|  |
| --- |
|  |
| **Title\*:** | **End-to-end security use cases and considerations for ETSI M2M Release 2** |
| Submitted by: | Francois Ennesser (francois.ennesser@gemalto.com) |
|  |  |
| from **Source**\*: | Gemalto |
| Submitted **To**\***:** | ETSI TC M2M WG4 |
|  |
| Relevant WI(s), or deliverable(s): | Release 2 requirements and architecture |
| Agenda Item: |  |
| Submission date**\***: | 2012-08-10 |
|  |
| **Document for\*:** | Decision |  | 🡨 a decision on is formally requested from the addressed (sub-)committee |
| Only one "**X**" | Discussion | **X** | 🡨 the contribution is expected to be presented and discussed, but no decision is formally requested |
|  | Information |  | 🡨 the contribution does not require discussion  |
|   |

**Decision/action requested** (Mandatory if Decision box is checked, optional otherwise)

*The present contribution provides use cases where M2M applications require End-to-end security and where the bootstrapping of security credentials causes difficulties that could be solved if the TC M2M Service bootstrapping architecture was extended to enable M2M applications to leverage on such capabilities (as proposed in M2MWG4(12)000007 / M2M(12)21\_018).*

**Background information:**

Discussions at the August 7 TC M2M WG4 teleconference around draft CR to TS 102 690 in M2MWG4(12)00007 concluded that related use cases would be useful to refine the technical proposal to bootstrap security credentials to be used by M2M applications for End-to-End security, and to assess the suitability of proposed solutions. For this purpose, the present contribution describes use cases from different verticals and analyzes their implications in terms of requirements for End-to-end security.

**Use Case 1: Smart Metering – Privacy preservation and critical infrastructure protection**

This use cases typically involves:

1. A utility distribution company that operates distribution services for a given commodity (water, gas, heat or electricity) for a set of consumers (e.g. a town or region): “Distributor”. A consumer with a smart meter may switch between distributors, e.g. to benefit from better tariffs.
2. An end consumer of the commodity (individual household or business, e.g. a hospital): “Consumer”.

Depending on national regulations, the Smart Meter measuring the flow of commodity may belong to the distributor or the consumer. The distributor typically operates local gateways that relay the communications between the smart meters connected to it via a local communication mean (e.g. Power Line Communication) and the Metering Head-end system in charge of controlling the infrastructure. Communication between Gateways and the Head-end system may go through an Access Network operated by a first operator, and the Head End System may be implemented as an ETSI M2M compliant “NA” to rely on ETSI M2M compliant services offered by an M2M Service Provider. That is, the distributor may act as an Application Service Provider in the ETSI M2M ecosystem.

**Data collected by smart meters are considered as sensitive personal data of the end consumers by the European Commission,** because access to such data enable to track whatever the consumer is doing, whatever appliance he operates in the intimacy of his/her home. As such, access to these data shall be strictly restricted to actors needing them to perform a legitimate purpose, such as the Distributor for billing purposes and an energy transmission company for grid optimization, or to provide a service explicitly requested by the consumer (e.g. consumption optimization). There are even **national regulations that prevent exposing such data to unauthorized third parties**. Even though most access networks provide encryption means, the access network operators can access the encrypted data as they control the encryption credentials. This is used as an argument by some utilities for not relying on third party data communication services in their Advanced Metering Infrastructures deployments.

The current ETSI M2M platform enables to secure data transmission from the Gateway to the NSCL, through the access network thanks to credentials bootstrapped by the M2M Service Provider. So this resolves the privacy problem with the Access Network Operator, but creates a new one with the M2M Service Provider, who knows the credentials used to encrypt the data. So **the current M2M bootstrapping infrastructure**, which can be seen as redundant when used on access network that provide their own encryption, **does not address the privacy issue of such M2M applications**.

* The privacy issue could be avoided if an authorized actor, such as an energy distributor, would act as an M2M Service Provider, but in this case the main advantage of the ETSI M2M approach, i.e. **horizontality, would be lost**!
* However the technical solution specified today for bootstrapping in the ETSI M2M **specification could easily be extended** to resolve the above problem, simply by **enabling the credential distribution to be performed by a Trusted Third Party**, possibly independent from the M2M Service Provider.

Beyond the privacy aspect, Smart meters create a multitude of **entry points to the Information System of a critical infrastructure.** For example at least in some countries, smart meters will be equipped with a remotely actionable switch enabling to remotely order connection/disconnection to the commodity, e.g. in case of unpaid bills. This could result in huge liability as attacks could result in unwanted power disruption to strategic places as critical times, which can motivate adverse foreign powers or organizations with extensive means that could be used e.g. for corrupting insiders. With the current M2M infrastructure, **liability may fall on the M2M Service Provider**, e.g. in case of insider’s involvement. Though the role of the M2M service Provider may typically be assumed by a telecommunication operator, as it mainly involves information routing capabilities, such actors will not necessarily accept the liability aspects resulting from the intermixed trust responsibilities, and may prefer to rely on other actors for that purpose. This gives an additional reason for the specification to **enable the separation of the roles related to information handling (M2M SP) and trust Provisioning** (Credential Service Provider in the current WG4 terminology).

**Use Case 2: Scenarios involving multiple Service Providers, e.g. Smart Cities emergency**

Another need acknowledged in TC M2M Requirements (TS 102 689) but not addressed by the ETSI M2M Release 1 security architecture is to **secure communications between M2M devices affiliated with different M2M Service providers**. Such scenario could become frequent in future Smart Cities environments, where personal devices with M2M subscriptions contracted by individuals (e.g. Healthcare monitoring devices or fire alarms monitored by insurance companies) will interact both with institutions or private organizations applications (e.g. Medical centres/doctors or emergency vehicle fleet services) and municipal services using public network infrastructures (e.g. traffic flow optimization).

Here again, the technical requirements on devices to bootstrap credentials could be leveraged upon to enable secure communication end-to-end independently of the intermediate service providers, provided that **dissociation from the M2M Service Provider of the bootstrapping framework** providing initial credentials to the devices would be enabled**.**

**Use Case 3: Consumer networking applications, e.g. Digital picture display frame**

While most M2M applications today assume a client-server relationship and therefore work well in the context of a single M2M SP, by the time the standards will be deployed, an evolution towards **“many-to-many”** relationships is likely to happen. For example in the industrial sector data from a sensor deployed by one entity may be used for various applications deployed by several other entities. The same evolution can be expected in the consumer segment with the advent of M2M devices in social networking, where for example a digital picture display frame in the grandmother’s living room would subscribe to retrieve pictures from her daughter’s camera to show the grandchildren. While **the subscribe-notify mechanism in the M2M architecture has been designed to handle such use cases**, the **security framework definitely needs to be extended** to address the security and privacy preservation challenges resulting from such evolution.

**Service level considerations:**

This paragraph aims at identifying the various technical pieces that will need to be specified to complete the end-to-end security part of the ETSI M2M system.

We start form the assumption that the M2M platform should offer a number of services to help setting up end-to-end data security, as follows:

**Policy enforcement services**: The M2M platform should handle requests for M2M data distribution (request for data, requests for data notification...). With the current architecture where data routing and trust function are offered by the same provider, the policy decision point and the policy enforcement point can both be collocated within the platform. In other words, the access rights are managed within the platform with the current architecture.

However, if we suppose that the trust functions are offered by an external provider, then the platform will need to enforce the data access and dissemination policies defined by an external entity. Services should be defined for this purpose.

**Discovery services**: In order to understand the data transmitted from an M2M devices, recipients will need to obtain the proper credentials. To do so they need to discover and authenticate with the proper credential distribution authority. When recipients are affiliated to an M2M service provider, the M2M platform could offer discovery services to help discovering and authenticating with the credential distribution authority.

To enable the above services, the following Stage 3 aspects will have to be addressed:

**Protocol definition:** Definition of the protocols to be used to obtain, renew and revoke credentials used for end-to-end data protection. A number of such protocols already exist. The idea is not to reinvent them, but rather to define which existing protocols could be used.

**Inter M2M service provider communication protocols:** End-to-end data security should be applicable between parties affiliated to different services providers. This is already the object of another work item for Release 2, which should define mechanisms that would allow M2M service providers to channel requests from affiliated devices to other M2M service providers.

**Further technical considerations:**

As the purpose of the present document is to reassess WG2 Release 2 priorities and refine their scope in relation with expected workload, the following technical aspects also deserve considerations:

1. **Multitude of bootstrapping options:**

As there are many bootstrapping options in M2M Release 1 specifications, the workload needed to bring a complete End-to-end security solution is multiplied. Feasibility would be eased if we can agree to extend only one or two options for Release 2, such as GBA for an access network based solution and EAP-TLS for an access network independent solution. Insight on which options are most likely to be implemented on the field would be helpful in that respect.

1. **How to extend end-to-end security from devices to applications:**

The considerations above would enable to provide end-to-end security between communicating D/G M2M Nodes. But End-to-end security is needed at the application level, which further involves the dIa reference point.

* In the case of a **D device holding several independent M2M DAs**, we need to ensure cryptographic separation between them, but the security of dIa could be left to implementation as these are internal interfaces. However we still need to consider how to move the credential from the D M2M node to the DA, e.g. should the D M2M Node perform an independent bootstrap procedure for each application, or could we diversify application keys from a unique device credential?
* In the case of a **Gateway bridging an M2M Area Network made of individual D’ devices**, the further difficulty is that the security over dIa cannot be ignored. While service layer security over dIa could in some cases rely on features of the M2M Area Network technology, document M2MWG4(12)000008 highlights the interest for an M2M service provider to extend its security framework through the Gateway to the locally connected D’ devices, especially in the case of meshed networks such as Zigbee.
* In such deployments, the Release 1 assumption that Gateways would be application-specific deserves to be revisited, because of a cost incentive to rely on **public or shared gateways** (not application-specific): This has further security implications which would need to be addressed.