

A CommVault White Paper: CommVault Galaxy Backup & Recovery

Abstract

The CommVault Galaxy™ Backup and Recovery product offers a powerful set of data and storage management tools to assist in the protection, restoration and management of critical enterprise information. Providing easier management of complex storage environments, the Galaxy software is designed to meet the changing data management needs facing every enterprise today.

**CommVault Corporate Headquarters
2 Crescent Place
Oceanport, New Jersey 07757-0900 USA
Telephone: 888.746.3849 or 732.870.4000**

Table of Contents

Introduction	1
CommVault QiNetix™ Data and Storage Management Concepts	3
CommVault® Galaxy™ Backup and Recovery	5
Galaxy Core Functionality	7
Galaxy Intelligent Data Agents (iDA)	7
Galaxy Media Management	8
Drive and Library Management	8
Disk to Disk Backup	8
Media Group Migration	9
Data Aging	10
Auto Discovery Features	10
Library Sharing	11
Intelligent Dynamic Drive Sharing (iDDS)	11
Microsoft RSM Support.....	12
Galaxy Advanced Feature Pack (AFP)	13
Data Encryption	13
Vault Tracker™	14
CommCell Migration.....	15
GridStor™	16
Full System Restoration	18
Galaxy Data Movement	18
DataPipe™	18
Multiplexing.....	18
Serverless Data Manager (SDM)	19
Snapshot-Assisted Backup.....	20
Image Level Backup	22
ProxyHost Backup	23
ImageLevel/ProxyHost Backup	23
Indexing	23
LAN-free Backup	23
iSCSI Support.....	23
Logical Data Management	24
Galaxy Scheduler.....	24
Storage Policies.....	25
Auxiliary Copy	25
Synthetic Full Copies.....	26
Ease of Use	27
Single Management Console.....	27

Sub-Client Policy	27
Web-accessible CommServe	28
Push and Silent Installation of Galaxy Software Modules	28
7CommCell Update Service	28
Job Controller	28
Event Viewer	28
Reporting	30
CommCell Explorer	30
Command Line Script Generator	30
Reliability	31
CommServe ExpressRecovery	31
CommCell Readiness Check	31
CommVault Galaxy on a Clustered System.....	31
Resumability.....	31
Operational Windows.....	33
Job Prioritization	33
Galaxy Storage Area Network (SAN) Solutions.....	34
Galaxy Network Attached Storage (NAS) Solutions.....	34
NDMP Support for NAS Backup and Restore.....	34
A Better Application Centric Approach.....	35
Appendix A - Galaxy Software Modules	36
Common Technology Engine	36
CommServe StorageManager	36
Client Agents.....	37
MediaAgent	38
Appendix B - Additional QiNetix Components.....	39
QiNetix Quick Recovery.....	39
QiNetix DataMigrator	39
QiNetix DataArchiver	39
QiNetix Storage Manager.....	39
QNet™	39
Appendix C - CommVault Galaxy Organizational View.....	40
Appendix D - CommVault Galaxy Data View.....	41
Appendix E - Glossary of Terms.....	42

CommVault® Galaxy™ Backup and Recovery Software

Introduction

CommVault continues to change how data protection and data management are defined. QiNetix 5.9 is the latest in a series of innovative product releases. QiNetix offers a fully integrated software platform that provides unparalleled functionality while offering significant reductions in administration and total cost of ownership. CommVault offers individual solutions for backup and recovery, email migration, HSM for Windows and UNIX, replication, archiving and compliance, SRM and global service level monitoring and management. These solutions can be deployed as stand alone products or a part of a unified platform. This combination of integrated capabilities is essential for IT to be able to define, deliver and monitor data management services.

The QiNetix platform architecture is designed from scratch to provide comprehensive, integrated data protection and data management. The benefit is the ability to manage data by the value it has to the organization. This is accomplished by linking the cost to store, protect, access and archive information to the cost of the associated storage resources necessary to deliver it; yielding, a service level perspective. Only through a complete understanding of the data management policies, their impact on the IT infrastructure and their consumption of IT resources can a true service level perspective be assembled.

It just so happens that the industry has also arrived at the same time to a place where data management by value has become the marketing message. The buzzword being used most often in connection with this data management strategy is ... information lifecycle management (ILM).

As most vendors describe it today, ILM is a solution in three parts. Part one is a set of storage devices of different capacity, throughput, connectivity and most importantly price. This is generally referred to as “tiered storage”. Part two is an engine that can move mission critical data to and from each of these storage layers, from disk to disk, to tape or to other mediums such as magneto-optical, without restriction on whether the source or target is local or remotely attached. Part three can’t be purchased. It is having an understanding of ones data and being able to ascribe proper value to each piece of data at the various points in the data’s lifecycle. Most vendors of ILM solutions fail to mention part three in their haste to sell you part one. What most also fail to properly define, is exactly what part two needs to provide in order to allow you to gain the return on investment all ILM vendors, hardware or software, promise.

This discussion guide serves as an introduction to the CommVault QiNetix platform but also, more importantly, to its comprehensive enterprise backup and recovery solution called Galaxy. Along the way, you will discover the core feature set that separates Galaxy software from its backup and recovery competition. You will also discover how Galaxy software, as part of an overarching QiNetix data management solution, can assist your company in implementing a true ILM strategy. Implementation of an ILM strategy with QiNetix enables demonstrable savings in Total Cost of Ownership, maximizing your investment in people, equipment and infrastructure. QiNetix also enables true Return on Investment through more efficient data protection and management processes, ultimately enabling positive impact on the corporate bottom line.

CommVault Galaxy backup and recovery software takes an application-integrated approach to protect customer data. By tightly integrating with mission critical applications, Galaxy manages the application data protection in a way that matches how customers manage and understand the data.

With this application-centric approach and a modern architecture that exploits advanced storage topologies like Network Attached Storage (NAS) and Storage Area Networks (SAN), the Galaxy software delivers data protection solutions that are focused on business resumption, not just data backup. What this means for you is that the Galaxy software is focused on restore, not backup. Restore is, after all, the reason for backup in the first place.

By focusing on restore, CommVault approaches data protection from a user perspective rather than a physical storage perspective. In the past, Backup and Recovery software has been about working around the limitations of the hardware used to store the data. Galaxy minimizes the administration of physical storage devices and focuses on providing multiple data protection options so users can restore it when needed.

By providing multiple means of protecting data and virtualizing the physical aspects of backup and recovery (B/R), Galaxy software allows users to view the B/R process from a logical viewpoint. This means when you want to restore data, you only have to know what kind of application the data is from, not where it is stored. This is accomplished through extensive policy-based management where users define criteria for how data is treated. Included are criteria such as location, number of copies, type of media each copy is stored to, the retention period for each copy, and the type of data movement that the B/R action should use.

Galaxy software's major benefits to users are to:

- Maximize data protection
- Maximize data availability
- Minimize storage costs and usage
- Reduce management costs and administrative disruption
- Manage data across the global enterprise
- Simplify the management of complex networks
- Span infrastructures, different storage types, operating systems and applications

Galaxy software excels at these tasks—confirmed by the many Global 2000 enterprises where the product is installed. Galaxy's functionality is continually enhanced so IT administrators can utilize the software to improve data protection and reduce the cost and complexity of maintaining access to business critical data.

This discussion guide gives a brief tour of Galaxy functional areas, highlighting some of the product's key features and functions. There are also several appendices that describe Galaxy's architecture, data flow, as well as a glossary of terms. The following section briefly describes the CommVault QiNetix platform, of which Galaxy backup and recovery is an integral element. For more information on the Galaxy and QiNetix architecture, refer to appendix B or to the QiNetix Architecture Guide located on the CommVault website at www.commvault.com.

CommVault QiNetix™ Data and Storage Management Concepts

The CommVault QiNetix (ki – net – ics) platform, based on CommVault's Common Technology Engine, is a single, integrated platform that manages and moves data based on its attributes and storage environment. The QiNetix solution integrates Galaxy backup and recovery, availability, replication, migration, compliance archiving, storage resource and SAN management software solutions. Customers can deploy individual products or seamlessly integrate new elements into an existing CommVault solution, all at a fraction of the time, effort and cost required by separate point products. See Figure 1 below: QiNetix Software Product Modules



Figure 1 – CommVault Systems QiNetix platform components

QiNetix consists of the following software modules:

- CommVault Common Technology Engine (CTE) – the CTE contains all of the elements common to any of the QiNetix software modules, metadata, master job scheduler, event viewer, GUI services, etc.
- CommVault Galaxy backup and recovery – software module for complete data protection
- QiNetix DataMigrator – software module for migration/HSM
- QiNetix DataArchiver – software for long term data archiving and archiving for compliance and legal regulations
- QiNetix Quick Recovery (QR) – software module for high availability data access available in two configurations:
 - QR HA – software for high availability and fast application recovery
 - QR DR – software for remote disaster recovery solutions
- QiNetix Storage Manager (QSM) - software module combining the components of storage resource management (SRM) and physical storage device and network element management (SNM)
- QiNetix QNet – software module providing metapolicy management, analysis and tracking of secondary storage and a single interface for managing multiple CommCells in local and remote sites.

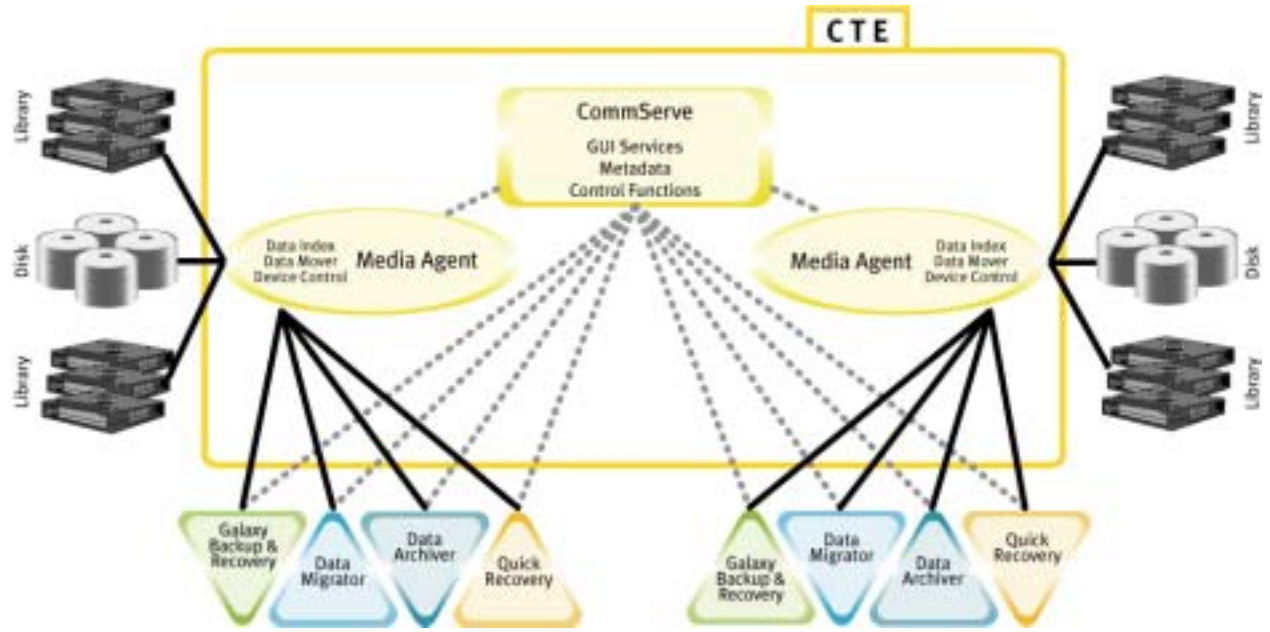


Figure 2 – QiNetix software module components and platform Architecture

CommVault® Galaxy™ Backup and Recovery

CommVault Galaxy backup and recovery software is a proven solution to protect and increase data access. The product simplifies data management in complex storage networks by offering a single, unified view based on either a logical application or physical system perspective. With this “new” view and way of managing critical data, the Galaxy solution takes traditional backup and recovery to new industry standards for ease of use, configuration, reliability, scalability, and flexible deployment.

In the Galaxy user interface, client data objects are mapped to storage resources—tape libraries, optical storage and RAID—in a logical manner. A logical entity called “Storage Policies” is the basis for easy administration. It consists of several attributes, like retention, storage utilization and organization of the backup data streams. This groundbreaking logical storage profile can be assigned to virtually any information set, such as file system data or application records. Once the policy is described, other data sets can also use that policy. The result is you do not need to know where the data is stored in order to protect or recover it.

The Galaxy solution is a specialized implementation of the CommVault Common Technology Engine™ (CTE). The CTE’s innovative architecture allows the Galaxy storage management intelligence to adapt to any storage model, LAN, DAS, NAS or SAN-based storage infrastructures. The Galaxy solution handles physical location and physical management of storage resources in the background, enabling the administrator to focus on protecting or restoring vital data.

For extremely large individual systems, the Galaxy architecture supports the ability to co-locate all modules on the same computer delivering high-performance direct-attached throughput.

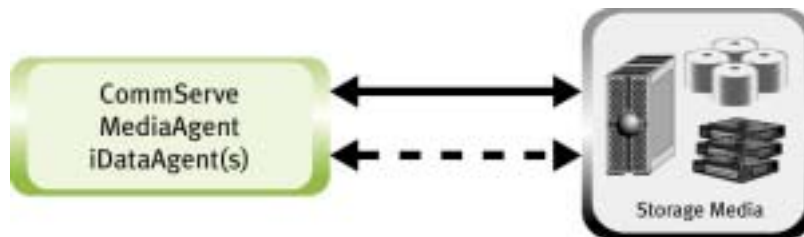


Figure 3 – Galaxy components on a single server

In environments where both centralized management and centralized storage are essential, such as storage for a single department or in raised-floor data centers, the Galaxy solution easily conforms to that data protection strategy.

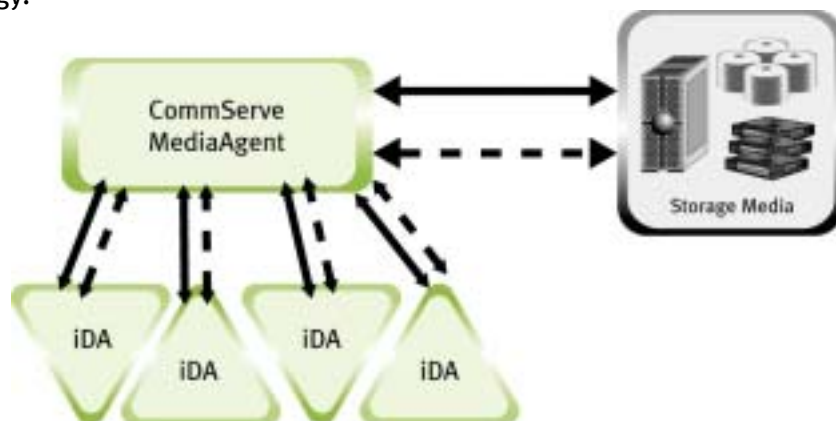


Figure 4 – Centralized management of distributed components

The product can be deployed with centralized control of distributed storage. This eliminates the requirement to move backup data across the LAN, significantly reducing B/R time. The following representation illustrates the Galaxy software's ability to provide centralized management control over remote storage. Because only control information is passed between the MediaAgent and the CommServe StorageManager software, slow communication links can be used.

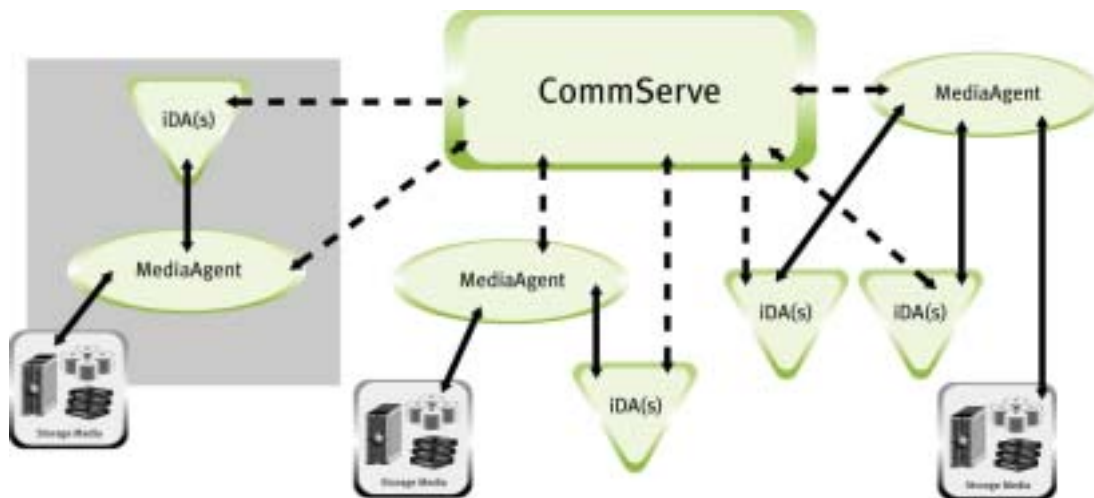


Figure 5 – Galaxy deployed in local and remote configurations

In addition, the Galaxy software can support storage networking architectures like SAN or NAS. In SAN environments, Galaxy software supports LAN-free backup as well as ServerFree and Serverless backup and recovery of data.

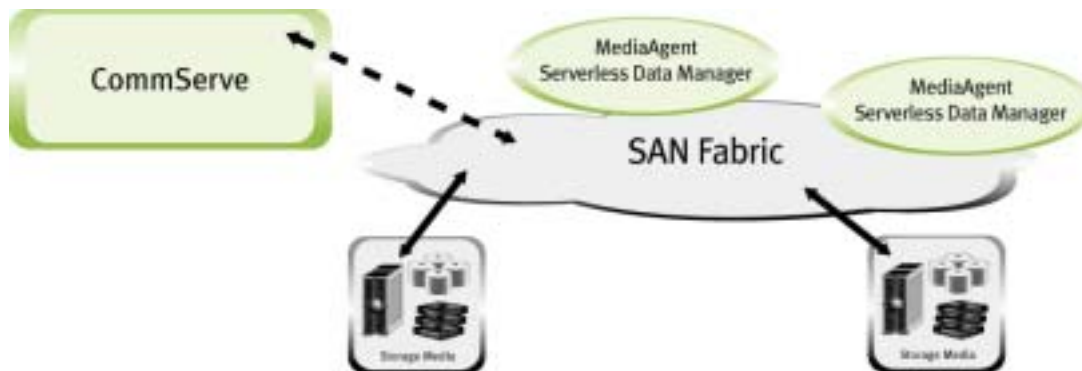


Figure 6 – Galaxy components deployed in a SAN

Galaxy Core Functionality

The following sections of this discussion guide briefly describe Galaxy’s significant advantages. Each section contains a brief list of key Galaxy features related to that topic. This is not an exhaustive list, nor does it discuss the full spectrum in which customers could implement these features to improve their data protection. Please refer to other marketing and technical materials available on the CommVault website at www.commvault.com or contact your local CommVault sales representative for a demonstration of the CommVault Galaxy product in person or via the web through a WebEx session.

Galaxy Intelligent Data Agents (iDA)

Galaxy has a number of client iDAs for various enterprise operating systems and specific iDAs for integrated application data protection. The figure below represents the major platforms and applications covered by Galaxy. CommVault is always expanding this list of covered platforms and applications please refer to the CommVault website, www.commvault.com or contact your local CommVault sales office for the most current platform coverage.

Platform Coverage	Application Agents
<ul style="list-style-type: none"> • NT4, W2k, XP, W2k3 • Windows Storage Server 2003 • Solaris • AIX • HP-UX • Tru64, SGI, MAC OSX • Red Hat Linux, SuSe Linux • FreeBSD • Mac OS • Novell Netware • NetApp, Celerra, IP/4700, Blue Arc, HDS NAS 	<ul style="list-style-type: none"> • Oracle • SAP • SQL Server • Exchange 5.5, 2K, 2K3 • Active Directory • Lotus Domino • DB2 • SharePoint Portal Server • Informix • Sybase • Cluster support

Figure 7 – Galaxy iDAs

Galaxy Media Management

Drive and Library Management

Galaxy contains extensive capabilities to simplify the management of backup media resources. Galaxy writes backup data to broad collection of storage devices, including traditional Tape and Optical media and automated libraries for Tape and Optical media. Galaxy can use magnetic disk drives as media backup media target as well. This ability to write to magnetic disk as a functional equal of all other media types while, exploiting the random access nature of the disk media, sets Galaxy software apart from the competition. With over a decade of experience in writing backups to random access media, Galaxy backup is uniquely poised to fully leverage the advent of a low cost secondary disk storage layer. Another Galaxy advantage is the ability to extend all traditional tape based storage management features and functions to disk as well.

Galaxy supports all major vendor media devices (tape, optical and disk based storage) as targets for Galaxy backups. Galaxy handles the drive and library allocation and management. Furthermore, with the use of Storage Policies, Galaxy isolates the administrator from having to deal with these storage devices at any time other than during the initial configurations. Galaxy lets administrators easily leverage their storage devices. This reduces management time and effort normally spent on monitoring and managing backups and backup media types.

Disk to Disk Backup

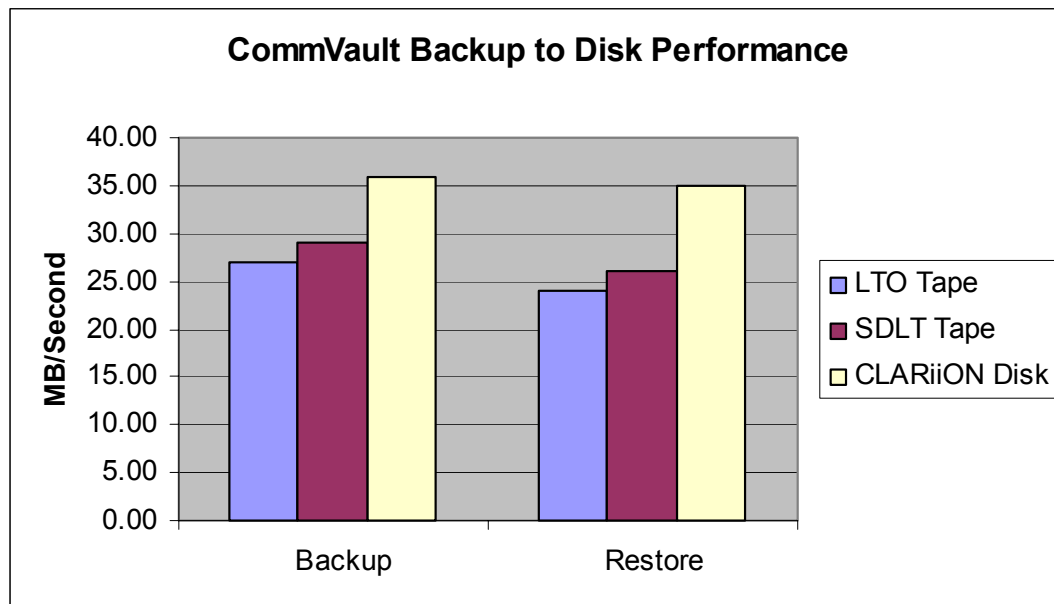
The advent of lower cost disk solutions has created another option in the storage hierarchy. The use of these “cheap disks” has created a new category of secondary storage generally referred to as “disk to disk” (D2D). This layer offers data access faster than tape but less expensive than primary disk. This use of disk as a secondary storage media does not replace the need for tape. However, it can move tape to a role of disaster recovery and offsite archive for critical data requiring long-term retention. Using disk for secondary storage offers the following advantages versus tape:

- Faster restore of data.
- Disks are generally faster than tapes; especially when mount and seek on tapes are factored in.
- Tape and library automation failure issues are eliminated.
- Disks are random access and are optimized for lookups – tapes are sequential and can be much slower for multiple random file recalls.
- Multiple hosts can access disk volumes simultaneously – disks have multiple read/write heads
- Using disk eliminates human errors in tape handling.

Understanding the nature of random access devices and implementing a solution that takes advantage of the specific capabilities of storage resource enables CommVault Galaxy to help IT staff optimize their storage resources. Taking advantage of the native file systems and the two part indexing scheme, Galaxy software is able to provide superior performance versus competing solutions that treat disk as a sequential “tape” device. This ability to recognize and optimize for disk as a backup target is especially important when data cannot be delivered to the backup media fast enough as in cases listed below:

- Slow WAN links
- Many small files
- Proprietary Application APIs that feed data slowly
- Disk writers can support slow or intermittent writes without the stop/go/position problem of tape (shoe shining)

In tests with disk backup devices, CommVault Galaxy software consistently has demonstrated the ability to provide maximum throughput to disk used for backup and consistently higher backup and restore versus the most advanced tape devices available.



Source: EMC CLARiiON Backup Storage Solutions Whitepaper, March 2003

Figure 8 – Backup to disk performance metrics

Galaxy is designed and architected to fully utilize magnetic disk as a key layer in customer’s overall information lifecycle management strategy. With Galaxy Storage Policies, it is easy to include disk as a fast backup and restore layer for near term needs. Utilizing Galaxy features such as data retention and auxiliary copy, data can be migrated from disk to local or remote tape or local or remote disk for vaulting, DR or legal retention regulations. This enables the freed up disk space to be reused for new versions of data to be stored for fast access. This ability to automatically manage the storage, migration and reuse of these secondary disk devices, enables customers to recognize immediate benefits to TCO, reduction in personnel and less risk of human error or tape handling issues.

Backup to Disk will continue to grow as disk prices continue to fall. Continuous new implementations of secondary disk for intermediate storage continue to enter the market and validate this storage layer. CommVault’s ability to take full advantage of the random access nature of disk and the ability to manage multiple copies of the data on disparate media, places Galaxy at the forefront of any solution that includes disk as a backup medium. CommVault is committed to support all disk devices that are designed for use as secondary storage. This includes solutions such as EMC Centera, Network Appliance NearStore, StorageTek BladeStore and EMC CLARiiON CX series as well as iSCSI based IP-SAN systems from StoneFly Networks, LeftHand Networks, EqualLogic and Intransa to name just a few.

Media Group Migration

Galaxy software allows you to migrate media between Galaxy MediaAgents. The ability to move media between MediaAgents in the same CommCell is useful when a MediaAgent needs to be freed up, or if a library suffers a failure and the associated media must be accessed for B/R operations. It is also useful for data movement between libraries in different departments or to perform workload balancing when one drive pool undergoes an increased amount of activity. Media Group Migration can occur for optical, tape or magnetic libraries. Seamless migration can also occur from UNIX or Windows MediaAgents.

Data Aging

Data Aging is a built-in Galaxy Storage Policy administrative feature that helps control data protection costs. The data retention period is a part of every Galaxy Storage Policy (or any Galaxy backup operation including Auxiliary and Synthetic Full copies). The retention period can be set as a specific time, such as number of days or number of available full backup cycles.

The Extended Retention feature enables a specific copy of data to be selected for longer retention than the other members of its storage policy. This is useful when a particular copy of data needs to be kept around for audit purposes, for instance. In addition, a specific day of the week or copy of data can be designated to have a longer retention than similar jobs run on different days of the week. There is also a facility to select a specific backup copy from being aged out under the normal retention policies within the same storage policy. The operational concept is to provide a tool flexible enough to meet the individual demands of the customer who may have one off requests for specific copies of data to be managed outside the normal retention rules.

The Data Aging operation is a clean-up routine that deletes data after it exceeds its data retention period. This frees up valuable media for reuse and removes unnecessary data that impacts performance or takes up valuable media space.

Auto Discovery Features

Galaxy uses auto-discovery techniques to provide a list of available storage devices, locations, etc. These are automatically made available to the administrator for storage policy setup. By seeing all possible targets for backup copies (disk, tape and optical), the administrator has a clear environmental picture and can set up the corresponding data protection schema utilizing all available resources. This cuts down on the potential to overlook possible storage devices or more importantly to mis-configure devices (by making a mistake on a path entry or similar detail). These details are discovered and stored by Galaxy so the administrator can easily point the policies to the listed devices. All of the details regarding how to connect to the device have already been discovered and recorded by Galaxy. Auto discovery features are also used in the Q-Net Storage Manager (QSM). In QSM, these features are essential in troubleshooting issues with network and storage element configurations, especially in SAN deployments. Being able to trace data paths through these implementations enables administrators to more easily discovery and remedy configuration issues for backup, restore, archiving and migration operations.

Library Sharing

This capability allows more than one MediaAgent software module or host to share a single tape library. CommVault Galaxy iDDS software (discussed in the following section) enables a single MediaAgent module to provide primary support for the library robotic arm, thus eliminating potential contention and tape cartridge loss. Each MediaAgent in a library-sharing configuration retains its dedicated data path to maximize throughput.

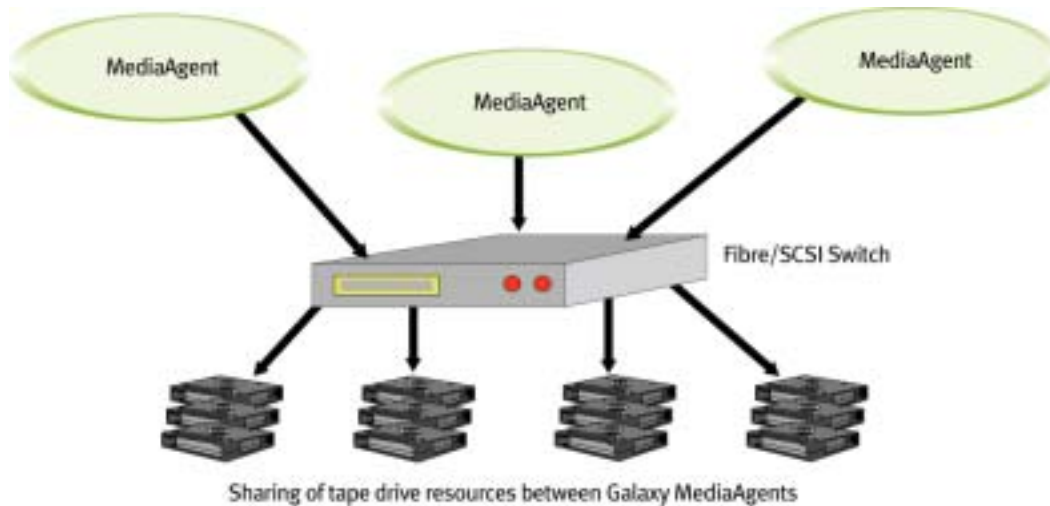


Figure 9 – Library sharing with Galaxy

Intelligent Dynamic Drive Sharing (iDDS)

The implementation of iDDS in CommVault Galaxy software allows for policy-based sharing of tape library drive resources among multiple backup systems. Unlike more elementary SCSI reserve and release strategies utilized by other B/R products, Galaxy software employs a software layer to manage the tape device sharing. This approach provides significantly greater reliability and improved manageability for mission critical data environments.

The Galaxy approach improves on elementary SCSI reserve and release method because:

- Drives within a drive pool can be dynamically re-allocated one-by-one to different jobs instead of as an entire pool
- Galaxy software controls reservation and allocation of tape drive resources eliminating constant pinging of the infrastructure
- Galaxy offers superior error handling capability without the need to reset the SAN infrastructure in the case of a failure
- Galaxy iDDS higher resource utilization means that jobs will be completed quicker with less chance of failure
- Galaxy software provides faster and easier configuration and management of complex networked storage environments.

The advantages of iDDS and Library Sharing together are significant and numerous:

- Better backup performance,
- Quicker ROI on hardware investment,
- Reduced hardware spending,
- Improved data protection
- Maximized use of tape drives and storage resources,
- Faster data access.

The Galaxy software uses the concept of drive pools, a group of drives in a logical class. A drive pool can be a single drive out of a ten drives in a library, or all ten drives, or any number in between. A single physical drive may be part of multiple logical drive pools. The drive pools are used by Galaxy Storage Policies to determine what resources each backup job can access. By definition, any client data set that shares the same Storage Policies will share the same drive pool. Galaxy also enables magnetic disk volumes to be shared in the same manner as tape drives. With the additional ability of multiple read and write heads on disk volumes, multiple backup and restore jobs can be simultaneously streamed to magnetic disk volumes managed by Galaxy.

Galaxy optionally allows SCSI reserve/release (instead of its embedded drive allocation resource manager) using persistent reservations with the SCSI-3 protocol. This new method counters the disadvantages of earlier versions of SCSI. It allows another host on the SAN that is part of the nexus to clear up the reservations using a unique reservation key. Furthermore, SCSI resets don't cause the reservations to be lost. Not employing SCSI-3 will in turn expose the environment to the following risks:

1. When a host doing the reserve takes a hit, the only way to recover is by resetting the target SCSI device which may involve rebooting the SAN, disrupting the backups as well as any other activity going in that SAN.
2. On a SCSI reset, the SCSI reservation on the target is lost.

Microsoft RSM Support

The Galaxy solution can be configured to use the Windows Removable Storage Manager (RSM) services to share storage devices (libraries, drives and media changers) among multiple applications. RSM can be used to configure both tape and optical libraries with or without barcode readers. This ability to take advantage of existing media management capabilities provided by Microsoft enables customers to fully leverage the technology and expertise of multiple vendors from within Galaxy.

Galaxy Advanced Feature Pack (AFP)

The Galaxy 5.9 Advanced Feature Pack (AFP) includes unique tools that may be of particular use in certain customer environments. Because they are not needed all standard customer configurations, they are each available as a separate, licensable feature. For enterprise sites, the entire AFP can be licensed as a group offering. The following functional areas are covered by AFP:

- Data Encryption – allows several levels of data encryption for increased security
- VaultTracker™ – provides a tool for managing and tracking the movement of media to and from an offsite storage facility.
- Client Migration – allows clients to move from one CommCell to another
- GridStor™ – enables failover, load balancing and transparency between media agents
- Data Verification – ensures restorability by verifying the integrity of the data written to media.

Each of these features is briefly discussed below. For more information on any of the AFP components, refer to the CommVault website, www.commvault.com.

Data Encryption

Data Encryption is a tool that allows data to be encrypted both over the wire and on the storage device. The data encryption algorithm is the same in each case, but Data Encryption offers a variety of code key encryption use to meet varying customer security needs. There are three distinct types of key encryption methods offered:

- Encrypt data just over the transport mechanism – this type of encryption is used for protecting the data as it is sent over the network. Once at the destination, the data is decrypted as it is stored on the media
- Encrypt data over the wire and on the media, but keep the key in the CommServe – this method of encryption keeps the data encrypted once it is stored, adding a level of security in the event of media being lost or stolen. By keeping the key on the CommServe, advanced features such as Auxiliary Copy and Synthetic Full are still enabled without disruption as Galaxy software has access to the key to decrypt the data for purposes of creating copies (that will also be encrypted) for ILM or vaulting purposes
- Encrypt the data over the wire and on the media and encrypt the key with a user defined pass-phrase. This will prevent the data from being viewed without user permission because the user must supply the appropriate pass-phrase. This level of security prevents unattended recovery or the ability to do automatic copy processes, such as Synthetic Fulls, without intervention from the user to enter the decrypt pass-phrase at the time these functions are being executed. However, even in this case, there are two additional scenarios that can be considered to preserve security while enabling advanced Galaxy functions
 1. A file can be exported that contains the encrypted key. Using this file QiNetix can recover the clients data to that computer (and only that computer) without prompting the user for the key
 2. You can explicitly enable Synthetic Full operations, which creates a copy of the key in the database. Regular recovery operations would still prompt the user to enter the key.

With these levels of encryption available, CommVault provides the customer with the capability to define the level of protection that they deem necessary for any particular piece of data. The addition of encryption to CommVault's already robust set of data access security and role based user security provide a robust and flexible solution for customer security needs.

Vault Tracker™

VaultTracker provides a solution for managing and tracking the movement of media to and from an offsite storage facility that is an extension to the Common Technology Engine. To use VaultTracker, a series of Tracking Policies are defined. These policies consist of the data to be moved, the destination for the data and when that data is moved. A significant difference over competing offsite tracking products is Galaxy software logically manages the data, not the removable media. Data is the construct used to determine what, where and when information is vaulted. The media are just the physical objects containing the data. VaultTracker solution supports a number of advanced concepts important to off site media management: virtual mail slots and multiple tape “containers”.

Once the Tracking Policies are defined, VaultTracker jobs can be scheduled as regular events or as an on demand process. There are several types of movement tracked in a Tracking Policy:

- Library to location
- Location to location
- Location to library
- Library to library

Once a VaultTracker job is initiated, one of two conditions can occur. Either the media is moved to the mail slot of the library for immediate removal or if specified, the media can be moved to a holding area defined as the “virtual mail slot”. The virtual mail slot is a series of contiguous slots in the library that can be defined to serve as a holding area for media being vaulted. This enables the easy identification and removal of media for transportation.

As with any offsite movement, the status of the media in transit must be monitored and the corresponding notations made in VaultTracker solution to ensure accurate retrieval of the media. Once the media has arrived at its location, and the proper notation is made in the VaultTracker job, that media can now be viewed in the VaultTracker history report with the standard CommCell browser and reporting infrastructure.

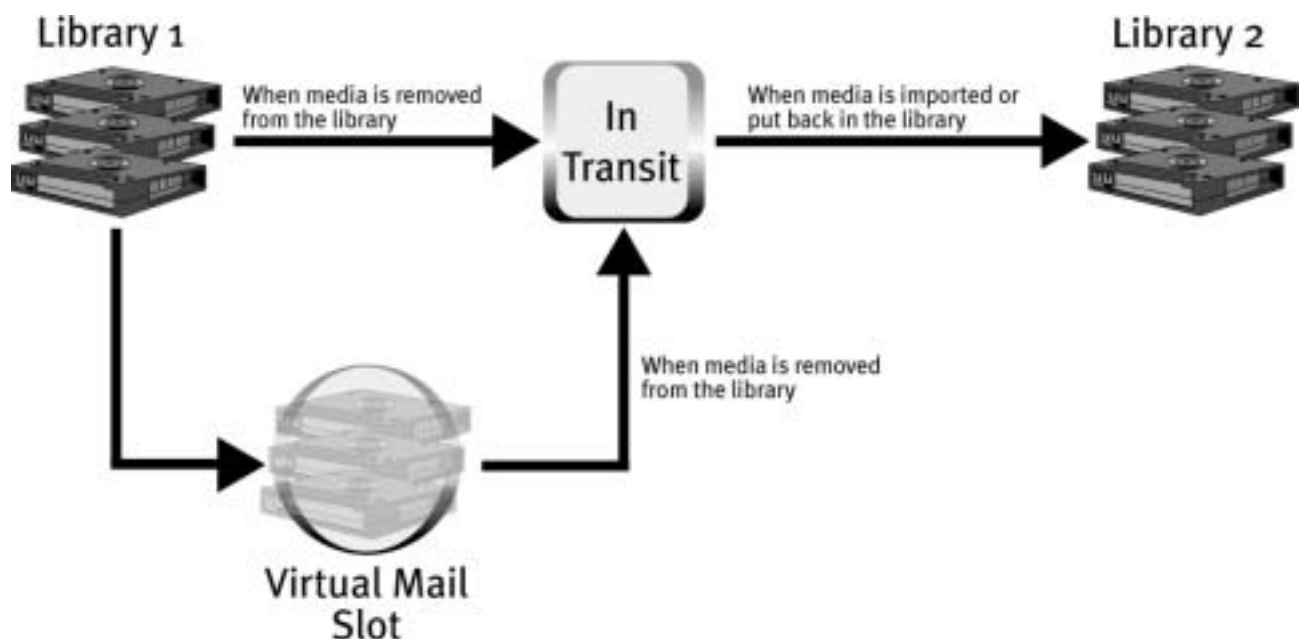


Figure 10 – VaultTracker policy for offsite movement between 2 libraries

As part of the Tracking Policies, Due Back reports and jobs can also be scheduled to generate pull lists for the remote vault site to use to gather corresponding media for returned to the main site for reuse. A reverse set of notations are use to track the media until it is return to the main campus libraries, ready for reuse.

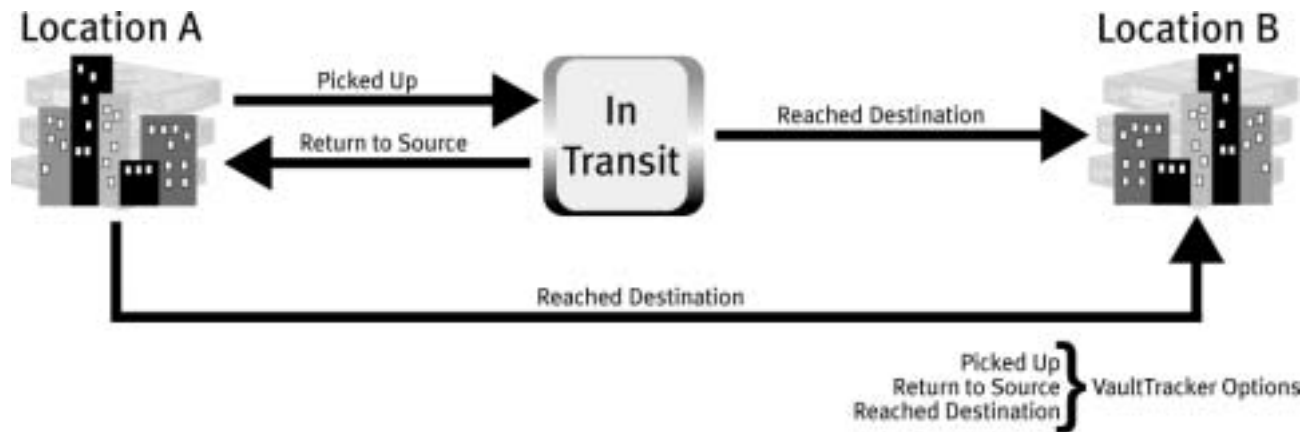


Figure 11 – VaultTracker movement of data between two locations

VaultTracker provides an easy to use, integrated extension to the QiNetix platform for combining both local and remote management of critical data. It maintains the status of the media, local and vaulted, easily accessible by seamlessly integrating Galaxy and QiNetix data management viewpoints. Through the use of VaultTracker, inefficiency and lost media are dramatically reduced through the ability to provide an integrated approach to the process of offsite vaulting.

CommCell Migration

CommCell migration is a facility for migrating Clients and their associated data from one CommCell to another CommCell. This movement can be temporary or permanent. Some reasons for using CommCell migration include:

- Merging CommCells – merging two or more CommCells for operational convenience
- Permanent migration of clients in one CommCell to another CommCell for consolidation, merger, relocation, etc.
- Temporary migration of clients from CommCell to CommCell for relocation, movement of equipment, etc.

During the migration of the clients from CommCell to CommCell the following information is transferred with the client:

- Client configuration
- iDataAgent configurations associated with the client
- Information about the data backed up from the client, including job history, media locations and all storage policy information

Once the client migration has been completed, the client can now be added to existing storage policies defined in the new CommCell.

GridStor™

With Storage Area Networks (SAN), dynamic drive sharing enables drives to be shared by multiple MediaAgents (Media Servers). This approach improves resource utilization and offers a measure of redundancy. However, SAN networked storage architecture does not eliminate failures caused by hardware, networks or the storage media itself. As a result, backup failures happen, exposing data to potential loss.

With QiNetix GridStor technology, the software provides failover, load balancing, pooling and provisioning capabilities to lower TCO and reduce administration while improving access and use of nearline and offline storage. Unlike current solutions in the market, Galaxy's GridStor technology functions across operating system environment and storage type. For example, Windows file system backup jobs can failover from a Windows MediaAgent to a Solaris MediaAgent. On the restore, the user would not need to know, nor be aware of the situation.

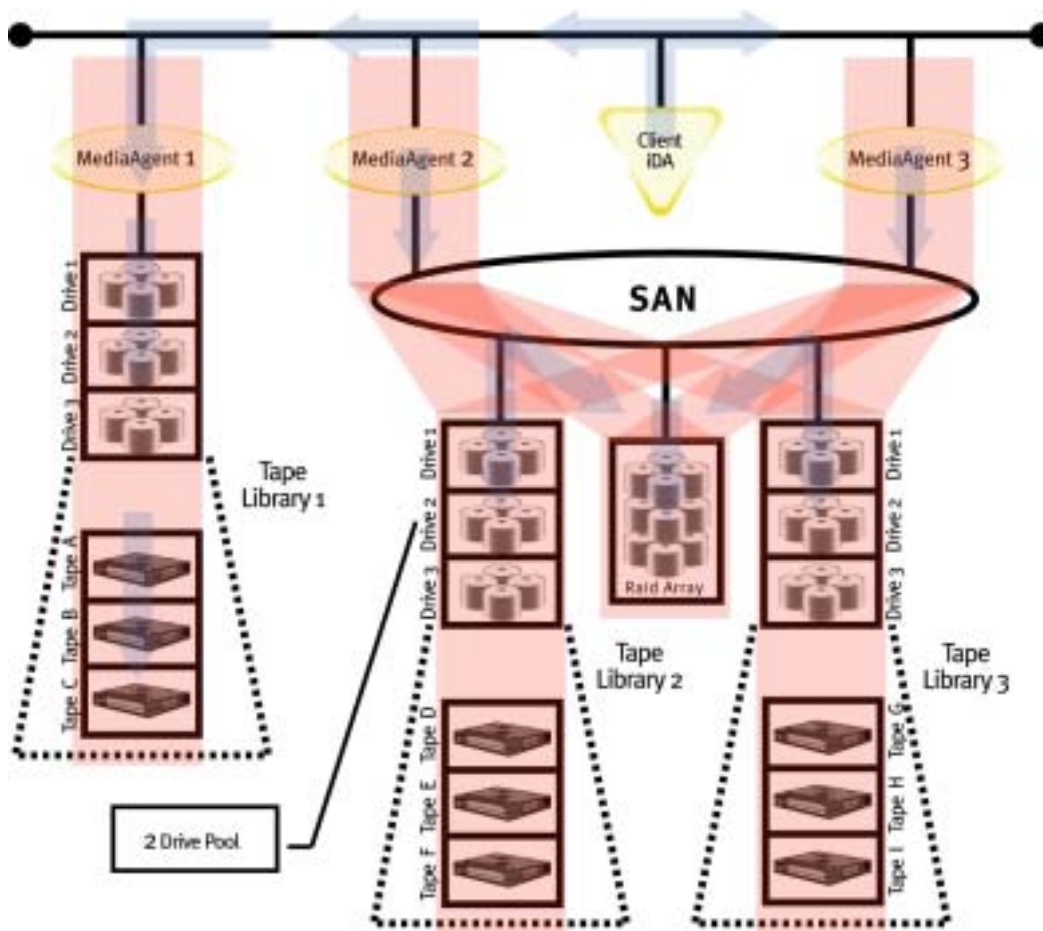


Figure 12 – GridStor shared storage and data paths

This means that alternate paths are always available to enable access to specific storage even if the MediaAgent that wrote the data is unavailable. During backups, either the original or substitute nearline or offline resource may be used. The priority for selecting resources is configured by the user. Once done, the hierarchy of resource use is automatic and transparent. This advancement optimizes resource utilization and as importantly, allows for load balancing to occur by enabling proactive management of resources, re-directing jobs to access underutilized storage resources and improve access to data by eliminating data protection and recovery job failures.

Data Verification

When data is backed up to a storage device there is no way to make sure that the data is truly restorable, short of immediately performing a restore. Since this would be inefficient and double the cost, time and resources for data protection, other means of ensuring restorability are necessary. Tape devices have built in CRC checking to ensure that data is written. However, this does not ensure that the data written is restorable. The CommVault Data Verification tool is used to verify that backups can be restored.

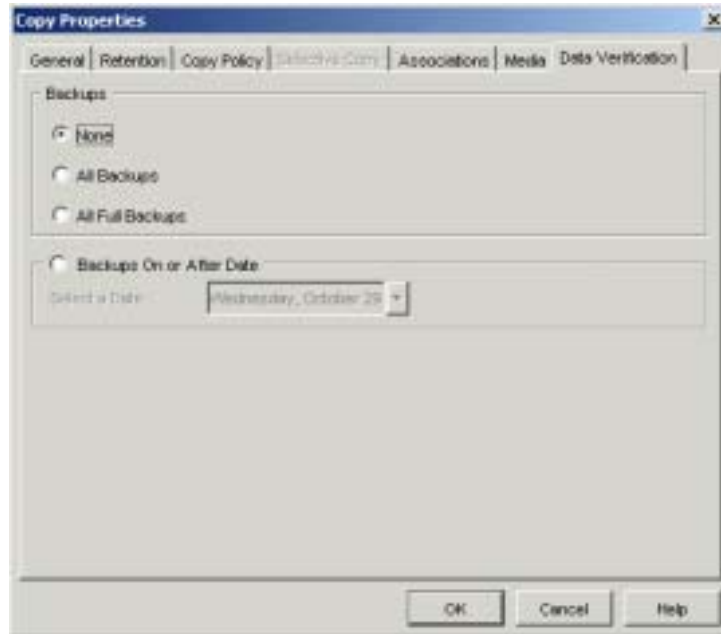


Figure 13 – Data Verification configuration

The Data Verification tool can be configured to run after all backups, all full backups, or backups occurring on or after a certain date. Using the Data Verification tool can provide peace of mind that in the event of restore activity, data is truly restorable when it is required.

Status	Client	DataAgent	Instance	Backup Set	Subclient	Backup Type	Fa...	Failed	Start Time	End Time	Data Tr...	User Name	Data Verification Status	Date & Time
Available	purple	Windows 20...	defaultBacku...	Purple_Progr...	Incremental	0	0	0	2003/07/15 1...	2003/07/15 1...	35.81 MB	cvadmin	Picked for verification	
Available	purple	Windows 20...	defaultBacku...	System State	Full	0	0	0	2003/07/15 1...	2003/07/15 1...	239.73 MB	cvadmin	Picked for verification	
Available	purple	Windows 20...	defaultBacku...	default	Incremental	0	0	0	2003/07/15 1...	2003/07/15 1...	5.67 MB	cvadmin	Picked for verification	
Available	purple	Windows 20...	defaultBacku...	System State	Full	0	0	0	2003/07/15 0...	2003/07/15 0...	239.73 MB	cvadmin	Not picked	
Available	purple	Windows 20...	defaultBacku...	Purple_Progr...	Full	0	0	0	2003/07/15 0...	2003/07/15 0...	289.44 MB	cvadmin	Not picked	
Available	purple	Windows 20...	defaultBacku...	Purple_D_Dri...	Full	0	0	0	2003/07/15 0...	2003/07/15 0...	2.29 GB	cvadmin	Not picked	
Available	purple	Windows 20...	defaultBacku...	System State	Full	0	0	0	2003/07/15 0...	2003/07/15 0...	239.73 MB	cvadmin	Not picked	
Available	purple	Windows 20...	defaultBacku...	default	Full	0	0	0	2003/07/15 0...	2003/07/15 0...	1.60 GB	cvadmin	Not picked	
Available	purple	Windows 20...	defaultBacku...	Purple_Progr...	Differential	0	0	0	2003/07/15 0...	2003/07/15 0...	4.18 MB	cvadmin	Not picked	
Available	purple	Windows 20...	defaultBacku...	Purple_D_Dri...	Differential	0	0	0	2003/07/15 0...	2003/07/15 0...	15.83 MB	cvadmin	Not picked	
Available	purple	Windows 20...	defaultBacku...	System State	Full	0	0	0	2003/07/15 0...	2003/07/15 0...	239.73 MB	cvadmin	Not picked	
Available	purple	Windows 20...	defaultBacku...	default	Differential	0	0	0	2003/07/15 0...	2003/07/15 0...	8.96 MB	cvadmin	Not picked	
Available	purple	Windows 20...	defaultBacku...	Purple_Progr...	Incremental	0	0	0	2003/07/15 0...	2003/07/15 0...	1.62 MB	cvadmin	Not picked	
Available	purple	Windows 20...	defaultBacku...	Purple_D_Dri...	Incremental	0	0	0	2003/07/15 0...	2003/07/15 0...	15.21 MB	cvadmin	Not picked	
Available	purple	Windows 20...	defaultBacku...	System State	Full	0	0	0	2003/07/15 0...	2003/07/15 0...	239.73 MB	cvadmin	Not picked	
Available	purple	Windows 20...	defaultBacku...	default	Incremental	0	0	0	2003/07/15 0...	2003/07/15 0...	5.56 MB	cvadmin	Not picked	

Figure 14 – Data Verification scheduler

Full System Restoration

A new capability in QiNetix 5.9 is One-Touch Recovery. Unlike other Bare-Metal Restore (BMR) products available, One-Touch Recovery provides an integrated solution with the backup repository ensuring the most up-to-date image for recovery. With One Touch Recovery, you designate a server in your environment as your One-Touch Server and have available your Windows installations. When a client failure occurs, you simply insert a writeable CD into the One-Touch server and provide some information regarding the identity of the failed client. A bootable CD image is created which is inserted into the failed client. Upon booting, the One-Touch process takes over. All appropriate Windows systems images, including service packs, are installed onto the client along with the file system iDA. A full system restore is then initiated bringing the client back to the state as of the last backup.

No client agents are required. There is nothing to schedule. Unlike other BMR alternatives, the client image does not need to be refreshed whenever a patch is applied or application installed as this is part of the normal Galaxy backup process.

Galaxy Data Movement

DataPipe™

Galaxy DataPipe™ technology is designed to move data as fast as the source client can provide it, the data transport layer can pass it, and the backup media device can write it. The Galaxy software uses the same process for writing backups to direct-attached SCSI devices as it does for network TCP/IP connections. By employing patented double buffering and shared memory transfer, the Galaxy DataPipe technology provides high performance data movement with extremely low overhead. As a result, in performance testing over TCP/IP networks, the software has produced data transfer rates of close to the theoretical limit of the network—minus protocol overhead. Its technical construction allows it to work as well when transferring data between identical media types [i.e., tape to tape] as with disparate media [e.g., disk to tape or optical to tape].

In some cases, it is necessary to restrict the amount of network bandwidth being utilized for backup purposes. In these cases, Galaxy software offers network bandwidth throttling. This is accomplished through a tunable feature in the Galaxy Storage Policy. In this manner, bandwidth consumption is managed at the storage policy level.

Multiplexing

Galaxy software offers customers the ability to use multiplexing for simultaneously streaming multiple backup jobs to the same tape drive. Multiplexing is useful where data is being transferred over slow networks and multiple jobs can have their data interleaved to prevent tape drives from stopping while waiting on the next data transfer. As tape drives have become even faster, a single client host cannot supply data quickly enough to keep the tape drive continuously writing data.

Tape drives are meant to stream. When they pause to wait for data, they must stop spinning to protect the mechanisms in the tape drive. Starting and stopping tape drives severely degrades the performance throughput and negates the value of the device.

As network bandwidth became more readily available and applications became more capable of keeping tape drive buffers full, multiplexing became less important. The advent of disk to disk backup also has made multiplexing unnecessary for applications like Galaxy that can stream data to disk utilizing multiple read/write heads on the disks. However, the recent advent of faster tape devices with very fast throughput has swung the pendulum back again.

CommVault offers the option to turn on multiplexing for specific Storage Policies. By enabling multiplexing on a selective basis, Galaxy software lets the customer use multiplexing for those specific jobs where it is needed.

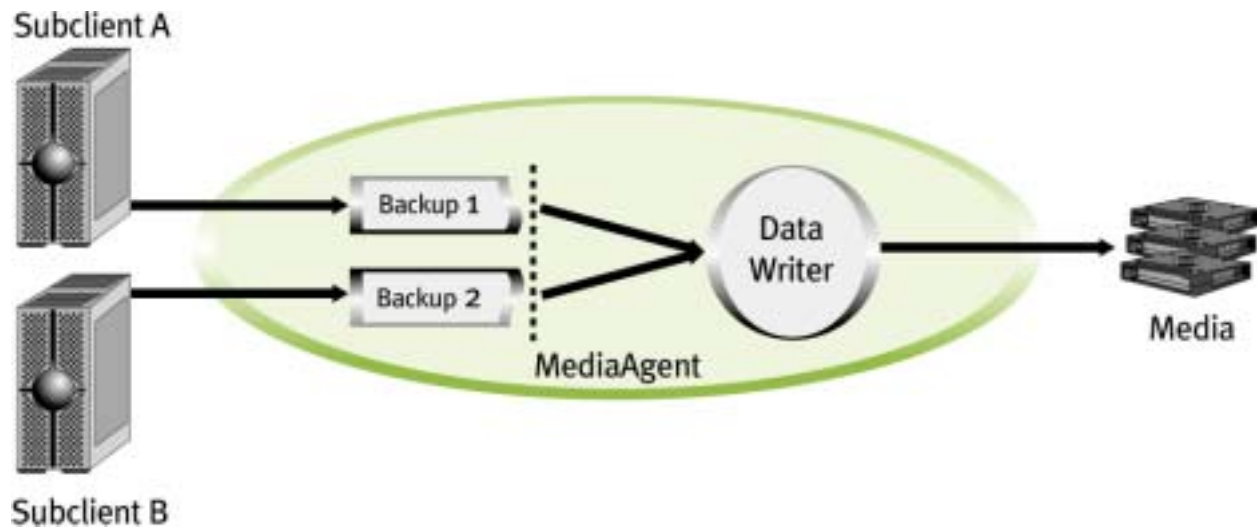


Figure 15 – Multiplexing dataflow diagram

The main problem with multiplexing is the latency associated with restoring data that has been interwoven with other, non-related data on the same tape. This “demultiplexing price” was the penalty the user paid for a fast backup – very slow restores.

As mentioned previously, CommVault is focused on restore not backup. So the solution was designed with fast restores as a prime requirement. Because of Galaxy’s advanced indexing capabilities, the Galaxy solution is able to quickly restore individual files or entire volumes and directories without the traditional restore penalty usually associated with multiplexing. Utilizing our “One Pass Restore” technology, we know the exact location of each block making up the file or files that are being restored from the stream. As a result, the software makes a single, one direction pass through the tape with no rewind, pulling off all the blocks to reconstitute and restore the file(s) to the user or application. This ability makes our multiplexing solution a viable option for instances where multiplexing is a necessity.

Our ability to separate the multiplexed streams on the fly is critical when we do our auxiliary copies and synthetic full backups. Having a multiplexed source does not affect the ability to do either of these operations. Auxiliary Copy and Synthetic Full are processes critical to an ILM strategy and are discussed in more detail later in the discussion guide.

Serverless Data Manager (SDM)

Galaxy software has a data movement module, Serverless DataManager (SDM) that allows certain job types to take advantage of the true serverless data movement offered in SAN based storage routers. Using the SCSI Extended Copy command set, Galaxy SDM is able to supply a list of blocks to the storage router for transfer. True serverless data movement is the movement of data from one set of disk devices to another disk or tape device without using a traditional server CPU to process and move the data. Instead the movement of the data occurs outboard in the SAN based storage router. Using this type of data movement removes the impact of I/O processing from the application servers, thus freeing up tremendous CPU cycles for use in production rather than backup efforts.

While serverless technology has been hyped for many years, it has not gained mainstream adoption because the technology applies only to data movement. There is no built-in capability to interact with

systems and applications, or common items like security, reusability and guarantees of transmission of data. Without these items, the serverless technology was unable to provide the necessary value to customers for them to adopt it.

With this in mind, CommVault developed solutions utilizing serverless data movement as an option for reducing application server cycles and providing easy implementation. The Galaxy product uses customer snapshot technologies to take a point in time snapshot of the data being backed up. Once this consistent copy of data is created, Galaxy software can utilize the Extended Copy command set to move the data from the snapshot location to the destination device. This removes both the load on the application server and the need to have a dedicated backup server attached to the snapshot volumes. Additionally, Galaxy also provides the necessary application awareness to automatically place the application into the appropriate backup mode to snap a transaction consistent image of the data. This combination provides further leverage to the IT shop that already has investments in SAN hardware and or snapshot technologies from their RAID disk providers.

CommVault, via its software, is committed to working with both partners and customers to fully optimize existing technology. The use of serverless technology and partner snapshot technologies is proof of this commitment.

Snapshot-Assisted Backup

Galaxy software provides features to perform Snapshot-Assisted Backup. The primary purpose of the Snapshot-Assisted Backup is to free the production server from spending precious CPU cycles on backup I/O. By using the snapshot engine capabilities of leading disk vendor's, the Galaxy solution is able to integrate with both the applications and snapshot tools to automate the process of creating an application snapshot for use as a backup source.

The Galaxy product provides a way to automate a previously intensive manual process—using snapshot technologies to create backup source copies of data for use in subsequent backup or testing efforts. In the past it has been a multi-stage process:

- Manually shutdown/quiesce the application through the appropriate application interface
- Once the application is in the required state, go to the snapshot interface and execute the commands to cause a snapshot to occur – this is usually a process that entails the creation of numerous scripts that must also be maintained
- Once the snapshot has completed, return to the application interface and restart the application
- Go to the Backup product interface and manually kick off a backup job, providing the location of the snapshot volume as the source for the backup
- Monitor the backup to completion, then go back to the snapshot interface or execute the script to delete the snapshot copy or resync the snapshot volume with the primary volume
- Manually note the data snapped, the backup job name, the media location and volume ID, and the location of the data on the primary system

Needless to say, this is a tedious and resource-consuming activity that has prevented the widespread adoption of snapshot technology usage in all but the largest or most competently staffed data center.

The Galaxy solution automates the process. It supports a growing number of snapshot technology engines, including the following list:

- EMC TimeFinder
- EMC SnapView
- HDS Shadow Image
- HP EVM

- HP EVA
- Microsoft VSS

CommVault also provides the Qsnap software snapshot engine.

CommVault is continually working to add more vendor snapshot technologies to the list of integrated snapshots working with Galaxy.

Utilizing Galaxy's application integration capabilities with Solaris, AIX, Windows, Exchange, SQL and Oracle, it provides a snapshot assisted backup procedure that encapsulates all the manual steps listed above into an automated, scheduled process. The snapshot-assisted backup is scheduled via the Job Scheduler menu. Once the job kicks off, Galaxy software automatically interfaces with the application to put it in backup mode, calls the snapshot engine to make the snap, returns the application to full production at the end of the snapshot and kicks off the backup job to protect the data on the snapshot volume.

In today's complicated world of acronyms and buzzwords, two have been abused by many parties: serverless and serverfree. For the purposes of Galaxy discussions, serverless means data movement utilizing the SCSI Extended Copy command set found in storage routers from Crossroads, ADIC and others and also in these same storage routers that have been embedded in libraries from ADIC, StorageTek, and ATL among others. Serverfree refers to the movement of data from a dedicated backup server that is NOT the production application server.

To illustrate this point, Galaxy product supports both types of data movement with the Snapshot-Assisted Backup capability. Once the snapshot is on a disk volume, it can either move the data to a target backup device using the Serverless DataManager (SDM) module, CommVault's data movement module that utilizes the Extended Copy commands in the storage routers. The user may elect to deploy an alternate host or backup server instead, where the Galaxy MediaAgent would reside, to facilitate the movement of the data from the snapshot volume to the backup target. In this manner the snapshot volume is mounted to the backup server and utilizes the CPU cycles of the backup server to drive the data to the backup storage device. This would be an example of serverfree technology.

Regardless of the method chosen, at the end of the scheduled backup job, Galaxy software would either delete the snapshot (in the case of "copy on write" snapshot products, like HDS ShadowImage) or issue the commands to reattach the snapshot volume back to the primary volume for resynchronization (EMC TimeFinder/BCV like snapshots).

The main point to remember is that Galaxy Snapshot-Assisted Backup provides yet another way to reduce the cost of data protection operations by leveraging potential existing customer technology and reducing the load on the production server by removing the backup I/O server cycles.

Image Level Backup

The Image Level iDA allows fast block-based backups of volume level data. Because data is transferred at the block level, backup windows are reduced by orders of magnitude. Not only does the initial full backup take a fraction of the amount of time a regular file system backup would, but subsequent incremental backup is much faster, too.

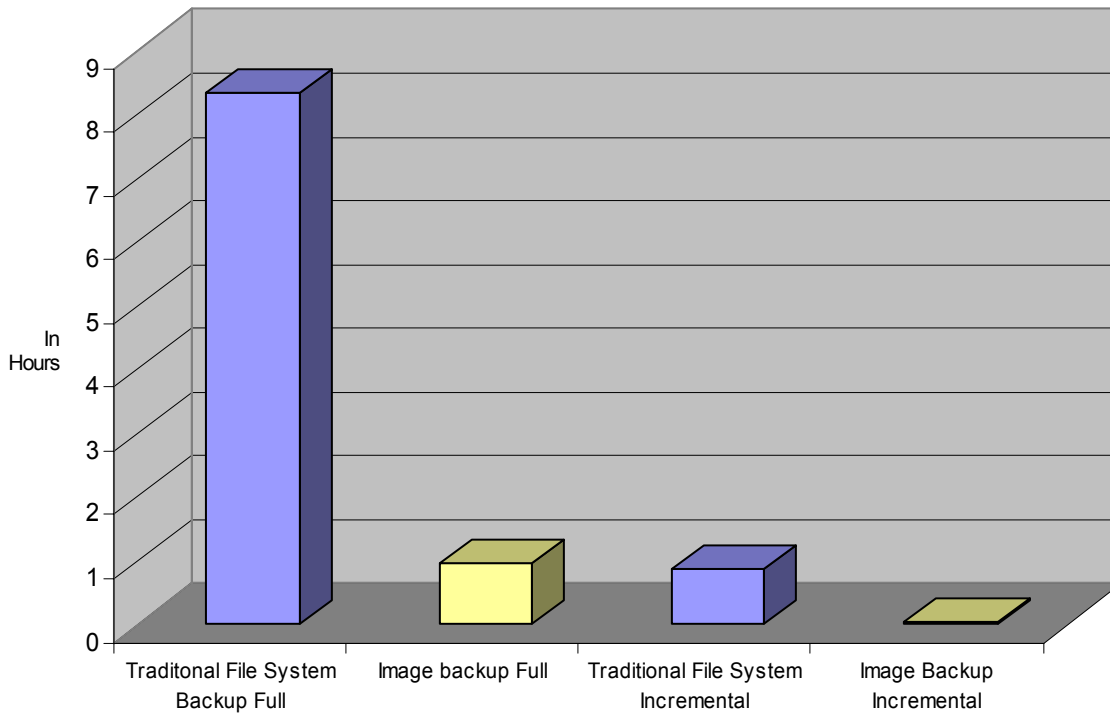


Figure 16 – Comparison of Image versus Traditional File-based Backup

The value of Image Level is the ability to use snapshot technology to create a near instantaneous image of the data, with little impact to the application, but still offering file and folder level restore granularity. A typical volume level backup or snapshot can only be restored as a full volume. With Galaxy's advanced indexing capabilities, we are able to index and restore individual files or folders from the volume level image backup.

In this manner, CommVault also uses block level incremental technology to capture changed blocks in subsequent images and update the backed up copies accordingly. Image Level technology is especially applicable in the following environments:

- Large filesystems volumes with millions of files
- Environments where minimal disruption from backup and fast backup completion are more important than restore speed
- Cases where full volume restores are more likely than granular restores

Server down time is virtually eliminated by capturing a snapshot image of the production server's disk with the CommVault QSnap technology. This image is then used by the Image Level iDA to create a backup copy of the data. Image Level supports both FAT and NTFS file systems. Once again, CommVault offers significant variety and flexibility to customers to tailor their data protection schemes to meet the needs of the data and the protection level that is necessary for any operating environment.

ProxyHost Backup

ProxyHost Backup provides the ability to offload the backup processing from the primary application server in shared storage environments. Like ImageLevel, ProxyHost utilizes snapshot technology to capture an application consistent point-in-time view of the data then utilizes an alternate (or proxy) host within the storage network to perform the backup of the snapshot data. This allows the application server to continue unaffected by backup processing. One unique feature of this approach is the ability for Galaxy to maintain the file browse information as if the backup occurred from the primary application server.

ImageLevel/ProxyHost Backup

ImageLevel/ProxyHost combines the best of both approaches by utilizing a secondary host in a shared storage configuration while providing a bandwidth-efficient block incremental off that secondary host. Based on application performance requirements and data change rates, Galaxy can be configured to provide optimal data protection.

Indexing

The Galaxy software uses a two-part synchronized indexing scheme. It consists of a centralized meta-database catalog residing within the CommServe StorageManager software and an index co-located with the MediaAgent software. This approach provides the Galaxy storage management software with the ability to efficiently scale to accommodate data growth, easily support redeployment of storage resources and increase reliability of the entire system.

A permanent copy of the index is stored on the backup media. The Galaxy software maintains an active copy of the index on the client computer disk where the MediaAgent is installed. This local index cache disk is finite. As new data is written to media, new indices are created. Configurable parameters let administrators set the size of the disk cache and duration of the local index. If the index exceeds the pre-configured capacity, older indices are overwritten using a least recently used (LRU) algorithm.

Index data efficiently gathers information regarding the location of files during recovery processing and enables rapid browsing of backed-up data. Requests for information found in the indices are satisfied from the cached copy of the index. If the index is no longer on disk (cache miss), a request is fulfilled by accessing the permanent index on the media.

LAN-free Backup

Galaxy supports LAN-free backups, a capability broadly used by customers today. With complete media management capabilities and the ability to simultaneously monitor and manage devices attached via SAN, DAS, NAS or LAN topologies, Galaxy enables every type of data movement to maximize customer options. The ability to perform backups from LAN attached servers to SAN attached devices gives customers a way to fully utilize and leverage their SAN infrastructure to offload backup data from the primary LAN networks.

iSCSI Support

All Galaxy features are totally applicable to storage devices deployed in an iSCSI/IP-SAN environment. Since Galaxy is both topology and device agnostic in its management framework, there is no loss of function if iSCSI and IP-SAN technologies are used as part of a customer's ILM strategy. It is a result of forward thinking, integral to QiNetix platform that new technologies can be instantly deployed and managed as part of the QiNetix infrastructure in customer environments.

Logical Data Management

Galaxy Scheduler

Scheduling in Galaxy software is a flexible and highly leverageable capability. The scheduling facility extends to more than just backup or restore jobs; but to all operational capabilities. The scheduler ensures these things are automatically performed on a regular basis. Galaxy schedules are created for the following items:

- Backups
- Restores
- Administrative Jobs
- Data Aging
- Express Recovery Backup
- Auxiliary Copy
- Synthetic Fulls
- Reports
- Media Exports
- VaultTracker
- Data Verification

Within the Galaxy Scheduler, there are varieties of different recurrences that can be selected, or customized patterns can be created. In addition, the Galaxy software includes the concept of Schedule Policies: the ability to create a template recurrence schedule and have it applied to a group of objects, such as subclients.

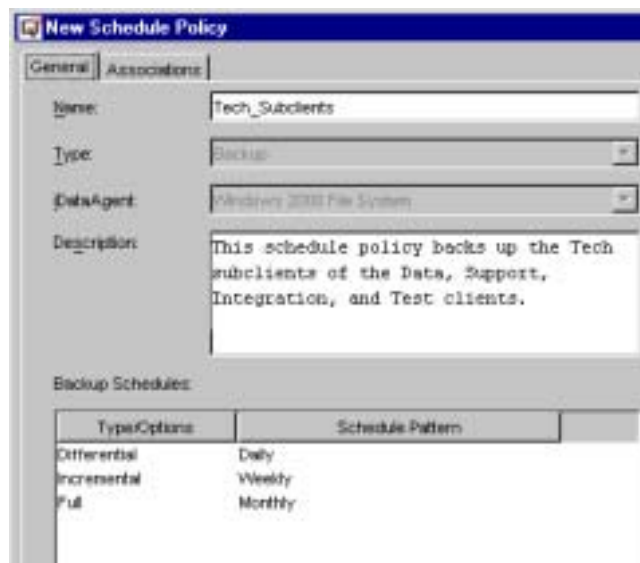


Figure 16 – Schedule policies

Each job has a date and time and allows for the specification of the time zone to use for the time specified. This last feature is important in the case of remote administration, where the administrator could be scheduling jobs using the Galaxy Console via the Internet and might not be in the same time zone or even the same country. The comprehensive nature of the Galaxy Scheduler combined with its extensive policy capabilities; enable the creation of a set of sophisticated, lights out procedures, significantly reducing management complexity and expense.

Storage Policies

Storage Policies are a fundamental element of the software's logical view of storage resources. Through QiNetix Storage Policies, all key parameters are defined. These include where the data is stored, how long it is retained, the number of copies to create, the location of the copies, the retention of the copies and when to make the additional copies. Once Storage Policies are defined, data is "assigned" to a Storage Policy for management according to those guidelines. It is easy, point and click, to assign data to a different Storage Policy, changing the way the data is managed. There is no reconfiguration of hardware, any re-cabling or re-networking to accomplish these changes. It is all handled within Galaxy software and is derived from the Storage Policy definitions. This feature reduces the cost and complexity faced in many IT shops when setting up and maintaining the infrastructure and management schema for safeguarding the data.

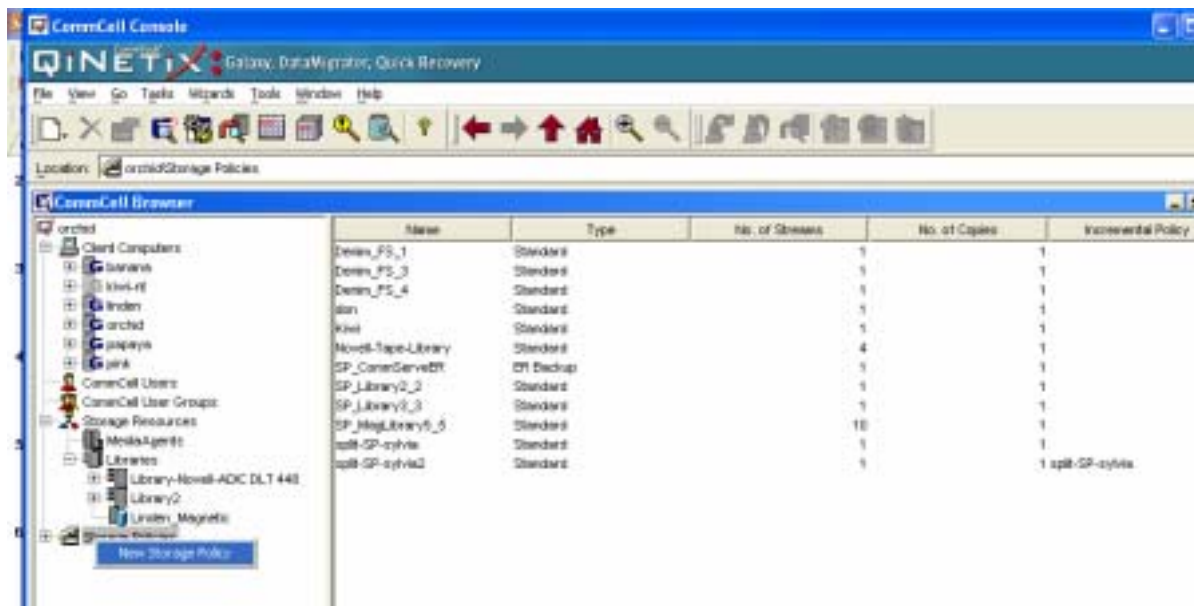


Figure 17 – Storage Policies

With Storage Policies, much of this complexity is simplified and the corresponding cost of managing the data storage environment is greatly reduced. Galaxy software provides a default Storage Policy for each media library, standalone tape drive or magnetic drive. This default Storage Policy ensures the data protection of all visible data to Galaxy software and ensures complete coverage from the initial installation. Subsequent Storage Policies are defined and as data is assigned to other Storage Policies, it is removed from the default policy.

Auxiliary Copy

Galaxy Auxiliary Copy operations create secondary copies of backup data independent of the original copy. The Auxiliary Copy feature copies data from the primary copy to one or more secondary copies. These secondary copies do not have to be of the same media type. So for instance, if the primary copy is made to a magnetic disk library, local to the application, Auxiliary copies could be made to a local tape in a tape library as well as to a remote tape in an offsite disaster recovery site.

As defined in the Storage Policy, the combination of Auxiliary Copies and retention periods for all copies provides a Storage HSM capability. As data ages on more expensive media and Auxiliary copies are made, the copy on the expensive short-term media type can be expired, freeing up the media for new copies of data to be stored. With the Auxiliary Copy function, rather than having to migrate the data from storage to

storage, a copy has automatically been created as an automated function of the Galaxy Storage Policy. This provides for long-term retention of data while simultaneously handling the management of storage space and cost. This eliminates the need for personnel to track and execute these details manually.

The Galaxy software offers multiple types of Auxiliary Copy capabilities:

- Full Auxiliary Copy which duplicates an entire tape set (full and all incremental backups)
- Selective Auxiliary Copy which duplicates only the most recent full backup.
- Job-based Auxiliary Copy allowing for specific jobs within a storage policy to be designated for Auxiliary Copy, independent of the remaining jobs in the storage policy
- In-line Copy which allows for writing multiple copies of the backup stream to different media simultaneously.
- Cascading copy which allows for the creation of copies from other copies without having to re-read from the primary data set

Synthetic Full Copies

Synthetic full “backups” have many benefits; first, it dramatically reduces the I/O load on the client machine by eliminating full backups after the first full is successfully done. Secondly, it provides a way to create a new full image of the client machine using an off line process, and finally, it can improve full server restores. Synthetic full backups enable administrators to do a full backup to new media without involving the client. The Synthetic Full feature allows for the creation of a new “full” backup image by combining a previous full backup with the associated incremental backups. In essence, it consolidates your previous backups onto a new tape or disk volume. One advantage of the Synthetic Full feature is that it does this without touching the source data again or communicating with the original product host. This removes the impact on the application server CPU and allows the customer to create a new set of full backup tapes for other uses, such as vaulting or setting up a new site or test system.

Ease of Use

Single Management Console

One core objective of the Galaxy solution is to provide data management and protection for Windows, UNIX, Netware and Linux systems without users switching between multiple consoles or learning different interfaces. This unique approach can be contrasted to the multiple interfaces; multiple products offered by many of the leading storage management companies. .

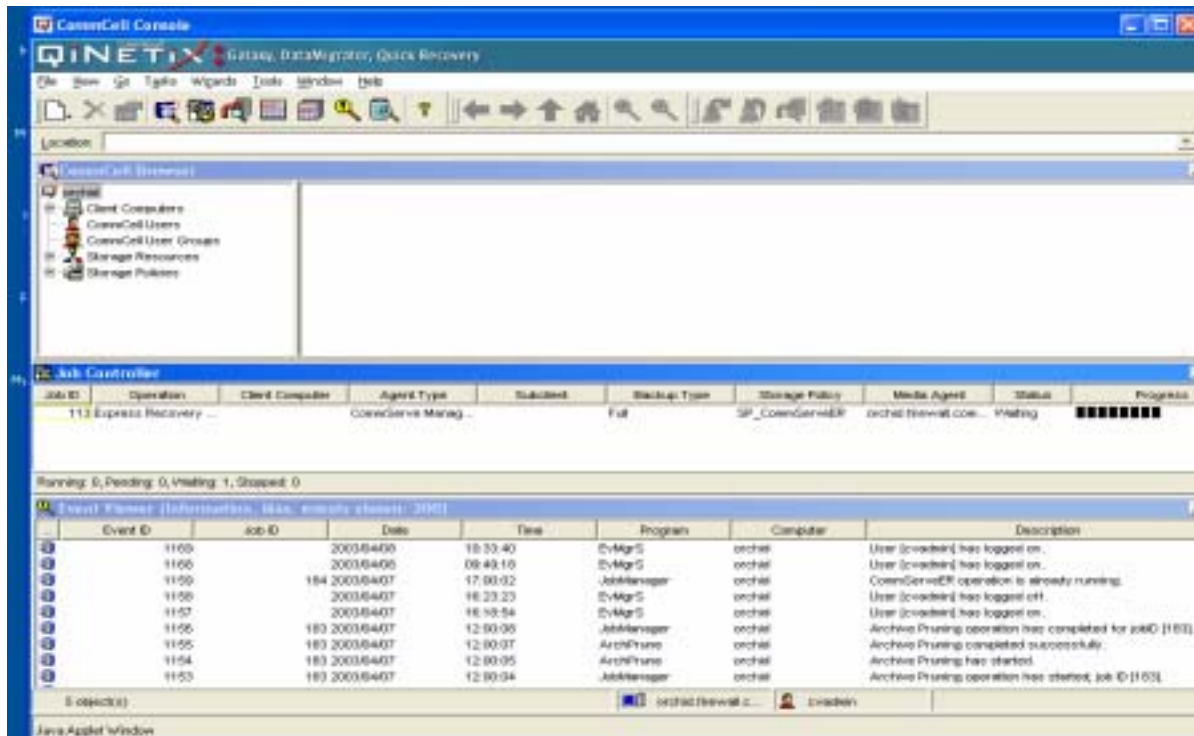


Figure 19 – CommCell unified browser

Eliminating the user frustration and the expense necessary to train IT staff on multiple products and trying to administrate systems that are not aware of each other, Galaxy software is designed to use a single shared database to house common information. Also, each module, from the MediaAgents to the iDataAgents (client software) interact with UNIX, Windows, Netware and LINUX components in a consistent manner, yet offers the flexibility to restrict access to only those users who should have permission to use the Galaxy system. Because of this approach, customers can deploy a single unified product with common policies for applications on Windows, UNIX, Netware and LINUX.

Sub-Client Policy

As the number of clients within the Galaxy environment grows, the management burden of the environment doesn't need to grow with it. Sub-Client policy allows the Galaxy administrator to configure multiple clients that share a common sub-client configuration with a single operation. This becomes an effective tool when deploying Galaxy in large environments with tens to hundreds of clients that share a common sub-client configuration.

Web-accessible CommServe

As a core objective, Galaxy's ease of use is clearly focused on making the single console easy to use and access. This is accomplished with the CommServe's Browser-based GUI that allows the administrator to log into the CommServe from any HTTP console on any Internet-attached machine. Given the appropriate user security permissions, different levels of operations and administration staff can remotely control data protection and management operations. This is extremely valuable as the administrator can still locally or remotely monitor and manage all Galaxy data management activities. An additional benefit of this feature allows very large organizations with multiple worldwide installations to remotely monitor and manage CommCells throughout the world. This facilitates a "follow the sun" approach to managing data protection in all key sites regardless of where they are located.

Push and Silent Installation of Galaxy Software Modules

The Galaxy software uses a push installation method for its software modules that need to be installed throughout the production environment. In this manner, installations and upgrades can be accomplished without user intervention and with minimal or no impact on the receiving systems. In this way, Galaxy is also an appliance-friendly product. With Galaxy's remote installation capabilities, it can be installed on "headless" devices located in remote sites where personnel are not available or trained to administer the data management infrastructure. In addition, the product offers silent installs through the use of answer files for remote and network push installation.

7CommCell Update Service

Galaxy software includes a service to periodically check a CommVault FTP site for patches and updates to the software. The updates are automatically downloaded to a cache directory on the CommServe software module and the administrator is notified there are updates ready to be applied. Once the administrator is ready to have the updates installed, the CommCell Update Service automatically installs the updates to the CommServe, Media Agents and iDataAgents as needed. The service provides a simple, easy way for the administrators to stay current on all patch levels and critical updates that are posted to the CommVault service site. The application of patches and updates are also logged in the Event Viewer.

Job Controller

The job controller provides the interface to manage and monitor all jobs through a single window. If the Galaxy administrator desires multiple windows that are focused on specific clients, job types, or software modules can be opened and monitored simultaneously. Detailed viewing information, events and media-related items are available—so administrators do not have to hunt between clients and backup servers to gather all job information. Job Information is updated in real time in the Job Controller window. Within the Job Controller window, the administrator can perform any number of actions on the jobs, simply by highlighting the job and right clicking on it. Job control functions include stopping, pausing, restarting and killing the jobs. When combined with the event viewer (see description in Event Viewer section) Galaxy software provides two real-time tools that allow administrators to take full control of all data protection and management operations and to immediately implement actions required during backup and recovery processes.

Event Viewer

The Galaxy Event Viewer allows you to monitor all Galaxy events or just a subset of them. The Event Viewer displays the most recent events of the Galaxy operations. You can set your own user preferences to display the severity levels and number of events to view. You can also run a search query to view events by time period, severity or Job ID. Here too, multiple windows focused on specific clients, events or software modules can be opened and monitored simultaneously. The event viewer provides a customizable tool to allow the administrator to effectively and efficiently monitor and manage the jobs. As part of the ongoing effort to provide an easy to use product, Galaxy system also enables the customer to use their own names

for clients, reports, jobs, etc., and these names are carried through to the various reports and job displays in the Job Controller and Event Viewer.

Reporting

The base Galaxy software includes enterprise class reporting capability, not as an extra cost add-on option. It provides the ability to assess, plan, and monitor activities across a CommVault Galaxy installation. With over 17 pre-defined, color coded reports (created specifically to meet customer requirements), the reporting capability allows the generation of a variety of reports, each tailored to a particular aspect of data management. Report areas include: Scheduling, Event Management, Media Management and Data Aging. Available reports include Backup History, Data Aging History, Auxiliary Copy History, Job History, Library and Drive, Media in Library, Restore History and Storage Policy. CommVault continues to constantly update both the number of reports available and the ability to tailor reports to meet specific customer needs.

CommCell Explorer

The Galaxy software includes a tool called the CommCell Explorer. This tool enables the generation of custom reports and enables specific report data to be exported to third party reporting tools such as Crystal reports.

Command Line Script Generator

The Galaxy user interface provides a utility for capturing a series of GUI actions as an executable script for use from a command line. This is important for certain pre and post processing activities where the end of a process needs to kick off an unattended Galaxy activity, for instance, at an unattended disaster recovery site. The script is “recorded” by mimicking the activities necessary through the exact series of GUI activities necessary to perform the operation. This is then encapsulated in the script and can be called as any other command line process. This utility removes the need to know a scripting language, requisite API calls and syntax to perform the processes. The following activities can have scripts generated through the Command Line Script Generator tool:

- Data Protection – Backups
- Auxiliary Copies
- Express Recovery Backup (CommServe Backup)
- Data Aging

Reliability

CommServe ExpressRecovery

The Galaxy software provides a utility for backing up its meta-database that is part of the CommServe software module called ExpressRecovery. It backs up this database (and corresponding Windows Registry data) during an ExpressRecovery backup. Like any other Galaxy software activity, ExpressRecovery activity leverages the Common Technology Engine. As a result, Schedule, Event and Job administration tools available for data protection activities can be applied to ExpressRecovery jobs. ExpressRecovery backups can be restored at any production site or Galaxy hot-site using the CommServe Recovery Tool. This backup can be performed to any media type accessible to the CommServe server, including a local or remote network drive. Using this tool, CommVault automates the protection of this critical asset.

CommCell Readiness Check

Many failures that occur within a scheduled data protection operation are due to problems that could have been prevented had the IT administrator been aware of them. Perhaps the network administrator failed to notify the backup administrator of the latest network configuration change. The zoning configuration on the SAN was modified, or there aren't enough tapes in the library to support the next backup operation.

Enter the CommCell Readiness Check. This check can be scheduled to run during normal datacenter operation to perform a 'dry run' of the scheduled backup operation. It verifies that all communication paths between the CommServe, Media Agents, and iData Agents are working properly. It also performs a media check to ensure that sufficient media is available for the expected volume of data to be written. The process can be either scheduled or run on-demand to give the administrator a higher level of confidence of a successful backup operation.

CommVault Galaxy on a Clustered System

All modules in the Galaxy solution (CommServe StorageManager, MediaAgent and intelligent Data Agents) leverage the same fail over protection afforded to virtual servers within the clustering environment. If an active node fails, every Galaxy module is able to function from the node that has not failed—via automatic fail over to the active node. Regardless of the hosting node, the software is able to perform both B/R operations for virtual servers as long as it has access to the network and to the virtual servers' network names and IP addresses. Galaxy software has been designed to treat clustering as a truly virtual environment. In this manner, it has been able to easily adapt to many types of cluster environments, including Microsoft Cluster Server (MSCS), Sun Clusters, HP ServiceGuard and Oracle FailSafe among others. Finally, multiple instances of Galaxy software modules may be installed and run in multiple virtual nodes. This offers administrators the ability to load balance clustered backup activities as well as set up fail over scenarios using different MediaAgents, Storage Policies and storage resources.

Resumability

The Galaxy software provides the ability to resume operations and individual jobs:

1. Jobs that are resumable from point of interruption include all granular backup jobs, including Windows, Unix, Linux file system, Exchange mailbox, Lotus Notes/Domino document, Image and ProxyHost backups. In addition, for Network Appliance filers utilizing their Data ONTAP release 6.4 or greater, Galaxy also has resumability of jobs for both NDMP backups and auxiliary copies of NDMP backups.
2. Operational jobs that offer the ability to resume include regular Auxiliary Copy, Selective Auxiliary Copy, and Synthetic Full jobs.

Interruptions may occur because of use of Operational Windows (explained later in this section) or because a network, disk, tape or server failed in the middle of a process. In the cases where the type of backup allows, Galaxy monitors the last committed archive file in the backup and resumes the backup from that point.

For those job types that do not allow resume from point of failure for data consistency and integrity reasons, such as database backups, the Galaxy software will automatically restart the job from the beginning. The ability to automatically retry jobs without user intervention means a greater opportunity for the scheduled job to complete.

Operational Windows

The Galaxy operational window feature allows for the definition of a specific time in which a particular operation is not permitted. This feature helps prevent an unexpected, time-consuming job from disrupting normal operations. A specified job, submitted outside of its permitted operational window, is held in pending state until the next window opens. Jobs started in the operational window that do not complete are suspended and resumed during the next operational window (if the job type is resumable). If they are not resumable from point of failure, Galaxy software finishes or cancels the job depending on administrator settings. The Operational Window helps the administrator control key resources during critical time periods while still maintaining the integrity of operations.

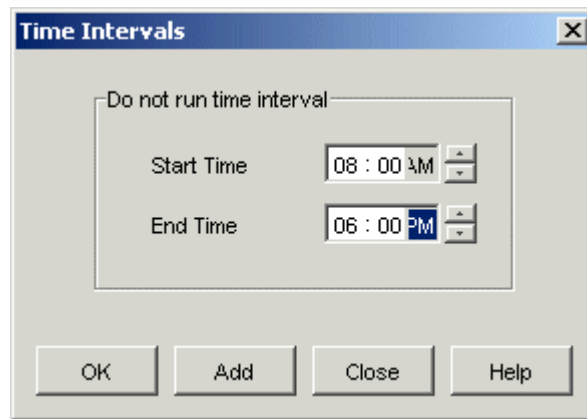


Figure 20 – Operational Window setting

Job Prioritization

Job priorities determine which jobs or operations are run, in what order. They ensure critical operations get priority access to resources—ensuring they are completed within operational windows. In addition, job priorities ensure that vital restore jobs get precedence when they are competing for scarce storage resources or when data is lost. Each job is assigned a priority number and the combination of client computer and job priority determines the order of the jobs. These priorities are defined by the administrator and are easy to configure or change using the Galaxy user interface. Default priorities are assigned, with restores prioritized as the highest job, and activities like Auxiliary Copy with lower priority.

Galaxy software also offers Dynamic Job Prioritization, allowing the administrator to change the priority of a job on the fly. Administrators can change the priority of a job that is currently running, being initiated or being scheduled. This flexibility enables the administrator to take immediate action on a job by job basis without affecting the job schedules and priority settings previously defined for normal operations.

Galaxy Storage Area Network (SAN) Solutions

The Galaxy software is architected to take full advantage of SAN environments – in order to maximize resource sharing and optimization. It is fully-certified with all the major component vendors providing SAN hardware. Furthermore, all Galaxy capabilities discussed in this Discussion Guide work equally well in SAN, DAS, NAS or LAN based topologies.

Some significant features that were discussed earlier in the Guide are specific to SAN environments. Features included within “Snapshot-Assisted Backup” section can leverage SAN-based technology like 3rd Party Copy to deliver serverless backup. CommVault is dedicated to leveraging our customers’ investments in SAN infrastructure.

Galaxy Network Attached Storage (NAS) Solutions

Network-attached storage devices are rapidly growing in popularity. Originally used to reduce data management and administration costs by offering highly available and reliable "file serving", the role of filers is expanding. Filers are now being used as Internet caching devices as well as hosting relational databases and messaging applications. But, as their acceptance has grown so too has their capacity. Today, the capacity of a single Network Appliance filer can be many terabytes. Storage consolidation on filers has introduced new issues for IT organizations—how to adequately protect vital data stored on them.

NDMP Support for NAS Backup and Restore

The Galaxy backup and recovery solution provides the performance, reliability, and ease of management required to protect multi-terabyte NAS filers. Using NDMP (Network Data Management Protocol) to control the B/R processes, CommVault Galaxy software offers a comprehensive solution covering direct attached, 3-way backup, and library sharing between filers. Some Galaxy features for NAS include:

- Direct Access Recovery (DAR) makes individual file and directory restores up to 9 times faster.
- Restartable (from point of failure) NDMP backups and Auxiliary Copies for Network Appliance Filers running Data ONTAP 6.4 or greater.
- Ability to restore data backed up by NDMP to be restored to a Windows system, eliminating the requirement to have a filer as the restore destination.
- Integrated library sharing between many filers and/or server-based storage for optimum use and faster ROI on automated tape libraries.
- Remote NDMP Tape Server allows the use of a Windows MediaAgent to write an NDMP backup to direct attached tape eliminating the need for locally attached devices on every filer.
- High performance local backup of NAS filers to remove backup traffic from the LAN network.
- 3-way backup of filers eliminates the requirement for a tape drive locally attached to every filer.
- Single file, volume or directory recovery to the same or alternative filer including wild card search capabilities.
- Single unified GUI to manage traditional server-based storage and NAS-based storage via all-inclusive Storage Policies.

Galaxy software supports filer backups to devices located in the SAN, such as the Network Appliance TapeSAN initiative. It also supports the ability to do Auxiliary copies of NDMP based filer backups. This improves the NAS information lifecycle management capabilities. In addition, Galaxy can backup filers as a network share. In this manner, devices like the Network Appliance NearStore, are fully functional as backup consolidation devices for all types of Galaxy backups, not just filer backups.

A Better Application Centric Approach

CommVault approaches data management from an application perspective. How the data is protected is a direct function of how the users may need to restore the data in the event of a data loss. This approach is unique to QiNetix and enables customers to adopt a data centric approach to data protection rather than one that is based on limitations of the available storage or backup application.

As part of this approach, CommVault created intelligent Data Agents (iDAs) for both operating system platforms AND mission critical applications. This application focus at the agent level allows CommVault to create agents that utilize specific application APIs, enable levels of data granularity, and offer each data type a unique management strategy that are key to meeting customer data protection needs. Doing complete database, application or file system backups are critical for disaster recovery, but in most cases, data loss is not catastrophic, but rather individual. The administrator needs to only recover a specific portion of data, not an entire database. CommVault has agents for both full database backups and granular backups for applications that can expose the data at a more granular level.

Appendix A - Galaxy Software Modules

Common Technology Engine

The CommVault Common Technology Engine (CTE) is underlying software foundation giving CommVault software the unique ability to implement a meta-policy approach. With this, Quality of Service directives are transformed into actionable policies at the software product/module level. Accomplished by sharing a common meta data model that can be implemented as a single back end meta database or multiple instances of the CommVault meta database, the CTE is the backbone of the QiNetix architecture. In this way, interaction and communication between stand alone products for backup/restore, migration, quick recovery, storage resource and SAN management is achieved.

The degree of interaction and communication leads to new levels of automation between previously independent data and storage management software categories: Backup, SRM, HSM, Availability, Archiving and SAN management. New kinds of automated processes are available to administrators with the QiNetix platform. For example, if the storage resource module senses a disk volume is about to reach its high water mark, it communicates with the appropriate data movement module (e.g., migration and archiving) to alleviate the “out of disk” situation. Once the disk space declines below the high water mark, the data migration automatically ceases.

The CommVault CTE consists of two interdependent software modules: CommServe StorageManager and MediaAgent, if media management functionality is necessary.

CommServe StorageManager

A single CommServe StorageManager software module directs combinations of client Agents and combinations of MediaAgents and client Agents - the numbers and types are dependent on the desired strategy. The CommServe software is the command and control center of the CommCell. This software is a central management point for controlling interaction between various software modules within the CommCell. The CommServe software handles all requests for activity between QiNetix software modules. Only control information - not the data being moved - passes to and from the CommServe software module. From a data management perspective, the CommServe meta database(s) also houses all logical information gathered by the Storage Resource Agents and the Device Management Connections. Because the QiNetix platform employs a common metadata description, automated interaction between traditionally separate products is seamless and brought under a single management umbrella.

The CommServe module hosts the “point and click” user interface, consisting of the centralized event and job managers plus the logical and physical management tree, and houses the meta database catalog. This database includes metadata about the type of activity, critical logical element to physical object mapping, scheduling and management information. The centralized event manager logs all events, providing unified notification of important events. The job manager controls all the major activity of the software and provides CommVault QiNetix platform its industry-leading reliability and restart capabilities. Since the CommCell console is displayed via a web browser interface or Microsoft Management Console (MMC) snap-in, the entire QiNetix system can be remotely managed from anywhere on the LAN or through web-based access.

The CommServe software may reside on a separate system within the CommCell or it may reside on any system already hosting client Agents or MediaAgents.

Client Agents

The Client Agent is a software module that is specific to the operation and type of data it manages. One or more different types of client agents may be deployed on a single system or throughout the enterprise depending on the storage management objectives. If data movement tasks are desired, then iDataAgents™ (iDA) for backup, Serverless Data Manager (SDM) for serverless backup, DataMigrator™ Agents (DMA) for data migration, and QR Agents (QRA) for Quick Recovery operations are installed on the local systems to be protected. If data management is the objective, then Storage Resource Agent (SRA) or Device Management Connections (DMC) are installed or configured.

For instance, there are Galaxy specialized Backup and Recovery iDataAgents for managing Windows or UNIX file systems, SharePoint Portal server, Microsoft Exchange server, Oracle databases, SQL databases, Network Appliance filers, SNAP enabled disk arrays, Lotus Notes servers and more. An iDataAgent is required for each managed data type per client system — whether the system is physical or virtual. The same concept applies to DataMigrator, Quick Recovery, and Storage Resource Agents.

This philosophy is especially important as QiNetix data and storage management software is deployed on clustered systems or in SAN configurations where there are many ‘virtual’ servers or nodes. Therefore, a client system containing both Microsoft Exchange and Windows file system data requires the appropriate Microsoft Exchange and Windows file system client agents. For example, if backup, data migration and quick recovery activities all are required, then a Windows and Exchange Galaxy backup iDA, an Exchange DataMigrator DMA, and a Quick Recovery QRA must be installed on that host.

Each client Agent can manage multiple instances of the appropriate data type per client. So a single backup iDA or migration DMA for Solaris file system is able to manage multiple file system instances on the same client computer. This approach offers a significant administration advantages over traditional system-based point level products that are based on the structure of the physical host data. With CommVault, users can browse data across an entire server, not just a single backup, migration or quick recovery job. For example, administrators using QiNetix platform for Exchange 2000 may browse multiple and different types of data across multiple Storage Groups and Information Stores speeding the location and access to individual messages. This reduces search and seek time from hours to minutes, even seconds.

The use of specific client Agent for each element offers advantages in the management of that data. First, because each client Agent can take advantage of the API's for each data type and function, then movement and management operations are optimized. Second, because many policies are established and managed at the Agent level for each client computer, system users can easily implement individual strategies that are optimized for the data type.

Finally, since multiple client Agents can reside on a single physical computer, the QiNetix software offers the ability to manage different types of data on a single physical machines using storage strategies customized to that data type. Conversely, since client Agents can be grouped by type and managed as a single unit, this gives users a single unified view of all data associated with a single application type, such as all Oracle or all Exchange data. Further, by associating that “group” of client Agents with a single Storage Policy, then all data is managed with a consistent, single policy.

MediaAgent

Since the MediaAgent software is operating system independent, a Solaris MediaAgent can read storage media created by a Windows MediaAgent; it can also serve as the media management for data streams from NetWare, Windows, Linux or relational databases. This separates the QiNetix platform from other legacy backup and recovery products.

In addition, every MediaAgent is capable of supporting many data movement functions. So, a single MediaAgent can support many Backup and Recovery, migration and Quick Recovery operations, simultaneously. As a result, administrators can seamlessly share expensive high-performance resources among many different types of data movement tasks. The MediaAgent is the software module responsible for managing the movement of data between the physical backup storage devices and the corresponding iDataAgents. MediaAgents manage the backup storage devices and house the low-level data index of what's on the storage media. Designed to be operating system and storage-media independent, the MediaAgent software is capable of supporting a wide variety of storage architectures. This approach provides the ability to rapidly adapt to changes in storage technology. For instance, QiNetix MediaAgents interface with the following types of storage devices:

- Magnetic Disk. The magnetic storage can be configured as JBOD or employed in more strategic configurations such as RAID.
- Intelligent Storage Arrays. Advanced disk arrays that have snapshot capabilities or remote copy capabilities, such as EMC Symmetrix, HP StorageWorks or HDS Lightning models.
- Automated magnetic tape libraries. Typically a robotic tape library holds many pieces of magnetic tape media and houses multiple tape drives for reading and writing data. The MediaAgent manages the cartridges, tape drives, and movement of the robotic arm within the library.
- Tape stacker/loader. This is a single tape drive device that is capable of loading multiple pieces of media in sequence from a magazine. The MediaAgent manages the magazine movement. For simplicity, the stacker can be considered a small, single-drive, automated library.
- Stand-alone tape drives. The MediaAgent manages the tape drive. Media must be manually loaded and unloaded.
- Bar coded magneto-optical libraries, such a DISC jukeboxes.
- Non-bar coded or “blind” media.

Appendix B - Additional QiNetix Components

QiNetix Quick Recovery

Quick Recovery creates point-in-time Recovery Volumes on any magnetic disk, allowing administrators to fully recover applications within minutes. Quick Recovery has a simple, unified snapshot management interface and boosts snapshot ROI by creating, tracking, administering and managing point-in-time snapshots of production data for testing, recovery or business continuance. It allows customers to leverage their snapshot investments by automating an intensive manual process and helps optimize snapshot technology through automation, application integration, speed, and simplicity. Quick Recovery offers two types of solutions:

- Quick Recovery HA – a solution for high availability of application data for local environments
- Quick Recovery DR – a solution specifically designed for use in building and maintaining disaster recovery copies of data at remote sites

For more information on QiNetix Quick Recovery, refer to the Quick Recovery Discussion Guide on the CommVault website at www.commvault.com.

QiNetix DataMigrator

The QiNetix DataMigrator product migrates older data from primary storage to secondary, less expensive storage. DataMigrator software shrinks backup windows, reduces primary disk storage, eases IT administrative burden and improves primary application or file system performance—all reducing customers' Total Cost of Ownership. Because DataMigrator is integrated with the host file system or application, end users do not have to access a separate interface to recall migrated data. They simply use the familiar file directory or application interface. For more information on QiNetix DataMigrator, refer to the DataMigrator Discussion Guide on the CommVault website at www.commvault.com.

QiNetix DataArchiver

The QiNetix DataArchiver product provides a method for capturing and archiving email data for compliance with various regulatory, corporate or legal retention requirements. Additional capabilities such as content indexing, keyword search and Auxiliary Copy provide flexibility and electronic tracking and search for easy satisfaction of legal search requests. The software's secure and audited retrieval meets the need for legal or regulatory compliance. For more information on QiNetix DataArchiver, refer to the DataArchiver Discussion Guide on the CommVault website at www.commvault.com.

QiNetix Storage Manager

QNet Storage Manager (QSM) is a comprehensive, powerful management solution that allows storage administrators to analyze and manage all aspects of DAS, LAN or SAN-attached storage – from high-level application content to block-level data on the disks, as well as the file system information in between. Differing from traditionally separate monitoring and visualization tools, QSM combines the features of SRM-style products with SAN management utilities. By unifying intelligence about the “logical” attributes of data with the “physical” attributes of the same data, for the first time, storage administrators have a single, cohesive picture of their storage infrastructure from application to device.

QNet™

The QNet solution provides two main functional capabilities. QNet software provides the ability to group CommCells together into a federation where each CommCell is aggregated into a single interface. It also provides advanced, executive level reporting and alerting mechanisms so senior management can see if IT service levels are being met – in a single glance. The QNet management approach lets users visualize, administrate and implement global management over groups of CommCells, as well as the ability to “drill down” to individual QiNetix software modules. The QNet software also offers sophisticated central management of all CommCells in the Q-Net because it leverages meta-policies that control the interaction of software modules and therefore, CommCells.

Appendix C - CommVault Galaxy Organizational View

Galaxy Organizational View (File System iDataAgent)

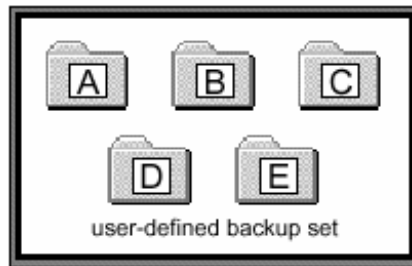
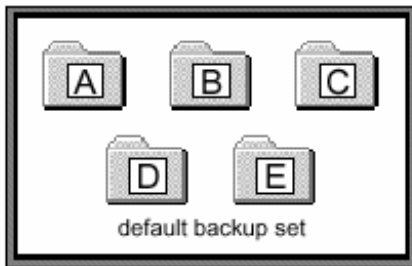
A File System client



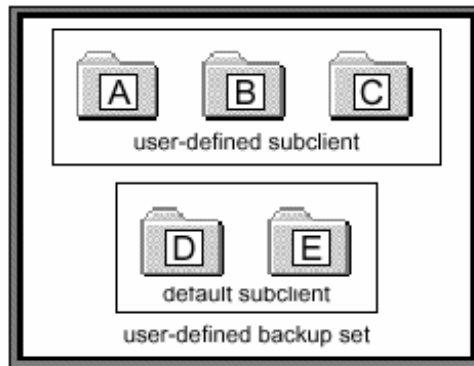
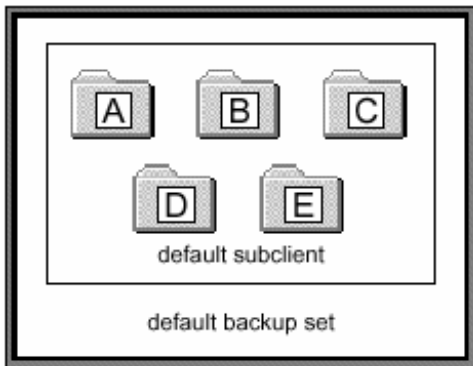
contains directories and files



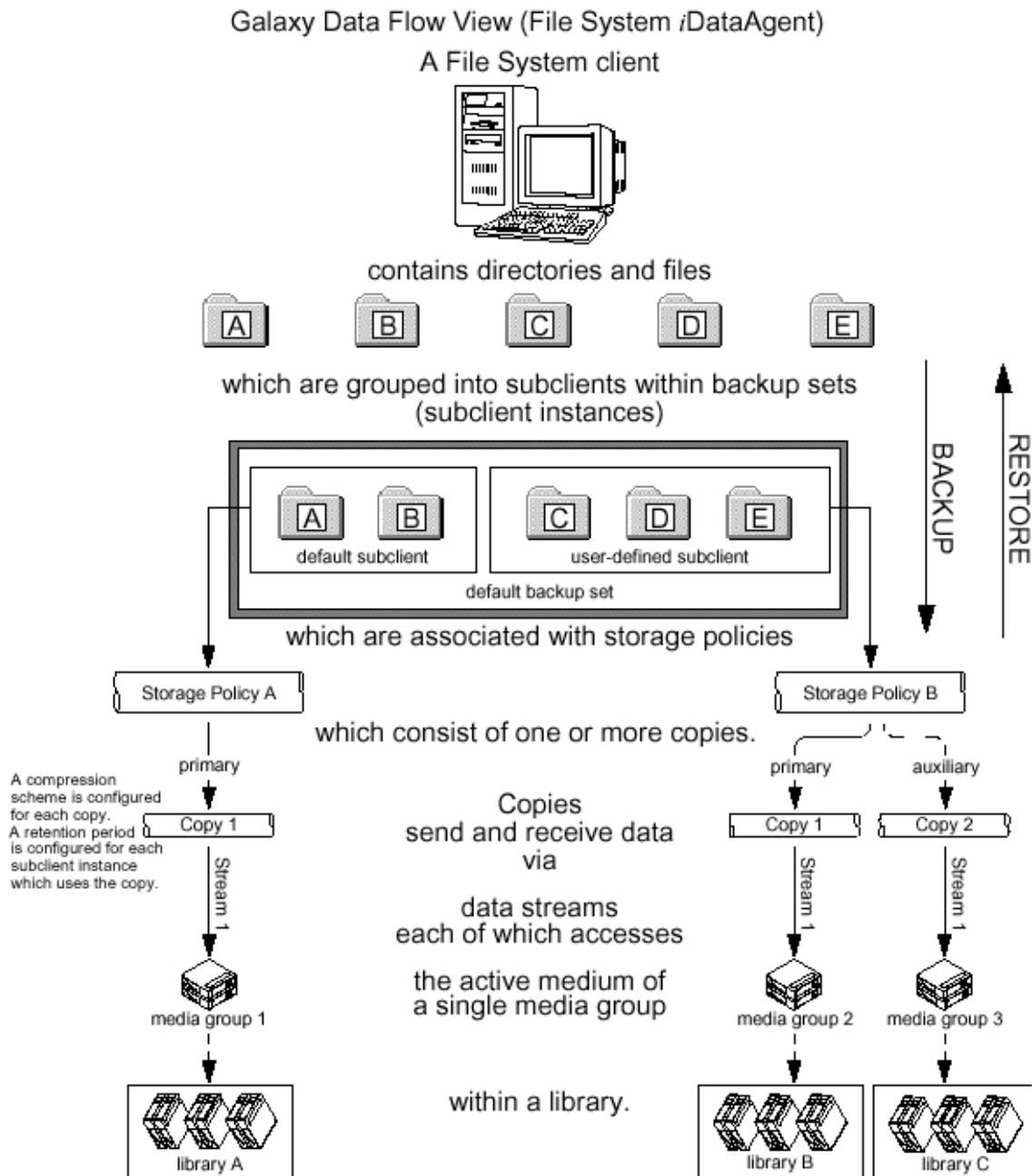
which are all contained within each of one or more backup sets



which are divided into subclients.



Appendix D - CommVault Galaxy Data View



Appendix E - Glossary of Terms

Backup	A process where data is copied from the primary storage to secondary storage in a specialized format that is indexed so users can browse and restore the data at another point in time. The data on the primary storage is left in place.
Client Agents	Software modules in the QiNetix platform that reside on host systems. They are specialized to the type of data and the type of function they perform. Therefore, there are client agents for backup (iDA), serverless backup (SDM), SRM (SRA), migration (DMA) and availability (QRA), among others.
CommCell™	The CommCell is the primary building block of the QiNetix framework, consisting of a single CommServe StorageManager and its embedded catalogue database, one or more client Agents, and, if data movement functions are required, one or more MediaAgents.
Common Technology Engine™ (CTE)	Fundamental CommVault QiNetix software modules (CommServe Storage Manager and MediaAgent) that are the foundation for its backup, migration and availability solutions. The CTE is also a requirement for the data management modules, although the MediaAgent does not get installed.
CommServe™ StorageManager (CSM)	Command and Control software module that houses the unified meta database. Part of the CommVault Common Technology engine
CommVault Galaxy™	The brand name for CommVault's enterprise backup and recovery software
Create QR Volume	The process where snapshots are used to create a transaction consistent image of a primary storage volume and then the data is copied to a second location.
DataMigrator™ or QiNetix DataMigrator (QDM)	A product that's part of the QiNetix platform. It moves data from primary storage, based on predetermined attributes, to secondary storage. By reducing storage resources and their administration, DataMigrator offers a solid ROI.
Logical view	A way of presenting information in the user interface that abstracts physical objects and their relationship to one another into cohesive whole. Policies can be applied to these abstraction to significantly reduce administration of the CommVault software
MediaAgent™	Part of the CommVault Common Technology Engine that provides media management functions, is part of the data path and houses the low level media index.
Migrate	A process where data is copied from primary storage to secondary storage, and the data on the primary storage is replaced with a pointer to the secondary storage.
Mount QR Volume	The process in which the QR Volume replaces the primary storage volume for an application.
Policy-based management	The abilities to have the software take pre-determined actions based on comparing the status of the system or data to a list of states or attributes. Behavior is more complex than simple rule based actions, such as if "this", then "that".
QiNetix Storage Manager (QSM)	A comprehensive, powerful management solution that will allow storage administrators the ability to analyze and manage all aspects of LAN or SAN-attached storage – from high-level application content to block-level data on the disks, as well as the file system information in between.
QiNetix™	The brand name for CommVault's unified software platform that combines data movement and data management products into a single automated solution.
Q-Net	Q-Net software provides the ability to group CommCells together into a federation where each CommCell has a parent/child relationship to other CommCells in the hierarchy. It also provides advanced reporting and management of events, jobs and operations so senior operations personnel can see the status of jobs, events and operations in a single glance.
QR Volume	An exact "bit-for-bit" copy of the primary storage volume in another location that can be mounted by the application as a substitute for the primary.
Qualitative Information Network (QiN)	Self-managing storage networks based on data-centric business and operational objectives that map to the treatment of application data.
Quick Recovery or QiNetix Quick Recovery (QR)	A data availability product that's part of the QiNetix platform. It can restore and recover an entire application in minutes.
Recall	A process where data is copied from secondary storage to primary storage, where the pointer on the primary storage is replaced with the original data.
Restore	A process where data is copied from secondary storage to primary storage to replace lost or corrupted data.
Single unified view	Integrates the administrator's view of all managed copies of data: from snapshots on intelligent disk arrays, secondary persistent copies of these snapshots, Quick Recovery volumes, migrated, backup, off site, auxiliary and other copies of the same data set.
Two Part Synchronized Index	Description of the unique catalogue and index for the data movement products: backup, migration and availability. This split index offers superior scalability, enhanced granularity and superior browse-ability without sacrificing performance or creating a bottleneck.