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SERIES Y: GLOBAL INFORMATION
INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS,
NEXT-GENERATION NETWORKS, INTERNET OF
THINGS AND SMART CITIES

Cloud Computing

Cloud computing – Functional architecture of inter-cloud computing

Recommendation ITU-T Y.3516

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Recommendation ITU-T Y.3516

Cloud computing – Functional architecture of inter-cloud computing

Summary

Recommendation ITU-T Y.3516 specifies inter-cloud computing functional architecture, including functions and functional components, based on the inter-cloud computing framework specified in Recommendation ITU-T Y.3511. The Recommendation builds upon the functional view of the cloud computing reference architecture (Recommendation ITU-T Y.3502) and makes extensions to functional components with inter-cloud functions.

Recommendation ITU-T Y.3516 also describes the mapping between functions and functional requirements of inter-cloud computing and examples of inter-cloud related reference points.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
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Inter-cloud computing, functions, functional architecture, functional component.

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Recommendation ITU-T Y.3516

Cloud computing – Functional architecture of inter-cloud computing

1 Scope

This Recommendation specifies inter-cloud computing functional architecture, including functions and functional components, based on the inter-cloud computing framework specified in [ITU-T Y.3511]. The Recommendation builds upon the functional view of the cloud computing reference architecture [ITU-T Y.3502] and makes extensions to functional components with inter-cloud functions.

The scope of this Recommendation consists of:

- overview of inter-cloud computing functional architecture;
- functions of inter-cloud computing;
- functional components of inter-cloud computing architecture.

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 X.1601] Recommendation ITU-T X.1601 (2015), *Security framework for cloud computing*.
- [ITU-T Y.3502] Recommendation ITU-T Y.3502 (2014) | ISO/IEC 17789: 2014, *Information technology – Cloud computing – Reference architecture*.
- [ITU-T Y.3511] Recommendation ITU-T Y.3511 (2014), *Framework of inter-cloud computing*.
- [ITU-T Y.3514] Recommendation ITU-T Y.3514 (2017), *Cloud computing – Trusted inter-cloud computing framework and requirements*.
- [ITU-T Y.3522] Recommendation ITU-T Y.3522 (2016), *End-to-end cloud service lifecycle management requirements*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 activity [ITU-T Y.3502]: A specified pursuit or set of tasks.

3.1.2 cloud service [b-ITU-T Y.3500]: One or more capabilities offered via cloud computing invoked using a defined interface.

3.1.3 cloud service customer [b-ITU-T Y.3500]: Party which is in a business relationship for the purpose of using cloud services.

NOTE – A business relationship does not necessarily imply financial agreements.

3.1.4 cloud service provider [b-ITU-T Y.3500]: Party which makes cloud services available.

3.1.5 functional component [ITU-T Y.3502]: A functional building block needed to engage in an activity, backed by an implementation.

3.1.6 inter-cloud computing [ITU-T Y.3511]: The paradigm for enabling the interworking between two or more cloud service providers.

NOTE – Inter-cloud computing is also referred as inter-cloud.

3.1.7 peer cloud service [ITU-T Y.3502]: A cloud service of one cloud service provider which is used as part of a cloud service of one or more other cloud service providers.

3.1.8 peer cloud service provider [ITU-T Y.3502]: A cloud service provider who provides one or more cloud services for use by one or more other cloud service providers as part of their cloud services.

3.1.9 primary cloud service provider [ITU-T Y.3511]: In inter-cloud computing, a cloud service provider which is making use of cloud services of peer cloud service providers (i.e., secondary cloud service providers) as part of its own cloud services.

3.1.10 role [ITU-T Y.3502]: A set of activities that serves a common purpose.

3.1.11 secondary cloud service provider [ITU-T Y.3511]: In inter-cloud computing, a cloud service provider which provides cloud services to a primary cloud service provider.

NOTE – The primary cloud service provider can use the services of secondary cloud service providers as part of its services offered to cloud service customers.

3.1.12 sub-role [ITU-T Y.3502]: A subset of the activities of a given role.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

API Application Programming Interface

BSS Business Support System

CSC Cloud Service Customer

CSP Cloud Service Provider

CSU Cloud Service User

KPI Key Performance Indicator

OSS Operations Support System

QoS Quality of Service

SLA Service Level Agreement

5 Conventions

None.

6 Overview

6.1 Inter-cloud functional architecture with different patterns

Inter-cloud computing describes the interworking of cloud service providers (CSPs) in order to deliver cloud services to cloud service customers (CSCs) and cloud service users (CSUs).

[ITU-T Y.3511]. One important target of inter-cloud computing for CSPs is to take benefit of the inter-cloud relationships established between peer CSPs (through inter-cloud patterns) in order to satisfy cloud service requirements of CSCs. The CSP who provides services for CSCs plays the role of primary CSP. The primary CSP is responsible for the cloud service level agreement (SLA) and interacts with peer CSP(s) within an inter-cloud relationship.

An inter-cloud relationship is bidirectional. As illustrated on Figure 6-1, CSP A plays a role of primary CSP when using the services of CSP B for providing services to its own customers, CSC A1 and CSC A2 (highlighted by black coloured arrows). CSP A plays the role of secondary CSP when providing services to CSP B, who plays the role of primary CSP and provides services to its own customers, CSC B1 and CSC B2 (highlighted by grey coloured arrows).

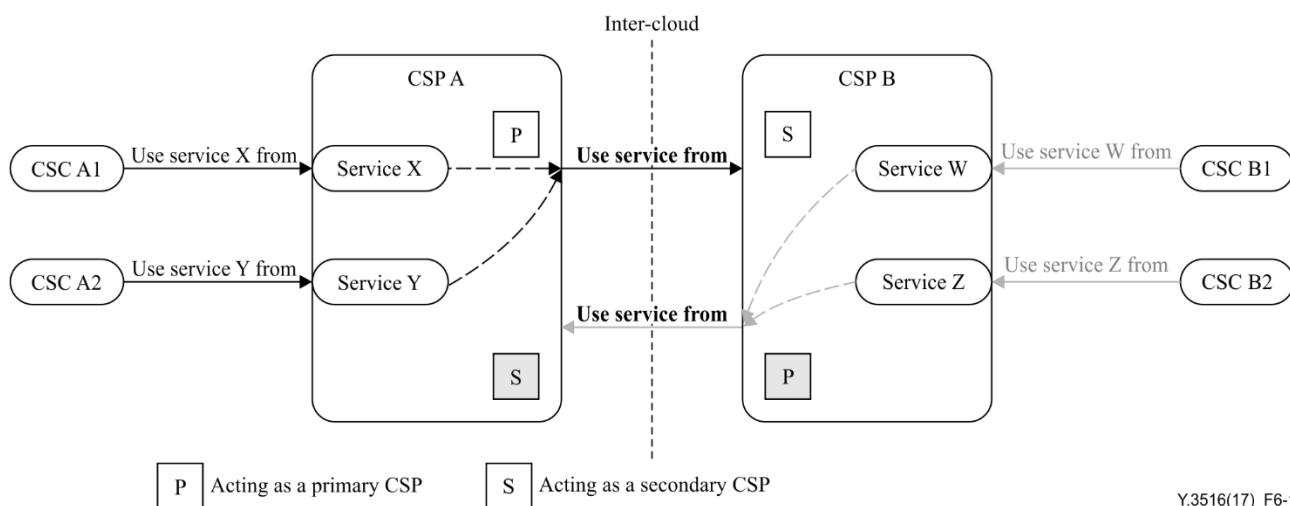


Figure 6-1 – Illustration of bidirectional relationship in inter-cloud computing

The inter-cloud computing concept is based on the relationship (pattern) among multiple CSPs as follows: peering, federation, and inter-cloud intermediary [ITU-T Y.3511]. These patterns are different in terms of business models and relationships between CSPs. However, these patterns are convergent from the viewpoint of inter-cloud computing functions and architecture.

The inter-cloud peering pattern contains only two CSPs and is the fundamental pattern, which may exist on its own or can be used in the other two patterns. The inter-cloud federation pattern involves a group of peer CSPs who mutually combine their service capabilities in order to provide the set of cloud services required by CSCs. The involved peer CSPs forming the inter-cloud federation establish and share common agreement which may range from service related policies, service level agreements (SLAs). The inter-cloud intermediary pattern refers to one and provides intermediation, aggregation and arbitrage of services provided by these peer CSPs.

The roles of the three patterns are also the same, the CSC, the primary CSP, and the secondary CSP. Among the multiple peer CSPs, the one that directly provides cloud services to its CSCs is called the primary CSP, while the one which indirectly provides its cloud service is called the secondary CSP. The secondary CSP treats the primary CSP as a CSC. Cloud services provided by the secondary CSP to the primary CSP are used by the primary CSP to offer services to its own customers (cf. the "perform peering, federation, intermediation, aggregation, arbitrage" activity defined in clause 8.3.2.16 of [ITU-T Y.3502]). For resource handling, the primary CSP negotiates to use the resources of secondary CSPs as an inter-cloud service.

NOTE – This Recommendation uses the term *inter-cloud service* instead of *abstracted resources* employed in [ITU-T Y.3511].

From the architecture point of view, the functions and functional components, as well as reference points for inter-cloud are the same, no matter which inter-cloud patterns are used.

6.2 Relationship with cloud computing reference architecture

The high-level interaction between CSPs for an inter-cloud relationship is described in the cloud computing reference architecture [ITU-T Y.3502]. Two functional components are defined to support inter-cloud computing [ITU-T Y.3502]: peer service integration (shown in Figure 6-2) and peer service management (shown in Figure 6-3 and Figure 6-4). As shown in Figure 6-2, a peer service integration functional component is used by a primary CSP to integrate services from peer CSP(s) (available through service access functional component in access layer) with its own services.

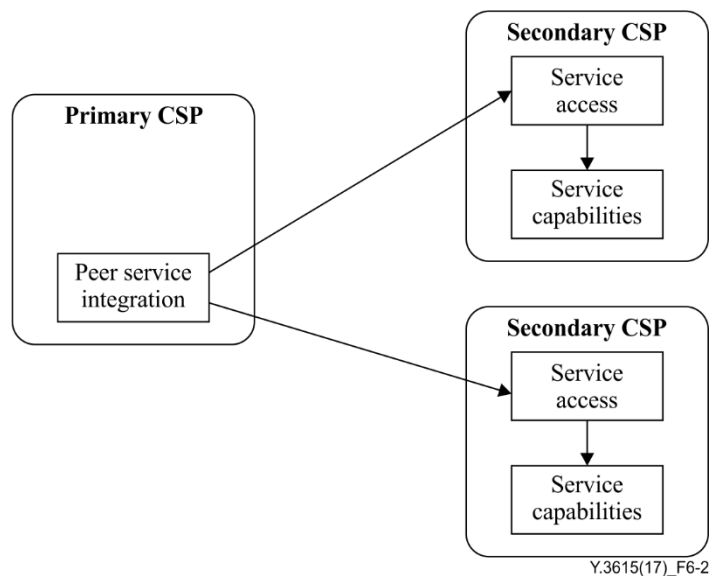


Figure 6-2 – Primary CSP using cloud services provided by secondary CSPs

Figure 6-3 and Figure 6-4 indicate primary CSP use peer service management functional component to make access to the secondary CSPs' operational support systems and business support systems (BSSs) through business access functional component and business capabilities, administration access functional component and business capabilities respectively.

This Recommendation describes additional extensions to [ITU-T Y.3502] for the support of inter-cloud, in particular extensions to functions and the definition of reference points necessary to support interactions between relevant functional components.