



GROUP REPORT

Network Function Virtualisation (NFV) Release 3; Charging; Report on Usage Metering and Charging Use Cases and Architectural Study

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Foreword

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

Modal verbs terminology

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1 Scope

The present document studies use cases and charging triggers for usage metering of virtualised resources. It proposes new functional blocks for:

- 1) the collection and provision of accounting information; and
- 2) the triggering of charging requests.

The interfaces (and information flows) between the proposed functional blocks and the current NFV Architectural Framework are part of the study.

The following models have been taken into account: Infrastructure as a Service (IaaS), and VNF as a Service (VNFaaS).

The present document includes recommendations to either modify existing or new specifications, or both.

While management and orchestration event charging for VNFaaS is part of the present work, usage event charging for VNFaaS is for further study.

2 References

2.1 Normative references

Normative references are not applicable in the present document.

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] | ETSI GS NFV 003: "Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV". |
| [i.2] | TM Forum GB989 Impact of SDN/NFV on Charging and Billing R15.5.1 Standard. |

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.1] and the following apply:

resource monitor: agent within the resource that monitors resource usage and reports to Charging Function

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI GS NFV 003 [i.1] and the following apply:

BSS	Business Support Systems
CDR	Call Detail Record
CPU	Central Processing Unit
CTP	Charging Triggering Point
CTQ	Charging Quota Tracker
IaaS	Infrastructure as a Service
MANO	Management and Orchestration
MNO	Mobile Network Operator
MVNO	Mobile Virtual Network Operator
OSS	Operations Support Systems
QT	Quota Tracker
SaaS	Software as a Service
VIM	Virtualised Infrastructure Manager

4 Charging Concepts in NFV

4.1 High Level Expectations

The high-level expectations for usage metering and charging in NFV are:

- to provide charging information for all charges incurred and requiring settlement between the different roles (e.g. NFV Infrastructure Provider, VNF Provider, VNF Service Provider, Consumer, etc.);
- to produce sufficient charging information to allow for the following:
 - revenue assurance on NFV resource usage;
 - fraud detection and mitigation;
 - itemized billing for all NFV resource usage by the charged party;
 - cost control of NFV resource usage by the charged party;
 - to support for a charged party to prepay for NFV resources;
- to support NFV management and orchestration lifecycle events to be mapped to chargeable events;
- to provide real-time usage information.

4.2 Resources in NFV

Below is a list of resources (see clause 3.1 for definitions) that are deemed to be of value for users and operators, and thus chargeable for consumption of those resources. Hardware resources are not taken into consideration in this clause.

- **Virtualisation Layer**
- **Virtualisation Container**
- **Virtualised Resources:**
 - Virtualised CPU including processor and memory
 - Virtualised Storage including volumes of storage at either block or file-system level
 - Virtual Network including networks, subnets, ports, addresses, links and forwarding rules, for the purpose of ensuring intra- and inter-VNF connectivity

- **Virtualised Accelerator:** An accelerator is a software or hardware component (as stated above hardware resources are not taken into consideration) intended to improve the NFVI performance or to enable VNFs to offload some portion of their processing
- **VNF Instance:** A VNF is considered as a composite resource consisting of a number of Virtualised Compute, Virtual Network and Virtualised Storage resources
- **Network Service Instance**

The list of resources and corresponding functional blocks that provide information on resource consumption is presented in table 1.

Table 1: Mapping resources to functional blocks

Resources in NFV	Functional Block
Virtualisation Layer	VIM
Virtualisation Container	VIM
Virtual Resources	VIM
Virtualised Accelerators	VIM
VNF Instance	NFVO/VNFM
Network Service Instance	NFVO

4.3 Chargeable Events

4.3.0 Introduction

Chargeable events are those events that provide Charging and Billing functions with information for rating and billing purposes. Information can be related to usage of resources or management tasks, such as reservation, instantiation, scaling, and termination of virtual resources (see clause 4.1).

Therefore, chargeable events can be classified into these two categories:

- Usage Events
- Management and Orchestration Events

4.3.1 Usage Events

In the perspective of NFV MANO Usage Events are those events which provide usage information of NFV resources (as defined in clause 4.2) in volume/duration or combination of both. For example, a usage event representing the *"Peak or average number of CPU cores used in the last one hour duration by a running VNF instance"*.

4.3.2 Management and Orchestration Events

"Management and Orchestration" event is a unique action performed by NFV MANO through one or more function or API calls to achieve the desired output such as (not a complete list):

- Create/Delete VNF Instance
- Create/Delete Virtualisation Container
- Scale VNF Instance
- Create/Delete Network Service Instance

4.4 Charging Scenarios

The charging scenarios that are relevant to real-time charging of chargeable items:

- Event based charging model is applicable for management and orchestration events and involves an immediate charging action in a single charge request:
 - In this charging scenario, the chargeable item is immediately charged in a single transaction. For example, instantiation of a VNF.
- Continuous based charging model is applicable for resource consumption and will be based on sessions: In this charging method, the consumption of data traffic (or CPU time or storage) by virtual resources is the chargeable item. So examples are volume and the length of time. Continuous charging starts when a resource consumption begins, for example, at the start of data transfer and ends on resource termination or lack of funds/credit limit for consumption. Continuous charging flow involves an initial quota request, followed by one or more intermediate quota requests, and finally followed by a stop charging request.

5 Use Cases for Usage Metering and Charging Triggers

5.1 General

Table 2 summarizes the two use cases described in this clause for charging triggers.

Table 2: Summary of Use Cases

Use Case #	Use Case Name
1	Charging for NFV Infrastructure as a Service
2	Charging for VNF as a Service

Each use case is described using the following items:

- Motivation
- Summary
- Pre-Condition
- Begins When
- Description
- End When
- Post-Condition
- Exception

5.2 Actors, Roles and Domains

5.2.0 introduction

This item introduces the concepts of actors, roles and domains used in the use cases description.

Table 3 provides the list of Actors that have been identified.

Table 3: Definition of Actors

Actor	Definition
NFV Infrastructure Provider	The entity that owns the infrastructure and provides infrastructure as a service
NFV Infrastructure Consumer	The user of Infrastructure as a Service
VNF Provider	The entity that sells VNF Software
VNF Service Provider	The entity that offers VNF as a service to an End User
VNF Consumer	The user of VNF as a service
Consumer	The user of the service offered
Mobile Network Operator	The entity that provides hosted VNFs to its MVNO customers

5.2.1 Actors and Business Relationships

Many actors are involved in the end-to-end service delivery within an NFV framework.

Aligned with the TM Forum proposal (TMF GB989) [i.2] and through an example, the possible actors and their business relationships are highlighted.

The example considered in the present document is of an intelligent lighting system for the streets of a city. The system consists of connected street lights and ensures energy efficiency by offering optimal light intensity. It also reduces maintenance cost by remotely monitoring street lights.

This light system is offered **as a service** by a Lighting Service Provider (the company that provides intelligent lighting system) to the city authority (the consumer of the service).

The Lighting Service Provider connects all the lights with a dedicated virtual packet core network provided **as a service** by a Network Service Provider in this example an MVNO. The virtual packet core network consists of multiple VNFs (for example: vMME and vP-GW) provided as a service by a VNF Service Provider in this example a telecom operator (MNO).

In this example, the VNF Software Provider (the software vendor) sells the VNF Software (needed for vP-GW and vMME) to VNF Software users such as the telecom operator.

Finally, the telecom operator uses the virtual resources of a third party NFV Infrastructure for the deployment and running of the VNF Software. The NFV Infrastructure Provider is a company that provides the resources, as a service, to NFV Infrastructure Consumers. In this case, the telecom operator is the Infrastructure Consumer.

A graphical representation of the above example is given in figure 1. The arrow pointing up indicates the direction of the service that is being provided by the entity in the box below. For example, in the Lighting Service Provider box, a data network connecting lights is consumed as a service by the Lighting Service Provider.

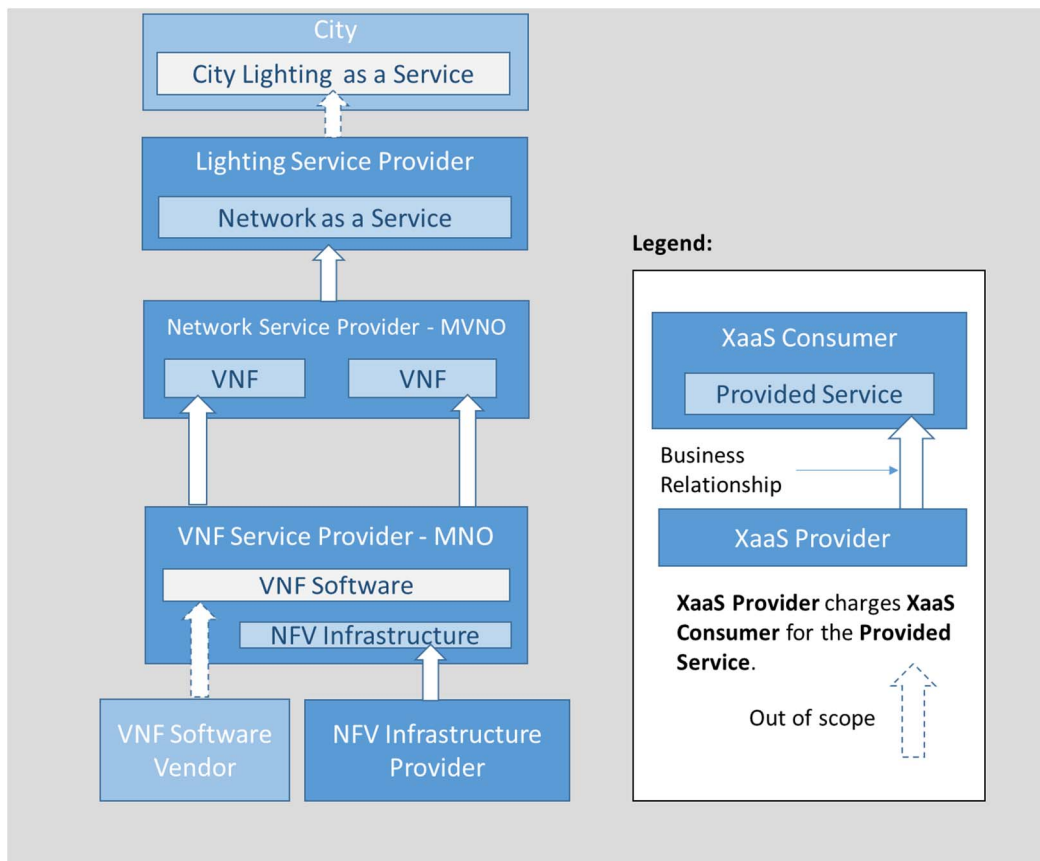


Figure 1: Illustration of Actors and Business Relationships

5.3 Use Case #1: Charging for NFV Infrastructure as a Service

5.3.1 Actors

The actors related to this use case are:

- NFV Infrastructure Provider
- NFV Infrastructure Consumer

5.3.2 Motivation

IaaS provides a lot of flexibility and cost reduction when compared to the capex model of the traditional data center.

5.3.3 Summary

This use case enables a cost-effective model to offer cloud resources and charge for the usage of resources in real-time.

In this use case:

- The NFV Infrastructure provider and consumer have a Business to Business relationship.
- The NFV Infrastructure provider offers virtual resources (see clause 4.2) as a service to an NFV Infrastructure consumer.
- The NFV Infrastructure provider charges the NFV Infrastructure consumer for the usage of NFV Infrastructure resources. This charging can be performed offline or online. Billing operations as well as low balance notifications, balance recharge and top-up are outside the scope of the present document.

5.3.4 Pre-Condition

The following pre-conditions apply for this use case:

- NFVI provider and consumer have an agreement in place for a consumption based charging model.
- If credit/cost control is required then a credit limit/threshold is established.

5.3.5 Begins When

The use case begins when the consumer places an order for virtual resources from the IaaS provider. This triggers the instantiation of the virtual resources by the IaaS Provider. The IaaS provider utilizes its NFV MANO functionality to instantiate the services.

5.3.6 Description

Off-line charging:

This flow assumes that the consumer of the NFV Infrastructure is charged offline. This means that the consumer receives a bill at the end of a contractually-defined billing cycle that will trigger the payment. Billing and payment of the usage is outside the scope of the present document. Figure 2 is a simplified sequence of offline charging information flows that shows collection of management and usage events:

- 1) Events are generated for resource usage (usage events) and resource lifecycle operation (management events).
- 2) Resource monitor periodically (Reporting period) reports Usage Data Records and Management Data Records that summarize respectively Usage and Management events).
- 3) Data Records are communicated to Offline Charging Data Collection for aggregation and correlation. Data Records may need to be enriched with additional information such as correlation IDs (or be rated and have a cost added at this stage) required for further billing processing.
- 4) Billing uses the aggregated/correlated event records to charge the consumer at the end of the billing cycle.
- 5) If the dunning process NFV Infrastructure provider indicates that the resource is suspended, a request from their BSS is sent to their order management system to suspend the resource.

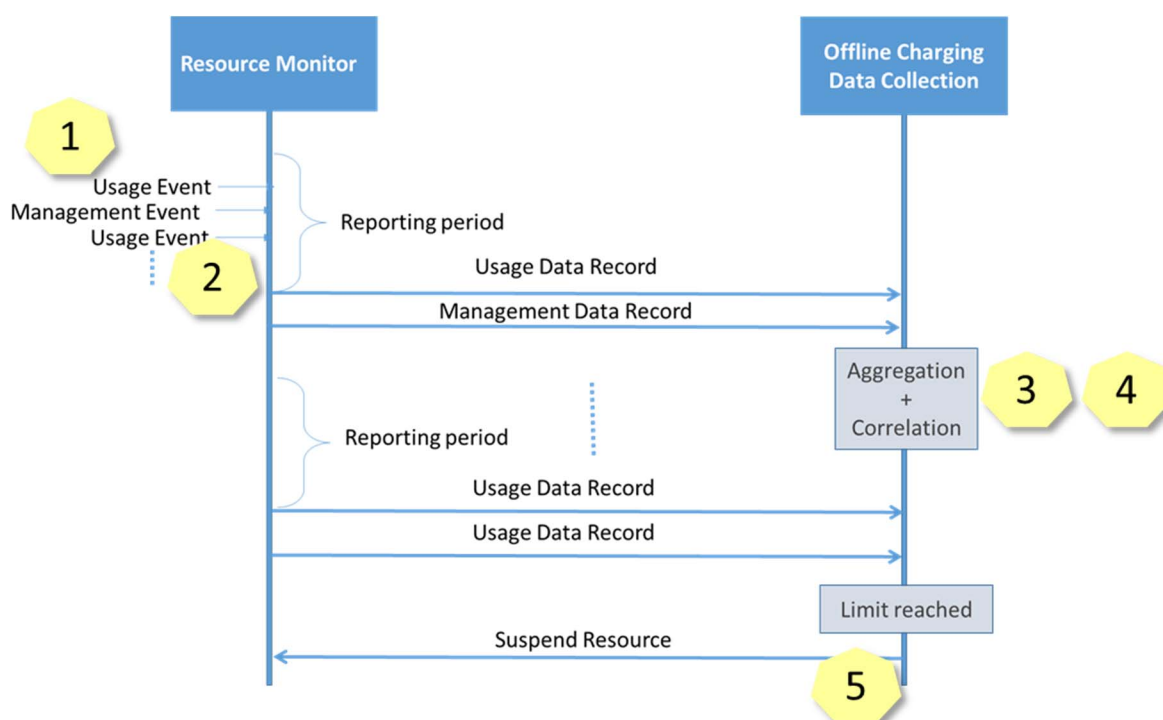


Figure 2: Usage and Management Data Collection for Offline Charging

On-line charging:

This flow assumes that the consumer of the NFV Infrastructure has a balance allocated to the usage of the NFV Infrastructure. Figure 3 is a simplified sequence of online charging interactions:

- 1) Upon first event of resource usage, the entity that controls the resource and monitors the quota (Quota Monitor) triggers an online charging request towards charging function in the BSS domain of the NFV Infrastructure provider.
- 2) Charging identifies the user of the resource and, in response, sends back a granted quota for consumption.
- 3) The same entity supervises the resource for the granted quota consumption. When the allocated quota is almost fully used (configurable threshold % used), the entity reports the usage of the resource and requests for additional quota from the online charging function.
- 4) The charging function may allocate a new quota (back to step 2 and step 3).
- 5) Or deny as there are no funds in the balance. In case of denial the supervising entity at the Charging Trigger Point suspends the resource.

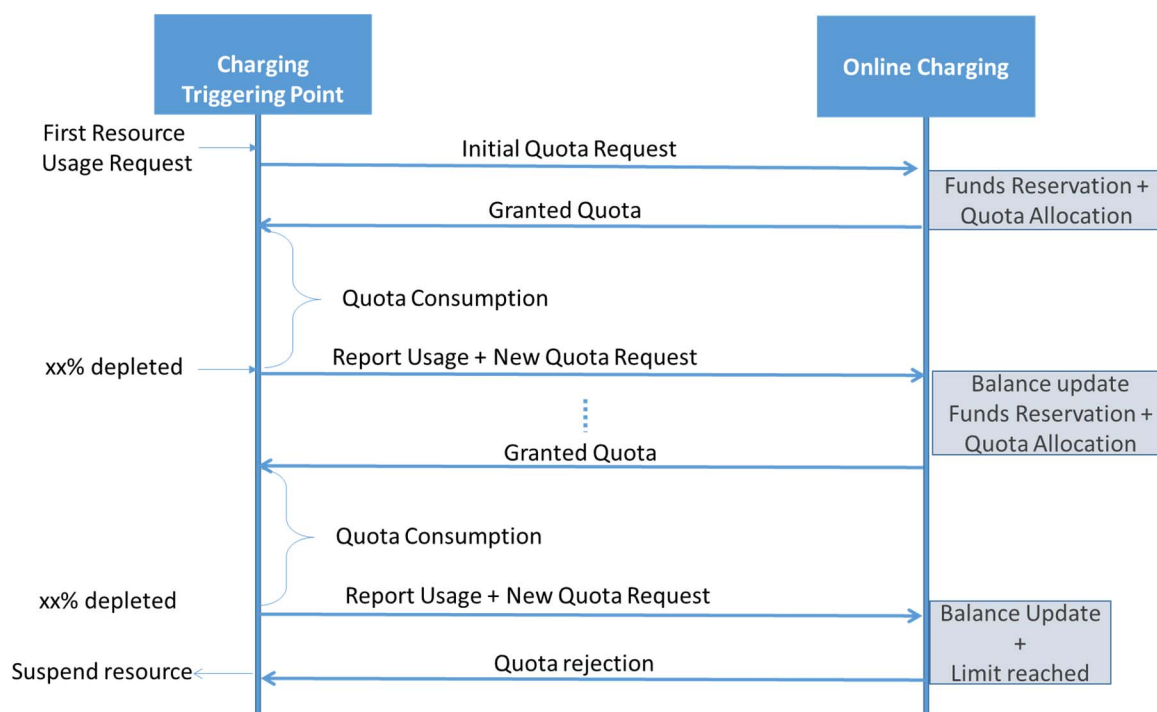


Figure 3: Online Charging flow for NFV Infrastructure as a Service

5.3.7 Ends When

The use case ends when the consumer terminates the use of virtual resources.

5.3.8 Post-Conditions

The balance of the NFV Infrastructure Consumer decremented to reflect the virtual resources they have consumed.

5.3.9 Exceptions

None.

5.4 Use Case #2: Charge For VNF as a Service

5.4.1 Actors

The actors related to this use case are:

- VNF Service Provider. There are possibilities for several actors to assume this role in an NFV environment e.g.:
 - A Mobile Network Operator providing VNFs to its MVNO customers as illustrated in figure 1.
 - A VNF Software Provider employing a SaaS delivery model.
- VNF Consumer e.g. a Network Service Provider consuming the services of a VNF.

5.4.2 Motivation

Traditionally the process of obtaining and deploying a network function had previously been a costly one with relatively long time to accrue benefits. For someone requiring a VNF, employing a VNF as a service approach has potential benefits such as:

- Reduced costs - pay-as-you-go models allow VNF customers to pay for only what they are using and not pay heavily for un-used licensing.
- Reduced installation/deployment times.
- Easier scaling.
- Easier upgrading.

5.4.3 Summary

Operators are looking to adopt consumption based charging models for the network functions that they deploy in their environments. This use case enables VNF Service Providers to charge VNF consumers for VNF instances on a pay-as-you-go basis.

5.4.4 Pre-Conditions

The following pre-conditions apply for this use case:

- The VNF Consumer and VNF Service Provider have a contractual (including payment schedule) agreement in place for the supply of VNFs to meet the needs of the network service based upon a consumption based charging model.
- At least one of the VNF Consumer network services requires specified network functionality that is available as a service from the VNF Provider.
- The VNF Service Provider has on-boarded the VNF (the VNF Service Provider may need to obtain a software license for the VNF to be offered as service).
- If credit/cost control is required then a credit limit/threshold is established.

5.4.5 Begins When

The use case begins when the VNF Consumer utilizes its NFV MANO functionality to instantiate the network service. This triggers the instantiation of the VNF by the VNF Service Provider.

5.4.6 Description

The use case is composed of the following steps.

Offline Charging:

- 1) The VNF instance resource monitor periodically creates chargeable event records capturing the charging information of the VNF instance for a VNF Consumer based on agreed metrics.
- 2) The VNF chargeable event records are collected and delivered to the VNF Service Provider's BSS. The VNF Service Provider's BSS may perform additional aggregation and correlation of the chargeable event records.
- 3) The next reporting cycle elapses. Based on agreed payment schedule the VNF Consumer settles with the VNF Service Provider for the usage metered by the instantiated VNF instances. Settlement procedures are outside the scope of the present document.

The next reporting cycle elapses and the VNF instance resource monitor creates chargeable event records as per step 1. This continues for the lifetime of the VNF instance.

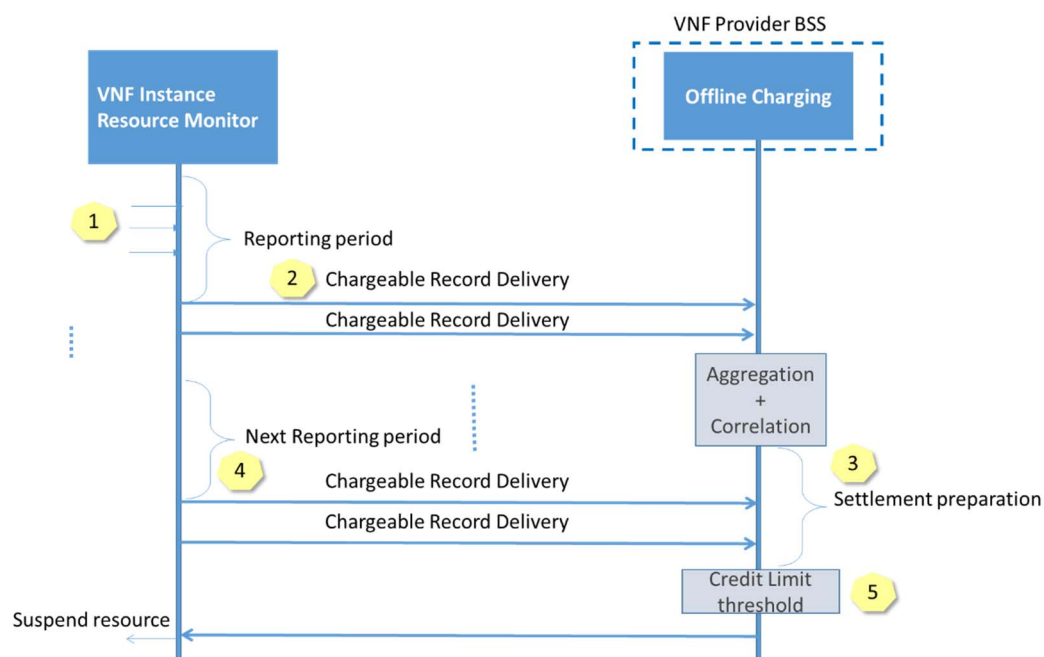


Figure 4: Offline Charging Flow for VNF as a Service

Online Charging:

- 1) A Management and Orchestration Event detected by the VNF Service Provider's CTP causes a charging request to be sent to the VNF Service Provider's online charging system.
- 2) The VNF Service Provider's online charging system determines the cost of fulfilling the request and if there are sufficient available to service the request. In this instance there are sufficient funds so the balance is updated and a response message accepting the charges is sent.
- 3) The CTP reports that charging approval has been received.
- 4) Another Management and Orchestration Event detected by the CTP causes a charging request to be sent to the VNF Service Provider's online charging system.
- 5) The VNF Service Provider's online charging system determines the cost of fulfilling the request and if there are sufficient available to service the request. In this instance there are not sufficient funds available and a response message rejecting the requested resources is sent.
- 6) The CTP reports that charging approval has not been received.

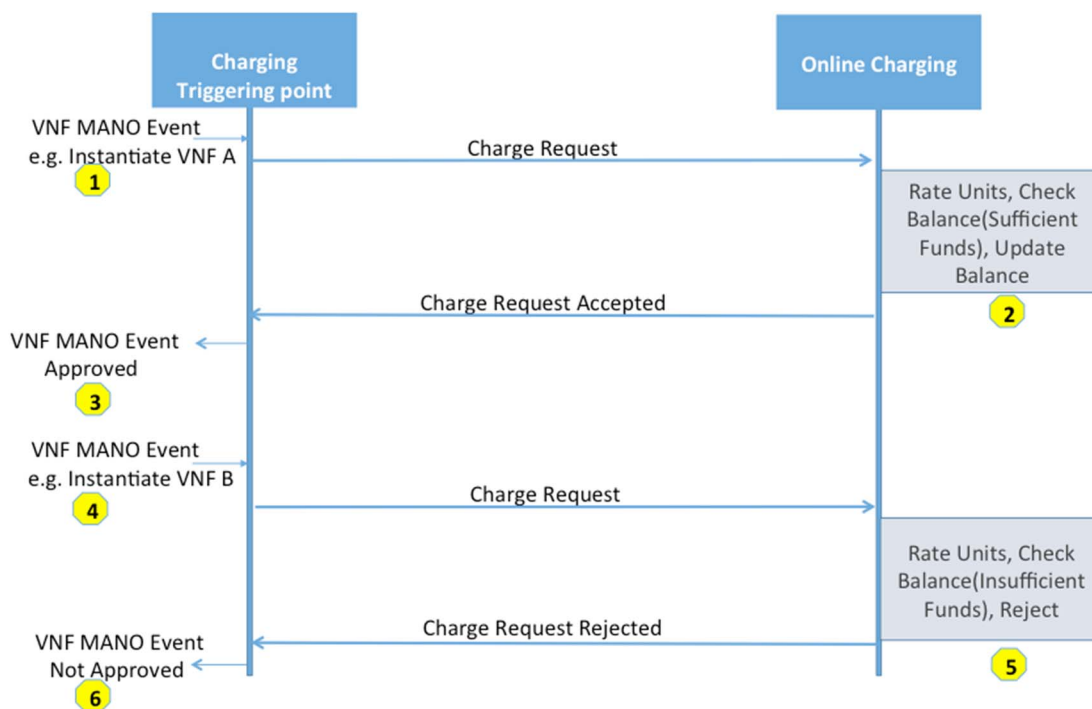


Figure 5: Online Charging Flow for VNF as a Service

5.4.7 Ends When

The use case ends when the VNF Consumer stops using the VNF instance.

5.4.8 Post-Conditions

An accurate record of the VNF usage has been captured and shared with the VNF consumer for payment settlement purposes.

5.4.9 Exceptions

None.

6 Charging Triggers in an NFV Architectural Framework

6.1 Online Charging Architecture for NFV

6.1.1 Online Charging Architecture for NFV Infrastructure as a Service

6.1.1.0 introduction

The online charging architecture for NFV framework will enable service providers to monetize their cloud network infrastructure. The NFV architecture has to support a mechanism by which NFV Infrastructure provider can apply real-time policy and charging control for virtualised resources used by the NFV Infrastructure consumer aka tenant. In order to support real-time charging for NFVIaaS described in clause 5.3, two key functions are required to enable real-time charging. The two functions could be combined or split into two distinct entities as described in table 4.

Table 4: Real-Time Functional Components

Function	Description
Charging Triggering Point (CTP)	<ul style="list-style-type: none"> • Trigger authorization for initial quota (credit check before activation). • A charging quota is fetched from the Charging Function. The charging quota is chosen in a way that it can be paid for by the tenant. This means the funds to pay for the quota are reserved and cannot be used for anything else until they are used up, or released. • Requests CQT to track charging quota for the resource and report usage. • Dialog with Charging Function in the OSS/BSS functional block for fund reservation. • Dialog with Charging Function for usage reporting and re-reservation. • Request Charging Function for additional charging quota. • Enforce Policy when Charging Function denies charging quota.
Charging Quota Tracker (CTQ)	<p>Track usage versus granted charging quota for the resource. Report usage to CTP as soon as it exhausts charging quota.</p>

6.1.1.2 New Architectural Functional Capabilities

6.1.1.2.1 Charging Quota Tracker

This new functionality will reside in the NFVI domain to support real-time charging quota tracking and reporting of usage associated with a specific consumer to the CTP. Communication between the QT and CTP will reuse the existing and extend the Nf-Vi reference point with new operations to exchange quota and usage information.

6.1.1.2.2 Charging Trigger Point

The CTP is an interworking node between the NFV domain and the Charging Function. This new functional capability will be present in the VIM functional block and interact with NFVI. The overall objective is to exchange charging information between the CTP and the BSS domain. To that end, there are two options for establishing an interface between CTP and Charging Function. Both options are described here in the order of preference.

6.1.1.3 Direct Approach: Charging Triggering Point to Charging Function

An operator can offer its NFV infrastructure as a service (there may be multiple OSS/BSS instances across different administrative domains in this scenario). This architecture depicts the use of a direct interface from VIM to Charging Function in the BSS domain of the NFV Infrastructure Provider.

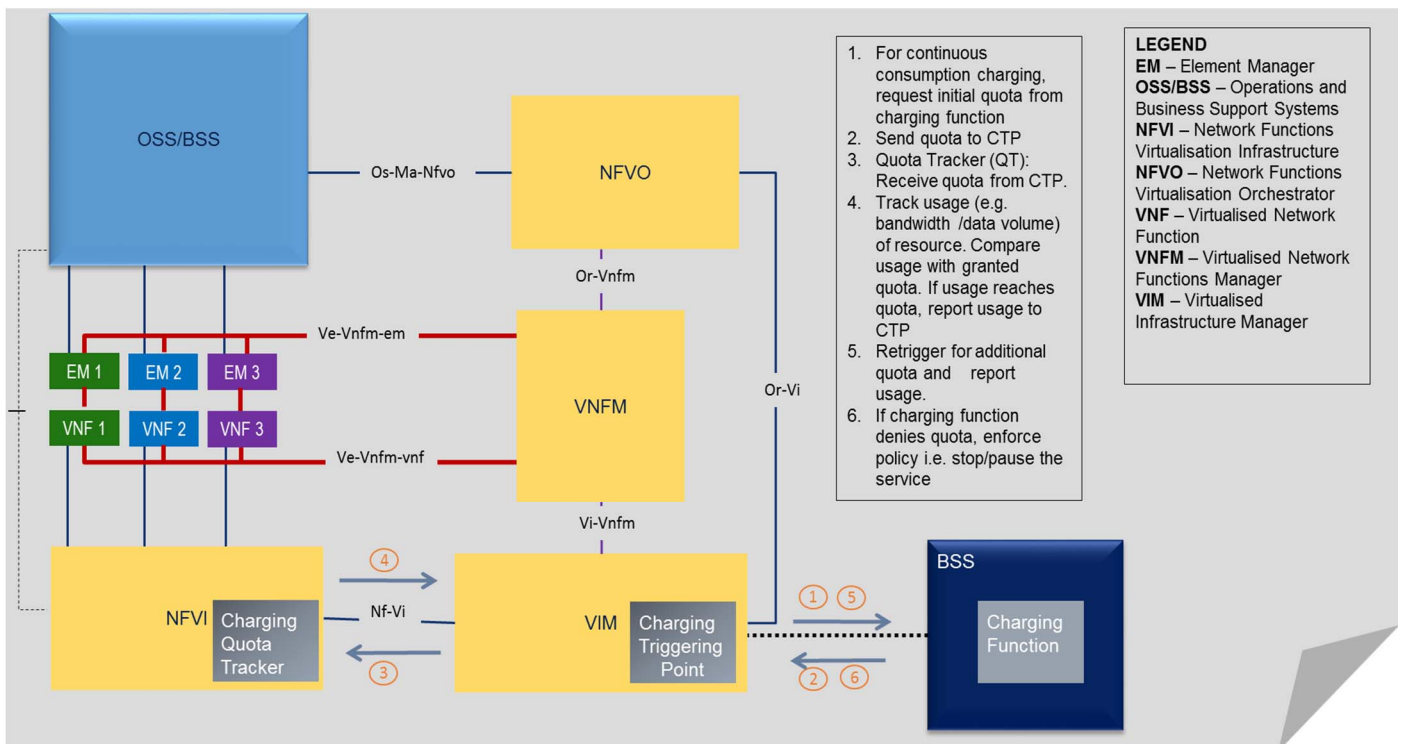


Figure 6: Online Charging Architecture for NFVlaaS (Direct Approach)

6.1.1.4 Relay Approach: Charging Triggering Point to Charging Function

This non-ideal approach is described here, should there be some concern about introducing a new reference point between VIM and OSS/BSS to provide a direct interface between CTP and Charging Function. The CTP should use APIs to request charging quota and reserve funds for usage of NFVI resources. The CTP will communicate with the NFVO using and extending the existing Or-Vi Reference Point with new operations to exchange charging information. Likewise, the Os-Ma reference point will be extended with new operations to exchange charging information. It is possible that the NFVO may enrich the charging request with additional information.

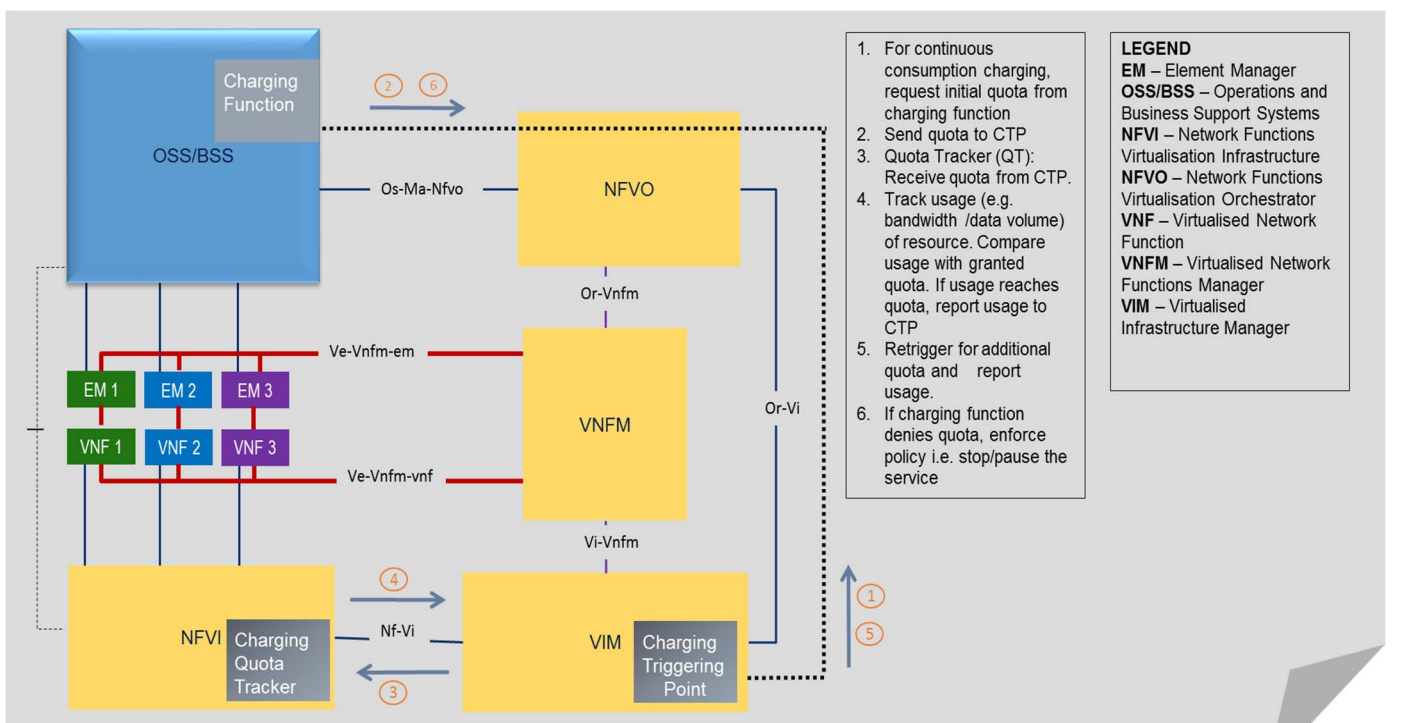


Figure 7: Online Charging Architecture for NFVlaaS (Relay Approach)

6.1.1.5 Basic Flow

During the instantiation of the virtual resource, the Charging Trigger Point (CTP) puts the execution of the resource on hold and contacts the Charging Function in either direct mode or relay mode, as explained in clauses 6.1.1.3 and 6.1.1.4, with charging input over an online bi-directional interface. So the CTP will essentially perform the following steps:

- Fetch the charging quota for the virtualised resource from Charging Function.
- The Charging Function will calculate the charging quota based on the charging input and account information and reserve funds. These funds cannot be used for anything else until they are used up, or released by CTP.
- When the charging quota is granted, the CTP tracks the resource usage so that it does not exhaust the charging quota given to it.
- If the reserved charging quota is used up, the CTP will inform Charging Function, which will then deduct the funds for the used charging quota and return a new charging quota to CTP.
- If the resource is stopped, the CTP reports back any unused charging quota to the Charging Function.
- If no more charging quota can be obtained, the CTP prevents the resource from continuing to function.

6.1.2 Online Charging Architecture for VNF as a Service

It's expected that charging for VNF as a service occurs as a management and orchestration chargeable item. This means when VNFM receives the request to instantiate a VNF, it asks NFVO to seek authorization from Charging Function in real-time to carry out the instantiation. NFVO communicates with Charging Function in real-time and sends a request for event charging. Charging Function determines if the request can be authorized, and then debits the Consumer's account before granting the request to NFVO.

Figure 8 illustrates this architecture.

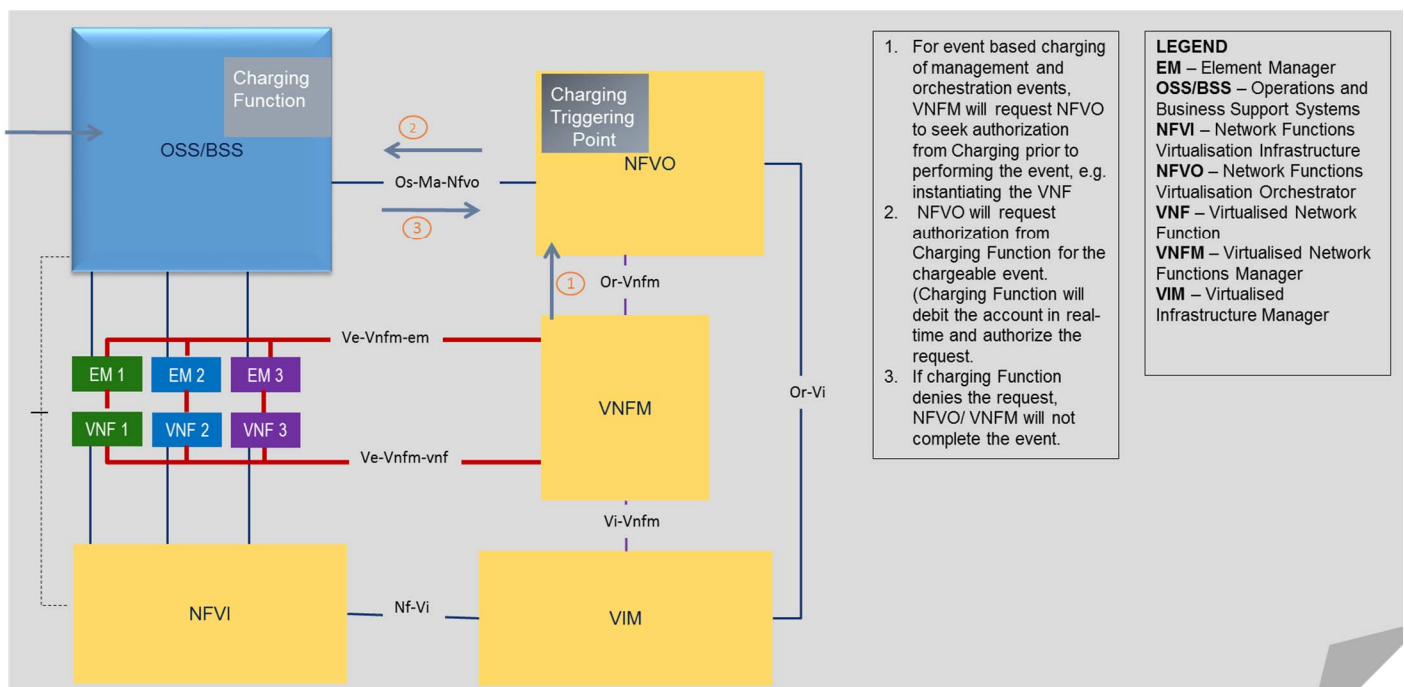


Figure 8: Online Charging Architecture for VNFaaS

6.2 Offline Charging Architecture for NFV

6.2.1 Offline Charging Impact on NFV Architecture

The diagram in this clause calls out the key architectural requirements for offline charging.

This clause describes at a high-level some aspects offline charging that can have an impact on the NFV architecture.

Transportation: All CDRs (Management and Orchestration, Usage events) are expected to be delivered reliably from NFV MANO to the BSS.

Collection of Management and Orchestration events: A functional component that performs charging triggering of Management and Orchestration events. This functional component detects chargeable Management and Orchestration events and produces CDRs describing these events. This study proposes locating this functionality within the NFV Orchestrator for tracking management and orchestration events for VNFAaS.

Collection of Usage Events: A functional component that performs charging triggering of Usage events. This functional component detects chargeable Usage events and produces CDRs describing these events. This study proposes locating this functionality within the Virtualised Infrastructure Manager for NFVIaaS.

If as anticipated the aggregation/correlation of Usage events to Management and Orchestration events is required, then each of the trigger point (e.g. located within the NFV Orchestrator and Virtualised Infrastructure Manager) are dependent on sharing aggregation/correlation keys.

Figure 9 illustrates the key architectural impacts described above.

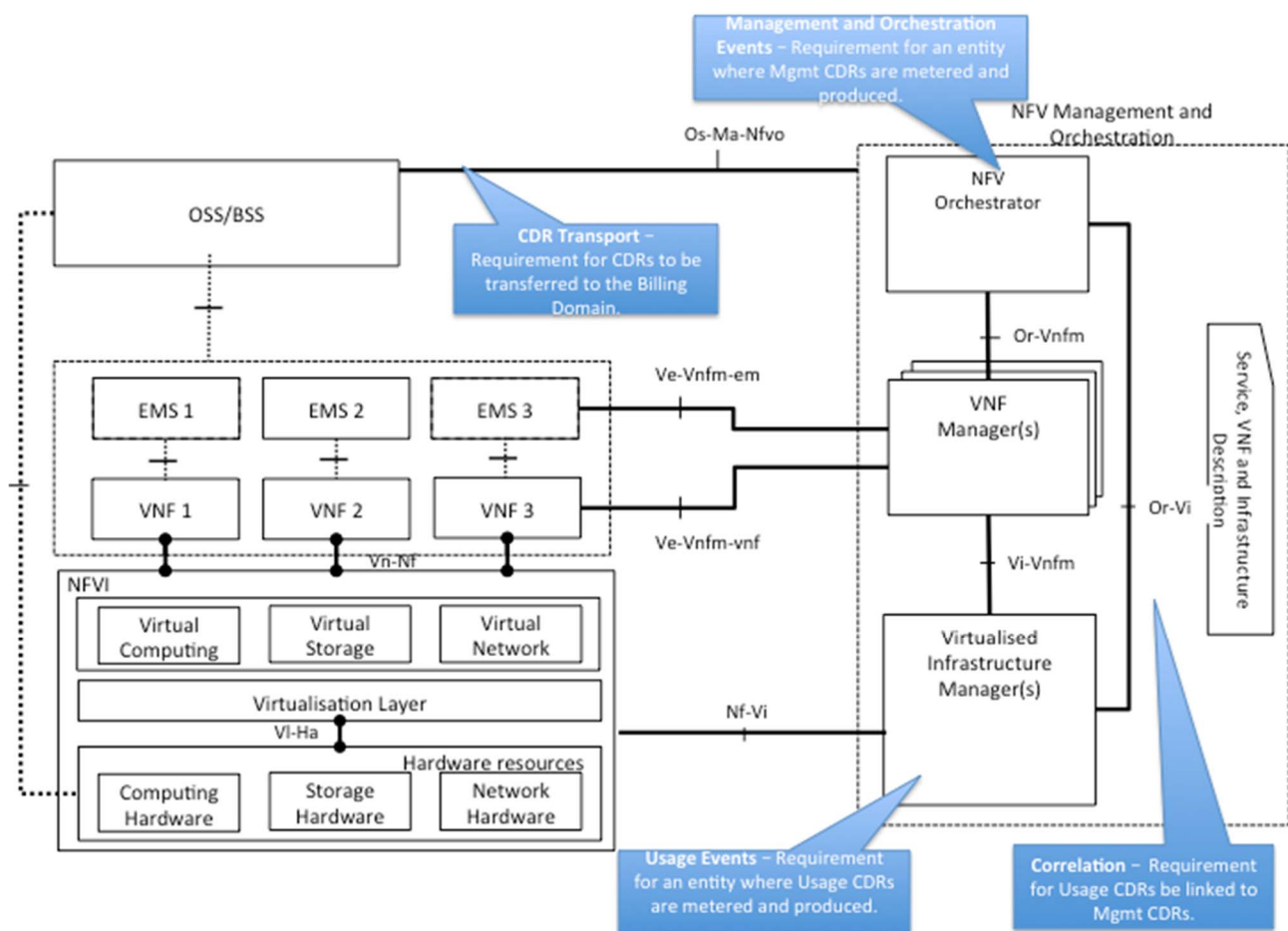


Figure 9: Key Architectural Impacts

6.2.2 Offline Charging Overlay Architecture

6.2.2.1 Introduction

This clause recommends at a high-level how offline charging can be overlaid on the NFV architecture.

6.2.2.2 Relayed CDR Delivery Scenario

In the relayed CDR scenario Usage events are processed as follows.

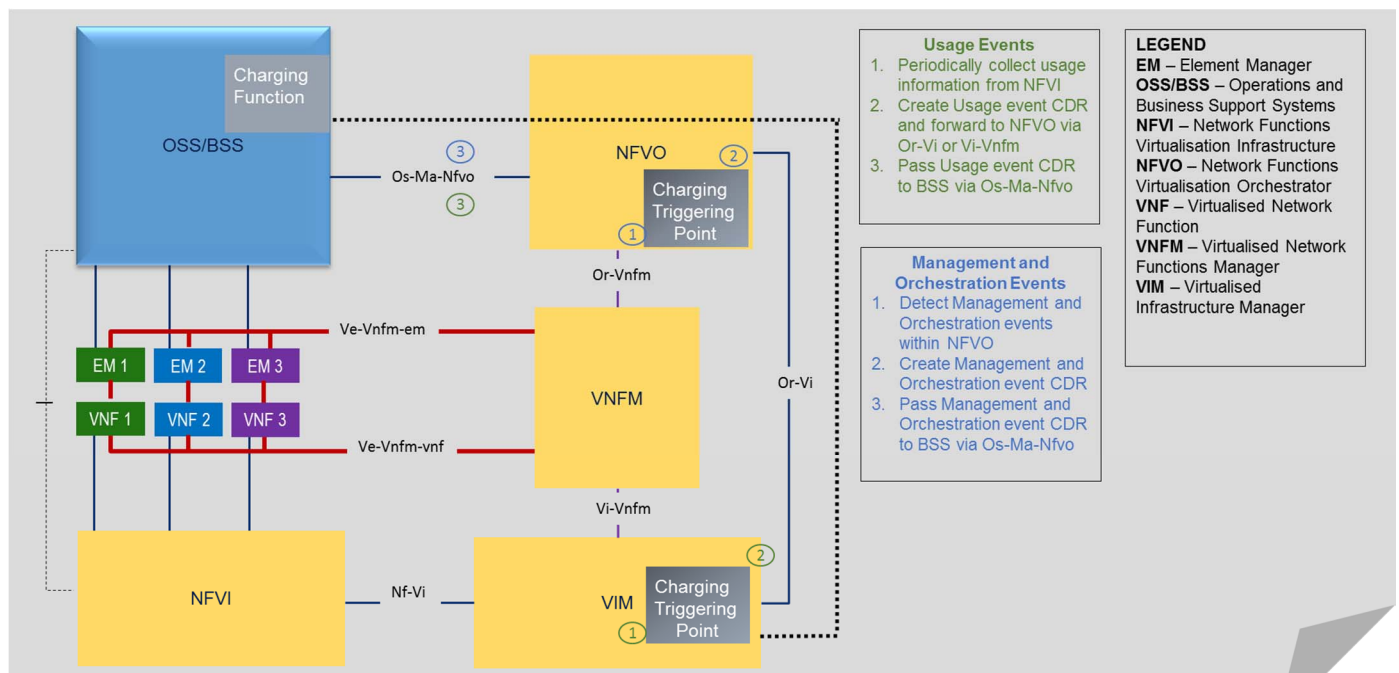


Figure 10 depicts an example scenario which has two charging trigger points (CTPs), located in the NFV Orchestrator and Virtualised Infrastructure Manager respectively.

In this scenario Usage events are processed as follows:

- 1) Usage information is periodically collected from the NFVI by the Usage event CTP in the VIM.
- 2) The Usage event CTP creates a CDR, which has identifiers that can be used to link it to the VNF and Network Service instances, and passes this CDR towards the NFVO via Or-Vi or Vi-Vnfm.
- 3) The NFVO passes the Usage event CDR to the BSS via Os-Ma-Nfvo.

Similarly, each Management and Orchestration event is reported as follows:

- 1) Management and Orchestration events are detected within NFVO by the Management and Orchestration event CTP.
- 2) The Management and Orchestration event CTP creates a CDR.
- 3) The NFVO passes the Management and Orchestration event CDR to the BSS via Os-Ma-Nfvo.

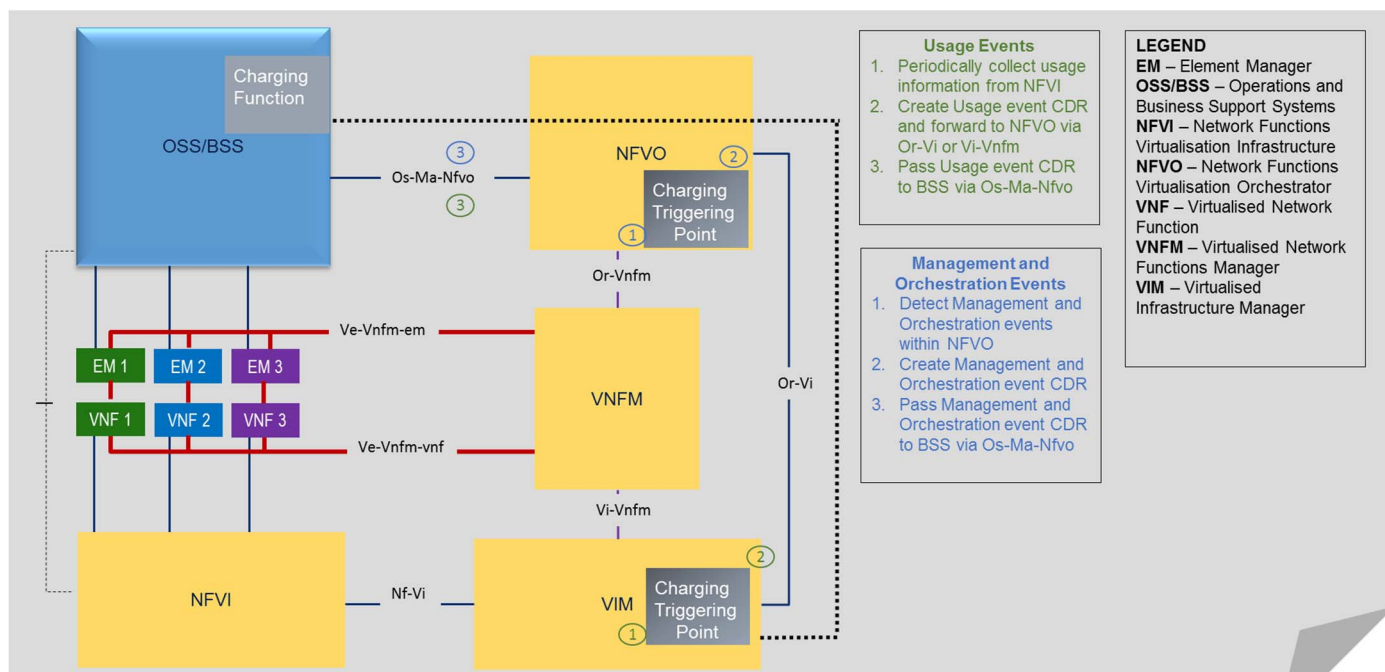


Figure 10: Offline Charging Related CDR Delivery Scenario

6.2.2.3 Direct CDR Delivery Scenario

In the direct delivery CDR scenario Usage events are processed as follows.

Figure 11 depicts an example scenario which has two charging trigger points (CTPs), located in the NFV Orchestrator and Virtualised Infrastructure Manager respectively.

In this scenario Usage events are processed as follows:

- 1) Usage information is periodically collected from the NFVI by the Usage event CTP in the VIM.
- 2) The Usage event CTP creates a CDR, which has identifiers that can be used to link it to the VNF and Network Service instances.
- 3) The NFVO passes the Usage event CDR directly to the BSS.

Similarly, each Management and Orchestration event is reported as follows:

- 1) Management and Orchestration events are detected within NFVO by the Management and Orchestration event CTP.
- 2) The Management and Orchestration event CTP creates a CDR.
- 3) The NFVO passes the Management and Orchestration event CDR directly to the BSS.

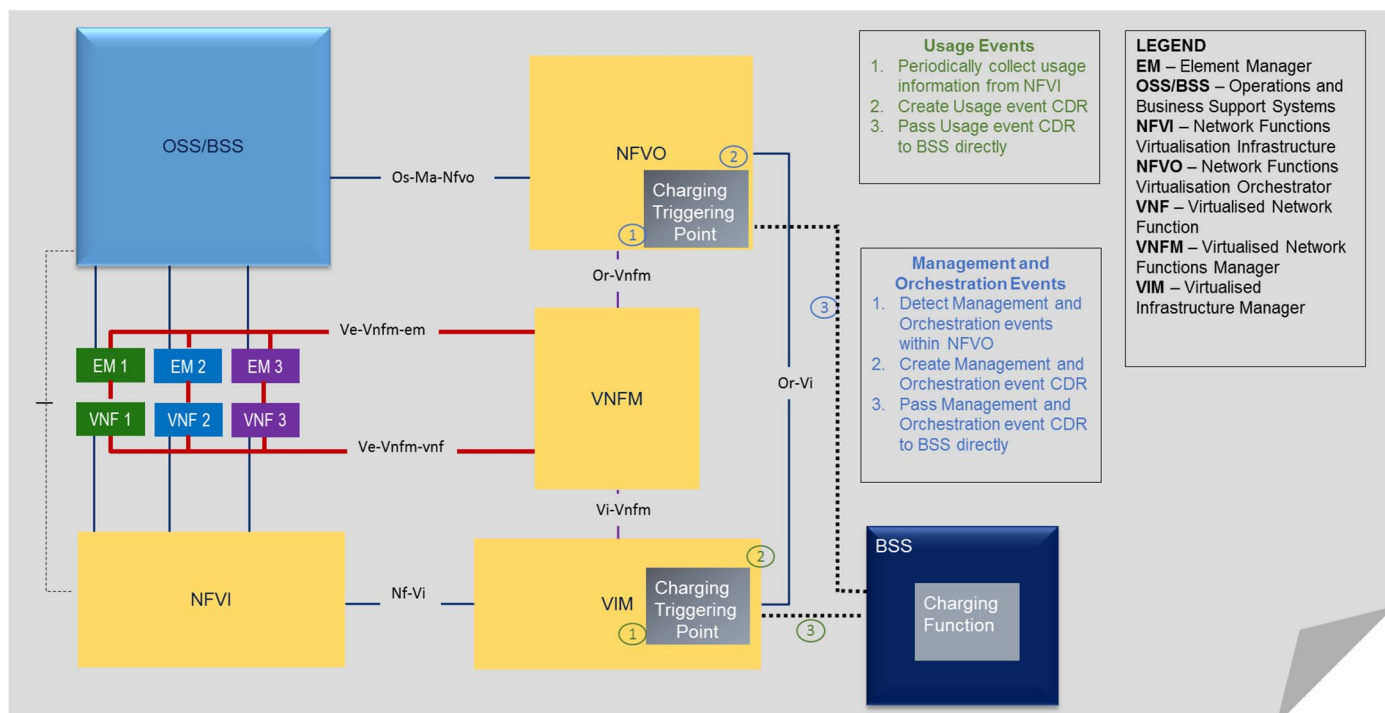


Figure 11: Offline Charging Direct CDR Delivery Scenario

7 Recommendation

Table 5: Proposed Enhancements to ETSI NFV MANO Architecture

Target deliverable	Recommendation	Type	Reference
New reference point between VIM and Charging Function, Or-Vi (IFA005), Os-Ma (IFA0013), Nf-Vi (IFA 004),	<p>It is recommended a direct interface be specified to request initial and subsequent quotas from Charging Function for online charging of NFVlaaS.</p> <p>It is also recommended that an interface be specified between NFVO and Charging Function to support to request event based charging and offline charging</p> <p><i>It is recommended that an interface be specified to support passing of charging event records to BSS.</i></p>	Interface	Clause 6.1.1. Clause 6.2.2.

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Annex B: Change History

Date	Information about changes
2017-12-08	NFV(17)000342 EVE008 - Editorial changes to be applied before approval of the final draft
2017-12-08	NFV(17)000341 EVE008 Scope tuning
2017-07-13	NFVEVE(17)000167r2 EVE 008 Charging Scenarios
2017-07-07	NFVEVE(17)000 161r1 EVE 008 Online Charging Architecture for NFVI as a Service
2017-04-06	NFVEVE(17)000063r3 Updates to Offline Charging Architecture Section 6
2017-02-06	NFVEVE(17)000027 EVE008 TheRoleofChargingTriggeringPoint in Online Char
2017-05-18	NFVEVE(16)000234r3 EVE008 Section 5.1 Use Case 1 Charging for NFV Infrastruct
2016-11-23	NFVEVE(16)000211r1_000194r2 EVE008 Section 5.0 Actors Business Relationships
2016-10-13	NFVEVE(16)000180r1 Contribution for 4.3.2 of EVE008
2016-10-13	NFVEVE(16)000179r1 Contribution for 4.3.1 of EVE008
2016-10-13	NFVEVE(16)000178r1 EVE008 Section 5.1 Use Case 1
2016-06-16	NFVEVE(16)000100r4 EVE008 updates to Sec 4.1 Charging Events in NFV
2016-06-16	NFVEVE(16)000093r6 EVE008 Section 4.1.1 Resources in NFV
2016-05-23	NFVEVE(16)000092r1 EVE008 Section 4.1 Charging Events in NFV
2016-05-10	NFVEVE(16)000071r2 EVE008 4 Concept of Charging Events
2016-04	Initial Draft (NFVEVE(16)000062r1 Table of Contents prepared by Rapporteur

History

Document history		
V3.1.1	December 2017	Publication