ETSI GR NFV-TST 007 V3.1.1 (2022-05)



Network Functions Virtualisation (NFV) Release 3; Testing; Guidelines on Interoperability Testing for MANO

Disclaimer

The present document has been produced and approved by the Network Functions Virtualisation (NFV) ETSI Industry Specification Group (ISG) and represents the views of those members who participated in this ISG.

It does not necessarily represent the views of the entire ETSI membership.

Reference

RGR/NFV-TST007ed311

Keywords

interoperability, management, MANO, NFV, testing

ETSI

650 Route des Lucioles F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B Association à but non lucratif enregistrée à la Sous-Préfecture de Grasse (06) N° w061004871

Important notice

The present document can be downloaded from: http://www.etsi.org/standards-search

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at www.etsi.org/deliver.

Users of the present document should be aware that the document may be subject to revision or change of status.

Information on the current status of this and other ETSI documents is available at https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx

If you find errors in the present document, please send your comment to one of the following services: https://portal.etsi.org/People/CommiteeSupportStaff.aspx

If you find a security vulnerability in the present document, please report it through our Coordinated Vulnerability Disclosure Program:

https://www.etsi.org/standards/coordinated-vulnerability-disclosure

Notice of disclaimer & limitation of liability

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2022. All rights reserved.

Contents

Intell	ectual Property Rights	/
Forev	word	7
Moda	al verbs terminology	7
1	Scope	8
2	References	Q
2.1	Normative references	
2.1	Informative references.	
3	Definition of terms, symbols and abbreviations	9
3.1	Terms	
3.2	Symbols	
3.3	Abbreviations	9
4	Interoperability Features Statement (IFS)	10
4.1	Introduction	10
4.2	IFS for VIM	10
4.2.1	Software Image Management	
4.2.2	VNF Package Management	
4.2.3	VNF Lifecycle Management	
4.2.4	Fault Management	
4.2.5	Performance Management	
4.2.6	NS Lifecycle Management	
4.3	IFS for VNFM	
4.3.1	Software Image Management	
4.3.2	VNF Package Management	
4.3.3	VNF Lifecycle Management	
4.3.4 4.3.5	Fault Management	
4.3.5 4.3.6	Performance Management	
4.3.0 4.4	IFS for NFVO	
4.4.1	Software Image Management	
4.4.2	VNF Package Management	
4.4.3	VNF Lifecycle Management	
4.4.4	Fault Management	
4.4.5	Performance Management	
4.4.6	NS Lifecycle Management	26
4.5	IFS for EM/VNF	28
4.5.1	Software Image Management	
4.5.2	VNF Package Management	
4.5.3	VNF Lifecycle Management	
4.5.4	Fault Management	
4.5.5	Performance Management	
4.5.6	NS Lifecycle Management	29
5	System Under Test (SUT)	
5.1	SUT Configuration 1	
5.2	SUT Configuration 2	
5.3	SUT Configuration 3	
5.4	SUT Configuration 4	31
6	Test Suite Structure	32
6.1	Introduction	32
6.2	Software Image Management Test Cases Overview	32
6.3	VNF Package Management Test Cases Overview	
6.4	VNF Lifecycle Management Test Cases Overview	
6.5	Fault Management Test Cases Overview	
6.6	Performance Management Test Cases Overview	34

6.7 6.8	NS Lifecycle Management Test Cases Overview	
	-	
	Test Descriptions	
7.1	Introduction	
7.2	Software Image Management	
7.2.1	Add Software Image	
7.2.2	Query Software Image	
7.2.2.1	Query Software Image by NFVO	
7.2.2.2		
7.2.3	Update Software Image	
7.2.4	Delete Software Image	
7.3	VNF Package Management	
7.3.1	On-board VNF Package	
7.3.2	Delete VNF Package	
7.3.3	Abort VNF Package Delete Operation	
7.4	VNF Lifecycle Management	
7.4.1	Instantiate VNF with an EM Request	
7.4.2	Query VNF with an EM Request	
7.4.3 7.4.4	Modify VNF Configuration Information with an EM Request Start VNF/VNFC with an EM Request	
7.4.4 7.4.5	1	
	Stop VNF/VNFC with an EM Request	
7.4.6 7.4.7	VNF Healing with an EM/VNF Request	
7. 4 .7 7.4.8	VNF Scale In with an EM/VNF Request	
7. 4 .8 7.4.9	Terminate VNF with an EM Request	
7. 4 .9 7.5	Fault Management	
7.5.1	Virtualised Resource Fault Management	
7.5.1.1	Virtualised Resource Fault Alarm Notification	
7.5.1.2	Virtualised Resource Fault Alarm Clearance Notification	
7.5.2	VNF Fault Management	
7.5.2.1	VNF Fault Alarm Notifications	
7.5.2.2		
7.5.3	NS Fault Management	
7.5.3.1	NS Fault Alarm Subscription Creation	
7.5.3.2	NS Fault Alarm Subscription Deletion	52
7.5.3.3	NS Fault Alarm Notification	
7.5.3.4		
7.5.3.5		
7.6	· · · · · · · · · · · · · · · · · · ·	
7.6.1	Virtualised Resource Performance Management	
7.6.1.1	Virtualised Resource PM Job Creation and Notification Monitoring	
7.6.1.2	Virtualised Resource PM Job Creation and Threshold Monitoring	
7.6.1.3	Virtualised Resource PM Job Deletion	
7.6.1.4	Virtualised Resource PM Threshold Deletion	
7.6.2	VNF Performance Management	
7.6.2.1	VNF PM Job Creation and Notification Monitoring	
7.6.2.2	VNF PM Job Creation and Threshold Monitoring	
7.6.2.3	VNF PM Job DeletionVNF PM Threshold Deletion	
7.6.2.4 7.6.3	NS Performance Management	
7.6.3.1	NS PM Monitoring Job Creation	
7.6.3.1	NS PM Performance Metrics Query	
7.6.3.2	NS PM Threshold Creation	
7.6.3.4	NS PM Subscription Creation for Threshold Information	
7.6.3.5	NS PM Subscription Creation for Performance Information	
7.6.3.6	NS PM Threshold Notification	
7.6.3.7	NS PM Monitoring Information Notification	
7.6.3.8	NS PM Subscription Deletion	
7.6.3.9	NS PM Monitoring Job Deletion	
7.6.3.10	•	
7.7	NS Lifecycle Management	

7.7.1	NS Instantiation	66
7.7.1.1	Standalone NS Instantiation	66
7.7.1.2	Nested NS Instantiation	
7.7.1.3	Multi-Site NS Instantiation	70
7.7.1.4	SFC NS Instantiation	72
7.7.2	NS Scaling	
7.7.2.1	NS Scale Out	
7.7.2.1.1	NS Scale out with an Operator Action	
7.7.2.1.2	NS Scale out with a VNF Indicator notification	
7.7.2.1.3	NS Scale out with a VIM KPI	
7.7.2.1.4	NS Scale out with a query to VNF Indicator by VNFM	
7.7.2.1.5	NS Scale out for Multi-Site with an Operator Action	
7.7.2.2	NS Scale In	
7.7.2.2.1	NS Scale In with an Operator Action	
7.7.2.2.2	NS Scale in with a VNF Indicator notification	
7.7.2.2.3	NS Scale in with a VIM KPI	
7.7.2.2.4	NS Scale in with a query to VNF Indicator by VNFM	
7.7.2.2.5	NS Scale in for Multi-Site with an Operator Action	
7.7.2.3	NS VNF Scale Out	
7.7.2.3.1	NS VNF Scale Out with an Operator Action	
7.7.2.3.2	NS VNF Scale Out with a VNF Indicator notification	
7.7.2.3.3	NS VNF Scale Out with a VIM KPI	
7.7.2.3.4	NS VNF Scale Out with a query to VNF Indicator by VNFM	
7.7.2.3.5	NS VNF Scale Out for Multi-Site with an Operator Action	
7.7.2.4	NS VNF Scale In	
7.7.2.4.1	NS VNF Scale In with an Operator Action	
7.7.2.4.2	NS VNF Scale In with a VNF Indicator notification	
7.7.2.4.3	NS VNF Scale In with a VIM KPI	
7.7.2.4.4	NS VNF Scale In with a query to VNF indicator by VNFM	
7.7.2.4.5	NS VNF Scale In for Multi-Site with an Operator Action	
7.7.2.5	NS Scale to Level	
7.7.2.5.1	NS Scale to Level with an Operator Action	
7.7.2.5.2	NS Scale to Level from VNF Indicator notification	
7.7.2.5.3	NS Scale to Level from a VIM KPI	
7.7.2.5.4	NS Scale to Level with an Operator Action for Multi-Site	
7.7.2.6		
7.7.2.6.1 7.7.2.6.2	NS VNF Scale to Level with an Operator Action NS VNF Scale to Level from VNF Indicator notification	
7.7.2.6.3 7.7.2.6.4	NS VNF Scale to Level with a VIM KPI NS VNF Scale to Level with an Operator Action for Multi-Site	
7.7.2.0.4	NS UpdateNS Update	
7.7.3 7.7.3.1	Start VNF Instance	
7.7.3.1	Stop VNF Instance	
7.7.3.2	Instantiate VNF and Add Instance to NS Instance	
7.7.3.4	Remove VNF Instances from a NS Instance	
7.7.3.4	Add Shared VNF Instances to NS Instance.	
7.7.3.6	Remove Shared VNF Instances from NS Instance	
7.7.3.7	Change VNF Deployment Flavour	
7.7.3.8	VNF Configuration update on runtime	
7.7.4 7.7.4	NS Healing	
7.7.4.1	Partial NS Healing with an Operator Action	
7.7.4.2	Complete NS Healing with an Operator Action	
7.7.5	NS Termination	
7.7.5.1	Standalone NS Termination	
7.7.5.2	Nested NS Termination	
7.7.5.3	Multi-Site NS Termination	
7.7.5.4	SFC NS Termination	
7.8	Virtualised Resource Management	
7.8.1	Virtualised Compute Resource Management	
7.8.1.1	Generic Virtualised Compute Resource Allocation	
7.8.1.2	ARM Virtualised Compute Resource Allocation	
7.8.1.3	x86 Virtualised Compute Resource Allocation	

7.8.1.4	Anti-affinity Virtualised Compute Resource Allocation	119
7.8.1.5	NUMA Virtualised Compute Resource Allocation	
7.8.1.6	Compute Resource Allocation in Huge Page Memory Mode	121
7.8.1.7	Virtualised Compute Resource Using SR-IOV	121
7.8.2	Virtualised Network Resource Management	
7.8.2.1	Allocate an IPv6 Address to virtualised network interface via DHCP	122
7.8.3	Virtualised Storage Resource Management	123
7.8.3.1	Generic Virtualised Storage Resource Allocation	123
7.8.3.2	RDMA Virtualised Storage Resource Allocation	123
Annex	A: Technical Report Card Sample	124
Annex	B: Document Usage Process Diagram	125
Annex	C: Interoperability Features Statement (IFS) Diagram	126
C.0 (General	126
C.1 I	FS for VIM	126
C.2 I	FS for VNFM	127
C.3 I	FS for NFVO	128
C.4 I	FS for EM/VNF	129
Annex	D: Void	130
Annex	E: Usage of test tools	131
History	7	132

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org/).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

DECTTM, **PLUGTESTS**TM, **UMTS**TM and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP**TM and **LTE**TM are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M**TM logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM**[®] and the GSM logo are trademarks registered and owned by the GSM Association.

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 <u>ETSI Drafting Rules</u> (Verbal forms for the expression of provisions).

"must" and "must not" are NOT allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document describes a set of informative interoperability test guidelines for NFV capabilities that require interactions between the components implementing NFV functionality, namely, the NFVO, VNFM, EM-VNF and VIM-NFVI (Functions under Test).

The guidelines in the present document follow the interoperability testing methodology described in ETSI GS NFV-TST 002 [i.1] and are implementation agnostic. The capabilities in scope are enabled by the interfaces on the main NFV reference points between the Functions Under Test:

- Or-Vi;
- Or-Vnfm;
- Vi-Vnfm; and
- Ve-Vnfm.

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-TST 002 (V1.1.1): "Network Functions Virtualisation (NFV); Testing
	Methodology; Report on NFV Interoperability Testing Methodology".

- [i.2] ETSI GS NFV 003 (V1.6.1): "Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV".
- [i.3] ETSI GS NFV-IFA 005 (V3.5.1): "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Or-Vi reference point Interface and Information Model Specification".
- [i.4] ETSI GS NFV-IFA 006 (V3.5.1): "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Vi-Vnfm reference point Interface and Information Model Specification".
- [i.5] ETSI GS NFV-IFA 007 (V3.5.1): "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Or-Vnfm reference point Interface and Information Model Specification".
- [i.6] ETSI GS NFV-IFA 008 (V3.5.1): "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Ve-Vnfm reference point Interface and Information Model Specification".
- [i.7] ETSI GS NFV-IFA 010 (V3.5.1): "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Functional requirements specification".

- [i.8] ETSI GS NFV-IFA 011 (V3.5.1): "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; VNF Descriptor and Packaging Specification".
- [i.9] ETSI GS NFV-IFA 013 (V3.5.1): "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Os-Ma-nfvo reference point Interface and Information Model Specification".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI GS NFV 003 [i.2] apply.

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI GS NFV 003 [i.2] and the following apply:

NOTE: An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in ETSI GS NFV 003 [i.2].

CRM Compute Resource Management

DF Deployment Flavour
EM Element Manager
FM Fault Management

IFS Interoperability Features Statement

KPI Key Performance Indicator
MANO Management and Orchestration
NFV Network Function Virtualisation

NFVI NFV Infrastructure NFVO NFV Orchestrator

NIC Network Interface Controller NRM Network Resource Management

NS Network Service NSD NS Descriptor

NUMA Non-Uniform Memory Access
PM Performance Management
RDMA Remote Direct Memory Access
SRM Storage Resource Management

SUT System Under Test

VIM Virtual Infrastructure Manager

VL Virtual Link
VLD VL Descriptor
VM Virtual Machine

VNF Virtual Network Functions

VNFC VNF Component
VNFD VNF Descriptor
VNFFG VNF Forwarding Graph
VNFFGD VNFFG Descriptor
VNFM VNF Manager
VR Virtual Resource

4 Interoperability Features Statement (IFS)

4.1 Introduction

This clause compiles the Interoperability Features Statement (IFS) for VIM, VNFM, EM/VNF and NFVO according to clause 4.3.3 of ETSI GS NFV-TST 002 [i.1] and following the example in ETSI GS NFV-TST 002 [i.1], annex A.

The interoperability feature statement identifier starts with a reference to the relevant functional block that produces or consumes the interface:

- IDs starting with "VIM_" designate features on interfaces produced or consumed by the VIM.
- IDs starting with "VNFM_" designate features on interfaces produced or consumed by the VNFM.
- IDs starting with "NFVO_" designate features on interfaces produced or consumed by the NFVO.
- IDs starting with "EM_" designate features on interfaces produced or consumed by the EM/VNF.

The purpose of the Interoperable Features Statement (IFS) is to identify those standardized functions which a FUT supports, including those which are optional and those which are conditional on the support of other functions. Supported interoperability feature statements should be indicated by Y in the Support column (or N if not supported). The Details column can be used to add further support details when necessary.

4.2 IFS for VIM

4.2.1 Software Image Management

Table 4.2.1-1

Functional Block	unctional Block VIM			
Functional Area	Software Image Management			
Observed Reference Point	Or-Vi			
Observed Interface	Software Image Management			
Producer/Consumer	Producer			
References	ETSI GS NFV-IFA 005 [i.3]			
Interoperability Features				
ld	Feature	Status	Support	Details
VIM_SWIM_QUERY_IM_BY_NFVO	VIM supports software image information queries by the NFVO	М		
VIM_SWIM_ADD_IM	VIM supports "add image" operations by the NFVO	М		
VIM_SWIM_UPDATE_IM	VIM supports "update image" operations by the NFVO	М		
VIM_SWIM_DELETE_IM	VIM supports "delete image" operations by the NFVO	M		

Table 4.2.1-2

Functional Block	VIM			
Functional Area	Software Image Management			
Observed Reference Point	t Vi-Vnfm			
Observed Interface	Software Image Management			
Producer/Consumer	Producer			
References	ETSI GS NFV-IFA 006 [i.4]			
Interoperability Features				
ld	Feature	Status	Support	Details
VIM_SWIM_QUERY_IM_BY_VNFM	VIM supports software image information queries by the VNFM	М		

4.2.2 VNF Package Management

No IFS needed for VNF Package Management on the VIM.

4.2.3 VNF Lifecycle Management

Table 4.2.3-1

Functional Block	IVIM			
Functional Area	VNF Lifecycle Management			
Observed Reference Point	Vi-Vnfm			
Observed Interface	Virtualised Compute Resource Manage	ment		
Producer/Consumer	Producer			
References	ETSI GS NFV-IFA 006 [i.4]			
Interoperability Features	•			
ld	Feature	Status	Support	Details
VIM_CRM_ALLOCATE_BY_VNFM	VIM supports "allocate compute resource" operation requests from the VNFM	M		
VIM_CRM_INFO_TO_VNFM	VIM can send compute resource information to the VNFM	М		
VIM_CRM_OPERATE_BY_VNFM	VIM supports "operate compute resource" operation requests from the VNFM	М		
VIM_CRM_TERMINATE_BY_VNFM	VIM supports "terminate compute resource" operation requests from the VNFM	М		

Table 4.2.3-2

Functional Block	VIM				
Functional Area	Network Resource Management	Network Resource Management			
Observed Reference Point	/i-Vnfm				
Observed Interface	Virtualised Network Resource Management				
Producer/Consumer	Producer				
References	ETSI GS NFV-IFA 006 [i.4]				
Interoperability Features					
ld	Feature	Status	Support	Details	
VIM_NRM_ALLOCATE_BY_VNFM	VIM supports "allocate network resource" operation requests from the VNFM	М			
VIM_NRM_INFO_TO_VNFM	VIM can send network resource information to the VNFM	М			
VIM_NRM_TERMINATE_BY_VNFM	VIM supports "terminate network resource" operation requests from the VNFM	М			

Table 4.2.3-3

Functional Block	VIM			
Functional Area	VNF Lifecycle Management			
Observed Reference Point	Vi-Vnfm			
Observed Interface	Virtualised Storage Resource Manager	ment		
Producer/Consumer	Producer			
References	ETSI GS NFV-IFA 006 [i.4]			
Interoperability Features				
ld	Feature	Status	Support	Details
VIM_SRM_ALLOCATE_BY_VNFM	VIM supports "allocate storage resource" operation requests from the VNFM	М		
VIM_SRM_INFO_TO_VNFM	VIM can send storage resource information to the VNFM	М		
VIM_SRM_TERMINATE_BY_VNFM	VIM supports "terminate storage resource" operation requests from the VNFM	М		

4.2.4 Fault Management

Table 4.2.4-1

Functional Block	VIM			
Functional Area	Fault Management			
Observed Reference Point	Or-Vi			
Observed Interface	Virtualised Resources Fault Managem	nent		
Producer/Consumer	Producer			
References	ETSI GS NFV-IFA 005 [i.3]			
Interoperability Features				
ld	Feature	Status	Support	Details
VIM_FM_SUBSCRIBE_BY_NFVO	VIM supports alarm notifications subscriptions by the NFVO	М		
VIM_FM_NOTIFY_BY_NFVO	VIM can generate virtualised resources fault alarm notifications to the NFVO	М		
VIM_FM_QUERY_BY_NFVO	VIM supports virtualised resource fault alarm list queries by the NFVO	М		

Table 4.2.4-2

Functional Block	VIM				
Functional Area	Fault Management				
Observed Reference Point	Vi-Vnfm	** ******			
Observed Interface	Virtualised Resources Fault Management				
Producer/Consumer	Producer				
References	ETSI GS NFV-IFA 006 [i.4]	ETSI GS NFV-IFA 006 [i.4]			
Interoperability Features					
ld	Feature	Status	Support	Details	
VIM_FM_SUBSCRIBE_BY_VNFM	VIM supports alarm notifications subscriptions by the VNFM	М			
VIM_FM_NOTIFY_BY_VNFM	VIM can generate virtualised resources fault alarm notifications to the VNFM	М			
VIM_FM_QUERY_BY_VNFM	VIM supports virtualised resources fault alarm list queries by the VNFM	М			

4.2.5 Performance Management

Table 4.2.5-1

Functional Block	VIM			
Functional Area	Fault Management			
Observed Reference Point	Or-Vi			
Observed Interface	Virtualised Resources Performand	ce Manage	ement	
Producer/Consumer	Producer			
References	ETSI GS NFV-IFA 005 [i.3]			
Interoperability Features				
ld	Feature	Status	Support	Details
VIM_PM_PMJOB_CREATE_BY_NFVO	VIM supports VR PM jobs creation by the NFVO	М		
VIM_PM_PMJOB_SUBSCRIBE_BY_NFVO	VIM supports VR PM job subscriptions from the NFVO	М		
VIM_PM_PMJOB_NOTIFY_BY_NFVO	VIM can generate VR PM notifications to the NFVO	М		
VIM_PM_PMJOB_QUERY_BY_NFVO	VIM supports VR PM job queries by the NFVO	М		
VIM_PM_PMJOB_DELETE_BY_NFVO	VIM supports VR PM jobs deletion by the NFVO	М		
VIM_PM_PMTH_CREATE_BY_NFVO	VIM supports VR PM thresholds creation by the NFVO	М		
VIM_PM_PMTH_QUERY_BY_NFVO	VIM supports VR PM threshold queries by the NFVO	М		
VIM_PM_PMTH_DELETE_BY_NFVO	VIM supports VR PM thresholds deletion by the NFVO	М		

Table 4.2.5-2

Functional Block	VIM				
Functional Area	Performance Management				
Observed Reference Point	Vi-Vnfm				
Observed Interface	Virtualised Resources Performance M	/lanageme	ent		
Producer/Consumer	Producer				
References	ETSI GS NFV-IFA 006 [i.4]				
Interoperability Features					
ld	Feature	Status	Support	Details	
VIM_PM_PMJOB_CREATE_BY_VNFM	VIM supports VR PM jobs creation by the VNFM	М			
VIM_PM_PMJOB_SUBSCRIBE_BY_VNFM	VIM supports VR PM job subscriptions from the VNFM	М			
VIM_PM_PMJOB_NOTIFY_BY_VNFM	VIM can generate VR PM notifications to the VNFM	М			
VIM_PM_PMJOB_QUERY_BY_VNFM	VIM supports VR PM job queries by the VNFM	М			
VIM_PM_PMJOB_DELETE_BY_VNFM	VIM supports VR PM jobs deletion by the VNFM	М			
VIM_PM_PMTH_CREATE_BY_VNFM	VIM supports VR PM thresholds creation by the VNFM	М			
VIM_PM_PMTH_QUERY_BY_VNFM	VIM supports VR PM threshold queries by the VNFM	М			
VIM_PM_PMTH_DELETE_BY_VNFM	VIM supports VR PM thresholds deletion by the VNFM	М			

4.2.6 NS Lifecycle Management

Table 4.2.6-1

Functional Block	VIM			
Functional Area	NS Lifecycle Management			
Observed Reference Point	Or-Vi			
Observed Interface	Software Image Management			
Producer/Consumer	Producer			
References	ETSI GS NFV-IFA 005 [i.3]			
Interoperability Features				
Id	Feature	Status	Support	Details
VIM_SWIM_QUERY_IM_BY_NFVO	VIM supports software image information queries by the NFVO	М		

Table 4.2.6-2

Functional Block	VIM				
Functional Area	NS Lifecycle Management	NS Lifecycle Management			
Observed Reference Point	Vi-Vnfm				
Observed Interface	Software Image Management				
Producer/Consumer	Producer				
References	ETSI GS NFV-IFA 006 [i.4]				
Interoperability Features					
ld	Feature	Status	Support	Details	
VIM_SWIM_QUERY_IM_BY_VNFM	VIM supports software image information queries by the VNFM	М			

Table 4.2.6-3

Functional Block	VIM				
Functional Area	NS Lifecycle Management				
Observed Reference Point	Dr-Vi				
Observed Interface	/irtualised Compute Resource Management				
Producer/Consumer	Producer				
References	ETSI GS NFV-IFA 005 [i.3]	ETSI GS NFV-IFA 005 [i.3]			
Interoperability Features					
ld	Feature	Status	Support	Details	
VIM_CRM_ALLOCATE_BY_NFVO	VIM supports "allocate compute resource" operation requests from the NFVO	М			
VIM_CRM_TERMINATE_BY_NFVO	VIM supports "terminate compute resource" operation requests from the NFVO	М			
VIM_CRM_INFO_TO_NFVO	VIM can send compute resource information to the NFVO	М			
VIM_CRM_OPERATE_BY_NFVO	VIM supports "operate compute resource" operation requests from the NFVO	М			

Table 4.2.6-4

Functional Block	VIM	VIM				
Functional Area	NS Lifecycle Management					
Observed Reference Point	Or-Vi					
Observed Interface	Virtualised Network Resource Management					
Producer/Consumer	Producer					
References	ETSI GS NFV-IFA 005 [i.3]					
Interoperability Features						
ld	Feature	Status	Support	Details		
VIM_NRM_ALLOCATE_BY_NFVO	VIM supports "allocate network resource" operation requests from the NFVO	М				
VIM_NRM_TERMINATE_BY_NFVO	VIM supports "terminate network resource" operation requests from the NFVO	М				
VIM_NRM_INFO_TO_NFVO	VIM can send network resource information to the NFVO	М				

Table 4.2.6-5

Functional Block	VIM	/IM				
Functional Area	NS Lifecycle Management					
Observed Reference Point	Or-Vi					
Observed Interface	Virtualised Storage Resource Manager	ment				
Producer/Consumer	Producer					
References	ETSI GS NFV-IFA 005 [i.3]					
Interoperability Features	Interoperability Features					
ld	Feature	Feature Status Support Details				
VIM_SRM_ALLOCATE_BY_NFVO	VIM supports "allocate storage resource" operation requests from the NFVO	М				
VIM_SRM_TERMINATE_BY_NFVO	VIM supports "terminate storage resource" operation requests from the NFVO	М				
VIM_SRM_INFO_TO_NFVO	VIM can send storage resource information to the NFVO	M				

Table 4.2.6-6

Functional Block	VIM				
Functional Area	NS Lifecycle Management				
Observed Reference Point	Or-Vi				
Observed Interface	Virtualised Resources Performance Management				
Producer/Consumer	Producer				
References	ETSI GS NFV-IFA 005 [i.3]				
Interoperability Features	Interoperability Features				
ld	Feature	Status	Support	Details	
VIM_PM_PMJOB_CREATE_BY_NFVO	VIM supports VR PM jobs creation by the NFVO	М			
VIM_PM_PMJOB_SUBSCRIBE_BY_NF VO	VIM supports VR PM job subscriptions from the NFVO	М			
VIM_PM_PMJOB_NOTIFY_BY_NFVO	VIM can generate VR PM notifications to the NFVO	М			
VIM_PM_PMTH_CREATE_BY_NFVO	VIM supports VR PM thresholds creation by the NFVO	М			

Table 4.2.6-7

Functional Block	VIM					
Functional Area	NS Lifecycle Management					
Observed Reference Point	Vi-Vnfm Vi-Vnfm					
Observed Interface	Virtualised Resources Performance M	lanageme	nt			
Producer/Consumer	Producer					
References	ETSI GS NFV-IFA 006 [i.4]					
Interoperability Features						
Id	Feature	Status	Support	Details		
VIM_PM_PMJOB_CREATE_BY_VNFM	VIM supports VR PM jobs creation by the VNFM	М				
VIM_PM_PMJOB_SUBSCRIBE_BY_VNFM	VIM supports VR PM job subscriptions from the VNFM	М				
VIM_PM_PMJOB_NOTIFY_BY_VNFM	VIM can generate VR PM notifications to the VNFM	М				
VIM_PM_PMTH_CREATE_BY_VNFM	VIM supports VR PM thresholds creation by the VNFM	М				

4.3 IFS for VNFM

4.3.1 Software Image Management

Table 4.3.1-1

Functional Block	VNFM	VNFM				
Functional Area	Software Image Management					
Observed Reference Point	Vi-Vnfm					
Observed Interface	Software Image Management	Software Image Management				
Producer/Consumer	Consumer	Consumer				
References	ETSI GS NFV-IFA 006 [i.4]					
Interoperability Features						
ld	Feature	Feature Status Support Details				
VNFM_SWIM_QUERY_IM	VNFM can query software image information on the VIM	М				

4.3.2 VNF Package Management

No IFS needed for VNF Package Management on the VNFM.

4.3.3 VNF Lifecycle Management

Table 4.3.3-1

Functional Block	VNFM	VNFM				
Functional Area	VNF Lifecycle Management	VNF Lifecycle Management				
Observed Reference Point	Vi-Vnfm					
Observed Interface	Virtualised Compute Resource Manag	gement				
Producer/Consumer	Consumer					
References	ETSI GS NFV-IFA 006 [i.4]					
Interoperability Features						
ld	Feature	Status	Support	Details		
VNFM_CRM_QUERY	VNFM can query compute resource information from the VIM	М				
VNFM_CRM_ALLOCATE	VNFM can generate "allocate compute resource" operation requests to the VIM	М				
VNFM_CRM_OPERATE	VNFM can generate "operate compute resource" operation requests to the VIM	М				
VNFM_CRM_TERMINATE	VNFM can generate "terminate compute resource" operation requests to the VIM	М				

Table 4.3.3-2

Functional Block	VNFM				
Functional Area	/NF Lifecycle Management				
Observed Reference Point	Vi-Vnfm				
Observed Interface	Virtualised Network Resource Manager	ment			
Producer/Consumer	Consumer				
References	ETSI GS NFV-IFA 006 [i.4]				
Interoperability Features	·				
ld	Feature	Status	Support	Details	
VNFM_NRM_QUERY	VNFM can query network resource information from the VIM	М			
	VNFM can generate "allocate network resource" operation requests to the VIM	М			
	VNFM can generate "terminate network resource" operation requests to the VIM	М			

Table 4.3.3-3

Functional Block	VNFM				
Functional Area	VNF Lifecycle Management				
Observed Reference Point	/i-Vnfm				
Observed Interface	Virtualised Storage Resource Management				
Producer/Consumer	Consumer				
References	ETSI GS NFV-IFA 006 [i.4]				
Interoperability Features	atures				
Id	Feature	Status	Support	Details	
VNFM_SRM_QUERY	VNFM can query storage resource information from the VIM	М			
VNFM_SRM_ALLOCATE	VNFM can generate "allocate storage resource" operation requests to the VIM	М			
VNFM_SRM_TERMINATE	VNFM can generate "terminate storage resource" operation requests to the VIM	М			

Table 4.3.3-4

Functional Block	VNFM			
Functional Area	VNF Lifecycle Management			
Observed Reference Point	Or-Vnfm			
Observed Interface	VNF Lifecycle Management			
Producer/Consumer	Producer			
References	ETSI GS NFV-IFA 007 [i.5]			
Interoperability Features				
ld	Feature	Status	Support	Details
	VNFM supports VNF information queries by the NFVO	М		

Table 4.3.3-5

Functional Block	VNFM			
Functional Area	VNF Lifecycle Management			
Observed Reference Point	Ve-Vnfm			
Observed Interface	VNF Lifecycle Management			
Producer/Consumer	Producer			
References	ETSI GS NFV-IFA 008 [i.6]			
Interoperability Features				
ld	Feature	Status	Support	Details
VNFM_VNFLCM_VNF_INSTANTIAT E	VNFM supports "instantiate VNF" requests from the EM	М		
VNFM_VNFLCM_VNF_QUERY	VNFM supports "query VNF" requests from the EM	М		
VNFM_VNFLCM_VNF_MODIFY_IN FO	VNFM supports "modify VNF information" requests from the EM	М		
VNFM_VNFLCM_VNF_OPERATE	VNFM supports "operate VNF" requests from the EM	М		
VNFM_VNFLCM_VNF_HEAL	VNFM supports "heal VNF" requests from the EM/VNF	М		
VNFM_VNFLCM_VNF_SCALE_OU T	VNFM supports "scale out by adding VNFC instances" requests from the EM/VNF	М		
VNFM_VNFLCM_VNF_SCALE_IN	VNFM supports "scale in by removing VNFC instances" requests from the EM/VNF	М		
VNFM_VNFLCM_VNF_TERMINATE	VNFM supports "terminate VNF" requests from the EM	М		

Table 4.3.3-6

Functional Block	VNFM			
Functional Area	VNF Lifecycle Management			
Observed Reference Point	Or-Vnfm			
Observed Interface	VNF Lifecycle Operation Granting			
Producer/Consumer	Consumer			
References	ETSI GS NFV-IFA 007 [i.5]			
Interoperability Features				
ld	Feature	Status	Support	Details
VNFM_VNFLCM_GRANTING	VNFM can generate "Grant VNF Lifecycle Operation" requests to the NFVO	0		

4.3.4 Fault Management

Table 4.3.4-1

Functional Block	VNFM				
Functional Area	Fault Management				
Observed Reference Point	Vi-Vnfm				
Observed Interface	Virtualised Resources Fault Management				
Producer/Consumer	Consumer				
References	ETSI GS NFV-IFA 006 [i.4]				
Interoperability Features					
ld	Feature	Status	Support	Details	
VNFM_FM_VR_SUBSCRIBE	VNFM can subscribe to alarm notifications on the VIM	М			
VNFM_FM_VR_NOTIFY	VNFM can process virtualised resource fault alarm notifications from by the VIM	М			
VNFM_FM_VR_GET_ALARM	VNFM can get the list of virtualised resource fault alarms from the VIM	М			

Table 4.3.4-2

Functional Block	VNFM				
Functional Area	Fault Management				
Observed Reference Point	Or-Vnfm				
Observed Interface	VNF Fault Management				
Producer/Consumer	Producer				
References	ETSI GS NFV-IFA 007 [i.5]				
Interoperability Features					
ld	Feature	Status	Support	Details	
VNFM_FM_VNF_SUBSCRIBE	Feature VNFM supports alarm notifications subscriptions from by the NFVO	Status M	Support	Details	
	VNFM supports alarm notifications		Support	Details	

4.3.5 Performance Management

Table 4.3.5-1

Functional Block	VNFM	/NFM			
Functional Area	Performance Management				
Observed Reference Point	Vi-Vnfm				
Observed Interface	Virtualised Resources Performance Management	anageme	nt		
Producer/Consumer	Consumer	Consumer			
References	ETSI GS NFV-IFA 006 [i.4]				
Interoperability Features					
ld	Feature	Status	Support	Details	
VNFM_PM_VR_PMJOB_CREATE	VNFM can create VR PM jobs on the VIM	М			
VNFM_PM_VR_PMJOB_SUBSCRIBE	VNFM can subscribe to VR PM jobs on the VIM	М			
VNFM_PM_VR_PMJOB_NOTIFY	VNFM supports VR PM job notifications from the VIM	М			
VNFM_PM_VR_PMJOB_QUERY	VNFM can query VR PM jobs from the VIM	М			
VNFM_PM_VR_PMJOB_DELETE	VNFM can delete VR PM jobs from the VIM	М			
VNFM_PM_VR_PMTH_CREATE	VNFM can create VR PM thresholds on the VIM	М			
VNFM_PM_VR_PMTH_QUERY	VNFM can query VR PM thresholds from the VIM	М			
VNFM_PM_VR_PMTH_DELETE	VNFM can delete VR PM thresholds from the VIM	М			

Table 4.3.5-2

	L					
Functional Block	VNFM					
Functional Area	Performance Management					
Observed Reference Point	Or-Vnfm					
Observed Interface	VNF Performance Management					
Producer/Consumer	Producer					
References	ETSI GS NFV-IFA 007 [i.5]					
Interoperability Features						
ld	Feature	Status	Support	Details		
VNFM_PM_VNF_PMJOB_CREATE	VNFM supports VNF PM jobs creation by the NFVO	М				
VNFM_PM_VNF_PMJOB_SUBSCRIBE	VNFM supports VNF PM job subscriptions from the NFVO	М				
VNFM_PM_VNF_PMJOB_NOTIFY	VNFM can generate VNF PM notifications to the NFVO	М				
VNFM_PM_VNF_PMJOB_QUERY	VNFM supports VNF PM job queries by the NFVO	М				
VNFM_PM_VNF_PMJOB_DELETE	VNFM supports VNF PM jobs deletion by the NFVO	М				
VNFM_PM_VNF_PMTH_CREATE	VNFM supports VNF PM thresholds creation by the NFVO	М				
VNFM_PM_VNF_PMTH_QUERY	VNFM supports VNF PM threshold queries by the NFVO	М				
VNFM_PM_VNF_PMTH_DELETE	VNFM supports VNF PM thresholds deletion by the NFVO	М				

4.3.6 NS Lifecycle Management

Table 4.3.6-1

Functional Block	/NFM				
Functional Area	NS Lifecycle Management				
Observed Reference Point	Vi-Vnfm				
Observed Interface	Virtualised Resources Performance Management				
Producer/Consumer	Consumer				
References	ETSI GS NFV-IFA 006 [i.4]				
Interoperability Features					
ld	Feature	Status	Support	Details	
VNFM_PM_VR_PMJOB_CREATE	VNFM can create VR PM jobs on the VIM	М			
VNFM_PM_VR_PMJOB_SUBSCRIBE	VNFM can subscribe to VR PM jobs on the VIM	М			
VNFM_PM_VR_PMJOB_NOTIFY	VNFM supports VR PM job notifications from the VIM	М			

Table 4.3.6-2

Functional Block	VNFM			
Functional Area	NS Lifecycle Management			
Observed Reference Point	Or-Vnfm			
Observed Interface	VNF Lifecycle Management			
Producer/Consumer	Producer			
References	ETSI GS NFV-IFA 007 [i.5]			
Interoperability Features				
ld	Feature	Status	Support	Details
VNFM_VNFLCM_CREATE_VNFID	VNFM supports "create VNF identifier" operation requests from the NFVO	М		
VNFM_VNFLCM_INSTANTIATE	VNFM supports "instantiate VNF" operation requests from the NFVO	М		
VNFM_VNFLCM_DELETE_VNFID	VNFM supports "delete VNF identifier" operation requests from the NFVO	М		
VNFM_VNFLCM_TERMINATE	VNFM supports "terminate VNF" operation requests from the NFVO	М		
VNFM_VNFLCM_QUERY	VNFM supports VNF information queries by the NFVO	М		
VNFM_VNFLCM_HEAL	VNFM supports VNF healing requests from the NFVO	М		
VNFM_VNFLCM_OPERATE	VNFM supports "operate VNF" operation requests from the NFVO	М		
VNFM_VNFLCM_NS_SCALE_OUT	VNFM supports "scale out by adding VNF instances" requests from the NFVO	М		
VNFM_VNFLCM_NS_SCALE_IN	VNFM supports "scale in by removing VNF instances" requests from the NFVO	М		
VNFM_VNFLCM_VNF_SCALE_OUT	VNFM supports "scale out by adding VNFC instances" requests from the NFVO	М		
VNFM_VNFLCM_VNF_SCALE_IN	VNFM supports "scale in by removing VNFC instances" requests from the NFVO	М		

Table 4.3.6-3

Functional Block	VNFM				
Functional Area	NS Lifecycle Management				
Observed Reference Point	Or-Vnfm				
Observed Interface	Indicator				
Producer/Consumer	Producer				
References	ETSI GS NFV-IFA 007 [i.5]				
Interoperability Features					
Id	Feature	Status	Support	Details	
VNFM_NSVNFINDI_SUBSCRIBE	VNFM supports VNF indicator subscriptions from the NFVO	М			
VNFM_NSVNFINDI_NOTIFY	VNFM can generate VNF indicator notifications to the NFVO	М			

Table 4.3.6-4

Functional Block	VNFM			
Functional Area	NS Lifecycle Management			
Observed Reference Point	Ve-Vnfm			
Observed Interface	Indicator			
Producer/Consumer	Consumer			
References	ETSI GS NFV-IFA 008 [i.6]			
Interoperability Features				
ld	Feature	Status	Support	Details
VNFM_VNFINDI_SUBSCRIBE	VNFM can subscribe to VNF indicators on the EM/VNF	Status M	Support	Details

4.4 IFS for NFVO

4.4.1 Software Image Management

Table 4.4.1-1

Functional Block	NFVO				
Functional Area	Software Image Management				
Observed Reference Point	Or-Vi				
Observed Interface	Software Image Management				
Producer/Consumer	Consumer				
References	ETSI GS NFV-IFA 005 [i.3]				
Interoperability Features					
ld	Feature	Status	Support	Details	
NFVO_SWIM_ADD_IM	NFVO can add software images on the VIM	М			
NFVO_SWIM_QUERY_IM	NFVO can query software image information on the VIM	М			
NFVO_SWIM_UPDATE_IM	NFVO can update software image information on the VIM	М			
NFVO_SWIM_DELETE_IM	NFVO can delete software images from the VIM	М			

4.4.2 VNF Package Management

Table 4.4.2-1

Functional Block	NFVO				
Functional Area	VNF Package Management				
Observed Reference Point	Os-Ma-Nfvo				
Observed Interface	VNF Package Management				
Producer/Consumer	Producer				
References	ETSI GS NFV-IFA 013 [i.9]				
Interoperability Features					
ld	Feature	Status	Support	Details	
NFVO_VNFPM_VALIDATE	NFVO can check the integrity and validity of VNF Packages	М			
NFVO_VNFPM_ACCESS	NFVO can access the VNF catalogue where the VNF Packages information is stored	М			
NFVO_VNFPM_QUERY	NFVO supports on-boarded VNF Packages queries	М			
NFVO_VNFPM_ABORT_DELETE	NFVO supports the delete VNF Package operation abortion	М			

4.4.3 VNF Lifecycle Management

Table 4.4.3-1

Functional Block	NFVO			
Functional Area	VNF Lifecycle Management			
Observed Reference Point	Or-Vnfm			
Observed Interface	VNF Lifecycle Management			
Producer/Consumer	Consumer			
References	ETSI GS NFV-IFA 007 [i.5]			
Interoperability Features				
ld	Feature	Status	Support	Details
	NFVO can query VNF information from the VNFM	М		

Table 4.4.3-2

Functional Block	NFVO			
Functional Area	VNF Lifecycle Management			
Observed Reference Point	Or-Vnfm			
Observed Interface	VNF Lifecycle Operation Granting			
Producer/Consumer	Producer			
References	ETSI GS NFV-IFA 007 [i.5]			
Interoperability Features				
ld	Feature	Status	Support	Details
NFVO_VNFLCM_GRANTING	NFVO supports "Grant VNF Lifecycle Operation" requests from the VNFM	0		

4.4.4 Fault Management

Table 4.4.4-1

Functional Block	NFVO				
Functional Area	Fault Management				
Observed Reference Point	Or-Vi				
Observed Interface	Virtualised Resource Fault Managemer	nt			
Producer/Consumer	Consumer				
References	ETSI GS NFV-IFA 005 [i.3]				
Interoperability Features					
ld	Feature	Status	Support	Details	
NFVO_FM_VR_SUBSCRIBE	NFVO can subscribe to virtualised resource fault alarms on the VIM	М			
NFVO_FM_VR_NOTIFY	NFVO can process virtualised resource fault alarm notifications from the VIM	М			
	line viivi				

Table 4.4.4-2

Functional Block	NFVO			
Functional Area	Fault Management			
Observed Reference Point	Or-Vnfm			
Observed Interface	VNF Fault Management			
Producer/Consumer	Consumer			
References	ETSI GS NFV-IFA 007 [i.5]			
Interoperability Features				
Id	Feature	Status	Support	Details
	NFVO can subscribe to alarm notifications on the VNFM	Status M	Support	Details
NFVO_FM_VNF_SUBSCRIBE NFVO_FM_VNF_NOTIFY	NFVO can subscribe to alarm		Support	Details

4.4.5 Performance Management

Table 4.4.5-1

Functional Block	NFVO				
Functional Area	Performance Management				
Observed Reference Point	Or-Vi				
Observed Interface	Virtualised Resource Performance Management				
Producer/Consumer	Consumer				
References	ETSI GS NFV-IFA 005 [i.3]				
Interoperability Features					
ld	Feature	Status	Support	Details	
NFVO_PM_VR_PMJOB_CREATE	NFVO can create VR PM jobs on the VIM	М			
NFVO_PM_VR_PMJOB_SUBSCRIBE	NFVO can subscribe to VR PM jobs on the VIM	М			
NFVO_PM_VR_PMJOB_NOTIFY	NFVO supports VR PM notifications from the VIM	М			
NFVO_PM_VR_PMJOB_QUERY	NFVO can query VR PM jobs from the VIM	М			
NFVO_PM_VR_PMJOB_DELETE	NFVO can delete VR PM jobs from the VIM	М			
NFVO_PM_VR_PMTH_CREATE	NFVO can create VR PM thresholds on the VIM	М			
NFVO_PM_VR_PMTH_QUERY	NFVO can query VR PM thresholds from the VIM	M			
NFVO_PM_VR_PMTH_DELETE	NFVO can delete VR PM thresholds from the VIM	М			

Table 4.4.5-2

Functional Block	NFVO				
Functional Area	Performance Management				
Observed Reference Point	Or-Vnfm				
Observed Interface	VNF Performance Management				
Producer/Consumer	Consumer				
References	ETSI GS NFV-IFA 007 [i.5]				
Interoperability Features					
ld	Feature	Status	Support	Details	
NFVO_PM_VNF_PMJOB_CREATE	NFVO can create VNF PM jobs on the VNFM	М			
NFVO_PM_VNF_PMJOB_SUBSCRIBE	NFVO can subscribe to VNF PM jobs on the VNFM	М			
NFVO_PM_VNF_PMJOB_NOTIFY	NFVO supports VNF PM notifications from the VNFM	М			
NFVO_PM_VNF_PMJOB_QUERY	NFVO can query VNF PM jobs from the VNFM	М			
NFVO_PM_VNF_PMJOB_DELETE	NFVO can create VNF PM jobs on the VNFM	М			
NFVO_PM_VNF_PMTH_CREATE	NFVO can create VNF PM thresholds on the VNFM	М			
NFVO_PM_VNF_PMTH_QUERY	NFVO can query VNF PM thresholds from the VNFM	М			
NFVO_PM_VNF_PMTH_DELETE	NFVO can delete VNF PM thresholds from the VNFM	М			

4.4.6 NS Lifecycle Management

Table 4.4.6-1

Functional Block	NFVO			
Functional Area	NS Lifecycle Management			
Observed Reference Point	Or-Vi			
Observed Interface	Software Image Management			
Producer/Consumer	Consumer			
References	ETSI GS NFV-IFA 005 [i.3]			
Interoperability Features	Interoperability Features			
ld	Feature	Status	Support	Details
NFVO_SWIM_QUERY_IM	NFVO can query software image information on the VIM	М		

Table 4.4.6-2

Functional Block	NFVO			
Functional Area	NS Lifecycle Management			
Observed Reference Point	Or-Vi			
Observed Interface	Virtualised Compute Resource Manag	gement		
Producer/Consumer	Consumer			
References	ETSI GS NFV-IFA 005 [i.3]			
Interoperability Features				
Id	Feature	Status	Support	Details
NFVO_CRM_QUERY	NFVO can query compute resource information from the VIM	М		
NFVO_CRM_ALLOCATE	NFVO can generate "allocate compute resource" operation requests to the VIM	М		
NFVO_CRM_OPERATE	NFVO can generate "operate compute resource" operation requests to the VIM	М		
NFVO_CRM_TERMINATE	NFVO can generate "terminate compute resource" operation requests to the VIM	М		

Table 4.4.6-3

Functional Block	NFVO			
Functional Area	IS Lifecycle Management			
Observed Reference Point	Or-Vi			
Observed Interface	Virtualised Network Resource Manage	ement		
Producer/Consumer	Consumer			
References	ETSI GS NFV-IFA 005 [i.3]			
Interoperability Features				
Id	Feature	Status	Support	Details
NFVO_NRM_QUERY	NFVO can query network resource information from the VIM	М		
NFVO_NRM_ALLOCATE	NFVO can generate "allocate network resource" operation requests to the VIM	М		
NFVO_NRM_TERMINATE	NFVO can generate "terminate network resource" operation requests to the VIM	М		

Table 4.4.6-4

Functional Block	NFVO			
Functional Area	NS Lifecycle Management			
Observed Reference Point	Or-Vi			
Observed Interface	Virtualised Storage Resource N	Managemo	ent	
Producer/Consumer	Consumer			
References	ETSI GS NFV-IFA 005 [i.3]			
Interoperability Features				
ld	Feature	Status	Support	Details
NFVO_SRM_QUERY	NFVO can query storage resource information from the VIM	М		
NFVO_SRM_ALLOCATE	NFVO can generate "allocate storage resource" operation requests to the VIM	М		
NFVO_SRM_TERMINATE	NFVO can generate "terminate storage resource" operation requests to the VIM	М		

Table 4.4.6-5

Functional Block	NFVO			
Functional Area	NS Lifecycle Management			
Observed Reference Point	Or-Vi			
Observed Interface	Virtualised Resource Performance Mar	nagement		
Producer/Consumer	Consumer			
References	ETSI GS NFV-IFA 005 [i.3]			
Interoperability Features				
ld	Feature	Status	Support	Details
	i catule	Status	Support	Details
NFVO_PM_VR_PMJOB_CREATE	NFVO can create VR PM jobs on the VIM	M	Зиррогі	Details
	NFVO can create VR PM jobs on the		Зиррогі	Details

Table 4.4.6-6

Functional Block	NFVO			
Functional Area	NS Lifecycle Management			
Observed Reference Point	Or-Vnfm			
Observed Interface	VNF Lifecycle Management			
Producer/Consumer	Consumer			
References	ETSI GS NFV-IFA 007 [i.5]			
Interoperability Features				
ld	Feature	Status	Support	Details
NFVO_VNFLCM_CREATE_VNFID	NFVO can generate "create VNF identifier" operation requests to the VNFM	М		
NFVO_VNFLCM_INSTANTIATE	NFVO can generate "instantiate VNF" operation requests to the VNFM	М		
NFVO_VNFLCM_DELETE_VNFID	NFVO can generate "delete VNF identifier" operation requests to the VNFM	М		
NFVO_VNFLCM_TERMINATE	NFVO can generate "terminate VNF" operation requests to the VNFM	М		
NFVO_VNFLCM_QUERY	NFVO can query VNF information from the VNFM	М		
NFVO_VNFLCM_HEAL	NFVO can generate VNF healing requests to the VNFM	М		
NFVO_VNFLCM_OPERATE	NFVO can generate "operate VNF" operation requests to the VNFM	М		
NFVO_VNFLCM_NS_SCALE_OUT	NFVO can generate "scale out by adding VNF instances" requests to the VNFM	М		
NFVO_VNFLCM_NS_SCALE_IN	NFVO can generate "scale in by removing VNF instances" requests to the VNFM	М		
NFVO_VNFLCM_VNF_SCALE_OUT	NFVO can generate "scale out by adding VNFC instances" to the VNFM	М		
NFVO_VNFLCM_VNF_SCALE_IN	NFVO can generate "scale in by removing VNFC instances" to the VNFM	М		

Table 4.4.6-7

Functional Block	NFVO			
Functional Area	NS Lifecycle Management	NS Lifecycle Management		
Observed Reference Point	Or-Vnfm Or-Vnfm			
Observed Interface	Indicator			
Producer/Consumer	Consumer			
References	ETSI GS NFV-IFA 007 [i.5]			
Interoperability Features	nteroperability Features			
ld	Feature	Status	Support	Details
VNFM_NSVNFINDI_SUBSCRIBE	NFVO can subscribe to VNF indicators on the VNFM	М		
VNFM NSVNFINDI NOTIFY	NFVO supports VNF indicator	М		

4.5 IFS for EM/VNF

4.5.1 Software Image Management

No IFS needed for Software Image Management on the EM/VNF.

4.5.2 VNF Package Management

No IFS needed for VNF Package Management on the EM/VNF.

4.5.3 VNF Lifecycle Management

Table 4.5.3-1

Functional Block	EM/VNF			
Functional Area	VNF Lifecycle Management			
Observed Reference Point	Ve-Vnfm			
Observed Interface	VNF Lifecycle Management			
Producer/Consumer	Consumer			
References	ETSI GS NFV-IFA 008 [i.6]			
Interoperability Features				
ld	Feature	Status	Support	Details
EM_VNFLCM_VNF_INSTANTIATE	EM can generate "Instantiate VNF" requests to the VNFM	М		
EM_VNFLCM_VNF_QUERY	EM can generate "query VNF" requests to the VNFM	М		
EM_VNFLCM_VNF_MODIFY_INF O	EM can generate "modify VNF information" requests to the VNFM	М		
EM_VNFLCM_VNF_OPERATE	EM can generate "operate VNF" requests to the VNFM	М		
EM_VNFLCM_VNF_SCALE_OUT	EM/VNF can generate "scale out by adding VNFC instances" requests to the VNFM	М		
EM_VNFLCM_VNF_SCALE_IN	EM/VNF can generate "scale in by removing VNFC instances" requests to the VNFM	М		
EM_VNFLCM_VNF_HEAL	EM/VNF can generate "heal VNF" requests to the VNFM	М		
EM_VNFLCM_VNF_TERMINATE	EM can generate "terminate VNF" requests to the VNFM	М		

4.5.4 Fault Management

No IFS needed for Fault Management on the EM/VNF.

4.5.5 Performance Management

No IFS needed for Performance Management on the EM/VNF.

4.5.6 NS Lifecycle Management

Table 4.5.6-1

Functional Block	EM/VNF			
Functional Area	NS Lifecycle Management			
Observed Reference Point	Ve-Vnfm			
Observed Interface	Indicator			
Producer/Consumer	Producer			
References	ETSI GS NFV-IFA 008 [i.6]			
Interoperability Features	nteroperability Features			
ld	Feature	Status	Support	Details
EM_VNFINDI_SUBSCRIBE	EM/VNF supports VNF indicator subscriptions from the VNFM	М		
_	EM/VNF can generate VNF			

5 System Under Test (SUT)

5.1 SUT Configuration 1

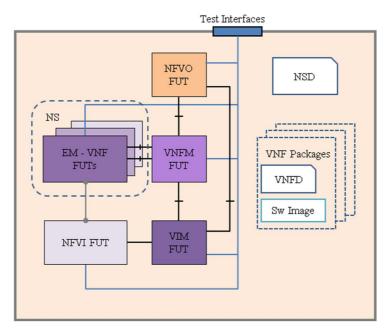


Figure 5.1-1: SUT Configuration 1

5.2 SUT Configuration 2

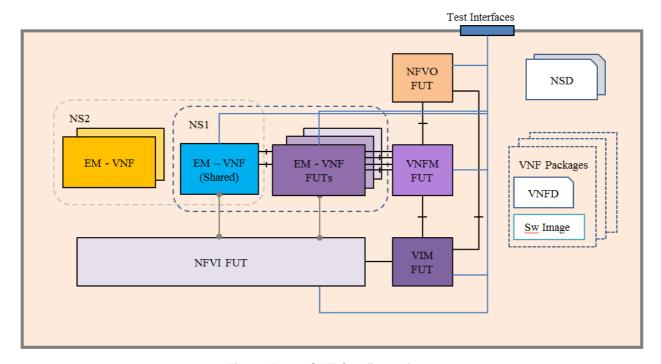


Figure 5.2-1: SUT Configuration 2

5.3 SUT Configuration 3

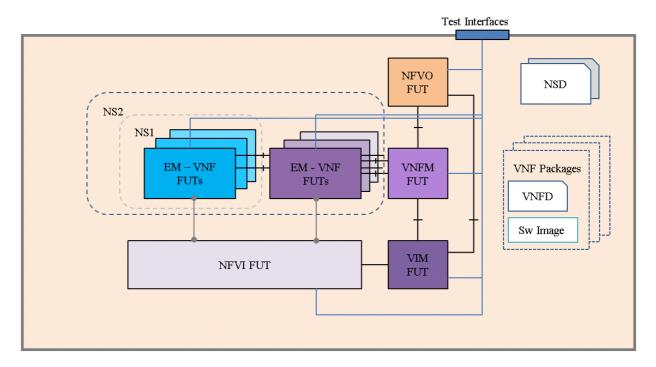


Figure 5.3-1: SUT Configuration 3

5.4 SUT Configuration 4

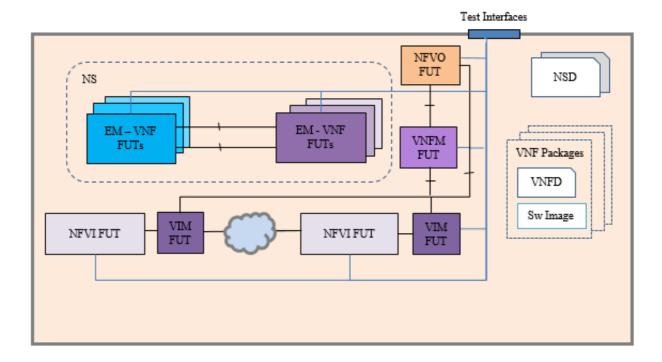


Figure 5.4-1: SUT Configuration 4

6 Test Suite Structure

6.1 Introduction

This clause describes the test suite structure and naming convention for the test descriptions according to ETSI GS NFV-TST 002 [i.1], clause 4.3.5.

The test cases in this test suite are grouped by the major functional areas they cover. The test identifiers use a common prefix of TD_NFV_ with an additional unique string for each area. Each test has a unique test identifier and a running number of the test case (in case of additional test case that cover similar test purpose).

The test case groups and their corresponding identifier naming prefix are described in table 6.1-1.

Table 6.1-1

Test Case Group	Identifier Name Prefix
Software Image Management	TD_NFV_SWIM_
VNF Package Management	TD_NFV_VNFPM_
VNF Lifecycle Management	TD_NFV_VNFLCM_
Fault Management	TD_NFV_FM_
Performance Management	TD_NFV_PM_
NS Lifecycle Management	TD_NFV_NSLCM_
Virtualised Resource Management	TD_NFV_VRM_

6.2 Software Image Management Test Cases Overview

Table 6.2-1

Test description identifier	Test purpose
TD_NFV_SWIM_ADD_001	Verify that the NFVO can add a software image to the image repository managed by the VIM
TD_NFV_SWIM_QUERY_001	Verify that the NFVO can retrieve the information of a software image from the image repository managed by the VIM
TD_NFV_SWIM_QUERY_002	Verify that the VNFM can retrieve the information of a software image from the image repository managed by the VIM
TD_NFV_SWIM_UPDATE_001	Verify that the NFVO can update the metadata of a software image in the image repository managed by the VIM
TD_NFV_SWIM_DELETE_001	Verify that the NFVO can delete a software image from the image repository managed by the VIM

6.3 VNF Package Management Test Cases Overview

Table 6.3-1

Test case Identifier	Test case purpose
TD_NFV_VNFPM_ONBOARD_001	To verify that a VNF Package can be successfully on-boarded to the VNF catalogue managed by the NFVO
TD_NFV_VNFPM_DELETE_001	To verify that an on-boarded VNF Package can be successfully deleted from the VNF catalogue managed by the NFVO
TD_NFV_VNFPM_ABORTDEL_001	To verify that an on-boarded VNF Package that has been in deletion pending state can be successfully aborted the deletion by the NFVO

6.4 VNF Lifecycle Management Test Cases Overview

Table 6.4-1

Test case Identifier	Test case purpose
TD_NFV_VNFLCM_INSTANTIATE_VNF_001	Verify that a VNF be successfully instantiated when a "instantiate VNF" operation is triggered by the EM
TD_NFV_VNFLCM_QUERY_VNF_001	Verify that the VNF instance's information can be queried successfully by the EM
TD_NFV_VNFLCM_MODIFY_VNF_INFO_001	Verify that the VNF information can be updated successfully by the EM
TD_NFV_VNFLCM_START_VNF_001	Verify that a VNF/VNFC instance be successfully started when an "operate VNF" operation is triggered by the EM
TD_NFV_VNFLCM_STOP_VNF_001	Verify that a VNF/VNFC instance be successfully stopped when an "operate VNF" operation is triggered by the EM
TD_NFV_VNFLCM_HEAL_VNF_001	Verify that a VNF can be successfully healed when VNF healing request is sent out by the EM/VNF
TD_NFV_VNFLCM_SCALE_OUT_VNF_001	Verify that a VNF can be successfully scaled out by adding VNFC instances triggered by a EM/VNF request
TD_NFV_VNFLCM_SCALE_IN_VNF_001	Verify that a VNF can be successfully scaled in by removing VNFC instances triggered by a EM/VNF request
TD_NFV_VNFLCM_TERMINATE_VNF_001	Verify that a VNF be successfully terminated when a "terminate VNF" operation is triggered by the EM

6.5 Fault Management Test Cases Overview

Table 6.5-1

Test case Identifier	Test case purpose
TD_NFV_FM_VR_NOTIFY_001	Verify that a fault alarm notification propagates to the NFVO when a virtualised resource that is required for the NS connectivity fails
TD_NFV_FM_VR_CLEAR_001	Verify that a fault clearance notification propagates to the NFVO when a failed virtualised resource that is required for the NS connectivity is recovered
TD_NFV_FM_VNF_NOTIFY_001	Verify that a VNF fault alarm notification propagates via the VNFM to the NFVO when a VNF fault is triggered by a failed virtualised resource
TD_NFV_FM_VNF_CLEAR_001	Verify that a VNF fault alarm clearance notification propagates via the VNFM to the NFVO when a VNF fault is cleared by resolving a failed virtualised resource
TD_NFV_FM_NS_ALARM_SUBSCRIPTION_C REATE_001	Verify that it is possible to subscribe to alarm notifications related to faults on the NS instance
TD_NFV_FM_NS_ALARM_SUBSCRIPTION_D ELETE_001	Verify that the subscription to NS faults alarm notifications can be deleted
TD_NFV_FM_NS_ALARM_NOTIFICATION_00 1	Verify that a fault alarm notification is exposed by the NFVO when a NS related resource fails
TD_NFV_FM_NS_ALARM_CLEAR_NOTIFICA TION_001	Verify that an alarm clear notification is dispatched by the NFVO when a NS related resource failure is cleared
TD_NFV_FM_NS_ALARM_QUERY_001	Verify that an alarm clear notification is dispatched by the NFVO when a NS related resource failure is cleared

6.6 Performance Management Test Cases Overview

Table 6.6-1

Test case Identifier	Test case purpose
	Verify that the performance metrics of a virtualised resource that is
TD_NFV_PM_VR_CREATE_NOTIFY_001	required for a NS instance connectivity can be monitored using
	PM jobs and notifications
TO NEV DM VD OBEATE THRESHOLD 004	Verify that the performance metrics of a virtualised resource that is required for a NS instance connectivity can be monitored using
TD_NFV_PM_VR_CREATE_THRESHOLD_001	PM jobs and thresholds
	Verify that the monitoring of performance metrics of a virtualised
TD_NFV_PM_VR_DELETE_MONITOR_001	resource that is required for a NS instance connectivity can be
TD_IN V_I IM_VI_BELETE_IMONITOR_001	stopped by deleting PM jobs
	Verify that a threshold created for a virtualised resource that is
TD_NFV_PM_VR_DELETE_THRESHOLD_001	required for a NS instance connectivity can be deleted
	Verify that the performance metrics of a virtualised resource that is
TD_NFV_PM_VNF_CREATE_NOTIFY_001	allocated to a VNF instance inside a NS instance can be
	monitored using PM jobs and notifications
	Verify that the performance metrics of a virtualised resource that is
TD_NFV_PM_VNF_CREATE_THRESHOLD_001	allocated to a VNF instance inside a NS instance can be
	monitored using PM jobs and thresholds
	Verify that the monitoring of performance metrics of a virtualised
TD_NFV_PM_VNF_DELETE_MONITOR_001	resource that is allocated to a VNF instance inside a NS instance
	can be stopped by deleting PM jobs
TD_NFV_PM_VNF_DELETE_THRESHOLD_001	Verify that a threshold created for a virtualised resource that is
	allocated to a VNF instance inside a NS instance can be deleted
TD_NFV_PM_NS_MONITORING_JOB_CREATE 001	Verify that performance monitoring job for monitoring NS related metrics can be created to start monitoring NS performance metrics
TD_NFV_PM_NS_PERFORMANCE_METRICS_	Verify that NS related performance monitoring metrics can be
QUERY_001	retrieved in the form of reports by querying the NFVO
	Verify that performance monitoring thresholds can be created for
TD_NFV_PM_NS_THRESHOLD_CREATE_001	one or more NS related performance metrics on the NFVO
TD_NFV_PM_NS_SUBSCRIPTION_CREATE_00	Verify that it is possible to subscribe to NS performance metrics
1	notifications related to threshold crossed notifications
TD_NFV_PM_NS_SUBSCRIPTION_CREATE_00	Verify that it is possible to subscribe to NS performance metrics
2	notifications related to availability of performance information
TD_NFV_PM_NS_MONITORING_INFO_NOTIFIC	Verify that a monitoring information availability notification is
ATION_001	exposed by the NFVO when new and updated NS performance
	monitoring metrics are available
TD_NFV_PM_NS_SUBSCRIPTION_DELETE_00	Verify that the subscription to NS performance monitoring
1	notifications can be deleted
TD_NFV_PM_NS_MONITORING_JOB_DELETE_	Verify that performance monitoring job for monitoring NS related
001	metrics can be deleted to stop monitoring NS performance metrics
TD_NFV_PM_NS_THRESHOLD_DELETE_001	Verify that performance monitoring thresholds can be deleted for
	one or more NS related performance metrics on the NFVO

6.7 NS Lifecycle Management Test Cases Overview

Table 6.7-1

Test case Identifier	Test case purpose
TD_NFV_NSLCM_INSTANTIATE_001	To verify that a standalone NS can be successfully instantiated
TD_NFV_NSLCM_INSTANTIATE_NEST_NS_001	To verify that a NS referencing an existing nested NS can be successfully instantiated
TD_NFV_NSLCM_INSTANTIATE_MULTISITE_001	To verify that an NS can be successfully instantiated across different sites
TD_NFV_NSLCM_INSTANTIATE_SFC_001	To verify that an NS with NSH based SFC can be successfully instantiated
TD_NFV_NSLCM_SCALE_OUT_001	Verify that the NS can be successfully scaled out by adding VNF instances triggered by an operator action
TD_NFV_NSLCM_SCALE_OUT_002	Verify that the NS can be successfully scaled out by adding VNF instances triggered automatically by a VNF indicator notification

Test case Identifier	Test case purpose
TD_NFV_NSLCM_SCALE_OUT_003	Verify that the NS can be successfully scaled out by adding VNF
TD_NFV_NSECM_SCALE_OUT_003	instances triggered automatically by a VIM KPI
TD_NFV_NSLCM_SCALE_OUT_004	Verify that the NS can be successfully scaled out by adding VNF instances triggered automatically in VNFM by querying VNF Indicator
TD_NFV_NSLCM SCALE_OUT_MULTISITE_001	To verify that a multi-site NS can be successfully scaled out (by adding VNF instances) if triggered by a MANO operator
TD_NFV_NSLCM_SCALE_IN_001	Verify that the NS can be successfully scaled in by removing VNF instances triggered by an operator action
TD_NFV_NSLCM_SCALE_IN_002	Verify that the NS can be successfully scaled in by removing VNF instances triggered automatically by a VNF indicator notification
TD_NFV_NSLCM_SCALE_IN_003	Verify that the NS can be successfully scaled in by removing VNF instances triggered automatically by a VIM KPI
TD_NFV_NSLCM_SCALE_IN_004	Verify that the NS can be successfully scaled in by removing VNF instances triggered automatically in VNFM by querying VNF Indicator
TD_NFV_NSLCM_SCALE_IN_MULTISITE_001	To verify that a multi-site NS can be successfully scaled in (by removing VNF instances) if triggered by a MANO operator
TD_NFV_NSLCM_SCALE_OUT_VNF_001	To verify that a VNF in a NS can be successfully scaled out by adding VNFC instances when triggered by a NFVO operator
TD_NFV_NSLCM_SCALE_OUT_VNF_002	To verify that a VNF in a NS can be successfully scaled out by adding VNFC instances when triggered automatically by a VNF indicator notification
TD_NFV_NSLCM_SCALE_OUT_VNF_003	To verify that a VNF in a NS can be successfully scaled out by adding VNFC instances when triggered automatically by a VIM KPI
TD_NFV_NSLCM_SCALE_OUT_VNF_004	To verify that a VNF in a NS can be successfully scaled out by adding VNFC instances when triggered automatically in VNFM by querying VNF Indicator
TD_NFV_NSLCM_SCALE_OUT_VNF_MULTISITE _001	To verify that a VNF in a multi-site NS can be successfully scaled out (by adding VNFC instances (VMs)) when triggered by a MANO operator
TD_NFV_NSLCM_SCALE_IN_VNF_001	Verify that a VNF in a NS can be successfully scaled in by removing VNFC instances from an existing VNF triggered by an operator action
TD_NFV_NSLCM_SCALE_IN_VNF_002	Verify that a VNF in a NS can be successfully scaled in by removing VNFC instances triggered automatically by a VNF indicator notification
TD_NFV_NSLCM_SCALE_IN_VNF_003	Verify that a VNF in a NS can be successfully scaled in by removing VNFC instances triggered automatically by a VIM KPI
TD_NFV_NSLCM_SCALE_IN_VNF_004	Verify that a VNF in a NS can be successfully scaled in by removing VNFC instances triggered automatically in VNFM by querying VNF Indicator
TD_NFV_NSLCM_SCALE_IN_VNF_MULTISITE_0 01	To verify that a VNF in a multi-site NS can be successfully scaled in (by removing VNFC instances (VMs)) when triggered by a MANO operator
TD_NFV_NSLCM_SCALE_TO_LEVEL_001	Verify that the NS can be successfully scaled to another existing instantiation level by an operator action
TD_NFV_NSLCM_SCALE_TO_LEVEL_002	Verify that the NS can be successfully scaled to another existing instantiation level automatically by a VNF indicator notification
TD_NFV_NSLCM_SCALE_TO_LEVEL_003	Verify that the NS can be successfully scaled to another existing instantiation level automatically by a VIM KPI
TD_NFV_NSLCM_SCALE_TO_LEVEL_ MULTISITE_001	Verify that a multi-site NS can be successfully scaled to another existing instantiation level (Scale NS to level) by an operator
TD_NFV_NSLCM_SCALE_TO_LEVEL_VNF_001	To verify that a VNF in a NS can be successfully scaled to another existing instantiation level by a NFVO operator
TD_NFV_NSLCM_SCALE_TO_LEVEL_VNF_002	To verify that a VNF in a NS can be successfully scaled to another existing instantiation level by a VNF indicator notification
TD_NFV_NSLCM_SCALE_TO_LEVEL_VNF_003	To verify that a VNF in a NS can be successfully scaled out by adding VNFC instances when triggered automatically by a VIM KPI
TD_NFV_NSLCM_SCALE_TO_LEVEL_VNF_MULT ISITE_001	Verify that a VNF in a multi-site NS can be successfully scaled to another existing instantiation level (Scale VNF to Level) by an operator
TD_NFV_NSLCM_UPDATE_START_001	Verify the capability to start a VNF instance inside a NS instance
TD_NFV_NSLCM_UPDATE_STOP_001	Verify the capability to stop a VNF instance inside a NS instance

Test case Identifier	Test case purpose
TD_NFV_NSLCM_UPDATE_INST_ADD_VNF_001	To verify that one or more VNFs can be instantiated and the instances added to a running NS instance
TD_NFV_NSLCM_UPDATE_REM_VNF_001	To verify that one or more VNF instances can be removed from a running NS instance
TD_NFV_NSLCM_UPDATE_ADD_SHVNF_001	To verify that one or more shared VNF instances can be added to a running NS instance
TD_NFV_NSLCM_UPDATE_REM_SHVNF_001	To verify that one or more shared VNF instances can be removed from a running NS instance
TD_NFV_NSLCM_UPDATE_ADD_VL_001	To verify that one or more virtual links (VL) can be added to a running NS instance
TD_NFV_NSLCM_UPDATE_REM_VL_001	To verify that one or more virtual links (VL) can be removed from a running NS instance
TD_NFV_NSLCM_UPDATE_VNF_DF_001	To verify that the deployment flavour of one or more VNF instances in a NS instance can be changed
TD_NFV_NSLCM_UPDATE_VNF_CONFIG_001	To verify that the configuration of a VNF running in a NS can be successfully updated
TD_NFV_NSLCM_HEAL_001	Verify that VNF instances inside the NS can be successfully healed when partial NS healing (VNF healing) is triggered by an operator action
TD_NFV_NSLCM_HEAL_002	Verify that a NS can be successfully healed when complete NS healing is triggered by an operator action
TD_NFV_NSLCM_TERMINATE_001	To verify that a standalone NS instance can be successfully terminated
TD_NFV_NSLCM_TERMINATE_NESTED_NS_001	To verify that a NS instance referencing an existing nested NS can be successfully terminated
TD_NFV_NSLCM_TERMINATE_MULTISITE_001	To verify that a multi-Site NS can be successfully terminated
TD_NFV_NSLCM_TERMINATE_SFC_001	To verify that a NS can be successfully terminated

6.8 Virtualised Resource Management Test Cases Overview

Table 6.8-1

Test case Identifier	Test case purpose
TD_NFV_VRM_COMPUTE_ALLOCATE_001	To verify that virtualised compute resources can be successfully
	allocated.
TD_NFV_VRM_COMPUTE_ALLOCATE_002	To verify that virtualised compute resources with CPU
	architecture type of x86/ARM can be successfully allocated.
TD_NFV_VRM_COMPUTE_ALLOCATE_003	To verify that virtualised compute resources can be successfully
	allocated according to an anti-affinity rule.
TD_NFV_VRM_COMPUTE_ALLOCATE_004	To verify that virtualised compute resources with enablement of
	NUMA can be successfully allocated.
TD_NFV_VRM_COMPUTE_ALLOCATE_005	To verify that virtualised compute resources can be successfully
	allocated in huge page memory mode.
TD_NFV_VRM_COMPUTE_ALLOCATE_006	To verify that virtualised compute resources can use SR-IOV as
	the type of network interface.
TD_NFV_VRM_NETWORK_ALLOCATE_001	To verify that an IPv6 address can be allocated via DHCP.
TD_NFV_VRM_STORAGE_ALLOCATE_001	To verify that virtualised storage resources can be successfully
	allocated.
TD_NFV_VRM_STORAGE_ALLOCATE_002	To verify that RDMA virtualised storage resources can be
	successfully allocated.

7 Test Descriptions

7.1 Introduction

This clause contains the test descriptions for the NFV functional areas. The results of IOP Checks and IOP Verdict inside each test description form should be indicated by OK/NOK according to clause 4.3.7 of ETSI GS NFV-TST 002 [i.1]. Non-applicable test descriptions can be marked as N/A. Collective results for functional areas can be reported according to the sample report card in annex A of the present document.

7.2 Software Image Management

7.2.1 Add Software Image

			Test Description: add software image			
Identifier		TD_NFV_SWIM_ADD_001				
Test Purpose		Verify that the N	FVO can add a software image to the image repository managed	by the VIM		
Configuration		SUT Configurati	on 1			
References		ETSI GS NFV-IF	FA 005 [i.3]			
Applicability		 NFVO can a 	add software images on the VIM (NFVO_SWIM_ADD_IM)			
		 VIM suppor 	ts "add image" operations by the NFVO (VIM_SWIM_ADD_IM)			
			ts software image information queries by the NFVO			
			1_QUERY_IM_BY_NFVO)			
		,	,			
Pre-test cond	itions	 Software im 	age information (e.g. name, metadata, location) is defined			
Test	Step	Туре	Description	Result		
Sequence	1	Stimulus	Trigger an "add image" operation on the NFVO			
	2	IOP Check	Verify the image information by querying the list of images on			
the image repository managed by the VIM						
	3	IOP Check	Verify that the NFVO shows no "add image" operation errors			
IOP Verdict						

7.2.2 Query Software Image

7.2.2.1 Query Software Image by NFVO

		Test	Description: query software image by NFVO			
Identifier		TD_NFV_SWIM_QUERY_001				
Test Purpose	Fest Purpose Verify that the NFVO can retrieve the information of a software image from the image.					
-		managed by the	VIM			
Configuration		SUT Configuration	on 1			
References		ETSI GS NFV-IF	A 005 [i.3]			
Applicability		 NFVO can of 	query software image information on the VIM (NFVO_SWIM_QUE	RY_IM)		
			s software image information queries by the NFVO	_ ,		
			QUERY_IM_BY_NFVO)			
		 				
Pre-test condi	tions		e image to be queried is added to the image repository managed IsWIM_ADD_001)	by the VIM		
Test	Step	Type	Description	Result		
Sequence	1	Stimulus	Trigger the query of the relevant image information on the			
			NFVO using the unique image identifier			
	2	IOP Check	Verify the image information by querying the list of images on			
			the image repository managed by the VIM			
	3	IOP Check	Verify that the image information obtained by the NFVO			
			matches the image information in step 2			
IOP Verdict						

7.2.2.2 Query Software Image by VNFM

		Test	Description: query software image by VNFM			
Identifier		TD_NFV_SWIM_QUERY_002				
Test Purpose		Verify that the V	NFM can retrieve the information of a software image from the image	age repository		
		managed by the	· VIM			
Configuration		SUT Configurati	on 1			
References		ETSI GS NFV-II	FA 006 [i.4]			
Applicability	•	 VNFM can 	query software image information on the VIM (VNFM_SWIM_QUE	RY_IM)		
			ts software image information queries by the VNFM	•		
			//_QUERY_IM_BY_VNFM)			
Pre-test condi	tions	 The softwar 	re image to be queried is added to the image repository managed	by the VIM		
		(TD_NFV_S	SWIM_ADD_001)			
Test	Step	Туре	Description	Result		
Sequence	1	Stimulus	Trigger the query of the relevant image information on the			
			VNFM using the unique image identifier			
	2	IOP Check	Verify the image information by querying the list of images on			
			the image repository managed by the VIM			
	3	IOP Check	Verify that the image information obtained by the VNFM			
			matches the image information in step 2			
IOP Verdict						

7.2.3 Update Software Image

Test Description: update software image					
Identifier	TD_NFV_SWIM	_UPDATE_001			
Test Purpose	Verify that the N	VO can update the metadata of a software image in the image repository			
	managed by the	VIM			
Configuration	SUT Configuration	on 1			
References	ETSI GS NFV-IF	FA 005 [i.3]			
Applicability	 NFVO can t 	update software image information on the VIM (NFVO_SWIM_UPI	DATE_IM)		
	 VIM support 	ts "update image" operations by the NFVO (VIM_SWIM_UPDATE	IM)		
		ts software image information queries by the NFVO	_ ,		
(VIM_SWIM_QUERY_IM_BY_NFVO)					
		,			
Pre-test conditions	The software image to be updated is added to the image repository managed by the VIM				
	(TD_NFV_S	(TD_NFV_SWIM_ADD_001)			
	 The updated 	The updated software image metadata is defined			
Test Step	Type	Description	Result		
Sequence 1	Stimulus	Trigger an "update image" operation on the NFVO using the			
		unique image identifier and including the updated metadata			
2	IOP Check	Verify the updated image information by querying the list of			
		images on the image repository managed by the VIM			
3	IOP Check	Verify that the NFVO shows no "update image" operation errors			
IOP Verdict					

7.2.4 Delete Software Image

			Test Description: delete software image			
Identifier		TD_NFV_SWIM_DELETE_001				
Test Purpose		Verify that the N	FVO can delete a software image from the image repository mana	ged by the VIM		
Configuration		SUT Configurati	on 1			
References		ETSI GS NFV-II	FA 005 [i.3]			
Applicability		NFVO can	delete software images from the VIM (NFVO_SWIM_DELETE_IM)			
	ļ		ts "delete image" operations by the NFVO (VIM_SWIM_DELETE_			
			ts software image information queries by the NFVO	,		
			LQUERY_IM_BY_NFVO)			
Pre-test condit	tions		re image to be deleted has been added to the image repository ma FV_SWIM_ADD_001)	naged by the		
Test	Step	Type	Description	Result		
Sequence	1	Stimulus	Trigger a "delete image" operation on the NFVO using the unique image identifier			
	2	IOP Check	Verify that the affected image has been deleted from the image repository managed by the VIM by querying the list of images			
	3	IOP Check	Verify that the NFVO shows no "delete image" operation errors			
IOP Verdict						

7.3 VNF Package Management

7.3.1 On-board VNF Package

			Test Description: on-board VNF package	
Identifier			M_ONBOARD_001	
Test Purpose To verify that a VNF Package can be successfully on-boarded to the VNF catalogue man the NFVO				
Configuration	1	SUT Configurati	on 1	
References			FA 013 [i.9] and ETSI GS NFV-IFA 011 [i.8]	
Applicability Pre-test cond	litions	NFVO can a (NFVO_VN)	check the integrity and validity of VNF Packages (NFVO_VNFPM_) access the VNF catalogue where the VNF Packages information is FPM_ACCESS) ackage contains all the necessary information including VNFD, soft	stored
Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger the on-boarding of a VNF Package on the NFVO	
	2	IOP Check	Verify that the VNF Package is stored in the VNF catalogue managed by the NFVO	
	3	IOP Check	Verify that a unique identifier for the VNF Package is generated by querying the VNF Package information on the NFVO	
IOP Verdict				

7.3.2 Delete VNF Package

	Test Description: delete VNF package				
Identifier		TD_NFV_VNFPM_DELETE_001			
Test Purpose		To verify that an on-boarded VNF Package can be successfully deleted from the VNF catalogue managed by the NFVO			
Configuration		SUT Configuration	on 1		
References		ETSI GS NFV-IF	A 013 [i.9]		
Applicability		NFVO can access the VNF catalogue where the VNF Packages information is stored (NFVO_VNFPM_ACCESS)			
		 NFVO suppo 	orts on-boarded VNF Packages queries (NFVO_VNFPM_QUERY)	
			<u> </u>		
Pre-test condit			ckage is on-boarded, not in a "used" state, and not in a "deletion instances associated to the VNF Package are terminated	pending" state	
Test	Step	Type	Description	Result	
Sequence	1	Stimulus	Trigger the deletion of a VNF Package on the NFVO		
	2	IOP Check	Verify that VNF Package has been deleted by querying the NFVO		
IOP Verdict					

7.3.3 Abort VNF Package Delete Operation

		Test De	escription: abort VNF package delete operation			
Identifier		TD_NFV_VNFPM_ABORTDEL_001				
Test Purpose		To verify that an on-boarded VNF Package that is in deletion pending state can be s				
		aborted from del	etion by the NFVO			
Configuration		SUT Configuration	on 1			
References		ETSI GS NFV-IF	^T A 013 [i.9]			
Applicability		 NFVO supports the delete VNF Package operation abortion (NFVO_VNFPM_ABORT_DELETE) NFVO supports on-boarded VNF Packages queries (NFVO_VNFPM_QUERY) 				
Pre-test condi	tions	The VNF Pa	ackage is on-boarded and in "deletion pending" state			
Test	Step	Type	Description	Result		
Sequence	1	Stimulus	Trigger the abortion of the deletion operation of an on-boarded VNF Package on NFVO			
	2	IOP Check	Verify that the VNF Package is not deleted by querying the NFVO			
	3	IOP Check	Verify the VNF Package is in disabled state by querying the NFVO			
IOP Verdict						

7.4 VNF Lifecycle Management

7.4.1 Instantiate VNF with an EM Request

Test Description: instantiate VNF with an EM request			
Identifier	TD_NFV_VNFLCM_INSTANTIATE_VNF_001		
Test Purpose	Verify that a VNF be successfully instantiated when an "instantiate VNF" operation is triggered by the EM		
Configuration	SUT Configuration 1		
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5] and ETSI GS NFV-IFA 008 [i.6]		

Applicability

- NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE)
- NFVO/VNFM can generate "allocate network resource" operation requests to the VIM (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE)
- NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE)
- VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM)
- VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM)
- VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM)
- NFVO/VNFM can query software image information from the VIM (NFVO_SWIM_QUERY_IM)
 or VNFM_SWIM_QUERY_IM)
- VIM supports software image information queries by the NFVO/VNFM (VIM_SWIM_QUERY_IM_BY_NFVO or VIM_SWIM_QUERY_IM_BY_VNFM)
- NFVO/VNFM can query compute resource information from the VIM (NFVO_CRM_QUERY or VNFM_CRM_QUERY)
- NFVO/VNFM can query network resource information from the VIM (NFVO_NRM_QUERY or VNFM_NRM_QUERY)
- NFVO/VNFM can query storage resource information from the VIM (NFVO_SRM_QUERY or VNFM_SRM_QUERY)
- VIM can send compute resource information to the NFVO (VIM_CRM_INFO_TO_NFVO or VIM_CRM_INFO_TO_VNFM)
- VIM can send network resource information to the NFVO (VIM_NRM_INFO_TO_NFVO or VIM_NRM_INFO_TO_VNFM)
- VIM can send storage resource information to the NFVO (VIM_SRM_INFO_TO_NFVO or VIM_SRM_INFO_TO_VNFM)
- EM can generate "Instantiate VNF" requests to the VNFM (EM_VNFLCM_VNF_INSTANTIATE)
- VNFM supports "instantiate VNF" requests from the EM (VNFM_VNFLCM_VNF_INSTANTIATE)
- Optionally, VNFM can generate "Grant VNF Lifecycle Operation" requests to the NFVO
- (VNFM_VNFLCM_GRANTING) and NFVO supports "Grant VNF Lifecycle Operation" requests from the VNFM (NFVO_VNFLCM_GRANTING)

Pre-test conditions

- Any constraints required for the virtualised resource such as affinity/anti-affinity rules and resource locations are defined in the VNFD
- The software image repository is reachable by the VIM
- The required resources are available on the NFVI

Test	Step	Type	Description	Result
Sequence	1	Stimulus	Trigger an "instantiate VNF" operation on the EM	
	2	IOP Check	If VNFM_VNFLCM_GRANTING and	
			NFVO_VNFLCM_GRANTING are supported, verify that the	
			requested grant for the "instantiate VNF" operation has been	
			approved by the NFVO	
	3	IOP Check	Verify that the software images have been successfully added	
			to the image repository managed by the VIM	
	4	IOP Check	Verify that the requested virtualised resources have been	
			allocated by the VIM according to the VNFD	
	5	IOP Check	Verify that virtualised resource allocation constraints have been	
			met by querying the VIM	
	6	IOP Check	Verify that any existing virtualised resources have not been	
			affected by the allocation of the new virtualised resources by	
			querying the VIM	
	7	IOP Check	Verify that the VNF instance resources are visible on the	
			VNFM	
	8	IOP Check	Verify that the VNF instance resources are visible on the NFVO	
	9	IOP Check	Verify that the VNF instance is reachable via the management	
			network	
	10	IOP Check	Verify that the VNF instance has been configured according to	
			the VNFD by querying the VNFM	
	11	IOP Check	Verify that the EM shows no "instantiate VNF" operation errors	
IOP Verdict				

7.4.2 Query VNF with an EM Request

		Test Desc	ription: query VNF information with an EM request			
Identifier		TD_NFV_VNFLCM_QUERY_VNF_001				
Test Purpose			NF instance's information can be queried successfully by the EM			
Configuration		SUT Configurati				
References		ETSI GS NFV-II	FA 008 [i.6]			
Applicability		 EM can generate "query VNF" requests to the VNFM (EM_VNFLCM_VNF_QUERY) VNFM supports "query VNF" requests from the EM (VNFM_VNFLCM_VNF_QUERY) 				
Pre-test condit	tions	The VNF is	instantiated (TD_NFV_VNFLCM_INSTANTIATE_VNF_001)			
Test	Step	Туре	Description	Result		
Sequence	1	Stimulus	Trigger the EM to query the VNF information using the unique VNF instance identifier from the VNFM	rtodut		
Sequence	2		Trigger the EM to query the VNF information using the unique	Noodin		
Sequence	2	Stimulus	Trigger the EM to query the VNF information using the unique VNF instance identifier from the VNFM Verify that the EM has received the VNF information from the	Kooun		
Sequence		Stimulus IOP Check	Trigger the EM to query the VNF information using the unique VNF instance identifier from the VNFM Verify that the EM has received the VNF information from the VNFM Verify that VNF information in Step 2 matches the VNF			

7.4.3 Modify VNF Configuration Information with an EM Request

		Test	Description: update VNF with an EM request		
Identifier		TD_NFV_VNFLO	CM_MODIFY_VNF_INFO_001		
Test Purpose	urpose Verify that the VNF information can be updated successfully by the EM				
Configuration	Configuration SUT Configuration 1				
References		ETSI GS NFV-IF	FA 007 [i.5] and ETSI GS NFV-IFA 008 [i.6]		
Applicability • EM can g (EM_VNF • VNFM su			erate "modify VNF information" requests to the VNFM CM_VNF_MODIFY_INFO) orts "modify VNF information" requests from the EM FLCM_VNF_MODIFY_INFO)		
			query VNF information from the VNFM (NFVO_VNFLCM_QUERY)		
			orts VNF information queries by the NFVO (VNFM_VNFLCM_QUEVT)		
		v vivi ivi supp	orts vivi information queries by the ivi vo (vivi ivi_vivi Ecivi_Qo	_1\(\)	
Pre-test cond	itions	 The original 	instantiated (TD_NFV_VNFLCM_INSTANTIATE_VNF_001) VNF instance information is available for comparison /NFLCM_QUERY_VNF_001)		
Test	Step	Туре	Description	Result	
Sequence	1	Stimulus	Trigger the EM to modify the VNF instance information on the VNFM		
	2	IOP Check	Verify that the VNF instance information has been updated on the VNFM		
3		IOP Check	Verify that the VNF instance information has been updated by querying the NFVO		
	4	IOP Check	Verify that the EM indicates the "modify VNF information" operation result as successful		
IOP Verdict					

7.4.4 Start VNF/VNFC with an EM Request

		Test D	escription: start VNF/VNFC with an EM request	
Identifier		TD_NFV_VNFL	CM_START_VNF_001	
Test Purpose		Verify that a VN	F/VNFC instance be successfully started when an "operate VNF" of	peration is
		triggered by the		
Configuration		SUT Configurat		
References		ETSI GS NFV-II GS NFV-IFA 00	FA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.: 8 [i.6]	5] and ETSI
Applicability				OPERATE)
 EM can generate "operate VNF" requests to the VNFM (EM_VNFLCM_VNF_OPERATE) VNFM supports "operate VNF" requests from the EM (VNFM_VNFLCM_VNF_OPERATE) NFVO/VNFM can generate "operate compute resource" operation requests to the VIM (NFVO_CRM_OPERATE or VNFM_CRM_OPERATE) VIM supports "operate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_OPERATE_BY_NFVO or VIM_CRM_OPERATE_BY_VNFM) NFVO/VNFM can query compute resource information from the VIM (NFVO_CRM_QUERY) VIM can send compute resource information to the NFVO/VNFM (VIM_CRM_INFO_TO_NFVO or VIM_CRM_INFO_TO_VNFM) VIM can send network resource information to the NFVO/VNFM (VIM_NRM_INFO_TO_NFVO or VIM_NRM_INFO_TO_VNFM) VIM can send storage resource information to the NFVO/VNFM (VIM_SRM_INFO_TO_NFVO or VIM_SRM_INFO_TO_VNFM) NFVO can query VNF information from the VNFM (NFVO_VNFLCM_QUERY) VNFM supports VNF information queries by the NFVO (VNFM_VNFLCM_QUERY) Optionally, VNFM can generate "Grant VNF Lifecycle Operation" requests to the NFVO (VNFM_VNFLCM_GRANTING) and NFVO supports "Grant VNF Lifecycle Operation" requests from the VNFM (NFVO_VNFLCM_GRANTING) 			OPERATE) the VIM VNFM CRM_QUERY or NFO_TO_NFVO ERY) he NFVO	
			,	
Pre-test condi	tions		instantiated (TD_NFV_VNFLCM_INSTANTIATE_VNF_001) /VNFC instance is in a "stopped" operational state. See note.	
Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger the EM to start the target VNF/VNFC instance	
	2	IOP Check	If VNFM_VNFLCM_GRANTING and NFVO_VNFLCM_GRANTING are supported, verify that the requested grant for the "operate VNF" operation has been approved by the NFVO	
	3	IOP Check	Verify that the compute resources allocated to the target VNF/VNFC instance have been started by querying the VIM	
	4	IOP Check	Verify that other existing compute resources have not been affected by the performed operation by querying the VIM	
	5	IOP Check	Verify that the VNF/VNFC instance operational state on the VNFM is indicated as "started"	
	6	IOP Check	Verify that the EM indicates the "operate VNF" operation result as successful	
	7	IOP Check	Verify that the VNF/VNFC instance operates successfully by running the end-to-end functional test	
IOP Verdict				
		STOPPED, the vinated.	virtualised container(s), where the VNFC instance(s) of the VNF ru	n, are shut down

ETSI

7.4.5 Stop VNF/VNFC with an EM Request

			escription: stop VNF/VNFC with an EM request	
Identifier		TD_NFV_VNFL	CM_STOP_VNF_001	
Test Purpose			F/VNFC instance be successfully stopped when an "operate VNF"	operation is
	triggered by the EM			
Configuration		SUT Configurati		
References		ETSI GS NFV-IF GS NFV-IFA 00	FA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.£ R [i.6]	i] and ETSI
Applicability			o [i.o] herate "operate VNF" requests to the VNFM (EM_VNFLCM_VNF_(DEDATE)
Дрисавиту			ports "operate VNF" requests from the EM (VNFM_VNFLCM_VNF_	
			M can generate "operate compute resource" operation requests to	
			M_OPERATE or VNFM_CRM_OPERATE)	UIC VIIVI
			ts "operate compute resource" operation requests from the NFVO/	VNFM
			OPERATE_BY_NFVO or VIM_CRM_OPERATE_BY_VNFM)	
			M can query compute resource information from the VIM (NFVO_0	CRM QUERY or
		VNFM_CRI	· · ·	_ '
		 VIM can ser 	nd compute resource information to the NFVO/VNFM	
		(VIM_CRM_	_INFO_TO_NFVO or VIM_CRM_INFO_TO_VNFM)	
			nd network resource information to the NFVO/VNFM	
			_INFO_TO_NFVO or VIM_NRM_INFO_TO_VNFM)	
			nd storage resource information to the NFVO/VNFM (VIM_SRM_IN	NFO_TO_NFVO
			M_INFO_TO_VNFM)	
			query VNF information from the VNFM (NFVO_VNFLCM_QUERY)	
			orts VNF information queries by the NFVO (VNFM_VNFLCM_QUI	
			VNFM can generate "Grant VNF Lifecycle Operation" requests to t	
			FLCM_GRANTING) and NFVO supports "Grant VNF Lifecycle Op	eration"
		requests irc	om the VNFM (NFVO_VNFLCM_GRANTING)	
Pre-test condi	tions	The VNF is	instantiated (TD_NFV_VNFLCM_INSTANTIATE_VNF_001)	
i re-test condi	lions		/VNFC instance is in a "started" operational state	
		• raiget vivi	/ VIVIFO III Starte is in a started operational state	
Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger the EM to stop the target VNF/VNFC instance	
•	2	IOP Check	If VNFM_VNFLCM_GRANTING and	
			NFVO_VNFLCM_GRANTING are supported, verify that the	
			requested grant for the "operate VNF" operation has been	
			approved by the NFVO	
	3	IOP Check	Verify that the compute resources allocated to the target	
			VNF/VNFC instance have been stopped by querying the VIM.	
			See note.	
	4	IOP Check	Verify that other existing compute resources have not been	
			affected by the performed operation by querying the VIM	
	5	IOP Check	Verify that the VNF/VNFC instance operational state on the	
	<u> </u>	105.6:	VNFM is indicated as "stopped"	
	6	IOP Check	Verify that the EM indicates the "operate VNF" operation result	
			as successful	
IOP Verdict	1	OTODDED 4		1
			virtualised container(s), where the VNFC instance(s) of the VNF rui	n, are shut down
l but r	not term	ınated.		

ETSI

7.4.6 VNF Healing with an EM/VNF Request

11			scription: VNF healing with an EM/VNF Request		
Identifier Test Purpose			CM_HEAL_VNF_001 F can be successfully healed when a VNF healing request is sent o	out by the	
-		EM/VNF		out by the	
Configuration		SUT Configuration		-1 FTO!	
References			FA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.£ 8 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]	oj, ETSI	
Applicability			M can generate "allocate compute resource" operation requests to	the VIM	
			M_ALLOCATE or VNFM_CRM_ALLOCATE)		
			M can generate "allocate network resource" operation requests to M_ALLOCATE or VNFM_NRM_ALLOCATE)	the VIM	
		NFVO/VNFI	M can generate "allocate storage resource" operation requests to t M_ALLOCATE or VNFM_SRM_ALLOCATE)	the VIM	
			ts "allocate compute resource" operation requests from the NFVO/ _ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM)	/VNFM	
		 VIM support 	ts "allocate network resource" operation requests from the NFVO/ _ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM)	√NFM	
		 VIM support 	ts "allocate storage resource" operation requests from the NFVO/\ _ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM)	/NFM	
		NFVO/VNFI	M can generate "terminate compute resource" operation requests	to the VIM	
		NFVO/VNFI	M_TERMINATE or VNFM_CRM_TERMINATE) M can generate "terminate network resource" operation requests to	o the VIM	
			M_TERMINATE or VNFM_NRM_TERMINATE) M can generate "terminate storage resource" operation requests to	the VIM	
		` —	M_TERMINATE or VNFM_SRM_TERMINATE) ts "terminate compute resource" operation requests from the NFV0	O/VNFM	
		(VIM_CRM_	_TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM))	
		VIM supports "terminate network resource" operation requests from the NFVO/VNFM (VIM_NRM_TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM)			
		 VIM supports "terminate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM) 			
		VNFM supports "heal VNF" requests from EM/VNF (VNFM_VNFLCM_VNF_HEAL) The supports "heal VNF" requests from EM/VNF (VNFM_VNFLCM_VNF_HEAL) The supports "heal VNF" requests from EM/VNF (VNFM_VNFLCM_VNF_HEAL)			
		 Optionally, \(\text{VNFM_VN} \) 	n generate "heal VNF" requests to the VNFM (EM_VNFLCM_VNF VNFM can generate "Grant VNF Lifecycle Operation" requests to t FLCM_GRANTING) and NFVO supports "Grant VNF Lifecycle Op	he NFVO	
		requests iro	om the VNFM (NFVO_VNFLCM_GRANTING)		
Pre-test condit	ions		failed state (for example a virtualised resource needed by the impass been terminated directly on the VIM)	acted VNF	
Test	Ston		Description	Result	
Sequence	Step 1	Type Stimulus	Trigger the EM/VNF to send a VNF healing request to the	Result	
	2	IOP Check	VNFM If VNFM_VNFLCM_GRANTING and		
			NFVO_VNFLCM_GRANTING are supported, verify that the		
			requested grant for the "heal VNF" operation has been approved by the NFVO		
	3	IOP Check	Verify that any additional resources required for the healing process have been allocated by the VIM according to the descriptors		
	4	IOP Check	Verify that healed VNF instance is running and reachable via the management network		
	5	IOP Check	Verify that the healed VNF instance has been configured according to the descriptors by querying the VNFM		
	6	IOP Check	Verify that any failed resources have been terminated and released by the VIM		
	7	IOP Check	Verify that the EM/VNF indicates the VNF healing operation		
	8	IOP Check	result as successful Verify that the NFVO indicates the VNF healing operation result		
	9	IOP Check	as successful Verify that the VNF has been healed by running an end-to-end		
		3	functional test factoring in the functionality of the healed VNF instance		
IOP Verdict					
IOF VEIGICE					

7.4.7 VNF Scale Out with an EM/VNF Request

			scription: scale out VNF with an EM/VNF request	
Identifier			CM_SCALE_OUT_VNF_001	
Test Purpose		Verify that a VNI EM/VNF	F can be successfully scaled out by adding VNFC instances trigge	red by the
Configuration		SUT Configurati	on 1	
References		ETSI GS NFV-IF	FA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.4	5], ETSI
Applicability Province the computer is a computer of the computer is a computer of the comput		the VIM the VIM VNFM VNFM VNFM VNFM VNF the NFVO eration"		
Pre-lest condit	10115		nfigured to trigger scale out when scale out request is received fro the required amount of consumable virtual resources to run the scal	
			scale level of the VNF instance is not at the maximum scale level	
		The current	scale level of the vivi instance is not at the maximum scale level	
Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger the EM/VNF to send a "scale out by adding VNFC	
	2	IOP Check	instance(s)" request to the VNFM If VNFM_VNFLCM_GRANTING and	
	2	IOI CHECK	NFVO_VNFLCM_GRANTING and verify that the requested grant for the "VNF scale out" operation has been approved by the NFVO	
	3	IOP Check	Verify that the "scale out by adding VNFC instance(s)" procedure has been started on the NFVO	
	4	IOP Check	Verify that the additional VNFC instance(s) have been deployed by querying the VNFM	
	5	IOP Check	Verify that the additional resources have been allocated by the VIM according to the VNFD	
	6	IOP Check	Verify that the additional VNFC instance(s) are running and are reachable through their management network	
	7	IOP Check	Verify that the VNF configuration has been updated to include the additional VNFC instances according to the VNFD by querying the VNFM	
	8	IOP Check	Verify that the additional VNFC instances(s) are connected to the VL(s) according to the VNFD	
	9	IOP Check	Verify that the EM/VNF indicates the scaling operation result as successful	
	10	IOP Check	Verify that the NFVO indicates the scaling operation result as successful	
	11	IOP Check	Verify that VNF has been scaled out by running the end-to-end functional test in relevance to the VNF scale and capacity	
IOP Verdict			. ,	

7.4.8 VNF Scale In with an EM/VNF Request

			escription: VNF scale in with an EM/VNF request	
Identifier Test Purpose			.CM_SCALE_IN_VNF_001 IF can be successfully scaled in by removing VNFC instances trigg	orod by the
restruipose		EM/VNF	ir can be successibly scaled in by removing viviro instances tinggi	ered by the
Configuration		SUT Configurat	ion 1	
References			FA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5	5], ETSI
			08 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]	
Applicability		(NFVO_CR NFVO/VNF (NFVO_NR NFVO/VNF (NFVO_SR VIM suppor (VIM_CRM VIM suppor (VIM_NRM VIM suppor (VIM_SRM EM/VNF ca (EM_VNFL	FM can generate "terminate compute resource" operation requests RM_TERMINATE or VNFM_CRM_TERMINATE) FM can generate "terminate network resource" operation requests to RM_TERMINATE or VNFM_NRM_TERMINATE) FM can generate "terminate storage resource" operation requests to RM_TERMINATE or VNFM_SRM_TERMINATE) rts "terminate compute resource" operation requests from the NFVO L_TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM) rts "terminate network resource" operation requests from the NFVO L_TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM) rts "terminate storage resource" operation requests from the NFVO L_TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM) an generate "scale in by removing VNFC instances" to the VNFM LCM_VNF_SCALE_IN) ports "scale in by removing VNFC instances" requests from the EM	o the VIM O the VIM O/VNFM O/VNFM O/VNFM
Pre-test condi	tions	(VNFM_VN	VFLCM_VNF_SCALE_IN) VNFM can generate "Grant VNF Lifecycle Operation" requests to t VFLCM_GRANTING) and NFVO supports "Grant VNF Lifecycle Op om the VNFM (NFVO_VNFLCM_GRANTING) t NS deployment size allows scaling in	he NFVO
		• The current	t scale level of the VNF instance is not at the minimum scale level	
Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger the EM/VNF to send a "scale in by removing VNFC instance(s)" request to the VNFM	
	2	IOP Check	If VNFM_VNFLCM_GRANTING and	
		, c. c. c.	NFVO_VNFLCM_GRANTING are supported, verify that the requested grant for the "VNF scale in" operation has been approved by the NFVO	
	3	IOP Check	requested grant for the "VNF scale in" operation has been approved by the NFVO Verify that the "scale in by removing VNFC instance(s)" procedure has been started in NFVO	
	3	IOP Check	requested grant for the "VNF scale in" operation has been approved by the NFVO Verify that the "scale in by removing VNFC instance(s)" procedure has been started in NFVO Verify that the impacted VNFC instance(s) inside the VNF have been terminated by querying the VNFM	
		IOP Check IOP Check	requested grant for the "VNF scale in" operation has been approved by the NFVO Verify that the "scale in by removing VNFC instance(s)" procedure has been started in NFVO Verify that the impacted VNFC instance(s) inside the VNF have been terminated by querying the VNFM Verify that the impacted VNFC instance(s) resources have been released by the VIM	
	4 5 6	IOP Check IOP Check IOP Check	requested grant for the "VNF scale in" operation has been approved by the NFVO Verify that the "scale in by removing VNFC instance(s)" procedure has been started in NFVO Verify that the impacted VNFC instance(s) inside the VNF have been terminated by querying the VNFM Verify that the impacted VNFC instance(s) resources have been released by the VIM Verify that the remaining VNFC instance(s) are still running and reachable via their management network	
	4 5	IOP Check IOP Check IOP Check IOP Check IOP Check	requested grant for the "VNF scale in" operation has been approved by the NFVO Verify that the "scale in by removing VNFC instance(s)" procedure has been started in NFVO Verify that the impacted VNFC instance(s) inside the VNF have been terminated by querying the VNFM Verify that the impacted VNFC instance(s) resources have been released by the VIM Verify that the remaining VNFC instance(s) are still running and reachable via their management network Verify that the VNF configuration has been updated to exclude the removed VNFC instances according to the descriptors by querying the VNFM	
	4 5 6	IOP Check IOP Check IOP Check	requested grant for the "VNF scale in" operation has been approved by the NFVO Verify that the "scale in by removing VNFC instance(s)" procedure has been started in NFVO Verify that the impacted VNFC instance(s) inside the VNF have been terminated by querying the VNFM Verify that the impacted VNFC instance(s) resources have been released by the VIM Verify that the remaining VNFC instance(s) are still running and reachable via their management network Verify that the VNF configuration has been updated to exclude the removed VNFC instances according to the descriptors by querying the VNFM Verify that the remaining VNFC instances(s) and VL(s) are still	
	4 5 6 7	IOP Check IOP Check IOP Check IOP Check IOP Check	requested grant for the "VNF scale in" operation has been approved by the NFVO Verify that the "scale in by removing VNFC instance(s)" procedure has been started in NFVO Verify that the impacted VNFC instance(s) inside the VNF have been terminated by querying the VNFM Verify that the impacted VNFC instance(s) resources have been released by the VIM Verify that the remaining VNFC instance(s) are still running and reachable via their management network Verify that the VNF configuration has been updated to exclude the removed VNFC instances according to the descriptors by querying the VNFM Verify that the remaining VNFC instances(s) and VL(s) are still connected according to the descriptors Verify that the EM/VNF indicates the scaling operation result as successful	
	4 5 6 7	IOP Check IOP Check IOP Check IOP Check IOP Check IOP Check	requested grant for the "VNF scale in" operation has been approved by the NFVO Verify that the "scale in by removing VNFC instance(s)" procedure has been started in NFVO Verify that the impacted VNFC instance(s) inside the VNF have been terminated by querying the VNFM Verify that the impacted VNFC instance(s) resources have been released by the VIM Verify that the remaining VNFC instance(s) are still running and reachable via their management network Verify that the VNF configuration has been updated to exclude the removed VNFC instances according to the descriptors by querying the VNFM Verify that the remaining VNFC instances(s) and VL(s) are still connected according to the descriptors Verify that the EM/VNF indicates the scaling operation result as	
	4 5 6 7 8 9	IOP Check	requested grant for the "VNF scale in" operation has been approved by the NFVO Verify that the "scale in by removing VNFC instance(s)" procedure has been started in NFVO Verify that the impacted VNFC instance(s) inside the VNF have been terminated by querying the VNFM Verify that the impacted VNFC instance(s) resources have been released by the VIM Verify that the remaining VNFC instance(s) are still running and reachable via their management network Verify that the VNF configuration has been updated to exclude the removed VNFC instances according to the descriptors by querying the VNFM Verify that the remaining VNFC instances(s) and VL(s) are still connected according to the descriptors Verify that the EM/VNF indicates the scaling operation result as successful Verify that the NFVO indicates the scaling operation result as	

7.4.9 Terminate VNF with an EM Request

	ı		Description: terminate VNF with an EM request		
Identifier			CM_TERMINATE_VNF_001		
Test Purpose		Verify that a VNF is successfully terminated when a "terminate VNF" operation is triggered by the EM			
Configuration		SUT Configuration			
References		ETSI GS NFV-IF GS NFV-IFA 008	FA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.: 3 [i.6]	5] and ETSI	
Applicability		 NFVO/VNFI 	M can generate "terminate compute resource" operation requests M_TERMINATE or VNFM_CRM_TERMINATE)	to the VIM	
			M can generate "terminate network resource" operation requests t M_TERMINATE or VNFM_NRM_TERMINATE)	o the VIM	
			M can generate "terminate storage resource" operation requests to M_TERMINATE or VNFM_SRM_TERMINATE)	the VIM	
			ts "terminate compute resource" operation requests from the NFV _TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM]		
		(VIM_NRM_	ts "terminate network resource" operation requests from the NFVC _TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM])	
		(VIM_SRM_	ts "terminate storage resource" operation requests from the NFVO TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM)		
		 NFVO/VNFM can query compute resource information from the VIM (NFVO_CRM_QUER' VNFM_CRM_QUERY) 			
 NFVO/VNFM can query network resource information VNFM_NRM_QUERY) 					
		VNFM_SRM		_	
		VIM_CRM_	send compute resource information to the NFVO (VIM_CRM_INFO_TO_NFVO or M_INFO_TO_VNFM)		
		VIM_NRM_	nd network resource information to the NFVO (VIM_NRM_INFO_T INFO_TO_VNFM)		
		VIM_SRM_I	nd storage resource information to the NFVO (VIM_SRM_INFO_T INFO_TO_VNFM)		
			erate "terminate VNF" requests to the VNFM (EM_VNFLCM_VNF orts "terminate VNF" requests from the EM (VNFM_VNFLCM_VN		
	 Optionally, VNFM can generate "Grant VNF Lifecycle Operation" requests to the NFVO (VNFM_VNFLCM_GRANTING) and NFVO supports "Grant VNF Lifecycle Operation" 				
	requests from the VNFM (NFVO_VNFLCM_GRANTING)				
Pre-test condit	ione	The target \	/NE is instantiated		
	1		/NF is instantiated		
Test	Step	Туре	Description	Result	
Sequence	1	Stimulus	Trigger an "terminate VNF" operation on the EM		
	2	IOP Check	If VNFM_VNFLCM_GRANTING and		
			NFVO_VNFLCM_GRANTING are supported, verify that the		
			requested grant for the "VNF terminate" operation has been approved by the NFVO		
	3	IOP Check	Verify that the impacted virtualised resources have been		
		101 01100K	terminated by the VIM		
	4	IOP Check	Verify that other allocated virtualised resources have not been		
			affected by the termination of the virtualised resources of the		
IOD V ". f			VNF instance by querying the VIM		
IOP Verdict					

7.5 Fault Management

7.5.1 Virtualised Resource Fault Management

7.5.1.1 Virtualised Resource Fault Alarm Notification

		Test Desci	ription: virtualised resource fault alarm notification		
Identifier		TD_NFV_FM_VR_NOTIFY_001			
Test Purpose			t alarm notification propagates to the NFVO when a virtualised res NS connectivity fails	ource that is	
Configuration		SUT Configurati	on 1		
References		ETSI GS NFV-IF	A 005 [i.3] and ETSI GS NFV-IFA 013 [i.9]		
Applicability		 NFVO can s (NFVO_FM) 	subscribe to virtualised resource fault alarms on the VIM _VR_SUBSCRIBE)		
		(VIM_FM_S	ts alarm notifications subscriptions from the NFVO (SUBSCRIBE_BY_NFVO)		
			nerate virtualised resources fault alarm notifications to the NFVO IOTIFY_BY_NFVO)		
		NFVO can process virtualised resource fault alarm notifications from the VIM (NFVO_FM_VR_NOTIFY)			
		 NFVO can get the list of virtualised resource fault alarms from the VIM (NFVO_FM_VR_GET_ALARMS) 			
			ts virtualised resource fault alarm list queries by the NFVO QUERY_BY_NFVO)		
Pre-test condit			ntiated (TD_NFV_NSLCM_INSTANTIATE_001) bscribed to virtualised resources fault alarms on the VIM		
T1	01	T	December 1997	D M	
Test	Step	Туре	Description	Result	
Sequence	1	Stimulus	Trigger a fault on a virtualised resource that is required for the NS instance connectivity on the NFVI (e.g. disable the NIC allocated to a network resource)		
	2	IOP Check	Verify that a virtualised resource fault alarm has been created on the VIM by querying the list of virtualised resource fault alarms		
	3	IOP Check	Verify that a NS fault alarm has been created on the NFVO by querying the list of NS fault alarms		
IOP Verdict					

7.5.1.2 Virtualised Resource Fault Alarm Clearance Notification

	Test Description: virtualised resource fault alarm clearance notification					
Identifier	TD_NFV_FM_VR_CLEAR_001					
Test Purpose	Verify that a fault clearance notification propagates to the NFVO when a failed virtualised resource that is required for the NS connectivity is recovered					
Configuration	SUT Configuration 1					
References	ETSI GS NFV-IFA 005 [i.3] and ETSI GS NFV-IFA 013 [i.9]					
Applicability	 NFVO can subscribe to virtualised resource fault alarms on the VIM (NFVO_FM_VR_SUBSCRIBE) VIM supports virtualised resource fault alarms subscriptions from the NFVO (VIM_FM_SUBSCRIBE_BY_NFVO) VIM can generate virtualised resource fault alarm notifications to the NFVO (VIM_FM_NOTIFY_BY_NFVO) NFVO can process virtualised resource fault alarm notifications from the VIM (NFVO_FM_VR_NOTIFY) NFVO can get the list of virtualised resource fault alarms from the VIM (NFVO_FM_VR_GET_ALARMS) 					
	 VIM supports virtualised resource fault alarm list queries by the NFVO (VIM_FM_QUERY_BY_NFVO) 					

Pre-test cond	itions	NFVO is suNS fault ala	ntiated (TD_NFV_NSLCM_INSTANTIATE_001) ubscribed to virtualised resources fault alarms on the VIM arm is created on the NFVO by failing a virtualised resource that is tivity (TD_NFV_FM_VR_NOTIFY_001)	required for the
Test	Step	Type	Description	Result
Sequence	1	Stimulus	Resolve the failure of the virtualised resource that is required for the NS instance connectivity (e.g. reconnect the NIC allocated to a network resource)	
	2	IOP Check	Verify that the relevant virtualised resource fault alarm has been cleared on the VIM by querying the list of virtualised resource fault alarms	
	3	IOP Check	Verify that the relevant NS fault alarm has been cleared on the NFVO by querying the list of NS fault alarms	
IOP Verdict				

7.5.2 VNF Fault Management

7.5.2.1 VNF Fault Alarm Notifications

7.5.2.1	VN	F Fault Alarr	m Notifications			
		Te	st Description: VNF fault alarm notification			
Identifier		TD_NFV_FM_VNF_NOTIFY_001				
Test Purpose		Verify that a VN	F fault alarm notification propagates via the VNFM to the NFVO when the	nen a VNF fault		
		is triggered by a	failed virtualised resource			
Configuration		SUT Configuration 1				
References		ETSI GS NFV-IF	FA 006 [i.4], ETSI GS NFV-IFA 007 [i.5] and ETSI GS NFV-IFA 01:	3 [i.9]		
Applicability		 NFVO can s 	subscribe to alarm notifications on the VNFM (NFVO_FM_VNF_SU	JBSCRIBE)		
			orts alarm notifications subscriptions from the NFVO _VNF_SUBSCRIBE)			
		 VNFM can : 	subscribe to alarm notifications on the VIM (VNFM_FM_VR_SUBS	CRIBE)		
		 VIM suppor 	ts alarm notifications subscriptions by the VNFM SUBSCRIBE_BY_VNFM)	,		
		,	generate VNF fault alarm notifications to the NFVO (VNFM_FM_V	NF NOTIFY)		
			process VNF fault alarm notifications from the VNFM (NFVO_FM_	•		
		 VIM can ge 	nerate virtualised resources fault alarm notifications to the VNFM IOTIFY_BY_VNFM)	,		
		 VNFM can process virtualised resource fault alarm notifications by the VIM (VNFM_FM_VR_NOTIFY) 				
		NFVO can get the list of VNF fault alarms from the VNFM (NFVO_FM_VNF_GET_ALARMS)				
		VNFM supports VNF fault alarm list queries by the NFVO (VNFM_FM_VNF_QUERY)				
		VNFM can get the list of virtualised resource fault alarms from the VIM				
		(VNFM_FM_VR_GET_ALARM)				
		VIM supports virtualised resources fault alarm list queries by the VNFM (VIM_FM_QUERY_BY_VNFM)				
		[(VIIVI_I IVI_O	XOLICI_DI_VIVIIVI)			
Pre-test condi	tions	NS is instar	ntiated (TD_NFV_NSLCM_INSTANTIATE_001)			
		NFVO is subscribed to VNF fault alarms on the VNFM				
		VNFM is subscribed to virtualised resources fault alarms on the VIM				
		VINFIVI IS SU	bscribed to virtualised resources fault alaints on the viivi			
Test	Step	Type	Description	Result		
Sequence	1	Stimulus	Trigger a failure on a virtualised resource allocated to the relevant VNF instance (e.g. terminate the virtualised resource directly on the VIM)			
	2	IOP Check	Verify that a virtualised resource fault alarm has been created			
		lor onesk	on the VIM by querying the list of virtualised resource fault alarms			
	3	IOP Check	Verify that a VNF fault alarm has been created for the affected VNF instance on the VNFM by querying the list of VNF fault alarms			
	4	IOP Check	Verify that a NS fault alarm has been created on the NFVO by querying the list of NS fault alarms			
IOP Verdict						

7.5.2.2 VNF Fault Alarm Clearance Notifications

Verify that a VNF fault alarm clearance notification propagates via the VNFM to the NFVO when a VNF fault is cleared by resolving a failed virtualised resource				scription: VNF fault alarm clearance notification		
VNF fault is cleared by resolving a failed virtualised resource	Identifier					
SUT Configuration SUT Configuration 1	Test Purpose					
Applicability Pre-test conditions ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5] and ETSI GS NFV-IFA 013 [i.9] NFVO can subscribe to alarm notifications on the VNFM (NFVO_FM_VNF_SUBSCRIBE) VNFM supports alarm notifications subscriptions from the NFVO (VNFM_FM_VNF_SUBSCRIBE) VNFM can subscribe to alarm notifications on the VIM (VNFM_FM_VR_SUBSCRIBE) VNFM can generate VNF fault alarm clearance notifications to the NFVO (VNFM_FM_VNF_NOTIFY) NFVO can process VNF fault alarm clearance notifications from the VNFM (NFVO_FM_VNF_NOTIFY) VIM can generate vNF fault alarm clearance notifications from the VNFM (NFVO_FM_VNF_NOTIFY) NFVO can process VNF fault alarm clearance notifications from the VNFM (VIM_FM_NOTIFY_BY_VNFM) VAFM can process virtualised resources fault alarm clearance notifications from the VNFM (VIM_FM_NOTIFY_BY_NOTIFY) NFVO can get the list of VNF fault alarms from the VNFM (NFVO_FM_VNF_GET_ALARM) VNFM supports VNF fault alarm list queries by the NFVO (VNFM_FM_VNF_QUERY) VIM supports VNF fault alarm list queries by the VNFM (VIM_FM_QUERY_BY_VNFM) Pre-test conditions NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001) NFVO is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to VNF fault alarms on the VNFM NS fault alarm is created on the NFVO by failing a virtualised resource that is allocated to the relevant VNF instance (TD_NFV_FM_VNF_NOTIFY_001) Test Sequence Step Type Description Result Resolve the failure of the virtualised resource fault alarm has been cleared on the VIM by querying the list of Virtualised resource fault alarms A IOP Check Verify that the relevant VNF fault alarm has been cleared on the VNFM by querying the list of VNF fault alarms 4 IOP Check Verify that the relevant VNF fault alarms has been cleared on the NFVO by querying the list of VNF fault alarms						
NFVO can subscribe to alarm notifications on the VNFM (NFVO_FM_VNF_SUBSCRIBE) VNFM supports alarm notifications subscriptions from the NFVO (VNFM_FM_VNF_SUBSCRIBE) VNFM can subscribe to alarm notifications on the VIM (VNFM_FM_VR_SUBSCRIBE) VIM supports alarm notifications on the VIM (VNFM_FM_VR_SUBSCRIBE) VIM supports alarm notifications by the VNFM (VIM_FM_SUBSCRIBE_BY_VNFM) VNFM can generate VNF fault alarm clearance notifications to the NFVO (VNFM_FM_VNF_NOTIFY) NFVO can process VNF fault alarm clearance notifications from the VNFM (NFVO_FM_VNF_NOTIFY) VIM can generate virtualised resources fault alarm clearance notifications to the VNFM (VIM_FM_NOTIFY_BY_VNFM) VNFM can process virtualised resource fault alarm clearance notifications from the VIM (VNFM_FM_VR_NOTIFY) NFVO can get the list of VNF fault alarms from the VNFM (NFVO_FM_VNF_GET_ALARM) VNFM supports virtualised resources fault alarm list queries by the NFVO (VNFM_FM_VNF_QUERY) VIM supports virtualised resources fault alarm list queries by the VNFM (VIM_FM_QUERY_BY_VNFM) Pre-test conditions NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001) NFVO is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to VNF fault alarms on the VNFM NS fault alarm is created on the NFVO by failing a virtualised resource that is allocated to the relevant VNF instance (TD_NFV_FM_VNF_NOTIFY_001) Test Sequence Step						
VNFM supports alarm notifications subscriptions from the NFVO (VNFM_FM_VNF_SUBSCRIBE) VNFM can subscribe to alarm notifications on the VIM (VNFM_FM_VR_SUBSCRIBE) VIM supports alarm notifications subscriptions by the VNFM (VIM_FM_SUBSCRIBE_BY_VNFM) VNFM can generate VNF fault alarm clearance notifications to the NFVO (VNFM_FM_VNF_NOTIFY) NFVO can process VNF fault alarm clearance notifications from the VNFM (NFVO_FM_VNF_NOTIFY) VIM can generate virtualised resources fault alarm clearance notifications to the VNFM (VIM_FM_NOTIFY_BY_VNFM) VNFM can process virtualised resource fault alarm clearance notifications from the VIM (VNFM_FM_VR_NOTIFY) NFVO can get the list of VNF fault alarms from the VNFM (NFVO_FM_VNF_GET_ALARM) VNFM supports VNF fault alarm list queries by the NFVO (VNFM_FM_VNF_QUERY) VIM supports virtualised resources fault alarm list queries by the VNFM (VIM_FM_VR_NOTIFY) NFVO is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to VNF fault alarms on the VNFM VNFM is created on the NFVO by failing a virtualised resource that is allocated to the relevant VNF (e.g. restart the virtualised resource allocated to the relevant VNF (e.g. restart the virtualised resource fault alarm has been cleared on the VNFM by querying the list of VNF fault alarms 3 IOP Check Verify that the relevant VNF fault alarm has been cleared on the NFVO by querying the list of NNF fault alarms 4 IOP Check Verify that the relevant VNF fault alarm has been cleared on the NFVO by querying the lis			ETSI GS NFV-II	FA 006 [i.4], ETSI GS NFV-IFA 007 [i.5] and ETSI GS NFV-IFA 01:	3 [i.9]	
(VNFM_FM_VNF_SUBSCRIBE) VNFM can subscribe to alarm notifications on the VIM (VNFM_FM_VR_SUBSCRIBE) VNFM can process or VNF fault alarm clearance notifications to the NFVO (VNFM_FM_VNF_NOTIFY) NFVO can process VNF fault alarm clearance notifications from the VNFM (NFVO_FM_VNF_NOTIFY) VIM can generate virtualised resources fault alarm clearance notifications to the NFVO (VNFM_FM_NOTIFY) VIM can generate virtualised resources fault alarm clearance notifications to the VNFM (NFVO_FM_NNF_NOTIFY) VIM can generate virtualised resource fault alarm clearance notifications from the VNFM (VIM_FM_NOTIFY_BY_VNFM) VNFM can process virtualised resource fault alarm clearance notifications from the VIM (VNFM_FM_VR_NOTIFY) NFVO can get the list of VNF fault alarms from the VNFM (NFVO_FM_VNF_GET_ALARM) VNFM supports virtualised resources fault alarm list queries by the VNFM (VIM_FM_VR_NOTIFY) VIM supports virtualised resources fault alarm list queries by the VNFM (VIM_FM_VR_QUERY) VIM Supports virtualised resources fault alarms on the VNFM VNFM is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to VNF fault alarms on the VIM NS fault alarm is created on the NFVO by failing a virtualised resource that is allocated to the relevant VNF instance (TD_NFV_FM_VNF_NOTIFY_001) Test Sequence Step Type Description Result Result Pre-test conditions 1 Stimulus Resolve the failure of the virtualised resource allocated to the relevant VNF (e.g. restart the virtualised resource directly on the VIM VIM fault alarm has been cleared on the VIM by querying the list of VNF fault alarms 3 IOP Check Verify that the relevant VNF fault alarm has been cleared on the NFVO by querying the list of VNF fault alarms	Applicability		 NFVO can s 	subscribe to alarm notifications on the VNFM (NFVO_FM_VNF_SU	JBSCRIBE)	
VNFM can subscribe to alarm notifications on the VIM (VNFM_FM_VR_SUBSCRIBE) VIM supports alarm notifications subscriptions by the VNFM (VIM_FM_SUBSCRIBE_BY_VNFM) VNFM can generate VNF fault alarm clearance notifications to the NFVO (VNFM_FM_VNF_NOTIFY) NFVO can process VNF fault alarm clearance notifications from the VNFM (NFVO_FM_VNF_NOTIFY) VIM can generate virtualised resources fault alarm clearance notifications to the VNFM (VIM_FM_NOTIFY_BY_VNFM) VNFM can process virtualised resource fault alarm clearance notifications from the VIM (VNFM_FM_VR_NOTIFY) NFVO can get the list of VNF fault alarms from the VNFM (NFVO_FM_VNF_GET_ALARM) VNFM supports VNF fault alarm list queries by the NFVO (VNFM_FM_VNF_QUERY) VIM supports vNF fault alarm list queries by the VNFM (VIM_FM_QUERY_BY_VNFM) Pre-test conditions						
VIM supports alarm notifications subscriptions by the VNFM (VIM_FM_SUBSCRIBE_BY_VNFM) VNFM_can generate VNF fault alarm clearance notifications to the NFVO (VNFM_FM_VNF_NOTIFY) NFVO can process VNF fault alarm clearance notifications from the VNFM (NFVO_FM_VNF_NOTIFY) VIM can generate virtualised resources fault alarm clearance notifications to the VNFM (VIM_FM_NOTIFY_BY_VNFM) VNFM can process virtualised resource fault alarm clearance notifications from the VIM (VNFM_FM_VR_NOTIFY) NFVO can get the list of VNF fault alarms from the VNFM (NFVO_FM_VNF_GET_ALARM) VNFM supports VNF fault alarm list queries by the NFVO (VNFM_FM_VNF_QUERY) VIM supports virtualised resources fault alarm list queries by the VNFM (VIM_FM_QUERY_BY_VNFM) Pre-test conditions			•	•	CRIBE)	
VNFM can generate VNF fault alarm clearance notifications to the NFVO (VNFM_FM_VNF_NOTIFY) NFVO can process VNF fault alarm clearance notifications from the VNFM (NFVO_FM_VNF_NOTIFY) VIM can generate virtualised resources fault alarm clearance notifications to the VNFM (VIM_FM_NOTIFY_BY_VNFM) VNFM can process virtualised resource fault alarm clearance notifications from the VIM (VNFM_FM_VR_NOTIFY) NFVO can get the list of VNF fault alarms from the VNFM (NFVO_FM_VNF_GET_ALARM) VNFM supports VNF fault alarm list queries by the NFVO (VNFM_FM_VNF_QUERY) VIM supports virtualised resources fault alarm list queries by the VNFM (VIM_FM_QUERY_BY_VNFM) VIM Supports virtualised resources fault alarms on the VNFM (VIM_FM_QUERY_BY_VNFM) NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001) NFVO is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to virtualised resources fault alarms on the VIM NS fault alarm is created on the NFVO by failing a virtualised resource that is allocated to the relevant VNF instance (TD_NFV_FM_VNF_NOTIFY_001) Test Step Type Description Result			 VIM suppor 	ts alarm notifications subscriptions by the VNFM	,	
(NFVO_FM_VNF_NOTIFY) VIM can generate virtualised resources fault alarm clearance notifications to the VNFM (VIM_FM_NOTIFY_BY_VNFM) VNFM can process virtualised resource fault alarm clearance notifications from the VIM (VNFM_FM_VR_NOTIFY) NFVO can get the list of VNF fault alarms from the VNFM (NFVO_FM_VNF_GET_ALARM) VNFM supports VNF fault alarm list queries by the NFVO (VNFM_FM_VNF_QUERY) VIM supports virtualised resources fault alarm list queries by the VNFM (VIM_FM_QUERY_BY_VNFM) Pre-test conditions NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001) NFVO is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to VNF fault alarms on the VNFM NS fault alarm is created on the NFVO by failing a virtualised resource that is allocated to the relevant VNF instance (TD_NFV_FM_VNF_NOTIFY_001) Test Step Type Description Result Sequence I Stimulus Resolve the failure of the virtualised resource allocated to the relevant VNF (e.g. restart the virtualised resource directly on the VIM) 2 IOP Check Verify that the relevant virtualised resource fault alarm has been cleared on the VIM by querying the list of virtualised resource fault alarms 3 IOP Check Verify that the relevant VNF fault alarm has been cleared on the VNFM by querying the list of VNF fault alarms 4 IOP Check Verify that the relevant NS fault alarm has been cleared on the NFVO by querying the list of NS fault alarms			 VNFM can 	generate VNF fault alarm clearance notifications to the NFVO		
(VIM_FM_NOTIFY_BY_VNFM) VNFM can process virtualised resource fault alarm clearance notifications from the VIM (VNFM_FM_VR_NOTIFY) NFVO can get the list of VNF fault alarms from the VNFM (NFVO_FM_VNF_GET_ALARM) VNFM supports VNF fault alarm list queries by the NFVO (VNFM_FM_VNF_QUERY) VIM supports virtualised resources fault alarm list queries by the VNFM (VIM_FM_QUERY_BY_VNFM) Pre-test conditions NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001) NFVO is subscribed to VNF fault alarms on the VNFM NFVO is subscribed to virtualised resources fault alarms on the VIM NS fault alarm is created on the NFVO by failing a virtualised resource that is allocated to the relevant VNF instance (TD_NFV_FM_VNF_NOTIFY_001) Test Sequence Step Type Description Result Resolve the failure of the virtualised resource allocated to the relevant VNF (e.g. restart the virtualised resource directly on the VIM) 2 IOP Check Verify that the relevant virtualised resource fault alarm has been cleared on the VIM by querying the list of virtualised resource fault alarms 3 IOP Check Verify that the relevant VNF fault alarm has been cleared on the VNFM by querying the list of VNF fault alarms 4 IOP Check Verify that the relevant NS fault alarm has been cleared on the NFVO by querying the list of NS fault alarms						
(VNFM_FM_VR_NOTIFY) NFVO can get the list of VNF fault alarms from the VNFM (NFVO_FM_VNF_GET_ALARM) VNFM supports VNF fault alarm list queries by the NFVO (VNFM_FM_VNF_QUERY) VIM supports virtualised resources fault alarm list queries by the VNFM (VIM_FM_QUERY_BY_VNFM) Pre-test conditions NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001) NFVO is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to virtualised resources fault alarms on the VIM NS fault alarm is created on the NFVO by failing a virtualised resource that is allocated to the relevant VNF instance (TD_NFV_FM_VNF_NOTIFY_001) Test Sequence Step Type Description Result Resolve the failure of the virtualised resource allocated to the relevant VNF (e.g. restart the virtualised resource directly on the VIM) 2 IOP Check Verify that the relevant virtualised resource fault alarm has been cleared on the VIM by querying the list of virtualised resource fault alarms 3 IOP Check Verify that the relevant VNF fault alarm has been cleared on the VNFM by querying the list of VNF fault alarms 4 IOP Check Verify that the relevant NS fault alarm has been cleared on the NFVO by querying the list of NS fault alarms			(VIM_FM_N	NOTIFY_BY_VNFM)		
VNFM supports VNF fault alarm list queries by the NFVO (VNFM_FM_VNF_QUERY) VIM supports virtualised resources fault alarm list queries by the VNFM (VIM_FM_QUERY_BY_VNFM) Pre-test conditions NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001) NFVO is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to virtualised resources fault alarms on the VIM NS fault alarm is created on the NFVO by failing a virtualised resource that is allocated to the relevant VNF instance (TD_NFV_FM_VNF_NOTIFY_001) Test Sequence Step Type Description Result					n the VIM	
VIM supports virtualised resources fault alarm list queries by the VNFM (VIM_FM_QUERY_BY_VNFM) NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)			NFVO can get the list of VNF fault alarms from the VNFM (NFVO_FM_VNF_GET_ALARM)			
VIM_FM_QUERY_BY_VNFM			 VNFM supports VNF fault alarm list queries by the NFVO (VNFM_FM_VNF_QUERY) 			
VIM_FM_QUERY_BY_VNFM			 VIM suppor 			
Pre-test conditions NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001) NFVO is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to virtualised resources fault alarms on the VIM NS fault alarm is created on the NFVO by failing a virtualised resource that is allocated to the relevant VNF instance (TD_NFV_FM_VNF_NOTIFY_001) Test Sequence Step Type Description Result Stimulus Resolve the failure of the virtualised resource allocated to the relevant VNF (e.g. restart the virtualised resource directly on the VIM) IOP Check Verify that the relevant virtualised resource fault alarm has been cleared on the VNFM by querying the list of virtualised resource fault alarms IOP Check Verify that the relevant VNF fault alarm has been cleared on the VNFM by querying the list of VNF fault alarms IOP Check Verify that the relevant NS fault alarm has been cleared on the NFVO by querying the list of NS fault alarms						
NFVO is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to virtualised resources fault alarms on the VIM NS fault alarm is created on the NFVO by failing a virtualised resource that is allocated to the relevant VNF instance (TD_NFV_FM_VNF_NOTIFY_001) Step Type Description Result						
NFVO is subscribed to VNF fault alarms on the VNFM VNFM is subscribed to virtualised resources fault alarms on the VIM NS fault alarm is created on the NFVO by failing a virtualised resource that is allocated to the relevant VNF instance (TD_NFV_FM_VNF_NOTIFY_001) Step Type Description Result	Pre-test condit	tions	 NS is instar 	ntiated (TD_NFV_NSLCM_INSTANTIATE_001)		
NS fault alarm is created on the NFVO by failing a virtualised resource that is allocated to the relevant VNF instance (TD_NFV_FM_VNF_NOTIFY_001) Step Type Description Result				· ·		
NS fault alarm is created on the NFVO by failing a virtualised resource that is allocated to the relevant VNF instance (TD_NFV_FM_VNF_NOTIFY_001) Step Type Description Result			 VNFM is su 	bscribed to virtualised resources fault alarms on the VIM		
Test Sequence Step Type Description Result					allocated to the	
Step Type Description Result						
Sequence 1 Stimulus Resolve the failure of the virtualised resource allocated to the relevant VNF (e.g. restart the virtualised resource directly on the VIM) 2 IOP Check Verify that the relevant virtualised resource fault alarm has been cleared on the VIM by querying the list of virtualised resource fault alarms 3 IOP Check Verify that the relevant VNF fault alarm has been cleared on the VNFM by querying the list of VNF fault alarms 4 IOP Check Verify that the relevant NS fault alarm has been cleared on the NFVO by querying the list of NS fault alarms						
Sequence 1 Stimulus Resolve the failure of the virtualised resource allocated to the relevant VNF (e.g. restart the virtualised resource directly on the VIM) 2 IOP Check Verify that the relevant virtualised resource fault alarm has been cleared on the VIM by querying the list of virtualised resource fault alarms 3 IOP Check Verify that the relevant VNF fault alarm has been cleared on the VNFM by querying the list of VNF fault alarms 4 IOP Check Verify that the relevant NS fault alarm has been cleared on the NFVO by querying the list of NS fault alarms	Test	Step	Type	Description	Result	
2 IOP Check Verify that the relevant virtualised resource fault alarm has been cleared on the VIM by querying the list of virtualised resource fault alarms 3 IOP Check Verify that the relevant VNF fault alarm has been cleared on the VNFM by querying the list of VNF fault alarms 4 IOP Check Verify that the relevant NS fault alarm has been cleared on the NFVO by querying the list of NS fault alarms	Sequence			relevant VNF (e.g. restart the virtualised resource directly on		
3 IOP Check Verify that the relevant VNF fault alarm has been cleared on the VNFM by querying the list of VNF fault alarms 4 IOP Check Verify that the relevant NS fault alarm has been cleared on the NFVO by querying the list of NS fault alarms		2	IOP Check	Verify that the relevant virtualised resource fault alarm has been cleared on the VIM by querying the list of virtualised		
4 IOP Check Verify that the relevant NS fault alarm has been cleared on the NFVO by querying the list of NS fault alarms		3	IOP Check			
		4	IOP Check	Verify that the relevant NS fault alarm has been cleared on the		
	IOP Verdict					

7.5.3 NS Fault Management

7.5.3.1 NS Fault Alarm Subscription Creation

	Test Description: NS Fault Alarm Subscription Creation			
Identifier	TD_NFV_FM_NS_ALARM_SUBSCRIPTION_CREATE_001			
Test Purpose	Verify that it is possible to subscribe to alarm notifications related to faults on the NS instance			
Configuration	SUT Configuration 1 SUT Configuration 3 SUT Configuration 4			
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5] and ETSI GS NFV-IFA 013 [i.9]			

VNFM expo			ports receiving VNF faults/alarms from VNFM (notifications) oses VNF alarms towards NFVO (notifications) ports receiving virtualised resource faults/alarms from VIM	
Pre-test cond	ditions	NS is insta	ntiated (TD_NFV_NSLCM_INSTANTIATE_001)	
Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Subscribe to the alarm notifications related to NS instance faults from NFVO (i.e. create new subscription resource)	
	2	IOP Check	Verify that a new subscription resource is created in the NFVO	
	3	IOP Check	Verify that the NFVO is subscribed on the VNFM to the related VNF resources faults alarm notifications	
	4	IOP Check	If applicable, verify that the VNFM is subscribed to the related VNF or virtualised resources faults alarm notifications	
IOP Verdict			•	

7.5.3.2 NS Fault Alarm Subscription Deletion

		Test De	scription: NS Fault Alarm Subscription Deletion		
Identifier		TD_NFV_FM_N	S_ALARM_SUBSCRIPTION_DELETE_001		
Test Purpose)	Verify that the su	ubscription to NS faults alarm notifications can be deleted		
Configuration	n	SUT Configurati	on 1		
		SUT Configurati	on 3		
		SUT Configurati	on 4		
References		ETSI GS NFV-IF	FA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.	5] and ETSI	
		GS NFV-IFA 01:	3 [i.9]	_	
Applicability		NFVO supp	orts receiving VNF faults/alarms from VNFM (notifications)		
			ses VNF alarms towards NFVO (notifications)		
		•	orts receiving virtualised resource faults/alarms from VIM		
			one recommendation and the recommendation of		
Pre-test cond	ditions	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)			
		NFVO is subscribed to the NS faults alarm notifications			
			FM_ALARM_SUBSCRIPTION_CREATE_001)		
		,	·		
Test	Step	Туре	Description	Result	
Sequence	1	Stimulus	Delete the subscription to related to NS instance faults in the NFVO		
	2	IOP Check	Verify that the subscription related to NS instance fault alarm notifications is deleted in the NFVO		
	3	IOP Check	Verify that the NFVO deletes the subscription on the VNFM to VNF related resources faults alarm notifications		
	4	IOP Check	If applicable, verify that the VNFM in turn deletes its subscription to VNF or virtualised resource related resources faults alarm notifications		
IOP Verdict			padio diami notifications		

7.5.3.3 NS Fault Alarm Notification

Test Description: NS Fault Alarm Notification						
Identifier	TD_NFV_FM_NS_ALARM_NOTIFICATION_001					
Test Purpose	Verify that a fault alarm notification is exposed by the NFVO when a NS related resource fails					
Configuration	SUT Configuration 1 SUT Configuration 3 SUT Configuration 4					
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5] and ETSI GS NFV-IFA 013 [i.9]					

Applicability	 NFVO supports receiving VNF faults/alarms from VNFM (notifications) VNFM exposes VNF alarms towards NFVO (notifications) VNFM supports receiving virtualised resource faults/alarms from VIM 			
Pre-test cond	litions	NFVO is su	ntiated (TD_NFV_NSLCM_INSTANTIATE_001) bscribed to the NS faults alarm notifications FM_ALARM_SUBSCRIPTION_CREATE_001)	
Test	Step	Type	Description	Result
Sequence	1	Stimulus	Trigger a fault on a NS related resource matching an existing alarm notification subscription	
	2	IOP Check	If applicable, verify that a VNF fault alarm notification has been received by the VNFM (e.g. by querying the NS fault alarms database)	
	3	IOP Check	Verify that a VNF fault alarm notification is generated and dispatched by the VNFM to the NFVO	
	4	IOP Check	Verify that an NS fault alarm notification is generated and dispatched by the NFVO (e.g. by checking the GUI where applicable)	
IOP Verdict				

7.5.3.4 NS Fault Alarm Notification Clearance

		Test De	scription: NS Fault Alarm Notification Clearance		
Identifier		TD_NFV_FM_N	S_ALARM_CLEAR_NOTIFICATION_001		
		Verify that an alarm clear notification is dispatched by the NFVO when a NS related resource failure is cleared			
Configuration	1	SUT Configurati			
		SUT Configurati SUT Configurati			
References		ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5] and ETSI GS NFV-IFA 013 [i.9]			
Applicability		 NFVO supp 	orts receiving VNF faults/alarms from VNFM (notifications)		
		 VNFM expo 	ses VNF alarms towards NFVO (notifications)		
		 VNFM supp 	orts receiving virtualised resource faults/alarms from VIM		
Pre-test cond	litions	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)			
		NS fault alarm is created on the NFVO by failing a NS related resource			
		(TD_NFV_FM_VR_ALARM_NOTIFY_001)			
		NFVO is subscribed to the NS faults alarm notifications (TD NEV FM ALARM SUBSCRIPTION CREATE 2011)			
		(ID_NFV_F	FM_ALARM_SUBSCRIPTION_CREATE_001)		
Test	Step	Туре	Description	Result	
Sequence	1	Stimulus	Clear the failure of the NS related resource that triggered the alarm notification		
	2	IOP Check	If applicable, verify that a VNF clear alarm notification has been received by the VNFM (e.g. by querying the NS fault alarms database)		
	3	IOP Check	Verify that a VNF clear alarm notification is generated and dispatched by the VNFM to the NFVO		
	4	IOP Check	Verify that an NS clear alarm notification is generated and dispatched by the NFVO (e.g. by checking the GUI where applicable)		
IOP Verdict					

7.5.3.5 NS Fault Alarm Query

Test Description: NS Fault Alarm Query		
Identifier	TD_NFV_FM_NS_ALARM_QUERY_001	
Test Purpose	Verify that NS related fault alarms can be queried from the NFVO	

Configuration		SUT Configuration 1 SUT Configuration 3 SUT Configuration 4			
References		ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5] and ETSI GS NFV-IFA 013 [i.9]			
Applicability		 NFVO supports receiving VNF faults/alarms from VNFM (query) VNFM exposes VNF alarms towards NFVO (query response) VNFM supports receiving virtualised resource faults/alarms from VIM 			
Pre-test cond	itions	NS is instar	ntiated (TD_NFV_NSLCM_INSTANTIATE_001)		
Test	Step	Type	Description	Result	
Sequence	1	Stimulus	Trigger a fault on a NS related resource		
	2	IOP Check	If applicable, verify that a VNF fault alarm has been collected by the VNFM (e.g. by querying its VNF fault alarms database)		
	3	IOP Check	Verify that the VNF fault alarms are queried by NFVO from the VNFM and are properly exposed as NS fault alarms upon explicit NS fault alarms query on the NFVO (e.g. by checking the GUI where applicable)		
IOP Verdict					

7.6 Performance Management

7.6.1 Virtualised Resource Performance Management

7.6.1.1 Virtualised Resource PM Job Creation and Notification Monitoring

		i est Descrip	otion: VR PM job creation and notification monitoring		
Identifier	TD_NFV_PM_VR_CREATE_NOTIFY_001				
Test Purpose		Verify that the performance metrics of a virtualised resource that is required for a NS instance			
connectivity can be monitored using PM jobs and notifications					
Configuration SUT Configuration 1					
References ETSI GS NFV-IFA 005 [i.3] and ETSI GS NFV-IFA 013 [i.9]					
Applicability		 NFVO can create VR PM jobs on the VIM (NFVO_PM_VR_PMJOB_CREATE) 			
	,	VIM supports VR PM jobs creation by the NFVO (VIM_PM_PMJOB_CREATE_BY_NFVO)			
		 NFVO can s 	subscribe to VR PM jobs on the VIM (NFVO_PM_VR_PMJOB_SU	BSCRIBE)	
			ts VR PM job subscriptions from the NFVO	,	
			PMJOB_SUBSCRIBE_BY_NFVO)		
		•	nerate VR PM notifications to the NFVO (VIM_PM_PMJOB_NOTIF	Y BY NEVO)	
		•	orts VR PM job notifications from the VIM (NFVO_PM_VR_PMJOE	•	
		• •	query VR PM jobs from the VIM (NFVO_PM_VR_PMJOB_QUERY	•	
			ts VR PM job queries by the NFVO (VIM_PM_PMJOB_QUERY_B	•	
	I	v iivi suppoi	is vit i ivi job queries by the ivi vo (viivi_i ivi_i ivi50b_QoLit i_b	1_N VO)	
Pre-test condit	ions	NS is instan	atiated (TD, NEV, NSI CM, INSTANTIATE, 001)		
. To tool oonan		 NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001) Monitoring parameters (e.g. metrics, metric groups, collection and reporting periods) are 			
				riada) ara	
I		0.	parameters (e.g. metrics, metric groups, collection and reporting pe	eriods) are	
		defined	parameters (e.g. metrics, metric groups, collection and reporting pe	eriods) are	
Test	Step	defined		·	
Test Sequence	Step 1	0.	Description	eriods) are Result	
		defined Type	Description Trigger the NFVO to create a VR PM job for a virtualised	·	
		defined Type	Description	·	
	1	Type Stimulus	Description Trigger the NFVO to create a VR PM job for a virtualised resource that is allocated to the target NS instance	·	
	1	Type Stimulus	Description Trigger the NFVO to create a VR PM job for a virtualised resource that is allocated to the target NS instance Verify that a VR PM job has been created on the VIM according	·	
	2	Type Stimulus IOP Check Stimulus	Description Trigger the NFVO to create a VR PM job for a virtualised resource that is allocated to the target NS instance Verify that a VR PM job has been created on the VIM according to the monitoring parameters by querying the VR PM jobs Trigger the NFVO to subscribe to the VR PM job created in step 1	·	
	2	Type Stimulus IOP Check	Description Trigger the NFVO to create a VR PM job for a virtualised resource that is allocated to the target NS instance Verify that a VR PM job has been created on the VIM according to the monitoring parameters by querying the VR PM jobs Trigger the NFVO to subscribe to the VR PM job created in step 1 Verify that a "performance information available" notification for	·	
	2	Type Stimulus IOP Check Stimulus	Description Trigger the NFVO to create a VR PM job for a virtualised resource that is allocated to the target NS instance Verify that a VR PM job has been created on the VIM according to the monitoring parameters by querying the VR PM jobs Trigger the NFVO to subscribe to the VR PM job created in step 1 Verify that a "performance information available" notification for the monitored virtualised resource was generated by the VIM to	·	
Sequence	2	Type Stimulus IOP Check Stimulus	Description Trigger the NFVO to create a VR PM job for a virtualised resource that is allocated to the target NS instance Verify that a VR PM job has been created on the VIM according to the monitoring parameters by querying the VR PM jobs Trigger the NFVO to subscribe to the VR PM job created in step 1 Verify that a "performance information available" notification for	·	
Sequence IOP Verdict	3 4	Type Stimulus IOP Check Stimulus IOP Check	Description Trigger the NFVO to create a VR PM job for a virtualised resource that is allocated to the target NS instance Verify that a VR PM job has been created on the VIM according to the monitoring parameters by querying the VR PM jobs Trigger the NFVO to subscribe to the VR PM job created in step 1 Verify that a "performance information available" notification for the monitored virtualised resource was generated by the VIM to	·	

7.6.1.2 Virtualised Resource PM Job Creation and Threshold Monitoring

		Test Descri	ption: VR PM job creation and threshold monitoring			
Identifier		TD_NFV_PM_VR_CREATE_THRESHOLD_001				
Test Purpose			Verify that the performance metrics of a virtualised resource that is required for a NS instance			
	connec		be monitored using PM jobs and thresholds			
Configuration		SUT Configurati				
References		ETSI GS NFV-II	FA 005 [i.3] and ETSI GS NFV-IFA 013 [i.9]			
Applicability		NFVO can create VR PM jobs on the VIM (NFVO_PM_VR_PMJOB_CREATE)				
		VIM supports VR PM jobs creation by the NFVO (VIM_PM_PMJOB_CREATE_BY_NFVO)				
		 NFVO can of 	create VR PM thresholds on the VIM (NFVO_PM_VR_PMTH_CRE	ATE)		
			ts VR PM thresholds creation by the NFVO	,		
			PMTH_CREATE_BY_NFVO)			
		 VIM can ge 	nerate VR PM notifications to the NFVO (VIM_PM_PMJOB_NOTIF	Y_BY_NFVO)		
		•	orts VR PM job notifications from the VIM (NFVO_PM_VR_PMJO	•		
		• •	query VR PM jobs from the VIM (NFVO_PM_VR_PMJOB_QUERY			
			ts VR PM job queries by the NFVO (VIM_PM_PMJOB_QUERY_B	•		
		• •	query VR PM thresholds from the VIM (NFVO_PM_VR_PMTH_QL	•		
		VIM supports VR PM threshold queries by the NFVO (VIM_PM_PMTH_QUERY_BY_NFVO)				
		• VIIVI Suppor	to vivi in the short queries by the ivi ve (vivi_i ivi_i ivi_i with_well	11_01_111 00)		
Pre-test condit	tions	NS is instar	ntiated (TD_NFV_NSLCM_INSTANTIATE_001)			
			parameters (e.g. metrics, metric groups, thresholds) are defined			
		- Wormtoning	saramotoro (e.g. motrico, motrio groupo, arrosmoto) are dominod			
Test	Step	Туре	Description	Result		
Sequence	1	Stimulus	Trigger the NFVO to create a VR PM job for a virtualised			
			resource that is allocated to the target NS instance			
	2	IOP Check	Verify that a VR PM job has been created on the VIM according			
			to the monitoring parameters by querying the VR PM jobs			
	3	Stimulus	Trigger the NFVO to create a VR PM threshold for the			
			virtualised resource monitored in step 1			
	4	Stimulus	Trigger the NFVO to subscribe to the threshold crossing			
1		Ctimeralian	notification for the VR PM threshold created in step 3			
	5	Stimulus	notification for the VR PM threshold created in step 3 Trigger the virtualised resource to cross the specified threshold			
	5	Stimulus	notification for the VR PM threshold created in step 3 Trigger the virtualised resource to cross the specified threshold (e.g. by increasing resource utilization levels in the			
	5		notification for the VR PM threshold created in step 3 Trigger the virtualised resource to cross the specified threshold (e.g. by increasing resource utilization levels in the virtualisation container)			
		Stimulus IOP Check	notification for the VR PM threshold created in step 3 Trigger the virtualised resource to cross the specified threshold (e.g. by increasing resource utilization levels in the virtualisation container) Verify that the "threshold crossed" notification for the monitored			
			notification for the VR PM threshold created in step 3 Trigger the virtualised resource to cross the specified threshold (e.g. by increasing resource utilization levels in the virtualisation container)			

7.6.1.3 Virtualised Resource PM Job Deletion

	Test Description: VR PM job deletion					
Identifier	TD_NFV_PM_VR_DELETE_MONITOR_001					
Test Purpose	Verify that the monitoring of performance metrics of a virtualised resource that is required for a NS					
	nstance connectivity can be stopped by deleting PM jobs					
Configuration	SUT Configuration 1					
References	ETSI GS NFV-IFA 005 [i.3] and ETSI GS NFV-IFA 013 [i.9]					
Applicability	NFVO can delete VR PM jobs from the VIM (NFVO_PM_VR_PMJOB_DELETE)					
	VIM supports VR PM jobs deletion by the NFVO (VIM_PM_PMJOB_DELETE_BY_NFVO)					
	NFVO can subscribe to VR PM jobs on the VIM (NFVO_PM_VR_PMJOB_SUBSCRIBE)					
	VIM supports VR PM job subscriptions from the NFVO (VIM RNA					
	(VIM_PM_PMJOB_SUBSCRIBE_BY_NFVO)					
	 VIM can generate VR PM notifications to the NFVO (VIM_PM_PMJOB_NOTIFY_BY_NFVO) 					
	NFVO supports VR PM job notifications from the VIM (NFVO_PM_VR_PMJOB_NOTIFY)					
	NFVO can query VR PM jobs from the VIM (NFVO_PM_VR_PMJOB_QUERY)					
	VIM supports VR PM job queries by the NFVO (VIM_PM_PMJOB_QUERY_BY_NFVO)					
Pre-test conditions	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)					
	 A virtualised resource that is required for the NS connectivity is monitored by the NFVO (TD_NFV_PM_VR_CREATE_NOTIFY_001) 					

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger the NFVO to delete a VR PM job of a virtualised resource that is allocated to the target NS instance	
	2	IOP Check	Verify that the relevant VR PM job has been deleted on the VIM by querying the VR PM jobs	
	3	IOP Check	Verify that no "performance information available" notification for the monitored virtualised resource has been generated by the VIM to the NFVO by monitoring the VR PM notifications. See note.	
IOP Verdict				
NOTE: Virtua	alised re	esource metric c	ollection and reporting periods should be taken into account.	

7.6.1.4 Virtualised Resource PM Threshold Deletion

	Test Description: VR PM threshold deletion						
Identifier	TD_NFV_PM_VR_DELETE_THRESHOLD_001						
Test Purpose	Verify that a threshold created for a virtualised resource that is required for a NS instance						
	connectivity can be deleted						
Configuration	SUT Configuration 1						
References	ETSI GS NFV-IFA 005 [i.3] and ETSI GS NFV-IFA 013 [i.9]						
Applicability	NFVO can delete VR PM thresholds from the VIM (NFVO_PM_VR_PMTH_DELETE)						
	VIM supports VR PM thresholds deletion by the NFVO (VIM_PM_PMTH_DELETE_BY_NFVO)						
	 NFVO can subscribe to VR PM jobs on the VIM (NFVO_PM_VR_PMJOB_SUBSCRIBE) 						
	VIM supports VR PM job subscriptions from the NFVO (VIM_PM_PMJOB_SUBSCRIBE_BY_NFVO)						
	VIM can generate VR PM notifications to the NFVO (VIM_PM_PMJOB_NOTIFY_BY_NFVO)						
	NFVO supports VR PM job notifications from the VIM (NFVO_PM_VR_PMJOB_NOTIFY)						
	NFVO can guery VR PM thresholds from the VIM (NFVO PM VR PMTH QUERY)						
	VIM supports VR PM threshold queries by the NFVO (VIM_PM_PMTH_QUERY_BY_NFVO)						
Pre-test conditions	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)						
	A threshold for a virtualised resource that is required for the NS connectivity is created by the NFVO (TD_NFV_PM_VR_CREATE_THRESHOLD_001)						

resource that is allocated to the target NS instance 2 IOP Check Verify that the relevant VR PM threshold has been deleted on the VIM by querying the VR PM thresholds 3 Stimulus Trigger the virtualised resource to cross the specified threshold (e.g. by increasing resource utilization levels in the virtualisation container) 4 IOP Check Verify that no "threshold crossed" notification for the monitored virtualised resource has been generated by the VIM to the	Test	Step	Type	Description	Result
the VIM by querying the VR PM thresholds 3 Stimulus Trigger the virtualised resource to cross the specified threshold (e.g. by increasing resource utilization levels in the virtualisation container) 4 IOP Check Verify that no "threshold crossed" notification for the monitored virtualised resource has been generated by the VIM to the	Sequence	1	Stimulus		
(e.g. by increasing resource utilization levels in the virtualisation container) 4 IOP Check Verify that no "threshold crossed" notification for the monitored virtualised resource has been generated by the VIM to the		2	IOP Check		
virtualised resource has been generated by the VIM to the		3	Stimulus	(e.g. by increasing resource utilization levels in the	
		4	IOP Check		
IOP Verdict	IOP Verdict				

7.6.2 VNF Performance Management

7.6.2.1 VNF PM Job Creation and Notification Monitoring

	Test Description: VNF PM job creation and notification monitoring				
Identifier	TD_NFV_PM_VNF_CREATE_NOTIFY_001				
Test Purpose	Verify that the performance metrics of a virtualised resource that is allocated to a VNF instance inside a NS instance can be monitored using PM jobs and notifications				
Configuration	SUT Configuration 1				
References	ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5] and ETSI GS NFV-IFA 013 [i.9]				

Applicability		NFVO can	create VNF PM jobs on the VNFM (NFVO_PM_VNF_PMJOB_DEL	ETE)		
		VNFM supports VNF PM jobs creation by the NFVO (VNFM_PM_VNF_PMJOB_CREATE)				
		 VNFM can 	create VR PM jobs on the VIM (VNFM_PM_VR_PMJOB_CREATE	<u>.</u>		
			rts VR PM jobs creation by the VNFM (VIM_PM_PMJOB_CREATE	,		
			subscribe to VNF PM jobs on the VNFM (NFVO_PM_VNF_PMJOE			
			ports VNF PM job subscriptions from the NFVO	,		
			1_VNF_PMJOB_SUBSCRIBE)			
			subscribe to VR PM jobs on the VIM (VNFM_PM_VR_PMJOB_SU	IBSCRIBE)		
			rts VR PM job subscriptions from the VNFM	,		
			PMJOB_SUBSCRIBE_BY_VNFM)			
		•	enerate VR PM notifications to the VNFM (VIM_PM_PMJOB_NOTII	FY_BY_VNFM)		
		•	ports VR PM job notifications from the VIM (VNFM_PM_VR_PMJO	•		
			generate VNF PM notifications to the NFVO (VNFM_PM_VNF_PM	,		
	J.		ports VNF PM job notifications from the VNFM	/		
			1_VNF_PMJOB_NOTIFY)			
	J.	•	query VR PM jobs from the VIM (VNFM_PM_VR_PMJOB_QUER)	()		
	Į,		rts VR PM job queries by the VNFM (VIM_PM_PMJOB_QUERY_B	•		
			query VNF PM jobs from the VNFM (NFVO_PM_VNF_PMJOB_QL	·		
			ports VNF PM job queries by the NFVO (VNFM_PM_VNF_PMJOB	,		
			,	_ ,		
Pre-test cond	litions	NS is instar	ntiated (TD_NFV_NSLCM_INSTANTIATE_001)			
			parameters (e.g. metrics, metric groups, collection and reporting pe	eriods) are		
		defined on	NFVO TO			
	1-					
Test	Step	Туре	Description	Result		
Sequence	1	Stimulus	Trigger the NFVO to create a VNF PM job for a virtualised resource allocated to the relevant VNF instance inside the			
			target NS instance			
	2	IOP Check	Verify that a VNF PM job has been created on the VNFM			
		101 CHECK	according to the monitoring parameters by querying the VNF			
			PM jobs			
	3	IOP Check	Verify that a virtualised resource PM job has been created on			
			the VIM according to the monitoring parameters by querying			
			the VR PM jobs			
	4	Stimulus	Trigger the NFVO to subscribe to the VNF PM job created in			
	<u> </u>	100.01	step 1			
	5	IOP Check	Verify that a "performance information available" notification for			
			the monitored virtualised resource was generated by the VIM to the VNFM by monitoring the VR PM notifications. See note.			
	6	IOP Check	Verify that a "performance information available" notification for			
		101 OHECK	the monitored virtualised resource was generated by the VNFM			
			to the NFVO by monitoring the VNF PM notifications. See note.			
IOP Verdict						
	tric collec	tion and reporti	ng periods should be taken into account.			

7.6.2.2 VNF PM Job Creation and Threshold Monitoring

	Test Description: VNF PM job creation and threshold monitoring				
Identifier	TD_NFV_PM_VNF_CREATE_THRESHOLD_001				
Test Purpose	Verify that the performance metrics of a virtualised resource that is allocated to a VNF instance inside a NS instance can be monitored using PM jobs and thresholds				
Configuration	SUT Configuration 1				
References	ETSI GS NFV-IFA 006 (i.4). ETSI GS NFV-IFA 007 (i.5) and ETSI GS NFV-IFA 013 (i.9)				

Applicability

- NFVO can create VNF PM jobs on the VNFM (NFVO_PM_VNF_PMJOB_CREATE)
- VNFM supports VNF PM jobs creation by the NFVO (VNFM_PM_VNF_PMJOB_CREATE)
- VNFM can create VR PM jobs on the VIM (VNFM_PM_VR_PMJOB_CREATE)
- VIM supports VR PM jobs creation by the VNFM (VIM_PM_PMJOB_CREATE_BY_VNFM)
- NFVO can create VNF PM thresholds on the VNFM (NFVO_PM_VNF_PMTH_CREATE)
- VNFM supports VNF PM thresholds creation by the NFVO (VNFM_PM_VNF_PMTH_CREATE)
- VNFM can create VR PM thresholds on the VIM (VNFM PM VR PMTH CREATE)
- VIM supports VR PM thresholds creation by the VNFM (VIM_PM_PMTH_CREATE_BY_VNFM)
- NFVO can subscribe to VNF PM jobs on the VNFM (NFVO_PM_VNF_PMJOB_SUBSCRIBE)
- VNFM supports VNF PM job subscriptions from the NFVO (VNFM_PM_VNF_PMJOB_SUBSCRIBE)
- VNFM can subscribe to VR PM jobs on the VIM (VNFM_PM_VR_PMJOB_SUBSCRIBE)
- VIM supports VR PM job subscriptions from the VNFM (VIM_PM_PMJOB_SUBSCRIBE_BY_VNFM)
- VIM can generate VR PM notifications to the VNFM (VIM_PM_PMJOB_NOTIFY_BY_VNFM)
- VNFM supports VR PM job notifications from the VIM (VNFM_PM_VR_PMJOB_NOTIFY)
- VNFM can generate VNF PM notifications to the NFVO (VNFM_PM_VNF_PMJOB_NOTIFY)
- NFVO supports VNF PM job notifications from the VNFM (NFVO_PM_VNF_PMJOB_NOTIFY)
- VNFM can query VR PM jobs from the VIM (VNFM_PM_VR_PMJOB_QUERY)
- VIM supports VR PM job queries by the VNFM (VIM_PM_PMJOB_QUERY_BY_VNFM)
- NFVO can query VNF PM jobs from the VNFM (NFVO_PM_VNF_PMJOB_QUERY)
- VNFM supports VNF PM job gueries by the NFVO (VNFM PM VNF PMJOB QUERY)
- VNFM can query VR PM thresholds from the VIM (VNFM_PM_VR_PMTH_QUERY)
- VIM supports VR PM threshold queries by the VNFM (VIM_PM_PMTH_QUERY_BY_VNFM)
- NFVO can query VNF PM thresholds from the VNFM (NFVO_PM_VNF_PMTH_QUERY)
- VNFM supports VNF PM threshold gueries by the NFVO (VNFM PM VNF PMTH QUERY)

Pre-test conditions

- NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)
- Monitoring parameters (e.g. VNF instance, metrics, metric groups, threshold) are defined on NFVO

Test	Step	Type	Description	Result
Sequence	1	Stimulus	Trigger the NFVO to create a PM job for a virtualised resource allocated to the relevant VNF instance inside the target NS instance	
	2	IOP Check	Verify that a VNF PM job has been created on the VNFM according to the monitoring parameters by querying the VNF PM jobs	
	3	IOP Check	Verify that a VR PM job has been created on the VIM according to the monitoring parameters by querying the VR PM jobs	
	4	Stimulus	Trigger the NFVO to create a VNF PM threshold for the virtualised resource monitored in step 1	
	5	Stimulus	Trigger the NFVO to subscribe to the threshold crossing notification for the VNF PM threshold created in step 4	
	6	Stimulus	Trigger the virtualised resource to cross the specified threshold (e.g. by increasing resource utilization levels in the virtualisation container)	
	7	IOP Check	Verify that the "threshold crossed" notification for the monitored virtualised resource was generated by the VIM to the VNFM by monitoring the VR PM notifications	
	8	IOP Check	Verify that the "threshold crossed" notification for the monitored virtualised resource was generated by the VNFM to the NFVO by monitoring the VNF PM notifications	
IOP Verdict				_

7.6.2.3 VNF PM Job Deletion

			Test Description: VNF PM job deletion			
Identifier			NF_DELETE_MONITOR_001			
Test Purpose		Verify that the monitoring of performance metrics of a virtualised resource that is allocated to a VNF instance inside a NS instance can be stopped by deleting PM jobs				
Configuration		SUT Configuration				
References			A 006 [i.4], ETSI GS NFV-IFA 007 [i.5] and ETSI GS NFV-IFA 013	3 [i.9]		
Applicability			delete VNF PM jobs from the VNFM (NFVO_PM_VNF_PMJOB_DE			
			orts VNF PM jobs deletion by the NFVO (VNFM_PM_VNF_PMJO	•		
			delete VR PM jobs from the VIM (VNFM_PM_VR_PMJOB_DELET	,		
			ts VR PM jobs deletion by the VNFM (VIM_PM_PMJOB_DELETE_	•		
			delete VNF PM thresholds from the VNFM (NFVO_PM_VNF_PMT	•		
			orts VNF PM thresholds deletion by the NFVO	11_DEEE1E)		
		•	_VNF_PMTH_DELETE)	-,		
			delete VR PM thresholds from the VIM (VNFM_PM_VR_PMTH_DE	ELETE)		
			ts VR PM thresholds deletion by the VNFM MTH_DELETE_BY_VNFM)			
		 NFVO can s 	subscribe to VNF PM jobs on the VNFM (NFVO_PM_VNF_PMJOE	S_SUBSCRIBE)		
			orts VNF PM job subscriptions from the NFVO _VNF_PMJOB_SUBSCRIBE)			
			subscribe to VR PM jobs on the VIM (VNFM_PM_VR_PMJOB_SU	BSCRIBE)		
			ts VR PM job subscriptions from the VNFM	500. (ISL)		
		(VIM_PM_F	MJOB_SUBSCRIBE_BY_VNFM)			
			nerate VR PM notifications to the VNFM (VIM_PM_PMJOB_NOTIF orts VR PM job notifications from the VIM (VNFM_PM_VR_PMJO			
		• • • • • • • • • • • • • • • • • • • •	generate PM notifications to the NFVO (VNFM_PM_VNF_PMJOB_	_ ,		
			·	_NOTIFT)		
		NFVO supports VNF PM job notifications from the VNFM (NFVO_PM_VNF_PMJOB_NOTIFY)				
		VIM supports VR PM job queries by the VNFM (VIM_PM_PMJOB_QUERY_BY_VNFM)				
		NFVO can query VNF PM jobs from the VNFM (NFVO_PM_VNF_PMJOB_QUERY)				
		VNFM supports VNF PM job queries by the NFVO (VNFM_PM_VNF_PMJOB_QUERY)				
			query VR PM thresholds from the VIM (VNFM_PM_VR_PMTH_QL	•		
			ts VR PM threshold queries by the VNFM (VIM_PM_PMTH_QUER	•		
			query VNF PM thresholds from the VNFM (NFVO_PM_VNF_PMTH	·		
			orts VNF PM threshold queries by the NFVO (VNFM_PM_VNF_PI	,		
		viti iii capp		<u></u>		
Pre-test condit	ions	NS is instan	tiated (TD_NFV_NSLCM_INSTANTIATE_001)			
			d resource that is allocated to a VNF instance inside the target NS	instance is		
			y the NFVO (TD_NFV_PM_VNF_CREATE_NOTIFY_001)	instance is		
			, , , , , , <u> </u>			
Test	Step	Туре	Description	Result		
Sequence	1	Stimulus	Trigger the NFVO to delete a PM job of a virtualised resource			
			that is allocated to a VNF instance inside the target NS			
	_	IOD Ob I	instance			
	2	IOP Check	Verify that the relevant VNF PM job has been deleted on the VNFM by querying the VNF PM jobs			
	3	IOP Check	Verify that the relevant VR PM job has been deleted on the VIM			
		100.01	by querying the VR PM jobs			
	4	IOP Check	Verify that no "performance information available" notification			
			for the monitored virtualised resource has been generated by the VIM to the VNFM by monitoring the VR PM notifications.			
			See note.			
	5	IOP Check	Verify that no "performance information available" notification			
			for the monitored virtualised resource has been generated by			
			the VNFM to the NFVO by monitoring the VNF PM			
			notifications. See note.			
IOP Verdict						
NOTE: Virtua	alicad r	esource metric c	ollection and reporting periods should be taken into account.			

7.6.2.4 VNF PM Threshold Deletion

		Τe	est Description: VNF PM threshold deletion			
Identifier			NF_DELETE_THRESHOLD_001			
Test Purpose)	Verify that a threshold created for a virtualised resource that is allocated to a VNF instance inside				
		a NS instance can be deleted				
Configuration						
References			FA 006 [i.4], ETSI GS NFV-IFA 007 [i.5] and ETSI GS NFV-IFA 01	3 [i.9]		
Applicability			delete VNF PM thresholds from the VNFM (NFVO_PM_VNF_PMT			
		 VNFM supp 	ports VNF PM thresholds deletion by the NFVO _VNF_PMTH_DELETE	II_DEEETE)		
		•	l_VNF_PMTH_DELETE) delete VR PM thresholds from the VIM (VNFM_PM_VR_PMTH_D	FLETE)		
		 VIM suppor 	ts VR PM thresholds deletion by the VNFM PMTH_DELETE_BY_VNFM)	,		
		•	subscribe to VNF PM jobs on the VNFM (NFVO_PM_VNF_PMJO	3 SUBSCRIBE)		
		 VNFM supp 	orts VNF PM job subscriptions from the NFVO LVNF_PMJOB_SUBSCRIBE)	,		
		•	subscribe to VR PM jobs on the VIM (VNFM_PM_VR_PMJOB_SU	IBSCRIBE)		
			ts VR PM job subscriptions from the VNFM PMJOB_SUBSCRIBE_BY_VNFM)			
		 VIM can ge 	nerate VR PM notifications to the VNFM (VIM_PM_PMJOB_NOTI	FY_BY_VNFM)		
		VNFM supports VR PM job notifications from the VIM (VNFM_PM_VR_PMJOB_NOTIFY)				
		• •	query VR PM jobs from the VIM (VNFM_PM_VR_PMJOB_QUER)	•		
		VIM supports VR PM job queries by the VNFM (VIM_PM_PMJOB_QUERY_BY_VNFM)				
			query VNF PM jobs from the VNFM (NFVO_PM_VNF_PMJOB_QU	,		
		 VNFM supp 	oorts VNF PM job queries by the NFVO (VNFM_PM_VNF_PMJOB	_QUERY)		
	,					
Pre-test cond	litions	 NS is instar 	ntiated (TD_NFV_NSLCM_INSTANTIATE_001)			
		 A threshold 	for a virtualised resource that is allocated to a VNF instance inside	e a NS instance		
			y the NFVO (TD_NFV_PM_VNF_CREATE_THRESHOLD_001)			
	I		, , , , , , , , , , , , , , , , , , , 			
Test	Step	Туре	Description	Result		
Sequence	1	Stimulus	Trigger the NFVO to delete a VNF PM threshold of a virtualised resource that is allocated to a VNF instance inside the target NS instance			
	2	IOP Check	Verify that the relevant VNF PM threshold has been deleted on the VNFM by querying the VNF PM thresholds			
	3	IOP Check	Verify that the relevant VR PM threshold has been deleted on the VIM by querying the VR PM thresholds			
	4	Stimulus	Trigger the virtualised resource to cross the specified threshold			
			(e.g. by increasing resource utilization levels in the virtualisation container)			
	5	IOP Check	Verify that no "threshold crossed" notification for the monitored			
			virtualised resource has been generated by the VNFM to the			
			NFVO by monitoring the VNF PM notifications. See note.			
	6	IOP Check	Verify that no "threshold crossed" notification for the monitored			
			virtualised resource has been generated by the VIM to the			
			VNFM by monitoring the VR PM notifications. See note.			
IOP Verdict						
	ualised r	esource metric o	collection and reporting periods should be taken into account.	1		
· · · · · · · · · · · · · · · · · · ·		3.000.110 0	The fact of the state of the st			

7.6.3 NS Performance Management

7.6.3.1 NS PM Monitoring Job Creation

	Test Description: NS PM Monitoring Job Creation				
Identifier	TD_NFV_PM_NS_MONITORING_JOB_CREATE_001				
Test Purpose	Verify that performance monitoring job for monitoring NS related metrics can be created to start monitoring NS performance metrics				
Configuration	SUT Configuration 1 SUT Configuration 3 SUT Configuration 4				

References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5] and ETSI GS NFV-IFA 013 [i.9]				
Applicability • NFVO • VNFM			ports receiving VNF performance metrics from VNFM (notifications) ports receiving virtualised resource performance metrics from VIM pases VNF performance metrics towards NFVO (notifications)		
Pre-test condi	tions	Monitoring	ntiated (TD_NFV_NSLCM_INSTANTIATE_001) parameters (e.g. performance metrics, metric groups) are defined i e.g. CPU usage, memory usage, etc.)	n the NS	
Test	Step	Type	Description	Result	
Sequence	1	Stimulus	Create a performance monitoring job on the NFVO to start monitoring, with given collection and reporting periods, one or more performance metrics defined in the NS descriptor		
	2	IOP Check	If applicable, verify that the NFVO creates one or more performance monitoring jobs on the VNFM to collect the VNF related performance metrics		
	3	IOP Check	If applicable, verify that the VNFM in turn issues the creation of performance monitoring jobs to collect the VNF performance metrics as virtualised resource metrics		
	4	IOP Check	Verify that performance metrics are properly collected by the VNFM with the requested collection period		
	5	IOP Check	Verify that NS performance metrics are properly collected by the NFVO from the VNFM with the requested collection period, e.g. by querying performance metrics database (if any) or checking directly the Graphical User Interface (if applicable)		
IOP Verdict					

7.6.3.2 NS PM Performance Metrics Query

		Test D	Description: NS PM Performance Metrics Query				
Identifier	TD_NFV_PM_N		S_PERFORMANCE_METRICS_QUERY_001				
Test Purpose)		Verify that NS related performance monitoring metrics can be retrieved in the form of reports by querying the NFVO				
Configuration		SUT Configurati SUT Configurati SUT Configurati	on 3				
References			ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5] and ETSI GS NFV-IFA 013 [i.9]				
Applicability		VNFM suppVNFM expo	The Competition of the periodical control of the management of the				
Pre-test cond	litions	 NS perform 	ntiated (TD_NFV_NSLCM_INSTANTIATE_001) ance monitoring job is created and NFVO is collecting performance PM_NS_MONITORING_JOB_CREATE_001)	e metrics			
Test	Step	Туре	Description	Result			
Sequence	1	Stimulus	Issue the query of one or more performance monitoring reports related to NS performance metrics to the NFVO				
	2	IOP Check	If applicable, verify that the NFVO queries VNF related performance monitoring reports from the VNFM to retrieve the given NS related metrics				
	3	IOP Check	If applicable, verify that the VNFM queries virtualised resource related performance monitoring reports to retrieve the VNF related metrics				
	4	IOP Check	Verify that the performance metrics are properly retrieved from the VNFM and returned by the NFVO, e.g. checking directly the NFVO Graphical User Interface (if applicable)				
IOP Verdict							

7.6.3.3 NS PM Threshold Creation

		Te	est Description: NS PM Threshold Creation		
Identifier		TD_NFV_PM_N	IS_THRESHOLD_CREATE_001		
Test Purpose			rmance monitoring thresholds can be created for one or more NS retrics on the NFVO	elated	
Configuration		SUT Configurati SUT Configurati SUT Configurati	ion 3		
References		ETSI GS NFV-IF GS NFV-IFA 01	FA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.£ 3 [i.9]	i] and ETSI	
Applicability		 VNFM supp 	ports receiving VNF performance metrics from VNFM (notifications) ports receiving virtualised resource performance metrics from VIM oses VNF performance metrics towards NFVO (notifications)		
Pre-test condit		 NS perform 	ntiated (TD_NFV_NSLCM_INSTANTIATE_001) ance monitoring job is created and NFVO is collecting performance PM_NS_MONITORING_JOB_CREATE_001)	e metrics	
Test	Step	Туре	Description	Result	
Sequence	1	Stimulus	Create on the NFVO a performance monitoring threshold for a NS related monitored performance metric		
	2	IOP Check	If applicable, verify that the NFVO in creates one or more thresholds on the VNFM for VNF monitored performance metrics related to the given NS instance		
	3	IOP Check	If applicable, verify that the VNFM in turn creates one or more thresholds on virtualised resource monitored performance metrics related to the given VNF		
	4	IOP Check	Verify that the performance monitoring thresholds are properly created and maintained by the NFVO and the VNFM (e.g.		
			checking the Graphical User Interface, if applicable)		

7.6.3.4 NS PM Subscription Creation for Threshold Information

7	Test Description: NS PM Subscription Creation for Threshold Information					
Identifier	TD_NFV_PM_NS_SUBSCRIPTION_CREATE_001					
Test Purpose	Verify that it is possible to subscribe to NS performance metrics notifications related to threshold					
	crossed notifications					
Configuration	SUT Configuration 1					
	SUT Configuration 3					
	SUT Configuration 4					
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5] and ETSI					
	GS NFV-IFA 013 [i.9]					
Applicability	NFVO supports receiving VNF performance metrics from VNFM (notifications)					
	VNFM supports receiving virtualised resource performance metrics from VIM					
	VNFM exposes VNF performance metrics towards NFVO (notifications)					
Pre-test conditions	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)					
	NS performance monitoring job is created and NFVO is collecting performance metrics					
	(TD_NFV_PM_NS_THRESHOLD_CREATE_001,					
	TD_NFV_PM_NS_MONITORING_JOB_CREATE_001)					

Test	Step	Type	Description	Result
Sequence	1	Stimulus	Subscribe to the threshold crossed notifications related to a NS performance monitoring threshold available in the NFVO (i.e. create new subscription resource)	
	2	IOP Check	Verify that a new subscription resource is created in the NFVO	
	3	IOP Check	Verify that the NFVO is subscribed on the VNFM to the threshold crossed notifications related to VNF performance metrics for the given NS instance	
	4	IOP Check	If applicable, verify that the VNFM in turn subscribes to the threshold crossed notifications related to virtualised resource performance metrics for the given VNFs	
IOP Verdict				

7.6.3.5 NS PM Subscription Creation for Performance Information

	Te	st Description:	NS PM Subscription Creation for Performance Information			
Identifier		TD_NFV_PM_N	S_SUBSCRIPTION_CREATE_002			
Test Purpose		Verify that it is p	ossible to subscribe to NS performance metrics notifications relate	d to availability		
		of performance i	nformation			
Configuration		SUT Configuration	on 1			
		SUT Configuration	on 3			
		SUT Configuration	on 4			
References		ETSI GS NFV-IF	FA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.4]	5] and ETSI		
		GS NFV-IFA 013	3 [i.9]			
Applicability		 NFVO supp 	orts receiving VNF performance metrics from VNFM (notifications)			
		 VNFM supp 	orts receiving virtualised resource performance metrics from VIM			
		 VNFM expo 	ses VNF performance metrics towards NFVO (notifications)			
Pre-test condit	tions	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)				
		NS perform: (TD NE)/ F	ance monitoring job is created and NFVO is collecting performanc PM_NS_MONITORING_JOB_CREATE_001)	e metrics		
		(ID_NEV_E	WINS_WONTORING_JOB_CREATE_001)			
Test	Step	Type	Description	Result		
Sequence	1	Stimulus	Subscribe to the performance information availability			
-			notifications related to a NS performance job in the NFVO (i.e.			
		100.01	create new subscription resource)			
	2	IOP Check	Verify that a new subscription resource is created in the NFVO			
	3	IOP Check	Verify that the NFVO is subscribed on the VNFM to the			
			threshold crossed notifications related to VNF performance metrics for the given NS instance			
	4	IOP Check	If applicable, verify that the VNFM in turn subscribes to the			
			performance information availability related to virtualised			
			resource performance metrics for the given VNFs			
IOP Verdict						

7.6.3.6 NS PM Threshold Notification

	Test Description: NS PM Threshold Notification				
ldentifier	TD_NFV_PM_NS_THRESHOLD_NOTIFICATION_001				
Test Purpose	Verify that a threshold crossed notification is exposed by the NFVO when a NS performance metric crosses a previously created threshold				
Configuration	SUT Configuration 1 SUT Configuration 3 SUT Configuration 4				
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5] and ETSI GS NFV-IFA 013 [i.9]				
Applicability	 NFVO supports receiving VNF performance metrics from VNFM (notifications) VNFM supports receiving virtualised resource performance metrics from VIM VNFM exposes VNF performance metrics towards NFVO (notifications) 				

Pre-test cond	ditions	 NS perform notifications 	ntiated (TD_NFV_NSLCM_INSTANTIATE_001) nance monitoring subscription is created to collect performance mo s related to thresholds crossed PM_NS_SUBSCRIPTION_CREATE_001)	nitoring
Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger the monitored NS performance metric to cross the specified threshold	
	2	IOP Check	If applicable, verify that the VNFM receives and collects virtualised resource threshold crossed notifications for the impacted VNF	
	3	IOP Check	Verify that a "threshold crossed" notification for the monitored VNF performance metric is generated and dispatched by the VNFM	
	4	IOP Check	Verify that a "threshold crossed" notification for the monitored NS performance metric is collected from the VNFM and dispatched by the NFVO (e.g. checking the Graphical User Interface, if applicable)	
IOP Verdict			· · · · · · · · · · · · · · · · · · ·	

7.6.3.7 NS PM Monitoring Information Notification

		Tes	t Description: NS PM Threshold Notification		
Identifier		TD_NFV_PM_NS_MONITORING_INFO_NOTIFICATION_001			
Test Purpose			nitoring information availability notification is exposed by the NFV formance monitoring metrics are available	O when new and	
Configuration	Configuration SUT Co SUT Co SUT Co		on 3		
References			TSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5] and ETSI GS NFV-IFA 013 [i.9]		
Applicability		 VNFM supp 	O supports receiving VNF performance metrics from VNFM (notifications) M supports receiving virtualised resource performance metrics from VIM M exposes VNF performance metrics towards NFVO (notifications)		
Pre-test conditions		 NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001) NS performance monitoring subscription is created to collect performance monitoring notifications related to the availability of new monitoring information (TD_NFV_PM_NS_SUBSCRIPTION_CREATE_002) 			
Test	Step	Type	Description	Result	
Sequence	1	Stimulus	If applicable, verify that the VNFM receives and collects virtualised resource monitoring information availability notification for the impacted VNF		
	2	IOP Check	Verify that a monitoring information availability notification for the monitored VNF performance metric is generated and dispatched by the VNFM		
	3	IOP Check	Verify that a monitoring information availability notification for the monitored NS performance metric is collected from the VNFM and dispatched by the NFVO (e.g. checking the Graphical User Interface, if applicable)		
IOP Verdict					

7.6.3.8 NS PM Subscription Deletion

Test Description: NS PM Subscription Deletion						
Identifier	Identifier TD_NFV_PM_NS_SUBSCRIPTION_DELETE_001					
Test Purpose	Verify that the subscription to NS performance monitoring notifications can be deleted					
Configuration	SUT Configuration 1					
	SUT Configuration 3					
	SUT Configuration 4					

References	5] and ETSI			
Applicability		 NFVO supplement 	ports receiving VNF performance metrics from VNFM (notifications)
		 VNFM supplement 	ports receiving virtualised resource performance metrics from VIM	
		• •	oses VNF performance metrics towards NFVO (notifications)	
		•		
Pre-test condi	itions	NS is insta	ntiated (TD_NFV_NSLCM_INSTANTIATE_001)	
		 NFVO is su 	ubscribed to the NS faults alarm notifications	
		(TD_NFV_	PM_NS_SUBSCRIPTION_CREATE_001 or	
	TD_NFV_PM_NS_SUBSCRIPTION_CREATE_002)			
Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Delete the subscription related to NS performance monitoring notifications in the NFVO	
	2	IOP Check	Verify that the subscription related to NS performance monitoring notifications is deleted in the NFVO	
	3	IOP Check	Verify that the NFVO deletes on the VNFM the subscription to VNF related resources performance monitoring notifications	
	4	IOP Check	If applicable, verify that the VNFM in turn deletes the subscription to virtualised resource related resources performance monitoring notifications	
	1	ı	idenormance monitoring notifications	1

7.6.3.9 NS PM Monitoring Job Deletion

		Test	Description: NS PM Monitoring Job Deletion			
Identifier		TD_NFV_PM_NS_MONITORING_JOB_DELETE_001				
Test Purpose			rmance monitoring job for monitoring NS related metrics can be de erformance metrics	eleted to stop		
Configuration SUT Configura SUT Configura SUT Configura			on 3			
References		ETSI GS NFV-IF GS NFV-IFA 01:	A 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i. 3 [i.9]	5] and ETSI		
NFVO supports receiving VNF performance metrics from VNFM (notifications) VNFM supports receiving virtualised resource performance metrics from VIM VNFM exposes VNF performance metrics towards NFVO (notifications)						
Pre-test cond		 NS perform 	tiated (TD_NFV_NSLCM_INSTANTIATE_001) ance monitoring job is created and NFVO is collecting performance PM_NS_MONITORING_JOB_CREATE_001)	e metrics		
Test	Step	Type	Description	Result		
Sequence	1	Stimulus	Delete a performance monitoring job on the NFVO to stop monitoring one or more performance metrics			
	2	IOP Check	If applicable, verify that the NFVO deletes the related VNF performance monitoring jobs on the VNFM to stop monitoring the impacted VNF performance metrics			
	3	IOP Check	Verify that the NS and VNF performance metrics are no more collected by the NFVO and the VNFM, e.g. by querying the performance metrics database (if any) or checking directly the Graphical User Interface (if applicable)			
IOP Verdict						

7.6.3.10 NS PM Performance Metrics Threshold Deletion

Test Description: NS PM Performance Metrics Threshold Deletion						
Identifier	dentifier TD_NFV_PM_NS_THRESHOLD_DELETE_001					
Test Purpose	Verify that performance monitoring thresholds can be deleted for one or more NS related performance metrics on the NFVO					

Configuration		SUT Configuration 1 SUT Configuration 3				
SUT Configuration 4						
References			FA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.4	5] and ETSI		
Applicability		 NFVO supp 	ports receiving VNF performance metrics from VNFM (notifications)			
		 VNFM supp 	NFM supports receiving virtualised resource performance metrics from VIM			
		 VNFM expo 	ses VNF performance metrics towards NFVO (notifications)			
Pre-test condition	tions	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)				
		NS performance monitoring threshold is created in the NFVO				
		(TD_NFV_PM_NS_THRESHOLD_CREATE_001)				
Test	Step	Туре	Description	Result		
Sequence	1	Stimulus	Delete on the NFVO the performance monitoring threshold for the NS related monitored performance metric			
	2	IOP Check	If applicable, verify that the NFVO deletes the related thresholds on VNF monitored performance metrics in the VNFM			
	3	IOP Check	Verify that the NS and VNFM performance monitoring thresholds are properly deleted in the NFVO and VNFM (e.g. checking the Graphical User Interface, if applicable)			
IOP Verdict						

7.7 NS Lifecycle Management

7.7.1 NS Instantiation

7.7.1.1 Standalone NS Instantiation

Test Description: standalone NS instantiation				
Identifier	TD_NFV_NSLCM_INSTANTIATE_001			
Test Purpose	To verify that a standalone NS can be successfully instantiated			
Configuration	SUT Configuration 1			
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI			
	GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]			

Applicability

- NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE)
- NFVO/VNFM can generate "allocate network resource" operation requests to the VIM (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE)
- NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE)
- VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM)
- VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM)
- VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM)
- NFVO/VNFM can query software image information from the VIM (NFVO_SWIM_QUERY_IM or VNFM_SWIM_QUERY_IM)
- VIM supports software image information queries by the NFVO/VNFM (VIM_SWIM_QUERY_IM_BY_NFVO or VIM_SWIM_QUERY_IM_BY_VNFM)
- NFVO/VNFM can query compute resource information from the VIM (NFVO_CRM_QUERY or VNFM_CRM_QUERY)
- NFVO/VNFM can query network resource information from the VIM (NFVO_NRM_QUERY or VNFM_NRM_QUERY)
- NFVO/VNFM can query storage resource information from the VIM (NFVO_SRM_QUERY or VNFM_SRM_QUERY)
- VIM can send compute resource information to the NFVO (VIM_CRM_INFO_TO_NFVO or VIM_CRM_INFO_TO_VNFM)
- VIM can send network resource information to the NFVO (VIM_NRM_INFO_TO_NFVO or VIM_NRM_INFO_TO_VNFM)
- VIM can send storage resource information to the NFVO (VIM_SRM_INFO_TO_NFVO or VIM_SRM_INFO_TO_VNFM)
- NFVO can guery VNF information from the VNFM (NFVO VNFLCM QUERY)
- VNFM supports VNF information queries by the NFVO (VNFM_VNFLCM_QUERY)

Pre-test conditions

- NSD, its associated descriptors (VLD(s), VNFFGD(s)) and VNF Package(s) have been onboarded to the NFVO
- The software image repository is reachable by the VIM
- The required resources are available on the NFVI

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger NS instantiation on the NFVO	
Ì	2	IOP Check	Verify that the VNFM receives instantiation requests for the	
			VNFs composing the given NS	
	3	IOP Check	If VNFM is in direct mode:	
			 Verify that the VNFM is granted by the NFVO to 	
			allocate the virtualised resources required for the	
			VNFs composing the given NS in the VIM	
			If VNFM is in indirect mode:	
			 Verify that the VNFM sends resource allocation 	
			request using resource provider ID through the NFVO	
			to manage the instantiation of the VNFs composing	
			the given NS	
	4	IOP Check	Verify that the software images have been successfully added	
			to the image repository managed by the VIM	
	5	IOP Check	Verify that the requested resources have been allocated by the	
			VIM according to the descriptors	
	6	IOP Check	Verify that the VNF instance(s) have been deployed according	
			to the NSD (i.e. query the VIM and VNFM for VMs, VLs and	
			CPs)	
	7	IOP Check	Verify that the VNF instance(s) are reachable via the	
			management network	
	8	IOP Check	Verify that the VNF instance(s) have been configured according	
			to the VNFD(s) by querying the VNFM	
	9	IOP Check	Verify that the VNF instance(s), VL(s) and VNFFG(s) have	
			been connected according to the descriptors	
	10	IOP Check	Verify that the NFVO indicates NS instantiation operation result	
		105.01	as successful	
	11	IOP Check	Verify that the NS is successfully instantiated by running the	
1001/ 11:			end-to-end functional test	
IOP Verdict				

7.7.1.2 Nested NS Instantiation

	Test Description: nested NS instantiation			
Identifier	TD_NFV_NSLCM_INSTANTIATE_NEST_NS_001			
Test Purpose	To verify that a NS referencing an existing nested NS can be successfully instantiated			
Configuration	SUT Configuration 3			
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]			
Applicability	NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE)			
	 NFVO/VNFM can generate "allocate network resource" operation requests to the VIM (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE) 			
	 NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE) 			
	 VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM) 			
	 VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) 			
	 VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM) 			
	 NFVO/VNFM can query software image information from the VIM (NFVO_SWIM_QUERY_IM or VNFM_SWIM_QUERY_IM) 			
	 VIM supports software image information queries by the NFVO/VNFM (VIM_SWIM_QUERY_IM_BY_NFVO or VIM_SWIM_QUERY_IM_BY_VNFM) 			
	 VIM can send compute resource information to the NFVO (VIM_CRM_INFO_TO_NFVO or VIM_CRM_INFO_TO_VNFM) 			
	 VIM can send network resource information to the NFVO (VIM_NRM_INFO_TO_NFVO or VIM_NRM_INFO_TO_VNFM) 			
	 VIM can send storage resource information to the NFVO (VIM_SRM_INFO_TO_NFVO or VIM_SRM_INFO_TO_VNFM) 			
	 NFVO can query VNF information from the VNFM (NFVO_VNFLCM_QUERY) 			
	 VNFM supports VNF information queries by the NFVO (VNFM_VNFLCM_QUERY) 			

Pre-test conditions	•	NSD2, its associated descriptors (VLD(s), VNFFGD(s)) and VNF Package(s) have been on- boarded to the NFVO
	•	NSD2 references nested NSD1
	•	NS2 is not instantiated
	•	NS1 is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)
	•	The software image repository is reachable by the VIM
	•	The required resources are available on the NFVI

Test	Step	Type	Description	Result
Sequence	1	Stimulus	Trigger NS2 instantiation on the NFVO	
	2	IOP Check	Verify that the software images of the VNF(s) referenced in NSD2 have been successfully added to the image repository managed by the VIM	
	3	IOP Check	Verify that resources associated to NS2 have been allocated by the VIM according to the descriptors	
	4	IOP Check	Verify that the VNF instance(s) have been deployed according to the NSD (i.e. query the VIM and VNFM for VMs, VLs and CPs)	
	5	IOP Check	Verify that existing VNF instance(s) in NS1 are running and reachable via the management network	
	6	IOP Check	Verify that the VNF instance(s) in NS2 are running and reachable through the management network	
	7	IOP Check	Verify that the VNF instances(s) in NS2 have been configured according to the VNFD(s) by querying the VNFM	
	8	IOP Check	Verify that the VNF instance(s), VL(s) and VNFFG(s) in NS2 have been connected according to the descriptors	
	9	IOP Check	Verify that the NFVO indicates NS2 instantiation operation result as successful	
	10	IOP Check	Verify that NS2 is successfully instantiated by running an end- to-end functional test re-using the functionality of VNF instance(s) inside NS1	
IOP Verdict				

7.7.1.3 Multi-Site NS Instantiation

	Test Description: Multi-Site NS instantiation		
Identifier	TD_NFV_NSLCM_INSTANTIATE_MUTLISITE_001		
Test Purpose	To verify that the NS can be successfully instantiated across different sites		
Configuration	SUT Configuration 4		
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI		
A I! I- !!! t	GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]		
Applicability	 NFVO/VNFM can generate "allocate compute resource" operation requests to the VIMs (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE) deployed in different sites 		
	 NFVO/VNFM can generate "allocate network resource" operation requests to the VIMs (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE) deployed in different sites 		
	 NFVO/VNFM can generate "allocate storage resource" operation requests to the VIMs (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE) deployed in different sites 		
	VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM)		
	 VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) 		
	 VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM) 		
	 NFVO/VNFM can query software image information from the VIM (NFVO_SWIM_QUERY_IM) or VNFM_SWIM_QUERY_IM) deployed in different sites 		
	 VIM supports software image information queries by the NFVO/VNFM (VIM_SWIM_QUERY_IM_BY_NFVO or VIM_SWIM_QUERY_IM_BY_VNFM) 		
	 NFVO/VNFM can query compute resource information from the VIMs (NFVO_CRM_QUERY or VNFM_CRM_QUERY) deployed in different sites 		
	 NFVO/VNFM can query network resource information from the VIMs (NFVO_NRM_QUERY or VNFM_NRM_QUERY) deployed in different sites 		
	 NFVO/VNFM can query storage resource information from the VIMs (NFVO_SRM_QUERY or VNFM_SRM_QUERY) deployed in different sites 		
	 VIM can send compute resource information to the NFVO (VIM_CRM_INFO_TO_NFVO or VIM_CRM_INFO_TO_VNFM) 		
	 VIM can send network resource information to the NFVO (VIM_NRM_INFO_TO_NFVO or VIM_NRM_INFO_TO_VNFM) 		
	 VIM can send storage resource information to the NFVO (VIM_SRM_INFO_TO_NFVO or VIM_SRM_INFO_TO_VNFM) 		
	NFVO can query VNF information from the VNFM (NFVO_VNFLCM_QUERY)		
	VNFM supports VNF information queries by the NFVO (VNFM_VNFLCM_QUERY)		
	NFVO/VNFM supports multi-site deployments		
Pre-test conditions	NSD, its associated descriptors (VLD(s), VNFFGD(s)) and VNF Package(s) have been		
	on-boarded to the NFVO		
	The software image repository is reachable by the VIMs		
	The required resources are available on the NFVI		
	1		

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger multi-site NS instantiation on the NFVO	
	2	IOP Check	Verify that the VNFM receives instantiation requests for the VNFs composing the given NS	
	3	IOP Check	If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate the virtualised resources required for the VNFs composing the given NS in the VIMs If VNFM is in indirect mode:	
			Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS	
	4	IOP Check	Verify that the software images have been successfully added to the image repository managed by the VIMs	
	5	IOP Check	Verify that the requested resources have been allocated by the VIMs according to the descriptors	
	6	IOP Check	Verify that the VNF instance(s) have been deployed according to the NSD (i.e. query the VIMs and VNFM for VMs, VLs and CPs)	
	7	IOP Check	Verify that the VNF instance(s), VL(s) and VNFFG(s) have been created according to the descriptors	
	8	IOP Check	Verify that the VNF(s) have been deployed according to the multi-site location constraints.	
	9	IOP Check	Verify that the VNF instance(s) are reachable via the management network.	
	10	IOP Check	Verify that the VNF instance(s) have been configured according to the VNFD(s) by querying the VNFM	
	11	IOP Check	Verify that the VNF instance(s), VL(s) and VNFFG(s) have been connected according to the descriptors	
	12	IOP Check	Verify that the VNF instance(s) have multi-site connectivity through the multi-site VL(s).	
	13	IOP Check	Verify that the NS is successfully instantiated by running the end-to-end functional test	
IOP Verdict				

7.7.1.4 SFC NS Instantiation

	Test Description: SFC NS instantiation
Identifier	TD_NFV_NSLCM_INSTANTIATE_SFC _001
Test Purpose	To verify that a NS with NSH based SFC can be successfully instantiated
Configuration	SUT Configuration 1
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]
Applicability	NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE)
	NFVO/VNFM can generate "allocate network resource" operation requests to the VIM (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE)
	NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE)
	 VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM)
	 VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM)
	 VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM)
	 NFVO/VNFM can query software image information from the VIM (NFVO_SWIM_QUERY_IM) or VNFM_SWIM_QUERY_IM)
	 VIM supports software image information queries by the NFVO/VNFM (VIM_SWIM_QUERY_IM_BY_NFVO or VIM_SWIM_QUERY_IM_BY_VNFM)
	 NFVO/VNFM can query compute resource information from the VIM (NFVO_CRM_QUERY or VNFM_CRM_QUERY)
	 NFVO/VNFM can query network resource information from the VIM (NFVO_NRM_QUERY or VNFM_NRM_QUERY)
	 NFVO/VNFM can query storage resource information from the VIM (NFVO_SRM_QUERY or VNFM_SRM_QUERY)
	 VIM can send compute resource information to the NFVO (VIM_CRM_INFO_TO_NFVO or VIM_CRM_INFO_TO_VNFM)
	 VIM can send network resource information to the NFVO (VIM_NRM_INFO_TO_NFVO or VIM_NRM_INFO_TO_VNFM)
	 VIM can send storage resource information to the NFVO (VIM_SRM_INFO_TO_NFVO or VIM_SRM_INFO_TO_VNFM)
	NFVO can query VNF information from the VNFM (NFVO_VNFLCM_QUERY)
	VNFM supports VNF information queries by the NFVO (VNFM_VNFLCM_QUERY)
Pre-test conditions	 NSD, its associated descriptors (VLD(s), VNFFGD(s)) and VNF Package(s) have been on-boarded to the NFVO
	The software image repository is reachable by the VIM
	The required resources are available on the NFVI

Test	Step	Type	Description	Result
Sequence	1	Stimulus	Trigger NS instantiation on the NFVO	
	2	IOP Check	Verify that the VNFM receives instantiation requests for the VNFs composing the given NS	
	3	IOP Check	If VNFM is in direct mode:	
			 Verify that the VNFM is granted by the NFVO to allocate the virtualised resources required for the VNFs composing the given NS in the VIM If VNFM is in indirect mode: Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO 	
			to manage the instantiation of the VNFs composing the given NS	
	4	IOP Check	Verify that the software images have been successfully added to the image repository managed by the VIM	
	5	IOP Check	Verify that the requested resources have been allocated by the VIM according to the descriptors	
	6	IOP Check	Verify that the VNF instance(s) have been deployed according to the NSD (i.e. query the VIM and VNFM for VMs, VLs and CPs)	
	7	IOP Check	Verify that the VL and VNFFG instance(s) have been created according to the descriptors	
	8	IOP Check	Verify that the VNF(s) are running and reachable through the management network	
	9	IOP Check	Verify that the VNF(s) have been configured according to VNFD(s) (i.e by obtaining a result from the management interface)	
	10	IOP Check	Verify that the VNF(s), VL(s) and VNFFG(s) have been connected according to the Descriptors	
	11	IOP Check	Verify that the NS is successfully instantiated by running the end-to-end functional test (NSH Traffic)	
IOP Verdict				

7.7.2 NS Scaling

7.7.2.1 NS Scale Out

7.7.2.1.1 NS Scale out with an Operator Action

Identifier	TD NFV NSLCM SCALE OUT 001
Test Purpose	Verify that the NS can be successfully scaled out by adding VNF instances triggered by an operator action
Configuration	SUT Configuration 1
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]
Applicability	 NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE)
	 NFVO/VNFM can generate "allocate network resource" operation requests to the VIM (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE)
	 NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE)
	 VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM)
	 VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM)
	 VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM)
	 NFVO can generate "scale out by adding VNF instances" requests to the VNFM (NFVO_VNFLCM_NS_SCALE_OUT)
	 VNFM supports "scale out by adding VNF instances" requests from the NFVO (VNFM_VNFLCM_NS_SCALE_OUT)

Pre-test cond			ntiated (TD_NFV_NSLCM_INSTANTIATE_001) ne required amount of consumable virtual resources to run the scal	ed-out NS
	104			
Test	Step	Type	Description	Result
Sequence	1	Stimulus	Trigger NS scale out by adding VNF instances to the NS in	
			NFVO with an operator action	
	2	IOP Check	Verify that the VNFM receives instantiation request for the	
			additional VNF(s) to be deployed for the given NS	
	3	IOP Check	If VNFM is in direct mode:	
			 Verify that the VNFM is granted by the NFVO to 	
			allocate the virtualised resources required for the	
			additional VNFs in the VIM	
			If VNFM is in indirect mode:	
			 Verify that the VNFM sends resource allocation 	
			request using resource provider ID through the NFVO	
			to manage the instantiation of the VNFs composing	
			the given NS	
	4	IOP Check	Verify that the additional VNF instance(s) have been deployed	
			by querying the VNFM	
	5	IOP Check	Verify that the additional resources have been allocated by the	
			VIM according to the descriptors	
	6	IOP Check	Verify that the additional VNF instance(s) are running and	
			reachable via their management network	
	7	IOP Check	Verify that the additional VNF instances(s) have been	
			configured according to the descriptors by querying the VNFM	
	8	IOP Check	Verify that the additional VNF instances(s), VL(s) and	
			VNFFG(s) are connected according to the descriptors	
	9	IOP Check	Verify that the NFVO indicates the scaling operation result as	
			successful	
	10	IOP Check	Verify that NS has been scaled out by running the end-to-end	
		- 3110011	functional test factoring the VNF scale and capacity	
IOP Verdict				

7.7.2.1.2 NS Scale out with a VNF Indicator notification

	Test Description: NS scale out with a VNF indicator notification
Identifier	TD_NFV_NSLCM_SCALE_OUT_002
Test Purpose	Verify that the NS can be successfully scaled out by adding VNF instances triggered automatically
	by a VNF indicator
Configuration	SUT Configuration 1
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]
Applicability	 NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE) NFVO/VNFM can generate "allocate network resource" operation requests to the VIM (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE) NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE) VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM) VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM) VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM) VNFM can subscribe to VNF indicators on the EM/VNF (VNFM_VNFINDI_SUBSCRIBE) EM/VNF supports VNF indicator subscriptions from the VNFM (EM_VNFINDI_NOTIFY) VNFM supports VNF indicator notifications to the VNFM (VNFM_VNFINDI_NOTIFY) NFVO can generate "scale out by adding VNF instances" requests to the VNFM (NFVO_VNFLCM_NS_SCALE_OUT)
	VNFM supports "scale out by adding VNF instances" requests from the NFVO (VNFM_VNFLCM_NS_SCALE_OUT)

Pre-test conditions	•	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)
	•	NFVI has the required amount of consumable virtual resources to run the scaled-out NS
	•	NFVO/VNFM is configured to trigger "scale out by adding VNF instances" when a given VNF indicator value crosses a certain threshold
	•	VNF/EM is configured to trigger notification when VNF Indicator value crosses a certain threshold

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger the EM/VNF to send the targeted VNF indicator to the VNFM until the configured threshold is crossed	
	2	IOP Check	Verify that the "scale out by adding VNF instance(s)" procedure has been started in NFVO	
	3	IOP Check	If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate the virtualised resources required for the additional VNFs in the VIM If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS	
	4	IOP Check	Verify that the additional VNF instance(s) have been deployed by querying the VNFM	
	5	IOP Check	Verify that the additional resources have been allocated by the VIM according to the descriptors	
	6	IOP Check	Verify that the additional VNF instance(s) are running and reachable via their management network	
	7	IOP Check	Verify that the additional VNF instances(s) have been configured according to the descriptors by querying the VNFM	
	8	IOP Check	Verify that the additional VNF instances(s), VL(s) and VNFFG(s) are connected according to the descriptors	
	9	IOP Check	Verify that the NFVO indicates the scaling operation result as successful	
	10	IOP Check	Verify that NS has been scaled out by running the end-to-end functional test factoring the VNF scale and capacity	
IOP Verdict				

7.7.2.1.3 NS Scale out with a VIM KPI

	Test Description: NS scale out with a VIM KPI
Identifier	TD_NFV_NSLCM_SCALE_OUT_003
Test Purpose	Verify that the NS can be successfully scaled out by adding VNF instances triggered automatically by a VIM KPI
Configuration	SUT Configuration 1
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]
Applicability	 NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE) NFVO/VNFM can generate "allocate network resource" operation requests to the VIM (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE) NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE) VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM)
	 VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM) NFVO/VNFM can create VR PM jobs on the VIM (NFVO_PM_VR_PMJOB_CREATE or VNFM_PM_VR_PMJOB_CREATE) VIM supports VR PM jobs creation by the NFVO/VNFM (VIM_PM_PMJOB_CREATE_BY_NFVO or VIM_PM_PMJOB_CREATE_BY_VNFM) NFVO/VNFM can create VR PM thresholds on the VIM (NFVO_PM_VR_PMTH_CREATE or VNFM_PM_VR_PMTH_CREATE) VIM supports VR PM thresholds creation by the NFVO/VNFM (VIM_PM_PMTH_CREATE_BY_NFVO or VIM_PM_PMTH_CREATE_BY_VNFM) NFVO/VNFM can subscribe to VR PM jobs on the VIM (NFVO_PM_VR_PMJOB_SUBSCRIBE or VNFM_PM_VR_PMJOB_SUBSCRIBE) VIM supports VR PM job subscriptions from the NFVO/VNFM (VIM_PM_PMJOB_SUBSCRIBE_BY_NFVO or VIM_PM_PMJOB_SUBSCRIBE_BY_VNFM) VIM can generate VR PM notifications to the NFVO/VNFM (VIM_PM_PMJOB_NOTIFY_BY_NFVO or VIM_PM_PMJOB_NOTIFY_BY_VNFM) NFVO/VNFM supports VR PM notifications from the VIM (NFVO_PM_VR_PMJOB_NOTIFY or VNFM_PM_VR_PMJOB_NOTIFY) NFVO can generate "scale out by adding VNF instances" requests to the VNFM (NFVO_VNFLCM_NS_SCALE_OUT) VNFM supports "scale out by adding VNF instances" requests from the NFVO (VNFM_VNFLCM_NS_SCALE_OUT)
Pre-test conditions	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001) NFVI has the required amount of consumable virtual resources to run the scaled-out NS NFVO/VNFM is configured to trigger "scale out by adding VNF instances" when a given VIM KPI value crosses a certain threshold Virtualised resource PM job with threshold monitoring has been created
	(TD_NFV_PM_VR_CREATE_THRESHOLD_001)

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger the VIM to send the targeted KPI to the NFVO/VNFM until the configured threshold is crossed	
	2	IOP Check	Verify that the "scale out by adding VNF instance(s)" procedure has been started in NFVO	
	3	IOP Check	If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate the virtualised resources required for the additional VNFs in the VIM If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS	
	4	IOP Check	Verify that the additional VNF instance(s) have been deployed by querying the VNFM	
	5	IOP Check	Verify that the additional resources have been allocated by the VIM according to the descriptors	
	6	IOP Check	Verify that the additional VNF instance(s) are running and reachable via their management network	
	7	IOP Check	Verify that the additional VNF instances(s) have been configured according to the descriptors by querying the VNFM	
	8	IOP Check	Verify that the additional VNF instances(s), VL(s) and VNFFG(s) are connected according to the descriptors	
	9	IOP Check	Verify that the NFVO indicates the scaling operation result as successful	
	10	IOP Check	Verify that NS has been scaled out by running the end-to-end functional test factoring the VNF scale and capacity	
IOP Verdict				

7.7.2.1.4 NS Scale out with a query to VNF Indicator by VNFM

	Test Description: NS scale out with a query to VNF indicator by VNFM
Identifier	TD_NFV_NSLCM_SCALE_OUT_004
Test Purpose	Verify that the NS can be successfully scaled out by adding VNF instances triggered automatically in VNFM by a querying VNF Indicator
Configuration	SUT Configuration 1
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]
Applicability	 NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE) NFVO/VNFM can generate "allocate network resource" operation requests to the VIM (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE) NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE) VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM) VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM) VNFM can subscribe to VNF indicators on the EM/VNF (VNFM_VNFINDI_SUBSCRIBE) EM/VNF supports VNF indicator subscriptions from the VNFM (EM_VNFINDI_NOTIFY) VNFM supports VNF indicator notifications to the VNFM (EM_VNFINDI_NOTIFY) VNFM supports VNF indicator notifications from the EM/VNF (VNFM_VNFINDI_NOTIFY) NFVO can generate "scale out by adding VNF instances" requests to the VNFM (NFVO_VNFLCM_NS_SCALE_OUT) VNFM supports "scale out by adding VNF instances" requests from the NFVO (VNFM_VNFLCM_NS_SCALE_OUT)
Dro toot conditions	NO : 1 / 1/TD NEW NOISM INOTANTIATE COA
Pre-test conditions	- 110 to initiating (15_11 V_1020M_11017111112_001)
	NFVI has the required amount of consumable virtual resources to run the scaled-out NS
	 NFVO/VNFM is configured to trigger "scale out by adding VNF instances" when a given VNF indicator value crosses a certain threshold

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	In the VNF, trigger the target VNF indicator to cross the configured auto-scaling threshold value for scale out operation	
	2	IOP Check	Verify that the "scale out by adding VNF instance(s)" procedure has been started in NFVO	
	3	IOP Check	If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate the virtualised resources required for the additional VNFs in the VIM If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS	
	4	IOP Check	Verify that the additional VNF instance(s) have been deployed by querying the VNFM	
	5	IOP Check	Verify that the additional resources have been allocated by the VIM according to the descriptors	
	6	IOP Check	Verify that the additional VNF instance(s) are running and reachable via their management network	
	7	IOP Check	Verify that the additional VNF instances(s) have been configured according to the descriptors by querying the VNFM	
	8	IOP Check	Verify that the additional VNF instances(s), VL(s) and VNFFG(s) are connected according to the descriptors	
	9	IOP Check	Verify that the NFVO indicates the scaling operation result as successful	
	10	IOP Check	Verify that NS has been scaled out by running the end-to-end functional test factoring the VNF scale and capacity	
IOP Verdict				

7.7.2.1.5 NS Scale out for Multi-Site with an Operator Action

	Test Description: NS scale out for Multi-Site with an Operator Action					
Identifier	TD_NFV_NSLCM_SCALE_OUT_MULTISITE_001					
Test Purpose	Verify that a multi-site NS can be successfully scaled out by adding VNF instances triggered by an					
	operator action					
Configuration	SUT Configuration 4					
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]					
Applicability	NFVO/VNFM can generate "allocate compute resource" operation requests to the VIMs (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE) deployed in different sites					
	NFVO/VNFM can generate "allocate network resource" operation requests to the VIMs (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE) deployed in different sites					
	NFVO/VNFM can generate "allocate storage resource" operation requests to the VIMs (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE) deployed in different sites					
	 VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM) 					
	 VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) 					
	 VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM) 					
	NFVO can generate "scale out by adding VNF instances" requests to the VNFM (NFVO_VNFLCM_NS_SCALE_OUT)					
	 VNFM supports "scale out by adding VNF instances" requests from the NFVO (VNFM_VNFLCM_NS_SCALE_OUT) 					
	NFVO/VNFM supports multi-site deployments					
Pre-test conditions	Multi-site NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_MULTISITE_001)					
	NFVI has the required amount of consumable virtual resources to run the scaled-out NS					

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger multi-site NS scale out by adding VNF instances to the NS in NFVO with an operator action	
	2	IOP Check	Verify that the VNFM receives instantiation request for the	
			additional VNF(s) to be deployed for the given NS	
	3	IOP Check	If VNFM is in direct mode:	
			 Verify that the VNFM is granted by the NFVO to 	
			allocate the virtualised resources required for the additional VNFs in the VIM	
			If VNFM is in indirect mode:	
			 Verify that the VNFM sends resource allocation 	
			request using resource provider ID through the NFVO	
			to manage the instantiation of the VNFs composing	
			the given NS	
	4	IOP Check	Verify that the requested resources have been allocated by the	
			VIM according to the descriptors	
	5	IOP Check	Verify that the additional VNF instance(s) have been deployed	
			by querying the VNFM (VMs, VLs, CPs)	
	6	IOP Check	Verify that the additional resources have been allocated by the	
			VIM according to the multi-site location constraints	
	7	IOP Check	Verify that the additional VNF instance(s) are running and	
			reachable via their management network	
	8	IOP Check	Verify that the additional VNF instances(s) have been	
			configured according to the descriptors by querying the VNFM	
	9	IOP Check	Verify that the additional VNF instances(s), VL(s) and	
			VNFFG(s) are connected according to the descriptors	
	10	IOP Check	Verify that the additional VNF Instance(s) have multi-site	
			connectivity through the multi-site VL(s)	
	11	IOP Check	Verify that multi-site NS has been scaled out by running the	
			end-to-end functional test factoring the VNF scale and capacity	
IOP Verdict				

7.7.2.2 NS Scale In

7.7.2.2.1 NS Scale In with an Operator Action

	Test Description: NS scale in with an operator action
Identifier	TD_NFV_NSLCM_SCALE_IN_001
Test Purpose	Verify that the NS can be successfully scaled in by removing VNF instances triggered by an
	operator action
Configuration	SUT Configuration 1
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI
	GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]
Applicability	NFVO/VNFM can generate "terminate compute resource" operation requests to the VIM (NFVO_CRM_TERMINATE or VNFM_CRM_TERMINATE)
	NFVO/VNFM can generate "terminate network resource" operation requests to the VIM (NFVO_NRM_TERMINATE or VNFM_NRM_TERMINATE)
	 NFVO/VNFM can generate "terminate storage resource" operation requests to the VIM (NFVO_SRM_TERMINATE or VNFM_SRM_TERMINATE)
	VIM supports "terminate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM)
	VIM supports "terminate network resource" operation requests from the NFVO/VNFM (VIM_NRM_TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM)
	VIM supports "terminate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM)
	NFVO can generate "scale in by removing VNF instances" requests to the VNFM (NFVO_VNFLCM_NS_SCALE_IN)
	VNFM supports "scale in by removing VNF instances" requests from the NFVO (VNFM_VNFLCM_NS_SCALE_IN)
	· · ·
Pre-test conditions	NFVO supports triggering "scale in by removing VNF instances" with an operator's action
	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)
	The current NS deployment size supports scaling in
	The same of the sa

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger NS scale in by removing VNF instances from the NS in NFVO with an operator action	
	2	IOP Check	Verify that the VNFM receives terminate request from the NFVO for the VNF(s) to be removed in the given NS	
	3	IOP Check	If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to delete the virtualised resources in use by the impacted VNFs in the VIM If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS	
	4	IOP Check	Verify that the impacted VNF instance(s) have been terminated by querying the VNFM	
	5	IOP Check	Verify that the impacted VNF related resources have been released by the VIM	
	6	IOP Check	Verify that the remaining VNF instances(s) are still running and reachable via their management network	
	7	IOP Check	Verify that the remaining VNF instances(s), VL(s) and VNFFG(s) are still connected according to the descriptors	
	8	IOP Check	Verify that the NFVO indicates the scaling operation result as successful	
	9	IOP Check	Verify that NS has been scaled in by running the end-to-end functional test factoring the VNF scale and capacity	
IOP Verdict				

7.7.2.2.2 NS Scale in with a VNF Indicator notification

	Test Description: NS scale in with a VNF indicator notification
Identifier	TD_NFV_NSLCM_SCALE_IN_002
Test Purpose	Verify that the NS can be successfully scaled in by removing VNF instances triggered automatically by a VNF indicator
Configuration	SUT Configuration 1
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]
Applicability	 NFVO/VNFM can generate "terminate compute resource" operation requests to the VIM (NFVO_CRM_TERMINATE or VNFM_CRM_TERMINATE) NFVO/VNFM can generate "terminate network resource" operation requests to the VIM (NFVO_NRM_TERMINATE or VNFM_NRM_TERMINATE) NFVO/VNFM can generate "terminate storage resource" operation requests to the VIM (NFVO_SRM_TERMINATE or VNFM_SRM_TERMINATE) VIM supports "terminate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM) VIM supports "terminate network resource" operation requests from the NFVO/VNFM (VIM_NRM_TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM) VIM supports "terminate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM) VIM supports "terminate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM) VIF can subscribe to VNF indicators on the EM/VNF (VNFM_VNFINDI_SUBSCRIBE) EM/VNF supports VNF indicator subscriptions from the VNFM (EM_VNFINDI_NOTIFY) VNFM supports VNF indicator notifications from the EM/VNF (VNFM_VNFINDI_NOTIFY) NFVO can subscribe to VNF indicators on the VNFM (NFVO_NSVNFINDI_NOTIFY) NFVO supports VNF indicator notifications from the NFVO (VNFM_NSVNFINDI_NOTIFY) NFVO supports VNF indicator notifications from the VNFM (NFVO_NSVNFINDI_NOTIFY) NFVO can generate "scale in by removing VNF instances" requests to the VNFM (NFVO_VNFLCM_NS_SCALE_IN) VNFM_vNFLCM_NS_SCALE_IN)

Pre-test conditions	•	NFVO is configured to trigger "scale in by removing VNF instances" when a given VNF
		indicator value crosses a certain threshold
	•	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)
	•	The current NS deployment size should support scaling in
	•	VNF/EM is configured to trigger notification when VNF Indicator value crosses a certain threshold

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger the EM/VNF to send the targeted VNF indicator to the VNFM until the configured threshold is crossed	
	2	IOP Check	Verify that the "scale in by removing VNF instance(s)" procedure has been started in NFVO	
	3	IOP Check	If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to delete the virtualised resources in use by the impacted VNFs in the VIM If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS	
	4	IOP Check	Verify that the impacted VNF instance(s) have been terminated by querying the VNFM	
	5	IOP Check	Verify that the impacted VNF related resources have been released by the VIM	
	6	IOP Check	Verify that the remaining VNF instance(s) are still running and reachable via their management network	
	7	IOP Check	Verify that the remaining VNF instances(s), VL(s) and VNFFG(s) are still connected according to the descriptors	
	8	IOP Check	Verify that the NFVO indicates the scaling operation result as successful	
	9	IOP Check	Verify that NS has been scaled in by running the end-to-end functional test factoring the VNF scale and capacity	
IOP Verdict				

7.7.2.2.3 NS Scale in with a VIM KPI

	Test Description: NS scale in with a VIM KPI		
Identifier	TD_NFV_NSLCM_SCALE_IN_003		
Test Purpose	Verify that the NS can be successfully scaled in by removing VNF instances triggered automatically by a VIM KPI		
Configuration	SUT Configuration 1		
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]		

Applicability

- NFVO/VNFM can generate "terminate compute resource" operation requests to the VIM (NFVO_CRM_TERMINATE or VNFM_CRM_TERMINATE)
- NFVO/VNFM can generate "terminate network resource" operation requests to the VIM (NFVO_NRM_TERMINATE or VNFM_NRM_TERMINATE)
- NFVO/VNFM can generate "terminate storage resource" operation requests to the VIM (NFVO_SRM_TERMINATE or VNFM_SRM_TERMINATE)
- VIM supports "terminate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM)
- VIM supports "terminate network resource" operation requests from the NFVO/VNFM (VIM_NRM_TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM)
- VIM supports "terminate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM)
- NFVO/VNFM can create VR PM jobs on the VIM (NFVO_PM_VR_PMJOB_CREATE or VNFM_PM_VR_PMJOB_CREATE)
- VIM supports VR PM jobs creation by the NFVO/VNFM (VIM_PM_PMJOB_CREATE_BY_NFVO or VIM_PM_PMJOB_CREATE_BY_VNFM)
- NFVO/VNFM can create VR PM thresholds on the VIM (NFVO_PM_VR_PMTH_CREATE or VNFM_PM_VR_PMTH_CREATE)
- VIM supports VR PM thresholds creation by the NFVO/VNFM (VIM_PM_PMTH_CREATE_BY_NFVO or VIM_PM_PMTH_CREATE_BY_VNFM)
- NFVO/VNFM can subscribe to VR PM jobs on the VIM
 (NFVO_PM_VR_PMJOB_SUBSCRIBE or VNFM_PM_VR_PMJOB_SUBSCRIBE)
- VIM supports VR PM job subscriptions from the NFVO/VNFM (VIM_PM_PMJOB_SUBSCRIBE_BY_NFVO or VIM_PM_PMJOB_SUBSCRIBE_BY_VNFM)
- VIM can generate VR PM notifications to the NFVO/VNFM (VIM_PM_PMJOB_NOTIFY_BY_NFVO or VIM_PM_PMJOB_NOTIFY_BY_VNFM)
- NFVO/VNFM supports VR PM notifications from the VIM (NFVO_PM_VR_PMJOB_NOTIFY or VNFM_PM_VR_PMJOB_NOTIFY)
- NFVO can generate "scale in by removing VNF instances" requests to the VNFM (NFVO_VNFLCM_NS_SCALE_IN)
- VNFM supports "scale in by removing VNF instances" requests from the NFVO (VNFM VNFLCM NS SCALE IN)

Pre-test conditions

- NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)
- The current NS deployment size should support scaling in
- NFVO/VNFM is configured to trigger "scale in by removing VNF instances" when a given VIM KPI value crosses a certain threshold
- Virtualised resource PM job with threshold monitoring has been created (TD_NFV_PM_VR_CREATE_THRESHOLD_001)

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger the VIM to send the targeted KPI to the NFVO/VNFM until the configured threshold is crossed	
	2	IOP Check	Verify that the "scale in by removing VNF instance(s)" procedure has been started in NFVO	
	3	IOP Check	If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to delete the virtualised resources in use by the impacted VNFs in the VIM If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS	
	4	IOP Check	Verify that the impacted VNF instance(s) have been terminated by querying the VNFM	
	5	IOP Check	Verify that the impacted VNF related resources have been released by the VIM	
	6	IOP Check	Verify that the remaining VNF instance(s) are still running and reachable via their management network	
	7	IOP Check	Verify that the remaining VNF instances(s), VL(s) and VNFFG(s) are still connected according to the descriptors	
	8	IOP Check	Verify that the NFVO indicates the scaling operation result as successful	
	9	IOP Check	Verify that NS has been scaled in by running the end-to-end functional test factoring the VNF scale and capacity	

IOP Verdict

7.7.2.2.4 NS Scale in with a query to VNF Indicator by VNFM

<u> </u>	Test Description: NS scale in with a query to VNF indicator by VNFM
Identifier	TD_NFV_NSLCM_SCALE_OUT_004
Test Purpose	Verify that the NS can be successfully scaled in by adding VNF instances triggered automatically
<u> </u>	in VNFM by a querying VNF Indicator
Configuration	SUT Configuration 1
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI
	GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]
Applicability	 NFVO/VNFM can generate "terminate compute resource" operation requests to the VIM (NFVO_CRM_TERMINATE or VNFM_CRM_TERMINATE)
	NFVO/VNFM can generate "terminate network resource" operation requests to the VIM
	(NFVO_NRM_TERMINATE or VNFM_NRM_TERMINATE)
	NFVO/VNFM can generate "terminate storage resource" operation requests to the VIM (NFVO_SRM_TERMINATE or VNFM_SRM_TERMINATE)
	 VIM supports "terminate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM)
	 VIM supports "terminate network resource" operation requests from the NFVO/VNFM (VIM_NRM_TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM)
	VIM supports "terminate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM)
	VNFM can subscribe to VNF indicators on the EM/VNF (VNFM_VNFINDI_SUBSCRIBE)
İ	EM/VNF supports VNF indicator subscriptions from the VNFM (EM_VNFINDI_SUBSCRIBE)
İ	EM/VNF can generate VNF indicator notifications to the VNFM (EM_VNFINDI_NOTIFY)
İ	VNFM supports VNF indicator notifications from the EM/VNF (VNFM_VNFINDI_NOTIFY)
	NFVO can subscribe to VNF indicators on the VNFM (NFVO_NSVNFINDI_SUBSCRIBE)
	 VNFM supports VNF indicator subscriptions from the NFVO (VNFM_NSVNFINDI_SUBSCRIBE)
	VNFM can generate VNF indicator notifications to the NFVO (VNFM_NSVNFINDI_NOTIFY)
l	NFVO supports VNF indicator notifications from the VNFM (NFVO_NSVNFINDI_NOTIFY)
	NFVO can generate "scale in by removing VNF instances" requests to the VNFM (NFVO_VNFLCM_NS_SCALE_IN)
1	VNFM supports "scale in by removing VNF instances" requests from the NFVO
<u> </u>	(VNFM_VNFLCM_NS_SCALE_IN)
5	
Pre-test conditions	NFVO is configured to trigger "scale in by removing VNF instances" when a given VNF indicator value crosses a certain threshold
Ì	
	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001) The average NO depth are not size at least the pull average to a plice in the pull average to a pli
 	The current NS deployment size should support scaling in

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	In the VNF, trigger the target VNF indicator to cross the configured autoscaling threshold value for scale in operation	
	2	IOP Check	Verify that the "scale in by removing VNF instance(s)" procedure has been started in NFVO	
	3	IOP Check	If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to delete the virtualised resources in use by the impacted VNFs in the VIM If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS	
	4	IOP Check	Verify that the impacted VNF instance(s) have been terminated by querying the VNFM	
	5	IOP Check	Verify that the additional resources have been allocated by the VIM according to the descriptors	
	6	IOP Check	Verify that the additional VNF instance(s) are running and reachable via their management network	
	7	IOP Check	Verify that the additional VNF instances(s) have been configured according to the descriptors by querying the VNFM	
	8	IOP Check	Verify that the additional VNF instances(s), VL(s) and VNFFG(s) are connected according to the descriptors	
	9	IOP Check	Verify that the NFVO indicates the scaling operation result as successful	
	10	IOP Check	Verify that NS has been scaled in by running the end-to-end functional test factoring the VNF scale and capacity	
IOP Verdict		1		

7.7.2.2.5 NS Scale in for Multi-Site with an Operator Action

	Test Description: NS Scale in for Multi-Site with an Operator Action					
Identifier	TD_NFV_NSLCM_SCALE_IN_MULTISITE_001					
Test Purpose	Verify that the multi-site NS can be successfully scaled in by removing VNF instances triggered by an operator action					
Configuration	SUT Configuration 4					
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]					
Applicability	 NFVO/VNFM can generate "terminate compute resource" operation requests to the VIMs (NFVO_CRM_TERMINATE or VNFM_CRM_TERMINATE) deployed in different sites NFVO/VNFM can generate "terminate network resource" operation requests to the VIMs (NFVO_NRM_TERMINATE or VNFM_NRM_TERMINATE) deployed in different sites NFVO/VNFM can generate "terminate storage resource" operation requests to the VIMs (NFVO_SRM_TERMINATE or VNFM_SRM_TERMINATE) deployed in different sites VIM supports "terminate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM) VIM supports "terminate network resource" operation requests from the NFVO/VNFM (VIM_NRM_TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM) VIM supports "terminate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM) NFVO can generate "scale in by removing VNF instances" requests to the VNFM (NFVO_VNFLCM_NS_SCALE_IN) VNFM supports "scale in by removing VNF instances" requests from the NFVO (VNFM_VNFLCM_NS_SCALE_IN) 					
Pre-test conditions	NFVO supports triggering "scale in by removing VNF instances" with an operator's action					
	Multi-site NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_MULTISITE_001)					
	 Multi-site NS has been scaled out by adding VNF instances (TD_NFV_NSLCM_SCALE_OUT_MULTISITE_001) 					
	The current NS deployment size supports scaling in					

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger multi-site NS scale in by removing VNF instances from the NS in NFVO with an operator action	
	2	IOP Check	Verify that the VNFM receives from the NFVO scale in operation for the impacted VNF in the given NS	
	3	IOP Check	If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to delete the virtualised resources related to the impacted VNF If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS	
	4	IOP Check	Verify that the impacted VNF instance(s) have been terminated and not running in the correspondent VIM site / instance	
	5	IOP Check	Verify that the impacted VNF related resources have been released by the proper VIM site / VIM instance	
	6	IOP Check	Verify that the remaining VNF instances(s) are still running and reachable via their management network	
	7	IOP Check	Verify that the remaining VNF instances(s), VL(s) and VNFFG(s) are still connected according to the descriptors	
	8	IOP Check	Verify that the remaining VNF instance(s) have still multi-site connectivity through the multi-site VL(s)	
	9	IOP Check	Verify that multi-site NS has been scaled in by running the end- to-end functional test	
IOP Verdict				-

7.7.2.3 NS VNF Scale Out

7.7.2.3.1 NS VNF Scale Out with an Operator Action

	Test Description: NS VNF scale out with an operator action
Identifier	TD_NFV_NSLCM_SCALE_OUT_VNF_001
Test Purpose	To verify that a VNF in a NS can be successfully scaled out by adding VNFC instances when triggered by a NFVO operator
Configuration	
Configuration	SUT Configuration 1
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]
Applicability Pre-test conditions	 NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE) NFVO/VNFM can generate "allocate network resource" operation requests to the VIM (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE) NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE) VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM) VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM) NFVO can generate "scale out by adding VNFC instances" to the VNFM (NFVO_VNFLCM_VNF_SCALE_OUT) VNFM supports "scale out by adding VNFC instances" requests from the NFVO (VNFM_VNFLCM_VNF_SCALE_OUT) NFVO supports triggering "scale out by adding VNFC instances" with an operator's action
	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)
	NFVI has the required amount of consumable virtual resources to run the scaled-out NS

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger NS scale out by adding VNFC instance(s) to a VNF in the NS in NFVO with an operator action	
	2	IOP Check	If VNFM is in direct mode:	
			Verify that the VNFM is granted by the NFVO to allocate the virtualised resources required for the VNFs composing the given NS in the VIM If VNFM is in indirect mode:	
			Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS	
	3	IOP Check	Verify that the additional VNFC instance(s) have been deployed for the VNF by querying the VNFM	
	4	IOP Check	Verify that the additional resources have been allocated by the VIM according to the descriptors	
	5	IOP Check	Verify that the additional VNFC instance(s) are running and reachable via the management network	
	6	IOP Check	Verify that the VNF configuration has been updated to include the additional VNFC instances according to the descriptors by querying the VNFM	
	7	IOP Check	Verify that the additional VNFC instances(s) are connected to the VL(s) according to the descriptors	
	8	IOP Check	Verify that the NFVO indicates the scaling operation result as successful	
	9	IOP Check	Verify that NS has been scaled out by running the end-to-end functional test in relevance to the VNF scale and capacity	
IOP Verdict			· •	

7.7.2.3.2 NS VNF Scale Out with a VNF Indicator notification

	Test Description: NS VNF scale out with a VNF indicator notification
Identifier	TD_NFV_NSLCM_SCALE_OUT_VNF_002
Test Purpose	To verify that a VNF in a NS can be successfully scaled out by adding VNFC instances when
	triggered automatically by a VNF indicator
Configuration	SUT Configuration 1
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI
	GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]
Applicability	NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM
	(NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE)
	NFVO/VNFM can generate "allocate network resource" operation requests to the VIM NFVO/VNFM can generate "allocate network resource" operation requests to the VIM
	(NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE)
	NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM
	(NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE)
	VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM CRM ALLOCATE BY NEVO or VIM CRM ALLOCATE BY VIVIA.)
	(VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM)
	 VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM)
	VIM supports "allocate storage resource" operation requests from the NFVO/VNFM
	(VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM)
	VNFM can subscribe to VNF indicators on the EM/VNF (VNFM_VNFINDI_SUBSCRIBE)
	EM/VNF supports VNF indicator subscriptions from the VNFM (EM_VNFINDI_SUBSCRIBE)
	EM/VNF can generate VNF indicator notifications to the VNFM (EM_VNFINDI_NOTIFY)
	VNFM supports VNF indicator notifications from the EM/VNF (VNFM_VNFINDI_NOTIFY)
	The interpolation in indicator in the control of th
Pre-test conditions	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)
	NFVI has the required amount of consumable virtual resources to run the scaled-out NS
	VNFM is configured to trigger "scale out by adding VNFC instances" when a given VNF
	indicator value crosses a certain threshold
	 VNF/EM is configured to trigger notification when VNF Indicator value crosses a certain threshold
	1

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger the EM/VNF to send the targeted VNF indicator to the VNFM until the configured threshold is crossed	
	2	IOP Check	Verify that the "scale out by adding VNFC instance(s)" procedure has been started in NFVO	
	3	IOP Check	If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate the virtualised resources required for the VNFs composing the given NS in the VIM If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS	
	4	IOP Check	Verify that the additional VNFC instance(s) have been deployed by querying the VNFM	
	5	IOP Check	Verify that the additional resources have been allocated by the VIM according to the descriptors	
	6	IOP Check	Verify that the additional VNFC instance(s) are running and are reachable through their management network	
	7	IOP Check	Verify that the VNF configuration has been updated to include the additional VNFC instances according to the descriptors by querying the VNFM	
	8	IOP Check	Verify that the additional VNFC instances(s) are connected to the VL(s) according to the descriptors	
	9	IOP Check	Verify that the NFVO indicates the scaling operation result as successful	
	10	IOP Check	Verify that NS has been scaled out by running the end-to-end functional test in relevance to the VNF scale and capacity	
IOP Verdict				

7.7.2.3.3 NS VNF Scale Out with a VIM KPI

	Test Description: NS VNF scale out with a VIM KPI				
Identifier	TD_NFV_NSLCM_SCALE_OUT_VNF_003				
Test Purpose	To verify that a VNF in a NS can be successfully scaled out by adding VNFC instances when triggered automatically by a VIM KPI				
Configuration	SUT Configuration 1				
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]				

Applicability

- NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE)
- NFVO/VNFM can generate "allocate network resource" operation requests to the VIM (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE)
- NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE)
- VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM)
- VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM)
- VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM SRM ALLOCATE BY NFVO or VIM SRM ALLOCATE BY VNFM)
- NFVO/VNFM can create VR PM jobs on the VIM (NFVO_PM_VR_PMJOB_CREATE or VNFM_PM_VR_PMJOB_CREATE)
- VIM supports VR PM jobs creation by the NFVO/VNFM (VIM_PM_PMJOB_CREATE_BY_NFVO or VIM_PM_PMJOB_CREATE_BY_VNFM)
- NFVO/VNFM can create VR PM thresholds on the VIM (NFVO_PM_VR_PMTH_CREATE or VNFM_PM_VR_PMTH_CREATE)
- VIM supports VR PM thresholds creation by the NFVO/VNFM (VIM_PM_PMTH_CREATE_BY_NFVO or VIM_PM_PMTH_CREATE_BY_VNFM)
- NFVO/VNFM can subscribe to VR PM jobs on the VIM (NFVO_PM_VR_PMJOB_SUBSCRIBE or VNFM_PM_VR_PMJOB_SUBSCRIBE)
- VIM supports VR PM job subscriptions from the NFVO/VNFM
 (VIM_PM_PMJOB_SUBSCRIBE_BY_NFVO or VIM_PM_PMJOB_SUBSCRIBE_BY_VNFM)
- VIM can generate VR PM notifications to the NFVO/VNFM
 (VIM_PM_PMJOB_NOTIFY_BY_NFVO or VIM_PM_PMJOB_NOTIFY_BY_VNFM)
- NFVO/VNFM supports VR PM notifications from the VIM (NFVO_PM_VR_PMJOB_NOTIFY)
 or VNFM_PM_VR_PMJOB_NOTIFY)
- NFVO can generate "scale out by adding VNFC instances" to the VNFM (NFVO_VNFLCM_VNF_SCALE_OUT)
- VNFM supports "scale out by adding VNFC instances" requests from the NFVO (VNFM_VNFLCM_VNF_SCALE_OUT)

Pre-test conditions

- NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)
- NFVI has the required amount of consumable virtual resources to run the scaled-out NS
- NFVO/VNFM is configured to trigger "scale out by adding VNFC instances" when a given VIM KPI value crosses a certain threshold
- Virtualised resource PM job with threshold monitoring has been created (TD_NFV_PM_VR_CREATE_THRESHOLD_001)

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger the VIM to send the targeted KPI to the NFVO/VNFM until the configured threshold is crossed	
	2	IOP Check	Verify that the "scale out by adding VNFC instance(s)" procedure has been started in NFVO	
	3	IOP Check	If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate the virtualised resources required for the VNFs composing the given NS in the VIM If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request	
			using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS	
	4	IOP Check	Verify that the additional VNFC instance(s) have been deployed by querying the VNFM	
	5	IOP Check	Verify that the additional resources have been allocated by the VIM according to the descriptors	
	6	IOP Check	Verify that the additional VNFC instance(s) are running and are reachable through their management network	
	7	IOP Check	Verify that the VNF configuration has been updated to include the additional VNFC instances according to the descriptors by querying the VNFM	
	8	IOP Check	Verify that the additional VNFC instances(s) are connected to the VL(s) according to the descriptors	
	9	IOP Check	Verify that the NFVO indicates the scaling operation result as successful	
	10	IOP Check	Verify that NS has been scaled out by running the end-to-end functional test in relevance to the VNF scale and capacity	
IOP Verdict				

7.7.2.3.4 NS VNF Scale Out with a query to VNF Indicator by VNFM

	Test Description: NS VNF scale out with a query VNF indicator by VNFM
Identifier	TD_NFV_NSLCM_SCALE_OUT_VNF_004
Test Purpose	To verify that a VNF in a NS can be successfully scaled out by adding VNFC instances when
	triggered automatically in VNFM by querying a VNF indicator
Configuration	SUT Configuration 1
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI
	GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]
Applicability	NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM (NFVO ORM ALLOCATE TRANSPORTED TO ALLOCATE)
	(NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE)
	NFVO/VNFM can generate "allocate network resource" operation requests to the VIM (AUT) (20 AUT)
	(NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE)
	NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO SPM ALLOCATE TRANSPORTED AND ALLOCATE)
	(NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE)
	VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM)
	VIM supports "allocate network resource" operation requests from the NFVO/VNFM
	(VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM)
	VIM supports "allocate storage resource" operation requests from the NFVO/VNFM
	(VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM)
	VNFM can subscribe to VNF indicators on the EM/VNF (VNFM_VNFINDI_SUBSCRIBE)
	EM/VNF supports VNF indicator subscriptions from the VNFM (EM_VNFINDI_SUBSCRIBE)
	EM/VNF can generate VNF indicator notifications to the VNFM (EM_VNFINDI_NOTIFY)
	VNFM supports VNF indicator notifications from the EM/VNF (VNFM_VNFINDI_NOTIFY)
Pre-test conditions	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)
	NFVI has the required amount of consumable virtual resources to run the scaled-out NS
	VNFM is configured to trigger "scale out by adding VNFC instances" when a given VNF
	indicator value crosses a certain threshold

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	In the VNF, trigger the target VNF indicator to cross the configured autoscaling threshold value for scale out operation	
	2	IOP Check	Verify that the "scale out by adding VNFC instance(s)" procedure has been started in NFVO	
	3	IOP Check	If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate the virtualised resources required for the VNFs composing the given NS in the VIM If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS	
	4	IOP Check	Verify that the additional VNFC instance(s) have been deployed by querying the VNFM	
	5	IOP Check	Verify that the additional resources have been allocated by the VIM according to the descriptors	
	6	IOP Check	Verify that the additional VNFC instance(s) are running and are reachable through their management network	
	7	IOP Check	Verify that the VNF configuration has been updated to include the additional VNFC instances according to the descriptors by querying the VNFM	
	8	IOP Check	Verify that the additional VNFC instances(s) are connected to the VL(s) according to the descriptors	
	9	IOP Check	Verify that the NFVO indicates the scaling operation result as successful	
	10	IOP Check	Verify that NS has been scaled out by running the end-to-end functional test in relevance to the VNF scale and capacity	
IOP Verdict				

7.7.2.3.5 NS VNF Scale Out for Multi-Site with an Operator Action

	Test Description: NS VNF scale out for Multi-Site with an Operator Action
Identifier	TD_NFV_NSLCM_SCALE_OUT_VNF_MULTISITE_001
Test Purpose	To verify that a VNF in a multi-site NS can be successfully scaled out by adding VNFC instances
	when triggered by a NFVO operator
Configuration	SUT Configuration 4
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]
Applicability	NFVO/VNFM can generate "allocate compute resource" operation requests to the VIMs (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE)
	 NFVO/VNFM can generate "allocate network resource" operation requests to the VIMs (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE)
	 NFVO/VNFM can generate "allocate storage resource" operation requests to the VIMs (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE)
	 VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM)
	 VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM)
	 VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM)
	 NFVO can generate "scale out by adding VNFC instances" to the VNFM (NFVO_VNFLCM_VNF_SCALE_OUT)
	 VNFM supports "scale out by adding VNFC instances" requests from the NFVO (VNFM_VNFLCM_VNF_SCALE_OUT)

Pre-test cond		Multi-Site NNFVI has t	ports triggering "scale out by adding VNFC instances" with an opera NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_MULTISITE_0 he required amount of consumable virtual resources to run the scale onfigured to trigger SCALE OUT (by adding VNFC instances) when rator	01) ed-out NS
Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger multi-site NS scale out by adding VNFC instance(s) to a VNF in the NS in NFVO with an operator action	
	2	IOP Check	Verify that the VNFM receives from the NFVO scale out request for the impacted VNF in the given NS	
	3	IOP Check	If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate the virtualised resources required for scaling the impacted VNF If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS	
	4	IOP Check	Verify that the requested resources have been allocated by the VIM according to the descriptors	
	5	IOP Check	Verify that the additional VNFC instance(s) have been deployed for the VNF by querying the VNFM	
	6	IOP Check	Verify that the additional VNFC instance(s) have been deployed according to the multi-site location constraints	
	7	IOP Check	Verify that the additional VNFC instance(s) are running and reachable via the management network	
	8	IOP Check	Verify that the additional VNFC instances(s) have been configured according to the descriptors (i.e. by getting a result through the management interface)	
	9	IOP Check	Verify that the additional VNFC instances(s), VL(s) and VNFFG(s) are connected according to the Descriptors	
	10	IOP Check	Verify that the additional VNFC instance(s) have multi-site connectivity through the multi-site VL(s)	
	11	IOP Check	Verify that NS has been scaled out by running the end-to-end functional test in relevance to the VNF scale and capacity	
IOP Verdict				

7.7.2.4 NS VNF Scale In

7.7.2.4.1 NS VNF Scale In with an Operator Action

Test Description: NS VNF scale in with an operator action			
Identifier	TD_NFV_NSLCM_SCALE_IN_VNF_001		
Test Purpose	Verify that a VNF in a NS can be successfully scaled in by removing VNFC instances from an existing VNF triggered by an operator action		
Configuration	SUT Configuration 1		
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]		

Applicability NFVO/VNFM can generate "terminate compute resource" operation requests to the VIM (NFVO_CRM_TERMINATE or VNFM_CRM_TERMINATE) NFVO/VNFM can generate "terminate network resource" operation requests to the VIM (NFVO_NRM_TERMINATE or VNFM_NRM_TERMINATE) NFVO/VNFM can generate "terminate storage resource" operation requests to the VIM (NFVO_SRM_TERMINATE or VNFM_SRM_TERMINATE) VIM supports "terminate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM) VIM supports "terminate network resource" operation requests from the NFVO/VNFM (VIM_NRM_TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM) VIM supports "terminate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM) NFVO can generate "scale in by removing VNFC instances" to the VNFM (NFVO_VNFLCM_VNF_SCALE_IN) VNFM supports "scale in by removing VNFC instances" requests from the NFVO (VNFM_VNFLCM_VNF_SCALE_IN)

Pre-test conditions

- NFVO supports triggering scale in with an operator's action
- NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)
- The current NS deployment size should support scaling in

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger NS scale in by removing VNFC instance(s) from a VNF in the NS in NFVO with an operator action	
	2	IOP Check	Verify that the VNFM receives from the NFVO scale in operation for the impacted VNF in the given NS	
	3	IOP Check	If VNFM is in direct mode: Verify that the VNFM is granted by the NFVO to allocate the virtualised resources required for scaling the impacted VNF If VNFM is in indirect mode: Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS	
	4	IOP Check	Verify that the impacted VNFC instance(s) inside the VNF have been terminated by querying the VNFM	
	5	IOP Check	Verify that the impacted VNFC instance(s) resources have been released by the VIM	
	6	IOP Check	Verify that the remaining VNFC instance(s) are still running and reachable via their management network	
	7	IOP Check	Verify that the VNF configuration has been updated to exclude the removed VNFC instances according to the descriptors by querying the VNFM	
	8	IOP Check	Verify that the remaining VNFC instances(s) and VL(s) are still connected according to the descriptors	
	9	IOP Check	Verify that the NFVO indicates the scaling operation result as successful	
	10	IOP Check	Verify that NS has been scaled in by running the end-to-end functional test in relevance to the VNF scale and capacity	
IOP Verdict		_		

7.7.2.4.2 NS VNF Scale In with a VNF Indicator notification

			ion: NS VNF scale in with a VNF indicator notification			
Identifier			M_SCALE_IN_VNF_002			
Test Purpose		Verify that a VNF in a NS can be successfully scaled in by removing VNFC instances triggered automatically by a VNF indicator				
Configuration		SUT Configuration 1				
References		ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI				
Applicability			3 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9] M can generate "terminate compute resource" operation requests			
		(NFVO_CRM_TERMINATE or VNFM_CRM_TERMINATE) • NFVO/VNFM can generate "terminate network resource" operation requests to the VIM				
		(NFVO_NRI	M_TERMINATE or VNFM_NRM_TERMINATE)			
		(NFVO_SRI	M can generate "terminate storage resource" operation requests to M_TERMINATE or VNFM_SRM_TERMINATE)			
		(VIM_CRM_	ts "terminate compute resource" operation requests from the NFV _TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM)		
			ts "terminate network resource" operation requests from the NFVC _TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM			
			ts "terminate storage resource" operation requests from the NFVC _TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM;			
		 VNFM can s 	subscribe to VNF indicators on the EM/VNF (VNFM_VNFINDI_SUpports VNF indicator subscriptions from the VNFM (EM_VNFINDI_	BSCRIBE)		
			n generate VNF indicator notifications to the VNFM (EM_VNFIND)			
			orts VNF indicator notifications from the EM/VNF (VNFM_VNFINE			
				/		
Pre-test condit	ions	 NS is instan 	tiated (TD_NFV_NSLCM_INSTANTIATE_001)			
		 The current 	NS deployment size should support scaling in			
		 VNFM is cor 	nfigured to trigger "scale in by removing VNFC instances" when a	given VNF		
			ue crosses a certain threshold			
	1 -	_				
Test	Step	Туре	Description	Result		
Sequence	1	Stimulus	Trigger the EM/VNF to send the targeted VNF indicator to the VNFM until the configured threshold is crossed			
	2	IOP Check	Verify that the "scale in by removing VNFC instance(s)" procedure has been started in NFVO			
	3	IOP Check	If VNFM is in direct mode:			
			Verify that the VNFM is granted by the NFVO to			
			allocate the virtualised resources required for scaling			
			the impacted VNF If VNFM is in indirect mode:			
			Verify that the VNFM sends resource allocation			
			request using resource provider ID through the NFVO			
			to manage the instantiation of the VNFs composing			
			the given NS			
	4	IOP Check	Verify that the impacted VNFC instance(s) inside the VNF have been terminated by querying the VNFM			
	5	IOP Check	Verify that the impacted VNFC instance(s) resources have been released by the VIM			
	6	IOP Check	Verify that the remaining VNFC instance(s) are still running and reachable via their management network			
	7	IOP Check	Verify that the VNF configuration has been updated to exclude the removed VNFC instances according to the descriptors by querying the VNFM			
	8	IOP Check	Verify that the remaining VNFC instances(s) and VL(s) are still connected according to the descriptors			
	9	IOP Check	Verify that the NFVO indicates the scaling operation result as successful			
	10	IOP Check	Verify that NS has been scaled in by running the end-to-end			
IOP Verdict			functional test in relevance to the VNF scale and capacity			
HUP verdict				1		

7.7.2.4.3 NS VNF Scale In with a VIM KPI

Test Purpose Ve	D_NFV_NSLCM_SCALE_IN_VNF_003					
-						
l lat	erify that a VNF in a NS can be successfully scaled in by removing VNFC instances triggered utomatically by a VIM KPI					
Configuration SI	SUT Configuration 1					
	TSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI S NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]					
Applicability Applicability	S NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9] NFVO/NNFM can generate "terminate compute resource" operation requests to the VIM (NFVO_CRM_TERMINATE or VNFM_CRM_TERMINATE) NFVO/VNFM can generate "terminate network resource" operation requests to the VIM (NFVO_NRM_TERMINATE or VNFM_NRM_TERMINATE) NFVO/VNFM can generate "terminate storage resource" operation requests to the VIM (NFVO_SRM_TERMINATE or VNFM_SRM_TERMINATE) VIM supports "terminate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM) VIM supports "terminate network resource" operation requests from the NFVO/VNFM (VIM_NRM_TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM) VIM supports "terminate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM) VIM supports "terminate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM) NFVO/NFM can create VR PM jobs on the VIM (NFVO_PM_VR_PMJOB_CREATE or VNFM_PM_VR_PMJOB_CREATE) VIM supports VR PM jobs creation by the NFVO/VNFM (VIM_PM_PMJOB_CREATE_BY_NFVO or VIM_PM_PMJOB_CREATE_BY_VNFM) NFVO/VNFM can subscribe to VR PM jobs on the VIM (NFVO_PM_VR_PMJOB_SUBSCRIBE) VIM supports VR PM job subscriptions from the NFVO/VNFM (VIM_PM_PMJOB_SUBSCRIBE_BY_NFVO or VIM_PM_PM_VR_PMJOB_SUBSCRIBE_BY_VNFM) NFVO/NNFM can create VR PM thresholds on the VIM (NFVO_PM_VR_PMTH_CREATE or VNFM_PM_VR_PMTH_CREATE) VIM supports VR PM thresholds creation by the NFVO/VNFM (VIM_PM_PMTH_CREATE_BY_NFVO or VIM_PM_PMTH_CREATE_BY_VNFM) VIM can generate VR PM notifications to the NFVO/VNFM (VIM_PM_PMJOB_NOTIFY_BY_NFVO or VIM_PM_PMJOB_NOTIFY_BY_VNFM) NFVO/NNFM supports VR PM notifications from the VIM (NFVO_PM_VR_PMJOB_NOTIFY or VNFM_PM_VR_PMJOB_NOTIFY)					
-	OF VNFM_PM_VR_PMJOB_NOTIFY) NFVO can generate "scale in by removing VNFC instances" to the VNFM (NFVO_VNFLCM_VNF_SCALE_IN)					
•	VNFM supports "scale in by removing VNFC instances" requests from the NFVO (VNFM_VNFLCM_VNF_SCALE_IN)					
Dro toot conditions	NO. 1 A STATE OF A STA					
Pre-test conditions •	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)					
•	The current NS deployment size should support scaling in					
•	NFVO/VNFM is configured to trigger "scale in by removing VNFC instances" when a given VIM KPI value crosses a certain threshold					
•	Virtualised resource PM job with threshold monitoring has been created (TD_NFV_PM_VR_CREATE_THRESHOLD_001)					

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger the VIM to send notifications of the targeted KPI to the NFVO/VNFM until the configured threshold is crossed	
	2	IOP Check	Verify that the "scale in by removing VNFC instance(s)" procedure has been started in NFVO	
	3	IOP Check	If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate the virtualised resources required for scaling the impacted VNF If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS	
	4	IOP Check	Verify that the impacted VNFC instance(s) inside the VNF have been terminated by querying the VNFM	
	5	IOP Check	Verify that the impacted VNFC instance(s) resources have been released by the VIM	
	6	IOP Check	Verify that the remaining VNFC instance(s) are still running and reachable via their management network	
	7	IOP Check	Verify that the VNF configuration has been updated to exclude the removed VNFC instances according to the descriptors by querying the VNFM	
	8	IOP Check	Verify that the remaining VNFC instances(s) and VL(s) are still connected according to the descriptors	
	9	IOP Check	Verify that the NFVO indicates the scaling operation result as successful	
	10	IOP Check	Verify that NS has been scaled in by running the end-to-end functional test in relevance to the VNF scale and capacity	
IOP Verdict				

7.7.2.4.4 NS VNF Scale In with a query to VNF indicator by VNFM

1	Test Description: NS VNF scale in with a query to VNF indicator by VNFM
Identifier	TD_NFV_NSLCM_SCALE_IN_VNF_004
Test Purpose	Verify that a VNF in a NS can be successfully scaled in by removing VNFC instances triggered
	automatically in VNFM by querying a VNF indicator
Configuration	SUT Configuration 1
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI
	GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]
Applicability	NFVO/VNFM can generate "terminate compute resource" operation requests to the VIM
	(NFVO_CRM_TERMINATE or VNFM_CRM_TERMINATE)
	NFVO/VNFM can generate "terminate network resource" operation requests to the VIM
	(NFVO_NRM_TERMINATE or VNFM_NRM_TERMINATE)
	NFVO/VNFM can generate "terminate storage resource" operation requests to the VIM
	(NFVO_SRM_TERMINATE or VNFM_SRM_TERMINATE)
	VIM supports "terminate compute resource" operation requests from the NFVO/VNFM
	(VIM_CRM_TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM)
	 VIM supports "terminate network resource" operation requests from the NFVO/VNFM
	(VIM_NRM_TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM)
	VIM supports "terminate storage resource" operation requests from the NFVO/VNFM
	(VIM_SRM_TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM)
	VNFM can subscribe to VNF indicators on the EM/VNF (VNFM_VNFINDI_SUBSCRIBE)
	EM/VNF supports VNF indicator subscriptions from the VNFM (EM_VNFINDI_SUBSCRIBE)
	EM/VNF can generate VNF indicator notifications to the VNFM (EM_VNFINDI_NOTIFY)
	VNFM supports VNF indicator notifications from the EM/VNF (VNFM_VNFINDI_NOTIFY)
Pre-test conditions	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)
	The current NS deployment size should support scaling in
	VNFM is configured to trigger "scale in by removing VNFC instances" when a given VNF
	indicator value crosses a certain threshold

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	In the VNF, trigger the target VNF indicator to cross the configured autoscaling threshold value for scale out operation	
	2	IOP Check	Verify that the "scale in by removing VNFC instance(s)" procedure has been started in NFVO	
	3	IOP Check	If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate the virtualised resources required for scaling the impacted VNF If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing	
	4	IOP Check	the given NS Verify that the impacted VNFC instance(s) inside the VNF have been terminated by querying the VNFM	
	5	IOP Check	Verify that the impacted VNFC instance(s) resources have been released by the VIM	
	6	IOP Check	Verify that the remaining VNFC instance(s) are still running and reachable via their management network	
	7	IOP Check	Verify that the VNF configuration has been updated to exclude the removed VNFC instances according to the descriptors by querying the VNFM	
	8	IOP Check	Verify that the remaining VNFC instances(s) and VL(s) are still connected according to the descriptors	
	9	IOP Check	Verify that the NFVO indicates the scaling operation result as successful	
	10	IOP Check	Verify that NS has been scaled in by running the end-to-end functional test in relevance to the VNF scale and capacity	
IOP Verdict				

7.7.2.4.5 NS VNF Scale In for Multi-Site with an Operator Action

	Test Description: NS VNF scale in for Multi-Site with an Operator Action					
Identifier	TD_NFV_NSLCM_SCALE_IN_VNF_MULTISITE_001					
Test Purpose	To verify that a VNF in a multi-site NS can be successfully scaled in by removing VNFC instances from an existing VNF triggered by an operator action					
Configuration	SUT Configuration 4					
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]					
Applicability	 NFVO/VNFM can generate "terminate compute resource" operation requests to the VIMs (NFVO_CRM_TERMINATE or VNFM_CRM_TERMINATE) deployed in different sites NFVO/VNFM can generate "terminate network resource" operation requests to the VIMs (NFVO_NRM_TERMINATE or VNFM_NRM_TERMINATE) deployed in different sites NFVO/VNFM can generate "terminate storage resource" operation requests to the VIMs (NFVO_SRM_TERMINATE or VNFM_SRM_TERMINATE) deployed in different sites VIM supports "terminate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM) VIM supports "terminate network resource" operation requests from the NFVO/VNFM (VIM_NRM_TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM) VIM supports "terminate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM) VIM SUPPORTS "terminate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM) NFVO can generate "scale in by removing VNFC instances" to the VNFM (NFVO_VNFLCM_VNF_SCALE_IN) VNFM supports "scale in by removing VNFC instances" requests from the NFVO (VNFM_VNFLCM_VNF_SCALE_IN) NFVO/VNFM supports multi-site deployments 					
Dro toot conditions						
Pre-test conditions	 NFVO supports triggering scale in with an operator's action Multi-site NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_MULTISITE_001) The current NS deployment size should support scaling in NS Multi-site NS has been scaled out by adding VNFC instances (TD_NFV_NSLCM_SCALE_OUT_VNF_MULTISITE_001) 					

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger NS scale in by removing VNFC instance(s) from a VNF in the NS in NFVO with an operator action	
	2	IOP Check	Verify that the VNFM receives terminate request from the NFVO for the VNF(s) to be removed in the given NS	
	3	IOP Check	If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate the virtualised resources required for scaling the impacted VNF If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS	
	4	IOP Check	Verify that the impacted VNFC instance(s) have been terminated and not running in the correspondent VIM site / instance	
	5	IOP Check	Verify that the impacted VNFC instance(s) resources have been released by the VIM site / VIM instance	
	6	IOP Check	Verify that the remaining VNFC instance(s) are still running and reachable via their management network	
	7	IOP Check	Verify that the remaining VNFC instances(s), VL(s) and VNFFG(s) are still connected according to the descriptors	
	8	IOP Check	Verify that the remaining VNFC instance(s) have still multi-site connectivity through the multi-site VL(s)	
	9	IOP Check	Verify that multi-site NS has been scaled in by running the end- to-end functional test	
IOP Verdict				

7.7.2.5 NS Scale to Level

7.7.2.5.1 NS Scale to Level with an Operator Action

	Test Description: NS Scale to Level with an Operator Action					
Identifier	TD_NFV_NSLCM_SCALE_TO_LEVEL_001					
Test Purpose	Verify that the NS can be successfully scaled to another existing instantiation level by an operator action					
Configuration	SUT Configuration 1 SUT Configuration 3 SUT Configuration 4					
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]					
Applicability	 NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE) NFVO/VNFM can generate "allocate network resource" operation requests to the VIM (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE) NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE) VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM) VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) NIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM) NFVO supports scale to level NS supports scale to level 					

Pre-test conditions		NS is instar	ntiated (TD_NFV_NSLCM_INSTANTIATE_001)		
• The N		The NS initi	initial deployment size should support scaling to or from a specified level		
		The Status	of NS supports scale to level		
	l				
Test	Step	Type	Description	Result	
Sequence	1	Stimulus	Trigger NS scale to another existing instantiation level in NFVO with an operator action		
	2	IOP Check	Verify that the VNFM receives instantiation or termination request (according to the target scale level) for the impacted VNF(s)		
	3	IOP Check	If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate or delete the virtualised resources for the impacted VNFs in the VIM If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS		
_	4	IOP Check	Verify that the all resources have been allocated or deleted in the VIM according to the descriptors		
	5	IOP Check	Verify that the all VNF instance(s) are running and reachable via their management network		
	6	IOP Check	Verify that the all VNF instances(s), VL(s) and VNFFG(s) are connected according to the descriptors		
	7	IOP Check	Verify in the NFVO that the NS has been scaled as requested (i.e. query or display the NS instance resource)		
	8	IOP Check	Verify that NS has been scaled to level by running the end-to- end functional test factoring the VNF scale and capacity		
IOP Verdict					

7.7.2.5.2 NS Scale to Level from VNF Indicator notification

	Test Description: NS Scale to Level from VNF indicator notification				
Identifier	TD_NFV_NSLCM_SCALE_TO_LEVEL_002				
Test Purpose	Verify that the NS can be successfully scaled to another existing instantiation level automatically by a VNF indicator notification				
Configuration	SUT Configuration 1 SUT Configuration 3 SUT Configuration 4				
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]				
Applicability	 NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE) NFVO/VNFM can generate "allocate network resource" operation requests to the VIM (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE) NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE) VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM) VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM) VNFM can subscribe to VNF indicators on the EM/VNF (VNFM_VNFINDI_SUBSCRIBE) EM/VNF supports VNF indicator subscriptions from the VNFM (EM_VNFINDI_SUBSCRIBE) EM/VNF can generate VNF indicator notifications to the VNFM (EM_VNFINDI_NOTIFY) VNFM supports VNF indicator notifications from the EM/VNF (VNFM_VNFINDI_NOTIFY) NFVO supports scale to level NS supports scale to level 				

Pre-test conditions	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)
	 NFVO/VNFM is configured to trigger "scale NS to level" when a given VNF indicator value crosses a certain threshold
	 The NS initial deployment size should support scaling to or from a specified level
	 VNF/EM is configured to trigger notification when VNF Indicator value crosses a certain threshold
	The Status of NS supports scale to level

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger the EM/VNF to send the targeted VNF indicator to the	
			VNFM until the configured threshold is crossed	
	2	IOP Check	Verify that the "scale NS to level by adding/removing VNF	
			instance(s)" procedure has been started in NFVO	
	3	IOP Check	If VNFM is in direct mode:	
			 Verify that the VNFM is granted by the NFVO to 	
			allocate or delete the virtualised resources for the	
			impacted VNFs in the VIM	
			If VNFM is in indirect mode:	
			 Verify that the VNFM sends resource allocation 	
			request using resource provider ID through the NFVO	
			to manage the instantiation of the VNFs composing	
			the given NS	
	4	IOP Check	Verify that the virtualised resources have been allocated or	
			deleted in the VIM according to the descriptors	
	5	IOP Check	Verify that the all VNF instance(s) are running and reachable	
			via their management network	
	6	IOP Check	Verify that the all VNF instances(s), VL(s) and VNFFG(s) are	
			connected according to the descriptors	
	7	IOP Check	Verify in the NFVO that the NS has been scaled as requested	
			(i.e. query or display the NS instance resource)	
	8	IOP Check	Verify that NS has been scaled to level by running the end-to-	
			end functional test factoring the VNF scale and capacity	
IOP Verdict				

7.7.2.5.3 NS Scale to Level from a VIM KPI

	Test Description: NS scale to Level from a VIM KPI				
Identifier	TD_NFV_NSLCM_SCALE_TO_LEVEL_003				
Test Purpose	Verify that the NS can be successfully scaled to another existing instantiation level automatically by a VIM KPI				
Configuration	SUT Configuration 1 SUT Configuration 3 SUT Configuration 4				
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]				

Applicability

- NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE)
- NFVO/VNFM can generate "allocate network resource" operation requests to the VIM (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE)
- NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE)
- VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM)
- VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM)
- VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM)
- NFVO/VNFM can create VR PM jobs on the VIM (NFVO_PM_VR_PMJOB_CREATE or VNFM_PM_VR_PMJOB_CREATE)
- VIM supports VR PM jobs creation by the NFVO/VNFM (VIM_PM_PMJOB_CREATE_BY_NFVO or VIM_PM_PMJOB_CREATE_BY_VNFM)
- NFVO/VNFM can create VR PM thresholds on the VIM (NFVO_PM_VR_PMTH_CREATE or VNFM_PM_VR_PMTH_CREATE)
- VIM supports VR PM thresholds creation by the NFVO/VNFM (VIM_PM_PMTH_CREATE_BY_NFVO or VIM_PM_PMTH_CREATE_BY_VNFM)
- NFVO/VNFM can subscribe to VR PM jobs on the VIM (NFVO_PM_VR_PMJOB_SUBSCRIBE or VNFM_PM_VR_PMJOB_SUBSCRIBE)
- VIM supports VR PM job subscriptions from the NFVO/VNFM (VIM_PM_PMJOB_SUBSCRIBE_BY_NFVO or VIM_PM_PMJOB_SUBSCRIBE_BY_VNFM)
- VIM can generate VR PM notifications to the NFVO/VNFM
 (VIM_PM_PMJOB_NOTIFY_BY_NFVO or VIM_PM_PMJOB_NOTIFY_BY_VNFM)
- NFVO/VNFM supports VR PM notifications from the VIM (NFVO_PM_VR_PMJOB_NOTIFY or VNFM_PM_VR_PMJOB_NOTIFY)
- NFVO supports scale to level
- NS supports scale to level

Pre-test conditions

- NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)
- NFVI has the required amount of consumable virtual resources to run the scaled-out NS
- NFVO/VNFM is configured to trigger "scale NS to level" when a given VIM KPI value crosses a certain threshold
- Virtualised resource PM job with threshold monitoring has been created (TD_NFV_PM_VR_CREATE_THRESHOLD_001)

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger the VIM to send the targeted KPI to the NFVO/VNFM until the configured threshold is crossed	
	2	IOP Check	Verify that the "scale NS to level by adding/removing VNF instance(s)" procedure has been started in NFVO	
	3	IOP Check	If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate or delete the virtualised resources for the impacted VNFs in the VIM If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS	
	4	IOP Check	Verify that the virtualised resources have been allocated or deleted in the VIM according to the descriptors	
	5	IOP Check	Verify that the all VNF instance(s) are running and reachable via their management network	
	6	IOP Check	Verify that the all VNF instances(s), VL(s) and VNFFG(s) are connected according to the descriptors	
	7	IOP Check	Verify in the NFVO that the NS has been scaled as requested (i.e. query or display the NS instance resource	
	8	IOP Check	Verify that NS has been scaled out by running the end-to-end functional test factoring the VNF scale and capacity	
IOP Verdict				

7.7.2.5.4 NS Scale to Level with an Operator Action for Multi-Site

	Test Description: NS scale to Level with an Operator Action for Multi-Site
Identifier	TD_NFV_NSLCM_SCALE_TO_LEVEL_MULTISITE_001
Test Purpose	Verify that a multi-site NS can be successfully scaled to another existing instantiation level (Scale
	NS to Level) by an operator
Configuration	SUT Configuration 4
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]
Applicability	 NFVO/VNFM can generate "allocate compute resource" operation requests to the VIMs (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE) deployed in different sites NFVO/VNFM can generate "allocate network resource" operation requests to the VIMs (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE) deployed in different sites NFVO/VNFM can generate "allocate storage resource" operation requests to the VIMs (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE) deployed in different sites VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM) VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM) NFVO can "scale to level by adding/removing VNF instances" requests to the VNFM VNFM supports "scale to level by adding/removing VNF instances" requests from the NFVO NFVO/VNFM supports multi-site deployments NFVO supports NS scale to level
	NS supports scale to level
Pre-test conditions	Multi-site NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_MULTISITE_001)
	 NFVI has the required amount of consumable virtual resources to run the scaled to level for NS
	The NS initial deployment size should support scaling to or from a specified level
	Current status of NS supports scale to level

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger multi-site NS scale to another existing instantiation level in NFVO with an operator request	
	2	IOP Check	Verify that the VNFM receives instantiation or termination request (according to the target scale level) for the impacted VNF(s)	
	3	IOP Check	If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate or delete the virtualised resources for the impacted VNFs in the VIM If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS	
	4	IOP Check	Verify that the virtualised resources have been allocated or deleted in the VIM according to the descriptors	
	5	IOP Check	Verify that all VNF instance(s) are running and reachable via the management network	
	6	IOP Check	Verify in the NFVO that the multi-site NS has been scaled as requested (i.e. query or display the NS instance resource)	
	7	IOP Check	Verify that NS is functional by running the end-to-end functional test	
IOP Verdict				

7.7.2.6 NS VNF Scale to Level

7.7.2.6.1 NS VNF Scale to Level with an Operator Action

Identifier			ption: NS VNF Scale to Level with an operator action M_SCALE_TO_LEVEL_VNF_001			
Test Purpose		To verify that a VNF in a NS can be successfully scaled to another existing instantiation level by				
		NFVO operator				
Configuration		SUT Configurati SUT Configurati				
		SUT Configurati				
References		ETSI GS NFV-II	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]			
Applicability			M can generate "allocate compute resource" operation requests to	the VIM		
		(NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE) NFVO/VNFM can generate "allocate network resource" operation requests to the VIM (NFVO_NFM_ALLOCATE)				
		(NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE) • NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM				
		 VIM suppor 	M_ALLOCATE or VNFM_SRM_ALLOCATE) rts "allocate compute resource" operation requests from the NFVO	/VNFM		
			_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM)	\		
		(VIM_NRM	ts "allocate network resource" operation requests from the NFVO/ _ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM)			
		(VIM_SRM	rts "allocate storage resource" operation requests from the NFVO/\ _ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM)	VNFM		
			ports scale to level			
			s scale to level ports NS scaling by adding/removing VNF instances			
			ports VNF scaling out/in by adding/removing VNFC instances			
		operator's a				
			ntiated (TD_NFV_NSLCM_INSTANTIATE_001) The required amount of consumable virtual resources to run the scale	led NS to level		
			ntiated (TD_NEV_NSLCM_INSTANTIATE_001) ne required amount of consumable virtual resources to run the scal	led NS to level		
Test	Step	NFVI has th Type	ne required amount of consumable virtual resources to run the scal	led NS to level		
Test Sequence	Step 1	NFVI has the Type Stimulus	Description Trigger NS scale by scaling to existing instantiation level to a VNF in the NS in NFVO with an operator action	_		
		Type Stimulus IOP Check	Description Trigger NS scale by scaling to existing instantiation level to a	_		
	1	NFVI has the Type Stimulus	Description Trigger NS scale by scaling to existing instantiation level to a VNF in the NS in NFVO with an operator action Verify that the VNFM receives scale to level request for the impacted VNF(s) in the given NS If VNFM is in direct mode:	_		
	2	Type Stimulus IOP Check	Description Trigger NS scale by scaling to existing instantiation level to a VNF in the NS in NFVO with an operator action Verify that the VNFM receives scale to level request for the impacted VNF(s) in the given NS If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate or delete (according to the target scale level) the virtualised resources for scaling the impacted	_		
	2	Type Stimulus IOP Check	Description Trigger NS scale by scaling to existing instantiation level to a VNF in the NS in NFVO with an operator action Verify that the VNFM receives scale to level request for the impacted VNF(s) in the given NS If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate or delete (according to the target scale level)	_		
	2	Type Stimulus IOP Check	Description Trigger NS scale by scaling to existing instantiation level to a VNF in the NS in NFVO with an operator action Verify that the VNFM receives scale to level request for the impacted VNF(s) in the given NS If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate or delete (according to the target scale level) the virtualised resources for scaling the impacted VNF(s) If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation	_		
	2	Type Stimulus IOP Check	Description Trigger NS scale by scaling to existing instantiation level to a VNF in the NS in NFVO with an operator action Verify that the VNFM receives scale to level request for the impacted VNF(s) in the given NS If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate or delete (according to the target scale level) the virtualised resources for scaling the impacted VNF(s) If VNFM is in indirect mode:	_		
	2	Type Stimulus IOP Check	Description Trigger NS scale by scaling to existing instantiation level to a VNF in the NS in NFVO with an operator action Verify that the VNFM receives scale to level request for the impacted VNF(s) in the given NS If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate or delete (according to the target scale level) the virtualised resources for scaling the impacted VNF(s) If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing	_		
	3	Type Stimulus IOP Check IOP Check	Description Trigger NS scale by scaling to existing instantiation level to a VNF in the NS in NFVO with an operator action Verify that the VNFM receives scale to level request for the impacted VNF(s) in the given NS If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate or delete (according to the target scale level) the virtualised resources for scaling the impacted VNF(s) If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS Verify that the all resources have been allocated or deleted in the VIM according to the descriptors by VNFM Verify that the all VNFC instance(s) are running and reachable	_		
	3	Type Stimulus IOP Check IOP Check	Description Trigger NS scale by scaling to existing instantiation level to a VNF in the NS in NFVO with an operator action Verify that the VNFM receives scale to level request for the impacted VNF(s) in the given NS If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate or delete (according to the target scale level) the virtualised resources for scaling the impacted VNF(s) If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS Verify that the all resources have been allocated or deleted in the VIM according to the descriptors by VNFM Verify that the all VNFC instance(s) are running and reachable via the management network Verify from the NFVO that the VNF in a NS has been successfully scaled (i.e. query or display the NS instance	_		
	3 3 5	Type Stimulus IOP Check IOP Check IOP Check IOP Check	Description Trigger NS scale by scaling to existing instantiation level to a VNF in the NS in NFVO with an operator action Verify that the VNFM receives scale to level request for the impacted VNF(s) in the given NS If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate or delete (according to the target scale level) the virtualised resources for scaling the impacted VNF(s) If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS Verify that the all resources have been allocated or deleted in the VIM according to the descriptors by VNFM Verify that the all VNFC instance(s) are running and reachable via the management network Verify from the NFVO that the VNF in a NS has been	_		

NS VNF Scale to Level from VNF Indicator notification 7.7.2.6.2

		Test Description	n: NS VNF Scale to Level from VNF indicator notification			
Identifier		TD_NFV_NSLCM_SCALE_TO_LEVEL_VNF_002				
Test Purpose		To verify that a \	/NF in a NS can be successfully scaled to another existing instant	iation level by a		
Configuration		VNF indicator notification SUT Configuration 1				
· ·		SUT Configurati	on 3			
		SUT Configuration 4				
References		GS NFV-IFA 008				
Applicability		NFVO/VNFI (NFVO_CR NFVO/VNFI (NFVO_NR NFVO/VNFI (NFVO_SRI VIM support VIM Support VIM Support VIM Support VIM Support VNFM can selection VNFM support NFVO suppont NFVO suppont NFVO suppont NFVO suppont	(NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE) NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE) VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM) VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM)			
Pre-test condit						
		 VNFM is co given VNF i 	ne required amount of consumable virtual resources to run the scal infigured to trigger "scale NS to level by adding/removing VNFC instruction of the crosses a certain threshold configured to trigger notification when VNF Indicator value crosses	stances" when a		
Test	Step	Туре	Description	Result		
Sequence	1	Stimulus	Trigger the EM/VNF to send the targeted VNF indicator to the	11000		
Coquonos			VNFM until the configured threshold is crossed			
	2	IOP Check	Verify that the "scale VNF(s) in NS to level by adding/removing VNF instance(s)" procedure has been started in NFVO			
	3	IOP Check	If VNFM is in direct mode: Verify that the VNFM is granted by the NFVO to allocate or delete (according to the target scale level) the virtualised resources for scaling the impacted VNF(s) If VNFM is in indirect mode: Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS Verify that the all resources have been allocated or deleted in the VIM according to the descriptors by VNFM.			
	5	IOP Check	the VIM according to the descriptors by VNFM Verify that the all VNFC instance(s) are running and are			
			reachable through their management network			
	6	IOP Check	Verify from the NFVO that the VNF in a NS has been successfully scaled (i.e. query or display the NS instance resource)			
	7	IOP Check	Verify that VNF has been scaled to level by running the end-to- end NS functional test in relevance to the VNF scale and			
IOD \/a = d! = t			capacity			
IOP Verdict						

7.7.2.6.3 NS VNF Scale to Level with a VIM KPI

	Test Description: NS VNF scale out with a VIM KPI
Identifier	TD_NFV_NSLCM_SCALE_TO_LEVEL_VNF_003
Test Purpose	To verify that a VNF in a NS can be successfully scaled out by adding VNFC instances when triggered automatically by a VIM KPI
Configuration	SUT Configuration 1
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI
	GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]
Applicability	 NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE)
	NFVO/VNFM can generate "allocate network resource" operation requests to the VIM (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE)
	NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE)
	 VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM)
	 VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM)
	 VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM)
	 NFVO/VNFM can create VR PM jobs on the VIM (NFVO_PM_VR_PMJOB_CREATE or VNFM_PM_VR_PMJOB_CREATE)
	VIM supports VR PM jobs creation by the NFVO/VNFM (VIM_PM_PMJOB_CREATE_BY_NFVO or VIM_PM_PMJOB_CREATE_BY_VNFM)
	 NFVO/VNFM can create VR PM thresholds on the VIM (NFVO_PM_VR_PMTH_CREATE or VNFM_PM_VR_PMTH_CREATE)
	VIM supports VR PM thresholds creation by the NFVO/VNFM (VIM_PM_PMTH_CREATE_BY_NFVO or VIM_PM_PMTH_CREATE_BY_VNFM)
	NFVO/VNFM can subscribe to VR PM jobs on the VIM (NFVO_PM_VR_PMJOB_SUBSCRIBE or VNFM_PM_VR_PMJOB_SUBSCRIBE)
	VIM supports VR PM job subscriptions from the NFVO/VNFM (VIM_PM_PMJOB_SUBSCRIBE_BY_NFVO or VIM_PM_PMJOB_SUBSCRIBE_BY_VNFM)
	VIM can generate VR PM notifications to the NFVO/VNFM (VIM_PM_PMJOB_NOTIFY_BY_NFVO or VIM_PM_PMJOB_NOTIFY_BY_VNFM)
	 NFVO/VNFM supports VR PM notifications from the VIM (NFVO_PM_VR_PMJOB_NOTIFY or VNFM_PM_VR_PMJOB_NOTIFY)
	 NFVO can generate "scaled VNF to level by adding/removing the VNFC instances" to the VNFM
	NFVO supports scale to level
	NS supports scale to level
	NFVO supports NS scaling by adding/removing VNF instances NFM supports VNF applied out/in by adding/removing VNFC instances
	VNFM supports VNF scaling out/in by adding/removing VNFC instances
Pre-test conditions	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)
	NFVI has the required amount of consumable virtual resources to run the run the scaled VNF to level
	NFVO/VNFM is configured to trigger "scale VNF to level by adding/removing the VNFC
	 instances" when a given VIM KPI value crosses a certain threshold Virtualised resource PM job with threshold monitoring has been created (TD_NFV_PM_VR_CREATE_THRESHOLD_001)
	\

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger the VIM to send the targeted KPI to the NFVO/VNFM until the configured threshold is crossed	
	2	IOP Check	Verify that the "scale VNF(s) in NS to level by adding/removing VNF instance(s)" procedure has been started in NFVO	
	3	IOP Check	If VNFM is in direct mode: Verify that the VNFM is granted by the NFVO to allocate or delete (according to the target scale level) the virtualised resources for scaling the impacted VNF(s) If VNFM is in indirect mode: Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS	
	4	IOP Check	Verify that the all resources have been allocated or deleted in the VIM according to the descriptors by VNFM	
	5	IOP Check	Verify that the all VNFC instance(s) are running and are reachable through their management network	
	6	IOP Check	Verify from the NFVO that the VNF in a NS has been successfully scaled (i.e. query or display the NS instance resource)	
	7	IOP Check	Verify that VNF has been scaled to level by running the end-to- end NS functional test in relevance to the VNF scale and capacity	
IOP Verdict				

7.7.2.6.4 NS VNF Scale to Level with an Operator Action for Multi-Site

-	Test Description: NS VNF scale to Level with an Operator Action for Multi-Site
Identifier	TD_NFV_NSLCM_SCALE_TO_LEVEL_VNF_MULTISITE_001
Test Purpose	Verify that a VNF in a multi-site NS can be successfully scaled to another existing instantiation
-	level (Scale VNF to Level) by an operator
Configuration	SUT Configuration 4
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]
Applicability	 NFVO/VNFM can generate "allocate compute resource" operation requests to the VIMs (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE) NFVO/VNFM can generate "allocate network resource" operation requests to the VIMs (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE) NFVO/VNFM can generate "allocate storage resource" operation requests to the VIMs (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE) VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM) VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM) NFVO can generate "scale out by adding VNFC instances" to the VNFM (NFVO_VNFLCM_VNF_SCALE_OUT) VNFM supports "scale out by adding VNFC instances" requests from the NFVO (VNFM_VNFLCM_VNF_SCALE_OUT) NFVO can "scale to level by adding/removing VNF instances" requests from the NFVO
	NFVO/VNFM supports multi-site deployments NEVO supports NS scale to level.
	 NFVO supports NS scale to level VNF(s) in the NS can scale to level
	VINE(2) III the INO Call Scale to level

Pre-test cond		 The NS initi 	Multi-Site NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_MULTISITE_001) The NS initial deployment size should support scaling to a specified level NS/VNF supports scale to level by adding/removing VNFC instances		
Test	Step	Туре	Description	Result	
Sequence	1	Stimulus	Trigger multi-site NS scale by scaling to another existing instantiation level a VNF in the NS in NFVO with an operator request		
	2	IOP Check	Verify that the VNFM receives scale to level request for the impacted VNF(s) in the given NS		
	3	IOP Check	If VNFM is in direct mode: • Verify that the VNFM is granted by the NFVO to allocate or delete (according to the target scale level) the virtualised resources for scaling the impacted VNF(s) If VNFM is in indirect mode: • Verify that the VNFM sends resource allocation request using resource provider ID through the NFVO to manage the instantiation of the VNFs composing the given NS		
	4	IOP Check	Verify that the virtualised resources have been allocated or deleted in the VIM according to the descriptors by the VNFM		
	5	IOP Check	Verify that all VNFC instance(s) are running and reachable via the management network		
	6	IOP Check	Verify from the NFVO that the VNF in a multi-site NS has been successfully scaled (i.e. query or display the NS instance resource)		
	7	IOP Check	Verify that the NS is functional by running the end-to-end functional test		
IOP Verdict					

7.7.3 NS Update

7.7.3.1 Start VNF Instance

	Test Description: start VNF instance						
Identifier	TD_NFV_NSLCM_UPDATE_START_001						
Test Purpose	Verify the capability to start a VNF instance inside a NS instance						
Configuration	SUT Configuration 1						
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5] and ETSI GS NFV-IFA 013 [i.9]						
Applicability	NFVO can generate "operate VNF" operation requests to the VNFM (NFVO_VNFLCM_OPERATE)						
	 VNFM supports "operate VNF" operation requests from the NFVO (VNFM_VNFLCM_OPERATE) 						
	 NFVO/VNFM can generate "operate compute resource" operation requests to the VIM (NFVO_CRM_OPERATE or VNFM_CRM_OPERATE) 						
	 VIM supports "operate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_OPERATE_BY_NFVO or VIM_CRM_OPERATE_BY_VNFM) 						
	 NFVO/VNFM can query compute resource information from the VIM (NFVO_CRM_QUERY or VNFM_CRM_QUERY) 						
	 VIM can send compute resource information to the NFVO (VIM_CRM_INFO_TO_NFVO or VIM_CRM_INFO_TO_VNFM) 						
	 VIM can send network resource information to the NFVO (VIM_NRM_INFO_TO_NFVO or VIM_NRM_INFO_TO_VNFM) 						
	 VIM can send storage resource information to the NFVO (VIM_SRM_INFO_TO_NFVO or VIM_SRM_INFO_TO_VNFM) 						
	 NFVO can query VNF information from the VNFM (NFVO_VNFLCM_QUERY) 						
	 VNFM supports VNF information queries by the NFVO (VNFM_VNFLCM_QUERY) 						
Pre-test conditions	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)						
	 Target VNF is in a stopped operational state. See note. 						

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger the NFVO to start the target VNF instance inside the NS instance	
	2	IOP Check	Verify that the compute resources allocated to the VNFC instances inside the target VNF instance have been started by querying the VIM	
	3	IOP Check	Verify that other existing compute resources have not been affected by the performed operation by querying the VIM	
	4	IOP Check	Verify that the VNF instance operational state on the VNFM is indicated as "started"	
	5	IOP Check	Verify that the NFVO shows no "operate VNF" operation errors	
	6	IOP Check	Verify that the NS functionality that utilizes the started VNF instance operates successfully by running the end-to-end functional test	
IOP Verdict				

NOTE: In the state STOPPED, the virtualised container(s), where the VNFC instance(s) of the VNF run, are shut down but not terminated.

7.7.3.2 Stop VNF Instance

7.7.5.2	Oic	p vivi ilista	noc		
			Test Description: stop VNF instance		
Identifier TD_NFV_NSLCM_UPDATE_STOP_001					
	Test Purpose Verify the capability to stop a VNF instance inside a NS instance				
Configuration SUT Configuration 1					
References ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i GS NFV-IFA 013 [i.9]					
Applicability			NFVO can generate "operate VNF" operation requests to the VNFM (NFVO_VNFLCM_OPERATE)		
			oorts "operate VNF" operation requests from the NFVO FLCM_OPERATE)		
		 NFVO/VNF (NFVO_CR 	M can generate "operate compute resource" operation requests to M_OPERATE or VNFM_CRM_OPERATE)	the VIM	
			ts "operate compute resource" operation requests from the NFVO/M (VIM_CRM_OPERATE_BY_NFVO or VIM_CRM_OPERATE_B		
		NFVO/VNFM can query compute resource information from the VIM (NFVO_CRM_QUER) VNFM_CRM_QUERY)			
		 VIM can send compute resource information to the NFVO (VIM_CRM_INFO_TO_NFVO or VIM_CRM_INFO_TO_VNFM) 			
		VIM can send network resource information to the NFVO (VIM_NRM_INFO_TO_NFVO or VIM_NRM_INFO_TO_VNFM)			
		 VIM can send storage resource information to the NFVO (VIM_SRM_INFO_TO_NFVO or VIM_SRM_INFO_TO_VNFM) 			
		NFVO can query VNF information from the VNFM (NFVO_VNFLCM_QUERY)			
			ports VNF information queries by the NFVO (VNFM_VNFLCM_QUI		
		- VIVI W OUPP	white vita information queriously the fit ve (vita in_vita Eem_qe)		
Pre-test cond	litions	NS is instar	ntiated (TD_NFV_NSLCM_INSTANTIATE_001)		
		_			
Test	Step	Туре	Description	Result	
Sequence	1	Stimulus	Trigger the NFVO to stop the target VNF instance inside the NS instance		
	2	IOP Check	Verify that the compute resources allocated to the VNFC instances inside the target VNF instance have been stopped by querying the VIM. See note.		
	3	IOP Check	Verify that other existing compute resources have not been affected by the performed operation by querying the VIM		
	4	IOP Check	Verify that the VNF instance operational state on the VNFM is indicated as "stopped"		
	5	IOP Check	Verify that the NFVO shows no "operate VNF" operation errors		
IOP Verdict					
	he state not term		virtualised container(s), where the VNFC instance(s) of the VNF rui	n, are shut down	

7.7.3.3 Instantiate VNF and Add Instance to NS Instance

		Test Description	on: NS update instantiating VNFs and adding instances						
Identifier	ľ		M_UPDATE_INST_ADD_VNF_001						
Test Purpose		To verify that one or more VNFs can be instantiated and the instances added to a running NS							
		instance							
Configuration		SUT Configuration 1							
References		ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]							
Applicability		NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE)							
		NFVO/VNFM can generate "allocate network resource" operation requests to the VIM (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE)							
		NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE)							
		VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM)							
		 VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM) NFVO can generate "create VNF identifier" operation requests to the VNFM (NFVO_VNFLCM_CREATE_VNFID) VNFM supports "create VNF identifier" operation requests from the NFVO (VNFM_VNFLCM_CREATE_VNFID) NFVO can generate "instantiate VNF" operation requests to the VNFM (NFVO_VNFLCM_INSTANTIATE) VNFM supports "instantiate VNF" operation requests from the NFVO 							
							(VNFM_VN	FLCM_INSTANTIATE)	
					Dro tost sand	itions	110:::.	CLASSIC TO A PER A NOTAN THAT E AND A	
					Pre-test conditions		NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)		
							VNF Packa	ges whose VNFDs are referred to in the NSD are on-boarded to the	ie NFVO
					Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger a NS update instantiating VNF(s) and adding the resulting instance(s) to a running NS on the NFVO	Result					
	2	IOP Check	Verify that the additional VNF instance(s) have been deployed by querying the VNFM						
	3	IOP Check	Verify that the additional resources have been allocated by the VIM according to the descriptors						
	4	IOP Check	Verify that the additional VNF instance(s) are running and reachable via their management network						
	5	IOP Check	Verify that the additional VNF instances(s) have been configured according to the descriptors by querying the VNFM						
	6	IOP Check	Verify that the NFVO indicates the VNF(s) instantiation and instance(s) addition operation result as successful						
	7	IOP Check	Verify that NS has been updated by running the end-to-end functional test that includes the additional VNF instance(s)						
IOP Verdict									

7.7.3.4 Remove VNF Instances from a NS Instance

		Test D	escription: NS update removing VNF instances			
Identifier		TD_NFV_NSLCM_UPDATE_REM_VNF_001				
Test Purpose		To verify that one or more VNF instances can be removed from a running NS instance				
Configuration		SUT Configuration 1				
References		ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI				
		GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]				
Applicability			M can generate "terminate compute resource" operation requests t M_TERMINATE or VNFM_CRM_TERMINATE)	o the VIM		
			M can generate "terminate network resource" operation requests to M_TERMINATE or VNFM_NRM_TERMINATE)	the VIM		
			M can generate "terminate storage resource" operation requests to M_TERMINATE or VNFM_SRM_TERMINATE)	the VIM		
			ts "terminate compute resource" operation requests from the NFV(_TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM)			
		(VIM_NRM_	ts "terminate network resource" operation requests from the NFVO _TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM)			
		(VIM_SRM_	ts "terminate storage resource" operation requests from the NFVO _TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM)	VNFM		
			generate "terminate VNF" operation requests to the VNFM FLCM_TERMINATE)			
			orts "terminate VNF" operation requests from the NFVO FLCM_TERMINATE)			
		 NFVO can generate "delete VNF identifier" operation requests to the VNFM (NFVO_VNFLCM_DELETE_VNFID) 				
		VNFM supports "delete VNF identifier" operation requests from the NFVO				
			FLCM_DELETE_VNFID)			
Pre-test condi	itions	 NS is instan 	ntiated (TD_NFV_NSLCM_INSTANTIATE_001)			
		 NS can fund 	ction without the impacted VNF instance(s)			
			verification of the VNF instance(s) removal is possible (i.e. reduced	capacity)		
			, , ,	1 7/		
Test	Step	Туре	Description	Result		
Sequence	1	Stimulus	Trigger a NS update removing one or more VNF instances from a running NS instance on the NFVO			
	2	IOP Check	Verify that the impacted resources have been terminated by the VIM according to the descriptors			
	3	IOP Check	Verify that the remaining VNF instance(s) are running and reachable via their management network			
	4	IOP Check	NFVO indicates the update operation was successful			
	5	IOP Check	Verify that NS instance has been updated by running the end- to-end functional test factoring the removal of the VNF instance(s)			
IOP Verdict						

7.7.3.5 Add Shared VNF Instances to NS Instance

	Test Description: NS update adding shared VNF instances				
Identifier	TD_NFV_NSLCM_UPDATE_ADD_SHVNF_001				
Test Purpose	To verify that one or more shared VNF instances can be added to a running NS instance				
Configuration	SUT Configuration 2				
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI				
	GS NFV-IFA 008 (i.6), ETSI GS NFV-IFA 010 (i.7) and ETSI GS NFV-IFA 013 (i.9)				

(NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE) • NFVO/VNFM can generate "allocate network resource" operation requests to the VIM (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE) • NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE) • VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM) • VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) • VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM) • NS1 is instantiated (TD_NFV_NSLCM_INSTANTIATE_001) • NS1 can utilize shared VNF instances • Functional verification of the additional shared VNF instances is possible (i.e. traffic load sharing) Test Step Type Description Result					
(NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE) NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE) VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_NFM) VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM) Pre-test conditions NS1 is instantiated (TD_NFV_NSLCM_INSTANTIATE_001) NS1 can utilize shared VNF instances Functional verification of the additional shared VNF instances is possible (i.e. traffic load sharing) Test Sequence Test Stimulus Trigger a NS update adding one or more shared VNF instances to NS1 on the NFVO 2 IOP Check Verify that any additional resources associated to NS1 have been allocated and deployed by the VIM according to the updated descriptors 3 IOP Check Verify that the existing VNF instance(s) in NS1 are running and reachable through the management network 4 IOP Check Verify that the additional shared VNF instance(s) have been configured according to the descriptors by querying the VNFM 5 IOP Check Verify that the NFVO indicates the shared VNF instance(s) addition operation result as successful 6 IOP Check Verify that NFS1 has been updated by running the end-to-end functional test that includes the additional shared VNF instance(s) 7 IOP Check Verify that NS2 instance was unaffected by the NS update operation by running the relevant end-to-end functional tests that include the shared VNF instance(s)	Applicability				the VIM
(NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE) VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM) VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM) Pre-test conditions NS1 is instantiated (TD_NFV_NSLCM_INSTANTIATE_001) NS1 can utilize shared VNF instances Functional verification of the additional shared VNF instances is possible (i.e. traffic load sharing) Test Sequence Step Type Description Result Trigger a NS update adding one or more shared VNF instances to NS1 have been allocated and deployed by the VIM according to the updated descriptors Verify that any additional resources associated to NS1 have been allocated and deployed by the VIM according to the updated descriptors IOP Check Verify that the existing VNF instance(s) in NS1 are running and reachable through the management network Verify that the additional shared VNF instances(s) have been configured according to the descriptors by querying the VNFM To IOP Check Verify that the NEVO indicates the shared VNF instance(s) addition operation result as successful Verify that the NEVO indicates the shared VNF instance(s) Addition operation result as successful Verify that NS1 has been updated by running the end-to-end functional test that includes the additional shared VNF instance(s) Verify that NS2 instance was unaffected by the NS update operation by running the relevant end-to-end functional tests that include the shared VNF instance(s)		'			the VIM
(VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM) VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM) Pre-test conditions NS1 is instantiated (TD_NFV_NSLCM_INSTANTIATE_001) NS1 can utilize shared VNF instances Functional verification of the additional shared VNF instances is possible (i.e. traffic load sharing) Test Sequence Step Type Description Result Trigger a NS update adding one or more shared VNF instances to NS1 on the NFVO IOP Check Verify that any additional resources associated to NS1 have been allocated and deployed by the VIM according to the updated descriptors IOP Check Verify that the existing VNF instance(s) in NS1 are running and reachable through the management network IOP Check Verify that the additional shared VNF instances(s) have been configured according to the descriptors by querying the VNFM Top Check Verify that the NFVO indicates the shared VNF instance(s) addition operation result as successful Verify that NS1 has been updated by running the end-to-end functional test that includes the additional shared VNF instance(s) Top Check Verify that NS2 instance was unaffected by the NS update operation by running the relevant end-to-end functional tests that include the shared VNF instance(s)		((NFVO_SRI	M_ALLOCATE or VNFM_SRM_ALLOCATE)	
(VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM) Pre-test conditions NS1 is instantiated (TD_NFV_NSLCM_INSTANTIATE_001) NS1 can utilize shared VNF instances Functional verification of the additional shared VNF instances is possible (i.e. traffic load sharing) Test Sequence Step Type Description Result Trigger a NS update adding one or more shared VNF instances to NS1 on the NFVO IOP Check Verify that any additional resources associated to NS1 have been allocated and deployed by the VIM according to the updated descriptors IOP Check Verify that the existing VNF instance(s) in NS1 are running and reachable through the management network IOP Check Verify that the additional shared VNF instances(s) have been configured according to the descriptors by querying the VNFM IOP Check Verify that the NFVO indicates the shared VNF instance(s) addition operation result as successful IOP Check Verify that NS1 has been updated by running the end-to-end functional test that includes the additional shared VNF instance(s) TOP Check Verify that NS2 instance was unaffected by the NS update operation by running the relevant end-to-end functional tests that include the shared VNF instance(s)		ľ			VNFM
Pre-test conditions NS1 is instantiated (TD_NFV_NSLCM_INSTANTIATE_001) NS1 can utilize shared VNF instances Functional verification of the additional shared VNF instances is possible (i.e. traffic load sharing) Test Sequence Step Type Description Result Stimulus Trigger a NS update adding one or more shared VNF instances to NS1 on the NFVO IOP Check Verify that any additional resources associated to NS1 have been allocated and deployed by the VIM according to the updated descriptors IOP Check Verify that the existing VNF instance(s) in NS1 are running and reachable through the management network IOP Check Verify that the additional shared VNF instances(s) have been configured according to the descriptors by querying the VNFM IOP Check Verify that the NFVO indicates the shared VNF instance(s) addition operation result as successful IOP Check Verify that NS1 has been updated by running the end-to-end functional test that includes the additional shared VNF instance (s) Verify that NS2 instance was unaffected by the NS update operation by running the relevant end-to-end functional tests that include the shared VNF instance(s)		ľ			/NFM
NS1 can utilize shared VNF instances Functional verification of the additional shared VNF instances is possible (i.e. traffic load sharing) Test Sequence Step Type Description Result					/NFM
Sequence 1 Stimulus Trigger a NS update adding one or more shared VNF instances to NS1 on the NFVO 2 IOP Check Verify that any additional resources associated to NS1 have been allocated and deployed by the VIM according to the updated descriptors 3 IOP Check Verify that the existing VNF instance(s) in NS1 are running and reachable through the management network 4 IOP Check Verify that the additional shared VNF instances(s) have been configured according to the descriptors by querying the VNFM 5 IOP Check Verify that NFVO indicates the shared VNF instance(s) addition operation result as successful 6 IOP Check Verify that NS1 has been updated by running the end-to-end functional test that includes the additional shared VNF instance(s) 7 IOP Check Verify that NS2 instance was unaffected by the NS update operation by running the relevant end-to-end functional tests that include the shared VNF instance(s)	Pre-test condi		NS1 can utiFunctional v	lize shared VNF instances	traffic load
Sequence 1 Stimulus Trigger a NS update adding one or more shared VNF instances to NS1 on the NFVO 2 IOP Check Verify that any additional resources associated to NS1 have been allocated and deployed by the VIM according to the updated descriptors 3 IOP Check Verify that the existing VNF instance(s) in NS1 are running and reachable through the management network 4 IOP Check Verify that the additional shared VNF instances(s) have been configured according to the descriptors by querying the VNFM 5 IOP Check Verify that NFVO indicates the shared VNF instance(s) addition operation result as successful 6 IOP Check Verify that NS1 has been updated by running the end-to-end functional test that includes the additional shared VNF instance(s) 7 IOP Check Verify that NS2 instance was unaffected by the NS update operation by running the relevant end-to-end functional tests that include the shared VNF instance(s)	Tost	Ston	Type	Description	Posult
2 IOP Check Verify that any additional resources associated to NS1 have been allocated and deployed by the VIM according to the updated descriptors 3 IOP Check Verify that the existing VNF instance(s) in NS1 are running and reachable through the management network 4 IOP Check Verify that the additional shared VNF instances(s) have been configured according to the descriptors by querying the VNFM 5 IOP Check Verify that the NFVO indicates the shared VNF instance(s) addition operation result as successful 6 IOP Check Verify that NS1 has been updated by running the end-to-end functional test that includes the additional shared VNF instance(s) 7 IOP Check Verify that NS2 instance was unaffected by the NS update operation by running the relevant end-to-end functional tests that include the shared VNF instance(s)	Sequence			Trigger a NS update adding one or more shared VNF instances	Nesuit
3 IOP Check Verify that the existing VNF instance(s) in NS1 are running and reachable through the management network 4 IOP Check Verify that the additional shared VNF instances(s) have been configured according to the descriptors by querying the VNFM 5 IOP Check Verify that the NFVO indicates the shared VNF instance(s) addition operation result as successful 6 IOP Check Verify that NS1 has been updated by running the end-to-end functional test that includes the additional shared VNF instance(s) 7 IOP Check Verify that NS2 instance was unaffected by the NS update operation by running the relevant end-to-end functional tests that include the shared VNF instance(s)		2	IOP Check	Verify that any additional resources associated to NS1 have been allocated and deployed by the VIM according to the	
4 IOP Check Verify that the additional shared VNF instances(s) have been configured according to the descriptors by querying the VNFM 5 IOP Check Verify that the NFVO indicates the shared VNF instance(s) addition operation result as successful 6 IOP Check Verify that NS1 has been updated by running the end-to-end functional test that includes the additional shared VNF instance(s) 7 IOP Check Verify that NS2 instance was unaffected by the NS update operation by running the relevant end-to-end functional tests that include the shared VNF instance(s)		3	IOP Check	Verify that the existing VNF instance(s) in NS1 are running and reachable through the management network	
addition operation result as successful 6 IOP Check Verify that NS1 has been updated by running the end-to-end functional test that includes the additional shared VNF instance(s) 7 IOP Check Verify that NS2 instance was unaffected by the NS update operation by running the relevant end-to-end functional tests that include the shared VNF instance(s)				configured according to the descriptors by querying the VNFM	
functional test that includes the additional shared VNF instance(s) 7 IOP Check Verify that NS2 instance was unaffected by the NS update operation by running the relevant end-to-end functional tests that include the shared VNF instance(s)				addition operation result as successful	
operation by running the relevant end-to-end functional tests that include the shared VNF instance(s)		6	IOP Check	functional test that includes the additional shared VNF instance(s)	
IOP Verdict		7	IOP Check	operation by running the relevant end-to-end functional tests	

7.7.3.6 Remove Shared VNF Instances from NS Instance

	Test Description: NS update removing shared VNF instances						
Identifier	TD_NFV_NSLCM_UPDATE_REM_SHVNF_001						
Test Purpose	To verify that one or more shared VNF instances can be removed from a running NS instance						
Configuration	SUT Configuration 2						
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]						
Applicability	NFVO/VNFM can generate "terminate compute resource" operation requests to the VIM (NFVO_CRM_TERMINATE or VNFM_CRM_TERMINATE)						
	 NFVO/VNFM can generate "terminate network resource" operation requests to the VIM (NFVO_NRM_TERMINATE or VNFM_NRM_TERMINATE) 						
	 NFVO/VNFM can generate "terminate storage resource" operation requests to the VIM (NFVO_SRM_TERMINATE or VNFM_SRM_TERMINATE) 						
	 VIM supports "terminate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM) 						
	 VIM supports "terminate network resource" operation requests from the NFVO/VNFM (VIM_NRM_TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM) 						
	 VIM supports "terminate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM) 						
Pre-test conditions	NS1 is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)						
	NS1 can function without the impacted VNF instances						
	Functional verification of the VNF instance(s) removal is possible (i.e. reduced capacity)						

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger a NS update removing one or more existing VNF instances from NS1 on the NFVO	
	2	IOP Check	Verify that any additional resources associated to NS1 have been removed by the VIM according to the updated descriptors	
	3	IOP Check	Verify that the existing VNF instance(s) in NS1 are still running and reachable through the management network	
	4	IOP Check	Verify that the previously shared VNF instances(s) have been configured according to the updated descriptors by querying the VNFM	
	5	IOP Check	Verify that the NFVO indicates the shared VNF instance(s) removal operation result as successful	
	6	IOP Check	Verify that NS1 has been updated by running the end-to-end functional test factoring the shared VNF instance(s) removal	
	7	IOP Check	Verify that NS2 instance was unaffected by the NS update operation by running the relevant end-to-end functional tests that include the previously shared VNF instance(s)	
IOP Verdict				_

7.7.3.7 Change VNF Deployment Flavour

Idontifion	Test Description: NS update changing VNF instances DF
Identifier	TD_NFV_NSLCM_UPDATE_VNF_DF_001
Test Purpose	To verify that the deployment flavour of one or more VNF instances in a NS instance can be
0	changed
Configuration	SUT Configuration 1
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]
Applicability	 NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE)
	 NFVO/VNFM can generate "allocate network resource" operation requests to the VIM (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE)
	 NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE)
	 VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM)
	 VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM)
	 VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM)
	 NFVO/VNFM can generate "terminate compute resource" operation requests to the VIM (NFVO_CRM_TERMINATE or VNFM_CRM_TERMINATE)
	 NFVO/VNFM can generate "terminate network resource" operation requests to the VIM (NFVO_NRM_TERMINATE or VNFM_NRM_TERMINATE)
	 NFVO/VNFM can generate "terminate storage resource" operation requests to the VIM (NFVO_SRM_TERMINATE or VNFM_SRM_TERMINATE)
	 VIM supports "terminate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM)
	 VIM supports "terminate network resource" operation requests from the NFVO/VNFM (VIM_NRM_TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM)
	VIM supports "terminate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM)
Pre-test condition	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_001)
	NS contains at least one VNF that accepts multiple deployment flavours
	The new deployment flavour is expected to impact a functional aspect of the VNF (i.e. scale or performance)

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger a NS update changing the deployment flavour (DF) of one or more VNF instances in a NS instance on NFVO	
	2	IOP Check	Verify that the virtualised resources have been updated by the VIM according to the new deployment flavour	
	3	IOP Check	Verify that the impacted VNF instance(s) are running and reachable through the management network	
	4	IOP Check	Verify that the NFVO indicates the VNF DF update operation result as successful	
	5	IOP Check	Verify that NS has been updated by running the end-to-end functional test factoring the new VNF DF	
IOP Verdict				

7.7.3.8 VNF Configuration update on runtime

		Test De	scription: VNF Configuration update on runtime			
Identifier		TO_NFV_NSLCM_UPDATE_VNF_CONFIG_001				
Test Purpose		To verify that the configuration of a VNF running in a NS can be successfully updated				
Configuration		SUT Configuration				
		SUT Configurati				
		SUT Configuration				
References			A 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.4]	5] and ETSI		
A mustic a bility :		GS NFV-IFA 013				
Applicability			generate "operate VNF" operation requests to the VNFM FLCM_OPERATE)			
			orts "operate VNF" operation requests from the NFVO FLCM_OPERATE)			
			M can generate "operate compute resource" operation requests to M_OPERATE or VNFM_CRM_OPERATE)	the VIM		
			ts "operate compute resource" operation requests from the NFVO/ _OPERATE_BY_NFVO or VIM_CRM_OPERATE_BY_VNFM)	VNFM		
		•	M can query compute resource information from the VIM (NFVO_0	CRM_QUERY or		
		VIM can send compute resource information to the NFVO (VIM_CRM_INFO_TO_NFVO or VIM_CRM_INFO_TO_VNFM) VIM_CRM_INFO_TO_VNFM)				
		VIM can send network resource information to the NFVO (VIM_NRM_INFO_TO_NFVO or VIM_NRM_INFO_TO_VNFM)				
		VIM can send storage resource information to the NFVO (VIM_SRM_INFO_TO_NFVO or VIM_SRM_INFO_TO_VNFM)				
		NFVO can query VNF information from the VNFM (NFVO_VNFLCM_QUERY)				
		VNFM supports VNF information queries by the NFVO (VNFM_VNFLCM_QUERY)				
		NFVO supports NS update operations for VNF configuration modification				
		VNFM supports VNF modification operations for configuration modification				
		 VNF suppor 	ts VNF configuration modification			
			<u> </u>			
Pre-test condit	ions	NS is instan	tiated (TD_NFV_NSLCM_INSTANTIATE_001)			
Test	Step	Туре	Description	Result		
Sequence	1	Stimulus	Trigger the NS update in NFVO with an operator request, specifying the new modified configuration to be applied to the given VNF(s)			
	2	IOP Check	Verify that the VNFM receives a VNF modification request for each new configuration to be applied to the given VNF(s)			
	3	IOP Check	Verify that the VNFM issue the modified configuration request to the relevant VNF(s) instance(s)			
	4	IOP Check	Verify that the modified configuration has been successfully applied in the given VNF(s)			
IOP Verdict						

7.7.4 NS Healing

7.7.4.1 Partial NS Healing with an Operator Action

1-1	1		cription: partial NS healing with an operator action				
Identifier		TD_NFV_NSLC					
Test Purpose			instances inside the NS can be successfully healed when partial N	IS healing (VNF			
		healing) is triggered by an operator action					
Configuration		SUT Configuration 1					
References			FA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.				
			8 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]				
Applicability			M can generate "allocate compute resource" operation requests to	the VIM			
		(NFVO_CR	M_ALLOCATE or VNFM_CRM_ALLOCATE)				
		 NFVO/VNF 	M can generate "allocate network resource" operation requests to	the VIM			
		(NFVO_NR	M_ALLOCATE or VNFM_NRM_ALLOCATE)				
		 NFVO/VNF 	M can generate "allocate storage resource" operation requests to	the VIM			
		(NFVO_SR	M_ALLOCATE or VNFM_SRM_ALLOCATE)				
			rts "allocate compute resource" operation requests from the NFVO	/VNFM			
		(VIM_CRM	_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM)				
			ts "allocate network resource" operation requests from the NFVO/	VNFM			
			_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM)				
İ			rts "allocate storage resource" operation requests from the NFVO/	√NFM			
İ			_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM)				
İ			M can generate "terminate compute resource" operation requests	to the VIM			
İ			M_TERMINATE or VNFM_CRM_TERMINATE)				
İ			M can generate "terminate network resource" operation requests t	to the VIM			
İ			M_TERMINATE or VNFM_NRM_TERMINATE)				
İ		NFVO/VNFM can generate "terminate storage resource" operation requests to the VIM					
		(NFVO_SRM_TERMINATE or VNFM_SRM_TERMINATE)					
		VIM supports "terminate compute resource" operation requests from the NFVO/VNFM (VIM ORM TERMINATE BY NEW ORM TERMINATE BY VIMINA					
İ		(VIM_CRM_TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM)					
İ		VIM supports "terminate network resource" operation requests from the NFVO/VNFM (VIM NIDM TERMINATE BY NEVO or VIM NIDM TERMINATE BY VNEW)					
İ		(VIM_NRM_TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM)					
İ		VIM supports "terminate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM)					
İ							
İ							
		 VNFM supp 	ports VNF healing requests from the NFVO (VNFM_VNFLCM_HEA	AL)			
Des test seed!							
Pre-test condi	tions		ntiated (TD_NFV_NSLCM_INSTANTIATE_001)				
İ			ailed state (for example a virtualised resource needed by one or m	ore VNF			
		instances ir	nside the NS has been terminated directly on the VIM)				
Test	Step	Type	Description	Result			
Sequence	1	Stimulus	Trigger partial NS healing (VNF healing) operation on the				
			NFVO with an operator action				
	2	IOP Check	Verify that any additional resources required for the healing				
			process have been allocated by the VIM according to the				
İ			descriptors				
1	3	IOP Check	Verify that other VNF instances(s) inside the NS are still				
ı			running and reachable via their management network				
ı	4	IOP Check	Verify that healed VNF instance(s) are running and reachable				
ı			via their management network				
ı	5	IOP Check	Verify that the healed VNF instances(s) have been configured				
ı			according to the descriptors by querying the VNFM				
ı	6	IOP Check	Verify that any failed resources have been terminated and				
			released by the VIM				
	7	IOP Check	Verify that the NFVO indicates the partial NS healing (VNF				
			healing) operation result as successful				
	0	IOP Check	Verify that NS has been successfully healed by running an				
	8	IOI CHECK					
IOP Verdict	0	101 Check	end-to-end functional test factoring the healed VNF instance(s)				

7.7.4.2 Complete NS Healing with an Operator Action

			iption: complete NS healing with an operator action			
Identifier		TD_NFV_NSLC				
Test Purpose		Verify that a NS can be successfully healed when complete NS healing is triggered by an				
		action				
Configuration		SUT Configurati				
References			FA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.			
			8 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]			
Applicability			M can generate "allocate compute resource" operation requests to M_ALLOCATE or VNFM_CRM_ALLOCATE)	the VIM		
		 NFVO/VNF 	M can generate "allocate network resource" operation requests to M_ALLOCATE or VNFM_NRM_ALLOCATE)	the VIM		
		 NFVO/VNF 	M can generate "allocate storage resource" operation requests to M_ALLOCATE or VNFM_SRM_ALLOCATE)	the VIM		
		 VIM suppor 	ts "allocate compute resource" operation requests from the NFVO	/VNFM		
		 VIM suppor 	_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM) ts "allocate network resource" operation requests from the NFVO/	VNFM		
			_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM) ts "allocate storage resource" operation requests from the NFVO/	√NFM		
			_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM)			
			M can generate "terminate compute resource" operation requests M_TERMINATE or VNFM_CRM_TERMINATE)	to the VIM		
		 NFVO/VNF 	M can generate "terminate network resource" operation requests t	to the VIM		
			M_TERMINATE or VNFM_NRM_TERMINATE) M can generate "terminate storage resource" operation requests t	o the VIM		
		(NFVO_SRM_TERMINATE or VNFM_SRM_TERMINATE)				
		VIM supports "terminate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM)				
		 VIM supports "terminate network resource" operation requests from the NFVO/VNFM (VIM_NRM_TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM) 				
		 VIM supports "terminate storage resource" operation requests from the NFVO/VNFM 				
		(VIM_SRM_	_TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM)		
Pre-test condit	tions	NO:- in-t-	GALLATO NEVANOLOM INOTANTIATE COA			
rie-lest condi	lions		ntiated (TD_NFV_NSLCM_INSTANTIATE_001)	–		
			ailed state (for example a virtualised resource needed by one or m	ore VNF		
		instances in	nside the NS has been terminated directly on the VIM)			
Tool	Ctor	T	Description	Decult		
Test Sequence	Step 1	Type Stimulus	Description Trigger complete NS healing operation on the NFVO with an	Result		
ocquence	'	Sumulus	operator action			
	2	IOP Check	Verify that resources allocated to the faulty NS instance have			
	-	10. 0.1001	been terminated by the VIM			
	3	IOP Check	Verify that resources required by the new NS instance have			
	1		been allocated by the VIM			
	4	IOP Check	Verify that VNF instance(s) inside the new NS instance are			
			running and reachable via their management network			
	5	IOP Check	Verify that the VNF instances(s) inside the new NS instance			
			have been configured according to the descriptors by querying the VNFM			
	6	IOP Check	Verify that the NFVO indicates the complete NS healing			
	1	I	operation result as successful			
		100.0:	N/ '' (I (NO) I I (U) I (U) I (U) I			
	7	IOP Check	Verify that NS has been successfully healed by running an end-to-end functional test			

7.7.5 NS Termination

7.7.5.1 Standalone NS Termination

		Te	est Description: standalone NS termination			
Identifier		TD_NFV_NSLCM_TERMINATE_001				
Test Purpose		To verify that a standalone NS instance can be successfully terminated				
Configuration		SUT Configurati				
References			FA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.	5], ETSI		
			8 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]			
Applicability			M can generate "terminate compute resource" operation requests M_TERMINATE or VNFM_CRM_TERMINATE)	to the VIM		
			M can generate "terminate network resource" operation requests to	o the VIM		
			M_TERMINATE or VNFM_NRM_TERMINATE)			
			M can generate "terminate storage resource" operation requests to M_TERMINATE or VNFM_SRM_TERMINATE)	the VIM		
			ts "terminate compute resource" operation requests from the NFV0 _TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM)			
		 VIM suppor 	ts "terminate network resource" operation requests from the NFVC _TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM))/VNFM		
		VIM supports "terminate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM)				
		VIM can send compute resource information to the NFVO (VIM_CRM_INFO_TO_NFVO or VIM_CRM_INFO_TO_VNFM)				
		VIM can send network resource information to the NFVO (VIM_NRM_INFO_TO_NFVO or VIM_NRM_INFO_TO_VNFM)				
		VIM can send storage resource information to the NFVO (VIM_SRM_INFO_TO_NFVO or				
		VIM_SRM_INFO_TO_VNFM)				
		NFVO can query VNF information from the VNFM (NFVO_VNFLCM_QUERY)				
		 VNFM supp 	orts VNF information queries from the NFVO (VNFM_VNFLCM_Q	(UERY)		
	_					
Pre-test condi	tions	 NS is instar 	tiated (TD_NFV_NSLCM_INSTANTIATE_001)			
Test	Step	Туре	Description	Result		
Sequence	1	Stimulus	Trigger the termination of the NS instance on the NFVO			
	2	IOP Check	Verify that all the VNF instance(s) have been terminated by querying the VNFM.			
	3	IOP Check	Verify that the resources allocated to the NS and VNF instance(s) have been released by the VIM			
	4	IOP Check	Verify that the NFVO indicates NS instance termination operation result as successful			
IOP Verdict						
<u> </u>						

7.7.5.2 Nested NS Termination

	Test Description: nested NS termination				
Identifier	TD_NFV_NSLCM_TERMINATE_NESTED_NS_001				
Test Purpose	To verify that a NS instance referencing an existing nested NS can be successfully terminated				
Configuration	SUT Configuration 3				
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI				
	GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]				

Ammiliants!!!	1				
Applicability			M can generate "terminate compute resource" operation requests M_TERMINATE or VNFM_CRM_TERMINATE)	to the VIM	
			M can generate "terminate network resource" operation requests t M_TERMINATE or VNFM_NRM_TERMINATE)	o the VIM	
			M can generate "terminate storage resource" operation requests to M_TERMINATE or VNFM_SRM_TERMINATE)	o the VIM	
			ts "terminate compute resource" operation requests from the NFV _TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM		
			ts "terminate network resource" operation requests from the NFVC _TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM		
		(VIM_SRM_ compute res	ts "terminate storage resource" operation requests from the NFVC _TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM) source information to the NFVO (VIM_CRM_INFO_TO_NFVO or INFO_TO_VNFM)		
			nd network resource information to the NFVO (VIM_NRM_INFO_TO_NFVO or INFO_TO_VNFM)		
			end storage resource information to the NFVO (VIM_SRM_INFO_TO_NFVO or I_INFO_TO_VNFM) In query VNF information from the VNFM (NFVO_VNFLCM_QUERY)		
		 NFVO can d 			
		 VNFM supp 	orts VNF information queries from the NFVO (VNFM_VNFLCM_C	UERY)	
			·	,	
Pre-test cond	litions	 NSD2 refere 	ences nested NSD1		
		 NS2 is insta 	ntiated (TD_NFV_NSLCM_INSTANTIATE_NEST_NS_001)		
			e can function without the impacted NS2 instance		
			o carrianent mineat are impacted from modified		
Test	Step	Туре	Description	Result	
Sequence	1	Stimulus	Trigger NS2 instance termination on the NFVO		
•	2	IOP Check	Verify that the resources that were allocated to the VNF		

Test	Step	Type	Description	Result
Sequence	1	Stimulus	Trigger NS2 instance termination on the NFVO	
	2	IOP Check	Verify that the resources that were allocated to the VNF	
			instance(s) inside NS2 have been released by the VIM	
	3	IOP Check	Verify that VNF instance(s) inside NS1 are still running and	
			reachable through the management network	
	4	IOP Check	Verify that all VNF instance(s) in NS2 have been terminated by	
			querying the VNFM	
	5	IOP Check	Verify that the NFVO indicates NS2 instance termination	
			operation result as successful	
	6	IOP Check	Verify that NS1 instance was unaffected by NS2 instance	
			termination by running an end-to-end functional test factoring in	
			the functionality of VNF instance(s) in NS1	
IOP Verdict				

7.7.5.3 Multi-Site NS Termination

Test Description: Multi-Site NS terminate				
Identifier	TD_NFV_NSLCM_TERMINATE_MULTISITE_001			
Test Purpose	To verify that a Multi-Site NS instance can be successfully terminated			
Configuration	SUT Configuration 4			
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI			
	GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]			

	,			
(NFVO_CRI NFVO/VNFN (NFVO_NRI NFVO/VNFN (NFVO_SRI VIM support (VIM_CRM_ VIM support (VIM_NRM_ VIM support (VIM_SRM_ VIM can ser VIM_CRM_I VIM can ser VIM_NRM_I VIM can ser VIM_NRM_I VIM can ser VIM_NRM_I NFVO can co			M can generate "terminate compute resource" operation requests M_TERMINATE or VNFM_CRM_TERMINATE) deployment in difficion of the compute resource operation requests to the compute resource operation requests to the compute resource operation requests to the compute resource operation requests to the compute resource operation requests from the NFVO or VIM_CRM_TERMINATE or VNFM, state "terminate compute resource" operation requests from the NFVO or VIM_CRM_TERMINATE_BY_VNFM, the "terminate network resource" operation requests from the NFVO or VIM_NRM_TERMINATE_BY_VNFM, the "terminate storage resource" operation requests from the NFVO or TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM, and compute resource information to the NFVO (VIM_CRM_INFO_TINFO_TO_VNFM) on the network resource information to the NFVO (VIM_NRM_INFO_TINFO_TO_VNFM) on the network resource information to the NFVO (VIM_SRM_INFO_TINFO_TO_VNFM) on the network resource information to the NFVO (VIM_SRM_INFO_TINFO_TO_VNFM) on the network resource information to the NFVO (VIM_SRM_INFO_TO_VNFM) on the network resource information to the NFVO (VIM_SRM_INFO_TO_INFO_TO_VNFM) on the network resource information to the NFVO (VIM_SRM_INFO_TO_INFO_TO_VNFM) on the network resource information to the NFVO (VIM_SRM_INFO_TO_INFO_TO_VNFM) on the network resource information to the NFVO (VIM_SRM_INFO_TO_INFO_TO_VNFM) on the network resource information to the NFVO (VIM_SRM_INFO_TO_INFO_TO_VNFM) on the network resource information to the NFVO (VIM_SRM_INFO_TO_INFO_TO_VNFM) on the network resource information from the NFVO (VIM_SRM_INFO_TO_INFO_TO_VNFM) on the network resource information from the NFVO (VIM_SRM_INFO_TO_INFO_TO_VNFM) on the network resource information from the NFVO (VIM_SRM_INFO_TO_INF	erent site o the VIMs erent site o the VIMs erent site o the VIMs erent site O/VNFM) O/VNFM TO_NFVO or TO_NFVO or
Pre-test cond	itions	Multi-Site N	IS is instantiated (TD_NFV_NSLCM_INSTANTIATE_MULTISITE_0	,
Pre-test cond				001)
	Step	Multi-Site N Type Stimulus	IS is instantiated (TD_NFV_NSLCM_INSTANTIATE_MULTISITE_0 Description Trigger the termination of the Multi-Site NS instance on the NFVO	,
Test	Step	Туре	Description Trigger the termination of the Multi-Site NS instance on the NFVO Verify that all the VNF instance(s) have been terminated in the given sites	001)
Test	Step 1	Type Stimulus	Description Trigger the termination of the Multi-Site NS instance on the NFVO Verify that all the VNF instance(s) have been terminated in the	001)
Test	Step 1	Type Stimulus IOP Check	Description Trigger the termination of the Multi-Site NS instance on the NFVO Verify that all the VNF instance(s) have been terminated in the given sites Verify that the resources allocated to the Multi-Site NS and VNF instance(s) have been released by the involved VIMs If applicable, verify that the NFPs have been deleted	001)
Test	Step	Type Stimulus IOP Check IOP Check	Description Trigger the termination of the Multi-Site NS instance on the NFVO Verify that all the VNF instance(s) have been terminated in the given sites Verify that the resources allocated to the Multi-Site NS and VNF instance(s) have been released by the involved VIMs	001)

7.7.5.4 SFC NS Termination

	Test Description: SFC NS termination
Identifier	TD_NFV_NSLCM_TERMINATE_SFC_001
Test Purpose	To verify that a NS instance can be successfully terminated
Configuration	SUT Configuration 1
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4], ETSI GS NFV-IFA 007 [i.5], ETSI GS NFV-IFA 008 [i.6], ETSI GS NFV-IFA 010 [i.7] and ETSI GS NFV-IFA 013 [i.9]
Applicability	 NFVO/VNFM can generate "terminate compute resource" operation requests to the VIM (NFVO_CRM_TERMINATE or VNFM_CRM_TERMINATE) NFVO/VNFM can generate "terminate network resource" operation requests to the VIM
	 (NFVO_NRM_TERMINATE or VNFM_NRM_TERMINATE) NFVO/VNFM can generate "terminate storage resource" operation requests to the VIM (NFVO_SRM_TERMINATE or VNFM_SRM_TERMINATE) VIM supports "terminate compute resource" operation requests from the NFVO/VNFM
	(VIM_CRM_TERMINATE_BY_NFVO or VIM_CRM_TERMINATE_BY_VNFM) VIM supports "terminate network resource" operation requests from the NFVO/VNFM (VIM_NRM_TERMINATE_BY_NFVO or VIM_NRM_TERMINATE_BY_VNFM)
	 VIM supports "terminate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_TERMINATE_BY_NFVO or VIM_SRM_TERMINATE_BY_VNFM) VIM can send compute resource information to the NFVO (VIM_CRM_INFO_TO_NFVO or
	VIM_CRM_INFO_TO_VNFM) • VIM can send network resource information to the NFVO (VIM_NRM_INFO_TO_NFVO or VIM_NRM_INFO_TO_VNFM)
	VIM can send storage resource information to the NFVO (VIM_SRM_INFO_TO_NFVO or VIM_SRM_INFO_TO_VNFM) NEVO. (A STATE OF A STATE OF
	 NFVO can query VNF information from the VNFM (NFVO_VNFLCM_QUERY) VNFM supports VNF information queries from the NFVO (VNFM_VNFLCM_QUERY)
Pre-test conditions	NS is instantiated (TD_NFV_NSLCM_INSTANTIATE_SFC_001)

Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger the termination of the NS instance on the NFVO	
	2	IOP Check	Verify that all the VNF instance(s) have been terminated by querying the VNFM	
	3	IOP Check	Verify that the resources allocated to the NS and VNF instance(s) have been released by the VIM	
	4	IOP Check	If applicable, verify that the NFPs have been deleted	
	5	IOP Check	Verify that the NFVO indicates NS instance termination operation result as successful	
IOP Verdict				

7.8 Virtualised Resource Management

7.8.1 Virtualised Compute Resource Management

7.8.1.1 Generic Virtualised Compute Resource Allocation

		Test Descrip	tion: generic virtualised compute resource allocation		
Identifier		TD_NFV_VRM_COMPUTE_ALLOCATE_001			
Test Purpose		To verify that virtualised compute resources can be successfully allocated.			
Configuration	1	SUT Configurati	on 1		
References		ETSI GS NFV-IF	FA 005 [i.3], ETSI GS NFV-IFA 006 [i.4]		
Applicability		NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE).			
		 VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM). 			
		VNFM_CRI	M can query compute resource information from the VIM (NFVO_IM_QUERY).		
			nd compute resource information to the NFVO (VIM_CRM_INFO_ INFO_TO_VNFM).	10_NF VO 01	
Pre-test cond	itions		sed compute resource is defined in the VNFD.		
		The required resources are available on the NFVI.			
		The software image repository is reachable by the VIM.			
Test	Step	Type	Description	Result	
Sequence	1	Stimulus	Trigger an "allocate compute resource" operation on the NFVO/VNFM		
	2	IOP Check	Verify that the requested virtualised compute resources have been allocated by the VIM according to the VNFD		
	3	IOP Check	Verify that virtualised compute resource allocation constraints have been met by querying the VIM		
IOP Verdict					
	•				

7.8.1.2 ARM Virtualised Compute Resource Allocation

Test Description: ARM virtualised compute resource allocation							
Identifier	TD_NFV_VRM_COMPUTE_ALLOCATE_002						
Test Purpose	To verify that ARM virtualised compute resources can be successfully allocated.						
Configuration	SUT Configuration 1						
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4]						
Applicability	 NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE). VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM). NFVO/VNFM can query compute resource information from the VIM (NFVO_CRM_QUERY or VNFM_CRM_QUERY). VIM can send compute resource information to the NFVO (VIM_CRM_INFO_TO_NFVO or VIM_CRM_INFO_TO_VNFM). 						

cpu_archite The require The softwa			d resources are available on the NFVI. e image repository is reachable by the VIM.	
			servers are available on the NFVI. One set of servers has the x8 the other set of servers has the ARM CPU architecture.	6 CPU
Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger an "allocate compute resource" operation on the NFVO/VNFM.	
	2	IOP Check	Verify that the virtualised compute resources have been allocated by the VIM according to the VNFD.	
	3	IOP Check	Verify that the virtualised compute resource is allocated on a server whose CPU architecture type is ARM by querying the	

7.8.1.3 x86 Virtualised Compute Resource Allocation

IOP Verdict

		Test Descr	ription: x86 virtualised compute resource allocation	
Identifier	-	TD_NFV_VRM_	COMPUTE_ALLOCATE_003	
Test Purpose	ŀ	To verify that x8	6 virtualised compute resources can be successfully allocated.	
Configuration	,	SUT Configurati	on 1	
References		ETSI GS NFV-IF	FA 005 [i.3], ETSI GS NFV-IFA 006 [i.4]	
Applicability		 NFVO/VNF 	M can generate "allocate compute resource" operation requests to M_ALLOCATE or VNFM_CRM_ALLOCATE).	the VIM
	1		ts "allocate compute resource" operation requests from the NFVO _ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM).	/VNFM
	1		M can query compute resource information from the VIM (NFVO_0 M_QUERY).	CRM_QUERY or
			nd compute resource information to the NFVO (VIM_CRM_INFO_ INFO_TO_VNFM).	TO_NFVO or
Pre-test condition	ons	The virtualised compute resource is defined in the VNFD, including a specific value "x86" for cpu_architecture.		
		The required resources are available on the NFVI.		
	Į,	The software image repository is reachable by the VIM.		
	1	Two sets of servers are available on the NFVI. One set of servers has the x86 CPU architecture, the other set of servers has the ARM CPU architecture.		
Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger an "allocate compute resource" operation on the NFVO/VNFM.	
	2	IOP Check	Verify that the virtualised compute resources have been allocated by the VIM according to the VNFD.	
	3	IOP Check	Verify that the virtualised compute resource is allocated on a server whose CPU architecture type is x86 by querying the VIM.	
			V IIVI.	

7.8.1.4 Anti-affinity Virtualised Compute Resource Allocation

	T I D I I I I I I I I I I I I I I I I I
	Test Description: Anti-affinity virtualised compute resource allocation
Identifier	TD_NFV_VRM_COMPUTE_ALLOCATE_004
Test Purpose	To verify that virtualised compute resources can be successfully allocated according to an anti-
-	affinity rule.
Configuration	SUT Configuration 4
References	ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4]

Applicability	NFVO/VNFM can generate "allocate compute resource" operation requests (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE). VIM supports "allocate compute resource" operation requests from the NFV0 (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM). NFVO/VNFM can query compute resource information from the VIM (NFVO_VNFM_CRM_QUERY). VIM can send compute resource information to the NFVO (VIM_CRM_INFO_VIM_CRM_INFO_TO_VNFM).			/VNFM CRM_QUERY or
Pre-test conditions		-	ed resources are available on the two NFVI nodes. re image repository is reachable by the VIM.	
Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger an "allocate compute resource" operation on the NFVO/VNFM, to create VNF_1.	
	2	IOP Check	Verify that the virtualised compute resources have been allocated by the VIM.	
	3	Stimulus	Trigger an "allocate compute resource" operation that includes an anti-affinity rule (with the scope as NFVI_NODE and AntiAffinityResourceList as VNF_1) on the NFVO/VNFM.	
	4	IOP Check	Verify that the virtualised compute resources have been allocated by the VIM.	
	5	IOP Check	Verify that two VNFs are allocated on different NFVI nodes by querying the VIM.	
IOP Verdict				

7.8.1.5 NUMA Virtualised Compute Resource Allocation

		Test Descrip	tion: NUMA virtualised compute resource allocation			
Identifier		TD_NFV_VRM_COMPUTE_ALLOCATE_005				
Test Purpose		To verify that virtualised compute resources with enablement of NUMA can be successfully				
		allocated.				
Configuration		SUT Configuration 1				
References		ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4]				
• NFVO/VNFM can generate "allocate compute resource" operation requests to the (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE).		the VIM				
			ts "allocate compute resource" operation requests from the NFVO. _ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM).	/VNFM		
			M can query compute resource information from the VIM (NFVO_0	CRM_QUERY or		
			nd compute resource information to the NFVO (VIM_CRM_INFO_INFO_TO_VNFM).	TO_NFVO or		
Pre-test conditi	ons	 The require 	d resources are available on the NFVI.			
		The software image repository is reachable by the VIM.				
		The virtualised compute resource is defined in the VNFD, including a specific value 'true' for				
		numa_enabled.				
		Two sets of servers are available on the NFVI. One set of servers supports NUMA, the other				
		set of serve	rs does not.			
		Ī				
1	Step	Туре	Description	Result		
Sequence	1	Stimulus	Trigger an "allocate compute resource" operation on the NFVO/VNFM.			
	2	2 IOP Check Verify that the virtualised compute resources have been allocated by the VIM according to the VNFD.				
	3	IOP Check	Verify that the virtualised compute resource is allocated on a server supporting NUMA by querying the VIM.			
IOP Verdict				_		

7.8.1.6 Compute Resource Allocation in Huge Page Memory Mode

	Te	st Description:	compute resource allocation in huge page memory mode.			
Identifier		TD_NFV_VRM_COMPUTE_ALLOCATE_006				
Test Purpose		To verify that virtualised compute resources can be successfully allocated in huge page memory				
		mode.				
Configuration	1	SUT Configurati	on 1			
References		ETSI GS NFV-IF	FA 005 [i.3], ETSI GS NFV-IFA 006 [i.4]			
Applicability			M can generate "allocate compute resource" operation requests to	the VIM		
			M_ALLOCATE or VNFM_CRM_ALLOCATE).			
			ts "allocate compute resource" operation requests from the NFVO	VNFM		
			_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM).	NOM OUEDV		
			M can query compute resource information from the VIM (NFVO_0 M_QUERY).	CRM_QUERY or		
		 VIM can send compute resource information to the NFVO (VIM_CRM_INFO_TO_NFVO or VIM_CRM_INFO_TO_VNFM). 				
		V IIVI_CKIVI_	INFO_TO_VINFIVI).			
Pre-test cond	itions	The virtualis	sed compute resource is defined in the VNFD that includes a mem	ory requirement		
			requiring that memoryPageSize is "1G".			
			The required resources are available on the NFVI.			
		•	re image repository is reachable by the VIM.			
			- mage represent the result of			
Test	Step	Туре	Description	Result		
Sequence	1	1 Stimulus Trigger an "allocate compute resource" operation on the NFVO/VNFM.				
	2					
			been allocated by the VIM according to the VNFD.			
3		IOP Check	Verify that virtualised compute resource has memory page size			
			of 1Gigabyte by querying the VIM.			
IOP Verdict						

7.8.1.7 Virtualised Compute Resource Using SR-IOV

Test Purpose To verify	/_VRM_COMPUTE_ALLOCATE_007 / that virtualised compute resources can use SR-IOV as the type of network interface.			
	that virtualised compute resources can use SR-IOV as the type of network interface.			
	SUT Configuration 1			
	8			
	S NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4]			
(NF	/O/VNFM can generate "allocate compute resource" operation requests to the VIM VO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE).			
(NF	/O/VNFM can generate "allocate network resource" operation requests to the VIM VO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE).			
	supports "allocate compute resource" operation requests from the NFVO/VNFM I_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM).			
	supports "allocate network resource" operation requests from the NFVO/VNFM // NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM).			
	/O/VNFM can query compute resource information from the VIM (NFVO_CRM_QUERY or FM_CRM_QUERY).			
	/O/VNFM can query network resource information from the VIM (NFVO_NRM_QUERY or FM_NRM_QUERY).			
	can send compute resource information to the NFVO (VIM_CRM_INFO_TO_NFVO or LCRM_INFO_TO_VNFM).			
	can send network resource information to the NFVO (VIM_NRM_INFO_TO_NFVO orNRM_INFO_TO_VNFM).			
Pre-test conditions • The	virtualised network resource is defined in the VNFD.			
	virtualised compute resource is defined in the VNFD, including a specific value 'SR-IOV' ypeVirtualNic.			
• The	required resources are available on the NFVI.			
	sets of servers are available on the NFVI. One set of servers has network interfaces porting SR-IOV, the other set of servers do not support SR-IOV.			
	software image repository is reachable by the VIM.			

Test	Step	Type	Description	Result
Sequence	1	1 Stimulus Trigger an "allocate network resource" operation and an "allocate compute resource" operation on the NFVO/VNFM.		
	2	IOP Check	Verify that the requested virtualised compute resources and virtualised network resources have been allocated by the VIM according to the VNFD.	
	3	IOP Check	Verify that the virtualised compute resource is allocated on a server whose network interfaces support SR-IOV by querying the VIM.	
IOP Verdict				

7.8.2 Virtualised Network Resource Management

7.8.2.1 Allocate an IPv6 Address to virtualised network interface via DHCP

	Test D	escription: alloc	cate an IPv6 address to virtualised network interface via DHCI)	
Identifier		TD_NFV_VRM_NETWORK_ALLOCATE_001			
Test Purpose		To verify that an IPv6 address can be allocated via DHCP.			
Configuration		SUT Configuration			
References					
Applicability		 ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4] NFVO/VNFM can generate "allocate compute resource" operation requests to the VIM (NFVO_CRM_ALLOCATE or VNFM_CRM_ALLOCATE). NFVO/VNFM can generate "allocate network resource" operation requests to the VIM (NFVO_NRM_ALLOCATE or VNFM_NRM_ALLOCATE). VIM supports "allocate compute resource" operation requests from the NFVO/VNFM (VIM_CRM_ALLOCATE_BY_NFVO or VIM_CRM_ALLOCATE_BY_VNFM). VIM supports "allocate network resource" operation requests from the NFVO/VNFM (VIM_NRM_ALLOCATE_BY_NFVO or VIM_NRM_ALLOCATE_BY_VNFM). NFVO/VNFM can query compute resource information from the VIM (NFVO_CRM_QUERY or VNFM_CRM_QUERY). NFVO/VNFM can query network resource information from the VIM (NFVO_NRM_QUERY or VNFM_NRM_QUERY). VIM can send compute resource information to the NFVO (VIM_CRM_INFO_TO_NFVO or VIM_CRM_INFO_TO_VNFM). VIM can send network resource information to the NFVO (VIM_NRM_INFO_TO_NFVO or VIM_CRM_INFO_TO_NFVO OR VIM_CRM_INFO_TO_NFVO OR VIM_CRM_INFO_TO_NFVO OR VIM_CRM_INFO_TO_NFVO OR VIM_CRM_INFO_TO_NFVO OR VIM_CRM_INFO_TO_NFVO OR VIM_CRM_INFO_TO_NFVO OR VIM_CRM_INFO_TO_NFVO OR VIM_CRM_INFO_TO_NFVO OR VIM_CRM_INFO_TO_NFVO OR			
		VIM_NRM_I	NFO_TO_VNFM).		
Pre-test conditions The virtualised network resource that is called NW1 that includes an L3Protocol ip_version is IPv6, the dhcpEnabled is TRUE and ipv6AddressMode is dhcpv6-defined in the VNFD. The virtualised compute resource associated with NW1 is defined in the VNFD.		6-stateful) is			
		• The required	d resources are available on the NFVI.		
		 The software 	e image repository is reachable by the VIM.		
			·		
Test	Step	Type	Description	Result	
Sequence	1	Stimulus	Trigger an "allocate network resource" operation and an "allocate compute resource" operation on the NFVO/VNFM		
	2	IOP Check	Verify that the requested virtualised compute resources and virtualised network resources have been allocated by the VIM according to the VNFD		
	3	IOP Check	Verify that the created virtualised network interface is allocated an IPv6 address by querying the VIM		
IOP Verdict					

7.8.3 Virtualised Storage Resource Management

7.8.3.1 Generic Virtualised Storage Resource Allocation

		Test Descrip	tion: generic virtualised storage resource allocation				
Identifier		TD_NFV_VRM_STORAGE_ALLOCATE_001					
Test Purpose		To verify that virtualised storage resources can be successfully allocated.					
Configuration		SUT Configuration	SUT Configuration 1				
References		ETSI GS NFV-IF	A 005 [i.3], ETSI GS NFV-IFA 006 [i.4]				
Applicability		 NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE). VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM). NFVO/VNFM can query storage resource information from the VIM (NFVO_SRM_QUERY or VNFM_SRM_QUERY). VIM can send storage resource information to the NFVO (VIM_SRM_INFO_TO_NFVO or VIM_SRM_INFO_TO_VNFM). 					
Pre-test condi	tions	The virtualis	ed storage resource is defined in the VNFD.				
		 The require 	d resources are available on the NFVI.				
	_						
Test	Step	Туре	Description	Result			
Sequence	1	Stimulus Trigger an "allocate storage resource" operation on the NFVO/VNFM					
	2	IOP Check	Verify that the requested virtualised storage resources have been allocated by the VIM according to the VNFD				
IOP Verdict							

7.8.3.2 RDMA Virtualised Storage Resource Allocation

	Test Descri	iption: RDMA virtualised storage resource allocation					
Identifier	TD_NFV_VRM	TD_NFV_VRM_STORAGE_ALLOCATE_002					
Test Purpose		To verify that RDMA virtualised storage resources can be successfully allocated.					
Configuration	SUT Configurat	SUT Configuration 1					
References		ETSI GS NFV-IFA 005 [i.3], ETSI GS NFV-IFA 006 [i.4]					
 NFVO/VNFM can generate "allocate storage resource" operation requests to the VIM (NFVO_SRM_ALLOCATE or VNFM_SRM_ALLOCATE). VIM supports "allocate storage resource" operation requests from the NFVO/VNFM (VIM_SRM_ALLOCATE_BY_NFVO or VIM_SRM_ALLOCATE_BY_VNFM). 							
	 NFVO/VNF 	I'M can query storage resource information from the VIM (NFVO_SIM_QUERY).	RM_QUERY or				
		and storage resource information to the NFVO (VIM_SRM_INFO_T_INFO_TO_VNFM).	O_NFVO or				
Pre-test conditions	 The virtualis 	sed storage resource is defined in the VNFD.					
	 The require 	The required resources are available on the NFVI.					
	Two sets of	f storage devices are available on the NFVI. One set of storage devother set of storage devices does not.	vices supports				
T			D				
Test Step		Description	Result				
Sequence 1	Stimulus	Trigger an "allocate storage resource" operation that includes attribute rdmaEnabled as 'TRUE' on the NFVO/VNFM					
2	IOP Check	Verify that the requested virtualised storage resources have been allocated by the VIM according to the VNFD					
3	IOP Check	Verify that the virtualised storage resource is allocated on a storage device supporting RDMA by querying the VIM					
IOP Verdict							

Annex A: Technical Report Card Sample

Test ID	XXXX
Tested By	XXXX
Date and Time	dd-mm-yyyy hh:mm

Functional Block	Product Name	Version	Product Description	Configuration
NFVO				
VNFM				
VIM				
NFVI				
EM				
VNF				

Functional Area	Test Description ID	SUT Configuration	IOP Verdict
Software Image Management	TD_NFV_SWIM_ADD_001	SUT Configuration 1	OK
Software Image Management	TD_NFV_SWIM_DELETE_001	SUT Configuration 1	OK
VNF Package Management	TD_NFV_VNFPM_ONBOARD _001	SUT Configuration 1	OK
VNF Package Management	TD_NFV_VNFPM_DELETE_001	SUT Configuration 1	OK
VNF Lifecycle Management	TD_NFV_VNFLCM_INSTANTIATE_VNF_001	SUT Configuration 1	OK
VNF Lifecycle Management	TD_NFV_VNFLCM_QUERY_VNF_001	SUT Configuration 1	OK
VNF Lifecycle Management	TD_NFV_VNFLCM_MODIFY_VNF_INFO_001	SUT Configuration 1	NOK
VNF Lifecycle Management	TD_NFV_VNFLCM_START_VNF_001	SUT Configuration 1	OK
VNF Lifecycle Management	TD_NFV_VNFLCM_STOP_VNF_001	SUT Configuration 1	NOK
VNF Lifecycle Management	TD_NFV_VNFLCM_HEAL_VNF_001	SUT Configuration 1	N/A
VNF Lifecycle Management	TD_NFV_VNFLCM_SCALE_OUT_VNF_001	SUT Configuration 1	NOK
VNF Lifecycle Management	TD_NFV_VNFLCM_SCALE_IN_VNF_001	SUT Configuration 1	NOK
VNF Lifecycle Management	TD_NFV_VNFLCM_TERMINATE_VNF_001	SUT Configuration 1	OK
NS Lifecycle Management	TD_NFV_NSLCM_INSTANTIATE_001	SUT Configuration 1	OK
NS Lifecycle Management	TD_NFV_NSLCM_SCALE_OUT_001	SUT Configuration 1	OK
NS Lifecycle Management	TD_NFV_NSLCM_SCALE_IN_001	SUT Configuration 1	NOK
NS Lifecycle Management	TD_NFV_NSLCM_TERMINATE_001	SUT Configuration 1	ОК

Annex B: Document Usage Process Diagram

This clause explains how the present document can be best utilized in a process diagram.

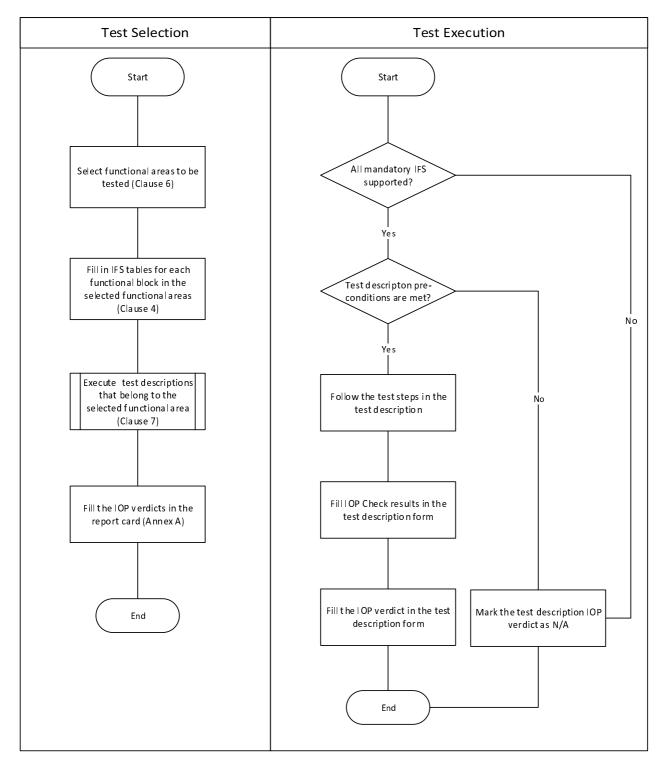


Figure B-1: Document usage process diagram

Annex C: Interoperability Features Statement (IFS) Diagram

C.0 General

This clause illustrates the IFS defined or VIM, VNFM, NFVO, and EM/VNF based on clause 4 of the present document in a diagram.

C.1 IFS for VIM

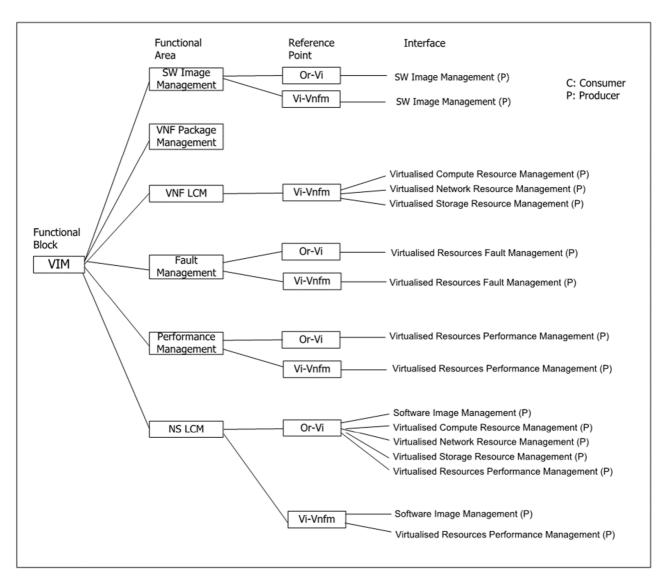


Figure C.1-1: IFS for VIM

C.2 IFS for VNFM

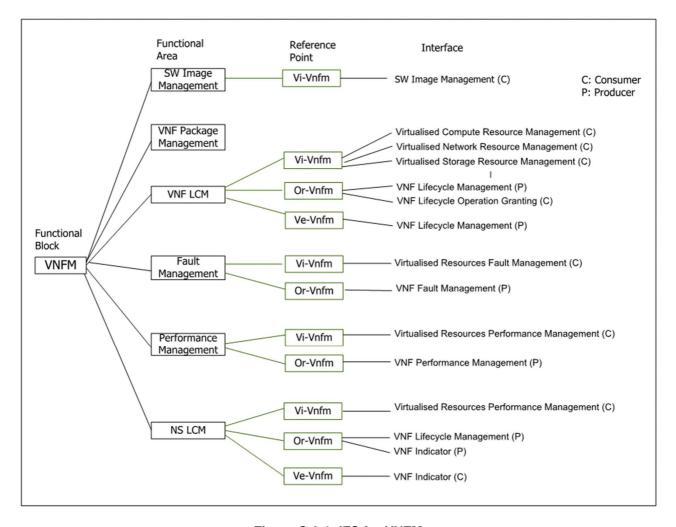


Figure C.2-1: IFS for VNFM

C.3 IFS for NFVO

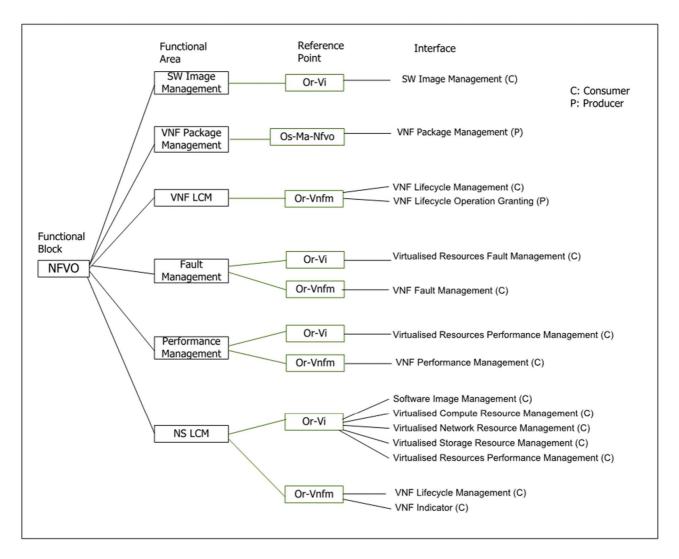


Figure C.3-1: IFS for NFVO

C.4 IFS for EM/VNF

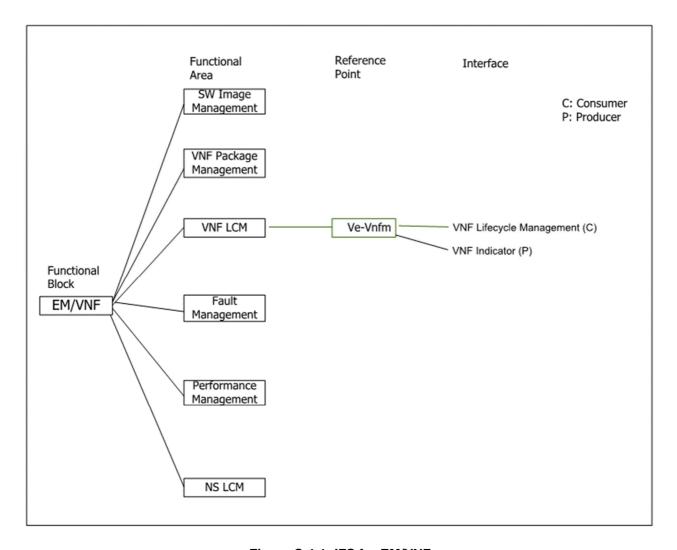


Figure C.4-1: IFS for EM/VNF

Annex D: Void

Annex E: Usage of test tools

Multiple types of test tools can be used in order to help complete and automate the interoperability tests. The test tools mostly fall into the following two categories:

- Test VNF: This is a lightweight, limited functionality VNF used to provide very basic functionality, or to just provide the presence of a VNF in order to complete a test.
- Test Driver: As discussed in [i.1], clause 4.2.7, this is a tool that can implement the test steps by communicating with the SUT via the defined test interfaces.

To help the consumer to understand how to use the Test VNF or the Test Driver, it is recommended that the vendor should identify a list of supported test cases.

History

Document history				
V3.1.1	May 2022	Publication		