

Hitachi HiCommand® Path Provisioning Software

End-to-end, Rules-based Provisioning of
Heterogeneous Storage

Application Brief

February 2005

Executive Summary

Connecting application servers to storage capacity in a SAN is a manual and time-consuming process made more complex by the multivendor nature of today's enterprise storage infrastructures. Provisioning capacity—creating volumes, securing LUNs, and performing zoning—requires that storage administrators maintain an intimate understanding of each vendor's management tools and processes. To keep business applications supplied with the capacity they need for day-to-day operations, administrators must repetitively log in to each component of the storage infrastructure and perform the provisioning tasks appropriate to that piece of hardware or software. This process is inefficient, error prone, and costly.

With storage management responsible for upwards of 80 percent of the total cost of storage ownership, improving administrator productivity has become a priority. Automating routine tasks, like provisioning, in the storage administration workflow promises to significantly reduce the management burden. However, the heterogeneous composition of typical enterprise storage infrastructures, and the proprietary management interfaces deployed by each vendor, make automation problematic.

Recognizing the need for greater storage management interoperability, the Storage Networking Industry Association (SNIA) has developed the Storage Management Initiative Standard (SMI-S). SMI-S is based on the Common Information Model (CIM), developed by the Desktop Management Task Force (DMTF), and provides a common, open storage management interface that promises to dramatically improve the automation of routine storage management tasks.

Hitachi HiCommand® Storage Services Manager software, powered by ApplQ, is the first storage management platform to make use of the open SMI-S protocols. Storage Services Manager software allows administrators to manage capacity across a broad range of heterogeneous storage systems, from application to spindle, using open standard interfaces. The HiCommand Path Provisioning module is specifically designed to automate the storage allocation workflow. Path Provisioning software significantly alleviates much of the day-to-day pain of storage management by speeding the process of allocating capacity and eliminating the errors inherent to manual provisioning. Path Provisioning software delivers greater application availability, increases storage administrator productivity, and lowers the operational and capital costs of the storage environment.

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Provisioning Enterprise Storage

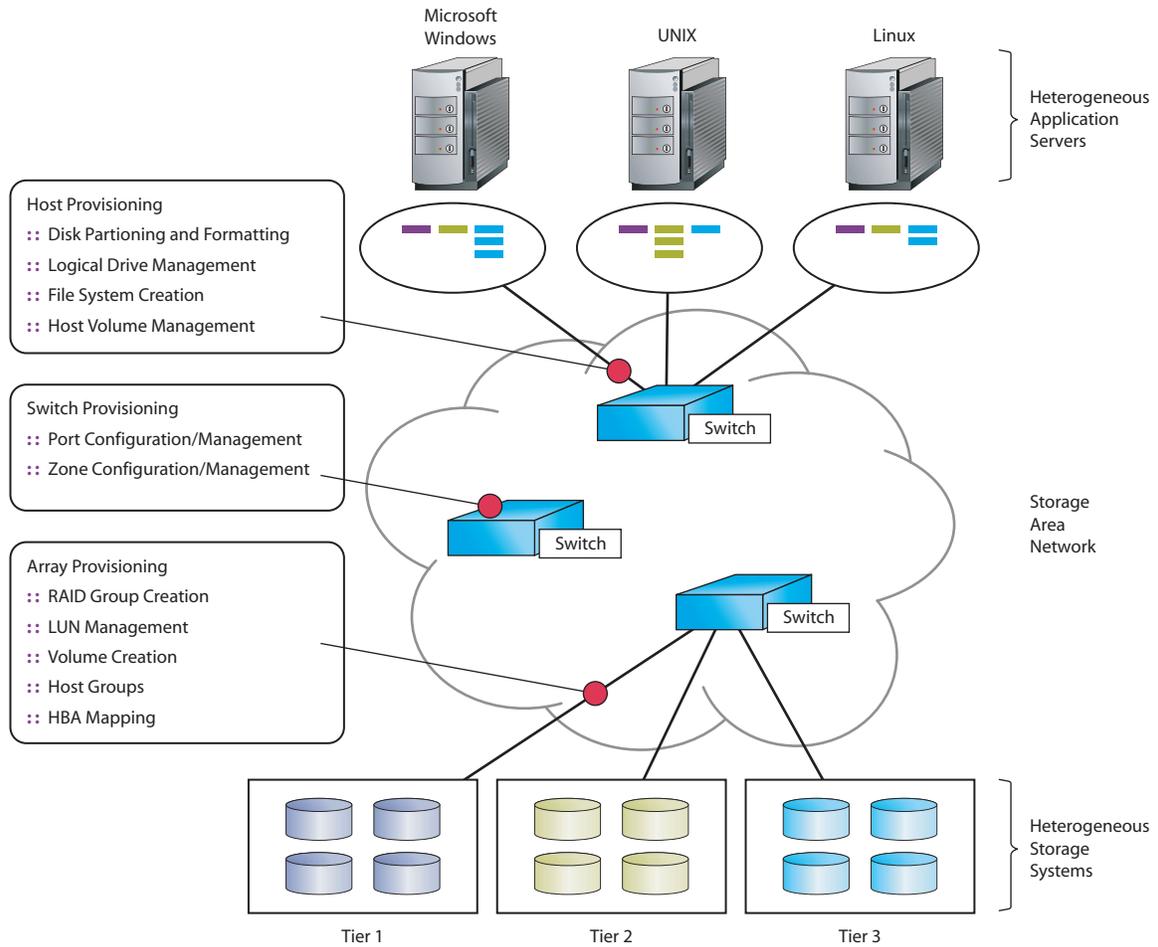
Storage administrators are in the unenviable position of being on the critical path governing successful operation of line-of-business applications. As demand for application storage capacity escalates ever upwards, it is the responsibility of the administrator to ensure that storage appropriate to the needs of the application is allocated on time. An out-of-space condition will inevitably cause applications to fail, and the consequent downtime can have a serious financial impact on the business.

Guaranteeing applications access to the storage capacity they need, without wastefully over-allocating resources, is a significant portion of the storage administrator's workload. Capacity in the existing infrastructure must be allocated to application servers and additional resources must be integrated into the environment and made available. The process of provisioning storage is continuous, as new application deployments demand fresh capacity, existing systems require additional space, and allocations are constantly juggled to ensure infrastructure efficiency.

The seemingly simple task of making capacity on a storage system available to an application server is confounded by the complexity of the storage area network (SAN) environment, as shown in Figure 1. Predominantly a manual process, storage provisioning relies on the administrator having up-to-date information about the resources on the SAN and their specific characteristics; knowing that volumes allocated to a mission-critical Oracle database must be multipathed does not help if the administrator cannot tell which storage systems are configured for multipathing. And, once the correct resources have been identified, the administrator must invariably navigate the unique management interfaces of any number of different vendor point tools to make capacity visible to the application server. The cumbersome, repetitive, and time-consuming nature of the storage provisioning workflow makes it prone to error.

Despite the availability of tools to aid in the discovery of components of a storage network, the reality of day-to-day SAN management is that administrators usually work from a map of their environment rather than real-time information. The World Wide Names (WWNs) of hosts, switches, and storage systems and the zones, zone sets, security groups, and LUN maskings that dictate what resources are available to which hosts, are often documented by hand in spreadsheets and on white boards. Each time the administrator is tasked with making storage available to a host, the map of the SAN must be consulted to locate the most appropriate resources, and then updated with the newly modified mapping. The potential for manual error in the data-gathering phase of the provisioning task is as significant as it is during the execution of jobs that map volumes to LUNs, mask LUNs to host bus adapters (HBAs), and create and modify zones and zone sets.

Figure 1: Storage Provisioning in a Heterogeneous SAN Environment



The seemingly simple task of making capacity on a storage system available to an application server is confounded by the complexity of the SAN environment.

The Benefits of Automating Storage Provisioning

As with many other manually intensive IT processes, storage administration is ripe for automation. According to Gartner, storage area management (SAM) is the task of managing the relationship between applications and their storage, and it includes everything in between the application server and the spindles of a storage system. Storage provisioning is one aspect of SAM. Automating the storage provisioning workflow brings productivity, availability, and total cost of ownership benefits.

Greater Productivity

One of the most significant advantages offered by automated storage provisioning software is increased storage administrator productivity. Storage capacity being managed by IT professionals is growing at a rate of 30 percent per year, according to Gartner, but this increase is rarely matched by a

growth in the number of storage administrators. This means that storage administrators are expected to manage more and more capacity in the same amount of time: a trend that cannot be maintained without growth in administrator productivity.

Automated storage provisioning software keeps track of the myriad connections, associations, and dependencies that tie application servers, HBAs, switches, and storage systems together in the SAN. With accurate information coming directly from the SAN, administrators no longer need to manually document the infrastructure. Rules and policies can be applied to the information gathered by the provisioning software and encapsulated in well-defined workflows, allowing junior administrators to safely provision storage without necessarily understanding the complex interactions between all of the components of the SAN.

With ready access to accurate data showing which storage resources are accessible by host servers, administrators are able to use automated storage provisioning software to perform previously manual provisioning tasks—creating SAN zones and zone sets, managing storage pools, mapping volumes and LUNs, and assigning LUNs to hosts. The software eliminates the need for the administrator to repetitively log in to different management tools across the SAN. It also reinforces rules so that only storage resources appropriate to the needs of the host are allocated—for example, ensuring all mission-critical Oracle database storage allocations are properly multipathed.

The time savings from using automated storage provisioning tools amount to a significant boost in administrator productivity. Automation also allows more junior administrators to perform previously complex provisioning tasks, freeing senior staff to focus on more strategic projects.

Improved Application Availability

The manual process of provisioning storage in a complex SAN environment is prone to errors. The consequence of these errors—unanticipated increase in scheduled downtime due to a provisioning task taking longer anticipated, or a sudden outage due to a provisioning mistake that caused an out-of-space failure—can cost the organization in unexpected application downtime.

Automated storage provisioning software helps to eliminate errors inherent to the manual process of allocating storage to application servers. Benefiting from automated discovery and tracking features, the provisioning software ensures that administrators always have an accurate picture of the SAN environment from which to plan provisioning activity. This accurate map eliminates errors that occur from having faulty information and allows rules and policies to be implemented to ensure application servers receive the storage allocations that they need.

The automation of provisioning tasks also eliminates the potential for mistakes during execution. With a single interface from which to manage the storage provisioning workflow, administrators no longer need to perform time-consuming repetitive logons to individual components of the SAN infrastructure. This relieves the pressure on the administrator and eliminates the potential for manual error.

Reduced Total Cost of Storage Ownership

The storage infrastructure is the fastest growing capital cost in the data center. And dwarfing the cost of storage equipment is the cost of managing storage. Total cost of ownership (TCO) of the storage environment is now a hot topic with IT management.

Automated storage provisioning software reduces storage environment TCO by improving the administrator's ability to efficiently allocate storage resources. The cumbersome process of manually provisioning storage works against storage allocation efficiency. Hard pressed to deal with the demands of new storage allocations, administrators rarely have the bandwidth to go back and reclaim faulty allocations from the past, which results in wasted space in the storage infrastructure that cannot be accessed.

With automated tools for storage provisioning, administrators are able to manage the storage environment more effectively. Mistakes of the past can be easily corrected, without taking time away from new provisioning tasks that crop up daily, and fresh storage allocations benefit from more accurate infrastructure data made available by the provisioning tools. The result is a more efficient storage environment and reduced infrastructure costs.

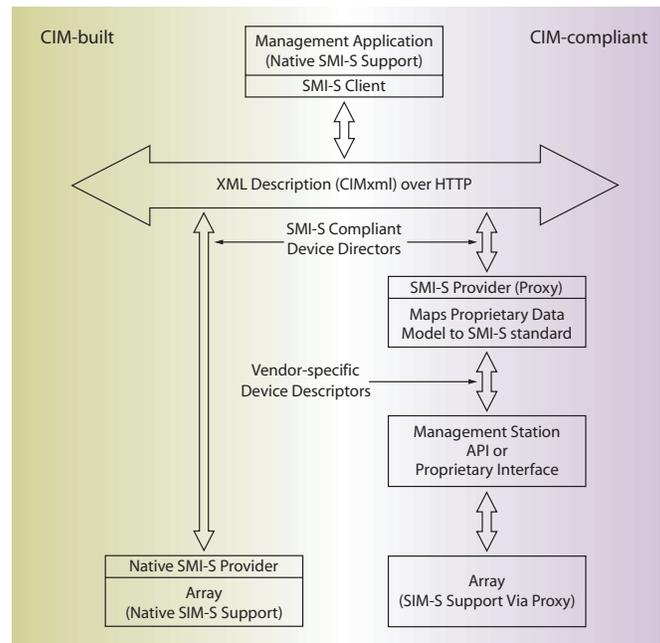
Provisioning Heterogeneous Storage Resources

With a multivendor mix of components now a universal feature of most enterprise SANs, automating SAM processes takes on a new complexity. Each vendor's equipment has its own unique management interface and these tools rarely communicate with products from other vendors. Just as heterogeneous SAN components tax the resources of administrators, who must maintain an intimate understanding of each vendor's management solution, multivendor resources also frustrate vendor attempts at automation. However, thanks to efforts by the Storage Networking Industry Association (SNIA) and pressure from enterprise customers, storage vendors have been quick to adopt the new open-standards-based SMI-S protocol, which is designed to provide a common interface between a SAM product and the components of the SAN.

The Storage Management Initiative Standard (SMI-S)

SMI-S is a vendor-neutral application programming interface (API) specification designed to facilitate the integration of storage devices and storage management applications on an enterprise SAN. In the SMI-S model storage systems, HBAs, switches, and tape drives, collectively considered SMI-S providers, communicate via agent software with management applications, the SMI-S clients, as shown in Figure 2. This integration allows the administrator to discover, monitor, and control SMI-S-compliant SAN resources from a single Web-based application console.

Figure 2: Comparing the CIM-built and CIM-compliant Data Path



The vendor-neutral application programming interface (API) SMI-S facilitates the integration of storage devices and storage management applications on an enterprise SAN.

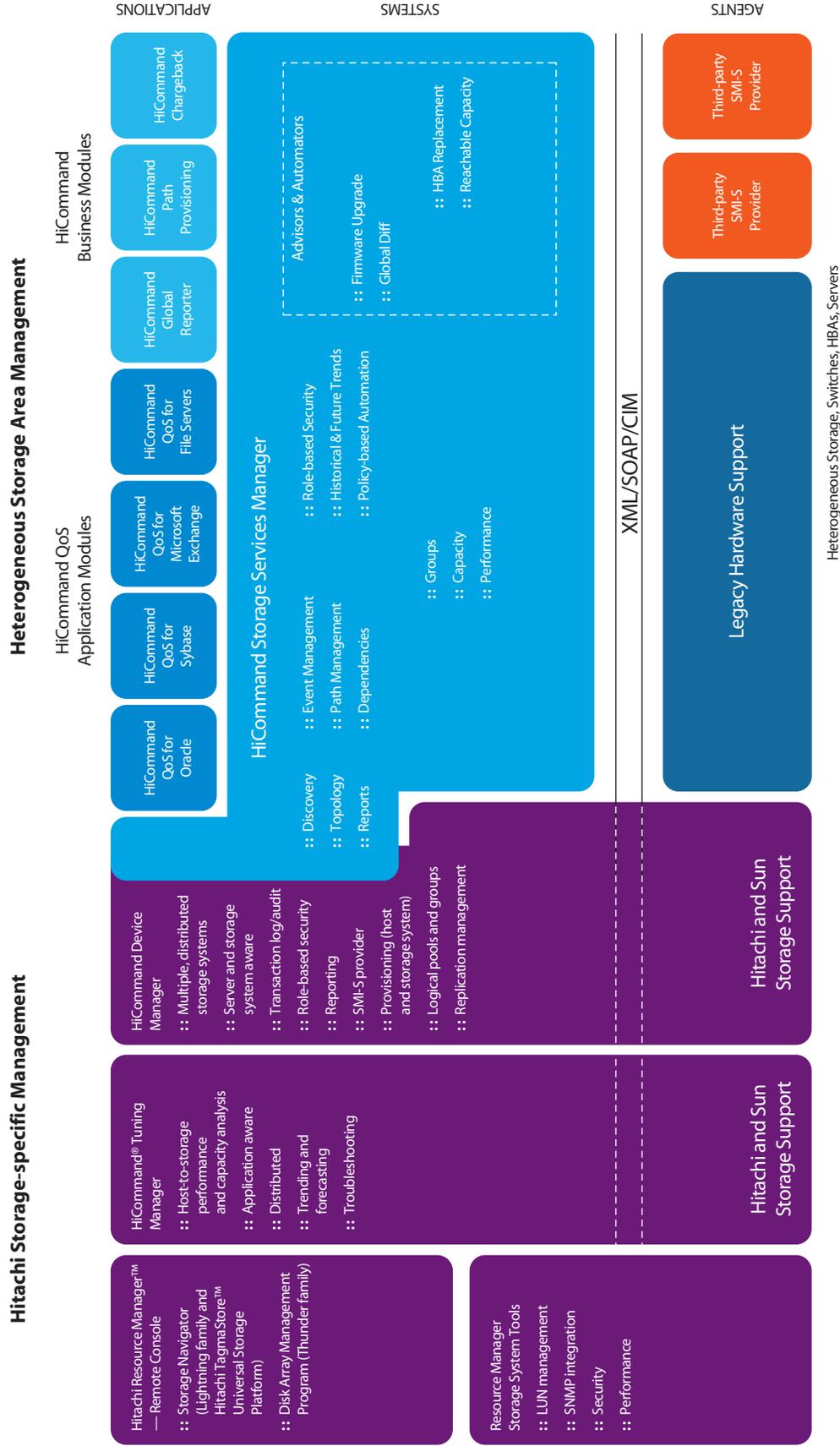
SNIA offers vendors of networked storage devices and storage management applications two options for achieving compliance with the SMI-S standard. The first uses a proxy interface to enable existing proprietary APIs to communicate with other SMI-S-compliant products on the SAN. This allows a vendor to provide SMI-S compliance without significant reengineering effort. The second is to create new, native SMI-S-compliant interfaces to devices and management applications based on the SMI-S object-oriented model and the CIM language. Products developed using the second option, referred to as CIM-built, have significantly greater flexibility over CIM-compliant products that use the proxy method.

HiCommand Storage Services Manager Software and the HiCommand Path Provisioning Module

HiCommand Storage Services Manager software is the foundation component and main console for the Hitachi Storage Area Management (SAM) Suite's heterogeneous software modules. As shown in Figure 3, the modules include support for path provisioning, chargeback, global reporting, and application-specific QoS for Oracle, Microsoft Exchange, Sybase, and file systems, giving storage administrators the ability to discover, monitor, report, maintain, and automate the management of all SAN infrastructure resources. Storage Services Manager software increases application availability and performance, improves storage management efficiency, maximizes resource utilization, and reduces the operational and capital costs of the storage infrastructure.

Leveraging the SMI-S and CIM architectures, Storage Services Manager software and HiCommand software modules provide support for heterogeneous storage resources in a SAN. Each component of the Hitachi SAM Suite is CIM-built, offering administrators the highest level of standards-based, heterogeneous storage management integration available.

Figure 3: Hitachi Storage Area Management (SAM) Suite



The Hitachi SAM Suite includes heterogeneous HiCommand modules, powered by ApplQ, that are based on open architecture. These modules protect investments by working with almost any infrastructure to manage business and application demands. It also contains Hitachi storage-specific modules, which provide granular discovery and control of your Hitachi storage environment, including attached storage systems that are virtualized into the storage pool of the Hitachi TagmaStore™ Universal Storage Platform.

Components of the SAN infrastructure that are not yet SMI-S compliant are supported through Storage Services Manager software's CIM wrapping capability. Storage Services Manager software wraps noncompliant vendor device management APIs in a normalized CIM interface to allow those resources to be managed by the HiCommand modules. Storage Services Manager software gives storage administrators a single-point of control for all storage resources in the SAN.

HiCommand Path Provisioning Software

HiCommand Path Provisioning software supports the step-by-step automated creation of storage pools, volumes, and LUNs across the entire range of heterogeneous devices supported by Storage Services Manager software. The Path Provisioning module allows the administrator to perform LUN masking, zone creation, and zone set activation, for all SAN components, from a single console.

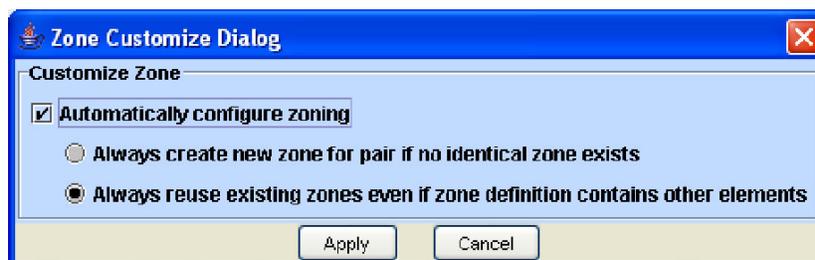
Combining the discovery functionality of Storage Services Manager software with a sophisticated rules engine and context-defining smart forms, the Path Provisioning module ensures that the correct storage resources are provisioned to applications every time. The automation of path provisioning dramatically simplifies, speeds, and removes errors from the task of allocating enterprise storage resources to application hosts.

Sophisticated Rules Engine

The Path Provisioning module centralizes all provisioning tasks on a single screen. When building a path provisioning job, the administrator is prompted to select options from lists of available resources that appear in different panes of the screen. This well-defined workflow ensures that the administrator chooses resources appropriate to the provisioning task at hand. For example, if the Volume Creation system action is chosen from the Path Provisioning screen—to create a metavolume—the administrator must select a storage system, after which the Path Provisioning software populates a pane of the display with free extents available to be included in the volume.

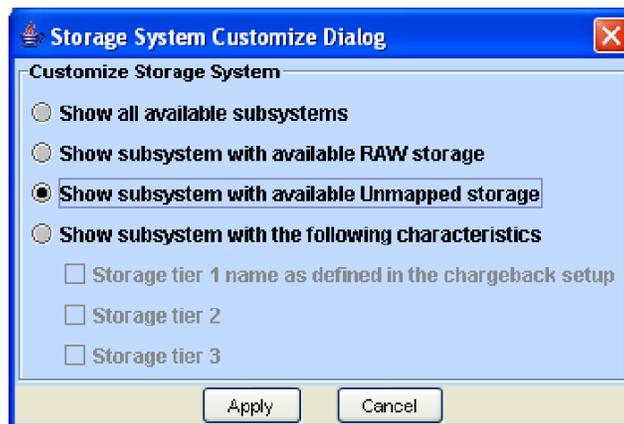
The Path Provisioning rules engine allows a knowledgeable storage administrator or architect to pre-establish workflows that restrict the choices available during each step of a path provisioning activity, depending on the activity or resources chosen. These filters are applied for storage system, host, volume, LUN, and Zone to enforce policies on the SAN infrastructure, as shown in Figures 4–7. For example, the storage system dependency filter can be used to restrict the storage systems displayed on the screen to only those with available raw storage, only those with available unmapped storage, or only systems belonging to a specified tier of storage.

Figure 4: HiCommand Path Provisioning Zone Dependency Filter



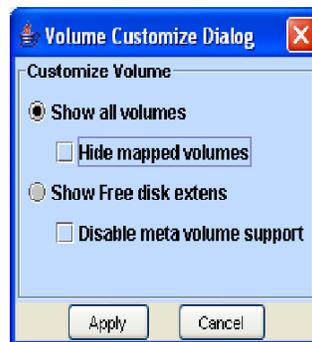
Multiple filters, such as the Zone Customize Dialog, are available to pre-establish workflow and enforce policies on the SAN infrastructure.

Figure 5: HiCommand Path Provisioning Storage System Dependency Filter



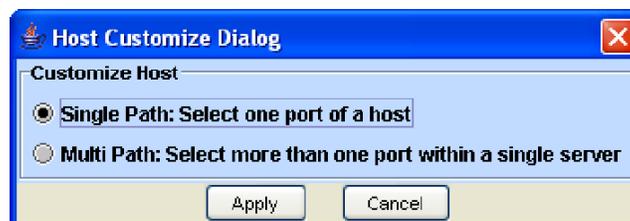
The Storage System Customize Dialog screen allows you to choose resources to make available when pre-establishing workflow.

Figure 6: HiCommand Path Provisioning Volume Dependency Filter



Choose volume views from the Volume Customize Dialog screen as you plan provisioning activity in the pre-established workflow.

Figure 7: HiCommand Path Provisioning Host Dependency Filter



Choose hosts for pre-established workflow using the Host Dependency Dialog screen.

Using filters, storage administrators and architects are able to enforce dependencies between components on a SAN and restrict the path provisioning workflow to only appropriate storage resources. For example, filters can be used to ensure that an Oracle database only be allocated storage

from multipathed, tier-one storage systems. The contextual enforcement provided by the rules engine significantly reduces the possibility of making mistakes during the provisioning process.

Smart Forms

Smart forms leverage the dependencies documented by the senior administrator or architect in the rules engine to guide a user through the workflow of a path provisioning process. The smart forms display only resources that are appropriate to the storage system or host being provisioned (see Figure 8) and allow junior administrators to complete complex provisioning tasks with less chance of introducing errors or inconsistencies into the environment. The rules engine and smart forms standardize storage provisioning throughout the SAN and eliminate the need to maintain detailed manual records of the SAN infrastructure and its configuration.

When a path provisioning task is selected, the Storage Services Manager software's auto-discovery and topology mapping functions apply rules engine filters to the list of resources presented on the screen. Only hosts reachable on the same fabric as a chosen storage system will be displayed, along with their HBAs, host initiator ports, and the existing zoning configurations for ports of the storage system. Hosts and storage systems connected to multiple fabrics are also shown. Existing LUN masks and candidates for LUN mapping are displayed, along with mapped, unmapped, and unmasked volumes on the storage system.

By restricting the display of extraneous information and limiting the options available to the user, smart forms add essential context to the task of storage provisioning. And because data gathering is automated by the Storage Services Manager software, there is no need for administrators to rely on potentially inadequate, manually updated maps of the SAN infrastructure maintained in spreadsheets and on white boards.

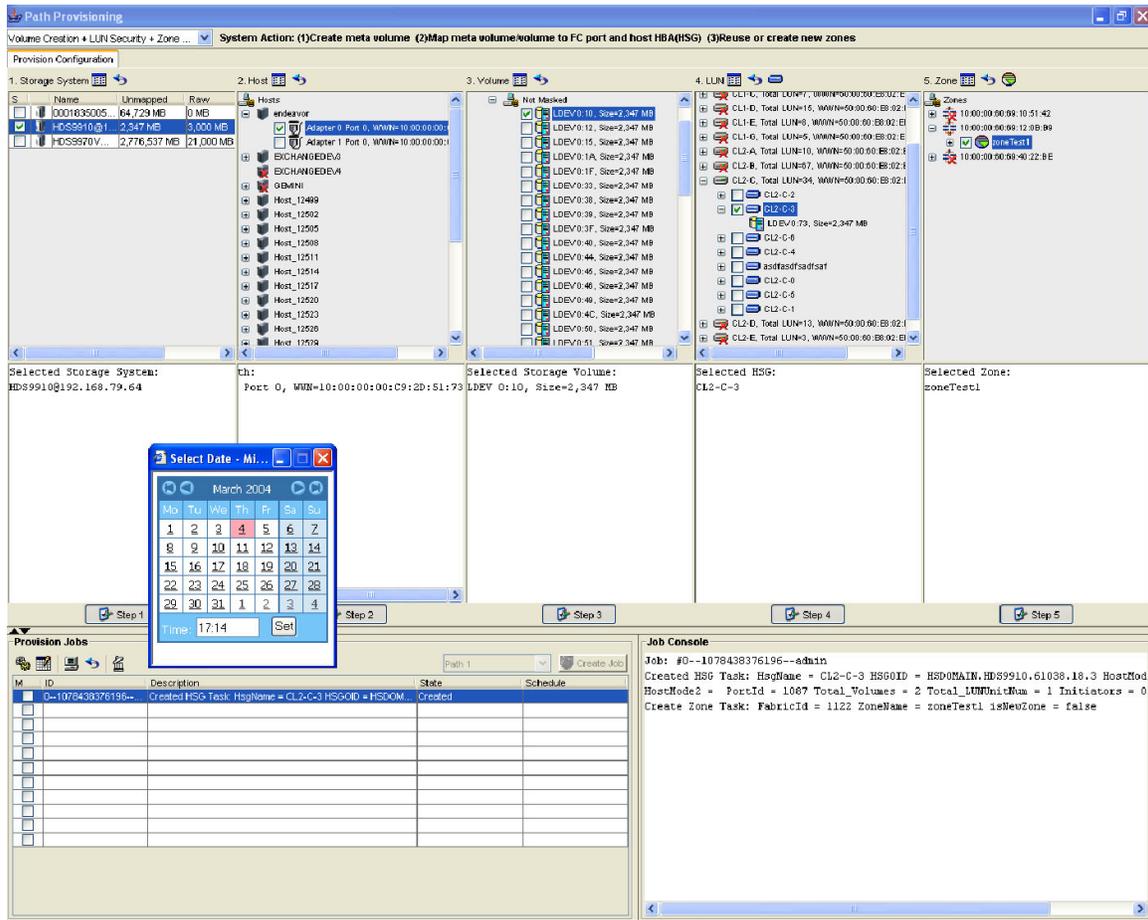
Provisioning Flexibility

HiCommand Path Provisioning software provides wizard-based operational assistance to guide the administrator step-by-step through the workflow of provisioning storage resources. Path Provisioning software also offers the flexibility to automate an entire workflow or to trigger specific storage allocation tasks. Wizards automate the building of storage provisioning jobs. Each job can contain: a single task, such as mapping a LUN; a set of similar tasks, such as multiple LUN mappings; or several different tasks, such as map a LUN, zone required ports, and then mask the LUN. And jobs can be run immediately or stored in a job queue for scheduled execution at a later time.

SMI-S and Non-SMI-S Interoperability

Just as SNMP allows multivendor components of a data network to be centrally monitored and managed, the CIM- and SMI-S-based architecture of Storage Services Manager software allows it to report on and manage storage devices in a heterogeneous SAN environment. SMI-S agents on devices being managed connect via CIM and SMI-S standard interfaces to a dedicated server running Storage Services Manager software. Non-SMI-S device support is provided by the Storage Services Manager software, which wraps a vendor's existing legacy APIs with a layer that maps them to CIM and SMI-S. The wrapper allows Storage Services Manager software and the Path Provisioning module to treat noncompliant storage assets as if they were fully compliant SMI-S resources.

Figure 8: A Fully Populated HiCommand Path Provisioning Software Screen



Smart forms leverage the dependencies documented by the senior administrator or architect in the rules engine to guide a user through the workflow of a path provisioning process.

Conclusion

The dramatic growth in enterprise SAN storage capacity is leaving storage administrators to play catch up, as they try to stay ahead of end-user demand for disk space. And, while technology advances have made it possible to quickly add more resources to the SAN, similar advances have not been applied to the task of allocating those resources to application hosts. Hitachi HiCommand Storage Services Manager software and the HiCommand Path Provisioning module rectify the disparity between capacity and the storage administrator's ability to manage it.

The first SAM product to make full use of the open SMI-S standard, Storage Services Manager software delivers the long-sought-after goal of a single console from which to manage all resources on a heterogeneous SAN. The automated storage provisioning functionality of the Path Provisioning module promises to significantly increase administrator productivity, while simultaneously improving application availability and reducing the total cost of storage ownership. Leveraging the auto-discovery capabilities of the Storage Services Manager software, the Path Provisioning module's sophisticated rules engine and wizard-driven smart forms speed, standardize, and error-proof the methods and procedures used to allocate storage resources across the enterprise SAN.

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