

# HP StorageWorks

## MPxIO for Sun Solaris

### application notes

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## Application notes information

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## Intended audience

This document is intended for customers who are using Sun Solaris MPxIO with HP storage systems.

## Other documentation

A complete library of related documentation is available at:

<http://h18006.www1.hp.com/storage/saninfrastructure.html>.

For Solaris 8 & 9, the following documentation is available at [http://www.sun.com/products-n-solutions/hardware/docs/Network\\_Storage\\_Solutions/SAN/san\\_software/index.htm](http://www.sun.com/products-n-solutions/hardware/docs/Network_Storage_Solutions/SAN/san_software/index.htm):

- Sun StorEdge SAN Foundation Software 4.4 Installation Guide
- Sun StorEdge SAN Foundation Software 4.4 Configuration Guide
- Sun StorEdge SAN Foundation Software 4.4.x Release Notes, including Sun StorEdge Traffic Manager for the Solaris Operating System
- Sun StorEdge Traffic Manager Installation and Configuration Guide For the Solaris Operating System
- Sun StorEdge SAN Foundation Software 4.4

For Solaris 10, the Solaris Fibre Channel and Storage Multipathing Administration Guide is available at <http://docs.sun.com/app/docs/doc/819-0139>.

## MPxIO overview

MPxIO provides basic failover and load-balancing capability to HP StorageWorks EVA3000/5000 V4, EVA4000/6000/8000, and the XP line of storage systems. Different storage devices can connect to the same system. Failover to other storage devices is allowed.

## New features

This release provides support for Sun Solaris MPxIO multipathing on EVA3000/5000 4.004 and EVA4000/6000/8000 disk arrays.

**NOTE:**

MPxIO is not supported on versions of the EVA3000/5000 prior to 4.004.

## Supported hardware and software

Table 1 describes supported hardware and software.

**Table 1 Supported hardware and software**

Component	Version
Operating system	Solaris 8, 9, 10 (SPARC) <sup>1</sup>
Sun native adapters	SG-XPCI1FC-QF2 (X6767A) SG-XPCI2FC-QF2 (X6768A) SG-XPCI2FC-QF2-Z SG-XPCI1FC-QF4 SG-XPCI2FC-QF4 SG-XPCI1FC-EM4-Z SG-XPCI2FC-EM4-Z SG-XPCIE2FC-QB4-Z <sup>2</sup> SG-XPCIE1FC-QF4 <sup>2</sup> SG-XPCIE2FC-QF4 <sup>2</sup> SG-XPCI1FC-QL2 SG-XPCI1FC-EM2 SG-XPCI2FC-EM2 SG-XPCIE1FC-EM4 <sup>2</sup> SG-XPCIE2FC-EM4 <sup>2</sup>
QLogic adapters	QLA2310F QLA2340 QLA2342 QLA2460 QLA2462 QLE2460 <sup>2</sup> QLE2462 <sup>2</sup>
Emulex adapters	LP10000 LP10000DC LP11000 LP11002 LPe11000 <sup>2</sup> LPe11002 <sup>2</sup>
Storage Systems	HP StorageWorks EVA3000/5000 4.004 HP StorageWorks EVA4000/6000/8000 HP StorageWorks XP128/1024 HP StorageWorks XP10000/12000

<sup>1</sup>For Solaris 10 x86 only Sun native adapters or specific FCAs for HP Proliant Blade servers are supported. Please check the array release notes or with your HP representative for the supported FCAs.

<sup>2</sup>PCI-Express FCAs are not supported on Solaris 8 and are supported on Solaris 9 only with some server models.

## Supported multipathing combinations

The combination of MPxIO and Secure Path on the same server can only be supported if FCA2257P is used for Secure Path and Sun native or Emulex adapters are used for MPxIO.

To view more multipathing combinations supported by MPxIO, go to <http://www.hp.com/go/sandesignguide>. From the web page, select the complete *HP StorageWorks SAN design reference guide (1-5)* and check the table *Sun Solaris multipathing coexistence support*.

## Preparing the host system

To set up the host system:

- 1.** For Solaris 8 & 9 and Fibre Channel Adapters (FCAs) from Sun or QLogic:  
If the OS has been installed before adding QLogic based FCAs, you may need to install SUNWqlc and SUNWqlcx first. See <http://sunsolve.sun.com> (and select *Document id 74507*) for further details.
- 2.** Install the necessary software components for the different Solaris versions:
  - a.** For Solaris 8 and 9, download the Sun SAN Foundation Software (SFS) 4.4.8 or later, SAN\_4.4.x\_install\_it.tar.Z which includes all the patches. Install it with the included install\_it script, available at [http://www.sun.com/storagetek/storage\\_networking/](http://www.sun.com/storagetek/storage_networking/) by selecting *SAN 4.4 release Software/Firmware Upgrades & Documentation*. To verify which version of SFS has been installed, go to <http://sunsolve.sun.com> (see *Document id 77230*).
  - b.** For Solaris 10 (SPARC), the required patches depend on the FCA.
    - With QLogic based FCAs (from Sun or QLogic) SUNWqlc with patch 119130–26 or later is required
    - With Emulex based FCAs (from Sun or Emulex), SUNWemlxs and SUNWemlxu with patches 120222–11 and 119130-26 or later
    - Use /usr/bin/updatesmanager (see <http://www.sun.com/service/sunupdate/>) to update to the current Sun SAN patch level
  - c.** For Solaris 10 (x86), the required patches depend on the FCA. Choose from one of the following
    - For QLogic FCAs (from Sun or QLogic) SUNWqlc with patch 119131-24 or later
    - For Emulex FCAs (from Sun or Emulex) SUNWemlxs and SUNWemlxu with patches 119131-24 and 120223-11 or later are required
    - To update to the current Sun Solaris SAN patch level, enter /usr/bin/updatesmanager  
See <http://www.sun.com/service/sunupdate> for more information.
- 3.** Reboot the Host after installing the (software and) patches.
- 4.** Upgrade each FCA to the latest FCA Fcode/OpenBoot if required (typically requires single user mode and no I/O activity):
  - For FCAs from Sun, go to <http://sunsolve.sun.com/> or check with Sun if the FCA requires an fcode update and follow the instructions in the patch description in case a patch is available
  - For native Emulex FCAs, check the Emulex web site (<http://www.emulex.com>) for the latest OpenBoot version for the given FCA. Download the fcode and FCA utilities from that web site and use /opt/EMLXemlxu/bin/emlxadm to check and update the fcode
  - For native QLogic FCAs, check the QLogic web site at <http://www.qlogic.com> for the latest qlc Fcode. Download the fcode and SANSurfer CLI from that web site and use /opt/QLogic\_Corporation/SANSurferCLI/scli to check and update the fcode
- 5.** Reboot the Host after updating the Fcode on the FCAs.

# Configure and verify the host

## Verifying configuration settings

Verify that all paths to the storage system are present with `cfgadm -al` command. To display the LUNs configured to each path, execute `cfgadm -al -o show_FCP_dev` as shown in the example below.

The following examples are with 4 paths (ports) visible from the array on the host and with 2 LUNs configured on the array for the host. You should normally see 4 paths with EVA3000/ EVA5000/ EVA4000/ EVA6000, however you might also see up to 8 paths with EVA8000.

1. Enter the `cfgadm` command to verify the paths to the LUNs (note that you need to have configured LUNs on the array for the host in order to see the "disk" lines):

```
Example: # cfgadm -al -o show_FCP_dev
Ap_Id          Type          Receptacle  Occupant    Condition
c2             fc-fabric     connected   unconfigured unknown
c2::50001fe1002709f8,0 array-ctrl   connected   unconfigured unknown
c2::50001fe1002709f8,1 disk         connected   unconfigured unknown
c2::50001fe1002709f8,2 disk         connected   unconfigured unknown
c2::50001fe1002709fc,0 array-ctrl   connected   unconfigured unknown
c2::50001fe1002709fc,1 disk         connected   unconfigured unknown
c2::50001fe1002709fc,2 disk         connected   unconfigured unknown
c3             c-fabric     connected   unconfigured unknown
c3::50001fe1002709f9,0 array-ctrl   connected   unconfigured unknown
c3::50001fe1002709f9,1 disk         connected   unconfigured unknown
c3::50001fe1002709f9,2 disk         connected   unconfigured unknown
c3::50001fe1002709fd,0 array-ctrl   connected   unconfigured unknown
c3::50001fe1002709fd,1 disk         connected   unconfigured unknown
c3::50001fe1002709fd,2 disk         connected   unconfigured unknown
```

With Solaris 8 or 9, the Occupant status will be displayed as above in a SAN environment. With Solaris 10 (SPARC and x86), you will see a configured status.

2. For Solaris 8 and 9, use `cfgadm -c configure c#` command to configure the host to access the storage system as shown in the example below. The value of # is gathered from the output of the `cfgadm -al` previously executed.

Example:

```
# cfgadm -c configure c2
# cfgadm -c configure c3
```

3. Execute the `cfgadm` command to view configured devices. After the configuration, the following command will show the array controllers as configured:

```
# cfgadm -al
Ap_Id          Type          Receptacle  Occupant    Condition
c0             scsi-bus     connected   configured  unknown
c0::dsk/c0t0d0 disk         connected   configured  unknown
c0::dsk/c0t6d0 CD-ROM       connected   configured  unknown
c1             scsi-bus     connected   unconfigured unknown
c2             fc-fabric     connected   configured  unknown
c2::50001fe1002709f8 array-ctrl   connected   configured  unknown
c2::50001fe1002709fc array-ctrl   connected   configured  unknown
c3             fc-fabric     connected   configured  unknown
c3::50001fe1002709f9 array-ctrl   connected   configured  unknown
c3::50001fe1002709fd array-ctrl   connected   configured  unknown
```

---

 **NOTE:**

Using the option `-o show_FCP_dev` could result in the output of the `cfgadm` command to display the Type `array-ctrl` as unconfigured. This is not a problem. (See example below).

---

```
# cfgadm -al -o show_FCP_dev
Ap_Id                               Type                Receptacle          Occupant             Condition
c2                                   fc-fabric           connected            configured            unknown
c2::50001fe1002709f8,0              array-ctrl          connected            unconfigured         unknown
c2::50001fe1002709f8,1              disk                 connected            configured            unknown
c2::50001fe1002709f8,2              disk                 connected            configured            unknown
...
```

4. Verify that the LUNs/disks are visible with the `format` command through all the EVA paths.
  - a. The following output is for all Solaris releases on SPARC:

```
# echo | format
Searching for disks...done
c2t50001FE1002709F8d1: configured with capacity of 1008.00MB
c2t50001FE1002709F8d2: configured with capacity of 1008.00MB
c2t50001FE1002709FCd1: configured with capacity of 1008.00MB
c2t50001FE1002709FCd2: configured with capacity of 1008.00MB
c3t50001FE1002709F9d1: configured with capacity of 1008.00MB
c3t50001FE1002709F9d2: configured with capacity of 1008.00MB
c3t50001FE1002709FDd1: configured with capacity of 1008.00MB
c3t50001FE1002709FDd2: configured with capacity of 1008.00MB

AVAILABLE DISK SELECTIONS:
 1. c2t50001FE1002709F8d1 <HP-HSV210-5100 cyl 126 alt 2 hd 128 sec 128>
    /pci@1f,4000/QLGC,qla@4/fp@0,0/ssd@w50001fe1002709f8,1
 2. c2t50001FE1002709F8d2 <HP-HSV210-5100 cyl 126 alt 2 hd 128 sec 128>
    /pci@1f,4000/QLGC,qla@4/fp@0,0/ssd@w50001fe1002709f8,2
 3. c2t50001FE1002709FCd1 <HP-HSV210-5100 cyl 126 alt 2 hd 128 sec 128>
    /pci@1f,4000/QLGC,qla@4/fp@0,0/ssd@w50001fe1002709fc,1
 4. c2t50001FE1002709FCd2 <HP-HSV210-5100 cyl 126 alt 2 hd 128 sec 128>
    /pci@1f,4000/QLGC,qla@4/fp@0,0/ssd@w50001fe1002709fc,2
 5. c3t50001FE1002709F9d1 <HP-HSV210-5100 cyl 126 alt 2 hd 128 sec 128>
    /pci@1f,4000/lpfc@5/fp@0,0/ssd@w50001fe1002709f9,1
 6. c3t50001FE1002709F9d2 <HP-HSV210-5100 cyl 126 alt 2 hd 128 sec 128>
    /pci@1f,4000/lpfc@5/fp@0,0/ssd@w50001fe1002709f9,2
 7. c3t50001FE1002709FDd1 <HP-HSV210-5100 cyl 126 alt 2 hd 128 sec 128>
    /pci@1f,4000/lpfc@5/fp@0,0/ssd@w50001fe1002709fd,1
 8. c3t50001FE1002709FDd2 <HP-HSV210-5100 cyl 126 alt 2 hd 128 sec 128>
    /pci@1f,4000/lpfc@5/fp@0,0/ssd@w50001fe1002709fd,2

Specify disk (enter its number)
```

- b. Solaris 10 (x86) is shipped with MPxIO enabled by default. When you enter the `format` command, a single device is displayed for each LUN regardless of the number of paths connected. The following output is for all Solaris 10 (x86):

```
# echo | format
 1. c4t600508B40010293400006000041B0000d0 <HP-HSV210-6000 cyl 1916 alt 2 hd 128 sec 128>
    /scsi_vhci/disk@g600508b40010293400006000041b0000
 2. c4t600508B40010293400006000040C0000d0 <HP-HSV210-6000 cyl 1916 alt 2 hd 128 sec 128>
    /scsi_vhci/disk@g600508b40010293400006000040c0000
 3. c4t600508B40010293400006000040F0000d0 <HP-HSV210-6000 cyl 1916 alt 2 hd 128 sec 128>
    /scsi_vhci/disk@g600508b40010293400006000040f0000
 4. c4t600508B4001029340000600004250000d0 <HP-HSV210-6000 cyl 1916 alt 2 hd 128 sec 128>
    /scsi_vhci/disk@g600508b4001029340000600004250000
 5. c4t600508B4001029340000600004220000d0 <HP-HSV210-6000 cyl 1916 alt 2 hd 128 sec 128>
    /scsi_vhci/disk@g600508b4001029340000600004220000
```

- For all Solaris releases on SPARC, check the multi-pathing information for all LUNs (first example) and either for a given disk/LUN or for the array WWN or a port WWN. The multipathing information is already available although MPxIO has not yet been enabled:

```
# luxadm probe
No Network Array enclosures found in /dev/es
Found Fibre Channel device(s):

Node WWN:50001fe1002709f0 Device Type: Disk device
  Logical Path:/dev/rdsk/c2t50001FE1002709F8d1s2
  Logical Path:/dev/rdsk/c2t50001FE1002709FCd1s2
  Logical Path:/dev/rdsk/c3t50001FE1002709F9d1s2
  Logical Path:/dev/rdsk/c3t50001FE1002709FDd1s2
Node WWN:50001fe1002709f0 Device Type: Disk device
  Logical Path:/dev/rdsk/c2t50001FE1002709F8d2s2
  Logical Path:/dev/rdsk/c2t50001FE1002709FCd2s2
  Logical Path:/dev/rdsk/c3t50001FE1002709F9d2s2
  Logical Path:/dev/rdsk/c3t50001FE1002709FDd2s2

# luxadm display /dev/rdsk/c2t50001FE1002709F8d1s2
DEVICE PROPERTIES for disk: /dev/rdsk/c2t50001FE1002709F8d1s2
Vendor: HP
Product ID: HSV210
Revision: 5100
Serial Num: Unavailable
Unformatted capacity: 1024.000 MBytes
Read Cache: Enabled
  Minimum prefetch: 0x0
  Maximum prefetch: 0x0
Device Type: Disk device
Path(s):

/dev/rdsk/c2t50001FE1002709F8d1s2
/devices/pci@1f,4000/QLGC,qla@4/fp@0,0/ssd@w50001fe1002709f8,1:c,raw
  LUN path port WWN:      50001fe1002709f8
  Host controller port WWN: 210000e08b1759bd
  Path status:           O.K.
/dev/rdsk/c2t50001FE1002709FCd1s2
/devices/pci@1f,4000/QLGC,qla@4/fp@0,0/ssd@w50001fe1002709fc,1:c,raw
  LUN path port WWN:      50001fe1002709fc
  Host controller port WWN: 210000e08b1759bd
  Path status:           O.K.
/dev/rdsk/c3t50001FE1002709F9d1s2
/devices/pci@1f,4000/lpfc@5/fp@0,0/ssd@w50001fe1002709f9,1:c,raw
  LUN path port WWN:      50001fe1002709f9
  Host controller port WWN: 1000000c93d5cee
  Path status:           O.K.
/dev/rdsk/c3t50001FE1002709FDd1s2
/devices/pci@1f,4000/lpfc@5/fp@0,0/ssd@w50001fe1002709fd,1:c,raw
  LUN path port WWN:      50001fe1002709fd
  Host controller port WWN: 1000000c93d5cee
  Path status:           O.K.
```

## Errors for Solaris 8, 9, and 10

You will see error messages similar to the following for each EVA controller for LUN 0 on the console and in /var/adm/messages. You can ignore these error messages.

```
May 18 15:10:30 simonb fcp: [ID 305930 kern.warning] WARNING: fpl: no
driver for device @w50001fe1002709e8,0:
```

```
May 18 15:10:30 simonb compatible: scsiclass,0c.vHP.pHSV210.r5100
scsiclass,0c.vHP.pHSV210 scsa,0c.bfcf scsiclass,0c scsiclass
```

```
May 18 15:10:30 simonb scsi: [ID 243001 kern.warning] WARNING:
/pseudo/fcp@0 (fcp0):
```

## Enabling MPxIO

To enable MPxIO for HP storage devices, the appropriate information for `device-type-scsi-options-list` need to be added in the `/kernel/drv/scsi_vhci.conf` file.

1. Use a text editor to change the configuration file. For example:

```
# vi /kernel/drv/scsi_vhci.conf
```

2. For Solaris 8 and 9 perform the following steps:

- a. Change the `mpxio-disable` parameter to the following:

```
mpxio-disable="no";
```

- b. Verify that the `load-balance` and `auto-failback` parameters are set to the following values (the default setting may vary depending on the patch level / OS version):

```
load-balance="none";
```

```
auto-failback="disable";
```

- c. Add the following lines to cover all HP arrays:

```
device-type-scsi-options-list =  
"HP      HSV101", "symmetric-option",  
"COMPAQ HSV111", "symmetric-option",  
"HP      HSV2", "symmetric-option",  
"HP      OPEN", "symmetric-option";  
symmetric-option = 0x1000000;
```

---

 **NOTE:**

Enter six spaces after "HP" and two spaces after "COMPAQ".

---

3. For Solaris 10 (patch 118833-24 for SPARC, patch 118855-19 for x86), the `scsi_vhci` driver is capable of detecting Asymmetric Logical Unit Access (ALUA) compliant devices advertised in the Target Port Group Support (TPGS) field. The EVA 4000/6000/8000 and the EVA 3000/5000 V4 are ALUA compliant arrays. Add the following lines to cover all HP arrays:

```
device-type-scsi-options-list =  
"HP      OPEN", "symmetric-option";  
symmetric-option = 0x1000000;
```

---

 **NOTE:**

Enter six spaces after "HP".

---

4. Depending on the Solaris version, select one of the following options:

- a. For Solaris 8 or 9—run a reconfiguration `reboot` in order to activate the changes:

```
# reboot -- -r
```

- b. For Solaris 10 (SPARC)—run the `stmsboot` command and confirm the reboot:

```
# stmsboot -e
```

- c. For Solaris 10 (x86)—reboot the system to load the new definition if you are configuring for XP. Configuring for EVA does not require a reboot since definition has already been configured.

# Verify the MPxIO configuration

After the system has rebooted, use the `format` or `luxadm` command to verify that the MPxIO enablement has been successful.

---

## NOTE:

In the `format` or `luxadm` output, controllers `c2` and `c3` no longer show up. A single, virtual controller path such as `c4` now displays the MPxIO-configured LUNs. The `cfgadm` output does NOT change after the MPxIO enablement.

---

1. Verify with either `format` or `luxadm` probe that only one device file is shown for each LUN:

```
# echo | format
Searching for disks...done

c4t600508B400102E640000B000081C0000d0: configured with capacity of 1008.00MB
c4t600508B400102E640000B00008100000d0: configured with capacity of 1008.00MB

AVAILABLE DISK SELECTIONS:
0. c0t0d0 <SUN18G cyl 7506 alt 2 hd 19 sec 248>
   /pci@8,600000/SUNW,qlc@4/fp@0,0/ssd@w2100002037e46c64,0
1. c4t600508B400102E640000B000081C0000d0 <HP-HSV210-5100 cyl 126 alt 2 hd 128 sec 128>
   /scsi_vhci/ssd@g600508b400102e640000b000081c0000
2. c4t600508B400102E640000B00008100000d0 <HP-HSV210-5100 cyl 126 alt 2 hd 128 sec 128>
   /scsi_vhci/ssd@g600508b400102e640000b00008100000Specify disk (enter its number):

# luxadm probe
No Network Array enclosures found in /dev/es

Found Fibre Channel device(s):
Node WWN:50001fe1002709f0 Device Type:Disk device
  Logical Path:/dev/rdisk/c4t600508B400102E640000B000081C0000d0s2
Node WWN:50001fe1002709f0 Device Type:Disk device
  Logical Path:/dev/rdisk/c4t600508B400102E640000B00008100000d0s2
```

2. Check the different paths with the `luxadm display` command (either for a given disk or for the array WWN or a port WWN):

- a. For Solaris 8 and 9:

```
# luxadm display 50001fe1002709f0
DEVICE PROPERTIES for disk: 50001fe1002709f0
Vendor:                HP
Product ID:            HSV210
Revision:              5100
Serial Num:            Unavailable
Unformatted capacity: 1024.000 MBytes
Read Cache:           Enabled
  Minimum prefetch:    0x0
  Maximum prefetch:    0x0
Device Type:           Disk device
Path(s):

/dev/rdisk/c4t600508B400102E640000B000081C0000d0s2
/devices/scsi_vhci/ssd@g600508b400102e640000b000081c0000:c,raw
Controller              /devices/pci@1f,4000/QLGC,qla@4/fp@0,0
Device Address          50001fe1002709f8,2
Host controller port WWN 210000e08b1759bd
Class                   primary
State                   ONLINE
Controller              /devices/pci@1f,4000/QLGC,qla@4/fp@0,0
Device Address          50001fe1002709fc,2
Host controller port WWN 210000e08b1759bd
```

```

Class                primary
State                ONLINE
Controller           /devices/pci@1f,4000/lpfc@5/fp@0,0
Device Address       50001fe1002709f9,2
Host controller port WWN 10000000c93d5cee
Class                primary
State                ONLINE
Controller           /devices/pci@1f,4000/lpfc@5/fp@0,0
Device Address       50001fe1002709fd,2
Host controller port WWN 10000000c93d5cee
Class                primary
State                ONLINE
...

```

- b. For Solaris 10 (SPARC and x86), the following is displayed:

 **NOTE:**

The *Class* of the device shows primary through one controller and shows secondary through the other controller. This is because the array is now configured as an Asymmetric Active/Active (A/A/A) array, and the array controller that indicates the primary path owns the LUN.

```

# luxadm -v display /dev/rdisk/c4t600508B4001029340000600004180000d0s2
DEVICE PROPERTIES for disk: /dev/rdisk/c4t600508B4001029340000600004180000d0s2
Vendor:              HP
Product ID:          HSV210
Revision:            6000
Serial Num:          Unsupported
Unformatted capacity: 15360.000 MBytes
Read Cache:         Enabled
  Minimum prefetch:  0x0
  Maximum prefetch:  0x0
Device Type:        Disk device
Path(s):

/dev/rdisk/c4t600508B4001029340000600004180000d0s2
/devices/scsi_vhci/disk@g600508b4001029340000600004180000:c,raw
Controller          /dev/cfg/c1
  Device Address     50001fe100270c29,5
  Host controller port WWN 10000000c9551826
  Class              secondary
  State              ONLINE
Controller          /dev/cfg/c1
  Device Address     50001fe100270c2d,5
  Host controller port WWN 10000000c9551826
  Class              primary
  State              ONLINE
Controller          /dev/cfg/c2
  Device Address     50001fe100270c2a,5
  Host controller port WWN 10000000c9551827
  Class              secondary
  State              ONLINE
Controller          /dev/cfg/c2
  Device Address     50001fe100270c2e,5
  Host controller port WWN 10000000c9551827
  Class              primary
  State              ONLINE

```