Redbooks Paper

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IBM System Storage FlashCopy Manager and PPRC Manager Overview

Introduction

IBM® System Storage™ FlashCopy® Manager and System Storage PPRC Manager are IBM program products for IBM z/OS® and System z™ CKD IBM storage users. These program products assist in the implementation and use of System Storage DS8000™, DS6000™, or Enterprise Storage Server® (ESS) FlashCopy as well as IBM Metro Mirror, Global Copy, and Global Mirror. They are composed of Interactive System Productivity Facility (ISPF) menu-driven application dialogs that generate z/OS batch jobs. In turn, these jobs invoke specialized z/OS programs that are designed to provide the following functions:

► Simplified data collection, automated configuration, and creation of z/OS batch jobs that set up and execute a FlashCopy, Metro Mirror, Global Copy, Global Mirror, or Metro/Global Copy, to System z CKD storage

► Improvement in quality and time to completion for implementing these Advanced Copy Services into any z/OS or System z production and batch CKD storage environment, using any existing z/OS batch job scheduler

► Improvement in System z storage administrator productivity to operate these functions

► Ease of use and risk mitigation tools for operationally migrating from non-IBM point-in-time disk copy or a non-IBM disk mirroring to an IBM storage environment

► Specialized performance enhancements for FlashCopy on System z CKD volumes

► Support for technology migrations between DS8000, DS6000, and ESS disk subsystems using Peer to Peer Remote Copy (PPRC)

► Support for data center migrations using IBM PPRC on IBM disk subsystems

In providing these specialized functions, FlashCopy Manager and PPRC Manager are designed as supplements to the strategic IBM Business Continuity automation tools of Geographically Dispersed Parallel Sysplex™ (GDPS®) and z/OS TotalStorage® Productivity Center (TPC) for Replication.

These program products may also be used to provide a basic z/OS IBM Copy Services toolkit for environments where the recovery requirement is only for Business Continuity Tier 1 to 4

point-in-time z/OS recovery (that is, less time-critical recoveries, which only require periodic point-in-time copies).

FlashCopy Manager and PPRC Manager provide a common style of ISPF menu-driven application dialog interface, operate in a similar fashion, and are designed to complement each other. A user who is familiar with one of these program products will find the other program product easy to learn and use.

Contents of this paper

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- ▶ "Sample FlashCopy Manager session" on page 41

A sample FlashCopy Manager session follows the descriptions of the offerings. Because of the similarities between the FlashCopy Manager and PPRC Manager interface, by viewing the FlashCopy Manager sample session, you will also become familiar with what a PPRC Manager session looks like.

We assume that you are familiar with IBM enterprise disk subsystem, FlashCopy, and PPRC terminology.

FlashCopy Manager overview

FlashCopy Manager is a z/OS-based FlashCopy integration, automation, and usage set of tools, invoked through ISPF menu-driven dialogs, that is delivered as an IBM software program product. It is designed to provide significant ease of use, automation, performance enhancements, and productivity for z/OS and System z CKD storage users of FlashCopy on ESS, DS6000, and DS8000.

The FlashCopy Manager tools, ISPF menu-driven dialogs, and generated jobs provide the following functions:

- ▶ Enable significant FlashCopy performance enhancements in any System z CKD storage environment
- ▶ Provide time and effort savings that lower risk and enable migration from a non-IBM z/OS or System z storage point-in-time copy to FlashCopy
- ▶ Provide a unique set of z/OS-based tools that can accelerate the integration of FlashCopy into any z/OS or System z-based production and batch IBM storage environment
- ▶ Provide a z/OS-based System z enablement toolkit where only lower Business Continuity Tier 1-4 recovery is required (that is, disaster recovery based on periodic point-in-time copy)

FlashCopy Manager and its companion program product, PPRC Manager, provide z/OS batch jobs that are designed to supplement strategic IBM Business Continuity automation tools such as z/OS TPC for Replication and GDPS.

z/OS users have successfully used the FlashCopy Manager toolkit in large System z IBM storage environments, with thousands of FlashCopy volume pairs.

At a glance: Typical Business Continuity Tier levels 1 to 4 (for FlashCopy Manager)

FlashCopy Manager provides an interactive set of z/OS-based ISPF menu-driven application dialogs, which auto-generate z/OS batch jobs, that invoke specialized z/OS programs for full volume point-in-time FlashCopy applications:

- ► Enables significant FlashCopy performance enhancements for z/OS and System z IBM CKD storage
- ► Enables *operational migration* and provides *risk mitigation* when moving from non-IBM disk point-in-time copy technology to FlashCopy
- ► Enables simpler integration of full volume FlashCopy operations into z/OS and System z CKD storage customers job streams
- ► Supports FlashCopy configuration definitions based on z/OS device numbers, VOLSERs, DFSMS™ Storage Groups, and VTOC/VTOC indexing matching
- ► With FlashCopy Manager jobs, provides significant unit control block (UCB) constraint relief by doing a FlashCopy to volumes not in the IOGEN
- ► Provides the ability to create consistent FlashCopy point-in-time copies from Metro Mirror secondaries without impacting Metro Mirror disaster recovery capability

FlashCopy Manager solution description

DS8000, DS6000, and ESS FlashCopy technology can be exploited to address a wide range of business objectives and requirements. These may include simple tasks such as creating a point-in-time copy of production z/OS data for transfer from disk to tape. They also may include more complex tasks, such as an on-demand copy of a large online z/OS DB2® database for application development and quality assurance testing, without taking the z/OS DB2 database offline.

FlashCopy Manager is a series of efficient, low overhead REXX™, assembler programs and ISPF panels. By using them, the z/OS storage administrator can define, build, and run FlashCopy jobs for any sized z/OS or System z IBM CKD storage FlashCopy environment. In particular, z/OS and System z IBM storage users, who have a large number of FlashCopy pairs, in the hundreds or thousands of FlashCopy pairs, will find FlashCopy Manager of significant value.

FlashCopy Manager provides specialized z/OS FlashCopy invocation programs that provide significantly enhanced FlashCopy initialization times. Particularly in z/OS or System z IBM storage environments that have large numbers of volumes, these performance enhancements can make viable the use of FlashCopy and FlashCopy Consistency Group, where it would not have been feasible by using a standard Time Sharing Option (TSO), DFSMS, or ANTRQST invocation.

Experience has shown that z/OS FlashCopy environments tend to be highly dynamic and changing from day to day. Especially in large z/OS environments, DFSMS allocations are constantly on the move, and database administrators and applications teams are constantly changing and tuning their environments.

Accordingly, z/OS and System z IBM storage customers can use FlashCopy Manager for the following tasks:

► Simplify and improve the accuracy of the z/OS or System z IBM storage FlashCopy configuration process, with easy-to-use ISPF dialogs and generated batch jobs

► Generate z/OS batch jobs to dynamically discover, define, establish, and control the System z IBM storage FlashCopy configuration

► With FlashCopy Manager jobs, support any System z CKD IBM storage volume, for which the executing z/OS image can establish shared addressability. FlashCopy Manager has been successfully used in TPF, z/VM®, and Linux® on System z environments.

The FlashCopy Manager toolkit provides significant value to any z/OS or System z IBM storage environment. It provides an automated ability to dynamically discover and reconfigure the System z IBM storage FlashCopy environment on a daily basis, according to the current state of the volumes in the production environment.

You do not need to understand the detailed operation of FlashCopy in order to use the FlashCopy Manager to configure and manage a FlashCopy environment. You only need to understand how to define and match FlashCopy source and target volumes. The FlashCopy Manager ISPF dialogs provide tools for automated, correct FlashCopy source and target matching. FlashCopy Manager then creates all necessary FlashCopy management functions by creation of a complete set of z/OS batch jobs.

With this approach, you can submit individual FlashCopy jobs or construct a complex z/OS job stream that includes non-FlashCopy software. You can control the entire process by using standard z/OS job scheduling facilities to accomplish a required set of business objectives. The FlashCopy Manager-created jobs are a key part of that total job stream. In a disk-to-tape process, the FlashCopy Manager-created jobs control the FlashCopy part of the process. The standard disk-to-tape software products complete the disk-to-tape portion of the process. The control data sets that are created by FlashCopy Manager make it easy to dynamically create control commands for the disk-to-tape processes or other processes.

See "Usage scenarios and solution benefits" on page 23 for more information about FlashCopy Manager usage scenarios and the associated IT and business benefits.

FlashCopy Manager technical highlights

FlashCopy Manager provides a straightforward set of ISPF menu panels, used in a question and answer format, to obtain the necessary parameters for building FlashCopy jobs.

FlashCopy Manager programs provide the following capabilities:

► Identify FlashCopy source volumes by specification of source or target volumes in the following ways:
  – VOLSER (with wildcard)
  – DFSMS storage groups
  – Device number ranges

► Automatically discover candidate FlashCopy targets by using the same capabilities as described in the previous item

► Correctly match the candidate targets with defined FlashCopy source volumes

► Build the z/OS jobs that will execute the FlashCopy environment, including (but not limited to) jobs that perform the following tasks:
  – Withdraw FlashCopy relationships
  – Verify the state of active FlashCopy relationships

- – If specified, establish FlashCopy with Consistency Group across one or multiple System z IBM disk subsystems
- – If specified, establish Incremental FlashCopy
- – If specified, establish Inband FlashCopy to a remote IBM disk subsystem PPRC secondary
- – Provide significant System z UCB constraint relief by using FlashCopy to copy to volumes not in the IOGEN
- – Query the progress of the FlashCopy and the background copy
- – ICKDSF jobs to re-label FlashCopy source volumes
- – ICKDSF jobs to re-label FlashCopy target volumes

► Execute FlashCopy Manager jobs from a z/OS image. The FlashCopy source volumes can be any System z CKD format volumes, for which the executing z/OS image can establish shared addressability. FlashCopy Manager has been successfully used on z/TPF, z/VM, and Linux on System z volumes.

► Build jobs for use in a Global Mirror testing and initial implementation in a z/OS or System z IBM storage environment. When used together with PPRC Manager, FlashCopy Manager can also build jobs that perform the following tasks:

- – Perform analysis of the state of the Global Mirror FlashCopy targets, and depending on the results, perform any required processing (REVERT or COMMIT) that is required for individual FlashCopy relationships that need corrective action to create a consistent set of data on all Global Mirror targets (must be CKD volumes)
- – Execute a Fast Reverse Restore FlashCopy process that creates a set of consistent data on suspended Global Mirror PPRC-XD volumes

► Provide an audit trail of FlashCopy parameter specification

FlashCopy Manager supports z/OS and System z CKD FlashCopy environments, in which FlashCopy pairs reside in single or multiple IBM storage subsystems. The source and target of any pair must be in the same storage subsystem. Full support of FlashCopy Consistency Group functionality provides point-in-time data consistency across multiple storage subsystems.

FlashCopy Manager has special programs that dynamically and quickly obtain device information that is needed to develop the configuration and create the files and jobs that are needed for FlashCopy ESTABLISH. FlashCopy Manager is fully aware of, and dynamically discovers and correlates, DS8000, DS6000, and ESS specifics such as SSID, storage controller serial number, z/OS VTOC structures, and volume size matching. Source and target volumes are matched based on equal size. FlashCopy Manager discovery programs are also written in assembler language and perform the discovery, matching, and job build process quickly with low overhead.

FlashCopy Manager jobs use specialized high performance FlashCopy execution programs that initialize FlashCopy with a significantly shorter elapsed time than standard FlashCopy invocation by using DFSMS, TSO, or ANTRQST. This high performance FlashCopy execution capability includes the FlashCopy Consistency Group, thus making possible the creation of a point-in-time *consistent copy* of multiple z/OS or System z CKD volumes. FlashCopy Manager's specialized FlashCopy execution programs attain these performance benefits. It does this by using the information gathered during the FlashCopy source-target configuration build process. It then uses the configuration information in specialized invocation programs to achieve a significant reduction in the FlashCopy initialization overhead.

FlashCopy Manager provides an audit trail, so that the definition and running of jobs under its control can be tracked and managed. FlashCopy Manager provides you valuable diagnostic

information when each command is executed. It can notify you of any problems involved in issuing FlashCopy commands and report back how long it took to execute the FlashCopy across all volumes or data sets.

The ease of use of the FlashCopy Manager set of tools for z/OS or System z CKD IBM storage can help enable faster migration and lower the risk of the *operational migration* from a non-IBM disk point-in-time disk copy environment to an IBM point-in-time disk copy environment.

FlashCopy Manager components and requirements

FlashCopy Manager has the following software and hardware requirements:

► Hardware

– FlashCopy Manager jobs are supported on CKD volumes on DS8000, DS6000, or ESS disk subsystems.

> **Note:** FlashCopy Manager jobs are not supported on non-IBM storage subsystems.

– Both source and target FlashCopy volumes must be contained within the same DS8000, DS6000, or ESS. The Point-in-Time or FlashCopy license must be installed.

– The FlashCopy source volumes must be addressable from the z/OS image running the FlashCopy Manager jobs.

– FlashCopy Manager jobs support any System CKD IBM storage volume, for which the executing z/OS image can establish shared addressability. FlashCopy Manager has been successfully used in TPF, z/VM, and Linux on System z environments.

> **Tip:** When using FlashCopy Manager jobs on non-z/OS System z volumes, non-z/OS operating system considerations are outside the scope of FlashCopy Manager.

– The FlashCopy target devices do not have to be in the IOGEN of the z/OS image running the FlashCopy Manager jobs. This can be of significant value for UCB constraint relief in a large System z environment.

► Software

As of the writing of this paper, the most current level of FlashCopy Manager is V5R1.

– FlashCopy Manager jobs must be run from a z/OS image at z/OS 1.7 or higher, with TSO and ISPF installed. No other pre-requisite software is required.

– FlashCopy Manager's load library must be APF authorized.

– FlashCopy Manager has no known z/OS system release dependencies.

> **Note:** FlashCopy Manager only supports volume-level FlashCopy.

Interoperability

The FlashCopy Manager toolkit is designed to be a stand-alone program product, but can be used with other products in a z/OS or System z environment, such as GDPS, and GDPS HyperSwap™, z/OS TPC for Replication, or PPRC Manager.

The FlashCopy Manager's specialized z/OS programs that provide significant FlashCopy initialization performance enhancements can be of high value to any z/OS user. This includes z/OS users of TPC for Replication, GDPS, and GDPS HyperSwap, or PPRC Manager.

See "Usage scenarios and solution benefits" on page 23 for usage scenarios and examples of the FlashCopy Manager solution benefits.

The following examples indicate usage of FlashCopy Manager with other products in a z/OS environment:

► GDPS, GDPS HyperSwap

– FlashCopy of Metro Mirror, Global Mirror, or z/OS Global Mirror primary for local backup purposes

– Supplemental options for FlashCopy of a Metro Mirror, Global Mirror, or z/OS Global Mirror secondary

– Specialized FlashCopy performance enhancements for any z/OS volumes running in the same System z complex

– Specialized FlashCopy performance enhancements for non-z/OS CKD volumes running in the same System z complex (such as Linux on System z, z/VM, or z/TPF)

► z/OS TPC for Replication

– FlashCopy of Metro Mirror or Global Mirror secondary
– FlashCopy of Metro Mirror or Global Mirror primary

► PPRC Manager

– Definition of FlashCopy targets for a Global Mirror configuration
– FlashCopy of Metro Mirror, Global Copy, or Global Mirror secondary
– FlashCopy of Metro Mirror, Global Copy, or Global Mirror primary

Usage scenarios

The FlashCopy Manager usage scenarios may be categorized as follows:

► FlashCopy only
► FlashCopy followed by PPRC
► FlashCopy followed by PPRC followed by FlashCopy
► FlashCopy of a PPRC primary
► PPRC followed by FlashCopy

See "Usage scenarios and solution benefits" on page 23 for more information about these usage scenarios and the solution benefits for IT and the business.

Summary

FlashCopy Manager provides z/OS and System z users an improved FlashCopy user interface through easy-to-use ISPF menu-driven application dialogs, generating batch jobs that invoke specialized z/OS programs for dynamic discovery, build, and execution of System z FlashCopy environments. The goal is to enhance the use of z/OS and System z FlashCopy technology on DS8000, DS6000, and ESS CKD volumes.

FlashCopy Manager is designed to perform the following functions:

► Enable the ability to operationally migrate from non-IBM storage point-in-time copy environments to IBM storage

► Provide an enablement toolkit to accelerate integration and exploitation of FlashCopy into any z/OS production and batch environment

► Enable significant System z FlashCopy performance enhancements

See "Sample FlashCopy Manager session" on page 41 for a better understanding of a FlashCopy Manager and PPRC Manager session and to discover the types of productivity benefits that these program products can deliver.

PPRC Manager overview

The PPRC Manager provides a series of efficient, low overhead REXX, assembler programs and ISPF menu-driven application dialog panels. By using these panels, the z/OS ISPF user can define, build, and run DS8000, DS6000, and ESS Metro Mirror (Synchronous PPRC), Global Copy (PPRC-XD), Global Mirror (Asynchronous PPRC), and Metro/Global Copy jobs for any-sized z/OS or System z IBM storage environment.

PPRC Manager jobs execute from a z/OS image. However, they may address and manage PPRC on any System z CKD volumes, for which shared addressability can be established.

The PPRC Manager program product is designed to perform the following functions:

► Enable operational procedure migration and provide risk mitigation when migrating from non-IBM z/OS storage replication to IBM PPRC technology

► Enable IBM storage technology migration by using PPRC technology (for example, ESS to DS8000 or an older DS8000 to a newer DS8000)

► Provide unique z/OS-based tools to accelerate the integration of Metro Mirror, Global Copy, or Global Mirror into any z/OS or System z production and batch environment, including z/OS TPC for Replication or GDPS

► Provide a z/OS-based enablement toolkit where only lower Business Continuity Tier 1-4 recovery is required (that is, recovery based on periodic point-in-time copy)

PPRC Manager and its companion program product, FlashCopy Manager, are designed to provide specialized functions that supplement strategic IBM Business Continuity automation solutions such as GDPS and z/OS TPC for Replication.

Users have successfully used the PPRC Manager software tools in large System z PPRC environments, with thousands of FlashCopy volume pairs.

At a glance: Typical Business Continuity Tier levels 1 to 4 (for PPRC Manager)

PPRC Manager provides a set of z/OS ISPF menu-driven dialogs, generated batch jobs, and specialized programs that are designed to perform the following functions:

► Enable *operational migration* and lower the migration risk when moving from System z non-IBM disk replication technology to IBM disk mirroring (for example, EMC SRDF to IBM Metro Mirror or Global Mirror)

► Enable *physical data migration*, using PPRC, between compatible System z CKD disk subsystems (for example, ESS or DS6000 to DS8000 or an older DS8000 to a newer DS8000)

- ► Simplify the integration of PPRC technology into existing or new Business Continuity Tier 1 to 4 point-in-time-based disaster recovery z/OS job stream environments
- ► Provide the ability to create and manage System z full volume point-in-time disk copies by using PPRC "loopback" to the same System z storage subsystem
- ► Provide the ability to define and operate IBM PPRC Split Mirror backups, including specialized high-speed FREEZE enhancements that can split the mirrors without impact to high-volume mission-critical workloads on z/OS or System z IBM CKD storage
- ► Provide information that can enable faster System z IBM storage subsystem FlashCopy and PPRC definition, configuration, testing, and implementation.
- ► Provide information that can enable faster implementation of GDPS or z/OS TPC for Replication
- ► When combined with FlashCopy Manager, provide full support for definition, implementation, and testing of Global Mirror

PPRC Manager is supported on DS8000, DS6000, and ESS. It supports any System z CKD volumes that can be addressed from a batch job running in a z/OS environment. When combined with FlashCopy Manager, it provides assistance in the definition and setup of a testing environment for a Metro/Global Mirror configuration. PPRC Manager does not support management of z/OS Basic HyperSwap or GDPS HyperSwap.

> **Tip:** PPRC Manager does not support the operation of three-site Metro/Global Mirror. That support is available with either TPC for Replication or GDPS.

PPRC Manager accomplishes these functions with a set of z/OS-based software tools that provide the following support:

- ► Fast and dynamic collection of all PPRC configuration data required to define the z/OS PPRC environment, such as the subsystem identifier (SSID), serial numbers, logical subsystem (LSS), and so on
- ► Creation of z/OS batch jobs to define and control the PPRC configuration
- ► Creation of z/OS jobs to track and monitor the state of the PPRC configuration

Naming

The name PPRC Manager has been selected to reflect its focus on managing the several different operating modes of IBM PPRC disk mirroring technology. Executing from a z/OS environment, PPRC Manager can define and control the following PPRC technology functions on any System z CKD disk on the ESS, DS6000, and DS8000:

- ► Metro Mirror (Synchronous PPRC)
- ► Global Copy (PPRC-Extended distance)
- ► Global Mirror (Asynchronous PPRC)
- ► Metro/Global Copy (Cascaded PPRC)

PPRC Manager solution description

PPRC Manager was created to simplify use of DS8000, DS6000, and ESS PPRC disk mirroring technology in the following areas:

- ► z/OS and System z CKD storage technology migrations
- ► z/OS and System z CKD data center migrations
- ► PPRC initial setup, configuration, and testing

Most migrations and the initial setup are one-time events, and as such, place a high value on ease of use and minimum educational requirements. PPRC Manager addresses these concerns by providing a simplified z/OS ISPF menu-driven user interface for using PPRC technologies. These program products provide tools that automate the following tasks:

► The fast and dynamic collection of all PPRC configuration data required to define the z/OS or System z PPRC environment, such as SSID, serial numbers, LSS, and so on

► The creation of z/OS batch jobs to define and control the PPRC configuration

► The creation of z/OS jobs to track and monitor the state of the PPRC configuration

The information that is collected and generated can also be used to reconfigure z/OS or System z CKD IBM storage environments, perform internal data movement, and accelerate implementation of PPRC environments for control by strategic IBM tools such as GDPS or z/OS TPC for Replication.

The PPRC Manager toolkit generates z/OS batch job processes that are intended primarily for use in migration and data transfer scenarios. However, with appropriate integration into an overall operational plan, they may also be used as the foundation processes where the requirement is only for a basic Business Continuity Tiers 1 to 4 (periodic point-in-time) disaster recovery scenario.

The PPRC Manager program product has been developed in close working relationship with customers who actively work with the PPRC Manager to exploit the advanced functions that are available with the DS8000, DS6000, and ESS storage subsystems. Customers have used the PPRC Manager set of tools to perform the following migrations tasks:

► Migrate z/OS data between remote data centers as part of a long distance data center move

► Migrate large amounts of z/OS data to newer IBM storage technology in a short period of time

► Operationally migrate from non-IBM z/OS storage replication to DS8000, DS6000, and ESS storage replication

The PPRC Manager has undergone numerous changes and enhancements as a direct result of these experiences of IBM customers.

PPRC Manager technical highlights

The PPRC Manager program product provides a straightforward set of ISPF menu-driven dialogs that are used in a question and answer format. These dialogs obtain the necessary parameters for building z/OS-based batch jobs that define and control Metro Mirror, Global Copy, Global Mirror, and Metro/Global Copy PPRC configurations. The design point for PPRC Manager is to use these PPRC functions for technology migrations, data center migrations, or both. PPRC Manager makes all standard PPRC options available through the ISPF menu-driven dialogs.

The PPRC Manager program product provides the following capabilities:

► Automatically discover candidate Metro Mirror (PPRC), Global Copy (PPRC-XD), and Global Mirror source volumes

► Automatically discover candidate PPRC secondaries

▶ Provide a robust, flexible *mix and match* capability for the candidate PPRC source and target volumes

This feature provides the essential ability to flexibly and easily configure (and quickly reconfigure) the PPRC environment, while adhering to the many restrictions or unique constraints that may be imposed by the current System z client environment.

▶ Build the z/OS-based jobs that will establish and control the PPRC environment

▶ Query the progress of the PPRC and the background copy

▶ Provide an audit trail of the PPRC parameter specification

PPRC Manager is written in efficient REXX and assembler language programs. It performs this discovery, matching, and job build process quickly with low overhead. Combined with fast speed of execution, PPRC Manager is especially useful for the discovery, initial setup, testing, and migration of configurations extending into many thousands of PPRC pairs.

The PPRC Manager program product includes the following features:

▶ PPRC Manager jobs execute from a z/OS image. They can address any CKD format volume on an IBM storage subsystem, as long as the executing z/OS image can establish shared addressability. PPRC Manager has been used successfully on z/TPF, z/VM, and Linux on System z volumes.

▶ With PPRC Manager, you can define the PPRC environment by using the device number and disk subsystem host bus adapter (HBA) physical ports used in the PPRC links between boxes.

▶ PPRC Manager has special programs that dynamically and quickly obtain the device information needed to develop the configuration and to create the files and batch jobs for PPRC ESTABLISH.

▶ With these programs, PPRC Manager dynamically discovers and correlates DS8000, DS6000, and ESS specifics such as SSIDs, LSS IDs, serial numbers, and subsystem adapter IDs (SAIDs).

▶ z/OS VOLSER information is also included to enhance user understanding of the environment. Even though VOLSERs can change with time, a REFRESH job updates PPRC to use the correct VOLSERs.

▶ A REVERSE process is available to simplify the creation of a PPRC configuration in which the flow of data is from the recovery site to the production site.

▶ Each of the PPRC Manager output files can be ISPF edited to handle special cases that do not match the general mix and match capability that PPRC Manager and FlashCopy Manager provide to minimize the data entry task.

▶ To solve security considerations after a migration is complete and when returning old disk subsystems back to the vendor, PPRC Manager includes jobs that issue the appropriate ICKDSF commands to securely clear all data at the end of the migration. As a result, upgrading to a new z/OS disk becomes easier and does not put any intellectual property that had been stored on the old IBM disk subsystems at risk.

▶ PPRC Manager provides tools for diagnosing problems within the z/OS PPRC relationship. When an operation changes the state of PPRC relationships, PPRC Manager does the following tasks:

  – Obtains and records the current PPRC and FlashCopy state of the environment.
  – Executes the change request.
  – Obtains and records the new PPRC and FlashCopy state of the environment.

> **Note:** All state change data that is recorded is documented and made easily available through the SYSLOG.

– When problems occur, it is possible to run a job to force state saves on all System z disk subsystems in the PPRC configuration. By doing this, errors can be diagnosed more easily, regardless of where they start.

The PPRC Manager program product features a significant set of usability enhancements, for any z/OS or System z CKD IBM storage environment, that provide improved ease of use for Metro Mirror (Synchronous PPRC), Global Copy (PPRC-XD), Global Mirror, and Metro/Global Copy. PPRC Manager is especially useful in large configurations of volume pairs and where PPRC usage is for technology and data center migrations.

Interoperability with FlashCopy Manager

PPRC Manager is designed to be a stand-alone program product. However, it can be used with FlashCopy Manager to provide a more comprehensive and complete set of tools for defining z/OS or System z CKD DS8000, DS6000, or ESS Advanced Copy Services configurations.

FlashCopy Manager can be used together with PPRC Manager to provide the following tools:

► Global Mirror

FlashCopy Manager builds all of the jobs that are required to set up the FlashCopy environment for a Global Mirror configuration. Additionally, FlashCopy Manager builds all the jobs required to perform the Revert/Commit recovery analysis and the Fast Reverse Restore FlashCopy process.

► InBand FlashCopy

With the Inband FlashCopy process, FlashCopy commands can be issued to remote PPRC secondary devices. This allows for FlashCopy of a PPRC secondary device at a remote site that does not have host connectivity at the remote site.

► FlashCopy of PPRC primary

FlashCopy Manager can perform a FlashCopy of PPRC primary device, where the PPRC primary device is the FlashCopy source. This is useful in cases where a point-in-time copy is desired before data at the primary site is modified.

► FlashCopy of PPRC secondary

FlashCopy Manager can perform a FlashCopy of PPRC secondary devices, where the PPRC secondary device is the FlashCopy source. This is useful in cases where a point-in-time copy of the data at the remote site is desired.

Support for PPRC Consistency Group FREEZE

Because some PPRC migration and basic Business Continuity Tier 1 to 4 disaster recovery applications require a *planned* PPRC FREEZE or RUN capability and require support for PPRC failover/failback, PPRC Manager provides jobs that supports these functions.

Where necessary to support consistency in PPRC secondary data, PPRC Manager contains specially designed programs that support the PPRC Consistency Group FREEZE process. As these commands are passed through the z/OS Asynchronous Operations Manager, they can simultaneously FREEZE all IBM disk subsystems in the configuration. As a result, PPRC Manager can control a Split Mirror configuration, in which the secondary site data consistency is assured when splitting the PPRC pairs. PPRC Manager, like FlashCopy Manager, uses the

information collected during the PPRC Manager definition of the configuration. Therefore, PPRC Manager can build and invoke specialized high performance programs that can significantly reduce the time required to execute the PPRC FREEZE as compared to standard DSCLI, TSO or ANTRQST invocation.

The PPRC Manager program product is primarily intended for usage in initial implementations, technology migrations, or data center migrations. As part of that support, the PPRC Manager toolkit has jobs that monitor the status of each of the PPRC pairs. If an event occurs that suspends PPRC, the monitor job can initiate support for an unplanned outage in the form of a FREEZE and GO. A FREEZE and GO ensures the consistency of data in the secondary disk. This way databases can be restarted if a disaster has occurred, but applications continue to run in the production configuration.

> **Important:** PPRC Manager provides only a *basic level* of FREEZE and GO support. It does not include any automation for halting applications or restarting systems in a remote data center. This basic unplanned outage support of PPRC Manager is primarily intended for use in technology or data center migrations. It can only address the basic DASD requirements for a z/OS unplanned outage. PPRC Manager does *not* provide support for other z/OS unplanned outage requirements, such as performing an IPL of z/OS recovery systems, switching communications between environments, reconfiguring System z hardware, and so on. Such a level of automation is available through GDPS.

PPRC Manager usage scenarios

The PPRC Manager usage scenarios may be categorized as follows:

- ► PPRC only
- ► PPRC followed by FlashCopy
- ► FlashCopy followed by PPRC
- ► FlashCopy followed by PPRC followed by FlashCopy
- ► Cascaded PPRC

See "Usage scenarios and solution benefits" on page 23 for more information about these usage scenarios and the solution benefits for IT and the business.

Support for many types of PPRC configurations

PPRC Manager can flexibly define and build z/OS batch jobs to operate many types of IBM PPRC configurations to support System z CKD storage technology migrations, data migrations, initial definition, and testing. These features can be of significant benefit to IBM PPRC configurations that will be controlled in production by strategic IBM automation tools such as z/OS TPC for Replication or GDPS.

We discuss some of the many types of PPRC configurations in the sections the follow.

Metro Mirror or Global Copy environments

PPRC Manager can create the data collection, definition, and implementation jobs for Metro Mirror and Global Copy PPRC environments.

PPRC Manager has a definition option, called CLONE, which can provide the ability for the z/OS DEVICE numbers to be preserved at the remote recovery or test system. This insures maximum testability and maintainability of operational procedures.

PPRC Manager can also build jobs that issue a planned PPRC FREEZE to insure data consistency on multiple PPRC secondaries, spread across one or multiple IBM storage

subsystems. When the secondaries are frozen, you can execute PPRC Manager and FlashCopy Manager jobs that establish the PPRC secondaries as FlashCopy source volumes. After the FlashCopy environment is created, normal PPRC operation is resumed, and the FlashCopy volumes are available for disaster recovery testing or other applications.

> **Tip:** PPRC Manager can be used in conjunction with FlashCopy Manager to provide specialized high performance execution of FlashCopy with Consistency Group. This capability can enable the making of a full data consistent point-in-time copy, at either the local or the remote Metro Mirror site, without requiring a quiesce of the Metro Mirror pairs. In this way, FlashCopy Manager can enable maintaining Metro Mirror disaster recovery protection while taking a system-wide point-in-time copy.

The option is available to designate the FlashCopy target volumes to have the same z/OS device numbers as the original PPRC volumes. This creates the exact copy of the original system environment. The usage an exact copy of the addresses for the environment offers advantages for both data migrations and for disaster recovery applications, since the production device numbers are the same for both PPRC primaries and secondaries. This simplifies the operational documentation, testing, and operator training processes.

To properly function in a disaster recovery environment, the PPRC Manager software should be run in a logical partition (LPAR) that does not access the controlled storage. This ensures that it is not slowed by any processes that are affecting the devices during periods of high activity.

Metro/Global Copy configurations

PPRC Manager has a definitional mode known as CASCADE. In this mode, PPRC Manager supports the definition of a *cascaded* Metro/Global Copy PPRC environment. The primaries for this environment are the PPRC secondaries of an earlier, previously defined PPRC environment. This configuration is often used in disk subsystem technology migrations or data center migrations.

Figure 1 shows an example of a Metro/Global Copy configuration.
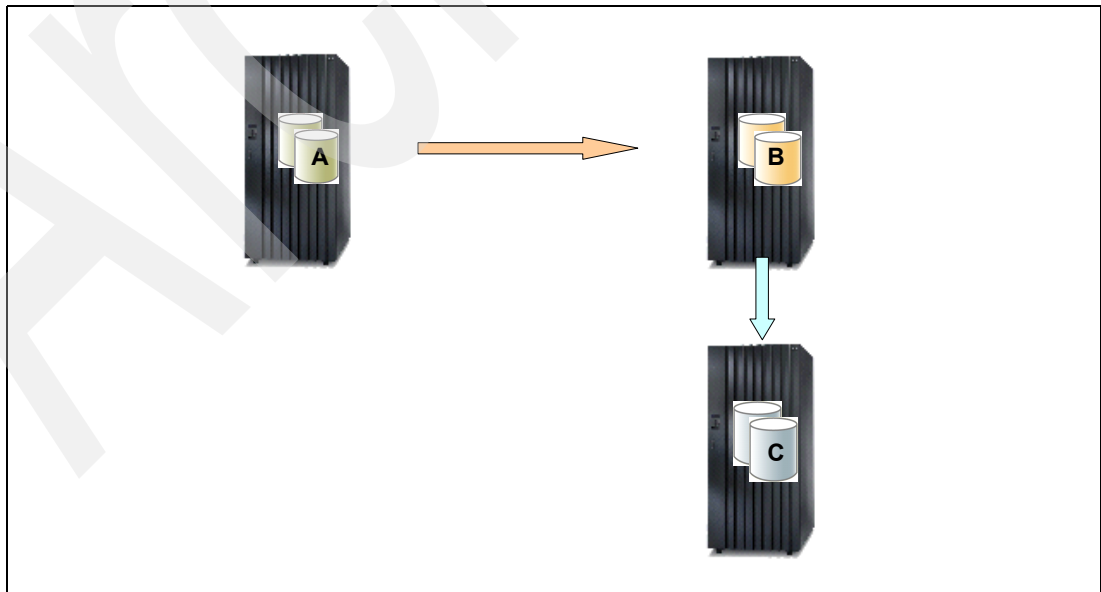
Figure 1   Example of a Metro/Global Copy environment – Volumes A to B to C

PPRC Manager adheres to DS8000, DS6000, and ESS PPRC configuration rules when defining a Metro/Global Copy environment, which requires that the cascaded B →C relationship be a non-synchronous one (that is, Global Copy, also called PPRC-XD). The A →B relationship can be a synchronous one (that is, Metro Mirror, also called PPRC Sync), or it can be a non-synchronous one (that is, Global Copy, also called PPRC-XD).

Tip: In Figure 1 on page 14, the DS8000, DS6000, and ESS microcode does not allow simultaneous PPRC from A →B and from A →C at the same time.

In Figure 1 on page 14, if the A →B relationship is a synchronous one, the PPRC Manager can create jobs that allow you to FREEZE or RUN data on the A →B relationships. PPRC Manager also creates other jobs that are used to monitor the B →C Global Copy relationships, to determine when the Global Copy secondaries are out-of-sync and when they are all in-sync.

In this cascaded PPRC environment, PPRC Manager also includes jobs that can be issued to perform other desired process against the data on remote devices. A typical example is to FlashCopy the remote pairs, to an additional set of devices, for testing or creation of point-in-time backups.

Global Mirror configurations

PPRC Manager has a definitional mode called GLOBAL MIRROR. In this mode, PPRC Manager, together with FlashCopy Manager, can define and build the following jobs, among other jobs, for a Global Mirror environment:

► Define the FlashCopy environment for a Global Mirror configuration

► Define the PPRC environment for a Global Mirror configuration

► In combination with FlashCopy Manager, perform analysis of the state of the Global Mirror FlashCopy targets, and depending on the results, perform any required processing (REVERT or COMMIT) that is required for individual FlashCopy relationships that need corrective action to create a consistent set of data on all Global Mirror targets (must be System z CKD volumes)

► Execute a Fast Reverse Restore FlashCopy process that creates a set of consistent data on suspended Global Mirror PPRC-XD volumes

As with all other PPRC Manager output jobs, PPRC Manager jobs for Global Mirror do not include any automation for halting applications or restarting systems in a remote data center. The primary purpose of PPRC Manager Global Mirror support is to enable technology migrations and data center migrations, through enablement of initial setup and testing. This basic Global Mirror unplanned outage support of PPRC Manager can only address the basic DASD requirements for an z/OS unplanned outage. PPRC Manager Global Mirror jobs do *not* provide support for other z/OS unplanned outage requirements, such as performing an IPL of z/OS recovery systems, switching of communications between environments, reconfiguring System z hardware, and so on. That level of automation is available through GDPS.

PPRC Manager prerequisites and requirements

PPRC Manager has the following software and hardware requirements:

► Hardware

– Both the primary and secondary PPRC devices must be in an ESS, DS6000, or DS8000, with the appropriate PPRC microcode licenses installed.

– PPRC Manager jobs must execute from a z/OS operating system. The jobs can address any CKD volumes on IBM subsystems, for which the executing z/OS image can establish shared addressability.

> **Tip:** When using PPRC Manager jobs on non-z/OS System z CKD volumes, non-z/OS operating system considerations are outside the scope of PPRC Manager.

– The PPRC secondary CKD devices must be accessible from a z/OS image during the setup process. They do not have to be varied online during this phase of activity, nor do they need labels and VTOCs on them.

> **Note:** PPRC Manager jobs are only supported on System z CKD volumes in the DS8000, DS6000, and ESS.
>
> PPRC Manager does not support definition or controlling of a z/OS Global Mirror (extended remote copy (XRC)) environment. In addition, PPRC Manager does not support controlling a z/OS Basic HyperSwap or GDPS HyperSwap environment.
>
> PPRC Manager only supports System z CKD volumes. It does not support FBA format devices, IBM SAN Volume Controller, or DS4000™.

► Software

– PPRC Manager jobs must be executed from a z/OS 1.7 or newer operating system.

– The PPRC Manager load library must be APF authorized.

– The TSO PPRC and FlashCopy commands must be installed. In addition, the user and jobs that are submitted must have Resource Access Control Facility (RACF®) authority to use these commands.

Positioning IBM Business Continuity offerings

IBM offers a comprehensive suite of Business Continuity automation, replication, and data migration tools. In this section, we position the following IBM offerings:

► GDPS
► GDPS HyperSwap Manager
► TPC for Replication
► Softek Data Mobility software
► FlashCopy Manager
► PPRC Manager

We begin by reviewing the varying types and ranges of client requirements.

Varying client requirements

Clients have many varying levels of requirements as shown in Figure 2.

Varying recovery, budget requirements

Mission Critical

- **(near) Continuous availability, end-to-end automation**
  – RTO = Near continuous, RPO = small as possible (BC Tier 7)
  – Priority = Uptime, with high value justification

- **Rapid data recovery**
  – RTO = Minutes, to (approx. range): 2 to 6 hours
  – Business Continuity Tiers 6, 4
  – Balanced priorities = Uptime and cost/value

- **Backup/restore**
  – (A large majority of clients)
  – 8 hour, 12 hour, 16 hour, 24+ hour recovery
  – These are the lower Business Continuity Tiers
  – Priority = Cost

Low cost   **Approximation: numbers of IT shops**

Figure 2   Varying recovery and budgetary requirements

Not every client can justify near continuous availability solutions. A balance between the priorities of uptime and cost, in concert with the needs of the business, is always necessary.

We provide general positioning of these various tools based on the curve shown in Figure 3.

Positioning System z recovery solutions by Business Continuity Tiers

Balancing recovery time objective, scale, scope, cost/value

Recovery from a disk image   *Recovery from tape copy*

BC Tier 7 – GDPS/PPRC, GDPS/PPRC with HyperSwap, GDPS/XRC

BC Tier 6 – GDPS HyperSwap Manager

BC Tier 6 and 4 – TPC for Replication for System z or Open Source

BC Tiers 1-4: Recovery using tools and toolkits

Cost / Value

15 Min.   1-4 Hr..   8-12 hr   24 hr +

Recovery Time   Recovery times shown are guidelines only.

Figure 3   Position System z recovery solutions by Business Continuity Tiers

The Business Continuity Tiers represent the required elapsed time of recovery. In general, the Business Continuity Tier recovery timing shown is accomplished by using the following types of technologies:

► Business Continuity Tier 7: Fully automated end-to-end failover, involving all aspects of server, storage, software, and network

► Business Continuity Tier 6: Real-time storage replication, synchronous or asynchronous; semi-automated or manual server and workload restart

► Business Continuity Tier 4 to 1: Make periodic point-in-time copies (on disk, or on tape for the lower tiers) and replicate the copies to a remote site; semi-automated or manual server and workload restart

In Figure 3 on page 17, we illustrate where these various solutions and toolkits typically fall on the recovery time curve. The FlashCopy Manager and PPRC Manager are sets of *tools* only. If they are used as the basis for a lower Business Continuity Tier 1 to 4 recovery, you must integrate them into an overall operational solution.

In addition, where these tools provide added value in terms of FlashCopy performance, ease of migration, or accelerating FlashCopy or PPRC implementation, they may be used as a *supplement* to the strategic IBM Business Continuity automation tools such as GDPS, GDPS HyperSwap Manager, and z/OS TPC for Replication.

Positioning guidelines

In the following sections, we define each IBM offering and provide basic guidelines for when each offering is typically selected.

> **Tip:** These are general guidelines and are not intended to cover all situations. Continue to use a detailed evaluation and design team, staffed with appropriate expertise, to finalize the selection of the appropriate automation solution or toolset for your needs.

GDPS (Business Continuity Tier 7)

The GDPS is an IBM GTS Services product and is the strategic, comprehensive IBM Business Continuity automated solution for the System z IT environment. Complete Level 1, 2, and 3 support is provided, and the reliability, availability, and serviceability characteristics are comparable with z/OS.

GDPS provides an end-to-end System z integration infrastructure of servers, storage, software and automation, networking, and installation services. GDPS is serviced with 24x7 worldwide support by IBM Global Services. It is a standard product-level participant in the IBM worldwide support structure, and it is enhanced and updated on an ongoing basis by IBM.
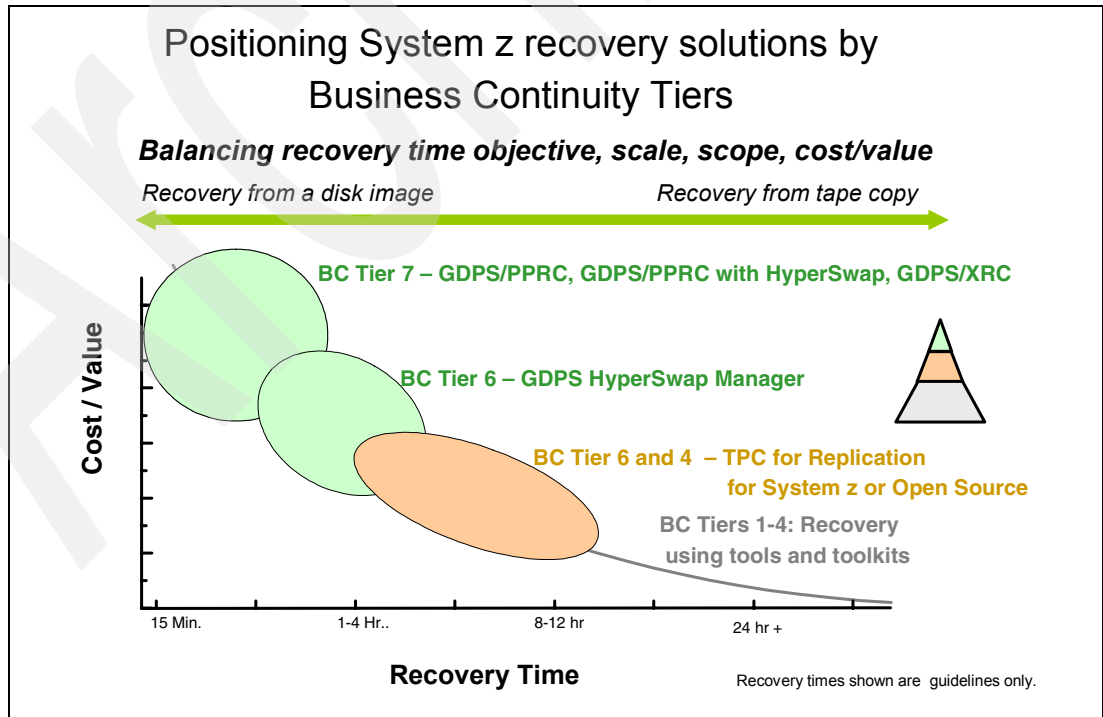
GDPS is intended to provide the following features and functions:

► Provides full end-to-end System z automated failover, with Metro Mirror (Synchronous PPRC), asynchronous Global Mirror, or asynchronous z/OS Global Mirror (XRC) technology

► Provides full end-to-end System z automated failover with GDPS HyperSwap, based upon Metro Mirror (Synchronous PPRC)

► Automates all aspects of System z failover, including server, storage, coupling facility, hardware, LPAR, management console, z/OS workload manager, and so on

- ▶ Provides the premier, most proven System z failover automation offering
- ▶ Supports Metro Mirror, Metro Mirror with HyperSwap, Global Mirror, z/OS Global Mirror, Metro/Global Mirror, and z/OS Metro/Global Mirror (XRC)

Requirements for using GDPS

GDPS is typically used with the following requirements:

- ▶ End-to-end System z automated failover Tier 7
- ▶ When end-to-end System z recovery support is required for either of the following disk mirroring technologies, which are only supported by GDPS and are not supported by z/OS TPC for Replication or PPRC Manager:
  - – z/OS Global Mirror (XRC)
  - – z/OS Metro/Global Mirror (PPRC/XRC), a multi-target z/OS-only configuration with the primary volumes simultaneously being the source for both z/OS Global Mirror (XRC) and Metro Mirror

When GDPS is not used

GDPS is typically not used when the level of System z recovery time required is not yet at Business Continuity Tier 7.

GDPS HyperSwap Manager (Business Continuity Tier 6)

GDPS HyperSwap Manager is the entry-level GDPS offering that manages Metro Mirror disk mirroring (including HyperSwap). With a reduced price to accompany the reduced scope, GDPS HyperSwap Manager is an ideal GDPS entry point for clients who desire to eventually grow their Business Continuity recovery capability to a fully automated GDPS Business Continuity Tier 7 server, storage, software, networking solution. Users of GDPS HyperSwap Manager may upgrade to full GDPS/PPRC, fully protecting the investment that is already made.

The GDPS HyperSwap Manager is the Metro Mirror disk replication management portion of a full GDPS/PPRC. It features a packaged, cost-effective entry price to the GDPS family of solutions and is upgradable to full GDPS.

GDPS HyperSwap Manager supports any PPRC-compliant storage. Currently supported PPRC-compliant storage includes enterprise storage subsystems from IBM, Hitachi, EMC, and STK.

When GDPS HyperSwap Manager is used

GDPS HyperSwap Manager is typically used in the following situations:

- ▶ The Premium High Availability and Disaster Recovery management of Metro Mirror in a System z CKD storage environment is required across one or two sites.
- ▶ GDPS HyperSwap is required to a *remote* site.
- ▶ A mix of enterprise storage PPRC synchronous mirroring vendors is required.
- ▶ Entry level to a full GDPS is desired and future plans may include upgrade to a full GDPS.

TPC for Replication (Business Continuity Tiers 6 and 4)

TPC for Replication is the strategic IBM storage replication management tool. It is designed to provide a common storage replication management interface across System z or Open Systems, for a portfolio of IBM storage replication running on DS8000, DS6000, ESS Model 800, and SAN Volume Controller.

TPC for Replication is designed to manage these various IBM storage replication platforms with a common GUI and ease of use. In the event of an unplanned outage, TPC for Replication brings the storage to a consistent, restartable state. TPC for Replication is not intended to address other server or software recovery actions, such as performing an IPL of z/OS recovery systems, switching of communications between environments, reconfiguring System z hardware, restarting the database and application software, and so on. That level of automation is available through GDPS.

TPC for Replication includes the following features:

► A common, intuitive, GUI-based user interface for common definition, management, and control of IBM storage replication across

► Management software that can run on either Open Systems or in a native z/OS address space

► The ability to manage disaster recovery practice volumes while maintaining disaster recovery capability

► The ability to site switch and return to the original site

► The ability to configure z/OS Basic HyperSwap for protection against z/OS IBM storage subsystem failures

► The ability to provide z/OS UCB relief, because TPC for Replication can manage ECKD™ volumes through FICON® or through TPC/IP

When z/OS TPC for Replication is used

z/OS TPC for Replication *is typically used* in the following situations:

► When a common, GUI-based storage replication management tool is required, for consolidated configuration, management, and monitoring of ECKD and FBA disk volumes, across System z, Open Systems, or both:

– For Metro Mirror, Global Mirror, Metro/Global Mirror and FlashCopy

– Across DS8000, DS6000, ESS Model 800, or SAN Volume Controller

► When z/OS Basic HyperSwap is to be used for local site storage high availability:

– z/OS Basic HyperSwap is a *single site* only. z/OS Basic HyperSwap is not supported across two geographically dispersed sites.

– If HyperSwap across two geographically dispersed sites is required, then GDPS HyperSwap Manager is the proper choice.

► When GDPS is not planned to be a part of any current or future strategic client plans or requirements

When z/OS TPC for Replication is not used

z/OS TPC for Replication *is not used* in the following situations:

► A current or future requirement is end-to-end System z recovery, in which case, use GDPS instead.

► A Business Continuity and Disaster Recovery combination with System z HyperSwap across two sites is required, in which case, use GDPS HyperSwap Manager instead.

► Management of z/OS Global Mirror (XRC) is required.

► Management of non-IBM storage systems is required.

► Future plans include moving to GDPS.

Tools and toolkits (FlashCopy Manager and PPRC Manager)

FlashCopy Manager and PPRC Manager are *tools*. You might think of them as *toolkits* that are designed to be an optional z/OS-centric supplement to the previously described strategic Business Continuity automation offerings. These tools are typically used when specialized System z FlashCopy or PPRC usages and functions are needed that strategic Business Continuity automation solutions are not designed to provide.

In particular, when moving from non-IBM System z storage to IBM storage, neither TPC for Replication nor GDPS are intended to provide tools or facilities to assist in the customer operational skills, operational procedure, and production job-stream migration. Also, neither TPC for Replication nor GDPS are intended to provide tools or facilities to assist in the integration of IBM Advanced Copy Services into the z/OS batch production environment.

FlashCopy Manager and PPRC Manager are designed to supplement the IBM strategic z/OS TPC for Replication and GDPS solutions by addressing these specialized additional requirements. FlashCopy Manager and PPRC Manager are intended to provide z/OS-based software tools that can perform the following functions:

► Enable z/OS and System z storage technology operational migrations from non-IBM copy services to IBM copy services

► Enable z/OS and System z data center migrations

► Enable z/OS IBM disk subsystem reconfiguration, with associated data movement

► Enable System z point-in-time FlashCopy initialization speed enhancements

► Enable integration and exploitation of IBM Advanced Copy Services into the production z/OS batch environment, using any existing z/OS job scheduler

► Address situations where System z client requirement is only for lower Business Continuity Tiers 1 to 4 disaster recovery (That is, only periodic point-in-time copy is required for recovery.)

FlashCopy Manager and PPRC Manager are intended as supplements, not replacements, for z/OS TPC for Replication, GDPS, or GDPS HyperSwap Manager.

When FlashCopy Manager is used

FlashCopy Manager is typically used, often as a supplement to z/OS TPC for Replication or GDPS, when a z/OS or System z IBM storage client has the following requirements:

► A z/OS toolkit to enable fast migration and that lowers the risk of the operational migration, from a non-IBM z/OS or System z storage point-in-time copy to FlashCopy

► A set of unique z/OS tools to integrate and dynamically manage FlashCopy into the existing z/OS production and batch environment

► Significant z/OS FlashCopy performance enhancements:
  – Compared to standard IBM TSO, DFSMS, or ANTRQST invocation methods
  – Compared to non-IBM point-in-time copy services

► Significant z/OS or System z UCB constraint relief to enable the use of FlashCopy

► An affordable z/OS-base recovery enablement toolkit for System z, when the requirement is only for lower criticality Business Continuity Tier 1-4 local point in time recovery (that is, periodic point-in-time copy for disaster recovery)

► A z/OS-familiar ISPF interface, rather than a GUI, is preferred for control and management of FlashCopy

When PPRC Manager is used

PPRC Manager is typically used, often as a supplement z/OS to TPC for Replication or GDPS, when a z/OS IBM storage client has the following requirements:

► For technology migration, an affordable z/OS-based set of tools to lower risk and enable an operational migration from non-IBM storage replication to IBM PPRC technology on System z-attached DS8000, DS6000, or ESS

   This is especially useful for one-time events.

> **Tip:** Physical data migration from non-IBM storage to IBM storage is performed by using tools such IBM Softek Data Mobility software. FlashCopy Manager and PPRC Manager assist with the operational migration and batch production job integration. See "Physical data migration" on page 22 for more positioning information.

► For data migration, an affordable z/OS set of tools to lower risk and enable large scale z/OS or System z data physical data migration from IBM storage to other IBM storage, for example, ESS to DS8000, older DS8000 to new DS8000

   This is especially useful for one-time events.

► A unique set of z/OS tools to supplement GDPS or z/OS TPC for Replication, by accelerating and automating the data collection, definition, setup, testing, and operational integration of Metro Mirror, Global Copy, Global Mirror, Metro/Global Copy, or Metro/Global Mirror into any z/OS or System z production batch environment

► An affordable z/OS-based recovery enablement toolkit for System z, where the requirement is only for lower criticality Business Continuity Tier 1 to 4 remote point-in-time recovery

   For example, this is useful for periodic point-in-time copy for disaster recovery at remote site.

► A z/OS-familiar ISPF menu-driven dialog interface preferred, rather than a GUI, for using PPRC technology

Physical data migration

IBM offers various solutions for physical data migration, which include the following z/OS options:

► Softek Data Mobility software

   This z/OS software moves the data between z/OS-attached storage through the System z server by using z/OS server cycles.

► PPRC Manager

When Softek Data Mobility is used

Physical data migration, using Softek Data Mobility software, is used to migrate z/OS data when the following requirements exist:

► There is physical z/OS data migration between different storage vendors, such as between EMC and IBM and between Hitachi and IBM.

► There is a need for a dynamic data switch.

► IBM-to-IBM data migration using System z server cycles is preferred.

► Concurrent volumes being migrated are in the hundreds.

In addition, the following factors are acceptable:

► A client can install z/OS Softek Data Mobility software on all participating z/OS images.

► Physical data can be migrated in stages over time, when the number of concurrent volumes is typically in the low hundreds.

Tip: At the time of the writing of this paper, Softek offers a rule of thumb of about 1 TB per day for physical data migration when using the Softek software.

When PPRC Manager toolkit is used

The PPRC Manager toolkit is used to physically migrate z/OS data when the following requirements exist:

► There is a need to migrate physical z/OS or System z data between IBM storage hardware such as DS8000, DS6000, and ESS.

Typically a technology migration is from older IBM storage subsystems to newer IBM storage subsystems.

► There is a need for the shortest time window to achieve large scale IBM-to-IBM physical data migration.

Typically this is when the number of concurrent z/OS or System z volumes that are being migrated is in the thousands.

► There is a need to avoid the manpower, time, and expense required for an installation and qualification test cycle for installation software in a production z/OS environment.

► There is a need to avoid z/OS server cycle usage and real memory requirements when using z/OS software-based physical data migration.

► The requisite IBM storage subsystem Remote Copy, Metro Mirror or Global Mirror licenses, and requisite storage network infrastructure are already in place and can be readily used.

In addition, the following factors are acceptable:

► A customer can install (or use existing) Metro Mirror or Global Mirror microcode licenses on all participating z/OS IBM storage.

► A short outage occurs when the cutover is made.

Tip: PPRC Manager is supported only on System z CKD volumes on the DS8000, DS6000, and ESS disk subsystems. This includes z/OS, Linux on System z, z/VM, and z/TPF CKD volumes. PPRC Manager does not support disk mirroring for open systems FBA disk subsystems.

Usage scenarios and solution benefits

In this section, we provide ideas, suggestions, and real-life experiences in using the FlashCopy Manager and PPRC Manager program products. The scenarios and configurations for FlashCopy and PPRC usage are not exclusive to FlashCopy Manager and PPRC Manager. The configurations can be operated in any environment. However, the FlashCopy Manager and PPRC Manager tools provide specific z/OS and System z CKD storage performance enhancements and z/OS usability enhancements that enable the viability of the usage scenario and optimize the System z exploitation of the FlashCopy and PPRC Advanced Copy Services.

The FlashCopy and PPRC usage scenarios may be categorized as follows:

- ► "Scenario 1: FlashCopy" on page 24
- ► "Scenario 2: FlashCopy followed by PPRC" on page 26
- ► "Scenario 3: FlashCopy followed by PPRC, followed by FlashCopy" on page 27
- ► "Scenario 4: FlashCopy of a PPRC primary" on page 28
- ► "Scenario 5: PPRC only" on page 29
- ► "Scenario 5d: PPRC followed by FlashCopy" on page 35
- ► "Scenario 6: Cascaded PPRC" on page 39

In each of these scenarios, we include the following information:

- ► Examination of real-life customer usage of each of these scenarios in detail
- ► Description of the FlashCopy Manager and PPRC Manager enablement roles and specific features that make the solution possible
- ► Description of the overall client business solution benefits

Scenario 1: FlashCopy

Figure 4 illustrates the FlashCopy configuration (scenario 1).
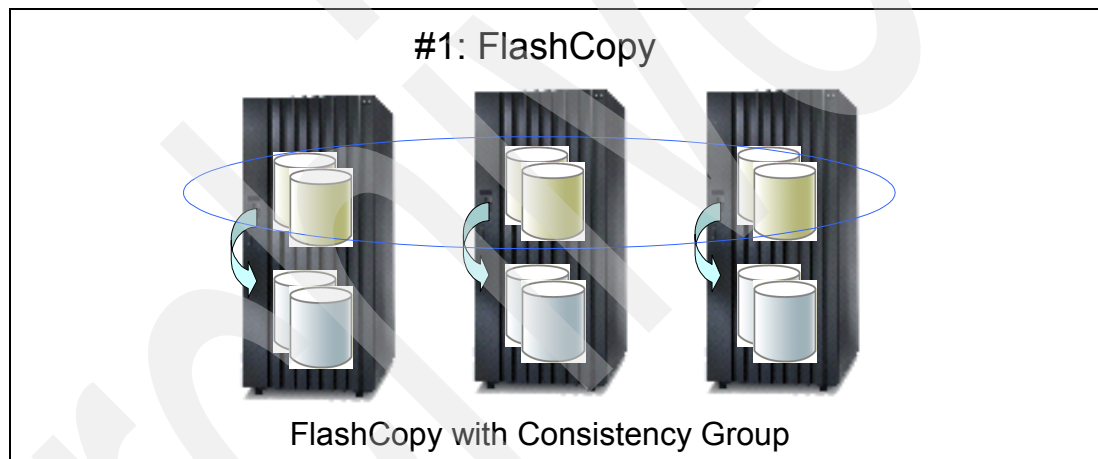
Figure 4   Usage scenario 1: FlashCopy with consistency group

Client environment and requirements

The client has several large important z/OS DB2 environments that use a shared catalog, with a total of more than 8,000 z/OS volumes. Multiple times in a day, they want to make various combinations of point-in-time FlashCopies of some, or all, of the z/OS DB2 volumes in this environment. The purpose of the copies is for quality assurance (QA), testing, development, data warehousing, backups, and disaster recovery.

Configuring the FlashCopy source-target matching for these multiple DB2 environments is extremely challenging, because the DFSMS allocations are constantly changing. The IT operations staff cannot readily know about all the DB2 database administrator or application volume changes that have been made in the environment since the previous FlashCopy. Maintaining correct, 100% data consistency among the volumes in the FlashCopy is paramount. Finally, to maximize the amount of FlashCopies that can be made for a minimum amount of physical GB requirements, there must be a shared, reusable pool of FlashCopy target volumes.

As a result, FlashCopy source and target matching must change all the time.

FlashCopy Manager enablement role

In this configuration, FlashCopy Manager is invoked to dynamically build batch jobs that perform the following tasks:

► Dynamically discover and verify the *current* state of the several z/OS DB2 and FlashCopy environments, including current VOLSERs and current FlashCopy relationships.

► Dynamically define the correct FlashCopy source and target configuration or configurations, selecting FlashCopy target volumes based on wildcard specifications. FlashCopy Manager knows to match on proper source and target size, on proper DEVNOs, and on the proper VTOC/VTOC Index characteristics.

  FlashCopy Manager is aware of proper matching of z/OS VTOC/VTOC Index characteristics. Otherwise, a VARY OFF or VARY ON of all of the FlashCopy targets is needed to resolve the matching. This is not feasible in an environment of this size.

► The client z/OS batch job automation then submits the FlashCopy Manager job that performs a z/OS full volume FlashCopy with Consistency Group, using the specialized high performance FlashCopy invocation programs. In this environment, across more than 8,000 z/OS volumes, the FlashCopy Manager jobs can initialize the FlashCopy Consistency Group in approximately 6 seconds. This duration is short enough that the online DB2 production environments continue to run and do not need a quiesce.

> **Initialization:** In an environment of this size, invocation of FlashCopy with Consistency Group across more than 8,000 volumes by standard TSO, DFSMS, or ANTRQST invocation takes approximately more than 10 minutes. Your results may vary.

► The FlashCopy target volumes are then readied for use by the QA, testing, development, data warehousing, or backup teams.

> **Tip:** Preparing the FlashCopy volumes for subsequent use is typically done through a secondary program product. Examples program products include IBM DB/2 Cloning Tool or Mainstar Volume Conflict Rename (VCR). These software products automate the necessary renaming of metadata (for example, the data set names in the catalog) after the FlashCopy of the volumes.

This process is repeated, on demand, multiple times per day.

Client usage and solution value

The client is able to move from making a point-in-time copy once per week to accurately making multiple point-in-time DB2 copies, affordably, on an on-demand, automated basis.

This enables significant new business values and applications, such as the following examples, to be created that were not feasible before:

► Creation of accurate, up-to-date online DB2 query important database applications that support more than 4 billion DB2 queries a day

► Measurable, significant improvements in application time to implementation, with better quality

► Significant savings in costs for testing, QA, and development and better currency of data for backups and disaster recovery

FlashCopy Manager provides the enabling toolkit and performance to allow these capabilities to be considered normal, every-day procedures.

Scenario 2: FlashCopy followed by PPRC

Figure 5 illustrates the FlashCopy followed by PPRC configuration (scenario 2).
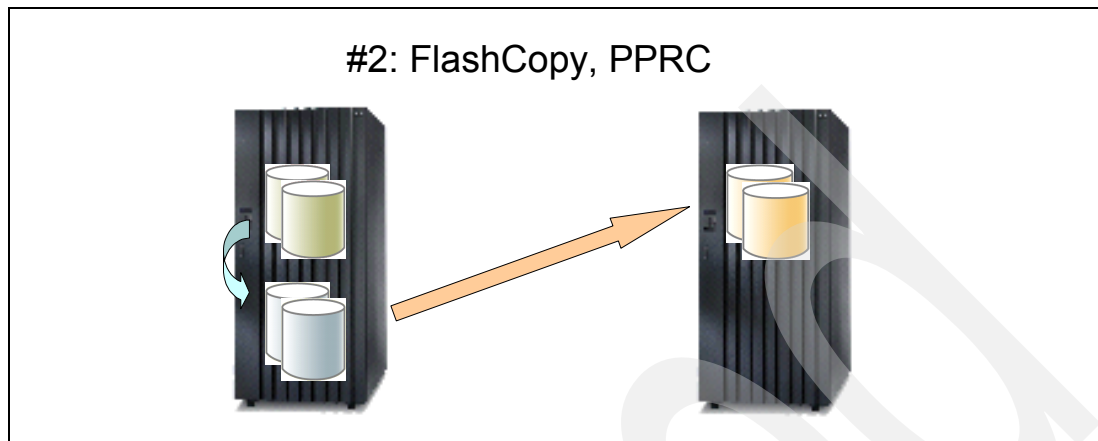
Figure 5   Usage scenario 2 FlashCopy followed by PPRC

Client environment and requirements

The client has a high performance z/TPF and z/OS transaction processing environment with greater than 3,000 volumes. Uptime is essential, because it is a worldwide, 24x7x365 reservation service.

The client must make frequent, consistent FlashCopy point-in-time copies of the production environment for local database corruption, on-site backup, and off-site disaster recovery purposes, without taking the production reservation services and applications offline.

The FlashCopies are made to a round-robin rotating pool of target volumes, so that three generations of backups are made locally, before overlaying the oldest one. This is done for purposes of local database corruption protection. Simultaneously, the consistent point-in-time backups must be drained to a remote disaster recovery site by using PPRC technology.

FlashCopy Manager and PPRC Manager enablement role

In this configuration, FlashCopy Manager jobs are invoked from z/OS to provide high performance FlashCopy with Consistency Group initialization speed to shared addressable TPF CKD volumes. The fast initialization speed is necessary to make the point-in-time copies without causing timeouts in the z/TPF reservation system. In this particular, specialized environment, FlashCopy Manager jobs can perform the FlashCopy with Consistency Group, across more than 3,000 large volumes, across more than ten DS8300 Turbos, in less than one second.

> **Result in your environment:** These results are specific to this environment. Your results may vary.

FlashCopy Manager jobs are used in the initial setup of the FlashCopy environment and to perform ongoing maintenance and changes to the FlashCopy configuration.

PPRC Manager jobs are used as the foundation of your processes to establish and control the transfer of the FlashCopies, by using PPRC, to the remote disaster recovery.

Client usage and solution value

By using the high performance FlashCopy invocation programs, the client can make frequent, consistent, large scale point-in-time FlashCopies for local database corruption and backup, without taking down the reservation service at any time. PPRC technology accurately and efficiently forwards the point-in-time disaster recovery copies to the remote site. Maintaining and updating the environment can be done with speed and efficiency.

Scenario 3: FlashCopy followed by PPRC, followed by FlashCopy

Figure 6 illustrates the FlashCopy followed by PPRC, followed by FlashCopy configuration (scenario 3).
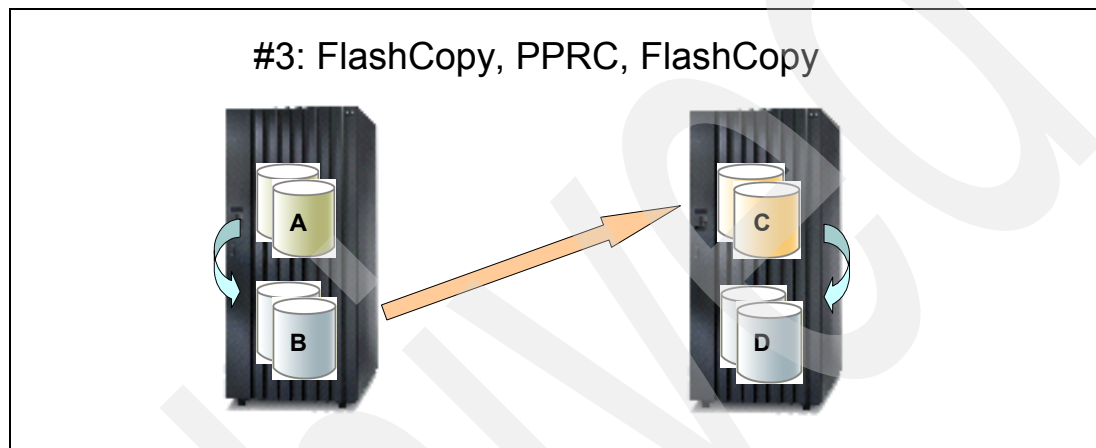
Figure 6   Usage scenario 3: FlashCopy followed by PPRC followed by FlashCopy

Client environment and requirements

The client wants to make consistent point-in-time copies, twice a day, at the z/OS local site, for local database corruption protection, backup, and disaster recovery. The point-in-time copies must be made without taking a production quiesce or outage.

The data is to be forwarded to a remote site that is 1000 km away. There is no live, active CPU at the remote site, and no connectivity to the remote site, other than the PPRC links.

For cost and budgetary reasons, the data at the remote site does not need to be within seconds. The requirement is only for the data at the remote site to be no more than 12 hours old.

FlashCopy Manager and PPRC Manager enablement role

FlashCopy Manager jobs are used to define and operate the local FlashCopy environment from a z/OS production batch job scheduler. When required, FlashCopy Manager jobs that invoke high performance FlashCopy execution times, execute an Incremental FlashCopy with Consistency Group, across all volumes (A) in the z/OS production environment. The execution time is fast enough that no production outages need be scheduled. The Incremental FlashCopy function transfers only the changed incremental data to the FlashCopy targets (B), thus minimizing the transfer time to load the data to the Global Copy (PPRC-XD) primary (B) volumes.

PPRC Manager jobs manage the Global Copy (PPRC-XD) session that transmits the incremental changes to the remote site. As soon as incrementally changed data appears on the Global Copy (PPRC-XD) primaries (B), the data begins to be drained to the remote site volumes (C).

The incremental change feature of this configuration, both on the FlashCopy and on the Global Copy, significantly reduces the bandwidth requirement and enhances the data currency at the remote site.

PPRC Manager jobs monitor the Global Copy (PPRC-XD) session. As soon as the data is fully transferred onto the Global Copy (PPRC-XD) secondary volumes (C), FlashCopy Manager jobs are executed at the *primary site*, to perform an Inband FlashCopy to the remote site storage, from the Global Copy (PPRC-XD) secondary volumes (C) to the (D) volumes.

When this is accomplished, a golden copy for disaster recovery purposes is hardened at the remote site and is typically no more than six hours old. Then, the cycle of taking another FlashCopy with Consistency Group at the primary site can begin.

The reason for two sets of volumes at the remote site is to overlap the loading of the next set of backup data onto the Global Copy (PPRC-XD) secondaries (C), while retaining a good, golden copy on the D volumes for disaster recovery purposes.

Client solution value

FlashCopy Manager and PPRC Manager jobs, used in combination, provide ease of use in setup, control, and automated management of this local point-in-time copy. They also provide remote disaster recovery of this z/OS environment, in which only a cost-effective local point-in-time and remote disaster recovery solution is required. For this solution, the data only must not be more than 12 hours old.

No production outages need be scheduled due to the speed of the FlashCopy Manager job execution time at the primary site. Incremental FlashCopy and Global Copy minimize the data transferred to incremental changes only, thus minimizing bandwidth and maximizing data currency within this scenario.

Inband FlashCopy, issued from FlashCopy Manager jobs running at the primary site, provides the significant cost and total cost of ownership (TCO) benefit of not requiring an active CPU to be live at the remote site.

Scenario 4: FlashCopy of a PPRC primary

Figure 7 illustrates the FlashCopy of a PPRC primary configuration (scenario 4).
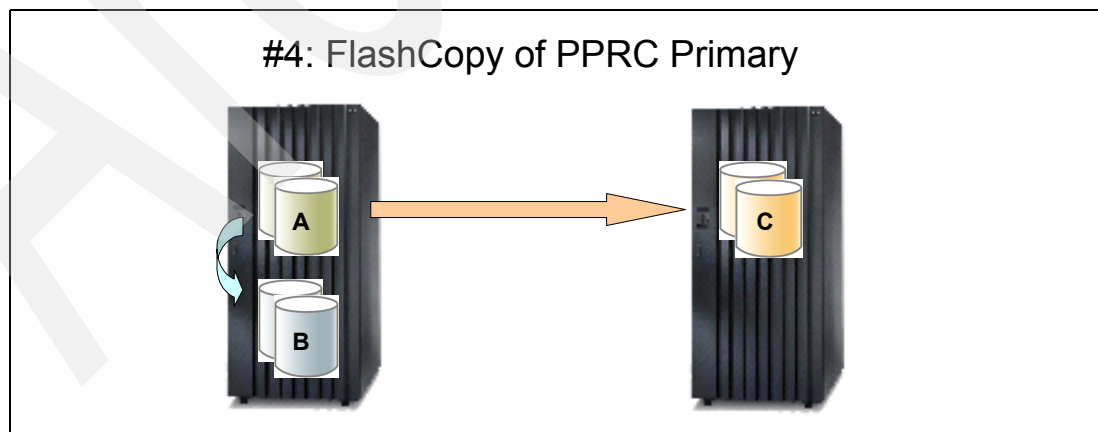
Figure 7   Usage scenario 4: FlashCopy of a PPRC Primary

Client environment and requirements

This usage scenario is a variation of the FlashCopy Manager usage scenario 2. This scenario is only different from usage scenarios 2 and 3 in that the FlashCopy targets are not to be forwarded to the remote site.

However, the client still has a requirement to make FlashCopies with Consistency Group, of large important volumes at the local site, for usage as local backup, local database corruption protection, or local testing. At the same time, the client does not want to pause the applications, nor do they want to pause the PPRC Disaster Recovery mirroring protection.

FlashCopy Manager enablement role

FlashCopy Manager jobs, as previously described, use specialized high performance FlashCopy invocation programs to enable the FlashCopy, Incremental FlashCopy, or FlashCopy with Consistency Group initialization, which is significantly faster than standard DFSMS, TSO, or ANTRQST FlashCopy invocation. The client can use FlashCopy Manager jobs to create several thousand volume FlashCopies with Consistency Group, in a matter of single digit seconds. At this level of scalability, FlashCopy invocation through the standard DFSMS, TSO, or ANTRQST usually takes several minutes.

Client solution value

By using FlashCopy Manager jobs, no quiesce of the applications nor pause of the disaster recovery mirroring protection is required. A large FlashCopy with Consistency Group is possible, where it would not have been feasible with standard DFSMS, TSO, or ANTRQST FlashCopy invocation.

Scenario 5: PPRC only

Several client environments may fit the PPRC only configuration (scenario 5), which is shown in Figure 8.
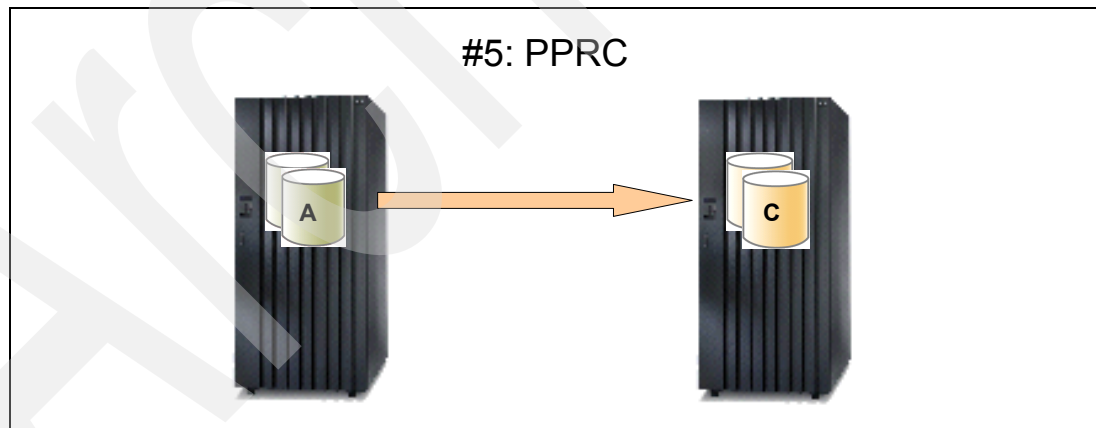
Figure 8   Usage scenario 5: PPRC

Client environment and requirements

This configuration is primarily used in migration environments, such as the following types:

► Technology migrations: "Usage scenario 5a: Technology migrations" on page 30
► Data center migrations: "Usage scenario 5b: Data center migrations" on page 32

These environments can also be the following scenarios:

- ► "Usage scenario 5c: Split Mirror backups" on page 33
- ► "Usage scenario 5d: Periodic remote point-in-time copy" on page 36
- ► "Usage scenario 5e: Keeping a synchronous copy live while making a point-in-time copy" on page 37
- ► "Usage scenario 5f: Accelerate implementation of GDPS" on page 38

Usage scenario 5a: Technology migrations

We begin by describing the client requirements for disk storage technology migration.

Client requirements for 5a: Technology migrations

The technology migrations include the following examples:

- ► Example 1

  The client desires to lower the risk of migrating from a large non-IBM disk mirroring environment to a similar, "like-to-like" large Metro Mirror, Global Copy, or Global Mirror environment.

  - – Because this is a one-time event, a high value is placed on minimum educational requirements and maximum ease of use for definition and control of the new environment. The client must have the full ability to operate at a large scale with high performance and to integrate with existing z/OS batch job schedulers and procedures that are already installed.

  - – If the effort is too high to operationally migrate, the client cannot realistically choose any another disk vendor other than the one that is currently installed.

- ► Example 2

  The client has existing IBM CKD-based disk technology and a large amount of data running in a mission-critical environment that cannot be paused or taken offline. The client desires to migrate to newer IBM storage technology, with minimal risk and in a short window of time. Because this is a one-time event, a high value is placed on a minimum of educational requirements and maximum ease of use for definition and control of the new IBM environment.

- ► Example 3

  The client has existing IBM CKD-based disk technology and a large amount of data, running in a mission-critical environment that cannot be readily paused or taken offline. The client desires to migrate and move data within their IBM disk farm, to accommodate the movement of data to a different, more optimum location within the disk farm. This may be required for the following reasons among others:

  - – Obtain better balance in workload distribution across DASD subsystems.

  - – Move related types of data to the same disk subsystem.

  - – Correct a data distribution situation that happened many years ago and that has been a constant "special case headache" for which no simple data relocation opportunity existed prior to the ease of migration using PPRC technology.

  - – As a migration tends to be a one-time event, a high value is place placed on a minimum of educational requirements, minimum amount of risk, and maximum ease of use for definition and movement of the data to the new location.

- ► Example 4

  The client is interested in GDPS HyperSwap or in z/OS Basic HyperSwap:

  - – System z HyperSwap has a rigorous requirement for specific Metro Mirror configuration symmetry in terms of configuration requirements. In many cases, the existing storage subsystems may need to have their data, DEVNO, VOLSER, LSS configuration and placements significantly re-oriented in order to comply with HyperSwap requirements.

  - – Usually data that is important enough to be HyperSwapped cannot readily be paused or taken offline for reconfiguration.

  - – The client desires to migrate and move data within their IBM disk farm, to reconfigure their storage to properly comply with HyperSwap configuration requirements.

In the next section, we see how PPRC Manager can help address the needs of these various technology migrations.

PPRC Manager enablement role for 5a: Technology migrations

Most migrations and their initial setup are one-time events. As such, they place a high value on ease of use and minimum educational requirements. This is especially true when migrating from a non-IBM environment to an IBM environment. PPRC Manager addresses these concerns by providing a simplified z/OS user interface for initial setup, testing, implementation, and usage of PPRC technologies, by automating the following functions:

- ► Fast and dynamic collection of all PPRC configuration data required to define the z/OS or System z CKD IBM PPRC environment, such as SSID, serial numbers, LSS, and so on

- ► Repetitive accurate creation of z/OS batch jobs to define and control the evolving new IBM PPRC configuration

- ► Repetitive accurate creation of z/OS batch jobs to test, define, control, track, and monitor the state of the new IBM PPRC configuration

- ► Creation of a flexible mix-and-match capability for defining the PPRC pairs to work within the configuration constraints that the client needs to work with

- ► Document and change control tracking of the evolving PPRC configuration

PPRC Manager information is dynamically collected and is used to generate new, reconfigured z/OS and System z IBM PPRC storage environments. These PPRC environments can be used to perform internal data movement using PPRC, as needed, and to migrate the physical PPRC configuration in stages, toward the final desired configuration. In this way, these tools can also be of significant benefit to projects where the goal is to accelerate the implementation of IBM PPRC and IBM HyperSwap for strategic IBM automation tools and solutions such as GDPS and TPC for Replication for System z.

Client value and solution benefit for 5a: Technology migrations

Users of PPRC Manager can define and begin initial testing of large new PPRC configurations in a couple of days. Because of the dynamic data collection features, accuracy in definition is high. Also, time is spent on the actual aspects of workload testing, error injection, and so on, and not on definition or configuration. PPRC Manager jobs are standard ISPF data set members and can easily be integrated into existing z/OS batch production environments and existing z/OS job schedulers.

PPRC Manager provides tools to accelerate time to project completion, with high accuracy and quality, significantly reduced manpower. These tools all contribute to mitigating the risk, manpower, and expense of performing a technology migration.

Usage scenario 5b: Data center migrations

The client must move large amounts of data between data centers, as part of a large consolidation or relocation effort. The client must also lower the risk of performing this large, yet one-time event. As such, a high value is placed on a minimum of educational requirements and maximum ease of use for definition and control of the new environment. The client must have full ability to operate at a large scale with high performance and integrate with any existing z/OS batch job schedulers that are currently installed and used for production control.

Initial testing environments for the move must be set up. Initial and repetitive multiple test and cutover runs must be done and rigorously tested. Cutover jobs must be built and tested and then reset and tested again. Failover and failback procedures must be built and tested as insurance against a failed cutover.

Bandwidth must be minimized. Because this is a one-time event, cost for storage at the remote site must be minimized. Therefore, a full set of "golden copy" storage at the new site is not always possible. Finally, depending on the project, the new remote CPUs may not be fully in place and operational until a later stage in the project.

Client requirements for 5b: Data center migration

The client must migrate a major online 24x7x365 financial authorization application from the west coast of the United States to Denver. The number of z/OS volumes is greater than 4,000. Bandwidth between the two sites is constrained. At the new target data center, cost constraints require that no extra disk space is available for a second copy of the new storage for testing. Manpower is limited, client expertise in data replication at this scale is not in-house, and the time frame for the project is compressed.

PPRC Manager enablement role for 5b: Data center migration

IBM Global Copy (PPRC-XD) is used between the old volumes and new volumes. Global Copy (PPRC-XD) provides non-synchronous transmission of data to the secondary volumes, with low overhead and no impact to the primary production volumes.

PPRC Manager is used to do the initial setup of the Global Copy environment, and the initial load starts within two days of the new IBM target disk subsystems being installed. PPRC Manager monitors the Global Copy sessions, ensuring that the data that is transmitted over the telecommunications lines moves properly. Global Copy transmits data in performance sequence, not in data integrity sequence, to maximize bandwidth utilization. This lowers the bandwidth costs that are required to accomplish the migration.

After the initial load is complete, PPRC Manager monitors continual transmission of new changed data with Global Copy to the target new data center, thus keeping the new site as current as possible. PPRC Manager jobs are used to do a Global Copy Go-to-Sync, followed by a FREEZE, followed by establishment of a PPRC failover/failback session, so that incremental change tracking is done on both sides of the Global Copy session. Testing then proceeds directly on the Global Copy (PPRC-XD) secondaries, testing and proving that the cutover jobs work. Testing frequency is enhanced by the dynamic data collection, matching, and continual ability to define, refine, monitor, and control of PPRC Manager.

When testing is completed, PPRC Manager jobs command Global Copy to be re-enabled from the primary with failover/failback, causing only incremental changes that need to be sent and loaded to the secondary. Any changes on the secondary that need to be reset are automatically sent from the primary as well. In this way, the client avoids the need for a second set of disks at the remote site, thus significantly lowering the cost of the migration.

After multiple successful tests, during a planned window, the now proven and tested PPRC Manager-created CUTOVER jobs are executed, and a successful launch of the new storage and applications at the new remote site is done.

Client value and solution benefit for 5b: Data center migration

The client experiences significant time-to-project completion improvements due to PPRC Manager's ability to continually define, refine, control, and monitor the entire migration. High confidence levels are generated by multiple successful tests. Manpower that is allocated to the storage replication is significantly reduced, requiring only one quarter of one storage administrator's time allocated to the entire project. Bandwidth costs are lowered through the use of Global Copy (PPRC-XD), managed by PPRC Manager. Inherent risk in a major critical data center migration is successfully addressed and mitigated.

Usage scenario 5c: Split Mirror backups

Certain client situations may require a different approach to backups than using FlashCopy. This occurs when the client requires full independence of the backup copy from the source copy, instantaneously, as soon as the "split" is made.

Client requirements for 5c: Remote Split Mirror

For Split Mirror for a *remote copy* can include the following requirements, for example:

► Split the remote PPRC secondary volumes from the local PPRC primary volumes, and use the remote secondary volumes as a point-in-time backup (for example, an SAP® environment), data warehouse, or other uses.

► The nature of the applications and client business does not require a high amount of data currency for disaster recovery. For cost reasons, the indicated design for the remote site data is that a consistent point-in-time copy of the data is needed only once or twice a day.

Client requirements for 5c: Local Split Mirror

The requirements for Split Mirror backups can also indicate a need for *local Split-Mirror backup* environments, as shown in Figure 9.
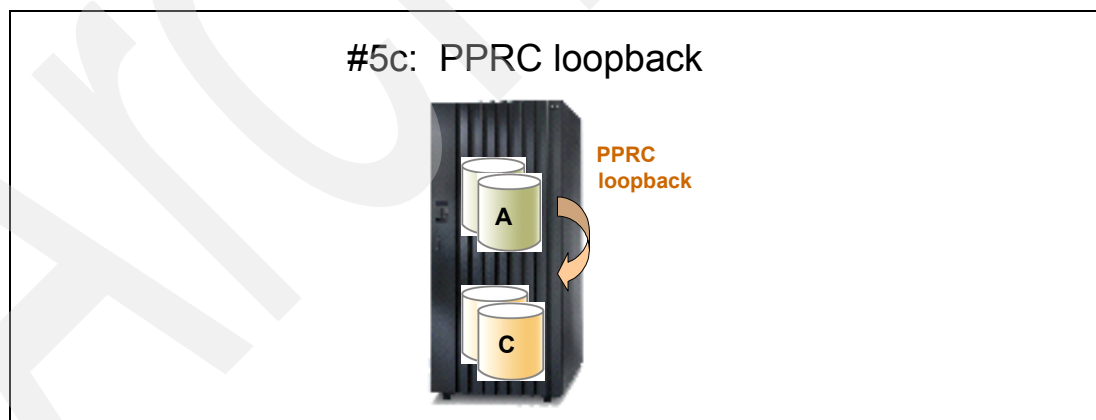
Figure 9   Usage scenario 5c: PPRC 'loopback' for local Split Mirror

This configuration is often used to satisfy the following requirements:

► After point-in-time checkpoint copies are made of the production volumes A, the source volumes A are to be used for high I/O-intensive batch updates.

► Using FlashCopy may be undesirable in some circumstances, particularly when a high I/O write rate on the source volumes A might cause excessive *copy on write overhead* in the storage subsystem. An excessive copy on write overhead may, in turn, overly impact the

throughput on production batch update volumes A. In those specific circumstances, an alternative approach may be desired.

One approach is to use local PPRC split-mirror with PPRC *loopback*, instead of FlashCopy, to make the local consistent point-in-time copy. That is, define local PPRC pairs, and then when desired, split the local PPRC pairs and use the PPRC secondaries as the point-in-time copy.

► The alternative method achieves complete independence of the point-in-time volumes C from the production volumes A, at the time that the split is done and the point-in-time copies are made.

Figure 10 shows a useful additional variation of this scenario.
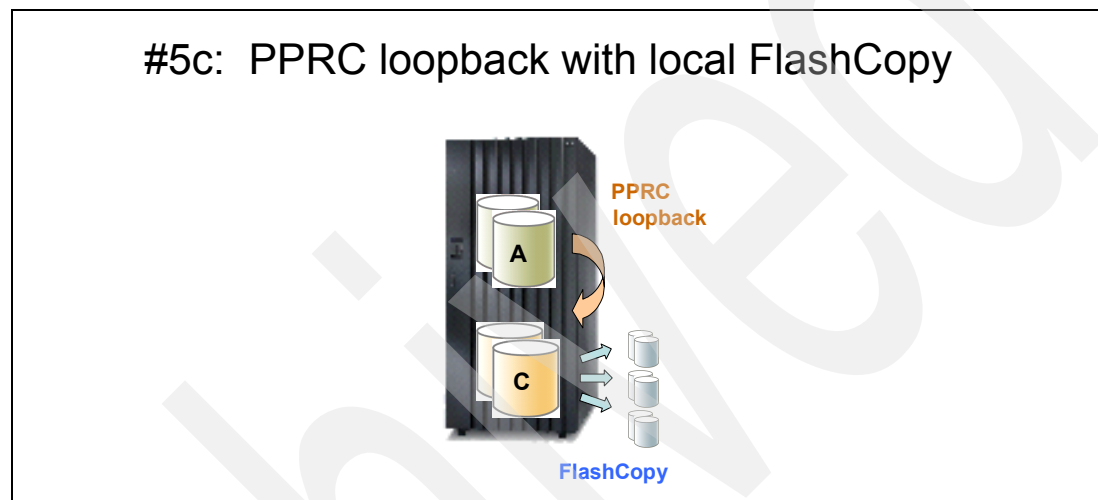
Figure 10   Usage scenario 5c: PPRC loopback for local Split Mirror, with subsequent FlashCopy

This usage scenario is useful as an extension to the Split Mirror to address the following requirements:

► The point-in-time copy C, when made, is then desired to be immediately copied multiple times. This requirement can be common in many large application environments. An example might be an SAP installation requirement for many multiple copies for data warehouse, QA testing, and so on. These copies may be desired to be made often, perhaps several times a day.

► By using the configuration shown in Figure 10 and implementing a combination of local PPRC Split Mirror with PPRC loopback, followed by multiple subsequent FlashCopies, the goal can be accomplished of immediately making multiple copies of the point-in-time copy.

PPRC Manager enablement role for 5c: Remote or local Split Mirror

PPRC Manager provides a simplified z/OS user interface for using PPRC technologies, through a ISPF-based z/OS toolkit. It builds the jobs and automates the tasks required to define the operational jobs and integrate them into the z/OS batch job scheduler. PPRC Manager provides the following functions:

► Fast and dynamic collection of all PPRC configuration data required to define the z/OS PPRC environment, such as SSID, serial numbers, LSS, and so on

► Creation of z/OS batch jobs to define and control the PPRC configuration

► Creation of z/OS jobs to track and monitor the state of the PPRC configuration

In a manner similar to FlashCopy Manager, PPRC Manager also provides specialized high performance FREEZE invocation programs and jobs that can be used to split the pairs, especially if the Split Mirror is to be controlled from a z/OS batch job scheduler.

By using the information collected during PPRC Manager dynamic data discovery, the PPRC Manager-created jobs can also execute a PPRC FREEZE in a much shorter time than normal TSO or ANTRQST invocation. Existing PPRC Manager users have seen a PPRC FREEZE, across several thousand volumes, execute in approximately 60 milliseconds. This high speed of rate of FREEZE execution from a batch job can make feasible Split Mirror backups that otherwise might not be possible with normal TSO or ANTRQST Split Mirror invocation.

> **Results in your environment:** These results are specific to this environment. Your results may vary.

Also, as shown in Figure 10 on page 34, FlashCopy Manager can be used in conjunction with PPRC Manager to create the jobs that are needed to make multiple FlashCopies of PPRC secondary Split Mirror volumes.

PPRC Manager and FlashCopy Manager enable the creation of batch jobs that can operate a split-mirror environment from a z/OS batch job scheduler. PPRC Manager FREEZE invocation programs and jobs provide high performance that makes the split time short and fast enough that applications can stay live during the split.

> **PPRC configuration usage scenarios 5a, 5b, and 5c:** PPRC configuration usage scenarios 5a, 5b, and 5c may occur in any z/OS environment, including environments where GDPS and z/OS TPC for Replication are in use as the strategic replication management tools. When the requirement is to manage some of these scenarios from the z/OS production batch job scheduler, PPRC Manager and FlashCopy Manager may be of assistance in providing the required supplementary batch jobs.

Client usage and solution value for 5c: Local or remote Split Mirror

Local or remote Split Mirror provides an excellent alternative method to create large point-in-time copies, especially for large important application sets, such as SAP. By using Split Mirror, the new source copy can be used to create multiple system-wide point-in-time backup copies for disaster recovery, backup, testing, development, and data warehouse purposes, all without impact to the production applications.

Especially for large application systems that may span thousands of volumes, Split Mirror is an excellent methodology for assuring IT Business Continuity.

PPRC Manager's high performance FREEZE invocation programs and batch jobs can supplement strategic IBM solutions, such as z/OS TPC for Replication and GDPS, where the requirement is to enable z/OS batch production job scheduler control of Split Mirror backups. It does this while providing ease of use and higher productivity for the storage administrator and using less manpower, with higher quality.

Scenario 5d: PPRC followed by FlashCopy

The following configurations are extensions of usage scenarios 5a, 5b, and 5c. As we introduced at the end of the previous section, this scenario adds FlashCopy of the PPRC secondary.

We first examine a scenario where only a weekly periodic point-in-time recovery copy at the remote site is required for disaster recovery: periodic point-in-time recovery copy at long distance using Global Copy (PPRC-XD).

Then, we examine two example scenarios where PPRC Manager and FlashCopy Manager provide significant added value to existing strategic disaster recovery automation tools such as GDPS:

► Keep GDPS/PPRC Metro Mirror synchronous disaster recovery protection live while taking a point-in-time copy at the remote site.
► Accelerate definition and testing of a Global Mirror (Asynchronous PPRC) environment managed by GDPS.

Figure 11 illustrates a common diagram that represents all three of these scenarios.
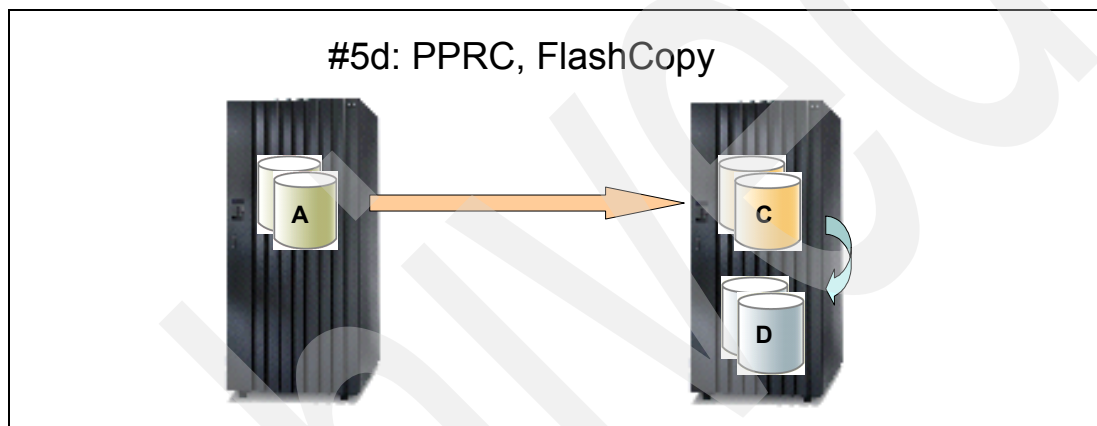
Figure 11   Usage Scenario 5d: PPRC followed by FlashCopy

Usage scenario 5d: Periodic remote point-in-time copy

Next we consider a situation where a periodic, weekly remote point-in-time copy is the replication requirement for disaster recovery.

Client environment and requirements for 5d: Periodic remote point-in-time copy

A client in a distribution industry must make an off-site consistent point-in-time copy of their 3,000 volume z/OS databases for disaster recovery purposes, from each of their two data centers to the other, at a distance of 654 miles. The copy must be made only once a week, because in the event of a disaster, batch job processes will re-run. However, cost pressures are high, and the telecommunications line bandwidth to the remote site is expensive.

Therefore, a continuous trickle of changed data from one site to the other is required in order to accomplish the amount of data transfer within the amount of time required. This will allow the weekend's lighter workload to Go-To-Sync in an acceptably short period of time to get a consistent copy.

In the future, if business requirements dictate, the client might eventually move to Global Mirror for periodic Consistency Groups at widely spaced intervals, but no plans are firmly set for when this may occur.

PPRC Manager and FlashCopy Manager enablement role for 5d: Periodic remote point-in-time copy

In this case, PPRC Manager jobs are is used to quickly and efficiently set up and manage a Global Copy (PPRC-XD) session. PPRC Manager jobs monitor the session, and at the appointed time, issue the Go-To-Sync commands that are necessary to make the consistent point-in-time copy at the remote site.

FlashCopy Manager jobs are used to quickly and efficiently define the FlashCopy targets at the remote site. When the Global Copy (PPRC-XD) Go-To-Sync process has drained all of the data to the remote site, Inband FlashCopy is invoked through FlashCopy Manager jobs to save a golden copy at the remote site.

At a future point in time, the configuration may transition to Global Mirror. FlashCopy Manager and PPRC Manager will read the existing configuration and create the jobs that will define and manage a basic Global Mirror environment.

Client usage and solution value for 5d: Periodic remote point-in-time copy

FlashCopy Manager and PPRC Manager provide an excellent cost-effective way to efficiently implement a z/OS Disaster Recovery solution with this required level of periodic recovery, while providing a upgrade path to Global Mirror should future requirements dictate. z/OS storage administrator productivity is excellent, and the skills required to set up and maintain the environment are minimal.

PPRC Manager and FlashCopy Manager generate all basic jobs for controlling this environment through a batch z/OS job scheduler.

Usage scenario 5e: Keeping a synchronous copy live while making a point-in-time copy

Next, we consider an environment in which we need to keep a Metro Mirror disaster recovery protection live, while making a point-in-time copy at the secondary, without taking an application outage or quiesce.

Client environment and requirements for 5e: Keeping a synchronous copy live while making a point-in-time copy

The client has an existing z/OS TPC for Replication Metro Mirror or GDPS/PPRC configuration. To make a consistent point-in-time FlashCopy at the remote site (for testing, data warehousing, or any number of reasons), the client normally must undergo a FREEZE/SUSPEND of the Metro Mirror pairs. They must perform the FlashCopy and then perform a resync. This compromises the Metro Mirror disaster recovery protection during the time that the Metro Mirror pairs are suspended. The client desires to make this point-in-time copy without compromising Metro Mirror disaster recovery protection.

PPRC Manager and FlashCopy Manager enablement role for 5e: Keeping a synchronous copy live while making a point-in-time copy

In this case, FlashCopy Manager jobs are used to issue an Inband FlashCopy with Consistency Group to the remote PPRC secondaries (C).

When the PPRC secondary or FlashCopy source volumes (C) go to an extended long busy (ELB) state due to the FlashCopy Consistency Group, the PPRC primary volumes (A) also go into an ELB state. Because of the high performance execution speed of FlashCopy that is enabled by FlashCopy Manager jobs, the ELB status duration is short. As previously described, the FlashCopy initialization is complete, and the ELB status is cleared within a few seconds, even across thousands of large z/OS Metro Mirror pairs.

This ELB status allows the primary site applications to continue to run. In addition, the FlashCopy can be taken at the remote site, without taking either a Metro Mirror SUSPEND event or requiring an application quiesce.

> **Tip:** When implementing FlashCopy Consistency Group in the manner described, coordinate the GDPS trigger timeout specifications with the FlashCopy Consistency Group long busy time. Ensure that GDPS does not interpret the FlashCopy Consistency Group long busy time as a false trigger.

Client usage and solution value for 5e: Keeping a synchronous copy live while making a point-in-time copy

FlashCopy Manager jobs enable the taking of a consistent point-in-time copy at the remote site without compromising the Metro Mirror (sync PPRC) Disaster Recovery capability. This can be a benefit to any z/OS or System z CKD IBM storage environment that is running Metro Mirror, including GDPS and z/OS TPC for Replication environments.

Usage scenario 5f: Accelerate implementation of GDPS

Finally we consider a scenario in which the client wants to accelerate the implementation of Metro Mirror and Global Mirror into their GDPS environment.

Client requirements for 5f: Accelerate implementation of GDPS

The client wants to set up an environment for Metro Mirror and Global Mirror for use in a GDPS environment. The time frame for implementation and the resources is tight. Many other GDPS project tasks require attention, in addition to setting up Metro Mirror and Global Mirror. The environment is quite large and complex, and the data collection, planning, and initial disk mirroring setup for the project is projected to take too much time out of the project timeline. In addition, to conform to GDPS HyperSwap requirements, some significant reconfiguration of the existing IBM storage subsystems is required.

To accelerate the project and meet the deadlines, the client wants a basic z/OS tool with which they can collect the configuration data on their IBM storage subsystems, get the basics of Metro Mirror or Global Mirror quickly reconfigured and defined, and set up a test environment. Such a tool can minimize the amount of time required for a system programmer and storage administrator to do the necessary IBM disk mirroring link and network reconfiguration, setup, testing, load testing, loading of initial copies, capacity planning, and many other tasks. The storage and system administrator resources must be allocated to other important tasks in the GDPS implementation to accelerate the implementation. Finally, the Metro Mirror or Global Mirror configuration should be easily imported into GDPS.

PPRC Manager and FlashCopy Manager enablement role for 5f: Accelerate implementation of GDPS

PPRC Manager and FlashCopy Manager are used to quickly and efficiently define and set up the Metro Mirror and Global Mirror requirements, by using the following methods:

► Collection and documentation of the large z/OS storage subsystem PPRC environment, including LSSs, VOLSERs, and DEVNOs, across several thousand volumes

► Definition of the PPRC links

► Identification and matching of the pairs, with a rich mix and match capability in defining the Metro Mirror, Global Copy (PPRC-XD) session), Global Mirror, or FlashCopy targets, supporting customer configuration constraints

► Providing the capability to easily redefine the PPRC configuration in stages, as the configuration is migrated toward a HyperSwap-compliant configuration

- ► In the case of Global Mirror, initial definition and setup of test of the Global Mirror configuration, including FlashCopy targets, Global Mirror Master and subordinates, and definition and execution of the test environment
- ► Creation of a large suite of test batch jobs for initial definition, redefinition, and testing of the Metro Mirror and Global Mirror
- ► Importing the resulting proven and tested configurations and procedures into the GDPS definitions

FlashCopy Manager is used to supplement GDPS FlashCopy capabilities, for making point-in-time copies that are outside of the normal GDPS disk mirroring tertiary copies.

Client usage and solution value for 5f: Accelerate implementation of GDPS

FlashCopy Manager and PPRC Manager can provide an excellent, cost-effective toolset to efficiently collect, identify, configure, test, and turn over to GDPS, a well-tested Metro Mirror, Global Mirror, or Metro/Global Copy IBM storage configuration. Productivity is excellent, allowing a significant amount of z/OS storage administrator time to be allocated to other aspects of the GDPS project. The time to completion of the GDPS project for PPRC setup, configuration, and testing is significantly accelerated, with higher quality. Finally, FlashCopy exploitation outside of the GDPS project is facilitated, and FlashCopy performance is enhanced by FlashCopy Manager.

Scenario 6: Cascaded PPRC

Figure 12 shows an example of the Cascaded PPRC configuration (scenario 6).
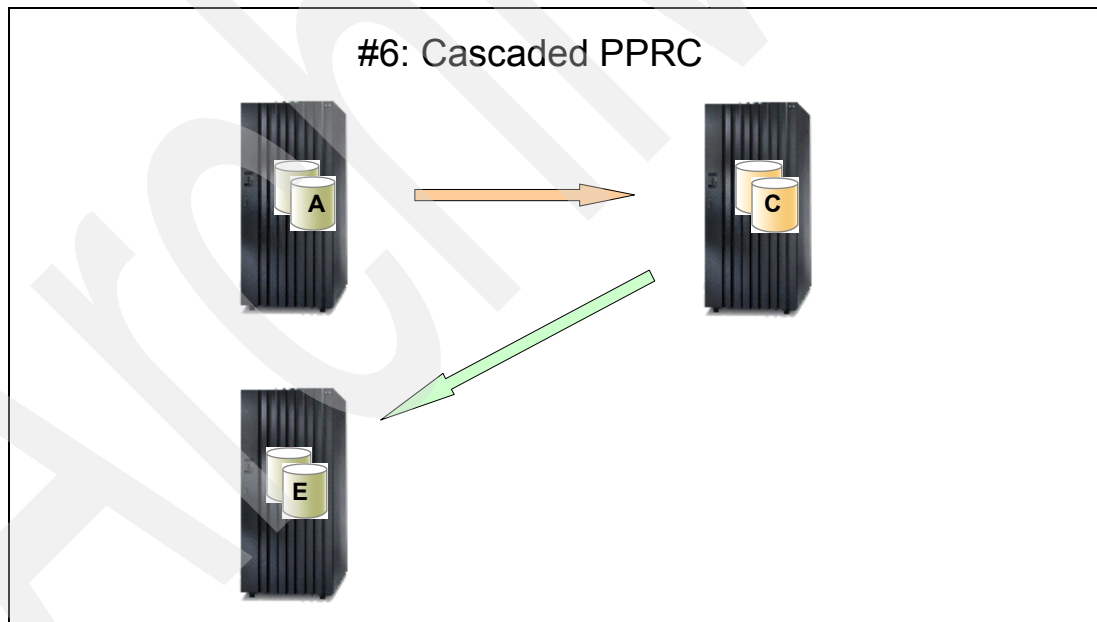
Figure 12   Usage scenario 6: Cascaded PPRC, example 1

Client environment and requirements

The client has an existing Metro Mirror configuration that is running on IBM enterprise storage, with a large amount of storage. They need the primary side storage to be migrated to a newer IBM enterprise storage subsystem. At the same time, the disk mirroring disaster recovery protection on the A-to-C link must be maintained, while the large amount of data is migrated as quickly as possible into the new storage subsystem. Because this is a one-time

event, a high value is placed on ease-of-use and minimal education requirements. Risk mitigation is important.

PPRC Manager and FlashCopy Manager enablement role

PPRC Manager is used to collect all required information from the existing running Metro Mirror configuration. PPRC Manager then defines and generates all jobs to configure, operate, and monitor the Global Copy portion of the Metro/Global Copy configuration shown in Figure 12.

PPRC Manager jobs are defined to monitor and track the status of the copying, as well as to perform FREEZE and SUSPENDs if needed at appropriate times. Cutover jobs are also a standard part of the PPRC Manager definition set. PPRC Manager also creates the ICKDSF jobs to erase sensitive financial data that is on the previous IBM storage subsystem, prior to it being decommissioned.

If necessary, FlashCopy Manager jobs can be defined to make point-in-time copies at necessary points in the migration process.

Client usage and solution value

Metro Mirror disaster recovery protection stays up and running while large scale, fast loading of the new incoming IBM storage subsystem is performed. Manpower is reduced, accuracy and quality of the PPRC configuration is high, and all necessary jobs to perform the migration are defined by the PPRC Manager. The need for ease of use and minimal education requirements are satisfied, while simultaneously mitigating the risk of performing the migration.

Other Cascaded PPRC configurations are possible

More Cascaded PPRC configurations are possible than the one shown in Figure 12 on page 39. Figure 13 shows another example of a Cascaded PPRC configuration, which this time is performed for a dual migration of both ends of a Metro Mirror configuration.
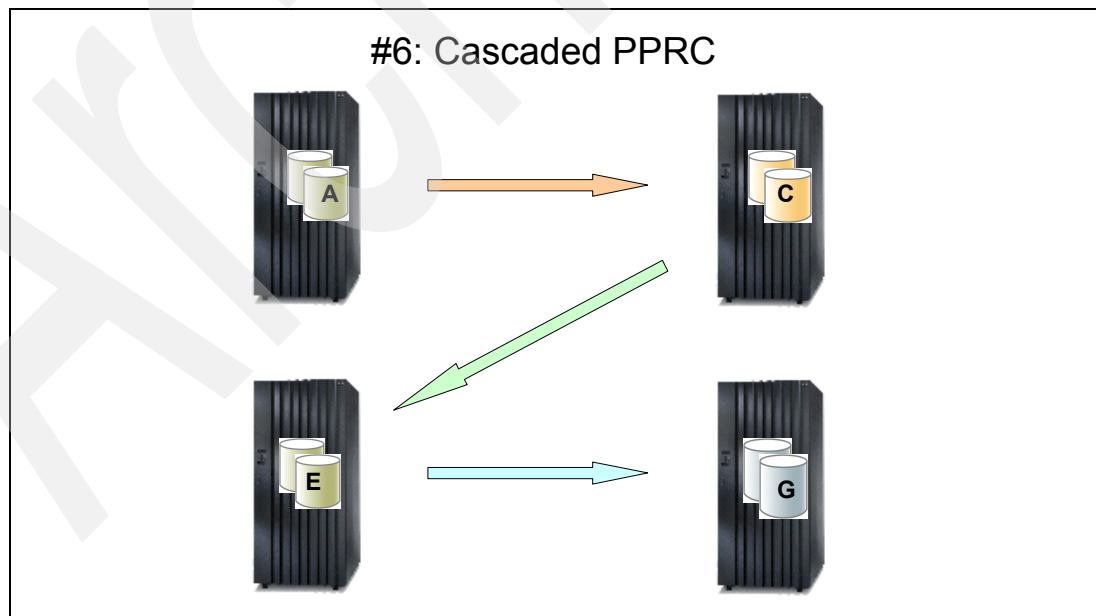
Figure 13   Usage scenario 6: Cascaded PPRC, example 2

PPRC Manager and FlashCopy Manager have the flexibility to define any number of valid Cascaded PPRC configurations.

Summary

In this section, we illustrated and described various FlashCopy Manager and PPRC Manager usage scenarios and combinations. For each one, we explained the business value and solutions that they provide. We presented several helpful ideas about how FlashCopy and PPRC can be used in various combinations to successfully solve real IT and business problems and challenges in a System z IBM storage environment, in an efficient and affordable manner.

Sample FlashCopy Manager session

In this section, we show a sample FlashCopy Manager session from beginning to end. By reading this section, you will have a better understanding of how a FlashCopy Manager session works and its benefits. You will also understand better how a PPRC Manager session works, since its mode of operation is similar to FlashCopy Manager.

The main difference is that PPRC Manager must deal with both a local and a remote set of IBM disk subsystems. FlashCopy Manager must only deal with volumes within one set of local IBM disk subsystems.

Main FlashCopy Manager panel

After logging on to TSO and ISPF, type the ISPF command to start the FlashCopy Manager:

FCMGR

In the FlashCopy Manager main ISPF panel (Figure 14) that opens, start with the top function (1 ALLOCATE) and proceed to the bottom function (6 BUILD-JOBS).

```
FLYPFC00 ---------- FlashCopy Manager -  V5R1M0  - Primary panel ---
 OPTION ===>  1


 Enter one of the following options:

FlashCopy Manager functions:

    1  ALLOCATE      - Allocate/De-allocate data sets
    2  SETUP         - Create and submit setup JOB
    3  SEL-SOURCE    - Select Source devices/volumes
    4  SEL-TARGET    - Select Target devices/volumes
    5  CONFIGURE     - Configure Source-Target environment
    6  BUILD-JOBS    - Build FlashCopy Manager Jobs

FlashCopy Manager Dataset Control Information
    High level DSN qualifier  ===> C816171
    FC Group qualifier        ===> FC2107

Service level: April 24, 2008
```

Figure 14   FlashCopy Manager - Primary panel

In the FlashCopy Manager ISPF menu-driven dialog, you use the following functions to set up a FlashCopy environment and create the jobs to manage FlashCopy:

1. ALLOCATE

   Allocate data sets used by FlashCopy Manager.

2. SETUP

   Create and submit setup and configuration data collection jobs.

3. SEL-SOURCE

   Select source volumes.

4. SEL-TARGET

   Select target volumes.

5. CONFIGURE

   Configure the FlashCopy source and target environments.

6. BUILD-JOBS

   Build FlashCopy Manager jobs.

If desired, each step can be automated and included to run as part of a z/OS automated job stream.

Step 1: FlashCopy Manager – File Management

The first step is to allocate the data sets that will hold FlashCopy Manager definitions for the upcoming FlashCopy jobs to be defined. To do so, from the FlashCopy Manager main ISPF panel, select option 1.

The File Management panel (Figure 15) is displayed. VOLSERs can be specified, including wildcard options. In addition, DFSMS management class and storage classes can be specified. After completing the information, submit the job and press Enter.

```
FLYPAF00 ---------- FlashCopy Manager - File Management  ---------------
 COMMAND ===>


 Function type ===>        (A=Allocate, D=delete, or R=rename)



 To customize the location of FC Manager allocated data sets, enter
 values into either VOLSER or MGMTCLAS/STORCLAS fields. Blank values
 in all of the fields will use the default allocation algorithms for
 your system.

 VOLSER ===>                   MGMTCLAS ===>
                               STORCLAS ===>



 High DSN qualifier  ===> C816171
 FC Group qualifier  ===> FC2107

 Press ENTER to execute function (after entering required information)

Press PF3(END) to exit function
```

Figure 15   Allocating data sets to hold FlashCopy Manager definitions

Figure 16 shows an extract of the ISPF messages that display as the job is executing.

```
Allocating C816171.FCMGR.FC2107.NEW.DEVICE.DATA
Allocating C816171.FCMGR.FC2107.NEW.CONFIG
Allocating C816171.FCMGR.FC2107.NEW.CONFIG.DATA
Allocating C816171.FCMGR.FC2107.NEW.CONFIG.STATUS
Allocating C816171.FCMGR.FC2107.NEW.CONFIG.MANUAL
Allocating C816171.FCMGR.FC2107.NEW.CONFIG.WITHDRAW
Allocating C816171.FCMGR.FC2107.NEW.CONFIG.ESTABLSH
Allocating C816171.FCMGR.FC2107.NEW.SOURCE.DEFN
Allocating C816171.FCMGR.FC2107.NEW.TARGET.DEFN
Allocating C816171.FCMGR.FC2107.NEW.SOURCE.DEVICES
Allocating C816171.FCMGR.FC2107.NEW.TARGET.DEVICES
Allocating C816171.FCMGR.FC2107.NEW.JOBS
Allocating C816171.FCMGR.FC2107.NEW.EXTRN
Allocating C816171.FCMGR.FC2107.CURRENT.CONFIG
Allocating C816171.FCMGR.FC2107.CURRENT.CONFIG.DATA
Allocating C816171.FCMGR.FC2107.CURRENT.CONFIG.JOBS
```

Figure 16   FlashCopy Manager data set definition job messages

After reviewing successful completion of the FlashCopy Manager data set allocation job, return to the FlashCopy Manager main ISPF panel.

Step 2: Dynamic FlashCopy device information gathering

Next, by using FlashCopy Manager, you create and submit a job that dynamically collects all required device and volume information, across all GENed ESSs, DS6000s, and DS8000s, to set up a FlashCopy configuration of any size, whether small, medium, or large.

From the FlashCopy Manager main ISPF panel (Figure 17), select option 2 to automatically create and build the FlashCopy setup job.

```
 FLYPFC00 ---------- FlashCopy Manager - V5R1M0 - Primary panel ----
 OPTION ===>    2


 Enter one of the following options:


    FlashCopy Manager functions


    1  ALLOCATE      - Allocate/De-allocate data sets
    2  SETUP         - Create and submit setup JOB
    3  SEL-SOURCE    - Select Source devices/volumes
    4  SEL-TARGET    - Select Target devices/volumes
    5  CONFIGURE     - Configure Source-Target environment
    6  BUILD-JOBS    - Build FC Manager Jobs


 FC Manager Dataset Control Information
    High level DSN qualifier  ===> C816171
    FC Group qualifier        ===> FC2107


Service level: April 24, 2008
```

Figure 17   Creating and submitting the setup JOB from the main panel

FlashCopy Manager SETUP jobs are specialized z/OS batch jobs that dynamically collect, from the currently running z/OS storage environment, the necessary device information that is required from each DASD disk subsystem that is GENed and physically attached.

The panel in Figure 18 opens from which you create and submit the batch job that *dynamically* collects all the device information from the ESS, DS6000, or DS8000 that is required to create a FlashCopy configuration. That device and configuration information is subsequently used to create all the jobs that will be used to manage the FlashCopy configuration. This data collection job dynamically collects information from each disk device that is GENed to the z/OS system. Because the device numbers or allocations can change, especially in a large, active IT shop, the ability to quickly, accurately, and dynamically collect the required configuration information can save a significant amount of time and effort, while ensuring high quality.

```
FLYPSE00-------------- FlashCopy Manager - Build setup jobs ------------
 COMMAND ===>

 High DSN qual ===> C816171            FC Group  ===> FC2107

  Build Data Collection JOB (Y/N)  ---> Y

....Use Model JOB cards in ---> FLYOJOBS

  Submit Data Collection JOB(Y/N)  ---> Y

 Press ENTER to execute function (after entering required information)
 Press PF3(END) to exit function
```

Figure 18   FlashCopy Manager Build setup jobs panel

Tip: This collected configuration information has proven to be of high value for other purposes, because of its accuracy and speedy ease of use in obtaining the information. You may easily and dynamically collect an accurate end-to-end configuration view of an entire System z CKD storage hardware configuration and correlate it with z/OS specifics such as VOLSER. Especially a large, dynamically changing environment, this has proven to be of significant storage administrator value.

This configuration information is readily available by editing the appropriate FlashCopy Manager data set. You are free to examine, copy, and reuse this FlashCopy Manager output data set for any other purpose.

Figure 19 shows an example of the contents of the
C816171.FCMGR.FC2107.NEW.DEVICE.DATA data set showing the left side of the panel.

```
 Menu Utilities Compilers Help
  SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS
  BROWSE C816171.FCMGR.FC2107.NEW.DEVICE.DATA Line 000000 Columns 0001 080
  Command ===>                                                Scroll ===> CSR
  ****** **************************** Top of Data ****************************
 FLYATO3C DATE 08120 TIME: 142730 SYSTEM: MES1
 DEVN MODEL... VOLSER STORAGE SSID STG CNTL. STRING STRING.... DEVICE DEVICE
 ......................CONTROL .....SERIAL.......... SERIAL .......... SERIAL
 D811 3390-2C. ?????? 2105F20 8102 13-00FCA81 2105. 13-00FCA81 2105.. 13-00FCA8
 D812 3390-2C. ?????? 2105F20 8102 13-00FCA81 2105. 13-00FCA81 2105.. 13-00FCA8
 D813 3390-2C. ?????? 2105F20 8102 13-00FCA81 2105. 13-00FCA81 2105.. 13-00FCA8
 D814 3390-2C. ?????? 2105F20 8102 13-00FCA81 2105. 13-00FCA81 2105.. 13-00FCA8
 D815 3390-3.. IND815 2105F20 8108 13-00FCA81 2105. 13-00FCA81 2105.. 13-00FCA8
 D816 3390-3.. IND816 2105F20 8108 13-00FCA81 2105. 13-00FCA81 2105.. 13-00FCA8
 D817 3390-3.. IND817 2105F20 8108 13-00FCA81 2105. 13-00FCA81 2105.. 13-00FCA8
 D818 3390-3.. IND818 2105F20 8108 13-00FCA81 2105. 13-00FCA81 2105.. 13-00FCA8
 D911 3390-9.. IND911 2105F20 8108 13-00FCA81 2105. 13-00FCA81 2105.. 13-00FCA8
 D912 3390-9.. IND912 2105F20 8108 13-00FCA81 2105. 13-00FCA81 2105.. 13-00FCA8
 etc.
```

Figure 19   FlashCopy Manager data collection output data set (left side of panel)

Figure 20 shows the right side of the panel.

```
 Menu Utilities Compilers Help
  SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS
  BROWSE C816171.FCMGR.FC2107.NEW.DEVICE.DATA Line 000000 Columns 053 132
  Command ===>                                                Scroll ===> CSR
  ****** **************************** Top of Data ****************************

 STRING.... DEVICE DEVICE.... CCA DDC LSS. CYLS T/CYL
 SERIAL .......... SERIAL
 13-00FCA81 2105.. 13-00FCA81 10. 10. 01.. .2226 15 .. OFF
 13-00FCA81 2105.. 13-00FCA81 11. 11. 01.. .2226 15 .. OFF
 13-00FCA81 2105.. 13-00FCA81 12. 12. 01.. .2226 15 .. OFF
 13-00FCA81 2105.. 13-00FCA81 13. 13. 01.. .2226 15 .. OFF
 13-00FCA81 2105.. 13-00FCA81 64. 64. 07.. .3339 15 .. ON
 13-00FCA81 2105.. 13-00FCA81 65. 65. 07.. .3339 15 .. ON
 13-00FCA81 2105.. 13-00FCA81 66. 66. 07.. .3339 15 .. ON
 13-00FCA81 2105.. 13-00FCA81 67. 67. 07.. .3339 15 .. ON
 13-00FCA81 2105.. 13-00FCA81 68. 68. 07.. 10017 15 .. ON
 13-00FCA81 2105.. 13-00FCA81 69. 68. 07.. 10017 15 .. ON
 etc.
```

Figure 20   FlashCopy Manager data collection output data set (right side of panel)

This configuration information is especially of value in large IBM storage configurations,
where this configuration table contains hundreds or thousands of volumes.

With a successful zero return code of the data collection job, FlashCopy Manager now has
the configuration information that it needs to continue the definition process. Return to the
FlashCopy Manager main ISPF panel, and perform the source FlashCopy volume selection.

Step 3: Selecting the source FlashCopy volumes

To specify the source FlashCopy volumes, from the FlashCopy Manager main ISPF panel, select option 3, as shown in Figure 21.

```
FLYPFC00 ----------FlashCopy Manager -  V5R1M0  - Primary panel ---
OPTION ===>   3


Enter one of the following options:


   FlashCopy Manager functions


   1  ALLOCATE     - Allocate/De-allocate data sets
   2  SETUP        - Create and submit setup JOB
   3  SEL-SOURCE   - Select Source devices/volumes
   4  SEL-TARGET   - Select Target devices/volumes
   5  CONFIGURE    - Configure Source-Target environment
   6  BUILD-JOBS   - Build FC Manager Jobs


FC Manager Dataset Control Information
   High level DSN qualifier  ===> C816171
   FC Group qualifier        ===> FC2107


Service level: April 24, 2008
```

Figure 21   Selecting option 3 from the main panel to identify source FlashCopy volumes

The FC Source definition/selection panel (Figure 22) is displayed. On this panel, enter the name of a data set that contains the list of volumes that are the *source* FlashCopy volumes. There are several methods, including DFSMS Storage Group name, ISMF volume list, or device numbers.

```
FLYPSS00 ----------FlashCopy Manager - FC Source definition/selection -------
 COMMAND ===>


 High DSN qual ===> C816171              FC Group ===> FC2107


  FC Manager is calling ISPF EDIT to allow you to enter/modify a list
  of FC Source device selection criteria. Selection is done using any
  combination of the four specifications statements.


  1. IMPORTISMFL(data set-name) DSN fully qualified, no quotes
  2. STORAGEGROUP(a) - Storage group names must be separated by commas
  3. VOLSERs with ending wildcards - MX8* would select volumes
     that have labels starting MX8.
  4. Device number range -  9510,8 or 9510-9517 for example.


 Group ids are specified by the GID(x) suffix on any specification


 FC Manager will select device records based on the selection criteria
 and will then automatically enter a enter a second ISPF edit session
 to allow you to review and edit the selected FC source devices.


 Press ENTER to execute function


 Press PF3(END) to exit function
```

Figure 22   FlashCopy source volume definition and selection

Selection of source and target volumes can be done by using any combination of the following statements. Multiple different selections can be used in one FlashCopy Manager environment.

► IMBEDISMFL

Select devices listed in an ISMF STORAGEGROUP volume report in a data set

► STORAGEGROUP

► DEVNO

By specifying a range of DEVICE numbers

► VOL*

By VOLSER and wildcard

For example, you can specify the following values:

► XI*
► STORAGEGROUP (DB2, IMS™)
► 951E-951F

With these values, FlashCopy Manager creates a FlashCopy environment that consists of volumes that start with XI, all of the volumes in storage groups named DB2 and IMS, and the two volumes 951E and 951F. Multiple types of volume selection specifications are possible within the same FlashCopy Manager configuration stream.

Tip: Specification by VOLSER or STORAGEGROUP is most often used for source selection in production environments. Specification by device number is most often used in initial testing.

In this example, you choose a device number for this particular example session and enter those specifications into the FlashCopy Manager-provided ISPF panel as shown in Figure 23. The specification says to select eight volumes, starting at address D811, and to select an additional 92 volumes, starting at address D911.

```
 File  Edit  Edit_Settings  Menu  Utilities  Compilers  Test  Help
 sssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
 EDIT       C816171.FCMGR.FC2107.NEW.SOURCE.DEFN           Columns 00001 00072
 Command ===>                                              Scroll ===> CSR
 ****** **************************** Top of Data ******************************
 000100 D811,8
 000200 D911,92

 ****** *************************** Bottom of Data ****************************
```

Figure 23   ISPF edit session to specify the source FlashCopy volumes

After entering the device numbers and saving the file, FlashCopy Manager shows the panel in Figure 24. It is based upon the overall ESS, DS6000, or DS8000 device configuration information gathered in the SETUP jobs shown in Figure 18 on page 44. This panel indicates that 6,193 volumes were GENed within this z/OS system. From that number, 100 devices were selected in this step as FlashCopy source volumes.

```
Initiating Source selection phase


input_device_count  =  6193
source_device_count =  100

***
```

Figure 24   Status panel after the source FlashCopy volume specification

To continue, return to the FlashCopy Manager main ISPF panel.

Step 4: Selecting the target FlashCopy volumes

Next, you repeat the same process to identify the desired target FlashCopy volumes. From the FlashCopy Manager main ISPF panel, select option 4 as shown in Figure 25.

```
FLYPFC00 --------- FlashCopy Manager -  V5R1M0  - Primary panel ---
OPTION ===>  4

Enter one of the following options:

   FlashCopy Manager functions

   1  ALLOCATE      - Allocate/De-allocate data sets
   2  SETUP         - Create and submit setup JOB
   3  SEL-SOURCE    - Select Source devices/volumes
   4  SEL-TARGET    - Select Target devices/volumes
   5  CONFIGURE     - Configure Source-Target environment
   6  BUILD-JOBS    - Build FC Manager Jobs

FC Manager Dataset Control Information
   High level DSN qualifier  ===> C816171
   FC Group qualifier        ===> FC2107

Service level: April 24, 2008
```

Figure 25   Selecting option 4 from the main panel to identify target FlashCopy volumes

The FC Target definition/selection panel in Figure 26 is presented. This panel is similar to the one shown in Figure 22 on page 46, except that this panel is used to select the *target* FlashCopy volumes that you wants to identify. Again, a variety of commonly used z/OS methods are available to specify those volumes as shown in Figure 26.

```
FLYPSTOO ------- FlashCopy Manager - FC Target definition/selection ----------
 COMMAND ===>

 High DSN qual ===> C816171              FC Group ===> FC2107

  FC Manager is calling ISPF EDIT to allow you to enter/modify a list
  of FC Target device selection criteria. Selection is done using any
  combination of the five specifications statements.

   1. IMPORTISMFL(data set-name) DSN fully qualified, no quotes
   2. STORAGEGROUP(a) - Storage group names must be separated by commas
   3. VOLSERs with ending wildcards - MX8* would select volumes
      that have labels starting MX8.
   4. Device number range -  9510,8 or 9510-9517 for example.
   5. EXCLUDE(gq) - Exclude targets used in hq.FCMGR.gq.NEW.CONFIG

  Group ids are specified by the GID(x) suffix on specifications 1-4

  FC Manager will select device records based on the selection criteria
  and will then automatically enter a enter a second ISPF edit session
  to allow you to review and edit the selected FC target devices.

 Press ENTER to execute function
 Press PF3(END) to exit function
```

Figure 26   FlashCopy target volume definition/selection

Choose a method. We use the device number range method again, as shown in Figure 27.

```
 File  Edit  Edit_Settings  Menu  Utilities  Compilers  Test  Help
 sssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
 EDIT        C816171.FCMGR.FC2107.NEW.TARGET.DEFN            Columns 00001 00072
 Command ===>                                                 Scroll ===> CSR
 ****** *************************** Top of Data *****************************
 000100 DB11,8
 000200 DC11,92
 ****** *************************** Bottom of Data **************************
```

Figure 27   ISPF edit session to specify the target FlashCopy volumes

After entering these specifications, press PF3 to continue. FlashCopy Manager now displays the status panel shown in Figure 28, which is for the target selection. It is based on the overall ESS, DS6000, or DS8000 device configuration information gathered in the SETUP job shown in Figure 18 on page 44. This panel shows that, out of the 6,193 volumes GENed to this z/OS system, 100 are selected FlashCopy target volumes.

```
Initiating Target selection phase


input_device_count  =  6193
target_device_count =  100

***
```

Figure 28   Status panel after target FlashCopy volume specification

To continue, return to the FlashCopy Manager main ISPF panel.

Step 5: Configuring the FlashCopy source-target environment

Let us review briefly what you have accomplished in this section:

- ► You dynamically gathered all required FlashCopy device information.
- ► You specified the source FlashCopy and target FlashCopy volumes.

Next, you are ready to match the volumes into FlashCopy pairs. That is, you configure the FlashCopy *environment*. Select option 5 from the FlashCopy Manager main ISPF panel (Figure 29).

```
FLYPFC00 ----------- FlashCopy Manager -  V5R1M0  - Primary panel ---
OPTION ===>   5


Enter one of the following options:


  FlashCopy Manager functions


    1  ALLOCATE       - Allocate/De-allocate data sets
    2  SETUP          - Create and submit setup JOB
    3  SEL-SOURCE     - Select Source devices/volumes
    4  SEL-TARGET     - Select Target devices/volumes
    5  CONFIGURE      - Configure Source-Target environment
    6  BUILD-JOBS     - Build FC Manager Jobs

FC Manager Dataset Control Information
   High level DSN qualifier  ===> C816171
   FC Group qualifier        ===> FC2107

Service level: April 24, 2008
```

Figure 29   Selecting option 5 from the main panel to configure the FlashCopy environment

The FlashCopy configuration generation panel (Figure 30) is displayed.

```
FLYPCF00 ------- FlashCopy Manager - FC Configuration generation ----------
 COMMAND ===>

 High DSN qual ===> C816171              FC Group ===> FC2107

  FC Manager currently supports three ways to create a FlashCopy
  Configuration

  V = VTOC match - automatic process that matches source/target volumes
                    based on VTOC structure and device hardware values
  1 = First match - automatic process that matches source/target volumes
                    based on device hardware characteristics
  M = Manual - a multistep process that allows the user to control the
                    source/target matching process at the device level

  Select process matching process ===>  V
      ( V = VTOC match, 1 = First Match = 1, M = Manual )

 Press ENTER to execute function (after entering required information)

 Press PF3(END) to exit function
```

Figure 30   FlashCopy Manager configuration generation

In this panel, you have three ways to specify the matching of FlashCopy source volumes with FlashCopy target volumes:

► VTOC match

  Automatic process that matches source and target volumes based on VTOC structure and device hardware values.

► First match

  Automatic process that matches source and target volumes based on device hardware characteristics.

► Manual

  A multistep process that allows you to control the source and target matching process at the device level.

FlashCopy Manager knows about z/OS specifics, such as VTOC structures, and some of the idiosyncrasies. If you request, FlashCopy Manager properly handles the VTOC considerations when matching source and volume pairs.

FlashCopy Manager recommends that you use the VTOC match or first match process for production applications. Manual match is useful in testing environments in which the programmer requires detailed control over the pairing. As you might imagine, in a large FlashCopy environment that consists of thousands of volumes, this automated matching can be of significant time savings.

In this example, select V for VTOC match and press Enter.

Then FlashCopy Manager shows a progress panel with the number of sources, targets, and pairs defined (Figure 31).

```
FC sources defined =     100
FC targets defined =     100
FC pairs defined   =     100

Calling ISPF Edit for final configuration review
***
```

Figure 31   Progress panel showing the number of sources, targets, pairs defined

Next FlashCopy Manager shows an ISPF edit session (Figure 32) with the resulting pairs, and more importantly, all the detailed level parameters that were *dynamically discovered and automatically matched*, to result in the pairing. For clarity in this panel, we highlight and italicize the two matched FlashCopy source and target volumes D811 and DB11.

```
 File  Edit  Edit_Settings  Menu  Utilities  Compilers  Test  Help
 ssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
 EDIT        C816171.FCMGR.FC2107.NEW.CONFIG.WORK           Columns 00001 00072
 Command ===>                                                    Scroll ===> CSR
 ****** **************************** Top of Data ****************************
 ==MSG> -Warning- The UNDO command is not available until you change
 ==MSG>            your edit profile using the command RECOVERY ON.
 000001  Flash Copy Manager Configuration Data for FC2107 : 7 Mar 2005 13:46:47
 000002 |--------------- FC SOURCE ---------------| |----- FC TARGET  ---------|
 000003 DEVN VOLSER MODEL    SSID SERIAL      CCA LSS SSID SERIAL     CCA LSS DEVN
 000004 D811 IND811 3390-2C 8102 13-00FCA81 11. 00  6809 13-00FCA81 11   09  DB11
 000005 D812 IND812 3390-2C 8102 13-00FCA81 12  00  6809 13-00FCA81 12   09  DB12
 000006 D813 IND813 3390-2C 8102 13-00FCA81 13  00  6809 13-00FCA81 13   09  DB13
 000007 D814 IND814 3390-2C 8102 13-00FCA81 14  00  6809 13-00FCA81 14   09  DB14
 000008 D815 IND815 3390-3  8108 13-00FCA81 15  00  6809 13-00FCA81 15   09  DB15
 000009 D816 IND816 3390-3  8108 13-00FCA81 16  00  6809 13-00FCA81 16   09  DB16
 000010 D817 IND817 3390-3  8108 13-00FCA81 17  00  6809 13-00FCA81 17   09  DB17
 000011 D818 IND818 3390-3  8108 13-00FCA81 18  00  6809 13-00FCA81 18   09  DB18
 000012 D911 IND911 3390-9. 8108 13-00FCA81 11  03  6832 13-00FCA81 11   32  DC11
 000013 D912 IND912 3390-9. 8108 13-00FCA81 12  03  6832 13-00FCA81 12   32  DC12
 000014 D913 IND913 3390-9. 8108 13-00FCA81 13  03  6832 13-00FCA81 13   32  DC13
 000015 D914 IND914 3390-9. 8108 13-00FCA81 14  03  6832 13-00FCA81 14   32  DC14
 000016 D915 IND915 3390-9. 8108 13-00FCA81 15  03  6832 13-00FCA81 15   32  DC15
 000017 D916 IND916 3390-9. 8108 13-00FCA81 16  03  6832 13-00FCA81 16   32  DC16
```

Figure 32   ISPF panel showing FlashCopy pairings (left side of the panel)

While the panels are somewhat busy, they show that FlashCopy Manager has automated the rather difficult and labor-intensive process. FlashCopy Manager has gathered and correlated a large amount of necessary volume identification information and automatically presented a proposed configuration of FlashCopy pairs.

As shown in Figure 33, further detailed information about FlashCopy source volume D811 is matched with target volume DB11.

> **Tip:** This panel also serves as an audit trail by showing the volumes that are paired.

```
 Menu   Utilities   Compilers   Help
 ssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
 BROWSE     C816171.FCMGR.FC2107.NEW.CONFIG.DATA         Line 00000000 Col 001 080
 Command ===>                                                   Scroll ===> CSR
 ******************************* Top of Data **********************************
 No errors were identified in this configuration


 Matching process used = V - VTOC Match


 Source configuration information - total device count = 100


 Serial No.(devn) GID  MODEL   CYLS VID  COUNT  TARGET
                                                SURPLUS
 13-0001461(D811) $$$ 3390-2C .2226 ...      100 0


 Target configuration information - total device count = 100


 Serial No.(devn) GID  MODEL   CYLS VID  COUNT
 13-0001461(DB11) $$$ 3390-2C .2226 ... ..100
```

Figure 33   A close-up of FlashCopy source and target matching information

As a review, the FlashCopy Manager ISPF menu-driven dialogs and special programs achieved this end result by performing the following tasks:

1. Running the SETUP JOB, which dynamically discovered all the required detailed hardware device information as shown in "Step 2: Dynamic FlashCopy device information gathering" on page 43

2. Specifying FlashCopy source volumes shown in Figure 23 on page 47

3. Specifying FlashCopy target volumes shown in Figure 27 on page 49

The dynamic discovery, documentation, and mix and match automated capability of the FlashCopy Manager program product is designed to be useful and productive. It is also a significant time saver, especially in a large shop with thousands of FlashCopy pairs to manage.

Press PF3 here and return to the FlashCopy Manager main ISPF panel.

Step 6: Building FlashCopy Manager jobs

You are now ready to build the whole suite of FlashCopy jobs that is necessary to establish, manage, query, and withdraw this FlashCopy configuration. You do this with one press of an ISPF PF key. In this next step, you specify the desired FlashCopy and the optional parameters.

From the FlashCopy Manager main ISPF panel (Figure 34), select option 6 and press Enter.

```
   FLYPFC00 --------- FlashCopy Manager -  V5R1M0  - Primary panel ---
   OPTION ===>   6


   Enter one of the following options:

       FlashCopy Manager functions


       1  ALLOCATE      - Allocate/De-allocate data sets
       2  SETUP         - Create and submit setup JOB
       3  SEL-SOURCE    - Select Source devices/volumes
       4  SEL-TARGET    - Select Target devices/volumes
       5  CONFIGURE     - Configure Source-Target environment
       6  BUILD-JOBS    - Build FC Manager Jobs


   FC Manager Dataset Control Information
       High level DSN qualifier  ===> C816171
       FC Group qualifier        ===> FC2107


   Service level: April 24, 2008
```

Figure 34   Selecting option 6 from the main panel to build FlashCopy jobs

In the FlashCopy JOB Creation panel (Figure 35), you can specify any of the FlashCopy parameters that are supported by FlashCopy Manager. The options that you choose apply to all FlashCopy matched pairs within this job build. The jobs built are not only the establish jobs. FlashCopy Manager builds WITHDRAW jobs, QUERY jobs, ICKDSF jobs, VERIFY jobs, and more.

```
   FLYPBJ00 -------------- FlashCopy Manager - FC JOB Creation ------------
   COMMAND ===>


   High DSN qual ===> C816171               FC Group ===> FC2107

    Select the following options for use in JOB creation

      Basic or Incremental FlashCopy(B or I)    ===> B
      Persistent FC relationship(P or N)        ===> N
      Background Copy or NOCOPY(C or N)          ===> C
      Write inhibit FC target(I or N)           ===> N
      Keep FC Target offline (Y or N)           ===> N

      FlashCopy Target Re-label options
        Re-Label algorithm                      ===> 0
         (0-retain,,1-left,2-right,3-Dev Num)
        Re-label data                           ===> ??

   Use Model JOB cards in ===> JOBCARDS
   FlashCopy Identifier =====>

   Press ENTER to execute function (after entering required information)

   Press PF3(END) to exit function
```

Figure 35   FlashCopy Manager JOB Creation panel

You specify the desired FlashCopy parameters and then press Enter. The status panel shown in Figure 36 is displayed. As shown in Figure 36, FlashCopy Manager has built a complete set of jobs for 100 pairs. The value of FlashCopy Manager is that the process is exactly the same and executes quickly, even for hundreds or thousands of FlashCopy pairs.

```
Configuration contains 100 FC pairs
Configuration uses volumes on  3 LSSs

Calling JOB build process
JOB build process successfully completed
***
```

Figure 36   Status panel: Build job summary

In the section that follows, we show what FlashCopy Manager has built.

FlashCopy Manager output

After completion of the build job step, FlashCopy Manager places the output in the data set C816171.FCMGR.FC2107.NEW.JOBS (Figure 37).

```
 Menu  Options  View  Utilities  Compilers  Help
 ssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
 DSLIST - Data Sets Matching C816171.FCMGR.FC2107                  Row 4 of 27
 Command ===>                                           Scroll ===> CSR

 Command - Enter "/" to select action                 Message        Volume
 -------------------------------------------------------------------------------
         C816171.FCMGR.FC2107.CURRENT.CONFIG.STATUS                   TV9902
         C816171.FCMGR.FC2107.CURRENT.EXTRN                           TV9902
         C816171.FCMGR.FC2107.CURRENT.JOBS                            TV9901
         C816171.FCMGR.FC2107.CURRENT.VERIFY.ERRORS                   TV9902
         C816171.FCMGR.FC2107.NEW.CONFIG                              TV9902
         C816171.FCMGR.FC2107.NEW.CONFIG.DATA                         TV9902
         C816171.FCMGR.FC2107.NEW.CONFIG.ESTABLSH                     TV9901
         C816171.FCMGR.FC2107.NEW.CONFIG.MANUAL                       TV9902
         C816171.FCMGR.FC2107.NEW.CONFIG.STATUS                       TV9901
         C816171.FCMGR.FC2107.NEW.CONFIG.WITHDRAW                     TV9901
         C816171.FCMGR.FC2107.NEW.CONFIG.WORK                         TV9903
         C816171.FCMGR.FC2107.NEW.DEVICE.DATA                         TV9903
         C816171.FCMGR.FC2107.NEW.DEVICE.DATA.RDC                     TV9903
         C816171.FCMGR.FC2107.NEW.DEVICE.DATA.VTOC                    TV9902
         C816171.FCMGR.FC2107.NEW.DEVICE.DATA.VTOCE                   TV9902
         C816171.FCMGR.FC2107.NEW.EXTRN                               TV9902
 e       C816171.FCMGR.FC2107.NEW.JOBS                  Browsed       TV9903
```

Figure 37   FlashCopy Manager output: The NEW.JOBS data set

That data set contains the jobs that are built by FlashCopy Manager as shown in Figure 38.

```
 Menu  Functions  Confirm  Utilities  Help
 SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS
 BROWSE            C816171.FCMGR.FC2107.NEW.JOBS               Row 00001 of 00016
 Command ===>                                                 Scroll ===> CSR
          Name      Prompt      Size   Created          Changed         ID
 _____  @OPTIONS
 _____  A@WITHDR
 _____  B@ESTABL
 _____  C@VERIFY
 _____  D@SWITCH
 _____  Q@
 _____  Q@STATUS
 _____  S@
 _____  S@ICKDSF
 _____  T@ICKDSF
 _____  X@
 _____  X@GETDEV
 _____  X@VARY
 _____  Z@
 _____  Z@ESTABL
 _____  Z@WITHDR
          **End**
```

Figure 38   FlashCopy Manager output jobs: Establish and control the environment

Notice that the jobs are labeled A, B, C, and so on. This is the exact order in which these jobs are typically executed. FlashCopy Manager (and PPRC Manager) provides an intuitive JOB naming convention for understanding the typical job submission sequence.

Let us look a little further into two of the jobs. First, Figure 39 shows the @OPTIONS job. The @OPTIONS job shows all of the specifications for this execution of FlashCopy Manager. This is useful for an audit trail of recording the FlashCopy build jobs environment.

```
 Menu  Utilities  Compilers  Help
 SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS
 BROWSE    C816171.FCMGR.FC2107.NEW.JOBS(@OPTIONS)    Line 00000000 Col 001 080
 Command ===>                                                 Scroll ===> CSR
 ******************************** Top of Data *********************************
 Jobs were created at 1:50pm on Tuesday, 29 April 2008
 Allow FC Establish Targets to be ONLINE at FC Establish time
 Basic Flash Copy mode
 Transient relationship
 Background Copy
 Allow writes to FC target
 FC Targets can be brought online
 Re-label algorithm : 0 - Use original Target label
 Re-label data      : ??
 ******************************* Bottom of Data *******************************
```

Figure 39   @OPTIONS contents for audit trail purposes

Figure 40 shows the FlashCopy ESTABLISH job. By submitting this job built by the FlashCopy Manager, the FlashCopy pairs are established.

```
 Menu  Utilities  Compilers  Help
 ssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
 BROWSE    C816171.FCMGR.FC2107.NEW.JOBS(Z@ESTABL)    Line 00000000 Col 001 08
 Command ===>                                                   Scroll ===> CSR
******************************* Top of Data **********************************
//FC@ZEST  JOB ,
//              MSGLEVEL=(1,1),CLASS=A,MSGCLASS=H,
//              NOTIFY=&SYSUID,REGION=4M,TIME=(,10)
/*JOBPARM S=ANY
//*********************************************************************
//* FC MANAGER JOB TO ESTABLISH FC RELATIONSHIPS USING
//* DEVICES IN THE C816171.FCMGR.FC2107.NEW.CONFIG  DATASET
//*  OPTIONS: BASIC FC MODE, TRANSIENT, BACKGROUND COPY
//*********************************************************************
//STATUSB  EXEC PGM=PPRCFC03,
//              PARM='STATUS,ND=002'
//STEPLIB   DD DISP=SHR,DSN=C816171.PMIGRATE.FCMGR.LOAD.V35.EV9LIA
//LOADDS    DD DISP=SHR,DSN=C816171.PMIGRATE.FCMGR.LOAD.V35.EV9LIA
//SNAP      DD SYSOUT=*
//SYSLOG    DD SYSOUT=*
//SYSPRINT  DD SYSOUT=*
//SYSUDUMP  DD SYSOUT=*
//SYSABEND  DD SYSOUT=*
//DEVLIST   DD DISP=SHR,
//              DSN=C816171.FCMGR.FC2107.NEW.CONFIG
//PRINT     DD SYSOUT=*
//*********************************************************************
//ESTABLSH EXEC PGM=PPRCFC08,
//              PARM='FCEST,F1=002600,ND=002,TON'
//STEPLIB   DD DISP=SHR,DSN=C816171.PMIGRATE.FCMGR.LOAD.V35.EV9LIA
//LOADDS    DD DISP=SHR,DSN=C816171.PMIGRATE.FCMGR.LOAD.V35.EV9LIA
//SNAP      DD SYSOUT=*
//SYSLOG    DD SYSOUT=*
//SYSPRINT  DD SYSOUT=*
//SYSUDUMP  DD SYSOUT=*
//SYSABEND  DD SYSOUT=*
//DEVLIST   DD DISP=SHR,
//              DSN=C816171.FCMGR.FC2107.NEW.CONFIG
//PRINT     DD SYSOUT=*
//*********************************************************************
//STATUSA  EXEC PGM=PPRCFC03,
//              PARM='ESTFST,T1=0500,T2=3000,ND=002'
//STEPLIB   DD DISP=SHR,DSN=C816171.PMIGRATE.FCMGR.LOAD.V35.EV9LIA
//LOADDS    DD DISP=SHR,DSN=C816171.PMIGRATE.FCMGR.LOAD.V35.EV9LIA
//SNAP      DD SYSOUT=*
//SYSLOG    DD SYSOUT=*
//SYSPRINT  DD SYSOUT=*
//SYSUDUMP  DD SYSOUT=*
//SYSABEND  DD SYSOUT=*
//DEVLIST   DD DISP=SHR,
//              DSN=C816171.FCMGR.FC2107.NEW.CONFIG
//PRINT     DD SYSOUT=*
******************************* Bottom of Data *******************************
```

Figure 40   FlashCopy Manager ESTABLISH job

Other jobs are already built to QUERY, WITHDRAW, and otherwise manage the FlashCopy environment.

Users of FlashCopy Manager typically use output jobs as the foundation for further integration of FlashCopy invocation into their production job automation and job schedulers.

This concludes our overview of the FlashCopy Manager session.

Summary

FlashCopy Manager and PPRC Manager are IBM program products that consist of ISPF menu-driven dialogs, automated batch job generator, and specialized programs. You can think of them as toolkits for z/OS and System z CKD IBM storage users to accelerate the implementation and use of DS8000, DS6000, or ESS FlashCopy, Metro Mirror, Global Copy, Metro/Global Copy, and Global Mirror in any z/OS and System z CKD IBM storage environment. These toolkits are designed to provide the following benefits:

► Simplified data collection, automated configuration, and creation of z/OS batch jobs that set up and execute a FlashCopy, Metro Mirror, Global Copy, Global Mirror, or Metro/Global Copy to System z CKD storage

► Improvement in quality and time to completion for implementing these IBM Advanced Copy Services in a z/OS or System z CKD IBM storage environment

► Improvement of z/OS storage administrator productivity to operate these functions

► A z/OS-based set of tools for ease of use and lower the risk of operationally migrating from non-IBM point-in-time disk copy or a non-IBM disk mirroring to an IBM storage environment

► Specialized performance enhancements for z/OS FlashCopy

► Tools for storage technology migrations

► Tools for data center migrations

► Tools to accelerate integration of IBM Advanced Copy Services into any z/OS production and batch environment and the use any existing z/OS batch job schedulers

As such, these program products are intended to supplement the strategic IBM Business Continuity automation tools GDPS or z/OS TPC for Replication. Finally, FlashCopy Manager and PPRC Manager can also be used to provide a basic z/OS IBM Copy Services set of tools for environments where the requirement is only for Business Continuity Tier 1 to 4 point-in-time z/OS recovery (that is, less time-critical recoveries that only require periodic point-in-time copies). For more information, contact your IBM marketing representative.

The team that wrote this paper

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