

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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- 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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Presented: Oracle OpenWorld - 3 October, 2012

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 1969

Around Oracle stack since 1984

Developer, Admin, Operations, Architect, CTO

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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?



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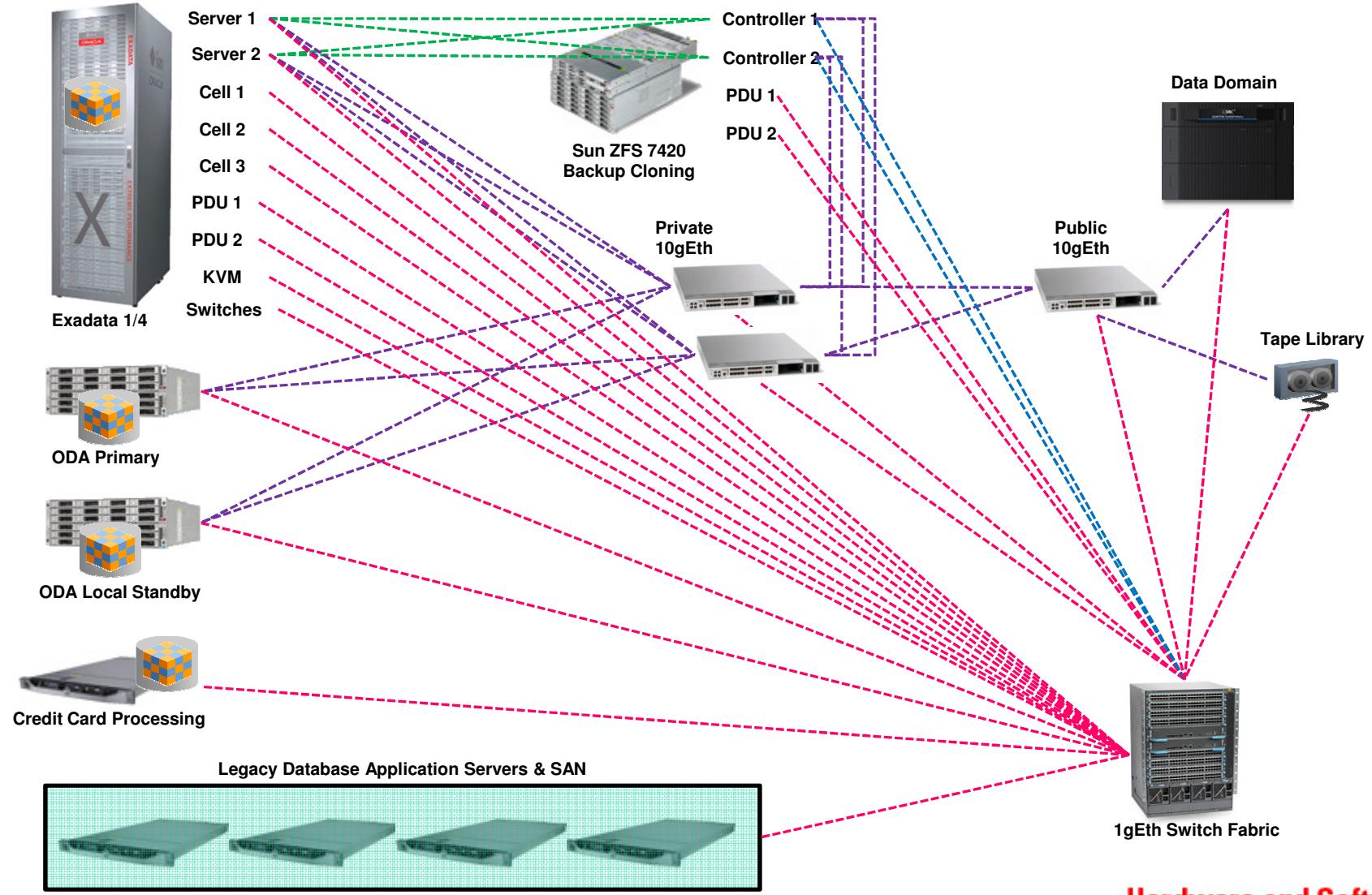
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Puzzle Pieces

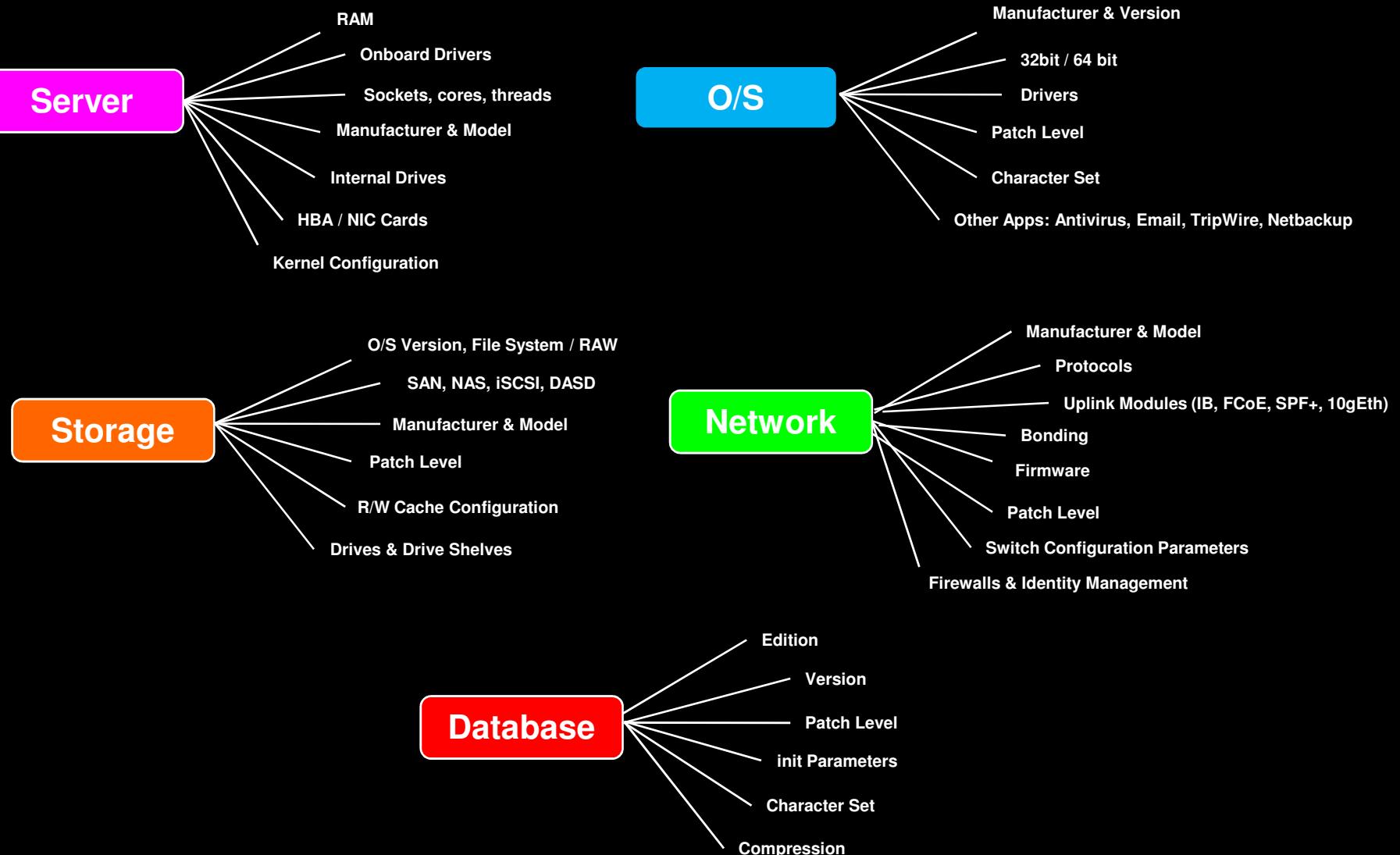


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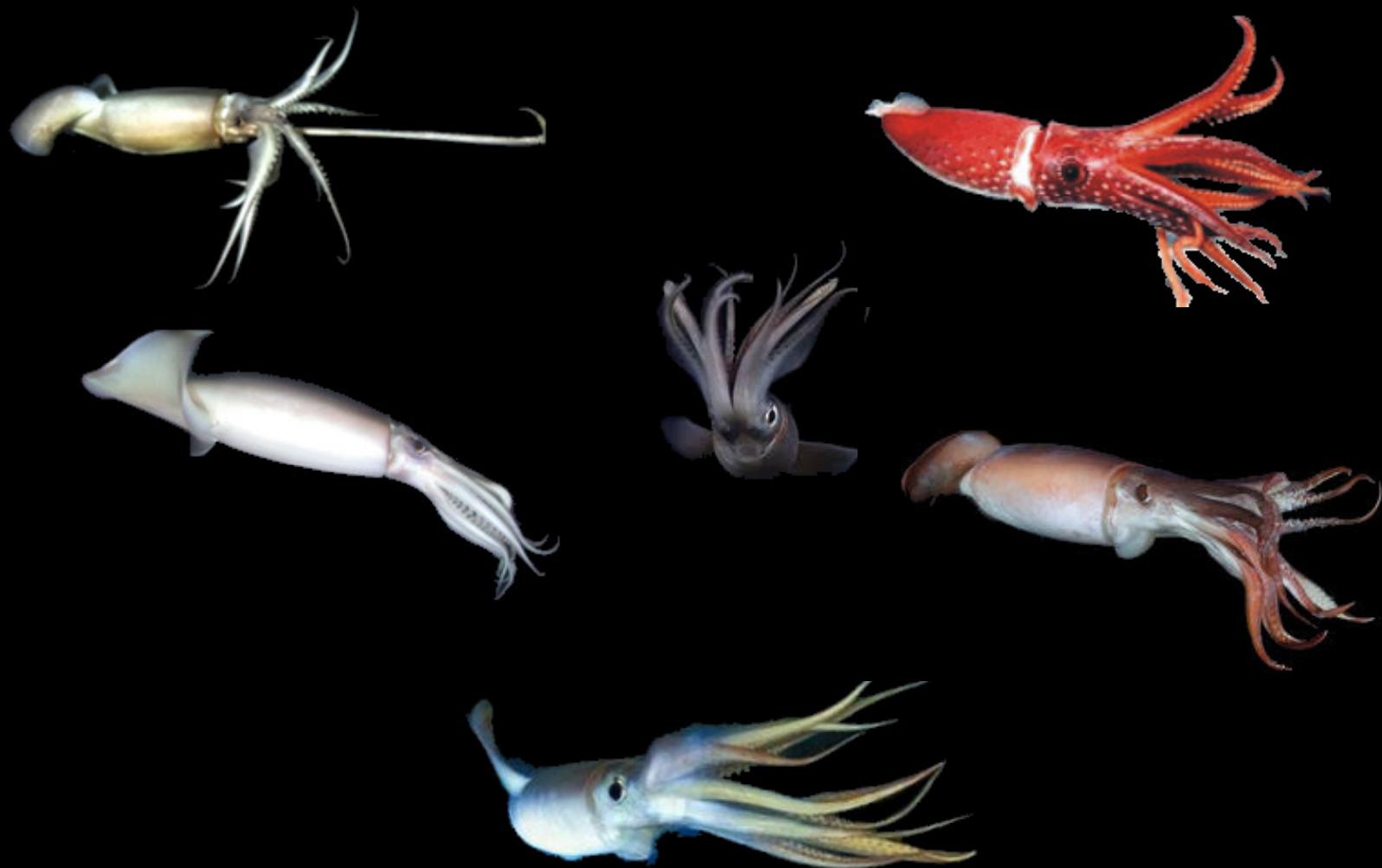
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Static Puzzle Pieces



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

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LONELINESS

IF YOU FIND YOURSELF STRUGGLING WITH LONELINESS, YOU'RE NOT ALONE.
AND YET YOU ARE ALONE. SO VERY ALONE.

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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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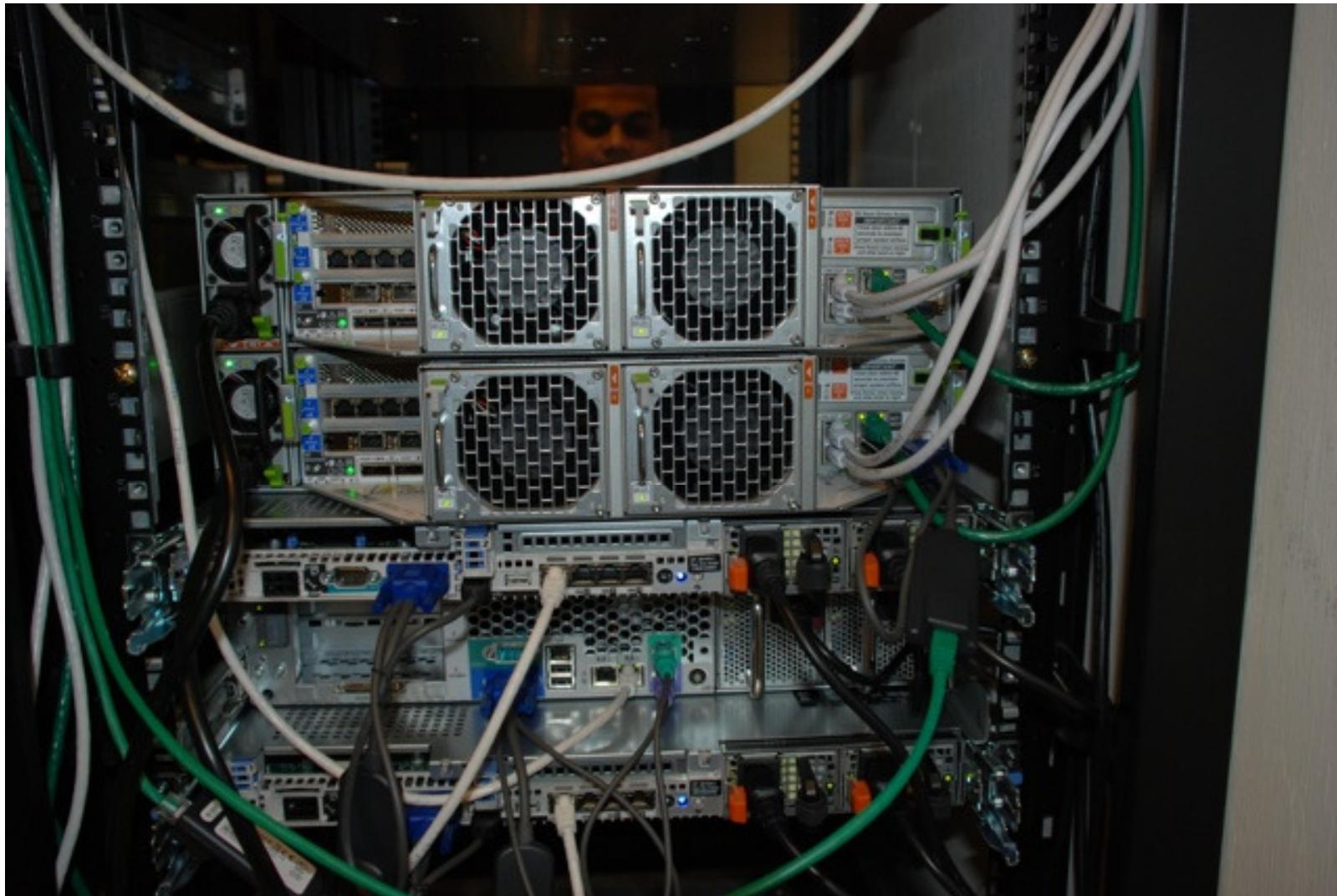
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ODA in Pictures



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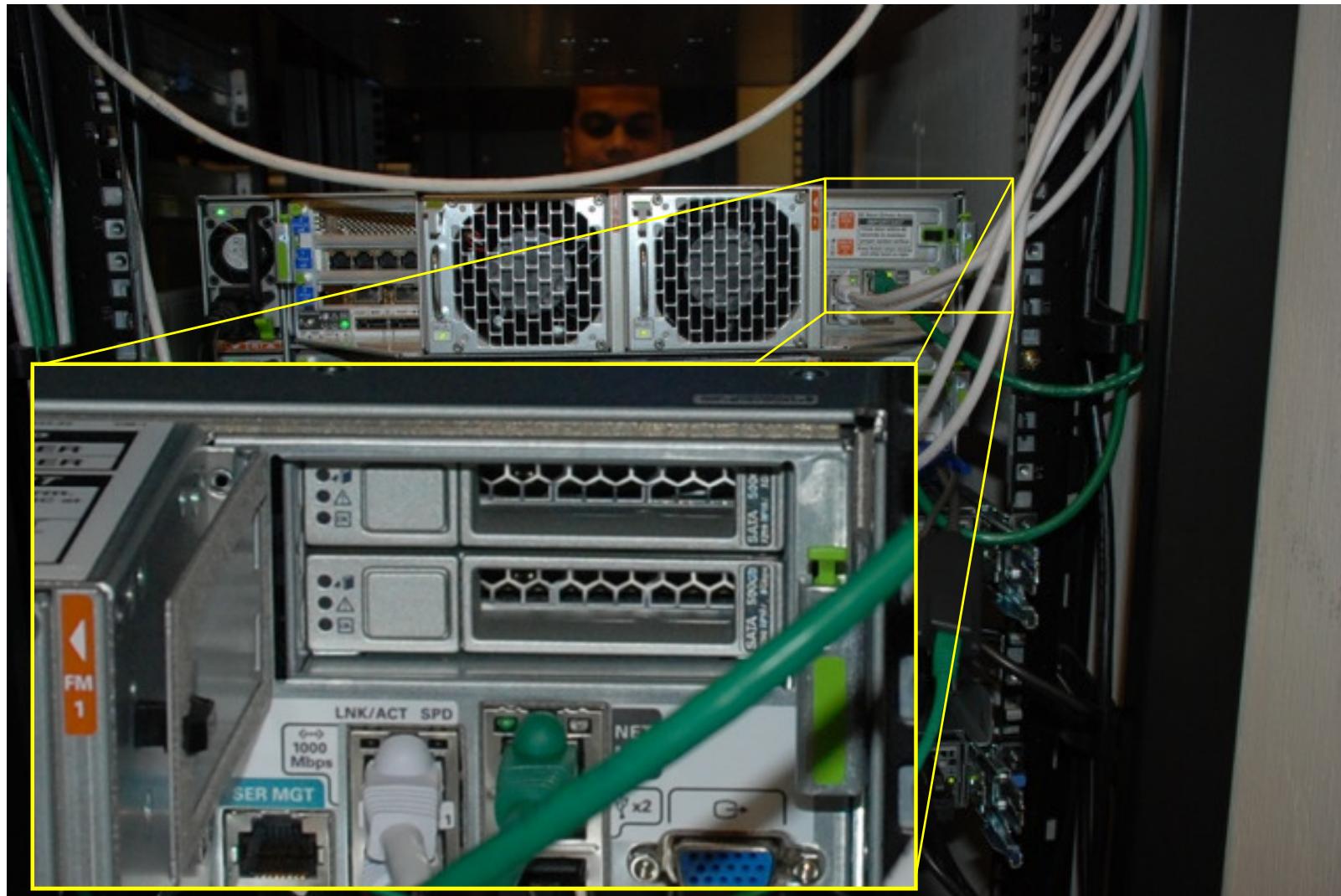
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ODA in Pictures



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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

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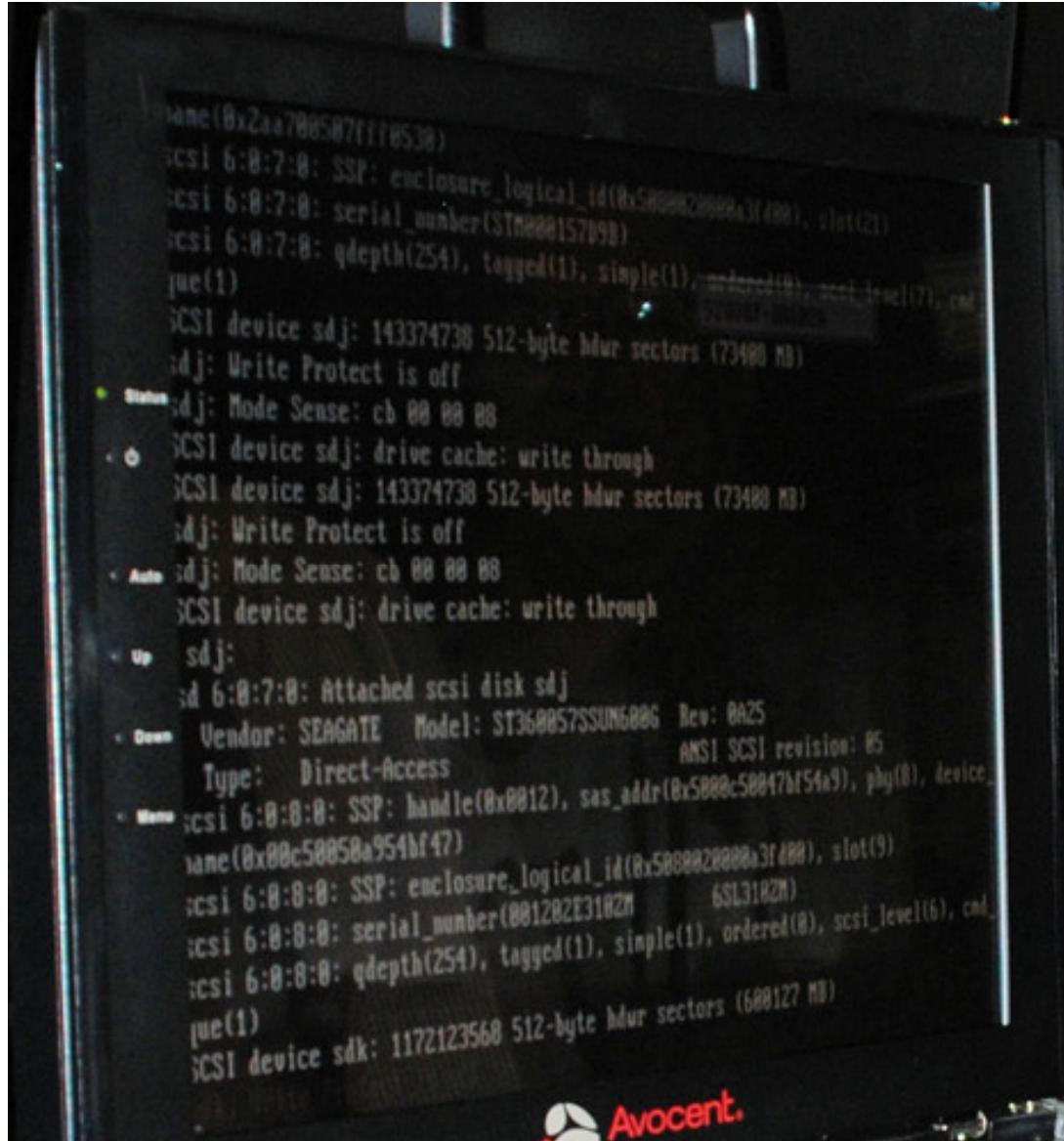
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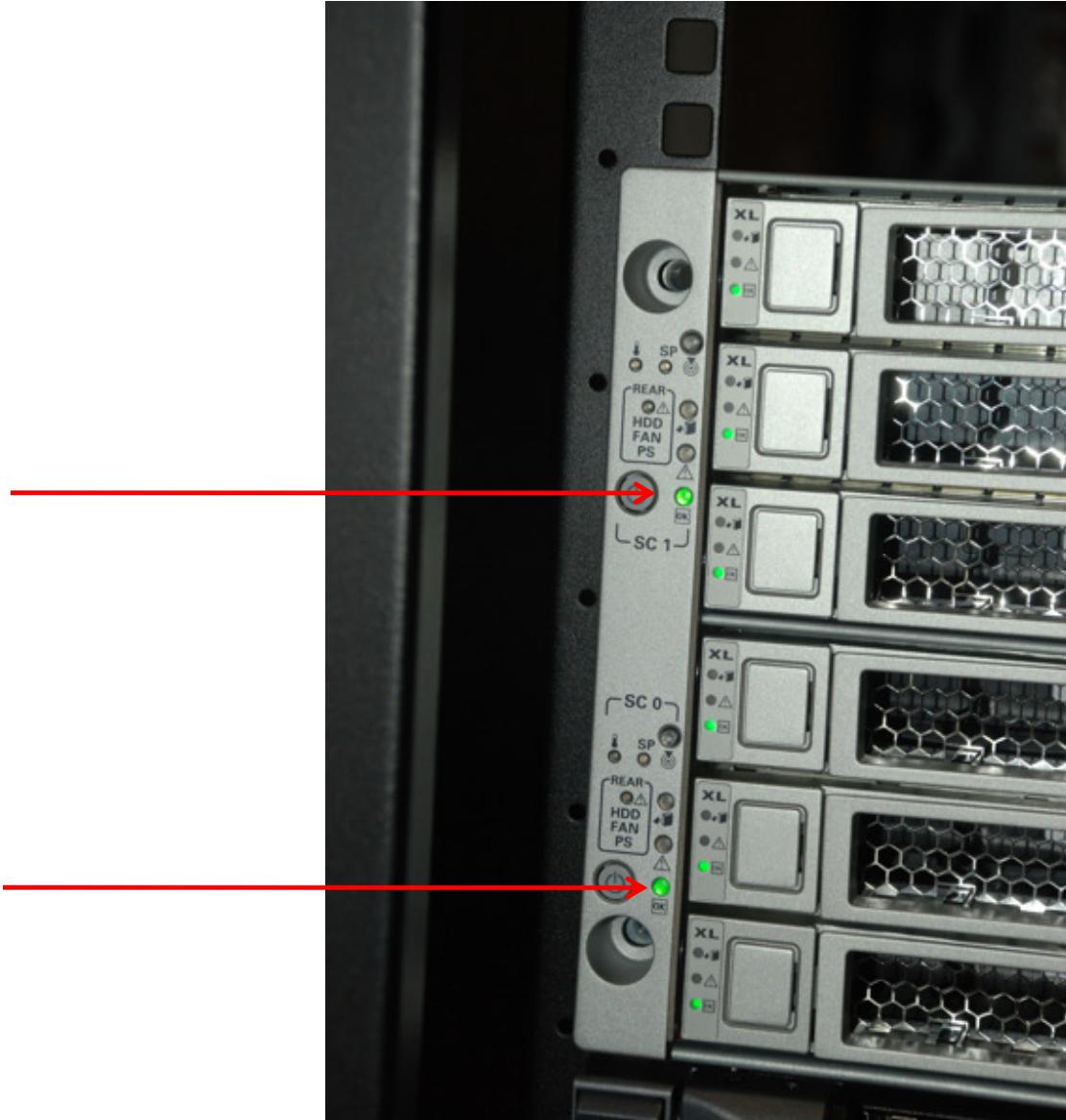
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Step 1: Power On



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Step 2: Wait for OK Lights



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Step 3: Log In as root



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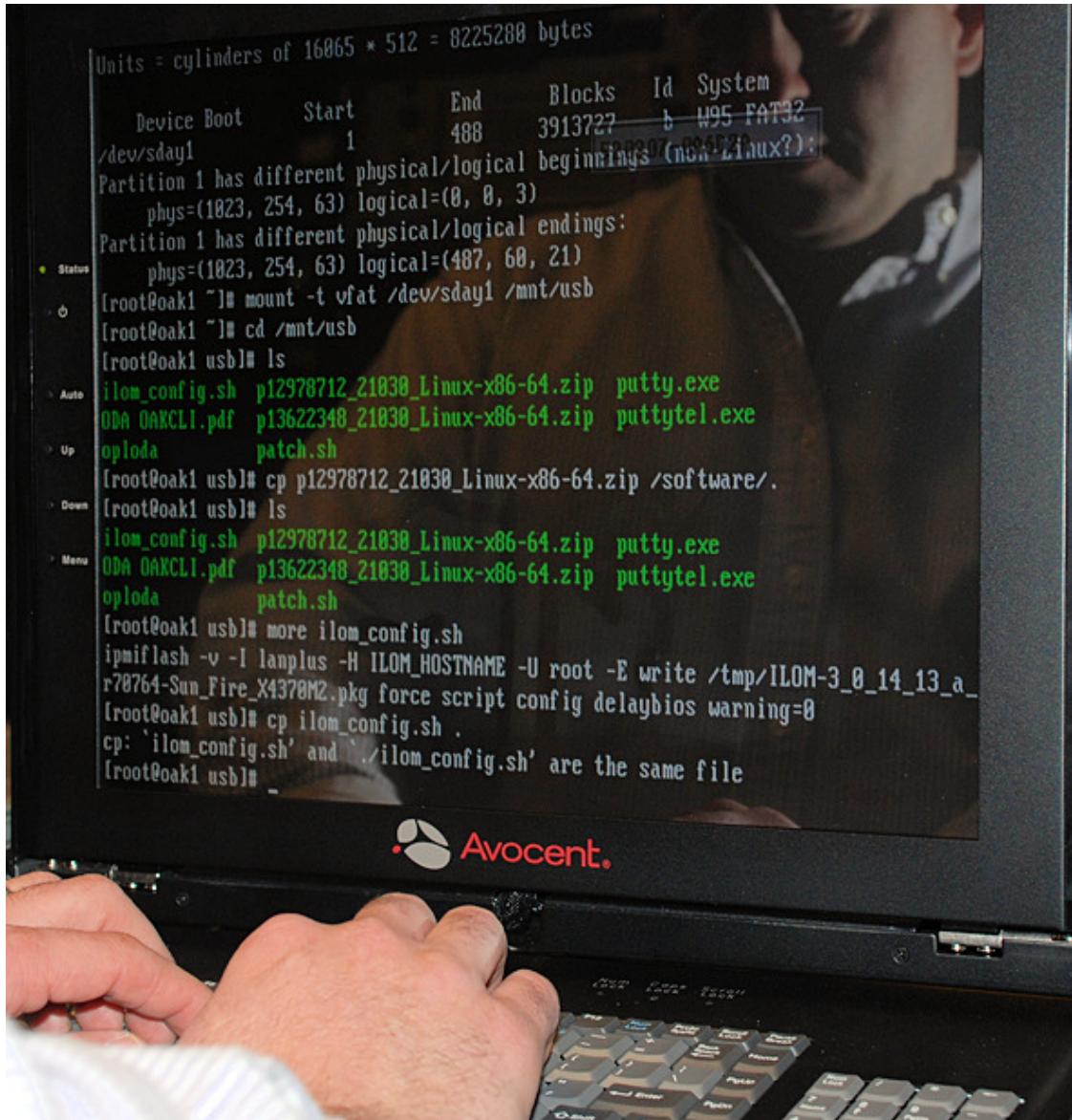
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Step 5: Perform ILOM Configuration



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Install Screens: 1



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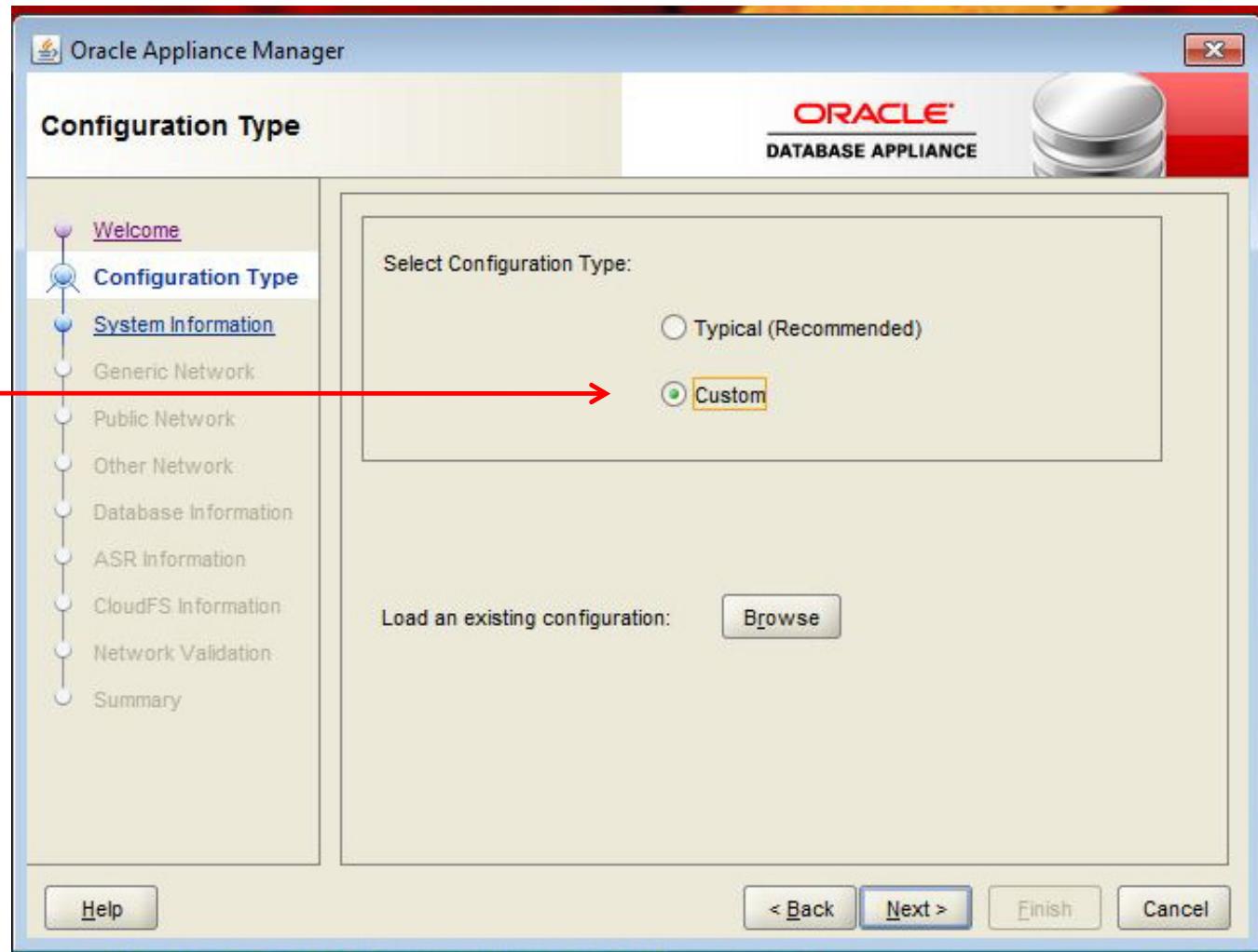
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Install Screens: 2



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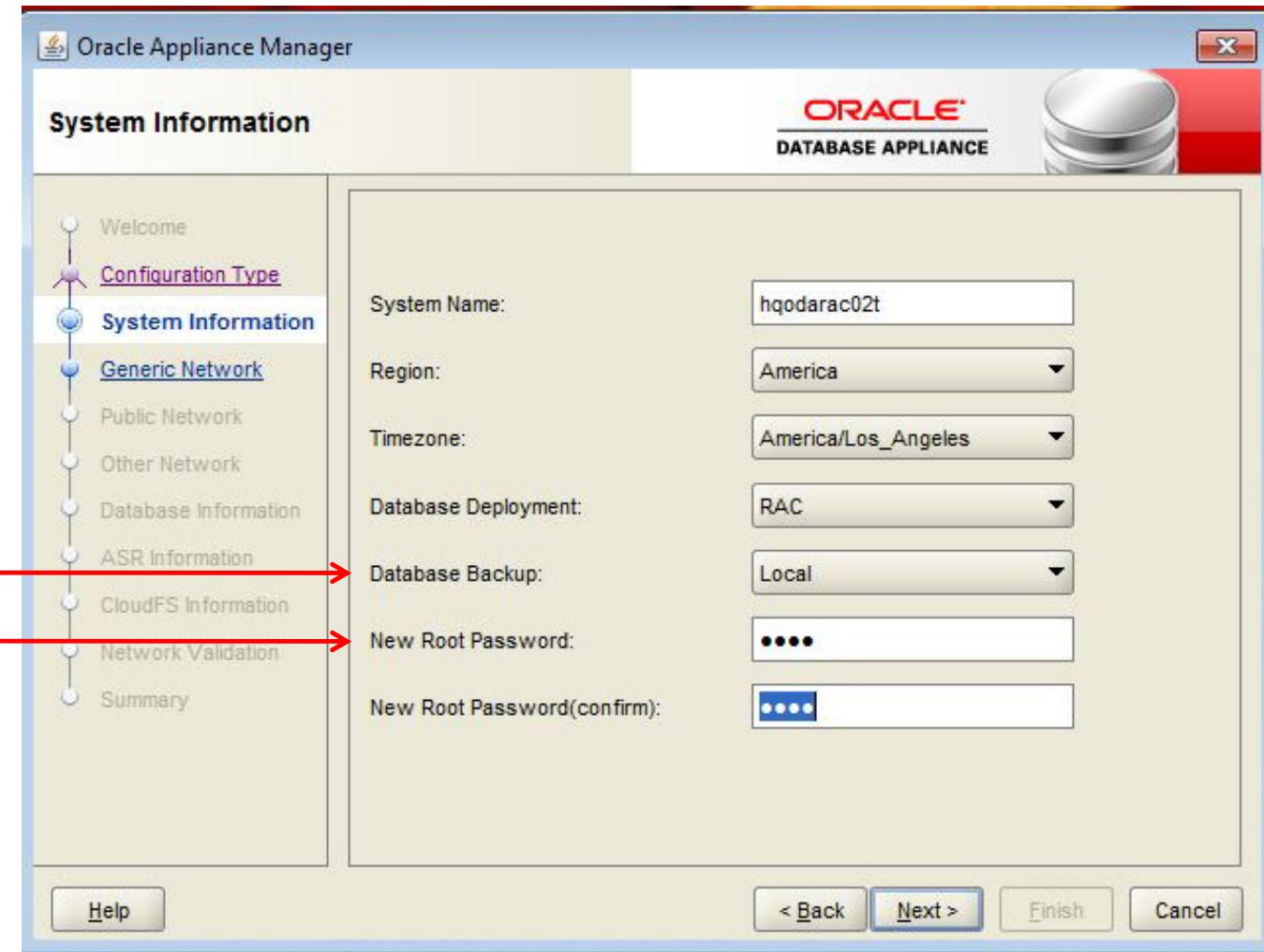
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Install Screens: 3



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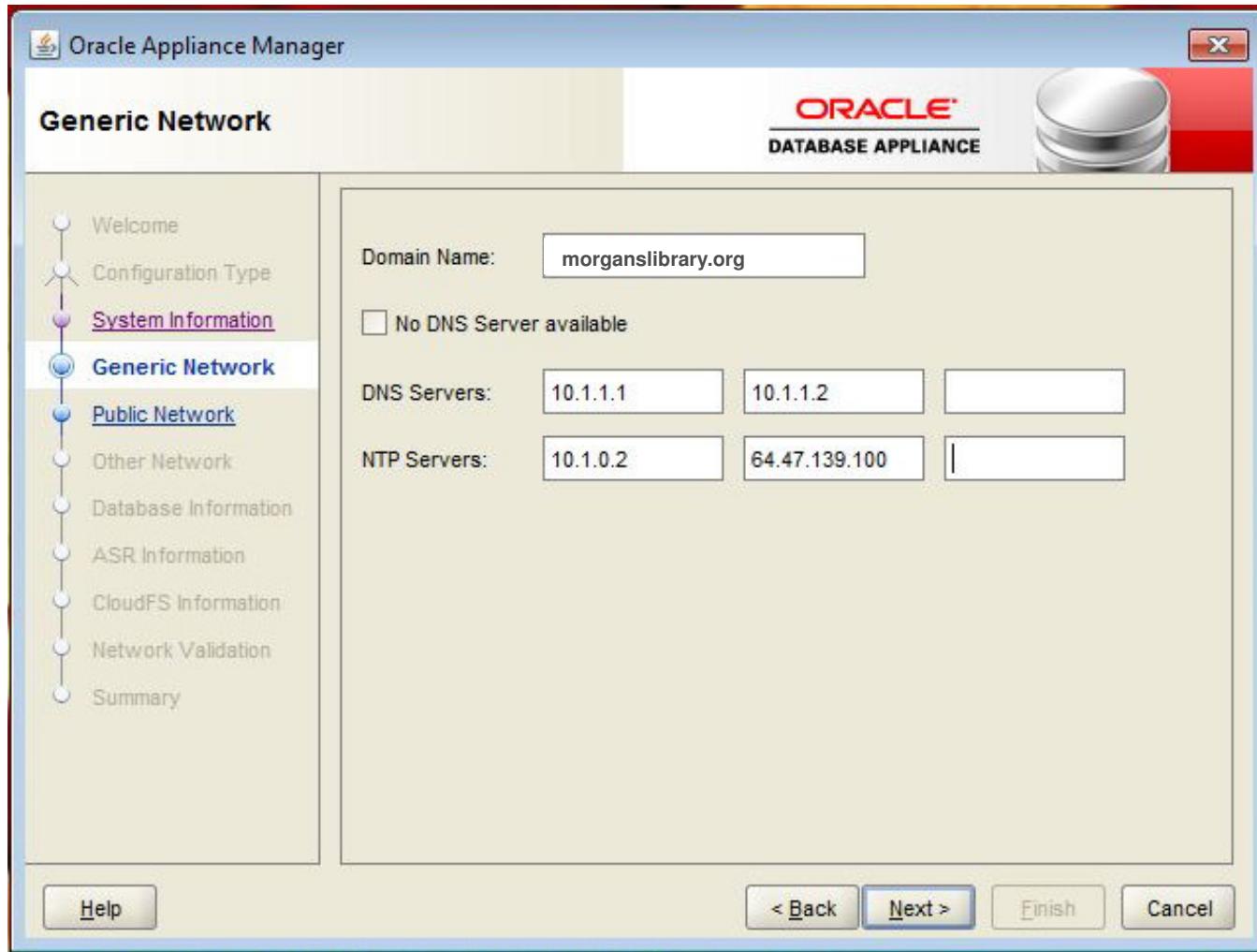
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Install Screens: 4



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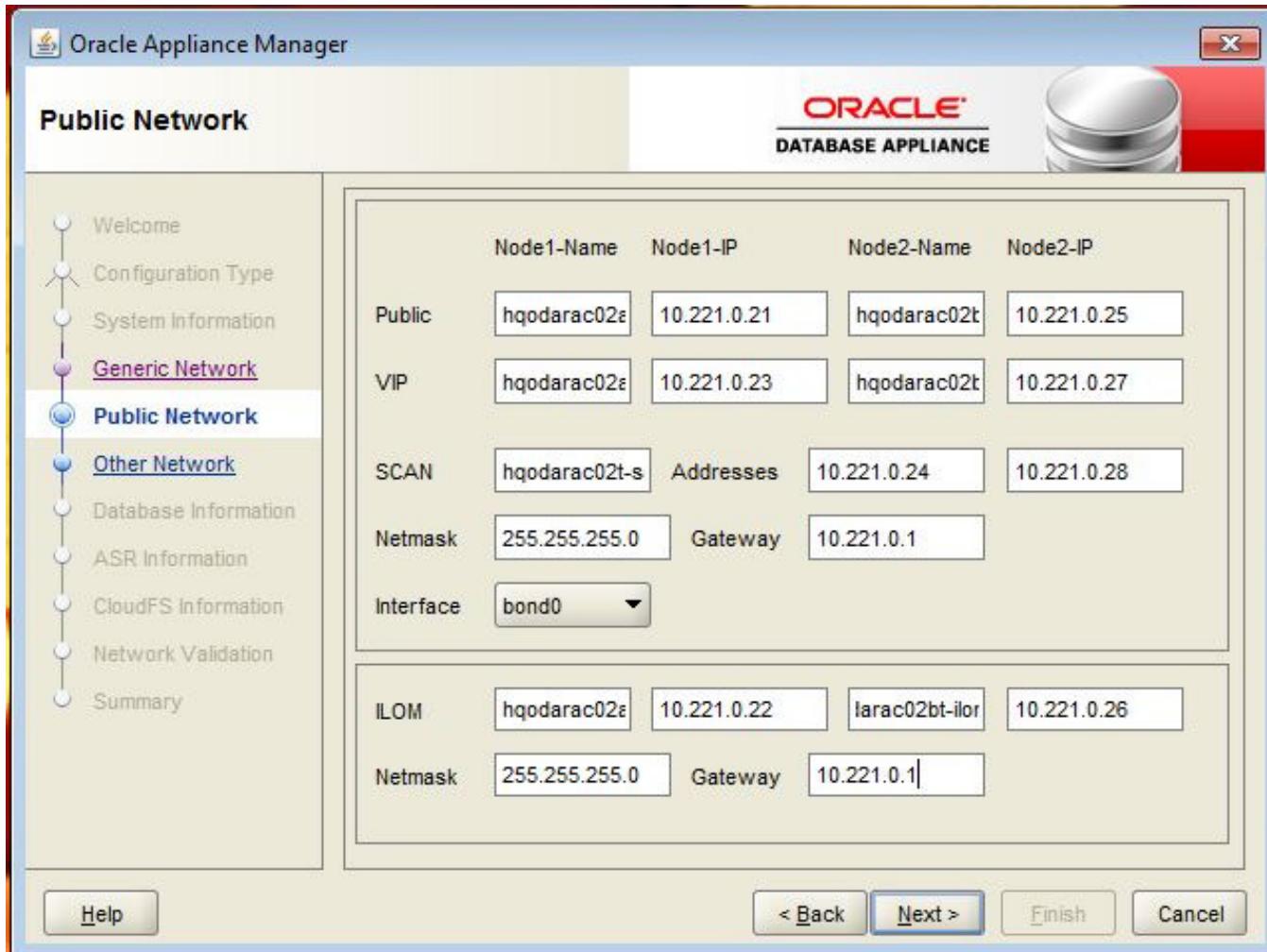
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Install Screens: 5



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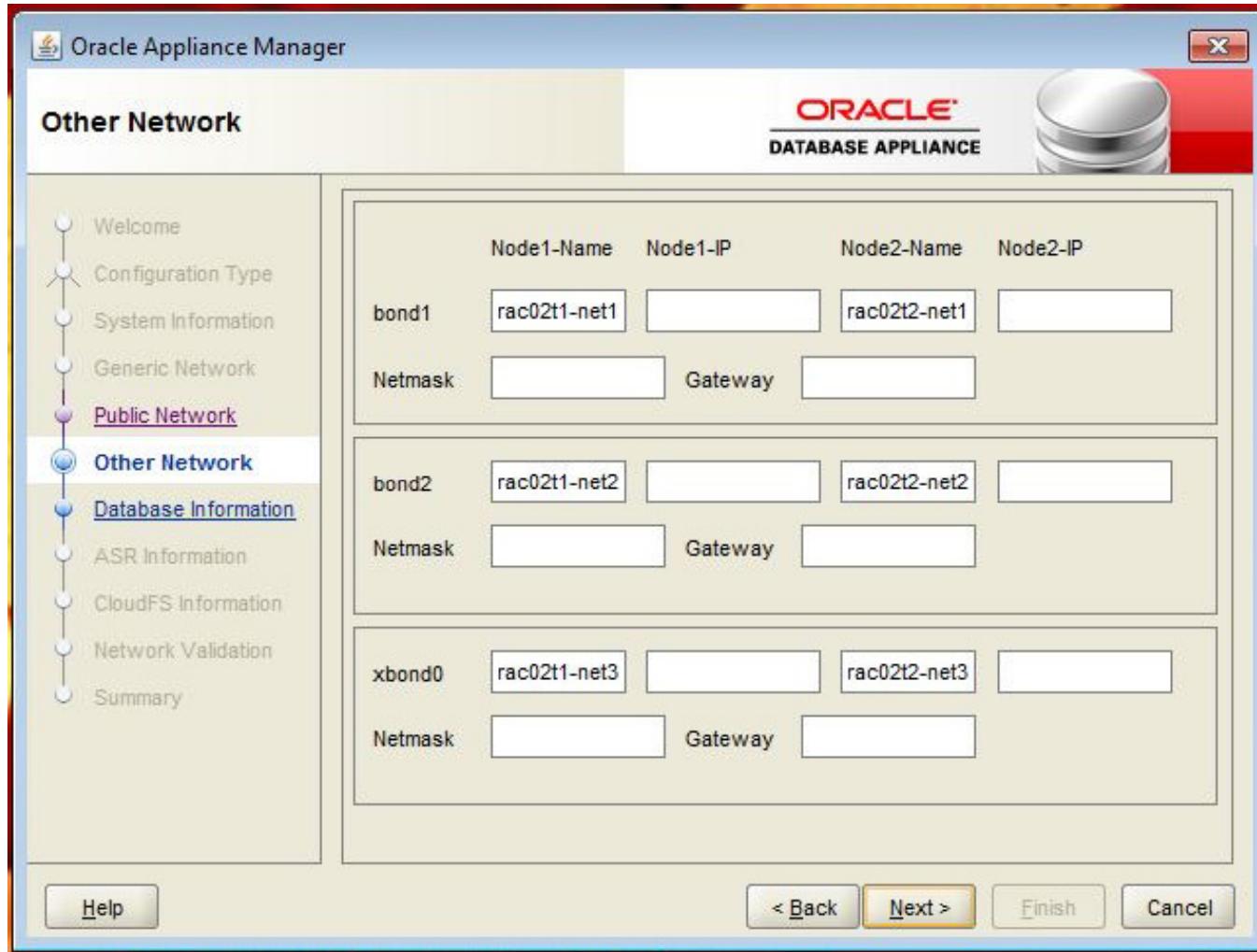
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Install Screens: 6



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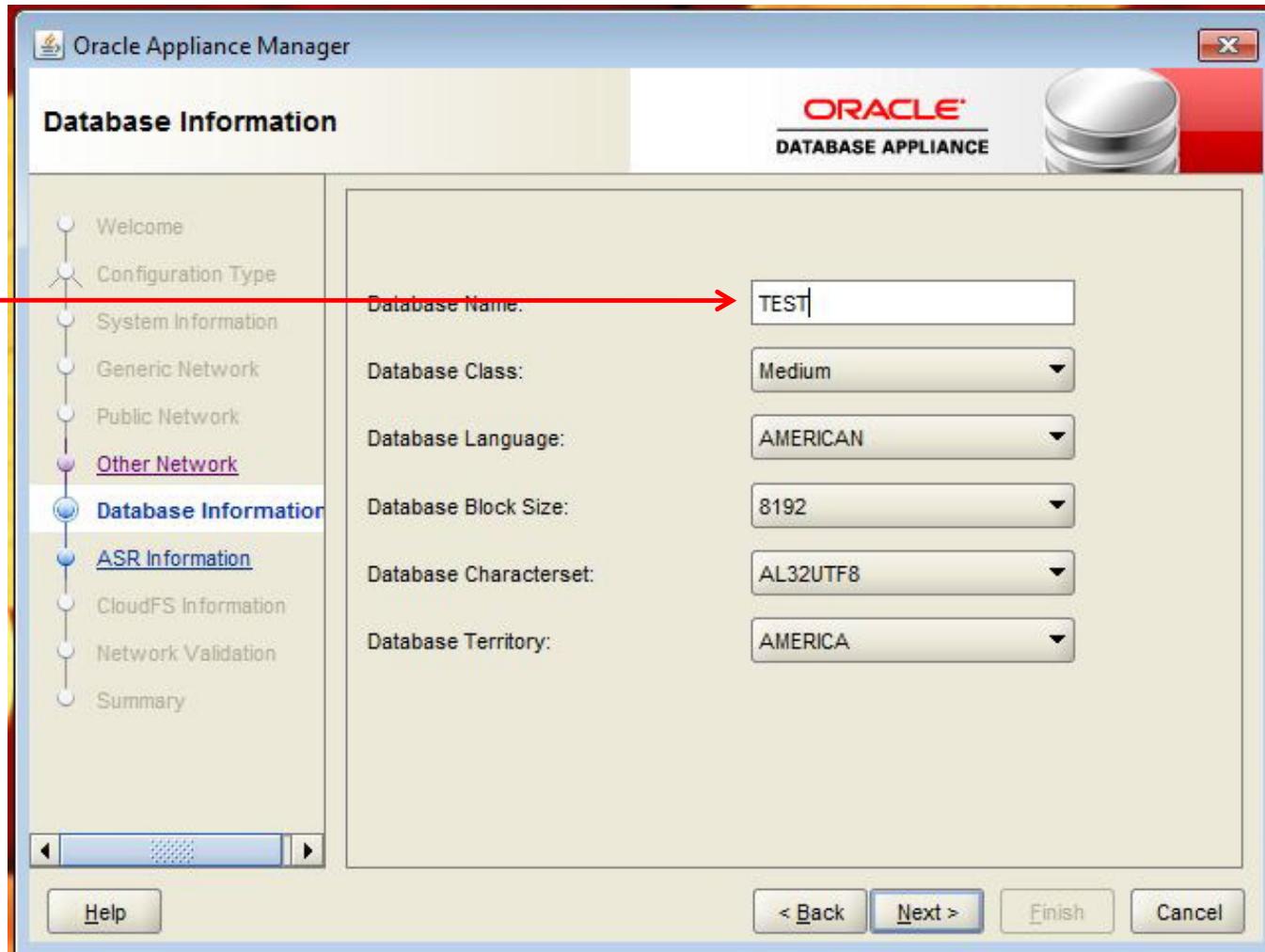
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Install Screens: 7



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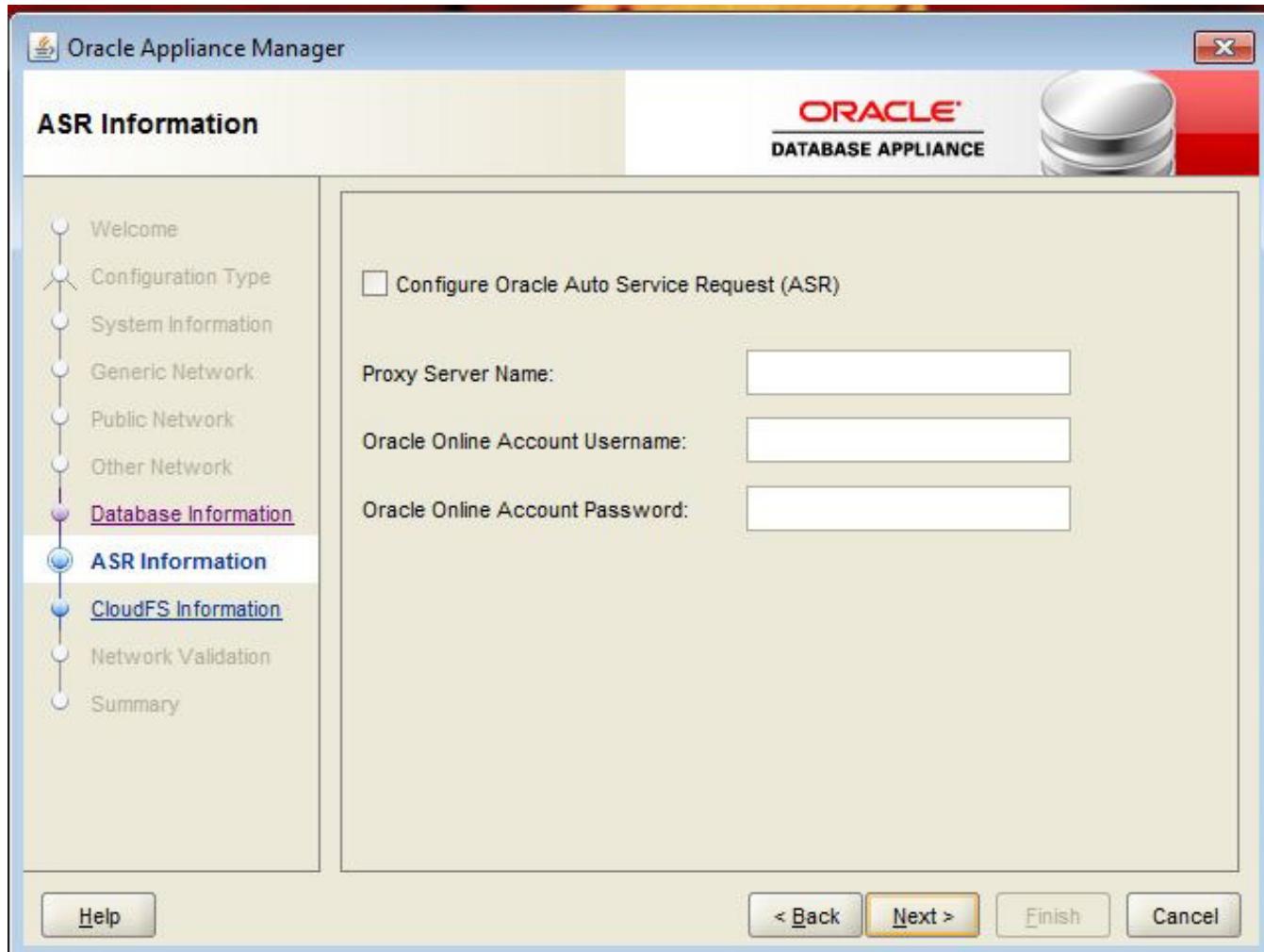
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Install Screens: 8



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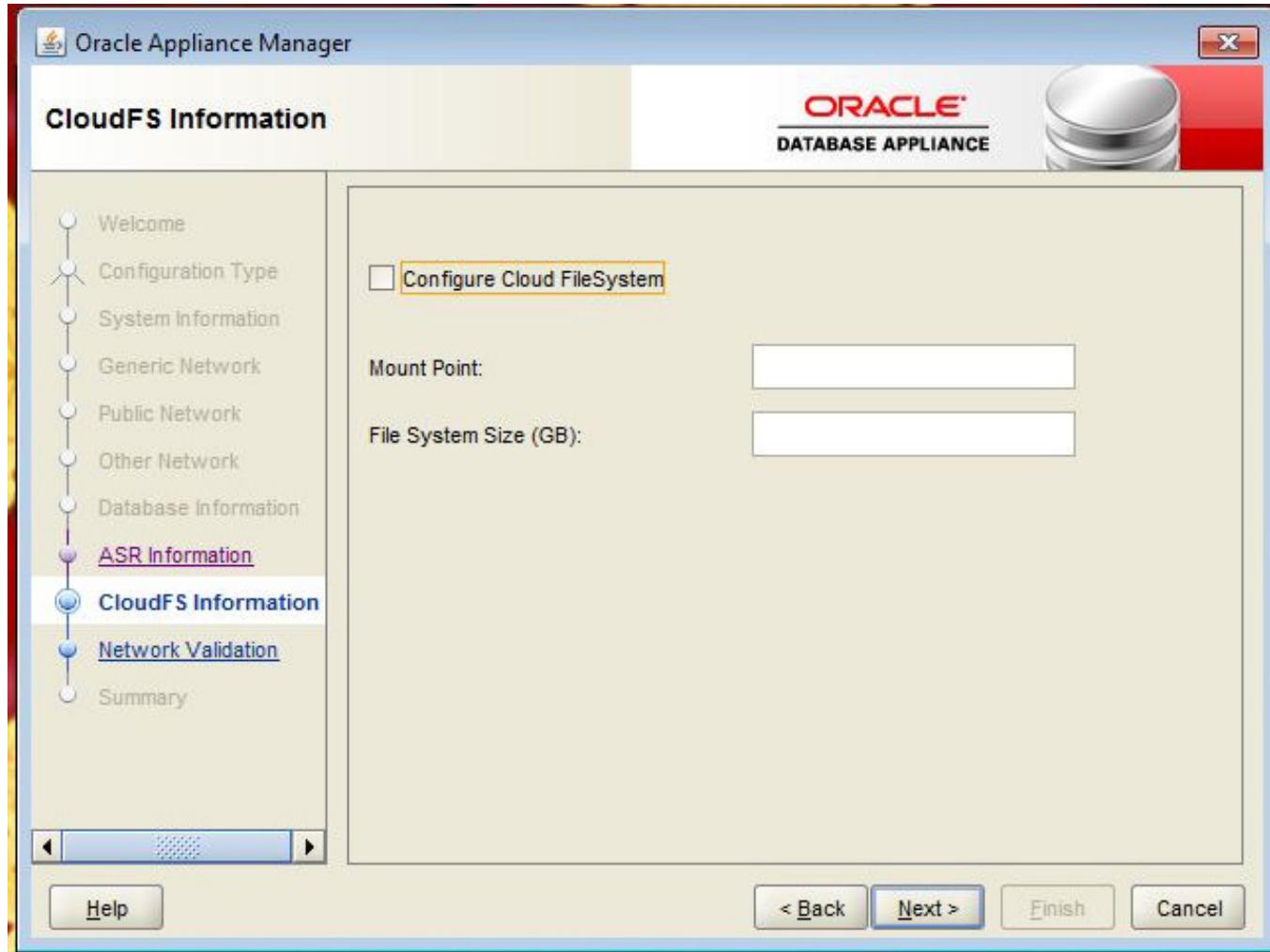
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Install Screens: 9



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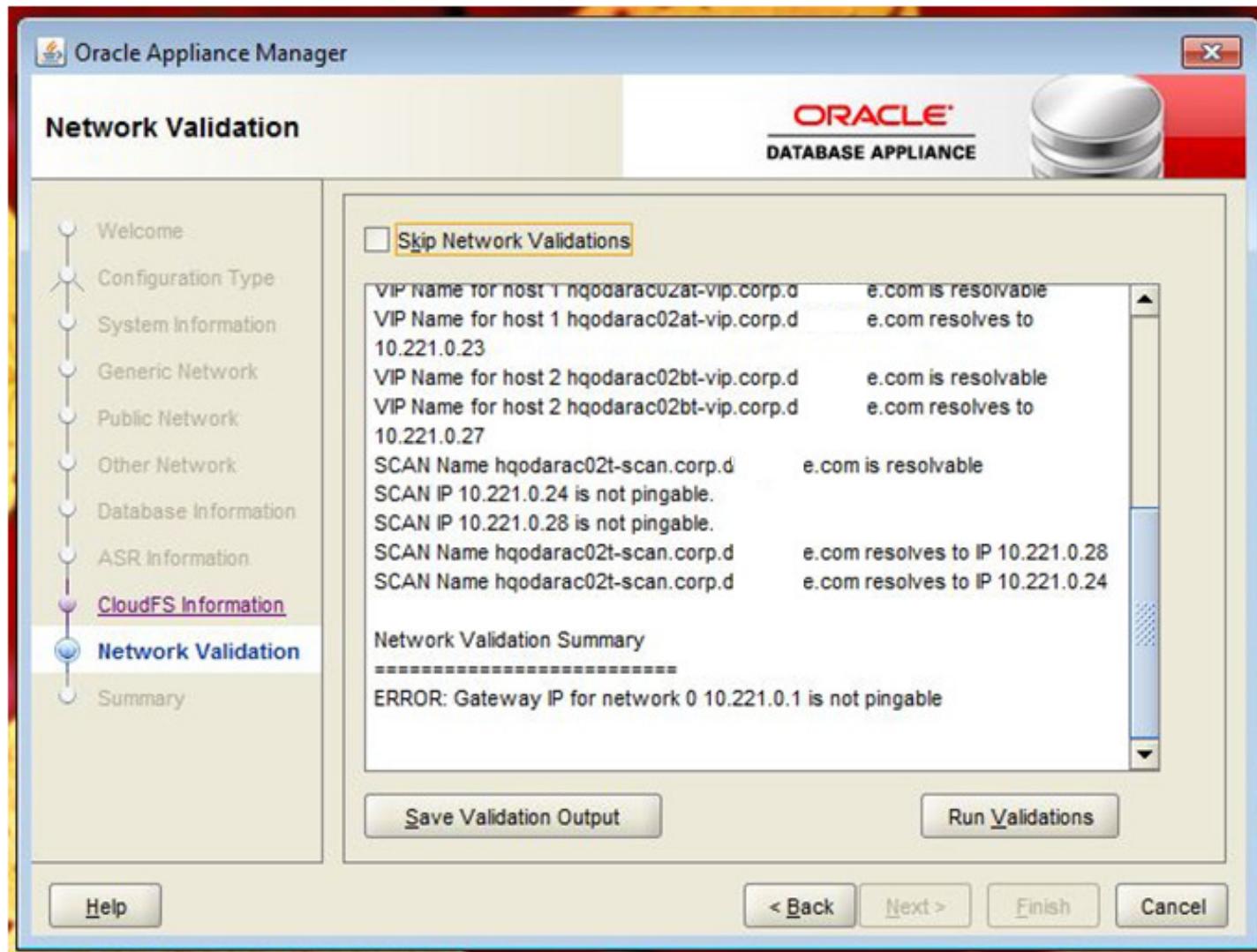
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Install Screens: 10



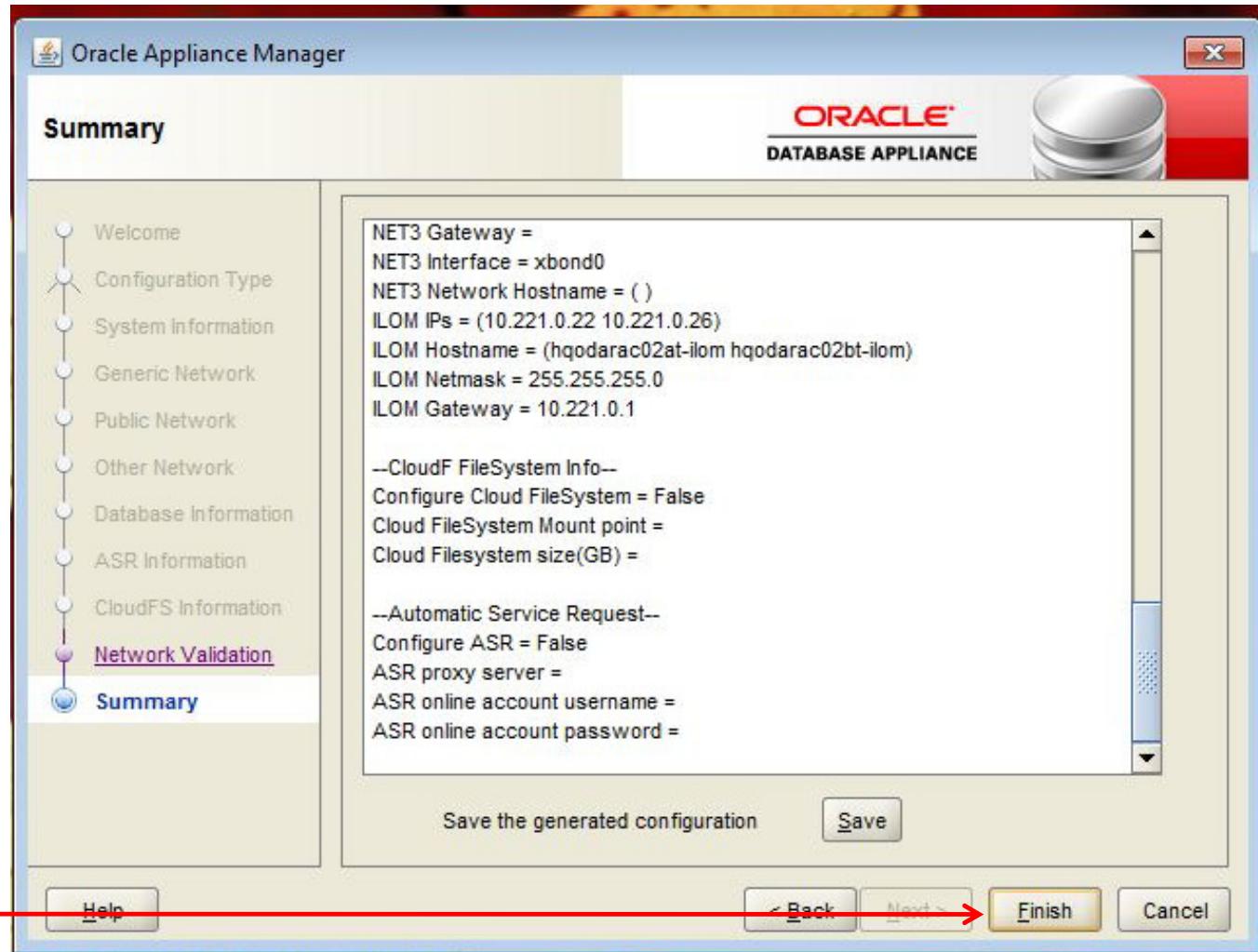
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Install Screens: 11



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Value Adds

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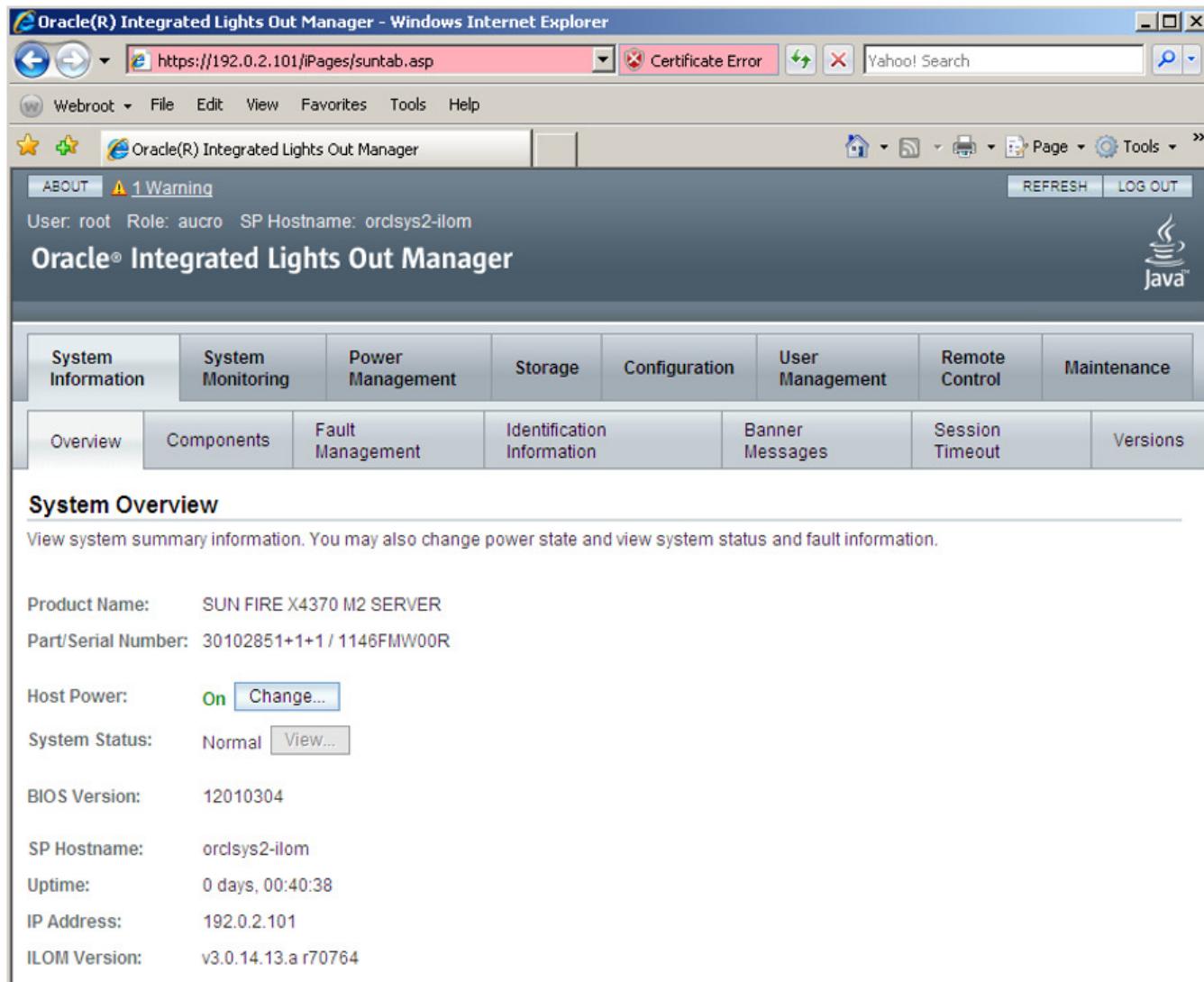
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ILOM: System Information: Overview



Oracle(R) Integrated Lights Out Manager - Windows Internet Explorer
https://192.0.2.101/iPages/suntab.asp Certificate Error Yahoo! Search

User: root Role: aucro SP Hostname: orclsys2-ilom

Oracle® Integrated Lights Out Manager

System Information System Monitoring Power Management Storage Configuration User Management Remote Control Maintenance

Overview Components Fault Management Identification Information Banner Messages Session Timeout Versions

System Overview

View system summary information. You may also change power state and view system status and fault information.

Product Name: SUN FIRE X4370 M2 SERVER

Part/Serial Number: 30102851+1+1 / 1146FMW00R

Host Power: **On** [Change...](#)

System Status: Normal [View...](#)

BIOS Version: 12010304

SP Hostname: orclsys2-ilom

Uptime: 0 days, 00:40:38

IP Address: 192.0.2.101

ILOM Version: v3.0.14.13.a r70764

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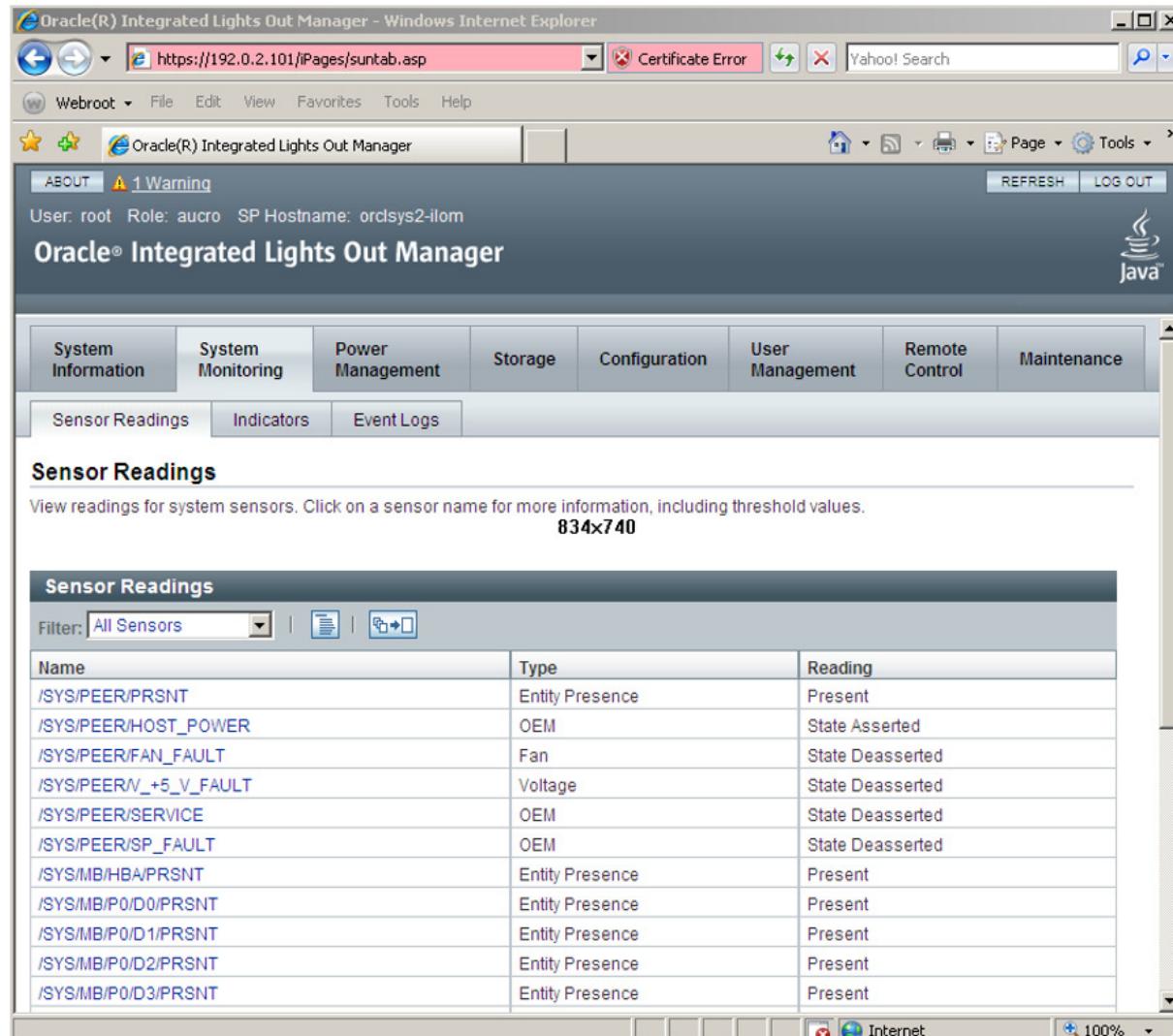
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ILOM: System Monitoring: Sensor Readings



The screenshot shows the Oracle Integrated Lights Out Manager (ILOM) interface in a Windows Internet Explorer browser. The URL is <https://192.0.2.101/iPages/suntab.asp>. The page title is "Oracle(R) Integrated Lights Out Manager". The top menu bar includes Webroot, File, Edit, View, Favorites, Tools, and Help. The toolbar includes Back, Forward, Stop, Refresh, and Search. A "Certificate Error" message is displayed in the top right. The main content area shows the user is "root" with role "auro" and SP Hostname "orclsys2-ilom". The "System Monitoring" tab is selected, and the "Sensor Readings" sub-tab is active. The "Sensor Readings" section displays a table of system sensors with the following data:

Name	Type	Reading
/SYS/PEER/PRSNTR	Entity Presence	Present
/SYS/PEER/HOST_POWER	OEM	State Asserted
/SYS/PEER/FAN_FAULT	Fan	State Deasserted
/SYS/PEER/V_+5_V_FAULT	Voltage	State Deasserted
/SYS/PEER/SERVICE	OEM	State Deasserted
/SYS/PEER/SP_FAULT	OEM	State Deasserted
/SYS/MB/HBA/PRSNTR	Entity Presence	Present
/SYS/MB/P0/D0/PRSNTR	Entity Presence	Present
/SYS/MB/P0/D1/PRSNTR	Entity Presence	Present
/SYS/MB/P0/D2/PRSNTR	Entity Presence	Present
/SYS/MB/P0/D3/PRSNTR	Entity Presence	Present

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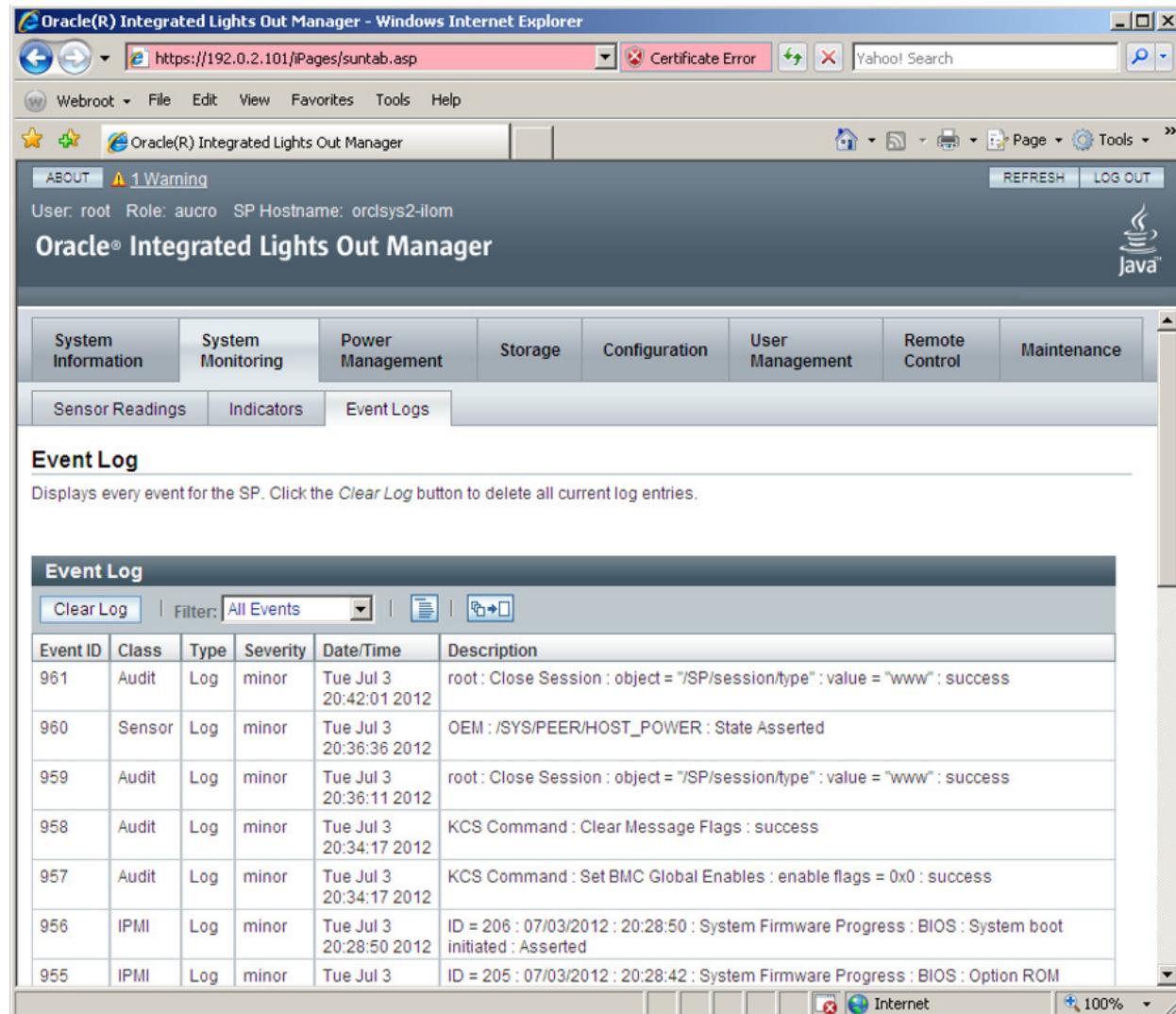
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ILOM: System Monitoring: Event Logs



The screenshot shows the Oracle Integrated Lights Out Manager (ILOM) interface within a Windows Internet Explorer browser window. The URL is <https://192.0.2.101/iPages/suntab.asp>. The browser status bar shows a 'Certificate Error' and a 'Yahoo! Search' link. The ILOM interface has a dark blue header with the title 'Oracle® Integrated Lights Out Manager'. Below the header is a navigation menu with tabs: System Information, System Monitoring (which is selected), Power Management, Storage, Configuration, User Management, Remote Control, and Maintenance. Under the System Monitoring tab, there are three sub-tabs: Sensor Readings, Indicators, and Event Logs (which is selected). The main content area is titled 'Event Log' and contains the following text: 'Displays every event for the SP. Click the Clear Log button to delete all current log entries.' Below this text is a table titled 'Event Log' with the following data:

Event ID	Class	Type	Severity	Date/Time	Description
961	Audit	Log	minor	Tue Jul 3 20:42:01 2012	root: Close Session : object = "/SP/session/type" : value = "www" : success
960	Sensor	Log	minor	Tue Jul 3 20:36:36 2012	OEM : /SYS/PEER/HOST_POWER : State Asserted
959	Audit	Log	minor	Tue Jul 3 20:36:11 2012	root: Close Session : object = "/SP/session/type" : value = "www" : success
958	Audit	Log	minor	Tue Jul 3 20:34:17 2012	KCS Command : Clear Message Flags : success
957	Audit	Log	minor	Tue Jul 3 20:34:17 2012	KCS Command : Set BMC Global Enables : enable flags = 0x0 : success
956	IPMI	Log	minor	Tue Jul 3 20:28:50 2012	ID = 206 : 07/03/2012 : 20:28:50 : System Firmware Progress : BIOS : System boot initiated : Asserted
955	IPMI	Log	minor	Tue Jul 3	ID = 205 : 07/03/2012 : 20:28:42 : System Firmware Progress : BIOS : Option ROM

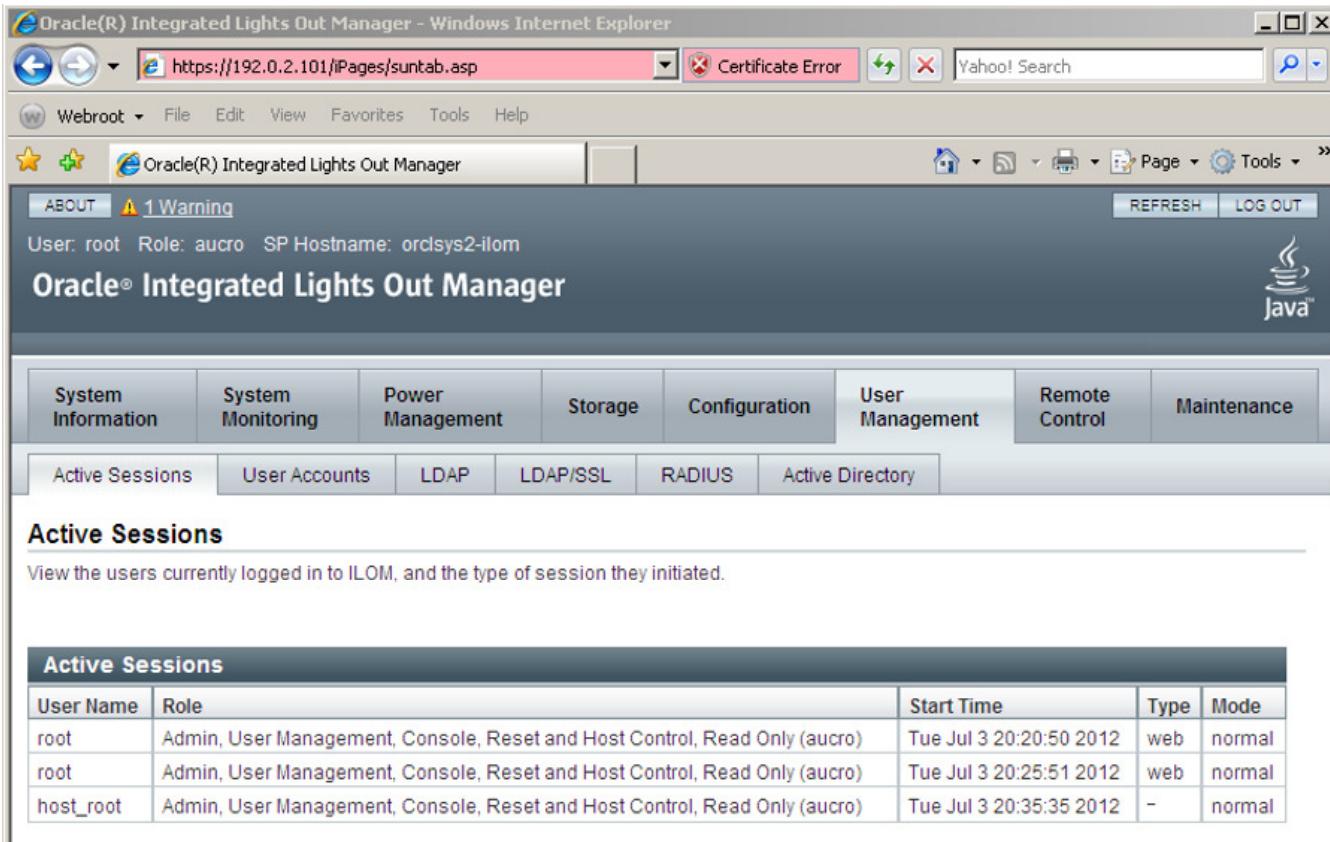
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ILOM: User Management: Active Sessions



The screenshot shows the Oracle Integrated Lights Out Manager (ILOM) User Management interface. The browser title is "Oracle(R) Integrated Lights Out Manager - Windows Internet Explorer" and the URL is "https://192.0.2.101/iPages/suntab.asp". A "Certificate Error" message is displayed in the address bar. The page header includes "Webroot" and "Oracle(R) Integrated Lights Out Manager". A "1 Warning" message is shown. The user is "root" with role "aucro" and SP Hostname "orclsys2-ilom". The Java logo is present. The main menu bar includes "ABOUT", "REFRESH", and "LOG OUT". The navigation menu at the top has tabs: System Information, System Monitoring, Power Management, Storage, Configuration, User Management, Remote Control, and Maintenance. The "User Management" tab is selected. Below it, sub-tabs are: Active Sessions (which is selected), User Accounts, LDAP, LDAP/SSL, RADIUS, and Active Directory. The "Active Sessions" section has a sub-header "Active Sessions" and a sub-instruction "View the users currently logged in to ILOM, and the type of session they initiated." A table titled "Active Sessions" lists the following data:

User Name	Role	Start Time	Type	Mode
root	Admin, User Management, Console, Reset and Host Control, Read Only (aucro)	Tue Jul 3 20:20:50 2012	web	normal
root	Admin, User Management, Console, Reset and Host Control, Read Only (aucro)	Tue Jul 3 20:25:51 2012	web	normal
host_root	Admin, User Management, Console, Reset and Host Control, Read Only (aucro)	Tue Jul 3 20:35:35 2012	-	normal

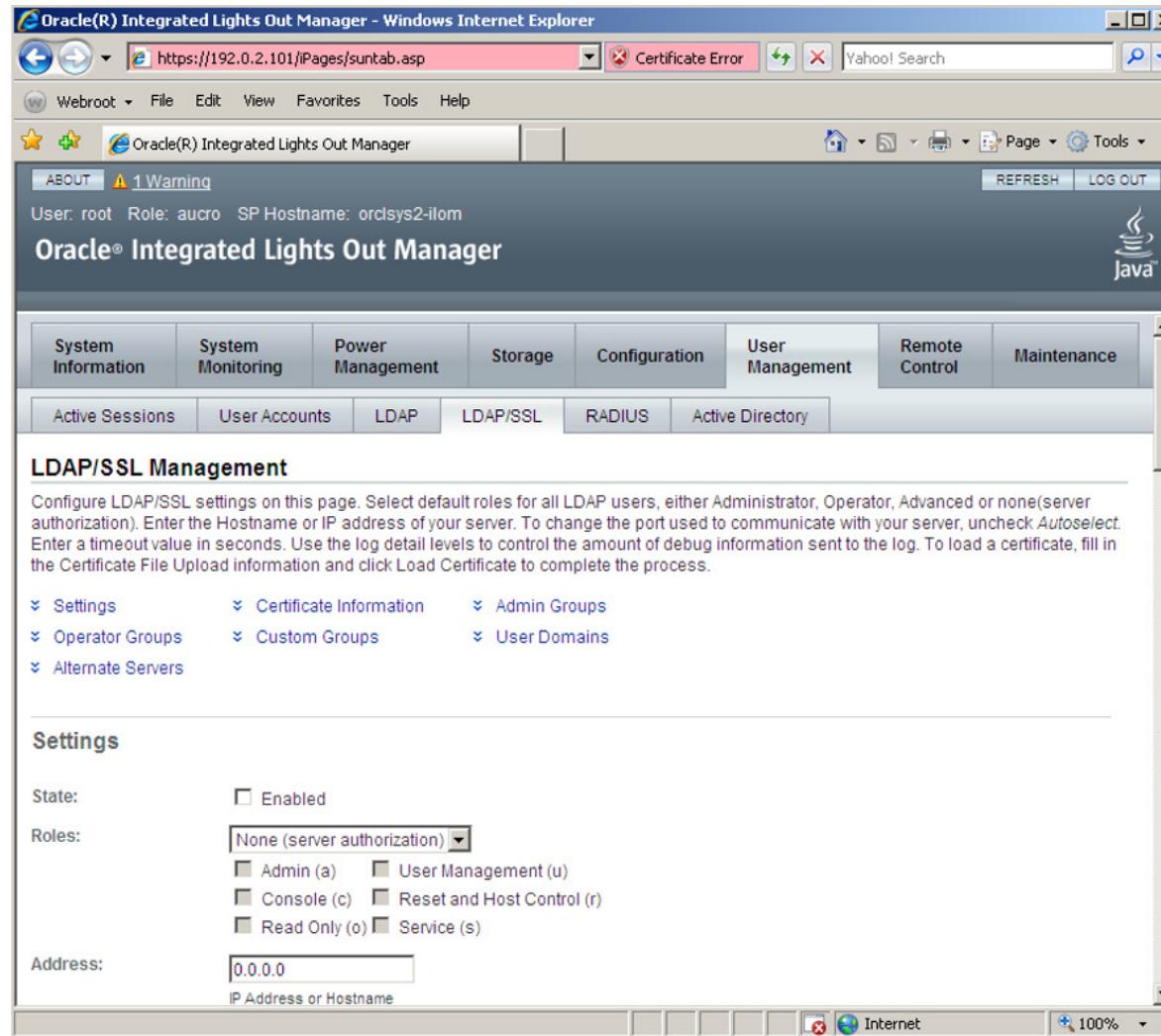
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ILOM: User Management: LDAP / SSL



The screenshot shows the Oracle Integrated Lights Out Manager (ILOM) web interface in a Windows Internet Explorer browser. The URL is <https://192.0.2.101/iPages/suntab.asp>. The page title is "Oracle(R) Integrated Lights Out Manager". The top menu bar includes "Webroot", "File", "Edit", "View", "Favorites", "Tools", and "Help". The toolbar includes "Home", "Back", "Forward", "Stop", "Search", and "Tools". The main header displays "User: root Role: acuro SP Hostname: orclsys2-ilom" and the "Oracle® Integrated Lights Out Manager" logo. The navigation menu at the top has tabs: System Information, System Monitoring, Power Management, Storage, Configuration, User Management, Remote Control, and Maintenance. The "User Management" tab is selected. Below the tabs is a sub-menu with tabs: Active Sessions, User Accounts, LDAP, LDAP/SSL, RADIUS, and Active Directory. The "LDAP/SSL" tab is selected. The main content area is titled "LDAP/SSL Management". It contains a configuration section for LDAP/SSL settings, including "Settings", "Certificate Information", "Admin Groups", "Operator Groups", "Custom Groups", "User Domains", and "Alternate Servers". Below this is a "Settings" section with fields for "State" (checkbox "Enabled" checked), "Roles" (dropdown menu set to "None (server authorization)" with checkboxes for Admin (a), User Management (u), Console (c), Reset and Host Control (r), Read Only (o), and Service (s)), and "Address" (input field "0.0.0.0" with placeholder "IP Address or Hostname"). The bottom of the page includes standard browser controls and a status bar showing "Internet" and "100%".

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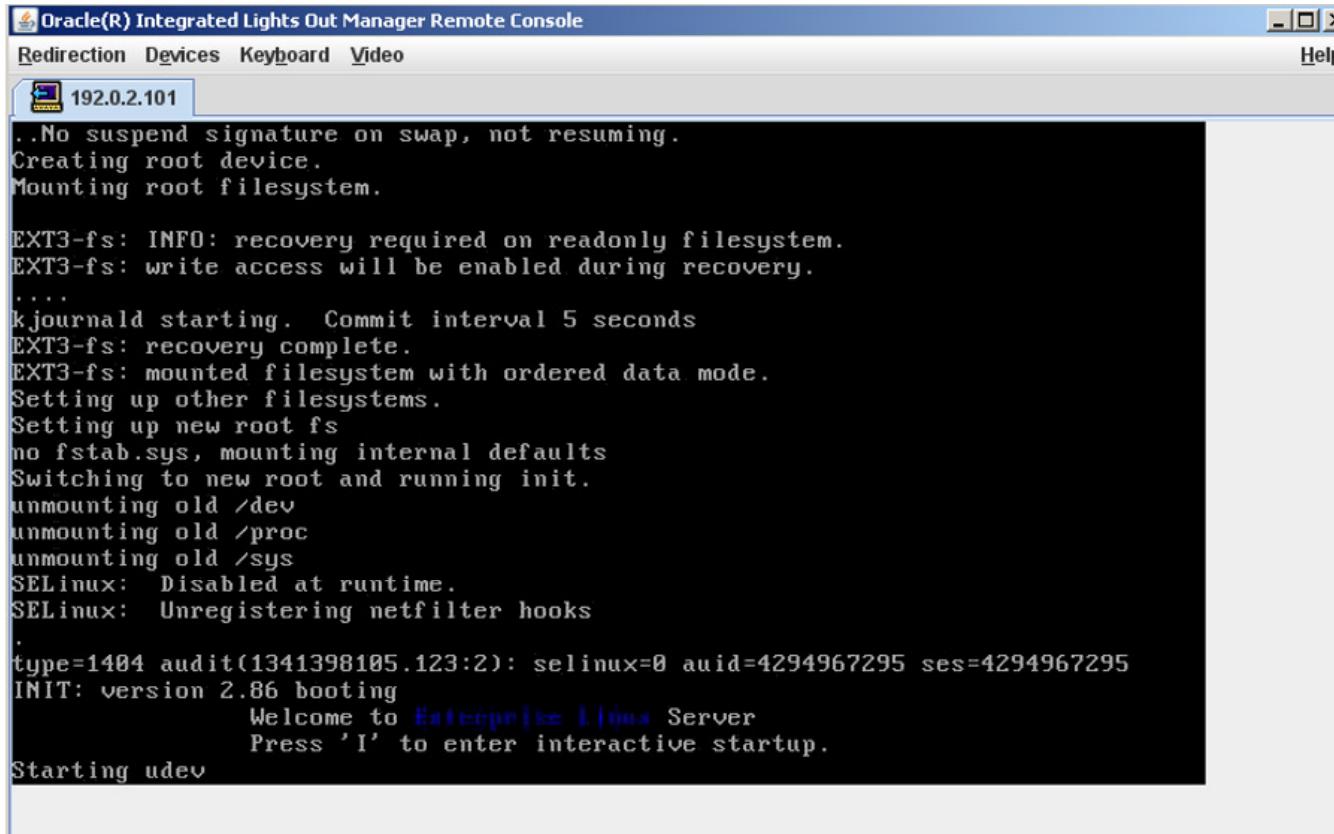
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Remote Control: Host Control: Remote Console



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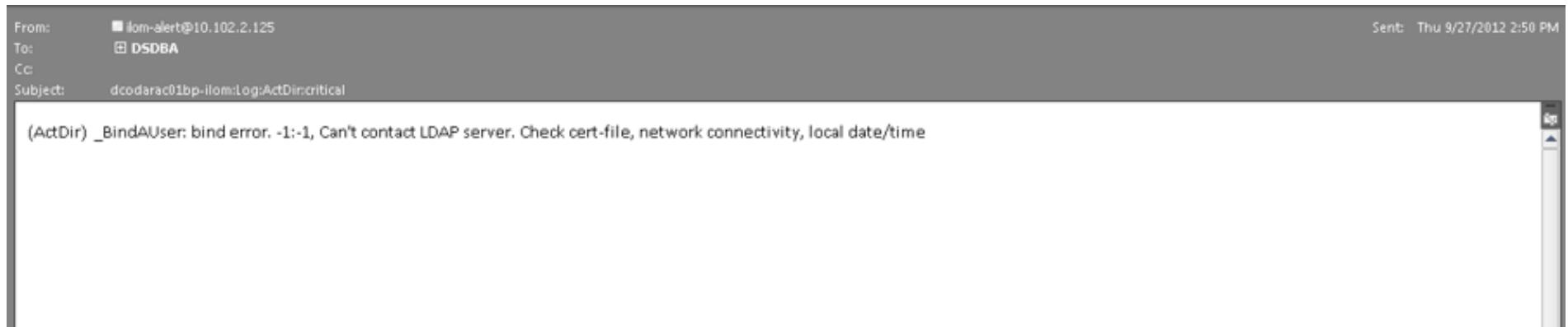
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ILOM Warning Message



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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

The screenshot shows a Mozilla Firefox browser window displaying the Oracle Support Center. The URL is https://support.html.oracle.com/epmos/faces/ui/km/SearchDocDisplay.jspx?_afrLoop=6463580628317000&type=DOCUMENT&id=1449552.2&displayInd=1. The page title is "Document Display - Mozilla Firefox". The main content area is titled "Information Center: Oracle Database Appliance [ID 1449552.2]". The left sidebar shows a search for "Search : ODA STIG" and a list of results. The main content area includes sections for "Information Centers", "Alerts", "News & Announcements", and "New Troubleshooting and Problem-Solution Documents".

Information Centers

- Overview
- Hot Topics**
- Resources
- Sun System Handbook
- Hardware Compatibility Lists

Refine Search By Task

- Use Product
- Troubleshoot
- Patching And Maintenance
- Install And Configure
- Upgrade
- Optimize Performance

Alerts

Content Refreshed: 27 Jun 2012

- ALERT - ODA (Oracle Database Appliance) Mandatory OAK Patch 2.1.0.3.1 [Document 1452085.1 Updated: 04/23/2012]

News & Announcements

Read recently published news and announcements about your product.

No Results

New Troubleshooting and Problem-Solution Documents

Read recently published Troubleshooting and Problem-Solution documents about your product

- NEW ODA SETUP: FAILS WITH DOMAINNAME OF "EXAMPLE", NOT EXAMPLE.COM [Document 1455719.1 Updated: 05/04/2012]
- DBUA (DataBase Upgrade Assistant) failing with "Cannot find the ORACLE_HOME for the database" on ODA (Oracle Database Appliance)

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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

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[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.

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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
```

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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
```

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However

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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

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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 ...

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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

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Clustered File System?

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

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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?

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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 as 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)

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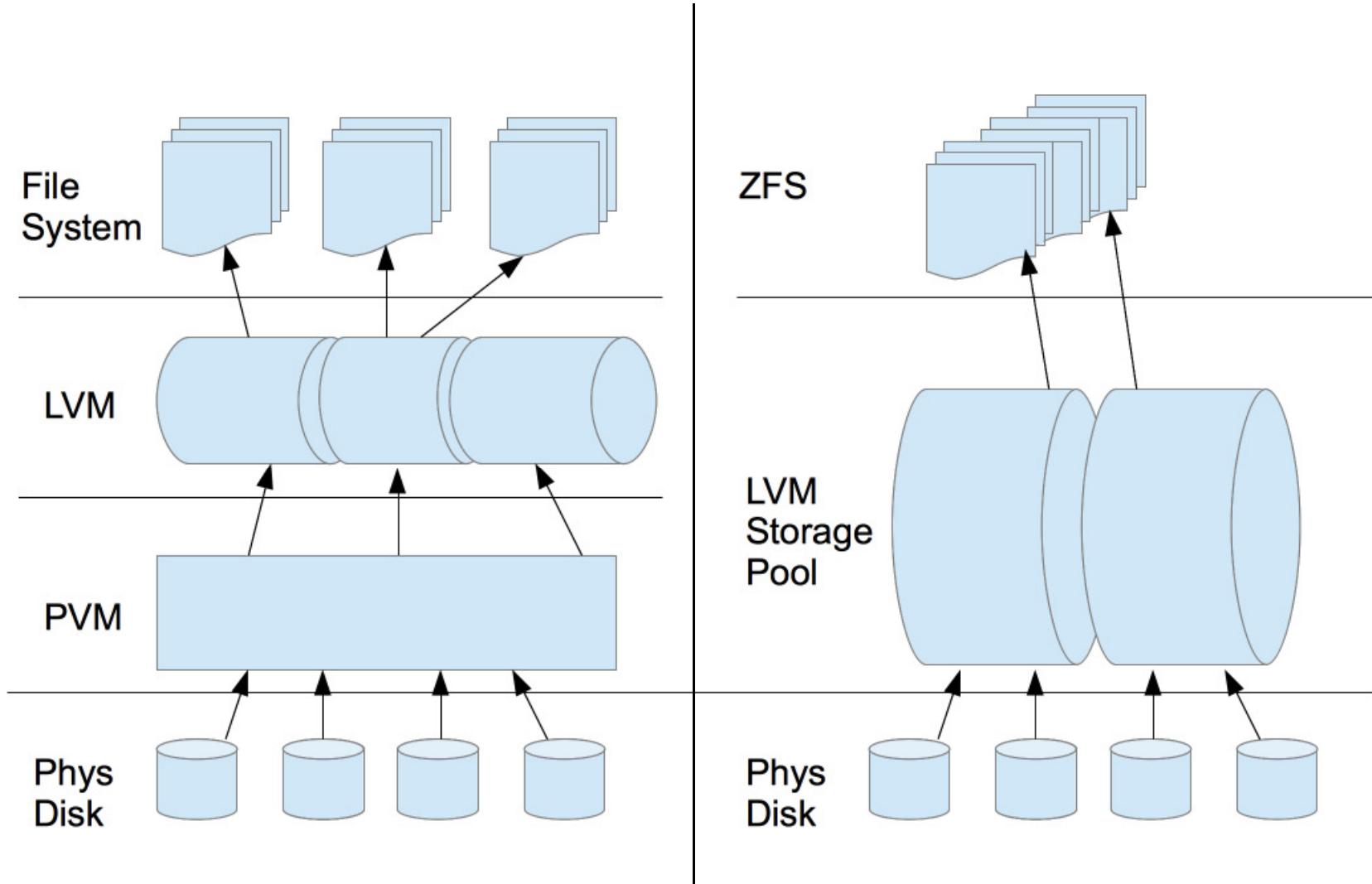
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Traditional File System stack vs ZFS



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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 its 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

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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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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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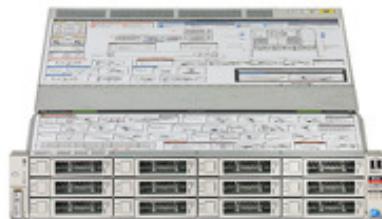
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What is a ZFS Appliance?

- 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	<ul style="list-style-type: none">• 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)	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• 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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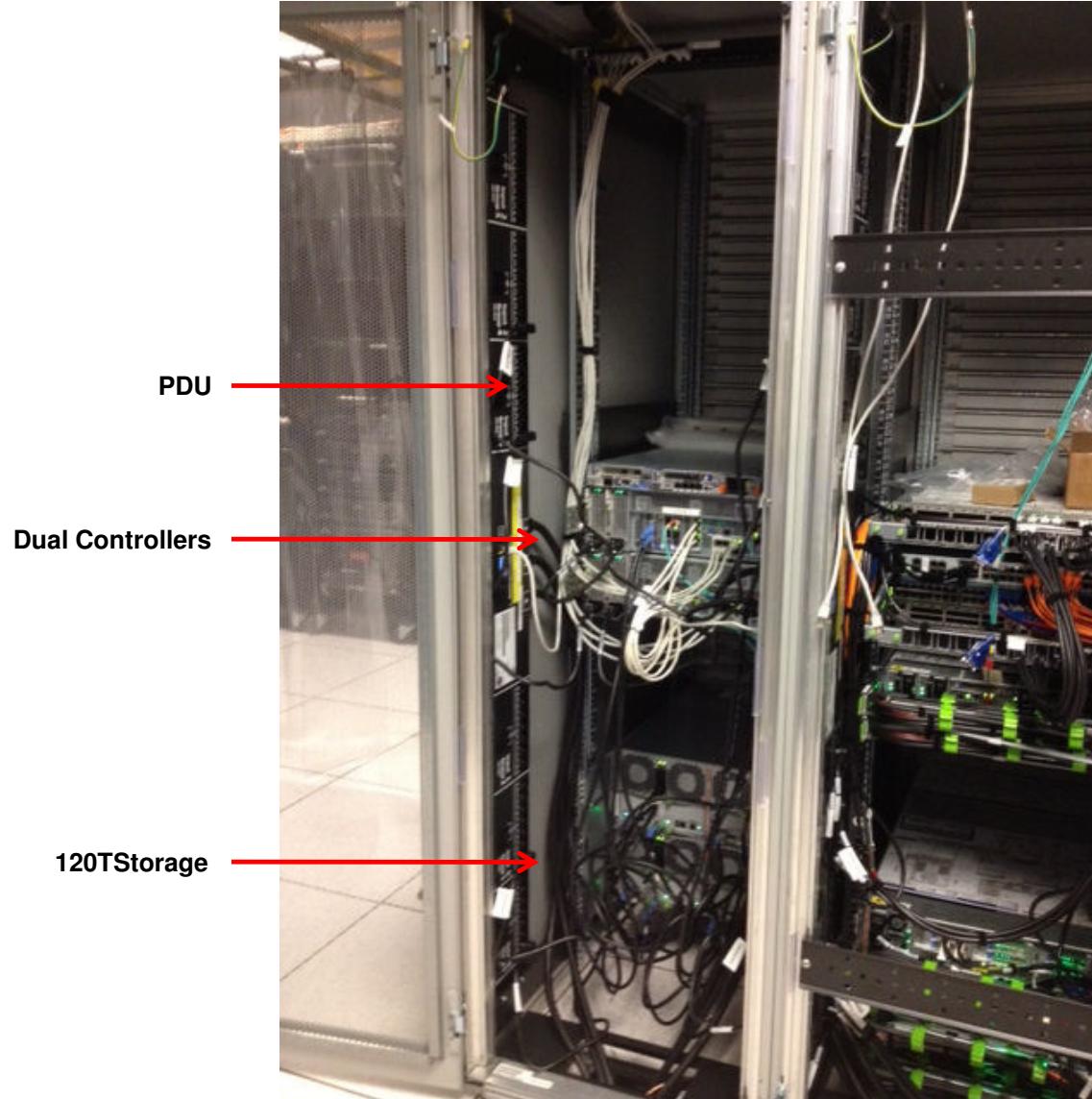
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ZFS Internals



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ZFS BUI

The screenshot shows the ZFS BUI interface. At the top, the user is Daniel Morgan@c0zfs742001p. The navigation bar includes Configuration, Maintenance (highlighted in yellow), Shares, Status, and Analytics. Under Configuration, sub-options are HARDWARE, SYSTEM, PROBLEMS, LOGS, and WORKFLOWS. The main content area displays the details for a system named c0zfs742001p. It shows the following specifications:

Manufacturer	Oracle	System	932GB (2 disks)
Model	Sun ZFS Storage 7420	Data	-
Serial	1235FMJ00N	Cache	-
Processors	4x2GHz Intel(r) Xeon(r) CPU E7- 4820 @ 2.00GHz	Log	-
Memory	512GB	Total	932GB (2 disks)

Below this, a "Disk Shelves" section shows two entries:

NAME	MFR/MODEL	RPM	DATA	CACHE	LOG	PATHS
1235FMD003	Sun Microsystems, Inc./Sun Disk Shelf (SAS-2) 7200	7200	54.6TB	-	137GB	2
1235FMD002	Sun Microsystems, Inc./Sun Disk Shelf (SAS-2) 7200	7200	54.6TB	-	137GB	1

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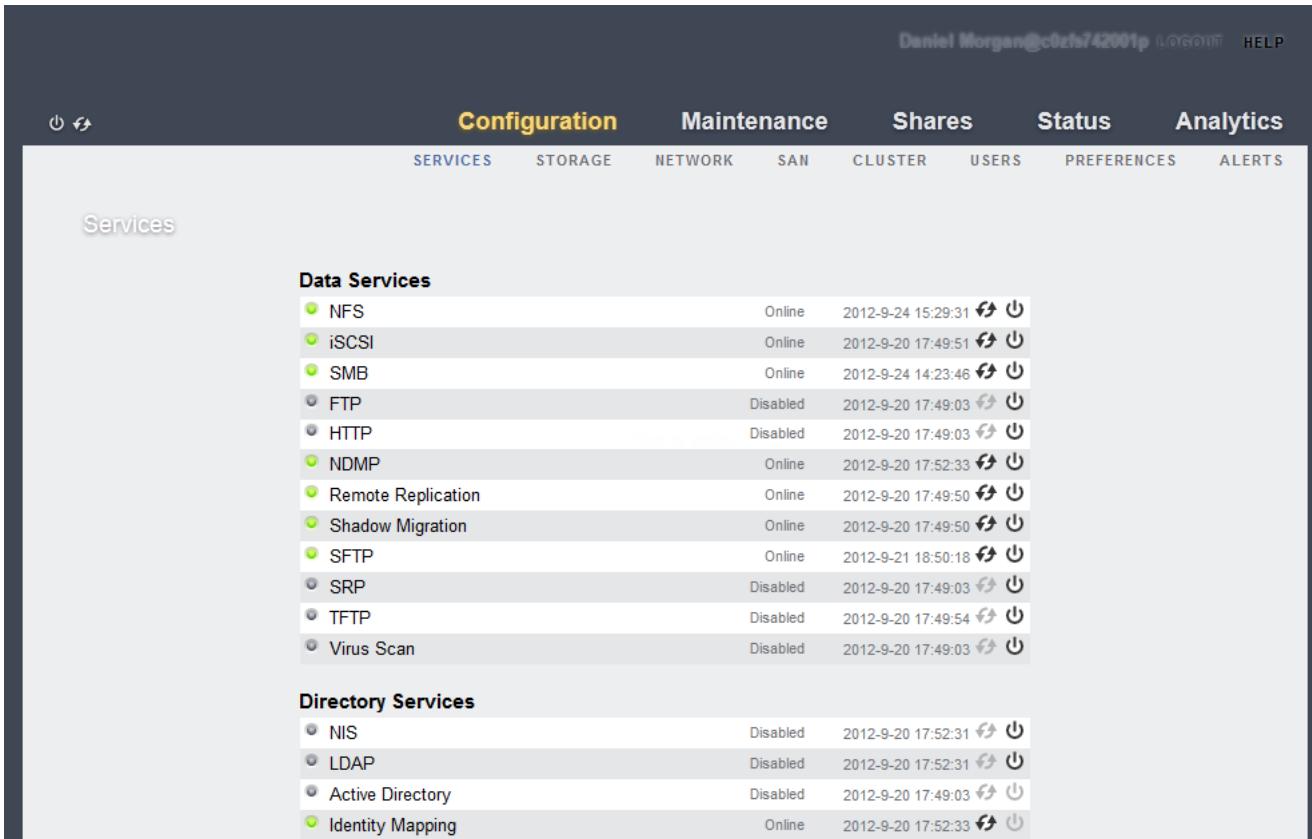
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ZFS Config Services



The screenshot shows the ZFS Config Services interface. At the top, there is a navigation bar with tabs: Configuration (highlighted in yellow), Maintenance, Shares, Status, and Analytics. Below the navigation bar, there are sub-tabs: SERVICES, STORAGE, NETWORK, SAN, CLUSTER, USERS, PREFERENCES, and ALERTS. The main content area is titled "Services". It is divided into two sections: "Data Services" and "Directory Services".

Data Services

Service	Status	Last Update	Actions
NFS	Online	2012-9-24 15:29:31	 
iSCSI	Online	2012-9-20 17:49:51	 
SMB	Online	2012-9-24 14:23:46	 
FTP	Disabled	2012-9-20 17:49:03	 
HTTP	Disabled	2012-9-20 17:49:03	 
NDMP	Online	2012-9-20 17:52:33	 
Remote Replication	Online	2012-9-20 17:49:50	 
Shadow Migration	Online	2012-9-20 17:49:50	 
SFTP	Online	2012-9-21 18:50:18	 
SRP	Disabled	2012-9-20 17:49:03	 
TFTP	Disabled	2012-9-20 17:49:54	 
Virus Scan	Disabled	2012-9-20 17:49:03	 

Directory Services

Service	Status	Last Update	Actions
NIS	Disabled	2012-9-20 17:52:31	 
LDAP	Disabled	2012-9-20 17:52:31	 
Active Directory	Disabled	2012-9-20 17:49:03	 
Identity Mapping	Online	2012-9-20 17:52:33	 

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ZFS BUI

Daniel Morgan@c0zfs742001p LOGOUT HELP

Configuration		Maintenance		Shares		Status		Analytics	
SERVICES	STORAGE	NETWORK	SAN	CLUSTER	USERS	PREFERENCES	ALERTS		
Available Pools									
HOST : POOL		DATA PROFILE			LOG PROFILE		STATUS		
c0zfs742001p:GENERIC		Single parity, narrow stripes			-		Online		
c0zfs742001p:PARTRECOV		Single parity, narrow stripes			-		Online		
c0zfs742001p:CLONEDB		Mirrored			-		Online		
c0zfs742001p:RMANBACK		Mirrored			Mirrored log		Online		
c0zfs742001p:GENERIC		Please wait...			ADD		UNCONFIG		Allocation
		Data Profile Single parity, narrow stripes							
		Log Profile -							
		Pool Status Online							
		Data Errors No known persistent errors							
		Scrub Status Scrub completed: 0 errors							
		2012-9-24 15:29:46 (0h0m)							
		SCRUB							
Device Status		0 errors			Data 7.88T		Parity 2.91T		Reserved 128G
		No device faults have been detected in the storage pool.			Data + Parity 4 disks		Spare 0 disks		
					Log 0 disks		Cache 0 disks		

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Configuration Maintenance Shares Status Analytics

Hardware System Problems Logs Workflows

Alerts 119 Total

ALERTS FAULTS SYSTEM AUDIT PHONE HOME

TIME	EVENT ID	DESCRIPTION	TYPE
2012-9-24 15:29:46	63714813-695f-c125-f88e-e434ebcd27d	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-c247-8882df53ff7	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-af07-d8eab505b33a	Full IP connectivity via interface ixgbe2 has been established.	Minor alert
2012-9-24 14:23:15	d8a0d18b-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-efef98a944f39	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

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Configuration **Maintenance** **Shares** **Status** **Analytics**

Network

To configure networking, build Datalinks on Devices, and Interfaces on Datalinks. Click on a pencil icon to edit object properties. Select an object to view its relationship to other objects. Drag objects to extend Aggregations or IP Multipathing Groups.

Devices		12 total
BUILT-IN		
	igb0	1Gb (full)
	igb1	1Gb (full)
	igb2	link down
	igb3	link down
PCIe 3		
	ixgbe0	10Gb (full)
	ixgbe1	link down
PCIe 6		
	ixgbe2	10Gb (full)
	ixgbe3	link down
PCIe 7		
	ibp2	port down
	ibp3	port down
PCIe 2		
	ibp0	port down
	ibp1	port down

Datalinks		4 total
	igb0	via igb0
	igb1	via igb1
	ixgbe0	Custom MTU(9000), via ixgbe0
	ixgbe2	Custom MTU(9000), via ixgbe2

Interfaces		4 total
	head1 net0	IPv4 static, 192.168.40.248/22, via igb0
	head2 net1	IPv4 static, 192.168.40.249/22, via igb1
	private10gb	IPv4 static, 10.221.112.49/24, via ixgbe0
	private10gb2	IPv4 static, 10.221.112.50/24, via ixgbe2

Configuration **Addresses** **Routing**

REVERT **APPLY**

Please wait...

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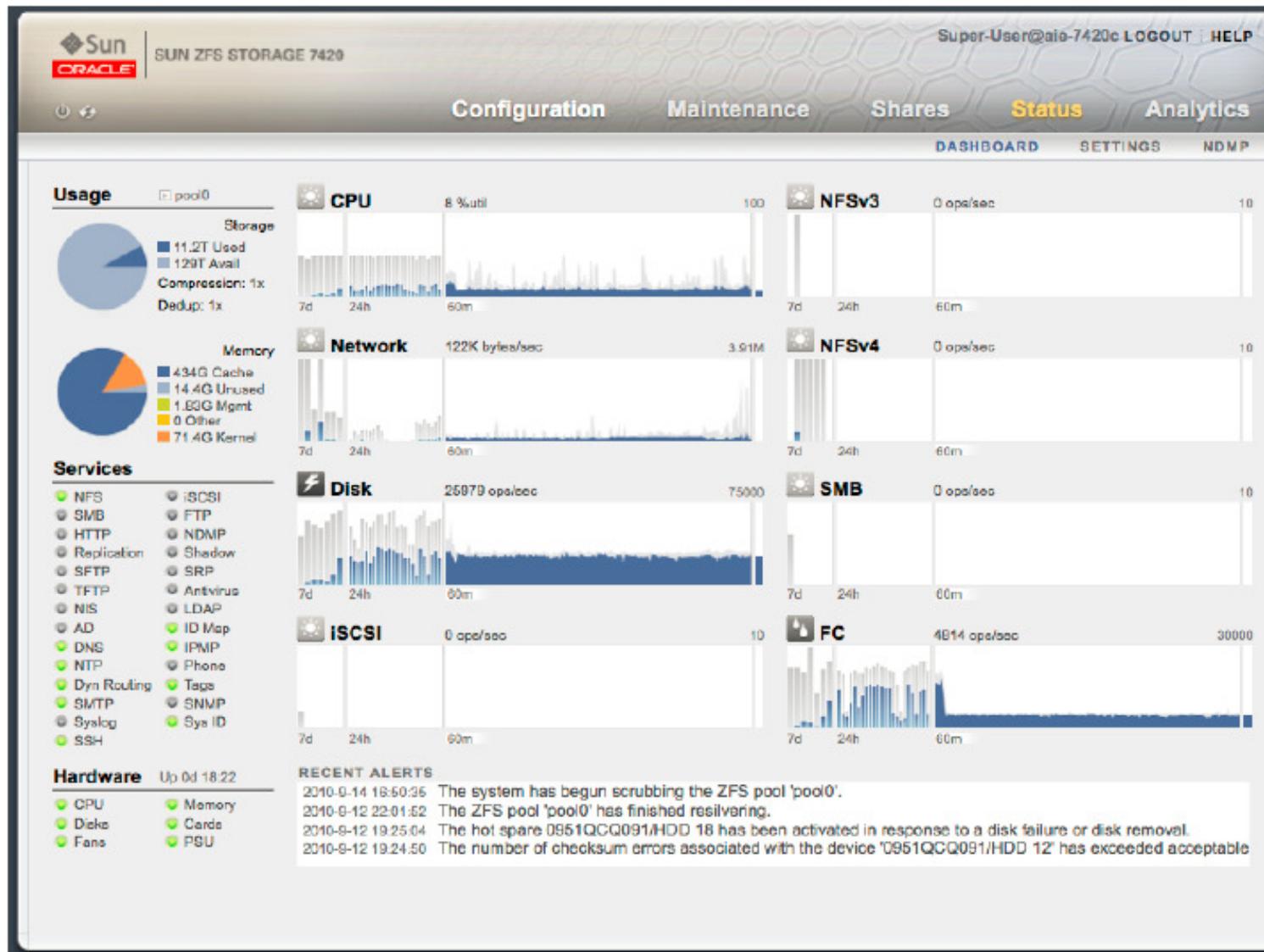
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ZFS Storage Appliances



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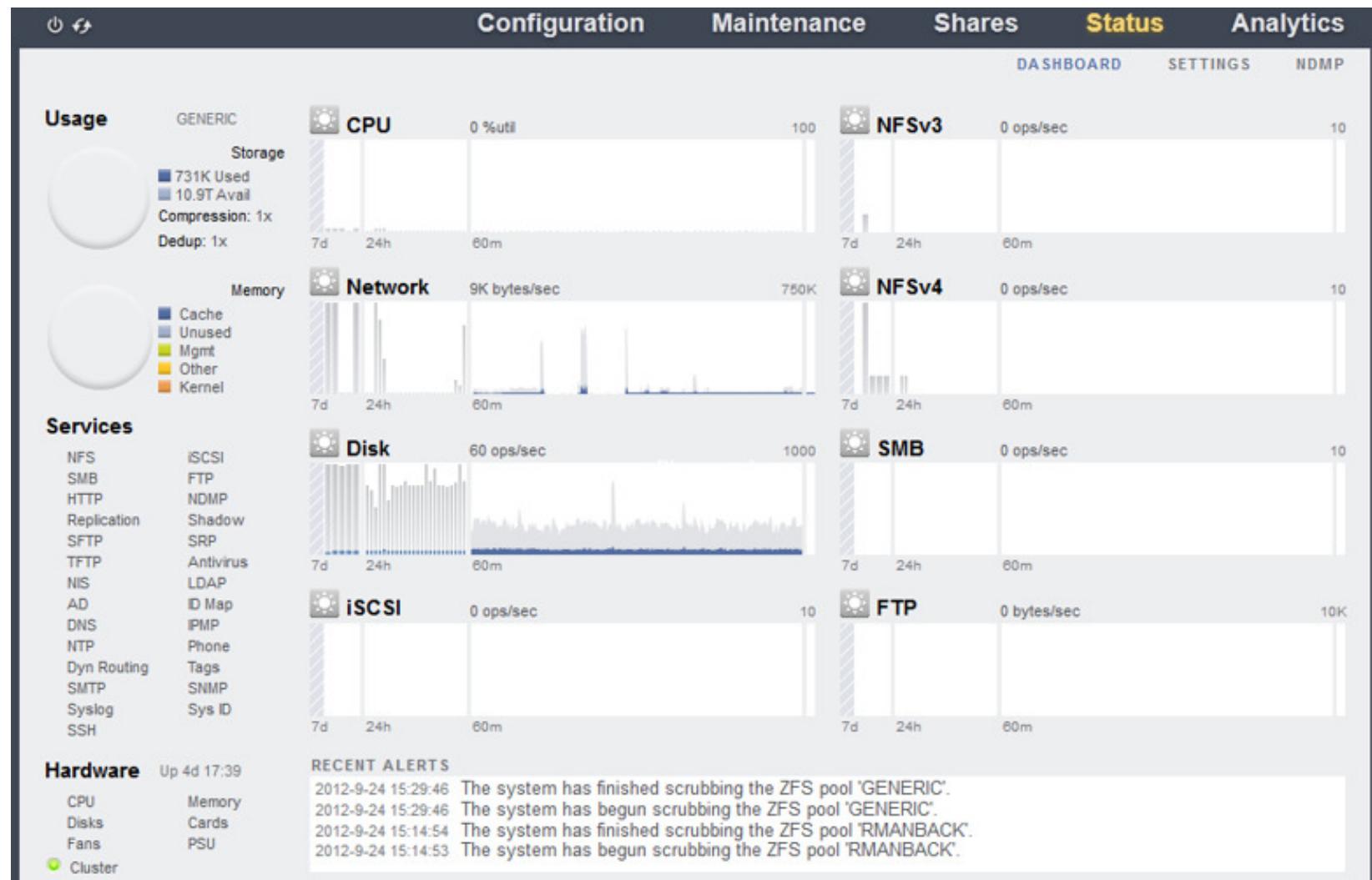
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How Does This Change Our Jobs?

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	<ul style="list-style-type: none">Gives up appliance root passwordGives 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

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Questions

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



Thank you

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