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GROUP REPORT

Network Functions Virtualisation (NFV) Release 3; Licensing Management; Report on License Management for NFV

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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

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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Introduction

Today there is huge diversity of license management mechanisms across VNF Providers which makes service provisioning and license renewing operations more complex, error prone and time consuming. It also makes it difficult to deal with VNF license usage information for settlement between the Service Provider and the VNF Provider.

These issues can be resolved by establishing a standard NFV license management architecture which will have the following benefits:

- Speed up provision of VNF service without customizing the license management procedure for each VNF-type or VNF Provider.

- Simplifying acquisition of VNF license usage information.

- Reduce licensing errors.

- Simplified license management operations independent of the underlying VNF solution.

A guiding principle is to minimize the impact on the existing NFV specifications by identifying the minimum features needed to implement any commercial license management framework typically residing in a separate or higher layer system (e.g. OSS/BSS).

In order to provide a standardized licensing mechanism, it is necessary to identify the functional blocks, interfaces, and flows impacted by the requirement to implement any commercial license management framework.

1   Scope

The present document studies the features needed within the NFV-MANO framework to support license management for NFV. In this version of the document, a focus is made on the software licenses for VNFs. A set of use cases related to VNF licenses in the NFV environment are described, analyzed and used to understand the issues and produce recommendations regarding support for license management within the NFV architectural and NFV-MANO frameworks.

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]   TM Forum IG1143 Release 16.5.1: "Frameworx Exploratory Report - License Management".

[i.2]   ISO/IEC 19770-5:2015: "Information technology - IT asset management - Part 5: Overview and vocabulary".

NOTE: Available at https://www.iso.org/standard/68291.html.

[i.3]   ETSI GS NFV 003: "Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV".

3   Definitions and abbreviations

3.1   Definitions

For the purposes of the present document, the terms and definitions given in [i.3] and the following apply:

NOTE: A term defined in the present document takes precedence over the definition of the same term, if any, in [i.3].

license key: identifier key or activation code associated with VNF, made available by VNF Provider to Service Provider for operating a VNF instance

license pool: pool of licenses containing licenses to be processed on-demand without need for real-time interaction with the VNF Provider

NOTE: The Service Provider could maintain a real-time view of all licenses available in the license pools.

VNF license: legal rights to use a VNF in accordance with terms and conditions specified by the VNF licensor

NOTE 1: "Using a VNF" can include: accessing, copying, distributing, installing and executing the VNF software, depending on the license's terms and conditions.

NOTE 2: Specified license terms and conditions can include VNF components' license information if different than the one of the VNF.

NOTE 3: This definition has been specialized from the term "software license" as defined in International Standard ISO/IEC 19770-5 [i.2].

VNF license entitlement: VNF license use rights as defined through agreements between a VNF licensor and a VNF licensee

NOTE 1: Effective use rights take into account any contracts and all applicable licenses, including full licenses, upgrade licenses and maintenance agreements.

NOTE 2: A commonly used synonym for this term is "VNF license terms".

NOTE 3: This definition has been specialized from the term "software entitlement" as defined in International Standard ISO/IEC 19770-5 [i.2].

VNF licensee: person or organization granted a license to use a specific VNF

NOTE: This definition has been specialized from the term "software licensee" as defined in International Standard ISO/IEC 19770-5 [i.2].

VNF licensor: person or organization who owns or holds the rights to issue a VNF license for a specific VNF package

NOTE 1: This entity might or might not create the VNF software.

NOTE 2: This definition has been specialized from the term "software licensor" as defined in International Standard ISO/IEC 19770-5 [i.2].

VNF usage: consumption against a VNF license entitlement measured as defined by the terms and conditions of that entitlement

NOTE 1: Depending on the specific terms and conditions, usage can include accessing, copying, distributing, installing and executing the VNF software.

NOTE 2: This definition has been specialized from the term "software usage" as defined in International Standard ISO/IEC 19770-5 [i.2].

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in [i.3] and the following apply:

NOTE: An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any in [i.3].

BSD   Berkeley Software Distribution
BSS   Business Support System
CAPEX   Capital Expenditures
CI/CD   Continuous Integration / Continuous Development
EM   (Network) Element Manager
EPC   Evolved Packet Core
EULA   End-User License Agreement
FOSS   Free and Open Source Software
GPL   General Public License
IMS   IP Multimedia Subsystem
LGPL   Lesser General Public License
LM   License Management
MIT   Massachusetts Institute of Technology
MPL   Mozilla Public License

NFVI	Network Functions Virtualisation Infrastructure
NFVO	NFV Orchestrator
OPEX	Operational Expenditure
OSS	Operation Support System
PAYG	Pay As You Go/Grow
RGW	Residential GateWay
SAM	Software Asset Management
SAU	Simultaneous Active Users
VNF	Virtual Network Function
VNFC	Virtualised Network Function Component

4   NFV licenses

4.1   NFV licenses scope

Generally speaking (see note) the software licenses differ according to the rights that are actually granted to the licensee by the licensor. The scope of those rights covers all what the licensee could do with the licensed software in his business processes and which may be subject to authorization by the licensor. Usually, the licensee might **copy** the software, possibly **modify** for internal development purpose, resell the derived software and by the way **sublicense** the acquired licensed software, **distribute** it as such or simply deploy and **use** it to provide services to his customers.

The rights can be granted for a delimited period, i.e. **subscription-based** license or without time limit, i.e. **perpetual** license.

NOTE: This is not limited to NFV software.

4.2   NFV licenses categorization

4.2.1   Introduction

Different types of software licenses exist today and many of them can be reused in the context of NFV. A classification is generally made according to the **entitlement** regarding the reproduction (i.e. copy), distribution and use of the software, which can be different depending on the process of software production and motivations of the **licensor**, which can be, for example a software editor or an open source community.

Table 1 gives a high level classification of software licenses.

Table 1: Overall classification of software licenses

Rights	Public domain	Free and Open Source Software (FOSS)			Freeware, Shareware, Freemium	Proprietary	Trade secret
		Open Source (Without copyleft)	Open Source (Weak copyleft)	Open Source (Strong copyleft)			
Examples	SQLite, ImageJ	Apache, BSD, MIT	GNU LGPL, MPL	GNU GPL, GNU Affero	Irfanview, Winamp	Windows	World of warcraft
Copyright retained	No	Yes	Yes	Yes	Yes	Yes	Yes
Right to use	Yes	Yes	Yes	Yes	Yes	Yes	No
Right to copy	Yes	Yes	Yes	Yes	Often	No	No
Right to modify	Yes	Yes	Yes	Yes	No	No	No
Right to distribute	Yes	Yes, under same license	Yes, under same license	Yes, under same license	Often	No	No
Right to sublicense	Yes	Yes	No	No	No	No	No

The present document focuses on two "families" of software license:

- Open Source software licenses.

- Proprietary software licenses, used for commercial software products.

4.2.2 Open Source software licenses

There are several subtypes of Open Source software but they all assume that the source code is available according to the terms of a license that allows the licensee to use but also modify and distribute this code.

Open Source software is also characterized by a charter on rights and duties based on a community model organizing the use of the software for the benefit of all licensees.

Three subtypes are distinguished in particular by a criterion called **copyleft** which diverts the principle of copyright to preserve the freedom of any user to use, modify and distribute the software and its derived versions.

Three degrees of copyleft are identified which specify the obligations with regard to the distribution of modified software:

- *Strong copyleft* implies that the whole modified software is subject to the same type of license as the original copyleft software.

- *Weak copyleft* allows to compose the copyleft software components with any other software (open source or proprietary), and in the modified software, only the copyleft software components keep the original copyleft license.

- *Without copyleft*, where the choice of the software license for the modified software is free (open source or proprietary).

4.2.3 Proprietary software licenses

For commercial proprietary software the licensor grants the use of one or more copies of software under the End-User License Agreement (EULA), but ownership of those copies remains with the licensor, therefore also called proprietary software.

This characteristic of proprietary software means that, on one hand certain rights relating to the software (see Table 1), in particular those regarding modification and distribution are reserved by the licensor and on the other side the use are allowed but subject to entitlements, i.e. the terms and conditions specified in the license.

Business Models

For commercial software products, the licensor monetizes use and distribution rights to finance the development costs and make profits. Examples of business models for proprietary licenses are:

- FLAT: A perpetual right to use the software is purchased at a fixed price. The price depends on the features of the software, but is bought entirely from the beginning.

- PAY-AS-YOU-GROW: A perpetual right to use the software is purchased progressively according to the growth of the service it is deployed for. A metric is used to measure the growth.

- SUBSCRIPTION: A temporary right to use the software (term base) is acquired for a given period of time. The renewal of this right is decided at the end of each period.

  NOTE: License restrictions can be applied to the above business models.

Metrics

Business models of proprietary software licenses are all based on a manner to measure the use of the software. Any measuring technique relies on well-defined metrics. Metrics differ according to several criteria as for instance, the network domain and market considered. For instance, for software dedicated to a user (e.g. vRGW), counting the number of instances actually deployed is probably sufficient. In the case of the Virtualisation of mobile core network and IMS network functions (e.g. vIMS, vEPC), other metrics are usually used such as the Simultaneous Active Users (SAU).

4.2.4   Declarative software licenses

In this approach, software use is left to the software license and enforcement to license terms and condition is done offline as per the business agreement. One of possible way is to implement it through audit.

Reconciliations between the software licensor and the software licensee can be carried out (off-line) on the basis of:

1)   Software usage measurements and reporting based upon the license defined metrics.

2)   Explicit business agreements between the software licensor (e.g. VNF Provider) and the software licensee (e.g. Service Provider).

4.3   VNF licenses

Software licenses are applicable in the different functional domains of network architectures based on NFV (e.g. OSS / BSS, NFV-MANO, VNF, NFVI). However, it is in the VNF domain that the ruptures are the most important. Indeed, the promise of time-to-market reduction relies on CI/CD concepts and automated processes (e.g. on-boarding) are essential across all the domains. In the present document a focus is made on the software licenses for VNFs.

Service providers will be deploying VNFs from many VNF Providers with various terms and agreement for use. Runtime VNFs instances will be managed and orchestrated by NFV-MANO based on agreed licensing policies and business models. Streamlining/automating the management and operational aspects of VNF licenses will be very important to realize the cost saving benefits for NFV. On the other side, it is expected that the management of licenses does not have impact on service continuity:

- NFV-MANO will use the license for the VNF instantiation and operation.

- Enforcement of the contract between the VNF Provider and the Service Provider should be enabled by a mechanism trusted by both the parties.

- Usage of VNF licenses needs to be handled proactively to meet the requirements for continuity of the service.

- Service providers adhere to the license policies as per agreed business model and metrics.

- Auto scaling may not work if desired licenses are not in place and even a well-defined automated process for obtaining licenses on demand cannot guarantee to have the license installed on-time.

- To get the desired business benefit, especially for long term planning it is important to monitor the usage of VNFs based on the VNF license agreements in place.

- Ability to implement a flexible and extensible model for VNF licenses is essential for cost efficiency.

- There is need to standardize the acquisition of VNF licenses information's to ensure it is VNF and VNF Provider agnostic.

It is important to note that in the B2B market, and especially with important customers as telecommunication operators, a **declarative license** approach is commonly used (in place of a license management module) which consists in entrusting the software licensee with the task of controlling by himself that the use of the software is made in accordance with the license terms defining the rights of use and associated limits. Telecommunication operators are used to managing their software licenses and have a dedicated business process called Software Asset Management (SAM). The SAM needs to be adapted to fit with automation processes orchestrated by NFV-MANO.

Telecommunication operators have always collected **usage data** from their network resources for scaling and business planning and this will not change with the Virtualisation of network functions. Obviously, these usage data are considered as sensitive and Virtualisation will not change this.

The management of VNF licenses in the Service Provider and VNF Provider environment is outside the scope of the present document. The TM Forum IG1143 [i.1] has studied the implications for OSS/BSS of license management and it is a useful reference to gain a complete picture of VNF license management requirements.

4.4 Enforcement of VNF licenses

Different approaches are used today for the enforcement of software licenses. Following are the two examples:

- The first approach is based on an automated enforcement of VNF licenses during VNF operations, especially during instantiation and scaling of VNFs. In this case, an operation (e.g. instantiation) will not be carried out if it contravenes the terms of the acquired license(s).

- The second approach is based on the declarative VNF license concept (see clause 4.3). In this case the operations on the VNF will be carried out as per the license agreement. A regularization is carried out on the basis of VNF usage measurements and reporting as well as explicit business agreements between the VNF Provider (i.e. the VNF licensor) and the Service Provider (i.e. the VNF licensee) regarding this situation. Business agreements might refer to the possibility of audits performed by the VNF licensor in order to strengthen the confidence on the well follow-up of the terms of the business agreements.

The use cases presented in clause 5 cover both approaches:

- Use cases 1 to 6 assume the existence of an on-line license enforcement (using a licenses management function).

- Use case 7 assumes a declarative license, the possibility of audits and an off-line regularization (using a centralized SAM function).

NOTE: Enforcement of license is to be looked into from both Service Provider and VNF Provider perspective.

5 NFV Licenses use cases

5.1 Use Case 1: On-demand instantiation and termination of Virtual Firewall (vFirewall)

5.1.1 Introduction

This use case highlights the use of license for vFirewall VNF, instantiation and termination based on End User order journey. A vFirewall VNF is composed of a single VNFC which is packaged as a VNF sourced from a VNF Provider.

For the purpose of describing the license management lifecycle, it is assumed that the Service Provider has already on-boarded the vFirewall VNF Package from the VNF Provider. It is further assumed that:

- For each End User there will be separate instances of vFirewall that will be created to fulfil the End User order.

- The on-boarded vFirewall VNF Package will be used to create new instances.

- The Service Provider will procure a new license for each new instance of vFirewall.

5.1.2 Business Value

Efficient management of VNF licenses will enable realization of the expected OPEX and CAPEX cost savings for NFV deployment through automation of the VNF lifecycle, including automation of VNF licensing:

- Service Provider only pays for the number of active instances of vFirewall.

- Once the End User disconnects the vFirewall service offering, the Service Provider will release the license key back to the VNF Provider or release it to the license pool for reuse.

- Automation of on-boarding and release of licenses without manual intervention.

- Enforcement of the contract between the VNF Provider and the Service Provider should be enabled by a mechanism trusted by both the parties.