OM2M

Horizontal platform for the IoT

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Nicolas Seydoux (IRIT)

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**.

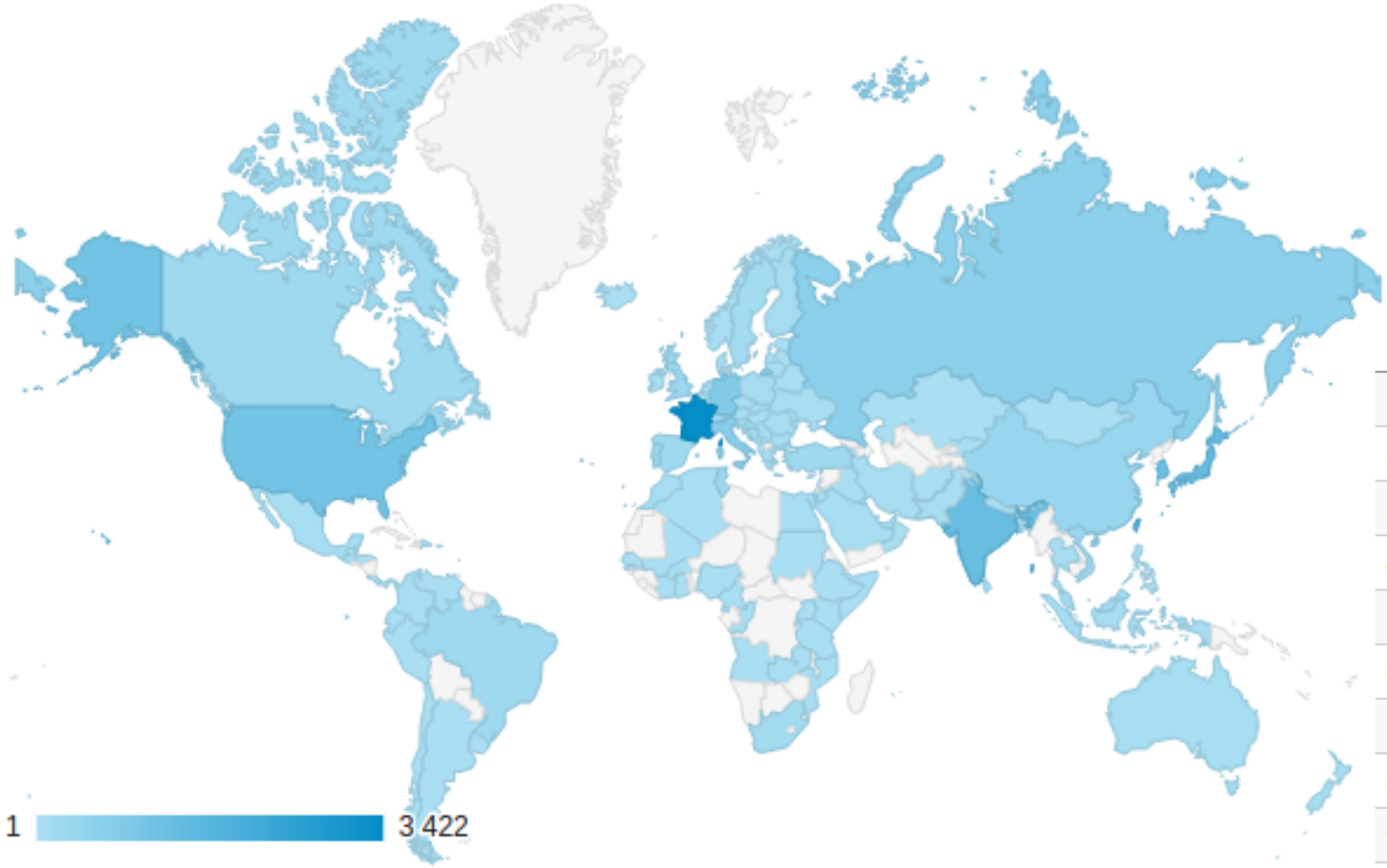
OM2M: Horizontal IoT Service Platform

- **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



	Pays	Sessions	% Sessions
1.	France	3 422	18,74 %
2.	Taiwan	1 930	10,57 %
3.	Japan	1 445	7,91 %
4.	India	1 398	7,66 %
5.	South Korea	1 308	7,16 %
6.	United States	1 152	6,31 %
7.	Germany	848	4,64 %
8.	Italy	723	3,96 %
9.	Russia	617	3,38 %
10.	China	387	2,12 %

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)*

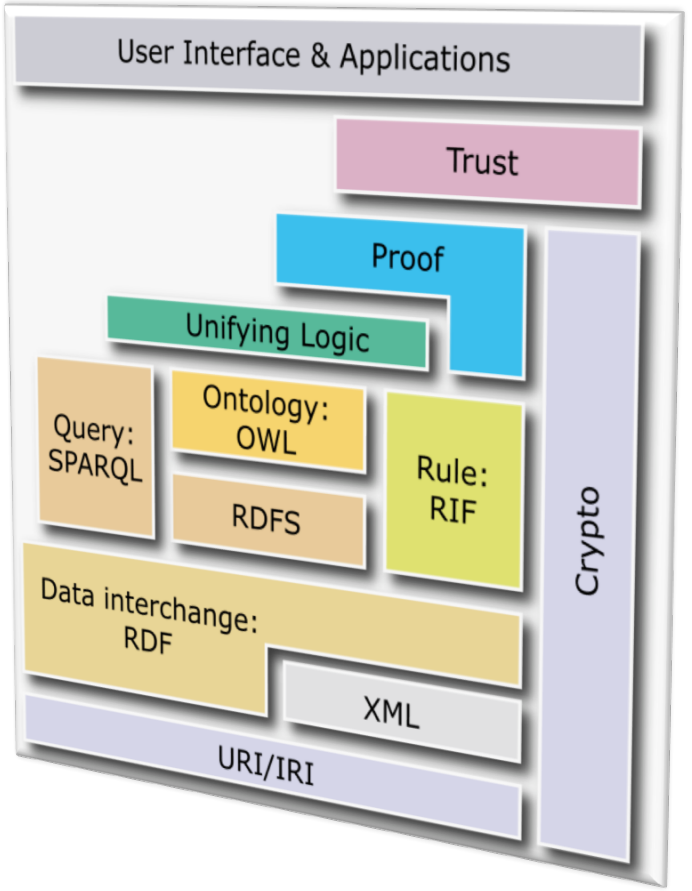
› **Contributions**
  – Orange & SierraWireless
    › Contribution with OSGi expertise *(Knoplerfish)*
    › Base drivers for IoT technologies and corresponding IPE
    › Interworking Proxy Entities
    › Device Management expertise (LWM2M)

Excerpt of OM2M contributors, users and interested parties

Roadmap

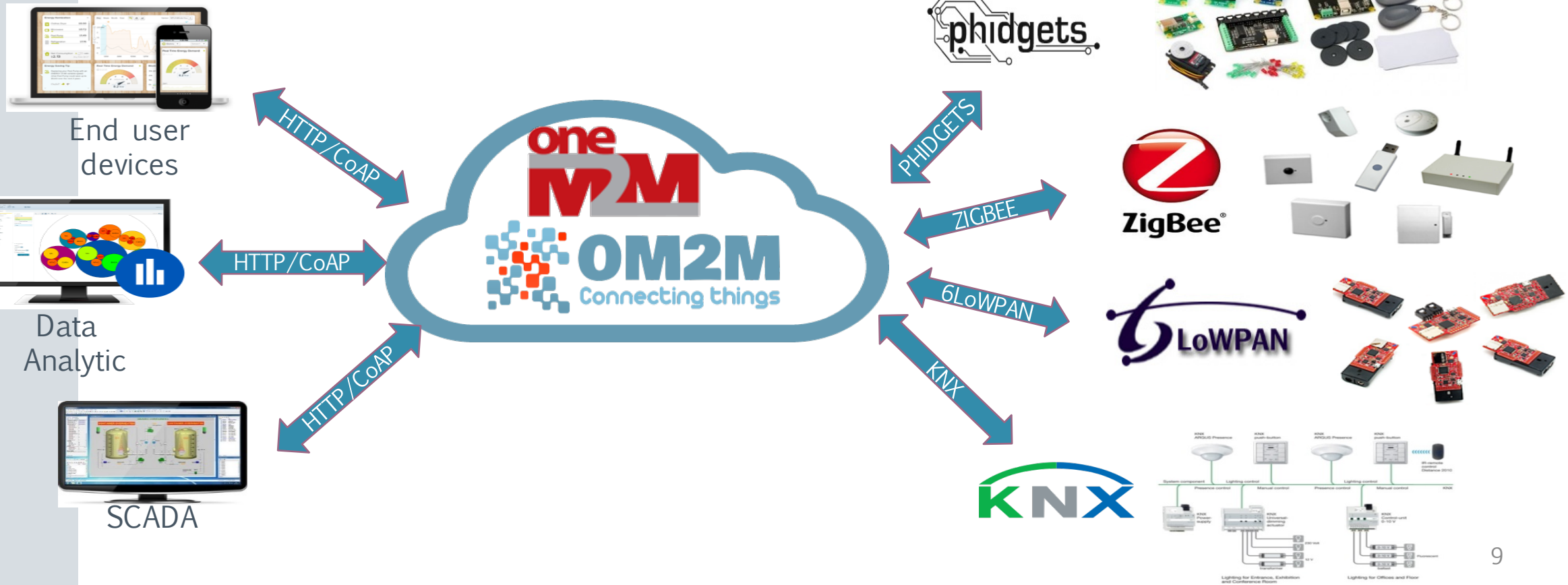
- **Eclipse**
  - Code enhancement and optimisation (v1.0)
  - New communication protocols (CoAP)
  - Integration of new standard features
    - oneM2M rel. 1.6
    - oneM2M rel. 2.0
  - Bug fix (v0.8 & v1.0)
    - Contribute on our Bugzilla!

- **Research & contributions**
  - Semantic aspects
    - Research theme in our laboratory
    - Implementation of oneM2M semantic mechanisms
  - Autonomic computing



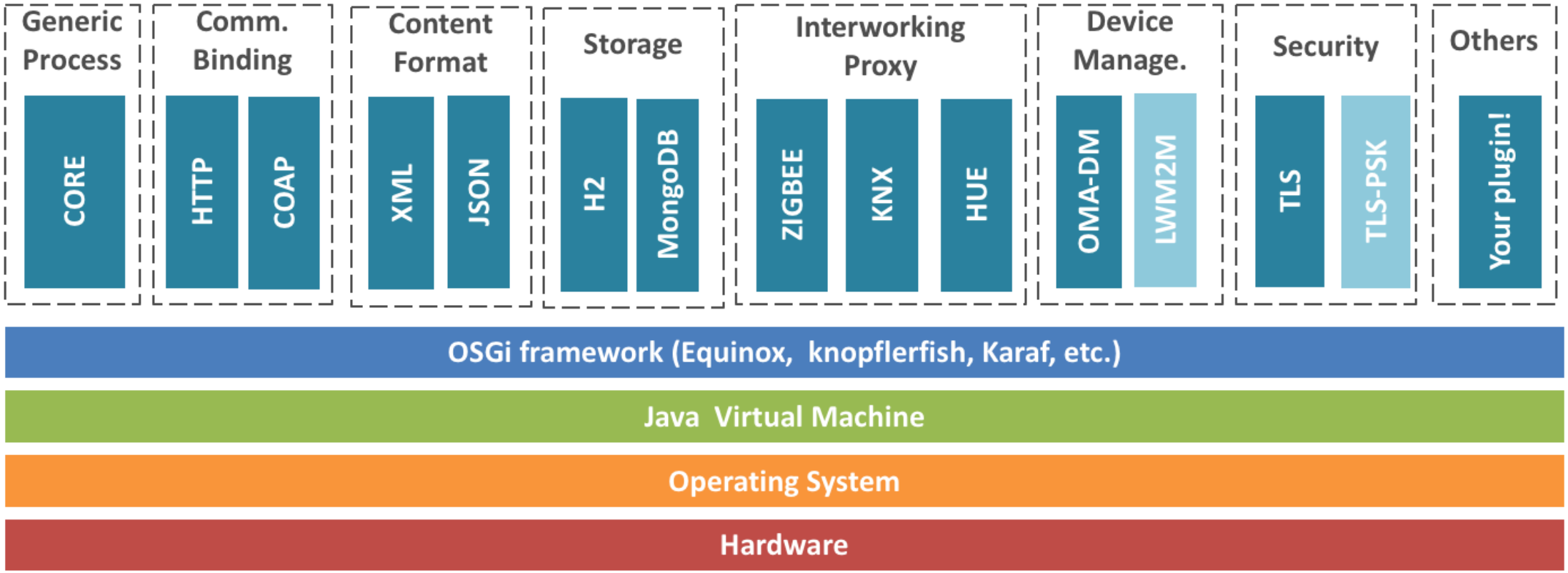
OM2M: Horizontal IoT Service Platform

- 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

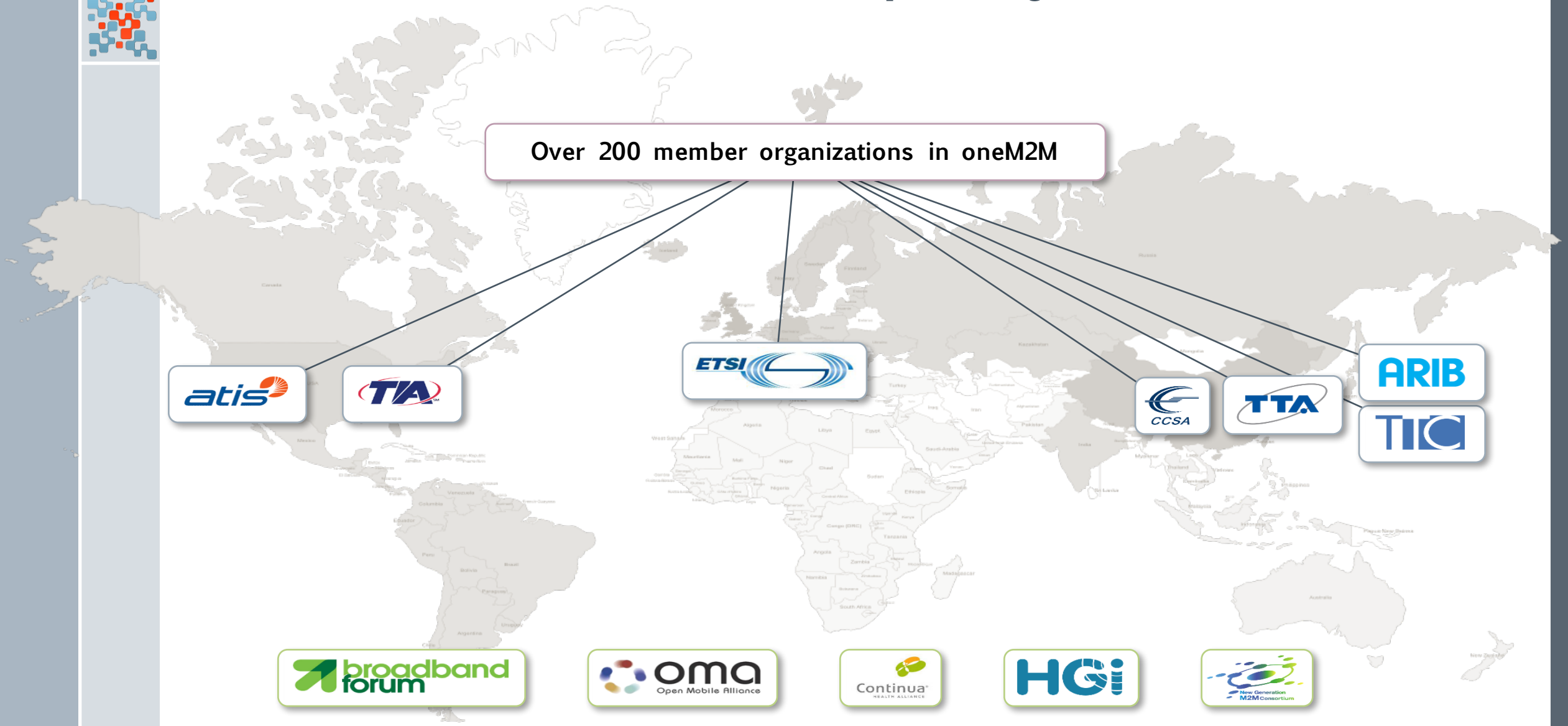
- Java platform running on top of an **OSGi** runtime
  - Highly extensible via **plugins**
  - **Flexible OSGi container**: Equinox, Knopflerfish, or others.
  - **Flexible database**: SQL or NoSQL.
- Build with **Maven** and **Tycho** for fast plugin development



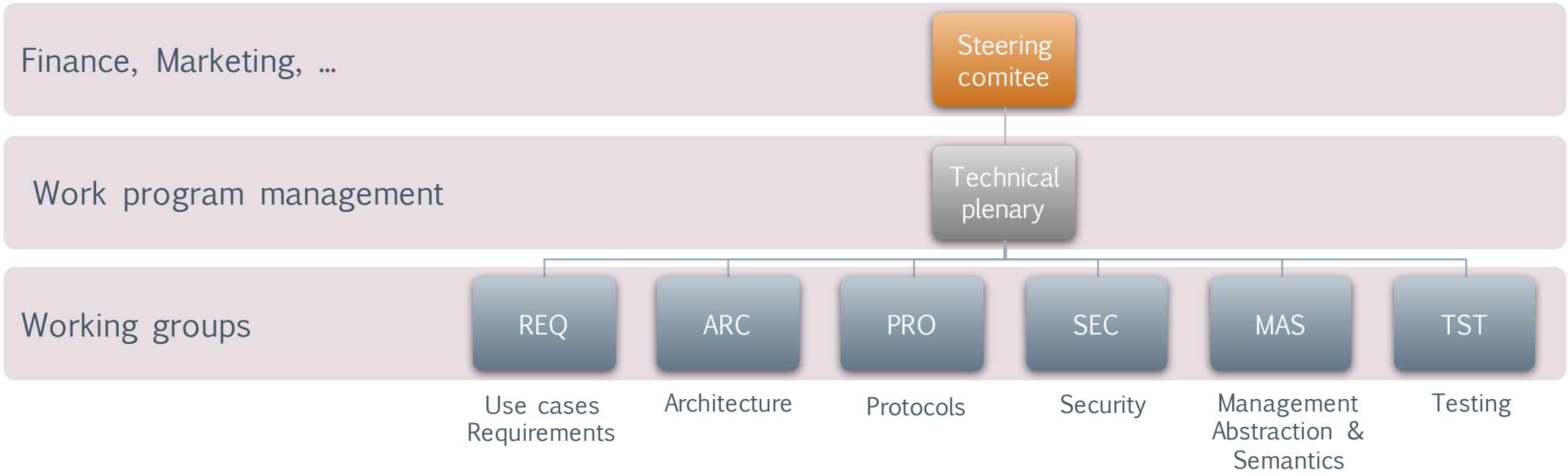
Standards landscape for IoT and M2M

- 143 organizations around the world are involved in M2M standardization according to the Global Standards Collaboration M2MTask Force.

oneM2M: The Partnership Project

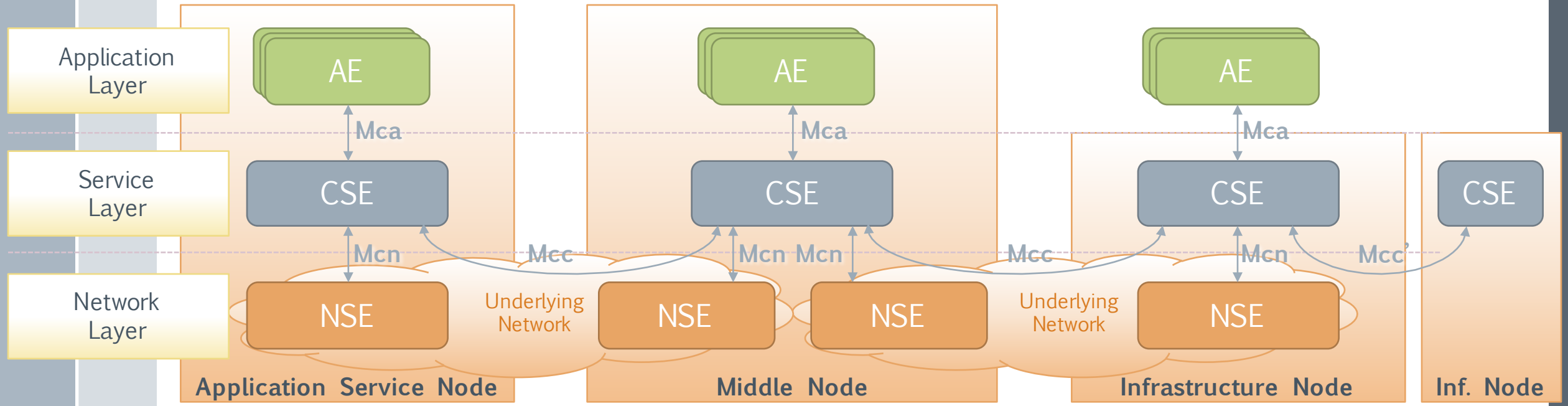


oneM2M: Organization & Structure



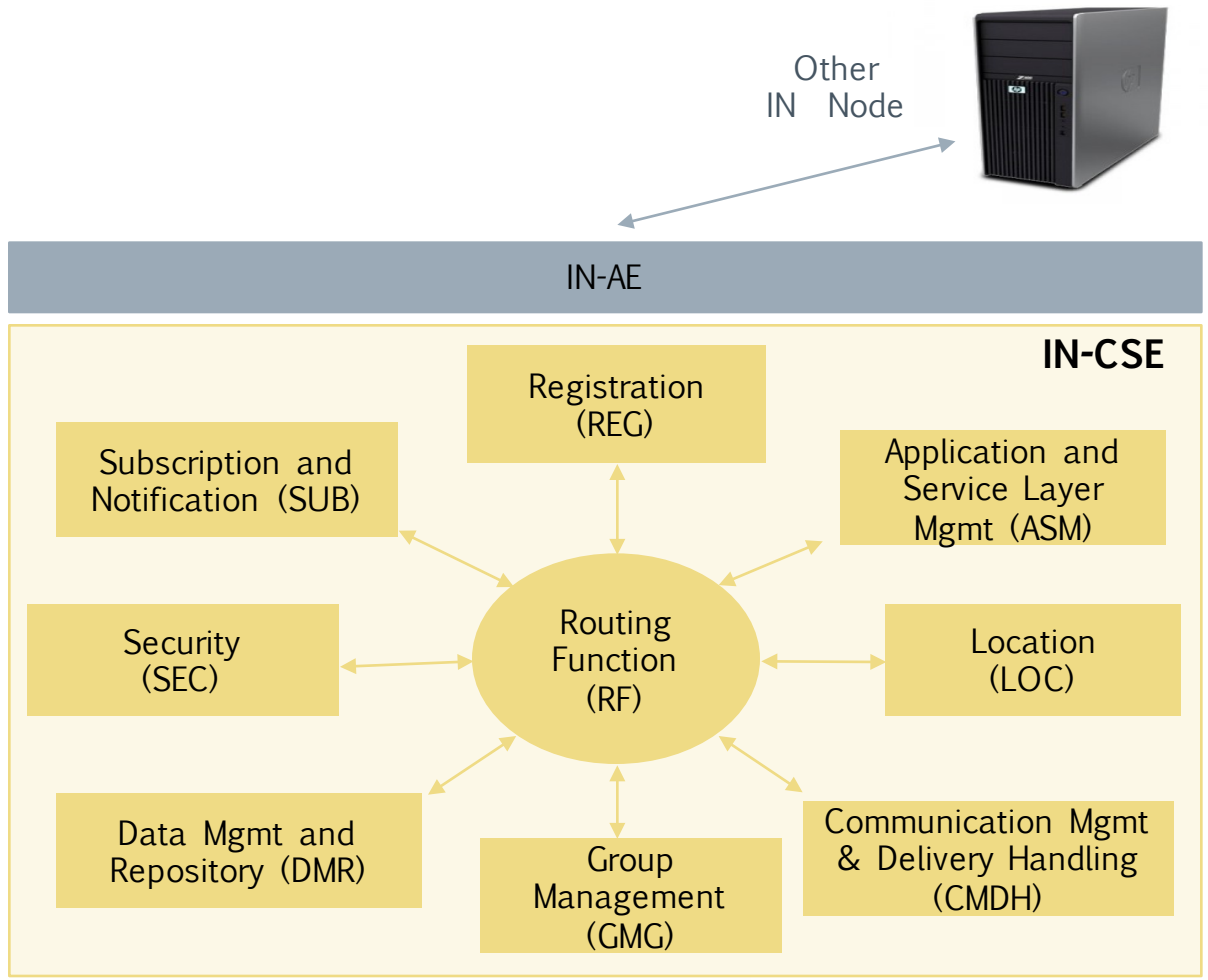
OneM2M Architecture

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)
device	



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

OM2M high level architecture



OM2M high level architecture

Other
MN Node

MN-AE

MN-CSE

SUB
REG
ASM
SEC
RF
LOC
DMR
GMG
CMDH

MN Node

Other
IN Node

IN-AE

IN-CSE

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

IN Node

OM2M high level architecture

Other
MN Node

MN-AE

MN-CSE

REG
SUB
ASM
SEC
RF
LOC
DMR
GMG
CMDH

MN Node

ASN-AE

ASN-CSE

REG
SUB
ASM
SEC
RF
LOC
DMR
GMG
CMDH

ASN
Node

Other
IN Node

IN-AE

IN-CSE

Registration
(REG)

Subscription and
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Application and
Service Layer
Mgmt (ASM)

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Routing
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Communication Mgmt
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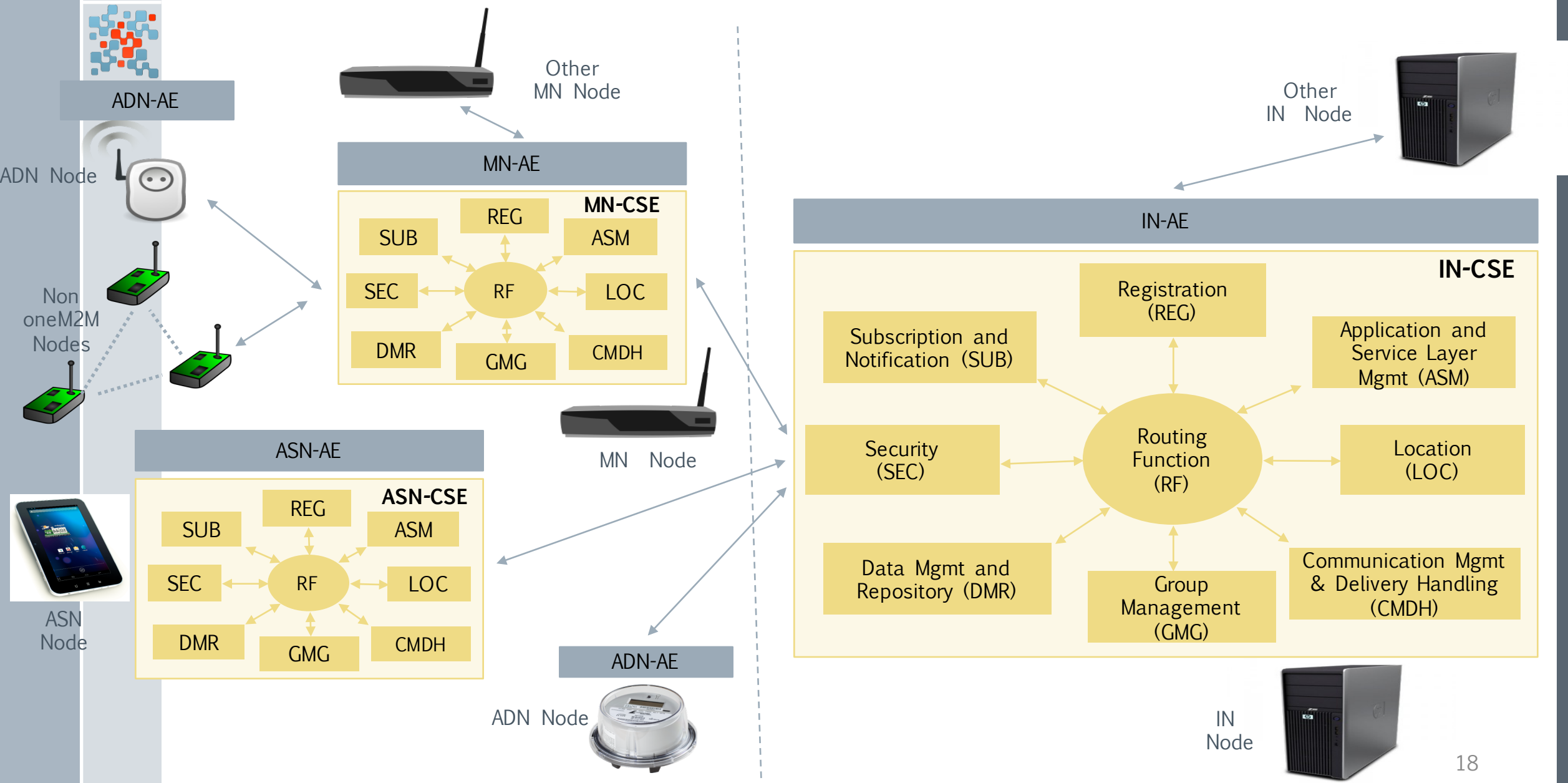
IN
Node

OM2M high level architecture



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

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

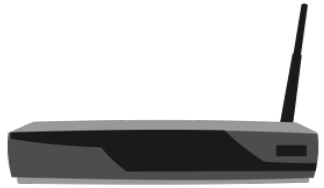
oneM2M Resources

- **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
    - …

OM2M resource tree example

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

Smart Meter (ADN)



Gateway (MN-CSE)

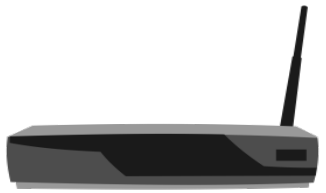
Server/Cloud (IN-CSE)

End user (DA)

OM2M resource tree example

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

MN-CSE-HOME

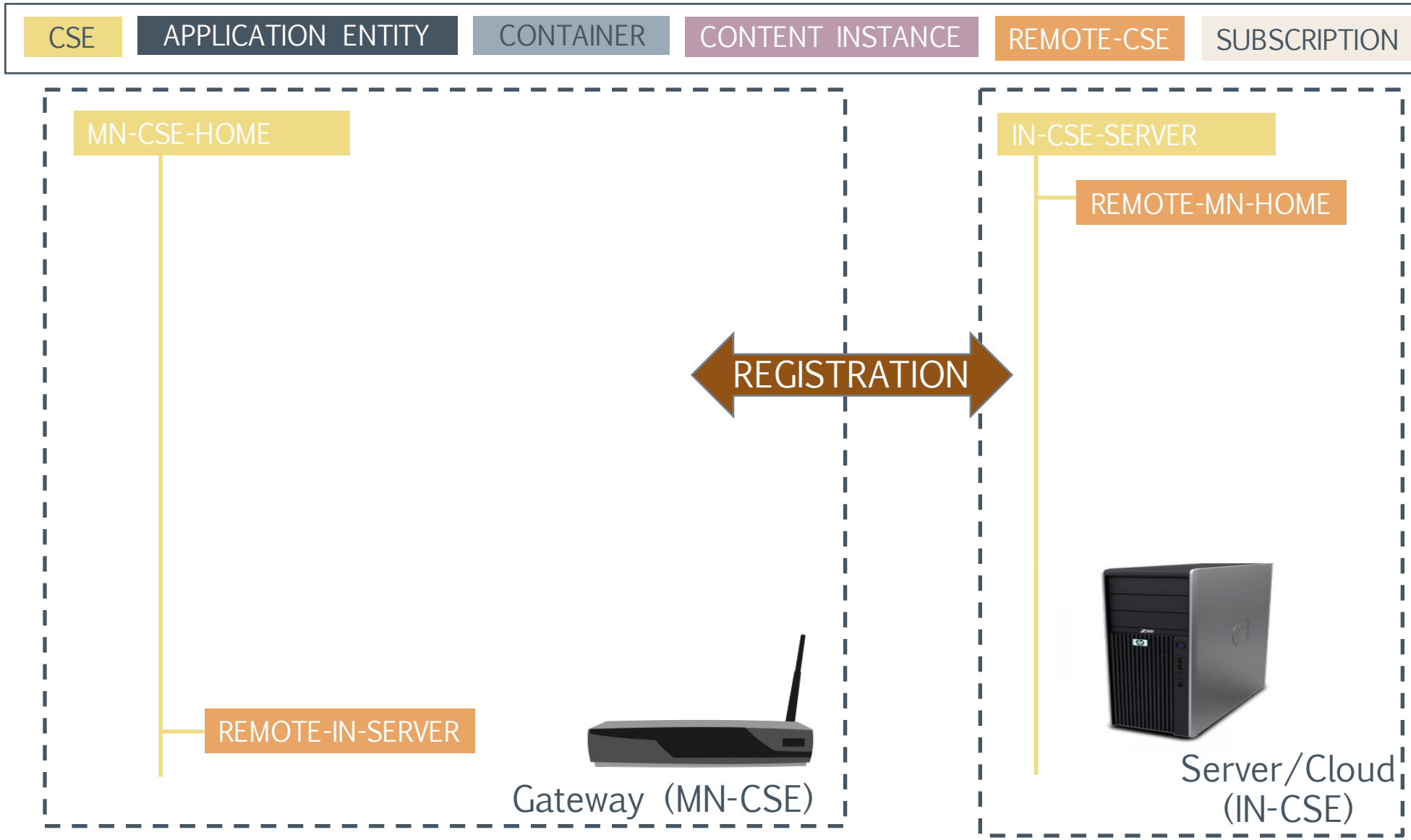


Gateway (MN-CSE)

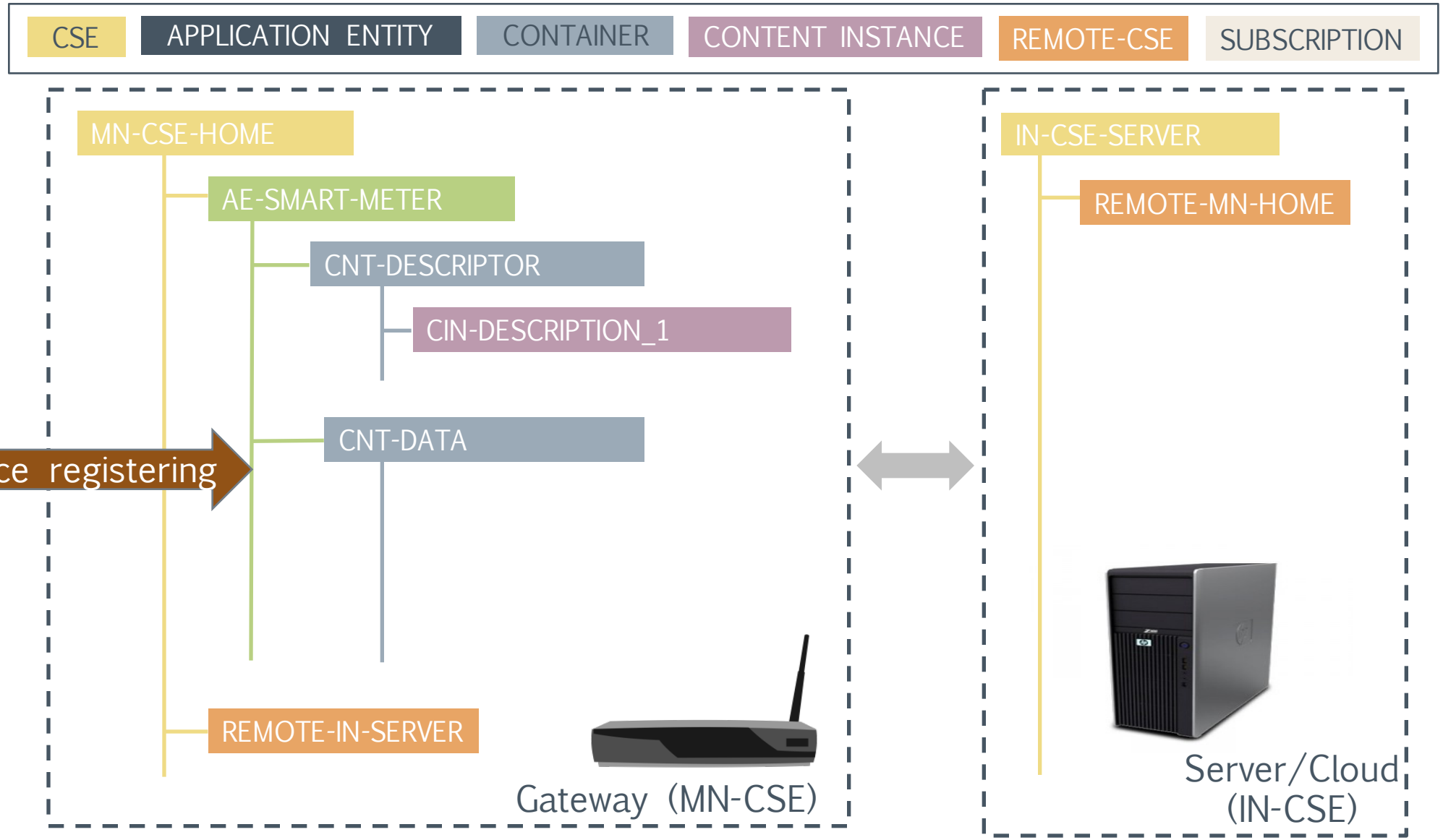
IN-CSE-SERVER

Server/Cloud
(IN-CSE)

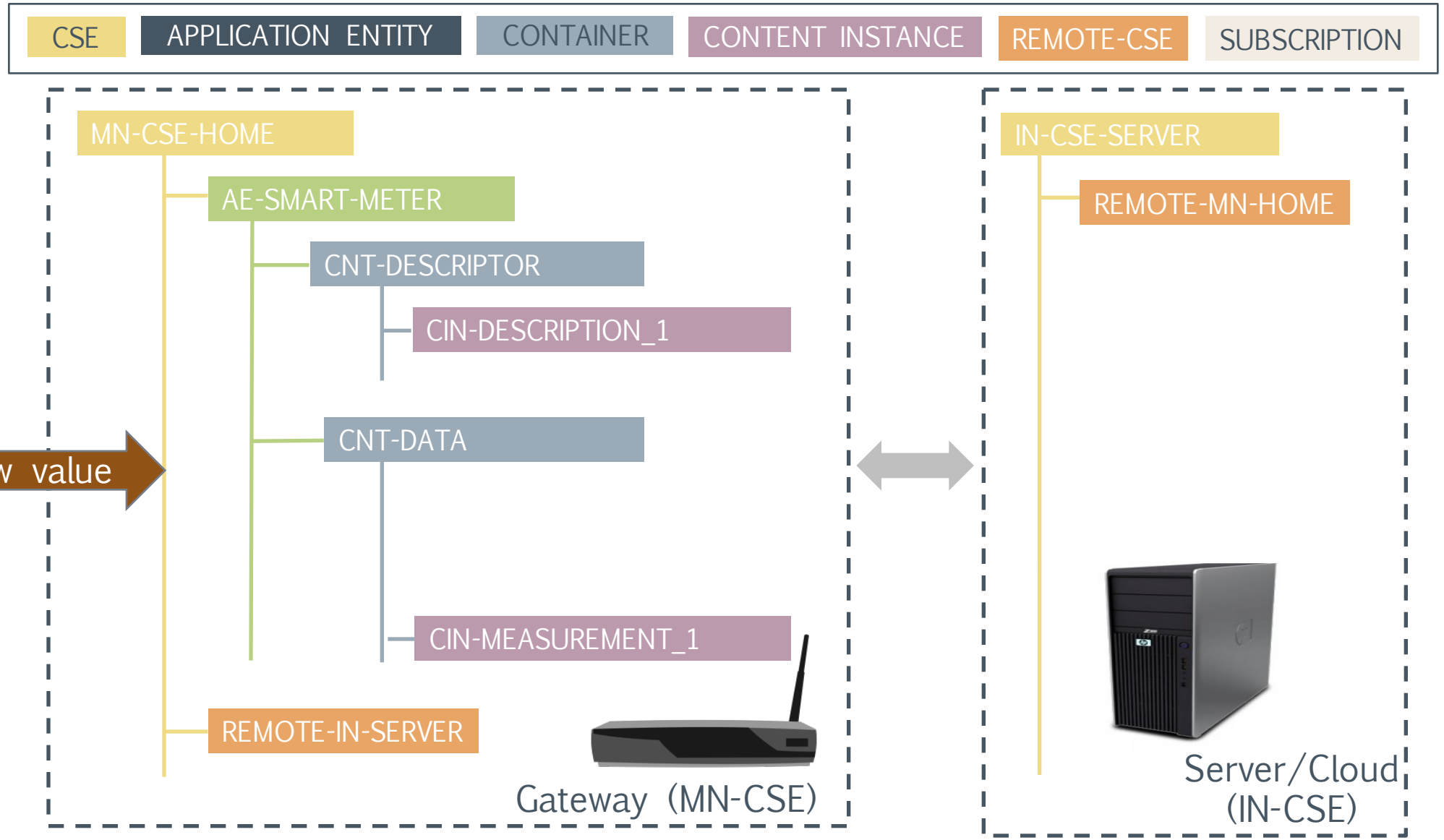
OM2M resource tree example



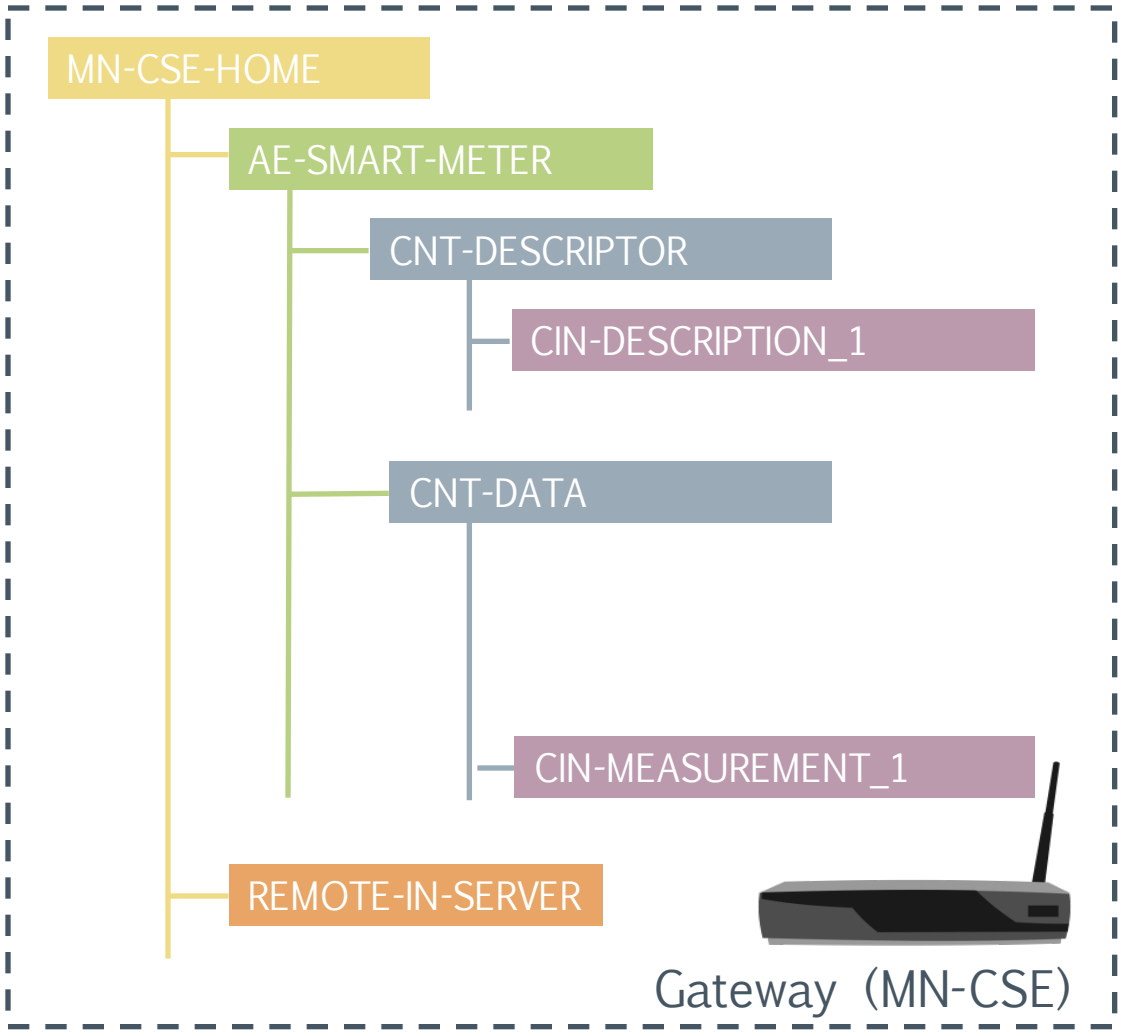
OM2M resource tree example



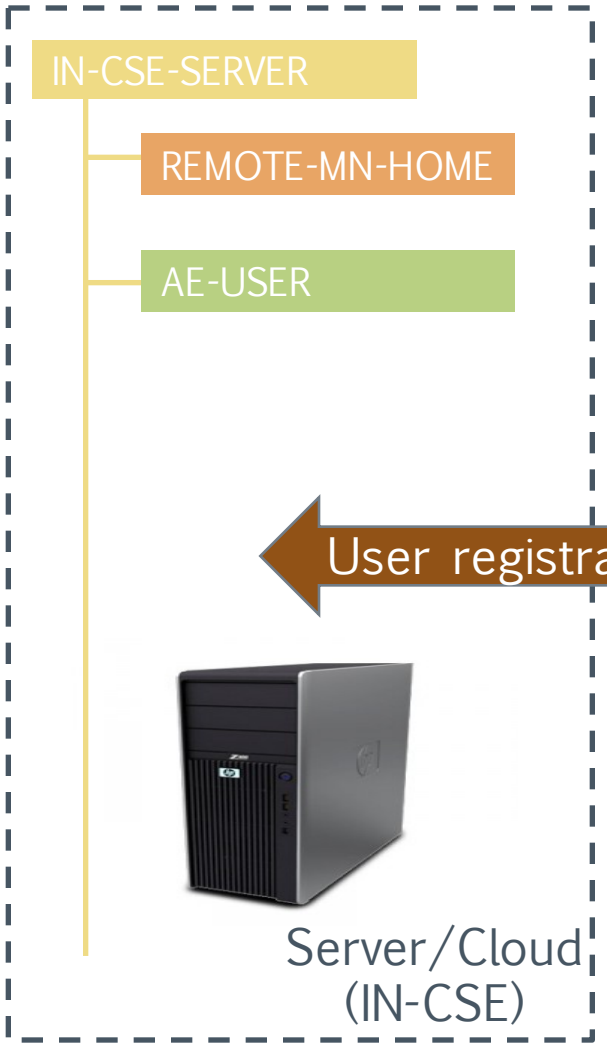
OM2M resource tree example



OM2M resource tree example



Smart Meter (ADN)



User registration

End user (DA)

OM2M resource tree example

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

Smart Meter (ADN)

MN-CSE-HOME

AE-SMART-METER

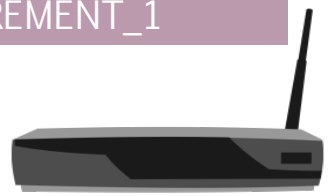
CNT-DESCRIPTOR

CIN-DESCRIPTION_1

CNT-DATA

CIN-MEASUREMENT_1

REMOTE-IN-SERVER



Gateway (MN-CSE)

IN-CSE-SERVER

REMOTE-MN-HOME

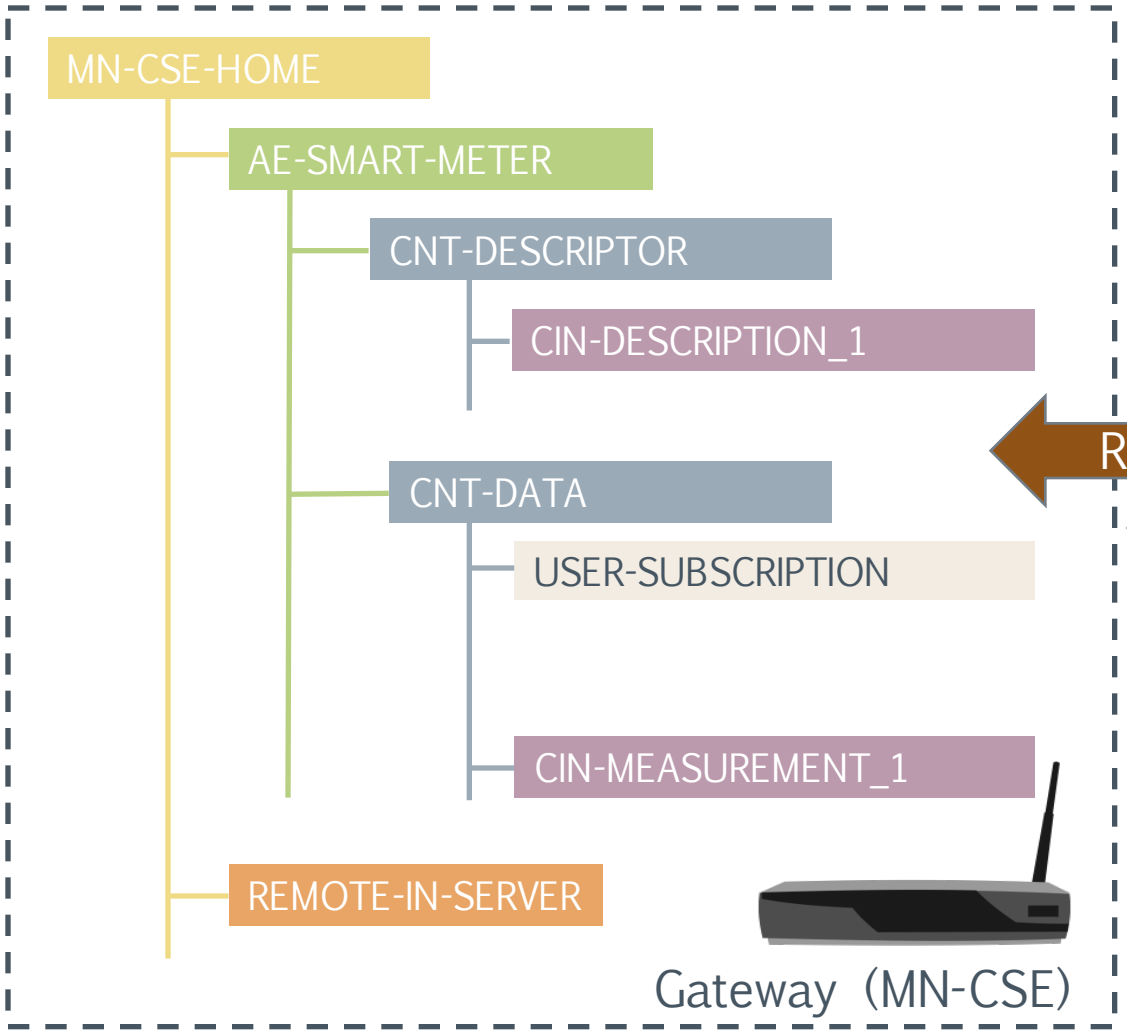
AE-USER

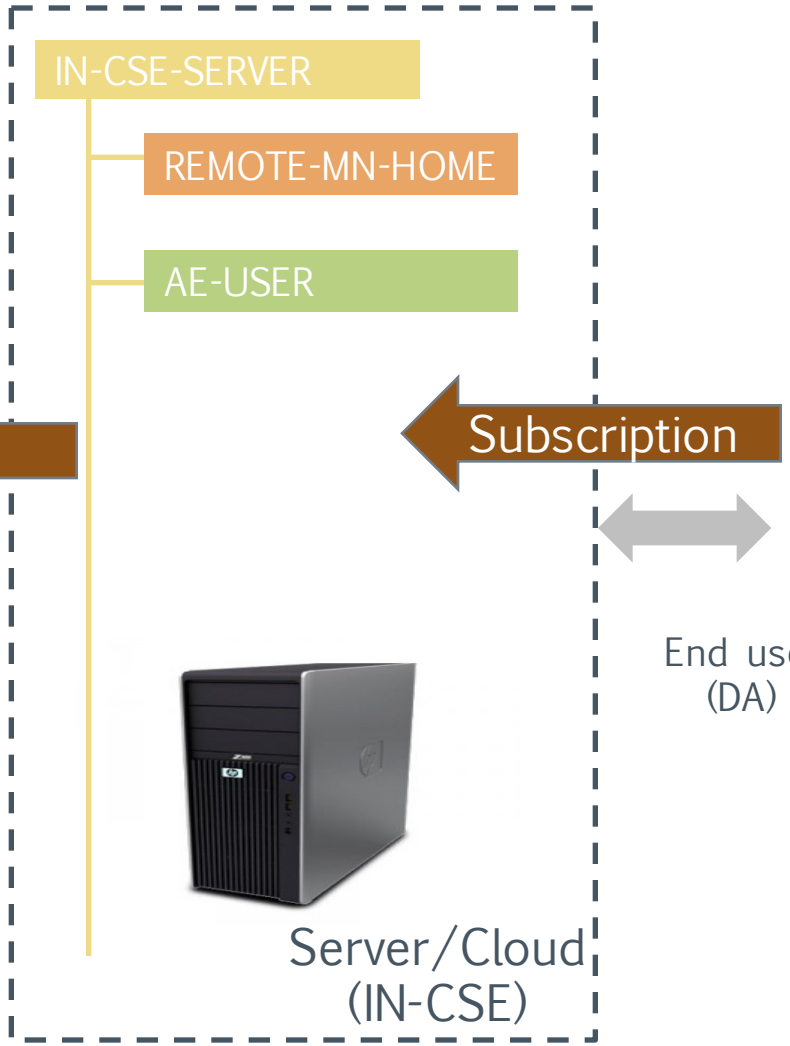
Subscription

End user (DA)

Server/Cloud (IN-CSE)

OM2M resource tree example





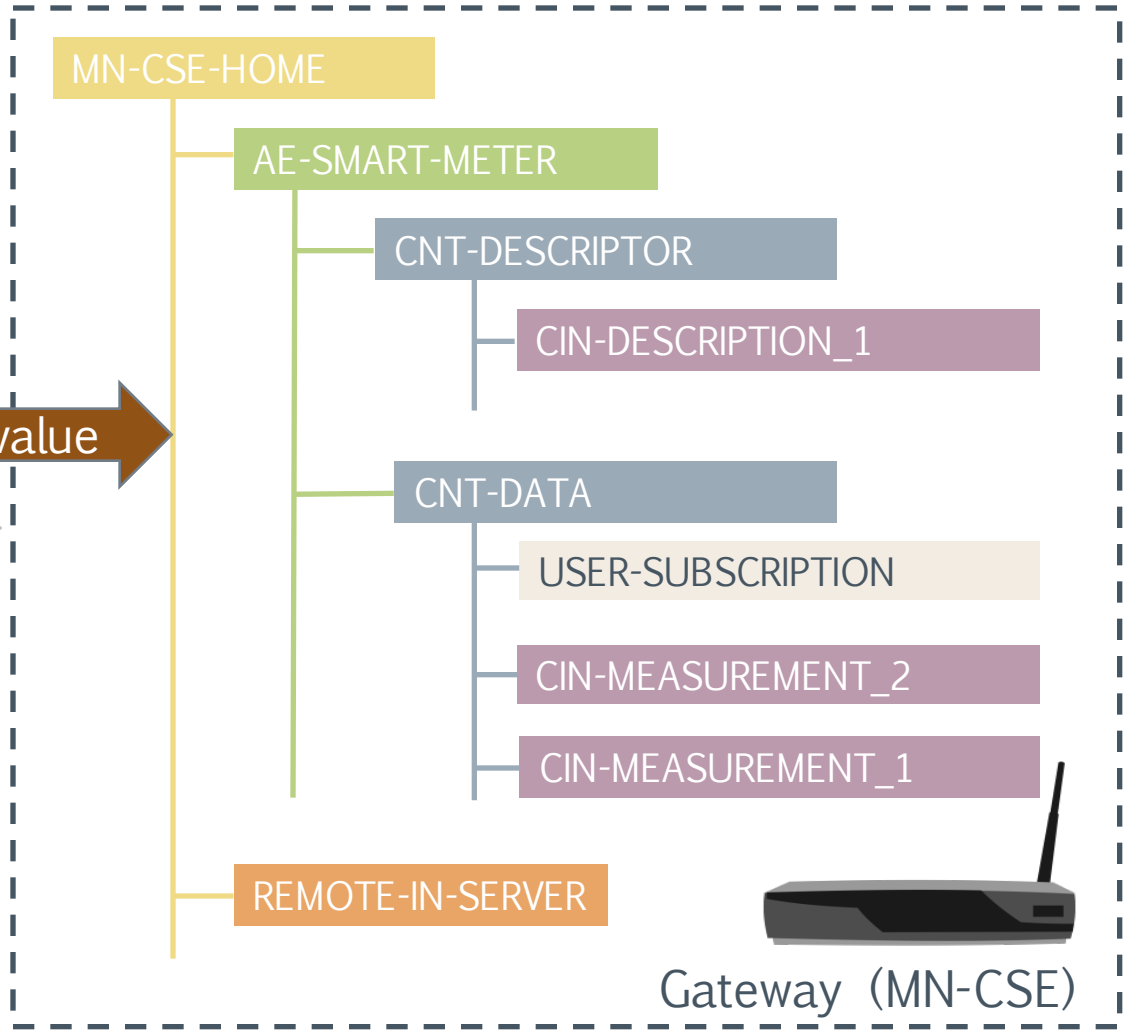
Redirect

Subscription

Smart Meter
(ADN)

End user
(DA)

OM2M resource tree example

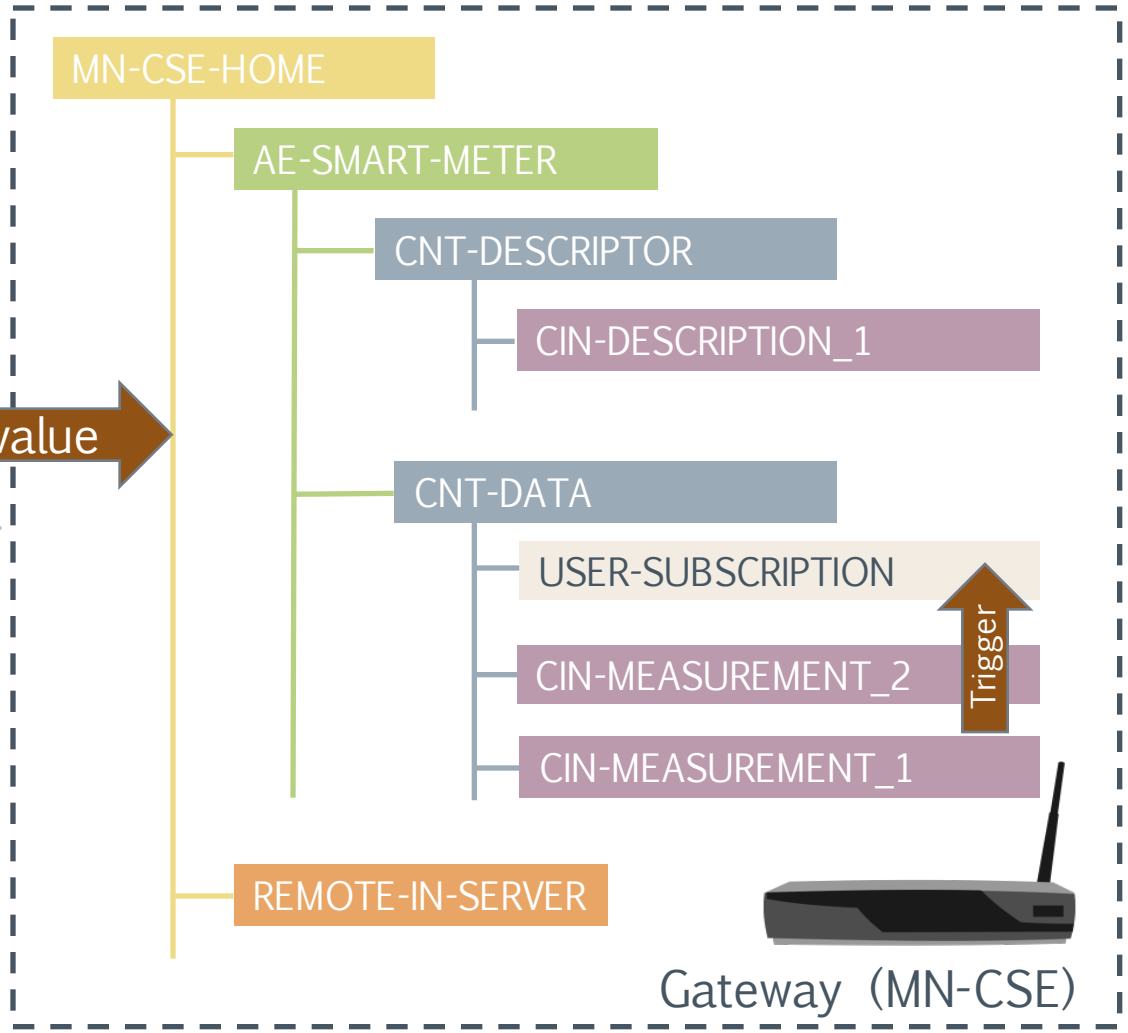


New value

Smart Meter
(ADN)

End user
(DA)

OM2M resource tree example

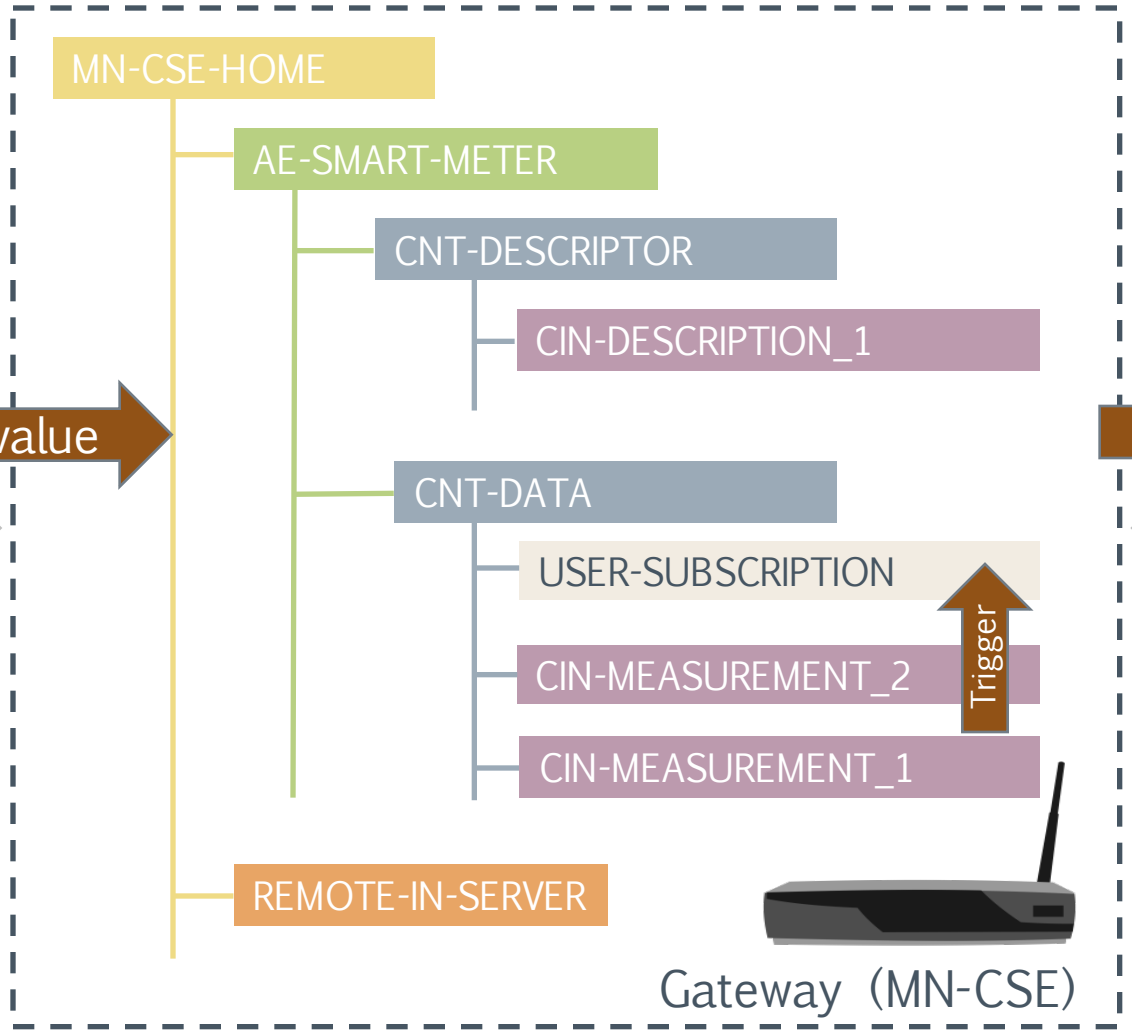


New value

Smart Meter
(ADN)

End user
(DA)

OM2M resource tree example



Smart Meter
(ADN)

New value

Redirect

Redirect

End user
(DA)

OM2M resource tree example

Smart Meter (ADN)

MN-CSE-HOME

AE-SMART-METER

CNT-DESCRIPTOR

CIN-DESCRIPTION_1

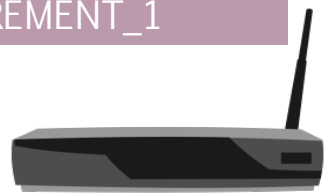
CNT-DATA

USER-SUBSCRIPTION

CIN-MEASUREMENT_2

CIN-MEASUREMENT_1

REMOTE-IN-SERVER



Gateway (MN-CSE)

IN-CSE-SERVER

REMOTE-MN-HOME

AE-USER

Server/Cloud (IN-CSE)

End user (DA)

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**: monteil@laas.fr
    - **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