

InfoBrief

Dell 2-Node Cluster Achieves Unprecedented Result with Three-tier SAP® SD Parallel Standard Application Benchmark on Linux

*Leveraging Oracle®9i Real Application Clusters
(RAC) Technology and Red Hat®
Enterprise Linux 3, Dell Proves Scalability
“Outside the Box”*

Results

- On June 29, 2004, SAP certified the results of a three-tier SAP® Sales and Distribution (SD) Parallel Standard Application Benchmark on two Dell PowerEdge 6650 servers supporting a total of 1,350 SAP SD Parallel Benchmark users.
- Dell demonstrates its technology leadership in being the first to certify a Linux result running the SAP R/3® Enterprise Release 4.7 solution, Oracle9i R2 database with Real Application Clusters (RAC)

on Red Hat Enterprise Linux 3 for the three-tier SAP SD Parallel Standard Application Benchmark.

- When compared with two-tier SAP SD Standard Application Benchmark results from competitors such as HP, IBM, Fujitsu Siemens, Unisys and NEC, running on a total of eight (8) processors (see Table 1 below), the Oracle9i RAC database configuration spread across two Dell PowerEdge 6650's, each with 4 Intel® Xeon™ processors, demonstrates the potential advantages to scale enterprise solutions using industry-standards based servers instead of relying on larger, often proprietary, SMP servers.
- As Oracle9i RAC database technology is inherently capable of maintaining a functional database when one of the database nodes fails, customers using this technology can expect a robust and highly available database setup for their mission-critical SAP solution-based implementations on Linux. The Dell configuration is designed to provide this high-availability and scalability combined with excellent TCO.

The Challenge and the Configuration

Enterprise solutions such as the mySAP™ Business Suite family of business applications demand high-availability and easy scalability regardless of the size of the customer's organization. Users of SAP solutions demand uninterrupted database access whether or not hardware and software failures occur. Businesses and organizations grow, and their IT requirements can change rapidly. Adding capacity or changing workloads to SAP systems may require re-configuring or replacing the database server to adapt to the new situation. Deploying a database cluster instead of one single, dedicated machine can help maximize the availability of the overall system in situations like these.

The configuration used to achieve this outstanding result was chosen for its simplicity in meeting this challenge and, with potential limited customer resources in mind, to show how far two standard, 4-way Dell PowerEdge servers could go in establishing adequate performance, provide failover and scaling capability, in addition to driving down overall hardware costs for a SAP solution-based system landscape. Expansion in this concept is simple: add cloned nodes as needed.

Another reason for using the benchmark configuration setup below is that the Linux operating system has now become a viable part of the data center. For customers with longstanding UNIX backgrounds and investments, Linux is often easier to operate and maintain than other operating systems. Historically, Linux's lack of database failover mechanisms has hurt its acceptance in the SAP solution-based market

space. However, by clustering two or more server nodes together into an Oracle9i RAC configuration, this situation has been rectified.

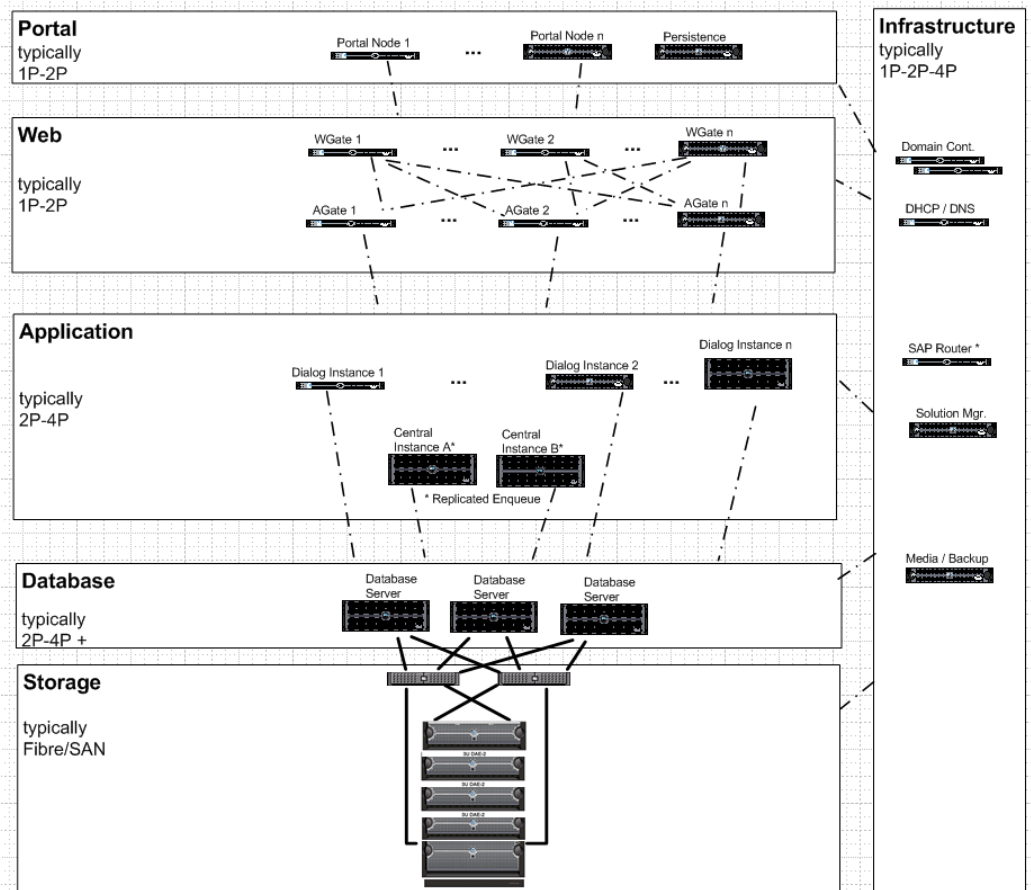
Each identical Dell PowerEdge 6650 server contained the following components:

- 4 x Intel Xeon MP 3.0 GHz processors with 4MB L3 cache
- 8 GB RAM
- 2 x Gigabit Ethernet adapter for the public network
- 1 x Gigabit Ethernet adapter for the Oracle9i RAC cluster interconnect
- Dell PERC4/DC RAID controller for the 2 x 36GB internal SCSI HDs
- QLogic 2340 fibre channel adapter

The high-performance storage used for this benchmark :

- Dell/EMC CX600 fully redundant fibre channel storage solution with a total of 30 x 73GB HDs

Figure 1: The diagram shows an example of how scalability can be achieved in a typical SAP solution-based landscape at all layers of the solution. Oracle9i RAC provides the scalability and reliability for the database layer. Note: The actual benchmark was run on two Dell servers comprising both the database and application layers. This is not the configuration shown here.



Customers Have Platform Choice: Some Comparisons

Organizations have a wide choice of hardware platforms, operating systems, and databases to choose from when determining how best to deploy their SAP applications to meet their unique business needs. In addition, as Figure 1 above clearly shows, the proven scalability of a SAP three-tier application architecture adds the element of flexibility to sizing and designing a SAP solution-based landscape that can meet the performance and budgetary requirements of any implementation of SAP solutions.

Comparison #1

The result of the Dell 2-node cluster on the three-tier SAP SD Parallel Standard Application Benchmark that has now been certified by SAP was achieved running on a total of 8 Intel Xeon 32-bit processors. As the transactions used in all SAP SD Standard Application Benchmarks are the same, whether running in a two-tier, three-tier, or Parallel set-up², the number of SAP SD Benchmark Users achieved in any of the SAP SD Standard Application Benchmarks is indicative of the performance level that a particular configuration actually delivers. When run using the same release of SAP R/3, results among SAP SD Benchmark types can be compared. As a special requirement for SAP SD Parallel Standard Application Benchmarks, a so called "Round-Robin" load distribution must take place. This configuration may imply higher resource consumption on the application server.

Table 1 below compares the result of the Dell 2-node three-tier SAP SD Parallel Standard Application Benchmark to some specific results of other vendors running SAP R/3 Enterprise 4.7 in a two-tier SAP SD Standard Application Benchmark environment, using various processor types, clock speeds, cache sizes, and operating systems, as certified by SAP. These vendors include HP, IBM, Fujitsu Siemens, Unisys, and NEC.

Table 1 – The selected results shown are for certified SAP SD Standard Application Benchmarks running SAP R/3 Enterprise 4.7 as of June 29, 2004 (for complete details of these and all other SAP benchmark results and their certificates see www.sap.com/benchmark).

Platform	Number of processors used in the benchmark	Type of processor and speed used	Number of certified SAP SD Benchmark Users /Architecture	Operating System/Database Used	SAP Benchmark Certification number
2 x Dell PowerEdge 6650	8	Intel Xeon MP 3.0 GHz 4MB L3 cache	1,350 SD Parallel	Red Hat Enterprise Linux 3 / Oracle9i R2 (RAC)	2004038
HP Integrity rx4640-8	8	4 HP mx2 dual processor modules with Intel® Itanium® 2 1.1 GHz, 4MB L3	1,320 SD two-tier	HP UX 11i / Oracle9i	2004020
HP Integrity rx7620	8	Intel Itanium 2 1.5GHz, 6MB L3 cache	1,240 SD two-tier	Windows Server™ 2003 Enterprise Edition/ SQL Server 2000	2004037
HP 9000 Rp4440	8	PA-8800, 1 GHz, 768 KB(I) + 768 KB(D) L1 cache	1,240 SD two-tier	HP UX 11.11 / Oracle9i	2004001
IBM x455 Model 8855 3-RX	8	Intel Itanium 2 1.5GHz, 6MB L3 cache	1,200 SD two-tier	Windows Server 2003 Enterprise Edition/ DB2 UDB 8.1	2003063
Unisys ES7000 Model 550	16	Intel Xeon MP, 2.8 GHz, 2MB L3 cache	1,200 SD two-tier	Windows Server 2003 Datacenter Edition / SQL Server 2000	2004002
IBM x445 Model 8870-42X	8	Intel Xeon MP 3.0 GHz 4MB L3 cache	1,165 SD two-tier	Windows Server 2003 Datacenter Edition / DB2 UDB 8.1	2004010
Fujitsu Siemens PRIMERGY Model RX800	8	Intel Xeon MP, 2.8 GHz, 2MB L3 cache	955 SD two-tier	SuSE Linux Enterprise Server 8 / SAP DB 7.3.0.28	2004009
NEC Express5800 Model 180Rd-4	8	Intel Xeon MP, 2.8 GHz, 2MB L3 cache	860 SD two-tier	Windows Server 2003 Enterprise Edition / SQL Server 2000	2003068

The selected results in Table 1 highlight the following:

- The Dell 2-node cluster running Oracle9i RAC on Red Hat Enterprise Linux outperformed the listed larger SMP platforms by up to 56%.
- Based on the results listed in Table 1, the Dell 2-node cluster of two 4-way, 32-bit servers demonstrated better performance than an 8-processor 64-bit RISC server, 8-way 64-bit Itanium 2 servers, and even a 16-way 32-bit Xeon server.
- The Dell 2-node cluster running Red Hat Enterprise Linux 3 outperformed the next best Linux result running on a total of 8 processors by 41%.
- The Dell 2-node cluster utilized a total of 16GB system memory between the two nodes, while many of the 8-way SMP servers in Table 1 above used more memory to achieve a worse result. For details see www.sap.com/benchmark.
- Beside throughput and performance, the Dell RAC configuration implicitly delivers a level of high availability that cannot be achieved with a single 8-way SMP server.

Comparison #2

A comparison of two 4-way Dell PowerEdge 6650's to various 8-way servers shows that customers can scale effectively "outside the box" by leveraging Oracle9i RAC technology. Owing to the fact that the SAP application is known to scale well, customers could opt for a three-tier system landscape using two 4-way servers without using cluster technology to theoretically achieve similar benchmark results. What could be expected from this kind of benchmark configuration?

Table 2 below compares the Dell result on the three-tier SAP SD Parallel Standard Application Benchmark of 1,350 SAP SD Benchmark Users with three two-tier SAP SD Standard Application Benchmark results from HP, IBM, and Fujitsu Siemens, as certified. The HP and IBM results are the highest certified 4-way results achieved by these companies as of June 29, 2004 using Intel Xeon 32-bit processor technology, while the Fujitsu Siemens certified result represents the highest 4-way result using Linux as the operating system and utilizing Intel Xeon processors (clock speed and cache sizes are lower on the Fujitsu Siemens server) as of the same date.

Table 2 – Selected results are for certified SAP SD Standard Application Benchmarks running SAP R/3 Enterprise 4.7 as of June 29, 2004 (for complete details of these and all other SAP benchmark results and their certificates see www.sap.com/benchmark).

Platform	Number of processors used in the benchmark	Type of processor and speed used	Number of certified SAP SD Benchmark Users	Operating System/Database Used	SAP Benchmark Certification number
2 x Dell PowerEdge 6650	8	Intel Xeon MP 3.0 GHz 4MB L3 cache	1,350 SD <u>Parallel with round robin</u>	Red Hat Enterprise Linux 3 / Oracle9i R2 (RAC)	2004038
IBM x365 Model 88626-RX	4	Intel Xeon MP 3.0 GHz 4MB L3 cache	720 SD <u>two-tier no round robin</u>	Windows Server 2003 Enterprise / DB2 UDB 8.1	2004019
HP ProLiant DL580 G2	4	Intel Xeon MP 3.0 GHz 4MB L3 cache	667 SD <u>two-tier no round robin</u>	Windows Server 2003 Enterprise / SQL Server 2000	2004013
Fujitsu Siemens PRIMERGY Model TX600/RX600	4	Intel Xeon MP, 2.8 GHz, 2MB L3 cache	536 SD <u>two-tier no round robin</u>	SuSE Linux Enterprise Server 8 / SAP DB 7.3.0	2004004

- Assuming that by going from the two-tier configuration to a three-tier setup using two 4-way servers in each case can theoretically achieve 100% linear SAP application scalability, the IBM, HP, and Fujitsu Siemens results can be doubled to 1,440 SAP SD Benchmark Users for IBM, 1,334 SAP SD Benchmark Users for HP, and 1,072 SAP SD Benchmark Users for Fujitsu Siemens (with lower clock speed and less cache).
- When weighing all factors with regard to the required use of Round-Robin load distribution in the SAP SD Parallel Standard Application Benchmark (see above)², the Dell certified results measure up favorably to a classic three-tier SAP SD Standard Application Benchmark running the same number and type of processors.
- The vital aspect in this comparison is: While the other three-tier configurations running on two 4-way servers would have roughly the same performance levels as measured in SAP SD Benchmark Users, only the Dell configuration using Oracle9i RAC would offer customers a highly available database, one that would not have to be restarted if a database node fails. A running SAP solution-based system depends on a functional database. The Dell Oracle9i RAC configuration for SAP solutions layer offers both performance and high-availability for the database layer.

Summary

The Dell 2-node cluster result for the three-tier SAP SD Parallel Standard Application Benchmark shows that building SAP solution-based systems with relatively small, industry-standard servers can perform well in an SAP solution-based environment. In addition, owing to the inherent robustness and highly-available nature of an Oracle9i RAC cluster, customers should be able to create flexible system landscapes that can quickly and easily adapt to new requirements or performance profiles, thus helping to reduce costs, increase productivity and accelerate their return on investment.

¹ The Dell result on the three-tier SAP SD Parallel Application Benchmark was certified on June 29, 2004, certification number 2004038, and fully complies with the guidelines issued by the SAP Benchmark Council. More information on SAP Standard Application Benchmarks is available at <http://www.sap.com/benchmark>.

² For full details and descriptions of all SAP Standard Application Benchmarks please refer to <http://www.sap.com/benchmark>.

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