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## Requirements for Cloud Service Management

### Summary

This recommendation identifies the relationship between cloud service management and cloud resource management, defines the general management requirements and management function requirements that support the cloud service fulfilment, operation, and provides functional framework for cloud servicesmanagement.

### Keywords

Cloud computing, Cloud service, Cloud resource

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## CONTENTS

1	Scope.....	3
2	References.....	3
3	Definitions .....	3
	Terms defined elsewhere: .....	3
	Terms defined in this Recommendation .....	4
4	Abbreviations and acronyms .....	4
5	Conventions .....	5
6	Introduction.....	5
7	General requirements for cloud service management .....	5
8	Cloud Service Management Function Framework .....	6
9	Function Requirements for cloud service management.....	7
	9.1 Portal and self-service management .....	7
	9.2 Order Management .....	8
	9.3 Service Catalogue Management .....	8
	9.4 Service Instance Management .....	9
	9.5 User management .....	10
	9.6 Policy Management .....	10
	9.7 QoS/SLA management .....	10
	9.8 Charging and Billing Management.....	11
	9.9 Alarm management.....	12
	9.10 Trouble Management.....	12
	9.11 Report Management.....	13
	9.12 Security Management .....	13
	9.13 Interface Management .....	13
	9.14 Monitoring and Audit management.....	13

## 1 Scope

This recommendation identifies the relationship between cloud service management and cloud resource management, defines the general management requirements and management function requirements that support the cloud service fulfilment, operation, and provides function framework for cloud services management.

## 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.

[\[ITU-T Y.CCDEF\]](#) Draft Recommendation [ITU-T Y.CCDEF](#), *Cloud Computing Definition Overview and Vocabulary* (~~Y.eedef~~), Geneva, June 2012

~~1) Draft Recommendation on cloud computing ecosystem, use cases, and general requirements (Y.CCEco), Geneva, June 2012~~

[\[ITU-T Y.CCRA\]](#) Draft Recommendation ~~Ree-~~ [ITU-T Y.CCRA](#), *Cloud Computing Reference Architecture* (~~Y.CCRA~~), Geneva, June 2012

[\[ITU-T M.3050.1\]](#) Recommendation [ITU-TM.3050.1](#) (2007), *Enhanced Telecom Operations Map (eTOM) – The business process framework*.

[\[ITU-T Y.3501\]](#) Recommendation [ITU-TY.3501](#) (2013), *Cloud computing framework and high-level requirements*

## 3 Definitions

### [3.1](#) Terms defined elsewhere:

This Recommendation uses the following terms defined elsewhere:

**3.1.1 Cloud Service** [ITU-T Y. ~~eedef~~CCDEF]: one or more capabilities offered via cloud computing invoked using a declared interface~~A service that is delivered and consumed on demand at any time, through any access network and using any connected devices using cloud computing technologies.~~

**3.1.2 Cloud Service User (CSU)** [ITU-T Y. ~~eedef~~CCDEF]: person associated with a cloud service customer that uses cloud services~~A person or organization that consumes delivered cloud services.~~

**3.1.3 Cloud Service Customer (CSC)** [ITU-T Y.3501]: a person or organization that consumes delivered cloud services within a contract with a cloud service provider.

**3.1.4 Cloud Service Provider (CSP)** [ITU-T Y. ~~eedef~~CCDEF]: party which makes cloud services available~~An organization that provides and maintains delivered cloud services to be delivered and consumed.~~

**3.1.5 Service** [M.3050.1-(04)]: Services are developed by a Service Provider for sale within Products. The same service may be included in multiple products, packaged differently, with different pricing, etc.

## **3.2 Terms defined in this Recommendation**

This Recommendation defines the following terms:

**3.2.1 Self-service portal:** Self-service portal is an interface provided by service providers, for provides the web-based interface to the cloud service user,

*Editor's Note: To be extended*

## **4 Abbreviations and acronyms**

<Include all abbreviations used in this Recommendation>

CSC	Cloud Service Customer
CSP	Cloud Service Provider
IaaS	Infrastructure as a Service
PaaS	Platform as a Service
SaaS	Software as a Service
DaaS	Desktop as a Service
CaaS	Communication as a Service
VDC	Virtual Data Centre
CSM	Cloud Service Management
CRM	Cloud Resource Management
BSS	Business Support System
OSS	Operation Support System

## **5 Conventions**

In this document, mandatory requirements are indicated by the use of the word “shall”. Desirable requirements are indicated by the use of the word “should”. Optional requirements are indicated by the use of the word “may” or “can”.

## **6 Introduction**

As cloud computing technology has been introduced into telecom network, cloud resource has become a new type of telecommunication infrastructure, and Telecom Operator have start to offer cloud-based service to the customer. It is a new challenge for Telecom Operator to conduct holistic management over cloud resource and cloud service in the context of telecom BSS/OSS framework. This recommendation would focus on the cloud service management from Telecom Operator’s view.

According to the definition of ITU-T, Cloud service category includes IaaS, Paas, SaaS, NaaS, CaaS. Cloud service management, which is based on cloud resource management, should support flexible, on-demand and cost-efficient service delivery, to meet the requirements of cloud service users and cloud service scenarios.

From the viewpoint of end-to-end service delivery, there are very close relationships between cloud resource management and cloud service management. Cloud resource management should realize the holistic control and orchestration over the heterogeneous virtual resource and physical resource of different resource pools, such as:

- Maintain the status of all the resources, perform physical & virtual resource health monitoring and capacity monitoring
- Fulfil the function such as resource allocation, alteration and release according to the requirement of cloud service management
- Ensure physical & virtual resources’ availability and performance in order to support SLA objectives.

Cloud service management should include service fulfilment, service assurance and operation management through the lifecycle of cloud service:

- Service fulfilment: to fulfil the resource capacity and service quality requirements of CSUs, maintain the readiness of the resource and service capacity, provide function and interface to CSUs for the access and consumption of cloud service.
- Service assurance and operation management: support the function and process of cloud service assurance and operation management, includes cloud service performance and alarm monitoring, service trouble management, service charging and billing.

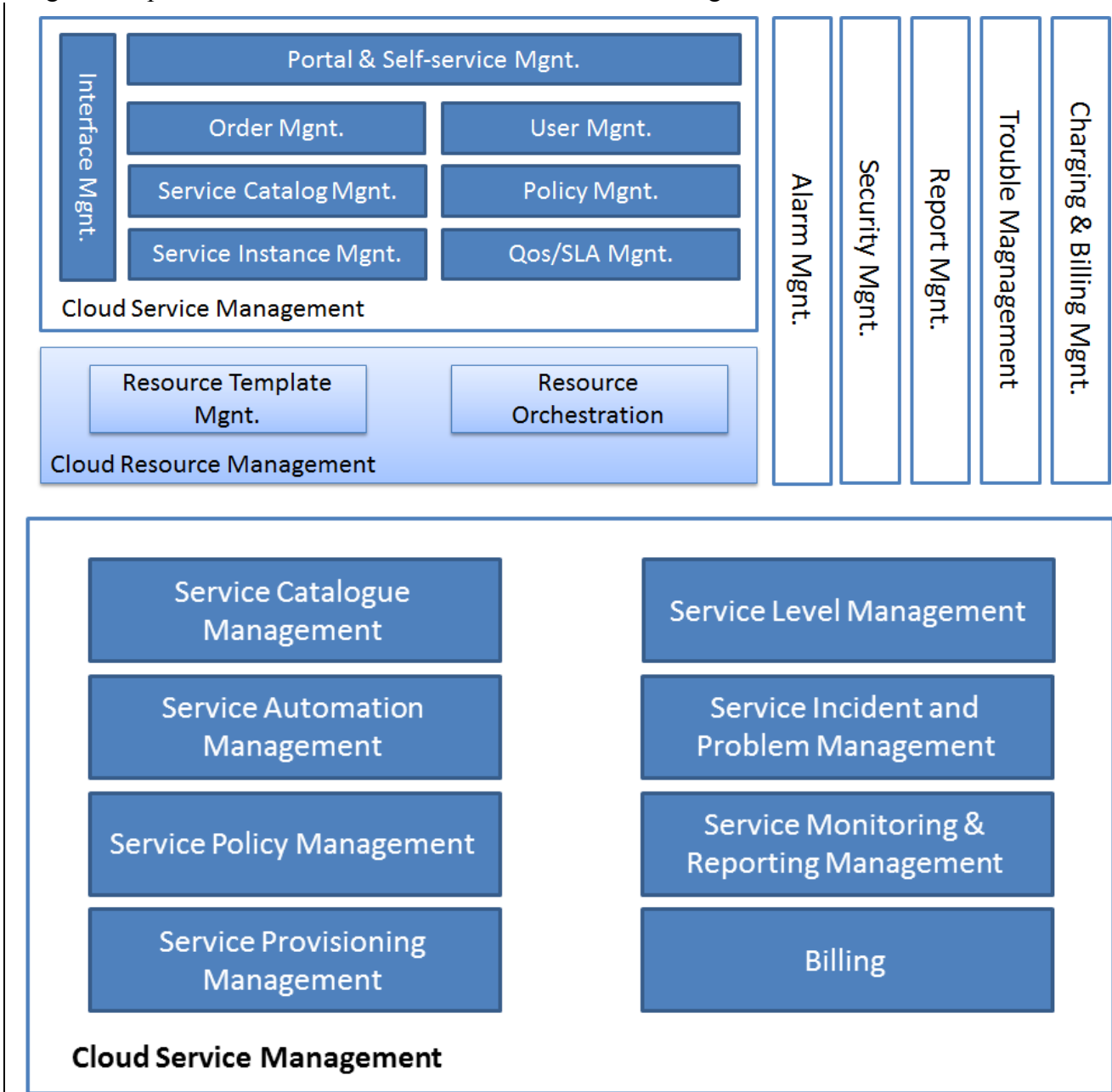
## **7 General requirements for cloud service management**

- Support the on-demand and automated service provisioning, modification and termination, and enable rapid and elastic resource allocation inner cloud and inter clouds.
- Support the integration of cloud infrastructure and telecommunication infrastructure to meet special requirements of cloud service use case, for example, cloud-based call centre.
- Support self-service management, allowing customers to realize service fulfilment, configuration, alteration, deletion, and to support resource application, modification, and termination in the self-help manner.

- Support the end-to-end quality assurance of cloud service, and provide high levels of reliability and availability according to the SLA agreement.
- Support charging based on per-used, according to use time, bandwidth, resource usage and any combination of above.
- Support the cloud service monitoring, auditing and report, for the purpose of service quality evaluation and assurance.
- Support the integration and interoperation with other BSS/OSS, to meet the requirements of service fulfilment, assurance and billing.

## 8 Cloud Service Management Function Framework

Figure 1 depicts the function framework of cloud service management:



[Figure 1] cloud service management function framework

Cloud service management is based upon cloud resource management, and to support the cloud service life cycle management. Cloud service management function should be comprised of [Service Catalogue Management, Service Automation Management, Service Policy Management, Service Provisioning Management, Service Level Management, Service Incident and Problem Management, Service Monitoring & Reporting Management, Billing portal and self-service management, order management, service catalogue management, service instance management, user management, policy management, QoS/SLA management, and the cross-layer function such as alarm and report management, security management, charging and billing management.](#)

[//Editor's Note- As the function framework has been changed, further discussion and modification are required about the content of chapter 9. Proposals are invited and appreciated.](#)

## 9 Function Requirements for cloud service management

### 9.1 Portal and self-service management

#### 9.1.1 Admin portal

- Service Publication: Allow the administrator publish the cloud services through the Admin portal, as well as to prepare resources for the service delivery.
- The Admin Portal provides administrators with the capability to perform monitoring and testing of cloud services and resources.
- Publish announcement and alerting to inform CSU.
- To receive and handle online complaints and other support requests from CSU.

#### 9.1.2 Self-service portal

Self-service portal provides the web-based interface to the cloud service user, allowing customer to inquiry cloud service directory, experience the cloud service, supporting online service subscription/alternation/cancellation, resource usage enquiry/monitor/control/analyse/statistics, online complaints and assurance.

- Customer information management: Allowing customer to open/close an account, register and enquiry personal information, such as name, contact, and service subscription information, such as user account, product name, subscription date and time, SLA, tariff, etc.
- Service information enquiry: Allowing customer to enquiry product information for all the published services in the cloud service catalogue, including product introduction/ function description/tariff, service and resource requirements, and to acquire guidelines for using the service, frequently asked question, to receive announcement and alert from the cloud service provider, and to allow user to experience the cloud service that have published through the portal.
- Service subscription, activation/invoication, alteration and cancellation: Allow customer to select service template, subscribe, alter, and cancel the cloud service and cloud resource configuration online, and support customer to enquiry his order, include the order number, date to order, products and service subscribed, date to take effect, date to terminate, service price, status of the order, etc. Allow CSU confirmed the SLAs and charge model with selected service and resources.
- Cloud resource manipulation: Allow customer to control the virtual resource that he has subscribed, includes startup, shutdown, suspend, restart of VMs, backup and recovery of

personal data. Allow customer to monitor the cloud resource capabilities, usage, and performance.

- Online complaint submitting and enquiry: Self-service portal provides the CSUs with the online channel to report cloud service troubles to the CSP and enquiry the status of the trouble tickets. And provide points-of-contact for communicating, clarifying and resolving customer issues and problems
- Allowing CSN to create and submit new cloud services/applications.
- Appropriate security mechanisms should be applied to avoid the illegal access and unauthorized operation.

## **9.2 Order Management**

Order Management allow taking the service order from service portal and other BSS, and manage the life cycle of the order including order creation, order execution such as cloud resource preparation and service instance creation, order modification and termination.

- Subscription Management: Manage service contracts, setup/negotiate/close/terminate contract, SLA contract definition;
- Order execution: Automatically deploying cloud systems based on the requested service/resources/capabilities according to CSU's request;

## **9.3 Service Catalogue Management**

### **9.3.1 Service Catalogue Creation**

- Support the service provider to define and create the service catalogue, and offer the cloud resource to the customer in the form of cloud service.
- The attributes of service catalogue should include service name, service version, computing resource configuration, storage resource configuration, network resource configuration, tariff, service policy, access permission, SLA.

### **9.3.2 Service Catalogue Publication**

- Support service catalogue publication on the service portal, allowing customer to access and subscribe the service.
- Support the function to assess whether the resource (resource type, capacity, quantity) can support the service implementation before service publication.

### **9.3.3 Service catalogue maintain**

- Support the modification of settable attributes of cloud service catalogue by service provider/operator.
- Support the entry update for a given service offering in the product catalogue, whenever the business aspects or the technical aspects of the offering are changed.
- Support the verification, revoking serviced catalogue.

### **9.3.4 Service catalogue enquiry**

Support the enquiry of service catalogue by service provider/service user.



### **9.3.5 Service catalogue Deletion**

Support the deletion of cloud service catalogue and withdrawal from the service portal by service provider/operator.

## **9.4 Service Instance Management**

Service Instance is the implementation of service catalogue according to the service user's requirement. Service instance management should support the service instance life cycle management such as pre-creation, approval, creation, alteration, deletion.

### **9.4.1 Service instance application and approval**

Service Instance Management should support the reception of the customer's service application, and allowing the service operator to determine the customer is valid for applying for the service.

### **9.4.2 Service instance pre-creation**

Support the function to pre-create the service instance by CSP according to the definition of service catalogue after the approval, and order the cloud resource management function to allocate the resource for the service creation.

### **9.4.3 Service instance creation**

Support the resources reserved and setup based on the service requirements. And support the pre-installation and activation of middleware and applications.

Support the creation of service instance by CSP after the readiness of cloud resource allocation and the service billing function. The state of the service instance is changed to creation from pre-creation, and cloud service instance is offered to the service user.

### **9.4.4 Service instance suspend and activation**

Service Instance Management should support the function to allow the service operator to suspend or reactivate the service instance.

The suspended service instance should not be operated, modified or released by the cloud service user.

### **9.4.5 Service Instance modification, enquiry and termination**

The service instance should be modified according to the following cases:

- Modification of service catalog by service provider.
- Modification of attributes of service instance by the service provider/service user.

### **9.4.6 Service Instance monitoring**

Support the real-time monitoring of the running state of the service instances, and provide notification and alarm if necessary.

- Serviceinstance monitoring function should monitor the service running state according to the predefined service policy.
- Service instance monitoring function should periodically check the resource usage of all types of service instances, and send out alert when the overall cloud resource usage threshold is reached or possible cloud resource abuse is detected.

- Service instance monitoring function should create the running log during the monitoring and supervision, and allow service operator and service user to subscribe the monitoring report.

### **9.5 User management**

- Support the operation of user accounts, includes open/close/terminate accounts, support the user role definition, user profile definition, access permission control.
- Support the management of customer relationship by providing point-of-contact and resolution for customer issues and problems.
- Support the creation of user access log, and support the collecting and analyse of user's access and operation.
- Single sign-on access control: Allow CSU to access and consume cloud resource and service functionality with appropriate security requirements through a single sign-on mechanism.

### **9.6 Policy Management**

Policy management function provides the dynamic, elastic, and on-demand control and orchestration over the cloud resource, based on the state of cloud service and the usage of resource, and adapt to the event occurred during the cloud service running, to ensure the cloud service QoS, to avoid the SLA violation, maximize CSU's satisfaction and optimize the cloud resource utility, especially in those cases as shortage of cloud resource or service quality deterioration because cloud traffic surge or problem occurs.

- Policy Management should support the policy definition, which includes the trigger events and the responding operation and process.
- Policy Management should support the dynamic adaption and adjustment of cloud resource usage based on user's SLA and his resource consumption, service type and priority.
- Policy Management should support the collection and analyse of alarms and logs that generated by the cloud resource management function and cloud service management function, and apply dynamic control based on the predefined policy.
- Policy Management should support the utilization and performance trends analysis and prediction based on the monitoring of the activity of cloud service and related resource environment, and apply dynamic control over the cloud service and cloud infrastructure accordingly.
- Policy Management should support the negotiation, and settle down of service provisioning policies between multiple cloud service providers.
- Support the immediate notification to the CSU of the policy enforcement, adjustment and change based on the situation of service traffic and other possible factors, which may affect the cloud service user, such as resource allocation policy, charging policy, etc.

### **9.7 QoS/SLA management**

- QoS/SLA management function should support the definition of SLA template and design what service metrics to be captured and how to be captured, and publication of SLA template on the service portal

- QoS/SLA management should support cloud user to choose, modify the service level and service terms, and enforce the SLA requirements without manual intervention.
- QoS/SLA management should support the SLA metrics monitoring and gathering, and compare with SLA requirements and detection of SLA violation, and trigger problem resolution process or the predefined policies.
- QoS/SLA management function should generate logfile/statistics report during the monitoring, and allow the service operator/ service user to subscribe.
- QoS/SLA management function should support the service charging based on the SLA and the statistics of SLA violation.

## **9.8 Accounting, Charging and Billing Management**

[accounting, charging and billing, contact with SG3 for the improvement of the content]

Service Charging function should collect the accounting information of the virtual machine

Accounting Information Collection of Virtual Machine:

- VM type: the type of configuration of VM, such as the CPU, memory, disk and network capacity of different type of VM.
- Start up and shut down time: the time for the VM start up and shut down, and the resource usage and duration.
- VM Owner information: the information of the VM owner.

Accounting information Collection of Network resource:

- The number of IP address
- The duration of IP address usage- the usage duration of each IP address
- Network flow- network flow for each IP address
- Firewall and usage duration- whether Firewall is equipped and the usage duration
- Load-balance and usage duration - whether load-balance is equipped and the usage duration

Accounting information collection of storage:

- Size of storage - the disk size used by user
- Time of Storage usage- the start-time, stop-time and duration of using the storage
- Storage backup – the function of storage backup is used or not
- Extra storage space- extra storage usage besides the disk size defined in the VM

Accounting information collection of specific service:

- Time of service usage - the start-time, stop-time and duration of using the service
- Number of times of user access or service consumption.
- Service Level Agreements
- Resource usage of specific service

Support the creation of the billing tickets and the transfer to the billing system periodically or by request.

Support the enquiry of instant service costs and history billing tickets by CSU or O&M staff.

Support flexible charging policy, and implement discount or chargeback based on:

- Sum of resource consumption, total time and time period of resource consumption
- Total time and time period of service usage
- Service Level Agreements and the occurrence of SLA violation

### **9.9 Alarm management**

Alarm management function should support the receiving and collection of alarm information from physical processor, virtual machine, network equipment, storage equipment, software, and deal with alarm information from different vendors, different types of resource.

It should be support to submit alarm information to other OSS system for centralized alarming management via standardized interfaces.

It should be supported that transferring the alarm to the service policy management function for applying automatic policy action to solve the problem or relief the range and severity of the problem.

Support the Alarm class definition and Operation including alarm notification to O&M staff, alarm termination...

The following alarm events of virtual resource should be included:

- VM exception: fetch the abnormal state of the virtual machine and generate alarm.
- VM migration: generate alarm when VM migration is failed.
- VM snapshot: generate alarm when VM snapshot is failed.
- Resource usage: cloud resource is over-usage and threshold is reached.

The following alarm events of cloud service should be included:

- The deterioration of cloud service QoS.
- SLA metrics Violation is detected.
- Events that threat the security and normal running of cloud service.
- Unauthorized access is detected.

### **9.10 Trouble Management**

According to CCRA recommendation, trouble management should support the fault handling process includes:

- Trouble Management should support the detection of service faults;
- Support the receiving and handling customer reports of service faults;
- Support the open of trouble ticket, recording the problem and routing it to O&M staff. Support the tracing of trouble tickets.
- Support the procedure and process management for the problem handling, including service priority, impact to customer.
- Support the self-help trouble positioning and resolution by the CSU through the self-service portal.

### **9.11 Report Management**

- Supports real-time reporting of a cloud service health condition, service usage/metrics (i.e. service performance, security), events and other related activities (i.e., service user/volume statistics)
- Support the periodic report of the cloud resource health condition, including resource status and usage, events and other related activities (i.e. resource allocation failure, resource usage trends)
- Support the generation and provision of cloud service test report, SLA compliance reports.

### **9.12 Security Management**

- Support user certification when user access the cloud service, and authorize the access permission based on the user ID, user group, and user level.
- Provide strict control for different tenants' access to different resources, to avoid the abuse of cloud resources and user data leakage.

### **9.13 Interface Management**

- Cloud service management function should be integrated into the telecom management framework, and provide interfaces with the existing BSS/OSS system to fulfil the function of cloud service billing, centralized monitoring, alarm and report management.
- Cloud service management function should provide the interface with the cloud resource management function, to realize the cloud resource enquiry, allocation and alteration to fulfil CSU's request, and to receiving the cloud resource problem and alarms and apply control policy over the resource for the cloud service quality assurance.
- Cloud service management should provide interface with other CSM function of the same CSP or of other CSPs, in order to fulfil inner and inter cloud resource orchestration and service provision.

### **9.14 Monitoring and Audit management**

Cloud service quality should be monitored from the perspective of service functionality, servicesecurity, service reliability, service responsiveness.

Support the monitoring of Cloud infrastructure, on the periodic or per request basis, including the hardware resource and virtual resource status, and the load of resource usage;

Support the monitoring of application/middleware and cloud service health statusand the service trafficon the periodic or per request basis;

Support the end to end monitoring of SLA/QoSmetrics and service performance, and detecting the SLA violation inner and inter cloud;

Support the exchange of monitoring information between cloud resource management function and cloud service management function in the standardized manner.

Support the exchange of monitoring information between different CSP in the standardized manner.

Support the notification to the CSU of the monitoring events such as shortage of resources, detection of SLA violation, critical service failure, decline of QoS, change of charging policy.

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