WoT-AD: A Descriptive Language for Group of Things in Massive IoT

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Outline

- Motivation and Problem Statements
- Descriptive Language for Group of Things
  - WoT-AD
  - WoT framework
- Proof of Concept.
- Conclusion and Future Work
Motivation: The explosion of Things and IoT

- **A huge number of Things:** 23.14 Billion Things by 2018.
- **IoT is considered as a current revolution of the Internet that positively affects several real-life aspects**
  - Transportation systems, automation, manufacturing, logistics, etc.

Source: iot-analytics.com
**Motivation: Things Description Limitations**

- **Web of Things = Internet of Things + Web technologies**
- **A logical interface represents IoT Things**
- **The existing proposals** [Khaled. 2018][Datta. 2016][Kaebisch. 2016]
  - Target to describe a single Things
  - No solution to describe the Group of Things (Asset)

**A descriptive language and WoT framework for Group of Things (WoT-AD)**
WoT-AD: WoT Asset Description

- **WoT-AD architecture**
  - Descriptive metadata
  - Interaction
  - Entities

- **User-cases**
  - Smart building
  - Weather station
WoT-AD: WoT Asset Description

- **WoT-AD architecture**
  - Descriptive metadata
  - Interaction
  - Entities

- **User-cases**
  - Smart building
  - Weather station
"interaction": {
"properties": {
"temperature": {
"@id": "meeting-room-temp",
"description": "The temperature of all meeting room",
"type": "int",
"input": "avg(device_1.temp + device_2.temp)"

"forms": [

{"href": "https://buiding.example.com/floor1/temperature",
"method": "GET"
]
]
},
"events": {
"overheating": {
"@id": "overheating_meetingRoom",
"description": "Room reaches a high temperature",
"condition": "self.meeting-room-temp > 30",
"action": "self.air_conditioner_on"
}
],
"actions": {
"toggle": {
"@id": "air_conditioner_on",
"description": "Turn on the conditioner",
"trigger": "self.overheating_meetingRoom",
"output": "device_3.actuator_1",
"forms": [

{"href": "https://buiding.example.com/floor1/air_conditioner_on",
"method": "PATCH",
"mediaType": "application/json"
]
}
]
},
}
WoT Framework for WoT-AD: Architecture View

- **Framework architecture**
  - Connection layer handles the device connection
  - Processing layer updates the Asses resources
  - Presentation layer assists end-users

A WoT framework architecture
WoT Framework for WoT-AD: Operation View

- Updating Asset resources via Virtual Sensor Framework
- Controlling the Things via Regular Model
**Proof of Concept**

- **Deployment scenario**
  - Installed in a Raspberry Pi model B as a smart gateway
  - 10 IoT devices with multiple sensors connecting the gateway

- **Framework performance**
  - CPU load 20-30%
  - Local database for storing Asset consumes 100MB/32GB
Conclusion

- A semantic description for the Asset and a WoT framework enabling semantic interoperability

- The effectiveness of the designed solution is ensured by choosing and combining some technologies and IoT frameworks that have been practically demonstrated in real use-cases
Thank you for your attention!
Question?