Draft new Recommendation ITU-T Y.ecs-reqts

Edge computing - Functional requirements of edge computing service (ECS)

Summary

This Recommendation provides functional requirements of edge computing service. To provide its functional requirements, this recommendation specifies the introduction to edge computing service focusing on introduction of internal logical components. This recommendation also identifies the various use cases related with usages of edge computing service in terms of edge computing provider and edge computing customer.

Keywords

Edge computing, Edge computing service, functional requirement, use case

Introduction

<Optional - This clause should appear only if it contains information different from Scope and Summary>

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1 Scope

Edge computing service is defined to one or more capabilities provided on edge computing infrastructure in [ITU-T Y.3540]. This Recommendation provides functional requirements of edge computing service based on its concept in [ITU-T Y.3540]. This Recommendation addresses the following subjects:

- Introduction to edge computing and edge computing service;
- Functional requirements of edge computing service;
- Use cases of edge computing service;
- Alignment with [ITU-T Y.3540].

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.3073] Recommendation ITU-T Y.3073 (2019), *Framework for service function chaining in information-centric networking.*

[ITU-T Y.3540] Recommendation ITU-T Y.3540 (2023), *Edge computing – Overview and high-level requirements.*

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

[Editors' Note in Oct. 2023] These definitions need to be enhanced. Contributions are invited.

3.1.1 edge computing [ITU-T Y.3073]: This refers to a strategy to deploy processing capability at network edge where end terminals are connected, and to perform the processing of data which is derived from and fed to the end terminals.

3.1.2 edge computing application [ITU-T Y.3540]: Business logic deployed and delivered to users using edge computing service.

3.1.3 edge computing infrastructure [ITU-T Y.3540]: Resources that provide processing, network and storage at or near a physical location close to user in edge computing

3.1.4 edge computing service [ITU-T Y.3540]: One or more capabilities provided on edge computing infrastructure.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

[Editors' Note in Oct. 2023] These definitions need to be enhanced. Contributions are invited

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ECC Edge Computing Customer

ECP Edge Computing Provider

ECS Edge Computing Service

[Editors' Note in Oct. 2023] These abbreviations and acronyms should be enhanced. Contributions are invited.

5 Conventions

[Editors' Note in Oct. 2023] The texts in this clause are from other Recommendations. If necessary, they will be revised during the progress of 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 document is to be claimed.

The keywords "**is prohibited from**" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed.

The keywords "**is recommended**" indicate a requirement which is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformance.

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.

In the body of this document and its annexes, the words shall, shall not, should, and may sometimes appear, in which case they are to be interpreted, respectively, as is required to, is prohibited from, is recommended, and can optionally. The appearance of such phrases or keywords in an appendix or in material explicitly marked as informative are to be interpreted as having no normative intent.

6 Introduction to edge computing and edge computing service

[Editors' Note in Oct. 2023] This clause includes the introduction for edge computing requirement with functional view. Also, logical components for edge computing are included. The contributions are invited.

Edge computing refers the computing technology to deploy processing capability at network edge where end terminals are connected, and to perform the processing of data which is derived from and fed to the end terminals [ITU-T Y.3073]. A network edge corresponds to a physical location where data is generated or consumed.

6.1 Overview of edge computing in functional view

[Editors' Note in Oct. 2023] This clause includes functional view of edge computing and background description for general configuration of edge computing. The contributions are invited.

The functional view of edge computing refers to the perspective that focuses on edge computing roles, capabilities of edge computing and general configuration of logical components within edge computing ecosystem.

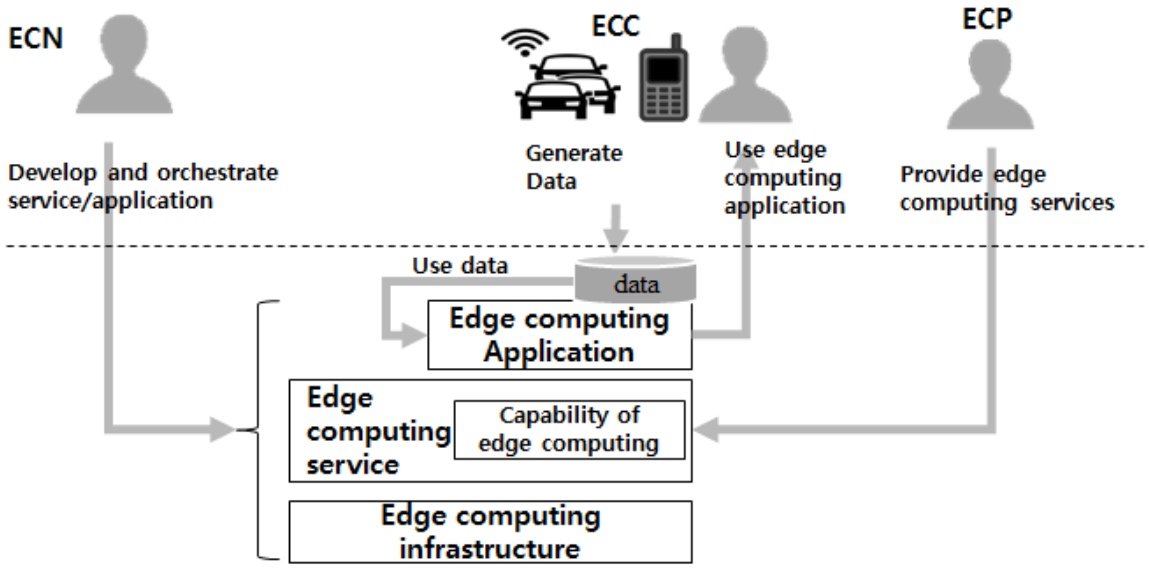


Figure 5-1 – The functional view of edge computing based on [ITU-T Y.3540]

The functional view of edge computing based on [ITU-T Y.3540] describes high-level composition of edge computing and ecosystem as shown in figure 5-1. According to [ITU-T Y.3540], edge computing comprises with edge computing application, edge computing service and edge computing infrastructure.

NOTE – [ITU-T Y.3540] describes the examples of edge computing capability such as user proximity, network connectivity, data proximity, cooperation, and orchestration.

6.2 Overview of edge computing service

[Editors' Note in Oct. 2023] This clause includes explanation of edge computing in detail.

Among three components, edge computing service is defined to one or more capabilities provided on edge computing infrastructure. The edge computing service is a service provided from ECP to ECC as cloud service is provided by a CSP to CSC. When ECC uses edge computing services, an edge computing application can be used. Based on various sensors and actuators, ECC uses various individual devices depending on the application domain, so there is a potential possibility that this edge computing application cannot be provided from ECP. Of course, the edge computing infrastructure, which is the basis of the edge computing service, is managed and operated by ECP.

The edge computing service also provides edge computing capabilities according to the characteristics required by edge computing applications. In fact, the edge computing service is an interface between the edge computing application and the edge computing infrastructure in that the

edge computing service enables the edge computing application to use the edge computing infrastructure and provides edge computing capabilities through the edge computing application.

The general configuration of edge computing service with logical components is specified for the functional requirements in this recommendation.

6.3 General configuration of edge computing service

[Editors' Note in Oct. 2023] This clause includes logical component of edge computing service. Logical components are possibly separated with each component. Following classification is not fixed. Contributions are invited.

The logical component of edge computing service is based on description in [ITU-TY.3540]. The logical component of edge computing service consists of edge computing user/device interface, edge computing service operation, and edge computing service management. The following sub-clauses describe sub-logical components of each edge computing service logical component with diagrams.

[Editors' Note in Oct. 2023] The following figures and descriptions have not yet been finalized and need to be revised.

6.3.1 Edge computing user/device interface

Figure 5-1 shows logical components of edge computing user/device interface. The sub-logical components of edge computing user/device interface comprise in user/device connection and data processing.

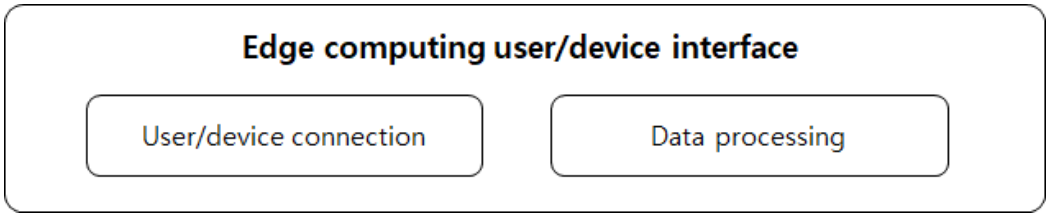


Figure 5-1 – Configuration of edge computing application

- User/device connection: This sub-logical component provides ECC and edge device connectivity. It is responsible for interworking with various types of communication interfaces of edge devices and data integration of heterogeneous protocols. It is also responsible for authentication and registration/deregistration of ECC using edge computing service.
- Data processing: This sub-logical component converts and unifies the specifications of message data from heterogeneous edge devices to transmit data to storage inside edge computing application and edge computing infrastructure. In addition, this sub-logical component pseudonymizes personal information contained in ECC's personal information and data from edge devices, or sensitive information that can be identified as a certain individual ECC to provide data to outside.

6.3.2 Edge computing service operation

Figure 5-2 shows logical components of edge computing service operation. The sub-logical components of edge computing service operation are network connection, edge computing cooperation, edge computing orchestration, data proximity support, and heterogenous infra integration.

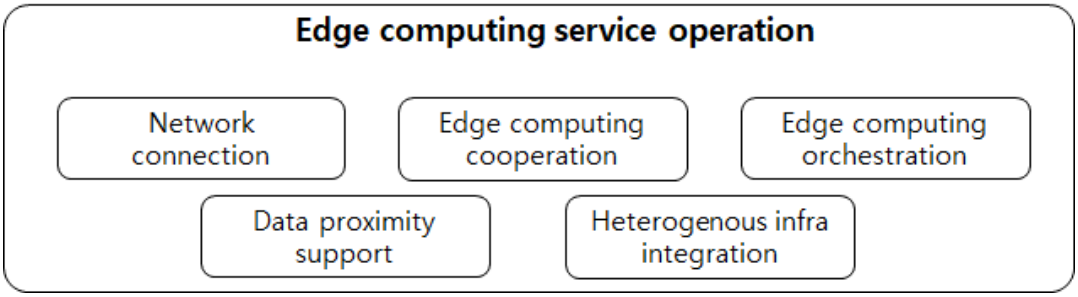


Figure 5-2 – Configuration of edge computing service

- Network connection: This sub-logical component links heterogeneous networks such as 5G, 4G, and PS-LTE for connection to other edge computing infrastructures, and provides a method of configuring network bypass path through real-time monitoring in case of network disconnection.
- Edge computing cooperation: This sub-logical component uses edge computing infrastructure in different regions or other technology infrastructure such as cloud computing and data centre to run edge computing applications by distributed processing.
- Edge computing orchestration: This sub-logical component optimizes the size of resources in the edge computing infrastructure required to run each edge computing application, and provides a method of packaging, deployment, and automatic execution of edge computing applications.
- Data proximity support: This sub-logical component performs storing, sharing, and synchronization of input and output data of edge computing applications for data probability.
- Heterogenous infra integration: This sub-logical component configures the virtual infrastructure by integrating and managing virtual machines and containers in edge computing infrastructure.

6.3.3 Edge computing service management

Figure 5-3 shows logical components of edge computing service management. The sub-logical components of edge computing service management include operational management and development environment support.

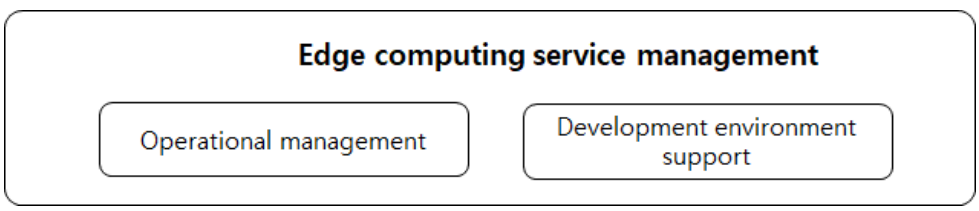


Figure 5-3 – Configuration of edge computing management

- Operational management: This sub-logical component manages the overall operations of edge computing, including lifecycle management of edge computing services, deployment

of edge computing application, and registration/deregistration of edge computing infrastructure.

- Development environment support: This sub-logical component provides IDE such as SDKs, libraries, and interfaces necessary for the development of edge computing services and edge computing applications.

[Editors' Note in Oct. 2023] For edge computing service management logical component, it is necessary to refer to multi-layer functions in ITU-T Y.3502.

7 Functional requirements for edge computing service

The following describes the functional requirements in each component for edge computing service.

[TBD]

8 Security considerations

[Editors' Note in Oct. 2023] The normative description of security consideration will be addressed in this clause, contributions are invited.

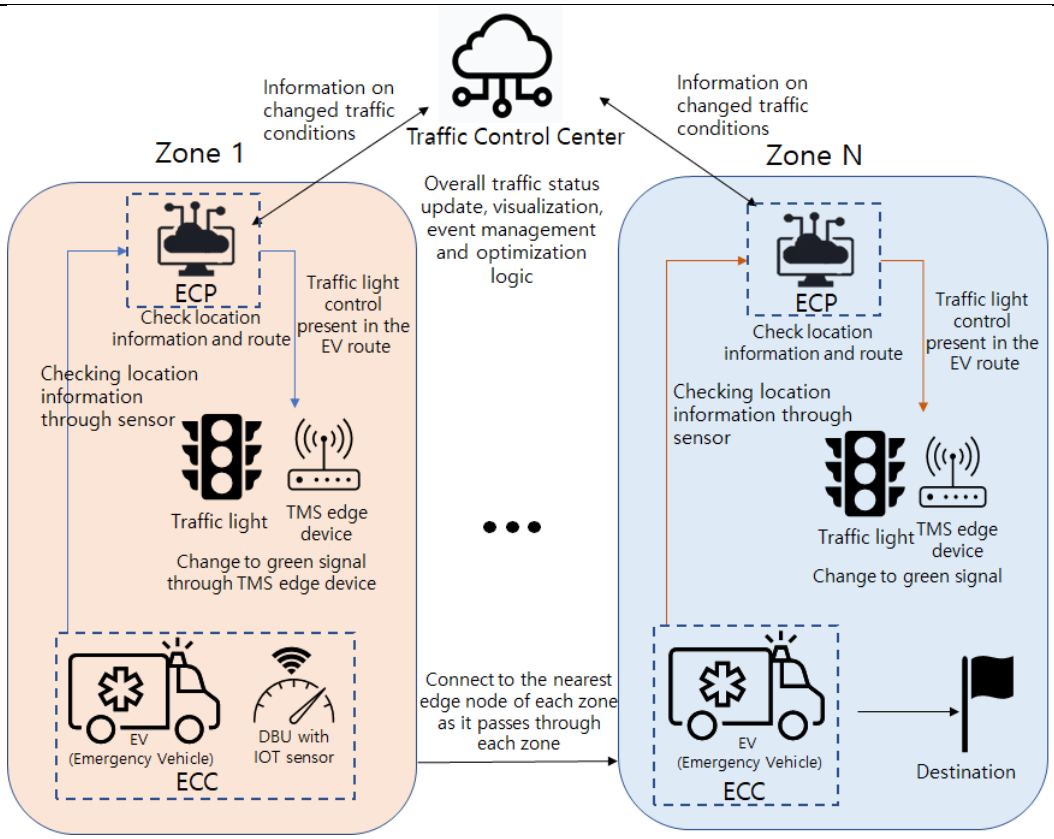
Appendix I. Use case for functional requirement of edge computing service

[Editors' Note in Oct. 2023] The use cases described in ITU-T Y.3540 are not enough to extract detailed functional requirements of edge computing focusing on edge computing service. The use cases in this clause will be based on the various well-known application domains investigated in Appendix I of ITU-T Y.3540. And descriptions and figures should include roles defined in ITU-T Y.3540. Contributions are invited.

I.1 Use case

[Editors' Note in Oct. 2023] A sample use case is described as below.

Title	Emergency vehicle priority system using smart city edge computing and IoT sensor
Application domains	Smart city - traffic signal control
Description	This use case provides a service that uses both edge computing service and IoT sensors to give priority to an ECC, emergency vehicles (EV) in this use case, and reduce waiting time for general traffic. The whole city will be divided into several districts. Each zone has a single edge computing service in an ECP, which is connected to a traffic management system (TMS) edge device. In order to minimize the arrival time to the arrival area when time-sensitive vehicles such as ambulances and fire trucks are dispatched, the nearby traffic lights in a certain zone are automatically changed to smoothly change the traffic situation. This process is carried out continuously until the EV arrives at the destination in another zone. The update of entire traffic state, visualization, event management, and optimization logic for route are executed on a traffic control centre. An edge device equipped with a TMS is attached at the traffic lights to control them. The EV uses DBU (Dash Board Unit) provided from the edge computing application in ECP to identify the states of traffic lights on the route and location information. The EV also equips GPS-based IoT sensors that create virtual boundaries or zones based on actual locations to find a nearby edge computing infrastructure in an ECP in the zone and continuously transmit location information packets to the edge computing service in the ECP every unit time. The IoT sensor can have different types, and different standard specifications can be used for sending packets. By extracting the location information from the packets, the edge computing service in the ECP checks the direction and entry time of the EV vehicle and controls the TMS edge device in the path that the EV will pass, changing the signal of the traffic light to green.
Role/Sub-role	ECP, ECC

Figure (optional)	
Pre-conditions (optional)	
Post-conditions (optional)	
Derived requirements	*[Editors' Note in Oct. 2023] A sample derived requirement for this use case is described as below.* It is required that edge computing service in ECP provide interworking with various types of edge devices.

Bibliography

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