WoT Thing Directory
by LinkSmart
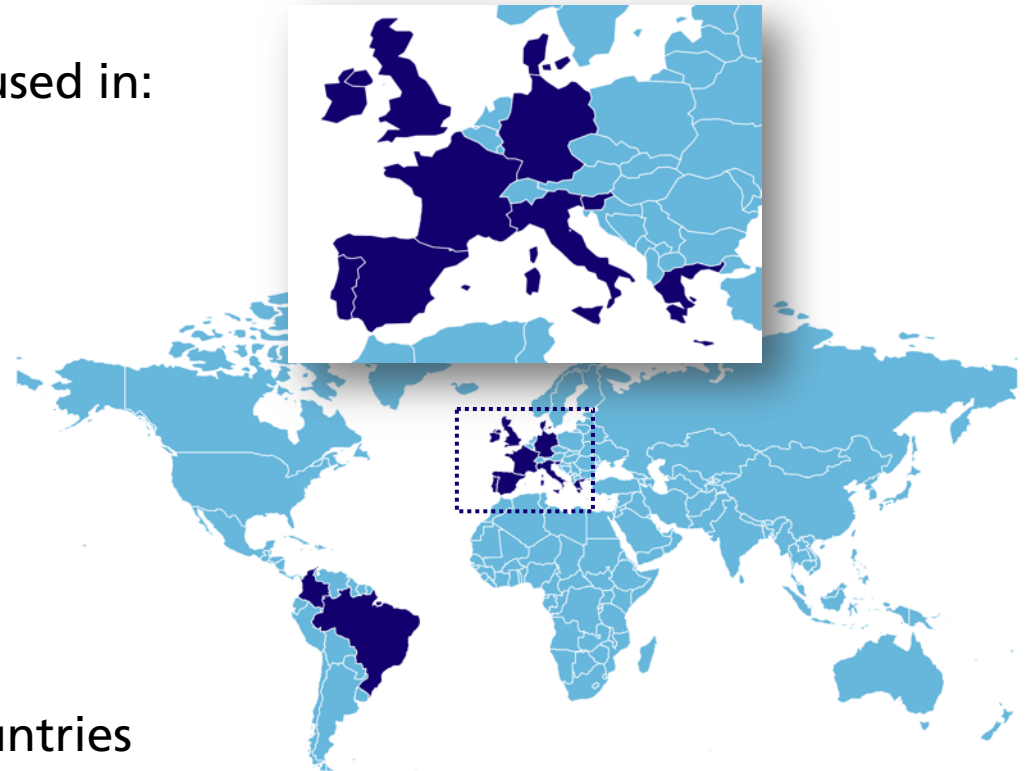
Farshid Tavakolizadeh

User-Centered Computing

15. April 2020

W3C Web of Things (WoT) Main Conference Call

LinkSmart

- Developed over the course of several research projects*

    - E.g. DIMMER, ALMANAC, Flex4Grid, COMPOSITION

- Open Source building blocks used in:

    - Connected Buildings

    - Industry 4.0

    - Smart Cities

    - Smart Grids

- Deployed in more than 10 countries

* https://linksmart.eu/

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LinkSmart Projects

- **Device Gateway:** Device abstraction

- **Data Processing Agent:** Live data processing and actuation

- **Historical Datastore:** Lightweight time-series SenML storage

- **Service Catalog:** Service discovery over HTTP and MQTT

- **Grafana OGC SensorThings Plugin:** Sensor data and location visualization

- **Border Gateway:** Uniform API security for HTTP, MQTT, WS

- **Apache NiFi OPC-UA Bundle:** OPC-UA controller and processor

- …

Figure from http://www.dlt.com/blog/2018/03/23/internet-demo-jam-brains-demo

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Our use-case for WoT

- BIMERR H2020 Project*

  - Tools for renovation of buildings for energy efficiency

- Deployment of sensors in households for resident profiling

- Discovery of resource endpoints

  1. Current sensor measurements (gateway/broker endpoint)
  2. Historical sensor/aggregated data (edge/cloud storage nodes)
  3. Meta information related to each sensor

* https://bimerr.eu/

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Thing Description for the virtual thing

```json
{
    "@context":"https://www.w3.org/2019/wot/td/v1",
    "created":"2020-04-07T14:14:01.403935979Z",
    "id":"urn:uuid:c13929a9-3474-4488-971f-06ecb5695333",
    "meta":{
        "nodered":{
            "transformation":"raw_to_senml"
        },
        "senml_name":"c5/room2/device2",
        "zway_name":"ZWayVDev_zway_3-0-49-4"
    },
    "modified":"2020-04-07T14:14:01.403935979Z",
    "properties":{
        "current":{
            "forms":[
                {
                    "op":[
                        "readproperty"
                    ],
                    "href":"https://example.gateway.com/status",
                    "contentType":"application/senml+json",
                    "security":["basic_sc"]
                }
            ],
            "type":"number"
        },
        "history":{
            "forms":[
                {
                    "href":"https://example.storage-service.com/data/c5/room2/device2",
                    "contentType":"application/senml+json",
                    "security":["basic_sc"]
                }
            ],
            "type":"number"
        }
    },
    "security":["basic_sc"],
    "securityDefinitions":{
        "basic_sc":{
            "in":"header",
            "scheme":"basic"
        }
    },
    "title":"Fibaro Wall Plug"
}
```
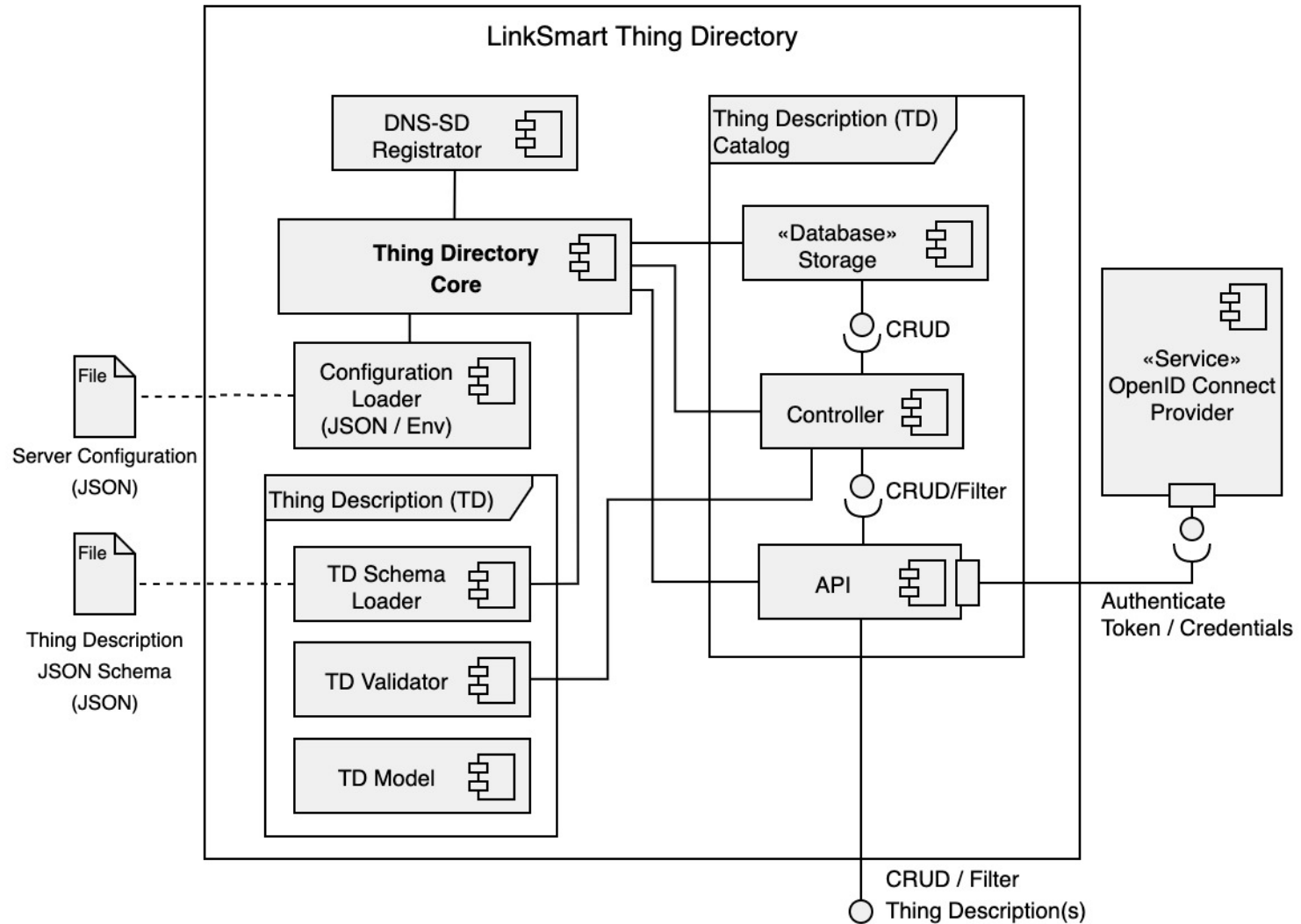
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LinkSmart Thing Directory

- **A fork of LinkSmart Resource Catalog**

  - A proprietary registry of devices/resources

- **Written in Go language**

- **Apache 2.0 License**

- **CI Platform**

  - TravisCI: will migrate to Github Actions

- **Distributions**

  - Binaries: linux/amd64, linux/arm64, linux/arm, darwin/amd64, windows/amd64

  - Docker Images: linux/amd64

- **Documentation**

  - Github wiki (TBC), OpenAPI Specs

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Architecture

Design Decisions

- **Configurable schema**

    - TD JSON Schema* loaded as a configuration file

    - Used for validation of Thing Descriptions

- **Thing Description model and validation available as a library**

- **System generated values for *created* and *modified* attributes**

- **Added optional *time to live (TTL)* attribute to specify validity period and automatically remove TDs**

- **Catalog of Thing Descriptions (next slides)**

* https://www.w3.org/TR/wot-thing-description/#json-schema-for-validation

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Thing Directory: TD Catalog

- **Create a new Thing Description**

`POST /td`

System generated id, created time, modified time

- **Create a new TD with the given ID, or update an existing one**

`PUT /td/{id}`

System generated modified time

- **Retrieve a Thing Description**

`GET /td/{id}`

- **Remove a Thing Description**

`DELETE /td/{id}`

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Thing Directory: TD Catalog

■ Paginated list of Thing Descriptions

```
GET /td
{
  "@context": "TBA"
  "items": [
    { thing description },
    ...
  ],
  "page": 1,
  "perPage": 100,
  "total": 10
}
```

```
GET /td?page=1&perPage=3
{
  "@context": "TBA"
  "items": [
    { thing description },
    { thing description },
    { thing description }
  ],
  "page": 1,
  "perPage": 3,
  "total": 10
}
```

Thing Directory: TD Catalog

■ Search/Fetch with JSON Path*

```
GET /td?fetch=$..href
-> hrefs of all TDs:
{
  "@context": "TBA"
  "items": [
    "https://example.storage-service.com/data/urn:example:1234"
    ...
  ],
  "page": 1,
  "perPage": 100,
  "total": 10
}

GET /td?fetch=$[?(@.title=='Fibaro Wall Plug')].properties
-> Properties of TDs with title Fibaro Wall Plug

GET /td?fetch=$[?(@.title=~/.*Wall Plug/)]
-> TDs with title ending with Wall Plug
```

* https://goessner.net/articles/JsonPath/

https://github.com/oliveagle/jsonpath#example-json-path-syntax

Next Steps

- **Complete Development**

  - Unit Tests

  - Documentation

  - Context extensions for

    - TTL

    - Catalog terminology: items, page, perPage, total

- **Release stable version (est. May 2020)**

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Thank you for listening

LinkSmart Thing Directory

https://github.com/linksmart/thing-directory

LinkSmart

https://linksmart.eu/

https://github.com/linksmart

Fraunhofer FIT

https://www.fit.fraunhofer.de/en.html

Contact: Farshid Tavakolizadeh <firstname.lastname@fit.fraunhofer.de>

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