



Integrating the **O**racle **D**atabase **A**ppliance with the Sun **ZFS** Storage Appliance to Create an Ideal Database Environment

Agenda

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

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

■ Upcoming Presentations

- Apr 16-18: Oracle User Group Norway
- Apr 19-20: Oracle User Group Finland
- May 13: Oracle User Group Turkey
- May 15 Oracle User Group Azerbaijan
- May 19 Bulgarian Oracle User Group




Official Beta Site
ORACLE
DATABASE **11g**

ORACLE
RAC SIG

International
zSeries
Oracle SIG

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Oracle Core



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- [OUG Harmony Finland](#) - May 30 - 31, 2012
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Oracle Events




Next Event: RMOUG Denver, CO Feb 14-16

Morgan



aboard USA-71





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Travels



LAD Tour: Machu Picchu Peru



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

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?



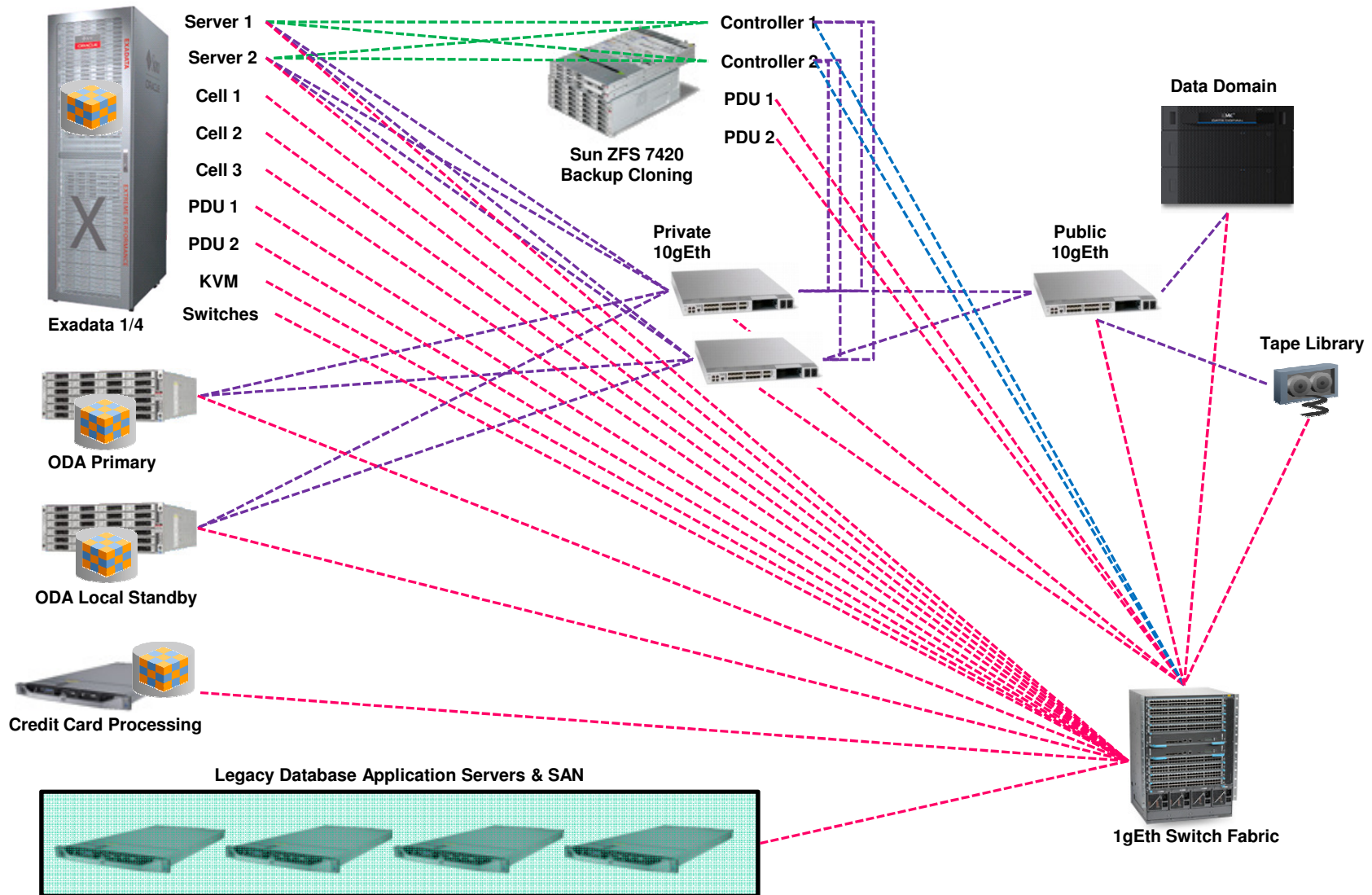
IT infrastructure on a good day



IT infrastructure meets a single point of failure



Puzzle Pieces



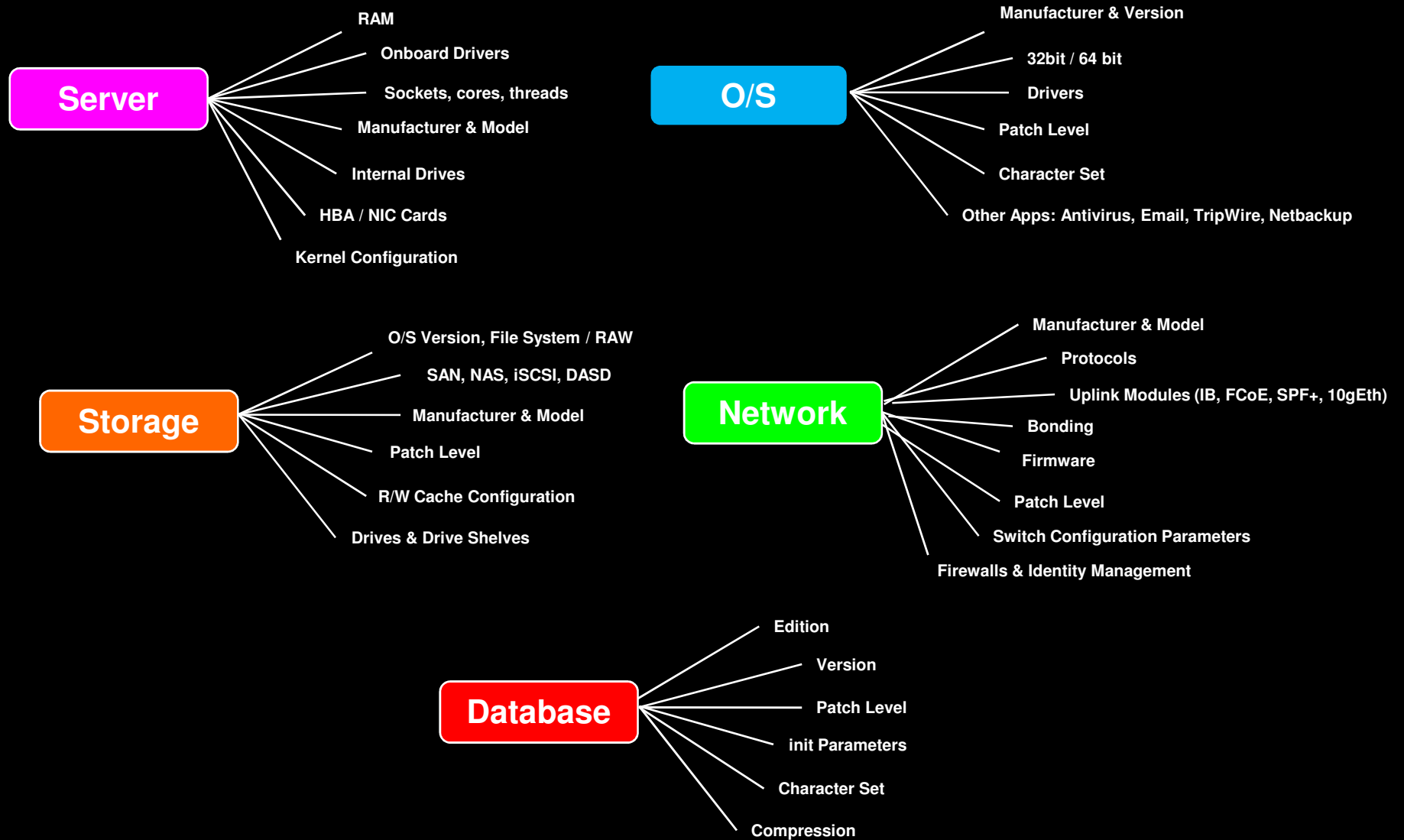
Each connection shown must be multiplexed and bonded

Daniel Morgan | damorgan12c@gmail.com | morganslibrary.org

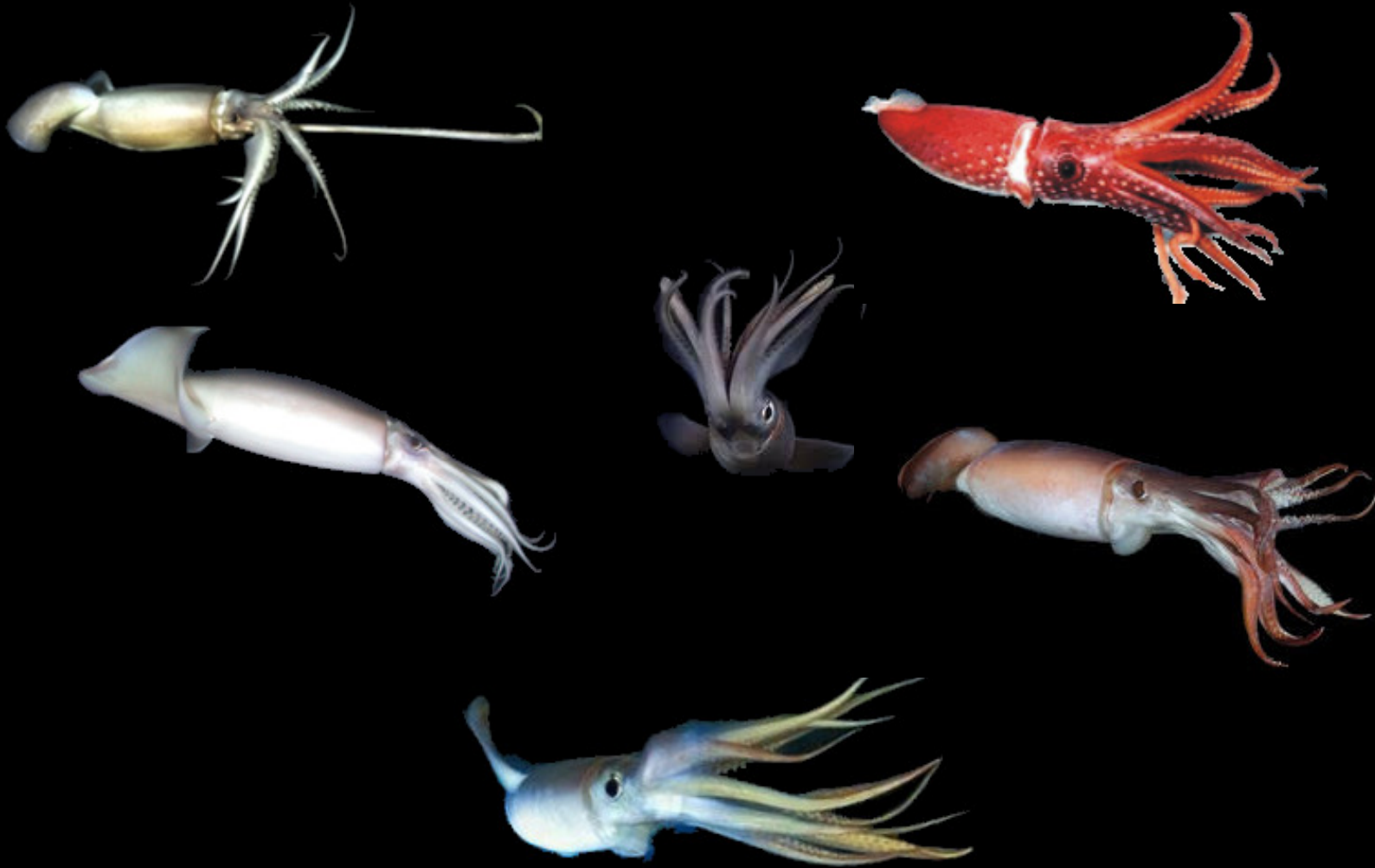
Integrating ODAs with ZFS to Create an Ideal Database Environment

Presented: Utah Oracle User Group - 13 February, 2013

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



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

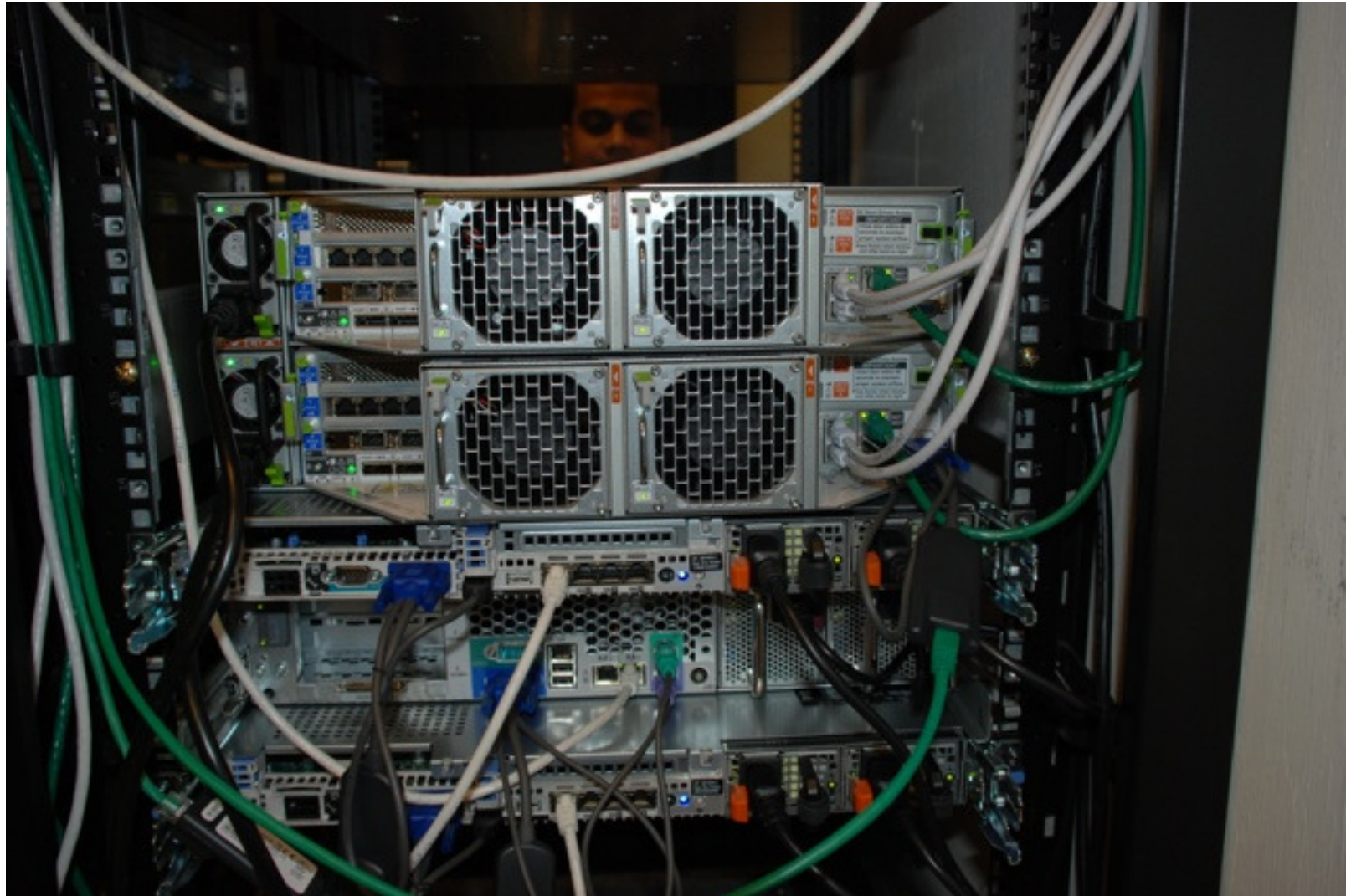
What is an ODA?

- 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 mirroring
 - 2TB RAID mirrored 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

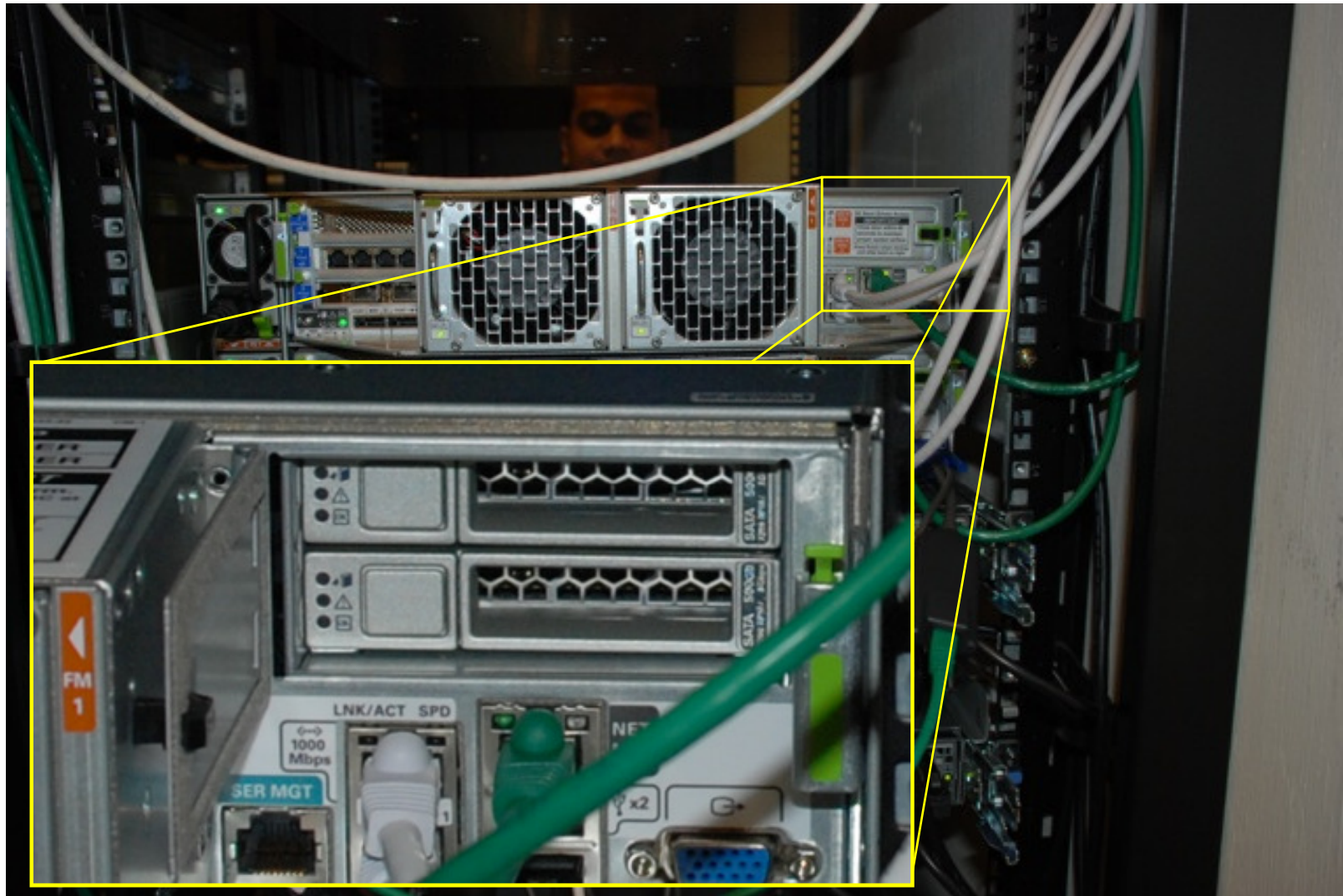
ODA in Pictures



ODA in Pictures



ODA in Pictures



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

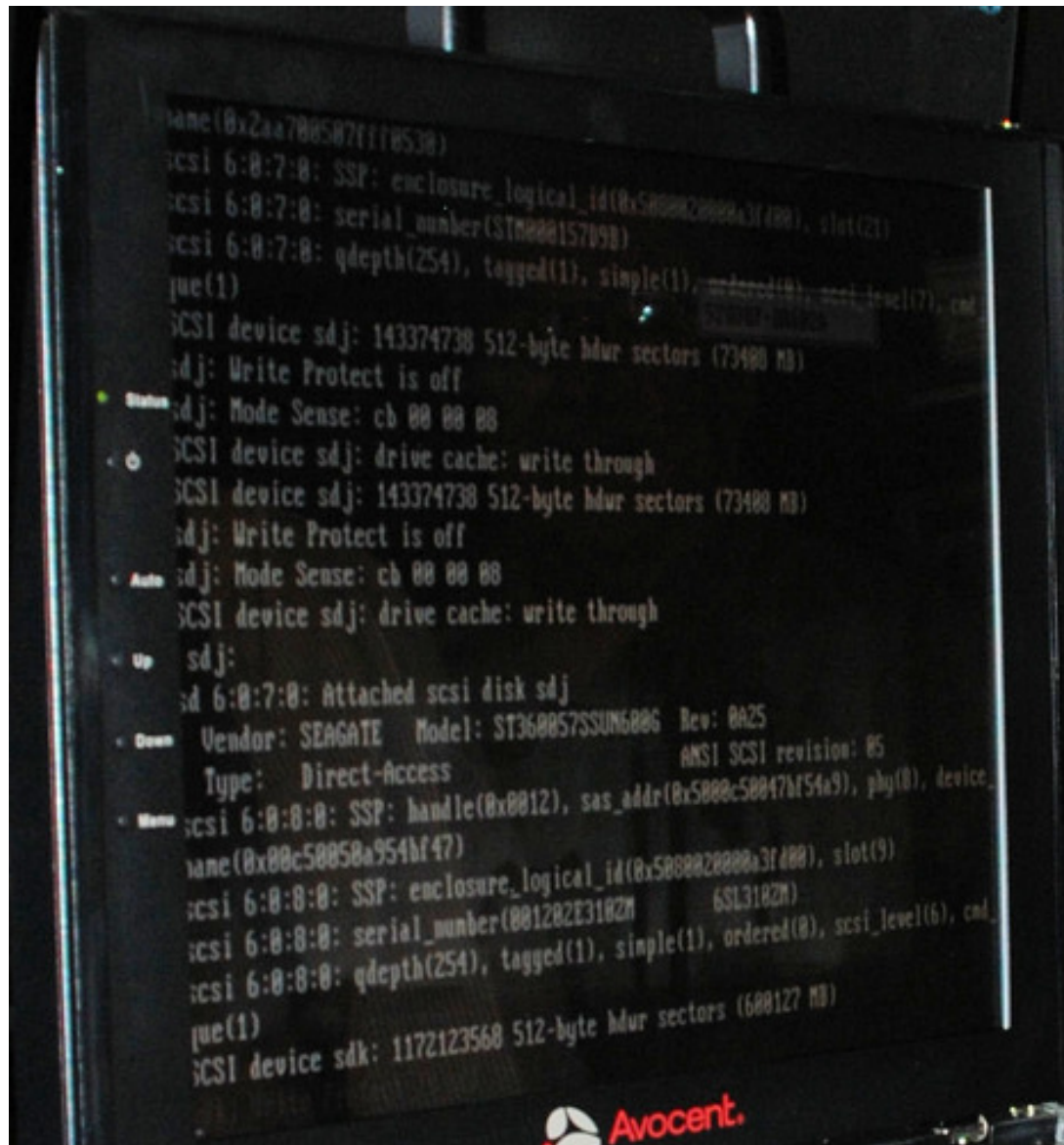
No rolling patches ... and they are not childproof



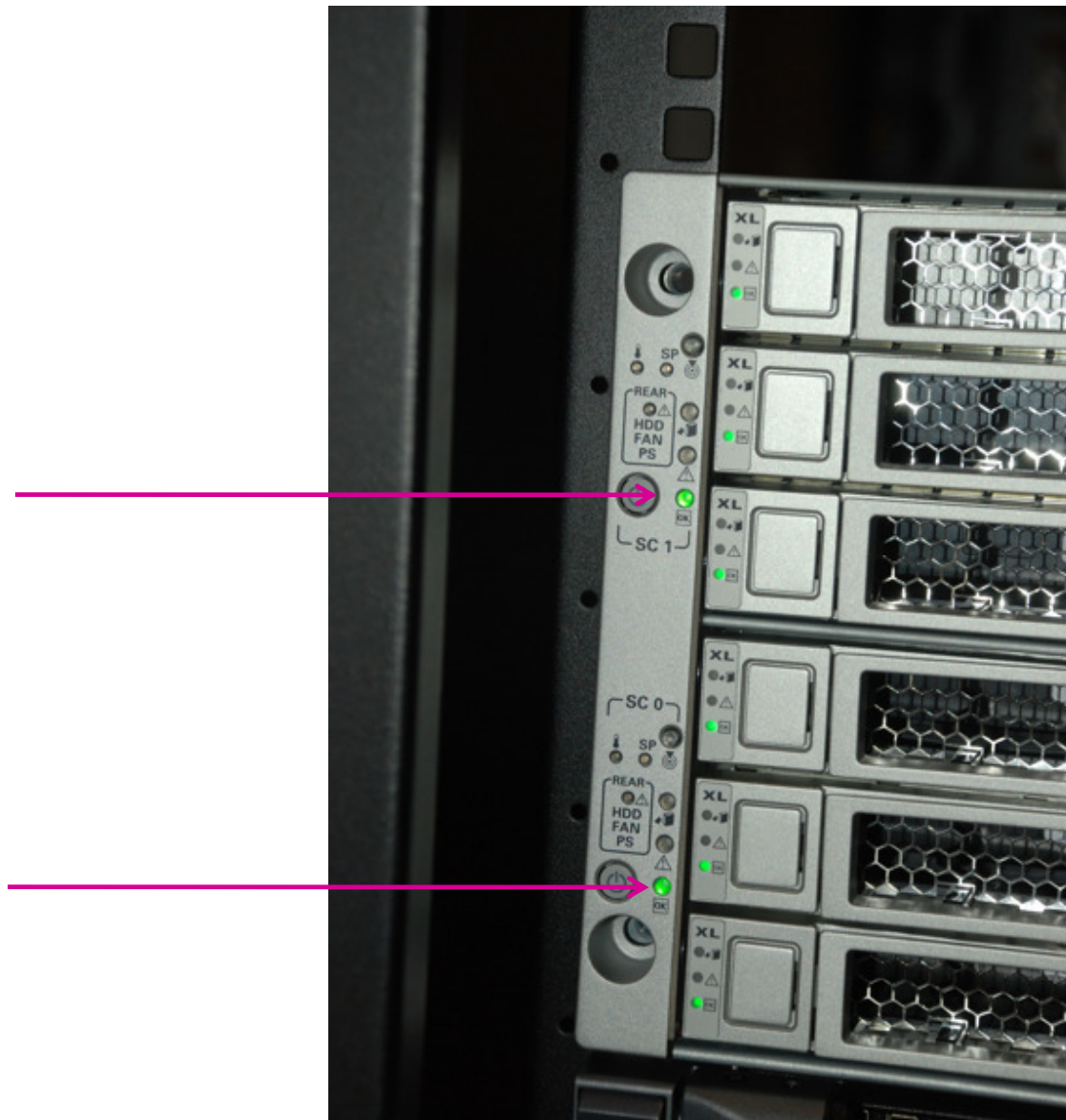
Discussion

Installation

Step 1: Power On



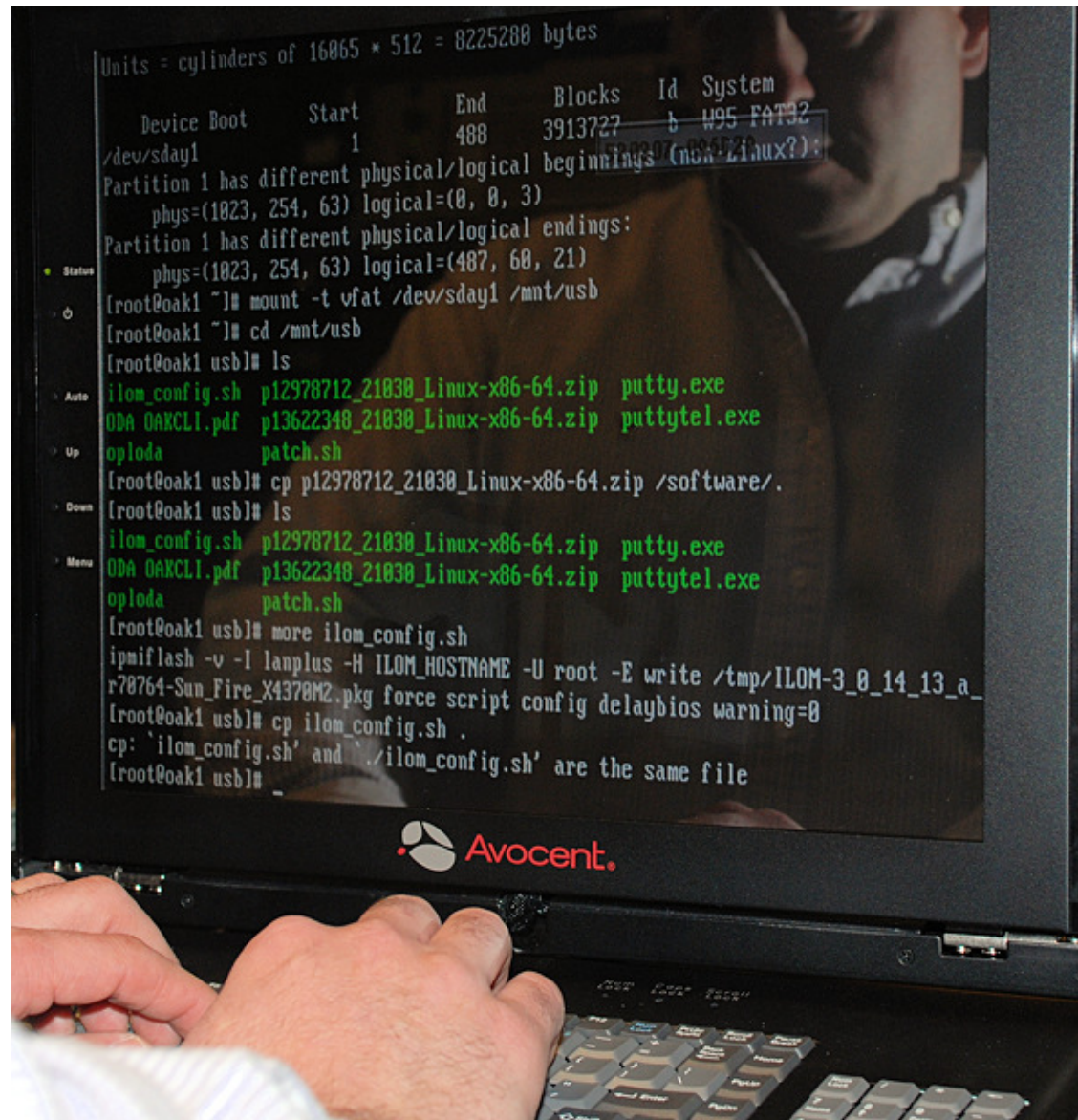
Step 2: Wait for OK Lights



Step 3: Log In as root



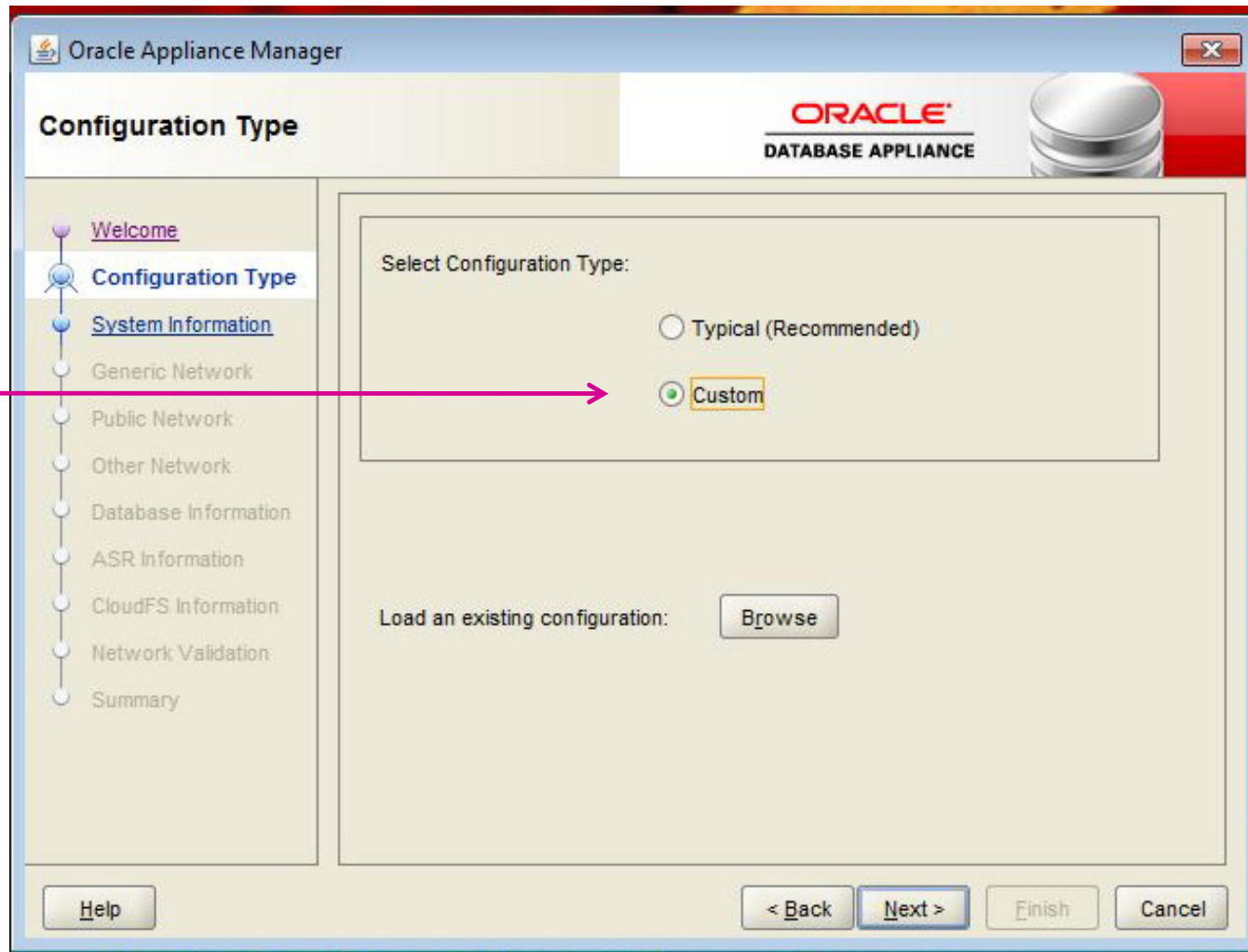
Step 5: Perform ILOM Configuration



Install Screens: 1



Install Screens: 2



Install Screens: 3

Oracle Appliance Manager

System Information

ORACLE
DATABASE APPLIANCE

System Name: hqodarac02t

Region: America

Timezone: America/Los_Angeles

Database Deployment: RAC

Database Backup: Local

New Root Password:

New Root Password(confirm):

Help < Back Next > Finish Cancel

Install Screens: 4

The screenshot shows the 'Generic Network' configuration window in the Oracle Appliance Manager. The window has a title bar 'Oracle Appliance Manager' and a red header bar with the 'ORACLE DATABASE APPLIANCE' logo and a disk icon. On the left is a vertical navigation pane with a tree view containing: Welcome, Configuration Type, System Information, Generic Network (selected), Public Network, Other Network, Database Information, ASR Information, CloudFS Information, Network Validation, and Summary. The main area contains the following fields:

- Domain Name:
- ☐ No DNS Server available
- DNS Servers:
- NTP Servers:

At the bottom, there is a 'Help' button on the left and navigation buttons '< Back', 'Next >', 'Finish', and 'Cancel' on the right.

Install Screens: 5

Oracle Appliance Manager

Public Network

ORACLE
DATABASE APPLIANCE

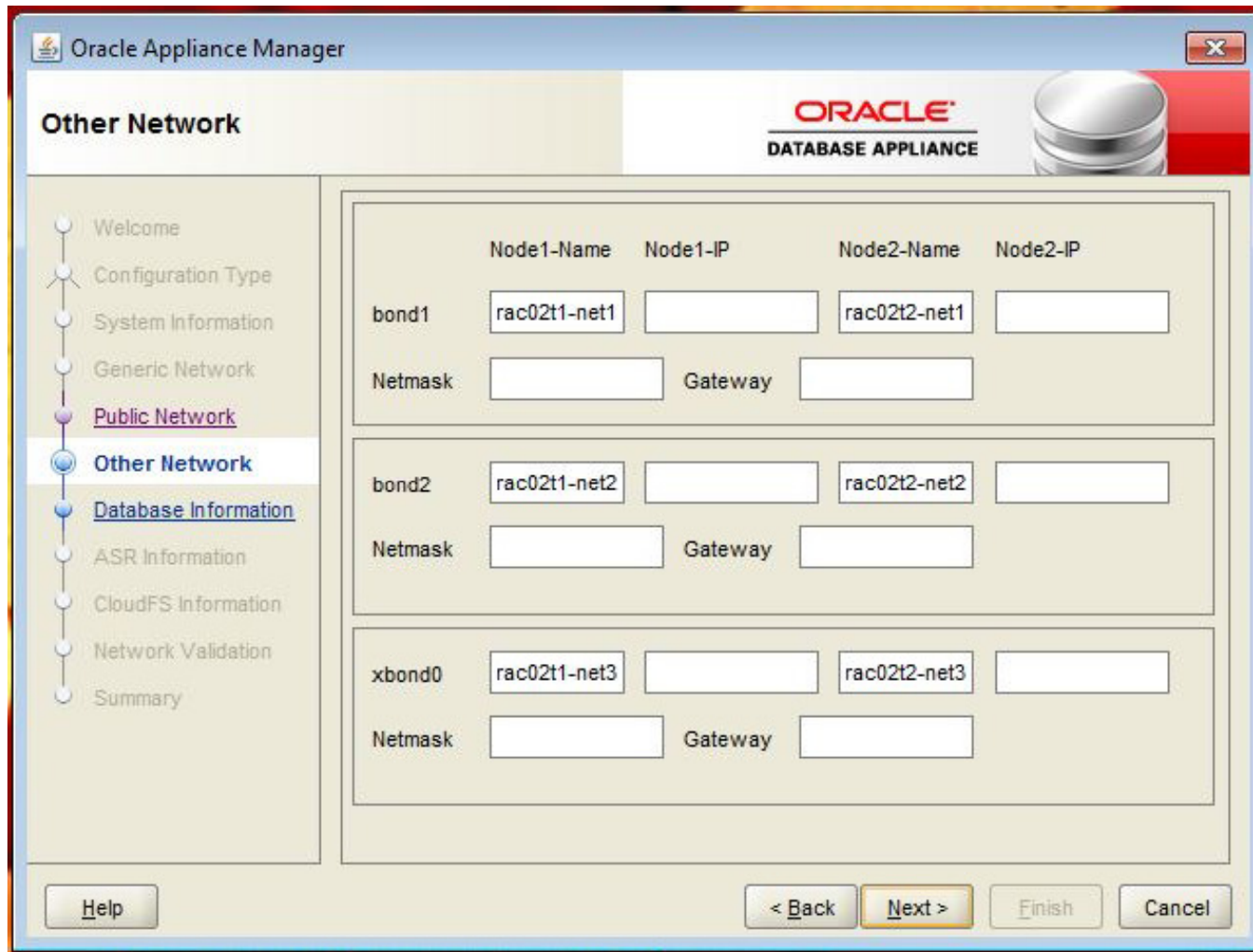
Welcome
Configuration Type
System Information
Generic Network
Public Network
Other Network
Database Information
ASR Information
CloudFS Information
Network Validation
Summary

	Node1-Name	Node1-IP	Node2-Name	Node2-IP
Public	hqodrac02s	10.221.0.21	hqodrac02t	10.221.0.25
VIP	hqodrac02s	10.221.0.23	hqodrac02t	10.221.0.27
SCAN	hqodrac02t-s	Addresses	10.221.0.24	10.221.0.28
Netmask	255.255.255.0	Gateway	10.221.0.1	
Interface	bond0			

ILOM	hqodrac02s	10.221.0.22	larac02bt-ilor	10.221.0.26
Netmask	255.255.255.0	Gateway	10.221.0.1	

Help < Back Next > Finish Cancel

Install Screens: 6



The screenshot shows the 'Other Network' configuration screen in the Oracle Appliance Manager. The window title is 'Oracle Appliance Manager'. The Oracle logo and 'DATABASE APPLIANCE' text are in the top right. A sidebar on the left lists the installation steps: Welcome, Configuration Type, System Information, Generic Network, Public Network, **Other Network** (selected), Database Information, ASR Information, CloudFS Information, Network Validation, and Summary. The main area contains three network configuration sections for bond1, bond2, and xbond0. Each section has fields for Node1-Name, Node1-IP, Node2-Name, Node2-IP, Netmask, and Gateway. The 'Next >' button is highlighted.

	Node1-Name	Node1-IP	Node2-Name	Node2-IP
bond1	rac02t1-net1		rac02t2-net1	
Netmask		Gateway		
bond2	rac02t1-net2		rac02t2-net2	
Netmask		Gateway		
xbond0	rac02t1-net3		rac02t2-net3	
Netmask		Gateway		

Buttons: Help, < Back, **Next >**, Finish, Cancel

Install Screens: 7

Oracle Appliance Manager

Database Information

ORACLE
DATABASE APPLIANCE

Database Name: TEST

Database Class: Medium

Database Language: AMERICAN

Database Block Size: 8192

Database Characterset: AL32UTF8

Database Territory: AMERICA

Help < Back Next > Finish Cancel

Install Screens: 8

The screenshot shows the 'Oracle Appliance Manager' window. The title bar includes the Oracle logo and the text 'ORACLE DATABASE APPLIANCE'. The main window is titled 'ASR Information'. On the left is a vertical navigation pane with a list of steps: Welcome, Configuration Type, System Information, Generic Network, Public Network, Other Network, Database Information, ASR Information (highlighted with a blue circle), CloudFS Information, Network Validation, and Summary. The main content area contains a checkbox labeled 'Configure Oracle Auto Service Request (ASR)'. Below this are three text input fields: 'Proxy Server Name:', 'Oracle Online Account Username:', and 'Oracle Online Account Password:'. At the bottom of the window are four buttons: 'Help', '< Back', 'Next >', and 'Finish'. The 'Next >' button is highlighted with a yellow border.

Oracle Appliance Manager

ASR Information

ORACLE
DATABASE APPLIANCE

Configure Oracle Auto Service Request (ASR)

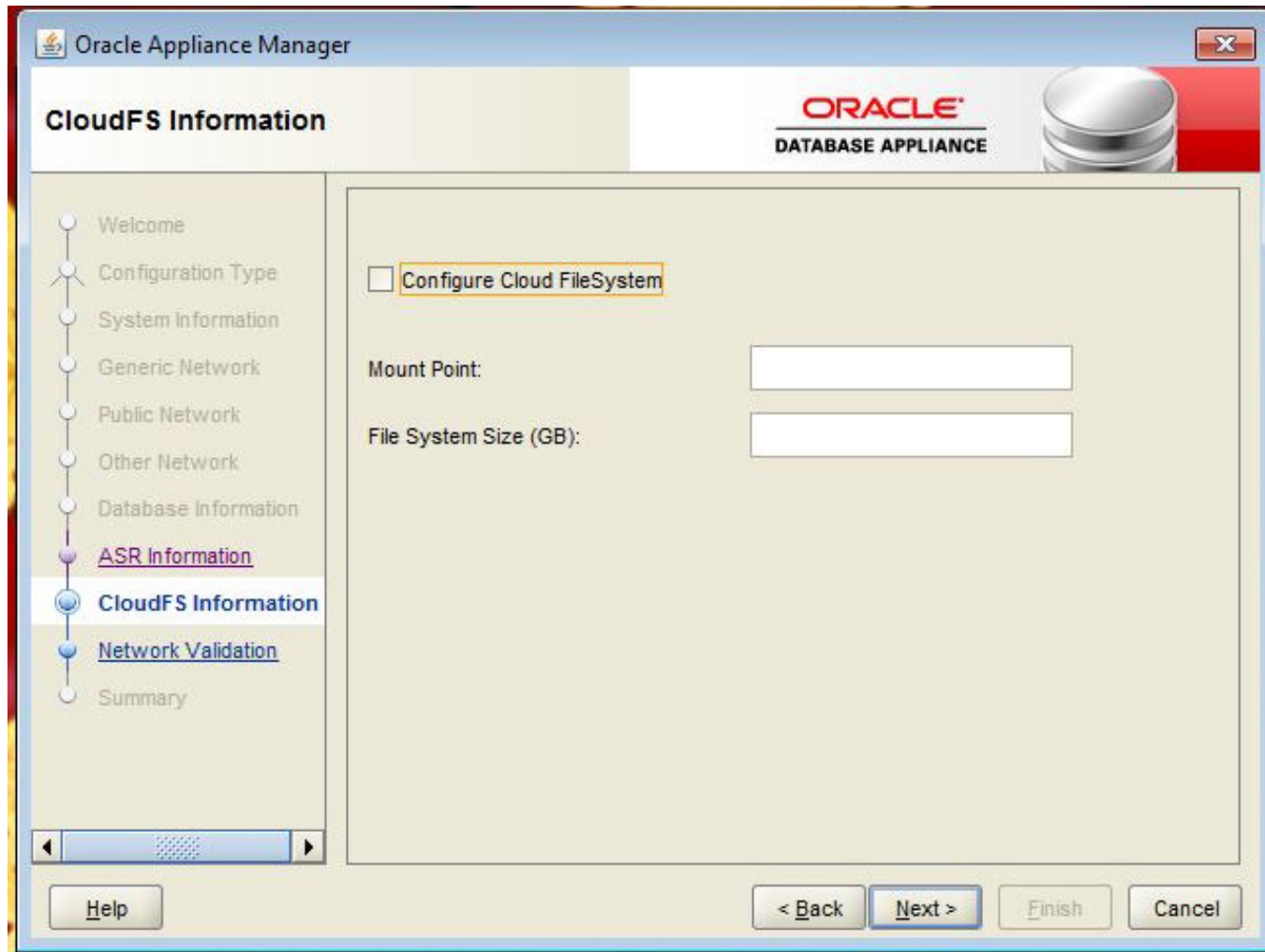
Proxy Server Name:

Oracle Online Account Username:

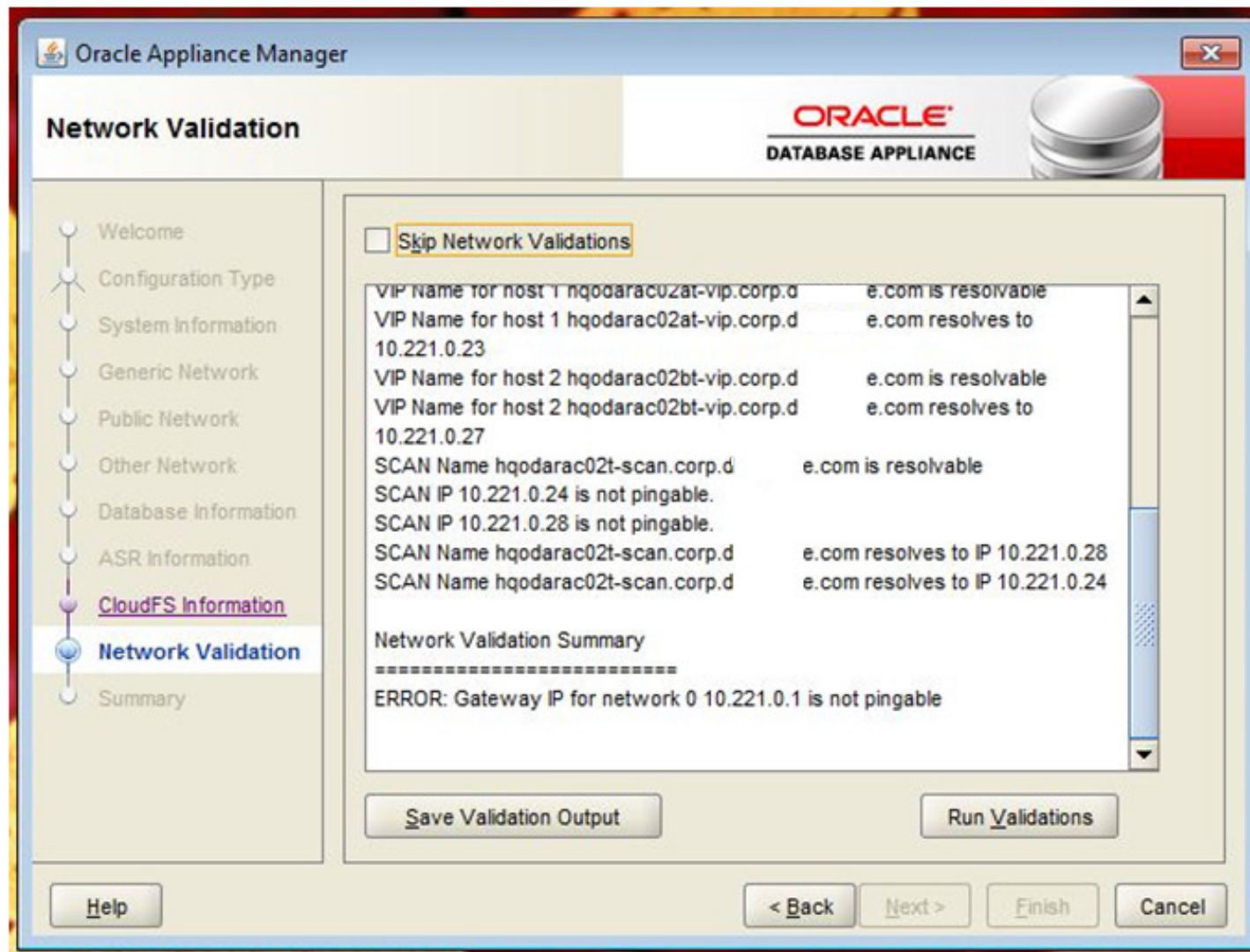
Oracle Online Account Password:

Help < Back Next > Finish Cancel

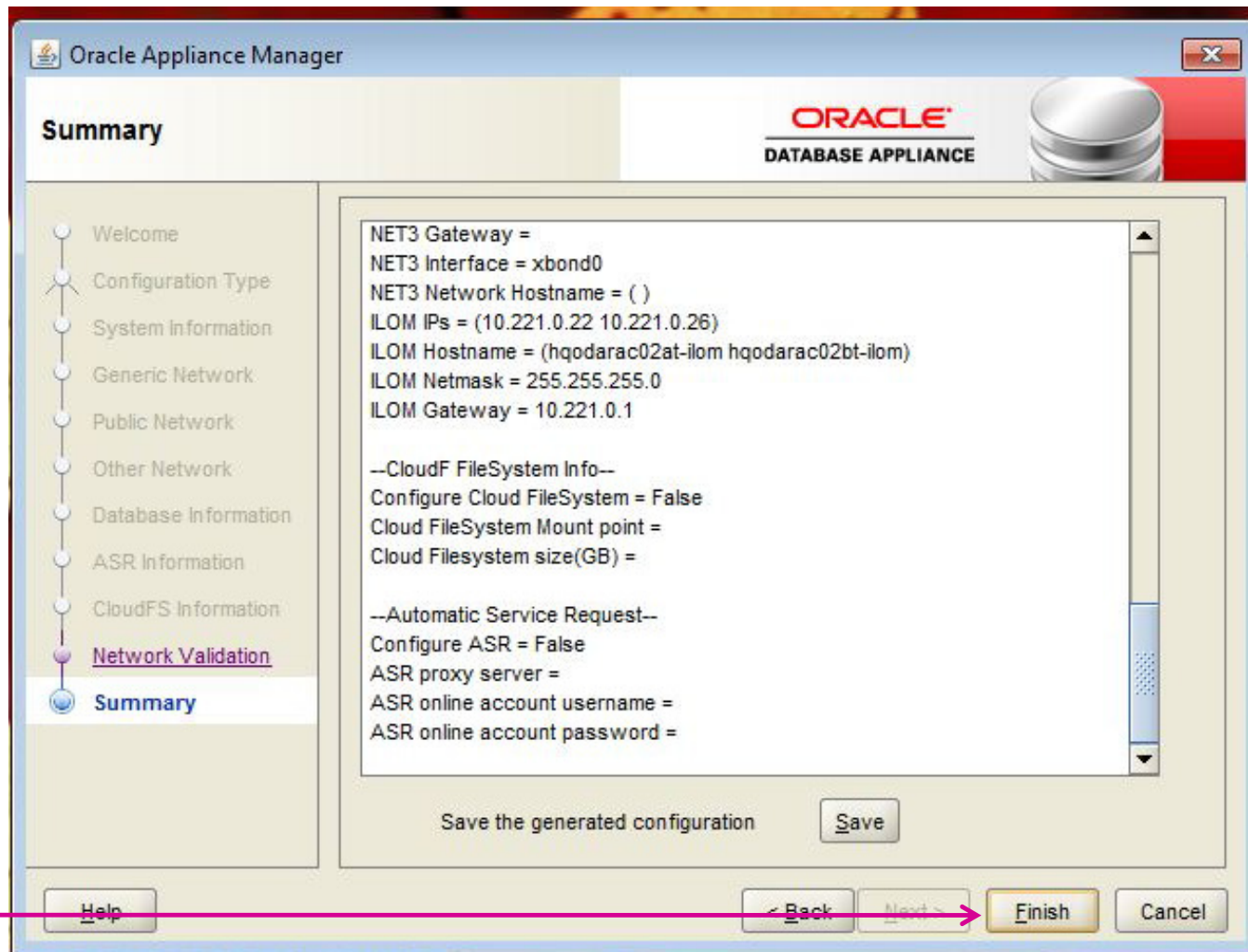
Install Screens: 9



Install Screens: 10

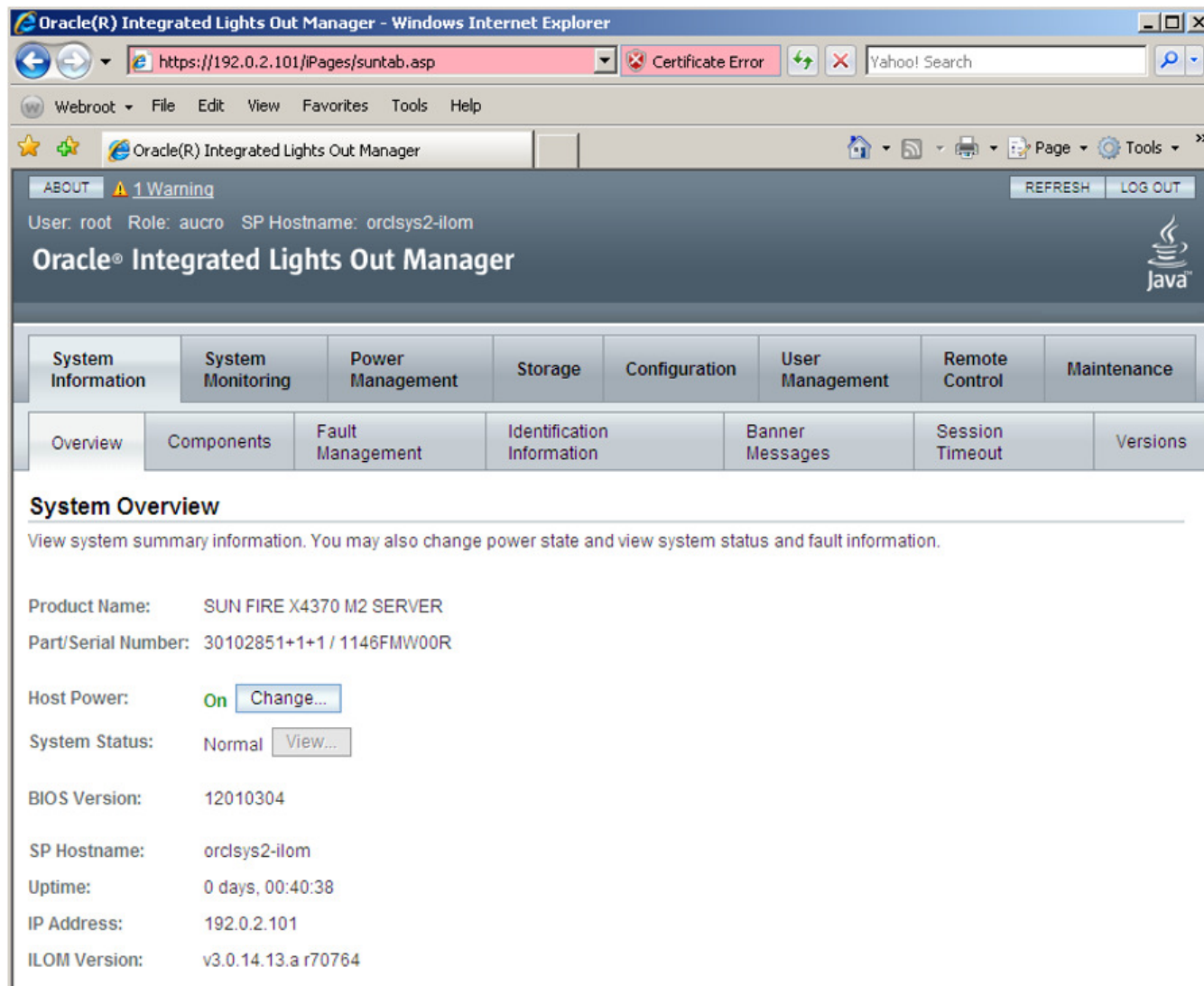


Install Screens: 11



Value Adds

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

Webroot File Edit View Favorites Tools Help

Oracle(R) Integrated Lights Out Manager

ABOUT 1 Warning REFRESH LOG OUT

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

ILOM: System Monitoring: Sensor Readings

The screenshot shows the Oracle(R) Integrated Lights Out Manager (ILOM) web interface in a Windows Internet Explorer browser. The address bar shows the URL <https://192.0.2.101/iPages/suntab.asp>. The page title is "Oracle(R) Integrated Lights Out Manager". The user is logged in as "root" with the role "auro" and the SP Hostname is "ordsys2-ilom". The page displays a "1 Warning" and a "Certificate Error". The main navigation menu includes "System Information", "System Monitoring", "Power Management", "Storage", "Configuration", "User Management", "Remote Control", and "Maintenance". The "System Monitoring" tab is selected, and the "Sensor Readings" sub-tab is active. The "Sensor Readings" section shows a table of sensor readings. The table has three columns: "Name", "Type", and "Reading". The table lists 11 sensors, all of which are "Present".

Name	Type	Reading
/SYS/PEER/PRSNT	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/PRSNT	Entity Presence	Present
/SYS/MB/P0/D0/PRSNT	Entity Presence	Present
/SYS/MB/P0/D1/PRSNT	Entity Presence	Present
/SYS/MB/P0/D2/PRSNT	Entity Presence	Present
/SYS/MB/P0/D3/PRSNT	Entity Presence	Present

ILOM: System Monitoring: Event Logs

The screenshot shows the Oracle(R) Integrated Lights Out Manager (ILOM) web interface in a Windows Internet Explorer browser. The address bar shows the URL <https://192.0.2.101/iPages/suntab.asp>. The page title is "Oracle(R) Integrated Lights Out Manager". The user is logged in as "root" with the role "aucro" and the SP Hostname is "orcdsys2-ilom". The page displays a "Warning" icon and a "1 Warning" message. The main navigation menu includes "System Information", "System Monitoring", "Power Management", "Storage", "Configuration", "User Management", "Remote Control", and "Maintenance". The "System Monitoring" tab is selected, and the "Event Logs" sub-tab is active. The "Event Log" section displays a table of events. The table has columns for Event ID, Class, Type, Severity, Date/Time, and Description. The events listed are:

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

ILOM: User Management: Active Sessions

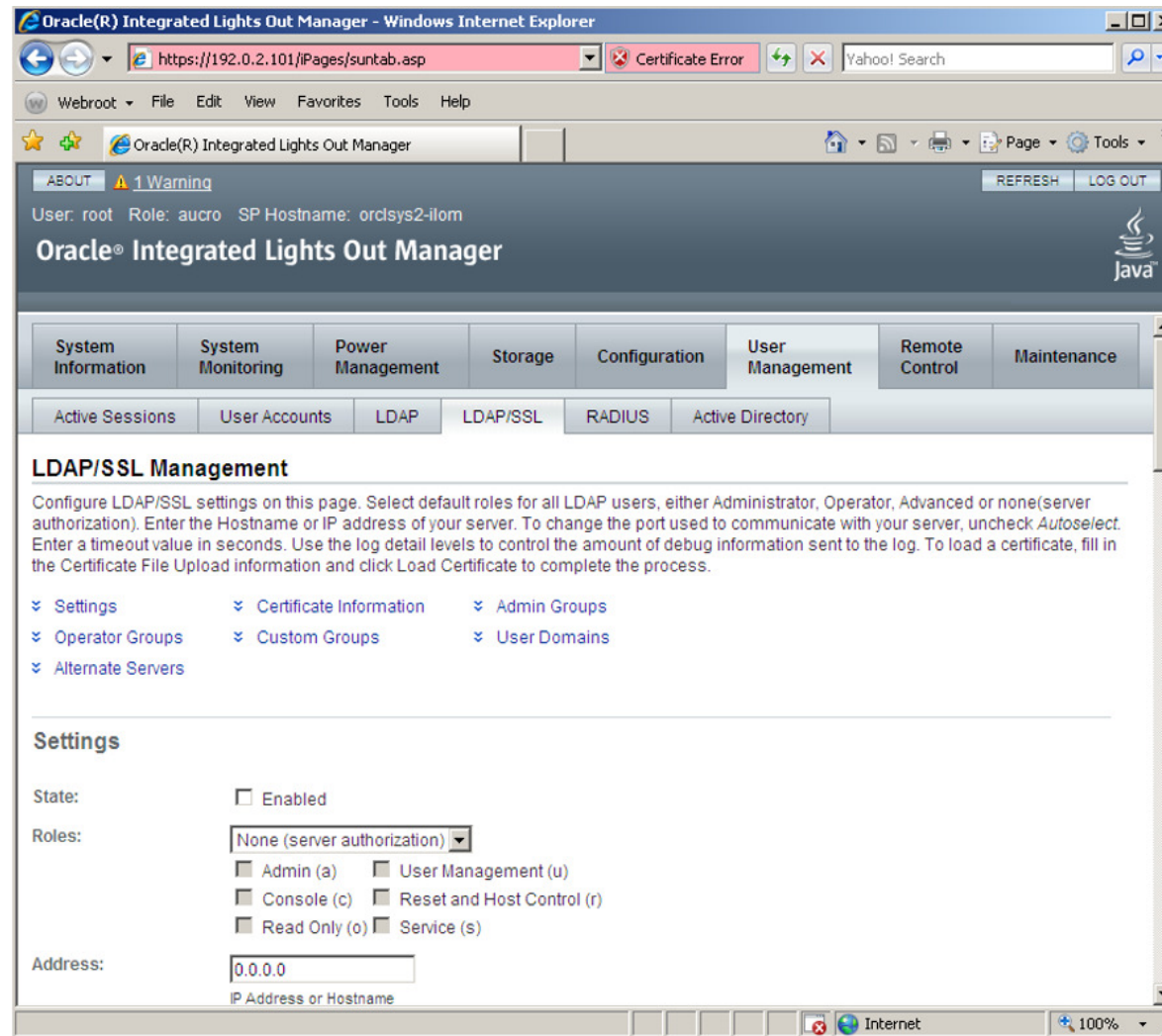
The screenshot shows the Oracle(R) Integrated Lights Out Manager (ILOM) web interface in a Windows Internet Explorer browser. The address bar shows the URL <https://192.0.2.101/iPages/suntab.asp>. The page title is "Oracle(R) Integrated Lights Out Manager". The user is logged in as "root" with the role "aucro" and the SP Hostname is "ordsys2-ilom". The page displays a "1 Warning" icon and "REFRESH" and "LOG OUT" buttons. The main navigation menu includes "System Information", "System Monitoring", "Power Management", "Storage", "Configuration", "User Management", "Remote Control", and "Maintenance". The "User Management" menu is expanded, showing "Active Sessions", "User Accounts", "LDAP", "LDAP/SSL", "RADIUS", and "Active Directory". The "Active Sessions" sub-menu is selected, displaying a table of active sessions.

Active Sessions

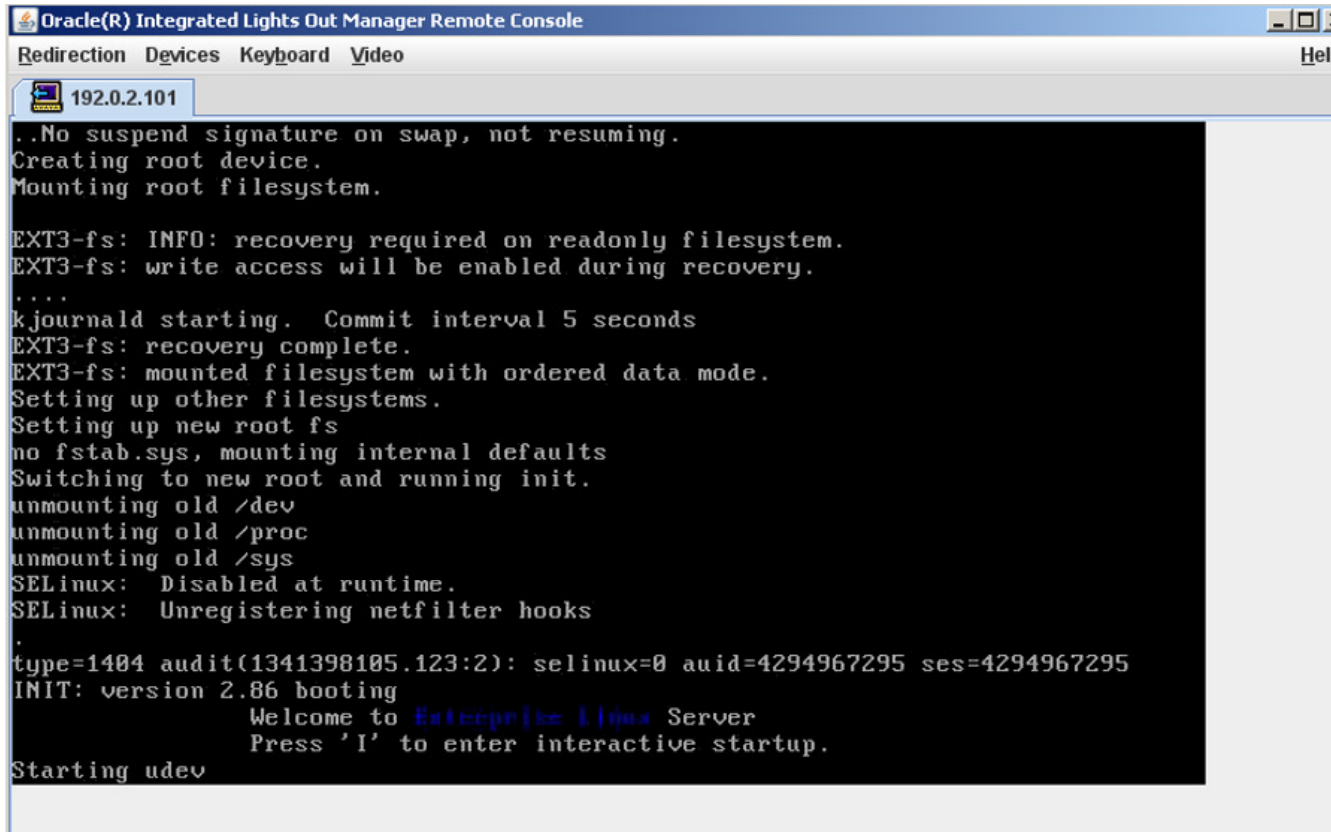
View the users currently logged in to ILOM, and the type of session they initiated.

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

ILOM: User Management: LDAP / SSL



Remote Control: Host Control: Remote Console



The screenshot shows a remote console window titled "Oracle(R) Integrated Lights Out Manager Remote Console". The window has a menu bar with "Redirection", "Devices", "Keyboard", "Video", and "Help". Below the menu bar is a tab labeled "192.0.2.101". The main area displays a black terminal window with white text showing the boot process of a Linux system. The logs include messages about swap, root device creation, filesystem recovery, journaling, and SELinux status. The system is currently at the "Welcome to Enterprise Linux Server" prompt, with instructions to press 'I' for interactive startup. The "Starting udev" message is visible at the bottom of the terminal output.

```
..No suspend signature on swap, not resuming.
Creating root device.
Mounting root filesystem.

EXT3-fs: INFO: recovery required on readonly filesystem.
EXT3-fs: write access will be enabled during recovery.
....
kjournald starting. Commit interval 5 seconds
EXT3-fs: recovery complete.
EXT3-fs: mounted filesystem with ordered data mode.
Setting up other filesystems.
Setting up new root fs
no fstab.sys, mounting internal defaults
Switching to new root and running init.
unmounting old /dev
unmounting old /proc
unmounting old /sys
SELinux: Disabled at runtime.
SELinux: Unregistering netfilter hooks
.
type=1404 audit(1341398105.123:2): selinux=0 auid=4294967295 ses=4294967295
INIT: version 2.86 booting
       Welcome to Enterprise Linux Server
       Press 'I' to enter interactive startup.

Starting udev
```


ILOM Warning Message



Full Support for High Availability

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

One Button Solutions

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

Support Center

Document Display - Mozilla Firefox

File Edit View History Bookmarks Tools Help

oracle.com https://supporthtml.oracle.com/epmos/faces/jsp/SearchDocDisplay.jspx?_afLoop=6463580628317000&type=DOCUMENT&id=1449552.2&displayInd=1

ORACLE MY ORACLE SUPPORT PowerView is Off

Welcome, Daniel (0) Contact Us Help Sign Out

Dashboard Knowledge Service Requests Patches & Updates Community Certifications Systems Reports More... Search Knowledge Base Advanced

Document Display

Search: ODA STIG

1 - 2 Back to Results

- Place holder for STIG Implementation Script for Oracle Database Appliance
- Information Center: Oracle Database Appliance

Information Center: Oracle Database Appliance [ID 1449552.2]

Content Refreshed: 27 Jun 2012

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- 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

View the most up-to-date high impact and urgent issues for your product.?

- 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 Knowledge Documents

Read recently published documents about your product

- Oracle Database Appliance FAQ [Document 1463638.1 Updated: 06/05/2012]
- How to use a separate Linux machine as your RPM repository to download and apply RPM's

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)

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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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 6TB 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

Source: Linux Today: 2009

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?

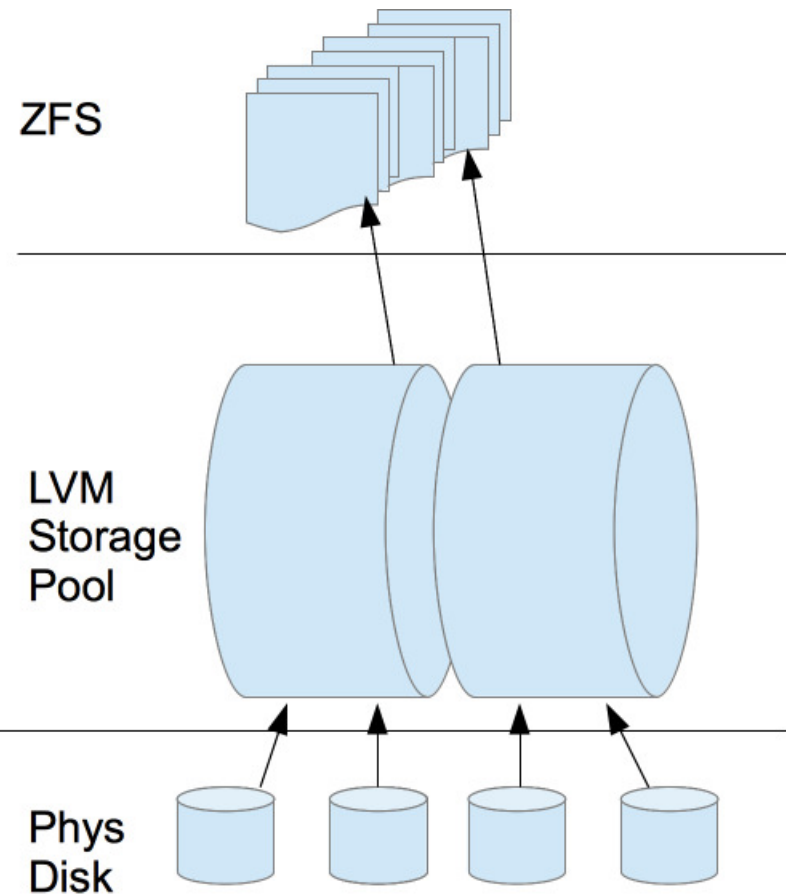
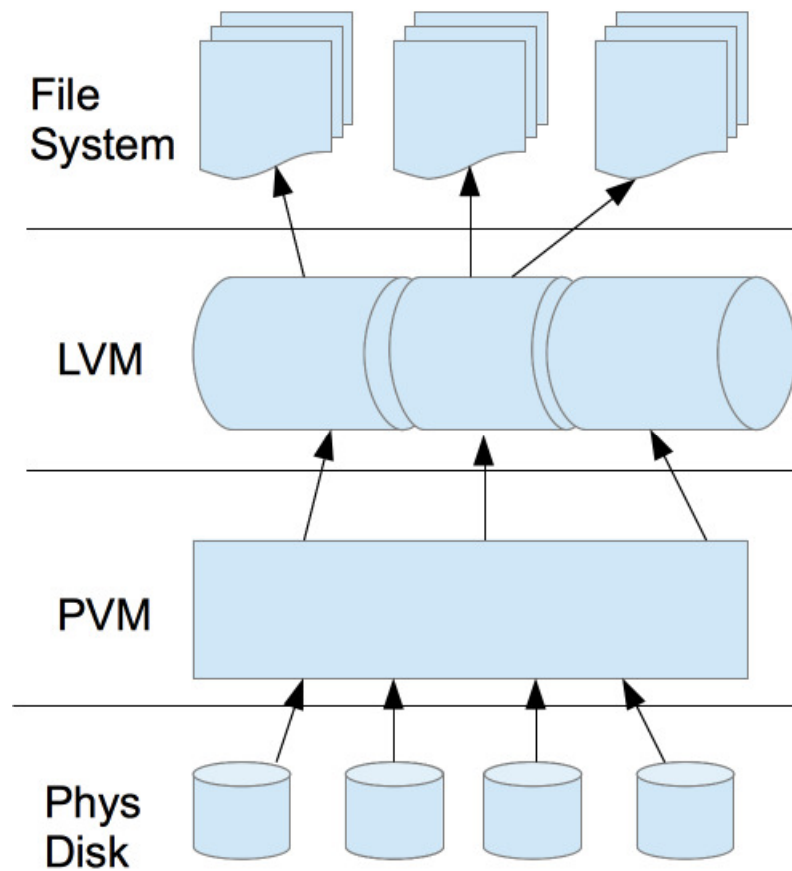
- Local File System
 - May be suitable for some applications,
 - But we have two separate hosts in ODA
 - Standard Linux-oriented
 - Still traditional HBA discussion

- [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
- ZFS 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)

Traditional File System stack vs ZFS



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?

ZFS Storage Appliance

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

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



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

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

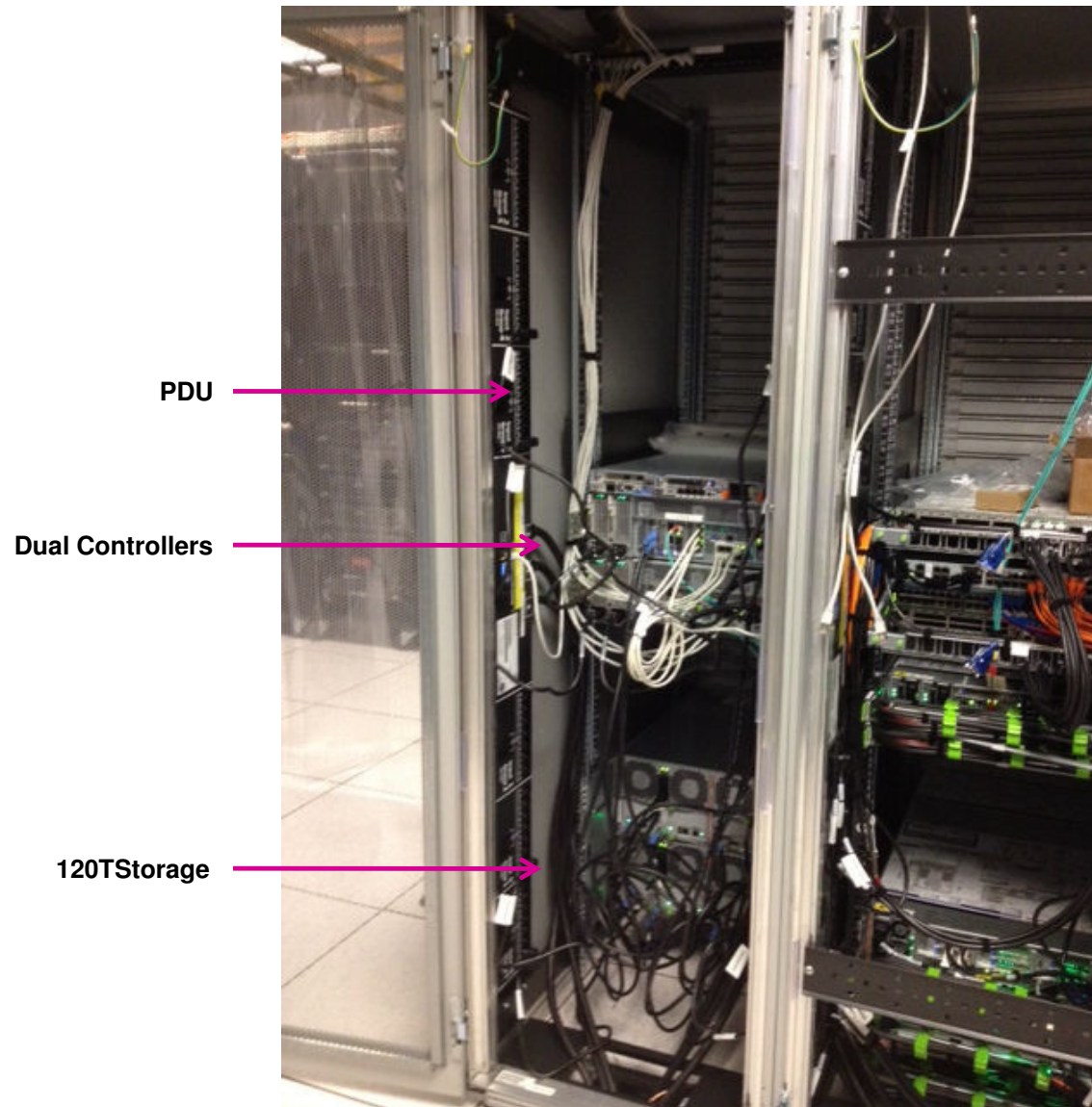
ZFS In The Data Center



ZFS 7420



ZFS Internals




ZFS BUI: Config Services

The screenshot displays the Sun ZFS Storage 7420 BUI Configuration page. The top navigation bar includes 'Configuration', 'Maintenance', 'Shares', 'Status', and 'Analytics'. Below this, a secondary navigation bar lists 'SERVICES', 'STORAGE', 'NETWORK', 'SAN', 'CLUSTER', 'USERS', 'PREFERENCES', and 'ALERTS'. The 'Services' tab is selected, showing a list of services categorized into Data Services, Directory Services, System Settings, and Remote Access. Each service entry includes a status indicator (green dot for Online, grey dot for Disabled), the service name, its current status, the last update time, and icons for refresh and power.

Category	Service	Status	Last Update	Refresh	Power
Data Services	NFS	Online	2012-10-10 09:28:04	🔄	🔌
	iSCSI	Disabled	2012-9-25 16:19:08	🔄	🔌
	SMB	Disabled	2012-9-25 16:19:15	🔄	🔌
	FTP	Disabled	2012-9-20 17:49:03	🔄	🔌
	HTTP	Disabled	2012-9-20 17:49:03	🔄	🔌
	NDMP	Disabled	2012-9-25 16:19:21	🔄	🔌
	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	🔄	🔌
Directory Services	TFTP	Disabled	2012-9-20 17:49:54	🔄	🔌
	Virus Scan	Disabled	2012-9-20 17:49:03	🔄	🔌
	NIS	Disabled	2012-9-25 16:12:36	🔄	🔌
	LDAP	Online	2012-9-25 16:12:36	🔄	🔌
System Settings	Active Directory	Online	2012-9-25 15:59:30	🔄	🔌
	Identity Mapping	Online	2012-9-25 15:56:16	🔄	🔌
	DNS	Online	2012-9-25 16:12:36	🔄	🔌
	IPMP	Online	2012-9-20 17:49:51	🔄	🔌
	NTP	Online	2012-9-24 14:23:46	🔄	🔌
	Phone Home	Disabled	2012-9-20 17:49:50	🔄	🔌
	Dynamic Routing	Online	2012-10-8 14:53:10	🔄	🔌
	Service Tags	Online	2012-9-20 17:49:50	🔄	🔌
	SMTP	Online	2012-9-25 16:12:36	🔄	🔌
	SNMP	Online	2012-9-21 18:39:52	🔄	🔌
Remote Access	Syslog	Online	2012-9-21 18:20:47	🔄	🔌
	System Identity	Online	2012-9-20 17:52:32	🔄	🔌
Remote Access	SSH	Online	2012-9-20 17:52:33	🔄	🔌

ZFS BUI: Config Storage







SUN ZFS STORAGE 7420The cluster peer has rejoined the cluster.LOGOUT HELPDismiss

Confirm that all devices are present and minimally functional, and allocate them to a storage pool.ABORTCOMMIT

Verify and allocate devices

Step 1 of 2

Devices may be added on a per-device basis, however SATA devices in SAS-1 enclosures may be added in half- or whole-chassis units only. While affected devices may be allocated, they will not be available for use and cannot be added later without reconfiguring the pool; for best results, defer configuring storage until any problems can be repaired. Mixing devices of differing speeds within a storage pool is strongly discouraged.

NAME	MODEL	RPM	DATA	LOG	CACHE	
 c0zfs742001p	Sun ZFS Storage 7420	--	-	-	-	
 1235FMD003	Sun Disk Shelf (SAS-2)	7200	5 (49.1T)	-	-	
 1235FMD002	Sun Disk Shelf (SAS-2)	7200	18 (49.1T)	-	-	

0

1

2

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18

ZFS BUI: Config Storage



SUN ZFS STORAGE 7420

LOGOUT HELP
Dismiss

The cluster peer has rejoined the cluster.

Confirm that all devices are present and minimally functional, and allocate them to a storage pool.

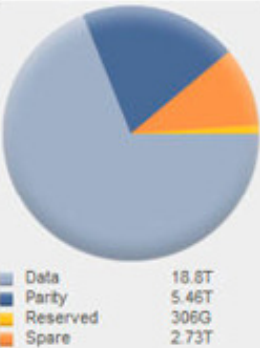
ABORTCOMMIT

Choose Storage Profile

◀ Step 2 of 2 ▶

Configure available storage into a pool by defining its underlying redundancy profile. Carefully read the profile descriptions to understand how each balances the inherent trade-offs between availability, performance, and capacity, and select the profile that best fits your workload. If available, NSPF indicates no single point of failure, which affords certain profiles the ability for a pool to survive through loss of a single disk shelf.

Storage Breakdown



Data	18.8T
Parity	5.46T
Reserved	306G
Spare	2.73T

Disk Breakdown

Data + Parity	9 disks
Spare	1 disks
Log	0 disks
Cache	0 disks

Data Profile

TYPE ^	NSPF	AVAILABILITY	PERFORMANCE	CAPACITY	SIZE
Double parity	No	■■■■■	■■■■■	■■■■■	18.8T
Mirrored	Yes	■■■■■	■■■■■	■■■■■	10.7T
Mirrored	No	■■■■■	■■■■■	■■■■■	10.7T
Single parity, narrow stripes	No	■■■■■	■■■■■	■■■■■	16.1T
Striped	No	■■■■■	■■■■■	■■■■■	26.9T
Triple mirrored	Yes	■■■■■	■■■■■	■■■■■	8.06T
Triple mirrored	No	■■■■■	■■■■■	■■■■■	8.06T
Triple parity, wide stripes	No	■■■■■	■■■■■	■■■■■	16.1T

Data profile: Double parity

Each array stripe contains two parity disks, yielding high availability while increasing capacity over mirrored configurations. Double parity striping is recommended for workloads requiring little or no random access, such as backup/restore.

ZFS BUI: Config Network Config

The screenshot shows the Sun ZFS Storage 7420 BUI interface. At the top, the Sun and Oracle logos are on the left, and the user 'Super-User@c0zfs742001p' is logged in on the right. The main navigation bar includes 'Configuration', 'Maintenance', 'Shares', 'Status', and 'Analytics'. Below this, a sub-navigation bar shows 'SERVICES', 'STORAGE', 'NETWORK' (selected), 'SAN', 'CLUSTER', 'USERS', 'PREFERENCES', and 'ALERTS'. The 'Network' section is active, with sub-tabs for 'Configuration', 'Addresses', and 'Routing'. A help text block explains that users can configure networking by building Datalinks on Devices and Interfaces on Datalinks. The interface is divided into three main columns: Devices (12 total), Datalinks (4 total), and Interfaces (4 total). The Devices column lists built-in and PCIe devices, some with link status. The Datalinks column shows connections between devices. The Interfaces column lists network interfaces with their IP addresses and parent devices.

Devices	Datalinks	Interfaces
BUILT-IN		
igb0 (1Gb full)	igb0 (via igb0)	head1 net0 (IPv4 static, 192.168.40.248/22, via igb0)
igb1 (1Gb full)	igb1 (via igb1)	head2 net1 (IPv4 static, 192.168.40.249/22, via igb1)
igb2 (link down)	ixgbe0 (Custom MTU(9000), via ixgbe0)	private10gb (IPv4 static, 10.221.112.49/24, via ixgbe0)
igb3 (link down)	ixgbe2 (Custom MTU(9000), via ixgbe2)	private10gb2 (IPv4 static, 10.221.112.50/24, via ixgbe2)
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)		

ZFS BUI: Configuration Services LDAP

The screenshot shows the Sun ZFS Storage 7420 BUI Configuration page for the LDAP service. The top navigation bar includes 'Configuration', 'Maintenance', 'Shares', 'Status', and 'Analytics'. Below this, a secondary bar lists 'SERVICES', 'STORAGE', 'NETWORK', 'SAN', 'CLUSTER', 'USERS', 'PREFERENCES', and 'ALERTS'. The 'Services' tab is active, showing the 'LDAP' service status as 'Online' with a timestamp of '2012-10-11 12:30:32'. The 'LDAP Directory Service' section provides a description and links to 'Help: LDAP' and 'Wikipedia: LDAP'. The configuration fields include: 'Protect LDAP traffic with SSL/TLS' (unchecked), 'Base search DN' (dc-unix, dc-m1ib,dc=com), 'Search scope' (Subtree (recursive) selected), 'Authentication method' (Simple (RFC 4513) selected), 'Bind credential level' (Anonymous selected), and 'Schema definition' (Edit...). Below these fields, a 'Servers' section shows a table with one entry: 'perrito3.m1ib.com:389'. The table has columns for 'SERVER', 'CERTIFICATE', and 'EXPIRES'.

Sun ORACLE | SUN ZFS STORAGE 7420 | Super-User@c0zfs742001p | LOGOUT | HELP

Configuration | Maintenance | Shares | Status | Analytics

SERVICES | STORAGE | NETWORK | SAN | CLUSTER | USERS | PREFERENCES | ALERTS

Services | **LDAP** | Properties | Logs

Back to Services | 2012-10-11 12:30:32 Online | REVERT | APPLY

LDAP Directory Service
Recognize users and groups defined in an LDAP directory. Once the LDAP service is configured, go to Configuration/Users to give users permission to log into the administrative interface.

See Also
Help: LDAP
Wikipedia: LDAP

Protect LDAP traffic with SSL/TLS ☐

Base search DN

Search scope ☐ One-level (non-recursive) ☒ Subtree (recursive)

Authentication method

Bind credential level ☒ Anonymous ☐ Proxy

DN

Password

☐ Self

Schema definition [Edit...](#)

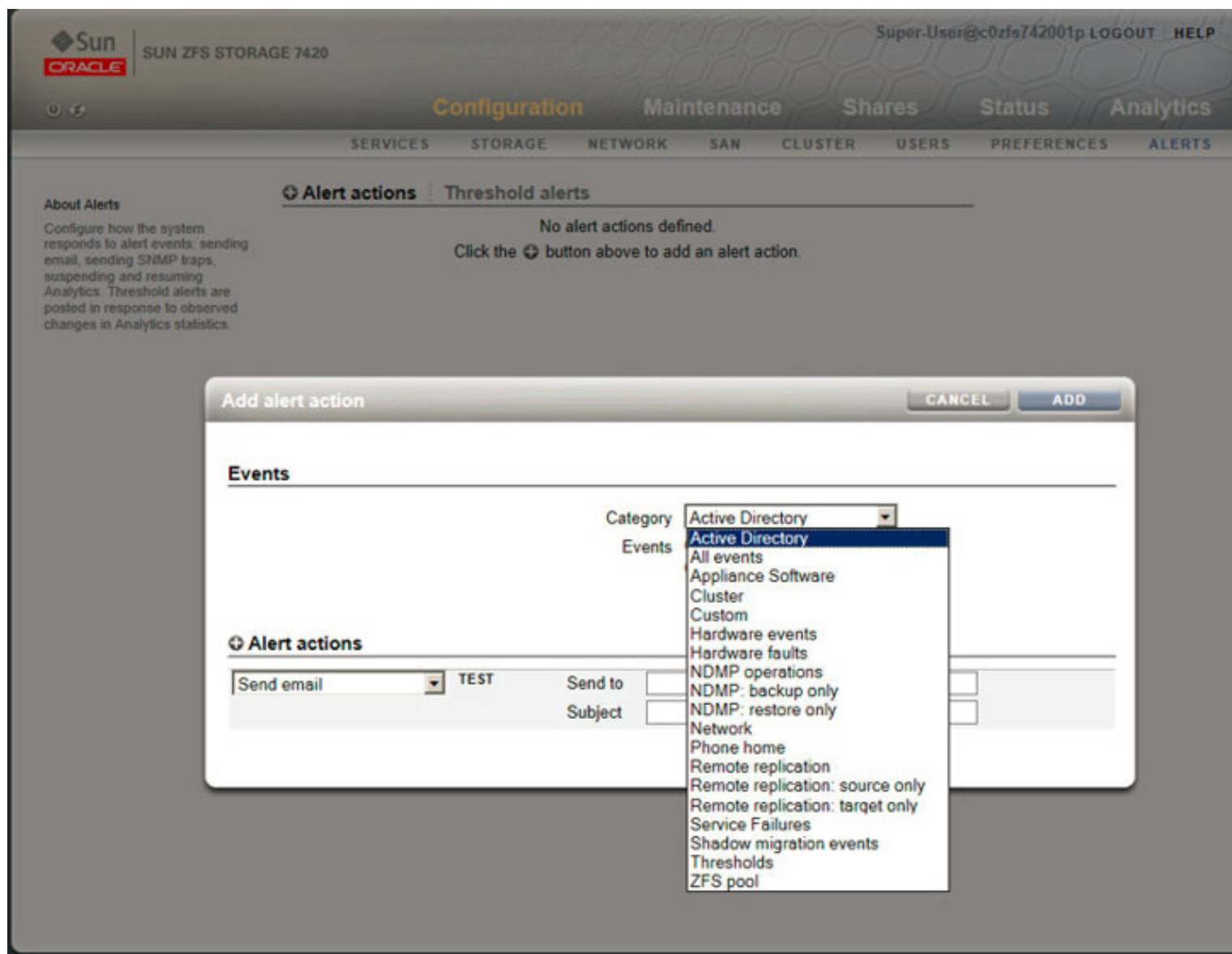
Servers 1 Total

SERVER	CERTIFICATE	EXPIRES
perrito3.m1ib.com:389		

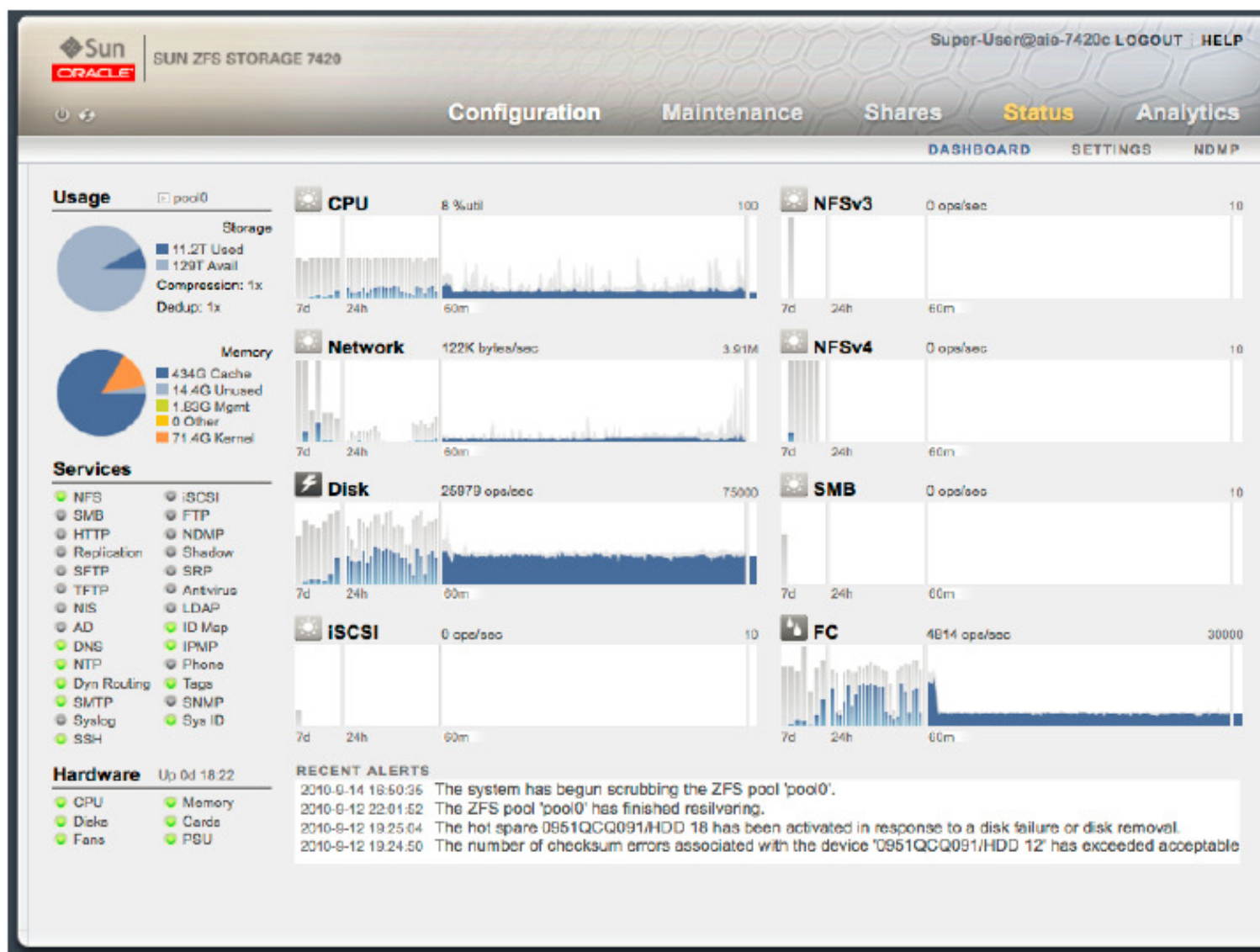
ZFS BUI: Maintenance Logs

		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-e434ebd2f7d	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-cb9f-f61bb1b5fe8d	The system has begun scrubbing the ZFS pool 'RMANBACK'.				Minor Alert
2012-9-24 14:23:44	2d5106de-ee58-c299-c247-8882df53fb7	Network connectivity via datalink ixgbe0 has been established.				Minor alert
2012-9-24 14:23:44	0a2e7265-49b1-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: Configuration Alerts



ZFS Storage Appliances



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 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.

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