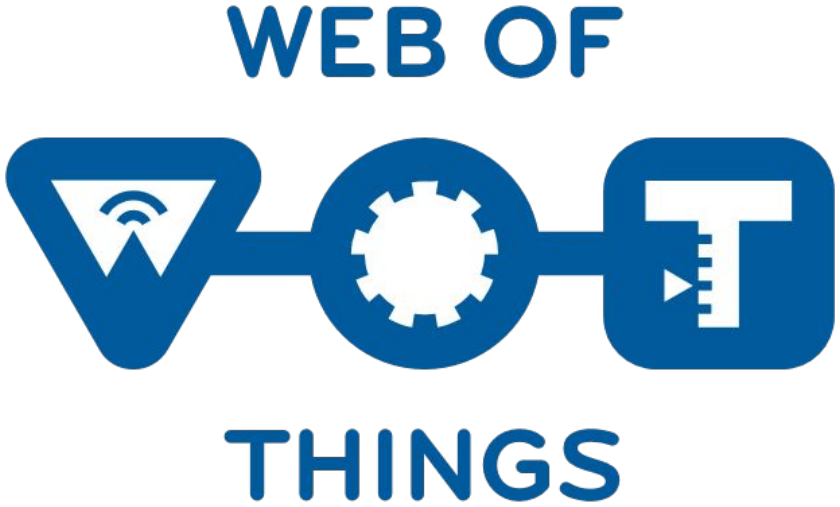


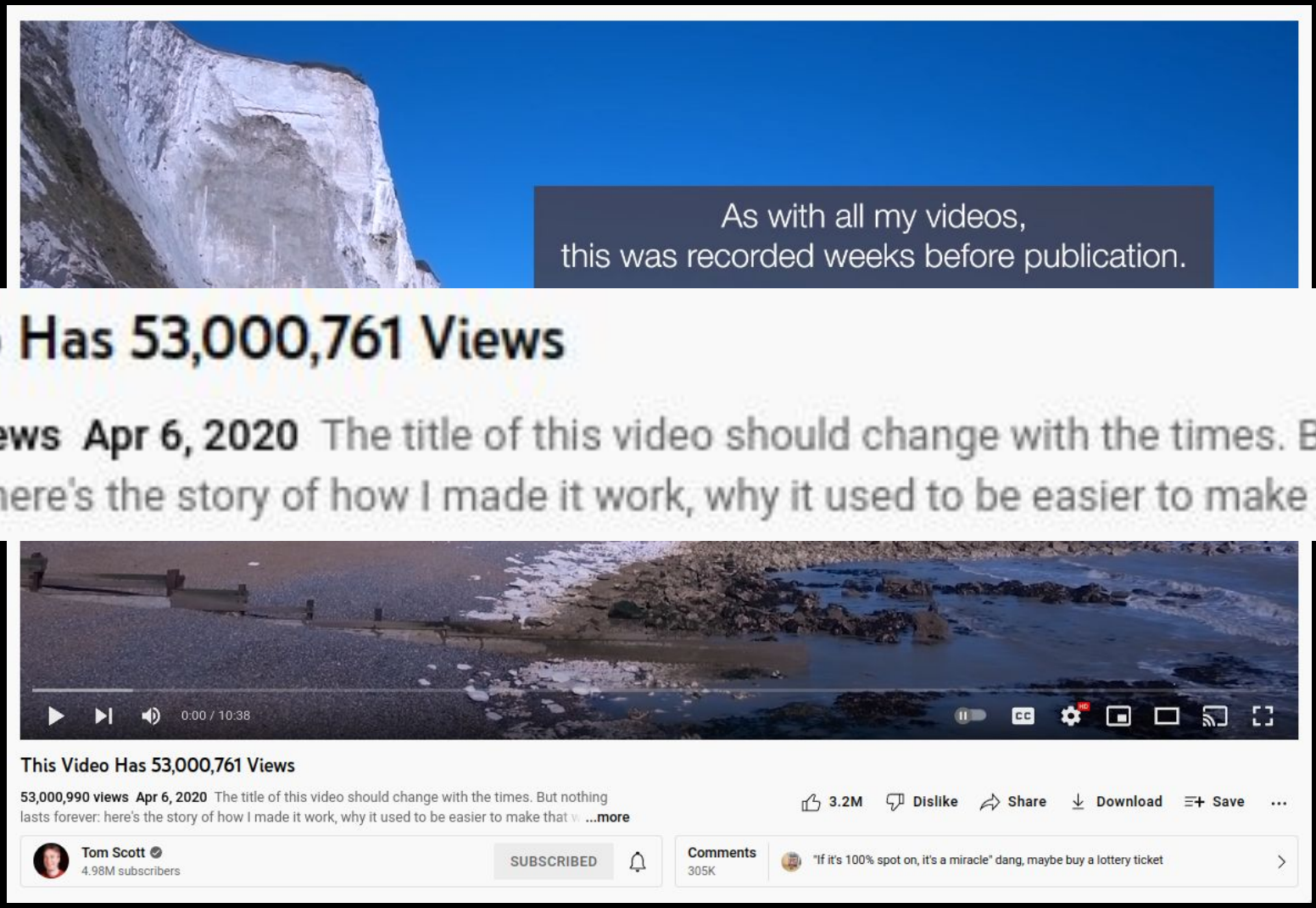
W3C Web of Things Community Group

TPAC 2023 - Introduction to WoT

Cristiano Aguzzi - Ege Korkan

September 14th, 2023

A Peculiar YouTube Video Title

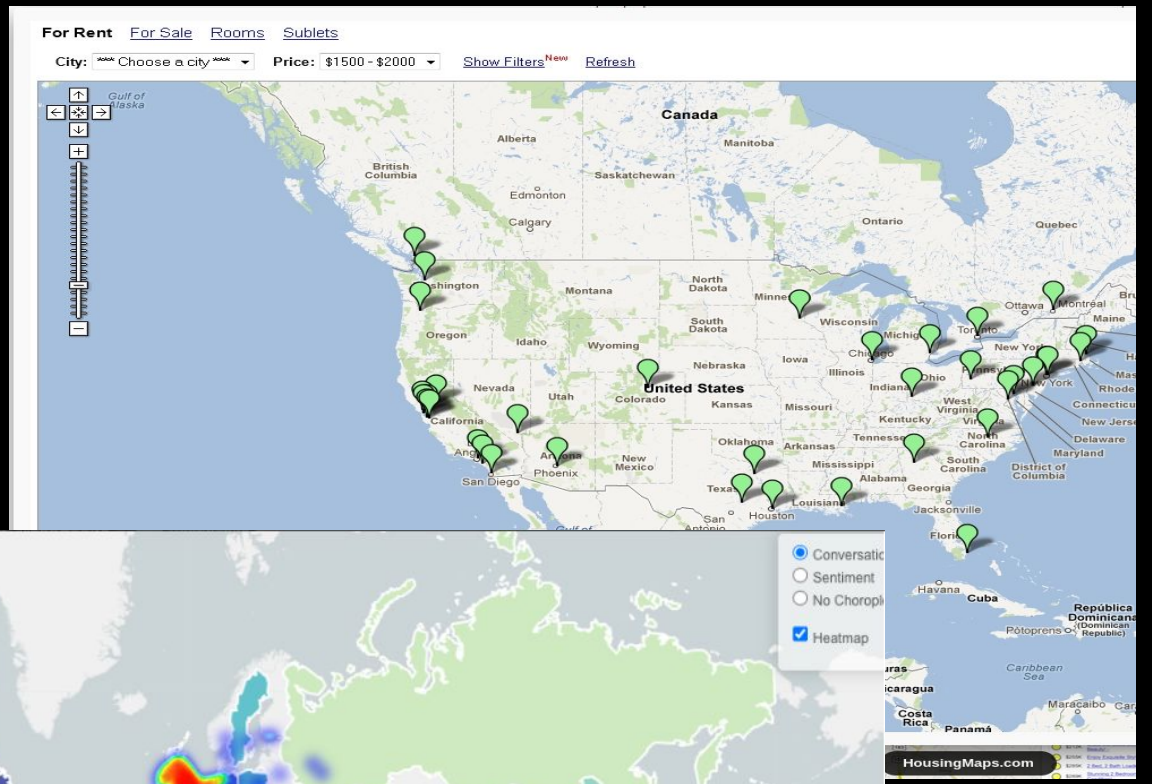


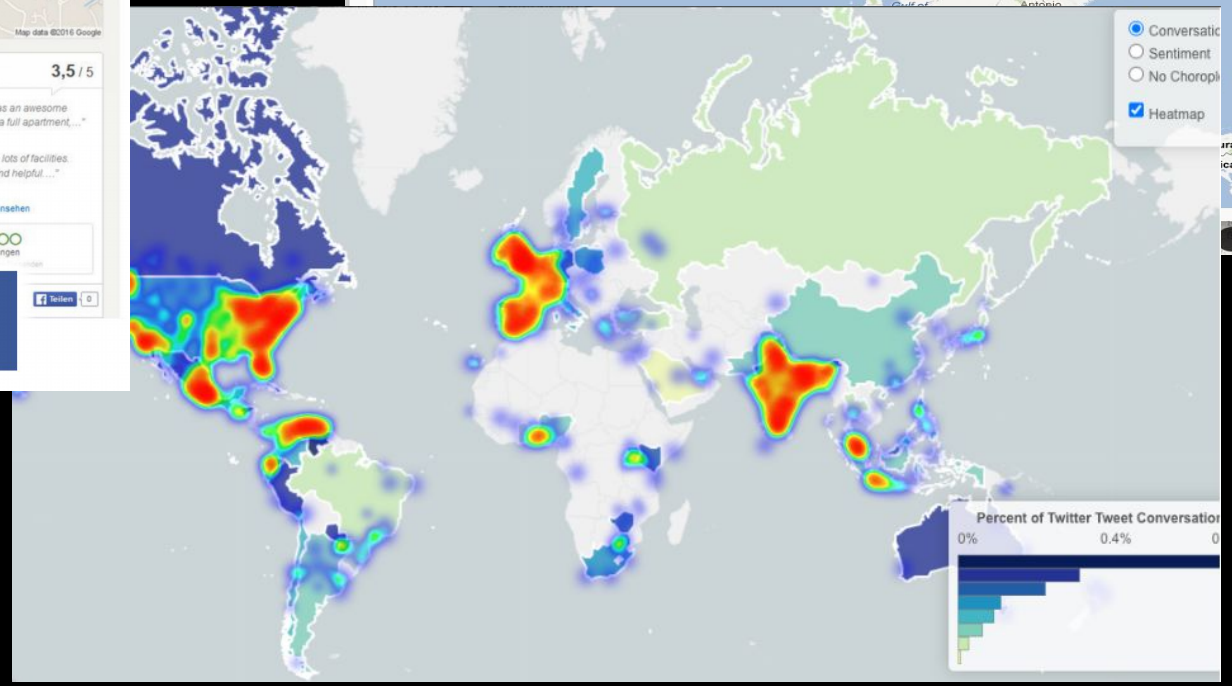
https://www.youtube.com/watch?v=BxV14h0kFs0

Web Mashups?

https://www.expedia.com/

http://www.housingmaps.com/





https://www.trendsmap.com/

APIs exist in the Web, what about in IoT?

They are here too…

… but not so straightforward

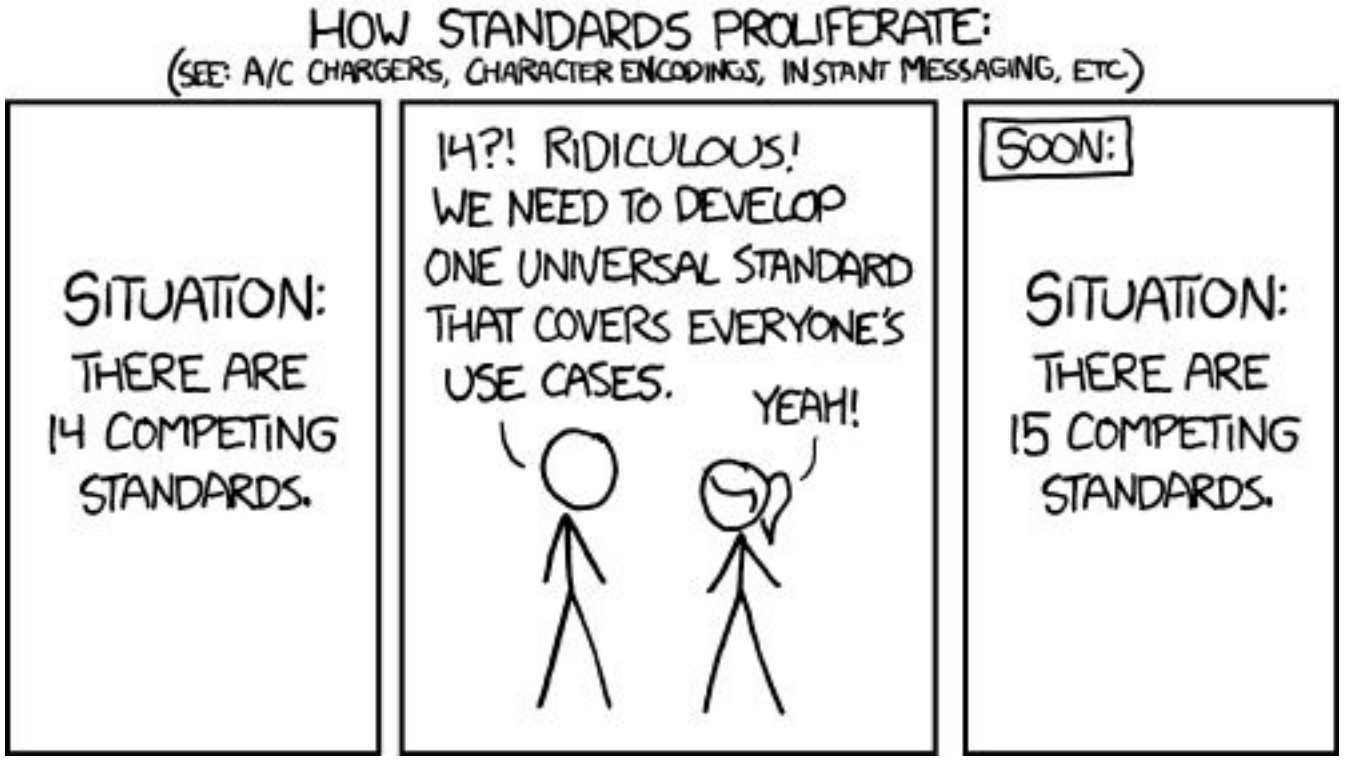
- Not just HTTP, welcome CoAP, MQTT, Modbus, OPC UA, BACnet and more…
- Not just about a server serving data, there is influence of/on the real world
- Domain specific
- Dependency to SDKs

Overall, there is a fragmentation problem

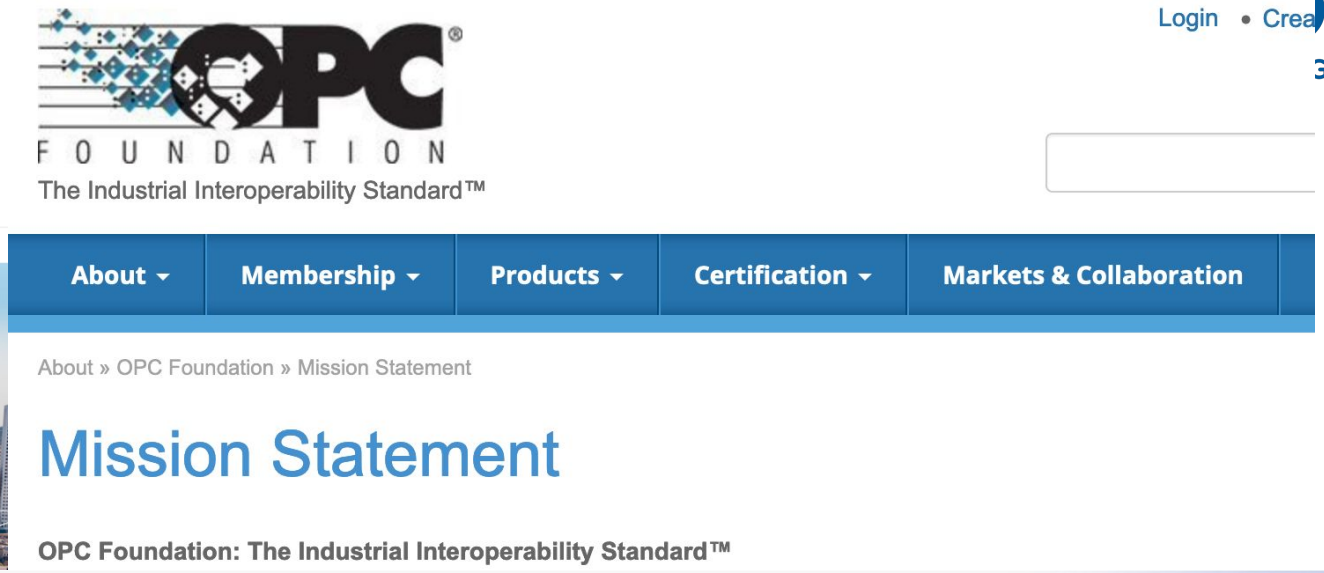
Like in the old days of the Internet

- Multiple separate networks
- No consensus on the protocols to use

So let’s have one standard we agree on!

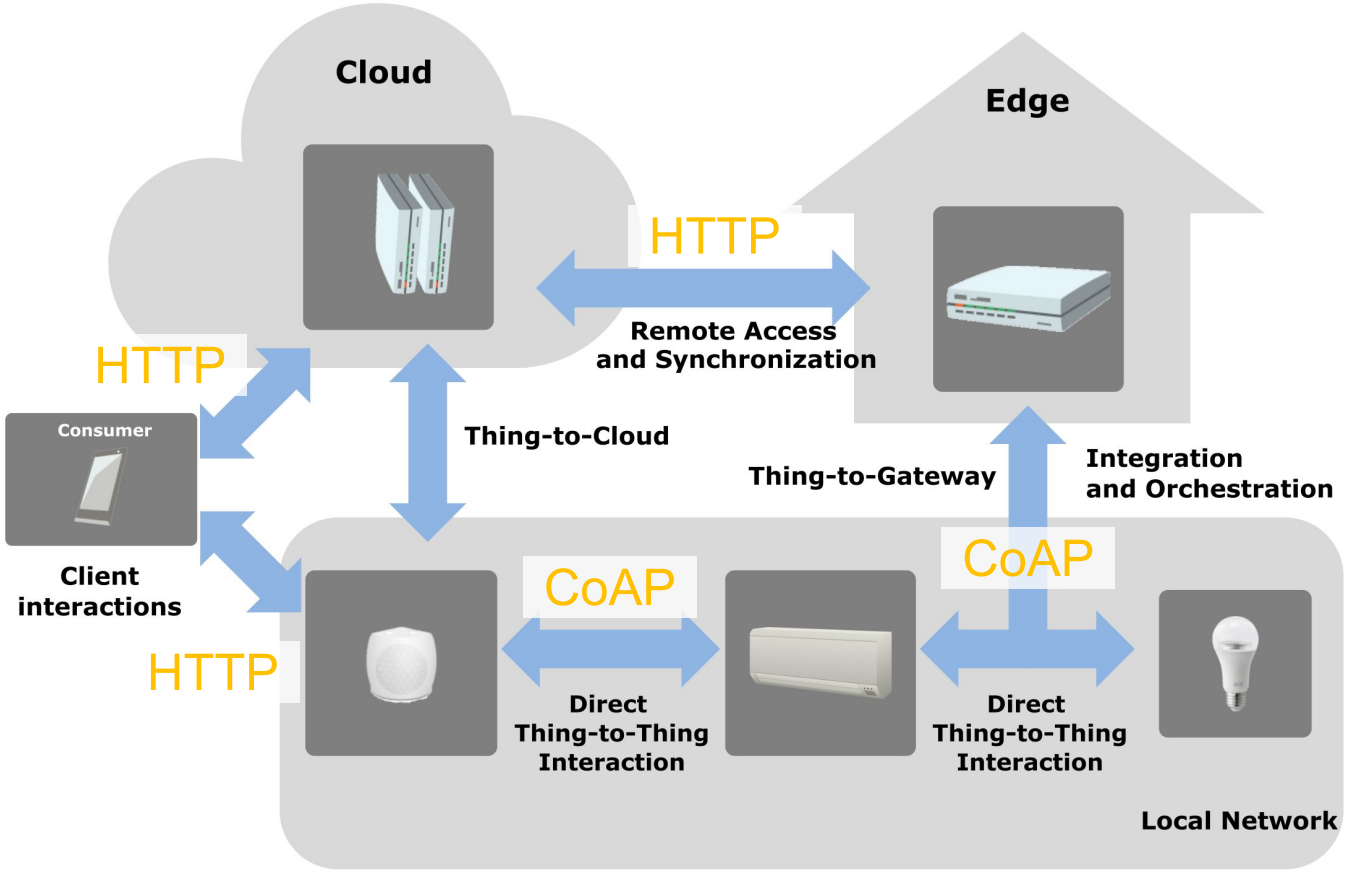

HOW STANDARDS PROLIFERATE:
(SEE: A/C CHARGERS, CHARACTER ENCODINGS, INSTANT MESSAGING, ETC)
SITUATION: THERE ARE 14 COMPETING STANDARDS.
14?! RIDICULOUS! WE NEED TO DEVELOP ONE UNIVERSAL STANDARD THAT COVERS EVERYONE'S USE CASES.
YEAH!
SOON:
SITUATION: THERE ARE 15 COMPETING STANDARDS.

Also true for IoT

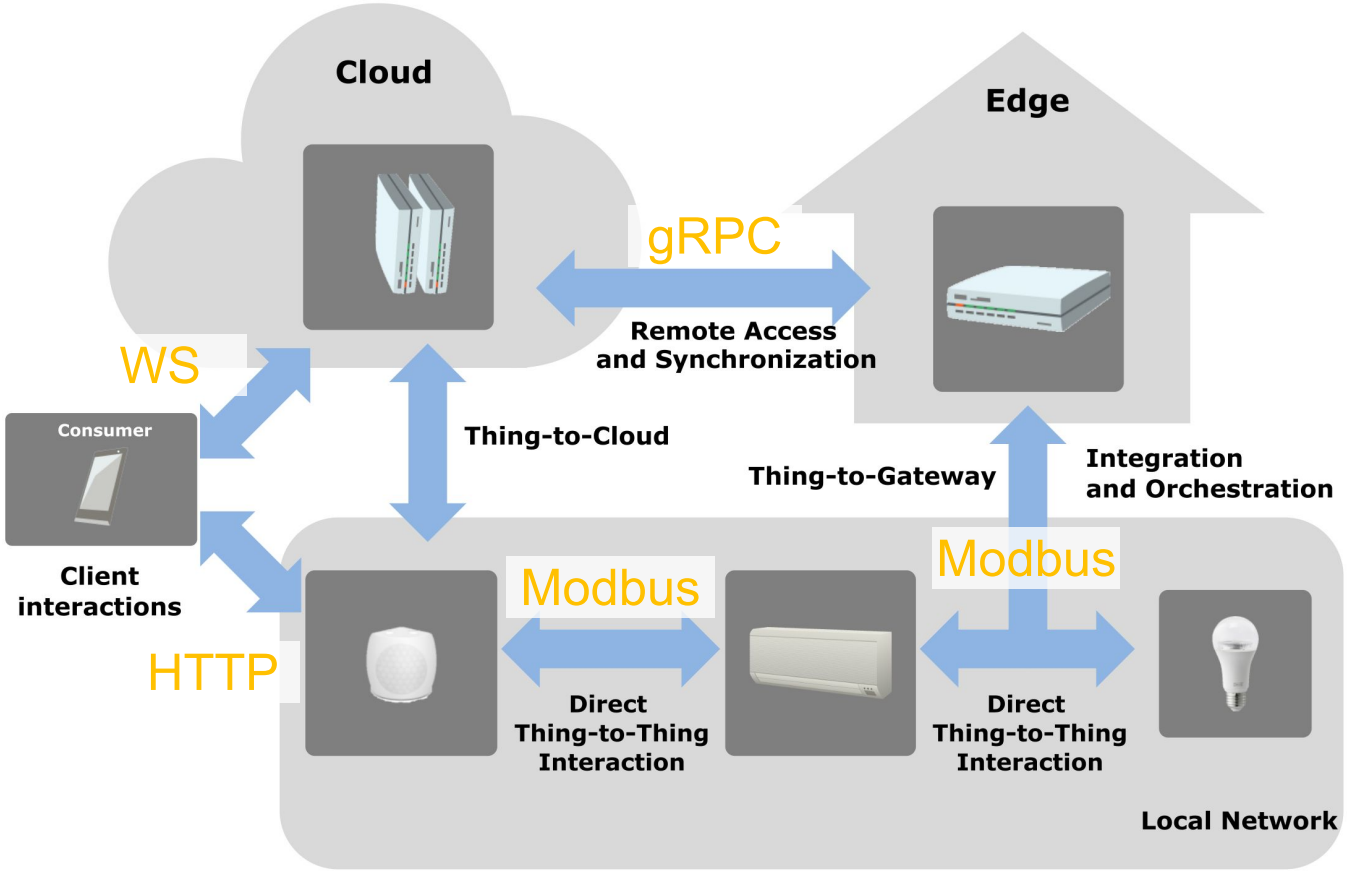


Each domain has its own set of protocols, standards, tools, vocabularies

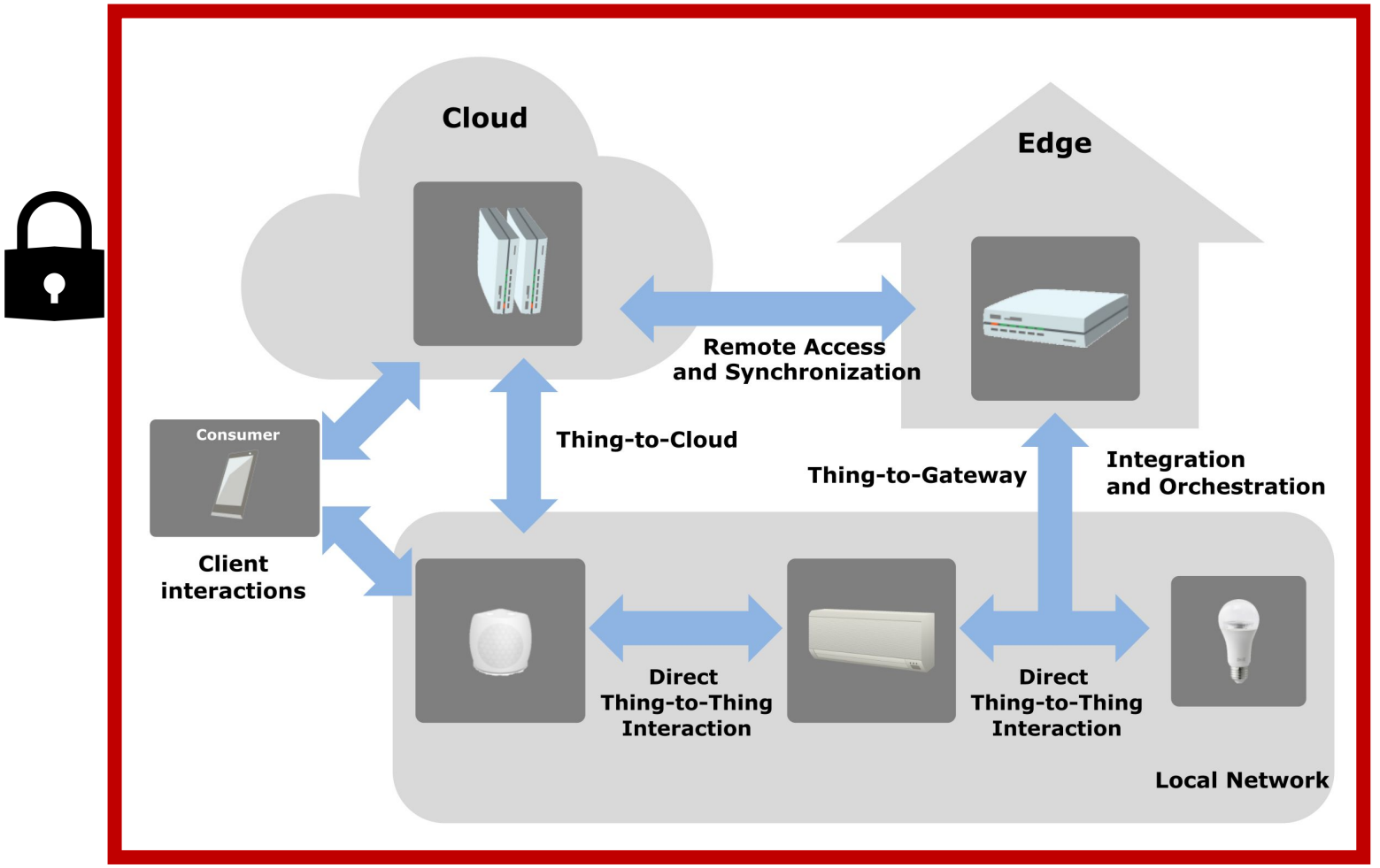
Possible Combinations: Protocols



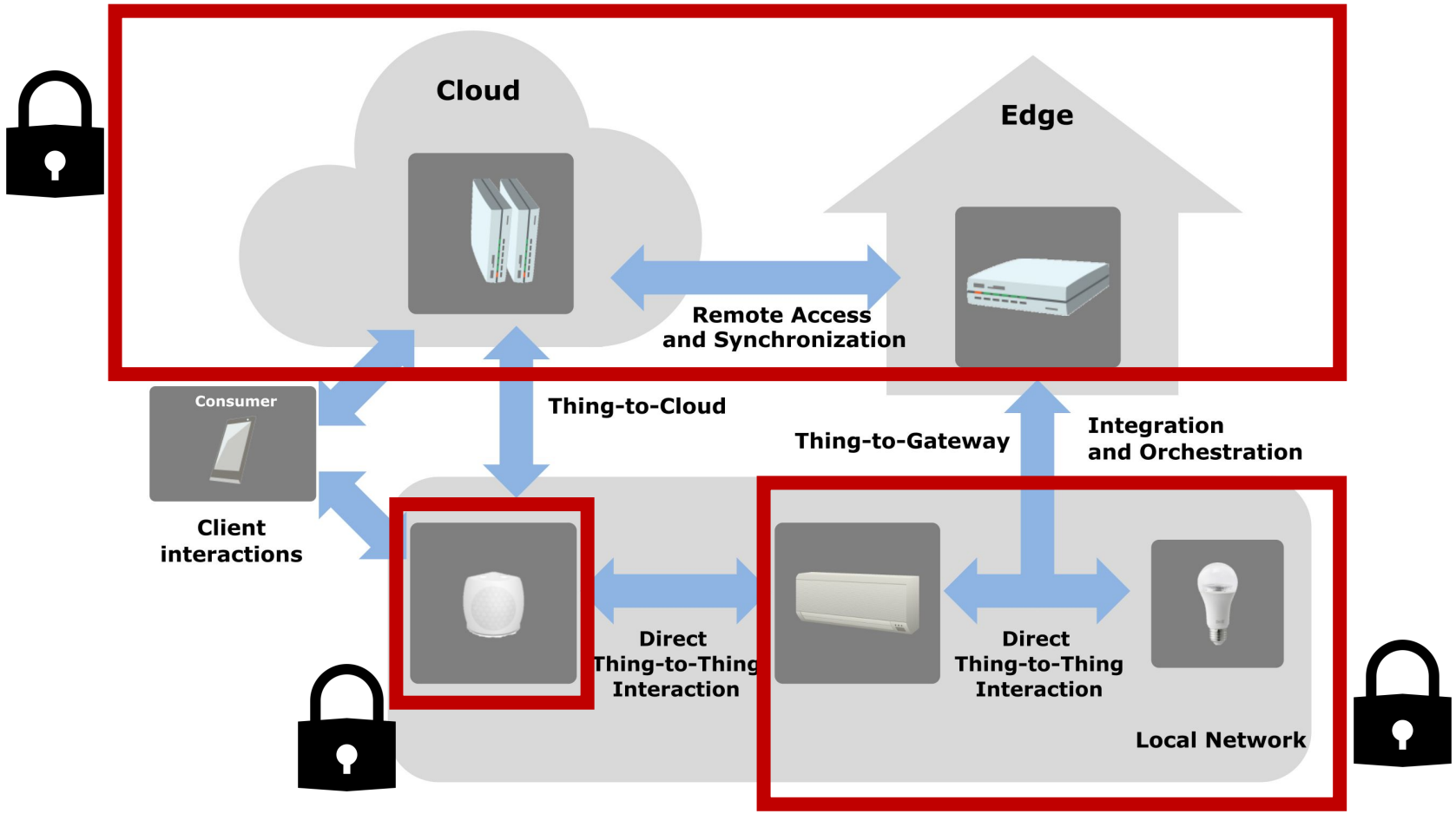
Possible Combinations: Protocols



Possible Combinations: Security



Possible Combinations: Security

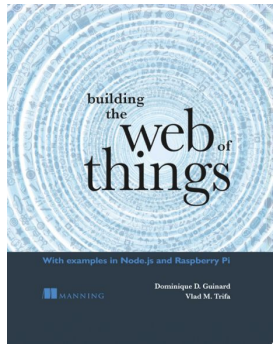


This is not bad though!

Different use cases and requirements

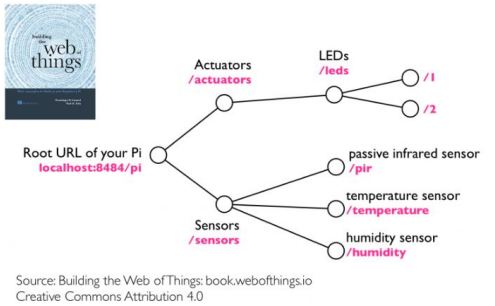
Switch to Cris

Initial Idea for the Web of Things



Source: Building the Web of Things: book.webofthings.io
Creative Commons Attribution 4.0

Web of Things Now



Source: Building the Web of Things: book.webofthings.io
Creative Commons Attribution 4.0

Was a proposal on how to build REST APIs for IoT devices

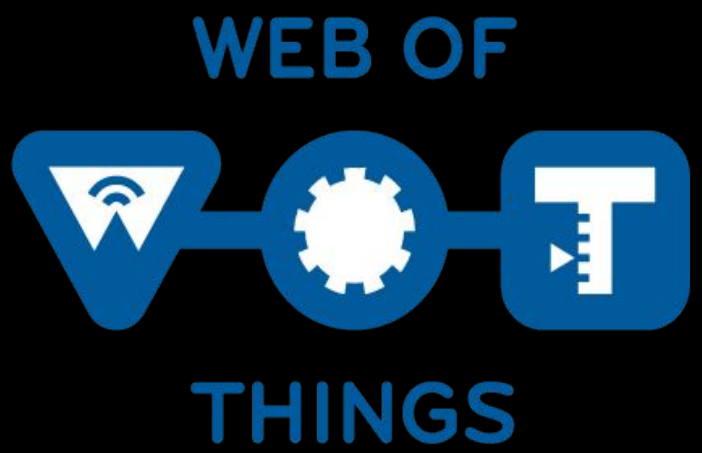
Is about describing *any* kind of API for IoT devices using *any* protocol

Now 4 normative deliverables, participants from over 35 organizations, dozens of implementations

Mashups at Standardization Events (since 2016!)

Family of W3C Standards

(Re)Usable API Descriptions
for every *Thing*



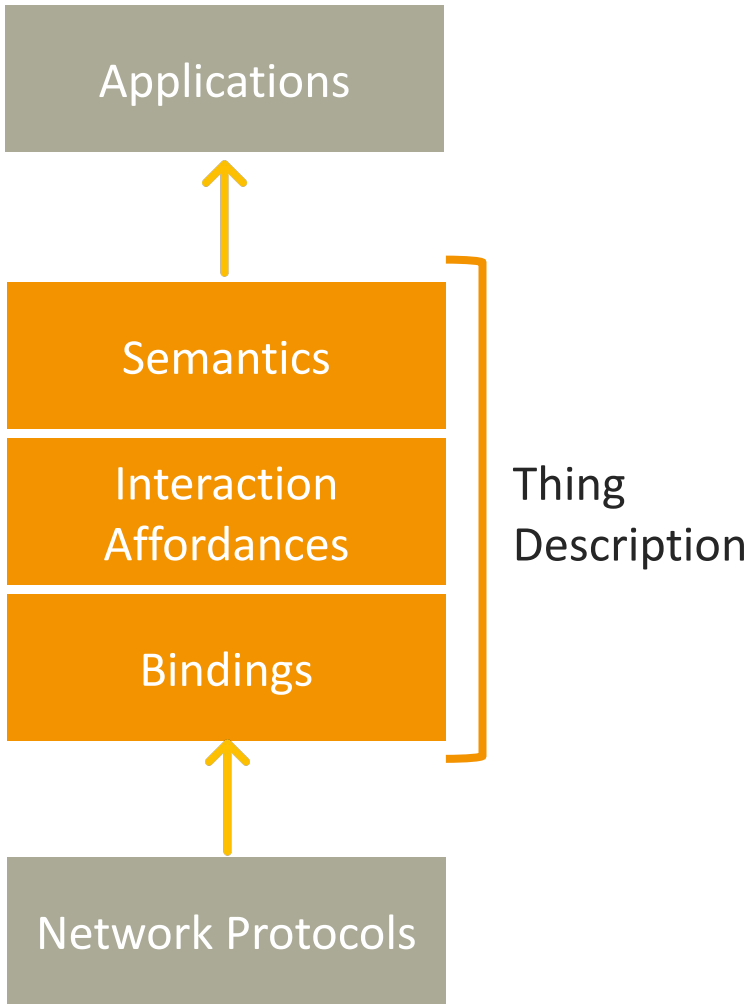
Royalty Free and Open

Open Source

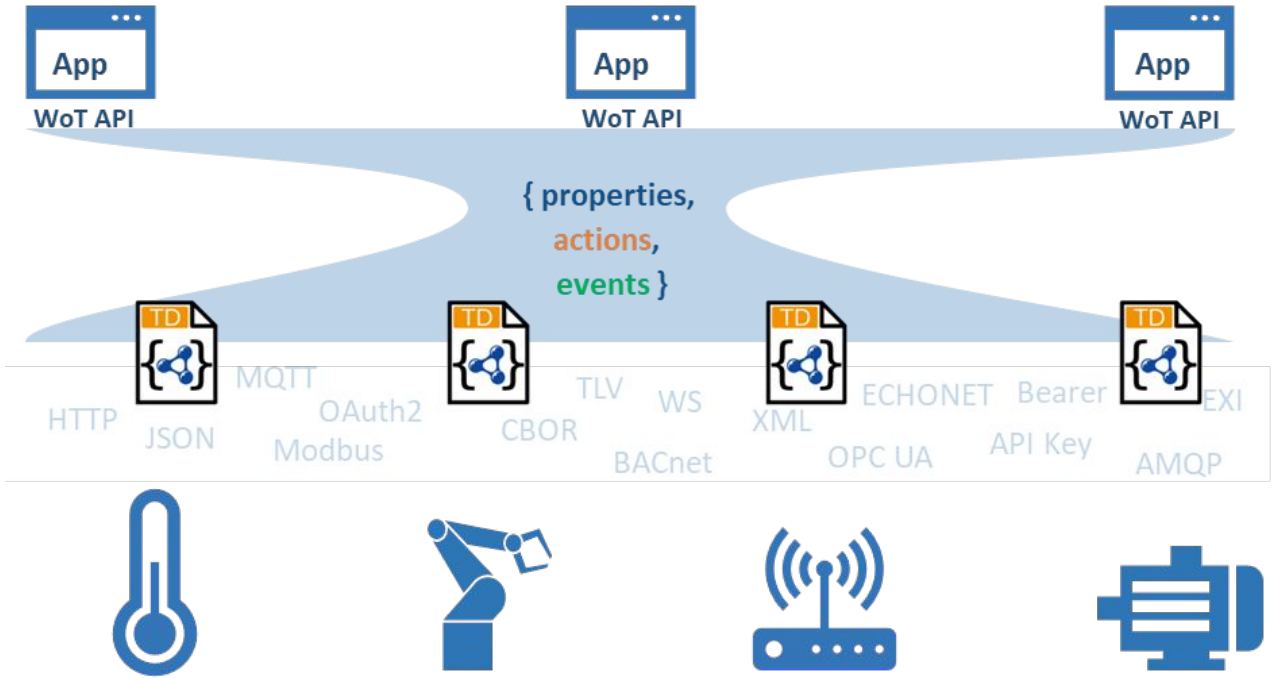
Developer Friendly

Market Adoption

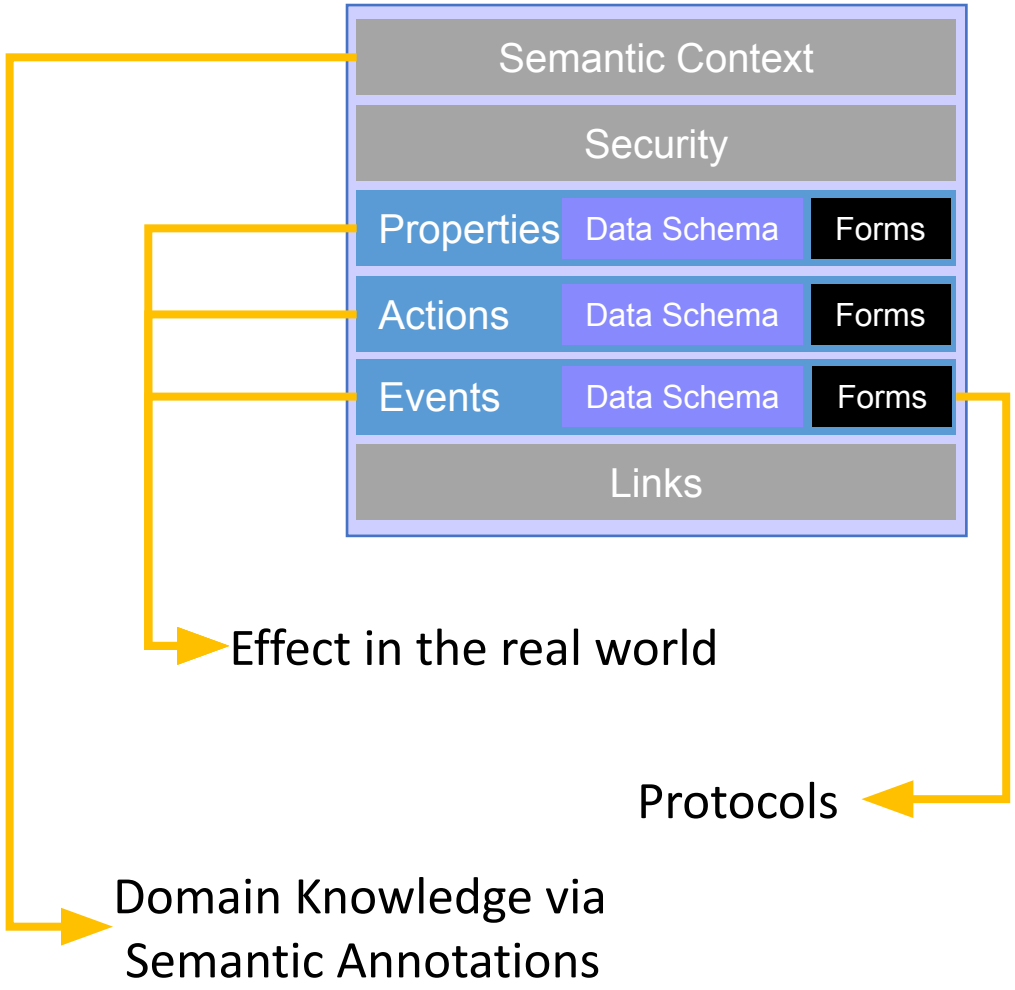
Web of Things, not a Protocol



Narrow Waist Model



Core Specification: Thing Description (TD)

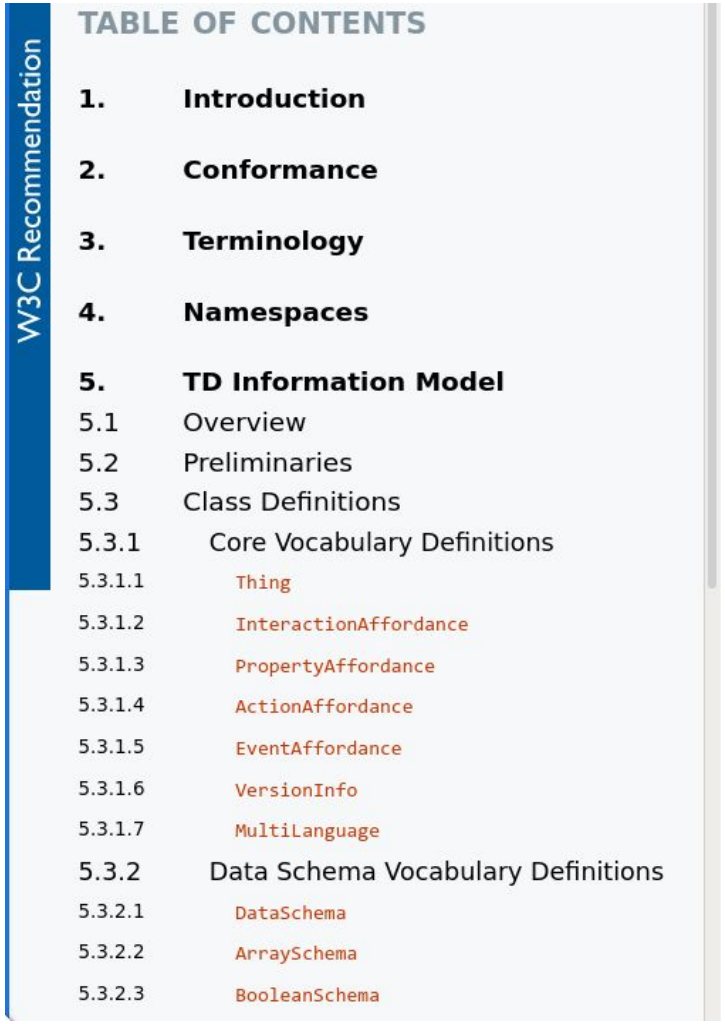



```
{
  "@context": "https://www.w3.org/2019/wot/td/v1",
  "id": "urn:HotelRoom",
  "@type": "Thing",
  "base": "coap://localhost:3000",
  "title": "simulated Hotel Room",
  "properties": {
    "brightness": {
      "type": "integer",
      "title": "Light Brightness",
      "forms": [
        {
          "href": "/light/Brightness",
          "contentType": "application/cbor",
          "op": [
            "observeproperty",
            "readproperty",
            "writeproperty"
          ]
        }
      ]
    },
```

JSON-LD Serialization

Discovery and
Usage by Clients

Deeper look into the Thing Description



Web of Things (WoT) Thing Description

W3C Recommendation 9 April 2020 (Link errors corrected 23 June 2020)

This version:
https://www.w3.org/TR/2020/REC-wot-thing-description-20200409/

Latest published version:
https://www.w3.org/TR/wot-thing-description/

Latest editor's draft:
https://w3c.github.io/wot-thing-description/

Implementation report:
https://w3c.github.io/wot-thing-description/testing/report.html

Previous version:
https://www.w3.org/TR/2020/PR-wot-thing-description-20200130/

Editors:
Sebastian Kaebisch (Siemens AG)
Takuki Kamiya (Fujitsu Laboratories of America)
Michael McCool (Intel)
Victor Charpenay (Siemens AG)
Matthias Kovatsch (Huawei)

Participate:
GitHub w3c/wot-thing-description

Version 1.1 almost out!

Deeper look: **Thing Level**

```
{
    "@context": [
                "https://www.w3.org/2022/wot/td/v11",
                {"iot":"http://iotschema.org"}
    ],
    "@type":"SprinklerStation",
    "id": "urn:dev:ops:Agriculture-7331",
    "title": "SoilStation",
    "description": "A soil management station for use in agriculture",
    "securityDefinitions": { "basic_sc": {"scheme": "basic"} },
    "security": "basic_sc",
    "properties": {
        "temperature": {...}
    },
    "actions": {
        "startSprinkler": {...}
    },
    "events": {
        "tooDry": {...}
    },
    "links":["href":"docs", "rel":"about", "type":"text/html"]
}
```

Semantic Annotations

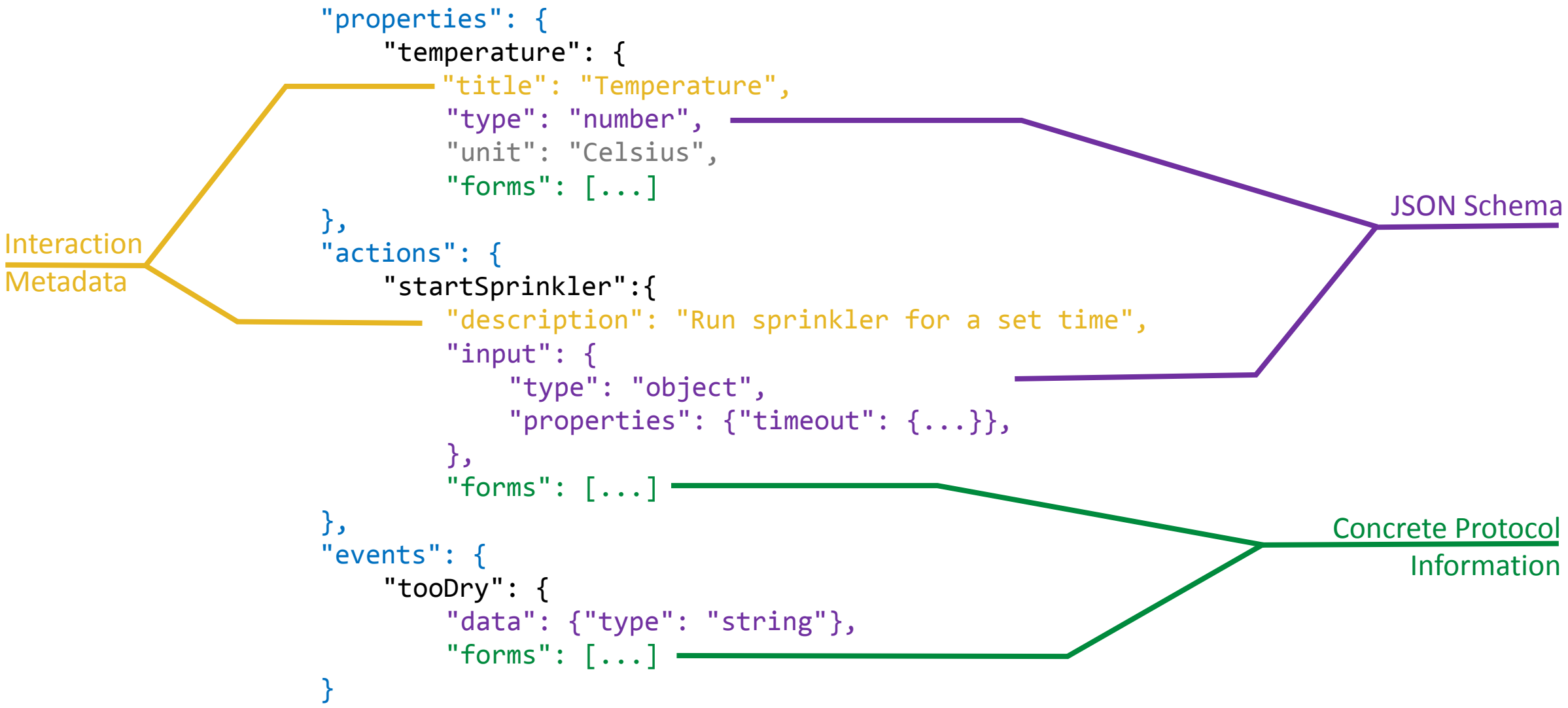
Thing Metadata

Security Metadata

Definitions of Interaction Affordances

Links to other Documents

Deeper look: **Affordance Level**



Deeper look: **Protocol Level**

What to do with a TD

- Communicating with the Thing
- Device Proxying and Protocol Translation
- UI generation
- Device Management
- Business/Application Logic Composition (Mashups)

Other WoT Specifications

WEB OF THINGS

Architecture

REC

Common Reference, Deployment Patterns, Relationship between specifications

Discovery

REC

How to find TDs in a network, TD management via a REST API

Profile

REC*

A mechanism for creating subset of TD for less flexibility but easier implementability

Binding Templates

Extending TDs for different protocols, media types, ecosystems, etc.

Scripting API

Programming API for building Consumer and Thing applications

Use Cases and Requirements

Where different WoT specifications get motivation for new features

Scripting API Crash Course for Hands-On Tutorial

In a JavaScript runtime after fetching a Thing Description as a plain Object, one can create a ConsumedThing.

```
let res = await fetch("https://tds.mythings.org/sensor11");
let td = res.json();
let thing = await wot.consume(td);

// Read a property
const temperatureData = await thing.readProperty("temperature");
const temperature = await temperatureData.value();
// Observe to a property
await thing.observeProperty("temperature", async (data) => {});
// Subscribe to event
await thing.subscribeEvent("alarm", async (data) => {});
// Invoke an Action
const response = await thing.invokeAction("takePicture"));
const image = await response.arrayBuffer();
```

Where to Learn More?

Official Web Page of W3C WoT

https://www.w3.org/WoT/

@W3C_WoT

Try node-wot , ediTDor and Playground

Do a simple tutorial

Read documentation and
watch some videos on the official page

Join one of the office hours

Stay in Touch

- Join our Discord: https://discord.gg/RJNYJsEgnb
- Open GitHub Issues or start GitHub Discussions at https://github.com/w3c/wot-cg
- Send Emails to public-web-of-things@w3.org
- All future events are visible in our calendar at https://www.w3.org/groups/cg/wot/calendar
- All TDs that were used for testing: https://github.com/w3c/wot-testing