ORACLE

Best Practices for Oracle Database on Windows

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Agenda

- Oracle Architecture on Windows
- Increasing Addressable Process Memory
- Tuning Memory with AWE/PAE, ORASTACK and Shared Server
- Monitoring Memory Usage
- 64-bit Environments
- General Tips on Running Oracle/Windows
- High Availability Solutions for Scalability
- Maximum Availability Architecture (MAA)
- Patching

Windows 32-bit Platform Support

OS	9iR2	10gR1	10gR2
Windows 2000	Yes	Yes	Yes
Windows XP Professional	Yes	Yes	Yes
Windows Server 2003	Yes	Yes	Yes
Windows Vista	No	No	Yes*

*Requires special 10203 client/server release for Vista

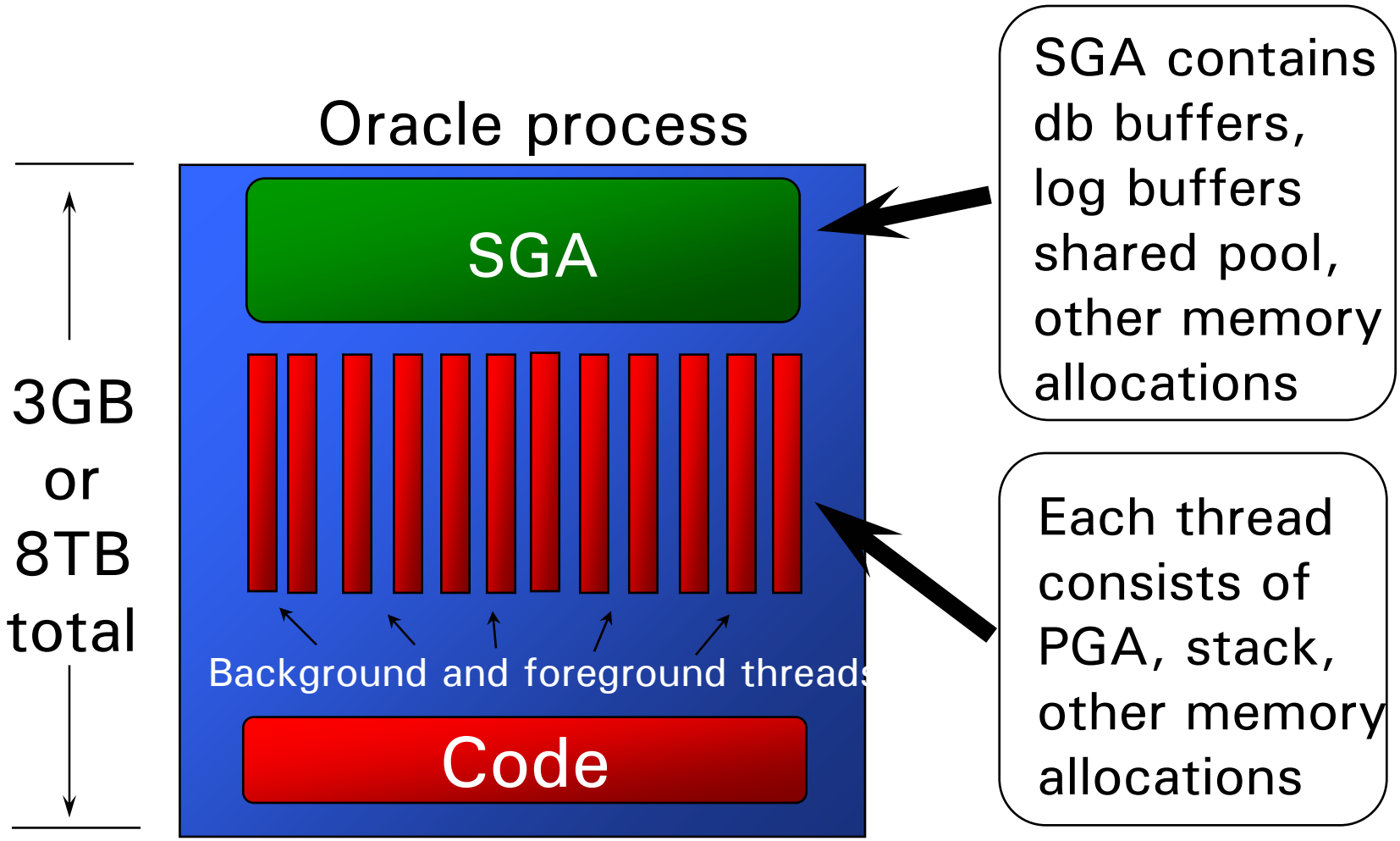
Windows 64-bit Platform Support

OS	9iR2	10gR1	10gR2
Windows Server 2003 for Itanium (64-bit DB)	Yes	Yes	Yes
32-bit Windows XP & Windows Server 2003 on EM64T (32-bit DB)	Yes	Yes	Yes
Windows XP & Windows Server 2003 x64 (32-bit DB)	Yes (client only)	Yes (client only)	Yes (client only)
Windows XP & Windows Server 2003 x64 (64-bit DB)		Developer Release (May 04)	Yes
Windows Vista x64			Planned later CY2007

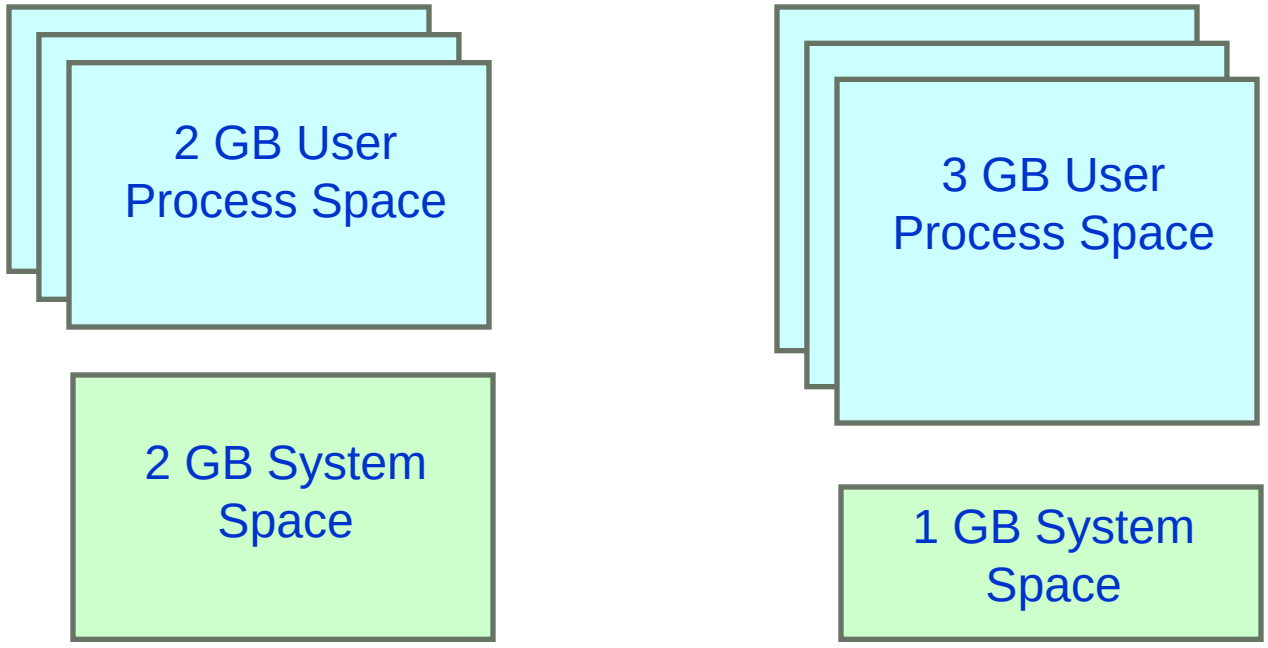
Database Architecture

- Unlike UNIX ports, Oracle on Windows is implemented as a single operating system process.
- Typical “processes” such as PMON and LGWR have been converted to native Windows threads running in a single process.
- One process exists per instance on a Windows server.

Architecture: Thread Model



32-Bit Address Space



Virtual Memory Address Space is limited to 4 GB in 32-bit architecture

4GT RAM Tuning

- Increase addressable memory available to the Oracle process by adding /3GB switch to boot.ini file:

  multi(0)disk(0)rdisk(0)partition(1)\WINNT="Microsoft Windows 2000 Advanced Server" /fastdetect /3GB

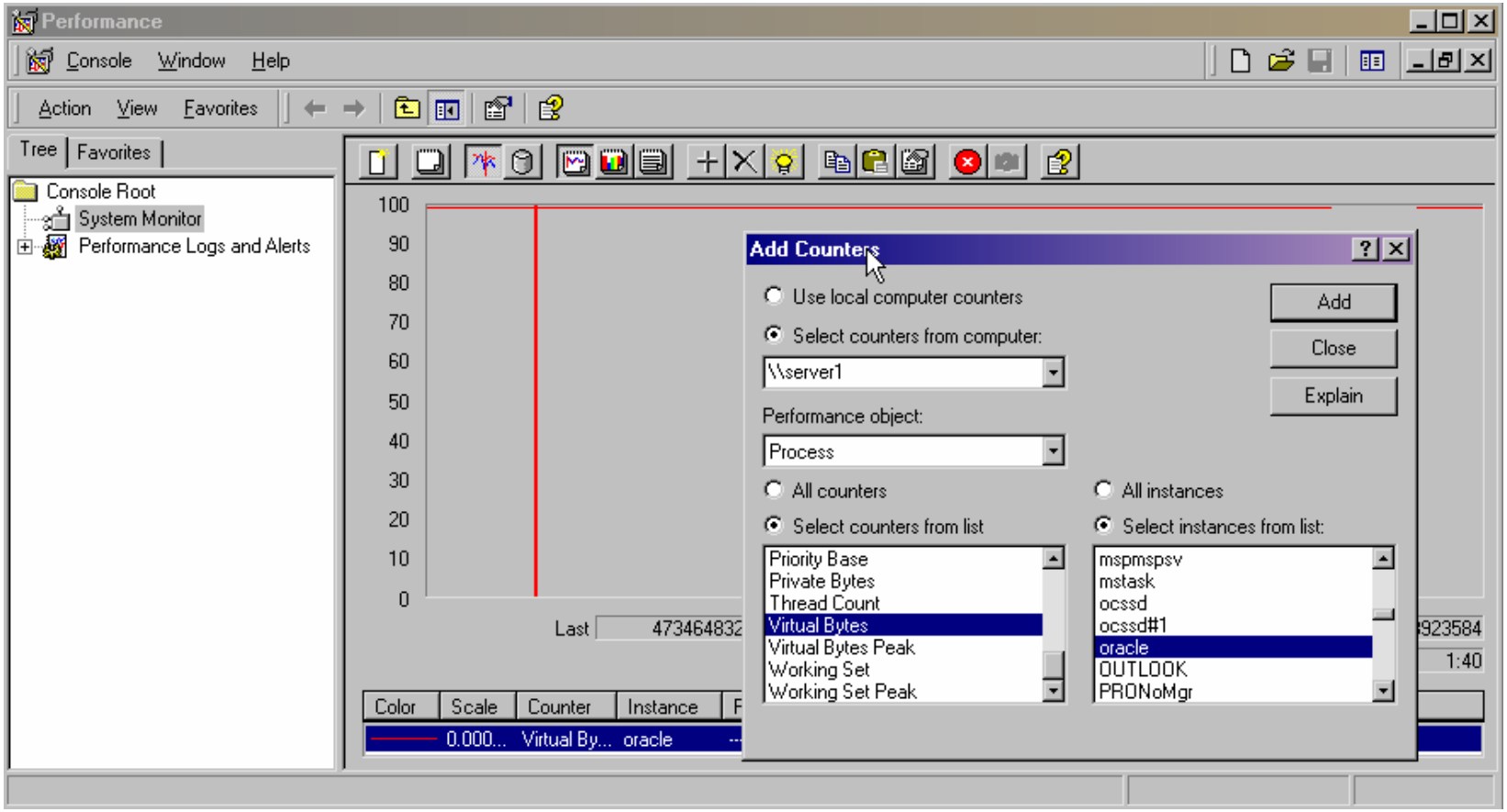
- Reboot server to enable
- Must monitor kernel memory closely to prevent instability of operating system
- See Metalink Notes 46001.1 and 297498.1
- See Microsoft KB article 297812

Monitoring Memory

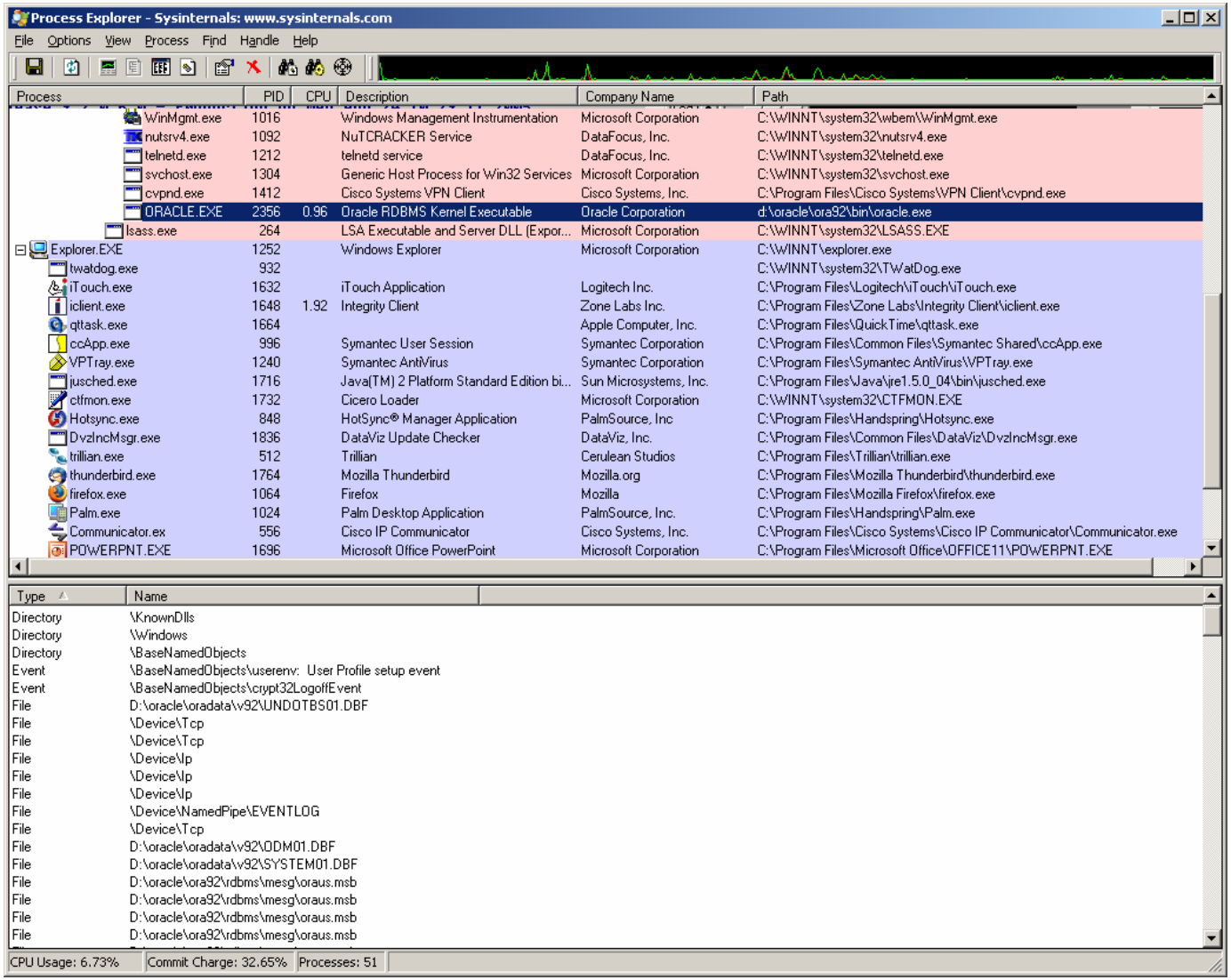
- Key Items to Monitor for Memory Usage:
  - Performance Monitor - Virtual Bytes for oracle.exe to see total memory used by the process
  - Total Pool Non-Paged Bytes – Memory Counter
  - Total Pool Paged Bytes – Memory Counter
  - Free System Page Table Entries (PTE's) – Memory Counter
  - In addition to Perfmon, the Process Explorer tool from Windows Sysinternals is invaluable:

    http://www.microsoft.com/technet/sysinternals/default.mspx

Performance Monitor



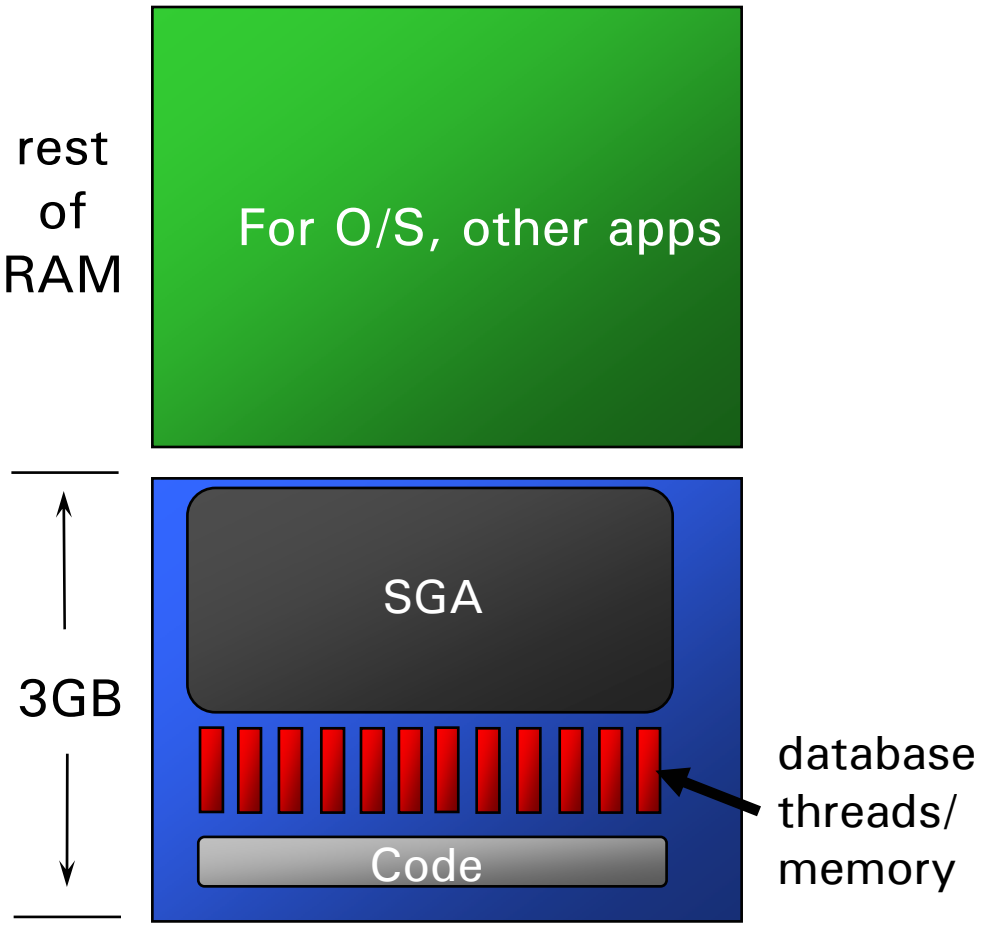
Process Explorer



OS Tools

- tasklist, taskkill
- tlist (Shows command line args with -c)
- driverquery
- diskpart
- sc (sc query state= all)
  http://www.microsoft.com/technet/sysinternals/default.mspx
- regmon, filemon, procexp, tcpview
- Windows Services for Unix

32-bit: VLM Support



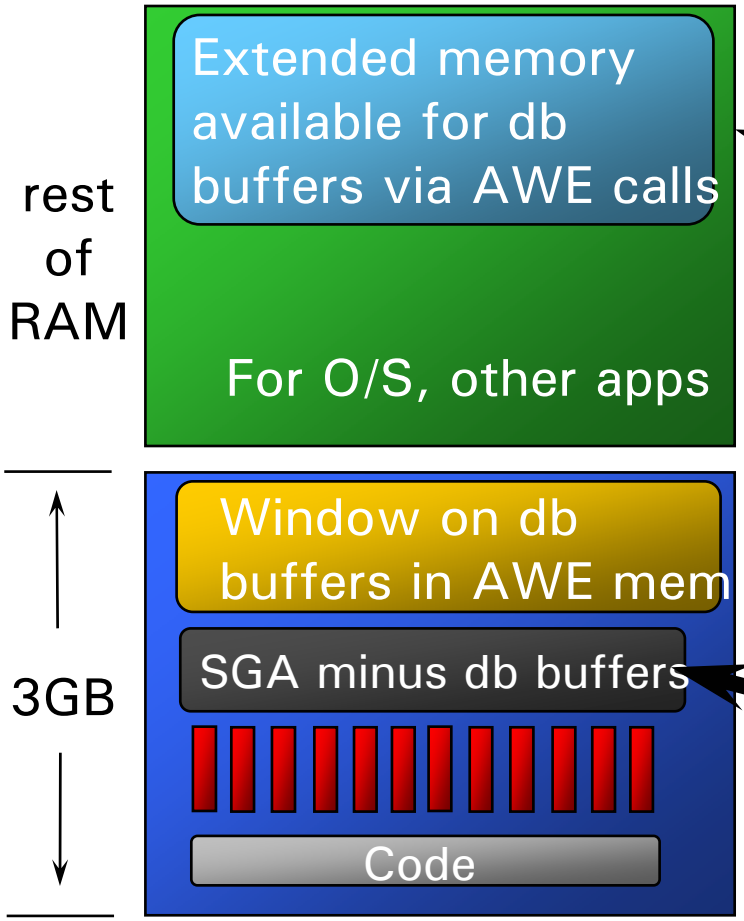
Windows Server 2003
Memory Limits (32-bit)

Standard Edition:
4GB

Enterprise Edition:
32GB

Datacenter Edition:
64GB

32-bit: VLM Support



Memory from AWE calls used for db buffers only.
The amount of AWE memory allocated equals db_block_size times db_block_buffers.

Oracle operating system process. Normally limited to 3GB of address space. With VLM, Oracle can get up to 12GB of database buffers.

Implementing AWE

- Use AWE with Oracle by adding initialization parameter USE_INDIRECT_DATA_BUFFERS
- Use DB_BLOCK_BUFFERS instead of DB_CACHE_SIZE
- With AWE, database buffer cache can be increased up to roughly 12 GB
- Default value for AWE_WINDOW_MEMORY is 1 GB
- See Metalink Note 225349.1 for more information

Using ORASTACK

- Each thread within Oracle process is provided 1MB reserved stack space
- Reduce to 500k without consequence:

  C:\ orastack tnslsnr.exe 500000

  C:\ orastack oracle.exe 500000
- See Metalink Note 46001.1 for more information

Using Shared Server

- With Shared Server, client connections are ultimately sent to a Dispatcher, which binds the client to an already established virtual circuit
- Implement Shared Server in tnsnames.ora:

```
(DESCRIPTION=
   (ADDRESS=(PROTOCOL=tcp)
      (HOST=sales-server)(PORT=1521))
      (CONNECT_DATA= (SERVICE_NAME=sales.us.acme.com)
      (SERVER=shared) ))
```

- See Net Admin Guide for more details

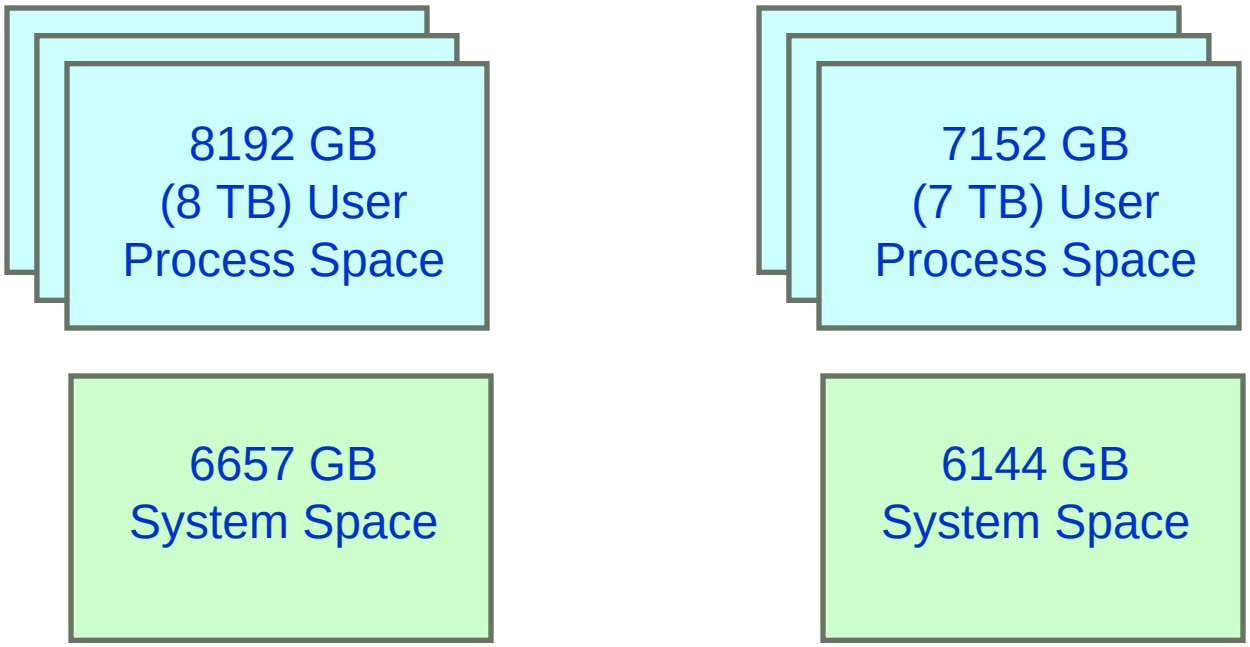
Best Practices for 32-Bit Memory Optimization

- Implement the /3GB switch
- Combine /3GB with /USERVA switch
- Run orastack to reduce stack size for both tnslsnr.exe and oracle.exe – be aware that patches change the executables, so run it again after patching.
- Use shared servers in implementations where large#'s of users connect in to the database.
- Control PGA Memory by using PGA_AGGREGATE_TARGET parameter

Best Practices for 32-bit Memory Optimization (continued)

- Verify Monitor Kernel Memory and Oracle Memory by using Perfmon or other tools that accurately measure Virtual Bytes.
- Use Automatic Workload Repository (AWR) to monitor cache hit ratios and shared_pool stats, etc. Make sure that values are not overstated
- If large buffer cache is needed, implement AWE, but be aware that using AWE disables Automatic Memory Management features (SGA_TARGET cannot be used when USE_INDIRECT_DATA_BUFFERS is set).

64-Bit Address Space



X64 (AMD or EM64T)

Itanium

Virtual Memory Address Space is limited to
7-8 TB in 64-bit architecture (depending on chip)

64-bit Oracle Releases

- Oracle has a long history of supporting 64-bit databases on other platforms
- Interoperability between 32-bit clients and 64-bit servers and vice versa
- Improved performance, availability and scalability
- Itanium is supported with 9.2.0.3 and higher
- x64 (AMD/EM64T) is supported with 10.2.0.1 and higher

Migration to 64-bit

- 32-bit to 64-bit upgrade process is simple
  - 32-bit data files are compatible with 64-bit DB
- No need to recreate the database
- Full export and import not required
- Database Upgrade Assistant automates process
- Transparent migration for end-user applications
  - No changes required to existing client applications when running against 64-bit database

64-Bit Best Practices

- Run correct 64-Bit version of Oracle for the architecture – i.e. 64-Bit Oracle for AMD or 64-Bit Oracle for Itanium.
- 32-Bit Oracle RDBMS not supported on 64-Bit platforms
- Use MBR disks instead of GPT disks
- For RAC environments with SGA's > 4GB, apply latest Oracle patchset.
- Enable Large Pages (Note 422844.1)

Additional General Best Practices

- Take Advantage of Hyperthreading, which allows a single CPU to look like 2 CPU's
- Don't set ORACLE_HOME in environment – Oracle gets the environment via the Registry. Oracle.key file in OH\bin points to correct registry key.
- SQLNET.AUTHENTICATION_SERVICES=(NTS)
  this is a default value in sqlnet.ora for a reason – it should be left at default.
- In 10.2.x, SQLNET.INBOUND_CONNECT_TIMEOUT defaults to 60 – this may need to be set to 0 in some situations. Prior to 10.2 this is not an issue. (Note 363705.1 explains)
- Use Automatic Storage Management (ASM) whether running single-instance or RAC

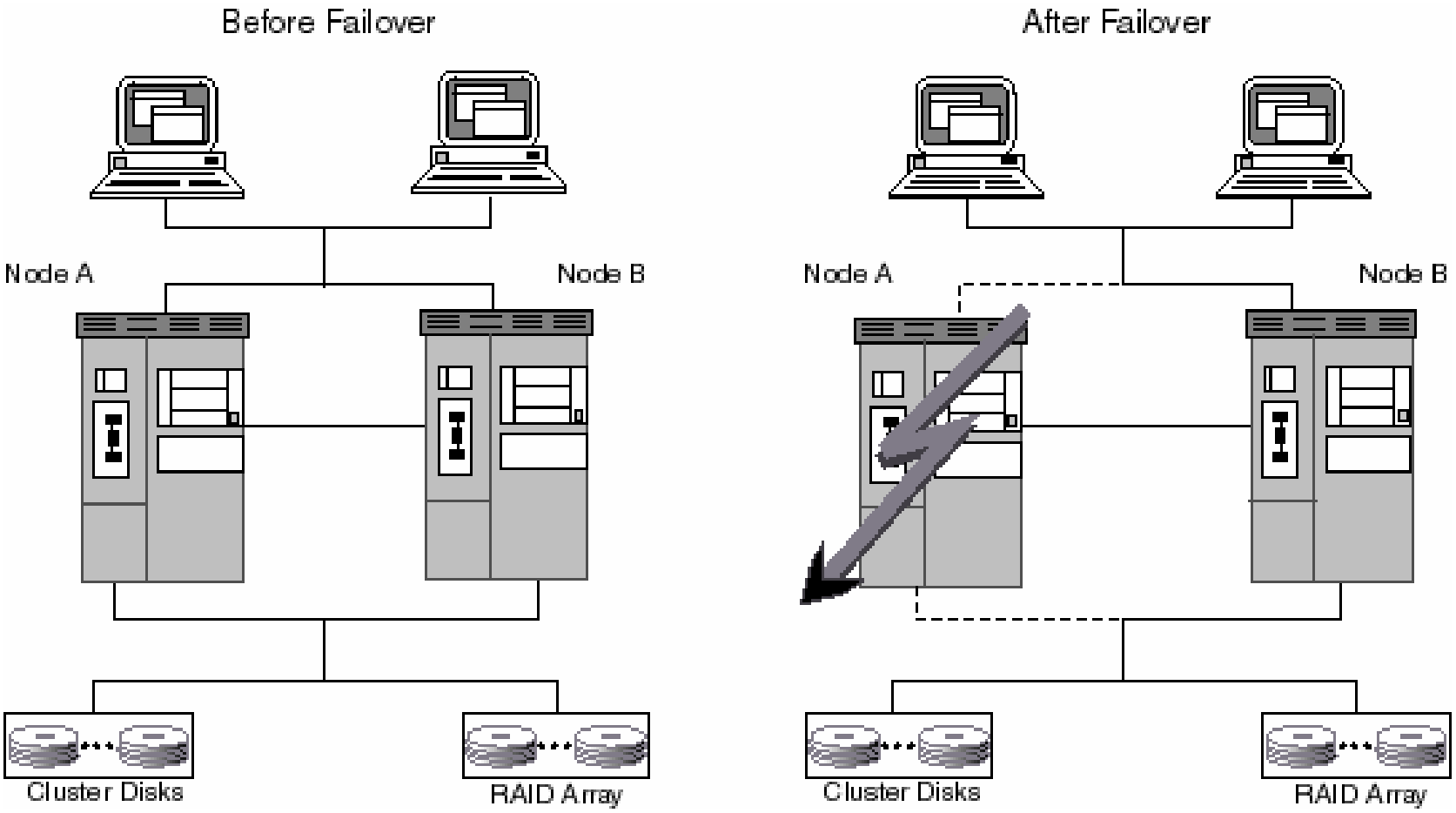
High Availability Solutions

- HA becomes essential as databases are critical component of business
- HA Goals: Minimize downtime to your company and your customers
- Solutions for Windows Environments
  - Oracle Fail Safe
  - Real Application Clusters (RAC)
  - Data Guard (DG)
  - Maximum Availability Architecture (MAA)

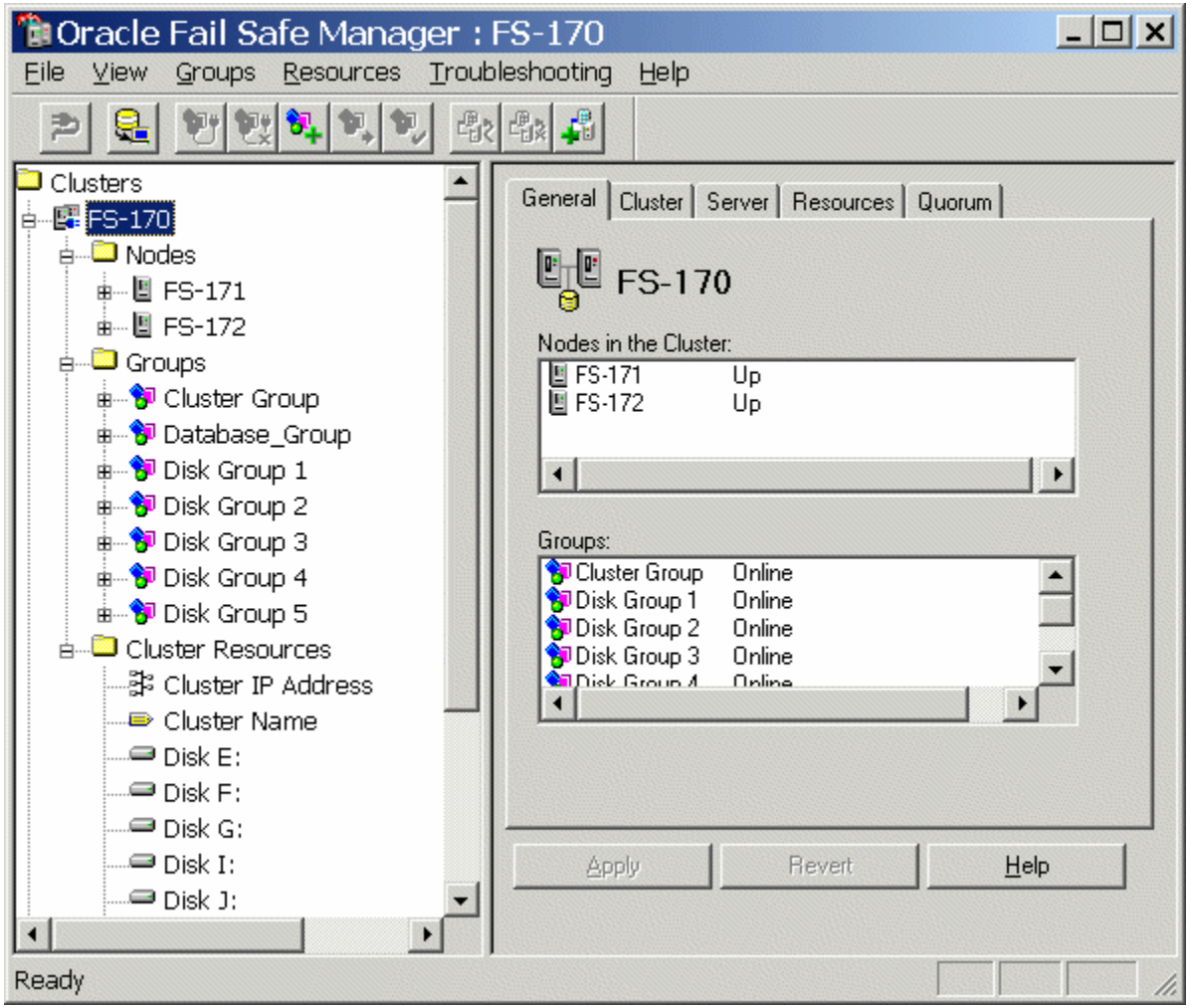
Oracle Fail Safe

- Integrated with Microsoft Clustering, Fail Safe is a core feature included with every Oracle 10*g* and Oracle9*i* license for Windows NT, Windows 2000, and Windows 2003
- In the event of a system failure, Oracle Fail Safe works with Microsoft Cluster Server to restart Oracle databases and applications on a surviving cluster node
- MSCS and Fail Safe uses “share-nothing” architecture (only one node can access shared datafiles at any time)

Fail Safe Architecture



Fail Safe Manager



Fail Safe Best Practices

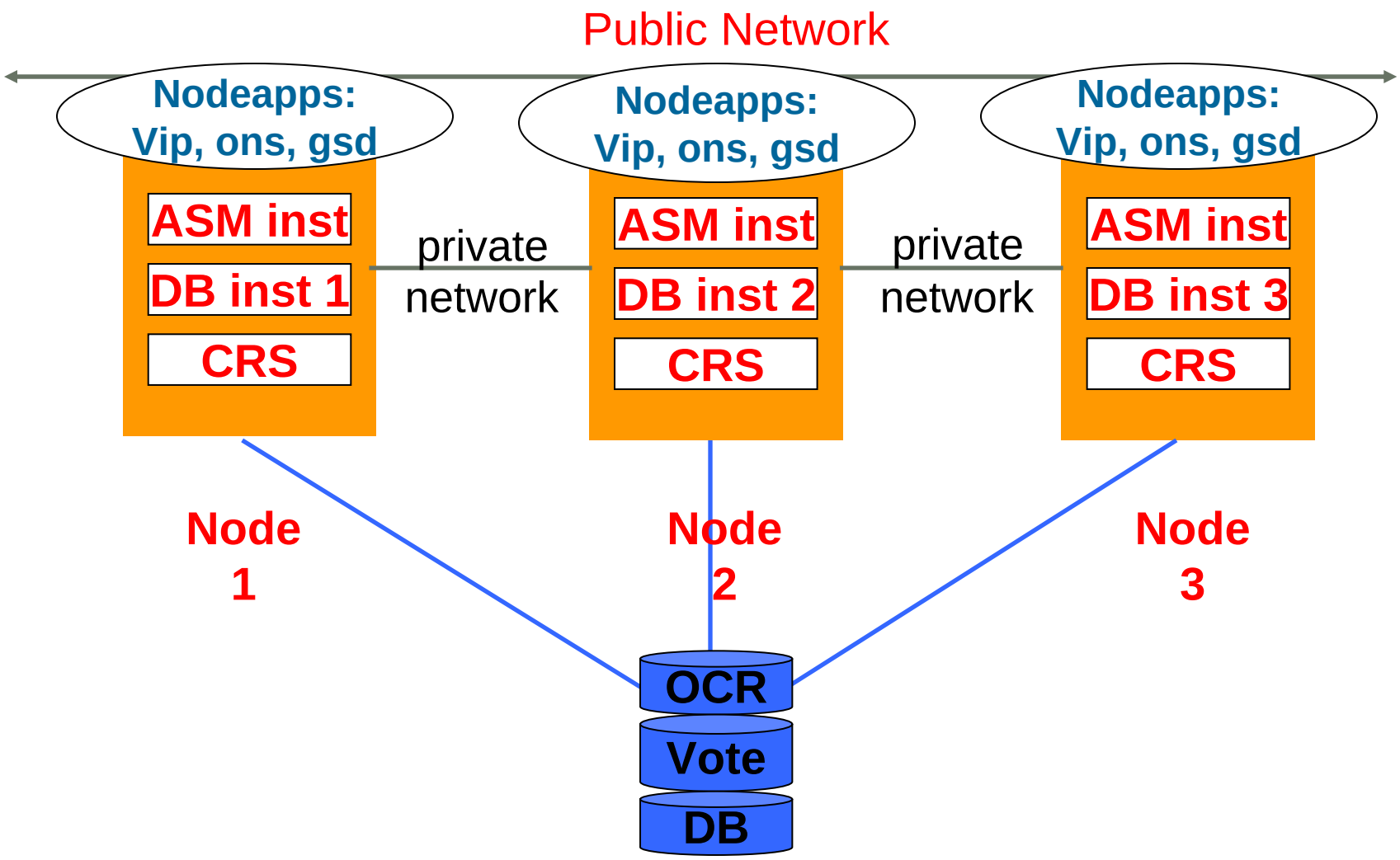
- One database per group
  - Separate production from non-production databases into different groups
- Multiple physical disks to be separated into different groups
- Failback and Restart properties should be reviewed for business needs

http://otn.oracle.com/tech/windows/failsafe/index.html

Real Applications Clusters

- Use RAC for scalability
  - Add instances against same database files providing more Oracle processes and increasing number of users
  - Provides unique scalability on Windows that no other vendor offers
- Clustered databases supported on Windows platforms since version 7.3.3
- Uses Oracle's own clustering software, not MSCS
- Oracle 10g provides platform independent Cluster Ready Services (CRS) to handle failover of services to surviving nodes

RAC Instance Architecture



RAC/CRS Install Options

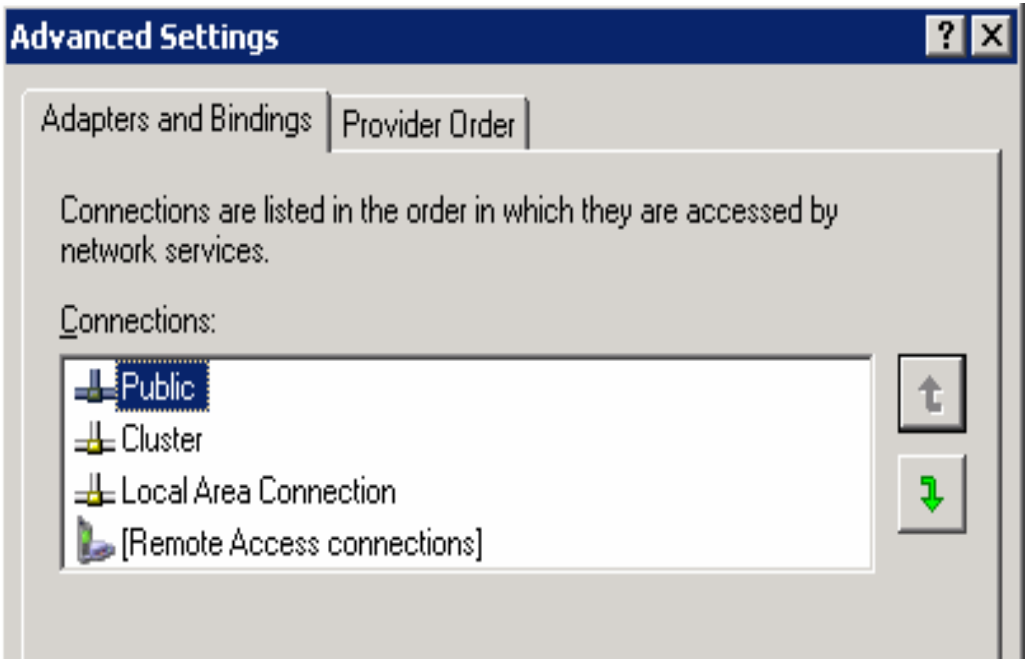
- Oracle Home can be on local NTFS drives or Oracle Cluster File System (OCFS)
  - Vast majority of installs use local NTFS homes
  - CRS home must be local NTFS drive
- Datafiles can reside on OCFS, RAW, or Automatic Storage Management (ASM)
- OCR and Voting file can reside on OCFS or RAW
- Refer to documentation for recommended partition sizes

Shared Storage

- Automount must be enabled in Windows 2003
  - Diskpart.exe can be used:

    diskpart> automount enable
- Creating Partitions
  - Create all partitions on one node
  - Extended Partitions, w/logical drives
  - Use Basic disks: Dynamic Disks not supported
  - Windows 2003 requires a reboot
    - Remove drive letter assignments
  - Verify all nodes see all shared partitions

RAC Network Checklist



Network Connections

Advanced-> Advanced Setting

- Public adapter should be first
- Private adapter should be second
- Ping node's public hostname to verify
- Ping each node's public & private hostname

RAC Best Practices

- Eliminate Single Points of Failure
  - NIC's, Switches, Interconnect, Shared Storage, Power Supplies
  - Understand cost vs. availability tradeoff
- Use fastest switch available for private interconnect
  - Disable additional protocols such as spanning tree protocol
  - Increase MTU size as high as switch allows – i.e. 9000
  - Allow cards and switch ports to autonegotiate speed.
- Use static IP addresses
  - Public LAN resolved by DNS and hosts file
  - For cluster interconnect use non-routable IP (10.X or 192.168.X)

RAC Best Practices

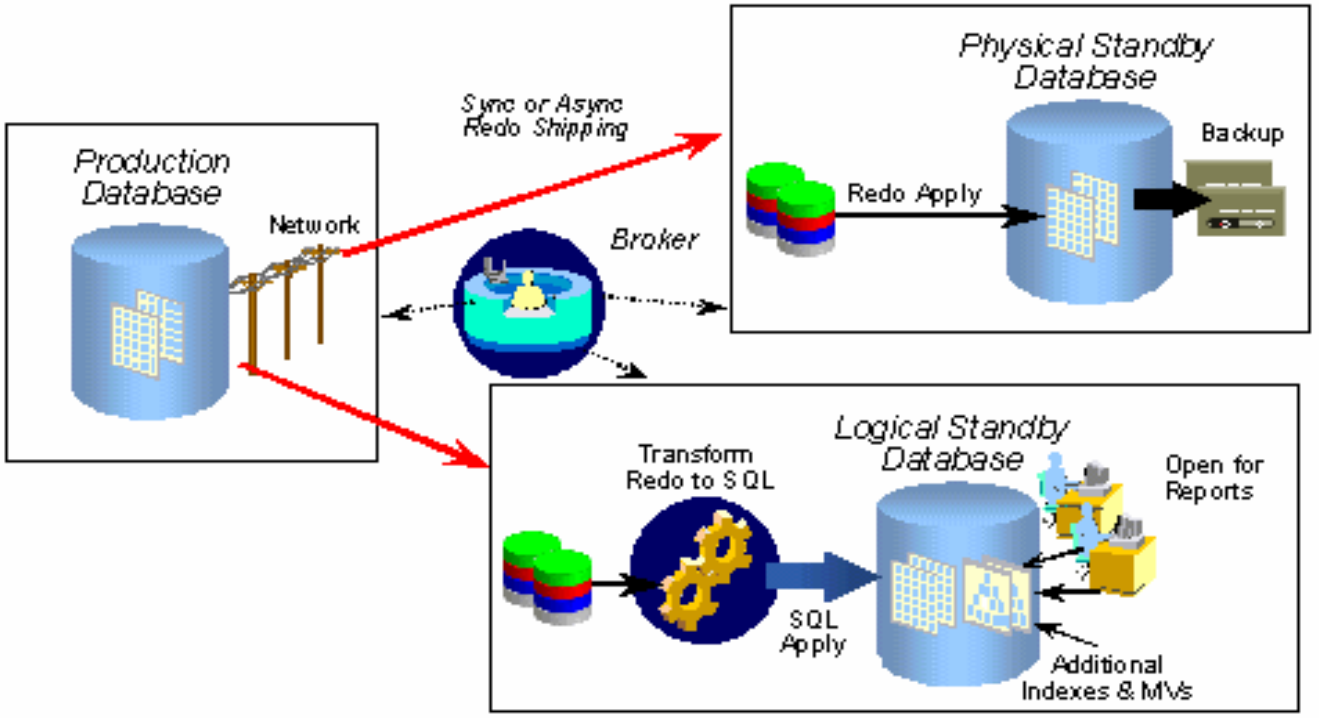
- On 10gR1, be sure to manually backup Voting Disk/File.
- Backups of files on RAW devices can be done via ‘ocopy’ utility on windows – i.e.:
  - Ocopy \\.\votedsk C:\backups\votedsk.bak
  - Backups of OCR can be taken manually as well, but CRS backs up OCR every 4 hours (on 10.1.0.4)
- 10gR2 allows mirroring of OCR and Voting Disks

Oracle Data Guard

- Data Guard is Oracle's Disaster Recovery product which maintains and monitors one or more standby databases to protect enterprise data from failures, disasters, errors, and corruptions
- Standby databases, which can be located across large geographic regions away from the primary database, can be switched to the production role if a problem occurs with the primary
- Can use different Windows versions for primary and standby (2003 for primary, 2000 for standby)
- DG is free with Enterprise Edition of RDBMS

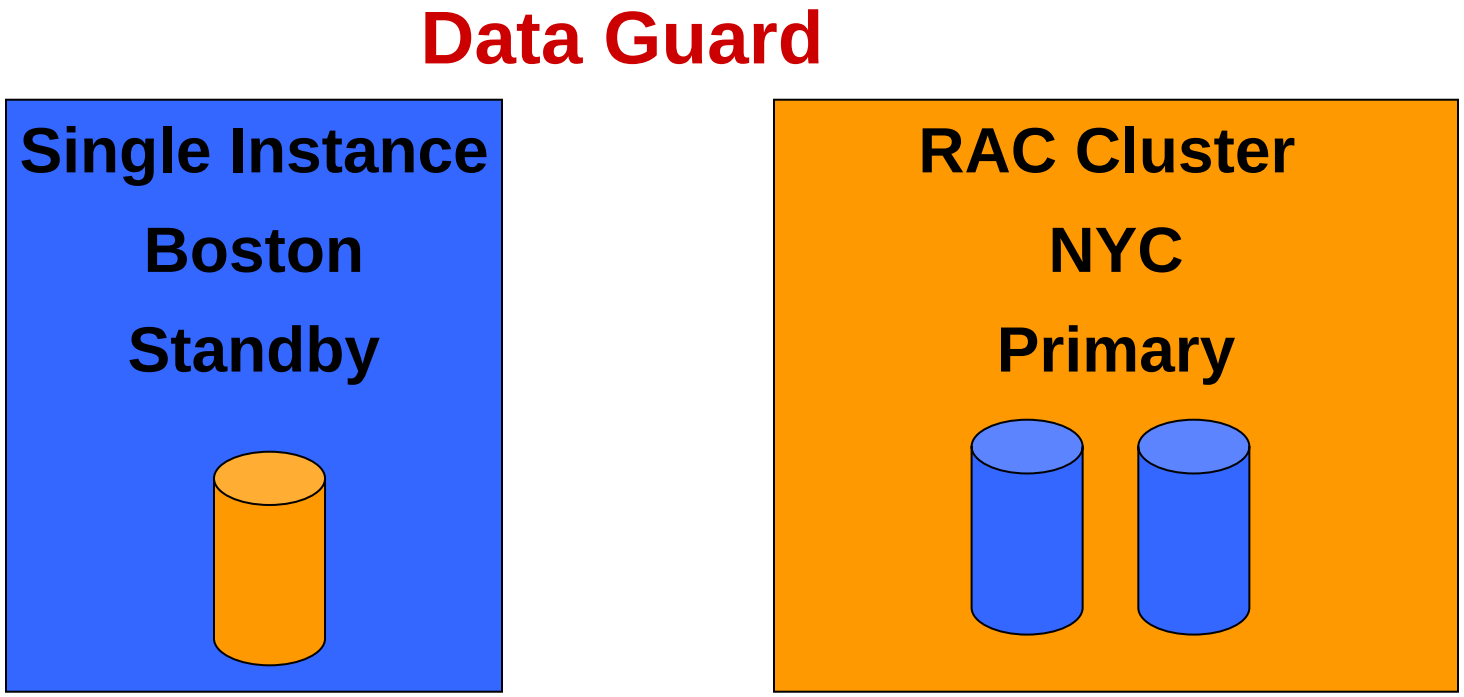
http://www.oracle.com/technology/deploy/availability/htdocs/DataGuardOverview.html

Data Guard Architecture



Maximum Availability Architecture (MAA)

- RAC + DataGuard
  - Eliminates physical location as SPOF



Patching Best Practices

- Apply CRS Patchset before RDBMS install
  - Simplifies process
  - Install patch to all nodes in the cluster
  - Apply patch to each node
  - Provides the ability for rolling updates
- For new installs on patched Oracle Homes, run catpatch after creating cloned databases with DBCA

Patching Best Practices

- For existing installs, make plans to test and apply future patchsets
- At minimum, CPU patches are released quarterly
- Fifth-digit patches provided on Windows platforms which bundle one-off patches
- For fixing new issues, applying latest patchset and fifth-digit patches available will help in eliminating known bugs

More Information

- Windows Server Technology Center
  - http://otn.oracle.com/windows
- Oracle Documentation on OTN: Windows tab at http://www.oracle.com/pls/db102/homepage
- http://www.oratips.com - debut edition in October contains article on Oracle/Windows by Scott Jesse
- “Oracle9i for Windows 2000 Tips & Techniques”
  - Authors: Scott Jesse, Matthew Hart, Michael P. Sale
- For more questions
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