Eclipse OM2M: an open-source oneM2M-compliant IoT platform

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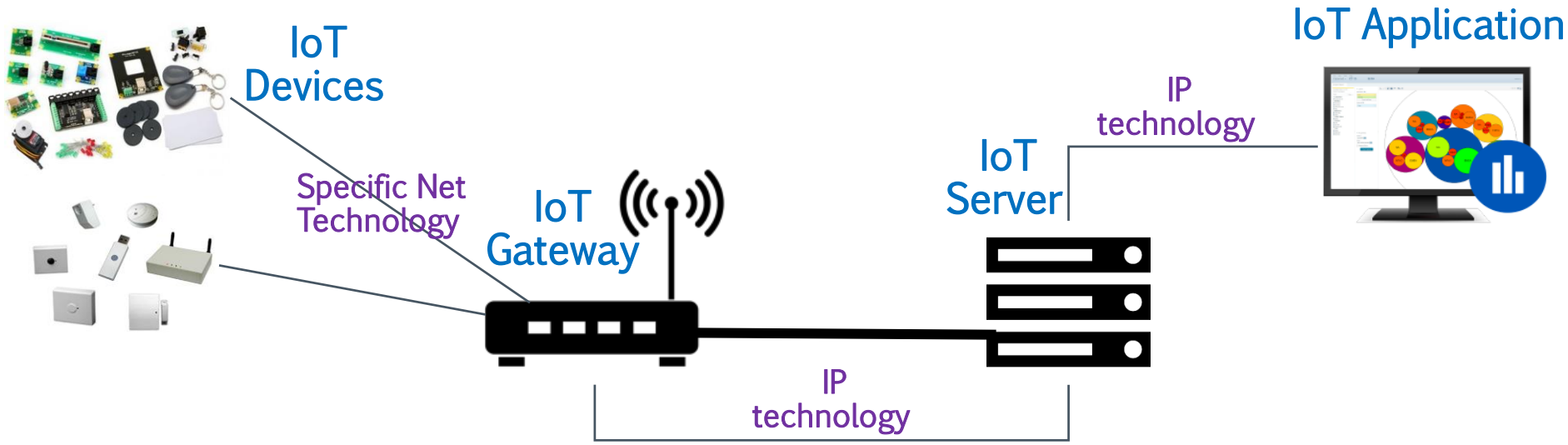
Plan

- Deployment scenario
- Baseline scenario
- REST API
  - ApplicationEntity
  - Container
  - ContentInstance
  - Subscription & Notification
  - Discovery features

OM2M REST API

- Deployment example:



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- IoT Gateway – IoT Server : IP Technology
- IoT Server – IoT Application : IP Technology

OM2M REST API

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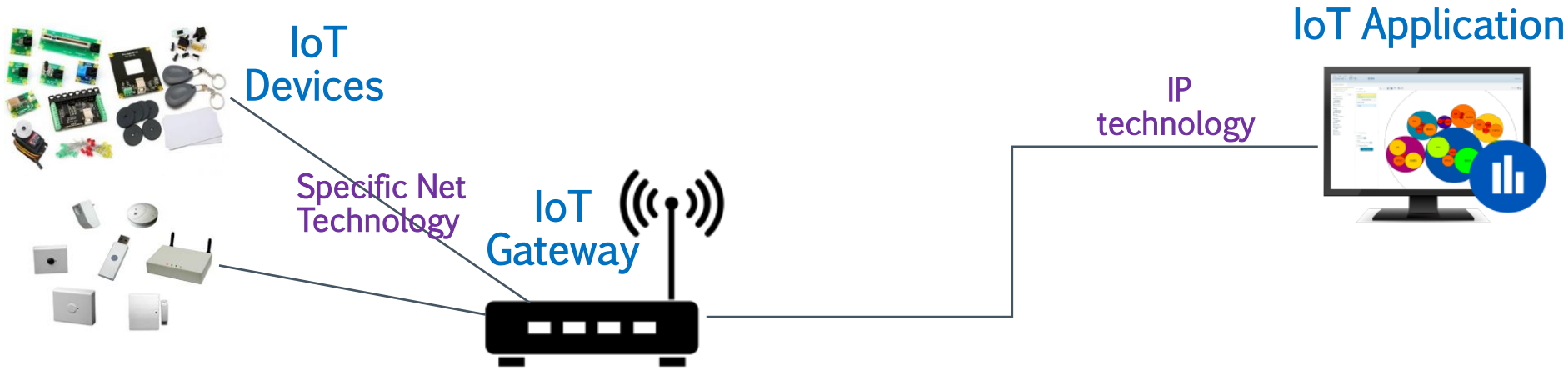

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OM2M REST API

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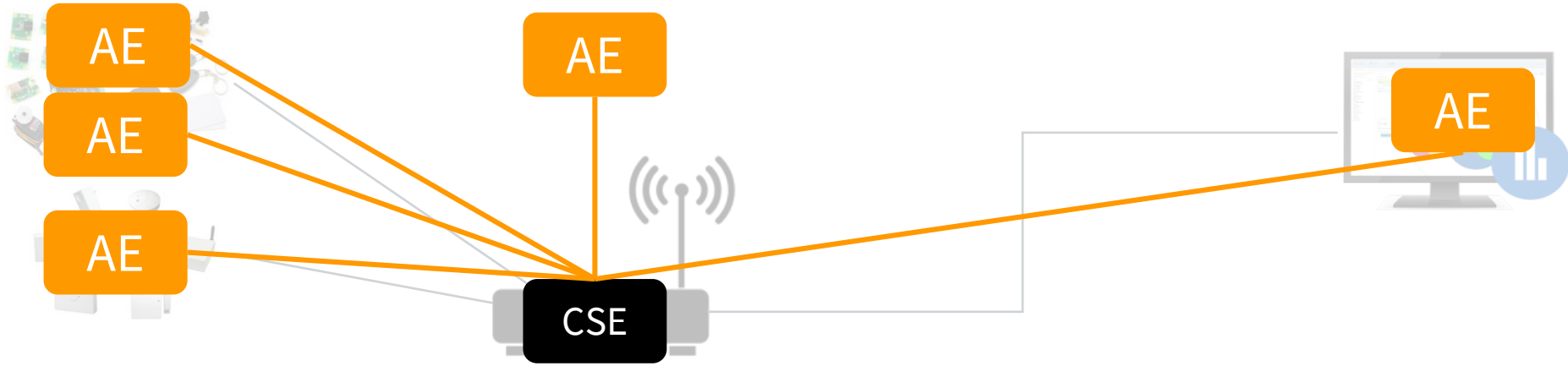
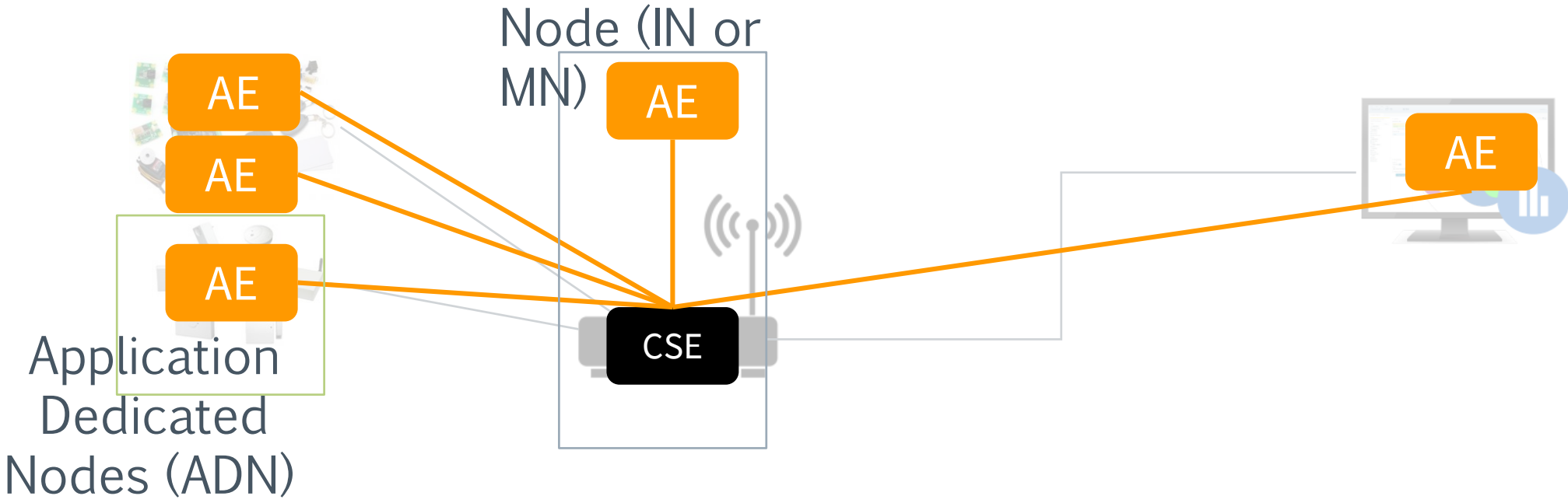


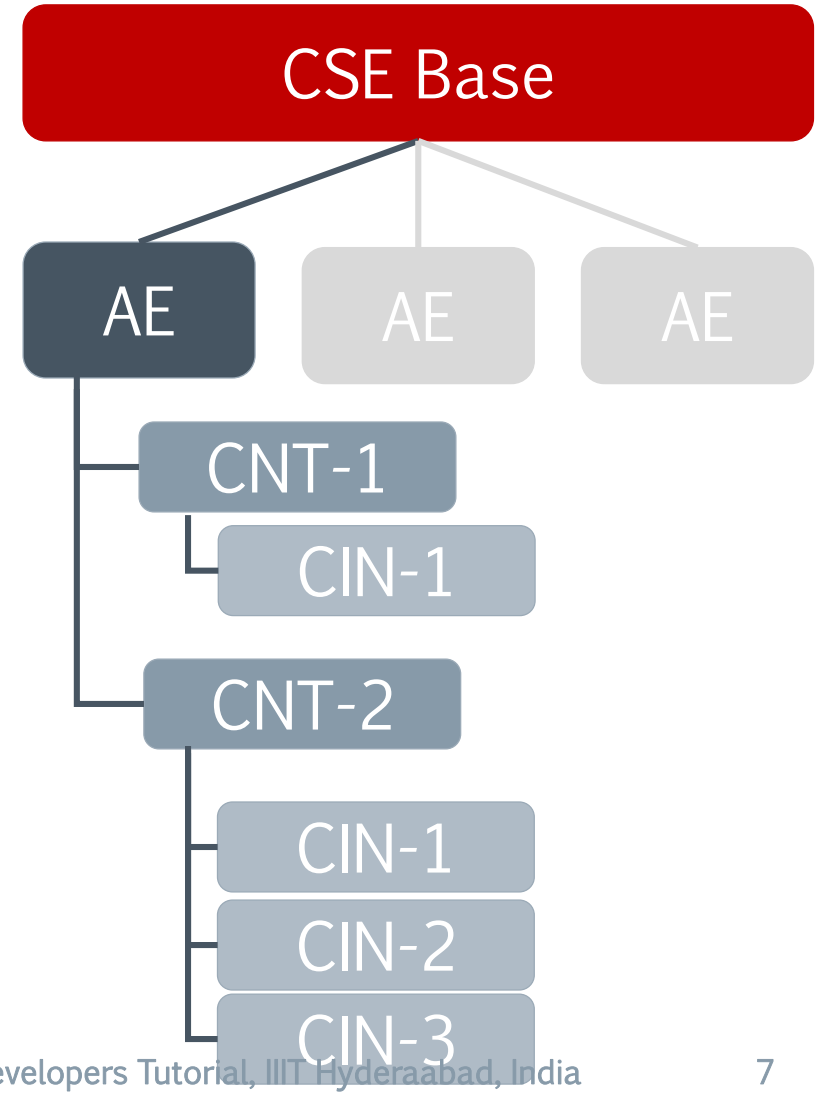
OM2M REST API

- Deployment example:



OM2M REST API

- Important resources:
  - CSE : oneM2M middleware node
    - A set of common services deployed within the same software entity
  - AE : Application Entity
    - A logical representation of a device, application, process
  - CNT : Container
    - A way to organize “data” in the oneM2M resource tree
  - CIN : Content Instance
    - Instance of the “data” in a container
  - SUB : Subscription
    - Description of a subscription to any modification of a resource
  - NOTIFY : Notification
    - The description of the resource update that is transmitted to subscribers.



OM2M resource tree example

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

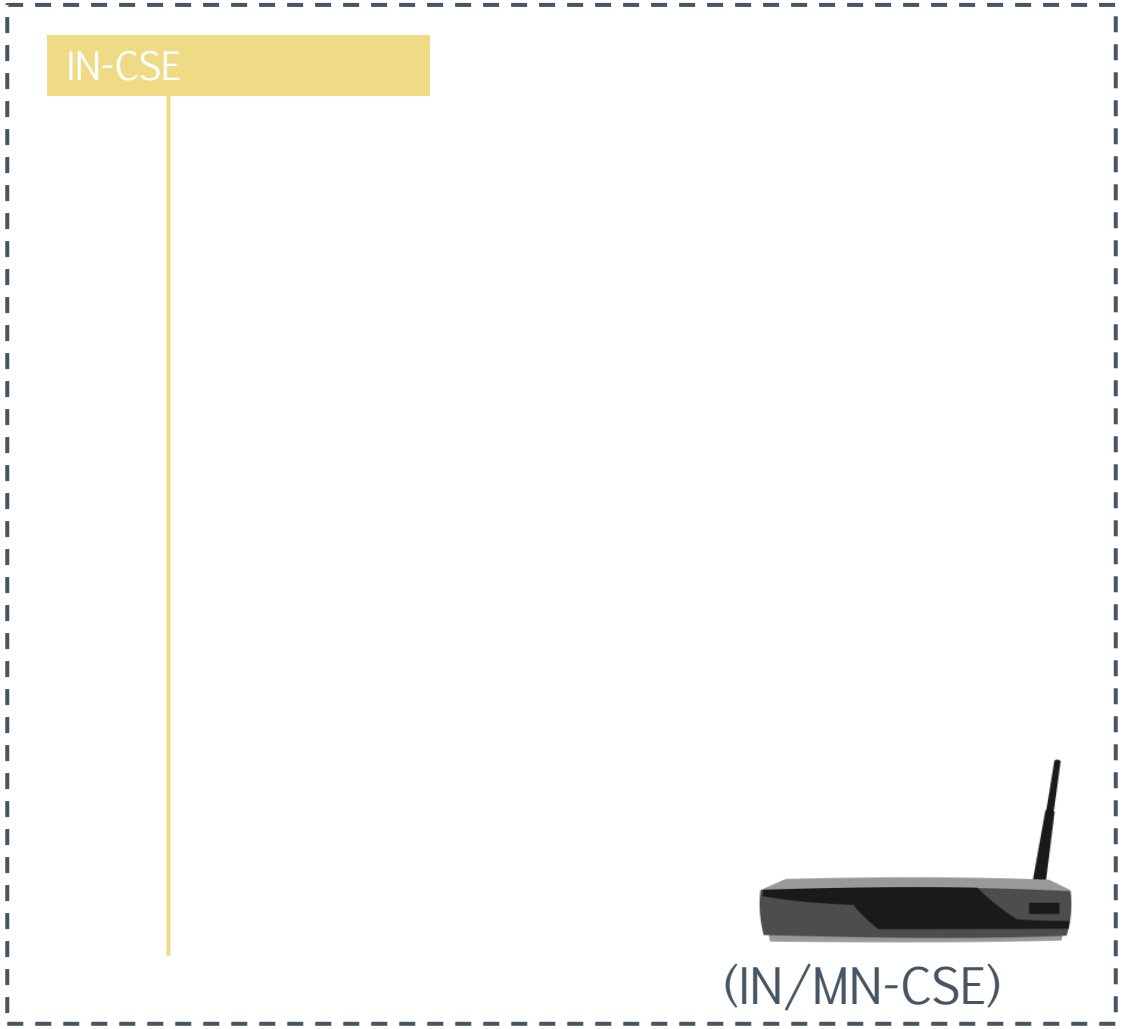
Smart Meter (ADN)

Gateway (IN/MN-CSE)

End user (DA)

OM2M resource tree example

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



Request-URI

REST API

- Creation/Registration of an Application Entity (AE)

```
POST ~/in-cse/in-name
Host: 127.0.0.1:8080
X-M2M-Origin: admin:admin
Content-type: application/xml;ty=2

<m2m:ae xmlns:m2m="http://www.onem2m.org/xml/protocols" rn="AE_LumSensor" >
    <api>app-sensor</api>
    <lbl>Type/sensor Category/luminosity Location/home</lbl>
    <rr>false</rr>
</m2m:ae>

Expected result : 201 Created
```

Request-URI

REST API

- Creation of a Container (Descriptor)

```
POST ~/in-cse/in-name/AE_LumSensor
Host: 127.0.0.1:8080
X-M2M-Origin: admin:admin
Content-type: application/xml;ty=3

<m2m:cnt xmlns:m2m="http://www.onem2m.org/xml/protocols" rn="DESCRIPTOR" >
</m2m:cnt>

Expected result : 201 Created
```

Request-URI

REST API

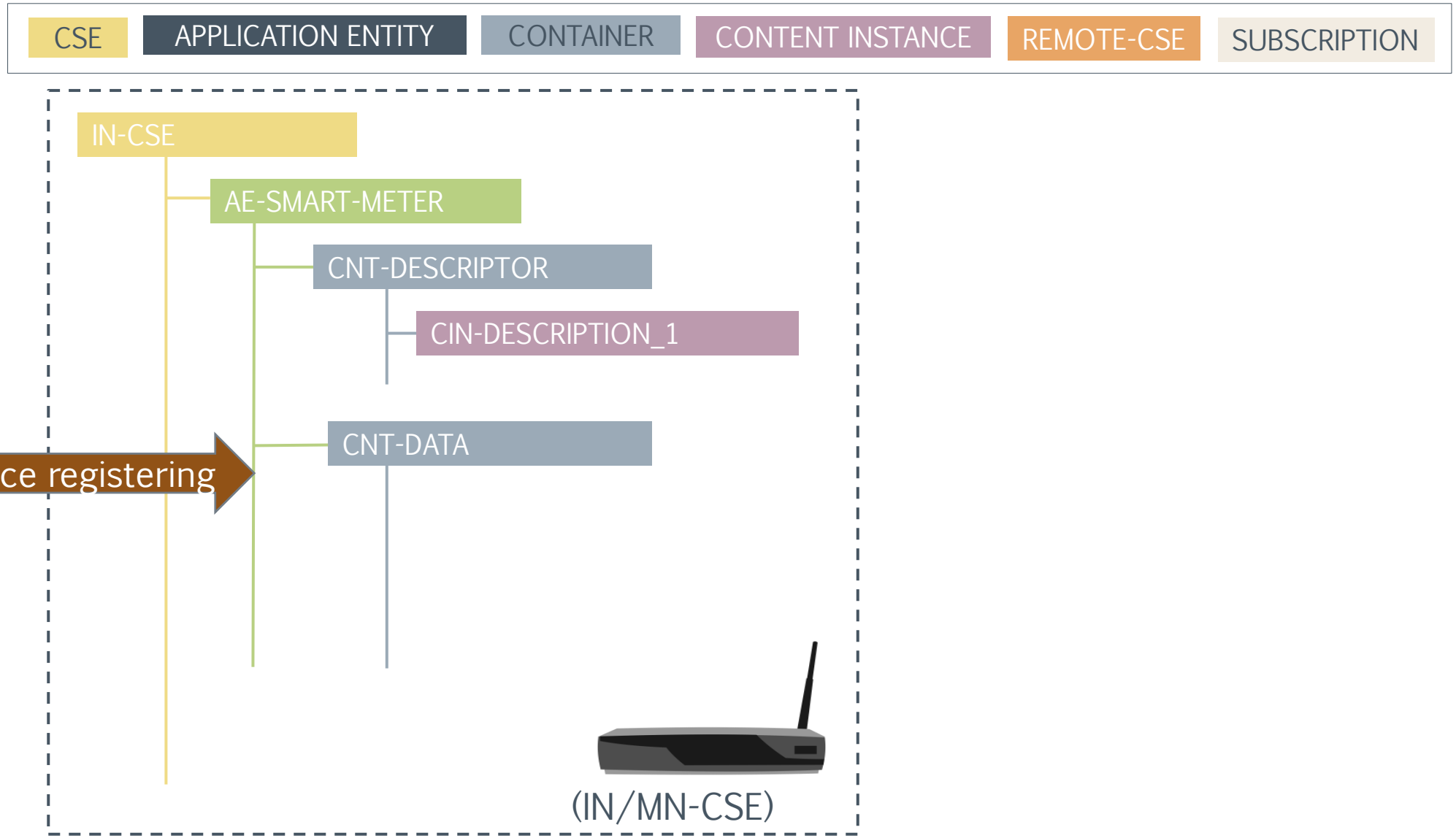
- Creation of a Container (Data)

```
POST ~/in-cse/in-name/AE_LumSensor
Host: 127.0.0.1:8080
X-M2M-Origin: admin:admin
Content-type: application/xml;ty=3

<m2m:cnt xmlns:m2m="http://www.onem2m.org/xml/protocols" rn="DATA" >
</m2m:cnt>

Expected result : 201 Created
```

OM2M resource tree example



Request-URI

REST API

- Creation of a ContentInstance (initial description)

```
POST ~/in-cse/in-name/AE_LumSensor/DESCRIPTOR
Host: 127.0.0.1:8080
X-M2M-Origin: admin:admin
Content-type: application/xml;ty=4

<m2m:cin xmlns:m2m="http://www.onem2m.org/xml/protocols">
    <cnf>application/xml</cnf>
    <con>
        <obj>
            <str name="type" val="Luminosity_Sensor"/>
            <str name="location" val="Home"/>
            <str name="appId" val="AE_LumSensor"/>
            <op name="getValue" href="/in-cse/in-name/AE_LumSensor/DATA/la"
         in="obix:Nil" out="obix:Nil" is="retrieve"/>
        </obj>
    </con>
</m2m:cin>

Expected result : 201 Created
```

Request-URI

REST API

- Creation of a ContentInstance (initial description)

```
POST ~/in-cse/in-name/AE_LumSensor/DESCRIPTOR
Host: 127.0.0.1:8080
X-M2M-Origin: admin:admin
Content-type: application/xml;ty=4

<m2m:cin xmlns:m2m="http://www.onem2m.org/xml/protocols">
    <cnf>application/xml</cnf>
    <con>
        &lt;obj&gt;
            &lt;str name=&quot;type&quot; val=&quot;Luminosity_Sensor&quot;/ &gt;
            &lt;str name=&quot;location&quot; val=&quot;Home&quot;/ &gt;
            &lt;str name=&quot;appId&quot; val=&quot;AE_LumSensor&quot;/ &gt;
            &lt;op name=&quot;getValue&quot; href=&quot;/in-cse/in-name
            /AE_LumSensor/DATA/la&quot; in=&quot;obix:Nil&quot; out=&quot;obix:Nil&quot;
            is=&quot;retrieve&quot;/ &gt;
        &lt;/obj &gt;
    </con>
</m2m:cin>

Expected result : 201 Created
```

REST API

- Creation of a ContentInstance (data instance)

Request-URI

```
POST ~/in-cse/in-name/AE_LumSensor/DATA
Host: 127.0.0.1:8080
X-M2M-Origin: admin:admin
Content-type: application/xml;ty=4

<m2m:cin xmlns:m2m="http://www.onem2m.org/xml/protocols">
    <cnf>application/xml</cnf>
    <con>
      &lt;obj&gt;
        &lt;str name=&quot;appId&quot; val=&quot;AE_LumSensor&quot;/&gt;
        &lt;str name=&quot;category&quot; val=&quot;luminosity &quot;/&gt;
        &lt;int name=&quot;data&quot; val=&quot;234&quot;/&gt;
        &lt;int name=&quot;unit&quot; val=&quot;lux&quot;/&gt;
      &lt;/obj&gt;
    </con>
</m2m:cin>

Expected result : 201 Created
```

OM2M resource tree example

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

Smart Meter (ADN)

New value

IN-CSE

AE-SMART-METER

CNT-DESCRIPTOR

CIN-DESCRIPTION_1

CNT-DATA

CIN-MEASUREMENT_1

(IN/MN-CSE)

Request-URI

REST API

- Creation of a Subscription (to DATA container updates)

```
POST ~/in-cse/in-name/AE_LumSensor/DATA
Host: 127.0.0.1:8080
X-M2M-Origin: admin:admin
Content-type: application/xml;ty=23

<m2m:sub xmlns:m2m="http://www.onem2m.org/xml/protocols" rn="SUB_AE_LumSensor" >
    <nu>http://127.0.0.1:1400/monitor</nu>
    <nct>1</nct>
</m2m:sub>

Expected result : 201 Created
```

OM2M resource tree example

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

Smart Meter
(ADN)

IN-CSE

AE-SMART-METER

CNT-DESCRIPTOR

CIN-DESCRIPTION_1

CNT-DATA

CIN-MEASUREMENT_1

REMOTE-IN-SERVER

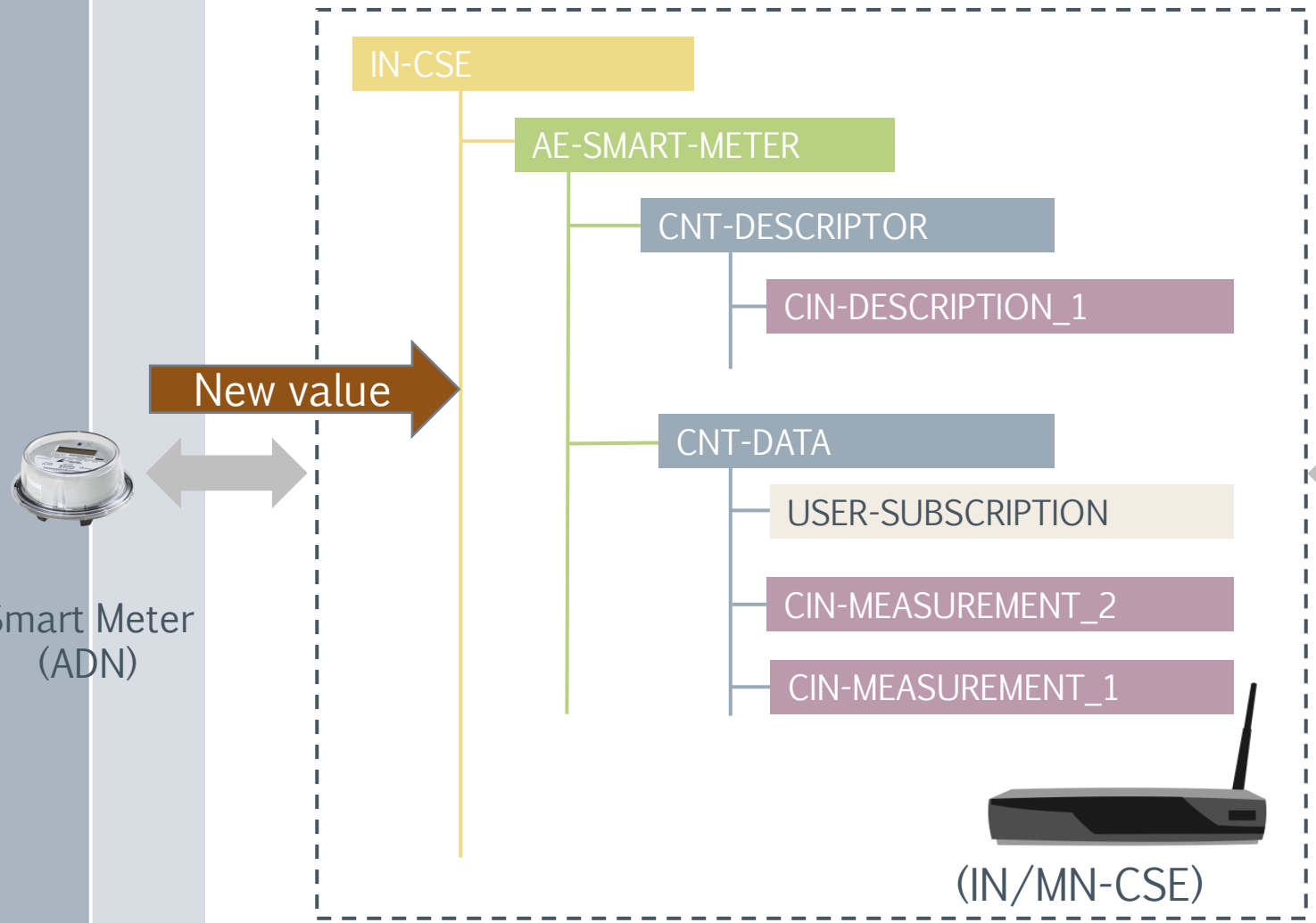
(IN/MN-CSE)

Subscription

End user
(DA)

OM2M resource tree example

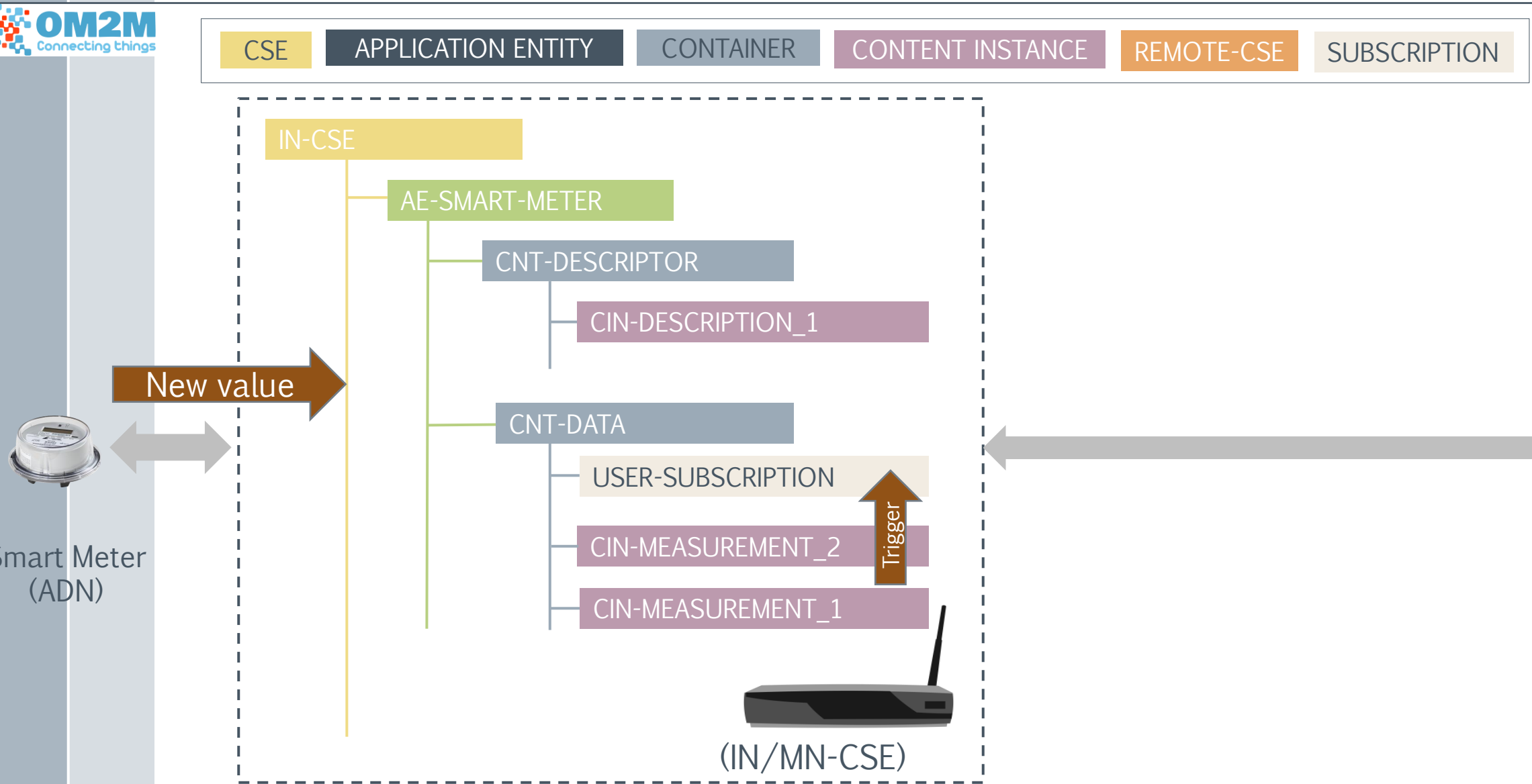
CSE | APPLICATION ENTITY | CONTAINER | CONTENT INSTANCE | REMOTE-CSE | SUBSCRIPTION



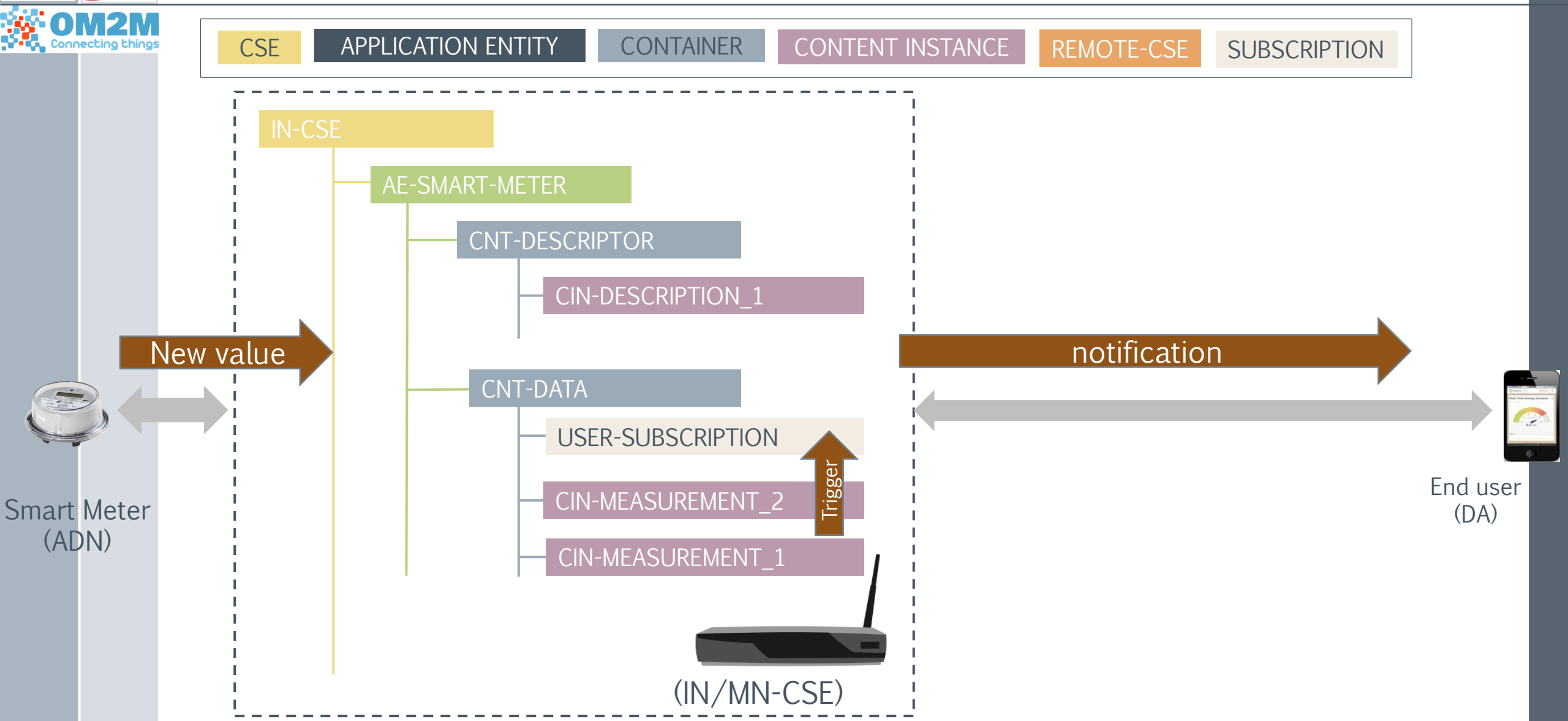
Smart Meter
(ADN)

End user
(DA)

OM2M resource tree example



OM2M resource tree example



Request-URI

REST API

- Reception of a NOTIFY (i.e. notification)

```
<?xml version="1.0" encoding="UTF-8"?>
<m2m:sgn xmlns:m2m="http://www.onem2m.org/xml/protocols">
   <nev>
      <rep rn="cin_name1">
         <ty>4</ty>
         <ri>cin-46677406</ri>
         <pi>/in-cse/cnt-397256037</pi>
         <ct>20151104T162611</ct>
         <lt>20151104T162611</lt>
         <st>0</st>
         <cnf>application/obix</cnf>
         <cs>11</cs>
         <con> <obj>. . . </obj> </con>
      </rep>
      <rss>1</rss>
   </nev>
   <sud>false</sud>
   <sur>/in-cse/in-name/AE_LumSensor/DATA/SUB_AR_LumSensor</sur>
</m2m:sgn>
```

Request-URI

REST API

- Discovery

```
GET ~/in-cse/in-name?fu=1&ty=2
Host: 127.0.0.1:8080
X-M2M-Origin: admin:admin
Accept: application/xml

Response:
<m2m:ae xmlns:m2m="http://www.onem2m.org/xml/protocols" rn="AE_LumSensor" >
    <api>app-sensor</api>
    <lbl>Type/sensor Category/luminosity Location/home</lbl>
    <rr>false</rr>
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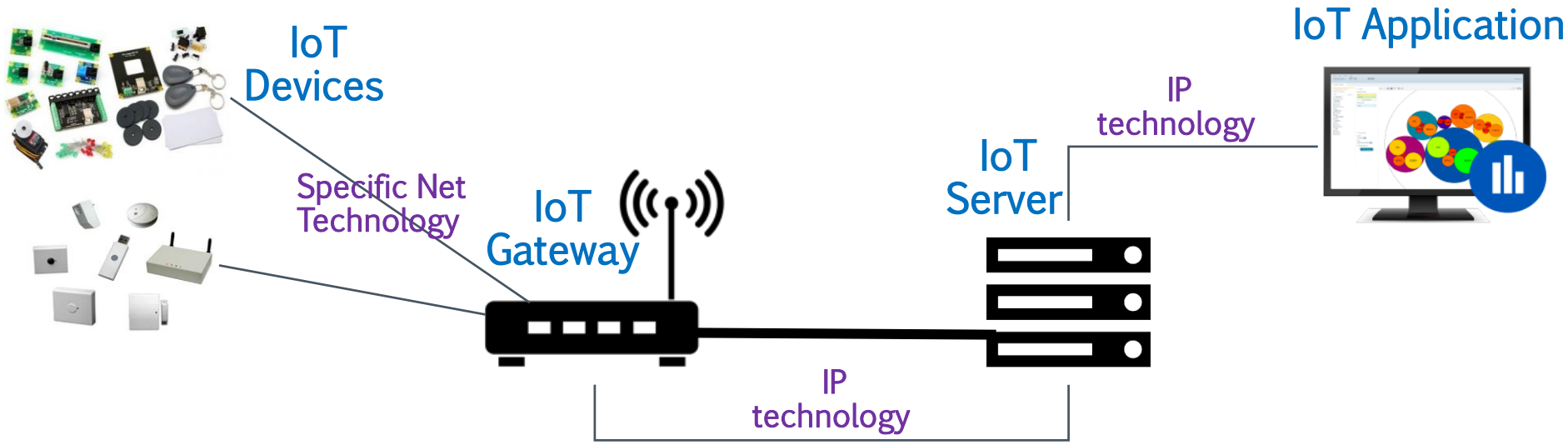

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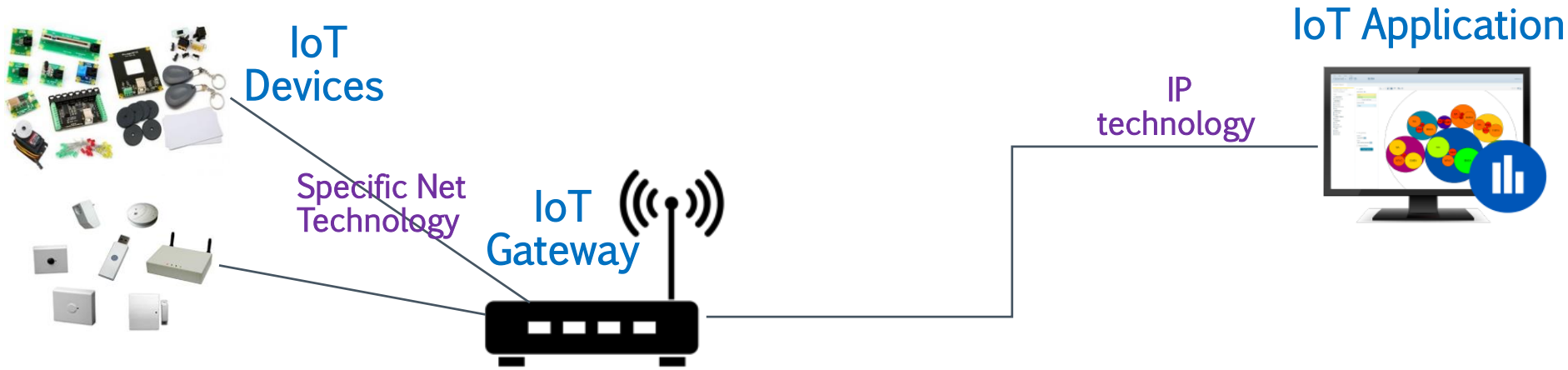

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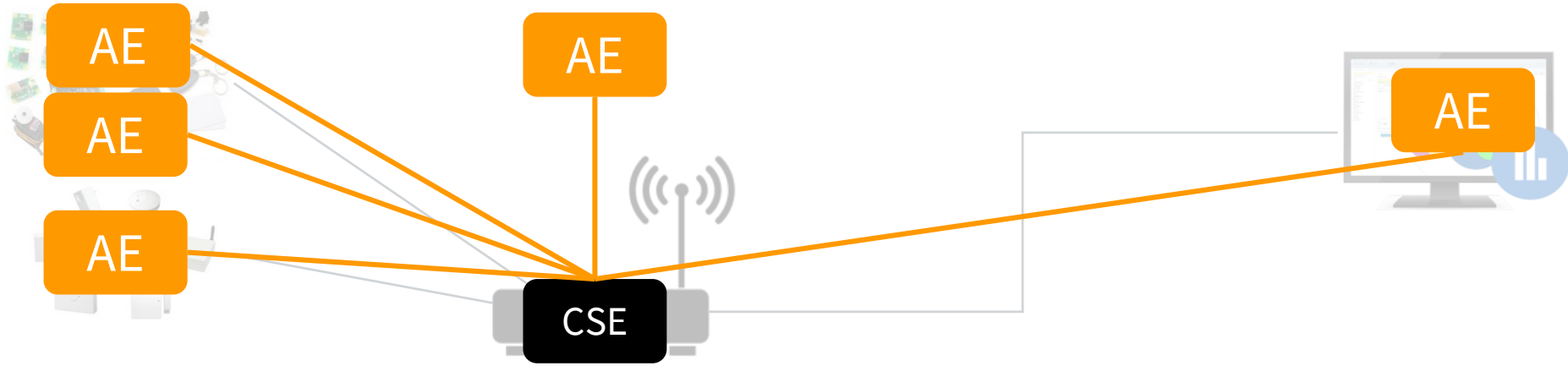

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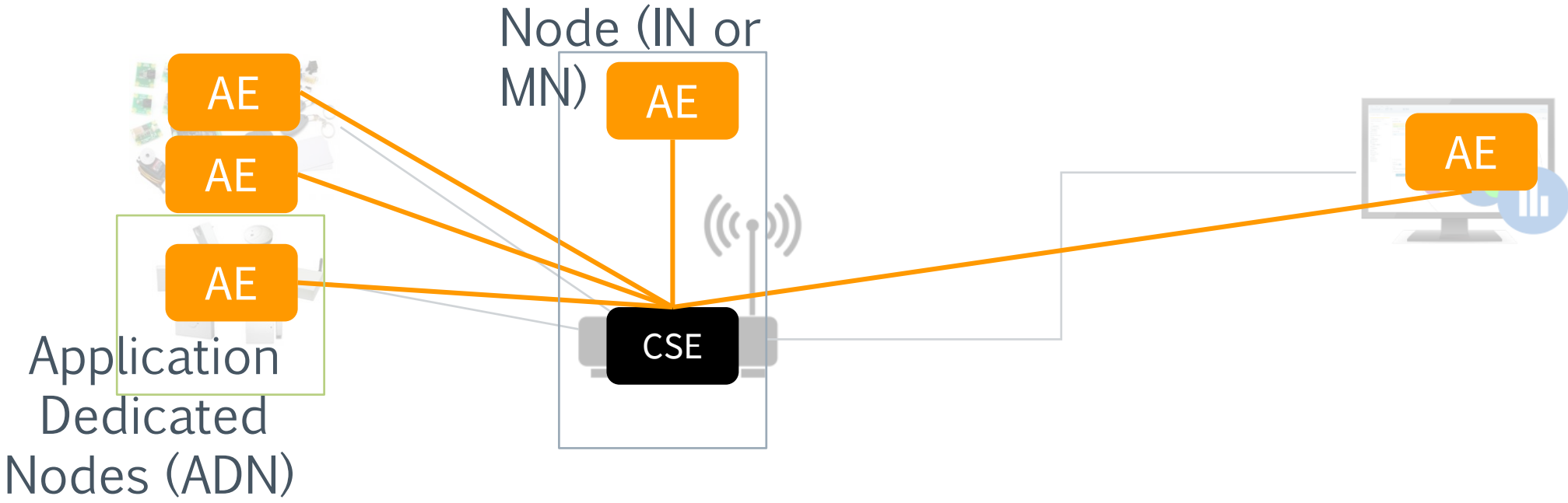

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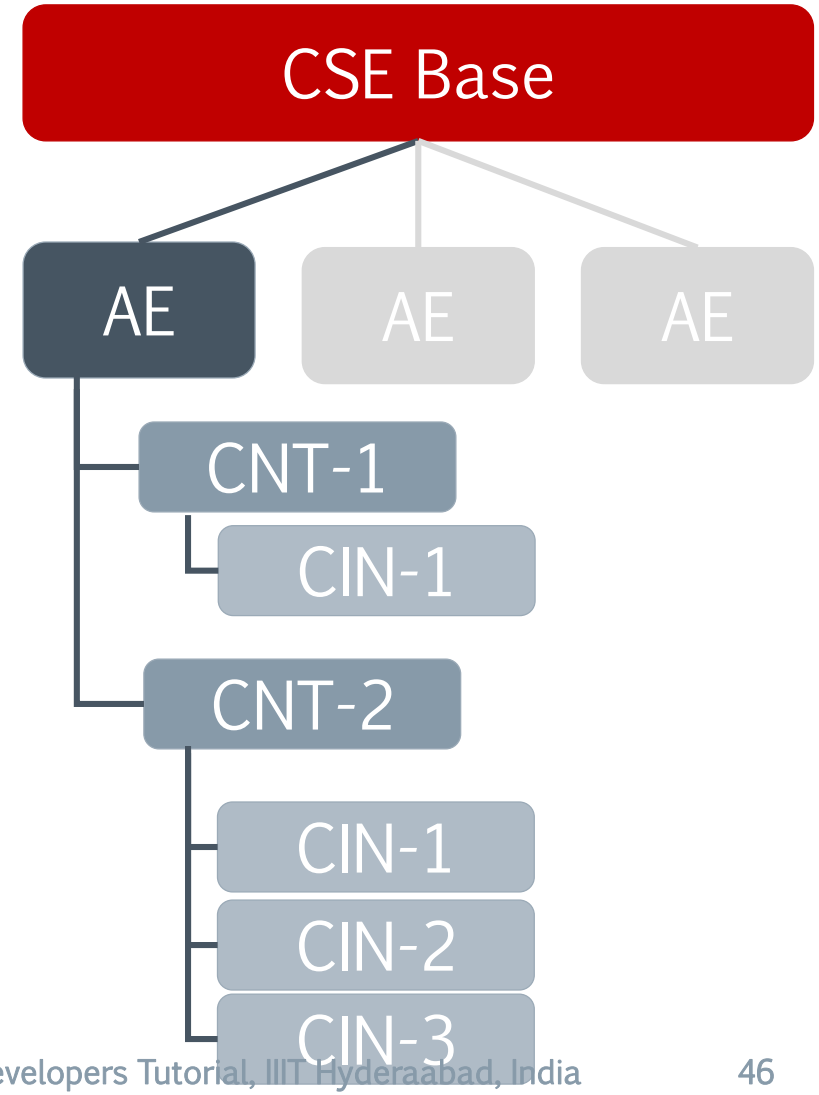

OM2M resource tree example

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Gateway (IN/MN-CSE)

End user (DA)

OM2M resource tree example

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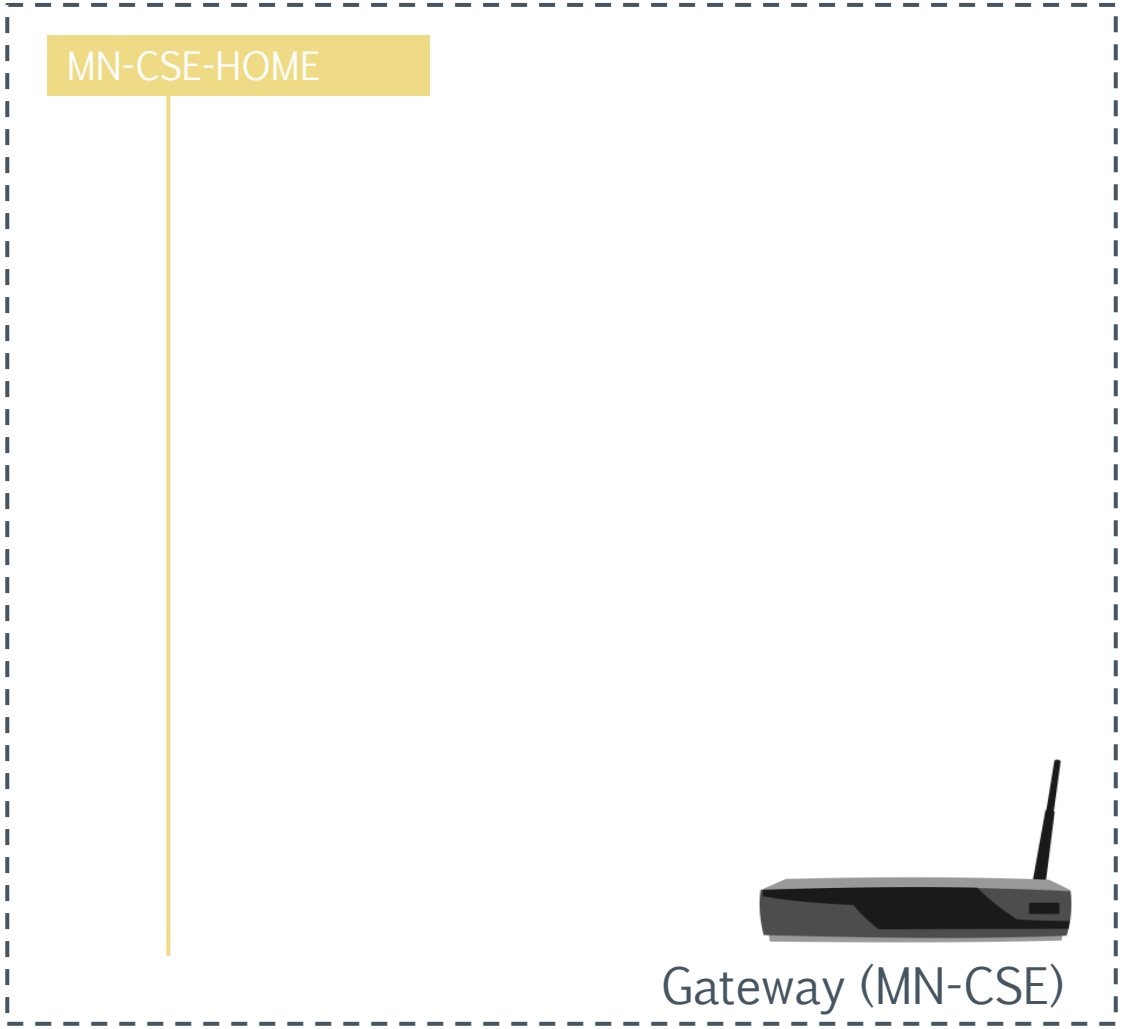


Request-URI

REST API

- Creation/Registration of an Application Entity (AE)

```
POST ~/in-cse/in-name
Host: 127.0.0.1:8080
X-M2M-Origin: admin:admin
Content-type: application/xml;ty=2

<m2m:ae xmlns:m2m="http://www.onem2m.org/xml/protocols" rn="AE_LumSensor" >
    <api>app-sensor</api>
    <lbl>Type/sensor Category/luminosity Location/home</lbl>
    <rr>false</rr>
</m2m:ae>

Expected result : 201 Created
```

Request-URI

REST API

- Creation of a Container (Descriptor)

```
POST ~/in-cse/in-name/AE_LumSensor
Host: 127.0.0.1:8080
X-M2M-Origin: admin:admin
Content-type: application/xml;ty=3

<m2m:cnt xmlns:m2m="http://www.onem2m.org/xml/protocols" rn="DESCRIPTOR" >
</m2m:cnt>

Expected result : 201 Created
```

Request-URI

REST API

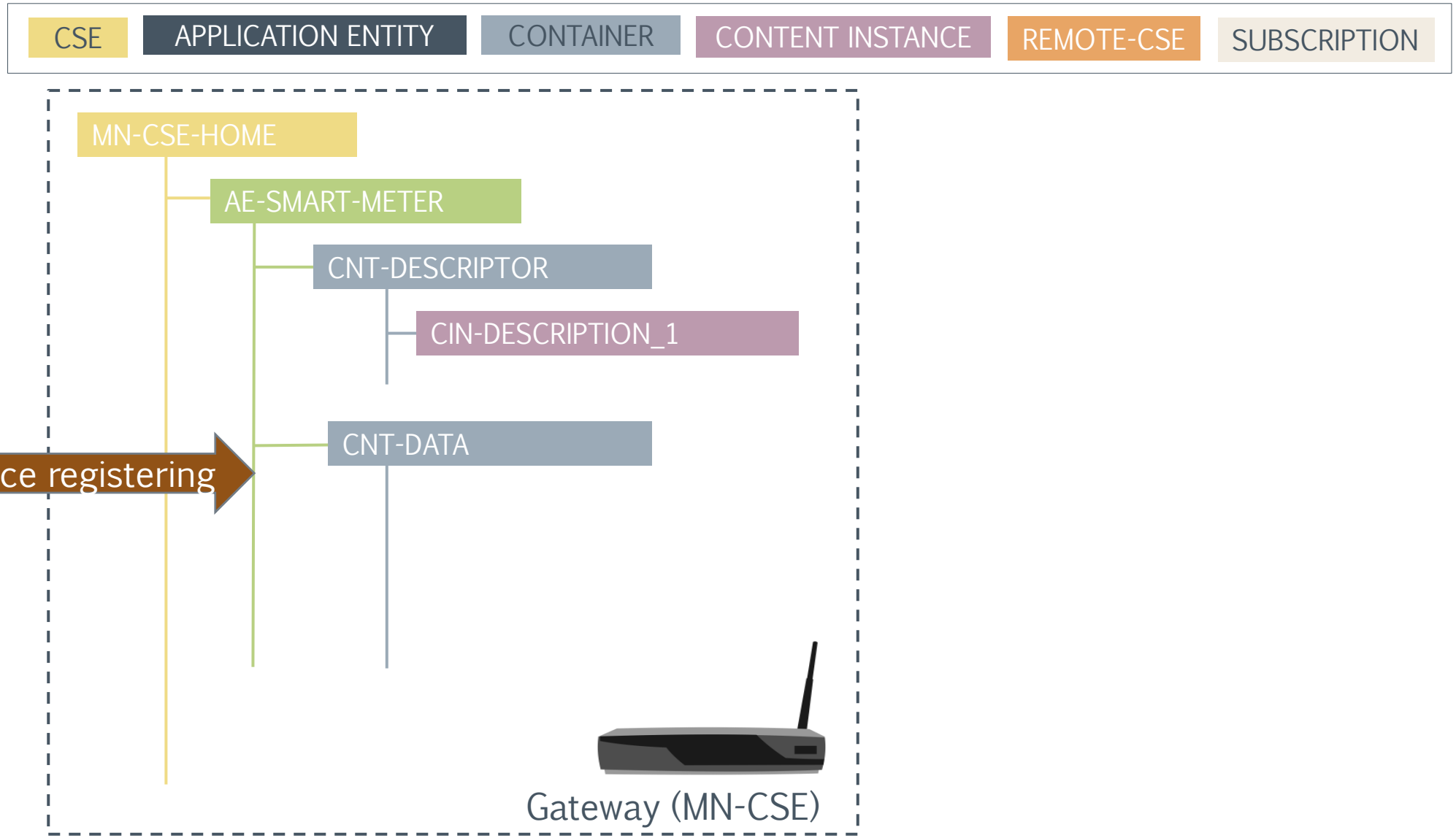
- Creation of a Container (Data)

```
POST ~/in-cse/in-name/AE_LumSensor
Host: 127.0.0.1:8080
X-M2M-Origin: admin:admin
Content-type: application/xml;ty=3

<m2m:cnt xmlns:m2m="http://www.onem2m.org/xml/protocols" rn="DATA" >
</m2m:cnt>

Expected result : 201 Created
```

OM2M resource tree example



Request-URI

REST API

- Creation of a ContentInstance (initial description)

```
POST ~/in-cse/in-name/AE_LumSensor/DESCRIPTOR
Host: 127.0.0.1:8080
X-M2M-Origin: admin:admin
Content-type: application/xml;ty=4

<m2m:cin xmlns:m2m="http://www.onem2m.org/xml/protocols">
    <cnf>application/xml</cnf>
    <con>
        <obj>
            <str name="type" val="Luminosity_Sensor"/>
            <str name="location" val="Home"/>
            <str name="appId" val="AE_LumSensor"/>
            <op name="getValue" href="/MN_Gateway-cse/MN_Gateway-name/AE_LumSensor/DATA/la"
         in="obix:Nil" out="obix:Nil" is="retrieve"/>
        </obj>
    </con>
</m2m:cin>

Expected result : 201 Created
```

Request-URI

REST API

- Creation of a ContentInstance (initial description)

```
POST ~/in-cse/in-name/AE_LumSensor/DESCRIPTOR
Host: 127.0.0.1:8080
X-M2M-Origin: admin:admin
Content-type: application/xml;ty=4

<m2m:cin xmlns:m2m="http://www.onem2m.org/xml/protocols">
    <cnf>application/xml</cnf>
    <con>
        &lt;obj&gt;
            &lt;str name=&quot;type&quot; val=&quot;Luminosity_Sensor&quot;/ &gt;
            &lt;str name=&quot;location&quot; val=&quot;Home&quot;/ &gt;
            &lt;str name=&quot;appId&quot; val=&quot;AE_LumSensor&quot;/ &gt;
            &lt;op name=&quot;getValue&quot; href=&quot;/MN_Gateway-cse/MN_Gateway-name
            /AE_LumSensor/DATA/la&quot; in=&quot;obix:Nil&quot; out=&quot;obix:Nil&quot;
            is=&quot;retrieve&quot;/ &gt;
        &lt;/obj &gt;
    </con>
</m2m:cin>

Expected result : 201 Created
```

Request-URI

REST API

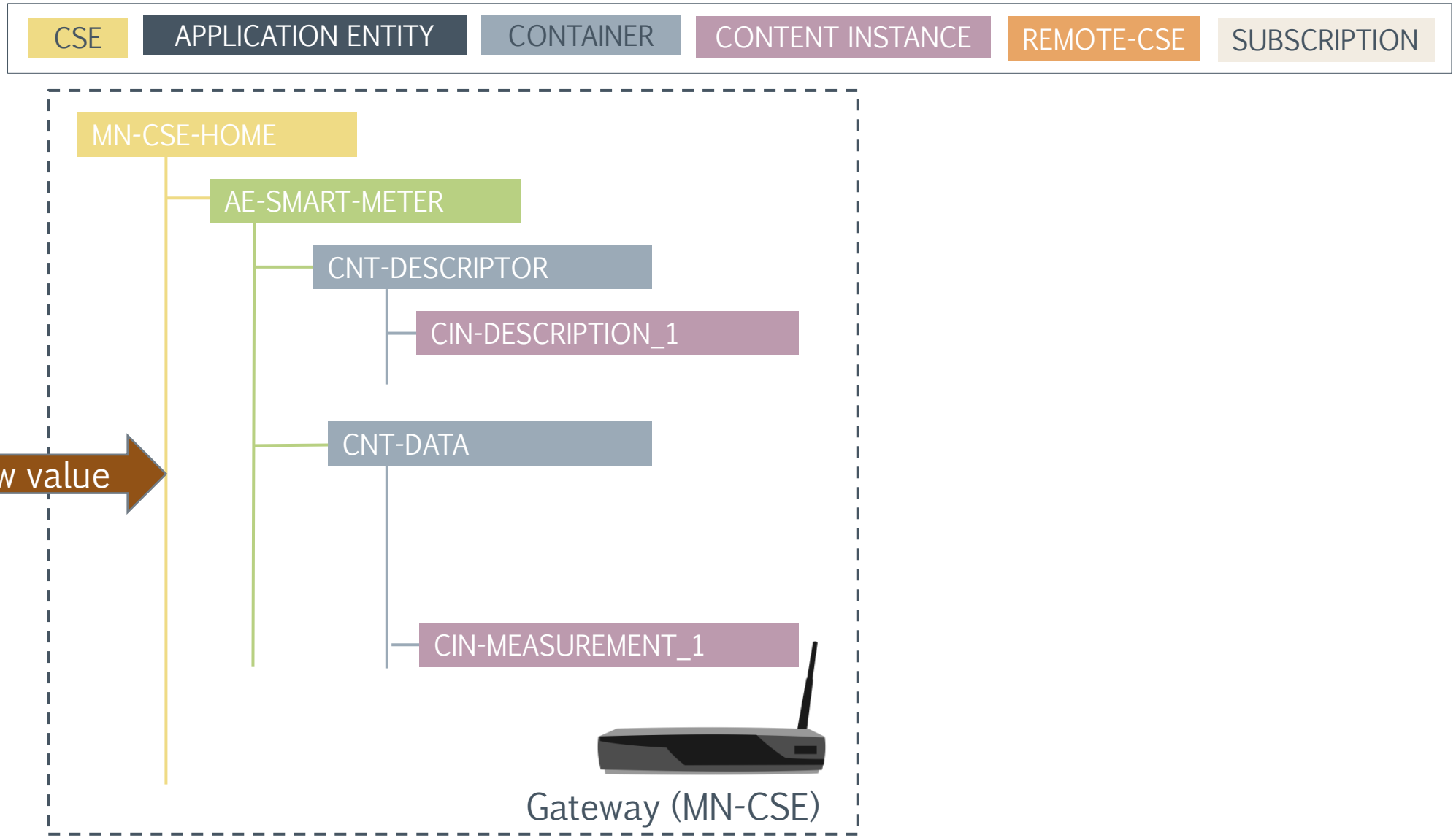
- Creation of a ContentInstance (data instance)

```
POST ~/in-cse/in-name/AE_LumSensor/DATA
Host: 127.0.0.1:8080
X-M2M-Origin: admin:admin
Content-type: application/xml;ty=4

<m2m:cin xmlns:m2m="http://www.onem2m.org/xml/protocols">
    <cnf>application/xml</cnf>
    <con>
      &lt;obj&gt;
        &lt;str name=&quot;appId&quot; val=&quot;AE_LumSensor&quot;/&gt;
        &lt;str name=&quot;category&quot; val=&quot;luminosity &quot;/&gt;
        &lt;int name=&quot;data&quot; val=&quot;234&quot;/&gt;
        &lt;int name=&quot;unit&quot; val=&quot;lux&quot;/&gt;
      &lt;/obj&gt;
    </con>
</m2m:cin>

Expected result : 201 Created
```

OM2M resource tree example



Request-URI

REST API

- Creation of a Subscription (to DATA container updates)

```
POST ~/in-cse/in-name/AE_LumSensor/DATA
Host: 127.0.0.1:8080
X-M2M-Origin: admin:admin
Content-type: application/xml;ty=23

<m2m:sub xmlns:m2m="http://www.onem2m.org/xml/protocols" rn="SUB_AE_LumSensor" >
    <nu>http://127.0.0.1:1400/monitor</nu>
    <nct>1</nct>
</m2m:sub>

Expected result : 201 Created
```

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

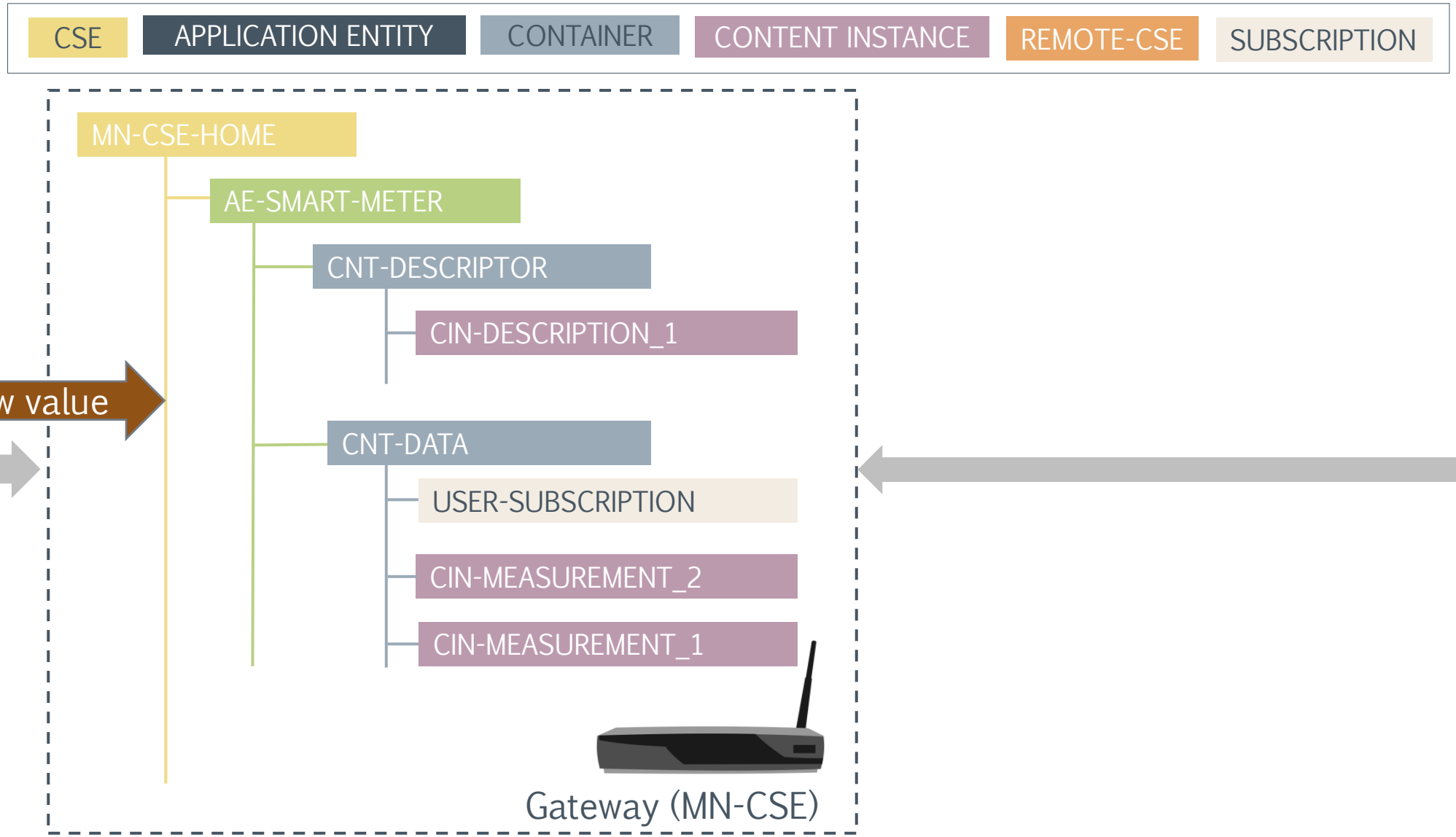
REMOTE-IN-SERVER

Gateway (MN-CSE)

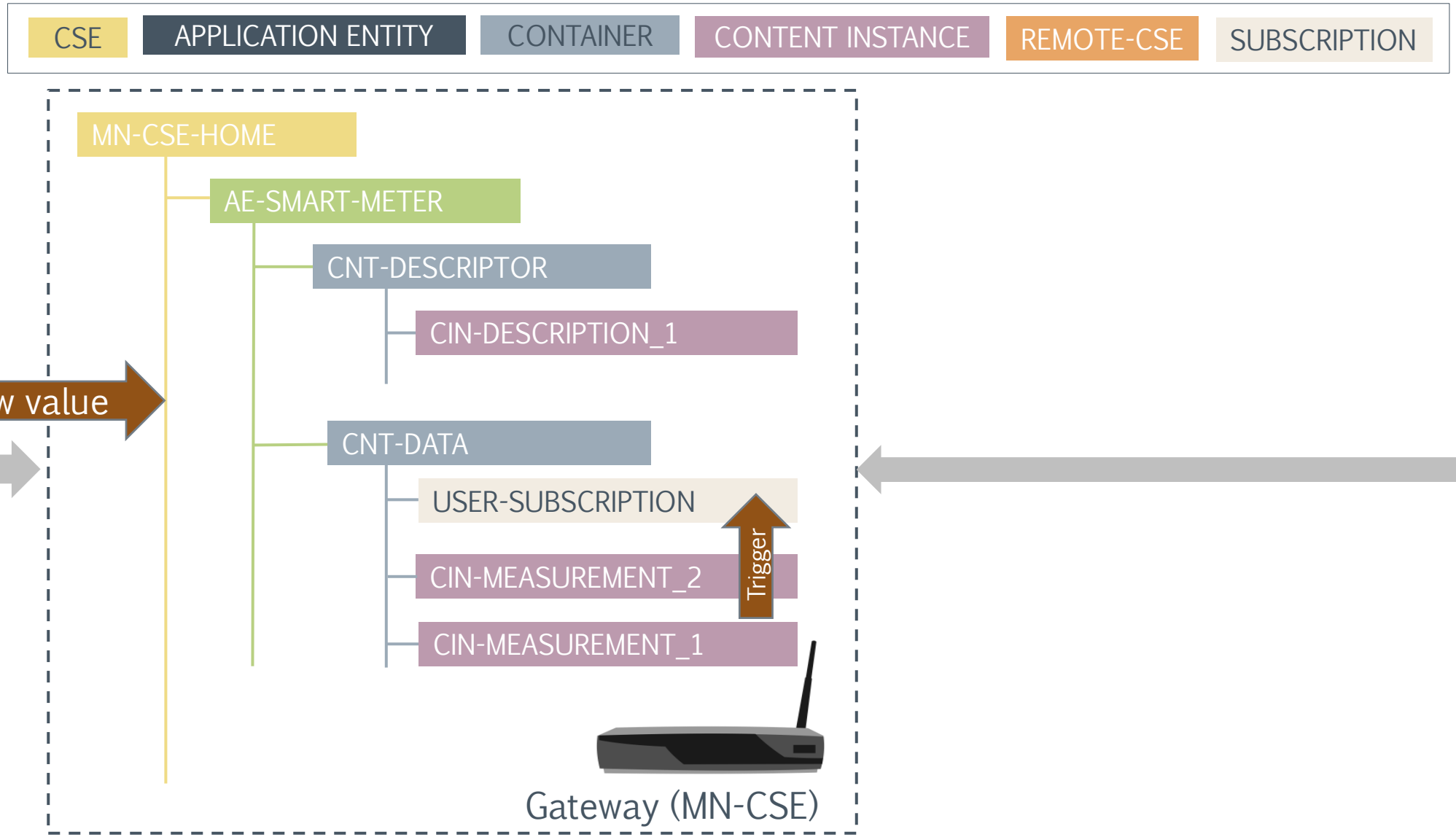
Subscription

End user (DA)

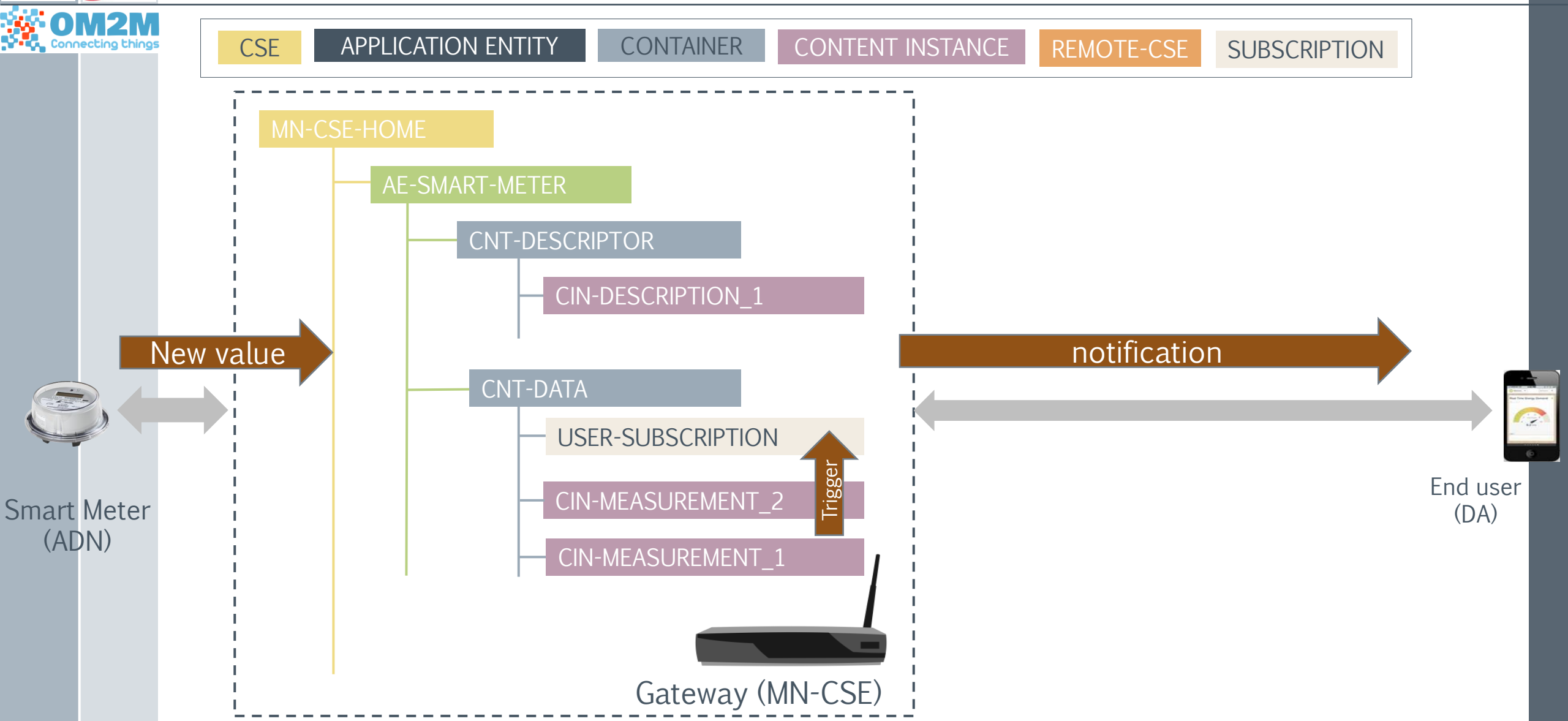
OM2M resource tree example



OM2M resource tree example



OM2M resource tree example



Request-URI

REST API

- Reception of a NOTIFY (i.e. notification)

```
<?xml version="1.0" encoding="UTF-8"?>
<m2m:sgn xmlns:m2m="http://www.onem2m.org/xml/protocols">
   <nev>
      <rep rn="cin_name1">
         <ty>4</ty>
         <ri>cin-46677406</ri>
         <pi>/in-cse/cnt-397256037</pi>
         <ct>20151104T162611</ct>
         <lt>20151104T162611</lt>
         <st>0</st>
         <cnf>application/obix</cnf>
         <cs>11</cs>
         <con> <obj>. . . </obj> </con>
      </rep>
      <rss>1</rss>
   </nev>
   <sud>false</sud>
   <sur>/in-cse/in-name/AE_LumSensor/DATA/SUB_AR_LumSensor</sur>
</m2m:sgn>
```

Request-URI

REST API

- Discovery

```
GET ~/in-cse/in-name?fu=1&ty=2
Host: 127.0.0.1:8080
X-M2M-Origin: admin:admin
Accept: application/xml

Response:
<m2m:ae xmlns:m2m="http://www.onem2m.org/xml/protocols" rn="AE_LumSensor" >
    <api>app-sensor</api>
    <lbl>Type/sensor Category/luminosity Location/home</lbl>
    <rr>false</rr>
</m2m:ae>

Expected result : 201 Created
```

Eclipse OM2M: an open-source oneM2M-compliant IoT platform

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