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INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS
AND NEXT-GENERATION NETWORKS

Next Generation Networks – Frameworks and functional
architecture models

**Requirements for the support of machine-
oriented communication applications in the next
generation network environment**

Recommendation ITU-T Y.2061

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Recommendation ITU-T Y.2061

Requirements for the support of machine-oriented communication applications in the next generation network environment

Summary

Recommendation ITU-T Y.2061 provides an overview of machine-oriented communication (MOC) applications in the next generation network (NGN) environment. This includes the description of an MOC ecosystem, the characteristics of MOC and some relevant use cases. By analysing the service requirements of MOC applications, it specifies the requirements for NGN capabilities and the requirements of MOC-device domain capabilities based on these service requirements. Furthermore, this Recommendation provides a reference framework for MOC capabilities.

History

Edition	Recommendation	Approval	Study Group
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Machine-oriented communication (MOC), MOC applications, MOC capabilities, MOC device, MOC-device domain, MOC gateway, MOC-service domain, NGN, NGN capabilities, NGN domain, service requirements.

FOREWORD

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Recommendation ITU-T Y.2061

Requirements for the support of machine-oriented communication applications in the next generation network environment

1 Scope

This Recommendation covers extensions and additions to next generation networks as well as device capabilities in order to support machine-oriented communication (MOC) applications in the NGN environment. Although this Recommendation deals with the support of MOC applications in the NGN environment, these capabilities can conceptually be applicable to other networks.

The scope of this Recommendation includes:

- network overview; description of an MOC ecosystem and the characteristics of MOC
- service requirements for the support of MOC applications
- requirements of NGN capabilities based on MOC service requirements
- requirements of MOC-device domain capabilities based on MOC service requirements
- reference framework for MOC capabilities.

NOTE – Appendix I provides details of actors and roles in an MOC ecosystem and Appendix II provides relevant use cases of MOC applications in the NGN environment.

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 Q.1706] | Recommendation ITU-T Q.1706/Y.2801 (2006), <i>Mobility management requirements for NGN</i> . |
| [ITU-T Y.2012] | Recommendation ITU-T Y.2012 (2010), <i>Functional requirements and architecture of next generation networks</i> . |
| [ITU-T Y.2060] | Recommendation ITU-T Y.2060 (2012), <i>Overview of the Internet of things</i> . |
| [ITU-T Y.2201] | Recommendation ITU-T Y.2201 (2009), <i>Requirements and capabilities for ITU-T NGN</i> . |
| [ITU-T Y.2221] | Recommendation ITU-T Y.2221 (2010), <i>Requirements for support of ubiquitous sensor network (USN) applications and services in the NGN environment</i> . |
| [ITU-T Y.2233] | Recommendation ITU-T Y.2233 (2008), <i>Requirements and framework allowing accounting and charging capabilities in NGN</i> . |
| [ITU-T Y.2240] | Recommendation ITU-T Y.2240 (2011), <i>Requirements and capabilities for next generation network service integration and delivery environment</i> . |
| [ITU-T Y.2701] | Recommendation ITU-T Y.2701 (2007), <i>Security requirements for NGN release 1</i> . |

[ITU-T Y.2702] Recommendation ITU-T Y.2702 (2008), *Authentication and authorization requirements for NGN release 1*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 device [ITU-T Y.2060]: With regard to the Internet of things, this is a piece of equipment with the mandatory capabilities of communication and the optional capabilities of sensing, actuation, data capture, data storage and data processing.

3.1.2 gateway [ITU-T Y.2091]: A unit which interconnects different networks and performs the necessary translation between the protocols used in these networks.

3.1.3 ID terminal [b-ITU-T Y.2213]: A device with a data reading and optional writing capability which reads (and optionally writes) identifier(s) and optionally application data from/into an ID tag.

3.1.4 network mobility [ITU-T Q.1703]: The ability of a network, where a set of fixed or mobile nodes are networked to each other, to change, as a unit, its point of attachment to the corresponding network upon the network's movement itself.

3.1.5 NGN service integration and delivery environment (NGN-SIDE) [ITU-T Y.2240]: An open environment in NGN integrating resources from different domains and delivering integrated services to applications over NGN.

NOTE – These domains include, but are not limited to, a telecommunication domain (e.g., fixed and mobile networks), Internet domain, broadcasting domain and content provider domain.

3.1.6 open service environment capabilities [ITU-T Y.2234]: Capabilities provided by an open service environment to enable enhanced and flexible service creation and provisioning based on the use of standards interfaces.

3.1.7 sensor [ITU-T Y.2221]: An electronic device that senses a physical condition or chemical compound and delivers an electronic signal proportional to the observed characteristic.

3.1.8 universal IC card (UICC) [b-ITU-T Q.1741.7]: A physically secure device, an IC card (or 'smart card'), that can be inserted and removed from the terminal. It may contain one or more applications. One of the applications may be a USIM.

3.2 Terms defined in this Recommendation

This Recommendation defines or uses the following terms:

3.2.1 actuator: A device performing physical actions caused by an input signal.

NOTE – As examples, an actuator might act on the flow of a gas or liquid, on electricity distribution, or through a mechanical operation. Dimmers and relays are examples of actuators. The decision to activate the actuator may come from an MOC application, a human or MOC devices and gateways.

3.2.2 machine-oriented communication (MOC): A form of data communication between two or more entities in which at least one entity does not necessarily require human interaction or intervention in the communication process.

3.2.3 machine-oriented communication (MOC) capabilities: A set of functions for the support and management of MOC applications, shared by different MOC applications and accessed through a set of standard interfaces.

NOTE 1 – When MOC capabilities are supported by NGN, they provide standard interfaces for MOC applications to MOC devices and gateways for data collection, management and operation. They also reuse or interact with NGN capabilities [ITU-T Y.2201] [ITU-T Y.2240], IT capabilities or Internet capabilities to provide MOC applications.

NOTE 2 – When MOC capabilities are supported by MOC devices and gateways, they interact with NGN functionalities and MOC applications through a set of standard interfaces.

3.2.4 machine-oriented communication (MOC) device: A device involved in the support of MOC applications.

NOTE – In the NGN environment, an MOC device connects with NGN directly or indirectly through an MOC gateway.

3.2.5 machine-oriented communication (MOC) end user: An end user of MOC applications.

NOTE – This end user may be a system (e.g., MOC application server, other network equipment, other applications, MOC device, MOC gateway), or a human (e.g., NGN end user).

3.2.6 machine-oriented communication (MOC) gateway: A gateway which interconnects and provides interoperability between MOC local networks and the network, and where applicable, interoperability at the MOC application level.

NOTE – In the NGN environment, an MOC gateway acts as a proxy or data aggregator to ensure interoperability and interconnection of MOC devices with the NGN.

3.2.7 machine-oriented communication (MOC) group: A list of MOC devices and/or gateways grouped according to one or multiple criteria.

NOTE – Criteria may include the MOC application subscriber, MOC device manufacturer, MOC application, or location.

3.2.8 machine-oriented communication (MOC) local network: A network which provides connectivity between MOC devices without the intermediation of an MOC gateway, and between MOC devices and gateways.

NOTE – An MOC local network may provide IP based and/or non-IP based connectivity.

3.2.9 meter: A device that measures and optionally records the quantity, degree, or rate of something, especially the amount of electricity, gas or water used.

NOTE – A meter is responsible for measuring the total amount of something consumed in a period.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ACI	Application to Capability Interface
ANI	Application to Network Interface
API	Application Programming Interface
B2C	Business to Customer
CDR	Charging Data Record
GNSS	Global Navigation Satellite Systems
GPS	Global Positioning System
IC	Integrated Circuit
ID	Identification
IP	Internet Protocol
IT	Information Technology

MOC	Machine-Oriented Communication
NGN	Next Generation Network
NNI	Network to Network Interface
OSE	Open Service Environment
QoS	Quality of Service
SIDE	Service Integration and Delivery Environment
SIP	Session Initiation Protocol
SLA	Service Level Agreement
SMS	Short Message Service
SNS	Social Network Services
UICC	Universal Integrated Circuit Card
UNI	User to Network Interface

5 Conventions

In this Recommendation:

The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed.

The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus this requirement needs not be present to claim conformance.

The keywords "can optionally" and "may" indicate an optional requirement which is permissible, without implying any sense of being recommended. These terms are not intended to imply that the vendor's implementation must provide the option and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with the specification.

6 Introduction

6.1 Network overview

Machine-oriented communications (MOC) are a form of data communications between two or more entities in which at least one entity does not necessarily require human interaction or intervention in the process of communication.

MOC include communications with remote MOC devices for the support of procedures covering aspects such as registration, authentication, authorization, monitoring, maintenance, provisioning and troubleshooting. MOC applications intend to automate decision and communication processes.

Figure 6-1 shows the network overview for the support of MOC applications in the NGN environment.

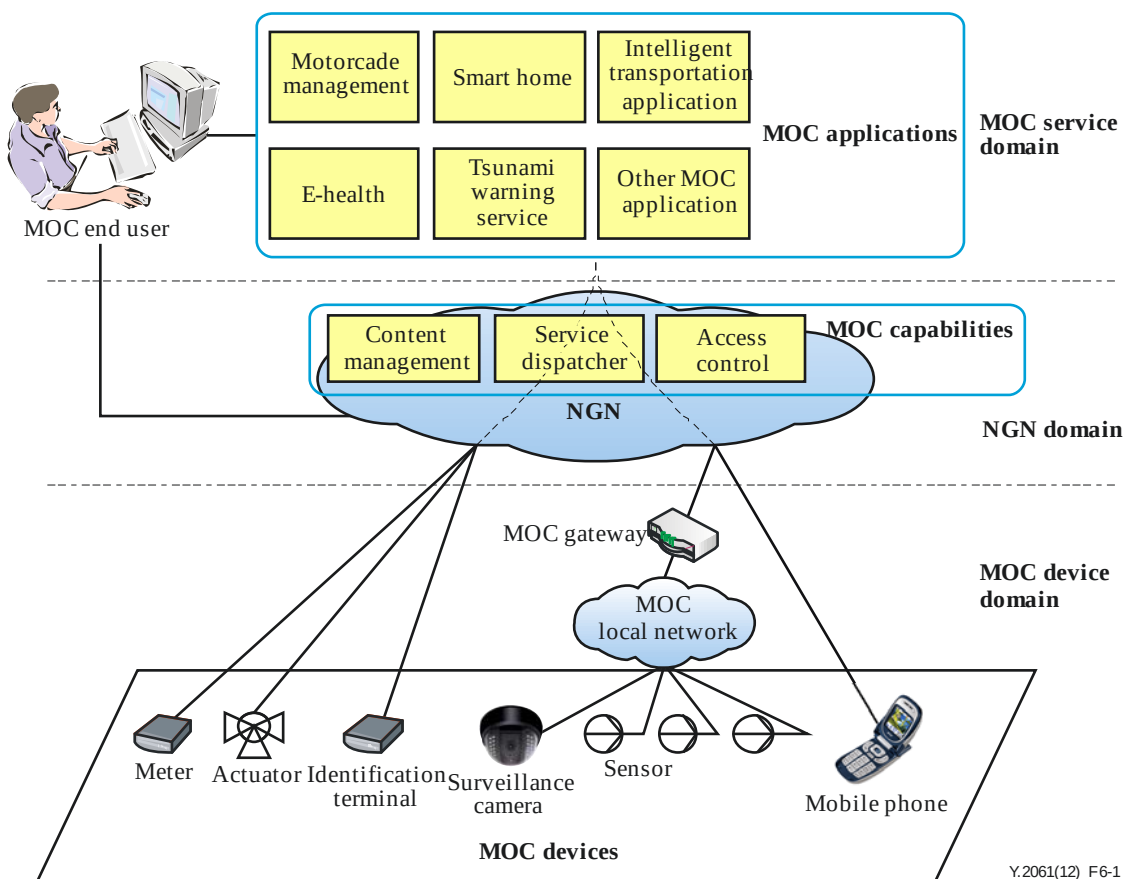


Figure 6-1 – Network overview for the support of MOC applications in the NGN environment

The MOC device domain includes MOC devices and MOC gateways. MOC devices include various types of devices as shown in Figure 6-1.

NOTE 1 – Proprietary devices (see Figure 11-1) are not shown in the above figure.

MOC devices can be categorized into general devices, data capturing devices, data carrying devices and sensing or actuating devices [ITU-T Y.2060]. Examples for the different categories include:

- sensing or actuating devices: sensor, surveillance camera, meter, actuator with remote control;
- data capturing devices and data carrying devices: identification terminal (ID terminal);
- general devices: mobile phone, personal computer, networked television.

MOC devices may access the NGN directly or via an MOC local network and the MOC gateways attached to it. MOC devices or gateways may access the NGN by use of wire-line or wireless connectivity.

MOC devices and gateways may access NGN via multiple access networks, for example to ensure reliable communications.

The NGN domain not only provides access, data transportation, network control and interconnection (with other networks) functions, but also provides MOC capabilities to support multiple MOC applications.

MOC capabilities reuse or interact with NGN capabilities [ITU-T Y.2201], expose functionalities to MOC applications through a set of standard interfaces, provide support to facilitate application development and deployment through hiding network specificities to MOC applications. MOC capabilities include capabilities for content management, the service dispatcher and access control. Details can be found in clause 11.

NOTE 2 – Although not shown in Figure 6-1, MOC capabilities in NGN can also interact with other applications outside the MOC service domain, such as social network services (SNS) or blog applications, which can make MOC related information available in accordance with customer or application requirements.

The MOC service domain includes MOC applications. MOC applications run the application logic and use MOC capabilities accessible via standard interfaces.

NOTE 3 – Although not shown in Figure 6-1, MOC capabilities and MOC applications can also exist in the MOC device domain.

6.2 Types of machine-oriented communications

MOC covers communications among MOC devices and humans, specifically:

- communications among different MOC devices and among MOC devices and MOC applications;
- communications among MOC devices and other devices controlled by humans.

The first type of communications deals with data collection, device management, device operations and other communication functions with remote equipment. These communications are used in many scenarios, e.g., that of MOC applications getting the relevant information provided by sensors.

The second type of communications may be initiated by remote MOC devices to timely inform humans about relevant information detected in MOC devices, or may be initiated by humans to get relevant information from remote MOC devices. These communications involve many scenarios, e.g., a human connecting to a surveillance camera in his house by using a mobile phone.

In the case of an MOC device interacting with MOC capabilities in a network domain or with MOC applications, the execution of an MOC application in an NGN environment may be divided into the following phases:

- Data collection: the MOC device detects, measures and records data (e.g., data related to physical properties, multimedia data, etc.). When the MOC device meets a trigger threshold or receives an instruction from MOC capabilities in the network domain or MOC applications, the MOC device requests the NGN to transfer the data to the MOC application.

NOTE 1 – The MOC device follows the pre-configured policy, which can be decided by the MOC capabilities or the MOC applications. According to the policy, the MOC device detects data, executes the logic, and initiates the communication to the MOC applications or human-controlled MOC devices to report the relevant information.

- Data transportation: the NGN establishes a data path between the MOC device and the MOC capabilities. The MOC application can communicate with the MOC device directly (without gateway) under the authorization of the MOC capabilities in NGN: in order to manage the MOC device, the MOC application gets the authorization information from the MOC capabilities which are used for the secure communication's authorization and session key negotiation.

NOTE 2 – The MOC device may also initiate such a process.

- Data analysis: the MOC application analyses data received from the MOC device. MOC capabilities in NGN can also analyse the data based on rules defined by MOC end users.
- Service delivery: the MOC application executes the service logic and decides how to publish the information to MOC end users (including MOC devices, humans or other applications). Information delivery can be "active" meaning that the MOC application forwards information to MOC end users automatically. The MOC application also supports forwarding the information based on demand from MOC end users ("passive" information delivery).

NOTE 3 – Not all of the above phases are necessary for the execution of all MOC applications. For example, an MOC end user can send a request to a vehicle-related MOC application to turn on the klaxon of the vehicle when he/she wants to find out his/her vehicle in a large parking area, and the vehicle-related MOC application will turn on the vehicle klaxon after receiving the request. In this example, data collection and data transportation from the MOC device (the vehicle) to the MOC application are not executed.

6.3 MOC ecosystem

Figure 6-2 depicts business roles which are relevant in an MOC ecosystem, and their relationships. The business roles identified in Figure 6-2 and their relationships are based on the IoT ecosystem [ITU-T Y.2060] and adapted to the context of MOC.

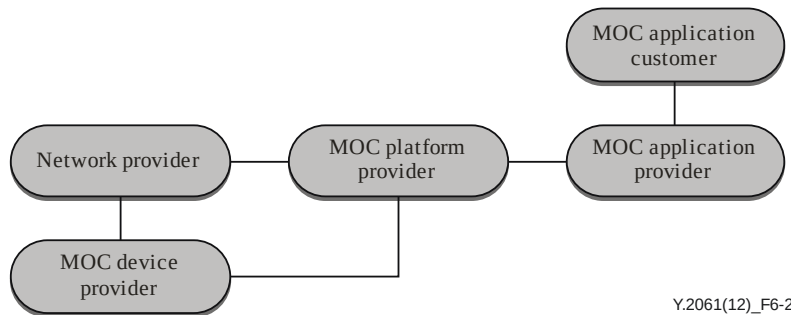


Figure 6-2 – Business roles in an MOC ecosystem

Five key roles are identified: MOC application customer, network provider, MOC device provider, MOC platform provider and MOC application provider.

- Network provider

In the context of this Recommendation, the network provider is the role that offers the NGN capabilities as described in [ITU-T Y.2201].

The network provider has a business relationship with the MOC platform provider and the MOC device providers.

NOTE 1 – An actor playing the role of network provider can also play the roles of MOC platform provider, MOC device provider and MOC application provider.

- MOC application provider

The MOC application provider is the role providing functions in the MOC service domain. It utilizes capabilities provided by the MOC platform provider in order to provide services to the MOC application customer.

The MOC application provider has a business relationship with the MOC application customer and the MOC platform provider.

NOTE 2 – An actor playing the role of MOC application provider can also play the role of MOC platform provider.

- MOC device provider

The MOC device provider is responsible for providing functions in the MOC device domain. It provides raw data or other necessary resources to the network provider and the MOC platform provider according to the service logic.

The MOC device provider has a business relationship with the MOC platform provider and the network provider.

NOTE 3 – An actor playing the role of MOC device provider can also play the role of MOC application provider and the MOC platform provider.

- MOC platform provider

The MOC platform provider is the role responsible for providing the following functions in the NGN domain:

- access to and integration of resources provided by MOC device providers and the network provider;
- support and control of the service integration and delivery functionalities;
- offering to the MOC application provider of capabilities (including resource exposure) for support of MOC applications.

The MOC platform provider has a business relationship with the MOC device provider, the MOC application provider and the network provider.

NOTE 4 – An actor playing the role of MOC platform provider can also play the role of MOC application provider and MOC device provider.

- MOC application customer

The MOC application customer may be a human or a device. The MOC application customer consumes applications offered by the MOC application provider. Organizations or persons such as enterprise, family or individuals are examples of MOC application customers.

The MOC application customer has a business relationship with the MOC application provider. The MOC application customer is a subscriber of the MOC application provider.

NOTE 5 – A given MOC application customer can represent multiple MOC end users in the MOC-service domain.

Appendix I provides details of actors and roles in the MOC ecosystem.

7 Characteristics of MOC

This clause provides the characteristics of MOC including those for applications, devices and gateways. Consideration should be given to the fact that these characteristics may vary across MOC applications, devices and gateways. These characteristics include, but are not limited to, the following:

- 1) Variety of MOC device types and capability levels

There are various types of MOC devices for different uses; some of them have low performance and limited functionality (e.g., low processing capability, small memory, limited security capabilities), while others have powerful embedded capabilities (e.g., bilateral authentication and authorization capabilities with the network and MOC applications).

- 2) MOC applications support of heterogeneous MOC devices

MOC applications may communicate with more than one type of MOC devices. In such cases, MOC applications need to cope with this heterogeneity.

- 3) Grouping of MOC devices

In some use cases, groups of MOC devices are deployed for services. Usually, the MOC devices of a specific group have the same characteristics, functions, performance or policies.

- 4) Variety of mobility levels of MOC devices and gateway

Some MOC devices and gateways are mobile and can be used everywhere. Some devices and gateway do not move. Some MOC devices and gateways move only within a certain area. Some MOC devices and gateways should not be moved once installed (their movement would mean theft of these devices has taken place).