2nd ETSI NFV Plugtests Sophia Antipolis, France 15th – 19th January 2018





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Foreword

This Test Plan has been produced by ETSI Centre for Testing and Interoperability during the preparation of the 2^{nd} ETSI NFV Plugtests.

Introduction

The present document describes the Interoperability Test Plan that was followed during the 2nd ETSI NFV Plugtests held from 15th to 19th January 2018 in Sophia Antipolis, France.

The Test Plan was developed following the interoperability testing methodology and guidelines defined by ETSI NFV in [TST002] and [TST007] and building on the learnings of the 1^{st} NFV Plugtests.

1 Scope

The goal of this document is to support the interoperability test sessions run during the 2nd NFV Plugtests. This event aimed at verifying early interoperability between different implementations of the main components of the NFV Architectural Framework, which included:

- Virtual Network Functions (VNF), possibly providing EM and/or specific VNF Manager (VNFM) functionality
- Management and Orchestration (MANO) solutions, providing pre-integrated NFV Orchestrator (NFVO) and generic VNFM functionality
- NFV Platforms providing pre-integrated NFV Infrastructure (NFVI) and Virtual Infrastructure Manager (VIM) functionality

This document includes several System Under Test Configurations to illustrate how Functions Under Test are combined to provide different end-to-end functionality

The NS compositions shown in this Test Plan are not mandated but provided as examples. The Test Descriptions have been written in such a way that also apply to more complex NS derived from the examples provided in the SUT Configurations.

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.

[NFV002]	ETSI GS NFV 002: "Network Functions Virtualisation (NFV); Architectural Framework".
[NFV003]	ETSI GS NFV 003: "Network Functions Virtualisation (NFV); Terminology for main concepts in NFV".
[IFA005]	ETSI GS NFV-IFA 005: "Network Functions Virtualisation (NFV); Management and Orchestration; Or-Vi reference point - Interface and Information Model Specification".
[IFA006]	ETSI GS NFV-IFA 006: "Network Functions Virtualisation (NFV); Management and Orchestration; Vi-Vnfm reference point - Interface and Information Model Specification".
[IFA007]	ETSI GS NFV-IFA 007: "Network Functions Virtualisation (NFV); Management and Orchestration; Or-Vnfm reference point - Interface and Information Model Specification".
[IFA008]	ETSI GS NFV-IFA 008: "Network Functions Virtualisation (NFV); Management and Orchestration; Ve-Vnfm reference point - Interface and Information Model Specification".
[IFA010]	ETSI GS NFV-IFA 010: "Network Functions Virtualisation (NFV); Management and Orchestration; Functional requirements specification".
[IFA013]	ETSI GS NFV-IFA 013: "Network Functions Virtualisation (NFV); Management and Orchestration; Os-Ma-Nfvo reference point - Interface and Information Model Specification".
[TST002]	ETSI GS NFV-TST 002: "Network Functions Virtualisation (NFV); Testing Methodology; Report on NFV Interoperability Testing Methodology"
[TST007]	ETSI GS NFV-TST 007: "Network Function Virtualization (NFV); Testing; Guidelines on Interoperability Testing for MANO"

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in [NFV003] and [TST002] apply.

3.2 Symbols

None

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in [NFV003] and [TST002] apply.

4 Test Suite Structure

4.1 Naming Convention

The Test Ids of this Test Plan have been created as per the following naming convention:

 $TEST\ ID = TD_<ROOT>_<GROUP>_<SUBGROUP>_<OPERATION>_<COMPLEMENT>_<NN>$

Where <ROOT> is NFV, and <NN> corresponds to a sequential number starting at 01.

The possible values for <GROUP>, <SUBGROUP>, <OPERATION> and <COMPLEMENT> are summarized in the table below:

<group></group>	<subgroup></subgroup>	<operation></operation>	<complement></complement>	Description
	SETUP	ONBOARD	VNF_PKG	Onboard VNF Package
	SETOT		NSD	Onboard Network Service Descriptor
		INSTANTIATE	-	Instantiate Network Service
			EPA	Instantiate Network Service with EPA
			OUT	Scale Out by adding VNF instance(s)
		SCALE	IN	Scale In by removing VNF instance(s)
		SCALE	OUT_EPA	Scale Out by adding VNF instance(s) with EPA
	NS_LCM		IN_EPA	Scale In by removing VNF instance(s) with EPA
		SCALE (VNF)	OUT_VNF	Scale Out by adding VNFC instance(s)
			IN_VNF	Scale In by removing VNFC instance(s)
			OUT_VNF_EPA	Scale Out by adding VNFC instance(s) with EPA
			IN_VNF_EPA	Scale In by removing VNFC instance(s) with EPA
BASE		TERMINATE	-	Terminate Network Service
	FM_VR	NOTIFY	-	Virtualised resource fault alarm notification propagation
		CLEAR	-	Virtualised resource fault clearance notification propagation
	ENA VALE	NOTIFY	-	VNF fault alarm notification propagation
	FM_VNF	CLEAR	-	VNF fault clearance notification propagation
		CREATE	NOTIFY	Virtualised resource performance metrics monitoring jobs with notifications
			THRESHOLD	Virtualised resource performance metrics monitoring jobs with thresholds
	PM_VR	DELETE	NOTIFY	Termination of virtualised resource performance metrics monitoring jobs with notifications
			THRESHOLD	Termination of virtualised resource performance metrics monitoring jobs with thresholds
	PM_VNF_VR	0.7.4	NOTIFY	VNF virtualised resource performance metrics monitoring jobs with notifications through VNFM
		CREATE	THRESHOLD	VNF virtualised resource performance metrics monitoring jobs with thresholds through VNFM

		DELETE	NOTIFY	Termination of virtualised resource performance metrics monitoring jobs with notifications through VNFM
		DELETE	THRESHOLD	Termination of virtualised resource performance metrics monitoring jobs with thresholds through VNFM
	PM_VNF_KPI	CREATE	NOTIFY	VNF indicator monitoring
	1 W_VW	DELETE	- NOTIFY	Deletion of VNF indicator monitoring
	TEARDOWN	DELETE	NSD	Deletion Network Service Descriptor
	TEARDOWN DELETE		VNF_PKG	Deletion VNF Package
		INSTANTIATE	-	Instantiate Multi Site Network Service
		SCALE	OUT	Multi Site Scale Out by adding VNF instance(s)
MULTISITE	SITE NS_LCM		IN	Multi Site Scale In by removing VNF instance(s)
WOLTIOITE		SCALE (VNF)	OUT_VNF	Multi Site Scale Out by adding VNFC instance(s)
			IN_VNF	Multi Site Scale In by removing VNFC instance(s)
	TERMINATE		-	Terminate Multi Site Network Service

4.2 Test Summary

4.2.1 BASE

4.2.1.0 SUT Configurations

The System Under Test Configurations applicable to this group are:

- SUT_BASE
- SUT_S-VNFM-D
- SUT_S-VNFM-I

See Clause 5 for further details

4.2.1.1 ONBOARD

Test Id	Test Purpose
TD_NFV_BASE_ONBOARD_VNF_PKG_001	To on-board a VNF Package
TD_NFV_BASE_ONBOARD_NSD_001	To onboard a NSD

4.2.1.2 INSTANTIATE

4.2.1.2.1 INSTANTIATE

Test Id	Test Purpose
TD_NFV_BASE_NS_LCM_INSTANTIATE_001	To verify that an NS can be successfully instantiated

4.2.1.2.2 INSTANTIATE - EPA

Test Id	Test Purpose
TID NEV DAGE NO LUM INOTANTIALE ERA UUT	To verify that an NS can be successfully instantiated with EPA requirements

4.2.1.3 SCALE NS

4.2.1.3.1 SCALE NS MANUALLY

Test Id	Test Purpose
TD_NFV_BASE_NS_LCM_SCALE_OUT_001	To verify that a NS can be successfully scaled out (by adding VNF instances) if triggered by a MANO operator
TD_NFV_BASE_NS_LCM_SCALE_IN_001	To verify that a NS can be successfully scaled in (by removing VNF instances) if triggered by a MANO operator

4.2.1.3.2 SCALE NS MANUALLY - EPA

Test Id	Test Purpose
TD_NFV_BASE_NS_LCM_SCALE_OUT_EPA_001	To verify that a NS can be successfully scaled out with EPA requirements (by adding VNF instances) if triggered automatically by a MANO operator
TD_NFV_BASE_NS_LCM_SCALE_IN_EPA_001	To verify that a NS can be successfully scaled in with EPA requirements (by removing VNF instances) if triggered automatically by a MANO operator

4.2.1.3.3 SCALE NS FROM VNF INDICATOR

Test Id	Test Purpose
	To verify that a NS can be successfully scaled out (by adding VNF instances) if triggered automatically in MANO by a VNF Indicator notification
TD_NFV_BASE_NS_LCM_SCALE_IN_002a	To verify that a NS can be successfully scaled in (by removing VNF instances) if triggered automatically in MANO by querying a VNF Indicator
TD_NFV_BASE_NS_LCM_SCALE_OUT_002b	To verify that a NS can be successfully scaled out (by adding VNF instances) if triggered automatically in MANO by a VNF Indicator notification
TD_NFV_BASE_NS_LCM_SCALE_IN_002b	To verify that a NS can be successfully scaled in (by removing VNF instances) if triggered automatically in MANO by querying a VNF Indicator

4.2.1.3.3 SCALE NS FROM VIM KPI

Test Id	Test Purpose
TD_NFV_BASE_NS_LCM_SCALE_OUT_003	To verify that a NS can be successfully scaled out (by adding VNF instances) if triggered automatically in MANO by a VIM KPI
TD_NFV_BASE_NS_LCM_SCALE_IN_003	To verify that a NS can be successfully scaled in (by removing VNF instances) if triggered automatically in MANO by a VIM KPI

4.2.1.3.4 SCALE NS FROM VNF REQUEST

Test Id	Test Purpose
TD_NFV_BASE_NS_LCM_SCALE_OUT_004	To verify that a NS can be successfully scaled out (by adding VNF instances) if triggered in MANO by a VNF/EM request
TD NEV BASE NO LOM SCALE IN 004	To verify that a NS can successfully scale in (by removing VNF instances) if triggered in MANO by a VNF/EM request

4.2.1.4 SCALE VNF

4.2.1.4.1 SCALE VNF MANUALLY

Test Id	Test Purpose
TD_NFV_BASE_NS_LCM_SCALE_OUT_VNF_001	To verify that a VNF in a NS can be successfully scaled out (by adding VNFC instances (VMs)) when triggered by a MANO operator
	To verify that a VNF in a NS can be successfully scaled in (by removing VNFC instances (VMs)) when triggered by a MANO operator

4.2.1.4.2 SCALE VNF MANUALLY - EPA

Test Id	Test Purpose
TD_NFV_BASE_NS_LCM_SCALE_OUT_VNF_EPA_001	To verify that a VNF in a NS can be successfully scaled out with EPA requirements (by adding VNFC instances (VMs)) when triggered by a MANO operator
TD_NFV_BASE_NS_LCM_SCALE_IN_VNF_EPA_001	To verify that a VNF in a NS can be successfully scaled in with EPA requirements (by removing VNFC instances (VMs)) when triggered by a MANO operator

4.2.1.4.3 SCALE VNF FROM VNF INDICATOR

Test Id	Test Purpose
TD_NFV_BASE_NS_LCM_SCALE_OUT_VNF_002a	To verify that a VNF in a NS can be successfully scaled out (by adding VNFC instances (VMs)) when triggered automatically in MANO by a VNF Indicator
TD_NFV_BASE_NS_LCM_SCALE_IN_VNF_002a	To verify that a VNF in a NS can be successfully scaled in (by removing VNFC instances (VMs)) when triggered automatically in MANO by a VNF Indicator
TD_NFV_BASE_NS_LCM_SCALE_OUT_VNF_002b	To verify that a VNF in a NS can be successfully scaled out (by adding VNFC instances (VMs)) when triggered automatically in MANO by a VNF Indicator

TD_NFV_BASE_NS_LCM_SCALE_IN_VNF_002b	To verify that a VNF in a NS can be successfully scaled in (by removing VNFC instances (VMs)) when triggered automatically in MANO by a VNF Indicator by guerying a VNF Indicator
	in MANO by a VNF Indicator by querying a VNF Indicator

4.2.1.4.4 SCALE VNF FROM VIM KPI

Test Id	Test Purpose
TD_NFV_BASE_NS_LCM_SCALE_OUT_VNF_003	To verify that a VNF in a NS can be successfully scaled out (by adding VNFC instances (VMs)) when triggered automatically in MANO by a VIM KPI
TD_NFV_BASE_NS_LCM_SCALE_IN_VNF_003	To verify that a VNF in a NS can be successfully scaled in (by removing VNFC instances (VMs)) when triggered automatically in MANO by a VIM KPI

4.2.1.4.5 SCALE VNF FROM VNF REQUEST

Test Id	Test Purpose
TD_NFV_BASE_NS_LCM_SCALE_OUT_VNF_004	To verify that a VNF in a NS can be successfully scaled out (by adding VNFC instances (VMs)) when triggered in MANO by a VNF/EM request
TD_NFV_BASE_NS_LCM_SCALE_IN_VNF_004	To verify that a VNF in a NS can be successfully scaled in (by removing VNFC instances (VMs)) when triggered in MANO by a VNF/EM request

4.2.1.5 UPDATE VNF

Test Id	Test Purpose
TD_NFV_BASE_NS_LCM_UPDATE_STOP_VNF_001	To verify that a VNF running in a NS can be successfully stopped by MANO
TD_NFV_BASE_NS_LCM_UPDATE_START_VNF_001	To verify that a stopped VNF in a NS can be successfully restarted by MANO

4.2.1.6 FAULT MANAGEMENT

4.2.1.6.1 FAULT MANAGEMENT - VR

Test Id	Test Purpose
TD_NFV_BASE_FM_VR_NOTIFY_001	To verify that a fault alarm notification propagates when a virtualised resource that is required for the NS network connectivity fails.
TD_NFV_BASE_FM_VR_CLEAR_001	To verify that a fault clearance notification propagates when a failed virtualised resource that is required for the NS network connectivity is recovered

4.2.1.6.2 FAULT MANAGEMENT - VNF

Test Id	Test Purpose
TD_NFV_BASE_FM_VNF_NOTIFY_001	To verify that a VNF fault alarm notification propagates via the VNFM when a VNF fault is triggered by a failed virtualised resource
	Verify that a VNF fault alarm clearance notification propagates via the VNFM to the MANO when a VNF fault is cleared by resolving a failed virtualised resource

4.2.1.7 PERFORMANCE MANAGEMENT

4.2.1.7.1 PERFORMANCE MANAGEMENT - VR

Test Id	Test Purpose
TD_NFV_BASE_PM_VR_CREATE_NOTIFY_001	To verify that the performance metrics of a virtualised resource that is required for a NS instance can be monitored using performance monitoring jobs and notifications
TD_NFV_BASE_PM_VR_CREATE_THRESHOLD_001	To verify that the performance metrics of a virtualised resource that is required for a NS instance can be monitored using performance monitoring jobs and thresholds
TD_NFV_BASE_PM_VR_DELETE_NOTIFY_001	To verify that the performance metrics of a virtualised resource that is required for a NS instance can be monitored using performance monitoring jobs and notifications
TD_NFV_BASE_PM_VR_DELETE_THRESHOLD_001	To verify that the performance metrics of a virtualised resource that is required for a NS instance can be monitored using performance monitoring jobs and thresholds

4.2.1.7.2 PERFORMANCE MANAGEMENT – VNF VR

Test Id	Test Purpose
TD_NFV_BASE_PM_VNF_VR_CREATE_NOTIFY_001	To verify that the performance metrics of a virtualised resource that is allocated to a VNF instance inside a NS instance can be monitored using VNFM performance monitoring jobs and notifications
TD_NFV_BASE_PM_VNF_VR_CREATE_THRESHOLD_001	To verify that the performance metrics of a virtualised resource that is allocated to a VNF instance inside a NS instance can be monitored using VNFM performance monitoring jobs and thresholds
TD_NFV_BASE_PM_VNF_VR_DELETE_NOTIFY_001	To 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 performance monitoring jobs on the VNFM
TD_NFV_BASE_PM_VNF_VR_DELETE_THRESHOLD_001	To verify that a performance monitoring threshold created for a virtualised resource that is allocated to a VNF instance inside a NS instance can be deleted on the VNFM

4.2.1.7.3 PERFORMANCE MANAGEMENT - VNF

Test Id	Test Purpose
TD_NFV_BASE_PM_VNF_KPI_CREATE_NOTIFY_001	To verify that a VNF indicator inside a NS instance can be monitored using subscriptions and notifications
TD_NFV_BASE_PM_VNF_KPI_DELETE_NOTIFY_001	To verify that the monitoring of a VNF indicator inside a NS instance can be stopped by deleting subscriptions

4.2.1.8 TERMINATE

est ld	Test Purpose
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TD_NFV_BASE_NS_LCM_TERMINATE_001	To verify that a NS can be successfully terminated
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4.2.1.9 DELETE

Test Id	Test Purpose
TD_NFV_BASE_TEARDOWN_DELETE_NSD_001	To delete a NSD
TD_NFV_BASE_TEARDOWN_DELETE_VNF_PKG_001	To delete a VNF Package

4.2.2 MULTI-SITE

4.2.2.0 SUT Configurations

The System Under Test Configurations applicable to this group are:

• SUT_MULTI-SITE

See Clause 5 for further details

4.2.2.1 INSTANTIATE

Test Id	Test Purpose
TD_NFV_MULTISITE_NS_LCM_INSTANTIATE_001	To verify that an NS can be successfully instantiated across different sites

4.2.2.2 SCALE NS MANUALLY

Test Id	Test Purpose
TD_NFV_MULTISITE_NS_LCM _SCALE_OUT_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_MULTISITE_NS_LCM_SCALE_IN_001	To verify that a multi-site NS can be successfully scaled in (by removing VNF instances) if triggered by a MANO operator

4.2.2.3 SCALE VNF MANUALLY

Test Id	Test Purpose
TD_NFV_MULTISITE_NS_LCM_SCALE_OUT_VNF_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_ MULTISITE_NS_LCM_SCALE_IN_VNF_001	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

4.2.2.4 TERMINATE

Test Id	Test Purpose
TD_NFV_MULTISITE_NS_LCM_TERMINATE_001	To verify that a a multi-site NS can be successfully terminated

5 System Under Test Configurations

5.1 SUT_BASE

This configuration involves:

- one MANO solution, providing NFVO and VNFM functionality
- one VIM&NFVI platform
- one or more VNFs, eventually providing also EM functionality,
- one or more Test VNFs, allowing to validate NS and VNF(s) functional behaviour

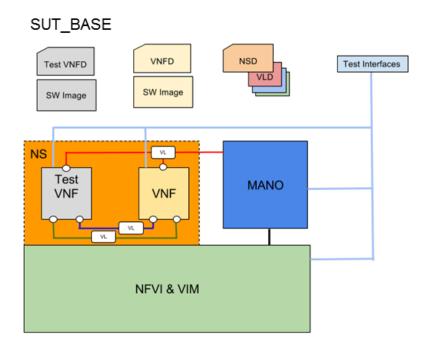


Figure 1. SUT_BASE

5.2 SUT_MULTI-SITE

This configuration involves:

- one MANO solution, providing NFVO and VNFM functionality
- two or more interconnected VIM&NFVI platforms
- one or more VNFs, eventually providing also EM functionality,
- one or more Test VNFs, allowing to validate NS and VNF(s) functional behaviour

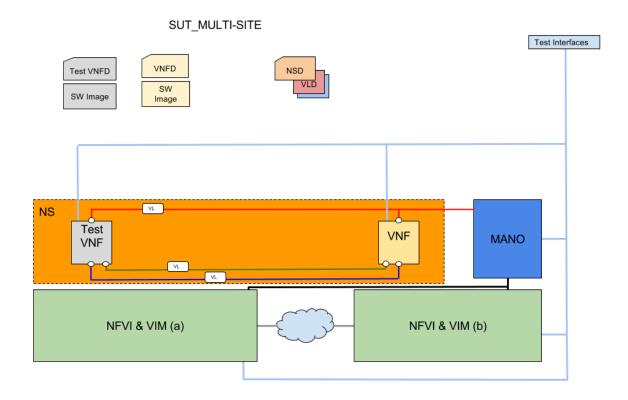


Figure 2. SUT_MULTI-SITE

5.3 SUT_S-VNFM-D

This configuration involves:

- one MANO solution, providing NFVO and VNFM functionality, and supporting interaction with external VNFM(s) in Direct Mode (*)
- one VIM&NFVI platform
- one or more VNFs, providing also VNFM (and eventually EM) functionality in Direct Mode (*)
- one or more Test VNFs, allowing to validate NS and VNF(s) functional behaviour
- (*) Direct Mode: VNF related resource management by VNFM

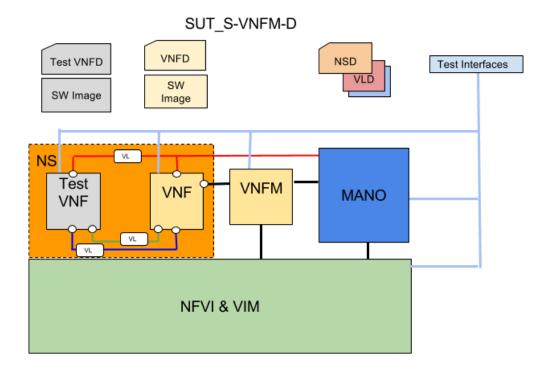


Figure 3. SUT_S-VNFM-D

5.4 SUT_S-VNFM-I

This configuration involves:

- one MANO solution, providing NFVO and VNFM functionality, and supporting interaction with external VNFM(s) in Indirect Mode (*)
- one VIM&NFVI platform
- one or more VNFs, providing also VNFM (and eventually EM) functionality in Indirect Mode (*)
- one or more Test VNFs, allowing to validate NS and VNF(s) functional behaviour
- (*) Indirect Mode: VNF related resource management by NFVO (in MANO)

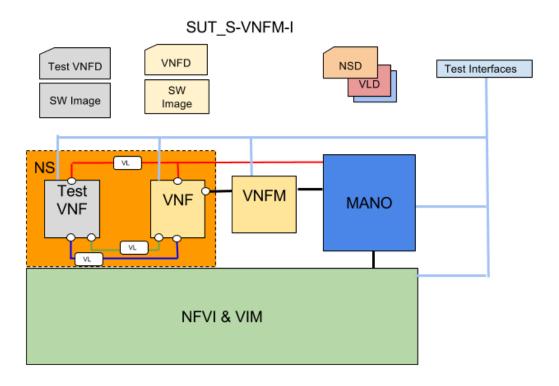


Figure 4. SUT_S-VNFM-I

ETSI Plugtests

6 Interoperability Test Descriptions

6.1 BASE

6.1.1 ONBOARD

6.1.1.1 TD_NFV_BASE_ONBOARD_VNF_PKG_001

			Interoperability Test Description		
Identifie	r	TD_NFV_E	BASE_ONBOARD_VNF_PKG_001		
Test Purpo	ose	To on-boar	o on-board a VNF Package		
Configurat	ion	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
Reference	es	ETSI GS N	FV-IFA013 V2.3.1 (clauses 7.7.2)		
Applicabil	lity				
Pre-test condition	-		age resides on a repository reachable by MANO age is complete and consumable by MANO		
Test Sequence	Step	Туре	Description	Result	
Coquonico	1	Stimulus	Trigger the on-boarding of VNF package on MANO		
	2	IOP Check	Verify the VNF Package information is correct and complete on MANO (i.e. displayor query and check release date, vendor info, manifest, VNFD, SW image meta-data, files contained in the VNF Package,)		
IOP Verdict					

6.1.1.2 TD_NFV_BASE_ONBOARD_NSD_001

			Interoperability Test Description	
Identifier	•	TD_NFV_E	BASE_ONBOARD_NSD_001	
Test Purpo	se	To onboard	d a NSD	
Configurati	on	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I		
Reference	s	ETSI GS N	FV-IFA013 V2.3.1 (clauses 7.2.2)	
Applicabili	ty			
Pre-test conditions			referenced VLD and VNFFGDs exist and can be reached and consumed by MAVNF Packages have been on-boarded (TD_NFV_BASE_ONBOARD_VNF_PK	
	Step	Туре	Description	Result
Test	1	Stimulus	Trigger the on-boarding of the NSD on MANO	
Sequence	2	IOP Check	Verify that NSD is successfully on-boarded in MANO (i.e query, display,)	
	3	IOP Check	Verify that all VLDs and VNFFGDs referenced in the NSD have been successfully on-boarded in MANO	
IOP Verdict				

6.1.2 INSTANTIATE

6.1.2.1 INSTANTIATE

6.1.2.1.1 TD_NFV_BASE_NS_LCM_INSTANTIATE_001

			Interoperability Test Description	
Identifie	•	TD_NFV_E	BASE_NS_LCM_INSTANTIATE_001	
Test Purpo	se	To verify the	hat an NS can be successfully instantiated	
Configurat	ion	SUT_BASE SUT_S-VNI SUT_S-VNI	FM-D	
Reference	es	ETSI GS NFV-IFA013 V2.3.1 (clause 7.3.3) ETSI GS NFV-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) ETSI GS NFV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) ETSI GS NFV-IFA007 V2.3.1 (clause 7.2.3)		
Applicabil	ity			
Pre-test condition		* The softw	o(s), VNFFGD(s) and VNF Package(s) have been on-boarded in MANO are image repository is reachable by the VIM red resources are available on the NFVI	
	ı			
	Step	Туре	Description	Result
	Step 1	Type Stimulus	Description Trigger NS instantiation in MANO	Result
	<u> </u>	Stimulus	<u>-</u>	Result
	1	Stimulus IOP Check	Trigger NS instantiation in MANO	Result
	1 2	Stimulus IOP Check IOP Check	Trigger NS instantiation in MANO Verify that the software images have been onboarded in the VIM Verify that the requested resources have been allocated by the VIM according	Result
Test Sequence	1 2 3	Stimulus IOP Check IOP Check IOP Check	Trigger NS instantiation in MANO Verify that the software images have been onboarded in the VIM Verify that the requested resources have been allocated by the VIM according to the descriptors Verify that the VNF(s) have been deployed according to the descriptors (VMs,	Result
	1 2 3 4	Stimulus IOP Check IOP Check IOP Check IOP Check	Trigger NS instantiation in MANO Verify that the software images have been onboarded in the VIM Verify that the requested resources have been allocated by the VIM according to the descriptors Verify that the VNF(s) have been deployed according to the descriptors (VMs, VLs, CPs) Verify that the VL and VNFFG instance(s) have been created according to the	Result
	1 2 3 4	Stimulus IOP Check IOP Check IOP Check IOP Check IOP Check	Trigger NS instantiation in MANO Verify that the software images have been onboarded in the VIM Verify that the requested resources have been allocated by the VIM according to the descriptors Verify that the VNF(s) have been deployed according to the descriptors (VMs, VLs, CPs) Verify that the VL and VNFFG instance(s) have been created according to the descriptors Verify that the VNF(s) are running and reachable through the management	Result
	1 2 3 4 5	Stimulus IOP Check IOP Check IOP Check IOP Check IOP Check IOP Check	Trigger NS instantiation in MANO Verify that the software images have been onboarded in the VIM Verify that the requested resources have been allocated by the VIM according to the descriptors Verify that the VNF(s) have been deployed according to the descriptors (VMs, VLs, CPs) Verify that the VL and VNFFG instance(s) have been created according to the descriptors Verify that the VNF(s) are running and reachable through the management network Verify that the VNF(s) have been configured according to VNFD(s) (i.e by	
	1 2 3 4 5 6	Stimulus IOP Check IOP Check IOP Check IOP Check IOP Check IOP Check	Trigger NS instantiation in MANO Verify that the software images have been onboarded in the VIM Verify that the requested resources have been allocated by the VIM according to the descriptors Verify that the VNF(s) have been deployed according to the descriptors (VMs, VLs, CPs) Verify that the VL and VNFFG instance(s) have been created according to the descriptors Verify that the VNF(s) are running and reachable through the management network Verify that the VNF(s) have been configured according to VNFD(s) (i.e by obtaining a result from the management interface) Verify that the VNF(s), VL(s) and VNFFG(s) have been connected according to	

6.1.2.2 INSTANTIATE - EPA

6.1.2.2.1 TD_NFV_BASE_NS_LCM_INSTANTIATE_EPA_001

			Interoperability Test Description	
Identifie	r	TD_NFV_B	ASE_NS_LCM_INSTANTIATE_EPA_001	
Test Purp	ose	To verify th	at an NS can be successfully instantiated with EPA requirements	
Configura	tion	SUT_BASE SUT_S-VNF SUT_S-VNF		
Referenc		ETSI GS NFV-IFA013 V2.3.1 (clause 7.3.3) ETSI GS NFV-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) ETSI GS NFV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) ETSI GS NFV-IFA007 V2.3.1 (clause 7.2.3)		
Applicabi	lity	* [IFS_NFV_MANO_28] MANO supports deploying VNFs with EPA requirements towards NFV * [IFS_NFV_VIM_NFVI_1] NFVI/VIM supports EPA attributes * [IFS_NFV_VNF_1] VNF requires EPA		s NFVI/VIM
Dro too	4	* NCD VI D	(a) MIFFOD(a) and MIF Deckage (a) hour bean an bearded in MANO	
Pre-tes condition		* On-boarde * The softwa	(s), VNFFGD(s) and VNF Package(s) have been on-boarded in MANO ed VNFD(s) include EPA requirements are image repository is reachable by the VIMs ed resources are available on the NFVIs	
	ı	I		
	Step		Description	Result
	1	Stimulus	Trigger NS instantiation in MANO	
	2	IOP Check	Verify that the software images have been onboarded in the VIM	
	3	IOP Check	Verify that the requested resources have been allocated by the VIM according to the descriptors	
	4	IOP Check	Verify that the VNF(s) have been deployed according to the descriptors (VMs, VLs, CPs)	
	5	IOP Check	Verify that the VL and VNFFG instance(s) have been created according to the descriptors	
Test Sequence	6	IOP Check	Verify that required EPA attributes have been configured as expected, e.g. checking configuration of: - SR-IOV - CPU pinning - NUMA topology - PCI passthrough	
	7	IOP Check	Verify that the VNF(s) are running and reachable through the management network	
	8	IOP Check	Verify that the VNF(s) have been configured according to VNFD(s) (i.e by obtaining a result from the management interface)	
	9	IOP Check	Verify that the VNF(s), VL(s) and VNFFG(s) have been connected according to the Descriptors	
	10	IOP Check	Verify that the NS is successfully instantiated by running the end-to-end functional test	
	11	IOP Check	Verify that the EPA requirements are matched in the NS instance and the running VNFs (e.g. performance check)	
IOP Verdict				

6.1.3 SCALE NS

6.1.3.1 SCALE NS MANUALLY

6.1.3.1.1 TD_NFV_BASE_NS_LCM_SCALE_OUT_001

			Interoperability Test Description		
Identifie	r	TD_NFV_B	BASE_NS_LCM_SCALE_OUT_001		
Test Purpo	ose	To verify that a NS can be successfully scaled out (by adding VNF install by a MANO operator		gered	
Configurat	ion	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
Referenc	es	ETSI GS NFV-IFA013 V2.3.1 (clause 7.3.4) ETSI GS NFV-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) ETSI GS NFV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) ETSI GS NFV-IFA007 V2.3.1 (clause 7.2.4)			
Applicabil	lity		_MANO_14] MANO supports scaling byadding/removing VNF instances _VNF_4] VNF can scale out/in by adding/removing VNF instances		
Pre-tes condition		* NS is inst	tantiated (TD_NFV_NS_LCM_INSTANTIATE_001)		
Test	Step	Туре	Description	Result	
Test Sequence	Step 1	Type Stimulus	Description Trigger NS scale out (by adding VNF instances) in MANO with an operator action	Result	
		Stimulus	Trigger NS scale out (by adding VNF instances) in MANO with an operator	Result	
	1	Stimulus IOP Check	Trigger NS scale out (by adding VNF instances) in MANO with an operator action Verify that the requested resources have been allocated by the VIM according	Result	
	1 2	Stimulus IOP Check IOP Check	Trigger NS scale out (by adding VNF instances) in MANO with an operator action Verify that the requested resources have been allocated by the VIM according to the descriptors	Result	
	2	Stimulus IOP Check IOP Check IOP Check	Trigger NS scale out (by adding VNF instances) in MANO with an operator action Verify that the requested resources have been allocated by the VIM according to the descriptors Verify that the additional VNF instance(s) have been deployed Verify that the additional VNF instances(s) are running and reachable from the	Result	
	1 2 3 4	Stimulus IOP Check IOP Check IOP Check IOP Check	Trigger NS scale out (by adding VNF instances) in MANO with an operator action Verify that the requested resources have been allocated by the VIM according to the descriptors Verify that the additional VNF instance(s) have been deployed Verify that the additional VNF instances(s) are running and reachable from the management network Verify that the additional VNF instances(s) have been configured according to		
	1 2 3 4	Stimulus IOP Check IOP Check IOP Check IOP Check	Trigger NS scale out (by adding VNF instances) in MANO with an operator action Verify that the requested resources have been allocated by the VIM according to the descriptors Verify that the additional VNF instance(s) have been deployed Verify that the additional VNF instances(s) are running and reachable from the management network Verify that the additional VNF instances(s) have been configured according to the descriptors (i.e. by geting a result through the management interface) Verify that the additional VNF instances(s), VL(s) and VNFFG(s) are connected		

6.1.3.1.2 TD_NFV_BASE_NS_LCM_SCALE_IN_001

			Interoperability Test Description				
Identifier		TD_NFV_E	TD_NFV_BASE_NS_LCM_SCALE_IN_001				
Test Purpo	se		hat a NS can be successfully scaled in (by removing VNF instances) if by a MANO operator				
Configurat	ion	SUT_BASE SUT_S-VNI SUT_S-VNI	FM-D				
Reference	es	ETSI GS NI ETSI GS N	FV-IFA013 V2.3.1 (clause 7.3.4) FV-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) FV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) FV-IFA007 V2.3.1 (clause 7.2.4)				
Applicabil	ity		*[IFS_NFV_MANO_14] MANO supports scaling by adding/removing VNF instances *[IFS_NFV_VNF_4] VNF can scale out/in by adding/removing VNF instances				
Pre-test condition			antiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) een scaled out by adding VNF instances				
Test				<u> </u>			
Sequence	Step	Type	Description	Result			
-	1	Stimulus	Trigger NS scale in (by removing VNFs) in MANO with an operator action				
	2	IOP Check	Verify that the impacted VNF instance(s) have been terminated				
	3	IOP Check	Verify that the impacted VNF related resources have been released by the VIM				
	4	IOP Check	Verify that the remaining VNF instances(s) are still running and reachable through the management network				
	5	IOP Check	Verify that the remaining VNF instances(s), VL(s) and VNFFG(s) are still connected according to the descriptors				
	6	IOP Check	Verify that NS has been scaled in by running the end-to-end functional test				
IOP Verdict							

6.1.3.2 SCALE NS MANUALLY – EPA

6.1.3.2.1 TD_NFV_BASE_NS_LCM_SCALE_OUT_EPA_001

			Interoperability Test Description				
Identifi	er	TD_NFV_B	ASE_NS_LCM_SCALE_OUT_EPA_001				
Test Purp	ose		at a NS can be successfully scaled out with EPA requirements (by adding VNF triggered automatically by a MANO operator				
Configura	ation	SUT_BASE SUT_S-VNI SUT_S-VNI	FM-D				
Reference		ETSI GS NF ETSI GS NF	FV-IFA013 V2.3.1 (clause 7.3.4) FV-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) FV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) FV-IFA007 V2.3.1 (clause 7.2.4)				
Applicab	ility	* [IFS_NFV] * [IFS_NFV]	_MANO_14] MANO supports scaling by adding/removing VNF instances _MANO_28] MANO supports deploying VNFs with EPA requirements towards N _VNF_4] VNF can scale out/in by adding/removing VNF instances _VNF_1] VNF requires EPA _VIM_NFVI_1] NFVI/VIM supports EPA attributes	FVI/VIM			
Pre-tes		* NS is inst	antiated (TD_NFV_NS_LCM_INSTANTIATE_EPA_001)				
conditio	ons						
Test Sequence	Step	Туре	Description	Result			
ocquence	1	Stimulus	Trigger NS scale out (by adding VNF instances) in MANO with an operator action				
	2	IOP Check	Verify that the scale out (by adding VNF(s)) procedure has been started in MANO				
	3	IOP Check	Verify that the requested resources have been allocated by the VIM according to the descriptors				
	4	IOP Check	Verify that required EPA attributes have been configured as expected, e.g. checking configuration of: - SR-IOV - CPU pinning - NUMA topology - PCI passthrough				
	5	IOP Check	Verify that the additional VNF instance(s) have been deployed				
	6	IOP Check	Verify that the additional VNF instances(s) are running and reachable from the management network				
	7	IOP Check	Verify that the additional VNF instances(s) have been configured according to the descriptors (i.e. by geting a result through the management interface)				
	8		Verify that the additional VNF instances(s), $VL(s)$ and $VNFFG(s)$ are connected according to the Descriptors				
	9		Verify that the EPA requirements are matched in the scaled VNF(s) (e.g. performance check)				
	10	IOP Check	Verify that NS has been scaled out by running the end-to-end functional test				
IOP Verdict							

6.1.3.2.2 TD_NFV_BASE_NS_LCM_SCALE_IN_EPA_001

			Interoperability Test Description				
Identifie	er	TD_NFV_BA	D_NFV_BASE_NS_LCM_SCALE_IN_EPA_001				
Test Purp	ose		at a NS can be successfully scaled in with EPA requirements (by removing triggered automatically by a MANO operator	ing VNF			
Configura	tion	SUT_BASE SUT_S-VNF SUT_S-VNF					
Reference		ETSI GS NF' ETSI GS NF'	V-IFA013 V2.3.1 (clause 7.3.4) V-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) V-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) V-IFA007 V2.3.1 (clause 7.2.4)				
Applicab	ility	* [IFS_NFV_ * [IFS_NFV_ * [IFS_NFV_	MANO_14] MANO supports scaling by adding/removing VNF instances MANO_28] MANO supports deploying VNFs with EPA requirements towards NVNF_4] VNF can scale out/in by adding/removing VNF instances VNF_1] VNF requires EPA VIM_NFVI_1] NFVI/VIM supports EPA attributes	NFVI/VIM			
Pre-tes			entiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_EPA_001) en scaled out by adding VNF instances with EPA requirements				
Test Sequence	Step	Туре	Description	Result			
•	- 4						
	1	Stimulus	Trigger NS scale in (by removing VNFs) in MANO with an operator action				
	2	Stimulus IOP Check					
		IOP Check	Verify that the scale in (by removing VNF(s)) procedure has been started in				
	2	IOP Check	Verify that the scale in (by removing VNF(s)) procedure has been started in MANO Verify that the impacted VNF instance(s) have been terminated				
	2	IOP Check IOP Check	Verify that the scale in (by removing VNF(s)) procedure has been started in MANO Verify that the impacted VNF instance(s) have been terminated Verify that EPA configurations of VNF(s) to be scaled-in have been deallocated/released as expected, e.g. checking de-configuration of: - SR-IOV - CPU pinning - NUMA topology - PCI passthrough				
	3 4	IOP Check IOP Check IOP Check IOP Check	Verify that the scale in (by removing VNF(s)) procedure has been started in MANO Verify that the impacted VNF instance(s) have been terminated Verify that EPA configurations of VNF(s) to be scaled-in have been deallocated/released as expected, e.g. checking de-configuration of: - SR-IOV - CPU pinning - NUMA topology - PCI passthrough Verify that the impacted VNF related resources have been released by the VIM Verify that the remaining VNF instances(s) are still running and reachable through the management network				
	3 4	IOP Check IOP Check IOP Check IOP Check IOP Check	Verify that the scale in (by removing VNF(s)) procedure has been started in MANO Verify that the impacted VNF instance(s) have been terminated Verify that EPA configurations of VNF(s) to be scaled-in have been deallocated/released as expected, e.g. checking de-configuration of: - SR-IOV - CPU pinning - NUMA topology - PCI passthrough Verify that the impacted VNF related resources have been released by the VIM Verify that the remaining VNF instances(s) are still running and reachable through the management network Verify that the remaining VNF instances(s), VL(s) and VNFFG(s) are still connected according to the descriptors				
	2 3 4 5 6	IOP Check IOP Check IOP Check IOP Check IOP Check	Verify that the scale in (by removing VNF(s)) procedure has been started in MANO Verify that the impacted VNF instance(s) have been terminated Verify that EPA configurations of VNF(s) to be scaled-in have been deallocated/released as expected, e.g. checking de-configuration of: - SR-IOV - CPU pinning - NUMA topology - PCI passthrough Verify that the impacted VNF related resources have been released by the VIM Verify that the remaining VNF instances(s) are still running and reachable through the management network Verify that the remaining VNF instances(s), VL(s) and VNFFG(s) are still connected according to the descriptors				

6.1.3.3 SCALE NS FROM VNF INDICATOR

6.1.3.3.1 TD_NFV_BASE_NS_LCM_SCALE_OUT_002a

			Interoperability Test Description				
Identifie	r	TD_NFV_B	_NFV_BASE_NS_LCM_SCALE_OUT_002a				
Test Purpo	ose	To verify that a NS can be successfully scaled out (by adding VNF instances) if trigge automatically in MANO by a VNF Indicator notification					
Configurat	ion	SUT_BASE SUT_S-VNI SUT_S-VNI	FM-D				
Reference	es	ETSI GS NI ETSI GS N	FV-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) FV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) FV-IFA007 V2.3.1 (clause 7.2.4) FV-IFA008 V2.3.1 (clause 6.3.3)				
Applicabil	ity	* [IFS_NFV_ VNF/EM * [IFS_NFV_ * [IFS_NFV_	_MANO_17] MANO supports receiving VNF indicators from VNF/EM _MANO_18] MANO supports automatic scaling triggered by VNF indicators from _MANO_14] MANO supports scaling by adding/removing VNF instances _VNF_4] VNF can scale out/in by adding/removing VNF instances _VNF_9] VNF can send indicators (KPIs) to MANO				
Pre-test condition		* MANO is a	antiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) configured to trigger SCALE OUT (by adding VNF instances) when a given VNF lue crosses a certain threshold				
Test Sequence	Step	Туре	Description	Result			
Coquemes	1	Stimulus	Trigger the VNF to send the targeted VNF indicator notification to MANO until the configured threshold is crossed				
	2	IOP Check	Verify that the scale out (by adding VNF instance(s)) procedure has been started in MANO				
	3	IOP Check	Verify that the requested resources have been allocated by the VIM according to the descriptors				
	4	IOP Check	Verify that the additional VNF instance(s) have been deployed				
	5	IOP Check	Verify that the additional VNF instance(s) are running and reachable through the management network				
	6	IOP Check	Verify that the additional VNF instances(s) have been configured according to VNFD (i.e by obtaining a result from the management interface)				
	7	IOP Check	Verify that the additional VNF instances(s), VL(s) and VNFFG(s) are connected according to the Descriptors				
	8	IOP Check	Verify that NS has been scaled out by running the end-to-end functional test				
IOP Verdict							

6.1.3.3.2 TD_NFV_BASE_NS_LCM_SCALE_IN_002a

			Interoperability Test Description					
Identifie	r	TD_NFV_B	D_NFV_BASE_NS_LCM_SCALE_IN_002a					
	To verify that a NS can be successfully scaled in (by removing VNF instances) if triggered automatically in MANO by a VNF Indicator notification							
Configurat	ion	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I						
References ETSI GS NFV-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) ETSI GS NFV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) ETSI GS NFV-IFA007 V2.3.1 (clause 7.2.4) ETSI GS NFV-IFA008 V2.3.1 (clause 6.3.3)								
Applicabil	lity	* [IFS_NFV_ VNF/EM * [IFS_NFV_ * [IFS_NFV_	MANO_17] MANO supports receiving VNF indicators from VNF/EM [MANO_18] MANO supports automatic scaling triggered by VNF indicators from MANO_14] MANO supports scaling by adding/removing VNF instances [VNF_4] VNF can scale out/in by adding/removing VNF instances [VNF_9] VNF can send indicators (KPIs) to MANO	om				
Pre-tes condition	-	* NS has be * MANO is o	antiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) een scaled out by adding VNF instances configured to trigger SCALE IN (by removing VNF instances) when a given VN ue crosses a certain threshold	F				
Test Sequence	Step	Туре	Description	Result				
Sequence	1	Stimulus	Trigger the VNF to send the targeted VNF indicator notification to MANO until the configured threshold is crossed					
	2	IOP Check	Verify that the scale in (by removing VNF instance(s)) procedure has been started in MANO					
	3	IOP Check	Verify that the impacted VNF instance(s) have been terminated					
	4	IOP Check	Verify that the impacted VNF related resources have been released by the VIM					
	5	IOP Check	Verify that the remaining VNF instances(s) are still running and reachable through the management network					
	6	IOP Check	Verify that the remaining VNF instances(s), VL(s) and VNFFG(s) are still connected according to the descriptors					
	7	IOP Check	Verify that NS has been scaled in by running the end-to-end functional test					
IOP Verdict								

6.1.3.3.3 TD_NFV_BASE_NS_LCM_SCALE_OUT_002b

			Interoperability Test Description			
Identifie	r	TD_NFV_B	ASE_NS_LCM_SCALE_OUT_002b			
Test Purpo		automatica	hat a NS can be successfully scaled out (by adding VNF instances) if trig ally in MANO by querying a VNF Indicator	gered		
Configurat	ion					
Reference						
Applicabil	lity	* [IFS_NFV_ VNF/EM * [IFS_NFV_ * [IFS_NFV_	_MANO_17] MANO supports receiving VNF indicators from VNF/EM _MANO_18] MANO supports automatic scaling triggered by VNF indicators from _MANO_14] MANO supports scaling by adding/removing VNF instances _VNF_4] VNF can scale out/in by adding/removing VNF instances _VNF_9] VNF can send indicators (KPIs) to MANO			
Pre-test condition		* MANO is	antiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) configured to trigger SCALE OUT (by adding VNF instances) when a given VNF lue crosses a certain threshold			
		indicator va	ide closses a certain uneshold			
Toot		Indicator va	lue crosses a certain unestiolu			
Test Sequence	Step	Туре	Description	Result		
	Step 1a					
	-	Туре	Description In the VNF, trigger the target VNF indicator to cross the configured auto-scaling			
	1a	Type Stimulus Stimulus	Description In the VNF, trigger the target VNF indicator to cross the configured auto-scaling threshold value for scale out operation			
	1a 1b	Type Stimulus Stimulus	Description In the VNF, trigger the target VNF indicator to cross the configured auto-scaling threshold value for scale out operation Trigger MANO to query the VNF for retrieving a new value of the VNF indicator Verify that the scale out (by adding VNF instance(s)) procedure has been			
	1a 1b 2	Type Stimulus Stimulus IOP Check	Description In the VNF, trigger the target VNF indicator to cross the configured auto-scaling threshold value for scale out operation Trigger MANO to query the VNF for retrieving a new value of the VNF indicator Verify that the scale out (by adding VNF instance(s)) procedure has been started in MANO Verify that the requested resources have been allocated by the VIM according			
	1a 1b 2	Type Stimulus Stimulus IOP Check IOP Check	Description In the VNF, trigger the target VNF indicator to cross the configured auto-scaling threshold value for scale out operation Trigger MANO to query the VNF for retrieving a new value of the VNF indicator Verify that the scale out (by adding VNF instance(s)) procedure has been started in MANO Verify that the requested resources have been allocated by the VIM according to the descriptors			
	1a 1b 2 3	Type Stimulus Stimulus IOP Check IOP Check IOP Check	Description In the VNF, trigger the target VNF indicator to cross the configured auto-scaling threshold value for scale out operation Trigger MANO to query the VNF for retrieving a new value of the VNF indicator Verify that the scale out (by adding VNF instance(s)) procedure has been started in MANO Verify that the requested resources have been allocated by the VIM according to the descriptors Verify that the additional VNF instance(s) have been deployed Verify that the additional VNF instance(s) are running and reachable through			
	1a 1b 2 3 4 5	Type Stimulus Stimulus IOP Check IOP Check IOP Check IOP Check IOP Check	Description In the VNF, trigger the target VNF indicator to cross the configured auto-scaling threshold value for scale out operation Trigger MANO to query the VNF for retrieving a new value of the VNF indicator Verify that the scale out (by adding VNF instance(s)) procedure has been started in MANO Verify that the requested resources have been allocated by the VIM according to the descriptors Verify that the additional VNF instance(s) have been deployed Verify that the additional VNF instance(s) are running and reachable through the management network Verify that the additional VNF instances(s) have been configured according to VNFD (i.e by obtaining a result from the management interface) Verify that the additional VNF instances(s), VL(s) and VNFFG(s) are connected according to the Descriptors			
	1a 1b 2 3 4 5	Type Stimulus Stimulus IOP Check IOP Check IOP Check IOP Check IOP Check	Description In the VNF, trigger the target VNF indicator to cross the configured auto-scaling threshold value for scale out operation Trigger MANO to query the VNF for retrieving a new value of the VNF indicator Verify that the scale out (by adding VNF instance(s)) procedure has been started in MANO Verify that the requested resources have been allocated by the VIM according to the descriptors Verify that the additional VNF instance(s) have been deployed Verify that the additional VNF instance(s) are running and reachable through the management network Verify that the additional VNF instances(s) have been configured according to VNFD (i.e by obtaining a result from the management interface) Verify that the additional VNF instances(s), VL(s) and VNFFG(s) are connected			

6.1.3.3.4 TD_NFV_BASE_NS_LCM_SCALE_IN_002b

			Interoperability Test Description				
Identifie	r	TD_NFV_B	ASE_NS_LCM_SCALE_IN_002b				
Test Purp	ose	To verify that a NS can be successfully scaled in (by removing VNF instances) if triggered automatically in MANO by querying a VNF Indicator					
Configura	tion	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I					
Referenc	es	ETSI GS NE ETSI GS NE	FV-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) FV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) FV-IFA007 V2.3.1 (clause 7.2.4) FV-IFA008 V2.3.1 (clause 6.3.4)				
Applicabi	lity	* [IFS_NFV_ VNF/EM * [IFS_NFV_ * [IFS_NFV_	MANO_17] MANO supports receiving VNF indicators from VNF/EM MANO_18] MANO supports automatic scaling triggered by VNF indicators from MANO_14] MANO supports scaling by adding/removing VNF instances VNF_4] VNF can scale out/in by adding/removing VNF instances VNF_9] VNF can send indicators (KPIs) to MANO	m			
Pre-tes condition		* NS has be * MANO is o	antiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) en scaled out by adding VNF instances configured to trigger SCALE IN (by removing VNF instances) when a given VNF ue crosses a certain threshold				
Test	Step	Туре	Description	Result			
Sequence	1a	Stimulus	In the VNF, trigger the target VNF indicator to cross the configured autoscaling threshold value for scale in operation	rtooun			
	1b	Stimulus	Trigger MANO to query the VNF for retrieving a new value of the VNF indicator				
	2	IOP Check	Verify that the scale in (by removing VNF instance(s)) procedure has been started in MANO				
	3	IOP Check	Verify that the impacted VNF instance(s) have been terminated				
	4	IOP Check	Verify that the impacted VNF related resources have been released by the VIM				
	5		Verify that the remaining VNF instances(s) are still running and reachable through the management network				
	6	IOP Check	Verify that the remaining VNF instances(s), VL(s) and VNFFG(s) are still connected according to the descriptors				
	7	IOP Check	Verify that NS has been scaled in by running the end-to-end functional test				
	'	IOI OHOOK					

6.1.3.4 SCALE NS FROM VIM KPI

6.1.3.4.1 TD_NFV_BASE_NS_LCM_SCALE_OUT_003

			Interoperability Test Description					
Identifie	r	TD_NFV_B	D_NFV_BASE_NS_LCM_SCALE_OUT_003					
Test Purpo	ose		o verify that a NS can be successfully scaled out (by adding VNF instances) if triggered utomatically in MANO by a VIM KPI					
Configurat	Configuration SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I							
Referenc	es	ETSI GS N	FV-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) FV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) FV-IFA007 V2.3.1 (clause 7.2.4)					
Applicabi	lity	* [IFS_NFV. * [IFS_NFV. * [IFS_NFV. MANO/VNF. * [IFS_NFV. MANO/VNF.	S_NFV_MANO_19] MANO supports receiving VMVNFC KPIs from VIM (S_NFV_MANO_20] MANO supports automatic scaling out/in triggered by KPIs from VIM (S_NFV_MANO_14] MANO supports scaling by adding/removing VNF instances (S_NFV_VNF_4] VNF can scale out/in by adding/removing VNF instances (S_NFV_VIM_NFVI_3] NFVI/VIM exposes VMVNFC virtual compute resource KPIs to NO/VNFM (S_NFV_VIM_NFVI_4] NFVI/VIM exposes VMVNFC virtual network resource KPIs to NO/VNFM (S_NFV_VIM_NFVI_5] NFVI/VIM exposes VMVNFC virtual storage resource KPIs to					
Pre-tes condition	-	* MANO is	antiated (TD_NFV_NS_LCM_INSTANTIATE_001) configured to trigger SCALE OUT (by adding VNF instances) when a given VIM I es a certain threshold	KPI				
Test	Step	Turno	Description	Result				
Sequence	1	Type Stimulus	Description Trigger the VIM to send the targeted KPI to MANO until the configured threshold is crossed	Result				
	2	IOP Check	Verify that the scale out (by adding VNF instance(s)) procedure has been started in MANO					
	2	IOP Check	Verify that the requested resources have been allocated by the VIM according to the descriptors					
	3	IOP Check	Verify that the additional VNF instance(s) have been deployed					
	4	IOP Check	Verify that the additional VNF instance(s) are running and reachable through the management network					
	5	IOP Check	Verify that the additional VNF instances(s) have been configured according to VNFD (i.e by obtaining a result from the management interface)					
	6	IOP Check	Verify that the additional VNF instances(s), VL(s) and VNFFG(s) are connected according to the Descriptors					
	7	IOP Check	Verify that NS has been scaled out by running the end-to-end functional test					
IOP Verdict								

6.1.3.4.2 TD_NFV_BASE_NS_LCM_SCALE_IN_003

			Interoperability Test Description			
Identifie	r	TD_NFV_B	ASE_NS_LCM_SCALE_IN_003			
Test Purpo	ose	•	nat a NS can be successfully scaled in (by removing VNF instances) if utomatically in MANO by a VIM KPI			
Configurat	ion	SUT_BASE SUT_S-VNF SUT_S-VNF				
Reference	es	ETSI GS NI	FV-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) FV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) FV-IFA007 V2.3.1 (clause 7.2.4)			
Applicabil	ity	* [IFS_NFV_ * [IFS_NFV_ * [IFS_NFV_ * [IFS_NFV_ MANO/VNFI * [IFS_NFV_ MANO/VNFI	* [IFS_NFV_MANO_19] MANO supports receiving VMVNFC KPIs from VIM * [IFS_NFV_MANO_20] MANO supports automatic scaling out/in triggered by KPIs from VIM * [IFS_NFV_MANO_14] MANO supports scaling by adding/removing VNF instances * [IFS_NFV_VNF_4] VNF can scale out/in by adding/removing VNF instances * [IFS_NFV_VIM_NFVI_3] NFVI/VIM exposes VMVNFC virtual compute resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_4] NFVI/VIM exposes VMVNFC virtual network resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_5] NFVI/VIM exposes VMVNFC virtual storage resource KPIs to MANO/VNFM			
Pre-test condition	-	* NS has be * MANO is o	antiated (TD_NFV_NS_LCM_INSTANTIATE_001) een scaled out by adding VNF instances configured to trigger SCALE IN (by removing VNF instances) when a given VIN es a certain threshold	1 KPI		
Test	Step	Туре	Description	Result		
Sequence	1	Stimulus	Trigger the VIM to send the targeted KPI to MANO until the configured threshold is crossed			
	2	IOP Check	Verify that the scale in (by removing VNF instance(s)) procedure has been started in MANO			
	3	IOP Check	Verify that the impacted VNF instance(s) have been terminated			
	4	IOP Check	Verify that the impacted VNF related resources have been released by the VIM			
	5		Verify that the remaining VNF instances(s) are still running and reachable through the management network			
	6		Verify that the remaining VNF instances(s), VL(s) and VNFFG(s) are still connected according to the descriptors			
	7	IOP Check	Verify that NS has been scaled in by running the end-to-end functional test			
IOP Verdict						

6.1.3.5 SCALE NS FROM VNF REQUEST

6.1.3.5.1 TD_NFV_BASE_NS_LCM_SCALE_OUT_004

			Interoperability Test Description	
Identifie	r	TD_NFV_B	ASE_NS_LCM_SCALE_OUT_004	
Test Purpose			hat a NS can be successfully scaled out (by adding VNF instances) if trig by a VNF/EM request	gered
Configurat	ion	SUT_BASE SUT_S-VN SUT_S-VN	FM-D	
Referenc	es	ETSI GS N ETSI GS N	FV-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) FV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) FV-IFA007 V2.3.1 (clause 7.2.4) FV-IFA008 V2.3.1 (clause 7.2.4)	
* [IFS_N * [IFS_N			_MANO_16] MANO supports scaling out/in request from VNF/EM _MANO_14] MANO supports scaling byadding/removing VNF instances _VNF_4] VNF can scale out/in by adding/removing VNF instances _VNF_8] VNF/EM can request scaling to MANO	
Pre-tes condition		* NS is inst	antiated (TD_NFV_NS_LCM_INSTANTIATE_001)	
_	1			
Test Sequence	Step		Description	Result
-	1	Stimulus	Trigger the VNF/EM to send a scale out (by adding VNFs) request to MANO	
	2	IOP Check	Verify that the scale out (by adding VNF instance(s)) procedure has been started in MANO	
	3	IOP Check	Verify that the requested resources have been allocated by the VIM according to the descriptors	
	4	IOP Check	Verify that the additional VNF instance(s) have been deployed	
	5	IOP Check	Verify that the additional VNF instance(s) are running and reachable through the management network	
	6	IOP Check	Verify that the additional VNF instances(s) have been configured according to VNFD (i.e by obtaining a result from the management interface)	
	7	IOP Check	Verify that the additional VNF instances(s), $VL(s)$ and $VNFFG(s)$ are connected according to the Descriptors	
	8	IOP Check	Verify that NS has been scaled out by running the end-to-end functional test	
IOP Verdict		1		

6.1.3.5.2 TD_NFV_BASE_NS_LCM_SCALE_IN_004

			Interoperability Test Description			
Identifie	r	TD_NFV_E	BASE_NS_LCM_SCALE_IN_004			
Test Purpose		•	hat a NS can successfully scale in (by removing VNF instances) if trigge a VNF/EM request	red in		
Configurati	ion	SUT_BASE SUT_S-VNI SUT_S-VNI	FM-D			
Reference	es	ETSI GS N ETSI GS N	IFV-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) IFV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) IFV-IFA007 V2.3.1 (clause 7.2.4) IFV-IFA008 V2.3.1 (clause 7.2.4)			
Applicabili	ity	* [IFS_NFV] * [IFS_NFV]	* [IFS_NFV_MANO_16] MANO supports scaling out/in request from VNF/EM * [IFS_NFV_MANO_14] MANO supports scaling by adding/removing VNF instances * [IFS_NFV_VNF_4] VNF can scale out/in by adding/removing VNF instances * [IFS_NFV_VNF_8] VNF/EM can request scaling to MANO			
Pre-test condition			antiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) een scaled out by adding VNF instances			
Test Sequence	Step	Туре	Description	Result		
Ocquence	1	Stimulus	Trigger the VNF/EM to send a scale out (by removing VNFs) request to MANO			
	2	IOP Check	Verify that the scale out (by removing VNF instance(s)) procedure has been started in MANO			
	3	IOP Check	Verify that the impacted VNF instance(s) have been terminated			
	4	IOP Check	Verify that the impacted VNF related resources have been released by the VIM			
	5	IOP Check	Verify that the remaining VNF instances(s) are still running and reachable through the management network			
	6		Verify that the remaining VNF instances(s), VL(s) and VNFFG(s) are still connected according to the descriptors			
	7	IOP Check	Verify that NS has been scaled in by running the end-to-end functional test			
IOP Verdict						

6.1.4 SCALE VNF

6.1.4.1 SCALE VNF MANUALLY

6.1.4.1.1 TD_NFV_BASE_NS_LCM_SCALE_OUT_VNF_001

			Interoperability Test Description		
Identifie	r	TD_NFV_B	ASE_NS_LCM_SCALE_OUT_VNF_001		
Test Purpo	ose	•	nat a VNF in a NS can be successfully scaled out (by adding VNFC insten triggered by a MANO operator	ances	
Configurat	ion	SUT_BASE SUT_S-VNF SUT_S-VNF			
Reference	es	ETSI GS NF ETSI GS NF	FV-IFA013 V2.3.1 (clause 7.3.4) FV-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) FV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) FV-IFA007 V2.3.1 (clause 7.2.4)		
Applicabil	ity		MANO_15] MANO supports scaling out/in by adding/removing VNFC instance: VNF_5] VNF can scale out/in by adding/removing VNFC instances	S	
Pre-test condition	-	* NS is insta	antiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001)		
Test Sequence	Step	Туре	Description	Result	
ooquonoo	1	Stimulus	Trigger NS scale out (by adding VNFC instances (VMs) to a VNF in the NS) in MANO with an operator action		
	2	IOP Check	Verify that the requested resources have been allocated by the VIM according to the descriptors		
	3	IOP Check	Verify that the additional VM(s) have been deployed (i.e by querying the VIM)		
	4	IOP Check	Verify that the additional VM(s) are running and are reachable through the management network		
	5		Verify that the additional VM(s) are connected to the VL(s) according to the descriptors		
	6	IOP Check	Verify that NS has been scaled out by running the end-to-end functional test		
IOP Verdict					

6.1.4.1.2 TD_NFV_BASE_NS_LCM_SCALE_IN_VNF_001

			Interoperability Test Description			
Identifie	r	TD_NFV_BA	SE_NS_LCM_SCALE_IN_VNF_001			
Test Purpo	ose	•	at a VNF in a NS can be successfully scaled in (by removing VNFC in n triggered by a MANO operator	stances		
Configurat	tion	SUT_BASE SUT_S-VNFI SUT_S-VNFI				
Referenc	es	ETSI GS NFV-IFA013 V2.3.1 (clause 7.3.4) ETSI GS NFV-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) ETSI GS NFV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) ETSI GS NFV-IFA007 V2.3.1 (clause 7.2.4)				
Applicabi	lity		*[IFS_NFV_MANO_15] MANO supports scaling out/in by adding/removing VNFC instances *[IFS_NFV_VNF_5] VNF can scale out/in by adding/removing VNFC instances			
Pre-tes condition	-	* NS has bee	en scaled out by adding VM			
Test						
	Step	Туре	Description	Result		
Sequence	Step 1	Type Stimulus	Description Trigger NS scale in (by removing VNFC instances (VMs)) in MANO with an operator action	Result		
			Trigger NS scale in (by removing VNFC instances (VMs)) in MANO with an operator action	Result		
	1	Stimulus	Trigger NS scale in (by removing VNFC instances (VMs)) in MANO with an operator action Verify that the impacted VM(s) have been terminated	Result		
	1 2	Stimulus IOP Check IOP Check	Trigger NS scale in (by removing VNFC instances (VMs)) in MANO with an operator action Verify that the impacted VM(s) have been terminated Verify that the impacted VM related resources have been released by the	Result		
	1 2 3	Stimulus IOP Check IOP Check	Trigger NS scale in (by removing VNFC instances (VMs)) in MANO with an operator action Verify that the impacted VM(s) have been terminated Verify that the impacted VM related resources have been released by the VIM Verify that the remaining VM(s) are still running and reachable through the management network	Result		
	1 2 3 4	Stimulus IOP Check IOP Check IOP Check IOP Check	Trigger NS scale in (by removing VNFC instances (VMs)) in MANO with an operator action Verify that the impacted VM(s) have been terminated Verify that the impacted VM related resources have been released by the VIM Verify that the remaining VM(s) are still running and reachable through the management network Verify that the remaining VM(s) and VL(s) are still connected according to	Result		

6.1.4.2 SCALE VNF MANUALLY – EPA

6.1.4.2.1 TD_NFV_BASE_NS_LCM_SCALE_OUT_VNF_EPA_001

			Interoperability Test Description					
Identifi	er	TD_NFV_B	NFV_BASE_NS_LCM_SCALE_OUT_VNF_EPA_001					
Test Purp	ose		nat a NS can be successfully scaled out with EPA requirements (by adding if triggered automatically by a MANO operator	g VNF				
Configura	ition	SUT_BASE SUT_S-VNI SUT_S-VNI	FM-D					
Reference		ETSI GS NF ETSI GS NF	FV-IFA013 V2.3.1 (clause 7.3.4) FV-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) FV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) FV-IFA007 V2.3.1 (clause 7.2.4)					
Applicab	ility	* [IFS_NFV] * [IFS_NFV]	_MANO_15] MANO supports scaling out/in by adding/removing VNFC instances _MANO_28] MANO supports deploying VNFs with EPA requirements towards N _VNF_5] VNF can scale out/in by adding/removing VNFC instances _VNF_1] VNF requires EPA _VIM_NFVI_1] NFVI/VIM supports EPA attributes					
Pre-tes condition		* NS is inst	antiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_EPA_001)					
Test	Step	Туре	Description	Result				
Sequence	1	Stimulus	Trigger NS scale out (by adding VNF instances) in MANO with an operator action	rtodut				
	2	IOP Check	Verify that the scale out (by adding VNF(s)) procedure has been started in MANO					
	3	IOP Check	Verify that the requested resources have been allocated by the VIM according to the descriptors					
	4	IOP Check	Verify that required EPA attributes have been configured as expected, e.g. checking configuration of: - SR-IOV - CPU pinning - NUMA topology - PCI passthrough					
	5	IOP Check	Verify that the additional VNF instance(s) have been deployed					
	6	IOP Check	Verify that the additional VNF instances(s) are running and reachable from the management network					
	7	IOP Check	Verify that the additional VNF instances(s) have been configured according to the descriptors (i.e. by geting a result through the management interface)					
	8		Verify that the additional VNF instances(s), $VL(s)$ and $VNFFG(s)$ are connected according to the Descriptors					
	9		Verify that the EPA requirements are matched in the scaled VNF(s) (e.g. performance check)					
	10	IOP Check	Verify that NS has been scaled out by running the end-to-end functional test					
IOP Verdict								

6.1.4.2.2 TD_NFV_BASE_NS_LCM_SCALE_IN_VNF_EPA_001

			Interoperability Test Description				
ldentifi	er	TD_NFV_B	TD_NFV_BASE_NS_LCM_SCALE_IN_VNF_EPA_001				
Test Purp	ose		hat a NS can be successfully scaled in with EPA requirements (by removing triggered automatically by a MANO operator	ing VNF			
Configura	ation	SUT_BASE SUT_S-VN SUT_S-VN	FM-D				
Reference		ETSI GS NE ETSI GS NE	FV-IFA013 V2.3.1 (clause 7.3.4) FV-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) FV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) FV-IFA007 V2.3.1 (clause 7.2.4)				
Applicab	ility	* [IFS_NFV] * [IFS_NFV] * [IFS_NFV]	_MANO_15] MANO supports scaling out/in by adding/removing VNFC instance _MANO_28] MANO supports deploying VNFs with EPA requirements towards N_VNF_5] VNF can scale out/in by adding/removing VNFC instances _VNF_1] VNF requires EPA _VIM_NFVI_1] NFVI/VIM supports EPA attributes	s NFVI/VIM			
Pre-tes			antiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_EPA_001) een scaled out by adding VNF instances with EPA requirements				
	ı						
Test Sequence			Description	Result			
	1	Stimulus	Trigger NS scale in (by removing VNFs) in MANO with an operator action				
	2	IOP Check	Verify that the scale in (by removing VNF(s)) procedure has been started in MANO				
	3	IOP Check	Verify that the impacted VNF instance(s) have been terminated				
	4	IOP Check	Verify that EPA configurations of VNF(s) to be scaled-in have been deallocated/released as expected, e.g. checking de-configuration of: - SR-IOV - CPU pinning - NUMA topology - PCI passthrough				
	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 through the management network				
	7		Verify that the remaining VNF instances(s), VL(s) and VNFFG(s) are still connected according to the descriptors				
	10	IOP Check	Verify that NS has been scaled in by running the end-to-end functional test				
IOP Verdict							

6.1.4.3 SCALE VNF FROM VNF INDICATOR

6.1.4.3.1 TD_NFV_BASE_NS_LCM_SCALE_OUT_VNF_002a

			Interoperability Test Description					
Identifie	r	TD_NFV_BA)_NFV_BASE_NS_LCM_SCALE_OUT_VNF_002a					
Test Purp		(VMs)) whe	o verify that a VNF in a NS can be successfully scaled out (by adding VNFC instances /Ms)) when triggered automatically in MANO by a VNF Indicator notification					
Configura	tion		UT_BASE UT_S-VNFM-D UT_S-VNFM-I					
Referenc	es	ETSI GS NF	V-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) V-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) V-IFA007 V2.3.1 (clause 7.2.4) V-IFA008 V2.3.1 (clause 6.3.3)					
Applicabi	lity	* [IFS_NFV_I VNF/EM * [IFS_NFV_I * [IFS_NFV_Y	WANO_17] MANO supports receiving VNF indicators from VNF/EM WANO_18] MANO supports automatic scaling triggered by VNF indicators from WANO_15] MANO supports scaling out/in by adding/removing VNFC instances VNF_5] VNF can scale out/in by adding/removing VNFC instances VNF_9] VNF can send indicators (KPIs) to MANO					
Pre-tes condition	-	* MANO is co	ntiated (TD_NFV_BASE:NS_LCM_INSTANTIATE_001) onfigured to trigger SCALE OUT (by adding VM(s)) when a given VNF Indicato rtain threshold	rvalue				
Test Sequence	Step	Туре	Description	Result				
Sequence	1	Stimulus	Trigger the VNF to send the targeted VNF indicator notification to MANO until the configured threshold is crossed					
	2	IOP Check	Verify that the scale out (by adding VNFC instances (VMs)) procedure has been started in MANO					
	2	IOP Check	Verify that the requested resources have been allocated by the VIM according to the descriptors					
	3	IOP Check	Verify that the additional VM(s) have been deployed (i.e by querying the VIM)					
	4	IOP Check	Verify that the additional VM(s) are running and are reachable through the management network					
	5	IOP Check	Verify that the additional VM(s) are connected to the VL(s) according to the descriptors					
	6	IOP Check	Verify that NS has been scaled out by running the end-to-end functional test					
IOP Verdict								

6.1.4.3.2 TD_NFV_BASE_NS_LCM_SCALE_IN_VNF_002a

			Interoperability Test Description					
Identifie	r	TD_NFV_NS	D_NFV_NS_LCM_BASE_SCALE_IN_VNF_002a					
Test Purpo	ose	To verify that a VNF in a NS can be successfully scaled in (by removing VNFC instance (VMs)) when triggered automatically in MANO by a VNF Indicator notification						
Configurat	tion	SUT_BASE SUT_S-VNFI SUT_S-VNFI						
Referenc	es	ETSI GS NF	V-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) V-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) V-IFA007 V2.3.1 (clause 7.2.4) V-IFA008 V2.3.1 (clause 6.3.3)					
Applicabi	* [IFS_NFV_ * [IFS_NFV_ VNF/EM * [IFS_NFV_ * [IFS_NFV_		WANO_17] MANO supports receiving VNF indicators from VNF/EM WANO_18] MANO supports automatic scaling triggered by VNF indicators from WANO_15] MANO supports scaling out/in by adding/removing VNFC instances VNF_5] VNF can scale out/in by adding/removing VNFC instances VNF_9] VNF can send indicators (KPIs) to MANO					
Pre-tes condition	-	* NS has bee * MANO is co	ntiated (TD_NFV_NS_LCM_INSTANTIATE_001) en scaled out by adding VM(s) onfigured to trigger SCALE IN (by removing VM(s)) when a given VNF Indicator rtain threshold	rvalue				
Test Sequence	Step	Туре	Description	Result				
Coquonoc	1	Stimulus	Trigger the VNF to send the targeted VNF indicator notification to MANO until the configured threshold is crossed					
	2	IOP Check	Verify that the scale out (by removing VNFC instances (VMs)) procedure has been started in MANO					
	3	IOP Check	Verify that the impacted VM(s) have been terminated					
	4	IOP Check	Verify that the impacted VM related resources have been released by the VIM					
	5	IOP Check	Verify that the remaining VM(s) are still running and reachable through the management network					
	6	IOP Check	Verify that the remaining VM(s) and VL(s) are still connected according to the descriptors					
	7	IOP Check	Verify that NS has been scaled in by running the end-to-end functional test					
IOP Verdict								

6.1.4.3.3 TD_NFV_BASE_NS_LCM_SCALE_OUT_VNF_002b

			Interoperability Test Description					
Identifie	r	TD_NFV_BA	D_NFV_BASE_NS_LCM_SCALE_OUT_VNF_002b					
Test Purpo		(VMs)) whe	at a VNF in a NS can be successfully scaled out (by adding VNFC instanting in the control of the	ances				
Configurat	tion	SUT_BASE SUT_S-VNF SUT_S-VNF						
Referenc	es	ETSI GS NF ETSI GS NF	V-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) V-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) V-IFA007 V2.3.1 (clause 7.2.4) V-IFA008 V2.3.1 (clause 6.3.4)					
Applicabil	lity	* [IFS_NFV_ VNF/EM * [IFS_NFV_ * [IFS_NFV_	[IFS_NFV_MANO_17] MANO supports receiving VNF indicators from VNF/EM [IFS_NFV_MANO_18] MANO supports automatic scaling triggered by VNF indicators from					
Pre-tes condition	-	* MANO is co	ntiated (TD_NFV_BASE:NS_LCM_INSTANTIATE_001) configured to trigger SCALE OUT (by adding VM(s)) when a given VNF Indicato ertain threshold	r value				
Test Sequence	Step	Туре	Description	Result				
	1a	Stimulus	In the VNF, trigger the target VNF indicator to cross the configured autoscaling threshold value for scale out operation					
	1b	Stimulus	Trigger MANO to query the VNF for retrieving a new value of the VNF indicator					
	2	IOP Check	Verify that the scale out (by adding VNFC instances (VMs)) procedure has been started in MANO					
	2	IOP Check	Verify that the requested resources have been allocated by the VIM according to the descriptors					
	3	IOP Check	Verify that the additional VM(s) have been deployed (i.e by querying the VIM)					
	4	IOP Check	Verify that the additional VM(s) are running and are reachable through the management network					
	5	IOP Check	Verify that the additional VM(s) are connected to the VL(s) according to the descriptors					
	6	IOP Check	Verify that NS has been scaled out by running the end-to-end functional test					
IOP Verdict								

6.1.4.3.2 TD_NFV_BASE_NS_LCM_SCALE_IN_VNF_002b

			Interoperability Test Description					
Identifie	r	TD_NFV_NS	LCM_BASE_SCALE_IN_VNF_002b					
Test Purpo	ose	(VMs)) whe	o verify that a VNF in a NS can be successfully scaled in (by removing VNFC instance (Ms)) when triggered automatically in MANO by querying a VNF Indicator					
Configurat	tion	SUT_BASE SUT_S-VNFI SUT_S-VNFI						
Referenc	es	ETSI GS NF ETSI GS NF	V-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) V-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2) V-IFA007 V2.3.1 (clause 7.2.4) V-IFA008 V2.3.1 (clause 6.3.4)					
Applicabi	lity	* [IFS_NFV_I VNF/EM * [IFS_NFV_I * [IFS_NFV_'	MANO_17] MANO supports receiving VNF indicators from VNF/EM MANO_18] MANO supports automatic scaling triggered by VNF indicators from VMANO_15] MANO supports scaling out/in by adding/removing VNFC instances VNF_5] VNF can scale out/in by adding/removing VNFC instances VNF_9] VNF can send indicators (KPIs) to MANO					
Pre-tes condition		* NS has bee * MANO is co	ntiated (TD_NFV_NS_LCM_INSTANTIATE_001) en scaled out by adding VM(s) onfigured to trigger SCALE IN (by removing VM(s)) when a given VNF Indicator rtain threshold	value				
Test	Step	Туре	Description	Result				
Sequence	1a	Stimulus	In the VNF, trigger the target VNF indicator to cross the configured autoscaling threshold value for scale in operation					
	1b	Stimulus	Trigger MANO to query the VNF for retrieving a new value of the VNF indicator					
	2	IOP Check	Verify that the scale out (by removing VNFC instances (VMs)) procedure has been started in MANO					
	3	IOP Check	Verify that the impacted VM(s) have been terminated					
	4	IOP Check	Verify that the impacted VM related resources have been released by the VIM					
	5	IOP Check	Verify that the remaining VM(s) are still running and reachable through the management network					
	6	IOP Check	Verify that the remaining VM(s) and VL(s) are still connected according to the descriptors					
	7	IOP Check	Verify that NS has been scaled in by running the end-to-end functional test					
IOP Verdict								

6.1.4.4 SCALE VNF FROM VIM KPI

6.1.4.4.1 TD_NFV_BASE_NS_LCM_SCALE_OUT_VNF_003

			Interoperability Test Description					
Identifie	r	TD_NFV_BA	_NFV_BASE_NS_LCM_SCALE_OUT_VNF_003					
Test Purpo	ose		verify that a VNF in a NS can be successfully scaled out (by adding VNFC instance) when triggered automatically in MANO by a VIM KPI					
Configurat	tion	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I						
Referenc	es	ETSI GS NF	V-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) V-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) V-IFA007 V2.3.1 (clause 7.2.4)					
Applicability		* [IFS_NFV_N * [IFS_NFV_N * [IFS_NFV_N * [IFS_NFV_N MANO/VNFM * [IFS_NFV_N MANO/VNFM	* [IFS_NFV_MANO_19] MANO supports receiving VMVNFC KPIs from VIM * [IFS_NFV_MANO_20] MANO supports automatic scaling out/in triggered by KPIs from VIM * [IFS_NFV_MANO_15] MANO supports scaling by adding/removing VNFC instances * [IFS_NFV_VNF_5] VNF can scale out/in by adding/removing VNFC instances * [IFS_NFV_VIM_NFVI_3] NFVI/VIM exposes VMVNFC virtual compute resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_4] NFVI/VIM exposes VMVNFC virtual network resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_5] NFVI/VIM exposes VMVNFC virtual storage resource KPIs to					
Pre-tes condition		* MANO is co	ntiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) onfigured to trigger SCALE OUT (by adding VM(s)) when a given VIM KPI valu rtain threshold	e				
Test Sequence	Step	Туре	Description	Result				
Coquenico	1	Stimulus	Trigger NS scale out (by adding VMs to a VNF inside the NS) in MANO with a VIM KPI					
	2	IOP Check	Verify that the scale out (by adding VNFC instances (VMs)) procedure has been started in MANO					
	3	IOP Check	Verify that the requested resources have been allocated by the VIM according to the descriptors					
	4	IOP Check	Verify that the additional VM(s) have been deployed (i.e by querying the VIM)					
	5	IOP Check	Verify that the additional VM(s) are running and are reachable through the management network					
	6	IOP Check	Verify that the additional VM(s) are connected to the VL(s) according to the descriptors					
	6	IOP Check	Verify that NS has been scaled out by running the end-to-end functional test	_				
IOP Verdict								

6.1.4.4.2 TD_NFV_BASE_NS_LCM_SCALE_IN_VNF_003

			Interoperability Test Description				
Identifie	r	TD_NFV_BAS	SE_NS_LCM_SCALE_IN_VNF_003				
Test Purpo	ose		o verify that a VNF in a NS can be successfully scaled in (by removing VNFC instant/Ms)) when triggered automatically in MANO by a VIM KPI				
Configurat	tion	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I					
Referenc	es	ETSI GS NF\	/-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) /-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) /-IFA007 V2.3.1 (clause 7.2.4)				
Applicability		* [IFS_NFV_MANO_19] MANO supports receiving VMVNFC KPIs from VIM * [IFS_NFV_MANO_20] MANO supports automatic scaling out/in triggered by KPIs from VIM * [IFS_NFV_MANO_15] MANO supports scaling by adding/removing VNFC instances * [IFS_NFV_VNF_5] VNF can scale out/in by adding/removing VNFC instances * [IFS_NFV_VIM_NFVI_3] NFVI/VIM exposes VMVNFC virtual compute resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_4] NFVI/VIM exposes VMVNFC virtual network resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_5] NFVI/VIM exposes VMVNFC virtual storage resource KPIs to MANO/VNFM					
Pre-tes condition		* NS has bee * MANO is co	ntiated (TD_NFV_NS_LCM_INSTANTIATE_001) n scaled out by adding VM(s) nfigured to trigger SCALE IN (by removing VM(s)) when a given VIM KPI valu rtain threshold	e			
Test	Step	Туре	Description	Result			
Sequence	1	Stimulus	Trigger NS scale in (by removing VNFC instances (VMs)) in MANO with a VIM KPI				
	2	IOP Check	Verify that the scale out (by removing VM(s)) procedure has been started in MANO				
	3	IOP Check	Verify that the impacted VM(s) have been terminated				
	4	IOP Check	Verify that the impacted VM related resources have been released by the VIM				
	5	IOP Check	Verify that the remaining VM(s) are still running and reachable through the management network				
	6	IOP Check	Verify that the remaining VM(s) and VL(s) are still connected according to the descriptors				
	7	IOP Check	Verify that NS has been scaled in by running the end-to-end functional test				
IOP Verdict	_						

6.1.4.5 SCALE VNF FROM VNF REQUEST

6.1.4.5.1 TD_NFV_BASE_NS_LCM_SCALE_OUT_VNF_004

			Interoperability Test Description				
Identifie	r	TD_NFV_BA	D_NFV_BASE_NS_LCM_SCALE_OUT_VNF_004				
Test Purpose			at a VNF in a NS can be successfully scaled out (by adding VNFC instanting triggered in MANO by a VNF/EM request	ances			
Configurat	ion	SUT_BASE SUT_S-VNFN SUT_S-VNFN					
Reference	es	ETSI GS NF	V-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) V-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) V-IFA007 V2.3.1 (clause 7.2.4) V-IFA008 V2.3.1 (clause 7.2.4)				
Applicabil	lity	* [IFS_NFV_N * [IFS_NFV_\	MANO_16] MANO supports scaling out/in request from VNF/EM MANO_15] MANO supports scaling by adding/removing VNFC instances /NF_5] VNF can scale out/in by adding/removing VNFC instances /NF_8] VNF/EM can request scaling to MANO				
Pre-test condition		* NS is instar	ntiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001)				
Test Sequence	Step	Туре	Description	Result			
Coquonico	1	Stimulus	Trigger the VNF/EM to send a scale out (by adding VNFC instances (VMs)) request to MANO				
	2	IOP Check	Verify that the scale out (by adding VM(s)) procedure has been started in MANO				
	3	IOP Check	Verify that the requested resources have been allocated by the VIM according to the descriptors				
	4	IOP Check	Verify that the additional VM(s) have been deployed (i.e by querying the VIM)				
	5	IOP Check	Verify that the additional VM(s) are running and are reachable through the management network	_			
	6	IOP Check	Verify that the additional VM(s) are connected to the VL(s) according to the descriptors				
	7	IOP Check	Verify that NS has been scaled out by running the end-to-end functional test				
IOP Verdict							

6.1.4.5.2 TD_NFV_BASE_NS_LCM_SCALE_IN_VNF_004

			Interoperability Test Description				
Identifie	r	TD_NFV_BA	NFV_BASE_NS_LCM_SCALE_IN_VNF_004				
Test Purpose		(VMs)) where	at a VNF in a NS can be successfully scaled in (by removing VNFC insomorphics) in triggered in MANO by a VNF/EM request	tances			
Configurat	ion	SUT_BASE SUT_S-VNFN SUT_S-VNFN					
Reference	es	ETSI GS NF	V-IFA005 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) V-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) V-IFA007 V2.3.1 (clause 7.2.4) V-IFA008 V2.3.1 (clause 7.2.4)				
Applicabil	lity	* [IFS_NFV_N * [IFS_NFV_\	MANO_16] MANO supports scaling out/in request from VNF/EM MANO_15] MANO supports scaling by adding/removing VNFC instances /NF_5] VNF can scale out/in by adding/removing VNFC instances /NF_8] VNF/EM can request scaling to MANO				
Pre-test condition	-		ntiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) en scaled out by adding VM(s)				
Test Sequence	Step	Туре	Description	Result			
Coquonico	1	Stimulus	Trigger the VNF/EM to send a scale in (by removing VNFC instances (VMs)) request to MANO				
	2	IOP Check	Verify that the scale out (by removing VM(s)) procedure has been started in MANO				
	3	IOP Check	Verify that the impacted VM(s) have been terminated				
	4	IOP Check	Verify that the impacted VM related resources have been released by the VIM				
	5	IOP Check	Verify that the remaining VM(s) are still running and reachable through the management network				
	6	IOP Check	Verify that the remaining VM(s) and VL(s) are still connected according to the descriptors				
	7	IOP Check	Verify that NS has been scaled in by running the end-to-end functional test				
IOP Verdict							

6.1.5 UPDATE VNF

6.1.5.1 TD_NFV_BASE_NS_LCM_UPDATE_STOP_VNF_001

			Interoperability Test Description			
Identifie	•	TD_NFV_BASE_NS_LCM_UPDATE_STOP_VNF_001				
Test Purpo	se	To verify the	at a VNF running in a NS can be successfully stopped by MANO			
Configurati	ion	SUT_BASE SUT_S-VNI SUT_S-VNI	FM-D			
Reference	es		FV-IFA013 V2.3.1 (clause 7.3.5) FV-IFA007 V2.3.1 (clause 7.2.11)			
Applicabili	ity		* [IFS_NFV_MANO_32] MANO can request to start/stop VNFs/VNFCs to the VIM * [IFS_NFV_VIM_NFVI_10] NFVI/VIM supports start/stop of VMs/VNFCs			
Pre-test condition			antiated (TD_NFV_NS_LCM_INSTANTIATE_001) unce(s) in the NS are running			
Test Sequence	Step	Туре	Description	Result		
Coquonico	1	Stimulus	Trigger the VNF(s) stop operation in MANO			
	2	IOP Check	Verify the VNF(s) state inside the NS is "Stopped" on MANO (query, display)			
	3	IOP Check	Verify that individual VM(s) inside the VNF(s) are shutdown on VIM (i.e query or displaythe state from VIM)			
IOP Verdict						

6.1.5.2 TD_NFV_BASE_NS_LCM_UPDATE_START_VNF_001

			Interoperability Test Description					
Identifier		TD_NFV_B	TD_NFV_BASE_NS_LCM_UPDATE_START_VNF_001					
Test Purpo	se	To verify that	at a stopped VNF in a NS can be successfully re-started by MANO					
Configurati	ion	SUT_BASE SUT_S-VNF SUT_S-VNF	FM-D					
Reference	es		FV-IFA013 V2.3.1 (clause 7.3.5) FV-IFA007 V2.3.1 (clause 7.2.11)					
Applicabili	ity		_MANO_32] MANO can request to start/stop VNFs/VNFCs to the VIM _VIM_NFVI_10] NFVI/VIM supports start/stop of VMs/VNFCs					
Pre-test condition			antiated (TD_NFV_NS_LCM_INSTANTIATE_001) inside the NS has been stopped (TD_NFV_NS_LCM_UPDATE_STOP_VNF_00)1)				
Test Sequence	Step	Туре	Description	Result				
Goquonos	1	Stimulus	Trigger the VNF(s) start operation in MANO					
	2	IOP Check	Verify the VNF(s) state inside the NS is "Started" on MANO (i.e query, display,)					
	3	IOP Check	Verify that individual VM(s) inside the VNF(s) are started on VIM (i.e query or displaythe state from VIM)					
	4		Verify that the NS is successfully recovered by running the end-to-end functional test					
IOP Verdict								

6.1.6 FAULT MANAGEMENT

6.1.6.1 FAULT MANAGEMENT – VR

6.1.6.1.1 TD_NFV_BASE_FM_VR_NOTIFY_001

			Interoperability Test Description					
Identifie	r	TD_NFV_B	D_NFV_BASE_FM_VR_NOTIFY_001					
Test Purpo			at a fault alarm notification propagates when a virtualised resource that is require vork connectivity fails.	d for				
Configurat	ion	SUT_BASE SUT_S-VNI SUT_S-VNI	FM-D					
Reference	es		FV-IFA005 V2.3.1 (clauses 5.3.10, 7.6.2, 8.6.2) FV-IFA013 V2.3.1 (clauses 5.3.5, 7.6.3, 8.5.2)					
Applicabil	ity		[IFS_NFV_MANO_23] MANO supports receiving VMVNFC faults/alarms from VIM [IFS_NFV_VIM_NFVI_6] NFVI/VIM exposes VMVNFC faults/alarms to MANO/VNFM					
Pre-test condition	-	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * MANO is subscribed to virtualised resources fault alarms on the VIM						
	Step	Туре	Description	Result				
	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					
Test Sequence	3	IOP Check	Verify that a NS fault alarm has been created on the MANO by querying the list of NS fault alarms					
IOP Verdict								

6.1.6.1.2 TD_NFV_BASE_FM_VR_CLEAR_001

			Interoperability Test Description			
Identifie	r	TD_NFV_BASE_FM_VR_CLEAR_001				
Test Purpo	ose	,	a fault clearance notification propagates when a failed virtualised resource that is the NS network connectivity is recovered			
Configurat	ion	SUT_BASE SUT_S-VN SUT_S-VN	FM-D			
Referenc	es		FV-IFA005 V2.3.1 (clauses 5.3.10, 7.6.2, 8.6.3) FV-IFA013 V2.3.1 (clauses 5.3.5, 7.6.3, 8.5.3)			
Applicabi	lity		_MANO_23] MANO supports receiving VM/VNFC faults/alarms from VIM _VIM_NFVI_6] NFVI/VIM exposes VM/VNFC faults/alarms to MANO/VNFM			
Pre-tes condition	-	* MANO is : * NS fault a	antiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) subscribed to virtualised resources fault alarms on the VIM larm is created on the NFVO by failing a virtualised resource that is required for th r (TD_NFV_BASE_FM_VR_NOTIFY_001)	ne NS		
	Step	Туре	Description	Result		
	1	Stimulus	Trigger a fault on a virtualised resource that is required for the NS instance connectivity on the NFVI (e.g. reconnect of the NIC allocated to a network resource)			
	2	IOP Check	Verify that the correspondant virtualised resource fault alarm has been cleared on the VIM by querying the list of virtualised resource fault alarms			
Test Sequence	3	IOP Check	Verify that the relevant NS fault alarm has been cleared on the MANO by querying the list of NS fault alarms			
IOP Verdict						

6.1.6.2 FAULT MANAGEMENT – VNF

6.1.6.2.1 TD_NFV_BASE_FM_VNF_NOTIFY_001

			Interoperability Test Description				
ldentifi	er	TD_NFV_B	_NFV_BASE_FM_VNF_NOTIFY_001				
Test Purp	ose	,	at a VNF fault alarm notification propagates via the VNFM when a VNF fault is triggulatised resource	gered by			
Configura	ition	SUT_S-VNI SUT_S-VNI					
Reference	ces	ETSI GS N	FV-IFA006 V2.3.1 (clauses 5.3.9, 7.6.3, 8.6.2) FV-IFA007 V2.3.1 (clauses 5.3.7, 6.4.6, 7.5.3, 8.4.7) FV-IFA013 V2.3.1 (clauses 5.3.5, 7.6.3, 8.5.2)				
Applicab	ility	* [IFS_NFV] * [IFS_NFV]	_MANO_24] MANO supports receiving VNF faults/alarms from external VNFM _VNFM_16] VNFM supports receiving VMVNFC faults/alarms from VIM _VNFM_19] VNFM exposes VNF faults/alarms towards MANO _VIM_NFVI_6] NFVI/VIM exposes VMVNFC faults/alarms to MANO/VNFM				
Pre-tes conditio		* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * MANO is subscribed to VNF fault alarms on the VNFM * VNFM is subscribed to virtualised resources fault alarms on the VIM					
	Step	Туре	Description	Result			
	1	Stimulus	Trigger a failure on a virtualised resource allocated to the relevant VNF instance (e.g. power off the 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 VNF fault alarm has been created for the affected VNF instance on the VNFM by querying the list of VNF fault alarms				
Test Sequence	4	IOP Check	Verify that a NS fault alarm has been created on the MANO by querying the list of NS fault alarms				
IOP Verdict							

6.1.6.2.2 TD_NFV_BASE_FM_VNF_CLEAR_001

			Interoperability Test Description				
Identifi	er	TD_NFV_BA)_NFV_BASE_FM_VNF_CLEAR_001				
Test Purp	Test Purpose To verify t		a VNF fault alarm clearance notification propagates via the VNFM when a VNF solving a failed virtualised resource	fault is			
Configura	ation	SUT_S-VNFN SUT_S-VNFN					
Reference	ces	ETSI GS NF\	V-IFA006 V2.3.1 (clauses 5.3.9,7.6.3, 8.6.3) V-IFA007 V2.3.1 (clauses 5.3.7,6.4.6, 7.5.3, 8.4.7) V-IFA013 V2.3.1 (clauses 5.3.5,7.6.3, 8.5.3)				
Applicab	ility	* [IFS_NFV_MANO_24] MANO supports receiving VNF faults/alarms from external VNFM * [IFS_NFV_VNFM_16] VNFM supports receiving VMVNFC faults/alarms from VIM * [IFS_NFV_VNFM_19] VNFM exposes VNF faults/alarms towards MANO * [IFS_NFV_VIM_NFVI_6] NFVI/VIM exposes VMVNFC faults/alarms to MANO/VNFM					
Pre-tes conditio		* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * MANO 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_BASE_FM_VNF_NOTIFY_001)					
	Step	Туре	Description	Result			
	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				
Test Sequence	4	IOP Check	Verify that the relevant NS fault alarm has been cleared on the MANO by querying the list of NS fault alarms				
IOP Verdict							

6.1.7 PERFORMANCE MANAGEMENT

6.1.7.1 PERFORMANCE MANAGEMENT – VR

6.1.7.1.1 TD_NFV_BASE_PM_VR_CREATE_NOTIFY_001

			Interoperability Test Description					
Identific	er	TD_NFV_B	TD_NFV_BASE_PM_VR_CREATE_NOTIFY_001					
Test Purp	ose	To verify that the performance metrics of a virtualised resource that is required for a NS instance be monitored using performance monitoring jobs and notifications						
Configura	ation		**					
Reference	ces		FV-IFA005 V2.3.1 (clauses 5.3.9, 7.7.2, 7.7.5, 7.7.6, 8.5) FV-IFA013 V2.3.1 (clauses 5.3.4, 7.5.2, 7.5.4, 7.5.5, 8.4)					
Applicab	ility	* [IFS_NFV] MANO/VNF * [IFS_NFV] MANO/VNF	_VIM_NFVI_4] NFVI/VIM exposes VM/VNFC virtual network resource KPIs to M _VIM_NFVI_5] NFVI/VIM exposes VM/VNFC virtual storage resource KPIs to)				
Pre-tes conditio		* Monitoring memoryus	antiated (TD_BASE_NFV_NS_LCM_INSTANTIATE_001) g parameters (e.g. performance metrics, metric groups) are defined (e.g. CPU age, etc.) g collection and reporting periods are defined	Jusage,				
	Step	Туре	Description	Result				
	1	Stimulus	Trigger MANO to create a new perfomance job for a virtualised resource that is allocated to the target NS instance					
	2	IOP Check	Verify that a performance job has been created on the VIM according to the monitoring parameters					
	3	Stimulus	Trigger the MANO to subscribe to the virtualised resource performance job created in step 1, and thus enable the collection of asyncronous performance reports from the VIM					
Test Sequence	4	IOP Check	Verify that performance reports notification for the monitored virtualised resource are generated by the VIM and collected by MANO, e.g. by quering MANO performance metrics database (if any) or checking the notifications from the VIM					
IOP Verdict								

6.1.7.1.2 TD_NFV_BASE_PM_VR_CREATE_THRESHOLD_001

			Interoperability Test Description				
Identifi	er	TD_NFV_B	D_NFV_BASE_PM_VR_CREATE_THRESHOLD_001				
Test Purp	ose		at the performance metrics of a virtualised resource that is required for a NS insta ed using performance monitoring jobs and thresholds	nce can			
Configura	ation	SUT_BASE SUT_S-VNI SUT_S-VNI	FM-D				
Reference	ces		FV-IFA005 V2.3.1 (clauses 5.3.9, 7.7.6, 7.7.7, 8.5) FV-IFA013 V2.3.1 (clauses 5.3.4, 7.5.7, 8.4)				
Applicab	Applicability * [IF * [IF MAN * [IF MAN * [IF		NFV_MANO_19] MANO supports receiving VMVNFC KPIs from VIM NFV_VIM_NFVI_3] NFVI/VIM exposes VMVNFC virtual compute resource KPIs to VNFM NFV_VIM_NFVI_4] NFVI/VIM exposes VMVNFC virtual network resource KPIs to VNFM NFV_VIM_NFVI_5] NFVI/VIM exposes VMVNFC virtual storage resource KPIs to VNFM				
Pre-tes conditio		* Monitoring memoryus	antiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) g parameters (e.g. performance metrics, metric groups) are defined (e.g. CPU usa age, etc.) g performance thresholds are defined	age,			
	Step	Type	Description	Result			
	1	Stimulus	Trigger MANO to create a new perfomance job for a virtualised resource that is allocated to the target NS instance				
	2	IOP Check	Verify that a virtualised resource performance monitoring job has been created on the VIM according to the monitoring parameters				
	3	Stimulus	Trigger MANO create a performance monitoring threshold for the virtualised resource monitored in step 1				
	4	Stimulus	Trigger MANO to subscribe to the threshold crossing notification for the performance monitoring threshold created in step 3				
	5	Stimulus	Trigger the virtualised resource to cross the specified threshold (e.g. by increasing resource utilisation levels in the VM)				
Test Sequence	6	IOP Check	Verify that the "threshold crossed" notification for the monitored virtualised resource was generated by the VIM and collected by MANO (e.g. quering the related MANO database or checking the performance monitoring thresholds notifications)				
IOP Verdict							

6.1.7.1.3 TD_NFV_BASE_PM_VR_DELETE_NOTIFY_001

			Interoperability Test Description					
Identific	er	TD_NFV_B	D_NFV_BASE_PM_VR_DELETE_NOTIFY_001					
Test Purp	ose		o verify that the monitoring of performance metrics of a virtualised resource that is required for a NS netance can be stopped by deleting performance monitoring jobs					
Configura	ition	SUT_BASE SUT_S-VNF SUT_S-VNF						
Reference	ces		FV-IFA005 V2.3.1 (clauses 5.3.9, 7.7.4, 7.7.5, 7.7.6, 8.5) FV-IFA013 V2.3.1 (clauses 5.3.4, 7.5.3, 7.5.4, 7.5.5, 8.4)					
Applicab	ility	* [IFS_NFV_MANO_19] MANO supports receiving VMVNFC KPIs from VIM * [IFS_NFV_VIM_NFVI_3] NFVI/VIM exposes VMVNFC virtual compute resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_4] NFVI/VIM exposes VMVNFC virtual network resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_5] NFVI/VIM exposes VMVNFC virtual storage resource KPIs to MANO/VNFM						
Pre-tes conditio		* A virtualise	antiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) ed resource part of the NS instance is monitored by MANO BASE_PM_VR_CREATE_NOTIFY_001)					
	Step	Туре	Description	Result				
	1	Stimulus	Trigger MANO to delete a performance job related to a virtualised resource that is allocated to the target NS instance					
	2	IOP Check	Verify that the relevant virtaulised resource performance job has been deleted on the VIM					
Test Sequence	3	IOP Check	Verify that no "performance information available" notification for the monitored virtualised resource has been generated by the VIM to the MANO by monitoring the VR PM notifications.					
IOP Verdict								

6.1.7.1.4 TD_NFV_BASE_PM_VR_DELETE_THRESHOLD_001

			Interoperability Test Description					
Identifi	er	TD_NFV_B	D_NFV_BASE_PM_VR_DELETE_THRESHOLD_001					
Test Purp	ose		o verify that a performance monitoring threshold created for a virtualised resource that is required fo NS instance can be deleted					
Configura	ition	SUT_BASE SUT_S-VNF SUT_S-VNF						
Reference	ces		FV-IFA005 V2.3.1 (clauses 5.3.9, 7.7.6, 7.7.9, 8.5) FV-IFA013 V2.3.1 (clauses 5.3.4, 7.5.5, 7.5.8, 8.4)					
Applicab	* [IFS_NFV_MANO_19] MANO supports receiving VMVNFC KPIs from VIM * [IFS_NFV_VIM_NFVI_3] NFVI/VIM exposes VMVNFC virtual compute resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_4] NFVI/VIM exposes VMVNFC virtual network resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_5] NFVI/VIM exposes VMVNFC virtual storage resource KPIs to MANO/VNFM							
Pre-tes conditio		* A perform	antiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) ance monitoring threshold for a virtualised resource that is part of the NS instance MANO (TD_NFV_BASE_PM_VR_CREATE_THRESHOLD_001)	ce is				
	Step	Туре	Description	Result				
	1	Stimulus	Trigger MANO to delete a performance monitoring threshold of a virtualised resource that is allocated to the target NS instance					
	2	IOP Check	Verify that the relevant virtual resource performance monitoring threshold has been deleted on the VIM					
	3	Stimulus	Trigger the virtualised resource to cross the specified threshold (e.g. by increasing resource utilisation levels in the virtualisation container)					
Test Sequence	4	IOP Check	Verify that no "threshold crossed" notification is generated for the given virtualised resource by the VIM (and thus not collected by MANO)					
IOP Verdict								

6.1.7.2 PERFORMANCE MANAGEMENT – VNF VR

6.1.7.2.1 TD_NFV_BASE_PM_VNF_VR_CREATE_NOTIFY_001

			Interoperability Test Description					
Identifi	er	TD_NFV_B	D_NFV_BASE_PM_VNF_VR_CREATE_NOTIFY_001					
Test Purp	ose		o verify that the performance metrics of a virtualised resource that is allocated to a VNF instance aside a NS instance can be monitored using VNFM performance monitoring jobs and notifications					
Configura	ition		JT_S-VNFM-D JT_S-VNFM-I					
Reference	ces	ETSI GS N	FV-IFA006 V2.3.1 (clauses 5.3.8, 7.7.2, 7.7.5, 7.7.6, 8.5) FV-IFA007 V2.3.1 (clauses 5.3.6, 7.4.2, 7.4.4, 7.4.5, 8.7) FV-IFA013 V2.3.1 (clauses 5.3.4, 7.5.2, 7.5.4, 7.5.5, 8.4)					
Applicab	ility	* [IFS_NFV] * [IFS_NFV] * [IFS_NFV] MANO/VNFI * [IFS_NFV] MANO/VNFI	_VIM_NFVI_4] NFVI/VIM exposes VMVNFC virtual network resource KPIs to M _VIM_NFVI_5] NFVI/VIM exposes VMVNFC virtual storage resource KPIs to					
Pre-tes	et	* NS is inst	antiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001)					
conditio	-	* Monitoring	g parameters (e.g. VNF instance, performance metrics, metric groups) are define e, memory usage, etc.) g collection and reporting periods are defined	ed (e.g.				
	Step	Туре	Description	Result				
	1	Stimulus	Trigger MANO to create a VNF performance monitoring job for a virtualised resource allocated to the relevant VNF instance inside the target NS instance					
	2	IOP Check	If applicable, verify that a VNF performace monitoring job has been created on the VNFM according to the monitoring parameters					
	3	IOP Check	Verify that a virtualised resource performace monitoring job has been created on the VIM according to the monitoring parameters					
	4	Stimulus	Trigger the MANO to subscribe to the VNF performace monitoring job created in step 1					
	5	IOP Check	If applicable, verify that performance report notifications for the monitored virtualised resource are generated by the VIM and collected by the VNFM					
Test Sequence	6	IOP Check	If applicable, verify that performance report notifications for the monitored VNF are generated by the VNFM and collected by MANO					
IOP Verdict								

6.1.7.2.2 TD_NFV_BASE_PM_VNF_VR_CREATE_THRESHOLD_001

			Interoperability Test Description				
Identifie	r	TD_NFV_B	_NFV_BASE_PM_VNF_VR_CREATE_THRESHOLD_001				
Test Purpo	ose		verify that the performance metrics of a virtualised resource that is allocated to a VNF instance in the performance can be monitored using VNFM performance monitoring jobs and thresholds				
Configurat	tion		JT_S-VNFM-D JT_S-VNFM-I				
Referenc	es	ETSI GS NI	ETSI GS NFV-IFA006 V2.3.1 (clauses 5.3.8, 7.7.5, 7.7.6, 7.7.7, 8.5) ETSI GS NFV-IFA007 V2.3.1 (clauses 5.3.6, 7.4.4, 7.4.5, 7.4.7, 8.7) ETSI GS NFV-IFA013 V2.3.1 (clauses 5.3.4, 7.5.7, 8.4)				
Applicabi	* [IFS. MANC. * [IFS. MANC. * [IFS. MANC. * [IFS. * [I		[IFS_NFV_MANO_21] MANO supports receiving VNF KPIs from external VNFMs [IFS_NFV_VNFM_18] VNFM exposes VNF KPIs and indicators towards MANO [IFS_NFV_VNFM_14] VNFM supports receiving VMVNFC KPIs from VIM [IFS_NFV_VIM_NFVI_3] NFVI/VIM exposes VMVNFC virtual compute resource KPIs to IANO/VNFM [IFS_NFV_VIM_NFVI_4] NFVI/VIM exposes VMVNFC virtual network resource KPIs to IANO/VNFM [IFS_NFV_VIM_NFVI_5] NFVI/VIM exposes VMVNFC virtual storage resource KPIs to IANO/VNFM				
Pre-tes condition		* Monitoring CPU usage	antiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) I parameters (e.g. VNF instance, performance metrics, metric groups) are defined, memory usage, etc.) I performance thresholds are defined	d (e.g.			
	Step	Туре	Description	Result			
	1	Stimulus	Trigger MANO to create a performance job for a virtualised resource allocated to the relevant VNF instance inside the target NS instance	1.00			
	2	IOP Check	If applicable, verify that a VNF performance monitoring job has been created on the VNFM according to the monitoring parameters				
	3	IOP Check	Verify that a virtualised performance monitoring job has been created on the VIM according to the monitoring parameters				
	4	Stimulus	Trigger MANO to create a VNF performance monitoring threshold for the virtualised resource monitored in step 1				
	5	Stimulus	Trigger MANO to subscribe to the threshold crossing notification for the VNF performance monitoring threshold created in step 4				
	6	Stimulus	Trigger the virtualised resource to cross the specified threshold (e.g. by increasing resource utilisation levels in the VM)				
	7	IOP Check	If applicable, verify that the "threshold crossed" notification for the monitored virtualised resource was generated by the VIM and collected by the VNFM				
Test	8	IOP Check					
Sequence			VNF was generated by the VNFM and collected by MANO				

6.1.7.2.3 TD_NFV_BASE_PM_VNF_VR_DELETE_NOTIFY_001

			Interoperability Test Description			
Identifie	r	TD_NFV_BASE_PM_VNF_VR_DELETE_NOTIFY_001				
Test Purp	ose		t the monitoring of performance metrics of a virtualised resource that is allocated the inside a NS instance can be stopped by deleting performance monitoring jobs			
Configura	tion	SUT_S-VNF SUT_S-VNF				
Referenc	es	ETSI GS NF	V-IFA006 V2.3.1 (clauses 5.3.8,7.7.4, 7.7.5, 7.7.6, 8.5) V-IFA007 V2.3.1 (clauses 5.3.6,7.4.3, 7.4.4, 7.4.5, 8.7) V-IFA013 V2.3.1 (clauses 5.3.4,7.5.3, 7.5.4, 7.5.5, 8.4)			
* [IFS_NF * [IFS_NF * [IFS_NF * [IFS_NF MANO//N * [IFS_NF MANO//N			VIM_NFVI_4] NFVI/VIM exposes VMVNFC virtual network resource KPIs to // // /// /// /// /// /// // // // // /			
Pre-tes condition	-	* A virtualise	Intiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) and resource that is allocated to a VNF instance inside the target NS instance is by the MANO (TD_NFV_BASE_PM_VNF_VR_CREATE_NOTIFY_001)			
	Step	Туре	Description	Result		
	1	Stimulus	Trigger MANO to delete a performance monitoring job of a virtualised resource that is allocated to a VNF instance inside the target NS instance			
	2	IOP Check	If applicable, verify that the relevant VNF performance monitoring job has been deleted on the VNFM			
	3	IOP Check	Verify that the relevant virtualised resource perfomance monitoring job has been deleted on the VIM			
	4		If applicable, verify that no performance report notifications for the monitored virtualised resource are generated by the VIM and collected by the VNFM			
Test Sequence	5	IOP Check	If applicable, verify that no performance report notifications for the monitored VNF are been generated by the VNFM and collected by MANO			
IOP Verdict	_					

6.1.7.2.4 TD_NFV_BASE_PM_VNF_VR_DELETE_THRESHOLD_001

			Interoperability Test Description			
Identifie	er	TD_NFV_BASE_PM_VNF_VR_DELETE_THRESHOLD_001				
Test Purp	ose	To verify that a VNF insta	at a performance monitoring threshold created for a virtualised resource that is allo nnce inside a NS instance can be deleted on the VNFM	cated to		
Configura	tion	SUT_S-VNFM-D SUT_S-VNFM-I				
Reference	ces	ETSI GS N	FV-IFA006 V2.3.1 (clauses 5.3.8, 7.7.5, 7.7.6, 7.7.9, 8.5) FV-IFA007 V2.3.1 (clauses 5.3.6, 7.4.4, 7.4.5, 7.4.8, 8.7) FV-IFA013 V2.3.1 (clauses 5.3.4, 7.5.5, 7.5.8, 8.4)			
Applicability		* [IFS_NFV_MANO_21] MANO supports receiving VNF KPIs from external VNFMs * [IFS_NFV_VNFM_18] VNFM exposes VNF KPIs and indicators towards MANO * [IFS_NFV_VNFM_14] VNFM supports receiving VMVNFC KPIs from VIM * [IFS_NFV_VIM_NFVI_3] NFVI/VIM exposes VMVNFC virtual compute resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_4] NFVI/VIM exposes VMVNFC virtual network resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_5] NFVI/VIM exposes VMVNFC virtual storage resource KPIs to MANO/VNFM				
Pre-tes conditio		* A perform inside a NS	antiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) ance monitoring threshold for a virtualised resource that is allocated to a VNF insta instance is created by the MANO BASE_PM_VNF_VR_CREATE_THRESHOLD_001)	ance		
	Step	Туре	Description	Result		
	1	Stimulus	Trigger MANO to delete a VNF performance monitoring threshold of a virtualised resource that is allocated to a VNF instance inside the target NS instance			
	2	IOP Check	If applicable, verify that the relevant VNF performance monitoring threshold has been deleted on the VNFM			
	3	IOP Check	Verify that the relevant virtualised resource performance monitoring threshold has been deleted on the VIM			
	4	Stimulus	Trigger the virtualised resource to cross the specified threshold (e.g. by increasing resource utilisation levels in the VM)			
	5	IOP Check	If applicable, verify that no "threshold crossed" notification for the monitored virtualised resource is generated by the VIM and collected by the VNFM			
Test Sequence	6	IOP Check	If applicable, verify that no "threshold crossed" notification for the monitored VNF is generated by the VNFM and collected by MANO			
IOP Verdict						

6.1.7.3 PERFORMANCE MANAGEMENT – VNF

6.1.7.3.1 TD_NFV_BASE_PM_VNF_KPI_CREATE_NOTIFY_001

			Interoperability Test Description				
Identific	er	TD_NFV_B	_NFV_BASE_PM_VNF_KPI_CREATE_NOTIFY_001				
Test Purp	ose To verify the notifications		at a VNF indicator inside a NS instance can be monitored using subscriptions and s				
Configura	ition	SUT_S-VNI SUT_S-VNI					
References			FV-IFA008 V2.3.1 (clauses 5.3.1.4, 5.4.1.4, 6.3.2, 6.3.3, 6.3.4, 8.2.2, 8.2.3, 8.2.4, 9 FV-IFA007 V2.3.1 (clauses 5.3.9, 7.7.2, 7.7.3, 7.7.4, 8.10)	9.6)			
Applicability		* [IFS_NFV] * [IFS_NFV	_MANO_21] MANO supports receiving VNF KPIs from external VNFMs _VNFM_18] VNFM exposes VNF KPIs and indicators towards MANO _VNFM_12] VNFM supports receiving VNF indicators from VNF/EM _VNF_9] VNF can send indicators (KPIs) to MANO/VNFM				
Pre-tes conditio			antiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) g information (e.g. VNF instance) is defined and VNF indicators are available in the	NSD			
	Ī			ı			
	Step		Description	Result			
	1	Stimulus	Trigger MANO to subscribe to a VNF indicator value change for the relevant VNF instance inside the target NS instance $$				
	2	IOP Check	If applicable, verify that the VNFM subscribes in turn to the given VNF indicator value changes on the proper VNF/EM instance				
	3	Stimulus	Trigger the monitored VNF indicator to change value on the given VNF/EM instance				
	4	IOP Check	Verify that the VNF indicator notifications are generated by the VNF/EM and updated values collected by the VNFM/MANO				
Test Sequence	5	IOP Check	If applicable, verify that the VNF indicator notifications are generated by the VNFM and updated values collected by MANO				
IOP Verdict							

6.1.7.3.2 TD_NFV_BASE_PM_VNF_KPI_DELETE_NOTIFY_001

			Interoperability Test Description	
Identifie	ID_NFV_BA		ASE_PM_VNF_KPI_DELETE_NOTIFY_001	
Test Purpose		To verify the subscription	at the monitoring of a VNF indicator inside a NS instance can be stopped by dele ns	ting
SU.		SUT_BASE SUT_S-VNI SUT_S-VNI	FM-D	
References			FV-IFA008 V2.3.1 (clauses 5.3.1.4, 5.4.1.4, 6.3.5, 8.2.5, 9.6) FV-IFA007 V2.3.1 (clauses 5.3.9, 7.7.5, 8.10)	
Applicability		* [IFS_NFV] * [IFS_NFV]	_MANO_21] MANO supports receiving VNF KPIs from external VNFMs _VNFM_18] VNFM exposes VNF KPIs and indicators towards MANO _VNFM_12] VNFM supports receiving VNF indicators from VNF/EM _VNF_9] VNF can send indicators (KPIs) to MANO/VNFM	
Pre-test condition		* A VNF inc	antiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) dicator specified in the NSD of the target NS instance is monitored by the MANO BASE_PM_VNF_KPI_CREATE_NOTIFY_001)	
Test	Step	Туре	Description	Result
Sequence	1	Stimulus	Trigger MANO to delete a VNF indicator subscription for a VNF instance inside the target NS instance	
	2	IOP Check	If applicable, verify that the VNFM terminate in turn the VNF indicator subscription on the given VNF/EM instance	
	3	IOP Check	Verify that the relevant VNF indicator subscription has been terminated on the VNF/EM instance	
	4	Stimulus	Trigger the given VNF indicator to change value on the VNF/EM instance	
	5		Verify that no notification for the VNF indicator value change is generated by the VIM and no updated value is collected by the VNFM/MANO	
	6	IOP Check	If applicable, verify that no notification for the VNF indicator value change is generated by the VNFM and no updated value is collected by the MANO	
IOP Verdict				

6.1.8 TERMINATE

6.1.8.1 TD_NFV_BASE_NS_LCM_TERMINATE_001

			Interoperability Test Description	
Identifier		TD_NFV_E	BASE_NS_LCM_TERMINATE_001	
Test Purpo	se	To verify the	at a NS can be successfullyterminated	
Configuration		SUT_BASE SUT_S-VNI SUT_S-VNI	FM-D	
References		ETSI GS N ETSI GS N	FV-IFA013 V2.3.1 (clause 7.3.7) FV-IFA005 V2.3.1 (clause 7.3.1.5, clause 7.4.1.5, clause 7.5.1.5) FV-IFA006 V2.3.1 (clause 7.3.1.5, clause 7.4.1.5, clause 7.5.1.5) FV-IFA007 V2.3.1 (clause 7.2.7)	
Applicabili	ty			
Pre-test conditions		* NS has be	een instantiated	
	Step	Туре	Description	Result
	1	Stimulus	Trigger NS termination in MANO	
Test	2	IOP Check	Verify that all the VNF instance(s) have been terminated	
Sequence	3	IOP Check	Verify that the resources that were allocated to the NS and VNF(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 NS instance does no longer exist	
IOP Verdict				

6.1.9 DELETE

6.1.9.1 TD_NFV_BASE_TEARDOWN_DELETE_NSD_001

			Interoperability Test Description				
Identifier		TD_NFV_E	BASE_TEARDOWN_DELETE_NSD_001				
Test Purpo	se	To delete a	NSD				
Configuration		SUT_S-VN	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I				
References		ETSI GS N	ETSI GS NFV-IFA013 V2.3.1 (clause 7.2.6)				
Applicability							
Pre-test cond	itions		eated in MANO (TD_NFV_BASE_ONBOARD_NSD_001) ssociated with the NSD have been terminated				
Test Sequence	Step	Туре	Description	Result			
Joquenes	1	Stimulus	Trigger the deletion of NSD on MANO (i.e using tools produced by MANO)				
	2	IOP Check	Verify that the NSD and referenced VLD(s) and VNFFGD(s) no longer exists on MANO				
IOP Verdict							

6.1.9.2 TD_NFV_BASE_TEARDOWN_DELETE_VNF_PKG_001

			Interoperability Test Description	
Identifier		TD_NFV_BA	ASE_TEARDOWN_DELETE_VNF_PKG_001	
Test Purpos	e	To delete a	VNF Package	
Configuration		SUT_BASE SUT_S-VNF SUT_S-VNF		
References		ETSI GS NF	FV-IFA013 V2.3.1 (clause 7.7.5)	
Applicabilit	у			
Pre-test condit	ions	* VNF packa	age has been on-boarded in MANO(TD_NFV_BASE_ONBOARD_VNF_Pk	(G _001)
Test Sequence	Step	Туре	Description	Result
	1	Stimulus	Trigger the deletion of the VNF package on MANO	
	2	IOP Check	Verify that the VNF Package information has been deleted from MANO	
IOP Verdict				

6.2 MULTI-SITE

6.2.1 INSTANTIATE

6.2.1.1 TD_NFV_MULTISITE_NS_LCM_INSTANTIATE_001

			Interoperability Test Description	
Identifi	er	TD_NFV_N	//ULTISITE_NS_LCM_INSTANTIATE_001	
Test Purp	ose	To verify the	nat an NS can be successfully instantiated across different sites	
Configura	ation	SUT_MULT	I-SITE	
References		ETSI GS NF ETSI GS NF ETSI GS NF ETSI GS NF	FV-IFA013 V2.3.1 (clause 7.3.3) FV-IFA005 V2.3.1 (clause 7.2.4) FV-IFA006 V2.3.1 (clause 7.2.3) FV-IFA008 V2.3.1 (clause 6.2.3) FV-IFA010 V2.3.1 (clause 6.3.2) FV-IFA022 V0.8.0 (clause 5.2)	
Applicability		geographic	_MANO_1] MANO supports multi-site/multi-region deployments (i.e. two or neally distributed sites managed by different VIM instances) _VIM_NFVI_2] NFVI/VIM supports multi-site/multi-region deployment	nore
		+ NOD \ # =	() NAIFFOR() INAIF D. I. () I	
Pre-test conditions		* The softw	r(s), VNFFGD(s) and VNF Package(s) have been on-boarded in MANO are image repository is reachable by the VIMs red resources are available on the NFVIs	
	Step	Туре	Description	Result
	1	Stimulus	Trigger multi-site NS instantiation in MANO	
	2	IOP Check	Verify that the software images have been onboarded in the VIMs	
	3	IOP Check	Verify that the requested resources have been allocated by the VIMs according to the descriptors	
	4	IOP Check	Verify that the VNF(s) have been deployed according to the descriptors (VMs, VLs, CPs)	
Tool	5	IOP Check	Verify that the VL and VNFFG instance(s) have been created according to the descriptors	
Test Sequence	6	IOP Check	Verify that the VNF(s) have been deployed according to the multi-site location constraints	
	7		Verify that the VNF(s) are running and reachable through the management network	
	8	IOP Check	Verify that the VNF(s) have been configured according to VNFD(s) (i.e by obtaining a result from the management interface)	
	9	IOP Check	Verify that the VNF(s), VL(s) and VNFFG(s) have been connected according to the Descriptors	
	10	IOP Check	Verify that the VNF(s) have multi-site connectivity through the multi-site $VL(s)$	
	11	IOP Check	Verify that the multi-site NS is successfully instantiated by running the end-to-end functional test	

6.2.2 SCALE NS MANUALLY

6.2.2.1 TD_NFV_MULTISITE_NS_LCM _SCALE_OUT_001

			Interoperability Test Description				
Identifi	er	TD_NFV_N	MULTISITE_NS_LCM _SCALE_OUT_001				
Test Purp	To verify the triggered by		hat a multi-site NS can be successfully scaled out (by adding VNF instance) a MANO operator	ces) if			
Configuration SUT_MUL References ETSI GS N		SUT_MULT	TI-SITE				
		ETSI GS NE ETSI GS NE ETSI GS NE	FV-IFA005 V2.3.1 (clause 5.3.4) FV-IFA006 V2.3.1 (clauses 7.3.1,7.4.1) FV-IFA008 V2.3.1 (clause 7.2.4) FV-IFA010 V2.3.1 (clauses 6.2.3,6.3.3) FV-IFA022 V0.8.0 (clause 5.4)				
Applicability		geographic *[IFS_NFV_ * [IFS_NFV	* [IFS_NFV_MANO_1] MANO supports multi-site/multi-region deployments (i.e. two or more geographically distributed sites managed by different VIM instances) *[IFS_NFV_MANO_14] MANO supports scaling by adding/removing VNF instances * [IFS_NFV_VIM_NFVI_2] NFVI/VIM supports multi-site/multi-region deployment *[IFS_NFV_VNF_4] VNF can scale out/in by adding/removing VNF instances				
Pre-test conditions		* Multi-site	NS is instantiated (TD_NFV_MULTISITE_NS_LCM_INSTANTIATE_001)				
	T						
	Step	Туре	Description	Result			
	1	Stimulus	Trigger multi-site NS scale out (by adding VNF instances) in MANO with an operator action				
	2	IOP Check	Verify that the requested resources have been allocated by the VIM according to the descriptors				
	3	IOP Check	Verify that the additional VNF instance(s) have been deployed according to the descriptors (VMs, VLs, CPs)				
Test	4	IOP Check	Verify that the additional VNF instance(s) have been deployed according to the multi-site location constraints				
Sequence	5	IOP Check	Verify that the additional VNF instances(s) are running and reachable from the management network				
	6	IOP Check	Verify that the additional VNF instances(s) have been configured according to the descriptors (i.e. by geting a result through the management interface)				
	7	IOP Check	Verify that the additional VNF instances(s), VL(s) and VNFFG(s) are connected according to the Descriptors				
	8	IOP Check	Verify that the additional VNF instance(s) have multi-site connectivity through the multi-site VL(s)				
	9	IOD Chook	Verify that multi-site NS has been scaled out by running the end-to-end				
		IOP Check	functional test				

6.2.2.2 TD_NFV_MULTISITE_NS_LCM_SCALE_IN_001

			Interoperability Test Description			
Identifie	er	TD_NFV_N	MULTISITE_NS_LCM_SCALE_IN_001			
Test Purp	ose		hat a multi-site NS can be successfully scaled in (by removing VNF insolv a MANO operator	stances) if		
			I-SITE			
References		ETSI GS NF ETSI GS NF ETSI GS NF	FV-IFA005 V2.3.1 (clause 5.3.4) FV-IFA006 V2.3.1 (clauses 7.3.1, 7.4.1) FV-IFA008 V2.3.1 (clause 7.2.4) FV-IFA010 V2.3.1 (clauses 6.2.3, 6.3.3) FV-IFA022 V0.8.0 (clause 5.4)			
Applicability		* [IFS_NFV_MANO_1] MANO supports multi-site/multi-region deployments (i.e. two or more geographically distributed sites managed by different VIM instances) *[IFS_NFV_MANO_14] MANO supports scaling by adding/removing VNF instances * [IFS_NFV_VIM_NFVI_2] NFVI/VIM supports multi-site/multi-region *[IFS_NFV_VNF_4] VNF can scale out/in by adding/removing VNF instances				
Pre-tes conditio		* Multi-site I	NS is instantiated (TD_NFV_MULTISITE_NS_LCM_INSTANTIATE_001) NS has been scaled out by adding VNF instances (TD_NFV_MULTISITE SCALE_OUT_001)			
	Step	Type	Description	Result		
	1	Stimulus	Trigger multi-site NS scale in (by removing VNFs) in MANO with an operator action			
	2	IOP Check	Verify that the impacted VNF instance(s) have been terminated and not running in the correspondant VIM site / instance			
Test	3	IOP Check	Verify that the impacted VNF related resources have been released by the proper VIM site / VIM instance			
Sequence	4	IOP Check	Verify that the remaining VNF instances (s) are still running and reachable through the management network			
	5	IOP Check	Verify that the remaining VNF instances(s), VL(s) and VNFFG(s) are still connected according to the descriptors			
	6	IOP Check	Verify that the remaining VNF instance(s) have still multi-site connectivity through the multi-site VL(s)			
	7	IOP Check	Verify that multi-site NS has been scaled in by running the end-to-end functional test	_		
IOP Verdict						

6.2.3 SCALE VNF MANUALLY

6.2.3.1 TD_NFV_MULTISITE_NS_LCM_SCALE_OUT_VNF_001

			Interoperability Test Description					
Identifie	er	TD_NFV_N	ULTISITE_NS_LCM_SCALE_OUT_VNF_001					
Test Purpose Configuration		-	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					
Configura	tion	SUT_MULT	I-SITE					
References		ETSI GS NF ETSI GS NF ETSI GS NF ETSI GS NF	FV-IFA005 V2.3.1 (clause 5.3.4) FV-IFA006 V2.3.1 (clauses 7.3.1, 7.4.1) FV-IFA013 V2.3.1 (clause 7.3.4) FV-IFA008 V2.3.1 (clause 7.2.4) FV-IFA010 V2.3.1 (clauses 6.2.3, 6.3.3) FV-IFA022 V0.8.0 (clause 5.4)					
Applicability		geographic *[IFS_NFV_ * [IFS_NFV_	* [IFS_NFV_MANO_1] MANO supports multi-site / multi-region deployments (i.e. two or more geographically distributed sites managed by different VIM instances) *[IFS_NFV_MANO_15] MANO supports scaling by adding/removing VNFC instances * [IFS_NFV_VIM_NFVI_2] NFVI/VIM supports multi-site / multi-region deployment *[IFS_NFV_VNF_5] VNF can scale out/in by adding/removing VNFC instances					
Pre-tes conditio			NS is instantiated (TD_NFV_MULTISITE_NS_LCM_INSTANTIATE_001) configured to trigger SCALE OUT (by adding VNFC instances) when triggered by	ra MANO				
Test Sequence	Step	Туре	Description	Result				
ocquence	1	Stimulus	Trigger multi-site NS scale out (by adding VNFC instances (VMs) to a VNF in the NS) in MANO with an operator action					
	2	IOP Check	Verify that the requested resources have been allocated by the VIM according to the descriptors					
	3	IOP Check	Verify that the additional VNFC instance(s) have been deployed according to the descriptors (VMs, VLs, CPs)					
	4	IOP Check	Verify that the additional VNFC instance(s) have been deployed according to the multi-site location constraints					
	5	IOP Check	Verify that the additional VNFC instances(s) are running and reachable from the management network					
	6	IOP Check	Verify that the additional VNFC instances(s) have been configured according to the descriptors (i.e. by geting a result through the management interface)					
	7	IOP Check	Verify that the additional VNFC instances(s), VL(s) and VNFFG(s) are connected according to the Descriptors					
	8	IOP Check	Verify that the addtional VNFC instance(s) have multi-site connectivity through the multi-site VL(s)					
	9	IOP Check	Verify that NS has been scaled in by running the end-to-end functional test					
IOP Verdict								

6.2.3.2 TD_NFV_MULTISITE_NS_LCM_SCALE_IN_VNF_001

			Interoperability Test Description			
Identifie	r	TD_NFV_MU	JLTISITE_NS_LCM_SCALE_IN_VNF_001			
Test Purpose			at a VNF in a multi-site NS can be successfully scaled in (by removing VMs)) when triggered by a MANO operator	VNFC		
Configuration		SUT_MULTI	-SITE			
References		ETSI GS NFV-IFA005 V2.3.1 (clause 5.3.4) ETSI GS NFV-IFA006 V2.3.1 (clauses 7.3.1,7.4.1) ETSI GS NFV-IFA013 V2.3.1 (clause 7.3.4) ETSI GS NFV-IFA008 V2.3.1 (clause 7.2.4) ETSI GS NFV-IFA010 V2.3.1 (clauses 6.2.3,6.3.3) ETSI GS NFV-IFA022 V0.8.0 (clause 5.4)				
Applicability		geographica *[IFS_NFV_I * [IFS_NFV_	MANO_1] MANO supports multi-site/multi-region deployments (i.e. two or modally distributed sites managed by different VIM instances) MANO_15] MANO supports scaling by adding/removing VNFC instances VIM_NFVI_2] NFVI/VIM supports multi-site/multi-region deployment VNF_5] VNF can scale out/in by adding/removing VNFC instances	ore		
Pre-tes condition		* Multi-site N	IS is instantiated (TD_NFV_MULTISITE_NS_LCM_INSTANTIATE_001) IS has been scaled out by adding VNFC instances IULTISITE_NS_LCM_SCALE_OUT_VNF_001)			
Test Sequence	Step	Туре	Description	Result		
Sequence	1	Stimulus	Trigger NS scale in (by removing VNFC instances (VMs) from a VNF in the NS) in MANO with an operator action			
	2	IOP Check	Verify that the impacted VNFC instance(s) have been terminated and not running in the correspondant VIM site / instance			
	3	IOP Check	Verify that the impacted VNFC related resources have been released by the proper VIM site / VIM instance			
	4	IOP Check	Verify that the remaining VNFC instances(s) are still running and reachable through the management network			
	5	IOP Check	Verify that the remaining VNFC instances(s), VL(s) and VNFFG(s) are still connected according to the descriptors			
	6	100001	Variety that the averagining VAICO inches on (a) have a till resulting its accompanient.			
		IOP Check	Verify that the remaining VNFC instance(s) have still multi-site connectivity through the multi-site VL(s)			
	7	IOP Check	through the multi-site VL(s)			

6.2.4 TERMINATE

6.2.4.1 TD_NFV_MULTISITE_NS_LCM_TERMINATE_001

			Interoperability Test Description				
Identifie	r	TD_NFV_N	IULTISITE_NS_LCM_TERMINATE_001				
Test Purpose		To verify tha	t a Multi Site NS can be successfully terminated				
Configuration		SUT_MULT	I-SITE				
References		ETSI GS NF	ETSI GS NFV-IFA013 V2.3.1 (clause 7.3.7) ETSI GS NFV-IFA005 V2.3.1 (clause 7.3.1.5, 7.4.1.5, 7.5.1.5) ETSI GS NFV-IFA008 V2.3.1 (clause 7.2.7)				
Applicability		* [IFS_NFV_MANO_1] MANO supports multi-site / multi-region deployments (i.e. two or more geographically distributed sites managed by different VIM instances) *[IFS_NFV_MANO_15] MANO supports scaling by adding/removing VNFC instances					
Pre-tes condition	-	* Multi Site N	NS has been instantiated				
	Step	Туре	Description	Result			
	1	Stimulus	Trigger Multi Site NS termination in MANO				
Test	2	IOP Check	Verify that all the VNF instance(s) have been terminated in the given sites				
Sequence	3	IOP Check	Verify that the resources that were allocated to the Multi Site NS and VNF(s) have been released by the involved VIMs				
	4	IOP Check	If applicable, verify that the NFPs have been deleted				
		TOT OTTOOK					
	5	IOP Check	Verify that the Multi Site NS instance does no longer exist				

Annex A:Interoperability Feature Statements

A.1 IFS for MANO

IFS_ID	GROUP	Description	Support
IFS_NFV_MANO_1	Multi-site	MANO supports multi-site / multi-region deployments (i.e. two or more geographically distributed sites managed by different VIM instances)	
IFS_NFV_MANO_2	APIs	MANO supports multi-VIM deployments (i.e. different VIMs technologies, e.g. OpenStack and VMWare)	
IFS_NFV_MANO_3	VNFM	MANO provides generic VNFM functionality	
IFS_NFV_MANO_4	VNFM	MANO supports specific VNFMs (external) in direct mode (resource management by VNFM)	
IFS_NFV_MANO_5	VNFM	MANO supports specific VNFMs (external) in in-direct mode (resource management by MANO)	
IFS_NFV_MANO_6	APIs	MANO supports IFA013 as NBI (Os-ma-nfvo)	
IFS_NFV_MANO_7	APIs	MANO supports IFA007 with external VNFM (Or-Vnfm)	
IFS_NFV_MANO_8	APIs	MANO supports IFA008 with VNF/EM (Ve-Vnfm)	
IFS_NFV_MANO_9	APIs	MANO supports SOL005 as NBI (Os-ma-nfvo)	
IFS_NFV_MANO_10	APIs	MANO supports SOL003 with external VNFM (Or-Vnfm)	
IFS_NFV_MANO_11	APIs	MANO supports SOL002 with VNF/EM (Ve-Vnfm)	
IFS_NFV_MANO_12	APIs	MANO supports IFA011 for VNFD modelling	
IFS_NFV_MANO_13	APIs	MANO supports IFA014 for NSD modelling	
IFS_NFV_MANO_14	LCM	MANO supports scaling by adding/removing VNF instances	
IFS_NFV_MANO_15	LCM	MANO supports scaling out/in by adding/removing VNFC instances	
IFS_NFV_MANO_16	LCM	MANO supports scaling out/in request from VNF/EM	
IFS_NFV_MANO_17	PM	MANO supports receiving VNF indicators from VNF/EM	
IFS_NFV_MANO_18	РМ	MANO supports automatic scaling triggered by VNF indicators from VNF/EM	
IFS_NFV_MANO_19	PM	MANO supports receiving VM/VNFC KPIs from VIM	
IFS_NFV_MANO_20	РМ	MANO supports automatic scaling out/in triggered by KPIs from VIM	
IFS_NFV_MANO_21	PM	MANO supports receiving VNF KPIs from external VNFMs	
IFS_NFV_MANO_22	PM	MANO supports automatic scaling out/in triggered by KPIs from external VNFMs	
IFS_NFV_MANO_23	FM	MANO supports receiving VM/VNFC faults/alarms from VIM	
IFS_NFV_MANO_24	FM	MANO supports receiving VNF faults/alarms from external VNFM	
IFS_NFV_MANO_25	FM	MANO supports VNF/VNFC healing triggered by faults/alarms from VIM	

IFS_NFV_MANO_26	LCM	MANO supports adding/removing VNFs to an instatiated NSs	
IFS_NFV_MANO_27	LCM	MANO supports adding/removing VLs to an instatiated NSs	
IFS_NFV_MANO_28	EPA	MANO supports deploying VNFs with EPA requirements towards NFVI/VIM	
IFS_NFV_MANO_29	Network	MANO can manage SDN Controller APIs exposed by VIM	
IFS_NFV_MANO_30	Network	MANO supports provisioning and configuration of network forwarding paths	
IFS_NFV_MANO_31	FM	MANO supports receiving VNF faults/alarms from VNF/EM	
IFS_NFV_MANO_32	LCM	MANO can request to start/stop VNFs/VNFCs to the VIM	

A.2 IFS for VIM/NFVI

IFS_ID	GROUP	Description	Support
IFS_NFV_VIM_NFVI_1	EPA	NFVI/VIM supports EPA attributes	
IFS_NFV_VIM_NFVI_2	Multi- site	NFVI/VIM supports multi-site / multi-region deployment	
IFS_NFV_VIM_NFVI_3	PM	NFVI/VIM exposes VM/VNFC virtual compute resource KPIs to MANO/VNFM	
IFS_NFV_VIM_NFVI_4	РМ	NFVI/VIM exposes VM/VNFC virtual network resource KPIs to MANO/VNFM	
IFS_NFV_VIM_NFVI_5	РМ	NFVI/VIM exposes VM/VNFC virtual storage resource KPIs to MANO/VNFM	
IFS_NFV_VIM_NFVI_6	FM	NFVI/VIM exposes VM/VNFC faults/alarms to MANO/VNFM	
IFS_NFV_VIM_NFVI_7	Network	NFVI/VIM embeds SDN Controller	
IFS_NFV_VIM_NFVI_8	Network	NFVI/VIM exposes SDN Controller functionalities to MANO	
IFS_NFV_VIM_NFVI_9	Network	NFVI/VIM exposes network forwarding path functionalities to MANO	
IFS_NFV_VIM_NFVI_10	LCM	NFVI/VIM supports start/stop of VMs/VNFCs	

A.3 IFS for VNF

IFS_ID	GROUP	Description	Support
IFS_NFV_VNF_1	EPA	VNF requires EPA	
IFS_NFV_VNF_2	VNFM	VNF has own VNFM (note: please fill in VNFM IFS/TQ)	
IFS_NFV_VNF_3	VNFM	VNF can work with generic VNFM	
IFS_NFV_VNF_4	LCM	VNF can scale out/in by adding/removing VNF instances	
IFS_NFV_VNF_5	LCM	VNF can scale out/in by adding/removing VNFC instances	
IFS_NFV_VNF_6	APIs	VNF/EM supports IFA008 for interaction with MANO via Ve- Vnfm	
IFS_NFV_VNF_7	APIs	VNF/EM supports SOL002 for interaction with MANO via Ve- Vnfm	
IFS_NFV_VNF_8	LCM	VNF/EM can request scaling to MANO	
IFS_NFV_VNF_9	РМ	VNF can send indicators (KPIs) to MANO	
IFS_NFV_VNF_10	LCM	VNF can be part of multi-vendor NS (please complete TQ_NFV_VNF_27)	

A.4 IFS for VNFM

IFS_ID	GROUP	Description	Support
IFS_NFV_VNFM_1	VNFM	VNFM supports direct mode (Resource management by VNFM)	
IFS_NFV_VNFM_2	VNFM	VNFM supports in-direct mode (Resource management by MANO)	
IFS_NFV_VNFM_3	APIs	VNFM can request granting to MANO	
IFS_NFV_VNFM_4	APIs	VNFM supports IFA007 with MANO (Or-Vnfm)	
IFS_NFV_VNFM_5	APIs	VNFM supports SOL003 with MANO (Or-Vnfm)	
IFS_NFV_VNFM_6	APIs	VNFM supports IFA011 for VNFD modelling	
IFS_NFV_VNFM_7	EPA	(if direct mode) VNFM supports deploying VNFs with EPA requirements towards VIM	
IFS_NFV_VNFM_8	Multi-site	(if direct mode) VNFM supports multi-site / multi-region deployments (i.e. two or more geographically distributed sites managed by different VIM instances)	
IFS_NFV_VNFM_9	APIs	(if direct mode) VNFM supports multi-VIM deployments (i.e. different VIMs technologies, e.g. OpenStack and VMWare)	
IFS_NFV_VNFM_10	LCM	VNFM supports VNF scaling out/in by adding/removing VNFC instances	
IFS_NFV_VNFM_11	LCM	VNFM supports VNF scaling out/in request from VNF/EM	
IFS_NFV_VNFM_12	FPM	VNFM supports receiving VNF indicators from VNF/EM	
IFS_NFV_VNFM_13	PM	VNFM supports automatic VNF scaling triggered by VNF indicators from VNF/EM	
IFS_NFV_VNFM_14	PM	VNFM supports receiving VM/VNFC KPIs from VIM	
IFS_NFV_VNFM_15	PM	VNFM supports automatic scaling out/in triggered by KPIs from VIM	
IFS_NFV_VNFM_16	FM	VNFM supports receiving VM/VNFC faults/alarms from VIM	
IFS_NFV_VNFM_17	FM	VNFM supports VNF/VNFC healing triggered by faults/alarms from VIM	
IFS_NFV_VNFM_18	PM	VNFM exposes VNF KPIs and indicators towards MANO	
IFS_NFV_VNFM_19	FM	VNFM exposes VNF faults/alarms towards MANO	

Note: the grey fields were included in the IFS forms, but are not directly leveraged by the current test plan.