

ControlCenter Foundations

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

- List the benefits of using ControlCenter
- List the architectural components of ControlCenter
- Identify the tasks that can be completed using ControlCenter
- Using the EMC ControlCenter Simulator, complete the lab exercise associated with this module

These are the learning objectives for this module.

This module is reinforced by lab exercises using the EMC ControlCenter Simulator.

ControlCenter Foundations

DEFINITION

We will now define what ControlCenter is and what it can do.

One Tool to Manage All

- ControlCenter has tools to manage:
 - Hosts
 - Networks
 - Storage
 - Applications (TimeFinder, SRDF, DB Backup)
- The use of one integrated tool allows:
 - End to end views of storage
 - Comprehensive alerts
 - Preemptive problem determination



Today, companies are storing ever increasing amounts of information. As enterprise storage networks become more complex, and storage devices grow in number and size, companies are faced with the challenge of effectively managing their storage.

ControlCenter is an integrated family of products that enable you to discover, monitor, automate, provision and report on networks, host resources, and storage resources across your entire information environment.

From a single console, ControlCenter will monitor and manage:

- Connectivity components, such as Fibre Channel switches and hubs
- Host components, such as host operating systems, file systems, volume managers, databases, and backup applications
- Storage arrays, such as Symmetrix, CLARiiON, and other vendors' storage arrays

ControlCenter shows a consolidated view of the storage environment, which allows one to monitor the health of, track the status of, report on, and control each object from a workstation anywhere on the network. ControlCenter is designed for use in a heterogeneous environment of multi-vendor storage networks, storage hosts, and storage resources. Information can reside on technologically disparate devices running a variety of operating systems.

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The ControlCenter Integrated Approach

The screenshot displays the EMC ControlCenter/Open Edition interface. The top menu bar includes File, Edit, View, Configure, and Help. The main window is divided into several panes. On the left, a 'Storage Allocation - Alert Chart' pane shows a tree view of storage components like Celerra, CLARiON, ESS, HDS, StorageWorks, and Symmetrix. The central pane features three bar charts labeled 'Alerts: 18', 'Alerts: 250', and 'Alerts: 227'. Below these charts is a table of 'Active Alerts: 182be045' with columns for Note, Severity, Object Name, and Message. The bottom pane shows a 'Relationship - Tablespace - INDEX, ORAGENT...' diagram with nodes like /dev/rdsk/c0t0d0s2, /dev/rdsk/c1t0d2s2, and /dev/rdsk/c1t0d1s2. The bottom status bar indicates '© 2006 EMC Corporation. All rights reserved.' and 'ControlCenter Foundations - 4'.

Architecture

- Scalability
- Ease of Use
- Heterogeneity
- Security
- Interoperability
- Centralized

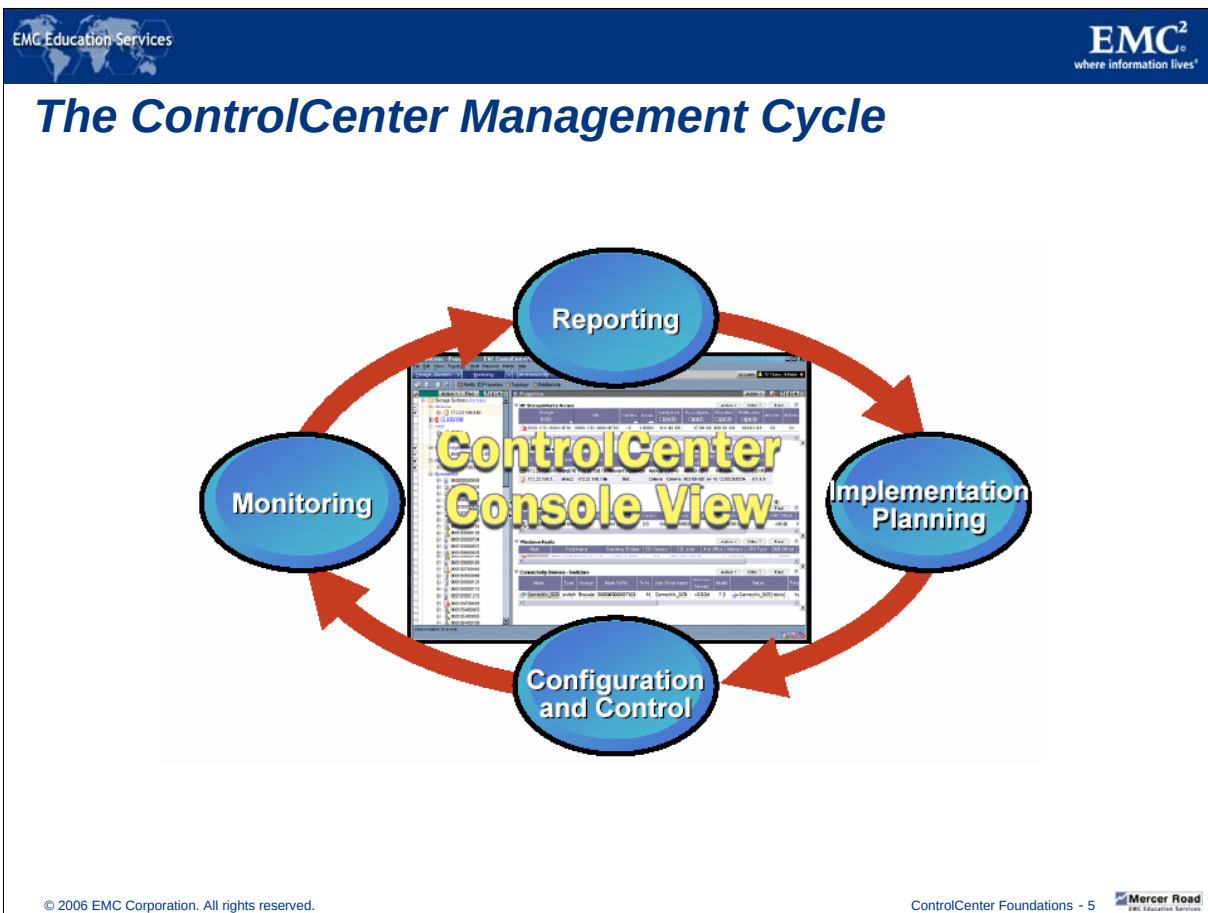
Functionality

- Discover
- Monitor
- Provision
- Protect
- Tune
- Predict

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ControlCenter is a complete set of storage management tools. As new Agents are integrated or enhanced, they are seamlessly integrated into the existing environment. The storage environment can be managed from end to end with one tool. This is the base functionality of ControlCenter.

Due to the interoperability of the architecture and the centralized storage of configuration information, ControlCenter allows IT organizations to manage the service they provide, not just the infrastructure they have.



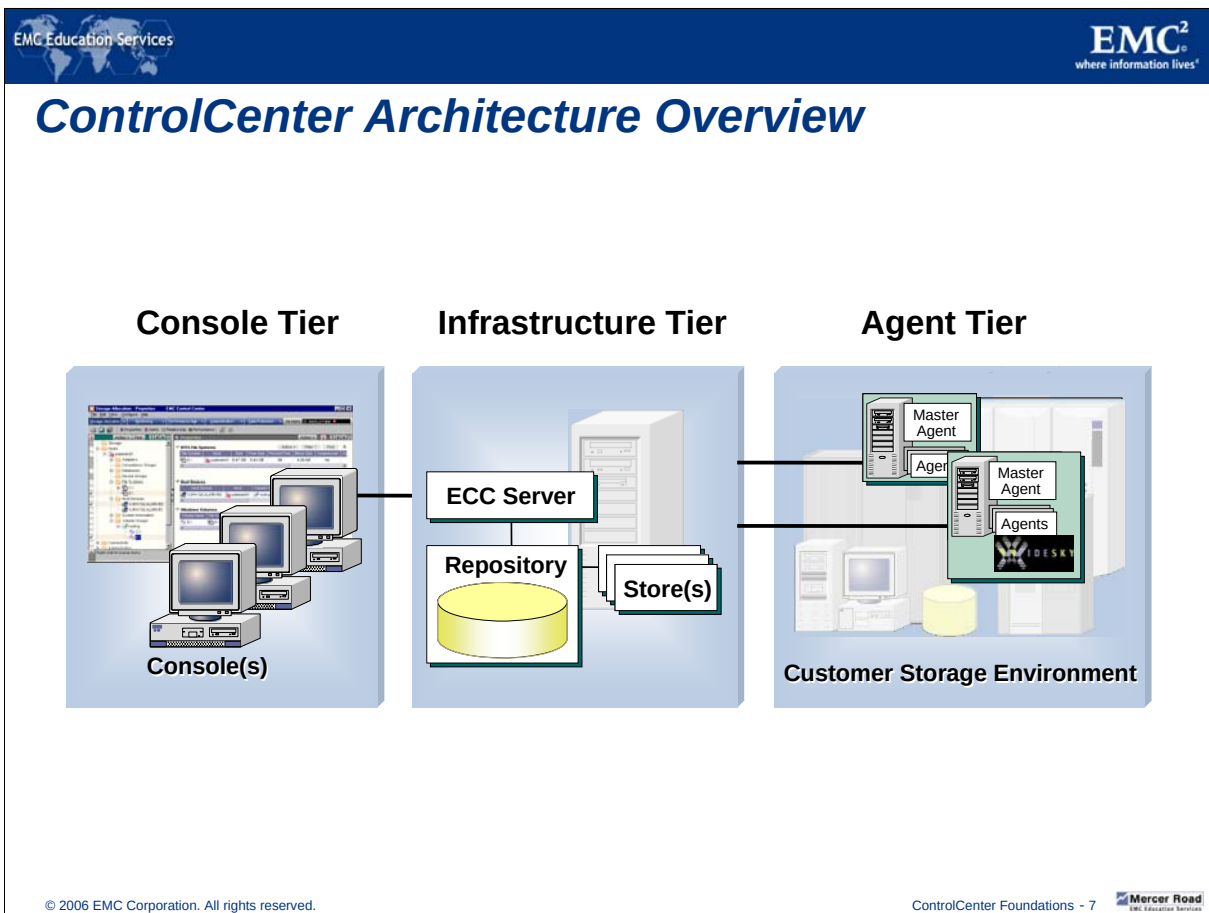
ControlCenter spans the entire EMC storage management life cycle. The first step in reporting involves knowing what you have. It is impossible to determine why your environment is not performing well without an accurate accounting of what is in your environment and how it is configured. Once that has been determined, the analysis of what should be changed is straightforward.

Planning for change is crucial if those changes are to be successfully implemented. Configuration and control processes are used to manage the environment and execute any changes that are required. Finally, monitoring can be set up that not only tells you when a component has failed, but also when a device has reached a state that could lead to failure. This allows you to preemptively change your environment and avoid or minimize the outage.

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COMPONENTS AND ARCHITECTURE

In this next section, we will review the ControlCenter components and architecture.



ControlCenter is comprised of three tiers. They can easily be thought of as data presentation, data storage, and data gathering.

Responsible for data storage, the Infrastructure consists of three separate processes which may run on one or multiple machines, depending on the size of the installation. The Repository contains a relational database that holds the current and historical data for the entire storage environment. The ControlCenter Server processes transactions from the Console requesting the Repository for data. The Store is a process that populates the Repository with data gathered by the Agents; it provides a store and retrieve interface between the Agents and the Repository.

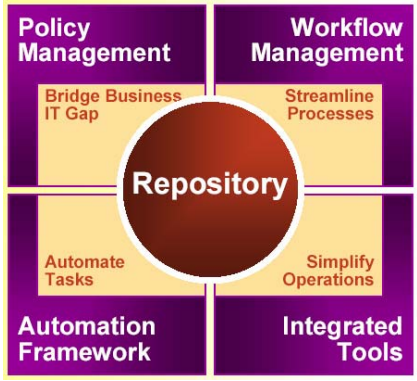
The Console tier handles data presentation. The Console is the user interface through which you view and manage the storage environment. It is a java based application that can be installed from a browser such as Microsoft Internet Explorer or Netscape, or from the command line. Additional applications are implemented as plug-ins to the Console and use the common collection of services provided by the other components (the Server, Repository, Store, and Agents). In addition, the Web Console provides a method of monitoring ControlCenter environment information, though it offers less functionality than the java based Console.

The Agent tier is responsible for data gathering. ControlCenter manages every physical and logical element using intelligent Agents. A different Agent manages each type of object. For example, there is a Storage Agent for Symmetrix, a Host Agent for Windows, and a Database Agent for Oracle.



The Repository

- Relational database
 - Special version of Oracle 9i
 - Designed for minimal customer interaction
 - Write access to the database is limited to ControlCenter applications
- Repository contains ControlCenter data regarding:
 - Storage arrays
 - Hosts
 - Switches
 - Applications



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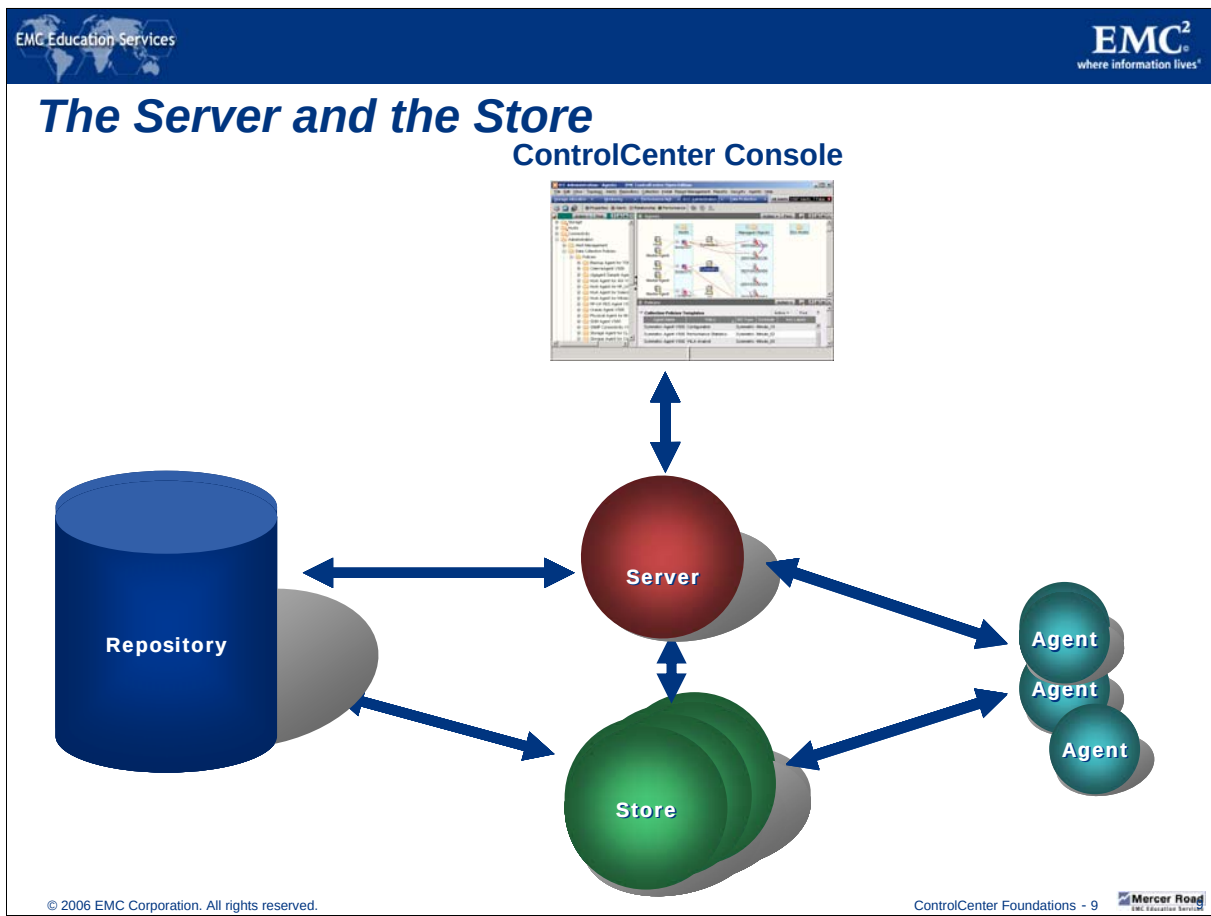
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The central Repository is a relational database. This embedded database is a licensed, special version of Oracle 9i, designed to be transparent to the user. Special care has been taken to allow it to function without user intervention.

Write access to the database is restricted to EMC ControlCenter applications. This allows us to respect the license agreement we have with Oracle.

The Repository will contain data from all of the Agents. This includes information on hosts, connectivity (switches), arrays, applications (databases, TimeFinder, SRDF) and ControlCenter configuration (users, network addresses and versions).



The ControlCenter Server and Store are processes that run on the infrastructure server or servers (for current information on the sizing of an infrastructure, check the ControlCenter Performance and Scalability guidelines). The first component to start is the Repository. The Server process starts next, reading configuration information from the Repository. Once the Server has started, the Store processes start, checking in with the Server to discover the location of the Repository. Each Store will then establish a connection with the Repository and wait for information updates from the Agents, which are then passed on to the Repository.

When the Agents start up, they initially check with the Server to discover which Store to contact, what conditions to monitor, what corrective actions to take, and how the monitored elements are currently recorded in the Repository. They will then contact the Store and give it any updates for the Repository. From this point on, all communication goes directly to the Store.

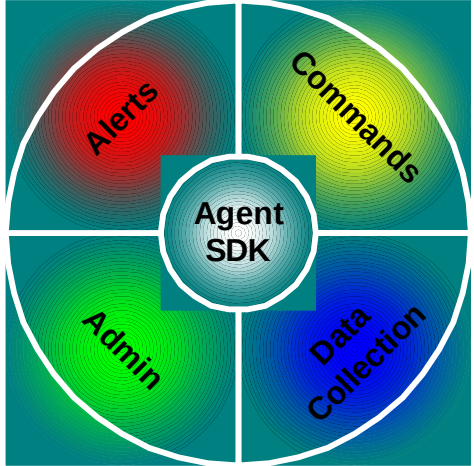
The Server is the primary interface for all ControlCenter components (Stores, Agents, Consoles). It is implemented as a Java process, running as a service on an Infrastructure host. The Server performs a wide range of functions, including communication, distributed processing, login security, and Store load balancing. Only one Server is installed for each environment.

The Store aggregates data discovered by Agents and sends it to the Repository. The Store is also implemented as a Java process running as a service. Depending on the size of an implementation, multiple stores may be implemented for load balancing and scalability (though there can be only one Store instance per physical machine).



The Agents

- Master Agent
- Storage Agents
- SAN Agents
- Host Storage Agents
- Data Types
 - Discovery
 - Configuration
 - Utilization
 - Status
 - Performance
- Collection Modes
 - Policy remote
 - Policy local
 - Real time explore



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The ControlCenter Agents are programs that run on a host, allowing monitoring and management of a storage environment. There are many types of ControlCenter Agents used to control and monitor a diverse collection of managed objects, including storage arrays, hosts, and databases.

The first Agent installed on a host is always the Master Agent. The Master Agent is responsible for the maintenance and administration of the other Agents. After the Master Agent is installed, additional Agents can be pushed from the Console.

Depending on which licenses are enabled, only certain Agents will be installable and only specific functionality will be available. Overall functionality will also be affected by where in the environment each Agent is installed. For a complete list of agents and what operating systems they are supported on, check the ControlCenter Support Matrix. This matrix displays the licensing package with which each agent is available.



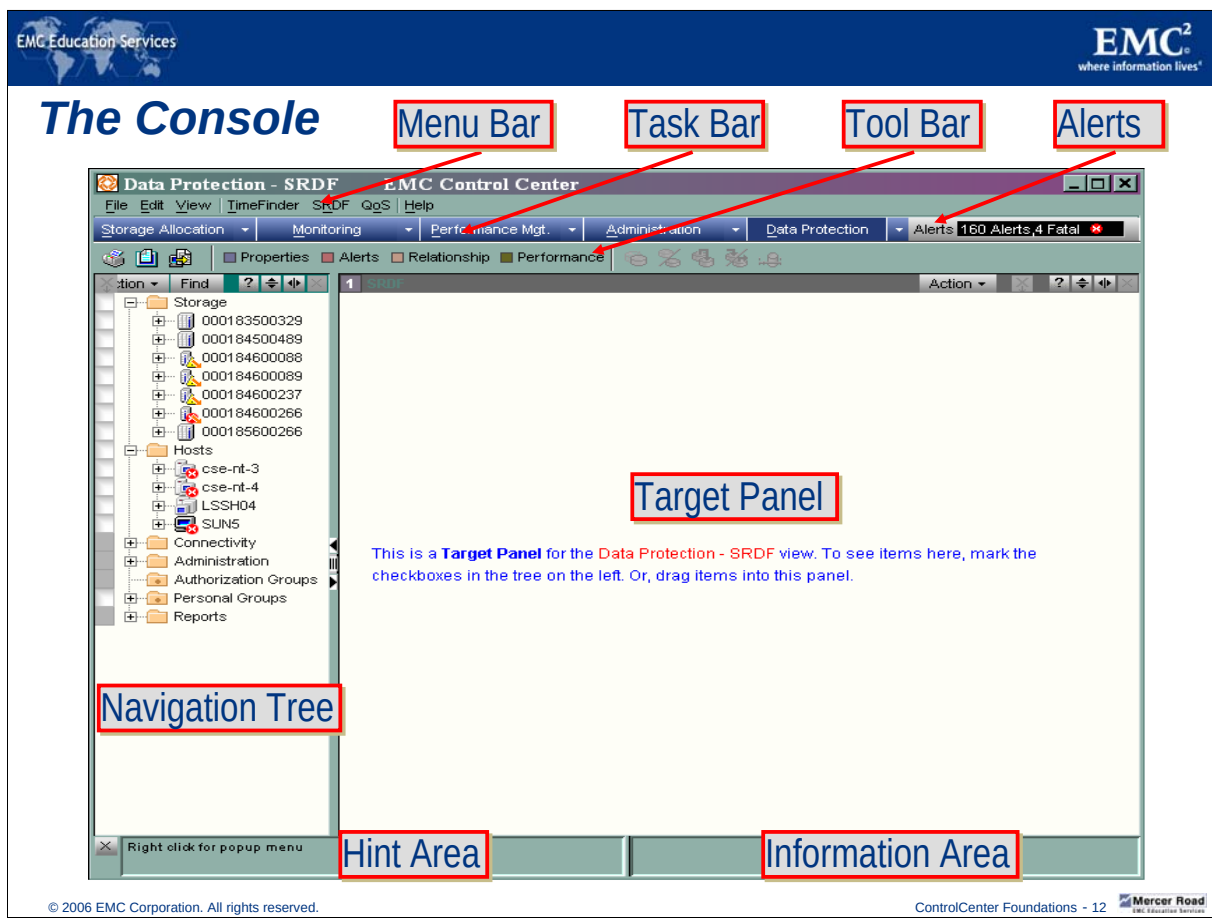
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NAVIGATION



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We will now briefly review the various navigation views available in the product.



The Console is designed to be a task oriented interface. At the top of the interface is the menu bar, which will change its options according to which task bar button has been selected.

Directly below the menu bar is the task bar, which includes the following five groups of tasks: storage allocation, monitoring, performance management, administration, and data protection.

Below the task bar is the tool bar, which gives access to the four most commonly used views of the system.

Also at the top of the Console is the alerts bar. Clicking on the alerts bar will show information on which alerts currently exist in the environment.

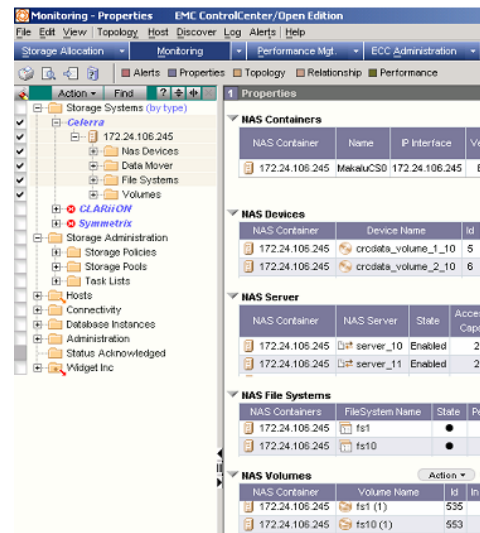
The navigation tree is found on the left side of the Console. The navigation tree displays all the managed objects that are available in a single ControlCenter environment.

To the right of the navigation tree, the target panel displays information from a combination of selected tasks from the task bar and selected managed objects from the navigation tree.

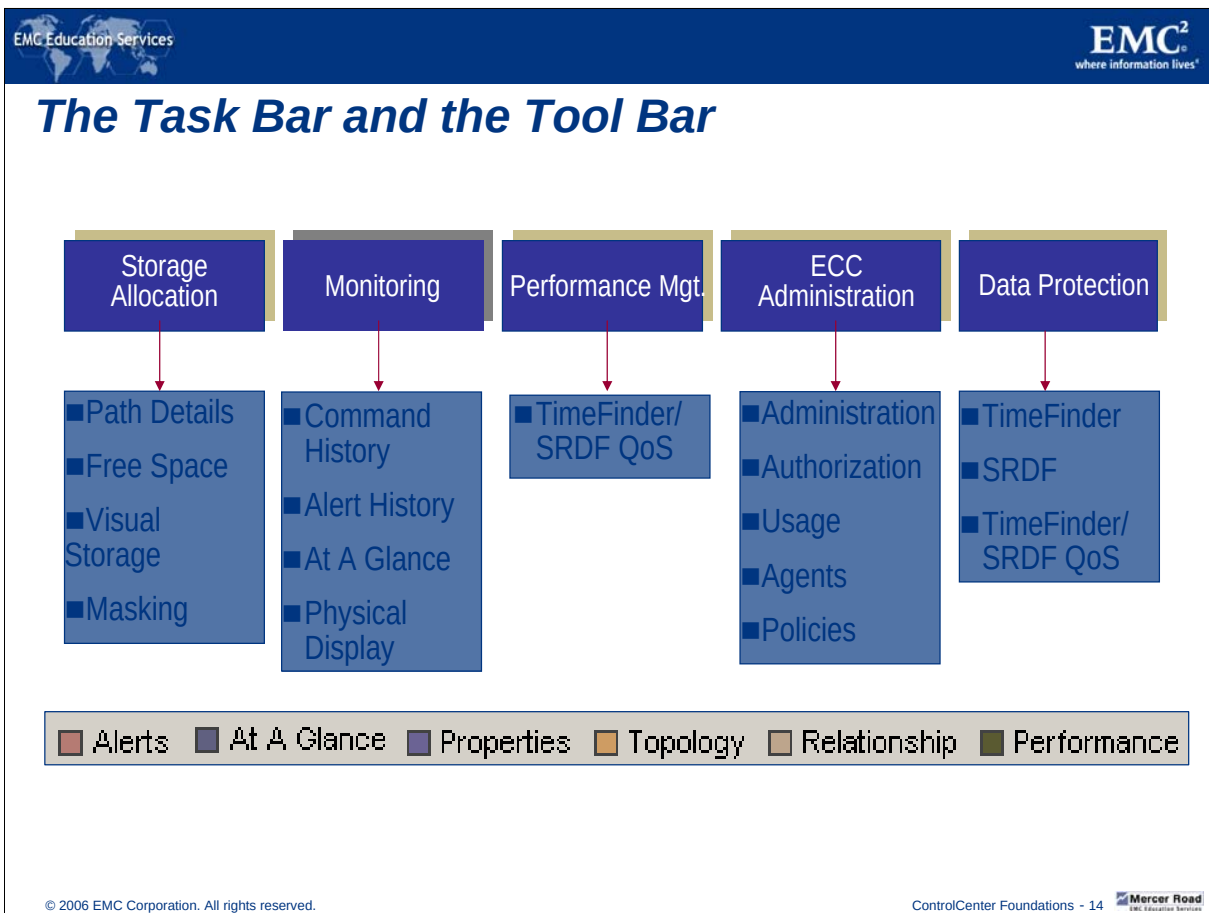
At the bottom of the Console, there is an information area which shows information about the ControlCenter environment. Also at the bottom, the hint area gives suggestions on what to do next.

The Navigation Tree

- Check to select for target panel
- Highlight to perform actions
- Ability to split windows
- Automatic grouping of objects by range



The navigation tree is on the left hand side of the console. At the top of the tree are all of the Storage, Host, and Connectivity objects known to ControlCenter. The bottom of the tree contains the administrative information (users, alerts, groups). Selecting an object in the tree provides information regarding that object in the target panel. Right clicking on objects brings pop-up menus that allow monitoring and control.

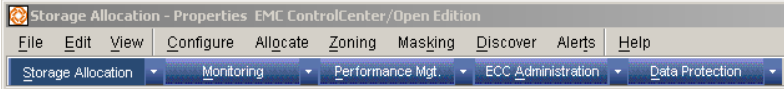
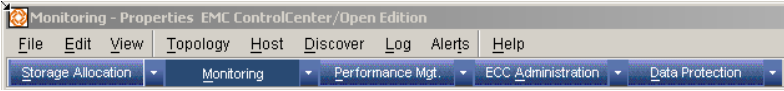
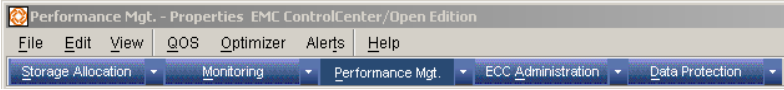
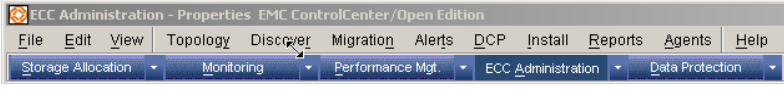
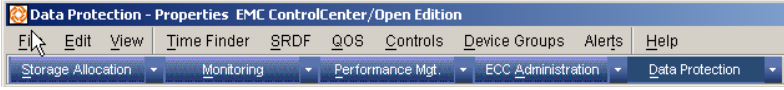


Task Buttons provide drop down menus with actions appropriate for the chosen tasks.

In the tool bar, the following views are available, regardless of which task has been selected: Alerts, At A Glance, Properties, Topology, Relationship, and Performance. The other views are only available when the appropriate task has been selected.



The Menu Bar

- Storage Allocation
- Monitoring
- Performance Management
- ECC Administration
- Data Protection

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The available menu bar selections are dependent on which task bar option is currently chosen. For a full discussion of menu bar options, please refer to the ControlCenter Administration/User Guide.

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Tool Bar Views: Alerts

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File Edit View Topology Discover Migration Alerts DCP Install Reports Agents Help

Storage Allocation Monitoring Performance Mgt. ECC Administration Data Protection All Alerts 62 New, 1 Fatal

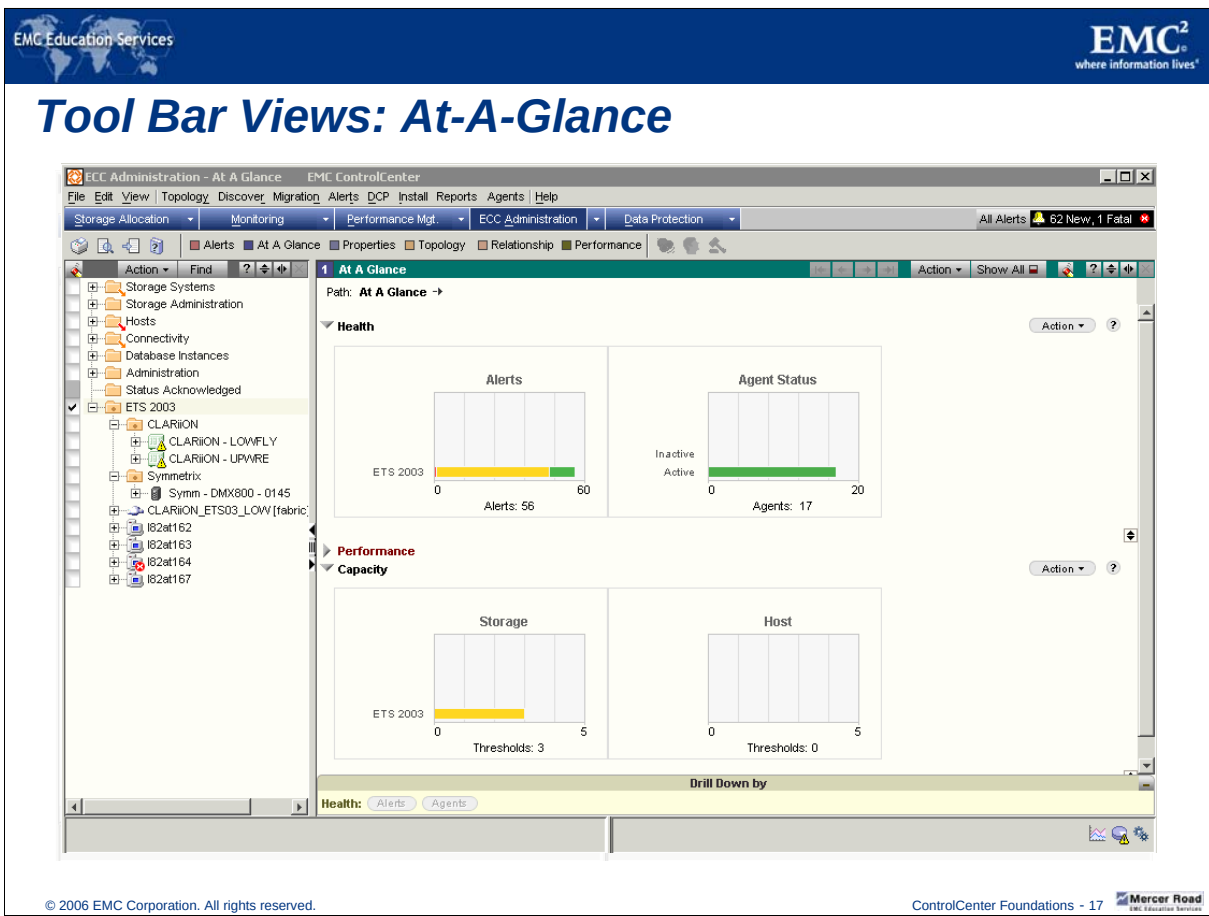
Alerts At A Glance Properties Topology Relationship Performance

1 Alerts - Selected

Object Name	Message	Created
CLARIION - LOWFLY	RAID Group 1 is at 0% free.	Mon Mar 17 14:22:25 EST 2003
CLARIION - UPWRE	RAID Group 1 is at 0% free.	Tue Mar 18 13:00:10 EST 2003
CLARIION - UPWRE	CLARIION has faulted.	Mon Mar 17 23:16:11 EST 2003
CLARIION - UPWRE	RAID Group 1 now has 0MB free space.	Mon Mar 17 23:16:07 EST 2003
Symm - DMX800 - 0145	Symmetrix 000187900145: KB/sec read is 0	Mon Mar 17 23:30:06 EST 2003
Symm - DMX800 - 0145	Symmetrix 000187900145: KB/sec written is 0	Mon Mar 17 23:30:04 EST 2003
I82at163	WLA Daily collection 20030317 for Host=I82at164.0000d1ecc3d1 is p...	Tue Mar 18 12:11:37 EST 2003
I82at163	WLA Daily collection 20030317 for Host=I82at167.Iss.emc.com is pr...	Tue Mar 18 11:59:58 EST 2003
I82at163	WLA Daily collection 20030317 for Clariion=FLY00022300012 is proc...	Tue Mar 18 11:52:50 EST 2003
I82at163	WLA Daily collection 20030317 for Host=L82at162.Iss.emc.com is p...	Tue Mar 18 11:52:37 EST 2003
I82at163	WLA Daily collection 20030318 for Clariion=WRE00022403458 is pro...	Wed Mar 19 00:00:49 EST 2003
I82at163	WLA Daily collection 20030318 for Symmetrix=000187900145 is pro...	Wed Mar 19 00:00:41 EST 2003
I82at163	WLA Daily collection 20030318 for Host=I82at163.00c04f60004a is pr...	Wed Mar 19 00:00:12 EST 2003
I82at164	Managed Object [NHHost, 9021] has been changed in the following...	Mon Mar 17 10:44:25 EST 2003
I82at164	Managed Object Hosts has been changed in the following way: R...	Tue Mar 18 10:34:01 EST 2003
I82at164	Managed Object [Clariion, 9558] has been changed in the followin...	Mon Mar 17 10:38:32 EST 2003
I82at164	Managed Object Fabrics has been changed in the following way: ...	Tue Mar 18 10:33:58 EST 2003
I82at164	Host Agent for Windows agent on host I82at164.0000d1ecc3d1 ha...	Mon Mar 17 10:38:10 EST 2003
I82at164	Managed Object New Group has been changed in the following w...	Tue Mar 18 09:31:23 EST 2003
I82at164	User eccadmin has successfully logged onto ECC	Fri Mar 14 15:27:40 EST 2003
I82at164	Managed Object 500 Status Acknowledged has been changed in ...	Fri Mar 14 15:26:51 EST 2003
I82at164	Logon failure: User ID for adminecc is invalid or unknown	Mon Mar 17 16:51:29 EST 2003

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The Alerts view displays the active alerts on the system. In the example shown, we see both Critical (level 3) and Warning (level 5) alerts. If you highlight an alert and right click, the menu will allow you to remove the alert from the display, reset the alert for all users, or further modify the alert through use of the edit alerts dialog box.



The At-A-Glance view is designed to provide a single graphical view of the entire environment. It shows a high level perspective by dividing the environment into categories such as storage array performance and host capacity. For the At-A-Glance view, ControlCenter consolidates related alerts and threshold notifications into charts that indicate the status of the various categories.

More detailed information is available through the right click pop-up menus and the other available views.

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Tool Bar Views: Properties

The screenshot displays the EMC ControlCenter interface. The left pane shows a tree view of storage systems, including Celerra CNS, CLARiiON, HDS, HP StorageWorks Arrays, Network Appliance, Storage Arrays, and Symmetrix. The right pane shows the 'Properties' view for selected objects, categorized into MVS Hosts, Windows Hosts, UNIX Hosts, Symmetrix Arrays, and CLARiiON Arrays.

MVS Hosts

Host	Host Cluster	Operating System	OS Version	OS Release	OS Level	CPU Type	# of CPUs	Vendor	Memory	Configure
AOSS	SWRXPLEX	z/OS	01	03	00		1	IBM	0.25 GB	

Windows Hosts

Host	Host Name	Operating System	OS Version	OS Level	# of CPUs	Memory	CPU Type	GMT Offset
I82ar154	cse-nt-4.lss.emc.com	Windows 2000	5.0	Service Pack 2	2	1.00 GB		-05:00

UNIX Hosts

Host	Host Name	Operating System	OS Version	OS Level	# of CPUs	Memory	CPU Type	GMT Offset
I82ar155	I82ar155.lss.emc.com	Solaris 2.8	2.8	Generic_108528-17	1	0.50 GB		-05:00

Symmetrix Arrays

Symmetrix	S/N	Managed	Model	Configured Capacity	Unconfigured Capacity	Total Standard	Total BCV	Total SRDF	Total Disk
000000005500	000000005500	No Symmetrix Agent	8730	3,374.72 GB	Not Avail.	2,910.09 GB	171.66 GB	350.19 GB	2
000187400069	000187400069	No Symmetrix Agent	DMX1000P	9,659.78 GB	Not Avail.	9,347.68 GB	312.10 GB	0.00	2
				3,034.51 GB	0.00	2,257.77 GB	483.76 GB	350.19 GB	

CLARiiON Arrays

CLARiiON	S/N	Vendor	Model	Configured Capacity	Unconfigured Capacity	Allocated Capacity	Unallocated Capacity	# LUNs	# Disks
WRE00022201023	WRE00022201023	EMC	600	1,514.66 GB	3,744.13 GB	1,350.02 GB	164.64 GB	94	90
				1,514.66 GB	3,744.13 GB	1,350.02 GB	164.64 GB	94	90

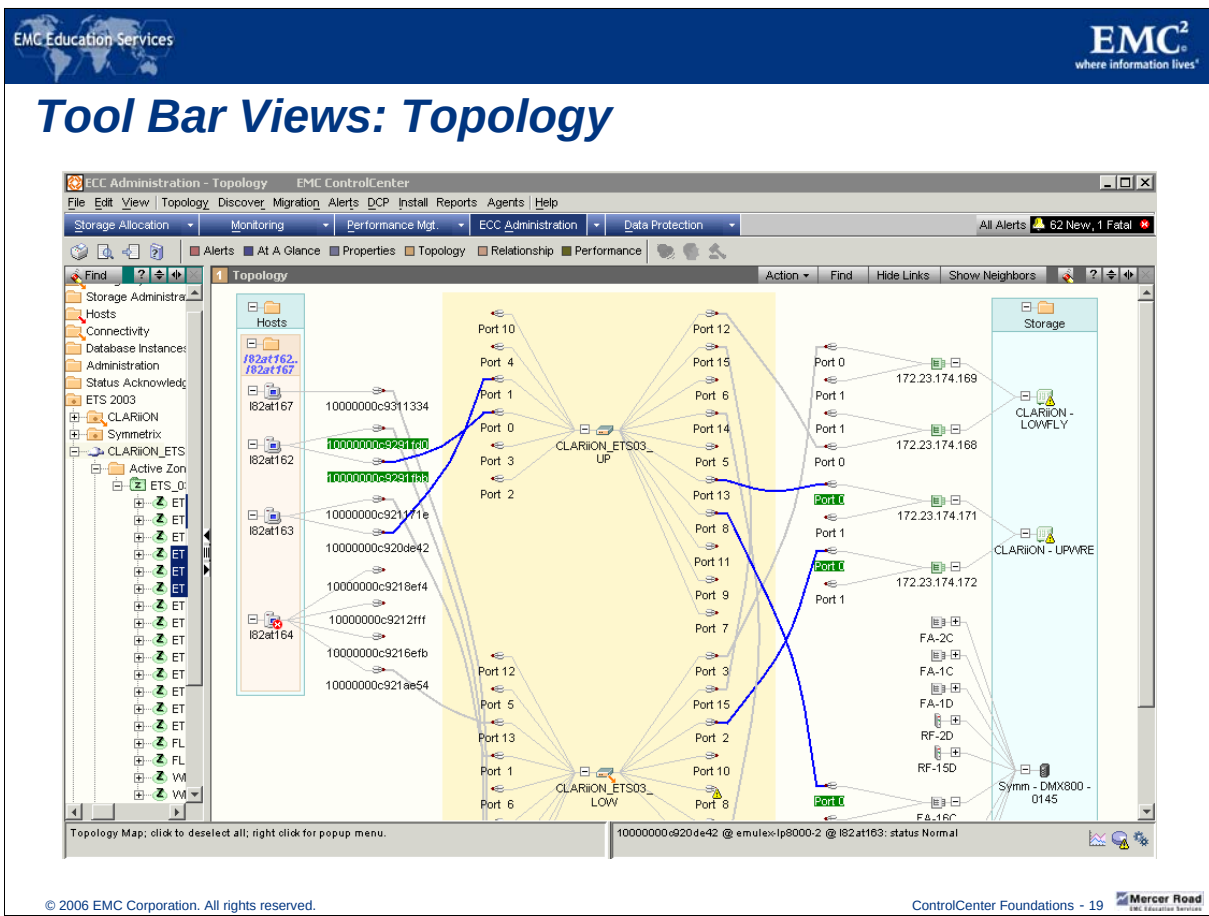
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The Properties view provides information on any selected managed object.

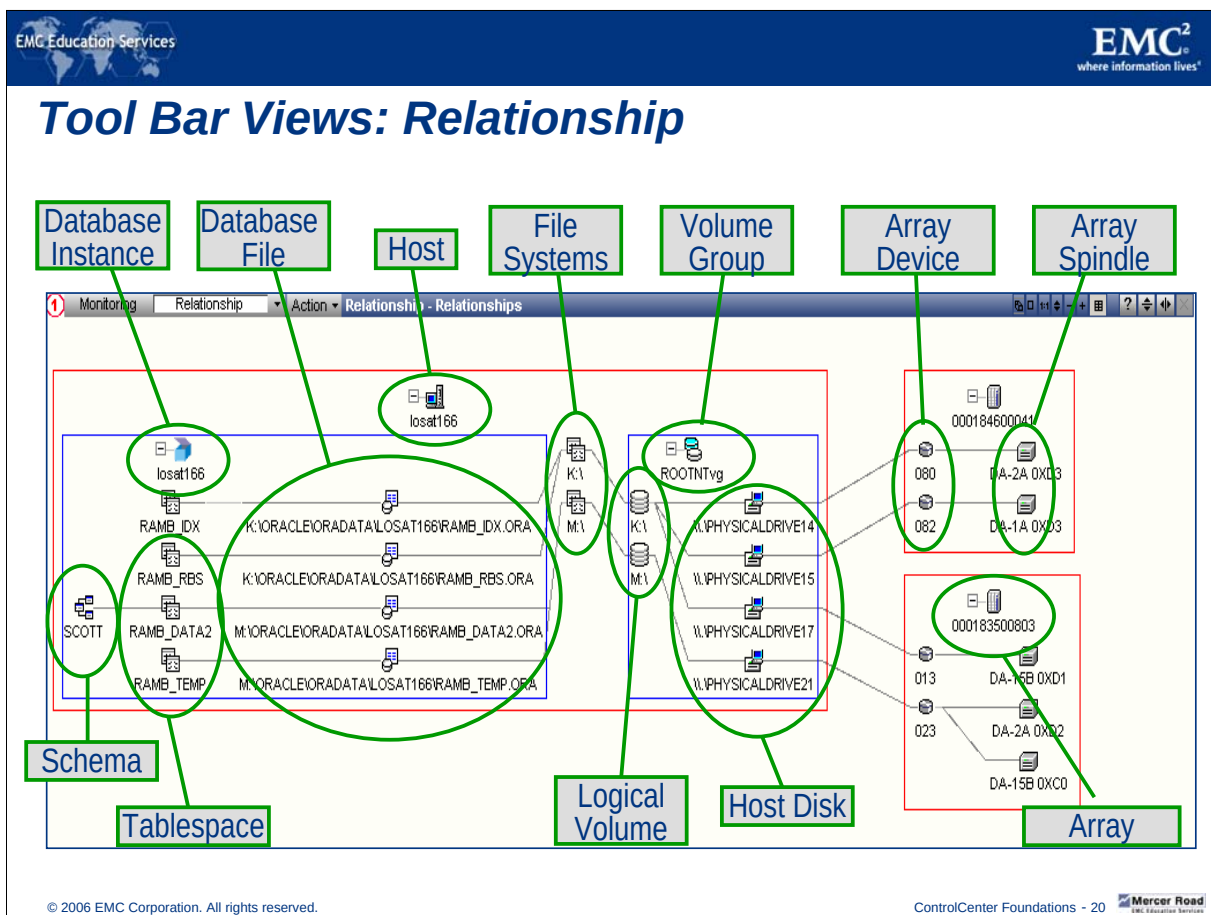
Information regarding multiple managed objects can be shown in a single properties view target panel. This example shows the high level properties of MVS hosts, Windows hosts, and UNIX hosts. Information about the operating system, network name, CPUs, memory, and storage is visible. Also shown are high level views of a Symmetrix array and a CLARiiON array. Information displayed includes the hardware configuration of the array and statistics for how many devices are being presented by the arrays. Further information is available by clicking on the managed objects shown.



The topology map is a graphical rendering of the SAN, built by selecting objects in the tree panel while the topology view is active. Topology maps can be saved and stored for use at a later time, or deleted when no longer needed. Saved topology maps are also referred to as saved topology view preferences.

ControlCenter supports multiple Topology View sessions, allowing you to simultaneously work on several instances of a topology map, or to view different maps at the same time. Many of the SAN management operations performed in the tree panel can also be performed in the topology map. For example, you can access the management URLs of depicted devices, check and modify switch and fabric connection settings, add HBAs to hosts, add Fibre Channel ports to switches, or associate unidentified ports with user-defined objects. Objects cannot be deleted from the map. However, when an object that is displayed in the map is deleted from the Console, the object, its children, and all associated links are removed from the map.

Topology maps, like the navigation tree panel, are updated in real time. Object status, relationships, and alerts displayed in the tree are also displayed in the map.



The Relationship view can show an end-to-end relationship from the host to the array that includes hosts, database instances, database files, tablespaces, file systems, volume groups, logical devices, and physical devices.

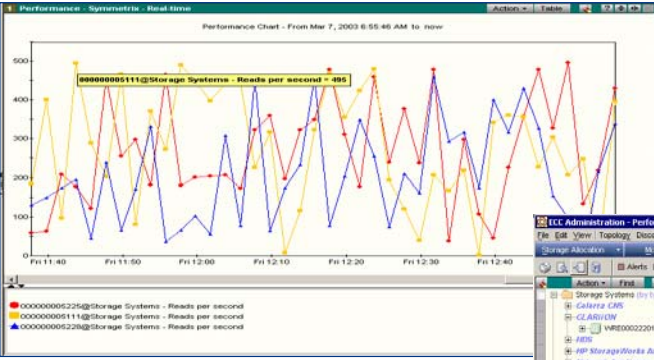
This view can also be shown in tabular form, if necessary. Like many views, it can also be exported to a file.

ControlCenter regularly gathers updated information on managed objects. The ControlCenter administrator regulates how often updated information is gathered. The administrator can also issue commands against managed objects to view and change their configuration, as well as report on storage capacity and performance data.



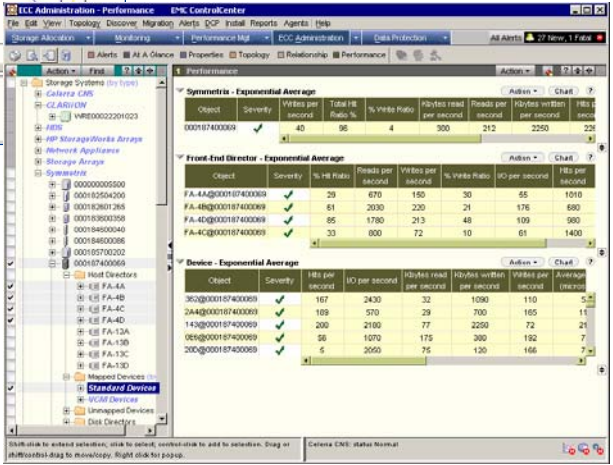


Tool Bar Views: Performance



Performance Chart - From Mar 7, 2003 6:55:46 AM to now

Graphs of performance metrics over the last day



Tables with more detailed information

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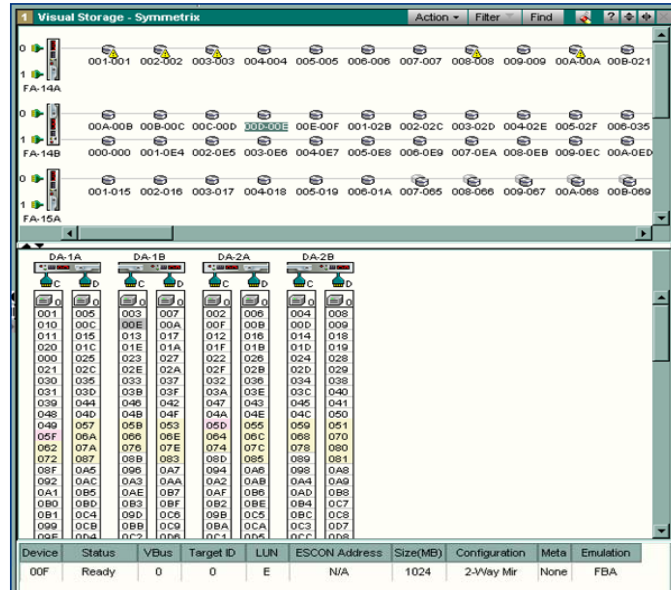
The Performance view allows you to see performance numbers on selected managed objects. In this example, Symmetrix performance information and some volume performance information is shown. The standard metrics displayed include:

- reads per second
- writes per second
- percent hits
- percentage of writes, as well as throughput information.

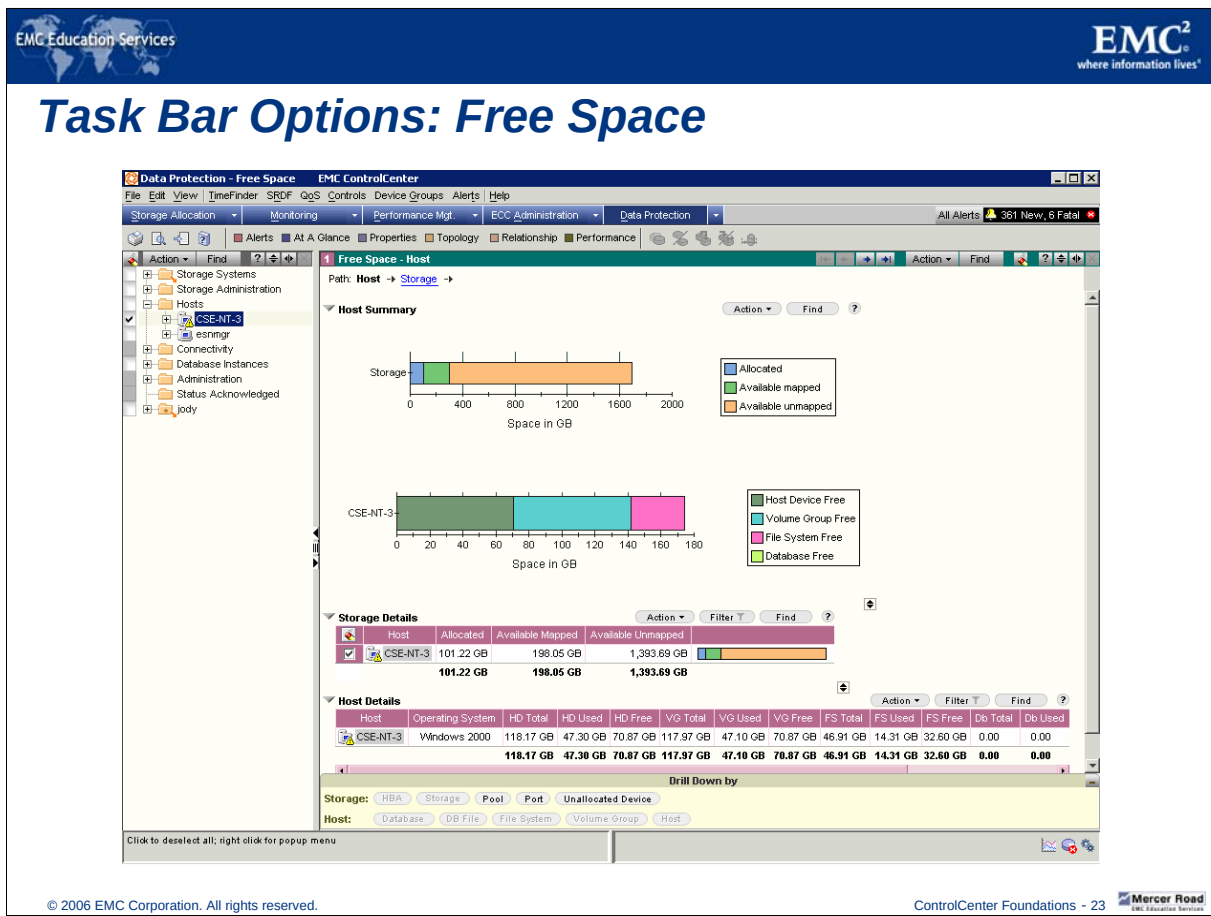
This information can be displayed in either tabular or graphical form. The view shows real-time information. If historical information is required, Performance Manager application is required.

Task Bar Options: Visual Storage

- Displays front-end and back-end information on the same display
- Selected managed object is highlighted in all views
- Information can be colored or filtered
- Reports can be generated



Visual Storage displays the front-end and back-end information on a selected Symmetrix or CLARiiON. You can highlight an object and the highlight will show in both sections, showing where the device appears. Information can be filtered or colors can be added to enhance the display. Reports can also be generated from this display.



The free space view allows a graphical depiction of space available across multiple managed objects in a storage environment. Host details shows free space available to a host, including:

- Free and used space inside Oracle databases
- Free and used space on file systems
- Free and used space in volume groups
- Available and used host devices

Storage free space can also be displayed, showing information that includes:

- Mapped and unmapped devices
- Capacity available per storage array
- Ports (and port details)
- Storage pools

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Task Bar Views: TimeFinder

Device Groups

TF device pairs

Time and date of last action

Track Information

Dev Groups	Symmetrix	STD	BCV	Dev Groups	State	Last action	STD inv trks	BCV inv trks	MBs left	MBs/sec	Time left
	000184600237	005	05A		Synchronized	2001-07-06 15:44:41.0	0	0	0	0.0	0
	000184600237	0E8	100		Synchronized	2001-08-10 17:49:48.0	0	0	0	0.0	0
plb_group	000184600237	0E9	101	plb_group	Sync In Progress	2001-09-05 18:20:25.0	0	249896	7809	9.3	839
plb_group	000184600237	0EC	104	plb_group	Sync In Progress	2001-09-05 18:20:22.0	0	257985	8062	6.6	1221
plb_group	000184600237	0EA	102	plb_group	Sync In Progress	2001-09-05 18:20:25.0	0	248714	7772	10.3	754
plb_group	000184600237	02C	07C	plb_group	Sync In Progress	2001-09-05 18:20:21.0	0	158707	4959	1.3	3814
plb_group	000184600237	018	06A	plb_group	Sync In Progress	2001-09-05 18:20:21.0	0	16501	515	5.4	95
	000184600237	03C	052		Split no Incremental		0	0	0	0.0	0
	000184600237	0EB	103		Split	2001-09-05 18:12:19.0	0	0	0	0.0	0
	000184600237	00C	05B	plb_group	Split	2001-08-30 20:55:06.0	0	1	0	0.0	0
plb_group	000184600237	00D	05D	plb_group	Split	2001-08-29 22:54:57.0	0	1	0	0.0	0
	000184600237	01A	065		Restored	2001-05-30 17:15:05.0	0	0	0	0.0	0
	000184600237		058		Never Established		0	0	0	0.0	0

TF pair state

Time Remaining

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The TimeFinder view allows you to see what is happening with TimeFinder operations on one screen. The device pair, state of the device pair, and information about the track and the copy status are shown. Selecting one of the pairs and right-clicking will allow you to perform TimeFinder operations. You can perform TimeFinder splits and establish Group BCVs and standards. Protected restores are also supported by ControlCenter. This display is updated, by default, every 1 minute.

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Task Bar Views: SRDF

Symmetrix serial number and device numbers of SRDF pairs
SRDF pair status
Device Status

R1 Dev Grp	R1 Symmetrix	R1	R2	R2 Symmetrix	R2 Dev Grp	R1 Grp	R2 Grp	Pair State	R1 State	R2 State	Dev SRDF Status
	000184600237	039	089	000184600266	R2Nightly	1	1	Synchronized	Ready	Write Disabled	Ready
R1Nightly	000184600266	041	089	000184600237		2	2				Ready
	000184600237	03A	08A	000184600266	R2Nightly	1	1	Synchronized	Ready	Write Disabled	Ready
R1Nightly	000184600266	042	08A	000184600237		2	2				Ready
	000184600237	03B	08B	000184600266	R2Nightly	1	1	Synchronized	Ready	Write Disabled	Ready
R1Nightly	000184600266	043	08B	000184600237		2	2				Ready
	000184600237	03C	08C	000184600266	R2Nightly	1	1	Synchronized	Ready	Write Disabled	Ready
R1Nightly	000184600266	044	08C	000184600237		2	2				Ready
R1Nightly	000184600266	045	08D	000184600237		2	2				Ready
	000184600237	03D	08D	000184600266	R2Nightly	1	1	Synchronized	Ready	Write Disabled	Ready

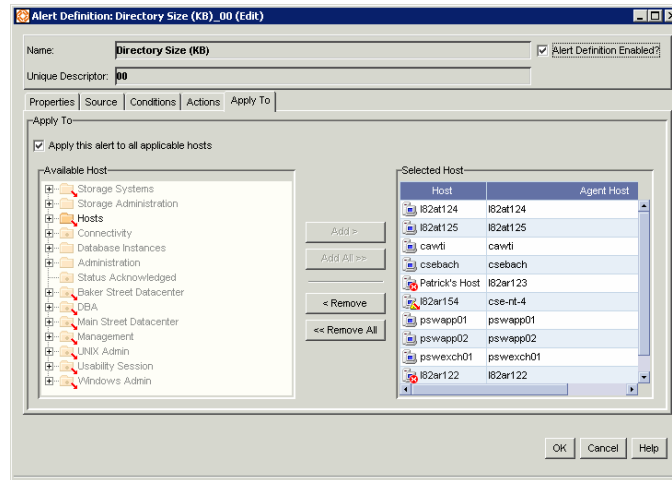
Device Groups
R1/R2 Groups
R1/R2 State

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The SRDF display shows information about the SRDF links and devices in one screen. The Symmetrix serial number and the device numbers of the SRDF pairs are displayed, along with the pair status, as well as the mode that the pair will use for copying data.

Alerts and Autofixes

- 750+ alert metrics
- Sources
 - Hosts
 - Switches
 - Arrays
- 5 levels of threshold
- Management policies
- Autofixes



ControlCenter allows you to monitor hundreds of metrics regarding the storage environment. For each metric, notification thresholds can be set to warn of pending problems.

You have several options for how ControlCenter notifies you. These options range from putting a notice on the ControlCenter Console to running a command to try and fix the problem. The option to run a command is called an Autofix.

The screenshot displays the EMC Web Console interface. At the top, there is a blue header bar with the EMC logo and the tagline "where information lives". Below the header, the page title "Web Console" is prominently displayed. The interface includes a navigation menu on the left with options like "File", "Alerts", and "Help". A search bar is located above the main content area. The main content area is divided into two sections: a left sidebar showing a tree view of storage systems and a right pane showing the properties of a selected system.

The left sidebar shows a tree view of storage systems. The selected system is "Symmetrix 000000003121". The tree view includes categories like "Storage Systems (by Type)", "Host Directors", "Mapped Devices (by Type)", "Unmapped Devices (by Type)", "System Devices (by Type)", and "SRDF".

The right pane displays the "Properties" for the selected system. The "General" tab is active, showing the following information:

Property	Value
Array	000000003121
S/N	000000003121
Type	
Model	5600
Vendor	EMC Corporation
Configured(GB)	
Unconfigured(GB)	
Raw(GB)	
Allocated(GB)	
Unallocated(GB)	
Total Standard(GB)	
Total BCV(GB)	
Total SRDF(GB)	
Free Disk Slots	0
Cache Size(GB)	
Software Version	
Microcode	

At the bottom of the page, there is a footer with the text "© 2006 EMC Corporation. All rights reserved." and "ControlCenter Foundations - 27".

The Web Console was developed in response to requests for a simpler interface into the ControlCenter environment. What has been created is a light weight, browser based tool that can work over higher network latencies than the java based console. This will eventually be the launching point for other web based applications as they are developed.

Selective functionality is available, particularly in viewing and monitoring capabilities. The Web Console runs on multiple operating systems and supports SSL for those customers who require secure communications. For more information regarding the Web Console, please refer to the ControlCenter Administration/User Guide.



ControlCenter

ENVIRONMENTAL MANAGEMENT



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In this next section, we will briefly review the environmental management of the product.

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Symmetrix Configuration

- Create SLVs
- Convert device types between Standard and BCVs
- Create Meta Devices
- Change Port Flag Settings
- Assign Devices to Front End Adapters
- Assign addresses to devices
- Perform Clone and Snap Operations
- Delete logical devices

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Symmetrix configuration is performed using the Symmetrix Manager license in ControlCenter. One function available is logical device configuration. Logical device configuration provides the ability to:

- Create logical volumes as needed
- Create FBA devices
- Set the size and protection of the devices

Another Symmetrix Manager function is device type definition. Device type definition allows conversion of device types between Standard, BCV, and DRV. It is not possible to change the size or protection of devices with this tool. Once devices have been created, it is possible to:

- Map a device to a front end port
- Un-map a device from a front-end port
- Remove devices from open systems front-end director ports

Additionally, the following functions are also available through Symmetrix Manager:

- The SCSI address assigned to a device may be changed
- Meta devices can be created
- The port flag setting of front-end adapters can be changed
- Logical devices can be deleted

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CLARiiON Configuration

- Bind/Unbind LUN
- Create MetaLUN
- Create/Remove RAID Group
- Create/Remove Storage Group
- Change Storage Group Name
- Change Storage Group Sharable State
- Change SP network settings

Create Storage Group

Array Name: WRE00022403458
New Storage Group Name:

OK Cancel Help

Bind LUN

RAID Type: RAID 0: Non Redundant Individual Access
LUN ID: 13 RAID Group: 0 (r5)
LUN Size: Max Size Qualifier: Use Default
Rebuild Priority: Use Default ☒ Enable Read Cache
Verify Priority: Use Default ☒ Enable Write Cache
Default Owner: Use Default ☒ Enable Auto-Assign
Element Size: Use Default (R0,R3,R5,R10)

OK Cancel Help

Create RAID Group

RAID Group ID: 3
Disks:
0_0_05
0_0_06
0_0_07
0_0_08
0_0_09

Add Delete

☐ Remove RAID group after last LUN is unbound

OK Cancel Help

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CLARiiON arrays can also be managed from the ControlCenter Console. Configuration tasks available for the CLARiiON provide the ability to:

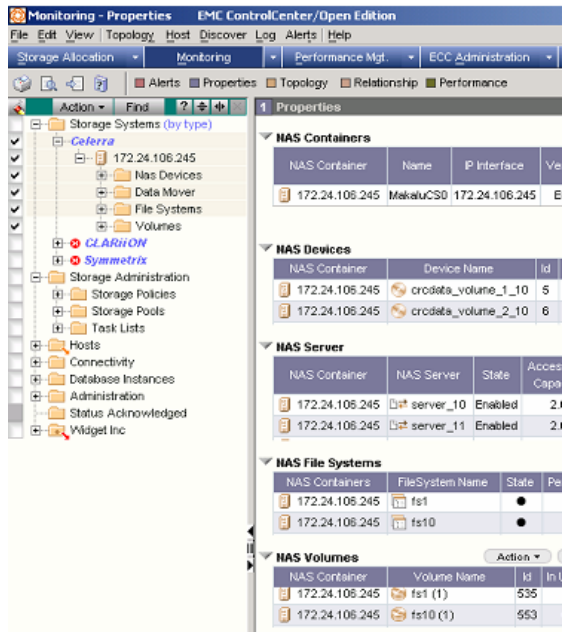
- Bind or unbind a LUN
- Create a MetaLUN
- Create or remove RAID group
- Create or remove storage group
- Change the storage group name
- Change the storage group sharable state
- Change the storage processor network settings

The properties view for the CLARiiON shows model information, the capacity of LUNs and disks, and the level of the FLARE environment. Specific properties are also available for storage processors, storage groups, LUNs, and metaLUNs.

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NAS Management

- Centrally manages Celerra & NetApp as part of the SAN
 - Detailed Properties
 - Relationship View
 - Topology View
 - Alerts
 - StorageScope Reporting
- Allows launch of Celerra Web Manager and NetApp FileView



The screenshot shows the 'Monitoring - Properties' window in EMC ControlCenter/Open Edition. The left pane displays a tree view of storage systems, including Celerra, CLARiON, and Symmetrix. The right pane shows the 'Properties' view for the selected system, displaying various tables of data:

NAS Containers			
NAS Container	Name	P Interface	Ve
172.24.106.245	MakaluCS0	172.24.106.245	E

NAS Devices			
NAS Container	Device Name	Id	
172.24.106.245	crdeta_volume_1_10	5	
172.24.106.245	crdeta_volume_2_10	6	

NAS Server			
NAS Container	NAS Server	State	Access Capa
172.24.106.245	server_10	Enabled	21
172.24.106.245	server_11	Enabled	21

NAS File Systems			
NAS Containers	File System Name	State	Pe
172.24.106.245	fs1	●	
172.24.106.245	fs10	●	

NAS Volumes			
NAS Container	Volume Name	Id	In
172.24.106.245	fs1 (1)	535	
172.24.106.245	fs10 (1)	553	

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The ControlCenter NAS Agent manages both Celerra and Network Appliance hardware. The Agent collects data for ControlCenter Console Views and StorageScope Reports. It also can function as an SNMP Trap Gateway.

For full functionality, agents other than the NAS Agent must also be installed. Specifically, the Fibre Channel Connectivity Agent and appropriate Storage Agent must be installed to accurately view all the volumes presented to the Celerra.

The NAS Server properties view includes a high-level summary of the state and configuration of all Celerra Data Movers, including detailed information on adapter cards, exports, quotas, shares, Celerra file systems, and the volumes presented to the Celerra.

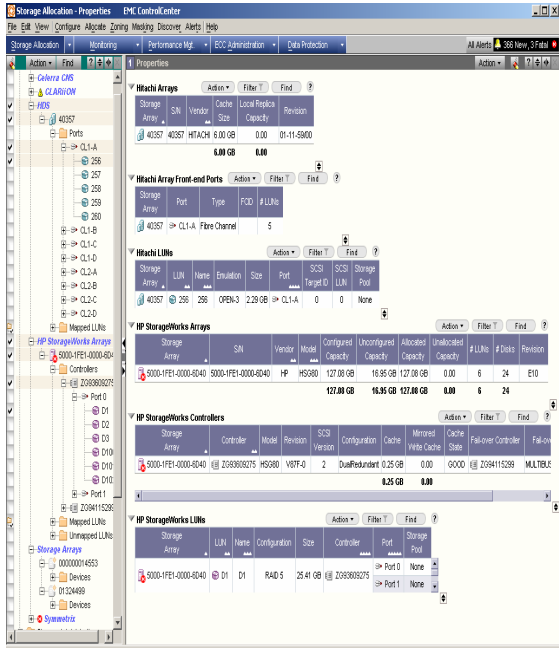
The relationship view shows the relationship between file systems and Celerra logical volumes, between Celerra logical volumes and disk volumes, and between disk volumes and Symmetrix logical volumes.

In the topology view, the Celerra appears in the NAS folder as a host.

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Third Party Storage Management

- Arrays
 - HP/Compaq StorageWorks
 - Hitachi Lightning
 - IBM ESS (Shark)
 - SMI Agent
- NAS
 - NetApps Filer
- SMI compliant devices



The screenshot shows the EMC ControlCenter interface. On the left is a tree view showing the hierarchy of storage components: Celerra CMS, CLARiiON, and HP StorageWorks. The main pane displays detailed information for selected components, including Hitachi Arrays, Hitachi Array Front-end Ports, Hitachi LUNs, HP StorageWorks Arrays, HP StorageWorks Controllers, and HP StorageWorks LUNs. Each section contains a table with columns for various attributes like Storage Array, SN, Vendor, Model, Capacity, and Configuration.

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ControlCenter can manage arrays from various storage vendors. All supported arrays can be monitored. For some arrays, the presentation of volumes and LUN masking can also be managed from the console.

Configuration capability requires that the appropriate APIs, CLIs, or agents from the array manufacturer be installed. For the most current listing of which arrays are supported and what software is required, please consult the ControlCenter Support Matrix on Powerlink and Avatar.

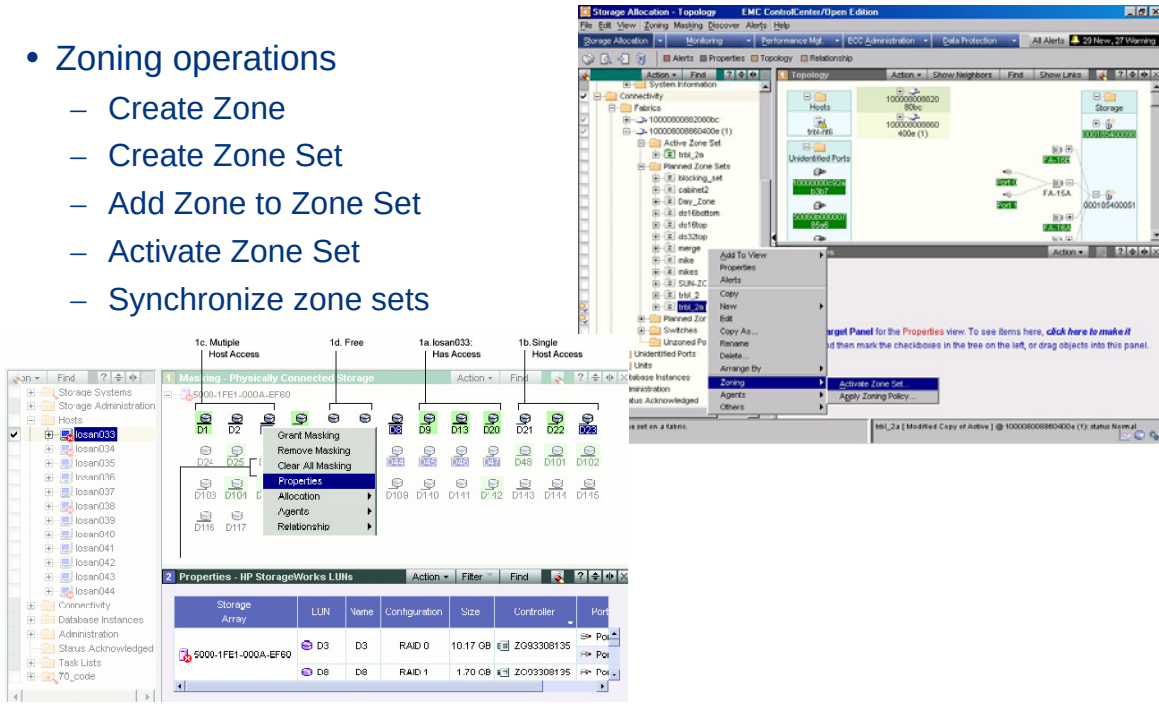
ControlCenter also provides an SMI Agent, which allows the gathering of information about SMI compliant arrays. Symmetrix and CLARiiON arrays are SMI compliant and may be discovered by this agent through the Solutions Enabler interface.

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Managing Switch Zoning and LUN Masking



- Zoning operations
 - Create Zone
 - Create Zone Set
 - Add Zone to Zone Set
 - Activate Zone Set
 - Synchronize zone sets



Storage Array	LUN	Name	Configuration	Size	Controller	Port
5000-1FE1-000A-EF60	D3	D3	RAID 0	10.17 GB	Z093308135	10G Po1
5000-1FE1-000A-EF60	D8	D8	RAID 1	1.70 GB	Z093308135	10G Po2

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Zone sets are associated with one fabric or VSAN only; however, a zone set can be copied and associated with another fabric or VSAN.

Zone sets can be active or inactive. Active zone sets cannot be directly modified or deleted. However, ControlCenter allows you to create a copy of an active zone set and then modify it. A copy of the most recent active zone set is stored in the Last Active Zone Set folders under each fabric in the tree panel.

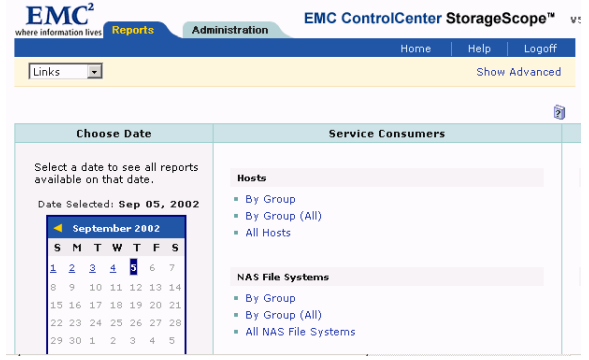
Zoning policies can be applied to inactive, planned zone sets. Zoning policies determine such factors as the zone naming convention, the type of zoning (WWN, port or mixed), the maximum number of host and storage ports allowed, and the host and storage vendor configuration (single or mixed). After applying a policy to a planned zone set, it can be activated on the fabric.

In addition to zoning, LUN Masking can be performed from ControlCenter. Storage device masking (SDM) is the management of host access to logical devices (or LUNs) in storage arrays. SDM provides a measure of efficiency and security by restricting host access to a defined set of logical devices on a given storage array.



StorageScope

- Automates the collection and reporting of storage utilization information
- Consolidate multiple views of all storage assets into a single set of reports:
 - Horizontally across the enterprise
 - Vertically by line of business
 - Using a simple web based interface
- Reports on available and allocated capacity



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StorageScope gives customers a simple, automated view of their infrastructure, from applications to storage and back. StorageScope is a business application that measures storage utilization. StorageScope answers several pressing questions that businesses have about their storage investment. These questions are: What is it? Where is it? Who is using it? When do I need more?

StorageScope is an open application that monitors storage resources across both EMC's storage platforms and other vendors storage platforms. The correlation of this storage infrastructure information, across multiple sites and multiple vendors, helps business managers make better decisions.

If your organization has multiple ControlCenter environments, StorageScope provides consolidation of reporting information across those environments through a single interface.

StorageScope allows both local and remote collection of SAN and NAS configuration, allocation, and capacity utilization information. Current and historical information is stored in a relational database which customers can access via CSV, HTML, or XML for integration with third-party applications.

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Performance Manager

- Detailed performance views
 - Flexible display with many metrics
 - Vital signs
 - User defined views
 - Relate host and array performance
 - Groups
 - Performance Utilization %
- Data navigation
 - Drill down
 - Configuration display
 - Point-in-time analysis
 - Links view
- Automated Reports
 - Define and test web reports

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Performance Manager provides performance data display and analysis. It is a Windows application that can be launched from the ControlCenter Console, or run as a stand-alone application. The data can be viewed via the EMC predefined views or with user-defined graphs.

There are more than 100 metrics for four levels: Symmetrix system, logical volumes, directors, and physical devices. There are 13 predefined views called Vital Signs. Together, they can show the basic performance information for a Symmetrix system. The current Symmetrix configuration information can be displayed and configuration changes can be highlighted.

Using the configuration view, users can sort and select objects, and then map their selections to create performance graphs. This is useful for selecting all of the objects associated with a host or application and then creating a custom view graph for those objects.

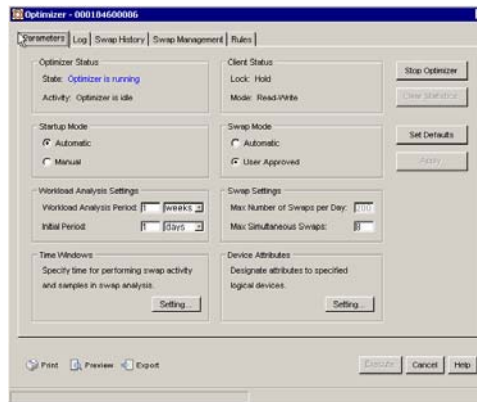
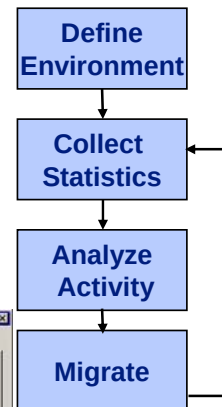
The Data Selection dialog box provides the ability to:

- Select a data provider class (array or host) and identifier
- Select the type of archived data to view: interval, daily, weekly, or monthly
- Choose the time range for data

The data is time-stamped daily, weekly, or monthly. By selecting multiple datasets or multiple times, users can perform trend analyses on the data.

Symmetrix Optimizer

- Define your environment using ControlCenter
- Optimizer works unattended on the service processor
 - Collects logical volume activity
 - Analyzes activity and determines solution
 - Migrates logical volumes to balance activity across disks



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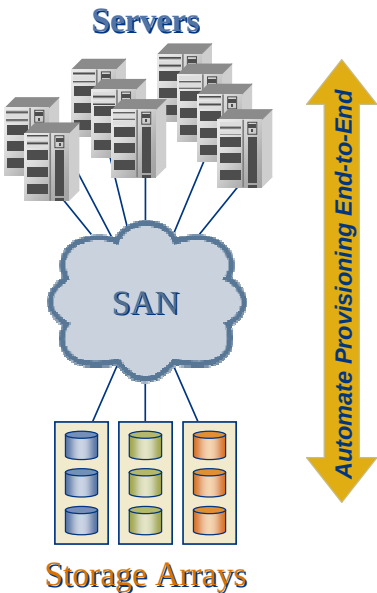
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With Symmetrix Optimizer, you define what's critical to your business; which logical volumes will be candidates for optimization, which volumes can be used to do the relocation, and the priority of those volumes. For example, you may want Optimizer to consider logical volume activity over a week, but exclude the window of time when batch jobs or backups occur. Once you set these parameters, Optimizer does the rest.



Storage Provisioning Services



- Manage storage provisioning end-to-end
- Allocate storage based on your business policies
- Enable immediate storage provisioning
- Standardize your storage provisioning best practices

“...With Storage Provisioning Services, we’ll set up policies and deliver it in minutes—saving IT time and improving our service to the business.”

— Regional Manufacturing Customer
EMC Executive Briefing Center, August 2002

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The Storage Provisioning Services functionality provided by Automated Resource Manager provides a complete end-to-end solution by automating allocation actions from the array to the host. It automates the search for unallocated disks of the appropriate capacity based on predefined policies. It then performs the complex tasks associated with storage provisioning in a heterogeneous SAN, including LUN masking, zoning, multipathing, and extension of filesystems or volume groups. As a result, SPS enables users to provide “just-in-time” storage provisioning to meet their service level agreements.

Not only does SPS expedite the entire storage provisioning process, it also reduces errors as staff with a lower level of experience can allocate storage based on business policies and best practices.

For the Symmetrix system, SPS can also configure any additional hosts involved in accessing local or remote replicas of the newly allocated storage. For example, the host used to back up a database from a local replica can also be configured for the newly allocated storage, when the database capacity is extended for the primary host.

Integration with Enterprise Frameworks

- Notification of ControlCenter alerts
 - Make framework recognize ControlCenter alerts
 - Display in event logs, change icon colors
- Discovery of ControlCenter managed objects
 - Query gateway to discover managed objects
 - Add icons to framework topologies
- Launch ControlCenter
- Integrate EMC ControlCenter into enterprise management frameworks environments

For customers using a management framework for their entire enterprise, ControlCenter extends existing enterprise management systems and business processes. Use ControlCenter for enterprise storage management monitoring and notification of ControlCenter managed objects. ControlCenter provides a basic format that can be tailored to customer needs.

Module Summary

Key points covered in this module:

- The benefits of using ControlCenter
- How ControlCenter fits into a Storage Area Network
- The architecture of ControlCenter
- The tasks that can be completed using ControlCenter

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