International Telecommunication Union

ITU-T Y.4413/F.748.5

(11/2015)

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

SERIES Y: GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS AND NEXT-GENERATION NETWORKS, INTERNET OF THINGS AND SMART CITIES

Internet of things and smart cities and communities – Frameworks, architectures and protocols

SERIES F: NON-TELEPHONE TELECOMMUNICATION SERVICES

Audiovisual services

Requirements and reference architecture of the machine-to-machine service layer

Recommendation ITU-T Y.4413/F.748.5

ITU-T Y-SERIES RECOMMENDATIONS

GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS AND NEXT-GENERATION NETWORKS, INTERNET OF THINGS AND SMART CITIES

GLOBAL INFORMATION INFRASTRUCTURE	
General	Y.100–Y.199
Services, applications and middleware	Y.200–Y.299
Network aspects	Y.300–Y.399
Interfaces and protocols	Y.400–Y.499
Numbering, addressing and naming	Y.500–Y.599
Operation, administration and maintenance	Y.600–Y.699
Security	Y.700–Y.799
Performances	Y.800–Y.899
INTERNET PROTOCOL ASPECTS	
General	Y.1000–Y.1099
Services and applications	Y.1100–Y.1199
Architecture, access, network capabilities and resource management	Y.1200–Y.1299
Transport	Y.1300–Y.1399
Interworking	Y.1400–Y.1499
Quality of service and network performance	Y.1500–Y.1599
Signalling	Y.1600–Y.1699
Operation, administration and maintenance	Y.1700–Y.1799
Charging	Y.1800–Y.1899
IPTV over NGN	Y.1900–Y.1999
NEXT GENERATION NETWORKS	
Frameworks and functional architecture models	Y.2000–Y.2099
Quality of Service and performance	Y.2100–Y.2199
Service aspects: Service capabilities and service architecture	Y.2200–Y.2249
Service aspects: Interoperability of services and networks in NGN	Y.2250–Y.2299
Enhancements to NGN	Y.2300–Y.2399
Network management	Y.2400–Y.2499
Network control architectures and protocols	Y.2500–Y.2599
Packet-based Networks	Y.2600–Y.2699
Security	Y.2700–Y.2799
Generalized mobility	Y.2800–Y.2899
Carrier grade open environment	Y.2900–Y.2999
FUTURE NETWORKS	Y.3000–Y.3499
CLOUD COMPUTING	Y.3500–Y.3999
INTERNET OF THINGS AND SMART CITIES AND COMMUNITIES	
General	Y.4000–Y.4049
Definitions and terminologies	Y.4050–Y.4099
Requirements and use cases	Y.4100–Y.4249
Infrastructure, connectivity and networks	Y.4250–Y.4399
Frameworks, architectures and protocols	**Y.4400–Y.4549**
Services, applications, computation and data processing	Y.4550–Y.4699
Management, control and performance	Y.4700–Y.4799
Identification and security	Y.4800–Y.4899

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T Y.4413/F.748.5

Requirements and reference architecture of the machine-to-machine service layer

Summary

Recommendation ITU-T Y.4413/F.748.5 identifies requirements of the machine-to-machine (M2M) service layer, which are common to all M2M verticals or specific to e-health application support, and provides an architectural framework of the M2M service layer.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T Y.4413/F.748.5	2015-11-29	16	11.1002/1000/12623

Keywords

Internet of things, IoT, M2M, machine-to-machine, service layer.

* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

Table of Contents

Recommendation ITU-T Y.4413/F.748.5

Requirements and reference architecture of the machine-to-machine service layer

1 Scope

This Recommendation identifies requirements of the machine-to-machine (M2M) service layer, which are common to all M2M verticals or specific to e-health application support, and to provide an architectural framework of the M2M service layer.

In particular, the scope of this Recommendation includes:

– definition of the M2M service layer;

– requirements of the M2M service layer;

– architectural framework of the M2M service layer;

– reference points of the M2M service layer.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T Y.4000] Recommendation ITU-T Y.4000/Y.2060 (2012), *Overview of the Internet of things*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 application dedicated node [b-oneM2M-TS-0011]: A node that contains at least one application entity and does not contain a common services entity. There may be zero or more application dedicated nodes (ADNs) in the field domain of the oneM2M system.

3.1.2 application entity [b-oneM2M-TS-0011]: Represents an instantiation of application logic for end-to-end M2M solutions.

3.1.3 application service node [b-oneM2M-TS-0011]: A node that contains one common services entity and contains at least one application entity. There may be zero or more ASNs in the field domain of the oneM2M system.

3.1.4 common service entity [b-oneM2M-TS-0011]: Represents an instantiation of a set of common service functions of the M2M environments. Such service functions are exposed to other entities through reference points.

3.1.5 infrastructure node [b-oneM2M-TS-0011]: A node that contains one common services entity and contains zero or more application entities. There is exactly one infrastructure node in the infrastructure domain per oneM2M service provider.

3.1.6 IoT [ITU-T Y.4000]: A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on, existing and evolving, interoperable information and communication technologies.

NOTE 1 – Through the exploitation of identification, data capture, processing and communication capabilities, the IoT makes full use of things to offer services to all kinds of applications, whilst ensuring that security and privacy requirements are fulfilled.

NOTE 2 – In a broad perspective, the IoT can be perceived as a vision with technological and societal implications.

3.1.7 middle node [b-oneM2M-TS-0011]: A node that contains one common services entity and contains zero or more application entities. There may be zero or more middle nodes in the field domain of the oneM2M system.

3.1.8 node [b-oneM2M-TS-0011]: Functional entity containing one of the following: one or more M2M applications; one CSE and zero or more M2M applications.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ADN	Application Dedicated Node
AE	Application Entity
ASN	Application Service Node
BAN	Body Area Network
CSE	Common Service Entity
CSF	Common Services Function
DA	Device Application
GA	Gateway Application
IN	Infrastructure Node
IoT	Internet of Things
M2M	Machine-to-Machine
MN	Middle Node
NA	Network Application
NSE	Network Service Entity
SCL	Service Capabilities Layer
SL	Service Layer

5 Conventions

None.

6 Definition of the ITU-T M2M service layer

6.1 The ITU-T M2M service layer and its relationship with the IoT reference model

From the ITU-T perspective, the machine-to-machine (M2M) technologies are a key enabler of the Internet of things (IoT), [ITU-T Y.4000].

The M2M service layer in the ITU-T scope, the "ITU-T M2M service layer", includes a set of generic and specific functions for the support of a variety of applications enabled by the M2M technologies. These include management functions and security functions, as well as service support and application support functions. The capabilities of the ITU-T M2M service layer are a subset of the entire set of capabilities of the IoT.

Figure 1 shows the ITU-T M2M service layer and its position in the IoT reference model [ITU-T Y.4000].

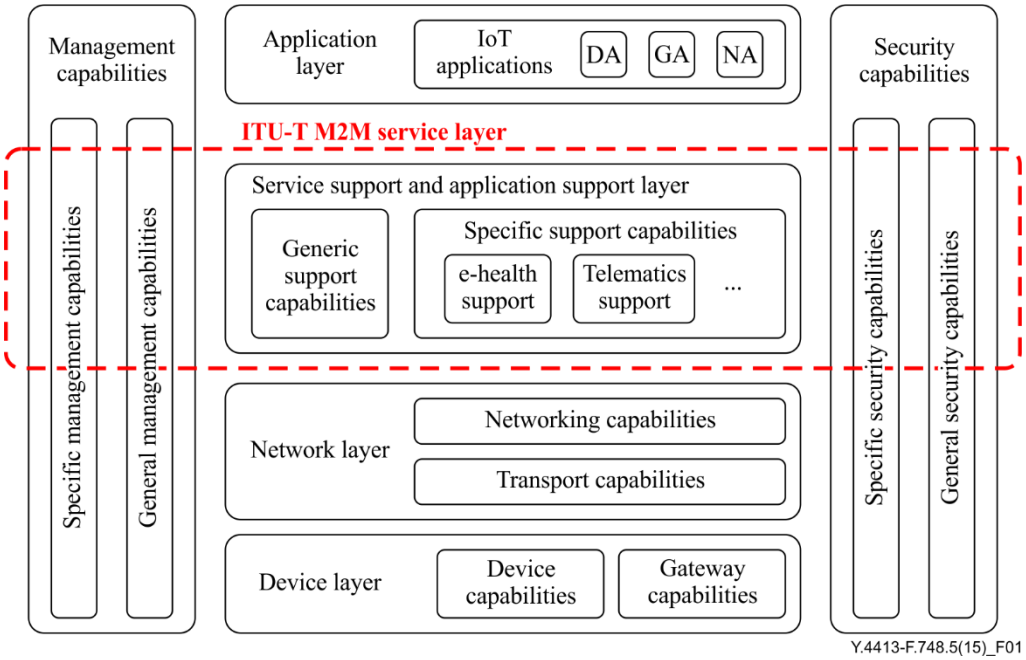

Figure 1 – The ITU-T M2M service layer in the IoT reference model

The layered architectural approach, as illustrated in Figure 1, reduces the implementation complexity while providing interoperability between the various applications enabled by the M2M technologies.

NOTE – Other architectural approaches are out of scope of this Recommendation. It is recognized that cross layer architectural approaches can show higher performances, but at the expense of higher implementation complexity.

The specific support capabilities in the service support and application support layer include application specific support capabilities (e.g., e-health support, telematics support) as shown in Figure 1).

Three types of applications are identified on top of the ITU-T M2M service layer (application layer): device application (DA), gateway application (GA) and network application (NA) servers. DA, GA and NA reside, respectively, in a device, gateway and network application server. All these applications can use capabilities provided by the ITU-T M2M service layer.

6.2 The ETSI M2M service capabilities layer and its relationship with the ITU-T M2M service layer

The ETSI M2M service capabilities layer (SCL) [b-ETSI 102 690] provides functions that are shared by different applications enabled by the M2M technologies, and can be positioned with respect to the IoT reference model described in [ITU-T Y.4000] as shown in Figure 2.

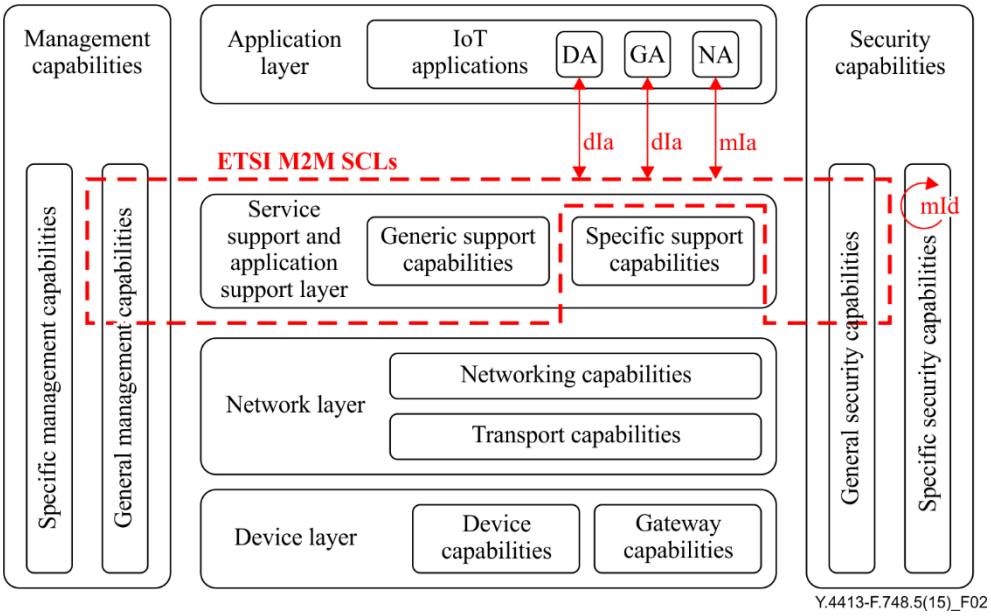

Figure 2 – ETSI M2M SCL in the IoT reference model

In Figure 2, dIa and mIa from [b-ETSI 102 690] can be considered as reference points between IoT applications and the service support and application support layer with inclusion of the general management capabilities and general security capabilities. mId from [b-ETSI 102 690] can be considered as the reference point between the service support and application support layer of different devices.

As shown in Figure 2, the ETSI M2M SCL includes only general functions of service support and application support layer, general management capabilities and general security capabilities.

Compared to the ETSI M2M SCL, the ITU-T M2M service layer includes specific support capabilities in the service support and application support layer, specific management capabilities and specific security capabilities as shown in Figure 1.

It is anticipated that dIa, mIa and mId from [b-ETSI 102 690] may need extension to include the support of the specific support capabilities in the service support and application support layer, the specific management capabilities and the specific security capabilities.

6.3 The oneM2M common service entity and its relationship with the ITU-T M2M service layer

The oneM2M common service entity (CSE) [b-oneM2M-TS-0001] means a group of the twelve common service functions (CSFs) that are shared by different applications enabled by the M2M application service provider and/or user, and can be positioned with respect to the IoT reference model described in [ITU-T Y.4000], as shown in Figure 3.

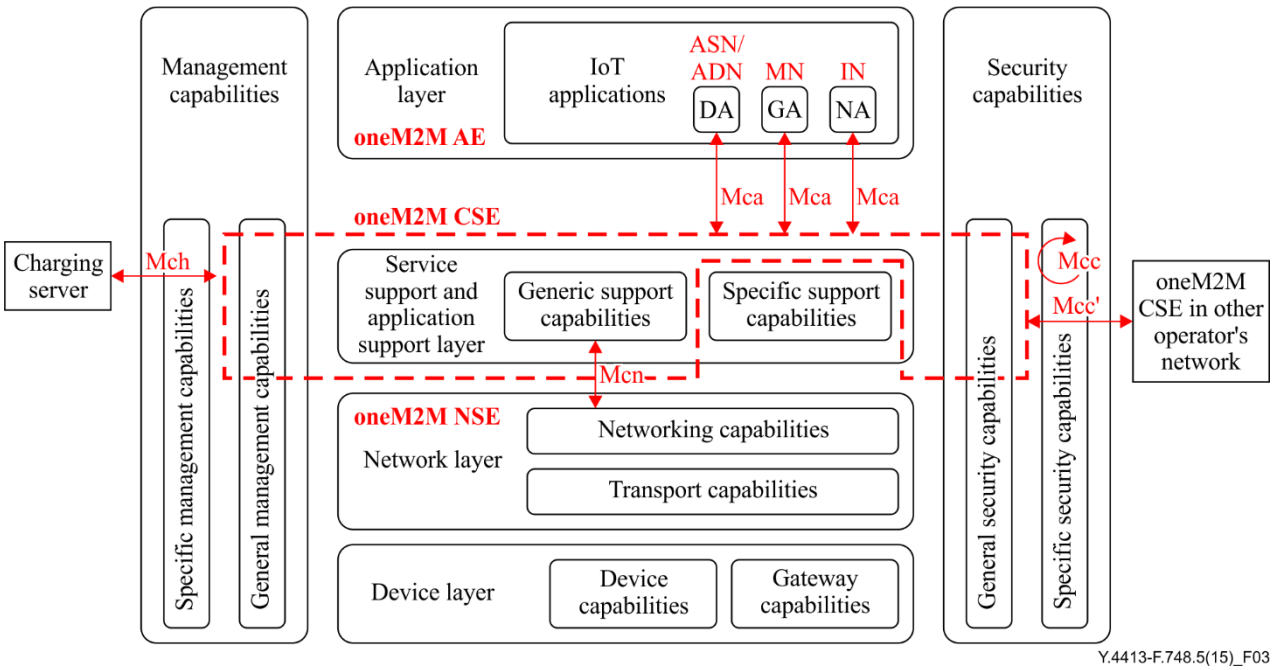

Figure 3 – oneM2M functional architecture in the IoT reference model

In Figure 3, Mca can be considered as reference points between IoT applications and the service support and application support layer with inclusion of the general management capabilities and general security capabilities. Mch can be considered as reference points between charging server and the service support and application support layer and with inclusion of the general management capabilities and general security capabilities. Mcc and Mcc' can be considered as the reference point between the service support and application support layer of different nodes. Here, Mcc' can be considered to connect to the CSE of other service providers.

As shown in Figure 3, the oneM2M CSE, like the ETSI M2M SCL, includes only general functions of service support and application support layer, general management capabilities and general security capabilities.

Compared to the oneM2M CSE, the ITU-T M2M service layer includes specific support capabilities in the service support and application support layer, specific management capabilities and specific security capabilities as shown in Figure 1.

7 Requirements of the ITU-T M2M service layer

7.1 Common requirements

7.1.1 Communication management

– Message scheduling:

  The ITU-T M2M service layer is required to support various priorities of messages.

– Various types of communications:

  The ITU-T M2M service layer is required to support various types of communication (e.g., on-demand, continuous) requested by applications. It should also support notification of communication failure.

– Various underlying network technologies support:

  The ITU-T M2M service layer is required to support underlying network technologies.

7.1.2 Application management

– Multiple applications support:

The ITU-T M2M service layer is required to support multiple applications concurrently.

7.1.3 Service and device discovery and registration

– Service and device discovery and registration:

The ITU-T M2M service layer is required to support service and device discovery and registration.

7.1.4 Service accounting and charging

– Service accounting and charging:

The ITU-T M2M service layer is required to support service accounting and charging.

7.1.5 Device management

– Auto configuration:

The ITU-T M2M service layer is required to support auto configuration and configuration management of devices and upgrading of software on the devices in a secure way.

– Management of multiple devices and various types of devices:

The ITU-T M2M service layer is required to support management of multiple devices and various types of devices.

7.1.6 Data processing

– Data storage and notification:

The ITU-T M2M service layer is recommended to provide capability of data storage for applications. Once data are updated, the ITU-T M2M service layer should inform subscribed applications.

– Data formatting and translation:

The ITU-T M2M service layer is recommended to provide capability of data formatting and translation to facilitate semantic interoperation between applications.

– Data collection and reporting:

The ITU-T M2M service layer is required to support both on-demand and periodic reporting as requested by applications.

7.1.7 Diagnostics and fault recovery

– Diagnostics and fault recovery:

The ITU-T M2M service layer is required to support diagnostic mechanisms for applications and devices. In addition, it should support fault recovery and fault management to recognize, isolate, correct and log faults that occur.

7.1.8 Identification, naming and addressing

– Reachability of devices by identification:

The ITU-T M2M service layer is required to support reachability of devices based on device identification.

7.1.9 Security

– Authentication:

The ITU-T M2M service layer is required to provide authentication mechanisms for applications and devices and prevent unauthorized use of the devices.

– Privacy:

The ITU-T M2M service layer is required to support privacy protection capabilities, such as anonymity of identity and location, according to regulation and laws.

– Confidentiality:

The ITU-T M2M service layer is required to support data transfer confidentiality.

– Integrity:

The ITU-T M2M service layer is required to support data integrity protection.

– Support of security for service scenarios involving multiple actors:

The ITU-T M2M service layer is required to support security capabilities, such as supporting user access control of protected data, for M2M service scenarios involving multiple actors inside a single administrative domain and across different administrative domains (e.g., countries, operators).

– Availability:

The ITU-T M2M service layer is required to support data availability. Typically, data, and their related-functions or services must be available whenever they are needed.

7.1.10 Location provisioning

– Location information:

The ITU-T M2M service layer is recommended to support collection, tracking and reporting of location information according to different collection, tracking and reporting strategies.

7.1.11 Group management

– Group management:

The ITU-T M2M service layer is required to support a mechanism to create and manage virtual group of devices.

7.2 e-health specific requirements

– Security for personal health information:

The ITU-T M2M service layer is required to provide security capabilities in compliance with regulation and laws regarding personal health information (personal data and medical data).

– Privacy protection:

The ITU-T M2M service layer is required to provide privacy protection capabilities for personal health information in compliance with regulation and laws (personal data and medical data when they are associated with a person's identification).

– e-health device profile support:

The ITU-T M2M service layer is required to support e-health device profile according to international standards (e.g., medical body area network (BAN) [b-IEEE 802.15.6], Bluetooth [b-Bluetooth]).

– Time synchronization and timestamping:

The ITU-T M2M service layer is required to support timestamping since health conditions vary over time. With timestamping, e-health applications can obtain useful information according to the health condition history. For support of timestamping, the ITU-T M2M service layer is also required to retrieve time parameters from authoritative time servers and publish time parameters according to the requests from e-health applications.

– Audit trail support:

The ITU-T M2M service layer is required to support audit trails ensuring that any access or attempt to access personal health information is fully transparent, traceable and reproducible.

8 Architectural framework of the ITU-T M2M service layer

8.1 Overview of the architectural framework of the ITU-T M2M service layer

As described in clause 6, the ITU-T M2M service layer is positioned between the application layer and the network layer, and provides various types of capabilities, including generic support capabilities, specific support capabilities, general and specific management capabilities, general and specific security capabilities.

Figure 4 shows the architectural framework of the ITU-T M2M service layer.

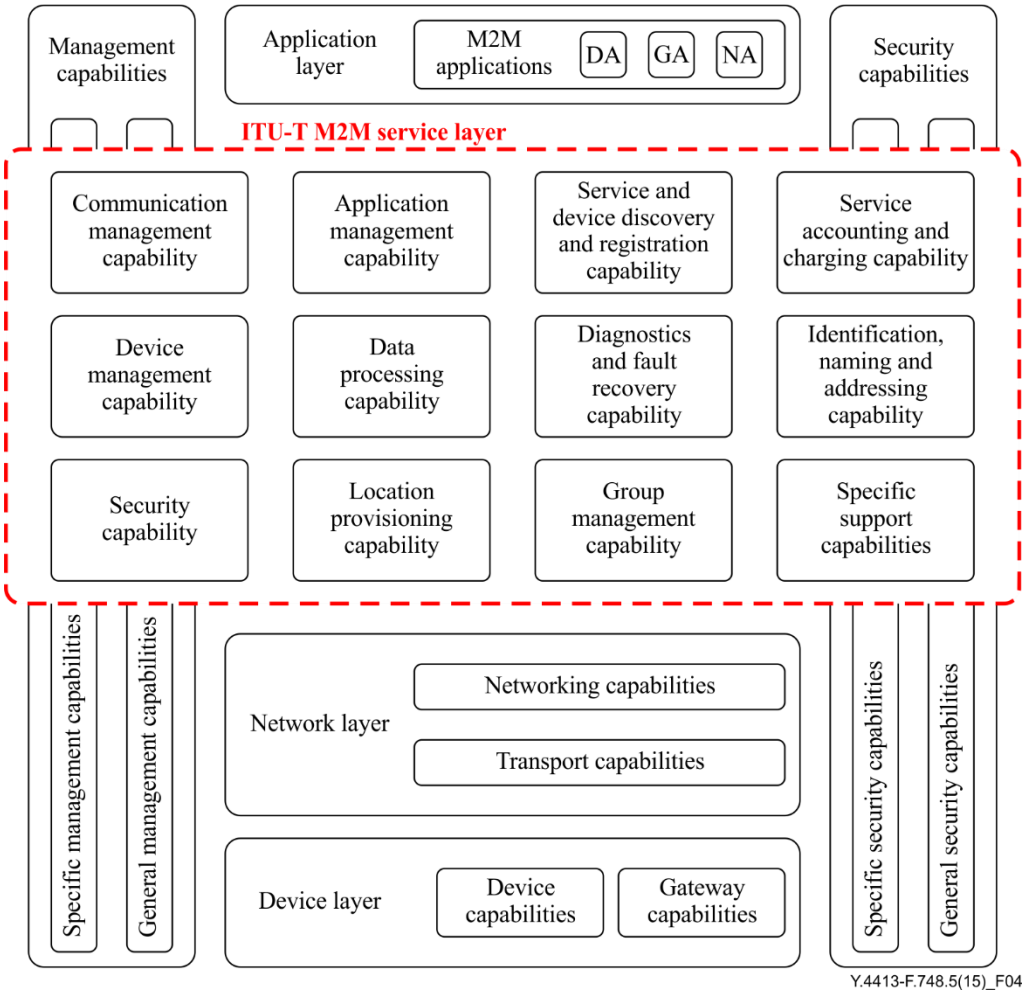

Figure 4 – The ITU-T M2M service layer architectural framework

8.2 The capabilities of the ITU-T M2M service layer

NOTE – The capabilities in clause 8.2 (i.e., 8.2.1 through 8.2.11) correspond to the requirements in clause 7.1 (i.e., 7.1.1 through 7.1.11), respectively.

8.2.1 Communication management

This capability supports message scheduling, various types of communications and various underlying network technologies.

8.2.2 Application management

This capability supports multiple applications.

8.2.3 Service and device discovery and registration

This capability supports service and device discovery and registration.

8.2.4 Service accounting and charging

This capability supports accounting and different charging models, including both online and offline charging.

8.2.5 Device management

This capability supports auto configuration, management of multiple devices and various types of devices.

8.2.6 Data processing

This capability supports data storage, notification, formatting, translation, collection and reporting.

8.2.7 Diagnostics and fault recovery

This capability supports recognition, isolation, correction and logging of the faults that occur in the application layer and the ITU-T M2M service layer.

8.2.8 Identification, naming and addressing

This capability supports reachability of devices based on device identification, naming and addressing.

8.2.9 Security

This capability supports authentication, privacy protection, confidentiality, integrity and support of security for service scenarios involving multiple actors.

8.2.10 Location provisioning

This capability supports the acquisition and management of location information based on the requests from applications.

8.2.11 Group management

This capability supports mechanisms to create and manage virtual group of devices.

8.2.12 Specific support

These capabilities are support capabilities that apply to specific applications. These capabilities are out of scope of this Recommendation.

9 Reference points of the ITU-T M2M service layer

9.1 Overview of the reference points

Figure 5 shows the reference points of the ITU-T M2M service layer.

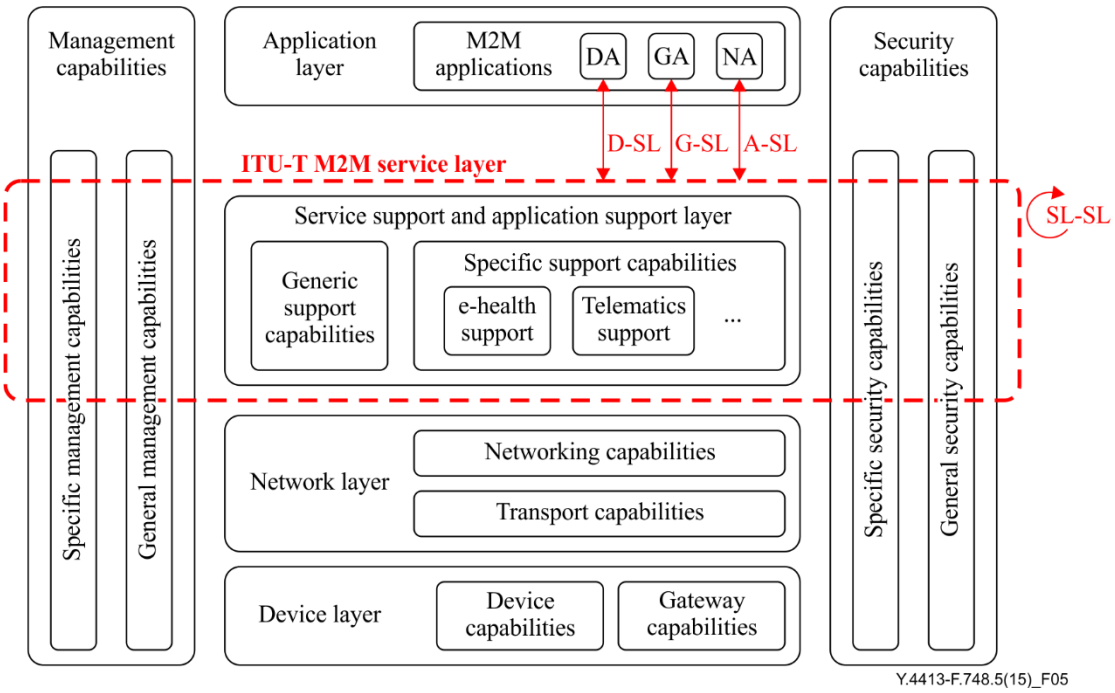

Figure 5 – Reference points of the ITU-T M2M service layer

As described in clause 6.1, three types of applications are identified on top of the ITU-T M2M service layer (application layer): DA, GA and NA servers. DA, GA and NA reside, respectively, in a device, gateway and network application server. All these applications can use capabilities provided by the ITU-T M2M service layer.

Four different reference points are identified for the ITU-T M2M service layer: D-SL, G-SL, A-SL and SL-SL. D-SL is the reference point between the DA and the ITU-T M2M service layer, G-SL is the reference point between the GA and the ITU-T M2M service layer, A-SL is the reference point between NA and the ITU-T M2M service layer, and SL-SL is the reference point between the ITU-T M2M service layers residing, respectively, in device, gateway and network application servers.

9.2 Details on the reference points

Figure 6 provides a detailed illustration of the reference points described in Figure 5.

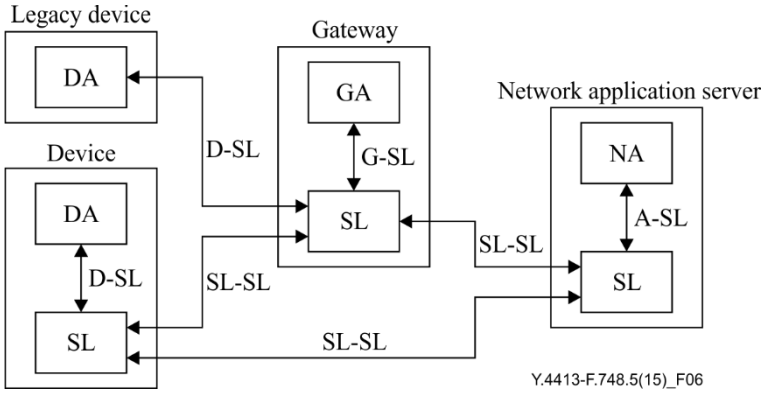

Figure 6 – Reference points between device, gateway and network application server

The D-SL reference point allows a device application in a device to access the ITU-T M2M service layer in the same device or in the gateway. The D-SL reference point between device application and service layer in a gateway is for legacy devices which do not have ITU-T M2M service layer capabilities.

The G-SL reference point allows a gateway application in a gateway to access the ITU-T M2M service layer in the same gateway.

The A-SL reference point allows a network application server to access the ITU-T M2M service layer in the same network application server.

The SL-SL reference point allows the ITU-T M2M service layer in a device, gateway or network application server to access the ITU-T M2M service layer in a different device, gateway or network application server.

Appendix I

Comparison between the capabilities of the ITU-T M2M service layer and common services functions of oneM2M

(This appendix does not form an integral part of this Recommendation.)

This appendix provides comparison between the capabilities of the ITU-T M2M service layer and CSFs of oneM2M. oneM2M defines CSE as Figure I.1 in [b-oneM2M-TS-0001].

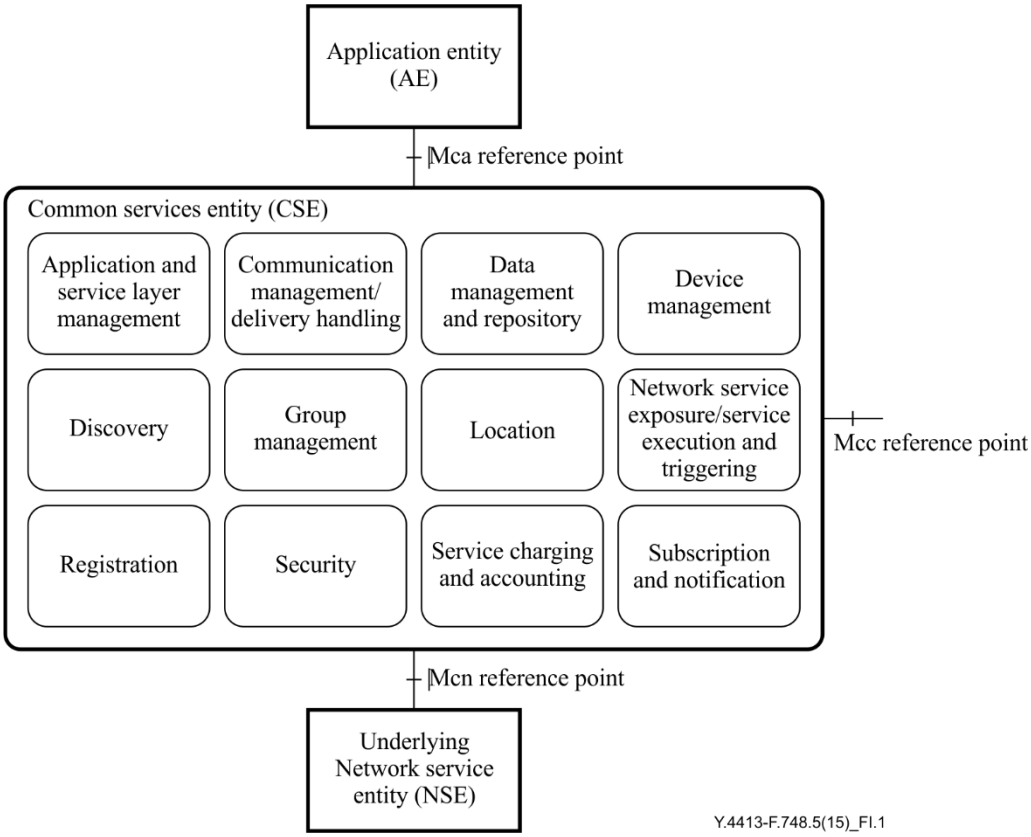

Figure I.1 – oneM2M common services functions

Figure I.2 shows the summary of comparison between the capabilities of the ITU-T M2M service layer and the CSFs of oneM2M.

For example, some functions of communication management/delivery handling and device management in CSFs of oneM2M is covered by communication management capability of the ITU-T M2M service layer.

The main differences between them are that oneM2M CSF does not dealing with the application-specific support and ITU-T M2M service layer does not dealing with the subscription and notification.

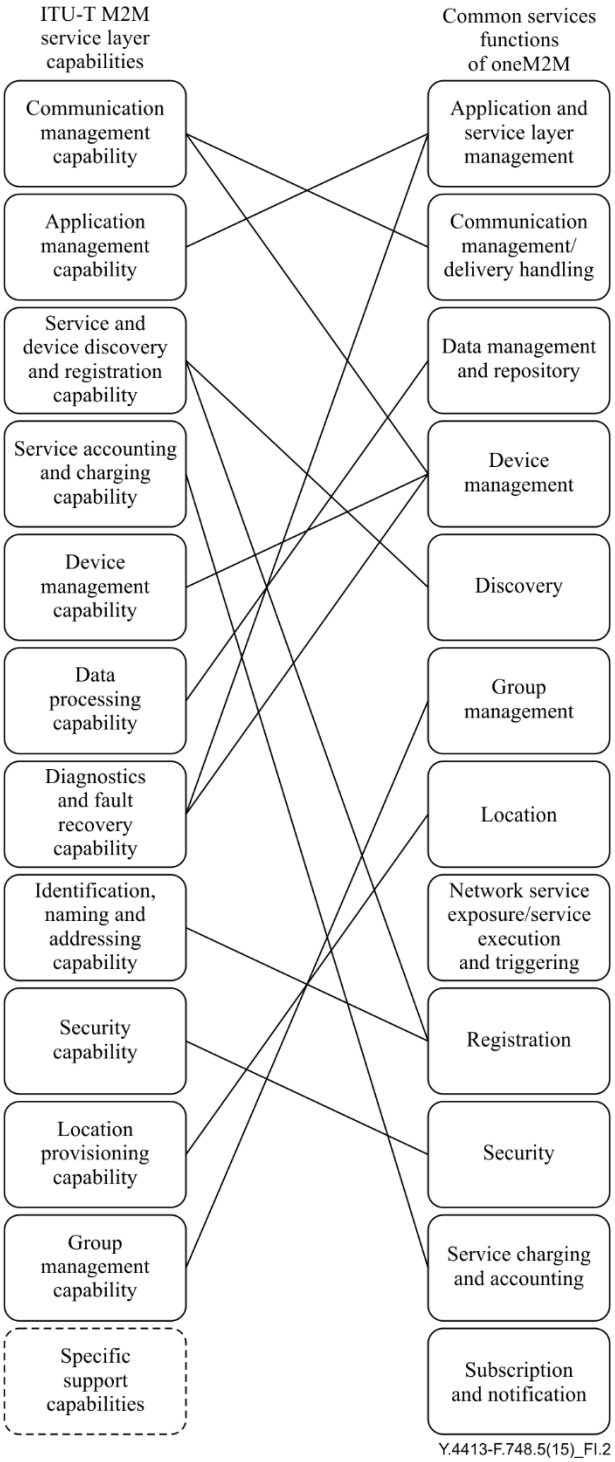

Figure I.2 – Comparison between the capabilities of the ITU-T M2M service layer and the CSFs of oneM2M

Appendix II

Comparison of reference points between the ITU-T M2M service layer and common services entity of oneM2M

(This appendix does not form an integral part of this Recommendation.)

Figure II.1 shows comparisons of reference points between the ITU-T M2M service layer and the CSE of oneM2M.

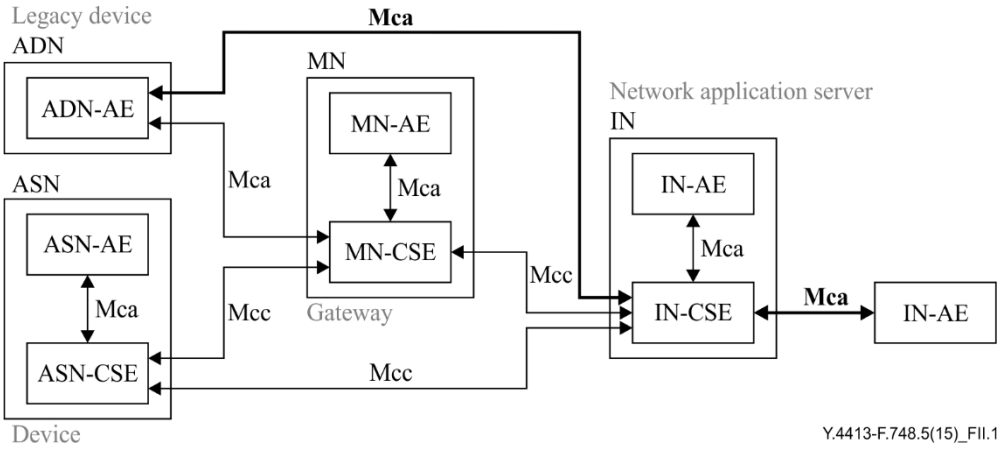

Figure II.1 – Comparison of reference points between the ITU-T M2M service layer and the CSEs of oneM2M

Compared to the ITU-T M2M service layer, oneM2M CSE has additional reference points between ASN-AE and IN-CSE and between IN-CSE and IN-AE.

Bibliography

[b-Bluetooth] Bluetooth, *adopted specifications*. <https://www.bluetooth.org/en-us/specification/adopted-specifications>

[b-ETSI 102 690] ETSI TS 102 690 v2.1.1 (2013), *Machine-to-Machine communications (M2M): Functional architecture*.

[b-IEEE 802.15.6] IEEE 802.15.6 (2012), *IEEE Standard for Local and metropolitan area networks - Part 15.6: Wireless Body Area Networks*. <http://standards.ieee.org/findstds/standard/802.15.6-2012.html>, accessed on 2014-06-10.

[b-oneM2M-TS-0001] oneM2M-TS-0001-V-2014-08 (2014), *oneM2M Functional Architecture Baseline Draft*.

[b-oneM2M-TS-0011] oneM2M-TS-0011-V-2014-08 (2014), *oneM2M Definitions and Acronyms*.

ITU-T F-SERIES RECOMMENDATIONS

NON-TELEPHONE TELECOMMUNICATION SERVICES

TELEGRAPH SERVICE	
Operating methods for the international public telegram service	F.1–F.19
The gentex network	F.20–F.29
Message switching	F.30–F.39
The international telemessage service	F.40–F.58
The international telex service	F.59–F.89
Statistics and publications on international telegraph services	F.90–F.99
Scheduled and leased communication services	F.100–F.104
Phototelegraph service	F.105–F.109
MOBILE SERVICE	
Mobile services and multidestination satellite services	F.110–F.159
TELEMATIC SERVICES	
Public facsimile service	F.160–F.199
Teletex service	F.200–F.299
Videotex service	F.300–F.349
General provisions for telematic services	F.350–F.399
MESSAGE HANDLING SERVICES	F.400–F.499
DIRECTORY SERVICES	F.500–F.549
DOCUMENT COMMUNICATION	
Document communication	F.550–F.579
Programming communication interfaces	F.580–F.599
DATA TRANSMISSION SERVICES	F.600–F.699
AUDIOVISUAL SERVICES	**F.700–F.799**
ISDN SERVICES	F.800–F.849
UNIVERSAL PERSONAL TELECOMMUNICATION	F.850–F.899
HUMAN FACTORS	F.900–F.999

For further details, please refer to the list of ITU-T Recommendations.

SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of ITU-T
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	**Non-telephone telecommunication services**
Series G	Transmission systems and media, digital systems and networks
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	Cable networks and transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	Environment and ICTs, climate change, e-waste, energy efficiency; construction, installation and protection of cables and other elements of outside plant
Series M	Telecommunication management, including TMN and network maintenance
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Terminals and subjective and objective assessment methods
Series Q	Switching and signalling
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	Data networks, open system communications and security
Series Y	**Global information infrastructure, Internet protocol aspects and next-generation networks**
Series Z	Languages and general software aspects for telecommunication systems

Printed in Switzerland
Geneva, 2016