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Network Functions Virtualisation (NFV); Accountability; Report on Quality Accountability Framework

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Reference

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Foreword

This Group Specification (GS) has been produced by ETSI Industry Specification Group (ISG) Network Functions Virtualisation (NFV).

The present document deals with specific aspects of Service Quality Accountability in the context of Network Function Virtualisation.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Introduction

The NFV Quality Accountability Framework supports the quality management principles of customer focus ([i.7] principle **0.2.a**), mutually beneficial supplier relationships ([i.7] principle **0.2.h**) and factual approach to decision making ([i.7] principle **0.2.g**) to enable continual improvement ([i.7] principle **0.2.f**). Clearly defining roles, responsibilities and demarcations is a quality management best practice because it clarifies accountabilities which permit any quality impairments to be rapidly localized, root causes to be identified and appropriate corrective actions to be agreed to promptly restore service and drive continuous quality improvement. This informative document defines key roles including NFV cloud service customer, provider(s) of NFV management, orchestration and/or infrastructure services, and their VNF suppliers and Integrators. The document lays out the responsibilities for each role based on both extrapolating traditional responsibilities and considering responsibilities for each of the six essential characteristics of cloud computing. As objective and quantitative measurement is necessary to enable methodical quality assurance and management, the present document offers a quality measurement framework that connects standard metrics and measurements with roles, and an annex that offers sample service quality SLAs for a cloud service customer. A second annex offers use case scenarios illustrating how the quality accountability framework applies to several quality impairment scenarios.

This framework uses principles of ISO/IEC 17788 "Cloud computing -- Overview and vocabulary" [i.1] and ISO/IEC 17789 "Cloud Computing - Reference Architecture" [i.2] to the ETSI NFV architecture [i.12] to enable quality measurements consistent with both "TL 9000 Quality Management System Measurements Handbook" and "Network Functions Virtualisation (NFV); Service Quality Metrics" and SLA management consistent with TM Forum's "SLA Management Guidebook" and "Enabling End-to-End Cloud SLA Management."

1 Scope

The present document describes a quality accountability framework for NFV. This release focuses on service quality management of network services, VNFs, NFV infrastructure, management and orchestration elements.

The present document describes the following aspects of the Quality Accountability Framework:

1) **Roles**, covered in clause 4 *Roles in the NFV Ecosystem*.

2) **Responsibilities**, covered in clauses 5 *Responsibilities by Role* and 6 *Responsibilities for Key Cloud Characteristics*.

3) **Service quality measurements and demarcation points,** covered in clause 7 *Quality Measurement Framework*.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

Not applicable.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ISO/IEC 17788 (First edition) (2014-10-15): "Information technology -- Cloud computing -- Overview and vocabulary".

NOTE: Available at http://standards.iso.org/ittf/PubliclyAvailableStandards/c060544_ISO_IEC_17788_2014.zip.

[i.2] ISO/IEC 17789 (First edition) (2014-10-15): "Information Technology -- Cloud Computing -- Reference Architecture".

NOTE: http://standards.iso.org/ittf/PubliclyAvailableStandards/c060545_ISO_IEC_17789_2014.zip.

[i.3] TM Forum, TR 178 (V2.0.2) (October 2014): "Enabling End-to-End Cloud SLA Management", Framework Release 14.

NOTE: https://www.tmforum.org/resources/technical-report-best-practice/tr178-enabling-end-to-end-cloud-sla-management-v2-0-2/.

[i.4] TM Forum Guidebook GB917 (July 2012): "SLA Management Guidebook, Release 3.1".

NOTE: https://www.tmforum.org/resources/standard/gb917-sla-management-handbook-release-3-1/.

[i.5] QuestForum (Release 5.0, July 2012): "TL 9000 Measurements Handbook".

NOTE: Available at http://www.tl9000.org/handbooks/measurements_handbook.html.

[i.6] ETSI GS NFV-INF 010 (V1.1.1) (12-2014): "Network Functions Virtualisation (NFV); Service Quality Metrics".

[i.7] ISO 9000 (Third Edition) (September 2005): "Quality Management Systems - Fundamentals and Vocabulary".

[i.8] "Quality Measurement of Automated Lifecycle Management Actions", 1.0, August 18th, 2015, QuEST Forum.

NOTE: http://www.tl9000.org/resources/documents/QuEST_Forum_ALMA_Quality_Measurement_150819.pdf.

[i.9] ETSI GS NFV-MAN 001 (V1.1.1) (12-2014): "Network Functions Virtualisation (NFV); Management and Orchestration".

[i.10] ETSI GS NFV 003 (V1.2.1) (12-2014): "Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV".

[i.11] ETSI GS NFV-REL 004 (09-2015): "Network Functions Virtualisation (NFV); Active monitoring & failure detection report".

[i.12] ETSI GS NFV 002 (V1.2.1) (12-2014): "Network Functions Virtualisation (NFV); Architectural Framework".

[i.13] ISO 9001:2015: "Quality management systems -- Requirements".

[i.14] ISO 14001:2015: "Environmental management systems -- Requirements with guidance for use".

[i.15] ISO 27729:2012: "Information and documentation -- International standard name identifier (ISNI)".

[i.16] ISO/IEC 27001:2013: "Information technology -- Security techniques -- Information security management systems -- Requirements".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI GS NFV 003 [i.10] and the following apply:

audit: systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which audit criteria are fulfilled

NOTE 1: Internal audits, sometimes called first-party audits, are conducted by, or on behalf of, the organization itself for management review and other internal purposes, and may form the basis for an organization's declaration of conformity. In many cases, particularly in smaller organizations, independence can be demonstrated by the freedom from responsibility for the activity being audited.

NOTE 2: External audits include those generally termed second- and third-party audits. Second-party audits are conducted by parties having an interest in the organization, such as customers, or by other persons on their behalf. Third-party audits are conducted by external, independent auditing organizations, such as those providing certification/registration of conformity to ISO 9001 [i.13] or ISO 14001 [i.14].

NOTE 3: This definition is from [i.7], clause 3.9.1.

cloud auditor: cloud service partner with the responsibility to conduct an audit of the provision and use of cloud services

NOTE: This definition is from [i.1], clause 3.2.3.

cloud computing: 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

NOTE 1: Examples of resources include servers, operating systems, networks, software, applications, and storage equipment.

NOTE 2: This definition is from [i.1], clause 3.2.5.

cloud service: one or more capabilities offered via cloud computing invoked using a defined interface

NOTE: This definition is from [i.1], clause 3.2.8.

cloud service broker: cloud service partner that negotiates relationships between cloud service customers and cloud service providers

NOTE: This definition is from [i.1], clause 3.2.9.

cloud service customer: party which is in a business relationship for the purpose of using cloud service

NOTE1: A business relationship does not necessarily imply financial agreements.

NOTE 2: This definition is from [i.1], clause 3.2.11.

cloud service developer: sub-role of cloud service partner which is responsible for designing, developing, testing and maintaining the implementation of a cloud service

NOTE 1: This can involve composing the service implementation from existing service implementations.

NOTE 2: This definition is from [i.2], clause 8.4.1.1.

cloud service partner: party which is engaged in support of, or auxiliary to, activities of either the cloud service provider or the cloud service customer, or both

NOTE: This definition is from [i.1], clause 3.2.14.

cloud service product: cloud service, allied to the set of business terms under which the cloud service is offered

NOTE 1: Business terms can include pricing, rating and service levels.

NOTE 2: This definition is from [i.2], clause 3.2.2.

cloud service provider: party which makes cloud services available

NOTE: This definition is from [i.1], clause 3.2.15.

cloud service user: natural person, or entity acting on their behalf, associated with a cloud service customer that uses cloud services

NOTE 1: Examples of such entities include devices and applications.

NOTE 2: This definition is from [i.1], clause 3.2.17.

functional component: functional building block needed to engage in an activity, backed by an implementation

NOTE: This definition is from [i.2], clause 3.2.3.

party: natural person or legal person, whether or not incorporated, or a group of either

NOTE 1: This definition is from [i.1], clause 3.1.6 and was preceded by "*The following term is defined in ISO 27729*".

NOTE 2: The term *domain* used in [i.10] is not necessarily synonymous with party in that the perimeter of a particular domain is not required to be identical to the accountability perimeter of a particular party. For example, [i.9] states "*Administrative Domains can be mapped to different organizations and therefore can exist within a single service provider or distributed among several service providers*", which is consistent with "*Administrative Domains can be mapped to different organizations and therefore can exist within a single **party** or distributed among **several parties***."

private cloud: cloud deployment model where cloud services are used exclusively by a single cloud service customer and resources are controlled by that cloud service customer

NOTE: This definition is from [i.1], clause 3.2.32.

product category: recognized grouping of products for calculating TL 9000 measurements

NOTE: This definition is from the glossary of [i.5].

public cloud: cloud deployment model where cloud services are potentially available to any cloud service customer and resources are controlled by the cloud service provider

NOTE: This definition is from [i.1], clause 3.2.33.

quality: degree to which a set of inherent characteristics fulfils requirements

NOTE 1: The term "quality" can be used with adjectives such as poor, good or excellent.

NOTE 2: "Inherent", as opposed to "assigned", means existing in something, especially as a permanent characteristic.

NOTE 3: This definition is from [i.7], clause 3.1.1.

Service Level Agreement (SLA): element of a formal, negotiated commercial contract between two Organizations, i.e. one with a Service Provider (SP) Role and one a Customer Role

NOTE 1: It documents the common understanding of all aspects of the Product and the roles and responsibilities of both Organizations from product ordering to termination.

NOTE 2: This definition is from [i.3].

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

BRR	Basic Return Rate
CSC	Cloud Service Customer
CSP	Cloud Service Provider
CSP:NP	Cloud Service Provider:Network Provider
DOA	Dead On Arrival
DPM	Defects Per Million
EM	Element Manager
EPC	Evolved Packet Core
EPO	Emergency Power Off
ERI	Early Return Index
ESD	Electro-Static Discharge
FCAPS	Fault Configuration Accounting Performance Security
FRT	Fix Response Time
IP	Internet Protocol
IP-TV	Internet Protocol Television
KQI	Key Quality Indicator
LTR	Long-term Return Rate
MANO	Management and Orchestration
MOP	Method of Procedure
NFV	Network Function Virtualisation
NFVI	NFV Infrastructure
NFVO	NFV Orchestrator
NPR	Number of Problem Reports

OFR	Overdue Fix Responsiveness
OSS	Operation Support System
OTD	On Time Delivery
OTS	On-Time Service delivery
PNF	Physical Network Function
RTP	Real-Time Protocol
SFQ	Software Fix Quality
SLA	Service Level Agreement
SO	Service Outage
SONE	Network Element Impact Outage
SP	Service Provider
SPR	Software Problem Report
SQ	Service Quality
SSO	Support Service caused Outages
VIM	Virtual Infrastructure Management
VM	Virtual Machine
VN	Virtual Network
VNF	Virtualised Network Function
VNFC	Virtualised Network Function Component
VNFM	VNF Manager
VoLTE	Voice over Long Term Evolution
YRR	one-Year Return Rate

4 Roles in the NFV Ecosystem

4.1 NFV Service Delivery Relationships

In the present document, an NFV cloud service customer is defined as a party having business relationships for using NFV infrastructure, management and orchestration services [i.9]. Figure 1 illustrates an example of an application service delivery relationship of an NFV cloud service customer following the customer/provider style of [i.3] and using roles from [i.1] and [i.2]. Figure 1 shows NFV Infrastructure, NFV management and orchestration and Functional component offered as a service being provided by a single cloud service provider (CSP) organization, but different organizational arrangement are also considered in the present document. Each of the cloud service customer's providers/suppliers (e.g. NFV infrastructure cloud service provider) may be customers of other suppliers; for example, a cloud service provider who offers NFV infrastructure-as-a-service to NFV cloud service customers (i.e. an NFV Infrastructure cloud service provider is a customer of suppliers of physical compute, networking and storage hardware, various software products and so on).

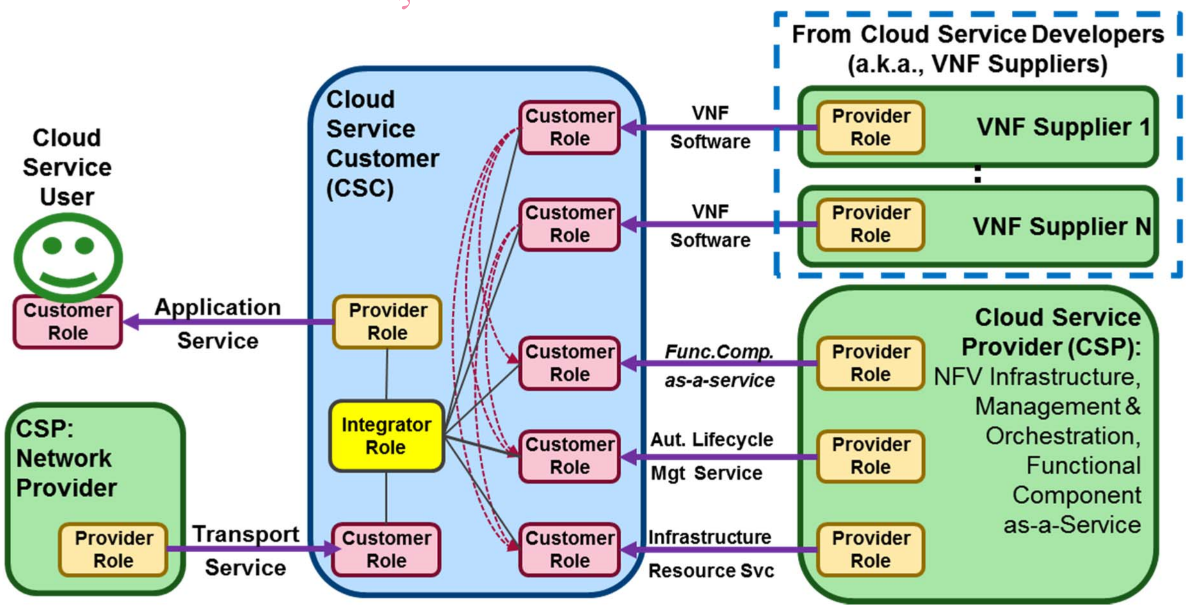


Figure 1: Example of an NFV Service Delivery Relationship for Cloud Service Customer

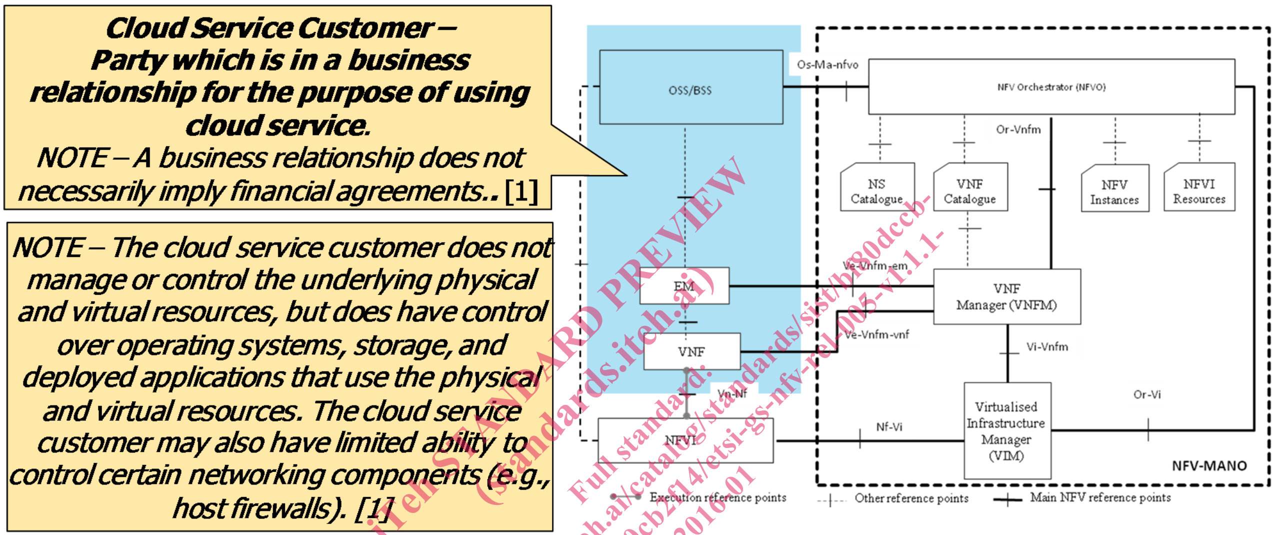
4.2 Role: Cloud Service User

Cloud Service Users are defined by [i.1] as the end users, or applications operating on their behalf, who use cloud services. In the context of NFV, a cloud service user refers to a natural person, or system/device acting on their behalf, that consumes services offered by a cloud service provider. For example, a cloud service user utilizes their smartphone to consume services Voice-over-LTE offered by an NFV cloud service customer.

4.3 Role: Cloud Service Customer

As shown in Figure 2**, Cloud Service Customer** (CSC) is a role that is responsible for operation of a network services for cloud service users to consume. In the context of NFV, a cloud service customer might operate a VNF-based network service like Voice-over-LTE, IP-TV or an evolved packet core that serves cloud service (a.k.a. end) users.

NOTE 1: In the context of TM Forum, a cloud service customer might be a provider of a digital service.



Cloud Service Customer – Party which is in a business relationship for the purpose of using cloud service. NOTE – A business relationship does not necessarily imply financial agreements.. [1]
NOTE – The cloud service customer does not manage or control the underlying physical and virtual resources, but does have control over operating systems, storage, and deployed applications that use the physical and virtual resources. The cloud service customer may also have limited ability to control certain networking components (e.g., host firewalls). [1]
OSS/BSS
Os-Ma-nfvo
NFV Orchestrator (NFVO)
Or-Vnfm
NS Catalogue
VNF Catalogue
NFV Instances
NFVI Resources
Ve-Vnfm-em
EM
VNF Manager (VNFM)
Ve-Vnfm-vnf
VNF
Vi-Vnfm
Vn-Nf
Or-Vi
NFVI
Nf-Vi
Virtualised Infrastructure Manager (VIM)
NFV-MANO
Execution reference points
Other reference points
Main NFV reference points

Figure 2: Cloud Service Customer Role in NFV

Figure 3 illustrates the practical implications of multi-tenancy in NFV: multiple (ISO-IEC 17788) **Cloud Service Customer** organizations are likely to share a public or private NFV infrastructure, management and orchestration cloud which enables each cloud service customer to efficiently offer VNF-based network services like VoLTE, EPC and IP-TV to their respective end users. A single public or private (ISO-IEC 17788) **Cloud Service Provider** organization offers NFV infrastructure, management and orchestration services to all of these cloud service customers.

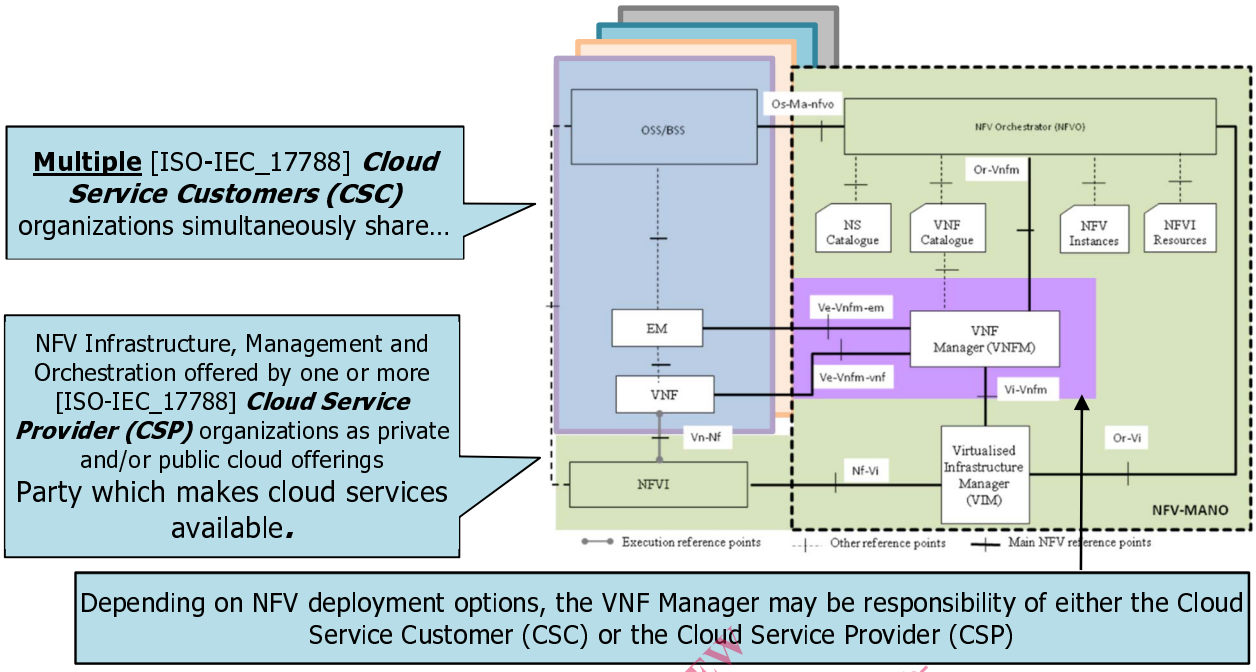


Figure 3: Multi-Tenancy in NFV

NOTE 2: This figure is illustrative and the position of the VNF Manager within the MANO scope is only one of the implementation options explored by the ETSI NFV IFA Working Group.

4.4 Role: Cloud Service Provider

As shown in Figure 4**, Cloud Service Provider** (CSP) is broadly defined by [i.1] as a "*Party which makes cloud services available*". In the context of NFV one or more cloud service provider organizations will offer infrastructure, management and orchestration services to cloud service customers, in order to host instances of VNFs that support cloud service customers' users. Cloud service provider organizations may also offer services like load balancing via functional component as-a-Service offerings.

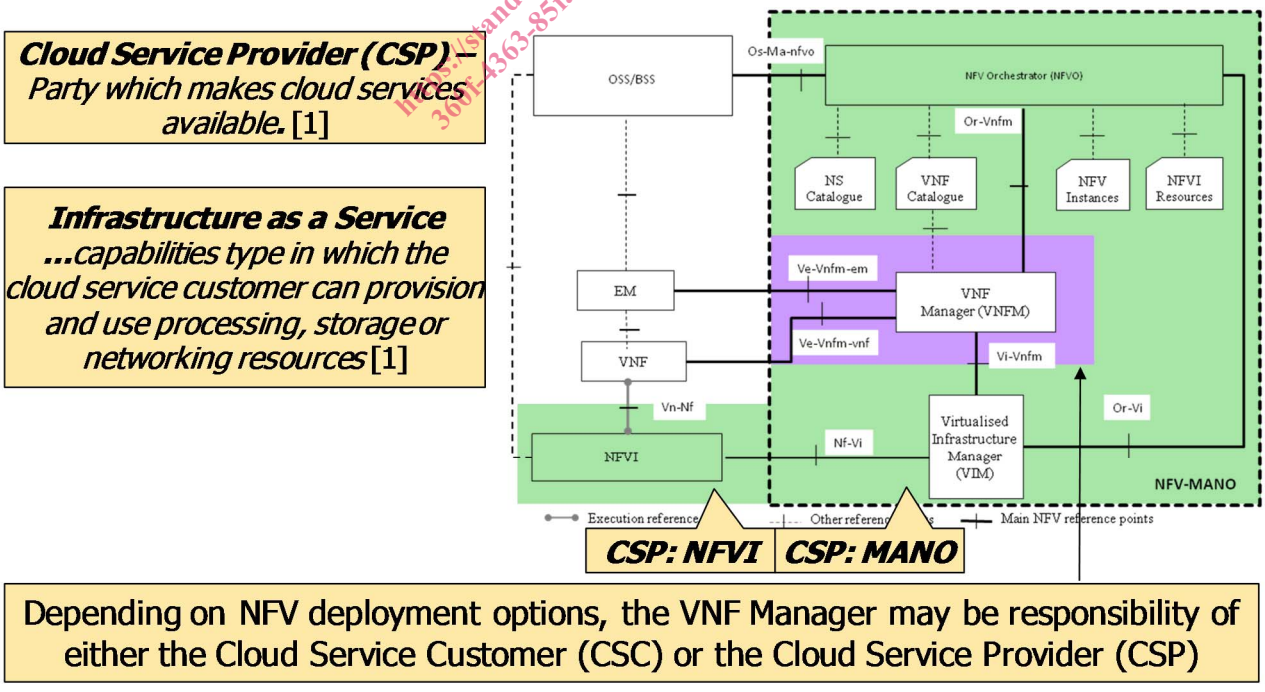


Figure 4: Cloud Service Provider Role in NFV

NOTE 1: This figure is illustrative and the position of the VNF Manager within the MANO scope is only one of the implementation options explored by the ETSI NFV IFA Working Group.