OVERVIEW OF ETSI M2M RELEASE 1 STAGE 3 – API AND RESOURCE USAGE

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Outline

- TS 102 921 overview
- ETSI M2M reference points
- ETSI M2M resource tree
- ETSI M2M API procedures
- Binding to HTTP and CoAP
- Example of call flows for a connected home use case
TS 102 921: mLa, dLa and mLD reference points

- API primitives and resource definitions
- Security operations
- Data types and attributes for resources and primitives
- Mapping of management objects
- HTTP and CoAP binding
- Interworking with XDMS
- XSD files
Example: Connected Home

- **Network Application (NA)**
- **M2M Network (NSCL)**
- **M2M Gateway (GSCL)**
- **M2M Devices with Device Application (DA)**
ETSI M2M Defines 3 Reference Points

**mla**
- Network Application (NA) ↔ Service Capabilities in the M2M Network Domain (NSCL)
- Is a reference point for NA to register to NSCL and access resources on NSCL

**dla**
- Device Application (DA) and Gateway Application (GA) ↔ Service Capabilities in the M2M Device / GW (D/GSCL)
- Is a reference point for DA/GA to register to D/GSCL and access resources on D/GSCL

**mld**
- Service Capabilities in the M2M Network Domain (NSCL) ↔ Service Capabilities in the M2M Device / GW (D/GSCL)
- Is a reference point for D/GSCL to register to NSCL and access resources on D/G/NSCL
RESTful Approach

REST (Representational state transfer) is a software architectural style by Roy T. Fielding in his Ph.D. dissertation

- Client-server
- Communication is stateless
- Resources can be cacheable
- Uniform Interface
- Resource operations
  - Resource: is a uniquely addressable entity in the RESTful architecture. A resource has a representation that shall be transferred and manipulated with the CRUD verbs. A resource shall be addressed using a Universal Resource Identifier (URI)
  - ... ...

REST approach is widely adopted and can be easily applied to M2M communications

Interface primitives are based on CRUD (Create, Retrieve, Update, Delete) operations

- Uniform interface can LARGELY reduce implementation efforts
Remote SCL registered to this `<sclBase>`

Locally registered applications

Announced applications

Containers are used to store data; they are at different locations of the tree for different owners

Groups of resources for bulk operations

Well-known resource

Active subscriptions for different resources

Defines access permissions for different resources

Manage M2M area networks
SCL base management: Retrieve and Update SCL base resource
Collection management: Retrieve and Update collection resources
SCL management: Registration (Create), De-registration (Delete), Update, Retrieve, Subscription
Application management: Registration (Create), De-registration (Delete), Update, Retrieve, Subscription, announce/de-announce
Access rights management: Create, Retrieve, Update, Delete, Subscription, announce/de-announce
Container management: Create, Retrieve, Update, Delete, Subscription, announce/de-announce; manage container instances
Group management: manage group resource and members
Subscription and notification management: subscribe for modifications to a resource and receive updates with the resource is modified
m2mPoC management: Create, Retrieve, Update, Delete
Remote entity management: applies RESTful methods to device management procedures
Resource discovery: retrieve resources under a resource tree
Announce/De-Announce: common procedures for resource advertisement

achieved by RESTful operations
Binding to HTTP and CoAP

- Binding to HTTP and CoAP is easy due to ETSI M2M RESTful approach
- Normative mapping defined for both HTTP and CoAP
- Primitives represent the resource operation in the Method domain

Illustration of ETSI M2M Primitive Binding to Transport Layer Protocols
## Mapping to HTTP and CoAP Methods

<table>
<thead>
<tr>
<th>Primitive type</th>
<th>HTTP Method</th>
<th>CoAP Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>xxxCreateRequestIndication</td>
<td>POST</td>
<td>POST</td>
</tr>
<tr>
<td>xxxRetrieveRequestIndication</td>
<td>GET</td>
<td>GET</td>
</tr>
<tr>
<td>xxxUpdateRequestIndication</td>
<td>PUT</td>
<td>PUT</td>
</tr>
<tr>
<td>xxxDeleteRequestIndication</td>
<td>DELETE</td>
<td>DELETE</td>
</tr>
<tr>
<td>xxxExecuteRequestIndication</td>
<td>POST (without a body)</td>
<td>PUT (a GET follows if the execution result or status is not piggybacked in the response)</td>
</tr>
<tr>
<td>xxxNotifyRequestIndication</td>
<td>POST (asynchronous notify) response to POST (long polling notify)</td>
<td>POST (asynchronous notify)</td>
</tr>
</tbody>
</table>
CREATE an scl Resource using HTTP

POST /scls HTTP/1.1
Host: nscl.example.com
Content-Type: application/xml
Content-Size: 42

<?xml version="1.0" encoding="UTF-8"?>
<scl id="123456789" xmlns:tns="http://uri.etsi.org/m2m"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <link>http://gscl.example.com</link>
  <expirationTime>2011-10-27T18:00:00</expirationTime>
  <accessRightID>http://nscl.example.com/accessRights/someAccessRight</accessRightID>
  <searchStrings>
    <searchString>location:sophia antipolis</searchString>
  </searchStrings>
  <mgmtProtocolType>OMA DM v1.2</mgmtProtocolType>
</scl>

HTTP/1.1 201 Created
Location: http://nscl.example.com/scls/123456789
Example of API and Resource Operations:
SCL and Application Registration

- **M2M Device (DA)**
- **M2M Gateway (GSCL)**
- **M2M Network (NSCL)**
- **Network Application (NA)**

**Secure M2M service bootstrap and connection**

- GSCL initiated; created GSCL resource tree root and its child resources
  `<myHomeGSCL>/…`
- NSCL initiated; created NSCL resource tree root and its child resources
  `<exampleNSCL>/…`

- GSCL Registers to NSCL (CREATE)
- Created counterpart resource for NSCL
  `<myHomeGSCL>/scls/<exampleNSCL>`
- Created resource for GSCL
  `<exampleNSCL>/scls/<myHomeGSCL>`

- DA Registers to GSCL (CREATE)
- Created resource for DA registration
  `<myHomeGSCL>/applications/Heating-App-ID`

- NA Registers to NSCL (CREATE)
- Created resource for NA registration
  `<exampleNSCL>/applications/SmartHome-ID`

Responses not shown for simplicity
Example of API and Resource Operations: Write Data to Containers, Announce and Data Retrieval

- **M2M Device (DA)**
  - DA creates its container in GSCL
  - DA writes data to GSCL container (CREATE)
  - Created resource for DA data in GSCL
    - `<myHomeGSCL>/applications/Heating-App-ID/containers/temperature/contentInstances/myHomeTemp1`
  - Created container resource for DA
    - `<myHomeGSCL>/applications/Heating-App-ID/containers/temperature`

- **M2M Gateway (GSCL)**
  - GSCL announces DA to NSCL (CREATE)
    - Created Annc resource for DA in NSCL
      - `<exampleNSCL>/scls/<myHomeGSCL>/applications/Heating-App-ID-Annc`

- **M2M Network (NSCL)**
  - NA discovers DA
    - Under `<nscl>/discovery`
    - Obtained a URI list
    - NA retrieves DA data (RETRIEVE)
    - `<myHomeGSCL>/applications/Heating-App-ID/containers/temperature/contentInstances/myHomeTemp>`
Example of API and Resource Operations: Subscription / Notifications

M2M Device (DA) → dlA → M2M Gateway (GSCL) → mId → M2M Network (NSCL) → mLa → Network Application (NA)

- Created subscription resource:
  `<myHomeGSCL>/applications/Heating-App-ID/containers/temperature/contentInstances/subscriptions/tempSub`

- DA writes new data to GSCL container (UPDATE)
  Updated resource for DA:
  `<myHomeGSCL>/applications/Heating-App-ID/containers/temperature/contentInstances/myHomeTemp2`

- NA subscribes to DA data stored on GSCL (CREATE)

- Notification to NA (NOTIFY)
  Obtained new temp
Conclusions

- Uniformed interfaces simplify implementation and enable interoperability
- Resources are managed by CRUD operations and addressed by URIs
- Binding to most popular protocols, such as HTTP and CoAP
- Independent from vertical domains (e.g. smart meters, eHealth...)
- Demos compliant to ETSI M2M R1 showing API and resource operations are available after the session
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Thank you!