AUTOPILOT

ICON oneM2M platform

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TIM provides an instance of ICON, a store&share platform compliant with oneM2M standard

oneM2M (http://www.onem2m.org/) is a standards for Machine to Machine (M2M) Communications and the Internet of Things (IoT).

oneM2M is a global organization that defines requirements, architecture, API specifications, security solutions and interoperability for M2M and IoT technologies

Main features supported by oneM2M standard:

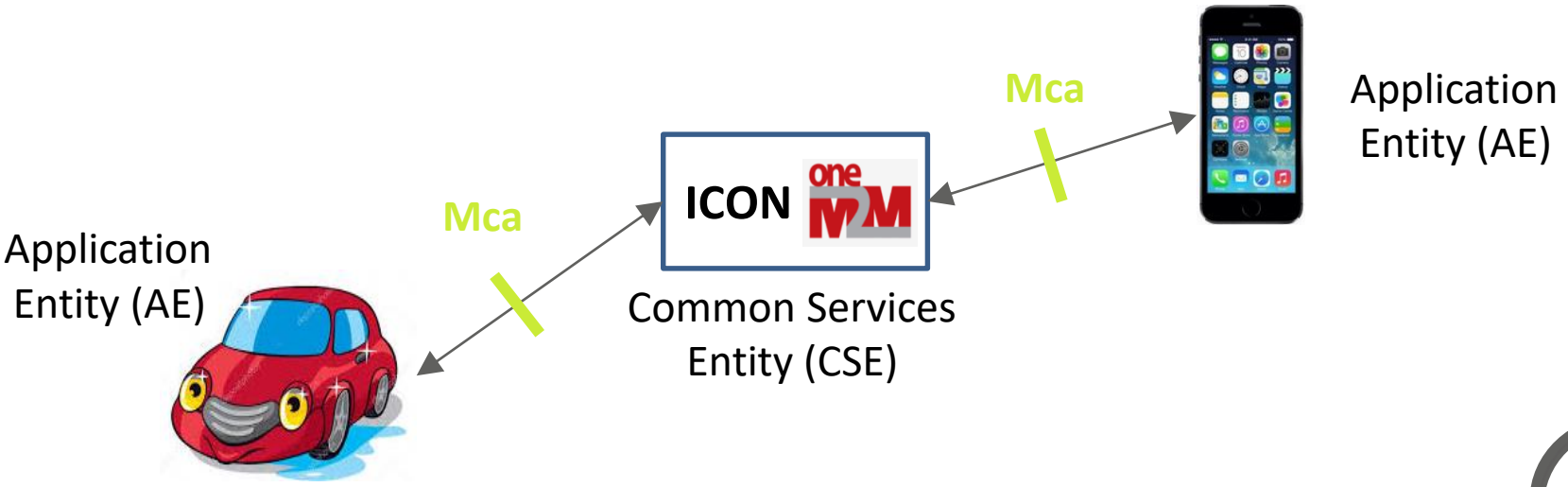
- Software/middleware layer
- Common set of functions to applications via APIs
- Stores and shares data
- Access control
- Notify about events to applications

oneM2M entities

In the oneM2M functional architecture two basic types of entities are defined:

- **Application Entity (AE)** that produces data (e.g. RSU, OBU) or reads data (e.g. a cloud application or an app of a smartphone)
- **Common Services Entity (CSE)** provides a common set of functions: Data Management & Repository, Subscription & Notification, Registration, Security etc. **ICON platform is a CSE**

The **Mca reference point** is used to interface an AE and CSE.



ICON platform

ICON platform: what is

- **TIM provides the oneM2M platform as Platform as a Service** (**PaaS**) that is a cloud model that provides all the infrastructure required to create and manage custom cloud applications
- ICON is installed in a TIM Self Data Center, a commercial platform for hosting, managed by TIM
- The platform is exposed on public Internet at https://icon-lab.tim.it
- It is based on Ocean platform, an open source product developed by a Korean consortium

Main features of ICON platform

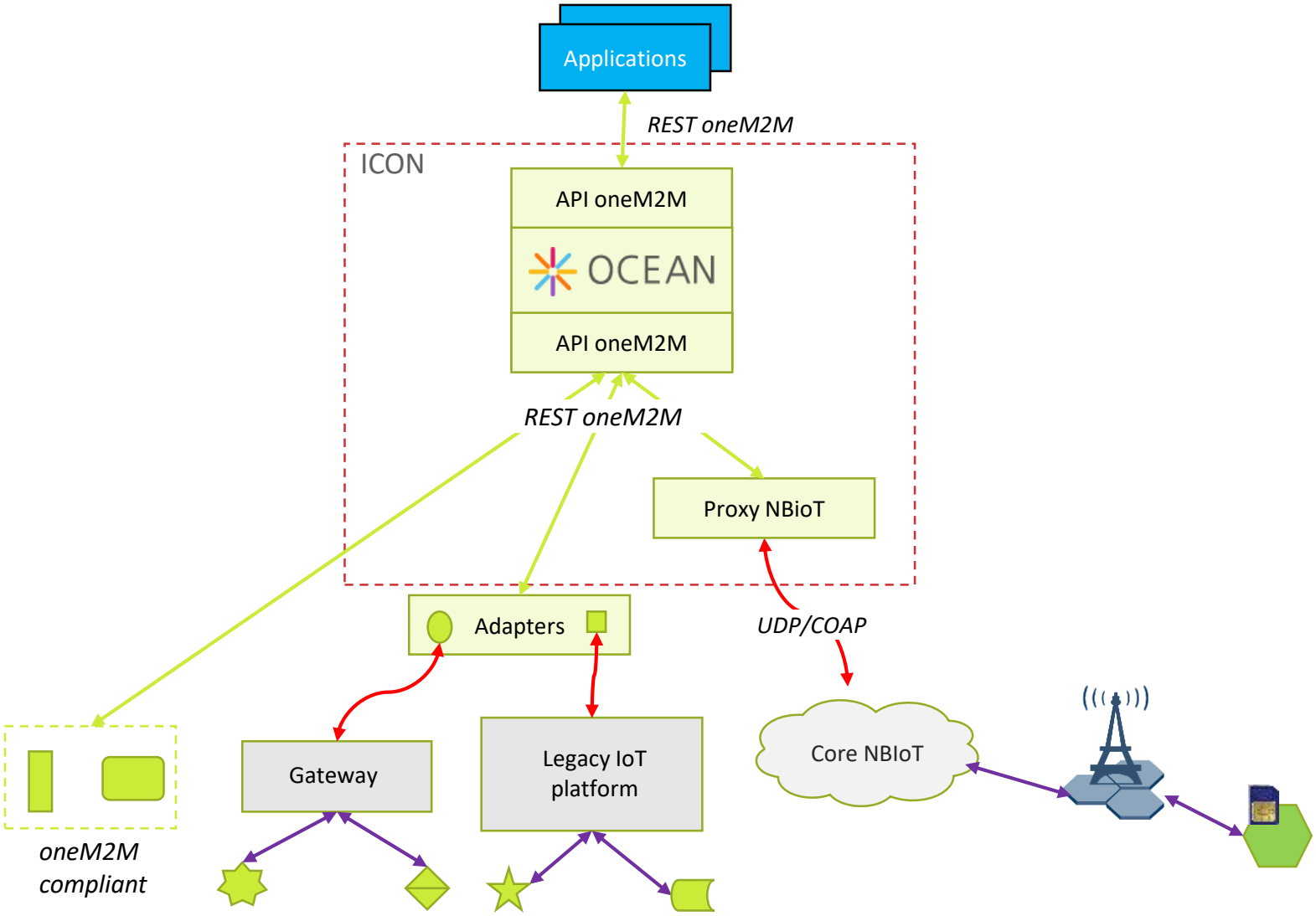
- Compliance with the oneM2M standard
- Southbound and northbound Rest APIs for data storage and sharing
- Data sharing by means of pull/push (subscription/notification)
- URIs for identifying resources
- Web console for resource management and provisioning
- Web console for administrators
- Service independent, interworking with legacy platforms and non-OneM2M platforms by means of Adapters/Proxies
- Multi-tenancy: each tenant has credentials for access to its data

Security of ICON platform

Security is based on the following features:

- oneM2M services and APIs are exposed through SSL (HTTPS, MQTTS).
- Authorization is based on credentials (username/password) associated with a specific user (tenant).
- An Access Control Policy (ACP) needs to be created for each Application Entity; ACP is defined as a set of conditions that determine whether entities are permitted to access a protected resource.

Platform high-level architecture

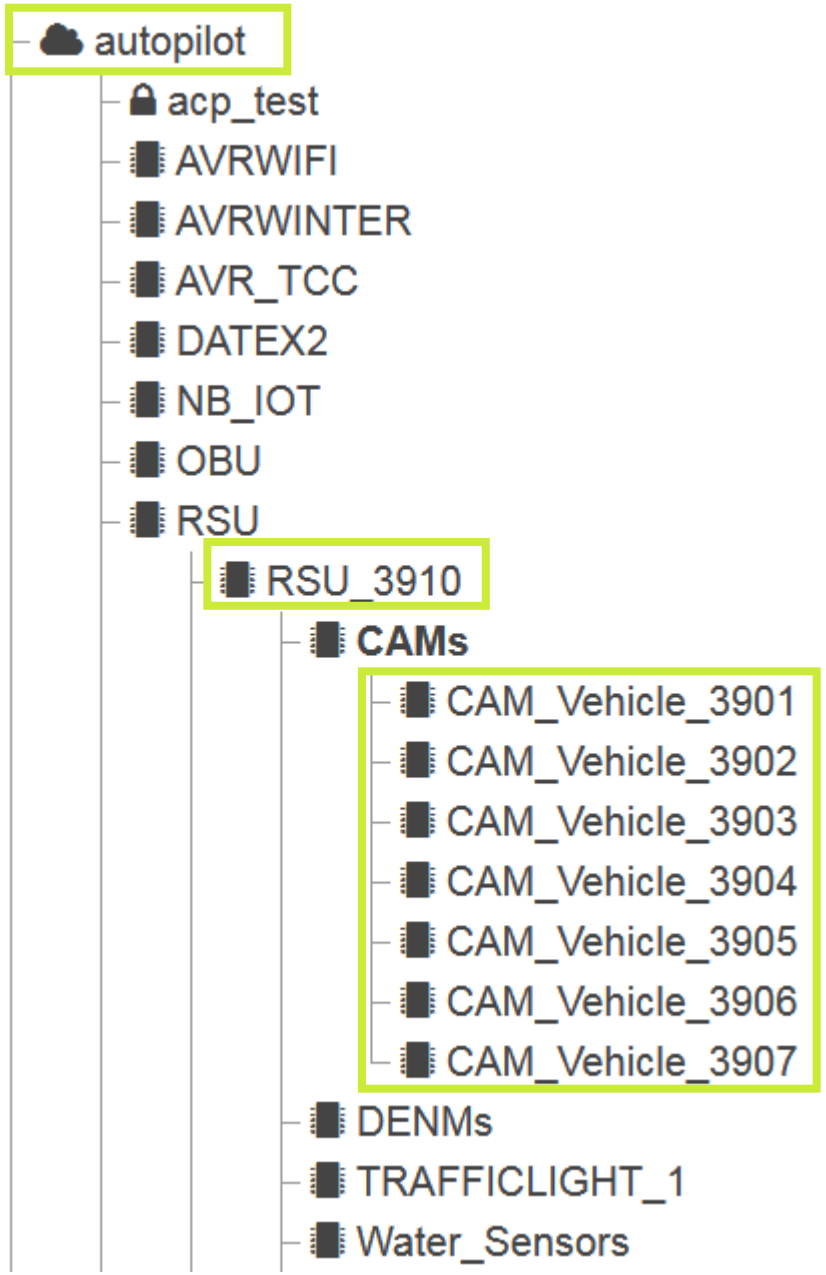


Resource tree

Resource tree

The resource tree is the data structure used by ICON platform

In the figure an example of resource tree for Autopilot tenant: for each RSU there is a container for CAM messages for each vehicle of pilot site



Example of a message

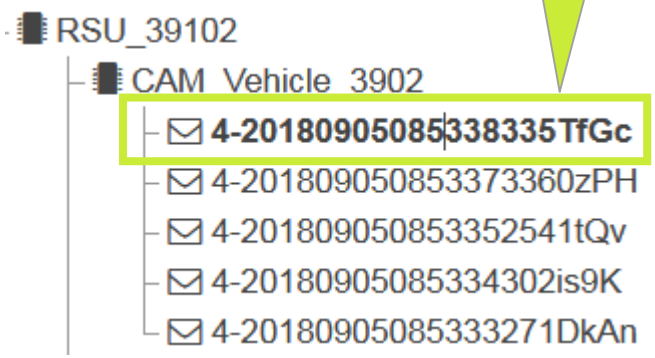
An example of a CAM message received and stored on ICON platform

Values of attributes

oneM2M attributes: Name, ID, time, type of content, etc.

Identifier

A CAM message that is the content stored on ICON



Attribute	Value
pi: parentID	SkG9OYG6wm
ty: resourceType	4 (contentInstance)
ct: creationTime	2018-09-05 10:53:38
ri: resourceID	SJf5qYfpPm
rn: resourceName	4-20180905085338335TfGc
lt: lastModifiedTime	2018-09-05 10:53:38
et: expirationTime	2028-09-05 10:53:38
acpi: accessControlPolicyIDs	AccessControlPolicyIDs: /onem2m/acp_autopilot
st: stateTag	29
cs: contentSize	1135
cr: creator	autopilot_prod
cnf: contentInfo	application/json:0
con: content	


```
{
    "header": {
        "rsuID": "39102",
        "timestamp": "463222418022"
    },
    "payload": {
        "cam": {
            "camParameters": {
                "basicContainer": {
                    "referencePosition": {
                        "altitude": {
                            "altitudeConfidence": 15,
                            "altitudeValue": 4
                        },
                        "latitude": 436224860,
                        "longitude": 104563710,
                        "positionConfidenceEllipse": {
                            "semiMajorConfidence": 4095
                            "semiMajorOrientation": 360
                            "semiMinorConfidence": 4095
                        }
```

Interfaces

Interfaces

These are the interfaces available on ICON platform compliant with oneM2M standard:

- **HTTPS** (JSON format)
- **MQTTS** (a simple messaging protocol, designed for constrained devices and with low-bandwidth)
- **CoAP** (a protocol that allows small devices with low-power sensors and actuators to communicate over the Internet)

«Adaptation layer» for converting a custom protocol/interface to oneM2M standard protocol supported by ICON