

vMRF Security Management

Virtual Multimedia Resource Function

User Guide

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1 Introduction

This document describes the security functions implemented by the vMRF. The document also describes the security-related procedures that can be performed.



2 Functions and Concepts

This document covers the following security functions provided by vMRF:

- Traffic separation
- O&M Traffic Protection
- O&M Administrator Access Control

For a complete list of vMRF functions, including other security functions, refer to the *vMRF Overview*.

2.1 Traffic Separation

The traffic for O&M, signaling, trusted payload, and untrusted payload uses separate vNICs. Virtual switch traffic separation is also a requirement in the cloud environment for vMRF. For more information on security requirements in the cloud environment for vMRF, refer to the *vMRF Infrastructure Requirements*.

2.2 O&M Traffic Protection

The Northbound Interface (NBI) is assumed to be accessed from a trusted O&M network. O&M traffic is secured using various security protocols, see [Services, Ports, and Protocols](#) on page 10 for the details. Other protocols, for example, Telnet or FTP, are not permitted on the O&M interface.

It is recommended to configure a rate limit in an external firewall for protection of the NBI. For a description of the O&M traffic architecture, refer to *Security Management for ECLI, NETCONF, and SFTP Users*.

2.3 O&M Administrator Access Control

vMRF uses Role-Based Access Control (RBAC) with different rules that can be granted to various role groups. vMRF uses an external Lightweight Directory Access Protocol (LDAP) server to provide user authentication. It is recommended to follow the operator's security policy when defining O&M users and assigning specific roles to them. It is recommended that access to sensitive information is restricted to those roles and operations personnel who need the access.

The following default roles are defined in vMRF:



Table 1 vMRF Roles

Role	Permission	MOM Fragment
SystemAdministrator	R	ManagedElement, SystemFunctions, SecM (only the MO, but not the attributes) ManagedElement, SystemFunctions, SecM, CertM, *
	RW	ManagedElement, SystemFunctions, SwInventory, *
	RWX	ManagedElement ManagedElement, SystemFunctions ManagedElement, SystemFunctions, Fm, * ManagedElement, SystemFunctions, Pm, * ManagedElement, SystemFunctions, SwM, * ManagedElement, SystemFunctions, SysM, * ManagedElement, Transport
SystemSecurityAdministrator	R	ManagedElement ManagedElement, SystemFunctions ManagedElement, SystemFunctions, Fm, * ManagedElement, SystemFunctions, SwInventory, *
	RWX	ManagedElement, SystemFunctions, SecM*
MrfApplicationOperator	R	ManagedElement, *
	RX	ManagedElement, SystemFunctions, SysM, *
MrfApplicationAdministrator	RWX	ManagedElement, *
	R	ManagedElement, SystemFunctions, SecM, *



Role	Permission	MOM Fragment
MrfApplicationSecurityAdministrator	R	ManagedElement,*
	RWX	ManagedElement,SystemFunctions,SecM,*

Users have access to CLI commands as defined by the POSIX groups shown in [Table 2](#). It is possible for a user to be a member of multiple POSIX groups. It is recommended that access to sensitive information is restricted to those roles and operations personnel who need the access. Media Stream Recording (MSR) access must only be granted to Ericsson troubleshooters. For more information, refer to *Media Stream Recording*.

Table 2 POSIX Groups for Command Restriction

Name	Group Identifier (GID)	Description
system-ts	2000	Troubleshooter; Access to commands of the underlying Ericsson Component Based Architecture (CBA) application
mrfs-op	2001	Normal operator; Access to all vMRF CLI commands for information printing
mrfs-ts	2002	Troubleshooter; Access to all vMRF CLI commands except for MSR
mrfs-msr	2003	Ericsson troubleshooter; Access to MSR commands
cmw-imm-users	2004	IMM troubleshooter; Access to imm OpenSAF commands
sftpusers ⁽¹⁾	2007	Restricted operator; Access to PM files and alarm and event logs through SFTP port (115) only
mrsv-admin	1001	Emergency user
system-journal	994	Access to logs produced by the vMRF for troubleshooting purposes



(1) The `sftusers` POSIX group restricts all other group rights. A member of the `sftusers` POSIX group only has SFTP access rights and cannot be a member of any other POSIX group.

The *emergency user* is a user that can log on to the system controller using SSH through the NBI, even when the LDAP server is unavailable. The *emergency user* is defined during deployment and cannot be changed during operation. The emergency user has access to all MOs and can therefore log on to the system to restore LDAP connectivity and return the system to normal operation.

Note: The emergency user must be only used for emergency recovery purposes and not as a shared account for normal O&M operations.

SSH login for the `root` user is not permitted for normal users. The `root` user is locked, so that normal users cannot change to `root` with the `su root` command. The emergency user can change to `root` with the `sudo -i` command.

Logging in through the serial port is not permitted.

SSH host keys (RSA, DSA, ECDSA) for the VMs of the VNF cluster are generated automatically by the first VM during the deployment process, and copied to all other VMs. The fingerprints of the SSH host keys are visible in the console tool after deployment.

2.4 Idle Session Time-out

An SSH session is an interval that starts when a user is authenticated and can start operations. It ends when the user exits, or when the connection to the VNF is closed because of user inactivity. If the session ends because of inactivity, the situation is called idle session time-out.

Idle session time-out is a fixed time of 30 minutes and is enforced for all CLI command, NETCONF, and file access sessions. Traffic is monitored only in the client-to-server direction.

2.5 Brute-Force Attack Protection

The vMRF SSH interface uses a mechanism to protect against password cracking with brute-force attacks. The mechanism temporarily bans login attempts from IP addresses that reach the maximum allowed number of failed login attempts. The ban period and the maximum allowed number of failed login attempts are preconfigured in vMRF.

The ban period is set to 10 minutes, and the maximum allowed number of failed login attempts is 10. This means that after 10 unsuccessful login attempts, no more login attempts are allowed from the given IP address for 10 minutes.



3 Security Configuration

This section describes how to configure the security functions in vMRF.

3.1 O&M Administrator Access Control

This section provides the instructions for operating the security functionality of the product.

3.1.1 Configure LDAP Authentication and Authorization in vMRF

This procedure describes how to configure vMRF to use an LDAP server for authentication and authorization.

Prerequisites:

- vMRF has been deployed.
- LDAP authentication and authorization has not yet been configured in the vMRF VNF, or the configuration needs to be changed. For instructions on how to import the LDAP configuration below into the VNF during deployment, refer to the relevant *deployment guide*.
- An LDAP server is available for vMRF and its IP address and port are known.
- The LDAP server has TLS enabled and one issuer certificate of its node credentials has been installed as trusted certificate.
- You have logged in to vMRF either as the emergency user, or as the security administrator.
- An Ericsson Command-Line Interface (ECLI) session in Exec mode is in progress.

Steps

Do the following:

1. Install vMRF node credentials using offline enrollment, as described in *Install or Renew Node Credential by PKCS 12*.
2. Install trusted certificates for the CA and the LDAP server, as described in *Install Trusted Certificate*.
3. Create a trust category for the LDAP server certificate, as described in *Create Trust Category*.



4. In the MOM, navigate to the *Ldap* MO and configure it:

```
>ManagedElement=1, SystemFunctions=1, SecM=1, UserManagement=1, LdapAuthenticationMethod=1, Ldap=1
```

```
(Ldap=1)>configure
```

```
(config-Ldap=1)>baseDn="dc=example,dc=org"
```

```
(config-Ldap=1)>bindDn="cn=admin,dc=example,dc=org"
```

Note: Replace the values with the actual DNS.

```
(config-Ldap=1)>ldapIpAddress="<IP address of the LDAP server>"
```

```
(config-Ldap=1)>serverPort=<Port of the LDAP server>
```

```
(config-Ldap=1)>nodeCredential="ManagedElement=1, SystemFunctions=1, SecM=1, CertM=1, NodeCredential=1"
```

```
(config-Ldap=1)>trustCategory="ManagedElement=1, SystemFunctions=1, SecM=1, CertM=1, TrustCategory="<Trust category created for the LDAP server certificate>"
```

```
(config-Ldap=1)>useTls=true
```

```
(config-Ldap=1)>filterType=ERICSSON_ROLES
```

```
(config-Ldap=1)>profileFilter=ERICSSON_FILTER
```

Note: The *filterType* and *profileFilter* attribute configuration is needed for RBAC.

```
(config-Ldap=1)>EricssonFilter=1
```

```
(config-EricssonFilter=1)>roleAliasesBaseDn="dc=example,dc=com"
```

```
(config-EricssonFilter=1)>up
```

```
(config-Ldap=1)>up
```

```
(config-LdapAuthenticationMethod=1)>administrativeState=UNLOCKED
```

```
(config-LdapAuthenticationMethod=1)>commit
```

5. Add the Ericsson schema to the LDAP server, and extend the LDAP server user accounts to use role based access control (RBAC).



- Define directory entries for all Posix groups (except for `mrsv-admin`, as it was already defined during deployment) listed in [POSIX Groups for Command Restriction](#). A Posix group is identified by the GID number.
- Define the directory entry representing the users Posix account for each user. In case the user is a member of multiple groups, the `memberUid` attribute in the directory entry for the Posix group can be used to list all members in the group.
- Define the role of the user by setting the `ericssonUserAuthorizationScope` attribute of the Posix account. The value of the authorization scope must have the format `<target_type>:<role>`, for example, **`ericssonUserAuthorizationScope:MrfApplicationOperator`**.
- To access logs produced by vMRF, define the directory entry for the `system-journal` Posix group. The `memberUid` attribute lists all user accounts with access rights to the system logs.
- To have users with access rights only to PM files, alarm and event logs via SFTP, define users as members of the `sftpusers` Posix group.

For more information on LDAP server user accounts, refer to *LDAP-Based Authentication and Authorization Interface*.

3.2 Recommended Periodic Operations

Even though vMRF has been installed and hardened securely, administrator and user activity over time can introduce security exposures. Also, new vulnerabilities which need to be mitigated are frequently found in the existing products. Therefore it is necessary to maintain the security posture of the product in service on a regular, ongoing basis.

This section describes recommended periodic operations.

- Take system backups regularly according to the *vMRF Backup and Restore Guideline*.
- Restrict access to backup files so that unauthorized persons cannot view or modify the included sensitive data. This recommendation also refers to backups stored in an external server.
- Apply password policies on the LDAP server to enforce password complexity, aging, and recovery.
- Ensure that no unnecessary accounts exist.
- Ensure that no unnecessary listening ports are open.



- Ensure that no shared user accounts are used.
- Ensure that the *emergency user* password is not known by more people than necessary.
- Ensure that user rights are assigned only to real needs.
- Monitor the log of access and authorization events in the system by using the following commands:
 - `journalctl SYSLOG_FACILITY=4` – sshd access logs
 - `journalctl SYSLOG_FACILITY=10` – authentication logs
 - `journalctl SYSLOG_FACILITY=17` – NBI audit logs

3.3 Handling of Patches

Patches are delivered as new vMRF SW packages. A new SW package is deployed as a new vMRF VNF, and if needed, the old VNF can be deleted.



4 Services, Ports, and Protocols

The services, ports, and protocols that are used by vMRF are listed in [Table 3](#).

Table 3 Services, Ports, and Protocols on the O&M Interface

Service or Interface Name	Protocol	IP Address Type	Port	Transport Protocol	IP Version
CLI access	SSH	O&M IP	22	TCP	IPv4
PM report file access	SFTP	O&M IP	115	TCP	IPv4
Alarm and alert log file access					
NETCONF	SSH	O&M IP	830	TCP	IPv4
	TLS	O&M IP	6513	TCP	IPv4
SNMP	SNMP	O&M IP	161 (configurable)	UDP	IPv4
	SNMP over DTLS	O&M IP	10161 (configurable)	UDP	IPv4
Synchronization	NTP	O&M IP	123	UDP	IPv4

Table 4 Services, Ports, and Protocols on the Control Plane Interface

Service or Interface Name	Protocol	IP Address Type	Port	Transport Protocol	IP Version
la, lx, or lq	H.248	Signaling IP	2944 (configurable)	SCTP	IPv4

*Table 5 Services, Ports, and Protocols on the User Plane Interfaces*

Service or Interface Name	Protocol	IP Address Type	Port	Transport Protocol	IP Version
Trusted network (IMS Core)	RTP, RTCP	Traffic IP	1024–65535	UDP	IPv4 or IPv6
Untrusted network	RTP, RTCP	Traffic IP	1024–65535	UDP	IPv4 or IPv6