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INTERNATIONAL STANDARD

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Internet of things (IoT) – Interoperability for IoT systems – Part 4: Syntactic interoperability



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Internet of things (IoT) – Interoperability for IoT systems – Part 4: Syntactic interoperability

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INTERNET OF THINGS (IoT) – INTEROPERABILITY FOR IoT SYSTEMS –

Part 4: Syntactic interoperability

FOREWORD

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The text of this International Standard is based on the following documents:

Draft	Report on voting
JTC1-SC41/255/FDIS	JTC1-SC41/269/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs and www.iso.org/directives.

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INTRODUCTION

In the world of the Internet of Things (IoT), heterogeneous systems and devices need to be connected and exchange data with others. How data exchange can be implemented becomes a key issue of interoperability among IoT industries. Information models (IMs), which can well represent specifications of data, are adopted and utilized to solve the interoperability problem. Meanwhile, as systems and devices in IoT can have different information models with different modelling methodologies and formats, interoperability based on different information models is recognized as an urgent problem. The IoT interoperability related systems and applications have an 11 trillion market potentially [1][1].

The ISO/IEC 21823 series standards address issues that relate to interoperability both between different IoT systems and within a single IoT system. ISO/IEC 21823-1 [2] describes a general framework for interoperability for IoT systems. It includes a five facet model for interoperability that includes transport, syntactic, semantic, behavioural, and policy viewpoints.

Different parts of ISO/IEC 21823, based on one of the facets, provide specifications from their corresponding viewpoints. Each of the parts can refer to others but is independent. Currently, ISO/IEC 21823-2 [3] defines specifications from the transport viewpoint, ISO/IEC 21823-3 [4] defines requirements, provides guidance, etc. from the semantic viewpoint, and ISO/IEC 21823-4 specifies the syntactic interoperability.

Syntactic interoperability means that exchanged information can be understood by the participating IoT systems which contain IoT devices. In more detail, the syntactic interoperability is related to the information models' representing formats, structures, and grammar of their modelling languages such as a length of a data string, constraints on data types, and forbidden characters.

This document first provides the principle of how to achieve syntactic interoperability based on metamodel-driven approaches. In other words, the reason why the information exchange rules based on metamodels can support syntactic interoperability among different IoT systems will be elaborated. Secondly, requirements on information models such as metamodels and models of IoT systems including IoT devices are described. Features related to IoT devices such as the identifier, device type, setup environments, and functions need to be considered to accomplish syntactic interoperability among different information models utilized in IoT systems. Thirdly, a framework for processes on developing information exchange rules related to IoT devices from the syntactic viewpoint is provided. For example, the kinds of metamodels, and the types of entities and relationships that shall be selected are specified, and the procedure of how to build the information exchange rules from different information models is provided.

In Annex A, possible intrinsic and extrinsic properties of IoT devices are listed as additional information of Clause 6. In Annex B, a use case of how the syntactic interoperability in accordance with specifications in this document among industrial IoT systems and IoT devices is described.

With this document, system and device vendors, who need to improve and/or develop their products to comply with IoT requirements, can implement specifications of this document to their products for an automatic or semi-automatic realization of IoT syntactic interoperability.

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1 Numbers in square brackets refer to the Bibliography.

INTERNET OF THINGS (IoT) – INTEROPERABILITY FOR IoT SYSTEMS –

Part 4: Syntactic interoperability

1 Scope

This part of ISO/IEC 21823 specifies the IoT interoperability from a syntactic point of view. In this document, the following specifications for IoT interoperability from a syntactic viewpoint are included:

– a principle of how to achieve syntactic interoperability among IoT systems which include IoT devices;

– requirements on information related to IoT devices for syntactic interoperability;

– a framework for processes on developing information exchange rules related to IoT devices from the syntactic viewpoint.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 20924, *Internet of Things (IoT) – Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 20924 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following web addresses:

- ISO Online browsing platform: available at http://www.iso.org/obp
- IEC Electropedia: available at http://www.electropedia.org/

3.1
instance
individual entity having its own value and possibly its own identity

[SOURCE: ISO 19103:2015 [5], 4.20]

3.2
metamodel
special kind of model that specifies the abstract syntax of a modelling language

Note 1 to entry: A model is an *instance* (3.1) of a metamodel

Note 2 to entry: IoT syntactic interoperability is achieved by information exchange rules through the structure, data format, and syntactic constraints using syntactic aspects of the metamodel.

[SOURCE: ISO/IEC 19506:2012 [6], modified – The description that follows the definition has been deleted. Notes to entry have been added.]

3.3
model
abstraction of some aspects of reality

[SOURCE: ISO 19109:2015 [7], 4.15]

3.4
property
particular characteristic of an object type

[SOURCE: ISO 16484-5:2017 [8], 3.2.74]

3.5
syntactic interoperability
interoperability such that the formats of the exchanged information can be understood by the participating systems

Note 1 to entry: System means IoT system.

Note 2 to entry: IoT device, IoT gateway, sensor and actuator are considered as system.

[SOURCE: ISO/IEC 19941:2017 [9], 3.1.4, modified – Notes to entry have been added.]

4 Abbreviated terms

CRS	coordinate reference system
EPIoT	extrinsic properties of physical IoT devices
IPIoT	intrinsic properties of physical IoT devices
IoT	Internet of Things
JSON	JavaScript Object Notation
MOF	Meta Object Facility
UML	Unified Modelling Language
XML	extensible markup language

5 Principle for IoT syntactic interoperability

5.1 General

In the ISO/IEC 21823 series, ISO/IEC 21823-1 [2] defines an overall framework for IoT interoperability. It specifies that IoT interoperability shall be supported by standards from five facets: transport, semantic, syntactic, behavioural, and policy. A standard based on each of the facets shall provide specifications from its corresponding viewpoint. Each of the standards can refer to or can be independent of standards based on other facets. ISO/IEC 21823-2 [3] defines specifications from the transport viewpoint. ISO/IEC 21823-3 [4] defines requirements, provides guidance, etc. from the semantic aspect. ISO/IEC 21823-4 (this document) addresses the syntactic interoperability that provides specifications from the syntax viewpoint.

5.2 Principle for IoT syntactic interoperability

In this subclause, a principle for IoT syntactic interoperability is specified. In order for an IoT system to achieve syntactic interoperability with other IoT systems and devices, the information exchange rules between their data are adopted.