EVA Setup and Configuration

Agenda

- Licensing
- Initializing the EVA
- Troubleshooting

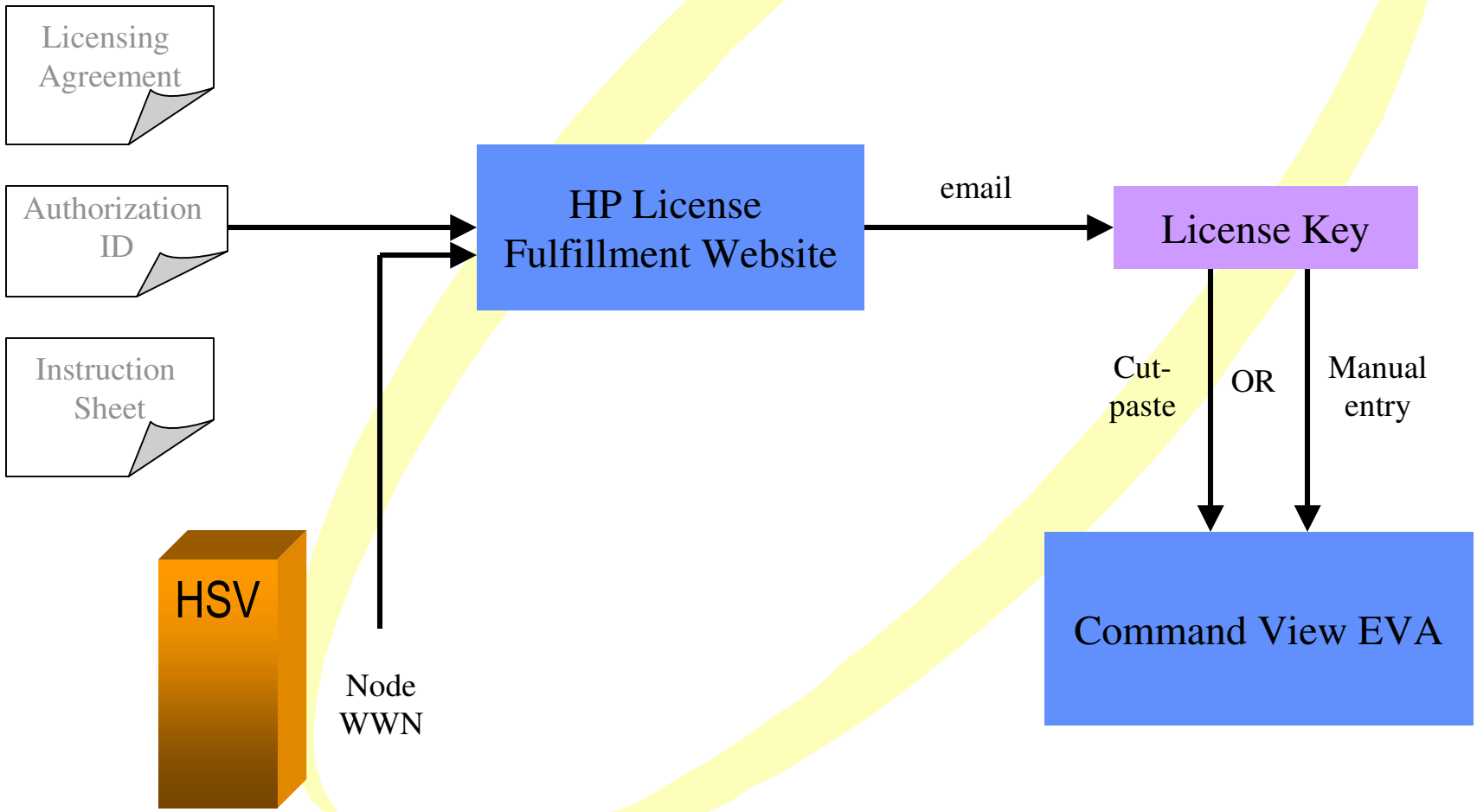
General HSV Licensing

- License keys are stored on Management Server hard drive and on each Management Logical Disk (MLD)
  - Keep Record
- Loss of Management Server does not lose licensing state
- VCS software on controller is full featured
- Basic license required to initialize storage cell
- Feature licenses are tied to a specific subsystem (WWN) and cannot be moved
- Feature License validated whenever a feature is requested :
  - By Command View EVA
- Basic license is never revalidated on an initialized storage cell
- Command View EVA blocks access to VCS features which do not have a corresponding license
- FLEXlm 7.0 is underlying product managing and creating licenses

General HSV Licensing

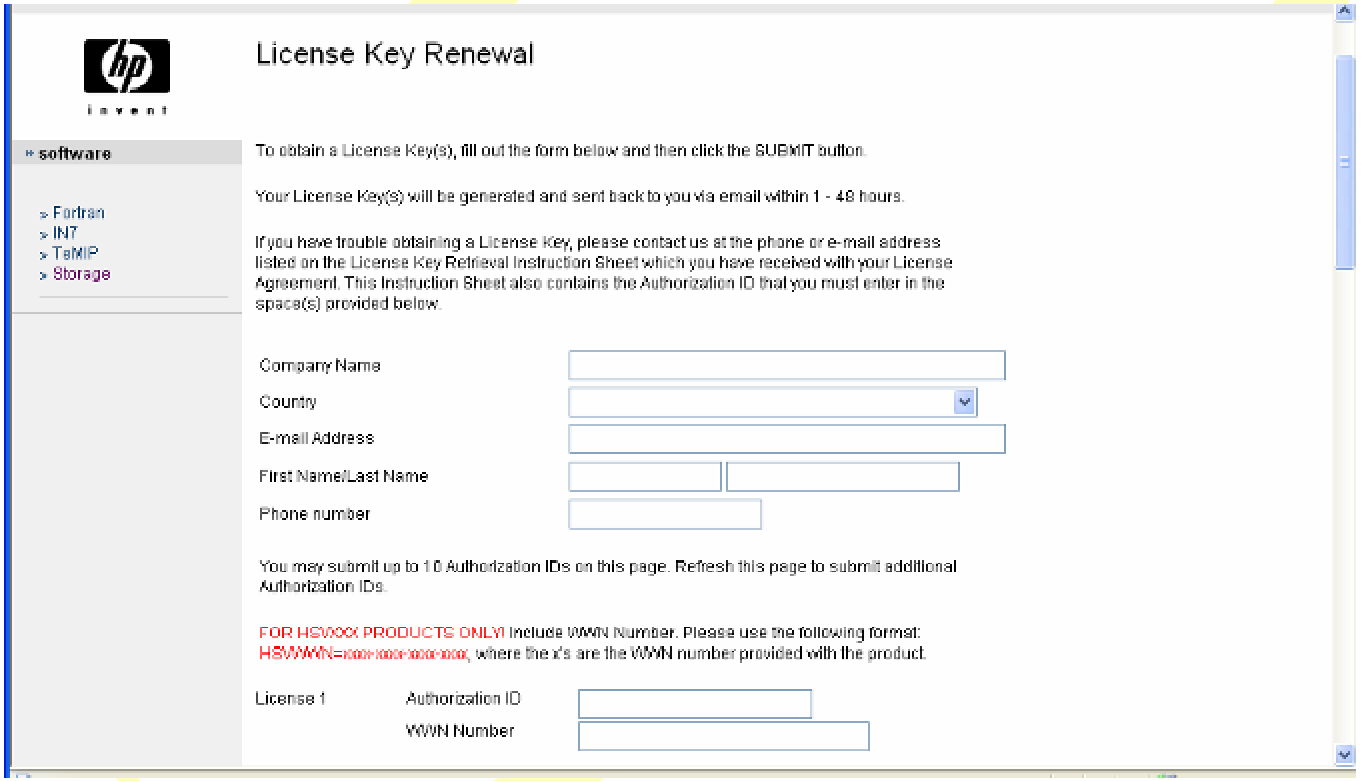
- License enforcement is based on VCS version number
- VCS versions are changed with a SuperImage firmware load
- 1.xy to 1.xz change does not require any new license keys
- 1.x to 1.y change requires new license keys
- SuperImage update which contains a VCS level which is not licensed will require a license in order to complete

HSV Licensing Flow



Obtaining Licenses

- Go to http://h18000.www1.hp.com/products/software/softwarekeys/index.html
- Enter authorization ID and WWN



Sample License—Base License

Compaq Computer Corporation

Version 3.5b GTLicensing Fulfillment System.

The lines of software instructions denoted below are your LICENSE KEY.

To avoid typographical errors, COPY the License Key from this message

using a text editor and PASTE into your license file. Refer to your FLEXlm

End User\'s Manual for more information on license files.

>>> LICENSE KEY begins AFTER THIS LINE <<< Start your copy there.

```
INCREMENT HSV110-BASIC Compaq 1.0 permanent uncounted 92ACB0BDABC7 \
        HOSTID=HSVWWN=5000-1FE1-0011-0000 NOTICE="Authorization \
        =xxxxxxxxxxxxxxxxxxxx, Qty 1, QM-6RNAA-AA1.0, VCS PKG V1.0 \
        DUAL HSV CNTLR" ck=100
```

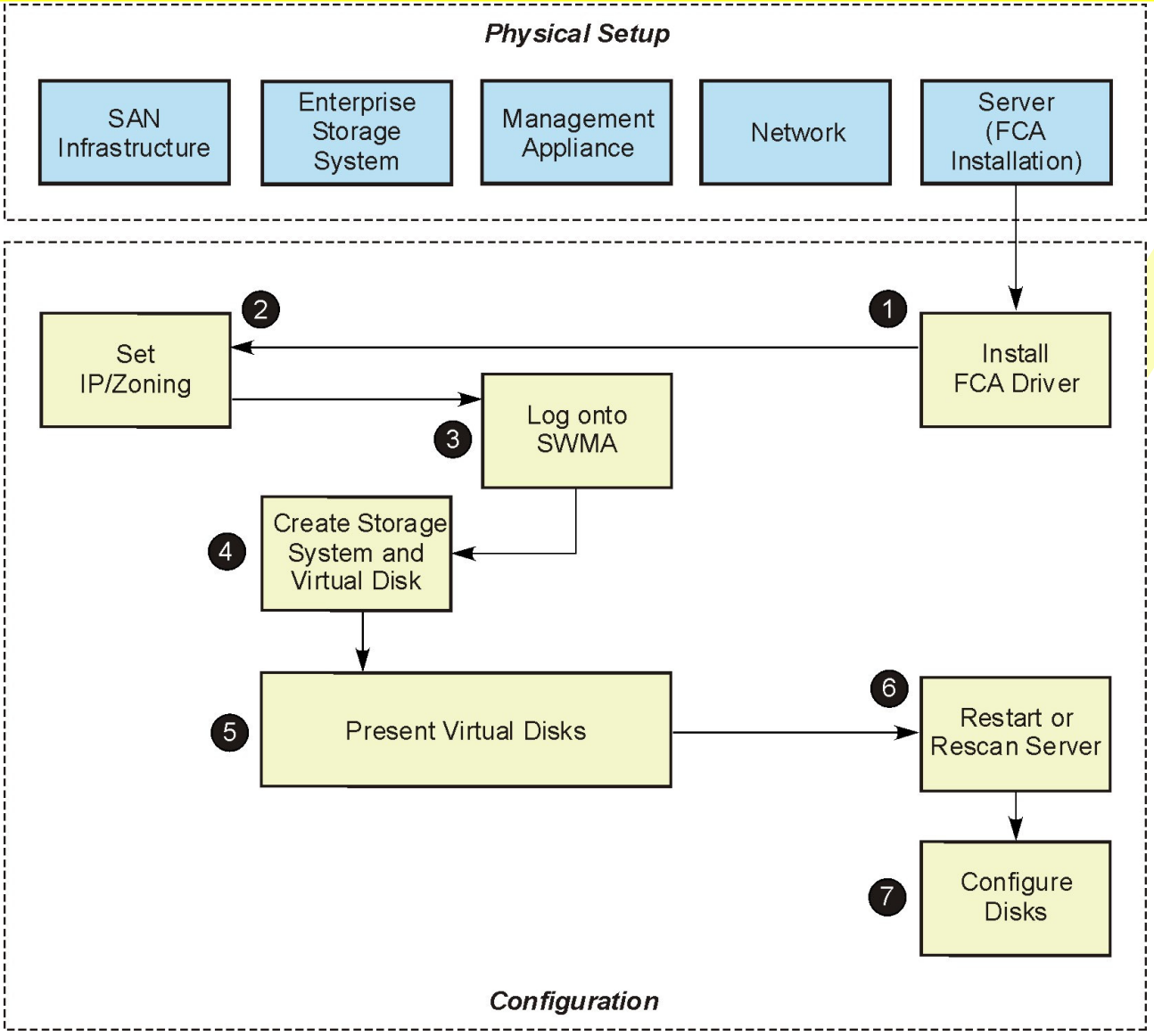
>>> LICENSE KEY ends BEFORE THIS LINE <<< End your selection on the PREVIOUS line

to complete your COPY.

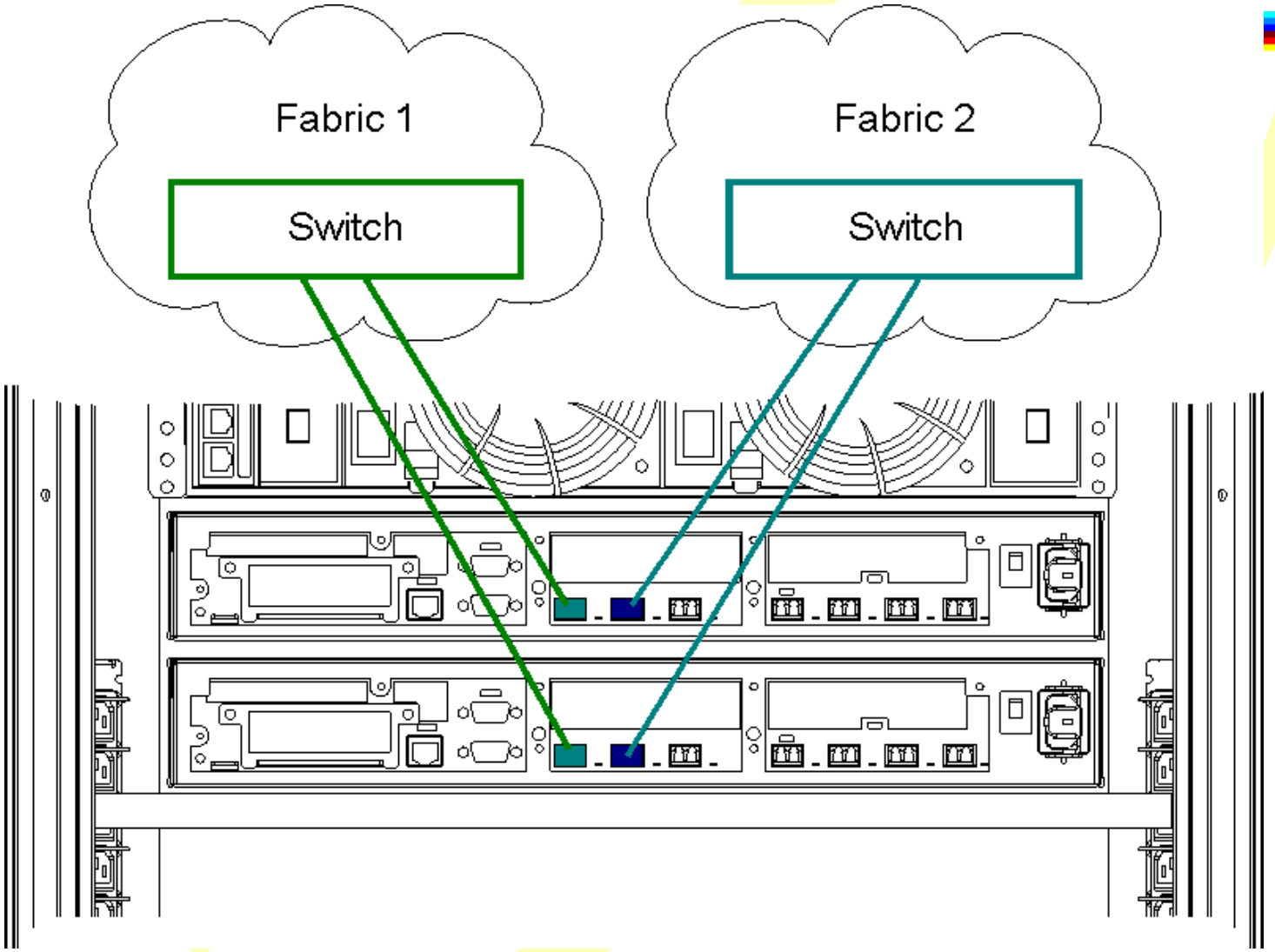
If you have any problems installing this license key, contact the parties listed on the

associated license documentation or web site.

Configuring the Enterprise Virtual Array



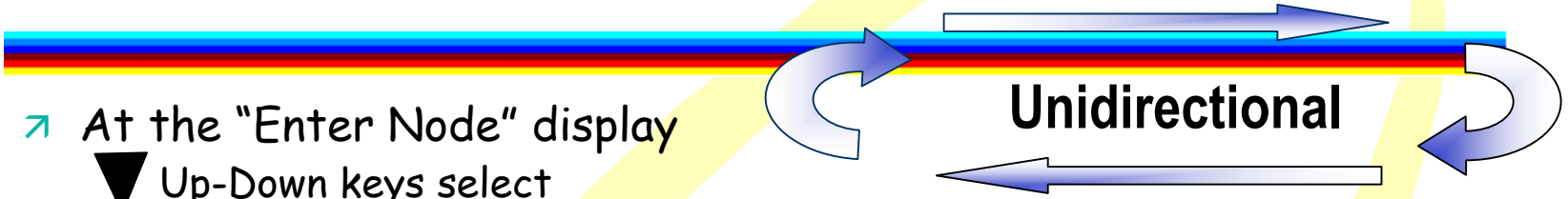
HSV110 Fabric Cabling



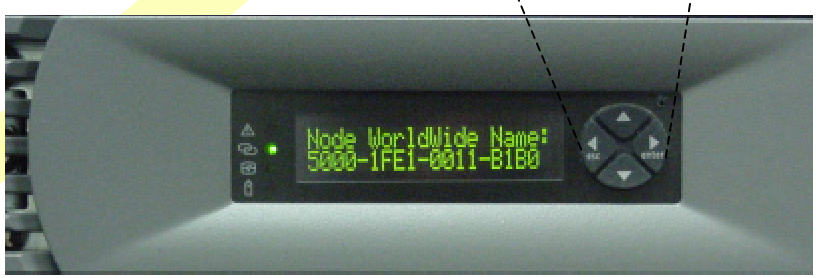
Step 1—Before Launching the Command View EVA

- Fabric ports (FP1, FP2) remain disabled until WWN is configured
- Use the Operator Control Panel (OCP) to enter in WWN and Checksum
  - Located on front of rack adjacent to HSV110 controllers
  - Successful configuration displays the WWN on LCD of both controllers
- Verify FP1 and FP2 have a link into the fabric, LED adjacent to each port
  - Green LED indicates link is up
  - Amber LED indicates link is down

LCD WWN Programming



- At the "Enter Node" display
  - Up-Down keys select hexadecimal number
  - Right key moves position to right
  - Left key enters the number and moves to checksum step
- At the "Enter Checksum" display
  - Up-Down keys select Letter/Number
    - Full alphabet
  - Right key moves to the right
  - Left key completes operation



LCD Front Panel Display Messages

Initialization Confirmation

REALLY INIT SYSTEM?
NO

↓

DATA WILL BE LOST!
NO

Password Confirmation

CHANGE PASSWORD?
NO

OR

CLEAR PASSWORD?
NO

Shutdown Confirmation

POWER OFF SYSTEM?
NO

OR

RESTART SYSTEM?
NO

OR

IDLE SYSTEM?
NO

WWID Entry

Enter World Wide ID:
0000-0000-0000-0000

↓

Enter WWID Checksum:
00

The Very First Time – Uninitialized Storage System

Compaq SANworks
HSV Element Manager

Appliance:
SWMAN1K215
172.16.120.100

Home | Options | Help | Exit

HSV Storage Network
Uninitialized Storage System

View Events... | Rediscover | Page Help

HSV Storage System Network Properties	
Name:	HSV Storage System Network
Total HSV systems:	1
Total storage space:	0.00 GB
Storage space used:	0.00 GB
Available storage space:	0.00 GB

Compaq Confidential

Uninitialized Storage Cell

Compaq SANworks
HSV Element Manager

Appliance:
SWMAN1K215
172.16.120.100

Home | Options | Help | Exit

HSV Storage Network
Uninitialized Storage System
Hardware

Initialize... | Set Time... | View Events... | Code Load... | Page Help

Uninitialized HSV Storage System Properties	
Name:	Uninitialized Storage System
Operational State:	Uninitialized - Good
Total storage space:	0.00 GB
Controller time:	05 Jul 2001 16:18:38

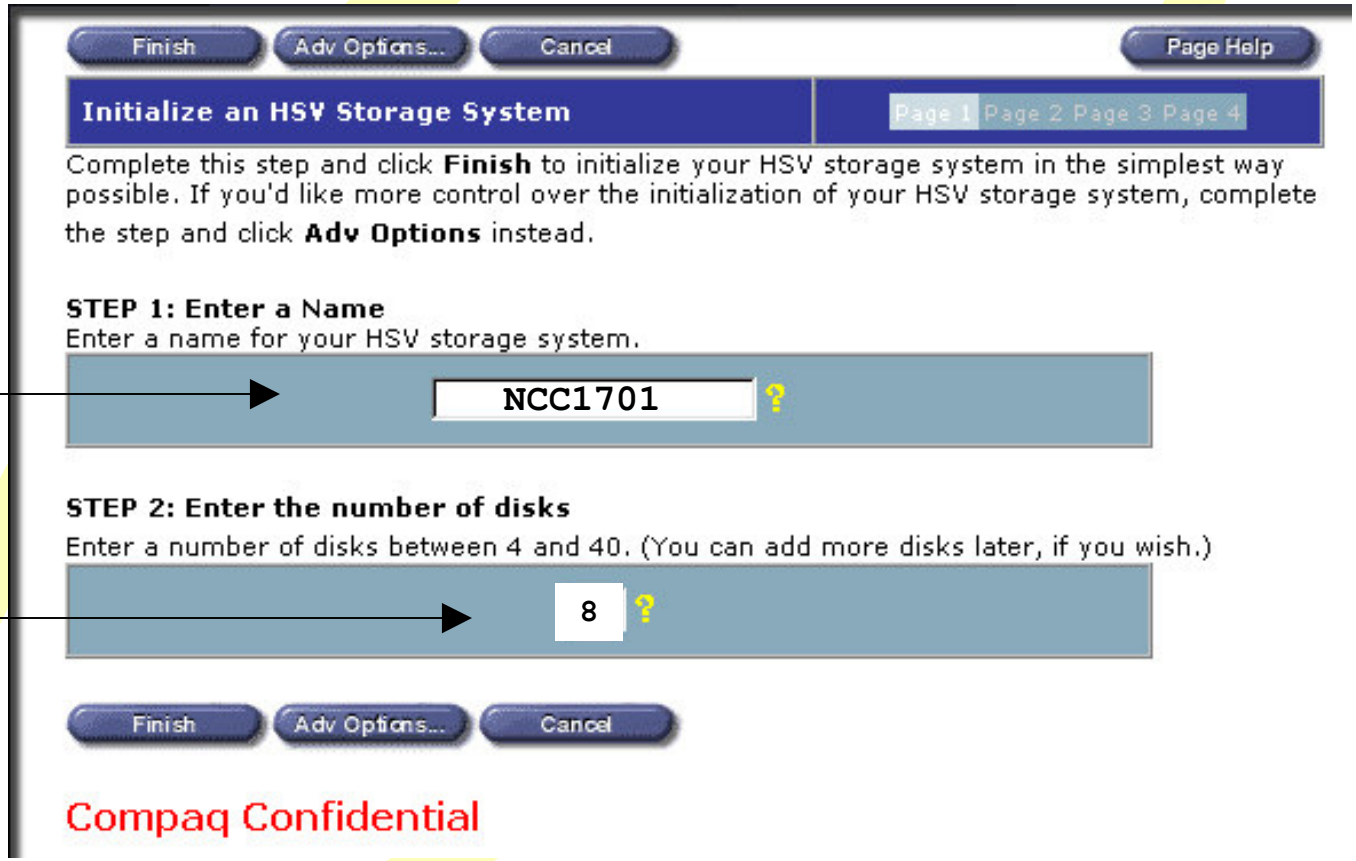
********** THIS SYSTEM IS UNINITIALIZED **********
Click the Initialize button to prepare the system for data storage.

Compaq Confidential

Storage Cell Initialization (Page 1 of 4) (8 disks min)

Enter the name of the Storage Cell

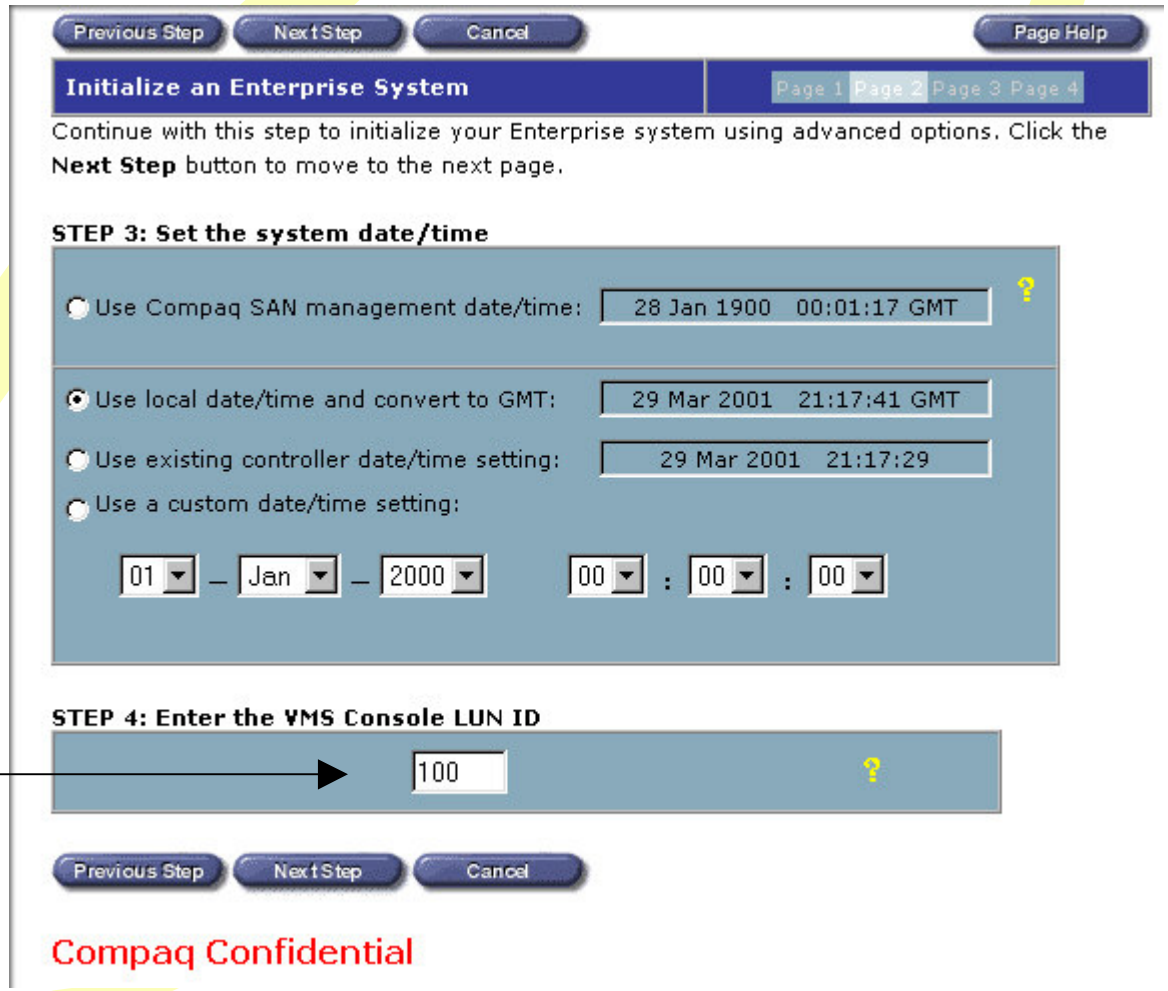
Enter Number of disk drives in Disk Group MIN 8 disks



Storage Cell Initialization (Page 2 of 4)

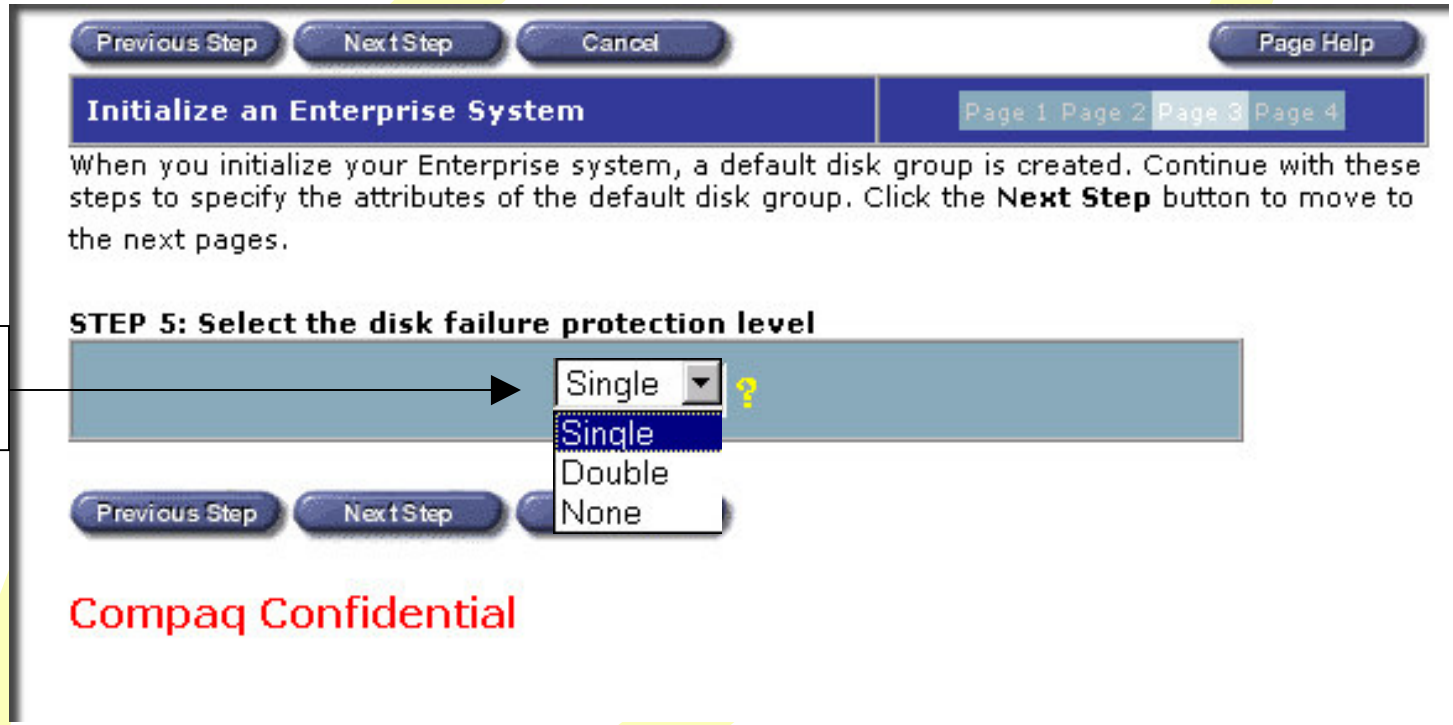
Use the Management Server time

Enter the Identifier of LUN 0 (SACD)



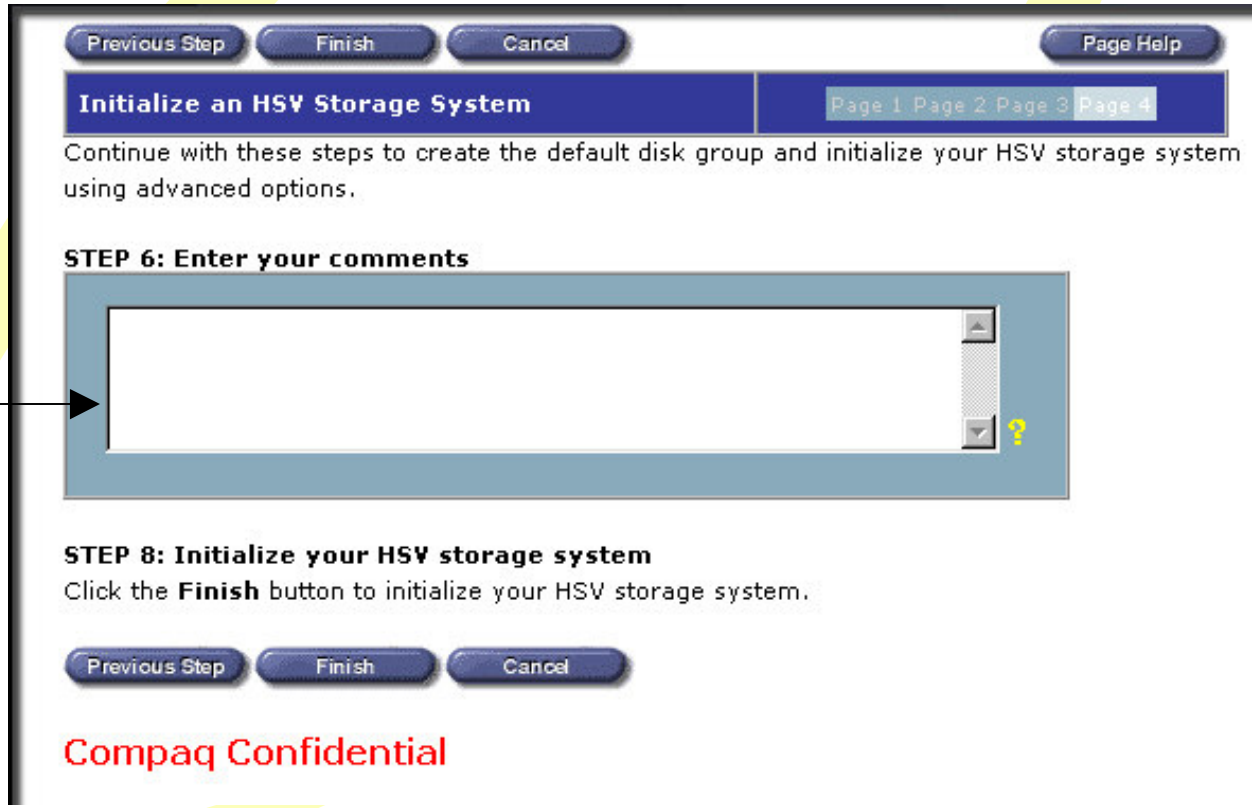
Storage Cell Initialization (Page 3 of 4)

Select Disk Group protection level



Storage Cell Initialization (Page 4 of 4)

You may want to enter some comment in here.



Storage Cell Initialized

HSV Storage Network

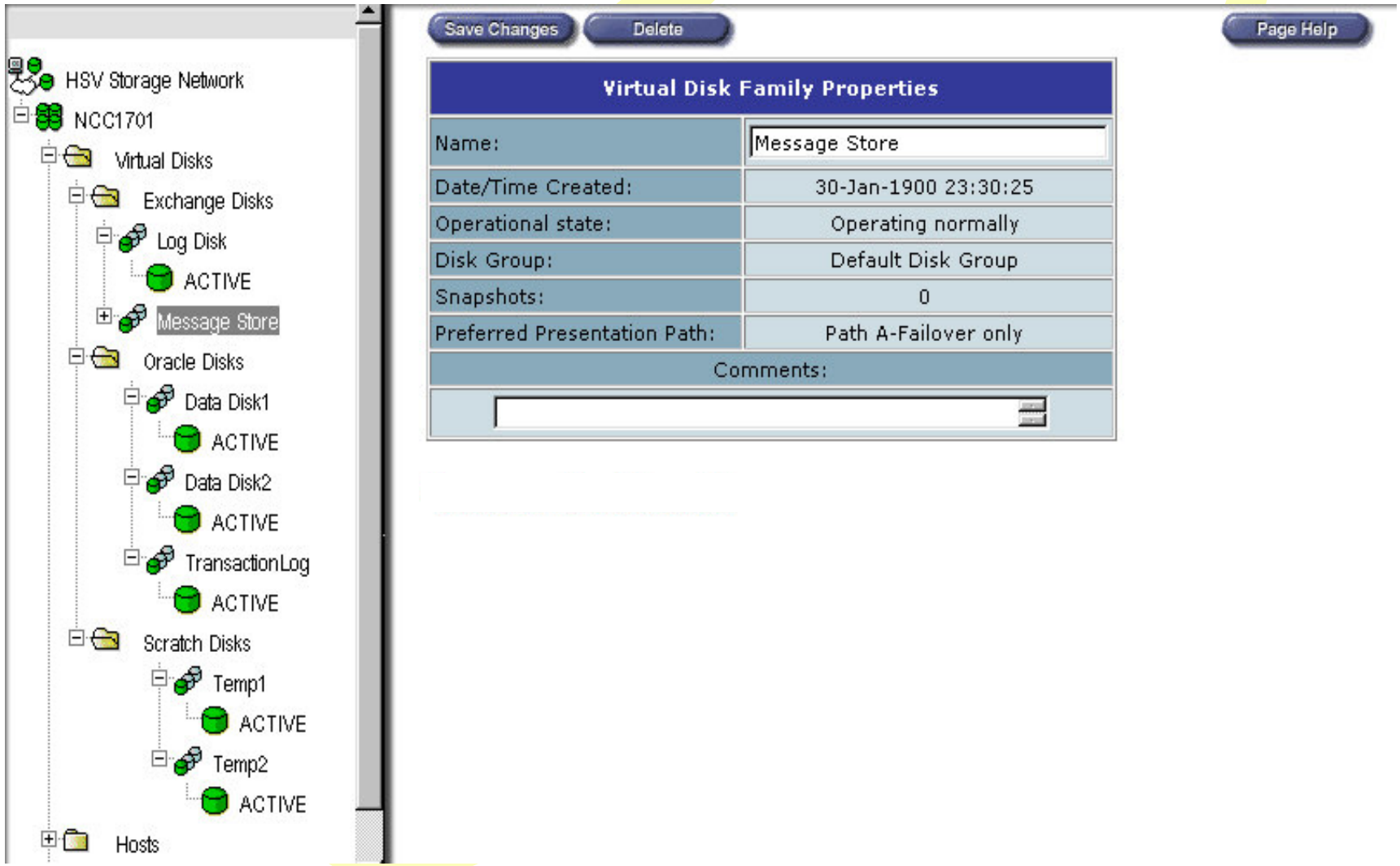
NCC1701

Save Changes | Options... | View Events... | Uninitialize | Code Load... | Page Help

Get Config File

Initialized Storage System Properties	
Name:	NCC1701
Operational State:	Initialized - Good
Total storage space:	50.48 GB
Storage space used:	0.00 GB
Available storage space:	50.48 GB
Device addition policy:	Manual
Disk replacement delay:	1 mins
Console LUN ID:	100
Controller time:	30 Jan 1900 00:35:19
Comments:	

Multiple Virtual Disks created



Enterprise Online Help

Contents | Index | Search

- Controlling and Monitoring
  - System-level operations
    - System Control Overview
    - Setting System Options
  - Working with Virtual Disks
    - Virtual Disk (VD) Control Overview
    - Creating a Virtual Disk
    - Creating a Snapshot of a VD
    - Creating a Copy of a VD
    - Modifying a Virtual Disk
    - Deleting a VD Family
  - Working with Hosts
    - Host Control Overview
    - Adding a Host
    - Modifying a Host
  - Working with Disk Groups
    - Disk Group Control Overview
  - Assigning and Unassigning Virtual Disks to H
    - Presenting a Virtual Disk to a Host
    - Unpresenting a Virtual Disk to a Host
  - Updating Software (Loading Code)
    - Code Loading Overview
    - Updating Controller Code
    - Updating Physical Disk Drive Code
    - Updating EMU Code
- About

SyncToc

About HSV Element Manager Software

HSV element manager offers a graphical user interface for configuration, management, and monitoring of StorageWorks HSV-series storage systems.

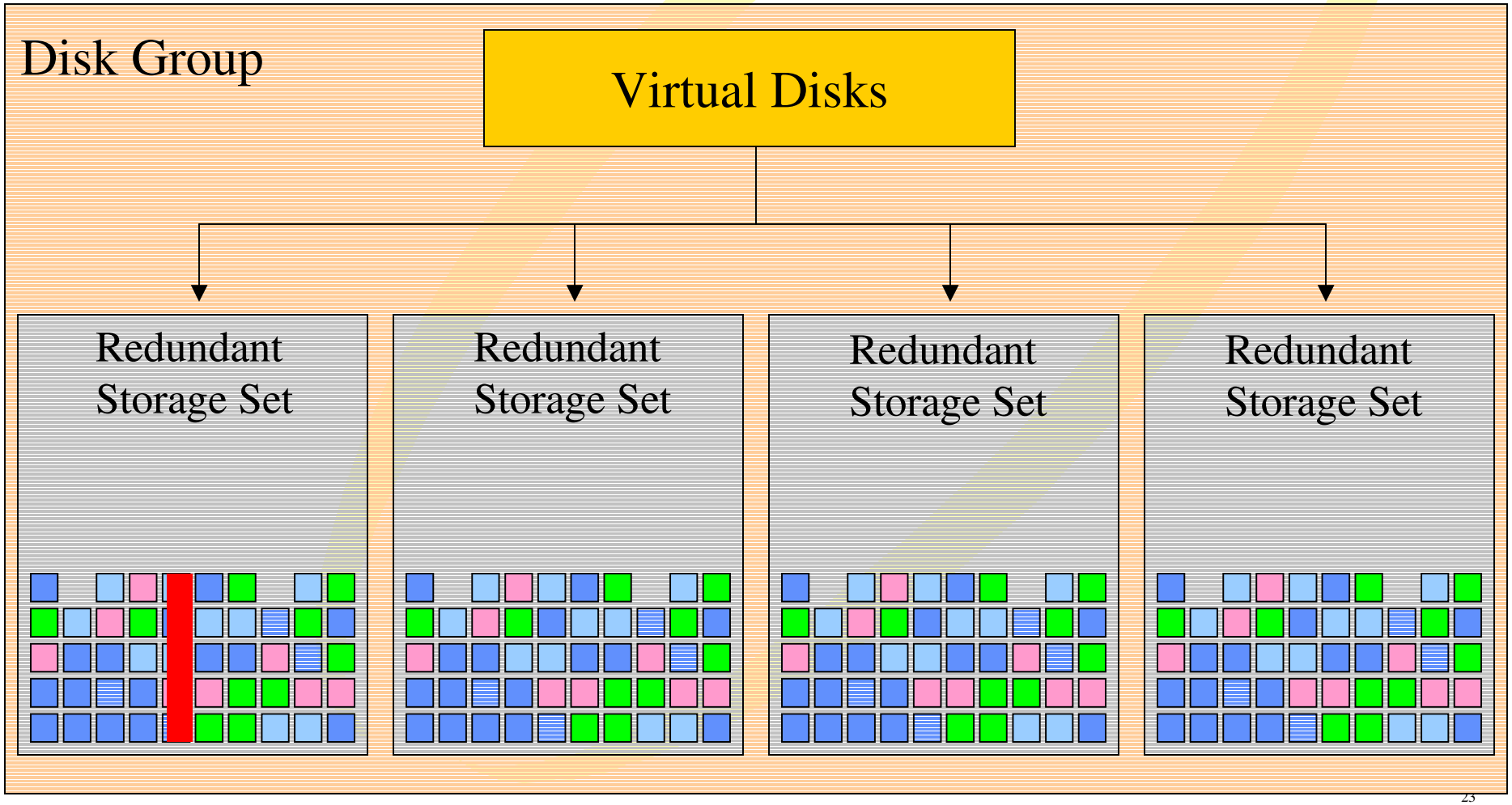
Version and build information.

Redundant Storage Sets (RSS)

- Reduces chance of data loss in large (> 12 physical disks) disk groups
- Not visible to user through Interface
- Complete managed by the HSV controllers
- Typical size for disk group: 8 - 12 physical disks
- If RSS equals 12 physical disks, it splits into 2 RSS of 6 disks each
- Failed disk drive recovery restricted to affected RSS only
  - Reduces access to number of disks, more efficient

- Example: Disk Group with 28 disks
  - # of disks – 6, repeat until the remainder is 12 or less
    - 28-6=22, 22-6=16, 16-6=10 stop
    - RSS configured as 6+6+6+10

HSV110 Virtualization : Redundant Storage Sets



Sizing HSV Disk Groups — Considerations

- Considerations:
  - Hardware versus software capacities
  - System metadata overhead
  - Vraid overhead
  - Snapshot working space
  - Spare capacity
  - Room for growth

Sizing HSV Disk Groups — Considerations

- Hardware versus software capacities
  - Physical 1000 000 000Bytes = 1GB
  - Software 1073 741 824Bytes = 1.07GB Physical (2^{30})
  - ~ 7% Variance → 1GB Physical = 0.93GB Software
- System metadata overhead — 0.2%
  - System metadata
  - MLD—Command View EVA metadata
  - Virtual Disk metadata
- Vraid overhead
  - Vraid0 — 0% (1 block for every 1 block usable)
  - Vraid1 — 50% (2 blocks for every 1 block usable)
  - Vraid5 — 20% (1.25 blocks for every 1 block usable)
- Snapshot working space
  - Snap — depends on rate of change of original data
  - Snapclone — same physical capacity as virtual disk
- Spare capacity
  - 2 X physical capacity of the largest physical disk X protection selected

Sizing HSV Disk Groups—Formula

$$\text{Disk Count} \simeq \frac{((\text{UsableV0} * 538) + (\text{UsableV5} * 673) + (\text{UsableV1} * 1076))}{(\text{DiskCap} * 476)} + (\text{ProtLevel} * 2)$$

- DiskCap: Disk drive capacity in hardware GB
- DiskCount: Integer number of disk drives
- ProtLevel: 0 for None, 1 for Single, 2 for Double
- UsableV0 Desired usable Vraid0 capacity in software GB
- UsableV1 Desired usable Vraid1 capacity in software GB
- UsableV5 Desired usable Vraid5 capacity in software GB
- VFactorx: 538 for Vraid0, 673 for Vraid5, 1076 for Vraid1

Sizing HSV Disk Groups—Summary of Steps

1. Determine:
   a. physical disk capacity
   b. disk failure protection level required for the disk group
2. Determine:
   a. number of virtual disks in the disk group
   b. usable capacity required for each virtual disk
   c. Vraid type for each virtual disk
3. Determine:
   a. amount usable capacity for snapshot working space for each virtual disk that will have snapshots
   b. Vraid type of the snapshots will match the original
4. Sum the total usable capacity required for each Vraid type
5. Solve for the number of disks using Formula

Sizing HSV Disk Groups—Example

$$\text{Disk Count} \simeq \frac{((\text{UsableV0} * 538) + (\text{UsableV5} * 673) + (\text{UsableV1} * 1076))}{(\text{DiskCap} * 476)} + (\text{ProtLevel} * 2)$$

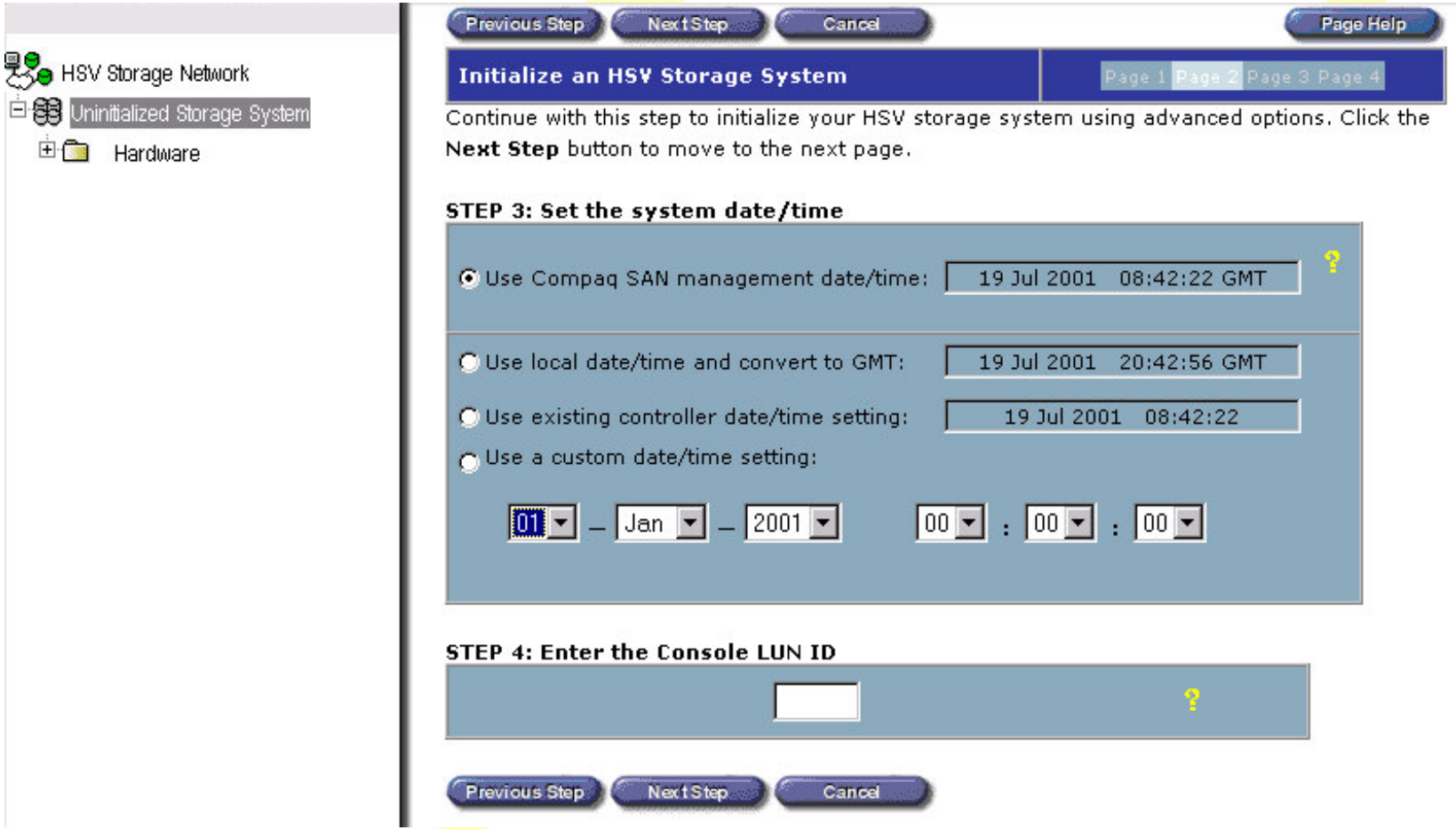
$$26.78 \simeq \frac{((0 * 538) + (500 * 673) + (50 * 1076))}{(36 * 476)} + (2 * 2)$$

- DiskCap: 36GB
- DiskCount: Integer number of disk drives
- ProtLevel: 2 for Double
- UsableV0 0GB
- UsableV1 50GB
- UsableV5 500GB
- VFactorx: 538 for Vraid0, 673 for Vraid5, 1076 for Vraid1

Trouble Shooting

Best Practices

- Synchronize HSV110 system date / time to same as Management Server
- Helps correlate events when trouble shooting



Configuration Remarks

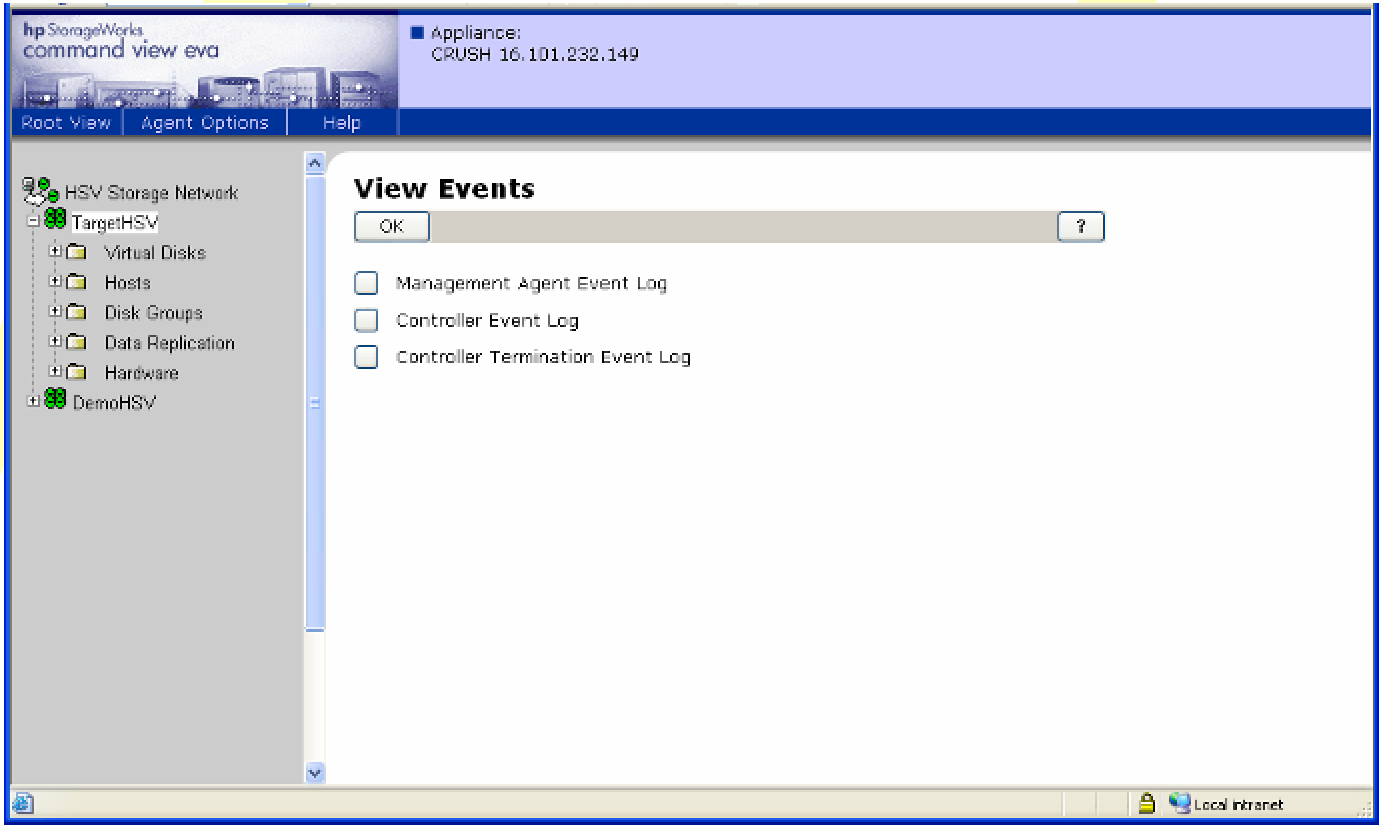
- Disk Groups can be created in 2 ways:
  - Vertically, so one disk drive per shelf
    - Pro:
      - 100% guarantee that it will survive a shelf meltdown failure
    - Con:
      - Limited number of disk drives per Disk Group
      - Performance (less spindles)
      - Cannot use full capacity due to loss in space reservation for (space efficient) snapshots

Configuration Remarks

- Disk Groups can be created in 2 ways (continued):
  - Multiple disk drives per shelf
    - Pro:
      - Unlimited performance due to large number of disk drives in disk group
      - No loss in space reservation for snapshots or snapclones
    - Con:
      - Isn't guaranteed to survive a shelf meltdown failure

Troubleshooting Tools—Events

- Management Agent Event Log
- Controller Event Log
- Controller Termination Event Log



Log Files

- Management Agent Event Log

: Management Agent Event Log - Microsoft Internet Explorer provided by Compaq Computer Corporation

OK | Filter Events... | Get Log File | Clear Log | Page Help

Management Agent Events

	Date	Time	Appliance	Code	Alarm	Description
✔	13-Nov-2001	10:49:44	SWMA31K 001	1014	No	The state of an object in the system has changed. View adjacent events for more detail.
✔	13-Nov-2001	10:49:24	SWMA31K 001	2048	No	Virtual Disk Family: Copy of vdisk-vraid1-01 - deleted successfully
✔	13-Nov-2001	10:47:02	SWMA31K 001	2042	No	Virtual Disk Copy of VD vdisk-vraid1-01/ACTIVE - Completed
✔	13-Nov-2001	10:45:50	SWMA31K 001	1014	No	The state of an object in the system has changed. View adjacent events for more detail.
✔	13-Nov-2001	10:45:16	SWMA31K 001	2048	No	Snapshot Virtual Disk: Allocate Completely Snapshot - deleted successfully
✔	13-Nov-2001	10:43:38	SWMA31K 001	2041	No	Virtual Disk Snapshot of VD - Completed
✔	13-Nov-2001	10:42:44	SWMA31K 001	1014	No	The state of an object in the system has changed. View adjacent events for more detail.
✔	13-Nov-2001	10:42:08	SWMA31K 001	2048	No	Snapshot Virtual Disk: Allocate on Demand Snapshot - deleted successfully

Audit / Event Logs

- Management Event Log:
  - Contains events created by Command View EVA
  - Used to report configuration changes
  - Filterable based on category for viewing, SNMP forwarding and posting to NT event log of SAN Appliance
  - Round robin buffer
    - 1000 entries per Storage Cell
    - Entry size: 512 bytes
  - Timestamps based on SAN Appliance time
  - Sometimes referred to as "Audit Log"

Log Files

- Controller Event Log

Controller Event Log - Microsoft Internet Explorer

Controller Events (Initialized system)

OK | Get log file | Get parse file | Send parse file | ?

Display Range: 1 - 400 | Previous group | Next group

Controllers:
- Controller B: 5005-08b4-0001-4909-0000-0000-0000-0000
- Controller A: 5005-08b4-0001-48c8-0000-0000-0000-0000

Date/Time Controller	Severity	Event Code	Sequence #
	Description		
12:57:17:000 25-Jun-2004 Controller B	✓	0101000d	#60
	The system time value was set to the value contained in the time field by a call to the EXEC$SET_TIME service. Corrective action code: 00 More details		
12:54:45:429 25-Jun-2004 Controller B	✓	42030007	#59
	An excessive number of link errors were detected on a HSV110 controller's Fibre Channel port. Corrective action code: 00 More details		
12:54:45:429 25-Jun-2004 Controller B	✓	42030007	#58
	An excessive number of link errors were detected on a HSV110 controller's Fibre Channel port. Corrective action code: 00 More details		
12:54:39:354 25-Jun-2004 Controller B	✓	09070005	#57
	The state of the Fibre Channel port identified in the attribute.value.str field and located on the rear panel of the HSV110 controller identified in the handle field has transitioned to the NORMAL state. Corrective action code: 00 More details		

Audit / Event Logs

- System Event Log
  - Contains events created by HSV controllers
  - Used to report Storage Cell state changes
    - Configuration changes
    - Storage Cell state changes
    - Software detected Inconsistencies
  - Round robin buffer of 2MB
    - No fixed entry size, so variable number of event
  - Filterable on importance level and category for forwarding to SNMP and posting in NT event log of SAN Appliance
  - Timestamps based on HSV controller time

Log Files

- Controller Termination Event Log

Controller Termination Event Log - Microsoft Internet Explorer

Controller Termination Events (Initialized system)

OK | Get log file | Get parse file | Send parse file | ?

Controllers:
Controller B: 5005-08b4-0001-4909-0000-0000-0000-0000
Controller A: 5005-08b4-0001-48c8-0000-0000-0000-0000

Date/Time Controller	Severity	Event Code	Sequence #
	Description		
12:48:39:200 25-Jun-2004 Controller A	✓	03660060	#54
	This HSV110 controller was requested to terminate operation and then power off. Corrective actions code: 00 More details		
23:44:40:373 27-Jan-2004 Controller A	▽	04240960	#53
	Power failed. Corrective actions code: 09 More details		
09:07:36:896 22-Jan-2004 Controller A	✓	03640020	#52
	This HSV110 controller was requested to terminate operation and then restart. Corrective actions code: 00 More details		
16:08:39:824 16-Jan-2004 Controller A	✓	03640020	#51
	This HSV110 controller was requested to terminate operation and then restart. Corrective actions code: 00 More details		
16:59:25:610 3-Dec-2003 Controller A	✓	03640020	#50
	This HSV110 controller was requested to terminate operation and then restart. Corrective actions code: 00 More details		

Audit / Event Logs

- Termination Event Log
  - Used to record HSV shutdown messages
    - Fatal errors (so firmware problems)
    - Graceful shutdowns
  - Controlled by the HSV controllers
  - Controller crash event logs
  - No crash dump (separate file)
  - Timestamps based on HSV controller time.
  - No forwarding capability to SNMP or posting into NT event log of SAN Appliance
  - Round robin buffer
    - 32 entries
    - Entry size: 10KB

Enterprise System Behavior

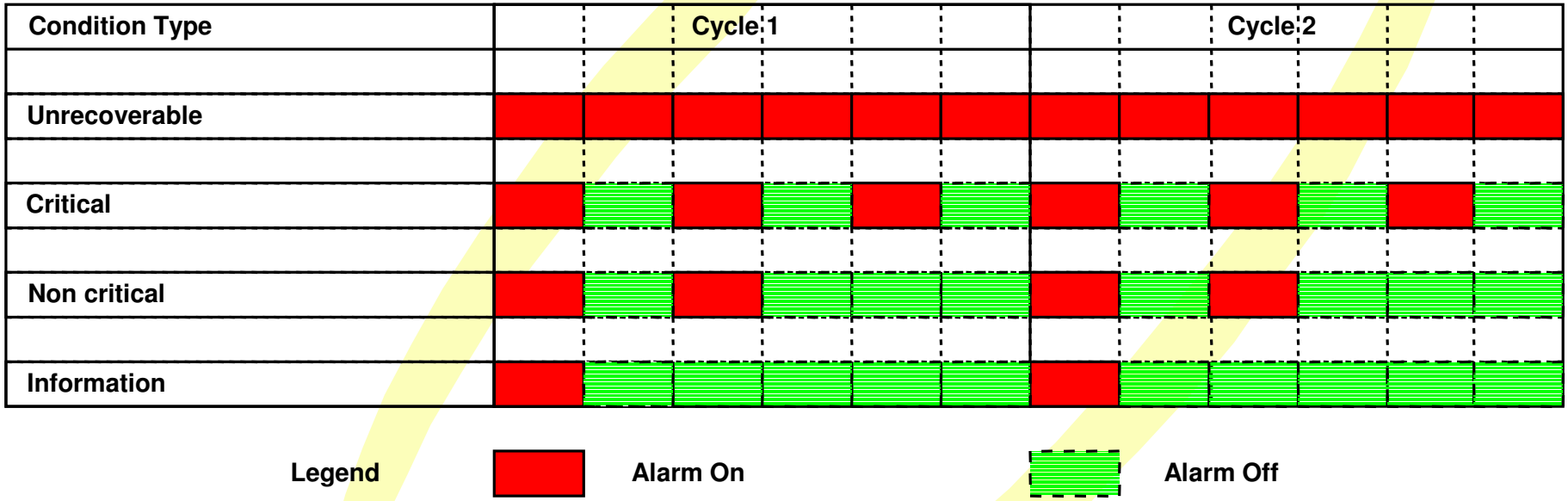
- Unconfigured HSV110 will not enable Host Ports until the WWN is configured with the OCP
  - LEDs adjacent to FP1 and FP2 are initially off
    - Green when enabled
    - Link symbol LED on HSV110 front panel
- Check port LEDs on:
  - FC-Switches → Green
  - Rear of HSV110 → Green
- If Host Ports (FP1, FP2) are off, no communication path

EMU error code

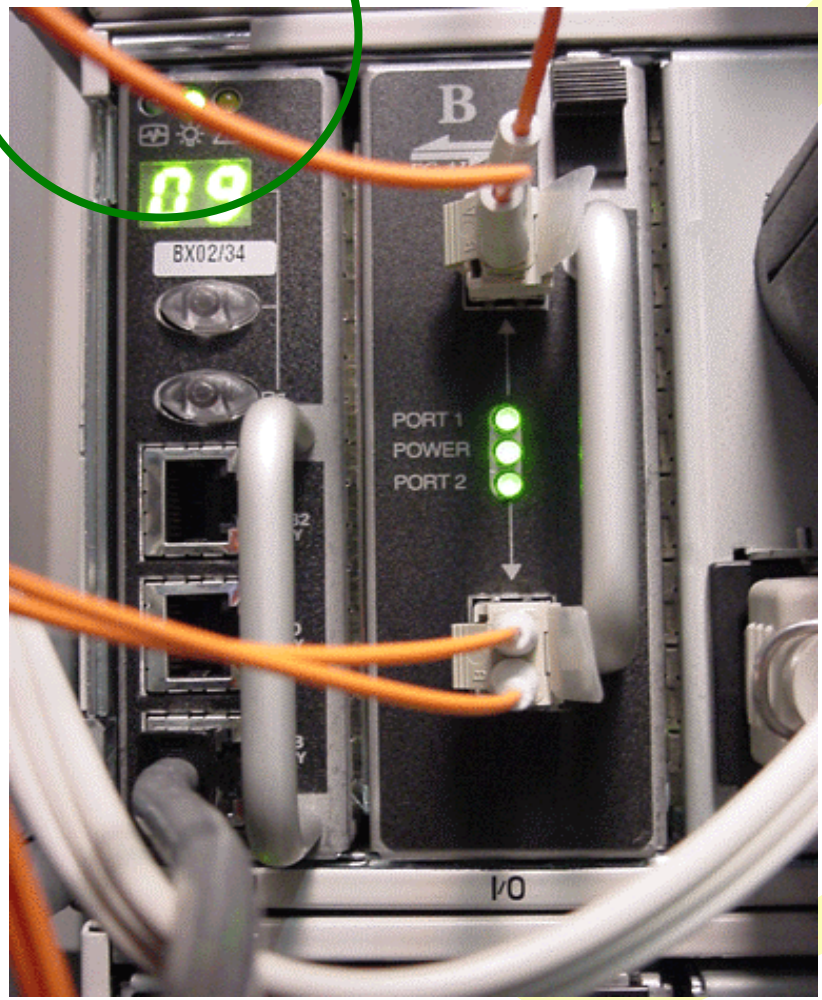
- Current Errors
  - Audible—beeping
  - Code available on EMU display
  - 3 part error code xx-xx-xx
  - May have multiple errors available
- Error log
  - Available through Command View EVA event page
  - 62 entries per EMU (enclosure)

Audible Alarm Sound Patterns

- Most severe alarm controls the alarm pattern
- Sounds until errors are cleared

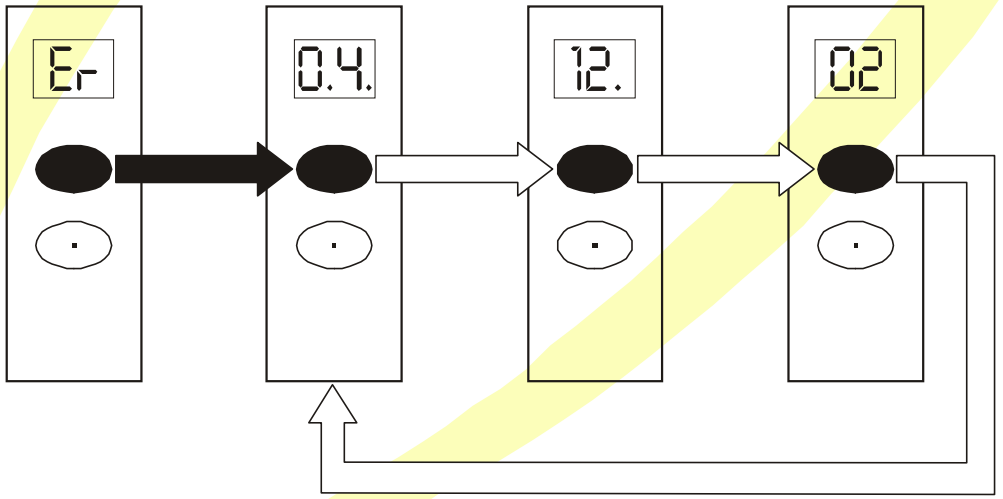


EMU error code



EMU error code

- Current error code collection
  1. Press and hold top button (~2 seconds)
  2. Record 2 digit number
  3. Press and release top button
  4. Record second 2 digit number
  5. Press and release top button
  6. Record third 2 digit number
- Repeat if error light still lit—Multiple errors



View Events

HSV Storage Network
NCC1701
Virtual Disks
Hosts
Disk Groups
Hardware

Save Changes | Options... | View Events... | Uninitialize | Code Load... | Page Help

Get Config File

Initialized Storage System Properties

Name:	NCC1701
Operational State:	Initialized - Good
Total storage space:	364.75 GB
Storage space used:	255.34 GB
Available storage space:	109.41 GB
Device addition policy:	Manual
Disk replacement delay:	1 mins
Console LUN ID:	100
Controller time:	02 Feb 1900 17:31:57

Comments:

Compaq Confidentia

OK | Page Help

View Events

View — Management Agent Event Log
View — Disk Shelf Event Log
View — Controller Event Log
View — Controller Termination Event Log

Compaq Confidential

Event Data and Collection

- The HSV controllers have 2 Event Logs:
  - Termination events
  - Spontaneous events (all controller events that are not termination events) that occur within the Storage Cell
- The termination events are stored in NVRAM in each controller AND on a logical disk in the storage cell

Event Data and Collection

- Be careful on time stamps
  - HSV controller time may be different than server time, which may be different than SAN Appliance time
  - More difficult to correlate different product timestamps
- Disk shelf logs do not contain timestamps, but "elapsed time as of last [EMU !!] reboot"

Command View EVA Events

- The Parse file is released with VCS build
  - Contains bit-to-text translation of VCS codes
  - HSV110_event_nxxxxxxxx_xxxxx.txt

Command View EVA Events

- Click on cell, select options in title bar
  - Event notification: System options
    - Select which events are sent as traps
  - Event notification: Host options
    - Add the host to receive the SNMP trap of events
    - Need MIB to decode

HSV—Errors

Simple → **Complex**

- Hardware failures
- Cable connectivity
- Versions of software/firmware
- Topology
- Cabling

- Intermittent
  - Drive connectivity
  - FC-AL LIPs
- Software incompatibility
- Zoning

HSV—Error Indication

Simple **Complex**

- LEDs
- Error Codes
- Audible
- Event logs

- None
- Management Server hangs
- No communication between Management Server and EVA
- Intermittent devices errors

Best Practices

- Ensure drives are properly seated
  - Gently apply pressure with thumb
- Check all cabling
  - Fibre Channel
  - Power—PDUs, PDMs
  - CAN Bus
- Use dust covers on cables and transceivers
- Don't touch end of cables
- Use care when removing Fibre Channel Cables—fragile

Symptom—No Enterprise in Command View EVA

- Installation check list
- Fabric connectivity
  - Check Fabric Name Server table
  - Are devices logged in?
    - Check cabling
    - Check HSV110 LCD—alternating System Name and WWN
  - Did you activate the HSV110 Controller password?
    - Does the password match with Command View EVA?
    - Default system password: ***AAAAAAAA***
- Command View EVA (EM) is installed but not visible
  - HSV EM has stopped
    - Check Appliance Manager → Services
  - Check required software and firmware
    - For example, SAN switch firmware v2.1.9m

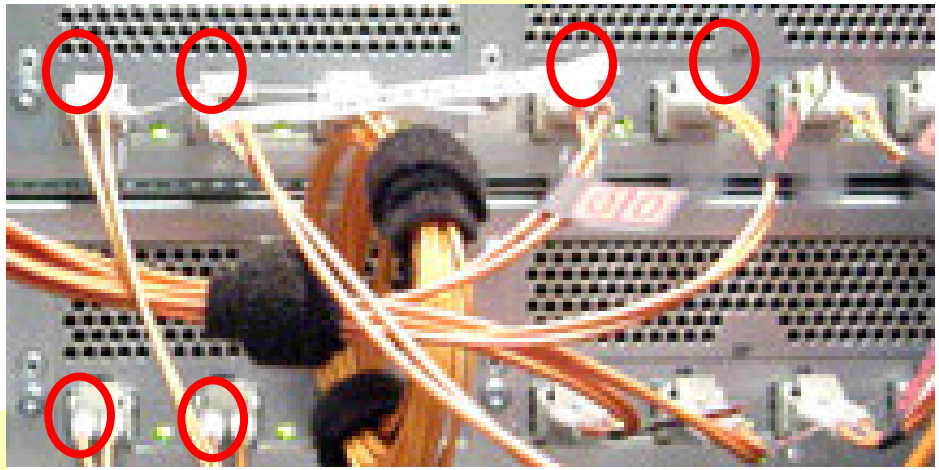
Symptom—No Enterprise in Command View EVA

- Device port (1A, 1B, 2A, 2B) Loop errors
  - Unstable system
  - Intermittent to no communication
  - Troubleshooting is challenging
- Need to reduce the bus configuration to isolate the failing component
  - Requires re-cabling/bus isolation
    - Risk to customer data—backup
    - Understanding flow of data
    - Disk Enclosure (5214)
      - Data IN → I/O module top (or bottom) port → bay 1 → bay 2..→ bay 14 → OUT I/O module bottom (or top) port
    - Bypass circuit:
      - Drive present—signal connected to drive
      - Empty bay—into bypass circuit to next bay
    - Disk errors logged in the Controller Event Log

Error Indication—Controller LEDs

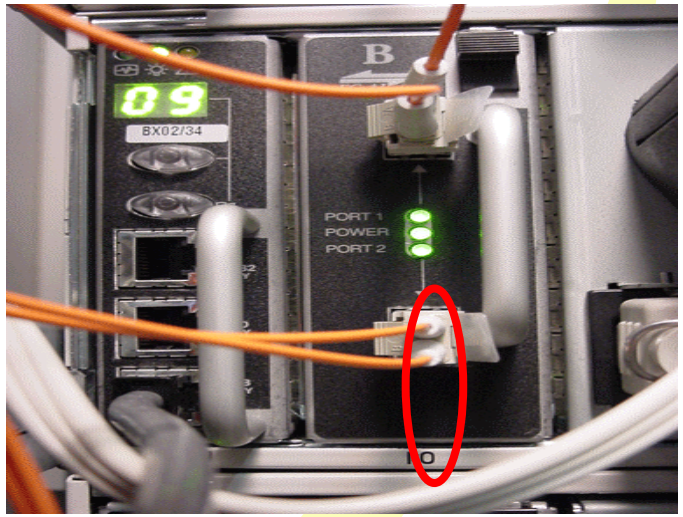
- Fault
- Host Link
- Controller Heartbeat
- Cache Battery Assembly

- Fabric Ports
- Mirror Port
- Device Ports



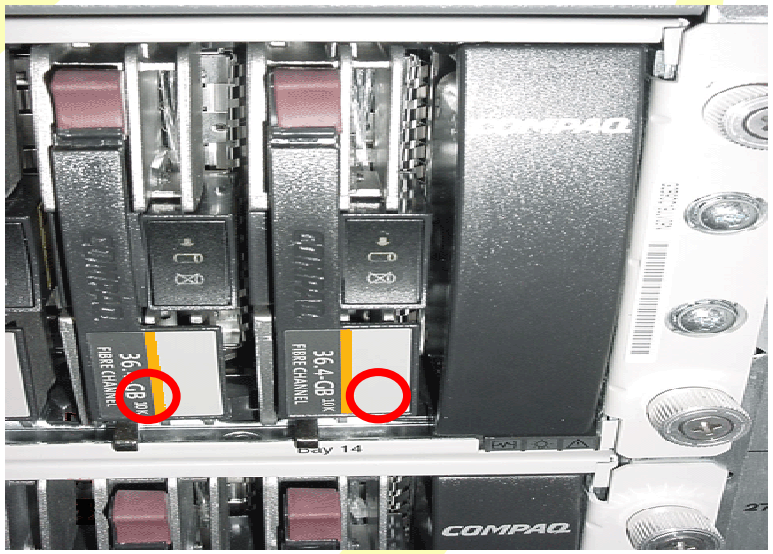
Error Indication—Enclosure I/O Module LEDs

- Top port status
- I/O Module power
- Bottom port status
- Flashing Port → data transfer
- Port Status → Off when:
  - Bad frames detected
  - Bad connection/cabling
  - No light from I/O module "upstream"
  - HSV110 Controller disabled device port as a result of too many errors
    - 10 minute timer before re-enabling
    - Wait for at least 11minutes to diagnose
  - Cable may be lit from both controllers
  - Remove cable from top controller → check ports → re-install and wait 10 minutes → remove cable from bottom controller → check ports



Error Indication—Drive LEDs

- Lit (Activity LED) indicates drive idle
- Flashing indicates activity
- When a drive is inserted:
  - Spin up and enable ports
  - LIP will occur (FC-AL)
- LIP will cause all drives on loop pair to flash the Activity LED
- All drives flashing Activity LED ~every 30 seconds may indicate system has detected problem
- LIPs to establish loop stability



Any Questions?