Healthy System Means Healthy System Manager

Presented by

Lori Spencer

www.parsec.com | 888-4-PARSEC

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To E-mail Lori
lspencer@parsec.com

www.parsec.com | 888-4-PARSEC

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Topics

- Objective
- Monitoring Uptime
- Volume Management
- Security Auditing
- Accounting Log File
- Questions

Objective

This presentation takes the system manager beyond the typical DCL SHOW command, although some will be presented along with some DCL command procedures, but to help system manager understand concepts and utilities that normally would not be implemented.

Monitoring Uptime

- Monitoring uptime goes beyond the typical SHOW command we will look at:
  - What should you do if the system crashes?
  - Why didn't the system reboot?
  - What should I do if the system doesn't respond?

Monitoring Uptime Topics

- Commands to monitor uptime
- Why did the system reboot?
- System will not reboot!
- System is not responding
- System Crashed, now what?

Command to Monitor Uptime

DCL examples:

Can be put in your LOGIN.COM

```
$ show system/noprocess/output=up.lis
$ open upt up.lis
$ read upt val
$ uptime = f$extract(54,999,val)
$ write sys$output "System ''uptime'“
$ close upt
$ purge up.lis
$ exit
```

Or use the PIPE command:

```
$ PIPE show system/noprocess | (read sys$input val ; -
  write sys$output -
  "System " + f$extract(f$locate("Uptime",val),999,val))
$ exit
```

Commands to Monitor Uptime

Examples:

```
$ show system/noprocess
OpenVMS V8.3  on node CLASS2  29-MAR-2007 11:24:18.87  Uptime  5 21:54:47
$ show system/noprocess/cluster
OpenVMS V8.3  on node CLASS2  29-MAR-2007 11:24:22.48  Uptime  5 21:54:50

OpenVMS V8.3  on node CLASS8  29-MAR-2007 11:24:22.49  Uptime  0 18:31:05

OpenVMS V7.3  on node CLASS9  29-MAR-2007 11:24:22.53  Uptime  6 01:59:23

OpenVMS V7.3-2  on node JOKER  29-MAR-2007 11:24:22.54  Uptime  2 00:53:21

OpenVMS V8.2  on node YIPPIE  29-MAR-2007 11:24:22.56  Uptime  2 00:16:33
```

- Notice node CLASS8 has only been up 18 hours, you will need to determine if it crashed, rebooted itself, or a schedule reboot was performed.

Why did the System Reboot?

- Schedule reboot
  - Schedule reboots should be coordinated through the system manager, management and users.
  - These should not be an issue, but if it is, then you have a employee issue, not an OpenVMS issue!

Why did the System Reboot?

- Unscheduled reboot
  - 90% are accidental.
  - Mostly happens when someone at the console terminal accidentally hits a CTL-P and then panics!
  - DO NOT panic, just enter CONTINUE at the >>> prompt within a timely fashion. Most systems will recover.
  - Power outages also cause unscheduled reboots.
  - System crashes! Unlikely, because we all know that OpenVMS doesn’t crash!
  - But if it did you need to determine why!

Continuing a System from the Console

Examples:

```
$ show system/noprocess
OpenVMS V8.3  on node CLASS2  29-MAR-2007 16:23:51.52  Uptime  0 00:04:35
$ CTL-P
halted CPU 0
CPU 1 is not halted
CPU 2 is not halted
CPU 3 is not halted
halt code = 1
operator initiated halt
PC = ffffffff857b2ac8

P00>>>cont

continuing CPU 0
$ show system/noprocess

OpenVMS V8.3  on node CLASS2  29-MAR-2007 16:24:00.90  Uptime  0 00:04:45
```

System will not Reboot!

- Check the console and if the system displays a BUGCHECK message on the console and shuts itself down, it means the system encountered a problem that made further operation impossible or dangerous.
- If the system does not automatically reboot then make sure your system is set to boot automatically by checking the console parameter AUTO_ACTION to ensure that it is set to RESTART.
  - The system attempts to write a crash dump to the dump file, and after the dump write completes, this makes the system try to reboot itself automatically.
  - SRM console command is:
    - PO>>> set auto_action restart

System is not responding!

- If the system stops responding to your commands (that is, the system “hangs”), there is a possible failure in a system software or hardware component
- If is the case then try to generate a crash dump and then reboot.
- DO NOT JUST POWER CYCLE THE SYSTEM. If you do you will never know why it “Hung”, and will probably do it again.

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System is not responding!

- How do I generate a Crash Dump
  - Run OPCCRASH from the console if possible.
  - If unable to run OPCCRASH, then HALT the system and CRASH.

System is not responding!

Examples:

```
$ mcr opccrash

  Quorum: 3 (of 5 votes); this node contributes 1 vote
    Cluster has no voting quorum disk.

**** Starting compressed selective memory dump at 29-MAR-2007 16:25...
......................................................
** System space, key processes, and key global pages have been dumped.
** Now dumping remaining processes and global pages...
.....................................
...Complete ****
        SYSTEM SHUTDOWN COMPLETE

halted CPU 0
halt code = 5
HALT instruction executed
PC = ffffffff80087b24
P00>>>
```

System is not responding!

Examples:

```
$ CTL-P
halted CPU 0
 . . .
P00>>>crash
CPU 0 restarting
**** OpenVMS Alpha Operating.
 System V8.3     - BUGCHECK ****

** Bugcheck code = 0000064C: OPERCRASH, Operator forced system crash
** Crash CPU: 00000000    Primary CPU: 00000000    Node Name: CLASS2
** Supported CPU count:   00000004
** Active CPUs:           00000000.0000000F
** Current Process:       NULL
** Current PSB ID:        00000001
** Image Name:
```

System is not responding!

Examples:

```
**** Starting compressed selective memory dump at 29-MAR-2007 16:16...
.....................................................
** System space, key processes, and key global pages have been dumped.
** Now dumping remaining processes and global pages...
.......................................
...Complete ****

halted CPU 0

halt code = 5
HALT instruction executed
PC = ffffffff80087b24

CPU 0 booting

(boot dkb300.3.0.5.1 -flags 0,0)
 . . .
```

System crashed, now what?

- This is not a crash dump analysis session. But system manager can do some preliminary work.
  - Copy the crash dump
  - Gather up the error log file
  - Contact you support provider or PARSEC Group (which can become your support provider) to analyze crash dump and error log.

System crashed, now what?

- Do not use BACKUP to move SYSDUMP.DMP
  - It is marked /NOBACKUP for starters
  - BACKUP only allocates and sets the file high-water mark to zero without copying any data
  - BUGCHECK writes the dump (it doesn't know about HWM) – so all looks well. But: SDA (& DUMP) gets zeroes back whenever the file is read – leads to the name "phantom dump"
  - %SDA-E-BADHWM error starting in V8.2
  - Can be fixed by most of the time by:
    - $ SET VOLUME/NOHIGHWATER ddcn: ! If necessary
    - $ SET FILE/END ddcn:[SYSn.SYSEXE]SYSDUMP.DMP
    - $ SET VOLUME/HIGHWATER ddcn: ! If necessary

System crashed, now what?

- Do not use DCL COPY to save contents of a system dump (or BACKUP/IGNORE=NOBACKUP)
- Multiple reasons to use SDA COPY
  - BUGCHECK probably didn't use the entire file
    - SDA COPY only saves used blocks
  - Integrity system dumps need process unwind data
    - SDA COPY collects it and appends it to the copy

System crashed, now what?

- Multiple reasons to use SDA COPY
  - File ID to filename translation data may be useful
    - SDA COPY collects it and appends it to the copy
  - SDA COPY will compress the dump if originally written as a raw dump
  - Only copies dump file if it is a valid dump
- Why not create a command procedure to do some work for you?
  - If saving to an alternate drive, mount device in SYCONFIG.COM.
  - Create logical pointing location of command procedure in SYLOGICALS.COM

System crashed, now what?

Examples

```
$ anal/crash sys$system:sysdump.dmp

OpenVMS system dump analyzer
...analyzing an Alpha compressed selective memory dump...

Dump taken on 29-MAR-2007 16:25:33.54 using version V8.3
OPERATOR, Operator requested system shutdown

SDA> copy storage:[crash_files]crash_mar29.dmp
%SDA-I-COLLECTING, collecting file and/or unwind data
SDA> exit
$
```

System crashed, now what?

Examples

```
$ type sys$manager:savedump.com
$!   Print dump listing if system just failed.
$!
$ analyze/crash_dump sys$system:sysdump.dmp
COPY STORAGE:[CRASH_FILES]SAVEDUMP.DMP  ! Save the dump file
SET OUTPUT SYSDUMP.LIS                  ! Create a listing file
CLUE CRASH
SHOW CRASH                              ! Display crash info
SHOW STACK                              ! Show current stack
SHOW SUMMARY/IMAGE                      ! List all active processes
SHOW PROCESS/PCB/PHD/REG                ! Display current process
SHOW SYMBOL/ALL                         ! Print system symbol table
EXIT
$ show log/full clue$site_proc
   "CLUE$SITE_PROC" [super] = "SYS$MANAGER:SAVEDUMP.COM" (LNM$SYSTEM_TABLE)
```

Volume Management

- Free space monitoring
- Shadow set members
  - Basic Shadow Terminology
  - Why is there a shadow copy?
  - Why is there a shadow merge?
  - Copy and merge fence
- Analyzing Disks Volumes

Free Space Monitoring

- In OpenVMS unlike Unix systems 0 blocks means 0 blocks
- If system disk gets to 0 blocks system will hang
- Database disk especially need monitoring
- Several ways to monitor disk space, but command procedure in a batch queue is the most reliable.
- By default, disk space is shown in blocks. It can be displayed in bytes by either:
  - $ show dev/unit=bytes d
  - $ set process/unit=bytes

Free Space Monitoring

- The following shows a command procedure that will monitor disk space.
- It’s a simple command procedure which you can modify for your specific needs.

Free Space Monitoring

Examples:

Here is the calculation.

```
$! DISKSPACE.COM - PARSEC Group 03/29/07
. . .
$   GET_DISK_NAME:
$   READ INFO_FILE DISK_RECORD /END_OF_FILE=EOF_LABEL
$   DISKNAME = F$ELEMENT(0, ":", DISK_RECORD)
$   TOTAL_SPACE = F$GETDVI(DISKNAME, "MAXBLOCK")/10
$   FREE_SPACE  = F$GETDVI(DISKNAME, "FREEBLOCKS")/10
$   TOTAL_USED  = TOTAL_SPACE - FREE_SPACE
$   CAPACITY    = (TOTAL_SPACE-FREE_SPACE) * 100 / TOTAL_SPACE
 . . .
```

Free Space Monitoring

Example Output:

```
DEVICE NAME     TOTAL SPACE     FREE SPACE      TOTAL USED     %CAPACITY USED
$5$DQA0         5863334         5289417         573917             9
$16$DKA0        411048          276732          134316             32
$16$DKA100      83252           55471           27781              33
$16$DKA200      83252           82460           792                0
$16$DKA300      411048          270023          141025             34
$18$DRA0        832307          744431          87876              10
$18$DRA1        832307          101645          730662             87
$22$DKA300      3555638         938304          2617334            73
$22$DKA506      4189014         488588          3700426            88
$22$DKA507      2512793         1280462         1232331            49
$32$DKA0        7113296         3233664         3879632            54
$32$DKA100      7113296         5616547         1496749            21
$82$DKA0        205086          3979            201107             98
```

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Basic Shadow Terminology

- HBVS Host Based Volume Shadowing
  - OpenVMS version of RAID1 implementation
- VU Virtual Unit
  - The volume that is mounted whose device name is DSA
- Shadow Set
  - The volume that is mounted using the letters DSA
- SSM   Shadow Set Member
  - Maximum of three devices can form a shadow set

Shadow States

- Shadow devices can be in one of two states:
  - ***Transient State,*** when one or more of its members are undergoing a copy or a merge operation.
  - ***Steady State,*** which means all of its members are known to contain identical data.

Why is there a shadow copy?

- The DCL MOUNT command initiates a copy operation, when a disk is added to an existing shadow set.
- Copy operation duplicates data on a source disk to a target disk
- Starts at first Logical Block on disk (LBN zero) and processes 127 blocks at a time from beginning to end.
- Read and writes access continue while a disk(s) are undergoing a copy operation.

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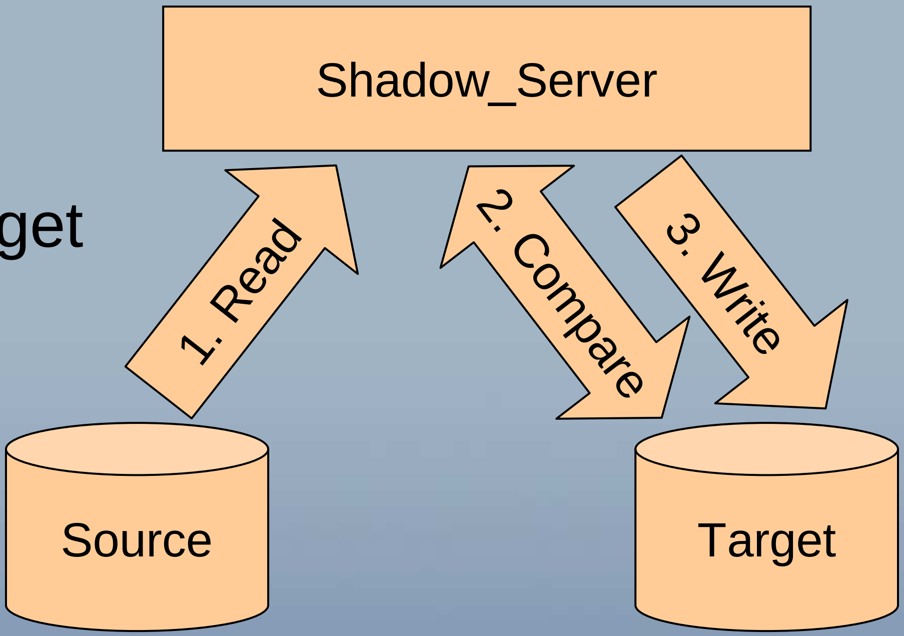
Why is there a shadow copy?

1. Read from source
2. Compare with target
3. If different, write data to target and start over at Step 1.



Creating a VU

```
$ init/system/shadow=(VDA17:,VDA16:,VDA15:) disk30
$ mount/system dsa30 /shadow=($1$VDA17:,$1$VDA16:,$1$VDA15:) disk30

%MOUNT-I-MOUNTED, DISK30 mounted on _DSA30:
%MOUNT-I-SHDWMEMSUCC, _$1$VDA17: (CLASS3) is now a valid member of the shadow set
%MOUNT-I-SHDWMEMSUCC, _$1$VDA16: (CLASS3) is now a valid member of the shadow set
%MOUNT-I-SHDWMEMSUCC, _$1$VDA15: (CLASS3) is now a valid member of the shadow set
```

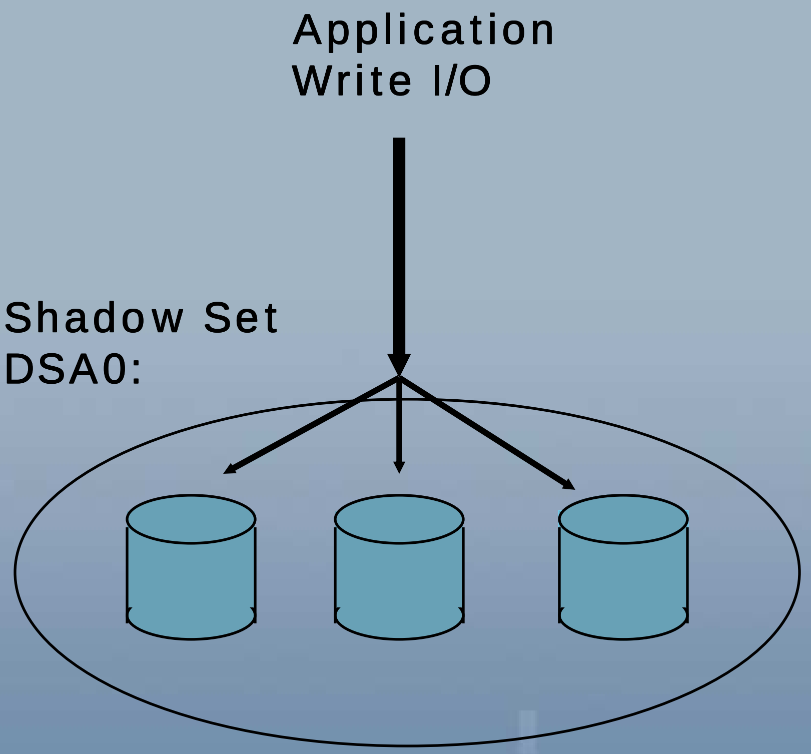
Adding to a VU

```
$ show dev dsa20

Device                  Device           Error    Volume         Free  Trans Mnt
 Name                   Status           Count     Label        Blocks Count Cnt
DSA20:                  Mounted              0   DISK20           2849     1   1
$1$VDA19:     (CLASS3)  ShadowSetMember      0  (member of DSA20:)
$1$VDA20:     (CLASS3)  ShadowSetMember      0  (member of DSA20:)
$ mount/system/confirm dsa20 /shadow=$1$VDA18: disk20
%MOUNT-F-SHDWCOPYREQ, shadow copy required
Virtual Unit - _DSA20:                               Volume Label - DISK20
     Member                    Volume Label Owner UIC
     _$1$VDA18: (CLASS3)       DISK0        [1,1]
Allow FULL shadow copy on the above member(s)? [N]:y
%MOUNT-I-MOUNTED, DISK20 mounted on _DSA20:
%MOUNT-I-SHDWMEMCOPY, _$1$VDA18: (CLASS3) added to the shadow set with a copy operation
%MOUNT-I-ISAMBR, _$1$VDA19: (CLASS3) is a member of the shadow set
%MOUNT-I-ISAMBR, _$1$VDA20: (CLASS3) is a member of the shadow set
$ show dev dsa20

Device                  Device           Error    Volume         Free  Trans Mnt
 Name                   Status           Count     Label        Blocks Count Cnt
DSA20:                  Mounted              0   DISK20           2849     1   1
$1$VDA18:     (CLASS3)  ShadowSetMember      0  (member of DSA20:)
$1$VDA19:     (CLASS3)  ShadowSetMember      0  (member of DSA20:)
$1$VDA20:     (CLASS3)  ShadowSetMember      0  (member of DSA20:)
```

Mini-Copy Scenario

- Mini-copy is a streamline copy operation
- A write bitmap tracks writes to a shadow set and is used to direct mini-copy operation
- Prior to the removal of a shadow set member, writes are sent directly to the shadow set
- To create the bitmap you specify /POLICY=MINICOPY when you DISMOUNT or MOUNT a shadow set member

Mini-Copy



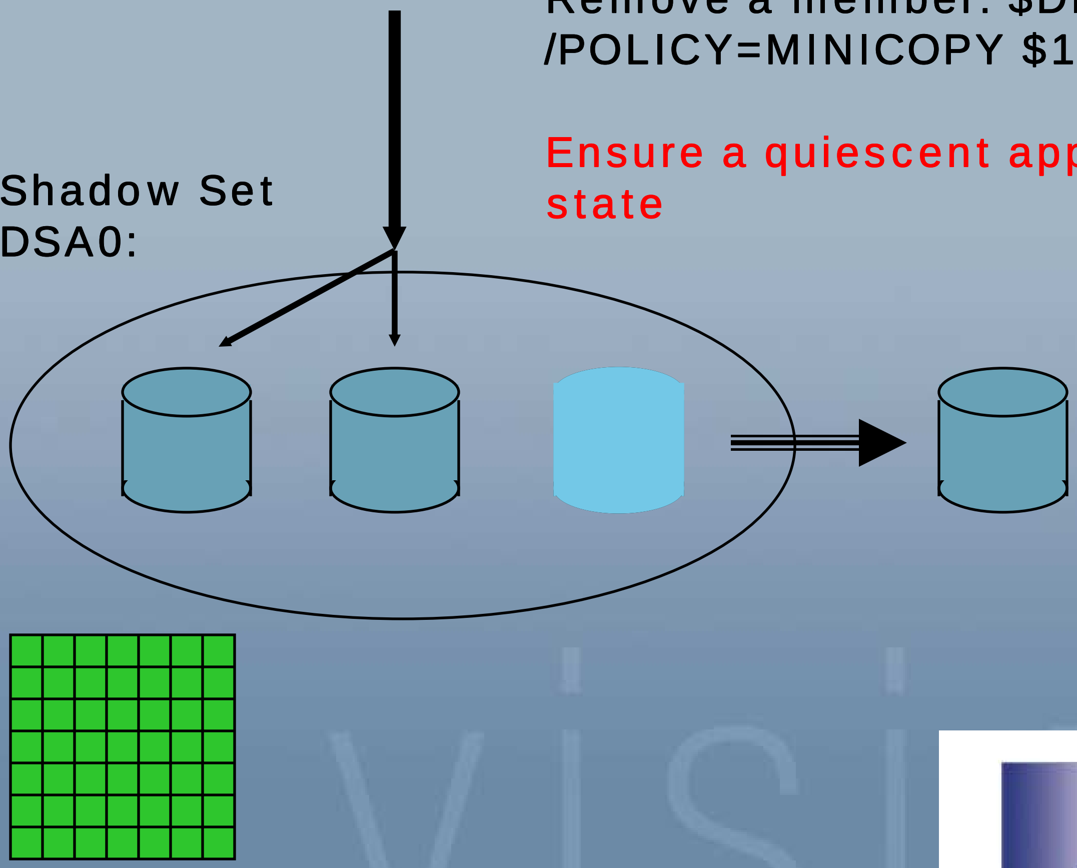
Mini-Copy

Application
Write I/O

Remove a member: $DISMOUNT /POLICY=MINICOPY $1$DGA1000

Ensure a quiescent application IO state

Shadow Set
DSA0:

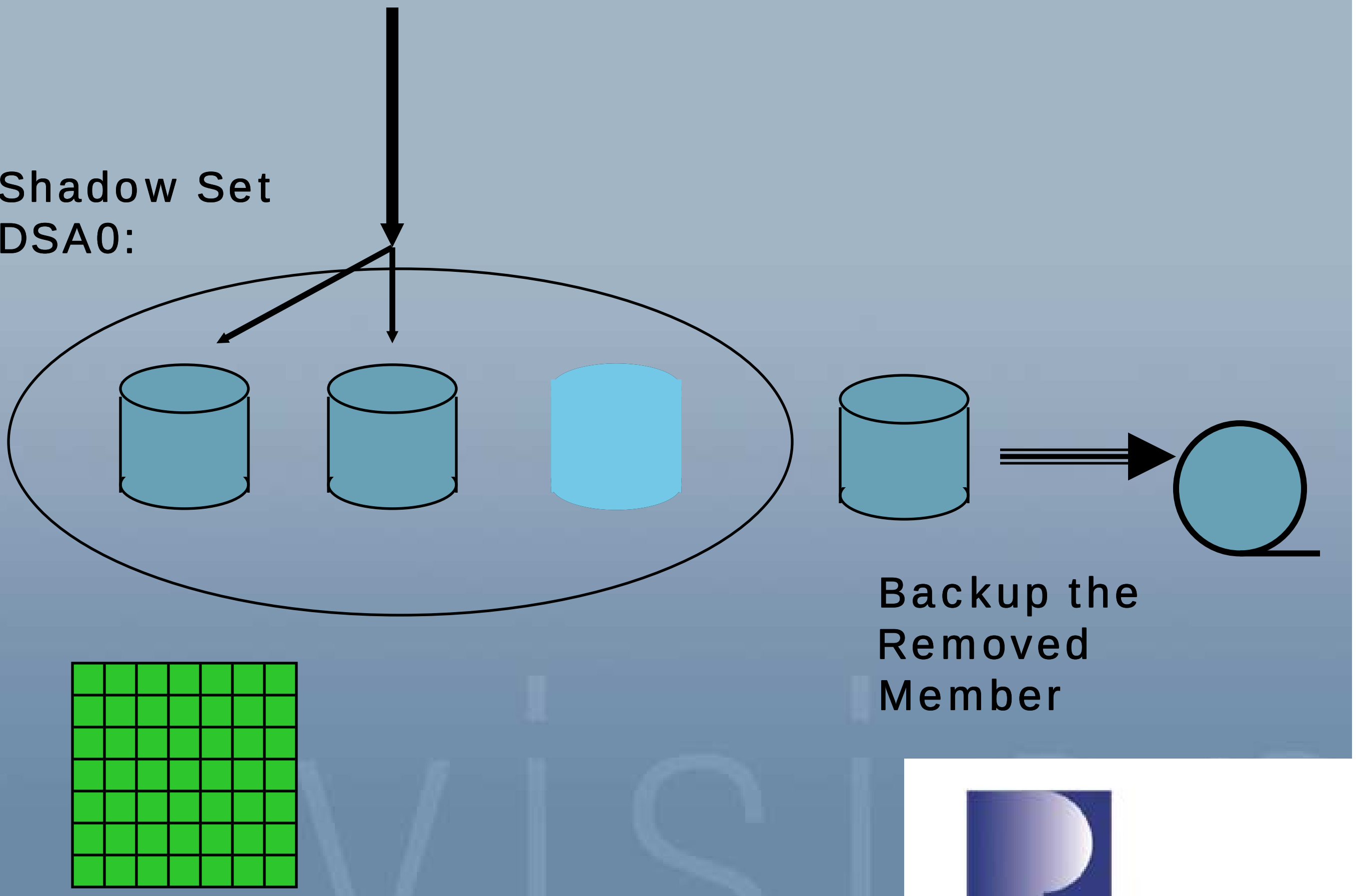


A write bitmap is created

Mini-Copy

Application Write I/O

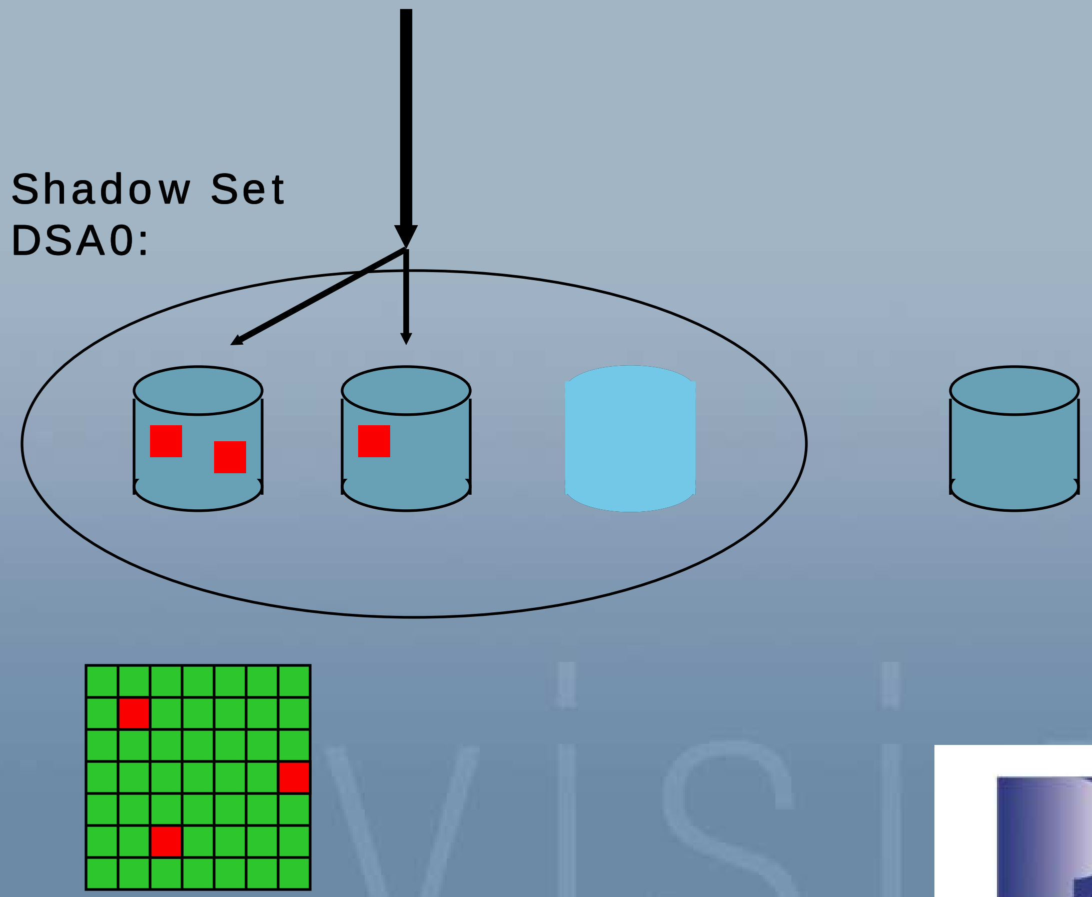
Shadow Set DSA0:



A write bitmap is created

Backup the Removed Member

Mini-Copy



Application Write I/O

Shadow Set DSA0:

Keeping track of Changes.

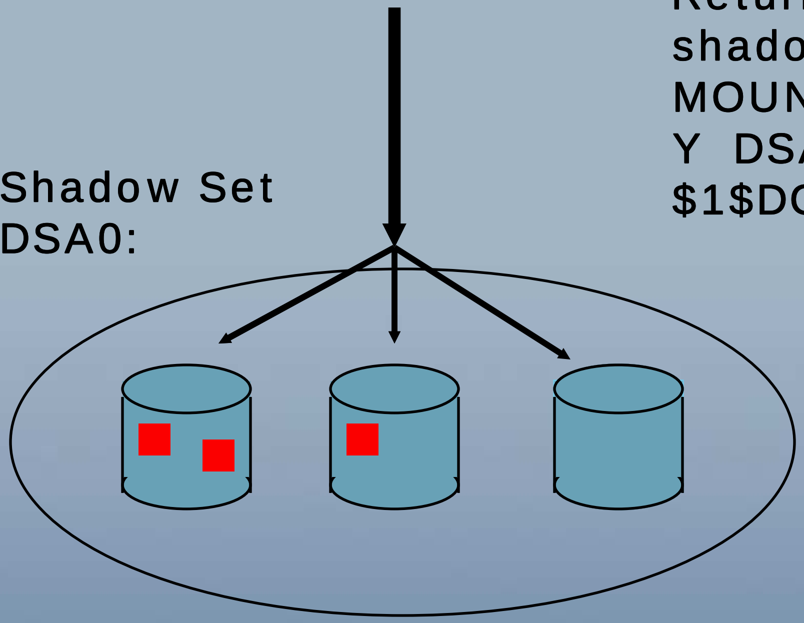
Mini-Copy

Application Write I/O

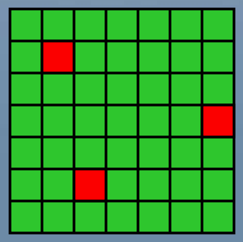
Return member to the shadow set

```
MOUNT/SYS/POL=MINICOPY DSAnnnn /SHAD= $1$DGA1000 volume_label
```

Shadow Set DSA0:



Keeping track of Changes.

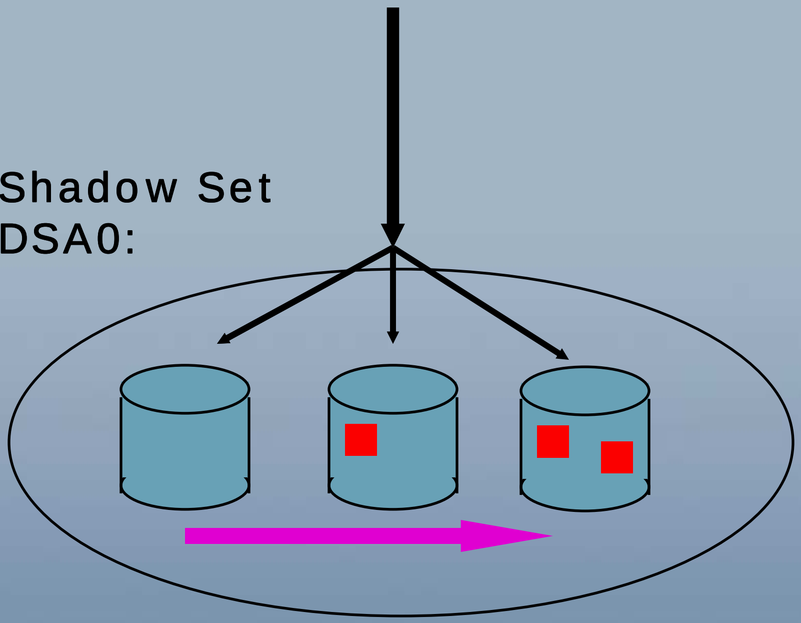


Mini-Copy

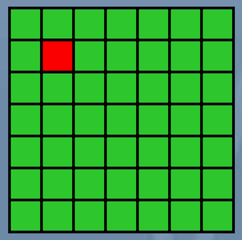
Now, we only copy the data which has changed!

Application Write I/O

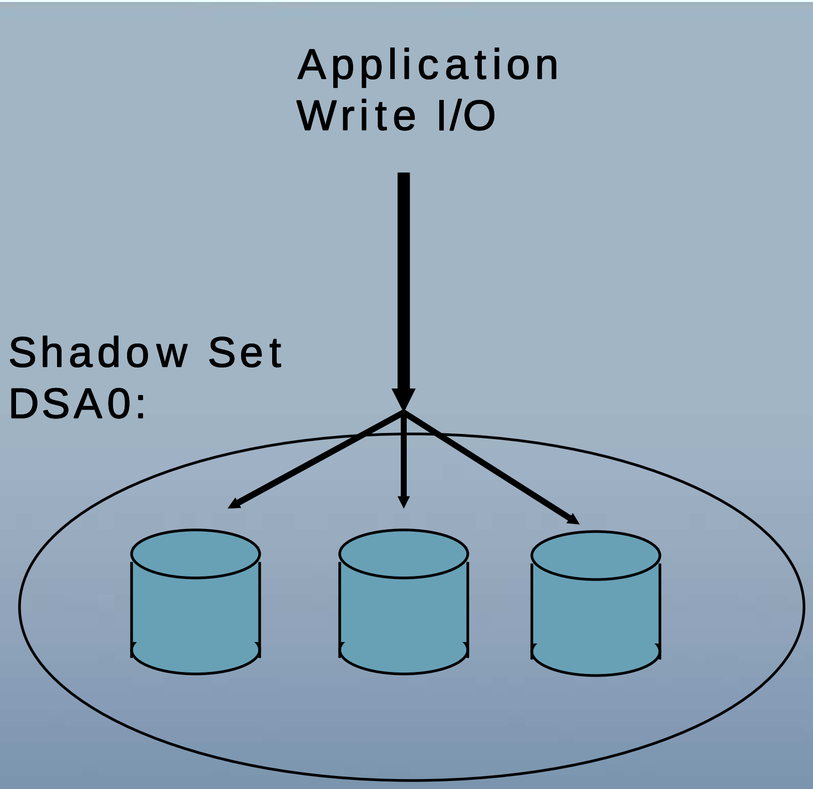
Shadow Set DSA0:



Keeping track of Changes.



Mini-Copy



The bitmap is deleted for the added member

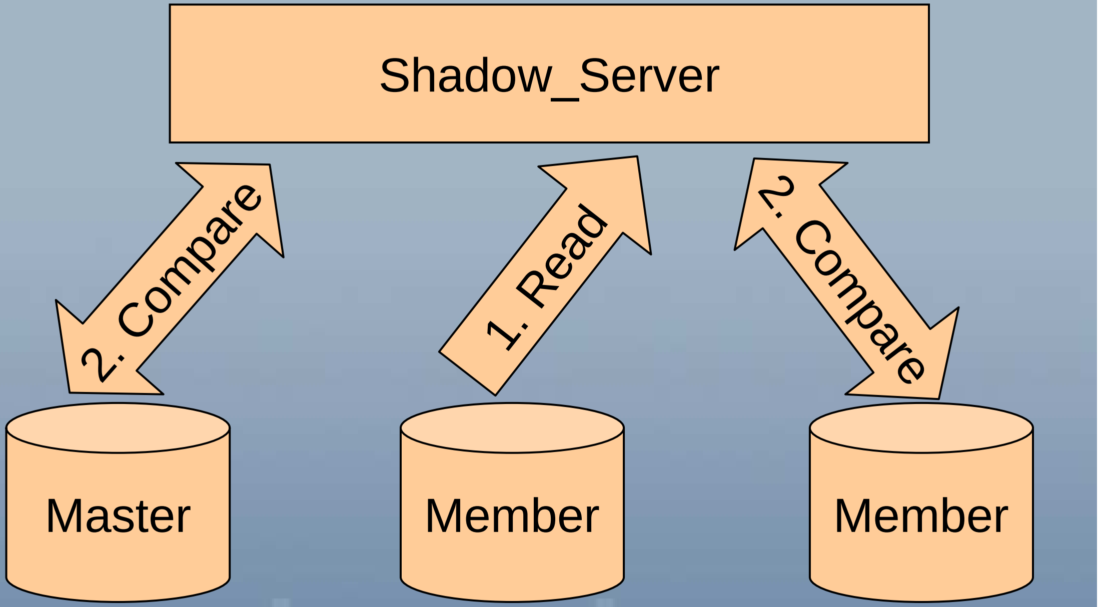
Shadow set is fully usable and consistent

Why is there a shadow merge?

- When a shadow set is “improperly” dismounted by a system a mandatory merge operation occurs.
  - An improper dismount (crash) can cause an application write I/O that is “in flight”, to write data to an indeterminate number of the shadow set members.
  - If a system aborts a shadow set and it has write I/O outstanding in its internal queues...a merge must be done
- Simply put, a merge operation insures that all devices contain identical data on ***all*** LBNS.

Why is there a shadow merge?

1. Read from any member
2. Compare with other member(s)
3. If different, do a Fix-Up: halt all I/Os to the shadowset, fix up differences using data from the Master member, then allow I/Os to continue



Host Based Mini-Merge

- Host based mini-merge is available for OpenVMS 7.3-2 with remedial patch
- Integrated in OpenVMS V8.2 for Alpha and Integrity
- Host based mini-merge depends on bitmaps and policies for information on mini-merge operations

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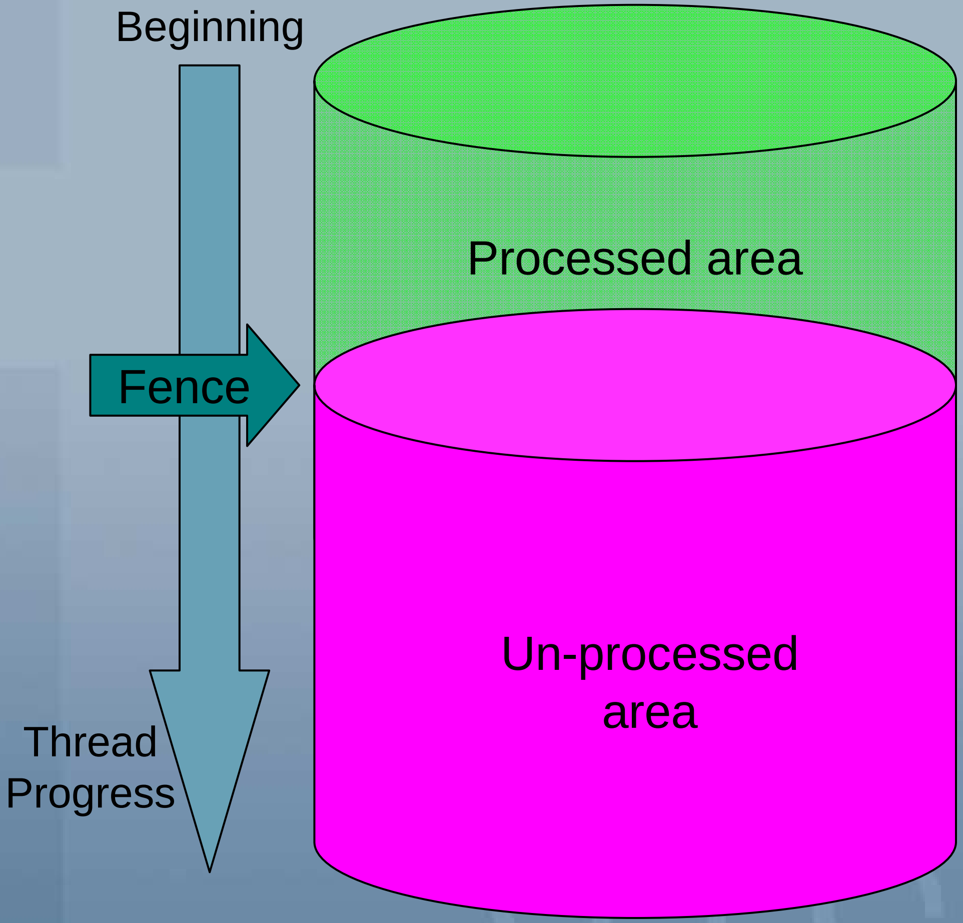
Host Based Mini-Merge

```
$ show shadow dsa20
_DSA20:   Volume Label: IA64SYS
  Virtual Unit State:   Steady State
  Enhanced Shadowing Features in use:
    Host-Based Minimerge (HBMM)

  VU Timeout Value      3600    VU Site Value          0
  Copy/Merge Priority   5000    Mini Merge       Enabled
  Served Path Delay     30

  HBMM Policy
    HBMM Reset Threshold: 50000
    HBMM Master lists:
      Any 1 of the nodes: PARSEC,BEAGLE
    HBMM bitmaps are active on PARSEC
    Modified blocks since bitmap creation: 254

  Device $32$DKA0
    Read Cost             2     Site 0
    Member Timeout        10

 Device $32$DKA100             Master Member
   Read Cost             501   Site 0
   Member Timeout        10
```

Copy and Merge Fence

- For both Merge and Copy operation there is an imaginary fence.
  - It separates the unprocessed and processed portion of the volume
  - Is specified by completed LBN value
  - Is periodically distributed cluster wide
  - LBNs at or below the fence have been processed
  - LBNs above the fence have not been processed

Why is there a shadow copy?



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Analyzing Disk Volumes

- The ANALYZE/DISK utility examines and repairs the OpenVMS file structure.
- It checks the readability and validity of the OpenVMS file structure.
- The utility write locks the volume when performing a repair
- Care should be taken when running this utility, because it could cause more damage than it fixes.

Analyzing Disk Volumes

- The utility has three modes:
  - Command to report errors
    - $ ANALYZE/DISK_STRUCTURE device_name
  - Command to report and repair errors
    - $ ANALYZE/DISK_STRUCTURE device_name
  - Command to report errors and selectively repair errors
    - $ ANALYZE/DISK_STRUCTURE/REPAIR/CONFIRM device_name

Analyzing Utility Warning!

- Analyze Utility can cause more problems then it fixes!
  - If you are logging a lot of hardware errors or if you suspect severe corruption, DO NOT run Analyze Utility in repair mode.
  - Try and get a physical backup to a save_set first.
  - Next run Analyze to get a report.
  - Then try and run Analyze in repair mode.
  - With the physical backup you can always get back to the original state of the disk.
- The next slide will show what happened when Analyze with repair was run and no back up of the device was completed.
  - They did loose data!
  - PARSEC did recover some of the data.

```
Analyze/Disk_Structure for _XMIT$DKB3: started on 18-DEC-2006 14:55:06.85

%ANALDISK-I-OPENQUOTA, error opening QUOTA.SYS
-SYSTEM-W-NOSUCHFILE, no such file
%ANALDISK-W-ALLOCCLR, blocks incorrectly marked allocated
    LBN 5563170 to 5563283, RVN 1
%ANALDISK-W-BADDIRENT, invalid file identification in directory entry
    [XMIT_DATA.20061218]0000005036-HQB-002.OSB;1
-ANALDISK-I-BAD_DIRHEADER, no valid file header for directory
%ANALDISK-W-BADDIRENT, invalid file identification in directory entry
    [XMIT_DATA.20061218]0000005036-JNE-002.OSB;1
-ANALDISK-I-BAD_DIRHEADER, no valid file header for directory
%ANALDISK-W-BADDIRENT, invalid file identification in directory entry
    [XMIT_DATA.20061218]0000005036-JPY-002.OSB;1
-ANALDISK-I-BAD_DIRHEADER, no valid file header for directory
%ANALDISK-W-BADDIRENT, invalid file identification in directory entry
          [XMIT_DATA.20061218]SPLIT_CBSSRV_CLS_XMT_145503.LOG;1
-ANALDISK-I-BAD_DIRHEADER, no valid file header for directory
%ANALDISK-W-FREESPADRIFT, free block count of 65559543 is incorrect (RVN 1);
    the correct value is 65558805
```

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Security Audit

- One of the more important aspect of maintaining a healthy system is security auditing. We will look at basic components of security auditing and also how to generate reports and pinpoint any issues that may have arose.

Security Audit

- Security Audit Basics
- Components Involved in Security Auditing
- Security Audit Reporting

Security Audit Basics

- OpenVMS can report security events as either “security audits” or “security alarms” or both.
  - Security Audits is a log of security events that is stored in a binary file and may be reviewed later.
  - Security Alarms are text message describing a security event sent to security operators.
    - Multiple terminals can be enabled as a security operator terminal.
    - Security alarms are used to notify system managers of an event that has or is occurring so they can take action.
    - You must have both OPER and SECURITY privilege to enable a terminal for security alarm messages.

Components Involved in Security Auditing

- Audit Server Process
  - The Audit Server process performs the following actions:
    - Logging security events to the cluster-wide security audit file
    - Formats security alarms for reporting to security operators and operator log file
    - Monitor system-wide resources needed to log security events
    - Prevent the loss of security information when resources are depleted
    - Stop and start the server with the following command:
      - $ SET AUDIT/SERVER=EXIT
      - $ SYS$SYSTEM:STARTUP AUDIT_SERVER

Components Involved in Security Auditing

- Audit Server Data File
  - The file VMS$AUDIT_SERVER.DAT contains information about the location of the security audit log file.
  - Should be shared by all nodes in a cluster for a single security domain.
  - Default location is SYS$COMMON:[SYSMGR].
  - Can be moved to another location by defining the logical VMS$AUDIT_SERVER

Components Involved in Security Auditing

- Security Audit Log File
  - All security audit events are logged to the security audit log file which is a binary file.
  - View information in the file using the DCL command ANALYZE/AUDIT.
  - The filename is SYS$MANAGER:SECURITY_AUDIT.AUDIT$JOURNAL.
  - Can be moved to another location by issue the DCL command $ SET AUDIT/DESTINATION=destination.

Security Reporting

- Keeping track of all the security information possible is useless if it is not possible to generate reports on the information.
- We will be looking at the DCL ANALZE/AUDIT command

Security Reporting

- The ANALYZE/AUDIT command is used to review security audit events. It is capable of generating four types of outputs which are:
  - Summary Report
  - Brief Report
  - Full Report
  - Binary Output File

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Summary Report

- This report provides a count of the number of each type of events included. It does not have any details about those events.
- This report is strictly a glimpse of the events and is a sound starting point for system managers to look deeper into security issues on the system.
- It is recommended to run this daily.

Summary Report

Example

```
$ analyze/audit/summary/since=1-feb-2007/before=1-mar-2007 common:

Total records read:      893021          Records selected:          98306
Record buffer size:         881
Successful logins:          255          Object creates:              852
Successful logouts:          38          Object accesses:           20658
Login failures:             339          Object deaccesses:          9186
Breakin attempts:            52          Object deletes:              946
System UAF changes:         102          Volume (dis)mounts:            9
Rights db changes:           32          System time changes:           0
Netproxy changes:             0          Server messages:               0
Audit changes:               26          Connections:                   0
Installed db changes:         0          Process control audits:      526
Sysgen changes:               1          Privilege audits:           2768
NCP command lines:           16          Persona audits:
```

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Brief and Full Reports

- After reviewing the summary report, it is decided that more information is needed about the “Audit changes” so a brief report is generated on those items.
- Next we are going to see who made the SYSGEN parameter change from the full report.

Brief Report

Example:

```
$ analyze/audit/summary/since=1-feb-2007/before=1-mar-2007 –
_$ /event_type=audit common:
 Date / Time        Type        Subtype       Node    Username      ID
---------------------------------------------------------------------------------
13-FEB-2007 10:13:33.60 AUDIT      ALARM_TERMINATE  CLASS2 SAUER        20C00240
20-FEB-2007 10:13:33.68 AUDIT      AUDIT_INITIATE   CLASS3 SYSTEM       23200105
20-FEB-2007 10:13:33.76 AUDIT      ALARM_STATE      CLASS2 SPENCER      29C000CB
20-FEB-2007 10:13:33.84 AUDIT      AUDIT_INITIATE   CLASS2 WILLIAMS     23400256
21-FEB-2007 10:13:33.92 AUDIT      ALARM_INITIATE   CLASS3 SYSTEM       24200085
22-FEB-2007 10:13:33.99 AUDIT      AUDIT_TERMINATE  CLASS3 SAUER        22C03883
24-FEB-2007 10:13:34.07 AUDIT      ALARM_STATE      CLASS2 SPENCER      29C000CB
24-FEB-2007 10:13:34.14 AUDIT      AUDIT_STATE      CLASS2 SPENCER      29C000CB
24-FEB-2007 10:13:34.22 AUDIT      ALARM_STATE      CLASS2 SPENCER      29C000CB
26-FEB-2007 10:13:34.30 AUDIT      AUDIT_STATE      CLASS2 PARSEC       28C0884B
26-FEB-2007 10:13:34.38 AUDIT      ALARM_STATE      CLASS2 PARSEC       28C0884B
26-FEB-2007 10:13:34.45 AUDIT      AUDIT_STATE      CLASS2 PARSEC       28C0884B
26-FEB-2007 10:13:34.52 AUDIT      ALARM_STATE      CLASS2 PARSEC       28C0884B
.
.
.
```

Full Report

Example:

```
$ analyze/audit/full/since=1-feb-2007/before=1-mar-2007/event_type=sysgen common:
 Security Audit Analysis Utility
---------------------------------------------------------------------
Security audit (SECURITY) on CLASS9, system id: 1040
Auditable event:          SYSGEN parameter set
Event time:                2-FEB-2007 15:07:20.56
PID:                      28C00123
Process name:             SPENCER
Username:                 SPENCER
Process owner:            [STAFF,SPENCER]
Terminal name:            RTA1:
Image name:               $16$DKA0:[SYS0.SYSCOMMON.][SYSEXE]SYSGEN.EXE
Parameters write:         $16$DKA0:<SYS10.SYSEXE>VAXVMSSYS.PAR;1
Parameters inuse:         Default
Startup:                  New:      SYS$SYSTEM:STARTUP1.COM
                          Original: SYS$SYSTEM:STARTUP.COM
SCSSYSTEMID:              New:      5367
                          Original: 0
SCSNODE:                  New:      BATGRL
                          Original:
```

Accounting

- The accounting report will have the system understand how the system is used and by whom.
- Originally designed for accountants to charge system resources usage back to the users of the system, which isn’t being used much today.
- Accounting data can track how users are utilizing the system and this information can help system managers detect unusual situations.

Accounting

- What is being tracked
- What to look for
- Accounting File
- Generating reports

What is being Tracked

- Proces - any process termination
- Image - image execution
- Interactive - interactive job termination
- Login Failure – failed login attempts
- Subprocess – Subprocess termination
- Detached – detached job termination
- Batch – batch job termination
- Network – network job terminal
- Print – all print jobs
- Message – user messages

What to look for

- Most important thing to look for in accounting information is anything unusual.
- The following is a guideline on what to look for, which doesn’t necessary indicate a problem, but only flags that should be considered.
- But in general, it is now most useful as an troubleshooting aide.

What to look for

- Unknown usernames
  - Users who normally do not log on to this system indicates a possible intrusion of the system.
- Unusual usage patterns
  - Look for users who are using the system on a weekend that normally uses the system only during the week. Also, consider times of the day the users are using the system.
- Unusual system resource usage
  - Check for process that is using an unusually large or small amount of resources compared to normal. This is an indication of the process doing things out of the ordinary.

What to look for

- Unexpected sources of login
  - If a process logs in from a network connection for a user that is normally working at their desk on an OpenVMS workstation may be an indication the user is trying to hide something.
- If using for troubleshooting, the last status field

Accounting File

- The accounting file is named SYS$MANAGER:ACCOUNTNG.DAT
- Can be moved to another disk or directory with the logical name ACCOUNTNG.
- Protect this file from processes that do need access to it, because it does contain usernames.

Accounting File

- Much like the Security Auditing, Accounting can generate reports. Use the ACCOUNTING command to generate these reports. ACCOUNTING is capable of generating four types of outputs which are:
  - Brief Accounting Report
  - Full Accounting Report
  - Binary version of selected or rejected records
  - Summary report on selected items

Accounting File

Example:

```
$ accounting/since/brief
 Date / Time      Type     Subtype     Username      ID     Source   Status
--------------------------------------------------------------------------------
30-MAR-2007 08:13:41 PROCESS SUBPROCESS  SPENCER      2E4005DF          00010001
30-MAR-2007 08:13:41 PROCESS SUBPROCESS  SPENCER      2E4005DE          00002BD4
30-MAR-2007 08:24:34 PROCESS SUBPROCESS  SPENCER      2E40061A          00010001
30-MAR-2007 08:24:34 PROCESS SUBPROCESS  SPENCER      2E400619          00002BD4
30-MAR-2007 13:49:46 LOGFAIL             <login>      2E400803 TNA6:    00D38064
30-MAR-2007 13:52:07 PROCESS INTERACTIVE MEHLHOP      2E400804 TNA7:    10000001
30-MAR-2007 14:15:11 PROCESS SUBPROCESS  SPENCER      2E400828          10000001
30-MAR-2007 14:15:11 PROCESS SUBPROCESS  SPENCER      2E400829          00010001
```

Accounting File

- Lets look at more information about the process with the ID of 2E400803, so lets generate a FULL report.

Accounting File

Example:

```
$ accounting/full/id=2E400803
 LOGIN FAILURE
-------------
Username:          <login>          UIC:               [SYSTEST,SYSTEM]
Account:           <login>          Finish time:       30-MAR-2007 13:49:46.74
Process ID:        2E400803         Start time:        30-MAR-2007 13:49:07.10
Owner ID:                           Elapsed time:                0 00:00:39.64
Terminal name:     TNA6:            Processor time:              0 00:00:00.04
Remote node addr:                   Priority:          4
Remote node name:                   Privilege <31-00>: 0010C000
Remote ID:         TELNET_0A64009F   Privilege <63-32>: 00000000
Remote full name:  10.100.0.159
Posix UID:         -2               Posix GID:         -2 (%XFFFFFFFE)
Queue entry:                        Final status code: 00D38064
Queue name:
Job name:
Final status text: %LOGIN-F-CMDINPUT, error reading command input
Page faults:               90       Direct IO:                 16
Page fault reads:           3       Buffered IO:               24
Peak working set:        1616       Volumes mounted:            0
Peak page file:        169216       Images executed:            1
```

Process Management

- At times it is necessary to look at, or change, a currently executing process.
- System managers with WORLD privilege may look at the process with the SHOW PROCESS command.
- The /ID qualifier specifies the process ID of the desired process.

Process Management

```
parsec> show process/all/id=23E00E6B
29-MAR-2007 09:43:54.19   User: PARSEC           Process ID:   23E00E6B
                          Node: CLASS3           Process name: "PARSEC"
Terminal:           TNA23:  (Host: tpg.parsec.com Port: 1141)
User Identifier:    [PARSEC]
Base priority:      7
Default file spec:  STAFF:[PARSEC]
Number of Kthreads: 1
Devices allocated:  CLASS3$TNA23:
Process Quotas:
 Account name:
 CPU limit:                         Infinite  Direct I/O limit:       150
 Buffered I/O byte count quota:        99808  Buffered I/O limit:     150
 Timer queue entry quota:                 10  Open file quota:        150
 Paging file quota:                    43712  Subprocess quota:        10
 Default page fault cluster:              64  AST quota:              248
 Enqueue quota:                         2000  Shared file limit:        0
 Max detached processes:                   0  Max active jobs:          0
```

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Process Management

```
Accounting information:
 Buffered I/O count:       159  Peak working set size:        4096
 Direct I/O count:          46  Peak virtual size:          171616
 Page faults:              782  Mounted volumes:                 0
 Images activated:           8
 Elapsed CPU time:          0 00:00:00.29
 Connect time:              0 00:03:57.55
Authorized privileges:
 NETMBX       SETPRV       TMPMBX
Process privileges:
 ALTPRI               may set any priority value
 NETMBX               may create network device
 TMPMBX               may create temporary mailbox
Process rights:
 PARSEC                            resource
 INTERACTIVE
 REMOTE
System rights:
 SYS$NODE_CLASS3
```

Process Management

```
Auto-unshelve: on
Image Dump: off
Soft CPU Affinity: off
Parse Style: Traditional
Case Lookup: Blind
Units: Blocks
Home RAD: 0
Scheduling class name: none
Process Dynamic Memory Area
  Current Size (KB)               128.00   Current Size (Pagelets)       256
  Free Space (KB)                 114.73   Space in Use (KB)           13.26
  Largest Var Block (KB)          114.21   Smallest Var Block (By)     96.00
  Number of Free Blocks                5   Free Blocks LEQU 64 bytes       0
There is 1 process in this job:
  PARSEC (*)
```

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Process Management

- The SET PROCESS command may be used to change the attributes of the executing process.
- Additionally, use the /ID qualifier to specify the process ID of the desired process.
- The STOP command may be used to abort a process.

Process Management

```
$ show system/process=parsec
OpenVMS V8.3  on node CLASS3  29-MAR-2007 09:54:59.05  Uptime  6 20:39:55
  Pid    Process Name    State  Pri      I/O       CPU       Page flts  Pages
23E00E6B PARSEC          COM      7      435   0 00:04:35.56      1231    125
$ set process/suspend/id=23E00E6B
$ show system/process=parsec
OpenVMS V8.3  on node CLASS3  29-MAR-2007 09:55:24.92  Uptime  6 20:40:21
  Pid    Process Name    State  Pri      I/O       CPU       Page flts  Pages
23E00E6B PARSEC          SUSP     7      435   0 00:04:55.51      1231    125
$ set process/resume/id=23E00E6B
$ show system/process=parsec
OpenVMS V8.3  on node CLASS3  29-MAR-2007 09:55:46.11  Uptime  6 20:40:42
  Pid    Process Name    State  Pri      I/O       CPU       Page flts  Pages
23E00E6B PARSEC          COM      7      435   0 00:05:10.21      1231    125
$ stop/id=23E00E6B
```

or

```
$ stop parsec
```

Simple Performance Monitoring

- The Monitor utility is part of OpenVMS and can display system statistics on an ongoing basis.
- It does not have the ability to show trends or graph historical data
- It is best used to look at a live system for performance problems
- Can create binary recording files, which can
  - Be played back, possibly at a different interval
  - Converted to CSV files by an hp supplied utility for analysis using T4 (discussed later)

Simple Performance Monitoring

- The Monitor utility has the following command syntax:

  MONITOR [/command qualifier[,...]] classname[,...] [/classname-qualifier[,...]]

- The following are useful Monitor qualifiers
  - /BEGINNING – Start time
  - /ENDING – End time
  - /BY_NODE – Displays performance data by node
  - /[NO]DISPLAY – Specify /nodisplay when in batch mode
  - /INPUT – Input recording file
  - /INTERVAL – Sampling interval
  - /RECORD – Create an output binary recording file
  - /SUMMARY – Summarizes monitor data

Simple Performance Monitoring

- The following classes can be specified via the Monitor utility:
  - ALL_CLASSES FILE_SYSTEM_CACHE
  - DISK DLOCK FCP
  - CLUSTER IO DECNET
  - LOCK MODES MSCP_SERVER
  - PAGE STATES RLOCK
  - RMS SCS PROCESSES
  - SYSTEM TIMER TRANSACTION
  - VBS VECTOR

Simple Performance Monitoring

```
OpenVMS Monitor Utility
            +-----+              PROCESS STATES
            | CUR |              on node CLASS2
            +-----+          29-MAR-2007 10:24:21.86

                                     0         10        20        30        40
                                     + - - - - + - - - - + - - - - + - - - - -+
 Collided Page Wait                  |
 Mutex & Misc Resource Wait          |
 Common Event Flag Wait              |
 Page Fault Wait                     |
 Local Event Flag Wait             1 |*
 Local Evt Flg (Outswapped)        5 |*****
                                     |         |         |         |          |

 Hibernate                        16 |****************
 Hibernate (Outswapped)           11 |***********
 Suspended                           |
 Suspended (Outswapped)              |
 Free Page Wait                      |
 Compute                           6 |******
 Compute (Outswapped)                |
 Current Process                   1 |*
                                     + - - - - + - - - - + - - - - + - - - - -+
```

Simple Performance Monitoring

```
OpenVMS Monitor Utility
            +-----+         TIME IN PROCESSOR MODES
            | CUR |              on node PARSEC
            +-----+          29-MAR-2007 10:30:48.06

                                     0         25        50        75       100
                                     + - - - - + - - - - + - - - - + - - - - -+
 Interrupt Stack                  8 |***
                                     |         |         |         |          |
 MP Synchronization                  |
                                     |         |         |         |          |
 Kernel Mode                      46 |******************
                                     |         |         |         |          |
 Executive Mode                    8 |***
                                     |         |         |         |          |
 Supervisor Mode                  36 |*************
                                     |         |         |         |          |
 User Mode                         3 |*
                                     |         |         |         |          |
 Compatibility Mode                  |
                                     |         |         |         |          |
 Idle Time                           |
                                     + - - - - + - - - - + - - - - + - - - - -+
```

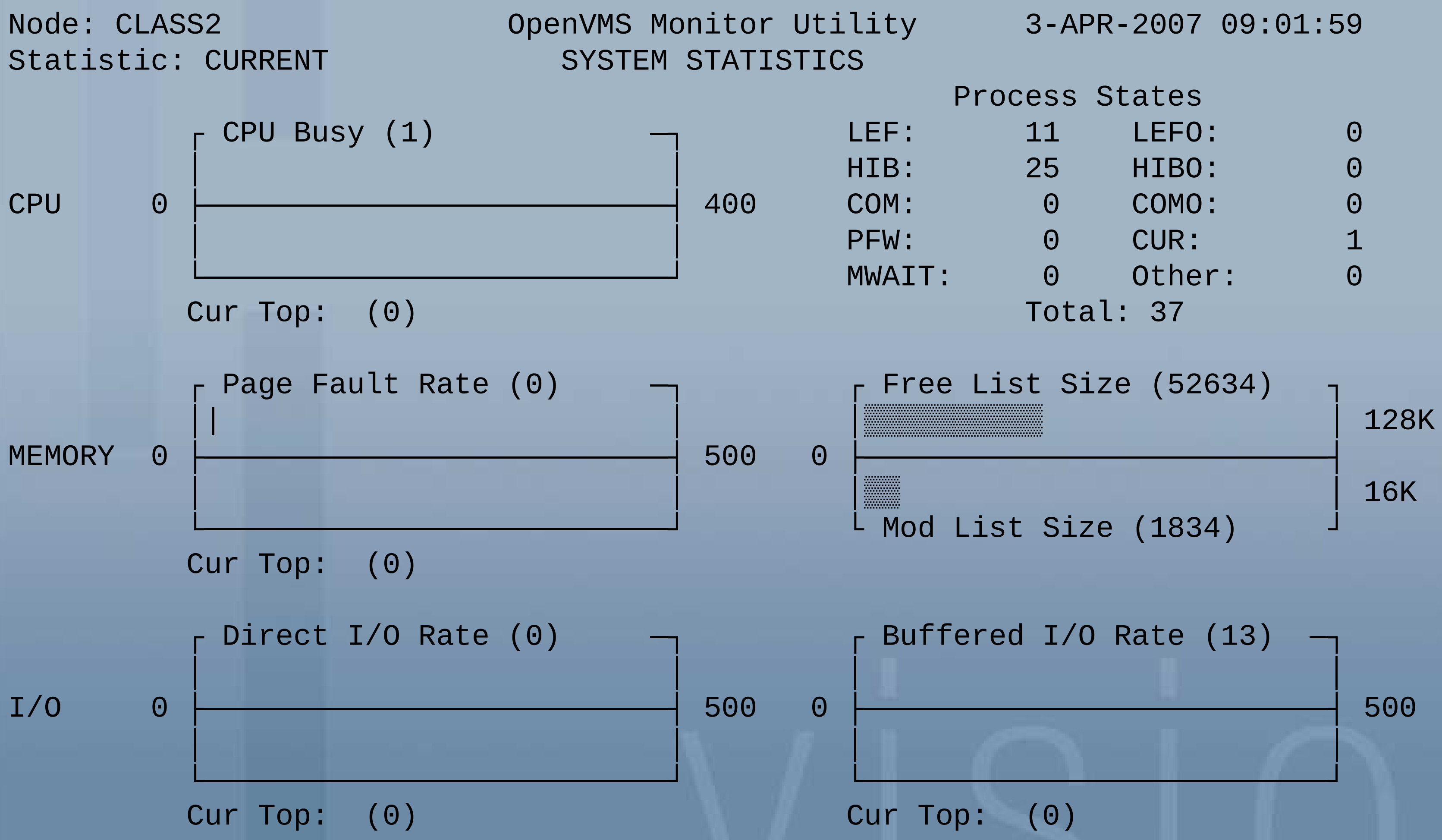
Simple Performance Monitoring

```
OpenVMS Monitor Utility
                             TOP CPU TIME PROCESSES
                                 on node PARSEC
                             29-MAR-2007 10:37:05.92

                                     0         25        50        75       100
                                     + - - - - + - - - - + - - - - + - - - - -+
 2020016A  BATCH_511              46  ******************
                                     |         |         |         |          |
 20200168  SAUER_1                40  ****************
                                     |         |         |         |          |
 2020005F  TNT_SERVER              3  *
                                     |         |         |         |          |
 2020012D  SAUER                   2
                                     |         |         |         |          |
 20200041  SWAPPER                 1
                                     |         |         |         |          |
 2020016F  FAULTER23               1
                                     |         |         |         |          |
 20200052  TP_SERVER               1
                                     |         |         |         |          |

                                     + - - - - + - - - - + - - - - + - - - - -+
```

Simple Performance Monitoring



```
Node: CLASS2                OpenVMS Monitor Utility      3-APR-2007 09:01:59
Statistic: CURRENT             SYSTEM STATISTICS
                                                              Process States
          ┌ CPU Busy (1)                ┐             LEF:       11     LEFO:        0
          │                             │             HIB:       25     HIBO:        0
CPU     0 ├─────────────────────────────┤ 400         COM:        0     COMO:        0
          │                             │             PFW:        0     CUR:         1
          └─────────────────────────────┘             MWAIT:      0     Other:       0
         Cur Top:  (0)                                          Total: 37

          ┌ Page Fault Rate (0)         ┐             ┌ Free List Size (52634)      ┐
          ││                            │             │▒▒▒▒▒▒▒▒▒▒                   │ 128K
MEMORY  0 ├─────────────────────────────┤ 500     0   ├─────────────────────────────┤
          │                             │             │▒▒                           │ 16K
          └─────────────────────────────┘             └ Mod List Size (1834)        ┘
         Cur Top:  (0)

          ┌ Direct I/O Rate (0)         ┐             ┌ Buffered I/O Rate (13)      ┐
          │                             │             │                             │
I/O     0 ├─────────────────────────────┤ 500     0   ├─────────────────────────────┤ 500
          │                             │             │                             │
          └─────────────────────────────┘             └─────────────────────────────┘
         Cur Top:  (0)                               Cur Top:  (0)
```

T4

- T4 – Tabular Timeline Tracking Tool
- Runs on OpenVMS
- Automatically creates historical archive
- Draws from multiple data sources
- Multiple performance metrics per source
- Merges to a **synchronized timeline** view
- Creates two-dimensional table (CSV)
  - CSV files can be imported to excel and other programs to create performance graphs

Acquiring T4

- You can download the T4V4 tool kit from **http://h71000.www7.hp.com/OpenVMS/products/t4/index.html**
- At this site, you can find the T4 kit, as well as the readme file, which is VERY beneficial
- T4V33 tool kit ships with the release of OpenVMS V7.3-2 in SYS$ETC:
- T4V34 tool kit ships with the release of OpenVMS V8.2 in SYS$ETC:
- T4 collection can be a useful **adjunct** to your existing performance management program.

TLVIZ

- TLViz (Time Line Vizualizer) is an HP internal tool, developed and used by OpenVMS Engineering to simplify and dramatically speed up the analysis of T4 style CSV files.
- TLViz is a Windows NT PC utility (written in Visual Basic) that allows you to quickly generate performance graphs using T4 generated CSV files
- Download the latest version from http://h71000.www7.hp.com/OpenVMS/products/t4/index.html
- The following example illustrates the use of TLViz

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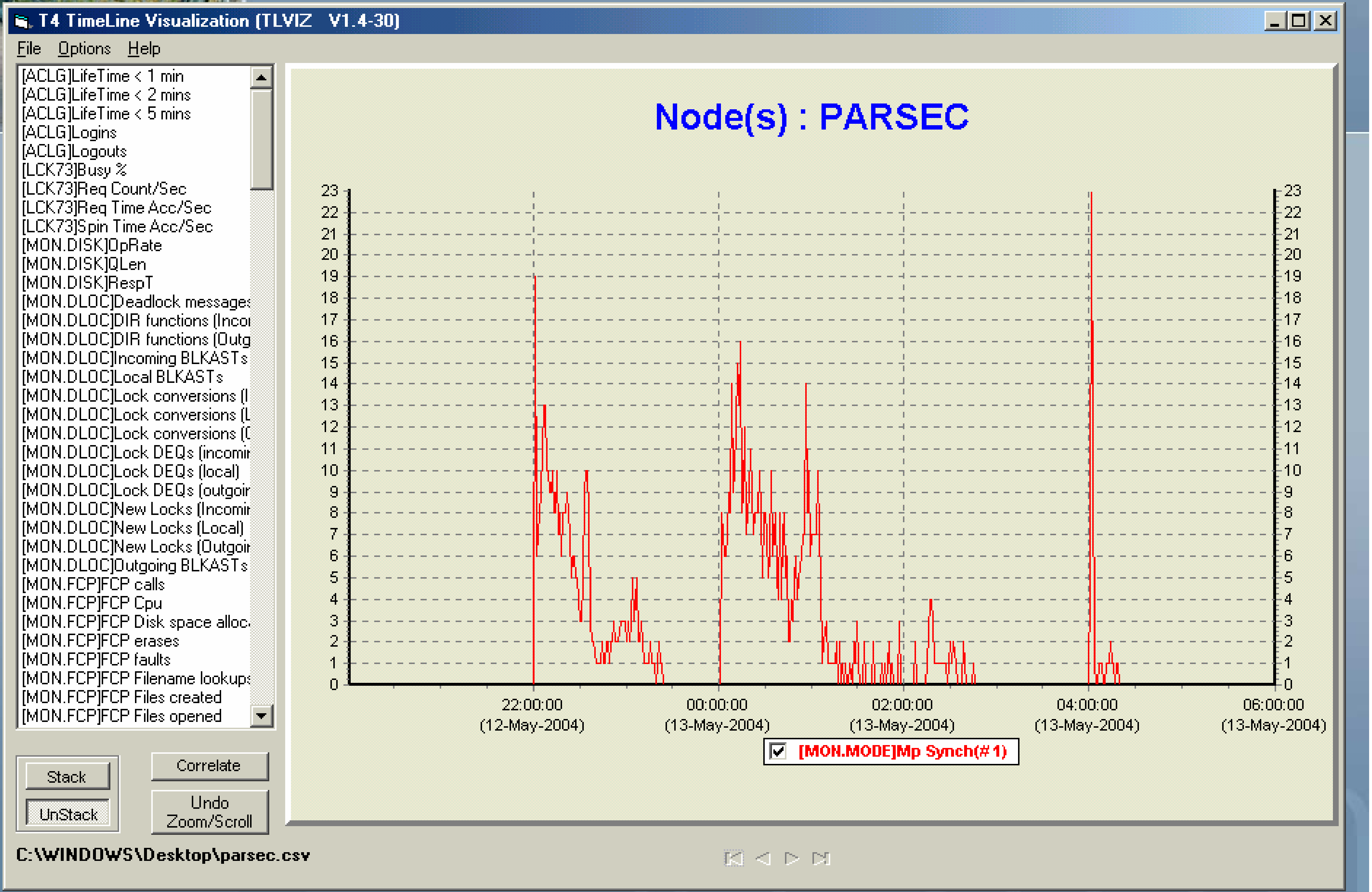

[ACLG]LifeTime < 1 min
[ACLG]LifeTime < 2 mins
[ACLG]LifeTime < 5 mins
[ACLG]Logins
[ACLG]Logouts
[LCK73]Busy %
[LCK73]Req Count/Sec
[LCK73]Req Time Acc/Sec
[LCK73]Spin Time Acc/Sec
[MON.DISK]OpRate
[MON.DISK]QLen
[MON.DISK]RespT
[MON.DLOC]Deadlock message:
[MON.DLOC]DIR functions (Incor
[MON.DLOC]DIR functions (Outg
[MON.DLOC]Incoming BLKASTs
[MON.DLOC]Local BLKASTs
[MON.DLOC]Lock conversions (I
[MON.DLOC]Lock conversions (L
[MON.DLOC]Lock conversions (C
[MON.DLOC]Lock DEQs (incomir
[MON.DLOC]Lock DEQs (local)
[MON.DLOC]Lock DEQs (outgoir
[MON.DLOC]New Locks (Incomir
[MON.DLOC]New Locks (Local)
[MON.DLOC]New Locks (Outgoir
[MON.DLOC]Outgoing BLKASTs
[MON.FCP]FCP calls
[MON.FCP]FCP Cpu
[MON.FCP]FCP Disk space alloc
[MON.FCP]FCP erases
[MON.FCP]FCP faults
[MON.FCP]FCP Filename lookup:
[MON.FCP]FCP Files created
[MON.FCP]FCP Files opened

C:\WINDOWS\Desktop\parsec.csv

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Questions??

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Question & Answer

Presented by
Lori Spencer
www.parsec.com | 888-4-PARSEC
lspencer@parsec.com

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To Download this Presentation, please visit:
http://www.parsec.com/public/HealthyManager.pdf

To E-mail Lori

lspencer@parsec.com

www.parsec.com | 888-4-PARSEC

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