TECHNICAL REPORT

ISO/IEC TR 23188

First edition
2020-02

Information technology — Cloud computing — Edge computing landscape



Reference number
ISO/IEC TR 23188:2020(E)

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Published in Switzerland

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Foreword

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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).

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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.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 38, *Cloud computing and distributed platforms*.

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.

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Introduction

Edge computing is increasingly used in systems that deal with aspects of the physical world. Edge computing involves the placement of processing and storage near or at the places where those systems interact with the physical world, which is where the "edge" exists. One of the trends in this space is the development of increasingly capable Internet of Things (IoT) devices (sensors and actuators), which generate more data or new types of data. There is significant benefit from moving the processing and storing of this data close to the place where the data is generated.

Cloud computing is commonly used in systems that are based on edge computing approaches. This can include the connection of both devices and edge computing nodes to centralized cloud services. However, it is the case that the locations in which cloud computing is performed are increasingly distributed in nature. The cloud services are being implemented in locations that are nearer to the edge in order to support use cases that demand reduced latency or avoiding the need to transmit large volumes of data over networks with limited bandwidth.

This document aims to describe edge computing and the significant elements which contribute to the successful implementation of edge computing systems, with an emphasis on the use of cloud computing and cloud computing technologies in the context of edge computing, including the virtualization of compute, storage and networking resources.

It is useful to read this document in conjunction with ISO/IEC TR 30164[1)] [27], which takes a view of edge computing from the point of view of IoT systems and the IoT devices which interact with the physical world.

1) Under development. Current stage 10.99.

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Information technology — Cloud computing — Edge computing landscape

1 Scope

This document examines the concept of edge computing, its relationship to cloud computing and IoT, and the technologies that are key to the implementation of edge computing. This document explores the following topics with respect to edge computing:

— concept of edge computing systems;

— architectural foundation of edge computing;

— edge computing terminology;

— software classifications in edge computing, e.g. firmware, services, applications;

— supporting technologies, e.g. containers, serverless computing, microservices;

— networking for edge systems, including virtual networks;

— data, e.g. data flow, data storage, data processing;

— management, of software, of data and of networks, resources, quality of service;

— virtual placement of software and data, and metadata;

— security and privacy;

— real time;

— mobile edge computing, mobile devices.

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 22123-1:—[2)], *Information technology — Cloud computing — Part 1: Terminology*

ISO/IEC TS 23167, *Information technology — Cloud computing — Common technologies and techniques*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 22123-1, ISO/IEC TS 23167 and the following apply.

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

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

2) To be published.

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3.1 Edge computing

3.1.1
distributed computing
model of computing in which a set of *nodes* (3.1.5) coordinates its activities by means of digital messages passed between the *nodes* (3.1.5)

3.1.2
edge
boundary between pertinent digital and *physical entities* (3.2.8), delineated by networked *sensors* (3.2.9) and *actuators* (3.2.1)

Note 1 to entry: Pertinent digital entities means that the digital entities which need to be considered can vary depending on the system under consideration and the context in which those entities are used. See 5.2 for more detail.

3.1.3
edge computing
distributed computing (3.1.1) in which processing and storage takes place at or near the *edge* (3.1.2), where the nearness is defined by the system's requirements

3.1.4
lightweight node
node (3.1.5) with limited processing, storage and networking capacities

3.1.5
node
networked machine with processing and storage capabilities

3.1.6
edge computing system
system providing functionalities of *edge computing* (3.1.3)

3.1.7
endpoint
combination of a binding and a network address

[SOURCE: ISO/TR 24097-3:2019, 3.4]

3.2 IoT terms

3.2.1
actuator
IoT device (3.2.4) that changes one or more properties of a *physical entity* (3.2.8) in response to a valid input

[SOURCE: ISO/IEC 20924:2018, 3.2.2]

3.2.2
Internet of Things
IoT
infrastructure of interconnected entities, people, systems and information resources together with services which processes and reacts to information from the physical world and virtual world

[SOURCE: ISO/IEC 20924:2018, 3.2.1]

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3.2.3
Internet Protocol
IP
protocol specified in RFC 791 (IP version 4) or in RFC 2460 (IP version 6)

[SOURCE: ISO/IEC TR 21890:2001, 3.4]

3.2.4
IoT device
entity of an *IoT system* (3.2.6) that interacts and communicates with the physical world through sensing or actuating

Note 1 to entry: An *IoT device* (3.2.4) can be a *sensor* (3.2.9) or an *actuator* (3.2.1).

[SOURCE: ISO/IEC 20924:2018, 3.2.4]

3.2.5
IoT gateway
entity of an *IoT system* (3.2.6) that connects one or more proximity networks and the *IoT devices* (3.2.4) on those networks to each other and to one or more access networks

[SOURCE: ISO/IEC 20924:2018, 3.2.6]

3.2.6
IoT system
system providing functionalities of *Internet of Things* (3.2.2)

Note 1 to entry: IoT system is inclusive of *IoT devices* (3.2.4), *IoT gateways* (3.2.5), *sensors* (3.2.9), and *actuators* (3.2.1).

[SOURCE: ISO/IEC 20924:2018, 3.2.7]

3.2.7
operational technology
OT
hardware and software that detects or causes a change through the direct monitoring and/or control of physical devices and systems, processes and events in the organization

3.2.8
physical entity
entity that has material existence in the physical world

[SOURCE: ISO/IEC 20924:2018, 3.1.26, modified — Note 1 to entry has been removed.]

3.2.9
sensor
IoT device (3.2.4) that measures one or more properties of one or more *physical entities* (3.2.8) and outputs digital data that can be transmitted over a network

[SOURCE: ISO/IEC 20924:2018, 3.2.9]

3.3 Real time

3.3.1
real time
processing of data by a computer in connection with another process outside the computer according to time requirements imposed by the outside process

[SOURCE: ISO/IEC 2382:2015, 2122900, modified: words 'pertaining to' removed to improve substitutability of definition; Notes 1 to 3 to entry have been removed.]

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3.3.2
real time system
system in which processing meets *real time* (3.3.1) requirements

3.3.3
hard real time system
real time system (3.3.2) whose operation is incorrect if results are not produced according to specified timing requirements

3.3.4
soft real time system
real time system (3.3.2) whose operation is degraded if results are not produced according to specified timing requirements

4 Symbols and abbreviated terms

AC	Alternating current
ASIC	Application-Specific Integrated Circuit
BYOD	Bring Your Own Device
CDN	Content Distribution Network
CSC	Cloud service customer
CSP	Cloud service provider
DDoS	Distributed Denial of Service
EPG	Electronic Programme Guide
EPROM	Erasable Programmable Read Only Memory
FPGA	Field Programmable Gate Array
Gb	Gigabyte
GPS	Global Positioning System
GPU	Graphics Processing Unit
IETF	Internet Engineering Task Force
IoT	Internet of Things
IP	Internet Protocol
IPTV	Internet Protocol television
LAN	Local Area Network
MDM	Mobile Device Management
OS	Operating system
PC	Personal Computer
PII	Personally Identifiable Information

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