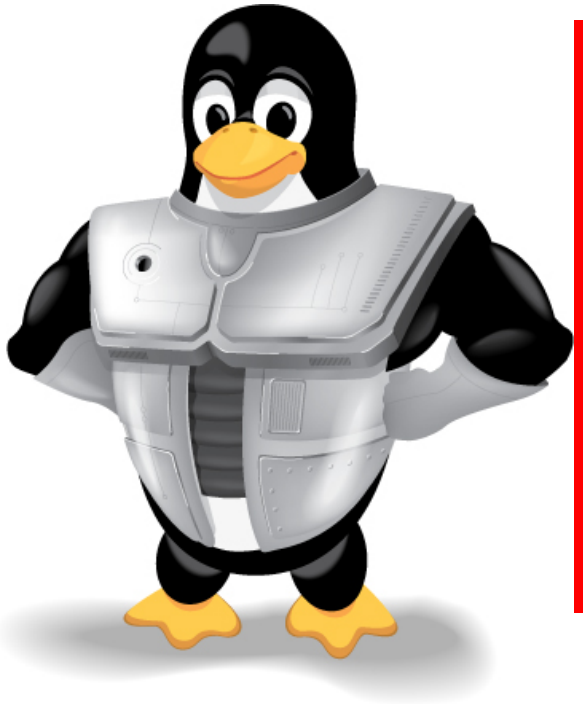
# Oracle Unbreakable Linux and Oracle VM



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# Agenda

- Oracle Enterprise Linux/Unbreakable Linux Support Overview
- Oracle Enterprise Linux (OEL) Release Cycle & Distribution Comparison with Red Hat Enterprise Linux (RHEL)
- Oracle VM Server Virtualization Technologies
- Oracle Grid and Oracle Virtualization Oracle VM 2.1.2 Technical Review
- Oracle VM Architecture & System Design

Photo: kyber

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# Resources

- **Oracle Linux Home Page**
  - http://oracle.com/linux
- **Linux Technology Center**
  - http://www.oracle.com/technology/tech/linux/
- **Unbreakable Linux Network**
  - http://linux.oracle.com
- **Unbreakable Linux Network: An Overview**
  - http://www.oracle.com/technologies/linux/uln-whitepaper.pdf

# Oracle Unbreakable Linux

- **Oracle Enterprise Linux** = Software
  - Tracks Red Hat Enterprise Linux product releases
- **Oracle Unbreakable Linux** = Support Program
  - http://linux.oracle.com

# Oracle's Long-term Investment in Linux

**1998** Oracle first commercial database on Linux
- Other ISV's then began porting their applications to Linux

**1999** Investments in multiple Linux startups
- Red Hat, Miracle Linux, VA Linux

**2002** Contributes cluster file system to Linux
- Key enabling technology for high-performance Linux grids

Unbreakable Linux program
- Oracle fixes Priority 1 Linux Bugs for Oracle customers
- Free Linux patches to customers and vendors

**2004** Oracle sponsors Linux security certification
- Linux gets EAL certified for use in secure systems

**2006** Offers enterprise-class support for Linux
- Ongoing technical contributions to Linux community

# Development Process

- Frequent checks with Red Hat (hourly – automated)
- Build server detects changed packages
- Most packages built automatically
- Typically available on ULN within hours
- Updates, bug fixes, and security fixes announced on EL Errata mail list

# Released Versions of OEL

- OEL4:
  - Update 4, Update 5, Update 6: x86, x86-64
  - Update 6: Itanium
- OEL5:
  - Update 1, Update 2: x86, x86-64
- ***ULN***
  - Enterprise Linux 3 Update 8, Update 9 x86, x86-64

# General Timelines for OEL Releases

- Major OEL releases (e.g. OEL5)
  - Several weeks after corresponding RHEL release
- Updates to existing releases (e.g. OEL4 U6, OEL5 U1)
  - One week after corresponding RHEL Update release
- Erratas for single packages
  - A few hours after corresponding RHEL errata

# Release Cycle

## Automated Process:

- Released Red Hat source rpms downloaded & imported
- Copyrights, trademarks, logos removed
- Oracle patches applied, if necessary
- Rebuild
- Extensive testing
- GPG sign packages
- Release on ULN and/or eDelivery

# Copyrights, Trademarks, Logos

- RHEL packages are released under Open Source Licenses, such as the GPL—Legally bound to make source code available
- To redistribute the software, trademarks must be removed
- Some documentation is released under Red Hat EULA license, it must be removed
- Remove “Red Hat” trademark and “Shadowman” logo
- Remove “RPM” and “Maximum RPM” logos
- Modify “Red Hat Enterprise Linux” to “Enterprise Linux”
- Modify bug reporting address/URL, if necessary

# OEL Specific Patches – 3 Types

1) Patches to handle trademark issues
   - No functionality changes
   - Not contributed back to Red Hat
2) Patches to rebuild
   - Minimal, usually related to missing include files or libraries
   - No code changes
   - Contributed back to Red Hat and upstream if appropriate
3) Patches for critical customer fixes
   - Very limited in number (since beginning of OEL, about 40)
   - Contributed back to Red Hat and upstream if appropriate

- No feature enhancements
- No optimizations

# A Patch Life

- For each Oracle code patch, a bug report including the patch is created in the Red Hat public bug repository (bugzilla.redhat.com)
- If appropriate, the patch is contributed to the upstream community.
- If package is reissued by Red Hat and includes a fix for the problem, Oracle patch is dropped and Red Hat version is adopted (whether or not solution is same as Oracle's)

# Distribution

- Binary RPMs: from ULN
- Source RPMs: from ULN
- ISOs: from eDelivery (for now only CD ISOs)
- DVDs: physically ordered via Oracle store
- Other sites:
  - http://oss.oracle.com/el4/
  - http://oss.oracle.com/el5/
  - Debuginfo RPMs and source RPMs available there
- ULN: separate channels for each version (4 and 5), each update and each architecture (x86, x86-64, Itanium)

# OEL and RHEL Compatibility

- OEL and RHEL are ABI, KABI and binary compatible
  - Application binary interface (ABI)
  - Kernel application binary interface (KABI)
- Oracle DB(10gR2, 11g) same binary runs on RHEL &OEL
- LSB certified (OEL4, OEL5, x86, x86-64)
  - Linux Standard Base
- EAL4+ security evaluation (OEL4 done, OEL5 in progress)
  - http://www.oracle.com/technology/deploy/security/seceval/security-evaluations.html
- Maintaining Compatibility: Oracle is responsible for fixing any ABI/API incompatibilities introduced by Oracle modifications

# RHEL and OEL Differences – OEL4

- 827 packages in the distribution (src.rpm's)
- 83 packages modified
  - ~70 packages: Trademark changes only
  - ~10 packages: Changes for rebuilds to work
  - < 5 packages: Changes for critical customer fixes
  - 3 packages: Oracle additions (OCFS2 related – wireshark, kernel, ethereal)
- 3 packages replaced
  - redhat-release, rpmdb-redhat, redhat-logos
- 2 packages removed
  - anaconda-product, specspo
- 10 packages added
  - ocfs2, ocfs2-tools, oracleasm, oracleasm-support, python-elementtree, python-sqlite, python-urlgrabber, sqlite, uln-yumconf, yum

# RHEL and OEL Differences – OEL5

- 1,105 packages in the distribution (src.rpm's)
- 68 packages modified
  - 54 packages: Trademark/logos/branding changes only
  - 7 packages: Changes for rebuilds to work
  - < 5 packages: Changes for critical customer fixes
  - 2 packages: Oracle additions (OCFS2 related)
- 8 packages replaced
- 6 packages removed
- 4 packages added

# Replaced and Removed RPMs (OEL5)

- Redhat-logos ➡ oracle-logos
- redhat-release ➡ enterprise-release
- redhat-release-notes-5Server ➡ enterprise-release-notes-5Server
- rhn-setup ➡ up2date
- rhn-setup-gnome ➡ up2date-gnome
- rhn-client-tools ➡ up2date
- rhns ➡ up2date
- rhn-check ➡ up2date
- yum-rhn-plugin
- Fonts-chinese
- Deployment_Guide (documentation package)
- Virtualization (documentation package)
- Global_File_System (documentation package)
- Cluster_Administration (documentation package)

# Added RPMs (OEL5)

- ocfs2
- ocfs2-tools
- oracleasm
- oracleasm-support

# OEL Kernels

- OEL 5 ISOs include 2 kernels.
  - RHEL unmodified kernel (installed by default)
  - Oracle modified kernel
- Typical kernel changes (OEL5)
  - Add entropy module option to e1000 and bnx2 [ORA 6045759]
  - Fix msi issue with kexec/kdump [ORA 6219364]
  - Fix alloc_pages_node() static `nid' race kernel crash [ORA 6187457]
  - Fix bad unlock_page() in error case [ORA 6263574]
  - Fix error-path crashes in dio [ORA 6242289]

# Unbreakable Linux Network

- Updates, bug fixes, and security fixes
- Extra packages
- Access via up2date and Web browser
- Errata mailing list

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# ULN Channels

- Enterprise Linux
  - Latest
    - default channel after registering
  - Installation media copy
  - Patches
  - Add ons
- Oracle software for Enterprise Linux
- Oracle VM

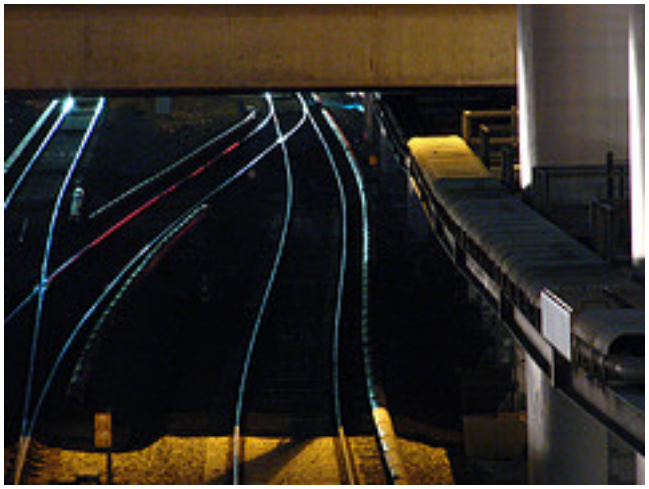
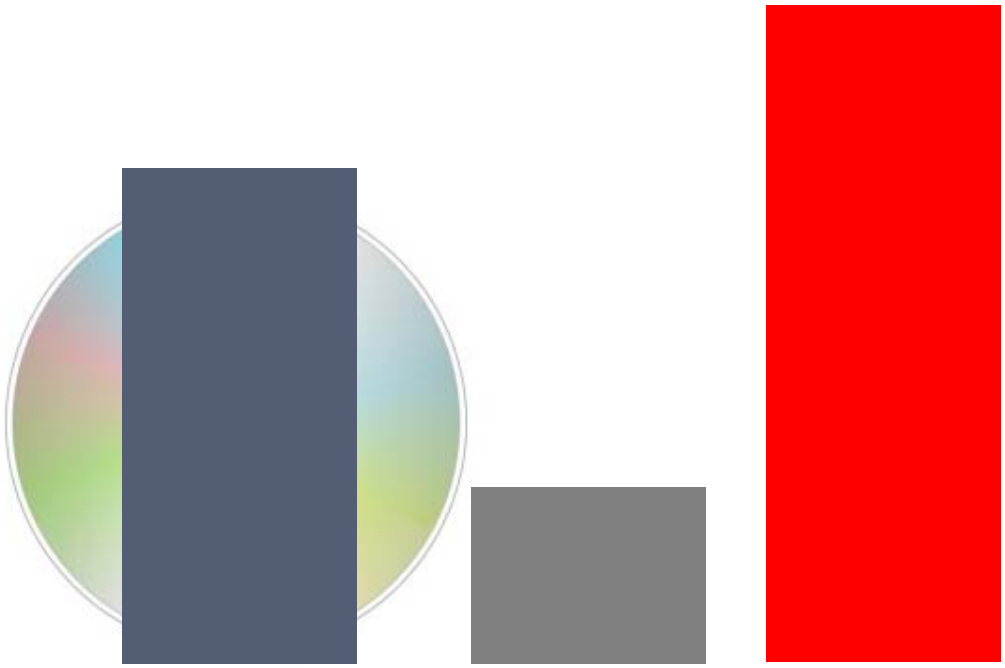


Photo: pbo31

# ULN Channels



- EL4 Update 5 installation media copy (x86_64)
- EL4 Update 5 Patches (x86_64)
- EL4 Latest (x86_64)

# Oracle Channel

- oracle-validated RPM
- Oracle ASM library
- Oracle XE
- Instant client
- Oracle authentication services
- SQL Developer

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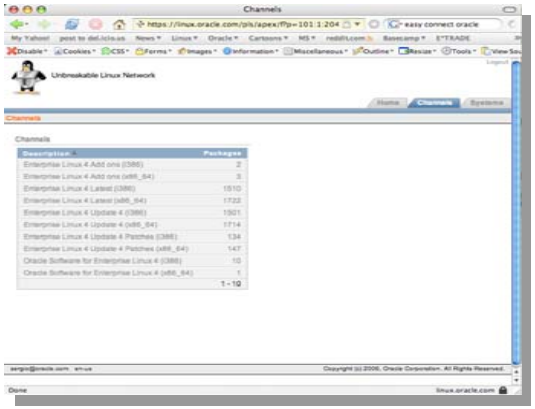
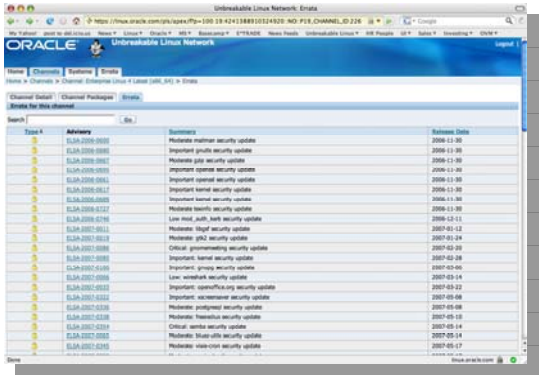
# ULN Web Access

- linux.oracle.com
- Search packages
- Download packages
  - Binary and source
- Manage channel subscriptions
- See how current your registered servers are



# Patching Systems with ULN

- Individually Registered Servers
- Local Yum Repositories
- Oracle Management Pack for Linux

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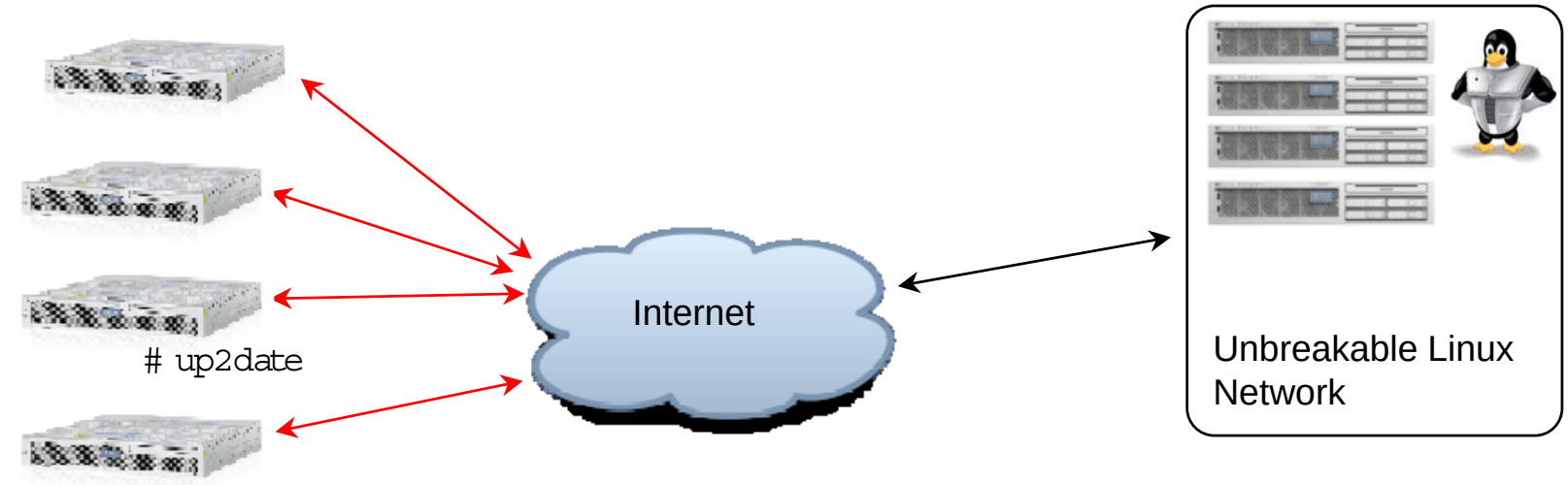
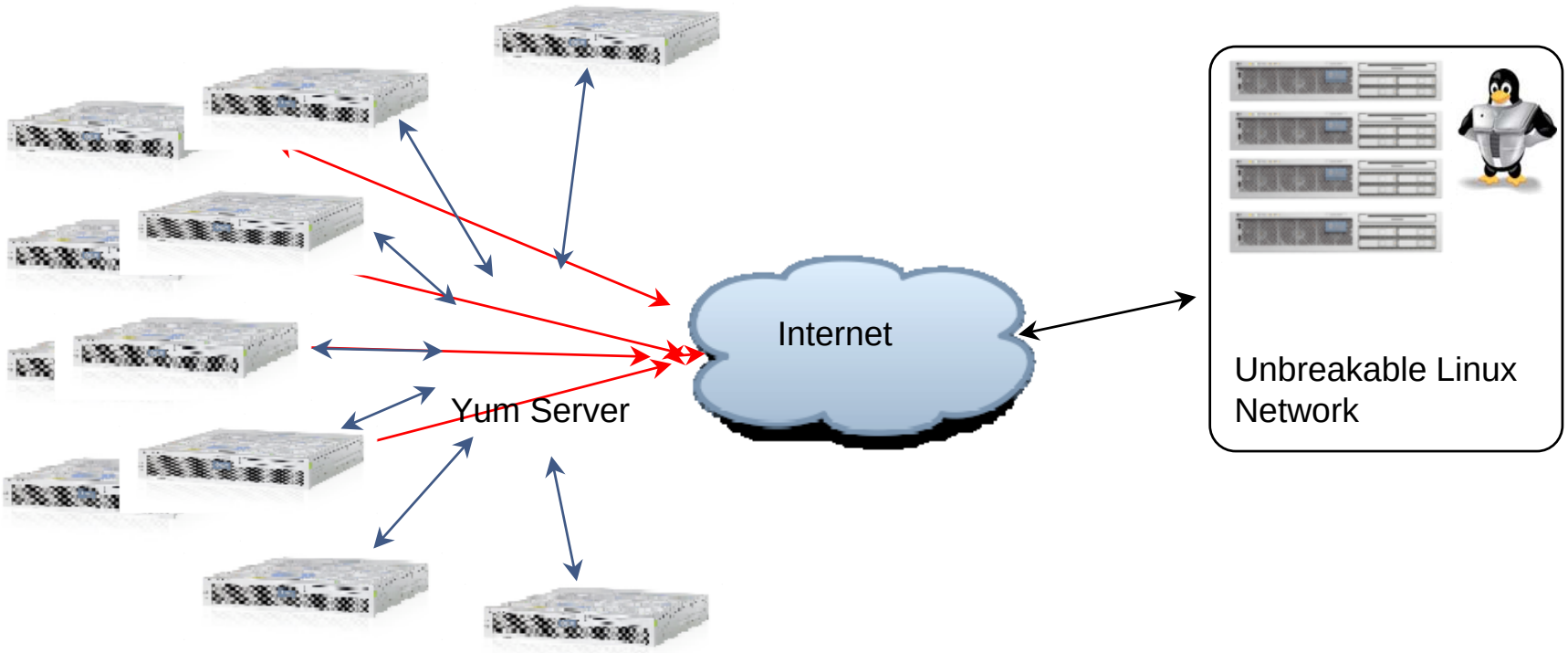
# Individually Registered Servers

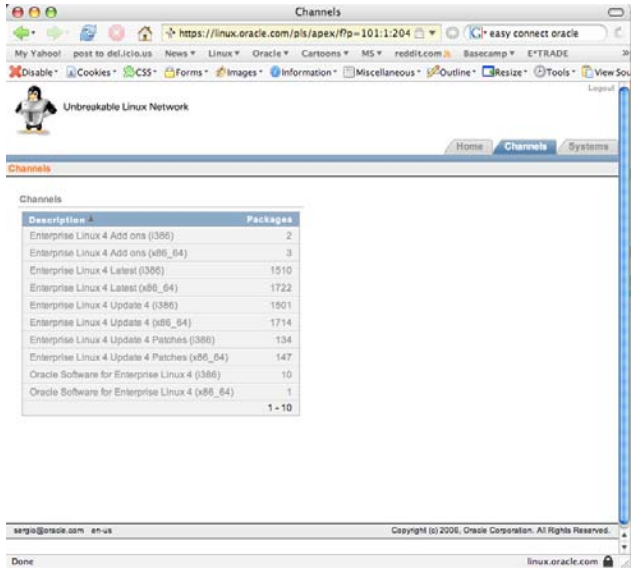


# Local Yum Server Setup

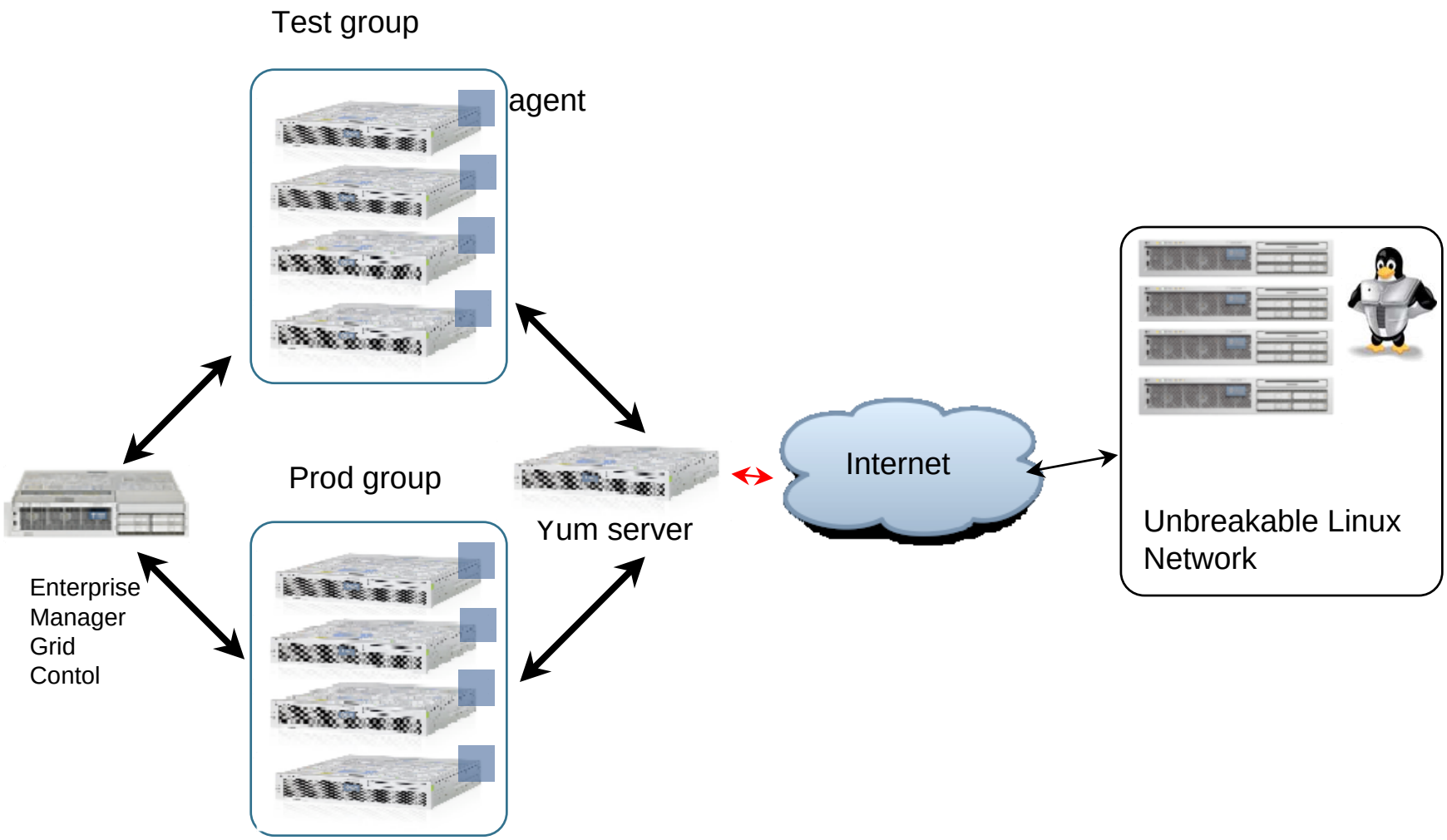


# Local YUM Repository

- Open source solution
- How to available via OTN
- Setup rpm via ULN
- Script to sync local repositories with ULN channels

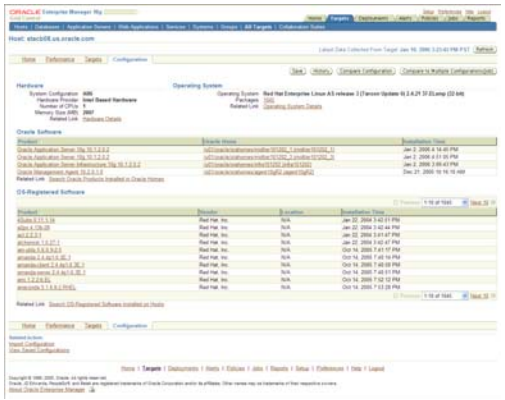


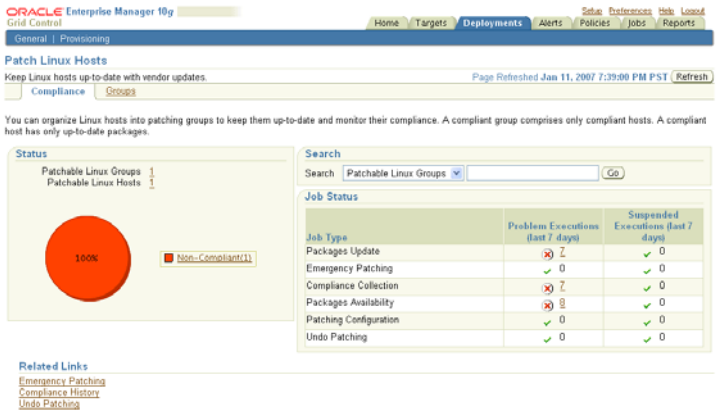
# Oracle Management Pack for Linux

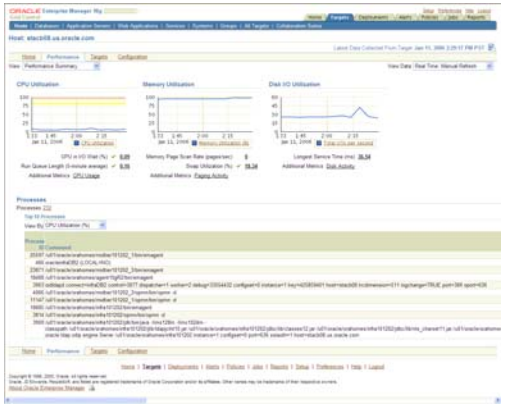


# Linux Management with Enterprise Manager

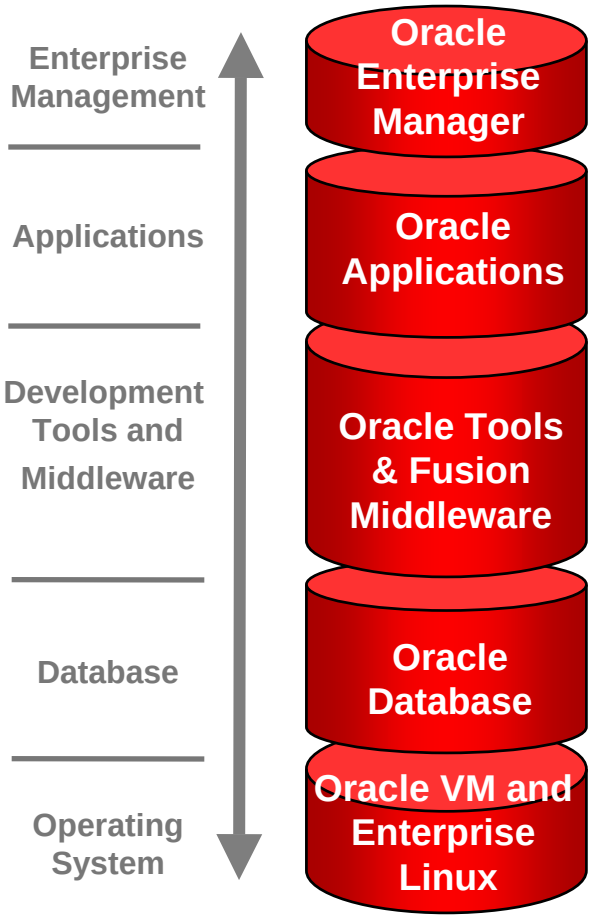
- Group management
- Linux patching
- Bare metal provisioning
- Configuration management
- Monitoring





# Oracle: Most Complete, Open, Integrated Enterprise Software Stack for Linux




## Customer Benefits

- Standard components
- Validated configurations
- Synchronized releases
- Easier to manage
- Greater security
- Higher reliability
- Rich partner ecosystem
- Hot-pluggable
- One-stop, seamless support
- Lowers cost of ownership
- Open and standards compliant
- Integrates open source components

# Oracle's Unique Focus on Linux Testing

- Real-world regression and stress testing
- Customer-centric testing:
  - Test Linux features that matter to Oracle customers
  - Oracle and non-Oracle workloads (e.g. backup) running concurrently
  - Adverse conditions (low memory, low disk space, etc.)
  - Long, continuously running stress tests (detect memory leaks)
  - Check for performance regression and degradation

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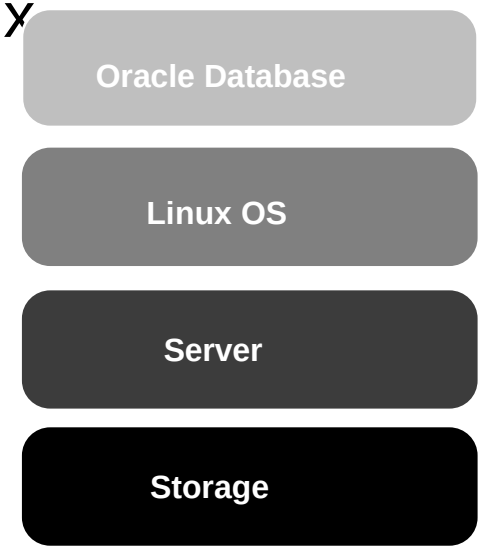
# Testing: Oracle Validated Configurations

- Pre-tested, validated, and supported Linux architectures, including
- Software, hardware, storage, drivers, networking components
- Best practices for Linux deployment
- Real-world testing of complete stack
- More than 30 configurations published, freely available for download
  - oracle.com/technology/tech/linux




**Oracle Validated Configurations offer faster Linux deployments while lowering infrastructure costs**

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# Oracle's Virtualization Technology


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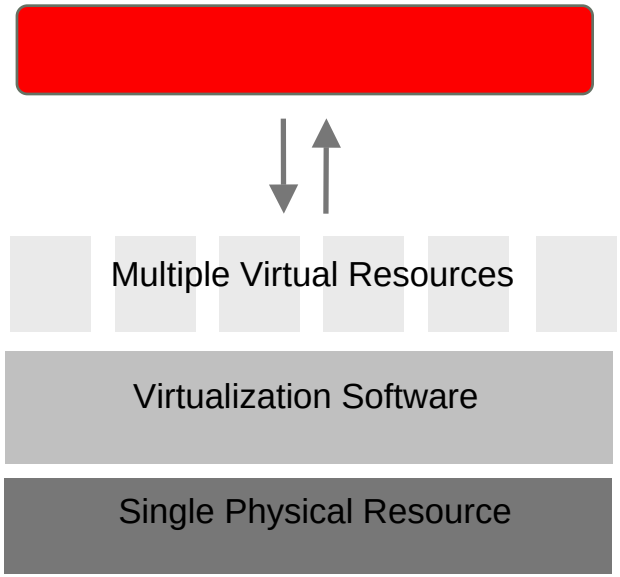
# Defining Virtualization

- Abstract underlying technology
- Simplify interfaces to resources

Make one resource look like many



# Announcing Oracle VM

- New server virtualization software and support
  - Free product download; available on wed.
- Runs both Linux and Windows
  - Supports PV on all hardware and HV on latest x86 hardware
  - 64-bit and 32-bit guests
  - Up to 64-way SMP
  - Up to 32 virtual processors per guest
  - Includes live migration at no additional cost
  - Integrated, browser-based management console
  - Free downloadable VM images
- Enterprise-quality support

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# Overview:
# Virtualization Technology

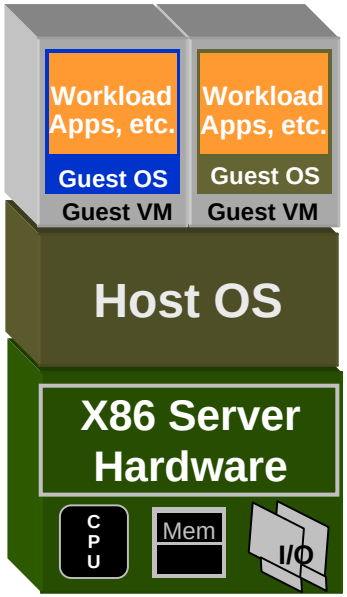
# Server Virtualization Technologies

**Host OS-based, e.g**
- VMware Workstation
- Microsoft Virtual Server
- KVM

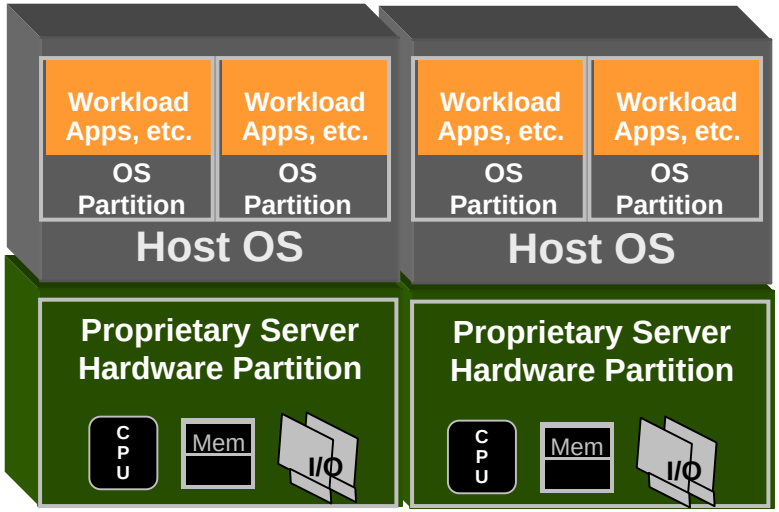
**Hardware Partitioning, e.g.**
- Sun SPARC Domains
- IBM PPARs
- HP nPARs

**OS Partitioning, e.g.**
- Solaris Containers
- AIX dLPARs
- HP vPARs

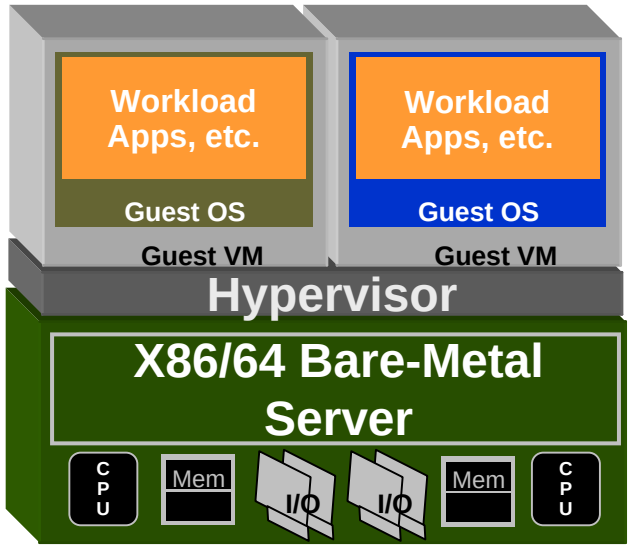
**Hypervisor-based, e.g.**
- Oracle VM
- VMware ESX Server
- Citrix XenServer
- Windows Hyper-V




- Primarily desktop
- Very slow (2 OSes)




- Excellent isolation
- Expensive, proprietary hw
- Coarse grain resources
- Mix OSes / versions




- Only moderate isolation
- Potentially good scalability
- Fine-grained resources
- Cannot mix OS/patch levels

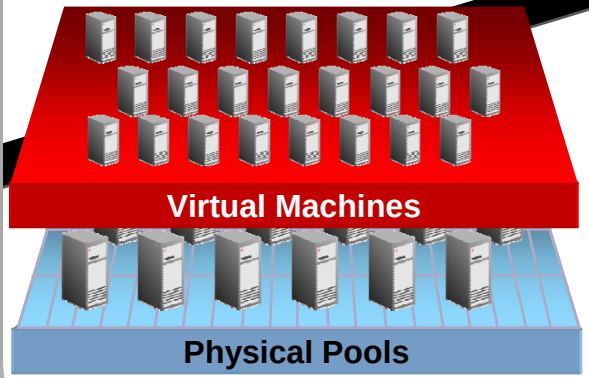
- Excellent isolation
- Affordable, multi-source hw
- Fine-grained resources
- Mix OSes / versions

# Oracle Grid-Based Computing
## Current Phase: The Flexible Grid

### The Grid
**Resources that are…**
- **Distributed**
- **Scalable**
- **Manageable**


### The Flexible Grid
**Adding…**
- **Flexibility**
- **Agility**

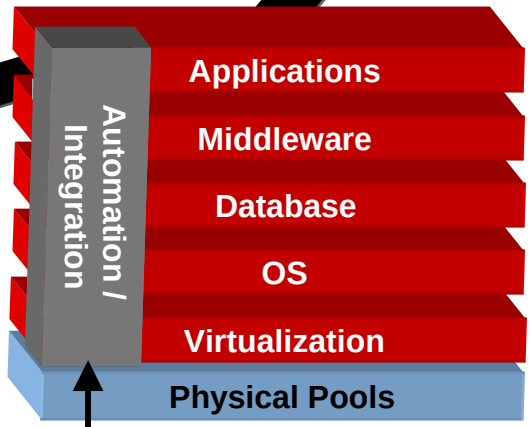
**…through virtualization**




Current Phase

### The Self-Managing Grid
**Integrating…**
- **Across the stack**

**Enabling…**
- **Automation**
- **Self-management**

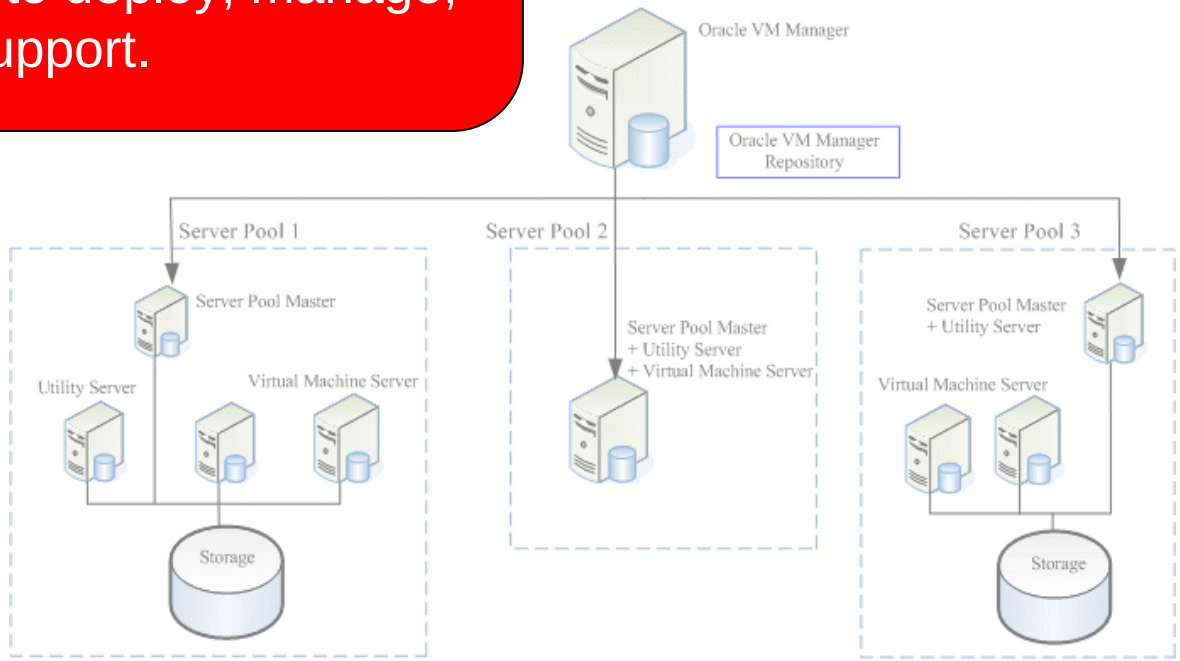



**Oracle's unique ability to deliver cross-stack**

# Oracle's Virtualization Platform: Oracle VM

# Oracle VM
## Server Virtualization and Management

Oracle VM is a free, state-of-the-art server virtualization and management solution that makes enterprise applications easier to deploy, manage, and support.



# Oracle VM
# Server Virtualization and Management

- Oracle VM contains…
  - Oracle VM Server ( Open Sourced )
  - Oracle VM Manager ( Oracle's Secret Sauce)
- Oracle VM Server
  - Open source server software tailored by Oracle
  - Installs on "bare-metal" servers from a single CD in about a minute
  - x86 and x86_64 based Intel and AMD Systems
- Oracle VM Manager
  - Web browser-based management console
  - Java-based management server
  - Database repository:  XE (incl.), SE, EE, or RAC

# Oracle VM
## Advanced Server Virtualization Solution

- State-of-the-Art architecture
- Advanced Migration & HA features
  - No additional charge
- Rapid Application Deployment
- Free download
  - Zero license costs, zero key management
- Affordable, full-stack enterprise-class support
- Leading price:performance
- Official application certification based on real-world testing

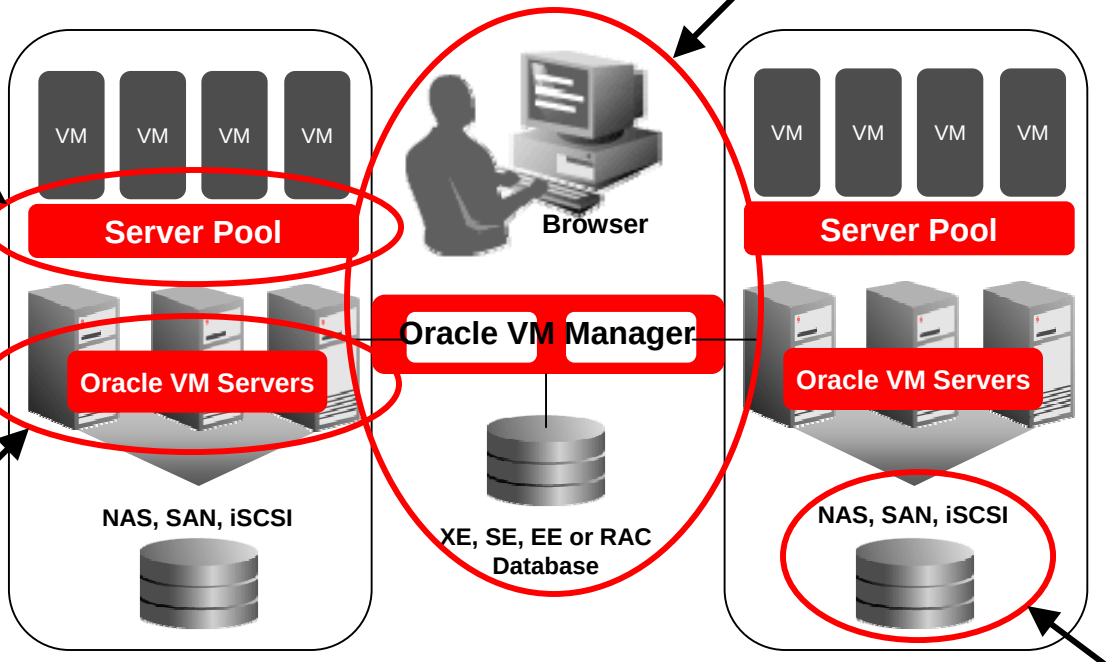
# Oracle VM
# Guest OS Support

- Support for paravirtualized (“virtualization aware”) OS kernels
  - Highest performance:  Great for I/O scalability
  - Enterprise Linux 4 and 5 (from Oracle or RedHat)
- Support for hardware virtualized (“unmodified”) OS versions (hardware support required)
  - RedHat Enterprise Linux 3
  - Windows 2003 Server (64bit and 32bit), Windows 2003, and Windows XP
- 64-bit and 32-bit guests
- Up to 64-way SMP hardware
- Up to 32 virtual processors per guest

# Oracle VM: Concepts Overview

**Oracle VM Manager:**
- Browser-based
- Java server
- Scalable & Available

**Server Pools:**
- Pool resources
- Load balance
- Migrate
- Auto failover

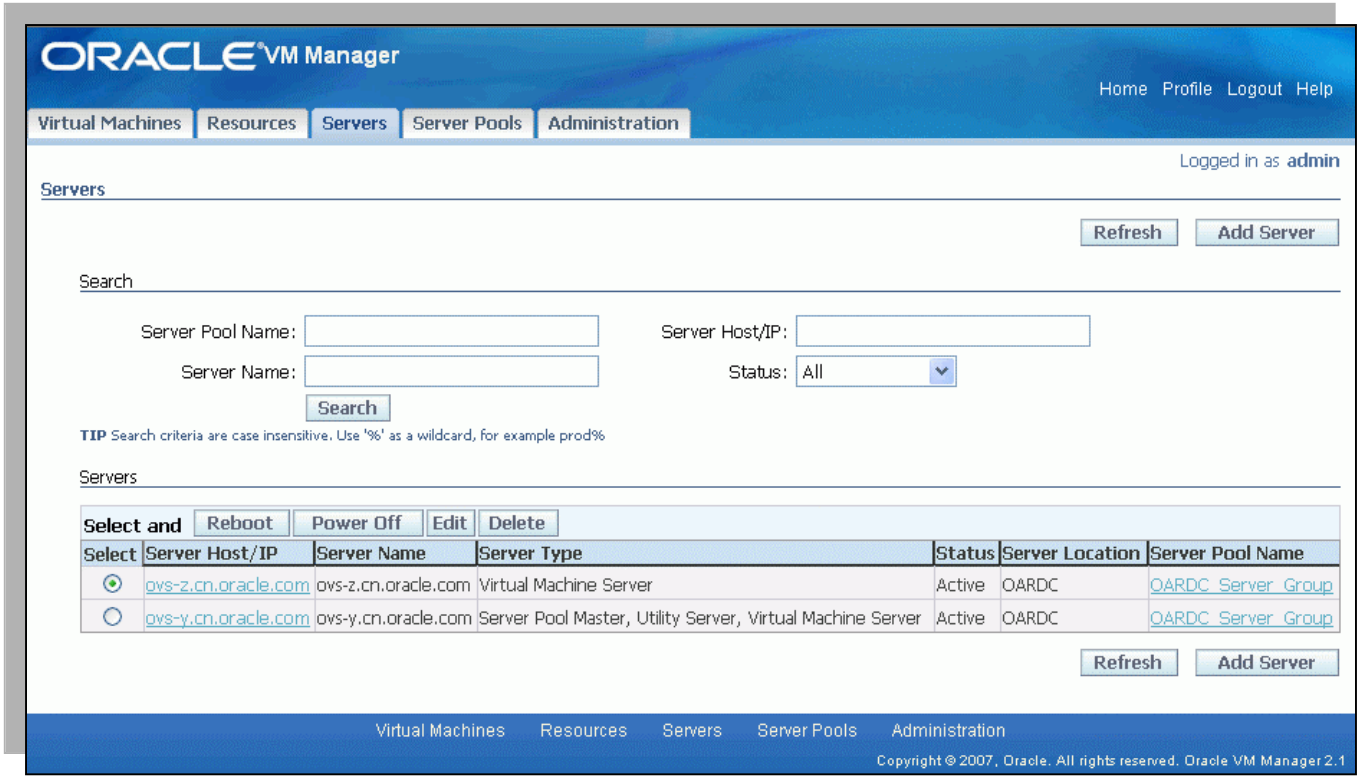



**Oracle VM Servers:**
- Host guest VMs
- Enterprise Linux
- Windows

**Shared Storage Pool Options:**
- NAS/NFS
- SAN
- iSCSI

# Oracle VM Manager

- Browser-based management solution
- Included with Oracle VM
- Full VM lifecycle management:
  - Create
  - Configure
  - Clone
  - Share
  - Boot
  - Migrate



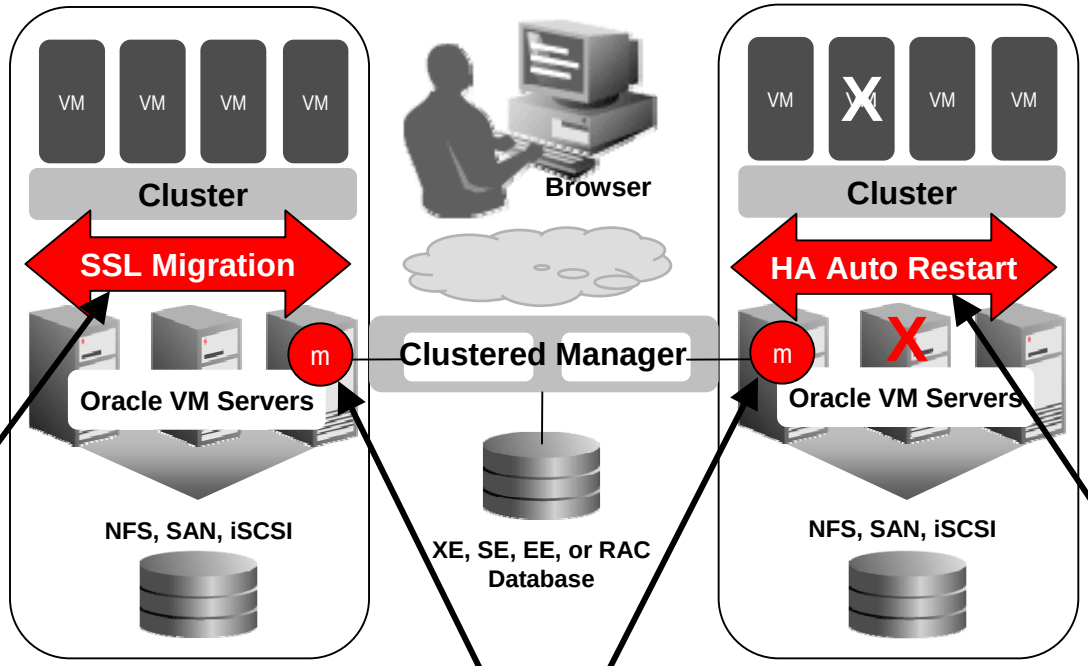
# Guest VM High Availability:

- **HA / Auto-restart**
- **Secure Live Migration**

# Guest VM High Availability

- Automatic restart of failed VMs across the pool
  - Server failure (all VMs restarted)
  - Individual VM failure
- Reliable restart based on proven Oracle Clusterware technology
  - Sophisticated heartbeat and lock management
  - Reliable failure detection and corruption prevention
- Maximize up-time without complexity of traditional HA clustering
  - Cost-effective solution
  - No guest VM agents or modifications required

# Guest VM High Availability
## Complete Solution



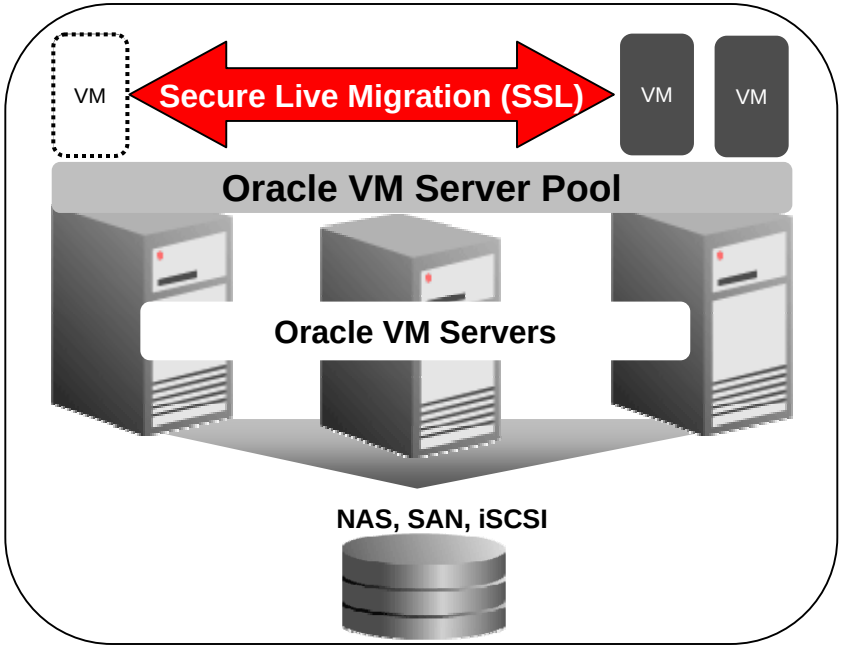

**Planned Events:**
- E.g. maintenance or upgrades
- Secure Live Migration
- Zero interruption

**Pool Masters assure Secure Migration or HA restarts complete in the event of a Manager outage**

**Unplanned Events**
- E.g. Server or VM failure
- HA Auto-restart in pool
- No manual intervention

# Secure Live Migration
## Uninterrupted Service

- Industry First:
  - Encrypted Live Migration by Default
  - No additional hardware required
  - Eliminates requirement for dedicated network
- Other products migrate VM data in the clear
  - Requires dedicated network
  - Leaves sensitive data vulnerable (passwords, account numbers, etc.)
- More secure, more flexible

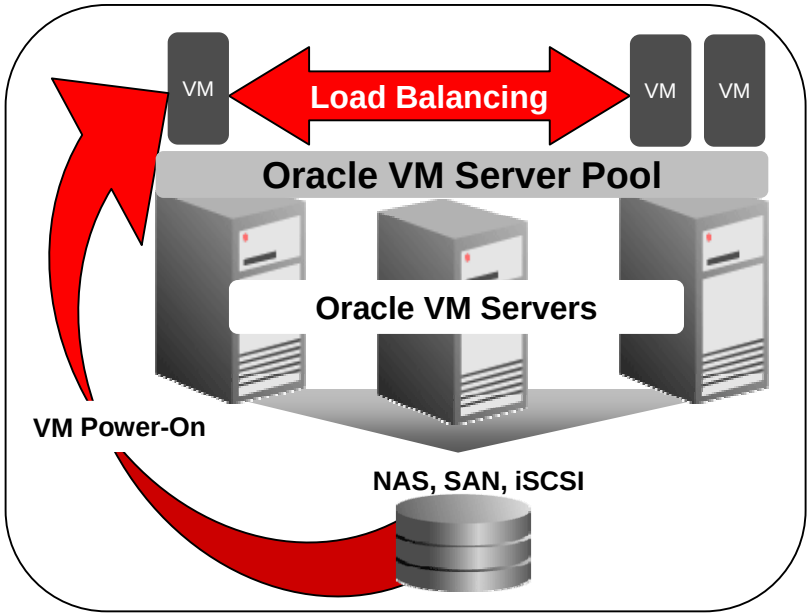


# Resource Management:

- Load Balancing
- VM I/O Management

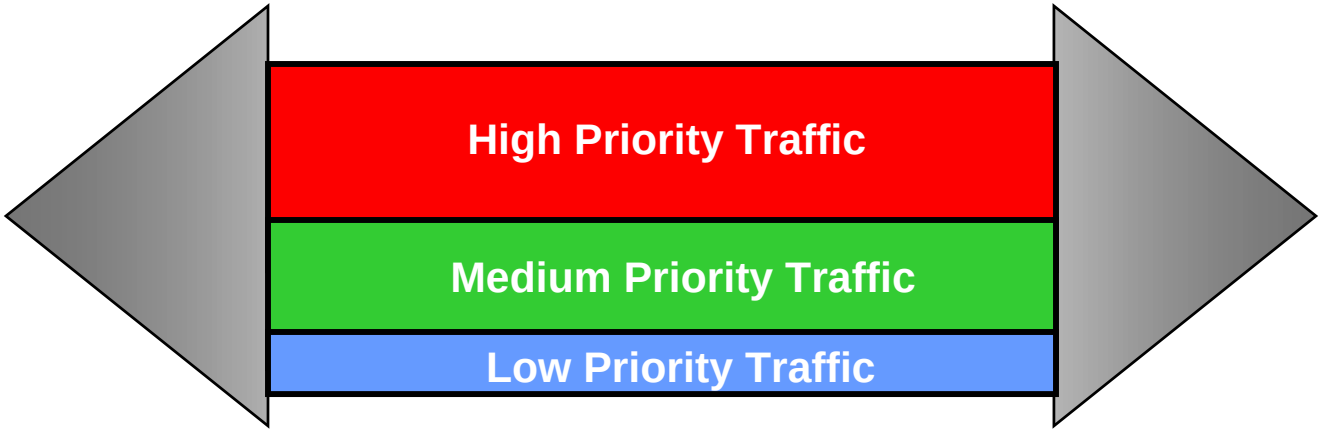
# Pool Load Balancing
## Reliable Start-Up & Resource Efficiency

- Automatic load balancing across all servers in (sub) pool
- User defined Preferred Server sub pools per guest VM
- Algorithm selects server with the most available compute resources (CPU and Mem)
- Efficient resource usage
- Assures that “down” server will not block VM power-on



# VM I/O Resource Management

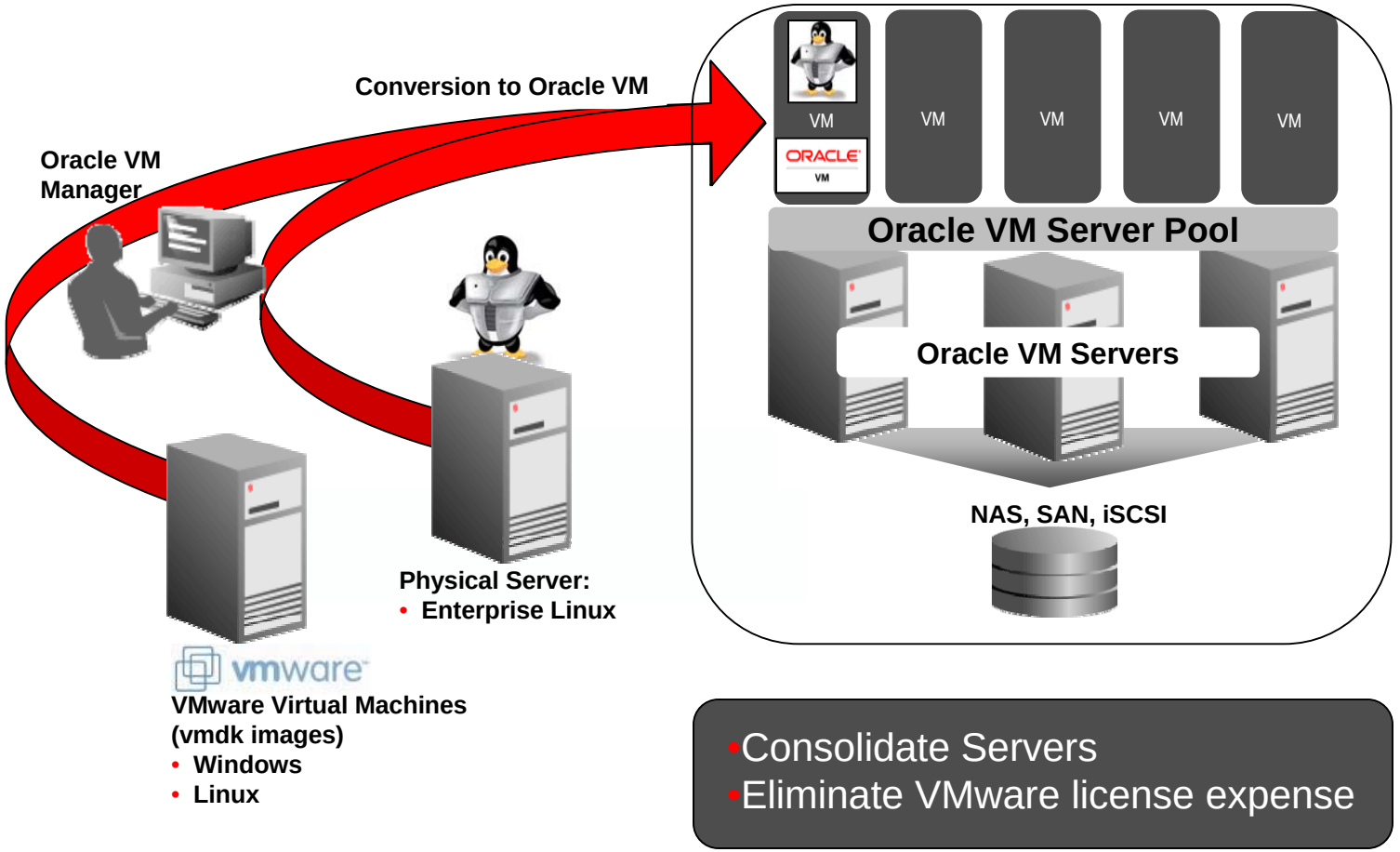
- Manage bandwidth and priorities within guest VM
- Network I/O traffic management
  - Set bandwidth cap for each virtual network interface
  - Assure low priority applications don't steal from critical apps
- Storage I/O prioritization
  - Prioritize virtual block devices as High, Medium, or Low
  - Adjusts queuing algorithm (top-of-queue vs. end-of-queue)



# Rapid Server and Workload Deployment:

- Machine Conversion
- Oracle VM Templates

# Physical-to-Virtual / Virtual-to-Virtual Machine Conversion



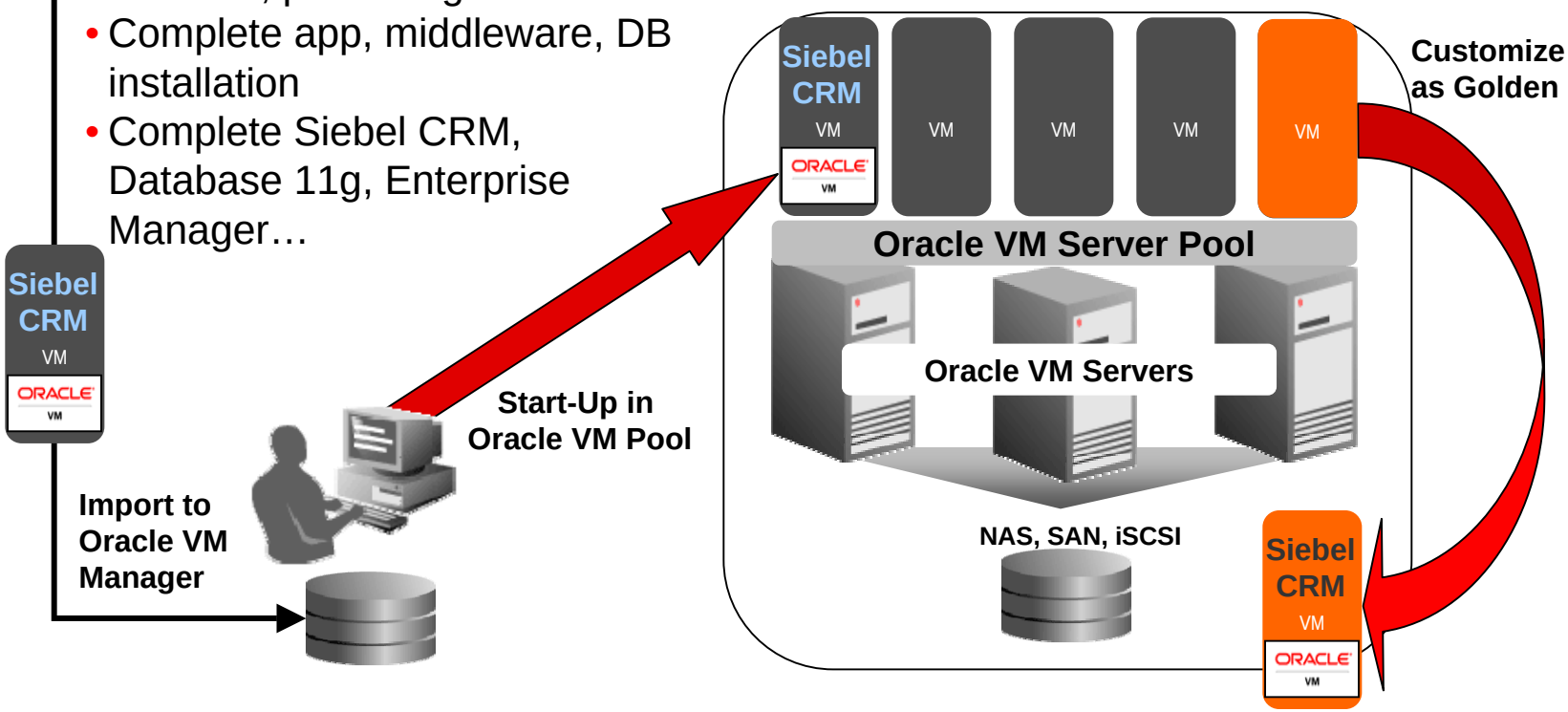

- Consolidate Servers
- Eliminate VMware license expense

# Oracle VM Templates
## Rapid Application Deployment

ORACLE E-Delivery

Download from Oracle
- Pre-built, pre-configured VM
- Complete app, middleware, DB installation
- Complete Siebel CRM, Database 11g, Enterprise Manager…

Save days or weeks in installation and configuration time



# Other New Features in Oracle VM 2.1.2

- Management High Availability
  - Oracle VM Manager HA: Clustered management server
- New Templates
  - Enterprise Manager Grid Control VM Template
  - Siebel CRM 8 VM Template
  - ( More on the way!!)
- Network and Storage
  - Updates and additions from Broadcom, Dell, Chelsio, Emulex, HP, Intel, LSI, open source / Linux and others
  - NIC, HBA, SCSI, RAID, and chipset/platform updates

# Other New Features in Oracle VM 2.1.2

- Ease of Use
  - Oracle VM Manager getting-started wizard
  - Keyboard language mapping for console session
  - Oracle VM Manager: Support for XE, SE, EE, or RAC management repository database (same- or separate server)
  - Debugger module for GDB (GNU Debugger) Server
    - Permits debugging of guest VMs even while guest is hung
- Performance
  - I/O enhancement: Block device emulation on top of OCFS2 files (“fast loopback”)
  - I/O enhancement:  Block device emulation on top of NFS volumes (“dm-nfs”)
- For the Xen / open source community:
  - kdb kernel debugger

# Oracle VM:

- **Performance**

# Performance Testing

- Extensive real-world testing
  - LMbench: microbenchmarking
    - Context switching, Null calls, TCP Selects, etc
  - Swingbench: DB workload benchmarking
    - Typical OLTP workloads
    - Varying SGA size, # of users, # of vCPUs
  - Paravirtualized domains with Enterprise Linux 4, 64bit
- Results:
  - On average **three times less overhead** compared server virtualization products from other vendors.
  - Virtual SMP scalability of Oracle VM is at 90+%
- Small workloads are at same performance as real hardware

# Oracle Product Certification with Oracle VM

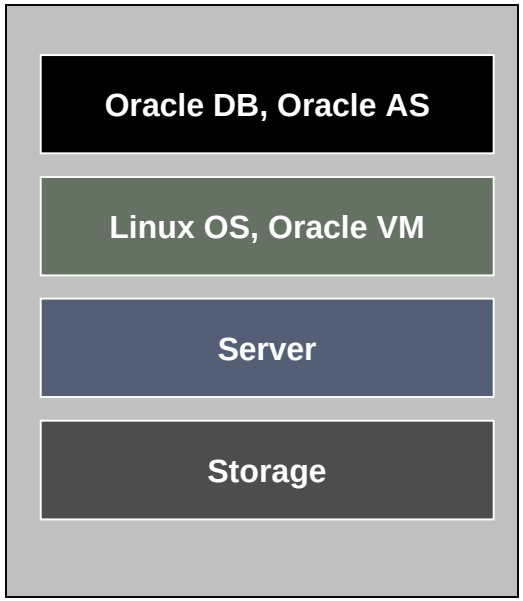
- Oracle Database
- Oracle Application Server
- Oracle Enterprise Manager
- Oracle Berkeley DB
- Oracle TimesTen
- Oracle E-Business Suite
- Oracle PeopleSoft
- Oracle Siebel
- Oracle Hyperion
- More information on Metalink Note 464754.1

# Oracle Validated Configurations for Linux and Oracle VM

Pre-tested, validated, and supported Linux and Oracle VM architectures,

- Software, hardware, storage, drivers, networking components
- Best practices for Linux and VM deployment
- Real-world testing of complete stack

**oracle.com/technology/tech/linux**




**Oracle Validated Configurations offer faster Oracle VM and Linux deployments while lowering costs**

# Hardware Support for Virtualization (HVM) Where does it fit-in?

- Goal: efficiently insure VM OSes are not “hurting” each other
  - E.g. Trying to unsafely modify common resources/state, etc.

| Techniques: | Purpose: | Benefits: | Comments: |
|---|---|---|---|
| **Paravirtualization (PV)** e.g. Oracle VM & Xen | Modify the OS and/or drivers so they knows how to behave in a virtual environment | • Good-to-excellent performance vs. bare-metal | • PV OS kernel req’d (but rapidly not an issue) |
| **Emulation / translation**, e.g. VMware ESX | Design the virtualization server to intercept or “trap” harmful requests and/or translate requests into appropriate forms | • Use unmodified OS<br>• HVM hardware not req’d (but rapidly not an issue) | • Poor scalability esp. under I/O load |
| **Hardware virtualization (HVM)**; e.g. Oracle VM & Xen | Design the hardware so it knows how to handle inappropriate requests itself. (Note: PV drivers can be used with an otherwise unmodified OS, e.g. Windows, to improve performance) | • Use unmodified OS | • Poor perf. today<br>• HVM hardware req’d (but rapidly not an issue) |

# Partner Support













# Oracle VM Support

- Faster and more efficient
  - Top-to-bottom with no finger-pointing
  - Validated with Oracle products
  - Enterprise quality
- Affordable
  - 24x7 support worldwide:
    - $599 for 2 processors per machine per year
    - $1199 for unlimited processors per machine per year
  - Includes Oracle VM Manager and all advanced features
- Risk-free
  - Deploy with confidence and full backing from Oracle

# One Support Call for the Complete Stack

7,000+ support staff in 17 global support centers

Support in 27 local languages

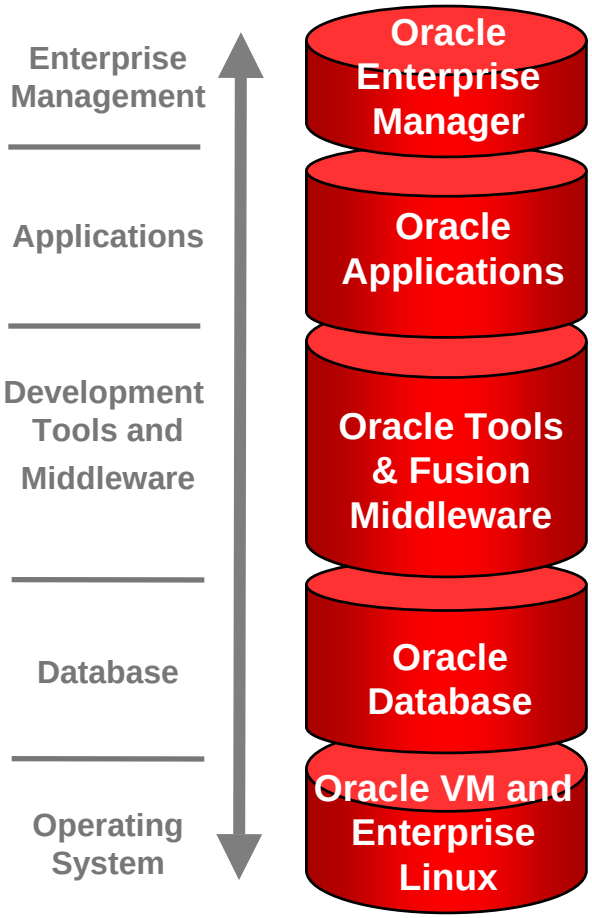
1.25M service requests filed electronically


400K+ knowledge solutions

450K service requests over the phone

110M+ web knowledge transfers

# Oracle: Most Complete, Open, Integrated Enterprise Software Stack for Linux




## Customer Benefits

- Standard components
- Validated configurations
- Synchronized releases
- Easier to manage
- Greater security
- Higher reliability
- Rich partner ecosystem
- Hot-pluggable
- One-stop, seamless support
- Lowers cost of ownership
- Open and standards compliant
- Integrates open source components

# Resources

- **Oracle VM Home Page**
  oracle.com/virtualization

- **Free Download: Oracle VM**
  edelivery.oracle.com/oraclevm

ORACLE VM

# Summary: Oracle VM
## Server Virtualization & Management

- State-of-the-Art performance architecture
- Advanced migration & HA features
- Rapid application deployment
- Zero license costs, zero key management
- Affordable, full-stack enterprise-class support
- Official application certification based on real-world testing
- A key part of Oracle's on-going Grid vision

ORACLE VM


ORACLE®