

BACKUP BENCHMARKING OF VERY
LARGE MICROSOFT SQL SERVER 7.0
DATABASES DURING ACTIVE ONLINE
TRANSACTION PERFORMANCE
LOADING ON COMPAQ HARDWARE

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Backup & Disaster Recovery for Windows NT



Overview

As organizations move towards the need for constant availability of data, foundation class software programs performing tasks such as backup and restore must do so without impacting the overall need of the system to perform its primary function. One of the major issues facing an organization today is the requirement to run mission critical applications 7x24x365 days of the year. This equates to data remaining active during backup without a sacrifice in performance.

Microsoft® SQL Server™ version 7.0 offers a built-in native function for backing up an active database under all load conditions. While setting the benchmark for speed, native SQL Server backup is a dedicated function and therefore limits its operation to a narrow band of functionality. In comparison, a quality commercial backup product offers the required functionality to support an entire enterprise.

In this paper, UltraBac demonstrates that it closely matches the performance of SQL Server 7.0's fast but dedicated native backup engine. UltraBac's test results are proof that organizations do not have to sacrifice backup and restore speed to gain the many benefits offered by a comprehensive enterprise backup solution.

With the requirement for nonstop computing, backup software must perform at such speeds and in such a way that traditional "backup windows" become redundant or is simply eliminated. To offer true nonstop computing, the design of the system must provide for use at any time. As this level of technology is achieved, the underlying foundation class programs will not impact the system performance in such a way as to mitigate its original use.

This benchmark demonstrates how UltraBac and SQL Server 7.0 can work together to provide excellent backup performance and extended functionality. Enhanced UltraBac features include: shared tape use for combining SQL Server & regular file-by-file backups, built in open shared file handling, strategic user exits, RAID, backup to tape or disk (local or remote), image backup & disaster recovery, and media management. These enhanced features are all available while the system is active and online with minimal impact on system performance even during very heavy loads.

Synopsis of Data

The benchmark tests produced these UltraBac results:

- Record-breaking transaction throughput during online backup in excess of 600 gigabytes per hour (GB/hour).
- Backup and restore was comparable in CPU usage and transaction throughput to the native SQL Server 7.0 backup & restore functionality.
- Transaction load had virtually no effect on backup throughput.

- Record-breaking backup throughput on a Microsoft Windows NT® server using a commercial product.
- Record-breaking restore throughput on a Microsoft Windows NT server by a commercial product.

All backups were performed while the test system was active and online with minimal degradation of performance to system. A single SQL Server 7.0 database containing 263 GB of actual data was used. Take note that the SQL Server 7.0 backup engine does not backup **unused space** that is normally allocated to a database for future expansion.

UltraBac has been designed to take advantage of the many new features and enhancements of Microsoft SQL Server 7.0 while maintaining backwards compatibility with previous versions of SQL Server. UltraBac provides reliable, high-performance, backup, restore, and disaster recovery services, while maintaining the 24-hour a-day, seven-day a week database availability that customers require. Key features include:

- Shared tape drive use
- File-by-file backup & restore
- Automatic open shared file handling
- Media drive failure protection
- Supports disk to disk & disk to tape backups
- Image Backup and Disaster Recovery for both Intel & Alpha machines
- RAID 0, 1, 0+1, 3 and 5
- Local and remote Registry backup/restore on the component level
- Microsoft Cluster Server compatible

UltraBac Comparison to Native SQL Server 7.0

The UltraBac benchmark tests were conducted under the direct supervision of the SQL Server Senior Development staff at Microsoft using the same equipment and conditions set up for the benchmark tests conducted for the native SQL Server backup utility.

The first test was conducted without a workload for a baseline result and then three online transaction processing (OLTP) workloads tests were performed corresponding to medium, heavy, and very heavy system usage. The backup was performed using UltraBac while SQL Server 7.0 was active and participating in the backup. Units of measure are transactions per second (tps) and gigabytes per hour (GB/hour). The chart's results were achieved using 32 Compaq® AIT tape drives.

The rates were computed from the total elapsed time for the backup operation and the amount of data backed up (263 GB). This included all the time necessary to position the tapes and to update the SQL Server 7.0 system database that tracks all backup and restore operations performed.

Under a medium transaction load, the Compaq® AlphaServer™ system was backed up at 539 GB/hour by UltraBac with little drop in transaction throughput (24 percent — only 2 points off of the native Microsoft SQL Server 7.0 numbers). Even under the heaviest workload and backing up to 32 tape drives, transaction throughput dropped by only 28 percent (4% better than native Microsoft SQL Server 7.0 backup), and the database was backed up at 508 GB/hour, 84 percent of the no-load backup throughput.

ULTRABAC Backup						
Transaction workload	Baseline CPU (%)	Total CPU (%)	Transaction rate without backup (tps)	Transaction rate with backup (tps)	Relative transaction throughput	Average backup throughput (GB/Hour)
None	0%	8%				604
Medium	50%	83%	156	118	76%	539
Heavy	63%	88%	197	141	72%	545
Very Heavy	75%	94%	225	162	72%	508
SQL Server 7 Native Backup						
Transaction workload	Baseline CPU (%)	Total CPU (%)	Transaction rate without backup (tps)	Transaction rate with backup (tps)	Relative transaction throughput	Average backup throughput (GB/Hour)
None	0%	NP				609
Medium	50%	NP	170	133	78%	602
Heavy	63%	NP	197	150	76%	596
Very heavy	75%	NP	278	188	68%	576

NP=Not Published

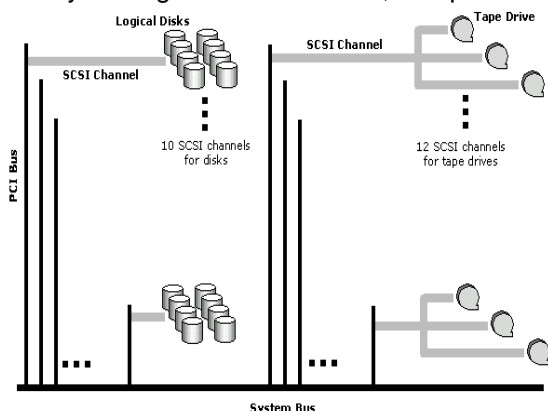
UltraBac Restore

This test demonstrates high-performance restore of the complete database, as would be necessary after a catastrophic failure affecting the entire database. The restore was performed using UltraBac.

UltraBac Restore		
Amount of data written	Average restore throughput	Average CPU usage
263 GB	508 GB/hour	8%
Native SQL7 Restore		
263 GB	536 GB/hour	8%

Hardware Configuration

The I/O devices were configured as shown in the following diagram. SCSI channels were distributed evenly among the 24 PCI buses, one per bus.



Server: Compaq's AlphaServer 8400 for Windows NT. Twelve UltraSCSI channels were dedicated to the 32 Compaq AIT tape drives, with either two or three tape drives attached to each channel.

The database files were distributed evenly across all 80

logical disks. Each logical disk was formed from three 9.1 GB disk drives by hardware striping. Eight logical disks were attached to a single UltraSCSI channel. An additional logical disk (not shown), consisting of 26 disk drives distributed across four UltraSCSI channels, was used for the SQL Server transaction log. This logical disk was created using Windows NT software striping.

UltraBac Configuration

The backup and restore tests were conducted using a standard UltraBac Enterprise License with the options for SQL Server and RAID enabled. The total list cost for this software was \$3,285 dollars.

Summation

SQL Server 7.0 databases using UltraBac can be backed up during normal operations, eliminating the need for a backup window during which your data is unavailable. This is crucial for 24 hour-a-day, seven day-a-week operations.

Very large SQL Server databases can be backed up online and just as importantly, restored in record time using UltraBac.

The benchmark against native Microsoft SQL Server performance loading and UltraBac indicates that using a commercial backup product to perform key support functions for SQL Server will not result in a significant degradation in the performance of the database. These results show that even under heavy load there will be minimal reduction of CPU while allowing the user to have all the associated benefits of a commercially created backup and restoration product.

UltraBac closely matched the performance of Microsoft's SQL Server 7.0 native backup and restore functionality. UltraBac's backup and restore speed was the fastest of any tested and published commercial backup software vendor. UltraBac was able to utilize all 32 tape drives simultaneously and maintain a CPU-to-Transaction processing ratio that was within 1% and 9% of the native SQL Server 7.0 capability for backing up and restoring very large databases.

NOTE: Other backup providers have been invited to benchmark their programs using the same hardware configuration and test conditions. Some of those results may be found at <http://www.microsoft.com>.

About BEI Corporation

BEI Corporation, publisher of UltraBac, has been in the business of developing enterprise class solutions since 1982. For over 18 years, the company has endeavored to develop leading edge software solutions and has over 15,000 active customers. Located in Bellevue, Washington, the company was recently recognized as the 17th fastest growing private company in the Northwest and can be found on Software Magazine's Software 500 list, as one of the 500 largest software companies in the world.

Resources

UltraBac Products

For more information about UltraBac, SQL Server and RAID, see the UltraBac.com Web page at <http://www.ultrabac.com/sql/>

For more information about other UltraBac Storage Management software, see the UltraBac website at <http://www.ultrabac.com>, or contact UltraBac sales at (425) 644-6000 or e-mail sales@ultrabac.com

Microsoft

For information about SQL Server 7.0, see <http://www.microsoft.com>.

Compaq Products

For more information, see the Compaq website at <http://www.Compaq.com>

UltraBac Product Overview

UltraBac Enterprise Edition for Windows NT is a high-performance storage management solution providing unrestricted multiple server & workstation backups from a single computer. Tape & disk backups are supported using either hardware or software compression (disk-to-disk allows a network disk as the output target). Key options include Image Backup & Disaster Recovery, SQL Agent, Exchange Agent, Netware Agent, Autoloader Support, UltraRAID, and UltraVue, the network administration module.

Additional Products and Features

UltraBac extends backup/restore functionality for Microsoft NT users in the following areas:

UltraBac Pro can backup virtually unlimited numbers of servers and workstations using an innovative design that both maximizes network (dynamic parallelism) bandwidth usage and maximizes tape drive speed with its unique tape library migration strategy. UltraBac is Microsoft BackOffice® certified.

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Microsoft Cluster Server compatible -- proven ability to do active online backups and restores of Microsoft Clustered Servers running Microsoft SQL Server.

The UltraBac Single Server, Network Server, and Enterprise Server Editions are fully capable of backing up active OLTP Microsoft databases when using the optional SQL Server and Exchange Agents. Unique features to UltraBac include the ability to backup to disk or tape, built-in open shared file handling, SMTP or MAPI email interfaces, hardware failure redirect, automatic media cascading, RAID 0, 1, 0+1, 3 & 5 operation and speed. UltraBac has been consistently found to be the fastest Windows NT backup product per independent benchmark comparisons between all competing third party backup solutions.