

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Y.2063

(07/2012)

SERIES Y: GLOBAL INFORMATION
INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS
AND NEXT-GENERATION NETWORKS

Next Generation Networks – Frameworks and functional
architecture models

Framework of the web of things

Recommendation ITU-T Y.2063

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Recommendation ITU-T Y.2063

Framework of the web of things

Summary

Recommendation ITU-T Y.2063 provides a framework of the web of things (WoT). As the use of various devices has become so widespread, it is difficult to access data on these devices in a unified way. The WoT allows physical devices to be accessed as resources of both the web and services/applications based upon a web-based service environment, as well as through legacy telecommunications.

This Recommendation describes the overview of the WoT and identifies the requirements to support the WoT. In addition, this Recommendation specifies the functional architecture including a deployment model for the WoT.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T Y.2063	2012-07-29	13

Keywords

Web, web of things, WoT.

FOREWORD

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Recommendation ITU-T Y.2063

Framework of the web of things

1 Scope

This Recommendation provides a framework of the web of things (WoT). The Recommendation covers the followings:

- overview of the WoT
- requirements to support the WoT
- deployment models of the WoT
- functional architecture for the WoT.

This Recommendation demonstrates how physical devices can interact with web resources. This Recommendation also includes WoT use cases in Appendix I and information flows in Appendix II. The detailed web technology including the semantics and ontology is beyond the scope of this Recommendation.

NOTE – This Recommendation only addresses physical devices within a broad scope of "things" [ITU-T Y.2060].

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.2002] Recommendation ITU-T Y.2002 (2009), *Overview of ubiquitous networking and of its support in NGN*.

[ITU-T Y.2060] Recommendation ITU-T 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 client [b-W3C WACterms]: The role adopted by an application when it is retrieving and/or rendering resources or resource manifestations.

3.1.2 device [b-W3C dig loss]: An apparatus through which a user can perceive and interact with the web.

NOTE – In the IoT, a piece of equipment with the mandatory capabilities of communication and the optional capabilities of sensing, actuation, data capture, data storage and data processing [ITU-T Y.2060].

3.1.3 Internet of things (IoT) [ITU-T Y.2060]: 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 – From a broad perspective, the IoT can be perceived as a vision with technological and societal implications.

3.1.4 resource [b-IETF RFC 3986]: The term "resource" is used in a general sense for whatever might be identified by a URI.

NOTE – Familiar examples include an electronic document, an image, a source of information with a consistent purpose (e.g., "today's weather report for Los Angeles"), a service (e.g., an HTTP-to-SMS gateway), and a collection of other resources. A resource is not necessarily accessible via the Internet; e.g., human beings, corporations, and bound books in a library can also be resources. Likewise, abstract concepts can be resources, such as the operators and operands of a mathematical equation, the types of a relationship (e.g., "parent" or "employee"), or numeric values (e.g., zero, one, and infinity).

3.1.5 server [b-W3C WACterms]: The role adopted by an application when it is supplying resources or resource manifestations.

3.1.6 the World Wide Web (WWW, or simply the web) [b-W3C web arch]: An information space in which the items of interest, referred to as resources, are identified by global identifiers called Uniform Resource Identifiers (URI).

3.1.7 thing [ITU-T Y.2060]: With regard to the Internet of things, this is an object of the physical world (physical things) or the information world (virtual things), which is capable of being identified and integrated into communication networks.

3.1.8 URI [b-IETF RFC 3986]: A simple and extensible means for identifying a resource.

3.1.9 user agent [b-W3C dig loss]: A client within a device that performs rendering. Browsers are examples of user agents, as are web robots that automatically traverse the web collecting information.

3.1.10 web resource [b-W3C WACterms]: A resource, identified by a URI, that is a member of the web core.

3.2 Term defined in this Recommendation

This Recommendation defines the following term:

3.2.1 Web of things (WoT): A way to realize the IoT where (physical and virtual) things are connected and controlled through the World Wide Web.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

FE	Functional Entity
HTTP	Hyper Text Transport Protocol
ID	Identifier
IoT	Internet of Things
JINI	Java Intelligent Network Infrastructure
NGN	Next Generation Network
REST	Representational State Transfer
UPnP	Universal Plug and Play
URI	Unique Resource Identifiers

WoT	Web of Things
WWW	World Wide Web

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 Recommendation is to be claimed.
- The keywords "can optionally" indicate an optional requirement which is permissible, without implying any sense of being recommended. This term is 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 Overview of the web of things

From the perspective of the creation of applications, the development of applications that run on top of physical devices is a difficult process that requires expert knowledge and time. In this context, many efforts are being veered towards networking to devices. There are a number of solutions to expose the functionality of devices upon which to build applications; for example, JINI and UPnP are a set of open protocols for allowing devices to collaborate in a peer-to-peer fashion. However physical devices are still dedicated to particular systems/applications. They cannot be controlled and managed without using dedicated protocol and proprietary interfaces due to the following reasons:

- a lack of interoperability across open and proprietary platforms: there are many hardware platforms, operating systems, databases, middleware and applications.
- Many heterogeneous networks: they cannot exchange content and information easily.
- Different data type: All systems worldwide have their own data representation formats and it is difficult to ensure compatibility between them.

The Internet of things (IoT) tries to find a way interconnecting things based on interoperable information and communication technologies. 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 maintaining the required privacy [ITU-T Y.2060]. Although the WoT has a similar viewpoint to the IoT, the WoT is intended so that physical devices can be accessed as resources of the web and services/applications can be provided based upon a web-based service environment as well as legacy telecommunications.

The World Wide Web (WWW) is used as a platform to deliver services to an end-user, the web enables business entities and applications to intercommunicate openly with each other over a network. The web has program language independent properties, uses message driven communications and easily bounds to different transport protocols. As a result, web technology allows the exposure of physical devices as resources on the web using a WoT approach. Therefore, users can interact with the devices using web interfaces. The WoT can provide capabilities of device reusability, portability across several heterogeneous networks and accessibility based on web with web standards.

Figure 6-1 shows the general concept of WoT. The physical devices are mapping the services into the web and those are considered as web resources so that service developers and/or service providers can easily create web applications for the physical devices.