



▶ Data Protection/Recovery for IBM iSeries

Commvault's IBMi iDataAgent provides the data protection, recovery and management of supported data types and levels of granularity needed to for IBM i OS and IFS architectures.



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▶ INTRODUCTION

Included as part of Commvault's overall data management platform the scalability, operational efficiency, and functionality of the IBM iSeries backup and recovery agent far exceeds the abilities of other IBM i data protection options, including the BRMS utility. With the release of the Version 11, Service Pack 4 of the software, the iDataAgent is more streamlined and has a number of options designed to improve backup performance and recovery ease.

The IBM iAgent, like all of the other Commvault agents, uses the Commvault Data Platform. The Data Platform is a tried and true foundation for data streaming, encryption, deduplication, compression, security and sharing of infrastructure. Leveraging the strengths of this "common" platform, each module, deployed individually or in combination with others, delivers unmatched feature capability performance against alternative system specific solutions. The many Commvault modules can be individually licensable, thus users have the flexibility to choose those that meet their current needs and activate additional modules as new requirements emerge.

▶ OVERVIEW

Like the IBM BRMS utility that many iSeries administrators are familiar with, Commvault software enables the backup and recovery of an entire IBM i LPAR, data and system. Commvault software however, uses a single systems console to manage all client data backups. Access to the Graphical User Interface (GUI) console can be via direct login, or via a web interface. The same master console can be accessed by multiple individuals from different locations at the same time. All access is controlled through roles based security which can be tied in with the sites' active directory implementation. Client system backups, IBM i or not, can share standard data management and scheduling policies. This ability to share policies across client systems supports the use of standards, enhances compliance and reduces the opportunities for errors of omission, commission or configuration. Backed up data can be copied to either tape, Virtual Tape Libraries or to standard disk arrays. Multiple copies of the data can be made concurrently or sequentially and sent to additional storage media at other locations. Through its extensive Media Management system Commvault software can completely automate the management, tracking, recall and life-cycling of data tapes and disk media.

Unlike many other data protection systems, Commvault software provides the option to do data reduction (compression, deduplication and encryption) in-line as the data is sent to the storage target. This capability can reduce the load put on the existing network infrastructures since only changed data blocks are sent down-stream. These data stream optimization features are part of the base product and require no specialized appliance nor hardware to support or enable them. Another base product feature aimed at supporting operational excellence is the level and breadth of the system's ability to provide actionable and immediate status updates. Job and event alerts, reports and job logs can all be provided, (email, SNMP, printed or published (HTML or PDF)) in near-real time as they occur. Most reports can also be scheduled to run so that they are available at a specified point in time. There is also extensive logging associated with many events, processes and jobs which can be tuned and used for troubleshooting or for audit purposes. For extensive log analysis or auditing efforts, Commvault software has a Log Analytics module.

Commvault software delivers the unparalleled advantages and benefits of a truly holistic approach to data management. It is one product built on a single unifying code base and platform—which enables users to Protect, Recover, Replicate, Archive, Analyze and Search their data. For additional

insight on any of the capabilities described in this document please refer to our Books Online documentation at: documentation.commvault.com/commvault/.

▶ THE COMMVAULT® DATA PLATFORM

The Commvault® Data Platform is the heart and foundation of Commvault's data management software solution. The Data Platform is used by all Commvault data protection and recovery agents. It provides a single unified architecture platform for all of the Commvault modules. It is through the Data Platform that all data management operations integrate and share a single instance view of all information and data under Commvault software's protection for a given Commcell. The Data Platform enables the following critical capabilities which are also some of the key differentiators between Commvault and other vendor products.

- Unified platform – reduces the cost of operations across acquisition, hardware, operations, storage and control.
- Distributed Data Indexing Layer / Data Movement – virtualizes data movement across the infrastructure, accelerates access and recovery.
- Single, common, graphical management console – allows full system management from multiple local and remote access points using role based security to control access, modify and execute privileges.
- Tiered storage policies – provide multiple copy redundancy to ensure recovery, security and storage efficiency. Initial storage target media can be to tape, or disk and secondary copies can go to tape, disk or cloud, each with their own retention definitions.
- Embedded data reduction – in-line data deduplication, data compression and data encryption with no additional infrastructure or licensing, and reduces the data transfer load on existing infrastructure, thereby helping to reduce total cost of ownership.
- Actionable and immediate system status updates – provide a 360 degree view of the managed data environment. Supports email and ITSM (SNMP) alerting, detailed event, job and process logging and ad-hoc or schedulable reports for email, web or print distribution.

It is this tried and true single code base which enables and supports the IBM iDataAgent and fundamentally distinguishes Commvault from all other competing products.

▶ IBM iSERIES iDATAAGENT KEY USE CASES

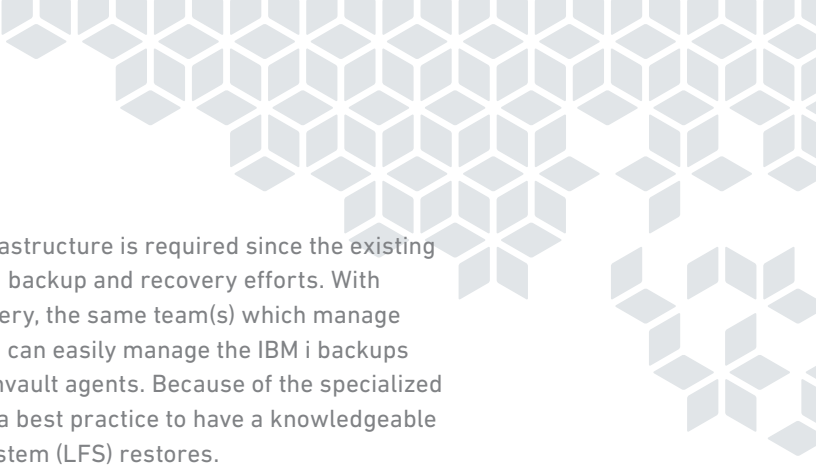
Commvault's IBM i backup and recovery agent was designed from the outset to address four main Use Cases:

1 Backup and recovery of the IBM i Integrated File System (IFS)

At the data, library and object levels, including physical and logical files, and library spool files. The agent supports Full, Incremental and Differential backups of each of the aforementioned elements, and for the non-library file system, it supports the use of Synthetic Full backups.

2 Consolidation and Cost reduction

By minimizing or in some cases eliminating islands of infrastructure, technologies and specialist expertise. Minimal additional infrastructure or operational expertise is required beyond that employed in an existing or minimal Commcell®. In fact in some deployments where Linux



systems are already being backed up, no additional infrastructure is required since the existing components can often be leveraged to support the IBM i backup and recovery efforts. With respect to the operational aspects of Backup and Recovery, the same team(s) which manage the daily operations for all other agent implementations can easily manage the IBM i backups also. Role based security is a native feature to all Commvault agents. Because of the specialized internal structure of the IBM i application libraries, it is a best practice to have a knowledgeable IBM i Systems Administrator assist with Library File System (LFS) restores.

3 Support for compliance reporting and risk management

This functionality is built-in to the implementation of the IBM i data agent. The IBM i agent relies on the well proven Commvault Data Platform and its rules based and auditable data management and schedule policies. These policies make addressing compliance and risk management requests a simple task and in many cases can be scheduled and automated. Basic reporting such as job Success and Failures, Failed Objects, detailed logging and audit trails are part of the base product. Altogether, with the base product reporting and the extended Metrics reporting there are close to 100 reports available within Commvault software to address Compliance, Risk Management and Operations and Management information requests.

4 Enabling Disaster Recovery and IBM i systems Life Cycle Management

This is another of the key use cases which the Commvault agent was designed to address. Commvault's IBM i agent supports the creation of either a "Go Save -Option 21" tape (same as BRMS) or a Minimal OS tape (equivalent to an Option 22) which is designed to enable a bare metal recovery after the ibase layer has been applied. Either of these approaches can be utilized to support the Program Temporary Fix (PTF) patching process or to recover a failed system.

One of the most advantageous aspects of the highly adaptable Commvault software architecture is that it is "Data Centric" and not host-centric as are many legacy systems. Legacy backup and recovery systems, (such as TSM¹ and BRMS) often use the host system as the focal point for all backup and recovery operations. All data on the host are considered to be of equal value and are managed the same. It is a one size fits all philosophy. Commvault recognizes that not all data on a host are necessarily of equal value to an organization. Therefore the Commvault backup agents allow the management of datasets according to user defined standard policies which may be used within and across different platforms. The data is the focal point. Separating the data into logical subsets enables the ability to manage the data according to its importance, value, restrictions, content and retention needs. Even migrating data from one host to another (out of place restore) is quite simple. When data is managed separate from the OS, it allows the OS Bare Metal Recovery backups to be used to initiate new systems without pre-existing data clutter.

► SUPPORTED IBM i SYSTEMS

The Commvault IBM iDataAgent supports the IBM i/OS versions 6.1, 7.1, 7.2 and 7.3 (Mod 0) on the IBM PowerPC (PPC) platform. PowerPC systems 5 through 8 are supported. The IBM iDataAgent utilizes the published IBM API libraries to manage the data collection from, and the restoration of data to, the IBM i IFS. The complete IFS Library and the hierarchical file system structures are supported in accordance with the rules and limitations of the OS version in use.

The Commvault iDataAgent has a minimal footprint on each Logical Partition (LPAR) on which it is installed. The agent also requires a location for the job results and logging directory. Other

¹ With the End of Support (EOS) of TSM 6.2, access to TSM Servers through the TSM API on IBM i will also reached EOS. TSM 6.2 was the *last* version of TSM to support IBM i. *No further versions of TSM will have API support for IBM i.* IBM Tivoli Storage Manager (TSM) Version 6.2 reached End of Support (EOS) on April 30, 2015.

requirements include the use of a TCP/IP port with sufficient bandwidth to manage the data backup load within the planned backup window. The agent uses a Linux Proxy for data streaming and communications between the IBM i and the data repository target, (Figure 1).

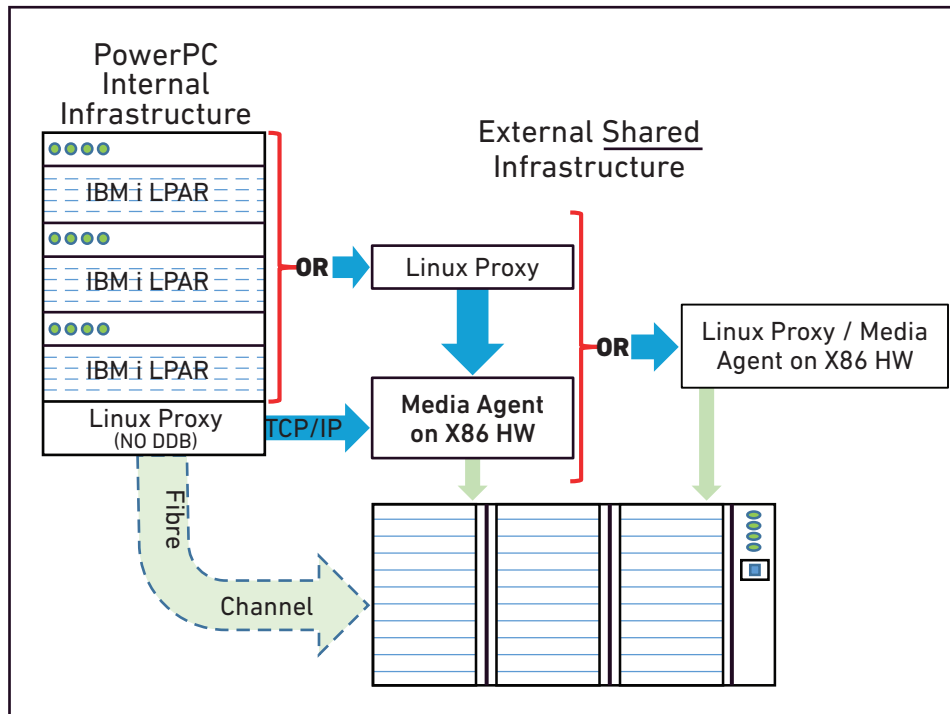


FIGURE 1: Linux Proxy Architecture Options

The Linux Proxy can be either a physical or virtual system and can be hosted on the IBM i host system (as a Linux LPAR) or be a separate entity on its own. If deduplication is to be used the Media Agent managing the deduplication database must be on an X86 architecture system.

► COMMVAULT® COMMCELL® LOGICAL HIERARCHY

Similar to IBM's BRMS Control Groups and Policies, Commvault software uses Backup Sets, SubClients and Policies to allow the complete and unattended data protection for the IBM i application libraries, objects and files. Figure 2 below illustrates the relationship between the logical hierarchy of Client systems, Data Sets, and subclients as depicted within the system's graphical interface.

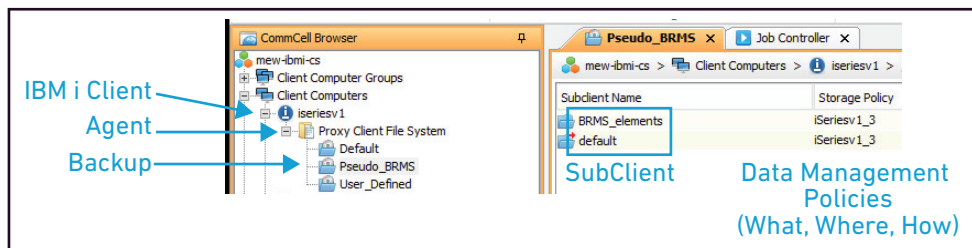


FIGURE 2: Client, Backup Set and SubClient Logical Hierarchy

BACKUP SETS AND SUBCLIENTS

A Commvault CommCell environment employs logical management of production data, represented as a hierarchical tree structure. Agents manage production data by interfacing with the file system or application. The agents can be configured according to the type of data being protected (e.g. database vs. file). Data protected by these agents is grouped into backup sets and within a backup set one or more subclients may be used to map out specific data. Specific subclients might be mapped out based on business rules which revolve around data value or regulatory requirements. The separate backup sets and subclients provide flexibility for the grouping of data into logical containers, which can then be configured and managed independently in the protected environment.

STORAGE AND SCHEDULE POLICIES

These define the *What, Where, When, and How* of the backup regime. A storage policy manages subclient data based on business requirements, even when the data resides on multiple different servers in the backup environment. A storage policy defines a specific set of rules to manage the associated data; which data will be protected (which subclients); where it will reside (the data path and tape or disk library/target repository); how long it will be kept (retention settings); and other media management options such as copy distribution, deduplication, compression, and encryption. The primary copy of the backed up data is typically stored on local disk libraries for quick access. Additional copies of the data can be automatically created from the primary copies already in the protected storage environment, and forwarded to other libraries and locations for consolidation, auditing, business continuity/DR, or ease of out-of-place recovery.

BRMS EQUIVALENCY

As part of the IBM i IFS backup capabilities, Commvault software provides a pre-defined subclient definition that can be used to match the standard BRMS control groups used in their Save Group Options (21, 22 and 23). Figure 3, illustrates the Pre-defined BRMS Equivalency SubClient Option.

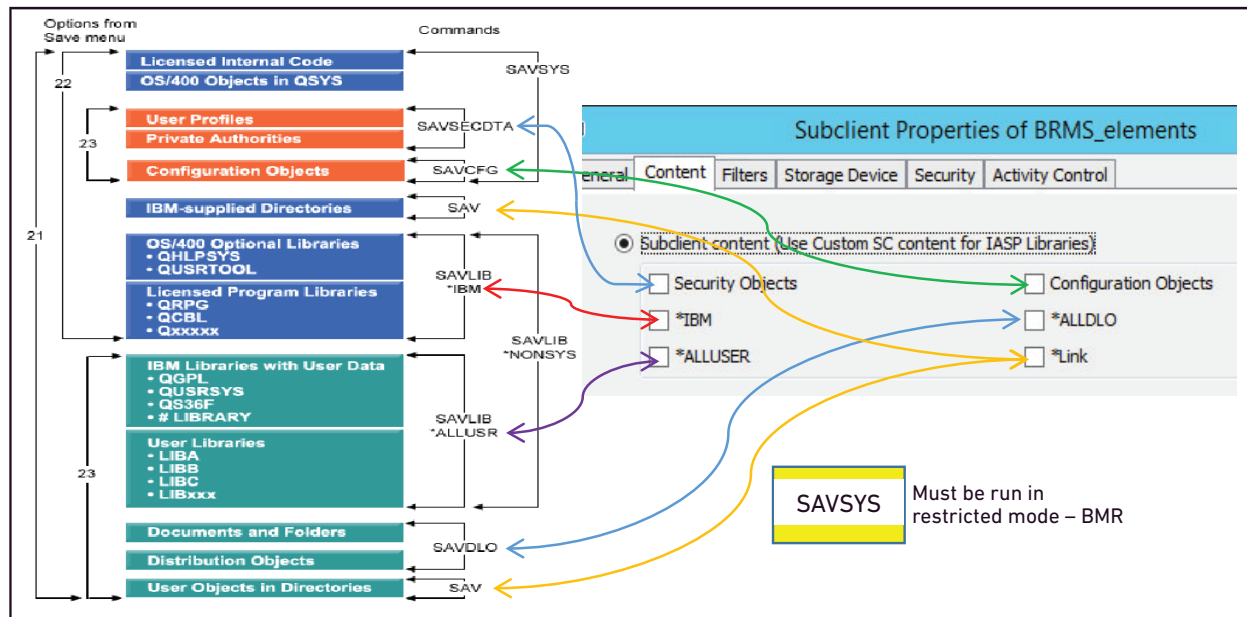


FIGURE 3: BRMS Equivalency SubClient Content Options

Selecting all six of the BRMS equivalent Control Group check boxes in the Commvault Pre-Defined subclient interface would backup the same data set as a Go Save Option 21 – *with the exception that it would not be a bootable image*. To achieve a true bootable OS image Commvault offers several options:

- A Minimal OS Tape – equivalent of the BRMS Option 22
- A true GO SAVE Option 21, which provides the full system save image (requires the system to be in a restricted state)
- And the ability to actually call a user’s BRMS scripts from within the Commvault backup routine via the pre- and post-script ports.

Any bootable image backups require the system be in single user, restricted mode. Table 1, provides a comparison of the Commvault options to the BRMS options. In addition to the pre-defined subclient option, Commvault supports the IBM i data groups and IASPs with the ability to use custom, user defined subclients. These user definable/custom subclients can be used to backup very specific libraries, objects or files. Custom subclients allow the user to maximize the benefit of Commvault’s “Data Centric” philosophy and manage their data at the level of granularity that makes the most sense for their business needs.

The custom subclients can also facilitate the migration of specific data sets from one LPAR to another or the life-cycle management of application libraries and files. The goal of having custom subclient content is to make the overall IBM i data management tasks more flexible, easier and responsive to real business needs. It also has the added benefit of enhancing operational excellence by providing a setup and usage approach which is common across all Commvault backup and recovery agents. Backing up quiesced application libraries via their own subclients and independent of the OS reduces the overall time needed to achieve a backup of the entire system because the backup jobs can be run in parallel and since the data is backed up separately, a Minimal OS Tape can be generated in a much shorter time than a full GO SAVE Option 21.

IBM i DEFINED “PARTS OF THE SYSTEM”	COMMVault PRE-DEFINED CONTENT	COMMVault BMR/MINIMAL OS TAPE	COMMVault USER DEFINED CONTENT	COMMVault & BRMS GO SAVE - OPTION 21	BRMS OPTION 22	BRMS OPTION 23
Licensed Internal Code		YES	X	X	X	
OS/400 Objects in QS YS		YES	X	X	X	
User Profiles	Security Objects	YES	X	X	X	X
Private Authorities	Security Objects	YES	X	X	X	X
Configuration Objects	Configuration Objects	YES	X	X	X	X
IBM-Supplied Directories	*Link	YES	X	X	X	
OS/400 Optional Libraries	*IBM	YES	X	X	X	
Licensed Program Libraries	*IBM	YES	X	X	X	

IBM i DEFINED "PARTS OF THE SYSTEM"	COMMVault PRE-DEFINED CONTENT	COMMVault BMR/MINIMAL OS TAPE	COMMVault USER DEFINED CONTENT	COMMVault & BRMS GO SAVE - OPTION 21	BRMS OPTION 22	BRMS OPTION 23
IBM Libraries with User Data	*ALLUser	(1)	X	X		X
User Libraries	*ALLUser	(1)	X	X		X
Documents and Folders	*ALLDLO		X	X		X
Distribution Objects	*ALLDLO		X	X		X
User Objects in Directories	*Link		X	X		X

(1) Only the Commvault Libraries (CVLIB) & CVLIBOBJ and user profile (CVADMIN, CVBKP), are included

TABLE 1: Commvault Pre-Defined Content and Minimal OS Tape image vs. BRMS Options

The Library File System architecture used by the IBM i application libraries is unique. It is an object oriented file system relying heavily on the internal DB2 database of the OS to manage application libraries and their objects and members. Hence, like other of Commvault's application aware and database agents, the IBM iDataAgent must be aware of the elements it is working with, their type and relationships (physical, and logical associations and hierarchy) to other elements and their current state.

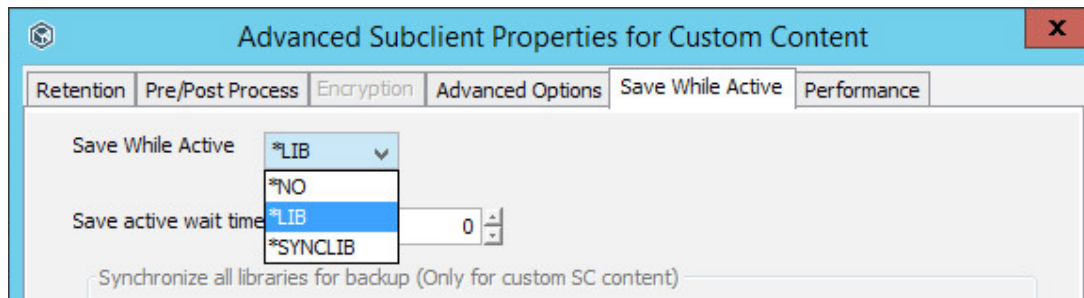


FIGURE 4: Save-While-Active Options

Many of the application libraries need to be quiesced and/or synchronized before being backed up. Several options are allowed for by the IBM i API for managing this need. Commvault software uses the Save-While-Active API (Figure 4), to enable consistent backups of these database dependent application libraries.

In tandem with these Save-While-Active options, are settings for Wait-Time which determines how long to pause for the libraries to quiesce and synch. If they fail to reach a synchronized state the item will fail and the backup will proceed. Failed items will be listed in the log files, the job details and the Jobs Report and if desired an email or SNMP alert can be generated. As shown in Figure 5 below, there are additional enablement settings for the SYNCLIB option.

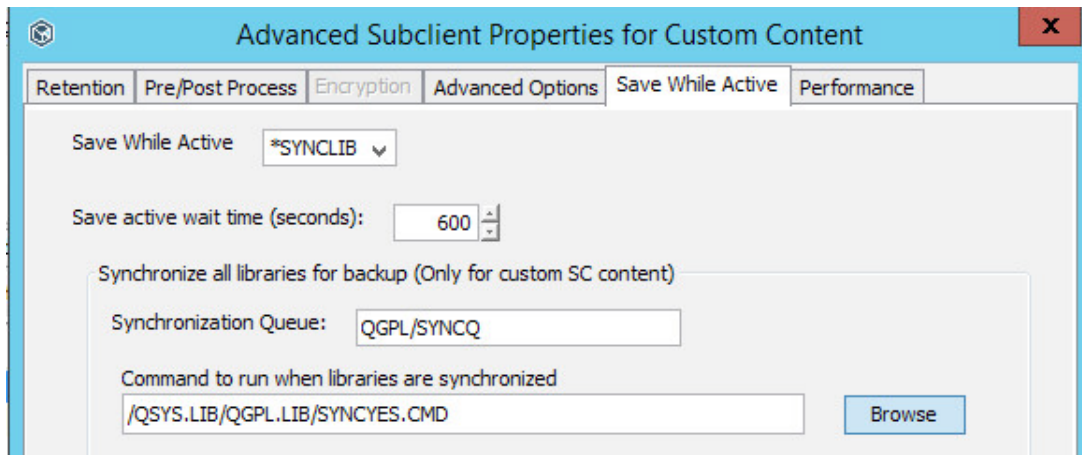


FIGURE 5: Save-While-Active SYNCLIB Options

The Synchronization Queue is used to specify the message queue that the IBM i save operation uses to notify the user that the checkpoint process for a library is complete. If there is a command that needs to be run to synchronize an application, it can be set in the synchronization command line field. Commvault software also supports pre- and post-scripts for all backup and restore jobs. The order in which these commands would be executed (if they were all used within a single job) is: 1) *Pre-scan script executes* – Scan process runs – 2) *Post-scan script executes* – 3) *Pre-backup script executes* – 4) *((SYNCLIB) Synchronize the libraries to reach check-point)* – 5) *(Command to run after Synchronization)* – Backup process runs – 6) *Post-backup script runs*. Note that any failure in this chain of events can cause the backup to restart or fail as determined by the user and if desired, an email or SNMP alert can be generated.

LOGGING, ALERTING AND REPORTING

Commvault software provides a detailed Job Log report and options to define the level of detail provided in the report and whether the report should be printed out or not. This Job Log report details all activities, errors, and data elements processed during the backup of the Library File System. Similar information for the hierarchical file system is also available through the base Commvault reporting user interface. As part of the normal software installation Commvault includes a wide variety of reports for Operations, Management, and Users which provide insight and detail on virtually every aspect of the CommCell and its backup jobs, and data recovery information (Job Catalogue). These reports can be either generated ad-hoc, or scheduled. In addition to these standard base system reports, Commvault also offers an advanced Metrics reporting capability with an additional several dozen specialized reports and the ability to build custom reports.

The Job Catalogue is always available in Commvault either as part of the Commcell management GUI and job history, or as one of the base reports. Using the interactive GUI allows the user to simply select a job and derive further information and details about the job, or to even begin a data restore operation. The same information is available in report form which can then be printed or forwarded to interested parties via email.

As part of the overall system management, operations effectiveness, security and compliance capabilities of the system, alerts for many different types and levels of events can be generated.

These alerts can be send via email, SNMP to an ITSM environment or as notifications to the open console.

Commvault software’s native system provides extensive system logging options for all backup and recovery processes occurring across each infrastructure component, (Client, Proxy, Media Agent and CommServe). These logs can provide a wealth of information useful for audits and troubleshooting. Logs are in ASCII text form allowing them to be perused via standard text editors. Commvault also provides a tool which can be used to access and search for key events within and across the logs. For more advanced and larger environments Commvault also offers a Log Analytics tool which is applicable for correlating events well beyond just the Commvault log environment.

While not a common necessity for daily operations, from time to time it is useful to be able to check on the backup and recovery job processes on the IBM i. Figure 6 shows the Process, IBM i Job Name and the resulting Log file name on the IBM i. The default log directory on the IBM i client system is “/var/commvault/log” and the default location for the job results directory is “/var/commvault/jobresults”.

Every backup job uses a pre-start job “QANEAGNT” to execute the backup commands. Any errors generated during the backup will also be logged under this job.

PROCESS	JOB ON IBM i	LOG FILE NAME
Services	CVD	cvd.log
Scan	CVSCN	cvscan.log
Backup	CVBKP	cvbkp.log
SYNCLIB Backup	CVBKP, CVBKPCTL, CVBKPDRV, CVBKPEXT	cvbkp.log, cvbkpdrv.log, cvbkpcti.log
Restore	CVRST	cvrest.log
Browse	BROWSEDRV	browse.log

FIGURE 6: Log File Names on the IBM i

To check the job log for “QANEAGNT”, the IBM i administrator can use the “WRKJOB JOB(QANEAGNT)” or “DSPLOG JOB(QANEAGNT)” to access the job log files on the IBM i green-screen.

In the event that Commvault’s support team is called on to assist with troubleshooting, the Commvault job console provides a semi-automated method of collecting all related and necessary log files, bundling them together and submitting them to the support team as part of a trouble ticket. For backup and restore logs, choose the option “Send logs” or “View logs” from the job console. The retrieved logs will contain logs from the following systems; IBM i client, Linux Proxy, MediaAgent, and the CommServe.

RESTORES

As described earlier, Commvault separates data backups from the operating system backups for operational efficiency and to minimize IBM i system downtime. Therefore, with the exception that if the native IBM i, BRMS or Commvault GO SAVE Option 21 was used, the data recovery is done separately from the operating system recovery.

DATA RESTORE

Simply stated, what Commvault software backs up, it can restore in a like manner, meaning library, object and file level restores are fully supported and physical and logical file relationships are maintained. All of the IBM i operating system rules and restrictions applicable to what and where data elements can be restored must be adhered to.

Data restores to both the IASPs and the Library File System are supported as are restores of the IASP non-Library data to a non IBM i system such as UNIX or Linux. With respect to the Library File System (LFS) there are several advanced restore options available;

Advanced LFS Options

- 1 Restore to a different auxiliary storage pool (ASP)
- 2 Restore deleted items
- 3 Exclude files and directories from the restore
- 4 Add a suffix to each file that you restore (map file)
- 5 Restore the private authority with the object
- 6 Restore spool files
- 7 Allow object differences (has sub-options)
- 8 Force Object Conversion to current operating system version
- 9 Job Log output (list, print)

SYSTEM RESTORE

The IBM i OS to a very large degree dictates how Full System, or Bare Metal Recoveries must be done, at least the initial steps of the process. Commvault software uses the IBM i Command Line Interface commands to define and initiate the OS System backups and restores. Note that none of the system level backups described here include the ibase stage. The ibase must be taken from the IBM provided media or some other alternative media. Commvault provides the ability for the IBM i administrator to generate a GO SAVE 21 Full System Backup which will cover the entire IBM i LPAR, system and data. All system level backups meant for system level recovery, require the system to be in a restricted state during the time of the backup. Commvault software also provides for a much reduced, Minimal OS or Bare Metal Tape. This tape recovers the system and the Commvault binaries to the point that data can be restored to the system. One of the major advantages of this option is that the IBM i system is in restricted mode for a much shorter period of time since all of the data has been backed up separately. The Minimal OS Tape allows the administrator to bring back a bare system without legacy data, and to lay down a new data footprint based on previous data backups.

A Minimal OS, or Bare Metal Recovery Tape includes the following system components:

- SAVSYS
 - LIC - License internal code
 - OS/400 Objects in QSYS
 - SAVSECDTA
 - » User profiles
 - » Private authorities
 - SAVCFG (configuration objects)
- *IBM Libraries (system libraries)
- System libraries with user data: QSYS2, QGPL, QUSRSYS
- Commvault Libraries: CV*
- System files and Commvault binaries with logs
- /QIBM/ProdData
- /QOpenSys/QIBM/ProdData

Once the system has loaded, and the Commvault processes have started, the user simply points the IBM i to the appropriate Linux Proxy via the management GUI and then selects the backup Job(s) or data to be restored.

▶ SUMMARY

The Commvault IBM iDataAgent supports all of the requisite levels, granular as well as type, of data protection, recovery and management that the IBM i OS and IFS architectures necessitate while at the same time providing the operational efficiencies, flexibility, reliability, and reporting necessary to meet the most stringent business and operational needs. Commvault's IBM iDataAgent relies on the same proven Commvault Data Platform that has enabled Commvault as a company to be in Gartner's top leadership quadrant for six years in a row. No single other product on the market has the same level of data protection assurance, operational efficiency, copy management, data reduction, alerting, reporting and overall flexibility that Commvault supports. As is normal for Commvault products, with each release of the agent, new features and capabilities become available and will continue to do so.

- ▶ We can help you transform your data into a powerful strategic asset, with data protection and information management solutions that enable you to protect, access and use all of your data — anywhere and anytime. Learn more at commvault.com.

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