OM2M
Horizontal platform for the IoT

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OM2M: Open platform for IoT

- Compliant to SmartM2M ETSI Standard (April 2014) & now with OneM2M Standard (November 2015)
- Horizontal service platform for IoT interoperability
- Restful API with a generic set of service capabilities
- OSGi-based architecture extensible via plugins
- 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.
- OM2M is an open source project
- Eclipse foundation project
- Member of Eclipse IoT Working Group.
OM2M: Horizontal IoT Service Platform

• **Flexible and extensible architecture**
  - Deployed and experimented in both: **LAAS ADREAM smart building** and **building mockup**.
  - **Commercial use** of OM2M by partners (Italtel, eDevice, ObjectSecurity)

• **Increasing user and developer community**
  - **SmartM2M & oneM2M showcases**
  - Used in **European** (ITEA2-A2NETS demonstrator) and **national** (S2C2, STM) **research projects**
  - **Summer schools**: Toulouse, Taipei, Hammamet, etc.
  - **Users around the world**: Japan, Taiwan, Korea, France, India, Italy, Tunisia, Canada, etc.

• **Already extended by several organizations in different domains**
  - e-health, device management, security, transportation systems, etc.
  - **High-level abstraction** for easy IoT application development
Short history of OM2M

› 2013: OM2M initial contribution
› April 2015: OM2M release v0.8
  - Key features:
    › Persistence policy
    › SmartM2M standard implementation
    › HTTP/CoAP binding
    › Performance improvement
    › Code enhancement
› December 2015: oneM2M compliance
  - oneM2M compliant code available on Eclipse repositories
  - Key features:
    › Architecture: add more modularity, OSGi framework mobility
    › Persistence flexibility: SQL/NoSQL databases
    › oneM2M Showcase in December at Nice (France)
› Official release v1.0: beginning of 2016
Website stats

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Contributors and commiters

› New direct **commiters**
  – Guillaume Garzone (Phd. Student, Engineer, LAAS-CNRS)
  – François Aïssaoui (Phd. Student, Engineer, LAAS-CNRS)
  ➔ **Publication** of v0.8 *(smartM2M)*
    **Design & Implementation** of v1.0 *(oneM2M)*

› **Contributions**
  – **Orange & SierraWireless**
    › Contribution with OSGi expertise *(Knoplerfish)*
    › Base drivers for IoT technologies and corresponding IPE
    › Interworking Proxy Entities
    › Device Management expertise *(LWM2M)*
Excerpt of OM2M contributors, users and interested parties

- e-device
- ITALTEL
- eCAD
- SPAN
- LIRIS
- Western
- ERICSSON
- orange
- CEA
- VTT
- Safran
- National Chiao Tung University
- SAP
- HANA
- UPEC
- LISSI
- Telecom Bretagne
- Politecnico di Torino
- HANA
Roadmap

› Eclipse
  – Code enhancement and optimisation (v1.0)
  – New communication protocols (CoAP)
  – Integration of new standard features
    › oneM2M rel. 1.6
    › oneM2M rel. 2.0
  – Bug fix (v0.8 & v1.0)
    › Contribute on our Bugzilla!

› Research & contributions
  – Semantic aspects
    › Research theme in our laboratory
    › Implementation of oneM2M semantic mechanisms
  – Autonomic computing
OM2M: Horizontal IoT Service Platform

- Horizontal Internet of Things service platform

- Based on:
  - Smart M2M standard ➔ OM2M Version 0.8
  - the global oneM2M standard ➔ OM2M version 1.0

- Seamless interaction between applications and devices.
- Effective interoperability in terms of communication and data.
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: SQL or NoSQL.

- Build with Maven and Tycho for fast plugin development
143 organizations around the world are involved in M2M standardization according to the Global Standards Collaboration M2M Task Force.
Over 200 member organizations in oneM2M
oneM2M: Organization & Structure

Finance, Marketing, ...

Work program management

Working groups

Steering committee

Technical plenary

REQ
ARC
PRO
SEC
MAS
TST

Use cases
Requirements
Architecture
Protocols
Security
Management
Abstraction &
Semantics
Testing
OneM2M Architecture

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 services to the CSEs besides the pure data transport

Node
Logical equivalent of a physical (or possibly virtualized, especially on the server side)
OM2M high level architecture

IN-Node

IN-AE

IN-CSE

Subscription and Notification (SUB)

Registration (REG)

Security (SEC)

Routing Function (RF)

Data Mgmt and Repository (DMR)

Group Management (GMG)

Application and Service Layer Mgmt (ASM)

Location (LOC)

Communication Mgmt & Delivery Handling (CMDH)

Other IN Node

IN Node
OM2M high level architecture

MN Node

MN-AE

SUB
REG
SEC
RF
DMR
GMG
MN-CSE
ASM
CMDH
LOC

IN Node

IN-AE

IN-CSE

Registration (REG)
Security (SEC)
Routing Function (RF)

Subscription and Notification (SUB)
Data Mgmt and Repository (DMR)
Application and Service Layer Mgmt (ASM)
Location (LOC)
Group Management (GMG)
Communication Mgmt & Delivery Handling (CMDH)
OM2M high level architecture

MN-AE

MN-CSE
- REG
- ASM
- LOC
- CMDH
- GMG
- DMR
- SEC
- RF
- SUB

IN-AE

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

ASN-AE

ASN-CSE
- REG
- ASM
- LOC
- CMDH
- GMG
- DMR
- SEC
- RF
- SUB
OM2M high level architecture

- **MN-AE**
  - **REG**
  - **ASM**
  - **LOC**
  - **CMDH**

- **IN-CSE**
  - **Registration (REG)**
  - **Application and Service Layer Mgmt (ASM)**
  - **Location (LOC)**
  - **Group Management (GMG)**
  - **Communication Mgmt & Delivery Handling (CMDH)**

- **IN-AE**
  - **Subscription and Notification (SUB)**
  - **Security (SEC)**
  - **Data Mgmt and Repository (DMR)**

- **ASN-AE**
  - **SUB**
  - **REG**
  - **ASM**
  - **LOC**
  - **CMDH**

- **ADN-AE**
  - **SUB**
  - **REG**
  - **ASM**
  - **LOC**
  - **CMDH**

- **Other MN Node**
- **Other IN Node**
Common Service Functions

- Registration
- Discovery
- Security
- Group Management
- Data Management & Repository
- Subscription & Notification
- Device Management
- Application & Service Management
- Communication Management
- Network Service Exposure
- Location
- Service Charging & Accounting
oneM2M Resources

› **CSE base**
  - Represents the CSE executed on the node

› **Application Entity (AE)**
  - Represents the remote or local application
  - Contains practical information for notification, etc...

› **Container**
  - Structures the data

› **Content instance**
  - Instance of data
  - Stored under a Container

› **Remote CSE**
  - Represents a distant CSE
  - Created when a CSE is registered to the local one
  - Stores data relative to the distant CSE *(point of access, etc.)*

› **Subscription**
  - Contains key information linking to the corresponding AE
  - Allows the framework to send notifications to the concerned entity

› **Access control handling**
  - Different resources allow access control handling
    › Access Control Policy
    › Access Control Rule
    › ...

20 oneM2M Resources
OM2M resource tree example

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

- MN-CSE-HOME
- Gateway (MN-CSE)
- IN-CSE-SERVER
- Server/Cloud (IN-CSE)
OM2M resource tree example
OM2M resource tree example

Device registering

Smart Meter (ADN)

Gateway (MN-CSE)

Server/Cloud (IN-CSE)
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

Gateway (MN-CSE)

New value

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

**OM2M Resource Tree Structure**

**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**

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

**Gateway (MN-CSE)**

**User registration**

End user (DA)
OM2M resource tree example

- 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

End user (DA)

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

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

IN-CSE-SERVER
  - REMOTE-MN-HOME
  - AE-USER
  - Subscription
  - Redirect
  - End user (DA)

Smart Meter (ADN)

Server/Cloud (IN-CSE)

CSE APPLICATION ENTITY CONTAINER CONTENT INSTANCE REMOTE-CSE SUBSCRIPTION
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)

Server/Cloud (IN-CSE)

End user (DA)

New value

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)
OM2M resource tree example

- MN-CSE-HOME
  - AE-SMART-METER
    - CNT-DESCRIPTION
      - 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
  - Server/Cloud (IN-CSE)
  - Redirect
  - Redirect
  - End user (DA)
  - New value
  - Trigger
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)**

**Smart Meter (ADN)**
Web Resources

› Main page
  ➔ http://om2m.org

› New wiki pages for oneM2M
  ➔ https://wiki.eclipse.org/OM2M/one

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

› oneM2M Specification
  ➔ http://onem2m.org
Thank you!
Any questions?

www.om2m.org
Last reminder!

Workshop(s) tomorrow

› Website
  - OM2M:
    › http://om2m.org
  - Tutorials:
    › http://wiki.eclipse.org/OM2M/one
  - SARA Team
    › http://www.laas.fr/SARA-EN
  - SARA IoT Working group
    › https://www.laas.fr/projects/IOT/

› Contact information
  - Project leads:
    › Thierry Monteil:
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    › Mahdi Ben Alaya:
      benalaya@sensinov.com
  - New developers:
    › Guillaume Garzone:
      garzone@laas.fr
    › François Aïssaoui:
      aissaoui@laas.fr
  - All contacts:
    › https://wiki.eclipse.org/OM2M/Team