INTRODUCTION TO ONE M2M
ONE M2M FEATURES, EVOLUTION, APP TO SMART CITY

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M2M Common Service Layer in a nutshell

A software “framework”

Located between the M2M applications and communication HW/SW that provide connectivity

Provides functions that M2M applications across different industry segments commonly need (eg. data transport, security/encryption, remote software update...)

Like an “Android” for the Internet of Things
But it sits both on the field devices/sensors and in servers
And it is a standard – not controlled by a single private company
Stron implementation base

Industry-driven Open source implementations

Examples of Commercial implementations /demos

4 interop. events so far
Pipe (vertical):
- 1 Application, 1 NW,
- 1 (or few) type of Device
- Point to point communications

Horizontal (based on common Layer)
- Applications share common service and network infrastructure
- Multipoint communications

Example diagram showing the oneM2M Architecture approach.
Nearly 40% of economic impact requires interoperability between IoT systems

<table>
<thead>
<tr>
<th>Potential economic impact of IoT¹</th>
<th>Value potential requiring interoperability</th>
<th>% of total value</th>
<th>Examples of how interoperability enhances value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$11.1 trillion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38%</td>
<td>Factories</td>
<td>1.3</td>
<td>Data from different types of equipment used to improve line efficiency</td>
</tr>
<tr>
<td>62%</td>
<td>Cities</td>
<td>0.7</td>
<td>Video, cellphone data, and vehicle sensors to monitor traffic and optimize flow</td>
</tr>
<tr>
<td></td>
<td>Retail environments</td>
<td>0.7</td>
<td>Payment and item detection system linked for automatic checkout</td>
</tr>
<tr>
<td></td>
<td>Work sites</td>
<td>0.5</td>
<td>Linking worker and machinery location data to avoid accidents, exposure to chemicals</td>
</tr>
<tr>
<td></td>
<td>Vehicles</td>
<td>0.4</td>
<td>Equipment usage data for insurance underwriting, maintenance, pre-sales analytics</td>
</tr>
<tr>
<td></td>
<td>Agriculture</td>
<td>0.3</td>
<td>Multiple sensor systems used to improve farm management</td>
</tr>
<tr>
<td></td>
<td>Outside</td>
<td>0.3</td>
<td>Connected navigation between vehicles and between vehicles and GPS/traffic control</td>
</tr>
<tr>
<td></td>
<td>Home</td>
<td>0.1</td>
<td>Linking chore automation to security and energy system to time usage</td>
</tr>
<tr>
<td></td>
<td>Offices</td>
<td>0²</td>
<td>Data from different building systems and other buildings used to improve security</td>
</tr>
</tbody>
</table>

¹ Includes sized applications only; includes consumer surplus.
² Less than $100 billion.
NOTE: Numbers may not sum due to rounding.

Source: McKinsey
... in particular true for Smart Cities

**Consumer IoT**
- Home energy mgmt
- Smart Home
- Connected Car

**Industrial IoT**
- Autonomous driving
- Smart manufacturing
  - Automation

**Enterprise IoT**
- Telemetry
- Health care
- Digital signage
- Asset tracking
- Fleet management
- Supply chain
- Smart Utilities
- Building automation

**Smart city**
Summary of Release 2/3 Features

Industrial Domain Enablement
- Time series data management
- Atomic Transactions
- Action Triggering
- Optimized Group Operations

Home Domain Enablement
- Home Appliance Information Models & SDT
- Mapping to existing standards (OCF, ECHONET, GoTAPI...)

Smart City & Automotive Enablement
- Service Continuity
- Cross resource subscriptions

Management
- M2M Application & Field Domain Component Configuration

Semantics
- Semantic Description/Annotation
- Semantic Querying
- Semantic Mashups
- oneM2M Base Ontology

Security
- Dynamic Authorization
- End to End Security
- Enrollment & Authentication APIs
- Distributed Authorization
- Decentralized Authentication
- Interoperable Privacy Profiles
- Secure Environment Abstraction

Market Adoption
- Developer Guides
- oneM2M Conformance Test
- Feature Catalogues
- Product Profiles

oneM2M as generic interworking framework
- 3GPP SCEF
- OMA LWM2M
- DDS
- OPC-UA
- Modbus
- AllJoyn/OCF
- OSGi
- W3C WoT
Nobody can do it alone

- Collaboration is important to reach common understanding, avoid overlap and build **interoperable** IoT ecosystems globally.
How well we do?
Source Gartner
WHY ONEM2M?
WHY NOW?
Why oneM2M? Why now?

- M2M (and IoT) communications existed for so many years, e.g.:
  - SCADA systems
  - Satellite based truck tracking

- So why oneM2M?
  - *Specific standards exist* for home automation, smart factory, energy management, etc. but much larger growth will come from a fully integrated Internet of Things
  - The IoT vision will not materialize if we do not solve interoperability issues, therefore drive down integration costs and ensure time to market

- Why now?
  - Technology is ready for an *outcome based economy* for a large number of use cases, more than what one can think of
Technology 1: connectivity, plenty to chose from

Source AIOTI, modified from an ALU contribution
**Technology 2: horizontalization**
«building IoT in Siloes belongs to the past »

<table>
<thead>
<tr>
<th>NICHE VERTICALS</th>
<th>BROAD ADOPTION</th>
</tr>
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<tbody>
<tr>
<td>Low volumes, high ARPC, high TCO</td>
<td>High volume, low ARPC, low TCO</td>
</tr>
</tbody>
</table>

- Devices and Applications are designed as “stove-pipes”
- Devices dedicated for single application use
- Solutions are closed and not scalable: duplication of dedicated infrastructure
- High development & delivery cost

- Devices and Applications are designed to collaborate across “clouds”
- Devices are used for multiple application purposes
- Devices and Applications offering continuously evolve
- Easy app development and device integration through APIs and standard interfaces

Source: Alcatel-Lucent
Technology 3: “softwarization” and IoT virtualization

Goal: End-to-End Quality and Extreme Flexibility to Accommodate Various Applications & Services

Applications & Services with various requirements (M2M/IoT, Content delivery, Tactile)

- Service & Network Control Plane
- App-Driven API
- Network Softwarization and Multi Domain Orchestration – Administration 1
- UE
- Radio access network (RAN)
- Mobile packet core
- Cloud
- Mobile Edge Computing

Virtualised Infrastructure S/W platform

Physical infrastructure (network, computing and storage resources)

- UE
- Devices
- Computation and storage resources
- Data Centers

Network resources

- RAT(s)
- MFH
- MBH
- Transport
- Sensors

Source: ITU-T Focus Group IMT2020

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Technology 4: Semantic interoperability, no longer a research syndrome?

Sent packages are tracked on the web

Plants action a tap to water themselves.

Let the things talk to each others

Take the world online

Take the control of the world

Monitor and control home appliances.

Communication Interoperability

Data Interoperability

Semantic Reasoning

Alarm ring earlier in case of traffic or bad weather.

Let Things become intelligent

Source: sensinov

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EXAMPLE : ROLE OF ONEM2M IN SMART CITIES
Key findings/trends «City 2.0»

• Smart city platforms bring significant efficiencies when the number of applications grows
  – Shared data
  – Single API set and data formats are beneficial for developers

• Initial cost of platform investment tends to be marginal compared to economies of scale, OPEX options can alleviate initial costs

• Connectivity, plenty to chose from

• Machine learning and analytics create great benefits (e.g. traffic management, parking management)

• Living labs for research and innovation

• Open standards are crucial for sustainable success
Vision for building smart cities

1. Build a vision

2. Digitalize and «sensorise»

3. Build Dashboards

4. Expand the vision, Integrate and Innovate

SMART CITY CONCEPTS

Source: Based on discussions with Dr. Martin Serrano, OASC and Insight centre

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### Key requirements for smart city IoT platform

#### Horizontal platform for new deployments
- Smart city is an **incremental and participatory** journey
- New deployments should, where possible, **leverage a converged networks and an horizontal service platform**
- **Open standards** are key to avoid lock-in and master the total cost of ownership

#### Existing deployments
- **Do not disrupt** existing “vertical deployment” but seek opportunities for an integration path with an horizontal approach
- **Build value** through mash-ups and open data

#### Participatory and innovative approach
- **Surveys**
- Address **needs for innovation** through app development:
  - **APIs**
  - **Access to, eventually semantically enriched, Open data** (where feasible and subject to privacy legislation/citizen consent)

#### Security and (device) management are key
- Despite initial focus on IoT data, there is an increased interest in security and device management (which go hand in hand).
- Need arises from security threat analysis conducted recently: e.g. “**Two researchers analyzed smart meters widely used in Spain and discovered that those can be hacked by attackers to harm the overall National power network.**”, source: [http://securityaffairs.co/wordpress/29353/security-smart-meters-hacking.html](http://securityaffairs.co/wordpress/29353/security-smart-meters-hacking.html)
A possible smart city blue-print

Cloud apps

Dashboards

City Apps

REST APIs

Group mgmt

Location

Discovery

Device Interworking

Data center

Field domain

Gateway

Gateway

Device

Smart city backend

Smart city frontend

Broker

FIWARE

Big Data Storage

Hadoop

Open data (Semantics)

W3C

ckan

REST APIs

SPARQL or REST APIs

Other data sources

Adapter

Existing deployments

Adapter

App

App

App

App

APIs

APIs

3rd party apps

3rd party apps

App

App

App

App

Device mgmt

Security

I/F to other IoT platforms
## Take-away

| Combat fragmentation | • Healthy eco-system with economies of scale  
<table>
<thead>
<tr>
<th></th>
<th>• More partnering choices and opportunities for M2M/IOT industry stakeholders</th>
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</table>
| Lower CAPEX          | • Standardized protocols / APIs -> simplifies application development/deployment  
|                      | • Cross-vertical standards -> same devices and back-ends in different industries |
| Lower OPEX           | • Standard features to use networks more efficiently -> get better tariffs  
|                      | • Flexibility for verticals -> utilize best transport network meeting business needs |
| Time to Market       | Reduced development, test and deployment lifecycles through focusing on core business (application logic) |