COLLABORATE14

TECHNOLOGY AND APPLICATIONS FORUM FOR THE ORACLE COMMUNITY

#C14LV

High Availability DB on the Cheap using Oracle VM, Oracle Linux, ASM, and DataGuard

Oracle Virtualization for High Availability and Cost Containment

Session # 331

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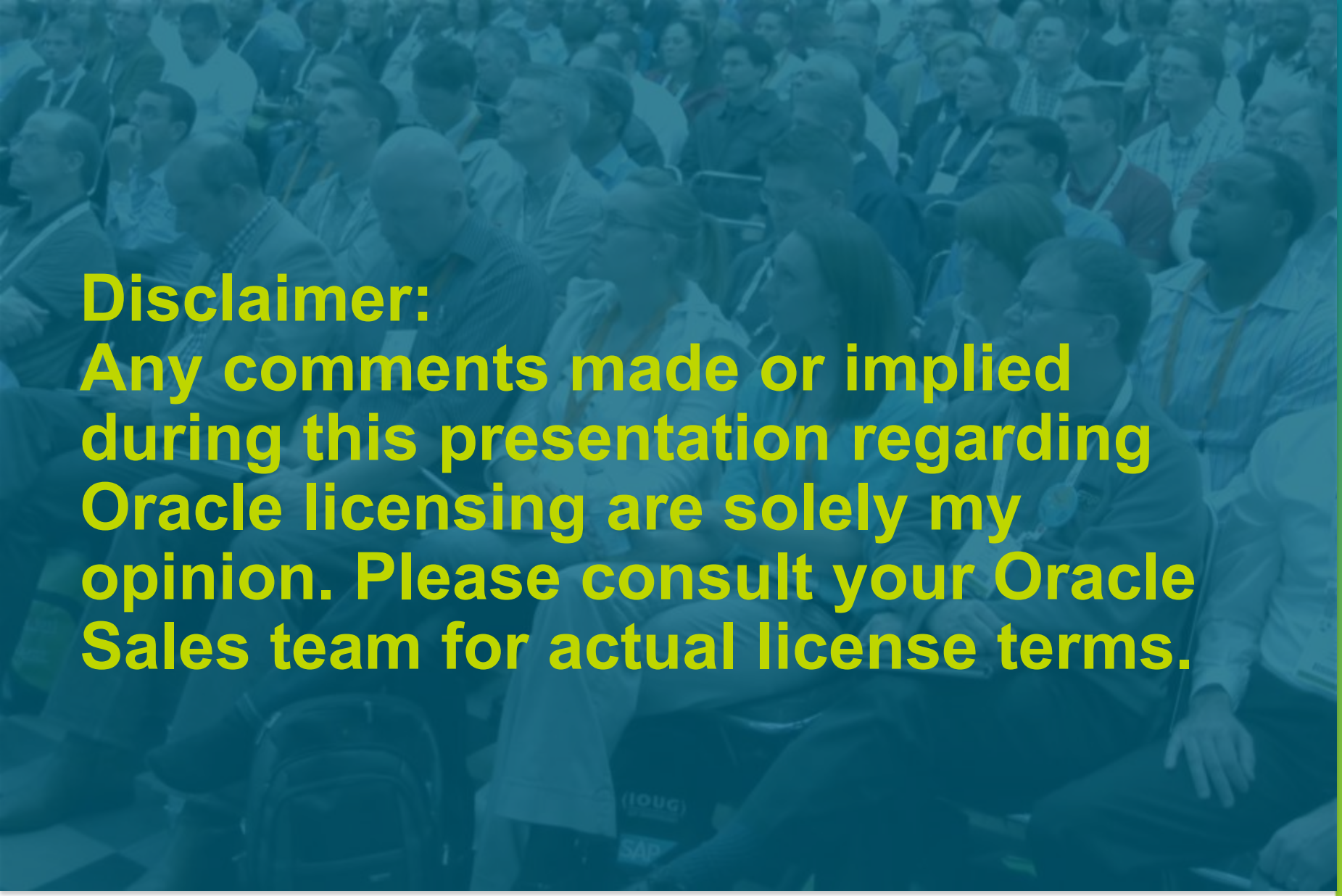
- Over 20 years working with Database Server Technology
  - Mostly Oracle including versions 5 through 12
  - Linux, Solaris, Windows, UNIX
  - VMWare, Oracle VM
- Small and large company experience
  - Environmental Testing, Transportation/Logistics, Insurance, Technology, Pharmaceutical, Banking, and Media
  - UPS, Oracle, Merck & Co, Nielsen Media, American Express, + off hours consulting
  - Consulting experience working for Oracle spanning industries, including Telecom and Government
- Board member of SOUG



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Business Environment

- Small company
- Banking industry related
- Primary business is moving money between bank accounts for client companies
  - No calculation errors acceptable
  - Near real-time bank transfers
  - Data loss is unacceptable
- Bank transfer data accepted 24 x 7 x 7
  - Bi-monthly scheduled downtime available 9 PM Friday – 9 AM Saturday only

Business Environment (Continued)

- Any unscheduled downtime reduces confidence of clients and banks
  - Cooperative banks can be hard to come by
  - Limited banking hours for fund transfers
  - Unscheduled downtime greater than 20 minutes jeopardizes batch deliverables
  - Clients can be fined by state governments if payments are not processed same day
- Database and application optimal performance less important than availability and consistency
  - Most customer reports finish in seconds
- OLTP and Batch
  - Analytics and Warehouse separate

Business Requirement Targets

- Full hardware redundancy at HQ (almost)
- Full hardware redundancy at DR (almost)
- Near real-time data synchronization to DR
- Maintain Oracle Database CPU based current license level with hardware refresh
- Limit downtime to less than 20 minutes from hardware failure
- Upgrade to supported Oracle version
- Migrate database servers from Windows to Linux

Database Architecture – Original

- Oracle 9i SE with 2nd database in Recovery mode and 3rd database in DR
  - Archive log shipping and apply via Visual Basic scripts with compression
  - Daily manual log manipulation required
- Limited monitoring of Database availability and performance
- Window NT Server OS – 32 Bit
- Hardware Redundancy
  - Extra server similar to Production – manual failover
- DR Server same as Production
  - limited bandwidth DB logs up to 1.5 days lag

Database Architecture – Pre-VM

- Oracle 10g EE - DataGuard
- Oracle 10g OEM – VMware VM -> Oracle VM 2.2
- Tuning Pack
- Diagnostics Pack
- Window 2003 Servers – 64Bit
- Internal hardware redundancy
- Test Server same as Production – manual failover
  - Production on SAN
  - Test on local disk
- DR Server same as Production
  - DataGuard Physical Standby database
  - Limited bandwidth DB logs up to 3 hours lag, usually 20 minutes

Virtualization Decision Factors

- OEM in Windows VMWare VM
  - Worked well until it didn't
- OEM in Oracle VM Server (2.x) VM
  - Fully supported and software was "free"
- Oracle database CPU licensing (named user for Dev/Test)
  - No new commodity fault tolerant hardware with 4 cores
- Oracle VM Server makes hardware effectively "smaller"
  - CPU Pinning
- Oracle VM Server worked well for OEM
- Oracle 10g support ended
- Hardware is near end of life

Why not VMWare?

- VMWare Shop
  - 3 Way Production cluster and 2 Way Test
  - All internal infrastructure was virtualized
    - Email, accounting, custom applications
  - All custom client facing web applications virtualized
- Original OEM installation ran under VMWare
  - It broke once and Oracle Support said call us back when on a supported platform
- Database \ Web Apps \ email resource contention
  - Separate databases
- VMWare licenses = $ x 6 servers
- CPU pinning enabling commodity hardware with internal redundancy – not with VMWare

Oracle VM and VMWare Costs

(http://www.oracle.com/us/media/calculator/vm/vm-home-2132015.html)

1 Calculate your Hypervisor and Management Costs: Including OS Support Cost

Select Guest OS you plan to deploy.

For Oracle VM — Oracle Linux

For VMware — Red Hat Enterprise Linux

2 Enter your system configuration.

Number of servers with 1 or 2 processors sockets — 6

Number of servers with more than 2 processors sockets — 0

Total number of processor sockets across all physical servers — 12

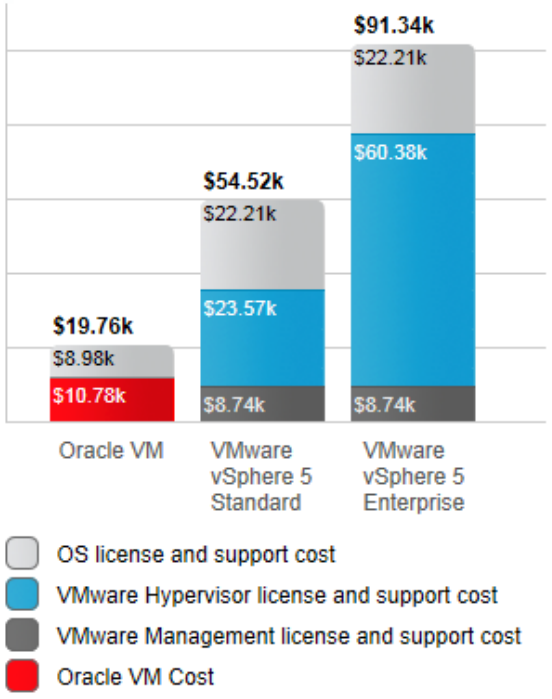
3 Enter total number of virtual guests. — 12

4 Choose a support term. — 1 year

Calculate Results

VMware vSphere with Red Hat Enterprise Linux costs between **$35k** and **$72k** more than Oracle VM and Oracle Linux.

That's **5x** more!



Virtualized Database Architecture Target

- Oracle 11g EE, ASM - Clusterware - Dataguard
- Oracle 11g OEM – Oracle VM Server VM
  - Tuning Pack
  - Diagnostics Pack
- Oracle Enterprise Linux
- Oracle VM Server 3.1
- Two clustered Production Servers
  - Shared SAN
- DR Servers same as Production
  - Separate SAN
  - Limited archive log transfer bandwidth

Migration Path

- All at once
  - Test custom applications once
  - Limit migration downtimes
- All new hardware
  - 2 socket dual core (1x) -> 2 socket 4 core (2x)
  - Xiotech -> NetApp SAN
- Oracle 10 -> 11
  - Database Files - OS -> ASM
  - Clusterware Oracle restart
- Windows -> Linux
- Bare-metal single server -> clustered VM Servers
- HQ and DR in one weekend
  - Test Running on Production hardware– moved back to Test after

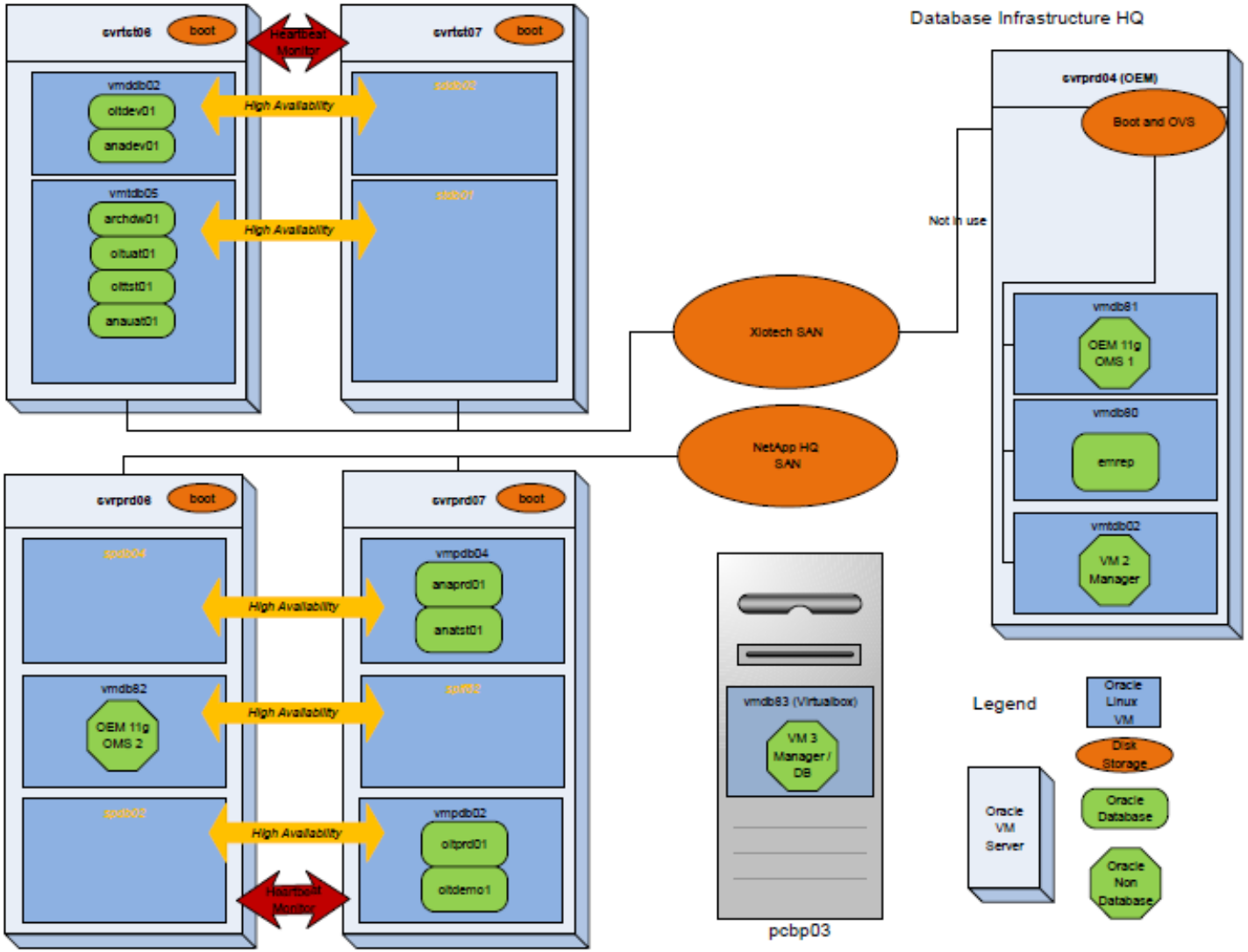
OVM Additional Benefits

- High Availability VM architecture
  - VM Live Migration with running databases
    - Think about it though
- Standardized Linux template installation
  - Portable across differing hardware
  - Quick deployment
- Minimal performance impact
  - Use physical devices, not virtual files for databases!
- CPU Pinning!

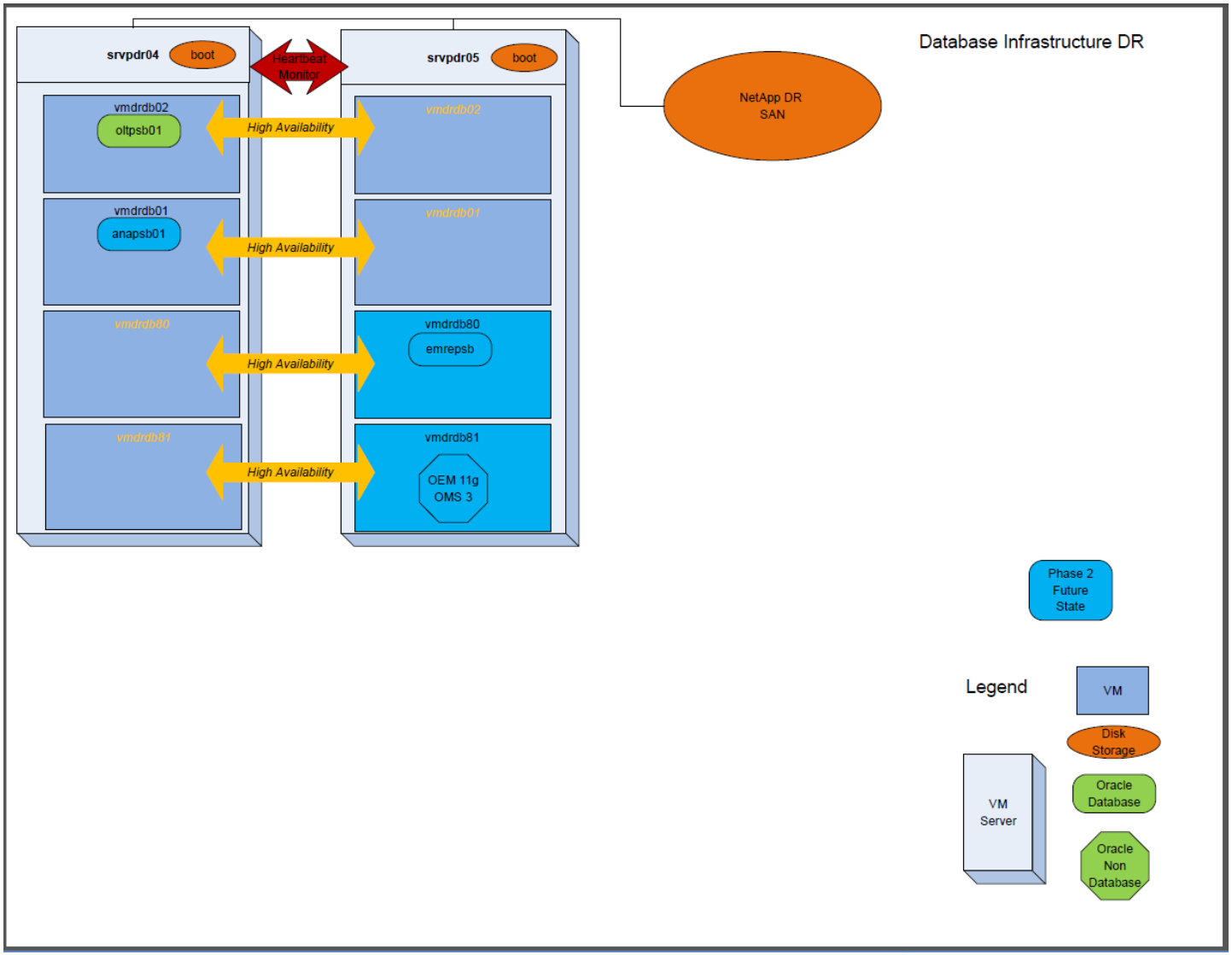
Target Database Architecture Overview

- OEM - 2 OMS
- Dev
- Test
  - Warehouse
- Production
  - OLTP
  - Analytics
- DR Site
  - OLTP
  - Analytics
  - OEM Installation (passive)

HQ Database Architecture



DR Site Database Architecture



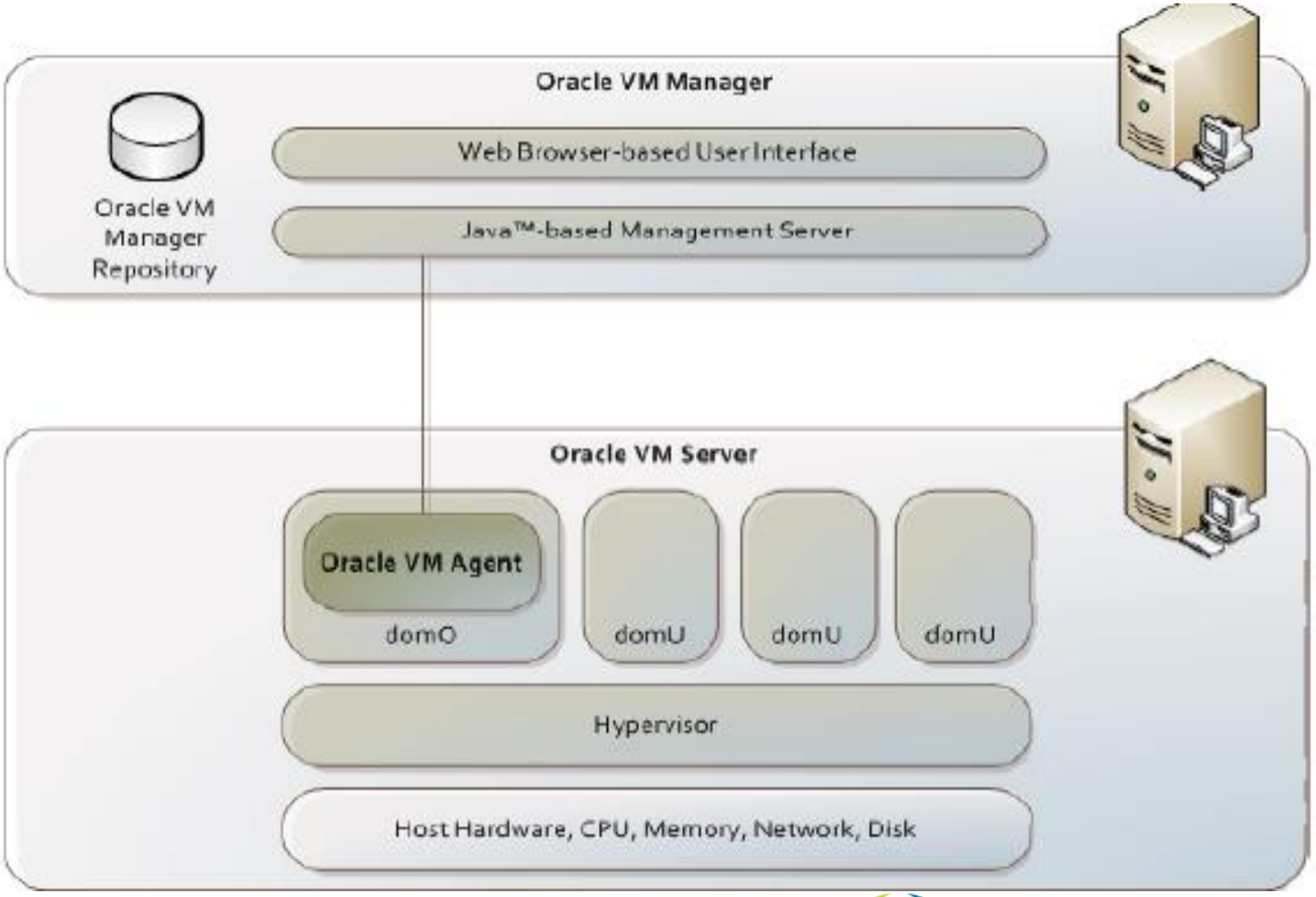
HA VM Server Minimum Requirements

- 2 identical servers
  - Memory to suit intended purpose
  - Internal boot storage
    - Hard Drive or USB Drive
- Shared Storage – SAN
  - ISCSI
  - Fiber Channel – HBA
  - NAS
- Networks
  - Public
  - Storage
  - Private - Heartbeat

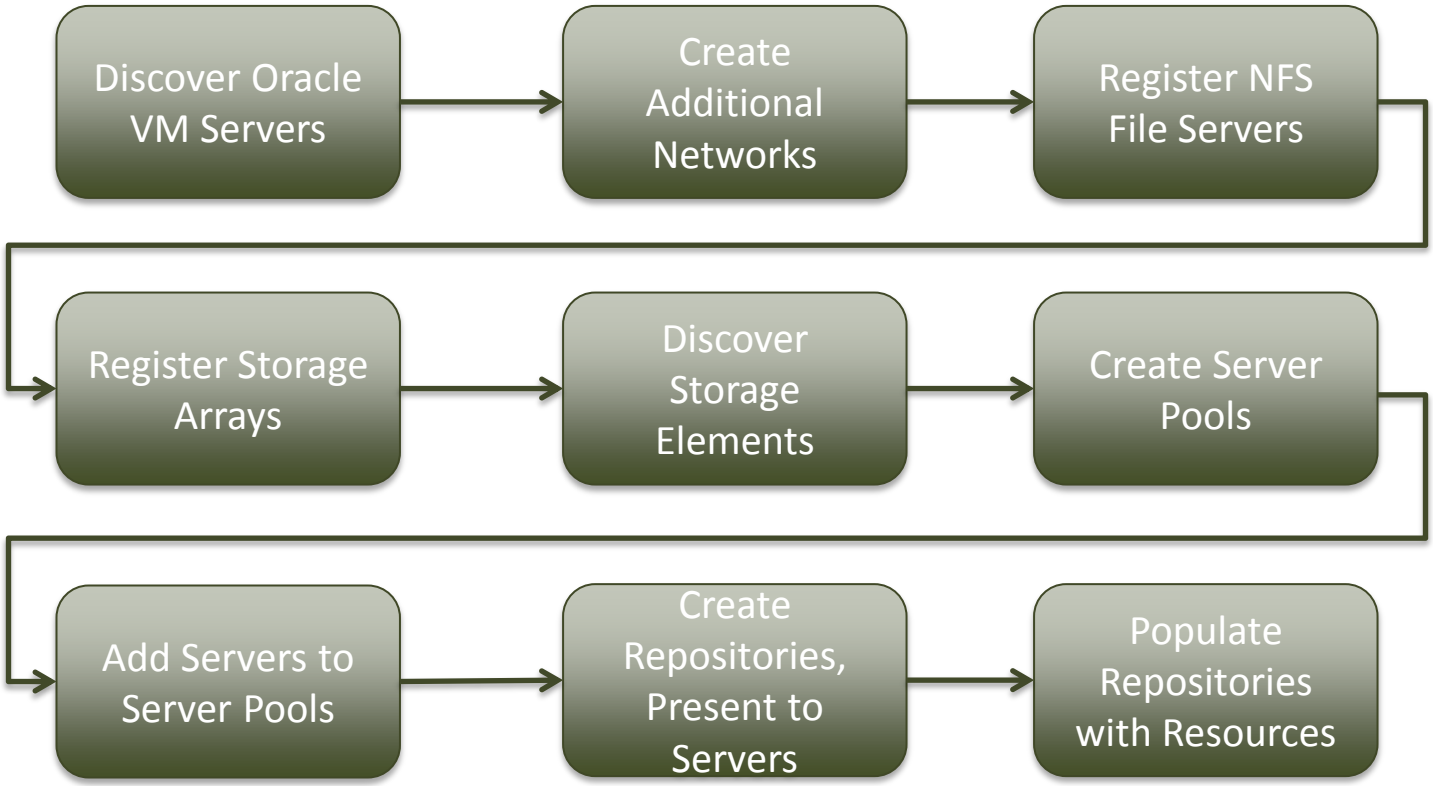
Database Server VM configuration

- Oracle Linux 5 release 6 64-Bit
- Oracle 11.2.0.3
  - Clusterware
  - ASM
  - Database
    - **Use “raw” volumes as physical drives, not virtual files for database files. 50%+ performance degradation with virtual files**
- Create “golden image” template of Linux with Oracle software staged for installation and cloning

OVM Architecture Components



OVM Configuration Overview



Oracle Virtualbox

- This is not Oracle VM
  - Requires full underlying OS GUI install
  - No High Availability features
  - High OS overhead impact on performance
- VM technology for the desktop
  - Linux or Windows Host
  - Linux, Windows, Solaris, … Guests
- Host OS 64 Bit recommended, but not required
- CPU and BIOS virtualization features recommended

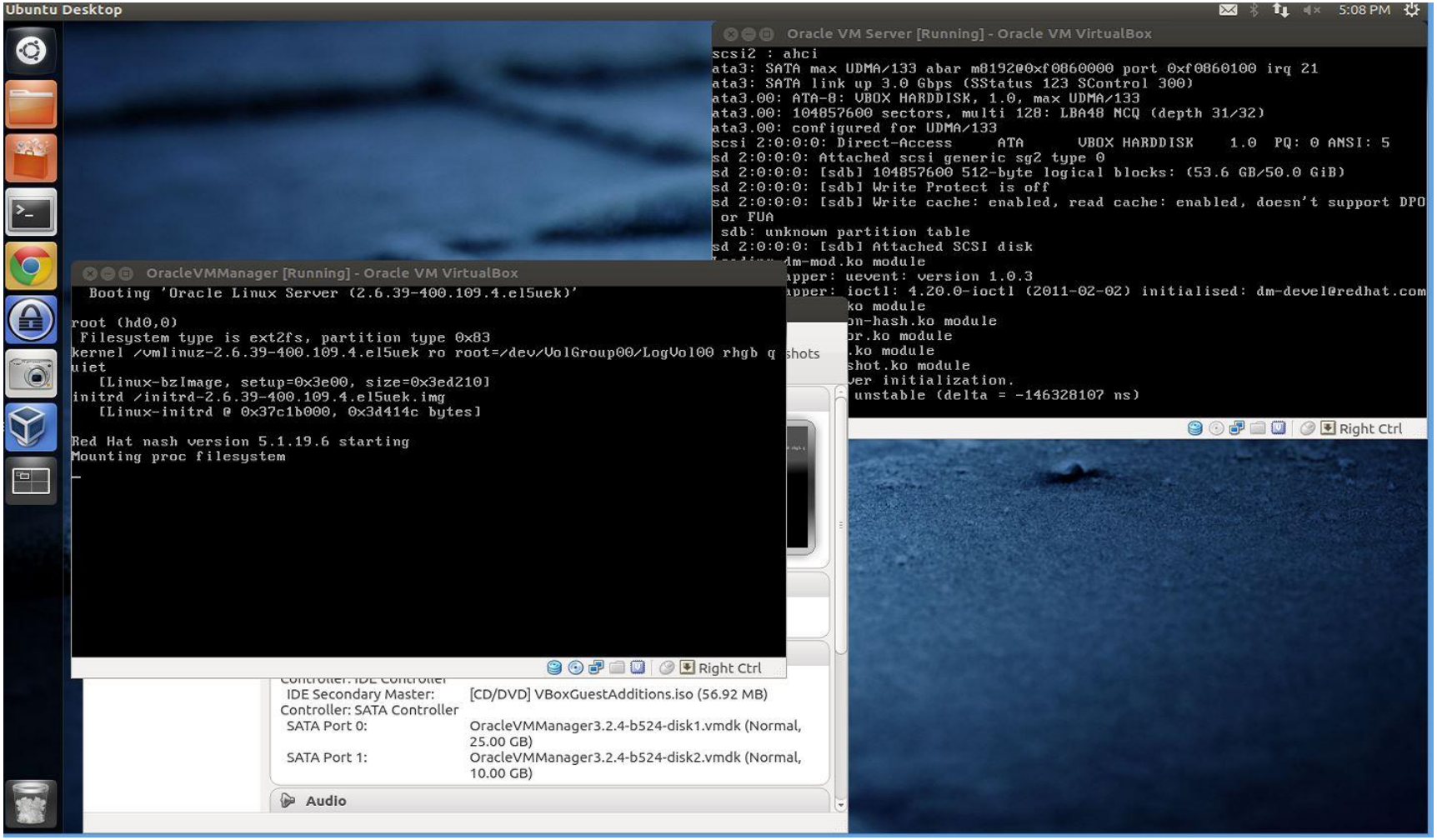
Demo Environment
OVM Server on Virtualbox

- Desktop or Laptop
  - 150 GB storage
  - 16 GB memory (12 will do)
  - Processor/BIOS with virtualization support
- 64 Bit OS Linux or Windows
- Oracle Virtualbox Software and guest additions
- VM Templates
  - OVM Manager
  - OVM Server
  - 12g RAC
  - Cluster Configuration Utility

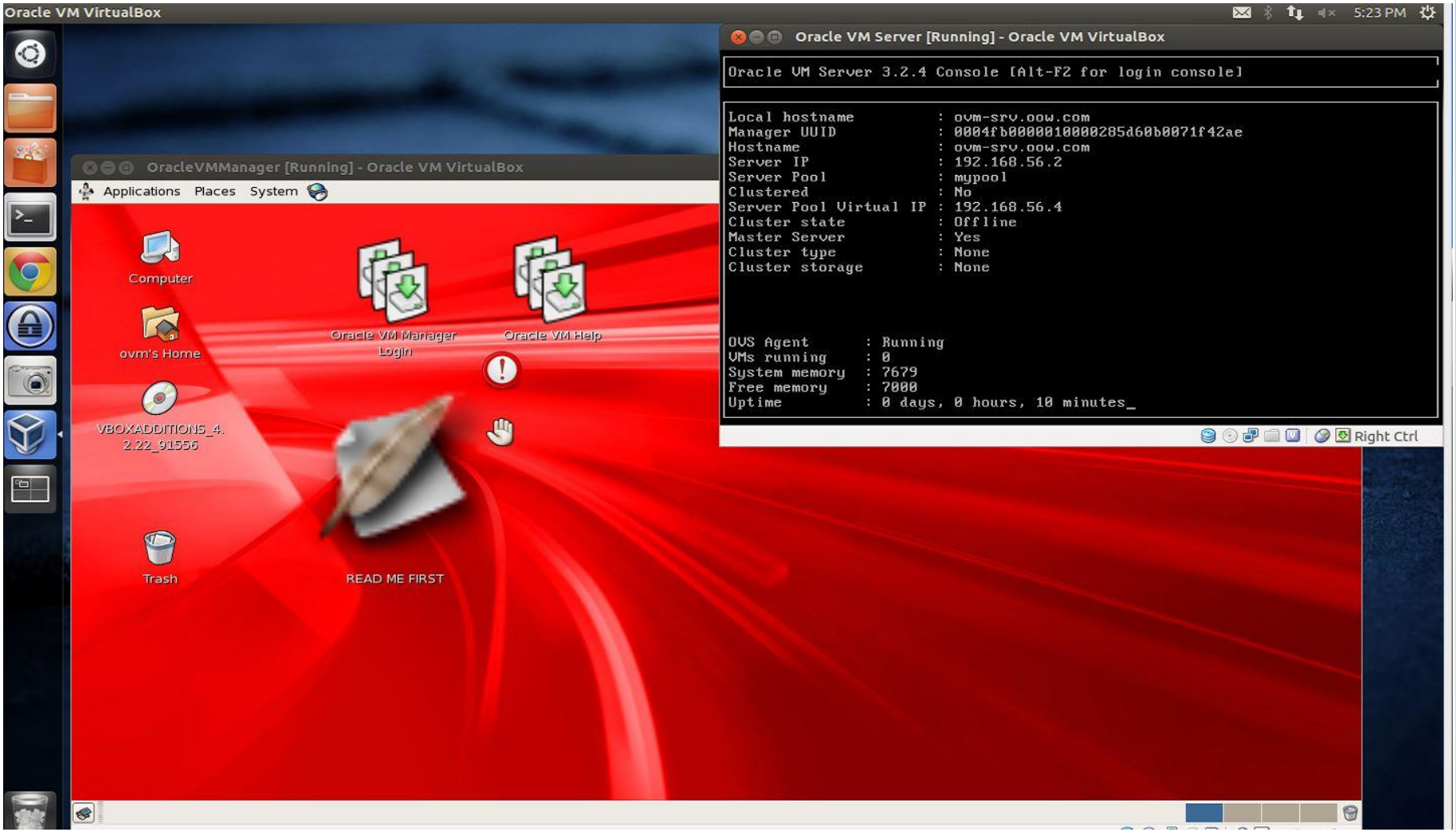
Demo OVM environment configure

- VM Manager
- Discover Servers
- Configure VM Network
- Create Server Pool
- Create Storage Repository
- Import templates with Oracle RAC
- Create VMs from templates
- Create shared storage for ASM
- Use OVM Deploycluster Tool to configure Oracle RAC Nodes

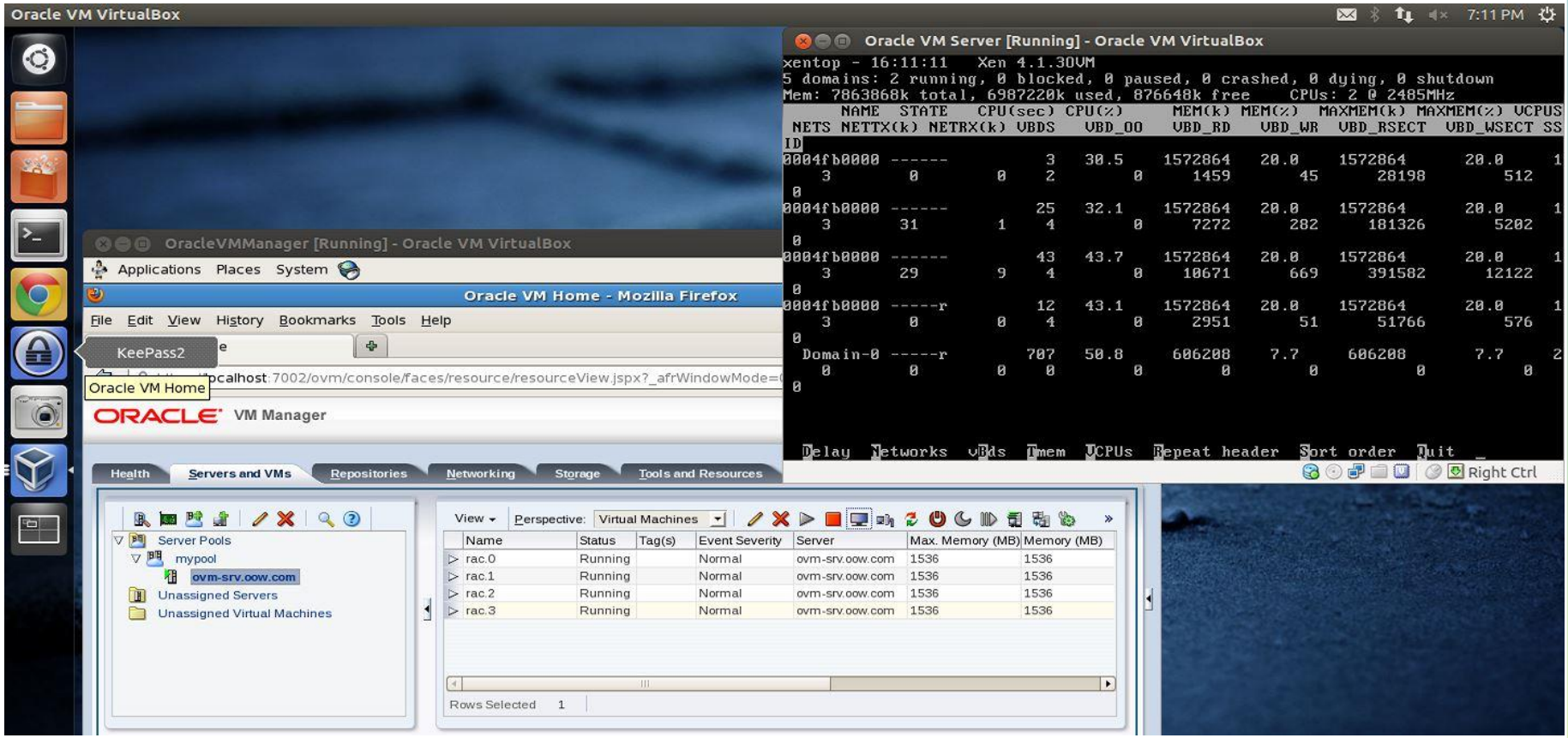
Startup of VM Manager and VM Server Virtualbox



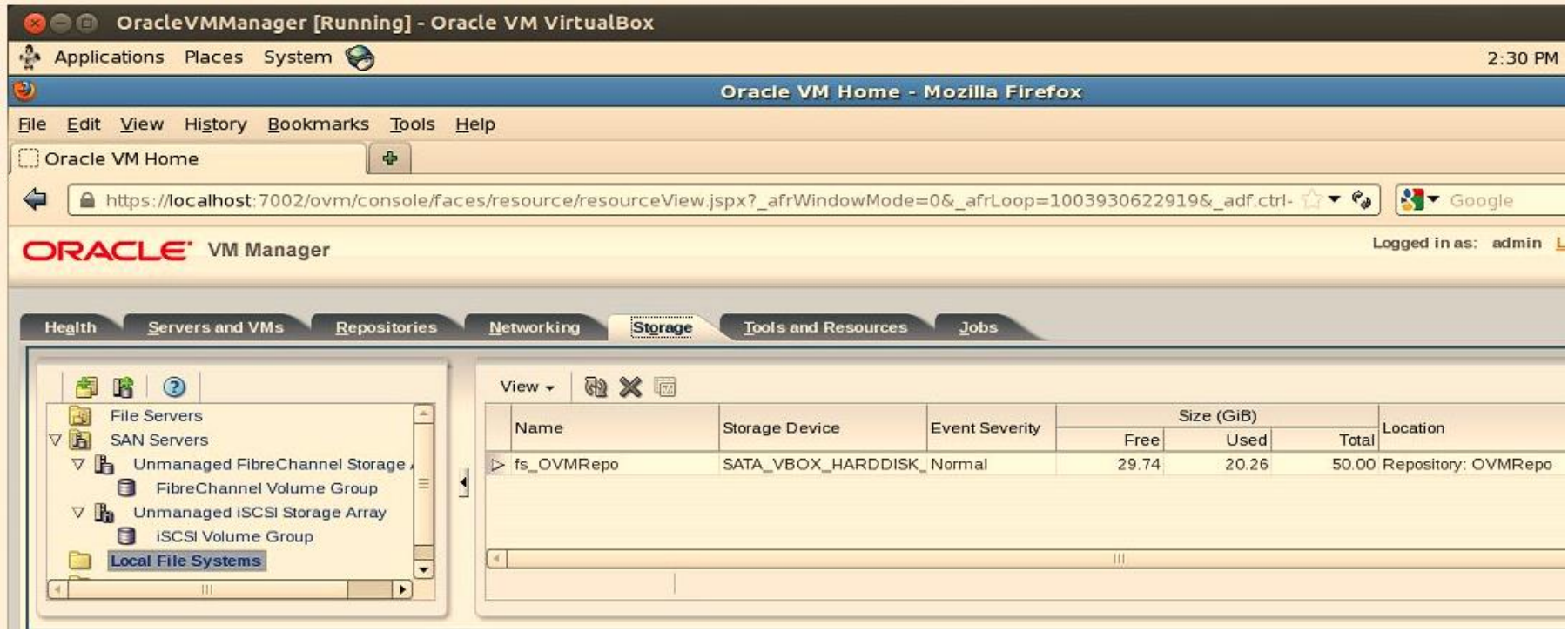
VM Manager and VM Server Virtualbox



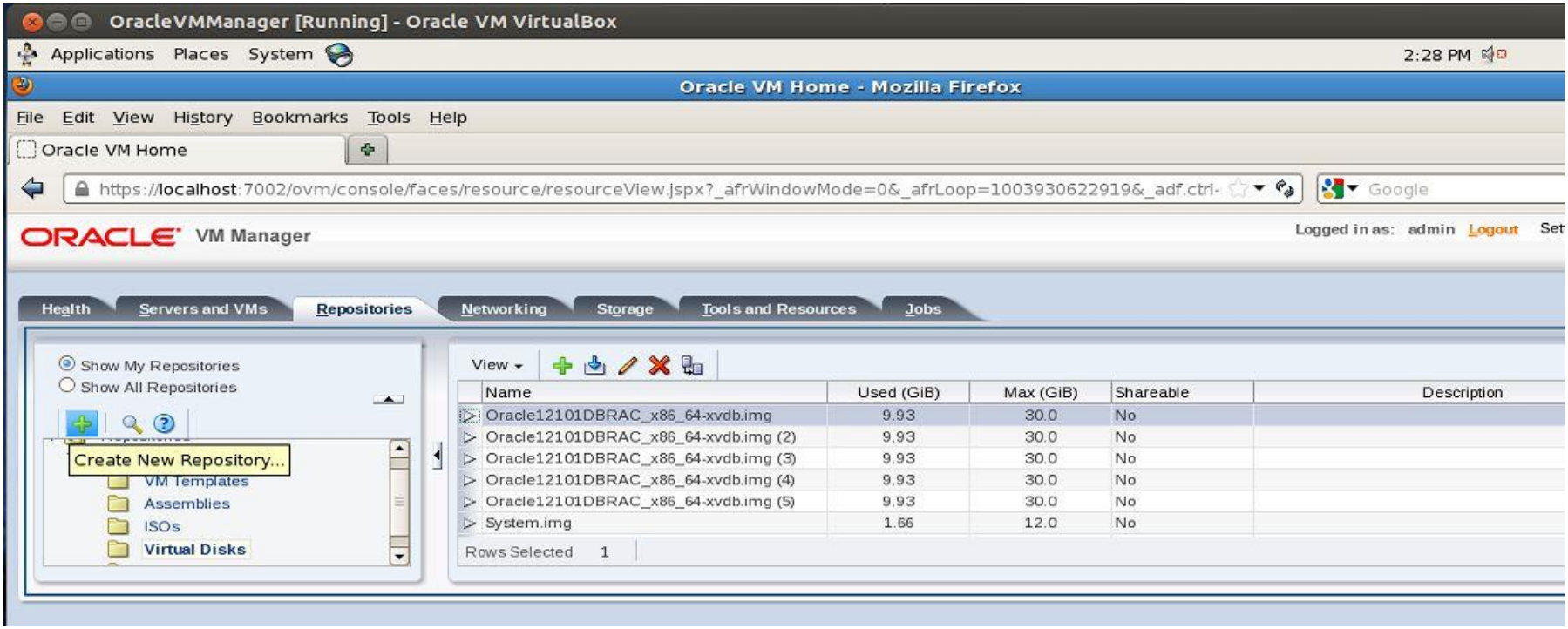
Four VMs running Virtualbox



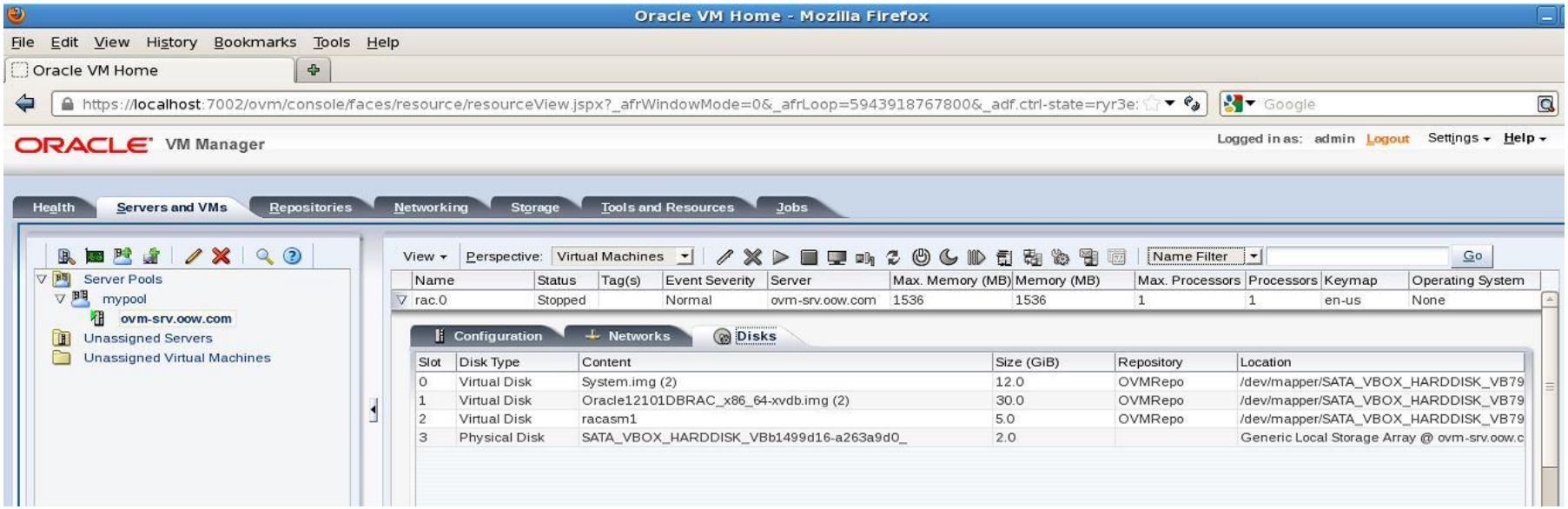
OVM Server
Virtual Disk Repository



OVM Server Virtual Disks



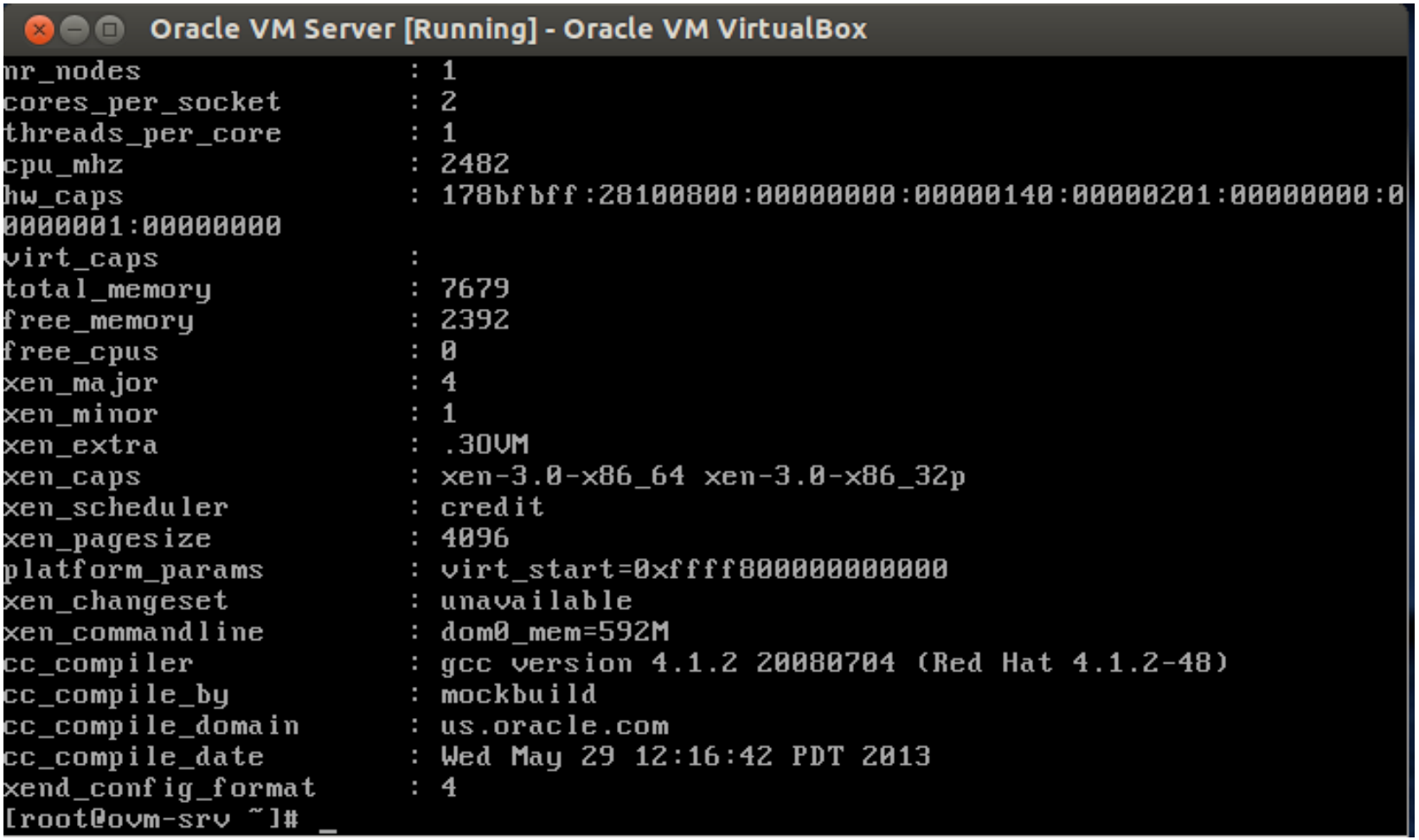
OVM Server
Virtual and Physical Disks – Single VM View



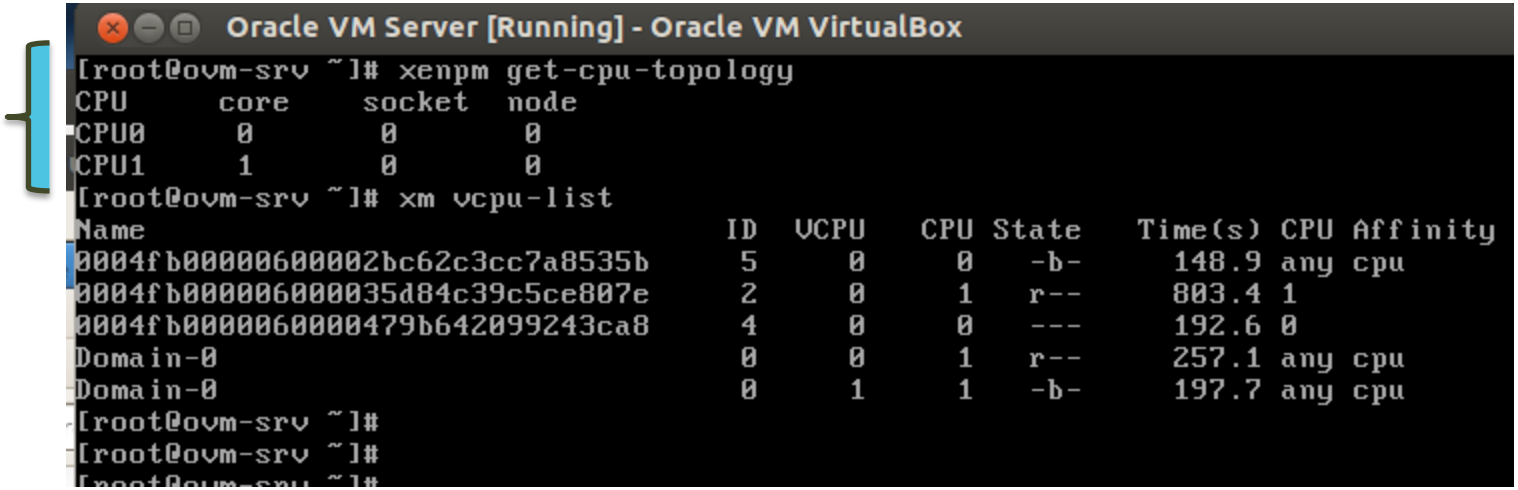
CPU Pinning OVM 3.1

- Binds a VM to physical CPUs (actually threads)
  - Supports CPU based licensing
  - Isolates VMs from each another
- Must be configured for each VM
  - Use the Oracle VM Utilities (ovm_vmcontrol) to set hard partitioning
    - Must be downloaded separately Oracle Support ID 13602094
  - Or modify vm.cfg manually on the VM Server
    - vi /<*repository file system path*>/VirtualMachines/<*virtual machine ID*>/vm.cfg
- Disabled during VM migrations between hosts
  - Must be re-enabled via the VM Utilities

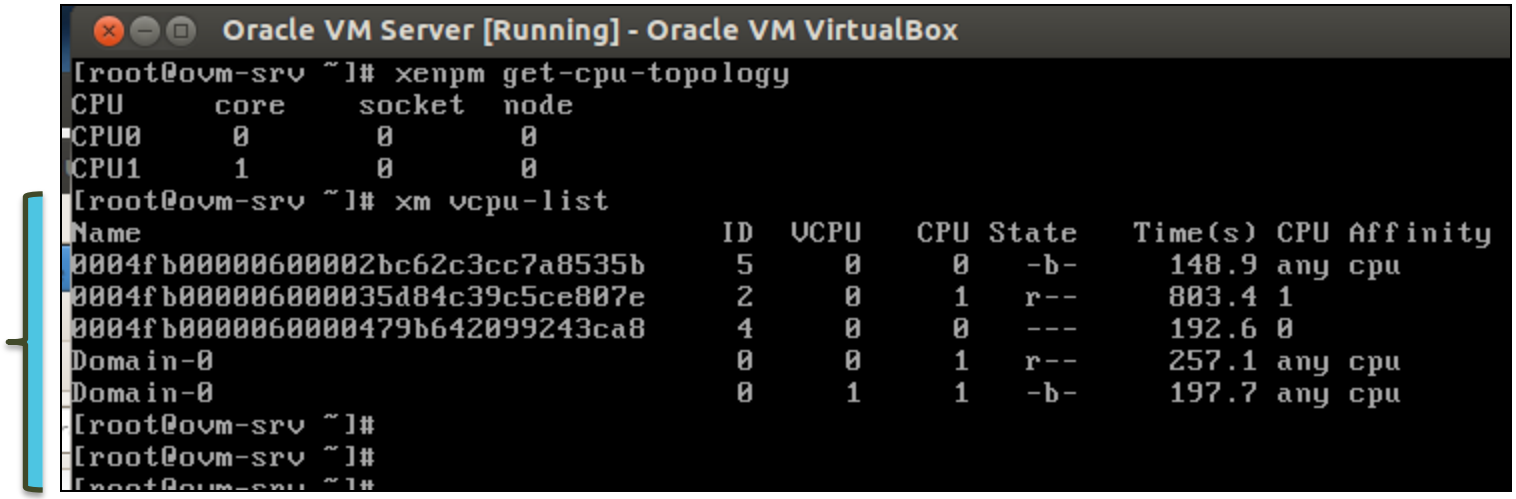
VMServer CPU Detail



VM Server
CPU Topology



VM Server
CPU Pinned

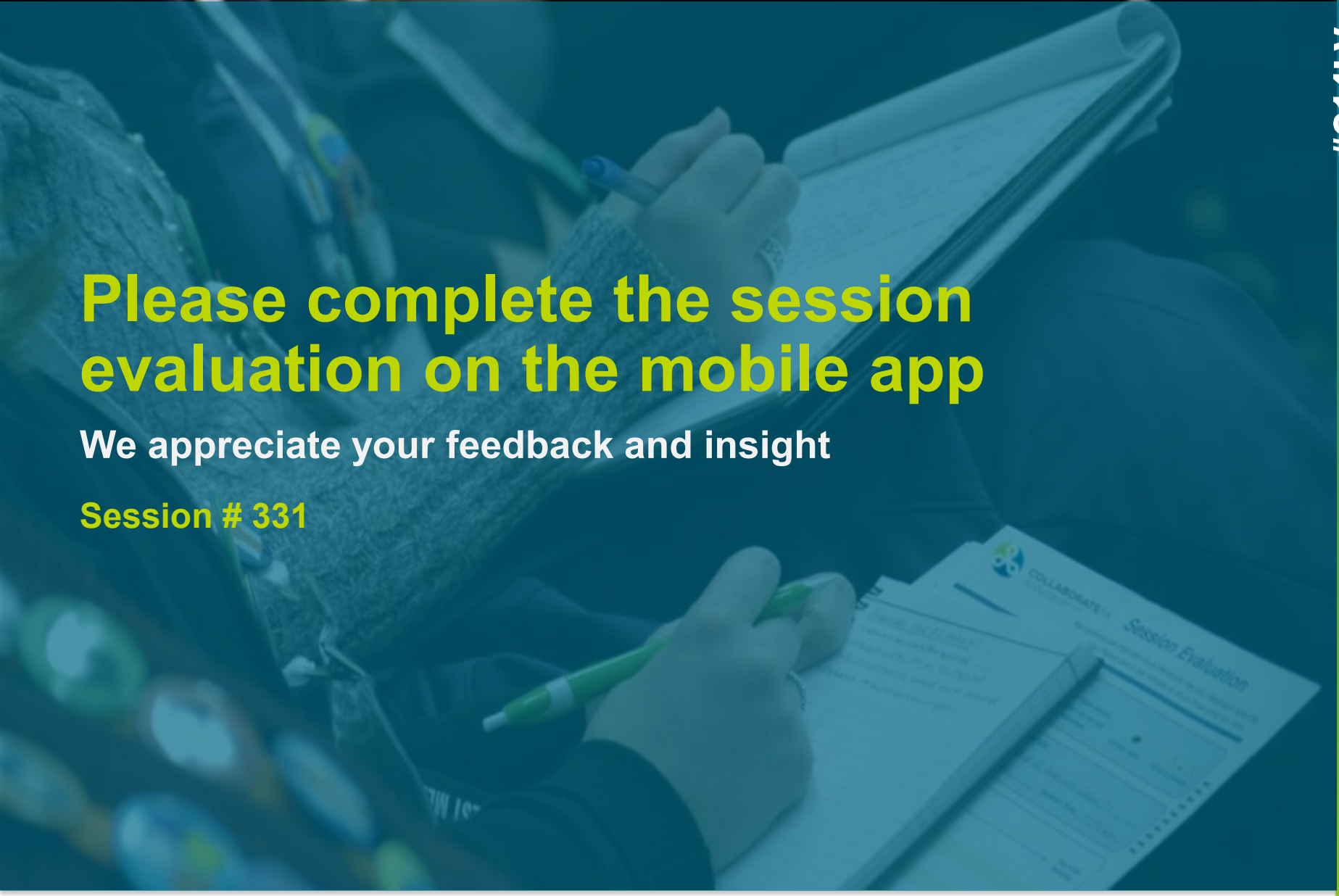


Oracle's VM hardware

- Oracle Database Appliance
  - Separate Dev/Test/Prod
  - Run you Applications with Database
- Oracle Exalytics
  - Separate Dev/Test/Prod
  - Separate Products
    - Separate Versions
- Oracle Virtual Compute Appliance
  - Brand new
  - Presentation from Wednesday at 4:30

Key feature review

- Key features enabling project success
  - CPU Pinning to limit hardware usage for purposes of database licensing
  - Physical disk configuration to support high performance
  - Clustering to guard against hardware failure
  - Excess CPU capacity was available to support OEM primary, secondary, and DR installations
    - VM Manager was actually later run using extra capacity in the Test cluster



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