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Information technology — Cloud computing ~~and distributed platforms — Cloud computing — Platform~~— Overview of platform capabilities type and ~~Platform~~platform as a ~~Service (PaaS)~~service

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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 ISO documentsdocument 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 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

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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.htmlwww.iso.org/members.html and www.iec.ch/national-committees.

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Introduction

Many cloud services allow a cloud service customer (CSC) to develop, upload, and execute their own code, rather than uploading a complete virtual machine image, or being confined to software provided by the cloud service provider.

This ability to write and execute their own code allows CSCs and others to develop or customise their own applications without having to run their own private datacentres, and without having to install, patch and manage operating systems and other elements typically required in legacy IaaS services. This approach allows the CSC to concentrate on the code that directly meets their business need rather than having to create a lot of peripheral "plumbing" code just to make things work.

While some cloud services are specifically designed as Platform as a Service (PaaS) wherein the execution of CSC-provided code is the primary purpose of the cloud service, others include a greater or lesser amount of "platform capabilities type" as a feature or supplement to the main function of the cloud service. These platform capabilities can be as basic as telephone call routing scripts or database stored procedures~~,~~ or can be as extensive as large function libraries or microservices for use in other applications. The full range of possibilities is too extensive to list exhaustively and is constantly growing as new ideas emerge.

In addition, the world of cloud computing is seeing wholly new developments and technologies added all the time. Many of these include the execution of CSC-provided code, or its equivalent for a different paradigm. For example, Artificial Intelligence (AI) services (e.g. machine learning) can be deployed as cloud services, and in this case the "CSC-provided code" can include both training data and procedural code. As another example, the world is preparing for the availability of Quantum Computing (QC) technology which (like AI) will probably be exposed to CSCs as various forms of cloud services. Both AI and QC technologies appear as services that can be incorporated within more traditional application designs, thus contributing their specialised and unique capabilities.

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It is therefore useful to describe both the purpose-built PaaS concept, and the more general "platform capabilities type" as it appears in other cloud services beyond PaaS. This document explains the differences between PaaS and other services, the types of CSC-provided code that such platforms can support, the general approaches to development of code for such services, common platform architectural approaches, and how cloud computing platforms can support new technology paradigms such as AI and QC in a consistent manner.

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In particular, this document provides an introduction to the "cloud native computing" concept as a pattern of platform capabilities type, providing an architectural pattern is focussed on cloud-first development and that offers greater flexibility and modularity than many older software design patterns.

It is also important to define some general recommendations to promote good practice in the provision and use of digital technology platforms of these kinds especially with respect to transparency of platform service offerings to existing and potential CSCs.

Throughout this document, unless otherwise explicitly stated, the term "platform" is always used in the engineering sense, specifically referring to the "digital technology platform" in accordance with ISO/IEC TS 5928 ~~[6]~~ as implemented in cloud services, edge services, mobile services, and other distributed platforms.

The common engineering usage of ~~"~~"digital technology platform~~"~~" includes:

— ~~Operating~~operating systems~~,~~

— "~~Platform~~platform as a ~~Service~~service" cloud services in accordance with ISO/IEC 22123-1 ~~[1]~~.

— ~~Other~~other cloud services that exhibit "platform capabilities type" in accordance with ISO/IEC 22123-2~~]~~ ~~[1]~~.

As such, this usage of platform refers to cloud services that enable a CSC to create and maintain their own hosted application, rather than using digital technology for the creation of a multi-sided market as typically used by economists and competition regulators.

However, as described in ISO/IEC TS 5928 [6], some types of cloud services (typically various forms of SaaS) that are implemented on top of the digital technology platform can also exhibit the characteristics of a digital economic platform by creating a multi-sided market. Such SaaS implementations by CSCs of the digital technology platform are generally outside the control and responsibility of the digital technology platform service operator.

The intended audience for this technical specificationdocument is:

— businesses considering the use of technology platform capabilities for new cloud applications (both as CSDs and as purchasers of installable cloud software)

— for those seeking to understand or describe the various cloud application development options available

— for those seeking to clearly describe digital technology platform services that they offer to CSCs

— for those developing governmental or procurement policies covering CSC-provided cloud applications

— those developing other standards that need to reference cloud technology platform capabilities and approaches.

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Information technology — Cloud ~~Computing~~computing — Overview of ~~Platform Capabilities Type~~platform capabilities type and ~~Platform~~platform as a ~~Service~~service

1 Scope

Within the context of digital technology platforms as defined in ISO/IEC TS 5928 ~~[6],~~ this document provides ~~the following~~:

— a description of the concepts of the platform capabilities type as it appears in various cloud service categories;

— a description of the specific cloud service category of platform as a service (PaaS~~)~~);

— descriptions of common technology platform architectures, development approaches, and life cycles of elements of technology platform services, including a high-level description of the popular cloud native computing concept;

— recommendations for cloud services that include platform capabilities, including but not limited to PaaS.

2 Normative references

~~This document contains no normative references.~~

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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, *Information technology — Cloud computing — Part 1: Vocabulary*

3 Terms and definitions

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

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

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

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

3.1
platform capabilities type
cloud capabilities type in which the cloud service customer can deploy, manage and run customer-created or customer-acquired applications using one or more programming languages and one or more execution environments supported by the cloud service provider

[Source: ISO/IEC 22123-1] [1]

Note 1 to entry: In this context "applications" includes complete or partial programs, containers, code and function libraries, microservices, AI training data, and other forms of source code or executable software code artefacts, with or without a user interface being included.

Note 2 to entry: This does *not* include any minimal scripting capability internal to a single application, such as simple macros within a spreadsheet.

Note 3 to entry: Notes 1 and 2 in this document clarify the existing definition in ISO/IEC 22123-1 [1] (which has no Notes) and will be submitted to that standard in a future revision.

[SOURCE: ISO/IEC 22123-1:2023, 3.5.4, modified — Notes 1 and 2 to entry have been added.]

3.2
digital platform

distributed platform
set of correlated and cohesive digital services

[SourceSOURCE: ISO/IEC TS 5928] [6]:2023, 3.1.2, modified — The original Notes to entry have been deleted.]

3.3
digital technology platform
digital platform that provides engineering components required to support creation and deployment of applications and services

[SourceSOURCE: ISO/IEC TS 5928] [6]:2023, 3.3.1, modified — The original Notes to entry have been deleted.]

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3.4
digital economic platform
one or more digital platforms creating a multi-sided market, which provide goods, services or licensed rights to two or more distinct participant groups who need each other in some way

[~~Source~~SOURCE: ISO/IEC TS 5928~~] [6]~~:2023, 3.4.2, modified — The original Notes to entry have been deleted.]

3.5
CSC-provided code
software code artefacts created by CSDs acting on the CSC's behalf, that are designed to execute within a cloud service to meet the needs of the CSC

Note 1 to entry: Such code artefacts can be supplemented by data or metadata.

Note 2 to entry: The CSDs creating the code can be employees or contractors of the CSC, or of another organization such as a vendor, partner, or contractor to the CSC.

3.6
metadata
data that defines and describes other data

~~[SOURCE: ISO/IEC 11179-3:2022, 3.2.30]~~

Note 1 to entry: Metadata can include many different kinds of attributes of the data it describes. Some metadata fields are almost universal, such as date of creation and last change, type of file or object, permissions, and ownership. Other metadata can be specific to the type of object, such as the camera settings of a digital image, the author's name for a document, the version of a code artefact, etc.

Note 2 to entry: Some metadata may be directly attached to (or embedded within) the data to which it relates and will always move with it. Other metadata may be stored separately and associated with the data by reference or other means.

[SOURCE: ISO/IEC 11179-3:2022, 3.2.30]

3.7
cloud native

cloud native computing
approach and practices for developing, deploying, and running applications and services in cloud computing systems with specific **platform capabilities type** which offer features such as functional decomposition, containerization, orchestration, microservices for applications, automation, monitoring and logging, and continuous operation

Note 1 to entry: Additional tools and technologies that support these capabilities include DevOps, CI-CD tools, automation of orchestration etc., which individually and collectively, enable autoscaling, resilience, superior performance, ease of portability and interoperability and ease of maintenance among other benefits.

Note 2 to entry: Orchestration refers to automatic or semi-automatic deployment, instantiation, interconnection, and management of containerised software.

Note 3 to entry: This approach contrasts with more traditional virtualisation-based approaches based largely on customer-managed Virtual Machines.

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3.8

jurisdiction
geographical or corporate area over which a cloud computing policy extends

Note 1 to entry: In a government policy context this will generally be the geographical area over which the body enacting the policy has legal authority either as government or as authorised regulator. However, in an enterprise or government agency environment, the jurisdiction of a policy might cover a business function, department, agency, or other organisational area of responsibility not tied to geography.

[SOURCE: ISO/IEC TR 22678:2019, 3.2 ~~{informative}~~]

4 Abbreviations

AI	artificial intelligence
API	application programming interface
CaaS	communications as a service
CaaS	container as a service
CDM	cloud deployment model
CPU	central processing unit
CSA	cloud service agreement
CSC	cloud service customer
CSD	cloud service developer
CSN	cloud service partner
CSP	cloud service provider
CSU	cloud service user
DBaaS	database as a service
DSaaS	data storage as a service
FaaS	function as a service
GPU	graphics processing unit
IaaS	infrastructure as a service
IAM	identity and access management
IDaaS	identity as a service
IoT	internet of things
ISV	independent software vendor
ML	machine learning
MLaaS	machine learning as a service
PaaS	platform as a service
PII	personally identifiable information
QC	quantum computing
QCaaS	quantum computing as a service

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SaaS	software as a service
SBoM	software bill of materials
SQL	structured query language
UI	user interface
W3C	World Wide Web Consortium
WCAG	web content accessibility guidelines

5 Overview of platform capabilities type

5.1 General

The definition of "platform capabilities type" means supporting the execution of CSC-provided software code written in a programming language, whether the code is written by the CSC themselves or obtained from another CSD (see clause 5.65.6), or perhaps from an open-source project. This can also include pre-compiled code provided (created or purchased) by the CSC, such as bytecode, libraries, container images, or microservices as described in ISO/IEC TS 23167 [7]. .

5.2 Examples of capabilities

Capabilities falling within the platform capabilities type include but are not limited to:

a) Capabilities to write, upload, compile, execute, monitor, and debug their own programming code within the service;

b) Execution of CSC-provided server code that operates on cloud data storage, such as SQL stored procedures for a cloud database (DbaaS});

c) The provision of APIs that allow CSC-provided code to access functions and capabilities offered by the cloud service. For example:

   1) Connection routing APIs for Network as a Service (NaaS});

   2) Call routing APIs for customer-support via Communication as a Service (CaaS});

d) The provision of APIs that allow CSC-provided code to communicate with external software functions either within the same cloud service or elsewhere;

e) The provision of APIs that allow CSC-provided code to construct and offer one or more user interfaces for communication with human users;

f) The provision of APIs that allow CSC-provided code to construct and expose one or more CSC-defined APIs for communication with other software applications or cloud services;

g) The provision of APIs that allow CSC-provided code to be managed with respect to data security, confidentiality, privacy, integrity, and accessibility for disabled persons.

5.3 Capabilities not included in the platform capabilities type

Capabilities falling outside the cloud computing platform capabilities type include but are not limited to:

a) Non-cloud capabilities;

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