Chapter 27
-
EVA Disk Arrays

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Hardware Overview

EVA5000 components

all components are using 2GB/s FC technology

2 HSV110 Controllers
each Controller has 2 FC frontend ports (for switchconnection to hosts) and 4 FC backend fibrechannel ports that connect to the IO modules of the shelves directly (4 or less shelves) or to the Loop switches (more than 4 shelves).

4 FC Loop switches
each equiped with 12 fibrechannel ports to connect the HSV110 controllers to the disk shelves. Up to 4 shelves these loop switches are optional, with more than 4 shelves, loop switches are mandatory.

2-18 Disk shelves
connected to the controllers through 2 IO modules with one FC loop per IO module.

up to 240 Disks
max. 14 disks per shelf. Supported disk types:

- 36GB/10k / 36GB/15k
- 72GB/10k / 72GB/15k
- 146GB/10k

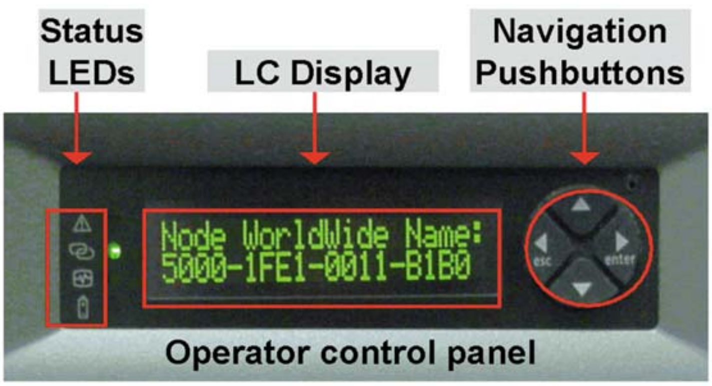
EVA3000 differences

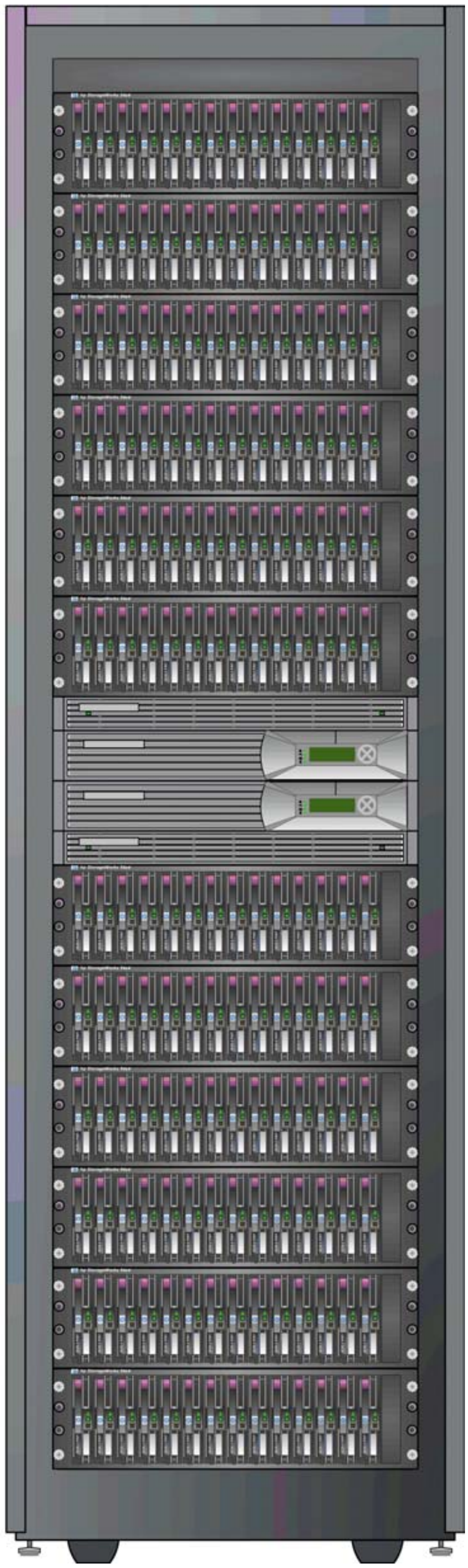
2 HSV100 Controllers
only 2 FC backend fibrechannel ports (copper, not fibre)

No Loop switches are supported

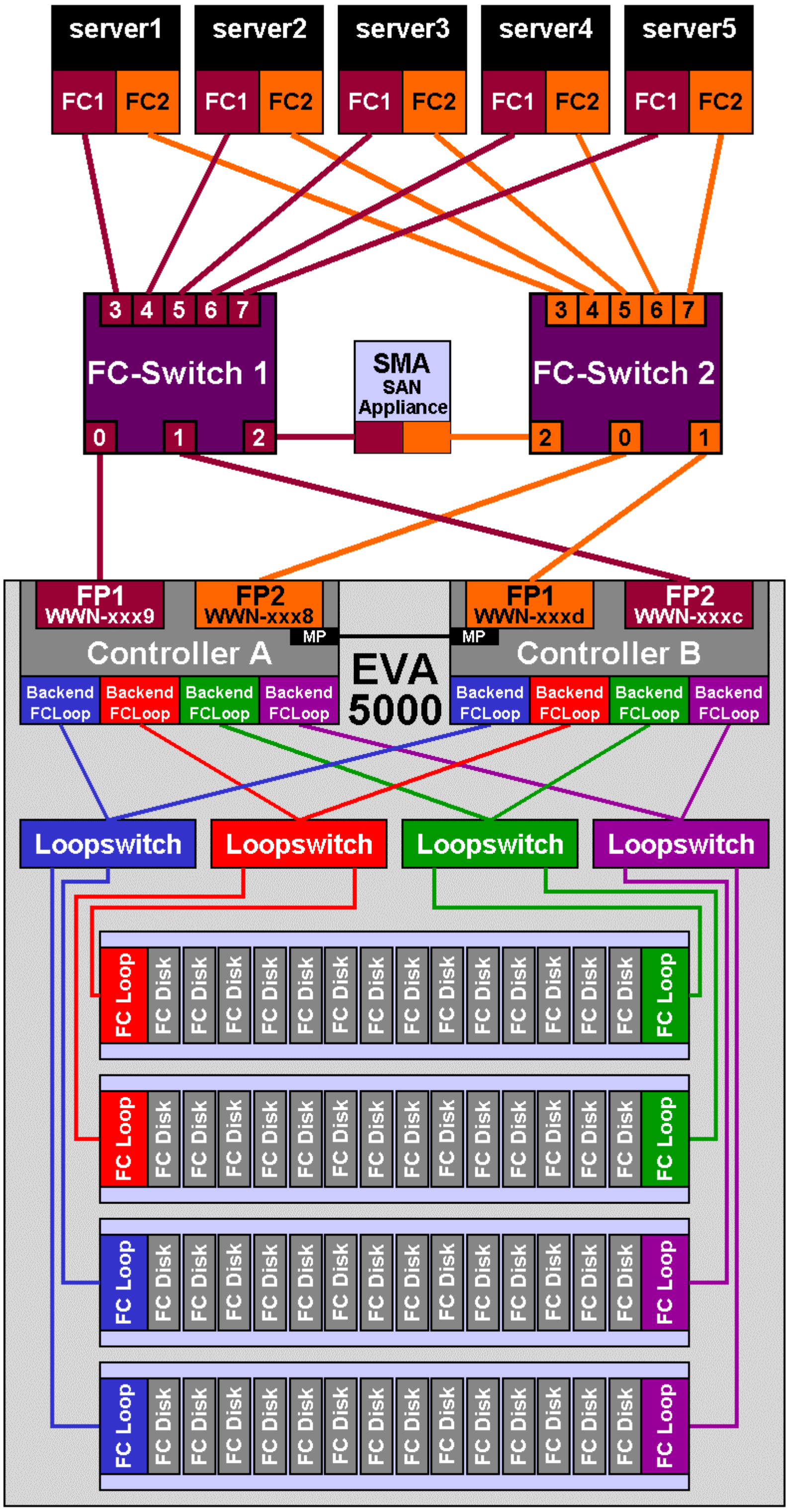
Only 2-4 Disk shelves
connected to the controllers through 2 IO modules with one FC loop (copper, not fibre) per IO module.

Only up to 56 Disks
same disks as in the EVA5000





Logical View of an EVA5000 in a sample SAN

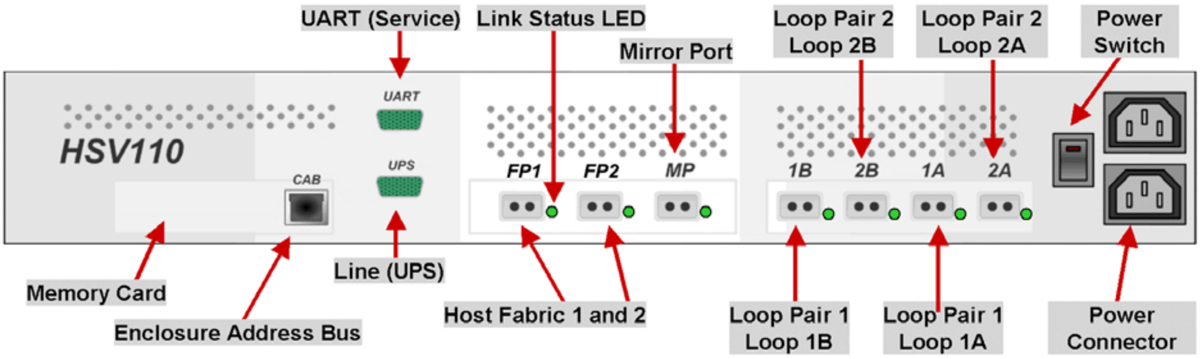


The fibrechannel connection between the EVA controllers and the FC-switch may look twisted (if configured symmetrically BOTH FP1 ports would be connected to FC-switch1 and BOTH FP2 ports would be connected to FC-switch2) however this "twisted" cabling scheme is a requirement if Continuous Access for EVA is used.

Hardware Architecture

HSV controllers

An EVA consists of a two array controllers (HSV110 for EVA5000 and HSV100 for EVA3000) each containing 2 fibrechannel ports for host connections (through FC switches) and 4 backend fibrechannel ports (only 2 for EVA3000) for the connection to the disk shelves.

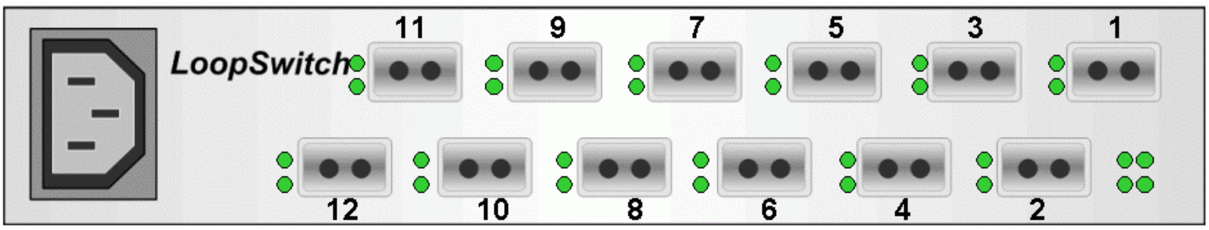


Rear view of a HSV110 controller

Both controllers (A and B) are connected over a single fibrechannel bus using the "Mirror Port MP". Through this link the two controllers exchange configuration information and mirror the write cache. Each HSV110 controller comes with 1GB Memory, divided to 512MB read and 256 mirrored write cache (not upgradeable). This amount of memory seems to be little compared to other disk arrays but looking at performance data it doesn't seem to have any negative impact on the EVA. The controllers A and B have WWNs (the "MAC address of the fibrechannel port") that end with "9" and "a" (Controller A FP1 and FP2) and with "d" and "c" (Controller B FP1 and FP2) as shown in the above picture. Until the EVA is initialized for the first time it cannot be said, which controller (upper or lower) will be controller A or controller B.

Loop switches

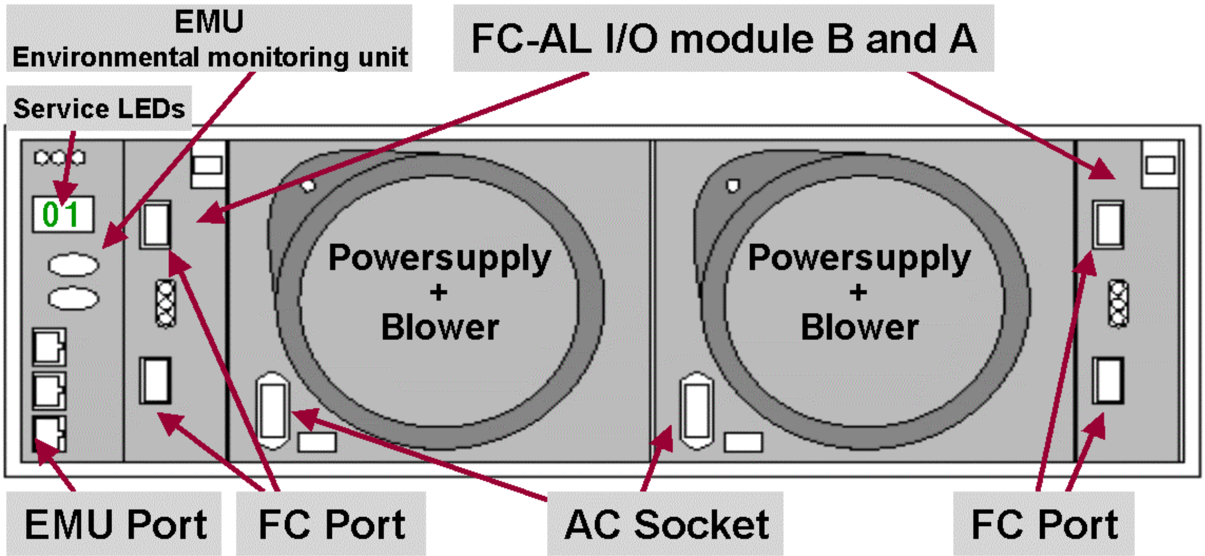
An EVA5000 with more than 4 disk shelves additionally includes 4 internal loop switches for the connection between controller and disk shelves. Disk shelves are always connected to two FC loops through the IO modules (2 per disk shelf).



Rear view of a Loop switch

Disk shelves

Each disk shelf can hold up to 14 dual ported fibrechannel disks. The Environmental Monitoring Unit EMU is connected via a serial bus to the controllers. The disk shelf contains 2 IO modules that are connected to the controllers directly or through the loop switch.



Rear view of a disk shelf

SAN Management Appliance

The SAN Management Appliance comes with every EVA and is a separate Proliant server running Windows 2000, equipped with one or two FC HBAs that connect to the EVA over a FC switch. The SAN Appliance acts as web server for the management of the EVA using "command view". All configuration communication (not the data traffic) between the hosts and the EVA must go through the SAN Appliance, tools like the scripting utility "sssu" must connect to the IP address of the SAN Appliance in order to issue commands like "create a vdisk", "create snapshot" or "add host".

EVA Design and best practices

The configuration of an EVA is rather simple and can be described in just a few words:

- Setup the hardware
- Initialize the EVA
- Create disk group(s)
- Define hosts
- Create virtual disks (vdisks) in vraid0, vraid1 or vraid5
- Present the vdisks to hosts

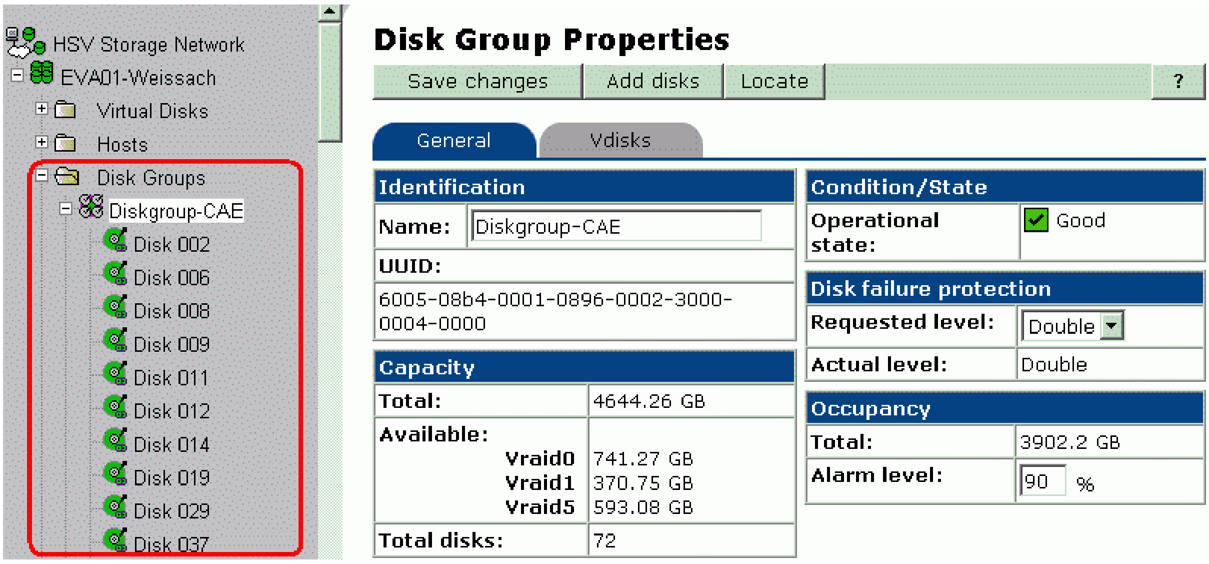
The management of the EVA by using the web interface of command view is very simple, there are not many parameters that could be "optimized". However it is important to understand the basic architecture of the EVA to be able to get a maximum of availability and performance.

Active / passive controller implementation

Different from other disk arrays like the VA or XP the two controllers A and B are not working active/active but rather active/passive for a LUN. That means that either Controller A OR controller B actively serves a certain LUN, not both at the same time. Multiple LUNs of course can be served from different controllers, so a kind of static load balancing between both controllers is possible by distributing the LUNs across both controllers. Every controller has 2 frontendports (FP1 and FP2) connected to fibrechannel switches. A LUN that is active on one controller can be load balanced across these two ports.
In case of a hardware failure it may be necessary that a LUN moves from one controller to the other controller. This controller failover needs to be initiated by the host by sending certain SCSI commands. Most operating systems (also HPUX) are not able to send this set of SCSI commands so additional software is needed in order to handle path failovers. For this reason Securepath is needed in all multipath environments. Securepath also is responsible for presenting only one path per vdisk to the host, multiple pathes are hidden. Securepath is described later in this chapter.
The 4 front end fibrechannel ports of the EVA always present the same LUNs, there is no way to configure the front end ports individually.

Disk Group

Physical disks are grouped into "disk groups". Disk groups are the only way to separate data onto different physical disks. LUNs (so called "virtual disks") within a disk group are always spread across all available disks in their disk group. A disk group can hold between 8 and 240 disks, disk types can be different in a disk group. The basic design decision for an EVA is how and if the disks are separated into different disk groups. There are many reasons to create only one single big disk group containing all the available disks in the EVA.



Advantages of a single big disk group

- The overall performance is optimal if the data of the virtual disks (LUNs) can be spread on as many disks as possible.
- If several small disk groups are created there is the chance that the overall free capacity would be enough in order to create an additional virtual disk but since this capacity is spread onto several disk groups it cannot be used for a single virtual disk. This then is called "stranded capacity". Stranded capacity can be avoided if only one big disk group is created.
- The protection level (reserved space for hot spare purposes) is defined per disk group. If many small disk groups would be created a lot of space would be needed to reserve this space in every disk group.

Possible reasons for creating more than one disk group

- If a physical isolation between different virtual disks (LUNs) is needed, the only way to do this is to create separate disk groups. An example is having 2 applications where one is accessing virtual disks from disk group 1 consisting of fast 36GB/15k disks and the second application is accessing virtual disks from disk group 2 consisting of big 146GB/10k disk drives.

Disk groups should never be 100% filled with virtual disk, because the EVA needs unallocated space in a disk group for certain tasks like sparing (recreating user data from redundancy information after a disk failure) or "leveling" (distributing data on all virtual disks evenly across all available disks in the disk group). The recommended maximum occupancy is 90% (starting from firmware version VCS3 also 95% should be ok, however still 90% are recommended). If the occupancy is higher than this, then these tasks may take much longer to complete or may not even complete at all.

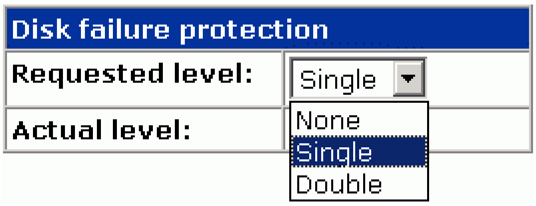
Because of the internal structure of the EVA firmware it is best to always have an even number of disks in a disk group and if possible to use a multiple of 8 disks in a disk group (see RSS below).

Redundant Storage Sets

The EVA VCS firmware manages disks in a disk group internally (not visible to the user)

using subsets referred to as Redundant Storage Sets or RSSs in order to maximize the availability of the data in an EVA. An RSS contains between six and 11 disk mechanisms with eight disks per RSS being the optimal number. All of the data in any given vraid-5 stripe (five blocks, four data and one parity block) will always reside on different disks in the same RSS. The same applies to vraid-1 virtual disks, two blocks building a mirrored pair ("married pair") always reside on different disks within the same RSS. The advantage is that no data is lost even if multiple disks fail simultaneously as long as the failed disks are located in different RSSs. The EVA VCS firmware tries to assign disks to RSSs so that all disks within a RSS are distributed across different disk shelves.
Example: an EVA with 8 disk shelves each containing 10 disks (80 disks total) is configured with one single disk group. Internally each RSS holds 8 disks, each residing in a separate disk shelve. If now a complete disk shelf fails (10 disks simultaneously!) then each RSS loses only 1 out of 8 disks and there is no data loss for vraid-1 and vraid-5 virtual disks.

Protection Level



Through specifying a protection level, capacity for hot spare purposes is reserved in a disk group. In order to spare a failed disk in a disk group containing vraid1 (striped and mirrored) virtual disks the EVA starts the hot spare process to two disks. For that reason the EVA reserves the capacity of the 2 largest disks if protection level "single" is used and the capacity of the largest 4 disks if the protection level "double" is used. If only raid5 (no raid1) virtual disks are used in a disk group a protection level "single" really is able to spare 2 sequentially failing disks ("double" then can even spare 4 sequentially failing disks). Before the reserved space defined in the protection level is used the EVA uses unallocated space for sparing failed disks.

Capacity planning

The following table shows a way how to roughly calculate the usable capacity for a disk group containing a certain number of disks:

	General	**Example**
Disk size	36GB / 72GB / 146GB	72 GB
# disks in disk group	Minimum 8, Maximum=# disks in the EVA	16
Protection Level	none / single / double	single
Raidlevel	Vraid0 / Vraid5 / Vraid1	Vraid5
Occupancy level	reserved space for sparing (90% recomm.)	90%
Raw capacity	disksize * # disks	72GB * 16 = 1152 GB
Reduction for formatting	approx. 7% ~ 93% of raw capacity	1152GB * 93% = 1071 GB
Reduction for protect. Level	2*(Protectionlevel)*(formatted disksize)	1071GB-(2*1*(72GB*93%)) ~ 948 GB
Reduction for Raidlevel	R0: 100%, R5: 80%, R1: 50%	948 * 80% = 758 GB
Reduction for Occupancy	recommended maximal 90%	758GB * 90% = **674 GB**

The following table contains roughly calculated values for different disk group configurations:

Sample EVA capacities with protection level single (72GB disks)										
Number of 72GB Disks	Raw capacity in GB	Usable capacity in GB (100% Occupancy)			Usable capacity in GB (90% Occupancy)			Usable capacity per 72GB Disk (90% Occupancy)		
		Vraid0	Vraid5	Vraid1	Vraid0	Vraid5	Vraid1	Vraid0	Vraid5	Vraid1
8	576	401	321	201	361	289	181	50	40	25
9	648	468	374	201	422	337	181	52	42	22
10	720	535	428	268	482	385	241	54	43	27
11	792	602	481	268	542	433	241	55	44	24
12	864	669	535	335	602	481	301	56	45	28
13	936	736	588	335	662	530	302	57	45	26
14	1008	803	642	401	723	578	361	57	46	29
15	1080	870	695	401	783	626	361	58	46	27
16	1152	937	749	468	843	674	422	59	47	29
24	1728	1472	1177	736	1325	1059	662	61	49	31
32	2304	2007	1605	1004	1807	1444	903	63	50	31
40	2880	2543	2033	1271	2288	1829	1144	64	51	32
48	3456	3078	2461	1539	2770	2215	1385	64	51	32
56	4032	3613	2889	1807	3252	2600	1626	65	52	32
64	4608	4149	3316	2074	3734	2985	1867	65	52	32
72	5184	4684	3744	2342	4216	3370	2108	65	52	33
80	5760	5219	4172	2610	4697	3755	2349	65	52	33
88	6336	5755	4600	2877	5179	4140	2590	65	52	33
96	6912	6290	5028	3145	5661	4525	2830	66	52	33
104	7488	6825	5456	3413	6143	4911	3071	66	52	33
112	8064	7361	5884	3680	6625	5296	3312	66	53	33
120	8640	7896	6312	3948	7106	5681	3553	66	53	33
240	17280	15926	12731	7963	14333	11458	7167	66	53	33

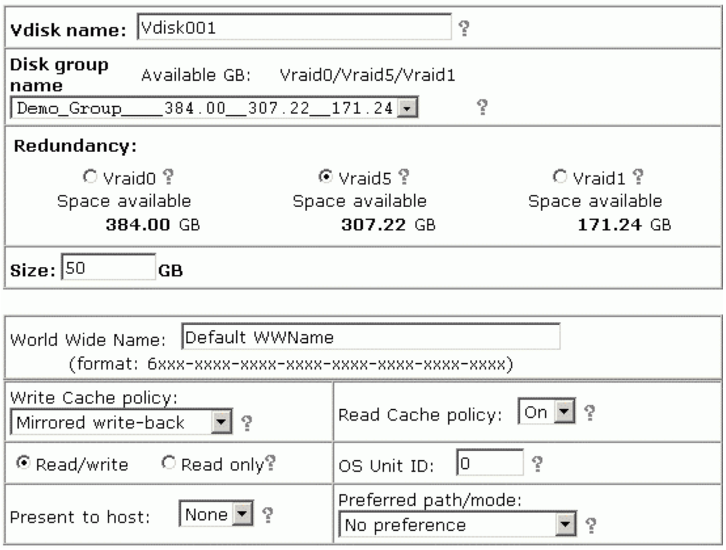
Virtual Disks

Virtual disks are created in a disk group and later presented to hosts (LUNs). Virtual disks are always spread all available disks in the disk group. If the disk group size changes (by adding or removing physical disks) the EVA starts a reorganization of the virtual disk data blocks (= leveling). As soon as the leveling process has completed every virtual disk again is distributed across all available disks in the disk group.

Virtual Disk parameters

Three different raid levels can be chosen:

- **Vraid-0**
  pure striping, no redundancy, distributed across all available disks in the disk group. Data loss after just one disk failure. Not recommended. Data efficiency: 100%
- **Vraid-5**
  4 data blocks and 1 parity block, distributed across all available disks in the disk group. Data efficiency: 80%
- **Vraid-1**
  striping and mirroring, distributed across all available disks in the disk group. Data efficiency: 50%



All virtual disk parameters (WWN, Mirrored-write-back, Read Cache Policy, Read/Write, OS Unit ID and preferred path/mode) should be left at their default values (as shown above).

Port loading equation

When it comes to the decision how many virtual disks you create you should take into account that for every LUN on each host a SCSI queue is opened which has to be served by a corresponding SCSI queue on the EVA front end fibrechannel ports. It should be avoided (for example by creating less but bigger LUNs) to overload the EVA by opening too many SCSI queues. The formula for the load calculation is as follows:

- Queue depth = 8 = default for HPUX (maybe bigger for Windows hosts!)
- max. Queue depth per EVA port = 2048
- max. Queue depth per EVA controller (2 ports per controller) = 4096 (worst case calculation assumes that one controller has failed and the other one has to handle all LUNs)
- max. amount of LUNs = 4096 / 8 = 512

Bottom line: in a pure HPUX environment there should be no more than 512 LUNs configured per EVA in order to avoid a possible port overloading. If hosts with greater Queue depths are used this number should be reduced according to the above calculation.

Snapshots and Snapclones

Snapshots are pointer-based instant copies from regular virtual disks. Snapshots can only be generated in the same disk group as the original vdisk. Only changes (write ios) to the original vdisk and to the snapshot are physically written to disk. This architecture allows the creation of “capacity free snapshots” (=“demand-allocated snapshots”). The physical capacity needed to store the snapshot can vary between 0 (if the data on the original vdisk and snapshot doesn’t change) and the full capacity of the original vdisk. Rather than creating “capacity free snapshots” it is also possible to create “standard snapshot” (=“fully-allocated snapshot”) which reserve the capacity of the original vdisk at the time of creation. Snapshots are typically used for split-mirror backups.

Snapclones can be created between different disk groups (other than snapshots!). The snapclone is instantly available through the same pointer technology as used in snapshots, but the data of the original vdisk is copied in the background to the destination vdisk/snapclone. As soon as this copy process has finished, the snapclone can be treated as any other vdisk in the system. Snapclones can be used for example to clone a productive system to a testsystem.

Continuous Access

Continuous Access can be established between two EVA5000 systems by connecting the frontend fibrechannel ports together. It then allows the creation of data replication (vdisk replication) between the two EVA5000 systems. The differences between CA for EVA compared to CA for XPs are:

- The replicated vdisks (on the remote EVA) are only visible to the hosts if a failover is initiated
- The target vdisks on the remote EVA are created automatically
- There is no way to resync from the remote EVA to the local EVA except a failover

Continuous Access like all other commands must be issued over TCP/IP to the SAN Management Appliance, there is no direct communication over fibrechannel from the host to the EVA (like raidmanager for the XP). Metrocluster for HPUX does not support EVA.

Securepath for HPUX

Because of the active/passive controller implementation of the EVA (descibed earlier in this chapter) Securepath for HPUX is required for accessing the EVA over multiple paths from HPUX. Securepath is able to handle controller failovers and hides all “physical” paths (usually 4 paths when using 2 HBAs connected to 2 separate SANs) to the EVA from HPUX, instead it creates one single virtual path / devicefile per vdisk.

Installation Secure Path

The HPUX system must be well patched before Securepath can be installed (see releasenotes of Securepath). Here is the procedure to install Securepath from CD:

```
# pfs_mountd &
# pfsd &
# pfs_mount /dev/dsk/c0t1d0 /SD_CDROM
# cd swsp_v30b_hp/
# ./CPQswspInstall_v30b.sh
```

There is an automatic reboot at the end of the installation!

PV timeout for Securepath devices

It is recommended to increase the PV timeout values from defaukt (30s) to 60s:

```
# pvchange -t 60 /dev/dsk/c100t0d0
```

ioscan with Securepath

It maybe necessary to reboot the machine once in order to make the EVA vdisks visible to HPUX. Here is how ioscan looks before Securepath is installed:

```
ba          11  1/4                     lba       CLAIMED    BUS_NEXUS    Local PCI Bus
             Adapter
fc           3  1/4/0/0                 td        CLAIMED    INTERFACE    HP Tachyon XL2
fcp          1  1/4/0/0.82              fcp       CLAIMED    INTERFACE    FCP Domain
ext_bus    112  1/4/0/0.82.9.0.0        fcparray  CLAIMED    INTERFACE    FCP Array Interface
target      14  1/4/0/0.82.9.0.0.0      tgt       CLAIMED    DEVICE
ctl         82  1/4/0/0.82.9.0.0.0.0    sctl      CLAIMED    DEVICE       COMPAQ  HSV110
             (C)COMPAQ
hsx         12  1/4/0/0.82.9.0.0.0.1    hsx       CLAIMED    DEVICE       HSV110  (C)COMPAQ
             PATH 0x600508B4000108960002100000AD0000
ext_bus     17  1/4/0/0.82.9.255.0      fcpdev    CLAIMED    INTERFACE    FCP Device
             Interface
target      15  1/4/0/0.82.9.255.0.0    tgt       CLAIMED    DEVICE
ctl        114  1/4/0/0.82.9.255.0.0.0  sctl      CLAIMED    DEVICE       COMPAQ  HSV110
             (C)COMPAQ
ext_bus    122  1/4/0/0.82.10.0.0       fcparray  CLAIMED    INTERFACE    FCP Array Interface
target      16  1/4/0/0.82.10.0.0.0     tgt       CLAIMED    DEVICE
ctl        116  1/4/0/0.82.10.0.0.0.0   sctl      CLAIMED    DEVICE       COMPAQ  HSV110
             (C)COMPAQ
hsx         16  1/4/0/0.82.10.0.0.0.1   hsx       CLAIMED    DEVICE       HSV110  (C)COMPAQ
             PATH 0x600508B4000108960002100000AD0000
ext_bus     20  1/4/0/0.82.10.255.0     fcpdev    CLAIMED    INTERFACE    FCP Device
             Interface
target      17  1/4/0/0.82.10.255.0.0   tgt       CLAIMED    DEVICE
ctl        142  1/4/0/0.82.10.255.0.0.0 sctl      CLAIMED    DEVICE       COMPAQ  HSV110
             (C)COMPAQ
```

After the Securepath installation all physical paths to the EVA disappear, instead one path per vdisk appears under HW path 255/255:

```
# ioscan -fkCdisk
Class      I  H/W Path       Driver   S/W State   H/W Type     Description
==========================================================================
disk       0  0/0/1/1.2.0    sdisk    CLAIMED     DEVICE       HP 36.4GST336753LC
disk       1  0/0/2/0.2.0    sdisk    CLAIMED     DEVICE       HP 36.4GST336753LC
disk       2  0/0/2/1.2.0    sdisk    CLAIMED     DEVICE       HP       DVD-ROM 305
disk       3  255/255/0.0.0  sdisk    CLAIMED     DEVICE       HSV110  (C)COMPAQ LUN
             0x600508B4000108960002100000AD0000
```

All vdisks (LUNs) presented to the HPUX host can be displayed using the following Securepath command:

```
# spmgr display
  Server:  kalmbachs-buexxe    Report Created: Thu, May 15 17:53:53 2003
  Command: spmgr display
  = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
  Storage:  5000-1FE1-5000-E0E0
  Load Balance: On   Auto-restore: Off
  Path Verify: On    Verify Interval: 30
  HBAs: td0  td1
  Controller:  P5849D4AAOJ05U, Operational
               P5849D4AAOJ05G, Operational
  Devices:  c100t0d0  c100t0d1  c100t0d2

  TGT/LUN   Device            WWLUN_ID                 H/W_Path           #_Paths
    0/  0   c100t0d0          6005-08B4-0001-0896-0002-1000-00AD-0000   4
                                                       255/255/0.0.0
          Controller  Path_Instance      HBA          Preferred?  Path_Status
          P5849D4AAOJ05U                                   no
                      c111t0d1           td0          no          Active
                      c112t0d1           td1          no          Available

          Controller  Path_Instance      HBA          Preferred?  Path_Status
          P5849D4AAOJ05G                                   no
                      c122t0d1           td0          no          Standby
                      c121t0d1           td1          no          Standby
```

Note that there is no relation between the SCSI address of the virtual Securepath device (devicefile) and the LUN number of the vdisk! The Securepath device file addresses are simply increased starting from t0d0. In order to save the relation between the vdisk and the device file (make it persistent across reboots) the following procedure must be executed every time a LUN change is done for the HPUX host. Please note that the procedure is documented here for Securepath version 3.0b. The procedure for Securepath 3.0a after "spmgr update" is slightly different, but "spmgr update" always displays the next steps.

```
# spmgr update

 Run kmadmin -L swspData
      config -M swspData -u
 for changes to persist across reboots.

# kmadmin -L swspData
kmadmin: Module swspData loaded, ID = 2

# config -M swspData -u
Generating module: swspData...
Requesting loadable module update...

  Specified module(s) below is(are) activated successfully.
      swspData
```

Securepath settings

The default settings are as follows and should not be changed:

```
# spmgr display
  Server:  kalmbachsbuexxe    Report Created: Mon, Apr 14 15:08:12 2003
  Command: spmgr display
  = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
  Storage:  5000-1FE1-5000-E010
  Load Balance: Off  Auto-restore: Off
  Path Verify: On    Verify Interval: 30
```

The settings can be changed using the following commands:

```
# spmgr set -b on   (Loadbalancing between FP1 and FP2, Default=off)
# spmgr set -a off  (Autorestore, Default=Off)
# spmgr set -p on   (Path Verification, Default=on)
# spmgr set -f 30   (Path Verification Interval, Default=30s)

# spmgr update ; kmadmin -L swspData ; config -M swspData -u
```

Securepath Administration

LUN addition

Every time new LUNs are presented to the HPUX host, Securepath assigns a certain device file to the LUN. In order to make this Device file persistent across reboots, the following procedure must be done (if not, the device file may change after the next reboot!):

```
# ioscan -fCdisk
# spmgr update

 Run kmadmin -L swspData
      config -M swspData -u
 for changes to persist across reboots.

# kmadmin -L swspData
kmadmin: Module swspData loaded, ID = 2

# config -M swspData -u
Generating module: swspData...
Requesting loadable module update...

  Specified module(s) below is(are) activated successfully.
      swspData
```

LUN deletion

LUNs that are deleted on the SAN Appliance are still visible in ioscan (even with “CLAIMED” !) until these LUNs are manually removed using Securepath commands. Careful! These commands even work on LUNs that are not deleted on the EVA! A LUN that has been deleted (or unpresented) on the Management Appliance is displayed as follows in Securepath:

```
# spmgr display
  TGT/LUN   Device             WWLUN_ID              H/W_Path            #_Paths
    0/  2   c100t0d2           6005-08B4-0001-0896-0002-1000-00B4-0000    4
                                                     255/255/0.0.2
          Controller  Path_Instance      HBA              Preferred?  Path_Status
          P5849D4AAOJ05U                                      no
                      c111t0d5           td0              no          ****FAILED
                      c112t0d5           td1              no          ****FAILED

          Controller  Path_Instance      HBA              Preferred?  Path_Status
          P5849D4AAOJ05G                                      no
                      c122t0d5           td0              no          ****FAILED
                      c121t0d5           td1              no          ****FAILED
```

In order to remove these LUNs from ioscan the following command needs to be issued:

```
# spmgr delete 6005-08B4-0001-0896-0002-1000-00B4-0000
```

To remove all EVA devices from the HPUX host, the following command can be used (where the WWN refers to the WWN of the EVA, see top of spmgr display):

```
# spmgr delete -r 5000-1FE1-5000-E0E0 all
```

In order to add all EVA devices back to the HPUX host, the following command can be issued:

```
# spmgr add -r 5000-1FE1-5000-E0E0 all
```

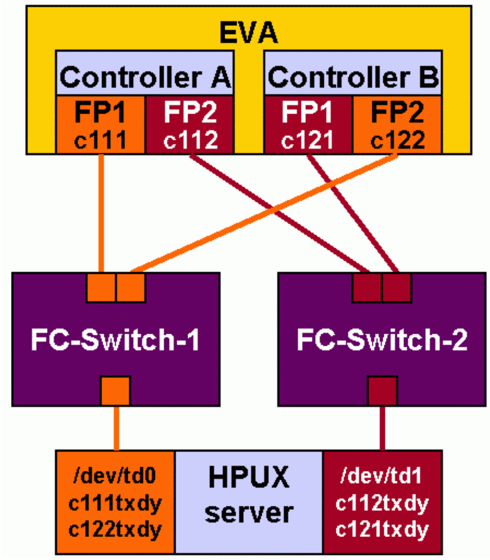
Securepath status check

With the following command all active paths to the EVA devices can be listed:

```
# spmgr display | grep Active | sort
                      c111t0d1           td0              no          Active
                      c112t0d2           td1              no          Active
                      c111t0d4           td0              no          Active
                      c121t0d3           td1              no          Active
                      c122t0d5           td0              no          Active
```

Selection of preferred paths

Using the spmgr select command, Securepath can switch the active paths to the EVA either from one HBA to a second HBA or from one EVA controller to another EVA controller. For better understanding in the following example the HPUX device file instances have been renumbered (using ioinit) so that the second digit behind “c” refers to 1 for controller A and 2 for controller B of the EVA ; the third digit refers to 1 for FP1 and 2 for FP2:




```
# spmgr select -?

Usage: spmgr select [option]

    options:
        -a <adapter>  [-d device]
        -c <controller_ser_num> [-d device]
        -p <path instance>

# spmgr display | grep Active
                 c111t0d1          td0          no          Active
                 c112t0d2          td1          no          Active
                 c111t0d4          td0          no          Active
                 c121t0d3          td1          no          Active
                 c122t0d5          td0          no          Active
# # Change all active paths to first HBA
# spmgr select -a td0
# spmgr display | grep Active
                 c111t0d1          td0          no          Active
                 c111t0d2          td0          no          Active
                 c111t0d4          td0          no          Active
                 c122t0d3          td0          no          Active
                 c122t0d5          td0          no          Active
# # Change all active paths to second HBA
# spmgr select -a td1
# spmgr display | grep Active
                 c112t0d1          td1          no          Active
                 c112t0d2          td1          no          Active
                 c112t0d4          td1          no          Active
                 c121t0d3          td1          no          Active
                 c121t0d5          td1          no          Active
# # Change all active paths to EVA controller A
# spmgr select -c P4889B49IM001P
# spmgr display | grep Active
                 c112t0d1          td1          no          Active
                 c112t0d2          td1          no          Active
                 c112t0d4          td1          no          Active
                 c111t0d3          td0          no          Active
                 c111t0d5          td0          no          Active
# # Change all active paths to EVA controller B
# spmgr select -c P4889B49IM000O
# spmgr display | grep Active
                 c122t0d1          td0          no          Active
                 c122t0d2          td0          no          Active
                 c122t0d4          td0          no          Active
                 c121t0d3          td1          no          Active
                 c121t0d5          td1          no          Active
```

Scripting Utility sssu

The EVA can be controlled not only from the web interface but also through a command line interface from hosts. The scripting utility sssu is part of the "platform kit" which is available for different operating systems, also HPUX. The sssu utility connects via network to the Management appliance that then forwards the commands to the EVA.

sssu startup and connection to the EVA

```
buexe3:root-/ # sssu
SSSU Build 72 for EVA Version 3

NoSystemSelected> select manager <Appliance-IP> user=administrator
            password=eva

NoSystemSelected> show system
Systems available on this Manager:
  Kalmbachs_EVA

NoSystemSelected> select system "Kalmbachs_EVA"

Kalmbachs_EVA>
```

Sample sssu session to display vdisks and hosts

```
Kalmbachs_EVA> ?
  The options are:
    ADD
    CAPTURE
    DELETE
    EXIT
    FILE
    HELP
    RESTART
    SELECT
    SET
    SHOW
    SHUTDOWN

Kalmbachs_EVA> show ?
  The options are:
    DISK
    DISK_GROUP
    DR_GROUP
    FOLDER
    HOST
    LUN
    MANAGER
    MONITOR
    OPTIONS
    POWER
    SYSTEM
    VDISK
    WORLD_WIDE_NAME

Kalmbachs_EVA> show HOST
Hosts available on this Cell:
  \Hosts\kalmbach\buexe0
  \Hosts\kalmbach\buexe1

Kalmbachs_EVA> show host "\Hosts\kalmbach\buexe0"
\Hosts\kalmbach\buexe0 information:
  Identification:
                      Name : \Hosts\kalmbach\buexe0
                 IPAddress : Dynamic IP Assignment
                    Status : Initialized - Good
          Operating_System : HPUX
    Fibre_Channel_adapter_ports:
```

```
   Fibre_Channel_adapter_ports [0]:
                             Port : 2100-00e0-8b0b-5955
 Presentation:
 Presentation [0]:
                            Lun : 1
                   Virtual_disk : \Virtual Disks\kalmbach\vdisk1\ACTIVE
 Presentation [1]:
                            Lun : 2
                   Virtual_disk : \Virtual Disks\kalmbach\vdisk2\ACTIVE
 Presentation [2]:
                            Lun : 3
                   Virtual_disk : \Virtual Disks\kalmbach\vdisk3\ACTIVE
 Presentation [3]:
                            Lun : 4
                   Virtual_disk : \Virtual Disks\kalmbach\vdisk4\ACTIVE
                   Comments :
                         ID : 00800710b4080560a94701000080000000f104
```

```
Kalmbachs_EVA> show vdisk
Vdisks available on this Cell:
  \Virtual Disks\kalmbach\vdisk1\ACTIVE
  \Virtual Disks\kalmbach\vdisk2\ACTIVE
  \Virtual Disks\kalmbach\vdisk3\ACTIVE
  \Virtual Disks\kalmbach\vdisk4\ACTIVE
```

Sample sssu session to capture the EVA configuration

The complete configuration of the EVA can be captured in a single text file. This file contains all sssu commands to recreate the EVA from scratch (including disk group, hosts and vdisk information). It can be of great value to backup the EVA configuration through this command just in case the EVA needs to be reconfigured after a disaster. Several files are generated, the important file containing all the configuration info is “evaconfig_Step1A”.

```
Kalmbachs_EVA> capture configuration /tmp/evaconfig
    CAPTURE CONFIGURATION may take awhile.  Do not modify configuration
    until command is complete.
Generating file /tmp/evaconfig_Step1A
..............................
    CAPTURE CONFIGURATION Step1A complete and successful
Generating file /tmp/evaconfig_Step1B
....
    CAPTURE CONFIGURATION Step1B complete and successful, but it was
    determined that it was unnecessary.  File not generated.
Generating file /tmp/evaconfig_Step1C
....
    CAPTURE CONFIGURATION Step1C complete and successful, but it was
    determined that it was unnecessary.  File not generated.
Generating file /tmp/evaconfig_Step2
    CAPTURE CONFIGURATION Step2 complete and successful, but it was
    determined that it was unnecessary.  File not generated.
Generating file /tmp/evaconfig_Step3
....
    CAPTURE CONFIGURATION Step3 complete and successful, but it was
    determined that it was unnecessary.  File not generated.
Kalmbachs_EVA>
```

Sample sssu session to create a vdisk

```
Kalmbachs_EVA> ADD FOLDER "\Virtual Disks\martin"
Kalmbachs_EVA> ADD FOLDER "\Hosts\martin"
Kalmbachs_EVA> ADD HOST "\Hosts\martin\buexe3" OPERATING_SYSTEM=HPUX
            WORLD_WIDE_NAME=5006-0b00-0013-0aec
Kalmbachs_EVA> ADD VDISK "\Virtual Disks\martin\lun1" DISK_GROUP="\Disk
            Groups\Default Disk Group" SIZE=1 REDUNDANCY=VRAID5
            MIRRORED_WRITEBACK READ_CACHE NOWRITE_PROTECT OS_UNIT_ID=0
            NOPREFERRED_PATH WAIT_FOR_COMPLETION
Kalmbachs_EVA> ADD LUN 1 VDISK="\Virtual Disks\martin\lun1\ACTIVE"
            HOST="\Hosts\martin\buexe3"
```

Additional Information

StorageWorks Software Support
http://h18006.www1.hp.com/storage/sanworks-support.html

EVA Licensing
http://h18000.www1.hp.com/products/software/softwarekeys/index.html

All following Links are HP internal:

Command view EVA v3.0 Offline Menu structure
http://aso.bbn.hp.com/~martiilg/eva/commandview-menu/index.html

Cybrary EVA5000
http://cybrary.inet.cpqcorp.net/HW/STOR/CONTROLLERS/HSV110/index.html

Cybrary Secure Path Home Page
http://cybrary.inet.cpqcorp.net/SW/LP/SYSMGT/STORAGE/SECUREPATH/index.html

EVA Platform Kits
http://stgwrks.mro.cpqcorp.net/IBS/pltkit.asp

NSS - EVA
http://storage.inet.cpqcorp.net/application/view/prodcenter.asp?ProdCode=278

NSS Expert Center, Boeblingen, Germany
http://hpbbse.bbn.hp.com/

Performance Tools XP+VA+EVA
http://nss-xpperftools.corp.hp.com/index.htm

Presales Linksammlung
http://storage.jgo.cpqcorp.net/presales/

Storage Software Download
http://storage.jgo.cpqcorp.net/kits/

Storage Tools
http://storagetools.lvld.hp.com/