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

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

Reference architecture for Internet of things network capability exposure

Recommendation ITU-T Y.4455

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ITU-T Y-SERIES RECOMMENDATIONS

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Recommendation ITU-T Y.4455

Reference architecture for Internet of things network capability exposure

Summary

Recommendation ITU-T Y.4455 introduces Internet of things (IoT) network capability exposure (NCE). The IoT NCE is a functional entity in network domain, and facilitates IoT applications and services to make full use of capabilities of their underlying networks. The IoT NCE can optimize user experience, improve network efficiency and expose network capability in order to optimize IoT applications and services.

Recommendation ITU-T Y.4455 clarifies the concept of the IoT NCE, identifies its general characteristics and common requirements, and provides the reference architecture and relevant capabilities for the IoT NCE. Additionally, it provides several use cases and common procedures to illustrate the concept and the architecture of the IoT NCE.

History

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FOREWORD

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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.

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

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Recommendation ITU-T Y.4455

Reference architecture for Internet of things network capability exposure

1 Scope

This Recommendation specifies reference architecture for Internet of things (IoT) network capability exposure (NCE). The scope of this Recommendation includes:

- the concept, general characteristics and requirements of IoT NCE;
- reference architecture for IoT NCE.

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 [b-ITU-T Y.2091]: A structured set of capabilities, which provide value-added functionality supported by one or more services, which may be supported by an API interface.

3.1.2 capability [b-ITU-R M.1224-1]: The ability of an item to meet a service demand of given quantitative characteristics under given internal conditions.

3.1.3 Internet of things (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.

3.1.4 service [b-ITU-T Y.2091]: A set of functions and facilities offered to a user by a provider.

3.1.5 thing [ITU-T Y.4000]: With regard to the Internet of things, this is an object of the physical world (physical things) or of the information world (virtual things), which is capable of being identified and integrated into communication networks.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

API	Application Programming Interface
CCM	Car Communication Manager
CDMA	Code Division Multiple Access
EC-FC	Exposure Coordination Functional Component
ES-FC	Exposure Supporting Functional Component
GSM	Global System for Mobile communications
ICT	Information and Communication Technology
IoT	Internet of things
LTE	Long Term Evolution
NA-FC	Network Agent Functional Component
NAM-FC	Network Agent Management Functional Component
NB-IoT	Narrowband IoT
NCE	Network Capability Exposure
QoS	Quality of Service
REST	Representational State Transfer
SCEF	Service Capability Exposure Framework
SDO	Standards Development Organization
SSAS	Service Support and Application Support
TLS	Transport Layer Security
WCDMA	Wideband Code Division Multiple Access
WiMAX	Worldwide interoperability for Microwave Access

5 Conventions

The following conventions are used 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 Recommendation is to be claimed.
- The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformance.

6 Introduction to the Internet of things network capability exposure

IoT NCE is a flexible approach developed for IoT network providers, which uses open or proprietary network application programming interfaces (APIs), such as RESTful APIs, to expose the capabilities of IoT networks.

Currently, from the perspective of network providers, due to a lack of uniform standards, various proprietary platforms have to be deployed and maintained in order to expose their various network capabilities (such as IoT device management or dynamic communication management). From the perspective of developers who integrate those network capabilities, they have to pay more costs to

develop and maintain their applications and services in order to integrate the various platforms and their related APIs.

The IoT NCE is a functional entity (see Figure 6-1) that facilitates IoT applications, services and IoT devices to make full use of capabilities of their underlying networks. Those networks with different information communication technologies (e.g., 3GPP-based networks, 3GPP2-based networks and WiMAX-based networks) publish open or proprietary APIs for their network capabilities on the IoT NCE. IoT NCE publishes network capabilities according to access policies and network requests. IoT applications and services can subscribe and access the exposed network capabilities using the reference points provided by the IoT NCE. Through the IoT NCE, IoT applications and services, and relevant IoT devices can interact with underlying networks to access the network capabilities exposed by the underlying networks.

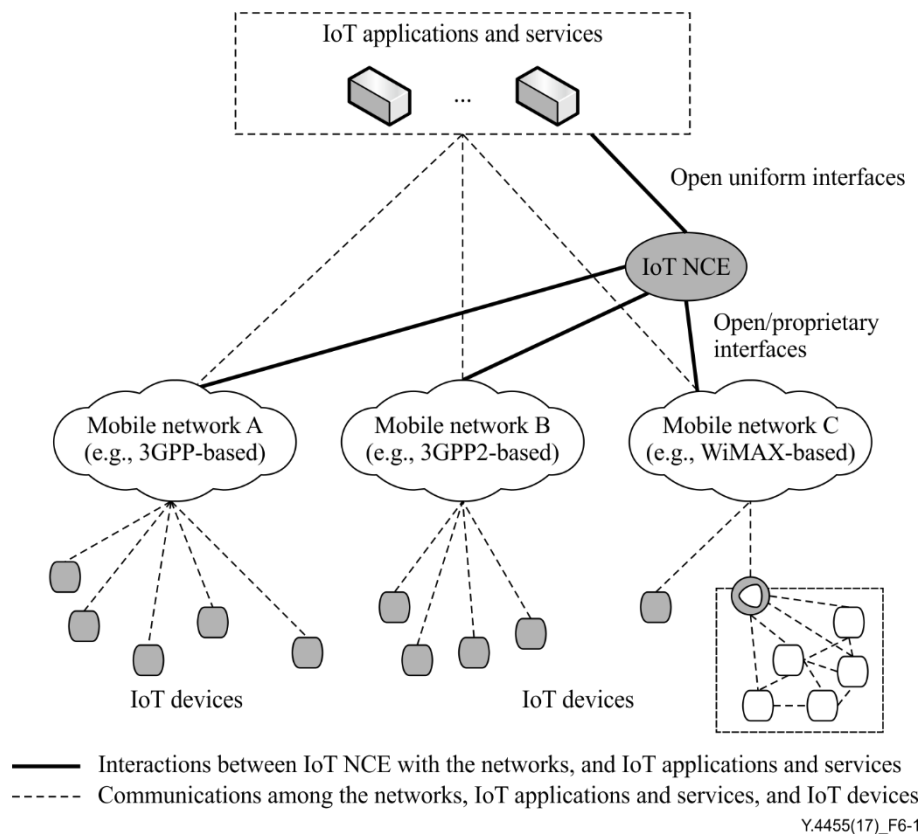


Figure 6-1 – Overview of the Internet of things network capability exposure

NOTE 1 – 3GPP-based network refers to a network mainly based on the communication standards specified by the Third Generation Partnership Project, e.g., global system for mobile communications (GSM), wideband code division multiple access (WCDMA), long term evolution (LTE) and narrowband IoT (NB-IoT).

NOTE 2 – 3GPP2-based network refers to a network mainly based on the communication standards specified by the Third Generation Partnership Project 2 (3GPP2), e.g., code division multiple access (CDMA) one and CDMA 2000.

NOTE 3 – WiMAX-based network refers to a network mainly based on the series of communication standards, e.g., [b-IEEE 802.16], specified by the worldwide interoperability for microwave access (WiMAX) forum.

7 General characteristics of the Internet of things network capability exposure

This clause provides general characteristics of the IoT NCE.