Developing IoT Solutions with OpenDayLight

The role of the middleware

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“Interoperability among IoT systems is required to capture 40 percent of the potential value”

McKinsey, June 2015: The Internet of things: mapping the value beyond the hype
Body Cameras Quick Facts

In the US, funding for 50,000 cameras, list price ~ $400

5 years archives

Largest deployment to date: Oakland
600 cameras

The market is in full expansion
Solution Overview
Not All Cameras are Created Equal…

- Buffer with or without sound?
- Camera with or without a monitor on it?
- Officers view the videos before writing the incident reports?
- Should there always be a blinking red light?
- Cameras' screens turned outward?
- Profound effect on how the cameras are used and who benefits from them
Solution Overview (revisited)
Enters the IoT Middleware

- Devices
- Standard APIs
- Protocol Plugins
- Standard and Published APIs
- IoT Apps
- CRM
- ERP

Data Repository

Create, Retrieve, Update, Delete, Notify
IoTDM at the Linux Foundation

- Project started in December 2014
- Goal:
  - open source IoT Middleware over OpenDaylight
  - Based on oneM2M
  - Basic set of resources supported
- Delivery: June 2015, Lithium release
- https://wiki.opendaylight.org/view/IoTDM:Main
IoTDM Platform Overview

Analytics

3rd Party Integration (Salesforce, azure etc)

Data Lake

Dashboards

GUI
Device Provisioning Account Mgt

Export Services
Core omeM2M
Other Middlewares

Plugins Infra

Client Binding
Devices
Physical World

Security

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A Few Words About Plugins…

• Most difficult thing to do

• Goal: make it as painless as possible to bring in devices

• Several Options in increasing order of difficulty
  • oneM2M Devices & systems (we have clients)
  • Devices & systems supporting RestFull APIs and JSON/XML payloads (many)
  • Devices & systems using complex protocols
  • Proprietary systems
Our Approach

• #1 problem in IoT: get the data off the things and into a format everybody understands

• For the IoT ecosystem, doing so with IoTDM means:
  1. Convert your data into a standard format (240 member companies)
  2. Write your plugins in an open source context
  3. As a result: device manufacturers open their data not just to a specific platform but to the world

• OpenSource + Open Standard
oneM2M Background

• The purpose of oneM2M is to develop technical specifications of a common embedded IoT Middleware
• Enables interoperability amongst the myriad of devices with M2M application servers
• Partnership project founded by 7 SDOs to minimize standards fragmentation
  • USA: TIA, ATIS
  • Japan: ARIB, TTC
  • China: CCSA
  • Europe: ETSI
  • Korea: TTA
• Focus on M2M common services applicable to any sectors (Energy, Home, Transportation etc.)

1st Interop Sept 2015, 23 companies participated
RESTful Architecture

- All IoT entities are represented in a tree as “Resources”:
  - Applications, Devices, Data, Groups, Access Rights, Billing Policies, etc.
- Attributes of resources describe how the system manages the resources (time to live, max byte size etc)
- The tree representation is standardized, not its implementation (could be XML, YANG, Hadoop etc…)
- By understanding a common tree structure, IoT components can interoperate
- Resources are manipulated using CRUD verbs
Tree design

- Designing the tree is part of the IoT Integrator’s task
- Plugin needs to know where to write the payload in the resource tree
Device Operations

Note: payload may come from a device or a gateway or a system

Src IEEE 1451
Plugin Operations

Core oneM2M Verifications (ACP, Format…)

Push/Pull
Content Parsing and device ID
Network Binding

Plugin Infra

JSON/XML

CoAP/HTTP/MQTT

L2/L3

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"type":"json",
"location":"10050133629250530163",
"projectID":"13",
"id":"10050133629250530163",
"state":"1",
"deviceName":"10G",
"deviceState":"10G",
"latitude":25.253063252493022,
"longitude":155.37687562017262,
"timestamp":"2013-10-29T14:01:01.031Z",
"variance":1.253063252493022,
"variance":10.0
Export Operations, many options

- Analytics
- 3rd Party Integration (Salesforce, azure etc)
- oneM2M Apps
- Data Export
- Dashboards

TSDR | 3rd party | oneM2M | Kafka | DSLink

Export Services

TSDR Data Model

TSDR Persistence Service

Cassandra
Hbase
H2

Plugins Infra

Core oneM2M

Kafka

DSLink
2016, the Year of Interworking

- LWM2M Interworking Underway (TCS)…
- ETRI volunteered to do OIC
Conclusion

• Middleware standards are maturing (far from over)
• Interoperability is a major stumbling block
• A solution is to adopt industry standard middleware(s)
• A practical way forward is plugin development in open-source context
Thank you.