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Introduction

A fundamental characteristic of cloud computing is broad network access (see ISO/IEC 22123-2 5.2.2 [3]) which includes accessibility to cloud services and interoperability among a wide range of devices, servers, software objects and application workloads. Interoperability (see ISO/IEC 19941) is fundamental for any endpoint participating in a cloud solution (see ISO/IEC 22123-1 3.1.3).

In a distributed computing system, the computing, storage and network resources can be deployed logically near the end user, in regional or sovereign domains, in relatively distant data centres or in any combination of locations. Edge computing (see ISO/IEC TR 23188 [7]) involves nodes (i.e. computing systems) that are logically or physically close to the end user. Edge computing use cases range from the Internet of Things (see ISO/IEC TR 30164 [8]) to private clouds, network gateways and mobile systems. Interactions among user devices, edge nodes and central cloud systems are highly dependent on connectivity, speed, latency, volume and other functional and non-functional network capabilities.

The term "networking" generally refers to the set of resources, including circuits, switches, routers, gateways, protocols, services and interfaces, that together implement a secure and reliable data transport infrastructure, called a cloud-edge ecosystem in this document (see Figure 1).

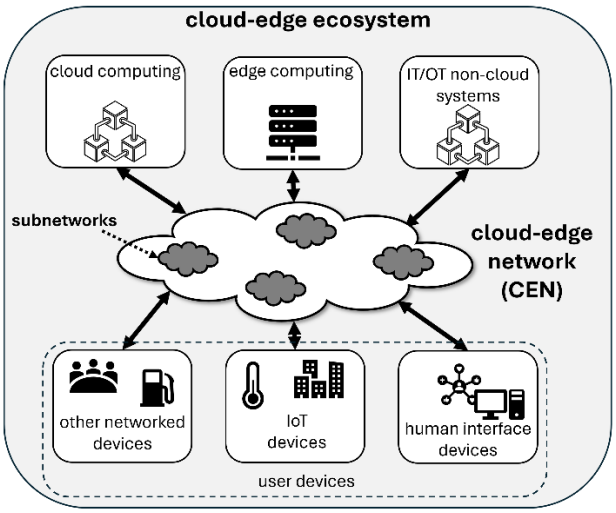


Figure 1 — Cloud-edge ecosystem

Networks for cloud computing (see ISO/IEC TS 23167 13 [5]) and for edge computing (see ISO/IEC TR 23188 6), collectively called "cloud-edge networks" herein, include several categories of subnetwork:

— proximity networks that connect device tier nodes to each other and to edge tier nodes;

— access networks that connect edge tier nodes to each other and to central tier nodes (e.g. cloud services);

— user networks that connect human end users to edge tier nodes and central tier nodes; and

— services networks that connect nodes within a single cloud service provider's environment and cloud services from independent cloud service providers (i.e. interoperability among CSPs).

This document is intended as an introduction to the key concepts, technologies and techniques that are available to provide networking in both simple and complex cloud and edge deployments. Consistent terms and concepts are especially important for solutions involving multiple service providers and disjointed edge solutions. This document examines cloud and edge networks from a user's perspective,

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describes the basic interconnection patterns, capabilities and qualities of service, and surveys the infrastructures that are emerging to meet user requirements.

This document provides concepts and terms for describing cloud-edge computing systems. It covers various aspects of a cloud-based ecosystem that features functionality that is distributed closer to the user.

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Title Information Technology — Cloud computing and distributed platforms — Networking in cloud computing and edge computing

1 Scope

This document describes the foundational concepts for edge computing and its relationship to cloud computing including the terminology, models and functional elements for networking in edge computing and cloud computing systems.

This document also applies to distributed platforms, multiple cloud models (including multi-cloud, hybrid cloud, inter-cloud and federated cloud) and related intelligent nodes.

2 Normative references

The following documents are referred to in the text in such a way that some or all 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 22123-1, Information technology — Cloud computing — Part 1: Vocabulary

ISO/IEC 19941, Information technology — Cloud computing — Interoperability and portability

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:

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

3.1 Networking terms

3.1.1
networking
practice of connecting computers, servers and other devices for the exchange of data and the sharing of resources

Note 1 to entry: Networking includes physical network components such routers and switches, software protocols such as TCP/IP, facilities and management applications that make interoperability achievable, reliable and efficient.

3.1.2
network
networking (3.1.1) for a specified ecosystem or context

Note 1 to entry: A network can include multiple technologies for varying requirements, locations and ownership.

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Note 2 to entry: Networks can support multiple data flows for the same or different purposes.

Note 3 to entry: Networks in different ecosystems can be jointly or independently operated and managed.

3.1.3
subnetwork
part of a *network* (3.1.2) that supports a defined set of devices and systems

Note 1 to entry: A network includes one or more subnetworks to meet varying functional, performance, location and ownership requirements.

3.1.4
network service
capability offered by a *network* (3.1.2) at a defined interface

3.1.5
node
networked machine with processing and storage capabilities

Note 1 to entry: Nodes include functional components (ISO/IEC 22123-1 3.3.9) within or attached to a *network* (3.1.2).

Note 2 to entry: Nodes can provide network functions and can include application processing and data storage capabilities.

[SOURCE: ISO/IEC TR 23188 3.1.9]

3.2 Terms related to edge computing

3.2.1
edge computing
distributed computing in which some or all processing and storage takes place at or near the edge, where the nearness is defined by the system's requirements

[SOURCE: ISO/IEC TR 23188 3.1.3 – modified: added "some or all"]

3.2.2
edge node
node (3.1.5) that provides processing, storage and *network services* (3.1.4) in an *edge solution* (3.2.5)

Note 1 to entry: Edge nodes provide *edge services* (3.2.3) and network functions (e.g. gateway, security or interoperability functions).

3.2.3
edge service
edge computing service
one or more capabilities offered by an *edge solution* (3.2.5) invoked using a defined interface in *edge computing* (3.2.1)

Note 1 to entry: Edge computing services are accessible from *edge nodes* (3.2.3).

Note 2 to entry: Edge computing services can be integrated with cloud services.

3.2.4
edge service provider role

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ESP role
set of activities that make *edge computing services* (3.2.3) available

Note 1 to entry: This definition is analogous to a cloud service provider (CSP) role (ISO/IEC 22123-1:2023, 3.3.15).

Note 2 to entry: CSPs, CSCs and third parties can act as an edge service provider.

3.2.5
edge solution
edge computing services (3.2.3) combined and controlled to meet customer requirements

Note 1 to entry: This definition is analogous to a cloud solution (ISO/IEC 22123-1 3.1.3).

Note 2 to entry: An edge solution can be combined with a cloud solution.

3.3 Terms related to cloud-edge networks

3.3.1
cloud-edge network
CEN
network (3.1.2) for a *cloud-edge ecosystem* (3.3.2)

Note 1 to entry: A *cloud-edge network* (3.3.1) can support a wide range of cloud and edge deployment, management and governance models.

3.3.2
cloud-edge ecosystem
configuration of cloud services, *edge computing services* (3.2.3) and other *nodes* (3.1.6) that meet defined requirements

Note 1 to entry: *Cloud-edge ecosystems* (3.3.2) can use a variety of cloud and edge deployment models including public, private, hybrid or federated.

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