

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

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The Morgan of Morgan's Library on the web



Board Member: Western Washington OUG



Executive Board: Vancouver/Victoria OUGs

## ■ Upcoming Presentations

- Apr 17-20: Oracle User Group Norway
- May 15 Oracle User Group Azerbaijan
- May 19 Bulgarian Oracle User Group



ORACLE  
RAC SIG

International  
zSeries  
Oracle SIG

# Morgan's Library: [www.morganslibrary.org](http://www.morganslibrary.org)

The screenshot shows the Morgan's Library website with a purple header. The header includes the site logo, the name 'Morgan's Library', and a search bar with the text 'www library'. Below the header is a navigation bar for the 'Morgan's 2012 - 2013 Calendar' with tabs for each month from February to January. A large black banner across the middle of the page contains the text '[ don't censor the web ]' and '[ don't be silent ]'. The main content area is divided into several sections: a left sidebar with links for 'Community', 'Resources' (highlighted with a pink arrow), and 'General'; a 'Oracle Core' section featuring a book cover; a 'Training Events' section with a list of upcoming events; an 'Oracle Events' section with a world map and the text 'Next Event: RMOUG Denver, CO Feb 14-16'; a 'Morgan' section with a photo of two people on a boat and the text 'aboard USA-71'; a 'Library News' section with a list of recent news items; and an 'ACE News' section with the text 'Would you like to become an Oracle ACE?' and a list of links for ACE-related resources. The footer of the website is a grey bar containing contact information and the site's purpose.

Morgan's Library

Morgan's Library

www library

Morgan's 2012 - 2013 Calendar

Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan

[ don't censor the web ] [ don't be silent ]

Home

Community

Events

Training

Evening Workshops

Resources

Library

How Can I?

Code Samples

Presentations

Links

Book Reviews

Downloads

User Groups

Humor

General

Contact

About

Services

Legal Notice & Terms of Use

Privacy Statement

Presentations Map

Oracle Core

Oracle Core

Essential Internals for DBAs and Developers

Training Events

- [Harvard University](#) - Feb 6 - 10, 2012
- [RMOUG Training Days](#) - Feb 14 - 16, 2012
- [VanOUG Canada](#) - Feb 23, 2012
- [OUGN: Oslo, Norway](#) - Mar 21 - 24, 2012
- [BeNeLux Connect: Maastricht](#) - Apr 24, 2012
- [OUG Harmony Finland](#) - May 30 - 31, 2012
- [OUG Harmony Latvia](#) - Jun 01, 2012

Oracle Events

Next Event: RMOUG Denver, CO Feb 14-16

Morgan

aboard USA-71

ORACLE ACE Director

Library News

- [Morgan's Notepad vi \(Blog\)](#)
- [Join the Western Washington OUG](#)
- [Morgan's Oracle Podcast](#)
- [US Government STIGs \(Security Checklists\)](#)
- [Bryn Llewellyn's PL/SQL White Paper](#)
- [Bryn Llewellyn's Editioning White Paper](#)
- [Explain Plan White Paper](#)
- [Troubleshooting Performance](#)

ACE News

Would you like to become an Oracle ACE?

Learn more about becoming an ACE

- [ACE Directory](#)
- [ACE Google Map](#)
- [ACE Program](#)
- [Stanley's Blog](#)

Congratulations to our newest ACEs

# Travels

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# LAD Tour: Machu Picchu Peru

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# Agenda

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

# Executive Summary

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- 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

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- 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

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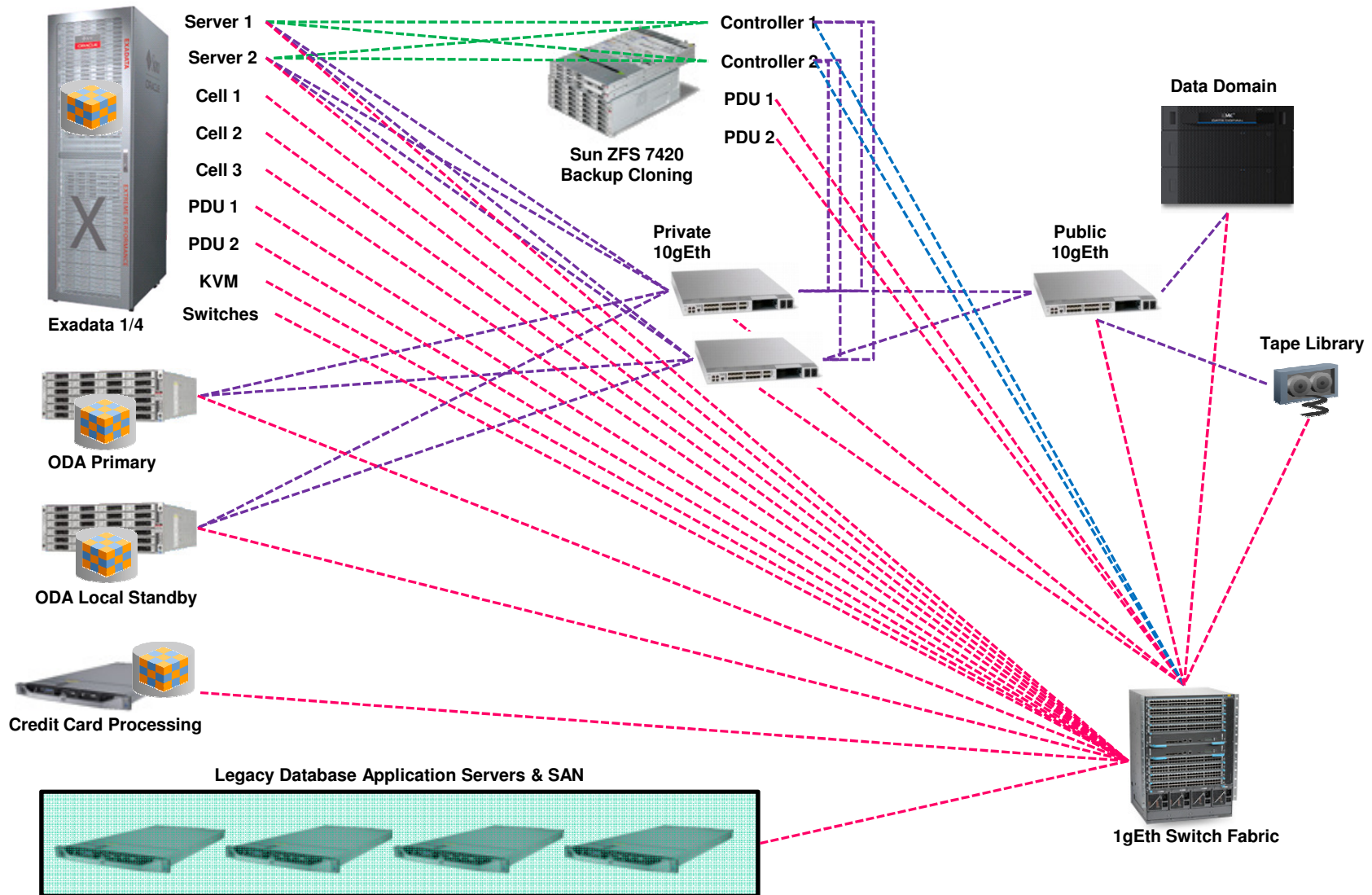


# IT infrastructure meets a single point of failure

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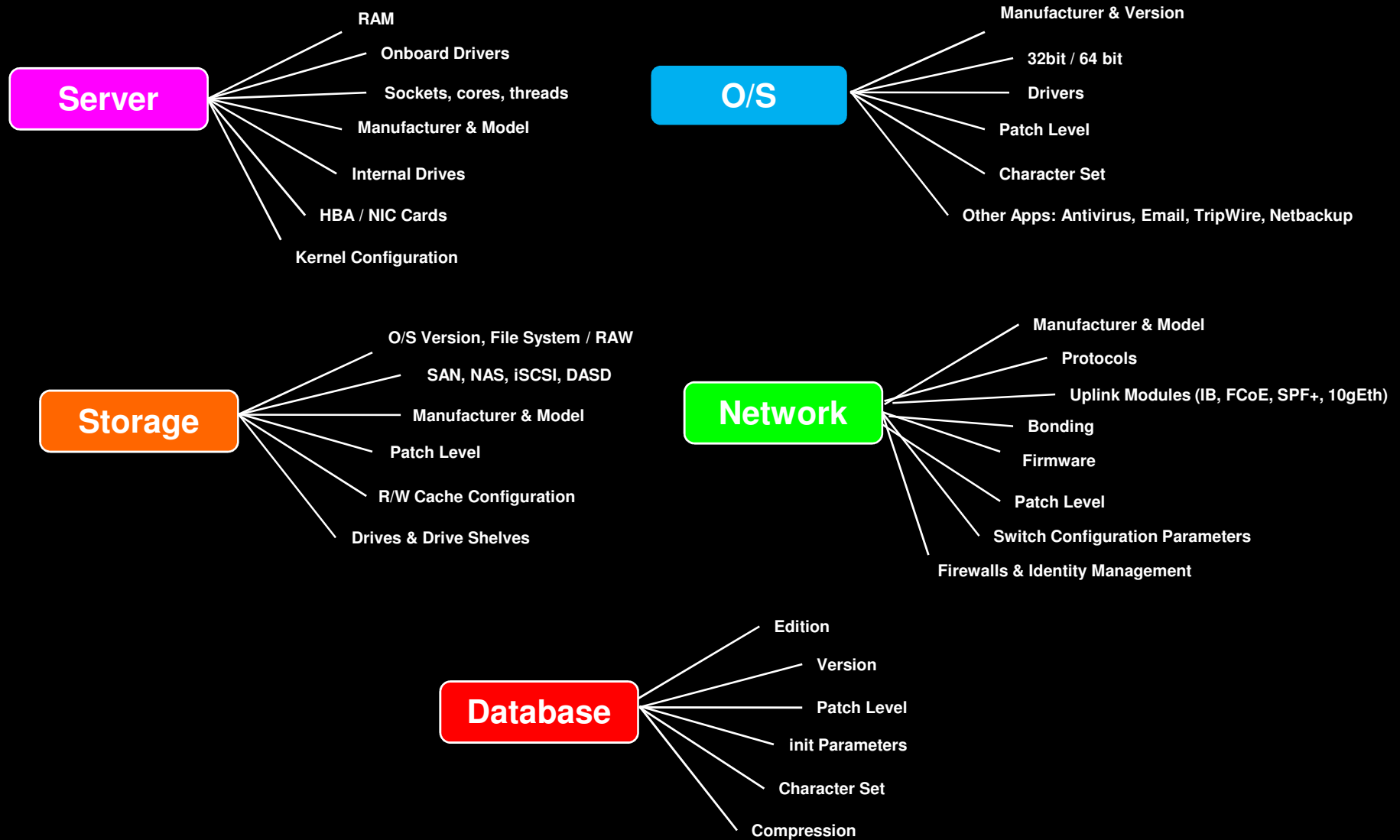


# Puzzle Pieces

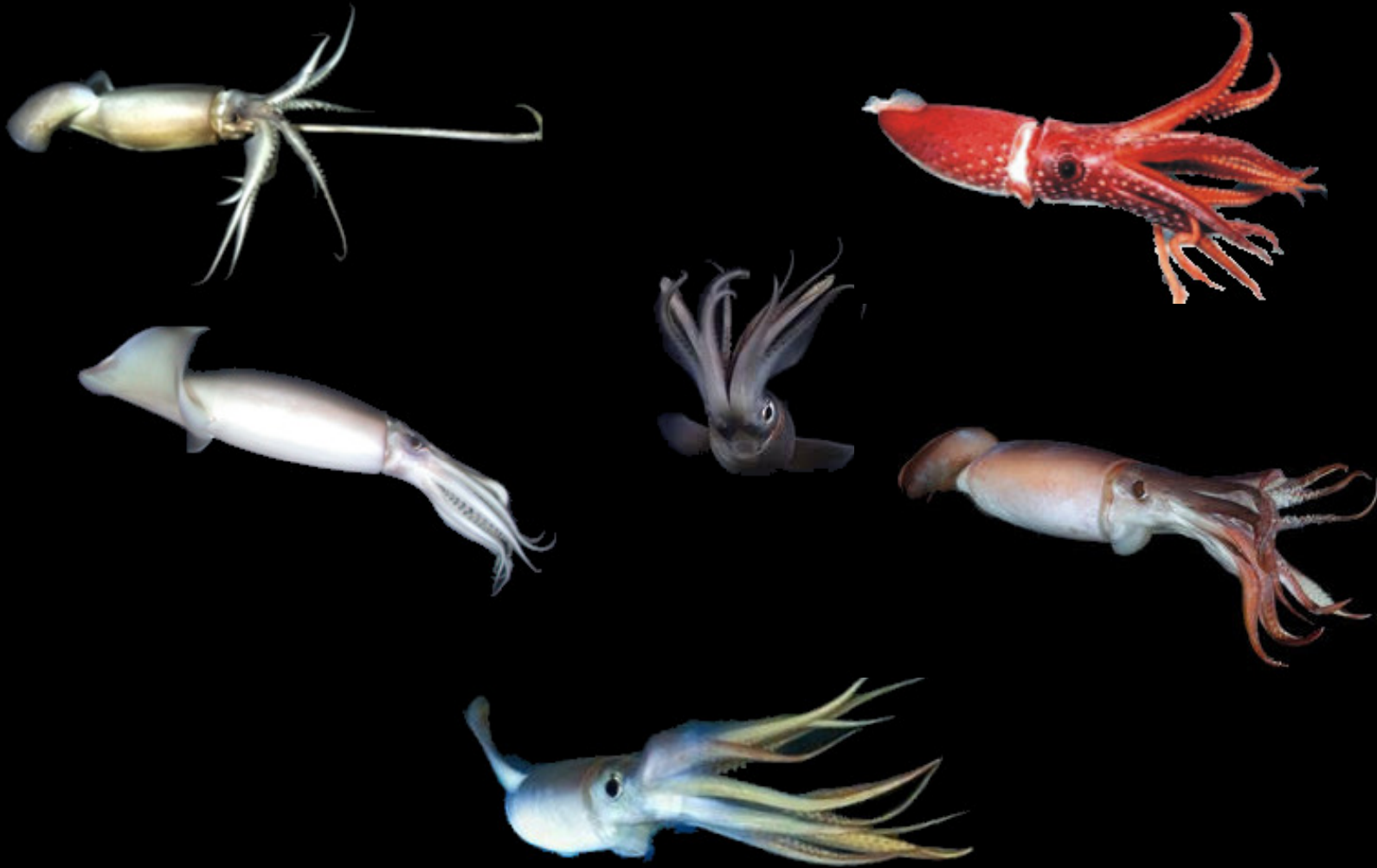


Each connection shown must be multiplexed and bonded

# Static Puzzle Pieces



# Animated Puzzle Pieces





# It's hard to embrace a barrel of squid



# Puzzle Pieces

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- 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?

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- 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

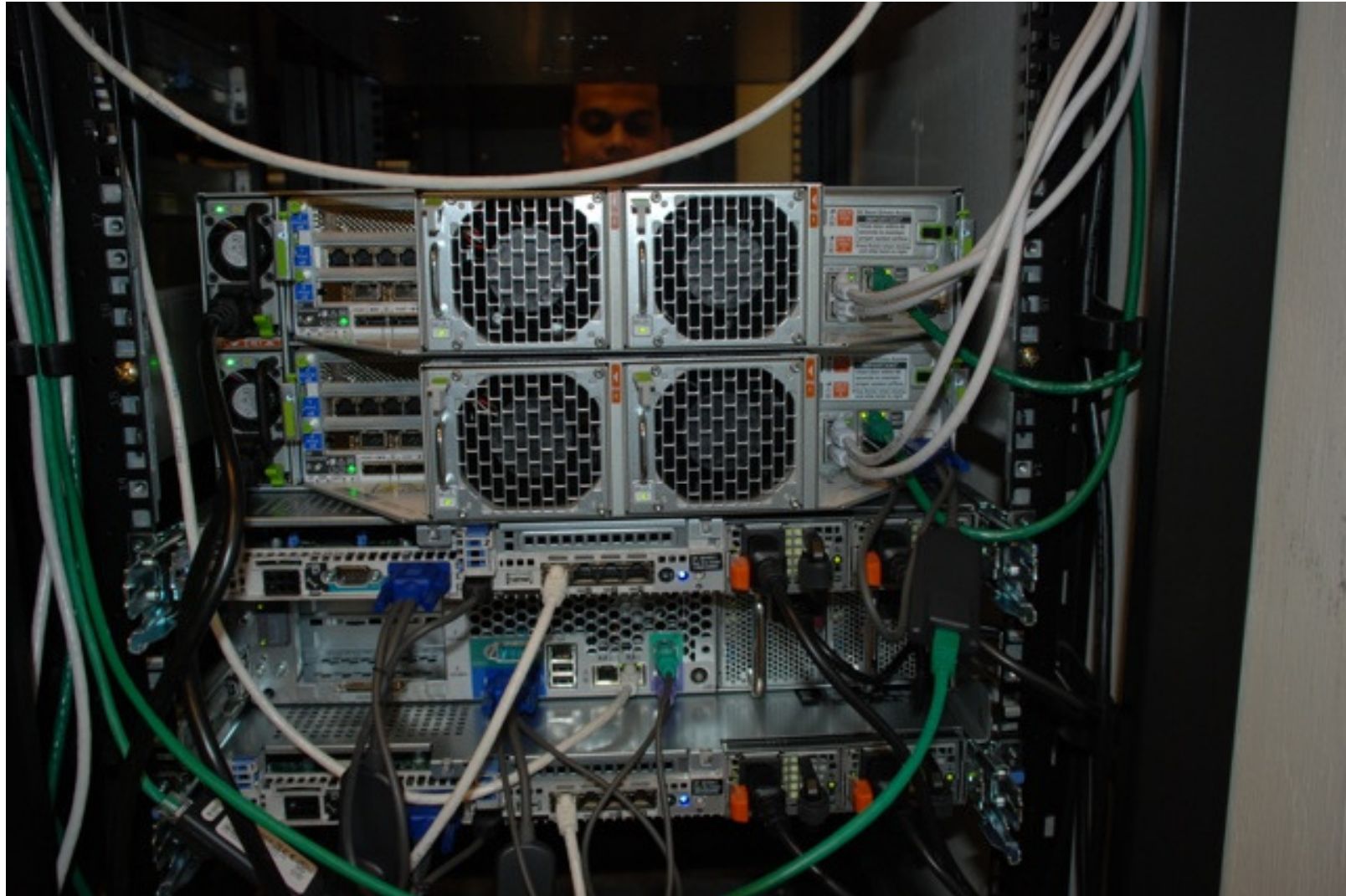
# ODA in Pictures

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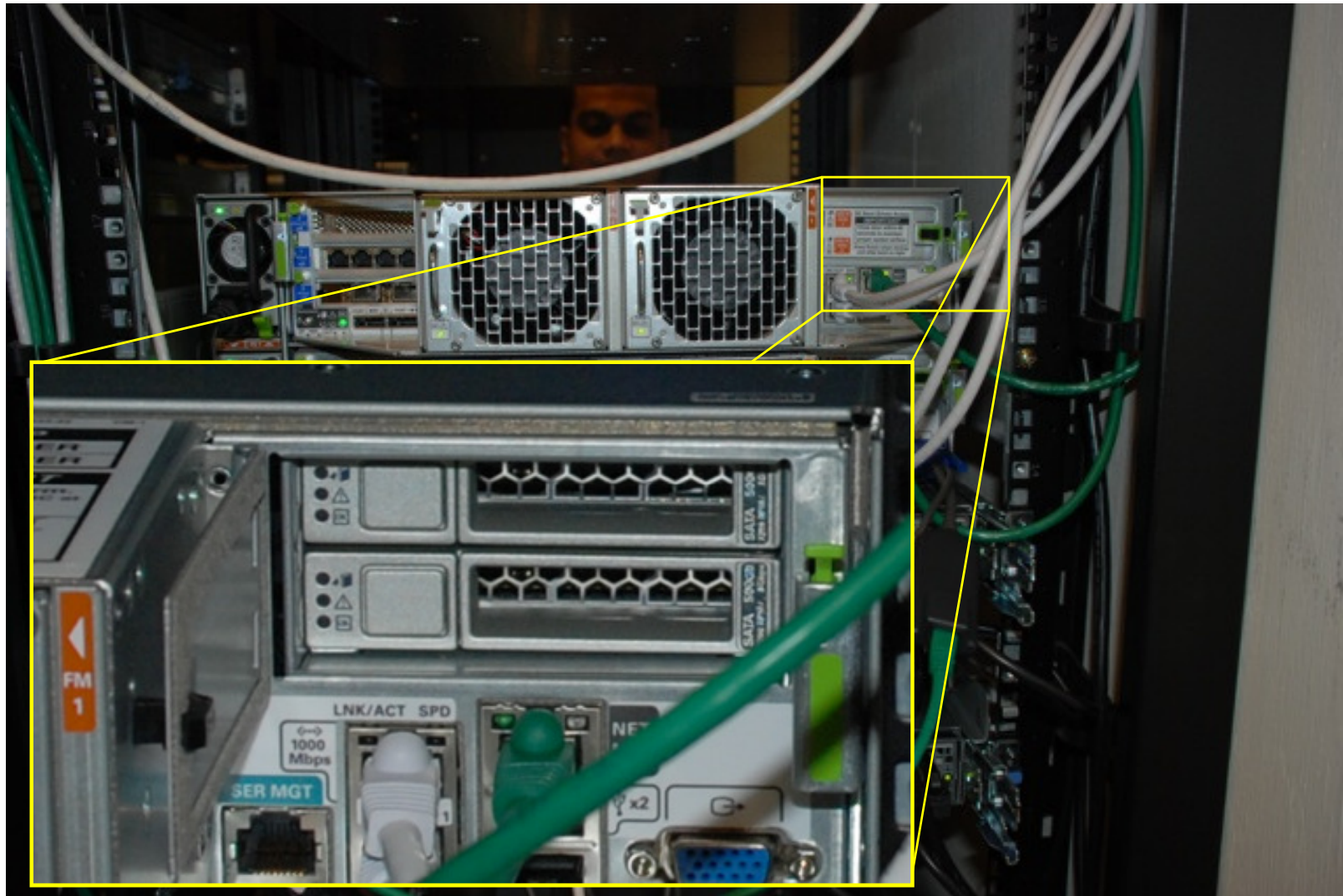
# ODA in Pictures

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# ODA in Pictures



# Why an ODA?

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- 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

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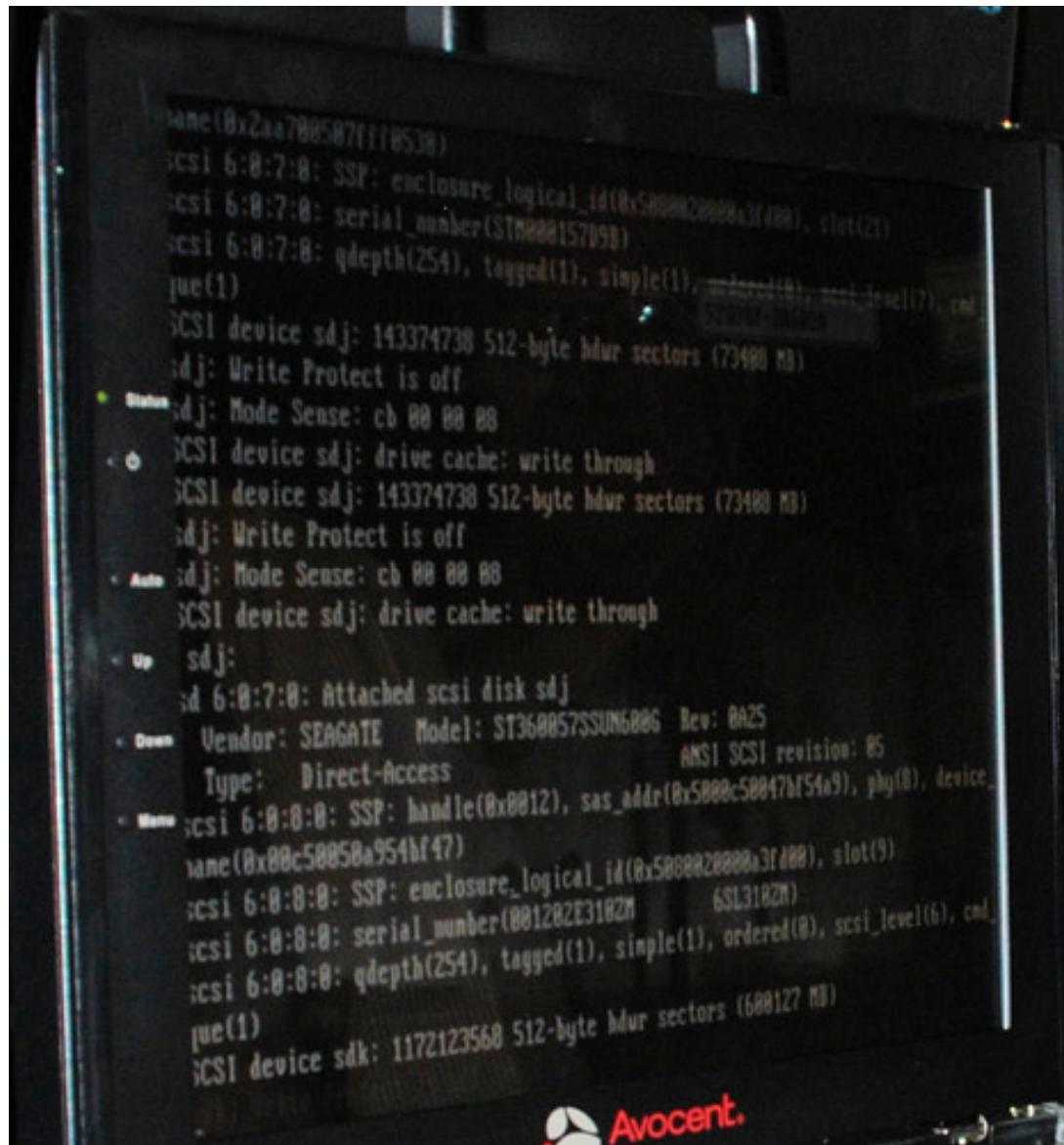
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# Discussion

## Installation

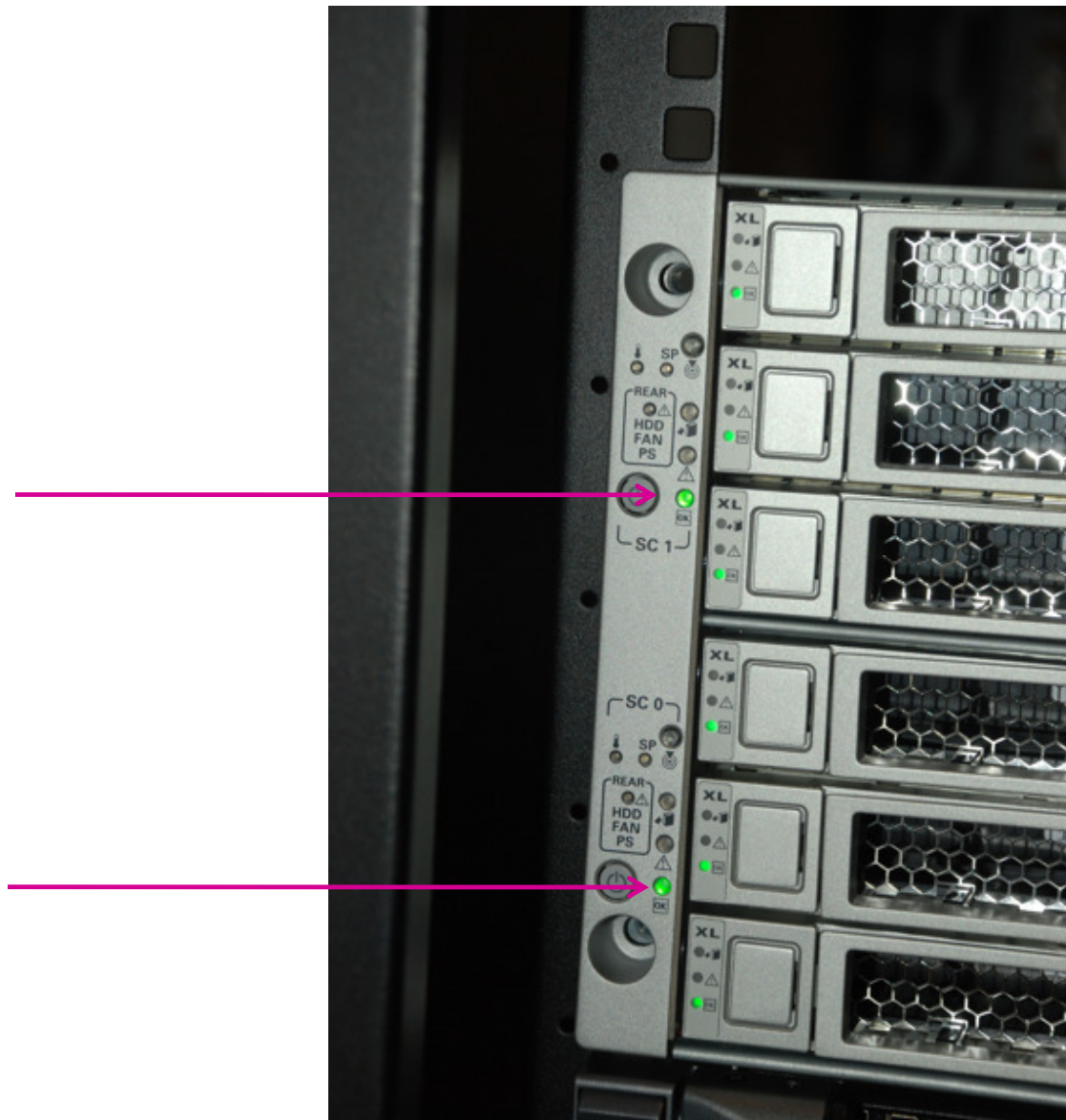


# Step 1: Power On

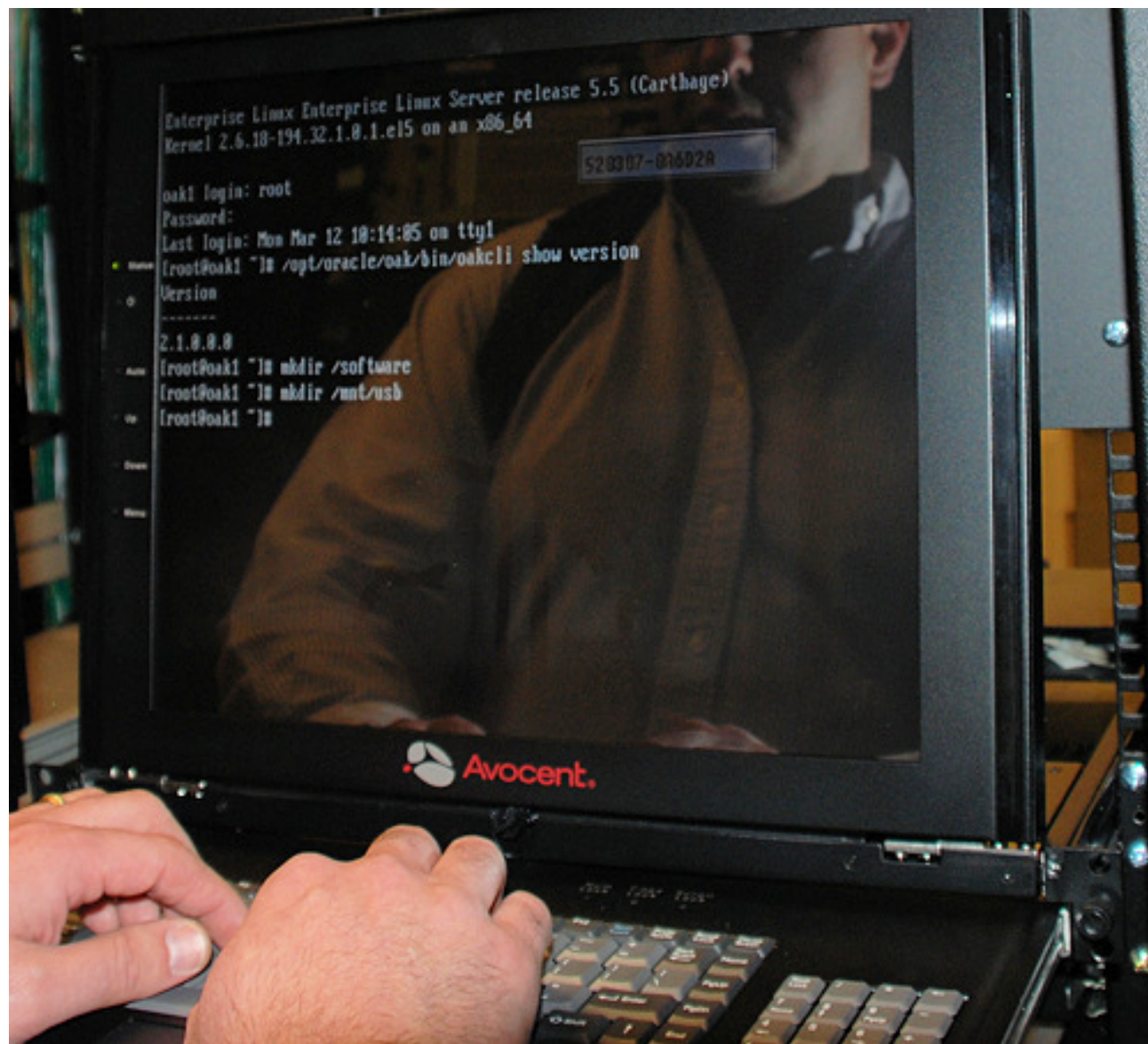


## Step 2: Wait for OK Lights

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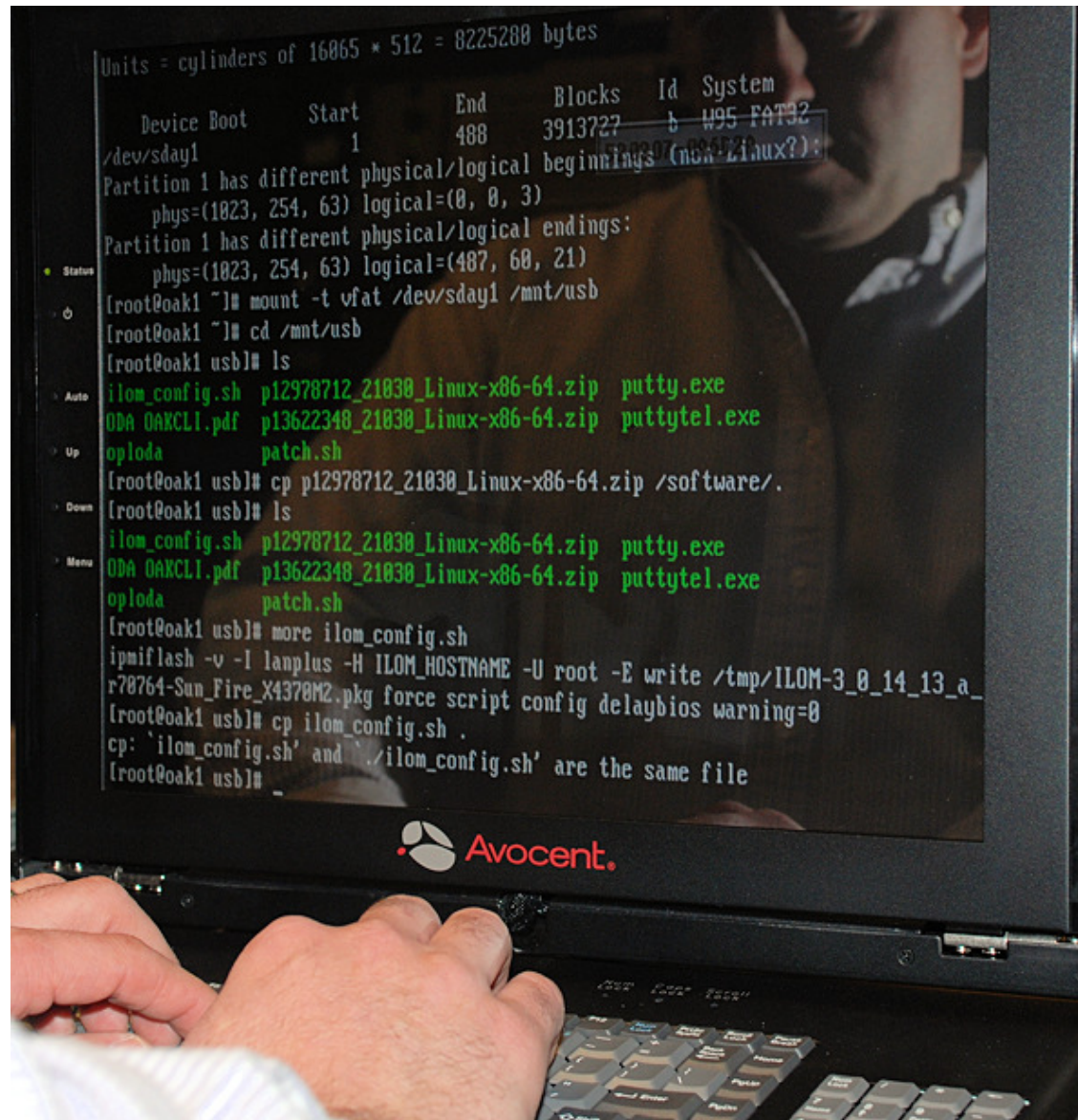


## Step 3: Log In as root





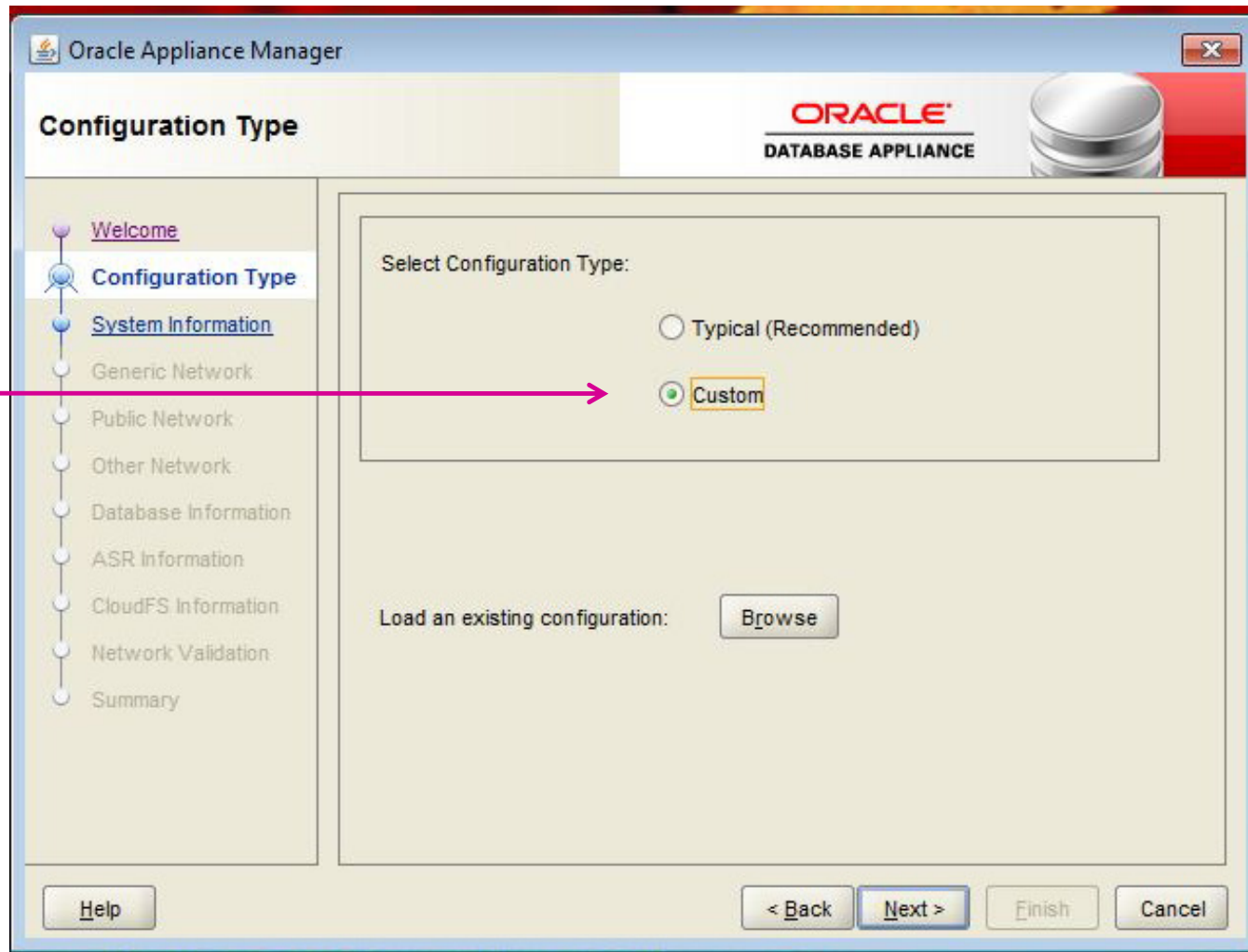
# Step 5: Perform ILOM Configuration



# Install Screens: 1



# Install Screens: 2



# Install Screens: 3

Oracle Appliance Manager

**System Information**

ORACLE  
DATABASE APPLIANCE

System Name: hqdarac02t

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 with the Oracle logo and 'DATABASE APPLIANCE'. On the left is a 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 is titled 'Generic Network' and contains the following fields:

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

At the bottom, there are buttons for Help, < Back, Next >, Finish, and Cancel.



# Install Screens: 5

Oracle Appliance Manager

**Public Network**

ORACLE  
DATABASE APPLIANCE

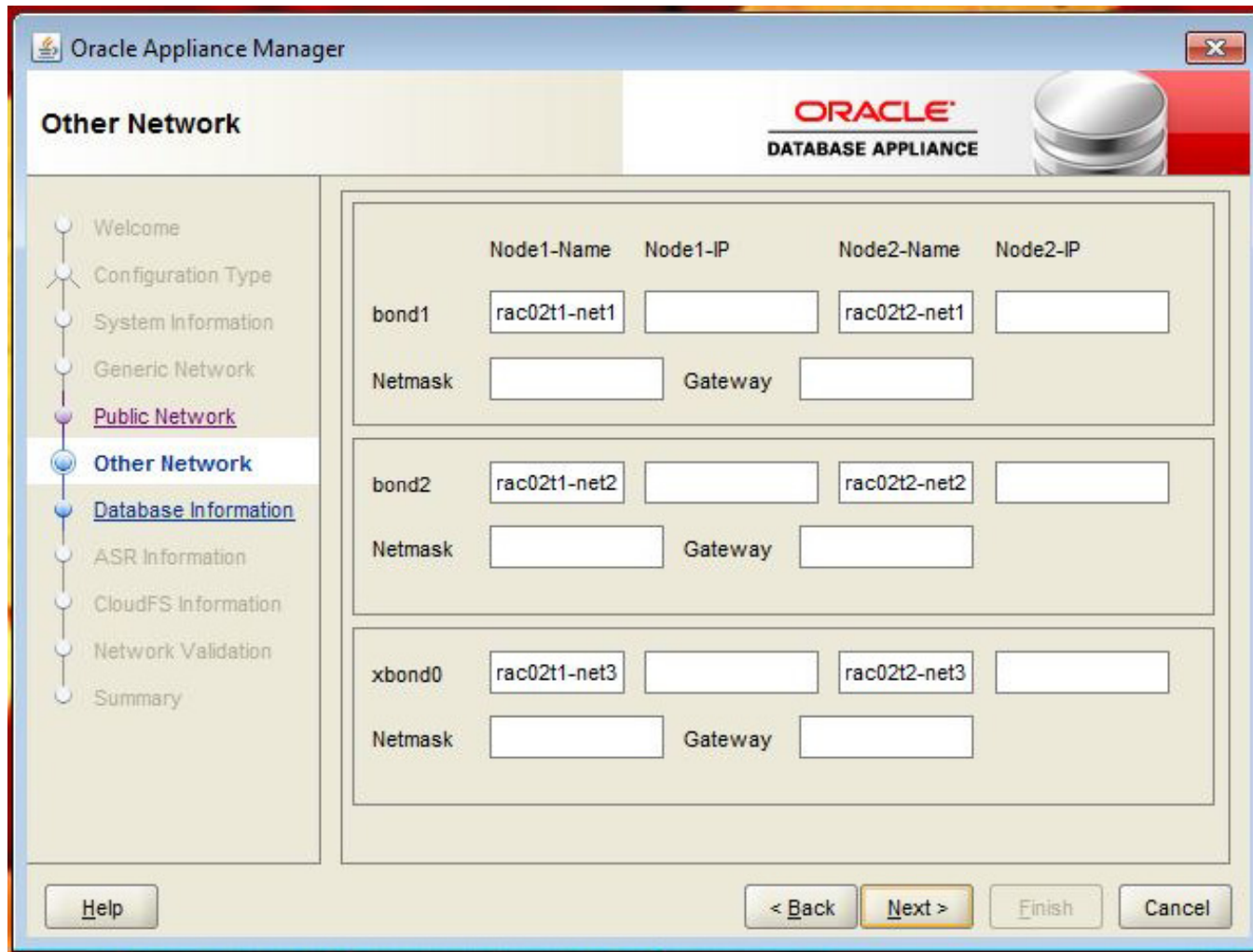
Welcome  
Configuration Type  
System Information  
Generic Network  
**Public Network**  
Other Network  
Database Information  
ASR Information  
CloudFS Information  
Network Validation  
Summary

	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

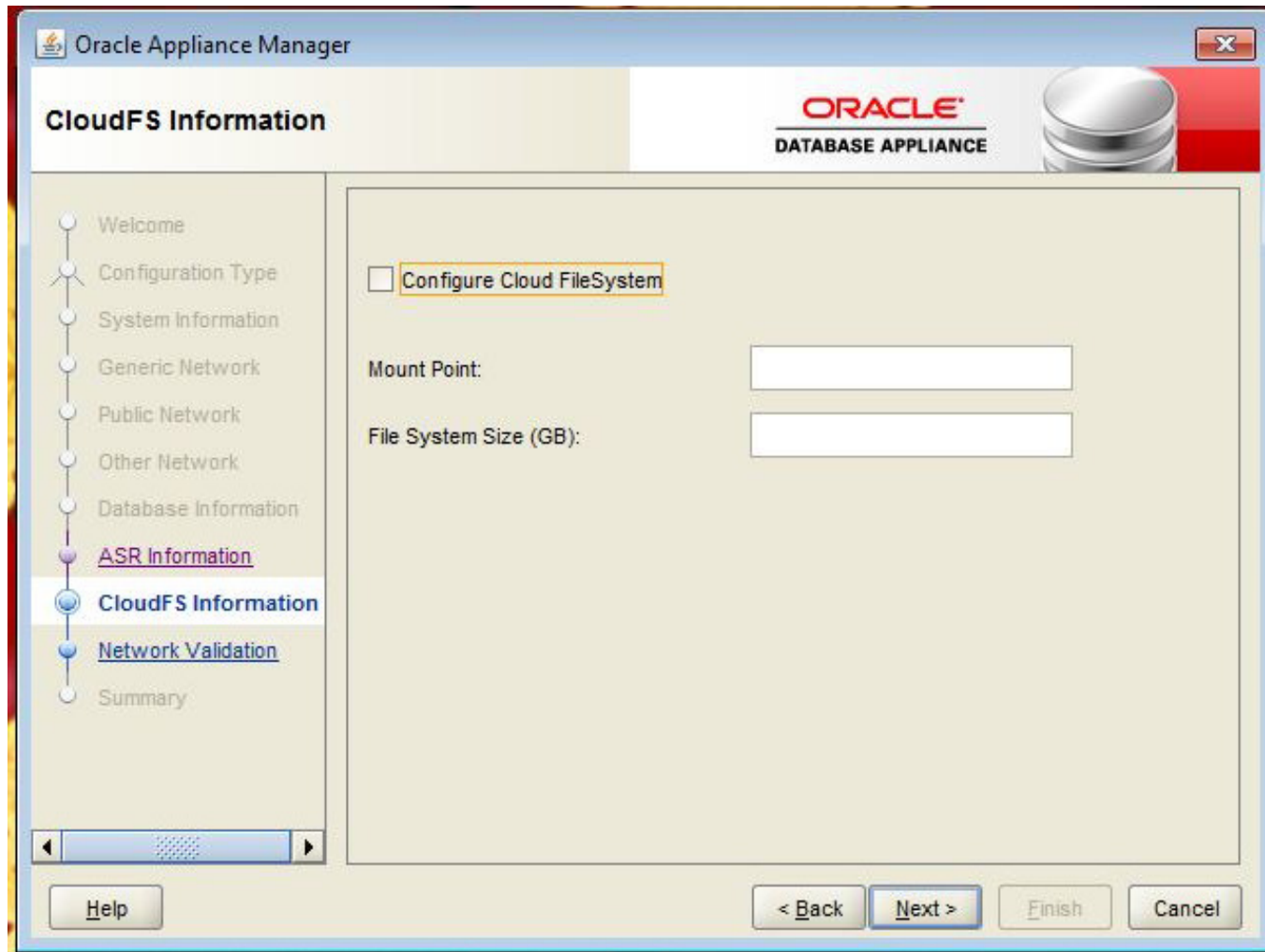
Database Territory: AMERICA

Help < Back Next > Finish Cancel

# Install Screens: 8

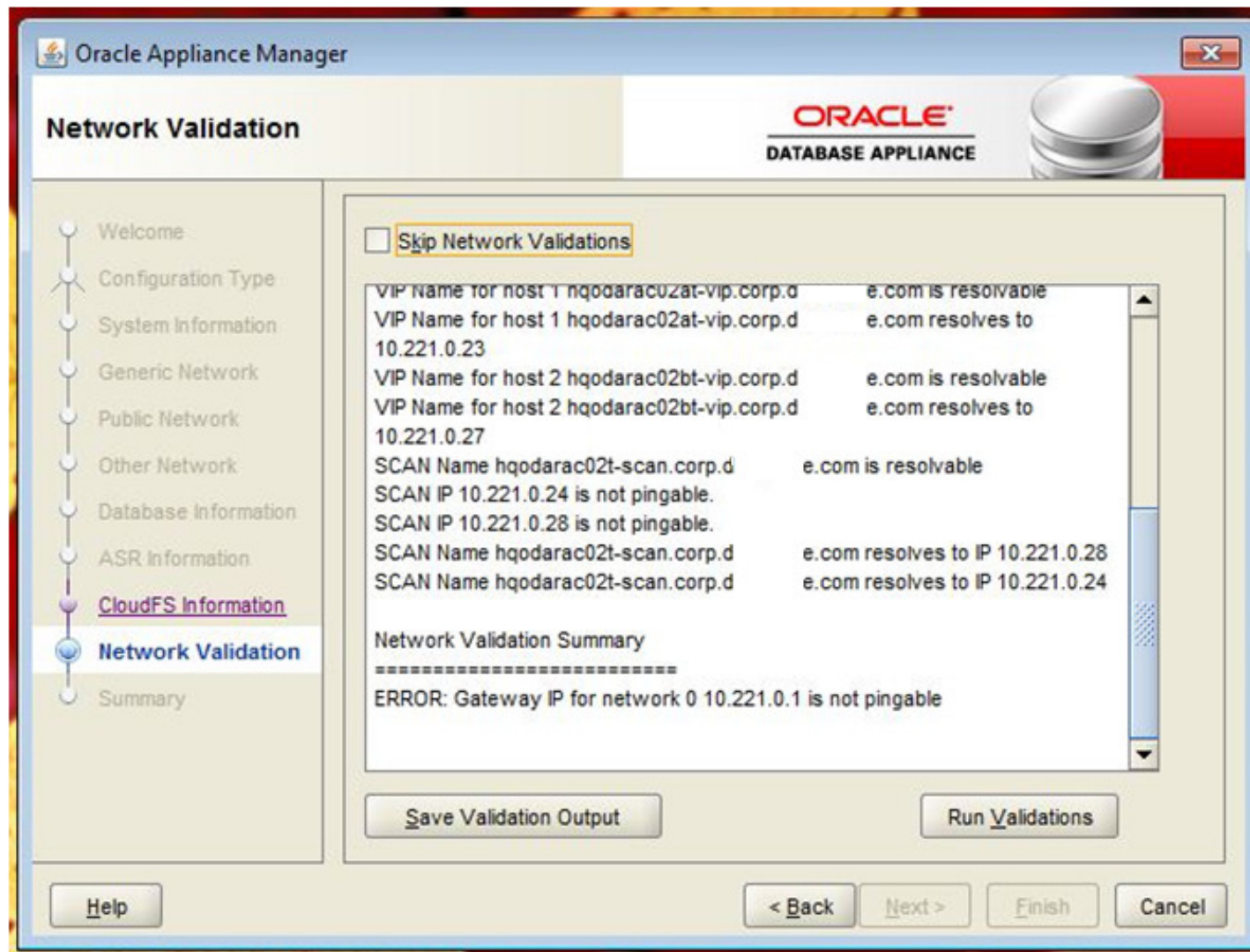
The screenshot shows the 'Oracle Appliance Manager' window. The title bar includes the Oracle logo and the text 'ORACLE DATABASE APPLIANCE'. The main window is titled 'ASR Information'. On the left, a vertical navigation pane lists the following steps: Welcome, Configuration Type, System Information, Generic Network, Public Network, Other Network, Database Information, **ASR Information** (highlighted), 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, there are four buttons: 'Help', '< Back', 'Next >', and 'Finish'. The 'Next >' button is highlighted.

# Install Screens: 9

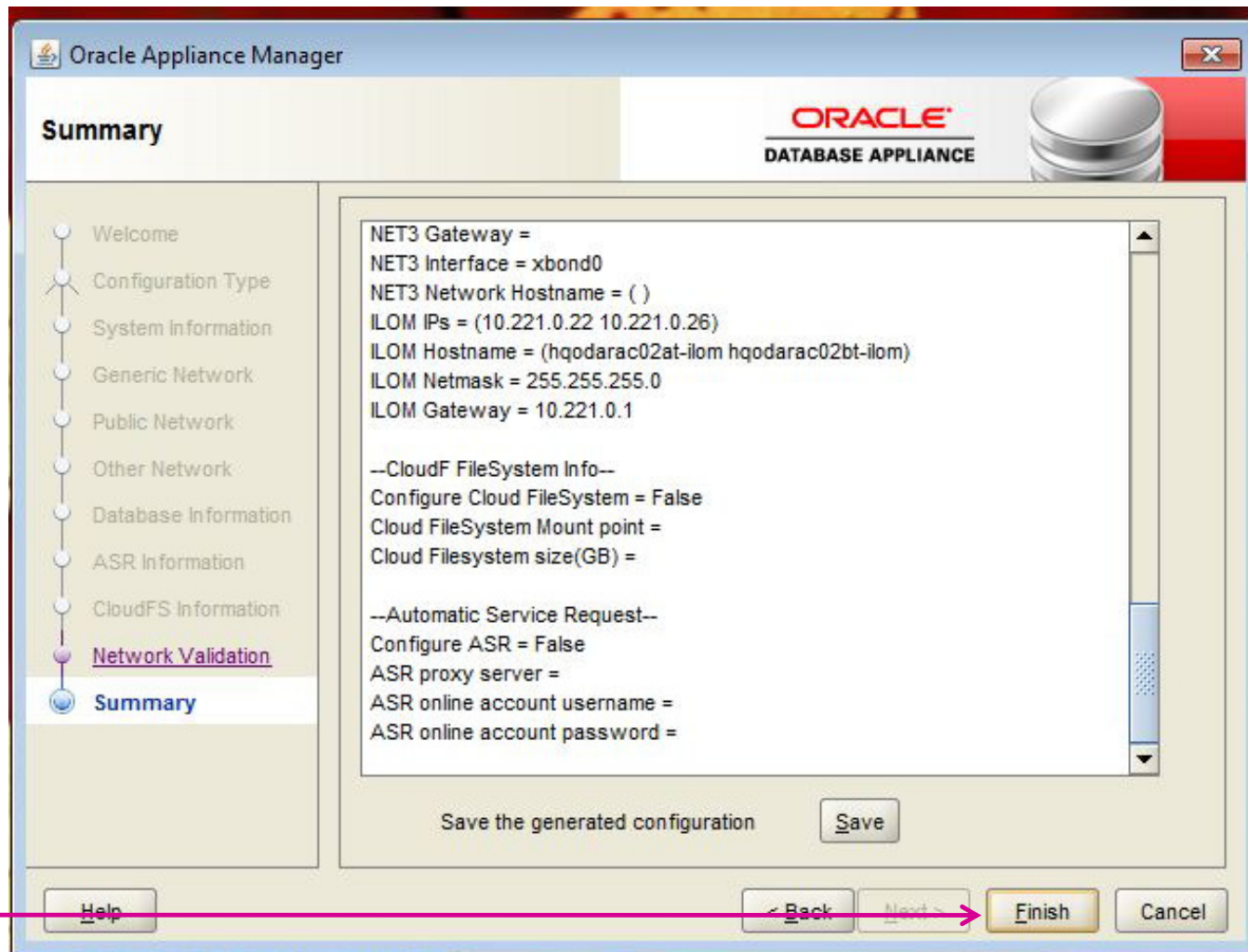




# Install Screens: 10



# Install Screens: 11



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# 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 has a "1 Warning" icon and buttons for "REFRESH" and "LOG OUT". 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 displays a table of sensor data. The table has three columns: "Name", "Type", and "Reading". The table lists various sensors, including those for the PEER, MB/HBA, and MB/P0/D0/D1/D2/D3. The "Reading" column shows the status of each sensor, such as "Present", "State Asserted", or "State Deasserted".

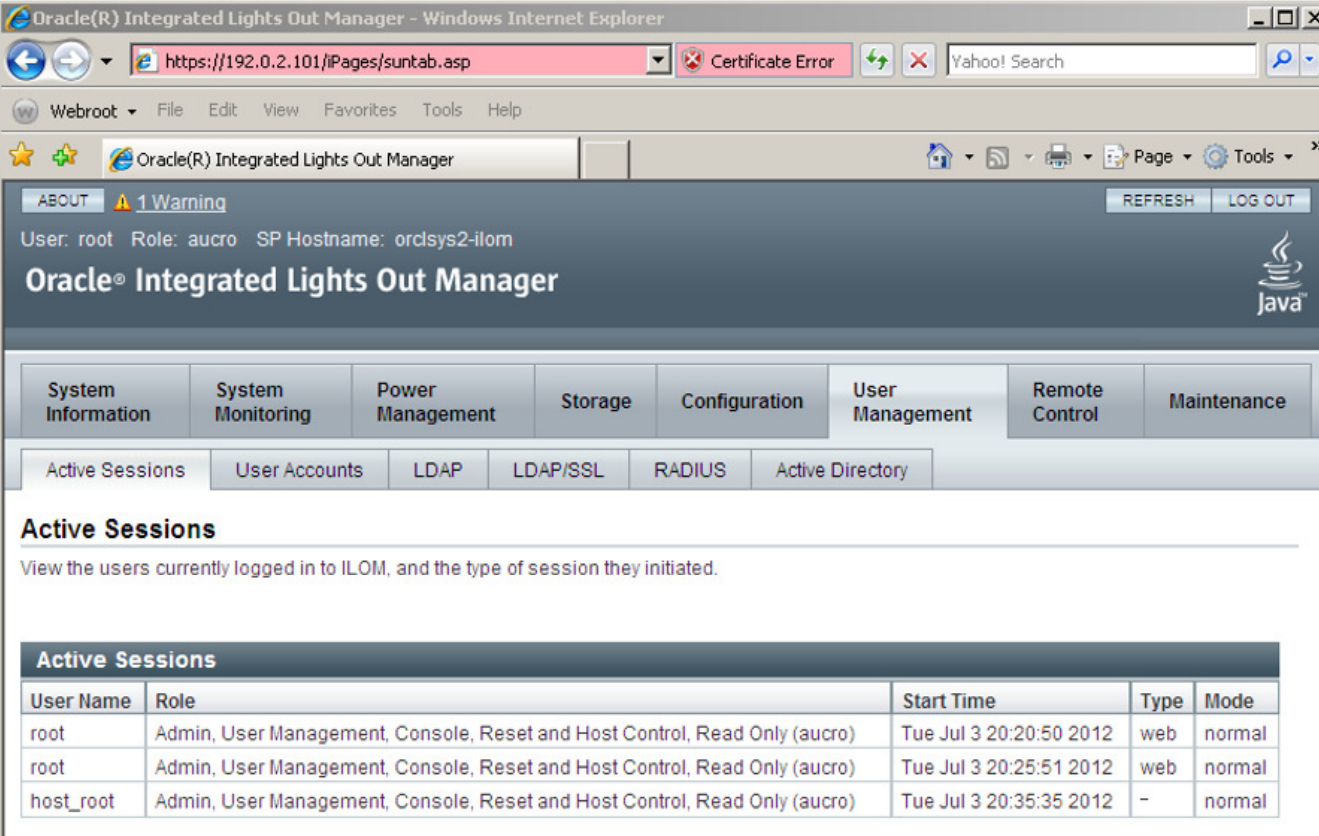
Name	Type	Reading
/SYS/PEER/PRSNT	Entity Presence	Present
/SYS/PEER/HOST_POWER	OEM	State Asserted
/SYS/PEER/FAN_FAULT	Fan	State Deasserted
/SYS/PEER/V_+5_V_FAULT	Voltage	State Deasserted
/SYS/PEER/SERVICE	OEM	State Deasserted
/SYS/PEER/SP_FAULT	OEM	State Deasserted
/SYS/MB/HBA/PRSNT	Entity Presence	Present
/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 displays the Oracle(R) Integrated Lights Out Manager (ILOM) web interface within a Windows Internet Explorer browser. The address bar shows the URL <https://192.0.2.101/iPages/suntab.asp>. The interface includes a navigation menu with tabs for System Information, System Monitoring, Power Management, Storage, Configuration, User Management, Remote Control, and Maintenance. Under the System Monitoring tab, there are sub-tabs for Sensor Readings, Indicators, and Event Logs. The Event Log tab is selected, showing 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



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: ordsys2-ilom

Oracle® Integrated Lights Out Manager

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

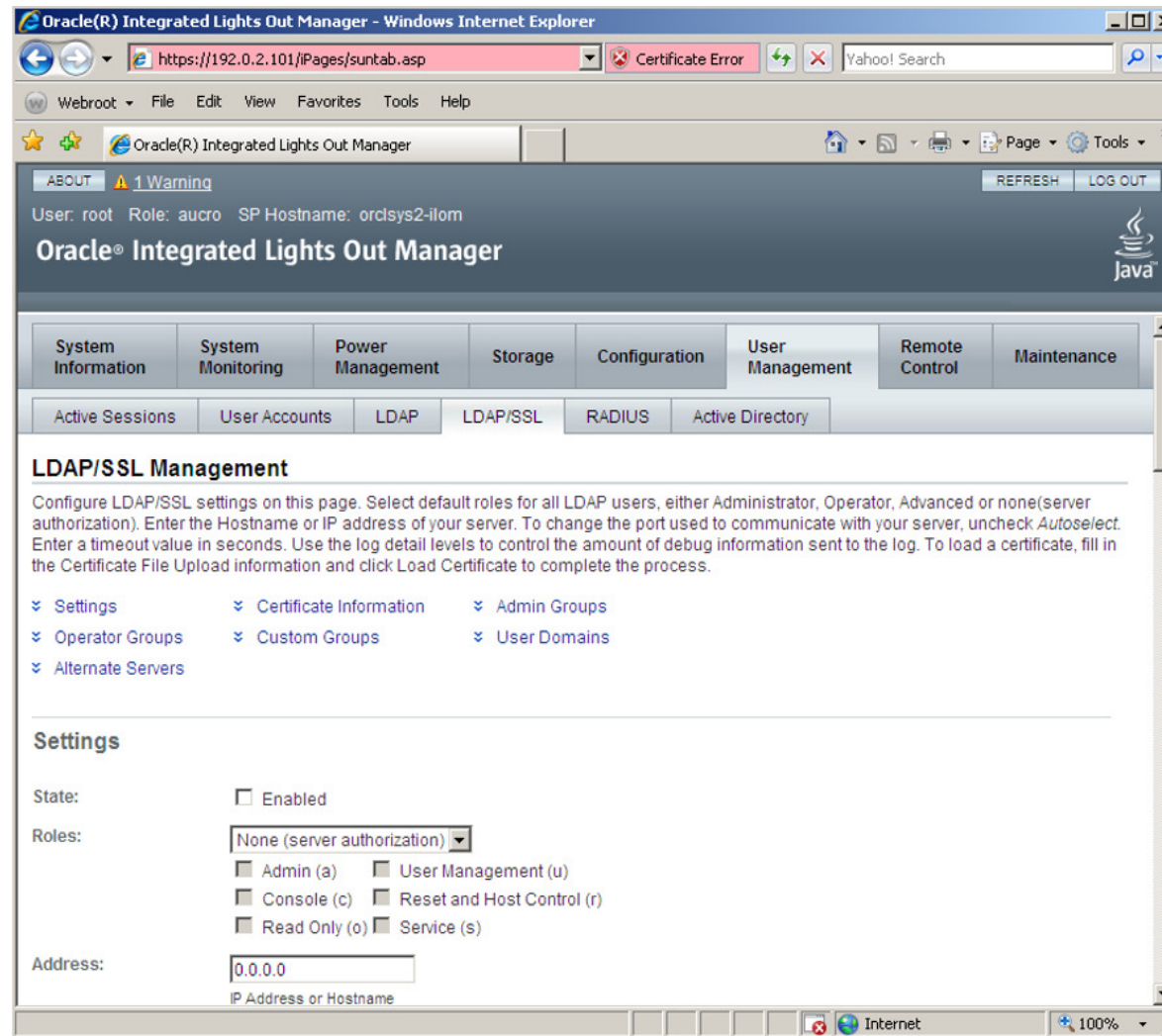
Active Sessions User Accounts LDAP LDAP/SSL RADIUS Active Directory

**Active Sessions**

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

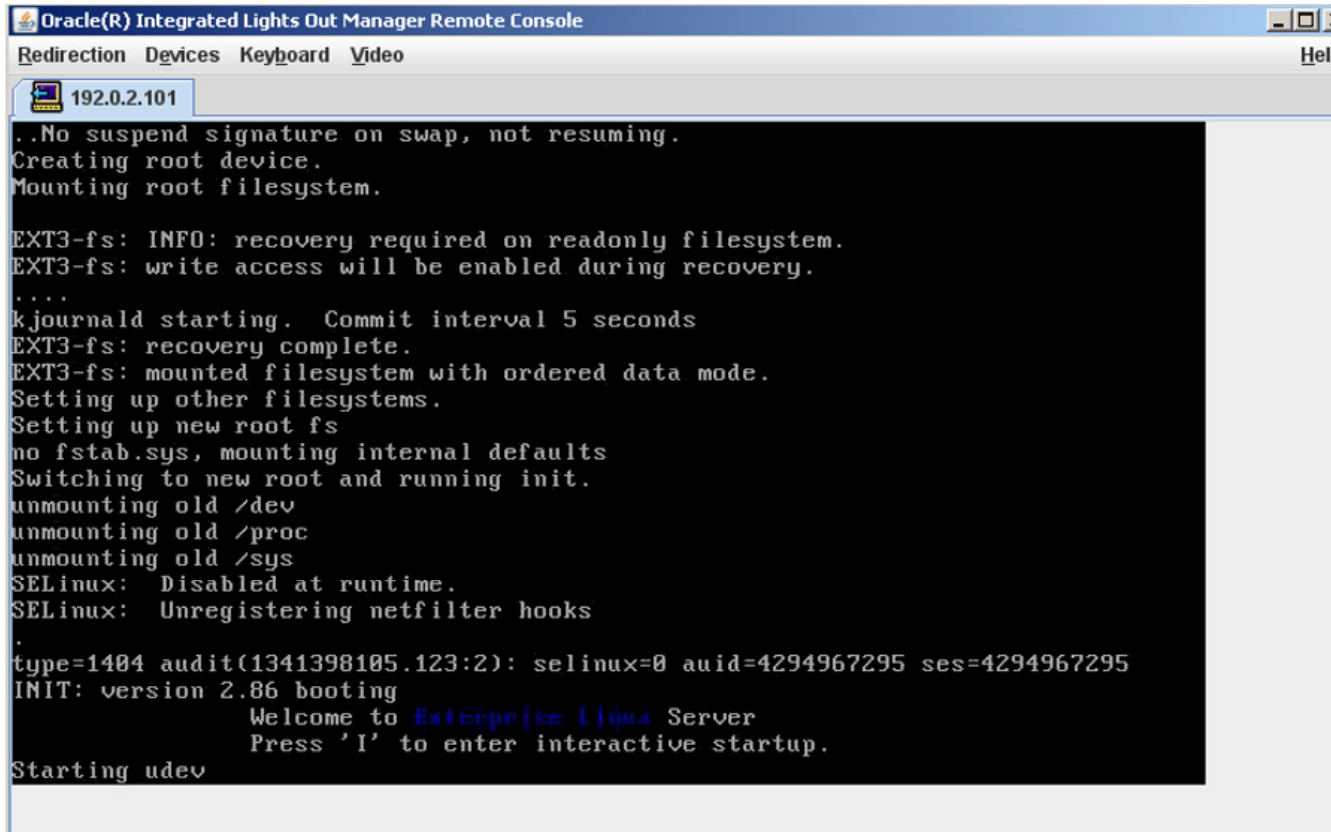
User Name	Role	Start Time	Type	Mode
root	Admin, User Management, Console, Reset and Host Control, Read Only (aucro)	Tue Jul 3 20:20:50 2012	web	normal
root	Admin, User Management, Console, Reset and Host Control, Read Only (aucro)	Tue Jul 3 20:25:51 2012	web	normal
host_root	Admin, User Management, Console, 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, there 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 text includes messages about swap, root device creation, filesystem mounting, journaling, and SELinux status. It ends with a welcome message to the Linux Server and a prompt to press 'I' for interactive startup.

```
..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

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# Full Support for High Availability

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

# One Button Solutions

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

# Support Center

The screenshot shows the Oracle Support Center interface in a Mozilla Firefox browser window. The browser's address bar displays the URL: [https://support.html.oracle.com/epmos/faces/jsp/SearchDocDisplay.jspx?\\_afLoop=6463580628317000&type=DOCUMENT&id=1449552.2&displayInd](https://support.html.oracle.com/epmos/faces/jsp/SearchDocDisplay.jspx?_afLoop=6463580628317000&type=DOCUMENT&id=1449552.2&displayInd). The Oracle logo and "MY ORACLE SUPPORT" are visible in the top navigation bar. The main content area is titled "Document Display" and shows a search for "ODA STIG". The search results list two items: "Place holder for STIG Implementation Script for Oracle Database Appliance" and "Information Center: Oracle Database Appliance". The "Information Center: Oracle Database Appliance [ID 1449552.2]" section is expanded, showing a sidebar with "Information Centers" (Overview, Hot Topics, Resources, Sun System Handbook, Hardware Compatibility Lists) and "Refine Search By Task" (Use Product, Troubleshoot, Patching And Maintenance, Install And Configure, Upgrade, Optimize Performance). The main content area displays "Alerts" (View the most up-to-date high impact and urgent issues for your product.?), "New Knowledge Documents" (Read recently published documents about your product), and "News & Announcements" (Read recently published news and announcements about your product.). The "Alerts" section lists an alert for "ALERT - ODA (Oracle Database Appliance) Mandatory OAK Patch 2.1.0.3.1" with document ID 1452085.1, updated on 04/23/2012. The "New Knowledge Documents" section lists two documents: "Oracle Database Appliance FAQ" (Document 1463638.1, updated 06/05/2012) and "How to use a separate Linux machine as your RPM repository to download and apply RPM's". The "News & Announcements" section shows "No Results". The "New Troubleshooting and Problem-Solution Documents" section lists two documents: "NEW ODA SETUP: FAILS WITH DOMAINNAME OF 'EXAMPLE', NOT EXAMPLE.COM" (Document 1455719.1, updated 05/04/2012) and "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

[Main Content](#)

[References](#)

### Applies to:

Oracle Database Appliance  
Generic Linux

### Main Content

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

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

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

# STIG Script

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- 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?

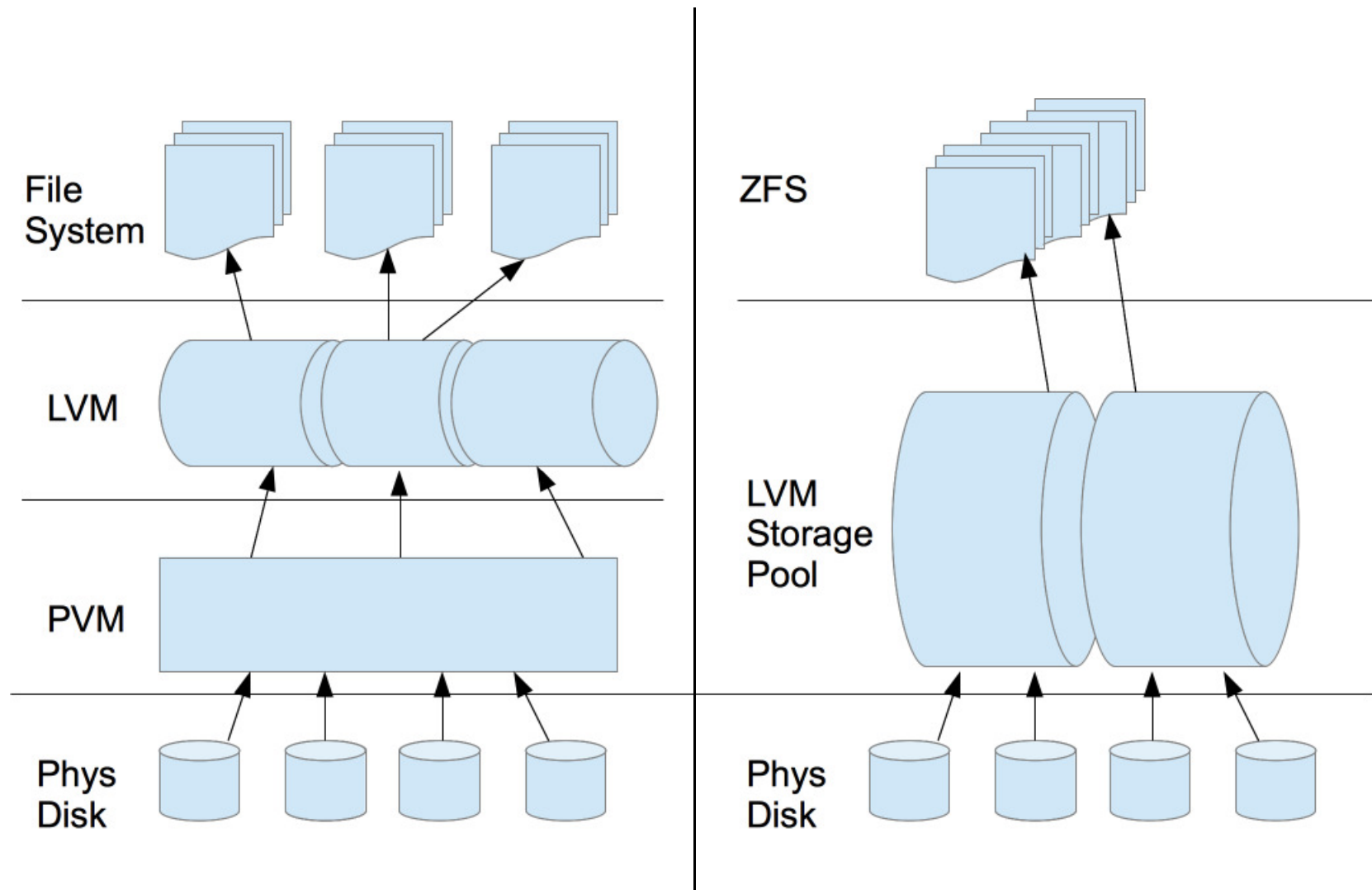


# Additional concern – silent corruption

---

- 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?

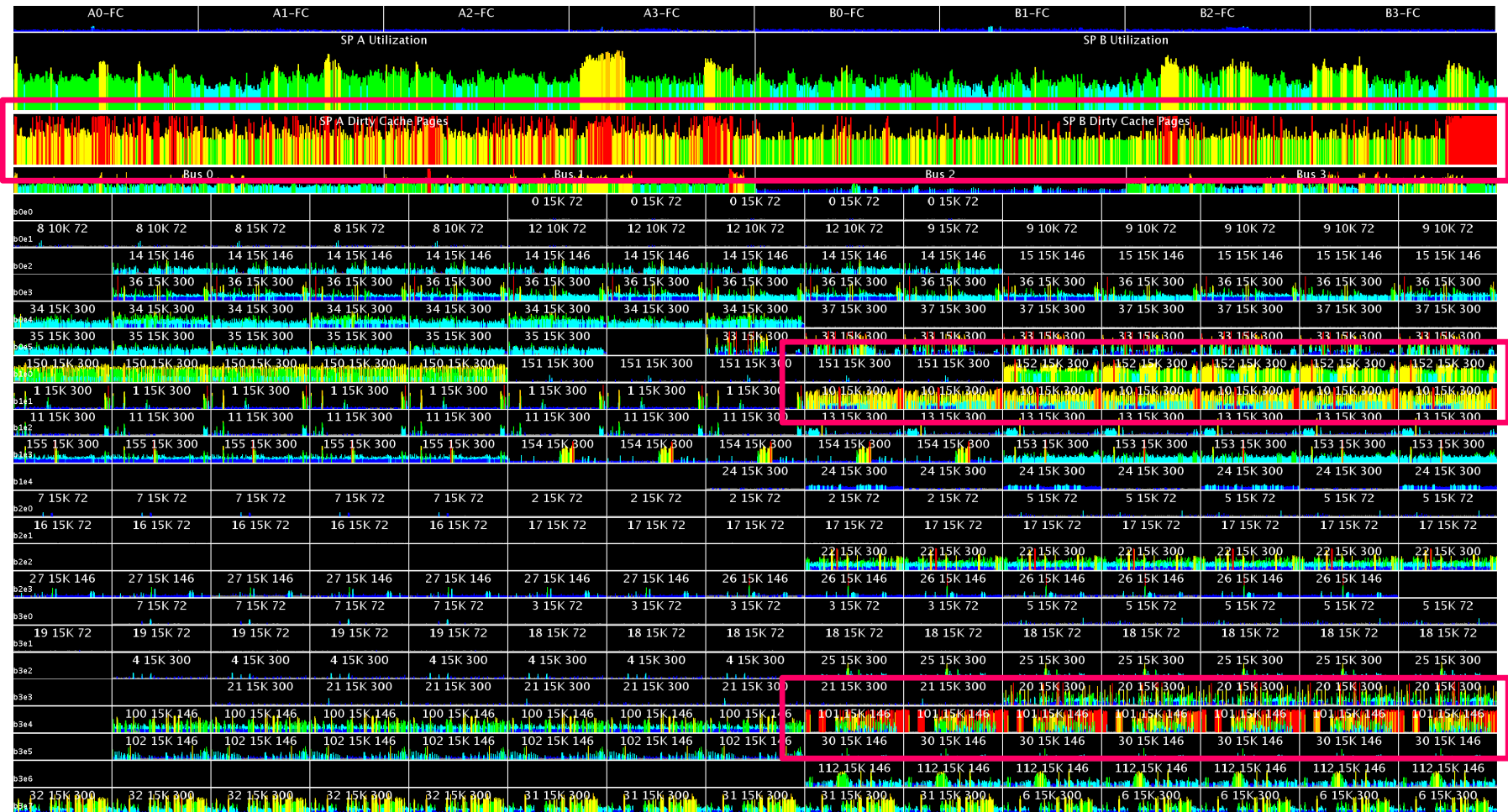
or would you rather be ...

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

---

# ZFS Storage Appliance

# CLARiiON CX4 480 Heat Map



1. Usage over 50% guarantees an component failure will overwhelm remaining resources producing an outage
2. Metrics coded in yellow are warnings
3. Metrics code in red indicate the database has been forced into a wait state while resources are recovered



# 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
<b>Architecture</b>			
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
<b>Base Configurations</b>			
Configuration options	<ul style="list-style-type: none"> <li>• 3.3 TB to 177 TB using either high-speed (15,000 RPM) or high-capacity (7,200 RPM) SAS-2 disks</li> <li>• 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)</li> </ul>	<ul style="list-style-type: none"> <li>• 6 TB to 432 TB using either high-speed (15,000 RPM) or high-capacity (7,200 RPM) SAS-2 disks</li> <li>• 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</li> </ul>	<ul style="list-style-type: none"> <li>• 6 TB to 1.73 PB using either high-speed (15,000 RPM) or high-capacity (7,200 RPM) SAS-2 disks</li> <li>• 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</li> </ul>

# ZFS In The Data Center

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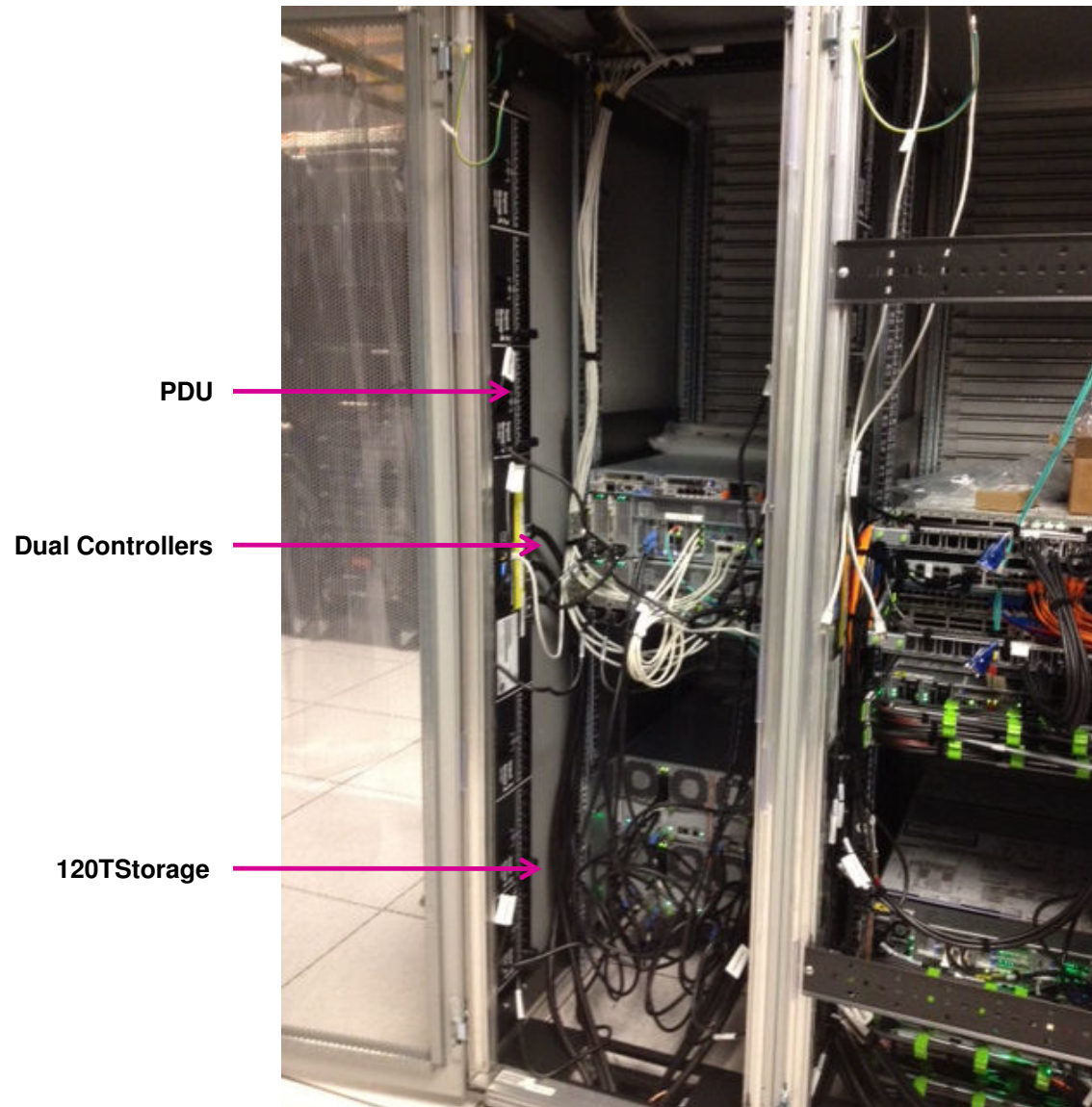
# ZFS 7420





# ZFS Internals

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# ZFS BUI: Config Services


The screenshot shows 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, displaying a list of services categorized into Data Services, Directory Services, System Settings, and Remote Access. Each service entry shows its name, status (Online or Disabled), a timestamp, and icons for refresh and power.

Category	Service Name	Status	Timestamp	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 7420

 The cluster peer has rejoined the cluster.

LOGOUT HELP

Dismiss







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

ABORT COMMIT

### 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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16

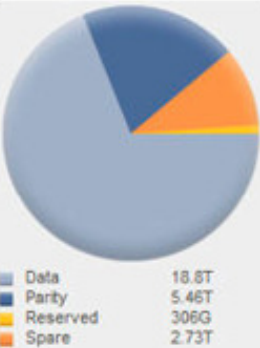
17

18

# ZFS BUI: Config Storage



SUN ZFS STORAGE 7420

 The cluster peer has rejoined the cluster.

LOGOUT HELP  
Dismiss

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

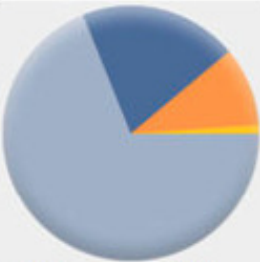
ABORTCOMMIT

### 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

#### Data Profile

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

#### Disk Breakdown

Data + Parity

9 disks  

Spare

1 disks  

Log

0 disks  

Cache

0 disks

#### 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.

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Integrating ODAs with ZFS to Create an Ideal Database Environment

Presented: Oracle User Group Finland - 16 April, 2013



# ZFS BUI: Config Network Config

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

**Configuration** Maintenance Shares Status Analytics

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

### 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.

**Configuration** Addresses Routing

REVERT APPLY

Devices	Datalinks	Interfaces
<b>BUILT-IN</b>		
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
<b>PCIe 3</b>		
ixgbe0 10Gb (full)		
ixgbe1 link down		
<b>PCIe 6</b>		
ixgbe2 10Gb (full)		
ixgbe3 link down		
<b>PCIe 7</b>		
ibp2 port down		
ibp3 port down		
<b>PCIe 2</b>		
ibp0 port down		
ibp1 port down		

# ZFS BUI: Configuration Services LDAP

The screenshot shows the Sun ZFS Storage 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 page is titled 'LDAP Directory Service' and provides instructions on recognizing users and groups in an LDAP directory. It also includes links for 'See Also', 'Help: LDAP', and 'Wikipedia: LDAP'. The configuration settings for the LDAP service are as follows:

- 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...](#)

Below the configuration settings, there is a 'Servers' section showing 1 total server. The table below lists the server details:

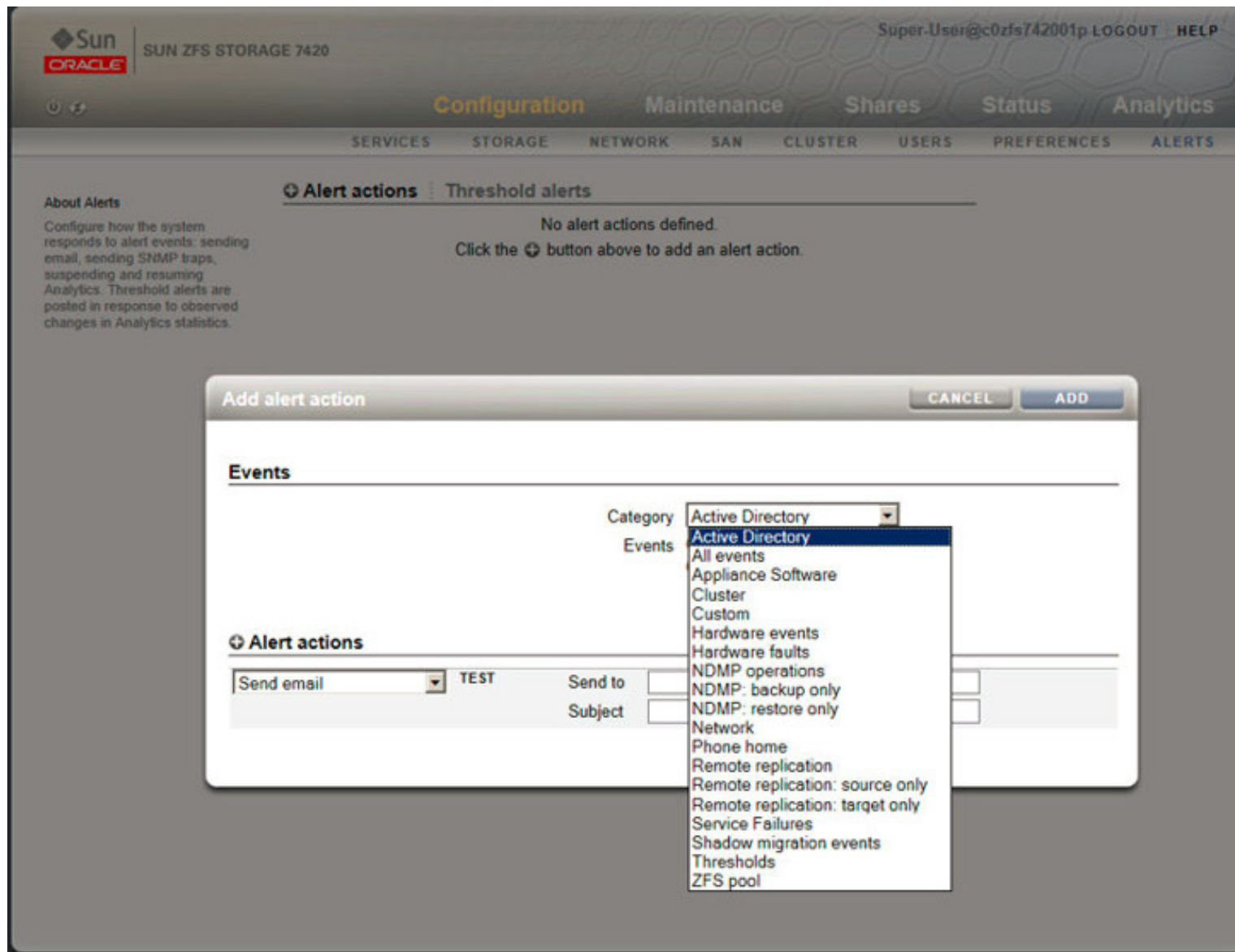
SERVER	CERTIFICATE	EXPIRES
perrito3.m1ib.com:389		



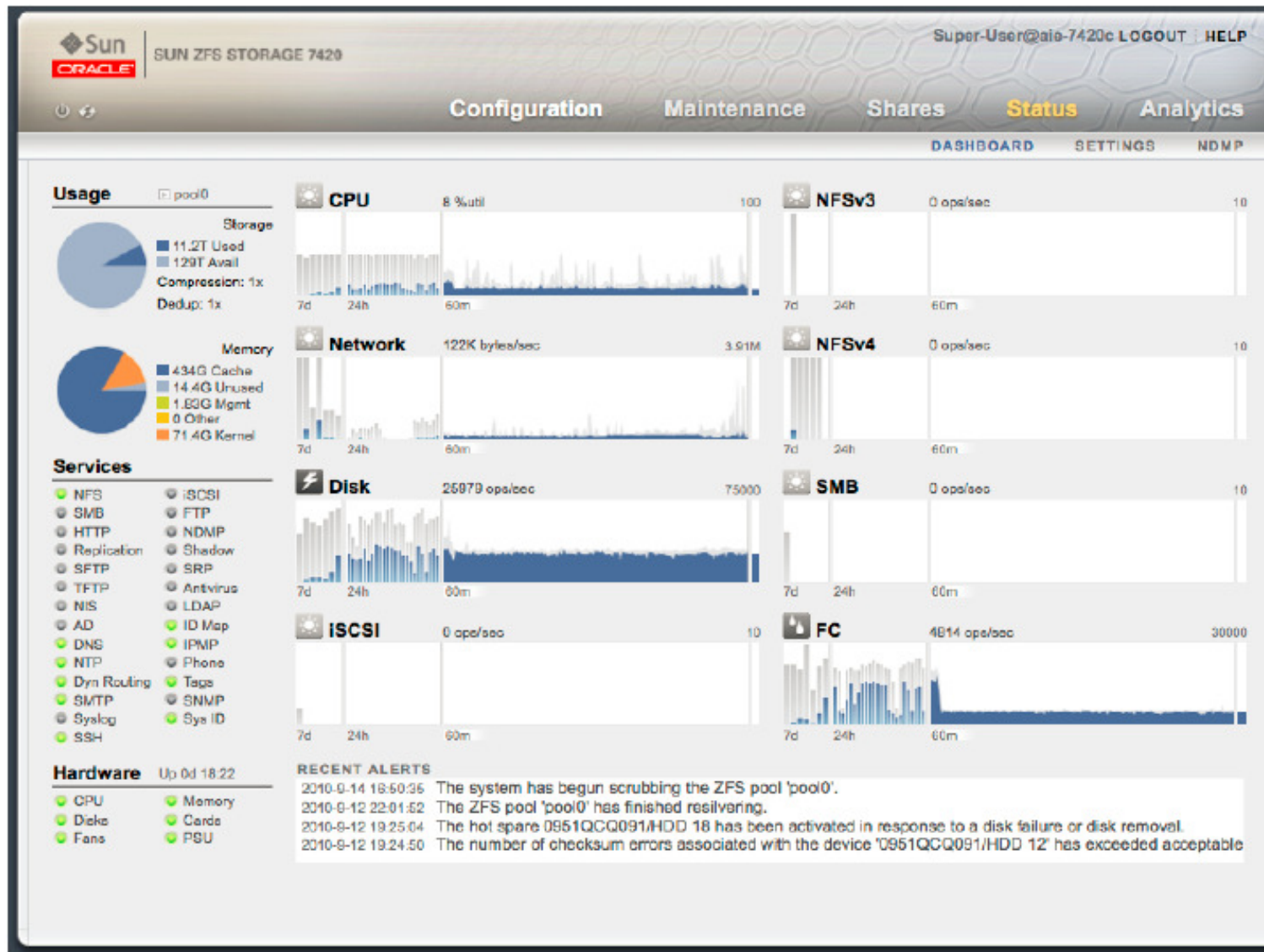
# ZFS BUI: Maintenance Logs

		Configuration	Maintenance	Shares	Status	Analytics
		HARDWARE		SYSTEM	PROBLEMS	LOGS
				WORKFLOWS		
<b>Alerts</b> 119 Total				100-119		
<b>ALERTS</b>		<b>FAULTS</b>		<b>SYSTEM</b>		
				<b>AUDIT</b>		
				<b>PHONE HOME</b>		
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"><li>▪ Gives up appliance root password</li><li>▪ Gives up 2:00am support calls</li></ul>	
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?

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- 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

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



Thank you