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STUDY GROUP 13

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TD

Source:	Editors
Title:	Draft new Supplement 49 to Y.3500-series (formerly Y.sup.ccsr): Cloud Computing Standardization Roadmap" – for approval
Purpose:	Decision
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Keywords:	Cloud computing; Recommendation; Standard; Roadmap
Abstract:	This document is the output of draft Supplement Y Suppl. 49 (formerly, Y.sup.ccsr) "Supplement on Cloud Computing Standardization Roadmap". It includes the discussion results in the Q17/13 meeting held at Geneva, 22 Oct.-2 Nov. 2018

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The following table shows discussion results for contribution during this meeting.

Contribution No.	Source	Title	Meeting results
C111R1	China Telecom	Y.sup.ccsr - Proposal on detail modification in draft Y.sup.ccsr	Accepted

C111R1 proposes detail modification in draft Y.sup.ccsr, including updating of analysis of SDO's deliverables, revision of the existing texts based on the progress on each deliverables, aligning the notation of date. This meeting agreed to adopt proposed modification in draft Supplement Y.sup.ccsr.

The following table shows LS discussed during this meeting.

TD No.	Source	Title	Question
TD304 (WP2/13)	BBF	LS/i/r on invitation to final review Cloud Computing Standardization Roadmap and provide missing or update information (reply to SG13-LS71) [from BBF]	Q17/13

TD305 (WP2/13)	SG11	LS/i/r to SG13 on invitation to review Cloud Computing Standardization Roadmap and provide missing or updated information (reply to SG13 - LS 43 -E) [from ITU-T SG11]	Q17/13
TD307 (WP2/13)	SG17	LS/i/r on SG17 updates to the cloud computing standards roadmap (reply to SG13-LS71) [from ITU-T SG17]	Q17/13
TD309 (WP2/13)	SG5	LS/i/r on invitation to review Cloud Computing Standardization Roadmap and provide missing or update information (reply to SG13-LS71, SG13-LS43) [from ITU-T SG5]	Q17/13

– It is agreed to adopt introduction and deliverables information of BBF from TD304 (WP2/13) with modifications.

– It is agreed to adopt introduction and deliverables information of SG11 from TD305 (WP2/13) with modifications.

– It is agreed to adopt introduction and deliverables information of SG17 from TD307 (WP2/13) with modifications.

Draft new Supplement 49 to Y.3500-series (Y.sup.ccsr) "Cloud Computing Standardization Roadmap" is proposed for the WP2/13 meeting for approval.

Draft Supplement 49 to Y.3500-series of ITU-T Recommendations (formerly Y.sup.ccsr)

Cloud Computing standardization roadmap

Summary

The purpose of this supplement is to provide the summary of cloud computing related deliverables in ITU-T SGs and other SDOs. For this purpose, it is necessary to collect all the information from ITU and other SDOs including their understanding of cloud computing and relation with cloud computing of their works.

Keywords

analysis matrix, cloud computing, Recommendation, roadmap, standard

Contents

Draft Supplement 49 to Y.3500-series (formerly Y.sup.ccsr)

Cloud Computing standardization roadmap

1   Scope

This supplement describes the summary of cloud computing related deliverables in ITU-T SGs and other SDOs. Also, this supplement provides the common matrix for the mapping of the deliverables to different cloud related categories. With the common matrix, this supplement provides analysis for cloud computing related deliverables in ITU-T SGs and other SDOs.

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.3500]   Recommendation ITU-T Y.3500 (2014), *Cloud computing - Overview and Vocabulary.*

[ITU-T Y.3501]   Recommendation ITU-T Y.3501 (2016), *Cloud computing framework and high-level requirements*

[ITU-T Y.3502]   Recommendation ITU-T Y.3502 (2014), *Cloud computing - reference architecture.*

3   Definitions

3.1   Terms defined elsewhere

This Supplement uses the following terms defined elsewhere:

3.1.1   **cloud computing** [ITU-T Y.3500]: Paradigm for enabling network access to a scalable and elastic pool of shareable physical or virtual resources with self-service provisioning and administration on-demand.

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

3.1.3   **cloud service category** [ITU-T Y.3500]: Group of cloud services that possess some common set of qualities.

3.1.4   **cloud service customer** [ITU-T Y.3500]: A person or organization that consumes delivered cloud services within a contract with a cloud service provider.

3.1.5 **cloud service provider** [ITU-T Y.3500]: An organization that provides and maintains delivered cloud services.

3.2 Terms defined in this Supplement

None.

4 Abbreviations and acronyms

This Supplement uses the following abbreviations and acronyms:

AC	Alternating Current
API	Application Programming Interface
ATIS	Alliance for Telecommunications Industry Solution
BBF	Broadband Forum
CADF	Cloud Auditing Data Federation
CCF	Cloud Computing Fundamentals
CCRA	Cloud Computing Reference Architecture
CDN	Content Distribution Network
CIM	Cloud Infrastructure Management
CIMI	Cloud Infrastructure Management Interface
CMP	Cloud Management Platform
CO	Central Office
CP	Cloud Provider
CSA	Cloud Service Agreement
CSB	Cloud services brokerage
CSC	Cloud Service Customer
CSDL	Common Schema Description Language
CSN	Cloud Service Partner
CSP	Cloud Service Provider
CSU	Cloud Service User
DaaS	Desktop as a Service
DC	Direct Current
DMTF	Distributed Management Task Force
EMF	Metro Ethernet Forum
ETSI	European Telecommunications Standards Institute
FCAPS	Fault, Configuration, Accounting, Performance, Security
FN	Future Network

GHG	Green House Gas
HTTP	Hypertext Transfer Protocol
IaaS	Infrastructure as a Service
ICP	Internet Content Provider
ICT	Information and Communication Technology
IEC	International Electro technical Commission
IoT	Internet of things
IPTV	Internet Protocol Television
ISO	International Organization for Standardization
ISP	Internet Service Provider
IT	Information Technology
LCA	Life Cycle Assessment
MIB	Management Information Base
NaaS	Network as a Service
NERG	Network Enhanced Residential Gateway
NFV	Network Function Virtualization
NFVI	Network Function Virtualization Infrastructure
NGN	Next Generation Network
NNI	Network-Network Interconnect
OB	Open Broadband
OBL	Open Broadband Laboratories
OS	Operating System
OVF	Open Virtualization Format
PaaS	Platform as a Service
PII	Personally Identifiable Information
PKI	Public Key Infrastructure
PNF	Physical Network Function
REST	Representational State Transfer
RFID	Radio Frequency Identification
RG	Residential Gateway
SaaS	Software as a Service
SDN	Software-Defined Networking
SDF	Service Delivery Framework
SDO	Standard Development Organization
SLA	Service Level Agreement

SLO   Service Level Objective

SMASH   System Management Architecture for Server Hardware

SMI   Service Management Interface

SNMP   Simple Network Management Protocol

SPMF   Scalable Platform Management Forum

SQO   Service Qualitative Objective

UPS   Uninterruptible Power Supply

ViLTE   Video over Long-Term Evolution

VM   Virtual Machine

VNF   Virtualised Network Function

VoLTE   Voice over Long-Term Evolution

XML   Extensible Markup Language

5   Conventions

None.

6   Landscape of Cloud Computing from ITU-T perspectives

Cloud computing is a paradigm for enabling network access to a scalable and elastic pool of shareable physical or virtual resources with self-service provisioning and administration on-demand.

The cloud computing is composed of key characteristics. Key characteristics of cloud computing described in [ITU-T Y.3500] are as follows:

−   **Broad network access**: A feature where the physical and virtual resources are available over a network and accessed through standard mechanisms that promote use by heterogeneous client platforms. The focus of this key characteristic is that cloud computing offers an increased level of convenience in that users can access physical and virtual resources from wherever they need to work, as long as it is network accessible, using a wide variety of clients including devices such as mobile phones, tablets, laptops, and workstations;

−   **Measured service**: A feature where the metered delivery of cloud services is such that usage can be monitored, controlled, reported, and billed. This is an important feature needed to optimize and validate the delivered cloud service. The focus of this key characteristic is that the customer may only pay for the resources that they use. From the customers' perspective, cloud computing offers the users value by enabling a switch from a low efficiency and asset utilization business model to a high efficiency one;

−   **Multi-tenancy**: A feature where physical or virtual resources are allocated in such a way that multiple tenants and their computations and data are isolated from and inaccessible to one another. Typically, and within the context of multi-tenancy, the group of cloud service users that form a tenant will all belong to the same cloud service customer organization. There might be cases where the group of cloud service users involves users from multiple

different cloud service customers, particularly in the case of public cloud and community cloud deployments. However, a given cloud service customer organization might have many different tenancies with a single cloud service provider representing different groups within the organization;

– **On-demand self-service**: A feature where a cloud service customer can provision computing capabilities, as needed, automatically or with minimal interaction with the cloud service provider. The focus of this key characteristic is that cloud computing offers users a relative reduction in costs, time, and effort needed to take an action, since it grants the user the ability to do what they need, when they need it, without requiring additional human user interactions or overhead;

– **Rapid elasticity and scalability**: A feature where physical or virtual resources can be rapidly and elastically adjusted, in some cases automatically, to quickly increase or decrease resources. For the cloud service customer, the physical or virtual resources available for provisioning often appear to be unlimited and can be purchased in any quantity at any time automatically, subject to constraints of service agreements. Therefore, the focus of this key characteristic is that cloud computing means that the customers no longer need to worry about limited resources and might not need to worry about capacity planning;

– **Resource pooling**: A feature where a cloud service provider's physical or virtual resources can be aggregated in order to serve one or more cloud service customers. The focus of this key characteristic is that cloud service providers can support multi-tenancy while at the same time using abstraction to mask the complexity of the process from the customer. From the customer's perspective, all they know is that the service works, while they generally have no control or knowledge over how the resources are being provided or where the resources are located. This offloads some of the customer's original workload, such as maintenance requirements, to the provider. Even with this level of abstraction, it should be pointed out that users might still be able to specify location at a higher level of abstraction (e.g., country, state, or data center).

The general requirements for cloud computing described in [ITU-T Y.3501] are as follows:

– **Service life-cycle management**: It is required that cloud service provider (CSP) supports automated service provisioning, modification and termination during the service life-cycle;

– **Regulatory**: It is required that all applicable laws and regulations be respected, including those related to the protection of Personally Identifiable Information (PII);

– **Security**: It is required that the cloud computing systems provided by CSP be appropriately secured to protect the interests of all involved parties (e.g. persons and organizations);

– **Accounting and charging**: It is recommended that cloud service provided by CSP supports various accounting and charging models and policies;

– **Efficient service deployment**: It is recommended that cloud service provided by CSP enables efficient use of resources for service deployment;

– **Interoperability**: It is recommended that cloud service provided by CSP comply with appropriate specifications and/or standards for allowing these systems to work together;

– **Portability**: It is recommended that cloud service provided by CSP supports the portability of software assets and data of cloud service customers (CSCs) with minimum disruption;

- **Service access**: CSP is recommended to provide CSCs with access to cloud services from a variety of user devices. It is recommended that CSCs be provided with a consistent experience when accessing cloud services from different devices;
- **Service availability, service reliability and quality assurance**: It is recommended that the CSP provides end-to-end quality of service assurance, high levels of reliability and continued availability of cloud services according to the service level agreement (SLA) with the CSC.

7   Overview of cloud computing standard roadmap

7.1   Introduction to Standard development organizations (SDOs) for cloud computing

7.1.1   ITU-T SG13

Study Group 13 is responsible for studies relating to the requirements, architectures, capabilities and mechanisms of future networks including studies relating to service awareness, data awareness, environmental awareness and socio-economic awareness of future networks. It is responsible for studies relating to cloud-computing technologies, big data, virtualization, resource management, reliability and security aspects of the considered network architectures.

- Q17/13 (Requirements, ecosystem, and general capabilities for cloud computing and big data)

The primary focus of this Question is to provide the necessary overall frameworks, definitions, and ecosystems including requirements and capabilities related to the integration or support of the cloud computing and big data model and technologies in telecommunication ecosystem. Also relationship between cloud computing and big data are developed. This Question is intended to develop new Recommendations for:

- cloud computing and big data definitions, overview, ecosystem, and use cases;
- cloud computing and big data requirements, and capabilities;
- requirements for interoperability data portability and exchange information in cloud computing and big data;
- relationship between cloud computing and big data;
- Q18/13 (Cloud functional architecture, infrastructure and networking)

The main focus of this Question is to provide cloud computing architectures, cloud computing infrastructure and cloud networking views related to the integration and support of the cloud computing paradigm and technologies in telecommunication ecosystems. Another focus of this Question is to provide big data architectures related to the integration and support of the big data paradigm and technologies in telecommunication ecosystems

This Question is intended to develop new Recommendations for:

- cloud computing functional architectures supporting cloud service categories (e.g. NaaS, IaaS, PaaS, BDaaS and XaaS);
- cloud computing functional architectures of inter-cloud;
- cloud computing infrastructure including cloud networking aspects (e.g. for the support of network slicing);
- big data functional architectures including big data exchange functional architecture and cloud computing based big data architecture.

–   Q19/13 (End-to-end Cloud computing management and security)

The primary focus of this Question is cloud service and infrastructure management and the management of composite cloud services and components that use a variety of telecom and IT infrastructure resources. These cloud services are typically composed of individual services elements that may be acquired from or exposed to third parties. This is a very complex management environment and requires the study of standards that provide a means to enable consistent end-to-end, multi-cloud management and monitoring of services exposed by and across different service providers' domains and technologies. This Question also includes the study of security mechanisms and methods to stream line and manage service delivery mechanisms across the service life cycles so that services can be created and delivered efficiently. The second focus of this Question is big data governance including data management, data preservation as well as lifecycle management of big data to provide the necessary overall frameworks, definitions, and ecosystems including requirements, capabilities related to the integration or support of the big data model and technologies in telecommunication ecosystem.

7.1.2   ITU-T SG17

ITU-T Study Group 17 (SG17) coordinates security-related work across all ITU-T Study Groups. Often working in cooperation with other standards development organizations (SDOs) and various ICT industry consortia, SG17 deals with a broad range of standardization issues.

To give a few examples, SG17 is currently working on cybersecurity; security management; security architectures and frameworks; countering spam; identity management; the protection of personally identifiable information; and the security of applications and services for the Internet of Things (IoT), smart grid, smartphones, software defined networking (SDN), web services, big data analytics, social networks, cloud computing, mobile financial systems, IPTV and telebiometrics.

One key reference for security standards in use today is Recommendation ITU-T X.509 for electronic authentication over public networks. ITU-T X.509, a cornerstone in designing applications relating to public key infrastructure (PKI), is used in a wide range of applications; from securing the connection between a browser and a server on the web, to providing digital signatures that enable e-commerce transactions to be conducted with the same confidence as in a traditional system. Without wide acceptance of the standard, the rise of e-business would have been impossible.

Cybersecurity remains high on SG17's agenda. Additionally, SG17 is coordinating security standardization work covering combating counterfeit and mobile device theft, IMT-2020, cloud based event data technology, e-health, open identity trust framework, Radio Frequency Identification (RFID), and Child Online Protection.

7.1.3   ITU-T SG5

ITU-T Study Group 5 (SG5) is responsible for studies on methodologies for evaluating ICT effects on climate change and publishing guidelines for using ICTs in an eco-friendly way. Under its environmental mandate SG5 is also responsible for studying design methodologies to reduce ICTs and e-waste's adverse environmental effects, for example, through recycling of ICT facilities and equipment.

In addition to its climate-focused activities, the ITU-T Recommendations, Handbooks and other publications produced by SG5 have four main objectives. The first is to protect telecommunication equipment and installations against damage and malfunction due to electromagnetic disturbances, such as those from lightning. In this field, SG5 is one of the world's most experienced and respected standardization bodies.

The second is to ensure safety of personnel and users of networks against current and voltages used in telecommunication networks. The third is to avoid health risks from electromagnetic fields (EMFs) produced by telecommunication devices and installations. The fourth is to guarantee a good quality of service (QoS) for high speed data services by providing requirements on characteristics of copper cables and on the coexistence of services delivered by different providers.

7.1.4   ITU-T SG11

Study Group 11 is responsible for develop test specifications for testing conformance and interoperability (C&I) for all types of networks, technologies and services, a testing methodology and test suites for standardized network parameters in relation to the framework for Internet-related performance measurement, as well as for existing technologies (e.g. NGN) and emerging technologies (e.g. FN, cloud, SDN, NFV, IoT, VoLTE/ViLTE, IMT-2020 technologies, flying ad-hoc networks, tactile Internet, augmented reality, etc.).

SG11 has been designated Lead study group for establishing test specifications, conformance and interoperability testing for all types of networks, technologies and services that are the subject of study and standardization by all ITU‑T study groups.

7.1.5   ITU-T SG16

ITU-T SG16 is advancing in its IPTV recommendations, which have been successfully deployed in various countries. However, bearing in mind that the business ecosystem is continuously changing and the video-oriented services became prosperous also out of IPTV domain, SG16 pursues more dynamic and adaptable features for IPTV specifications.

7.1.6   ITU-T SG20

ITU-T SG20 does not have any ongoing work item directly related to "Cloud Computing" at this stage. However, SG20's activities may be linked to the activities in the area of cloud computing in the context of IoT and Smart Cities & Communities. As an example, Q4/20 "*e/Smart services, applications and supporting platforms*" activities on supporting platform technologies for e/Smart services, applications are related to cloud computing.

7.1.7   ITU-T SG2

One of the mandates of ITU-T SG2 is "operational and management aspects of networks, including network traffic management, designations and transport-related operations procedures". ITU-T SG2 is also developing cloud computing management related recommendations. ITU-T SG2 has developed "Overview of end-to-end cloud computing management" and "Requirements for service management in cloud-aware telecommunication management system" recommendations. Currently ITU-T SG2 is developing "Requirements for resource management in cloud-aware telecommunication management system" and "Cloud-based network management functional architecture".

7.1.8   JTC 1 SC 38 (Cloud Computing and Distributed Platforms)

SC 38 is a standardization subcommittee in ISO/IEC JTC 1 of the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). Currently, there are two working groups under SC 38 like follows [b-JTC 1 SC 38];
–   WG 3 (Cloud Computing Fundamentals(CCF))
  •   Projects related to Cloud Computing Service Agreements
  •   Projects related to fundamental concepts, terminology and definitions for Cloud Computing

- Projects related to guidance on use of international standards in the development of policies that govern or regulate cloud service providers and cloud services, and policies that govern the use of cloud services in enterprise organizations

- Establish liaisons and collaborate with other entities within JTC 1, SDOs and consortia performing work related to Cloud Computing

– WG 5 (Data in cloud computing and related technologies)

- Standardization in the area of data in cloud computing, distributed platforms, connected devices and related technologies.

- Establish liaisons and collaborate with other entities within and external to JTC 1 as appropriate

7.1.9 DMTF (Distributed Management Task Force)

The DMTF is an industry standards organization working to simplify the manageability of network-accessible technologies through open and collaborative efforts by leading technology companies. DMTF creates and drives the international adoption of interoperable management standards, supporting implementations that enable the management of diverse traditional and emerging technologies including cloud, virtualization, network and infrastructure [b-DMTF].

The DMTF working groups that deliver standards used in cloud computing are [b-DMGF-WG]:

– Cloud Management Working Group (CMWG)

– Cloud Auditing Data Federation Working Group (CADF)

The DMTF working groups that deliver standards which may be used in cloud data centers are:

– CIM Profile for Platforms and Service Working Group (CPPSWG)

– Open Virtualization Format Working Group (OVF)

– Scalable Platform Management Forum (SPMF)

– Virtualization Management Working Group

7.1.10 TM Forum

TM Forum is the global member association for digital business. We provide a platform for hundreds of global members across a wide range of industries – communications, technology, cities and municipal government, finance, healthcare, and so on – to collaborate and partner to co-create, prototype, deliver, and monetize innovative digital services for their billions of customers[b-TMF].

7.1.11 ATIS

ATIS is where the leading ICT companies come for solutions when seeking industry alignment to advance their most critical priorities [b-ATIS].

7.1.12 Broadband Forum

The Broadband Forum, a non-profit industry organization, is focused on engineering smarter and faster broadband networks. Our work defines best practices for global networks, enables service and content delivery, establishes technology migration strategies, engineers critical device & service management tools, and is key to redefining broadband. Our free technical reports and white papers can be found at broadband-forum.org [b-Broadband].

The Cloud-based Central Office (CloudCO) project is the core of a number of BBF activities applying the design principles of Software Defined Networking (SDN) and Network Functions Virtualization (NFV) techniques enabling the decentralization of what has traditionally been monolithic networking elements. CloudCO enables dramatically faster & more efficient provisioning of new, Cloud-based services.

For management in an SDN&NFV architecture, NETCONF/YANG is expected to play a key role. The CloudCO project is leveraging the work done by the Broadband Forum Common YANG Work Area, which defines the YANG models required for management of ultrafast broadband networks based on copper and fibre access.

Open Broadband (OB) program is a collaborative space for integration, interop, testing of open source, vendor and standards-based implementations. The migration to Cloud-based, programmed, virtualized systems and coexistence with existing infrastructure drove OB. OB provides alignment with open source techniques and focus on interoperability to mitigate deployment risks. It provides value to service providers, integrators and suppliers.

Open Broadband Laboratories (OBL) are a collaborative resource for the integration, staging and testing of open source, commercial software, standards-based and vendor implementations where suppliers, integrators and operators can work together on new and coexisting solutions for CloudCO. OBLs are a common hardware and software platform with regional labs in Asia, Europe and USA that are open to members and non-members

7.2 Analysis of deliverable to provide its category

For the analysis of deliverables from clause 7, this supplement provides analysis template in form of matrix table.

Table 7-1 – Matrix for analysis of deliverables

	General, definition	Requirements Use Cases	Architecture	API, interface, profile	Data model, Format, schema	others
Fundamental						
Cloud service category						
Security						
Management						
Inter cloud, CSB						
SLA, metering						
Testing						
Others						

The vertical axis describes the sub or related technology. The horizontal axis describes document category which cover the subject of application as following:

–   General, definition: the standard which provides general description or terms and definitions of the technology;

–   Requirements, use cases: the standard which provides use cases and derived general/functional requirements;

–   Architecture: the standard which provides reference architecture;

–   API, interface, profile: the standard which provides common interface, API and/or its profile;

–   Data model, format, schema: the standard which provides data model or protocol including scheme and/or its encoding format;

–   Others (e.g. guideline, technical report, etc.).

NOTE 1 – The items of horizontal axis are not subordinate to the different technologies.

NOTE 2 – The items of vertical axis can be modified with technology change

NOTE 3 – A standard has more than one location on a matrix. If a standard includes multiple document (horizontal axis) categories or related technologies (vertical axis), it should be mapped multiply.

8   ITU-T SG13

8.1   Q17

Title of deliverable	Current status	Starting date	Target date
ITU-T Y.3500|ISO/IEC 17788 Information technology – Cloud computing – Overview and vocabulary	Recommendation | IS	09/2012	08/2014
ITU-T Y.3501, Cloud Computing Framework and high-level requirements	Recommendation	06/2012	05/2013
	2nd Edition Recommendation	05/2015	06/2016
ITU-T Y.3503, Requirement of Desktop as a Service	Recommendation	06/2012	05/2014
ITU-T Y.3600, Big data – cloud computing based requirements and capabilities	Recommendation	06/2013	11/2015
ITU-T Y.3504, Functional architecture for Desktop as a Service	Recommendation	07/2014	06/2016
ITU-T Y.cccm-reqts, Cloud Computing - Requirements for Containers and Micro-services	Draft Recommendation	05/2016	04/2018
ITU-T Y.3505, Cloud computing - Overview and functional requirements for data storage federation	Recommendation	05/2016	05/2018
ITU-T Y.ccdc-reqts, Distributed cloud overview and high-level requirements	Draft Recommendation	10/2016	06/2018

ITU-T Y.3507, Cloud computing physical machine requirements	Recommendation	10/2016	11/2018
ITU-T Y.3506, Cloud Computing - Functional requirements for Cloud Service Brokerage	Recommendation	10/2016	05/2018
ITU-T Y.MLaaS-reqts, Cloud computing - Functional requirements for machine learning as a service	Draft Recommendation	01/2018	12/2020
ITU-T Y.BaaS-reqts, Cloud computing - Functional requirements for blockchain as a service	Draft Recommendation	11/2017	12/2020

- **ITU-T Y.3500 | ISO/IEC 17788**: This Recommendation | International Standard provides an overview of cloud computing along with a set of terms, definitions and concepts. It is a terminology foundation for the cloud computing standardization work. This Recommendation | International Standard is applicable to all types of organization (e.g. commercial enterprises, government agencies, not-for-profit organizations).

   URI : http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12210

- **ITU-T Y.3501:** This Recommendation provides a cloud computing framework by identifying high-level requirements for cloud computing. The Recommendation addresses the general requirements and use cases for:

   − cloud computing;

   − Infrastructure as a Service (IaaS), Network as a Service (NaaS), and Desktop as a Service (DaaS) cloud services;

   − inter-cloud, end-to-end resource management, and cloud infrastructure.

   The first release of this Recommendation addresses a set of use cases and related requirements which are included in Appendix I. The second release of this Recommendation provides an update of this set of use cases and requirements. The release concept is described in Appendix II.

   URI : http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=11917

- **ITU-T Y.3503**: This Recommendation provides use cases, general requirements and functional requirements for Desktop as a Service (DaaS).

   URI : http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12167

- **ITU-T Y.3600**: This Recommendation provides approach to use cloud computing to meet challenges existing in use of big data. It addresses the following subjects:

   − Overview of big data;

      • Introduction to big data;

      • Big data ecosystem and roles;

   − Relationship between cloud computing and big data;

   − Cloud computing based big data system context and benefits;

   − Cloud computing based big data requirements;

   − Cloud computing based big data capabilities.

URI : http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12584

- **ITU-T Y.3504**: This Recommendation provides functional architecture for Desktop as a Service (DaaS) to specify the detailed functional components and their relationships based on the general and functional requirements of Y.3503. It addresses the following subjects:

    - DaaS functionalities related with DaaS components

    - DaaS functional architecture;

    - Mapping DaaS functional architecture to the cloud computing reference architecture.

    URI : http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12889

- **ITU-T Y.cccm-reqts**: The Recommendation provides an overview of the container concept describing its main characteristics and their in support of micro services. The document also identifies typical use cases related to the usage of containers and micro-services in cloud computing identifying use cases related to the support of Containers as a Service cloud service category by CSP. Based on the identified use cases, requirements and capabilities are derived regarding the support of Containers as a Service category. This Recommendation will consider the work as an open source activity initiated by Linux Foundation projects (Open Container Initiative, and Cloud Native Computing Foundation), and ETSI NFV. The scope of this recommendation consists of:

    - Overview of containers concept

    - Requirements of containers and micro-services

    - Use cases of containers and micro-services

    URI: https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=13641

- **ITU-T Y.3505**: This Recommendation provides overview and functional requirements of data storage federation. Data storage federation provides a single virtual volume from multiple data sources in heterogeneous storages. In this Recommendation, configuration for logical components, and ecosystem of data storage federation as well as cloud computing based data storage federation are introduced for data storage federation. Functional requirements are derived from use cases.

    URI: https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13616

- **ITU-T Y.ccdc-reqts**: This Recommendation provides an overview of the distributed cloud with the main objective of highlighting this important area for future standardization.

    - More specifically, this Recommendation covers the following:

    - definition of distributed cloud

    - concept and scope of distributed cloud

    - characteristics of distributed cloud

    - high-level requirements of distributed cloud

    - Distributed cloud use cases is provided in Appendix I.

    URI: http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=13649

- **ITU-T Y.3507**: This Recommendation provides functional requirements of physical machine for cloud computing based on cloud computing infrastructure requirements in [ITU-T Y.3510].

    It addresses the following subjects: (i) Overview of physical machine; (ii) Functional

requirements of the physical machine. The functional requirements provided in this Recommendation are derived from use cases.

URI: http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=13652

- **ITU-T Y.3506**: Cloud service brokerage is a service that arbitrates, delivers, and manages cloud services provided by cloud service providers for cloud service customers. This Recommendation provides functional requirements of cloud service brokerage. To provide functional requirements for the cloud service brokerage, this Recommendation specifies the overview including service model and configuration of the cloud service brokerage. Various use cases are also identified to derive the functional requirements.

URI: https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13612

- **ITU-T Y.MLaaS-reqts:** This Recommendation provides cloud computing requirements for machine learning as a service, which addresses capabilities, and requirements from use cases. Machine learning as a service (MLaaS) is a cloud service category to support the development and applications of machine learning in the cloud computing environments. On the perspective of cloud computing service provisioning, this Recommendation defines the capabilities and functional requirements for MLaaS to identify functionalities such as data gathering, machine learning modelling and computing resources, etc. This is fundamentally aligned with the cloud computing reference architecture of ITU-T Y.3502. Note - Developments of machine learning algorithms and methodology are out of the scope on this Recommendation.

URI: https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14484

- **ITU-T Y.BaaS-reqts:** Recommendation ITU-T Y. BaaS-reqts provides the functional requirements for blockchain as a service (BaaS) in cloud computing environment. Blockchain technologies use decentralized, shared, immutable ledgers to store data and record transactions history, by which the trust, accountability, transparency and efficiency can be achieved. Blockchain technologies include p2p networking, consensus mechanism, smart contract and cipher algorithms, which are now driving various emerging applications across a wide range, such as digital crypto currency, finance, insurance, banking, healthcare, government, manufacturing, retail, legal, media and entertainment, supply chain and logistics, accounting, notarization and certification.

URI: https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14485

8.2 Q18

Title of deliverable	Current status	Starting date	Target date
ITU-T Y.3502|ISO/IEC 17789 Information technology — Cloud computing - Reference architecture	Recommendation | IS	09/2012	08/2014
ITU-T Y.3510, Cloud Computing Infrastructure Requirements	Recommendation	06/2012	05/2013
	2nd Edition	05/2015	02/2016
ITU-T Y.3511, Framework of inter-cloud computing	Recommendation	06/2012	03/2014

ITU-T Y.3512, Cloud computing - Functional requirements of Network as a Service	Recommendation	06/2012	06/2013
ITU-T Y.3513, Cloud computing - Functional requirements of Infrastructure as a Service	Recommendation	02/2013	08/2014
ITU-T Y.3515, Cloud computing - Functional Architecture of Network as a Service	Recommendation	07/2014	02/2017
ITU-T Y.3516, Cloud computing - Functional Architecture of inter-cloud computing	Recommendation	05/2015	07/2017
ITU-T Y.3519, Cloud computing - Functional architecture of Big Data as a Service	Recommendation	05/2015	11/2018
ITU-T Y.dsf-arch, Cloud computing - Functional architecture for data storage federation	Draft Recommendation	05/2018	12/2019

- **ITU-T Y.3502|ISO/IEC 17789**: This Recommendation | International Standard specifies the cloud computing reference architecture (CCRA). The reference architecture includes the cloud computing roles, cloud computing activities as well as the cloud computing functional components and their relationships.

  URI : http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12209

- **ITU-T Y.3510**: This Recommendation identifies requirements for cloud infrastructure capabilities to support cloud services. The scope of this Recommendation includes:

  – Overview of cloud infrastructure;

  – Requirements for compute resources;

  – Requirements for network resources;

  – Requirements for storage resources;

  – Requirements for resource abstraction and control.

  URI : http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12713

- **ITU-T Y.3511**: This Recommendation describes the framework for interactions of multiple cloud service providers (CSPs) that is referred to as inter-cloud computing. Based on several use cases and consideration on different types of service offerings, this Recommendation describes the possible relationship among multiple CSPs; which are peering, federation, and intermediary. By introducing the concept of the primary CSP and /secondary CSPs, the Recommendation further describes CSP interactions in the cases of federation and intermediary patterns. The Recommendation also considers the network significance and its issues. Finally, relevant functional requirements are derived.

  URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12078

- **ITU-T Y.3512**: This Recommendation provides use cases and functional requirements of Network as a Service (NaaS), one of the representative cloud service categories. This Recommendation covers the following:

  – High level concept of NaaS;

  – Functional requirements of NaaS;

  – Typical NaaS use cases.

- This Recommendation provides use cases and functional requirements of NaaS application, NaaS platform and NaaS connectivity.

  URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12285

- **ITU-T Y.3513**: This Recommendation provides functional requirements and use cases of Infrastructure as a Service (IaaS), one of the representative cloud service categories. This Recommendation covers the following:

  - General description of IaaS;

  - Functional requirements of IaaS;

  - Typical IaaS use cases.

  URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12286

- **ITU-T Y.3515**: This Recommendation specifies NaaS functional architecture, including functionalities, functional components as well as reference points and procedures, based on the functional requirements specified in Y.3512. The scope of this Recommendation consists of:

  - Overview of NaaS functional architecture;

  - Functionalities of NaaS;

  - Functional components of NaaS;

  - Reference points between functional components of NaaS;

  - Procedures for typical NaaS use cases.

  URI: https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=13255

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

  URI: https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=13352

- **ITU-T Y.3519**: This Recommendation provides an overview of the big data as a service (BDaaS) functional architecture and defines the BDaaS functional architecture and cross-cutting aspects by specifying the functional components for the support of BDaaS.

  URI: https://www.itu.int/ITU-T/workprog/wp_item.aspx?isn=13627

- **ITU-T Y.dsf-arch**: This Recommendation describes functional architecture for data storage federation. The DSF functions based on DSF logical components identified in Y.35XX (ex Y.dsf-reqts) are introduced. The DSF functional architecture, including DSF functions and DSF functional components, is specified. This Recommendation also provides the relationship between the DSF functional architecture and the cloud computing reference architecture.

  URI: https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14623

8.3 Q19

Title of deliverable	Current status	Starting date	Target date
ITU-T Y.3520, Cloud computing framework for end to end resource management	Recommendation	06/2012	06/2013
	2nd Edition Recommendation	05/2015	09/2015
ITU-T Y. 3514, Trusted inter-cloud computing framework and requirements	Recommendation	05/2015	05/2017
ITU-T Y.3518, Cloud computing -Requirements for inter-cloud data management	Recommendation	07/2016	11/2018
ITU-T Y.3517, Cloud computing - Overview of inter-cloud trust management	Recommendation	07/2016	11/2018
ITU-T Y.cccsdaom-reqts, Cloud computing - Requirements of cloud service development and operation management	Draft Recommendation	08/2018	09/2020
ITU-T Y.ccm-reqts, Cloud computing maturity requirements and framework	Draft Recommendation	01/2018	12/2019
ITU-T Y.cslm-metadata, Metadata framework for cloud service lifecycle management	Draft Recommendation	03/2017	01/2019
ITU-T Y.e2efapm, Cloud Computing - End-to-end fault and performance management framework of virtual network services in inter-cloud	Draft Recommendation	08/2018	09/2020

- **ITU-T Y.3520**: This Recommendation provides a framework for end-to-end cloud computing resource management. This Recommendation includes:
    - general concepts of end to end cloud computing resource management;
    - a vision for adoption of cloud computing resource management in a telecommunication rich environment;
    - end-to-end management of cloud resource and services across multiple platforms, i.e. management of any hardware and software used in support of the delivery of cloud services.

    URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12585

- **ITU-T Y.3514**: This Recommendation specifies framework of trusted inter-cloud computing and relevant use cases, based on the framework specified in ITU-T Rec. Y.3511. The scope of this Recommendation includes:
    - objectives of trusted inter-cloud computing;
    - requirements for security of trusted inter-cloud;
    - requirements for governance of trusted inter-cloud;
    - requirements for resiliency of trusted inter-cloud.

URI: https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13254

- **ITU-T Y.3518**: This Recommendation specifies functional requirements for inter-cloud data management. It provides overview of inter-cloud data management and inter-cloud data classification in aspects of categories, identification qualifiers and dependency. This Recommendation proposes set of requirements for inter-cloud data annotation, processing and usage to enable justification of use of network data plane mechanisms for data protection and traffic isolation. The scope of this Recommendation includes:

  − overview of inter-cloud data management

  − inter-cloud data classification

  − requirements for inter-cloud data annotation, processing and usage

  − requirements for inter-cloud data isolation and protection

  − requirements for inter-cloud data management

  URI: https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=13645

- **ITU-T Y.3517:** This Recommendation specifies global overview of inter-cloud trust management includes inter-cloud trust management model and functionalities for managing isolation and security mechanism needed to guarantee both trust management and/or isolation in an inter-cloud environment. The scope of this Recommendation includes:

  − overview of inter-cloud trust management

  − inter-cloud trust management model

  − functionalities for managing isolation and security mechanism

  − inter-cloud trust management requirements and use cases

  URI**:** https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=13644

- **ITU-T Y.cccsdaom-reqts:** This proposed draft Recommendation aims to provides functional requirements of cloud service development and operation management. It covers the following aspects: - Overview of cloud service development and operation management; - Functional requirements of cloud service development and operation management; - Typical use cases of cloud service development and operation management.

  URI**:** https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14746

- **ITU-T Y.ccm-reqts:** This Recommendation specifies cloud computing maturity requirements and framework and relevant use cases. The scope of this Recommendation includes: 1) Overview of cloud computing maturity; 2) Cloud computing maturity requirements; 3) Cloud computing maturity framework; 4) Relationship with cloud computing reference architecture; 5) Typical use cases of cloud computing maturity.

  URI**:** https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14486

- **ITU-T Y.cslm-metadata:** This Recommendation specifies the metadata framework for cloud service lifecycle management in the closed-loop automation environment.

  URI**:** https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14077

- **ITU-T Y.e2efapm:** This Recommendation specifies an end-to-end fault and performance management framework and relevant use cases of virtual network services in inter-cloud computing. The scope of this Recommendation includes: - overview of end-to-end fault and performance management of virtual network services; - functional requirements of end-to-end

fault and performance management of virtual network services; - use cases relevant to end-to-end fault and performance management of virtual network services.

URI**:** https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14745

8.4 Analysis of ITU-T SG13 deliverables

Table 8-1 – Analysis of ITU-T SG13 deliverables

	General, definition	Requirements Use Cases	Architecture	API, interface, profile	Data model, Format, schema	others
Fundamental	ITU-T Y.3500|ISO/IEC 17788	ITU-T Y.3501, ITU-T Y.3510, ITU-T Y.3600	ITU-T Y.3502|ISO/IEC 17789			
Cloud service category		ITU-T Y.3503, ITU-T Y.cccm-reqts, ITU-T Y.3512, ITU-T Y.3513, ITU-T Y.MLaaS-reqts, ITU-T Y.BaaS-reqts, ITU-T Y.ccdc-reqts, ITU-T Y.3507, ITU-T Y.3505	ITU-T Y.3504, ITU-T Y.3515, ITU-T Y.3509, ITU-T Y.dsf-arch			
Security						
Management	ITU-T Y.3520, ITU-T Y.cslm-metadata	ITU-T Y.cccsdaom-reqts, ITU-T Y.ccm-reqts, ITU-T Y.e2efapm				
Inter cloud, CSB		ITU-T Y.3506, ITU-T Y.3511, ITU-T Y.3514, ITU-T Y.3518, ITU-T Y.3517	ITU-T Y.3516			
SLA, metering						
Testing						
Others						

9   ITU-T JRG-CCM (Joint Rapporteur Group on Cloud Computing Management) of ITU-T SG13 and ITU-T SG2

Title of deliverable	Current status	Starting date	Target date
ITU-T Y.3521/M.3070, Overview of end-to-end cloud computing management	Recommendation	02/2013	03/2016
ITU-T Y.3522, End-to-end cloud service lifecycle management requirements	Recommendation	06/2013	09/2016
ITU-T M.3371, Requirements for Service Management in Cloud-aware Telecommunication Management System	Recommendation	01/2013	09/2016

- **ITU-T Y.3521/M.3070**: Recommendation ITU-T Y.3521 presents the conceptual view and the common model of end-to-end (E2E) cloud computing management based on the service management interface (SMI) and cloud computing reference architecture, from the perspective of the telecommunications industry.

  URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12714

- **ITU-T Y.3522**: This Recommendation specifies the functional requirements of end-to-end (E2E) cloud service lifecycle management. This Recommendation consists of the following:

  − cloud service lifecycle metadata;

  − cloud service lifecycle management framework;

  − cloud service lifecycle management stages;

  − relationship with cloud computing reference architecture;

  − functional requirements and typical use cases of cloud service lifecycle management.

  URI: https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13020

- **ITU-T M.3371**: This recommendation defines the general and functional management requirements that support the service management in cloud-aware telecommunication management system [see ITU-T M.3070] and provides functional framework for services management in cloud-aware telecommunication management system.

  URI: https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=13064

Table 9-2 – Analysis of ITU-T JRG-CCM deliverables

	General, definition	Requirements Use Cases	Architecture	API, interface, profile	Data model, Format, schema	others
Fundamental						
Cloud service category						
Security						

Management	ITU-T M.3070/Y.3521	ITU-T M.3371, ITU-T Y.3522				
Inter cloud, CSB						
SLA, metering						
Testing						
Others						

10   ITU-T SG17

Title of deliverable	Current status	Starting date	Target date
ITU-T X.1601, Security framework for cloud computing	Recommendation	04/2010	10/2015
ITU-T X.1631 | ISO/IEC 27017, Information technology - Security techniques - Code of practice for information security controls based on ISO/IEC 27002 for cloud services	Recommendation	05/2013	07/2015
ITU-T X.1642, Guidelines of operational security for cloud computing	Recommendation	03/2012	03/2016
ITU-T X.1602, Security functional requirements for Software as a Service (SaaS) application environment	Recommendation	04/2011	03/2016
ITU-T X.1641, Guidelines for cloud service customer data security	Recommendation	09/2014	09/2016
ITU-T X.1603, Data security requirements for the monitoring service of cloud computing	Draft Recommendation	09/2015	03/2018
ITU-T X.SRIaaS, Security requirements of public infrastructure as a service (IaaS) in cloud computing	Draft Recommendation	03/2016	09/2019
ITU-T X.SRNaaS, Security requirements of Network as a Service (NaaS) in cloud computing	Draft Recommendation	09/2016	09/2019
ITU-T X.SRCaaS, Security requirements for Communication as a Service application environments	Draft Recommendation	09/2016	109/2019
ITU-T X.GSBDaaS, Guidelines on security of Big Data as a Service	Draft Recommendation	09/2016	09/2019
ITU-T X.sgcc, Security guidelines for container in cloud computing environment	Draft Recommendation	09/2018	Q4/2020

- **ITU-T X.1601**: This Recommendation provides guidelines for cloud service customer data security in cloud computing, for those cases where the cloud service provider (CSP) is responsible for ensuring that the data is handled with proper security. This is not always the case, since for some cloud services the security of the data will be the responsibility of the cloud service customer (CSCs) themselves. In other cases, the responsibility may be mixed.

  For example, in some cases the CSP may be responsible for restricting access to the data, while the CSC remains responsible for deciding which cloud service users (CSUs) should have access to it, and the behaviour of any scripts or applications with which the CSU processes the data.

  This Recommendation identifies security controls for cloud service customer data that can be used in different stages of the full data lifecycle. These security controls may differ when the security level of the cloud service customer data changes. Therefore, the Recommendation provides guidelines on when each control should be used for best security practice.

  URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?id=12613

- **ITU-T X.1631 | ISO/IEC 27017**: Recommendation ITU-T X.1631 | ISO/IEC 27017 provides guidelines for information security controls applicable to the provision and use of cloud services by providing:

  – additional implementation guidance for relevant controls specified in ISO/IEC 27002;

  – additional controls with implementation guidance that specifically relate to cloud services.

  This Recommendation | International Standard provides controls and implementation guidance for both cloud service providers and cloud service customers.

  URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12490

- **ITU-T X.1642**: This Recommendation provides guideline of operational security for cloud computing, which includes guidance of service level agreement (SLA) and daily security maintenance for cloud computing. The target audiences of this Recommendation are cloud service providers, such as traditional telecom operators, ISPs and ICPs.

  URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12616

- **ITU-T X.1602**: This Recommendation provides a generic functional description for secure service oriented Software as a Service (SaaS) application environment that is independent of network types, operating system, middleware, vendor specific products or solutions. In addition, this Recommendation is independent of any service or scenarios specific model (e.g., web services, Parlay X or REST), assumptions or solutions. This Recommendation describes a structured approach for defining, designing, and implementing secure and manageable service oriented capabilities in telecommunication cloud computing environment.

  URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12615

- **ITU-T X.1641**: This Recommendation provides generic security guidelines for the cloud service customer (CSC) data in cloud computing. It analyses the CSC data security lifecycle and proposes security requirements at each stage of the data lifecycle. Furthermore, the Recommendation provides guidelines on when each control should be used for best security practice.

  URI: https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12853

- **ITU-T X.1603**: Recommendation ITU-T X.1603 analyses data security requirements for the monitoring service of cloud computing which include monitoring data scope requirements, monitoring data lifecycle, security requirements of monitoring data acquisition and security

requirements of monitoring data storage. Monitoring data scope requirements include the necessary monitoring scope that CSPs should provide to maintain the cloud security and the biggest monitoring scope of CSPs. Monitoring data lifecycle includes data creation, data store, data use, data migrate, data present, data destroy and data backup. Monitoring acquisition determines the security requirements of the acquisition techniques of monitoring service. Monitoring data storage determines the security requirements for CSPs to store the monitoring data.

URI: https://www.itu.int/ITU-T/workprog/wp_item.aspx?isn=13562

- **ITU-T X.SRIaaS**: Infrastructure as a Service (IaaS) is one of the representative categories of cloud services, in which the cloud capabilities service provided to the CSC is an infrastructure capabilities type. IaaS environments and virtualized services are facing more challenges and threats than traditional information technology infrastructure and application. Platforms that share computing, storage, and network services need protections specific to the threats in the IaaS environment. If these threats are not carefully addressed, it will have very negative impact on the development of IaaS services. This recommendation aims to document the security requirements of public IaaS. This will be helpful for IaaS CSPs to improve the overall security level throughout the planning, constructing and operating stages of IaaS platform and services. This work also complements the security standardization activity related to Software Defined Networks, especially X.sdnsec.

URI: https://www.itu.int/ITU-T/workprog/wp_item.aspx?isn=13578

- **ITU-T X.SRNaaS**: Network as a Service (NaaS) is one of the representative cloud service categories, in which the capability provided to the cloud service customer (CSC) is transport connectivity and related network capabilities. NaaS services can provide any of three cloud capabilities as: NaaS application service, NaaS platform service and NaaS connectivity service. All the three kinds of NaaS service face particular security challenges such as application security vulnerabilities, security risks of network virtualization, eavesdropping, etc. Recommendation ITU-T X.SRNaaS analyses the security challenges and security requirements of NaaS application, NaaS platform and NaaS connectivity. This Recommendation could help NaaS service providers to address on the security issues. The capabilities provided by this Recommendation will take into account the national legal and regulatory obligations in individual Member States in which the NaaS services operate. The methodology of this proposal would follow the recommendations of clause 10 in Recommendation ITU-T X.1601.

URI: https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=13590

- **ITU-T X.SRCaaS**: Recommendation ITU-T X.SRCaaS recommends the security requirements of communication as a service (CaaS) application environments with the identification of the risks. The Recommendation describes the scenarios and the features of CaaS, into which multi-communication capabilities are plugged. Moreover, some special /unique risks are identified, which are caused by the unique features of CaaS. The corresponding security requirements are recommended for the following aspects: Identity fraud, orchestration security, multi devices security, countering spam, privacy protection, infrastructure attack, attack from infrastructure, Intranet attack and so on. The Recommendation refers to the common security requirements of Recommendation ITU-T X.1602 to avoid duplicated work. These measures in the requirements take into account the national legal and regulatory obligations in individual member states in which the platforms operate. The work applies the methodology standardized in clause 10 of Recommendation ITU-T X.1601.

URI: https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=13589

- **ITU-T X.GSDBaaS:** The recommendation analyzes security challenges faced by Big Data as a Service, and provides the componentized security framework of big data platform services, specifies security protection measures should be satisfied for the activities/components related to BDaaS and roles participated in the big data activities, etc.

  URI: http://www.itu.int/ITU-T/workprog/wp_item.aspx?isn=13591

- **ITU-T X.sgcc:** This recommendation analyses security threats and challenges on container in cloud computing environment, and provides the security guidelines and reference security framework for container in cloud.

  URI: https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14788

Table 10-3 – Analysis of ITU-T SG17 deliverables

	General, definition	Requirements Use Cases	Architecture	API, interface, profile	Data model, Format, schema	others
Fundamental						
Cloud service category						
Security	ITU-T X.1601	ITU-T X.1602, ITU-T X.1603, ITU-T X.SRIaaS, ITU-T X.SRNaaS, ITU-T X.SRCaaS,				ITU-T X.1642, ITU-T X.1631, ITU-T X.1641, ITU-T X.GSBDBaaS, ITU-T X.sgcc
Management						
Inter cloud, CSB						
SLA, metering						
Testing						
Others						

11   ITU-T SG5

Title of deliverable	Current status	Starting date	Target date
ITU-T L.1200, Direct current power feeding interface up to 400V at the input to telecommunication and ICT equipment	Recommendation	10/2010	05/2012

ITU-T L.1300, Best practices for green data centres	Recommendation		06/2014
ITU-T L.1410, Methodology for environmental life cycle assessments of information and communication technology goods, networks and services	Recommendation		12/2014
ITU-T L.1301, Minimum data set and communication interface requirements for data centre energy management	Recommendation		05/2015
ITU-T L.1201, Architecture of power feeding systems of up to 400 VDC	Recommendation		03/2014
ITU-T L.1202, Methodologies for evaluating the performance of an up to 400 VDC power feeding system and its environmental impact	Recommendation		04/2015
ITU-T L.1420, Methodology for energy consumption and greenhouse gas emissions impact assessment of information and communication technologies in organizations	Recommendation		02/2012
ITU-T L.1430, Methodology for assessment of the environmental impact of information and communication technology greenhouse gas and energy projects	Recommendation		12/2013
ITU-T L.1302, Assessment of energy efficiency on infrastructure in data centre and telecom centre	Recommendation		11/2015
ITU-T L.1320, Energy efficiency metrics and measurement for power and cooling equipment for telecommunications and data centres	Recommendation		03/2014
ITU-T L.renewable, Interfacing of renewable energy or distributed power sources to up to 400 VDC power feeding systems	Recommendation	12/2013	12/2016
ITU-T L.green_mgm_DC, Functionality requirements and framework of green data center energy-saving management system	WI approved	12/2014	2018
ITU-T L.1440, Methodology for environmental impact assessment of information and communication technologies at city level	Recommendation		10/2015
ITU-T L.1204, Extented architecture of power feeding systems of up to 400 VDC	Recommendation		06/2016
ITU-T L.1220, Innovative energy storage technology for stationary use - Part 1: Overview of energy storage	Recommendation		05/2017
ITU-T L.1206, Impact on information and communication technology equipment architecture	Recommendation		05/2017

of multiple AC, -48 VDC or up to 400 VDC power input			
L.se_DC, smart energy solutions for data centre and telecom centre	Draft Recommendation	05/2017	12/2018

- **ITU-T L.1200**: This Recommendation specifies the direct current (DC) interface between the power feeding system and ICT equipment connected to it. It also describes normal and abnormal voltage ranges, and immunity test levels for ICT equipment to maintain the stability of telecommunication and data communication services. The specified interface is operated from a DC power source of up to 400 V to allow increased power consumption and equipment power density, in order to obtain higher energy efficiency and reliability with less material usage than using a lower voltage such as -48 VDC or AC UPS power feeding solutions.

    URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=11638

- **ITU-T L.1300**: This Recommendation specifies best practices aimed at developing green data centres. A green data centre can be defined as a repository for the storage, management, and dissemination of data in which the mechanical, lighting, electrical and computer systems are designed for maximum energy efficiency and minimum environmental impact. The construction and operation of a green data centre includes advanced technologies and strategies. The Recommendation provides a set of rules to be referred to when undertaking improvement of existing data centres, or when planning, designing or constructing new ones.

    URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12204

- **ITU-T L.1410**: Recommendation ITU-T L.1410 deals with environmental life cycle assessments (LCAs) of information and communication technology (ICT) goods, networks and services. It is organized in two parts:
    - Part I: ICT life cycle assessment: framework and guidance
    - Part II: "Comparative analysis between ICT and reference product system (Baseline scenario); framework and guidance".

    Part I deals with the life cycle assessment (LCA) methodology applied to ICT goods, networks and services. Part II deals with comparative analysis based on LCA results of an ICT goods, networks and services product system, and a reference product system.

    URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12207

- **ITU-T L.1301**: Recommendation ITU-T L.1301 establishes a minimum data set necessary to manage data centres and telecommunication rooms in an environmentally responsible manner.

    The Recommendation specifies the communication interface and defines the parameters to be communicated depending on the equipment used in data centres, such as power systems (alternating current (AC)/direct current (DC) and uninterruptible power supply (UPS) and energy distribution), cooling systems and information and communication technology (ICT) equipment.

    URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12428

- **ITU-T L.1201**: Recommendation ITU-T L.1201 describes the architecture of power feeding systems of up to 400 VDC for information and communication technology (ICT) equipment in telecommunication centres, data centres and customer premises. It describes aspects such as configuration, redundancy, power distribution and monitoring, in order to construct safe, reliable and manageable power feeding systems. It can be used also as an architecture reference model for further Recommendations e.g., on the performance of DC power feeding systems.

URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12135

- **ITU-T L.1202**: Recommendation ITU-T L.1202 is provided as a complement to Recommendation ITU-T L.1201, which describes the architecture of direct current (DC) power systems with an up to 400 VDC information and communication technology (ICT) equipment interface. The up to 400 VDC ICT equipment interface is described in Recommendation ITU-T L.1200.

  Recommendation ITU-T L.1202 provides a framework for assessing performances of up to 400 VDC power feeding systems and the savings incurred when compared to other power feeding systems such as the −48 VDC power system and the AC uninterruptable power system (UPS) commonly used in information and communication technology (ICT) sites.

  This Recommendation deals with performance factors such as efficiency, reliability/availability and environmental impact.

  URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?id=12427

- **ITU-T L.1420**: Recommendation ITU-T L.1420 presents the methodology to be followed if an organization intends to claim compliance with this Recommendation when assessing its information and communication technology (ICT) related energy consumption and/or greenhouse gas (GHG) emissions.

  This Recommendation can be used to assess energy consumption and GHG emissions generated over a defined period of time for the following purposes: for assessment of related impact from ICT organizations or for assessment of impact from ICT related activities within non-ICT organizations.

  URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=11431

- **ITU-T L.1430**: Recommendation ITU-T L.1430 is intended as a complement to ISO standard ISO 14064-2 and the Project Protocol of the Greenhouse Gas Protocol (GHG Protocol).

  This Recommendation provides guidance for the application of a specific methodology to assess the environmental impact of information and communication technology (ICT) greenhouse gas (GHG) and energy projects. This assessment methodology is specifically directed at quantifying and reporting GHG emission reductions, GHG removal enhancements, energy consumption reductions, and enhancement of energy generation and storage in ICT GHG and energy projects.

  An ICT GHG project uses mainly ICT goods, networks and services (GNS) and is designed to reduce GHG emissions or increase GHG removals that are quantified by comparison between the environmental impact of a project activity and a corresponding baseline scenario.

  An ICT energy project uses mainly ICT goods, networks and services to reduce energy consumption and improve energy efficiency.

  From the ICT perspective, this Recommendation takes into account considerations based on existing project quantification guidelines and aims at covering ICT GHG and energy project activities within both the ICT and the non-ICT sectors.

  This Recommendation recognizes the importance of project validation and verification for the credibility of project results but does not enforce the validation and verification procedures to be applied. It is expected that such procedures will be determined by the selected GHG programme, national regulations, the project proponent's internal policy or the intended user's request.

  URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=11904

- **ITU-T L.1302**: Recommendation ITU-T L.1302 contains the energy efficiency assessment methodology for data centre and telecom centre, test equipment accuracy requirements, assessment period, assessment conditions and calculation methods.

  For data centre and telecom centre, it was divided into assessment methods for whole data centre /telecom centre efficiency and partial data centre/telecom centre.

  As main energy consuming infrastructure in data centre/telecom centre are power feeding system (power supply system) and cooling system, both system energy efficiency measurement methodologies are covered in this Recommendation.

  It will take advantage of methodologies and best practices currently in used or in development in networks and data centre/telecom centre.

  This Recommendation aimed at reducing the negative impact of data centre and telecom centre through providing the methodologies of energy efficiency assessment. It is commonly recognized that data centre and telecom centre will have an ever-increasing impact on the environment in the future. The application of the assessment methods defined in this Recommendation can help owners and managers to build future data centres/telecom centres, or improve existing ones, to operate in an environmentally responsible manner.

  URI: http://www.itu.int/itu-t/recommendations/rec.aspx?rec=12630

- **ITU-T L.1320**: Recommendation ITU-T L.1320 contains the general definition of metrics, test procedures, methodologies and measurement profiles required to assess the energy efficiency of power and cooling equipment for telecommunications and data centres. More detailed measurement procedures and specifications can be developed in future related ITU-T Recommendations.

  Metrics and measurement methods are defined for power equipment, alternating current (AC) power feeding equipment (such as AC uninterruptible power supply (UPS), direct current (DC/AC) inverters), DC power feeding equipment (such as AC/DC rectifiers, DC/DC converters), solar equipment, wind turbine equipment and fuel cell equipment.

  In addition, metrics and measurement methods are defined for cooling equipment such as air conditioning equipment, outdoor air cooling equipment and heat exchanging cooling equipment.

  URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?id=12136

- **ITU-T L.renewable**: Defining interface and architecture for injecting renewable energy and distributed power sources into an up to 400 V power system as defined in L.architecture.

  URL: http://www.itu.int/ITU-T/workprog/wp_item.aspx?isn=10018

- **ITU-T L.green_mgm_DC**: This Recommendation describes Functionality requirements and framework of green data center energy-saving management system. The energy-saving will be realized through performance to increase the energy efficiency of data center. The scope of this Recommendation includes:

  − Characteristics and operation flow of green data center energy-saving management system

  − Functionality requirements of green data center energy-saving management system (eg: Real-time energy consumption data acquisition; Energy consumption data analysis and chart show; Energy consumption data query; Energy consumption monitoring and early warning; Strategy Optimization, etc.)

- Capability needs of green data center energy-saving management system (eg: collect data from different communication interface; secure storage; control management, etc.)

- Framework of green data center energy-saving management system

Sensor definition, interface and protocol are not included in the scope of this Recommendation.

URL: http://web.itu.int/ITU-T/workprog/wp_item.aspx?isn=10367

- **ITU-T L.1440**: Recommendation ITU-T L.1440 gives general guidance for city level environmental assessments related to ICT, and provides a description of methodologies to be used for the assessment of the environmental impact of ICT in cities.

  In this first edition of this Recommendation, the assessment is limited to energy consumption and GHG emissions.

  The present Recommendation is divided in two parts.

  - Part I relates to the first order effects from the use of ICT goods and networks in city´s organizations and households.

  - Part II relates to the first and second order effects from ICT projects and services applied in the city.

  This Recommendation provides specific guidance in setting the city boundaries, preparing and performing the assessment of ICT related GHG emissions and energy consumption at city level.

  URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?id=12431

- **ITU-T L.1204**: Recommendation ITU-T L.1204 describes the extended architecture of power feeding systems of up to 400 volts DC (VDC) for information and communication technology (ICT) equipment in telecommunication centres, data centres and customer premises. It describes aspects such as configuration, redundancy, power distribution and monitoring, in order to construct safe, reliable and manageable power feeding systems. This Recommendation can be used also as an architecture reference model for future Recommendations e.g. on the performance of DC power feeding systems. This Recommendation describes extended power feeding architectures using up to 400 VDC e.g. hybrid redundant DC and AC power feeding based on Recommendation ITU-T L.1201.

  URI: http://www.itu.int/itu-t/recommendations/rec.aspx?rec=12882

- **ITU-T L.1220**: Overview of evolution of Energy Storage for stationary use for ICT/Telecom equipment. Global results of investigations from lab and field tests of solutions for site, network, data centre, and CPE resilience in smart sustainable city. Mobile and portable batteries are out of the scope.

  URI: http://www.itu.int/ITU-T/workprog/wp_item.aspx?isn=10713

- **ITU-T L.1206:** The document discusses multiple power interfaces to ICT equipment operated by standardized -48V direct current, alternating current source and direct current source up to 400 V in line with the interfaces, operational voltage and characteristics detailed within ITU-T Recommendation and ETSI relevant standards . It also includes some details on the power architecture within the ICT equipment between the ICT power interface and the ICT end load.

  URI: https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=13938

- **ITU-T L.se_DC:** Recommendation "smart energy solutions for data centre and telecom centre" defines establish clear requirements on data centre and telecom centre smart energy system performance, safety, energy efficiency and environmental impacts.

URI: https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14153

Table 11-4 – Analysis of ITU-T SG5 deliverables

	General, definition	Requirements Use Cases	Architecture	API, interface, profile	Data model, Format, schema	others
Fundamental						
Cloud service category						
Security						
Management		ITU-T L.1301, ITU-T L.green_mgm_DC				ITU-T L.1410
Inter cloud, CSB						
SLA, metering						
Testing						ITU-T L.1202, ITU-T L.1420, ITU-T L.1430, ITU-T L.1302, ITU-T L.1320, ITU-T L.1440
Others			ITU-T L.1201, ITU-T L.1204	ITU-T L.renewable		ITU-T L.1200, ITU-T L.1300, ITU-T L.1220, ITU-T L.1206, L.se_DC

12 ITU-T SG11

Title of deliverable	Current status	Starting date	Target date
ITU-T Q.4040, The framework and overview of Cloud Computing interoperability testing	Recommendation	02/2013	02/2016
ITU-T Q.4041.1, Cloud computing infrastructure capabilities interoperability testing – part 1: Interoperability testing between CSC and CSP	Recommendation	04/2015	11/2017
ITU-T Q.wa-iop, Cloud Interoperability testing about Web Application	Draft Recommendation	04/2016	03/2018

ITU-T Q.3914, Set of parameters of cloud computing for monitoring	Recommendation	07/2014	11/2017

- **ITU-T Q.4040**: This Recommendation describes the framework and provides an overview of Cloud Computing interoperability testing. According to the identified target areas of testing, the framework Recommendation includes overview of cloud computing interoperability testing with common confirmed items, infrastructure capabilities type, platform capabilities type and application capabilities type interoperability testing.

  URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12703

- **ITU-T Q.4041.1**: This Recommendation specifies the cloud computing infrastructure capabilities type interoperability testing between CSC and CSP, including interoperability testing of computing service, storage service, network service and related management functions based on the functional requirements specified in ITU-T Y.3513. The test cases of cloud computing infrastructure capabilities type interoperability testing between CSC and CSP have also been introduced.

  URI : https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13492&lang=en

- **ITU-T Q.wa-iop**: This document focuses on the Cloud interoperability testing about Web Application.

  URI: http://www.itu.int/ITU-T/workprog/wp_item.aspx?isn=13839

- **ITU-T Q.3914**: This Recommendation provides a set of parameters that indicate the status and event of a cloud computing system, including resource layer, service layer and access layer.

  URI: https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13487

Table 12-5 – Analysis of ITU-T SG11 deliverables

	General, definition	Requirements Use Cases	Architecture	API, interface, profile	Data model, Format, schema	others
Fundamental						
Cloud service category						
Security						
Management						
Inter cloud, CSB						
SLA, metering						
Testing	ITU-T Q.4040					ITU-T Q. 4041.1, ITU-T Q.wa-iop, ITU-T Q.3914
Others						

13   ITU-T SG16

Title of deliverable	Current status	Starting date	Target date
ITU-T H.248.CLOUD, Gateway control protocol: Cloudification of packet gateways	Draft Recommendation	07/2014	12/2018
ITU-T F.743.2, Requirements for cloud storage in visual surveillance	Recommendation	03/2015	07/2016
ITU-T H.626.2, Architectural requirements for cloud storage in video surveillance	Recommendation	12/2015	12/2017

- **ITU-T H.248.CLOUD**: This Recommendation does not define any new signalling extensions for the H.248 gateway control protocol. The purpose of this Recommendation is to provide some kind of guidance to the specification of H.248 profiles for H.248 gateways in cloud-based network solutions.

  URI: http://www.itu.int/ITU-T/workprog/wp_item.aspx?isn=13278

- **ITU-T F.743.2**: The purpose of this Recommendation is to define the cloud storage service requirements in visual surveillance. Cloud storage enables the service users to have ubiquitous, convenient and on-demand network access to a shared pool of configurable storage resources, which can be rapidly provisioned and released with minimal management effort or service-provider interaction. Cloud storage can realize flexible and reliable data storage for large scale visual surveillance, and its component is modularized and allocated dynamically based on the real usage. This recommendation provides the application scenarios and the requirements for cloud storage in visual surveillance.

  URI: http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12895

- **ITU-T H.626.2**: This Recommendation defines a cloud storage architecture in visual surveillance. Cloud storage enables the service users to have ubiquitous, convenient and on-demand network access to a shared pool of the configurable storage resources, which can be rapidly provisioned and released with the minimal management effort or service-provider interaction. Cloud storage can realize flexible and reliable data storage for large-scale visual surveillance, and its components are modularized and allocated dynamically based on the real usage. This Recommendation provides the architecture, entities, reference points and service control flow for cloud storage in visual surveillance.

  URI: https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13436

Table 13-6 – Analysis of ITU-T SG16 deliverables

	General, definition	Requirements Use Cases	Architecture	API, interface, profile	Data model, Format, schema	others
Fundamental						
Cloud service category		ITU-T F.743.2	ITU-T H.626.2			

Security						
Management				ITU-T H.248.CLOUD		
Inter cloud, CSB						
SLA, metering						
Testing						
Others						

14   ITU-T SG2

Title of deliverable	Current status	Starting date	Target date
ITU-T M.3071, Cloud-based network management functional architecture	Recommendation	04/2016	12/2017
ITU-T M.rrmctm, Requirements for resource management in cloud-aware telecommunication management system	Draft Recommendation	04/2017	12/2018

- **ITU-T M.3071**: This Recommendation introduces a new network management functional architecture with cloud-computing technology. In this Recommendation, the background and basic concept of cloud-based network management are provided. This Recommendation also provides details of a cloud-based network management functional architecture, including its basic components, functionalities and the relationship between its components.

  URI: https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13479

- **ITU-T M.rrmctm**: This document provides the functional framework and functional requirements for resource management in cloud-aware telecommunication management system, describes the composition of functional framework, explained the functions of each components in the framework.

  URI: http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14193

Table 13-7 – Analysis of ITU-T SG2 deliverables

	General, definition	Requirements Use Cases	Architecture	API, interface, profile	Data model, Format, schema	others
Fundamental						
Cloud service category						
Security						
Management		ITU-T M.rrmctm	ITU-T M.3071			

Inter cloud, CSB						
SLA, metering						
Testing						
Others						

15 ISO/IEC JTC 1 SC 38

Title of deliverable	Current status	Starting date	Target date
ITU-T Y.3500|ISO/IEC 17788, Information technology – Cloud computing – Overview and vocabulary	Recommendation | IS	09/2012	08/2014
ITU-T Y.3502|ISO/IEC 17789, Information technology – Cloud computing – Reference architecture	Recommendation | IS	09/2012	08/2014
ISO/IEC 19086-1, Cloud Computing – Service Level Agreement (SLA) Framework – Part 1 : Overview and Concepts	IS	02/2013	09/2016
ISO/IEC 19086-2, Information Technology – Cloud Computing – Service Level Agreement (SLA) Framework – Part 2 : Metric Model	DIS	10/2014	10/2017
ISO/IEC 19086-3, Information Technology – Cloud Computing – Service Level Agreement (SLA) Framework – Part 3 : Core Conformance Requirements	IS	10/2014	07/2017
ISO/IEC 19086-4, Information Technology – Cloud Computing – Service Level Agreement (SLA) Framework – Part 4 : Security and Privacy	IS	10/2014	01/2018
ISO/IEC 19941, Information Technology – Cloud Computing – Interoperability and Portability	IS	10/2014	10/2017
ISO/IEC 19944, Information Technology – Cloud Computing - Cloud services and devices: data flow,data categories and data use	IS	10/2014	10/2017
ISO/IEC 22123, Information Technology – Cloud Computing – Concepts and terminology	WD	01/2017	01/2020
ISO/IEC 22624, Information Technology – Cloud Computing - Taxonomy based data handling for cloud services	WD	10/2017	ongoing

ISO/IEC TR 22678, Information Technologies – Cloud Computing – Guidance for Policy Development	WD	04/2017	ongoing
ISO/IEC TR 23186, Information Technologies – Cloud Computing – Framework of trust for processing of multi-sourced data	WD	04/2017	ongoing
ISO/IEC TR 23187, Information technology – Cloud computing – Interacting with cloud service partners (CSNs)	WD	10/2017	ongoing
ISO/IEC TR 23188, Information technology – Cloud computing – Edge computing landscape	WD	10/2017	ongoing
ISO/IEC TS 23167, Information technology – Cloud computing – Common Technologies and Techniques	WD	12/2017	ongoing

- **ITU-T Y.3500|ISO/IEC 17788**: This Recommendation | International Standard provides an overview of cloud computing along with a set of terms, definitions and concepts. It is a terminology foundation for the cloud computing standardization work.

  This Recommendation | International Standard is applicable to all types of organization (e.g. commercial enterprises, government agencies, not-for-profit organizations).

  URI: https://www.iso.org/standard/60544.html

- **ITU-T Y.3502|ISO/IEC 17789**: This Recommendation | International Standard specifies the cloud computing reference architecture (CCRA). The reference architecture includes the cloud computing roles, cloud computing activities as well as the cloud computing functional components and their relationships.

  URI: https://www.iso.org/standard/60545.html

- **ISO/IEC 19086-1**: This document seeks to establish a set of common cloud SLA building blocks (concepts, terms, definitions, contexts) that can be used to create cloud Service Level Agreements (SLAs). This document specifies a) an overview of cloud SLAs, b) identification of the relationship between the cloud service agreement and the cloud SLA, c) concepts that can be used to build cloud SLAs, and d) terms commonly used in cloud SLAs. This document is for the benefit and use of both cloud service providers and cloud service customers. The aim is to avoid confusion and facilitate a common understanding between cloud service providers and cloud service customers. Cloud service agreements and their associated cloud SLAs vary between cloud service providers, and in some cases different cloud service customers can negotiate different contract terms with the same cloud service provider for the same cloud service. This document aims to assist cloud service customers when they compare cloud services from different cloud service providers. This document does not provide a standard structure that can be used for a cloud SLA or a standard set of cloud service level objectives (SLOs) and cloud service qualitative objectives (SQOs) that will apply to all cloud services or all cloud service providers. This approach provides flexibility for cloud service providers in tailoring their cloud SLAs to the particular characteristics of the offered cloud services. This document does not supersede any legal requirement.

  URI : https://www.iso.org/standard/67545.html

- **ISO/IEC 19086-2**: This part of ISO/IEC 19086 defines a model for specifying metrics for Cloud Service Level Agreements (SLAs) and includes applications of the model with examples. This part of ISO/IEC 19086 establishes a common terminology and approach for specifying metrics.

  This standard is for the benefit and use of both cloud service providers and cloud service customers.

  This standard is intended to complement ISO/IEC 19086-1, ISO/IEC 19086-3 and ISO/IEC 19086-4.

  This part of ISO/IEC 19086 does not mandate the use of a specific set of metrics for cloud SLAs.

  This part of ISO/IEC 19086 does not supersede any legal requirement.

  URI: https://www.iso.org/standard/67546.html

- **ISO/IEC 19086-3**: This international standard specifies: core conformance requirements for Service Level Agreements (SLA)s for cloud services for ISO/IEC 19086. This standard is for the benefit and use for providers and customers.

  This standard does not provide a standard structure that would be used for cloud SLA contracts.

  This document does not supersede any legal requirement.

  URI: https://www.iso.org/standard/67547.html

- **ISO/IEC 19086-4**: This document specifies security and protection of personally identifiable information components, SLOs and SQOs for cloud service level agreements (cloud SLA) including requirements and guidance. This document is for the benefit and use of both CSPs and CSCs.

  [Note] ISO/IEC 19086-4 is initiated in JTC 1/SC 38 and transferred to JTC 1/SC 27.

  URI: https://www.iso.org/standard/68242.html

- **ISO/IEC 19941**: This document specifies cloud computing interoperability and portability types, the relationship and interactions between these two cross-cutting aspects of cloud computing, and common terminology and concepts used to discuss interoperability and portability and particularly relating to cloud services. This document is related to other standards namely ISO/IEC 17788, ISO/IEC 17789, ISO/IEC 19086-1, ISO/IEC 19944, and in particular references the cross-cutting aspects and components identified in ISO/IEC 17788 and ISO/IEC 17789 respectively. The goal of this document is to ensure that all parties involved in cloud computing, particularly CSCs, CSPs and CSNs acting as Cloud Service Developers, have a common understanding of interoperability and portability for their specific needs. This common understanding helps to achieve interoperability and portability in cloud computing by establishing common terminology and concepts.

  URI: https://www.iso.org/standard/66639.html

- **ISO/IEC 19944**: This document extends the existing cloud computing vocabulary and reference architecture in ISO/IEC 17788 and ISO/IEC 17789 to describe an ecosystem involving devices consuming cloud services, describes the various types of data flowing within the devices and cloud computing ecosystem, describes the impact of connected devices on the data that flow within the cloud computing ecosystem, describes flows of data between cloud services, cloud service customers and cloud service users, provides foundational concepts, including a data taxonomy, identifies the categories of data that flow across the cloud service

customer devices and cloud services. This document is applicable primarily to cloud service providers, cloud service customers and cloud service 56 users, but also to any person or organization involved in legal, policy, technical or other implications of data 57 flows between devices and cloud services.

URI: https://www.iso.org/standard/66674.html

- **ISO/IEC 22123**: This document provides a consolidate set of terms and definitions extracted from the ISO/IEC cloud computing standards, including, but not limited to, ISO/IEC 17788, ISO/IEC 17789, ISO/IEC 19086, ISO/IEC 19941 and ISO/IEC 19944. In addition, relevant and stable terminology from non-cloud computing ISO sources (e.g., Information technology -- Security techniques) and external organization are also included. This document also contains terms and definitions that are not necessarily contained in other works. This document also addresses discrepancies and inconsistencies that have been identified in the consolidated terms and definitions to further enhance the usability of the ISO cloud computing terminology. This document includes additional descriptions and clarifications of cloud computing vocabulary terms, concepts, and their inter-relationships.

    URI: https://www.iso.org/standard/72627.html

- **ISO/IEC 22624**: This document:
    − describes a framework for the structured expression of data-related policies and practices in the cloud computing environment, based on the data taxonomy in ISO/IEC 19944;
    − covers expression of data-related policies and practices including, but not limited to, the following:
        • data geolocation: location of data in various jurisdictions, as it applies to data at rest;
        • cross border control of data: control of data that reside in different jurisdictions or under different sovereign control depending on their data categorization (ISO/IEC 19944), and/or classification hierarchy and data use statement structure (ISO/IEC 19944);
        • cross border flow of data: flow of data across borders and in general across various jurisdictions;
        • data portability: portability requirements of data in the cloud computing environment;
        • data classification: policies and practices which vary depending on the classification of the data;
        • data processing: processing of the data either by the CSP or by a 3rd party;
        • data management: management of the data either by the CSP or by a 3rd party;
        • data governance: governance of the data;
    − describes how the framework can be used in code(s) of conduct for practices regarding data at rest and in transit, including cross border transfer of data, as well as remote access to data;
    − provides guiding principles on application of the taxonomy for handling of data based on data subcategory and classification - including what processes are needed for data in different levels of categorization and classification;
    − provides use cases for data sovereignty challenges, i.e. control, access and location of data according to data categories just in-time elevations in data access for people in various roles (e.g., data centre operators and admins, and other roles in the cloud computing).

    This document is applicable primarily to cloud service providers, cloud service customers and cloud service users, but also to any person or organization involved in legal, policy, technical or other implications of taxonomy based data management in cloud services.
    URI: https://www.iso.org/standard/73614.html

- **ISO/IEC TR 22678**: This document provides guidance on the use of international standards as a tool in the development of those policies that govern or regulate cloud service providers (CSPs) and cloud services, and those policies and practices that govern the use of cloud services in enterprise organisations. This includes material that explains cloud computing concepts and the role of cloud computing international standards in formulating policies and practices. The document makes references to various international standards. Where possible, these standards are ISO/IEC documents. Where a suitable ISO/IEC standard is not available, references are made to documents published by other WTO-registered standards bodies. As explained in the WTO "Technical Barriers to Trade" (TBT) Agreement, standards play a vital role in supporting technical regulations and conformity assessment, however this document does not cover matters of trade.

  URI: https://www.iso.org/standard/73642.html

- **ISO/IEC TR 23186**: This document describes a framework of trust for the processing of Multi-Sourced Data that includes Data Use Obligations and Controls, Data Provenance, Chain of Custody, Security and Immutable Proof of Compliance as elements of the framework.

  URI: https://www.iso.org/standard/74844.html

- **ISO/IEC TR 23187**: This document provides an overview and discussion of interactions between Cloud service partners (CSNs), specifically cloud service brokers, cloud service developers and cloud service auditors, and other cloud service entities. In addition, the document describes how Cloud Service Agreements (CSAs) and Cloud Service Level Agreements (SLAs) should be used to address those interactions including the following:
  - Define Terms and concepts and provide an overview for interactions between Cloud service partners (CSNs) and Cloud service customers (CSCs) and Cloud service providers (CSPs)
  - Description of types of CSN interactions
  - Description of Interactions between CSNs and CSCs
  - Description of Interactions between CSNs and CSPs
  - Elements of CSAs and Cloud SLAs for CSN interactions, both with CSPs and with CSCs

  URI: https://www.iso.org/standard/74845.html

- **ISO/IEC TR 23188**: The scope of this technical report is to investigate and report on 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 report will explore 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 - for example: firmware, services, applications

  - Supporting technologies such as Containers, Serverless, Microservices

  - Networking for edge systems, including virtual networks

  - Data - data flow, data storage, data processing in edge computing

  - 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

URI: https://www.iso.org/standard/74846.html

- **ISO/IEC TR 23167**: This document describes a series of technologies and techniques commonly used to build applications and systems using cloud computing. These include:

  – Virtual Machines (VMs) and Hypervisors

  – Containers and Container Management systems

  – "Serverless" computing

  – Microservices architecture and automation

  – Platform as a Service systems and their architecture

  – Storage services

  – Security, Scalability and Networking as applied to the above cloud computing technologies

URI: https://www.iso.org/standard/74845.html

Table 15-8 – Analysis of JTC 1 SC 38 deliverables

	General, definition	Requirements Use Cases	Architecture	API, interface, profile	Data model, Format, schema	others
Fundamental	ISO/IEC 17788, ISO/IEC 22123		ISO/IEC 17789			
Cloud service category						
Security	ISO/IEC 19086-4					
Management						
Inter cloud, CSB	ISO/IEC TR 23187					
SLA, metering	ISO/IEC 19086-1	ISO/IEC 19086-3				ISO/IEC 19086-2
Testing						
Others	ISO/IEC 19941, ISO/IEC 19944		ISO/IEC 22624 ISO/IEC TR 23186			ISO/IEC TR 23188 ISO/IEC TS 23167

16 DMTF

Title of deliverable	Current status	Starting date	Target date
DSP0217, System Management Architecture for Server Hardware (SMASH) Implementation Requirements Version 2.1.0	DMTF Standard		12/2014
DSP0243, Open Virtualization Format Specification - Version 1.1.0	DMTF Standard (INCITS & ISO)		08/2015
DSP0243, Open Virtualization Format Specification - Version 2.1.1	DMTF Standard (INCITS)		08/2015
DSP0262, Cloud Auditing Data Federation (CADF) Data Format and Interface Definitions Specification Version 1.0.0	DMTF Standard		07/2014
DSP0263, Cloud Infrastructure Management Interface (CIMI) Model and REST Interface over HTTP e Version 2.0.0	DMTF Standard (ISO) [Chinese]		08/2016
DSP0264, Cloud Infrastructure Management Interface - Common Information Model (CIMI-CIM) Version 1.0.0	DMTF Standard [Chinese]		01/2013
DSP0266, Redfish Scalable Platform Management API Specification Version 1.1.0	DMTF Standard [Chinese]		01/2017
DSP0270, Redfish Host Interface Specification Version 1.0.0	DMTF Standard		01/2017
DSP8009, CIMI XML Schema	DMTF Standard		02/2014
DSP8010, Redfish Schema	DMTF Standard		01/2017
DSP8023, Open Virtualization Format XSD	DMTF Standard		01/2013

- DSP0217: The "System Management Architecture for Server Hardware (SMASH) Implementation Requirements" specifies the CIM profile implementation requirements needed to be conformant with SMASH 2.0.

  URI: http://dmtf.org/sites/default/files/standards/documents/DSP0217_2.1.0.pdf

- DSP0243: The "Open Virtualization Format (OVF) Specification" describes an open, secure, portable and extensible format for the packaging and distribution of software for execution in virtual machines across multiple virtualization platforms. This specification is recognized by INCITS (469-2010) and ISO/IEC (17203:2011)

  URI: http://dmtf.org/sites/default/files/standards/documents/DSP0243_1.1.0.pdf

  Version 2.1.1 of this document extends the format definition to support network ports, scaling at deployment time, basic placement policies, encryption of OVF packages, runtime disk sharing, advanced boot order, advanced data transfer to Guest OS, improved Internationalization - I18N, improved HASH, and CIM schema

URI: http://dmtf.org/sites/default/files/standards/documents/DSP0243_2.1.1.pdf

- **DSP0262**: The "Cloud Auditing Data Federation (CADF) Data Format and Interface Definitions Specification" document specifies a data model and associated schema definitions to format event records, logs, and reports that can be federated and are suitable for audit purposes.

  URI: http://dmtf.org/sites/default/files/standards/documents/DSP0262_1.0.0.pdf

- **DSP0263**: The "Cloud Infrastructure Management Interface (CIMI) Model and REST Interface over HTTP" specifies the model and protocol for management interactions between the provider of a cloud Infrastructure as a Service (IaaS) and a consumer of that service. The model includes machines, storage, and networks within the IaaS Provider which the IaaS consumer can perform lifecycle management.

  URI: http://dmtf.org/sites/default/files/standards/documents/DSP0263_1.0.1.pdf

- DSP0264: The "Cloud Infrastructure Management Interface - Common Information Model" specifies a CIM representation for the logical model contained in the "Cloud Infrastructure Management Interface" document (DSP0263).

  URI: http://dmtf.org/sites/default/files/standards/documents/DSP0264_1.0.0.pdf

- **DSP0266**: The "Redfish Scalable Platform Management API Specification" document specifies RESTful interface semantics to access the data defined in model format to perform out-of-band systems management. It is suitable for a wide range of servers, from stand-alone servers to rack mount and bladed environments but scales equally well for large scale cloud environments.

  URI: http://www.dmtf.org/sites/default/files/standards/documents/DSP0266_1.1.0.pdf

- **DSP0270**: The "Redfish Host Interface Specification" document specifies the functional requirements for Redfish Host Interfaces. The term "host interface" refers to interfaces that can be used by software running on a computer system to access the Redfish Service that is used to manage that computer system.

  URI: http://www.dmtf.org/sites/default/files/standards/documents/DSP0270_1.0.0.pdf

- DSP8009: The "CIMI XML Schema" contains the XML schema for representing CIMI interface. (DSP0263)

  URI: http://schemas.dmtf.org/ovf/envelope/2/dsp8009_1.0.2.xsd

- DSP8010: The "Redfish Schema' document contain the schema definitions for managing compute platforms. The schema are provided in two formats: json-schema format and OData CSDL (Common Schema Description Language) format.

  URI: http://www.dmtf.org/sites/default/files/standards/documents/DSP8010_2016.3.zip

- DSP8023: The "Open Virtualization Format XSD" contains the XML schema for representing DMTF OVF files (DSP0243)

  URI: http://schemas.dmtf.org/ovf/envelope/2/dsp8023_2.0.0.xsd

Table 16-9 – Analysis of DMTF deliverables

	General, definition	Requirements Use Cases	Architecture	API, interface, profile	Data model, Format, schema	others
Fundamental						
Cloud service category						
Security					DSP0262	
Management				DSP0217, DSP0263, DSP0264, DSP0266, DSP0270	DSP8009, DSP8010, DSP8023	
Inter cloud, CSB						
SLA, metering						
Testing						
Others						

17   TM Forum

Title of deliverable	Current status	Starting date	Target date
TMF061 Release 1.0, Service Delivery Framework (SDF) Reference Architecture, Release 1.0	Published		07/2009

- **TMF061 Release 1.0**: The SDF RA Release 1 defines the scope and characteristics of the essential elements which constitute the patterns that the SDF architecture must support.

  URI:
  http://www.tmforum.org/TechnicalSpecifications/TMF061ServiceDelivery/39341/article.html

Table 17-10 – Analysis of TM Forum deliverables

	General, definition	Requirements Use Cases	Architecture	API, interface, profile	Data model, Format, schema	others
Fundamental						
Cloud service category						
Security						
Management						

Inter cloud, CSB						
SLA, metering						
Testing						
Others			TMF061 Release 1.0			

18   ATIS

Title of deliverable	Current status	Starting date	Target date
ATIS-0200005, Cloud Framework for Telepresence Service	Published		02/2012
ATIS-0200008, Trusted Information Exchange (TIE)	Published		10/2012
ATIS-0200009, Cloud Service Lifecycle Checklist	Published		11/2012
ATIS-0200006, Virtual Desktop Requirements	Published		05/2012
ATIS-0200010, CDN Interconnection Use Cases and Requirements in a Multi-Party Federation Environment	Published		12/2012
ATIS-0200011, Multicast Delivery of Content to Mobile End User Devices	Approved		02/2014

- **ATIS-0200005**: This specification establishes a foundation for continuing ATIS work efforts on Unified Visual Communications. The specification explores a provider-agnostic and product-agnostic implementation. It will consider two primary aspects of the telepresence service. The first is use cases such as immersive telepresence that are deployed today. The second are future cases resulting from the application of the cloud and service evolution in the future.

  URI: http://www.atis.org/docstore/product.aspx?id=26079

- **ATIS-0200008**: This document describes the Trusted Information Exchange as an aggregated service and lists the high level requirements.

  URI: http://www.atis.org/docstore/product.aspx?id=26798

- **ATIS-0200009**: The Cloud Service Lifecycle checklist establishes a baseline of expectations between providers who are interoperating cloud services. The document will also be referenced in cloud service standards to provide a reference model for requirements development. Each enterprise has an existing governance model. The lifecycle checklist provides a way to extend the process model between participating companies.

  URI: http://www.atis.org/docstore/product.aspx?id=27854

- **ATIS-0200006**: This document addresses hosted virtual desktop services for medium and large enterprises. It specifies a federation framework to allow service providers to support high-performance virtual desktops beyond their normal coverage areas. The document also identifies an initial set of infrastructure-service interfaces and related requirements. This is a logical basis for the work on cloud infrastructure federation.

URI: http://www.atis.org/docstore/product.aspx?id=26147

- **ATIS-0200010**: ATIS Standard ATIS-0200003 provided initial use cases and requirements for Content Distribution Network (CDN) Interconnection between two CDN providers via Cache-based Unicast delivery method. ATIS Standard ATIS-0200004 developed use cases and requirements for content distribution via Multicast-based delivery. This standard, ATIS-0200005, extends the use cases and requirements for an environment involving multiple CDN providers joining together to form a CDN Federation. The interconnection lifecycle use cases and requirements developed in the previous two ATIS standards are re-examined for the impact arising from a federation of multiple CDN providers. Additional emphasis is placed on the interconnection domain functionality such that guidance on the eventual development of network-network interconnect (NNI) architectures and supporting protocol requirements can be derived.

URI: http://www.atis.org/docstore/product.aspx?id=27860

- **ATIS-0200011**: This document extends previous ATIS work on multicast-based content delivery methods to mobile End User devices. Three Use Cases describe potential situations where such devices can receive multicast-based broadcasts of specific live events/video content via the 3GPP Evolved Multimedia Broadcast Multicast System (eMBMS). Delivery processes, assumptions, Content Delivery Network interconnection implications, and supporting requirements are also provided.

URI: https://www.atis.org/docstore/product.aspx?id=28155

Table 18-11 – Analysis of ATIS deliverables

	General, definition	Requirements Use Cases	Architecture	API, interface, profile	Data model, Format, schema	others
Fundamental						
Cloud service category	ATIS-0200005	ATIS-0200006				
Security						
Management		ATIS-0200008				
Inter cloud, CSB						ATIS-0200009
SLA, metering						
Testing						
Others		ATIS-0200010, ATIS-0200011				

19   Broadband Forum

Title of deliverable	Current status	Starting date	Target date
TR-317, Network Enhanced Residential Gateway (NERG)	Published		06/2016
TR-328, Virtual Business Gateway	Published	09/2013	06/2017
TR-345, Broadband Network Gateway and Network Function Virtualization	Published		10/2016
WT-359, A Framework for Virtualization	Published		10/2016
TR-384, Cloud based Central Office Architectural Framework (CloudCO)	Published	09/2016	01/2018
WT-411, Functional module Interface definitions	Draft	09/2017	03/2019
WT-412, Test cases and application notes for Cloud CO system (collaborating with Open Broadband)	Draft	05/2017	05/2018
WT-413, SDN Management and Control Interfaces for CloudCO Network Functions	Draft	09/2017	05/2018
TR-416, CloudCO: Use Cases and Scenarios	Published	09/2016	05/2018

- **TR-317**: Network Enhanced Residential Gateway. Specifies the Network Enhanced Residential Gateway (NERG) architecture. NERG consists in shifting some of the functionality of a residential gateway (RG), as defined in TR-124 to the operator's network.

  URI: https://www.broadband-forum.org/technical/download/TR-317.pdf

- **TR-328**: Virtual Business Gateway. This Technical Report specifies architecture and requirements for the virtual business gateway. The virtual business gateway architecture supports the migration of functionalities running on a business gateway to the network service provider's infrastructure to enable network-based features and services. Such migration is expected to simplify the deployment and management of the network and business services.

  URI: https://www.broadband-forum.org/technical/download/TR-328.pdf

- **TR-345**: This Technical Report describes how VNFs and their supporting Network Function Virtualization Infrastructure (NFVI) can be integrated with these Broadband Forum architectures. This includes scenarios where NFVI is connected directly to a TR-101 access network and also where VNFs are deployed behind an MS-BNG as part of a service graph.

  URI: https://www.broadband-forum.org/technical/download/TR-345.pdf

- **TR-359**: A Framework for Virtualization significantly enhances the architectural modelling of the management and control of the Multi Service Broadband Network (MSBN). This document combined with TR-384 provides foundational underpinning of BBF work.

  URI: https://www.broadband-forum.org/technical/download/TR-359.pdf

- **TR-384**: Cloud-based Central Office (CloudCO) Reference Architectural Framework. Specifies is recasting of a Central Office hosting infrastructure utilizing SDN, NFV and Cloud technologies and aligned with the Forum's Open Broadband (OB) vision. CloudCO enables significantly faster & more efficient provisioning of new Cloud-based services to provide rapid

availability of new revenue generating services. Collectively the transformational nature of the CloudCO structure and defined functions facilitate choice, adaptability, migration/co-existence and implementation with Open Source to enable agility and a differentiation at the functional level.

URI: https://www.broadband-forum.org/technical/download/TR-384.pdf

- **WT-411** Definition of interfaces between Cloud CO Functional Modules. It defines the Interfaces between the Functional Modules in the Cloud CO Architectural Framework, as well as the Cloud CO Northbound API. Network Transport Protocols, the data models, schemas or APIs that are signaled across them will be defined as well. Existing Open Interface works, as described in Standards and Open Source work is being leveraged as much as possible.

- **WT-412** Test Cases for Cloud CO Applications. This work defines Test Cases for Cloud CO Applications. Cloud CO scenarios are described in Cloud CO Application Notes. The Cloud CO Application Notes will detail how a certain service is instantiated, maintained and consumed across the Cloud CO Architecture. The Test Cases will be consumed by the Open Broadband Labs, effectively validating the Cloud CO Application Note.

- **WT-413** SDN Management and Control Interfaces for CloudCO Network Functions. It primarily enables the migration from SNMP/MIB towards NETCONF/YANG interfaces and potentially other protocols to exercise not only traditional FCAPS management functions but also fine grained flow control across VNFs and PNFs network service graphs. This is an essential step towards Software Networking introduction, automation and Orchestration of PNFs and VNFs in a Cloud CO type of architecture. The development of this Working Text shall also shape the thinking on the way Cloud CO interfaces, especially for VNFs, are modelled and the opportunity to reuse/extend existing YANG work for that

- **WT-416** CloudCO Use Cases and Scenarios. This Working Text complements the CloudCO architectural framework specified in TR-384 by describing existing broadband service scenarios supported by the CloudCO architectural framework as well the Use Cases that can be established using this CloudCO architectural framework.

Table 19-12 – Analysis of Broadband Forum deliverables

	General, definition	Requirements Use Cases	Architecture	API, interface, profile	Data model, Format, schema	others
Fundamental	TR-359	TR-317, TR-328				
Cloud service category		WT-416	TR-384	WT-411		
Security						
Management				WT-413		
Inter cloud, CSB						
SLA, metering						
Testing		WT-412				

Others			TR-345			

20   Metro Ethernet Forum

Title of deliverable	Current status	Starting date	Target date
Carrier Ethernet Services for Cloud Use Cases	Working Drafts	03/2012	04/2014
Carrier Ethernet Services for Cloud Management Interface Profile	Working Drafts	03/2012	04/2014

- **Carrier Ethernet Services for Cloud Use Cases**:
    - Includes both Single and Multiple Ethernet Cloud Carrier Domain cases
    - Part1: for Cloud Provider Interconnect (CP to CP)
    - Part2: for Enterprise Access to CP

- **Carrier Ethernet Services for Cloud Management Interface Profile**:
    - Identify relevant Protocol Neutral MEF 7.x objects (and attributes)
    - Operational Use Cases and information requirements for CP to ECC management interface.
    - Focus on reconfiguration of specific Service Attributes (e.g., CIR)
    - Phase 1 approach: Changes to Service Attributes occur only when EVC/OVC is inactive or during a Maintenance Interval
    - Explore scheduled reconfiguration, and configuration durations.
    - Provide Interface Operational Requirements: Number of changes allowed over time (how long change should last); lead time for request fulfillment.
    - Describe SLSs for management interactions (performance metrics)

Table 20-13 – Analysis of Metro Ethernet Forum deliverables

	General, definition	Requirements Use Cases	Architecture	API, interface, profile	Data model, Format, schema	others
Fundamental						
Cloud service category		Carrier Ethernet Services for Cloud Use Cases				
Security						

Management				Carrier Ethernet Services for Cloud Management Interface Profile		
Inter cloud, CSB						
SLA, metering						
Testing						
Others						

Bibliography

[b-JTC 1 SC 38]   ISO/IEC Cloud Computing and Distributed Platforms' scope and study groups, https://www.iso.org/isoiec_jtc1sc38.html

[b-DMTF]   DMTF introduction, https://www.dmtf.org/about

[b-DMGF-WG]   DMTF Working Groups and Committees, https://www.dmtf.org/about/working-groups

[b-TMF]   TM Forum's vision, https://www.tmforum.org/

[b-ATIS]   Overview of ATIS, http://www.atis.org/01_about/

[b-Broadband]   Mission, Vision of broadband Forum, http://www.broadband-forum.org/about-the-broadband-forum/about-the-forum/mission-and-vision

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