oneM2M Interworking Architecture

- oneM2M defines an Interworking Proxy Entity (IPE) for interworking different IoT device technologies (e.g. OCF, ...) to the oneM2M service layer
  - IPE functions as an adapter that translates non-oneM2M protocols and data models to oneM2M
    - E.g. OCF $\leftrightarrow$ oneM2M translation
oneM2M Interworking Architecture

- oneM2M interworking framework can simultaneously interwork different IoT device technologies with one another
  - E.g. OCF, ZWAVE, Bluetooth, ZigBee, ...
- oneM2M provides an abstracted & simplified API for applications to communicate with devices
  - All devices are represented as oneM2M devices regardless of the technology they use
  - Via standardized oneM2M API, App developers can manage devices in a simpler and uniform manner
- Once abstracted into oneM2M, App Developers can sense/control all IoT devices in a common and uniform manner
  - Turn switch on/off, sample sensor reading, etc.
oneM2M Interworking Example #1

Service Layer

- OCF IPE
- Bluetooth IPE
- ZWAVE IPE

OCF Light
Bluetooth Light
ZWAVE Light
oneM2M Light

oneM2M Request to switch lights on
oneM2M Interworking Example #1

Service Layer

oneM2M Request to switch light on

OCF IPE

OCF Light

oneM2M Request to switch light on

Bluetooth IPE

Bluetooth Light

oneM2M Request to switch light on

ZWAVE IPE

ZWAVE Light

oneM2M Request to switch light on

oneM2M Light
oneM2M Interworking Example #1

Service Layer

- OCF IPE
  - OCF Request to switch light on
    - OCF Light
- Bluetooth IPE
  - Bluetooth Request to switch light on
    - Bluetooth Light
- ZWAVE IPE
  - ZWAVE Request to switch light on
    - ZWAVE Light
- oneM2M IPE
  - oneM2M Request to switch light on
    - oneM2M Light
oneM2M Interworking Example #1

Service Layer

- OCF IPE
  - OCF Light
  - OCF Response to switch light on

- Bluetooth IPE
  - Bluetooth Light
  - Bluetooth Response to switch light on

- ZWAVE IPE
  - ZWAVE Light
  - ZWAVE Response to switch light on

- oneM2M IPE
  - oneM2M Light
  - oneM2M Response to switch light on
oneM2M Interworking Example #1

Service Layer

- OCF IPE
  - OCF Light

- Bluetooth IPE
  - Bluetooth Light

- ZWAVE IPE
  - ZWAVE Light

- oneM2M IPE
  - oneM2M Light

oneM2M Response to switch light on

oneM2M Response to switch light on

oneM2M Response to switch light on

oneM2M Response to switch light on
oneM2M Interworking Example #1

Service Layer

- OCF IPE
- Bluetooth IPE
- ZWAVE IPE

oneM2M Response to switch light on

OCF Light
Bluetooth Light
ZWAVE Light
oneM2M Light
oneM2M Interworking Example #2

OCF Light Switch → OCF Request to switch lights on → OCF IPE → OCF Light

OCF IPE → Bluetooth IPE → Bluetooth Light

OCF IPE → ZWAVE IPE → ZWAVE Light

OCF IPE → oneM2M IPE → oneM2M Light
oneM2M Interworking Example #2

Service Layer

oneM2M Request to switch lights on

OCF Light Switch

OCF IPE

Bluetoothen IPE

ZWAVE IPE

OCF Light

Bluetoothen Light

ZWAVE Light

oneM2M Light
oneM2M Interworking Example #2

Service Layer

- oneM2M Request to switch lights on
- oneM2M Request to switch lights on
- oneM2M Request to switch lights on

OCF Light Switch

OCF IPE

Bluetooth IPE

ZWAVE IPE

oneM2M Light
oneM2M Interworking Example #2
oneM2M Interworking Example #2
oneM2M Interworking Example #2
oneM2M Interworking Example #2

Service Layer

- OCF Light Switch
  - OCF IPE
    - OCF Light
  - Bluetooth IPE
    - Bluetooth Light
  - ZWAVE IPE
    - ZWAVE Light
  - oneM2M Light

oneM2M Response to switch light on
oneM2M Interworking Example #2

Service Layer

OCF Light Switch

OCF Response to switch lights on

OCF Light

OCF IPE

Bluetooth IPE

Bluetooth Light

ZWAVE IPE

ZWAVE Light

oneM2M Light

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Example: Semantic Mash-up Use Case
Smart Car parking

Semantic Mashup
a process to discover and collect data from more than one source, and conduct semantic data orchestration (integration/computation) on behalf of an application.

See TR-0033 Study on Enhanced Semantic Enablement: Smart Parking Assistance Realized Through Semantic Mashup
oneM2M – LoRa Interworking Use Cases

Smart city Busan use case

Safety service for Children and the old

✓ A Smart location management and a service of smart education supporting which are based on the free communications for the disadvantaged people such as the demented elderly, disabled people, children, infants

- LoRa Trackers and gateways are deployed at Pyeongchang Olympic Stadium for Asset Tracking services
- The same device and gateways are deployed at Chamrousse Ski Station in France for Skier performance measurement services

- SKT deploys LoRa network and oneM2M platform for their IoT services
  - SKT has deployed the nationwide LoRa Nationwide LoRa network in June, 2016
  - SKT has acquired global standard authentication (TTA verified for oneM2M) in May 2016 for their ThingPlug oneM2M based IoT service platform

http://www.koreatimes.co.kr/www/tech/2018/10/133_204548.html

- EU-KR Wise-IoT Smart Cities Interworking Project
- SKT deploys LoRa network and oneM2M platform for their IoT services
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http://www.koreatimes.co.kr/www/tech/2018/10/133_204548.html
Takeaways

Many IoT deployments can have diverse types of IoT sub-systems and platforms that require interworking devices, apps and data all to one another

oneM2M interworking and abstraction capabilities, are able to hide the complexity of interworking from IoT app developers

oneM2M is able to help future proof IoT deployments by enabling different types of brownfield and greenfield technologies to more seamlessly be deployed together

oneM2M is a standard and mitigates vendor lock-in
oneM2M Implementation and Deployment Base

A vibrant and healthy ecosystem of oneM2M implementations exists!

Industry-driven Open source implementations

Examples of Commercial implementations, Prototypes, Trials

Certification Test Houses and Test Tool Vendors

Regular Interop Events (6 Held from 2015-2018)
oneM2M Adoption

oneM2M has global adoption

- ★ oneM2M Open Source Project
- green oneM2M Product Offerings
- amber oneM2M Trial Deployment
- blue oneM2M Commercial Deployment
Example implementations of oneM2M (I)

Source: oneM2M Industry Day #5
Example implementations of oneM2M (II)

- **Smart Buildings**
  - Sensinov – vendor-neutral solution for monitoring and control over multiple buildings
  - City of Bordeaux smart street lighting

- **Smart Cities**
  - LG’s CityHub platform for centralized management and data analysis of citywide IoT devices
  - InterDigital’s oneTRANSPORT data marketplace for smart city, transport and large arena management applications
  - Telecom Italia’s CityOS for smart city, transport deployments

- **Cross domain**
  - John Deere farm machinery interactions with passenger cars to improve road safety
  - PilotThings – centralized data and device management solution for cross-departmental enterprise networks, including multi-vendor hardware elements
  - Orange & Deutsche Telekom – remote management of home gateways across telco networks
Bhopal Smart City Development Corporation selects the HPE to create India’s first Cloud-Based Integrated Command and Control Centre

Operating multiple city command centre operations in parallel

Monitoring and administration of multiple city civic utilities and citizen services

State-wide monitoring of cities from a central command view

Adapt and integrate thousands of discrete sensors and applications on the platform

HPE Universal IoT Platform

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### oneM2M Certified Products

<table>
<thead>
<tr>
<th>NAME</th>
<th>VENDOR</th>
<th>PRODUCT TYPE</th>
<th>VERSION</th>
<th>DATE</th>
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<tbody>
<tr>
<td>Mobius</td>
<td>KETI</td>
<td>Software Component</td>
<td>TRSL V1.1</td>
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<td>Chordant™ Platform</td>
<td>Chordant™, an InterDigital business</td>
<td>End product(IN-CSE)</td>
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<td>C3SYSTEMS</td>
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<td>IREXNET</td>
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<td>nTels</td>
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<tr>
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<td>KT</td>
<td>Software component</td>
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</table>

**17 Certifications from 14 Companies**

oneM2M Certification from TTA [http://onem2mcert.com](http://onem2mcert.com)
oneM2M Timeline
oneM2M Feature Summary by Release

**Rel-1 Features**
- Registration
- Discovery
- Security
- Group Mgmt.
- Data Mgmt. & Repository
- Subscription & Notification
- Device Management
- Communication Mgmt.
- Service Charging
- Network Service Exposure
- App & Service Mgmt.
- HTTP/CoAP/AMQP Bindings

**Rel-2 Features**
- Time Series Data
- Flexible resources that can be customized by app developers
- Semantics Description & Discovery
- Security Enhancements
  - Dynamic Authorizations
  - Content Security
  - E2E Security
- WebSocket Binding
- Ontology for Home Area Information Model
- oneM2M App-IO Registry
- oneM2M Interworking
  - ETSI-TeleTwin
  - 5GPP Triggering

**Rel-3 Features**
- Semantic Querying/Mashups
- 3GPP SCEF Interworking
  - roaming IP Data Delivery
  - PLR Reachability Monitoring
  - Device Triggering
  - (IoT)
- Transaction Management
- Service Layer Routing
- Common oneM2M Interworking Framework
  - DIX, DPI, UA, STK, Message
- oneM2M Conformance Tests and Profiles
- Security Enhancements
  - Distributed Authorization, etc.
- Ontology-based Interworking

**Rel-4 Features (planned)**
- Fog/Edge Computing
  - Service Processing
  - Service Packaging, etc.
- 3GPP Interworking
  - Session-Flash
  - V2I
  - V2X Enhancements
  - Charging
- Vehicular Centric Features
  - Mobility, Inter-Interactions...
- Semantic Reasoning & Ontology Mapping
- Service/User Subscription
- Security Enhancements
  - User/Device Privacy, etc.
- WS-C Web Interworking
- IOT & II and the Information models for multiple domains
- [Streamlining oneM2M protocol]
- oneM2M Conformance Tests
Overall Takeaways

• oneM2M provides a common set of horizontal IoT services
• oneM2M interworks existing IoT technologies together with one another and abstracts away the complexity of IoT
• oneM2M has clear value-propositions to the IoT industry
  • Simplify life for IoT stakeholders - App developers, device manufactures, service providers, operators,…
  • Minimize development, deployment and maintenance costs
• oneM2M is a mature and commercially deployed technology
• oneM2M has a certification program to ensure conformance and interop between oneM2M solutions
Where to Find More Details

http://www.onem2m.org

oneM2M Device/Cloud Integrators

oneM2M IoT Application Developers