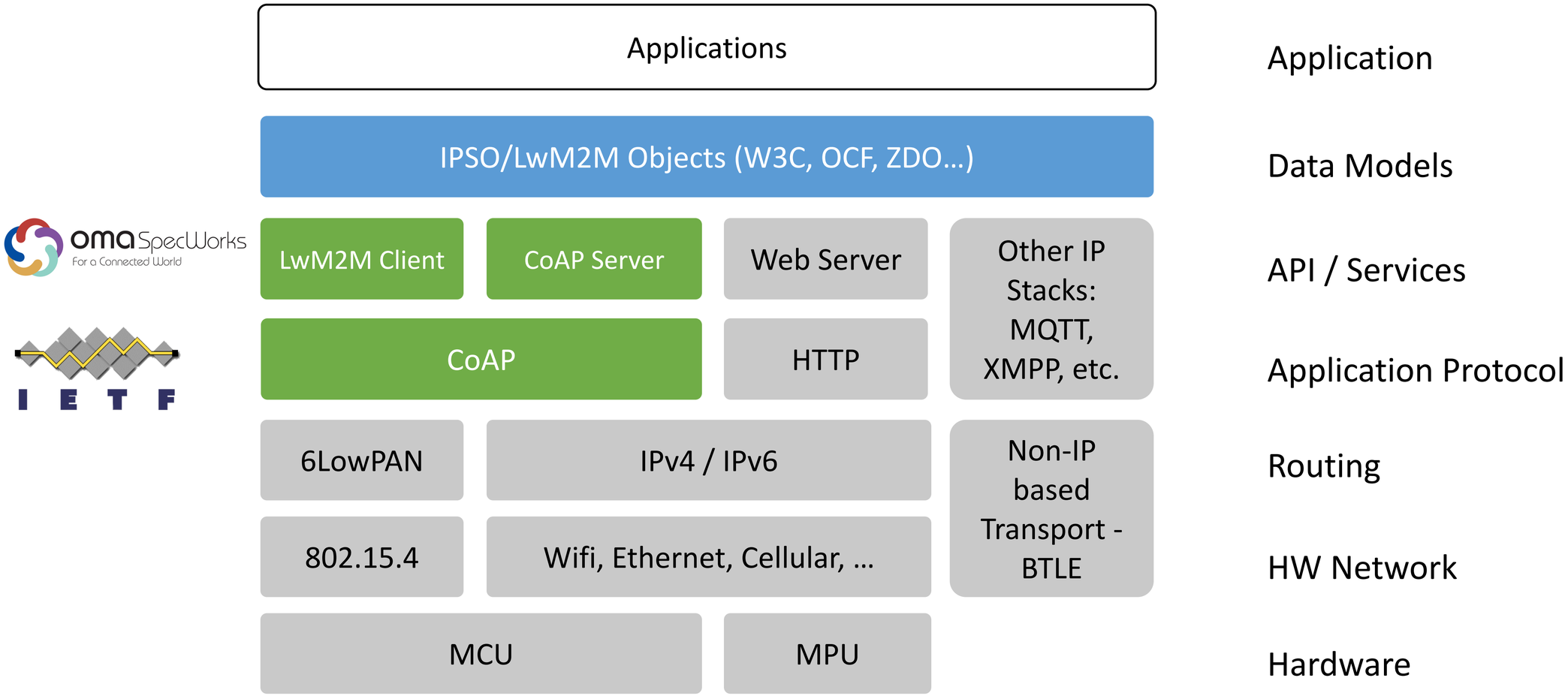
# V1.2 features, cont.

- Definition of new notification attributes (edge, confirmable notification, and maximum historical queue).
  - Edge allows notifications to be triggered on rising and falling edges.
  - Confirmable notifications allow the control of reliable transmissions of notifications.
  - Maximum historical queue allows the control of time-series data usage.
- Updates to use the latest communication security protocols based on TLS and DTLS 1.3 (as well as the use of the Connection ID).
  - Flexibility to control the use of TLS and DTLS 1.3 through configuration information.
- Untangling the relationship of security credentials and their server configuration.
- Clarifications of object versioning rules.
- Enhanced functionality for firmware updates.

# 📢 Leshan v1.0.2 is out ! 🎉 #831

- Leshan is a popular, open source implementation of LwM2M.
- Open source software development has always been a high priority for the LwM2M community.

# The IP for Smart Objects (IPSO) device stack (recap)

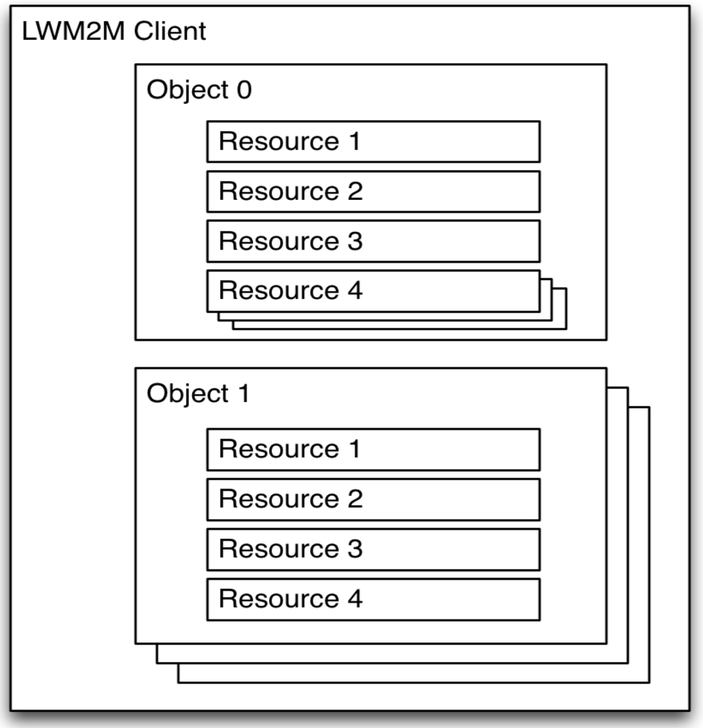


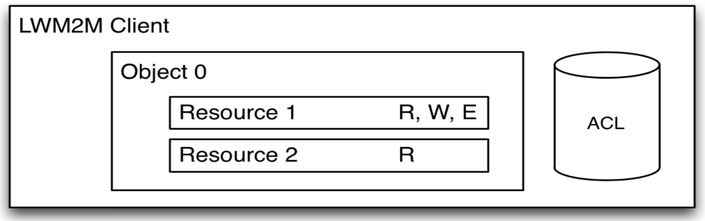
# IPSO Object Structure

- Same URIs as LwM2M : `/{Object ID}/{Object Instance}/{Resource ID}`

```
/3300/0/5700
- 3300  Temperature Sensor
- 0     Instance 0 of a Temperature Sensor
- 5700  Resource having the current value
```

- Data Types (String, Integer, …) as LwM2M
- Operations (Read, Write, Create…) as LwM2M
- Object Linking and Core Link
  - Object Linking is used to refer to Objects within the device.
  - Allows composition without nasty large nested structures
  - Allows for complex objects (i.e. appliance made of several sensors)
- Web Linking to refer to external items (over CoAP).
  - Query parameters: `GET <URL>?rt="urn:oma:lwm2m:temp"`
- Extensible data model
  - Only few "Mandatory" Resources to enable interoperability
  - Use of versioning for model updates



# IPSO Smart Objects

| Object | Object ID |
|---|---|
| Digital Input | 3200 |
| Digital Output | 3201 |
| Analogue Input | 3202 |
| Analogue Output | 3203 |
| Generic Sensor | 3300 |
| Illuminance Sensor | 3301 |
| Presence sensor | 3302 |
| Temperature Sensor | 3303 |
| Humidity Sensor | 3304 |
| Power Measurement | 3305 |
| Actuation | 3306 |
| Set Point | 3308 |
| Load Control | 3310 |
| Light Control | 3311 |
| Power Control | 3312 |
| Accelerometer | 3313 |
| Magnetometer | 3314 |
| Barometer | 3315 |
| Voltage | 3316 |

| Object | Object ID |
|---|---|
| Current | 3317 |
| Frequency | 3318 |
| Depth | 3319 |
| Percentage | 3320 |
| Altitude | 3321 |
| Load | 3322 |
| Pressure | 3323 |
| Loudness | 3324 |
| Concentration | 3325 |
| Acidity | 3326 |
| Conductivity | 3327 |
| Power | 3328 |
| Power Factor | 3329 |
| Distance | 3330 |
| Energy | 3331 |
| Direction | 3332 |
| Time | 3333 |

| Object | Object ID |
|---|---|
| Gyrometer | 3334 |
| Color | 3335 |
| GPS Location | 3336 |
| Positioner | 3337 |
| Buzzer | 3338 |
| Audio Clip | 3339 |
| Timer | 3340 |
| Addressable Text Display | 3341 |
| On/Off Switch | 3342 |
| Dimmer | 3343 |
| Up/Down Control | 3344 |
| Multiple Axis Joystick | 3345 |
| Rate | 3346 |
| Push Button | 3347 |
| Multi-state Selector | 3348 |
| Bitmap | 3349 |
| Stopwatch | 3350 |

# IPSO Reusable Resources

| Resource | Resource ID |
|---|---|
| Digital Input State | 5500 |
| Digital Input Counter | 5501 |
| Digital Input Polarity | 5502 |
| Digital Input Debounce | 5503 |
| Digital Input Edge Selection | 5504 |
| Digital Input Counter Reset | 5505 |
| Current Time | 5506 |
| Fractional Time | 5507 |
| Min X Value | 5508 |
| Max X Value | 5509 |
| Min Y Value | 5510 |
| Max Y Value | 5511 |
| Min Z Value | 5512 |
| Max Z Value | 5513 |
| Latitude | 5514 |
| Longitude | 5515 |
| Uncertainty | 5516 |
| Velocity | 5517 |
| Timestamp | 5518 |
| Min Limit | 5519 |
| Max Limit | 5520 |
| Delay Duration | 5521 |

| Resource | Resource ID |
|---|---|
| X Coordinate | 5528 |
| Y Coordinate | 5529 |
| Clear Display | 5530 |
| Contrast | 5531 |
| Increase Input State | 5532 |
| Decrease Input State | 5533 |
| Counter | 5534 |
| Current Position | 5536 |
| Transition Time | 5537 |
| Remaining Time | 5538 |
| Up Counter | 5541 |
| Down Counter | 5542 |
| Digital State | 5543 |
| Cumulative Time | 5544 |
| Max X Coordinate | 5545 |
| Max Y Coordinate | 5546 |
| Multi-state Input | 5547 |
| Level | 5548 |
| Digital Output State | 5550 |
| Digital Output Polarity | 5551 |
| Analog Input State | 5600 |
| Min Measured Value | 5601 |

| Resource | Resource ID |
|---|---|
| Reset Min and Max Measured Values | 5605 |
| Analog Output Current Value | 5650 |
| Sensor Value | 5700 |
| Sensor Units | 5701 |
| X Value | 5702 |
| Y Value | 5703 |
| Z Value | 5704 |
| Compass Direction | 5705 |
| Colour | 5706 |
| Application Type | 5750 |
| Sensor Type | 5751 |
| Instantaneous active power | 5800 |
| Min Measured active power | 5801 |
| Max Measured active power | 5802 |
| Cumulative active power | 5805 |
| Active Power Calibration | 5806 |
| Instantaneous reactive power | 5810 |
| Min Measured reactive power | 5811 |
| Max Measured reactive power | 5812 |
| Min Range reactive power | 5813 |

| Resource | Resource ID |
|---|---|
| Reactive Power Calibration | 5816 |
| Power Factor | 5820 |
| Current Calibration | 5821 |
| Reset Cumulative energy | 5822 |
| Event Identifier | 5823 |
| Start Time | 5824 |
| Duration In Min | 5825 |
| Criticality Level | 5826 |
| Avg Load Adj Pct | 5827 |
| Duty Cycle | 5828 |
| On/Off | 5850 |
| Dimmer | 5851 |
| On Time | 5852 |
| Muti-state Output | 5853 |
| Off Time | 5854 |
| Set Point Value | 5900 |
| Busy to Clear delay | 5903 |
| Clear to Busy delay | 5904 |
| Bitmap Input | 5910 |
| Bitmap Input Reset | 5911 |
| Element Description | 5912 |
| UUID | 5913 |

# Implementations and OMNA Registry

- Several Implementations support IPSO:
  - Example XML of the supported LwM2M and IPSO Objects in Leshan.
  - Sample C package for use of IPSO Objects in Contiki.
  - JS code templates of IPSO-defined devices code templates.
  - Sample Smart Objects Class can be used to create IPSO Smart Objects in your JavaScript applications.
  - BIPSO defines a set of BLE Characteristics that follows the IPSO Objects.
  - Contiki, Mbed, Zephyr and RIOT are example OS's that support IPSO Objects.

- Full object set available at the OMNA Registry:
  - http://www.openmobilealliance.org/wp/OMNA/LwM2M/LwM2MRegistry.html

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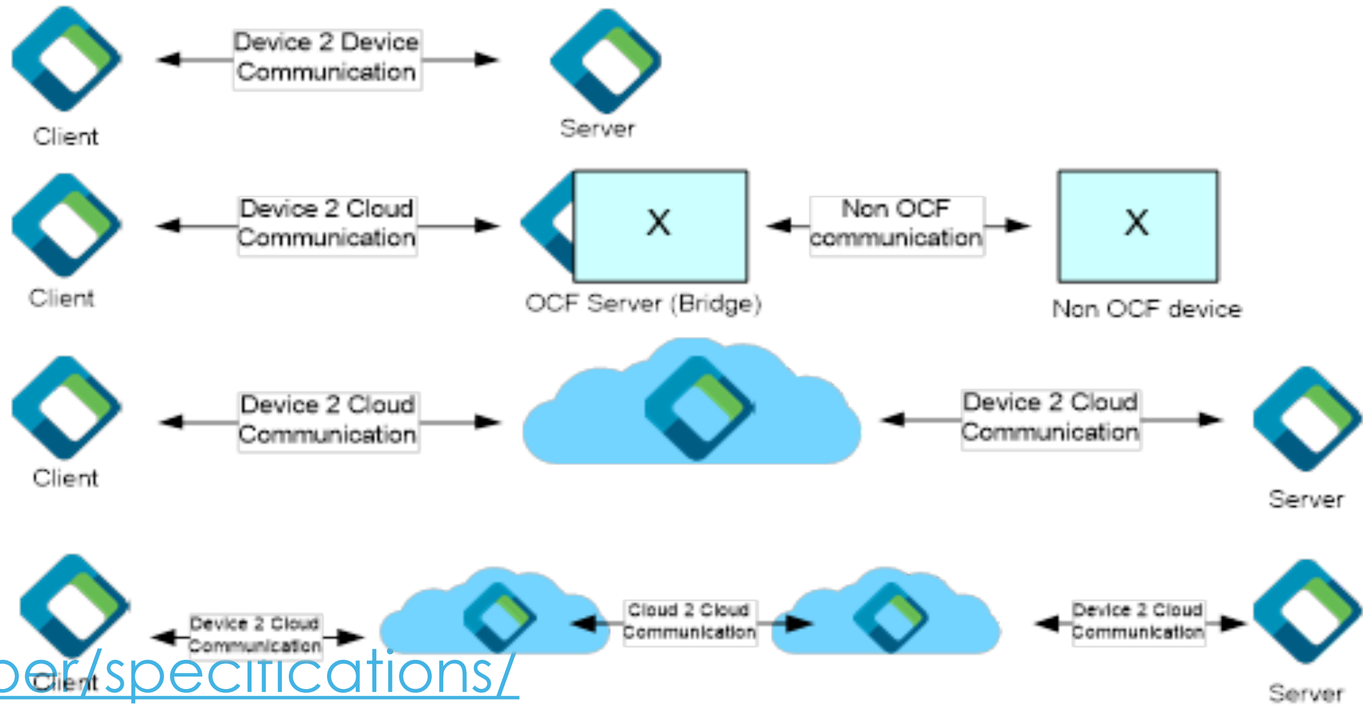
# Things2Things Research Group report out

# Specification release

- New version of Specifications (V2.2.0) has been released on 7 July
- This version includes
- OCF Cloud API for Cloud Services
  - Enabling integration of clouds
- Full scope of communications :
- Specifications are recognized ISO/IEC specifications




- More info: https://openconnectivity.org/developer/specifications/

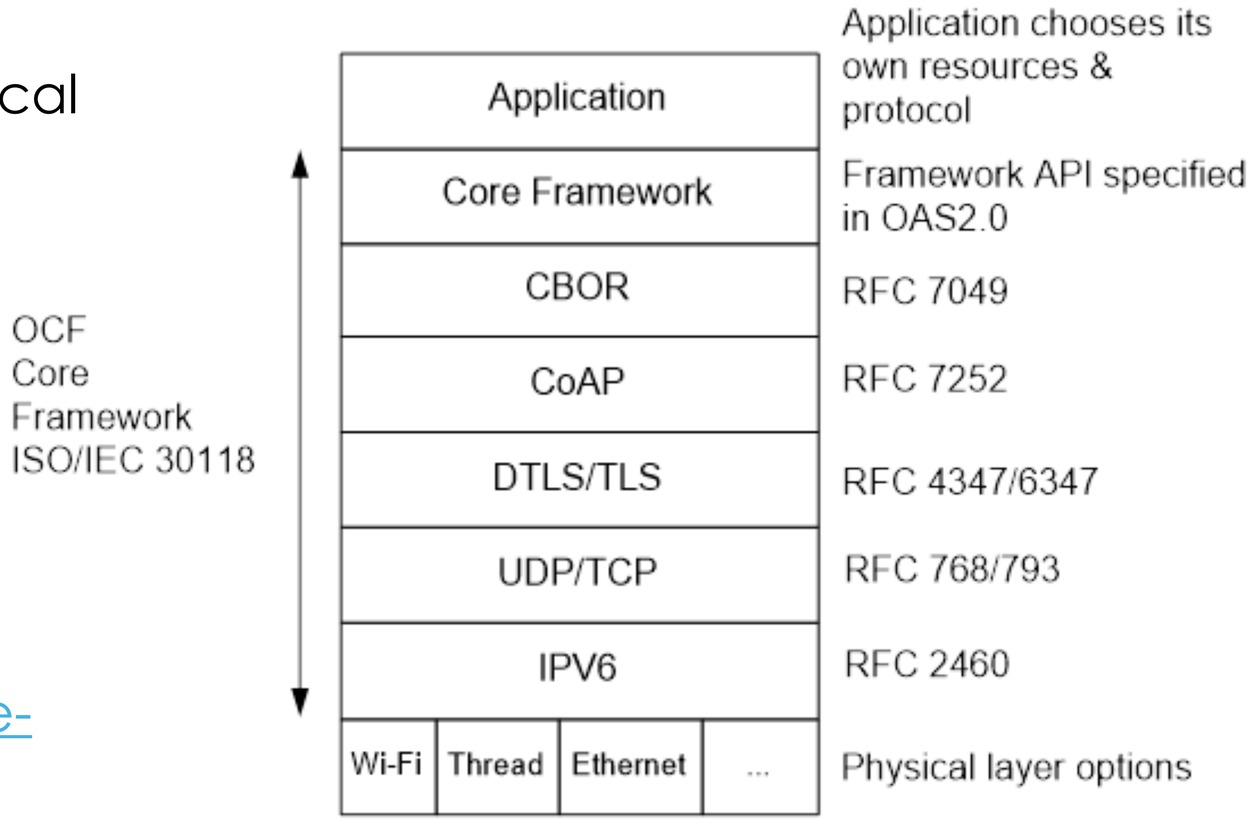
# Open source implementation of OCF

- Open source available for all specifications
- Code running on the device: Iotivity
  - https://iotivity.org/
  - https://github.com/iotivity/iotivity-lite
- Code running in the cloud: gOCF
  - https://gocf.dev/
  - https://github.com/go-ocf/cloud

# OCF Core Framework

- OCF Core Framework: The infrastructure that enables secure IP communication of the vertical defined application.
- **What does it solve:**

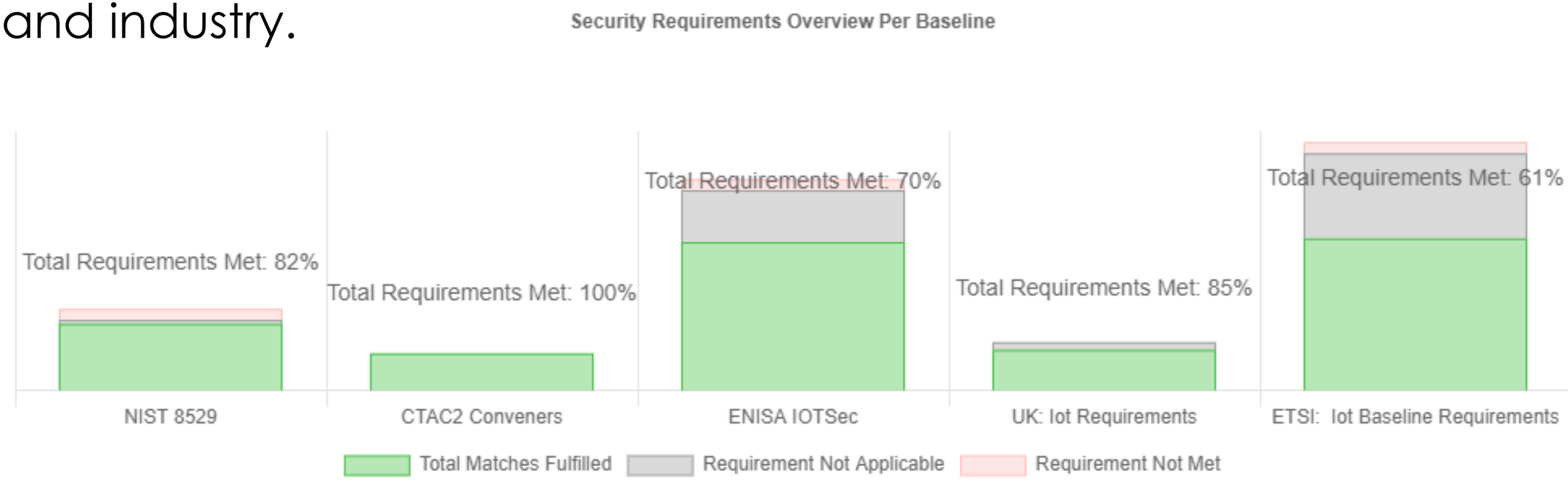
**The OCF Core Framework enables vertical agnostic secure IP communication by means of a standardized framework.**




More info:
https://openconnectivity.org/technology/core-framework/

# OCF Security

- The OCF specification's security-first approach brings it into close alignment with several of the security guidelines from government and industry.




More info: https://openconnectivity.org/technology/ocf-security/

# External Cooperation with other standards

- IP-BLiS
  - Cooperation towards alignment on IP for Building Automation
  - https://www.ipblis.org/
- OneDM
  - Cooperation on data model alignment
  - https://onedm.org/

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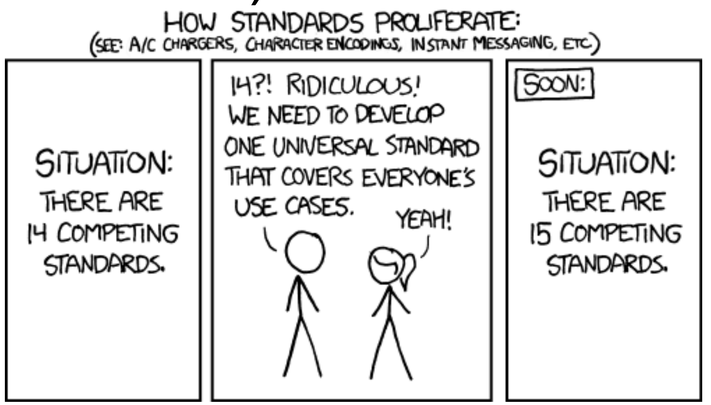
# W3C

# ASDF BoF outlook

Carsten Bormann, T2TRG pre-IETF 108 summary meeting
2020-07-16

# OneDM coming-out 2020-07-13

- OneDM — “One Data Model” (https://onedm.org)
  was started as a **liaison** process 2018, after ZigBee “hive” meeting
- Liaison: Not xkcd 927, but a forum for SDOs (and large vendors) to cooperate about harmonization
  - SDOs often operate under NDAs
- OneDM ran under NDAs for a year
- 2020-07-13: OneDM decided to have its coming out… **onedm.org**



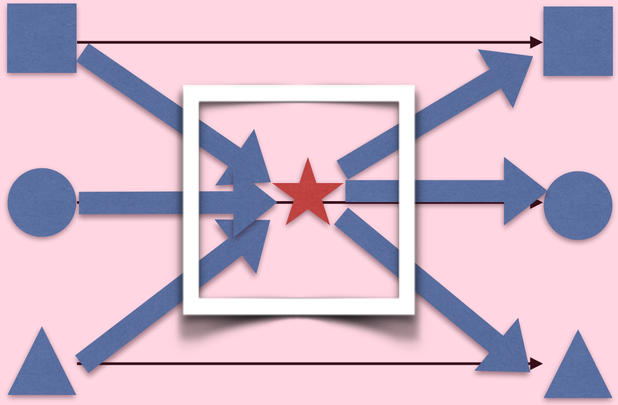
# What has OneDM achieved so far?

- Agreement on a **legal model**:
  - Like the IETF did for a long time, OneDM doesn't exist as an organization (OCF did help occasionally where that was inconvenient)
  - contributions and output are BSD-3-clause **open-source** licensed: Liberal copyright license; everyone keeps their trademarks and patents
- Agreement on a basic common **specification format**: **SDF** 1.0
  - **This** is what the BOF is about
- Collected a couple hundred contributed **data models** in SDF from 4 SDOs (Bluetooth, OCF, OMA, ZigBee; other SDOs in the pipeline)

# SDF

Standardized by

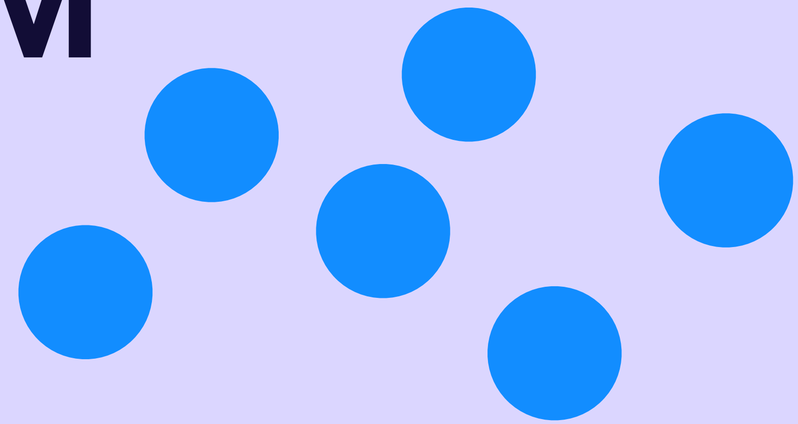
SDF RFC-to-be
(the red star)



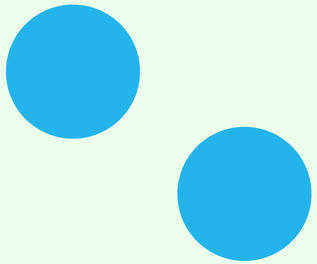
IETF

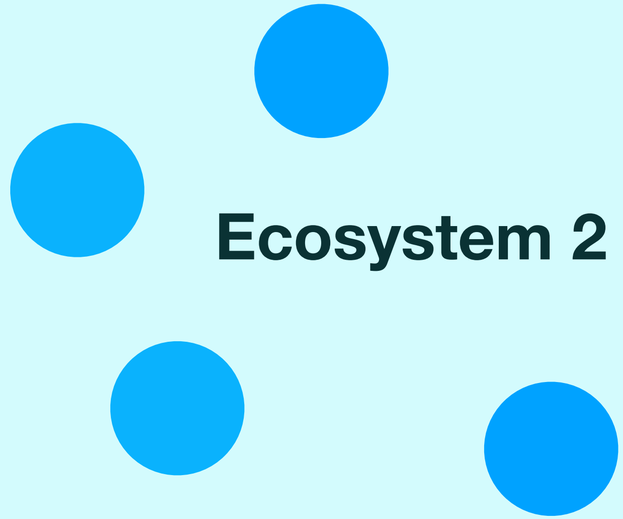
OneDM

Harmonized
Data
Models



Ecosystem 1





# ASDF BoF 2020-07-28

- ASDF: A Semantic Definition Format
- Non-WG forming BOF
- Inform IETF about what has happened
- Check everything is in place for forming an ASDF WG afterwards


# IoT Edge Computing Challenges and Functions

**https://tools.ietf.org/html/draft-hong-t2trg-iot-edge-computing-05**

J. Hong, Y-G. Hong, X. de Foy, M. Kovatsch, E. Schooler and D. Kutscher

Virtual T2TRG Meeting, July 2020

# History of the Draft

- draft-hong-iot-edge-computing-01 (IETF 103)
  - Draft was presented along with two demo videos of use cases for IoT Edge computing (smart construction and real-time control system)

- draft-hong-iot-edge-computing-02 (IETF 104)
  - In a discussion on Edge and IoT in the T2TRG meeting, this draft was considered a possible starting point for a group document. New co-authors joined.

- draft-hong-t2trg-iot-edge-computing-00 (IETF 105)
  - Draft was integrated with *Survey and gap analysis, a* presentation made in T2TRG at IETF 100

- draft-hong-t2trg-iot-edge-computing-01 (IETF 106)
  - Focus changed from use case examples to Edge function analysis.
  - Draft changed from showing one Edge architecture to  a range of models. Did not promote/preclude a particular model.

- draft-hong-t2trg-iot-edge-computing-02/3 (IETF 107)
  - Reorganized the draft
  - Extended the background section and the list of functions

- draft-hong-t2trg-iot-edge-computing-04/05 (IETF 108)
  - Addressed comments impacting content and structure
  - Completed section 4 with additional text on distributed model and research challenges
  - Call for adoption on -05

# Update 1/2

*Updates addressing comments (Thomas, Ari)*

- Improvements to section 3 *IoT challenges leading towards EC*
  - *Resilience to intermittent services* now also includes enabling a cloud service to access a device currently asleep
  - Hiding traffic patterns from devices is another privacy application of IoT edge computing

- Improvements to the document structure
  - Removed the appendix (it was moved to draft-defoy-t2trg-iot-edge-computing-background for reference)
  - Moved the *overview of IoT edge computing* section later in the draft, to improve flow (and cleaned up its references to the appendix)
  - Made editorial fixes in revision -05 based on Ari's comments

# Update 2/2

*Updates that were planned since IETF 107*

- Completed sections 4 (IoT Edge Functions) and 5 (Security Considerations)
  - Added an example of distributed IoT Edge Computing next to the general model
  - Added research challenges associated with IoT edge functions
  - Filled security section 5 with positive and negative impacts of edge computing
- Many editorial changes were also made to improve clarity and flow

# Quick Overview

**1. Introduction**

**2. Background**

- IoT, cloud computing, edge computing, use cases

**3. IoT Challenges Leading Towards Edge Computing**

- Time sensitivity, uplink cost, resilience to intermittent connectivity, privacy and security

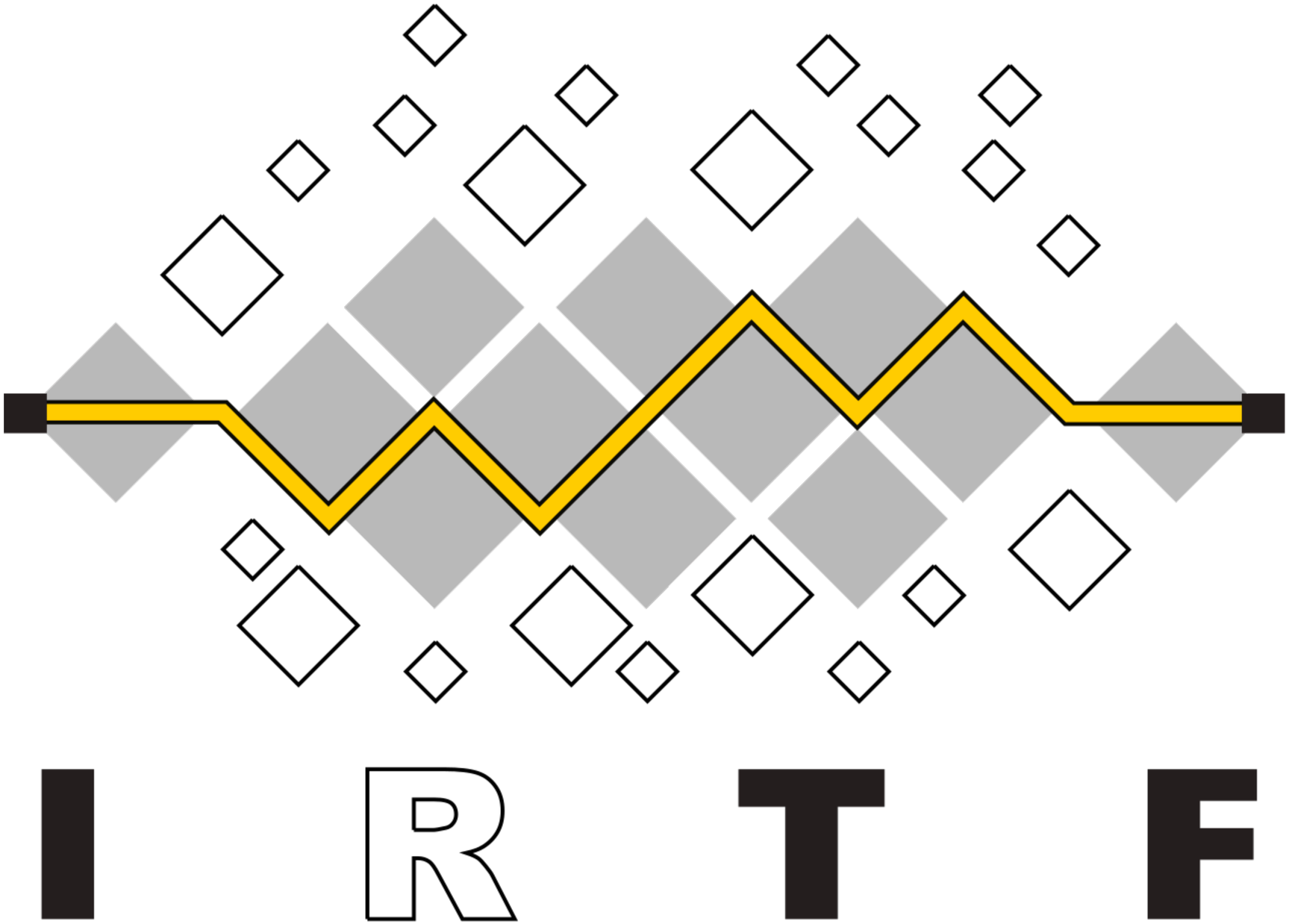
**4. IoT Edge Computing Functions**

- Overview of existing use of IoT edge computing, general model
- Functions/components
  - OAM components: virtualization management, resource discovery and authentication, edge organization and federation
  - Functional components: external APIs, communication brokering, in-network computation, edge caching, other services
  - Application components: IoT end devices management, data management
- Simulation and emulation environments

**5. Security Considerations**

# Conclusion

- We believe the draft is complete from the co-authors' standpoint:
  - It introduces IoT edge computing and describes reasons why it is needed for IoT
  - It describes a simple architecture model, major functions, and associated research challenges
  - It provides context for future work in this area in IRTF
- A good review helped fixing some issues with the flow and reduce the size of the draft significantly.
- The draft is now proposed for adoption by the RG.
  - If you are interested, please review and provide feedback on the list.


I R T F