Premiers pas avec OM2M et le standard oneM2M

Application aux Smart Buildings

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Use case: Smart Building

- Production of energy
- Consumption of energy
- Observation counting actions
- Electricity network
- WAN
- Production of energy
- Data center
- New services
Common architecture

- User display
- Data management
- Supervision
- Cloud
- Gateway
- WAN
- Sensors networks

Protocols:
- HTTP
- ZIGBEE
- Mqtt
- GLoWPAN
- KNX
Market Fragmentation

Fragmented Silo Approach
IoT SDOs and Alliances Landscape (Vertical and Horizontal Domains)

Home/Building
Manufacturing/Industry Automation
Vehicular/Transportation
Healthcare
Energy
Cities
Wearables
Farming/Agrifood

Horizontal/Telecommunication

Source: AIOTI WG3 (IoT Standardisation) – Release 1.2
oneM2M

Worldwide Horizontal IoT Standard
oneM2M: The Partnership Project

Over 200 member organizations in oneM2M

From oneM2M Service Layer Platform – Initial Release: Omar Elloumi / Nicolas Damour
oneM2M: Architecture

**Application Layer**
- Composed of Application Entities (AE)
- **AE**: Entity using services of CSEs
- Operational Logic

**Common Services Layer**
- Composed of Common Services Entities (CSE)
- **CSE**: provides a set of services through standard interfaces

**Network Service Layer**
- Composed of Network Service Entities (NSE)
- **NSE**: insures the communication between devices & underlying networks
Standardized Architecture of OneM2M

Reference Point
One or more interfaces – Mca, Mcn, Mcc and Mcc’ (between 2 service providers)

Common Services Entity
Provides the set of "Service Functions" that are common to the M2M environments

Application Entity
Provides application logic for the end-to-end M2M solutions

Network Services Entity
Provides network services to the CSEs besides the pure data transport

Node
Logical equivalent of a physical (or possibly virtualized) device

Application Layer
CSE

Service Layer
AE

Network Layer
NSE

Application Service Node

Middle Node

Infrastructure Node

From oneM2M Service Layer Platform – Initial Release: Omar Elloumi/Nicolas Damour
Standardized OneM2M Service

MN-AE

- SUB
- REG
- RF
- DMR
- GMG
- LOC
- CMDH
- SEC

Other MN Node

IN-AE

- Subs & Notification (SUB)
- Routing Function (RF)
- Security (SEC)
- Data Mgmt & Repository (DMR)
- Group Management (GMG)
- Application & Service Layer Mgmt (ASM)
- Communication Mgmt & Delivery Handling (CMDH)
- Location (LOC)

IN-CSE

Other IN Node

ADN-AE

- ASN

IN Node

Non oneM2M Nodes
REST Architecture Concepts

REST (representational state transfer)

› **Resource** oriented
  - Stored on a server

› **Access using an** URI
  - http://www.example.com/wiki/rest
  - http://www.example.com/software/releases/latest.tar.gz

› **Representation** of resources
  - Used in exchange with client/user
  - Can be any representation format: XML, JSON, BSON, ...

› **Link** to other resources
  - Dependencies, hierarchy is represented by link in resource representation
REST Architecture Properties

› **Addressability**
  - Each resource has unique URI

› **Statelessness**
  - Each request contains all application states necessary to handle that request

› **Connectedness**
  - Resources are linked between each others
  - You can put the service in different states just by following links

› **Uniform interface:** based on HTTP operations
  - Retrieve a resource: HTTP `GET`
  - Create new resource: HTTP `POST`
  - Update a resource: HTTP `PUT`
  - Delete a resource: HTTP `DELETE`
Standardized OM2M resource

Smart Meter (ADN) → Gateway (MN-CSE) → Server/Cloud (IN-CSE) → End user (DA)
OM2M resource tree example

- **CSE**
- **APPLICATION ENTITY**
- **CONTAINER**
- **CONTENT INSTANCE**
- **REMOTE-CSE**
- **SUBSCRIPTION**

**MN-CSE-HOME**
- Gateway (MN-CSE)

**IN-CSE-SERVER**
- Server/Cloud (IN-CSE)
OM2M resource tree example

Gateway (MN-CSE)

REMOTE-IN-SERVER

MN-CSE-HOME

REGISTRATION

REMOTE-MN-HOME

IN-CSE-SERVER

Server/Cloud (IN-CSE)
OM2M resource tree example

SMART METER (ADN)

Device registering

- MN-CSE-HOME
- AE-SMART-METER
  - CNT-DESCRIPTOR
  - CNT-DESCRIPTION_1
  - CNT-DATA
- REMOTE-IN-SERVER

Gateway (MN-CSE)

- IN-CSE-SERVER
  - REMOTE-MN-HOME

Server/Cloud (IN-CSE)
OM2M resource tree example

MN-CSE-HOME
  \|-- AE-SMART-METER
     \|-- CNT-_DESCRIPTOR
        \|-- CIN-DESCRIPTION_1
        \|-- CNT-DATA
           \|-- CIN-MEASUREMENT_1
               \|-- REMOTE-IN-SERVER

REMOTE-MN-HOME
  \|-- REMOTE-IN-SERVER

IN-CSE-SERVER
  \|-- Server/Cloud (IN-CSE)

Smart Meter (ADN)
OM2M resource tree example

MN-CSE-HOME
  AE-SMART-METER
    CNT-DESCRIPTR
      CIN-DESCRIPTION_1
    CNT-DATA
      CIN-MEASUREMENT_1
  REMOTE-IN-SERVER

Gateway (MN-CSE)

IN-CSE-SERVER
  REMOTE-MN-HOME
    AE-USER

Server/Cloud (IN-CSE)

User registration

End user (DA)

Smart Meter (ADN)
OM2M resource tree example

- **CSE**
- **APPLICATION ENTITY**
- **CONTAINER**
- **CONTENT INSTANCE**
- **REMOTE-CSE**
- **SUBSCRIPTION**

**MN-CSE-HOME**
- **AE-SMART-METER**
  - **CNT-_DESCRIPTOR**
    - **CIN-DESCRIPTION_1**
  - **CNT-DATA**
  - **CIN-MEASUREMENT_1**
- **REMOTE-IN-SERVER**

**IN-CSE-SERVER**
- **REMOTE-MN-HOME**
  - **AE-USER**

**Gateway (MN-CSE)**

**Subscription**

**Server/Cloud (IN-CSE)**

End user (DA)

Smart Meter (ADN)
OM2M resource tree example

Gateway (MN-CSE)

MN-CSE-HOME
- AE-SMART-METER
  - CNT-DESCRIPTOR
    - CIN-DESCRIPTION_1
  - CNT-DATA
    - USER-SUBSCRIPTION
    - CIN-MEASUREMENT_1
- REMOTE-IN-SERVER

IN-CSE-SERVER
- REMOTE-MN-HOME
  - AE-USER
- Redirect
- Subscription

End user (DA)

Server/Cloud (IN-CSE)

Smart Meter (ADN)
OM2M resource tree example

- MN-CSE-HOME
  - AE-SMART-METER
    - CNT-DESCRIPTOR
      - CIN-DESCRIPTION_1
    - CNT-DATA
      - USER-SUBSCRIPTION
      - CIN-MEASUREMENT_2
      - CIN-MEASUREMENT_1
  - REMOTE-IN-SERVER

- IN-CSE-SERVER
  - REMOTE-MN-HOME
    - AE-USER

- Gateway (MN-CSE)

- Smart Meter (ADN)

- End user (DA)

New value
OM2M resource tree example

MN-CSE-HOME
- AE-SMART-METER
  - CNT-DESCRIPTOR
    - CIN-DESCRIPTION_1
  - CNT-DATA
    - USER-SUBSCRIPTION
      - CIN-MEASUREMENT_2
      - CIN-MEASUREMENT_1
- REMOTE-IN-SERVER

IN-CSE-SERVER
- REMOTE-MN-HOME
  - AE-USER

Gateway (MN-CSE)

Server/Cloud (IN-CSE)

End user (DA)

New value

Smart Meter (ADN)
OM2M resource tree example

- MN-CSE-HOME
  - AE-SMART-METER
    - CNT-DESCRIPTOR
      - CIN-DESCRIPTION_1
    - CNT-DATA
      - USER-SUBSCRIPTION
      - CIN-MEASUREMENT_2
      - CIN-MEASUREMENT_1
    - REMOTE-IN-SERVER
  - Gateway (MN-CSE)

- IN-CSE-SERVER
  - REMOTE-MN-HOME
    - AE-USER

- Smart Meter (ADN)
- End user (DA)

New value

Redirect

Trigger

Redirect
OM2M resource tree example

- **MN-CSE-HOME**
  - **AE-SMART-METER**
    - **CNT-DESCRIPTOR**
      - **CIN-DESCRIPTION_1**
    - **CNT-DATA**
      - **USER-SUBSCRIPTION**
      - **CIN-MEASUREMENT_2**
      - **CIN-MEASUREMENT_1**
  - **REMOTE-IN-SERVER**

- **IN-CSE-SERVER**
  - **REMOTE-MN-HOME**
    - **AE-USER**

- **Smart Meter (ADN)**
- **Gateway (MN-CSE)**
- **Server/Cloud (IN-CSE)**
- **End user (DA)**
Eclipse OM2M
Open Source Implementation of oneM2M
OM2M: Open platform for IoT eclipse.org/om2m

› Standard benefits:
  - Compliant to SmartM2M Standard (April 2014) and with OneM2M Standard (November 2015)
  - Horizontal service platform for IoT interoperability
  - Restful API with a generic set of service capabilities
  - Allow developing services independently of the underlying network
  - Facilitate deployment of vertical applications
  - Main features:
    Machine registration, application deployment, container management, resource discovery, access right authorization, subscription / notification, group management and non-blocking requests.

› But also:
  - OSGi-based architecture extensible via plugins
  - Eclipse foundation project
  - OM2M is an open source project
  - Member of Eclipse IoT Working Group
OM2M Building Blocks

- Java platform running on top of an OSGi runtime
  - Highly extensible via plugins
  - Flexible OSGi container: Equinox, Knopflerfish, or others.
  - Flexible database based on EclipseLink
- Build with Maven and Tycho for fast plugin development
Web Resources

› Main page
  ➔ http://eclipse.org/om2m

› New wiki pages for OM2M
  ➔ https://wiki.eclipse.org/OM2M/one

› Git repository
  ➔ https://git.eclipse.org/r/om2m/org.eclipse.om2m

› oneM2M Specification
  ➔ http://onem2m.org
OM2M: Web Resources

› Tutorials
  – Clone & Build
  – Config & Start
  – Starting
  – Web Interface
  – REST API
  – Add your plugin
  – Interworking Proxy Entity
Demo

ADREAM & mockup
The ADREAM building

- Small scale OM2M deployment
- Heterogeneous technologies
- Various applications
Demo deployment

WiFi: OM2M
http://192.168.0.2:8080/webpage
Standardized format: oBIX representation

- Representation of device description
  - Meta information
    - Location
    - Type
    - Unit
  - Available operations
    - Retrieve the state directly
    - Switch on a lamp
    - Switch off a fan
    - ...

- Representation of a data instance
  - Will specify a value
  - Local meta information
    - Timestamp
    - Unit
    - ...

```xml
<obj>
  <str name="appId" val="switch"/>
  <str name="location" val="home"/>
  <op name="setOn" href="APP_SWITCH_0?op=true"/>
  <op name="setOff" href="APP_SWITCH_0?op=false"/>
  <op name="toggle" href="APP_SWITCH_0?op=toggle"/>
</obj>

<obj href="http://myhome/lux">
  <real name="light" unit="obix:units/lux" val="300.4"/>
</obj>
```
Thank you

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Eclipse OM2M
http://eclipse.org/om2m

oneM2M
http://onem2m.org