

**IBM Rochester Systems Lab Services
PowerHA Tools for IBM i**

**Full System FlashCopy
Manager
Users Guide**

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Version 5.2**

The most recent version of this document and updated information can be found online:

<http://ibm.biz/PowerHATools>

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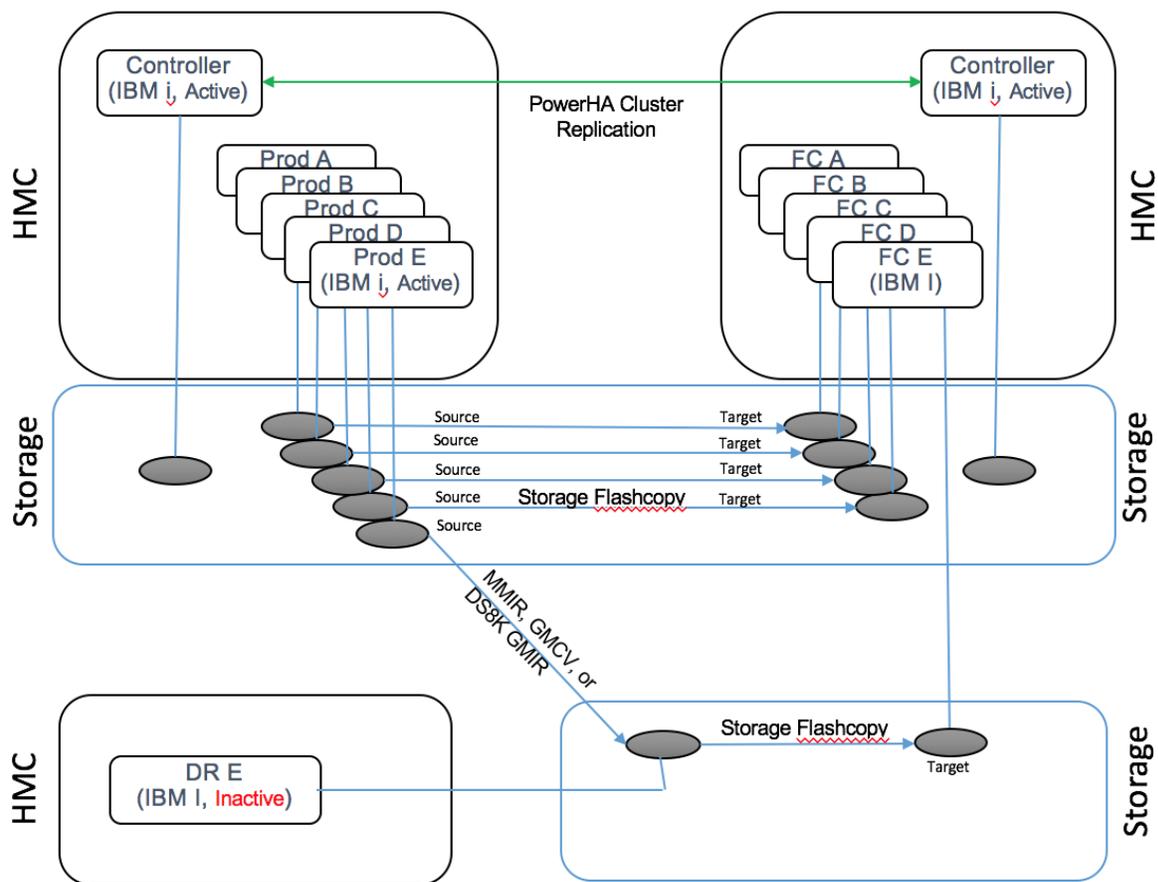
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Introduction

The following picture shows an overview of the PowerHA Tools for IBM i – Full System Flash Copy (FSFC) relationships between various entities involved in a HA and/or DR architecture for an IBM i environment.

Overview of Full System Flashcopy topography



*It is recommended to have 2 Controlling LPAR(s), but the toolkit will function properly with one.

Note: Any reference to SVC in this document applies equally to V5000, V7000, V9000 and other Storewize products such as the FS9150 etc.

The Controllers manage the FlashCopy relationships. They communicate with the storage, HMC, source and Target LPARs. All FSFC configuration details are stored on the Controllers in PowerHA Device Data Domains. It is encrypted, as well as sensitive communications with the production and Target LPARs. Communication with the HMC and storage is performed via ssh, DSCLI or REST APIs, which is also secured. Each controller is standalone, and using PowerHA they are kept synchronized.

The ‘source’ LPAR is usually the production LPAR, but other LPAR’s (development, QA, etc) can also be the ‘source’ of a Flash Copy. The toolkit will perform several actions on the Source LPAR to prepare it for Flash Copy, such as flushing memory, holding database transaction, preparing BRMS, etc. When the Source LPAR is suspended in preparation for Flash Copy, it cannot communicate with the storage to trigger a FlashCopy, thus the controller is required to perform this task.

The ‘target’ LPAR is the one attached to the Flash Copy LUNs, and is usually used for backups, but can also be utilized for data mining, UAT, or any other purpose where a nearly identical copy of the Source LPAR is required.

Storwize products which include an SVC are supported. DS8K products are also supported. All other storage products (for example XIV or non-IBM storage) are supported when attached to an SVC as managed disks.

Flash Copy is a technology contained within one storage unit. Thin-provisioned / Space-efficient, full and incremental flashcopies are supported by the FSFC Toolkit. Remote Flash Copy is possible when using replication:

- DS8K and SVC synchronous (Metro Mirror) replication
- DS8K asynchronous (Global Mirror) replication
- SVC snapshot (Global Mirror w/Change Volumes) replication

SVC asynchronous (Global Mirror) replication without Change Volumes does not support remote Flash Copy.

What’s new in 4.2

Full System Flash Copy was originally introduced at version 6.0 in an older family of the Copy Services Toolkit, and continued until version 7.70. The older toolkit did not require PowerHA. In 2017 we merged the 7.70 toolkit into our main family of toolkits (PowerHA Tools for IBM i) and switched to use the versioning sequence of that toolkit. That’s why an upgrade from 7.70 yielded version 4.2.

Some literature refers the “Version 1” and “Version 2” of the toolkit. Version 1 included all releases of Copy Services Toolkit up to and including 7.70; Version 2 starts with 4.2.

These are the primary enhancement which were added to Version 4.2:

- Multiple Controlling LPAR(s) for redundancy and resiliency
- All sensitive data stored and transferred is encrypted
- FlashCopy can be triggered from controlling or Source LPARs
- Simplified and improved interfaces and new commands for ease of use
- Less time required for deployment
- All communication is via IP addresses (no dependency on name resolution)
- Controller and Source toolkit code levels can be different for staging upgrades
- Improved platform for future features

- Integrated into same library (QZRDHASM) and release as IASP and Full System Replication Toolkits
- Use any DS8K user profile, not just QLPAR

Significantly, 4.2 requires PowerHA Standard Edition to be installed on the Controlling LPAR(s).

What's new in 4.3

Version 4.3 addressed several concerns our customers had:

- Support for more than approximately 11 FSR and FSFC CSE Data's. We have restructured how we use the PowerHA Device Data Domains and Cluster Resource Groups to allow the toolkit to create more CSE Data's. The upper limit is now in the thousands, far more than anyone would reasonable need to have. However, since the structure has changed, it is not compatible with 4.2 DDD's and CRG's. Upgrading from 4.2 to 4.3 will require recreating all the environments.
- Faster BRMS transfer speeds. Prior to version 4.3 we used a savefile to move BRMS from the flashcopy target to the source LPARs. The performance bottleneck was writing the records to the savefile in 528 records. FSFC 4.3 utilizes virtual tape instead, which sends all of its I/O through the IFS, and we are able to tailor the writes to 32k or 64k at a time, dramatically increasing the transfer rates. In our lab we have seen 5-6 times faster transfer rates, even including encrypting the data.
- Backwards compatibility. The toolkit philosophy is that the controller will be able to communicate with a production LPAR which is at most one release behind. Thus, a 4.3 controller can communication with a 4.2 or 4.3 production LPAR.
- Additional information is gathered during DMPINF to allow for validation of installation using just the zip file.
- Additional safeguards against the target LPAR starting the production LPAR startup program and coming online by modifying the startup program to call QZRDENDSBS.
- Recovery Flash Point allows the user to create frequent FlashCopies of the production LPAR for the purpose of recovery, not backups. This is a good option to create a point in time copy which can be used to protect against ransomware, corruption, or to provide a quick and easy way to revert to a pre-batch-processing state.
- Commands SAVDDD and RSTDDD to save and restore Toolkit device data domains.

What's new in 4.4

Version 4.4 added limited Full System CSM support and Physical-Virtual Isolation (PVI) of the production LPAR. This support ties into the DS8K SafeGuarded Copies feature. In addition, various tweaks and renaming of standard FSFC and FSR concepts have changed.

The limit for the number of CSE environments (WRKCSE) was lifted from approximately 60 to over one thousand

Customers who are not using CSM/SafeGuarded Copies or PVI and don't need the increased number of environments should stay on version 4.3.

In addition, many minor tweaks and defects have been addressed. Please review the FSFC Webpage (<https://ibm.biz/PowerHATools>) for the latest updates.

What's new in 4.5

Version 4.5 saw the addition of a number of significant new features as well as many minor enhancements. FSFC and FSR are better integrated.

Note that version 4.5 is not supported on IBM i 7.1 and the toolkit will be built and saved on version 7.2.

The list of features includes:

Major feature enhancements:

- Full system LUN switch
- CSM support for FSFC and FSR operations

DS8K enhancements:

- Cascading flashcopies on DS8K
- Support for DS8K host and volume mapping
- GMIR ESE D-Copy support

Storwize enhancements:

- View and change SVC copy and cleaning rates

FSFC enhancements:

- Wait for incremental copy to finish (USETARGET *COPIED)
- STRFSFLASH from source LPAR to either controller
- Prompt for HMC LPAR and profile names
- Prompt for backup command
- Before FSFC ensure target not running on source LUNs
- CHK commands warn if log files > 20 MB
- WRKCSE opt 16 (LUN mapping) counts LUNs
- Allow QSTRUPPGM *NONE
- Clean up useless and confusing log entries
- CHK/STRFSFLASH checks QLPAR isn't disabled or expired and as *ALLOBJ, *IOSYSCFG and *SECADM on the source
- List IP addresses that don't match when doing remote STRFSFLASH
- CSEDTA SHUTDOWN(*NO) and RESTART(*NO) changes to *YES/*NO
- FSFC support for virtual IP

- Send FSFC Finished to QSYSOPR as program messages
- Support for aggregate communication lines
- Turn off DS ping in CHKFSFLASH/STRFSFLASH
- QSTRUPPGM can be *NONE
- STRFSFLASH is aware of DS8K Hyperswap status
- Ensure target is not running on LUNs to be flashed over, if target is not to be shut down.
- CHKFSFLASH will warn if ctl.log is greater than 20 MB
- Warn or Fail if source LPAR is set to IPL to restricted state
- If ENDFSFLASH is unable to reach the source LPAR then try the IPs listed in WRKSTRPRSC *CMN

Enhanced integration with BRMS:

- ENDFSFLASH *CLNDYNMED also cleans up functional usage authorities
- CRT/CSEDTA allows for prompting of backup and shut down commands
- Enable FSFC pause/resume for BRMS Xfer method *ALL
- BRMS *SYSBAS custom timestamps
- Monitor BRMS control groups that end abnormally
- Display control group status while in batch restricted state
- Export BRMS backup logs to the controller (or any tagged joblog)
- On BRMS transfer *CHGONLY include BRMS files QA1AZCG (Control group status) and QA1ADXR (duplication cross reference file)

General enhancements:

- Migration of data from prior releases to 4.5
- Additional options on WRKCSEDTA
- WRKCSEDTA has more validations
- Log when explicit DDD lock commands are called

What's new in 4.6

Version 4.6 saw the integration of Safeguarded Copy for SVC and PowerVS Cloud services.

- WRKCSECRDL was changed to allow entering PowerVS API Keys, Cloud ID's and URNs
- WRKCSE Cloud environments to enter PowerVS instance IDs

Other features added:

- Memory flush option *NONE
- WRKCSEDTA filtering, position-to and option 15 = display log with auto refresh
- ENDFSFLASH *TAGJOBLOG works for normal FSFC BRMS operations, not just PVI.
- New exit points *PRERESTORE, *BRMFINTGT and *FAILNFY

- Concurrent control group backups
- Choose whether to ignore control groups which end in error.
- Delay to accommodate Storwize Volume Protection
- Support for BRMS Cloud Object Storage
- Memory flush method *NONE
- WRKCSECRDL Validation (option 6)
- QIPLDATTIME set to *NONE on the target
- WRKCSEDTA Option 15 – Auto-refresh log
- Check that QLPAR on the source is neither disabled nor expired and has *IOSYSCFG, *SECADM and *ALLOBJ
- Added commands CHKFSRFLSH and STRFSRFLSH
- QZRDIAEXT2 on the source LPAR will log incoming IP addresses in debug mode
- Restoring QUSRBRM requires that file level ID's match
- SAVDDD gets new parameter *GEN
- SAVDDD and RSTDDD have more log messages
- WRKCSEDTA F7 = WRKACTJOB SBS(QZRDFSR)
- Support for BRMS restricted state IP's with PVI
- Support for controller hostnames up to 63 characters
- Activation Engine Cloud-init automatically disabled

What's new in 5.1

Version 5.1 continued to provide updates and improvements to PowerVS FSFC and compatibility with new FlashSystem options. Additional improvements include:

- PowerVS FSFC streamlined for faster and more efficient volume operations
- PowerVS FSFC supports multiple source VMs sharing a backup VM
- New command WRKCLDVOL to manage PowerVS volumes
- New commands DSPCLDCLNL, CNLCLDCLN, DLTCLDCLN to assist with managing PowerVS volumes-clones
- New command STRCLDPVM to IPL PowerVS VM
- Improved iSCSI management; no need for environment variables
- PowerVS DSI Integration
- SETUPFSFC includes the choice of whether to migrate DDD information
- Controller log (ctl.log) displays time of source LPAR
- Remote FSFC can use custom timeout value
- BRMS Xfer *CHGONLY uses commitment control for faster SQL inserts

What's new in 5.2

Version 5.2's primary improvement was to support FlashSystem volume group flashcopy. Additional improvements include:

- Accommodate 7.5 changes to BRMS exit programs and commands
- Internal changes to use REST API's instead of ssh command lines
- Startup program is not changed on the target LPAR
- Don't delay if iCC volume xfer if iCC isn't installed
- Removed BRMS lock *TGTONLY etc. *SRCONLY will be performed by default.
- Removed BRMS lock type *HOLD and *BOTH (*FCNUSG will be automatic)
- References to PVM replaced with VSI (Virtual Server Instance)

Planning

Planning for FSFC installation is part of the services engagement associated with purchasing this product. This includes ensuring that all requirements/restrictions are followed. An overview of the Requirements and Restrictions is included below.

Requirements

Prior to the start of installation, the services representative must ensure the following requirements have been met. As this information can frequently change, please refer to the requirements published on our websites:

<http://ibm.biz/PowerHAToolsCompatibility>

<http://ibm.biz/FSFCManager>

Running FSFC jobs in another subsystem

FSFC jobs run in subsystems QZRDFSR and QSYSWRK. Any jobs submitted by the toolkit will use job description QGPL/QLPARJOB, which specifies job queue QSYSNOMAX. Modify that job description if the jobs must run elsewhere. Keep in mind that multiple threads/jobs may be needed to a single-threaded subsystem is inappropriate. Job description QLPARJOB is created by SETUPFSFC.

Clustering Security Requirements

*Note: Some of the TCP/IP servers used by clustering require that the QUSER user profile's STATUS = *ENABLED and that it does NOT have *SECADM or *ALLOBJ special authority. It must also NOT be expired. If this is not possible, the file /QIBM/ProdData/OS400/INETD/inetd.conf must be changed to use a different profile that matches these requirements.*

Edit File: /QIBM/ProdData/OS400/INETD/inetd.conf

Record : 10 of 20 by 10

Column : 1 76 by 126

```

Control : _____
CMD ....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8..
# ##### DO NOT MODIFY THIS FILE #####
#
# Any changes made to this file will be lost during release upgrade.
# User-defined services may be defined in file:
# /QIBM/UserData/OS400/INETD/inetd.conf
#
#
# Clustering
as400-cluster stream tcp wait QUSER /QSYS.LIB/QCSTINETD.PGM QCSTINETD
#
*****End of Data*****

```

The ALWADDCLU (Allow Add to Cluster) network attribute must be appropriately set on the node if trying to start a remote node. This should be set to *ANY or *RQSAUT depending on the environment. If set to *RQSAUT, then -- Digital Certificate Manager (57xxSS1 Option 34) on IBM i 6.1, or later release must be installed. This value can be changed back to ALWADDCLU(*NONE) after adding it to the cluster.

To change the ALWADDCLU (Allow Add to Cluster) network attribute, use the following green screen command:

CHGNETA (Change Network Attributes)
Specify ALWADDCLU = *ANY or *RQSAUT

Note: This applies only to the controlling nodes.

Requirement to coordinate QTIME between managing partitions

To prevent simultaneous operations on the same environment, a cluster wide lock per environment has been added, set at the start of SWPPRC, SWCSE, CHKPPRC, CHKCSE and STRFLASH etc. operations and released at the end. The default time for automatic release of the lock is 15 minutes, and the time-of-day for the timeout is calculated and communicated to the other nodes in the cluster. Therefore, it is preferable to make sure that the QTIME system value on all systems contain the same time-of-day. You should consider use of the Simple Network Time Protocol (SNTP) TCP server to automate keeping the time synchronized.

Note: If systems are in different time zones or the system times are significantly different, then this locking will work only on the local system.

Setting up Full System Flash Copy

Considerations

At setup time, the source system will be running, and all resources required for that partition will be known to the system. However some information about FlashCopy target node resources may not be known until that node is activated for the first time. Some of this information can be inferred from LPAR number and resources. The IP addresses for both the source and target should be known prior to starting the setup.

The Controller partitions do not need to be dedicated to this purpose. They can be any other partition available, i.e., dev, QA, etc. They need to be able to communicate with the source and target partitions they will manage via TCP with the Full System Flash Copy tools. However, PowerHA Standard Edition is required, and is licensed according to the number of cores used. It may be more economical to create a small dedicated Controlling LPAR(s).

System name vs. LPAR name

The system name is stored in *SYSBAS via the CHGNETA command. Thus when the Target LPAR is active, it sees its system name as that of the Source LPAR. The LPAR name is stored in the hosting HMC, and is not modified during Flash Copy.

System serial number and software licensing

The serial number is stored in the hardware and if the Target LPAR is on a different system, the serial number will be different between the source and Target LPARs. Licenses for 3rd party software that depend upon a specific serial number will need to be adjusted after a switch. The new RTVLPARINF command can be used to determine the current LPAR for the system. The new RUNLPARCMD command can also be used in the startup program to make changes. Licenses for FSFC allow multiple serial numbers and will not require adjustment. You should check with the vendors of other licensed software to determine how to install serial-number-based licenses for their products.

The FSFC Toolkit requires a valid license for the controlling and Source LPARs. It does not check for a license on the Target LPAR.

PowerVS Licensing is done on a subscription model and must be renewed on a regular basis, and can be purchased in one-year increments. It is recommended that VMs be 'hard pinned' to prevent serial numbers from changing, which will require additional licenses to be issued.

IP addresses

The IP addresses and subnetwork of an LPAR may need to change as part of a switchover. The IP addresses and line descriptions for the Target LPAR must be configured on the Source LPAR so that after a Flash Copy, they are available to the Target LPAR. The FSFC Toolkit will control which line descriptions and IP addresses are activated on the source or Target LPARs. Prior to the Flash Copy, the line description, TCP and IP interfaces are changed to not start with the controlling subsystem; after the Flash Copy they are changed back to their original values. When the Target LPAR IPLs, the toolkit will only start the specified line description and IP interface. Route entries can also be changed.

Clustering

One or two Controlling LPAR(s) are required in a cluster. The toolkit will function with a single controlling LPAR (i.e. a single node cluster). The cluster and device domain can have any names.

The cluster function allows the CSE data to be mirrored between the control nodes so that either control node can run functions at any time.

Source LPAR Communication Agent (PVI)

The controller(s) must be able to communicate with the Source LPARs. To do so, subsystem QZRDFSR must be started on the source, controlling and Target LPARs, with pre-start program QZRDIAEXT2 handling service requests. The subsystem can be started by using command STRSBS /QZRDHASM/QZRDFSR . Use of the SETUPFSFC will stop and restart the subsystem. QZRDFSR

The Communication Agent listens on a specified port, and default port is 55920. On the Source LPAR, use the command SETUPFSFC to change the port. This information is stored in file /QIBM/Qzrdhasm/FSRPort. On the Controlling LPAR(s), the port is configured using CRTCEDTA, CHGCSEDTA or WRKCEDTA opt 2. The port specified must be the same on both the controller and Source LPAR.

FSFC and FSR use the same communication agent and port information. QZRDIAEXT2 is also used to receive QUSRBRM after a backup.

Sensitive communications between the source and Controller are encrypted.

Credentials

The Controller(s) must be able to communicate with all participants in the Full System Flash Copy environment:

1. Source Power System HMC
2. Target Power System HMC
3. Source SVC/DS HMC
4. Target SVC/DS HMC
5. Source node
6. Target node
7. CSM servers

Configuring the user profiles and passwords for the SVCs, DS HMCs, CSMs and Power Systems HMCs in the configuration is required as part of setup.

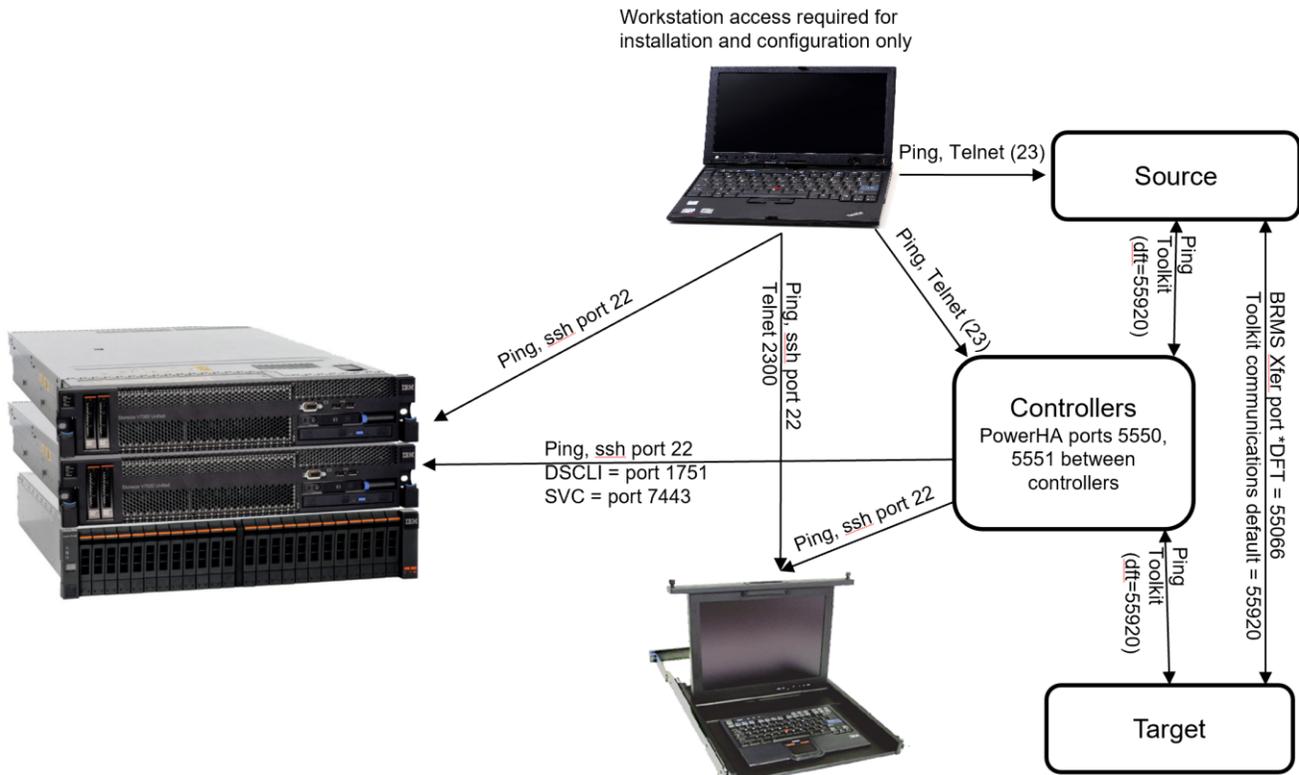
LPAR date and time

The date and time of an LPAR is stored in the HMC with offsets stored in IBM i *SYSBAS. Since only *SYSBAS, not the HMC data, is replicated to the target site, the first time an LPAR is IPLed the date and time may need to be configured. Subsequent IPLs will retain the correct date/time.

Communications ports

The following communications ports are used by Full System Flash Copy Toolkit and access must be allowed through the firewall:

- Controlling partitions to SVC on port 22 (if applicable)
- Controlling partitions to DS HMC on ports 1751/1750 (if applicable)
- Controlling partition to Power Systems HMC on port 22
- All Controllers to source and Target LPARs on port 55920 (or the port you specify)



Remote FlashCopy

A FlashCopy operation between two LUNs can only occur in a single storage unit, however the source LUNs can be the target of replication. The toolkit can manage the replication to a remote storage unit to facilitate FlashCopy there, in the following scenarios:

- Storwize using MMIR or GMCV
 - GMIR w/o change volumes is not supported
- DS8K using MMIR or GMIR
 - The toolkit will create use the D-Copy for FlashCopy purposes

For DS8K MMIR operations, there is no need to manage the replication. The toolkit Environments (WRKCSE) will use the remote storage as if it were the local one, because the MMIR target LUNs will always be synchronized with the source LUNs. Note that the FlashCopy toolkit will NOT monitor

MMIR replication status; the Full System Replication Manager (a separate feature in the toolkit) can perform this function.

For DS8K GMIR operations, two Environments must be created, *with the same name*: a GMIR environment for managing the replication, and a FLASH environment with D-Copy LUNs enabled for the Flashcopy operations. The toolkit will create the D-Copy using the GMIR ‘pause with secondary access’ function.

Storwize GMCV operations only requires one FLASH environment in WRKCSE which will contain the IP addresses of the local and remote storage units, as well as the Remote Copy Consistency Group ID’s. The toolkit will monitor the freeze points of the GMCV replication and perform the Flashcopy at the correct time. The toolkit will tolerate a freeze time as much as two hours delayed, but a much smaller (< 10 minutes) delay is recommended.

Storwize or FlashSystem FlashCopy from a MMIR target requires that replication be paused to prevent ‘torn pages’. This functionality was added in version 5.2 of the toolkit. In the WRKCSE environment, enter the source replication device IP and consistency group, and the toolkit will pause and resume replication as needed.

Object Save Timestamps on Source LPAR are not Updated

The backups occur on the FlashCopy target LPAR which means the objects on the target will have their save timestamps updated. The source LPAR objects will NOT have their timestamps updated. These timestamps are important for two reasons:

Incremental Backups

Customers with Full System FlashCopy typically do not perform incremental backups. With the ability to allow for longer backup windows, most of our customers can now perform full backups every night, allowing for much simpler recovery processes.

However, there are still a handful of customers who choose to perform incremental backups on the target LPAR. The challenge is that the objects’ save timestamps are not updated and SAVCHGOBJ will pick up all the changes since the previous full (*CUMML) or incremental (*INCR) backup *on the source LPAR*. The best way to handle this is to use BRMS. When BRMS on the target LPAR runs, it will record all the reference timestamps for the objects into file QUSRBRM/QA1ALR and move that to the source LPAR. The next FlashCopy will copy that file to the target LPAR, and BRMS will use the information in that file as the changed object reference date.

Journal Receiver Management

Many products use the save timestamp of the journal receiver to manage when it is deleted. Since there is no API for the toolkit to update the save timestamp of a journal receiver, the customer must evaluate the best method of addressing their journal receiver management.

The most common method is to save the receivers on the production LPAR after the flashcopy backups have been completed.

Another method is to change the way the receivers are managed, i.e. delete them when they are no longer needed vs. when they are saved. Note that a receiver exit program can be used to block or delay the deletion.

DS8K SafeGuarded Copies

Starting in version 4.4, support for DS8K SafeGuarded Copies was added. This is only supported on DS8Ks via CSM sessions. Interfaces were added to the toolkit to manage the SafeGuarded Copies. Creating a SafeGuarded Copy does not invoke Full System FlashCopy functions. Restoring and IPLing from the copies is not a function included in this toolkit.

FlashSystems SafeGuarded Copies

Starting in version 4.6, support for FlashSystem SafeGuarded Copies was added. This is only supported on via CSM sessions. Interfaces were added to the toolkit to manage the SafeGuarded Copies. Creating a SafeGuarded Copy does not invoke Full System FlashCopy functions. Restoring and IPLing from the copies is not a function included in this toolkit.

Physical-Virtual Isolation (PVI) for Production LPARs

In addition to SafeGuarded Copies, PVI for Production LPARs has been implemented in 4.4. Typically this involves replication from the production LPAR to a DR site, where the FlashCopy is created. There is no communication path back to the production (source) LPAR, which precludes the FSFC Toolkit from any memory flushes, changing startup programs or sending BRMS data back.

FSFC using Physical-Virtual Isolation has a different process than normal FSFC. Since there is no communication paths from the Controlling or Target LPARs to the Source (Production) LPAR, more data is stored on the Controlling LPAR. Because the Target LPAR must have some knowledge of how to reach the Controlling LPAR when it IPLs after the Flashcopy, additional data must be stored on the Source LPAR.

Memory Flush / Quiesce

The lack of communication to the Source LPAR prevents the Controller from notifying the Source LPAR that a FlashCopy is about to occur. Therefore it is not possible to flush memory or suspend database transactions on the Source LPAR prior to a FlashCopy. The FlashCopy will appear to the target LPAR as an immediate crash, with any data or transactions still cached in memory lost. To mitigate any damage to important files or partial database transactions, all important user data should be journaled, or the applications should have logical to detect and repair mid-transaction failures.

Startup Programs

The inability to notify the Source LPAR of an impending FlashCopy also means that no preparation to the Start Up program (system value QSTRUPPGM) and IPL attributes (CHGIPLA) is possible. These values must be set such that every time the Source or Target LPAR IPLs it must be able detect where it

is running and therefore take appropriate actions. Consequently, no information can be transferred to the Source LPAR prior to the FlashCopy, requiring the Source LPAR to maintain knowledge of which IP interfaces to activate when IPLing as a Target LPAR, and which Controlling LPAR to contact to continue the FlashCopy backup progress.

The Toolkit command CFGSTRPRSC must be added to the very start of the Source LPAR startup program. This command will determine where the LPAR IPLs using information from WRKSTRPRSC. If it detects that it is IPLing as a Production LPAR (*PS or *PT) it will modify the resources for that role and continue with the remainder of the startup program. However, if it detects it is running on the FlashCopy target, it will activate the correct IP address and contact the specified Controlling LPAR for further instructions.

Autostart Entries

Examine the controlling subsystem auto-start entries (WRKSBSD opt 3) to determine whether they might interfere with the FlashCopy process, or start unwanted applications on the Target LPAR. There should always at least the startup program (QSTRUPJD) autostart entry, but if additional autostart entries are used, consider moving these to the startup program, after CFGSTRPRSC, so that they are only processed if this isn't a FlashCopy LPAR IPL.

BRMS Considerations

When the Target LPAR IPLs it will:

1. Reset BRMS.
2. Connect to the Controller and retrieve the relevant BRMS records.
3. Initiate the backups
4. Perform any exit program processing (STRMNTBRM etc)
5. Upload new BRMS records and logs to the controller

Some changes to the standard FSFC process must be implemented to allow for that to happen. Since any BRMS information FlashCopied from the Source LPAR will be discarded, no BRMS changes are required on the Source LPAR.

BRMS System Name

Each target LPAR must be provided with a **BRMS System Name**. It should be chosen to reflect ownership of a source LPAR's FlashCopy backups. This name is the 'key' which correlates to the BRMS data (media and save history ownership) stored on the Controlling LPAR. There should be only one target LPAR using that BRMS System Name at a time. The BRMS System Name is entered into the CSE Data, which is retrieved by the target LPAR prior to retrieving the BRMS records.

The BRMS records transferred from the Controller to the Target are:

- Media owned by the BRMS System Name (QA1AMM)
- Save History owned by the BRMS System Name (QA1AHS)
- All media classes

- All media and move policies and locations
- All control groups

Note that the Target LPAR will not be in a BRMS network group. Neither the Source nor Target LPARs should be entered into the Controlling LPAR's BRMS network group.

BRMS Media

The BRMS media records used by the target LPAR are stored on the controlling LPAR. Since BRMS does not allow assigning media to a BRMS system which isn't in the BRMS network group, the Toolkit has the ability to change the media ownership. First, enroll and initialize the media on the Controller; then use the command CHGBRMSOBJ to change the ownership to the Target LPAR:

```

Change BRMS Object Attributes (CHGBRMSOBJ)

Type choices, press Enter.

BRMS Object type to change . . . > *MEDIA          *DEVICE, *MEDPCY...
Name of BRMS object to change . > volume_names  Object name
BRMS Attribute to change . . . . > *SYSNAME       *LOC, *MEDCLS, *MOVPCY...
New attribute value . . . . . > new_brms_name

```

Note that the volume names can be generic. The command will only process volumes which are expired and owned by the controlling LPAR, and skip others.

The CSE Data contains parameter “Minimum expired volumes”. Specify the minimum number of volumes required for the backup. At least this many expired volumes must exist in the BRMS inventory (WRKMEDBRM) and be assigned to the target partition's BRMS System Name (specified in the Network ID and BRMS System Name values). CHKFSFLASH and STRFSFLASH will fail if this number of expired media is not assigned to the specified BRMS system name.

Cloud Object Storage

If BRMS is saving to volumes which are linked to Cloud Object Storage, the toolkit will delay the BRMS transfer to the source LPAR until BRMS has finished transferring the virtual volumes to Cloud Object Storage. This is complete when there are no BRMS volumes in *TRF state. Note that the actual virtual volumes are not transferred to the source LPAR, so any restores from Cloud Object Storage enabled volumes will require accessing the remote storage.

Control Groups

The control groups must exist on the Controlling LPAR. One must therefore plan naming conventions carefully as the controller will be hosting control groups for multiple target LPARs.

BRMS control groups tolerate being created specifying libraries which don't exist on the LPAR. However, they do not tolerate specifying an IASP if there isn't a corresponding IASP device

description on the LPAR. To get around this limitation, there must be at least one IASP device description on the Controlling LPAR. Use that in the control group in place of the actual IASP name which will be saved on the Target LPAR. The Toolkit provides a command that can change the IASP names in a control group to one that doesn't exist:

```

Change BRMS Object Attributes (CHGBRMSOBJ)

Type choices, press Enter.

BRMS Object type to change . . . > *CTLGENTRY      *DEVICE, *MEDPCY...
Name of BRMS object to change . > cg_name          Object name
BRMS Attribute to change . . . . > *IASP           *LOC, *MEDCLS, *MOVPCY...
New attribute value . . . . . > tgt_iasp_name

```

There are three places where this command can be invoked:

1. CHGBRMSOBJ on the Controller LPAR prior to the FlashCopy. This will make it difficult to edit the control group, so steps must be taken to change it back to the actual IASP, then run CHGBRMSOBJ again before the next FlashCopy.
2. CHGBRMSOBJ on the Target LPAR prior to the backups running. Invoke the command as a Backup Command in the CSE Data prior to STRBKUBRM.
3. Use a WRKSTRPRSC *BRM entry on the Source LPAR. When the Target IPLs it will process the entry and change the control group as specified.

The control group should contain a final *EXIT entry which executes the following command:

```
QZRDHASM/ENDFSFLASH ACTION(*SBMNORMAL)
```

That command will submit ENDFSFLASH *NORMAL to job queue QSYSNOMAX and initiate the post-backup processing. It is not necessary to use SBMJOB with the *SBMNORMAL parameter. If you use the *NORMAL option then you will need to submit it.

Control group statistics in file QA1AZCG will be returned to the source LPAR to facilitate running the command *PRTRPTBRM TYPE(*CTLGRPSTAT) FROMSYS(<brms system name>)*.

BRMS Maintenance and Recovery Reports

BRMS Maintenance (STRMNTBRM) and creation of the recovery reports (STRRCYBRM) should be performed on the Target LPAR after the backups and before the BRMS data has been sent back to the controller. If maintenance is performed on the controller it will only process the media and save history owned by the controller, not that owned by the Target LPAR.

The best place to put these commands are in the Toolkit exit program on the source LPAR, at exit point *TGTBRMSAVF. Here's an example:

```

TGTBRMSAV:  IF          COND(&OPERATION *EQ '*TGTBRMSAV') THEN(DO)
              /* Will block */

```

```
/* Called on the target LPAR before BRMS is saved */
STRMNTBRM  PRTRCYRPT(*NONE)  PRTSYSINF(*YES)
STRRCYBRM  USRRCYINF(*ADD)
ENDDO
```

Specify the exit program on the CSE Data.

Note that the exit program must also exist on the controller, but it does not need to have the same contents, i.e. it can be empty or be coded to not perform any work.

Logs and Joblogs

The toolkit will create a temporary library on the Source and Controlling LPARs to move data between the LPARs. The name of the library is the BRMS System Name specified in the CSE Data. An output queue named QZOUTQ is created in the temporary library

TIP: Anything placed into this library at or after exit point *TGTBRMSAV will be included on the transfer to the controlling LPAR.

TIP: When ENDFSFLASH runs, the Toolkit will retrieve the joblog for any jobs with information placed on a specific data queue. To place that information on the data queue, issue this command in the job of which you want the joblog:

```
QZRDHASM/ENDFSFLASH ACTION(*TAGJOBLOG)
```

After those jobs have completed and generated spoolfiles, they will be copied to QZOUTQ and converted to streamfiles. Note that the ENDFSFLASH *TAGJOBLOG should not be run in the job that issues the ENDFSFLASH, i.e. if the backups are running in the startup job and not submitted elsewhere (it is not recommended to run the backups in the startup job).

If this is a regular FSFC operation the spoolfiles will be placed on the source LPAR in the BRMS output queue (or QUSRBRM/QZOUTQ if *PRTF).

If this is a PVI operation the spoolfiles will be placed on the controller at:

```
/QIBM/Qzrdhasm/fsfc/<CSE Data>/brmsysname_timestamp
```

To prevent CLEANLOG from removing these, and also accidental deletion, this directory and all its contents are marked "read only".

All the joblogs are converted to CCSID 1252 for viewing on PCs. Viewlog (/QIBM/Qzrdhasm/qzrdhasm.log), ctl.log and trg.log are all in the usual places. There is no src.log.

BRMS Logs

BRMS backups, maintenance and recovery reports will be executed using this outqueue. The output from *QSYS/DSPLOGBRM OUTPUT(*PRINT) DETAIL(*FULL)* will also be placed in this outqueue.

BRMS flight are zipped and brought back to the controller as well, in the BRMS logs directory, named for the CSEDTA. Only the most current copy is retained.

Log File Cleanup

Run the command CLEANLOGS on a regular basis to remove logs and directories older than the specified number of days. This will not remove the directories and files marked “read only”.

In the CSE Data, parameter “Number days to retain BRMS Logs” controls when the read-only logs and BRMS reports are changed to not read-only, allowing CLEANLOGS to remove them. This is performed at the end of the STRFSFLASH process. Note that CLEANLOGS checks the last modified date of a directory, and changing the *READONLY flag will update that date, therefore the directory will not be removed by CLEANLOGS until the specified number of days have elapsed since STRFSFLASH removed the *READONLY flag.

Live Partition Mobility (LPM) Support

In order to support Live Partition Mobility the FSFC Toolkit can search for an LPAR. To do so, when creating or editing the CSE Data, enter ‘*SEARCH’ on the ‘HMC managed system’ parameter (this must be upper case). CHKFSFLASH and STRFSFLASH will search all the managed systems on the specified HMC IP addresses and use the first LPAR it finds that matches.

Volume-Group FlashCopy

Support for Volume-group FlashCopy (VGFC) was added in version 5.2 to supplement the traditional consistency-group FlashCopy. Consistency-group FlashCopy continues to be supported. There are some differences:

- During setup the production (source) volumes will be in their own volume group.
- Do not create flashcopy target volumes. VGFC will create new target volumes and attach them to the LPAR.
- The Copy Services Environment (CSE) has a new storage type VGFC and allows selecting the source volume group and target volume pool.
- The target volume pool attributes dictate the storage characteristics (thin provision etc)
- The CSE must dictate a host without any volumes attached (WRKCSE opt 16)
- The Copy Services Environment Data (CSEDTA) remains unchanged.
- VGFC target volumes will be in a new volume group. The new volume group name will compromise <CSE name>_<CSEDTA_name>_<source volume group #>
- The toolkit will remove the target volume group when:
 - A new FlashCopy is created with the same CSE, CSEDTA and source volume group ID
 - If “Stop target after backups” is set to *RMV

- Remote Flashcopy is supported with Policy-based replication (PCYGM)
 - If PCYGM has reverted to GMCV then a remote flashcopy is not possible.

Converting from consistency group FlashCopy to volume group FlashCopy requires:

- Shutdown the target LPAR, delete the target volumes, flashcopy mappings and consistency group
- Delete the CSE
- Create the new VGFC CSE, specifying the source volume group and target pool.

Then proceed with CHKFSFLASH etc.

Updating or Upgrading Full System Flash Copy

Please refer to online documentation regarding the Update and Upgrade process:

<http://ibm.biz/FSFCManager>

Backups

The Full System Flash Copy Toolkit is designed to automate the process to create a point-in-time clone of a production LPAR for the purposes of backups. While it has provisions to start backups, the toolkit is not a backup application and it is the responsibility of the customer to manage and monitor their backups.

Device configuration

iSCSI Setup

If an iSCSI-connected backup device is used, the toolkit can configure it properly on the target LPAR. It must first remove any of the initiators used by the source LPAR, and then enter the new ones used by the target LPAR. Once this has been completed the device resource will be available for normal operations (i.e. the ‘Tape Device Setup’ referenced below):

To indicate to the toolkit which initiators must be removed on the target LPAR, create these environment variables on the source LPAR prior to a Flash Copy:

```
ADDENVVAR ENVVAR(QZ_FSFC_ISCSI_OLD_TARGET) VALUE('vtlname.source-lpar-name') LEVEL(*SYS)
ADDENVVAR ENVVAR(QZ_FSFC_ISCSI_OLD_TARGET_IP) VALUE('<VTL host name or IP address>')
LEVEL(*SYS)
ADDENVVAR ENVVAR(QZ_FSFC_ISCSI_OLD_TARGETPORT) VALUE(3260) LEVEL(*SYS)
ADDENVVAR ENVVAR(QZ_FSFC_ISCSI_OLD_INIT) VALUE('iqn.1924-02.com.ibm:ibmi.source-lpar-
name') LEVEL(*SYS)
```

Use these environment variables (on the source LPAR prior to a Flash Copy) to indicate the new initiators to be created on the target LPAR:

```
ADDENVVAR ENVVAR(QZ_FSFC_ISCSI_TARGET) VALUE('vtlname.target-lpar-name') LEVEL(*SYS)
ADDENVVAR ENVVAR(QZ_FSFC_ISCSI_TARGET_IP) VALUE('<VTL host name or IP address>')
LEVEL(*SYS)
ADDENVVAR ENVVAR(QZ_FSFC_ISCSI_TARGETPORT) VALUE(3260) LEVEL(*SYS)
ADDENVVAR ENVVAR(QZ_FSFC_ISCSI_INIT) VALUE('iqn.1924-02.com.ibm:ibmi.target-lpar-name')
LEVEL(*SYS)
```

Tape Device Setup

Use WRKCSEDTA to specify the serial number of the device and which device description to assign it to.

Backups without BRMS

The toolkit can call commands and programs to start whichever backup you choose. Any additional automation and integration or saving backup information must be done manually or by the backup application.

A sample CL program to approximate an option 21 'GO SAVE' backup is provided in QZRDHASM/QCLSRC member SAVSYSBCH. Modify it as needed and call it from the toolkit (in the CSESDTA 'Backup commands' section). Note that the contents of this program is NOT supported by IBM.

After the backups have completed call ENDFSFLASH *SBMNORMAL or *NORMAL on the target LPAR to notify the toolkit that they are finished.

Backups with BRMS

Overview

Performing a Flash Copy of a partition creates an identical copy of the partition, and that includes BRMS. If the BRMS processes are not followed, there will be two BRMS systems with identical names in the BRMS network group, with the result being a loss of integrity when the BRMS data is synchronized to one or more partitions. In order to manage this correctly, there must only be one unique active instance of a BRMS partition in a BRMS network group. BRMS has documented program calls to activate and deactivate partitions to maintain the integrity of the BRMS network group.

Consider the BRMS network group which consists of partitions SYSA, SYSB and SYSC. If a Flash Copy is performed on SYSA, there will be two active BRMS partitions named SYSA. In order to prevent this, we will deactivate BRMS on SYSA prior to the Flash Copy. After the Flash Copy is complete, we will activate BRMS on only one of the two instances of BRMS. The backups should be performed on the active BRMS partition. Backups can be performed on the inactive BRMS partition, but the information generated from the backups on the inactive BRMS partition will not be shared with the BRMS network group, and will be overwritten when QUSRBRM is copied back from the target partition. Restores can be performed on both inactive and active BRMS partitions since it does not change any BRMS information. After the backups have finished, and you wish to switch which partition has BRMS active, both partitions will be deactivated, the current data (library QUSRBRM) will be moved from where the backups were performed to the other partition, and BRMS on that partition will be activated. Following these procedures will maintain the integrity of the BRMS database.

The Flash Copy Toolkit has the ability to extract only changed BRMS media, save history and object detail from the target LPAR and insert it into the source LPAR's BRMS database. To enable this feature use the CRTCEDTA/CHGCEDTA parameter *BRMS Transfer method* (*CHGONLY). When using this, it is recommended that each target LPAR have a dedicated BRMS media class to select from.

The Flash Copy Toolki also has the ability to restrict the use of BRMS media classes on the source and target LPAR's. This is necessary to prevent the LPAR's from using media from the same media class

during simultaneous operations, as BRMS on each LPAR is not able to communicate with the other LPAR. To enable this feature use the CRTCEDTA/CHGCSEDTA parameter *Restricted media class(es)*. This will use the Functional Authority to manage access to the specified media classes when BRMS is vulnerable to overwriting media.

Backups in PowerVS

Monitoring Control Group Status in Batch Restricted State

The FSFC Toolkit has the ability to monitor the BRMS control groups when they are running in batch restricted state on the target LPAR. When the control group exit program is set to QZRDHASM/QZBRMSEXIT format *BOTH (or BKUI0100 on IBM i < R7.5) it will send messages to STRFSFLASH as each exit point is processed. This will appear in the STRFSFLASH joblog and ctl.log.

Monitoring Control Group for Abnormal End

The FSFC Toolkit has the ability to monitor the BRMS control groups and notify the controller (STRFSFLASH) if they end abnormally. The control group exit program must be set to QZRDHASM/QZBRMSEXIT format *BOTH (or BKUI0100 on IBM i < R7.5) and do not use ENDFSFLASH as the last exit.

Monitoring Control Group for Completing with errors

While it is ideal when control groups run clean, the inability to save an object will result in the control group completing with errors and issuing an escape message. The toolkit can be configured to consider a “complete with errors” to be a success by setting the “Control group error behavior” in the CSE Data to *IGNORE. Abnormal errors are never ignored.

Concurrent Control Group Backups

If concurrent control groups are run on the target LPAR then all backups must finish prior to the BRMS transfer. In the CSEDTA specify how many must control groups must finish and then ensure the control groups use a backup exit program QZBRMSEXIT. After the specified number of control groups finish the BRMS data will be transferred.

BRMS Network Feature

If BRMS is the configured backup application, the Full System Flash Copy Toolkit will integrate with it to ensure that the BRMS database is kept intact and updated from the target LPAR. BRMS requires that the Networking Feature be installed and licensed on the controlling LPAR to use Flash Copy.

However, the purpose of the Flash Copy function is to protect the BRMS database when it is participating in a BRMS Network Group; if the LPAR is not in a Network Group and does not have Network Feature installed, the Flash Copy Toolkit will not change the BRMS Flash Copy states.

Moving QUSRBRM

After the backups have been performed on the target partition, media, history, and object level detail must be moved from the target to the source partition. This information is stored in the library QUSRBRM and is illustrated by performing WRKMEDIBRM on both partitions after the backups have finished but before QUSRBRM has been moved. On the target partition, the command will display your new backup history. On the source partition there will be no record of the backup, even if the source partition is receiving media information, because incoming networking operations have been blocked. To keep this new information, QUSRBRM must be moved from the target partition to the source partition before the source partition is activated.

Note that QUSRBRM can be a large library and must be moved in its entirety. This move can take a while. To minimize the amount of data to transfer, and thus the time required to transfer QUSRBRM, consider reducing the amount of object detail retained and not receiving saved history information from other systems. If BRMS is not the specified backup application, this step will not be performed. Specifying the data compression for the save of QUSRBRM will only apply saving QUSRBRM to the virtual tape; *MEDIUM is usually the best compromise between time spent on compression vs. how much smaller the virtual tape file is. QUSRBRM is easily compressed to nearly one tenth of its size, so it is highly recommended that compression be tried. Ultimately, the effectiveness of the compression is going to depend on CPU and network resources.

Prior to version 4.3 QUSRBRM was saved to a savefile and then groups of records from the savefile were sent to the source LPAR. At version 4.3 virtual tape is used. The change to use the IFS dramatically reduced the time it took to transfer the data. The data is encrypted during the transfer.

The default method to move BRMS is *ALL, i.e. the entire library is sent from the target to the source partitions, and in most cases this is preferred. If the customer must retain access to the BRMS library on the source LPAR or is using Multi-Flash, then *CHGONLY must be used.

Partial Changes Only (*CHGONLY)

*CHGONLY only moves the new and changed records from the target LPAR to the source LPAR. The toolkit will only move the new records related to the media, history information, object detail, reference date/time, and log entries.. Changes to other BRMS artifacts such as control groups or system policies will not be brought back to the source LPAR. While this method will dramatically reduce the amount of data to transfer over the network, there is a time penalty for extracting that information on the target LPAR and then inserting it into the source LPAR. Whether this method is faster than bringing all of QUSRBRM back depends on many factors, such as the size of QUSRBRM, how much object detail is generated, CPW, disk arms and network speed.

The merge of records will be performed in two steps. First the save and object detail records for the media used will be removed from the BRMS files. Then media inventory and save history will be moved and BRMS will be unlocked and the merge exit program will be called with the “*MERGE1”

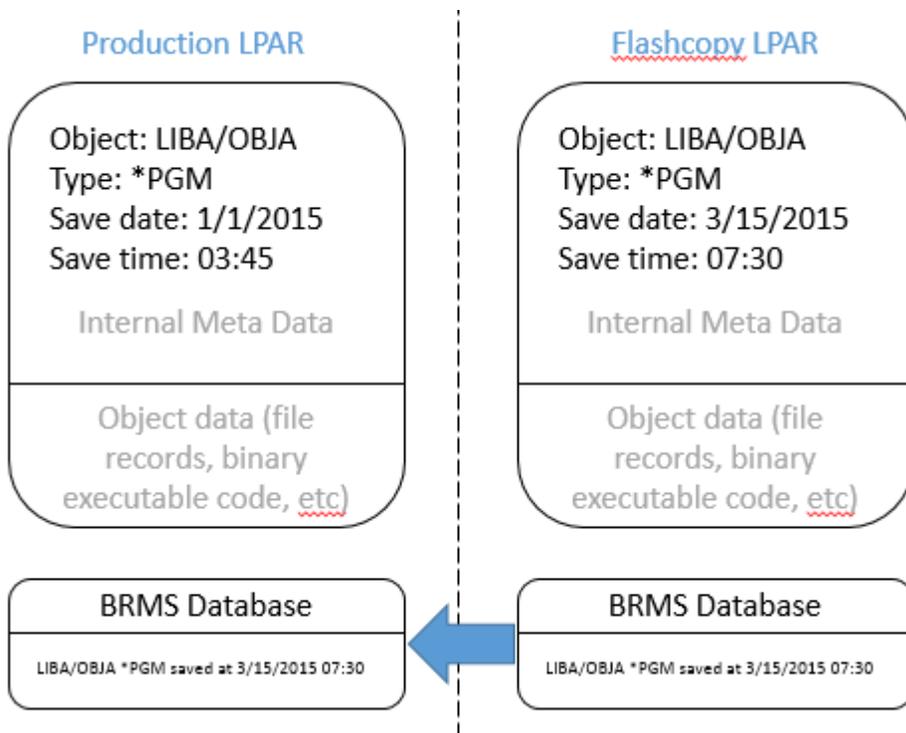
option. The next step is to clean out old history from the volumes merged, then the exit program is called with ‘*MERGE2’. Finally, the object detail will be merged and the exit program will be called with the “*MERGE3” parameter and the process will be finished.

A benefit of using this method is that BRMS can be active on both LPAR’s. In other words, you can perform backups on both the target and source LPAR at the same time, with the changes being merged back with the source LPAR. However, to avoid media collisions, it is HIGHLY recommended that each target LPAR have its own media class to select media from, since it will not be able to communicate with other LPAR’s during the backup. See the RSTDMEDCLS parameter on CRTCEDTA and CHGCSEDTA to restrict and allow specific media classes, and LOCKBRMS to block other BRMS activities. Use the STRBALBRM command to balance media across multiple LPARs and media classes.

Incremental Backups

With BRMS you can perform incremental (*INCR and *CUML) backups with Flash Copy. However, most Full System Flash Copy customers choose not to. The reason most non-Flash Copy customers perform incremental backups is to reduce the amount of time it takes to perform the backup. Since the Flash Copy technology removes the impact to the users, most Flash Copy customers will perform full backups instead, and that is our recommendation. Not only does it result in a more complete backup, but it also significantly reduces the complexity of restoring data, as only one restore is necessary vs. one full and then subsequent incrementals.

Each i5/OS object has internal information including when it was last saved. This information is used by SAVCHGOBJ to determine whether to save it again. When you perform a Flash Copy, that data is copied from the source LPAR to the target LPAR. However, that information is not moved back to the source LPAR after backups on the target LPAR, therefore native SAVCHGOBJ on the source LPAR will not be effective. However, BRMS retains a record of the full save, and thus BRMS will build the commands using the REFDATE and REFTIME parameters, with information from the BRMS files. These parameters will default to the actual backup date and time on the target LPAR; to truly reflect the object changes, it should be based on the Flash Copy timestamp. The Toolkit creates data area QZRDHASM/QZRFLSHTME on the source LPAR immediately before flushing memory and it contains the timestamp of the Flash Copy. This data area is then available on the target LPAR for use.



Note that in order to effectively perform incremental backups in BRMS, object detail must be saved.

Media Device Configuration

A side effect of performing Flash Copies with BRMS is that the device configurations on the paired partitions may not be identical. This poses a difficulty within BRMS because BRMS will retrieve the device capabilities when associating devices to densities in control groups and system policies. If the densities cannot be retrieved, BRMS cannot verify compatibility with the devices and will not allow you to change them.

In most environments both the source and target partitions are attached to the same tape devices, which allows configuring BRMS to use those devices on the source LPAR. When the LPAR is Flash Copied, the IPL process may identify the tape device attached to the target LPAR as a new device, and then auto-configure a new resource name and device description. BRMS is not aware of these devices, and rather than change the BRMS device tables and control groups, the Toolkit has the ability to identify the resource name based on the desired serial number, and then change the specified device description to use the new resource name. This configuration is performed in CRTCEDTA and CHGCEDTA. Please refer to those commands elsewhere in this document for more details.

The easiest method to configure BRMS when the source partition will not normally have a device attached is to temporarily attach a device and then perform the necessary configurations. Another option is to perform a test Flash Copy, configure BRMS on the target partition with the device, and then copy the entire QUSRBRM library back to the source partition.

A less common but equally valid configuration is where the source and target LPARs are at different sites and attached to different devices. In BRMS, this will be reflected as two different locations. The source LPAR must still know about the remote location's inventory so that the target LPAR has this information after a Flash Copy. The best way to implement this is to have a controlling LPAR at the remote site attached to the device, and which is also in a BRMS Network Group with the source LPAR. When the controlling LPAR performs media maintenance (ADDMLMBRM, MOVMEDBRM etc) the BRMS Network will ensure that the inventory awareness is shared with the source LPAR. It may be beneficial to use CHGBRMSOBJ and RUNLPARCMD to modify which location a device is associated with, based on which serial number it is currently running on.

Restricted State TCP/IP

BRMS has the ability to start a restricted state TCP/IP interface to communicate with other BRMS partitions. The Flash Copy Toolkit will automatically configure this if the BRMS integration is enabled and a TCP/IP interface is specified on the *IP Interface* parameter.

On the target partition, the Flash Copy Toolkit will remove all restricted state TCP/IP interfaces and add the interfaces specified on the *IP Interface* parameter. These values will not be moved back to the source partition. After QUSRBRM is moved to the source partition, the original restricted state TCP/IP interfaces on the source partition will remain unchanged.

Locking the QUSRBRM Library

If the Flash Copy Toolkit is configured to bring back the entire QUSRBRM library, access to it should be locked. After the backups have been performed on the target partition the QUSRBRM library will be moved to the source partition, overwriting any BRMS changes there. To prevent inadvertently performing backups, maintenance or other procedures which will change BRMS, and then be lost, use the *Lock BRMS* and *Lock type* parameters on the CRTCEDTA and CHGCSEDTA commands. This will cause the Flash Copy Toolkit to first save the current BRMS Functional Usage settings, then modify the following Functional Usage areas to prevent changing BRMS:

- QIBM_Q1A_ARC
- QIBM_Q1A_ARC_PCY
- QIBM_Q1A_BKU
- QIBM_Q1A_BKU_PCY
- QIBM_Q1A_MED
- QIBM_Q1A_MED_ADV
- QIBM_Q1A_MED_INF
- QIBM_Q1A_MGR
- QIBM_Q1A_MGR_ADV
- QIBM_Q1A_MGR_PCY
- QIBM_Q1A_MOV
- QIBM_Q1A_MOV_VFY
- QIBM_Q1A_INZBRM
- QIBM_Q1A_SYS

- QIBM_Q1A_SYS_ASP
- QIBM_Q1A_SYS_PCY
- QIBM_Q1A_SYS_MNT
- QIBM_Q1A_SYS_DEV

This will take effect on the source partition until QUSRBRM has been moved. If specified, the restrictions will be implemented on the target partition after QUSRBRM has been moved. The Flash Copy Toolkit also has the option to use the BRMS “STOPJOBS” mechanism to prevent BRMS jobs from running.

If the process fails and you need to restore the original Functional Usage settings, issue the following command:

```
ENDFSFLASH *RSTFCNUSG
```

If the user space is found, it will restore from it.

Restricting BRMS by Media Class

The toolkit has the ability to restrict backup activity by media class. On the CRTCEDTA and CHGCSEDTA commands there is a *Restricted media class(es)* parameter. Media classes entered here will behave in the following manner:

- Before FlashCopy:
No Restrictions.
- During backups on target:
Source: Cannot use restricted media classes.
Target: Can only use restricted media classes.
- After backups on target:
Source: No restrictions.
Target: All media classes restricted.

The toolkit uses a combination of Functional Usage and the Tape management exit program to achieve this functionality.

Control Group Modifications

If the backup commands specified on the CRTCEDTA and CHGCSEDTA commands are asynchronous, i.e. they submit backup commands to other jobs and return control back to the caller before the backups are finished, the controlling partition needs to be notified when the backups have finished. By default, STRBKUBRM will submit the backup to batch, and control will return to the caller immediately. In order to notify the controller that it must wait for a notification that the backups have finished, specify *Wait for ENDFSFLASH *YES* on the CRTCEDTA and CHGCSEDTA commands.

In prior releases of the toolkit we required that ENDFSFLASH be called from the final control group exit (*EXIT). With the advent of a new BRMS feature in a 2019 PTF there is now a better method using the control group backup item exit program. Use option 8 on the control group to access the attributes and page down to the Backup item exit program and enter QZRDHASM/QZBRMSEXIT format *BOTH (or BKUI0100 on IBM i < R7.5):

```

Change Backup Control Group Attributes

Group . . . . . : FULLSAVE

Type information, press Enter.

Backup item exit program . . . . . QZBRMSEXIT  Name, *NONE, *BKUPCY
  Exit program library . . . . . QZRDHASM      Name
  Exit program format . . . . . *BOTH          BKUI0100
Missed object policy . . . . . *BKUPCY        Name, *NONE, *BKUPCY
  Clear missed objects . . . . .              *NO, *YES
Journaling report object list . . . . . *NONE    *NONE, Name
Asynchronous bring . . . . . *YES           *BKUPCY, *NO, *YES
Sort by . . . . . *BKUPCY                   *BKUPCY, *NAME, *SIZE

```

If the control group ends abnormally or with errors, the exit program QZBRMSEXIT will be called, which will trigger ENDFSFLASH to start TCP and send a failure signal to the controller.

STRFSFLASH will then notify the user with a message (also sent to QSYSOPR) that the backups have failed and require intervention. To resolve this situation, restart the backups on the target or issue ENDFSFLASH *NORMAL or *FAILBKU manually, whichever is appropriate.

In addition, QZBRMSEXIT will be called for each control group entry and send a message to the controller, even if it is running in restricted state, so that backup progress can be monitored without a console.

We've experienced that if there is an escape message in the backup joblog, BRMS may call our exit program indicating an error has occurred, even if the escape message has been handled. This appears to be a BRMS defect, and we hope a future BRMS PTF will address it.

We've also seen situations where objects are not able to be saved and BRMS reports it as an error but continues with the backup. Yet the FSFC Toolkit is notified of the error. As the Toolkit does not try to distinguish a "good" vs "bad" error it has to treat it like an error.

It is best to have a control group which run clean, which requires carefully managing the omits such that BRMS does not attempt to save unsavable objects not required for recovery.

There are two options if a control group cannot be constructed to run clean:

1. The CSEDTA has a new parameter "Control group error behavior" where the user can decide whether to *IGNORE or *NOTIFY when the toolkit encounters a BRMS error. This is

equivalent to using the aforementioned environment variable but will not ignore abnormal control group errors, only the "completed with errors".

2. A new exit point *FAILNFY was created and will be called when ENDFSFLASH *FAILNFY is called (which may be triggered manually, in a *EXIT, or from QZBRMSEXIT). At this point the user can examine the backups and then force a *NORMAL or *FAILBKU by creating a data area QZRDHASM/CVTNORMAL or CVTFAILBKU.

The parameter “Asynchronous bring” should be set to *YES for FlashCopy backups.

On the final page of the control group attributes, none of the “Additional management” servers should be restarted:

Additional Backup Policy Properties		
Client backup policy	:	FULLSAVE
Type information, press Enter.		
Allow activity overrides	*YES	*NO, *YES
Allow retention overrides	*YES	*NO, *YES
Additional management:		
TCP/IP servers	*NO	*NO, *END, *RESTART, *BOTH
Lotus servers	*NO	*NO, *END, *RESTART, *BOTH
Integrated Windows servers	*NO	*NO, *VARYOFF, *VARYON ...
Guest partitions	*NO	*NO, *VARYOFF, *VARYON ...
Unmount user-defined file systems . . .	*NO	*NO, *YES
Run maintenance after backup	*NO	*NO, *YES

Prior to V7R4M0 these values were not editable on this panel and required the use of OpsNav or an API to edit.

BRMS Maintenance should not be run after backups on the target LPAR.

Duplication and Maintenance

It is not uncommon to perform duplications (DUPMEDBRM) and maintenance (STRMNTBRM) after the backup. This can be performed on either the source partition after QUSRBRM has been moved, or on the target partition before QUSRBRM has been moved.

You may choose to perform these operations on the target partition to minimize CPU, disk arm, I/O and device contention on the source system. However, it will keep BRMS locked on the source longer, therefore our recommendation is to perform these tasks on the source LPAR after the process has finished.

Many customers choose to place these tasks on the source LPAR job scheduler. It is crucial that these jobs start *after* the Flash Copy process has finished. An alternative which has worked well for many of our customers is to use the Toolkit Exit Program to launch post-backup tasks on the source LPAR. That

ensures that maintenance and duplication is performed immediately after the BRMS data has been copied back.

System Policy

If your backup strategy involves SAVSYS which requires operating in restricted state, change the BRMS system policy to allow backups to run in restricted state. To do so, issue WRKSYSPCY *SYS, then option 1, and page down to see the "Controlling subsystem: Allow backups in batch" parameter and change it to *YES. Consider whether it is necessary to specify a maximum time to remain in restricted state, in case your backups fail and BRMS fails to restart the subsystems. Most customers use *NOMAX.

Recoveries and Reports

The Toolkit makes as few changes as necessary to the target LPAR prior to the backups running, with the intent to keep the backup of the target LPAR as similar as a backup on the source LPAR would have been. However, there are some key changes performed to minimize the chance that the target LPAR can come online with the source LPAR IP addresses, running applications etc. These changes include:

- System value for startup program (QSTRUPPGM) is set to *NONE to prevent the customer's program from running when BRMS leave restricted state, if a user starts QCTL, or if the LPAR is IPL'd
- CHGIPLA STRTCP is set to *NO to prevent TCP from starting if the system is IPL'd
- Line descriptions are set to not vary on at IPL
- Removes the autostart job entry for the BRMS system start detection (QBRMSTRUP)
- Optionally holds all basic job scheduler entries
- Additional customizations

Based on the above, if a recovery from a Flash Copy backup is performed, these items must be changed back to the original values after the configuration is restored (RSTCFG). To assist recovery efforts, it is recommended to add these steps to the BRMS recovery reports. To do so, on the source LPAR edit the members in QUSRBRM/QO1AUSRRCY. Each member (STEP001 etc) corresponds to the step in the recovery report and any text in that member will be inserted at that step. Note that the steps are relative and may change at different releases; it is suggested that you view a complete recovery report from your system to determine the correct step for RSTCFG. Typically that is at Step 14 up to V7R2, and Step 19 thereafter.

Here is an example of a report with the custom user-recovery steps:

```
__ STEP 011 : Recover Configuration Data
Start date/time _____ Stop date/time _____
You should restore a current version of your system configuration.
If the "Select Recovery Items" display is not shown and you are
performing a complete system restore, run the following command.
STRRCYBRM OPTION(*RESUME)
Otherwise, run the following command.
```

```

STRRCYBRM OPTION(*SYSBAS) ACTION(*RESTORE)
Type the command choice and press "Enter".
Select the saved item(s) listed below from the "Select Recovery Items"
display and press "Enter" to recover these saved items. Recovery of
these saved items will require the volumes listed on the report or
duplicate volumes.
----- User Recovery Information -----
CHGSYSVAL SYSVAL(QSTRUPGM) VALUE('QSTRUP  QSYS  ')
CHGLINETH LIND(ETHLINE) ONLINE(*YES)
CHGTCPIFC INTNETADR('1.2.3.4') AUTOSTART(*YES)
CHGIPLA STRTCP(*YES)
Release the following jobs on the scheduler:
- one
- two
- three

```

```

-----
Saved      Save      ----- ASP ----- Save      Save      --- Objects ---
Item      Type      Name      Number   Date      Time      Saved      Not      Sequence
                Saved      Saved      Number
-----
_ *SAVCFG  *FULL    *SYSBAS   00001   8/17/17  23:01:21  319        0        25361

```

The BRMS maintenance command STRMNTBRM can create recovery reports, but they will not contain the customized user recovery steps. Only STRRCYBRM USRRCYINF(*ADD) will generate those reports. Our recommendation is to omit the reports from STRMNTRBM using the PRTRCYRPT(*NONE) parameter, and then issue the STRRCYBRM immediately after STRMNTBRM finishes.

BRMS Backup Logs

When using BRMS transfer method *ALL, the toolkit will bring back the entire QUSRBRM library. If you want to bring back the backup joblogs, place them in library QUSRBRM.

The toolkit will detect whether the BRMS Flight Recorders are in /tmp/brms or /QIBM/ and collect them from the correct location. They will be restored on the source LPAR in directory /FSFC off the default Flight Recorder directory. Note that only one copy of the FSFC Flight Recorder is brought back; subsequent flashcopies will overwrite the previous. Customers which require logs from multiple days should considering renaming the directory after each flashcopy operation.

Cloud Object Storage

The source LPAR much be at a BRMS PTF newer than September 2021 to use Cloud Object Storage (COS) with FSFC.

The Toolkit will detect that COS is in use and will delay the transfer of BRMS to the source LPAR until after the COS image files have been transferred to COS.

Refer to the online documentation for properly configuring BRMS to work with Cloud Object Storage:

<https://www.ibm.com/docs/en/i/7.4?topic=brms-using-cloud-storage-solutions-i>

BRMS Backups and PowerVS

In an IBM Cloud environment the challenge is an inability to do a D-Mode IPL from virtual tape. Therefore part of the backup must be done to virtual optical. The details for setting this up can be found on the BRMS website:

<https://helpsystemswiki.atlassian.net/wiki/spaces/IWT/pages/1597374482/BRMS+Cloud+Solutions>

Installing BRMS PTFs

Do not install BRMS PTF's on either the source or target LPAR between the time of FlashCopy and restoring BRMS from the target LPAR. If the file level ID's of the files in QUSRBRM on the source different from those on the target LPAR than the restore will fail. This is to prevent a mismatch between the programs in QBRM and the files in QUSRBRM.

Recovery Point FlashCopy

A **Recovery Point FlashCopy** (RPF) differs from a standard Full System FlashCopy (FSFC) in that the purpose of the FlashCopy isn't to create a backup, but rather to create a point in time copy which can easily be recovered from. System values, line descriptions etc are not changed prior the FlashCopy.

SafeGuarded Copies (SGC) has replaced RPF as the preferred solution. SGC provides a superior solution with immutable copies and far more efficient use of the storage units. For these reasons, RPF is no longer documented here and will neither be supported nor implemented by Technology Services.

While our Toolkit has some integrations to work with SafeGuarded Copies, it is licenses and documented separately from FSFC.

Commands

ADDCSECRDE - Add CSE Credential Entry

ADDCSECRDE allows the user to add credential entries. This information is used by the toolkit whenever it needs to communicate with the device specified on the Host IP address parameter, and is used when communicating with the DS8K, HMC and SVC's. This information is encrypted and stored in the PowerHA device data domain, and is available to all the nodes in the cluster.

```
                                Add CSE Credential Entry (ADDCSECRDE)

Type choices, press Enter.

Host IP address . . . . . _____
User ID . . . . . _____
Password . . . . . _____
Confirm password . . . . . _____
Host description . . . . . _____
```

Host IP address: Enter the IP address of the host which the credentials are for. A valid IP address is required; name resolution is not performed by the toolkit.

User ID: Enter the user ID which exists on the device specified by the Host IP address.

Password: Enter the password for the user ID which exists on the device specified by the Host IP address.

Confirm password: Re-enter the password to ensure that it is correct.

Host description: Enter a description to make it easy for humans to see which host the IP address is for.

CHGBLDFLG – Change Build Flags

This command alters flags held in the BUILD data area that are used for debugging and other purposes within PowerHA Toolkit for IBM i. The command should only be used when so recommended by an IBM consultant or support personnel.

```
Change ICSM Build Flag (CHGBLDFLG)

Type choices, press Enter.

Specific build flag . . . . . *DEBUGEXIT    *DEBUGEXIT, *DEBUGFLASH...
Setting . . . . . *OFF                *ON, *OFF
```

Specific build flag: Determines which flag to toggle. The possible values are:

- ***DEBUGCRG:** Change the DEBUGCRG flag used with the toolkit. Setting it on will result in more detailed messages related to the CRG DDD space.
- ***DEBUGEXIT:** Change the DEBUGEXIT flag used with the toolkit for debugging the CRG exit program.
- ***DEBUGFLASH:** Change the DEBUGFLASH flag used with the toolkit. Setting it on will result in more detailed messages related to flash operations.
- ***DEBUGTPC:** Change the DEBUGTPC flag used within the toolkit for debugging CSM (formerly TPC-R).
- ***DEBUGDDD:** Change the DEBUGDDD flag used within the toolkit. Setting it on will result in more detailed messages related to the DDD space.
- ***TEST:** Change the TEST flag used within the toolkit. This should only be used for toolkit development testing.
- ***XTRALOGS:** Change the XTRALOGS flag used within the toolkit. This will result in additional logging messages generated and retained.

Setting: Used to toggle the specified build flag. The possible values are:

- ***OFF:** Change the above flag to off.
- ***ON:** Change the above flag to on.

CHGBRMSOBJ - Change BRMS Object Attributes

This command allows you to change an attribute of a BRMS object. It is particularly useful for programmatically changing values which do not have a BRMS command line interface.

Change BRMS Object Attributes (CHGBRMSOBJ)	
Type choices, press Enter.	
BRMS Object type to change . . . _____	*DEVICE, *MEDPCY, *CTLGATTR
Name of BRMS object to change . _____	Object name
BRMS Attribute to change _____	*LOC, *MEDCLS, *MOVPCY...
New attribute value _____	

Object type to change: Specify the type of object to change. The objects which can be changed are:

- ***CTLGATTR:** The following control group attributes (WRKCTLGBRM opt 8) can be changed:
 - *DEVICE
- ***DEVICE:** The following device attributes (WRKDEVBRM) can be changed:
 - *LOC
 - *TEXT
- ***MEDPCY:** The following media policy attributes (WRKPCYBRM) can be changed:
 - *LOC
 - *MEDCLS
 - *MOVPCY
 - *MARKDUP
 - *MARKHST
 - *MINVOL
 - *TEXT
 - *VOLSEC

Name of BRMS object to change: Specify the name of the BRMS object to change.

BRMS Attribute to change: Specify the attribute of the object to change. The valid combination of object to change and the attribute to change varies.

- ***DEVICE:** Specifies the device(s) to be associated with the object. Only one device is currently supported. The possible values are:
 - ***BKUPCY:** The value for the backup device field in this control group uses the default value for this field from the backup policy.

- ***SYSPCY:** The value for the backup device field in this control group uses the default value for this field from the system policy.
 - **device-name:** Specify the names of the devices that are used in processing this backup control group. Only one device is currently supported.
 - ***NONE:** There is no device for this save operation. Save files are used to store the saved data.
 - ***MEDCLS:** Devices for this policy or control group are selected based on device types that support the density for the media class specified in the media policy. The ***MEDCLS** special value is used for devices that are part of a device pool, such as several systems that share a single or set of devices.
- ***LOC:** Specifies the storage location to be associated with the object. The possible values are:
 - ***ANY:** Any device in any location capable of saving to the specified media class can be utilized for the save operation.
 - **location-name:** Specifies the location name of the device that is to be used with this policy. Only devices assigned this location name can be used for the save operation.
- ***MEDCLS:** Specifies the name of the media class to be used for any volume created using this media policy. The possible values are:
 - ***NONE:** No media class is assigned for this media policy.
 - ***ADSM:** No media class is assigned for this media policy. The media is managed by the TSM server.
 - **media-class-name:** Specify the name of the media class that is to be used with this media policy.
- ***MOVPCY:** Specifies the name of the move policy to be associated with this object. The possible values are:
 - ***NONE:** Specifies that no move policy is associated with this media policy.
 - ***ADSM:** Specifies no move policy is associated with this media policy. A TSM server is responsible for movement and storage of the media.
 - **move-policy-name:** Specifies the name of the move policy that is to be assigned to volumes used by this media policy.
- ***MARKDUP:** Specifies whether history items created by the save will be marked for duplication. You can use `DUPMEDBRM VOL(*SRCHHST)` command to duplicate the marked saved items. The possible values are:
 - ***NO:** History items created during a save operation that use this media policy will not be marked for duplication.
 - ***YES:** History items created during a save operation that use this media policy will be marked for duplication.
- ***MARKHST:** Specifies whether media volumes will be marked for duplication. If a volume is a member of a media set and it is marked for duplication, all members of the media set will be marked for duplication. When the `DUPMEDBRM VOL(*SEARCH)` command is used, active volumes that have been marked will be selected and duplicated. The possible values are:

- *NO: Volumes written to during a save operation that use this media policy will not be marked for duplication.
- *YES: Volumes written to during a save operation that use this media policy will be marked for duplication.
- *MINVOL: Specifies the minimum number of expired volumes that must be present before any save can begin. The possible values are:
 - *NONE: There is no check done to determine the minimum number of required volumes before a save operation begins.
 - number-of-required-volumes: Specify the number of expired media volumes that must be available before any BRMS save operation will begin. The number of volumes can range from 1 to 9,999.
- *TEXT: Specifies text that describes the object. The possible values are:
 - *NONE: No text will be used to describe the object.
 - text-description: Specifies the text description to be used.
- *VOLSEC: The secure volume attribute will be changed. Value values are:
 - *NO: Volume security will not be applied to this media class. Volumes that do not have volume security can be read by anyone.
 - *YES: Only users with special authorities *ALLOBJ or *SECADM can read media volumes in this media class.
 - *ADSM: Volume security is managed by the TSM server.

New attribute value: Specify the new value value.

CHGCLDVOL - Change Cloud Volume

This command allows you to change an attributes of cloud volumes.

Change Cloud Volumes (CHGCLDVOL)	
Type choices, press Enter.	
API Key Name	_____
Volume ID	_____
+ for more values	_____
Action to perform	_____ *STOPREPL

API key name: Specify the key name (from WRKCSECRDL *CLOUD) containing the cloud instance id and PowerVS credentials.

Volume ID: Specify the IDs of the volumes to be changed.

Action to perform: Specify the action to perform on each volume.

- ***STOPREPL:** Remove the volume(s) from the consistency set and stop replication.

CHGCSECRDE - Change CSE Credential Entry

This command can be used to change a user credential entry in the Device Domain Data associated with IBM i Copy Services Manager. The information is encrypted using a 128 bit AES key before it is retained.

For a description of the parameters, see the command ADDCSECRDE.

CHGCSEDTA – Change CSE Data

CHGCSEDTA is used to change the CSE Data as it relates to the operational characteristics of the toolkit. The parameters of CRTCSEDTA and DSPCSEDTA are similar and these descriptions apply to those commands as well. Please refer to CRTCSEDTA for parameter details.

CHKFSFLASH - Check Full System Flash

The Check Full System FlashCopy Readiness (CHKFSFLASH) command performs checks to determine if the prerequisite conditions have been met for the identified CSE Data configuration to be able to perform a Full System FlashCopy via STRFSFLASH. Depending on whether the CSE Data refers to a Full System Flashcopy (FSFC) or Recovery Point Flash (RPF) the command will perform different steps. In both situations the purpose is to check whether the conditions are correct for a flashcopy. This command is not able to detect all conditions that could cause a STRFSFLASH command to fail, however, it will check the following:

- For DS8K environments, a flash relationship exists.
- For SVC environments, the consistency group and flashcopy mappings exist.
 - For RPF, the target LUNs must not have host connections
- The smc or svc is available
- The source partition is available
- The HMC for the source partition is available.
- The HMC for the target partition is available.
 - For RPF, there is no target partition.
- For SVC, that all host connections are valid.
- That no other instance of STRFSFLASH for this configuration is active.
- That the shutdown command is valid on the source partition.
- The cluster on the required nodes are operational.
- That all nodes are in the correct cluster domain.
- User profile QLPAR is neither disabled nor expired

The following checks are only made for FSFC operations:

- That device and line descriptions in the configuration exist on the source partition.
- That the BRMS port is available.
- That the backup commands are valid on the source partition.
- That the BRMS media classes are valid.
- IPL attribute STRRSTD is set to *NO
 - Warn by default
 - Fail if environment variable QZ_FSFC_STRRSTD_FAIL exists
 - Subsystem QZRDFSR must be restarted to pick up new environment variables

This command should be run in an attempt to pro-actively identify any conditions that must be corrected before STRFSFLASH can be completed successfully for the specified CSE Data configuration.

It will also issue a warning message if the ctl.log file is greater than 20 MB.

CSE Data name: This is a required parameter. Specifies the name of the CSE Data that contains the flashcopy configuration.

Controller IP address: Specifies the IP address on the controlling node where the processing for the CHKFSFLASH command will be performed. The possible values are:

- ***LOCAL:** The local system is the controller.
- **IP address:** IPv4 formatted address

Controller port: The port on which the controller is listening for remote commands. This parameter is ignored for CTLR(*LOCAL).

CHKFSRFLSH - Check Full System Replication and Flash

The Check Full System Replication and FlashCopy Readiness (CHKFSRFLSH) command performs checks to determine if the prerequisite conditions have been met for the identified CSE Data configuration to be able to perform a Full System FlashCopy via STRFSFLASH. It uses the information in the Replication Environment to determine the replication direction and status and also which LPAR is active. Based on this information it will select the correct CSE Data from the parameters passed in and perform a CHKFSFLASH with it.

This command must be run from a controlling LPAR.

Replication Environment: This is a required parameter. Specifies the name of the Full System Replication environment (from WRKCSE) to use to determine replication direction and status.

Preferred source remote flash: Specifies the CSEDTA to use when the source LPAR is active as *PS and replication is in consistent state. This takes present over a local flash copy.

Preferred source local flash: Specifies the CSEDTA to use when the source LPAR is active as *PS and replication is not in consistent state.

Preferred target remote flash: Specifies the CSEDTA to use when the source LPAR is active as *PT and replication is in consistent state. This takes present over a local flash copy.

Preferred target local flash: Specifies the CSEDTA to use when the source LPAR is active as *PT and replication is not in consistent state.

CHKRCYPNT – Check Recovery Point Flash

The Check Recovery Point Copy Readiness (CHKRCYPNT) command performs checks to determine if the prerequisite conditions have been met for the identified CSE Data configuration to be able to switch the partition LUNs to a recovery point copy via SWRCYPNT. This command is not able to detect all conditions that could cause a SWRCYPNT command to fail, however, it will check the following:

- That the environment is an SVC environments.
- That the consistency group and flashcopy mappings exist.
- The smc or svc is available.
- The source partition is available
- The HMC for the source partition is available.
- That all host connections are valid.
- That no other instance of STRFSFLASH for this configuration is active.
- That the shutdown command is valid on the source partition.
- The cluster on the required nodes are operational.
- That all nodes are in the correct cluster domain.

This command should be run in an attempt to pro-actively identify any conditions that must be corrected before SWRCYPNT can be completed successfully for the specified CSE Data configuration

CSE Data name (CSEDTA) This is a required parameter. Specifies the name of the CSE Data that contains the flashcopy configuration.

CLEANLOGS – Clean Toolkit Logs

This command will clean the logs related to the IASP Copy Services Manager, Full System Replication Manager, or Full System FlashCopy Manager. CLEANLOGS removes specified entries from the /QIBM/Qzrdhsm/Qzrdhsm.log, removes any temporary directories created by DMPINF, dmpinf zip files and toolkit joblogs in /QIBM/Qzrdhsm/joblogs/ which are older than the number of days

specified on this command. This command should be run periodically to prevent log files from consuming excessive space.

Days of information to retain: How many days of information to retain.

FSFC environment: The name of the FSFC environment to be cleaned.

- ***NONE:** Do not clean up the logs for any environment.
- ***ALL:** Clean up the logs for all environments.
- **environment-name:** Clean up the logs for the named environment.

CLNICSMLLOG – Clean ICSM Log

This command has been replaced with CLEANLOGS.

CLRDDD – Clear Device Data Domain

CLRDDD is a utility command used to clear data out of PowerHA device data domains. It should only be used when instructed by IBM personnel and may remove toolkit configuration data.

CNLCLDCLN – Cancel Cloud Volumes-Clone

The Cancel Cloud Clone (CNLCLDCLNL) command will cancel one or all Volumes-clones in progress.

API Key Name: This is a required parameter. Specifies the name of the API Key credentials to communicate with PowerVS APIs.

Volumes-clone ID: The id of the volumes-clone to be canceled. The following special value may be specified:

- ***ALL:** All volumes-clones associated with the cloud instance are to be canceled.
- **Volumes-clone ID:** The specified volumes-clone will be canceled. Use DSPCLDCLNL to find the volumes-clone ID.

CNLFSFLASH – Cancel Full System FlashCopy

Cancel a FlashCopy previously paused with STRFSFLASH. This is necessary if the intent is to issue another STRFSFLASH instead of RSMFSFLASH.

CPYCS EDTA – Copy CSE Data

This interactive command will create a new Cluster Resource Group and write configuration data to the CSE Data device domain based on information from an existing DDD and existing CSE Data. The configuration data may be modified before the CSE Data is created.

Please refer to the command CRTCS EDTA for a detailed description of the parameters.

CSE Data name: The name that identifies the CSE Data.

To CRG: Specifies the name of the CSE data which is to be prepared for backup. This is also the Environment name referenced elsewhere within ICSM. The environment is configured using WRKCSE.

CRTCS EDTA - Create Copy Services Environment Data

CRTCS EDTA is used to enter the CSE Data as it relates to the operational characteristics of the toolkit. The parameters of CHGCSEDTA and DSPCS EDTA are similar and these descriptions apply to those commands as well.

```
                                Create CSE CRG

Supply all required values, press Enter.

CRG Name . . . . . : TEST
Use . . . . . : *SYSTEM
Copy type . . . . . : *FLASH          *PPRC, *FLASH
```

The CRG Name can be different from the environment name. Entering use *SYSTEM and type *FLASH indicate this is going to be a CSE Data for Full System FlashCopy. Press Enter and the remaining FSFC-specific parameters are displayed.

```
                                Create Full System FlashCopy CSE Data

Supply all required values, press Enter.

CSE Data Name . . . . . : TEST
Use . . . . . : *SYSTEM
Copy type . . . . . : *FLASH

Environment . . . . . : _____ Name
Hyperswap environment . . . : _____ Name
Primary controlling node . . : _____ Name
Secondary controlling node . . : _____ Name
Communications port . . . . : 55920
```

Source LPAR IP address . . .	_____	IPv4 address
Source host alias	_____	Name
Target host alias	_____	Name

Environment: Refers to the environment previously created in WRKCSE. This must be an FSFC environment, and determines the external storage details. It is common for multiple CSE Data's to reference the same environment to facilitate daily vs. weekly backups. Note that only one FlashCopy using a specific environment can be executed at a time.

Hyperswap environment: If the source LPAR is participating in a DS8K Hyperswap environment, specify the secondary environment to use. Also specify a Hyperswap HMC LPAR Profile. If the toolkit detects that Hyperswap is suspended, it will use the environment which matches the Hyperswap primary DS8K.

Primary and Secondary controlling nodes: Enter the cluster node names of the controllers. There is no practical distinction between primary and secondary nodes. If there is only one node, do not enter a secondary node.

Communications port: The port on the source LPAR the controllers will use to communicate with the source and target LPARs. Program QZRDIAEXT2 in subsystem QZRDFSR is expected to be listening to this port when the FlashCopy operations are performed.

Source LPAR IP address: The IP address the controlling and target LPARs will use to contact the source LPAR.

Source and Target Host alias: These labels are used in the messages to identify which LPAR the message is referring to.

Method to flush memory . . .	<u>*FRCWRT</u>	*QUIESCE, *FRCWRT, *IPL, *NONE
------------------------------	----------------	-----------------------------------

Method to flush memory: The FlashCopy will only copy the data which is on disk, not that which is in the host's memory. Therefore, it is important that we flush as much data as possible from memory to disk prior to the FlashCopy. There are three methods we can use to achieve this:

- ***FRCWRT:** **FRCWRT has minimal impact to users, and is typically a good option to use when testing the FlashCopy process, or when creating a FlashCopy for non-backup purposes.* This option will flush memory but will not hold any database transactions. Users will not be impacted beyond additional disk I/O created to perform the flush. Neither TCP nor jobs, processes or subsystems are ended. Once the flush operation has finished, the toolkit will perform a FlashCopy in the storage, capturing whatever is on disk. There is an increased possibility that some objects may be damaged on the FlashCopy. The IPL of the FlashCopy LPAR may take a long time as database and journal recovery may need to roll back many transactions. Furthermore, it is not recommended to use *FRCWRT unless the items being

backed up are journaled, as files may have partially written records (applications may not tolerate improperly formatted data, such as NULL values in zoned integer fields, etc).

Method to flush memory . . .	*QUIESCE	*QUIESCE, *FRCWRT, *IPL, *NONE
Quiesce details:		
Maximum time quiesced . . .	59	0-240 seconds
Force flash copy	*YES	*YES, *NO

- *QUIESCE:** Use this option for minimal impact to users and to get a good FlashCopy for backups. The *QUIESCE option will first perform a *FRCWRT, then it will perform a *SUSPEND operation, followed by another *FRCWRT before the FlashCopy is executed. The purpose of the first *FRCWRT is to flush as much memory as possible before suspending database transactions (it could take 10-20 minutes to flush terabytes of memory on a busy system). Before suspending transactions the toolkit will spawn a second job which will automatically resume the system after a certain time period, to ensure that a failure or pause in the main toolkit process will not prevent access to the system longer than desired. During the *QUIESCE process, new database transactions will be suspended while allowing existing transactions to reach a commit boundary. The “**Maximum time quiesced**” parameter determines how long to wait for the transactions to reach a commit boundary. When all the transactions are held, the FlashCopy will occur. If there remains outstanding transactions, the toolkit will perform a flash anyway if the “**Force flash copy**” option is selected, as it is likely that many transactions were held. Otherwise the process will fail.

Method to flush memory . . .	*IPL	*QUIESCE, *FRCWRT, *IPL, *NONE
IPL details:		
Power down command	pwrdownsys delay(30)	
Confirmation message . . .	*NO	*YES, *NO
Source LPAR Information:		
HMC LPAR name	ctciha9m	
HMC Profile name	ctciha9m	
HMC managed system	CTCHA9	
Primary HMC IP	9.5.168.29	IPv4 address
Secondary HMC IP		IPv4 address

- *IPL:** By powering down the source LPAR we are ending all transactions and processes and moving all data from memory to disk. *This will create the best possible FlashCopy to perform backups from, but also has the greatest impact to the users of the source LPAR.* The *IPL option will (by default) issue and wait for a response to an inquiry message on the source LPAR, in QSYSOPR’s message queue. This confirmation can be removed by selecting *NO on the “**Confirmation message**” parameter. The benefit of having a confirmation message is 1) validates the correct LPAR is being shut down and 2) provides the option to prevent the shutdown. If *IPL is used, a “**Power down command**” must be supplied. This command can be PWRDWN SYS RESTART(*NO) (we recommend a 30-second [or longer] delay) or a command or program call which will terminate processes and applications then do a PWRDWN SYS RESTART(*NO).

Prompting (F4) is available on the shutdown command parameter. The prompting occurs on the controlling LPAR but the command will be executed on the source LPAR; therefore, if you attempt to prompt on a program or command that only exists on the source LPAR, it will fail. Likewise, selecting parameters and values that are only valid on the controller will fail when CHKFSFLASH or STRFSFLASH attempts to validate them on the source LPAR.

*IPL is not supported for PowerVS FSFC.

- ***RAGGED:** The purpose of using a Ragged Commit Boundary is to reduce the impact of a quiesce on the users of the source LPAR databases. The system will not flash on a commit boundary, and after a recovery the journals must be used to reach a commit boundary. The backups must be adjusted appropriately, and after the FlashCopy backups have finished the journal receivers should be saved on the source LPAR.

More details are available here: <https://www.ibm.com/support/pages/ragged-commit-boundary-0>

Note: The source LPAR must be at IBM i 7.5 and toolkit at 5.2 to use Ragged Commit Boundaries.

- ***NONE:** No attempt will be made to flush memory. This will result in a longer target LPAR IPL.

Source LPAR Information is only displayed if the method to flush memory is set to *IPL. The **HMC LPAR name**, **HMC profile name**, and **HMC managed system** parameters are case sensitive. The **Primary HMC IP** is required and **Secondary HMC IP** is optional. If the toolkit receives an unexpected response from the currently used HMC it will automatically retry the response on the other HMC, if it is configured.

Target LPAR Information:

Primary HMC IP	_____	IPv4 address
Secondary HMC IP	_____	IPv4 address
HMC managed system	_____	
HMC LPAR name	_____	
HMC Profile name	_____	
HMC HyperSwap Profile name	_____	
Shutdown target before		
FlashCopy	*YES	*YES, *NO
Restart target after		
FlashCopy	*YES	*YES, *NO, *INQ, *FRCINQ, *PAUSE, *COPIED

Target LPAR Information: Specify the details for the target LPAR. The **HMC LPAR name**, **HMC profile name**, and **HMC managed system** parameters are case sensitive. The **Primary HMC IP** is required and **Secondary HMC IP** is optional. If the toolkit receives an unexpected response from the currently used HMC it will automatically retry the response on the other HMC, if it is configured.

When using PowerVS FSFC, specify *CLOUDENV on the **Primary HMC IP** parameter. The toolkit will use the VM information entered in the copy services environment (WRKCSE).

If the source LPAR is participating in a DS8K Hyperswap environment, specify the **Hyperswap HMC LPAR Profile** to use. Each profile should contain the fiber channel adapters to connect to each DS8K, with the zoning required for each one. Otherwise the profiles should be similar or tape and communications resources may not configure correctly.

Shutdown target before FlashCopy: It is necessary that an LPAR not be running on the LUNs that are the destination for a Flashcopy. Note that a Flashcopy may be blocked if another STRFSFLASH is using the LUNs.

- ***YES:** Shut down the target LPAR immediately before the FlashCopy. This is the most common option. If there are multiple STRFSFLASH operations vying for the use of the target LPAR, one will randomly get a lock on it and the rest will continue to wait until they can also get a lock on it.
- ***NO:** Do not deactivate the target LPAR before the FlashCopy. It is not necessary to deactivate the target LPAR prior to performing a FlashCopy if the target LPAR is attached to other FlashCopy LUNs. This may be the case if two source LPARs with dedicated target disks share a common target LPAR. The toolkit will check whether the LPAR is running on the target LUNs and issue message IAS1627. The target LPAR must be available on the IP address listed in WRKCEDTA.

Restart target after FlashCopy: The toolkit has several options for restarting the target LPAR. Note that if host connection changes are specified, they will be processed immediately prior to activating the target LPAR.

- ***YES:** Restart the target LPAR immediately after the FlashCopy. This is the most common option. If there are multiple STRFSFLASH operations vying for the use of the target LPAR, one will randomly get a lock on it and the rest will continue to wait until they can also get a lock on it.
- ***NO:** Do not restart the target LPAR after the FlashCopy. Some customers use this to create a FlashCopy immediately before a critical operation on the source LPAR, such as batch processing, for the purposes of performing a reverse FlashCopy. Backups are not usually performed in this scenario.
- ***INQ:** Issue an inquiry message to QSYSOPR on the controller prior to restarting the target LPAR to allow an operator to control whether and when to start the target LPAR. This can also be used with multiple concurrent STRFSFLASH operations to control the order of target LPAR IPL's.
- ***PAUSE:** The Full System FlashCopy process will be paused at the point immediately after the flashcopy has completed and prior to the start of the IPL of the target partition. Use the Resume Full System FlashCopy (RSMFSFLASH) CL command to resume the process. Note that

STRFSFLASH *PAUSE then Hyperswap then RSMFSFLASH will not work properly. It will IPL from the wrong LUNs.

- ***COPIED:** Wait to IPL the target LPAR until all the FlashCopy mappings have reached 100% copied. Only supported for SVC operations.

Use BRMS integration	*YES	*YES, *NO
BRMS information:		
BRMS transfer method	*ALL	*ALL, *CHGONLY
BRMS transfer port	*DFT	*DFT, 1024-65535
Encrypt BRMS transfer	*NO	*YES, *NO
Custom SYSBAS timestamp	*NONE	*NONE, *BOTH, *QSYS, *IFS
Control group error behavior	*NOTIFY	*NOTIFY, *IGNORE
Control groups prior to xfer	1	1-254
Base media class	*NONE	class, *NONE
Base media class suffix	*NONE	suffix, *NONE
Restricted media class(es)	*NONE	*NONE, class
+ for more values		

Use BRMS integration: Controls whether the toolkit will integrate with BRMS. If set to *NO, the toolkit will not change the BRMS FlashCopy mode, manage journaling of files, lock users out of BRMS on the source, or transfer BRMS back, etc. *YES will enable the **BRMS information** parameters.

BRMS transfer method: This parameter determines how to transfer the BRMS database from the target to the source LPAR. This process is triggered when ENDFSFLASH *NORMAL is called on the target LPAR.

- ***ALL** will transfer the entire BRMS data library (QUSRBRM). This is the BRMS-supported method of managing the FlashCopy data, and will also perform the BRMS operations to set the proper BRMS FlashCopy mode. The entire library is placed into a savefile and transferred to the source LPAR using a proprietary file transfer protocol. Since the entire QUSRBRM is moved, overwriting what is on the source LPAR, any updates to the source LPAR QUSRBRM after the FlashCopy will be overwritten. This is why it is important to lock QUSRBRM on the source LPAR to prevent backups until QUSRBRM has been restored from the target LPAR. *ALL is by far the most common and least complicated option used to transfer the BRMS data. Restricted media classes are not allowed with BRMS Xfer *ALL.
- ***CHGONLY** will only move the updates to the media and object detail created during the backup on the target. While this will result in significantly less data to transfer, more time is spent extracting the data from the target QUSRBRM and inserting it into the source QUSRBRM that there is little, if any, improvement in the overall data transfer time. *CHGONLY was created to allow customers to perform backups on the source LPAR simultaneously with the backups on the target LPAR, or when using the toolkit to run multiple concurrent FlashCopy operations from a single source LPAR. When the BRMS data is transferred back to the source LPAR, it only only update media either expired or owned by the source LPAR so it is important to not override or reuse media classes assigned to the target LPAR. When the data is transferred

back to the source LPAR, it is done in two steps; the media inventory and save history will quickly be transferred (as it has less data) which releases the media classes used. Then the second stage will transfer the object detail, which can potentially take hours. It is also important to note that each target LPAR must have its own media class, specified either as a restricted media class or dynamic media class. *CHGONLY was developed with the help of the BRMS developers, but is not the BRMS-supported method to manage the BRMS database during FlashCopy (it is supported by the toolkit). It introduces significant complexity, may use additional disk space and has the possibility for error, and is usually discouraged unless the customer has a specific need for the benefits.

BRMS transfer port: This is the port the toolkit will open on the source LPAR to receive the BRMS database. *DFT will attempt to select port 55066; if it is not available it will search subsequent ports until one is available.

Encrypt BRMS transfer: Specify whether the toolkit should encrypt virtual tape files containing the BRMS data prior to transferring them. This is software encryption, and it expect the transfer time to double.

BRMS Custom SYSBAS Timestamp: Specify whether to use the BRMS custom timestamps for SYSBAS. This causes BRMS to use the flashcopy time on the backups rather than the actual backup time. BRMS requires the Advanced Feature to be installed and licensed to use custom SYSBAS timestamps.

Control group error behavior: Indicate whether the controlling LPAR should issue an inquiry message or ignore errors when BRMS control groups finish with errors. Control groups which end abnormally will not be ignored.

Control groups prior to xfer: Specify how many control groups calling QZBRMSEXIT must finish before BRMS data is transferred to the source LPAR. This is useful if multiple control groups need to run but the BRMS data must not be transferred until the last one has finished. The count is maintained on the target LPAR in data area QZRDHASM/QZCTLGcnt. Remove the data area to facilitate transferring BRMS the next time QBRMSEXIT is called.

Base media class: Only use this option with **BRMS transfer method *CHGONLY**. When using dynamic media classes, the toolkit will create a new media class from an existing base media class. The new media class will be named using the base media class and the **Base media class suffix**. The combined length of these two must be less than ten characters. The dynamic media class is created immediately prior to the FlashCopy, and is added to the **Restricted media class** list. Media previously used in a dynamic media class will be moved to the dynamic media class, and scratch volumes will also be moved to it. The toolkit will find all the media policies which use the base media class and specify the same media location as the device location of the devices specified on the CRTCEDTA command, and use the “Required Volumes” parameter to determine how many scratch media are required at each location. The toolkit will move that number of expired media to the dynamic media class. After the backups are finished the toolkit will write the text ‘#FSFC#’ to the media used during the backup to identify for future use in a dynamic media class. Then the media will be moved back to the base media class and the dynamic media class will be removed.

Restricted media classes: When a BRMS media class is placed in this list, the toolkit will remove the functional authority to it on the source LPAR, and remove the functional authority to all others on the target LPAR. After the backups the functional authority will be restored on the source LPAR. Dynamic media classes are automatically added to the restricted media class list. Restricted media classes are not allowed with BRMS Xfer *ALL.

```

Target Comm Interfaces:

  IO card location code . . . U8233.E8B.10001AP-V4-C2-T1
                                *NONE, identifier
  Line Description . . . . . F5FCLINE          line name, *VIRTUALIP
  IP interface . . . . . . . 9.5.167.93       IPv4 address

    + for more values . . .

Target LPAR default route:
  Binding interface . . . . . *NOCHANGE       IPv4 address
  Next hop . . . . . . . . . IPv4 address
  
```

Target Comm Interfaces: The target LPAR should come online with a different IP address than the source LPAR. Use these parameters to indicate which IP addresses and line descriptions to bring online.

- **IO card location:** Specify the target IO card location which should be associated with the specified line description. The special value *LPAR can be used in place of the type, model, serial number and virtual bus number, as the toolkit will resolve that from the system it is running on. For example, instead of U8233.E8B.10001AP-V4-C2-T1, specify *LPAR-C2-T1
- **Line description:** The line descriptions specified will be modified with the resource name associated with the IO card location, and it will be varied on. All other line descriptions will be set to ONLINE(*NO). This line description must exist on the source LPAR, with an invalid resource name and ONLINE(*NO).
- **IP interface:** The IP interface which will be started. STRTCP will be called but no interfaces will be auto-started. This interface must exist on the source LPAR with AUTOSTART(NO). The toolkit will set this IP interface to be the BRMS restricted state IP interface.

Target LPAR Default Route: If the target LPAR IP address is in a different subnet and/or requires changes to the routing tables, use these parameters. If a new default route is specified, the existing one will be removed.

- **Binding interface:** Specify the interface to use for routing.
- **Next hop:** Specify the next for the default route.

```

Target LPAR iSCSI Information:
  VTL IP address . . . . . *NONE          *NONE, IP address
  VTL port number . . . . . *DFT          *DFT, 0-65535
  VTL IQN . . . . .

  Initiator IQN . . . . .

Target LPAR Device Setup:

  Backup device description    TS3400PROD          *NONE, device name
  Device serial number . . .   78-78F1101

  + for more values . .

Target LPAR backup command    *NONE

  + for more values . .

```

Target LPAR iSCSI Information: If an iSCSI connection needs to be defined during the IPL of the target LPAR use these parameters. Any existing information copied from the source LPAR will be cleared and the new information will be added and the IOP reset.

- **VTL IP address:** Specify the IP address of the iSCSI device.
- **VTL port number:** The default (*DFT) port is 3260. Specify a different port if necessary.
- **VTL IQN:** Specify the IQN of the VTL device.
- **Initiator IQN:** Specify the IQN assigned to the target LPAR.

Target LPAR Device Setup: This is used to work with devices to ensure that they are in the correct state for BRMS or other backup to use. When the target LPAR IPL's, it will find the devices and auto-configure them to use the next available resource name.

- **Backup device description:** Specify the device description the backups are configured to use. This must exist on the source LPAR prior to the FlashCopy. This can be a tape drive or media library device description.
- **Device serial number:** Enter the device serial number from WRKHDWRSC *STG option 7. The toolkit will look for the specific serial number in WRKHDWRSC and determine the resource name which will be used on the specified device description. The serial number can be for a tape drive or a media library.

If there are multiple logical libraries in the media library then specify a media library device description with the serial number of a tape drive assigned to the logical library. The toolkit will then use the tape drive resource's parent library description to ensure the correct logical library is used.

All device descriptions will be varied off prior to varying any on.

Target LPAR backup command: Specify the backup commands to be issued by the toolkit. Prior to calling any of these commands, the toolkit will have started the specified IP interface. To prevent accidentally starting applications, the startup program has been changed to *NONE, line descriptions set to not vary on at *IPL, and TCP is set to not start on IPL. These are considerations to be taken when restoring from the backups.

These commands are issued in sequence. Processing will halt if any issue an escape message. The commands are executed as QLPAR in QSTRUPJD. It is strongly recommended that backups be submitted to a different subsystem than the controlling subsystem.

While prompting is available on this command, the command validation will occur on the controlling LPAR but the command will actually be executed on the target LPAR. This may prevent successful prompting of commands like STRBKUBRM because the control group will exist on the source LPAR, not the controlling LPAR.

At 7.5 BRMS changed the functional usage to be more restrictive. As a result, QPGMR does not have the authority to run BRMS commands. Therefore, one of the following must be done:

- On the source LPAR, issue SETUSRBRM USER(QPGMR) USAGE(*ADMIN) once
- Change the 'Target LPAR backup command' to:

```
SBMJOB CMD(STRBKUBRM CTLGRP(BACKUPS) SBMJOB(*YES or *CTLSBS))  
JOB(BRMBACKUP) JOBQ(QSYS/QSYSNOMAX) USER(QLPAR)
```

Wait for ENDFSFLASH	*YES	*YES, *NO
FlashCopy Exit program . . .	*NONE	
Library	*LIBL	*LIBL, library
Hold scheduled jobs	*YES	*YES, *NO
Target keylock position . . .	*AUTO	*PANEL, *AUTO, *MANUAL
Stop target after backups	*NO	*YES, *NO, *RMV
Request type	0	Number
Auto start cluster	*YES	*YES, *NO
Wait time	0	Number of seconds
Message Queue	*SYSOPR	name, *SYSOPR
Library		library name
Text		

Wait for ENDFSFLASH: ENDFSFLASH is the command that will notify the toolkit that the backups have finished.

- ***NO:** The toolkit will not wait for ENDFSFLASH to be called. It will be processed implicitly when the backup commands have all completed without issuing an escape message. Note that the toolkit is not able to monitor submitted backups.
- ***YES:** The toolkit will wait for ENDFSFLASH to be called. This is expected to be submitted from the last *EXIT in a control group, in SAVSYSBCH, a command line, etc. If any backups are submitted (for example to the controlling subsystem) *YES is the correct option.

Flash Copy Exit Program: The FlashCopy Exit Program is described elsewhere in this guide. It's purpose is to allow for additional custom automation steps.

Hold scheduled jobs: This applies only to the basic job scheduler. The job entries are held immediately at the beginning of the startup program.

Target keylock position: Indicate how to start the target LPAR.

- ***AUTO:** Start the LPAR in automatic / unattended mode. This is the recommended option.
- ***MANUAL:** Start the LPAR in manual / attended mode. The recommendation is to use this option the first FlashCopy to bring the LPAR up in restricted state and verify the startup program is properly set. This will validate that the correct LUNs are being FlashCopied.
- ***PANEL:** Use the default setting as defined in the HMC.

Stop target after backups: After the backups (and QUSRBRM transfer) the toolkit can deactivate and remove/stop the FlashCopy relationship.

- ***NO:** Do not deactivate the target LPAR after backups. The LPAR will remain running, using CPU and memory resources.

- ***YES:** Deactivate the LPAR from the HMC. The FlashCopy will remain active so the LPAR can be IPL'd later. This will free up CPU and memory resources and prevent users from accidentally signing on to the LPAR.
- ***RMV:** The LPAR will be deactivated and the FlashCopy relationship will be stopped / removed. The LPAR cannot be IPL'd until another FlashCopy is performed. This is the best option if using thin provisioned or space efficient FlashCopy.

Stop target after backups: After the backups (and QUSRBRM transfer) the toolkit can deactivate and remove/stop the FlashCopy relationship.

- ***NO:** Do not deactivate the target LPAR after backups. The LPAR will remain running, using CPU and memory resources.
- ***YES:** Deactivate the LPAR from the HMC. The FlashCopy will remain active so the LPAR can be IPL'd later. This will free up CPU and memory resources and prevent users from accidentally signing on to the LPAR.
- ***RMV:** The LPAR will be deactivated and the FlashCopy relationship will be stopped / removed. The LPAR cannot be IPL'd until another FlashCopy is performed. This is the best option if using thin provisioned or space efficient FlashCopy.

Source lock wait time out: The time in seconds to wait for the source LPAR to become available for a Full system flashcopy operation. This parameter is typically only used in a multi-flash scenario.

Target lock wait time out: The time in seconds to wait for the target LPAR to become available for a Full system flashcopy operation. This parameter is typically only used in a multi-flash scenario.

Auto start cluster: Indicate whether the toolkit should attempt to start the cluster when a CHKFSFLASH or STRFSFLASH is executed, if the cluster is not started.

Message Queue: Specify a different message queue to send messages to if QSYSOPR isn't appropriate.

DLTCLDCLN – Delete Cloud Volumes-Clone

The Delete Cloud Clone (DLTCLDCLNL) command will delete one or all Volumes-clones.

API Key Name: This is a required parameter. Specifies the name of the API Key credentials to communicate with PowerVS APIs.

Volumes-clone ID: The id of the volumes-clone to be canceled. The following special value may be specified:

- ***ALL:** All volumes-clones associated with the cloud instance are to be deleted.
- **Volumes-clone ID:** The specified volumes-clone will be deleted. Use DSPCLDCLNL to find the volumes-clone ID.
- **Cancel active:** Cancel the volumes-clone if it is active.
- **Delete target volumes:** Specify whether to delete volumes-clone target volumes if they are available and not marked as bootable.

DLTCLDCS - Delete Cloud Consistency Set

The Delete Cloud Consistency Set (DLTCLDCS) command deletes the specific consistency set. The consistency set must be empty.

API Key Name: This is a required parameter. Specifies the name of the API Key to use to find the cloud instance.

Consistency Set Name: The name that identifies the consistency set to delete.

- ***EMPTY:** Delete any empty consistency sets found.
- **Name:** Delete the consistency set specified.

DLTCSERTA - Delete CSE Data

This command will delete the specific CSE Data from the device domain data.

CSE Data name: The name that identifies the CSE Data.

DSPCLDCLNL - Display Cloud Clone List

The Display Cloud Clone List (DSPCLDCLNL) command lists all the volumes-clones for the cloud instance associated with the specified API Key Name.

The clones will be listed in the joblog with more details in VIEWLOG.

API Key Name: This is a required parameter. Specifies the name of the API Key to use to find the cloud instance.

DSPCSEDTA - Display Copy Services Data

This interactive command displays the specific CSE Data configuration information in the device domain data space.

CSE Data name: Specifies the name of the CSE Data and the exit data that is to be displayed.

DSPDDLCK - Display DDD lock holder

This is a utility command for display the job and user who holds a cluster-wide lock on the specified artifact. This command should be used if a log message indicates a lock is preventing an operation.

Name: Enter the name of the object to display a lock for.

Type: Enter the type of object to display a lock for.

ENDFSFLASH - End Full System Flash

Notifies the controlling partition that backups are finished.

If ENDFSFLASH is unable to reach the source LPAR IP address it will try the *PS and *PT IP addresses listed in WRKSTRPRSC *CMN. This is done at the beginning of the ENDFSFLASH process; if you are presented with IAS0735 and you want to change the IP then enter C to Cancel, modify WRKSTRPRSC *CMN, and execute ENDFSFLASH again. Note that if the IP address change is done before the backups start, STRFSFLASH may not be able to reach the source LPAR and there will be errors in both the source and target log files but BRMS will still transfer to the source LPAR.

Action: Indicates whether the backups finished successfully or failed.

- ***SBMNORMAL:** Submit *NORMAL to batch.
- ***NORMAL:** The backups finished with success. Will trigger moving QUSRBRM to the source partition if configured. The source partition will become the active BRMS instance. This is valid to run on the target partition.
- ***FAILBKU:** The backups did not finish with success. Will not move QUSRBRM to the source partition. The source partition will become the active BRMS instance. This is valid to run on the target partition.

- ***RSTFCNUSG:** Restore the Functional Usage values which were saved prior to the FlashCopy. Use this option if the backups or transfer of BRMS from the target partition failed and you will discard the BRMS backup history changes on the target partition. This is valid to run on the source partition.
- ***CLNDYNMED:** Clean up the dynamic media class. This will mark and move any media in the specified media class to the base media class and restore the BRMS functional usage for the specific media class.
- ***TAGJOBLOG:** Ensure that this joblog is copied back to the source or controlling LPAR. Call ENDFSFLASH *TAGJOBLOG in the job whose joblog to be copied back.

If this is used with physical-virtual isolation the tagged joblogs are copied back to the controlling LPAR. For normal FSFC operations, it will copy the joblogs to the source LPAR and place them in the output queue defined in the BRMS system policy (WRKPCYBRM *SYS opt 1). If *PRTF is the BRMS output queue then the toolkit will use QUSRBRM/QZOUTQ. The output queue will be created if it doesn't exist.

Config: Specifies a configuration. If used with ACTION(*RSTFCNUSG) this will restore the restricted media classes provided in the specified configuration. This may be further limited with the MEDCLS parameter.

- ***DFT:** The toolkit will use the standard configuration, typically only used with LOCKBRMS(*BOTH).
- ***MEDCLS:** Restore the function usage for the specified restricted media classes specified on the MEDCLS parameter, regardless which configuration they may be associated with.
- **Config-name:** The toolkit will use the configuration specified. You must specify the configuration if you have multiple flashcopies sending BRMS back to the source LPAR, or if using restricted media classes.

Media class: Specifies which media classes to restore function authority for or to clean up the dynamic media in. If a configuration is specified on the CONFIG parameter, only the function authorities for the media classes associated with the specified configuration will be restored.

- ***ALL:** All of the outstanding media class function authorities associated with the specified configuration will be restored.
- **Config-name:** Only the function authorities for the specified media class will be restored.

Base media class: If *CLNDYNMED is specified on the ACTION parameter, the Base Media Class specifies the class to merge the dynamic media class into.

- ***NONE:** This parameter is ignored.

- **Media-class-name:** Specifies the base media class.

Dynamic media class: If *CLNDYNMED is specified on the ACTION parameter, the Dynamic Media Class specifies the class to merge into the base media class. The dynamic media class will then be removed.

- ***NONE:** No media will be merged.
- **Dynamic-media-class-name:** The media class to merge from and remove.

The functional usage authorities are restored after the dynamic media class has been removed.

IPLPAR – IPL Partition

This command will activate the specified LPAR.

HMC partition name: Specify the name of the LPAR to activate. This parameter is case sensitive.

Partition profile: Specify the partition profile to use when activating the partition. This parameter is case sensitive.

- ***LPARNAME:** The name of the profile is the same as the partition name.

Managing system: The managed system name must be specified. This parameter is case sensitive.

Primary HMC IP address: Enter the IP address of the primary HMC. This address must have credentials listed in WRKCSECRDL.

Secondary HMC IP address: Enter the IP address of the secondary HMC. This address must have credentials listed in WRKCSECRDL. This IP address is optional and will only be used if an unexpected response is received from the primary HMC.

IPL Source: Specifies whether an initial-program-load (IPL) is started from the A-source, B-source or D-source of the system. This parameter allows you to control which Licensed Internal Code (LIC) storage source of the system to IPL. Also, the source of the system determines where LIC program temporary fixes (PTFs) are applied. This parameter also allows the system to be upgraded to a new release from an install image on DASD.

LIC has three storage areas known as the A-source, the B-source and the D-source. The D-source is the install media. The A- and B-sources are part of the system memory. Initially, the A- and B-sources are identical, but when Licensed Internal Code fixes are performed temporarily (PTF), the temporary fixes are stored on the B-source. When the same fixes become permanent, they are copied from the B-source to the A-source; therefore, the fixes reside on both the A-source and the B-source.

When you want to send temporary fixes to the B-source, you must start the system from the A-source, which causes the fixes to be sent to the B-source.

When you start the system from the A-source, you are running the system from the permanent fixes. When you start the system from the B-source, you are running the system from a mixture of temporary and permanent fixes. When you start the system from the D-source, you are using the Licensed Internal Code loaded from the install media.

It is recommended that you specify RESTART(*YES); otherwise, you cannot be assured which source of the system is actually started. This precaution can save you some time.

- ***PANEL:** The partition is started from the source that is currently shown on the operator's panel, the A-source, the B-source, or the D-source.
- **A:** The partition is started from the A-source.
- **B:** The partition is started from the B-source.
- **D:** The system is started from the D-source, the install media.

Keylock position: Specifies whether the LPAR will be activated for attended (manual) or unattended (auto) mode.

- ***PANEL:** The partition is started in the mode that is currently shown on the operator's panel.
- ***AUTO:** The partition is started in unattended mode.
- ***MANUAL:** The partition is started in attended mode.

Block until LPAR is active: This parameter determines whether IPLLPAR will return control to the caller immediately or after the LPAR has reached the “Running” state.

- ***YES:** IPLLPAR will remain active until the LPAR has reached a “Running” state.
- ***NO:** IPLLPAR will terminate immediately after activating the LPAR.

Max minutes to block: Specifies how long IPLLPAR will wait for the partition to reach a “Running” state. This is ignored if **Block until LPAR is active** is *NO. If the partition does not enter the “Running” state before the specified number of minutes has elapsed, IPLLPAR will issue and escape message.

Confirm activation: Configures IPLLPAR to wait on an inquiry message before activating the partition.

- ***YES:** IPLLPAR will issue an inquiry message and will wait for a positive response before activating the partition.

- ***NO:** IPLPAR will activate the partition immediately.

LOGMSG – Log Message

The default log is in /QIBM/Qzrdhasm/qzrdhasm.log but some toolkit processes will change to a different log. LOGMSG will insert the specified message to the current log in use by the job.

Message: Enter the message to be inserted, from 20-120 characters.

Message format: Determines how the message will look in the log.

- ***STD:** Use the standard message format. An example:

```
2017-07-27 12:46:00      standard message (logmsg)
```

- ***CMDSTR:** Use the ‘command start’ message format. An example:

```
682401 2017-07-27 12:51:10 Start command start message starting from job
682401/AASLAND/QPADEV001Q
```

Message type: Indicates the message status tag. The possible values are:

- ***INFO:** The message does not have a tag.
- ***ERROR:** The message is tagged with ‘Error’
- ***WARNING:** The message is tagged with ‘Warning’

PRTCSE – Print CSE Information

The PRTCSE command prints Copy Services Environment (CSE) information, that was entered by the WRKCSE command and stored in cluster Device Domain Data (DDD). The information is printed to a QPRINT spool file. Unlike the environment list generated within WRKCSE, this command can access defined environments from any node within the cluster. Any combination of ENV and TYPE parameter values may be used.

Environment name: Specifies the name of the environments for which all information is to be dumped. The possible values are:

- ***ALL:** All types of environments with the Copy Service Type below or all environments may be dumped.
- **Environment name:** All types of environments with the supplied environment name may be dumped.

Copy Service Type: The type of Advanced Copy Service environment. This parameter is required. The possible values are:

- ***ALL:** All types of environments with the environment name or all environments may be dumped.
- ***FLASH:** The FlashCopy environment with the environment name or all FlashCopy environments may be dumped.
- ***GMIR:** The PPRC Global Mirroring environment with this environment name or all GMIR environments may be dumped.
- ***LUN:** The LUN Level connection switching environment with this environment name or all LUN environments may be dumped.
- ***MMIR:** The PPRC Metro Mirroring environment with this environment name or all MMIR environments may be dumped.

RLSCSELCK - Release Copy Services Lock

This command releases a cluster wide environment lock used within IASP Copy Services Manager.

Environment name: Specifies the name of the Environment (which may be an Independent ASP). A special value of *ALL may be used with RLSTYPE(*OVR) to override all ICSM locks for the cluster.

Release type: The possible values are:

- ***JOB:** Release the lock that is held by this process.
- ***OVR:** Release a cluster wide environment lock which may be held by another process or when used with ENV(*ALL), release all ICSM locks for the cluster. Use this only to override locks held by processes which are no longer active.

RMVCSECRDE - Remove CSE Credential Entry

This command can be used to remove a user credential entry from the Device Domain Data associated with IBM i Copy Services Manager.

Host IP address: The address of the host to be removed.

RSMFSFLASH – Resume Full System FlashCopy

The Resume Full System FlashCopy (RSMFSFLASH) command resumes the processing of a previous invocation of Start Full System FlashCopy (STRFSFLASH) from the point immediately after the flashcopy and prior to the IPL of the target partition. The Restart Target parameter in the CSE Data must have been set to *PAUSE.

Note that STRFSFLASH *PAUSE then Hyperswap then RSMFSFLASH will not work properly. It will IPL from the wrong LUNs.

RSTDDD – Restore Toolkit Device Data Domains

The Toolkits uses Device Data Domains (DDD) to store WRKCSE, WRKCEDTA and WRKCSECRDL information. Use RSTDDD to restore the DDD from files created by SAVDDD.

The sole parameter is the path to the directory which contains the DDD backup files generated by SAVDDD.

RSTJOBSCDE – Restore Job Scheduler Entries

CFGSTRPRSC will save the existing job scheduler entries to a userspace then hold them. Use this command to display or restore and release the stored job entries if CFGSTRPRSC does not do so automatically. This command can also be used after recovering from a flashcopy backup.

RTVINP - Retrieve ICSM Information

The Retrieve Information (RTVINP) command retrieves specific information from IASP Copy Services Manager. This command is only valid when executed within a CL program.

Environment name: This is a required parameter. Specifies the name of the Environment (which may be an Independent ASP) for which information is to be retrieved.

Information: This is a required parameter and specified the type of information to be returned. The possible values are:

- ***CLUNODENAME:** The node name of this system within the cluster. The length of the first CL return variable below must be at least eight characters.

- ***FLASHNODES:** The backup Flash Copy node names for the Flash configurations. Up to six FlashCopy environments may be configured. All six CL return variables must be specified and each of their lengths must be at least eight characters.
- ***FLASHSTATUS:** First Flashcopy status. The length of the first CL return variable below must be at least three characters.
 - 0 = Ready
 - 100 = Flashed
 - other number = Flash in process
 - blank = undetermined.
- ***FLASH2STATUS:** Second Flashcopy status. The length of the first CL return variable below must be at least three characters.
 - 0 = Ready
 - 100 = Flashed
 - other number = Flash in process
 - blank = undetermined.
- ***FLASH3STATUS:** Third Flashcopy status. The length of the first CL return variable below must be at least three characters.
 - 0 = Ready
 - 100 = Flashed
 - other number = Flash in process
 - blank = undetermined.
- ***FLASH4STATUS:** Fourth Flashcopy status. The length of the first CL return variable below must be at least three characters.
 - 0 = Ready
 - 100 = Flashed
 - other number = Flash in process
 - blank = undetermined.
- ***FLASH5STATUS:** Fifth Flashcopy status. The length of the first CL return variable below must be at least three characters.
 - 0 = Ready
 - 100 = Flashed
 - other number = Flash in process
 - blank = undetermined.
- ***FLASH6STATUS:** Sixth Flashcopy status. The length of the first CL return variable below must be at least three characters.
 - 0 = Ready
 - 100 = Flashed
 - other number = Flash in process
 - blank = undetermined.

- ***GMIRDIRECTION:** The length of the first CL return variable below must be at least one character.
 - N = Normal
 - R = Reversed
 - Blank = undetermined.

- ***GMIRNODEROLE:** This key value MUST replace any use of *PPRCNODEROLE for GMIR type environments, else unpredictable results may occur. The length of the first CL return variable below must be at least one character.
 - S = Source
 - T = Target
 - blank = undetermined

- ***GMIRSTATE:** The length of the first CL return variable below must be at least one character.
 - 0 = Stopped
 - 1 = Running
 - 2 = Failover
 - 3 = Suspended
 - 4 = Lagging
 - 5 = Extreme Lagging
 - 6 = Paused
 - 9 = Other
 - M = Multi-target Incremental Resync Pair
 - blank = undetermined. RTVLPARINF

- ***GMIRSTATEDIRECT:** State is returned in RTNVALUE and the direction is returned in RTNVALUE2. The length of the first and second variables must be at least one character.
 - State (RTNVALUE):
 - 0 = Stopped
 - 1 = Running
 - 2 = Failover
 - 3 = Suspended
 - 4 = Lagging
 - 5 = Extreme lagging
 - 6 = Paused
 - 9 = Other
 - Direction: (RTNVALUE2):
 - M = Multi-target Incremental Resync Pair
 - N = Normal
 - R = Reversed
 - blank = undetermined

- ***GMIR2DIRECTION:** The length of the first CL return variable below must be at least one character:
 - N = Normal
 - R = Reversed

- Blank = undetermined
- ***GMIR2NODEROLE:** This key value MUST replace any use of *PPRCNODEROLE for GMIR2 type environments, else unpredictable results may occur. The length of the first CL return variable below must be at least one character
 - S = Source
 - T = Target
 - blank = undetermined.
- ***GMIR2STATE:** The length of the first CL return variable below must be at least one character
 - 0 = Stopped
 - 1 = Running
 - 2 = Failover
 - 3 = Suspended
 - 4 = Lagging
 - 5 = Extreme Lagging
 - 6 = Paused
 - 9 = Other
 - M = Multi-target Incremental Resync Pair
 - blank = undetermined.
- ***GMIR2STATEDIRECT:** State is returned in RTNVALUE and direction is returned in RTNVALUE2. The length of first and second CL return variables below must be at least one character.
 - State (RTNVALUE):
 - 0 = Stopped
 - 1 = Running
 - 2 = Failover
 - 3 = Suspended
 - 4 = Lagging
 - 5 = Extreme lagging
 - 6 = Paused
 - 9 = Other
 - Direction: (RTNVALUE2):
 - M = Multi-target Incremental Resync Pair
 - N = Normal
 - R = Reversed
 - blank = undetermined
- ***IASPNAME:** The name of the Independent ASP used for the VRYCFG commands. The length of the first CL return variable below must be at least ten characters.
- ***LUNCONNECTION:** The length of the first CL return variable below must be at least one character.
 - P = Connected to the Production Node

- H = Connected to the HA node
- Blank = undetermined
- ***LUNNODEROLE:** The values indicate the normal role of this node. The length of the first CL return variable below must be at least one character.
 - P = Production Node
 - H = HA node
 - Blank = undetermined
- ***MMIRDIRECTION:** The length of the first CL return variable below must be at least one character.
 - N = Normal
 - R = Reversed
 - Blank = undetermined
- ***MMIRNODEROLE:** This key value should replace any use of *PPRCNODEROLE for MMIR type environments. The length of the first CL return variable below must be at least one character.
 - S = Source
 - T = Target
 - Blank = undetermined
- ***MMIRSTATE:** The length of the first CL return variable below must be at least one character.
 - 0 = Failed
 - 1 = Running
 - 2 = Failover
 - 3 = Suspended
 - 4 = Resuming
 - 6 = Paused
 - M = Multi-target Incremental Resync Pair
 - blank = undetermined.
- ***MMIRSTATEDIRECT:** State is returned in RTNVALUE and direction is returned in RTNVALUE2. The length of first and second CL return variables below must be at least one character.
 - States:
 - 0 = Failed
 - 1 = Running
 - 2 = Failover
 - 3 = Suspended
 - 6 = Paused
 - M = Multi-target Incremental Resync Pair
 - blank = undetermined.
 - Directions:
 - N = Normal

- R = Reversed
 - blank = undetermined.
- ***MMIR2DIRECTION:** The length of the first CL return variable below must be at least one character.
 - N = Normal
 - R = Reversed
 - blank = undetermined.
- ***MMIR2NODEROLE:** This key value should replace any use of *PPRCNODEROLE for MMIR2 type environments. The length of the first CL return variable below must be at least one character.
 - S = Source
 - T = Target
 - blank = undetermined.
- ***MMIR2STATE:** The length of the first CL return variable below must be at least one character.
 - 0 = Failed
 - 1 = Running
 - 2 = Failover
 - 3 = Suspended
 - 4 = Resuming
 - 6 = Paused
 - M = Multi-target Incremental Resync Pair
 - blank = undetermined
- ***MMIR2STATEDIRECT:** State is returned in RTNVALUE and direction is returned in RTNVALUE2. The length of first and second CL return variables below must be at least one character.
 - States:
 - 0 = Failed
 - 1 = Running
 - 2 = Failover
 - 3 = Suspended
 - 6 = Paused
 - M = Multi-target Incremental Resync Pair
 - blank = undetermined.
 - Directions:
 - N = Normal
 - R = Reversed
 - blank = undetermined.
- ***MMIR3DIRECTION:** The length of the first CL return variable below must be at least one character.
 - N = Normal

- R = Reversed
- blank = undetermined.
- ***MMIR3NODEROLE:** This key value should replace any use of *PPRCNODEROLE for MMIR3 type environments. The length of the first CL return variable below must be at least one character.
 - S = Source
 - T = Target
 - blank = undetermined.
- ***MMIR3STATE:** The length of the first CL return variable below must be at least one character.
 - 0 = Failed
 - 1 = Running
 - 2 = Failover
 - 3 = Suspended
 - 4 = Resuming
 - 6 = Paused
 - M = Multi-target Incremental Resync Pair
 - blank = undetermined
- ***MMIR3STATEDIRECT:** State is returned in RTNVALUE and direction is returned in RTNVALUE2. The length of first and second CL return variables below must be at least one character.
 - States:
 - 0 = Failed
 - 1 = Running
 - 2 = Failover
 - 3 = Suspended
 - 6 = Paused
 - M = Multi-target Incremental Resync Pair
 - blank = undetermined.
 - Directions:
 - N = Normal
 - R = Reversed
 - blank = undetermined.
- ***MULTITARGET:** Multi-target configuration
 - N = None
 - M = Multi-target using two Metro Mirror environments
 - G = Multi-target using one Metro Mirror environment and one Global Mirror environment.
- ***PPRCNODEROLE:** The length of the first CL return variable below must be at least one character.
 - S = Source

- T = Target
 - blank = undetermined
- ***PPRCNODES:** The backup PPRC node names for the up to three PPRC configurations. RTNVALUE will contain the MMIR configuration node name. RTNVALUE2 will contain the GMIR configuration node name. RTNVALUE3 will contain the LUN configuration node name. All three CL return variables must be specified and each of their lengths must be at least eight characters.
 - **PPRCNODE:** The Production node name. RTNVALUE will contain the node name. The CL return variable must be specified with a length of at least eight characters.

Return value: This is a required parameter. Specifies a CL character variable name for returned value.

Return value 2: This is a required parameter for *MMIRSTATEDIRECT, *GMIRSTATEDIRECT, *FLASHNODES and *PPRCNODES. For *MMIRSTATEDIRECT and *GMIRSTATEDIRECT, the PPRC direction ('N' or 'R') is returned here. For *FLASHNODES, the second FlashCopy node will be returned here. For *PPRCNODES, the GMIR target node will be returned here. Specifies a CL character variable name for the second returned value.

Return value 3: This is a required parameter for *FLASHNODES and *PPRCNODES. Specifies a CL character variable name for the third returned value. For *FLASHNODES, the third FlashCopy node will be returned here. For *PPRCNODES, the LUN HA node will be returned here.

Return value 4: This is a required parameter for *FLASHNODES if a fourth FlashCopy environment is configured. Specifies a CL character variable name for the fourth returned value. The fourth FlashCopy node will be returned here.

Return value 5: This is a required parameter for *FLASHNODES if a fifth FlashCopy environment is configured. Specifies a CL character variable name for the fifth returned value. The fifth FlashCopy node will be returned here.

Return value 6: This is a required parameter for *FLASHNODES if a sixth FlashCopy environment is configured. Specifies a CL character variable name for the sixth returned value. The sixth FlashCopy node will be returned here.

RUNDSCMD - Run DS Scripted Command

The RUNDSCMD command is used in a CL program to run a scripted command through DSCLI and validate the results from the expected result list provided in the command parameters. The command optionally returns the total of numeric values in a specified column of the results.

Three exception messages may be issued:

- IAS0301 - Parameter error detected.

- IAS0302 - Result file error detected.
- IAS0303 - Results not as expected.

Script input file: The complete path and name of the script stream file. A value of '*' is allowed when no script is to be executed, and only prior results are to be validated.

Profile input file: The complete path and name of the profile stream file. A value of '*' is allowed when that value is also used for the script parameter.

Results output file: The complete path and name of the results stream file. This parameter is always required.

User: Specify the user profile name to be used to run the DSCLI scripted command.

Result validation list: A list of from one to ten validation entries to be matched against the results returned by the scripted command. The columns in the result file must be comma separated (refer to the profile that is in use).

Each validation list entry contains two or three elements:

- **Column position:** The comma separated column position for this element. This required value must be from one through 20.
- **Expected value:** The case sensitive character string that is expected. This value is required, must be enclosed in apostrophes, and may contain alphanumeric characters, blanks and punctuation marks except commas. Strings that are not to be found may be specified by placing a minus sign (-) as the first character of the string.
- **Logic to next in list:** The logical operator (*AND or *OR) to the next expected value in the list. This value is required on all list elements except the last. Note that the results of each file row are evaluated from the first to the last expected value. Careful consideration must be made when this value is mixed (both *AND and *OR used on a single RUNDSCMD command). If more complex result checking is required, the RUNDSCMD command may be run again specifying '*' for the SCRIPT parameter and combined results may be evaluated within the user's CL program.

Result file rows: The rows that are to be validated. The possible values are:

- ***ALL:** The results specified in the validation list are expected to be found in at all of the result file rows.
- ***ONE:** The results specified in the validation list are expected to be found in at least one of the result file rows.

Summation column: The comma separated column positional value that is to be summed and returned in the TOTAL parameter. Numeric values from one through 20 are allowed. The default is *NONE. If a numeric value is specified, the content of that column in the result file may only contain numeric data.

CL variable for returned total: Specifies the name of the CL program variable that receives the total value being returned. The type and length for the CL variable must be TYPE(*DEC) LEN(9 0). This parameter is required when the value of SUMCOLUMN is other than *NONE.

Return column: The comma separated column positional value that is to be returned in the RTNVALUE parameter. Numeric values from one through 20 are allowed. The default is *NONE. Refer to the RTNKEY parameter below. This parameter is requires that the RTNCOLUMN parameter is also specified.

Return key value: Specifies the key string used to locate the row in the result file where the return value (RTNVALUE) will be extracted. The default is *NONE. If a numeric value is specified for RTNCOLUMN and this parameter is *NONE, the value in the first row of the result file is returned in RTNVALUE. If a numeric value is specified for RTNCOLUMN and this parameter specifies a key value, the value in the first row of the result file that contains that key is returned in RTNVALUE. This parameter is requires that the RTNCOLUMN and RTNVALUE parameters are also specified.

CL variable for returned value: Specifies the name of the CL program variable that receives the character value being returned. The type and length for the CL variable must be TYPE(*CHAR) LEN(80). This parameter requires that the RTNCOLUMN parameter is also specified.

RUNLPARCMD - Run command based on LPAR/SRLN

This command will run a specific command based on the specified LPAR and serial numbers detected. This command is usually used in the startup program to perform different tasks based on the serial and LPAR numbers.

NOTE: It is possible to test the behavior of this command on different serial and LPAR numbers by creating the following data areas:

```
CRTDTAARA DTAARA(QZRDHASM/FAKELPAR) TYPE(*CHAR) LEN(3)
VALUE('123')
```

```
CRTDTAARA DTAARA(QZRDHASM/FAKESRLN) TYPE(*CHAR) LEN(8)
VALUE('1234567')
```

The command RUNLPARCMD will look for these data areas and use them instead of detecting the actual serial or LPAR numbers.

Serial number: Specify the serial number required to run this command. NOTE: Prompt (F4) to see the current serial number.

- ***ANY:** Run this command on any LPAR, regardless of serial number.
- **Serial-number:** Run the command on the LPAR with the specified serial number.

LPAR number: Specify the LPAR number required to run this command. NOTE: Prompt (F4) to see the current LPAR number.

- ***ANY:** Run this command on any LPAR regardless of the LPAR number.
- **lpar-number:** Run the command on the LPAR with the specified number.

Command to execute: Run this command if the LPAR and serial numbers match those of the current LPAR. NOTE: Prompt (F4) to assist with building the command.

RUNSVCCMD - Run SVC Command

This command establishes an ssh session to an SVC, runs the user entered command, and stores the results in a stream file. NOTE: This command can establish an ssh session with any type of host, not just SVCs.

Command: Specifies the command to be run.

SVC IP address: Specifies the IPv4 formatted IP address of the SVC to be used.

Results output file: Specifies the IFS path name of the output file containing the results of the SVC command.

Display results: Specifies whether the results of the SVC command should be displayed in addition to be written to the output file.

SAVDDD – Save Toolkit Device Data Domains

The Device Data Domains (DDD) are where the Toolkit stores WRKCSE, WRKCSEDTA and WRKCSECRDL information. The command SAVDDD will extract that information and place it into IFS files. Any sensitive information including passwords will be encrypted.

Use the RSTDDD command to restore / recreate the DDD information.

Directory path: Where the DDD elements will be saved to.

- ***GEN:** A directory using the current timestamp will be created

- **Path:** The path to the directory in which to place the files. The directory must exist.

SETCSELCK - Set Copy Services Lock

This command sets a cluster wide environment lock used within IASP Copy Services Manager.

Environment name: This is a required parameter. Specifies the name of the Environment (which may be an Independent ASP).

Timeout minutes: The number of minutes before the environment lock will self time out. The default is fifteen minutes.

SETDDLCK - Set DDD lock holder

This is a utility command for setting the job and user who holds a cluster-wide lock on a specified artifact.

Name: Enter the name of the object to display a lock for.

Type: Enter the type of object to display a lock for.

SETUPFSFC - Set up IBM Pwr HA tools – FSFC

This command prepares IBM Power HA toolkit for IBM i for Full System FlashCopy operation after its has operational library (QZRDHASM) has been restored. Caution should be taken before running this command.

Node Role: Special values indicating which role the system will be acting. The possible values are:

- ***CTL:** The system is a controlling node in Full System FlashCopy.
- ***SRC:** The system is the source LPAR in Full System FlashCopy.

FSFC Communications Port: The port to which the production node will be using for communications. This value must match the FSFC communications port value specified in either CRTCS EDTA or CHGCSEDTA that is run on the controlling node. The possible values are:

- ***SAME:** The value does not change. This is the only valid value for NODETYPE(*CTL)
- ***DFT:** The default port (55920) will be used.
- **1 – 65535:** Specify the port number that is to be used.

Toolkit access code: A hexadecimal character representation of a Product Access Code supplied by IBM. Specify the access code within single quotes. The access code must be provided in order to authorize any Full System FlashCopy operations. The access code may be entered on this command or entered on the ADDPRDACS CL command. If access code was previously entered, it does not need to be entered again.

Target line description: Line description to be created on the target LPAR for communicating with the controlling node. The possible values are:

- ***NONE:** No line description will be created
- **Name:** The name of line description to be created.

Target TCP/IP interface: TCP/IP interface to be created on the target LPAR for communicating with the controlling node. The possible values are:

- ***NONE:** No interface will be created
- **IPv4 address:** IPv4 formatted interface to be created.

Target TCP/IP interface Mask: The subnet mask of the TCP/IP interface to be created on the target LPAR. The possible values are:

- ***NONE:** No subnet mask provided
- **IPv4 address:** IPv4 formatted subnet mask.

STRCLDVSI - Start Cloud Power Virtual Machine

The Start Cloud VSI (STRCLDVSI) command will cause a Virtual Server Instance (VSI) to start by issuing a request to the cloud instance mapped to the API Key name.

VSI: Specifies the id of the virtual server instance (VSI) that is to be started.

Block until VSI is active: Specifies whether the command should block until the VSI has finished the IPL and is active. The possible values are:

- ***YES:** The command will block until the IPL is finished.
- ***NO:** The command will not block.

Max minutes to block: Specifies the maximum amount of time in minutes that the command should wait for the IPL to finish and the LPAR to become active.

STRFSFLASH - Start Full System Flash

This interactive command starts a Full System Flash Copy (FSFC) or Recovery Point Flash (RPF), as determined by the CSE Data it is performed on. For RPF it will create the flashcopy. For FSFC it will also perform the backup commands specified for the CSE Data. Use WRKCSEDTA or CRTCSEDTA and CHGCSEDTA to configure the FSFC or RPF.

STRFSFLASH for FSFC will perform these steps:

- Power down the target partition, if not already down,
- Flush memory in the source partition using a method specified in the CSE Data.
- Perform the flash of the external storage.

If the storage type is PowerVS, the clone volumes will be removed from consistency sets and replication disabled. This can be prevented with an environment variable (refer to the online documentation).

- Activate the source partition if not already up.
- Activate the target partition.
- Perform the backups on the backup partition.
- Check that IPL attribute STRRSTD is set to *NO
 - Warn by default
 - Fail if environment variable QZ_FSFC_STRRSTD_FAIL exists
 - Subsystem QZRDFSR must be restarted to pick up new environment variables

STRFSFLASH for RPF will perform these steps:

- Flush memory in the source partition using a method specified in the CSE Data.
- Perform the flash of the external storage.
- Activate the source partition if not already up.

CSE Data name: Specify the name of the CSE Data that contains configuration information for the FlashCopy to be performed.

Controller IP address: Specifies the IP address on the controlling node where the processing for the STRFSFLASH command will be performed. The possible values are:

- ***LOCAL:** The local system is the controller.

- ***AUTO:** Use the controller IP addresses from WRKSTRPRSC *CMN. The toolkit will look for entries with *CTLx usage and try them in order until one responds. The port supplied in WRKSTRPRSC *CMN is used.
- **IP address:** IPv4 formatted address

Controller port: The port on which the controller is listening for remote commands. This parameter is ignored for CTLR(*LOCAL).

STRFSRFLSH - Start Full System Replication and Flash

The Start Full System Replication and FlashCopy Readiness (STRFSRFLSH) command performs checks to determine if the prerequisite conditions have been met for the identified CSE Data configuration to be able to perform a Full System FlashCopy via STRFSFLASH. It uses the information in the Replication Environment to determine the replication direction and status and also which LPAR is active. Based on this information it will select the correct CSE Data from the parameters passed in and perform a STRFSFLASH with it.

This command must be run from a controlling LPAR.

Replication Environment: This is a required parameter. Specifies the name of the Full System Replication environment (from WRKCSE) to use to determine replication direction and status.

Preferred source remote flash: Specifies the CSEDTA to use when the source LPAR is active as *PS and replication is in consistent state. This takes precent over a local flash copy.

Preferred source local flash: Specifies the CSEDTA to use when the source LPAR is active as *PS and replication is not in consistent state.

Preferred target remote flash: Specifies the CSEDTA to use when the source LPAR is active as *PT and replication is in consistent state. This takes precent over a local flash copy.

Preferred target local flash: Specifies the CSEDTA to use when the source LPAR is active as *PT and replication is not in consistent state.

STRGMTGTFL - Start a GMIR Target Flash

This command starts Global Mirroring enviromnent D-Copy Target FlashCopy Backup as defined by the WRKCSE GMIR environment.

Environment name: This is a required parameter. Specifies the name of the environment for which the backup is to be started.

CSE Data name: Specifies the name of the CSE Data used for the flash. The possible values are:

- ***ENV:** Use the CSE data that is named the same as the environment
- **Name:** The name of a specific CSE data

SWRCYPNT – Switch Recovery Point Copy

The Switch Recovery Point Copy (SWRCYPNT) command causes the Production Node to be powered down, the host connections to be changed to another set of LUNs to which previously a recovery point copy had been written, and the production node powered back up.

Switch option (SWITCHTYPE): The possible values are:

- ***SCHEDULED:** This CSE switch is planned. The Production system is available.
- ***UNSCHEDULED:** This CSE switch is not planned. The Production system is not available.

TSTCOMM – Test Communication Paths

This interactive command will test the communication on the ports specified.

Role: This parameter specifies what type of communication role the partition is to take. The possible values are:

- ***SERVER:** The partition will act as a server.
- ***CLIENT:** The partition will act as a client.

IP Address: This parameter specifies the IP address of the other partition. For a client, this will be the server address. For a server, this will be the expected address received after the accept operation completes.

Port: This is the IP port that will be used for the test.

To use this command, log into the two LPARs to test the communication between and free the port to be tested (this may mean ending QZRDFSR). Designate one LPAR as the server, the other as the client. On the server, issue the following command

```
TSTCOMM ROLE(*SERVER) IPADDR('<client IP address>') PORT(55920)
```

When TSTCOMM is 'Listening on socket' issue the following command on the client:

```
TSTCOMM ROLE(*CLIENT) IPADDR('<server IP address>') PORT(55920)
```

The results will indicate either success or failure (timeout) communicating on the specified port.

VIEWLOG - View Log File

This interactive command allows editing of the Advanced Copy Services log file on the local system and displaying the same on another system. This utility can also view any stream file on the systems.

System name: The system where the file is located. The possible values are:

- ***LOCAL:** View the main log file on the local system.
- ***SNMP:** View the SNMP log file on the local system.
- **System name:** View the main log file on the named system.

Stream file: The specific file to be viewed. The possible values are:

- ***SNMP:** View the SNMP log file. This option allows the SNMP log file on another system to be viewed.
- **Path and name of the stream file:** The default is /QIBM/Qzrdhasm/qzrdhasm.log

WRKCLDVOL - Work with Cloud Volumes

This command retrieves and displays a list of the PowerVS volumes associated with the provided API key.

API key name: Specify the key name (from WRKCSECRDL *CLOUD) containing the cloud instance id and PowerVS credentials.

Volume name: Provide the name of the volume(s) to display. Names with special characters, spaces etc. may need to be enclosed in single quotes. The possible values are:

- ***ALL:** Display the volumes regardless of volume name.
- **Name:** Display only the volume with the provided name.
- **Generic-name:** Specify the generic name of the volumes to display. A generic name is a character string that contains one or more characters followed by an asterisk (*). If a generic name is specified, all volumes that have names with the same prefix as the generic name are shown.
- **Substring:** Specify a substring to be included in the names of the volumes displayed. A substring is a character string that contains one or more characters followed by two asterisks (**). If a substring is specified, all volumes that have names including the substring are shown.

Master volume name: Provide the name of the master volume(s) to display. Names with special characters, spaces etc may need to be enclosed in single quotes. The possible values are:

- ***ALL:** Display the volumes regardless of master volume name.
- **Name:** Display only the volume with the provided master volume name.
- **Generic-name:** Specify the generic master volume name of the volumes to display. A generic name is a character string that contains one or more characters followed by an asterisk (*). If a generic name is specified, all volumes that have master volume names with the same prefix as the generic name are shown.
- **Substring:** Specify a substring to be included in the master volume names of the volumes displayed. A substring is a character string that contains one or more characters followed by two asterisks (**). If a substring is specified, all volumes that have master volume names including the substring are shown.

Auxiliary volume name: Provide the name of the auxiliary volume(s) to display. Names with special characters, spaces etc may need to be enclosed in single quotes. The possible values are:

- ***ALL:** Display the volumes regardless of auxiliary volume name.
- **Name:** Display only the volume with the provided auxiliary volume name.
- **Generic-name:** Specify the generic auxiliary volume name of the volumes to display. A generic name is a character string that contains one or more characters followed by an asterisk (*). If a generic name is specified, all volumes that have auxiliary volume names with the same prefix as the generic name are shown.
- **Substring:** Specify a substring to be included in the auxiliary volume names of the volumes displayed. A substring is a character string that contains one or more characters followed by two asterisks (**). If a substring is specified, all volumes that have auxiliary volume names including the substring are shown.

Replication-enabled volumes: Indicate whether replication-enabled volumes are to be included, exclusively included, or excluded. The possible values are:

- ***ALL:** Do not exclude based on replication-enabled status.
- ***ONLY:** Only include replication-enabled volumes.
- ***NONE:** Do not include replication-enabled volumes.

Master volumes: Indicate whether master volumes are to be included, exclusively included, or excluded. The possible values are:

- ***ALL:** Do not exclude master volumes.
- ***ONLY:** Only include master volumes.
- ***NONE:** Do not include master volumes.

Auxiliary volumes: Indicate whether auxiliary volumes are to be included, exclusively included, or excluded. The possible values are:

- ***ALL:** Do not exclude auxiliary volumes.

- ***ONLY:** Only include auxiliary volumes.
- ***NONE:** Do not include auxiliary volumes.

Volume ID: Specify the volume ID of the volume to display.

Virtual Server instance ID: Display the volumes attached to the specified VSI.

The command lists volumes by consistency set (a consistency is a group of volumes replicating together). The following options and functions are available:

4=Delete: Deletes a Cloud Volume. You will be presented with a confirmation display prior to deleting the Cloud Volume.

5=Display: Display details about the volume or consistency set.

7=Rename: Rename a Cloud Volume. You will be prompted for a new name for the selected Cloud Volume.

8=Onboard: Onboard a Cloud Volume. Onboarding a Cloud Volume is a part of setting up replication.

10=Modify Consistency Set: Modify a Consistency Set. Add or remove volumes to/from a consistency set.

12=Toggle replication: Toggle replication. Enable or disable replication for a Cloud Volume. Enabling replication creates an auxiliary volume and a replication relationship between them. It is a requirement prior to adding it to a volume group. Disabling replication removes the replication relationship and deletes the auxiliary volume.

13=Toggle bootable: Toggle the boot status of a volume. Change the boot status of a volume. A VM must have at least one bootable volume.

14=Reset Consistency Set: Reset a consistency set in error status. Reset the status of a consistency set from error back to available.

F6=Create Volume: Press F6 to create a new volume.

F7=Create Consistency Set: Press F7 to create a new Consistency Set.

F10=View log: View the toolkit flight recorder log.

F11=Display replication state: Press F11 to show the replication state of the volumes.

WRKCSE - Work with Copy Services Environment

This interactive command allows creation and editing of Flash Copy, Metro-Mirroring, Global-Mirroring and LUN environments defined for use within IBM i Copy Services Manager. Menus are also provided for basic operations. The information is retained in cluster Device Domain Data associated with IBM i Copy Services Manager.

There are no command parameters.

From the WRKCSE main panel the following options are available:

1. Create a new environment. Follow the prompts for the type of environment you are creating.

2. Change an existing environment.
4. Delete an existing environment.
5. Display an existing environment.
12. Work with and existing environment. The type of environment dictates the options available. For example, Storwize flashcopy environments allow for changing the copy and clean rates, DS8K replication environments have options for switching, etc.
 - Pause / Resume replication
 - Start / Stop flashcopies
 - Detach / Re-attach LPARs
 - Switch Replication direction
 - Start Replication after a switch
 - Display and change copy and clean progress
 - Display out of sync sectors
 - Display replication relationships
 - Display flashcopy mappings
14. List stream files for DS8K environments. These files contain the DSCLI scripts issued on the DS8K units and can be edited. They will be re-generated if the environment is changed. Use option 9 to run a script.
16. Define Host Connections. These can be defined using F4, F6 and F7 to prompt, import and select host connections. How the host connections are used depends on the type of environment it is.
17. Make PPRC Paths can be used DS8K replication environments.

WRKCSECRDL - Work with CSE Credential List

This interactive command allows addition, editing, and removal of user credentials needed to establish SSH sessions with a host. Normally the host will be either a SAN Volume Controller (SVC) or a Hardware Management Console (HMC). The information is encrypted using a cryptographic derived 128 bit AES key and retained in cluster Device Domain Data associated with IBM i Copy Services Manager.

There are no command parameters.

For CSM operations enter the role of the user - *CSM or *CSMAUT – for the purpose of dual-control. The *CSM role is used to initiate requests and *CSMAUT is the role for approving any pending actions initiated by the *CSM role.

Non-CSM operations should specify *USER.

PowerVS credentials (API Keys, URN's etc) are managed from the *CLOUD panels (i.e. WRKCSECRDL FN-11 or WRKCSECRDL *CLOUD).

WRKCEDTA -Work with IBM i CSE Data

This interactive command provides basic operation to manage CSE Data used for Metro-Mirroring, Global-Mirroring, and Flash environments defined for use within IBM i Copy Services Manager.

Select: Select which CSE Data entries are to be displayed. The possible values are:

- ***CRG:** Display only the CSE Data entries that are complete.
- ***ALL:** Display all CSE Data entries.
- Generic subset

The panel has a 'Position To' parameter for quickly navigating to a desired CSEDTA.

WRKSTRPRSC -Work with Startup Resources

This interactive command provides the information for the toolkit to use. It should be executed on the source LPAR. The information is used by commands FIXSTRPRSC, CFGSTRPRSC, and STRFSFLASH.

There are five main panels on WRKSTRPRSC which can be selected on the command or cycled through using F11. The common element that ties the records together is the LPAR Usage. Once the toolkit (FIXSTRPRSC, CFGSTRPRSC) determines the current LPAR Usage, the rules on the remaining panels apply to when the LPAR is used in that role. Some LPAR Usage identifiers allow for multiple variations; for example, you can have two preferred source LPARs (*PT01, *PT02) depending on which serial number it is running on.

If the toolkit cannot determine the current role of the LPAR it will exit without performing any modifications.

The panels are:

- ***SYS:** Determine the LPAR Usage based on the serial and LPAR numbers.
 - ***PSxx:** Preferred Source – where your production LPAR is normally running.
 - ***PTxx:** Preferred Target – where the target LPAR can run after a roleswap
 - ***SGxx:** Safeguarded Copy – used when recovering from a Safeguarded Copy.
 - ***FCxx:** Flashcopy Target – where the backups will occur after a Safeguarded Copy.
 - **Default CSEDTA:** Used for PVI configurations to determine which configuration to use for flashcopy backups.
- ***CMN:** Determines which communications resources to bring online. All other lines and IP addresses are left offline.
 - **Usage:** Indicate the role in which these resources will be used

- ***PSxx:** Activated when the serial and LPAR numbers match the system usage for the preferred source.
 - ***PTxx:** Activated when the serial and LPAR numbers match the system usage for the preferred target.
 - ***SGxx:** Activated when the serial and LPAR numbers match the system usage for the Safeguarded Copy for recovery.
 - ***FCxx:** Activated when the serial and LPAR numbers match the system usage for Safeguarded Copy for backups.
 - ***CTL1:** The IP for the primary controller. Used by CFGSTRPRSC in a PVI configuration to reach the controllers. STRFSFLASH CTLR(*AUTO) will use this entry first to find a working controller. Hardware Resource Location is not used.
 - ***CTL2:** The IP for the secondary controller. Used by CFGSTRPRSC in a PVI configuration to reach the controllers. STRFSFLASH CTLR(*AUTO) will use this entry to find a working controller if the primary is not reached. Hardware Resource Location is not used.
- **IP Interface:** Specifies the IP interface to be activated and set to autostart when the LPAR is in the specified role. The IP address must exist on the source LPAR.
- **Line Description:** Specifies the line description to be activated and set to autostart when the LPAR is in the specified role. The line description must exist on the source LPAR.
 - ***IPADDR:** Use the line description currently assigned to the specified IP address.
 - ***VIRTUALIP:** The specified IP address is virtual and does not have a line description associated with it. Start this IP address after all preceding IP addresses have been started. The Hardware Resource Location must be *NONE.
- **Hardware Resource Location:** Indicates the hardware resource location that will be associated with the specified line description.
 - ***LINE:** Use the resource location currently associated with the specified line description.
 - ***NONE:** No hardware resource location is specified. This is only valid for *VIRTUALIP
- **Port:** Specify the port of the resource if necessary.
- ***ISCSI:** Specifies the iSCSI resources to configure based on the usage of the LPAR. All prior information will be removed during a switch. The system will only configure one iSCSI resource.
 - **Usage:** Configure the resource for the specified LPAR usage.
 - **IP Interface:** The IP interface of the remote iSCSI device.
 - **Port:** The port to use. The default 3260 is typical for FalconStor VTL's.
 - **Target Device IQN:** Enter the IQN on the remote iSCSI to connect to.
 - **Client Device IQN:** Enter the IQN assigned to the IBM i LPAR for the specified role.
- ***STG:** Determines the tape storage resources to configure based on the usage of the LPAR.
 - **Usage:** Configure the resource for the specified LPAR usage.
 - **Device Description:** What the toolkit will vary on and is expected to be used in the backups (WRKCTLGBRM etc).

- **Device Type:** Indicate whether the device is media library (*MLB) or tape drive (*TAP). If *DEV is specified, the toolkit will use the type which the device description refers to.
- **Serial Number:** Enter the serial number of the tape resource. The toolkit will find the resource name (TAPMLBxx) associated with this serial number (it must be operational) and change the specified device description to it.
- ***BRM:** Change the specified BRMS attributes. For example, you can change the location associated with a device, or the devices used by a control group, etc based on where the LPAR is IPL'ing. Note that only a handful of objects and attributes can be changed. See also the CHGBRMSOBJ command which has similar functionality.
 - **Usage:** Apply this rule to if the LPAR usage matches.
 - **Object Name:** The name of the BRMS object to change
 - **Object Type:** The type of BRMS object to change
 - **Attribute:** Which BRMS attribute to change
 - **New Value:** The new value for the specified attribute
- ***RTE:** Routing entry changes based on LPAR usage. If there are any new routes for a specific LPAR usage, then *all the existing routes (CFGTCP opt 2) will be removed*. The new routes will be created.
 - **Usage:** Apply the new route if the LPAR usage matches.
 - **Destination:** The route destination (IP or subnet)
 - **Subnet Mask:** The destination subnet mask.
 - **Next Hop:** The next hop in the network for the packet destined for the network
 - **Preferred Interface:** Which interface to use to send these packets

ZAPDDDLCK - Zap DDD lock

This is a utility command for releasing the job and user who holds a cluster-wide lock on a specified artifact. It is deprecated and has been replaced with RLSCSELCK.

Name: Enter the name of the object to display a lock for.

Type: Enter the type of object to display a lock for.

Exit Program and Points

The FSFC Exit Program is specified in the CSEDTA and the compiled program must exist on both the source and controlling LPAR (but it can have different contents). This source code is supplied as a sample. This source member should be copied out of QZRDHASM and the modifications made there. Otherwise revised source code may be overlaid by a restore of the QZRDHASM library.

The chart below indicates where and when each exit is called, from top (beginning) to the bottom (end). Some calls are asynchronous, i.e. submitted to another job, and will not block current toolkit operations. When the calls are synchronous they are performed inline with the toolkit, and toolkit operations will not continue until the exit program returns control to the caller, and if the exit program issues an escape message the toolkit will exit with an error. Most exit points are made with the user profile of the caller to the toolkit.

	CTL	SRC	TRG	SBMJOB	Comment
*PRECHKCTL	X				
*PRECHKSRC		X			CHKFSFLASH, STRFSFLASH
*PREPFLASH	X				Not if Flush = *IPL
*QUIESCE		X			Not if Flush = *IPL
*PREPFLASH	X				Not if Flush = *IPL
*PREFLASH	X				Not if Flush = *IPL
*QUIESCED		X			Not if Flush = *IPL, *FRCWRT
*POSTFLASH		X		SBMJOB	Not if Flush = *IPL
*PSTFLASH2	X			SBMJOB	Not if Flush = *IPL
*PAUSED	X			SBMJOB	Only for SWRCYPNT
*PREIPL	X				Only for SWRCYPNT
*TGTPREIPL	X				Only for STRFSFLASH
*PRETCPCFG			X		
*CMNHDWRSC			X		
*STRRSTD	X			SBMJOB	BRMS = *YES, SAVSYS, repeats
*ENDRSTD	X			SBMJOB	BRMS = *YES, SAVSYS, repeats
*FAILNFY			X		
*TGTPSTTCP			X		Called when TCP is started
*TGTBRMSAV			X		BRMS = *YES
*PSTBKUTGT			X	SBMJOB	
*PRERESTOR		X			BRMS = *YES
*PREMERGE		X			BRMS = *YES, *CHGONLY
*MERGE1		X		SBMJOB	BRMS = *YES, *CHGONLY
*MERGE2		X		SBMJOB	BRMS = *YES, *CHGONLY
*MERGE3		X		SBMJOB	BRMS = *YES, *CHGONLY
*POSTMERGE		X			BRMS = *YES, *CHGONLY
*BRMFINTGT			X		BRMS = *YES
*FINISH		X		SBMJOB	BRMS = *YES or Flush = *IPL
*PWRDWNTGT	X				Restart target after FC = *YES *AND Stop target after backup = *YES
*FINISHCTL	X				

