



## **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).

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## Modal verbs terminology

In the present document "**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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# 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.

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## 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.

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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.                       |

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## 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 |

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## 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.

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# 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.