

VisualSAN and VisualSRM

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

- Match VisualSAN and VisualSRM benefits to common IT needs
- Identify the architectural components of VisualSAN and VisualSRM
- State the features and function of VisualSAN and VisualSRM

The objectives for this module are shown here. Please take a moment to read them.



VisualSAN

MANAGEMENT TOOLS



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VisualSAN and VisualSRM Foundations - 2



In this section, we will define the suite of tools that make up the VisualSAN offering.

VisualSAN

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

- Relate business needs to VisualSAN benefits
- Explain the architecture of the VisualSAN environment
- State the main features of VisualSAN

The objectives for this section are shown here. Please take a moment to read them.

VisualSAN – A Definition

- **VisualSAN (Storage Area Network) – What is it?**
 - This is a suite of tools that will allow SAN administrators to more effectively manage and control their storage area network end-to-end
- **The suite of tools is comprised of several modules**
 - VisualSAN Network Manager
 - VisualSAN SAN Assistant
 - VisualSAN Configuration Manager
 - VisualSAN Performance Manager

The VisualSAN suite of tools gives an administrator the ability to effectively manage their Fibre Channel Storage Area Networks. One graphical user interface provides monitoring and control over the entire network.

VisualSAN Modules

Network Manager	SAN device management, topology visualization, configuration reports, zone management, alerting
SAN Assistant	Storage provisioning, LUN masking, automatic zoning, application-SAN-storage device visualization
Configuration Manager	Configuration management, SAN topology configuration archiving, configuration comparison, change alerting
Performance Manager	Real-time and historical performance monitoring

VisualSAN functionality is divided into four modules:

- The Network Manager module provides the base SAN device discovery, reporting, and zoning. The Network Manager module is included with every VisualSAN installation.
- The optional SAN Assistant module maps CLARiiON LUNs to hosts. Features include automatic path selection, automatic zoning, and LUN masking.
- The optional Configuration Manager module archives the SAN configuration. Archives can be compared to detect changes.
- The optional Performance Manager module monitors SAN performance.

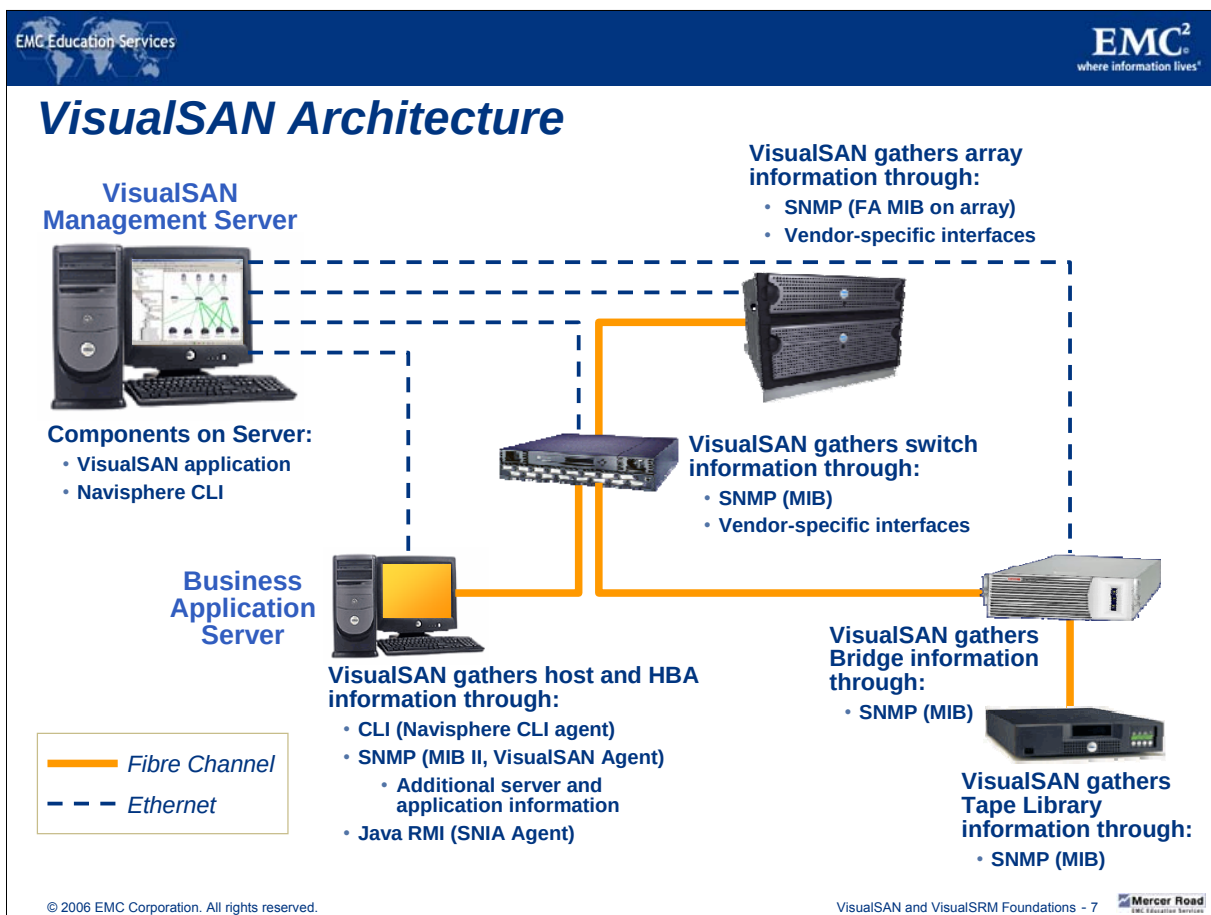
VisualSAN – Software Bundles

	VisualSAN Edition			
	Performance	Configu- ration	Network	Standard
<i>Network Manager</i>	●	●	●	●
<i>SAN Assistant</i>	●	●	●	
<i>Configuration Manager</i>	●	●		
<i>Performance Manager</i>	●			
Base number of ports	64	32	32	16

Licensed port increases can be purchased in units of 32 for Performance, Configuration, and Network editions

The VisualSAN software bundles are shown here. A wide range of needs are addressed from large, distributed enterprise environments to smaller, start up organizations. Any edition can be upgraded to an edition having more features.

A base number of switch ports can be monitored with each edition. Additional capacity can be licensed in increments of 32 ports.



VisualSAN runs on a management host discovering SAN devices, properties, and interconnects through interfaces made available by these devices. VisualSAN uses a combination of in-band and out-of-band discovery techniques to discover and monitor SAN devices.

Out-of-band communication methods include using SNMP for discovering and monitoring SNMP-enabled devices and network socket connections with device-specific communications for discovering and monitoring other vendor-specific devices. For example, VisualSAN utilizes network socket connections to gather both CLARiiON and HSG-80 information. For advanced monitoring of CLARiiON arrays, VisualSAN utilizes the Navisphere CLI and requires the CLI to be installed on the same management PC as VisualSAN.

In-band discovery techniques include using a switch's name server to discover devices connected to a discovered switch.

VisualSAN also utilizes other interfaces provided by devices to either gather additional information or allow for some form of control or management. An example of this is the integration that VisualSAN has done with the Brocade API to provide zone visualization and management.

VisualSAN gathers information about devices from as many sources as possible, compiling and correlating information to provide the most accurate representation of the SAN as possible.



VisualSAN

IMPLEMENTATION PERMUTATIONS

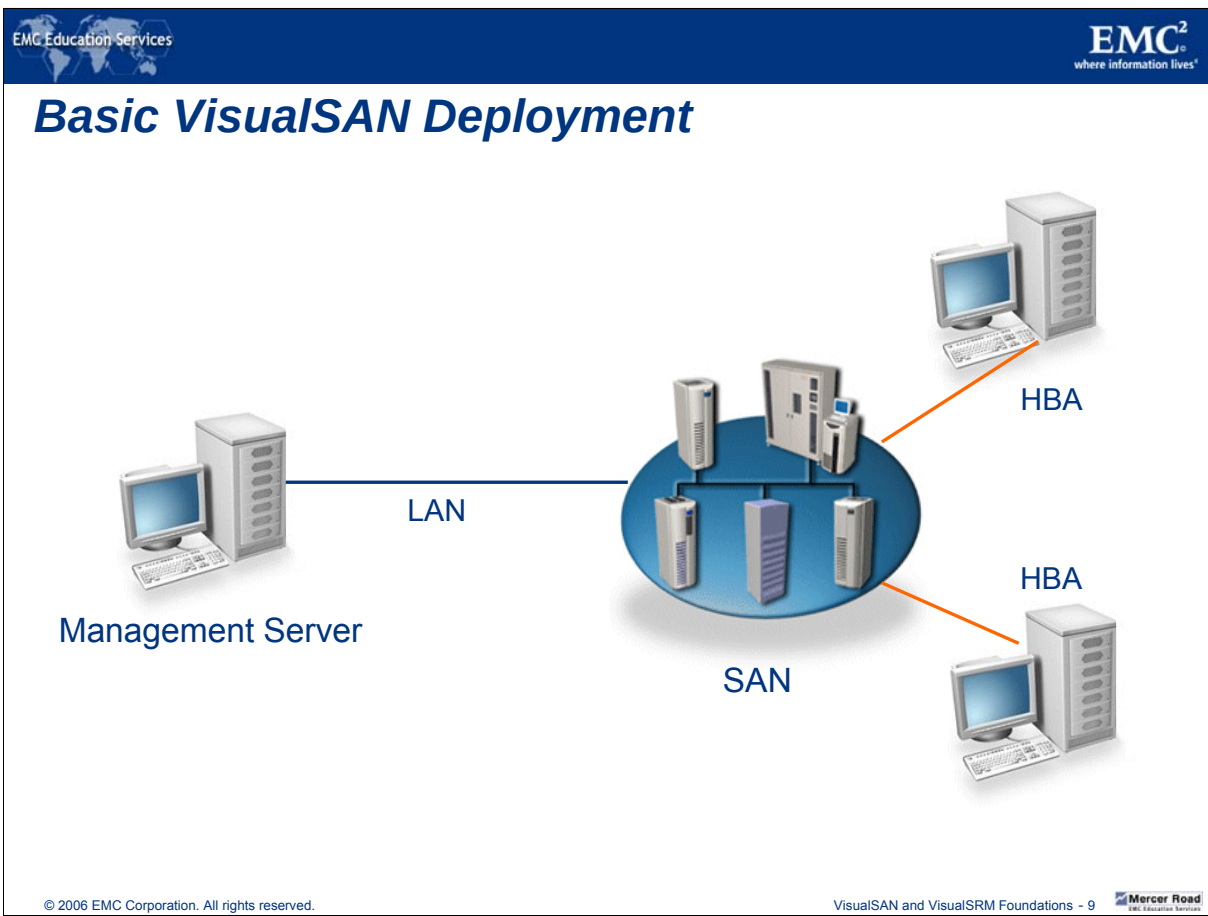


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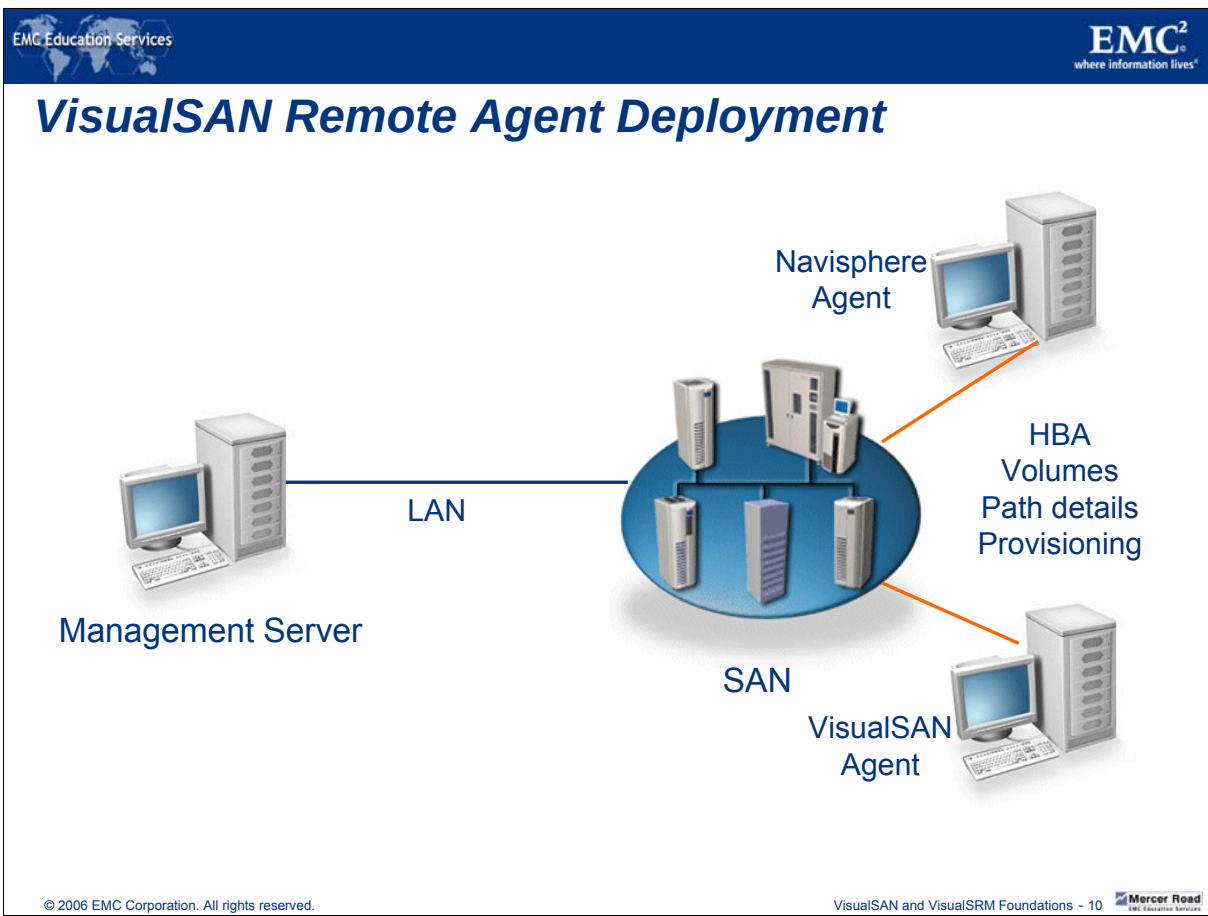
VisualSAN and VisualSRM Foundations - 8



Next, we will briefly review the various methods of VisualSAN implementation.



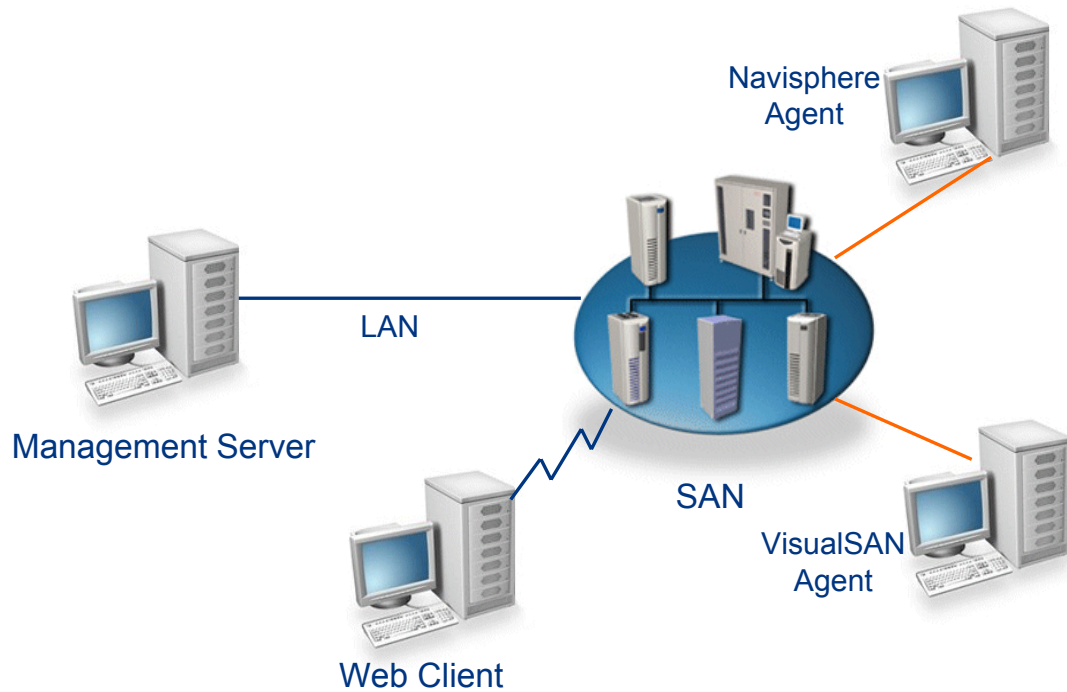
On a single VisualSAN server that is SAN attached, the application will be able to manage all attached switch devices. However, in this configuration, monitoring will be minimal. Hosts and HBAs will be detected since their identity is discovered by the switches they are connected to, but further details about the host will be unavailable.



In a Remote Agent deployment, full discovery of the SAN can take place through the communications between the management station and the Agents.

Navisphere and VisualSAN Host Agents provide volume capacity and configuration data, complete host to array path visualization, storage provisioning, and HBA status and configuration data. Data from these agents allow VisualSAN to automatically associate HBAs known to the switches with the host they are installed on.

VisualSAN Web Access Deployment



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The Web Access deployment model runs VisualSAN in a client web browser. This is intended for running the VisualSAN application from a remote station, not SAN attached.

VisualSAN Features by Agent	
Agents Deployed on Host	VisualSAN Features and Functionality Provided
No Agents Installed	• Host discovery • HBA discovery
Either: Navisphere Agent or VisualSAN SNIA Agent	• Automatic Host and HBA association • OS Logical Unit properties • Storage Logical Unit properties • Path visualization from Host > Volume > OS Logical unit > HBA > Switch > Storage System > Storage Processor > Storage Logical Unit
Additional Navisphere Agent Functionality	• Limited HBA property information • Discovery of SAN-based volumes • Create Storage Groups
Additional VisualSAN SNIA Agent Functionality	• Detailed HBA property information (firmware, BIOS, vendor model, etc.)
VisualSAN Host Agent (Windows only)	• Capacity on discovered SAN-based volumes
VisualSAN Application Agent (Windows only)	• Application discovery, and association with discovered SAN-based volumes
All Navisphere and VisualSAN Agents	• All of the above

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The amount of information VisualSAN discovers about HBAs, hosts, OS Logical Units, and path information is dependent on what agents are utilized.

As seen in this slide, VisualSAN can gather basic information about hosts and HBAs without the use of agents. Although not required, installation of agents is recommended to make full use of VisualSAN management capabilities. Agents run services on SAN-attached hosts, providing further information and management functionality to the VisualSAN management station. By viewing this information, Administrators have enhanced awareness of the operating conditions in their SANs and can manage the SAN more effectively. This slide details the functionality provided by VisualSAN for host systems containing a supported HBA, a supported operating system, and, if applicable, a supported agent.

Working closely with CLARiiON arrays, VisualSAN can utilize Navisphere agents that are already deployed to gather additional host and HBA information. Additionally, VisualSAN contains push technology that allows VisualSAN agents to be easily deployed to hosts running Windows operating systems. Deployment and management of VisualSAN agents for Windows operating systems is done through the VisualSAN user interface.



VisualSAN

MANAGEMENT INTERFACES



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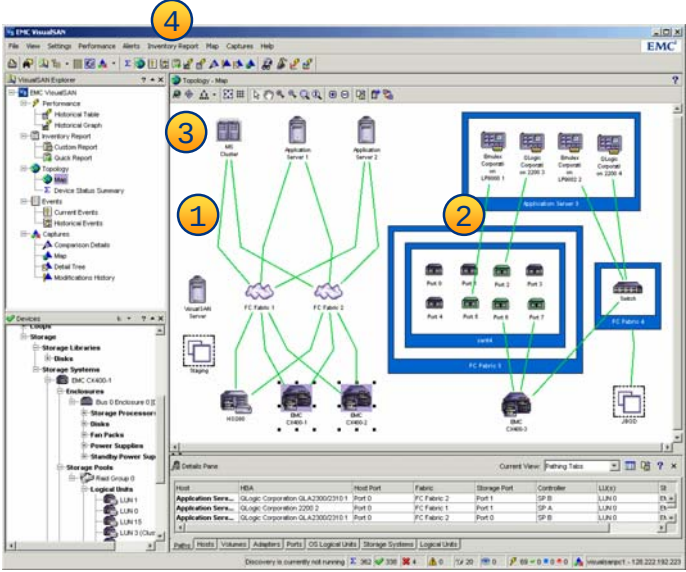


The next few slides review the VisualSAN management interfaces.

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Network Manager

- 1
Simplified Topology View
 - VisualSAN gathers and correlates information from devices across the environment
- 2
Topology visualization tools with drill down into device details
- 3
Discover and visualize server clusters
- 4
Generate detailed reports on gathered information



(User interface with Topology Map)

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VisualSAN is architected with small to medium business users in mind, focusing on easing the management tasks of Administrators. Ease of installation and ease of use are key components to VisualSAN, with an interface that is intuitive and structured in a Windows style and format. Additionally, VisualSAN can be run directly on a server or through a web browser for remote access, with both interfaces being identical in look and feel.

VisualSAN discovers and gathers information about devices across the SAN. Information about a specific device may come from multiple sources across the SAN. VisualSAN correlates all collected information and provides an easy to understand, end to end SAN topology view.

The Topology Map provides a drill-down capability, allowing users to see the contents of devices on the Topology Map. Users can expand a switch, for example, to expose and visualize individual ports with their status and connectivity. The Topology Map offers multiple layouts, as well as zooming and panning tools, and an overview window that allows for easier management of larger or multiple SANs. Microsoft clusters are discovered and visualized on the Topology Map, providing additional insight into how the SAN is configured.

To alleviate the time-consuming task of keeping up-to-date records of SAN assets, VisualSAN can generate reports based on device information that was gathered during the automatic discovery process. These inventory reports display details about devices in your SAN, including device characteristics such as display name, device type, firmware version, model number, serial number, and so on.

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Active Monitoring of SANs with Alerting

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- 1 VisualSAN monitors status of devices through:**

 - SNMP Trap listening
 - Any device
 - Status polling
 - VisualSAN discovered devices
- 2 Quickly pinpoint problems:**

 - Topology icon
 - Device Tree icon
 - Status Summary view
 - Status Summary bar
- 3 Alert Administrator of problems through:**

 - E-mail/page (with scheduling)
 - Popup window
 - CM capture
 - Application launch
 - SNMP trap (to other applications)

The screenshot shows the VisualSAN interface. On the left is a 'Devices' tree view with a yellow arrow icon next to the 'Routers' branch. On the right is a 'Topology Map' showing a 'Router' connected to a 'Brocade 3800 1' switch, which is connected to an 'FC Fabric'. Below the topology map is a 'Details Pane' with a table showing device status. At the bottom, a 'Critical Error' popup window is displayed, indicating a 'Router' status change from 'OK' to 'Critical'.

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VisualSAN not only listens for traps from any device, but also actively polls discovered devices for current status. Early warnings, made possible by status monitoring, are crucial to ensuring that the health of the SAN is not impacting application performance and availability. Status polling rates can be independently controlled for each device, allowing critical SAN components to be monitored at a higher rate.

If the status of a device does change during the ongoing monitoring activity, its new state will be reflected in multiple areas throughout the application. VisualSAN provides visual cues of a device's state in the Topology Map, the Tree view, the Status Bar, and the Summary Page.

The SAN Devices Tree propagates the worst-case status into the rollup pane heading, visually indicating that there is a problem within the hierarchical tree. In addition, in the tree, the heading for each device type is prefixed with a yellow arrow when a problematic device is embedded in the device type branch. You can follow the trail of arrows to find which device is experiencing problems. Device icons in the tree also reflect the state by changing color and adding an appropriate marker.

VisualSAN's alerting capabilities provides instant notification of SAN issues to ensure high availability for end-user applications. With these tools, Administrators need not be bound to a console, but can be alerted to trouble wherever they are.

Additionally, e-mail and page alerts can be configured to be sent during specific time periods to specific Administrators using the Alert Scheduler that is part of the wizard step-by-step process.

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Understand Connectivity and Manage Zones

- 1 View one or multiple zones, aliases, or zone sets in the Topology Map**

 - Quickly view the zoning configuration of the entire SAN
- 2 Add or delete a device from zones using Topology Map**

 - Control zones, zone sets, and aliases
- 3 Access all zone settings through the Zone Explorer**

(Topology Map with Zone View)

(Zone Explorer)

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With its zone visualization and control features, VisualSAN can depict zone configurations on the Topology Map, as well as modify or create zone configurations by simply pointing and clicking the appropriate devices.

This SAN level visualization enables Administrators with little SAN experience to more easily manage SAN network configurations. By visualizing active zones on the Topology Map, Administrators are able to quickly understand which devices have access to each other.

A zone explorer offers another means to create or modify zones, zone sets, and zone aliases without having to launch complex switch element management tools.

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Integrated SAN/NAS Management

Support for EMC NS Series

- Discovery and visualization of the Fibre Channel connections between the NS Series and the SAN**
 - Support for NS600G, NS702G, and NS704G
- Active monitoring of NS Series health status**
 - Includes enclosure, Control Stations, and logical components
- NS Series properties visible in VisualSAN Tree views, Topology Map, and properties dialogs**

Host	Status	Type	Standby	Standby For
server_3.faulted.server_5	OK	standby		server_3
server_3	OK	nas	server_3.faulted.server_5	
server_4	Critical	nas	standby	
server_2	OK	nas	standby	

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Adding NS Series gateway support to VisualSAN reduces complexity and allows holistic management of a CLARiiON/NS Series environment from a single VisualSAN console.

The Topology Map shows the connections between the NS Series and the SAN, and may be expanded to the port level, in very similar fashion to the way that CLARiiON storage systems are represented. As with CLARiiON storage systems, the NS Series gateway devices are displayed in the device tree and may be expanded to provide details at a component level. Drilling into the properties of any component provides a granular level of details of that component.

The CLARiiON array and its attached NAS servers must each be discovered independently for complete details to be displayed.

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Host-Fabric-Storage Connectivity

- 1 **Discover and visualize host-to-fabric-to-storage logical connectivity**
 - Exchange, SQL Server, and Oracle Applications
 - CLARiiON and HSG Array Storage
- 2 **Utilized connections are highlighted when a host, storage system, or LUN is selected**
- 3 **Show logical associations between devices with host and storage tree views**
 - Quickly view association between a volume on a host and a storage array LUN

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Through the use of host agents, VisualSAN automatically discovers all available data paths between devices. The path information is represented in easy to understand graphical views that allow Administrators to more quickly comprehend not only the physical layout of the SAN, but also the logical connectivity of devices.

The Topology Map presents visualization of data paths. When a specific device is selected in the Topology Map, valid data paths are automatically highlighted for the user. For instance, by selecting a host, the Administrator will see all of the paths from that host to all of the storage systems, down to the HBA and storage system controller port level.

Host and storage tree views allow for drill down into specific storage configurations. All views are coupled together, allowing users to quickly uncover associations between SAN devices. Administrators can now quickly determine which array is hosting storage for a specific volume on a server. When a device is selected in one tree, it is interactively highlighted in other trees, as well as in the Topology Map.

Administrators are asked to understand business needs and impact when planning and troubleshooting SAN configurations. Understanding which business applications are running on specific servers and being able to quickly uncover all devices that are utilized by these servers is critical. VisualSAN SAN Assistant discovers and associates Oracle, MS Exchange, and SQL Server applications to host volumes for Microsoft operating systems and also allows the Administrator to manually associate applications to volumes for other operating systems, giving them the tools they need to understand the business impact of SAN changes or problems.





SAN Assistant

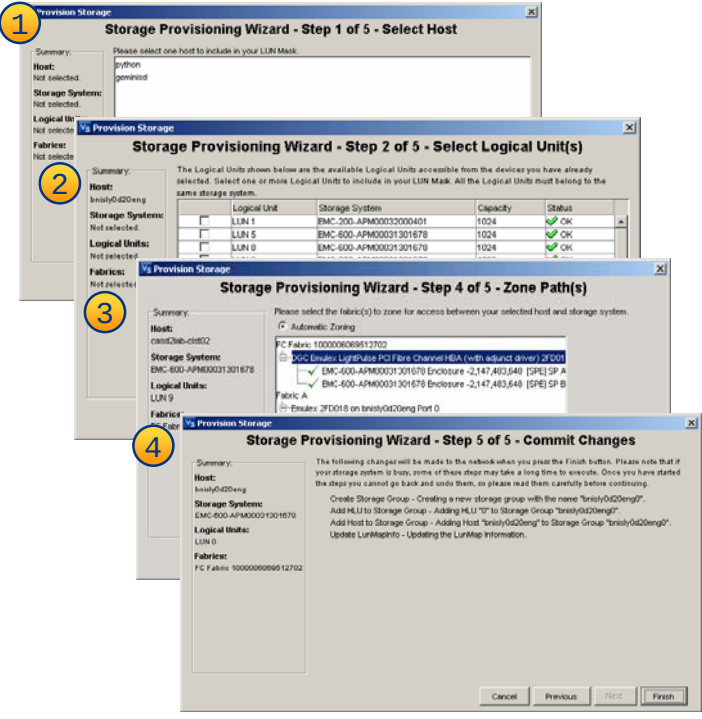
- 1

Path provisioning wizard
 - CLARiiON storage systems (only)
 - Connect a CLARiiON Logical Unit and host
- 2

Search for Logical Units
 - Locate Logical Units based on user-defined criteria
- 3

Select zone settings for desired fabric path
 - Select from available paths
- 4

Automate configuration process
 - Creates zones and masks (storage groups)
 - Monitor actions and status



The screenshots show the following steps:

- Step 1 of 5 - Select Host:** A dialog box asking to select a host to include in the LUN Mask. The host 'bristly020eng' is selected.
- Step 2 of 5 - Select Logical Unit(s):** A dialog box showing a table of available Logical Units. The table has columns: Logical Unit, Storage System, Capacity, and Status.

Logical Unit	Storage System	Capacity	Status
LUN 1	EMC-200-APM00032000401	1024	OK
LUN 5	EMC-600-APM00031301678	1024	OK
LUN 0	EMC-600-APM00031301678	1024	OK
- Step 4 of 5 - Zone Path(s):** A dialog box asking to select the fabric(s) to zone for access between the selected host and storage system. The 'Automatic Zoning' option is selected.
- Step 5 of 5 - Commit Changes:** A dialog box showing the summary of changes to be made to the notebook. It includes a warning that if the storage system is busy, some steps may take a long time to execute.

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One of the most common tasks for Administrators is provisioning storage to servers. That is, finding available storage, creating Storage Groups within the array, and configuring zones for proper access. These time-consuming tasks are simplified with the use of VisualSAN's Path Provisioning wizard.

The Path Provisioning wizard walks Administrators through all of the required steps and even allows users to search for Logical Units available in arrays that fit a specific configuration requirement. The VisualSAN Path Provisioning wizard also supports clusters and includes special rules that enable an Administrator to easily allocate storage to all members of a cluster. With the wizard and path visualization capabilities, VisualSAN simplifies management tasks, allowing Administrators to manage more efficiently.

Path wizard features are currently available for CLARiiON arrays only.

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Configuration Manager

- 1 Capture configuration of SAN at a point in time**
 - Device properties
 - Status
 - Connectivity
 - Zoning and logical connectivity
- 2 Compare captures with Topology Views of SAN changes**
 - Compare a capture to live SAN
 - Compare two captures together
 - Comparisons highlight modified (▲), added (●) and deleted (✖) devices
- 3 Select attributes used during comparisons**

(Configuration topology comparison)

(Comparison Properties)

VisualSAN allows point-in-time captures containing the state of a SAN configuration to be taken, with the touch of a button. These captures can be focused on a specific group, zone, fabric, or the entire SAN. Information stored in each capture includes device details, connectivity, and state. These captures are saved for future reference, reporting, or comparison. Utilizing captures, Administrators are able to quickly understand the configuration and connectivity of devices at a particular point in time.

VisualSAN also allows Administrators to compare a stored configuration capture against a live SAN or other stored captures. Using a stored capture of a SAN when it was in a known working state as a reference can significantly simplify troubleshooting. When a configuration comparison is done, a Topology Map view quickly highlights which devices have been modified, added, or deleted. Device details, such as changes in firmware or hardware or even zone configurations, are checked during comparison. Differences between captures are highlighted as modified devices.

VisualSAN provides control over which variables for each device type are used during a comparison. For example, Administrators can run a comparison on HBA Firmware version only, between captures taken before and after a SAN-wide HBA update. This comparison provides quick verification that all HBAs have been updated to the proper level.

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Configuration Manager

1

Schedule automated configuration captures to be taken at user-defined intervals

- Only take captures if changes have been made to SANs

2

Alert Administrators when automated captures are taken

- Alerts if any configuration change is detected

3

Alerts triggered by SAN status events can include an action to take a configuration capture

- Improves troubleshooting

1

Schedule Automatic Capture

Take the first automatic configuration capture:
Jul 1, 2003 4:06 PM
Take a configuration capture every: 7 Days
☒ Only take a configuration capture if the configuration has changed

Next Finish

2

Define New Alert Definition

Alert Name: Auto Capture Taken
Alert Type: CM Capture Alert

OK Cancel

3

Define New Alert Definition

Alert Name: Device Failure
Alert Type: Device Status Policy

OK Cancel

Vs Action Scheduler

Action
Scheduled Action(s)
Config Capture
Type of Schedule: Always

OK

(Configuration Scheduler)

(Configuration Alert)

(Status Alert with Configuration Capture Action)

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Combating the need to continually monitor and check SAN devices for configuration changes, VisualSAN provides the ability to schedule captures to be automatically taken at set intervals.

To manage the amount of information that is stored, Administrators can choose to store scheduled captures, only if there are changes noted in the SAN; otherwise the captures will be discarded. Upon detection of a change, which results in a scheduled capture to be stored, VisualSAN can be set to send an alert to Administrators. VisualSAN also allows configuration captures to be taken upon occurrence of user-defined events, such as a device status change.

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Performance Manager

1

Topology visualization using performance thresholds

- Fabric-level performance (throughput and error)
- User selects variable for topology visualization

2

Performance setup and control with:

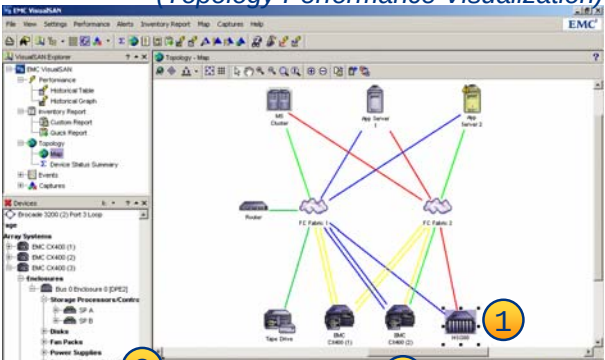
- Direct interface with the Topology Map
- Performance Setup window

3

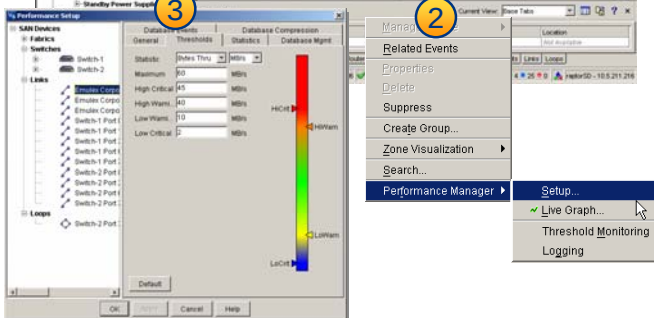
User controls:

- Variables monitored/archived
- Monitoring/archiving rates
- Thresholds (High/Low for Warning and Critical)

(Topology Performance Visualization)



(Performance Setup Window)



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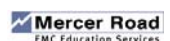
VisualSAN provides a SAN-level view of live performance activity through the Topology Map, allowing both hot and cold spots of SAN activity to be easily identified. This is a perfect tool for both troubleshooting and SAN planning. Understanding throughput and error information are key pieces to diagnosing problems or for re-configuring SANs with new devices.

VisualSAN collects link performance information by polling switch devices at user-defined intervals. After each polling interval, a new set of statistics is cached on the local computer until the next interval. If data logging is enabled, VisualSAN averages the information in the cache and saves selected statistics in the Performance Module database.

VisualSAN makes it simple to select and configure links for performance monitoring through the integration with VisualSAN's Topology Map. By selecting low and high warning and critical threshold levels for links and their variables, topology visualization is made possible. Users have full control over the links that are being monitored, the variables for each link, threshold settings for variables, and rates for background monitoring and archiving.

Highlighting deep integration with the Topology Map, performance rates can also be quickly accessed through tool tips that are displayed when hovering over a link.

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Performance Manager

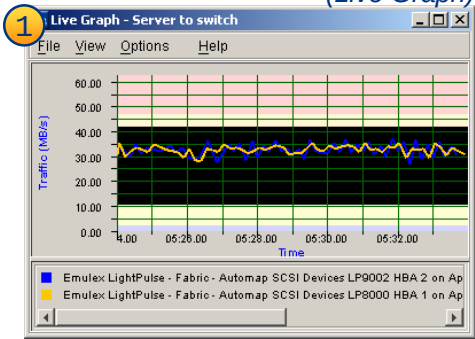
1 Live performance views

- Plot live performance in graphs
 - Multiple variables and links
 - View thresholds
 - Save and load settings
- Generate alerts based on performance thresholds

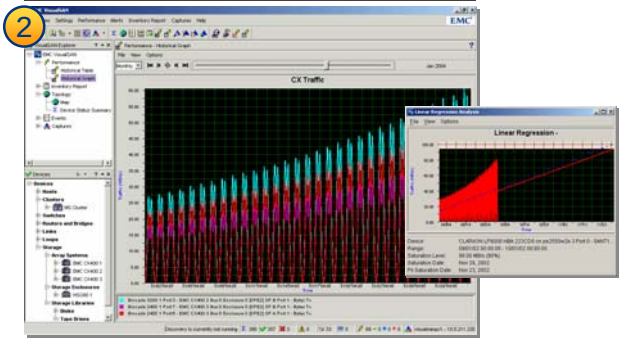
2 Historical performance views

- Historical graph
 - Multiple variables and links
 - View thresholds
 - Save and load settings
- Apply trending algorithms to historical graphs
 - Predicts saturation dates based on average and peak sustained performance data

(Live Graph)



2



(Historical Graph and Trending Report)

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Live performance graphs can be launched from the tool bar or directly from the Topology Map, with selected links automatically populating the graph. Multiple links and variables from across the SAN can be included in one graph to quickly understand and troubleshoot SAN performance problems. Consolidating performance information into one view reduces the number of independent device managers that would otherwise need to be accessed, saving Administrators valuable time.

Live performance graphs are highly flexible and can be configured to display thresholds, zoom in or out, change polling rates, and save and load configurations that are commonly used. A SANMeter tool is also available, and provides a ranked view of the highest performing links, providing another way to quickly assess SAN activity.

Based on user-defined performance thresholds, VisualSAN can be set to alert Administrators of thresholds being crossed. Performance alerts are integrated through the alert definition and monitoring interface, providing a common way to create and view alerts.

Once configured, graphs can be saved and reloaded for later analysis. In addition, VisualSAN uses trending algorithms that can be applied to graphs to estimate when links will saturate. This predictive analysis turns SAN management from being reactive to proactive, because it enables Administrators to improve SAN planning capabilities and avoid performance bottlenecks.



VisualSAN

BUSINESS JUSTIFICATION



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Having discussed what the products are, we will now review the business needs that the products address.

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Top SAN Management Issues

- #1** How can I manage increasing complexity within a fixed budget?
- #2** How can I perform faster root cause analysis?
- #3** How can I identify and resolve unplanned changes to my environment?

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SAN Administrators face problems such as collecting and reporting on ever increasing amounts of data under management and numbers of devices, and pressure to manage more without increasing headcount. Systems and Database Administrators, and other content owners, frequently demand high levels of service. Unwanted or inadvertent changes can cause performance problems.

All this can overwhelm Administrators of even small SANs.

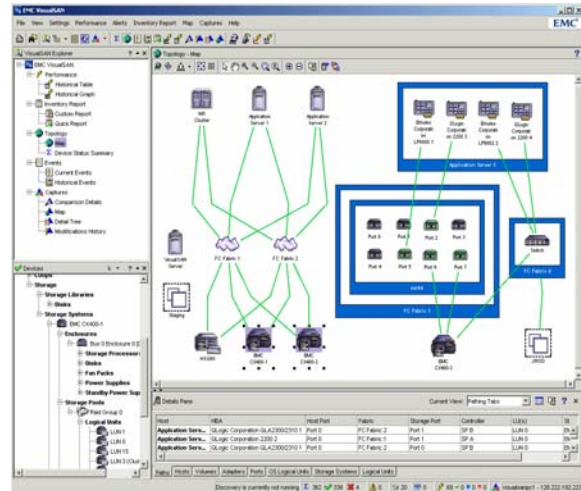
The Element Managers—non-integrated device management tools provided for SAN devices—do not provide the essential end-to-end views and capabilities that Administrators need to function efficiently.

Because of the inherent complexity in even a small SAN, problems can be difficult to isolate and resolve. This is especially true when the problem is a result of misconfiguration of logical elements instead of a device failure. An effective SAN management tool must address configuration change management so that SAN faults can be isolated and resolved rapidly.

Manage Increasing Storage Complexity

#1 A single management console

- Graphic display of physical and logical connections from the host through the switch to the array
- Consolidates information in an end-to-end view of SAN/NAS environments
- Increases productivity and reduces operational costs
- Provides a SAN Assistant Wizard to allocate storage as business demands



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VisualSAN is designed for environments where administration is being asked to do and manage more, without adding Administrators. VisualSAN provides a single console, a management umbrella, for control of SAN components.

An Administrator cannot use Element Managers for an end-to-end management view of the SAN. By managing devices through a single, remotely-accessible interface, VisualSAN consolidates management functions for increased administrative productivity. Without the VisualSAN console, Administrators must go to each Element Manager to accomplish management tasks. The same applies to gathering information on device configurations and for inventory reporting. It's tedious, error prone, costly in terms of time, and distracts from managing the SAN for maximum availability and fulfillment of requests for storage.

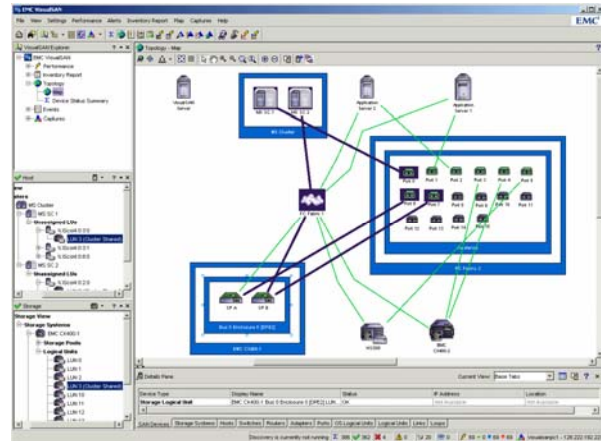
To provision storage to hosts, for example, the Administrator must go to the management application for the array, switch, and host bus adapter just to associate a particular storage logical unit with the application using it. The VisualSAN storage-path provisioning wizard does this all in a few easy steps. It walks Administrators through finding available storage and connects that storage to hosts SAFELY. It includes automatic LUN masking and zoning of switches. The wizard warns if the Administrator tries to override the unassigned LUNs it displays for selection by default and tries to attach a LUN already in use by one application to a new application.

VisualSAN is intuitive and easy to use, providing administration with the tools needed to quickly and efficiently manage their storage environments.

Troubleshoot Problems Quickly

#2 Device discovery, active monitoring, configuration capture, and comparison

- Automatically pinpoints configuration changes for rapid fault isolation and resolution
- Actively monitors and visualizes status of all discovered devices
- Generates status and performance alerts
- Highlights volumes and applications that are impacted by SAN outages
- Performs alert-triggered actions based on user-defined policies



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VisualSAN and VisualSRM Foundations - 27 

When the SAN goes down, for whatever reason, it's costly. Administrators need a tool to monitor the SAN for problems before they become critical, and to isolate the cause quickly.

An Administrator cannot use Element Managers for SAN level troubleshooting. VisualSAN improves troubleshooting through a SAN level visual overview and graphic cues that help to quickly pinpoint problem areas.

One of the first things the Administrator must determine is the real impact of the outage, i.e. which volumes and applications are impacted. VisualSAN's path visualization capabilities quickly highlight the devices that are impacted by a SAN outage.

The VisualSAN configuration capture and comparison utility immediately pinpoints SAN configuration changes that may be the source of SAN faults, drastically reducing problem resolution time and helping avoid costly downtime.

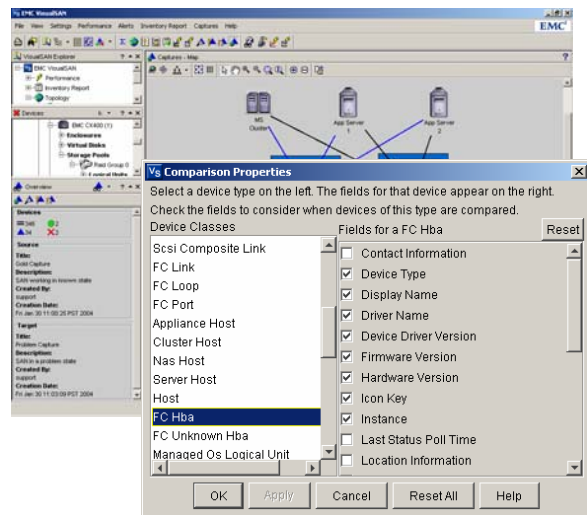
Configuration captures, taken over time, provide a history of SAN configurations and changes, providing vital information for problem resolution.

In addition, configuration captures can be taken and used for comparison against the configuration of a SAN to ensure that it is configured as expected.

Control Unwanted Changes to Devices

#3 Fast and accurate change management

- Automatically monitors, detects, and provides alerts whenever a change occurs
- Configuration captures when a change is detected
- Eliminate manual spreadsheets for device names, firmware levels, etc.



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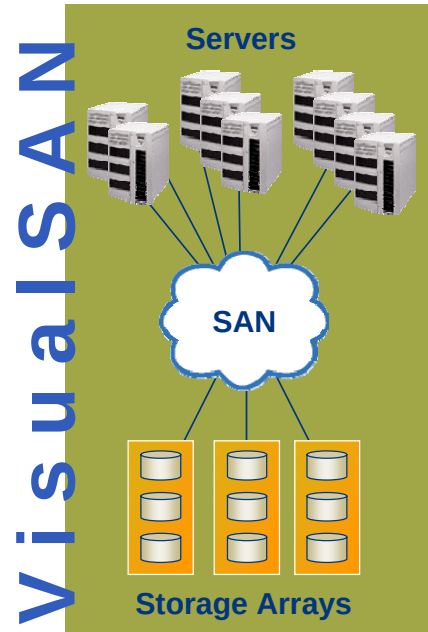
Change management and configuration tracking in VisualSAN are among many outstanding features that reduce the management burden on Administrators.

Active device polling and policy-based alerting notifies Administrators as soon as a problem arises. Compare this to other products that do not poll actively, and only wait for SNMP traps to trigger an alert. VisualSAN also can aggregate alerts from any device on the SAN, even those that it does not support in its other features. This gives SAN Administrators a single console for managing alerts.

In addition, VisualSAN identifies application-to-storage data paths so that Administrators can see, at a glance, which business processes may be affected by SAN problems.

VisualSAN Business Benefits

- Reduce storage management costs
 - Simplified visual display of complete environment and its status boosts Administrator efficiency
 - Policy-based actions when problems are discovered
- Increase data availability
 - Configuration change management and performance monitoring to quickly isolate and repair faults
- Manage business growth
 - Easily add storage to hosts or reconfigure components as business demands



VisualSAN addresses the most pressing SAN administration issues with the tools Administrators need to meet business objectives and gain the most from the SAN investment.

VisualSAN provides configuration management and performance monitoring to ensure high SAN availability. End-to-end visualization is also available with VisualSAN, but unavailable when using independent, non-integrated Element Managers. VisualSAN can also provision storage from one central tool, eliminating the need to use products from several vendors to accomplish one task.

VisualSAN

Key points covered in this section:

- VisualSAN benefits to business
- The architecture of the VisualSAN environment
- The main features of VisualSAN

Here are the key points covered in this section dealing with VisualSAN.



VisualSRM

**GRAPHICAL STORAGE MANAGEMENT
APPLICATION**



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VisualSAN and VisualSRM Foundations - 31 

In this section we will discuss the VisualSRM application.

VisualSRM

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

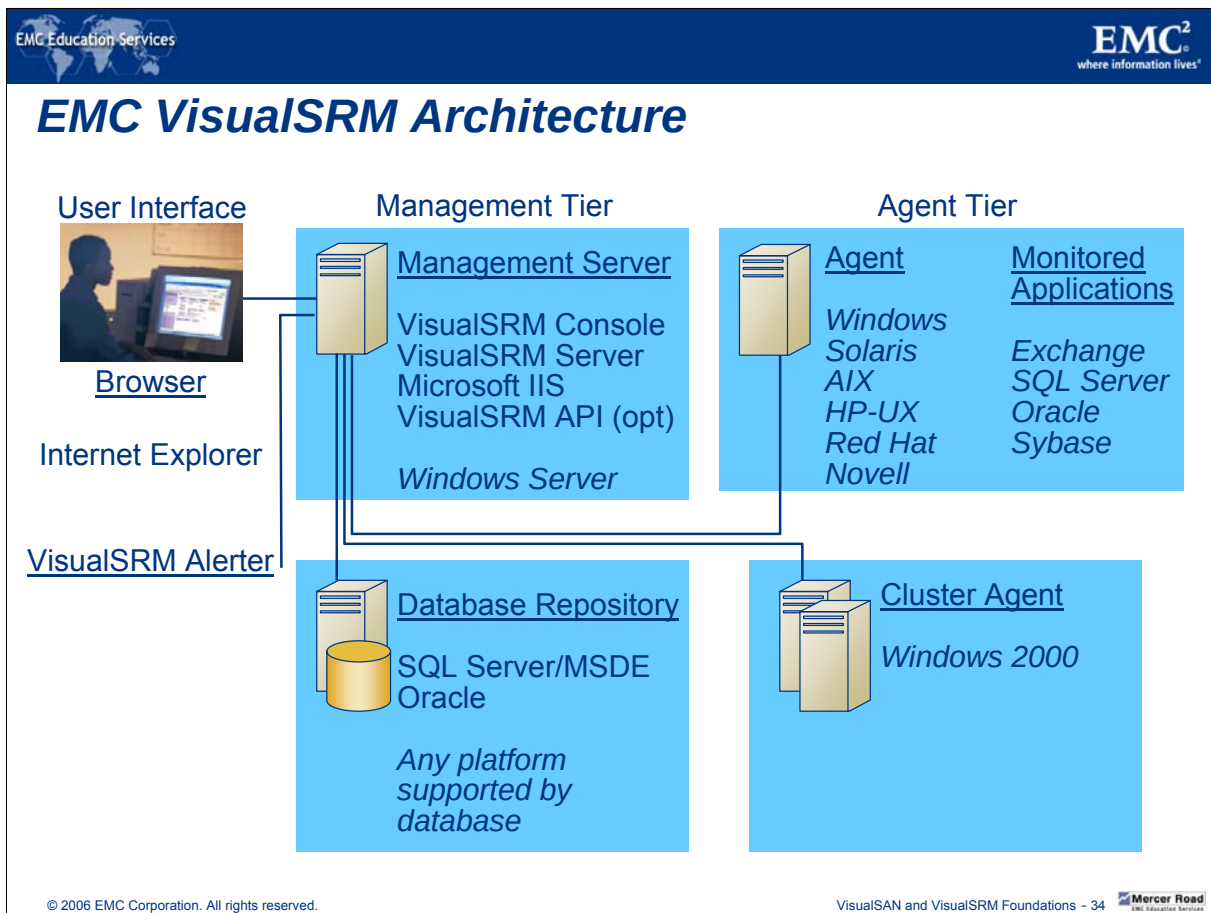
- Relate business needs to VisualSRM benefits
- Explain the architecture of the VisualSRM environment
- State the main features of VisualSRM
- Identify the main reporting categories of VisualSRM

The objectives for this section are shown here. Please take a moment to read them.

VisualSRM – A Definition

- **VisualSRM (Storage Resource Management) – What is it**
 - This a policies based, storage management application, that will allow administrators to consolidate and intelligently manage their storage infrastructure via a graphical user interface

VisualSRM is a resource management tool that collects detailed data on the usage of filesystems, databases, and mail servers. Administrators can run reports on the collected data to locate over utilized resources or unnecessary storage. Active management policies allow the administrator to take steps to resolve usage problems across the whole environment.



VisualSRM is a multi-tiered client/server application.

User Interface Tier: The User Interface tier provides browser-based (Microsoft Internet Explorer) access to the VisualSRM management system tier. The user interface allows you to view reports and administer policies, agents, and intelligent actions. The VisualSRM Alerter tool can be installed if the user wants to receive pop-up alerts.

Management Tier: The Management tier has two major components: the Management Server and the Database.

- The Management Server includes the Console, the Server, and the Web server. The Console provides a central location for management and control of agents, policies, and reports. The Server provides services to manage agents and policies, and also processes data from policies that agents execute. The Web server, Microsoft Internet Information Services (IIS), services HTTP requests between the management system tier and the user interface tier.
- Database - The database (SQL Server/MSDE or Oracle) stores current and historical information about all managed resources (for example, hosts, databases, Exchange Servers). The database may be installed on a separate host from the management system.
- The VisualSRM API can be installed on the Management Server, if needed. The API is a DLL (Dynamic Link Library) containing routines that a programmer might use to design an alternate VisualSRM interface. The routines can be used to query data and manage actions from a compiled program.

Managed Node Tier: The Managed Node tier consists of one or more managed nodes. A VisualSRM agent resides on each node to start and stop scans and to run intelligent actions. The agent scans managed objects such as files, databases, mailboxes, volumes, and directories, then transmits scan results to the management system tier.

VisualSRM/StorageScope FLR – Software Bundles

	VisualSRM Edition			Storage- Scope FLR
	Database	Exchange	Standard	
Database Repository: SQL Server/MSDE	●	●	●	●
Database Repository: Oracle	●			●
Agents: Windows (incl. MSCS), Linux, Novell	●	●	●	●
Agents: Solaris, AIX, HP-UX	●			●
Apps: SQL Server, Exchange	●	●		●
Apps: Oracle, Sybase	●			●

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VisualSAN and VisualSRM Foundations – 35



The Standard Edition is the entry level package designed for Intel platforms only: Windows, Linux, and Netware. Complete file level scanning and reporting is included, but no database or mail server applications can be monitored.

The Exchange Edition is designed to appeal to the majority of Microsoft Windows-centric mid-tier companies. In addition to file level monitoring, Exchange and SQL Server applications can be monitored.

The Database Edition is designed to appeal to the larger mid-tier companies that have a mix of Windows and UNIX servers, Database applications, and Exchange server. All of the product capabilities are available in the Database Edition.

Upgrading VisualSRM editions can be done by simply adding a new license key. No re-installation is needed.

StorageScope File Level Reporter is identical to VisualSRM Database Edition except for branding and licensing differences. This variant is installed in ControlCenter environments, while the stand-alone VisualSRM product is typically targeted toward Navisphere environments.

VisualSRM/StorageScope FLR – Licensing

- **VisualSRM**
 - Licensed by MAC address (network card ID) of VisualSRM Console/Server
 - Licensed by capacity
 - Total capacity of scanned resources
 - Can purchase more in 1 TB increments
 - Applications (database, mail) need to be licensed via Exchange or Database Server edition
 - Non-disruptive license upgrades
- **StorageScope FLR**
 - License is part of FLR Kit
 - Can be used on any host, with no capacity limit
 - Equivalent to a VisualSRM Database Edition license
- **License file is mandatory for installation**

Licenses are MAC address specific—a license file containing the encrypted MAC address must be created for each install. Changing the network card or moving the software to another server requires a new license file to be generated.

The software is capacity limited. The Database and Exchange Editions start at 1 TB of capacity, while the Standard Edition starts at 500 GB. Additional capacity for all licenses can be purchased in increments of 1 TB.

The StorageScope FLR license is not MAC address specific—the software can be installed on any compatible host. There is no capacity limit in this version.

All capacities are calculated based on total capacity of the scanned resources, not the used capacity. For example, including a 15 GB partition in a file scan counts the full 15 GB against the license capacity, no matter how much is actually used. Objects not added to scan policies do not count against the licensed capacity.



VisualSRM

IMPLEMENTATION AND MANAGEMENT



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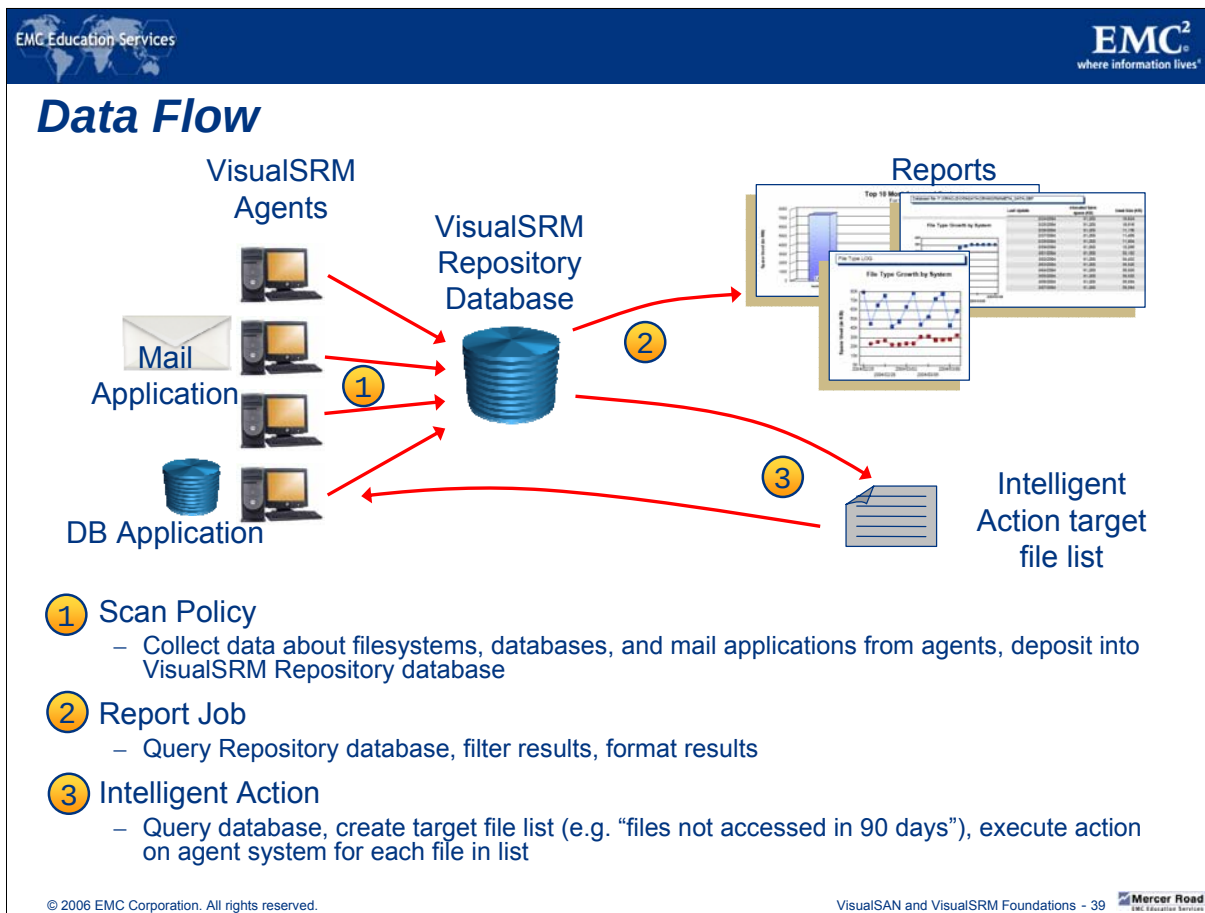
VisualSAN and VisualSRM Foundations - 37 

Having discussed what VisualSRM is, we will now briefly describe how it is implemented and managed.

VisualSRM – Policies Based

- The VisualSRM infrastructure is policy-based; a storage administrator is able to manage the environment within the boundaries of these policies
- There are several default policies and report jobs that are created upon installation that can be modified to suit your environmental needs
- Policies can be run either manually or automatically according to administrator defined schedules

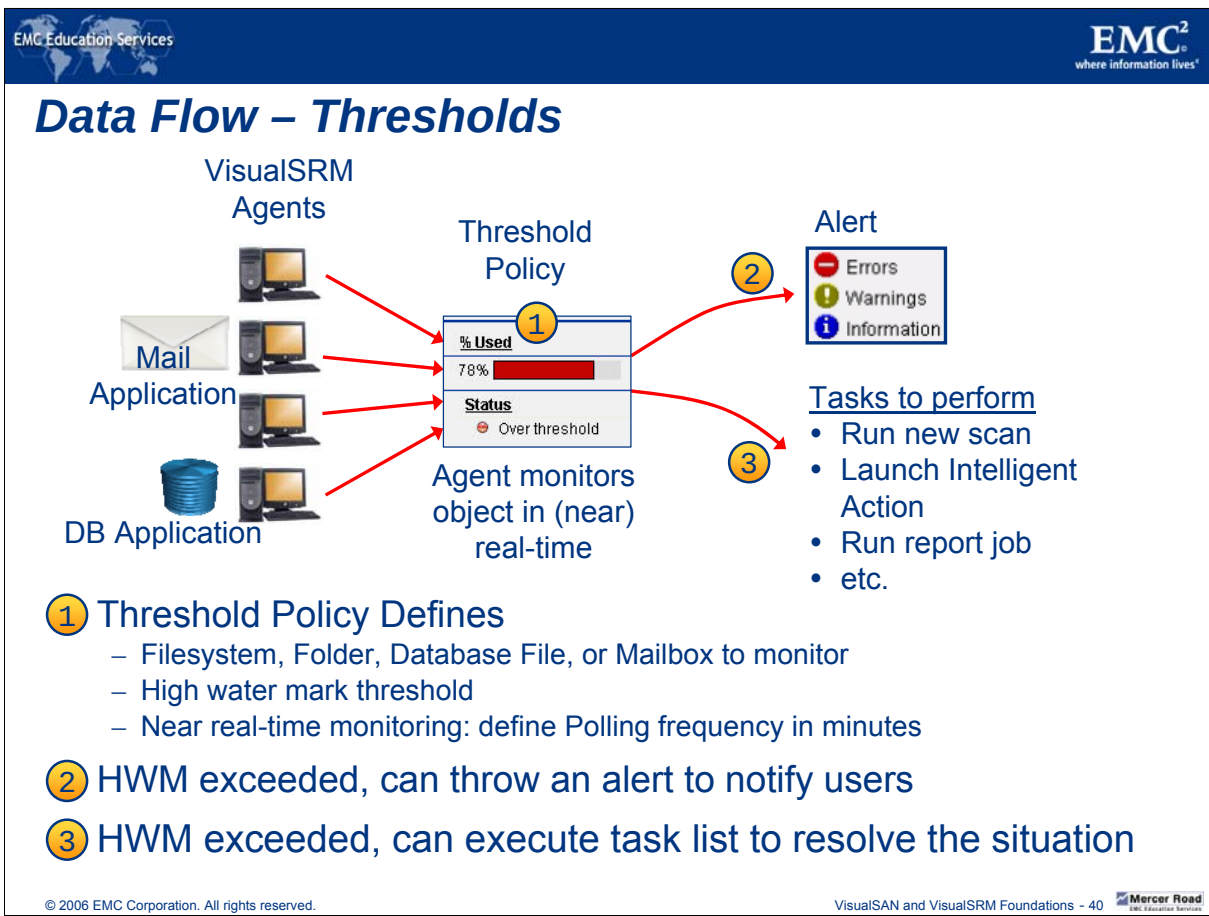
Most VisualSRM management tasks are implemented through policies which can be run manually or scheduled.



Scheduled Scan Policies indicate when an agent should collect data about the filesystems, mail applications, or databases they manage. Data transfers from the agents are managed by the VisualSRM Console; the VisualSRM Server stores the scanned data as records in the database repository.

Reporting should be scheduled after scans complete. Report jobs query the database repository for data about the monitored objects. Large, comprehensive reports can be generated, or the output can be filtered by almost any criteria.

Intelligent Action policies can be created to proactively manage the monitored files. An Intelligent Action includes file filter criterion: “all files not accessed in 90 days”, for instance. When the Intelligent Action executes, a query is made to the repository database to find files that match the criterion. The resulting file list is passed to the agents, who are responsible for operating on the files. The policy might indicate that the files be deleted, compressed, moved, or some other action.



Threshold policies operate in a more real-time way than reporting tasks. A Threshold Policy monitors the used space in a Filesystem, Folder, Database File, or user Mailbox. The policy polls the object every few minutes, and notifies the VisualSRM Console when the high water mark is exceeded.

When the high water mark is exceeded, an alert can be thrown to notify the users. Alerts can be sent by Email or to an SNMP management framework, or to the VisualSRM Alerter.

A set of tasks might also be triggered when a high water mark is exceeded. Any VisualSRM policy can be included in this task list, including re-scanning the object, launching an intelligent action, or running a report job. Careful implementation of these tasks can resolve the situation and even report on the effectiveness of the solution.

Resources

- **Systems**

- Scan details: Filesystems, Folders, Files
- Filesystems and NAS shares can be remotely scanned if they are shared via CIFS or NFS—agent maps share, then scans

- **Database Servers (SQL Server, Oracle, Sybase)**

- Scan details: Data and Log Files, Tables
- Databases can be remotely scanned via ODBC

- **Mail Servers (Exchange)**

- Scan details: Data stores, Mailboxes, Mailbox folders
- Mail servers can be remotely scanned via an Active Directory mailbox (MAPI login for Exchange 5.5)

There are three types of scanned resources in VisualSRM: Systems, Database Servers, and Mail Servers.

Scans of System resources reveal information about selected filesystems. The level of detail extends from the overall filesystem, to the folders and individual files. Ownership, size, type, and date are some of the features that are logged for these objects. File content is not scanned, so there is no way to report on the number of files that contain a given phrase, for instance.

Database Server scans reveal information about the Data and Log files, and individual Tables. Ownership, size, and number of records are some of the features that are logged for these objects. Individual record content is not logged, so there is no way to report on the number of times a given customer appears in a table, for instance.

Mail Server scans reveal information about Data Stores, Mailboxes, and Mailbox folders. Size, number of messages, and total size of attachments are some of the features logged for these objects. Individual message details are not logged, so there is no way to count the number of messages from a particular sender, for instance.

Remote scanning can be performed for file shares, databases, and mail servers, using the common network protocols listed here. Even if an object resides on a host for which there is no compatible agent, remote scanning can be used to manage it. Remote scanning can be slower, especially in the case of filesystem scans. Scan via local agents whenever possible.

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Resources – Systems

Dashboard ▾ Resources ▾ Policies ▾ Reports ▾ Settings ▾ Help ▾

Resources > Systems > dmx800win2

dmx800win2 Remove...

dmx800win2 properties

Managed by: dmx800win2
Hosted by: dmx800win2
Operating system: Microsoft Windows 2000 Advanced Server Service Pack 4 (Build 2195)
License status: Licensed
Related policies: [View policies that use this system](#)

30-day storage usage history (Details)

Storage volumes All volumes

Volume	Type	File system	% Used	Used size	Total size
C:	Hard drive	NTFS	96%	3.60 GB	3.77 GB
E:	Hard drive	NTFS	< 1%	7.02 MB	894.00 MB
F:	Hard drive	NTFS	< 1%	26.93 MB	4.67 GB

Export... 3 volumes

Add... Edit... Remove... Refresh

Volume information last updated on 11/2/2005 at 9:29:19 AM.

Recent events

There have been no related events within the last 15 minutes.

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The Resources page allows the user to view the current contents of the database repository. For example, this screen shows a particular System resource. Basic configuration data is shown at the top left of the display, and a 30-day storage usage summary appears at the top right. At the bottom, the individual volumes and their capacities and utilization are shown.

Further drill down on one of the volumes will show all subfolders and files. A complete record of the contents of the filesystem, as it was at the time of the last scan, can be browsed via the System resource page.

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Resources – Database Servers

Dashboard
Resources
Policies
Reports
Settings
Help

Resources > Database servers > losbd196-Oracle > losbd196-Oracle

losbd196-Oracle

Tablespaces
Data files
Log and Archive files
Tables

Tablespace	Type	Extent	Segment	Status	Logging	Bigfile	Free	Used	Largest	Utilization	# Tables	# Indexes
SYSTEM	PERMANENT	LOCAL	MANUAL	●	✓	✗	9.63 MB	490.00 MB	8.94 MB	98%	432	627
SYSAUX	PERMANENT	LOCAL	AUTO	●	✓	✗	28.31 MB	420.00 MB	11.06 MB	93%	810	1,453
TEMP	TEMPORARY	LOCAL	MANUAL	●	✗	✗	784.00 MB	2.02 GB	765.00 MB	62%	0	0
USERS	PERMANENT	LOCAL	AUTO	●	✓	✗	78.81 MB	96.25 MB	78.81 MB	18%	97	168
UNDOTBS1	UNDO	LOCAL	MANUAL	●	✓	✗	165.06 MB	190.00 MB	100.81 MB	13%	0	0
SRMINDEX	PERMANENT	LOCAL	AUTO	●	✓	✗	4.74 GB	5.00 GB	3.61 GB	5%	0	81

Tablespaces
Data files
Log and Archive files
Tables

Filename	Tablespace	Type	Capacity	Utilization	Auto-extend?	Disk size	Disk free
+DGROUP1/a300/datafile/system.256.1	SYSTEM	Data	490.00 MB	98%	✓	0 bytes	0%
+DGROUP1/a300/tempfile/temp.268.1	TEMP	Temporary	20.00 MB	95%	✓	0 bytes	0%
+DGROUP1/a300/datafile/sysaux.257.1	SYSAUX	Data	420.00 MB	93%	✓	0 bytes	0%
+DGROUP5/a300/tempfile/temp.260.1	TEMP	Temporary	2.00 GB	37%	✗	0 bytes	0%
+DGROUP1/a300/datafile/users.259.1	USERS	Data	96.25 MB	18%	✓	0 bytes	0%
+DGROUP1/a300/datafile/undotbs1.258.1	UNDOTBS1	Data	190.00 MB	13%	✓	0 bytes	0%
+DGROUP3/a300/datafile/srminindex.256.565184881	SRMINDEX	Data	5.00 GB	5%	✗	0 bytes	0%
+DGROUP2/a300/datafile/srmmetadata.256.565183223	SRMMETADATA	Data	15.00 GB	3%	✗	0 bytes	0%
+DGROUP5/a300/datafile/appliq.370.1	APPIQ	Data	100.00 MB	< 1%	✓	0 bytes	0%

Export...

9 items

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This example shows the Tablespaces and Data files utilization for a particular Oracle instance. The colors of the bars reflect the threshold policy that has been set for the tablespaces and data files. Red indicates that these files have exceeded the set threshold. Information about the Log and Archive files, as well as all the Tables in the database, can also be displayed by choosing the appropriate tab.

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Mail Recipients and Mailboxes

Mail Recipients

Mailbox	Username	Last login	Department	Message size	Attachment size	Total size
SystemMailbox{F42FBB94-793C-40BC-B4A7-CA2F754DDDB8}	SystemMailbox{F42FBB94-793C-40BC-B4A7-CA2F754DDDB8}			2.2 MB	0 bytes	2.2 MB
user4	user4			125.6 KB	0 bytes	125.6 KB
user5	user5					
user3	user3					

Recipient Mailboxes

Message Aging

Folder properties

Category	Size	Data aged 0-30 days	Data aged 31-60 days	Data aged 61-120 days	Data aged 121+ days
Messages here:	125.6 KB	125.6 KB	0 bytes	0 bytes	0 bytes
Messages in subfolders:	0 bytes	0 bytes	0 bytes	0 bytes	0 bytes
Attachments here:	0 bytes	0 bytes	0 bytes	0 bytes	0 bytes
Attachments in subfolders:	0 bytes	0 bytes	0 bytes	0 bytes	0 bytes
Allocated elsewhere:	11.9 MB				

Subfolders

Folder	Size	Aggregate size	% of total	# Messages	# Attachments	# Subfolders
Inbox	125.6 KB	125.6 KB	100%	75	0	0
Journal	0 bytes	0 bytes	0%	0	0	0
Contacts	0 bytes	0 bytes	0%	0	0	0
Notes	0 bytes	0 bytes	0%	0	0	0
Calendar	0 bytes	0 bytes	0%	0	0	0
Outbox	0 bytes	0 bytes	0%	0	0	0

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The Mail Server Resources page displays the objects scanned by a mailbox scan: mail recipients, and their folders. The data size, number of messages, and number of attachments are displayed at each level.

A pie chart showing the allocated storage of this folder, subfolders, and elsewhere on the server is included in the Properties tab.

This tab also shows the aging of the messages. Message aging shows how many messages are in each of four user-defined age groups. This shows an administrator which mail folders contain outdated mail.

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Events

- Events happen when:
 - Scans or jobs start, stop, or encounter errors
 - Threshold settings are exceeded
 - Intelligent actions and Task lists start, stop, or encounter errors
- Events have three severities:
 - Error
 - Warning
 - Information
- Events are always recorded in the VisualSRM Event log, but users can be notified via:
 - Email
 - VisualSRM Alerter popup
 - SNMP traps



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VisualSAN and VisualSRM Foundations - 45
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Events occur when nearly anything of interest happens in VisualSRM, including policy actions, threshold exceptions, and internal activity like intelligent actions and task list actions. Administrators can monitor events to determine if scan jobs are overlapping report jobs, if intelligent actions are acting as expected, or if any component encounters an error.

Events have three possible severities: Error, Warning, and Information. Severity levels are pre-defined for events related to the software, such as policy activity. Severity levels can be set by the user for user-defined events like thresholds.

All events are recorded in the VisualSRM Event log, under the Dashboard page. Advanced notification via email, the VisualSRM Alerter program, and SNMP traps are available as well.

Intelligent Actions

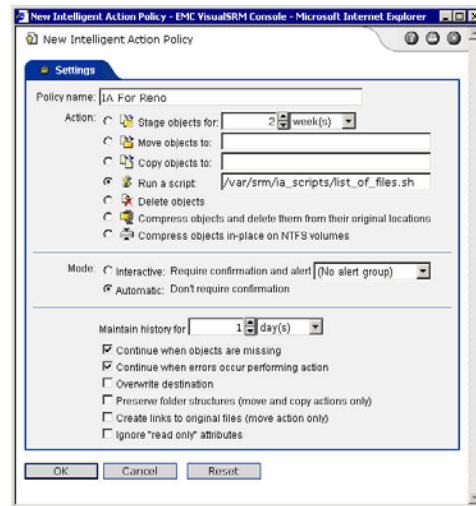
Move/Copy to destination folder

Delete/Compress files

Stage (Move to agent-controlled staging folder; delete after scheduled time)

Run agent-based script

- Action can be set for Automatic or Interactive (user logs in and approves action)
- Can create links to original files on move (only)



File-level actions can be carried out by an agent through an Intelligent Action policy. Actions include copying, moving, deleting, and compressing files. Files can also be staged or moved to an agent-controlled folder for a fixed time before being deleted. The VisualSRM operator does not need to write a script or even know the operating system type of the target host; each local agent knows how to perform the task on the given operating system.

If more complicated tasks need to be performed, a host-based script can be executed also.

Intelligent Actions can be set for automatic mode to run unattended. Alternatively, setting them for interactive mode will pause the policy to allow a user to log in to the VisualSRM console and confirm the action.

Reporting Features

- Report jobs can be scheduled—allows lengthy query to execute during off-hours
- Report data drawn from VisualSRM database—only as up-to-date as the last scan
- Reports can be published in PDF, HTML, RTF, XML, or XLS format
- “Reporting” users can be created with rights for only viewing reports

Reports can be added to report jobs for daily, weekly, monthly, or even quarterly scheduling. Complicated reports that summarize information about millions of objects can take a long time to run. Scheduling them for the off-hours keeps a user from having to wait for outcome.

Since report data is drawn from scan data in the VisualSRM database repository, the content of the report is only as up-to-date as the last scan. Running a report in the morning and then another in the afternoon is not useful unless a scan was performed in between. If no scan is performed, the second report will show the same data as the first one.

Reports can be generated in the variety of viewing and data formats listed here.

“Reporting” users can be created with rights for only viewing reports generated by report jobs. These users cannot run reports or scans, or perform any other administrative functions.

File Reports

File Details	Sort by owner, size, type, date, etc.
Path Details	Path sizes
Dormant Folders	Folders and included files not accessed for specified days
Duplicate Files	Files having same name and size on same server
Chargeback	Path usage × dollar amount for selected groups of paths
Trend View	Growth trends of systems, volumes, paths, owners, file types

Many File Reports are “File Details” reports: “File Details by Owner,” “File Details by Size,” etc. Each shows individual file records sorted and categorized by owner, size, etc. The reports can be filtered to focus the output on particular owners, modification dates, or other filters. Use these reports to list individual files meeting a specific set of filters.

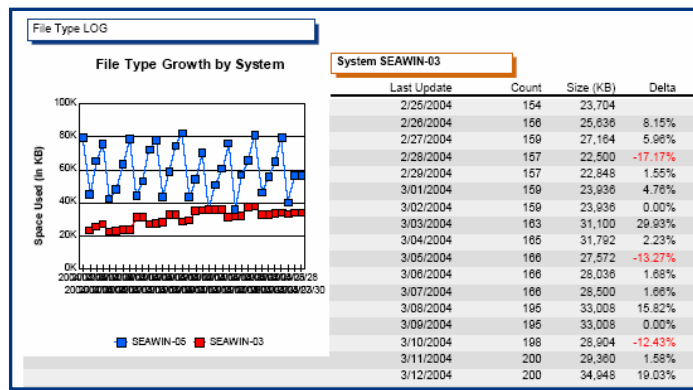
“Dormant Folders” and “Duplicate Files” list objects meeting a particular condition. “Dormant Folders” shows folder names which have no sub-folders or files that have been accessed for a specified time. “Duplicate Files” shows any files on a server that have the same name and byte count.

One “Chargeback” report is available. The report multiplies a dollar amount by the amount of used space in a specified group of folders. Different folder groups and dollar amounts can be set for different organizations.

Several “Trend View” reports are available that show growth trends of systems, volumes, or other objects over time. These reports are the only sort that shows data from past scans. All other reports show only up to date information.

File Report Examples

File Type Trend View



Dormant Folders – Folders not accessed in 90 days

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Dormant Folders

List of Dormant Folders in which all files are older than the specified days.
3/30/2004 1:53:06 AM
Page 1 of 36

Folders in which all files not accessed for more than 90 day(s).

Path	This Path And Deeper File Count	Size (KB)	Most recent Accessed Date Under this path
System SEAWIN-03			
C:\Documents and Settings\Administrator\Application Data\Microsoft\SystemCertificates\My\Keys\	1	4	12/20/2003 12:22:19 AM
C:\Documents and Settings\Administrator\Local Settings\History\History.IE5\	2	388	12/20/2003 12:22:28 AM
C:\Documents and Settings\Administrator\Templates\	12	68	12/20/2003 12:22:18 AM

Here are examples of the “File Type Trend View” and “Dormant Folders” reports. The “File Type Trend View” clearly shows that space used by LOG-type files rapidly cycles up and down between 40 and 80 KB on one server, while the other server’s LOG files are slowly consuming more space.

Database and Mail Reports

Database Space Usage	By database, data and log file, or table
Database Usage Trend View	Data and log file growth trends
Mail Message Details	Counts of messages and attachments by mail server, department, or user
Mail Space Usage	By mail server, store and log files, or user
Mail Usage Trend View	Mail server, department, or user growth trends
Trend View	Growth trends of systems, volumes, paths, owners, file types

Similar database and mail server reports show logical object space usage, physical file usage, and growth trends.

Database Server and Mail Server Examples

Database Table Usage Detail

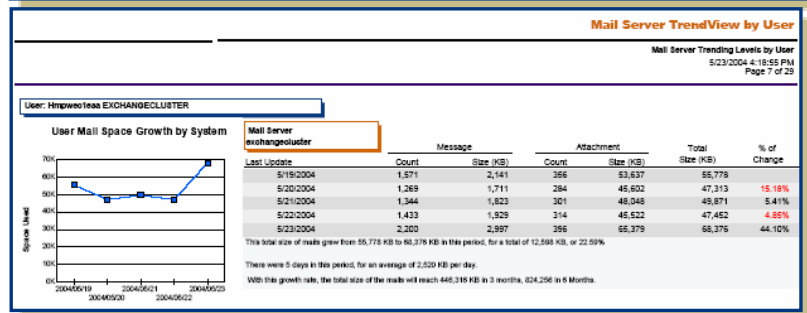
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Database Table Usage Detail

List Database Table Usage Detail
3/30/2004 9:27:50 AM
Page 1 of 53

Table Name	Table Space	Size Used (KB)	Index Used (KB)
Oracle Server: seawin-01-OracleSRM (seawin-01)			
Database: seawin-01-OracleSRM			
Owner: CTXSYS			
DR\$CLASS	DRSYS	64	0
DR\$INDEX	DRSYS	192	192
DR\$INDEX_ERROR	DRSYS	64	0
DR\$INDEX_PARTITION	DRSYS	128	128
DR\$INDEX_SET	DRSYS	128	128
DR\$INDEX_SET_INDEX	DRSYS	64	64

Mail Server Trend View by User



Here are examples of the “Database Table Usage Detail” and “Mail Server Trend View by User” reports.



VisualSRM

BUSINESS JUSTIFICATION



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VisualSAN and VisualSRM Foundations - 52 

Now that you have a basic understanding of what the product is, we will briefly discuss the business justification of the product.



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Questions You Face Daily

#1 Utilization problems
*Who owns what data?
How much is duplicate or stale?
How old is the data?
How much is non-business related?*

#2 Availability problems
*What data is at risk?
What data isn't backed up?
Where are bottlenecks?*

#3 Manual or script problems
*Do I do the housekeeping by scripts?
How do I maintain the scripts?
How do I update the scripts when the changes occur?*

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VisualSAN and VisualSRM Foundations - 53

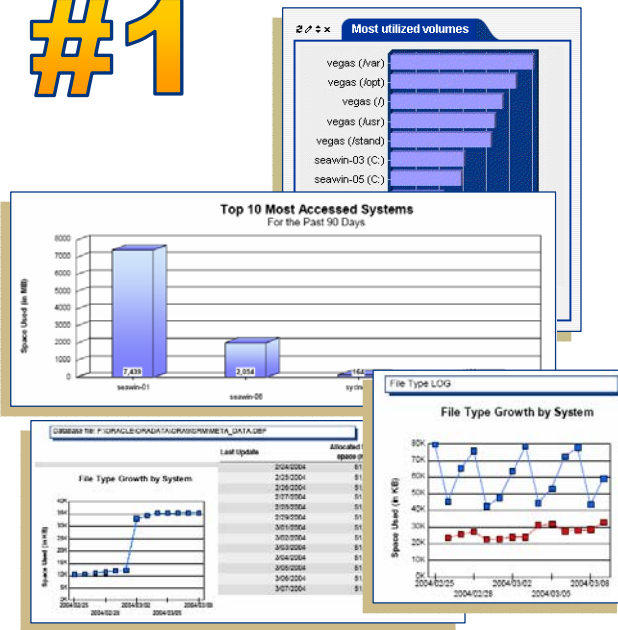
Mercer Road
EMC Education Services

VisualSRM is designed to answer common questions such as:

- Who owns the data and how much does that person or department have?
- How much data is duplicate or stale? Can I run a report and see all my data that hasn't even been accessed in the past six months or a year?
- How much space is used by non-business related data: MP3s, AVI files, etc.?
- What data is at risk? For example, what data hasn't been backed up?
- How much data do I have? How many days are left before I run out of space?
- How will my service levels be impacted?
- Do I perform the file maintenance tasks manually or do I automate with scripts?
- If I use scripts, how do I deploy them? What will be different in the script for each flavor of the operating system or difference in the configuration?

Solutions to Utilization Problems

#1



- Comprehensive reports that provide summary and file-level detail
- Snapshots in the user interface provide a quick view of your filesystems, mail servers, and databases
- Report utilization by:
 - Type: Multimedia files, Log files, System files, etc.
 - Owner: file, mailbox, tablespace
 - Date: folders, files not accessed in X days
 - Duplicate files

VisualSRM provides solutions to utilization problems by gathering file-level details on filesystems, table-level details on databases, and message-level details on mail servers. Data can be presented in Snapshots directly in the user interface, or in detailed, user-customizable reports. Tabular data can be displayed to examine the latest configuration, or trend charts can show growth over time.

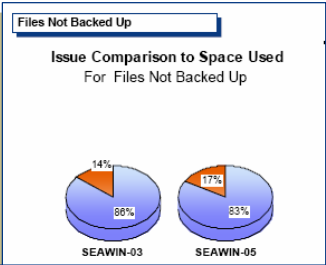




Solutions to Availability Problems

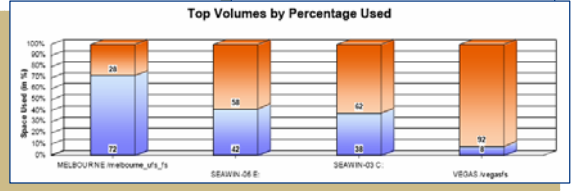
#2

- Thresholds warn you when you approach dangerous utilization levels
- Intelligent Actions automatically triggers when thresholds are breached
- Reports show what files are at risk due to failed backups



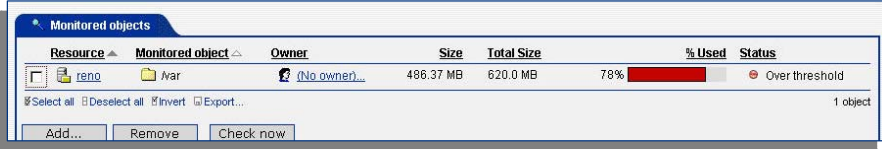
Files Not Backed Up
Issue Comparison to Space Used For Files Not Backed Up

Resource	Files Not Backed Up (%)	Space Used (%)
SEAWIN-03	14%	86%
SEAWIN-05	17%	83%



Top Volumes by Percentage Used

Resource	Space Used (MB)	Total Size (MB)	% Used
MELBOURNE: melbourne_mfls	28	72	39%
SEAWIN-05 E	58	42	138%
SEAWIN-03 C	42	38	111%
VESAS: vesas	92	7	1314%



Resource	Monitored object	Owner	Size	Total Size	% Used	Status
reno	/var	(No owner)	486.37 MB	620.0 MB	78%	Over threshold

1 object

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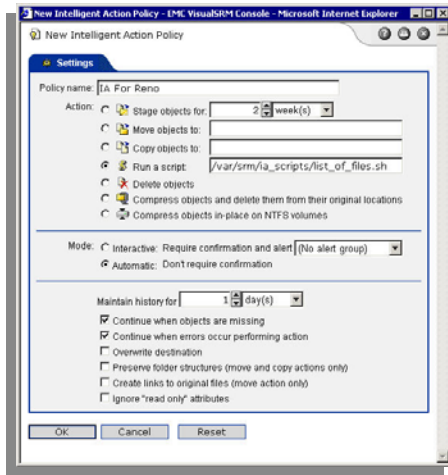
VisualSAN and VisualSRM Foundations - 55



VisualSRM provides solutions to availability problems by tracking the total and used sizes of filesystem, database, and mail server storage. Reports and snapshots easily show which resources are nearing their limits. Thresholds can be set to fire alerts when utilization levels are approaching dangerous levels. Intelligent Actions can be linked to thresholds to take corrective action.

Solutions to Automation Problems

#3



- Automate housekeeping tasks with Intelligent Actions
- Create best practice policies to maintain healthy storage
 - Compress files not accessed in X days
 - Move less active files from high-performance to low-performance storage
- Operating system and storage-agnostic

VisualSRM provides solutions to automation problems by acting on the files it monitors. Actions can be created to compress files not accessed in a given number of days, move files to lower performance storage, or execute a number of other activities. Each action can be designated for any monitored server using any type of storage—the local agents interpret the commands and translate them into OS-specific tasks. The administrator can implement a single policy across all systems in a heterogeneous environment.

VisualSRM

Key points covered in this section:

- VisualSRM benefits for business
- The architecture of the VisualSRM environment
- The main features of VisualSRM
- The main reporting categories of VisualSRM

Please take a moment to review the key points covered in this section.

Module Summary

Key points covered in this module:

- VisualSAN and VisualSRM benefits to common IT needs
- Architectural components of VisualSAN and VisualSRM
- Features and function of VisualSAN and VisualSRM

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