

# Oracle Corporation

## Oracle VM

### Performance Evaluation of Oracle VM Server Virtualization Software



Test  
Summary

*Premise: Server resources often are underutilized. It often is easy to accommodate the need for additional server resources by adding more hardware. But in today's cost-conscious landscape, with an emphasis on energy efficiency and managing power consumption, server virtualization emerges as a viable solution to maximize server utilization, achieve efficiency, provide scalability, while also being easy to deploy.*

Oracle Corporation commissioned The Tolly Group to evaluate the performance of Oracle VM running in a 32-bit Linux server environment and supporting a variety of workloads.

Tolly Group engineers examined the performance of virtual servers running on Oracle VM compared to typical bare-metal servers that consume more real estate and cost more to deploy.

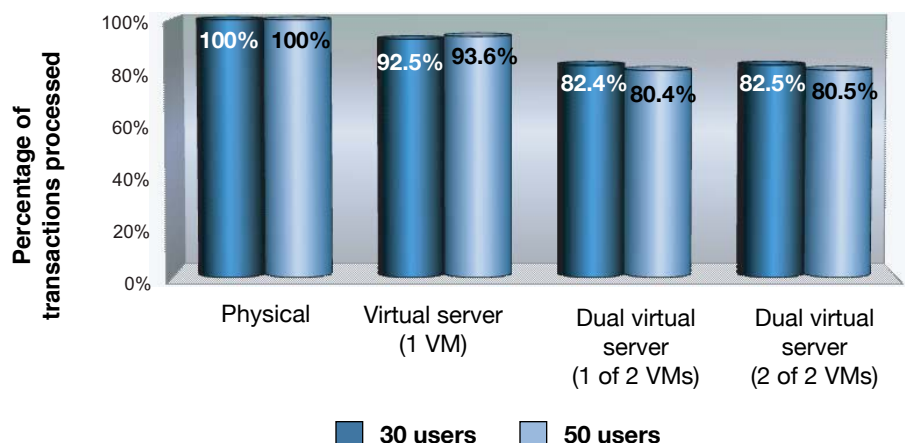
Engineers also conducted the same tests on two virtual machines to prove the performance scalability of the Oracle VM virtualization technology.

Tests were conducted in July 2008.

#### Test Highlights

- ▶ A single Oracle VM server processes almost 94% of the database transactions handled by a bare-metal server with 50 concurrent users
- ▶ Delivers 72% more database transactions when running two virtualized Oracle VM servers in a single machine, versus a single Oracle VM server
- ▶ Delivers 82.4% and 82.5% of the transaction load normally handled by a bare-metal server when two virtual servers are paired together to support 30 users
- ▶ Provides rapid deployment with pre-configured virtual machine templates of Oracle Enterprise Linux and Oracle Database

**Percentage of Database Transactions Delivered by 32-Bit Oracle VM Server vs. Bare-Metal Server as Reported by Swingbench 2.2**



Source: The Tolly Group, July 2008

Figure 1

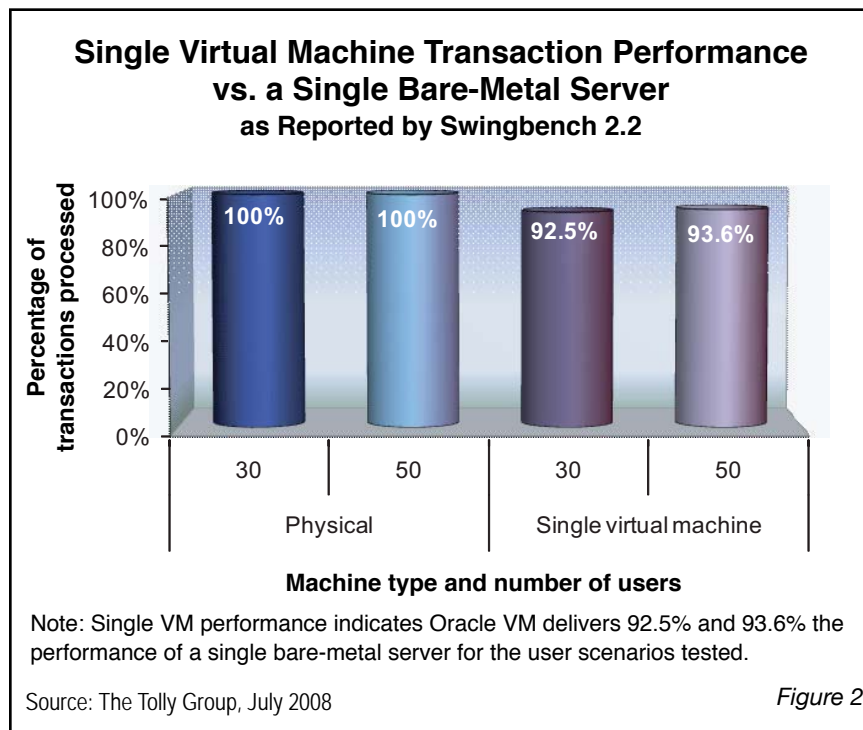
## Executive Summary

Oracle VM supports a variety of workloads efficiently in a virtualized environment with nominal overhead compared to a bare-metal server. It also demonstrates scalability by reporting a 72% performance improvement with two virtual machines compared to a single virtual machine.

Large IT organizations are either deploying or considering server virtualization solutions to assist with server consolidation, bolster greater availability and obtain increased flexibility. IT managers also are beginning to question if their computing infrastructures take advantage of the benefits provided by virtualization technology.

Tolly Group tests show that Oracle VM server virtualization software efficiently supports a variety of workloads and provides scalable performance with multiple virtual guests in the same physical machine. This means that users can install Oracle VM not only to virtualize an Oracle application, but also to consolidate other servers running non-Oracle applications.

In a comparison test between a bare-metal server and a single virtual machine in an Enterprise Linux server environment, the single virtual machine instance handled 94% of



the Oracle database transactions served by a bare-metal server supporting 50 concurrent users. That means deployment of an Oracle database in single VM results in just 6% overhead for the 50 concurrent user scenario. Considering that 20%~30% overhead by virtualization is considered acceptable in many user groups, less than 10% overhead is a good indicator of the efficiency of Oracle VM.

In an LMBench test (an open, publicly available free test suite) to measure low-level processing power by both configurations, the virtual machine using Oracle VM delivered similar results compared to the bare-metal server in a process and memory performance test. This proves that Oracle VM efficiently utilizes hardware resources. In a two virtual-machine test, engineers determined that users would handle 79% more database transactions running two VM servers than a single VM server. Compared to a bare-metal server with 4 GB of memory, a quad core-CPU server

with 8 GB of memory running two VM servers can handle the same database workload as the dual-CPU machine, plus, an additional 65% of transactions.

This result proves that Oracle VM manages the multiple guest OSes and provides impressive scalability. This also proves that Oracle VM not only consolidates the servers but also improves server performance by hosting multiple OSes in the 32-bit server environment.

## RESULTS

### PERFORMANCE EFFICIENCY – PHYSICAL VS. VIRTUAL SERVER (SWINGBENCH)

Tolly Group engineers measured the maximum transactions per minute (tpm) supported by a bare-metal server, versus the transactions served by a single virtual machine and dual virtual machines supporting Oracle VM.

Engineers used the Swingbench benchmark to measure the tpm.

Tests show that a single virtual machine was able to produce 92.5% of the transaction throughput achieved by a bare-metal server running Oracle Database 11g in a 32-bit Linux environment with 30 active users.

In comparison, by running two instances of Oracle VM on a single server, tests show combined throughput of 164.9% compared to the bare-metal server throughput.

With 50 users, the single Oracle VM server achieved 93.6% of the transactions delivered by the bare-metal server. And with two instances of Oracle VM the throughput was 160.9% compared to the bare-metal server throughput.

This demonstrates that Oracle VM software can deliver comparable performance to a bare-metal server without the expense of deploying and supporting extra hardware.

Oracle says that the high performance offered by Oracle VM is due, in part, to running Oracle Enterprise Linux in a virtualized mode. Since Linux is aware that it is virtualized, it interacts optimally with the hypervisor, Oracle says. This is the officially recommended and fully supported way of Oracle VM deployment.

## PERFORMANCE EFFICIENCY – PHYSICAL VS. VIRTUAL (LMBENCH)

Tolly Group engineers used Bitmover's LMBench, a free suite of software benchmarks that

measures bandwidth, latency and other variables associated with Unix system performance. Engineers used LMBench to test and analyze the performance between the bare-metal server and the Oracle VM environment.

Tests were run to prove that bandwidth and latencies of each environment were comparable.

Results show that there is little to no difference when testing the Level 1, Level 2 and main memory latencies of the bare-metal server compared to an Oracle virtual environment. (See Figure 3.) Tests were performed to evaluate the amount of time required to perform various internal processes within the bare-metal server and Oracle VM environment. Overall, LMBench tests show that the bare-metal server ran slightly more efficiently than the Oracle virtual environment.

The tests provided by LMBench provide users with critical data needed to assess the efficiency of VM servers. Users evaluating VM software should strongly consider using the benchmark to evaluate products on a head-to-head basis.

## SCALABILITY – SINGLE VM vs. DUAL VMS

The Tolly Group examined the performance scalability offered by Oracle VM and its effectiveness at supporting high-volume transactions when the virtual machines are doubled from one to two on the same hardware.

The tests used the throughput of a single VM with 30 active users as a baseline (100%).

Next, engineers installed two virtual machines, and subjected both to a load of database transactions. With 30 users, the first of the two virtual machines processed 89.1% of the transaction load, while the second vir-

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## Product Specifications

*Vendor-supplied information not necessarily verified by The Tolly Group*

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### Benefits:

- Oracle VM is a free, state-of-the-art server virtualization and management solution that makes enterprise applications easier to deploy, manage, and support and is backed worldwide by affordable enterprise-quality support for both Oracle and non-Oracle environments. Oracle VM facilitates the deployment and operation of your enterprise applications on a fully certified platform to reduce operations and support costs while simultaneously increasing IT efficiency and agility.

### Features:

- Faster application deployment with pre-configured VM templates
- Leading price/performance – Low-overhead architecture with no license costs
- Includes advanced, Web-based management and live VM migration
- Zero license costs
- Linux and Windows Support
- Official Oracle application certification based on real-world testing
- Affordable, full-stack Enterprise-class support from Oracle

### For more information, contact:

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URL: [www.oracle.com/virtualization](http://www.oracle.com/virtualization)

tual machine processed 89.3%.

With 50 users, the first of the two virtual machines processed 85% of the transaction load, while the second virtual machine processed 85.9%.

### TEST SETUP & METHODOLOGY

Tolly Group engineers tested Oracle VM 2.1.1 running on a custom server (one dual-core Intel Xeon 5060 3.2-GHz processors, 4-GB DDR2-667 PC-5300 of memory).

When testing two VM servers, Tolly Group engineers added a matching dual-core Xeon processor to the server and an additional 4 GB of RAM.

Oracle Enterprise Linux Release 4 Update 6 and Oracle Database 11g Enterprise Edition Release

11.1.0.6.0 ran in parallel on the same hardware platform.

The server was outfitted with a Supermicro X7DBE Motherboard, four SATA 3.0 Gbit/s

Seagate 250GB 7200RPM hard drives configured as RAID 0 array with a striping of 128k.

Engineers used Swingbench version 2.2 to record the number of

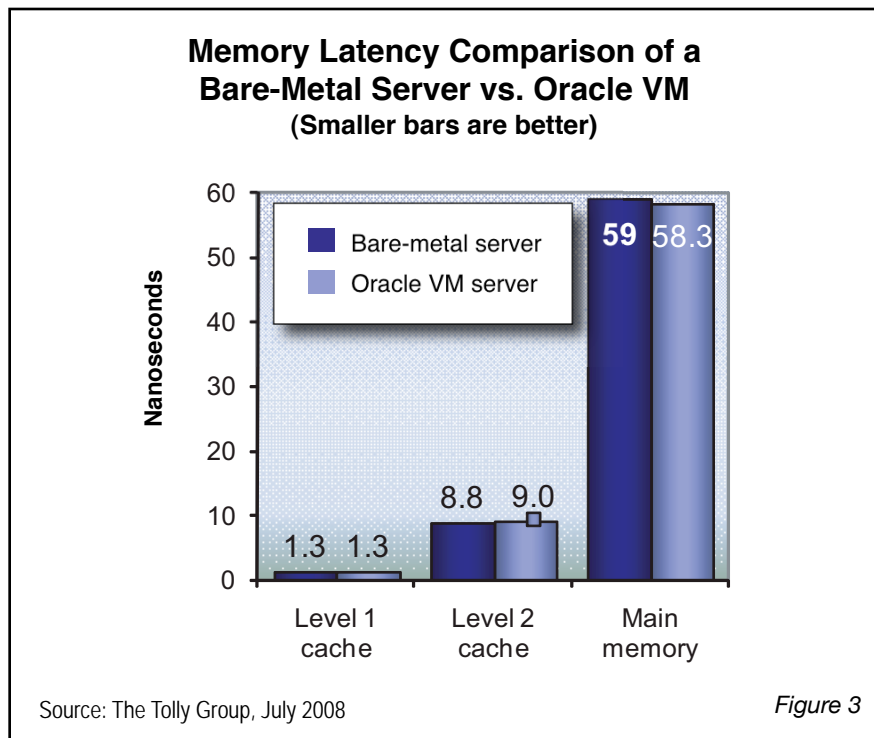


Figure 3

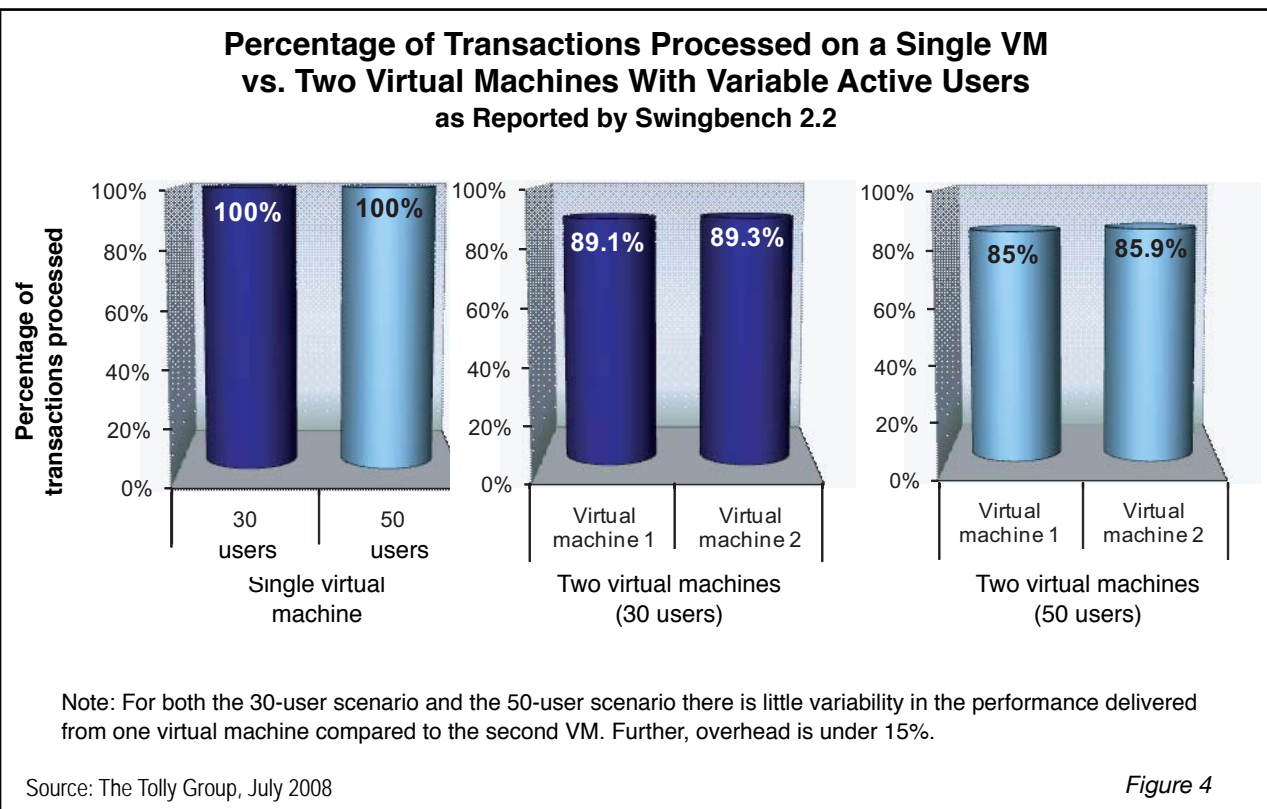


Figure 4

transactions executed during a test, which were used to report the transaction per minute rate.

Swingbench is a free load generator (and benchmarks) designed to stress test an Oracle database (9i,10g,11g).

The test also reports the average response time of the different transaction types. The test was run with 30 users and 50 users to show the impact which an increased load has on these metrics, and how well the system can scale up on different platforms.

The second test was conducted using LMbench version 2.5. LMbench was used to record the bandwidth consumption and latency of the Oracle bare-metal server and Oracle VM server environments.

For the bare-metal server test, engineers installed Oracle Enterprise Linux Release 4 Update 6 onto the hardware. A software RAID 0 array was configured during the Oracle Linux installation. The installation was completed with all the available packages through the installation CD. Upon completion, the “up2date” command was run to register with the Oracle Linux server, and all available patches and updates were applied.

Once the Oracle Linux installation and updates were completed Tolly Group engineers installed the Oracle Database 11g Enterprise Edition Release 11.1.0.6.0. The database disk image was downloaded from the Oracle

Web site and burned to a bootable cd. The installation of the database provided a graphical user interface to guide the user through the installation. The installation on the database was done using the default configuration settings outlined within the wizard.

Once Oracle Linux and the Oracle 11g database were installed, Tolly Group engineers then downloaded and installed Swingbench version 2.2. Swingbench provides two types of tests — a graphical and non-graphical benchmark. The first test produced a graphical representation of the transactions per minute.

The transactions included in this test are New Customer Registration, Browse Products, Order Products, Process Orders and Browse Orders. Tolly Group engineers ran this test to verify that the database was configured and working properly.

The second test, the non-graphical version of Swingbench, is known as Charbench. This is run from a terminal window.

Tolly Group engineers ran three iterations of Charbench with 30 users and three iterations of 50 users. A separate version of Charbench was dedicated to each of the VM servers tested. The Oracle database schema had to be nulled and re-populated between 30 and 50 users to prevent the database from becoming stale. Results from this test are compared to the results populated when running the same scenarios within a virtual environment, first with only one Oracle Virtual Machine running, then with two Virtual Machines running on the same hardware.

The software used to set up the virtualized environment included the Oracle VM Server, a template that included a com-

pletely configured and “ready to run” version of Oracle Enterprise Linux Release 4 Update 6 and a template of the Oracle Database 11g Enterprise Edition Release 11.1.0.6.0. These were downloaded from the Oracle Web site.

Installation of the Oracle VM Server 2.1.1 was fairly straightforward and very similar to the Oracle Linux setup and installation. The installation picked up the hardware RAID 0 array which had been configured through the onboard RAID controller which made the HDD setup and configuration much easier.

Oracle VM server runs from its own terminal, there is no graphical user interface for configuring or making changes.

After the server was booted up, the Oracle database was the next to be installed and configured.

### Test parameters

#### Non-default database tuning parameters

```
Compatible: 11.1.0.0.0
db_block_size: 8192
db_cache_size: 2147483648
open_cursors: 300
processes: 200
shared_pool_size: 167772160
```

#### Non-default Swingbench configuration parameters

```
oewizard.xml:
connectiontype: oci
customercount: 25,000
ordercount: 10,000,000

swingconfig.xml:
MinDelay="0", MaxDelay="0"
"New Customer registration"
Weight="5"
"Browse Products" Weight="10"
"Order Products" Weight="50"
"Process Orders" Weight="50"
"Browse Orders" Weight="10"
```

### Environmental Variables Configured for Different Machine Types

Machine type	CPU cores	RAM size	Page file size
32-bit physical server	2	4 GB	4 GB
One 32-bit virtual machine	2	4 GB	4 GB
Two 32-bit virtual machines	4 (2 for each VM)	8 GB (4 GB for each VM)	8 GB (4 GB for each VM)

Source: The Tolly Group, July 2008

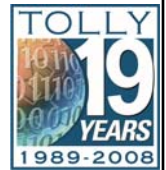
Figure 5

The next step was to load onto the VM templates that were provided by Oracle. Through the terminal window, the templates were simple

to install and execute. The final step was to install and run Charbench with the first three runs of 30 users, then clear the database schema, re-populate the database and run throughput

iterations of Charbench with 50 users logged on. The final results were compared to the final results of the bare-metal results.

The Tolly Group is a leading global provider of third-party validation services for vendors of IT products, components and services.



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### Test Software Summary

Vendor	Product	Web URL:
BitMover, Inc.	LMbench 3.0	<a href="http://www.bitmover.com/lmbench">http://www.bitmover.com/lmbench</a>
Public Domain	Swingbench 2.2	<a href="http://www.dominicgiles.com/swingbench.php">http://www.dominicgiles.com/swingbench.php</a>

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