# PowerEdge MX7000: Templates and Profiles

# Revisions

| Date | Description |
|------|-------------|
| Jan 2019 | Initial release |
|  |  |

# Acknowledgements

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# 1 Overview

This document provides general information about templates, deployment of templates, virtual identities and identity pools.

## 1.1 Templates

The configuration management and compliance operations provided in MX7000 Chassis provide the capability to manage and control the configuration of the devices in a network. A Template is a set of system configuration settings referred to as attributes. A template may contain a small set of attributes for a specific purpose, or all the attributes for a full system configuration. MX7000 Chassis provides several options for creating templates:

- MX7000 Chassis comes with several templates for specific purposes already installed.
- A template can be created by importing a Server Configuration Profile (SCP) file into MX7000 Chassis. The SCP file may be from a server or exported by OpenManage Essentials, OpenManage Enterprise, or MX7000 Chassis.
- Most frequently, templates are created by getting the current system configuration from a running network server (referred to in MX7000 Chassis as a "Reference Server").
- Templates may also be cloned (copied) and edited. This applies to all templates, whether built-in, imported, or created from a reference device.

## 1.2 Identities

Some of the attributes which are typically included a template are referred to as identity attributes. Identity attributes identify a device and distinguish it from all other devices on the network. Since identity attributes must uniquely identify a device, it is imperative that each device has a unique network identity. Otherwise, inter-device network communications cannot function properly.

Devices come with unique manufacturer-assigned identity values pre-installed (such as a factory-assigned MAC address). Those identities are fixed and never change. However, devices can assume a set of alternate identity values, called a "virtual identity", and function on the network using that identity, as if the virtual identity were its factory-installed identity. The use of virtual identity is the basis for stateless operations.

MX7000 Chassis provides management support for "virtual identities". Just like factory-installed identities, virtual identities must also be unique on the network. Using virtual identities enables MX7000 Chassis to support operations such as shifting (migrating) a full device configuration, including its virtual identity, from one server to another. In other words, a virtual identity can be removed from one device and assigned to a different device (for example, in case the original device stops working or needs maintenance).

## 1.3 Deployment

Deployment is the process of applying a full or partial system configuration on a specific target device. In MX7000 Chassis, templates are the basis for all deployments. Templates contain the system configuration attributes that get sent to the target device. The iDRAC on the target device applies the attributes contained in the template and reboots the device if necessary.

Often, templates contain virtual identity attributes. As mentioned above, identity attributes must have unique values on the network. Identity Pools facilitate the assignment and management of unique virtual identities.

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# 2 Template and Profile Operations

## 2.1 Create template

In MX7000 chassis, the template can be created from any existing device used as a reference by selecting the system configuration attributes that needs to be set on the target device or by cloning one of the given samples. If you already have a compatible template from other chassis, you can choose to import using the "Import from file" option.



## 2.2 Deploy template

The partial or full system configuration can be applied to one or more target devices and empty slots in MX7000 chassis. The system configuration application on a target device takes place immediately where on an empty slot, it happens soon as a device is inserted into that respective slot. The chassis inventory will be updated as soon as the deployment completes.
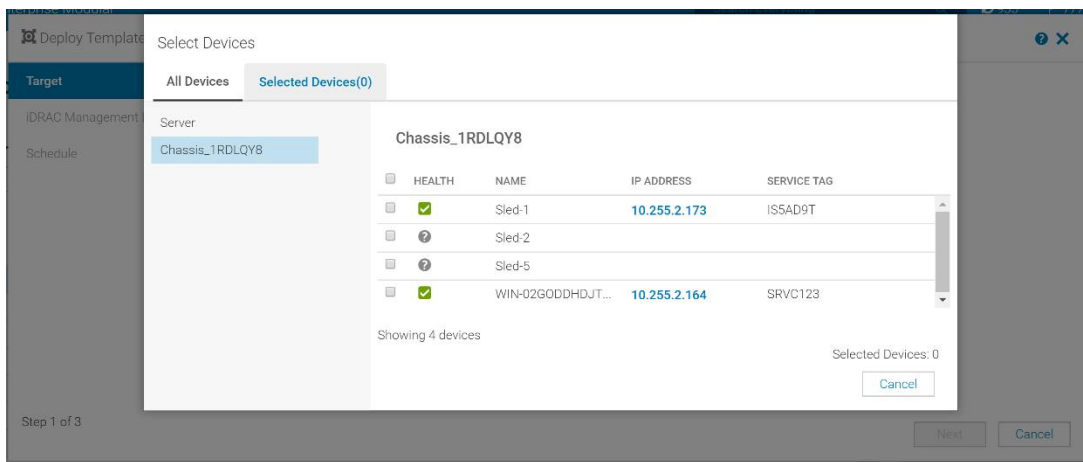
## 2.3 Edit Profile

A template, when deployed to a target device, is called a "Profile". MX7000 chassis facilitates the editing of a profile through its lifetime. This option will only show up when there is a template deployed to a device.
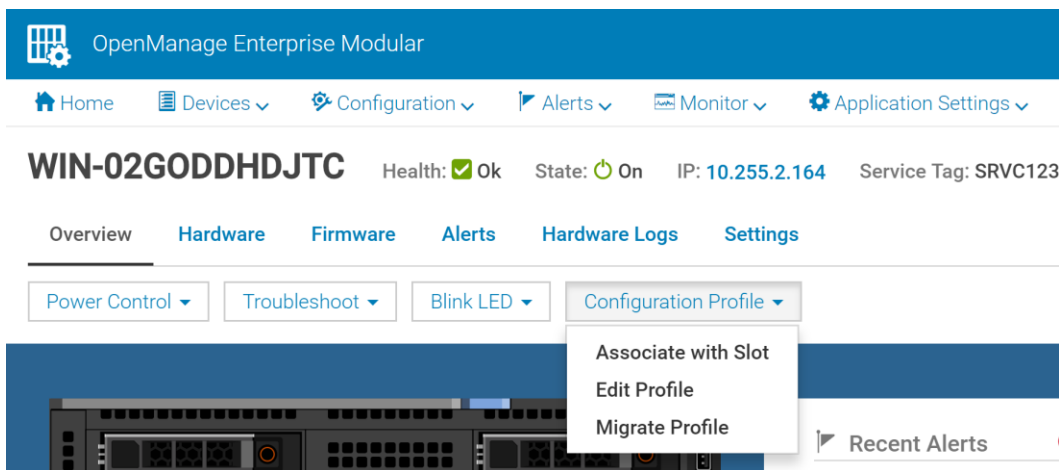


## 2.4 Migrate Profile

In scenarios when a device configuration needs to be moved to another one, customers might wish to have the target device loaded with the same system configuration as the previous one. Migrate profile options helps them achieve this without having to go through the entire re-configuration process.

## 2.5 Attach Profile

Customers can also choose to attach a profile by selecting one or more slots that do not have profiles already associated with them. The option is available on the chassis hardware tab when they choose "Chassis Slots".

## 2.6    Detach Profile

MX7000 Chassis uses detach profile to remove the system configuration attributes completely from the target device. The virtual identities that were assigned, using the template deployment process, will be removed completely from the target device.

# 3 Identity Pools

## 3.1 The Purpose of Identity Pools
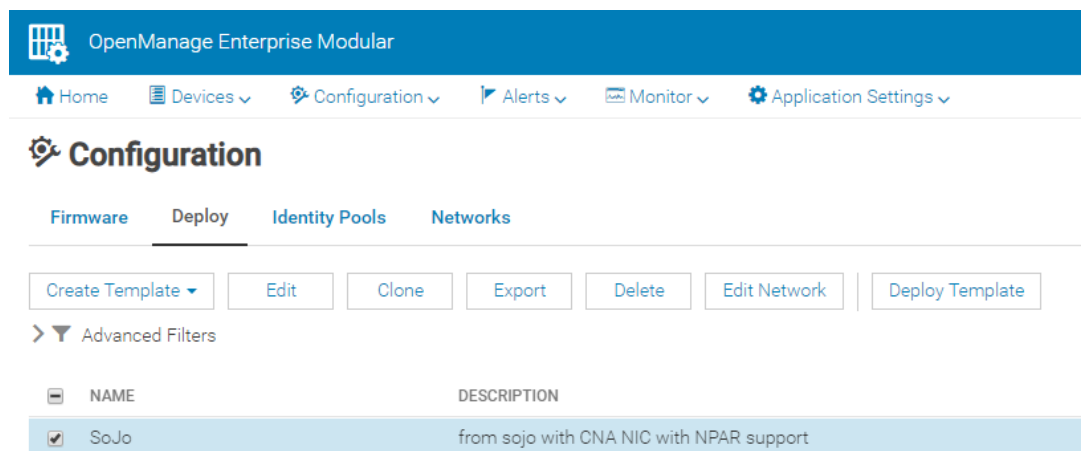
MX7000 Chassis uses identity pools to manage the set of values that can be used as virtual identities for discovered devices. MX7000 Chassis controls the assignment of virtual identity values, selecting values for individual deployments from pre-defined ranges of possible values. This allows the customer to control the set of values which can be used for identities, and means that the customer doesn't have to enter all needed identity values with every deployment request, or remember which values have or have not been used. Identity Pools make configuration deployment and migration much easier to manage.

## 3.2 How and When Identity Pools are Used

Identity Pools are used in conjunction with template deployment and profile operations. They provide sets of values that can be used for virtual identity attributes for deployment.

After a Template is created, an Identity Pool may be associated with it. Doing this specifies the Identity Pool to use to get identity values whenever the template is deployed to a target device. The same Identity Pool can be associated with (used by) any number of templates. Only one Identity Pool can be associated with a Template.

> An Identity Pool can be associated with a template by clicking on the "Edit Network" button on the "Configuration | Deploy" page.

An Identity Pool does not have to be associated with each Template. However, if a Template doesn't have an Identity Pool associated with it, then MX7000 Chassis cannot assign a virtual identity to target devices when the template is deployed. If a virtual identity cannot be assigned to a device, then MX7000 Chassis cannot perform some operations that would otherwise be supported (such as profile creation and migration).

If an Identity Pool is specified for a template, MX7000 Chassis automatically uses virtual identities for management operations involving that template.

To initiate deployment of a Template to a target device, or to attach a profile to a device, you select a template (on the "Configuration | Deploy" page) and click on the "Deploy Template" button. A Template can be deployed whether or not an Identity Pool has been specified for it. In other words, templates can be

deployed with or without a virtual identity. However, as mentioned above, if a template is deployed without a virtual identity, some configuration management operations cannot be done.

One of the steps in the Deploy Template wizard, when a template has an Identity Pool specified for it, is to "Assign Identities". This step reserves values from the associated Identity Pool for all virtual identity attributes needed by the template.

Each template will have specific virtual identity needs, based on its configuration. For example, one template may have iSCSI configured, so it will need appropriate virtual identities for iSCSI operations. Another template may not have iSCSI configured, but may have FCoE configured, so it will need virtual identities for FCoE operations but not for iSCSI operations; etc.

## 3.3    Identity States

As part of its virtual identity management functionality, MX7000 Chassis tracks usage information for each possible virtual identity that can be generated from the sub-pools in an Identity Pool. Each virtual identity that can be generated from an Identity Pool may be in one of the following states:

Unused              Indicates that the virtual identity value is not being used by any device (as far as MX7000 Chassis can tell) and is available for reservation for deployment.

Reserved            Indicates that the virtual identity value is reserved for deployment to a target device. Once MX7000 Chassis deploys the identity to the target device, and confirms that it was successfully applied on the device, it will change its state to Assigned.

Assigned            Indicates that the virtual identity value was deployed to a target device and MX7000 Chassis confirmed that the value was successfully applied on that device.

The following list shows when identity state may change:

**Available → Reserved**
- When the "Assign Identities" button in the Deploy Template wizard is pressed.

**Available → Assigned**
- If a task gets a system configuration (such as when creating a template) and a device is using a virtual identity defined in an Identity Pool. This is not expected to occur very often.

**Reserved → Available**
- After canceling out of the Deploy Template wizard (once the cleanup task runs).

**Reserved → Assigned**
- After deploying an identity to a target device and getting confirmation that it was successfully applied on the device.
- If a task gets a system configuration (such as when creating a template) and a device is using a virtual identity defined in an Identity Pool. This is not expected to occur very often.

**Assigned → Available**
- After running Reclaim Identity on a device (so it returns to using its factory-assigned identity).

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## 3.4 Anatomy of an Identity Pool

This section discusses the composition of an Identity Pool.

Each Identity Pool must have a unique name, and may have a description. In addition, each Identity Pool can contain values to use for generating virtual identities for one or more of the following protocols:

- Ethernet Identities
- iSCSI Identities
- FCoE Identities
- Fibre Channel (FC) Identities

An Identity Pool may be thought of as a collection of one or more sub-pools – one for Ethernet, one for iSCSI, etc. An Identity Pool only needs to include sub-pools which are applicable for its intended use. Identity information for each type of sub-pool is discussed in the sections that follow.

### 3.4.1 Ethernet Identities

Ethernet identities refers to the configuration attributes that provide a unique virtual identity for Ethernet operations on a network. The Ethernet page of the Identity Pool wizard is used to define a sub-pool to use for generating unique Ethernet virtual identities. Since MX7000 Chassis executes on an Ethernet network, most every Identity Pool will have to specify values for generating Ethernet virtual identities. The following values are specified to define a sub-pool for generating unique Ethernet virtual identities:

- Starting Virtual MAC Address, Count

The Identity Pool wizard allows the entry of a starting Virtual MAC address and a pool size (that is, the number of MAC addresses in the pool, up to a maximum size of 5,000 addresses).

> A valid MAC address, using hexadecimal digits, must be supplied. The wizard has a tool tip which shows acceptable formats. The range cannot include any broadcast MAC addresses (i.e., where the second digit in the first octet in the address is odd (1, 3, 5, 7, 9, B, or D).

### 3.4.2 iSCSI Identities

iSCSI identities refers to the configuration attributes that provide a unique virtual identity for iSCSI operations on a network. The iSCSI page of the Identity Pool wizard is used to define a sub-pool to use for generating unique iSCSI virtual identities. iSCSI can be used for connection to iSCSI-based storage and/or for booting from an iSCSI-based repository. These activities may require virtual MAC addresses, a name, and/or IP addresses; a sub-pool can be specified for each of these. The following values are specified to define applicable sub-pools for generating an iSCSI virtual identity:

- Starting Virtual MAC Address, Count

The pool functions the same as the Virtual MAC Address identities for Ethernet (and has the same value constraints), but is reserved for generating only iSCSI virtual identities. An iSCSI virtual MAC address is required whenever deploying a template in which iSCSI operations are enabled (either for an iSCSI connection or for iSCSI boot).

- IQN Prefix

The IQN Prefix value is used when iSCSI is configured for booting. In this case, the target device needs to configure an iSCSI initiator, and the initiator requires a unique name for its virtual identity. The Identity Pool wizard accepts a prefix to use for generating unique iSCSI IQNs for the target device to use. When an iSCSI IQN is needed, it will add a unique string

> The official IQN format is: `iqn.yyyy-mm.naming-authority:unique name`
>
> It is recommended that the specified IQN prefix at least begin with "`iqn.`" to avoid name rejection by a NIC. Think of MX7000 Chassis as supplying "`unique name`".

to the end of the specified prefix.

It is a "best practice" to always specify an IQN Prefix when configuring an Identity Pool to include iSCSI MAC addresses. Although an IQN is only required when iSCSI boot is configured, it is likely that some template that configures iSCSI will also require an iSCSI IQN, so it's best to just supply a prefix when the Identity Pool is defined, in order to avoid an error later in the Deploy Template wizard when an IQN is needed but no prefix is specified in the Identity Pool.

Unlike other ranges (for MAC addresses and IP addresses), the iSCSI IQN is just a text name; it is not a limited resource. MX7000 Chassis adds a 7-digit numerical suffix to the prefix specified in the wizard. Thus, every IQN pool can generate up to 10 million unique IQNs (minus one)!

- IP Address Range, Subnet Mask, Gateway, Primary DNS, Secondary DNS

These iSCSI Initiator IP settings are only used when iSCSI is configured for booting, and when iSCSI Initiator configuration via DHCP is disabled. When iSCSI Initiator configuration via DHCP is enabled, all of these values are obtained from a designated DHCP server.

The IP Address Range and Subnet Mask fields are used to specify a pool of IP addresses that MX7000 Chassis can assign to a device for it to use in its iSCSI Initiator configuration. Unlike the MAC address pools, a count is not specified for the IP Address Range. Instead, the IP Address Range may be specified as a range of specific addresses (a starting address and an ending address) or as a subnet (using either CIDR notation or the Subnet Mask field). A maximum of 64,000 IP addresses is allowed for a pool.

> The Identity Pool wizard in MX7000 Chassis supports only IPv4 address ranges. The following range formats are allowed:
>
> - startIP-endIP
>   - The wizard is picky; it doesn't allow any spaces around the dash!
>   - This format requires a Subnet Mask to be selected.
> - subnet/CIDR
>   - No Subnet Mask is applicable with this format.
> - subnet
>   - This format requires a Subnet Mask to be selected.

Gateway, Primary DNS, and Secondary DNS are not identity values nor used as a pool. They don't have to be unique on the network (and usually aren't unique), but they do serve a couple purposes related to identity management, so they're included on the iSCSI page in the wizard:

(a) When specified, MX7000 Chassis uses these values when deploying a template (rather than using the values originally contained in the template).

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(b) When specified, MX7000 Chassis will not assign those values from the IP address pool (if they fall within the specified IP Address Range). That is, they serve as exclusions from the specified IP Address Range (when applicable).

### 3.4.3 FCoE Identities

FCoE identities refers to the configuration attributes that provide a unique virtual identity for FCoE operations on a network. The FCoE page of the Identity Pool wizard is used to define a sub-pool to use for generating unique FCoE virtual identities. The generated identities are used for booting from an FCoE-based repository. The following values are specified to define a sub-pool for generating unique FCoE virtual identities:

- Starting Virtual MAC Address, Count

  This pool functions the same as the Virtual MAC Address identities for Ethernet (and has the same value constraints), but is reserved for FCoE identities only. An FCoE virtual MAC address is required whenever deploying a template in which FCoE operations are enabled.

FCoE provides Fibre Channel support on an Ethernet network. The endpoints use Fibre Channel addressing, but data packets (containing FC payloads) traverse an Ethernet network. Therefore, FCoE requires both virtual MAC addresses, for sending packets on the Ethernet network, and virtual FC addresses (i.e., virtual WWNN and virtual WWPN values), for Fibre Channel operations by the endpoints.

MX7000 Chassis generates all necessary FCoE virtual identities using the FCoE Virtual MAC Address range specified for a pool. It can do this because MAC addresses are 6-octet values and FC addresses are 8-octet values. MX7000 Chassis uses the FCoE Virtual MAC Address range to generate unique MAC virtual addresses for the Ethernet virtual identity. It also uses that range to generate unique virtual WWNN and virtual WWPN addresses for the FC virtual identity. It does this by prepending a two-octet prefix to each possible address in the MAC address range (0x2000 for virtual WWNN addresses and 0x2001 for virtual WWPN addresses). As a result, customers don't have to specify address pools for FC virtual WWNN and WWPN addresses.

### 3.4.4 Fibre Channel (FC) Identities

FC identities are virtual identities required by a device to support virtual FC operations. The FC page of the Identity Pool wizard is used to define a sub-pool to use for generating unique FC virtual identities. The following values are specified to define a sub-pool for generating unique FC virtual identities:

- Starting Postfix and Count

As mentioned earlier, Fibre Channel requires 8-octet virtual WWNN addresses (for nodes) and virtual WWPN addresses (for ports on a node). In MX7000 Chassis, the Identity Pool wizard page for defining an FC virtual identity pool has a starting postfix value, which takes a 6-octet value, and a count. Like it does for generating unique FC virtual WWNN and WWPN addresses for FCoE (as discussed above), MX7000 Chassis prepends a two-octet prefix to each 6-octet value defined by the Postfix and Count values entered for a pool. The same prefixes are used as were indicated for FCoE.

Note that the Starting Postfix value is NOT a MAC address, even though it happens to be a 6-octet value. It is merely a 6-octet value; MX7000 Chassis prepends two prefix octets, as mentioned above, in order to generate valid 8-octet FC WWNN and WWPN addresses. This approach means that the customer only has to specify one range (from which MX7000 Chassis will generate values as if there were two FC address pools).

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### 3.4.5   Address Constraints

Identity addresses within and across Identity Pools cannot overlap. For example:

- The MAC addresses that can be generated by sub-pools for Ethernet, iSCSI, and FCoE cannot overlap with each other, either within one pool or in different Identity Pools.

- The FC addresses that can be generated by sub-pools for FC and FCoE cannot overlap with each other, either within one pool or in different Identity Pools. Both FCoE sub-pools and FC sub-pools generate FC virtual WWNN and WWPN addresses which could conflict with each other.

In each case, the Identity Pool wizard will report an error if it finds an address overlap within a pool or between pools. Note that since FCoE pools generate both virtual MAC addresses and virtual FC addresses (virtual WWNN and virtual WWPN), they have two possibilities for range conflict, both within or across Identity Pools.

## 3.5   Managing Identity Pools

This section discusses the functionalities provided by MX7000 Chassis for managing Identity Pools

### 3.5.1   Identity Pool Portal

Identity Pools are created and managed via the Identity Pool portal. This page displays a list of identity pools, provides buttons for creating and managing identity pools, and identity pool summary and usage information.

#### 3.5.1.1   List of Identity Pools

The Identity Pool portal page lists the current set of Identity Pools.

If a single Identity Pool is selected, summary and usage information is displayed for it at the bottom of the page, and it can be edited, exported, or deleted.

If multiple Identity Pools are selected, Delete is the only operation allowed.

#### 3.5.1.2   Identity Pool Summary

This section of the page displays summary information for the last Identity Pool that was selected (or unselected) in the Identity Pool list (even if it is no longer selected). This is essentially the same info that is displayed if the Identity Pool is opened for editing.

#### 3.5.1.3   Identity Pool Usage

This section of the page displays usage information for the last Identity Pool that was selected (or unselected) in the Identity Pool list (even if it is no longer selected). Usage information can be displayed for Ethernet identities, iSCSI identities, FCoE identities, or Fibre Channel (FC) identities. For the selected identity type, the display shows the number of identities in the pool, the number of identities that are in use, and a list containing each Reserved or Assigned identity (available identities are not displayed). See the "Identity States" section for more info about identity states and their meanings.

### 3.5.2   Creating Identity Pools

The Create Identity Pool wizard is used to create a new Identity Pool. It is accessed via the Create button on the Identity Pools portal page ("Configuration | Identity Pools"). Each Identity Pool must have a unique name and may specify sub-pools for Ethernet identities, iSCSI identities, FCoE identities, and/or FC identities as

wanted. An Identity Pool can even be created without any sub-pools; it wouldn't be usable for deployment, but could be edited later to include sub-pool definitions.

See the "Anatomy of an Identity Pool" section for details about the different types of identities and sub-pools that can be configured for an Identity Pool.

It is important to remember that since a template can be associated with at most one Identity Pool, that Identity Pool must define sub-pools for all protocols which templates associated with the pool may need. Most templates will need Ethernet MAC addresses for virtual Ethernet identity, so a sub-pool for Ethernet MAC addresses will usually be required. Remember also that each port on each NIC may need a virtual Ethernet MAC address, so plan the pool size accordingly.

Other than that, each installation will need to determine whether or not their devices will require virtual identities for iSCSI, FCoE, or FC, and configure sub-pools accordingly.

### 3.5.3 Modifying Identity Pools

The Edit Identity Pool wizard is used to view or make changes to previously-created Identity Pools. It is accessed via the Edit button on the Identity Pools portal page ("Configuration | Identity Pools"). This wizard is the same as the Create Identity Pool wizard, except that a couple constraints may apply to sub-pool definitions.

If an Identity Pool has either Reserved or Assigned virtual identities, then the following restrictions apply to sub-pools already defined for the Identity Pool:

- For all sub-pools that generate MAC address virtual identities (Ethernet, iSCSI, and FCoE), if the Identity Pool defines a sub-pool for the protocol, and that sub-pool contains Reserved or Assigned virtual identities, then the Starting MAC Address designated for that sub-pool cannot be changed and its Count can only be increased. This constraint is made so that Reserved and Assigned virtual identity values don't drop out of an Identity Pool.

- An equivalent constraint applies to sub-pools that generate FC address virtual identities (FCoE and FC). Here too, if the sub-pool contains Reserved or Assigned identities, then the Starting Address cannot be changed, and the Count can only be increased.

### 3.5.4 Deleting Identity Pools

This operation deletes one or more identity pools. Identity Pools where one or more sub-pools contain Reserved or Assigned virtual identity values cannot be deleted.

### 3.5.5 Exporting Identity Pools

The Identity Pool portal also provides the ability to export an Identity Pool definition (including all sub-pool definitions) to a CSV file.

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## 3.6 Identity Pool Planning and Strategy

MX7000 Chassis supports the creation of multiple Identity Pools. Here are some things to consider when deciding whether to create a single Identity Pool for all template deployments to use, or to create different Identity Pools for different purposes.

- An Identity Pool does not need to specify a sub-pool for each different protocol. However, a Template can be associated with at most one Identity Pool, so identities for all protocols enabled in a template need to come from the Identity Pool associated with the template. Otherwise, the Assign Identities step in the Deploy Template wizard will fail.

- Identity range addresses specified in one Identity Pool cannot overlap identity range addresses in another Identity Pool (or even in the same Identity Pool), irrespective of protocol.

  This rule applies based on address type – for example, MAC addresses. MAC address ranges are specified for Ethernet identities, iSCSI Initiator identities, and FCoE identities. A MAC address range in one Identity Pool (regardless of the protocol) cannot overlap with any other MAC address range, either in the same Identity Pool or in a different Identity Pool.

- When any identities in a sub-pool of an Identity Pool are Reserved or Assigned, the only change allowed to those sub-pools is to increase their size. The starting address cannot be changed and the count cannot be reduced.

Each Identity Pool definition should include a sub-pool for each type of virtual identity expected to be enabled in the Templates with which the Identity Pool will be associated.

- Most Identity Pools will need an Ethernet sub-pool, for use as virtual MAC addresses for network communications. Each NIC port usually requires a virtual MAC address. If partitioning is enabled, each partition could require a virtual MAC address (unless Ethernet is disabled on the partition).

- If an Identity Pool will be associated with templates where iSCSI could be enabled, either for connections or for booting, then an iSCSI identity range for MAC addresses should be specified. If iSCSI may be enabled for booting, then an IQN prefix and an IP range should also be specified (unless it is known for certain that every template to be used for deployment will specify that iSCSI Initiator settings be obtained from a DHCP server).

- If an Identity Pool will be associated with templates where FCoE could be enabled, then an FCoE identity range should be specified.

- If an Identity Pool will be associated with templates that may have Fibre Channel host bus adapter, then a range should be specified for Fibre Channel (FC) identities.

Each installation should determine the number of identity pools, sub-pools per Identity Pool, and sub-pool sizes that best fit their needs.

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# A    Additional resources

Support.dell.com is focused on meeting your needs with proven services and support.

DellTechCenter.com is an IT Community where you can connect with Dell Customers and Dell employees for the purpose of sharing knowledge, best practices, and information about Dell products and installations.

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