



W3C Web of Things Summary and Applications

Michael McCool

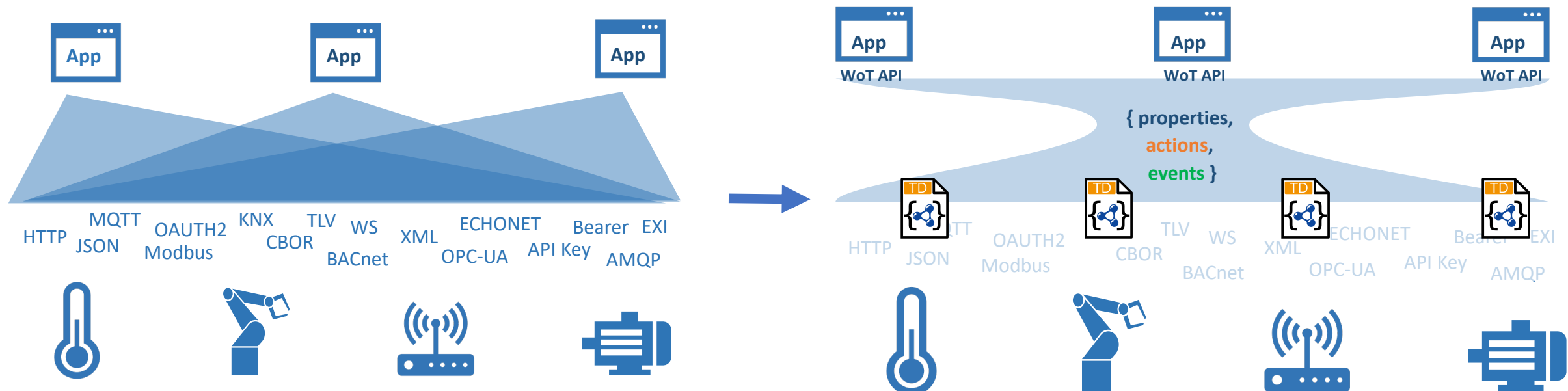
February 2022

Outline

- What is WoT?
 - Applying and extending web standards for IoT
 - Descriptive interoperability: Thing Descriptions
 - Finding Thing Descriptions: Discovery
- Use Cases and Applications
 - Use Cases and Requirements
 - Smart Buildings
 - Smart Cities
- Discussion
 - Gaps and Future Work

W3C Web of Things (WoT)

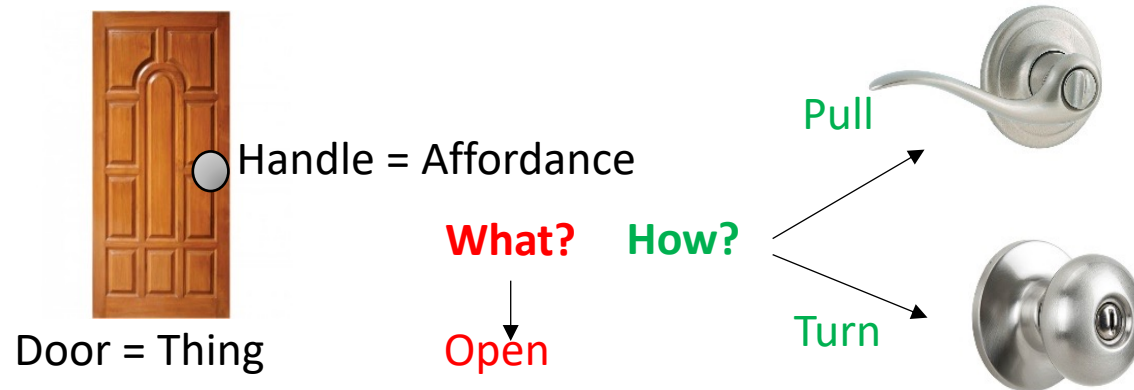
- W3C Working Group goal: Adapting web technologies to IoT
- Already published: Thing Description (TD) metadata format
 - TD describes the available interactions (network API) of a Thing
- New deliverables in progress, including Discovery
 - How does a potential user obtain the TD for a Thing?



Descriptive Interoperability: TDs

WoT Architecture

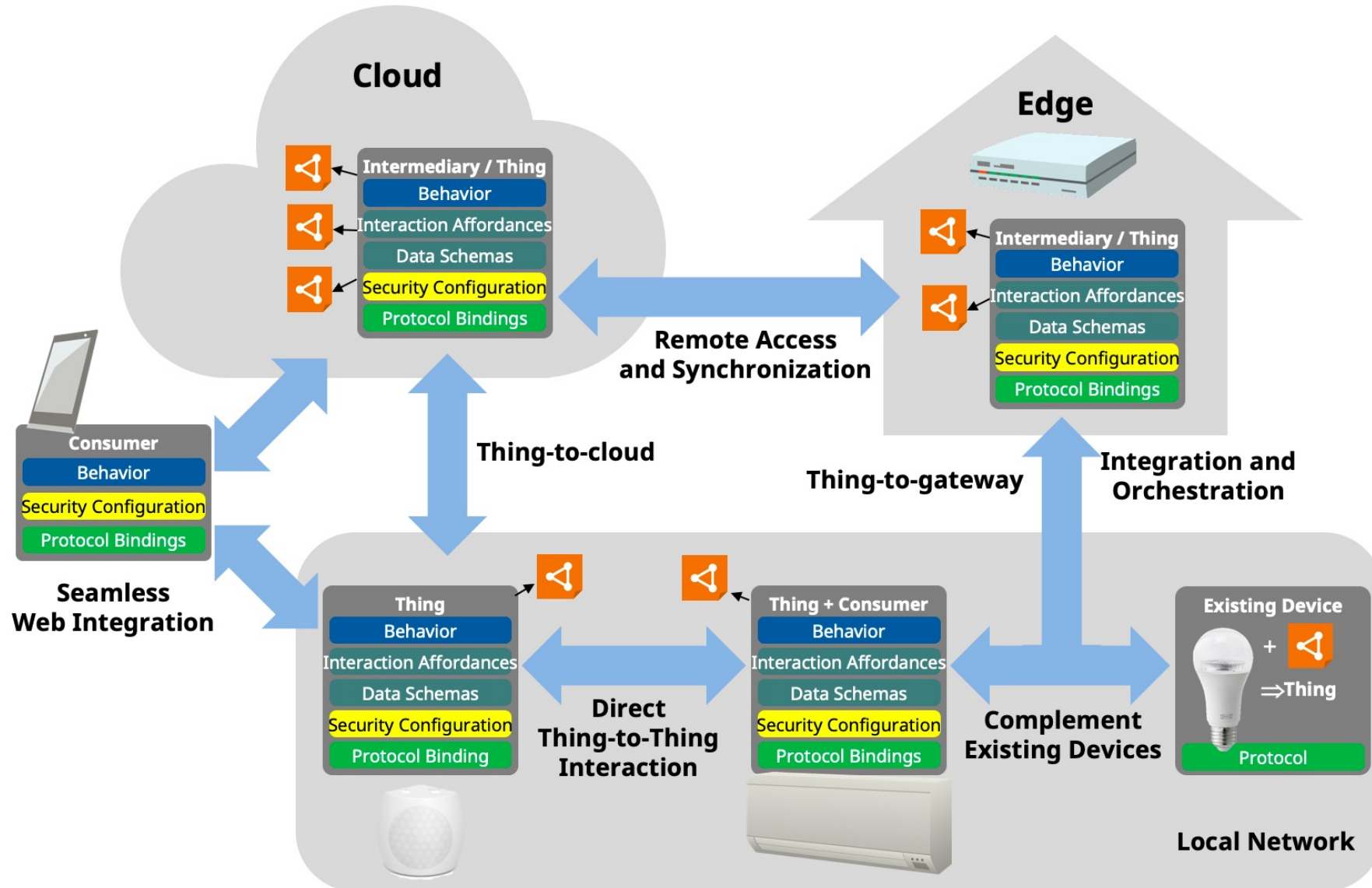
- Constraints
 - "Things" must have a TD
 - Must use URIs, IANA media types, etc.
- Thing Description Affordances
 - Describes WHAT the possible choices are
 - Describes HOW to interact with the Thing



WoT Thing Description (TD)

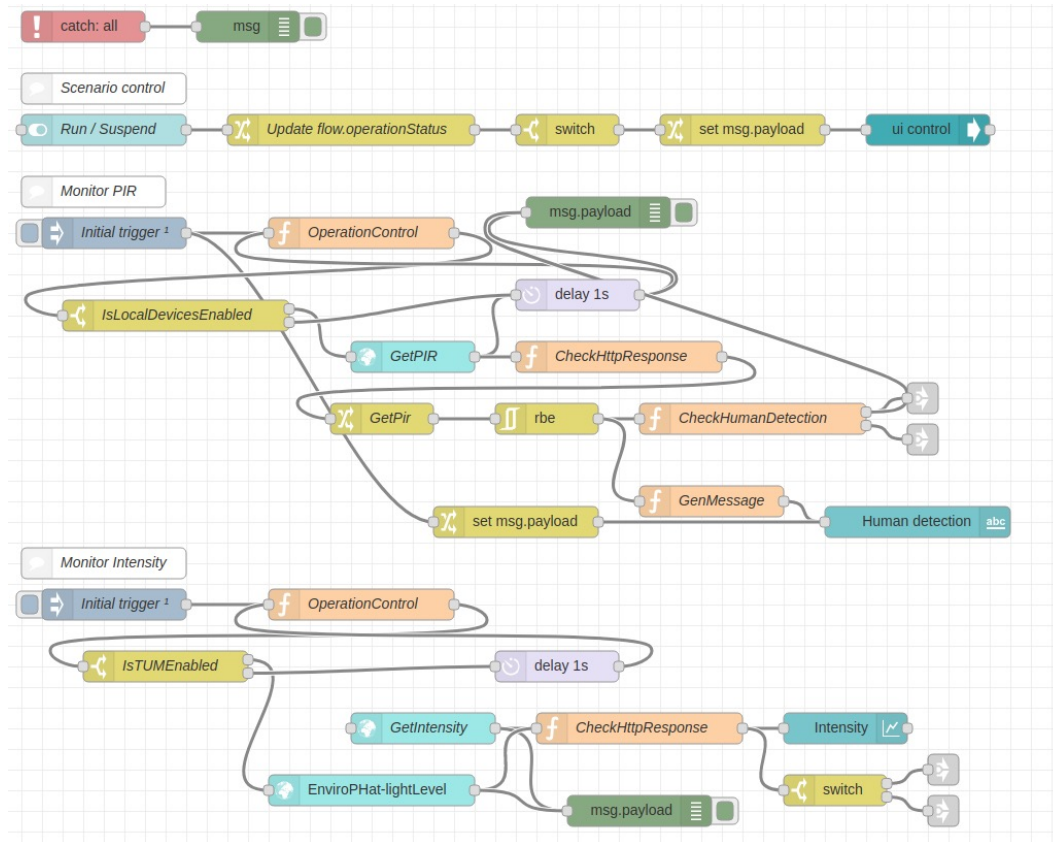
```
{
  "@context": [
    "https://www.w3.org/2019/wot/td/v1",
    { "iot": "http://iotschema.org/" }
  ],
  "id": "urn:dev:org:32473:1234567890",
  "title": "MyLEDThing",
  "description": "RGB LED torchiere",
  "@type": ["Thing", "iot:Light"],
  "securityDefinitions": [{"default": {
    "scheme": "bearer"
  }
}],
  "security": ["default"],
  "properties": {
    "brightness": {
      "@type": ["iot:Brightness"],
      "type": "integer",
      "minimum": 0,
      "maximum": 100,
      "forms": [ ... ]
    }
  },
  "actions": {
    "fadeIn": {
      ...
    }
  }
}
```

Usage Patterns Overview



Orchestration

Node-RED/node-gen



node-wot/Scripting API

```
WoTHelpers.fetch( "coap://localhost:5683/counter" ).then( async (td) => {  
  // using await for serial execution (note 'async' in then() of fetch())  
  try {
```

```
    let thing = await WoT.consume(td);  
    console.info( "=== TD ===" );  
    console.info(td);  
    console.info( "===== " );
```



```
    // read property #1
```

```
    let read1 = await thing.readProperty( "count" );  
    console.info( "count value is" , read1);
```

```
    // increment property #1 (without step)
```

```
    await thing.invokeAction( "increment" );  
    let inc1 = await thing.readProperty( "count" );  
    console.info( "count value after increment #1 is" , inc1);
```

```
    // increment property #2 (with step)
```

```
    await thing.invokeAction( "increment" , {'step' : 3});  
    let inc2 = await thing.readProperty( "count" );  
    console.info( "count value after increment #2 (with step 3) is" , inc2);
```

```
    // decrement property
```

```
    await thing.invokeAction( "decrement" );  
    let dec1 = await thing.readProperty( "count" );  
    console.info( "count value after decrement is" , dec1);
```

```
  } catch(err) {  
    console.error( "Script error:" , err);  
  }
```

```
}).catch( (err) => { console.error( "Fetch error:" , err); });
```

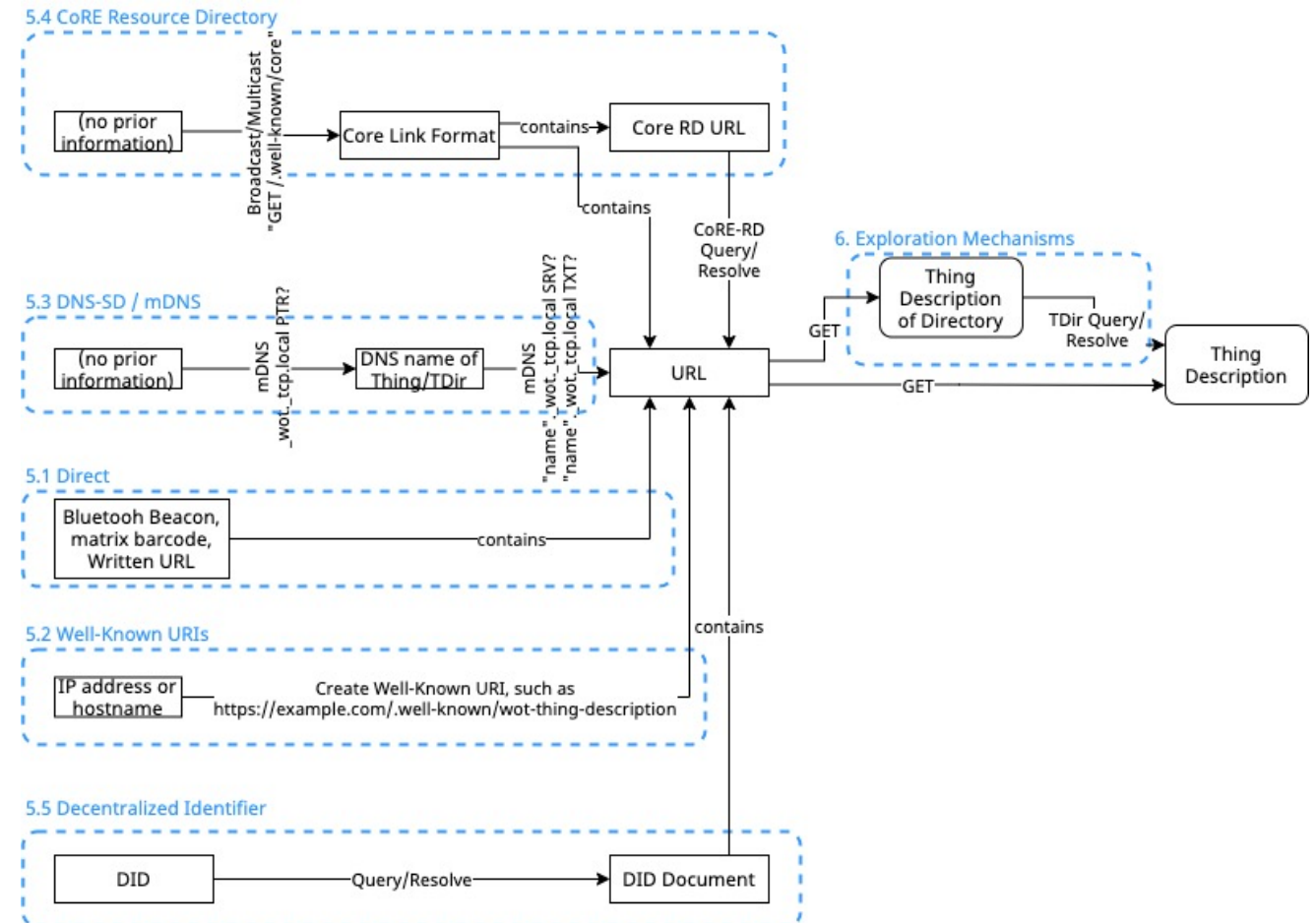
Discovery

Goal: Obtain TD of interest

- Not limited to local network
- Scalable to many TDs
- Need to preserve privacy
- Phased access:
 1. Introduction: open
 2. Exploration: controlled
- Searchable via JSON Path, XPath, or SPARQL
- Future work:
 - Find "nearby" Things using geospatial data

Phase 1: Introduction

Phase 2: Exploration



Deliverables

New/Updated Normative Documents:

- Architecture 1.1: <https://github.com/w3c/wot-architecture>
- Thing Description 1.1: <https://github.com/w3c/wot-thing-description>
- Discovery: <https://github.com/w3c/wot-discovery>
- Profiles: <https://github.com/w3c/wot-profile>

New/Updated Informative Documents:

- Binding Templates: <https://github.com/w3c/wot-binding-templates>
- Scripting API: <https://github.com/w3c/wot-scripting-api>
- Use Cases and Requirements: <https://github.com/w3c/wot-usecases>

Community Resources:

- Web Site: <https://www.w3.org/WoT/>

Recent Activity

- Plugfests
 - <https://github.com/w3c/wot-testing/tree/main/events>
- New Commercial Usages
 - Takenaka Construction – Smart Building Information Management systems
 - Netzo – IoT dashboards and device management
- Directory Implementations
 - WoT Hive, LogiLab (SPARQL based), Fraunhofer LinkSmart
- IETF Relationships: JSON Path, CoreRD, COSE/JOSE, ASDF
- Under Discussion:
 - Geospatial data, Embedded JSON Signatures
 - New Charters/New Deliverables

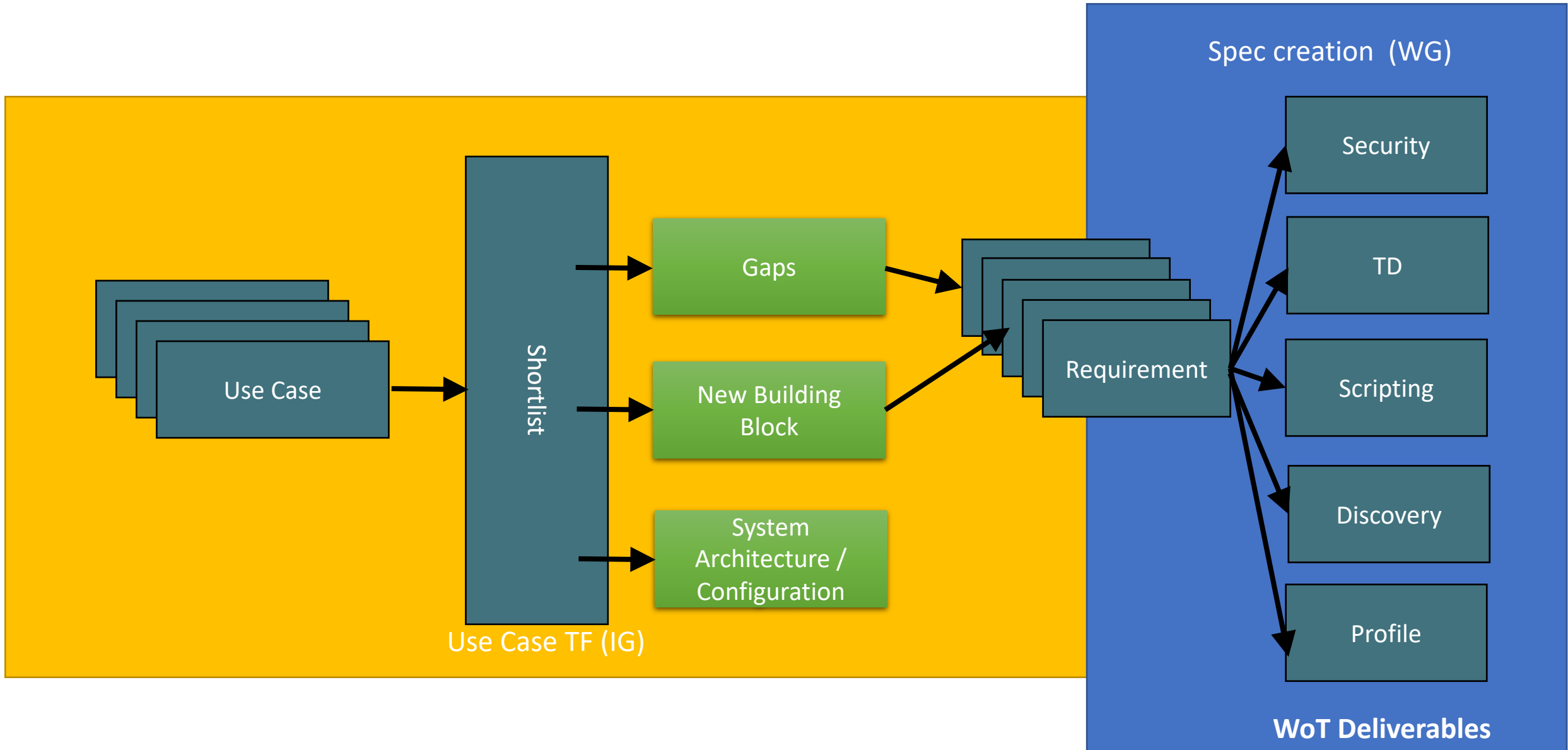
Use Cases and Requirements

Informative Deliverable: <https://github.com/w3c/wot-usecases>

Purpose and Process:

- Identify specific use cases
 - Identify application domains
 - Collect use cases from other W3C groups
 - Collect use cases from other stakeholders and SDOs
 - Identify usage patterns
 - For example, hubs, proxies, automation, etc.
 - Identify relevant technologies
 - For example, edge computing, digital twins, etc.
- Extract common requirements to drive current and future work

Use Cases / Requirements Process



WoT Use Cases Relevant to Smart Cities

- Smart City
 - Geolocation
 - Dashboard
 - Interactive Public Spaces
 - Meeting/Event Assistance
 - Smart Campus
 - Cultural Spaces
- Health
 - Public Health Monitoring
- Energy
 - Smart GRids
- Building Technologies
 - Smart Building
 - Connected Bldg Energy Efficiency
 - Automated Smart Bldg Management
 - Portable Bldg Applications
- Retail
 - All Stop Emergency Plunger
 - Door Sensor
 - Freezers and Refrigerators
 - Restrooms
 - Lighting
 - Canopies
 - Cameras

Recent Relevant Applications



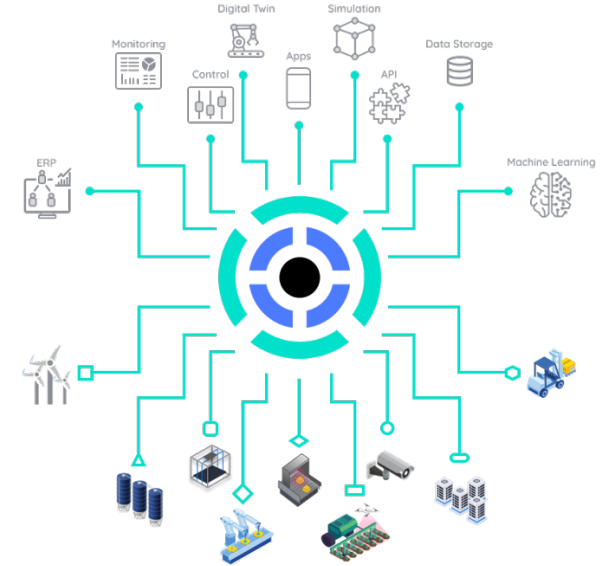
Takenaka Corporation

- EQ House, Tokyo 2019
- BIM applications



Siemens

- Desigo CC
- BIM system



Netzo

- IoT Data Hub
- Dashboards

Gaps and Discussion

- GIS Integration
 - Geospatial data and discovery
- Data Management
 - Digital Twins and shadows
 - Event notifications
 - Data management
- Security
 - Key provisioning and onboarding
 - Secure LAN access
 - Proxy services
 - Access control and ad-hoc sharing
 - MUDS
- Accessibility
 - Sensory modality mapping
 - Textual/descriptive interfaces
 - Service location
 - Mobility services
- Advanced Use Cases
 - Transportation
 - Logistics
 - Distributed energy management
 - AR visualization
 - Analytics integration e.g. for health and safety monitoring

Resources and Contacts

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

Dr. Michael McCool

Principal Engineer

Intel

Technology Pathfinding

michael.mccool@intel.com

Dr. Sebastian Kaebisch

Senior Key Expert

Siemens

Technology

sebastian.kaebisch@siemens.com