



## Network Functions Virtualisation (NFV) Release 3; Evolution and Ecosystem; Report on Network Slicing Support with ETSI NFV Architecture Framework

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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

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# 1 Scope

The present document analyses use cases related to network slicing as defined in SDOs and industry fora. Furthermore, the present document describes how these use cases could be mapped to the current NFV concepts and supported by the ETSI NFV architectural framework [i.2] and by NFV-MANO [i.10].

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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.

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 GR NFV 001 (V1.2.1) (05-2017): "Network Functions Virtualisation (NFV); Use Cases".
- [i.2] ETSI GS NFV 002 (V1.2.1) (12-2014): "Network Functions Virtualisation (NFV); Architectural Framework".
- [i.3] ETSI GS NFV 003 (V1.2.1) (12-2014): "Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV".
- [i.4] ETSI GS NFV-EVE 005 (V1.1.1) (12-2015): "Network Functions Virtualisation (NFV); Ecosystem; Report on SDN Usage in NFV Architectural Framework".
- [i.5] ETSI GS NFV-IFA 009: "Network Functions Virtualisation (NFV); Management and Orchestration; Report on Architectural Options".
- [i.6] ETSI GS NFV-IFA 013 (V2.1.1) (10-2016): "Network Functions Virtualisation (NFV); Management and Orchestration; Os-Ma-Nfvo reference point - Interface and Information Model Specification".
- [i.7] ETSI GS NFV-IFA 014 (V2.3.1) (08-2017): "Network Functions Virtualisation (NFV) Release 2; Management and Orchestration; Network Service Templates Specification".
- [i.8] ETSI GR NFV-IFA 022 (V0.8.1): "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Report on Management and Connectivity for Multi-Site Services".
- [i.9] ETSI GR NFV-IFA 028 (V0.13.0): "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Report on architecture options to support multiple administrative domains".
- [i.10] ETSI GS NFV-MAN 001 (V1.1.1) (12-2014): "Network Functions Virtualisation (NFV); Management and Orchestration".
- [i.11] ETSI GR NFV-REL 007 (V1.1.1) (09-2017): "Network Functions Virtualisation (NFV); Reliability; Report on the resilience of NFV-MANO critical capabilities".

- [i.12] ETSI GS NFV-SEC 009 (V1.2.1) (12-2016): "Network Functions Virtualisation (NFV); NFV Security; Report on use cases and technical approaches for multi-layer host administration".
- [i.13] ETSI GS NFV-SEC 012 (V3.1.1) (01-2017): "Network Functions Virtualisation (NFV) Release 3; Security; System architecture specification for execution of sensitive NFV components".
- [i.14] NGMN Alliance: "Description of Network Slicing Concept", January 2016.
- [i.15] NGMN Alliance: "5G security recommendations; Package #2: Network Slicing", April, 2016.
- [i.16] ONF TR-521: "SDN Architecture", Issue 1.1, February 2016.
- [i.17] ONF TR-526: "Applying SDN architecture to 5G slicing", Issue 1, April 2016.
- [i.18] ONF TR 527: "Functional Requirements for Transport API", June 2016.
- [i.19] ONF TR-540: "Orchestration: A More Holistic View", January 2017.
- [i.20] 3GPP TS 22.261 (V15.2.0) (09-2017): "Service requirements for next generation new services and markets".
- [i.21] 3GPP TR 28.801 (V15.0.0) (09-2017): "Telecommunication management; Study on management and orchestration of network slicing for next generation network".
- [i.22] ETSI GS NGP 001: "Next Generation Protocol (NGP); Scenario Definitions".
- [i.23] ETSI GS NFV-IFA 005: "Network Functions Virtualisation (NFV); Management and Orchestration; Or-Vi reference point - Interface and Information Model Specification".
- [i.24] ETSI GS NFV-IFA 006: "Network Functions Virtualisation (NFV); Management and Orchestration; Vi-Vnfm reference point - Interface and Information Model Specification".
- [i.25] ETSI GS NFV-IFA 008: "Network Functions Virtualisation (NFV); Management and Orchestration; Ve-Vnfm reference point - Interface and Information Model Specification".
- [i.26] ETSI GS NFV-IFA 012: "Network Functions Virtualization (NFV) Release 3; Management and Orchestration; Os-Ma-Nfvo reference point - Application and Service Management Interface and Information Model Specification".
- [i.27] ETSI GS NFV-IFA 010: "Network Functions Virtualisation (NFV); Management and Orchestration; Functional requirements specification".
- [i.28] ETSI GS NFV-IFA 011: "Network Functions Virtualisation (NFV); Management and Orchestration; VNF Packaging Specification".
- [i.29] 3GPP TR 23.799: "Study on Architecture for Next Generation System".
- [i.30] 3GPP TS 23.501: "System Architecture for the 5G System".
- [i.31] 3GPP TS 23.502: "Procedures for the 5G System".
- [i.32] 3GPP TR 33.899: "Study on the security aspects of the next generation system".
- [i.33] 3GPP TS 28.531: "Provisioning of network slicing for 5G networks and services".
- [i.34] 3GPP TS 28.530: "Management of network slicing in mobile networks; Concepts, use cases and requirements".

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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.3] apply.

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI GS NFV 003 [i.3] and the following apply:

3GPP	3rd Generation Partnership Project
5G	Fifth Generation
AN	Access Network
CN	Core Network
CSMF	Communication Service Management Function
HMEE	Hardware-Mediated Execution Enclave
NF	Network Function
NGMN	Next Generation Mobile Networks
NGP	Network Generation Protocols
NS	Network Service
NSI	Network Slice Instance
NSM	Network Slice Manager
NSMF	Network Slice Management Function
NSSI	Network Slice Subnet Instance
NSSMF	Network Slice Subnet Management Function
NST	Network Slice Template
OAM	Operations and Management
ONF	Open Networking Foundation
QoS	Quality of Service
SDN	Software Defined Networking
SDO	Standards Development Organisation
TN	Transport Network

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## 4 Overview of network slicing

### 4.1 Introduction

Network slicing is defined by multiple SDOs and Fora. However, the meaning and understanding of the network slicing concept are different from each other and there is no common definition. The present document does not define network slicing use cases or features but references external SDOs and Fora's definition and concept of network slicing within the context of each individual SDO/Fora.

Clause 4.2 shows relevant external body's documents which introduce and define network slicing, and describes related details provided in NGMN, 3GPP, and ONF. It also describes the possible relationship with the NFV constructs.

Clause 4.3 describes NFV and SDN relation in a multi-tenant and multi-domain environment in term of network slice deployment.

### 4.2 Concepts defined by SDOs and Fora and NFV architectural framework mapping

#### 4.2.1 Potential relevant SDOs and Fora

Table 4.2.1-1 describes relevant SDOs and Fora and their documentation which introduce and define the concept of network slicing.



Table 4.2.1-1: Relevant external bodies' documents

External Body (Upstream, User, or Both)	Title of Document or Activity	Area	Scope	Current Status	Relation to Network Slicing	Relation to NFV ISG support to Network Slicing
NGMN	5G white paper	High level requirements	5G white paper from NGMN	Published	Introduces network slicing, named as 5G slicing in 5G white paper, for purposes of flexibility, management and orchestration. Needs standardization phase to support those motivations and requirements.	
NGMN	White paper description of network slicing	High level requirements	NGMN white paper for network slicing	Published	NGMN white paper describing network slicing for service provider networks.	
ONF	Applying SDN Architecture to 5G Slicing (ONF TR-526 [i.17])	SDNizing network slicing for 5G services	Network slice abstraction for sustainability and business agility	Published	Generic requirements for SDN-based network slicing for 5G services including orchestration for holistic operations [i.19].	
3GPP SA2	Study on Architecture for Next Generation System (3GPP TR 23.799 [i.29])	High level requirements	Network slice related functionality	Published	Network architecture including network entity and UE. Key issues identified by 3GPP SA2 to address network slicing selection, isolation, roaming and security as well as some examples. 3GPP SA2 specifies network slicing concept and network architecture and does not have direct relation to virtualisation and MANO work in ISG NFV.	
3GPP SA2	System Architecture for the 5G System (3GPP TS 23.501 [i.30])	Architectural requirements	Network slice related functionality	Work in progress	Definition, identification, selection, subscription, configuration and storage aspects of network slicing. High level functionality for network slicing, and network slicing supported by the architecture including roaming and non-roaming scenarios.	

External Body (Upstream, User, or Both)	Title of Document or Activity	Area	Scope	Current Status	Relation to Network Slicing	Relation to NFV ISG support to Network Slicing
3GPP SA2	Procedures for the 5G System (3GPP TS 23.502 [i.31])	Procedures and flows of the architectural elements	Network slice related procedures	Work in progress	Procedures description and aspects of supporting network slicing in the 5G system.	
3GPP SA3	Study on the security aspects of the next generation system (3GPP TR 33.899 [i.32])	High level requirements	Network slice related security	Work in progress	Study work in 3GPP SA3 including security areas and high level security requirements related to network slicing.	
3GPP SA5	Study on management and orchestration of network slicing (3GPP TR 28.801 [i.21])	High level requirements	Network slice management	Published	Study work in 3GPP SA5 on management and orchestration of network slicing in mobile networks.	May be relevant to ETSI GS NFV-IFA 008 [i.25], ETSI GS NFV-IFA 013 [i.6], and ETSI GS NFV-IFA 014 [i.7].
3GPP SA5	Provisioning of network slicing for 5G networks and services (3GPP TS 28.531 [i.33])	Detailed specification of network slice provisioning	Network slice management	Work in progress	Work item in 3GPP SA5 on network slice provisioning which includes service provisioning related information model and NST specification.	May be relevant to ETSI GS NFV-IFA 013 [i.6] and ETSI GS NFV-IFA 014 [i.7].
3GPP SA5	Management of network slicing in mobile networks - concepts, use cases and requirements (3GPP TS 28.530 [i.34])	Detailed specification of network slice requirements	Network slice management	Work in progress	Work item in 3GPP SA5 on network slice management which specifies the management related use cases and requirements of 3GPP TR 28.801 [i.21].	May be relevant to ETSI GS NFV-IFA 013 [i.6], ETSI GR NFV-IFA 022 [i.8]
ETSI ISG NGP	Next Generation Protocols (NGP); Scenarios Definitions (ETSI GS NGP 001 [i.22])	High level requirements	Key scenarios for the NGP	Frozen	Specify the key scenarios for the NGP, including the network slicing use case of network virtualisation.	

## 4.2.2 NGMN

### 4.2.2.1 Network slicing as defined by NGMN

According to clause 4 of the NGMN's White Paper [i.14], a Network Slice Instance (NSI) may be composed by none, one or more Network Slice Subnet Instance (NSSI), which may be shared by another NSI. Similarly, the NSSI is formed of a set of Network Functions, which can be either VNFs or PNFs.

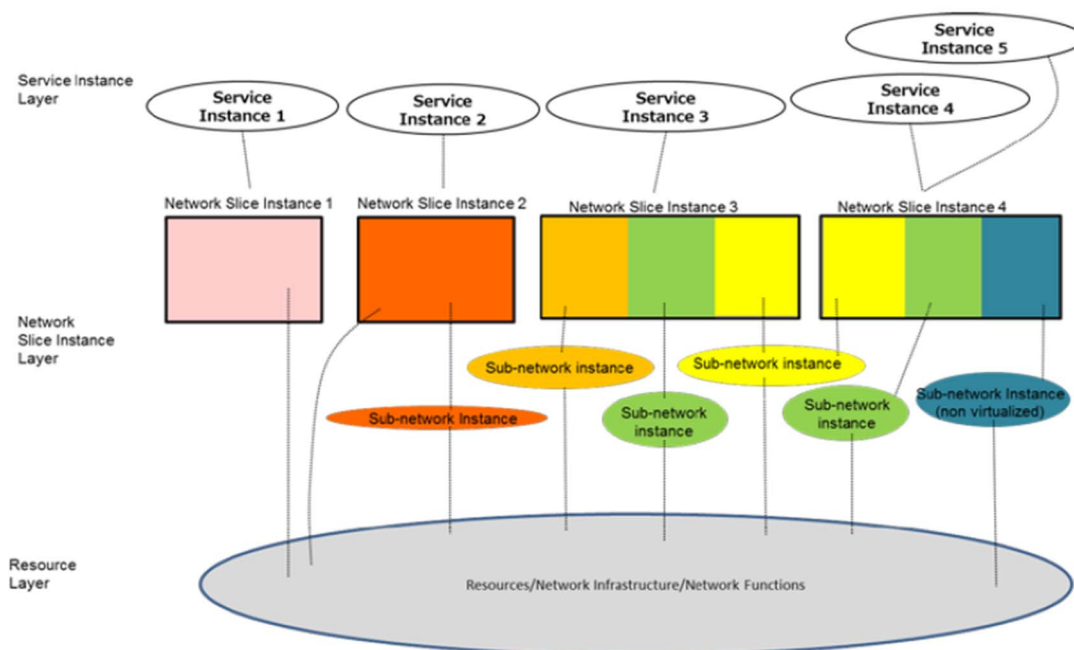


Figure 4.2.2.1-1: Network slice conceptual outline  
(figure 1 in NGMN White Paper [i.14])

## 4.2.3 3GPP

### 4.2.3.1 Network slicing as defined by 3GPP

According to clause 4.2.1 of 3GPP TR 28.801 [i.21], the network slice concept includes the following aspects:

- 1) Completeness of an NSI:
  - An NSI is complete in the sense that it includes all functionalities and resources necessary to support certain set of communication services thus serving certain business purpose.
- 2) Components of an NSI:
  - The NSI contains NFs (e.g. belonging to AN and CN).
  - If the NFs are interconnected, the 3GPP management system contains the information relevant to the connections between these NFs such as topology of connections, individual link requirements (e.g. QoS attributes), etc.
  - For the part of the TN (Transport Network) supporting connectivity between the NFs, the 3GPP management system provides link requirements (e.g. topology, QoS attributes) to the management system that handles the part of the TN supporting connectivity between the NFs.
- 3) Resources used by the NSI:
  - The NSI is realized via the required physical and logical resources.
- 4) Network Slice Template:
  - The network slice is described by a Network Slice Template (NST). The NSI is created using the NST and instance-specific information.
- 5) NSI policies and configurations:
  - Instance-specific policies and configurations are required when creating an NSI.
  - Network characteristics examples are ultra-low-latency, ultra-reliability, etc.