



TESTING ONEM2M COMPLIANT IMPLEMENTATIONS

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Who we are?

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On behalf of the oneM2M Tester project members:

Korea Electronic Technology Institute (KETI), Sejong University (SJU), Ericsson, Korea Telecommunications Technology Association (TTA), Easy Global Market (EGM), European Telecommunications Standards Institute (ETSI), Sensinov, InterDigital, LAAS-CNRS, InnoWireless, and DTNC

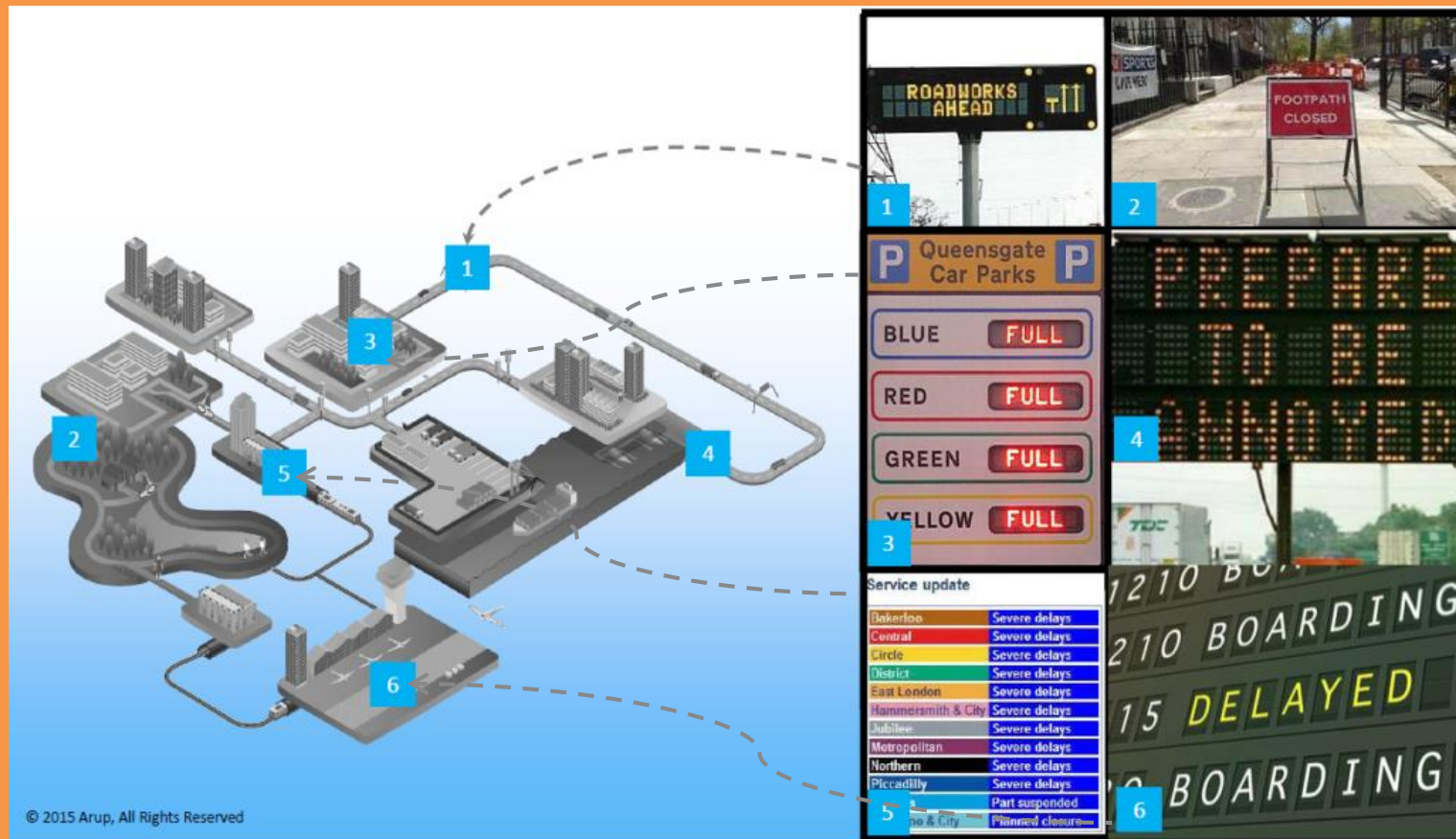
Content

- Why to standardize Internet of Things?
- oneM2M – Standardized M2M communication and Internet of Things
- Testing Landscape in oneM2M

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User experience of machine to machine (M2M) communication today: A transportation example



Source: Use of the oneM2M standard in the oneTRANSPORT field (<https://www.brighttalk.com/webcast/11949/190241>)

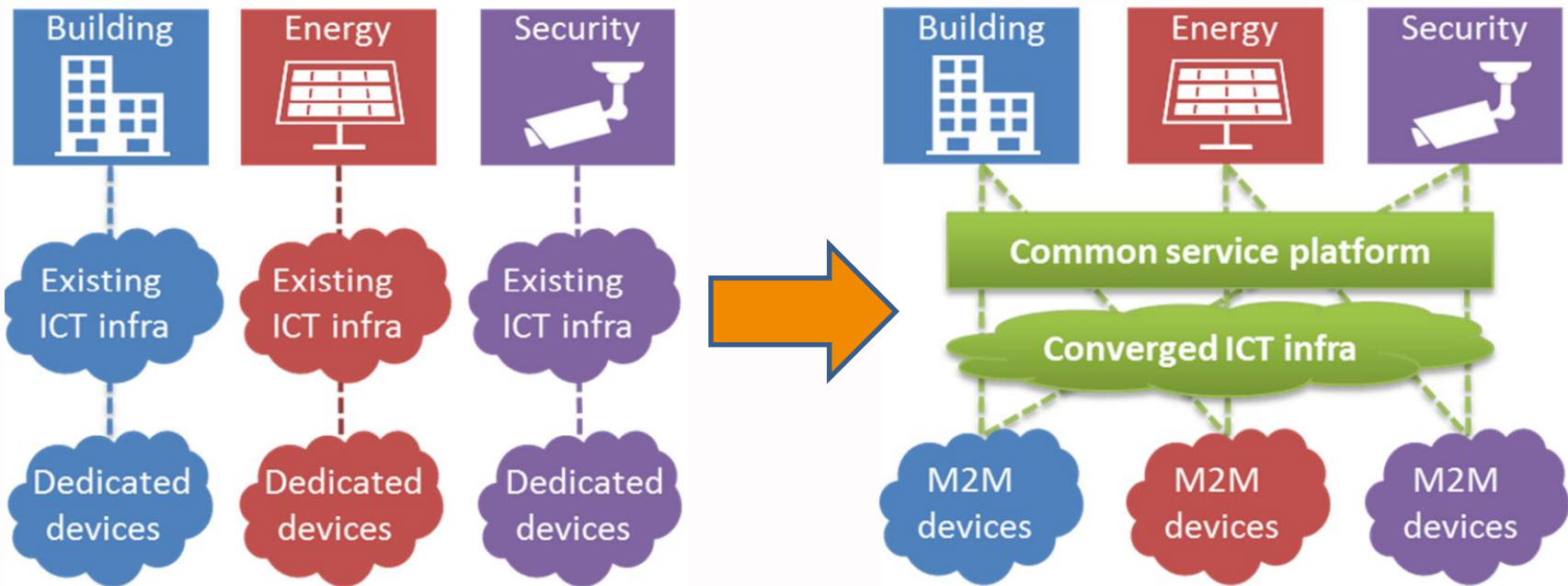
Why Horizontalization is urgently need?

Current situation

- Silo effect
- Inefficient

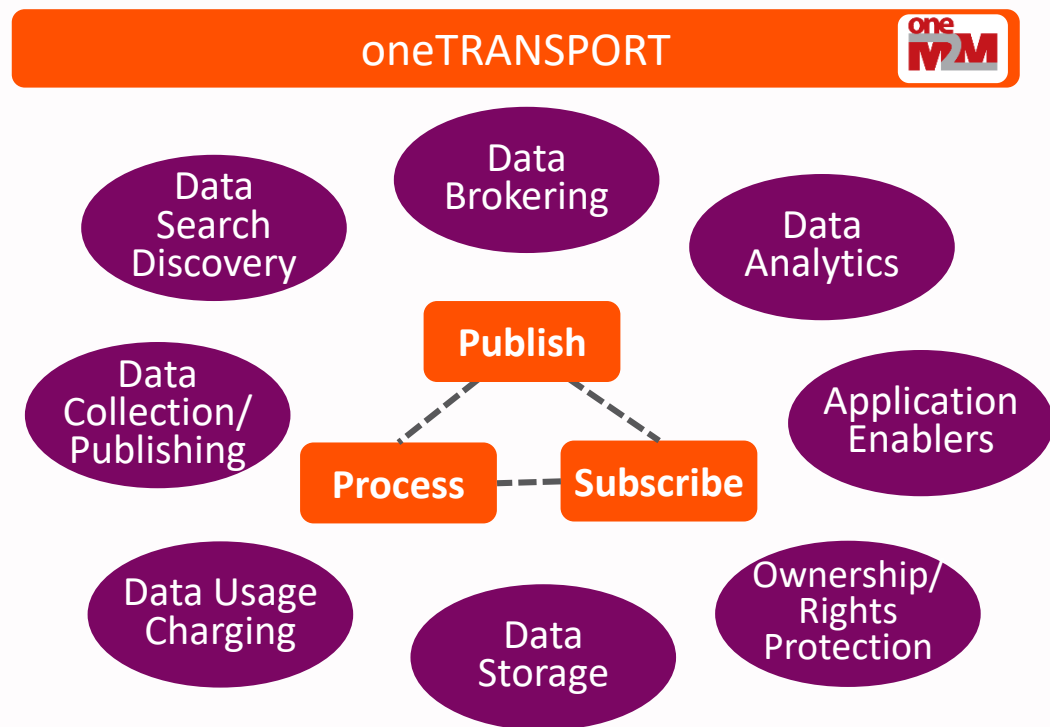
Target position

- **Interoperability** at the level of communications and **data**
- Efficient **common services** implement.
- Seamless **interaction** between heterogeneous applications and devices



Back to the transportation example: A Holistic Approach can deliver advanced services

- **oneTRANSPORT project:**
an open market for travel data
 - Buckinghamshire County, UK
 - 11 Multi-sector partners
 - 200+ data assets
- **Right information at the right time!**



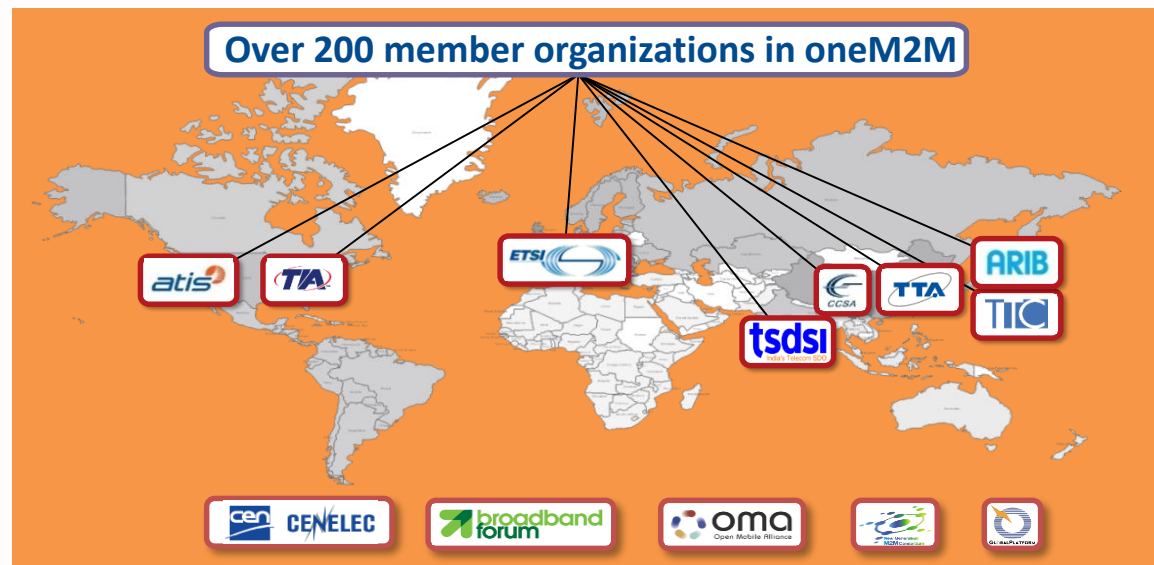
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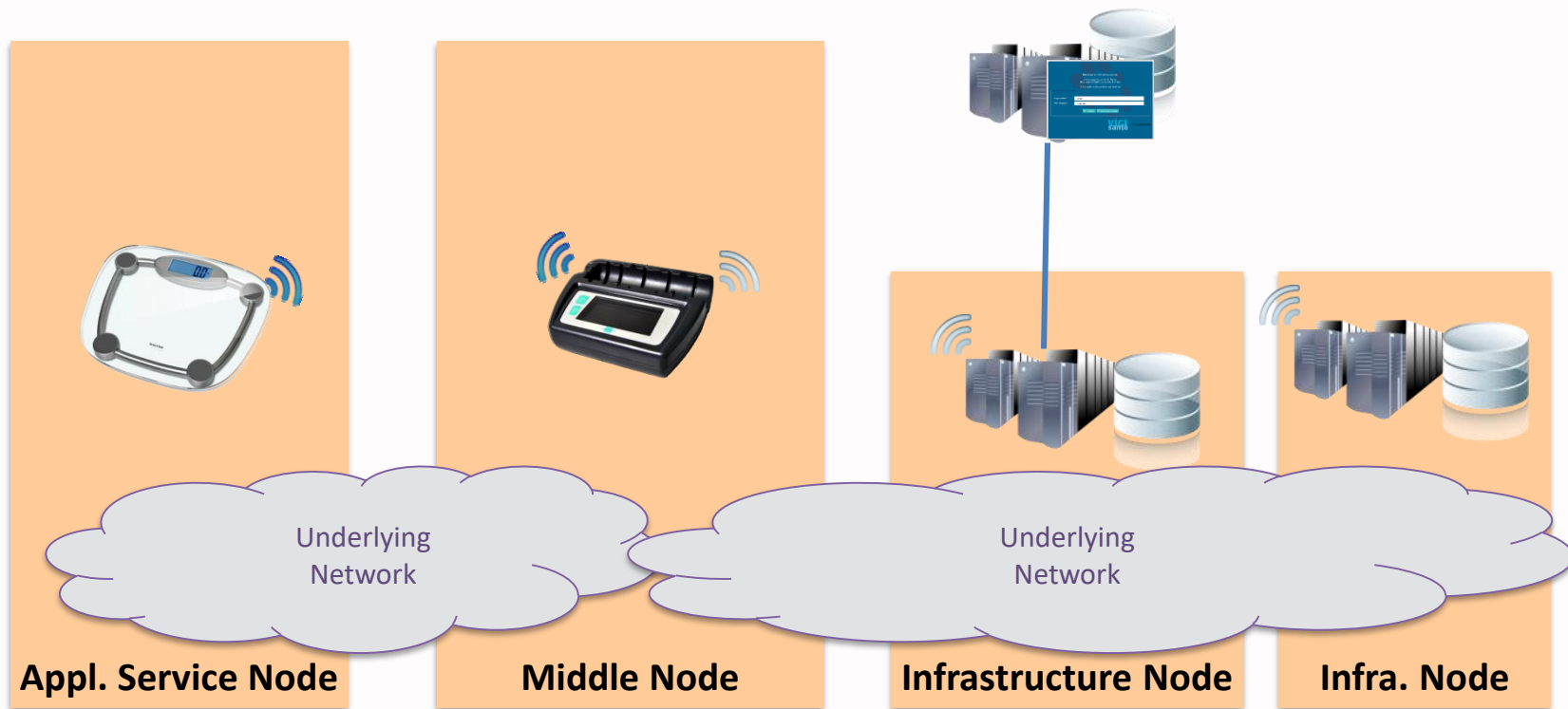
Do You Know **oneM2M**?

- A **global standards initiative** for M2M communication and IoT
 - Delivers Technical Reports and Technical Specifications
 - **Release 1:** January 2015, **Release 2:** August 2016
- **Member~ and partnership**
 - > **200 member** organizations
 - **8 regional SDOs**-> endorsing oneM2M specifications
 - Partnership with **6 international fora/standards bodies**



M2M: Machine-to-Machine
IoT: Internet of Things

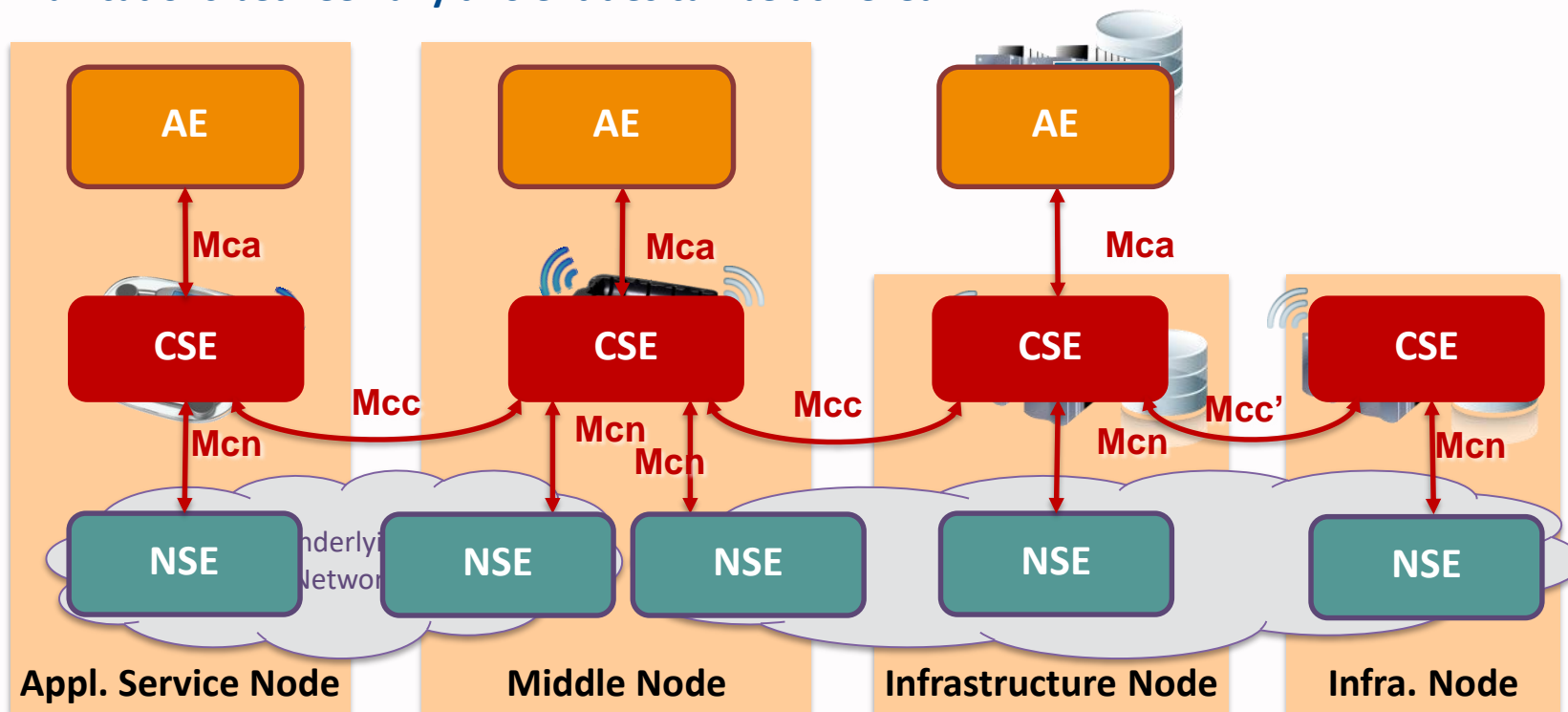
Architecture – “Node” view





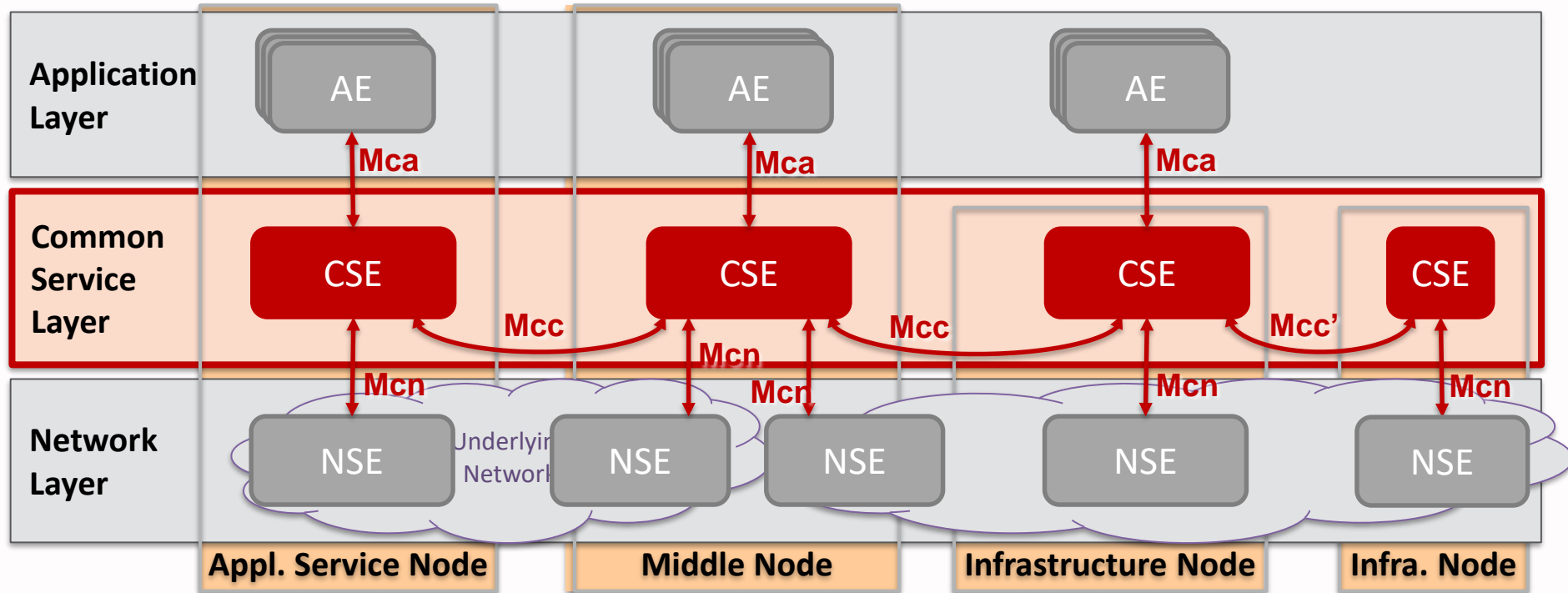
Architecture – functional view

oneM2M architecture consists of entities and reference points through which communications between any two entities can be achieved



- AE: Application entity
- CSE: Common service entity
- NSE: Network service node

Scope of **oneM2M** specifications



- AE: Application entity (provides application logic for end-to-end solutions)
- CSE: Common service entity (provides service functions that are common to M2M solutions)
- NSE: Network service node (provides data transport and network services to CSEs)
- Reference point: Communication interface between the entities

Why to Standardize Testing?

oneM2M Implementation Examples

- Implementations based on oneM2M Release 1

- Open Source



- Commercial (non-open source)



Most of implementations are **CSE based** and very few are ADN-AE implementations

- Projects



(UK)



(South Korea)



(EU)

Why to Standardize Testing?

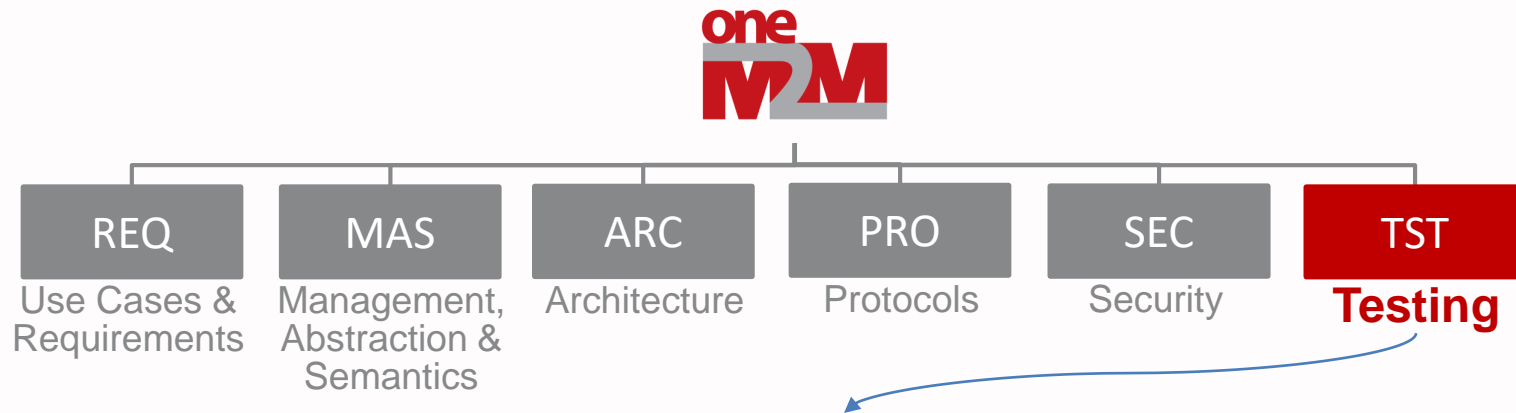
- To secure seamless **end-to-end working**
 - Applications are most often multi-vendor
 - IoT services and applications shall interoperate
- **Evaluation and certification**
 - Especially for industrial IoT services is greatly required
 - At some safety critical areas is a must



Content

- Why to standardize Internet of Things?
- oneM2M – Standardized M2M communication and Internet of Things
- Testing Landscape in oneM2M

oneM2M Working Groups



Goals

- To develop and publish **oneM2M Testing Specifications**
- Testing related activities
 - **Testing Events**
 - **Test Tool** development
- Create **oneM2M Certification Program**

Conformance Testing

• Scope

- Checking conformance with oneM2M **interface specs**
- Interfaces: oneM2M **Mca** and **Mcc** Reference Points

• Methodology

- Follows ISO/IEC 9646 methodology
- Developed in the standardized test language **TTCN-3**

• Test Execution

- For CSE is fully automatic
- For ADN-AE (future work) may be semi-automatic:
operator interaction may be needed

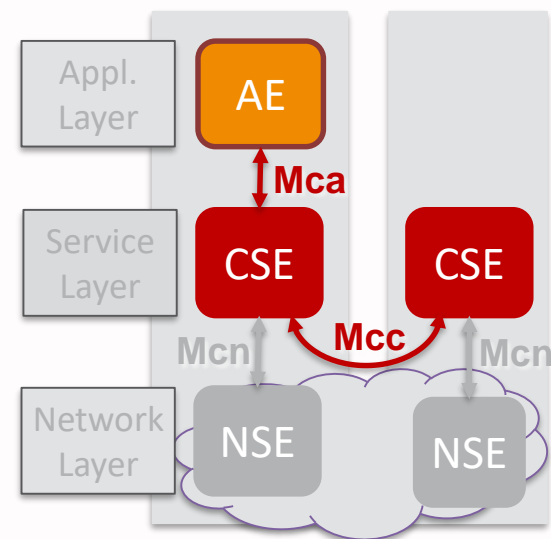


Image from <http://www.guru99.com/conformance-testing.html>

Interoperability Testing

- **Scope**
 - Check **end-to-end functionality** between application entities and common service entities
 - Interfaces: oneM2M **Mca** and **Mcc** Reference Points
- **Methodology**
 - Interoperability Testing Specification (TS-0013)
 - Complementary with conformance testing
- **Test Execution**
 - Manual



Image from <http://www.guru99.com/conformance-testing.html>

Testing Events

- **oneM2M Plugtest Events**

- 1st event (14-16 September 2015 in France)

- Focus on interoperability testing

- 2nd event (10-13 May 2016 in South Korea)*

- Interoperability and conformance testing

- **3rd event (29th November ~ 2nd December 2016 in Kobe, Japan)**

- Planned to cover interoperability and conformance testing

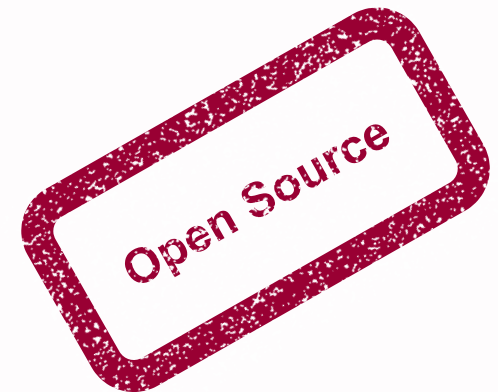


On schedule

* - 20 participating companies,
77 IoP test descriptions, 84 testing sessions,
15 conformance test cases, 38 conformance testing sessions

Tools

- **Conformance Testing tool development – oneM2M Tester**
 - **In parallel with the test code development**
 - Allows executing the conformance tests
 - Based on the open source TTCN-3 tool Titan
 - **oneM2M Tester** will be **open sourced**
 - **Evaluation**
 - At **oneM2M plugtest** events
 - **Demos and dissemination**
 - [At IoT Week Korea 2016](#)
 - At international conferences and events
 - UCAAT 2016, HUSTEF 2016, ECS 2016, etc.
 - Tutorials in the **oneM2M webinar** series



Tools

- **oneM2M Tester** in action

The image shows two software interfaces side-by-side. The left interface is the 'oneM2M Tester' running in a VMWare Workstation 12 Player. It displays a project explorer on the left with a tree structure including 'OneM2MTester', 'log', 'src', 'ATC', 'LibCommon', 'OneM2M_Functions.ttcn', 'OneM2M_Pixits.ttcn', 'OneM2M_Templates.ttcn', 'OneM2M_Testcases.ttcn', 'OneM2M_TestControl.ttcn', 'OneM2M_TestSystem.ttcn', 'OneM2M_Types.ttcn', 'OneM2M_TypesAndValues.ttcn', 'UsefulTtcn3Types.ttcn', 'XSD.ttcn', 'Config', 'OneM2MTest.cfg', 'HTTP_SA', 'OneM2MPort.cc', 'OneM2MPort.hh', 'Lib', 'Json_test_log.log', 'OneM2MTester.tpd', 'Xml_test_log.log', 'oneM2MTesterRel1', 'oneM2MTesterRel2', and 'TEST'. The main editor shows a TITAN script for 'OneM2M_TestControl.ttcn' with a red box highlighting the test logic. The right interface is the 'KETI Resource Tree Monitor' showing a resource path 'http://203.253.128.151:7579/mobius-yt/mytestae003' and a diagram of the resource tree with nodes like 'cse', 'ae', and 'sub'.

oneM2M Tester

KETI Resource Tree Monitor

Certification

- **oneM2M Testing for Certification Program**

- **Scope**

- Both **conformance** and **interoperability** are included

- **Status**

- **Current on-going work**

- Product Category for Certification scope and Certification scheme specification
- Testing tools are under development
- Certification body selection
- oneM2M certification logo design and etc.

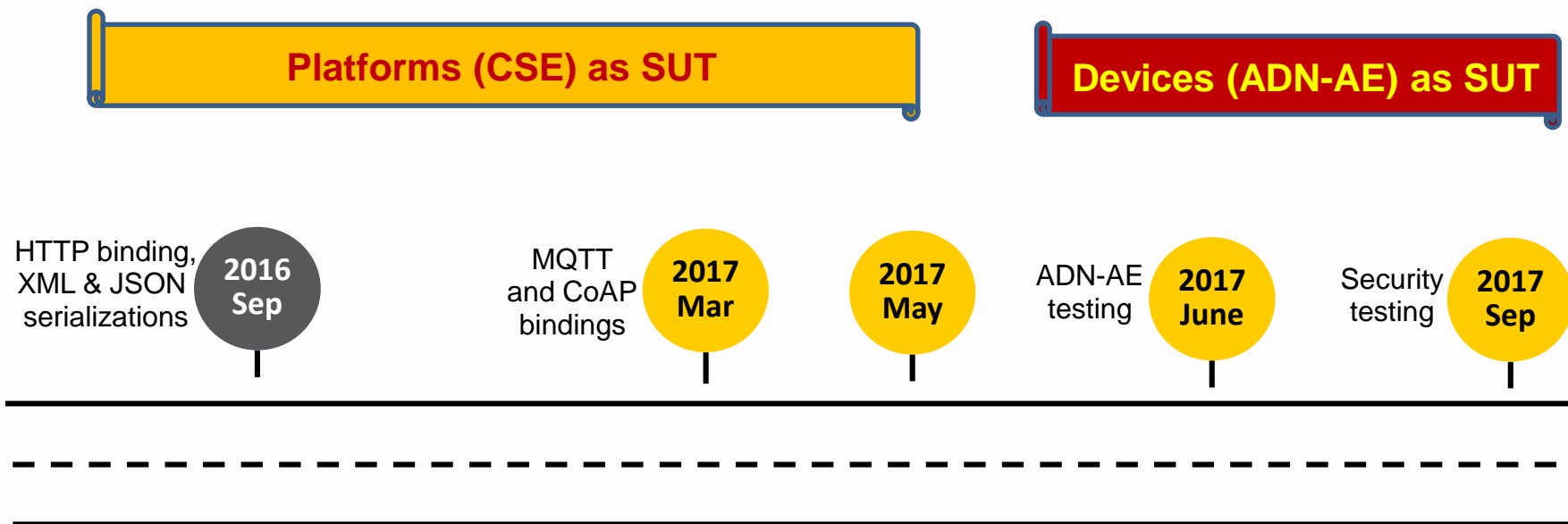


- **oneM2M TTA Verified Program (South Korea)**

- Requirement for certification of oneM2M implementations (CSE) especially from **three Telecom Service Providers** and **key manufacturers** in South Korea
- Satisfy requests of the **oneM2M minimum features** from Telecom Service Providers and key manufacturers to provide **IoT and M2M services**
- Designed in cooperation with **AT4Wireless**

Roadmap

- **oneM2M Tester Development**



Key take away-s

- oneM2M is a global standardization initiative for **IoT Platforms**
- oneM2M not only develops **technical specifications**, but
- Also **test specifications**, testing events, certification program
AND
- **Open source test tool** to execute conformance tests





ADDITIONAL INFORMATION

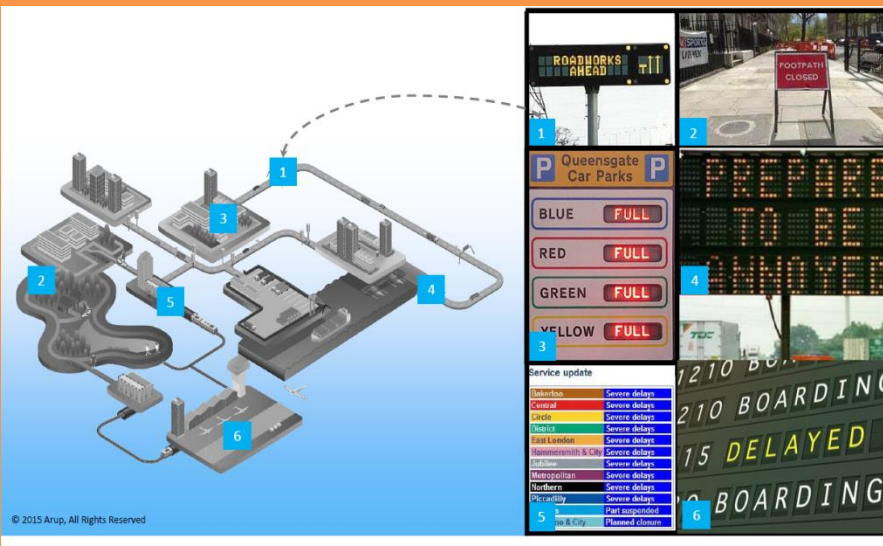
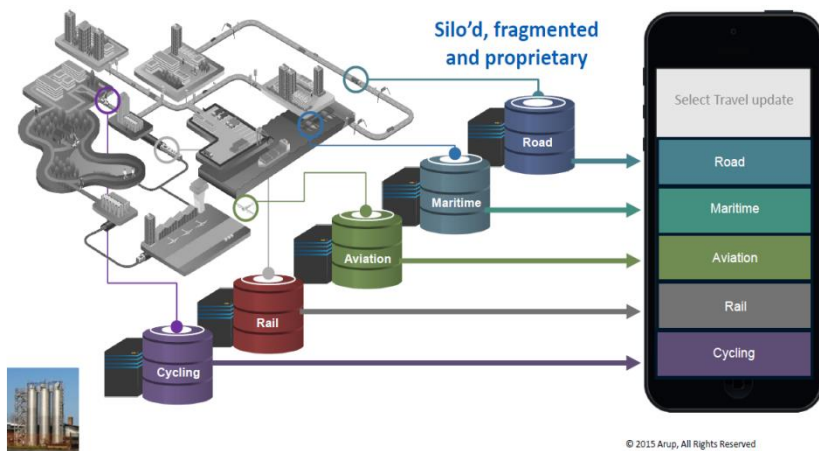
Please find more detailed information about some of the topics on the following slides

The reality of machine to machine (M2M) communication today: A transportation example

Transport today: a fragmented user experience

Wrong information, wrong time, wrong place

The User's Journey Experience



- Each provider has a proprietary data collection and delivery service -> incomplete value chain
- User receives pieces of information in different applications

Source: Use of the oneM2M standard in the oneTRANSPORT field (<https://www.brighttalk.com/webcast/11949/190241>)

oneM2M Implementation Examples

- **Open source and commercial oneM2M implementations based on oneM2M Release 1**
 - **OCEAN**: Open alliance for IoT standard releases Blue Octopus (Spring Framework version) and Mobius-Yellow Turtle (Node.js version) by Korea Electronics Technology Institute (KETI)
 - **OM2M**: Eclipse OM2M Open Source standard-based IoT platform by LAAS-CNRS
 - **IoTDM**: Daylight Open Source oneM2M compliant IoT data broker by Cisco, ETRI and Echelon
 - **OPENMTC**: (not open source) OPEN Machine-Type Communication by Fraunhofer FOKUS
 - **ThingPlug**: (not open source) Mobius-based commercial IoT platform by SK Telecom

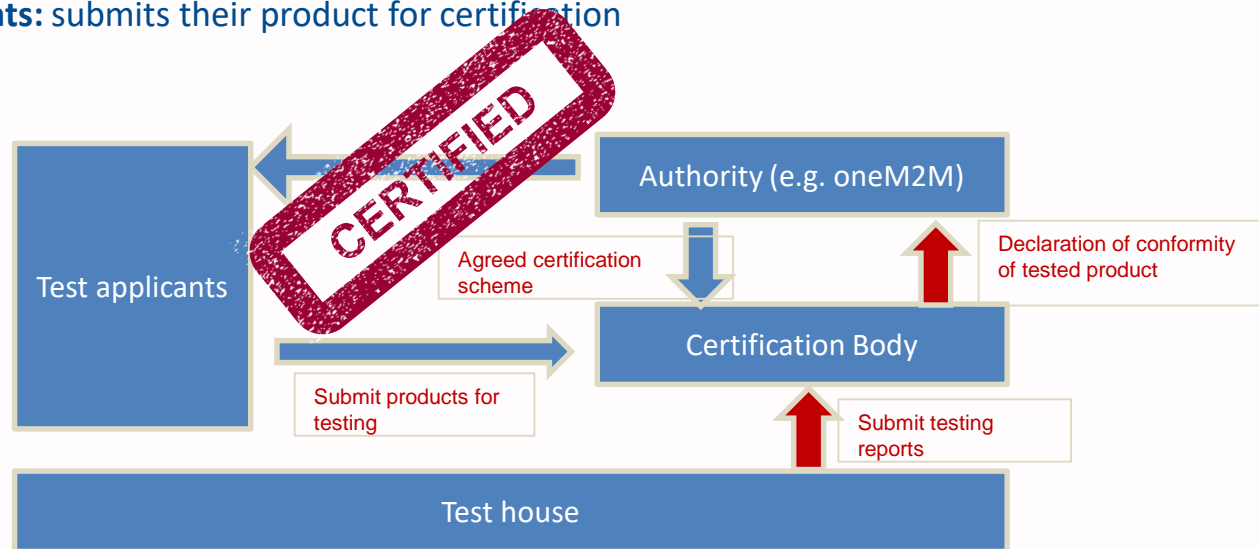
Most of implementations are **CSE based** and very few are ADN-AE implementations

- **Projects**
 - **oneTRANSPORT** (Buckinghamshire County, UK): to address transport issues and provide a better travel experience meanwhile improve the delivery of public transport services etc.
 - **Smart City** (Busan, South Korea) : to establish a transportation and tourism infrastructure, a disaster management system, and energy saving system etc.
 - **ARMOUR** (Armour Consortium, Europe; receives EU funding): to address security issues on IoT by providing certified security & trust solutions to enhance security, privacy and safety in large scale IoT

Generic Certification Flow

- **Roles in certification process**

- **Authority:** delivery certificate to an entity who got certified in its conformity to a standard or other references
- **Certification body:** receives certification requests and testing reports from test applicants and test house, respectively. Also in charges of sending test reports to authority.
- **Test house:** carries out tests and evaluation progress and generates test reports
- **Test applicants:** submits their product for certification



Generic certification flow

Challenges for oneM2M Certification Program

- No detailed information on **minimum features set** in oneM2M specs
- No approved **functional testing methodology for ADN** entities (current testing specs are designed only for ASN/MN/IN entities), which in fact are seen as the main testing product type in certification program

When it comes to security testing, work becomes more complex

- No **security testing spec including security testing methodology and ICS** (in fact it has been put on oneM2M Security & Testing WG schedule)
- No **Test Suite Structure & Test Purposes spec** until now

The Future work in **high priority** is to specify

URGENT

- **Product category for testing**
- **Testing methodology for testing ADN entity**
- **ICS functional testing spec with information of minimum feature set and additional feature set for ADN entity**
- **ICS security testing spec for ADN entity including abstracted security testing requirements prior to write test purposes for each single requirement**
- **Security testing flow for security authentication and authorization including access control policy mechanisms**