

CLARiiON Host Integration and Management

EMC Education Services

Module 7 – Advanced LUN Concepts

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Welcome to Module 7 of CLARiiON Host Integration and Management.

Module 7 Objectives

Upon completion of this module, you will be able to:

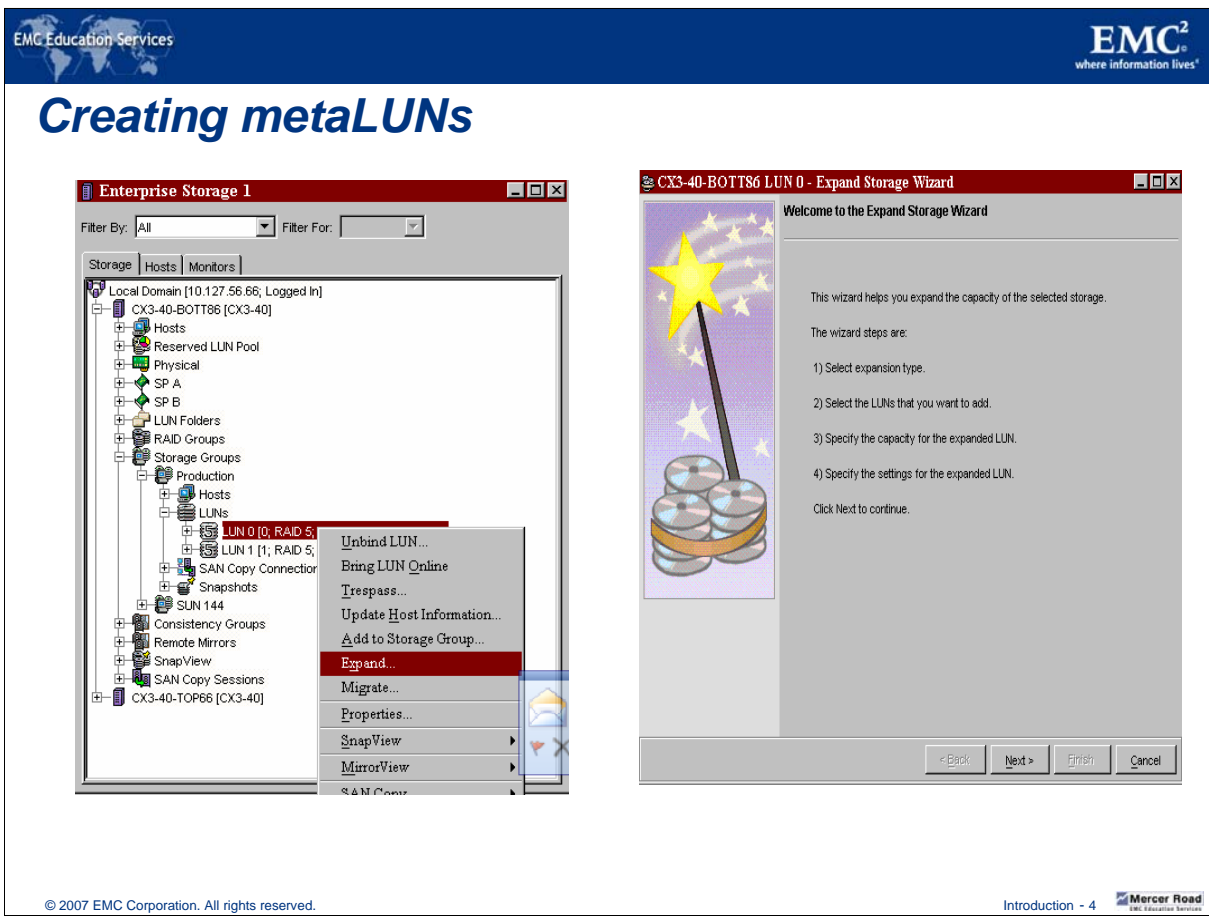
- List the procedures for managing metaLUNs
- List the procedures for migrating LUNs

Please take a moment to review the learning objectives listed above.

metaLUNs

- Creating metaLUNs
- The Expand Storage Wizard
- Managing metaLUNs
- Destroying metaLUNs

metaLUN topics are listed here.



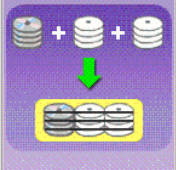
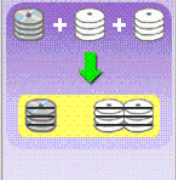
A MetaLUN is a LUN whose capacity is the combined capacities of all the LUNs that comprise it. Currently, MetaLUNs are only supported on CX3-series and CX-series storage systems. The MetaLUN feature lets you dynamically expand the capacity of a single LUN (base LUN) into a larger unit called a MetaLUN. You do this by adding additional LUNs to the base LUN. You can also add additional LUNs to a MetaLUN to increase its capacity even more. During the expansion operation, you can still access the existing data, but you cannot access the additional capacity until the expansion is complete. Like a LUN, a MetaLUN can belong to a Storage Group, and can participate in SnapView, MirrorView and SAN copy sessions.

Any LUN which is not a private LUN may be expanded. The Expand option from the right-click menu starts the Expand Storage Wizard. The user may also choose to use the Expand wizard from the Storage Management Task Bar menu. The example uses LUN 0 as the Base LUN for the expansion.

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Expand Storage Wizard

CX3-40-BOTT86 LUN 0 - Expand Storage Wizard

Select Expansion Type

LUN expansion by Striping
blends one or more LUNs into a single structure. Existing data must be re-striped across the newly formed LUN. The time required to re-stripe is proportional to the amount of existing data. Additional space becomes available only after re-striping is complete.

LUN expansion by Concatenation
links one or more LUNs together. Existing data structures remain in place. Additional space is available immediately.

	Pro's	Con's
Striping	Performance benefits of any additional spindles are shared by all data	Re-striping takes time, delaying the availability of additional space.
Concatenation	Simple. Additional Capacity is available quickly.	No performance benefit to existing data

Please choose a method of Expansion:

Striping
 Concatenation

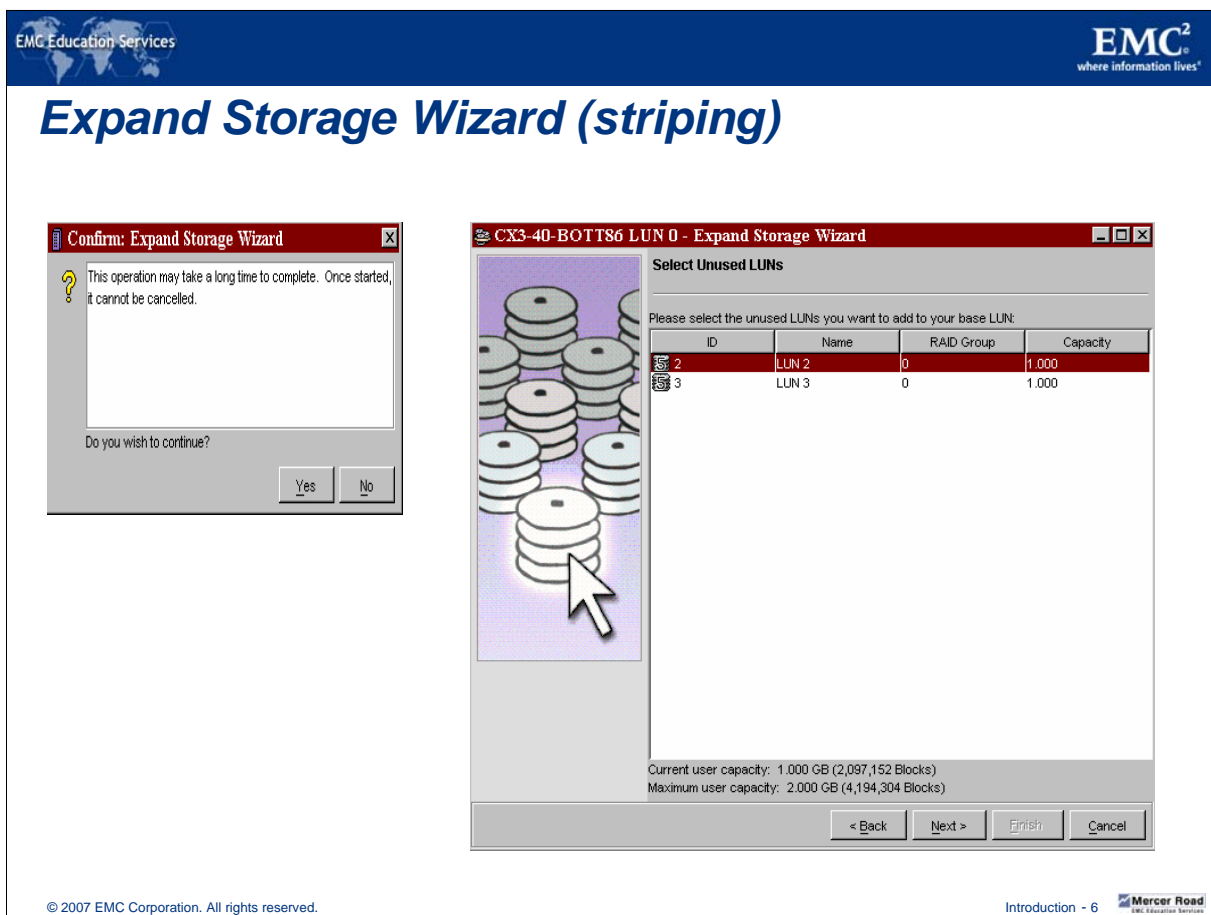
< Back
Next >
Finish
Cancel

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You cannot use any LUNs that are currently participating in a snapshot, clone, mirror or SAN Copy session as expansion LUNs. The software assigns new LUN IDs to expansion LUNs and makes them private LUNs. Expansion LUNs cannot belong to a Storage Group. If a LUN you want to use as an expansion LUN belongs to a Storage Group, you must first remove it from the Storage Group. Expansion LUNs retain their original World Wide Names and LUN names.

If data is potentially present on the LUN (because it has been in a Storage Group), the user is asked whether or not existing data should be preserved. A 'No' answer makes the process faster, but destroys the data.

In this screen, we choose Stripe or Concatenate expansion. The way that LUN expansion is achieved will be significantly different for these two methods.



A stripe expansion improves the performance of the metaLUN.

If you are expanding the base LUN, striping creates a metaLUN with one component which includes the base LUN and any LUNs that you add. Any data on the base LUN is re-striped across the base LUN and the new LUNs.

If you are expanding an existing metaLUN, striping re-stripes any data on the last component of a metaLUN across this component and any new LUNs that you add. The new LUNs become part of that metaLUN component.

The following requirements exist for a stripe expansion:

- All LUNs must be the same size and RAID type.
- All LUNs must be either a redundant or non-redundant RAID type.
- All disks in any of the LUNs must be the same type - ATA or Fibre Channel.

By default, metaLUN components always use the stripe expansion type.

If there is data on the Base LUN, and that LUN is not in a Storage Group, we are asked whether or not we wish to preserve the existing data.

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Expand Storage Wizard (concatenation)

CX3-40-BOTS6 LUN 0 - Expand Storage Wizard

Select Unused LUNs

Please select the unused LUNs you want to add to your base LUN:

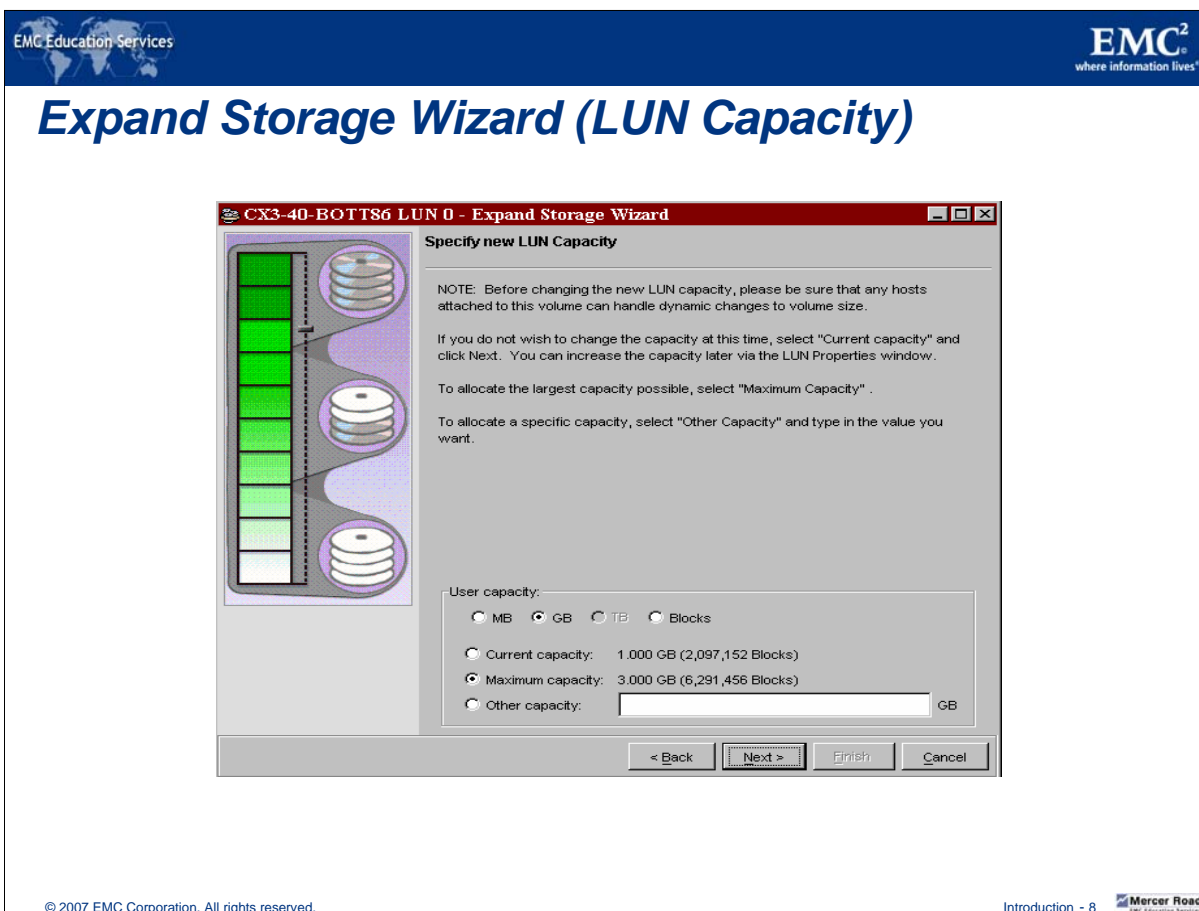
ID	Name	RAID Group	Capacity
2	LUN 2	0	1.000
3	LUN 3	0	1.000
4	LUN 4	0	2.000
5	LUN 5	0	2.000
6	LUN 6	0	3.000
7	LUN 7	0	3.000

Current user capacity: 1.000 GB (2,097,152 Blocks)
Maximum user capacity: 1.000 GB (2,097,152 Blocks)

< Back Next > Finish Cancel

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If we choose to expand by concatenation, available LUNs of the same disk type (FC or ATA) are shown. They do not have to be of the same size or RAID type. EMC does not recommend that you expand LUN capacity by concatenating LUNs of different RAID types. Do this only in an emergency situation when you need to add capacity to a LUN and you do not have LUNs of the same RAID type or the disk capacity to bind new ones. Concatenating metaLUN components with a variety of RAID types could impact the performance of the resulting metaLUN. Once you expand a LUN, you cannot change the RAID type of any of its components without destroying the metaLUN. Destroying a metaLUN unbinds all LUNs in the metaLUN, and therefore causes data to be lost.

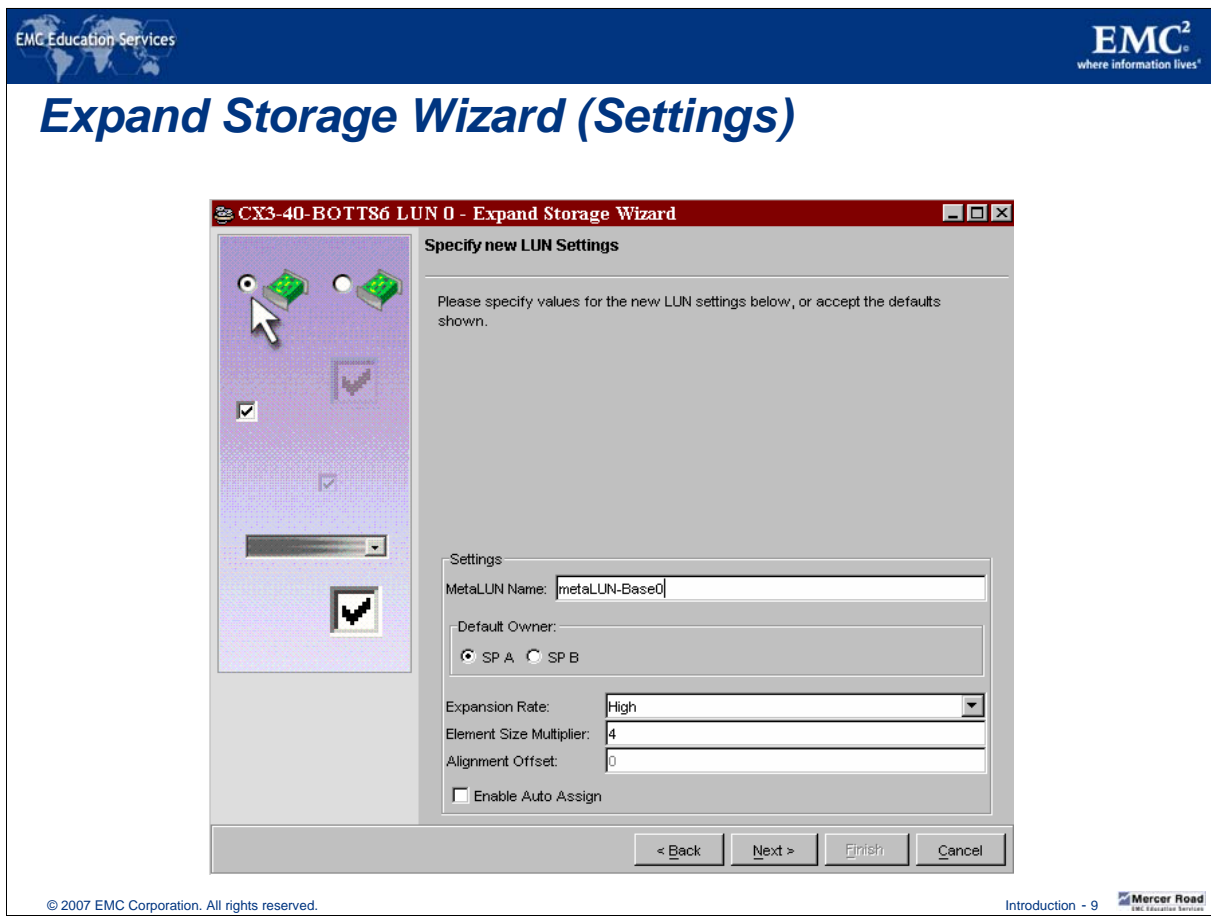


Once we have chosen the expansion type, we choose the desired new size of the LUN. The size may vary between the current size and the maximum, which is the total size of all LUNs in the metaLUN. We have chosen to expand the current LUN to its maximum capacity.

This screen allows you to specify the user capacity for the metaLUN. The current capacity may be different from the maximum capacity.

If the LUN or metaLUN you are expanding is participating in a SnapView (snapshot or clone), MirrorView, or SAN Copy session, you will not be able to change the user capacity at this time. The wizard will automatically select Current Capacity for you. In order to change the user capacity, you must wait for the expansion to complete and then follow the instructions in the online help or the Administrators Guide for SnapView, MirrorView or SAN Copy.

If a metaLUN has not been expanded to use all of the available space, it may be expanded at any time by viewing its Properties, then choosing the new size from the General Tab.



This screen is available only when you first create a metaLUN. If later, you need to modify the metaLUN settings, use the MetaLUN Properties dialog boxes. The example lets you change the settings for a new metaLUN or accept the defaults.

Setting Parameters:

Name - Lets you assign a name to the metaLUN.

Default Owner - SP that assumes ownership of the LUN when the storage system is powered up (defaults to the setting of the base LUN).

SP A - Assigns ownership of the metaLUN to SP A.

SP B - Assigns ownership of the metaLUN to SP B.

Enable Auto Assign - Enables or disables Auto-assign for the metaLUN. Auto Assign defaults to the setting of the base LUN.

Expansion Rate - Specifies the relative importance of making additional LUN capacity available to the host.

Element Size Multiplier - Sets the stripe element size for a metaLUN component. You determine this by multiplying the stripe size of the first LUN in each component by the element size multiplier. The stripe element size for each component in the metaLUN can be different since the stripe size of the first LUN in each component can vary. Valid multiplier values are 1 through 255. The default multiplier is 4.

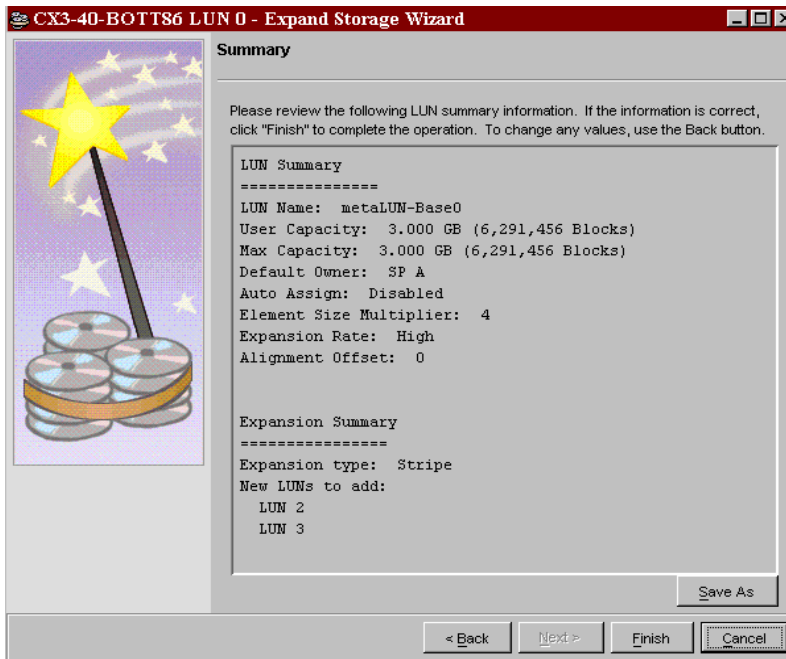
EMC recommends that you leave the element size multiplier value at 4.

Alignment Offset - If available, you can use alignment offset when the host operating system records private information at the start of the LUN. The default value is zero and this supports most host operating systems.

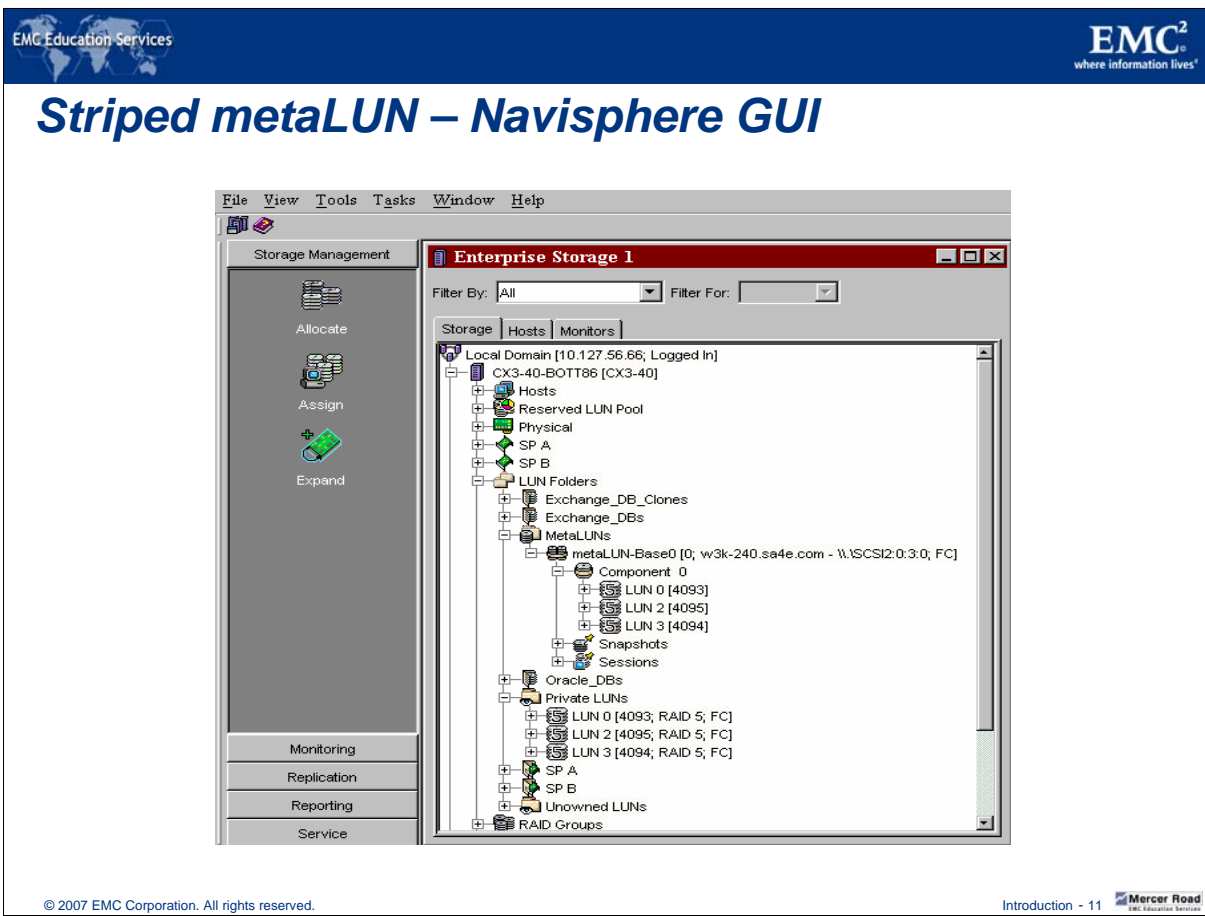
IMPORTANT: In order to properly use Alignment Offset, you must know the exact size of the private information on the LUN. Improper use will degrade performance.

In this screen, we can choose the 'human-friendly' name of the metaLUN, the default owner for the LUN, and other parameters. The Element Size Multiplier determines the stripe size for the metaLUN.

Expand Storage Wizard (Summary)

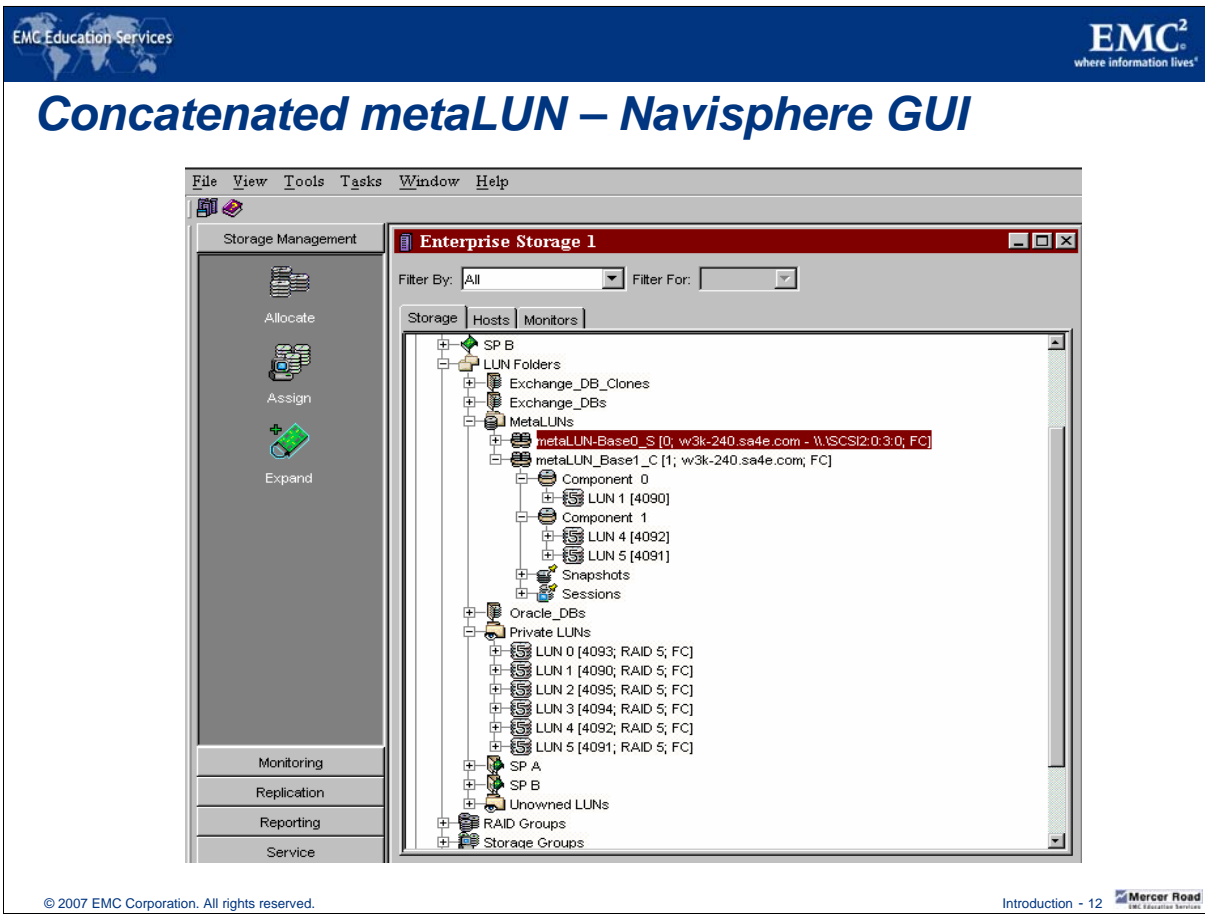


This is the Summary page for a Striped expansion.



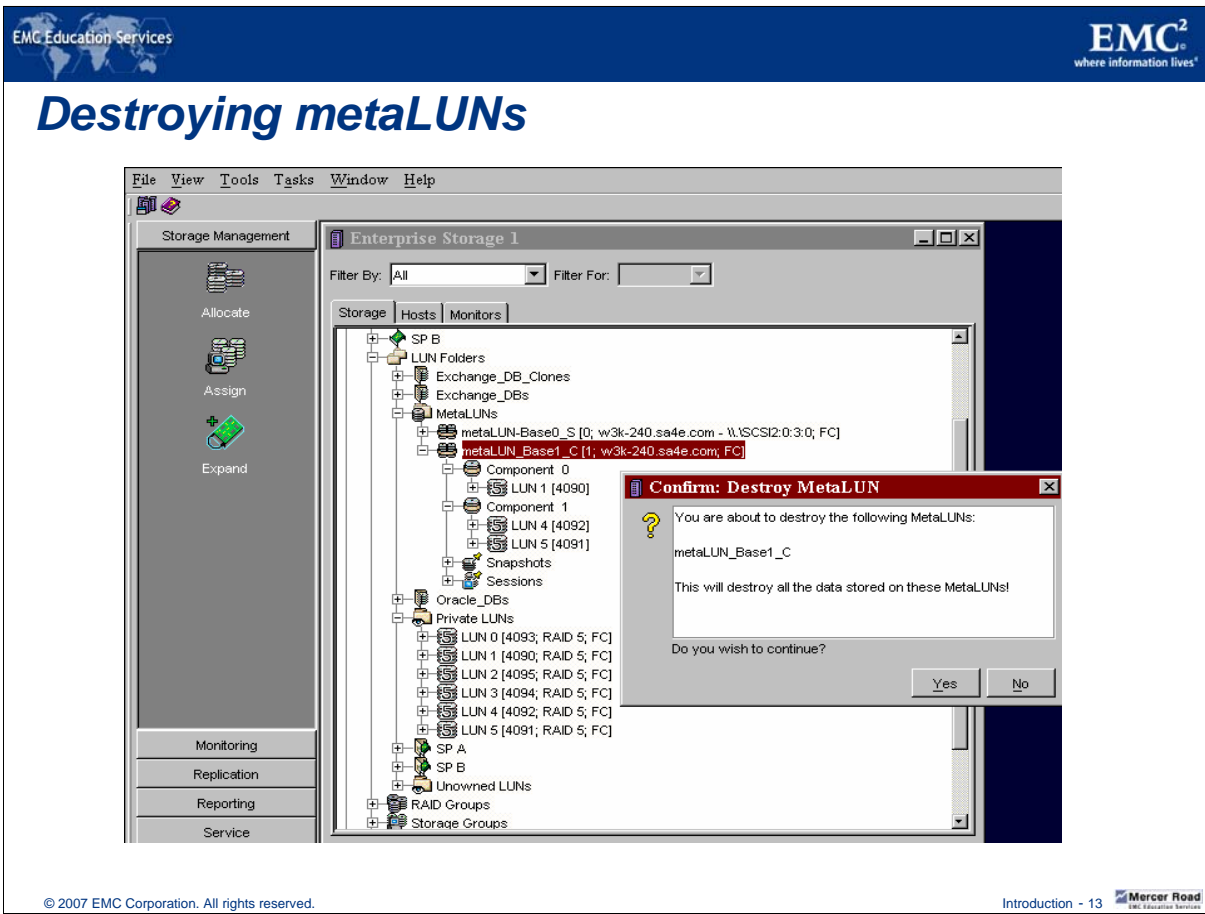
By expanding the LUN Folders > metaLUN containers, the user can view the components that comprise the metaLUN.

Here the metaLUN has a single component, 3 RAID 5 LUNs striped together make up the metaLUN.. Note also that the Base LUN and LUNs which were added have become Private LUNs, and have been given new LUN IDs. The metaLUN takes over the ID of the Base LUN. The LUN IDs given to the component LUNs are determined by the model number, typically starting at the highest available LUN.



This view of a concatenated metaLUN shows the 2 components from which it was constructed. The first component consists of a single LUN, the Base LUN. The second component consists of 2 LUNs striped together. The 2 components are concatenated to form a larger metaLUN.

Note again that the Base LUN and expansion LUNs have been renumbered, and have become Private LUNs.



A metaLUN can only be destroyed if it meets the same conditions that a FLARE LUN must meet before it can be unbound, it may not be in a Storage Group, nor may it be used by any feature of the storage system.

When a metaLUN is destroyed, all LUNs involved with its components are unbound, and all the data is lost.

metaLUN CLI Command Line Interface

- Platform-specific location
 - /opt/Navisphere/bin/naviseccli.jar (Solaris)
 - \Program Files\EMC\Navisphere CLI\naviseccli (Windows)
- Allows scripting of metaLUN commands
- Command format:
 - naviseccli -address <SPname> -user <username> -password <password> -scope <scope> command options
 - Username, password, scope not required if security file is configured (see next slide)
- Example:
 - naviseccli -address cx1spa metalun -info

The naviseccli CLI allows command line management of metaLUNs. In the slides that follow, examples will be given of CLI commands which perform similar actions to the GUI operations we've seen so far. Notice the format of the commands – this is the common format for all naviseccli CLI commands. There will be little or no explanation in the notes section – the body of the slide covers the command completely.

Secure CLI

- Preferred Command Line Interface for metaLUNs
- Platform-specific location
 - /opt/Navisphere/bin/naviseccli (Solaris)
 - \Program Files\EMC\Navisphere CLI\naviseccli.exe (Windows)
- Allows scripting of metaLUN commands
- Command format:
 - naviseccli [-address | -h] <SPname> -user <username> -password <password> -scope <scope> command options
 - Username, password, scope not required if security file is configured (see next slide)
- Example:
 - naviseccli -address cx1spa metalun -info

The Secure CLI allows command line management of metaLUNs. In the slides that follow, examples will be given of CLI commands which perform similar actions to the GUI operations we've seen so far. Notice the format of the commands – this is the common format for all Secure CLI commands, and is almost identical to the older Java CLI. There will be little or no explanation in the notes section – the body of the slide covers the command completely.

Secure CLI – Security File

- In the Navisphere CLI directory, run:
 - `naviseccli -addusersecurity [-user <username>] -password <password> -scope <scope>`
- Username is the same as the OS username by default
- Adds file to user home folder/directory
 - `SecuredCLISecurityFile.txt`
- Remove security file with:
 - `naviseccli -removeusersecurity`

Having a security file on the host removes the need for a username, password and scope to be added to each command line. The username which the user logs in with on the OS (or supplies on the command line) must match, including case, a username that is present in the CLARiiON domain, and the password and scope in the security file must match those in the CLARiiON domain. The security file is encrypted, and stored locally on the host in the user home directory.

Expanding metaLUNs – CLI


- ... metalun -expand -base <number> -lus <numbers> -type <c|s> ...
 - Expands base LUN with specified LUNs
 - Choose expansion type - stripe/concatenate
 - Choose expansion rate
 - Choose default owner
 - Can disable confirmation messages (-o switch)

```
C:\>navisecli -h 10.127.56.66 metalun -expand -base 0 -lus 1 -name metaLUN_Base0_S -type S
Stripe expansion on a in-use master LUN will redistribute data across the all components of the new
metaLUN. It might take long time to finish the expansion. The expanded space will not available unti
l the expansion is finished, although you can still access the data during expanding period.
Do you really want to perform the action (y/n)? y
```

The navisecli or navicli.jar metalun command with the –expand function creates a new metaLUN or expands the capacity of an existing one.

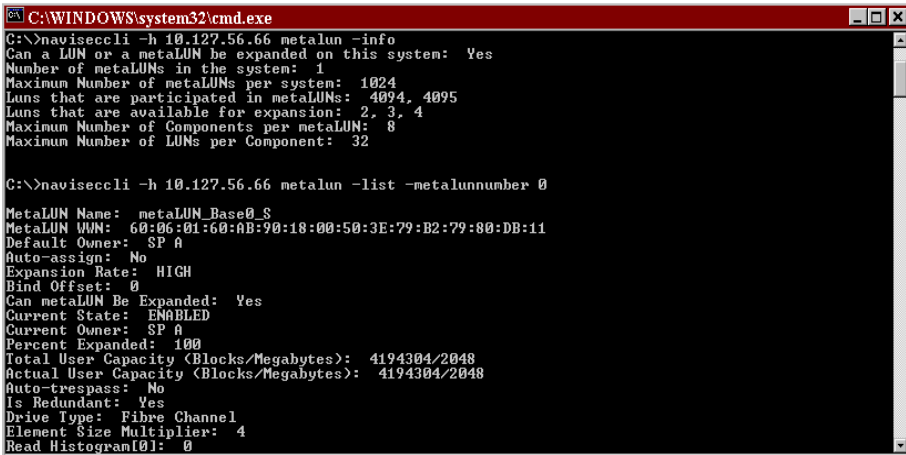
Note: If you are running a VMware ESX Server, after you create or expand the metaLUN, you must rescan the bus at the ESX Server level. You can also rescan at the virtual machine level (optional). You then must expand the filesystem at the virtual machine level. The ESX Server and the virtual machine will now recognize the new or expanded metaLUN.

This example expands Base LUN 0.

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metaLUN status – CLI

- ... metalun -info <options>
 - General information about metaLUNs on the storage system
- ... metalun -list -metalunnumber <number>
 - Information about specific metaLUNs




```

C:\WINDOWS\system32\cmd.exe
C:\>navisecli -h 10.127.56.66 metalun -info
Can a LUN or a metaLUN be expanded on this system: Yes
Number of metaLUNs in the system: 1
Maximum Number of metaLUNs per system: 1024
Luns that are participated in metaLUNs: 4094, 4095
Luns that are available for expansion: 2, 3, 4
Maximum Number of Components per metaLUN: 8
Maximum Number of LUNs per Component: 32

C:\>navisecli -h 10.127.56.66 metalun -list -metalunnumber 0
MetaLUN Name: metaLUN_Base0_S
MetaLUN WWN: 60:06:01:60:0B:90:18:00:50:3E:79:B2:79:80:DB:11
Default Owner: SP A
Auto-assign: No
Expansion Rate: HIGH
Bind Offset: 0
Can metaLUN Be Expanded: Yes
Current State: ENABLED
Current Owner: SP A
Percent Expanded: 100
Total User Capacity (Blocks/Megabytes): 4194304/2048
Actual User Capacity (Blocks/Megabytes): 4194304/2048
Auto-trespass: No
Is Redundant: Yes
Drive Type: Fibre Channel
Element Size Multiplier: 4
Read Histogram[0]: 0

```

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The navisecli or navicli.jar metalun command with the –info function and no other options displays all general information about the metaLUN environment for a storage system. Issuing this command with one or more options displays the information based on the options issued.

You must have a user account on the storage system on which you want to execute the command.

The navisecli or navicli.jar metalun command with the –list function and no other options lists all property information for all metaLUNs on a storage system. Issuing this command with one or more options displays the information based on the options issued.

Note: In order to return values for performance data, you must enable statistics logging for each SP in the storage system. Use Navisphere CLI or Navisphere Manager.

If you request performance data for a specific metaLUN, make sure that you enter the IP address for the SP that is the current owner of the metaLUN.

Modifying metaLUNs – CLI

- ... metalun -modify -metalun <number> ...
 - Expand size of an existing metaLUN not using full capacity
 - Change name, default owner, expansion rate
 - Can disable confirmation messages (-o switch)

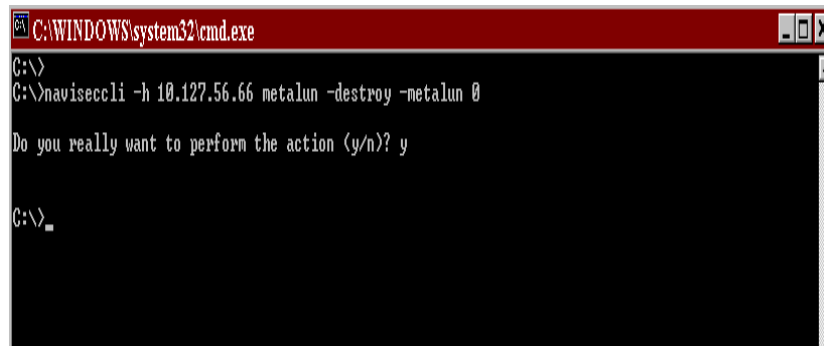
```
C:\>navisecli -h 10.127.56.66 metalun -modify -metalun 0 -newname newMetaLunBase0  
Do you really want to perform the action (y/n)? y
```

The navisecli or navicli.jar metalun command with the –modify function lets you edit certain properties of a specified metaLUN. You must specify either the number or WWN for the metaLUN, and you must specify at least one other switch.

You must have a user account on the storage system on which you want to execute the command.

Destroying metaLUNs – CLI

- ... metalun -destroy -metalun <number>
 - Destroys metaLUN
 - Unbinds all LUNs in all Components
 - All data is lost
 - Can disable confirmation messages (-o switch)



```
C:\WINDOWS\system32\cmd.exe
C:\>
C:\>navisecli -h 10.127.56.66 metalun -destroy -metalun 0
Do you really want to perform the action (y/n)? y
C:\>_
```

The navisecli or navicli.jar metalun command with the –destroy switch destroys an existing metaLUN and then unbinds all LUNs that were part of the metaLUN. You will lose all data on the LUNs. Note: You cannot destroy a metaLUN that belongs to a storage group. You must remove the metaLUN from the storage group in order to destroy it. You cannot destroy any metaLUNs that are currently participating in a snapshot, clone, mirror or SAN Copy session. Destroy a metaLUN, and unbind all the component LUNs .

LUN Migration

- Introduction to LUN Migration
- LUN Migration operation
- LUN Migration limits
- Managing LUN Migration
 - Navisphere Manager
 - Navisphere CLI

These are the LUN Migration topics covered in this module

Introduction to LUN Migration (virtual LUNs)

- Migration moves data from one LUN to another LUN
 - CX/CX3-series CLARiiONs only
 - Any RAID type to any RAID type, FC to ATA or ATA to FC
- Neither LUN may be private LUNs or Hot Spares
- Neither LUN may be binding, expanding, or migrating
- Either or both may be metaLUNs
- Destination LUN may not be in a Storage Group
- Destination LUN may not be part of SnapView or MirrorView operations
- Destination LUN may be larger than Source LUN

LUN migration allows data to be moved from one LUN to another regardless of raid type, disk type, speed and number of disks in the raid group. Data may be moved on CX/CX3-series CLARiiONs only.

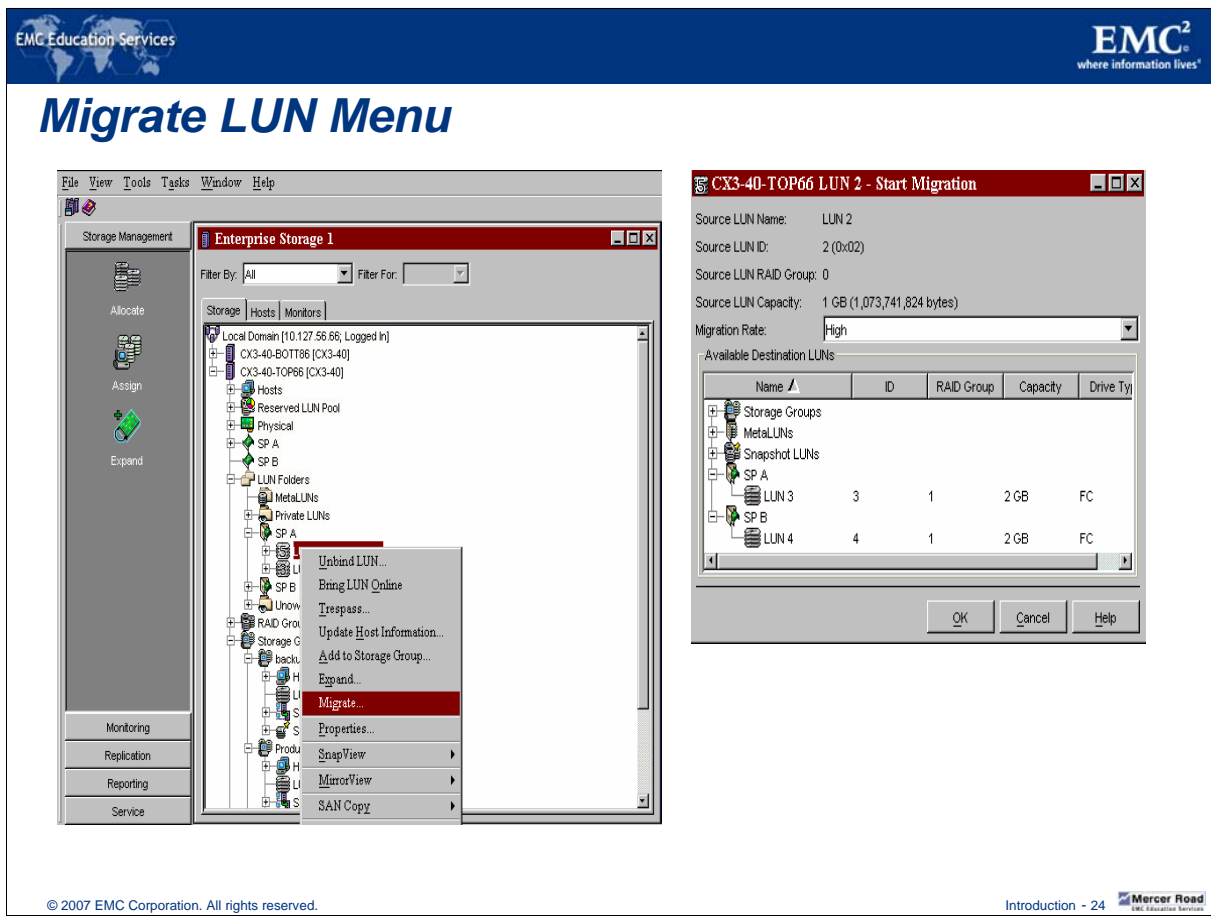
The LUNs used for migration may not be private LUNs or Hot Spares, nor may they be binding, expanding or migrating. Either LUN, or both LUNs, may be metaLUNs. Neither LUN may be a component LUN of a metaLUN. The destination LUN may not be part of SnapView Snapshot, SnapView Clone or MirrorView operations. This will include Clone Private LUNs, Write Intent Log LUNs, and Reserved LUN Pool LUNs.

Note that the Destination LUN is required to be at least as large as the Source LUN, and may be larger.

LUN Migration Operation

- Data is copied from Source LUN to Destination LUN
 - Source stays online and accepts I/O
- Destination assumes identity of Source when copy completes
 - LUN ID, WWN
 - Storage Group membership
- Source LUN is unbound after copy completes
- The migration process is non-disruptive
 - There may be a performance impact
- LUN Migration may be cancelled at any point
 - Storage system returns to its previous state

The migrating of data from one LUN to one other LUN with the LUN Migration feature is transparent to any host accessing the Source LUN, though there may be a performance impact. Copying of data proceeds while the Source LUN is available for read/write access, and the copy process may be terminated at any time. Once all data is copied, the Destination LUN assumes the full identity of the Source LUN, and the Source LUN is unbound as a security measure. The host accessing the Source LUN sees no identity change, though of course the LUN size may have changed. In that case, a host utility such as diskpart can be used to make the increased space available to the host OS.



Configures and starts the LUN migration operation.

If the destination LUN does not belong to the SP that owns the source LUN, the destination LUN will be trespassed to the SP that owns the source LUN before the migration starts.

Source LUN Name - Identifies the source LUN that will be participating in the migration operation.

Source LUN ID - Identifies the source LUN ID (iSCSI) or the WWN (Fibre Channel).

Source LUN Capacity - Identifies the capacity of the source LUN, for example, 5 GB.

Migration Rate - Sets the rate at which the data will be copied - valid values are Low, Medium, High, or ASAP.

Available Destination LUNs - Lists LUNs that are available to be destination LUNs.

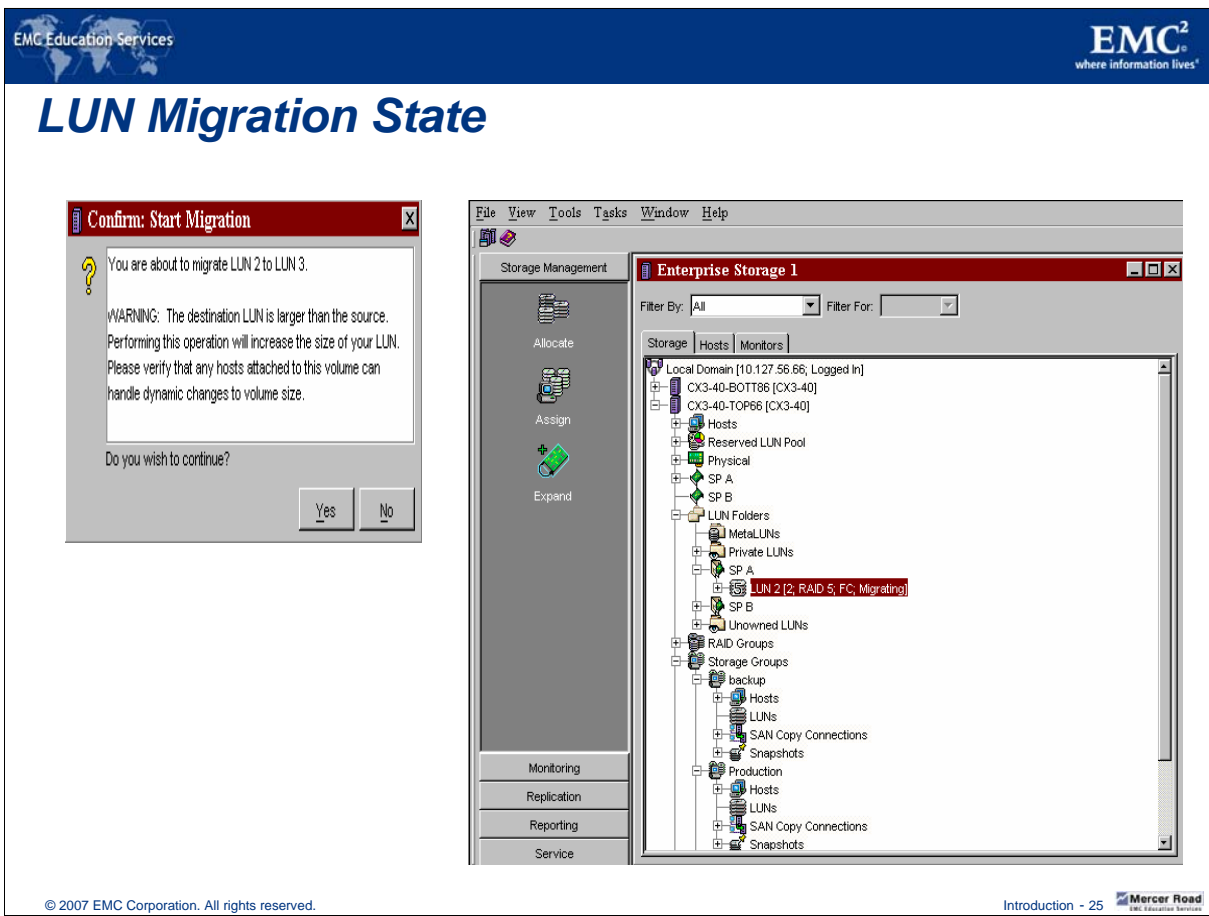
ID - Identifies each LUN, specified as either a LUN ID (iSCSI) or a WWN (Fibre Channel).

Name - Identifies each LUN by name.

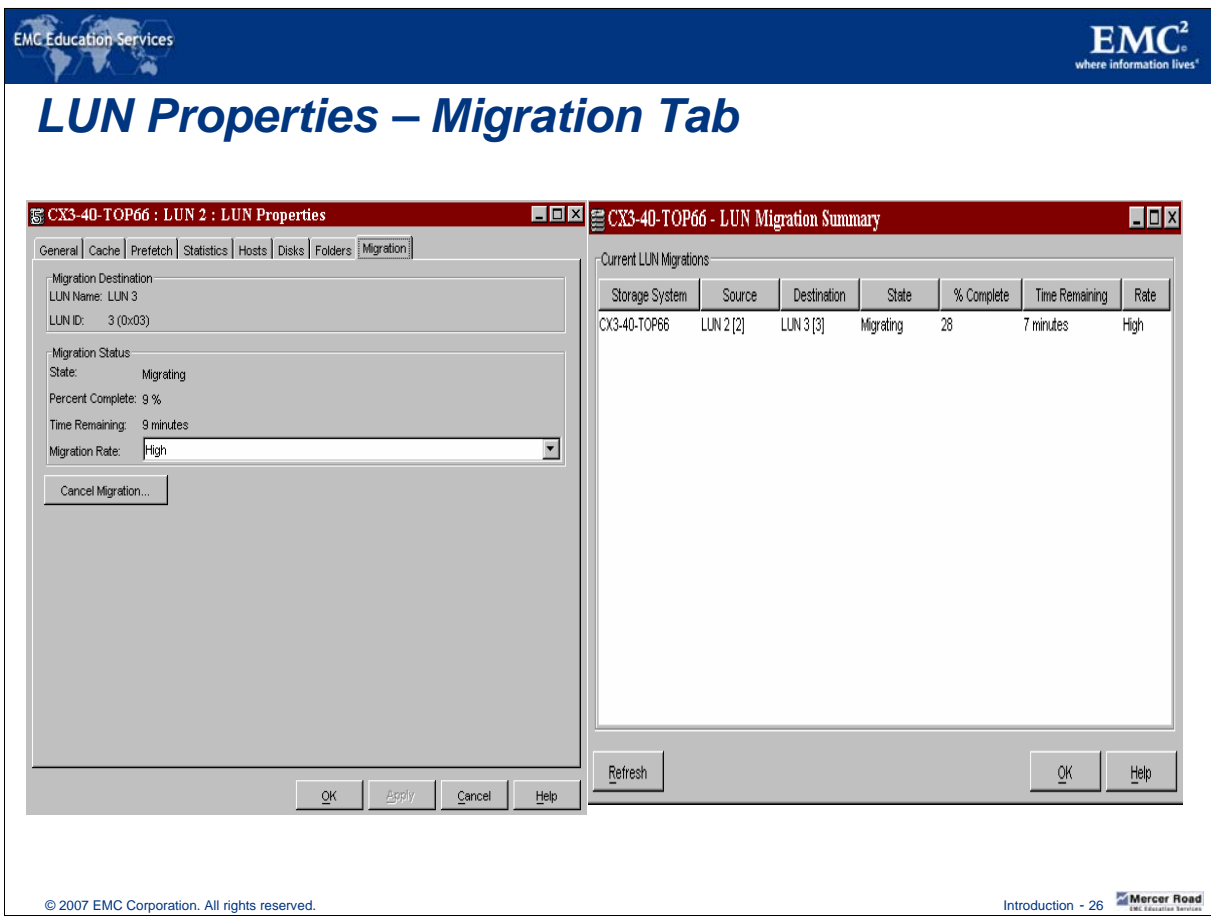
RAID Group - Identifies the RAID group of each LUN.

Capacity - Identifies the capacity of each LUN (lists only those LUNs with a capacity equal to or greater than the source LUN).

Drive Type - Identifies the type of disks that make up the destination LUN - Fibre Channel, ATA, SATA, or ATA/SATA.



Once you choose the destination LUN and start the migration, you are asked to confirm and continue. The right hand screen shows the LUN is Migrating. Right click on the LUN to get the LUN properties, migration window.



This tab is added to the LUN Properties page when migration starts. It displays the Migration state, progress, and an estimated time remaining. The Migration Rate may be changed on the fly. Migration may be cancelled from this tab; the storage system will then revert to its previous state. The example on the left shows the LUN properties migration window whereas the right side shows the storage system properties migration summary window.

The user may also view the SP event logs to migration events like time started and finished.

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LUN Properties – General Tab

The screenshot displays the 'LUN Properties' dialog box for 'CX3-40-TOP66 : LUN 2'. The 'General' tab is active, showing the following details:

- Identity:** LUN Name: LUN 2, LUN ID: 2 (0x02), Unique ID: 60:06:01:60:AB:90:18:00:52:3E:79:B2:79:80:DB:11, Current State: Normal.
- Miscellaneous:** RAID Type: RAID3, Drive Type: FC, RAID Group: 1.
- Capacity:** User Blocks: 4194304, User Capacity: 2 GB (2,147,483,648 bytes), Raw Capacity: 2.5 GB (2,684,354,560 bytes).
- Advanced:** Percent Bound: 100, Element Size: 128, Percent Rebuilt: 100, Alignment Offset: 0, Rebuild Priority: ASAP, Verify Priority: ASAP.
- Ownership:** Auto Assignment Enabled (unchecked), Default Owner: SP A (selected), Current Owner: SP A.

Blue arrows point to the RAID Type field and the User Capacity field.

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After Migration the destination LUN has taken on the identity of the source LUN. The RAID Type has been changed to reflect the destination LUN type, The SP ownership has remained the same since both LUNs were owned by SPA previously, and the User Capacity has been changed to reflect the additional LUN size.

LUN Migration CLI Commands

- LUN Migration uses the navicli.jar or naviseccli CLI ...
 - Navicli.jar –address <SP> ...
- Or, preferably, the Secure CLI
 - naviseccli [-address | -h] <SP> ...

```
C:\>naviseccli -h 10.127.56.66 migrate
Invalid Command. Too few parameters
usage: migrate

        -start -source number!WWN -dest number!WWN
            <-rate low!medium!high!ASAP!value> <-o>
        -cancel -source number!WWN <-o>
        -modify -source number!WWN <-rate low!medium!high!ASAP!value> <-o>
        -list <-source <number!WWN>> <-dest> <-rate> <-state> <-percentcomplete>
            <-timereaming>
```

Navisphere CLI commands can be used to migrate LUNS. Secure CLI is the preferred command line but a user may also use navicli.jar commands as well. The example shows the options that can be used with the migrate command.

LUN Migration CLI – Start

- Naviseccli -h <ip address>
 - migrate -start -source LUN ID|WWN -dest LUN ID|WWN [-rate
 - low|medium|high|asap|value]

```
C:\>naviseccli -h 10.127.56.66 migrate -start -source 2 -dest 4 -rate asap

C:\>naviseccli -h 10.127.56.66 migrate -list
Source LU Name: LUN 2
Source LU ID: 2
Dest LU Name: LUN 4
Dest LU ID: 4
Migration Rate: ASAP
Current State: MIGRATING
Percent Complete: 58
Time Remaining: 8 second(s)
```

The naviseccli or navicli.jar migrate command with the -start switch starts a LUN migration session.

If the maximum number of migrations already exists on the subsystem, the new session is still created, but its state is queued. Note: If you are running a VMware ESX Server and you are using the migration feature to copy LUNs to larger LUNs only, after you complete the migration you must rescan the bus at the ESX Server level. You can also rescan at the virtual machine level (optional). You then must expand the filesystem at the virtual machine level. The ESX Server and the virtual machine will now recognize the completed migration.

LUN Migration CLI – Cancel

- migrate -cancel -source LUN ID|WWN [-o]

```
C:\>naviseccli -h 10.127.56.66 migrate -cancel -source 2
```

The naviseccli or navicli.jar migrate command with the –cancel switch cancels an in-process LUN migration. The destination LUN is deleted when the cancel occurs.

You can cancel only one migration at a time.

You must have a user account on the storage system on which you want to execute the command.

The option switch -o (Override) does not prompt for confirmation.

LUN Migration CLI – Modify

- **migrate** -modify -source LUN ID|WWN [-rate low|medium|high|asap|value] [-o]

```
C:\>navisecli -h 10.127.56.66 migrate -modify -source 2 -rate low
```

The navisecli or navicli.jar migrate command with the –modify switch modifies a LUN migration session according to the parameters you specify.

You must have a user account on the storage system on which you want to execute the command.

Module Summary

Key points covered in this module:

- The procedures for managing metaLUNs
- The procedures for migrating LUNs

These are the key points covered in this module. Please take a moment to review them.