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**Internet of things (IoT) – Data exchange platform for IoT services –
Part 2: Transport interoperability between nodal points**

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INTERNET OF THINGS (IoT) – DATA EXCHANGE PLATFORM FOR IoT SERVICES –

Part 2: Transport interoperability between nodal points

FOREWORD

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ISO/IEC 30161-2 has been prepared by subcommittee 41: Internet of Things and Digital Twin, of ISO/IEC joint technical committee 1: Information technology. It is an International Standard.

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

Draft	Report on voting
JTC1-SC41/326/FDIS	JTC1-SC41/336/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, available at www.iec.ch/members_experts/refdocs.

A list of all parts in the ISO/IEC 30161 series, published under the general title *Internet of Things (IoT) – Data exchange platform for IoT services*, can be found on the IEC and ISO websites.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

ISO/IEC 30161-1:2020 specifies the requirements of an Internet of Things (IoT) data exchange platform (IoT DEP), which transfers IoT data to and from various IoT devices with small delay. The IoT DEP provides the following functions: abstraction of communication networks and lightweight transfer of IoT traffic. However, ISO/IEC 30161-1:2020 specifies only the concept and structure of the platform for IoT data exchange between an IoT device and an IoT-user through an IoT DEP. Therefore, it is essential to take into account that IoT devices and IoT-users are connected to each other through multiple nodal points, when a large number of IoT devices and IoT-users is included in the IoT system and is deployed over a wide geographical area.

This document focuses on the transport interoperability among nodal points in an IoT system. The transport interoperability among nodal points enables data exchange among nodal points in an IoT system with small overheads or data acquisition with low latency. Requirements for efficient transfer of IoT data among nodal points are specified. Functional blocks on a nodal point for the transport interoperability between nodal points in the IoT DEP are specified.

The transport interoperability among nodal points is realized by an IoT DEP network consisting of multiple nodal points. The transfer of IoT data among nodal points is not affected by a communication protocol in the transport layer. A nodal point has routing function and forwarding function to realize the transport interoperability.

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INTERNET OF THINGS (IoT) – DATA EXCHANGE PLATFORM FOR IoT SERVICES –

Part 2: Transport interoperability between nodal points

1 Scope

This part of ISO/IEC 30161 specifies the following items for the transport interoperability between nodal points in the IoT data exchange platform (IoT DEP):

- requirements;
- functional blocks;
- operation mechanism.

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 30161-1:2020, *Internet of Things (IoT) – Data exchange platform for IoT services – Part 1: General requirements and architecture*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

3.1

IoT data

bit strings exchanged among IoT DEP functions

3.2

IoT data exchange platform

IoT DEP

set of functional blocks that provide an abstraction of IoT data blocks and exchange of IoT data with other entities

Note 1 to entry: For example, in a huge number of sensors across various networks, IoT DEP reduces traffic volumes and exchanges IoT data with other entities. Functional blocks of IoT DEP are implemented at endpoints and nodal points in IoT networks. These functional blocks cooperate as a platform.

[SOURCE: ISO/IEC 30161-1:2020, 3.1]

3.3

IoT DEP network

network which consists of multiple nodal points

3.4

IoT service

service which exchanges data among endpoints in an IoT system

3.5

IoT system

system providing functionalities of IoT

Note 1 to entry: An IoT system can include, but not be limited to, IoT devices, IoT gateways, sensors, and actuators.

[SOURCE: ISO/IEC 20924:2021 [1], 3.2.9]

3.6

nodal point

point that investigates routing information specified in communication protocols and relays data blocks according to such information

[SOURCE: ISO/IEC 30161-1:2020, 3.2]

4 Abbreviated terms

CAC	communication access control
IoT	Internet of Things
IoT DEP	IoT data exchange platform
IP	internet protocol
OSI	open systems interconnection
QoS	quality of service

5 Overview

ISO/IEC 30161-1:2020 specifies an IoT data exchange platform (IoT DEP), which transfers IoT data to and from various IoT devices with small delay. Such various IoT devices are described in ISO/IEC TR 22417 [2]¹. The IoT DEP suppresses processing time delay (i.e. overhead due to DNS, IP routing based on a location) and reduces traffic volume by eliminating complicated protocols used by existing communication infrastructures (e.g. the Internet). ISO/IEC 30161-1:2020 also specifies four cases of IoT DEP implementation (Cases A, B, C, and D). IoT DEP functions for Case A are implemented in an IoT-user, IoT DEP functions for Case C are implemented in an IoT gateway, and IoT DEP functions for Case D are implemented in an IoT device. Case B of an IoT DEP is specified as a component which takes on the role of a nodal point.

Figure 4 of ISO/IEC 30161-1:2020 shows the locations of IoT DEP functions in the IoT reference models of ISO/IEC 30141 [3], which indicates the relationship of IoT DEP functions among an IoT device, an IoT-user, an IoT gateway, and "Resource access and interchange sub-system" as shown in Figure 1.

When a large number of IoT devices and IoT-users is included in the IoT system and the IoT system is deployed in a wide geographical area as a horizontal approach, IoT devices and IoT-users are connected to each other through multiple nodal points in an IoT DEP network as shown in Figure 2. Note that the IoT gateway corresponds to a nodal point. IoT devices and IoT-users correspond to endpoints connected to any of the nodal points.

¹ Numbers in square brackets refer to the Bibliography.

This document specifies requirements, functional blocks and operation mechanism for the efficient transfer of IoT data among nodal points in an IoT system where endpoints connect to multiple nodal points in the IoT DEP network, as shown in Figure 2. The IoT DEP network consists of multiple nodal points. IoT data exchange in an IoT system consisting of a single nodal point is specified in ISO/IEC 30161-1:2020. In this document, IoT data are exchanged among IoT DEPs, as shown in Figure 3. The IoT DEPs are implemented as middleware modules over a transport layer specified in the OSI reference model.

IoT data are transmitted and received as data blocks of IoT data between an endpoint and a nodal point or among nodal points. The bit strings that construct IoT data are composed of plural data blocks. A data block has parameters such as a data block size, a sequence number, a time stamp and a starting time.

The structure of this document is as follows.

Clause 6 includes the IoT DEP network configuration and specifies both system parameters for IoT data exchange between endpoints, and system parameters for IoT data transfer among nodal points. Clause 6 also specifies the functional requirements for the transport interoperability among nodal points. A nodal point has a routing function and a forwarding function to transfer IoT data received from an endpoint.

Clause 7 specifies functional blocks to comply with the requirements specified in Clause 6. Clause 7 also describes the relationship between those functions and the communication access control functional block of IoT DEP Case B and Case C.

Clause 8 describes operation mechanisms of a routing function and a forwarding function.

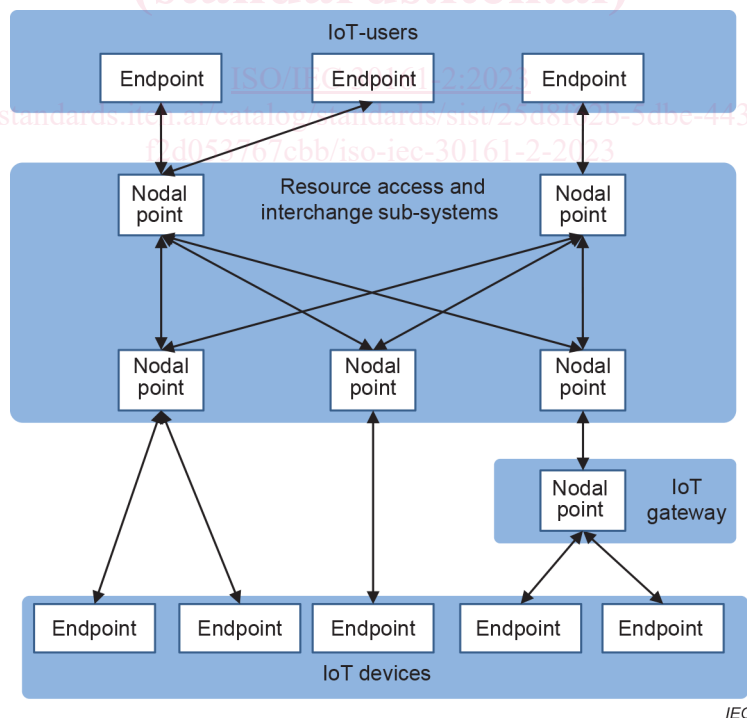


Figure 1 – Relationship with IoT Reference model

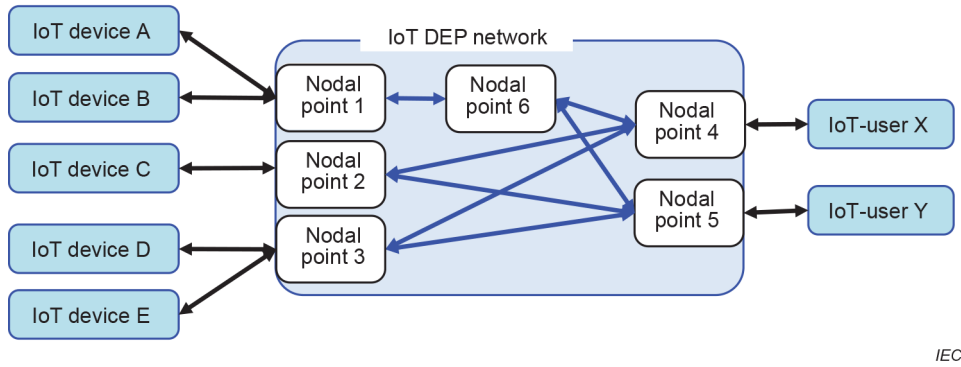


Figure 2 – IoT DEP network by multiple nodal points

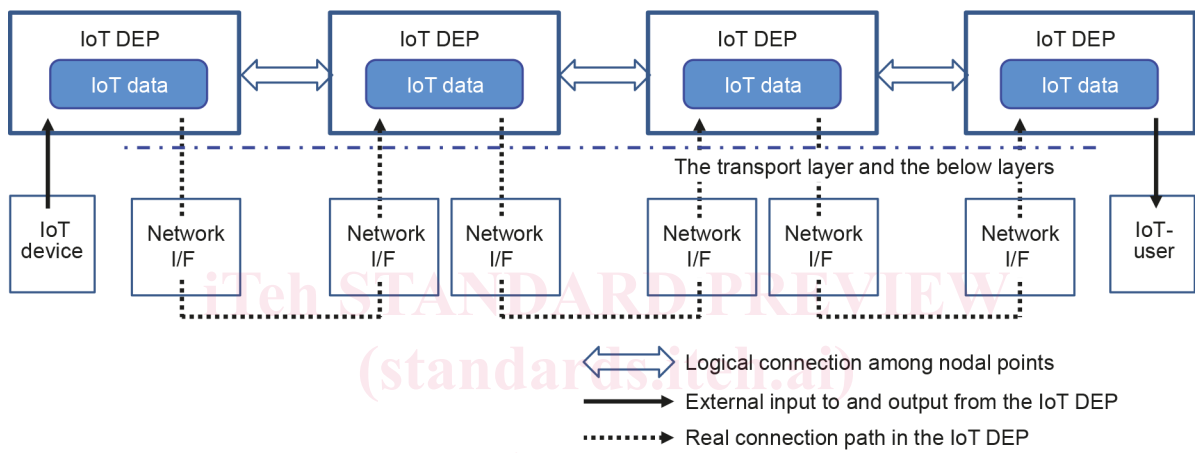


Figure 3 – IoT data exchanged among IoT DEPs

6 Functional requirements

6.1 General

This Clause 6 specifies functional requirements for the transport interoperability among nodal points in an IoT DEP network including multiple nodal points.

6.2 Transport interoperability among nodal points

The requirements and recommendations for the transport interoperability are as follows.

- 1) A nodal point transfers IoT data received from an endpoint to another nodal point. To transfer IoT data, a nodal point has the following functions.
 - A nodal point shall have a routing function. The routing function resolves an identifier of a next forwarding nodal point as a receiving nodal point of data blocks of IoT data, according to an identifier and attributes of the IoT data, and selects a communication path for the receiving nodal point.
 - A nodal point shall have a forwarding function to transfer IoT data according to the selected communication path.

- 2) In the case that IoT data need to be temporarily stored in an IoT system to provide an IoT service, an IoT DEP network provides a storage function.
 - A nodal point should have a storage function to store copies of IoT data temporarily. The storage function has the effect of reducing duplicate data transfer in response to requests from multiple IoT-users.
 - At least one nodal point in the IoT DEP network should be a nodal point with a storage function.

In order to configure an IoT DEP network, a nodal point shall provide the following functions in addition to the functions specified in ISO/IEC 30161-1:2020.

- a) A nodal point takes the role of a connection point to connect endpoints to an IoT DEP network. Thus, one of the functions of a nodal point is to receive IoT data from endpoints, i.e. IoT devices or IoT-users, and another is to transfer IoT data from other nodal points to endpoints.
- b) A nodal point takes the role of a relay point to transfer IoT data from endpoints or another nodal point to other nodal points. Thus, one of the functions of a nodal point is to transfer IoT data to other nodal points.
- c) A nodal point takes the role of a temporary storage point to store copies of IoT data. Thus, one of the functions of a nodal point is to store copies of IoT data.

NOTE A connection point which transfers IoT data from the IoT device to the IoT-user directly is not considered as a nodal point.

Figure 4 shows functions and positions on nodal points in an IoT DEP network. Nodal points comply with the requirements specified as a), b) and c).

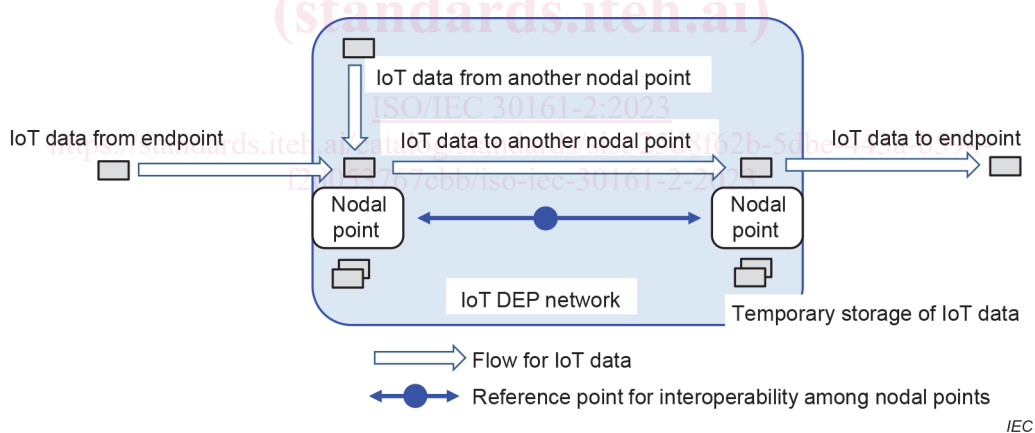


Figure 4 – Functions and positions of nodal points

System parameters for an IoT system are described in 6.3. The relationships between the IoT data exchange between endpoints and the IoT data transfer between nodal points are described in 6.4.

6.3 System parameters for an IoT system

An IoT DEP network has the following characteristics.

- a) In order for the IoT DEP network to efficiently realize IoT data exchange between endpoints, it has the following functions:
 - 1) the function that an endpoint exchanges IoT data with other endpoints using an identifier which is used to identify IoT data;
 - 2) the function of temporary storage of IoT data.