

# vMRF Network Impact Report

Virtual Multimedia Resource Function

NETWORK IMPACT REPORT

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# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>General Impact</b>	<b>2</b>
2.1	General Impact for vMRF 1.1	2
2.2	General Impact for vMRF 1.2	2
2.3	General Impact for vMRF 1.3	3
2.4	General Impact for vMRF 1.4	4
2.5	General Impact for vMRF 1.5.0	4
2.6	Other Network Elements	5
<b>3</b>	<b>Interfaces</b>	<b>10</b>
3.1	Interfaces in vMRF 1.1	10
3.2	Interfaces in vMRF 1.2	11
3.3	Interfaces in vMRF 1.3	12
3.4	Interfaces in vMRF 1.4	13
3.5	Interfaces in vMRF 1.5.0	14
<b>4</b>	<b>Summary of Impacts per Feature</b>	<b>21</b>
<b>5</b>	<b>Impact on vMRF Features</b>	<b>22</b>
5.1	Impact on vMRF Features from vMRF 1.0 to vMRF 1.1	22
5.2	Impact on vMRF Features from vMRF 1.1 to vMRF 1.2	22
5.3	Impact on vMRF Features from vMRF 1.2 to vMRF 1.3	23
5.4	Impact on vMRF Features from vMRF 1.3 to vMRF 1.4	23
5.5	Impact on vMRF Features from vMRF 1.4 to vMRF 1.5.0	24





# 1 Introduction

The Network Impact Report (NIR) describes how the current release of Virtual Multimedia Resource Function (vMRF) with new and changed features affects the previous release of vMRF and the operator's overall network, including all affected products and functions.

The purpose of this document is to provide sufficient information at an early stage to Ericsson system operators to help them plan the introduction of new products and upgrades to their networks.

This document is a living document and is subject to change during the development of the new release. Therefore, part of the information may be incomplete or unavailable until General Availability (GA) of the new vMRF release.



## 2 General Impact

This section describes the general impact for the various vMRF releases.

### 2.1 General Impact for vMRF 1.1

This section describes the general impact for the vMRF 1.1 release.

#### 2.1.1 Backward Compatibility

The enhanced functionality in the vMRF 1.1 is backward compatible.

#### 2.1.2 Capacity and Performance

In vMRF 1.1 hyperthreading support has been introduced. When hyperthreading is in use, vMRF VMs are deployed by allocating two vCPUs per each physical CPU core. The use of hyperthreading increases the capacity of a single physical CPU core up to 20%. It is recommended to use hyperthreading, in which case only even VM flavor sizes are supported.

#### 2.1.3 Operation

The following port number changes are introduced in vMRF 1.1 due to alignment with other IMS nodes:

- Cluster internal network port is moved to eth0
- O&M port is moved to eth1
- Signaling port is moved to eth2

### 2.2 General Impact for vMRF 1.2

This section describes the general impact for the vMRF 1.2 release.

#### 2.2.1 Backward Compatibility

vMRF 1.2 does not have upgrade compatibility with signaling subnet stacks created in previous releases. vMRF configuration can be imported to vMRF 1.2 from previous releases.



## 2.2.2 Capacity and Performance

No impact.

## 2.2.3 Operation

The vMRF 1.2 release includes parameter name changes in HOT and example environment files included in the software delivery package. Due to this, the `example_environment.yaml` from previous vMRF releases cannot be used when creating subnets. Before the deployment of vMRF 1.2, the old vMRF configuration must be backed up to a cluster-external storage, and the old vMRF stack and signaling subnet stack must be deleted. The `example_environment.yaml` file included in the vMRF 1.2 software delivery package must be prepared with site-specific data, and vMRF 1.2 must be deployed as described in the relevant [manual deployment guides](#). After deployment, the previously exported configuration can be imported.

The following parameter changes are introduced in vMRF1.2:

- `mrsv_` prefix parameters have been replaced with `mr_` prefix

The following new features are introduced in vMRF 1.2:

- Network-redundant upgrade method
- Workflow-based VNF Life Cycle Management (VNF-LCM)

## 2.3 General Impact for vMRF 1.3

This section describes the general impact for the vMRF 1.3 release.

### 2.3.1 Backward Compatibility

The enhanced functionality in the vMRF 1.3 is backward compatible.

### 2.3.2 Capacity and Performance

No impact.

### 2.3.3 Operation

The following new features are introduced in vMRF 1.3:

- Support for the Enhanced Voice Services (EVS) codec

The following enhanced features are introduced in vMRF 1.3:



- VNF Life Cycle Management enhancement: Upgrade workflow

## 2.4 General Impact for vMRF 1.4

This section describes the general impact for the vMRF 1.4 release.

The following new features are introduced in vMRF 1.4:

- Platform Automatic IP Address Configuration
- Tone Sender Service Configuration

### 2.4.1 Backward Compatibility

The enhanced functionality in the vMRF 1.4 is backward compatible.

### 2.4.2 Capacity and Performance

No impact.

### 2.4.3 Operation

In vMRF 1.4, a separate batch of HOT and example environment yaml files are included in the software delivery package for deployment with or without DHCP server configuration on OpenStack.

## 2.5 General Impact for vMRF 1.5.0

This section describes the general impact for the vMRF 1.5.0 release.

### 2.5.1 Backward Compatibility

The enhanced functionality in the vMRF 1.5.0 is backward compatible.

### 2.5.2 Capacity and Performance

In vMRF 1.5.0, the minimum VM storage disk space is increased to 6 GB.

### 2.5.3 Operation

Deployment on VMware vSphere is supported for vMRF 1.5.0.



## 2.6 Other Network Elements

### 2.6.1 Other Network Elements in vMRF 1.1

#### 2.6.1.1 General

The lowest interoperable releases for vMRF 1.1 are described in Table 1.

Table 1 Lowest Interoperable Releases for vMRF 1.1

MTAS	15B
vMTAS	16A
OSS-RC	17B

##### 2.6.1.1.1 Multimedia Telephony Application Server (MTAS)

vMRF 1.1 is compatible with the following MTAS releases: 4.1, 4.2, 4.3, and 4.4.

##### 2.6.1.1.2 Virtual Multimedia Telephony Application Server (vMTAS)

vMRF 1.1 is compatible with the following vMTAS release: 16A.

##### 2.6.1.1.3 OSS-RC

vMRF 1.1 is compatible with the following OSS-RC release: 17B.

### 2.6.2 Other Network Elements in vMRF 1.2

#### 2.6.2.1 General

The lowest interoperable releases for vMRF 1.2 are described in Table 2.

Table 2 Lowest Interoperable Releases for vMRF 1.2

MTAS	16A
vMTAS	16A
OSS-RC	17B

##### 2.6.2.1.1 Multimedia Telephony Application Server (MTAS)

vMRF 1.2 is compatible with the following MTAS releases: 4.0, 4.1, 4.2, 4.3, 4.4, 4.5, and 4.6.



**2.6.2.1.2 Virtual Multimedia Telephony Application Server (vMTAS)**

vMRF 1.2 is compatible with the following vMTAS releases: 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, and 1.6.

**2.6.2.1.3 OSS-RC**

vMRF 1.2 is compatible with the following OSS-RC releases: 17B, 18A.

## **2.6.3 Other Network Elements in vMRF 1.3**

### **2.6.3.1 General**

The lowest interoperable releases for vMRF 1.3 are described in Table 3.

Table 3 Lowest Interoperable Releases for vMRF 1.3

MTAS	16A
vMTAS	16A
OSS-RC	17B
ENM	17B
NeLS	1

**2.6.3.1.1 Multimedia Telephony Application Server (MTAS)**

vMRF 1.3 is compatible with the following MTAS releases: 4.0, 4.1, 4.2, 4.4, 4.5, and 4.6.

**2.6.3.1.2 Virtual Multimedia Telephony Application Server (vMTAS)**

vMRF 1.3 is compatible with the following vMTAS releases: 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, and 1.6.

**2.6.3.1.3 OSS-RC**

vMRF 1.3 is compatible with the following OSS-RC releases: 17B, 18A.

Full functionality support for vMRF 1.3 is provided by the following OSS-RC release: 18A

**2.6.3.1.4 Ericsson Network Manager (ENM)**

vMRF 1.3 is compatible with the following ENM release: 17B



Full functionality support for vMRF 1.3 is provided by the following ENM release: 18A.

#### 2.6.3.1.5 Network License Server (NeLS)

vMRF 1.3 is compatible with the following NeLS release: 1.

## 2.6.4 Other Network Elements in vMRF 1.4

### 2.6.4.1 General

The lowest interoperable releases for vMRF 1.4 are described in Table 4.

Table 4 Lowest Interoperable Releases for vMRF 1.4

MTAS	16A
vMTAS	16A
OSS-RC	17B
ENM	17B
NeLS	1

#### 2.6.4.1.1 Multimedia Telephony Application Server (MTAS)

vMRF 1.4 is compatible with the following MTAS releases: 4.0, 4.1, 4.2, 4.4, 4.5, 4.6, 4.7, and 4.8.

#### 2.6.4.1.2 Virtual Multimedia Telephony Application Server (vMTAS)

vMRF 1.4 is compatible with the following vMTAS releases: 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, and 1.6.

#### 2.6.4.1.3 OSS-RC

vMRF 1.4 is compatible with the following OSS-RC releases: 17B, 18A.

vMRF 1.4 has only “treat as” support in OSS-RC, meaning OSS-RC treats vMRF 1.4 as vMRF 1.3 with all basic functionality supported (including new alarms), but not the new vMRF 1.4 configuration attributes or PM counters.

#### 2.6.4.1.4 Ericsson Network Manager (ENM)

vMRF 1.4 is compatible with the following ENM release: 17B

Full functionality support for vMRF 1.4 is provided by the following ENM release: 18A.



#### 2.6.4.1.5 Network License Server (NeLS)

vMRF 1.4 is compatible with the following NeLS releases: 1, 2.

### 2.6.5 Other Network Elements in vMRF 1.5.0

#### 2.6.5.1 General

The lowest interoperable releases for vMRF 1.5.0 are described in Table 5.

Table 5 Lowest Interoperable Releases for vMRF 1.5.0

MTAS	16A
vMTAS	16A
OSS-RC	17B
ENM	17B
NeLS	1

##### 2.6.5.1.1 Multimedia Telephony Application Server (MTAS)

vMRF 1.5.0 is compatible with the following MTAS releases: 4.0, 4.1, 4.2, 4.4, 4.5, 4.6, 4.7, and 4.8.

##### 2.6.5.1.2 Virtual Multimedia Telephony Application Server (vMTAS)

vMRF 1.5.0 is compatible with the following vMTAS releases: 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, and 1.6.

##### 2.6.5.1.3 OSS-RC

vMRF 1.5.0 is compatible with the following OSS-RC releases: 17B, 18A.

vMRF 1.5.0 has only “treat as” support in OSS-RC, meaning OSS-RC treats vMRF 1.5.0 as vMRF 1.3 with all basic functionality supported (including new alarms), but not the new vMRF 1.5.0 configuration attributes or PM counters.

##### 2.6.5.1.4 Ericsson Network Manager (ENM)

vMRF 1.5.0 is compatible with the following ENM release: 17B

Full functionality support for vMRF 1.5.0 is provided by the following ENM release: 18A.



#### 2.6.5.1.5 Network License Server (NeLS)

vMRF 1.5.0 is compatible with the following NeLS releases: 1, 2.



## 3 Interfaces

This section describes interface changes between the existing and new revisions of the product.

### 3.1 Interfaces in vMRF 1.1

This section describes interface changes introduced in vMRF 1.1.

#### 3.1.1 Inter-node Interfaces

There are no changes to the inter-node interfaces in vMRF 1.1.

#### 3.1.2 Operation and Maintenance

This section describes changes to attributes, alarms, events and notifications, triggers, and counters.

##### 3.1.2.1 Configuration

This section lists changes in attributes. There are no changed, deprecated, obsolete, or new attributes.

##### 3.1.2.2 Fault Management

This section lists changes in alarms.

###### 3.1.2.2.1 Deleted Alarms

Table 6 shows the alarms deleted in vMRF 1.1.

Table 6 Deleted Alarms

Alarm Name
COM SA, AMF SI Unassigned
COM SA, CLM Cluster Node Unavailable

###### 3.1.2.2.2 New Alarms

Table 7 shows the new alarms introduced in vMRF 1.1.



Table 7 New Alarms

Alarm Name	Description
MRF IP Auto-Configuration Failure	The alarm is raised when IP auto-configuration of a media IP address in a VM fails, for example, if the DHCP client cannot obtain, renew, or rebind an IP address, or if the lease time of the IP address ends.
MRF Next Hop Router Unreachable	The alarm is issued when connection from VM to next hop router is lost, that is, if a vMRF VM does not receive ARP reply (IPv4) or neighbor advertisement message (IPv6) from the next hop router before the response timer expires.

### 3.1.2.3 Events and Notifications

This section lists changes in events and notifications. There are no changed or deleted events and notifications.

#### 3.1.2.3.1 New Event and Notifications

Table 8 shows the alarms that have been converted into events in vMRF 1.1.

Table 8 New Events and Notifications

Event or Notification Name	Description
COM SA, AMF SI Unassigned	Former alarm converted into event.
COM SA, CLM Cluster Node Unavailable	Former alarm converted into event.

### 3.1.2.4 Counters

There are no changed, deleted, deprecated, obsolete, or new counters in vMRF 1.1.

## 3.2 Interfaces in vMRF 1.2

This section describes interface changes introduced in vMRF 1.2.

### 3.2.1 Inter-node Interfaces

There are no changes to the inter-node interfaces in vMRF 1.2.



### 3.2.2 Operation and Maintenance

This section describes changes to attributes, alarms, events and notifications, triggers, and counters.

#### 3.2.2.1 Configuration

This section lists changes in attributes. There are no changed, deprecated, obsolete, or new attributes.

#### 3.2.2.2 Fault Management

This section lists changes in alarms. There are no new, changed or deleted alarms.

#### 3.2.2.3 Events and Notifications

This section lists changes in events and notifications. There are no changed or deleted events and notifications.

##### 3.2.2.3.1 New Events

The new events are shown in Table 9.

Table 9 New Events in vMRF 1.2

Event Name
MRF Compute Resource Lost

### 3.2.3 Counters

There are no changed, deleted, deprecated, obsolete, or new counters in vMRF 1.2.

## 3.3 Interfaces in vMRF 1.3

This section describes interface changes introduced in vMRF 1.3.

### 3.3.1 Inter-node Interfaces

### 3.3.2 Operation and Maintenance

#### 3.3.2.1 Configuration

This section lists changes in attributes. There are no changed, deprecated, or obsolete attributes.



### 3.3.2.1.1 New Attributes

This section lists changes in attributes. There are no changed or deprecated attributes.

New attributes are listed in Table 10.

Table 10 New Attributes for EVS

MO Class Name	Attribute Name	Description
MrfData	evsConfDataMoRef	Contains a reference to the <code>EvsConfData</code> MO instance associated with this <code>MrfData</code> MO.
EvsConfData	supportedBitRatesRangeBegin	Specifies the beginning of the supported bit rate range of EVS audio codec.
	supportedBitRatesRangeEnd	Specifies the end of the supported bit rate range of EVS audio codec.
	supportedBwRange	Specifies the supported audio bandwidth range of EVS audio codec.
SctpProfile	maxSctpPduSize	The maximum size of the SCTP PDU towards the Multimedia Telephony Application Server (MTAS).

### 3.3.2.2 Fault Management

This section lists changes in alarms. There are no changed or new alarms.

### 3.3.2.3 Events and Notifications

This section lists changes in alarms. There are no changed, deleted or new alarms.

### 3.3.3 Counters

There are no new, changed, deprecated, or obsolete counters.

## 3.4 Interfaces in vMRF 1.4

This section describes interface changes introduced in vMRF 1.4.



### 3.4.1 Inter-node Interfaces

### 3.4.2 Operation and Maintenance

#### 3.4.2.1 Configuration

This section lists changes in attributes. There are no changed, deprecated, or obsolete attributes.

##### 3.4.2.1.1 New Attributes

This section lists changes in attributes. There are no changed, or deprecated attributes.

New attributes are listed in Table 11.

Table 11 New MO Attributes

MO Class Name	Attribute Name	Description
TsTone	For the list of all the attributes refer to the TsTone MO in the MOM.	Configurable attributes for the Tone Sender service.

#### 3.4.2.2 Fault Management

This section lists changes in alarms. There are no changed or new alarms.

#### 3.4.2.3 Events and Notifications

This section lists changes in alarms. There are no changed, deleted or new alarms.

### 3.4.3 Counters

There are no new, changed, deprecated, or obsolete counters.

## 3.5 Interfaces in vMRF 1.5.0

This section describes interface changes introduced in vMRF 1.5.0.



### 3.5.1 Inter-node Interfaces

### 3.5.2 Operation and Maintenance

#### 3.5.2.1 MOs

This section lists changes in MOs.

New MOs are shown in Table 12.

Table 12 New MOs

MO Class Name	Description
ChainCertificate	Chain certificate belonging to the credential.

Changed MOs are shown in Table 13.

Table 13 Changed MOs

MO Class Name	Description
FmAlarm	An FmAlarm instance represents an active alarm. An alarm is a persistent indication of a fault that clears only when the triggering condition has been resolved.
FmAlarmType	A specific kind of alarm that can be reported, for example "power failure".  In an X.733 context it maps to event type, probable cause, and specific problem. The same principle is used for alert types as for alarm types.

#### 3.5.2.2 Configuration

This section lists changes in attributes.

##### 3.5.2.2.1 New Attributes

New attributes are listed in Table 14.

Table 14 New MO Attributes

MO Class Name	Attribute Name	Description
CertMC capabilities	keySupport	List of the key types the ME supports.



MO Class Name	Attribute Name	Description
EnrollmentAuthority	reservedBy	The MO Distinguished Names using this EnrollmentAuthority.
FmAlarm	originalAdditionalText	<p>The additional text set when the alarm was raised.</p> <p>This attribute is set when the alarm is raised and will not change during the alarm's lifetime.</p>
	originalEventTime	<p>The timestamp when the alarm was raised.</p> <p>This attribute is set when the alarm is raised and will not change during the alarm's lifetime.</p>
	originalSeverity	<p>The perceived severity set when the alarm was raised.</p> <p>It will not change during the alarm's lifetime.</p> <p>Specification: RFC3877</p>
FmAlarmType	configuredSeverity	<p>Gives the possibility to configure the perceived severity for all alarms of this type.</p> <p>If set, this value overrides the perceived severity provided by the alarming object. Setting this attribute has no impact on existing alarms, only new and updated ones.</p> <p>Specification: RFC3877</p>
	defaultSeverity	<p>The default perceived severity for all alarms of this type. Not set means alarms of this type can be assigned different severities.</p> <p>Specification: RFC3877</p>
NodeCredential	subjectAltName	The subjectAltName can be specified either as an IP address or a FQDN.
Snmp	engineId	Unique identifier of the SNMP agent. Only applicable when using SNMPv3.
TrustedCertificate	reservedBy	The Distinguished Names of MOs using this TrustedCertificate.



### 3.5.2.2.2 Changed Attributes

Changed attributes are listed in Table 15.

Table 15 Changed MO Attributes

MO Class Name	Attribute Name	Description
EnrollmentAuthority	enrollmentCaCertificate	The trusted certificate of the RA or CA used for enrollment authentication. Represents the certificate by the DN of the appropriate TrustedCertificate MO. The RA or CA certificate provided in the PKI response is authenticated by this trusted certificate. If this attribute has any value, the attribute enrollmentCaFingerprint is ignored.
EnrollmentServer	uri	<p>The URI of the enrollment server. The URI consists of a protocol, an IP or DNS address and an optional port number. Specify the optional port designation by appending a colon followed by the port number to the host part, for example, 192.168.33.27:8080. If no port number is provided, the default port is used.</p> <p>For SCEP, the URI contains the relative URI of the enrollment CA HTTP Common Gateway interface (CGI) script path, which is the resource identifier of the resource on the server which will process the enrollment request.</p>



MO Class Name	Attribute Name	Description
FmAlarm	activeSeverity	The perceived severity of the alarm. It may change during the alarm's lifetime. Specification: RFC3877
	additionalInfo	Further information about the problem. The information is represented as a set of data structures with two items of information, an identifier and a value. It may change during the alarm's lifetime.
	eventType	General category for the alarm. Specification: ITU-T X.733 X.736
	probableCause	Qualifies and provides further information on the reason for the event. A standard set of probableCause values is provided in the ERICSSON-ALARM-PC-MIB.
	sequenceNumber	A unique identity for every notification sent. This identity changes at every notification, that is, severity change and information change. It is not the same as the fmAlarmId as multiple notifications may be sent for one alarm instance.
	specificProblem	Provides further refinement to the information given by probableCause. Can be used to find an associated operating instruction (OPI).



MO Class Name	Attribute Name	Description
ManagedElement	dnPrefix	It provides naming context that allows the managed objects to be partitioned into logical domains. A Distinguished Name (DN) is defined by 3GPP TS 32.300, which splits the DN into a DN Prefix and Local DN, for example DN format: dnPrefix=<DN Prefix>, localDn =<Local DN>Fault Management: dnPrefix does not impact Fault Management, since an NMS recognises a Managed Element by IP address Performance Management (PM): The dnPrefix is present in the PM Data file, Result Output Period (ROP) file, if the dnPrefix attribute is specified, that is, not an empty string.
NodeCredential	keyInfo	Specifies the key type and length that is used for the next enrollment.  Mandatory for actions startOfflineCsrEnrollment or startOnlineEnrollment.  For the supported key types see CertMCapabilities MO keySupport attribute. Deprecated key types are not recommended for new enrollments.

### 3.5.2.2.3 Deprecated Attributes

Deprecated attributes are listed in Table 16.

Table 16 Deprecated MO Attributes

MO Class Name	Attribute Name
FmAlarmType	moClasses
ManagedElement	dateTimeOffset
	productIdentity
	localDateTime
	timeZone
TrustedCertificate	reservedByCategory

### 3.5.2.3 Fault Management

This section lists changes in alarms. There are no changed or new alarms.

### 3.5.2.4 Events and Notifications

This section lists changes in alarms. There are no changed, deleted or new alarms.



### 3.5.3

#### Counters

There are no new, changed, deprecated, or obsolete counters.



## 4 Summary of Impacts per Feature

This section summarizes the impact per feature when the feature is turned on.

The description of impact is as follows:

- **Major Impact** means that the feature has done an incompatible change so that another node requires an update.
- **Minor Impact** means that the feature has caused changes that affect other nodes, but with extra configuration, the previous behavior can be kept.
- **No Impact** means that the feature has no impact on the system.

A summary of impacts per feature is shown in Table 17.

Table 17 Summary of Impacts per Feature

Feature	Impact	Basic or Optional New or Enhanced	Feature Number	Relation to Other Features or Nodes	Release of Feature Introduction
Consumer Communication	No Impact	Basic, Enhanced	FAJ 801 0891	None	vMRF 1.1
Network-redundant upgrade method	No Impact	New, Optional	—	None	vMRF 1.2
Workflow-based VNF operations	No Impact	New, Optional	—	None	
Enhanced Voice Services	No Impact	New, Optional	FAJ 801 0893	NeLS	vMRF 1.3
Workflow-based VNF operations enhancement: Upgrade workflow	No Impact	Enhanced, Optional	—	None	
Platform automatic IP address configuration	No Impact	New, Optional	—	None	vMRF 1.4
Consumer Communication enhancement: Tone Sender Service Configuration	No Impact	Basic, Enhanced	FAJ 801 0891	None	vMRF 1.4



## 5 Impact on vMRF Features

This section shows the impact on the vMRF features when the feature is turned on.

### 5.1 Impact on vMRF Features from vMRF 1.0 to vMRF 1.1

#### 5.1.1 Media Stream Processing Enhancements

##### 5.1.1.1 Description

In vMRF 1.1 the G.722 audio codec has been introduced. The G.722 codec operates at a sampling rate of 16 kHz and offers audio bandwidth ranging from 50 Hz up to 7 kHz. The G.722 codec supports Packet Loss Concealment (PLC).

In vMRF 1.1 adaptive jitter service has been introduced. In the beginning of the call the jitter buffer size is always the configured initial jitter buffer size, but during the call the jitter buffer size adapts to the measured jitter. Static jitter service is not supported in vMRF 1.1.

#### 5.1.2 Troubleshooting Enhancements

##### 5.1.2.1 Description

In vMRF 1.1 the h.248 error codes are now expanded with descriptive text strings.

In vMRF 1.1 hanging termination notification towards the controlling server has been introduced.

### 5.2 Impact on vMRF Features from vMRF 1.1 to vMRF 1.2

#### 5.2.1 Upgrade Method Enhancements

##### 5.2.1.1 Description

In vMRF 1.2 the network-redundant upgrade method has been introduced. Network-redundant upgrade can be performed when two vMRF VNFs are available in parallel during normal operation. During the upgrade procedure, one of them is upgraded to the new version, while the other one handles traffic uninterrupted.



## 5.2.2 Workflow-based VNF Life Cycle Management

### 5.2.2.1 Description

In vMRF 1.2 the workflow-based VNF Life Cycle Management (VNF-LCM) has been introduced as a primary method for VNF cluster management. The following workflow-based procedures are supported in vMRF 1.2:

- Instantiation
- Scaling (scale-in, scale-out)
- Termination

Scaling and termination of a vMRF VNF using VNF-LCM is only supported if the vMRF was instantiated using the LCM workflow. Manual scaling and the removal of the cluster must be performed only if the vMRF VNF was deployed manually.

## 5.3 Impact on vMRF Features from vMRF 1.2 to vMRF 1.3

### 5.3.1 Enhanced Voice Services

In vMRF 1.3 transcoding support for the EVS codec is introduced. EVS is a multi-rate audio codec that operates at 8 kHz, 16 kHz, 32 kHz, and 48 kHz sampling rates, and offers full audio bandwidth ranging from 20 Hz up to 20 kHz. EVS supports bit rates from 5.9 kbps to 128 kbps. EVS supports comfort noise generation and error concealment.

The use of EVS requires the Enhanced Voice Services capacity license and connection to a Network License Server (NeLS).

### 5.3.2 VNF Life Cycle Management Enhancement

In vMRF 1.3, the network-redundant upgrade LCM operation has been introduced. This procedure can be used to upgrade the vMRF VNF to a newer version even without traffic loss, if another VNF is in operation during the upgrade.

## 5.4 Impact on vMRF Features from vMRF 1.3 to vMRF 1.4

### 5.4.1 Platform Automatic IP Address Configuration

In vMRF 1.4, support for deployment without DHCP server on OpenStack has been introduced. Separate batch of HOT and example environment yaml files are included in the software delivery package for deployment with or without DHCP server configuration on OpenStack. With platform automatic IP address configuration, IP addresses are assigned by the virtualization infrastructure.



## 5.4.2 Tone Sender Service Configuration

In vMRF 1.4 the Tone Sender (TS) service can be configured by the attributes of the new **TsTone** MO. The **TsTone** MO represents a tone as used by the Tone Sender service in the vMRF. An instance of this MO exists for each tone type supported by the VNF. The MO instances are created automatically by the system. The parameters, for example, tone type, tone duration, frequencies, levels, play and pause times, can be changed.

## 5.5 Impact on vMRF Features from vMRF 1.4 to vMRF 1.5.0

No new features are introduced in vMRF 1.5.0.