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Contents

Foreword

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Introduction

The present document is part of a TS-family covering the 3rd Generation Partnership Project Technical Specification Group Services and System Aspects, Telecommunication Management; as identified below:

TS 28.520:   Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Requirements

TS 28.521:   Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Procedures

TS 28.522:   Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Stage 2

TS 28.523:   Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Stage 3

1 Scope

The present document (together with the relevant requirements described in [2], [3], [4], [5] and [6]) specifies the requirements applicable to Performance Management (PM) of mobile networks that include virtualized network functions.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1]   3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2]   3GPP TS 32.401: "Telecommunication management; Performance Management (PM); Concept and requirements".

[3]   3GPP TS 32.411: "Telecommunication management; Performance Management (PM) Integration Reference Point (IRP): Requirements".

[4]   3GPP TS 28.500: "Telecommunication management; Management concept, architecture and requirements for mobile networks that include virtualized network functions".

[5]   3GPP TS 32.101: "Telecommunication management; Principles and high level requirements".

[6]   3GPP TS 32.102: "Telecommunication management; Architecture".

[7]   3GPP TS 32.426: "Telecommunication management; Performance Management (PM); Performance measurements Evolved Packet Core (EPC) network".

[8]   ETSI GS NFV-IFA 006 (V2.1.0): "Network Function Virtualisation (NFV); Management and Orchestration; Vi-Vnfm Reference Point - Interface and Information Model Specification".

[9]   3GPP TS 32.412: "Telecommunication management; Performance Management (PM) Integration Reference Point (IRP): Information Service (IS)".

[10]   ETSI GS NFV-IFA008 (V2.1.1): "Network Function Virtualization (NFV); Management and Orchestration; Ve-Vnfm Reference Point - Interface and Information Model Specification".

[11]   3GPP TS 28.521: "Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Procedures".

[12]   3GPP TS 28.522: "Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Stage 2".

[13]   3GPP TS 28.522: "Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Stage 3".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1]], 3GPP TS 28.500 [4], and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1] or in 3GPP TS 28.500 [4].

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1], 3GPP TS 28.500 [4], and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1] or in 3GPP TS 28.500 [4].

NF   Network Function
NFVI   NFV Infrastructure
VNFC   Virtualized Network Function Component
VR   Virtualized Resource

4 Concepts and background

4.1 Overview

The evaluation of PLMN-system behaviour will require performance data collected and recorded by VNF(s) according to a schedule established by the EM [2]. However, not all of these measurements will be required all the time, or from every VNF. Therefore, it is necessary to administer the measurements so as to determine which measurement types, on which measured resources, at which times, are to be executed (see TS 32.401 [2]).

The essence of NFV is to migrate the execution of network functions from vertically integrated hardware to the industry standard COTS (commercial of-the-shelf) servers in the data centre. Performance measurements that are independent of the migration (e.g. handover, tracking area update … related measurements [7]) are not impacted. Therefore, these performance measurements can be reused.

Other performance measurement that are to measure the hardware usages (e.g. MME Processor usage [7]) are impacted by the Virtualized Resource (VR) performance measurements.

4.2 Performance measurement data collection methods

Figure 4.2-1 shows the PM data collection methods for virtualized networks.

When it is necessary to collect the PM data (i.e. PM data related to 3GPP Network Function and 3GPP NF PM data related to VR), NM needs to create a PM collection task at EM. So EM knows the measurement types, the measured resources, the recording periods and collection times wanted (see TS 32.401 [2]).

For PM data related to 3GPP Network Function collection, EM will request VNF(s) to collect the PM data related to 3GPP Network Function as specified by NM.

For VNF PM data related to VR collection, EM will create a PM collection task at VNFM to collect VNF/VNFC PM data related to VR, based on the information provided by NM, so VNFM knows the measurement types, the measured resources, the recording periods, and collection times wanted. Then, VNFM will create a PM collection task at VIM, based on the information provided by EM (see clause 7.7.2 [8]). VIM will request NFVI to collect the VR PM data as specified by VNFM.

The various PM data collected are stored in data repositories. Data stored in data repositories may be fetched by NM (or any authorized user).
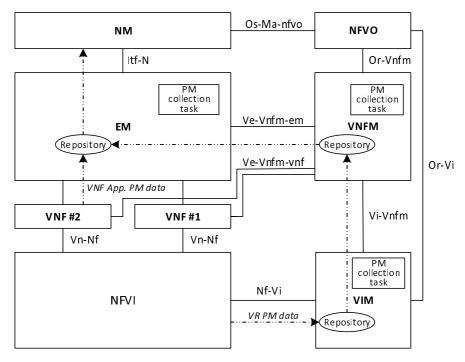
Figure 4.2-1: PM data collection methods for virtualized networks

5 Business level requirements

None.

6 Specification level requirements

6.1 Introduction

Note: The UCs/Requirements/Procedures/solutions defined in the present document, TS 28.521 [11], TS 28.522 [12] and TS 28.523 [13] are focused only on the protocol design/sequences that occur between systems and are not on the method/algorithm for mapping/processing/conversion of the performance metric types produced by VNFM/VIM to "3GPP NF performance measurements related to VR".

6.2 Requirements

6.2.1 Requirements for Itf-N

REQ-NFV_PM_Itf-N-FUN-1 IRPAgent should have the capability to send 3GPP NF performance alarms related VR to IRPManager.

REQ-NFV_PM_Itf-N-FUN-2 IRPAgent should have the capability allowing IRPManager to create measurement job for collecting the 3GPP NF performance measurements related to VR.

REQ-NFV_PM_Itf-N-FUN-3 IRPAgent should have the capability to send the VNF PM data related to VR available notification to the IRPManager.

REQ-NFV_PM_Itf-N-FUN-4 IRPAgent should have the capability allowing IRPManager to create a threshold for the 3GPP NF performance measurements related to VR.

REQ-NFV_PM_Itf-N-FUN-5 IRPAgent should have the capability allowing IRPManager to delete a threshold for the 3GPP NF performance measurements related to VR.

REQ-NFV_PM_Itf-N-FUN-6 IRPAgent should have the capability allowing IRPManager to list the detailed information of a threshold for the 3GPP NF performance measurements related to VR.

REQ-NFV_PM_Itf-N-FUN-7 IRPAgent should have the capability allowing IRPmanager to suspend a measurement job for 3GPP NF performance measurements related to VR (see 3GPP TS 32.411 [3]).

REQ-NFV_PM_Itf-N-FUN-8 IRPAgent should have the capability allowing IRPManager to resume a measurement job for 3GPP NF performance measurements related to VR (see 3GPP TS 32.411 [3])

6.2.2 Requirements for Os-Ma-nfvo

None.

6.2.3 Requirements for Ve-Vnfm-em

REQ- NFV_PM_Ve-Vnfm-em -FUN-1 The Ve-Vnfm-em reference point shall have the capability allowing VNFM to receive request to collect the VNF/VNFC performance measurement related to VR identified with the VNF/VNFC identifier (see Ve-Vnfm-em.VnfPm.01 in clause 5.2.1.6 in [10]).

REQ- NFV_PM_Ve-Vnfm-em -FUN-2 The Ve-Vnfm-em reference point shall have the capability allowing VNFM to make the VNF/VNFC performance measurements related VR available with the VNF/VNFC identifier (see Ve-Vnfm-em.VnfPm.01 in clause 5.2.1.6 in [10]).

REQ-NFV_PM_Ve-Vnfm-em-FUN-3 The Ve-Vnfm-em reference point shall support a capability allowing EM to subscribe for the notifications on the availability of the VNF/VNFC performance measurements related to VR (see Ve-Vnfm-em.VnfPm.05 in [10]).

REQ-NFV_PM_Ve-Vnfm-em-FUN-4 The Ve-Vnfm-em reference point shall have the capability allowing EM to create a PM job to collect the VNF/VNFC performance measurements related to VR (see Ve-Vnfm-em.VnfPm.02 in [10]).

REQ-NFV_PM_Ve-Vnfm-em-FUN-5 The Ve-Vnfm-em reference point shall have the capability allowing EM to delete one or more PM job(s) (see Ve-Vnfm-em.VnfPm.03 in [10]).

REQ-NFV_PM_Ve-Vnfm-em-FUN-6 The Ve-Vnfm-em reference point shall support a capability allowing EM to subscribe for the notifications related to VNF/VNFC threshold crossing alarms (see Ve-Vnfm-em.VnfPm.09 in [10]).

REQ-NFV_PM_Ve-Vnfm-em-FUN-7 The Ve-Vnfm-em reference point shall support a capability allowing EM to unsubscribe the notifications related to VNF/VNFC performance measurement related to VR.

REQ-NFV_PM_Ve-Vnfm-em-FUN-8 The Ve-Vnfm-em reference point shall have the capability allowing EM to query the details of one or more PM job(s) (see Ve-Vnfm-em.VnfPm.05 in [10]).

REQ-NFV_PM_Ve-Vnfm-em-FUN-9 The Ve-Vnfm-em reference point shall have the capability allowing VNFM to notify EM about the availability of VNF/VNFC performance information related to VR (see Ve-Vnfm-em.VnfPm.02 in [10]).

REQ-NFV_PM_Ve-Vnfm-em-FUN-10 The Ve-Vnfm-em reference point shall have the capability allowing VNFM to notify EM about a threshold crossing being detected for a VNF/VNFC performance measurement related to VR (see Ve-Vnfm-em.VnfPm.08 in [10]).

REQ-NFV_PM_Ve-Vnfm-em-FUN-11 The Ve-Vnfm-em reference point shall have the capability allowing EM to create, delete, and query the thresholds on VNF/VNFC performance information related to VR (see Ve-Vnfm-em.VnfPm.07 in [10]).

6.2.4 Requirements for Ve-Vnfm-vnf

None.

6.3 Actor roles

See detailed actors and roles for each use case in clause 6.5.

6.4 Telecommunications resources

See detailed telecommunication resources for each use case in clause 6.5.

6.5 Use cases

6.5.1 Measurement job operations

6.5.1.1 Measurement job creation for 3GPP NF performance measurements related to VR

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	Enable NM to know whether the 3GPP NF performance issue (if any) is caused by resource shortage.	
Actors and Roles	NM.	
Telecom resources	NM, EM, VNFM	
Assumptions	The VNF instance is in operation.	
Pre-conditions		
Begins when	NM decides to create a measurement job to collect the 3GPP NF performance measurements related to VR.	
Step 1 (M)	NM sends a request to EM to create a measurement job for 3GPP NF performance measurements related to VR (see clause 7.3.1 [9])	
Step 2 (M)	EM sends request(s) to VNFM to create the PM job(s) for VNF/VNFC performance measurements, based on the information provided by NM (see clause 7.4.2 [10]), if the measurement job requested by step 1 cannot be supported by the existing PM jobs of VNFM.	
Step 3 (M)	VNFM sends response(s) to EM with the identifier of the PM job(s) to indicate that the PM job(s) have been created successfully (see clause 7.4.2 [10]).	
Step 4 (M)	EM sends a response to NM to indicate the result of the measurement job creation (see clause 7.3.1.3 [9]).	
Ends when (*)	NM receives the response.	
Exceptions		
Post-conditions	NM is notified that the measurement job has been created.	
Traceability (*)	REQ-NFV_PM_Itf-N-FUN-2, REQ-NFV_PM_Ve-Vnfm-em-FUN-4, REQ-NFV_PM_Ve-Vnfm-em-FUN-2	

6.5.1.2   3GPP NF performance measurement related to VR job deletion

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	Enable NM to stop a performance measurement job that was created to collect the 3GPP NF PM data related to VR.	
Actors and Roles	NM.	
Telecom resources	NM, EM, VNFM	
Assumptions	The VNF instance is in operation.	
Pre-conditions	A performance measurement job for 3GPP NF PM data related to VR collection already exists.	
Begins when	NM decides to stop the measurement job.	
Step 1 (M)	NM sends a request to EM to stop a measurement job (see clause 7.3.2 [9]).	
Step 2 (O)	EM may send a request to VNFM to delete the correspondibg PM job(s), with a PM job identifier, that were used to support the measurement job of step 1 (see clause 7.4.3 [10]). It is up to EM to decide whether to delete the above-mentioned PM jobs through VNFM.	
Step 3 (O)	VNFM sends a response to EM with the identifier of the PM job being deleted (see clause 7.4.3 [10]).	
Step 4 (M)	EM sends a response to NM to indicate the result of PM job deletion (see clause 7.3.2.3 [9]).	
Ends when (*)	NM receives the response.	
Exceptions		
Post-conditions	No PM data can be collected.	
Traceability (*)	REQ-NFV_PM_Ve-Vnfm-em-FUN-5, REQ-NFV_PM_Ve-Vnfm-em-FUN-2	

6.5.1.3   Measurement job suspension for 3GPP NF performance measurements related to VR

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	Enable NM to suspend a measurement job that is collecting the 3GPP NF performance measurements related to VR.	
Actors and Roles	NM.	
Telecom resources	NM, EM, VNFM	
Assumptions	The VNF instance is in operation.	
Pre-conditions	A measurement job exists for collecting the 3GPP NF performance measurements related to VR.	
Begins when	NM decides to suspend the measurement job.	
Step 1 (M)	NM sends a request to EM with the `jobId` to suspend a measurement job (see clause 7.3.3 [9]).	
Step 2 (M)	EM stops the reporting of the measurement result data for the measurement job identified by the `jobId`.	
Step 3 (O)	EM may send a request to VNFM to delete the PM job(s), identified by the `pmJobId` that were used to support the measurement job identified by the `jobId`. It is up to EM to decide whether to delete the above-mentioned PM jobs through VNFM.	
Step 4 (O)	VNFM sends a response to EM with the identifier of the performance job being deleted.	
Step 5 (M)	EM sends a response to NM to indicate the result of measurement job suspension (see clause 7.3.3.3 [9]).	
Ends when (*)	NM receives the response.	
Exceptions		
Post-conditions	The measurement job is suspended.	
Traceability (*)	REQ-NFV_PM_Itf-N-FUN-7, REQ-NFV_PM_Ve-Vnfm-em-FUN-6, REQ-NFV_PM_Ve-Vnfm-em-FUN-2	

6.5.1.4 Measurement job resumption for 3GPP NF performance measurements related to VR

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	Enable NM to resume a suspended measurement job for 3GPP NF performance measurements related to VR.	
Actors and Roles	NM.	
Telecom resources	NM, EM, VNFM	
Assumptions	The VNF instance is in operation.	
Pre-conditions	EM supports the Optional operation suspend. A measurement job for 3GPP NF performance measurements related to VR has been suspended.	
Begins when	NM decides to resume the suspended measurement job.	
Step 1 (M)	NM sends a request to EM with the jobId to resume a suspended measurement job (see clause 7.3.4 [9]).	
Step 2 (CM)	If the PM jobs used to support the measurement job identified by the jobId do not exist anymore, EM sends a request to VNFM to create the PM job(s). The condition of the support qualifier is: the PM jobs used to support the measurement job identified by the jobId do not exist anymore.	
Step 3 (CM)	VNFM sends a response to EM with the identifier of the PM job(s) being created. The condition of the support qualifier is: step 2 has been executed.	
Step 4 (M)	EM sends a response to NM to indicate the measureemnt job has been resumed (see clause 7.3.4.3 [9]).	
Ends when (*)	NM receives the response.	
Exceptions		
Post-conditions	The measurement job is resumed.	
Traceability (*)	REQ-NFV_PM_Itf-N-FUN-8, REQ-NFV_PM_Ve-Vnfm-em-FUN-7, REQ-NFV_PM_Ve-Vnfm-em-FUN-2	

6.5.1.5 3GPP NF performance measurement related to VR job listing

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	Enable EM to list the information of all or a set of specified current performance measurement job.	
Actors and Roles	EM.	
Telecom resources	EM, VNFM	
Assumptions	The VNF instance is in operation.	
Pre-conditions	One or more performance measurement jobs for VNF PM data related to VR collection already exist	
Begins when	EM decides to get the list of the measurement jobs.	
Step 1 (M)	EM sends a request to VNFM to list the measurement jobs with the query criteria (see clause 7.4.6 [10]).	
Step 2 (M)	VNFM sends a response to EM with the detailed information of the PM job in the list (see clause 7.4.6 [10]).	
Ends when (*)	EM receives the response.	
Exceptions		
Post-conditions	PM job information is available.	
Traceability (*)	REQ-NFV_PM_Ve-Vnfm-em-FUN-8	

6.5.2 Threshold monitoring operations

6.5.2.1 Threshold creation for monitoring 3GPP NF performance measurement related to VR

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	Enable NM to create a threshold to monitor the 3GPP NF performance measurement related to VR that may or may not be defined in a measurement job.	
Actors and Roles	NM.	
Telecom resources	NM, EM, VNFM	
Assumptions	The VNF instance is in operation.	
Pre-conditions	EM supports the optional PMIRPOperations_2 Interface (see clause 7.4 of 3GPP PM IRP [9]).	
Begins when	NM decides to create a threshold to monitor the 3GPP NF performance measurement related VR.	
Step 1 (M)	NM sends a request to EM to create a threshold (see clause 7.4.1 [9]) to monitor the 3GPP NF performance measurement related to VR.	
Step 2 (O)	EM sends a request to VNFM to create a threshold to monitor the VNF/VNFC performance measurement related to VR (see clause 7.4.7 [10]), if the threshold requested by step 1 cannot be supported by the existing threshold(s) of VNFM..	
Step 3 (O)	VNFM sends a response to EM with the identifiers of the thresholds being created (see clause 7.4.7 [10]).	
Step 4 (M)	EM sends a response to NM to indicate the result of the threshold creation (see clause 7.4.1.3 [9]).	
Ends when (*)	NM receives the response.	
Exceptions		
Post-conditions	The threshold is created to monitor the 3GPP NF PM data related to VR.	
Traceability (*)	REQ-NFV_PM_Ve-Vnfm-em-FUN-11, REQ-NFV_PM_Itf-N-FUN-4	

6.5.2.2 Threshold deletion for monitoring 3GPP NF performance measurement related to VR

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	Enable NM to delete a threshold that has been created to monitor the 3GPP NF performance measurement related to VR.	
Actors and Roles	NM.	
Telecom resources	NM, EM, VNFM	
Assumptions	The VNF instance is in operation.	
Pre-conditions	The threshold to monitor the 3GPP NF performance measurement related to VR already exists. EM supports the optional PMIRPOperations_2 Interface (see clause 7.4 of 3GPP PM IRP [9]).	
Begins when	NM decides to delete a threshold.	
Step 1 (M)	NM sends a request to EM to delete a threshold (see clause 7.4.2 [9]).	
Step 2 (O)	EM may send a request to VNFM to delete the threshold(s) that were used to support the threshold of step 1 (see clause 7.4.8 [10]). It is up to EM to decide whether to delete the above-mentioned threshold(s) through VNFM.	
Step 3 (O)	VNFM sends a response to EM with the identifier of the threshold(s) being deleted (see clause 7.4.8 [10]).	
Step 4 (M)	EM sends a response to NM to indicate the result of threshold deletion (see clause 7.4.1.3 [9]).	
Ends when (*)	NM receives the response.	
Exceptions		
Post-conditions	The PM data threshold monitoring is not available to NM.	
Traceability (*)	REQ-NFV_PM_Ve-Vnfm-em-FUN-11, REQ-NFV_PM_Itf-N-FUN-5	

6.5.2.3 Threshold listing for monitoring VNF performance measurement related to VR

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	Enable EM to list the detailed information of thresholds that are used to monitor the VNF performance measurement related to VR	
Actors and Roles	EM.	
Telecom resources	EM, VNFM	
Assumptions	The VNF instance is in operation.	
Pre-conditions	EM supports the optional PMIRPOperations_2 Interface (see clause 7.4 of 3GPP PM IRP [9]).	
Begins when	EM needs to know the detailed information of thresholds being created.	
Step 1 (M)	EM sends a request to VNFM to list the thresholds that are identified by a list of threshold identifiers(see clause 7.4.9 [10]),	
Step 2 (M)	VNFM sends a response to EM with the details of thresholds (see clause 7.4.9 [10]).	
Ends when (*)	EM receives the response.	
Exceptions		
Post-conditions	The PM threshold information is available to EM.	
Traceability (*)	REQ-NFV_PM_Ve-Vnfm-em-FUN-11	

6.5.3 Performance measurement notifications

6.5.3.1 3GPP NF performance measurements related to VR available notification

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	Enable NM to be notified when the 3GPP NF performance measurement related to VR file(s) are available.	
Actors and Roles	NM.	
Telecom resources	NM, EM	
Assumptions		
Pre-conditions	VNFM/VIM have been set up to collect 3GPP NF performance measurement related to VR.	
Begins when	The 3GPP NF performance measurements related to VR for a VNF, are available at EM.	
Step 1 (M)	EM notifies NM the availability of the 3GPP NF performance measurements related to VR files for a particular VNF (see clause 8.1 [9]).	
Ends when (*)	NM receives the notification.	
Exceptions		
Post-conditions	The NM is notified.	
Traceability (*)	REQ-NFV_PM_Itf-N-FUN-3	

6.5.3.2 Performance alarm for 3GPP NF performance measurement related to VR

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	Enable EM to send performance alarm to NM.	
Actors and Roles	NM.	
Telecom resources	NM, EM	
Assumptions	NM is a subscriber for receiving alarm notification from EM.	
Pre-conditions	Threshold has been created to monitor the 3GPP NF performance measurement related to VR.	
Begins when	EM detects that the VNF/VNFC performance measurements related to VR has crossed the threshold.	
Step 1 (M)	EM determines to generate a performance alarm, by adding the 3GPP NF related VR performance alarm into its Alarm List, and sending a 3GPP NF related VR performance alarm to NM.	
Ends when (*)	NM receives the performance alarm.	
Exceptions		
Post-conditions	NM is notified.	
Traceability (*)	REQ-NFV_PM_Itf-N-FUN-1	

6.5.3.3 VNF performance measurements related to VR available notification

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	Enable EM to be notified when the 3GPP NF performance measurement related to VR file(s) are available.	
Actors and Roles	EM.	
Telecom resources	EM, VNFM, VIM	
Assumptions		
Pre-conditions	VNFM/VIM have been set up to collect 3GPP NF performance measurement related to VR.	
Begins when	The 3GPP NF performance measurements related to VR for a VNF, are available at VNFM.	
Step 1 (M)	VNFM notifies EM the availability of the VNF/VNFC performance measurements related to VR files for a particular VNF/VNFC identified by the object instance ID (see clause 7.4.5 [10]).	
Ends when (*)	EM receives the notification.	
Exceptions		
Post-conditions	The EM is notified.	
Traceability (*)	REQ-NFV_PM_Ve-Vnfm-em-FUN-9, REQ-NFV_PM_Ve-Vnfm-em-FUN-4	

6.5.3.4 VNF performance measurement related to VR threshold crossing notification

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	Enable EM to receive the threshold crossing notification of VNF performance measurement related to VR from VNFM.	
Actors and Roles	EM.	
Telecom resources	EM, VNFM, VIM	
Assumptions	EM is a subscriber for receiving threshold crossing notification from VNFM.	
Pre-conditions	Threshold has been created to monitor the VNF/VNFC performance measurement related to VR.	
Begins when	VNFM detects that the VNF/VNFC performance measurements related to VR has crossed the threshold.	
Step 1 (M)	VNFM notifies EM that a threshold has been crossed on a VNF/VNFC PM data related to VR performance measurement (see clause 7.4.5 [10]).	
Ends when (*)	EM receives the performance alarm.	
Exceptions		
Post-conditions	EM is notified.	
Traceability (*)	REQ-NFV_PM_Ve-Vnfm-em-FUN-10, REQ-NFV_PM_Ve-Vnfm-em-FUN-4	

6.5.4 Subscription operations

6.5.4.1 EM subscribe the notification for VNF performance measurement related to VR

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	Enable EM to subscribe the notification for the VNF performance measurement related to VR.	
Actors and Roles	EM.	
Telecom resources	EM, VNFM	
Assumptions		
Pre-conditions		
Begins when	EM decides to subscribe the VNF performance measurement related to VR.	
Step 1 (M)	EM sends a request to VNFM to subscribe the VNF related VR performance measurements (see clause 7.4.4 [10]).	
Step 2 (M)	VNFM sends a response to EM with the identifiers of the subscription (see clause 7.4.4 [10]).	
Ends when (*)	EM receives the response.	
Exceptions		
Post-conditions	EM has subscribed the notification of the VNF performance measurement related to VR.	
Traceability (*)	REQ-NFV_PM_Ve-Vnfm-em -FUN-3, REQ-NFV_PM_Ve-Vnfm-em -FUN-6	

6.5.4.2 EM unsubscribe the notification for VNF performance measurement related to VR

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	Enable EM to unsubscribe the notification for the VNF performance measurement related to VR.	
Actors and Roles	EM.	
Telecom resources	EM, VNFM	
Assumptions	The VNF instance is in operation.	
Pre-conditions		
Begins when	EM decides to unsubscribe the VNF performance measurement related to VR.	
Step 1 (M)	EM sends a request to VNFM with the identifier of subscription to unsubscribe the VNF performance measurement related to VR.	
Step 2 (M)	VNFM sends a response to EM with the identifiers of the un-subscription that has been unsubscribed.	
Ends when (*)	EM receives the response.	
Exceptions		
Post-conditions	EM has unsubscribed the notification of the VNF performance measurement related to VR.	
Traceability (*)	REQ-NFV_PM_Ve-Vnfm-em-FUN-7	

Annex A (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2018-06	SA#80	SP-180553	0001	1	B	Scope extension to cover RAN	15.0.0

History

Document history		
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