ETSI M2M solution introduction

ETSI Standard is enabling global M2M communications
A world.....

......made of intelligent and autonomous “things”
The M2M connectivity and service models are changing.

Everyday objects are becoming “things” that can be addressed, recognized, localized and controlled via telecommunication networks.
Everything belongs to the same wave
Machine-to-Machine (M2M) is about communication among Machines without (or only limited) human intervention

M2M

- Buildings
  - Home / Office Automation,
  - E - Health / Assisted Living
  - Production line management, Quality control
- Production
- Healthcare
- Security
- Energy
- Retail
- Transport
- On/Off Road Vehicles
- Supply Chain
- Home / Hospital
- Mobile
- Generation
- Distribution
- Home Automation, Goods Tracking /
  - Stores
  - Tourism
- Electronic Monitoring/
  - Military Use
- Desaster / Emergency
- Goods Tracking / Supply chain Automation
- Intelligent Transport Systems/E-Vehicles/
  - Green Energy
- Mobile
- Home Automation
- Production
- Healthcare
Existing M2M solutions are highly fragmented and typically dedicated to a single application (e.g. fleet management, meter reading, vending machines).

Multitude of technical solutions and dispersed standardization activities result in the slow development of the global M2M market.

Standardization is a key enabler to remove the technical barriers and ensure interoperable M2M services and networks.
M2M stovepipes to integrated offerings

Connecting Things

Pipe#1
1 Application, 1 Network
1 (or few) types of Device

Pipe#2
1 Application, 1 Network
1 (or few) types of Device

Pipe#N
1 Application, 1 Network
1 (or few) types of Device

Horizontal (based on common Layer)
Applications share common infrastructure, environments and network elements

Business Application

Transport Network (mobile, fixed, Powerline ..)

Gateway
Local NW
Device

Business Application

Transport Network (mobile, fixed, Powerline ..)

Gateway
Local NW
Device

Business Application

Transport Network (mobile, fixed, Powerline ..)

Gateway
Local NW
Device

Common Application Infrastructure

Transport Network 1

Transport Network 2

Gateway
Local NW

IP
Device

Device

Device

Device

Device

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Enabling information sharing

ETSI M2M is based on a “Store and Share” paradigm

The data may be made available in the platform to the other applications, interested application are notified by means of subscription

Privacy is ensured by a strict Access Rights Management
Connecting Things

The ETSI M2M Vision

- Horizontal Multi-Service Platform
- Multi-Application
- Technology Independent
- Existing Standards Re-use and integration
- End to End
- M2M Service Capabilities, Resource Based

End to End Technology Independent M2M Service Capabilities, Resource Based

Horizontal Multi-Service Platform
Value of a standardized horizontal M2M service layer

**Connecting Things**

- **Lower OPEX for M2M Services**
  - Reduced complexity, Standard APIs and protocols, Scalable horizontal solution, Reduced initial investment costs.

- **Lower CAPEX for M2M Services**
  - Same service layer for many verticals, Network independent, use best networks for deployment needs.

- **Faster time to new M2M to markets**
  - Re-use of platform to test and roll out new services, Simplified applications development.

- **Reduced complexity, Standard APIs and protocols opens vendor ecosystem, Reduces solution cost and improves interoperability.**

- **Better network efficiency**
  - Simplicity of deployment, Allows to trial new services, Less expensive to roll out than dedicated solution.

- **Simplified applications development.**

- **Interoperable solutions push cost down**
  - Hiding the complexity of underlying networks to Applications developers foster innovation of new services.

- **Re-use of platform to test and roll out new services, Simplified applications development.**

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- **Hiding the complexity of underlying networks to Applications developers foster innovation of new services.**
Example: EU driven mandates

EC’s M/411 Smart Metering Mandate:
- EC Mandate issued in March 2009 by DG TREN and sent to the 3 ESO’s: CEN, CENELEC and ETSI
- Objective: to build standards for European smart meters, allowing interoperability and Consumer actual consumption awareness

EC’s M/490 Smart Grid Mandate:
- EC Mandate issued in March 2011 by DG TREN and sent to the 3 ESO’s: CEN, CENELEC and ETSI
- Objective: to build standards for European Smart Grids.

ETSI TC M2M is coordinating work inside ETSI and contributing to the mandates M411 and M490.
ETSI M2M use cases

Connecting Things

ETSI M2M use cases

DTR/M2M-00003 102 691 Smart Metering Use Cases
DTR/M2M-00005 102 732 Use cases of eHealth
DTR/M2M-00006 102 857 Use cases of connected consumer
DTR/M2M-00007 102 897 City Automation Use Cases
DTR/M2M-00008 102 898 Automotive Use Cases
DTR/M2M-00011 102 935 Smart Grids
Simplified M2M Architecture
... based on existing Technologies

Connecting Things

M2M Application

Smart Energy

Smart User

Smart Health

Smart Transport

Application Domain

Network Domain

M2M Device Domain

Core Networks
- 3GPP (GPRS, EPC)
- ETSI TISPAN
- ATTM
- NGN

Service Capabilities

M2M Area Networks
- PLC
- SRD
- UWB
- ZigBee
- M-BUS
- Wireless M-BUS
- IEEE 802.15

Access Networks
- xDSL
- Hybrid FiberCoax
- PLC
- Satellite
- GERAN, UTRAN, eUTRAN
- WLAN
- SRDs
- UWB
- WiMAX

... based on existing Technologies

Smart Energy

Smart User

Smart Health

Smart Transport

Application Domain

Network Domain

M2M Device Domain
M2M – High Level Architecture

**M2M Device & Gateway Domain**

- **M2M Device**
  - M2M Device Application (DA)
  - Proprietary M2M Device

- **M2M Gateway**
  - M2M Gateway Service Capability (GSCL)

**M2M Network Domain**

- **WIDE AREA NETWORK**
  - M2M Service Capabilities Layer (M2M NSCL)
  - M2M Application

**Reference Points**

- M2M Service Capability (DSCL)
- Proprietary Interface
M2M high level system overview

Connecting Things

**M2M Application Domain**
- Application (e.g. Smart Metering application)

**User interface to application**
- e.g. Web portal interface
  - (usage monitoring, user preferences, ...)

**M2M Gateway**
- M2M Service Capabilities

**M2M Network Domain**
- Based on existing standards and technologies, e.g.: 3GPP, TISPAN, IETF, ...

**M2M Core**
- M2M Devices / Gateways

**Scope of ETSI M2M**
- M2M Gateway

**M2M Core Network**
- 3GPP, Fixed, IP...

**M2M Devices / Gateways**
- M2M Service Capabilities

**M2M Device Domain**
- Based on existing standards and technologies, e.g.: DLMS, CEN, CENELEC, PLT, Zigbee, M-BUS, KNX, etc.

**M2M Device(s)**
- M2M Service Capabilities
- Application
**Key M2M Elements**

- **M2M Device**
  - Device capable of replying to request for data contained within those devices or capable of transmitting data autonomously.

- **M2M Area Network (Device Domain)**
  - Provide connectivity between M2M Devices and M2M Gateways, e.g. personal area network.

- **M2M Gateway**
  - Uses M2M capabilities to ensure M2M Devices inter-working and interconnection to the communication network.

- **M2M Communication Networks (Network Domain)**
  - Communications between the M2M Gateway(s) and M2M application(s), e.g. xDSL, LTE, WiMAX, and WLAN.

- **M2M Applications**
  - Contains the middleware layer where data goes through various application services and is used by the specific business-processing engines.
ETSI M2M has adopted a RESTful architecture style
  • Information is represented by resources which are structured as a tree

ETSI M2M standardizes the resource structure that resides on an M2M Service Capability Layer (SCL)
  • Each SCL contains a resource structure where the information is kept

M2M Application and/or M2M Service Capability Layer exchange information by means of these resources over the defined reference points

ETSI M2M standardizes the procedure for handling the resources
Features offered by ETSI M2M

- Identification of the M2M Application and the M2M Devices
- Asynchronous and synchronous communication
- Store and forward mechanism based on policies for optimizing the communication
- Location information
- Device management based both on OMA DM (wireless) and BBF TR-69 (wireline)
- Mutual authentication between Network Service Capability Layer and Device/Gateway Service Capability Layer that are connected
- Secure channel for transporting data over mId reference point
- And much more ....
M2M Security

R1 provides standardized security mechanism for the reference point \textit{mld}

The device/gateway needs to have keys for securing the connection.

The device/gateway is provisioned with the key M2M Root Key.

The high level procedure are to

- Perform mutual \textit{mld} end point authentication
- Perform M2M Connection Key agreement
- Optionally establish a secure session over \textit{mld}
- Perform RESTful procedures over the \textit{mld}
M2M standards landscape

Connecting Things

M2M Applications

API

M2M Platform

SP networks (access, core)

Gateway Layer

M2M area Network

M2M Device

Example for metering applications

Source: ALU
ETSI M2M full Release 2 Architecture

- **Gateway (G):** provides M2M Service Capabilities (GSCL) that communicates to the NSCL using the mld reference point and to DA or GA using the dla reference point.

- **Device (D):** provides M2M Service Capability (DSCL) that communicates to an NSCL using the mld reference point and to DA using the dla reference point.

- **Device' (D'):** hosts DA that communicates to a GSCL or to NSCL using the dla reference point. D' does not implement ETSI M2M Service Capabilities.

- Additionally there is a non-ETSI M2M compliant device ('d') that connects to SCL using the xIP Capability (NIP, GIP, DIP). d devices do not use ETSI M2M defined reference protocols/APIs.
Connecting Things

**Charging**: definition of the architectural framework for recording, tracking and exchange of events relevant for the collection of statistical information and for the exchange of charging information, including correlation with charging information from the underlying network.

**Inter-domain communications**: between service platforms, i.e. inter-NSCL communication, on mlm reference point (a variant of mld). This allows application in a domain to exchange information with application in a different domain, in a transparent way respect to the domain they belong to.

**M2M Light**: ETSI M2M Release1 was already supporting very constrained devices via gateways, in Release 2 very constrained device can connect directly to the network platform. Implementation has been made on USB dongles.

**Semantic interworking** guidelines common semantic rules has been defined for applications belonging to different industrial segment, to assure the understanding of the shared data, for a very wide set of commonly used technologies.
M2M– Releases

Release 1

Core Release1 Finalized in November 2011 to support urgent market needs and provides an end-to-end architecture to support multiple M2M-type applications.

http://www.etsi.org/WebSite/NewsandEvents/2012_02_M2M_standards_release.aspx

Extended Release2 Finalized in December 2013 to complement and extend release 1, enabling very constrained devices and facilitating inter-service provider communication.

Etsi M2M Standard specifications are freely accessible

http://docbox.etsi.org/smartM2M/Open and www.etsi.org
ETSI M2M/SmartM2M available
Specifications Work

Use Cases [Stage 0]

- TR 102 691 Smart Metering
- TR 102 732 eHealth
- TR 102 857 Connected consumer
- TR 102 898 Automotive
- TR 102 897 City automation

Stage 1

- TS 102 689 M2M Service Requirements

Stage 2

- TS 102 690 M2M Functional Architecture

Stage 3

- TS 102 921 M2M Communications; mla, dla and mld interfaces

- TR 102 167 Threat analysis & counter measures to M2M service layer

- TR 102 935 Smart Grid impacts on M2M

- TR 102 966 Interworking with M2M Area Networks

- TR 102 925 M2M Definitions

- TS 101 404 OMA DM compatible Management Objects

- TS 102 921 BBF TR-069 compatible Management Objects

- TR 101 584 Semantic support for M2M Data
## Major ETSI M2M/SmartM2M specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
<th>URL</th>
</tr>
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<tbody>
<tr>
<td><strong>TS 102 689</strong></td>
<td>M2M Service Requirements</td>
<td><a href="http://www.etsi.org/deliver/etsi_ts/102600_102699/02.01.01_60/ts_102689v020101p.pdf">http://www.etsi.org/deliver/etsi_ts/102600_102699/02.01.01_60/ts_102689v020101p.pdf</a></td>
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<td><strong>TS 102 690</strong></td>
<td>M2M Functional Architecture</td>
<td><a href="http://www.etsi.org/deliver/etsi_ts/102600_102699/02.01.01_60/ts_102690v020101p.pdf">http://www.etsi.org/deliver/etsi_ts/102600_102699/02.01.01_60/ts_102690v020101p.pdf</a></td>
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<tr>
<td><strong>TS 102 921</strong></td>
<td>M2M Communications; mla, dla and mld interfaces</td>
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<tr>
<td><strong>TR 102 725</strong></td>
<td>M2M Definitions</td>
<td><a href="http://www.etsi.org/deliver/etsi_tr/102700_102799/01.01.01_60/tr_102725v010101p.pdf">http://www.etsi.org/deliver/etsi_tr/102700_102799/01.01.01_60/tr_102725v010101p.pdf</a></td>
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<td><strong>TS 103 092</strong></td>
<td>OMA DM compatible Management Objects</td>
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<td>BBF TR-069 compatible Management Objects</td>
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<td><strong>TR 102 966</strong></td>
<td>Interworking with M2M Area Networks</td>
<td><a href="http://www.etsi.org/deliver/etsi_tr/102900_102999/01.01.01_60/tr_102966v010101p.pdf">http://www.etsi.org/deliver/etsi_tr/102900_102999/01.01.01_60/tr_102966v010101p.pdf</a></td>
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<td>Semantic support for M2M Data</td>
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ETSI M2M had also created a series of highly popular technical workshops. With more than 240 participants and live demonstrations of real life implementations of ETSI M2M specifications.

Here follows some links where useful documentation is also available.

Videos [http://cftvideo.com/etsi/m2mdemos/](http://cftvideo.com/etsi/m2mdemos/)


2014 - 10-11 December 2014
• Support the European Commission Mandates in M2M and IoT areas; leading and coordinating the ETSI answer to:
  • Smart Metering (M/441) in collaboration with CEN/CENELEC
  • Smart Grid (M/490) in collaboration with CEN/CENELEC
  • Charging of Electrical Vehicles (M/468)

• Addressing the Smart Cities and other application specific M2M needs
ETSIm SmartM2M is supporting Smart Appliances communication standardization and opened a set of work items:

- To accommodate the result of the Study group,
- To complement it with proper communication framework
- To provide testing support
Openness: The specification will be developed according to ETSI procedures, nevertheless it is of interest of all the parties to have the wider participation possible, so the ETSI TB will invite the directly participation of all the interested stakeholders to the ETSI SmartM2M SAP discussions, as well via LS or via the ETSI Members.

The main technical contribution for the semantic/ontology part will be the reports from the Study Group. Study group and expert group need to be invited to the Smart M2M Sap discussions. It is expected that such common ontology will take into account all the interest of the relevant stakeholders, so it can go smoothly into standardization.

The communication framework will be based on the reuse of ETSI/oneM2M, with the understanding that such communication framework is designed to support M2M/IoT communication with a specific attention to the interworking among different semantics/ontologies.
Connecting Things

Scope

- To specify the common semantic/ontology, and to specify the mapping on the SmartM2M/oneM2M communication data model

Content

- Derived from the SG and standardized by SmartM2M
  - SAP Common Data model
  - SAP Common Ontology
- Developed in Smart M2M and standardized by SmartM2M
  - Mapping of SAP data model on the elementary ETSI M2M/oneM2M resources and services

Schedule

- WI approval and draft ToC May 2014
- Target date for ETSI approval May 2015
- Target date for Publication July 2015
- Current work item status
- Latest draft: [http://docbox.etsi.org/SmartM2M/Open/Latest_Drafts/](http://docbox.etsi.org/SmartM2M/Open/Latest_Drafts/)
Scope

- To specify the SAP communication framework based on ETSI SmartM2M/oneM2M specifications
- To complement the specification with any adaptation needed to assure the interworking for SAP

Content

- General informative description of the ETSI M2M/oneM2M framework in the SAP context.
- Normative description of the SAP interworking framework with normative reference to ETSI M2M/oneM2M specification
- Specification of all the required common initial configuration and setting to assure a full interworking with plug and play support for Smart Appliances

Schedule

- WI approval and draft ToC May 2014
- Target date for ETSI approval May 2015
- Target date for Publication July 2015
- Current work item status
- Initial skeleton: http://docbox.etsi.org/SmartM2M/Open/Latest_Drafts/
Scope

- Provide interoperability advise
- To identify the test priorities
- To specify the test suites

Content

- tbd

Schedule

- WI approval and draft ToC September 2014
- Target date for ETSI approval  4Q 2015
- Target date for Publication  1Q 2016
- Current work item status
- Initial skeleton: Not yet available