ORACLE OPEN WORLD
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Integrating the Oracle Database Appliance with the Sun ZFS Storage Appliance to Achieve High Availability and Security

Hardware and Software
Engineered to Work Together

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Disclaimer

- This room is an unsafe harbour
- No one from Oracle has previewed this presentation
- No one from Oracle knows what we are going to say
- No one from Oracle has supplied any of our material

- You may rely upon this presentation to make decisions for your enterprise

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Agenda

- Introductions
- Executive Summary
- Puzzle Pieces (HA)
- ODA
  - What and Why
  - Installation
  - Value Adds
- ZFS File System
  - Pooling
  - Redundancy
- ZFS Storage Appliance
- Questions

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Daniel A. Morgan

- Oracle ACE Director
- Consultant to Harvard University
- University of Washington Oracle Instructor, ret.
- The Morgan of Morgan's Library on the web
- Board Member: Western Washington OUG
- Member of the Compucom Oracle team
- More than 500 RAC clusters built
  - Largest RAC 24 nodes at OOW 2005
  - Largest DB 1.2PB
  - 2 x 10 node clusters w/ DataGuard

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Hans Forbrich

- Oracle ACE Director
  - First ACE Director in Canada
- Oracle University Instructor of the Year 2009-2010
- Owner: Forbrich Computing
  - Consultancy to City of Lethbridge, City of Edmonton, Government of Alberta, ATCO, Alberta Blue Cross …
- Founder: Shen Group
- Coding since in 1969
- Around Oracle stack since 1984
- Developer, Admin, Operations, Architect, CTO

Executive Summary

- Never make a technology argument when a financial argument will suffice
  - Your CFO wants to talk about ROI not IOPS
  - Will this technology support our organization's needs?
  - Can we right-size it today and will it scale for tomorrow?
  - Does it meet our regulatory and compliance requirements?
  - What is involved in migrating current operations to it?
  - Can our existing team deploy and maintain it?
  - Can we find qualified technologists who already know it?
  - Can the vendor(s) involved fully support the tech stack?
  - How will this affect our customers?
  - How will this affect our financial position?
    - capital expense to obtain it
    - operating expense to maintain it
    - future retirement expense

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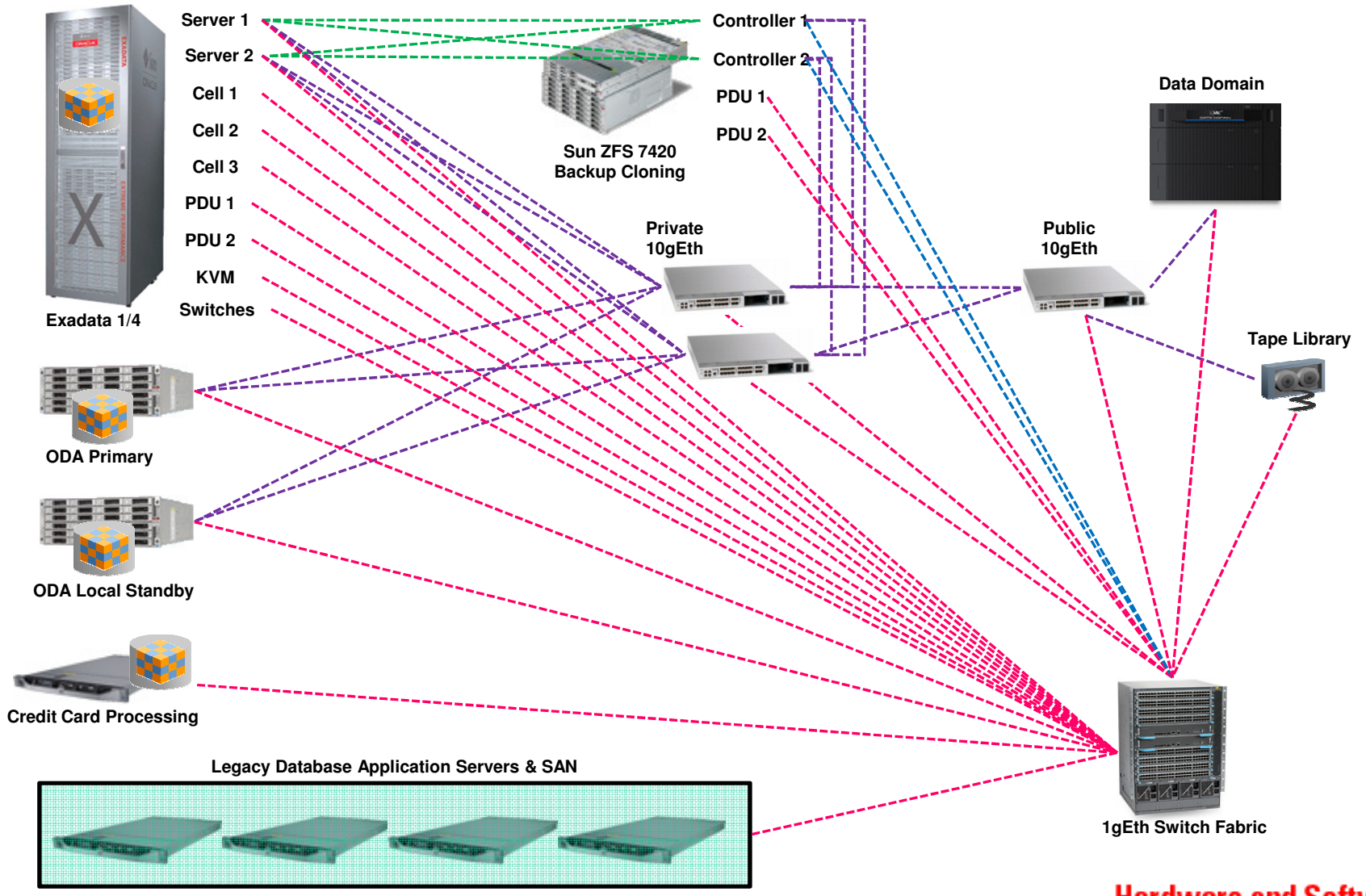
Questions we as IT professionals must answer

- Why does deployment take so long and cost so much?
- Why are we spending so much on support?
- Why does patching so often break something else?
- Why do we spend so much time fighting fires?

Puzzle Pieces



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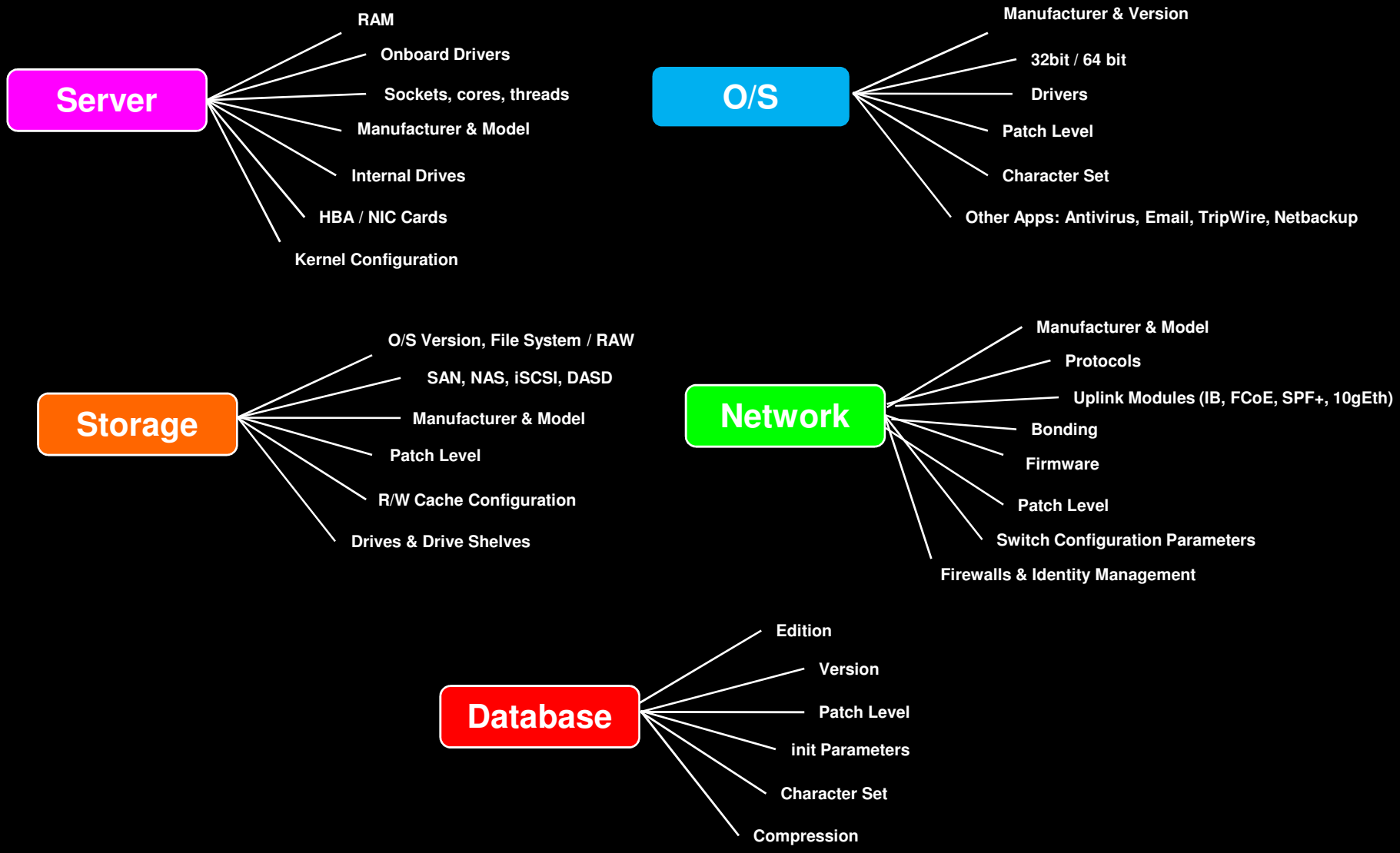
Static Puzzle Pieces



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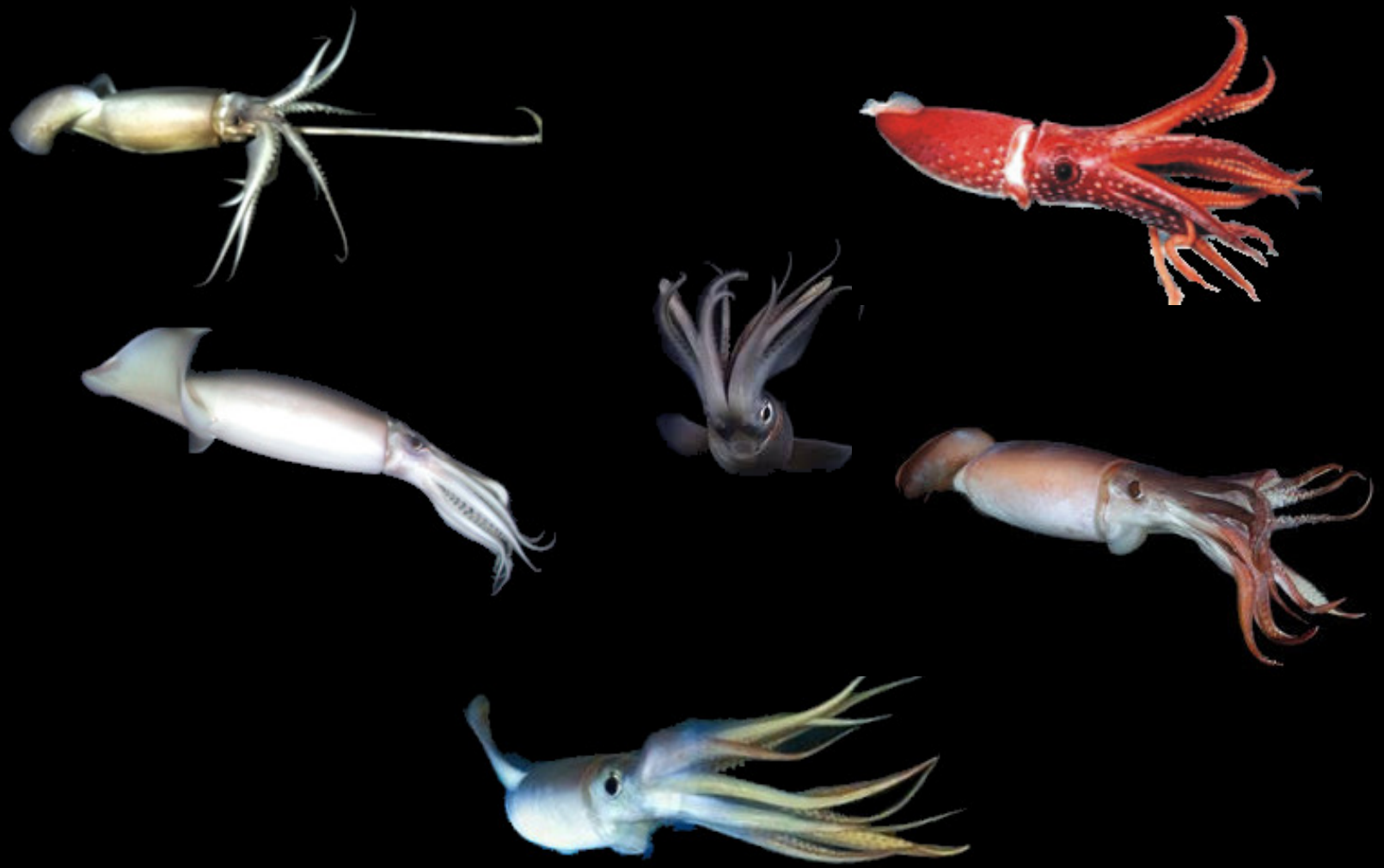
Animated Puzzle Pieces



It's hard to embrace a barrel of squid

Puzzle Pieces

- The decisions we've made in the past guarantee that
  - No one has ever built a RAC cluster with our configuration
  - No one has ever applied operating system and firmware patches to our configuration
  - No one has ever patched to our configuration
  - Oracle has never tested and certified our configuration
  - No one in support can exactly duplicate our environment

LONELINESS

If You Find Yourself Struggling with Loneliness, You're Not Alone.
And Yet You Are Alone. So Very Alone.

The Solution

make different, and better, decisions

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What is an ODA?

- An appliance
  - A single line on the invoice ... plus the power chords
  - But you get root and sys: The customer is in control
- Announced last year at OpenWorld
- Engineered two server RAC cluster in a 4U case
  - 24 CPU cores
  - 192 GB of RAM
  - 12 TB of direct attached storage with ASM triple mirroring
  - 1TB RAID 1 disks for O/S and Oracle binaries
- One size fits all ... but ...
- License only the resources you need
- Cores licensed dictate all on-board Oracle licensing

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ODA in Pictures

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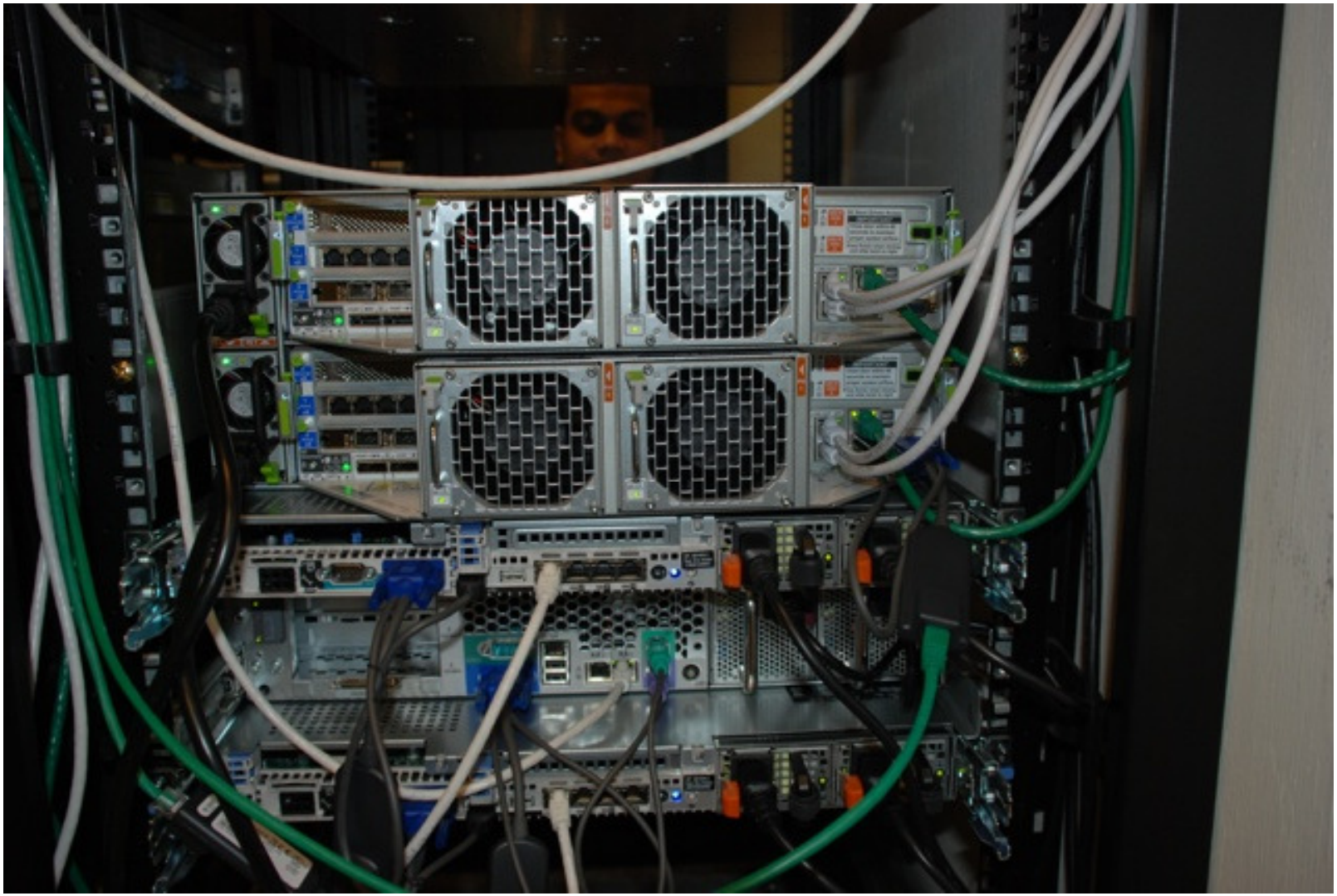
ODA in Pictures



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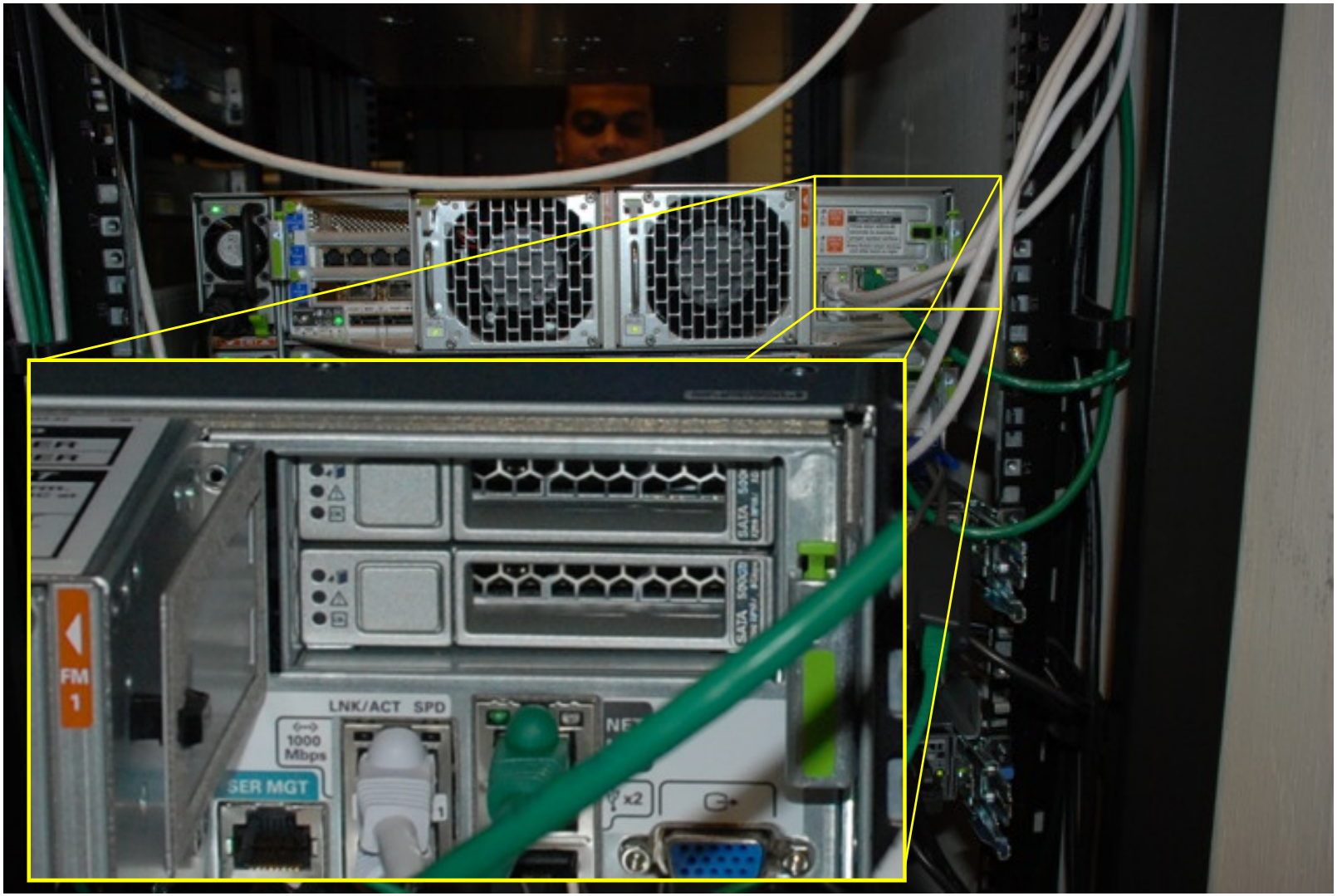
ODA in Pictures



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Why an ODA?

- Minimize complexity from rack-and-stack through database deployment
- Fewer resources required to deploy
  - UNIX System Admins: not required
  - Network Admins: not required
  - Storage Admins: not required
- Ease of maintenance and patching
  - One patch combines O/S, drivers, networking, infrastructure
  - One patch database
- Supports multiple Oracle databases
- Petabyte storage available with ZFS
- Can form the basis for deploying HA applications in organizations that lack in-depth technical resources

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No rolling patches ... and they are not childproof

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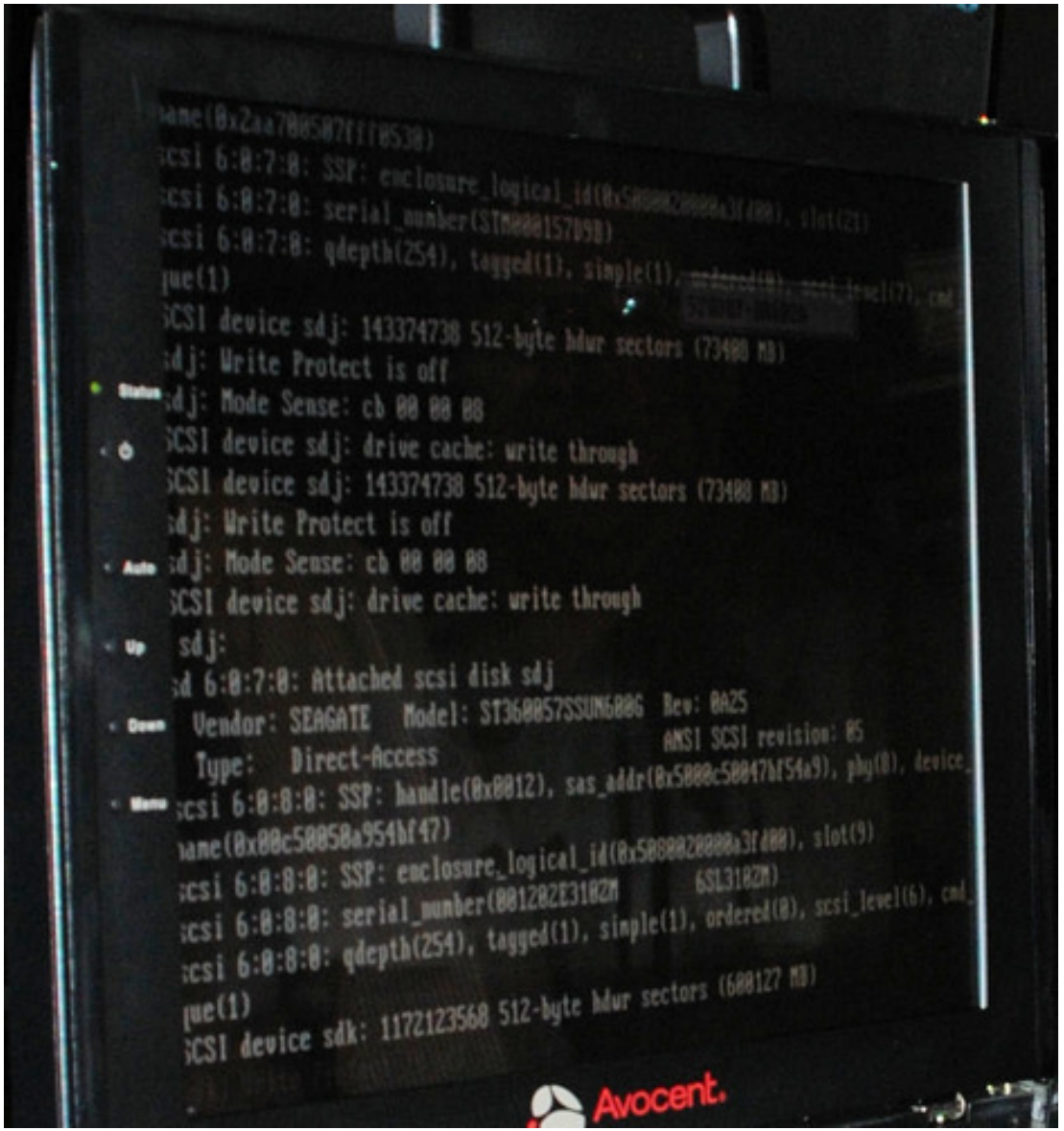
Discussion

Installation

Step 1: Power On



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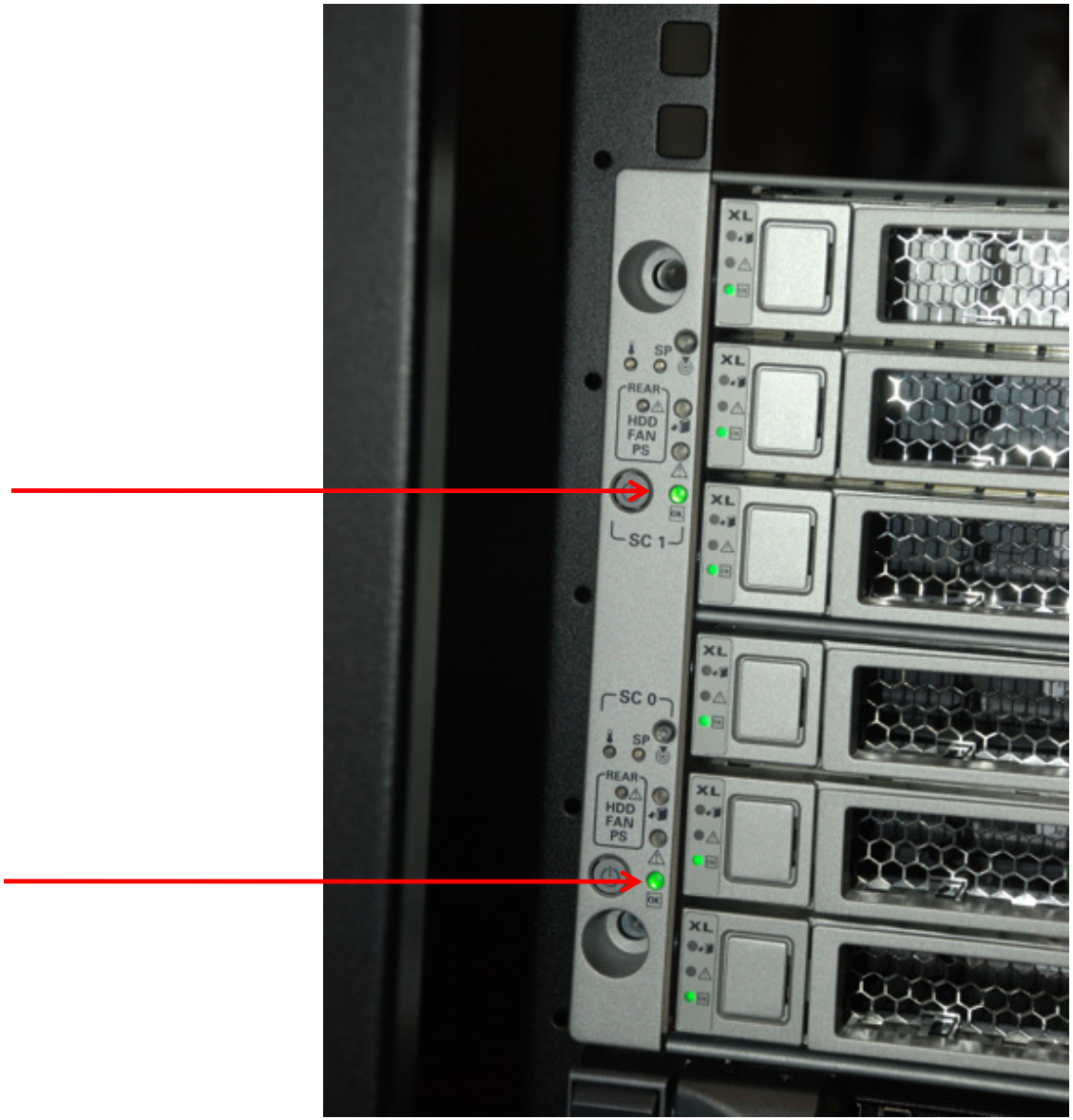
Step 2: Wait for OK Lights



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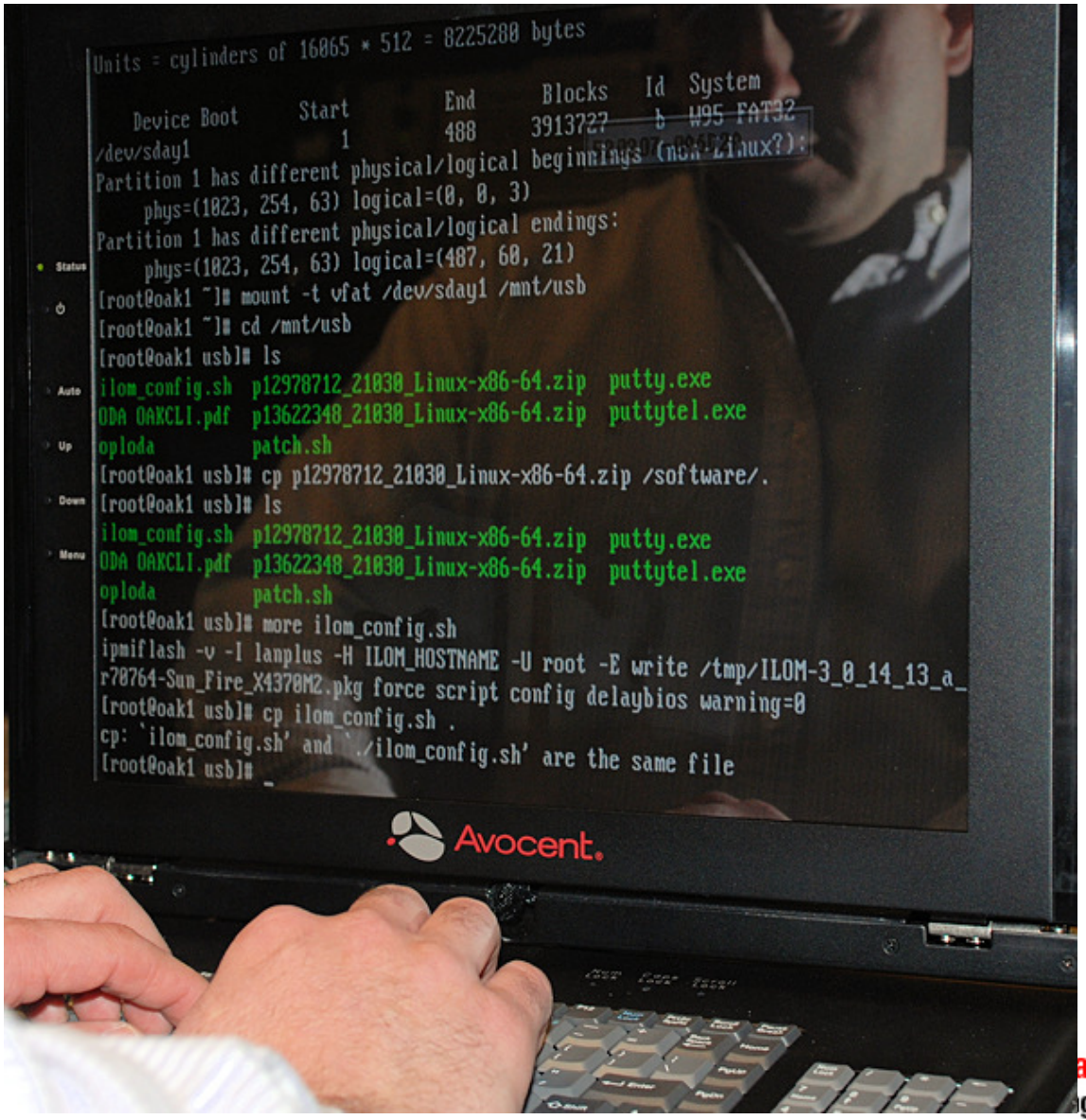
Step 3: Log In as root

Step 5: Perform ILOM Configuration



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Install Screens: 1

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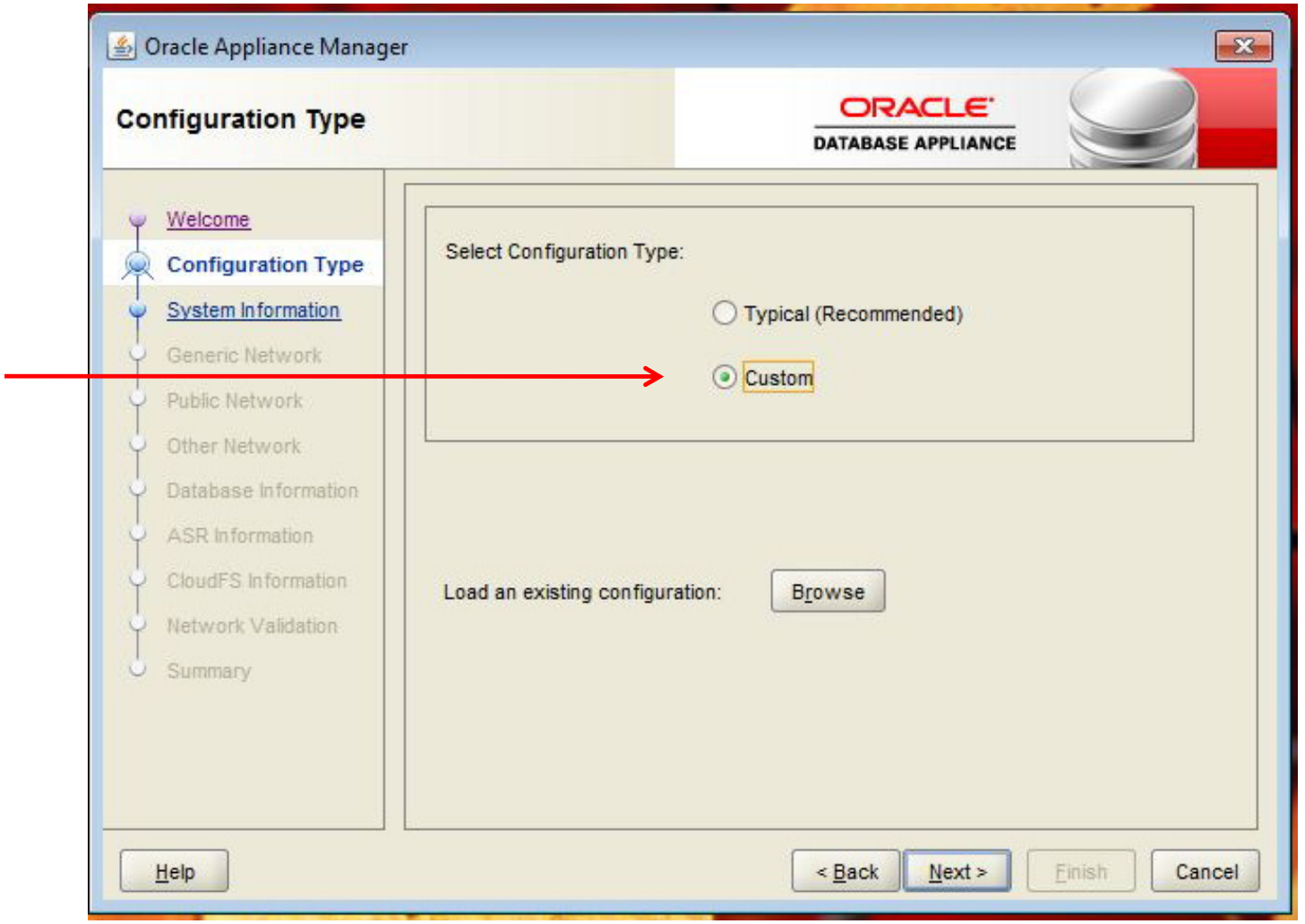
Install Screens: 2



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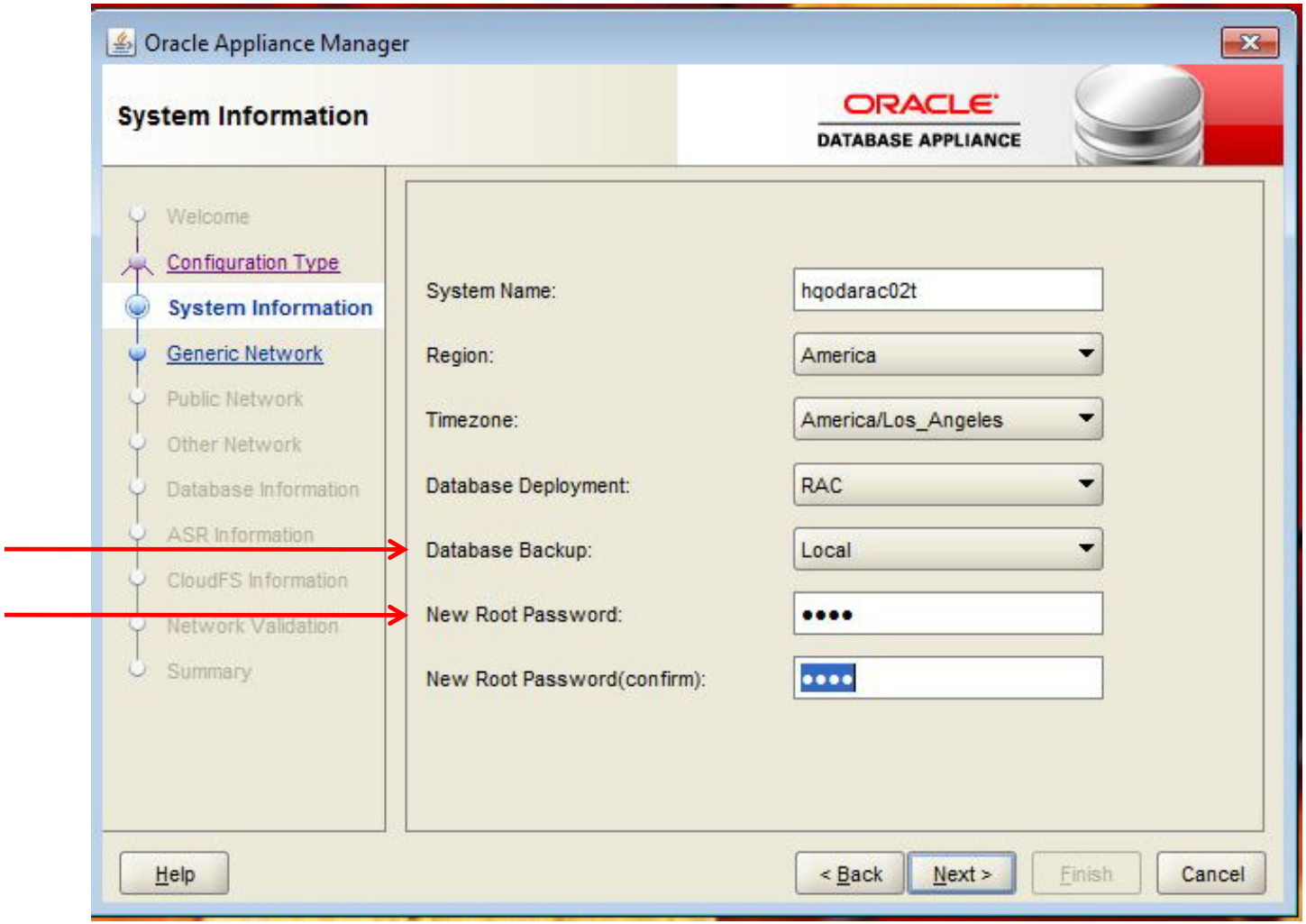
Install Screens: 3



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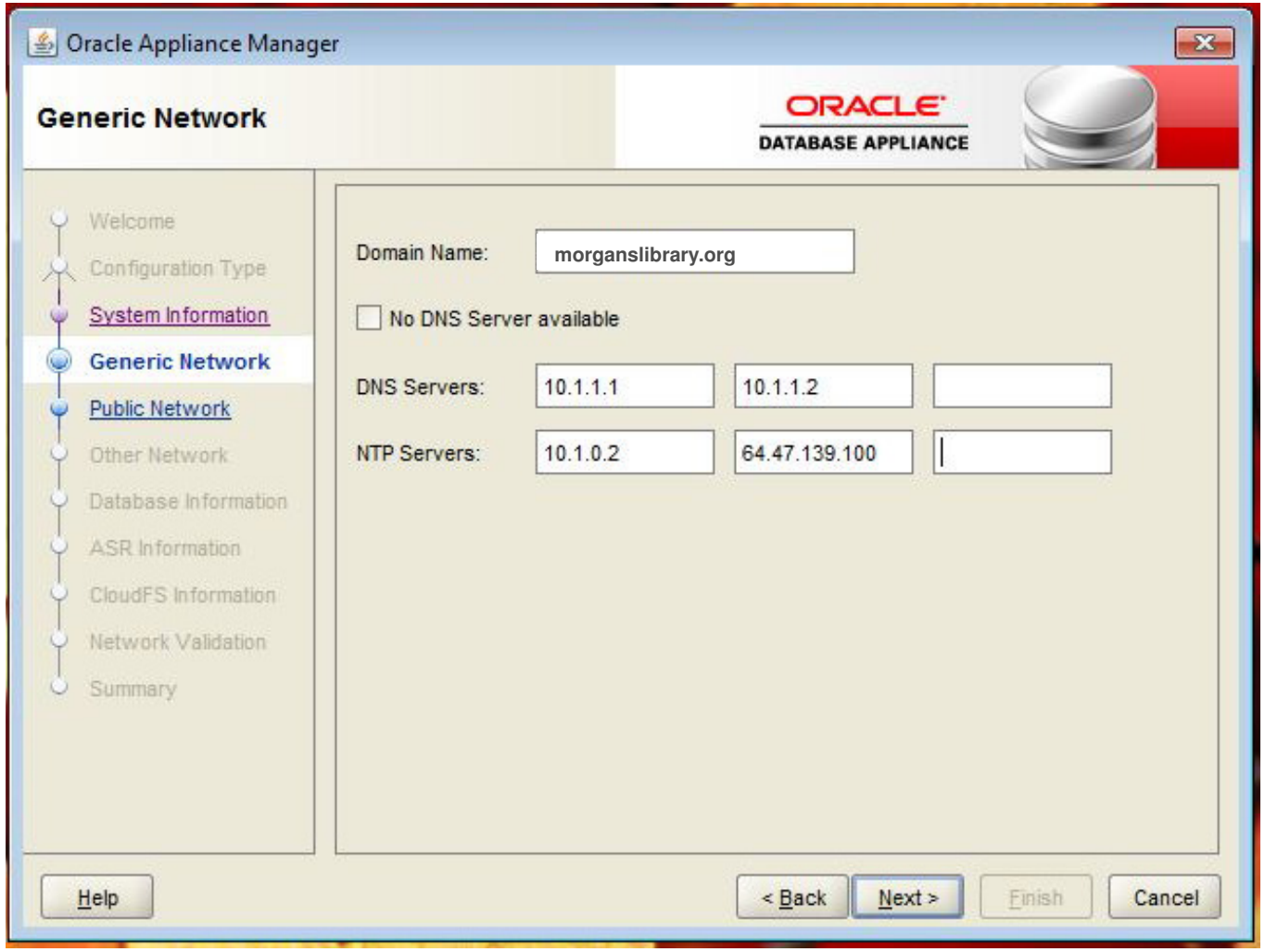
Install Screens: 4



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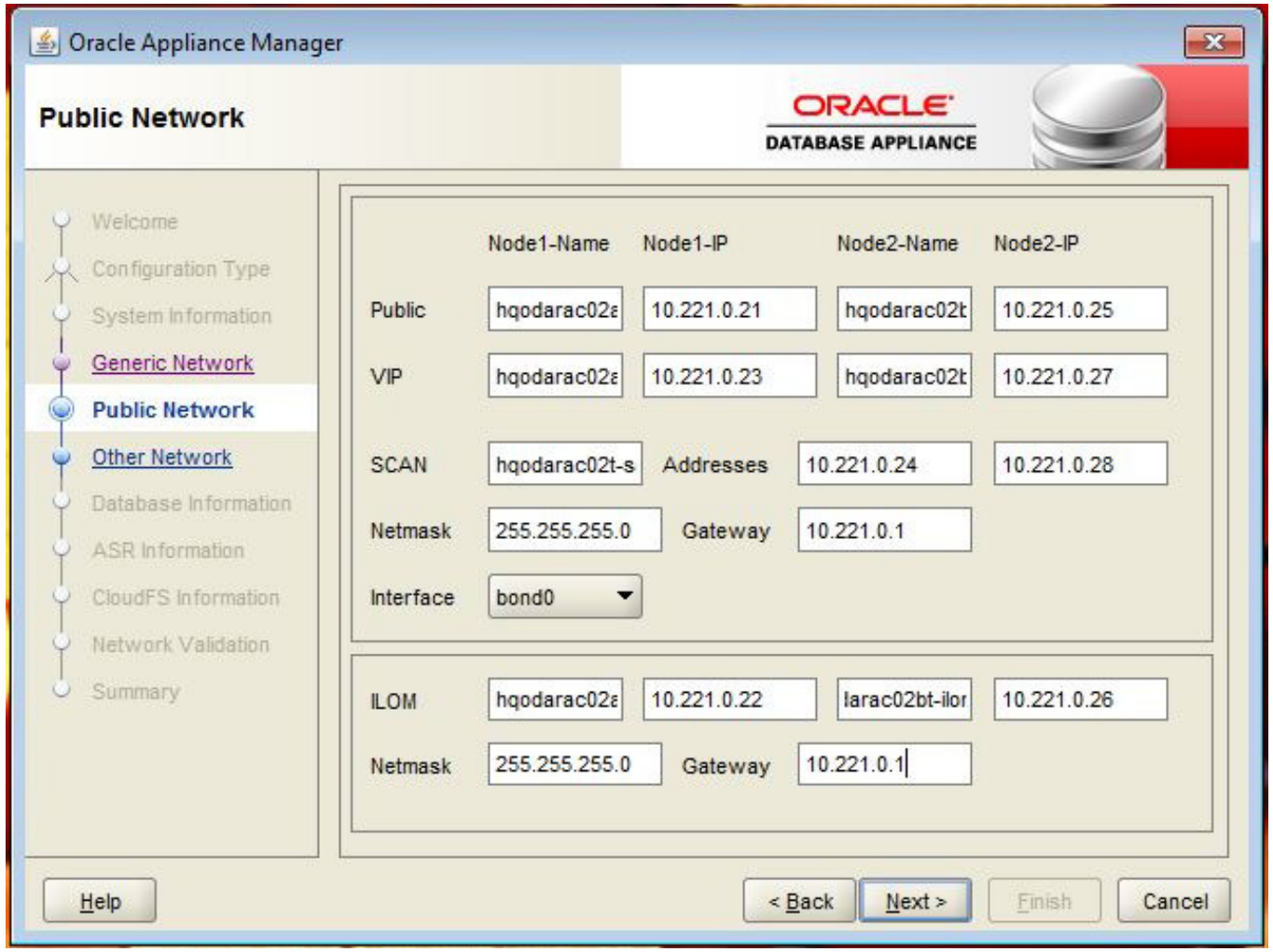
Install Screens: 5



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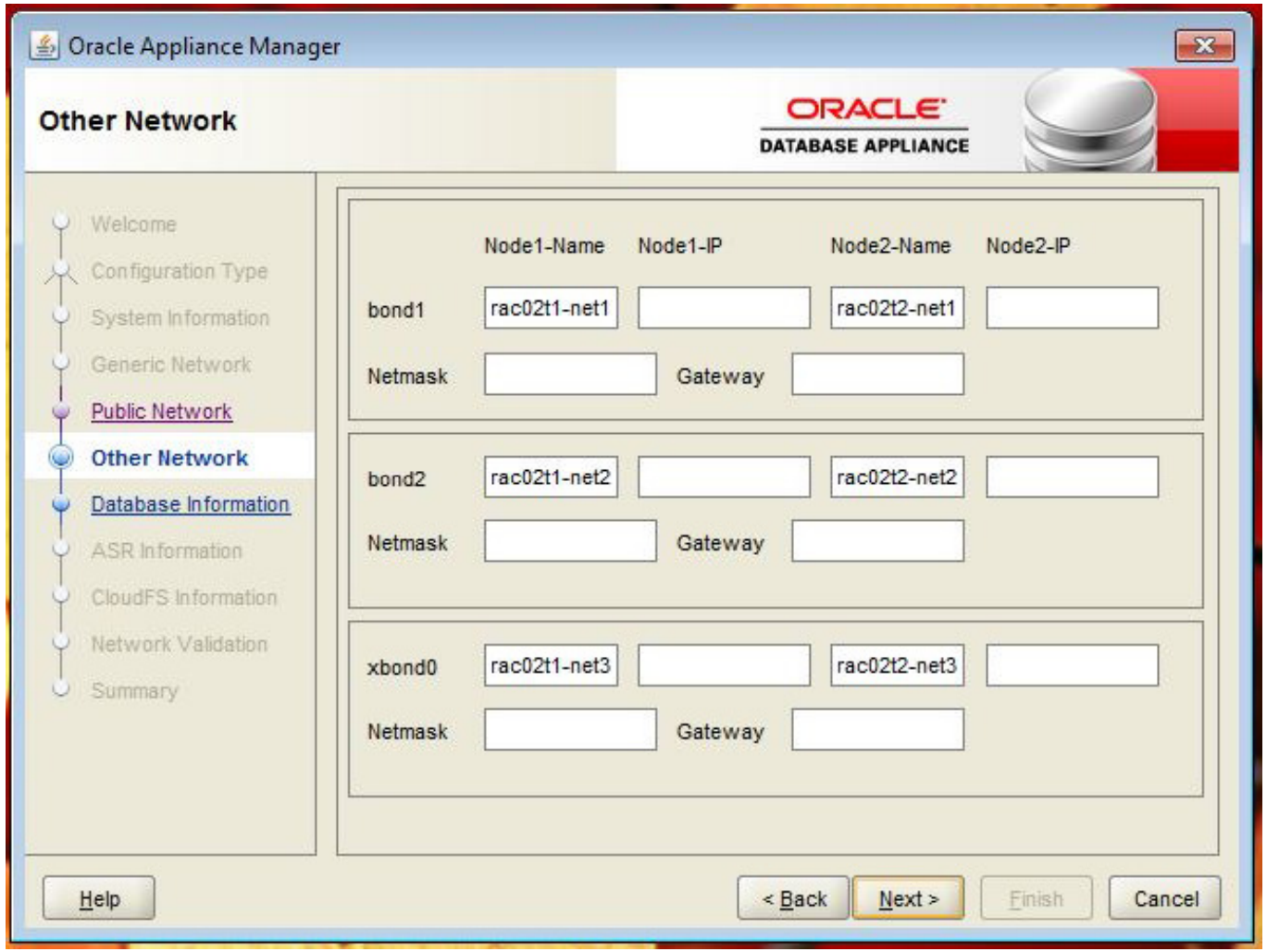
Install Screens: 6



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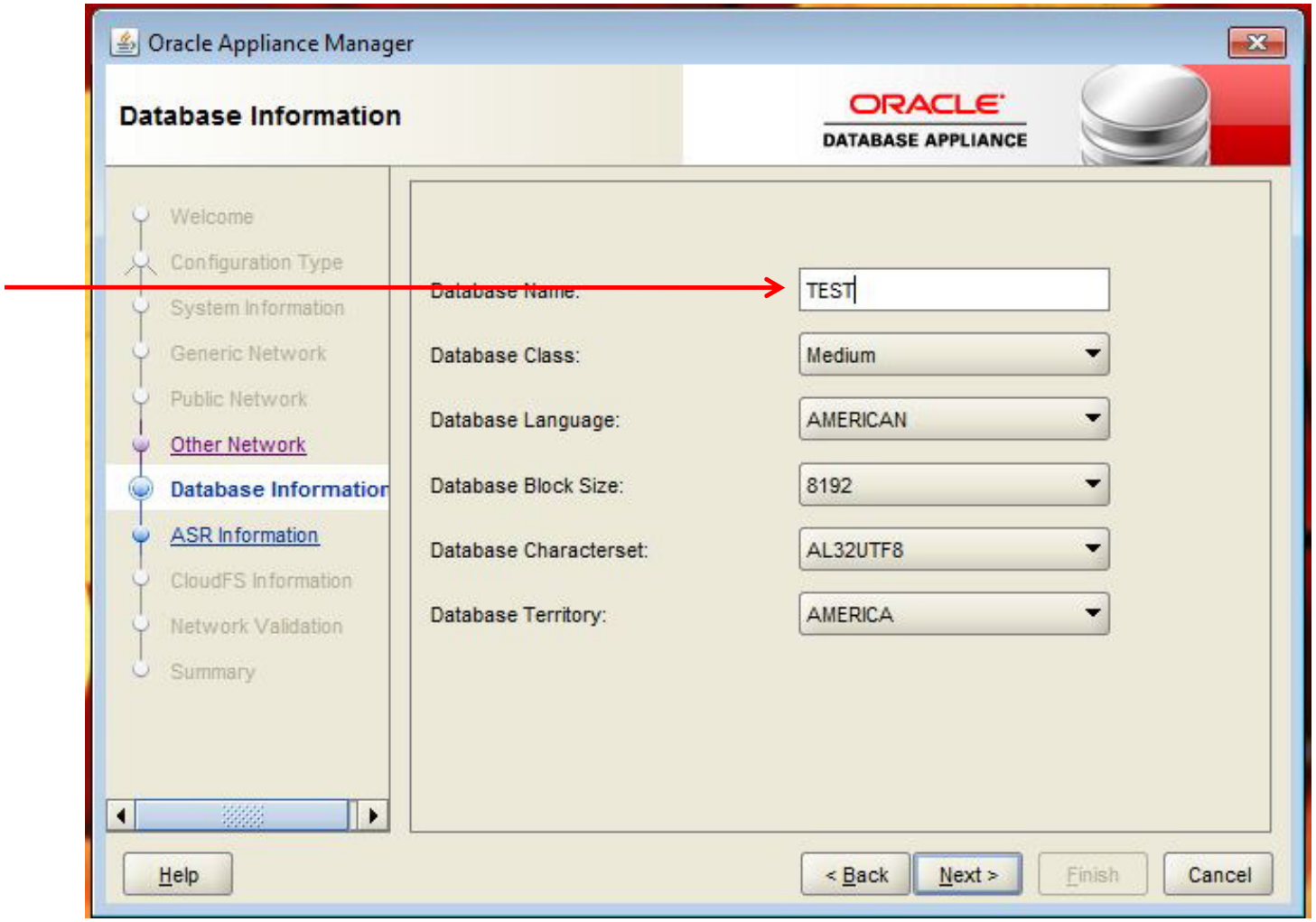
Install Screens: 7



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Install Screens: 8

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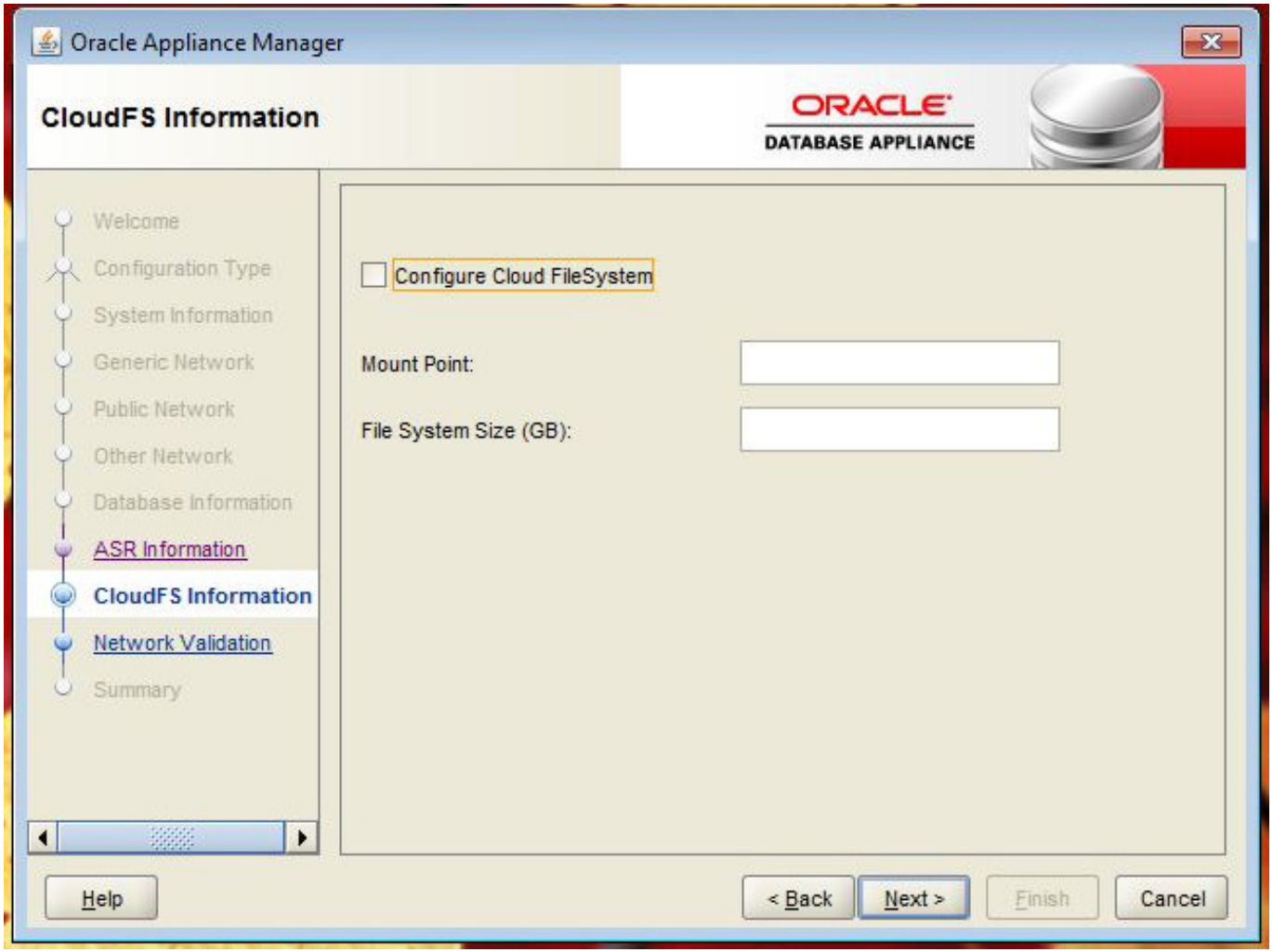
Install Screens: 9



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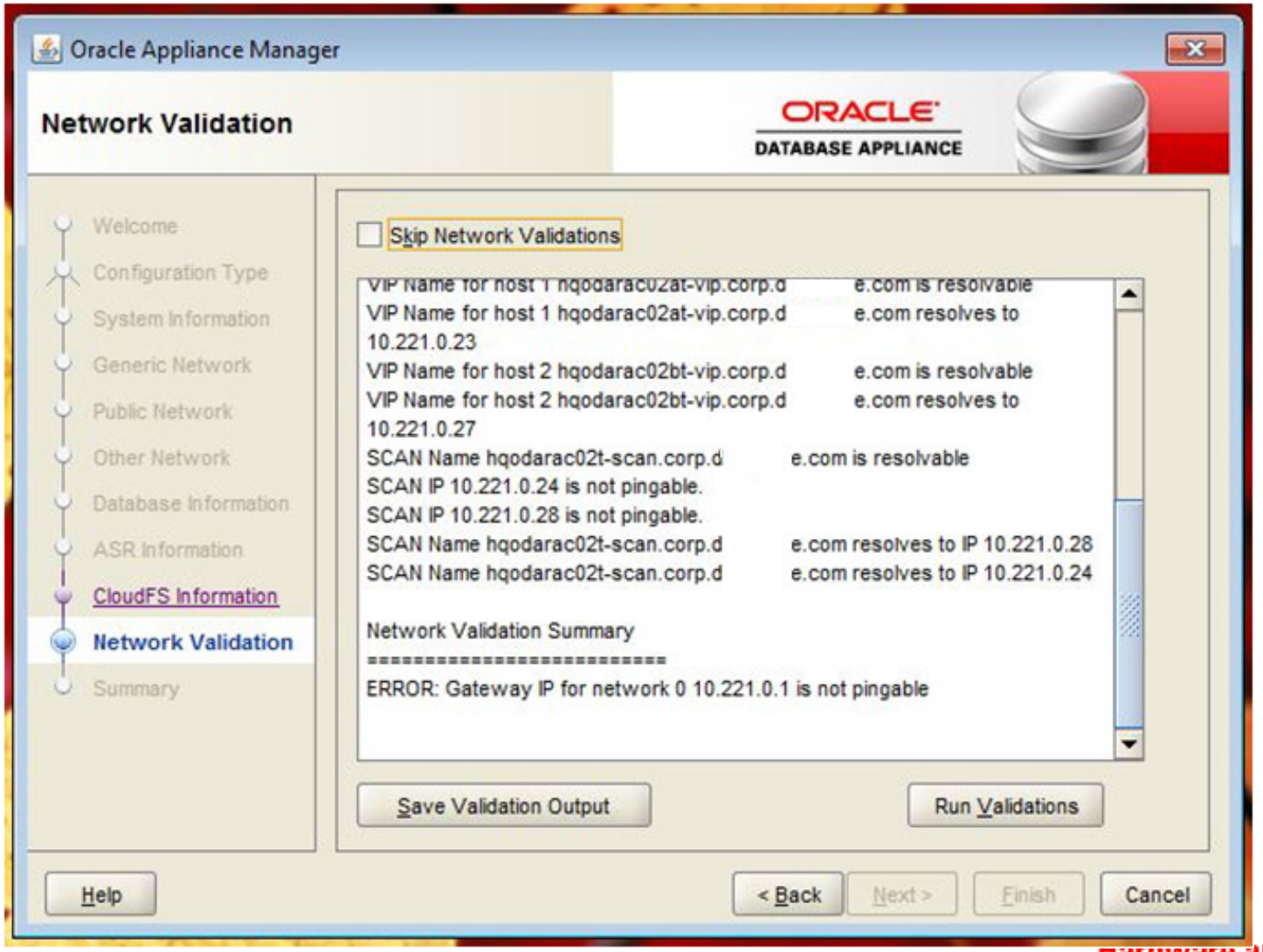
Install Screens: 10



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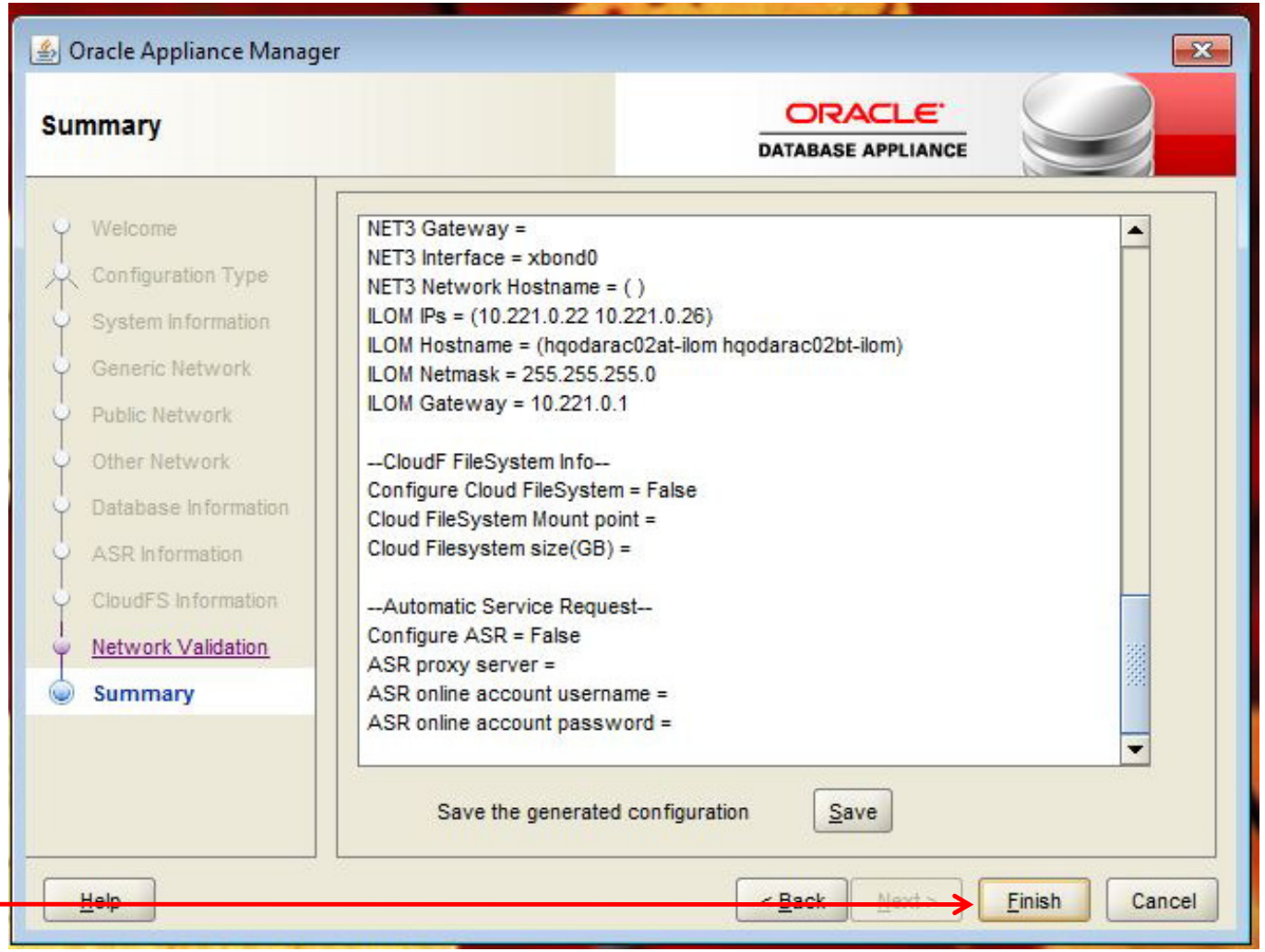
Install Screens: 11



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Value Adds

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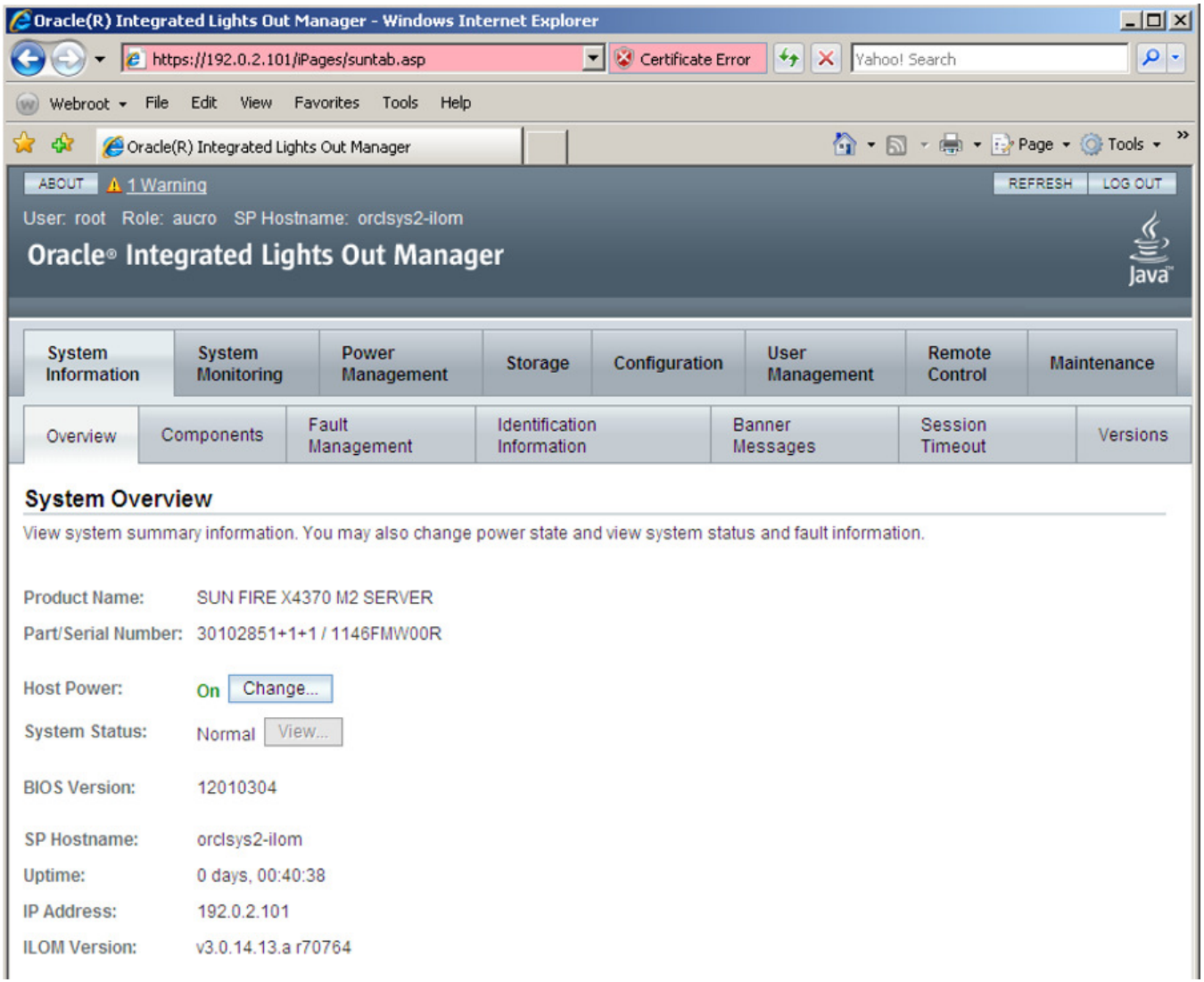
ILOM: System Information: Overview



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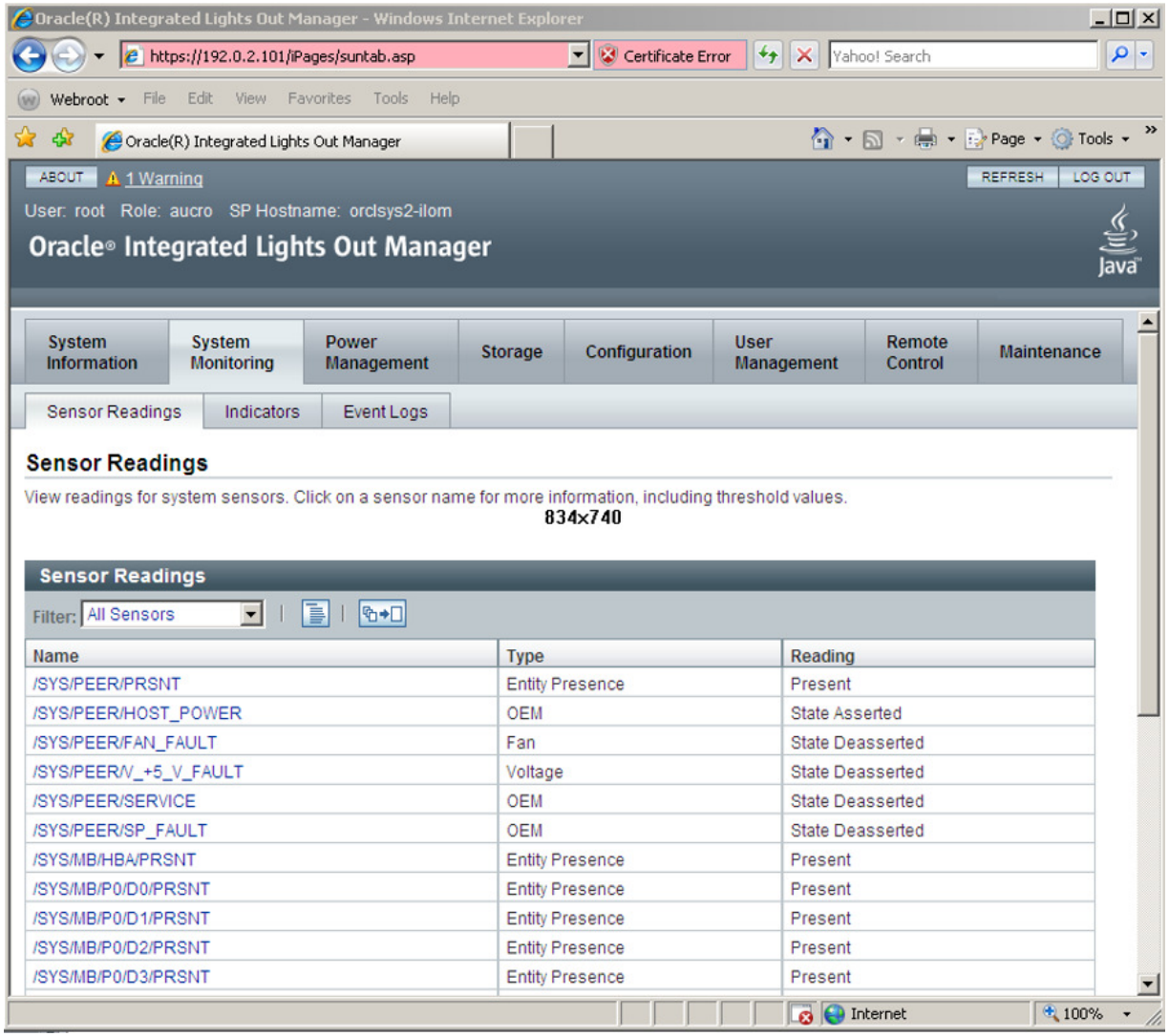
ILOM: System Monitoring: Sensor Readings



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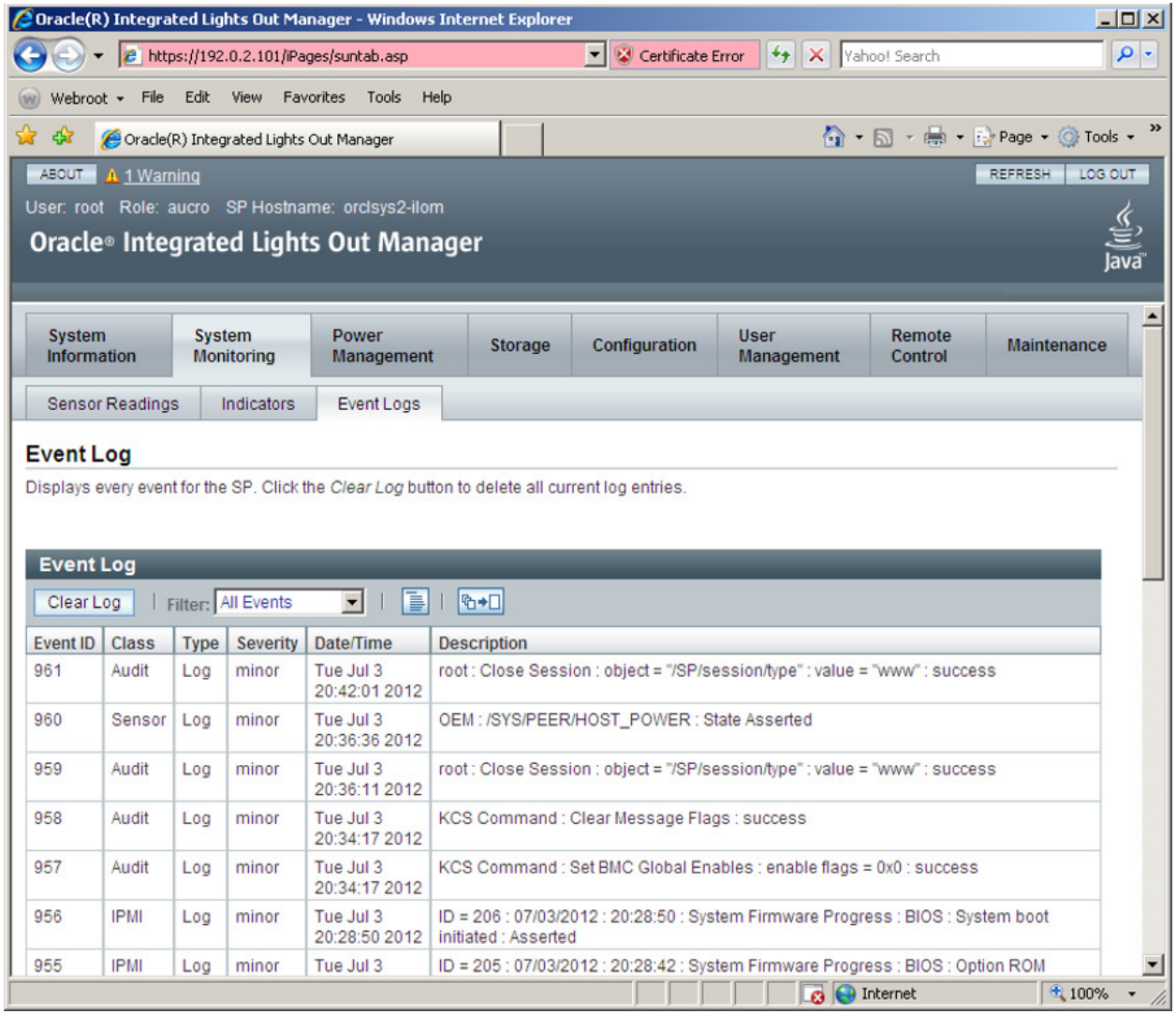
ILOM: System Monitoring: Event Logs



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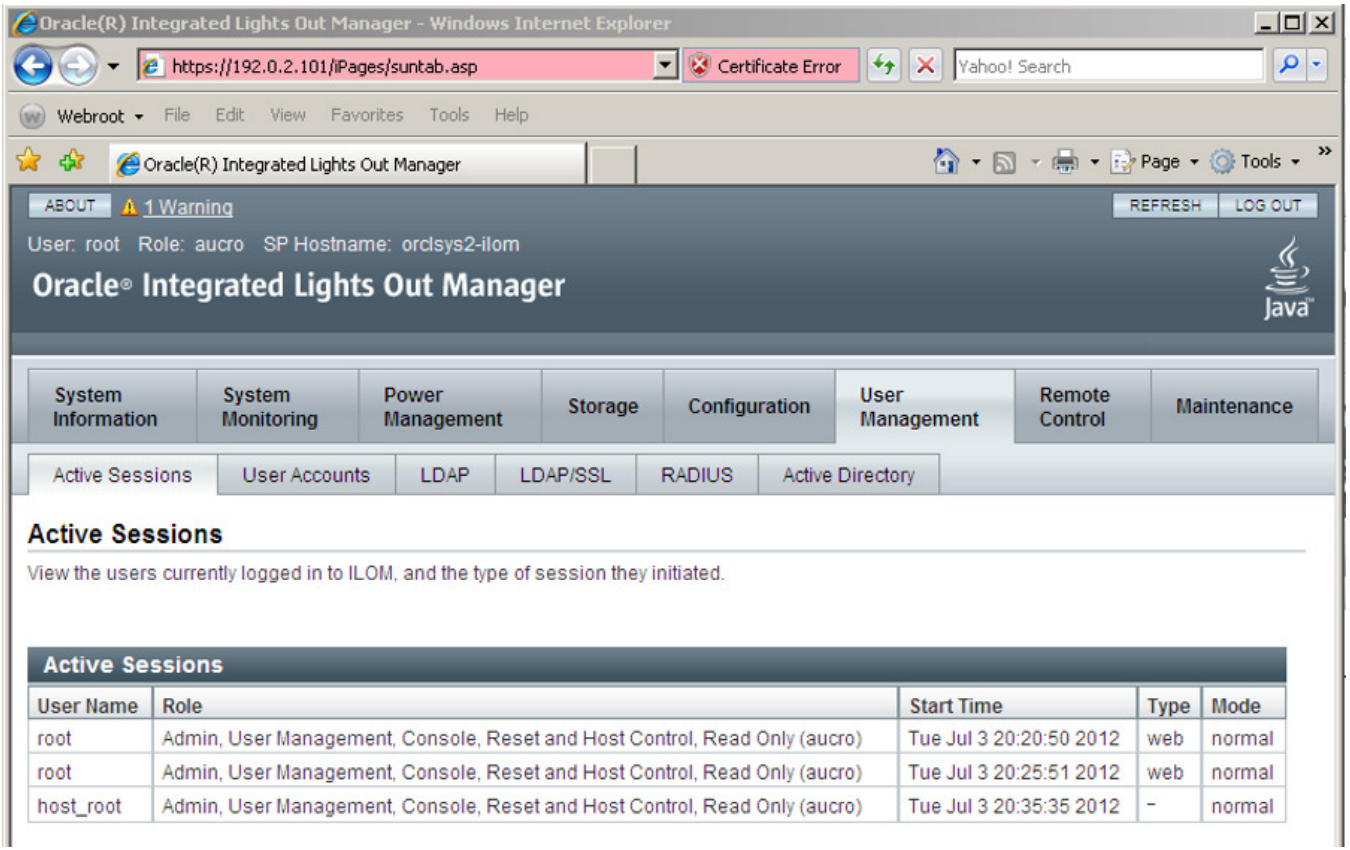
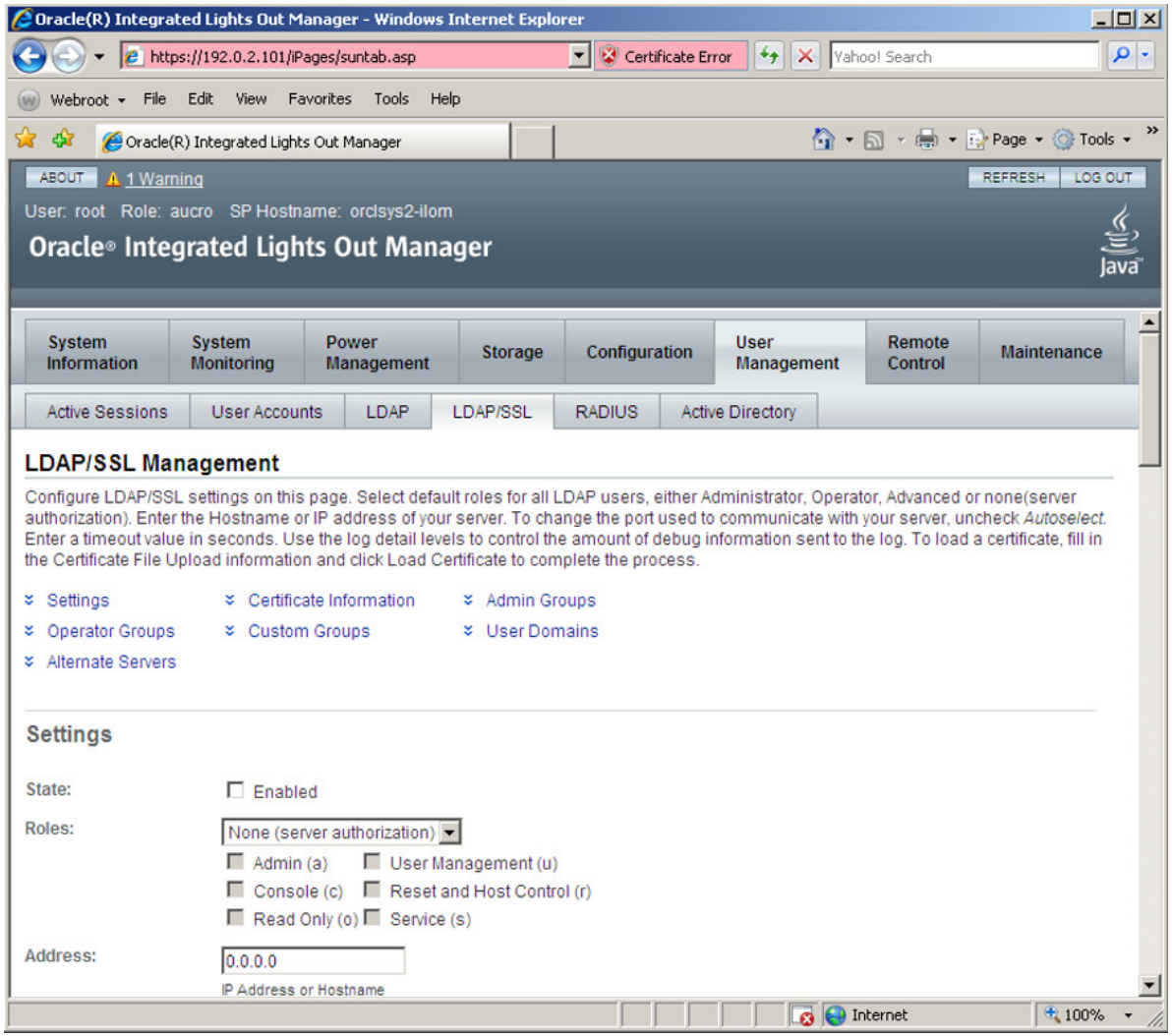
ILOM: User Management: Active Sessions



ILOM: User Management: LDAP / SSL



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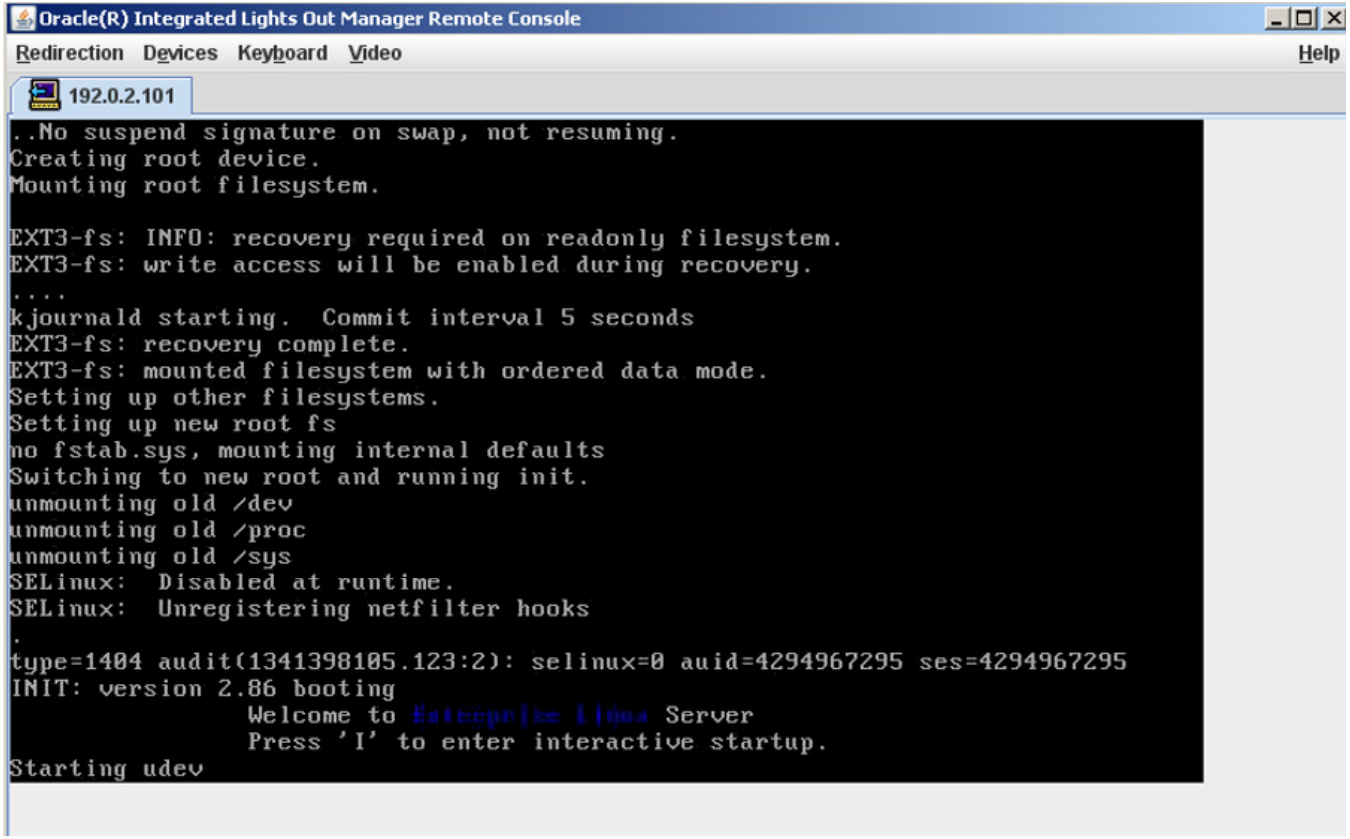
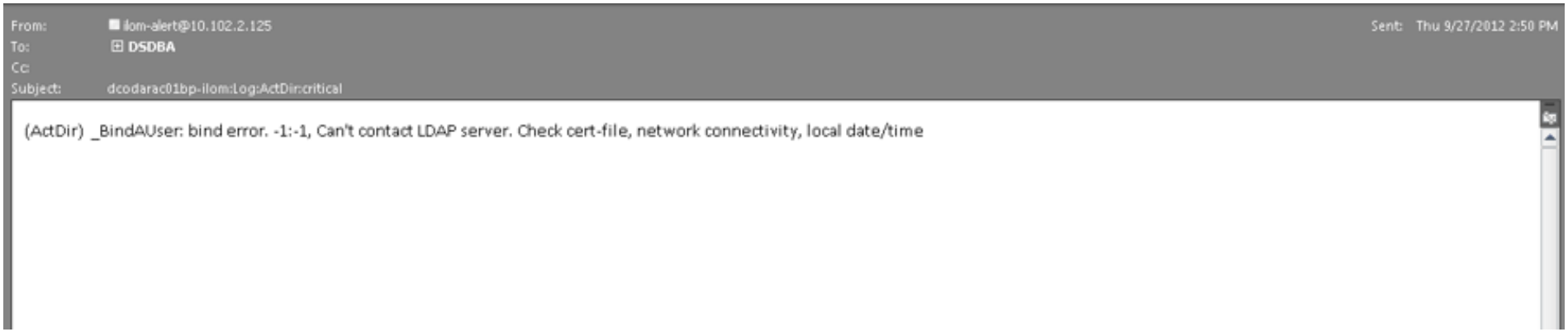
Remote Control: Host Control: Remote Console



ILOM Warning Message



Full Support for High Availability

- RAC
- Data Guard
- RMAN
- Streams
- OEM Cloud Control 12c
  - Diagnostic Pack
  - Tuning Pack
  - Data Masking Pack

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One Button Solutions

- Fully scripted, one button, solutions, for
  - Build
  - Secure
  - Migration
  - Bare Metal Restore
  - Data Guard
  - GoldenGate
  - RMAN Backup

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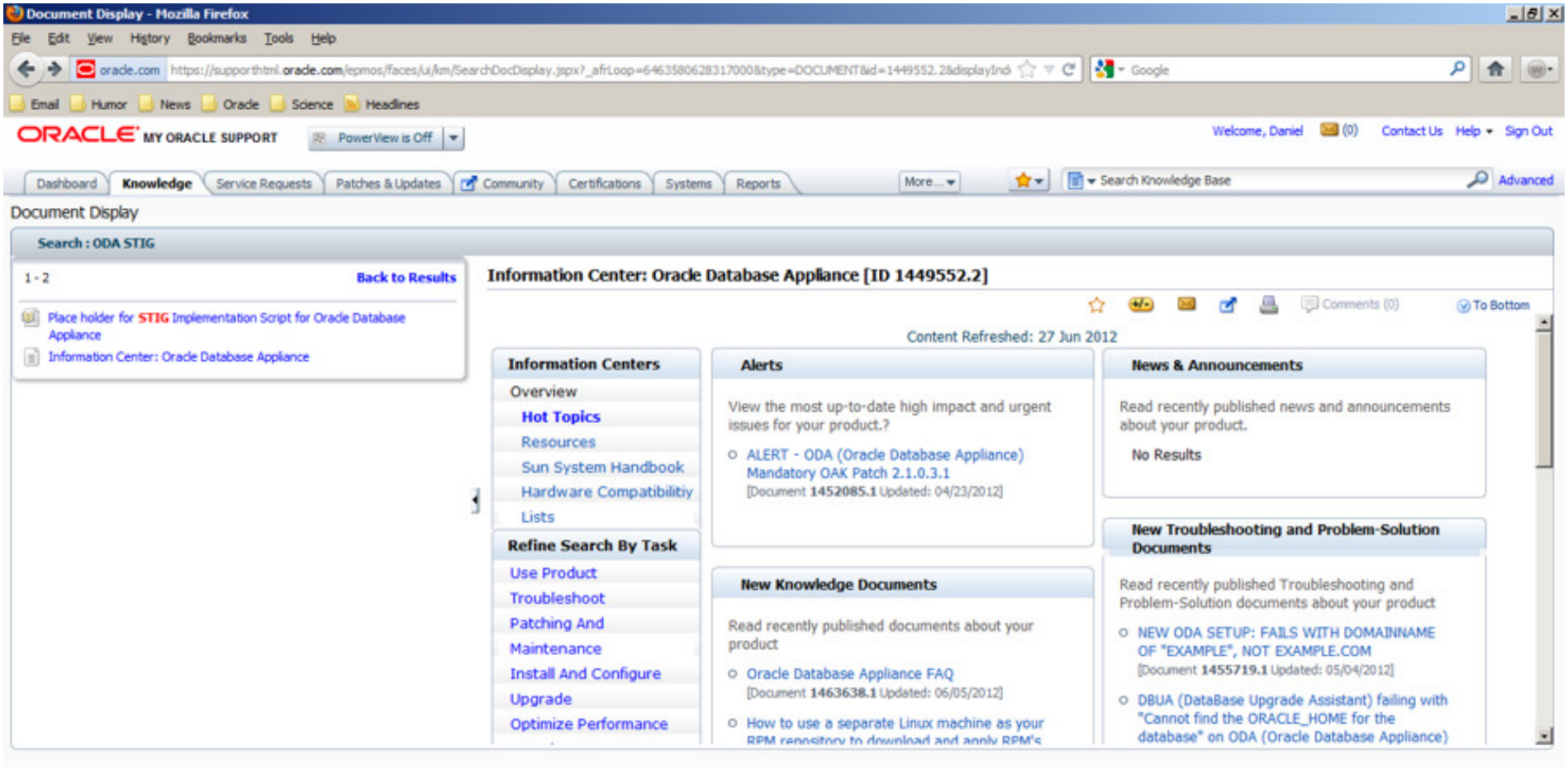
Support Center



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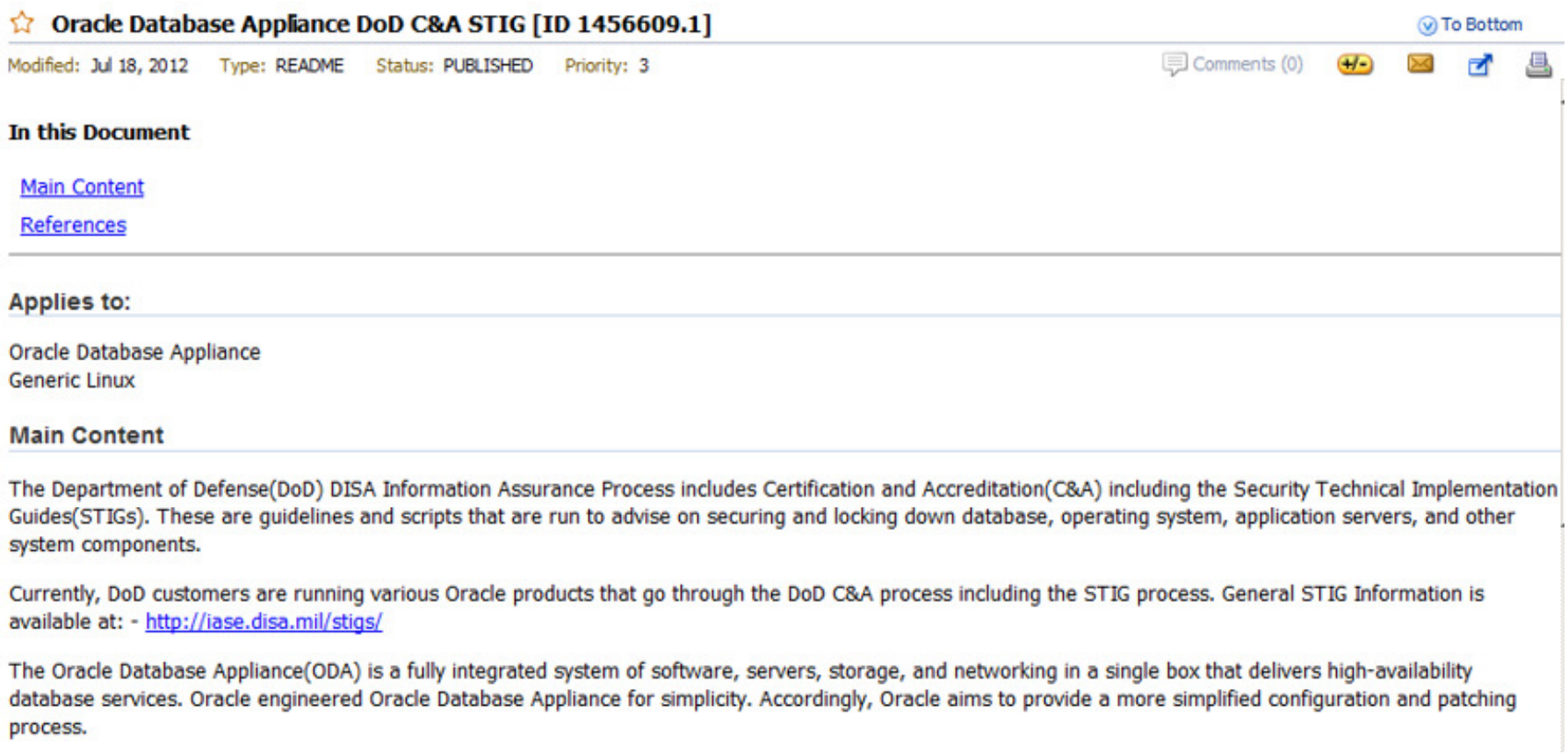
STIG Download



Oracle Database Appliance DoD C&A STIG [ID 1456609.1]

To Bottom

Modified: Jul 18, 2012 Type: README Status: PUBLISHED Priority: 3

Comments (0)

In this Document

Main Content

References

Applies to:

Oracle Database Appliance
Generic Linux

Main Content

The Department of Defense(DoD) DISA Information Assurance Process includes Certification and Accreditation(C&A) including the Security Technical Implementation Guides(STIGs). These are guidelines and scripts that are run to advise on securing and locking down database, operating system, application servers, and other system components.

Currently, DoD customers are running various Oracle products that go through the DoD C&A process including the STIG process. General STIG Information is available at: - http://iase.disa.mil/stigs/

The Oracle Database Appliance(ODA) is a fully integrated system of software, servers, storage, and networking in a single box that delivers high-availability database services. Oracle engineered Oracle Database Appliance for simplicity. Accordingly, Oracle aims to provide a more simplified configuration and patching process.

STIG Script

- STIG Script Syntax
  - The script logs its actions in the "/opt/oracle/oak/log//hostname/stig/" directory
  - **`-check`** checks the system for guideline violations
  - **`-force`** re-runs the script even if there are no violations
  - **`-fix`** used to implement guideline recommendations
  - lock and unlock options can be used to enable or disable direct ssh logging as root. Direct ssh login as root is required for Patching and therefore before patching, the unlock needs to be executed.

    Sample usage

    ```
    #./stig.sh -fix
    ```

STIG Script Output: Category 1

```
2012-06-28 01:18:12 : Running stig script version: '1.0'
2012-06-28 01:18:12 : Executing script : ./stig.sh -check
2012-06-28 01:18:12 : Checking for stig violations on system 'orclsys1'

2012-06-28 01:18:12 : List of Category-1 stig violation found by script
2012-06-28 01:18:12 : [STIG ID : LNX00140]    : [CHECK] : Password for grub not enabled                                  : FOUND
2012-06-28 01:18:12 : [STIG ID : GEN004640]   : [CHECK] : sendmail decode command is not commented in /etc/aliases      : FOUND
2012-06-28 01:18:12 : [STIG ID : LNX00320]    : [CHECK] : Privilege account 'shutdown' is present                       : FOUND
2012-06-28 01:18:12 : [STIG ID : LNX00320]    : [CHECK] : Privilege account 'halt' is present                           : FOUND
2012-06-28 01:18:12 : [STIG ID : LNX00580]    : [CHECK] : Ctrl-Alt-Del combination to shutdown system is enabled        : FOUND
2012-06-28 01:18:13 : [STIG ID : 2006-T-0013] : [CHECK] : RealVNC rpm is installed on system                            : FOUND
2012-06-28 01:18:13 : [STIG ID : LNX00040]    : [CHECK] : Support for usb device found in kernel                        : FOUND

2012-06-28 01:18:13 : List of Category-2 stig violation found by script
2012-06-28 01:18:13 : [STIG ID : GEN000020] : [CHECK] : Single user mode boot is enabled without a password            : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN000340] : [CHECK] : Non privileged account oprofile found on system               : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN000340] : [CHECK] : Non privileged account avahi-autoipd found on system          : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN000460] : [CHECK] : pam_tally not used to lock account after 3 consecutive failed logins : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN000800] : [CHECK] : remember not used in PAM configuration files                   : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN000600] : [CHECK] : Force of at least one lower case character is not set for password : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN000600] : [CHECK] : Force of at least one upper case character is not set for password : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN000620] : [CHECK] : Force of at least one numeric character is not set for password : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN000640] : [CHECK] : Force of at least one special character is not set for password : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN000480] : [CHECK] : Login delay is not enabled in /etc/pam.d/system-auth          : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN000700] : [CHECK] : Maximum age for a password change is more than 60 days        : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN000540] : [CHECK] : Password can be changed more than once in 24 hours            : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN000580] : [CHECK] : Password length is less than 8 characters                     : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN001120] : [CHECK] : Direct login as root is enabled from ssh                      : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN002100] : [CHECK] : ekshell supported by the pam.rhost                            : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN002960] : [CHECK] : Access to cron is not through cron.allow and cron.deny        : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN003080] : [CHECK] : Permission of file /etc/crontab is more permissive than octal 600 : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN003200] : [CHECK] : Permission of file /etc/cron.deny is more permissive than octal 600 : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN005400] : [CHECK] : Permission of file /etc/syslog.conf is more permissive than octal 640 : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN000920] : [CHECK] : Permission of directory /root is more permissive than octal 700 : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN003865] : [CHECK] : tcpdump rpm is installed on system                            : FOUND
2012-06-28 01:18:13 : [STIG ID : GEN004000] : [CHECK] : Permission of file /bin/traceroute is more permissive than octal 700 : FOUND
2012-06-28 01:18:13 : [STIG ID : LNX00340]  : [CHECK] : Unnecessary account ftp found on system                       : FOUND

2012-06-28 01:18:35 : List of Category-3 stig violation found by script
2012-06-28 01:18:35 : [STIG ID : GEN004560] : [CHECK] : sendmail version is not hidden.                               : FOUND
```

However

However

- We MAY want to preserve the 4TB ASM disk for data
- We may want more storage for
  - FRA, Flashback DB files, RMAN files …
  - Clone
  - Data Masking
  - Real Application Testing
  - Staging
  - Logs
  - And so on

Data Masking Pack

- Offers the ability to mask regulated or confidential data on test and development systems
- Mask format libraries
- Mask definitions
- Masking techniques
  - Condition-based masking
  - Compound masking
  - Deterministic masking
- Application masking templates import or export
- Mask format library import or export
- Masking script generation
- Clone and Mask workflow

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Choices

- ASM
  - Raw devices
- Clustered Storage
  - Which one? OCFS2, VxFS, …
- Non-Clustered Storage
  - Non-blocking visibility on both nodes
  - dNFS, CIFS …

ASM?

- Excellent decision for database storage
- Perhaps not optimal as a file system
  - ACFS?
- Requires raw disk to be presented to ODA
- Traditional HBA discussion

Clustered File System?

- Several CFS available for Linux
  - Need expertise
  - Wire it yourself
  - Tech concerns
    - File sizes
    - File counts
- Still traditional HBA discussion

Non-clustered File System?

- Local File System
  - May be suitable for some applications,
    - But we have two separate hosts in ODA
  - Standard Linux-oriented
    - Still traditional HBA discussion

- [d]NFS
  - Vendor: NetApp, Oracle ZFS Appliance
  - OpenFiler?

Additional concern – silent corruption

- An undetected or uncorrectable error can occur on average once every 10-20 TB of data storage OR transfer
  - In modern systems that could mean a corruption in a little as 15 minutes
- ZedFS was designed to combat this challenge
  - Checksum on all blocks
  - Copy on Write (preserve original block, not write in place)
  - Hot spares in pool
  - Auto-healing from ZFS mirror
  - Scrub instead of fsck
    - Monthly (or weekly for consumer disks)

Additional concern – silent corruption

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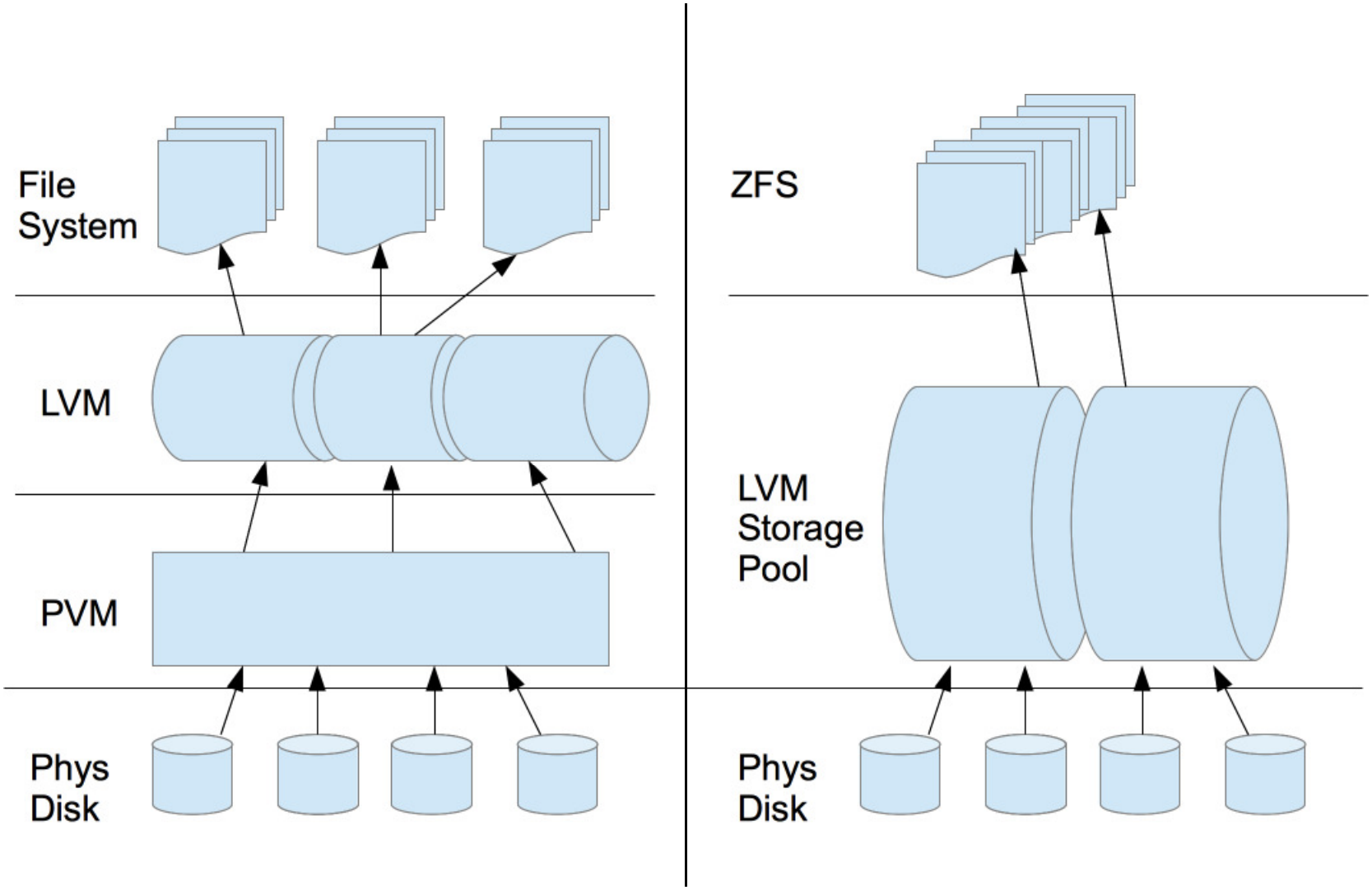
    - Monthly (or weekly for consumer disks)

Traditional File System stack vs ZFS



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Quick Notes

- RAID
  - ZFS cannot fully protect the user's data when using a hardware RAID controller, as it is not able to perform the automatic self-healing unless it controls the redundancy of the disks and data.
  - Instead, ZFS provides it's own RAID counterparts within the Storage Pool
- ZFS provides a hot-spare storage pool manager and a 128-bit, Copy on Write File System
- Capacity
  - Single file: 16 exabytes
  - Files in a pool: 264
  - Disks in a pool: 264
  - Pools in a system: 264

Where do you want to invest your time and treasure?

- Reinventing the wheel?
- Designing physical architecture?
- Applying one-off patches?
- Becoming Linux security experts?
- Writing shell scripts?

or would you rather be ...

- Managing your applications, users, and data?
- Optimizing your applications to maximize customer satisfaction?

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ZFS Storage Appliance

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Hans Forbrich | hans@forbrichcomputing.com

ZFS Storage Appliance

- ZFS file system with advanced error detection and self-healing capabilities
- Integrated with Oracle Engineered Systems
- Both ZFS Deduplication and Compression or Hybrid Columnar Compression
- Hybrid Storage Pools
- Simultaneous multiprotocol support across multiple network interconnects, including GbE, 10 GbE, fibre channel and InfiniBand
- Integrated with OEM Grid Control
- Web-based storage management
- Integrated real-time storage analytics

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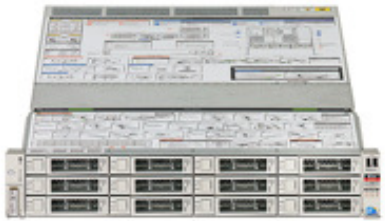
What is a ZFS Appliance?

- Enterprise class Network Attached Storage (NAS)
- Choose the size that meets your needs
- Hybrid Columnar Compression (w/o an Exadata)
- Hybrid storage pools for DRAM and Flash caches
- DTrace storage analytics
- Use for
  - Backup and Restore
  - Cloning
  - Data Masking



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ZFS Configurations

Sun ZFS Storage Appliance Configurations						
	Key Requirement	**Maximum Storage Capacity**	**Space (Rack Units)**	**Write Optimized Flash**	**Read Optimized Flash**	**Cluster Option**
Sun ZFS Storage 7120	Low-priced entry-level system with all software features	177 TB	2U/controller, 4U/disk shelf	73 GB	N	N
Sun ZFS Storage 7320	Entry-level cluster option for high availability	432 TB	1U/controller, 4U/disk shelf	Up to 1.2 TB	Up to 2 TB per controller	Y
Sun ZFS Storage 7420	Best price/performance	1.73 PB	3U/controller, 4U/disk shelf	Up to 7.0 TB	Up to 2 TB per controller	Y

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ZFS Specifications

Sun ZFS Storage Appliance Specifications			
	Sun ZFS Storage 7120	**Sun ZFS Storage 7320**	**Sun ZFS Storage 7420**
Architecture			
Processor	1x 4-core 2.4 GHz Intel® Xeon® Processor	2x 4-core 2.4 GHz Intel® Xeon® Processor, per controller	4x 8-core 2.0 GHz or 10-core 2.4GHz Intel® Xeon® Processors per controller
Main memory	48 GB	Up to 144 GB per controller	Up to 1 TB per controller
Base Configurations			
Configuration options	• 3.3 TB to 177 TB using either high-speed (15,000 RPM) or high-capacity (7,200 RPM) SAS-2 disks • Controller contains 11 HDDs and one SSD cache, supports up to two additional disk shelves with 24 disks each (300 GB, 600 GB, 2 TB, or 3 TB)	• 6 TB to 432 TB using either high-speed (15,000 RPM) or high-capacity (7,200 RPM) SAS-2 disks • Supports up to six disk shelves with 20 or 24 disks each (300 GB, 600 GB, 2 TB, or 3 TB) and up to four optional write-optimized SSDs per shelf	• 6 TB to 1.73 PB using either high-speed (15,000 RPM) or high-capacity (7,200 RPM) SAS-2 disks • Supports up to 24 disk shelves with 20 or 24 disks each (300 GB, 600 GB, 2 TB, or 3 TB) and up to four optional write-optimized SSDs per shelf

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ZFS In The Data Center

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ZFS 7420

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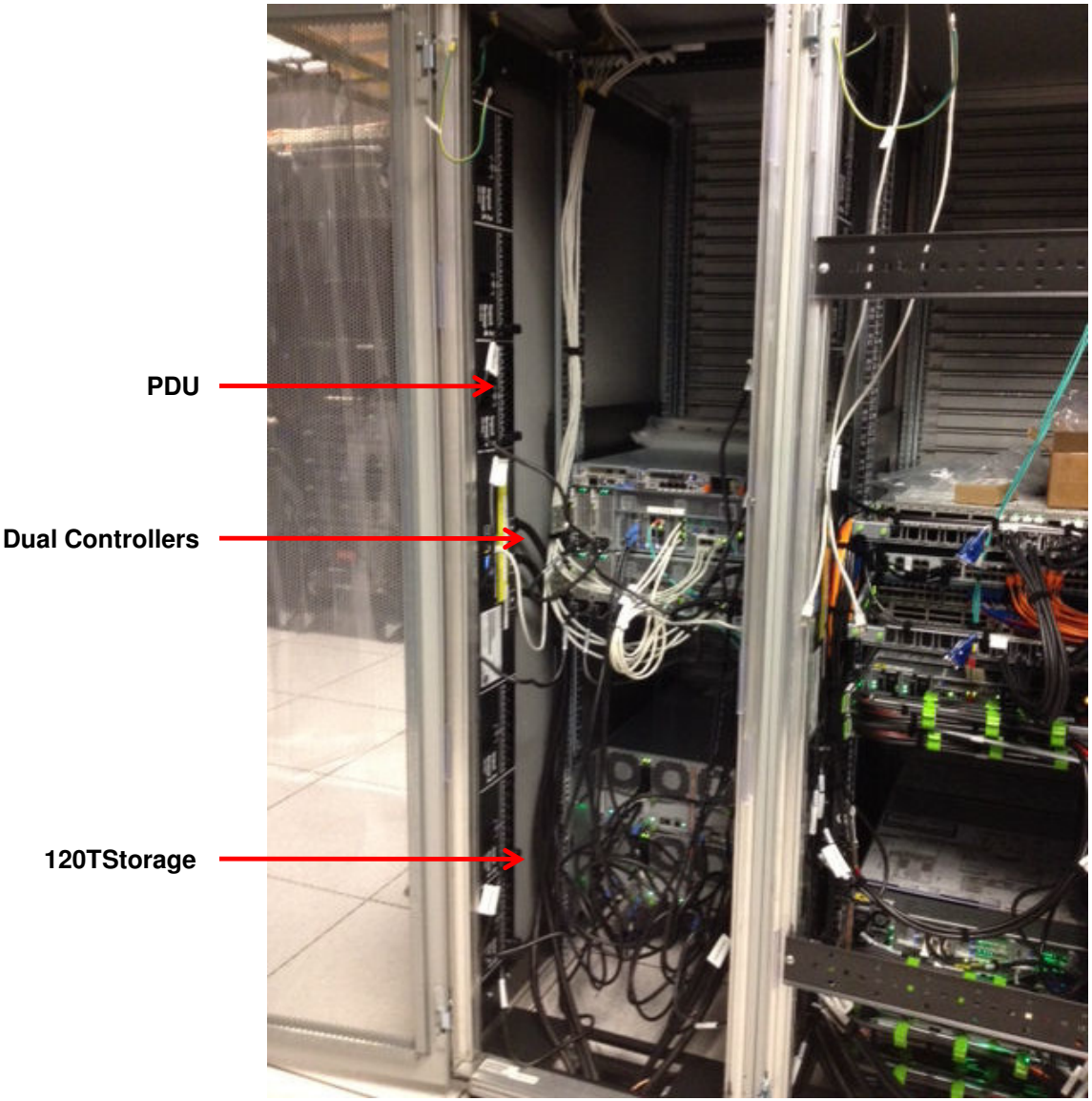
ZFS Internals



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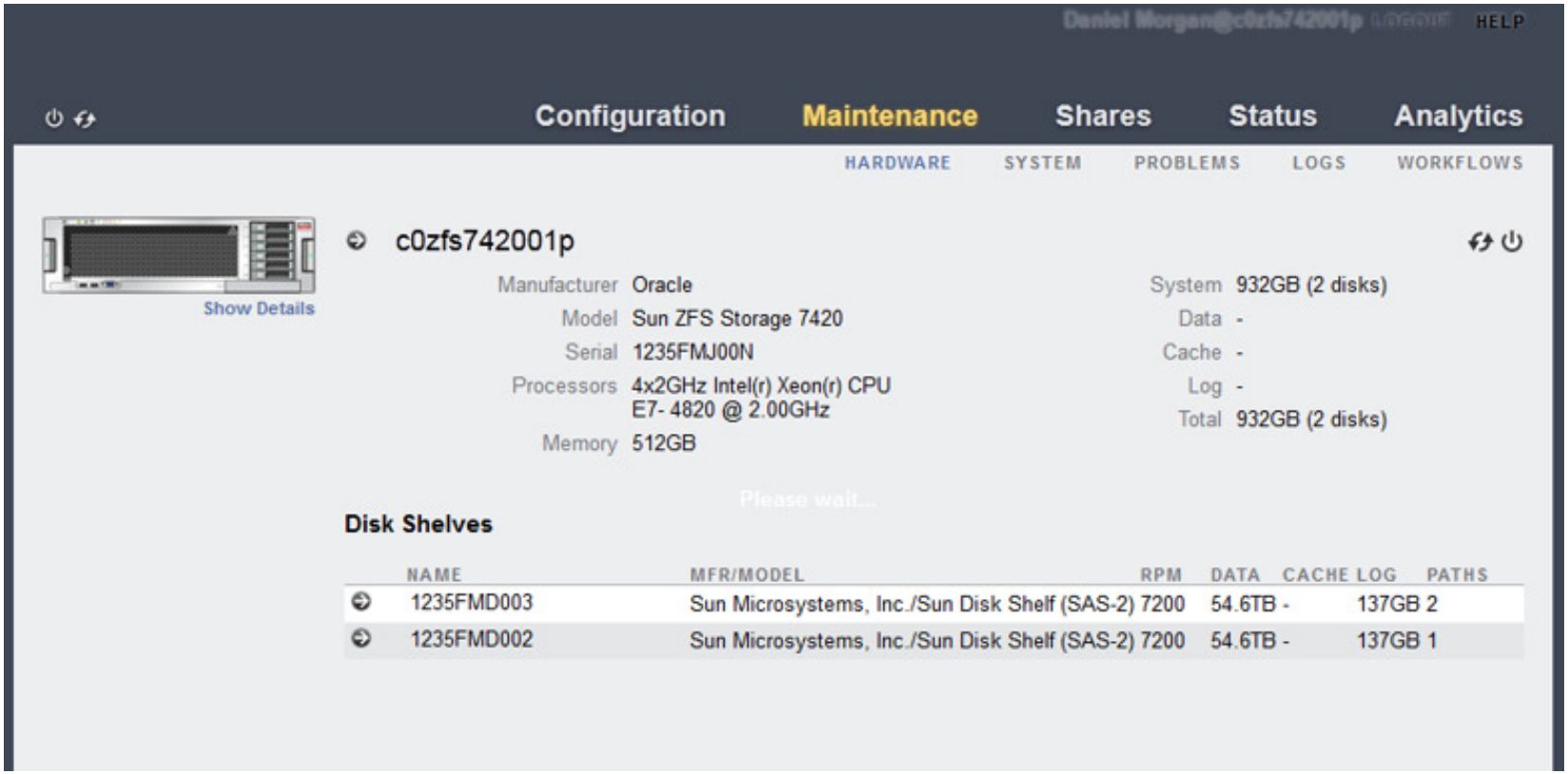
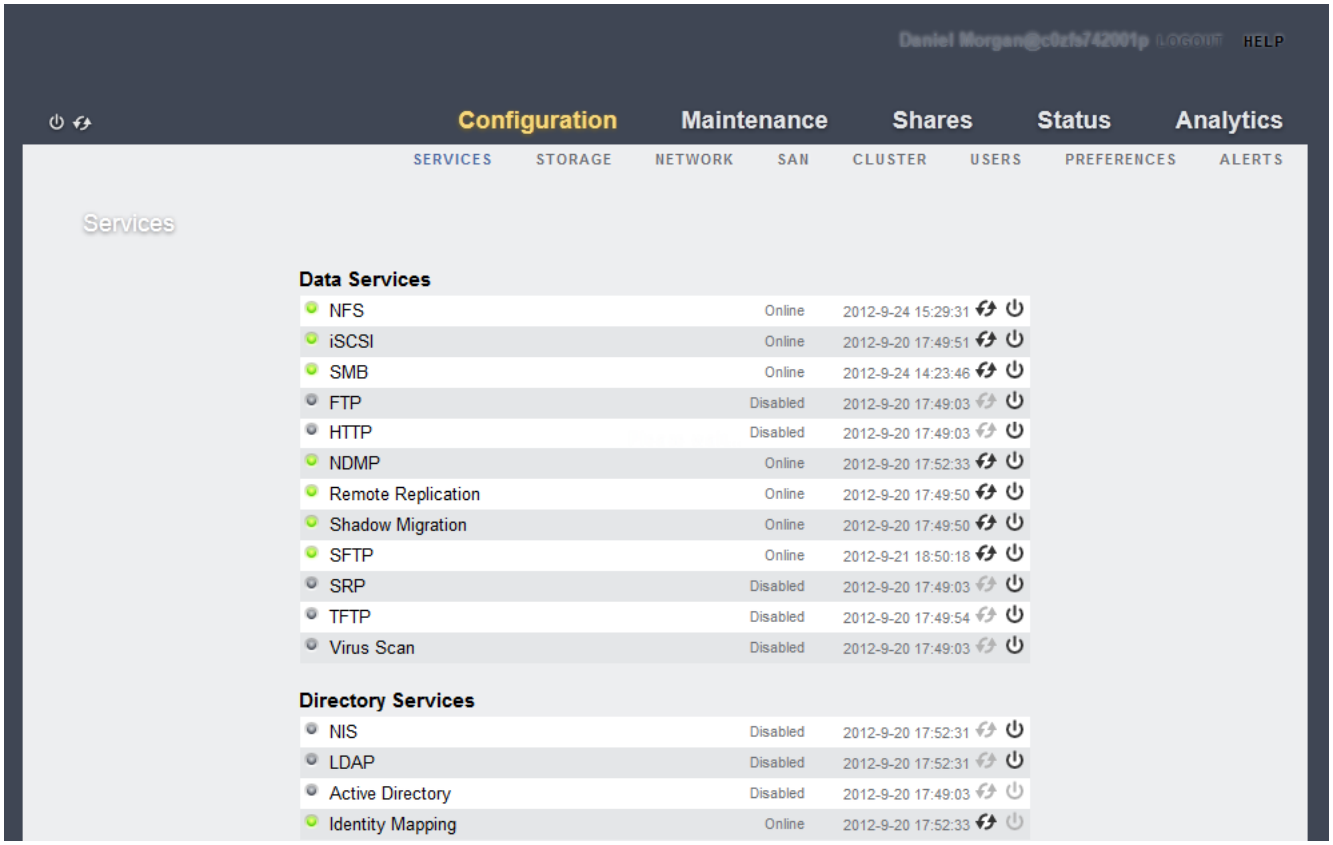
ZFS BUI


HELP
Configuration
Maintenance
Shares
Status
Analytics
HARDWARE
SYSTEM
PROBLEMS
LOGS
WORKFLOWS
Show Details
c0zfs742001p
Manufacturer Oracle
Model Sun ZFS Storage 7420
Serial 1235FMJ00N
Processors 4x2GHz Intel(r) Xeon(r) CPU E7- 4820 @ 2.00GHz
Memory 512GB
System 932GB (2 disks)
Data -
Cache -
Log -
Total 932GB (2 disks)
Please wait...
Disk Shelves
NAME MFR/MODEL RPM DATA CACHE LOG PATHS
1235FMD003 Sun Microsystems, Inc./Sun Disk Shelf (SAS-2) 7200 54.6TB - 137GB 2
1235FMD002 Sun Microsystems, Inc./Sun Disk Shelf (SAS-2) 7200 54.6TB - 137GB 1

ZFS Config Services



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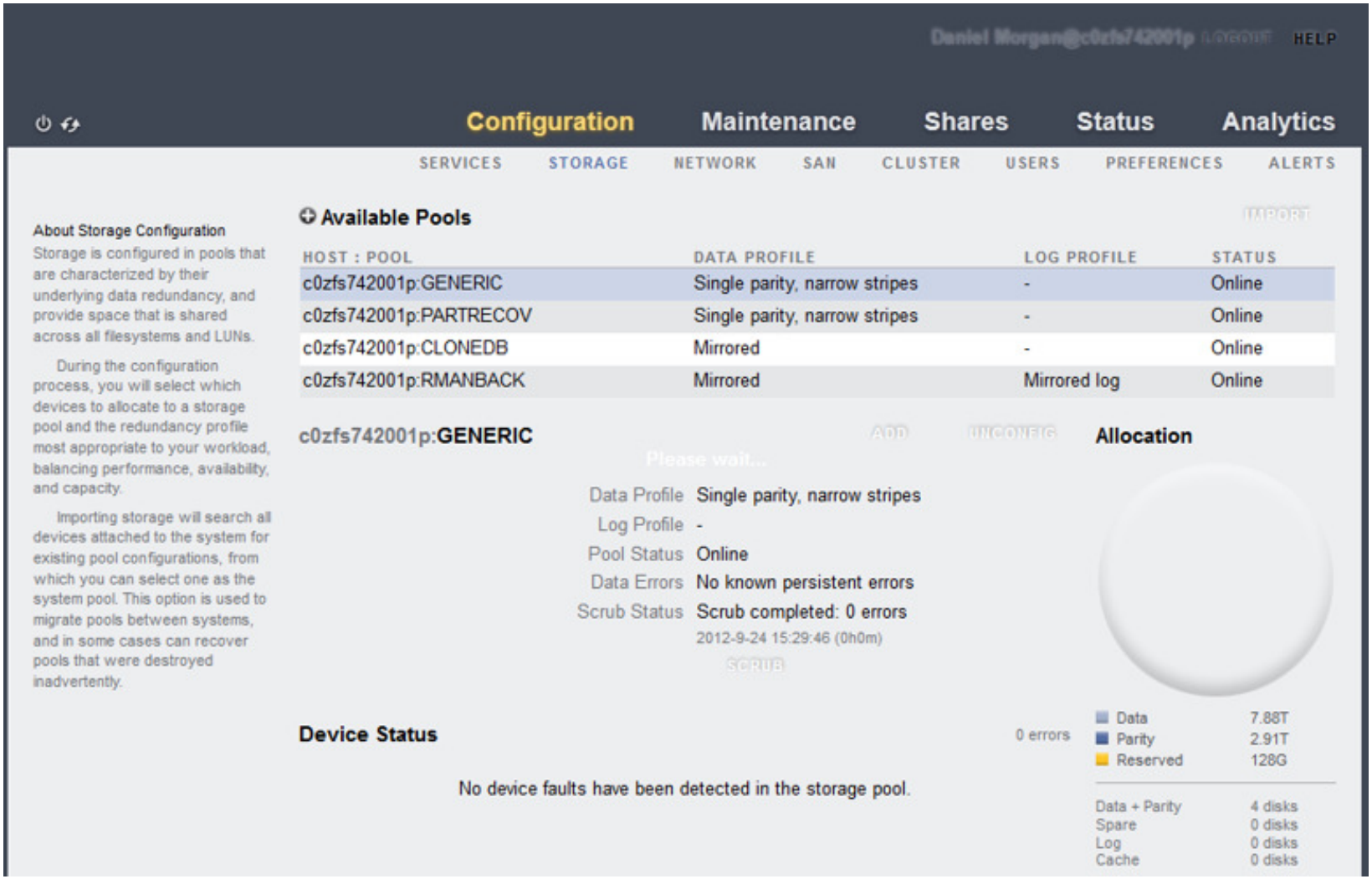
ZFS BUI



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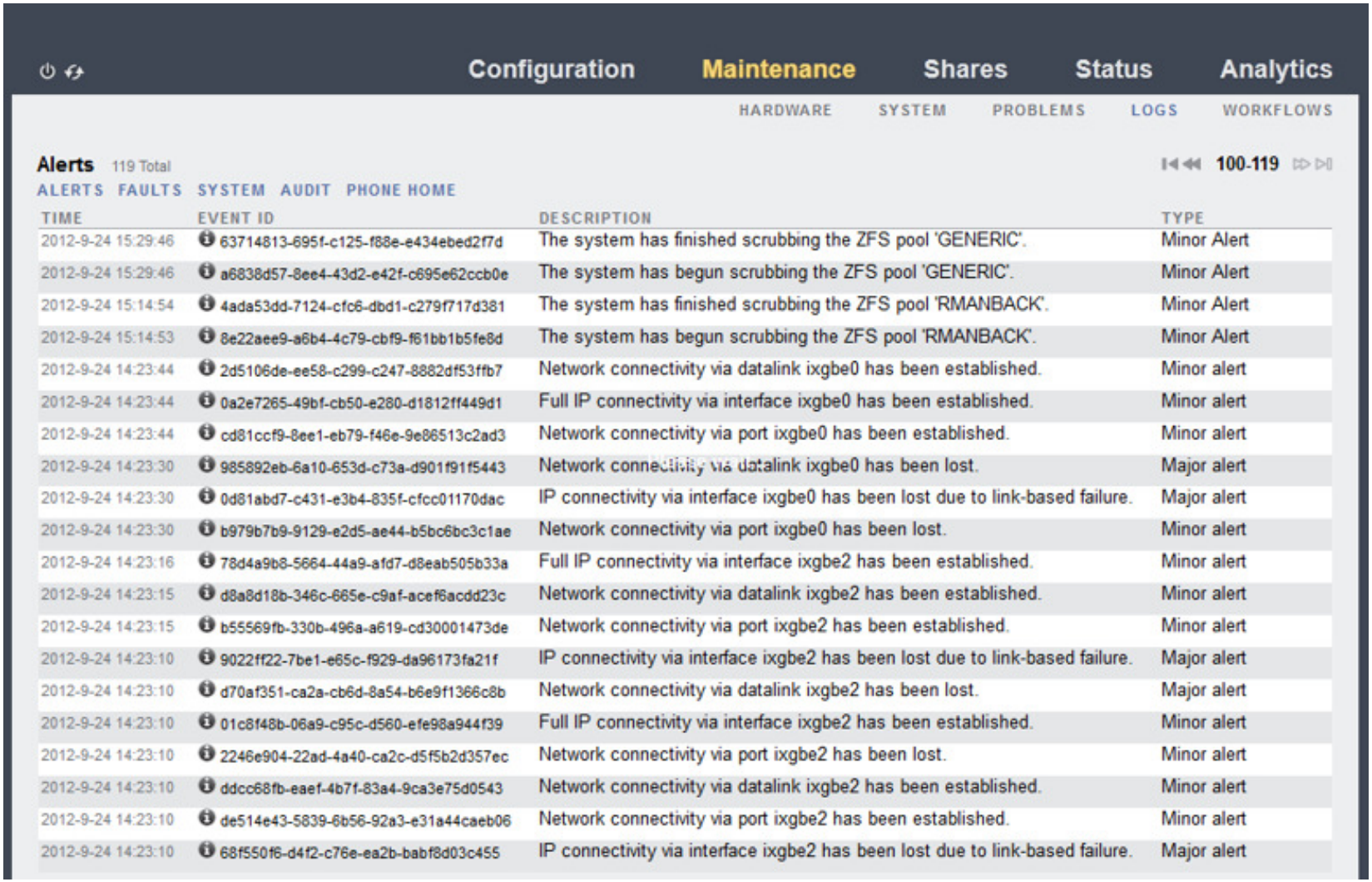
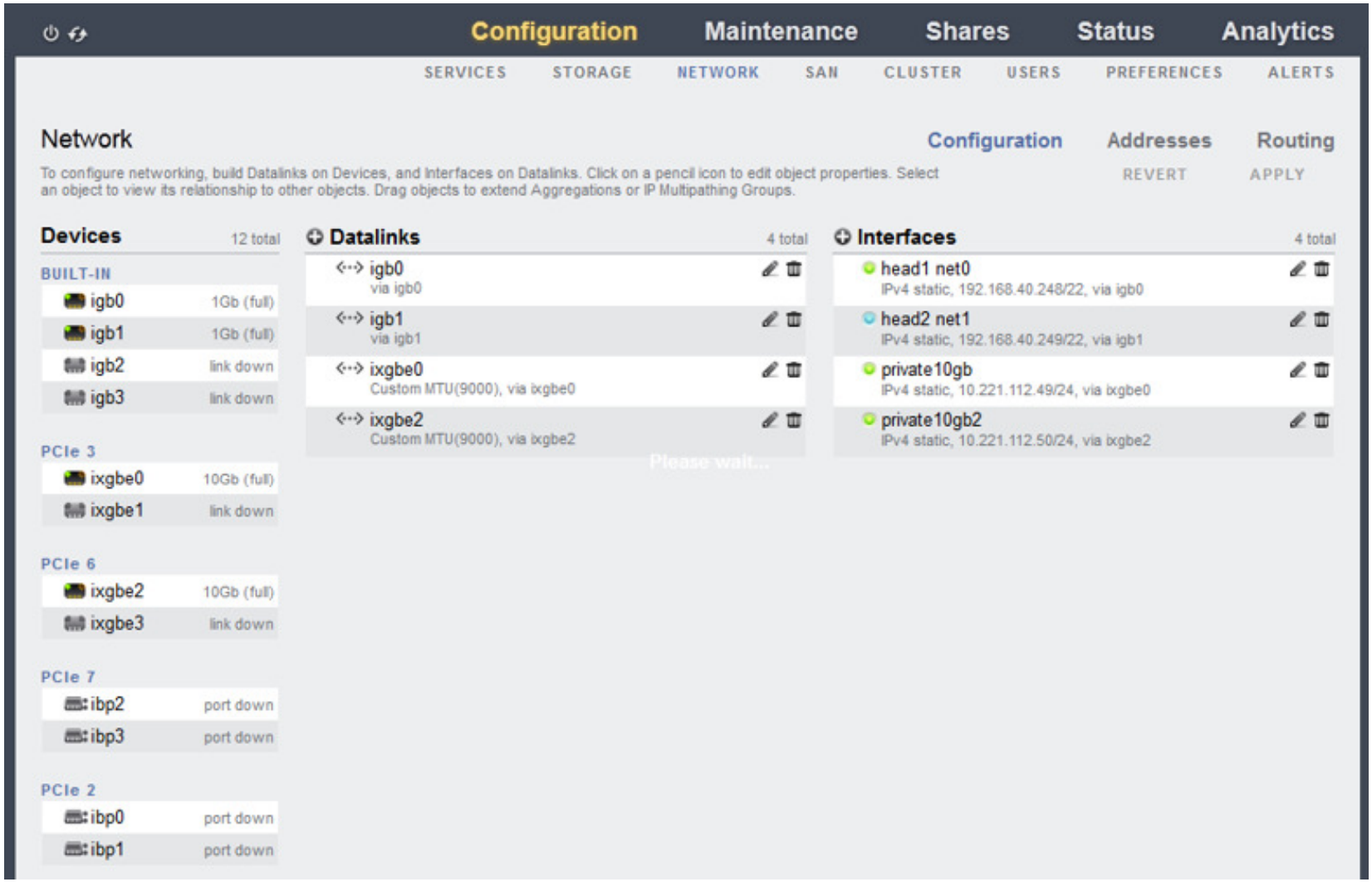
ZFS BUI


Configuration
Maintenance
Shares
Status
Analytics
HARDWARE
SYSTEM
PROBLEMS
LOGS
WORKFLOWS
Alerts 119 Total
100-119
ALERTS FAULTS SYSTEM AUDIT PHONE HOME
TIME EVENT ID DESCRIPTION TYPE
2012-9-24 15:29:46 63714813-695f-c125-f88e-e434ebed2f7d The system has finished scrubbing the ZFS pool 'GENERIC'. Minor Alert
2012-9-24 15:29:46 a6838d57-8ee4-43d2-e42f-c695e62ccb0e The system has begun scrubbing the ZFS pool 'GENERIC'. Minor Alert
2012-9-24 15:14:54 4ada53dd-7124-cfc6-dbd1-c279f717d381 The system has finished scrubbing the ZFS pool 'RMANBACK'. Minor Alert
2012-9-24 15:14:53 8e22aee9-a6b4-4c79-cbf9-f61bb1b5fe8d The system has begun scrubbing the ZFS pool 'RMANBACK'. Minor Alert
2012-9-24 14:23:44 2d5106de-ee58-c299-c247-8882df53ffb7 Network connectivity via datalink ixgbe0 has been established. Minor alert
2012-9-24 14:23:44 0a2e7265-49bf-cb50-e280-d1812ff449d1 Full IP connectivity via interface ixgbe0 has been established. Minor alert
2012-9-24 14:23:44 cd81ccf9-8ee1-eb79-f46e-9e86513c2ad3 Network connectivity via port ixgbe0 has been established. Minor alert
2012-9-24 14:23:30 985892eb-6a10-653d-c73a-d901f91f5443 Network connectivity via datalink ixgbe0 has been lost. Major alert
2012-9-24 14:23:30 0d81abd7-c431-e3b4-835f-cfcc01170dac IP connectivity via interface ixgbe0 has been lost due to link-based failure. Major alert
2012-9-24 14:23:30 b979b7b9-9129-e2d5-ae44-b5bc6bc3c1ae Network connectivity via port ixgbe0 has been lost. Minor alert
2012-9-24 14:23:16 78d4a9b8-5664-44a9-afd7-d8eab505b33a Full IP connectivity via interface ixgbe2 has been established. Minor alert
2012-9-24 14:23:15 d8a8d18b-346c-665e-c9af-acef6acdd23c Network connectivity via datalink ixgbe2 has been established. Minor alert
2012-9-24 14:23:15 b55569fb-330b-496a-a619-cd30001473de Network connectivity via port ixgbe2 has been established. Minor alert
2012-9-24 14:23:10 9022ff22-7be1-e65c-f929-da96173fa21f IP connectivity via interface ixgbe2 has been lost due to link-based failure. Major alert
2012-9-24 14:23:10 d70af351-ca2a-cb6d-8a54-b6e9f1366c8b Network connectivity via datalink ixgbe2 has been lost. Major alert
2012-9-24 14:23:10 01c8f48b-06a9-c95c-d560-efe98a944f39 Full IP connectivity via interface ixgbe2 has been established. Minor alert
2012-9-24 14:23:10 2246e904-22ad-4a40-ca2c-d5f5b2d357ec Network connectivity via port ixgbe2 has been lost. Minor alert
2012-9-24 14:23:10 ddcc68fb-eaef-4b7f-83a4-9ca3e75d0543 Network connectivity via datalink ixgbe2 has been established. Minor alert
2012-9-24 14:23:10 de514e43-5839-6b56-92a3-e31a44caeb06 Network connectivity via port ixgbe2 has been established. Minor alert
2012-9-24 14:23:10 68f550f6-d4f2-c76e-ea2b-babf8d03c455 IP connectivity via interface ixgbe2 has been lost due to link-based failure. Major alert

ZFS BUI



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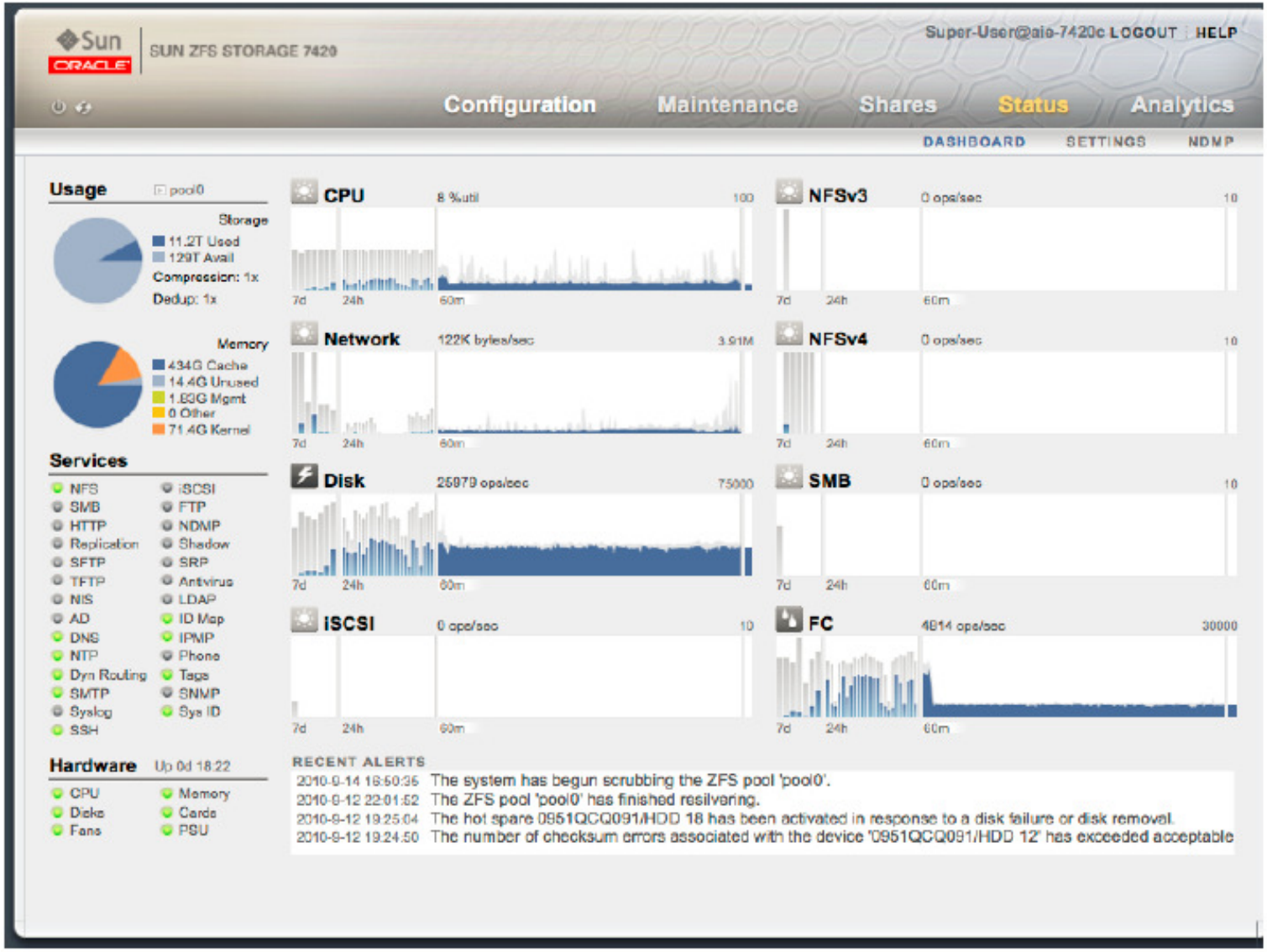
ZFS Storage Appliances



I Software
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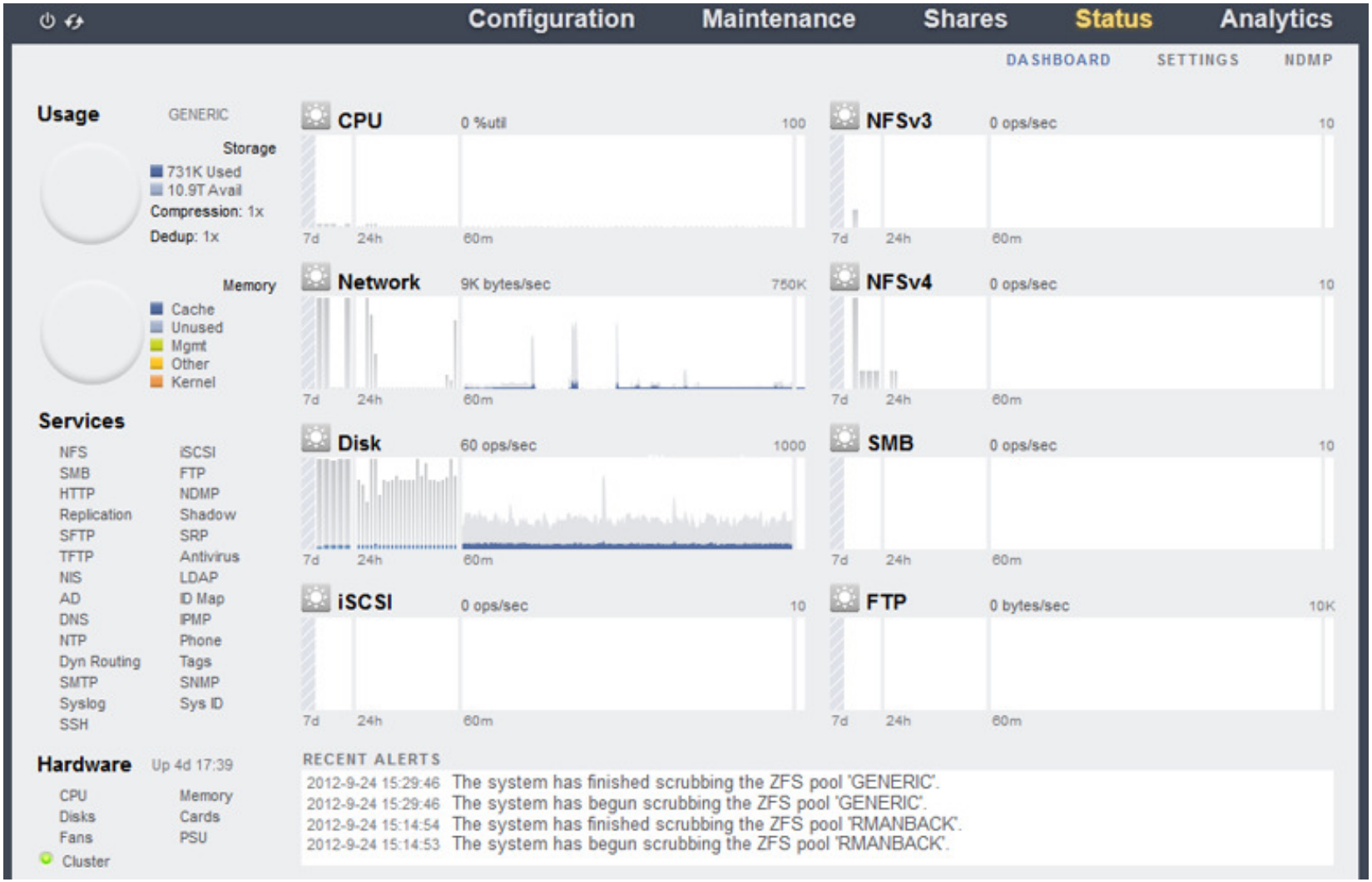
ZFS BUI



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How Does This Change Our Jobs?

Job Title	Loses	Gains
Storage Admins	Time wasted monitoring competing loads on the storage appliance balancing competing need to read/write cache, and allocation of disk.	More efficient storage environment as it is all file system.
Network Admins	Pain and suffering	Time to devote to troubleshooting, security monitoring, and other value-added tasks.
System Admins	▪Gives up appliance root password ▪Gives up 2:00am support calls	
Database Admins		Patching operating system, firmware, and database as a single unit with patches previously tested for compatibility

Your ODA is not a general purpose computer, will not be hosting files, applications, middleware, etc.

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How Does This Change Our Jobs?

- Storage Admin
  - No longer required
- Network Admin
  - Only required for public network interface
- System Admin
  - Advise on configuration
  - Install backup agent (ie Networker)
  - Install security software (ie TripWire)
- DBA
  - Just like with ASM ... assumes broader responsibility for deployment and patching
  - Gives up large amounts of unproductive time debugging configurations

Questions

ERROR at line 1:
ORA-00028: your session has been killed

Thank you

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