
**Telecommunications and information
exchange between systems — Future
network architecture —**

**Part 3:
Networking of everything**

*Télécommunications et échange d'informations entre systèmes —
Architecture du réseau du futur —
Partie 3: Réseautique universelle*

ISO/IEC 21558-3:2022

<https://standards.iteh.ai/catalog/standards/sist/8f772d93-3ee0-43d1-85ca-14e820dfdb1e/iso-iec-21558-3-2022>



iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO/IEC 21558-3:2022

<https://standards.iteh.ai/catalog/standards/sist/8f772d93-3ee0-43d1-85ca-14e820dfdb1e/iso-iec-21558-3-2022>



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2022

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Abbreviated terms	3
5 Future Networks — Networking of Everything (FN-NoE)	4
5.1 General.....	4
5.2 Thing-user social networking.....	4
5.3 Thing-user centric communication service.....	5
6 Architecture of FN-NoE	5
6.1 General.....	5
6.2 FN-NoE for thing-user centric communication service.....	7
6.3 Topologies of the FN-NoE.....	8
6.4 Reference model of the FN-NoE.....	9
7 Functional procedure of the FN-NoE	11
7.1 General.....	11
7.2 Thing-user and thing-user social community.....	12
7.3 Organizing and maintaining the thing-user social community.....	14
7.4 Sharing thing-user experiences in the thing-user social community.....	15
7.5 Thing-user manages the subscription and publishing of experiences in the level of cluster and each community tier — Finding the coordinated thing-user.....	15
7.6 Establishing and maintaining the proximal path.....	15
Annex A (informative) FN-NoE thing-user centric communication service	16
Annex B (informative) FN-NoE architecture over RINA (Recursive InterNetwork Architecture) based future networks	18
Bibliography	21

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents) or the IEC list of patent declarations received (see patents.iec.ch).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*.

A list of all parts in the ISO 21558 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

Introduction

This document specifies the Future Network – Networking of everything (FN-NoE) architecture, which is designed to provide further advanced NoE services identified in ISO/IEC TR 29181-9.

ISO/IEC TR 29181-9 is part of the ISO/IEC TR 29181 series of standards on Future Network (FN). ISO/IEC TR 29181-9, which addresses networking issues raised in ISO/IEC TR 29181-1, covers networking of everything.

The scope of this document focuses on the FN-NoE architecture, consisting of access and core networks, thing social networks, and proximity defined networks, in which smart devices participate.

This document provides the general characteristics of NoE which can be applied to future networks such as RINA as shown in [Annex B](#), especially from an Internet of Things (IoT) perspective, through a conceptual model of NoE.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO/IEC 21558-3:2022](#)

<https://standards.iteh.ai/catalog/standards/sist/8f772d93-3ee0-43d1-85ca-14e820dfdb1e/iso-iec-21558-3-2022>

Telecommunications and information exchange between systems — Future network architecture —

Part 3: Networking of everything

1 Scope

This document focuses on networking issues for integrating various networking technologies for integrating various networking techniques to provide the thing-user centric communication service.

This document specifies:

- the architectural model of the Future Network – Networking of Everything (FN-NoE);
- the functional procedure for providing advanced FN-NoE services that integrate various networks.

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/TR 29181-9:2017, *Information technology — Future Network — Problem statement and requirements — Part 9: Networking of everything*

<https://standards.iso.org/standards/catalog/standards/sist/6172d93-3ee0-43d1-85ca-14e820dfdb1e/iso-iec-21558-3-2022>

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC TR 29181-9 and the following apply.

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

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

3.1

object

intrinsic representation of an entity that is described at an appropriate level of abstraction in terms of its attributes and functions

[SOURCE: ISO/IEC TR 29181-9:2017, 3.12]

3.2

context

information that can be used to characterize the environment of a user

[SOURCE: ISO/IEC TR 29181-9:2017, 3.4]

3.3

thing

object of the physical world (physical things) or of the information world (virtual thing), which is capable of being identified and integrated into communication networks.

Note 1 to entry: Physical things are capable of being sensed, actuated, and connected to things such as robots, goods, and electrical equipment. Virtual things are capable of being stored, processed, and accessed by things such as multimedia content and application software.

[SOURCE: ISO/IEC TR 29181-9:2017, 3.16]

3.4

Internet of Things

IoT

global infrastructure for the information society enabling advanced services by interconnecting (physical and virtual) things based on existing or evolving interoperable information and communication technologies

[SOURCE: ISO/IEC TR 29181-9:2017, 3.8]

3.5

collaborative work group

group of thing users that can perform job planning, thing user recruitment, and coordination without human intervention

[SOURCE: ISO/IEC TR 29181-9:2017, 3.2]

3.6

proximity defined network

PDN

network configured among devices in close proximity, using conventional LAN or WAN technologies: which are in not only physically close proximity, but also closely related, or logically close proximity

Note 1 to entry: PDN is an instantaneous network that is formed during the networking of everything.

[SOURCE: ISO/IEC TR 29181-9:2017, 3.13, modified — Note 1 to entry added.]

3.7

identifier

series of digits, characters, and symbols or any other form of data used to identify a subscriber(s), a user(s), a network element(s), function(s), a network entity(es) providing services/applications, or other entities, e.g. physical or logical objects

Note 1 to entry: An identifier can also be a string of bits bound to an object that may be used to locate an object in a given context.

3.8

Future Network for Networking of Everything

FN-NoE

network that is capable of providing thing-user social networking and thing-user centric communication service to the thing-users

3.9

profile

all or some of the information statements about a thing-user, including (1) basic statements including Name, Identity, Address, URI, Account, Contract, Security; (2) motivation statements describing why the thing-user joins the social network; (3) mission statements describing what the thing-user plans to accomplish; or (4) its capacity statements which describe its predications, knowledge, resources

3.10**thing-user**

thing that uses the Future Network for Networking of Everything (FN-NoE) network service or the FN-NoE services provided by other things

3.11**everything**

equipment that is capable of performing Networking of Everything (NoE)

Note 1 to entry: "Everything" can be regarded as anything which can perform NoE in Future Network (FN).

3.12**Networking of Everything****NoE**

process that is capable of providing Future Network for Networking of Everything (FN-NoE) services

3.13**Network of Everything (NoE) terminal**

thing that can perform the process in the network capable of providing thing-user social networking and thing-user centric communication service to the thing-users

3.14**thing-user social network**

social network among thing-users which automatically shares its capabilities, context, communicative motivation, experiences, and intentions of collaboration for delivering the intelligent super-realistic service

Note 1 to entry: As the thing-user expands the social network, it may expand its knowledge.

Note 2 to entry: Thing-user social networking service can be a web application that thing-users use to build a social network provided by Networking of Everything (NoE).

3.15**thing-user centric communication**

process of conveying intended meanings from one thing-user to another thing-user or thing-user group through the use of mutually understood language

3.16**thing-user centric network**

network that allows a thing-user to discover another thing-user or thing-user group who understands its intention conveyed from the thing-user and supports the thing-user in achieving its mission

4 Abbreviated terms

FN	Future Network
FN-NoE	Future Network for Networking of Everything
ID	Identifier
IoT	Internet of Things
NoE	Networking of Everything
PDN	Proximity Defined Networks
SAP	Service Access Point
TSN	Thing-user Social Network

URI Uniform Resource Identifier
URL Uniform Resource Locator

5 Future Networks — Networking of Everything (FN-NoE)

5.1 General

Networking of Everything (NoE) refers to the process capable of providing FN-NoE services such as thing-user social networking and thing-user centric communication services to the thing users who participate in the FN-NoE.

FN-NoE provides a functional procedure that integrates various networking technologies through social networking among thing-users and provides user-centric communication. This document defines an architectural model of the FN-NoE and serves as a companion document to ISO/IEC 21559-3 for protocol and mechanisms specifying control protocols of the FN-NoE.

For the time being, since the deployment of FN-NoE will be very limited geographically or technically until more advanced applications for IoT emerge in the market, FN-NoE shall coexist with the conventional networks. FN-NoE is regarded as (connected) islands in the sea of the Internet, as shown in the [Figure 1](#).

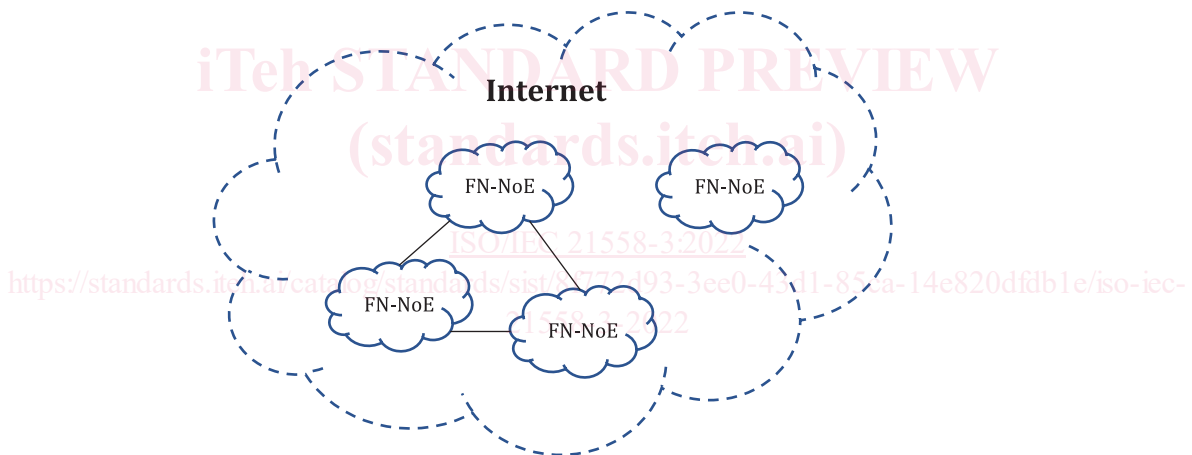


Figure 1 — Deployment of FN-NoE in the Internet

5.2 Thing-user social networking

A thing can be an intelligent thing-user that describes its sensing information, shares the acquired experience or knowledge with other things, and leverages the capabilities provided by other thing users. A thing will become a thing-user of the FN-NoE by having its physical entity or logical entity that performs a task with an equipped major skill-set and optional-skill set. The thing-user will have the expertise built on its experience performing tasks using specific domain-related knowledge. The thing-user may be classified according to the equipped skill set and expertise domain.

Thing-users can form a thing-user social network to share:

- basic information for communication of its device, e.g. ID, address, URI or URL, security (described in Basic statements),
- their capabilities (described in Capability statements in Profile),
- context,
- communicative motivation (described in Motivation statements),

- e) experiences,
- f) intentions of collaboration for delivering the intelligent super-realistic service (described in Mission statements).

To understand and share this information, each thing-user should use the language that computers understand, e.g. semantics to describe diverse context, standard DB structure to store, retrieve.

The central aspect of thing-user social networking is very similar to human social networking. The only difference is that each device or computer understands the social information through semantic language [4],[5] All such information is defined based on FN-NoE ontology and is updated continuously by a third party.

After a thing-user is initiated, it searches for social networks which fit its context and objectives, joins them, and shares its information with other thing-users that have already joined as partners. Depending on its context, a thing-user can join two or more social networks at the same time. While performing collaborative work with other thing-users, if a thing-user needs further information, it may request that its partners contact their partners to resolve it. This search process may repeat recursively.

5.3 Thing-user centric communication service

In the FN-NoE, the thing-user is intelligent and socialized to interact with other thing-users autonomously. In addition to producing digitalized information, thing-users also produce varieties of reactions based on a socialized decision. The thing-user describes communicative motivation or goals and conveys intended meanings to other thing-users or thing-user groups through mutually understood language. From the thing-user communities, the thing-user discovers another thing-user or thing-users capable of collaborating to accomplish its communicative goal as a human-user does. One of the service use-cases is shown in [Annex A](#).

The FN-NoE provides a structure in which a thing-user discovers and coordinates thing-users among the socialized things located within a space to autonomously perform collaborative work.

[https://standards.iteh.ai/catalog/standards/sist/8f772d93-3ee0-43d1-85ca-14e820dfdb1e/iso-iec-](https://standards.iteh.ai/catalog/standards/sist/8f772d93-3ee0-43d1-85ca-14e820dfdb1e/iso-iec-21558-3-2022)

6 Architecture of FN-NoE

6.1 General

The infrastructure for the FN-NoE is constructed by the access networks, the core networks, and the regional networks. The access networks and the core networks are evolved from the current networks. The FN-NoE is operated over either existing legacy networks or future networks. An NoE terminal located in a certain space connects to an access network. It is connected to another NoE terminal through the core networks and an access network.

Different network operators may operate the core networks between NoE terminals. The switching and routing schemes applied to the core networks may be different. The access network is managed by the core network operator. The access network is differentiated by the type of access links and access procedures. The access network may have a local network managed by the local private owner as a subnetwork. The local network may have a local network underneath it.

[Figure 2](#) shows a reference network model in which multiple NoE terminals located in a particular space are connected, as shown in [Figure 1](#). There is an NoE terminal connected to the A type access network of the core network managed by the operator X. There is an NoE terminal connected to the B type access network of the core network managed by the operator Y. There is an NoE terminal connected to the C type local network operated by the local operator, connected to the B type access network of the core network managed by the operator Y. There is an NoE terminal connected to the D type local network operated by the local operator, connected to the C type local network operated by the local operator, connected to the B type access network of the core network managed by the operator Y.