ETSI Plugtests Test Plan V1.0.0 (2018-02)

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

ETSI

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Contents

Foreword

This Test Plan has been produced by ETSI Centre for Testing and Interoperability during the preparation of the 2nd 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 learninigs of the 1st 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>	<SUBGROUP>	<OPERATION>	<COMPLEMENT>	Description
BASE	SETUP	ONBOARD	VNF_PKG	Onboard VNF Package
			NSD	Onboard Network Service Descriptor
	NS_LCM	INSTANTIATE	-	Instantiate Network Service
			EPA	Instantiate Network Service with EPA
		SCALE	OUT	Scale Out by adding VNF instance(s)
			IN	Scale In by removing VNF instance(s)
			OUT_EPA	Scale Out by adding VNF instance(s) with EPA
			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
		TERMINATE	-	Terminate Network Service
	FM_VR	NOTIFY	-	Virtualised resource fault alarm notification propagation
		CLEAR	-	Virtualised resource fault clearance notification propagation
	FM_VNF	NOTIFY	-	VNF fault alarm notification propagation
		CLEAR	-	VNF fault clearance notification propagation
	PM_VR	CREATE	NOTIFY	Virtualised resource performance metrics monitoring jobs with notifications
			THRESHOLD	Virtualised resource performance metrics monitoring jobs with thresholds
		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	CREATE	NOTIFY	VNF virtualised resource performance metrics monitoring jobs with notifications through VNFM
			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
			THRESHOLD	Termination of virtualised resource performance metrics monitoring jobs with thresholds through VNFM
	PM_VNF_KPI	CREATE	NOTIFY	VNF indicator monitoring
		DELETE		Deletion of VNF indicator monitoring
	TEARDOWN	DELETE	NSD	Deletion Network Service Descriptor
			VNF_PKG	Deletion VNF Package
MULTISITE	NS_LCM	INSTANTIATE	-	Instantiate Multi Site Network Service
		SCALE	OUT	Multi Site Scale Out by adding VNF instance(s)
			IN	Multi Site Scale In by removing VNF instance(s)
		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
TD_NFV_BASE_NS_LCM_INSTANTIATE_EPA_001	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
TD_NFV_BASE_NS_LCM_SCALE_OUT_002a	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_NFV_BASE_NS_LCM_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
TD_NFV_BASE_NS_LCM_SCALE_IN_VNF_001	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 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 re-started 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
TD_NFV_BASE_FM_VNF_CLEAR_001	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

Test Id	Test Purpose

TD_NFV_BASE_NS_LCM_TERMINATE_001	To verify that a NS can be successfully terminated

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

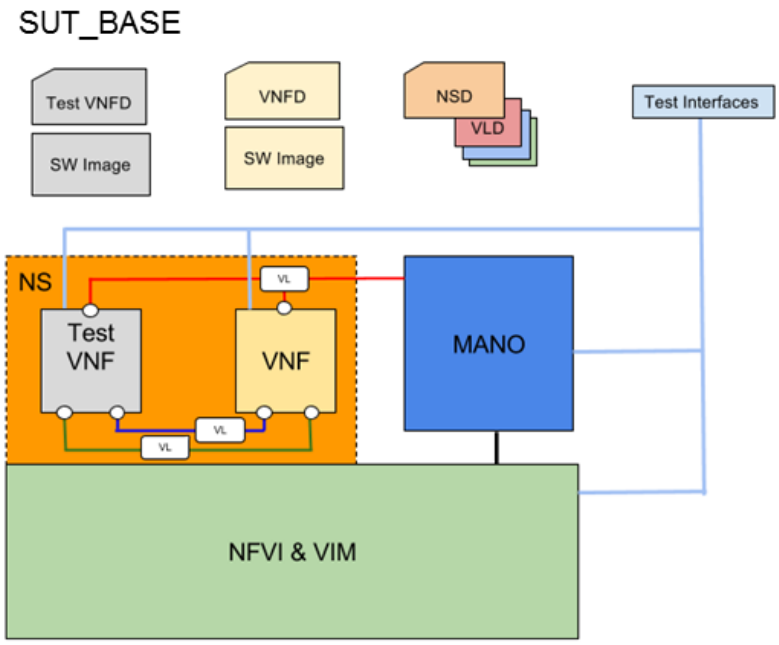

Figure 1. SUT_BASE

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

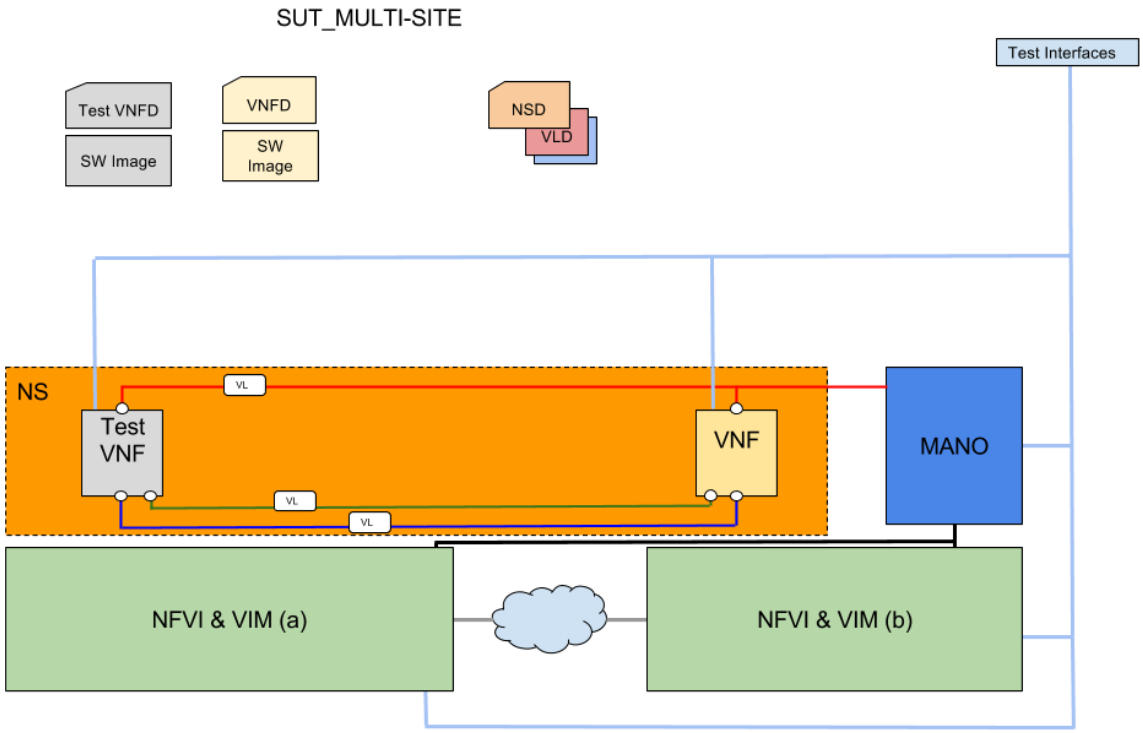

Figure 2. SUT_MULTI-SITE

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

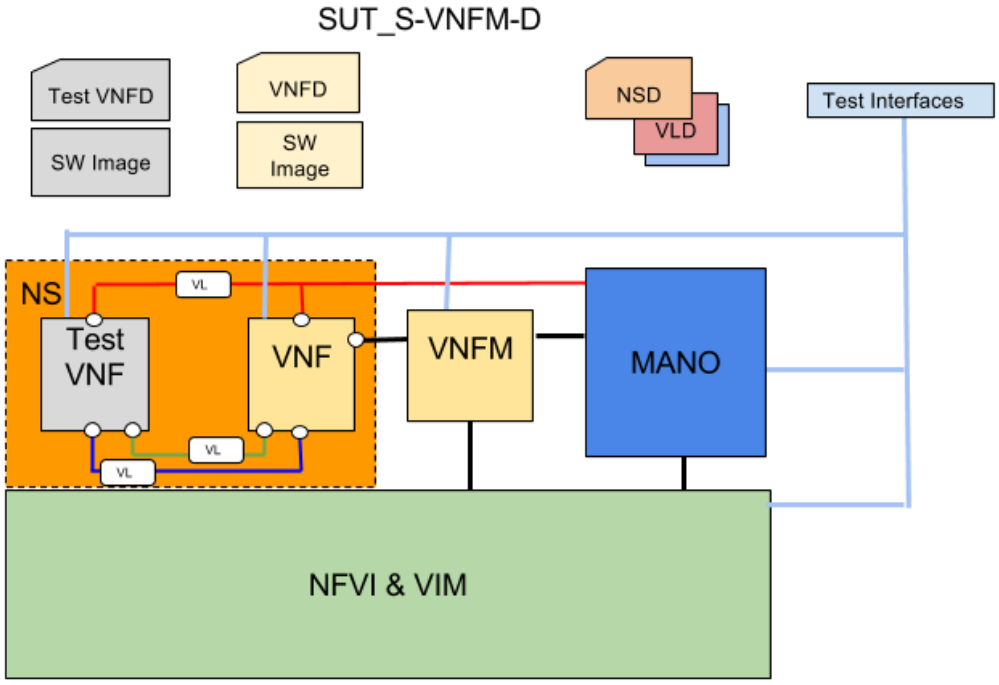

Figure 3. SUT_S-VNFM-D

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)

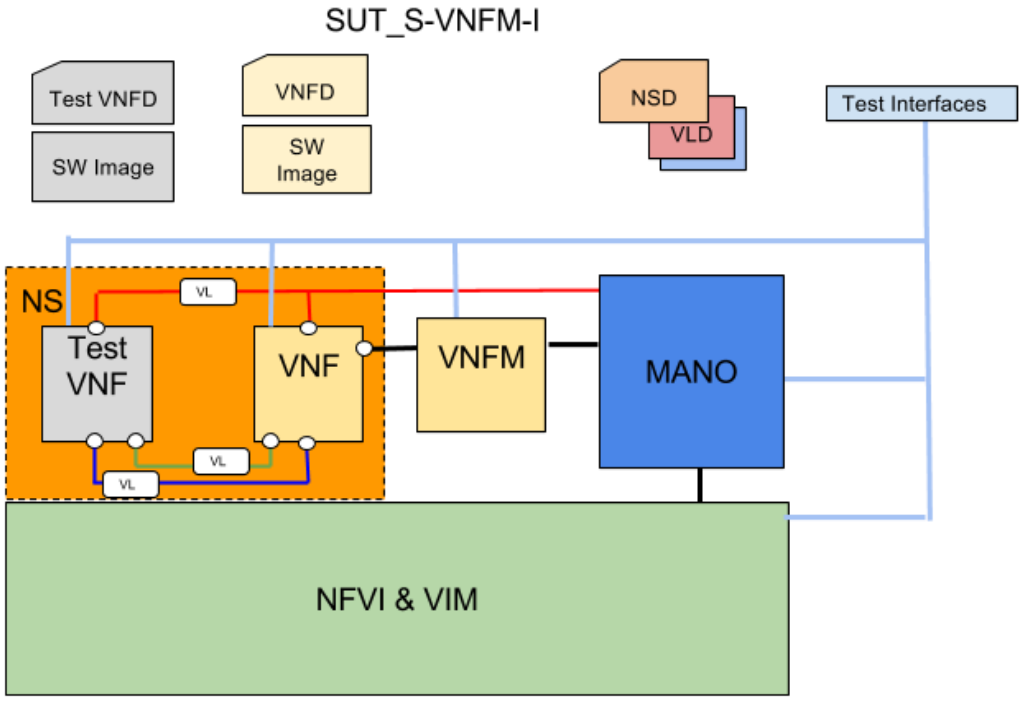

Figure 4. SUT_S-VNFM-I

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				
Identifier	TD_NFV_BASE_ONBOARD_VNF_PKG_001			
Test Purpose	To on-board a VNF Package			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	ETSI GS NFV-IFA013 V2.3.1 (clauses 7.7.2)			
Applicability				
Pre-test conditions	* VNF Package resides on a repository reachable by MANO * VNF Package is complete and consumable by MANO			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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. display or 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_BASE_ONBOARD_NSD_001			
Test Purpose	To onboard a NSD			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	ETSI GS NFV-IFA013 V2.3.1 (clauses 7.2.2)			
Applicability				
Pre-test conditions	* NSD and referenced VLD and VNFFGDs exist and can be reached and consumed by MANO * Required VNF Packages have been on-boarded (TD_NFV_BASE_ONBOARD_VNF_PKG_001)			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	1	Stimulus	Trigger the on-boarding of the NSD on MANO	
	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				
Identifier	TD_NFV_BASE_NS_LCM_INSTANTIATE_001			
Test Purpose	To verify that an NS can be successfully instantiated			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	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)			
Applicability				
Pre-test conditions	* NSD, VLD(s), VNFFGD(s) and VNF Package(s) have been on-boarded in MANO * The software image repository is reachable by the VIM * The required resources are available on the NFVI			
Test Sequence	**Step**	**Type**	**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	
	6	IOP Check	Verify that the VNF(s) are running and reachable through the management network	
	7	IOP Check	Verify that the VNF(s) have been configured according to VNFD(s) (i.e by obtaining a result from the management interface)	
	8	IOP Check	Verify that the VNF(s), VL(s) and VNFFG(s) have been connected according to the Descriptors	
	9	IOP Check	Verify that the NS is successfully instantiated by running the end-to-end functional test	
IOP Verdict				

6.1.2.2 INSTANTIATE - EPA

6.1.2.2.1 TD_NFV_BASE_NS_LCM_INSTANTIATE_EPA_001

Interoperability Test Description				
Identifier	TD_NFV_BASE_NS_LCM_INSTANTIATE_EPA_001			
Test Purpose	To verify that an NS can be successfully instantiated with EPA requirements			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	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)			
Applicability	* [IFS_NFV_MANO_28] MANO supports deploying VNFs with EPA requirements towards NFVI/VIM * [IFS_NFV_VIM_NFVI_1] NFVI/VIM supports EPA attributes * [IFS_NFV_VNF_1] VNF requires EPA			
Pre-test conditions	* NSD, VLD(s), VNFFGD(s) and VNF Package(s) have been on-boarded in MANO * On-boarded VNFD(s) include EPA requirements * The software image repository is reachable by the VIMs * The required resources are available on the NFVIs			
Test Sequence	**Step**	**Type**	**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	
	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				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_OUT_001			
Test Purpose	To verify that a NS can be successfully scaled out (by adding VNF instances) if triggered by a MANO operator			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	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)			
Applicability	*[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 conditions	* NS is instantiated (TD_NFV_NS_LCM_INSTANTIATE_001)			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	1	Stimulus	Trigger 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	
	4	IOP Check	Verify that the additional VNF instances(s) are running and reachable from the management network	
	5	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)	
	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				

6.1.3.1.2 TD_NFV_BASE_NS_LCM_SCALE_IN_001

Interoperability Test Description				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_IN_001			
Test Purpose	To verify that a NS can be successfully scaled in (by removing VNF instances) if triggered by a MANO operator			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	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)			
Applicability	*[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 conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * NS has been scaled out by adding VNF instances			
Test 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				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_OUT_EPA_001			
Test Purpose	To verify that a NS can be successfully scaled out with EPA requirements (by adding VNF instances) if triggered automatically by a MANO operator			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	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)			
Applicability	* [IFS_NFV_MANO_14] MANO supports scaling by adding/removing VNF instances * [IFS_NFV_MANO_28] MANO supports deploying VNFs with EPA requirements towards NFVI/VIM * [IFS_NFV_VNF_4] VNF can scale out/in by adding/removing VNF instances * [IFS_NFV_VNF_1] VNF requires EPA * [IFS_NFV_VIM_NFVI_1] NFVI/VIM supports EPA attributes			
Pre-test conditions	* NS is instantiated (TD_NFV_NS_LCM_INSTANTIATE_EPA_001)			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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	IOP Check	Verify that the additional VNF instances(s), VL(s) and VNFFG(s) are connected according to the Descriptors	
	9	IOP Check	Verify that the 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				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_IN_EPA_001			
Test Purpose	To verify that a NS can be successfully scaled in with EPA requirements (by removing VNF instances) if triggered automatically by a MANO operator			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	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)			
Applicability	* [IFS_NFV_MANO_14] MANO supports scaling by adding/removing VNF instances * [IFS_NFV_MANO_28] MANO supports deploying VNFs with EPA requirements towards NFVI/VIM * [IFS_NFV_VNF_4] VNF can scale out/in by adding/removing VNF instances * [IFS_NFV_VNF_1] VNF requires EPA * [IFS_NFV_VIM_NFVI_1] NFVI/VIM supports EPA attributes			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_EPA_001) * NS has been scaled out by adding VNF instances with EPA requirements			
Test 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 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	IOP Check	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				

6.1.3.3 SCALE NS FROM VNF INDICATOR

6.1.3.3.1 TD_NFV_BASE_NS_LCM_SCALE_OUT_002a

Interoperability Test Description				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_OUT_002a			
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			
Configuration	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)			
Applicability	* [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 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_9] VNF can send indicators (KPIs) to MANO			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * MANO is configured to trigger SCALE OUT (by adding VNF instances) when a given VNF Indicator value crosses a certain threshold			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_IN_002a			
Test Purpose	To verify that a NS can be successfully scaled in (by removing VNF instances) if triggered automatically in MANO by a VNF Indicator notification			
Configuration	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)			
Applicability	* [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 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_9] VNF can send indicators (KPIs) to MANO			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * NS has been scaled out by adding VNF instances * MANO is configured to trigger SCALE IN (by removing VNF instances) when a given VNF Indicator value crosses a certain threshold			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_OUT_002b			
Test Purpose	To verify that a NS can be successfully scaled out (by adding VNF instances) if triggered automatically in MANO by querying a VNF Indicator			
Configuration	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 6.3.4)			
Applicability	* [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 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_9] VNF can send indicators (KPIs) to MANO			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * MANO is configured to trigger SCALE OUT (by adding VNF instances) when a given VNF Indicator value crosses a certain threshold			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	1a	Stimulus	In the VNF, trigger the target VNF indicator to cross the configured auto-scaling 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 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				

6.1.3.3.4 TD_NFV_BASE_NS_LCM_SCALE_IN_002b

Interoperability Test Description				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_IN_002b			
Test Purpose	To verify that a NS can be successfully scaled in (by removing VNF instances) if triggered automatically in MANO by querying a VNF Indicator			
Configuration	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 6.3.4)			
Applicability	* [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 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_9] VNF can send indicators (KPIs) to MANO			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * NS has been scaled out by adding VNF instances * MANO is configured to trigger SCALE IN (by removing VNF instances) when a given VNF Indicator value crosses a certain threshold			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	1a	Stimulus	In the VNF, trigger the target VNF indicator to cross the configured auto-scaling 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 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				

6.1.3.4 SCALE NS FROM VIM KPI

6.1.3.4.1 TD_NFV_BASE_NS_LCM_SCALE_OUT_003

Interoperability Test Description				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_OUT_003			
Test Purpose	To verify that a NS can be successfully scaled out (by adding VNF instances) if triggered automatically in MANO by a VIM KPI			
Configuration	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, 7.7) ETSI GS NFV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) ETSI GS NFV-IFA007 V2.3.1 (clause 7.2.4)			
Applicability	* [IFS_NFV_MANO_19] MANO supports receiving VM/VNFC 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 VM/VNFC virtual compute resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_4] NFVI/VIM exposes VM/VNFC virtual network resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_5] NFVI/VIM exposes VM/VNFC virtual storage resource KPIs to MANO/VNFM			
Pre-test conditions	* NS is instantiated (TD_NFV_NS_LCM_INSTANTIATE_001) * MANO is configured to trigger SCALE OUT (by adding VNF instances) when a given VIM KPI value crosses a certain threshold			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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 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				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_IN_003			
Test Purpose	To verify that a NS can be successfully scaled in (by removing VNF instances) if triggered automatically in MANO by a VIM KPI			
Configuration	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, 7.7) ETSI GS NFV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) ETSI GS NFV-IFA007 V2.3.1 (clause 7.2.4)			
Applicability	* [IFS_NFV_MANO_19] MANO supports receiving VM/VNFC 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 VM/VNFC virtual compute resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_4] NFVI/VIM exposes VM/VNFC virtual network resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_5] NFVI/VIM exposes VM/VNFC virtual storage resource KPIs to MANO/VNFM			
Pre-test conditions	* NS is instantiated (TD_NFV_NS_LCM_INSTANTIATE_001) * NS has been scaled out by adding VNF instances * MANO is configured to trigger SCALE IN (by removing VNF instances) when a given VIM KPI value crosses a certain threshold			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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	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				

6.1.3.5 SCALE NS FROM VNF REQUEST

6.1.3.5.1 TD_NFV_BASE_NS_LCM_SCALE_OUT_004

Interoperability Test Description				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_OUT_004			
Test Purpose	To verify that a NS can be successfully scaled out (by adding VNF instances) if triggered in MANO by a VNF/EM request			
Configuration	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, 7.7) ETSI GS NFV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) ETSI GS NFV-IFA007 V2.3.1 (clause 7.2.4) ETSI GS NFV-IFA008 V2.3.1 (clause 7.2.4)			
Applicability	* [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 conditions	* NS is instantiated (TD_NFV_NS_LCM_INSTANTIATE_001)			
Test Sequence	**Step**	**Type**	**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				

6.1.3.5.2 TD_NFV_BASE_NS_LCM_SCALE_IN_004

Interoperability Test Description				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_IN_004			
Test Purpose	To verify that a NS can successfully scale in (by removing VNF instances) if triggered in MANO by a VNF/EM request			
Configuration	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, 7.7) ETSI GS NFV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) ETSI GS NFV-IFA007 V2.3.1 (clause 7.2.4) ETSI GS NFV-IFA008 V2.3.1 (clause 7.2.4)			
Applicability	* [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 conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * NS has been scaled out by adding VNF instances			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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	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				

6.1.4 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				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_OUT_VNF_001			
Test Purpose	To verify that a VNF in a NS can be successfully scaled out (by adding VNFC instances (VMs)) when triggered by a MANO operator			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	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)			
Applicability	*[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-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001)			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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	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				

6.1.4.1.2 TD_NFV_BASE_NS_LCM_SCALE_IN_VNF_001

Interoperability Test Description				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_IN_VNF_001			
Test Purpose	To verify that a VNF in a NS can be successfully scaled in (by removing VNFC instances (VMs)) when triggered by a MANO operator			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	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)			
Applicability	*[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-test conditions	* NS has been scaled out by adding VM			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	1	Stimulus	Trigger NS scale in (by removing VNFC instances (VMs)) in MANO with an operator action	
	2	IOP Check	Verify that the impacted VM(s) have been terminated	
	3	IOP Check	Verify that the impacted VM related resources have been released by the VIM	
	4	IOP Check	Verify that the remaining VM(s) are still running and reachable through the management network	
	5	IOP Check	Verify that the remaining VM(s) and VL(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				

6.1.4.2 SCALE VNF MANUALLY – EPA

6.1.4.2.1 TD_NFV_BASE_NS_LCM_SCALE_OUT_VNF_EPA_001

Interoperability Test Description				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_OUT_VNF_EPA_001			
Test Purpose	To verify that a NS can be successfully scaled out with EPA requirements (by adding VNF instances) if triggered automatically by a MANO operator			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	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)			
Applicability	* [IFS_NFV_MANO_15] MANO supports scaling out/in by adding/removing VNFC instances * [IFS_NFV_MANO_28] MANO supports deploying VNFs with EPA requirements towards NFVI/VIM * [IFS_NFV_VNF_5] VNF can scale out/in by adding/removing VNFC instances * [IFS_NFV_VNF_1] VNF requires EPA * [IFS_NFV_VIM_NFVI_1] NFVI/VIM supports EPA attributes			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_EPA_001)			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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	IOP Check	Verify that the additional VNF instances(s), VL(s) and VNFFG(s) are connected according to the Descriptors	
	9	IOP Check	Verify that the 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				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_IN_VNF_EPA_001			
Test Purpose	To verify that a NS can be successfully scaled in with EPA requirements (by removing VNF instances) if triggered automatically by a MANO operator			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	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)			
Applicability	* [IFS_NFV_MANO_15] MANO supports scaling out/in by adding/removing VNFC instances * [IFS_NFV_MANO_28] MANO supports deploying VNFs with EPA requirements towards NFVI/VIM * [IFS_NFV_VNF_5] VNF can scale out/in by adding/removing VNFC instances * [IFS_NFV_VNF_1] VNF requires EPA * [IFS_NFV_VIM_NFVI_1] NFVI/VIM supports EPA attributes			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_EPA_001) * NS has been scaled out by adding VNF instances with EPA requirements			
Test 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 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	IOP Check	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				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_OUT_VNF_002a			
Test Purpose	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 notification			
Configuration	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)			
Applicability	* [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 VNF/EM * [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 * [IFS_NFV_VNF_9] VNF can send indicators (KPIs) to MANO			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE:NS_LCM_INSTANTIATE_001) * MANO is configured to trigger SCALE OUT (by adding VM(s)) when a given VNF Indicator value crosses a certain threshold			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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				
Identifier	TD_NFV_NS_LCM_BASE_SCALE_IN_VNF_002a			
Test Purpose	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 notification			
Configuration	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)			
Applicability	* [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 VNF/EM * [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 * [IFS_NFV_VNF_9] VNF can send indicators (KPIs) to MANO			
Pre-test conditions	* NS is instantiated (TD_NFV_NS_LCM_INSTANTIATE_001) * NS has been scaled out by adding VM(s) * MANO is configured to trigger SCALE IN (by removing VM(s)) when a given VNF Indicator value crosses a certain threshold			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_OUT_VNF_002b			
Test Purpose	To verify that a VNF in a NS can be successfully scaled out (by adding VNFC instances (VMs)) when triggered automatically in MANO by querying a VNF Indicator			
Configuration	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 6.3.4)			
Applicability	* [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 VNF/EM * [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 * [IFS_NFV_VNF_9] VNF can send indicators (KPIs) to MANO			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE:NS_LCM_INSTANTIATE_001) * MANO is configured to trigger SCALE OUT (by adding VM(s)) when a given VNF Indicator value crosses a certain threshold			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	1a	Stimulus	In the VNF, trigger the target VNF indicator to cross the configured auto-scaling 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				
Identifier	TD_NFV_NS_LCM_BASE_SCALE_IN_VNF_002b			
Test Purpose	To verify that a VNF in a NS can be successfully scaled in (by removing VNFC instances (VMs)) when triggered automatically in MANO by querying a VNF Indicator			
Configuration	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 6.3.4)			
Applicability	* [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 VNF/EM * [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 * [IFS_NFV_VNF_9] VNF can send indicators (KPIs) to MANO			
Pre-test conditions	* NS is instantiated (TD_NFV_NS_LCM_INSTANTIATE_001) * NS has been scaled out by adding VM(s) * MANO is configured to trigger SCALE IN (by removing VM(s)) when a given VNF Indicator value crosses a certain threshold			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	1a	Stimulus	In the VNF, trigger the target VNF indicator to cross the configured auto-scaling 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				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_OUT_VNF_003			
Test Purpose	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			
Configuration	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, 7.7) ETSI GS NFV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) ETSI GS NFV-IFA007 V2.3.1 (clause 7.2.4)			
Applicability	* [IFS_NFV_MANO_19] MANO supports receiving VM/VNFC 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 VM/VNFC virtual compute resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_4] NFVI/VIM exposes VM/VNFC virtual network resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_5] NFVI/VIM exposes VM/VNFC virtual storage resource KPIs to MANO/VNFM			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * MANO is configured to trigger SCALE OUT (by adding VM(s)) when a given VIM KPI value crosses a certain threshold			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_IN_VNF_003			
Test Purpose	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			
Configuration	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, 7.7) ETSI GS NFV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) ETSI GS NFV-IFA007 V2.3.1 (clause 7.2.4)			
Applicability	* [IFS_NFV_MANO_19] MANO supports receiving VM/VNFC 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 VM/VNFC virtual compute resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_4] NFVI/VIM exposes VM/VNFC virtual network resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_5] NFVI/VIM exposes VM/VNFC virtual storage resource KPIs to MANO/VNFM			
Pre-test conditions	* NS is instantiated (TD_NFV_NS_LCM_INSTANTIATE_001) * NS has been scaled out by adding VM(s) * MANO is configured to trigger SCALE IN (by removing VM(s)) when a given VIM KPI value crosses a certain threshold			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_OUT_VNF_004			
Test Purpose	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			
Configuration	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, 7.7) ETSI GS NFV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) ETSI GS NFV-IFA007 V2.3.1 (clause 7.2.4) ETSI GS NFV-IFA008 V2.3.1 (clause 7.2.4)			
Applicability	* [IFS_NFV_MANO_16] MANO supports scaling out/in request from VNF/EM * [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_VNF_8] VNF/EM can request scaling to MANO			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001)			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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				
Identifier	TD_NFV_BASE_NS_LCM_SCALE_IN_VNF_004			
Test Purpose	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			
Configuration	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, 7.7) ETSI GS NFV-IFA006 V2.3.1 (clause 7.3.1.2, 7.4.1.2, 7.5.1.2, 7.7) ETSI GS NFV-IFA007 V2.3.1 (clause 7.2.4) ETSI GS NFV-IFA008 V2.3.1 (clause 7.2.4)			
Applicability	* [IFS_NFV_MANO_16] MANO supports scaling out/in request from VNF/EM * [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_VNF_8] VNF/EM can request scaling to MANO			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * NS has been scaled out by adding VM(s)			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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				
Identifier	TD_NFV_BASE_NS_LCM_UPDATE_STOP_VNF_001			
Test Purpose	To verify that a VNF running in a NS can be successfully stopped by MANO			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	ETSI GS NFV-IFA013 V2.3.1 (clause 7.3.5) ETSI GS NFV-IFA007 V2.3.1 (clause 7.2.11)			
Applicability	* [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 conditions	* NS is instantiated (TD_NFV_NS_LCM_INSTANTIATE_001) * VNF instance(s) in the NS are running			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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 display the state from VIM)	
IOP Verdict				

6.1.5.2 TD_NFV_BASE_NS_LCM_UPDATE_START_VNF_001

Interoperability Test Description				
Identifier	TD_NFV_BASE_NS_LCM_UPDATE_START_VNF_001			
Test Purpose	To verify that a stopped VNF in a NS can be successfully re-started by MANO			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	ETSI GS NFV-IFA013 V2.3.1 (clause 7.3.5) ETSI GS NFV-IFA007 V2.3.1 (clause 7.2.11)			
Applicability	* [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 conditions	* NS is instantiated (TD_NFV_NS_LCM_INSTANTIATE_001) * One VNF inside the NS has been stopped (TD_NFV_NS_LCM_UPDATE_STOP_VNF_001)			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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 display the state from VIM)	
	4	IOP Check	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				
Identifier	TD_NFV_BASE_FM_VR_NOTIFY_001			
Test Purpose	To verify that a fault alarm notification propagates when a virtualised resource that is required for the NS network connectivity fails.			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	ETSI GS NFV-IFA005 V2.3.1 (clauses 5.3.10, 7.6.2, 8.6.2) ETSI GS NFV-IFA013 V2.3.1 (clauses 5.3.5, 7.6.3, 8.5.2)			
Applicability	* [IFS_NFV_MANO_23] MANO supports receiving VM/VNFC faults/alarms from VIM * [IFS_NFV_VIM_NFVI_6] NFVI/VIM exposes VM/VNFC faults/alarms to MANO/VNFM			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * MANO is subscribed to virtualised resources fault alarms on the VIM			
Test Sequence	**Step**	**Type**	**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	
	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				
Identifier	TD_NFV_BASE_FM_VR_CLEAR_001			
Test Purpose	Verify that a fault clearance notification propagates when a failed virtualised resource that is required for the NS network connectivity is recovered			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	ETSI GS NFV-IFA005 V2.3.1 (clauses 5.3.10, 7.6.2, 8.6.3) ETSI GS NFV-IFA013 V2.3.1 (clauses 5.3.5, 7.6.3, 8.5.3)			
Applicability	* [IFS_NFV_MANO_23] MANO supports receiving VM/VNFC faults/alarms from VIM * [IFS_NFV_VIM_NFVI_6] NFVI/VIM exposes VM/VNFC faults/alarms to MANO/VNFM			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * MANO 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 required for the NS connectivity (TD_NFV_BASE_FM_VR_NOTIFY_001)			
Test Sequence	**Step**	**Type**	**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	
	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				
Identifier	TD_NFV_BASE_FM_VNF_NOTIFY_001			
Test Purpose	To verify that a VNF fault alarm notification propagates via the VNFM when a VNF fault is triggered by a failed virtualised resource			
Configuration	SUT_S-VNFM-D SUT_S-VNFM-I			
References	ETSI GS NFV-IFA006 V2.3.1 (clauses 5.3.9, 7.6.3, 8.6.2) ETSI GS NFV-IFA007 V2.3.1 (clauses 5.3.7, 6.4.6, 7.5.3, 8.4.7) ETSI GS NFV-IFA013 V2.3.1 (clauses 5.3.5, 7.6.3, 8.5.2)			
Applicability	* [IFS_NFV_MANO_24] MANO supports receiving VNF faults/alarms from external VNFM * [IFS_NFV_VNFM_16] VNFM supports receiving VM/VNFC faults/alarms from VIM * [IFS_NFV_VNFM_19] VNFM exposes VNF faults/alarms towards MANO * [IFS_NFV_VIM_NFVI_6] NFVI/VIM exposes VM/VNFC faults/alarms to MANO/VNFM			
Pre-test conditions	* 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	**Type**	**Description**	**Result**
Test Sequence	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	
	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				
Identifier	TD_NFV_BASE_FM_VNF_CLEAR_001			
Test Purpose	To verify that a VNF fault alarm clearance notification propagates via the VNFM when a VNF fault is cleared by resolving a failed virtualised resource			
Configuration	SUT_S-VNFM-D SUT_S-VNFM-I			
References	ETSI GS NFV-IFA006 V2.3.1 (clauses 5.3.9, 7.6.3, 8.6.3) ETSI GS NFV-IFA007 V2.3.1 (clauses 5.3.7, 6.4.6, 7.5.3, 8.4.7) ETSI GS NFV-IFA013 V2.3.1 (clauses 5.3.5, 7.6.3, 8.5.3)			
Applicability	* [IFS_NFV_MANO_24] MANO supports receiving VNF faults/alarms from external VNFM * [IFS_NFV_VNFM_16] VNFM supports receiving VM/VNFC faults/alarms from VIM * [IFS_NFV_VNFM_19] VNFM exposes VNF faults/alarms towards MANO * [IFS_NFV_VIM_NFVI_6] NFVI/VIM exposes VM/VNFC faults/alarms to MANO/VNFM			
Pre-test conditions	* 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)			
Test Sequence	**Step**	**Type**	**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	
	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				
Identifier	TD_NFV_BASE_PM_VR_CREATE_NOTIFY_001			
Test Purpose	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			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	ETSI GS NFV-IFA005 V2.3.1 (clauses 5.3.9, 7.7.2, 7.7.5, 7.7.6, 8.5) ETSI GS NFV-IFA013 V2.3.1 (clauses 5.3.4, 7.5.2, 7.5.4, 7.5.5, 8.4)			
Applicability	* [IFS_NFV_MANO_19] MANO supports receiving VM/VNFC KPIs from VIM * [IFS_NFV_VIM_NFVI_3] NFVI/VIM exposes VM/VNFC virtual compute resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_4] NFVI/VIM exposes VM/VNFC virtual network resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_5] NFVI/VIM exposes VM/VNFC virtual storage resource KPIs to MANO/VNFM			
Pre-test conditions	* NS is instantiated (TD_BASE_NFV_NS_LCM_INSTANTIATE_001) * Monitoring parameters (e.g. performance metrics, metric groups) are defined (e.g. CPU usage, memory usage, etc.) * Monitoring collection and reporting periods are defined			
Test Sequence	**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 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	
	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				
Identifier	TD_NFV_BASE_PM_VR_CREATE_THRESHOLD_001			
Test Purpose	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			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	ETSI GS NFV-IFA005 V2.3.1 (clauses 5.3.9, 7.7.6, 7.7.7, 8.5) ETSI GS NFV-IFA013 V2.3.1 (clauses 5.3.4, 7.5.7, 8.4)			
Applicability	* [IFS_NFV_MANO_19] MANO supports receiving VM/VNFC KPIs from VIM * [IFS_NFV_VIM_NFVI_3] NFVI/VIM exposes VM/VNFC virtual compute resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_4] NFVI/VIM exposes VM/VNFC virtual network resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_5] NFVI/VIM exposes VM/VNFC virtual storage resource KPIs to MANO/VNFM			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * Monitoring parameters (e.g. performance metrics, metric groups) are defined (e.g. CPU usage, memory usage, etc.) * Monitoring performance thresholds are defined			
Test Sequence	**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)	
	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				
Identifier	TD_NFV_BASE_PM_VR_DELETE_NOTIFY_001			
Test Purpose	To verify that the monitoring of performance metrics of a virtualised resource that is required for a NS instance can be stopped by deleting performance monitoring jobs			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	ETSI GS NFV-IFA005 V2.3.1 (clauses 5.3.9, 7.7.4, 7.7.5, 7.7.6, 8.5) ETSI GS NFV-IFA013 V2.3.1 (clauses 5.3.4, 7.5.3, 7.5.4, 7.5.5, 8.4)			
Applicability	* [IFS_NFV_MANO_19] MANO supports receiving VM/VNFC KPIs from VIM * [IFS_NFV_VIM_NFVI_3] NFVI/VIM exposes VM/VNFC virtual compute resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_4] NFVI/VIM exposes VM/VNFC virtual network resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_5] NFVI/VIM exposes VM/VNFC virtual storage resource KPIs to MANO/VNFM			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * A virtualised resource part of the NS instance is monitored by MANO (TD_NFV_BASE_PM_VR_CREATE_NOTIFY_001)			
Test Sequence	**Step**	**Type**	**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	
	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				
Identifier	TD_NFV_BASE_PM_VR_DELETE_THRESHOLD_001			
Test Purpose	To verify that a performance monitoring threshold created for a virtualised resource that is required for a NS instance can be deleted			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	ETSI GS NFV-IFA005 V2.3.1 (clauses 5.3.9, 7.7.6, 7.7.9, 8.5) ETSI GS NFV-IFA013 V2.3.1 (clauses 5.3.4, 7.5.5, 7.5.8, 8.4)			
Applicability	* [IFS_NFV_MANO_19] MANO supports receiving VM/VNFC KPIs from VIM * [IFS_NFV_VIM_NFVI_3] NFVI/VIM exposes VM/VNFC virtual compute resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_4] NFVI/VIM exposes VM/VNFC virtual network resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_5] NFVI/VIM exposes VM/VNFC virtual storage resource KPIs to MANO/VNFM			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * A performance monitoring threshold for a virtualised resource that is part of the NS instance is created by MANO (TD_NFV_BASE_PM_VR_CREATE_THRESHOLD_001)			
Test Sequence	**Step**	**Type**	**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)	
	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				
Identifier	TD_NFV_BASE_PM_VNF_VR_CREATE_NOTIFY_001			
Test Purpose	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			
Configuration	SUT_S-VNFM-D SUT_S-VNFM-I			
References	ETSI GS NFV-IFA006 V2.3.1 (clauses 5.3.8, 7.7.2, 7.7.5, 7.7.6, 8.5) ETSI GS NFV-IFA007 V2.3.1 (clauses 5.3.6, 7.4.2, 7.4.4, 7.4.5, 8.7) ETSI GS NFV-IFA013 V2.3.1 (clauses 5.3.4, 7.5.2, 7.5.4, 7.5.5, 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 VM/VNFC KPIs from VIM * [IFS_NFV_VIM_NFVI_3] NFVI/VIM exposes VM/VNFC virtual compute resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_4] NFVI/VIM exposes VM/VNFC virtual network resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_5] NFVI/VIM exposes VM/VNFC virtual storage resource KPIs to MANO/VNFM			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * Monitoring parameters (e.g. VNF instance, performance metrics, metric groups) are defined (e.g. CPU usage, memory usage, etc.) * Monitoring collection and reporting periods are defined			
Test Sequence	**Step**	**Type**	**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	
	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				
Identifier	TD_NFV_BASE_PM_VNF_VR_CREATE_THRESHOLD_001			
Test Purpose	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			
Configuration	SUT_S-VNFM-D SUT_S-VNFM-I			
References	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)			
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 VM/VNFC KPIs from VIM * [IFS_NFV_VIM_NFVI_3] NFVI/VIM exposes VM/VNFC virtual compute resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_4] NFVI/VIM exposes VM/VNFC virtual network resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_5] NFVI/VIM exposes VM/VNFC virtual storage resource KPIs to MANO/VNFM			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * Monitoring parameters (e.g. VNF instance, performance metrics, metric groups) are defined (e.g. CPU usage, memory usage, etc.) * Monitoring performance thresholds are defined			
Test Sequence	**Step**	**Type**	**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	
	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	
	8	IOP Check	If applicable, verify that the “threshold crossed” notification for the monitored VNF was generated by the VNFM and collected by MANO	
IOP Verdict				

6.1.7.2.3 TD_NFV_BASE_PM_VNF_VR_DELETE_NOTIFY_001

Interoperability Test Description				
Identifier	TD_NFV_BASE_PM_VNF_VR_DELETE_NOTIFY_001			
Test Purpose	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			
Configuration	SUT_S-VNFM-D SUT_S-VNFM-I			
References	ETSI GS NFV-IFA006 V2.3.1 (clauses 5.3.8, 7.7.4, 7.7.5, 7.7.6, 8.5) ETSI GS NFV-IFA007 V2.3.1 (clauses 5.3.6, 7.4.3, 7.4.4, 7.4.5, 8.7) ETSI GS NFV-IFA013 V2.3.1 (clauses 5.3.4, 7.5.3, 7.5.4, 7.5.5, 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 VM/VNFC KPIs from VIM * [IFS_NFV_VIM_NFVI_3] NFVI/VIM exposes VM/VNFC virtual compute resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_4] NFVI/VIM exposes VM/VNFC virtual network resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_5] NFVI/VIM exposes VM/VNFC virtual storage resource KPIs to MANO/VNFM			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * A virtualised resource that is allocated to a VNF instance inside the target NS instance is monitored by the MANO (TD_NFV_BASE_PM_VNF_VR_CREATE_NOTIFY_001)			
Test Sequence	**Step**	**Type**	**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	IOP Check	If applicable, verify that no performance report notifications for the monitored virtualised resource are generated by the VIM and collected by the VNFM	
	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				
Identifier	TD_NFV_BASE_PM_VNF_VR_DELETE_THRESHOLD_001			
Test Purpose	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			
Configuration	SUT_S-VNFM-D SUT_S-VNFM-I			
References	ETSI GS NFV-IFA006 V2.3.1 (clauses 5.3.8, 7.7.5, 7.7.6, 7.7.9, 8.5) ETSI GS NFV-IFA007 V2.3.1 (clauses 5.3.6, 7.4.4, 7.4.5, 7.4.8, 8.7) ETSI GS NFV-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 VM/VNFC KPIs from VIM * [IFS_NFV_VIM_NFVI_3] NFVI/VIM exposes VM/VNFC virtual compute resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_4] NFVI/VIM exposes VM/VNFC virtual network resource KPIs to MANO/VNFM * [IFS_NFV_VIM_NFVI_5] NFVI/VIM exposes VM/VNFC virtual storage resource KPIs to MANO/VNFM			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * A performance monitoring threshold for a virtualised resource that is allocated to a VNF instance inside a NS instance is created by the MANO (TD_NFV_BASE_PM_VNF_VR_CREATE_THRESHOLD_001)			
Test Sequence	**Step**	**Type**	**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	
	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				
Identifier	TD_NFV_BASE_PM_VNF_KPI_CREATE_NOTIFY_001			
Test Purpose	To verify that a VNF indicator inside a NS instance can be monitored using subscriptions and notifications			
Configuration	SUT_S-VNFM-D SUT_S-VNFM-I			
References	ETSI GS NFV-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, 9.6) ETSI GS NFV-IFA007 V2.3.1 (clauses 5.3.9, 7.7.2, 7.7.3, 7.7.4, 8.10)			
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_12] VNFM supports receiving VNF indicators from VNF/EM * [IFS_NFV_VNF_9] VNF can send indicators (KPIs) to MANO/VNFM			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * Monitoring information (e.g. VNF instance) is defined and VNF indicators are available in the NSD			
Test Sequence	**Step**	**Type**	**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	
	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				
Identifier	TD_NFV_BASE_PM_VNF_KPI_DELETE_NOTIFY_001			
Test Purpose	To verify that the monitoring of a VNF indicator inside a NS instance can be stopped by deleting subscriptions			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	ETSI GS NFV-IFA008 V2.3.1 (clauses 5.3.1.4, 5.4.1.4, 6.3.5, 8.2.5, 9.6) ETSI GS NFV-IFA007 V2.3.1 (clauses 5.3.9, 7.7.5, 8.10)			
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_12] VNFM supports receiving VNF indicators from VNF/EM * [IFS_NFV_VNF_9] VNF can send indicators (KPIs) to MANO/VNFM			
Pre-test conditions	* NS is instantiated (TD_NFV_BASE_NS_LCM_INSTANTIATE_001) * A VNF indicator specified in the NSD of the target NS instance is monitored by the MANO (TD_NFV_BASE_PM_VNF_KPI_CREATE_NOTIFY_001)			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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	IOP Check	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_BASE_NS_LCM_TERMINATE_001			
Test Purpose	To verify that a NS can be successfully terminated			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	ETSI GS NFV-IFA013 V2.3.1 (clause 7.3.7) ETSI GS NFV-IFA005 V2.3.1 (clause 7.3.1.5, clause 7.4.1.5, clause 7.5.1.5) ETSI GS NFV-IFA006 V2.3.1 (clause 7.3.1.5, clause 7.4.1.5, clause 7.5.1.5) ETSI GS NFV-IFA007 V2.3.1 (clause 7.2.7)			
Applicability				
Pre-test conditions	* NS has been instantiated			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	1	Stimulus	Trigger NS termination in MANO	
	2	IOP Check	Verify that all the VNF instance(s) have been terminated	
	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_BASE_TEARDOWN_DELETE_NSD_001			
Test Purpose	To delete a NSD			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	ETSI GS NFV-IFA013 V2.3.1 (clause 7.2.6)			
Applicability				
Pre-test conditions	* NSD is created in MANO (TD_NFV_BASE_ONBOARD_NSD_001) * All NSs associated with the NSD have been terminated			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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_BASE_TEARDOWN_DELETE_VNF_PKG_001			
Test Purpose	To delete a VNF Package			
Configuration	SUT_BASE SUT_S-VNFM-D SUT_S-VNFM-I			
References	ETSI GS NFV-IFA013 V2.3.1 (clause 7.7.5)			
Applicability				
Pre-test conditions	* VNF package has been on-boarded in MANO (TD_NFV_BASE_ONBOARD_VNF_PKG _001)			
Test Sequence	**Step**	**Type**	**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				
Identifier	TD_NFV_MULTISITE_NS_LCM_INSTANTIATE_001			
Test Purpose	To verify that an NS can be successfully instantiated across different sites			
Configuration	SUT_MULTI-SITE			
References	ETSI GS NFV-IFA013 V2.3.1 (clause 7.3.3) ETSI GS NFV-IFA005 V2.3.1 (clause 7.2.4) ETSI GS NFV-IFA006 V2.3.1 (clause 7.2.3) ETSI GS NFV-IFA008 V2.3.1 (clause 6.2.3) ETSI GS NFV-IFA010 V2.3.1 (clause 6.3.2) ETSI GS NFV-IFA022 V0.8.0 (clause 5.2)			
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_VIM_NFVI_2] NFVI/VIM supports multi-site / multi-region deployment			
Pre-test conditions	* NSD, VLD(s), VNFFGD(s) and VNF Package(s) have been on-boarded in MANO * The software image repository is reachable by the VIMs * The required resources are available on the NFVIs			
Test Sequence	**Step**	**Type**	**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...)	
	5	IOP Check	Verify that the VL and VNFFG instance(s) have been created according to the descriptors	
	6	IOP Check	Verify that the VNF(s) have been deployed according to the multi-site location constraints	
	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 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	
IOP Verdict				

6.2.2 SCALE NS MANUALLY

6.2.2.1 TD_NFV_MULTISITE_NS_LCM _SCALE_OUT_001

Interoperability Test Description				
Identifier	TD_NFV_MULTISITE_NS_LCM _SCALE_OUT_001			
Test Purpose	To verify that a multi-site NS can be successfully scaled out (by adding VNF instances) if triggered by a MANO operator			
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-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	* [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)			
Test Sequence	**Step**	**Type**	**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...)	
	4	IOP Check	Verify that the additional VNF instance(s) have been deployed according to the multi-site location constraints	
	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 addtional VNF instance(s) have multi-site connectivity through the multi-site VL(s)	
	9	IOP Check	Verify that multi-site NS has been scaled out by running the end-to-end functional test	
IOP Verdict				

6.2.2.2 TD_NFV_MULTISITE_NS_LCM_SCALE_IN_001

Interoperability Test Description				
Identifier	TD_NFV_MULTISITE_NS_LCM_SCALE_IN_001			
Test Purpose	To verify that a multi-site NS can be successfully scaled in (by removing VNF instances) if triggered by a MANO operator			
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-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	* [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-test conditions	* Multi-site NS is instantiated (TD_NFV_MULTISITE_NS_LCM_INSTANTIATE_001) * Multi-site NS has been scaled out by adding VNF instances (TD_NFV_MULTISITE NS_LCM_SCALE_OUT_001)			
Test Sequence	**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	
	3	IOP Check	Verify that the impacted VNF related resources have been released by the proper VIM site / VIM instance	
	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				
Identifier	TD_NFV_MULTISITE_NS_LCM_SCALE_OUT_VNF_001			
Test Purpose	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			
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	* [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-test conditions	* Multi-Site NS is instantiated (TD_NFV_MULTISITE_NS_LCM_INSTANTIATE_001) * MANO is configured to trigger SCALE OUT (by adding VNFC instances) when triggered by a MANO operator			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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				
Identifier	TD_NFV_MULTISITE_NS_LCM_SCALE_IN_VNF_001			
Test Purpose	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			
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	* [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-test conditions	* Multi-site NS is instantiated (TD_NFV_MULTISITE_NS_LCM_INSTANTIATE_001) * Multi-site NS has been scaled out by adding VNFC instances (TD_NFV_MULTISITE_NS_LCM_SCALE_OUT_VNF_001)			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	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	IOP Check	Verify that the remaining VNFC 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				

6.2.4 TERMINATE

6.2.4.1 TD_NFV_MULTISITE_NS_LCM_TERMINATE_001

Interoperability Test Description				
Identifier	TD_NFV_MULTISITE_NS_LCM_TERMINATE_001			
Test Purpose	To verify that a Multi Site NS can be successfully terminated			
Configuration	SUT_MULTI-SITE			
References	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-test conditions	* Multi Site NS has been instantiated			
Test Sequence	**Step**	**Type**	**Description**	**Result**
	1	Stimulus	Trigger Multi Site NS termination in MANO	
	2	IOP Check	Verify that all the VNF instance(s) have been terminated in the given sites	
	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	
	5	IOP Check	Verify that the Multi Site NS instance does no longer exist	
IOP Verdict				

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	PM	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	PM	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	PM	NFVI/VIM exposes VM/VNFC virtual network resource KPIs to MANO/VNFM	
IFS_NFV_VIM_NFVI_5	PM	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	PM	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.