StorageTek™ Shared Virtual Array

V2Xf/V2X4f Peer-to-Peer Remote Copy (PPRC)

Configuration Guide

96225

Revision G

StorageTek™ Shared Virtual Array (SVA)

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Sun Microsystems, Inc.
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Table of Contents

Figures

Tables

Preface

Notices

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Changes or modifications to this equipment that are not expressly approved in advance by Sun Microsystems Inc. will void the warranty. In addition, changes or modifications to this equipment might cause it to create harmful interference.

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The following compliance statement pertains to Federal Communications Commission Rules 47 CFR 15.105:

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The SVA complies with the following agencies:

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CE – Mark to show compliance to European Union Directives (European Union: Safety & EMC).

CISPR 22 and EN55022 Warning

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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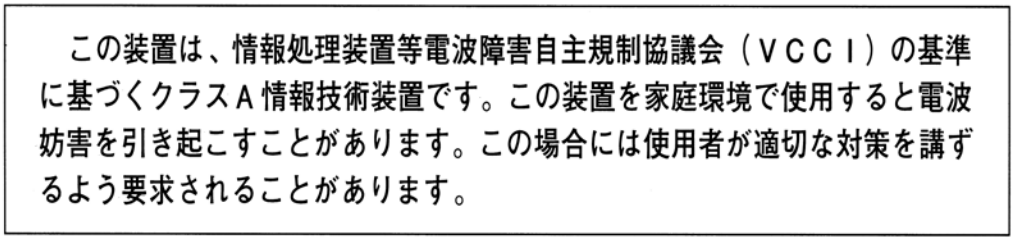
The following compliance statement in Japanese pertains to VCCI EMI regulations: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English translation: This is a Class A product. In a domestic environment, this product may cause radio interference, in which case, the user may be required to take adequate measures.

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You, the end user, agree to take all appropriate steps to ensure that all of your obligations set forth in this Notice are extended to any third party having access to the Equipmen

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Alert Messages

Alert messages call your attention to information that is especially important or that has a unique relationship to the main text or graphic.

Note: A note provides additional information that is of special interest. A note might point out exceptions to rules or procedures. A note usually, but not always, follows the information to which it pertains.

Caution: *informs you of conditions that might result in damage to hardware, corruption of data, or corruption of application software. A caution always precedes the information to which it pertains.*

WARNING:A warning alerts you to conditions that might result in long-term health problems, injury, or death. A warning always precedes the information to which it pertains.

Mensajes de alerta

Los mensajes de alerta llaman la atención hacia información de especial importancia o que tiene una relación específica con el texto principal o los gráficos.

Nota: Una nota expone información adicional que es de interés especial. Una nota puede señalar excepciones a las normas o procedimientos. Por lo general, aunque no siempre, las notas van después de la información a la que hacen referencia.

Precaución: Una precaución informa sobre situaciones que podrían conllevar daños del hardware, de los datos o del software de aplicación. Las precauciones van siempre antes de la información a la que hacen referencia.

Advertencia: Una advertencia llama la atención sobre condiciones que podrían conllevar problemas de salud crónicos, lesiones o muerte. Las advertencias van siempre antes de la información a la que hacen referencia.

Caution:

Information Control

Customer Services Support Center

The Customer Services Support Center (CSSC) is available 24 hours a day, seven days a week, to customers with Sun maintenance contracts and to Sun employees. You can find additional information about the CSSC on Sun's StorageTek external Web site at:

http://www.support.storagetek.com

History of Changes

Rev A – First release. November, 2003.

Rev B – Second release. March, 2004. Minor changes in addition to:

- Added information about channel switches in chapter two.
- Added list of figures pages.
- Chapter 4, Switch Support added.
- Added diagnostic section to the last chapter.

Rev C – Third release. December 2005.

- Change the title of PPRC Commands for OS390 to PPRC Commands for TSO on page page 15. This also change the title to the first two tables in that section as well.

Rev D – Fourth release. May 2006.

- Corrected COPYLIM settings.

Rev E – Fifth release. May, 2006. Minor changes and corrections in addition to:

- Add the chapter “PPRC Remote SnapShot Copy” on page 53.
- Added new appendix D regarding code upgrades.

Rev F – Sixth release. November, 2006. Minor changes and corrections in addition to:

- Added cascaded switch information in chapter 6.
- Appendix D removed.

Rev G – Seventh release. September 2007.

- Added changes to PPRC commands for SVAA in chapter 2.
- Added the chapter “DOP PPRC Status” on page 65. This new chapter is Chapter 6, replacing the former Chapter 6 (“Recovering PPRC After Unplanned Events”), which is now Chapter 7.

General PPRC Information

1

This chapter contains general information on Peer-to-Peer Remote Copy (PPRC).

V2Xf/V2X4f PPRC only works between V2Xf/V2X4f disk storage subsystems. PPRC of any form is not supported between a V2Xf/V2X4f and any other disk storage system.

Overview

Peer-to-Peer Remote Copy is a hardware solution activated by TSO or ICKDSF functions and commands that enable the shadowing of application system data.The application system data is updated on the “primary” subsystem volumes (for example, primary DASD) by application system users. This data is copied to “secondary” subsystem volumes (for example, secondary DASD) by the primary subsystem.

PPRC provides a synchronous data copying capability by sending updates directly from the primary storage control unit to the secondary storage control unit. Because of this, there is no disk data loss in the event of an outage at the primary site.

PPRC provides an image copy of a volume on an update-for-update basis. There is a one-to-one correspondence between each record on the primary volume and each record on the secondary volume. PPRC can be used to shadow ANY data, (system or application data) that is required for recovery at the secondary site.

PPRC is implemented almost entirely in the Licensed Internal Code (LIC). Software commands are available to initiate, monitor, and recover PPRC-managed data.

Installation Planning

Basic SVA Installation Planning

When the SVA installation is being planned, the key is to include PPRC planning from the start. If you can have a say over the planning for the MVS unit addresses and SSID's on the SVA, then the PPRC implementation becomes much easier. Also see *Shared Virtual Array SnapShot for OS/390 Installation, Customization, and Maintenance*.

Configuration Symmetry Considerations

To insure that both subsystems involved in a PPRC relationship can fully support the production configuration in the event of a disaster, it is good practice to make sure that the Physical Capacity (PCAP) of each subsystem is the same as the other.

Volumes

Primary Volumes

All volumes that are being mirrored under PPRC control are called PRIMARY volumes. A primary volume can be copied to only one secondary volume. A PPRC volume can be ONLY a primary or secondary – not both at the same time.

Secondary Volumes

PPRC volumes that are receiving the mirrored primary data are called secondary volumes. Like 3990 Dual-Copy secondary volumes, they are physically protected from non-PPRC updates, and MUST be offline to all connected hosts.

Links

PPRC links are the physical Fibre Channel (FC) connectors between two SVAs.

Multiple PPRC links are recommended for redundancy, availability, and performance.

Paths

A PPRC path is a logical connection between two logical control units used by PPRC. PPRC paths use SVA logical channels.

You can define multiple paths across a single PPRC link.

For PPRC to be able to access all volumes, you must have a minimum of 1 Link, and a path defined for each Virtual Control Unit (VCU)[1] that controls primary and secondary volumes.

Fibre Channels

Fibre Channel allows two-way traffic on fibre channels. The FC cables used for PPRC traffic are dedicated to PPRC traffic only in a point-to-point configuration.

Disaster Recovery

For controlling access to PPRC resources, refer to the *IBM Remote Copy Administrator's Guide and Reference*.

PPRC Secondary Devices Recovery

Notes:

1. A recovered secondary PPRC volume cannot be paired with another volume on the same SVA as the original primary PPRC volume unless the original primary PPRC volume has been terminated from PPRC operation.
2. Check for the latest information on Terminating and Recovering PPRC on Sun’s StorageTek Web site. Look for a Tech Tip under Current Products > Disk > and then the model of SVA.

In the event that the primary SVA has become disabled, use the following procedure to recover PPRC secondary volumes so the host can access these volumes. This procedure works for Direct PPRC and WAN PPRC.

1. Access the Terminate PPRC screen (shown in the following figure). This screen is accessed by:
   A. Log onto the SVA
   B. Click the **Configuration** line of text in the main menu.

1. A Virtual Control Unit is also known on the host end as a Logical Control Unit. For all intents and purposes, they are the same thing.

C. Click **Terminate PPRC**.

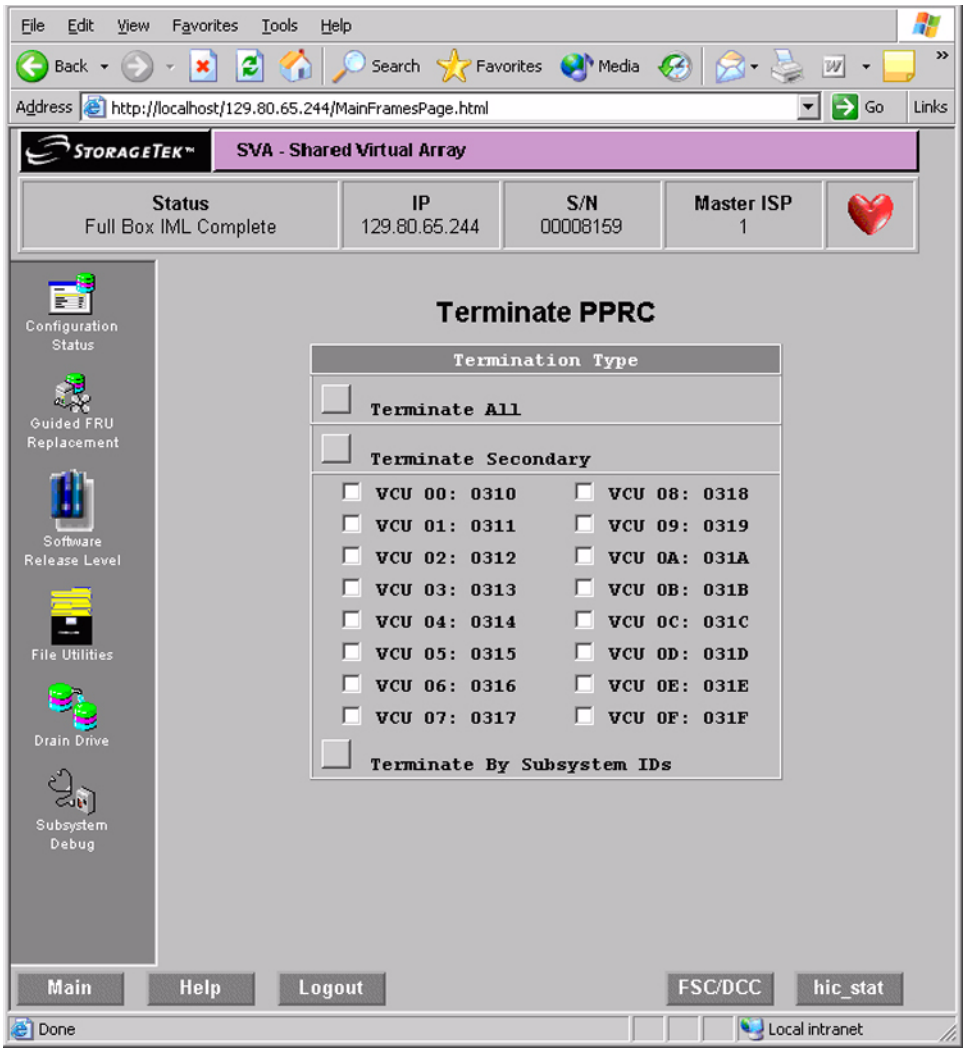


Figure 1 Terminate PPRC Screen

2. Click the VCUs you wish to terminate. (A mark appears in the box next to the VCU number. A second click removes the mark.)
3. Click:
   - The button next to **Terminate by Subsystem IDs** to terminate specific subsystem,
   - Click the button for **Terminate Secondary** to terminate all secondary connections associated with this SVA.
   - Click **Terminate All** to terminate all PPRC connections.

4. The following warning screen appears. At the bottom of this warning screen, click the **Continue** button (see Figure 3 on page 6).

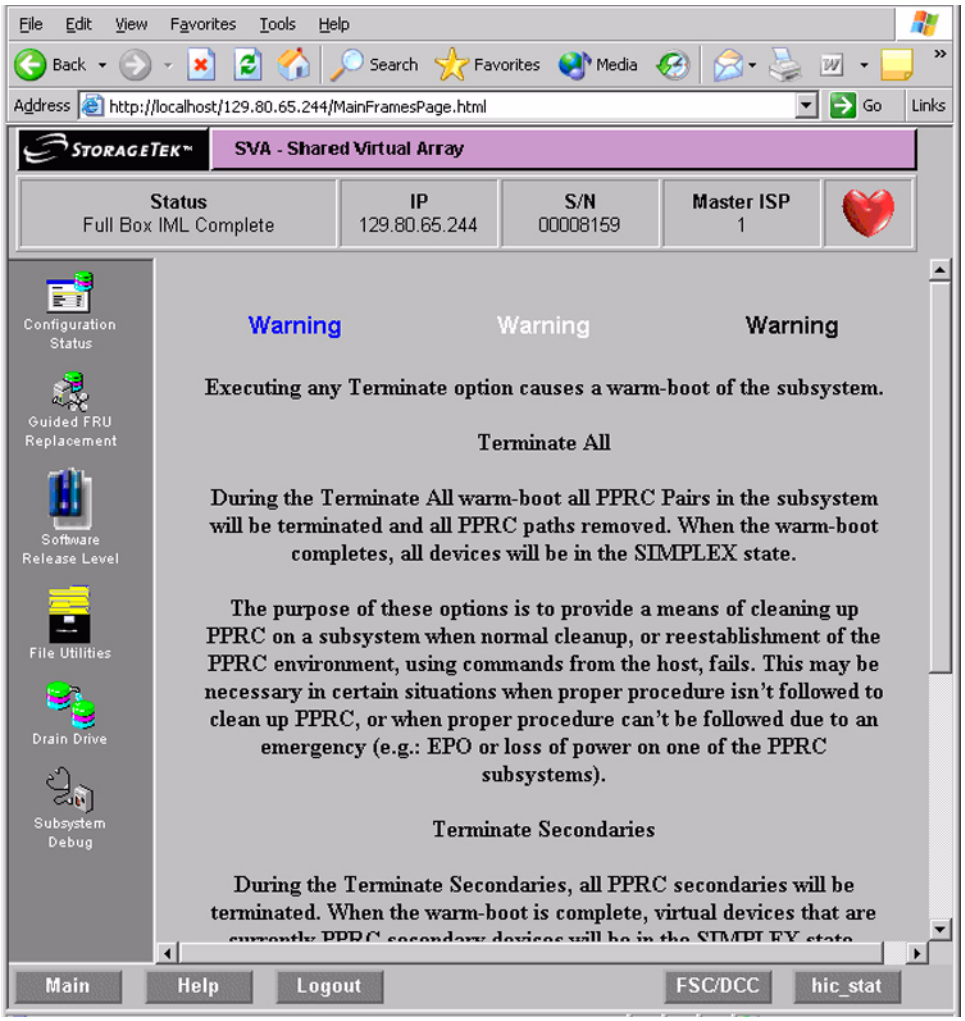


Figure 2 Terminate PPRC Warning (upper half)

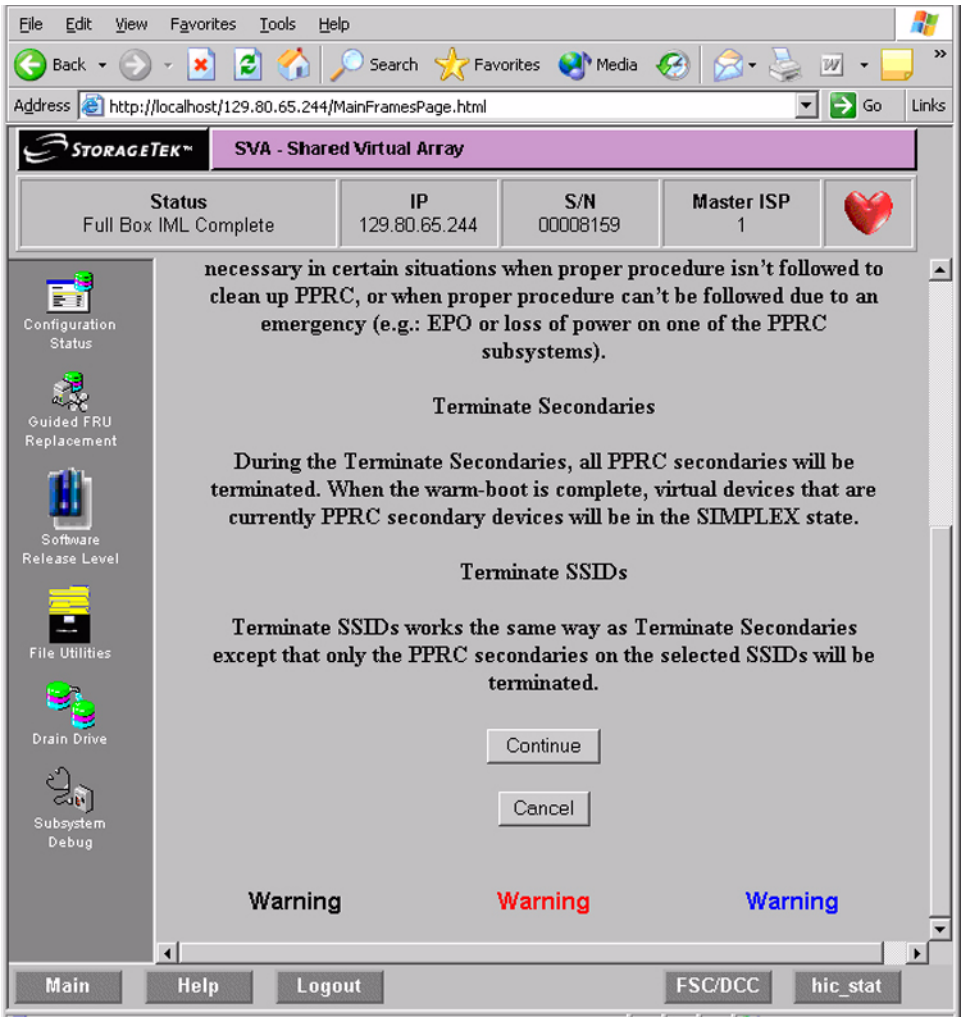


Figure 3 Terminate PPRC Warning (lower half)

Note: All devices that were PPRC secondary devices will be put in the simplex state. ***Exception:*** devices that are members of a bridge pair are **not** terminated (i.e. not put in the simplex state).

The SVA will do a warm start at this time.

PPRC Installation Checklist

Perform the following actions to install PPRC:

1. Ensure that Subsystem IDs (SSIDs) have been assigned for each Virtual Control Unit (VCU) in each subsystem that are involved in PPRC operations.
2. Enter these SSIDs into the subsystem(s).
3. Review the sections titled “Considerations” on page 10, and “Operational Procedures” on page 12.
4. Install the PPRC option.

PPRC on Fibre Channel

2

Note: The information contained in this section is for product model PPRC-fcn used in conjunction with the V2Xf/V2X4f model SVA only. For all other PPRC operations involving SVAs model 9500 through V2X2, see the *Peer-to-Peer Configuration Guide* P/N MP4007x.

Overview

PPRC on Fibre Channel allows for multiple track transfers from SVA to SVA without the handshaking protocol for each track. It allows chaining of unrelated tracks, reducing arbitration and de-selection or release of the link for each track transfer.

The principal advantage of PPRC on Fibre Channel is the reduction in the number of PPRC start I/Os when transferring data tracks from the primary system to the secondary system. If a significant number of data tracks are being transferred to a secondary system, this can result in a considerable savings in time. See the following figure.

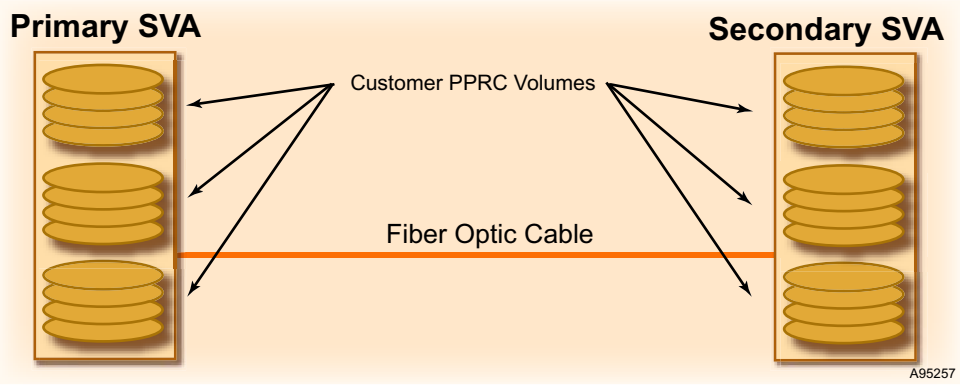


Figure 4 PPRC on Fibre Channel

Uni-directional and Bi-directional

PPRC on Fibre Channel supports both uni-directional and bi-directional PPRC. For information on uni-directional PPRC, see “Uni-Directional” on page 33. For information on bi-directional PPRC, see “Bi-Directional” on page 36.

Considerations

Fibre Channel PPRC Direct Connection (point-to-point)

- Long and short wave fibre channel cables are supported.
  - Long wave cables have a distance limitation of 10 KM
  - Short wave cables have a distance limitation of 300 M (nominal – actual distance varies with the diameter of the fiber)
- Any fibre channel switches must be placed ***outside*** the connection between the Edge WAN eXtender (USD-X) pair. Channel switches (if used) must be placed between the SVA and the Edge WAN eXtender[1]. (See “PPRC Switch Support” on page 59.)

COPYLIM Feature

The COPYLIM feature manages the number of PPRC pairs that the SVA is syncing at any given time. The range is 0 - 32 (the default is 4). The following describes the dynamics of the control unit when the user defines/changes this parameter.

If the user initially sets the number to 0, then the control unit defaults to 4 background syncs.

If the user initially sets the number to 1-32, then the control starts that many background syncs. Keep in mind that ***the higher the number, the greater the impact on performance at the host channel***. The maximum value is recommended to be NO higher than 16 for optimum performance.

If the user changes the number downward from the initial setting then there is a gradual draining of background syncs down to the specified level. In other words, the control unit does not stop the background syncs that are currently in progress.

If the user changes the number upward from the initial setting, there will be an increase of background syncs equal to the specified level.

1. See the note under “WAN Operation” on page 11.

Notes:

1. The parameter for the maximum number of synchronizations is set with the SVAA ALTER SUBSYSTEM COPYLIM (limit) command. See the manual *SVAA for OS/390 Configuration and Administration*.
2. The parameters for this feature are normally set by the SVAA configuration. See the SVAA manual for OS/390 for more information.
3. This feature is only available on the V2Xf and V2X4f products.

WAN Operation

Brocade's Edge WAN eXtender[1] operation is supported. No special PPRC-specific code is required.

Notes:

1. Sun has only tested its products on the Edge WAN eXtender. While other brands of channel extenders may work with Sun StorageTek products, Sun cannot guarantee the results. Sun will work with customers using other brands of channel extenders, but charges for time and material spent on anything beyond a minimal diagnostic effort.
2. The Edge WAN eXtender must either support the fibre channel protocol or have that upgrade installed before it can be used for V2Xf/V2X4f PPRC operation.

Secondary Volumes

- Devices must be defined with the volume type and CKD enabled; initialization with ICKDSF is not required.
- All established PPRC secondary volumes must be OFFLINE. The OFFLINE parameter might be specified in the Hardware Configuration Definition (HCD).

Note: For an MVS guest system, ensure that the volumes are also offline on the VM LPAR.

- Host access, except for allowed commands, to secondary volumes is prevented.
- Do not attempt to establish a PPRC pair that includes an ECAM volume.
- Verify secondary volumes to be designated for PPRC usage do not include critical data that are overwritten.

1. Edge WAN eXtender™ is a trademark of the Brocade Corporation, formerly CNT and later McData (now owned by Brocade Corp.). It was also called the UntraNet Converter - eXtended™.

Operational Procedures

SSID

SSIDs must be defined on the primary and secondary SVAs before enabling PPRC.

The SSIDs cannot be altered in an enabled PPRC environment. To change the SSIDs, PPRC must be disabled. SSIDs must be unique and defined in the hexadecimal range of 0001 to FFFF.

Data Migration

Prior to establishing PPRC pairs, complete all data migration to the primary volumes. Otherwise, performance is degraded.

Critical Primary and Alternate System Data Sets

Sun recommends the allocation of a critical primary system data set and its alternate on separate simplex volumes and SVAs without PPRC connectivity between them. Implement this recommendation to the extent possible in the operational environment to minimize timeouts or extended error recovery exposures.

One case of critical data sets are the primary and alternate COUPLE data sets in a sysplex environment. For example, allocate the primary COUPLE data set on a simplex volume on a PPRC primary SVA, and the alternate on a simplex volume on another SVA without PPRC connectivity to the first SVA.

Use the virtual architecture of the SVA to its advantage by allocating a critical dataset on a volume by itself.

Establishing A PPRC on Fibre Channel Direct Mode Environment

1. Using the “CESTPATH” command or the SVAA ESTPATH command, establish one or more PPRC paths from the primary SVA to the secondary SVA.

   ***Caution: Potential Data Loss* - The secondary volume is overwritten when the pair is established.**

2. Determine which data storage volumes on each subsystem are to be used to establish PPRC pairs.
3. Using the “CESTPAIR” command, establish PPRC pairs between the selected volumes.

Detaching a PPRC Connection over FC in the Direct Mode Environment

1. Using the “CDELPAIR” command, terminate all PPRC pairs.
2. Using the “CDELPATH” command or the SVAA DELPATH command, terminate the PPRC paths from the primary SVA to the secondary SVA.

Paths in a PPRC on Fibre Channel Environment

To modify paths in a PPRC on Fibre Channel environment, the CESTPATH command can be reissued to change the pathing (NOT the link addresses) of data volumes, with these restrictions:

1. Link addresses can not be changed.
2. A link can be removed from the pathing except for the last link.
3. A link might be added to the pathing.
4. As long as a PPRC pair exists, a path to its secondary control unit is required so the last path to the secondary control unit cannot be deleted.

z/VM Requirements for PPRC

Your z/VM user directory must include the following statement to be able to issue PPRC path and pair establish and delete commands:

```
STDEVOPT DASDSYS DATAMOVER
```

Refer to the IBM *z/VM CP Planning and Administration* for more information about this requirement.

PPRC Commands for SVAA

SVAA (SVA Administrator host software) now allows you to create and delete PPRC paths and pairs (instead of using TSO or ICKDSF for these tasks), if so desired. Note that SVAA (not TSO or ICKDSF) must be used to create and delete PPRC paths in a FICON cascaded switch environment (more than one FICON switch in a series).

See Figure 21 on page 63 and Figure 22 on page 63 for a description of cascaded switches.

The following new SVAA subcommands are provided with PTF L2P00D9 for z/OS:

- PPRCOPY ESTPATH
- PPRCOPY DELPATH
- PPRCOPY ESTPAIR
- PPRCOPY DELPAIR
- PPRCOPY SUSPEND
- PPRCOPY RECOVER
- PPRCOPY CGROUP (FREEZE or RUN)
- PPRCOPY QUERY

Refer to the *SVAA Configuration and Administration for z/OS Guide* for a complete details of the PPRCOPY commands and its parameters.

Note: Since SVA emulates a 3990 with extended features, if you are planning to use cascaded switches in the SVA PPRC configuration, the SVAA must be used to create and delete paths, and ICKDSF or TSO must be used to establish and delete pairs.

Table 1 SVA / TSO/, ICKDSF Command Cross Reference

SVAA PPRCOPY Parameter	TSO Command	ICKDSF PPRCOPY Parameter
ESTPATH	CESTPATH	ESTPATH
DELPATH	CDELPATH	DELPATH
ESTPAIR	CESTPAIR	ESTPAIR
DELPAIR	CDELPAIR	DELPAIR
SUSPEND	CSUSPEND	SUSPEND
RECOVER	CRECOVER	RECOVER
CGGROUP (FREEZE or RUN)	N/A	N/A
QUERY	CQUERY	QUERY

PPRC Commands for TSO

Notes:

1. To invoke the equivalent PPRC configuration commands in a VM environment use the Device Support Facilities (DSF); ICKDSF PPRCOPY command for CKD volumes (also available in OS390). Refer to the Device Support Facilities User's Guide and Reference for complete details on the commands and parameters.
2. The LSS parameter might be required depending on the microcode level. Refer to “PPRC Commands for ICKDSF” on page 27 for details. ICKDSF applies to both VM and MVS platforms.

The following table lists the PPRC commands and the volume to which the command can be issued. Table 1 is a cross reference between ICKDSF and TSO commands. Table 1 on page 14 provides a cross-reference for equivalent PPRC commands for TSO and SVAA.

Table 2 PPRC Commands for TSO

Command	Can Command be issued to a:	
	Primary	Secondary
“CDELPAIR”	Yes	No
“CDELPATH”	Yes	No
“CESTPAIR”	Yes	No
“CESTPATH”	Yes	No
“CGROUP”	Yes	No
“CQUERY”	Yes	Yes
“CRECOVER”	No	Yes
“CSUSPEND”	Yes	Yes

CDELPAIR

The CDELPAIR command deletes the relationship between a primary and secondary DASD volume. You would use this command to remove volumes from PPRC control.

The syntax of this command is as follows:

```
CDELPAIR DEVN(X'2154') PRIM(X'2001' 0007824 X'54')
SEC(X'1001' 0007825 X'54')
```

Table 3 CDELPAIR Command Parameters

Parameter	Meaning
DEVN(X'2154')	This parameter specifies the volume number of the primary volume.
PRIM(X'2001')	This parameter is the SSID where the Primary volume is allocated.
7824	This parameter is the right most seven digits of the serial number of the SVA for the primary volume[a]. Leading zeros can be excluded.
X'54'	This parameter is the HEX Channel Connection address of the primary volume (Is always the same as the last two digits of the DEVN).
SEC(X'1001')	This parameter is the SSID where the secondary volume is allocated.
7825	This parameter is the right most seven digits of the serial number of the SVA for the secondary volume. Leading zeros can be excluded.
X'54'	This parameter is the HEX Channel Connection address of the secondary volume.

a. Using all twelve digits of the SVA serial number results in error messages.

CDELPATH

The CDELPATH command is used to delete all established PPRC paths between a primary and secondary SVA logical control unit.Only active paths to the specified SSID are affected; all paths to other SSIDs are unaffected.

To delete only selected PPRC paths, use the CESTPATH command to specify the one(s) to be retained. The CDELPATH command fails if the PPRC pairs are active in duplex status. The syntax of the command is as follows:

```
CDELPATH DEVN (X'2154') PRIM(X'2001' 0007824)
SEC(X'1001' 0007825)
```

Table 4 CDELPATH Command Parameters

Parameter	Meaning
DEVN(X'2154')	This parameter specifies the volume number of ANY volume attached to the SSID whose paths you wish to delete.
PRIM(X'2001')	This parameter is the SSID where the Primary volume is allocated
7824	This parameter is the serial number of the SVA for the primary volume - leading zeros can be excluded.
SEC(X'1001')	This parameter is the SSID where the secondary volume is allocated
7825	This parameter is the serial number of the SVA for the secondary volume. Leading zeros can be excluded.

CESTPAIR

The CESTPAIR command is used to specify the PRIMARY and SECONDARY volume that the user wants to establish as a PPRC pair.

Note: The SVA has 256 asynchronous operation buffers available to handle asynchronous operations. CESTPAIR with any copy MODE is considered to be an asynchronous operation. If there are 256 asynchronous operations in progress, any further CESTPAIR commands are rejected (FSC 07BA) until a buffer is released by the microcode when an asynchronous operation completes. CESTPAIR is considered to be complete when the pair goes DUPLEX (becomes synchronized).

The primary and secondary volumes must have the same number of tracks on each cylinder, and the same number of bytes on each track.

The syntax of the command is as follows:

```
CESTPAIR DEVN(X'2154') PRIM(X'2001' 0007824 X'54')
SEC(X'1001' 0007825 X'54')
```

The explanation of the previous parameters is the same as the explanation for the "CDELPAIR" command, except, in this command, you are establishing the PPRC pair, not deleting it.

Additional parameters for the CESTPAIR command are as follows:

Table 5 CESTPAIR Command Parameters

Parameter Name	Parameter Value
MODE	Specifies one of the following PPRC modes: **MODE(COPY)**, **MODE(NOCOPY)**, and **MODE(RESYNC)** with MODE(COPY) being the default. See "MODE(COPY), MODE(NOCOPY), and MODE(RESYNC) Options for the CESTPAIR Command." on page 26.
PACE	Specifies the number of tracks to be copied prior to a host interrupt. **Note:** PACE is not used by any SVA.
CRIT	Specifies the PPRC data synchronization mode. **CRIT(NO)** means that when a primary volume goes into SUSPEND mode, subsequent write commands to the volume are accepted. **CRIT(YES)** means that when a primary volume goes into SUSPEND mode, subsequent write commands to the volume may be rejected. **Note:** The SVA/RVA honors both CRIT(YES) and CRIT(NO). When CRIT(YES) is specified and the primary volume goes into SUSPEND mode, if the reason for the suspend is that there are no paths available between the primary and secondary subsystem, then the primary subsystem unit checks subsequent writes to the primary volume. ***CRIT(YES) is not recommended as it can cause unit checks on the primary volume which can cause host jobs to fail.*** Instead, the "CGROUP" FREEZE and "CGROUP" RUN commands should be used for consistency groups.
MSGREQ	This parameter is only valid in COPY mode. This option is either YES or NO, and NO is the default.

For a full explanation of the previous options, refer to the IBM *Remote Copy Administrators Guide*.

An example of a batch job to create a PPRC pair is shown below.

```
//JOBCARD.....
//
//CESTPAIR EXEC PGM=IKJEFT01
//SYSTSPRT DD SYSOUT=H
```

```
//SYSTSIN DD *
 CESTPAIR +
DEVN(X'1000') +
PRIM(X'1000' 0007824 X'00') +
SEC(X'2000' 0007825 X'00') +
CRIT(N) MODE(NOCOPY)
/*
```

CESTPATH

***Caution: Potential Performance Issues* - VCU associations are limited to one VCU from a primary to one VCU on a secondary. Multiple primary VCU associations to a secondary VCU is NOT allowed and results in a command failure and FSC of 0444.**

The CESTPATH command is used to establish Fibre Channel PPRC paths between a primary and secondary SVA SSID. Each CESTPATH command can establish up to four paths (one for each link cable) from a primary to a secondary SSID.

Fibre Channel PPRC paths between SVA's are UNI-DIRECTIONAL. Include all links in a single CESTPATH command.

Notes:

1. Subsequent CESTPATH commands, should they occur, replaces any previously used CESTPATH commands and the information contained therein. Therefore, any additional CESTPATH commands need to contain the earlier command's information should it still be valid.
2. The primary device used to submit the CESTPATH command must also be defined on the secondary prior to executing the command.

   The syntax of the CESTPATH command is as follows:

```
CESTPATH DEVN(X'1022') PRIM(X'1000' 0007825)
SEC(X'2000 0003033) LINK(X'00020000' X'00070000'
X'000A0000' X'000F0000') CGROUP (Y)
```

Note: At the end of the CESTPATH command is the parameter "CGROUP." The default value is NO, and that value is used if YES is not specified as shown.

The explanations for the DEVN, PRIM and SEC commands are the same as the explanations in the "CDELPATH" command.

The **Consistency Grouping (CGROUP) parameter** is a feature that enables the primary and secondary SSIDs to respond to the CGROUP command. When the subsystem internally suspends a PPRC primary volume that uses consistency group enabled PPRC paths (normally due to loss of communication with the secondary subsystem) the volume goes into a long busy state for 2 minutes to prevent reads and writes to that volume of the consistency group, and it sends Format F Message B sense data to the host. Host automation software, such as Geographically Dispersed Parallel Sysplex (GDPS)[1], reacts to this sense data by causing a CGROUP command to be issued with the Freeze option. This causes suspension of other enabled primary volumes in the VCU (i.e. in the consistency group), removal of PPRC paths to the specified secondary subsystem VCU, and a second 2-minute long busy state. Host automation software then issues a CGROUP command with the Run option. This clears the long busy state so that reads and writes to the primary volumes can resume.

If the Freeze order is not received within the first long busy period, all members of the consistency group may not go suspended. If the Run order is not received within the second long busy period, that second period expires, and reads and writes to primary volumes can resume.

The **LINK parameter** specifies the addressing path to be used by PPRC to send updates from the primary volume to the secondary volume. You can specify up to eight addresses here to plan for performance and redundancy.

The values of the link address are as follows:

Table 6 Link Parameter Meanings

Parameter	Meaning
ffff	This parameter specifies the primary volume cluster and interface values. See the following table for the ffff values. The value of ffff depends on the IFC card and Fibre Channel connector on that IFC card.
gg	This parameter specifies the destination Link address
hh	This parameter specifies the destination Logical Address (VCU number).

1. An IBM software package.

Table 7 Link Parameter IFC Card Location Values

ffff Values	IFC Card Location (card slot)[a]							
	00	**01**	**02**	**03**	**10**	**11**	**12**	**13**
Top Fibre Channel Connector	0000	0002	0004	0006	0008	000A	000C	000E
Bottom Fibre Channel Connector	0001	0003	0005	0007	0009	000B	000D	000F

a. The card slot in the IBM books is known as a SAID (System Adapter IDentifier).

The following is an example of a batch job to create PPRC paths from the first five VCUs of the primary subsystem to the first five VCUs of the secondary subsystem. The fifth and last example is establishing a path through a switch; all others are done point to point.

```
//JOBCARD…….
//
//CESTPATH EXEC PGM=IKJEFT01
//SYSTSPRT DD SYSOUT=H
//SYSTSIN DD *
CESTPATH +
DEVN(X’1000’) +
PRIM(X’1000’ 0007824) +
SEC(X’2000’ 0007825) +
LINK(X’00000000’ X’00040000’ X’00080000’ X’000C0000’)
CESTPATH +
DEVN(X’1100’) +
PRIM(X’1001’ 0007824) +
SEC(X’2001’ 0007825) +
LINK(X’00000001’ X’00040001’ X’00080001’ X’000C0001’)
CESTPATH +
DEVN(X’1200’) +
PRIM(X’1002’ 0007824) +
SEC(X’2002’ 0007825) +
LINK(X’00000002’ X’00040002’ X’00080002’ X’00C00002’)
CESTPATH +
```

```
DEVN(X’1300’) +
PRIM(X’1003’ 0007824) +
SEC(X’2003’ 0007825) +
LINK(X’00000003’ X’00040003’ X’00080003’ X’000C0003’)
CESTPATH +
DEVN(X’1400’) +
PRIM(X’1004’ 0007824) +
SEC(X’2004’ 0007825) +
LINK(X’00001303’ X’00042103’ X’00083F03’ X’000C4703’)
/*
```

CGROUP

The CGROUP command is used to control operations for multiple PPRC volume pairs in a single SSID. This command allows you to suspend or resume all operations for all PPRC volumes in a single SSID.

You must issue a separate CGROUP command to suspend or resume operations on each SSID.

The syntax of the CGROUP command is as follows:

```
CGROUP DEVN(X'2154') PRIM(X'2001' 0007824) SEC(X'1001'
0007825) {FREEZE | RUN}
```

The explanations for the DEVN, PRIM and SEC commands are the same as the explanations in the "CDELPATH" command.

The explanation for the FREEZE and RUN parameters are as follows:

- **FREEZE** – Specifies that all PPRC operations for the SSID are to be stopped.
- **RUN** – Specifies that write operations to primary volumes for the SSID can be resumed.

CQUERY

The CQUERY command is used to query the status of one volume of a PPRC pair, or all the paths associated with the SSID for the named volume number.

CQUERY can be issued to either the primary, or secondary volume in a PPRC pair.

The syntax of the CQUERY command is as follows:

```
CQUERY DEVN(X'2154') xxxxxx
```

The optional parameter (*xxxxxx*) is as follows:

Table 8 CQUERY Command Parameters

Parameter	Meaning
PATHS	This parameter displays all the paths associated with this volume (or SSID), and the current status of each path (an example of the result of this command can be seen in the following figure). If this parameter is not used, it defaults to VOLUME.
VOLUME	This parameter displays the volume status of the specified volume. **This is the default parameter** (see Figure 6 for an example of the output from this display).

Note: The following two figures are *just examples*.

```
*****************  PPRC REMOTE COPY CQUERY - PATHS *********************
*  PRIMARY UNIT:SERIAL#= 000000007824  SSID= 1011        SS= V2Xf      *
*              FIRST        SECOND         THIRD         FOURTH        *
*            SECONDARY     SECONDARY      SECONDARY     SECONDARY      *
*SERIAL NO:   000000007825 ............   ............  ............   *
*     SSID:        1111       ....           ....          ....        *
*    PATHS:         4          0              0             0          *
*           SAID DEST S*  SAID DEST S*    SAID DEST S*   SAID DEST S*  *
*           --------- --  --------- --    --------- --    --------- -- *
*        1: 0002 0001 01  --------- --    --------- --    --------- -- *
*        2: 0003 0001 01  --------- --    --------- --    --------- -- *
*        3: 000A 0001 01  --------- --    --------- --    --------- -- *
*        4: 000B 0001 01  --------- --    --------- --    --------- -- *
*                                                                       *
*S*=PATH STATUS:                                                       *
*00=NO PATH           01=ESTABLISHED           02=INIT FAILED          *
*03=TIME OUT          04=NO RESOURCES AT PRI   05=NO RESOURCE AT SEC   *
*06=SERIAL# MISMATCH  07=SEC SSID MISMATCH     08=ESCON LINK OFFLINE   *
*09=ESTABLISH RETRY   0A=PATH ACTIVE TO HOST   0B=PATH TO SAME CLUSTER *
*10=CONFIGURATION ERROR                                                *
*************************************************************************
```

Figure 5 Path Status

Note: A value of FF in the last byte of the DEST column indicates that all paths failed and the secondary VCU number was verified.

```
************** PPRC REMOTE COPY CQUERY - VOLUME ********************
*                                        (PRIMARY)   (SECONDARY) *
*                                         SSID CCA    SSID CCA   *
*DEVICE   LEVEL      STATE     PATH STATUS  SERIAL#     SERIAL#    *
*------ ---------  ----------  ----------- ---------    ---------  *
* 3020  PRIMARY..  DUPLEX....   ACTIVE..    1010 20      1110 20   *
*       CRIT(NO).......       CGRPLB(NO). 000000007824 000000007742*
* PATHS SAID/DEST STATUS: DESCRIPTION                              *
* ----- --------- ------  ------------------                       *
*   4   0002 0000   01    PATH ESTABLISHED...                      *
*       0003 0000   01    PATH ESTABLISHED...                      *
*       000A 0000   01    PATH ESTABLISHED...                      *
*       000B 0000   01    PATH ESTABLISHED...                      *
*******************************************************************
```

Figure 6 Volume Status

CRECOVER

The CRECOVER command is used to allow the secondary system to gain control of a DASD volume on its SSID. This command forces the secondary volume into simplex mode to establish control of the volume. You can vary this volume online after this process if you wish.

The syntax of the CRECOVER command is as follows:

```
CRECOVER DEVN(X'2154') PRIM(X'2001' 0007824 X'54')
SEC(X'1001' 0007825 X'50') ID(xxxxxx yyyyyy)
```

The explanations for the DEVN, PRIM and SEC commands are the same as the explanations in the "CDELPAIR" command.

The optional parameter ID(xxxxxx yyyyyy) is used as follows:

Table 9 CRECOVER Command Parameters

Parameter	Meaning
xxxxxx	This parameter specifies the old volser. If used without a new volser, yyyyyy, this verifies the state, and set the volume to simplex mode.
yyyyyy	This parameter specifies a new volser to be written to the volume.

CSUSPEND

The CSUSPEND command is used to suspend all PPRC operations between a primary and secondary volume pair. No write data is transferred to the secondary volume.

The primary subsystem still records all cylinders that have changed on the primary volume.

The CSUSPEND command can be directed to either the primary, or secondary volume of a PPRC volume pair.

This command differs from the CGROUP FREEZE command in that the CGROUP command suspends all PPRC operations to all of the volumes on an entire SSID, whereas this command suspends all PPRC operations to a specific volume on any SSID.

On StorageTek products, the CSUSPEND command suspends the primary by just putting in the primary DEVN volume.

Caution: Service Interruption - Use of the parameter PRIMARY causes a unit check on the SVA.

The syntax of the CSUSPEND command is as follows:

```
CSUSPEND DEVN(X'2154) PRIM(X'2001' 0007824 X'54')
SEC(X'1001' 0007825 X'54') {PRIMARY | QUIESCE}
```

The optional parameters PRIMARY and QUIESCE are **NOT** used on an SVA.

The explanations for the DEVN, PRIM and SEC commands are the same as the explanations in the "CDELPAIR" command.

MODE(COPY), MODE(NOCOPY), and MODE(RESYNC) Options for the CESTPAIR Command.

The MODE parameter values (COPY, NOCOPY, and RESYNC) causes the subsystem to react differently.

When a CESTPAIR MODE(COPY) is issued to a volume, the pair goes into the DUPLEX PENDING state. The pair is then synchronized (all the data on the primary volume is copied to the secondary volume). When the synchronization is complete the pair goes into the DUPLEX state.

MODE(COPY) is the default option.

When a CESTPAIR MODE(NOCOPY) is issued, the volume goes directly into the DUPLEX state, since the user is indicating that no synchronization needs to be performed, by choosing this option.

Selecting the MODE(NOCOPY) option implies that:

1. You know that the primary volume currently contains no customer data, or
2. You know that the volume pair is already synchronized, or
3. You plan to synchronize the volume pair by another process; such as by using this volume pair as the target pair of a PPRC Snap command.

When a CESTPAIR MODE(RESYNC) is issued, the volume must be in a SUSPENDED state. The state of the pair is changed to DUPLEX PENDING; then the pair is re-synchronized. The only tracks that the subsystem has to re-synchronize are those tracks that have been updated by a host since the pair went into the SUSPENDED state.

Selecting the MODE(RESYNC) option implies that this pair was previously synchronized in the DUPLEX state, and then the pair was placed in SUSPENDED state.

Note: DDSR should be suspended during volume synchronization.

PPRC Commands for ICKDSF

Table 1 on page 14 provides a cross-reference for equivalent PPRC commands for ICKDSF and SVAA. Refer to IBM's *Device Support Facilities User's Guide and Reference*, *Release 17* for complete details on the PPRCOPY command and its parameters, but be aware of the following differences in PPRCOPY command requirements.

V2Xf/V2X4f with G01.xx.xx.00 Microcode

If the V2Xf/V2X4f subsystem is using a G01.xx.xx.00 microcode release, the LSS parameter is not supported and should not be specified on any PPRCOPY command.

V2Xf/V2X4f with G02.xx.xx.00 or later Microcode

If the V2Xf/V2X4f subsystem is using a microcode release of G02.xx.xx.00 or later, the LSS parameter is required and must be specified on every PPRCOPY command that supports the LSS parameter. These commands include, but are not limited to:

- PPRCOPY DELPAIR
- PPRCOPY DELPATH
- PPRCOPY ESTPAIR
- PPRCOPY ESTPATH
- PPRCOPY FREEZE
- PPRCOPY RECOVER
- PPRCOPY RUN
- PPRCOPY SUSPEND

LSS Parameter

The LSS parameter was introduced by IBM for storage controls that support logical subsystems (like the 2105 ESS). An IBM LSS is the equivalent of a Virtual Control Unit (VCU) on an SVA. The syntax of the LSS parameter is as follows:

```
LSS(X'pp',X'ss')
```

where:

- pp = the logical subsystem number of the primary subsystem (00-0F)
- ss = the logical subsystem number of the secondary subsystem (00-0F)

Omission of the LSS parameter on an ICKDSF command to a V2Xf/V2X4f subsystem using a microcode release of G02.xx.xx.00 or later produces an ICK31721I error message, a return code of 12, and a failure of the desired function:

```
PPRCOPY ESTPATH DDNAME(DEVN)  -
   PRIMARY(X'8000',0009876)    -
 SECONDARY(X'8800',0005432)    -
      LINK(X'00020008')
ICK00700I DEVICE INFORMATION FOR 8042 IS CURRENTLY AS
FOLLOWS:
          PHYSICAL DEVICE = 3390
          STORAGE CONTROLLER = 3990
          STORAGE CONTROL DESCRIPTOR = E9
          DEVICE DESCRIPTOR = 0A
          ADDITIONAL DEVICE INFORMATION = 79002135
          TRKS/CYL = 15, # PRIMARY CYLS = 3339
ICK04000I DEVICE IS IN SIMPLEX STATE
ICK31721I LSS PARAMETER REQUIRED FOR DEVICE TYPE
ICK30003I FUNCTION TERMINATED. CONDITION CODE IS 12
          10:10:57    06/20/05
ICK00002I ICKDSF PROCESSING COMPLETE.MAXIMUM CONDITION
CODE WAS 12
```

Also note that the Destination Logical Address specified in the LINK parameter (in purple) must match the logical subsystem number of the secondary subsystem specified in the LSS parameter (in blue), otherwise you receive an ICK31724I error message, a return code of 12, and a failure of the desired function:

```
PPRCOPY ESTPATH DDNAME(DEVN)  -
   PRIMARY(X'8000',0009876)    -
 SECONDARY(X'8800',0005432)    -
       LSS(X'00',X'08')        -
      LINK(X'00020007')
ICK00700I DEVICE INFORMATION FOR 8042 IS CURRENTLY AS
FOLLOWS:
          PHYSICAL DEVICE = 3390
          STORAGE CONTROLLER = 3990
          STORAGE CONTROL DESCRIPTOR = E9
          DEVICE DESCRIPTOR = 0A
          ADDITIONAL DEVICE INFORMATION = 79002135
ICK04000I DEVICE IS IN SIMPLEX STATE
ICK31724I SEC LSS SPECIFIED DOES NOT MATCH LSS IN
LINKADDR: X'0002 0007'
ICK30003I FUNCTION TERMINATED. CONDITION CODE IS 12
          11:16:23    06/20/05
ICK00002I ICKDSF PROCESSING COMPLETE.MAXIMUM CONDITION
CODE WAS 12
```

Examples

1. Establish Path on MVS

Establish a PPRC path between VCUs 0 and 8 (SSIDs 8000 and 8800) using a batch job on MVS. The soon-to-be PPRC Primary volume (SRC042) is online and is also used as a communications device between the host and subsystem. The physical PPRC connection uses the top port on the IFC01 card (system adapter ID value = 0002 on the LINK parameter) on subsystem #9876 and does not run through a FICON Director.

```
//JOBNAME  JOB (ACCT),USER,
// CLASS=A,
// MSGCLASS=1
//*
//PPRCOPY EXEC PGM=ICKDSF,REGION=1024K
//SYSPRINT DD SYSOUT=*
//DEVN     DD UNIT=3390,VOL=SER=SRC042,DISP=SHR
//SYSIN    DD *
 PPRCOPY ESTPATH DDNAME(DEVN)  -
   PRIMARY(X'8000',0009876)    -
 SECONDARY(X'8800',0005432)    -
       LSS(X'00',X'08')        -
      LINK(X'00020008')
/*
//
```

2. Establish Path on VM

Establish a PPRC path between VCUs 0 and 8 using ICKDSF commands on VM. The soon-to-be PPRC Primary volume (device 8042) is online, attached to the user's virtual machine, and is also used as a communications device between the host and the subsystem.

```
PPRCOPY ESTPATH UNIT(8042) PRI-
MARY(X'8000',0009876)    -
SECONDARY(X'8800',0005432) LSS(X'00',X'08')
LINK(X'00020008')
```

3. Establish Pair on MVS

Establish a PPRC pair between devices 8042 and 8842 using a batch job on MVS. The soon-to-be PPRC Primary volume (SRC042) is on-line and is also used as a communications device between the host and the subsystem.

```
//JOBNAME  JOB (ACCT),USER,
// CLASS=A,
// MSGCLASS=1
//*
//PPRCOPY EXEC PGM=ICKDSF,REGION=1024K
//SYSPRINT DD SYSOUT=*
//DEVN     DD UNIT=3390,VOL=SER=SRC042,DISP=SHR
//SYSIN    DD *
 PPRCOPY ESTPAIR DDNAME(DEVN)  -
   PRIMARY(X'8000',0009876,X'42') -
 SECONDARY(X'8800',0005432,X'42') -
       LSS(X'00',X'08')        -
 MODE(COPY)
/*
//
```

4. Establish Pair on VM

Establish a PPRC pair between devices 8042 and 8842 using ICKDSF commands on VM.

```
PPRCOPY ESTPAIR UNITADDRESS(8042) PRI-
MARY(X'8000',0009876,X'42') -
SECONDARY(X'8800',0005432,X'42') LSS(X'00',X'08')
MODE(COPY)
```

Volume Status

To successfully manage the PPRC environment, you must be aware of the different states of PPRC paired volumes. To determine the state of a PPRC volume, issue the "CQUERY" command to that volume. At any given time, a volume can be in one of the states shown in the following table:

Table 10 Volume Status Parameters

Parameter	Meaning
Simplex	Specifies the initial state of a volume that has not had the CESTPAIR command run against it.
Duplex Pending	This parameter specifies the initial state of a PPRC defined volume pair when a CESTPAIR with MODE(COPY) or MODE(RESYNC) is used. When in a duplex pending state, if you issue the CQUERY command against the volume, the bottom right corner of the display indicates the amount of data copied to the secondary volume, before the volume goes into the duplex state.
Duplex	Specifies the state of a volume pair after the copying from the primary volume is complete, and the volume pair is fully synchronized.
Suspended	Specifies the state of a volume pair when the primary and secondary SVA's cannot keep the PPRC volume pairs synchronized, or when a CSUSPEND command has been issued to either the primary or secondary volume in a PPRC pair. For the duration of a suspended state, the PPRC primary volume's storage control records the cylinders that have been updated. When a CESTPAIR command with the RESYNC parameter is issued, only the data in the cylinders that have been changed is copied to the secondary volume to restore the synchronized, duplex state.

SVA Configurations

PPRC can be configured in one of two ways, uni-directional or bi-directional.

Uni-Directional

This configuration physically splits the two SVA's, and has a primary SVA containing only primary PPRC volumes, and a secondary SVA containing only secondary PPRC volumes.

In this configuration, ALL PPRC Fibre channels transmit data from the primary SVA to the secondary SVA.

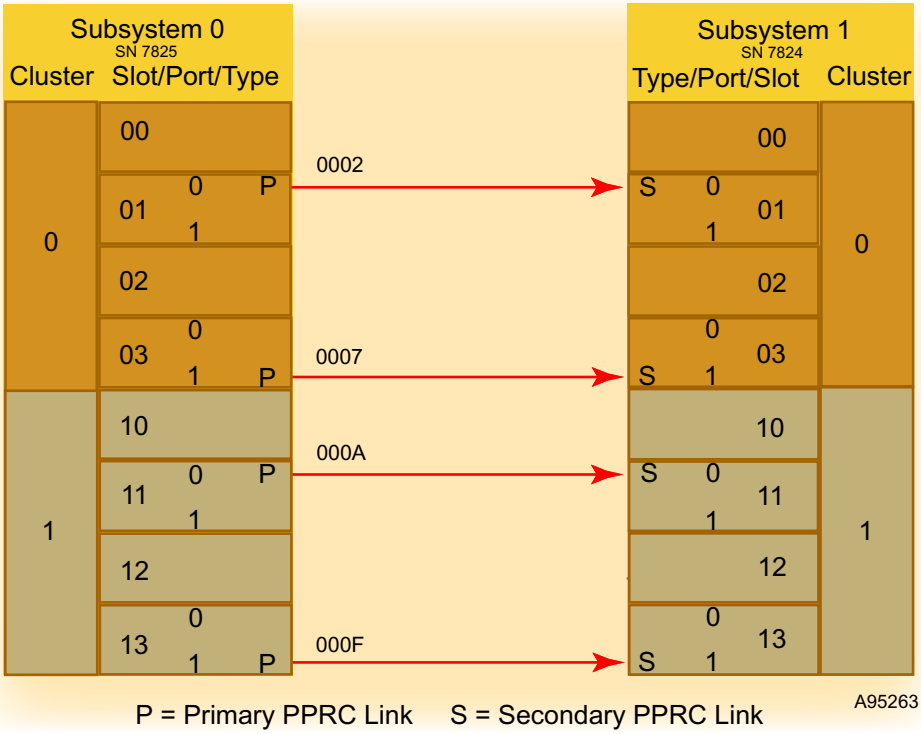


Figure 7 Uni-Directional PPRC Physical Connections

Notes:

1. Either port might be used on an IFC card. The previous figure is just an example and does show some flexibility in the configuration.
2. The numbers on the links in the previous figure are the location values (SAIDs – also see the previous table).

Attention: The secondary volumes should be varied offline before the PPRC pair is established.

Uni-directional Configuration Example[1]

SVA1 (Primary)

Serial Number7825

Subsystem ID’s1000100110021003

Device Address1000-10FF1100-11FF1200-12FF1300-13FF

SVA2 (Secondary)

Serial Number7824

Subsystem ID’s2000200120022003

Device Address2000-20FF2100-21FF2200-22FF2300-23FF

When configuring the PPRC pairs, try to configure the pairs with corresponding addresses, so that if the Primary PPRC volume on SVA1 is volume address 12AA, then the secondary PPRC unit address on SVA2 is 22AA.

PPRC Logical Configuration

The logical view of the ‘uni-directional’ PPRC cables for the previous example is shown in the following table.

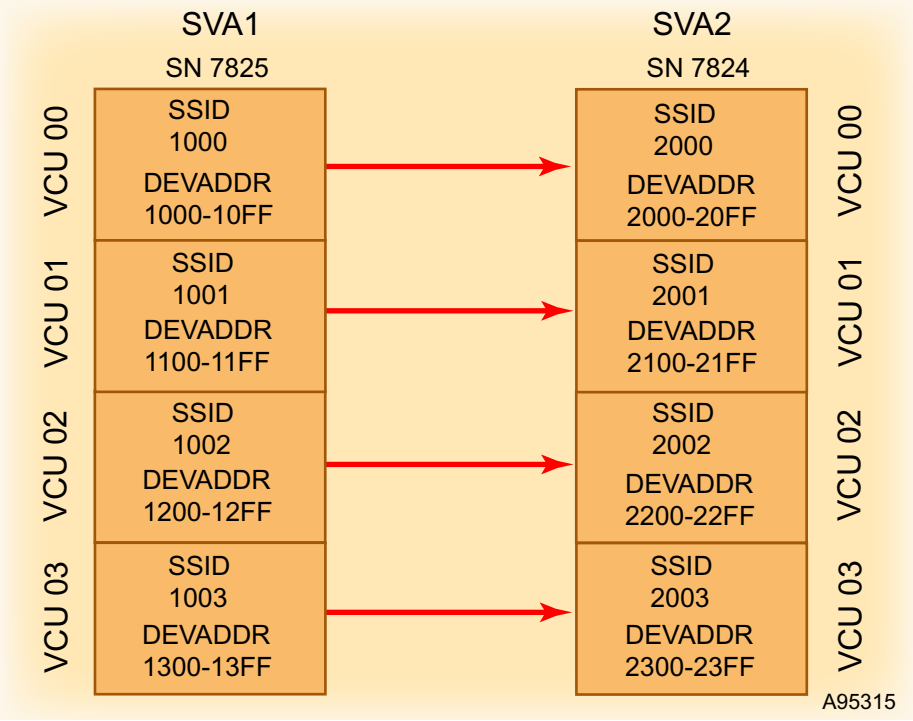


Figure 8 Uni-Directional PPRC Logical Connections

1. Only four control units are shown for clarity. In the case of an V2Xf/V2X4f there could be up to 16.

Establish Path and Pair Command Line Examples

The following is an ***partial example*** of the syntax for the Establish Path (CESTPATH) and Establish Pair (CESTPAIR) commands for the previous example, using Figure 7 on page 33 for the physical connections and the previous figure for the logical connections. Not all volumes were configured in this example - only three logical volumes are shown for each VCU.

SN 7825

For VCU 0

```
CESTPATH DEVN(X'1022') PRIM(X'1000' 0007825)
SEC(X'2000 0003033) LINK(X'00020000' X'00070000'
X'000F0000' X'000A0000')

CESTPAIR DEVN(X'10AA') PRIM(X'1000' 0007825 X'AA')
SEC(X'2000' 0007824 X'AA')

CESTPAIR DEVN(X'10AB') PRIM(X'1000' 0007825 X'AB')
SEC(X'2000' 0007824 X'AB')

CESTPAIR DEVN(X'10AC') PRIM(X'1000' 0007825 X'AC')
SEC(X'2000' 0007824 X'AC')
```

For VCU 1

```
CESTPATH DEVN(X'1022') PRIM(X'1000' 0007825)
SEC(X'2000 0007824) LINK(X'00020001' X'00070001'
X'000F0001' X'000A0001')

CESTPAIR DEVN(X'1110') PRIM(X'1001' 0007825 X'10')
SEC(X'2001' 0007824 X'10')

CESTPAIR DEVN(X'1111') PRIM(X'1001' 0007825 X'11')
SEC(X'2001' 0007824 X'11')

CESTPAIR DEVN(X'1112') PRIM(X'1001' 0007825 X'12')
SEC(X'2001' 0007824 X'12')
```

For VCU 2

```
CESTPATH DEVN(X'1203') PRIM(X'1002' 0007825)
SEC(X'2002 0007824) LINK(X'00020002' X'00070002'
X'000F0002' X'000A0002')

CESTPAIR DEVN(X'1220') PRIM(X'1002' 0007825 X'20')
SEC(X'2002' 0007824 X'20')

CESTPAIR DEVN(X'1221') PRIM(X'1002' 0007825 X'21')
SEC(X'2002' 0007824 X'21')

CESTPAIR DEVN(X'1222') PRIM(X'1002' 0007825 X'22')
SEC(X'2002' 0007824 X'22')
```

For VCU 3

```
CESTPATH DEVN(X’1303’) PRIM(X’1003’ 0007825)
SEC(X’2003 0007824) LINK(X’00020003’ X’00070003’
X’000F0003’ X’000A0003’)

CESTPAIR DEVN(X’13D0’) PRIM(X’1003’ 0007825 X’D0’)
SEC(X’2003’ 0007824 X’D0’)

CESTPAIR DEVN(X’13D1’) PRIM(X’1003’ 0007825 X’D1’)
SEC(X’2003’ 0007824 X’D1’)

CESTPAIR DEVN(X’13D2’) PRIM(X’1003’ 0007825 X’D2’)
SEC(X’2003’ 0007824 X’D2’)
```

Bi-Directional

To efficiently use the four internal processors in each cluster of the SVA, Sun recommends the following configuration for bi-directional PPRC. This configuration logically splits each SVA into a ‘sending’ and ‘receiving’ configuration, which allows you to have primary and secondary PPRC volumes on EACH SVA, and you are able to send and receive PPRC data on each SVA. This configuration is suggested so one SVA’s processor is not paired with another SVA’s processor, setting up a situation where they could begin sending or receiving an I/O at the same time, resulting in a time-out situation.

Note: Either port might be used on in IFC card.

Attention: The secondary volumes should be varied offline before the PPRC pair is established.

Bi-directional Configuration Example

SVA1

Serial Number 7825

Subsystem ID’s1000100110021003

Device Address1000-10FF1100-11FF1200-12FF1300-13FF

SVA2

Serial Number 7824

Subsystem ID’s2000200120022003

Device Address2000-20FF2100-21FF2200-22FF2300-23FF

When configuring the PPRC pairs, try to configure the pairs with corresponding addresses, so that if the Primary PPRC volume on SVA1 is volume address 12AA, then the secondary PPRC address on SVA2 is 22AA.

PPRC Logical Configuration

The logical view of the ‘bi-directional’ PPRC cables for the previous example is shown in the following figure.

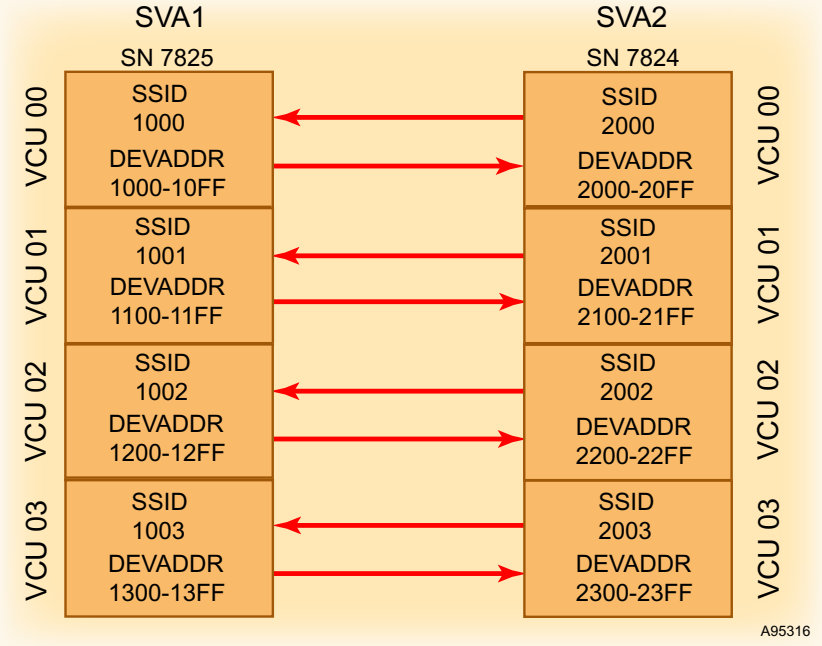


Figure 9 Bi-Directional PPRC Logical Connections

Note: The address ranges shown in the previous figure is two more addresses than the customer have for data.

Establish Path and Pair Command Line Examples

The following is a ***partial example*** of the syntax for the Establish Path (CESTPATH) and Establish Pair (CESTPAIR) commands. Not all volumes were configured in this example - only three logical volumes are shown for each VCU.

SVA 7825:

For VCU 0

```
CESTPATH DEVN(X’1022’) PRIM(X’1000’ 0007825)
SEC(X’2000 0007824) LINK(X’00020000’ X’00070000’
X’000F0000’ X’000A0000’)

CESTPAIR DEVN(X’10AA’) PRIM(X’1000’ 0007825 X’AA’)
SEC(X’2000’ 0007824 X’AA’)

CESTPAIR DEVN(X’10AB’) PRIM(X’1000’ 0007825 X’AB’)
SEC(X’2000’ 0007824 X’AB’)

CESTPAIR DEVN(X’10AC’) PRIM(X’1000’ 0007825 X’AC’)
SEC(X’2000’ 0007824 X’AC’)
```

For VCU 1

```
CESTPATH DEVN(X'1103') PRIM(X'1001' 0007825)
SEC(X'2001 0007824) LINK(X'00020001' X'00070001'
X'000F0001' X'000A0001')

CESTPAIR DEVN(X'1110') PRIM(X'1001' 0007825 X'10')
SEC(X'2001' 0007824 X'10')

CESTPAIR DEVN(X'1111') PRIM(X'1001' 0007825 X'11')
SEC(X'2001' 0007824 X'11')

CESTPAIR DEVN(X'1112') PRIM(X'1001' 0007825 X'12')
SEC(X'2001' 0007824 X'12')
```

For VCU 2

```
CESTPATH DEVN(X'1203') PRIM(X'1002' 0007825)
SEC(X'2002 0007824) LINK(X'00020002' X'00070002'
X'000F0002' X'000A0002')

CESTPAIR DEVN(X'1220') PRIM(X'1002' 0007825 X'20')
SEC(X'2002' 0007824 X'20')

CESTPAIR DEVN(X'1221') PRIM(X'1002' 0007825 X'21')
SEC(X'2002' 0007824 X'21')

CESTPAIR DEVN(X'1222') PRIM(X'1002' 0007825 X'22')
SEC(X'2002' 0007824 X'22')
```

For VCU 3

```
CESTPATH DEVN(X'1303') PRIM(X'1003' 0007825)
SEC(X'2001 0007824) LINK(X'00020003' X'00070003'
X'000F0003' X'000A0003')

CESTPAIR DEVN(X'13D0') PRIM(X'1003' 0007825 X'D0')
SEC(X'2003' 0007824 X'D0')

CESTPAIR DEVN(X'13D1') PRIM(X'1003' 0007825 X'D1')
SEC(X'2003' 0007824 X'D1')

CESTPAIR DEVN(X'13D2') PRIM(X'1003' 0007825 X'D2')
SEC(X'2003' 0007824 X'D2')
```

SVA 7824:

For VCU 0

```
CESTPATH DEVN(X'2003') PRIM(X'2000' 0007824)
SEC(X'1000 0007825) LINK(X'00030000' X'00060000'
X'000B0000' X'000E0000')

CESTPAIR DEVN(X'20BA') PRIM(X'2000' 0007824 X'BA')
SEC(X'1000' 0007825 X'BA')
```

```
CESTPAIR DEVN(X’20BB’) PRIM(X’2000’ 0007824 X’BB’)
SEC(X’1000’ 0007825 X’AB’)

CESTPAIR DEVN(X’20BC’) PRIM(X’2000’ 0007824 X’BC’)
SEC(X’1000’ 0007825 X’AC’)
```

For VCU 1

```
CESTPATH DEVN(X’2103’) PRIM(X’2001’ 0007824)
SEC(X’1001 0007825) LINK(X’00030001’ X’00060001’
X’000B0001’ X’000E0001’)

CESTPAIR DEVN(X’2030’) PRIM(X’2001’ 0007824 X’30’)
SEC(X’1001’ 0007825 X’10’)

CESTPAIR DEVN(X’2031’) PRIM(X’2001’ 0007824 X’31’)
SEC(X’1001’ 0007825 X’11’)

CESTPAIR DEVN(X’2032’) PRIM(X’2001’ 0007824 X’32’)
SEC(X’1001’ 0007825 X’12’)
```

For VCU 2

```
CESTPATH DEVN(X’2203’) PRIM(X’2002’ 0007824)
SEC(X’1002 0007825) LINK(X’00030002’ X’00060002’
X’000B0002’ X’000E0002’)

CESTPAIR DEVN(X’2040’) PRIM(X’2002’ 0007824 X’40’)
SEC(X’1002’ 0007825 X’20’)

CESTPAIR DEVN(X’2041’) PRIM(X’2002’ 0007824 X’41’)
SEC(X’1002’ 0007825 X’21’)

CESTPAIR DEVN(X’2042’) PRIM(X’2002’ 0007824 X’42’)
SEC(X’1002’ 0007825 X’22’)
```

For VCU 3

```
CESTPATH DEVN(X’2303’) PRIM(X’2003’ 0007824)
SEC(X’1003 0007825) LINK(X’00030003’ X’00060003’
X’000B0003’ X’000E0003’)

CESTPAIR DEVN(X’20E0’) PRIM(X’2003’ 0007825 X’E0’)
SEC(X’1003’ 0007824 X’D0’)

CESTPAIR DEVN(X’20E1’) PRIM(X’2003’ 0007825 X’E1’)
SEC(X’1003’ 0007824 X’D1’)

CESTPAIR DEVN(X’20E2’) PRIM(X’2003’ 0007825 X’E2’)
SEC(X’1003’ 0007824 X’D2’)
```

PPRC Dynamic Address Switching (P/DAS)[1]

PPRC Dynamic Address Switching (P/DAS) is a software function that provides the ability to redirect all application I/O from one PPRC volume to another volume. P/DAS allows application-transparent switching of I/O to support these tasks:

- Planned Outages (volume or subsystem)
- Device migration
- Workload movement

P/DAS commands allow the system operator to redirect application I/Os that are currently sent to the primary volume, to go to the secondary volume of the PPRC pair instead.

All I/O redirection is managed at the I/O supervisor level, and is transparent to any application program that uses the volume.

Configuration Symmetry Considerations

To insure that both subsystems involved in a PPRC relationship can fully support the production configuration in the event of a disaster, it is good practice to make sure that the Physical Capacity (PCAP) of each subsystem is the same as the other.

Requirements

The following software and environmental conditions must be met before a P/DAS operation is attempted:

Software

The z/OS operating system must be a release level currently supported by IBM.

Source Volume

1. Must be the PRIMARY volume of a PPRC pair
2. Must be online to the system
3. Cannot be part of an active XRC session
4. Cannot have any active paging data sets in use
5. Cannot have any outstanding reserves (you must cancel any jobs that have outstanding reserves prior to issuing the P/DAS commands)

1. PPRC Dynamic Address Switching (P/DAS) is a utility that allows the redirection of all I/O from a primary PPRC volume to a secondary PPRC volume.

Target Volume

1. Must be the SECONDARY volume of a PPRC pair
2. Must not have any target volume allocations to it.
3. Must be offline or the swap is rejected.

PPRC Status

The PPRC status of the volumes to be swapped MUST be DUPLEX, and fully synchronized.

P/DAS Commands

STOP

To suspend I/O's to the primary volume you wish to switch, you must initiate the P/DAS operation by issuing an IOACTION STOP command on all systems that are attached to the primary volume specified by DEV=pppp

All I/O that is issued to the primary volume remains queued in the MVS system until you issue an IOACTION RESUME command.

The Syntax of the command is as follows:

```
IOACTION STOP,DEV=pppp
```

The MVS system issues the following messages to the operator console of all systems when the I/O for the primary volume has been stopped on that system:

```
IOS600I  IOACTION - THE FOLLOWING DEVICE(S) HAVE BEEN
STOPPED :dev1
```

```
IOS601I  IOACTION - DEVICES REMAIN IN THE STOPPED
STATE. USE THE 'D IOS,STOP' COMMAND TO DISPLAY THE
DEVICES
```

SWAP

Once you have received the IOS600I message on ALL systems, which you entered the P/DAS STOP command, you should then issue the swap command for the volume pairs involved in the P/DAS operation.

The SWAP command directs the system to switch the source volume pppp with the target volume ssss, and prepares the system to redirect all I/Os issued originally to volume pppp to the target volume ssss.

The syntax of the command is:

```
SWAP pppp,ssss
```

Once you have issued the P/DAS SWAP command, P/DAS performs its own validation to ensure the swap can be completed successfully.

If conditions exist that could cause a data integrity exposure, P/DAS ends the swap and generates an error message that gives a reason for the termination.

When the SWAP command has been accepted by the system, you receive the following MVS message:

```
IGF520A VERIFICATION COMPLETE : REPLY 1 TERMINATE
PAIR, AND SWAP | 2 SWITCH PAIR, AND SWAP | 3 CONTINUE
SWAP | 4 TERMINATE SWAP
```

You must reply to this message based on the reply options contained in “IGF52xA Message Replies” on page 71.

When the swap has completed, you receive the following message:

```
IGF505I SWAP FROM pppp to ssss COMPLETE
```

RESUME

Once you have received the IGF502A message on ALL attached systems, you must then RESUME all operations to the volume.

To resume all operations you must issue the IOACTION RESUME command on ALL systems attached to volume *ssss.* (You must issue this command to volume *ssss*, as this is now the primary volume).

The syntax of the command is:

```
IOACTION RESUME,DEV=ssss
```

Once all application I/O’s have been completed, you receive the following message to indicate that the P/DAS operation has completed:

```
IOS607I   IOACTION - THE FOLLOWING DEVICE(S) HAVE BEEN
RESUMED: dev, dev1
```

P/DAS Non-Sysplex Operation

The following describes the sequence of commands to initiate a P/DAS operation in a non-sysplex, shared DASD environment. The primary (source) volume is referred to as *pppp*, and the secondary, (target) volume is referred to as ssss.

Before starting a P/DAS operation, you must identify all systems having access to the volumes to be switched.

The following P/DAS commands ***MUST*** be issued on ***ALL*** systems connected to the volumes being switched.

The sequence of events to initiate a P/DAS swap of volumes is as follows:

1. Stop all I/O's to the PRIMARY volume by issuing the IOACTION STOP command.
2. Swap the Primary and Secondary volumes to the system (direct all new I/O's to the new volume), by issuing the IOACTION SWAP command.
3. Resume all I/O's to the new Primary volume by issuing the IOACTION RESUME command.

P/DAS SYSPLEX Operation

In a sysplex environment, P/DAS operations are similar to those described in the previous pages.

Before initiating P/DAS operations in a sysplex environment, you must choose one system to be the "main system."

As with the non-sysplex environment, you MUST enter ALL of the following commands on ALL systems attached to the swap DASD.

1. Issue the following stop command:

   ```
   ROUTE *ALL,IOACTION,STOP,DEV=pppp
   ```

2. Issue the swap command as follows:

   ```
   ROUTE *ALL,SWAP,DEV=pppp ssss
   ```

   P/DAS now performs its validation checks, and if successful, issues the following message:

   ```
   IGF520A VERIFICATION COMPLETE…….
   ```

   Reply to the previous message as per the instructions for a non-sysplex P/DAS swap.

3. When you have replied to the verification message on ALL systems, you are able to issue the resume command. The command is as follows:

   ```
   ROUTE *ALL,IOACTION RESUME DEV=SSSS
   ```

V2Xf/V2X4f PPRC and GDPS

PPRC on the V2Xf/V2X4f is compatible with IBM's GDPS.

Reject Establish Pair When the Secondary Is Online

Sun added a change to protect the customer from deleting data when establishing a PPRC pair when the secondary is online to another host. However, the change does allow the pair to be established for PDAS. The rules are as follows:

Reject Establish Secondary Rule:

- If the volume was never a primary prior to the request and the volume is online then the request is rejected.
- If the volume was a primary and then it was terminated and then the host issued writes to the volume then the request is rejected.

Allow Establish Secondary Rules:

- If the volume was not a primary and the volume is not online then the request is allowed.
- If the volume was a primary and then it was terminated and the host did not do writes then the request is allowed.

PPRC SnapShot

3

About SnapShot

The SVA's unique virtual storage architecture has the capability of replicating data without copying data. This capability is known as SnapShot, and it consists of Licensed Internal Code (LIC) that runs on the SVA or 9393 hardware, and SnapShot host software.

The process of performing the SnapShot replication function is known as "snapping" data, and the result is known simply as a "snap". The object to be replicated is called the "source" and the result of the replication is called the "target".

SnapShot replicates S/390 volumes or SCSI partitions by copying pointers to the data, instead of physically copying the data itself. Two (or more) independent sets of pointers make the data appear as if it were two (or more) physically separate copies. Updates can occur simultaneously to the original data and to the replicated data, without compromising the integrity of the data in either.

Furthermore, a snap requires only the minimal host CPU, memory, and channel resources necessary to communicate a snap request from the host to the subsystem. Since the actual snapping is performed within the subsystem, no data is transferred across channels or through memory, and the time it takes to create backups or make test versions of the data available to an application is dramatically reduced. The only physical back-end storage allocated by the subsystem is for:

- The original S/390 volume or SCSI volume (shared between the source and target).
- Any changes made to the source.
- Any changes made to the target.

About PPRC SnapShot

PPRC SnapShot is a high visibility data transfer solution that gives you:

- the integrity of synchronized production and backup copies of vital disk data on both local and remote systems,
- the fast recovery of your operations in the event of a disaster. You can restart your applications at the secondary site using the disk backup copies instead of waiting for vital data on tape to be restored,
- and an easy way to run a disaster recovery test at the secondary site from the backup copy.

You can generate disaster recovery test data without moving or copying data, or using the actual backup copy of your data – and, without using additional disk space!

PPRC SnapShot Performance

SnapShot allows data to be replicated *without* host CPU cycles and *without* taking additional disk space, but it is restricted to the boundaries of a single subsystem. With PPRC SnapShot, you can snap a PPRC primary source volume to a PPRC primary target volume, and the corresponding PPRC secondary source volume simultaneously snaps to its corresponding PPRC secondary target volume.

PPRC SnapShot Reliability

If a warm start occurs during a PPRC Snapshot, the PPRC Snapshot must be rerun after the warm start completes, otherwise there is no assurance about the state of the data contained on either the target primary or target secondary volumes. This restriction is consistent with current SnapShot functionality. PPRC SnapShot is designed to maintain or improve overall subsystem reliability.

PPRC SnapShot Variations

The following figure shows an allowed PPRC SnapShot variation..

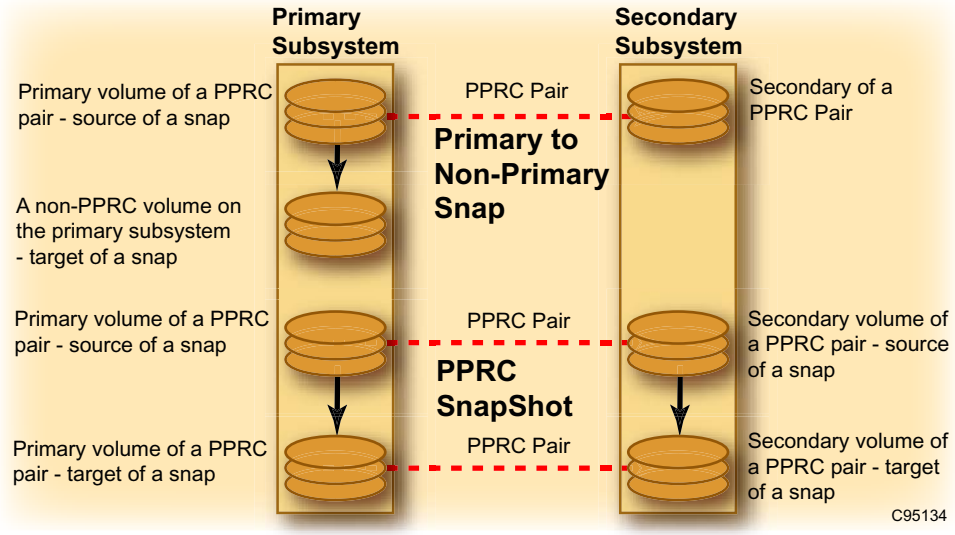


Figure 10 PPRC SnapShot Block Diagram

The following points should be remembered when the PPRC SnapShot configuration is installed:

- PPRC SnapShot is supported by most SVA models. Check with your Sun marketing representative to see if your SVA is supported.
- SnapShot must be ordered and installed on each machine participating in a PPRC SnapShot relationship, otherwise the PPRC SnapShot fails.
- PPRC paths must be established for both source and target control units in order to establish PPRC pairs. Once the PPRC paths are established, the PPRC pairs might be established.
- PPRC SnapShot requires that the secondary source and target volumes be in the same subsystem (see the bottom half of the previous figure).

Note: The latest SVAA PTF maintenance should be obtained and installed prior to using PPRC SnapShot.

PPRC SnapShot Considerations

The following points should be remembered once PPRC SnapShot is installed and ready for use:

- If you are using PPRC SnapShot to snap an entire volume from one PPRC pair to another, you might establish the secondary pair (the target of the SNAP) using the “MODE(NOCOPY)” option because all data is overwritten. However, if you are using PPRC SnapShot to snap data sets from one PPRC pair to another, ***it is mandatory, for data integrity reasons***, that you establish the PPRC pairs using the “MODE(COPY)” option so that the data contained on the source primary and secondary volumes are equivalent.
- A PPRC SnapShot[1] fails unless the source and all potential target volumes are in the proper PPRC configuration. The proper PPRC configuration is defined as when both the source and target volumes of a SnapShot are also PPRC Primary Volumes whose PPRC Secondaries reside on the same subsystem. A PPRC SnapShot performs no volume selection when the non-specific allocation of volumes using MVS esoteric or generic unit names, or when using SMS-managed volume selection (when SnapShot Volume Preferencing is enabled for the subsystem) is requested.
- For data set level PPRC SnapShots of multi-volume data sets, each source volume of the multi-volume data set must reside on a PPRC primary volume.
- You can PPRC SnapShot any data from a primary volume onto a volume that is not part of a PPRC pair without modifying the PPRC state of the primary volume. See “PPRC SnapShot Variations” on page 47.
- You can use PPRC SnapShot from a primary volume to another primary volume which is in either a DUPLEX or SUSPENDED state. Data set SnapShot only supports snap to a DUPLEX volume and makes the volume go DUPLEX PENDING, after which it is no longer eligible for another snap until the volume becomes DUPLEX. When volume SnapShot is used to a suspended volume, the SnapShot command is ONLY carried out on the primary (not secondary) side.
- PPRC SnapShot cannot be used to snap PPRC secondary volumes since host read or write operations are not allowed to secondary volumes.

1. A PPRC SnapShot is a Snapshot where source and target volume are PPRC *primary* volumes.

PPRC Snap-to-Primary

Basic Operation

Note: The PPRC SnapShot feature is required for PPRC Snap-to-Primary.

Snap-to-Primary provides a clean, asynchronous PPRC mirror for customers applications that cannot tolerate the write time penalty for a synchronous mirror.

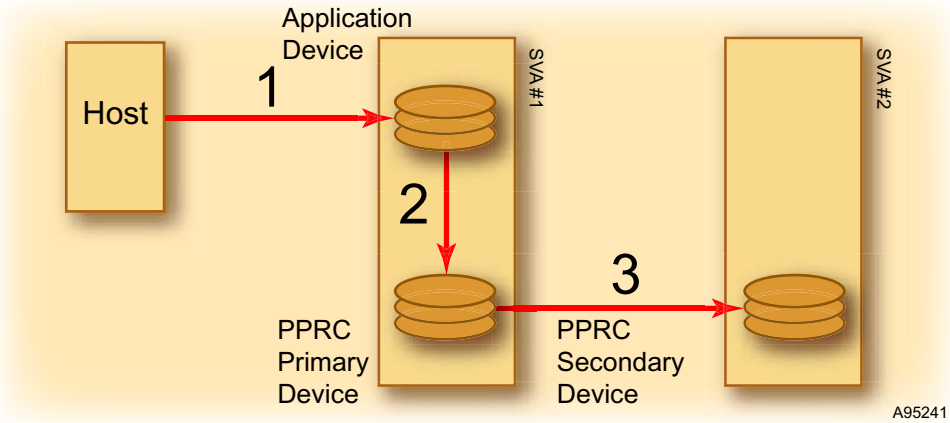


Figure 11 Configuration Example 1

In the previous example:

1. The host writes to simplex application volumes at full processing speed.
2. At intervals the application volume is Snap-to-Primary copied to the PPRC primary volume.
3. The PPRC primary volume goes into duplex pending state while the PPRC secondary volume is synchronized with the PPRC primary volume.
4. The PPRC primary volume then returns to duplex state. At this point a recoverable backup copy exists on both the primary SVA and the secondary SVA.

The interval for making snap copies can be timer driven or event driven:

- **Timer Driven** – the interval needs to be long enough that the PPRC primary volume has time to return to duplex state before the next interval.

- **Event Driven** – (For example when the application is running on a database) at intervals, the database flushes its buffers to sync up the storage volume with its buffers. This event then calls the snap copy to the PPRC primary volume. This sequence causes the snap copies to be made when the database is in a recoverable state.

With this configuration we always have a good backup volume on the primary SVA. The secondary SVA usually has a good backup volume. However, the backup volume on the secondary might be fuzzy if the process stops while the volumes are synchronizing in the duplex pending state.

We can be better protected on the secondary SVA by adding another step to the process that utilizes PPRC SnapShot.

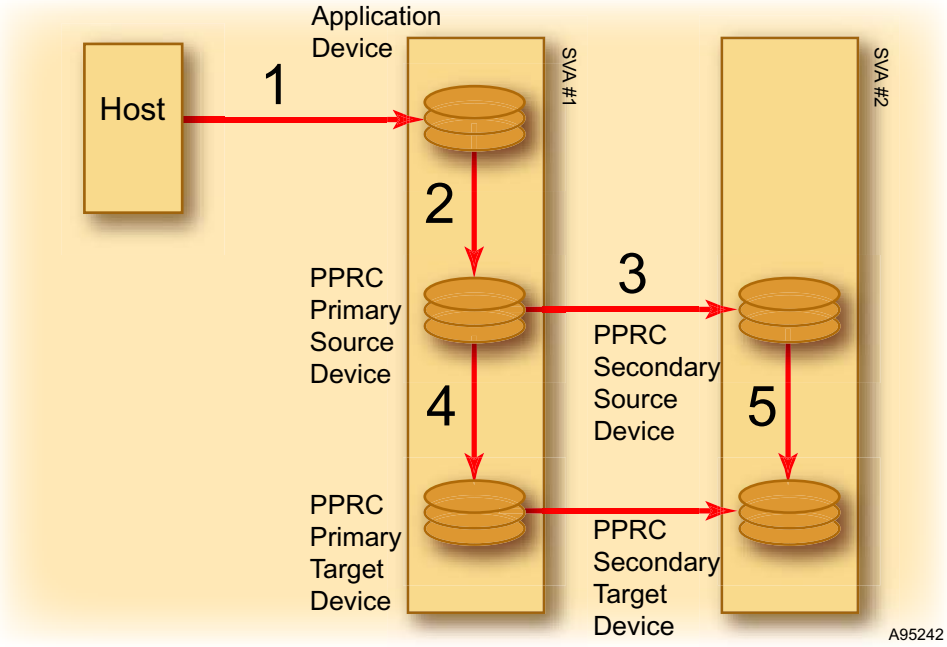


Figure 12 Configuration Example 2

In the previous example:

1. The host writes to simplex application volumes at full processing speed.
2. At intervals the application volume is Snap-to-Primary copied to the PPRC primary volume.
3. The PPRC primary volume goes into duplex pending state while the PPRC secondary volume is synchronized with the PPRC primary volume.

4. The PPRC primary volume then returns to duplex state.
5. When the PPRC primary volume returns to duplex state, then perform a PPRC SnapShot copy from the PPRC primary source volume to the PPRC primary target volume.
6. PPRC SnapShot automatically mirrors a snap copy from the PPRC secondary source volume to the PPRC SnapShot secondary target volume.

After the PPRC pair returns to the duplex state, and we have performed the PPRC Snap, then we have on the primary SVA two clean first generation backup volumes. On the secondary SVA we also have two clean first generation backup volumes. This condition continues until the next backup interval begins.

Snap-to-Primary Considerations

Multiple successive Snap-to-Primary operations to the same PPRC Primary volume might result in failures when the PPRC Primary volume is in the Duplex Pending state. This consideration applies to both data set and volume level Snap-to-Primary operations to the same PPRC Primary volume.

Customers can choose to wait until the PPRC pair has returned to the Duplex state before attempting the next Snap-to-Primary, or suspend the pair using the technique described by the following.

Symptoms

Note: The terms “volume” and “device” are interchangeable.

SIBBATCH

Customers encountering this situation using SIBBATCH in batch jobs receives a return code of 12 and the following error message:

SIB4672S Subsystem MYSUBSYS, HSI rc=13, pmRecvM80: HSgetMsg id=80 cc=9 rc=50

The ECAM Completion Code of 9 and Reason Code of 50 indicates that the failure is due to the PPRC Primary being in the Duplex Pending state.

SIBADMIN

Customers encountering this situation using SIBADMIN in TSO/ISPF receives a return code of 12 and the following error messages:

```
SIB4672S  Subsystem MYSUBSYS, HSI rc=13, pmRecvM80: HSgetMsg id=80
cc=9 rc=50
SIB4617I  12:17:24 SnapShot completed, rc=12.
SIB4608S  The SNAP subcommand aborted, rc=12.
```

DFSMSdss

Customers encountering this situation using DFSMSdss in batch jobs receives a return code of 4 and the following error message:

```
ADR935W (001)-T0MI (02), A FAILURE OCCURED WHILE ATTEMPTING TO
PERFORM FAST REPLICATION FOR DATA SET data.set.name ON VOLUME
volser.
DIAGNOSTIC INFORMATION: 00001791-0000001D
```

The System Data Mover (SDM) Return Code of 00001791 indicates that the SnapShot operation failed, and the SDM Reason Code of 0000001D indicates that the failure is due an unexpected or busy condition with the SVA.

Suspending the PPRC Pair

As mentioned earlier, multiple successive Snap-to-Primary operations to the same PPRC Primary volume might result in failures when the PPRC Primary volume is in the Duplex Pending state. To avoid this condition, do the following:

1. Establish the appropriate PPRC paths as you normally would.
2. Establish the appropriate PPRC pairs and allow them to fully synchronize into the Duplex state.
3. Suspend the appropriate PPRC pairs.
4. Execute Snap-to-Primary operations to the suspended PPRC Primaries.
5. Re synchronize (un-suspend) the PPRC pairs using the CESTPAIR command with the MODE(RESYNC) parameter and allow them to fully synchronize into the Duplex state.
6. Re-suspend the appropriate PPRC pairs.
7. Repeat steps 4-6 as needed.

PPRC Remote SnapShot Copy 4

Basic Operation

PPRC Remote SnapShot Copy provides a means to create a point-in-time copy of the data on a PPRC secondary volume, without the need for Host access to the secondary volume during normal operations.

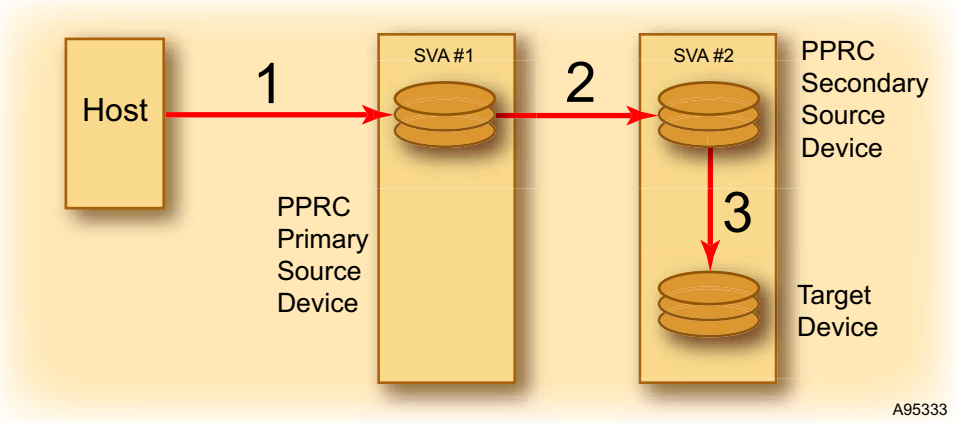
This feature has been implemented for the SVA to provide another means of dealing with the possibility of a "fuzzy" copy of data on a PPRC secondary volume.

Notes:

1. The primary and secondary subsystems must be a V2Xf, running G02.02 or newer microcode releases.
2. The PPRC SnapShot feature is required for PPRC Remote SnapShot Copy.
3. SnapShot operations are typically invoked with the user interface(s) provided by the SVAA/SnapShot host software. Refer to the SVAA/SnapShot Administration manual for your particular Host Operating System. In mainframe environments SnapShot might be invoked programmatically via an API.
4. PPRC Remote SnapShot is currently only available at the Volume or Unit level.

Customer's have requested a solution that would preserve a "good" point in time copy of the data at the disaster recovery site, while the next point in time SnapShot is being delivered to the disaster recovery site. Remote SnapShot provides this solution. This variation of SnapShot is totally under the customer control, and can be performed prior to any tracks being sent to the secondary control unit, or after all tracks have been sent to the secondary control unit. This is illustrated in the following figure and an explanation follows.

Figure 13 PPRC Remote SnapShot Copy Configuration Example



In the example of the previous figure:

1. At any desired interval, the SnapShot request is issued from the host to the primary subsystem source volume.
2. The primary source volume reflects the SnapShot request to it's secondary volume, which is the source volume for the SnapShot in the secondary subsystem. No SnapShot is performed on the primary subsystem.
3. The secondary subsystem executes the SnapShot from the secondary volume to the target volume.

PPRC Remote SnapShot Requirements

The primary benefit of PPRC Remote SnapShot Copy is that you can now use SnapShot to replicate volumes on a remote SVA subsystem without the need for direct host connectivity to the remote subsystem.

PPRC Remote SnapShot Copy allows a PPRC Secondary volume to be snapped to another functional volume on the same remote SVA subsystem as the Secondary volume. A request for a PPRC Remote SnapShot Copy is sent to a Source (PPRC Primary) volume on the local subsystem, is transferred to the PPRC Secondary volume on the remote subsystem using the PPRC connection, and then the Secondary volume on the remote subsystem is snapped to the designated Target volume on the remote subsystem.

Note: A PPRC Remote SnapShot Copy can be performed on a single subsystem assuming the necessary physical "loop-back" connection has been made. While a single subsystem configuration is not recommended for disaster recovery, such a configuration might be useful for testing purposes only.

The SVAA SNAP VOLUME subcommand has been enhanced to allow a remote functional volume to be specified as the Target volume.

PPRC Remote SnapShot Copy Operational Requirements

PPRC Remote SnapShot Copy has the following requirements:

- PPRC Remote SnapShot Copy is a volume-level operation only; PPRC Remote SnapShot of data sets is not supported.
- PPRC Remote SnapShot Copy is supported between two V2Xf subsystems, between two V2X4f subsystems, or between a V2Xf and a V2X4f subsystems.
- The PPRC SnapShot hardware feature must be installed on both the local and remote subsystems.
- The microcode support for PPRC Remote SnapShot Copy must be installed on both the local and remote subsystems.
- The SVAA PTF (L2P00BI for MVS, L2P00BJ for VM) and SnapShot PTF (L2P00CD for MVS, L2P00CE for VM) for PPRC Remote SnapShot Copy support must be installed.

General Requirements for Source, Secondary, and Target Volumes

1. The volumes must be defined as CKD
2. The volumes must be enabled - CKDENA(YES)
3. The volumes must be write enabled - CKDRW(YES)
4. The volumes cannot be PAV Aliases

Source Volume Requirements

1. A Source volume must be a PPRC Primary volume in the Duplex state. A Source volume cannot be a PPRC Secondary volume, a simplex (non-PPRC) volume, or a PPRC Primary volume in the Suspended or Pending states.
2. A Source volume might be online or offline to host systems

Secondary Volume Requirements

1. A Secondary volume must be a PPRC Secondary volume in the Duplex state. A Secondary volume cannot be a simplex (non-PPRC) volume or a PPRC Primary volume.
2. A Secondary volume must be offline to all host systems (i.e., no path groups established).
3. A Secondary volume must have the same virtual device type (3380, or 3390) as the Source volume.

Target Volume Requirements

1. A Target volume must be a simplex (non-PPRC) volume. A Target volume cannot be a PPRC Primary volume or a PPRC Secondary volume.
2. A Target volume must be offline to all host systems (i.e., no path groups established).
3. A Target volume must have the same virtual device type (3380, or 3390) as the Secondary volume.

PPRC Remote SnapShot Copy Operational Considerations

Users of PPRC Remote SnapShot Copy should be aware of the following:

- A PPRC pair cannot be established between volumes with different numbers of cylinders if the Primary volume has a larger number of cylinders than the Secondary volume.
- A PPRC pair can be established between volumes with different numbers of cylinders if the Secondary volume has a larger number of cylinders than the Primary volume, but this is not recommended for the following reasons:
  - This prevents the use of P/DAS to swap volumes back to the original configuration since the Secondary volume is now smaller than the Primary; configuration symmetry is recommended for ease of disaster recovery.
  - Additional user action (ICKDSF REFVTOC) is required on z/OS systems to be able to use the extra capacity on the Target volume since the VTOC/VTOCIX copied from the Secondary volume does not "know" about this extra space.

Performing PPRC Remote SnapShot Copies

Use the following steps as a guide to setting up and performing PPRC Remote SnapShot Copies:

1. If you already know what volume you want to use as a Source volume on the local subsystem, proceed to the next step, otherwise:
   A. Define the Source volume on the local subsystem. This is a PPRC Primary volume once you fully establish the PPRC connection (path and pair).
   B. Initialize the newly-defined Source volume using ICKDSF
   C. Vary the newly-defined Source volume online
   D. Place your user data on the newly-defined Source volume
2. If you know what volume you want to use as a Secondary volume on the remote subsystem (Warning: any data that exists on this volume is destroyed when the PPRC pair is established) proceed to the next step. Otherwise, define the volume on the remote

subsystem that is your PPRC Secondary volume once you fully establish the PPRC connection. This volume must have the same virtual device type (3380, 3390, or SCSI) as the Source volume

3. If you already know what volume you want to use as a Target volume on the remote subsystem (Warning: any data that exists on this volume is destroyed when the PPRC Remote SnapShot Copy is performed) proceed to the next step. Otherwise, define the Target volume on the remote subsystem. This is the designated target of the SnapShot and must have the same virtual device type (3380, 3390, or SCSI) as the Source and Secondary volumes
4. Establish the appropriate PPRC path(s) between the local and remote subsystems (refer to the PPRC Configuration Guide) using either the TSO CESTPATH command (MVS only) or the ICKDSF PPRCOPY ESTPATH command (MVS or VM).
5. Establish the PPRC pair between the Source (Primary) and Secondary volumes using either the TSO CESTPAIR command (MVS only) or the ICKDSF PPRCOPY ESTPAIR command (MVS or VM). On z/OS systems, an IEA494I message should be issued that confirms the pair is in a Pending state. For example:

   IEA494I 842,SW842,PPRC PAIR PENDING,SSID=8,CCA=42

   On z/VM systems, there is no equivalent message.
6. Wait for the PPRC pair to transition from Pending state to Duplex state. On z/OS systems, an IEA494I message should be issued that confirms the pair has transitioned to Duplex state. For example:

   IEA494I 842,SW842,PPRC PAIR FULL DUPLEX,SSID=8,CCA=42

   On z/VM systems, you should see the following messages:

   ICK223I PPRCOPY ESTPAIR FUNCTION COMPLETED SUCCESSFULLY

   ICK2231I DEVICE IS NOW A PEER TO PEER REMOTE COPY VOLUME
7. Perform the PPRC Remote SnapShot Copy operation by issuing a SVAA SNAP VOLUME subcommand or by using the SVAA ISPF panels to have the subcommand issued on your behalf. Refer to Chapter 8 of SVAA for OS/390 Configuration and Administration or Chapter 9 of SVAA for VM Configuration and Administration for the syntax of the SNAP VOLUME subcommand and an example of a subcommand used to perform a PPRC Remote SnapShot Copy.

PPRC Switch Support

5

This chapter describes changes to PPRC functionality to support a fabric switch or switches from the primary to the secondary subsystem.

Background

The V2Xf has been enhanced to support World Wide Node Name (WWNN) addressing in addition to N_Port_ID addressing to allow greater than one FICON switch. This requires a minimum microcode level of G02.03.xx.00.

Caution: When using more than one switch (also known as cascaded switches), they must all be of the same manufacturer between the host and the SVA. Sun has not tested a mix of manufacturers between a host and the SVA. A mix of switches is NOT supported by the manufacturers of the switch units and usually it does not work.

WWNN – A 16 hexadecimal address unique for each and every storage control subsystem. For PPRC configuration you might find the primary and secondary WWNN from the DOP configuration screen.

N_Port_ID – A 3 byte address that might be used to establish paths between primary and secondary through a single fabric switch.

- The 3 byte address consists of the Domain ID, Area ID, and Port ID. Each of which is 1 byte.

N_Port_ID (3 bytes)		
Domain ID (1 byte)	Area ID (1 byte)	Port ID (1 byte)

- The Domain ID identifies which switch the path is established through.
- The Area ID identifies which port on the switch, and therefore the physical link to the secondary or extender, the path is established through.
- The Port ID must be the same value for all ports on the primary, secondary, and switch according to the FICON specification and so is not used to identify any single entity.

Path Establishment

The SVAA PPRC ESTPATH command might be used to establish point-to-point, switched, and cascaded switch paths. To establish a PPRC path using SVAA the World Wide Node Name of both the primary and secondary storage control subsystems is passed as an argument to ESTPATH. Refer to the SVAA Configuration and Administration Guide for the complete syntax.

The "CESTPATH" command might be used to establish point-to-point and switched paths. To establish a PPRC path through a single switch, the Area_ID (port number on the switch) of the secondary's link must be passed in as argument 'gg' (see Table 6, "Link Parameter Meanings," on page 20) of the link address.

With the physical link identified, the Domain ID and Port ID can be determined internally by the SVA subsystem.

The N_Port_ID value can be constructed with the Area ID supplied in the CESTPATH command and the stored Domain ID and Port ID values.

Restrictions

The following restrictions apply with regard to switches:

- Any switch that handles both Host and FC-PPRC traffic must be a FICON switch. A switch that handles FC-PPRC traffic only might be a Non-FICON switch. The use of Non-FICON switches is untested and unsupported but the design does not preclude the customer from using Non-FICON switches provided that it assigns the same Port ID value to all ports as a FICON switch does.
- The switch must be configured so that any two ports that are communicating receives an RSCN (from the Fabric Controller) for an event affecting the other port. (e.g., A FICON-compliant switch must not have any underlying zones preventing such RSCN's.)
- Extenders (Edge WAN eXtender) might be used with a switch between a primary and secondary subsystem. The switch might be placed on either the primary or secondary side but not in between the extenders.
- Generally, the switches in a cascaded arrangement must be by the same manufacturer. Most switch manufacturer's switches are not compatable with other brands.

Supported Configuration Examples

The following examples represent some of the possible allowed configurations. Not all possibilities are shown.

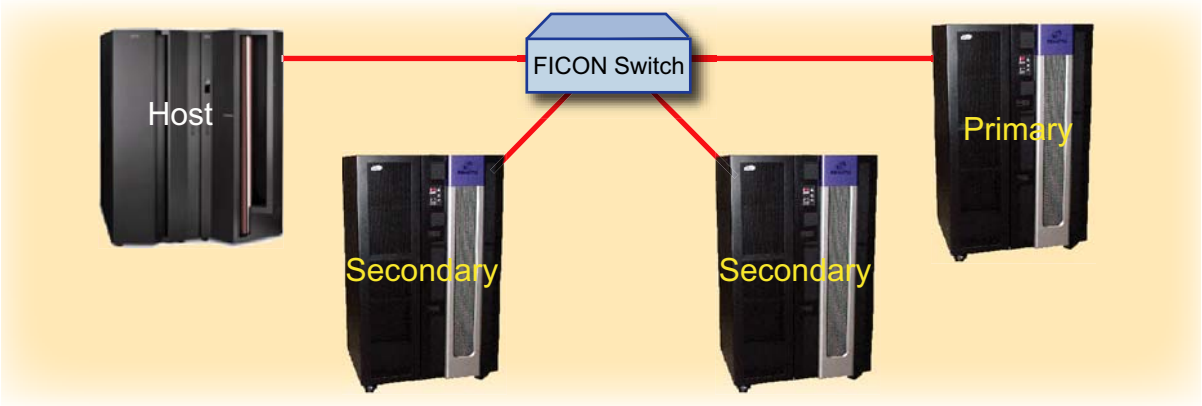


Figure 14 Switch Configuration Example #1

Figure 15 Switch Configuration Example #2

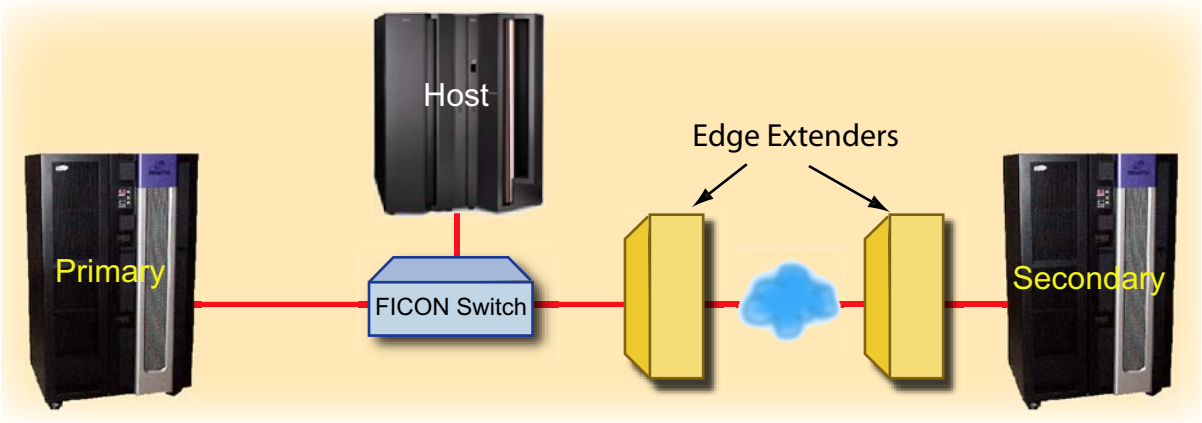


Figure 16 Switch Configuration Example #3

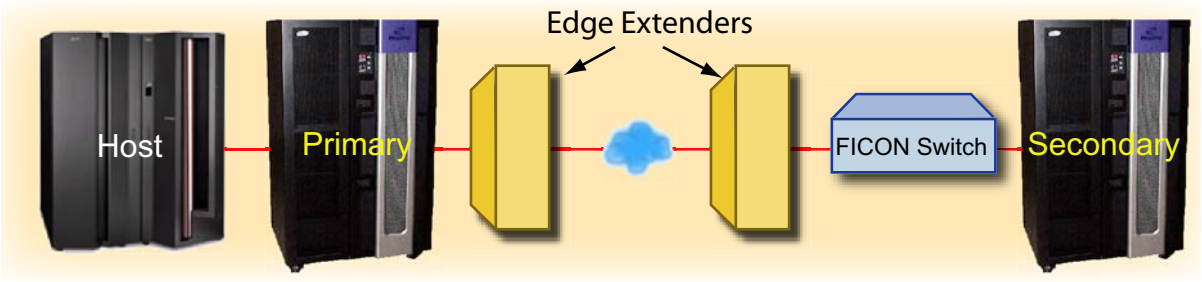


Figure 17 Switch Configuration Example #4

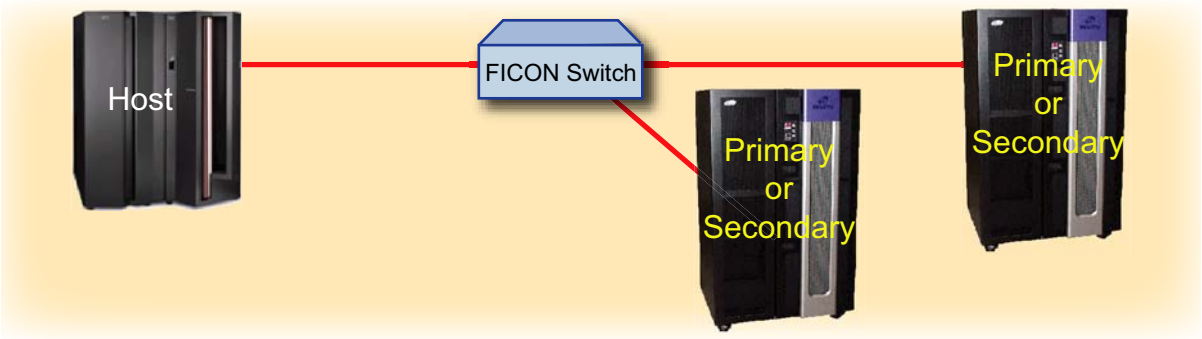


Figure 18 Switch Configuration Example #5

Figure 19 Switch Configuration Example #6

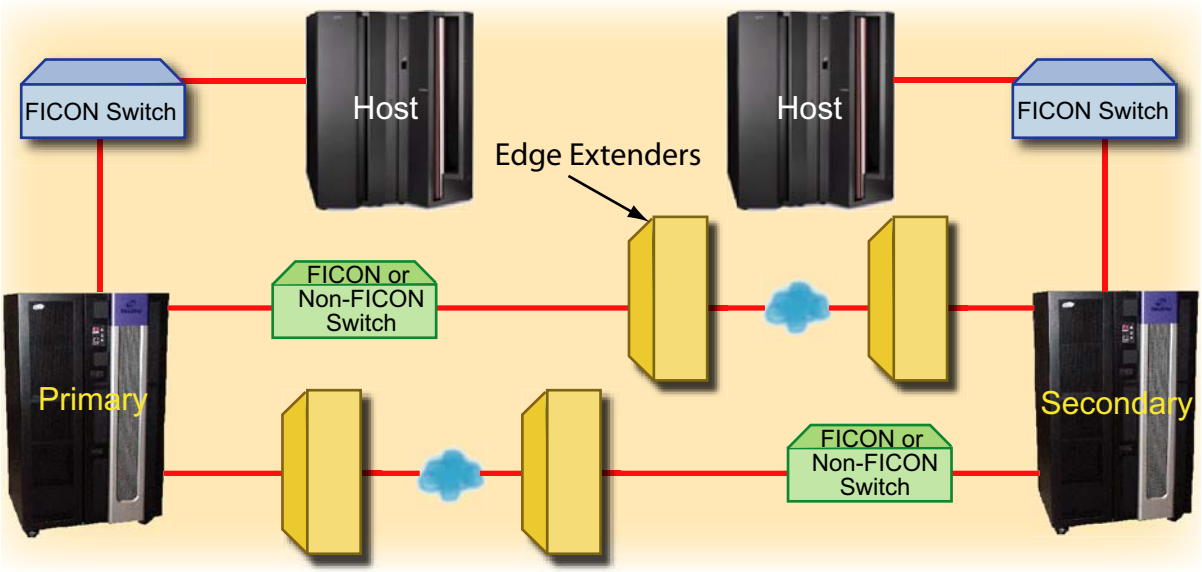


Figure 20 Switch Configuration Example #7

Cascaded Switches

Cascaded switches are supported as shown in the two following figures.

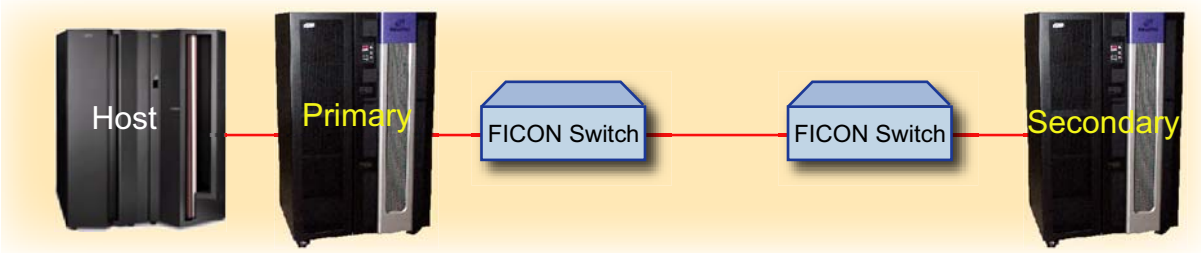


Figure 21 Cascaded Switches Between SVAs

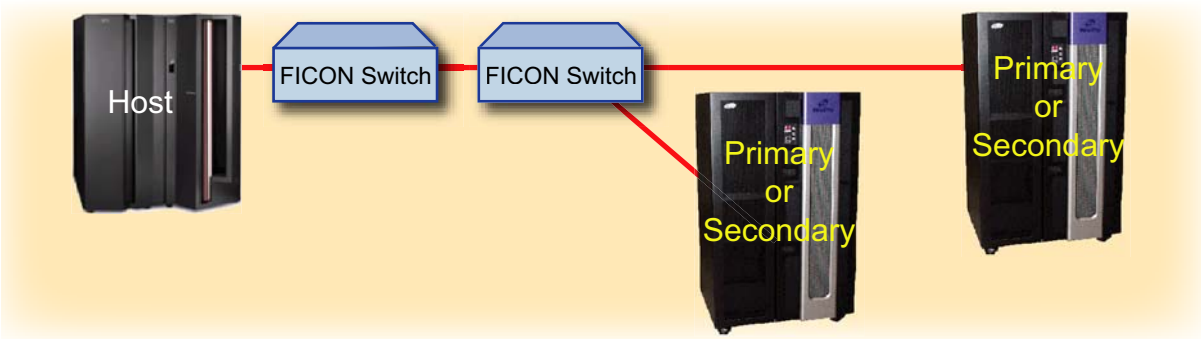


Figure 22 Cascaded switches Between the Host and the SVA

A combination of cascaded switches, as in a combination of the two preceding figures, is also supported.

Unsupported Configurations

The following figure is an example of an unsupported switch placement configuration.

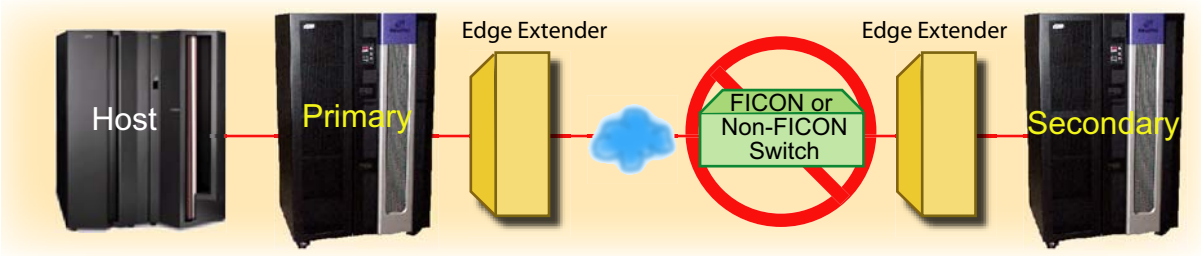


Figure 23 Example of an Incorrectly Placed FICON Switch

In the previous example, the switch is placed between the Edge WAN eXtender. It needs to have been placed outside of the Edge WAN eXtender to Edge WAN eXtender connection (see Figure 17 on page 62).

DOP PPRC Status

6

A new feature has been added to the G02.05 code release for the V2Xf , that allows the user to see the current status of all PPRC paths and pairs defined in the subsystem, from the DOP (Detached Operator Panel).

To use the feature:

1. Start up the DOP.
2. Select the "PPRC Paths" or "PPRC Pairs" button on the Main Menu. If you are logged into the CSE Menu, these buttons appear under the Configuration menu.

   The current status of the PPRC paths or pairs will be displayed on the DOP.
3. If the ISP code cannot obtain the requested PPRC information from the IUP code within 2 minutes, the error message "Unable to obtain path (or pair) information: see hic_stat for details" will be displayed on the DOP, and the following messages will be seen in hic_stat.dia: "DOP2: MBT timeout on message response" and "DOP : Get PPRC Paths failed" or "DOP : Get PPRC Pairs failed." If this occurs, exit the DOP PPRC status screen that you are in and try the operation again.

Note: Normally, the display of PPRC data occurs within a second or two, once the "PPRC Paths" or "PPRC Pairs" button is selected.

4. The arrangement of the data displayed, or the content of the display, can be changed by clicking on one of the column headings in the display.

   Example: Click on the 'State' column heading in the Pairs display, and all of the pair members that are DUPLEX will be displayed first; click on the heading again and all of the pair members that are SUSPENDED will be displayed first.

5. Select the "Help" button, when viewing one of the PPRC status displays for additional information.
6. The path or pair data is lost when you exit the PPRC status display that you are currently viewing. To re-obtain path or pair information, select the "PPRC Paths" or "PPRC Pairs" button again.
7. The display of the PPRC data is not dynamic. In other words, it does not automatically update when the status of PPRC paths or pairs change. If PPRC pair information is currently displayed on the DOP, and then the state of a pair member changes, in order to see the change in state, you can hit the REFRESH button on the display screen, or you can exit the display and request the data again.

Recovering PPRC After Unplanned Events

7

Applicable Products: V2Xf and V2X4f

Note: This information is correct for G01.02 and newer releases of microcode.

Reference the following matrix for instructions on how to recover from any of the four events listed.

Note: Use these procedures when the following events are unplanned and must be done without delay. If these events can be planned (scheduled), use the procedures documented in the section titled "*Code Upgrade for Systems with PPRC Active*" in the Release Notes for SVA code release G02.02.38 or higher. Using the Release Notes procedures might reduce the amount of time it takes to recover PPRC.

Condition / Event	**Action**
IML (cold start – EPO or CPD) of **Primary** subsystem.	Go to item 1.
IML (cold start – EPO or CPD) of **Secondary** subsystem.	Go to item 2. on page 68
NDCL on the **Primary** subsystem.	Go to item 3. on page 69
NDCL on the **Secondary** subsystem.	Go to item 4. on page 69

1. IML (cold start - EPO or CPD) of Primary subsystem:

   For FICON PPRC Direct or WAN, the following has occurred:

   - Primary data volumes go SUSPENDED (reason 9 = suspended by IML)
   - All PPRC paths are removed

   Recovery:

   On the Primary subsystem:

   - Re-establish PPRC paths to the Secondary subsystem
   - Re-sync the data volumes

Notes:

1. In the event of a cold IML after CPD, the out-of sync cylinder table is not retained. Therefore, the response of CESTPAIR MODE(RESYNC) commands issued to the suspended pairs is as if the CESTPAIR MODE (COPY) commands were issued to the PPRC pairs.
2. In the event of a cold IML after EPO, the out-of-sync cylinder table is retained. Therefore, the response of the CESTPAIR MODE(RESYNC) command issued to the suspended pairs is copying the out-of-sync (changed) cylinders only.

2. IML (cold start - EPO or CPD) of Secondary subsystem:

   For FICON PPRC Direct or WAN, the following has occurred:

   - On the Secondary subsystem, secondary data volumes go SUSPENDED (reason 9 = suspended by IML).
   - On the Primary subsystem primary data volumes might go SUSPENDED due to loss of communication with the secondary subsystem during the IML (they go SUSPENDED if they are syncing, or if a host write is issued to them and communication with the secondary subsystem isn't reestablished within an internal PPRC time-out period).

   Recovery:

   On the Primary subsystem there are two options:

   OPTION 1

   - Issue the host CSUSPEND commands to suspend all pairs on the primary subsystem. If the PPRC commands to suspend the pairs are not issued prior to the IML, then issue the commands after the IML.
   - Issue the host PPRC CQUERY PATHS command to all VCUs for verification that PPRC paths are still established.
   - Issue the host PPRC RESYNC commands to RESYNC all the PPRC pairs.

   OPTION 2

   - Issue the host PPRC CGROUP FREEZE and then CGROUP RUN commands to each VCU to suspend all pairs on the primary subsystem. If the CGROUP FREEZE commands to suspend the pairs are not issued prior to the IML, then issue the commands after the IML.

Note: CGROUP FREEZE commands can be expected to fail when they are issued to any VCU that does not have a pair established.

- Re-establish the PPRC Paths. (When the CGROUP FREEZE commands were issued in the prior step, the PPRC paths were eliminated).
- Issue the host PPRC RESYNC commands to RESYNC all the PPRC pairs.

Note: The RESYNC command fails if the primary volume is not in SUSPEND status or non-PPRC. If the secondary volume is in SUSPEND status and the primary volume is in DUPLEX status, the RESYNC command fails. When the secondary subsystem is powered down, all PPRC volumes on the secondary subsystem are suspended. The secondary volume of the PPRC pair is not known to be suspended until the first write I/O is issued to the primary volume. Therefore, after the cold start of a secondary subsystem, suspension of the primary volume does not take place until it receives a write update. z/OS system messages IEA491E, noting suspended devices, is detected in the SYSLOG during an extended time frame unless the previous recovery process is followed.

3. NDCL on the Primary subsystem:

Notes:

1. NDCL causes a warm start.
2. The following information pertains only to the subsystem status. To help avoid host problems see “RECOMMENDATION ” on page 70.

For FICON PPRC Direct or WAN, the following has occurred:

There should be no PPRC related consequence of the NDCL action on the Primary subsystem.

Recovery:

None required.

4. NDCL on the Secondary subsystem:

Notes:

1. NDCL causes a warm start
2. The following information pertains only to the subsystem status. To help avoid host problems see the following recommendation .

For FICON PPRC Direct or WAN, the following has occurred:

- On the Secondary subsystem secondary data volume PPRC state is unaffected (exception: if a DAC (Data Assurance

Check) condition is detected during the NDCL, secondary data volumes go SUSPENDED)

- On the Primary subsystem primary data volumes might go SUSPENDED due to loss of communication with the secondary subsystem during the warm start (they go SUSPENDED if they are syncing, or if a host write is issued to them and communication with the secondary subsystem isn't reestablished within an internal PPRC time-out period)

Recovery:

On the Primary subsystem CQUERY all VCUs in which PPRC paths have been established to verify the PPRC paths are still operational [optional] then re-sync the SUSPENDED data volumes.

RECOMMENDATION

To avoid problems at the host level with regard to sysplex timers, etc. Sun recommends that PRIOR to the NDCL a CSUSPEND be issued for all volumes. Then, after the NDCL is complete, resync all volumes.

IGF52xA Message Replies

A

The operators reply to the IGF52*x*A Message directs the P/DAS[1] action, as described in the following table.

In some cases, the activities performed by the P/DAS operation are based on a combination of the operator reply, and the environment at the time that the P/DAS swap request is made.

Your Reply:	Results in this system action:	Notes:
Terminate pair, and swap (IGF520A)	This reply directs the system to perform the following functions: 1. End PPRC pair and stop copy operations. Other PPRC operations for other pairs continue unchanged 2. Redirect all application I/O from the source volume *pppp* to the target volume *ssss*. Application I/O is not affected by the volume switch. The I/Os only update the secondary volume from this point on, and the primary and secondary volumes no longer contain the same data.	In a **sysplex**, issue this reply from the 'Main system' only. **USES:** For volume migration scenarios where the source volume is no longer going to be used, and you want to swap your primary and secondary volumes.

1. PPRC Dynamic Address Switching (P/DAS) is a utility that allows the redirection of all I/O from a primary PPRC volume to a secondary PPRC volume.

Your Reply:	Results in this system action:	Notes:
Switch pair, and swap (IGF520A)	This reply redirects application I/O to the secondary volume. The system takes action based on the PPRC environment that is in effect at the time of the swap request. The action performed depends on two conditions: 1. How the PPRC paths are currently established. 2. Whether the target volume is the same size as the source volume. The resulting system actions are summarized in "IGF53xA Actions" on page 75.	In a **sysplex**, issue this reply from the 'Main system' only. **USES:** For volume or subsystem maintenance, and/or workload movement.
Continue Swap (IGF520A IGF521A or IGF522A)	This Reply prompts the system to redirect application I/Os from the primary volume to the secondary volume. Thus, all I/Os that were directed to the source (primary) volume *pppp*, are now directed to the target (secondary) volume *ssss*. After completion of this option, volume *pppp* is no longer involved in any operation.	This reply is valid within sysplex and nonsysplex environments. In a **sysplex,** issue this reply from any system. **USES:** to remove a primary volume from the z/OS configuration.

Your Reply:	Results in this system action:	Notes:
Try Again (IGF521A or IGF522A)	This reply directs the system to perform the following functions: 1. End the pair, and return both volumes to simplex state. This is the equivalent of issuing the CDELPAIR PPRC command. 2. Establish a new PPRC pair in the reverse direction. The new path is from the new primary (originally the secondary volume *ssss*) to the new secondary (originally the primary volume *pppp*). This is the equivalent of issuing the CESTPATH and CESTPAIR PPRC commands for this pair. 3. Immediately suspend the new PPRC operation. This forces all changes made to the secondary volume to be recorded in the bit-maps for the operation. The changes are not copied to the original primary volume *pppp*. This is the equivalent of issuing a CSUSPEND PPRC command for the PPRC pair just established. 4. Redirect application I/Os from the primary volume to the secondary volume. This now means that all I/Os that were directed to the primary volume, are now directed to the secondary volume. When this has completed, the primary volume, *pppp* is no longer involved in any operations.	Before this option is used, paths should have been established in the opposite direction from the secondary (target) volume's SSID, to the primary (source) volumes SSID. In a **sysplex**, issue this reply from any system.
Terminate Swap (IGF520A, IGF521A or IGF522A)	This is a request to end the swap operation. The following message is issued to the SYSLOG IGF512I SWAP FROM pppp TERMINATED – SWAP TERMINATED BY OPERATOR P/DAS returns an error code of 16 to the system	In a **sysplex,** issue this reply from any system.

IGF53xA Actions

B

The following specific actions relate to actions detailed in “IGF52xA Message Replies” on page 71, based on your existing z/OS environment.

ACTION 1

There are PPRC paths in place from the primary volume to the secondary volume and also from the secondary to the primary. The source and target volumes have equivalent volume geometry.

Given the previous environment, selecting ‘switch pair, and swap’ directs P/DAS to perform the following actions:

1. End the current PPRC pair
2. Establish a new PPRC pair (with NOCOPY) to activate copying in the reverse direction
3. Immediately suspend the PPRC operation. All changes made to the secondary (target) are recorded in bit-maps, but not copied to the original primary (source) volume
4. Redirect all application I/O to the secondary (target) volume. The change is made transparent to the application programs.

The changes that occur between the swap and the subsequent re-synchronization of the volume pairs are maintained on the old secondary volume. The changed updated tracks are copied back to the original primary and the volumes become duplexed PPRC pairs again.

ACTION 2

There are PPRC paths in place from the primary volume to the secondary volume and also from the secondary to the primary. The target volume has a greater volume capacity than the source volume.

In this situation, ‘switch pair, and swap’ directs P/DAS to issue the following additional message to the SYSLOG:

```
IGF522A UNABLE TO SWITCH, FROM DEVICE IS SMALLER THAN TO
DEVICE: REPLY 1 TO CONTINUE SWAP | 2 TO TERMINATE SWAP
```

Select one of the message options, as described in “IGF52xA Message Replies” on page 71.

If you chose to continue with the swap, the changes that occur between the swap and the subsequent re-synchronization of the volume pairs are not maintained on the old secondary volume.

ACTION 3

A PPRC path exists from the primary to the secondary, but not in the reverse direction. The primary and secondary volumes have the same physical capacity.

In this situation, ‘switch pair, and swap’ directs P/DAS to issue the following message to the SYSLOG:

```
IGF521I NO PATH IN OPPOSITE DIRECTION: REPLY 1 TO CON-
TINUE SWAP | 2 TRY AGAIN | 3 TERMINATE SWAP
```

Select one of the messages as described in “IGF52xA Message Replies” on page 71.

ACTION 4

A PPRC path exists from the primary to the secondary, but not in the reverse direction. The primary and secondary volumes do not have the same physical capacity. P/DAS takes no special action to use the additional capacity on the target volume.

In this situation, ‘switch pair, and swap’ directs P/DAS to issue the following message to the SYSLOG:

```
IGF521I NO PATH IN OPPOSITE DIRECTION: REPLY 1 TO CON-
TINUE SWAP | 2 TRY AGAIN | 3 TERMINATE SWAP
```

Select one of the message options, as described in “IGF52xA Message Replies” on page 71, if you reply ‘2’, (try again), the following message is issued, requiring an operator reply:

```
IGF522A UNABLE TO SWITCH, FROM DEVICE IS SMALLER THAN TO
DEVICE: REPLY 1 TO CONTINUE SWAP | 2 TO TERMINATE SWAP
```

Select one of the message options, as described in “IGF52xA Message Replies” on page 71.

Troubleshooting

C

PPRC Command Failure

In the event a PPRC command fails and the message(s) around this failure do not conclusively indicate what the problem is, use following four step procedure to diagnose the problem:

1. Run a GTF trace with the following parameters for tracing IO of the failing command:
   TRACE=IOP,SSCHP,CCWP
   IO=SSCH=(*pppp*,*ssss*)
   CCW=(SI,DATA=80)
   END
   Where *pppp* and *ssss* is the device number of the primary and secondary volume. The least that is required is the primary volume device number.
2. Rerun the command and stop GTF.
3. Run a TSO batch job with following DD statements:
   - IPCSDDIR, with an IPCS dump directory that can be used for printing the trace, and,
   - TRACE, which points to the output data set of the GTF trace.
4. Print the GTF trace using following TSO statements:
   IPCS NOPARM
   DROPDUMP DD(TRACE)
   SETDEF DD(TRACE) LIST NOCONFIRM
   GTF

The output of Step 4 looks similar to that shown in “GTF Trace Print” on page 79. In the printout, near the bottom, is a line which contains EOS (End Of Sense). The CCW data that follows contains the sense bytes, as documented in the *SVA Reference* guide under the heading ECKD 32-Byte Sense Information Summary, appears after the EOS (see page 83). Bytes 22 and 23 contain the Fault Symptom Code (FSC).

Following is a table of FSC's that could be observed:

Table 11 PPRC Associated Fault Symptom Code

FSC	Meaning
08CD	Secondary volume is online. Vary the paths and devices offline prior to establishing the PPRC pairs.

GTF Trace Print

```
**** GTF TRACING ENVIRONMENT ****
Release: SP6.0.9   FMID: JBB6609   System name: C060
CPU Model: 9672  Version: 82  Serial no. 125874

  SSCH.... 2469     ASCB.... 00F99680 CPUID... 0000     JOBN.... SSMJYY2E RST..... 0E70C2B0
VST..... 020672B0

                    DSID.... 00000000 CC...... 00       ORB..... 00F3CEA8 02C0F000 0E70C2B0
SEEKA... 00000000 00000000

                    GPMSK... 00       OPT..... C0       FMSK.... 00       DVRID... 14
IOSLVL.. 01

                    UCBLVL.. 01       UCBWGT.. 00       BASE.... 2469

                 GMT-02/04/2002 15:03:52.826468  LOC-02/04/2002 16:03:52.826468


           CCW CHAIN         FORMAT 1          SSCH              DEV..... 2469     ASCB....
00F99680 CPU..... 0000

                             JOBN.... SSMJYY2E

           020672B0 64600040 149C88D0

           020672B8 FA600100 149C8910

           020672C0 54200030 149C8A10

  IO...... 2469     ASCB.... 00F99680 CPUID... 0000     JOBN.... SSMJYY2E PSW..... 070E0000
00000000

                    IRB..... 00C04007 0E70C2C8 0C000008 00200002 00000000 TCB..... 00AE0500
SENSE... N/A

                    FLA..... 00       OPT..... C0       DVRID... 14       IOSLVL.. 01
UCBLVL.. 01

                    UCBWGT.. 00       BASE.... 2469
```

```
                GMT-02/04/2002 15:03:52.826995  LOC-02/04/2002 16:03:52.826995

           CCW CHAIN         FORMAT 1          IO                DEV..... 2469     ASCB....
00F99680 CPU..... 0000

                             JOBN.... SSMJYY2E

           020672B0 64600040 149C88D0 3990EC33 900AD000 30962024 0D0B000F | ......}..O...... |
                                      E000E5A2 05940222 13090674 0D0B000F | \.VS.M.......... |
                                      0D0D000F 0D19001E 24240602 DFEE0001 | ................ |
                                      06770800 00007900 21600000 00000000 | .........-...... |
           020672B8 FA600100 149C8910 CC010100 4040F3F3 F9F0C2F3 C3E2E3D2 | ....  3390B3CSTK |
                                      F0F2F0F0 F0F0F0F0 F0F0F6F1 F1F80169 | 02000000006118.. |
                                      CC000000 4040F3F3                   | ....  33         |
                                      *** Back half of split data ***
                                      00000000 00000000 80000001 FA005900 | ................ |
                                      0021C069 6969010D 01400000 00000000 | ..{..... ..... . |
                                    **** 000008 CONSECUTIVE BYTES ARE ZERO ****
           020672C0 54200030 149C8A10 0169FF01 000000C0 00000060 00000059 | .......{...-.... |
                                      58000000 00000000 00000000 00010000 | ................ |
                                      00000000 00000021                   | ........         |

  SSCH.... 2469     ASCB.... 00F99680 CPUID... 0000     JOBN.... SSMJYY2E RST..... 0E70C2D8
VST..... 020672D8

                    DSID.... 00000000 CC...... 00       ORB..... 00F3CEA8 02C0F000 0E70C2D8
SEEKA... 00000000 00000000

                    GPMSK... 00       OPT..... C0       FMSK.... 00       DVRID... 14
IOSLVL.. 01
```


96225

```
                    UCBLVL.. 01       UCBWGT.. 00       BASE.... 2469
                  GMT-02/04/2002 15:03:52.827339  LOC-02/04/2002 16:03:52.827339

           CCW CHAIN         FORMAT 1          SSCH              DEV..... 2469     ASCB....
00F99680 CPU..... 0000
                             JOBN.... SSMJYY2E
           020672D8 27200021 149C8A88 62016969 F0F0F0F0 F0F0F0F0 F6F1F1F8 | ....000000006118 |
                                      0021F0F0 F0F0F0F0 F0F0F6F0 F1F00011 | ..000000006010.. |
                               **** 000001 CONSECUTIVE BYTES ARE ZERO ****
  IO...... 2469     ASCB.... 00F99680 CPUID... 0000     JOBN.... SSMJYY2E PSW..... 070E0000
00000000
                    IRB..... 00C04017 0E70C2E0 06000000 00200001 00000000 TCB..... 00AE0500
SENSE... N/A
                    FLA..... 00       OPT..... C0       DVRID... 14       IOSLVL.. 01
UCBLVL.. 01
                    UCBWGT.. 00       BASE.... 2469
                  GMT-02/04/2002 15:03:52.829432  LOC-02/04/2002 16:03:52.829432

1          CCW CHAIN         FORMAT 1          IO                DEV..... 2469     ASCB....
00F99680 CPU..... 0000
                             JOBN.... SSMJYY2E
           020672D8 27200021 149C8A88 62016969 F0F0F0F0 F0F0F0F0 F6F1F1F8 | ....000000006118 |
                                      0021F0F0 F0F0F0F0 F0F0F6F0 F1F00011 | ..000000006010.. |
                               **** 000001 CONSECUTIVE BYTES ARE ZERO ****
  SSCH.... 2469     ASCB.... 00F99680 CPUID... 0000     JOBN.... SSMJYY2E RST..... 00FF65B0
VST..... 00FC25B0
```

```
                    DSID.... 00000000 CC...... 00       ORB..... 00F3CEA8 02C02000 00FF65B0
SEEKA... 00000000 00000000

                    GPMSK... 20       OPT..... 80       FMSK.... 00       DVRID... 01
IOSLVL.. 01

                    UCBLVL.. 01       UCBWGT.. 00       BASE.... 2469

                GMT-02/04/2002 15:03:52.829486  LOC-02/04/2002 16:03:52.829486


          CCW CHAIN         FORMAT 1          SSCH              DEV..... 2469     ASCB....
00F99680 CPU..... 0000

                            JOBN.... SSMJYY2E

          00FC25B0 04200020 0073C520

  EOS..... 2469     ASCB.... 00F99680 CPUID... 0000     JOBN.... SSMJYY2E PSW..... 070E0000
00000000

                    IRB..... 00C04007 00FF65B8 0C000000 00200000 00000000 TCB..... N/A
SENSE... 8000

                    FLA..... 01       OPT..... 80       DVRID... 01       IOSLVL.. 01
UCBLVL.. 01

                    UCBWGT.. 00       BASE.... 2469

                GMT-02/04/2002 15:03:52.830543  LOC-02/04/2002 16:03:52.830543


          CCW CHAIN         FORMAT 1          EOS               DEV..... 2469     ASCB....
00F99680 CPU..... 0000

                            JOBN.... SSMJYY2E

          00FC25B0 04200020 0073C520 80000000 6900000F 520000BB 79000010 | ................ |

                                       420017E6 2121 0B3E 000040E3 00000000 | ...W...... T.... |
```


96225

Notes:

1. The End of Sense (EOS) mentioned earlier in the text is the bolded EOS four lines from the bottom of this GTF trace.
2. Normally when running this procedure you would be trying to further define a “command reject.” The command reject is indicated by an 80 appearing at the start of the sense bytes as shown in the previous example by the underlined 80.
3. The FSC (0B3E) is shown in the previous example in the different and bolded type face.

Missing Channel End Device End Messages

Missing channel end Device end messages can appear when issuing an ECAM request to a PPRC primary volume and the secondary is in a check0/warm start sequence. The host enters error recovery and reset the volume and re-drive the ECAM request.

Edge WAN eXtender Interface Card Resets

In a Power PPRC WAN setup, there are situations when it is necessary to cold IML both the primary and secondary SVAs or it becomes desirable to reverse the direction of the PPRC link. *Before starting this cold IML or direction reversal, the customer must physically locate the Edge WAN eXtender interface cards to which these SVAs are attached* – there might be other SVAs or other devices connected to the Edge WAN eXtender.

For a cold IML, once the interface cards have been located, begin the IML of the SVAs, then press the reset button on the interface cards of the Edge WAN eXtender (see Figure 24 on page 84).

For direction reversal, delete the PPRC link, press the reset buttons on the interface cards of the Edge WAN eXtender (see Figure 24), then re-establish the PPRC link in the opposite direction.

DO NOT reset unaffected interface cards.

Note: Sun does not recommend that a pencil of any type be used to push the reset button; use a pen or a straightened paperclip.

***Caution: Potential Data Loss* - DO NOT reset the Edge WAN eXtender by cycling the main breaker! Use the reset button located on the front of the interface card.**

Figure 24 Edge WAN Extender Interface Card Reset Button Location

Note: The preceding figure is an example. The actual location might vary from model to model of the WAN extender.

Valid Return Codes

The IBM PPRC configuration commands only allow for the following return codes:

- RC=0 – command completed successfully
- RC=4 – command partially completed
- RC=8 – command did not successfully complete
- RC=12 – command failed syntax and validity checking before any I/O was sent

Command Failures

A command usually fails because some of the required information was entered into the command improperly such as a Primary or Secondary sequence number, SSID or device. But the problem could be a link or other less obvious failure. In that case, start a GTF trace for the device on which the failing PPRC command is issued against, rerun the command, and then call Sun support with the GTF trace results for problem diagnosis.

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