

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Y.4459

(12/2020)

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

Digital entity architecture framework for Internet of things interoperability

Recommendation ITU-T Y.4459

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Recommendation ITU-T Y.4459

Digital entity architecture framework for Internet of things interoperability

Summary

Recommendation ITU-T Y.4459 introduces a digital entity architecture and its prospective in addressing interoperability and security among Internet of things (IoT) applications.

This Recommendation defines an architecture framework for information-oriented services that makes use of existing infrastructures, including the Internet infrastructure, to enhance secure and managed information sharing over a distributed networking environment. It defines an architecture framework for information management based on the use of digital entities, and a common set of secure services that will help the registration, discovery, resolution and dissemination of such digital entities. The set of services is designed to facilitate sharing across any storage boundaries, any heterogeneous application boundaries and any organization boundaries.

A digital entity architecture defines a minimum set of needed architectural components and services to provide a generic information and service interoperability. It will facilitate the interoperability of identification, description, representation, access, storage and security of IoT devices. This architecture framework encourages a common security and management interface across different IoT applications.

Under a digital entity architecture, information represented in digital form is structured as digital entities, each of which has an associated unique persistent identifier. However, metadata contained in the digital entities (e.g., location of the object) could be updated without changing its identifier.

The identifier allows the digital entities to be identified and discovered, regardless of where they are located or stored. Digital entities are not confined within any particular application boundary and may be moved from host to host, accessed from application to application, shared from organization to organization, without losing its ownership or management control, in order to enhance interoperability. A digital entity's data model allows ownership and access control information to be defined by data owners independently of any specific applications.

This Recommendation can be used with different identification and addressing protocols (e.g., Internet protocol (IP) and/or non-IP based networks).

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T Y.4459	2020-12-01	20	11.1002/1000/13861

Keywords

Digital entity architecture, Internet of things, interoperability, security.

* 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

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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.

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.

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Recommendation ITU-T Y.4459

Digital entity architecture framework for Internet of things interoperability

1 Scope

The intent of this Recommendation is to describe digital entity architecture features and their capabilities to meet relevant requirements of the Internet of things (IoT) [ITU-T Y.2066], especially the security and interoperability issues in IoT applications. This digital entity architecture is consistent with [ITU-T X.1255]¹. Other functional architectures may also be applicable for the IoT (e.g., [b-ITU-T Y.4500.1]).

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 X.1255] Recommendation ITU-T X.1255 (2013), *Framework for discovery of identity management information*.

[ITU-T Y.2066] Recommendation ITU-T Y.2066 (2014), *Common requirements of the Internet of things*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 address [b-ITU-T Y.2091]: An address is the identifier for a specific termination point and is used for routing to this termination point.

3.1.2 attribute [b-ITU-T X.1252]: Information bound to an entity that specifies a characteristic of the entity.

3.1.3 device [b-ITU-T Y.4000]: 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.

3.1.4 digital entity [ITU-T X.1255]: An entity represented as, or converted to, a machine independent data structure consisting of one or more elements in digital form that can be parsed by different information systems; the structure helps to enable interoperability among diverse information systems in the Internet.

3.1.5 element [ITU-T X.1255]: Part of a digital entity consisting of a type-value pair, where the type is represented by a resolvable persistent identifier and the value is the relevant digital information for that type.

¹ [ITU-T X.1255], which is based on a digital object architecture, provides a framework for discovery of identity management information.

3.1.6 entity [b-ITU-T Y.2720]: Anything that has separate and distinct existence that can be uniquely identified. In the context of IdM, examples of entities include subscribers, users, network elements, networks, software applications, services and devices. An entity may have multiple identifiers.

3.1.7 federated registries [ITU-T X.1255]: A collection of interoperable registries that register metadata and participate in a common set of methods to share information reliably and in a commonly understood format.

3.1.8 identifier [ITU-T X.1255]: A sequence of bits used to obtain state information about the digital entity being identified; typically, this is done via an appropriate resolution system.

3.1.9 Internet of things (IoT) [b-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.

3.1.10 interoperability [b-ITU-T Y.101]: The ability of two or more systems or applications to exchange information and to mutually use the information that has been exchanged.

3.1.11 metadata [ITU-T X.1255]: Structured information that pertains to the identity of users, systems, services, processes, resources, information or other entities.

3.1.12 persistent identifier [ITU-T X.1255]: A unique identifier that resolves to state information about a digital entity and that is resolvable for at least as long as the digital entity exists.

3.1.13 registry [ITU-T X.1255]: A mechanism for registering metadata about digital entities and storing metadata schemas, and which provides an ability to search the registry for persistent identifiers based on the use of the metadata schemas.

3.1.14 repository [ITU-T X.1255]: An interface that accepts deposits of digital entities, enables their retention, and provides secure access to the digital entities via their identifiers.

3.1.15 resolution system [ITU-T X.1255]: A system that accepts identifiers known to the system as input, and provides relevant state information about the entity being identified.

3.1.16 thing [b-ITU-T Y.4000]: 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.

3.1.17 trust [b-ITU-T Y.2720]: A measure of reliance on the character, ability, strength or truth of someone or something.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

API	Application Programming Interface
IdM	Identity Management
IoT	Internet of things
6LoWPAN	IPv6 over Low -Power Wireless Personal Area Network