FL MGUARD DM UNLIMITED Installation, Configuration and Usage of the mGuard device manager (mdm 1.17.x)

User manual

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FL MGUARD DM UNLIMITED Installation, Configuration and Usage of the mGuard device manager (mdm 1.17.x)

UM EN MDM 1.17, Revision 03 2025-01-29

This user manual is valid for:

Designation	Item No.
FL MGUARD DM UNLIMITED 1.17.x	2981974

111024_en_03

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1 Introduction

1.1 Manage MGUARD devices

mGuard device manager (mdm) enables the convenient management of mGuard security appliances. The tool offers a template mechanism that allows to centrally configure and manage thousands of mGuard devices.

With a click of your mouse you can generate the desired firewall rules, NAT settings, etc., and upload the generated configurations to the mGuard devices in the network, deploying in an instant your desired device configurations.

mdm is a client-server application, the client offering full control of all mdm features, the server storing the configuration in a database, generating configuration files, and uploading those files to the devices upon request.

Please read this document for information on the installation of mdm, how to efficiently generate configurations for and how to upload configurations to your mGuard devices. Also refer to the release notes of mdm 1.17.x.

System requirements: Ubuntu operating system in the mdm VA
mdm 1.17.x can no longer be operated under Windows, but only under the operating system Ubuntu 22.04 LTS (Server).
For this purpose, mdm 1.17.x can be installed in the virtual machine "mdm VA" provided by Phoenix Contact (see Section 2.1.3) or under the native operating system Ubuntu Server (see Section 2.1.4).

FL MGUARD 1000 devices are no longer supported
As of mdm 1.15.0, it is no longer possible to manage FL MGUARD 1102/1105 devices.

FL MGUARD 2000/4000 devices are fully supported
With version mdm 1.17.x it is possible to manage mGuard devices of the FL MGUARD 2000/4000-family.
Variables that are not available in comparison to devices with installed mGuard 8/9 firmware must be deactivated or reset to the factory settings on the mGuard 8/9 devices before they can be imported (from an ATV file or a template).
(See also the user manual UM EN FW MGUARD10 - 110191_en_xx, available for download at phoenixcontact.com/products).
The exact procedure for device migration is described in the user manual 111259_en_xx (AH EN MGUARD MIGRATE 10).

Supported firmware versions

mGuard device manager (mdm) 1.17.x supports the following firmware versions:

- mGuard 8.0 to 9.0 (completely)
- mGuard 10.3 to 10.5 (completely)
- mGuard 5.0 to 7.6 (with restrictions)

The firmware mGuardNT is no longer supported.

2 Installation

2.1 System requirements (mdm 1.17.x)

2.1.1 Microsoft Windows

No version of the "*mdm installer for Windows*" is provided for mdm 1.17.x, so that mdm 1.17.x can no longer be installed on a Windows system.

An update to mdm 1.17.x is likewise not supported on a Windows system.

To be able to continue to run mdm 1.17.x on a Windows system, you can use the virtual machine „mdm VA“ (VA = V*irtual Appliance*), provided by Phoenix Contact, running a pre-installed Ubuntu operating system (see Section 2.1.3).

If mdm 1.16.x is already installed in an mdm VA, it can be updated to version mdm 1.17.x within the mdm VA.

2.1.2 Ubuntu Linux

mdm 1.17.x can only be installed under the operating system Ubuntu 22.04 LTS (Server).

For this purpose, mdm 1.17.x can be installed either

– in the virtual machine "mdm VA" provided by Phoenix Contact (see Section 2.1.3) or
– installed under the native operating system Ubuntu Server (see Section 2.1.4).

2.1.3 mdm VA (with Ubuntu 22.04 LTS)

The virtual machine „mdm VA“ is provided as an OVA file and run using a virtualization software program. The mdm VA is preconfigured by means of a configuration file provided by Phoenix Contact and is an easy way of installing mdm 1.17.x.

The version of the Ubuntu operating system used in the mdm VA cannot be changed: Ubuntu 22.04 LTS (Server).

Basically, the following steps must be performed to install mdm 1.17.x in a virtual environment and use it as usual:

1. Download VirtualBox and install it in Windows
2. Download the mdm VA and import it into VirtualBox
3. Download the configuration file and add it to the mdm VA
4. Start the mdm VA and install mdm 1.17.x in the mdm VA
5. Migrate the mdm databases from mdm (1.13.x to 1.16.x) to mdm 1.17.x

The installation and operation of mdm 1.17.x in the virtual machine is described in detail in the user manual „Using mdm 1.17.x in the mdm VA“ (AH EN MDM VA - 110903_en_xx). (Download at: phoenixcontact.net/product/2981974.)

System requirements of the mdm VA:

– Memory (RAM): min. 4096 MB
– Hard disk space: min. 10 GB

System requirements mdm client:

– Operating system: Ubuntu / Windows
– Java platform (JRE): *OpenJDK 11* or later
– Memory (RAM): 512 MB at least
– Hard disk space: 500 MB at least

2.1.4 Ubuntu 22.04.LTS Server (native)

In addition to installing mdm 1.17.x under the Ubuntu operating system in the mdm VA (see Section 2.1.3), it is also possible to install mdm 1.17.x under the native operating system Ubuntu 22.04 (Server).

Please proceed with the following steps:

1. Download and install Ubuntu 22.04 (Server).
2. Create user *vadmin*.
3. Make the *sudo* program available.
4. Make the mdm repository available.
5. Install *mdm-cockpit*.
6. Install mdm 1.17.x
7. Migrate mdm databases from mdm (mdm 1.13.x to 1.16.x) to mdm 1.17.x.

Proceed as follows (requires root permissions):

- Install Ubuntu 22.04 (Server).
- If possible, create the user vadmin with the *user ID* 1000 during the installation.
- Log in to the Ubuntu operating system.
- Update the system:
  – `apt update && apt upgrade`

Making user "vadmin" available if necessary (requires root permissions)

- Check whether the vadmin user already exists on the system:
  – Log in as user *vadmin*.
  – Check the user ID of the *vadmin* user:
    `id -a`
    The command should return the following response: `uid=1000(vadmin)`
- Depending on whether the user exists, you must perform one of the following actions.

1. If the *vadmin* user exists, proceed with **“Making the program "sudo" available”**.
2. If the *vadmin* user exists but does not have the *user ID* 1000, assign the user ID 1000 to it as follows:
   – `usermod --uid 1000 vadmin`
   – Proceed with **“Making the program "sudo" available”** .
3. If another user (*example-user*) with the *user ID* 1000 is present on the system, carry out **one** of the following measures:
   a) Remove the user.
   – Proceed with point 4 (see below).
   b) Or change the *user ID* of the user to something other than 1000:
   – `usermod --uid 2000 example-user`
   – Proceed with point 4 (see below).
   c) Or rename the user to *vadmin*:

- `id example-user`
  `uid=1000(example-user)`
- `usermod -d /home/vadmin -m -c vadmin -l vadmin example-user`
- `id vadmin`
  `uid=1000(vadmin)`
- Proceed with **“Making the program "sudo" available”** .

4. If the user vadmin does not exist on the system, create it:
   - `useradd --home-dir /home/vadmin --create-home --uid 1000 --user-group vadmin`
   - Proceed with **“Making the program "sudo" available”** .

Making the program "sudo" available

- Check whether the *sudo* program is installed:
  - `dpkg -l sudo`
- If *sudo* is not installed, proceed as follows (root permissions):
  - `apt install sudo`
  - `visudo`
    Add the following entry at the end of the *sudoers* file:
    ```
    # User rules for vadmin
    vadmin ALL=(ALL) NOPASSWD:ALL
    ```
    Save the file.
  - Test whether the *vadmin* user can use the *sudo* command:
    `sudo cat /etc/sudoers` (log in and execute as user *vadmin*)

Making the mdm repository available

- Log in as the *vadmin* user.
- Create the directory in which the repository keys are stored.
  - `sudo mkdir -p /etc/apt/keyrings`
- Make the mdm repository key available on the system:
  - `curl -s -S -O https://repositories.mguard.com/pubkey.gpg`
- Check the fingerprint of the *public key*
  - `gpg -finger pubkey.gpg`
  - The fingerprint must have the following value:
    AD3E B1F9 473D 5CC7 2ED4 2D4C 0571 79A3 CC0F FA55
- Save the public key (public key):
  - `sudo gpg --dearmor --yes -o /etc/apt/keyrings/mdm.gpg pubkey.gpg`
- Make the mdm repository with the keys available:
  - `echo "deb [signed-by=/etc/apt/keyrings/mdm.gpg] http://repositories.mguard.com/mdm <version>/" | sudo tee /etc/apt/sources.list.d/pxccs.list`

Installing base component and WBM for the mdm VA "mdm-cockpit"

- Update the software repositories (Ubuntu and mdm):
  - `sudo apt update`
- Remove all files in the */etc/netplan* directory or change their file extension from *.yaml* to another file extension.

- Install the base component *mdm-cockpit*:
  - `sudo apt install mdm-cockpit`
- Reboot the system:
  - `sudo reboot`

Installing mdm 1.17.x in Ubuntu 22.04 LTS (Server)

- Install the desired mdm components as described in the mdm VA user manual (see 110903_en_xx at phoenixcontact.net/product/2981974):
  - For example with the command: `pxccs-install-mdm`

Migrating mdm databases from mdm (mdm 1.13.x to 1.16.x) to mdm 1.17.x

- Proceed as described in the user manual 110903_en_xx at phoenixcontact.net/product/2981974.

3 Pre-configurations

3.1 Pre-configure the mGuard appliances

Please follow the steps described in the User Manual “Installing and starting up the mGuard hardware“, available at: phoenixcontact.net/products, for starting up and configuring the device (IP addresses of the interfaces etc.).

For further information, please refer also to the Software Reference Manual “Configuration of the mGuard security appliances Firmware“, available at: phoenixcontact.net/products.

Enable SSH access

The mdm installs the configuration files on the mGuards using SSH. Therefore SSH has to be permitted on the mGuards if mdm is using the external (untrusted) interface to upload the configuration.

Select *Management » System Settings » Shell Access* in the menu of the Web user interface and enable *SSH remote access* in the menu *Device access*. For more detailed information on SSH remote access please consult the *mGuard Reference Manuals*.

If you enable remote access, make sure that you change the default admin and root passwords to secure passwords.

mdm is using the admin password to log into the mGuard. If the password was changed locally on the device please change the password setting in mdm accordingly using the **Set Current Device Passwords** option in the context menu of the device overview table. Otherwise mdm is not able to log into the device.

The current root password is part of the configuration file. If the password was changed locally on the device please change the password setting in mdm accordingly. Otherwise the mGuard will reject the configuration.

3.2 Pre-configure the HTTPS configuration pull server

To transmit information on the configuration status of an mGuard, the HTTPS pull server has to send SYSLOG messages to the mdm server (pull feedback).

Please make sure that neither the communication between the HTTPS server and the mdm server nor the communication between the HTTPS pull server and the mGuards is blocked by a firewall or a NAT device.

4 mdm server and mdm client

4.1 Starting the mdm server under Ubuntu

	mdm 1.17.x in the mdm VA / Ubuntu 22.04 LTS
Start	
mdm server	`sudo systemctl start mdm-server`
mdm ca server	`sudo systemctl start mdm-ca`
Stop	
mdm server	`sudo systemctl stop mdm-server`
mdm ca server	`sudo systemctl stop mdm-ca`

4.2 Using the mdm client with Windows

Prerequisite

– The Java runtime environment *OpenJDK 11* or later is installed on the Windows system.
– The mdm component *mdm-clientdownload* is installed in the mdm VA.

To use the mdm client on a windows system, proceed as follows:

- Connect to the mdm web server at the configured IP address:
  https://<IP address>/mdm
  – The file *mdm-client.zip* is offered for download.
- Unpack the zip file on the windows system.
- Start the mdm client by double-clicking on the file *mdm-client-1.17.x.jar.*
  Alternatively, you can start the program from the command line with the following command (e. g.): **`java -Xmx512m -jar mdm-client-1.17.0.jar`**.

5 mdm client – Overview

The mdm client is the graphical front-end to access all features of mdm. It allows to create and manage devices, templates, pools, and VPN groups, initiates the upload of configurations to devices or initiates the export of configuration files to the file system.

For information on how to start and stop the client see “mdm server and mdm client” on page 15.

5.1 Login

Before connecting to the server, you have to authenticate yourself in the login-window. The server IP address/hostname (of the mdm VA) must be entered in the field „Hostname“. Furthermore the server port to be used can be set in the login window.

Figure 5-1 The mdm client login window

There are three predefined user accounts: *root*, *admin* and *audit*. The user *root* can access all settings, *admin* can by default modify all configuration settings and read user management settings, whereas *audit* has read-only permission by default, i.e. the *audit* user cannot change any settings, except for his password. The permissions for the users can be changed, if desired (see “Manage users, roles, and permissions” on page 107). The default passwords for user *admin* is **admin**, the default password for user *audit* is **audit**, the default password for *root* is **root**.

It is highly recommended to change the default passwords after installation (please refer to “Manage users, roles, and permissions” on page 107).

Using multiple clients

Multiple mdm clients using an mdm server instance concurrently are fully supported only by the *mdm Unlimited Edition*. All other available editions still have the limitation to two concurrent clients. Entities are locked if this is necessary to prevent two users from editing the same variable simultaneously. This includes inheritance hierarchies (where a user could edit a variable that a descent template or device inherits), but not synthesized VPN connections (which are read-only in the receiving device). If another user tries to open the

device or the template an error message will be displayed. If a client opens a *Template properties dialog*, then the template and all devices referencing this template will be locked and cannot be opened by another user.

The same is true for pools and VPN groups.

In case the connection between a client and a server is interrupted and cannot be terminated gracefully, the device/template/pool/VPN group that was locked by that client will get released after an inactivity timeout (can be configured in the server configuration, see "mdm server (*preferences.xml file)" on page 149*, key *maxInactiveInterval*), i.e. it could happen that certain settings cannot be accessed until the inactivity timeout is reached.

5.2 mdm main window

The following screenshot shows the mdm main window:

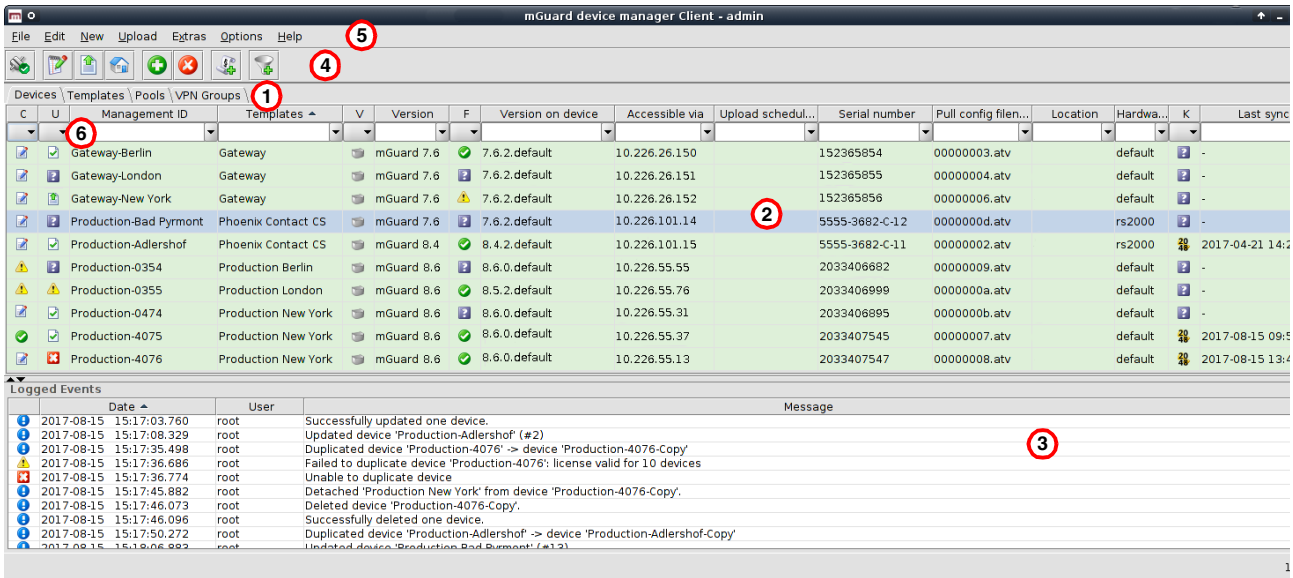


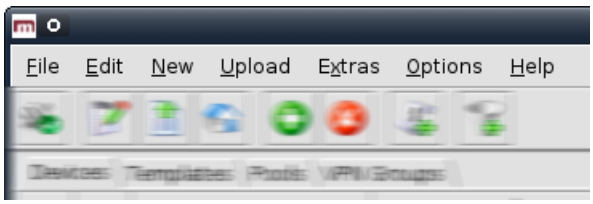
Figure 5-2 mdm main window

The mdm main window is divided into a **tab area** ① to open the device/template/pool/VPN group **overview tables** (e.g. ②) and a **log window** ③.

It also contains a **tool bar** ④ and the **main menu** ⑤. If enabled, the entries in the different columns can be filtered by typing any term in the text fields ⑥.

The different sections and their functionality are explained in the following chapters.

5.2.1 mdm main menu



The following entries can be selected in the mdm main menu.

The mdm main menu		
File	**Connect to Server/Disconnect from Server**	Connects to or disconnects from the server.
	Exit	Exits the client.
Edit	**Edit Item**	Opens the *Properties Dialog* of the currently selected item (device, template, pool, or VPN group) in the overview table.
	Web Configure	Opens the Web GUI for the selected devices in the device table. Only active if at least one device in the device table is selected. The **Accessible via** address is required for this option. It can be configured in the **General settings** of the *Device properties dialog* (see Chapter 6.3.3).
	Cut	Cuts the marked text in the currently active table filter field to the clipboard.
	Copy	Copies the marked text in the currently active table filter field to the clipboard.
	Paste	Pastes the clipboard contents to the currently active table filter field.
	Select All	Selects all entries in the currently active overview table.
New	**Device**	Creates a new device and opens the *Device properties dialog*.
	Template	Creates a new template and opens the *Template properties dialog*.
	Pool	Creates a new pool and opens the *Pool properties dialog*.
	VPN Group	Creates a new VPN group and opens the *VPN Group Properties Dialog*.

The mdm main menu		

	Device Import	Opens a window that allows to select an import file.
		
		With the device import option, you can import an automatically (e.g. with a script) generated file of devices. This can be used to create a large number of devices in mdm without going through the process of creating them manually.
		
		The import file must be *comma-separated value* (CSV) formatted. Either a comma (,) or a semicolon (;) can be used as a field separator. Each record (line) in the file describes a single device and consists of the following fields:
		
		Field > Description
		
		#0 > Management ID
		
		#1 > Firmware Version
		
		#2 > Template Name
		
		#3 > Reachable via" address
		
		#4 > Serial Number
		
		#5 > Flash ID
		
		#6...#n > Variable assigments
		
		The Management ID and Firmware Version (fields #0 and #1) are mandatory, all other fields are optional. If a field is empty or non-existent, the corresponding attribute is not set.
		
		The Firmware Version field must be a supported firmware version (without patchlevel) as it would appear in the Version column of the device overview table, e.g. mGuard 6.1.
		
		The Template Name must either be the name of an existing template, which is assigned to the new device, or empty, in which case no template is assigned.
		
		Scalar variables (i.e. variables that store a single value and are not contained in a table) can be set with an assignment of the form *<VARIABLE_NAME>=<VALUE>.*
		
		Example record:
		
		`My Device,mGuard 6.1,,192.168.2.3,17X46201,,`
		`ROUTERMODE=router,MY_LOCAL_IP=192.168.2.3`
		
		(Please note that the record must be contained in a single line.)
		
		If a record is not valid, it is skipped and an error message is logged.

	Import ATV & Create Device	Creates a new device with a selected ATV configuration. The firmware version for the device is taken from the ATV configuration.
	Import X.509 Certificates	Import certificates created during the manual certificate enrollment process (see "Machine certificates" on page 111 for more detailed information).

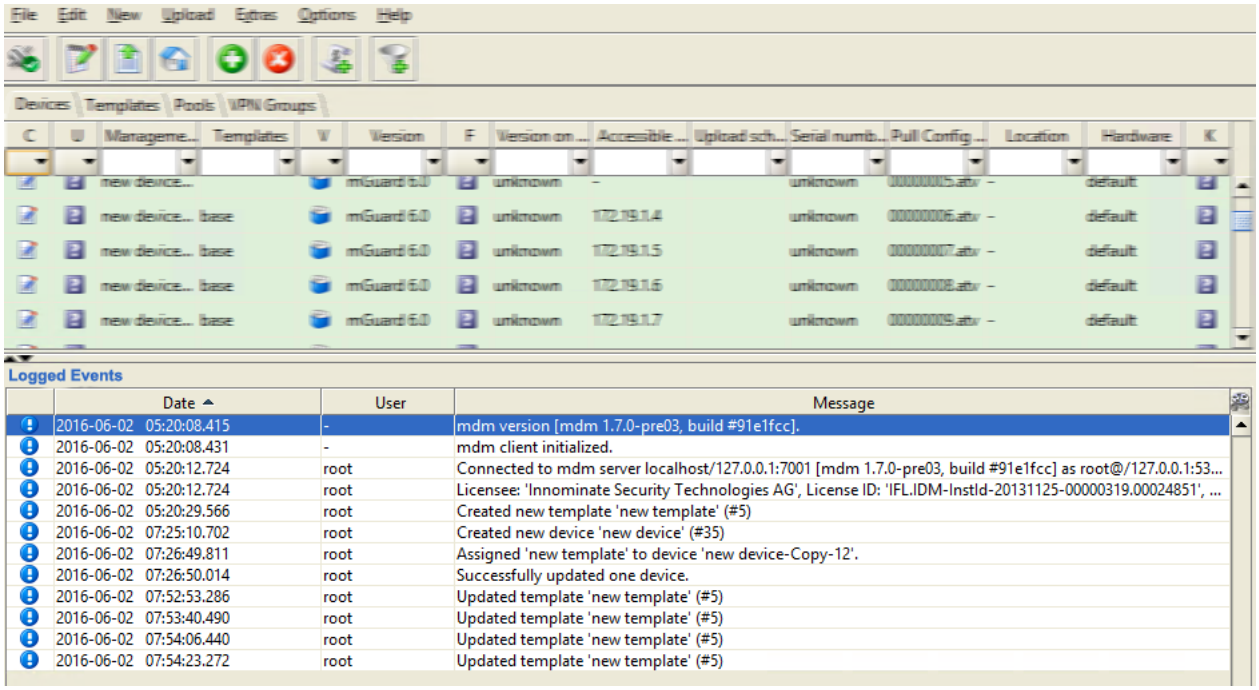
The mdm main menu		
Upload	For an overview of the configuration upload process and the different upload methods see “Upload configurations to mGuard devices” on page 99.	
	Selected	Uploads configurations to the devices currently selected in the device table.
	Changed	Uploads configurations to the devices with a configuration status of *out-of-date*.
	All	Uploads configurations to all devices.
Extras	**Manage Device Licenses...** **Manage License Vouchers...**	Manage your license vouchers and device licenses. For information on how to manage licenses and vouchers see “Manage license vouchers and device licenses” on page 104.
	Manage Profile Keys	Manage your profile keys. For information on how to manage profile keys see “Manage Profile Keys” on page 102.
	Change Own Password	Opens a dialog that enables the current user to change the password.
	Manage Users And Roles	Manage your users and roles. For information on how to manage users and roles see “Manage users, roles, and permissions” on page 107.
Options	**Default Browser**	Please specify a command line to be used to start the browser. The command line should start with the full path and the name of the binary. Append the string *{url}*, which will be replaced with the URL of the mGuard, e.g. on Windows enter: *C:\Program Files\Firefox\Firefox.exe {url}*
	Default Firmware Version	This is the firmware version that will be used when creating a new device or template.
	Disable Filtering	The filter in the device, template, pool, and VPN group table can be switched on and off using this option.
Help	**About...**	Shows information about the currently installed mdm version and included third-party software.
	mdm User Manual	Opens the *mdm User Manual* in a web browser (internet connection required).
	mdm Server License...	Shows the installed mdm license.

5.2.2 mdm tool bar

The tool bar offers short-cuts to some of the functions in the main menu or the context menu.

The mdm toolbar	
	No connection to server; if clicked: connect to server.
	Connection established; if clicked: disconnect from server.
	Edit the selected entry (device, template, pool, or VPN group).
	Upload the configuration to the selected devices.
	Upload the configuration to the selected devices.
	Open the Web GUI of the selected devices in the device table.
	Delete the currently selected entries.
	Open a dialog to generate/request licenses from the license server for the selected devices.
	Add an entry (device, template, pool, or VPN group) and open its *Properties Dialog*.
	Filter of the current overview table (device, template, pool, or VPN group) is active. If clicked: deactivate the filter.
	Filter of the current overview table (device, template, pool, or VPN group) is inactive. If clicked: activate the filter.

5.3 Log window



The log window shows various events, including the following:

- Upload results.
- Creation, deletion, modification of a device, template, pool, VPN group, user, or role.
- Connect or disconnect of the client.

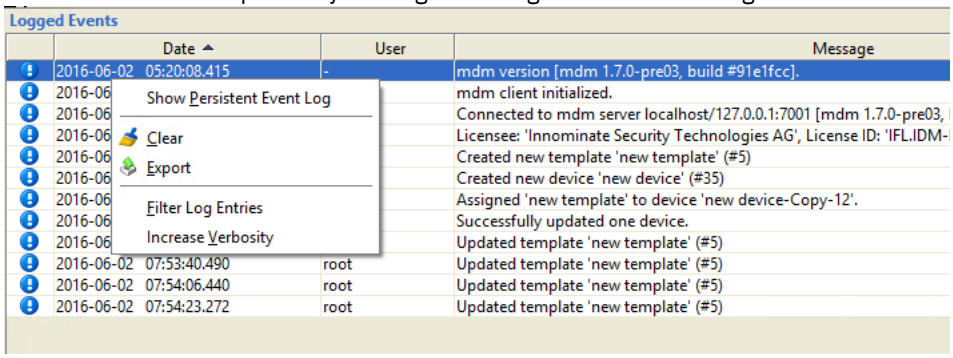
For each event, the severity, the date and time, the user name, and a message are logged. If an event is not the result of a user action, "–" is logged instead of the user name. Double-clicking on a log entry opens a window with detail information.

Sorting the table

The header of the table can be used to sort the table entries. A click on a header of a column will activate the (primary) sort based on this column. This is indicated by the arrow in the column header. A second click on the same header will reverse the sort order. Clicking on another column header activates the sort based on this new column, the previously activated column will be used as secondary sorting criterion.

5.3.1 Context menu

The context menu is opened by clicking on the log window with the right mouse button.



The following actions can be performed.

Log window context menu	
Show Persistent Event Log	Opens the Persistent Event Log Window (see “Persistent Event Log” on page 25).
Clear	Deletes the log entries. This applies to the current mdm client only, i.e. other clients are not affected.
Export	Opens a file chooser window and exports the log entries to an XML file.
Filter Log Entries	Enables or disables the filter for the log entry table. If the filter is enabled, the first row of the table accepts the input of regular expressions (see Chapter 11, *Regular expressions*), which can be used to efficiently filter the table entries.
Increase Verbosity	Enables or disables verbose logging. If verbose logging is enabled, some events which are not normally useful and may be confusing are logged.

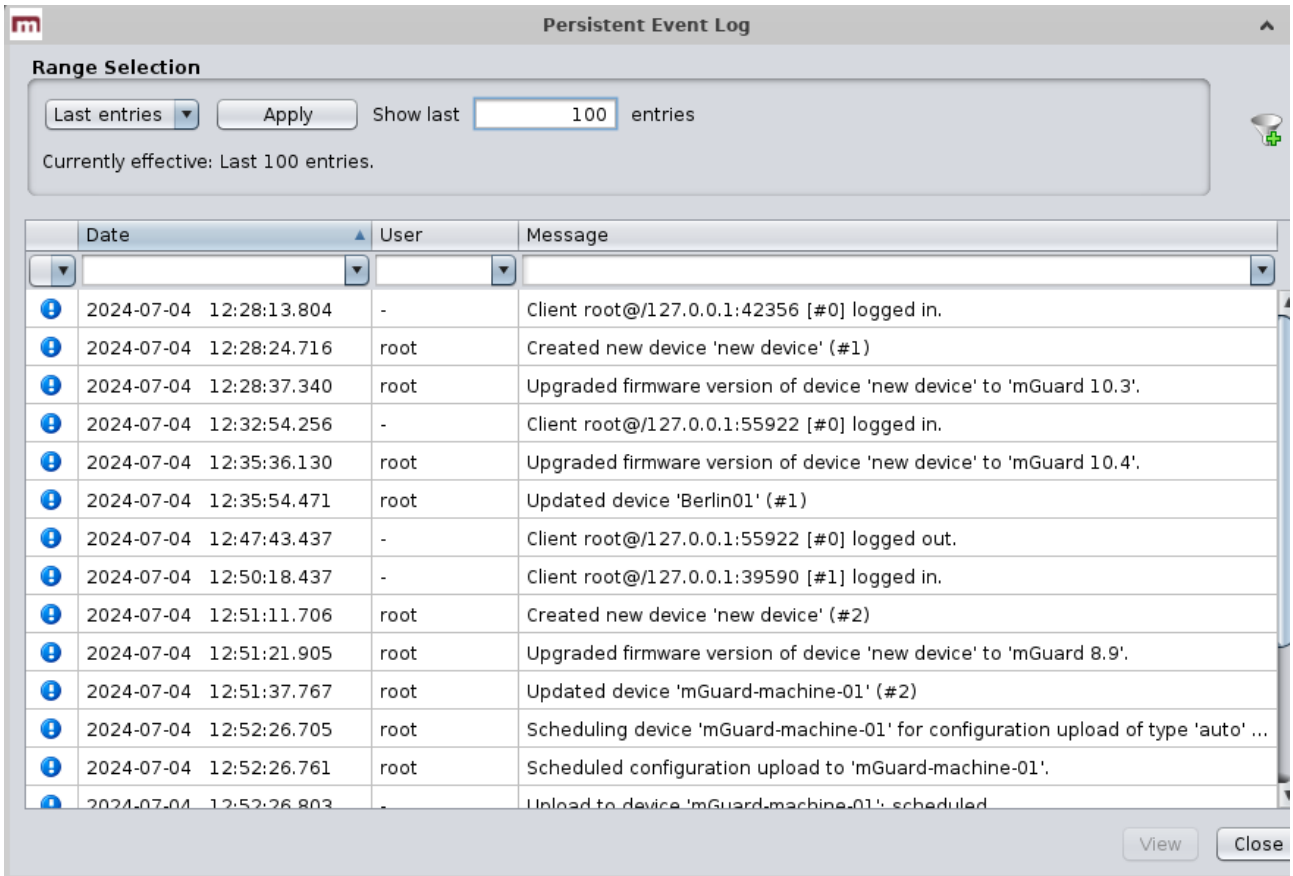
Auto-scrolling

If a new event is logged, the log window is automatically scrolled so that the new entry is visible by default. The auto-scrolling mechanism can be disabled and re-enabled by clicking on the  icon in the upper right corner of the log window.

5.3.2 Persistent Event Log

The Persistent Event Log window shows selected events in the same manner as the log window. Unlike the entries in the log window, the entries in the Persistent Event Log Window are stored persistently in the mdm database, i.e. they are retained even if the mdm server is restarted.

The number of days, after which the entries in the database expire (default: 200 days) can be configured in the file *preferences.xml* (node *event*).



Range selection

Since there can be a large number of persistent log entries, not all entries are automatically loaded from the mdm server when the dialog is opened. By changing the criteria in the Range Selection field and clicking the **Apply** button, the history entries matching the specified critera can be loaded.

By default, the latest (i.e. newest) 100 entries are loaded.

The persistent event log		
	All Entries	Loads all log entries. If the number of entries is large (i.e. thousands or more), loading all entries may incur a significant delay.
	Time Range	Loads all entries which have been created during a time range. The time range must be specified: – If a lower bound, but not an upper bound is specified, all entries newer than the lower bound are loaded. – If an upper bound, but not a lower bound is specified, all entries older than the upper bound are loaded. – If both a lower and an upper bound are specified, all entries created during the time interval given by the bounds are loaded. Times are specified as an ISO date (YYYY-MM-DD where YYYY is the year, MM is the month of the year between 01 and 12, and DD is the day of the month between 01 and 31) optionally followed by an ISO time (hh:mm:ss where hh is the hour according to the 24-hour timekeeping system, mm is the minute and ss is the second). For example, a quarter past 4 p.m. and 20 seconds on December 22nd, 2010 would be written as 2010-12-22 16:15:20. Alternatively, click on the icon to select the date from a calender.
	Last Entries	Loads the latest (i.e. newest) entries. The number of entries must be specified.

5.3.3 Logging events via syslog

The same events logged in the persistent event log (see “Persistent Event Log” on page 25), or a subset selected by the severity, can be sent to a syslog server (see “mdm server (*preferences.xml file)” on page 149*).

5.4 Hardware flavors

5.4.1 FL MGUARD RS2000

Most mGuard devices support the same configuration variables regardless of the hardware. However, FL/TC MGUARD (RS)2000 series devices only support a limited set of variables. In mdm it is possible to manage these devices via the hardware configuration mechanism *rs2000*. If the hardware configuration *rs2000* and not *default* is selected, variables that are not supported by this platform are omitted.

Prerequisite: mGuard firmware version 7.5.0 or higher must be installed and the feature „redundancy“ must be deactivated.

Templates do not have a hardware configuration. They always contain all variables that correspond to the *default* hardware configuration. In this case, the following applies to devices with the hardware configuration *rs2000*:

Variables inherited from a template that are not supported by the FL/TC MGUARD (RS)2000 series device are ignored.

Although some variables are supported on FL/TC MGUARD (RS)2000 devices, they only have a limited range of supported values. If such a variable is inherited by a device set to the *rs2000* configuration and the inherited value is not supported, the variable becomes invalid and must be corrected in the configuration dialog before it can be uploaded to the device.

mdm 1.17.x does not support a separate hardware configuration (flavor) for the devices of the series TC MGUARD RS2000, FL MGUARD RS2005 and FL MGUARD 2000 series devices. *rs2000* hardware configuration should be used in „Router“ network mode.

6 mdm client – Configuration tasks

6.1 General remarks

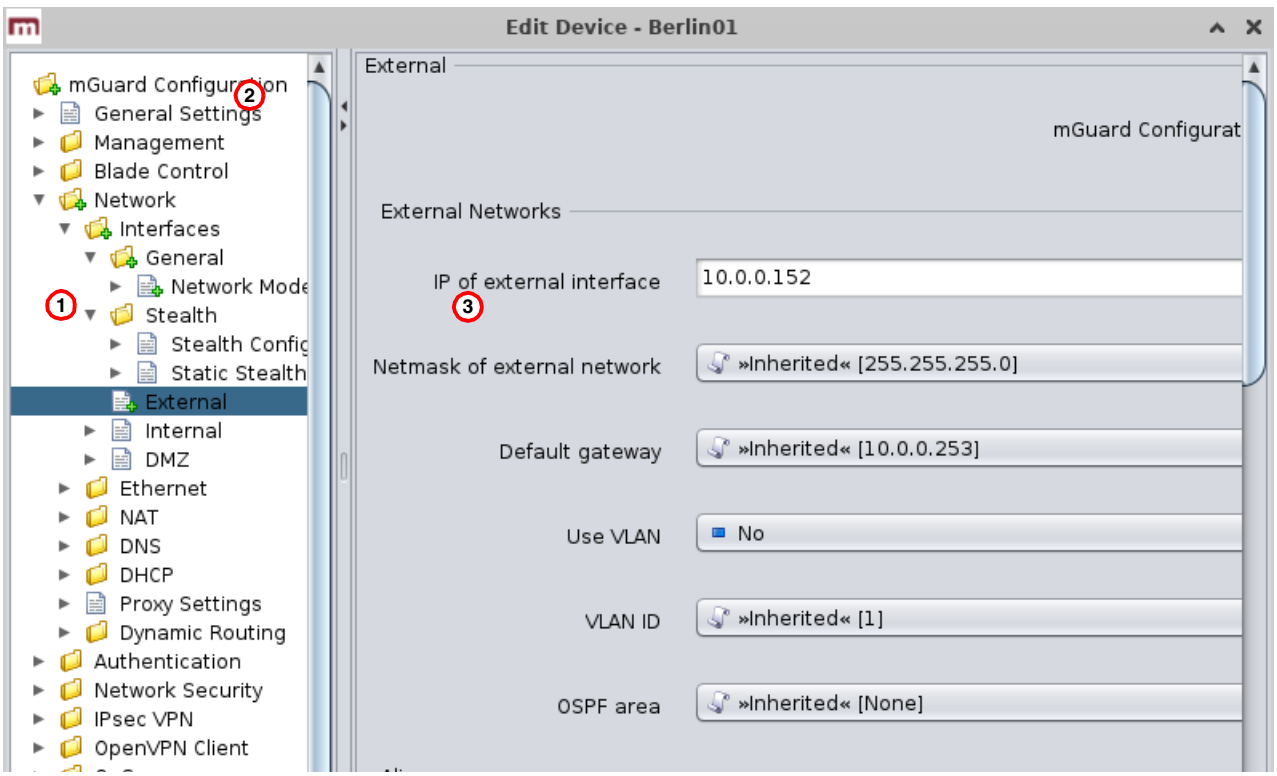
The *Device properties dialog*, the *Template properties dialog*, the *Pool Value Properties Dialog, and the VPN group properties dialog* are used to configure devices, templates, pools, or VPN groups, respectively. The device and template dialogs are very similar, therefore the common parts are described in this chapter.

Chapter 6.3.3 and Chapter 6.4.3 discuss the differences between the two dialogs. The pool configuration is explained in Chapter 6.5.3. For detailed information on the template and inheritance concept please refer to Chapter 6.4.5 (“Working with templates”). The VPN group configuration is described in Chapter 6.6.4.

6.1.1 Navigation tree

On the left side of the dialog you can find the navigation tree ①, which resembles the menu structure of the mGuard Web GUI. Compared to the mGuard GUI the navigation tree contains an additional entry **General Settings** ②, which contains template and device parameters only used in mdm.

For more information on the **General Settings** please refer to the following chapters.



Navigation tree context menu

The navigation tree has a context menu, which can be opened by clicking on the tree with the right mouse button. The context menu contains various entries to fold/unfold parts of the tree. Furthermore the context menu shows the key shortcuts to access the menu entries.

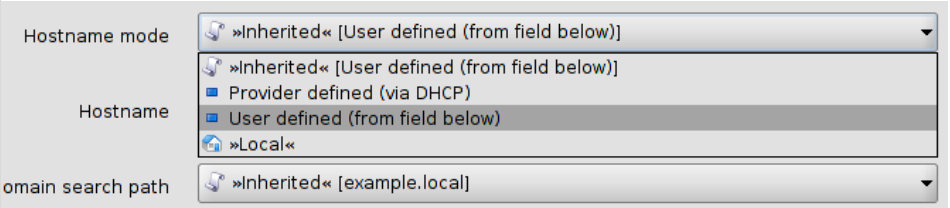
Navigation tree context menu		
Focus on Subtree	Only the subtree of the selected node will be fully expanded. All other currently expanded nodes/subtrees will be collapsed.	
Collapse All Other Nodes	All nodes that are currently not selected will be collapsed.	
Scroll to Active Node	The node that is currently selected will be focused if it is not already visible.	
Collapse	**Collapse All Nodes**	All nodes will be collapsed.
	Collapse Selected Subtree	The selected subtree will be collapsed.
	Collapse Selected Node	The selected node will be collapsed. Currently expanded subtrees of the node will appear expanded again, when the node will be expanded the next time.
Expand	**Expand All Nodes**	All nodes will be fully expanded.
	Expand Selected Subtree	The selected subtree will be fully expanded.
	Expand Selected Node	The selected node will be expanded (only one level).
	Focus on Here Defined Nodes	All nodes with values that are not inherited will be expanded (i.e. value types set to *custom* or *local*).
	Focus on Inherited Nodes	All nodes with inherited values will be expanded.
	Focus on Incomplete Nodes	All nodes with inherited "*None*" values or unsatisfied pool references will be expanded.

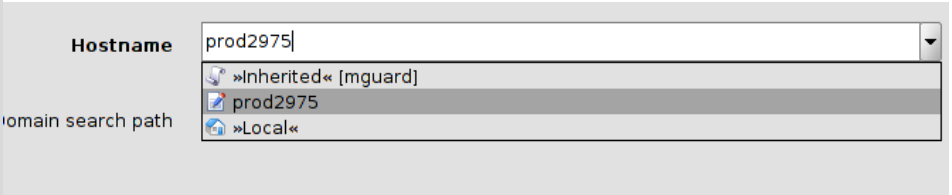
mGuard configuration

The navigation tree allows you to navigate conveniently to the mGuard variables. If you click on a "leaf" of the tree, the corresponding mGuard variables and the associated settings are shown in the right area ③ of the *Properties Dialog*.

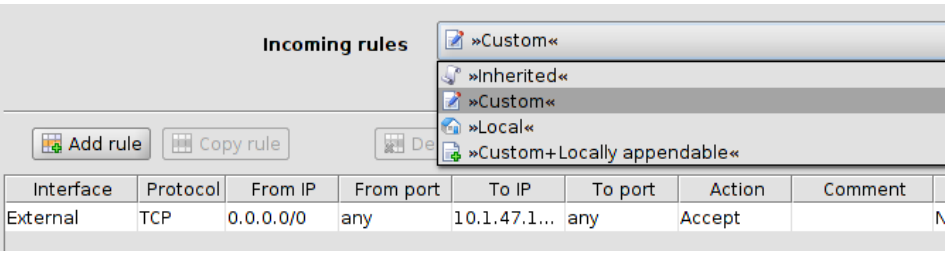
6.1.2 Value types of variables

Depending on the variable, different value types can be selected (exemplarily shown for the *Device properties dialog*, see below).

Different value types of variables	
Variables with a fixed value set	
Inherited	Set the variable to the default value or to the value defined in an assigned template (if applicable). The usage of templates and inherited values is further explained in “Template properties dialog” on page 70 and “Working with templates” on page 75.
Local	The mGuard supports (among others) two roles, the *admin* who is able to change all mGuard variables and the *netadmin* who is able to change only local variables. The **Local** value determines whether a variable is local, i.e. whether or not it can be managed by the *netadmin* on the mGuard. If a variable is local, it will *not be managed by mdm anymore* in order to avoid conflicts between mdm and the *netadmin.*
Fixed values	A number of fixed values which can be selected for this variable. The selectable values depend on the variable. In the example above (see figure) the fixed values are: **Provider defined** and **User defined** for the variable **Hostname mode**.

Different value types of variables	
Variables with an editable value	
Inherited	See above.
Local	See above.
Custom	If you select the **Custom** value entry, the combo box becomes editable and you can enter a specific value for the variable, e.g. **prod2975** in the example in the figure above. The value you entered is subsequently shown as available selection in the combo box.

Different value types of variables	
Table variables (e.g. incoming firewall rules)	Table variables allow the following choices (for more information on tables please see “Modifying mGuard table variables” on page 38).

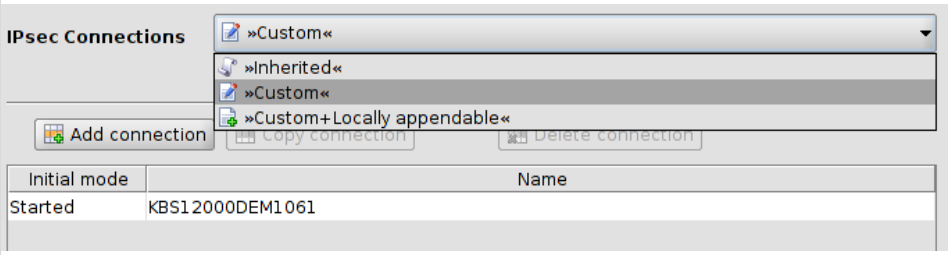


Inherited — Set the variable to the default rows or to the rows defined in an assigned template (if applicable). The inherited rows are shown at the beginning of the table in a different color and are not editable or selectable. The usage of templates and inherited values is further explained in “Template properties dialog” on page 70 and “Working with templates” on page 75.

Local — See above.
If you set a table variable to **Local** and mdm shows an error, please check whether *May append* is set as permission in the template (if any). If *May append* is selected as permission for the table in the template, it is only allowed to append rows in the *Device properties dialog*, therefore the selection of *Local* results in an error.

Different value types of variables		
	Custom	If you select **Custom** the table and its associated menu elements become enabled. Table rows defined in a template **may be** copied from the template to the device. They can be deleted and edited or new rows can be added in the *Device properties dialog* (only in certain cases: see described behavior below). Please note that deleting or editing the rows does not change the rows in the template. You may also add new rows to the table. **Behavior (only permission setting *May override*):** **General case**: In general, switching the table from **Inherited** to **Custom** overrides the table completely, i.e. the table content defined at the template is not *retained* on the device, but default table rows are set (e.g. Firewall Outgoing Rules). **Exception**: If the table has no default row (i.e. the table is empty), as a convenience, after switching from **Inherited** to **Custom** the table content inherited from the template is copied into the **Custom** table on the device in the form of new rows (e.g. Firewall Incoming Rules). **Workaround for the general case**: For the general case, there is a possibility of enforcing the copy of the inherited table rows: set the table as **Custom**, remove the default row(s), set the table back to **Inherited**, and then back again to **Custom**. The resulting **Custom** table will have copied the rows from its parent template. Please note that it is possible to switch between **Custom** and the other value types without losing any data. But if you switch from **Custom** to e.g. **Inherited** and then apply your settings and leave the dialog, all custom rows you entered will be lost.
	Custom + Locally appendable (*Device properties dialog* only)	Basically the same as **Custom**, but this option allows the user *netadmin* on the mGuard to add further rows. (The rows defined in mdm cannot be edited or deleted by the user *netadmin* on the mGuard.)

Different value types of variables	
Complex table variables (e.g. VPN connections)	Contrary to “normal” table variables, adding a row to or deleting a row from a complex table variable additionally adds or deletes a node from the navigation tree. An example for a complex table variable are the VPN connections: a VPN connection is represented by a table row in the overview table and by an additional node in the navigation tree, in which the settings for the connection can be made. Please note that the table cells of complex tables are not editable, i.e. all settings have to be made in the leafs of the navigation tree node. Complex table variables allow the following choices (for more information on tables please see “Modifying mGuard table variables” on page 38.



Inherited

The behavior is basically the same as described for the “normal” table variables above. Inherited rows from a template which also appear as navigation tree nodes are all set to read-only if **Inherited** is selected for the complex table variable. The usage of templates and inherited values is further explained in “Template properties dialog” on page 70 and “Working with templates” on page 75.

Custom

If you select **Custom** the table and its associated menu elements become enabled. Contrary to “normal” table variables the inherited table rows are *not* copied from the template to the device when switching to **Custom**. Inherited rows cannot be deleted, but can be edited if **Custom** is selected. Please note that changing or editing the rows does not change the rows in the template. You may also add new rows (nodes) to the table.

Please note that it is possible to switch between **Custom** and **Inherited** without losing any data while the *Properties Dialog* is open. But if you switch from **Custom** to **Inherited**, apply your settings, and then leave the dialog, all custom rows you entered will be lost.

Additional configuration in the template

In the *Template properties dialog* you can find additional settings for the variables. These settings are explained in “Template properties dialog” on page 70.

6.1.3 Indication of invalid input

Invalid input will be immediately indicated by a red variable name and by error icons in the navigation tree, as shown in the following figure for the external IP address:

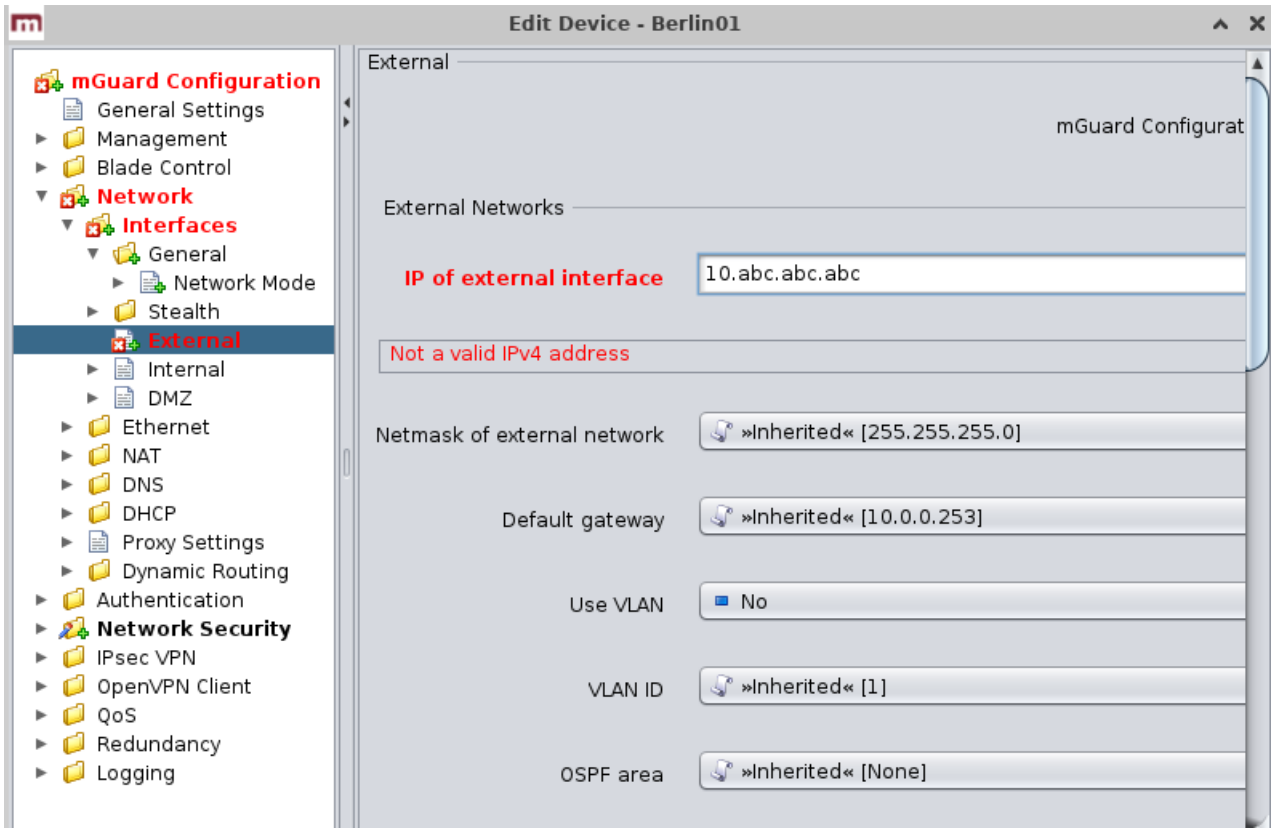


Figure 6-1 Input verification / invalid input

6.1.4 Indication of changed values

The icon in the leafs of the navigation tree (see the following figure) indicates that a change has been made to a variable in the leaf but has not been applied yet.

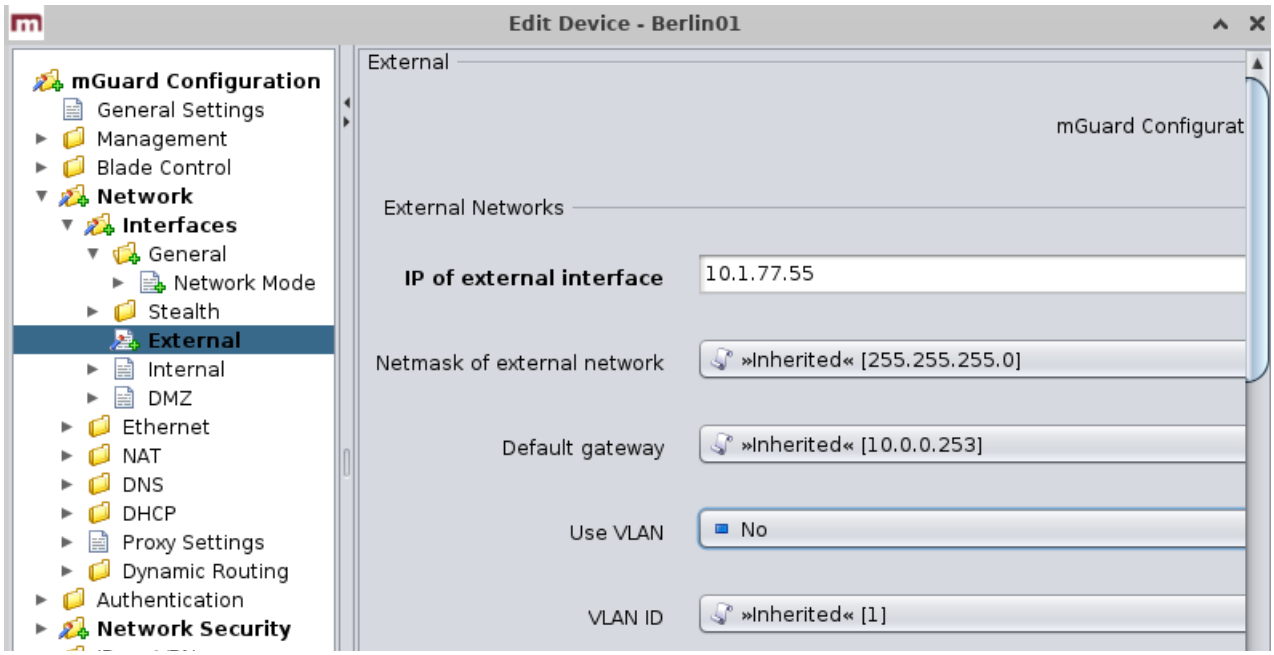


Figure 6-2 Indication of non-applied changes

The icon in the leafs of the navigation tree (see the following figure) indicates that settings have been changed in the respective leaf and have been applied.

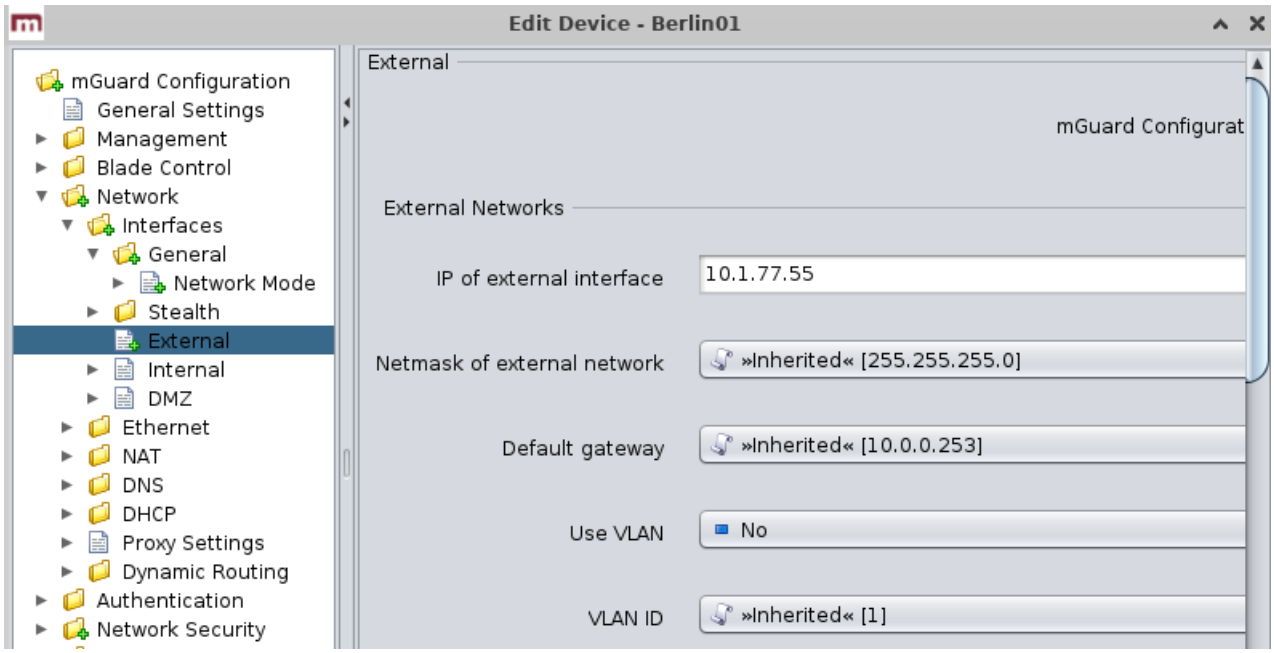


Figure 6-3 Indication of applied changes

6.1.5 Indication of “None“ value or exhausted pool

The icon in the leafs of the navigation tree (see the following figure) indicates either

– a “**None**“ value which has not been overridden (set) yet in the template hierarchy or
– a reference to an **exhausted pool.**

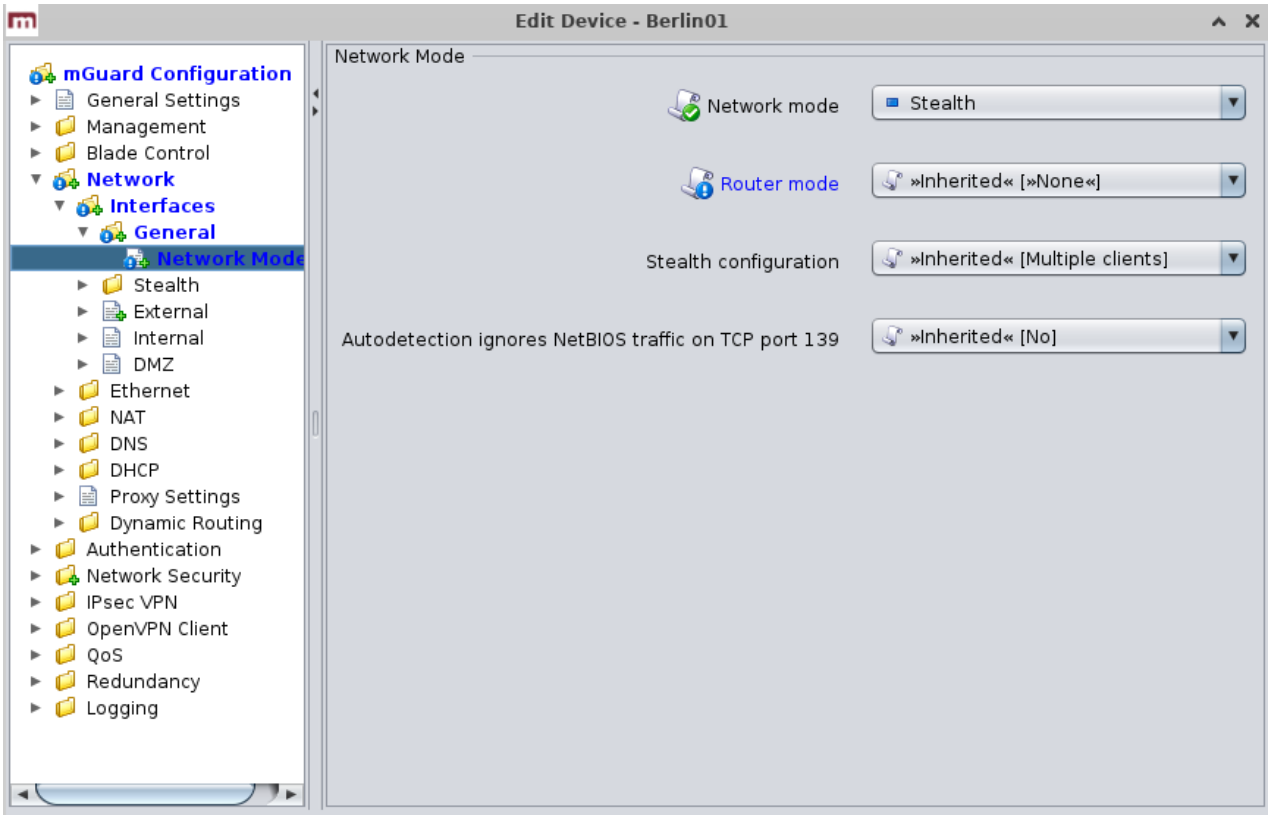


Figure 6-4 Indication of a “None“ value or an exhausted pool

6.1.6 Modifying mGuard table variables

The following figure shows an example of a table variable (incoming firewall rules):

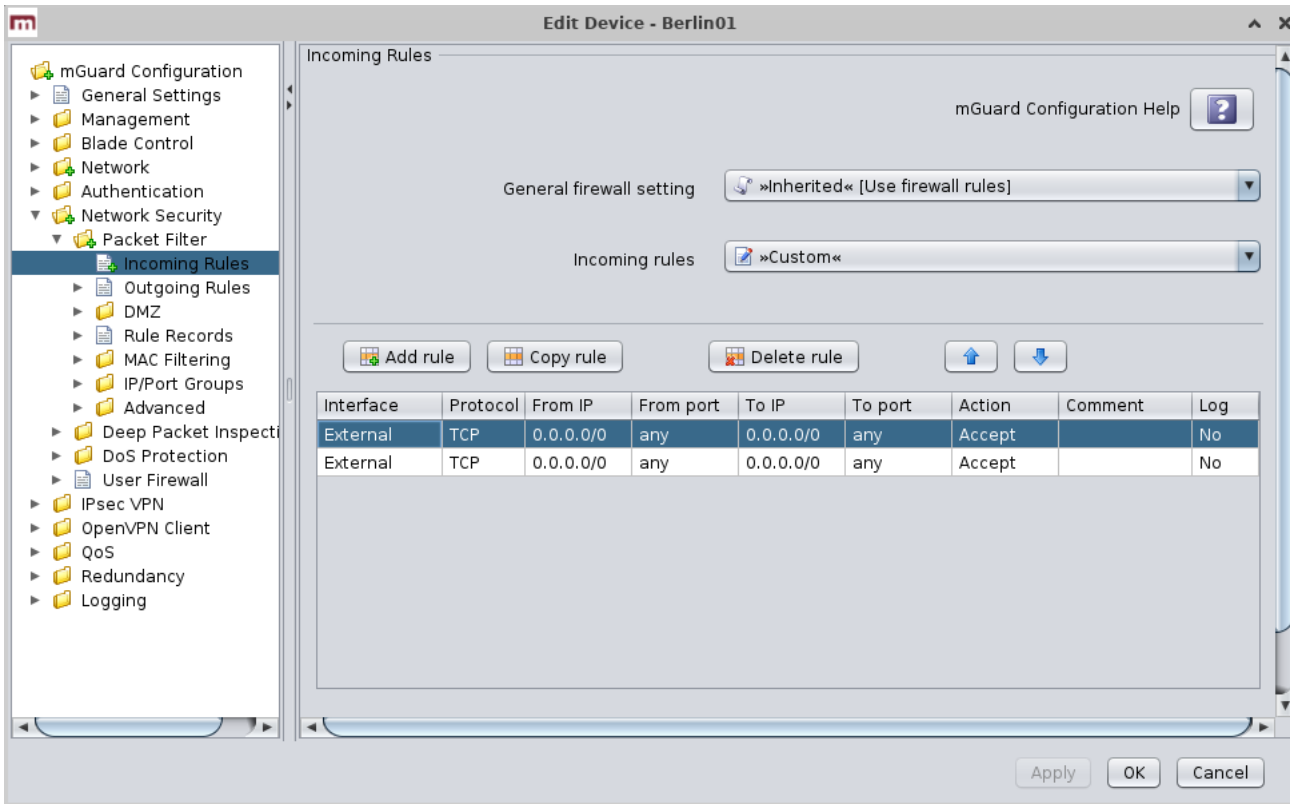


Figure 6-5 Modifying table variables

Add, delete, copy, or move rows

To add, delete, copy, or move rows, please use the respective buttons.

If none of the rows is selected then a click on the **Add** button will add the row at the beginning of the table. If one or more rows are selected, a new row will be added after the last selected row.

The **Delete** button is enabled only if at least one row is selected. It deletes the selected rows.

The **Copy** button is enabled only if at least one row is selected. It copies the selected rows and inserts them after the last selected row.

The **Move** buttons are enabled only if at least one row is selected. To move the current selection up one row press the button; to move it down please press the button.

The **Add**, **Delete**, **Copy,** and **Move** buttons are enabled only if either **Custom** or **Custom + locally appendable** is selected. Please refer to the Section *mGuard configuration* above.

Selecting table rows

By clicking on a table row with the left mouse button you select it. Multiple rows can be selected as a contiguous block of rows either by first selecting the upper or lower row of the block and then selecting the opposite row with a left click while holding the *<Shift>* key.

Rows can be added to the selection or removed from the selection by clicking with the left mouse button on the row while pressing the *<Ctrl>* key.

Changing a table cell

To edit a table cell please double click on the cell with the left mouse button. (A single click selects the table row).

Invalid values in tables

An invalid value in a table will not be indicated in the navigation tree, but the cell will be marked red. If you enter an invalid value in a table cell, and leave the cell e.g. by clicking on another navigation tree node, the last applied (valid) value will replace the invalid input.

In Firewall tables: If the chosen protocol is neither TCP nor UDP, the configured port will be ignored. In this case the cell will be marked in yellow.

Row colors

The rows of a table may have different colors, depending on the type of row. Inherited rows from an ancestor template are colored red, green or grey:

– a green row indicates that the row is editable,
– a red row indicates that the row cannot be edited or deleted,
– a grey row indicates that it is an inherited default row (which can be changed)

To change a green or grey row it is necessary to switch the value of the table from **Inherited** to **Custom**.

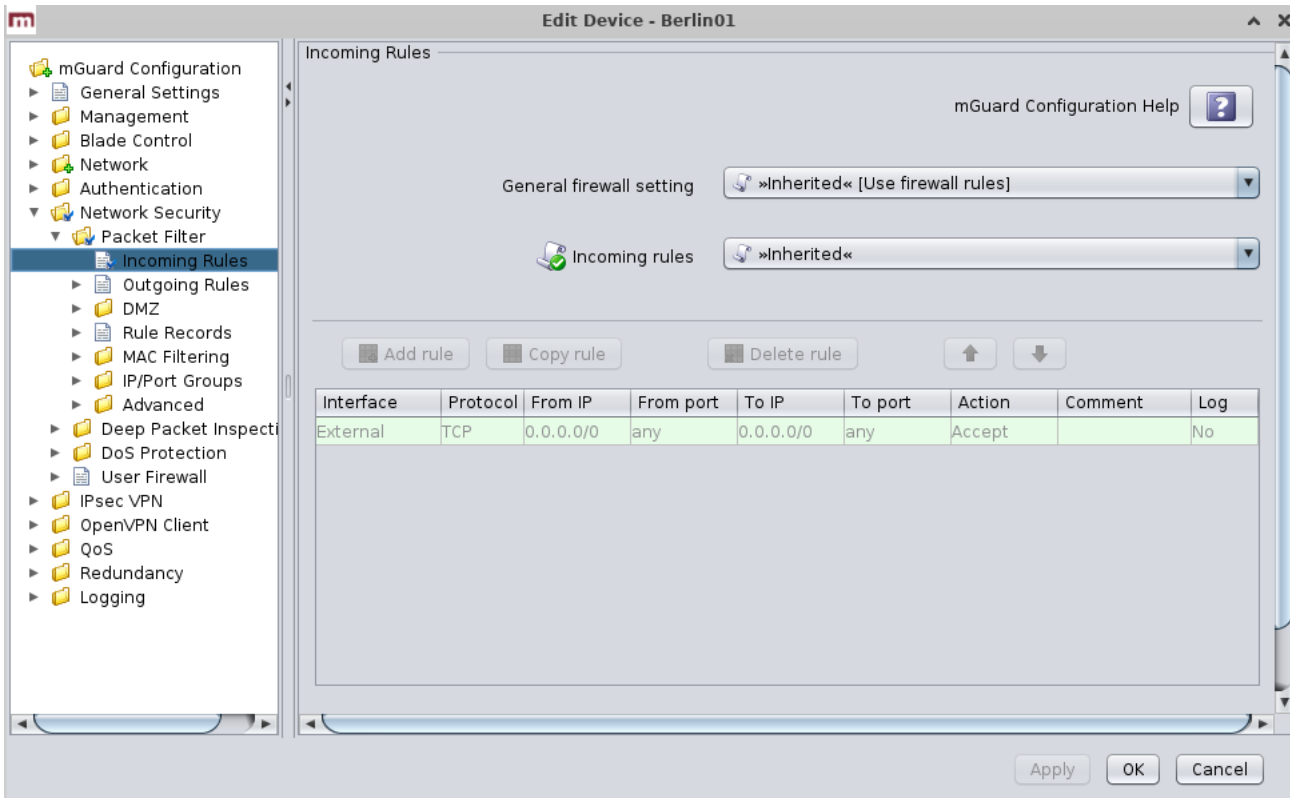


Figure 6-6 Table row colors

Context menu

Tables can also be edited using the context menu. Please click on the table with the right mouse button. The following menu will appear:

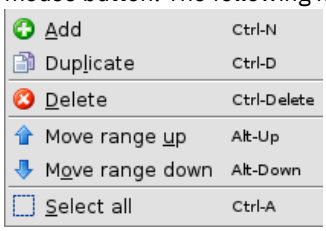


Figure 6-7 Context menu

6.1.7 Modifying complex table variables

For the definition of a complex table variable please refer to the section *mGuard configuration* above. Basically the previous section also applies to complex table variables. However there are some differences that the user should be aware of.

The following figure shows an example of a complex table variable (VPN connections):

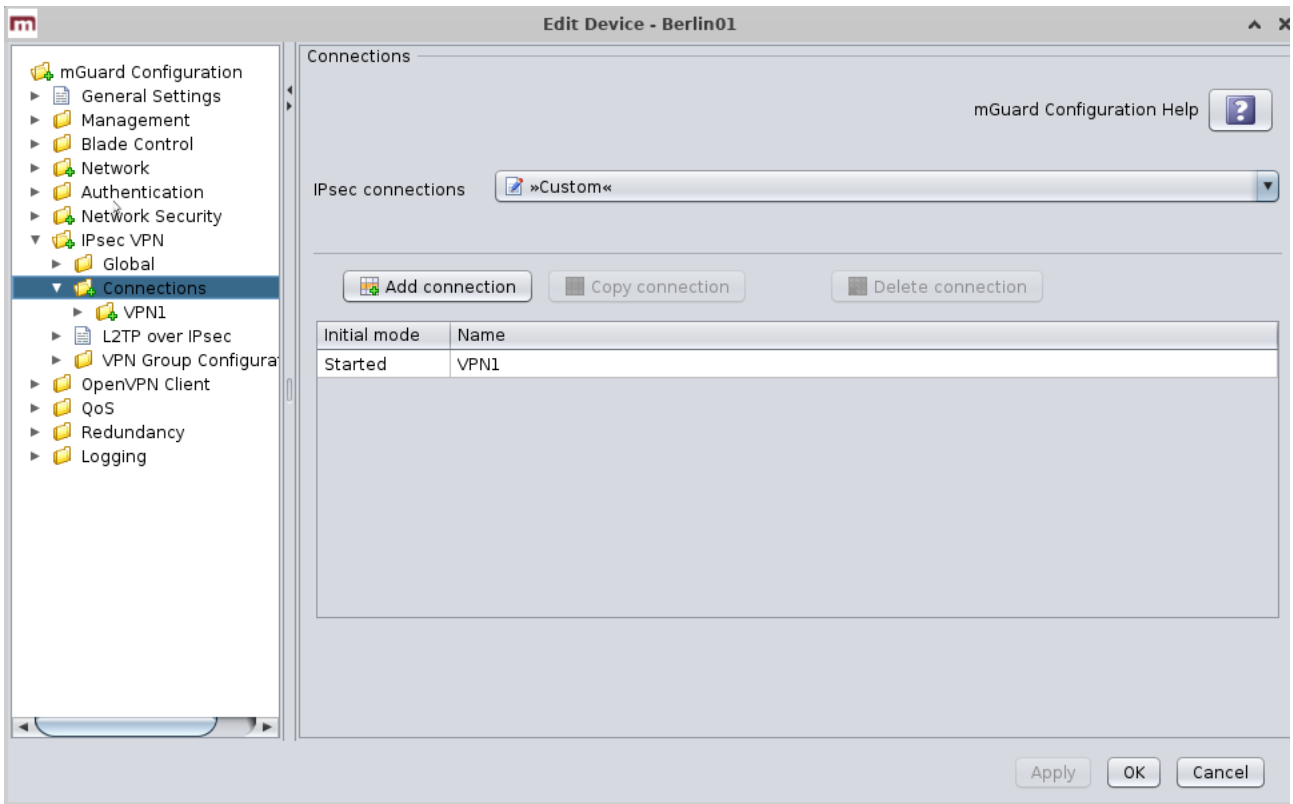


Figure 6-8 Modifying complex table variables

A complex table does not allow to move rows (the respective buttons are missing). Furthermore the cells of complex tables cannot be edited. Adding a row to a complex table also results in adding a node to the navigation tree (see Figure 6-8).

The **Add, Copy,** and **Delete** buttons are enabled only if **Custom** or **Custom+Locally appendable** is selected. Please refer to the Section *mGuard configuration* above.

6.1.8 Applying changes to the configuration

Changes made to the configuration are permanently stored with the **Apply** button (at the bottom of the dialog). If you make any changes without applying them, you can discard your changes by closing the dialog with the **Cancel** button. You can also apply your changes by closing the dialog with the **OK** button.

Please note that the configuration is **not** automatically transferred to the mGuard after applying a change. To transfer the configuration to an mGuard, you have to upload the configuration file to the mGuard (see Chapter 7.1).

6.2 Default values

If a default value is changed in the mGuard firmware, the management of this value in mdm will be affected:

1. if a firmware version of a managed device is upgraded to a firmware version with a changed default value,
2. if an inheriting child with a different mGuard firmware version than its parent inherits a value with a different default value.

The related behavior of mdm is described below.

If a device/template is upgraded to an mGuard firmware version (8.5 or 8.6), and a new default value differs from the old default value (see table above), the following applies:

If the default value is in default configuration and inherited (along the complete inheritance chain), then the old default value will be kept after the upgrade. In this case the value type (of the table) will be changed from "**Inherited**" to "**Custom**".

6.2.1 Inheritance of changed default values

The inheritance of **changed default values** depends on the installed mdm version and the mGuard firmware version of the affected device/template.

General behavior in mdm < 1.8.0:

If default values (value type = "*Inherited*" and **not** "*Local*" or "*Custom*") of the child differ from the default values of the parent (value type = "*Inherited*" along the complete inheritance chain), the inheritance will behave as follows:

1. The child keeps the default values corresponding to the child's firmware version. The value type will remain „***Inherited***".

General behavior in mdm 1.8.0 or later:

If default values (value type = "*Inherited*" and **not** "*Local*" or "*Custom*") of the child differ from the default values of the parent (value type = "*Inherited*" along the complete inheritance chain), the inheritance will behave as follows:

1. Default values that have been changed in **mGuard firmware versions < 8.5**:
   – The child keeps the default values corresponding to the child's firmware version. The value type will remain „***Inherited***".
2. Default values that have been changed in **mGuard firmware versions 8.5 or later**:
   – The child inherits the default values of the parent. The value type will remain „***Inherited***".

6.2.2 Behavior of changed default values (mGuard 10.x)

In mGuard firmware version 10.x the following default values have been changed (see Tabelle 6-1).

Tabelle 6-1 Changed mGuard default values

Changed in version	Path to value in the mGuard web interface	Value old (mGuard < 10)	Value new (mGuard 10.x)
10.x	Network >> Interfaces >> General >> Network mode	Stealth	Router
Description / Effect			
– The following generally applies: A device/template that is updated from firmware version < 10 to 10.x continues to use the configured value if a value is present/configured in the template chain (device/templates).			
– If the network mode is **not** configured in the template chain (device/templates) or in the device, the following applies: a) A device/template **without** a parent template (device/template) that is updated from firmware version < 10 to 10.x receives the network mode "Stealth" (value type: **Custom**). b) A device/template **with** a parent template (device/template) < 10, which is updated from firmware version < 10 to 10.x, receives the network mode "Stealth" (value type: **Custom**). c) A device/template (firmware version 10.x) that itself inherits from a template with firmware version < 10 with standard network mode is assigned the "Stealth" network mode (value type: **Inherited**). – A device/template that is created with a firmware version < 10 receives the network mode "Stealth" (value type: **Inherited**). – A device/template created with firmware version 10.x receives thenetwork mode "Router" (value type: **Inherited**).			

6.2.3 Behavior of changed default values (mGuard 8.5/8.6)

In mGuard firmware version 8.5 and 8.6 the following default values have been changed (see Table 6-2).

Table 6-2 Changed mGuard default values

Changed in version	Path to value in the mGuard web interface	Value old	Value new
8.5.0	IPsec VPN >> Connections >> EDIT >> IKE Options >> ISAKMP SA (Key Exchange)	3DES (Encryption)	AES-256
8.5.0	IPsec VPN >> Connections >> EDIT >> IKE Options >> IPsec SA (Data Exchange)	3DES (Encryption)	AES-256
8.6.0	CIFS Integrity Monitoring >> CIFS Integrity Checking >> Settings >> Checking of Shares	SHA-1 (Hash)	SHA-256
8.6.0	OpenVPN Client -> Connections >> EDIT >> Tunnel Settings >> Data Encryption	Blowfish (Encryption)	AES-256
8.6.0	Redundancy >> Firewall Redundancy >> Redundancy >> Encrypted State Synchronization	3DES (Encryption)	AES-256
8.6.0		SHA-1 (Hash)	SHA-256
8.5.0	Network Security >> Packet Filter >> Incoming/Outgoing	See mGuard firmware manual 8.5.x for further information, avaliableonline or at phoenixcontact.net/products.	

6.3 Configure Devices

6.3.1 Device overview table

Please select the **Device** tab to access the device overview table.:

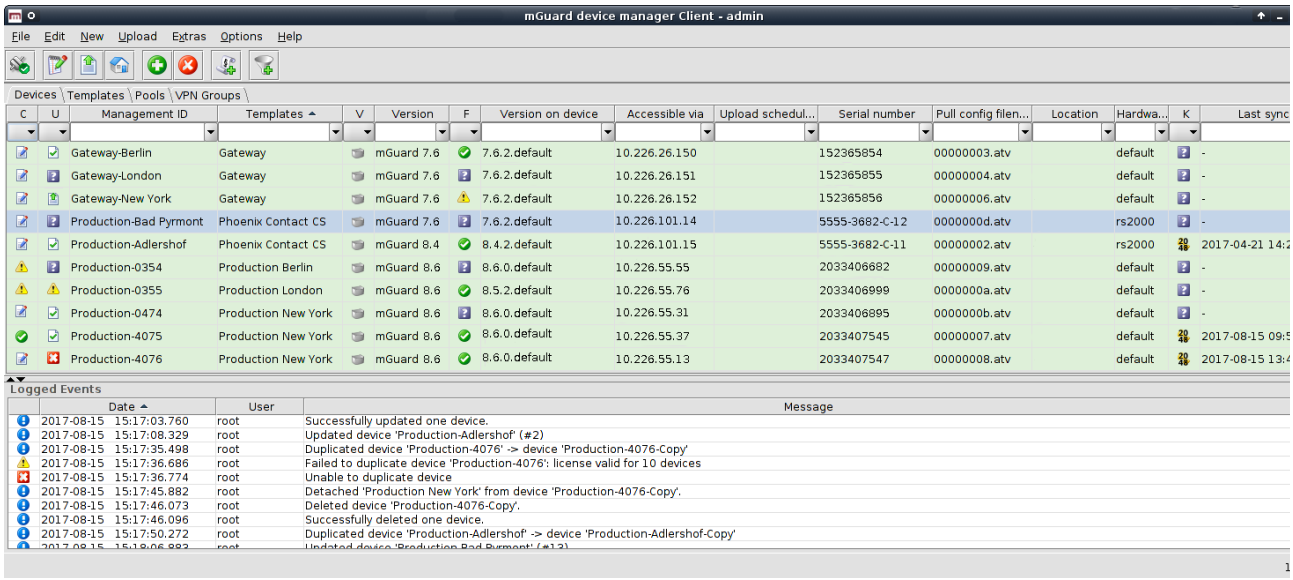


Figure 6-9 mdm main window with device table

Device table columns

The device overview table contains the following columns (see below).

The column width can be changed by placing the cursor on the header of the table at the border of two columns and dragging the border to the desired location. The order of the columns can be changed by dragging the column header to a different location.

Device table columns	
Status *C*	The column labeled with ***C*** shows the configuration status of the device, which indicates whether the configuration on the mGuard differs from the configuration of the device in mdm. The configuration status can take the following values.
Unknown	mdm is not able to determine whether the configuration of your mGuard is up-to-date.
OK	The configuration in mdm is identical to the current configuration of your mGuard.
Changed	The configuration in mdm is different to the current configuration of your mGuard, i.e. the changes made with mdm have not yet been uploaded to the device.

Device table columns		
	Locked	The configuration is locked by another user. This can happen if another user opens the *Device properties dialog* or the *Template properties dialog* of an assigned template. Please note that configuration changes performed by other means than mdm cannot be detected, i.e. the configuration status is displayed correctly only if solely the netadmin user changes the mGuard configuration locally on the device. If a template is changed the configuration status of **all** mGuards using this template is set to *out-of-date*, no matter whether the template change affected the device configuration or not. Please refer to Chapter 5.2 if you would like to manually reset the configuration status to *up-to-date*.
Status *U*	The column labled with ***U*** shows the upload status of the device, which indicates the status of a pending upload or the result of the last upload. Please refer to "Upload configurations to mGuard devices" on page 99 on how to upload configurations to the devices. The upload status can take the following values.	
	Unknown	mdm could not determine the status yet, since no upload has taken place.
	Up to date	The configuration on the device has not changed because it already was up to date.
	Updated	The configuration on the device has been updated.
	Configuration exported	The configuration files have been successfully exported to the file system.
	Pull feedback received	The mdm server has received a configuration pull feedback from the HTTPS server, but it could not be determined whether the configuration on the device is now up to date. This status indicates that the device has pulled a configuration file, but has not yet applied it, or that the configuration is outdated, because it has been changed in mdm after the export to the HTTPS server.
	Device credentials update	Indicates that an SSH host key reset was performed.
	Configuration invalid	mdm indicates that the current configuration is invalid, e.g. a **None** value (see "Template configuration" on page 74) in the template has not been overriden in the device.

Device table columns		
	Locked	The configuration is locked by another user. This can happen if another user opens the *Device properties dialog* or the *Template properties dialog* of an assigned template. Please note that configuration changes performed by other means than mdm cannot be detected, i.e. the configuration status is displayed correctly only if solely the netadmin user changes the mGuard configuration locally on the device. If a template is changed the configuration status of **all** mGuards using this template is set to *out-of-date*, no matter whether the template change affected the device configuration or not. Please refer to Chapter 5.2 if you would like to manually reset the configuration status to *up-to-date*.
Status *U*		The column labled with ***U*** shows the upload status of the device, which indicates the status of a pending upload or the result of the last upload. Please refer to "Upload configurations to mGuard devices" on page 99 on how to upload configurations to the devices. The upload status can take the following values.
	Unknown	mdm could not determine the status yet, since no upload has taken place.
	Up to date	The configuration on the device has not changed because it already was up to date.
	Updated	The configuration on the device has been updated.
	Configuration exported	The configuration files have been successfully exported to the file system.
	Pull feedback received	The mdm server has received a configuration pull feedback from the HTTPS server, but it could not be determined whether the configuration on the device is now up to date. This status indicates that the device has pulled a configuration file, but has not yet applied it, or that the configuration is outdated, because it has been changed in mdm after the export to the HTTPS server.
	Device credentials update	Indicates that an SSH host key reset was performed.
	Configuration invalid	mdm indicates that the current configuration is invalid, e.g. a **None** value (see "Template configuration" on page 74) in the template has not been overriden in the device.

Device table columns		
	Locked	The configuration is locked by another user. This can happen if another user opens the *Device properties dialog* or the *Template properties dialog* of an assigned template.
		Please note that configuration changes performed by other means than mdm cannot be detected, i.e. the configuration status is displayed correctly only if solely the netadmin user changes the mGuard configuration locally on the device.
		If a template is changed the configuration status of **all** mGuards using this template is set to *out-of-date*, no matter whether the template change affected the device configuration or not.
		Please refer to Chapter 5.2 if you would like to manually reset the configuration status to *up-to-date*.
Status *U*	The column labled with ***U*** shows the upload status of the device, which indicates the status of a pending upload or the result of the last upload. Please refer to "Upload configurations to mGuard devices" on page 99 on how to upload configurations to the devices.	
	The upload status can take the following values.	
	Unknown	mdm could not determine the status yet, since no upload has taken place.
	Up to date	The configuration on the device has not changed because it already was up to date.
	Updated	The configuration on the device has been updated.
	Configuration exported	The configuration files have been successfully exported to the file system.
	Pull feedback received	The mdm server has received a configuration pull feedback from the HTTPS server, but it could not be determined whether the configuration on the device is now up to date. This status indicates that the device has pulled a configuration file, but has not yet applied it, or that the configuration is outdated, because it has been changed in mdm after the export to the HTTPS server.
	Device credentials update	Indicates that an SSH host key reset was performed.
	Configuration invalid	mdm indicates that the current configuration is invalid, e.g. a **None** value (see "Template configuration" on page 74) in the template has not been overriden in the device.

Device table columns		
	**Upload or export error**	A permanent error has occured and mdm could not recover from the error or the maximum number of retries for the SSH/HTTPS configuration push has been reached without accessing the mGuard. The cause of the error is displayed in the log window. – **Host authentication failed** This error indicates that the SSH host authentication failed. This can be an indicator of an attack, but most likely it is due to the fact that a failing device was replaced. Before you continue please make sure that the devices in question was indeed replaced. To continue remove the device's active SSH hostkey with the option Set Current Device Credentials in the context menu of the device overview table (select the **Reset SSH Host Key** checkbox). The new SSH hostkey will be set with the next SSH connection. – **User authentication failed** This error indicates that the user credentials (e. g. user name *admin* and the password stored in the devices *active password*) were not accepted. It can also indicate that the SSH authentication method *password* was not accepted by the mGuard. – **I/O failed / Upload failed** This error indicates that an input/ouput (I/O) failure has occurred. In the case of SSH uploads this is probably a transient error and a retry should be scheduled. In the case of filesystem output (pull config) the failure is probably not transient and the cause should be examined by the user. – **Concurrent configuration upload** This indicates that another upload is currently active for the same device. An example is an SSH/HTTPS upload that detects a running pull config script. The usual way to handle this is to reschedule this update. – **Configuration rejected** This indicates that the device has rejected the configuration as invalid.
	**Upload timeout**	This indicates that the SSH connection to the device has timed out, i.e. the device has no reacted to the commands initiated by the mdm within a given (configurable) time frame. If the configuration contains a large number of VPN connections, it might be necessary to increase the timeout; see Chapter 10.1, node *service » storage » update » ssh » deadPeerDetectionTimeout* (**"Key *deadPeerDetectionTimeout*" on page 153**).
	**License could not be installed**	This indicates that an mGuard license file could not be installed on the device.
	**Pull configuration rolled back**	This indicates that a configuration pulled by the device was rolled back.

Device table columns			
		**Pull configuration blocked due to previous rollback**	This indicates that configuration is blocked due to a previous rollback.
		**Saving configuration for rollback failed**	This indicates that saving the rollback configuration failed, the configuration was not applied.
		**Pulled configuration invalid**	This indicates the device detected an invalid pull configuration and therefore the configuration was not applied.
		**Firmware upgrade failed**	The scheduled firmware upgrade failed.
		**Queued for upload or export**	The device is currently in the upload queue. Depending on the settings for the *configuration push retries* and the *waiting time between retries* the device might stay in the queue for a while.
		**Upload or export running**	The device has been accessed and the configuration file is currently being uploaded.
		**Requeued for upload or export**	If the device is not accessible, then it will be requeued and after *waiting time between retries* the upload will start again. If after *configuration push retries* the device has not been accessed an error is shown. This icon is also shown during an ongoing firmware upgrade, since mdm will periodically poll the device for the result of the firmware upgrade.
Management ID		The column shows the Management ID of the device.	
Templates		The column shows a comma-separated list of the device's ancestor templates. The first item in the list is the immediate parent template.	
Status *V*		The column labled with ***V*** shows the VPN group status.	
		**Not a member of a VPN group**	Hovering over one of the latter two icons with the mouse cursor will display a tooltip, listing the VPN group(s) in which the device is a member.
		**Member of exactly one VPN group**	
		**Member of more than one VPN group**	
Version		The column shows the firmware version currently selected in mdm for this device.	
Status *F*		The column labled with ***F*** shows the Firmware status.	
		**Unknown**	The status is unknown.
		**OK**	The firmware upgrade was successful and the firmware version configured in mdm corresponds to the firmware version on the device.
		**Upgrade scheduled**	The upgrade is scheduled.
		**Upgrade running**	The upgrade is running.
		**Version mismatch**	The Firmware version configured in mdm and firmware version on device do not match.

Device table columns		
	Error	An error occured during firmware upgrade.
Version on device	The column shows the firmware version currently installed on the device. Please refer to “Device properties dialog” on page 61 for more information. If the device is in redundancy mode (see “Redundancy mode” on page 118 for more details), the firmware versions of both devices, separated by a comma, are shown.	
Accessible via	The column shows the IP address or hostname which is used by mdm to access the device. This address can be configured in the **General settings** of the *Device properties dialog* (see “Device properties dialog” on page 61). Without an *Accessible via* address it is not possible to push configurations to the device, import ATV profile configurations or open the Web GUI of the device. Please note that this address might not correspond to the internal or external address of the mGuard if NAT is involved. If an **SSH port** has been set manually in the **General settings** or is obtained from the configured **Port for incoming SHH connections** it will be displayed as well. If the device is in redundancy mode (see “Redundancy mode” on page 118 for more details), the *Accessible via* addresses of both devices, separated by a comma, are shown.	
Upload scheduled at	The column shows the date/time the next configuration upload is scheduled for this device.	
Serial number	The column shows the serial number of this device (see “Device properties dialog” on page 61). If the device is in redundancy mode (see “Redundancy mode” on page 118 for more details), the serial numbers of both devices, separated by a comma, are shown.	
Pull config filename	If the configuration is exported to the file system, a unique ID is used as name of the configuration file. The filename of the configuration file is shown in this column.	
Location	The column shows the value of the SNMP Location variable (SYS_LOCATION). If the location is empty, a “-” character is displayed. If the device is in redundancy mode (see “Redundancy mode” on page 118 for more details) and different locations are set for each physical device, the locations of both devices, separated by a comma, are shown.	
Hardware	The column shows the hardware flavor of the device. See “Hardware flavors” on page 26 for more details.	
Status *K*	The column labeled with ***K*** shows the size of the *ssh* and *https* cryptographic keys on the mGuard. The size will be updated every time the mdm has access to the mGuard (only with devices with installed firmware version 7.5 or later). **mGuard devices** with installed firmware version < 7.5 will not update this information.	
	Unknown	The size is unknown.
	1024 bits	The size is 1024 bits.
	2048 bits	The size is 2048 bits.
	Key renewal scheduled	It is recommended to renew 1024 bit keys (see “Set Current Device Credentials” on page 59” for more details).

Device table columns	
Last sync	The column shows the date on which each device was last synchronized successfully with mdm. Synchronization means either updated by – an SSH upload to the device (*upload via SSH*), – a pull export to the device via an HTTPS configuration pull server + feedback (*prepare pull configuration*) or – an online import from the device to mdm (*Import ATV Profile*). If the device has been updated via **pull export** (*pull configuration*), *Last sync* will **only** display this synchronization, if all of the following apply: 1. the device configuration in mdm has not changed since the pull export was scheduled, 2. no additional SSH upload took place after the pull export, 3. the pull export actually changed the configuration on the mGuard device (subsequent pull feedback messages, where no configuration change takes place, are not registered as synchronization events). The column can be searched and sorted chronologically.

Filtering and sorting the table

The header of the table can be used to sort the table entries. A click on a header of a column will activate the (primary) sort based on this column. This is indicated by the arrow in the column header. A second click on the same header will reverse the sort order. Clicking on another column header activates the sort based on this new column, the previously activated column will be used as secondary sorting criterion.

The first row of the table accepts the input of regular expressions (please refer to "Glossary" on page 163, *Regular expressions*), which can be used to efficiently filter the table entries. Filtering based on regular expressions is not used for columns that do not contain text (columns **C**, **U, V,** or **F**).

The filter history will be saved for the current user and can be accessed using the drop down functionality of the filter fields.

Creating devices

There are several ways to create devices:

1. Open the context menu by clicking on the device table with the right mouse button. To open the *Device properties dialog* for a new mGuard please select **Add** in the context menu.
2. Select the **Device** tab and click on the  icon in the menu bar to open the *Device properties dialog* for a new mGuard.
3. Select **New » Device** in the main menu to open the *Device properties dialog* for a new mGuard device.
4. Select **New » Device Import** in the main menu to import mGuard-devices.
5. Select **New » Import ATV & Create Device** in the main menu to create an mGuard device with a selected ATV configuration.

Editing devices

There are several ways to edit a device:

1. Double-click with the left mouse button on the device in the table to open the *Device properties dialog*.
2. Select the device with the left mouse button and open the context menu by pressing the right mouse button. Then select **Edit** to open the *Device properties dialog*.

3. Select the device to be modified in the device table. Select **Edit » Edit Item** in the main menu to open the *Device properties dialog*.

The **Edit** entry in the context menu and the **Edit** button in the toolbar are only enabled if exactly one device is selected in the device table.

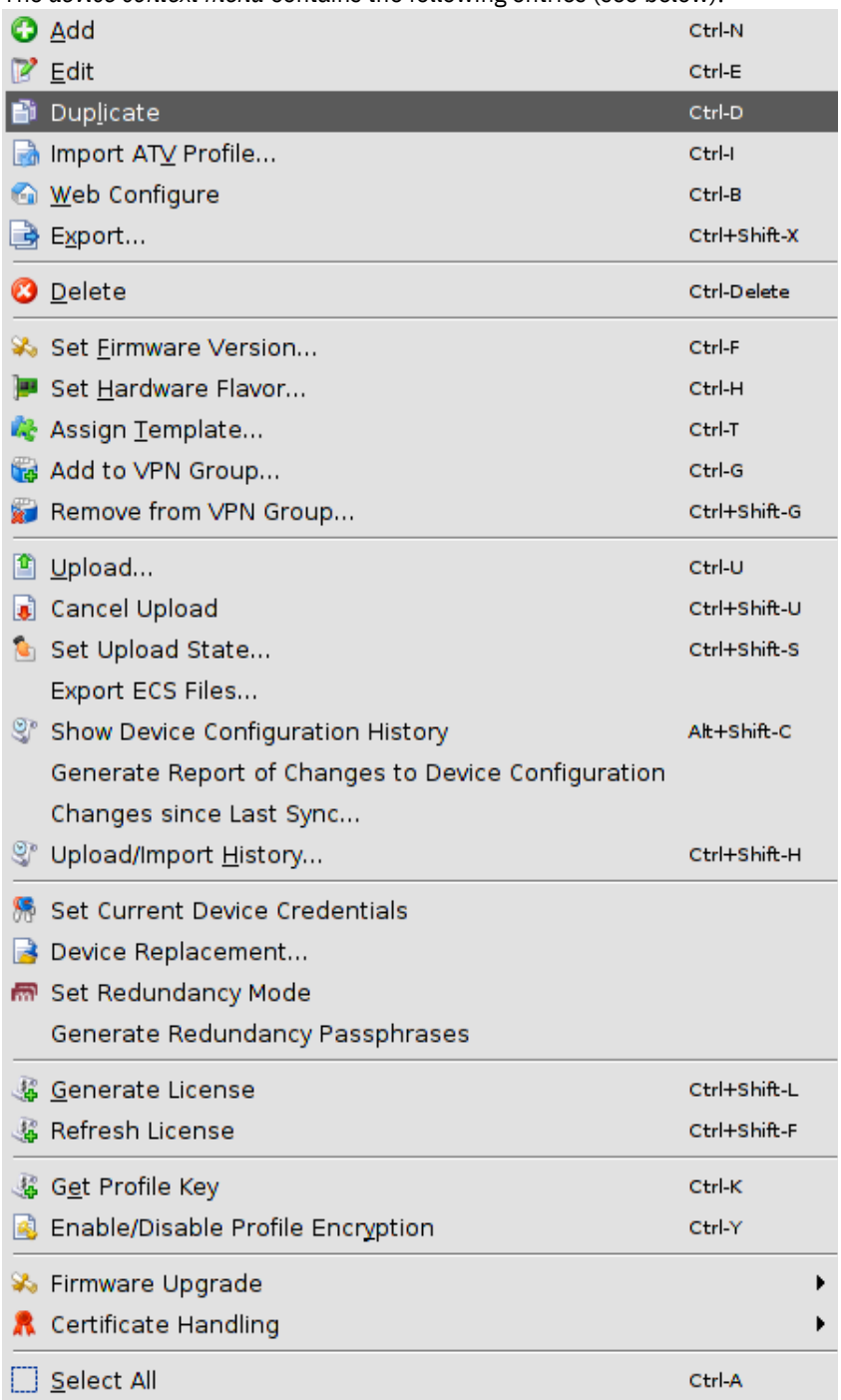
Deleting devices

There are several methods to delete devices:

1. Select the device(s) in the device table and open the context menu by clicking with the right mouse button. To delete the devices please select **Delete** in the context menu.
2. Select the devices to be deleted in the table and click on the  icon in the menu bar.

6.3.2 Device context menu

The *device context menu* contains the following entries (see below).



Device context menu	
Add	Create a new device and open the *Device properties dialog* of the new device.
Edit	Edit the selected device (only active if exactly one device is selected in the overview table).
Duplicate	To create a duplicate of a device please open the context menu by clicking with the right mouse button on the device in the device table. Select **Duplicate** in the context menu. mdm will create a copy of the device and append the string *_copy<n>* (<n> is a number) to the Management ID of the new device. Please note that the **Duplicate** menu entry is only enabled if exactly one device is selected in the device table.
Import ATV Profile	Import ATV profiles into the selected device(s):

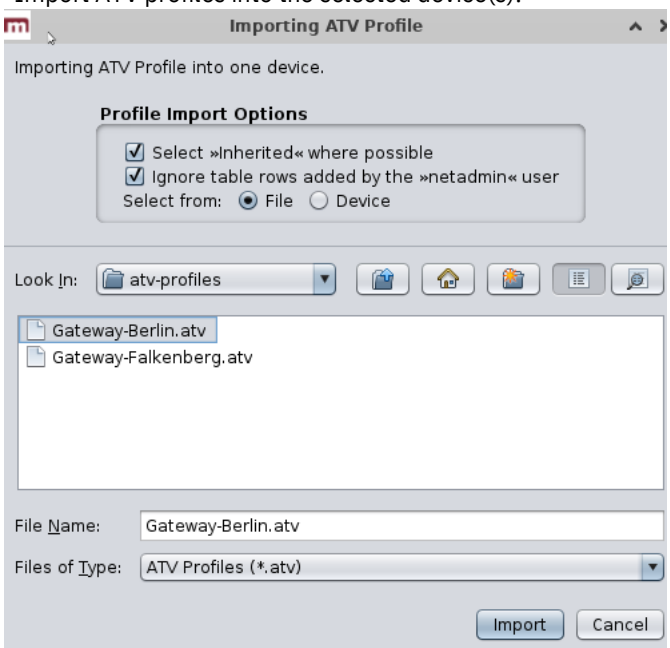


Figure 6-10 ATV import

The following options are available when importing a profile:

Select Inherited where possible

If this option is selected, variables, for which the imported value (i.e. the value in the ATV profile) is the same as the inherited value, are set to Inherited. Otherwise, all variables contained in the profile are set to Custom, regardless of their value.

Device context menu		
		Ignore table rows added by the netadmin user Tables rows that were created by the local **netadmin** user on the mGuard are not imported. **Select from File/Device** If *File* is selected, the ATV profile to import is uploaded as a file. This option is only available if an ATV import into a single device is performed. If *Device* is selected, mdm downloads the ATV profile from the mGuard. This requires that mdm can log into the mGuard with the *ssh* protocol or via the REST API (in case of FL MGUARD 1000 devices); the **Accessible via** address must be set. The related **SSH port** can be configured optionally (see "Accessible via" on page 63). **Import into <A>/<B>** If the device is in redundancy mode (see "Redundancy mode" on page 118 for more details), the profile can be imported into the configuration variables for the first or the second physical device. A few configuration variables cannot be imported and must be set manually if necessary: the passwords of the root and admin users, the passwords of the user firewall users, and certificate revocation lists (CRLs). ATV profiles downloaded from an mGuard either do not contain these variables at all or contain them in encrypted (hashed) form. Please note that mdm does import the password of the netadmin user if it is found in the ATV profile, but a profile downloaded from an mGuard does not contain it.
	Web Configure	Open the Web GUI of the device, if the device is accessible (see also **Accessible via** address in "Device properties dialog" on page 61). Any change made with the Web GUI will be overwritten by the next mdm configuration upload (except for changes made as netadmin to local variables).
	Export	Generate a CSV file containing the basic properties (but not the configurations) of the selected devices. The file is suitable to imported into mdm again (see "mdm main menu" on page 19, Device Import.
	Delete	Delete the selected devices.

Device context menu		
	Set Firmware Version	Upgrade the firmware version to a new version. Since different firmware versions of the mGuard software have different sets of variables, the firmware version corresponding to the installed firmware on the mGuard has to be selected here. **CAUTION: Irreversible changes** Upgrading the firmware version of the device might change default variable values at the target version. It is not possible to downgrade to an older release. So please be very careful when changing the firmware version. See “Firmware release settings and inheritance” on page 79 for more details. Once the upgrade has been performed, check all variable changes at the "Device Configuration History" (see “The configuration history dialog” on page 119). **NOTE: New default values in mGuard firmware 8.5 and 8.6** If a default value in the mGuard firmware is changed, the management of this value in mdm will be affected: 1. if a firmware version of a managed device is upgraded to a firmware version with a changed default value, 2. if a child with a different mGuard firmware version than its parent inherits a value with a different default value. The related behavior of mdm is described in the Chapter 6.2.3 (“Behavior of changed default values (mGuard 8.5/8.6)” on page 43). Please refer to “Manage firmware upgrades with mdm” on page 115 for more details.
	Set Hardware Flavor	Set the hardware flavor. Please refer to “Hardware flavors” on page 26 for more details.
	Assign Template	Open the *Assign template* dialog and assign a template to the selected devices.
	Add to VPN Group	Opens a dialog to add the selected devices to a VPN group.
	Remove from VPN Group	Opens a dialog to remove the selected devices from a VPN group.
	Upload	Open the Upload dialog. Please refer to “Upload configurations to mGuard devices” on page 99 for more details.
	Cancel Upload	Cancel the scheduled upload for the selected devices.

Device context menu		
	Set Upload State	The upload status will never be set to *successfully uploaded* automatically if no push upload is performed and no pull feedback from the configuration server is received (e.g. in a usage scenario where the exported configuration profiles are installed manually on the devices). You can use this option to set the upload state to *successfully uploaded* manually. Please select the device in the device table, open the context menu with a right click and then select **Set upload state.** If a device is in a state in which an upload would fail (e.g. if a None value has not been overridden, cf. Chapter 6.4.4), it is not possible to set the upload state to *successfully uploaded.*
	Export ECS Files	Download (encrypted) ECS files for the selected devices. Per default the ECS files will be encrypted. The user *root* and other authorized users can disable encryption and download unencrypted ECS files. (For granting rights to authorized users see “Manage users, roles, and permissions” on page 107). ECS files can be used to configure mGuard devices that support this mechanism through SD cards; please refer to the mGuard firmware manual for more details. A dialog is opened where the directory where to store the ECS files can be selected. The prerequisites for creating encrypted ECS files are same as for encrypted profiles. See “““Profile encryption” on page 101”.
	Show Device Configuration History	Open the configuration history dialog. Please refer to “The configuration history dialog” on page 119 for more detailed information.
	Generate Report of Changes to Device Configuration	Open a dialog to generate a report of changes to device configurations. Please refer to “Report of changes” on page 126 for more detailed information.

Device context menu		
	Changes since last Sync	A configuration dialog opens, showing performed changes since last synchronization. Synchronization means either – an SSH upload to the device (*upload via SSH*), – a pull export to the device via an HTTPS configuration pull server + feedback (*prepare pull configuration*), – an online import from the device to mdm (*Import ATV Profile*). If the device has been successfully synchronized once, the configuration changes since the last upload/online import are shown. If the device has been updated via **pull export** (*pull configuration*), a synchronization will **only** be registered and displayed, if all of the following apply: 1. the device configuration in mdm has not changed since the pull export was scheduled, 2. no additional SSH upload took place after the pull export and 3. the pull export actually changed the configuration on the mGuard device (subsequent pull feedback messages, where no configuration change takes place, are not registered as synchronization events). The behavior is similar to selecting two history entries in the "Device Configuration History" Dialog and clicking on "Compare..." (see “Comparison of historic configurations” on page 123). If the device has never been synchronized, the configuration changes since the device was created are shown. If the current configuration is the last synchronized configuration, the current configuration is shown.
	Upload/Import History	Displays an overview of the last synchronization actions. Synchronization means either – an SSH upload to the device (upload via SSH), – a pull export to the device via an *HTTPS configuration pull server* + feedback (prepare pull configuration), – upload via REST API (FL MGUARD 1000 devices) or – an online import from the device to mdm (Import ATV Profile).

Device context menu		
	Set Current Device Credentials	Open a dialog in which the device credentials can be set. The following attributes can be set: **Active root and admin passwords** The active passwords are the passwords that are currently in effect on the device. They may differ from the configured passwords when the current configuration has not yet been uploaded to or been pulled from the mGuard. mdm keeps track of the active passwords since the root password is needed to set a new root password, and the admin password is needed to log into the mGuard. **Reset SSH Host Key** mdm stores the SSH key of an mGuard after the initial contact. In case an mGuard has been replaced, the SSH keys do not match and mdm will refuse any connection to the replaced device. This function can be used to reset the SSH key. **Renew Secure Key Length** If this is selected, the mGuard will generate *ssh* and *https* keys on the next configuration upload or pull. It is recommended to generate new keys if 1024 bit keys are still in use.
	Device Replacement	Resets all settings specific to a device to default values. This can be used if a defective device has been replaced. – The following settings are reset: – Firmware Version on Device – Serial Number – Flash ID – SSH Hostkey – Profile Encryption Key – Licenses associated with the device
	Set Redundancy Mode	Open a dialog in which redundancy mode can be enabled or disabled for the selected devices.
	Generate Redundancy Passphrases	Set the redundancy passphrase variables in the device configuration to random values.
	Generate License	Please refer to “Manage license vouchers and device licenses” on page 104 for details regarding the license management.
	Refresh License	Please refer to “Manage license vouchers and device licenses” on page 104 for details regarding the license management.
	Get Profile Key	Obtain a profile key from the license server. Please refer to section ““Profile encryption” on page 101” or details.

Device context menu		
	Enable/Disable profile encryption	Enable or disable encryption of configuration profiles for the selected devices. Please refer to section ""Profile encryption" on page 101" for details.
	Firmware Upgrade » Schedule upgrade to latest patches	Schedule a firmware upgrade to the latest available patches. Please refer to "Manage firmware upgrades with mdm" on page 115 for more details.
	Firmware Upgrade » Schedule upgrade to latest minor release	Schedule a firmware upgrade to the latest available minor release. Please refer to "Manage firmware upgrades with mdm" on page 115 for more details.
	Firmware Upgrade » Schedule upgrade to next major version	Schedule a firmware upgrade to the next major version. Please refer to "Manage firmware upgrades with mdm" on page 115 for more details.
	Firmware Upgrade » Unschedule upgrade	Unschedule a firmware upgrade.
	Certificate Handling » Request additional certificate	Request a machine certificate for the device and append it to the list of existing machine certificates. Please refer to "Machine certificates" on page 111 for more details.
	Certificate Handling » Request replacement certificate	Request a machine certificate for the device and replace any existing machine certificates with the new one. Please refer to "Machine certificates" on page 111 for more details.  All existing machine certificates in the device are deleted, even if they have been imported manually. As a result, the device has a single machine certificate (the newly requested one). This function is therefore most useful for devices which contain a single machine certificate.
	Certificate Handling » Issue and Export Certificate Requests	Generate certificate requests for manual certificate enrollment. Please refer to "Machine certificates" on page 111 for more detailed information.
	Select All	Select all devices not excluded by the table filter.

6.3.3 Device properties dialog

The *Device properties dialog* allows to configure the mGuard variables and their associated settings for a device.

For information on how to create, delete or edit devices please refer to “mdm main window” on page 18.

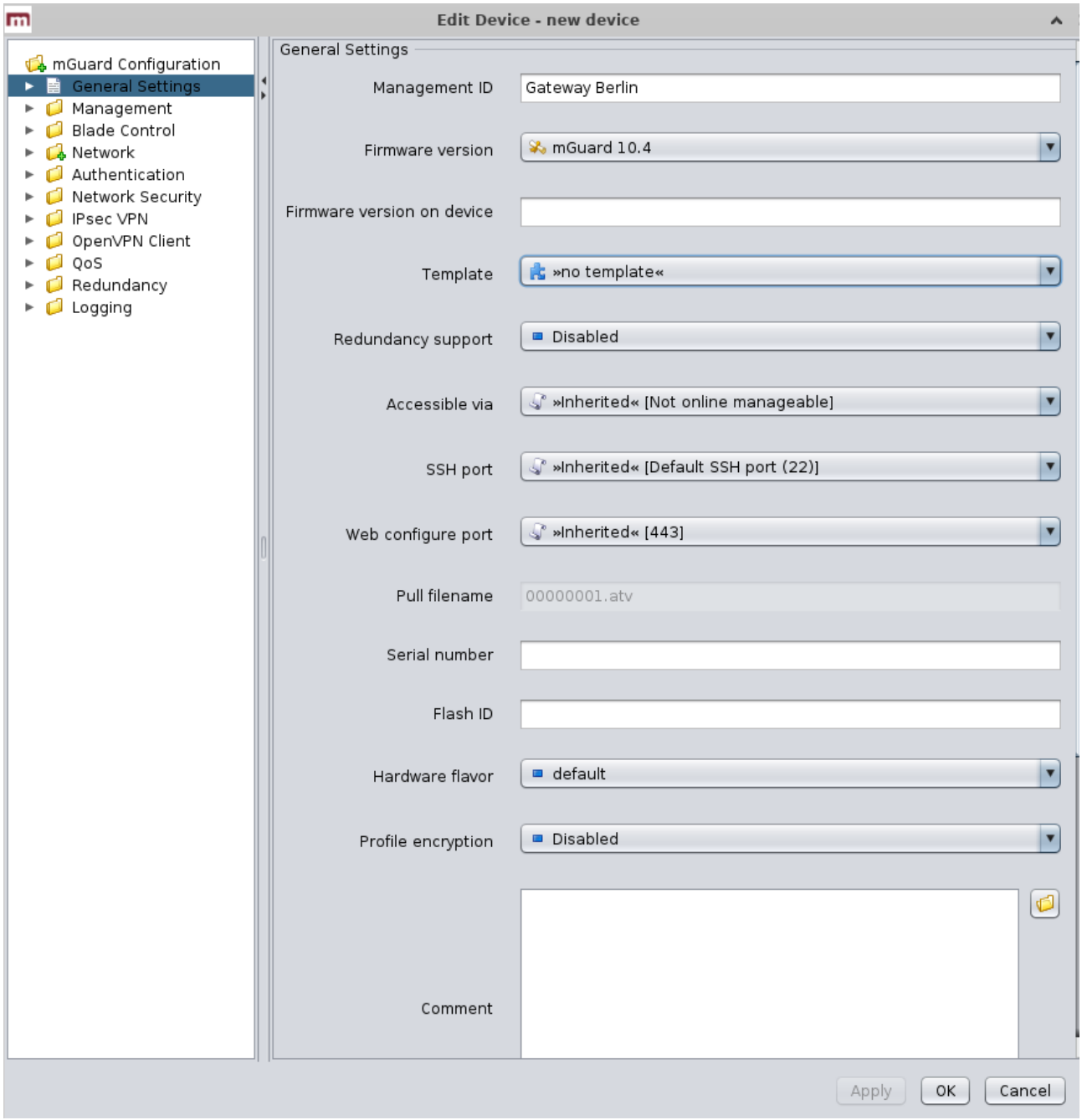


Figure 6-11 *Device properties dialog*

Similar to the *Template properties dialog* (see Chapter 6.4.3) the *Device properties dialog* contains a navigation tree on the left side that resembles the menu structure of the mGuard Web GUI. The navigation tree allows you to conveniently navigate to each mGuard variable.

The *Device properties dialog* contains the entry **General settings** for the configuration of additional parameters related to mdm. The following parameters can be set in the **General settings.**

Device properties dialog		
General Settings	**Management ID**	This ID is used to identify the device within mdm. The Management ID must be unique.
	Firmware version	Upgrade the firmware version to a new version. Since different firmware versions of the mGuard software have different sets of variables, the firmware version corresponding to the installed firmware on the mGuard has to be selected here.

CAUTION: Irreversible changes

Upgrading the firmware version of the device might change default variable values at the target version.

It is not possible to downgrade to an older release. So please be very careful when changing the firmware version. See “Firmware release settings and inheritance” on page 79 for more details.

Once the upgrade has been performed, check all variable changes at the "Device Configuration History" (see “The configuration history dialog” on page 119).

NOTE: New default values in mGuard firmware 8.5 and 8.6

If a default value in the mGuard firmware is changed, the management of this value in mdm will be affected:

1. if a firmware version of a managed device is upgraded to a firmware version with a changed default value,
2. if a child with a different mGuard firmware version than its parent inherits a value with a different default value.

The related behavior of mdm is described in the Chapter 6.2.3 (“Behavior of changed default values (mGuard 8.5/8.6)” on page 43).

For more information on how to manage firmware upgrades of your devices with mdm please refer to Chapter 7.6.

Device properties dialog		
	Firmware version on device	This field represents the firmware version currently installed on the device. It can be manually set, but is overridden with the value found on the device every time a push upload is performed or a pull feedback is received.
	Template	The parent template of the device.
	Redundancy support	The redundancy support of the device can be enabled or disabled.
	Accessible via	This is the IP address or hostname used by the mdm server to access the mGuard for an SSH push export of the configuration, an ATV profile import of the configuration or to open the web interface. Please refer to "Upload configurations to mGuard devices" on page 99 for more information on the upload procedure. The following values are available for **Accessible via** (the **SSH port** and the **Web configuration port** can be specified in the fields below. **Not online manageable** The device is not managed via SSH push. **Internal interface in auto stealth mode [1.1.1.1]** mdm accesses the mGuard using the address 1.1.1.1 (address of internal interface in automatic stealth mode). **Stealth management address** mdm accesses the external or internal interface of the mGuard in stealth mode. **First external IP address** mdm accesses the external interface of the mGuard in router mode. **First internal IP address** mdm accesses the internal interface of the mGuard in router mode. **Custom value** A custom value (IP address or hostname) might be required to access the mGuard in NAT scenarios.

Device properties dialog		
	SSH port	This is the SSH port number used by the mdm server to access the mGuard for an SSH push export or an ATV profile import of the configuration. In some cases it might be necessary to change the standard SSH port to connect to the device (e.g. the device is not connected to the Internet but gets a port forwarded from the firewall). If **Port for incoming SSH connections** is selected, the port configured in *Management >> System Settings >> Shell Access >> Shell Access Options >> Port for incoming SSH connections* will be used and displayed in the overview table. Please refer to "Upload configurations to mGuard devices" on page 99 for more information on the upload procedure.
	Web configuration port	This is the HTTPS port number used to access the graphical web interface of the mGuard. In some cases it might be necessary to change the standard HTTPS port to connect to the web interface of the device (e.g. the device gets a port forwarded from the firewall). If **Remote HTTPS TCP port** is selected, the port configured in *Management >> Web Settings >> Access >> HTTPS Web Access >> Remote HTTPS TCP port* will be used.
	Pull filename (read only)	If the configuration is exported to the file system, a unique ID, which is automatically assigned and cannot be changed, is used as name for the configuration file. The filename is shown in this field. Optionally, additional export files following a different naming scheme can be generated; please refer to "mdm server (*preferences.xml file)" on page 149* for more information.
	Serial number	The serial number of the device. The serial number is required for the license handling, especially the **license request and refresh** (see "Request/generate licenses" on page 104). It can be manually set, but is overridden with the value found on the device every time a push upload is performed or a pull feedback is received. If no push upload is ever performed and no pull feedback is ever received (e.g. in a usage scenario where the exported configuration profiles are installed manually on the devices), the serial number has to be entered here if you would like to create pull configuration filenames containing the serial number.

Device properties dialog		
	Flash ID	The flash ID of the device. The flash ID is required for the license handling, especially for the **license refresh** (see “Refresh licenses” on page 106). It can be manually set, but is overridden with the value found on the device every time a push upload is performed or a pull feedback is received.
	Comment	An optional comment.
	Hardware flavor	The hardware flavor of the device (see “Hardware flavors” on page 26). Setting it to *rs2000* has the effect that variables not supported by this platform are omitted.
	Profile encryption	Enable or disable encryption of configuration profiles for the selected devices. Please refer to section ““Profile encryption” on page 101” for details.
	Additional ATV include	This is a text field for additional settings that should be included in the configuration file of the mGuard. The input has to adhere to the mGuard configuration file conventions. You can also import the contents of a text file in the field by selecting a file with the *File Chooser* icon. Please note that the included configuration will be appended to the generated mdm settings, and therefore settings for the same variable in the include field will override settings generated by mdm.

6.4 Configure templates

6.4.1 Template overview table

Please select the **Template** tab to access the template overview table.

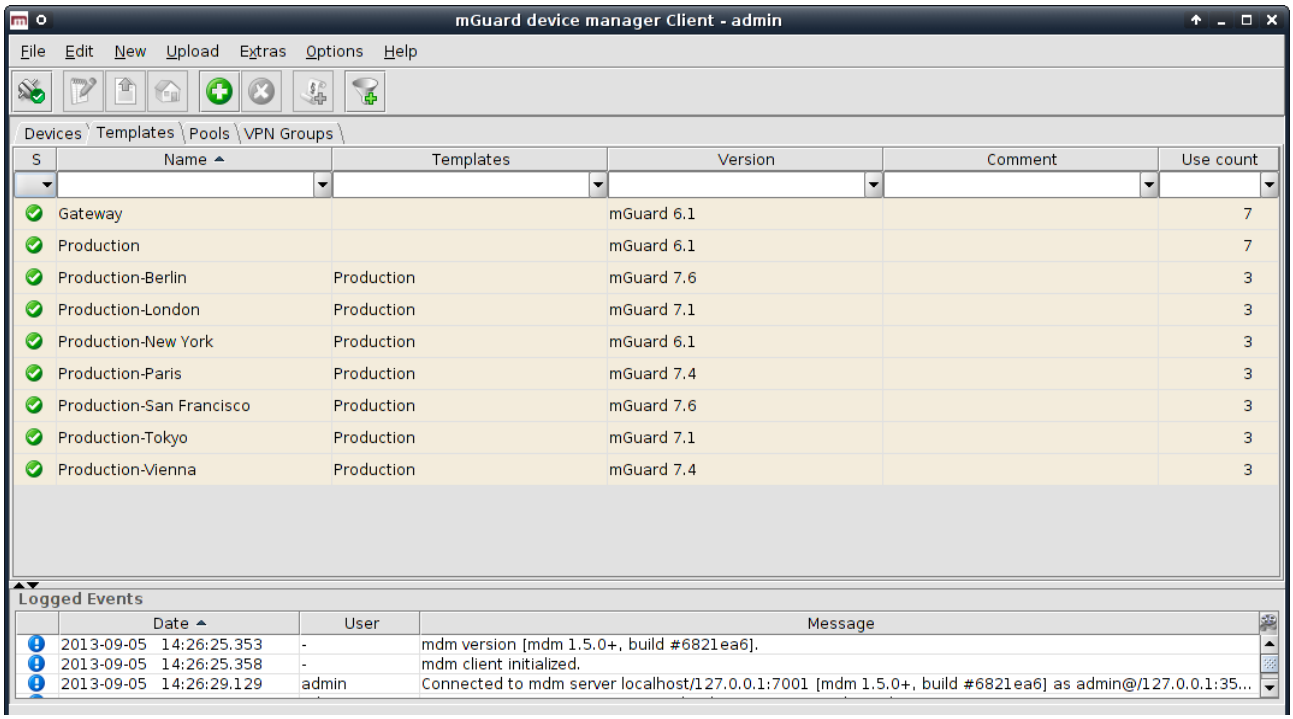


Figure 6-12 The mdm main window with template table

Template table columns

The template overview table contains the following columns.

The column width can be changed by placing the cursor on the header of the table at the border of two columns and dragging the border to the desired location. The order of the columns can be changed by dragging the column header to a different location.

Template table columns	
Status (*S*)	The status icon shows whether the template is currently locked.
Name	The name assigned to the template. The name can be set in the **General Settings** of the *Template properties dialog* (see "Template properties dialog" on page 70).
Templates	A comma-separated list of the template's ancestor templates. The first item in the list is the immediate parent template.
Version	The mGuard firmware version that is used for the template.

Template table columns		
	Comment	Optional comment. The comment can be set in the **General Settings** of the *Template properties dialog* (see "Template properties dialog" on page 70).
	Use count	This column shows the number of devices or other templates using this template.

Filtering and sorting the table

The header of the table can be used to sort the table entries. A click on a header of a column will activate the (primary) sort based on this column. This is indicated by the arrow in the column header. A second click on the same header will reverse the sort order. Clicking on another column header activates the sort based on this new column, the previously activated column will be used as secondary sorting criterion.

The first row of the table accepts the input of regular expressions (please refer to Chapter 11, *Regular expressions*), which can be used to efficiently filter the table entries. Filtering based on regular expressions is not used for the column that does not contain text (i.e. column **S**).

The filter criterion for the **Use count** column is not interpreted as a regular expression, but as a comma-separated list of numbers or number ranges
(e.g. 0,2-3).

The filter history will be saved for the current user and can be accessed using the drop down functionality of the filter fields.

Creating templates

There are several ways to create new templates:

1. Open the context menu by clicking on the template table with the right mouse button. To open the *Template properties dialog* for a new template please select **Add** in the context menu.
2. Select the **Template** tab and click on the icon in the menu bar to open the *Template properties dialog* for a new template.
3. Select **New » Template** in the main menu to open the *Template properties dialog* for a new template.

Editing templates

There are several ways to edit a template:

1. Double-click with the left mouse button on the template in the table to open the *Template properties dialog*.
2. Select the template with the left mouse button and open the context menu by pressing the right mouse button. Then select **Edit** to open the *Template properties dialog*.
3. Select the template to be modified in the template table. Select **Edit » Edit Item** in the main menu to open the *Template properties dialog*.

The **Edit** entry in the context menu and the **Edit** button in the toolbar are only enabled if exactly one template is selected in the template table.

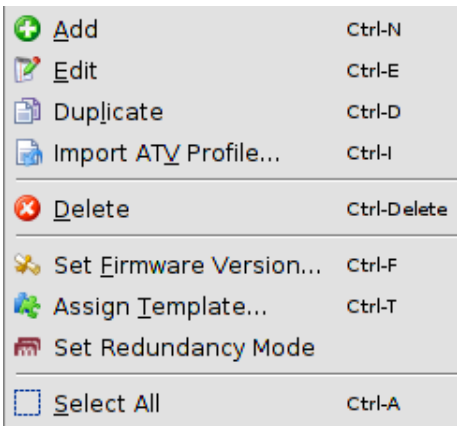
Deleting templates

There are several methods to delete templates:

1. Select the template(s) and open the context menu by clicking with the right mouse button. To delete the templates please select **Delete** in the context menu.
2. Select the templates to be deleted in the template table and click on the icon in the menu bar.

Please note that templates that are still assigned to devices or other templates cannot be deleted.

6.4.2 Template context menu



The following entries are available in the context menu of the template overview table.

Template context menu		
	Add	Create a new template and open the *Template properties dialog* of the new template.
	Edit	Edit the selected template (only active if exactly one template is selected in the overview table).
	Duplicate	To create a duplicate of a template please open the context menu by clicking with the right mouse button on the template in the template table. Select **Duplicate** in the context menu. mdm will create a copy of the template and append the string *_copy<n>* (<n> is a number) to the name of the new template. Please note that the **Duplicate** menu entry is only enabled if exactly one template is selected in the template table.
	Import ATV Profile	Import an ATV profile into the selected template(s). This works analogous to the ATV profile import into devices; please refer to “Device context menu” on page 53 for details.
	Delete	Delete the selected templates.

Template context menu		
	Set Firmware Version	Upgrade the firmware version to a new version. Since different firmware versions of the mGuard software have different sets of variables, the firmware version corresponding to the installed firmware on the mGuard has to be selected here. **CAUTION: Irreversible changes** Upgrading the firmware version of the device might change default variable values at the target version. It is not possible to downgrade to an older release. So please be very careful when changing the firmware version. See “Firmware release settings and inheritance” on page 79 for more details. Once the upgrade has been performed, check all variable changes at the "Device Configuration History" (see “The configuration history dialog” on page 119). **NOTE: New default values in mGuard firmware 8.5 and 8.6** If a default value in the mGuard firmware is changed, the management of this value in mdm will be affected: 1. if a firmware version of a managed device is upgraded to a firmware version with a changed default value, 2. if a child with a different mGuard firmware version than its parent inherits a value with a different default value. The related behavior of mdm is described in the Chapter 6.2.3 (“Behavior of changed default values (mGuard 8.5/8.6)” on page 43). Please refer to “Manage firmware upgrades with mdm” on page 115 for more details.
	Assign Template	Open the *Assign template* dialog and assign a parent template to the selected templates.
	Set Redundancy Mode	Open a dialog in which redundancy mode can be enabled or disabled for the selected templates.
	Select All	Select all templates not excluded by the table filter.

6.4.3 Template properties dialog

Templates offer a powerful mechanism to conveniently configure and manage a large number of devices.

By assigning a template to a device (see “Device properties dialog” on page 61), the device inherits the template settings and will use the values that are defined in the template. Depending on the permission settings, the template settings might be overridden in the device configuration.

Please read this chapter for an introduction to the template concept and refer to “Working with templates” on page 75 for detailed information on templates and inheritance.

For information on how to create, delete, or edit templates please refer to “mdm main window” on page 18.

The following screenshot shows the *Template properties dialog*:

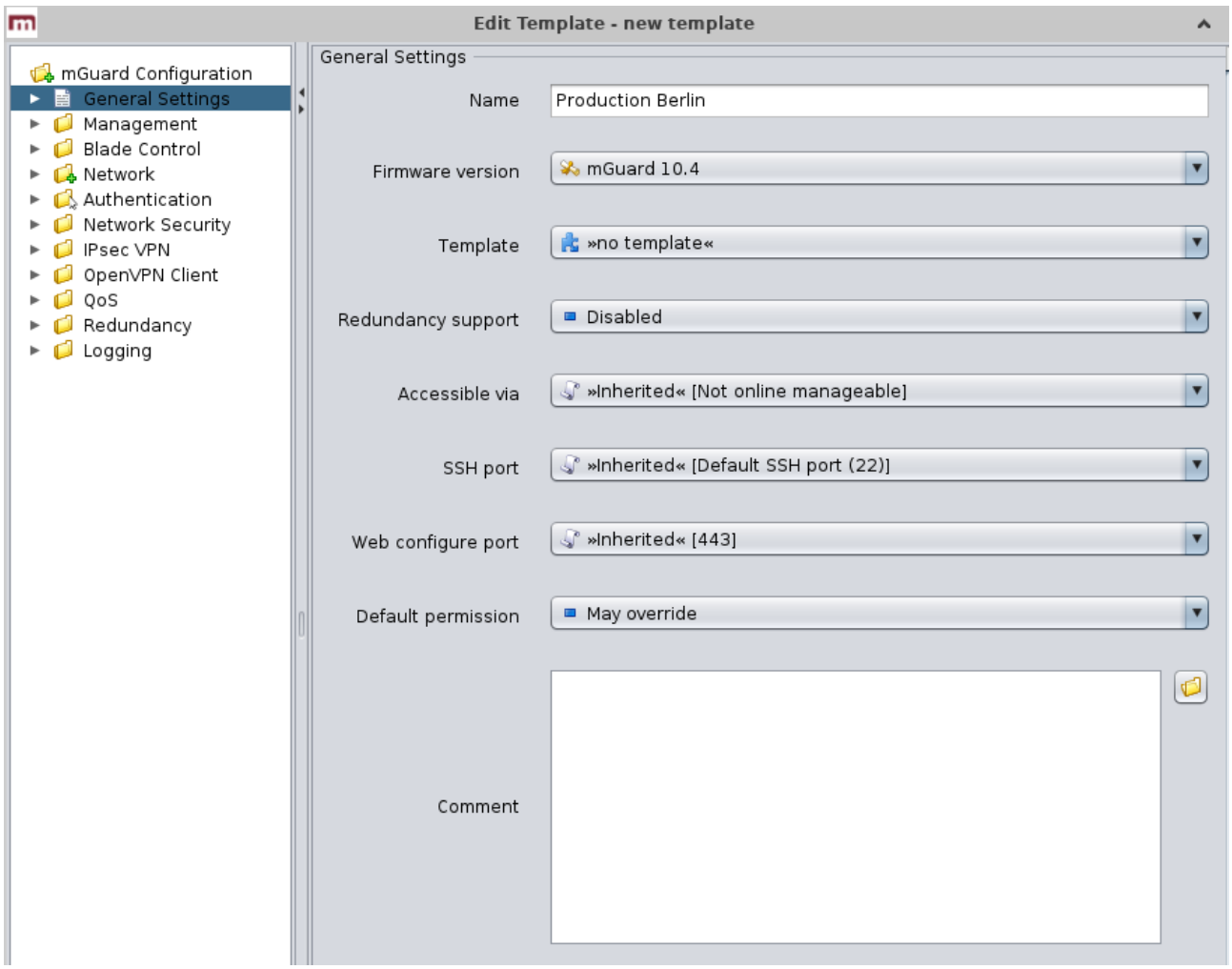


Figure 6-13 Template properties dialog

General settings

Similar to the *Device properties dialog* (see Chapter 6.3.3) the *Template properties dialog* contains a menu corresponding to the mGuard's Web GUI structure on the left side of the window.

Additionally the *Template properties dialog* contains the entry **General settings** for the configuration of parameters related to mdm:

Template properties dialog

Name

The name of the template.

Firmware version

Upgrade the firmware version to a new version.

Since different firmware versions of the mGuard have different sets of variables, the firmware version (or variable set) the template should use, has to be selected here.

CAUTION: Irreversible changes

Upgrading the firmware version of the device might change default variable values at the target version.

It is not possible to downgrade to an older release. So please be very careful when changing the firmware version. See "Firmware release settings and inheritance" on page 79 for more details.

Once the upgrade has been performed, check all variable changes at the "Device Configuration History" (see "The configuration history dialog" on page 119).

NOTE: New default values in mGuard firmware 8.5 and 8.6

If a default value in the mGuard firmware is changed, the management of this value in mdm will be affected:

1. if a firmware version of a managed device is upgraded to a firmware version with a changed default value,
2. if a child with a different mGuard firmware version than its parent inherits a value with a different default value.

The related behavior of mdm is described in the Chapter 6.2.3 ("Behavior of changed default values (mGuard 8.5/8.6)" on page 43).

For more information on how to manage firmware upgrades of your devices with mdm please refer to Chapter 7.6.

Template

The parent template of this template.

Redundancy support

The redundancy support of the device can be enabled or disabled.

Template properties dialog		
	Accessible via	This is the IP address or hostname used by the mdm server to access the mGuard for an SSH push export of the configuration, an ATV profile import of the configuration or to open the web interface. Please refer to "Upload configurations to mGuard devices" on page 99 for more information on the upload procedure. The following values are available for **Accessible via** (the **SSH port** and the **Web configuration port** can be specified in the fields below. **Not online manageable** The device is not managed via SSH push. **Internal interface in auto stealth mode [1.1.1.1]** mdm accesses the mGuard using the address 1.1.1.1 (address of internal interface in automatic stealth mode). **Stealth management address** mdm accesses the external or internal interface of the mGuard in stealth mode. **First external IP address** mdm accesses the external interface of the mGuard in router mode. **First internal IP address** mdm accesses the internal interface of the mGuard in router mode. **Custom value** A custom value (IP address or hostname) might be required to access the mGuard in NAT scenarios.
	SSH port	This is the SSH port number used by the mdm server to access the mGuard for an SSH push export or an ATV profile import of the configuration. In some cases it might be necessary to change the standard SSH port to connect to the device (e.g. the device is not connected to the Internet but gets a port forwarded from the firewall). If **Port for incoming SSH connections** is selected, the port configured in *Management >> System Settings >> Shell Access >> Shell Access Options>> Port for incoming SSH connections* will be used and displayed in the overview table. Please refer to "Upload configurations to mGuard devices" on page 99 for more information on the upload procedure.

Template properties dialog	
Web configuration port	This is the HTTPS port number used to access the graphical web interface of the mGuard. In some cases it might be necessary to change the standard HTTPS port to connect to the web interface of the device (e.g. the device gets a port forwarded from the firewall). If **Remote HTTPS TCP port** is selected, the port configured in *Management >> Web Settings >> Access >> HTTPS Web Access >> Remote HTTPS TCP port* will be used.
Default Permission	The permission mdm uses for variables set to Inherited when a device or template inherits from this template. The following permissions can be set: **May override** Variables set to Inherited have May override permission, i.e. they can be set in the inheriting device or template. **May append** Table variables set to Inherited have May append permission, i.e. rows can be appended in the inheriting device or template, but existing rows cannot be changed. Other variables set to Inherited have May override permission, i.e. they can be set in the inheriting device or template. **No override** Variables set to Inherited have No override permission, i.e. they cannot be set in the inheriting device or template.
Comment	An additional optional comment which is also shown in the template table of the main window.
Additional ATV include	This is a text field for additional settings that should be included in the configuration file of the mGuard. The input has to adhere to the mGuard configuration file conventions. You can also import the contents of a text file in the field by selecting a file with the *File Chooser* icon.  Please note that the included configuration will be appended to the generated mdm settings, and therefore settings for the same variable in the include field will override settings generated by mdm.

6.4.4 Template configuration

As explained above, the navigation tree on the left side of the *Template properties dialog* resembles the mGuard menu structure.

Figure 6-14 shows an example of the configuration for the internal interface.

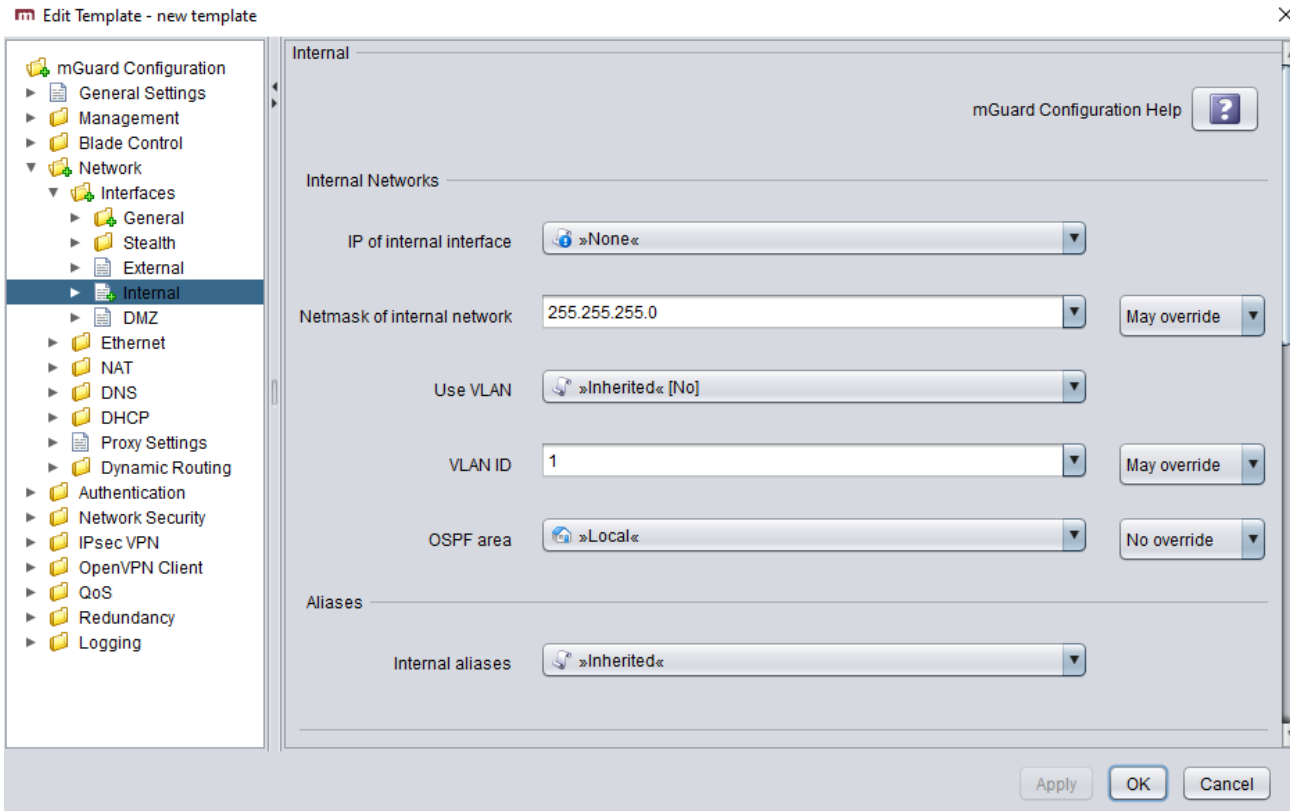


Figure 6-14 Template configuration

Compared to the *Device properties dialog* there are additional settings in the template configuration which are explained in the following sections.

For detailed information on the template and inheritance concept please refer to "Working with templates" on page 75.

None value type

In the template **None** can be selected as value, as you can see in the variable **IP of internal interface** in Figure 6-14. This means that the template designer does not want to define a value in the template, but wants to make sure the value is overridden in an inheriting template or device. Any attempt to upload a device in which a None value has not been overridden or has been overridden with a Local value results in an error.

Permission setting

In Figure 6-14 the variable **Netmask of internal network** has an additional permission setting. The permission controls whether and how an inheriting device or template can override the settings. The permission settings can be assigned on a per-variable basis.

Please note that the permission combo box is not visible if **Inherited** or **None** is selected as value.

The following permissions can be selected:

Template Configuration		
Permissions	**May override**	The value can be changed (overridden) in an inheriting template or device.
	No override	The value cannot be changed in an inheriting template or device.
	May append	This setting is only available for tables (e.g. firewall rules). If a table variable is set to **May append,** additional table rows can be appended in an inheriting device or template, but the inherited rows cannot be changed or removed. If **Local** is selected as value and **May append** as permission, new entries can be added in an inheriting device or template, as well as on the mGuard by the netadmin user.

6.4.5 Working with templates

Changes made to a template can potentially affect a large number of devices or other templates. Therefore please keep the following rules in mind when working with templates:

– Before making changes to a variable in a template, make sure that the effect on inheriting templates or devices is really desired.
– In particular, changes to a variable permission can have an irreversible effect on inheriting templates or devices. E.g. if a permission is changed from May override to No override, the value of the variable is discarded in all inheriting templates and devices.
– Templates that are still assigned to devices or other templates cannot be deleted.

This chapter gives more detailed information on the template mechanism.

Inheritance

Templates are the means to efficiently configure a large number of devices. Templates contain the common aspects of a group of devices or a group of child templates. By assigning a template to a child (this may be a device or another template) the child “inherits” the parent template’s settings and may optionally override some of the settings (if the permission in the parent template allows this). Any change made to the parent template will potentially have an impact on all inheriting templates and devices, depending on the setting of the value and permission in the parent template.

The permission setting in a template limits the choices in inheriting templates and devices.

Whether or not a child inherits settings from an ancestor template is indicated by an icon in front of the variable name in the *Properties Dialog*. If no icon is shown, then either there is no template assigned, or the variable has the value **Inherited** in all ancestor templates, i.e. no restrictions are defined for this variable.

According to the permissions listed in “Template configuration” on page 74 the following icons are shown in front of the variable name:

 May override.

 No override.

 May append (tables only).

No value defined (value = **None**), i.e. the value has to be set in the *Device properties dialog* or in one of the intermediate templates.

The following figures illustrate the inheritance mechanism. Figure 6-15 shows the settings for the *DHCP server options* in the **parent template**.

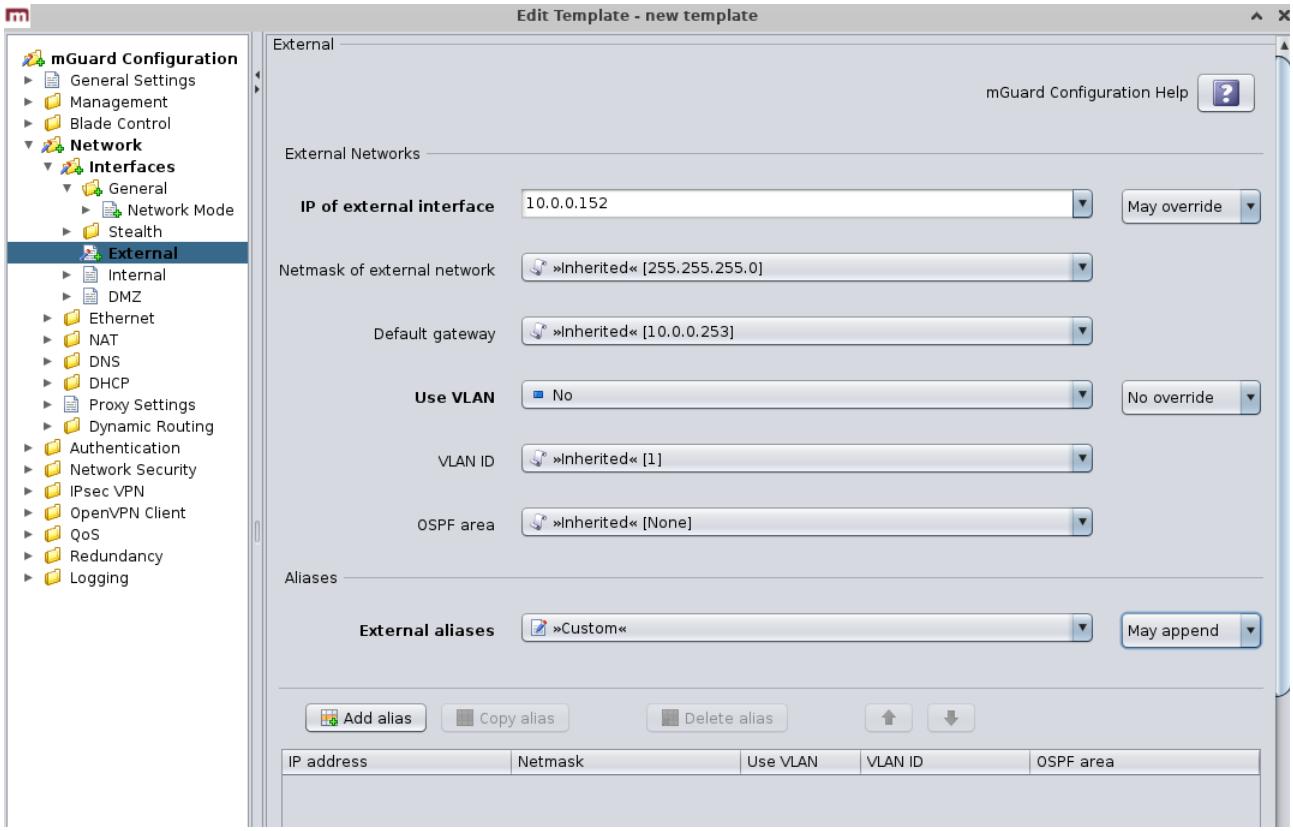


Figure 6-15 Settings in the parent template

Figure 6-16 shows the settings in the **device configuration (child)**. They are the result of values and permissions inherited from the parent template and modifications made in the device.

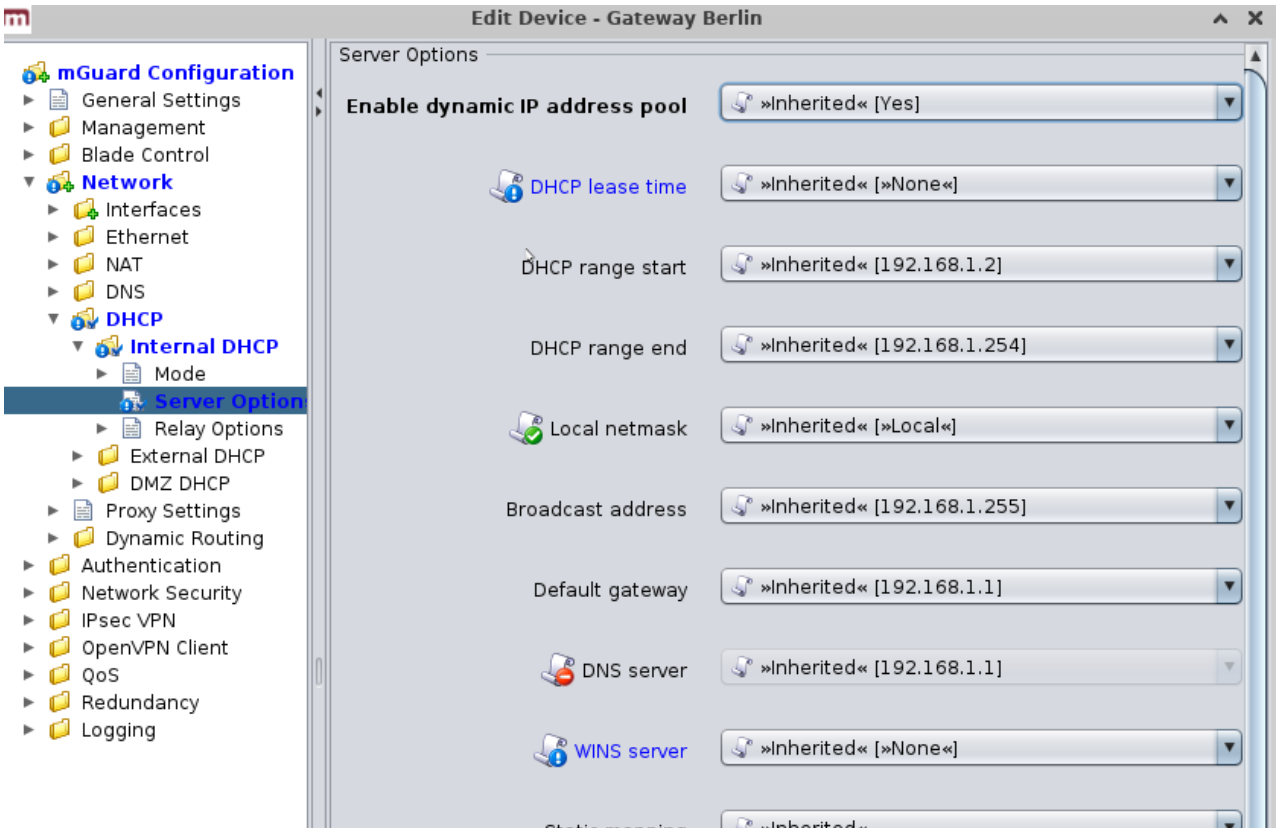


Figure 6-16 Settings in the inheriting device

Settings in the inheriting device		
	Enable dynamic IP address pool	This variable is set to **Yes** in the template and the permission is set to **No override**. Therefore the value of the variable cannot be changed in the device configuration. This is indicated by the disabled controls and by the icon in front of the variable name in the *Device properties dialog*.
	DHCP range start, DHCP range end	These variables are set to **Local** and the permission is set to **No override**, i.e. the **Local** setting cannot be changed in the device configuration. These values have to be set by the *netadmin* of the mGuard and are not managed by mdm.
	Local netmask, Broadcast address	There are no restrictions for these variables defined in the template, indicated by the missing icon in front of the variable name in the *Device properties dialog*. In the example the device configurator decided to use a custom value for **Broadcast address** and the (inherited) default value for **Local netmask**.

Settings in the inheriting device		
	Default gateway	The value of this variable is set in the template and the permission is set to **May override**. Therefore the value of the variable can be changed in the device configuration. This is indicated by the enabled controls and by the icon in front of the variable name. In the example the value from the template is overridden with a custom value.
	DNS server	The value of this variable is set in the template and the permission is set to **May override**. Therefore the value of the variable can be changed in the device configuration. This is indicated by the enabled controls and by the icon in front of the variable name. In this example the value from the template is overridden in the device configuration with a custom value.
	WINS server	The value of this variable is set to **None** in the template. Therefore a value for this variable *has to be assigned* in the device configuration. This is indicated by the icon in front of the variable name and the blue-colored label. If a device for which None values have not been assigned is uploaded, an error occurs.
	Static mapping	In the template, the table **Static mapping** is set to **Custom** and its permission is set to **May append.** As Figure 6-16 shows, rows can be added to the table in the device configuration after switching the table variable to **Custom**. Rows inherited from the template cannot be changed.

Miscellaneous

Complex table variables and permissions

The permission setting for complex table variables (see “General remarks” on page 29) in the parent template applies to the table itself, but not to the contents of the rows. If the table is set to **No Override**, it is not possible to add or delete rows in the child configuration, but it might be possible to change the value of variables in the inherited rows in the child. Each variable of a row (node) has a separate permission setting in the parent template that determines whether the variable can be overridden in the child. The permission setting of the table and the permission setting of a single variable within the table are completely independent.

Firmware release settings and inheritance

Certain restrictions apply to the **Firmware Version** setting in the **General Settings** of the child and the parent template:

- A child cannot inherit from a parent template that has a newer firmware version than the child itself.
- It is possible to change the firmware version of a parent template to a newer version only if all children inheriting from the parent template are already set to the new firmware version.
- The inheritance of **changed default values** depends on the installed mdm version and the mGuard firmware version of the device/template (see below).

Inheritance of changed default values

Default values have been changed in **mGuard firmware 8.5 and 8.6**.

General behavior in mdm < 1.8.0:

If default values (value type = “*Inherited*“ and **not** “*Local*“ or “*Custom*“) of the child differ from the default values of the parent (value type = “*Inherited*“ along the complete inheritance chain), the inheritance will behave as follows:

1. The child keeps the default values corresponding to the child‘s firmware version. The value type will remain „***Inherited***“.

General behavior in mdm 1.8.0 or later:

If default values (value type = “*Inherited*“ and **not** “*Local*“ or “*Custom*“) of the child differ from the default values of the parent (value type = “*Inherited*“ along the complete inheritance chain), the inheritance will behave as follows:

1. Default values that have been changed in **mGuard firmware versions < 8.5**:
   - The child keeps the default values corresponding to the child‘s firmware version. The value type will remain „***Inherited***“.
2. Default values that have been changed in **mGuard firmware versions 8.5 or later**:
   - The child inherits the default values of the parent. The value type will remain „***Inherited***“.

6.5 Configure pools

6.5.1 Pool value overview table

Please select the **Pool** tab to access the pool overview table. A pool defines a range of network addresses which can be automatically assigned to variables. For detailed information on pools and their usage please refer to “Pool properties dialog” on page 82.

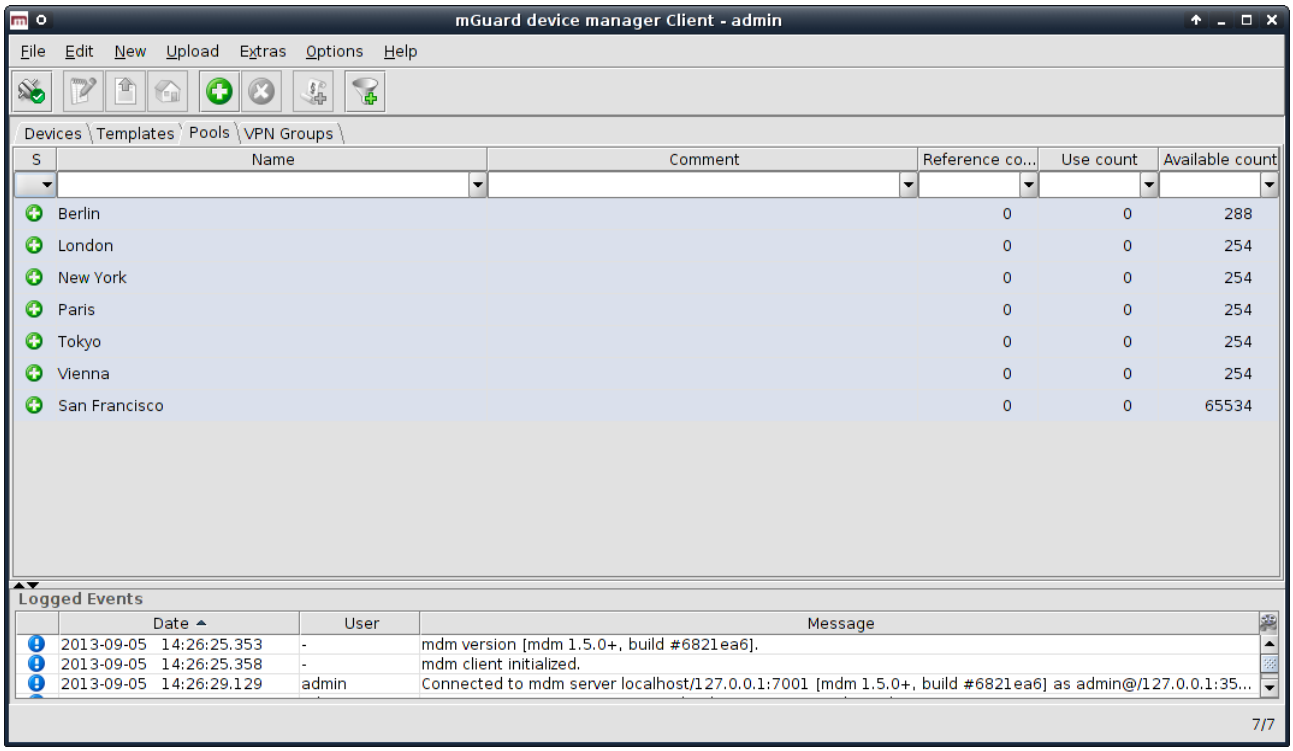


Figure 6-17 The mdm main window with pool table

Pool table columns

The pool overview table contains the following columns.

The column width can be changed by placing the cursor on the header of the table at the border of two columns and dragging the border to the desired location. The order of the columns can be changed by dragging the column header to a different location.

Pool table columns	
Status (*S*)	The status icon shows whether the pool definition is valid.
Name	The name assigned to the pool.
Comment	Optional comment.
Reference count	This column shows how many variables reference this pool (see “Pool properties dialog” on page 82).
Use count	This column shows how many values have been used from the pool (see “Pool properties dialog” on page 82).

Pool table columns		
	Available count	This number shows how many values are still available in the pool (see “Pool properties dialog” on page 82).

Filtering and sorting the table

The header of the table can be used to sort the table entries. A click on a header of a column will activate the (primary) sort based on this column. This is indicated by the arrow in the column header. A second click on the same header will reverse the sort order. Clicking on another column header activates the sort based on this new column, the previously activated column will be used as secondary sorting criterion.

The first row of the table accepts the input of regular expressions (please refer to Chapter 11, *Regular expressions*), which can be used to efficiently filter the table entries. Filtering based on regular expressions is not used for the column that does not contain text (i.e. column **S**).

The filter criterion for the three **count** columns is not interpreted as a regular expression, but as a comma-separated list of numbers or number ranges
(e.g. 0,2-3).

The filter history will be saved for the current user and can be accessed using the drop down functionality of the filter fields.

Creating pools

There are several ways to create new pools:

1. Open the context menu by clicking on the pool table with the right mouse button. To open the *Pool properties dialog* for a new pool please select **Add** in the context menu.
2. Select the **Pool** tab and click on the  icon in the menu bar to open the *Pool properties dialog* for a new pool.
3. Select **New » Pool** in the main menu to open the *Pool properties dialog* for a new pool.

Editing pools

There are several ways to edit a pool:

1. Double-click with the left mouse button on the pool in the table to open the *Pool properties dialog*.
2. Select the pool with the left mouse button and open the context menu by pressing the right mouse button. Then select **Edit** to open the *Pool properties dialog*.
3. Select the pool to be modified in the pool table. Select **Edit » Edit Item** in the main menu to open the *Pool properties dialog*.

The **Edit** entry in the context menu and the **Edit** button in the toolbar are only enabled if exactly one pool is selected in the pool table.

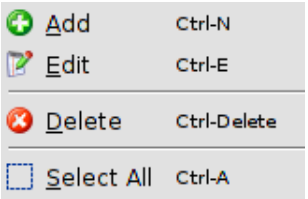
Deleting pools

There are several methods to delete pools:

1. Select the pool(s) and open the context menu by clicking with the right mouse button. To delete the pools please select **Delete** in the context menu.
2. Select the pools to be deleted in the pool table and click on the  icon in the menu bar.

Please note that pools that are still referenced by variables cannot be deleted.

6.5.2 Pool context menu



The following entries are available in the context menu of the pool overview table.

Pool context menu		
	Add	Create a new pool and open the *Pool properties dialog* of the new pool.
	Edit	Edit the selected pool (only active if exactly one pool is selected in the overview table).
	Delete	Delete the selected pools.
	Select All	Select all pools not excluded by the table filter.

6.5.3 Pool properties dialog

The *Pool properties dialog* allows to define value pools, which can be used to automatically configure certain variables (e.g. the virtual address for VPNs). Currently mdm allows to define address range pools (CIDR notation), see below for an example.

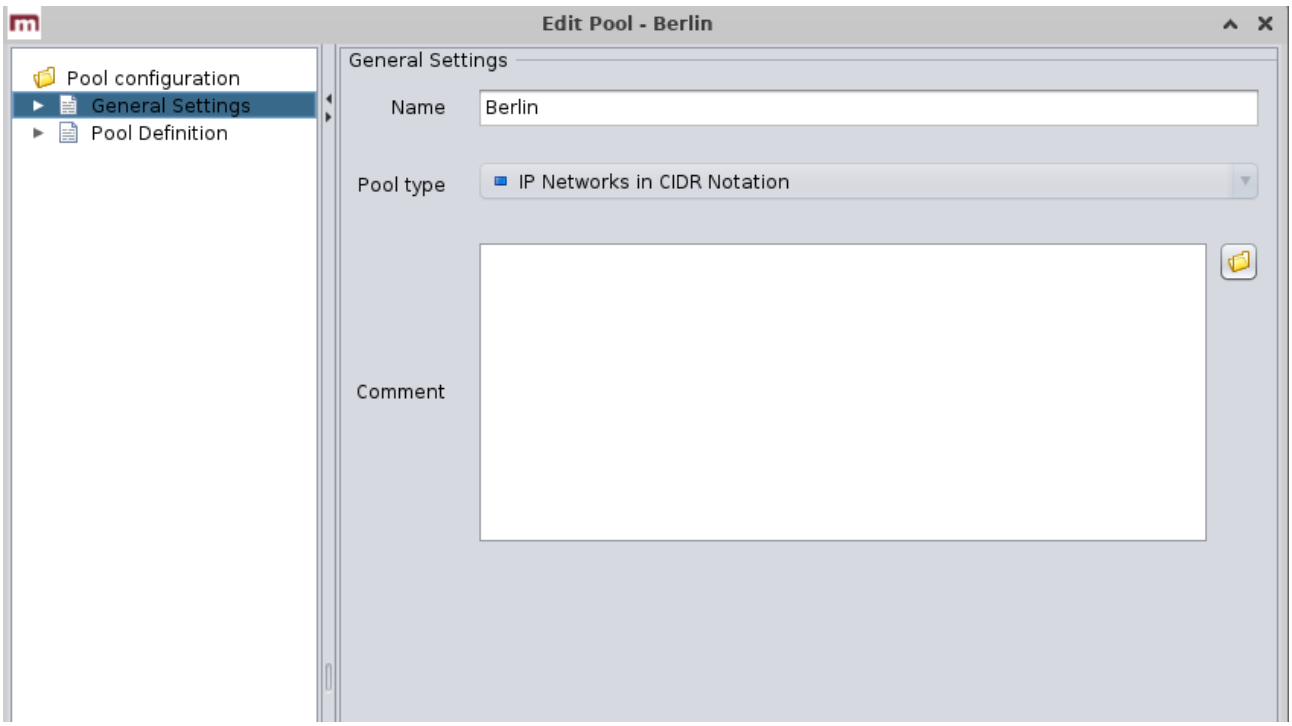


Figure 6-18 Pool properties dialog

General settings

The entry **General settings** contains the following parameters for the pool:

Pool properties dialog		
General settings	**Name**	A name for the pool. This name will be used when referencing the pool in a variable (see section *Pool values usage in variables* below).
	Pool type	Currently only the pool type *IP Networks in CIDR Notation* is available.
	Comment	A comment (optional).

Pool definition

The entry **Pool Definition** allows to define the value range of the pool and the address range of the values to be taken out of the pool. Figure 6-19 contains an example of a pool definition.

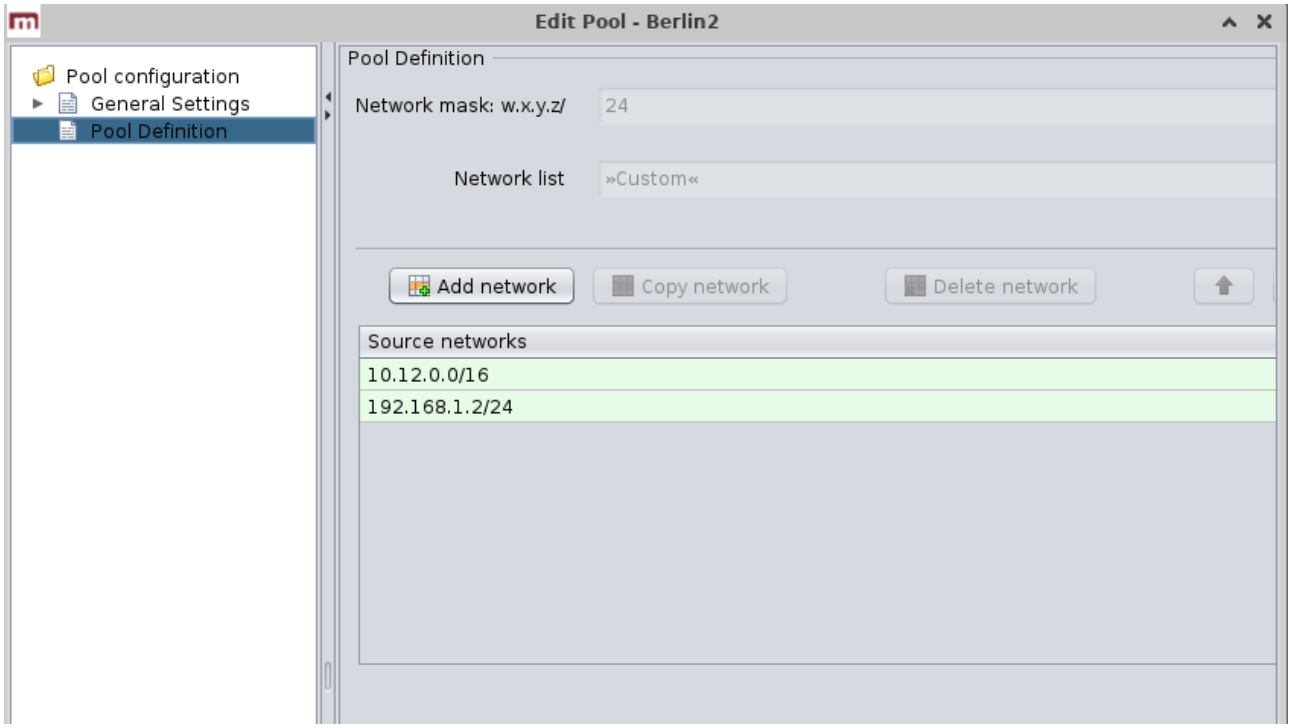


Figure 6-19 Definition of a CIDR pool

The CIDR pool in the example contains all addresses defined in the table **Network List**. The field **Network Mask** defines the range of single values to be taken out of the pool, i.e. when using this pool in a variable, mdm will automatically assign an IP address range with a mask of 24 out of the available Source Networks to that variable.

E.g. if the pool is used for the template variable **Remote network** (in a VPN connection), then mdm will automatically assign a value to the variable **Remote network** of all devices using the respective template. The pool overview table in the main window shows how many values have been taken out of the pool (*Use count*) and how many values are still available in the pool (*Available count*).

Please note that once defined, it is not possible to change or delete the source address ranges and the network mask in the pool any more, e.g. it is not possible to decrease the network range 10.12.0.0/16 to 10.12.0.0/19 in the example above. It is only possible to add further ranges to the pool, i.e. increase the pool value range. Please carefully plan the definition of the pool ranges in advance.

Pool value usage in variables

Pool values can only be used in templates. For certain variables you can choose the pool you would like to use from the drop down box, e.g. in Figure 6-20 a number of pools (*London, New York, Paris, etc.*) are available to be used for the variable *IP of external interface*. Only pools that match the variable type (e.g. CIDR pool and variable of type IP address) are shown in the drop down box. If a pool is used in a template, no value is assigned to

the respective variable, the pool is only referenced at this point. Therefore the *Reference count* in the pool table will be increased by one. If a value is assigned to a variable (which happens on device level, not on template level) the *Use count* is increased by one.

This assignment happens automatically if you edit an inherited template of a device by referencing a pool from a variable to the template or if you assign a template to a device that already references a pool.

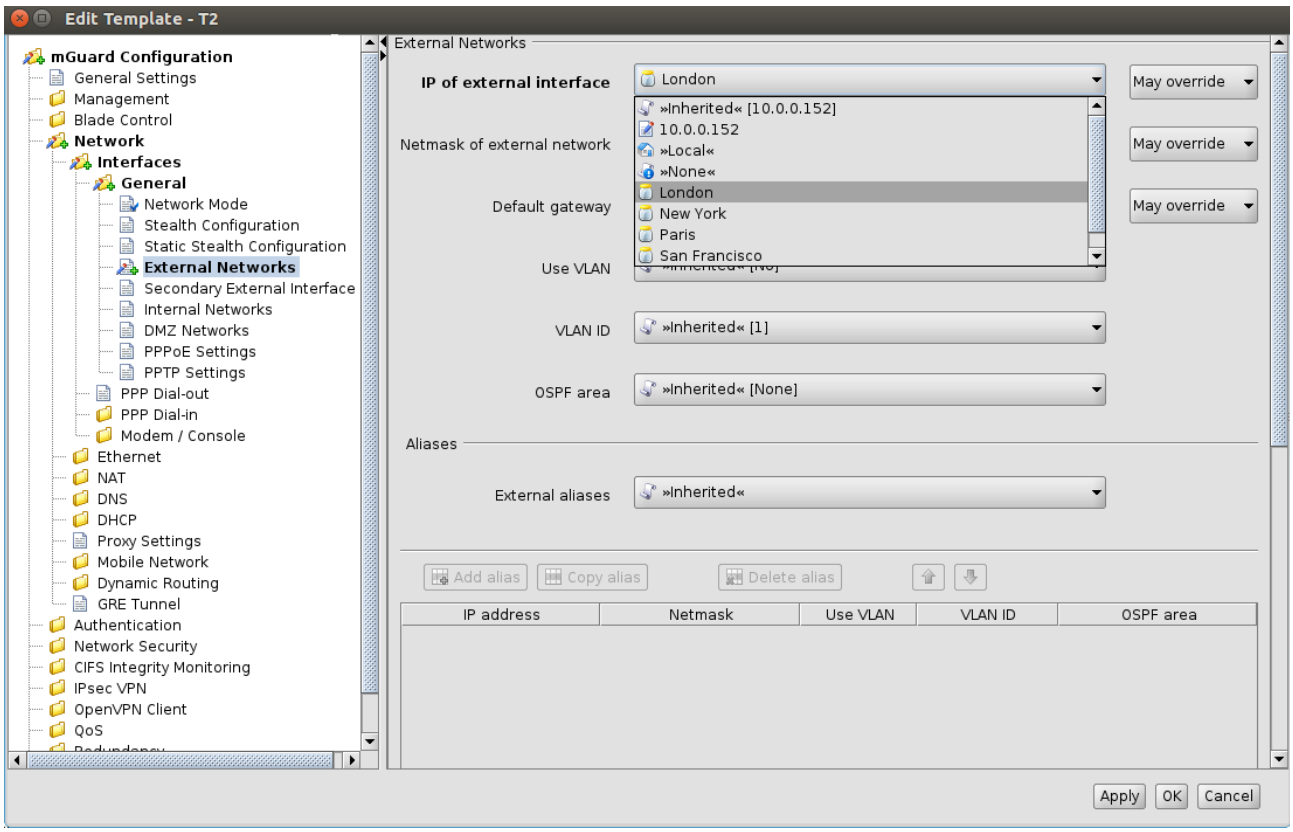


Figure 6-20 Usage of pool values

The following should be kept in mind when working with pools.

	In a variable that requires an IP address (not an IP network) only pools with a network mask of *32* can be referenced.
	If you decide to override a pool value in a device, the assigned pool value is not returned to the pool (i.e. the *use count* is not decreased), but remains assigned “in the back-ground”, in case you decide to use the inherited value again.
	Pools must be large enough to provide a value for every device that inherits from the template in which the pool is referenced, even if some of the devices override their re-spective pool value (see above).

6.6 Configure VPN groups

6.6.1 VPN group overview table

Please select the **VPN Groups** tab to access the VPN group overview table. A VPN group is used to group devices into a meshed VPN network. For detailed information on VPN groups and their usage please refer to “VPN group properties dialog (Meshed VPN networks)” on page 93.

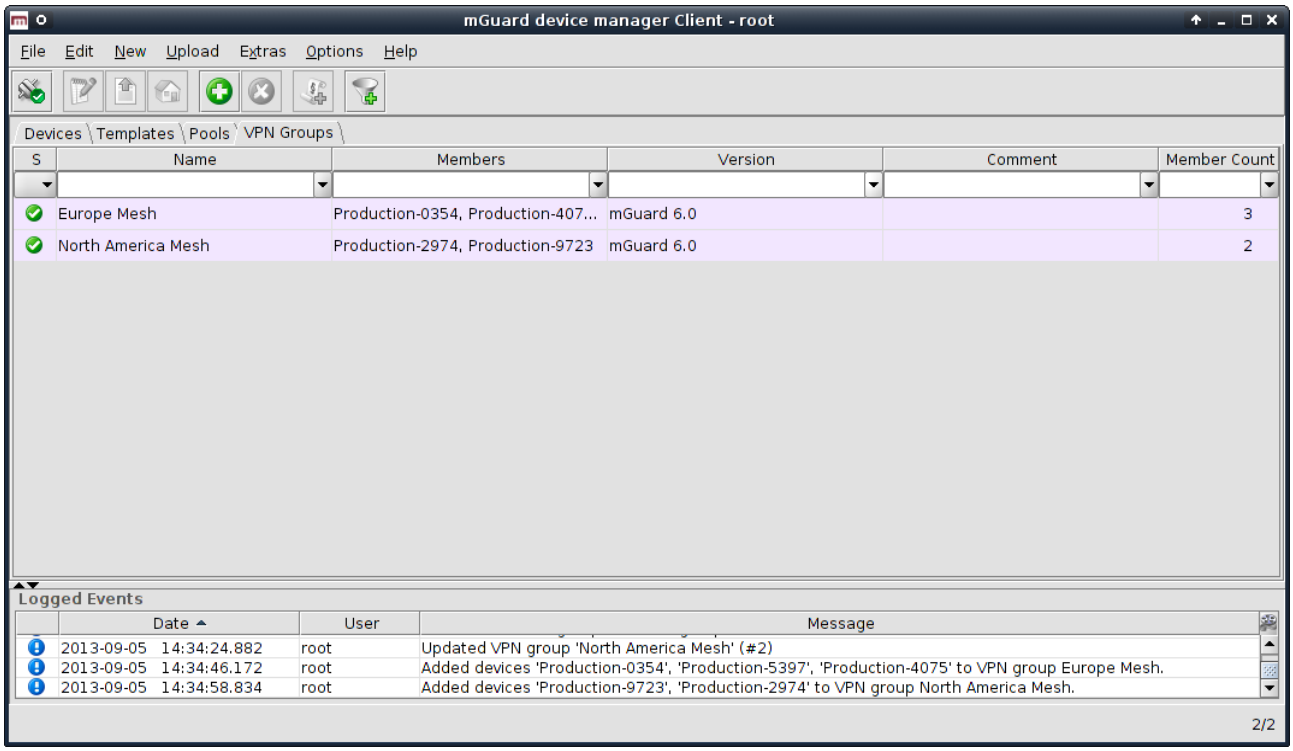


Figure 6-21 The mdm main window with VPN group table

VPN group table columns

The VPN group overview table contains the following columns

The column width can be changed by placing the cursor on the header of the table at the border of two columns and dragging the border to the desired location. The order of the columns can be changed by dragging the column header to a different location.

VPN group table columns	
Status (*S*)	The status icon shows whether the VPN group is currently locked.
Name	The name assigned to the VPN group. The name can be set in the **General Settings** of the *VPN group properties dialog* (see Chapter 6.6.4).

VPN group table columns		
	Members	A comma-separated list of the devices which are members of the VPN group (i.e. which are a part of the meshed VPN network defined by the VPN group).
	Version	The mGuard firmware version that is used for the VPN group.
	Comment	Optional comment. The comment can be set in the **General Settings** of the *VPN group properties dialog* (see Chapter 6.6.4).
	Member Count	This column shows the number of devices which are members of the VPN group.

Filtering and sorting the table

The header of the table can be used to sort the table entries. A click on a header of a column will activate the (primary) sort based on this column. This is indicated by the arrow in the column header. A second click on the same header will reverse the sort order. Clicking on another column header activates the sort based on this new column, the previously activated column will be used as secondary sorting criterion.

The first row of the table accepts the input of regular expressions (please refer to Chapter 11, *Regular expressions*), which can be used to efficiently filter the table entries. Filtering based on regular expressions is not used for the column that does not contain text (i.e. column **S**).

The filter criterion for the **Member Count** column is not interpreted as a regular expression, but as a comma-separated list of numbers or number ranges (e.g. 0,2–3).

The filter history will be saved for the current user and can be accessed using the drop down functionality of the filter fields.

Creating VPN groups

There are several ways to create new VPN groups:

1. Open the context menu by clicking on the VPN group table with the right mouse button. To open the *VPN group properties dialog* for a new VPN group please select **Add** in the context menu.
2. Select the **VPN Group** tab and click on the icon in the menu bar to open the *VPN group properties dialog* for a new VPN group.
3. Select **New » VPN Group** in the main menu to open the *VPN group properties dialog* for a new VPN group.

Editing VPN groups

There are several ways to edit a VPN group:

1. Double-click with the left mouse button on the VPN group in the table to open the *VPN group properties dialog*.
2. Select the VPN group with the left mouse button and open the context menu by pressing the right mouse button. Then select **Edit** to open the *VPN group properties dialog*.
3. Select the device to be modified in the device table. Select **Edit » Edit Item** in the main menu to open the *VPN group properties dialog*.

The **Edit** entry in the context menu and the **Edit** button in the toolbar are only enabled if exactly one VPN group is selected in the VPN group table.

Deleting VPN groups

There are several methods to delete VPN groups:

1. Select the VPN group(s) in the VPN group table and open the context menu by clicking with the right mouse button. To delete the VPN groups please select **Delete** in the context menu.
2. Select the VPN groups to be deleted in the table and click on the  icon in the menu bar.

Please note that VPN groups that still have member devices cannot be deleted.

6.6.2 VPN group context menu

The following entries are available in the context menu of the VPN group overview table.

VPN group context menu		
	Add	Create a new VPN group and open the *VPN group properties dialog* of the new VPN group.
	Edit	Edit the selected VPN group (only active if exactly one VPN group is selected in the overview table).
	Duplicate	To create a duplicate of a VPN group please open the context menu by clicking with the right mouse button on the VPN group in the VPN group table. Select **Duplicate** in the context menu. mdm will create a copy of the VPN group and append the string *_copy<n>* (<n> is a number) to the name of the new VPN group. Please note that the **Duplicate** menu entry is only enabled if exactly one VPN group is selected in the VPN group table.
	Delete	Delete the selected VPN groups.

VPN group context menu		
	Set Firmware Version	Since different firmware versions of the mGuard software have different sets of variables, the firmware version corresponding to the installed firmware on the mGuard has to be selected here. Only devices with a firmware version **equal to or newer** than the firmware version of the VPN group can become its members. **CAUTION: Irreversible changes** It is not possible to downgrade to an older release. So please be very careful when changing the firmware version. See “Firmware release settings and inheritance” on page 79 for more details. **NOTE: New default cipher values in mGuard firmware 8.5 and 8.6** If an existing VPN group will be upgraded from **mGuard firmware version < 8.5** to **8.5 or 8.6**, the following applies: If the table *Algorithms* in “ISAKMP SA (Key Exchange)“ and/or in “IPsec SA (Data Exchange)“ has the default configuration (Encryption), then the old default cipher value (3DES) will be kept. In this case the value type of the table will be changed from “**Default“ to “Custom“.** For more information on how to manage firmware upgrades of your devices with mdm please refer to Chapter 7.6.
	Assign/Remove Member Devices	Edit member devices of one or more VPN groups. Please refer to “Editing device membership in VPN groups” on page 91 for more details.
	Select All	Select all VPN groups not excluded by the table filter.

6.6.3 Editing device membership in VPN groups

When Assign/Remove Member Devices in the VPN group context menu is activated, a dialog opens to edit the device membership of the selected VPN groups:

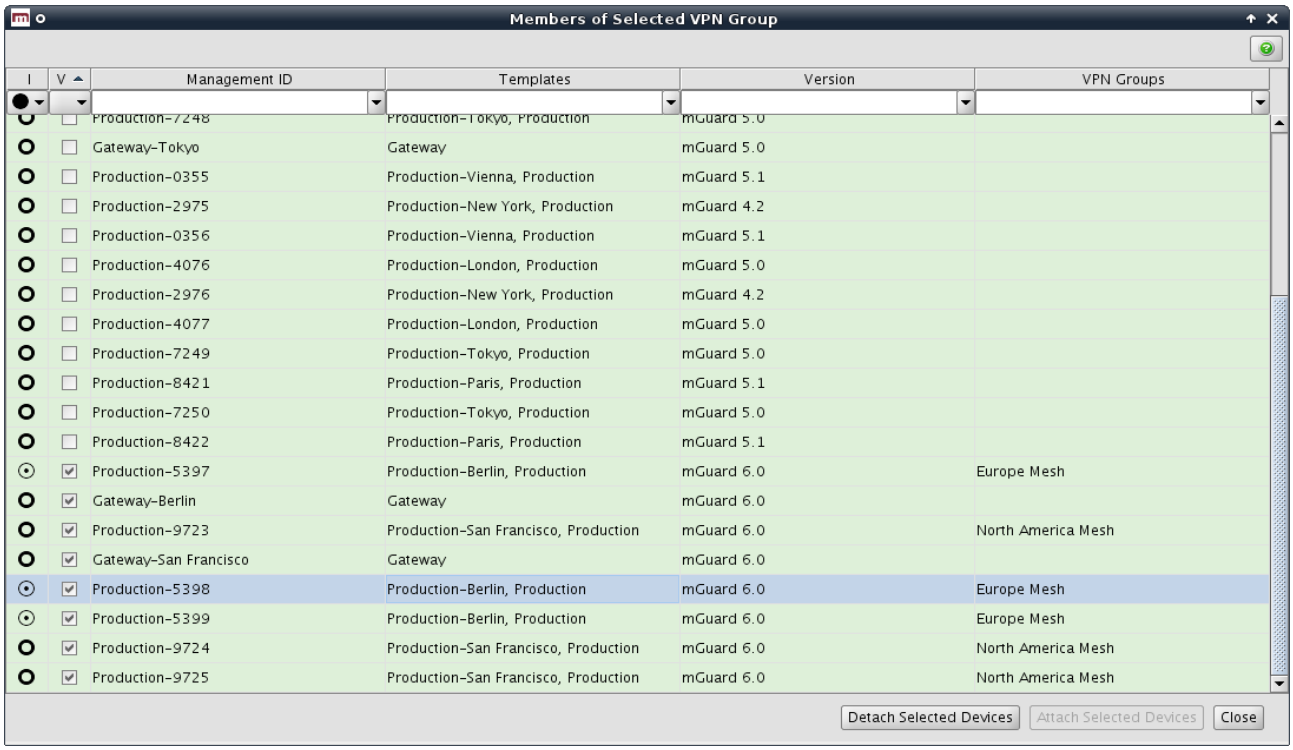


Figure 6-22 The dialog to edit device membership in VPN groups

VPN group membership table columns

The VPN group membership table contains the following columns.

The column width can be changed by placing the cursor on the header of the table at the border of two columns and dragging the border to the desired location. The order of the columns can be changed by dragging the column header to a different location.

VPN group membership table columns	
Status *I*	The ***I*** status icon indicates whether a device is a member of none, some, or all of the selected VPN groups. Click on the icon to open a dialog which explains the available icons and their meanings.
Status *V*	The ***V*** status icon shows whether the firmware version of the device is compatible with (i.e. equal to or newer than) the firmware version of the selected VPN groups.
Management ID	The Management ID of the device.
Templates	A comma-separated list of the device's ancestor templates. The first item in the list is the immediate parent template.

VPN group membership table columns		
	Version	The firmware version of the VPN group.
	VPN Groups	A comma-separated list of VPN groups that the device is currently a member of.

Filtering and sorting the table

The header of the table can be used to sort the table entries. A click on a header of a column will activate the (primary) sort based on this column. This is indicated by the arrow in the column header. A second click on the same header will reverse the sort order. Clicking on another column header activates the sort based on this new column, the previously activated column will be used as secondary sorting criterion.

The first row of the table accepts the input of regular expressions (please refer to Chapter 11, *Regular expressions*), which can be used to efficiently filter the table entries. Filtering based on regular expressions is not used for the columns that do not contain text (i.e. columns **I and V**).

Selecting devices

Select the device(s) for which to modify the VPN group membership:

– Click on a device to select it.
– Click on a device, then hold down the Shift key and click on a second device to select a range of devices.
– Click on a device while holding down the Ctrl key to toggle its selection state.

Assigning or removing VPN group membership

Click on the **Attach Selected Devices** button to make the selected devices members of the selected VPN groups (i.e. the VPN groups that were selected in the VPN group table when the dialog was opened). Likewise, click on the **Detach Selected Devices** button to revoke the membership of the selected devices from the selected VPN groups.

A device can only be a member of a VPN group if the device's firmware version is equal to or newer than the firmware version of the VPN group.

Any attempt to add a device to a VPN group of which it is already a member, or to remove a device from a VPN group of which it is not a member, is ignored.

Devices are added to or removed from VPN groups in the background. The dialog can be closed while the operation is still being performed.

6.6.4 VPN group properties dialog (Meshed VPN networks)

The member devices of a VPN group form a meshed VPN network: For each member device, mdm generates a VPN connection (referred to as a VPN group connection) to every other member device. A device can be a member of multiple VPN groups. If this results in multiple VPN connections between the same two devices, mdm generates only one such connection. VPN groups are not available for firmware versions earlier than 6.0.

The *VPN group properties dialog* allows to configure common variables used in all VPN connections within the group.

For information on how to create, delete or edit VPN groups, and how to add or remove member devices, please refer to "VPN group overview table" on page 86.

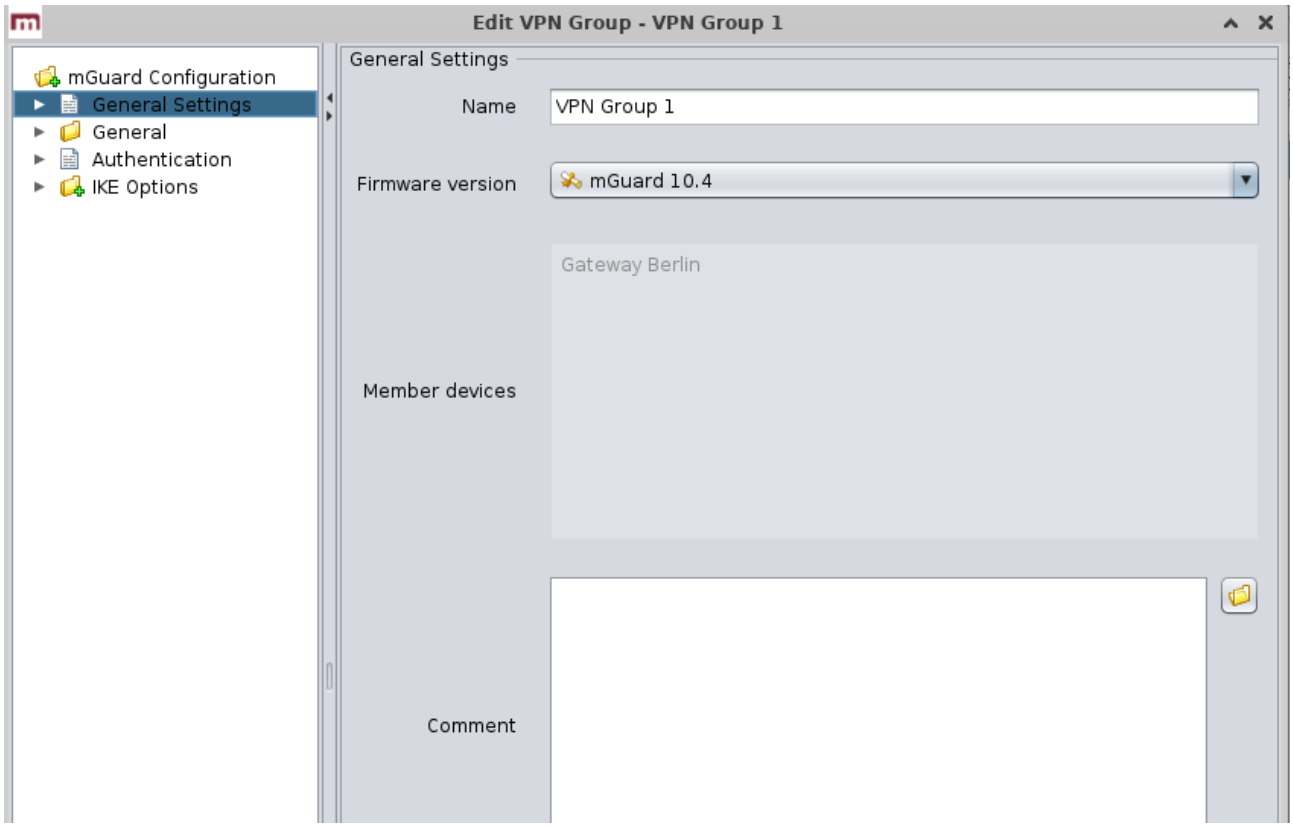


Figure 6-23 VPN group properties dialog

Similar to the Device and *Template properties dialogs* the *VPN group properties dialog* contains a navigation tree on the left side. It allows you to conveniently navigate to each variable.

General settings

The *VPN group properties dialog* contains the entry **General settings** for the configuration of additional parameters related to mdm. The following parameters can be set in the **General settings**.

VPN group properties dialog (Meshed VPN networks)		
General settings	**Name**	The name is used to identify the VPN group within mdm. It must be unique.
	Firmware Version	Since different firmware versions of the mGuard software have different sets of variables, the firmware version corresponding to the installed firmware on the mGuard has to be selected here. Only devices with a firmware version **equal to or newer** than the firmware version of the VPN group can become its members. **CAUTION: Irreversible changes** It is not possible to downgrade to an older release. So please be very careful when changing the firmware version. See "Firmware release settings and inheritance" on page 79 for more details. **NOTE: New default cipher values in mGuard firmware 8.5 and 8.6** If an existing VPN group will be upgraded from **mGuard firmware version < 8.5** to **8.5 or 8.6**, the following applies: If the table *Algorithms* in "ISAKMP SA (Key Exchange)" and/or in "IPsec SA (Data Exchange)" has the default configuration (Encryption), then the old default cipher value (3DES) will be kept. In this case the value type of the table will be changed from "**Default**" to "**Custom**". For more information on how to manage firmware upgrades of your devices with mdm please refer to Chapter 7.6.
	Member devices (read only)	The devices which are currently members of the VPN group.
	Comment	An optional comment.

VPN group connections

When generating VPN group connections, mdm combines the variables in the VPN group with additional variables in the device. While the variables in the VPN group are common to all connections in this group, the additional variables in the device are specific to the device, but common to all VPN group connections of the device.

The VPN group contains the following variables:

– General VPN settings
– Protocol settings

– Authentication settings
– IKE options

Devices and templates contain variables under the **IPsec VPN » VPN Group Configuration node which are used when mdm adds VPN group connections to a device:**

– Tunnel settings
– NAT settings
– Firewall settings

The local VPN network

The local VPN network to be used in VPN group connections can either be specified in the template or device (**IPsec VPN » VPN Group Configuration » Tunnel Settings » Local**), or, if the device is operated in router mode, it can be automatically derived. If the **IPsec VPN » VPN Group Configuration » Tunnel Settings » Use first internal address as local VPN network in router mode** variable is set to Yes, mdm uses the first internal address and associated netmask, so that the corresponding local network is visible through the VPN tunnel. The setting has no effect in stealth mode, i.e. if the device is operated in stealth mode, the local VPN network must always be specified.

Local 1:1 NAT

VPN group connections can be configured to perform 1:1 NAT on local addresses. None of the other NAT mechanisms for VPN connections are available in VPN group connections.

Local 1:1 NAT is enabled by setting the **IPsec VPN » VPN Group Configuration » NAT » Enable 1:1 NAT of local addresses** variable to Yes. The local network within the tunnel must be specified.

Please note that the network within the tunnel (i.e. the network addresses as seen by the peer) is specified in the 1:1 NAT settings. This is different from the mGuard Web GUI where the network outside of the tunnel (i.e. the network addresses as seen from the local network) is specified in the 1:1 NAT settings.

Extended firewall rules

The firewall rules under the **IPsec VPN » VPN Group Configuration** node contain additonal **Combine** fields associated with the **From IP** and **To IP** addresses or networks. If a Combine field is set to No, the corresponding address or network is used in the VPN group connection without modification.

If a **Combine** field is set to **Yes**, the address or network entered in the table is combined with the local or remote VPN network to calculate the network used in the VPN group connection.

– In the incoming firewall rules, the **From IP** field is combined with the remote VPN network and the **To IP** field is combined with the local VNP network.
– In the outgoing firewall rules, the **From IP** field is combined with the local VPN network and the **To IP** field is combined with the remote VNP network.

The value of the **From IP** or **To IP** field is combined with the VPN network by adding the addresses octet-wise, i.e. each octet is added individually. If the result of adding two octets overflows (i.e if it is greater than 255), the value 256 is subtracted (i.e. the addition “wraps around”). The network mask of the value of the **From IP** or **To IP** field (or 32 if the field does not contain a network mask) is applied to the result.

Examples:

– If the **From IP** or **To IP** field has the value 0.0.78.0/24, and the VPN network is 10.6.0.0/16, the combined value is 10.6.78.0/24.
– If the **From IP** or **To IP** field has the value 0.1.78.0/24, and the VPN network is 10.6.0.0/16, the combined value is 10.7.78.0/24.

6.7 Configure VPN connections

With mdm you can easily generate the configuration for a large number of VPN tunnels. In general, the information contained in Chapter 6.1, Chapter 6.3.3, Chapter 6.4.3 and Chapter 6.4.5 applies also to the VPN configuration.

But VPNs require some special settings to be taken into consideration, which are explained in this chapter, e.g. the automatic configuration of the VPN peer. You can find the VPN configuration in the node **IPsec VPN** of the navigation tree.

Adding and editing VPN connections

To add, change or delete VPN connections, please open the node **IPsec VPN » Connections**. To create a new connection, create a new table row (see "Modifying mGuard table variables" on page 38). As soon as you create a connection, it appears as node in the navigation tree. To edit the connection, open its node in the navigation tree and navigate to the desired settings. The structure of the connection node resembles the menu structure on the mGuard.

The connection table is read-only, i.e. you have to navigate to the respective node to make changes to the connection, e.g. change the name of the connection or disable a connection.

Please note that the permission setting of the connection table in a template applies to the table only, and not to the contents of the connections. If you set the table to *No override*, the settings of the VPN connection can still be modified on a device which uses this template, but the user on the device level is not allowed to add further connections to the table.

Automatic configuration of the VPN peer

You can automatically generate the VPN configuration for the peer device (see Figure 6-24): Place the cursor in the field **Peer device** and press the *Cursor Down* key. A list of available devices appears. You can limit the number of devices in the list by entering the first characters of the Management ID of the desired device. If you select a device, the VPN configuration for this device will be automatically generated.

Not all settings of the peer can be automatically generated, therefore you have to enter parts of the configuration manually. Please check the sub-nodes of the VPN connection for those settings, they are in the relevant subnodes separated from the other settings by the text **Configuration of peer device** (for an example see Figure 6-24).

The automatically generated VPN connections show up as read-only in the peer connection table, i.e. you cannot change the configuraton on the peer side.

If the VPN gateways have different firmware versions the configuration of a peer is only possible in the *Properties Dialog* of the device with the *older* firmware version. If you configure the peer in the *Properties Dialog* of the device with newer firmware the connection will not be generated in the device with the older firmware. There will be no error or warning displayed.

The automatically generated VPN connections can be used as alternative to the mGuard *Tunnel Group* feature (mGuard 5.0 or later), see comments in section *Hints for VPN configurations* below.

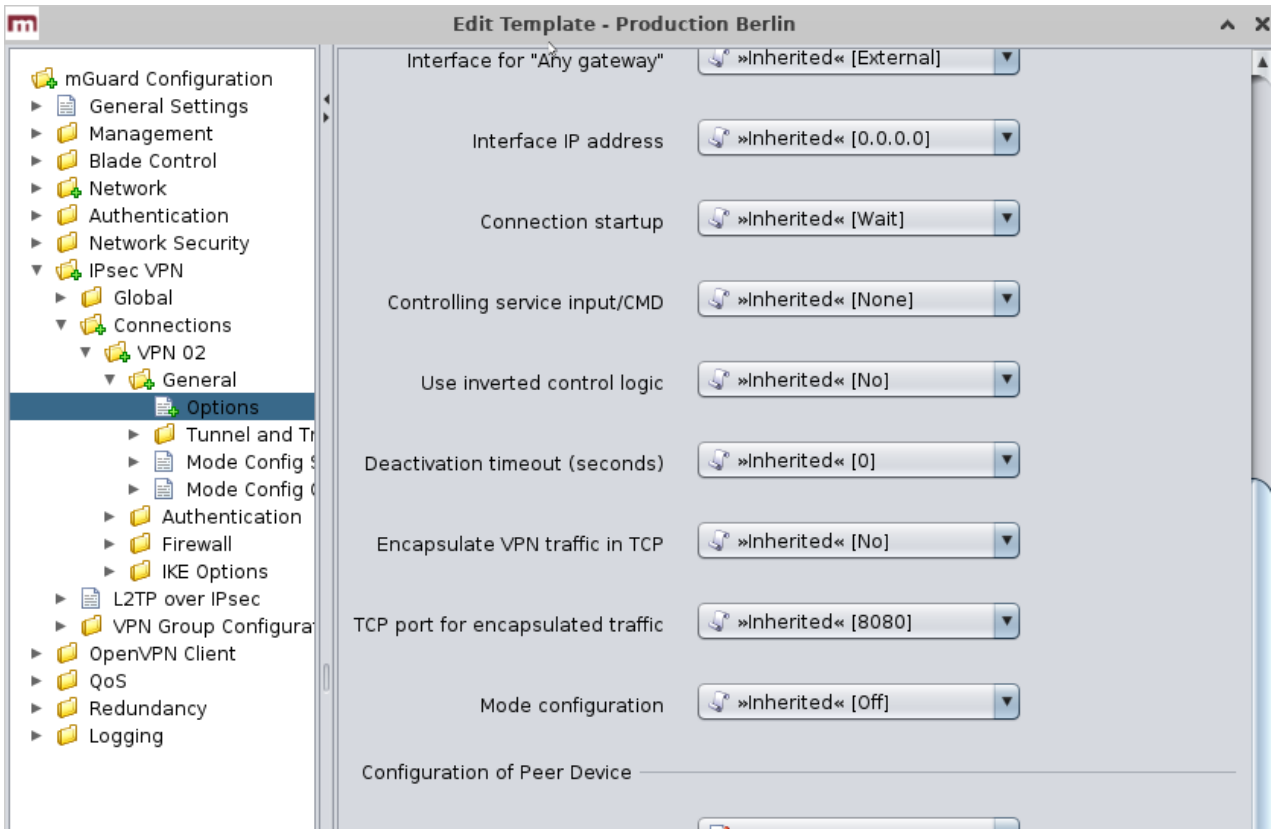


Figure 6-24 Automatic configuration of VPN peer

Setting VPN identifiers automatically

The local and the remote machine certificate are known to mdm in many typical usage scenarios (when VPN configuration for the peer device is generated by mdm). mdm can make use of this information to set the Local VPN Identifier and the Remote VPN Identifier variables automatically, i.e. derive the identifiers from the known certificates. It is necessary to set these variables when CA certificates are used to authenticate VPN connections.

To make use of this feature, open the **IPsec VPN » Connections » Connection Name » Authentication » VPN Identifiers node and set the variable Set VPN Identifiers automatically to yes. In this mode, the** Local VPN Identifier and the Remote VPN Identifier variables are ignored; the identifiers are derived from the cerificates.

Copying firewall rules

The firewall tables within VPN connections contain a **Copy from Main** button. Clicking this button copies the content of the corresponding firewall table for non-VPN traffic (i.e. if the current firewall table is for incoming traffic, the incoming firewall table for non-VPN traffic is copied; likewise for outgoing traffic).

A separate background color is used to indicate which firewall rules have been copied. The background color is cleared once a different navigation tree node is opened.

Hints for VPN configurations

These hints are useful if the tunnel group feature is not used and the VPN connections are explicitly defined.

In 1:N VPN configurations it is recommended to define the VPN connection in a template and select the central device in the **Peer devic**e field (See section *Automatic configuration of peer* above). If you assign this template to the devices mdm will automatically generate the N connection configurations for the central device.

In a 1:N VPN configuration it is required for the configuration of the peer to specify the gateway address of the current device (see Figure 6-24, **Configuration of peer device » Gateway address of peer**). If certificates are used *%any* (as shown in Figure 6-24) can be used as address in the template, but if PSK authentication is used, *%any* is not allowed. If PSK authentication is used, the external address (if no NAT us used) has to be entered into the field **Configuration of peer device » Gateway address of peer** for each device.

7 mdm client – Management tasks

7.1 Upload configurations to mGuard devices

7.1.1 Upload methods

You have the following options to initiate an upload of the configuration to the devices:

– Open the menu **Upload** in the main menu (Chapter 5.2.1) and select which devices should be uploaded (**All**, **Selected** or **Changed**, i.e. all devices in mdm, corresponding to mGuards with a configuration status of *out-of-date*).
– Select the entry **Upload** in the context menu (right-click on the device table). This will schedule all currently selected devices in the device table for upload.
– Click on the  icon in the tool bar to initiate an upload for the currently selected devices in the device table.

mdm offers several methods to upload the configuration files to the mGuards. After initiating the upload, please specify which upload method you prefer.

Auto

Depending on whether or not **Accessible via** in **General settings** is set, mdm will either perform

– an SSH push upload (see “Upload via SSH”) or
– an export of the configuration to the file system (see “Prepare pull configuration”)

Upload via SSH

mdm tries to upload all scheduled devices by using an SSH push upload.

For an SSH upload, an IP address or a hostname has to be specified in the field **Accessible via** in the **General settings** of the *Device properties dialog* (see Chapter 6.3.3). If this is not the case, an error will be displayed in the log window and the upload status will be set to error. An SSH port number (different from the standard SSH port 22) can be set optionally.

If mdm cannot login to the device due to wrong SSH authentication information, an error will be displayed in the log window and the upload status will be set to error.

If the mGuard is not accessible, mdm will retry to upload the configuration. After the maximum retry count is reached an error message will be displayed in the log window and the upload status will be set to error.

The mdm server accesses the mGuards using the SSH protocol. Subsequently the configuration file is copied to the device and put into operation. Any failures during the upload process are shown in the log window. To use this method the following requirements have to be met:

– In the **General Settings** of the *Device properties dialog* an IP address or a hostname has to be set for the field **Accessible via.** The SSH port number can be set optionally.
– The mGuard has to be accessible from the mdm server using the **Accessible via** address, i.e. a firewall must not block the traffic and a NAT device in the communication path has to be configured appropriately to allow the communication between the mdm server and the mGuard.

- In case the mGuard is accessed on the external interface, the SSH remote access has to be enabled on the mGuard.
- The passwords to access the device have to be set correctly. For uploading the device configuration to the mGuard, mdm logs in as user ***admin***. In case of a password change there are 2 passwords involved: the old password, which is used to access the device and the new password, which will be set after logging in. Therefore mdm automatically keeps track of the active password to be used to access the device and does *not* use the password configured in the *Device properties dialog* for this purpose. If you would like to manually change the active password you can use the option **Set Current Device Credentials** in the context menu of the device table.

If a device is not accessible, mdm will retry the connection after a waiting time. As soon as the maximum count of retries is reached mdm will stop trying to upload the configuration and will show an error in the log.

If a configuration change causes the mGuard to reboot (e.g. when switching from stealth to router mode), mdm is not immediately informed whether the configuration has been successfully applied. It will therefore reaccess the device after a waiting time. Adapt the **Accessible via**, **SSH port** and **Web configuration port** settings after the initial upload if necessary (see "Accessible via" on page 63). Alternatively the configuration state can be set manually with the option **Set Upload State** in the context menu of the device overview table.

If you change the password in the *Device properties dialog* and a subsequent upload of the device configuration fails, it may happen that the password change was applied on the mGuard but mdm was not able to keep track of the successful change. In this case you have to manually set the active password in mdm using the option **Set Current Device Credentials** in the context menu of the device overview table, otherwise mdm will not be able to log in for the next upload.

Due to this potential issue it is recommend to apply (upload) password changes separately from extensive configuration changes.

Prepare pull configuration

The configuration of all scheduled devices will be exported to the file system.

The export directory can be configured in the preferences file of the server (see Chapter 10.1).

The filename for each configuration file is shown in the **General settings** of the *Device properties dialog* and in the device table.

In case the files cannot be written to the file system (no permission, disk capacity exceeded, export directory not existent, etc.), mdm displays an error in the log and the upload status will be set to error.

The mGuards are able to pull configuration files from an HTTPS server. mGuards running firmware version 5.0 or later can additionally pull license files.

To use the configuration pull feature, please refer to the section *Manual configuration upload* above for a description how to export configuration and license files. Additionally the following requirements have to be met:

- An HTTPS configuration pull server has to be configured (see Chapter 3.2).

– The configuration pull has to be configured on the mGuards (please refer to the Reference Manual mGuard Firmware).
  Additionally the mGuards have to be configured with the 2 following commands to pull their configuration according to the mdm file name convention:

```
gaiconfig --set GAI_PULL_HTTPS_DIR <your_directory>
gaiconfig --set GAI_PULL_HTTPS_FILE <identifier>.atv
```

– In case that the mdm server and the configuration server are installed on different machines you have to make sure that the mdm export files are synced to the file system of the configuration server.
– If mdm is installed manually, additional steps are necessary if you would like to get a feedback whether or not the configuration pull was successful.
– mdm is able to receive Syslog messages on port UDP 7514 (default) in order to detect the configuration status of a device if mdm is configured as Syslog server in the configuration server settings.

The pull request contains information about the current configuraton status of the mGuard. This information will be sent as Syslog message from the configuration server to mdm. The port on which mdm listens for Syslog messages can be configured in the preferences file of the mdm server (see Chapter 10.1).

Profile encryption

Configuration profiles exported by the mdm server can optionally be encrypted with a device-specific key. The mdm server downloads the key from the license server. Only the public (encryption) key is known to Phoenix Contact; the corresponding private (decryption) key is stored within the mGuard in a special hardware module and cannot be extracted.

Profile encryption can only be used with mGuard hardware that supports this feature. Firmware version 7.6.0 or later is required.

Since profiles are encrypted with a device-specific key, only the mGuard for which the profile has been encrypted can read it.

Follow these steps to encrypt profiles:

– Obtain a user name and password to download profile keys from Phoenix Contact support. Configure the mdm server to use the "username" and "password"; see Chapter 10.1, nodes *license » licenseServer » reqUsername* **and** *license » licenseServer » reqPassword***.**
– Select the devices for which to encrypt profiles in the device overview table.
– Select the menu entry *Get Profile Key* in the context menu to download the keys to the mdm server. The serial numbers and flash IDs of the devices are used to identify them to the licsense server and must therefore be known to mdm; set them if necessary.
– Select the menu entry *Enable/Disable profile encryption* in the context menu to enable profile encryption.

Manage Profile Keys

The profile keys needed for profile encryption are listed in the table. New profile keys can be imported. Existing profile keys can be deleted.

Prepare pull configuration and try ssh upload

To update devices that are manageable online via ssh push upload and to update (export) their pull configuration at once, this method can be used.

The mdm will perform the following tasks:

1. Prepare the pull configuration as described above (see "Prepare pull configuration") for all selected devices.
2. Check, if an IP address or a hostname has been specified in the field **Accessible via** in the **General settings** of the *Device properties dialog* (see "Device properties dialog" on page 61) for each of the selected devices.
3. For those selected devices for which an IP address or a hostname has been specified, an SSH push upload to the selected device(s) will be performed (see "Upload via SSH").

Upload to FL MGUARD 1000

This method can be used to update FL MGUARD 1000 family devices. A push upload is performed via HTTPS over the REST API of the devices.

Manual configuration upload

In case there are only a few devices to be configured and the devices cannot be accessed by mdm, it is possible to export the configuration files to the file system and upload them manually to each device using the Web GUI of the respective device. Each device is identified by a unique identifier which is automatically assigned by mdm. This identifier (8-digit hex string with lower case characters) is used as file name for the export. The convention for the exported configuration file is: *<identifier>.atv.* The filename for each configuration file is shown in the **General settings** of the *Device properties dialog* and in the device table.
To export configuration files the following requirements have to be met:

– An export directory has to be configured in the preferences file of the mdm server (see Chapter 10.1). Please note that it is not possible to export the files locally on the client side. The files are always exported on the server side to the export directory configured in the server preferences file.
– The export directory has to be accessible and writeable from the server.
– There has to be enough disk space to export the files.

7.1.2 Upload time

The time when upload should be performed. Times are specified as an ISO date (YYYY-MM-DD where YYYY is the year, MM is the month of the year between 01 and 12, and DD is the day of the month between 01 and 31) optionally followed by an ISO time (hh:mm:ss where hh is the hour according to the 24-hour timekeeping system, mm is the minute and ss is the second). For example, a quarter past 4 p.m. and 20 seconds on December 22nd, 2010 would be written as 2010-12-22 16:15:20. Alternatively, click on the  icon to select the date from a calender.

If the current time (which is the default value) or a time in the past is specified, the upload is performed as soon as possible.

The Upload within ... minutes after field is used to specify an upper bound on the time frame in which mdm will attempt to perform the upload. If it does not succeed within the specified time, mdm will perform no more upload attempts and consider the upload failed.

7.1.3 Temporary upload password

If a password is entered into this field, and a push upload is performed, mdm uses this password when logging into the mGuard via SSH. The password is used for all devices. If the field is left empty (default), mdm uses the known admin password of each device.

The feature is useful if the mGuard does not use the configured admin password to authenticate the login request, e.g. if the mGuard uses RADIUS authentication.

When a temporary upload password is used, mdm can use a user name other than admin to log into the mGuard. This user name can be configured in the *Device properties dialog* or the *Template properties dialog.* Please open the „**Authentication » Local Users » Temporary Upload User**“ node in the navigation tree**.**

7.1.4 Upload history

Shows the upload history. The upload history contains details on the last upload actions and their results for each device. To review the upload history for a device, please select the mGuard in the device overview table and open the context menu with a click with the right mouse button. Select **Upload History** to open a window with the upload history.

7.2 Manage license vouchers and device licenses

mdm enables you to centrally manage your license vouchers and device licenses. The main menu contains two entries: **Licenses » Manage Device Licenses** and **Licenses » Manage License Vouchers** which are explained in detail in the following sections.

7.2.1 Manage license vouchers

To open the *Voucher Management Window* please select **Licenses » Manage License Vouchers** from the main menu.

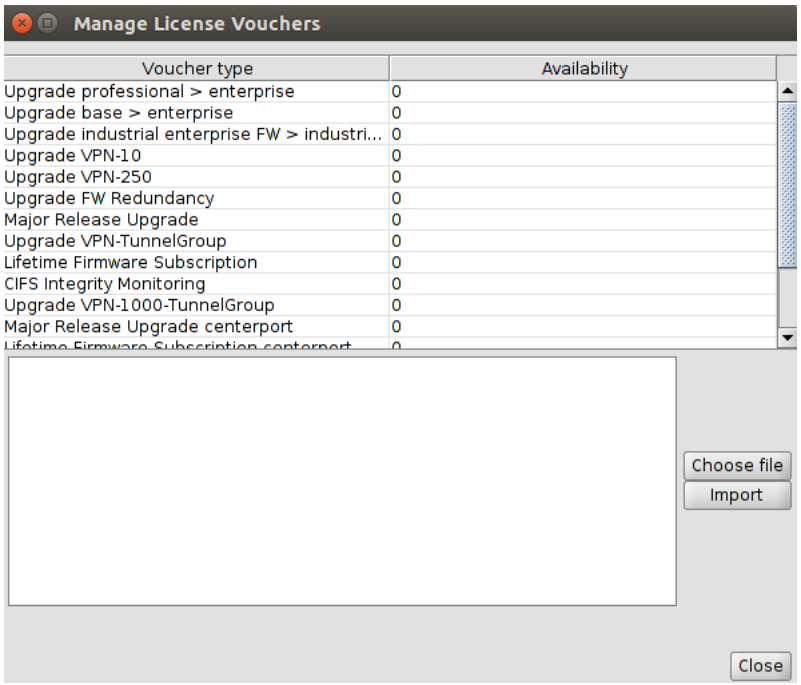


Figure 7-1 The Voucher Management Window

The window shows the available number of vouchers per voucher type. To import vouchers either paste the voucher information into the import field, or select a file that contains the voucher data and then click on *Import*. Only CSV is supported as import format, i.e. each line of the import data has to contain the following information:

<voucher number>,<voucher key>

7.2.2 Request/generate licenses

At least one voucher of the corresponding type (major release upgrade, VPN etc.) has to be imported into mdm before requesting a device license. Furthermore the serial number is required for the license request, i.e. the number has to be supplied in the **General Settings** of the device. This identification number may be entered manually or is automatically requested from the device during the push or pull upload procedure.

To request licenses, select the devices in the device overview table and either press the icon in the tool bar or select **Generate License** from the context menu. The generated licenses are subsequently shown in the *License Management Window* and on the

Management » Licensing page in the *Device properties dialog* and will be installed on the device with the next upload. The result of the license request is also shown in the log window.

mdm has to be able to connect to the license server in order to generate/request licenses.

7.2.3 Manage device licenses

To open the *License Management Window* please select **Licenses » Manage Device Licenses** from the main menu. All licenses managed by mdm and their licenses details are shown in the *License Management Window*. In addition to license requested/generated by the procedure described in the previous section, existing licenses can be imported. To import licenses either type or paste the filenames of the license files (one filename per line) into the import field and click on *Import* subsequently, or click on the **Choose File** button and select one or more files in the dialog.

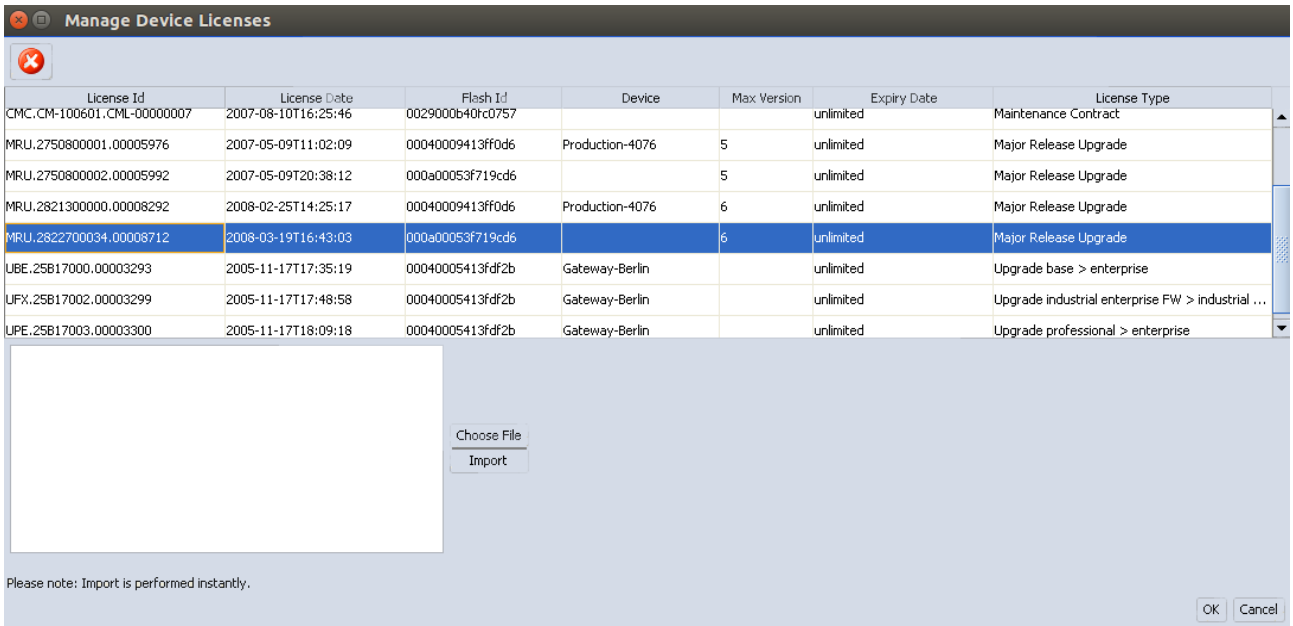


Figure 7-2 The License Management Window

A double-click on a license (row) in the table opens the *Device properties dialog* of the corresponding device (if any).

All licenses managed by mdm will be installed on the devices with every upload.

The licenses are automatically assigned to the devices by using the serial number contained in the license, i.e. without a serial number in the *General settings* of the device an assignment of the licenses is not possible.

7.2.4 Refresh licenses

To refresh all licenses in mdm for a device you can select the option **Refresh Licenses** in the context menu of the device overview table. mdm will contact the license server and retrieve all licenses that were bought for this device. The licenses will be installed with the next configuration upload. You can use this option, if you accidentally deleted licenses in mdm or if you would like to manage an mGuard that has already licenses installed that are not yet managed by mdm.

7.3 Manage users, roles, and permissions

The permission to log into the mdm client, and the permission to perform certain operations once logged in, are controlled through users and roles. A user corresponds to a person logging into the mdm client. Each user has one or more associated roles, and each role has an associated set of permissions. The union of all permissions associated with a user's roles determine what permissions are granted to a user.

The permissions are granted when a user logs in, and remain valid until the user logs out. Therefore, any modifications to the user, role, or permission configuration have no immediate effect on logged in users.

User and role management

Users, roles and permissions are managed in the Users and Roles Dialog, which is opened through the **Extras » Manage Users and Roles** menu entry:

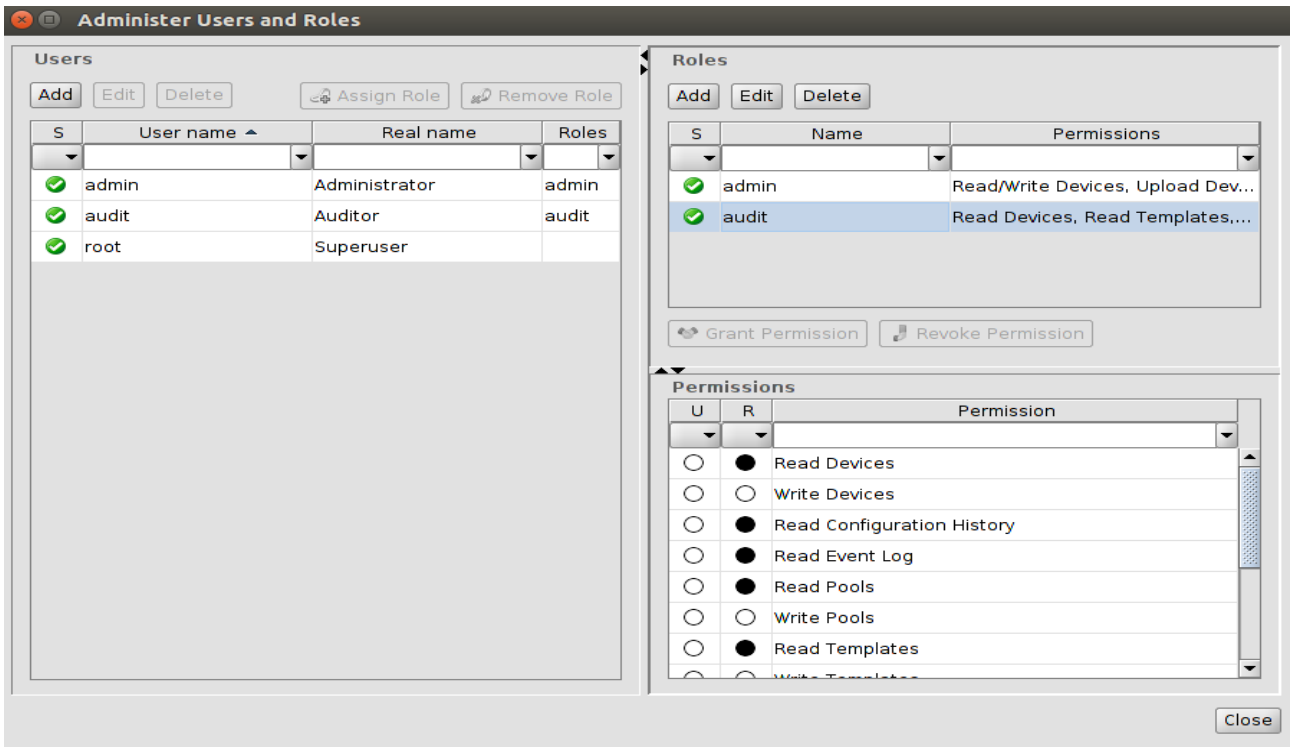


Figure 7-3 The users and roles dialog

The dialog consists of three panels, the Users Panel, the Roles Panel, and the Permissions Panel.

The Users Panel does not appear if RADIUS authentication is used; please refer to Chapter 7.3.4 for more details. The buttons to modify users or roles do not appear if the user opening the Users and Roles Dialog does not have the permission to modify users and roles.

7.3.1 Manage users

Users are managed in the Users Panel of the *Users and Roles* Dialog. They can be added with the **Add** button, deleted with the **Delete** button, and edited with the **Edit** button or by double-clicking on the user in the table. The following data must be specified when adding or editing a user:

Once a **Username** has been set, it can not be edited anymore.

- **Username**: The username which the user uses to log into the mdm client. Usernames must be unique.
- **Real Name**: The Real Name has no technical effect; its purpose is to make it easier to associate a user with a real person.
- **Password**: The user must provide the correct password to log into the mdm client.

Assigning roles to users

If one or more users in the Users Panel and one or more roles in the Roles Panel are selected, the roles can be assigned to the users by clicking the **Assign Role** button or removed by clicking the **Remove Role** button. All of the selected roles are assigned to or removed from all of the selected users.

The superuser root

A “superuser” with the user name *root* always exists. Although it has no associated roles, it has all permissions (i.e. it is treated specially by mdm). The superuser cannot be deleted, nor can permissions be revoked from the superuser.

Initial users

Three users exist in a fresh mdm installation, *root*, *admin*, and *audit*. The initial password of each of these users is identical to the respective user name.

Resetting the root password

If the password for the superuser *root* is lost, it is possible to reset it to root with the following psql command (to be performed while the mdm server is not running):

```
UPDATE mgnt_system_users SET "password" = 'WNd6PePC4QrGiz2zeKv6bQ==' WHERE "username" = 'root';
```

7.3.2 Manage roles

Roles are managed in the Roles Panel of the *Users and Roles* Dialog. They can be added with the **Add** button, deleted with the **Delete** button, and edited with the **Edit** button or by double-clicking on the role in the table. Each role has a name which must be unique.

Assigning permissions to roles

If one or more roles in the Roles Panel and one or more permissions in the Permissions Panel are selected, the permissions can be assigned to the roles by clicking the **Grant Permission** button or removed by clicking the **Revoke Permission** button. All of the selected permissions are assigned to or removed from all of the selected roles.

Initial roles

Two roles exist in a fresh mdm installation, admin, and audit. The admin role has all permissions except modification of users and roles. The audit role has read permissions, but no modification permissions.

7.3.3 Permissions

The permissions table in the Permissions Panel of the Users and Roles Dialog lists all available permissions. The permissions grant the following actions:

Permission	Granted Actions
Read Devices	View the list of devices, device configurations, device licenses, and license vouchers.
Write Devices	Edit, add, remove, or duplicate device configurations; add or remove device licenses; add license vouchers. If the user has the Read Configuration History permission in addition to this permission: Reconstruct devices from device configuration history entries.
Upload Device Configuration	Initiate the upload of configurations to devices or the export of pull configuration files.
Read Configuration History	View and compare device configuration history entries. If the user has the Write Devices permission in addition to this permission: Reconstruct devices from device configuration history entries.
Read Templates	View the list of templates and template configurations.
Write Templates	Edit, add, remove, or duplicate template configurations.
Read Pools	View the list of pools and pool configurations.
Write Pools	Edit, add, or remove pool configurations.
Read VPN Groups	View the list of VPN groups and VPN group configurations.
Write VPN Groups	Edit, add, remove, or duplicate VPN group configurations.
Read Users and Roles	View users, roles, and permissions.
Write Users and Roles	Manage users, roles, and permissions (including the permission to set other user's passwords).
Read Event Log	View the persistent event log.

Minimal permission set

The permissions Read Devices, Read Templates, Read Pools, and Read VPN Groups form the minimal permission set. These permissions cannot be revoked from a role.

Filtering the permission table

The columns U and R show how each permission relates to the currently selected users and roles. They can be used to filter the permission table.

The following icons can appear in the U column:

 The permission is not granted to any of the selected users.

 The permission is granted to some (but not all) of the selected users.

 The permission is granted to all of the selected users.

Likewise, the same icons are used in the R column to express if the permission is assigned to none, some, or all of the selected roles.

7.3.4 User authentication

mdm supports two mechanisms to authenticate users logging into the mdm client, the mdm database and RADIUS.

mdm database authentication

Authentication against the mdm database is the default mechanism. It uses the user names and passwords stored in the mdm database and configured in the Users Panel of the Users and Roles Dialog to authenticate users. Please refer to Chapter 7.3.1 for more details.

RADIUS authentication

Remote Authentication Dial In User Service (RADIUS) is a network protocol that provides a remote authentication service. If the mdm server is configured to use RADIUS authentication, the users stored in the mdm database are ignored. When a user attempts to log into the mdm client, the mdm server performs a request to one or more RADIUS servers to authenticate the user. The RADIUS reply must contain one or more Filter-Id attributes which the mdm server interprets as role names. If the login attempt is sucessful, the user is assigned to the roles specified in the Filter-Id attributes.

If RADIUS authentication is used, mdm does not use the concept of a superuser. The user name root is not treated specially in any way.

Please refer to Chapter 10.1 for more information on how to configure the mdm server to use RADIUS authentication.

7.4 Manage X.509 certificates

The functionality of the certificate management depends on the mGuard release. Beginning with mGuard firmware release 5.0 it is possible to:

– manage multiple machine certificates (prior to release 5.0 only one machine certificate was supported)
– manage CA certificates (prior to release 5.0 CA certificates were not supported)
– manage connection certificates at a central location (prior to 5.0 the connection certificate was part of the VPN connection only; beginning with 5.0 the connection certificates can be managed centrally and then be referenced for SSH or HTTPS authentication)
– manage CRLs (prior to release 5.0 CA CRLs were not supported)

Exporting Certificates

You can export certificates, e.g. if you would like to use the machine certificate as connection certificate for a VPN connection. To export a certificate please navigate to the respective certificate table (see below for more information) and click on the **Export** button. You can export the certificate to a folder of your choice.

7.4.1 Machine certificates

You can either import a machine certificate (PEM or PKCS#12 file), request a certificate from the mdm CA, request a certificate from any CA supporting the Simple Certificate Enrollment Protocol (SCEP), or manually enrol certificates.

In a template it is not possible to request or import a machine certificate. (It is only possible to import the connection certificate of the peer).

The file to be imported can be in PEM format containing the unencrypted private key and the certificate, or in PKCS#12 format protected by a password (the PKCS#12 file is only allowed to contain the “machine“ certificate and not an additional CA certificate). The file type is automatically detected. When importing a PKCS#12 file, a dialog asking for the password is displayed.
You can convert a PKCS#12 file to PEM using the command:
`openssl pkcs12 -in inputfile.p12 -nodes -out outputfile.pem.`

When SCEP is used, the CA server must be configured to issue certificates immediately. Pending requests are not supported.

Requesting a machine certificate

Prior to requesting a certificate make sure that the certificate attribute fields contain the desired values (for mGuard firmware 4.2 navigate to **IPsec VPN » Global » Machine certificate » Certificate attributes**, for mGuard firmware 5.0 or later navigate to **Authentication » Certificates » Certificate settings** and **Certificate attributes**).

In order to request a certificate from the mdm CA, the CA component has to be installed (see “mdm server (*preferences.xml file)” on page 149*).

To request a certificate select one or more devices in the device overview table and select **Certificate Handling » Request Additional Certificate** or **Certificate Handling » Request Replacement Certificate** from the context menu. The difference is that **Request Additional Certificate** will append the new certificate to the list of existing certificates while **Request Replacement Certificate** will replace the existing certificates with the new one, so that the device ends up with a single machine certificate.

The mdm server will request certificate(s) from the CA and will assign them to the device(s).

SCEP requires that a one-time challenge password is entered for each certificate request. Therefore, certificate requests can only be performed for a single device if SCEP is used. The mdm client will open a dialog window in which to enter the challenge password; please consult the documentation of your CA server on how to obtain the password.

OCSP and CRLs are not supported by mGuard 4.2. Nevertheless, if you would like to use firmware releases newer than 4.2 with CRL/OCSP support, you should configure values for these attributes.

Importing a machine certificate (mGuard firmware 4.2)

To import a certificate navigate to **IPsecVPN » Global » Machine certificate » Machine certificates** and click on the **Import** button (the **Import** button is only enabled if **Custom** or **Custom+Locally appendable** is selected as value for the machine certificate table). Select the file containing the machine certificate and click on **Open**. The machine certificate is subsequently shown in the table if the import was successful, otherwise an error message will be displayed.

Only the first entry of the machine certificate table is used as machine certificate.

Importing a machine certificate (mGuard firmware 5.0 or later)

To import a certificate navigate to **Authentication » Certificates » Machine Certificates** and click on the **Import** button (the **Import** button is only enabled if **Custom** or **Custom+Locally appendable** is selected as value for the machine certificate table). Select the file containing the machine certificate and click on **Open**. The machine certificate is subsequently shown in the table if the import was successful, otherwise an error message will be displayed.

Deleting machine certificates

To delete a machine certificate, navigate to **Authentication » Certificates » Machine Certificates,** select the certificate in the certificate table and click on the **Delete certificate** button.

Deleting a certificate does not automatically revoke the certificate.

Revoking machine certificates

To revoke a machine certificate, navigate to **Authentication » Certificates » Machine Certificates,** select the certificate and click on the button **Revoke certificate**. This button is enabled only if exactly one machine certificate is selected. After revoking a certificate the text **** REVOKED **** is automatically shown in the corresponding info field of the table. Any time a certificate is revoked, the mdm CA exports a new file containing all revoked certificates of this issuer.

If you need more information on the export of CRL files, please contact Phoenix Contact (phoenixcontact.com).

SCEP does not support revoking certificates.

CRLs are only supported by mGuard firmware 5.0 and newer.

Revoking a certificate does not delete the certificate from the table.

Manual certificate enrollment

If certificates issued by a CA are to be used, but requesting them online (from the mdm CA or via SCEP) is not an option, mdm supports manual certificate enrollment. Any CA software or service can be used. Follow these steps to enrol certificates manually for a number of devices:

1. Select one or more devices in the device overview table and select Certificate Handling **» Issue and Export Certificate Requests** from the context menu.
2. A file selection dialog opens. Select a directory and click on the **Choose** button.
3. mdm will generate private keys and certificate requests for the devices. The private keys are (invisibly) associated with the respective devices. The certificate requests are stored in the selected directory as PEM encoded files (one request per device).
4. Import the certificate requests into the CA and let the CA issue certificates. Please consult the documentation of your CA software or service for details of how to do this.
5. Select New **»** Import X.509 Certificates from the main menu.
6. A file selection dialog opens. Select the certificate files issued by the CA.
7. Select from the Import Settings whether to add the certificates or replace any certificate that may already exist in a device. Click on the **Choose** button.
8. mdm automatically associates the certificates with the correct devices and stores them in the machine certificate tables.

Only one pending certificate request per device is stored. If the Certificate Handling **» Issue and Export Certificate Requests action** is invoked more than once without importing the resulting certificates, only the certificates from the last invocation can be imported.

7.4.2 CA certificates (mGuard firmware 5.0 or later)

Importing CA certificates

Beginning with mGuard release 5.0 CA certificates (root or intermediate) are supported. To import a CA certificate navigate to **Authentication » Certificates » CA Certificates** and click on the **Import** button (the **Import** button is only enabled if **Custom** or **Custom+Locally appendable** is selected as value for the CA certificate table). Select the file containing the CA certificate and click on **Open**. The CA certificate is subsequently shown in the table if the import was successful, otherwise an error message will be displayed.

7.4.3 Remote certificates (mGuard firmware 5.0 or later)

Importing remote certificates

To import a remote certificate navigate to **Authentication » Certificates » Remote Certificates** and click on the **Import** button (the **Import** button is only enabled if **Custom** or **Custom+Locally appendable** is selected as value for the remote certificate table). Select the file containing the remote certificate and click on **Open**. The remote certificate is subsequently shown in the table if the import was successful, otherwise an error message will be displayed.

7.4.4 Connection certificates

Importing connection certificates

The connection certificate can only be imported in a VPN connection. To import the certificate navigate to **IPsec VPN » Connections »** *Connection Name* **» Authentication.** To import a certificate select **Custom** as value for the **Remote X.509 certificate** and click on the  icon. Select the file containing the certificate and click on **Open**. Subsequently the content of the file is shown in the certificate field. The validity of the data is checked when uploading the configuration to the mGuard.

7.5 Use X.509 certificates (mGuard firmware 5.0 or later)

The certificates which are managed in the tables discussed in Chapter 7.4 can be used for the configuration of SSH and HTTPS authentication. The usage is exemplarily explained for the SSH authentication. Please navigate in the *Device properties dialog* to **Management » System settings » Shell access » X.509 authentication**. To use a certificate, e.g. a CA certificate, you have to select **Custom** for the CA certificate table and then click on **Add certificate**. Please enter the *short name* of the certificate as specified in the CA certificate table in **Authentication » Certificates » CA Certificates**. mdm does not check whether the *short name* of the certificate exists.

7.6 Manage firmware upgrades with mdm

mdm supports the management of the firmware of your mGuards. The firmware itself is not uploaded to the device by mdm. mdm instructs the device during the configuration upload to download a firmware upgrade package from an upgrade server and apply it.

Prerequisites

- An upgrade server has to be set up and the required update packages etc. have to be put on the server. The upgrade server has to be accessible from the devices (and not necessarily from mdm).
- The server has to be configured in the device configuration (or in the template configuration). For 4.2 devices please navigate in the *Properties Dialog* to **Management » Firmware upgrade » Upgrade servers** or for 5.0 devices or later navigate to **Management » Update » Firmware upgrade » Upgrade servers** to add your upgrade server to the configuration.
- If you use the automatic firmware upgrade (see section below) together with a pull upload, make sure that the field **Firmware Version on Device** (see Chapter 6.3.3) has a valid value. The value can either be entered manually or alternatively mdm will automatically fill in this information after the initial push upload or pull configuration feedback. If entered manually the **Firmware Version on Device** field must *exactly* match the string shown in the icon in the upper-left corner of the mGuard's web interface, e.g. *6.1.0.default*.

Scheduling a firmware upgrade

There are two ways to schedule a firmware upgrade:

- Explicitly specify the target firmware
  To do so please navigate in the *Device properties dialog* to **Management » Firmware upgrade » Schedule firmware upgrade** for 4.2 devices or navigate to **Management » Update » Firmware upgrade » Schedule firmware upgrade** for 5.0 or newer devices. Enter the name of the package in the field **Package set name** and set **Install package set** to **Yes**.
- Perform an automated upgrade
  If you wish to use the automatic upgrade please navigate in the *Device properties dialog* to **Management » Firmware upgrade » Schedule firmware upgrade** for 4.2 devices or navigate to **Management » Update » Firmware upgrade » Schedule firmware upgrade** for 5.0 devices. Select one of the following options in **Automatic upgrade**:
  - Install latest patches
    This option will upgrade your device to the latest available patch release, e.g. from release 4.2.1 to release 4.2.3.
  - Install latest minor release
    This option will upgrade your device to the latest available minor release, e.g. from release 5.0.1 to release 5.1.0.
  - Install next major version
    This option will upgrade to the next major release, e.g. from release 4.2.3 to release 5.1.0.
    Please make sure that the major upgrade licenses for the devices are present in mdm (see Chapter 7.2) prior to initiating a major release upgrade.

  Alternatively you can schedule the automatic firmware upgrade for one or more devices using the context menu of the device overview table. Please open the context menu by right-clicking on the device table, then select the desired upgrade option.

To finally initiate the firmware upgrade the configuration has to be uploaded to the devices, after performing the steps above.

Canceling the scheduled firmware upgrade

You can unschedule a scheduled firmware upgrade with the option **Unschedule upgrade** in the context menu of the device overview table.

Upgrade process

When performing an upgrade it is important to follow the correct order of the steps.

Let us assume you would like to upgrade a device from release 4.2.3 to 5.1.0. The current firmware version configured (in the field **Firmware Version** in the *Device properties dialog*) in mdm is 4.2 corresponding to the firmware version on the device, which is also a 4.2 version. This should be indicated in the **Version on Device** field in the device overview table (see Chapter 6.3.1).

Make sure that all required prerequisites (see section *"Prerequisites"* above) are fulfilled and start a configuration upload for the device (see section *"Scheduling a firmware upgrade"* above).

First the icon in the **Version on Device** column will change to  , indicating that a firmware upgrade has been scheduled with the next upload. As soon as the configuration upload is started, the icon changes to  , indicating that a firmware upgrade is ongoing on the device (the  icon is only shown when performing a push upload). mdm polls the device periodically to get a feedback on the result of the firmware upgrade, which will finally be shown in the **Version on Device** field in the device overview table and in the **U** column of the device overview table.

The **Version on Device** field should now indicate a firmware mismatch, since the device has been upgraded to 5.1.0, but the mdm configuration for the device is still set to version 4.2. Therefore you should change the firmware version for the device to match the currently installed firmware. This has to be performed *after* the firmware upgrade on the device took place.

You can change the firmware version in the field **Firmware version** in the *Device properties dialog* or using the context menu of the device overview table.

CAUTION: Irreversible changes

Upgrading the firmware version of the device might change default variable values at the target version.

It is not possible to downgrade to an older release. So please be very careful when changing the firmware version. See “Firmware release settings and inheritance” on page 79 for more details.

Once the upgrade has been performed, check all variable changes at the "Device Configuration History" (see “The configuration history dialog” on page 119).

NOTE: New default values in mGuard firmware 8.5 and 8.6

If a default value in the mGuard firmware is changed, the management of this value in mdm will be affected:

1. if a firmware version of a managed device is upgraded to a firmware version with a changed default value,
2. if a child with a different mGuard firmware version than its parent inherits a value with a different default value.

The related behavior of mdm is described in the Chapter 6.2.3 (“Behavior of changed default values (mGuard 8.5/8.6)” on page 43).

If you want to add a new device/template with mGuard firmware version 8.5, set the *Default Firmware Version* to mGuard 8.5 first. In this case, no device upgrade takes place and the default values, corresponding to mGuard firmware version 8.5, will be set. The value type will remain as „Inherited“ (see “mdm main menu” on page 19 --> “Default Firmware Version”).

You can now start to configure features introduced with the new firmware version.

Monitoring the firmware upgrade

The firmware upgrade progress and the result is indicated by the icon in the column **Version on device** in the device overview table. Please refer to Chapter 6.3.1 for more information.

7.7 Rollback support

Configuration rollback is supported on devices with firmware version 5.0 or later. A rollback is performed by the device if it cannot access the configuration pull server after applying a pull configuration (this is interpreted by the device as misconfiguration). To enable rollback for a device please navigate in the *Properties Dialog* to **Management » Configuration Pull** and set the option **Rollback misconfigurations** to **Yes**.

7.8 Redundancy mode

If a device or template is in redundancy mode, it represents a pair of redundant mGuards (i.e. two physical devices). Settings and configuration variables which must or may be different for the two physical devices of a redundant pair can be set separately.

Additional navigation tree nodes and variables are visible in the Device and *Template properties dialog* in redundancy mode. Nodes and variables prefixed with Device#2 are used for the second device while those without prefix are used for the first device.

Separate settings

The following settings exist separately for the physical devices, but are not normally set by the user:

- **Firmware Version on Device**
- **Pull filename**
- **Serial Number**
- **Flash ID**

The following variables must be set to different values for the physical devices:

- The external and internal network settings in router mode.
- The stealth management address settings in stealth mode.
- The IP settings for the dedicated redundancy state synchronization interface (if this interface is used).

The following variables may be set to different values for the physical devices:

- The hostname
- The SNMP system name, location, and contact
- The MTU settings
- The http(s) proxy settings
- The passwords of the mGuard users
- The Quality of Service settings
- The redundancy priority
- The redundancy connectivity check settings
- The remote logging settings

Upload

When an upload to a redundant device pair is initiated, the two configurations are uploaded to the physical devices. The two uploads to the mGuards forming a redundant pair are never performed simultaneously (but may be performed simultaneously with uploads to other devices). An upload to a redundant pair is considered successful once the upload to both physical devices has succeeded.

Pull export

A pull configuration export for a redundant device pair creates two configuration profiles. The filename of the profile for the second device has _2 appended to the base name.

8 Configuration history

mdm keeps track of mGuard device configurations in the configuration history. Whenever a change is made to a device, template, or VPN group configuration, a new history entry is automatically created for each device that changes as a result.

Each device has its own independent history. When a device is deleted, its associated history is deleted as well.

The history stores configurations as they are uploaded to the mGuards. Variable permissions and template inheritance relations are not part of the history.

8.1 The configuration history dialog

To access a device's configuration history, select the device in the **device overview table** and activate the **Show Device Configuration History** option in the context menu. This opens the configuration history dialog which contains a list of history entries for the selected device.

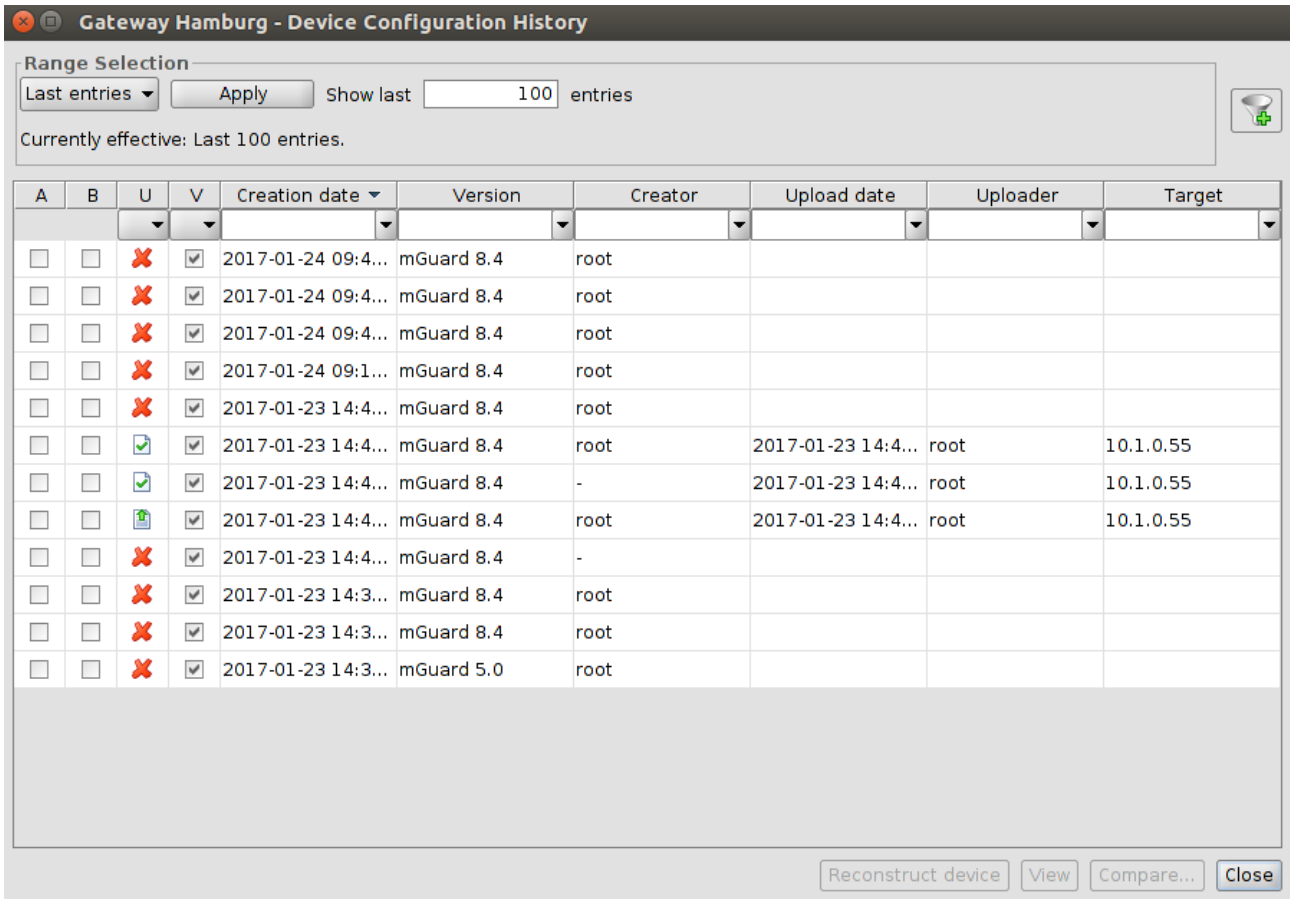


Figure 8-1 The configuration history dialog

Configuration history dialog	
Range selection	Since a device may have a large number of history entries, not all entries are automatically loaded from the mdm server when the dialog is opened. By changing the criteria in the Range Selection field and clicking the **Apply** button, the history entries matching the specified critera can be loaded. By default, the latest (i.e. newest) 100 entries are loaded. **All Entries** — Loads all history entries associated with the device. If the number of entries is large (i.e. thousands or more), loading all entries may incur a significant delay. **Time Range** — Loads all entries which have been created during a time range. The time range must be specified: – If a lower bound, but not an upper bound is specified, all entries newer than the lower bound are loaded. – If an upper bound, but not a lower bound is specified, all entries older than the upper bound are loaded. – If both a lower and an upper bound are specified, all entries created during the time interval given by the bounds are loaded. Times are specified as an ISO date (YYYY-MM-DD where YYYY is the year, MM is the month of the year between 01 and 12, and DD is the day of the month between 01 and 31) optionally followed by an ISO time (hh:mm:ss where hh is the hour according to the 24-hour timekeeping system, mm is the minute and ss is the second). For example, a quarter past 4 p.m. and 20 seconds on December 22nd, 2010 would be written as 2010-12-22 16:15:20. Alternatively, click on the icon to select the date from a calender. **Last Entries** — Loads the latest (i.e. newest) entries. The number of entries must be specified.
Configuration history table columns	The configuration history table contains the following columns (see below). The column width can be changed by placing the cursor on the header of the table at the border of two columns and dragging the border to the desired location. The order of the columns can be changed by dragging the column header to a different location.

Configuration history dialog	
Selection *A, B*	The checkboxes in the ***A*** and ***B*** columns are used to “activate” either one or two history entires. The activated history entries are used when an action is performed; please refer to the sections below for more details. – Check the checkboxes A and B in the same row to activate the corresponding history entry. Check the checkboxes A and B in different rows to activate two history entires. When two different history entries are activated, the entry checked in the ***A*** column is always older than the entry checked in the ***B*** column. Whenever a checkbox is checked, mdm automatically removes some checkboxes so that it is not possible to reverse the order. Activating two different entries is easiest when the table is sorted by creation date.
Status *U*	The ***U*** column shows the upload status, if the configuration corresponding to the history entry has been uploaded to an mGuard or exported for pull config. Please refer to Chapter 6.3.1 for a list of available upload status and their meanings. One additional upload status is available in the configuration history dialog: Not uploaded The configuration corresponding to the history entry has not been uploaded to an mGuard or exported for pull config. If the same configuration is uploaded or exported two or more times, the latest configuration history entry is duplicated, so that one entry exists for every successful or unsuccessful upload attempt.
Status *V*	The ***V*** status indicates whether or not the configuration corresponding to the history is valid. A configuration is not valid if a None value in a template has not been overridden, so that the configuration cannot be uploaded to an mGuard. Please refer to Chapter 6.1 for more information. A history entry corresponding to an invalid configuration cannot be activated.
Creation Date	The date and time when the configuration history entry was created.
Version	The firmware version that was set for the device when the configuration history entry was created.
Creator	The username of the user who made the change to a device, template, or VPN group configuration that caused the configuration history entry to be created.

Configuration history dialog		
	Upload Date	The date and time when the configuration corresponding to the history entry was uploaded to an mGuard or exported for pull config. Empty if the configuration has not been uploaded or exported.
	Uploader	The username of the user who initiated the upload or export. Empty if the configuration has not been uploaded or exported.
	Target	– If the configuration has been uploaded, the address to which it has been uploaded. – If the configuration is exported, the name of the file to which it has been exported. Otherwise empty.

Filtering and sorting the table

The header of the table can be used to sort the table entries. A click on a header of a column will activate the (primary) sort based on this column. This is indicated by the arrow in the column header. A second click on the same header will reverse the sort order. Clicking on another column header activates the sort based on this new column, the previously activated column will be used as secondary sorting criterion.

The first row of the table accepts the input of regular expressions (please refer to Chapter 11, *Regular expressions*), which can be used to efficiently filter the table entries. Filtering based on regular expressions is not used for columns that do not contain text (columns **U** or **V**).

Since the **A** and **B** columns do not contain information, but are used to activate history entries, they cannot be used for filtering or sorting.

Detail information

Double clicking on a row in the configuration history dialog opens a dialog which displays detail information about the configuration history entry. In particular, if the configuration has been uploaded, the messages received from the mGuard while applying the configuration are shown.

8.2 Viewing historic configurations

When a single history entry is activated in the configuration history dialog, the **View** button is enabled. Clicking on this button opens the History View Dialog which shows the historic configuration.

Although the History View Dialog looks similar to the *Device properties dialog*, the type of information that is visualized is different. History entries contain configurations as they are uploaded to the mGuards; variable permissions and template inheritance relations are not part of the history.

Special values

In addition to the variable value (or **Custom** if the variable value cannot be displayed, e.g. password variables), two special values are used:

- **Local** indicates that the variable has no value known to mdm. The value is set by the user netadmin on the mGuard.
- **Custom + Locally appendable** is only applicable to table variables. It indicates that the user netadmin on the mGuard has the permission to append rows to the table.

8.3 Comparison of historic configurations

When two history entries are activated in the configuration history dialog, the **Compare** button is enabled. Clicking on this button opens the History Comparison Dialog which shows a comparison of the two historic configurations.

Although the *History Comparison Dialog* looks similar to the *Device properties dialog*, the type of information that is visualized is different. History entries contain configurations as they are uploaded to the mGuards; variable permissions and template inheritance relations are not part of the history.

Navigation tree

Different icons and colors in the navigation tree are used to visualize where and how the older and newer configuration differ:

-  Unchanged (black label)
  The older and newer configuration are identical in the subtree below the node.
-  Modified (blue label)
  Variables have changed between the older and newer configuration in the subtree below the node.
-  Added (green label)
  The subtree has been added, i.e. it exists in the newer, but not in the older configuration.
-  Removed (red label)
  The subtree has been removed, i.e. it exists in the older, but not in the newer configuration.

Configuration variables

If a variable has not changed between the older and newer configuration, its single value is displayed. Otherwise, if a simple variable has changed, its old value is displayed above its new value. In cases where the variable value cannot be displayed (e.g. password variables), the text Custom is used instead.

If the single value Custom is displayed for a password variable, this indicates that the password has not changed. However, if the value Custom is displayed twice, the password has changed between the older and the newer configuration.

If a table variable has changed, the change is indicated by the background color of the changed row(s) and by a character in the “+/–” column:

– “+” indicator / green background
  The row has been inserted, i.e. it exists in the newer, but not in the older configuration.
– “–” indicator / red background
  The row has been deleted, i.e. it exists in the older, but not in the newer configuration.
– “M” indicator / blue background
  The row has changed between the older and newer configuration. This indicator is only used for complex table variables (e.g. VPN connections); otherwise, a changed row is treated as a deletion of the row with the old contents followed by an insertion of a row with the new contents.

Special values

In addition to the variable value or Custom, two special values are used:

– **Local** indicates that the variable has no value known to mdm. The value is set by the user netadmin on the mGuard.
– **Custom + Locally appendable** is only applicable to table variables. It indicates that the user netadmin on the mGuard has the permission to append rows to the table.

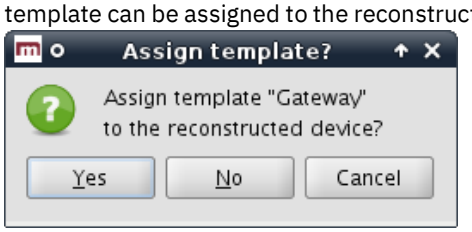
8.4 Reconstructing a device from a historic configuration

When a single history entry is activated in the configuration history dialog by checking the checkboxes in both the A and the B column, the **Reconstruct Device** button is enabled. Clicking on this button creates a new device in which all variables are set according to the historic configuration and opens the *Device properties dialog* for the reconstructed device.

Once created, the new device is no longer linked to the device from which it has been reconstructed. It is an independent device with an independent device history.

Template assignment

If the device was assigned to a template when the history entry was created, and if that template still exists, and if the firmware version the device had when the history entry was created is equal to or newer than the current firmware version of the template, the template can be assigned to the reconstructed device:



If the template is assigned to the device, variables in the device are set to Inherited if their value (in the historic configuration) matches the value in the template (in its current state).

If the template uses the No override or May append permission, it may not be possible to reproduce the historic configuration exactly.

8.5 Report of changes

The report of changes allows it to obtain an overview how multiple devices have changed between two points in time. Select one or more devices in the **device overview table** and activate the **Generate Report of Changes to Device Configuration** option in the context menu. This opens the history reporting dialog.

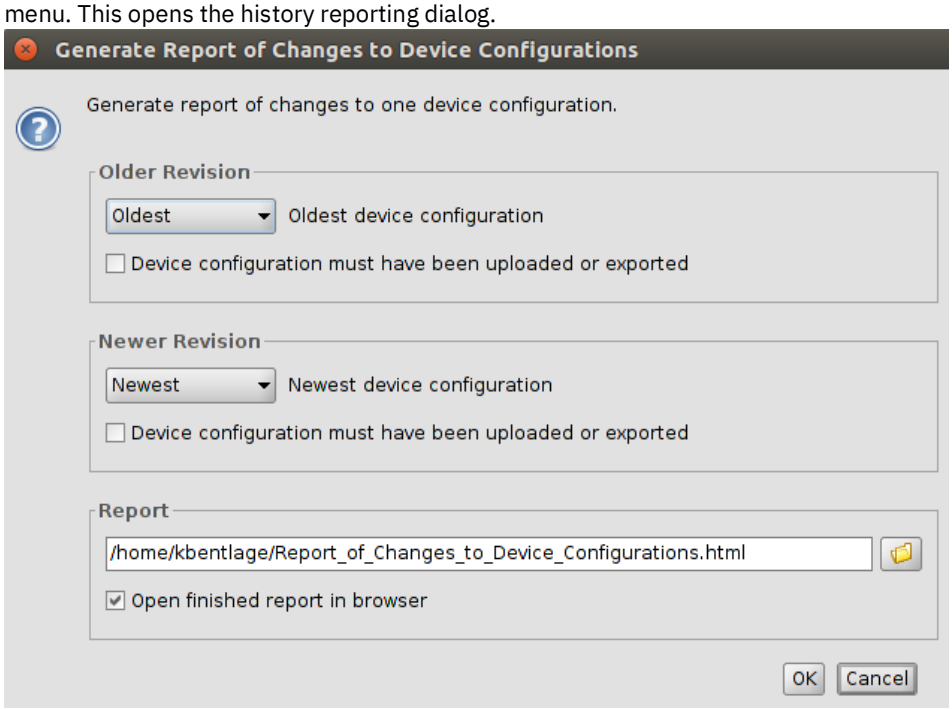


Figure 8-2 The dialog to generate a report of changes to device configurations

Selection criteria

The two historic configurations to compare are selected by applying two selection criteria, one to select the older revision and one to select the newer revision, to each selected device individually. The following criteria can be chosen:

Oldest

The oldest device configuration.

Newest

The newest device configuration.

Newest Before

The newest device configuration prior to a date and time. The date and time is specified as an ISO date (YYYY-MM-DD where YYYY is the year, MM is the month of the year between 01 and 12, and DD is the day of the month between 01 and 31) optionally followed by an ISO time (hh:mm:ss where hh is the hour according to the 24-hour timekeeping system, mm is the minute and ss is the second). For example, a quarter past 4 p.m. and 20 seconds on December 22nd, 2010 would be written as 2010-12-22 16:15:20.

Alternatively, click on the icon to select the date from a calender.

Device configuration must have been uploaded or exported

The criterion can be combined with the others. If the checkbox is checked, only history entries pertaining to configurations which have been uploaded to an mGuard or exported for pull configuration are considered.

Generating the report

The report consists of an HTML file which can be viewed with any web browser. The name of the file to which to write the report is specified in the Report field. If the Open finished Report in Browser checkbox is checked, mdm automatically opens a web browser and loads the report.

9 Creating and managing certificates

It is assumed that the reader has an extensive knowledge of certificates, certificate creating and public key encryption.

Create certificates only if you are sure to master the certificate creation.

This chapter explains the usage of *OpenSSL* to create certificates.

It is important to note that mdm requires two different types of certificates and keys:

– Certificates and keys used to secure the communication between the mdm components
– Certificates and keys used for the PKI

How to create certificates and keys to be used for the SSL communication is explained in Chapter 9.1. The certificates and keys used in a PKI are described in Chapter 9.2.

Please note that the process described in this section to create certificates is just one example of the usage of OpenSSL. There are also alternative ways to create your certificates. If you are not familiar with *OpenSSL* you should *exactly* follow the instructions below.

For security reasons, the use of current and up to date OpenSSL versions (at least version 3 or later) is generally recommended.

Keystores

Certificates and keys are stored in databases called keystores. A keystore is a file, containing the certificates and keys in encrypted form. To access the information in a keystore a passphrase is required. Keystores can have different formats, common formats are e.g. PKCS#12 or the proprietary Java KeyStore format (JKS). The encryption algorithm can usually be selected when creating the keystore. AES256 is recommended.

The *OpenSSL* configuration file

OpenSSL uses default values specified in the configuration file *openssl.cnf* (the directory where this file is located depends on your distribution, e.g. check in the directory */usr/ssl* or */usr/lib/ssl*).

If you omit mandatory arguments of a command, OpenSSL uses the default settings defined in the configuration file. If possible, all mandatory arguments for the example commands below are explicitly stated, i.e. if you use the commands as described below the important information is taken from the command line and not from the configuration file. If the configuration file is required for the respective command it is explicitly mentioned in the text.

For further information about the syntax and content of the configuration files, please refer to OpenSSL's documentation, particularly to the manual pages genrsa(1ssl), req(1ssl), ca(1ssl) and openssl(1ssl).

9.1 Certificates and keys for SSL

To set up a secure connection between entities (e.g. ET1, ET2) usually the following components are required:

– a private key for each entity participating in the communication:
  – $ET1_{key}$
  – $ET2_{key}$

The term *private key* already implies that it is important to keep these keys private and store them at a location only accessible to the administrator.

– and the corresponding certificates:
  – $ET1_{cert}$
  – $ET2_{cert}$

  The certificates contain among other information
  – the public key of the entity
  – information about the entity, e.g. the name and/or the IP address
  – further information about the certificate, e.g. the intended usage

  The certificate is either digitally signed with the private key of the respective entity (self-signed) or with a CA key.

  The certificates are public and can be distributed to anyone participating in the communication.

ET1 will use the public key contained in $ET2_{cert}$ to encrypt the data sent to ET2. This assures that only ET2 is able to decrypt the data. If $ET2_{cert}$ is self-signed it is assured that public key contained in $ET2_{cert}$ corresponds to $ET2_{key}$. If $ET2_{cert}$ is signed by a CA it is assured that the public key contained in $ET2_{cert}$ really belongs to ET2 (authentication).

Create the private key

ET_{key} has to be created first using the following command:

```
openssl genrsa -aes256 -passout pass:yourSSLPW -out privkey.pem
2048
```

Explanation of the arguments:

Argument	Explanation
genrsa	*genrsa* instructs *OpenSSL* to generate an RSA key.
-aes256	Use AES256 to encrypt the key.
-passout pass:*password*	The password used to encrypt the private key (in the example: *yourSSLPW)*. *yourSSLPW* is just an example and should be replaced by a secure password.
-out *filename*	Name of the file containing ET_{key} (in the example: *privkey.pem*).
2048	The length of the key.

The command above generates one output file: ***privkey.pem***

This file contains ET_{key} in PEM format. The key is encrypted with the AES256-algorithm. To access the key you have to know the passphrase specified above (in the example: *yourSSLPW*). Please use your own, secure password to encrypt the private key.

Sometimes it is necessary to create an unencrypted key. In this case just omit the *-aes256* and the *-passout* option in the command above.

Create the certificate

The certificate is created with the following command:

```
openssl req -batch -new -x509 -key privkey.pem -keyform PEM
-passin pass:yourSSLPW -sha256 -outform PEM -out serverCert.pem
```

Explanation of the arguments:

Argument	Explanation
req	*req* instructs *OpenSSL* to generate a certificate request (default) or a certificate.
-batch	Non interactive mode.
-new	Create a new request or a new certificate.
-x509	Create a self signed certificate instead of a certificate request.
-key *filename*	The corresponding private key (in the example: *privkey.pem*).
-keyform PEM	The private key is in PEM format.
-passin pass*:password*	Password required to decrypt the private key (in the example: *yourSSLPW*).
-sha256	Use the SHA256 algorithm to create the message digest for the signature (recommended).
-outform PEM	The format of the output file is PEM.
-out *filename*	The name of the output file, i.e. the certificate (in the example *serverCert.pem*).

The command above generates one output file: ***serverCert.pem***

This file contains the self-signed certificate ET_{cert}.

Create a keystore

The keys and certificates have to be included in keystores. The mdm VA contains the (proprietary) java tool *ImportKey* in the */etc/mdm/mdm-ca/demoCA* directory which can be used to create and manage keystores. Please copy the file *ImportKey.class* to your working directory.

First ET_{key} has to be converted to PKCS#8 format and both ET_{key} and ET_{cert} have to be included in a keystore. In the example, Java KeyStore format (JKS) is used. This can be accomplished with the tool *ImportKey*. *ImportKey* does accept the (unencrypted) key on standard input only, therefore the output of the *pkcs8* command has to be piped as follows:

```
openssl pkcs8 -topk8 -in privkey.pem -passin pass:yourSSLPW
-inform PEM -nocrypt -outform DER |java -cp . ImportKey
-alias yourAlias -storetype JKS -keystore serverKeystore.jks
-storepass pass:yourSSLPW -keypass pass:yourSSLPW
-chain serverCert.pem
```

Explanation of the ***openssl*** arguments:

Argument	Explanation
pkcs8	The *pkcs8* command is used to process private keys in PKCS#8 format.
-topk8	Use a traditional format private key as input and write a key in PKCS#8 format key.
-in *filename*	The name and the location of the input file (in the example: *privkey.pem*).
-passin pass:*password*	Password required to decrypt the input (in the example: *yourSSLPW*).
-inform PEM	The input format of the key is PEM.
-nocrypt	The output (the key) is not encrypted.
-outform DER	The ouput format is DER.

Explanation of the ***ImportKey*** arguments:

Argument	Explanation
-alias *name*	A keystore can contain multiple entries. The alias identifies the entry and therefore has to be unique in the keystore. Aliases are case-insensitive.
-keystore *filename*	The file containing the keystore (in the example: *serverKeyStore.jks*).
-storetype JKS	Use JKS as format for the keystore.
-storepass pass:*password*	Password required to decrypt the contents of the keystore (in the example: *yourSSLPW*).
-keypass pass:*password*	Additional password required to decrypt the private key in the keystore.
-chain *filename*	The certificate (in the example *serverCert.pem*).

The command above generates one output file: ***serverKeyStore.jks***

This is the keystore containing the certificate and the private key.

Import a certificate

After creating the keystore it is sometimes necessary to import additional certificates into the keystore. This can be accomplished by using the following command:

```
java -cp . ImportKey -alias yourAlias -storetype JKS
-file additionalCertificate.pem -storepass pass:yourSSLPW
-keystore serverKeystore.jks
```

Explanation of the ***ImportKey*** arguments:

Argument	Explanation
-alias *name*	A keystore can contain multiple entries. The alias identifies the entry and therefore has to be unique in the keystore. Aliases are case-insensitive.
-keystore *filename*	The file containing the keystore (in the example: *serverKeyStore.jks*).
-storetype JKS	The format for the keystore.
-storepass pass:*password*	Password required to decrypt the contents of the keystore (in the example: *yourSSLPW*).
-file *filename*	The certificate to be imported (in the example *additionalCertificate.pem*).

9.2 Certificates and keys for a PKI

When rolling out a Private Key Infrastructure (PKI), which is basically your intent when using the mdm CA, there are more requirements to be taken into account than mentioned in the previous chapter. This chapter first describes some of the PKI basics and then the usage of *OpenSSL* to roll out a PKI.

Please note that the certificates described in this section are not used for SSL.

Please note that the certificates and keys described in this section are not stored in the SSL-keystore of the mdm CA, but in the CA-keystore.

PKI basics

Among others the main reasons for using a PKI are:

– **Authentication**

  When communicating using data networks it is in most cases not possible to “see” the entity on the remote side (exception: video telephony), i.e. one cannot be sure that the entity on the remote side is the one it claims to be. The usage of a PKI assures the authenticity of the entities communicating with each other.

– **Data confidentiality**

  This is the reason VPNs are used to exchange data: The data packets are sent “in the public” (Internet), but unauthorized entities are prevented from accessing the information contained in the packets.

– **Data integrity**

  The assurance that the information received is identical to the information sent by the other entity. This prevents information to be altered by an entity “in the middle” which is not authorized to participate in the communication.

It is beyond the scope of this document to describe all components and their interactions involved in a complete PKI, therefore only the most important are mentioned here:

– **Certificates and private keys**

  Certificates are the means in a PKI to assure authentication. The identity of the certificate owner is approved by a CA by signing the certificate request of the respective owner. The public and private keys are used to encrypt/decrypt data and therefore assure data confidentiality.

– **Certification Authority (CA)**

  A *Certification Authority* is a component in a PKI which assures authenticity of the participating entities by signing certificate requests (i.e. issuing certificates). Usually there are multiple CAs in a PKI organized in a hierarchical structure with one root CA at the top.

– **CRL Distribution Points (CDP)**

  See the following section *Certificate extensions*.

– **Entities communicating with each other**

  The entities using a PKI use certificates to authenticate themselves and use the public/private key pairs to encrypt/decrypt the exchanged data. The entities request certificates from the CA. Usually a *Registration Authority* (RA) is also part of a PKI. The RA is responsible for the initial registration of entities that would like to use the PKI. An RA is not required in the mdm usage scenario.

Contents of a certificate

As mentioned in the previous chapter a certificate contains the following information:

– the public key of the entity

– information about the entity, e.g. the name and/or the IP address
– further information, e.g. about the certificate and the infrastructure

The following sections explain the contents in more detail.

The Subject Distinguished Name

The *Subject Distinguished Name* is a unique identifier of the certificate and its owner. It is composed of several components:

Abbreviation	Name	Explanation
CN	Common Name	Identifies the person or object owning the certificate. For example: CN=server1
E	E-mail Address	Identifies the e-mail address of the owner.
OU	Organizational Unit	Identifies a unit within the organization. For example: OU=Research&Development
O	Organization	Identifies the organization. For example: O=Innominate
L	Locality	Identifies the place where the entity resides. The locality can e.g. be a city: L=Berlin
ST	State	Identifies the state. For example: ST=Berlin
C	Country	Two letter code identifying the country. For example: C=DE (for Germany)

Depending on your policy, not all of the components are mandatory, but if the extension *Subject Alternative Name* is not included in the certificate, at least one component that can be used as identifier has to be included, typically this is the *Common Name* (CN). Please note that currently the mdm CA cannot handle certificates with *Subject Alternative Name* extensions.

Certificate extensions

Information about the certificate or the infrastructure is contained in the so called certificate extensions. Basically anyone can define its own extensions, but the standard extensions (X.509version3) are defined in RFC 3280 *Internet X.509 Public Key Infrastructure - Certificate and CRL Profile*. Here is a short description of the extensions that are important for the mdm CA:

– **Critical Bit**

  The *Critical Bit* is not an extension but used to force the usage of extensions in the certificate. The *Critical Bit* can be set for any extensions in the certificate. Applications verifying a certificate must be able to interpret an extension with the *Critical Bit*. If the application is not able to interpret the extension, the certificate must be rejected.

– **Basic Constraints**

  The *Basic Constraints* extension is used to indicate whether the certificate is a CA certificate or not. *Basic Constraints* consists of 2 fields:
  – *cA* field of type BOOLEAN and
  – *pathLenConstraint* field (optional) of type INTEGER

  For CA certificates the *cA* field must be set to *true*. *pathLenConstraint* is only used if the *cA* field is set to true and specifies the number of CA levels allowed below this certificate. *Basic Constraints* should be always marked as critical.
  Please refer to Chapter 9.2.3 for requirements regarding the *Basic Constraints* extension.

– **Key Usage**

  Key Usage controls the intended use of the certificate's corresponding keys. A key can be e.g. used to sign Certificate Revocation Lists (CRL), encrypt data or to sign certificates.
  Please refer to Chapter 9.2.3 for requirements regarding the *Key Usage* extension.

– **Subject Alternative Name**

  The extension *Subject Alternative Name* can be used to add more identifiers to the certificate. *Subject Alternative Name* can contain e.g. e-mail addresses, domain names etc. It can be used as substitute for the *Subject* as well, which must be empty in this case. Please note that the mdm CA is currently not able to handle *Subject Alternative Name* extensions.

– **CRL Distribution Points (CDP)**

  Certificates can be revoked, e.g. if a private key was compromised or if it is no longer valid. Usually an application has to check whether a certificate is still valid, by checking the validity period and/or by retrieving revocation information from a CRL distribution point (CDP). To retrieve the information either *Certificate Revocation Lists* (CRL) can be used or a dedicated protocol like OCSP. However, the certificate should contain the information, which CDP should be contacted.

– **Authority Information Access**

  Authority Information Access is not an X.509 standard extension, but an extension defined by the PKIX working group (http://www.ietf.org/html.charters/pkix-charter.html). *Authority Information Access* contains information about the issuing CA, e.g. policies, further root certificates or where to retrieve the higher certificates in the chain, if the complete chain is not contained in the certificate.
  Depending on the settings of these extensions the receiver (not the owner) of a certificate accepts or denies the communication with the peer, thus preventing any misuse of certificates and creating a higher level of security.

9.2.1 Create the CA certificates

Depending on your existing infrastructure the mdm CA needs the following certificates:

– A self-signed root certificate ($CA_{rootCert}$) and the matching private key ($CA_{rootKey}$).
  If you have another upstream (root) CA in place, there is no need to generate the root certificate and the matching private key.
  The (self-signed) root certificate is distributed to all entities participating in the communication. It is used by the entities to verify the authenticity of the communication peer and of any intermediate CAs in the certificate chain. The private key $CA_{rootKey}$ is used to sign the self-signed root certificate.

– A CA certificate (CA_{cert}) and the matching private key (CA_{key}). This is the certificate used by the CA to authenticate itself to other entities. This certificate has to be signed with the root private key, i.e. either with $CA_{rootKey}$ or with the key of your existing root CA. The private key CA_{key} is used to sign the certificate request sent by the mdm server, i.e. it is used to issue certificates for the mGuards.
– A template certificate ($CA_{templCert}$) which is used by the CA as template when issuing end entity (mGuard) certificates.

Figure 9-1 shows the certificate hierarchy:

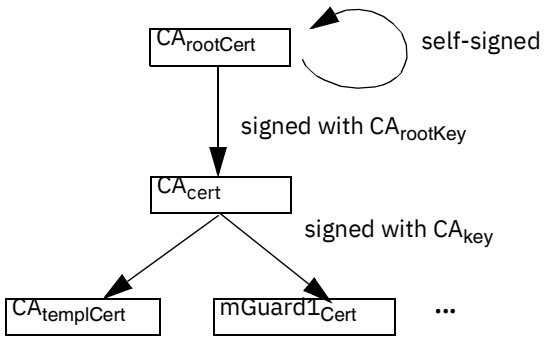


Figure 9-1 mdm CA certificate hierarchy

In the following it is assumed that there is no other root CA in place and that the mdm CA is used as root CA.

Important: Please keep the private key(s) at a secure location. In particular this is required for the root CA's private key.

It is recommended to create a working directory, e.g. called *security* in the mdm installation directory, where all the certificates and keys created during the following process are located.

Create the root certificate

The following *OpenSSL* commands require input from the *OpenSSL* configuration file *openssl.cnf* (the directory where this file is located depends on your distribution, e.g. check in the directory */usr/ssl* or */usr/lib/ssl*). Instead of changing the standard configuration file of your *OpenSSL* installation, it is recommend to use the example configuration files provided in the mdm VA in the directory */etc/mdm/mdm-ca* and adapt those files to your needs. You can instruct *OpenSSL* to use the provided configuration files instead of the standard configuration file.

Adapt the OpenSSL configuration file

Please copy the file *rootCert.conf* provided in the directory */etc/mdm/mdm-ca/demoCA* in the mdm VA to your working directory. Adapt the `[ root_dn ]` section of the file, which contains the *Subject Distinguished Name* of your root CA certificate:

```
[ root_dn ]
C= DE
O= Innominate Security Technologies AG
OU= Research & Development
CN= Test Root CA
```

Please note also the `[ root_ext ]` section of the configuration file, which is important for the proper generation of the root certificate (please refer to Section *Certificate extensions* for an explanation):

```
[ root_ext ]
keyUsage= cRLSign, keyCertSign
basicConstraints= critical, CA:true, pathlen:1
```

Generate the private key

$CA_{rootKey}$ has to be created first using the following command:

```
openssl genrsa -aes256 -passout pass:rootPW
-out rootKey.pem 2048
```

Explanation of the arguments:

Argument	Explanation
genrsa	*genrsa* instructs *OpenSSL* to generate an RSA key.
-aes256	Use AES256 to encrypt the key.
-passout pass:*password*	The password used to encrypt the private key (in the example: *rootPW*). *rootPW* is just an example and should be replaced by a secure password.
-out *filename*	Name of the file containing $CA_{rootKey}$ (in the example: *rootKey.pem*).
2048	The length of the key.

The command above generates one output file: ***rootKey.pem***

This file contains $CA_{rootKey}$ in PEM format. The key is encrypted with the AES256-algorithm. To access the key you have to know the passphrase specified above (in the example: *rootPW*). Please use your own, secure password to encrypt the private key.

Generate the root certificate

The OpenSSL command used to generate $CA_{rootCert}$ is:

```
openssl req -batch -new -config rootCert.conf -x509
-key rootKey.pem-keyform PEM -passin pass:rootPW-sha256 -days
5479 -outform PEM -out rootCert.pem
```

Explanation of the arguments:

Argument	Explanation
req	*req* instructs *OpenSSL* to generate a certificate request (default) or a certificate.
-batch	Non interactive mode.
-new	Create a new request or a new certificate.

Argument	Explanation
-config *filename*	The name and the location of the openssl configuration file (in the example: *rootCert.conf*).
-x509	Create a self signed certificate instead of a certificate request.
-key *filename*	The corresponding private key (in the example: *rootKey.pem*).
-keyform PEM	The private key is in PEM format.
-passin pass:*password*	Password required to decrypt the private key (in the example: *rootPW*).
-sha256	Use the SHA256 algorithm to create the message digest for the signature (recommended).
-days *5479*	The period for which the certificate will be valid.
-outform PEM	The format of the output file is PEM.
-out *filename*	The name of the output file, i.e. the certificate (in the example *rootCert.pem*).

The command above generates one output file: ***rootCert.pem***

This file contains the self-signed root certificate $CA_{rootCert}$.

Create the CA certificate

The intermediate CA certificate CA_{cert} is not self-signed but will be issued (signed) by the root CA. Therefore you first have to create a private key and a corresponding certificate request and then “send” this certificate request to the root CA. The root CA will in return issue CA_{cert}.

First the configuration file has to be adapted to your needs, as described in the previous section.

Adapt the OpenSSL configuration file and the environment

Please copy the file *caCert.conf* contained in the directory */etc/mdm/mdm-ca/demoCA* in the mdm VA to your working directory. Adapt the [ca_dn] section of the file, which contains the *Subject Distinguished Name* of your root CA certificate:

```
[ ca_dn ]
C= DE
O= Innominate Security Technologies AG
OU= Research & Development
CN= Test CA
```

Please adapt also entries `crlDistributionPoints` and `authorityInfoAccess` of the [ca_ext] section of the configuration file (please refer to Section *Certificate extensions* for an explanation):

```
[ ca_ext ]
```

```
crlDistributionPoints=URI:http://ca.example.com/ca-ca.crl
authorityInfoAccess=OCSP;URI:http://ca.example.com/ocsp/ca-ca
```

The configuration file contains some parameters, which cannot be entered on the command line. The entries specify files that *have* to be present in the file system. Therefore the files have to be created manually first (the filenames are also used in the configuration file *caCert.conf* , therefore please use exactly the file names as stated below):

– Create a subdirectory *archive* in your working directory
(Linux: `mkdir ./archive`)
– Create a file named *serial* containing a valid serial number for the certificate in the subdirectory *archive*
(Linux: `echo 1234 > archive/serial`)
– Create an empty file to be used as openssl database.
(Linux: `touch archive/index.txt`
Windows: `copy NUL: archive/index.txt`)

Generate a private key

The private key CA_{key} has to be created first using the following command:

```
openssl genrsa -aes256 -passout pass:caPW -out caKey.pem 2048
```

Explanation of the arguments:

Argument	Explanation
genrsa	*genrsa* instructs *OpenSSL* to generate an RSA key.
-aes256	Use AES256 to encrypt the key.
-passout pass:*password*	The password used to encrypt the private key (in the example: *caPW*). *caPW* is just an example and should be replaced by a secure password.
-out *filename*	Name of the file containing the private key (in the example: *caKey.pem*).
2048	The length of the key.

This command generates one output file: ***caKey.pem***

This file contains CA_{key} in PEM format. The key is encrypted with the AES256-algorithm. To access the key you have to know the passphrase specified above (in the example: *caPW*). Please use your own, secure password to encrypt the private key.

Generate a certificate request

To create a certificate request enter the following command:

```
openssl req -batch -new -config caCert.conf
-key caKey.pem -keyform PEM -passin pass:caPW -sha256
-out caCertReq.pem -outform PEM
```

Explanation of the arguments:

Argument	Explanation
req	*req* instructs *OpenSSL* to generate a certificate request (default) or a certificate.
-batch	Non interactive mode.
-new	Create a new request.
-config *filename*	The name and the location of the openssl configuration file (in the example: *caCert.conf*).
-key *filename*	The corresponding private key (in the example: *caKey.pem*).
-keyform PEM	The private key is in PEM format.
-passin pass:*password*	Password required to decrypt the private key (in the example: *caPW*).
-sha256	Use the SHA256 algorithm to create the message digest for the signature (recommended).
-outform PEM	The format of the output file is PEM.
-out *filename*	The name of the output file, i.e. the certificate (in the example *caCertReq.pem*).

The command above generates one output file: ***caCertReq.pem***

This file contains the certificate request.

Request the CA certificate

The request has to be sent to the root CA. Since the mdm CA is the root CA in the example you can issue the certificate with the following command:

```
openssl ca -batch -config caCert.conf -days 3653
-in caCertReq.pem -cert rootCert.pem -keyfile rootKey.pem
-passin pass:rootPW-md sha256 -notext -out caCert.pem
-outdir .
```

Explanation of the arguments:

Argument	Explanation
ca	The *ca* command is a minimal CA application. It can be used to sign certificate requests and generate CRLs.
-batch	Non interactive mode.

Argument	Explanation
-config *filename*	The name and the location of the openssl configuration file (in the example: *caCert.conf*).
-days *3653*	The period for which the certificate will be valid.
-in *filename*	The name of the file containing the certificate request (in the example: *caCertReq.pem*).
-cert *filename*	The name of the file containing the root certificate (in the example: *rootCert.pem*).
-keyfile *filename*	The name of the file containing the key used to sign the certificate request (in the example: *rootKey.pem*).
-passin pass:*password*	Password required to decrypt the private key (in the example: *rootPW*).
-md sha256	Use the SHA256 algorithm to create the message digest for the signature (recommended).
-notext	*openssl* has an option to include human readable, explanatory text in the certificate. But this would create problems later in the process when creating the keystores, therefore do not include any text in the certificate.
-outdir *directoryName*	The output directory (in the example the current working directory “.”).

The command above generates one output file: ***caCert.pem***

This file contains CA_{cert}.

The file *caCertReq.pem* is not required any more and should be deleted.

Create a certificate template

The purpose of the CA is to issue certificates. To do so the CA needs instructions how the certificates to be issued should look like, e.g. which extensions should be included. This can be accomplished by providing the CA with a certificate template ($CA_{templCert}$). $CA_{templCert}$ is a certificate issued by the CA. To issue a certificate you first have to adapt an OpenSSL configuration file again.

Adapt the OpenSSL configuration file

Please copy the file *templateCert.conf* contained in the directory */etc/mdm/mdm-ca/demoCA* in the mdm VA to your working directory. Adapt the entries `crlDistributionPoints` and `authorityInfoAccess` of the [template_ext] section of the configuration file (please refer to Section *Certificate extensions* for an explanation):

```
[ template_ext ]
crlDistributionPoints=URI:http://ca.example.com/ca-ee.crl
```

```
authorityInfoAccess=OCSP;URI:http://ca.example.com/ocsp/ca-ee
```

Please note that the configuration file *templateCert.conf* expects files to be existent that have to be manually created. (see previous section *Create the CA certificate*, subsection *Adapt the OpenSSL configuration file and the environment*).

Generate a private key

The private key has to be created first using the following command:

```
openssl genrsa -aes256 -passout pass:caPW -out templateKey.pem
2048
```

Explanation of the arguments:

Argument	Explanation
genrsa	*genrsa* instructs *OpenSSL* to generate an RSA key.
-aes256	Use AES256 to encrypt the key.
-passout pass:*password*	The password used to encrypt the private key (in the example: *caPW*). *caPW* is just an example and should be replaced by a secure password.
-out *filename*	Name of the file containing the private key (in the example: *templateKey.pem*).
2048	The length of the key.

This command generates one output file: ***templateKey.pem***

This file contains the encrypted private key.

Generate a certificate request

To create a certificate request enter the following command:

```
openssl req -new -batch -config templateCert.conf
-key templateKey.pem -keyform PEM -passin pass:caPW
-sha256 -outform PEM -out templateCertReq.pem
```

Explanation of the arguments:

Argument	Explanation
req	*req* instructs *OpenSSL* to generate a certificate request (default) or a certificate.
-batch	Non interactive mode.
-new	Create a new request or a new certificate.
-config *filename*	The name and the location of the openssl configuration file (in the example: *templateCert.conf*).

Argument	Explanation
-key *filename*	The corresponding private key (in the example: *templateKey.pem*).
-keyform PEM	The private key is in PEM format.
-passin pass:*password*	Password required to decrypt the private key (in the example: *caPW*).
-sha256	Use the SHA256 algorithm to create the message digest for the signature (recommended).
-outform PEM	The format of the output file is PEM.
-out *filename*	The name of the output file, i.e. the certificate (in the example *templateCertReq.pem*).

The command above generates one output file: ***templateCertReq.pem***

This file contains the certificate request.

Request the template certificate

The request has to be sent to the (intermediate) CA. You can sign the certificate request (issue the certificate) with the following command:

```
openssl ca -batch -config templateCert.conf -days 1826
-md sha256 -in templateCertReq.pem -keyfile caKey.pem
-cert caCert.pem -passin pass:caPW -notext
-out templateCert.pem -outdir .
```

Explanation of the arguments:

Argument	Explanation
ca	The *ca* command is a minimal CA application. It can be used to sign certificate requests and generate CRLs.
-batch	Non interactive mode.
-config *filename*	The name and the location of the openssl configuration file (in the example: *templateCert.conf*).
-days *1826*	The period for which the certificate will be valid.
-in *filename*	The name of the file containing the certificate request (in the example: *templateCertReq.pem*).
-cert *filename*	The name of the file containing the root certificate (in the example: *caCert.pem*).

Argument	Explanation
-keyfile *filename*	The name of the file containing the key used to sign the certificate request (in the example: *caKey.pem*).
-passin pass:*password*	Password required to decrypt the private key (in the example: *caPW*).
-md sha256	Use the SHA256 algorithm to create the message digest for the signature (recommended).
-notext	*openssl* has an option to include human readable, explanatory text in the certificate. But this would create problems later in the process when creating the keystores, therefore do not include any text in the certificate.
-outdir *directoryName*	The output directory (in the example the current working directory ".").

The command above generates one output file: ***templateCert.pem***

This file contains $CA_{templCert}$. The file should be copied to its final destination, the location must be configured in *ca-preferences.xml* in the node *certificateFactory » certTemplate.*

The files *templateCertReq.pem* and *templateKey.pem* are not needed any more and should be deleted.

9.2.2 Create the keystores

After following the steps described in Chapter 9.2.1 you should find the following files in your working directory:

- ***templateCert.pem***
  This file contains $CA_{templCert}$, signed with CA_{key}.
- ***caCert.pem***
  This file contains CA_{cert}, signed with$CA_{rootKey}$.
- ***caKey.pem***
  This file contains CA_{key}.
- ***rootCert.pem***
  This file contains the self-signed root certificate $CA_{rootCert}$.
- ***rootKey.pem***
  This file contains the encrypted private root key $CA_{rootKey}$.

Some of those files have to be included in keystores. The mdm VA contains the (proprietary) java tool *ImportKey* in the directory */etc/mdm/mdm-ca/demoCA* which can be used to create and manage keystores. Please copy the file *ImportKey.class* to your working directory.

First the intermediate CA certificate and the root certificate have to be merged into one file (create a certificate chain):

```
cat caCert.pem rootCert.pem > caCertWithChain.pem
```

Then the key *caKey.pem* has to be converted to PKCS#8 format and both CA_{key} and the certificate chain have to be included in a PKCS#12 keystore. This can be accomplished with the tool *ImportKey*. *ImportKey* does accept the (unencrypted) key on standard input only, therefore the output of the *pkcs8* command has to be piped as follows:

```
openssl pkcs8 -topk8 -in caKey.pem -passin pass:caPW
-inform PEM -nocrypt -outform DER |
java -cp . ImportKey -alias ca -keystore ca-keystore.jks -
storetype JKS -storepass pass:caPW -keypass pass:caPW
-chain caCertWithChain.pem
```

Explanation of the ***openssl*** arguments:

Argument	Explanation
pkcs8	The *pkcs8* command is used to process private keys in PKCS#8 format.
-topk8	Use a traditional format private key as input and write a key in PKCS#8 format key.
-in *filename*	The name and the location of the input file (in the example: *caKey.pem*).
-passin pass:*password*	Password required to decrypt the input (in the example: *caPW*).
-inform PEM	The input format of the key is PEM.
-nocrypt	The output (the key) is not encrypted.
-outform DER	The output format is DER.

Explanation of the ***ImportKey*** arguments:

Argument	Explanation
-alias *name*	A keystore can contain multiple entries. The alias identifies the entry and therefore has to be unique in the keystore. Aliases are case-insensitive.
-keystore *filename*	The file containing the keystore (in the example: *ca-keystore.jks*).
-storetype JKS	Use JKS as format for the keystore.
-storepass pass:*password*	Password required to decrypt the contents of the keystore (in the example: *caPW*).
-keypass pass:*password*	Additional password required to decrypt the private key in the keystore.
-chain *filename*	The certificate chain including the root certificate.

The command above generates one output file: ***ca-keystore.jks***

This is the keystore for your CA containing the certificate chain and the private CA key. Please copy the keystore to its final destination.

- The filename including the absolute or relative path of this keystore has to be configured in the *ca-preferences.xml* file in the node *certificateFactory » keyStore*.
- The password to access the keystore (in the example *caPW*) has to be configured in the *ca-preferences.xml* file in the node *certificateFactory » keyStorePassword*.
- The format of this keystore (Java KeyStore – JKS) has to be configured in the *ca-preferences.xml* file in the node *certificateFactory » keyStoreType.*
- The password to access the private key (in the example *caPW*) has to be configured in the *ca-preferences.xml* file in the node *certificateFactory » keyPassword.*
- The alias (*ca*) of the key has to be configured in the *ca-preferences.xml* file in the node *certificateFactory » keyAlias.*

The file *caCertWithChain.pem* is not needed any more and should be deleted.

9.2.3 Requirements for certificates

For proper function of the VPN certificates also with future versions of the mGuard firmware and the mdm, the certificates have to satisfy the following requirements:

1. The private key should have a length of at least 1024 bits. Phoenix Contact recommends a key length of 2048 bits for long term security.
2. Any certificate must conform to RFC 3280.
3. Any CA certificate must contain a *Basic Constraints* extension marked as critical and with the boolean *cA* field set to *true*.
4. Phoenix Contact strongly recommends to include the *pathLenConstraint* field in any CA certificate's *Basic Constraints* extension. It must be set to one less than the number of descendant CA certificates. So for a typical scenario where a certification chain is made up of one root CA certificate, a single intermediate CA certificate and an end entity certificate (VPN certificate in this case), the *pathLenConstraint* must be one (1) for the root CA certificate and zero for the intermediate CA certificate.
5. The template VPN certificate must have a *Basic Constraints* extension marked as critical with the boolean *cA* field set to *false* and without a *pathLenConstraint* field.
6. Any CA certificate must contain a *Key Usage* extension marked as critical with the bit *keyCertSign* set. It is recommended to have the bit *cRLSign* set as well.
7. The template VPN certificate does not need to contain any *Key Usage* extension.
8. Any intermediate CA certificate must contain one or both of the extensions *CRL Distribution Points* and *Authority Information Access*, if it is planned to distribute revocation information online with a future release of the mdm and the mGuard firmware. The extensions must be marked as non-critical. The former extension is required if it is intended to use Certificate Revocation Lists (CRLs) in the future. The latter extension is required if it is intended to use the Online Certificate Status Protocol (OCSP, see RFC 2560) in the future. Any of the extensions must contain HTTP URLs only.
9. The template VPN certificate should contain one or both of the extensions *CRL Distribution Points* and *Authority Information Access, described above,* if it is planned to distribute revocation information online in the future. Alternatively, the mdm server can be instructed to include them within the certification request sent to the mdm CA. The latter is more flexible, because this way the location of the revocation information (CRL) respectively information service (OCSP) can be set for groups of devices

or even for individual devices.
Please note: If the template VPN certificate already includes any of the extension and the mdm is instructed to include it within the certification request as well, the extension from the request overrides the one found within the template. The issued certificate will contain the extension copied from the request.

10. The keystore containing the certificates has to contain the complete certificate chain up to and including the root certificate.

10 Configure mdm server and mdm CA server

In order to operate properly, the mdm server requires an **XML preferences file** as a configuration file, which can be specified during server start-up (see "mdm server and mdm client" on page 15).

A default configuration file (*preferences.xml*) is contained in the mdm VA in the directory */etc/mdm/mdm-server*.

There are several passwords to be configured in the *preferences.xml* file. The respective keys accept the *ENV:VARNAME* pattern as value to take the password from the environment variable with name *VARNAME*. If you decide to use this pattern, please make sure that the respective environment variables are initialized *before* starting the server.

10.1 mdm server (*preferences.xml* file)

Node *com*

Default setting (do not change!)

node *innominate*

Default setting (do not change!)

node *innomms*

Default setting (do not change!)

node *is*

Key *expertMode*

If set to true, some unsupported configuration variables which are normally hidden are made available in the Device and *Template properties dialog* (default: false). Additionally, the mGuards are configured such that unsupported configuration variables become visible in their web interfaces. **Please do not change this value!**

Key *defaultAdminPassword*

The password of the *admin* user on newly created mGuards (default: *mGuard*). The default value corresponds to the mGuard factory default. If mGuard devices are pre-configured before they are used with mdm, a different default *admin* password can be set and the database must be updated by the following command:

```
java -Xmx1024m -jar mdm-server-1.17.x.jar update preferences.xml
```

Key *defaultRootPassword*

The password of the *root* user on newly created mGuards (default: *root*). The default value corresponds to the mGuard factory default. If mGuard devices are pre-configured before they are used with mdm, a different default *root* password can be set and the database must be updated by the following command:

```
java -Xmx1024m -jar mdm-server-1.17.x.jar update preferences.xml
```

Node *license*

Key *licenseFile*

Name and path of the license file.

Node *device*

Node *licenseServer*

– **Key *proto***

The protocol to be used to access the license server (default: *http*). Please do not change this value.

- **Key *address***
  The address of the license server (default: *online.license.innominate.com*). Please do not change this value.
- **Key *port***
  The port to be used to access the license server (default: 80). Please do not change this value.
- **Key *reqPage***
  The CGI script to be called when requesting licenses (default: cgi-bin/autoreq.cgi). Please do not change this value.
- **Key *refPage***
  The CGI script to be called when refreshing licenses (default: cgi-bin/autorefresh.cgi). Please do not change this value.
- **Key *reqProfKey***
  The CGI script to be called when requesting profile keys (default: cgi-bin/autodevcert.cgi). Please do not change this value.
- **Key *reqUsername***
  The user name needed to request profile keys. Please contact Phoenix Contact support to obtain a user name.
- **Key *reqPassword***
  The password needed to request profile keys. Please contact Phoenix Contact support to obtain a user name.
- **Key *retries***
  The number of retries to contact the license server (default: 3). Please do not change this value.
- **Key *timeout***
  The timeout in seconds when contacting the license server (default: 60). Please do not change this value.

Node *connection*

- **Key *useProxy***
  Here you can configure whether a proxy should be used to contact the license server (default: *false*).
- **Key *proxyAddress***
  The address of the proxy to contact the license server (default: *127.0.0.1*).
- **Key *proxyPort***
  The port of the proxy to be used to access the license server (default: *3128*).
- **Key *proxyRequiresAuthentication***
  Boolean defining whether the proxy requires authentication (default: *false*).
- **Key *proxyAuthenticationUsername***
  Key *proxyAuthenticationPassword*
  Key *proxyAuthenticationRealm*
  The credentials to be used if the proxy requires authentication (default: empty).

Node *service*

Key *address*

The IP address designating the network interface on which the server is listening for client connections. If you specify *0.0.0.0,* the server is listening on all interfaces (default: *127.0.0.1*).

Key *port*

The port number on which the server is listening for client connections (default: *7001*).

Key *backlog*

Number of log entries to be stored (default: *50*).

Key *storage*

The storage to be used (default: *database*).

Node *security*

Key *keyStore*

Name and path of the keystore file.

Key *keyStoreType*

Format of the keystore, either *JKS* (Java KeyStore) or *PKCS12* (OpenSSL).

Key *keyStorePassword*

Password for the keystore file. The special value *ENV:PASSWORD_SSL* will cause the mdm server to read this password upon startup from the environment variable named *PASSWORD_SSL*; the name *PASSWORD_SSL* is just an example and can be changed if desired.

Key *trustStore*

Name and path of the truststore file.

Key *trustStoreType*

Format of the truststore, either *JKS* (Java KeyStore) or *PKCS12* (OpenSSL).

Key *trustStorePassword*

Password for the truststore file. The special value *ENV:PASSWORD_SSL* will cause the mdm server to read this password upon startup from the environment variable named *PASSWORD_SSL*; the name *PASSWORD_SSL* is just an example and can be changed if desired.

Node *session*

Key *maxInactiveInterval*

The maximum time interval of inactivity (in seconds) that the server will keep a session open between client accesses.
A negative or zero time (default) indicates a session should never time out.

Please note that this timeout will be reset only, if there is an interaction between client and server. Actions that are local to the client, i.e. scrolling in a table or changing between the device, template, pool, or VPN group tab will not reset the inactive timeout.

Key *maxConcurrentSessions*

The maximum number of concurrent sessions (= connected clients). A negative or zero count (default) indicates that the upper limit of the number of concurrent sessions is defined by the license.

Node *storage*

- **Node *database***
  - **Key *host***
    The IP address (or hostname) mdm should connect to to get access to the PostgreSQL database (default: *127.0.0.1*).
  - **Key *port***
    The port that mdm should use to connect to the database (default: *5432*).
  - **Key *name***
    The name of the database (default: *innomms*).
  - **Key *user***
    The user of the database (default: *innomms).*
  - **Key *password***
    The password to be used to connect to the database (default: *ENV:PASSWORD_DB).*The special value *ENV:PASSWORD_DB* will cause the mdm server to read this password upon startup from the environment variable named *PASSWORD_DB*; the name *PASSWORD_DB* is just an example and can be changed if desired.

    Please make sure that the values for *port*, *name*, *user* and *password* match the values you specified during the PostgreSQL installation.

  - **Key *ssl***
    Enable/disable secure connection between the mdm server and the PostgreSQL server. Please note that enabling this option requires additional installation steps (default: *false).*

- **Node *update***
  - **Node *scheduler***
    - **Key *tries***
      Maximum number of attempts for an upload or export of a device configuration. If this maximum is reached, mdm will stop trying to upload a configuation to the device (default: *5*).
    - **Key *timeout***
      Maximum number of seconds until an upload of the device configuration is cancelled. After the timeout is reached, mdm will stop trying to upload a configuation to the device (default: *600*).
    - **Key *rescheduleDelay***
      Number of seconds between upload attempts (default: *45*).

  - **Node *firmwareUpgradeScheduler***
    - **Key *tries***
      Maximum number of connections mdm should attempt to get feedback from the device on the result of the firmware upgrade. If this maximum is reached, mdm will stop trying to contact the device (default: *5*).
    - **Key *timeout***
      Maximum number of seconds until mdm stops to contact a device for the result of a firmware upgrade. After the timeout is reached, mdm will indicate that the firmware upgrade failed (default: *3600*).
      Key *rescheduleDelay*
      Intervall in seconds between two attempts to obtain the result of a firmware upgrade from the device (default: *300*).

- **Node *ssh***
  - **Key *connectTimeout***
    Timeout for the initial SSH connect to a device (default: *60*).
  - **Key *socketTimeout***
    Timeout for the SSH connection TCP/IP socket, e.g. lost connection (default: *120*).
  - **Key *deadPeerDetectionTimeout***
    This timeout will get activated, if a device did not answer a command started on the device (default: *120*).

- **Node *pull***
  - **Node *export***

    Key *directory*
    The export base directory on the server where the configuration files should be exported to (e.g. for the configuration pull). Please note that the configuration files are always exported by the server and not the client, i.e. the client does not have any access to the files. The specified directory pathname should have the appropriate format of the respective OS (default: the default temporary directory of your installation, e.g. */tmp* for Linux).

    Key *filenames*
    A comma-separated list of naming schemes for pull configuration exports.
    dbid: A unique ID (automatically assigned) is used as filename and the files are written to the export base directory.
    serial: The serial number is used as filename and the files are written to the *serial/* subdirectory of the export base directory.
    mgntid: The Management ID is used as filename and the files are written to the *mgntid/* subdirectory of the export base directory (default: *dbid,serial,mgntid*).

  - **Node *feedback***

    Key *port*
    The mGuards can pull their configurations from an HTTPS server. Since the HTTPS server is a separate application, mdm does not get any direct feedback about the result of a configuration pull. To enable the feedback mechanism, mdm has to be configured as a Syslog server in the HTTPS server settings. mdm will then receive and analyze the HTTPS server syslog messages and display the result of configuration pulls in the client.
    It is recommend to use an unprivileged port (above 1024) so that the server can be run without administrator/root privileges (default: *7514*).

Node *auth*

Node *radius*

- **Key *numServers***
  Set this to the number of RADIUS servers to enable RADIUS authentication. Please refer to “User authentication” on page 110 for more detailed information. If set to 0, RADIUS authentication is disabled (default: 0).
- **Key *timeout***

The number of seconds that the mdm server waits for a reply from a RADIUS server. Only used if RADIUS authentication is enabled (default: 5).

– **Key *retries***
  The number of times that the mdm server sends requests to the RADIUS servers. If no reply is received within timeout seconds for retries times, the authentication request is considered failed. Only used if RADIUS authentication is enabled (default: 3).
– **Key *nasIdentifier***
  The NAS Identifier included in RADIUS requests sent by the mdm server. Some RADIUS servers ignore this, in which case the default value can be left unchanged (default: nas.identifier.example).

Nodes *0, 1, ...* (up to the number of RADIUS servers minus one)

Each numbered node identifies a single RADIUS server.

– **Key *host***
  The hostname or IP address of the RADIUS server (default: localhost).
– **Key *port***
  The port on which the RADIUS server listens for incoming requests (default: 1812).
– **Key *sharedSecret***
  The shared secret used to authenticate the RADIUS request. The same shared secret must be configured in the RADIUS server (default: secret).

Node *locale*

Country and language specific settings.

Leave the defaults, since these settings are not fully supported yet!

Key *language*
Key *country*
Key *variant*

Node *logging*

Node *syslog*

– **Key *numReceivers***
  Set this to the number of syslog receivers to which mdm sends log messages. If set to 0, logging via syslog is disabled (default: 1).
– **Key *logLevel***
  The minimum severity of the messages to log via syslog. Messages with a severity lower than the specified one are suppressed (default: INFO).
  The following severities can be used:
  – *SEVERE* (highest severity)
  – *WARNING*
  – *INFO*
  – *CONFIG*
  – *FINE*
  – *FINER*
  – *FINEST* (lowest severity)
– **Nodes *0, 1, ...*** (up to the number of syslog servers minus one)
  Each numbered node identifies a single syslog server.
  – **Key *host***
    The hostname or IP address of the syslog server (default: localhost).
  – **Key *port***

The port on which the syslog server listens for incoming log messages (default: 514).

Node *configurationHistory*

Key *expireAfterDays*

Configuration history entries older than the specified number of days are automatically expired (i.e. removed from the history).

If the value 0 is used, configuration history entries are never expired (default: 14).

The maximum value is 365250 (1000 years). If the value is < 0 or > 365250 or not an integer, the default value of 14 is assumed.

Please refer to "Configuration history" on page 119 for more detailed information on configuration history entries.

Node *event*

Key *cleanupDays*

Persistent event log entries older than the specified number of days are automatically expired (i.e. removed from the event log).

If the value 0 is used, *Persistent event log* entries are never expired (default: 200).

The maximum value is 365250 (1000 years). If the value is < 0 or > 365250 or not an integer, the default value of 200 is assumed.

Please refer to "Persistent Event Log" on page 25 for more detailed information on persistent event log entries.

Node *CA*

These settings are required only if a CA is used.

Key *type*

The type of CA to use. Valid values are mdm-CA to use the mdm CA or SCEP to communicate with a CA via SCEP (default: mdm-CA). Please refer to "Machine certificates" on page 111 for more detailed information on SCEP.

Key *protocol*

The protocol to be used to connect to the mdm CA. Valid values are http or https (default: *https*). When using the mdm CA, only *https* should be used since the mdm CA relies on transport layer security for authentication purposes. SCEP includes application layer authentication mechanisms, so http is usually used with SCEP.

Key *host*

The hostname or IP address of the CA server (default: *localhost*).

Key *port*

The port on which the CA server listens for incoming requests (default: *7070*). If 0 is specified, the https or http default port is used.

Key *requestDirectory*

The path within the URL the mdm server uses for certification requests (default: *request*). When using the mdm CA, request must be used. When using SCEP, consult the documentation of the CA server. If e.g. the Microsoft Windows Server 2008 CA is used, CertSrv/mscep/mscep.dll should be specified.

Key *revocationDirectory*

The path within the URL the mdm server uses for certificate revocation requests (default: *revoke*). When using the mdm CA, revoke must be used. Not applicable when SCEP is used.

Key *rsaKeySize*

The size (in bits) of the RSA modulus the mdm server uses to generate RSA key pairs (default: *2048*).

Node *SCEP*

– **Key *name***

  The instance name used in SCEP requests (default: mdm). Please note that some CAs ignore the instance name, but still require a non-empty value.

Node *httpServer*

These settings are required only, if the mdm server should be started as a RESTful server.

NOTE: Unauthorized access via HTTP
The RESTful server accepts requests without either authentication or encryption.
To avoid unauthorized access to the RESTful server via HTTP on the configured IP address and port, configure your firewall accordingly.

Key *start*

RESTful services of the mdm server can be enabled (value: *true*) or disabled (value: *false*). Default value: *false*.

Key *address*

The hostname or IP address on which the mdm RESTful server listens for incoming requests (default: *127.0.0.1*).

If you specify *0.0.0.0,* the mdm RESTful server listens on all interfaces.

Key *port*

The port on which the mdm RESTful server listens for incoming requests (default: *7080*).

10.2 mdm Certification Authority (CA)

mdm provides its own Certification Authority (CA). The mdm CA is a separate server instance. The CA is used to issue machine certificates for the mGuards, e.g. if you would like to use X.509 authentication for your VPN tunnels. Please refer to "Configure VPN connections" on page 96 and "Manage X.509 certificates" on page 111 on how to request certificates for an mGuard using the CA.

If you are not going to configure VPN tunnels with mdm or if you would like to use your own CA or pre-shared keys (PSK), the installation of the mdm-CA is not required.

10.2.1 Overview

The purpose of the mdm CA is to issue certificates, which are requested by the mdm server to be used as machine certificates for mGuards.

The mdm CA is implemented as a stand alone server. Its interface to the mdm server is a servlet driven web server (HTTP), which can be secured with SSL (HTTPS) and which can enforce client authentication. Especially in production environments Phoenix Contact highly recommends to use HTTPS with client authentication, because only then is it assured that the mdm CA will issue certificates to authenticated clients only.

The configuration file of the mdm CA server allows to configure different keystores (isolation) for the generation of certificates (CA-keystore) and for the SSL authentication (SSL-keystore, SSL-truststore). This assures that the CA private key (intended for issuing machine certificates) is not accidentally used for SSL authentication.

The mdm CA stores all required information in a PostgreSQL database. The communication between the mdm CA and the database should be also secured using SSL.

All the required keys and certificates to secure the communication between mdm CA, mdm server and the database have to be generated, installed in the file system and configured in the *ca-preferences.xml* file of the CA component and also in the *preferences.xml* file of the mdm server.

There are many tools to create and manage keys and certificates. This document describes the usage of the *OpenSSL* tools, which are available for Linux and Windows (e.g. as stand-alone binary or as part of the *cygwin* package). The tools to create the certificates, keys, and keystores need not be installed on the mdm CA target system.

For security reasons, the use of current and up to date OpenSSL versions (at least version 3 or later) is generally recommended.

Certificate Revocation Lists (CRLs) are not supported by mGuard 4.2, but are supported with mGuard firmware 5.0 and newer. If using mGuard 4.2 it is recommended to include the CRL distribution points (CDP) information already in the certificates when rolling out a PKI, since then an exchange of the certificates will not be required when updating to a newer mGuard firmware.

10.2.2 mdm CA server (*ca-preferences.xml* file)

This chapter describes the content of the configuration file *ca-preferences.xml.* Please adapt *ca-preferences.xml* according to your environment if necessary.

Node *certificateFactory*

Key *validityPeriodDays*

Number of days certificates issued by the mdm CA shall be valid (i.e. each certificate will be valid for the specified number of days starting from the time of its issuance).

Key *certTemplate*

Name and path of a certificate file to be used as template for new VPN certificates issued by the mdm CA.

Key *keyStore*

Name and path of the keystore file (see Chapter 10.2).

Key *keyStoreType*

Format of the keystore, either *JKS* (Java KeyStore) or *PKCS12* (OpenSSL).

Key *keyStorePassword*

Password for the keystore file (see Chapter 10.2). The special value *ENV:PASSWORD_CA* will cause the mdm server to read this password upon startup from the environment variable named *PASSWORD_CA*; the name *PASSWORD_CA* is just an example and can be changed if desired.

Key *keyAlias*

Name of the entry within the keystore, where the private key and associated public key certificate can be found (the keystore may contain more than one entry) - default matches the one from the example scripts described in Chapter 10.2.2. To find out the alias names in a *.p12* file please use the command:

```
openssl pkcs12 -in <filename>.p12 -nodes
```

The alias is shown as *Friendly Name* in the output.

To find out the alias names in a *JKS* file please use the command:

```
keytool -list <filename>
```

Key *keyPassword*

Password to decrypt the RSA private key contained within the keystore (see entry *keyAlias)*; the special value *ENV:PASSWORD_CA* will cause the mdm CA server to read this password upon startup from the environment variable named *PASSWORD_CA*; the name *PASSWORD_CA* is just an example and can be changed if desired.

Key *crlExportDirectory*

The path to the directory that is used by the mdm CA to export the files containing the CRLs (Certificate Revocation Lists). Each file contains a PEM encoded X.509 CRL of revoked certificates from a single issuer. The filename of each CRL file is composed of the hash value of the issuer with a *crl* extension, e.g. *5E84D566026616ED32169580A913661499FA6B03.crl*. Please make sure that the files contained in this directory are accessible from the mGuards. To configure the CRL URL on the mGuards please navigate to **Authentication » Certificates » CRLs** in the *Device* or

Template properties dialog (mGuard 5.0 or later only) and add the correct URL to the CRL table. Please refer to Chapter 7.4.1 for more details on certificate revocation (default: *security/crl)*.

Key *crlUpdatePeriodMinutes*

The time interval in minutes how often CRLs are exported to the *crlExportDirectory*. When a certificate is revoked, a CRL is exported immediately. Additionally, CRLs are exported periodically according to the specified time interval.

Key nextUpdatePeriodDays

The number of days into the future written into the *Next Update* field in exported CRLs. The field is a hint for the mGuard downloading the CRL when it is to be considered obsolete. It should therefore be significantly larger than *crlUpdatePeriodMinutes* (but note that *crlUpdatePeriodMinutes* is specified in minutes, while *nextUpdatePeriodDays* is specified in days).

Node *storage*

- **Node *database***
  - **Key *host***
    The IP address (or hostname) the mdm CA should connect to to get access to the PostgreSQL database (default: *127.0.0.1*).
  - **Key *port***
    The port that the mdm CA should use to connect to the database (default: *5432*).
  - **Key *name***
    The name of the database (default: *mdmca*).
  - **Key *user***
    The user of the database (default: *mdmca).*
  - **Key *password***
    The password to be used to connect to the database; the default value *ENV:PASSWORD_DB* will cause the mdm CA server to read this password upon startup from the environment variable named *PASSWORD_DB*; the name *PASSWORD_DB* is just an example and can be changed if desired.

Please make sure that the values for *port*, *name*, *user*, and *password* match the values you specified during the database initialization.

  - **Key *ssl***
    Enable/disable secure connection between the mdm CA and the PostgreSQL server. Use the value *true* to enable secure connections.
  - **Key *loglevel***
    Internal use only. Please do not change (default: *0*).
  - **Node *security***
    - **Key *trustStore***
      Name and path of the truststore file containing the trusted certificate of the database server.
    - **Key *trustStoreType***
      Format of the truststore, either *JKS* (Java KeyStore) or *PKCS12* (OpenSSL).
    - **Key *trustStorePassword***
      Password for the truststore file (see Chapter 10.2). The special value *ENV:PASSWORD_SSL* will cause the mdm server to read this password upon startup from the environment variable named *PASSWORD_SSL*; the name *PASSWORD_SSL* is just an example and can be changed if desired.

Node *certificationRequestHandler*

Key *maxRequestLength*

Number of bytes PKCS#10 certification requests can have at most; longer requests will be rejected to defend against simple DoS attacks (default: *102400*).

Node *revocationRequestHandler*

Key *maxRequestLength*

Number of bytes revocation requests must have at most; longer requests will be rejected to defend against simple DoS attacks (default: *10240*).

Node *httpServer*

Key *host*

IP address or hostname of the interface to listen on with the mdm CA's servlet interface; value *0.0.0.0* means to listen on any interface (default: *127.0.0.1*).

Key *port*

Port number the server should listen on for incoming connections (default: *7070*).

Key *minThreads*

Minimum number of instantiated HTTP server threads the mdm CA shall maintain in its pool (default: *2*).

Key *lowThreads*

Internal use only. Please do not change.

Key *maxThreads*

Maximum number of instantiated HTTP server threads the mdm CA shall keep in its pool (default: *5*).

Key *protocol*

The protocol the mdm CA's servlet interface should use; either *http* or *https.* To enable secure communication, *https* should be used.

Node *https*

The configuration in this node is used only if *protocol* in node *httpServer* is *https*.

- **Key *keyStore***
  Name and path of the keystore file.
- **Key *keyStoreType***
  Format of the keystore, either *JKS* (Java KeyStore) or *PKCS12* (OpenSSL).
- **Key *keyStorePassword***
  Password for the keystore file. The special value *ENV:PASSWORD_SSL* will cause the mdm server to read this password upon startup from the environment variable named *PASSWORD_SSL*; the name *PASSWORD_SSL* is just an example and can be changed if desired.
- **Key *keyPassword***
  The password required to decrypt the SSL private key contained in the keystore for the HTTPS server.
- **Key *clientAuth***
  Boolean value; *true* means clients need to authenticate via SSL too (not just the server); *false* means clients do not need to authenticate. This value should be set to *true*.

– **Key *trustStore***
  Name and path of the truststore file containing the trusted certificates for the SSL connection from the clients.
– **Key *trustStoreType***
  Format of the truststore, either *JKS* (Java KeyStore) or *PKCS12* (OpenSSL).
– **Key *trustStorePassword***
  Password for the truststore file (see Chapter 10.2). The special value *ENV:PASSWORD_SSL* will cause the mdm server to read this password upon startup from the environment variable named *PASSWORD_SSL*; the name *PASSWORD_SSL* is just an example and can be changed if desired.

Node *logging*

Key *file*

The base name of the rotated log file the mdm CA will produce; the file name may be used with a relative or absolute path name. The suffix *n.log* will be appended to the base name, with *n* being a non-negative integer.

Key *limit*

Maximum number of bytes a log file of the mdm CA can reach; when it grows beyond this number, it will be rotated.

Key *count*

Maximum number of rotated log files the mdm CA should keep.

Key *level*

Defines granularity of the logging messages the mdm CA will produce; acceptable values are:

– *OFF*
– *SEVERE* (highest value)
– *WARNING*
– *INFO*
– *CONFIG*
– *FINE*
– *FINER*
– *FINEST* (lowest value)
– *ALL*

11 Glossary

admin / netadmin (on the mGuard)

The user *admin* (mGuard user) can change all settings of the mGuard, whereas the user *netadmin* can only change local variables.

AIA

The certificate extension called Authority Information Access (AIA) indicates how to access CA information and services for the issuer of the certificate in which the extension appears. Such an extension is used to identify the OCSP server which provides current revocation status information for that certificate. mdm supports the inclusion of an AIA extension containing the URL of a single OCSP server. For detailed information on the AIA extension please refer to RFC 3280.

CDP

The certificate extension called CRL Distribution Points (CDP) identifies how CRL information is obtained for the certificate the extension is included in. mdm supports the creation of certificates containing the CDP extension with a single *http://* URL enclosed therein. The URL specifies the download location of the actual CRL. For more detailed information on CRL Distribution Points please refer to RFC 3280.

CRL

A Certificate Revocation List (CRL) is issued regularly by a Certification Authority (CA) to provide (public) access the revocation status of the certificates it issued. A CRL is a list of revoked certificates identified by serial number. Once a certificate is revoked, it is considered to be invalid. A revocation becomes necessary in particular, if associated private key material has been compromised. For more detailed information on CRLs please refer to RFC 3280.

Local (mGuard) variables

Local mGuard variables are not managed by mdm, but only by the *netadmin* locally on the mGuard. Within mdm (in the *Template properties dialog* or the *Device properties dialog*) each variable can be defined as local variable by selecting **Local** as value.

Inherited value

Devices or templates using a parent template “inherit” the values defined in the parent template. Depending on the permission setting, the inherited value can or cannot be overridden in the inheriting devices and templates.

Management ID

A unique logical identifier independent of the physical hardware that identifies each device, as opposed to an identifier of the physical device, e.g. the serial number.

OCSP

The Online Certificate Status Protocol (OCSP) specifies the message format for a service responding with actual revocation status information on individual certificates upon request. Such a service is conventionally embedded within an HTTP server. Thus most OCSP servers use HTTP as transport layer for the OCSP messages. Such an OCSP server is operated by some Certification Authorities as alternative to or replacement for CRLs. For detailed information on OCSP please refer to RFC 2560.

Permissions

The permissions in a template determine whether the user configuring an inheriting device or template can override/modify the settings of the parent template.

Regular expressions

Regular expressions are text strings to match portions of a field using characters, numbers, wildcards and metacharacters. Regular expressions can be used in mdm to filter the device, template, or pool table. For detailed information on regular expressions please refer to *www.regular-expressions.info* (2017-01-30).

Template

A set of mGuard variables and the corresponding values and permissions. The template can be used (i.e. inherited from) by a device or another template. A change in the template applies to all inheriting devices and templates, depending on the access privilege settings. The template is used in mdm only, but not on the mGuard. See also *"Inherited value"* and *"Permissions"*.

X.509 certificates

Digital certificates have been specified in the standard X.509 issued by the ITU-T. A profile of that standard is published as RFC 3280. Such certificates certify the identity of an entity. The certificate includes the entity's public key and an electronic signature from the Certification Authority (CA). X.509 certificates are organized hierarchically: A root CA creates a self signed trust anchor which needs to be configured as such for applications verifying digital signatures or certificates. The identity and trustworthyness of the intermediate CAs is certified with a CA certificate issued by the root CA respectively the upstream intermediate CA. The identity of the end entities is certified with a certificate issued by the lowest CA. Each certificate can contain extensions for the inclusion of arbitary additional information. The mdm supports the creation of end entity certificates for VPN connection end points and the optional inclusion of the CDP and AIA extensions. For detailed information on digital certificates please refer to RFC 3280.

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