



StorFacts™ Report

Internal Tape Drive Analysis

This StorFacts™ Report analyzes the current internal eServer tape technologies offered by IBM. Technologies discussed include the following:

1. DAT Tape Technology
2. VXA Tape Technology
3. LTO Tape Technology



For more information – <http://www.gstinc.com/store/Tape-C155.aspx>



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Improving Tape Drive Performance

There are a number of practices that can be used in any UNIX, AIX, Linux and Windows/NT server installation to improve the performance of tape backup and restore operations. These practices require no investment in hardware or software; only an understanding of the concepts behind the practices.

Ten tape performance techniques and tuning methodologies are covered in this report:

1. Use Ultra320 SCSI Adapters ~ 320MB/s
2. Use Ultra320 Disk Drives ~ 320MB/s
3. Use Ultra320 RAID Adapters ~ 320MB/s
4. Implement Concurrent or Parallel Backups
5. Optimize the Block Size of the Tape Drive
6. Defrag and/or Re-org Your Disk Drives
7. Install Additional Memory
8. Apply PTFs Regularly
9. Upgrade Your Network to Gigabit Technology
10. Use either AIX or Linux as Your Primary Operating System





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Top Ten Tips

1. Use Ultra320 SCSI Adapters ~ 320MB/s

The correct IBM SCSI tape adapter has a major effect on the degree of performance that you can get out of a tape drive, autoloader or library. Use of faster tape controllers can significantly boost performance. This is because a tape controller can act as a *governor*, limiting the throughput of a tape unit. *GST recommends utilizing Ultra320 SCSI adapters.*

2. Use Ultra320 Disk Drives ~ 320MB/s

Failing to use the correct disk drives will dramatically affect tape drive performance. Backup to tape follows a sequential process where everything is done in a step-wise fashion. The slowest component in the path that data must travel through to get from disk to a backup device is the gating factor for the backup or recovery process and limits the throughput to that slowest component's speed. Therefore, the maximum transfer rate of the SCSI connection is critical to achieving high tape drive transfer rates. *GST recommends utilizing Ultra320 disk drives.*

3. Use Ultra320 RAID Adapters ~ 320MB/s

Failing to use the correct disk controller can have a similar bad effect as using a slower disk drive. The key here is the handshake between the disk drive and the controller always negotiates down to the slowest speed. For example, if you attach an Ultra320 RAID adapter that transfers data at a 320MB/second rate to a disk drive that negotiates at 40MB/second, the RAID adapter will be degraded to a rate of 40MB/ second. For optimum performance of the disk drive and of the backup operation, your disk and RAID adapter should operate at the same speed. Remember, the tape backup unit at the end of the backup process can only operate at the lesser of: (1) its own speed, or (2) the speed of the SCSI adapter, or (3) the speed of the RAID adapter, or (4) the speed of the disk drives. *GST recommends utilizing Ultra320 RAID adapters.*

4. Implement Concurrent or Parallel Backups

Backing up to multiple tape drives at the same time can drastically reduce the time devoted to backups each day. This is particularly useful in situations where it is difficult to run all the production jobs as well as all backups within the normal work shifts. For a 24 x 7 shop that stays up and running constantly, there are only 24 hours available each day for both the production window and the backup window. As production times increase, the production window encroaches upon the backup window. To relieve this situation, either **concurrent** or **parallel** saves can be run to shorten the backup window. These two kinds of saves both make use of multiple tape drives saving at the same time:



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5. Optimize the Block Size of the Tape Drive

If possible, optimize the block size to the tape drive. In earlier times, tape drives used a 512 byte block. Today, tape block sizes run from 32K to 64K or even 128K. The block size settings are not always easy to reset and require modification of your ASPI settings or changes to the backup software being used.

6. Defrag and/or Re-org Your Disk Drives

The performance of the drives being backed up can affect the disk access times for retrieving data to be backed up. The more the disk drives are optimized, the better the access times and the better chance that the tape drives can be driven at a continuous rate. Your operating system has tools for reorganizing drives and defragging them. Use these to keep your disks optimized for peak performance. As a precaution, disks should be backed up before they are reorganized or defragged, so make sure data is not lost in the optimization process.

7. Install Additional Memory

IBM has established ratings for various server performance based on configurations that take advantage of maximum memory. If the memory allocated to backup and restore jobs is lower than the maximum memory available, then the operating system must move data from disk to backup devices in smaller segments. This increases the number of times the server has to go back to the disk for more data. Accessing memory is much faster than accessing any other storage device, so the more that memory is used the fewer times the disk must be accessed. More importantly, the less that memory is used in the backup operation, the more often reading from disk occurs, and that will result in slower backups.

8. Apply PTFs Regularly

Not applying the latest Program Temporary Fixes (PTFs) can be detrimental to tape drive performance as well as performance of other system resources. It would be difficult to list here the individual PTFs required, since they constantly change for each operating system. Your best practice is to make sure that the critical PTF packages are installed that your server provider recommends for optimizing backup and restore performance.



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Conclusion

The technology of tape drives has made tremendous improvements not only in increased capacity, but also in much faster performance. Tape drives today have native transfer rates between 3MB/sec and 80MB/sec. This can be doubled or almost tripled with compression. The possibility of backing up data at rates up to 450GB an hour sounds attractive to any IT manager. The path to making this happen often has little to do with the tape drive itself.

Today's fast tape drives can hit their rated speeds only if the data is arriving consistently at that rated speed. There are a myriad of components in between the tape drive and the disk drive its backing up. Each of these components or processes has the potential for robbing the high-performance drive of its promise for rapid backups.

Understanding your server, operating system and interfaces that will be supporting a high performance tape drive should be a prerequisite before purchasing a drive, autoloader or library.

Adopting the best practices summarized here for backups and restores will not solve all your performance issues associated with data protection. These practices can significantly improve the operation of your existing hardware and software backup configurations *for zero additional investment.*



1892

VXA-320 160/320GB Internal Tape Drive

The IBM 160/320 GB Internal Tape Drive with VXA* Technology is a 5.25-inch, half-high, Ultra2 LVD 16-bit tape drive, which provides a high capacity for save/restore and archive functions. The tape drive uses "X" media VXAtape* data cartridges and is compression capable, providing a capacity of up to 320 GB - a significant increase in capacity, and data transfer rate over the previous internal tape drives.

Characteristics

- Capacity: 160 GB native mode
- Capacity: 320 GB compress mode, typical
- Form Factor: 5.25-inch half high
- Media: uses VXAtape "X" media data cartridges
- Technology: Helical scan, rotating head
- Operation: Streaming
- Data Transfer Rate: 12 MBps native mode, 24MBps (typical) compression
- Interface: SCSI-2, SCSI-3 Ultra 160 (LVD) asynchronous/synchronous
- VXA-320 is read/write capable on X23, X10 and X6 media
- Compatibility: VXA-2 format (Read/Write) on X6, X10, and X23, VXA-320 format (Read/Write) on X6, X10, and X23.
- Attributes provided: One 160/320GB internal tape drive
- Attributes required: One 1.6-inch (41mm) half-high media bay and one SCSI-2 internal 16-bit address



1955

36/72 GB 4mm Internal Tape Drive

The 36/72 GB 4mm Internal Tape Drive is a 3.5-inch, half-high, Low Voltage Differential(LVD) auto-docking 16-bit tape drive for save/restore and archive functions. This tape drive uses IBM 4mm data cartridges and is compression capable, providing a capacity of up to 72 GB.

Characteristics

- Capacity: 36 GB native mode, 72 GB (typical) compression mode
- Form Factor: 3.5-inch half high
- Media: Supports DDS3, DDS4 and DAT72 media
- Technology: Helical scan, rotating head
- Operation: Streaming
- Data Transfer Rate: 3MBps native mode, 6MBps (typical) compression
- Interface: SCSI-2 (LVD) asynchronous/synchronous
- Boot Device: yes
- Compatibility: DDS3 - 12 GB native mode(Read/Write), 24 GB compression (Read/Write), DDS4 - 20 GB native mode(Read/Write), 40 GB compression (Read/Write), DAT72 - 36 GB native mode(Read/Write), 72 GB compression (Read/Write).
- Attributes provided: 4mm tape capability
- Attributes required: One DASD bays



1991

36/72GB 4mm Internal Tape Drive

The 36/70 GB 4-mm Internal Tape Drive is a 5.25-inch, half-high, single-ended 16-bit tape drive, which provides a high capacity for save/restore and archive functions. This tape drive uses IBM 4-mm data cartridges and is compression capable, providing a capacity of up to 70 GB - a significant increase in capacity over the previous 20/40 4-mm internal tape drives (when using DDS-4 media).

Characteristics:

- Capacity: 36 GB native mode, 70 GB (typical) compression mode
- Form Factor: 5.25-inch half high
- Media: IBM 4-mm supports new DAT72 media
- Technology: Helical scan, rotating head
- Operation: Streaming
- Data Transfer Rate: 3MBps native mode, 6MBps (typical) compression
- Interface: SCSI-2 (single ended) asynchronous/synchronous
- Compatibility: 4 GB mode (Read/Write), 8 GB compression (Read/Write); 12 GB mode(Read/Write), 24 GB compression (Read/Write), 36 GB mode (Read/Write), 70 GB compression (Read/Write).



1992

IBM 80/160 GB Internal Tape Drive with VXA Technology

The IBM 80/160 GB Internal Tape Drive with VXA* Technology is a 5.25-inch, half-high, Ultra2 LVD 16-bit tape drive, which provides a high capacity for save/restore and achieve functions. This tape drive uses VXAtape* data cartridges and is compression capable, providing a capacity of up to 160 GB - a significant increase in capacity over the previous internal tape drives.

Characteristics

- Capacity: 80 GB native mode, 160 GB (typical) compression mode
- Form Factor: 5.25-inch half high
- Media: uses VXAtape data cartridges
- Technology: Helical scan, rotating head
- Operation: Streaming
- Data Transfer Rate: 6MBps native mode, 12MBps (typical) compression
- Interface: SCSI-2 (LVD/SE) asynchronous/synchronous
- Compatibility: 80 GB mode (Read/Write), 160 GB compression (Read/Write)
- Attributes provided: One 80/160 GB internal tape drive
- Attributes required: One 1.6-inch (41mm) half-high media bay and one SCSI-2 internal 16-bit address



1997

200/400GB Half High Ultrium 2 Tape Drive

The IBM 200/400GB Half High Ultrium 2 Tape Drive is a 5.25-inch, half-high, Low Voltage Differential(LVD) 16-bit tape drive, which provides a high capacity for save/restore and achieve functions. This tape drive uses IBM Ultrium 1 and Ultrium 2 data cartridges and is compression capable, providing a typical capacity of up to 400GB.

Characteristics:

- Capacity: 200 GB native and typical 400 GB capacity with 2:1 compression.
- Form Factor: 5.25-inch half high
- Media: Half High Ultrium 2 Tape Drive supports Ultrium 1 and Ultrium 2 data cartridges.
- Operation: Streaming
- Data Transfer Rate: 24MBps native mode, 48MBps (typical) with 2:1 compression.
- The IBM 200/400GB Half High Ultrium 2 Tape Drives can read and write original LTO Ultrium Data Cartridges at original Ultrium 1 capacities at up to 16 MB/sec native(32 MB/sec with 2:1 compression).
- Interface: SCSI Ultra-160,LVD Ultra-80, and Single-ended SCSI.
- Compatibility: Ultrium 1 (Read/Write), Ultrium 2 (Read/Write).
- Attributes provided: Ultrium 1 and Ultrium 2 tape capability
- Attributes required: One 1.6-inch (41mm) half-high media bay and one SCSI-2 internal LVD 16-bit address



5755

200/400GB Half High Ultrium 2 Tape Drive

The IBM 200/400GB Half High Ultrium 2 Tape Drive is a 5.25-inch, half-high, Low Voltage Differential(LVD) 16-bit tape drive, which provides a high capacity for save/restore and achieve functions. This tape drive uses IBM Ultrium 1 and Ultrium 2 data cartridges and is compression capable, providing a typical capacity of up to 400GB.

Characteristics:

- Capacity: 200 GB native and typical 400 GB capacity with 2:1 compression.
- Form Factor: 5.25-inch half high
- Media: Half High Ultrium 2 Tape Drive supports Ultrium 1 and Ultrium 2 data cartridges.
- Operation: Streaming
- Data Transfer Rate: 24MBps native mode, 48MBps (typical) with 2:1 compression.
- The IBM 200/400GB Half High Ultrium 2 Tape Drives can read and write original LTO Ultrium Data Cartridges at original Ultrium 1 capacities at up to 16 MB/sec native(32 MB/sec with 2:1 compression).
- Interface: SCSI Ultra-160,LVD Ultra-80, and Single-ended SCSI.
- Compatibility: Ultrium 1 (Read/Write), Ultrium 2 (Read/Write).
- Attributes provided: Ultrium 1 and Ultrium 2 tape capability
- Attributes required: One 1.6-inch (41mm) half-high media bay and one SCSI-2 internal LVD 16-bit address



6120

IBM 80/160 GB Internal Tape Drive with VXA Technology

The IBM 80/160 GB Internal Tape Drive with VXA* Technology is a 5.25-inch, half-high, Ultra2 LVD 16-bit tape drive, which provides a high capacity for save/restore and archive functions. This tape drive uses VXAtape* data cartridges and is compression capable, providing a capacity of up to 160 GB - a significant increase in capacity over the previous internal tape drives.

Characteristics:

- Capacity: 80 GB native mode, 160 GB (typical) compression mode
- Form Factor: 5.25-inch half high
- Media: uses VXAtape data cartridges
- Technology: Helical scan, rotating head
- Operation: Streaming
- Data Transfer Rate: 6MBps native mode, 12MBps (typical) compression
- Interface: SCSI-2 (LVD/SE) asynchronous/synchronous
- Compatibility: 80 GB mode (Read/Write), 160 GB compression (Read/Write)
- Attributes provided: One 80/160 GB internal tape drive
- Attributes required: One 1.6-inch (41mm) half-high media bay and one SCSI-2 internal 16-bit address



6258

36/72GB 4mm Internal Tape Drive

The 36/72 GB 4-mm Internal Tape Drive is a 5.25-inch, half-high, single-ended 16-bit tape drive, which provides a high capacity for save/restore and archive functions. This tape drive uses IBM 4-mm data cartridges and is compression capable, providing a capacity of up to 72 GB - a significant increase in capacity over the previous 20/40 4-mm internal tape drives (when using DDS-4 media).

Characteristics:

- Capacity: 36 GB native mode, 72 GB (typical) compression mode
- Form Factor: 5.25-inch half high
- Media: IBM 4-mm supports new DAT72 media
- Technology: Helical scan, rotating head
- Operation: Streaming
- Data Transfer Rate: 3MBps native mode, 6MBps (typical) compression
- Interface: SCSI-2 LVD and single ended

Compatibility:

- DDS3 - 12 GB native (Read/Write), 24 GB compression (Read/Write)
- DDS4 - 20 GB native (Read/Write), 40 GB compression (Read/Write)
- DAT72 - 36 GB native (Read/Write), 72 GB compression (Read/Write)
- Attributes provided: 4mm tape capability
- Attributes required: One 1.6-inch (41mm) half-high media bay and one SCSI-2 LVD internal 16-bit address or SE



6279

VXA-320 160/320GB Internal Tape Drive

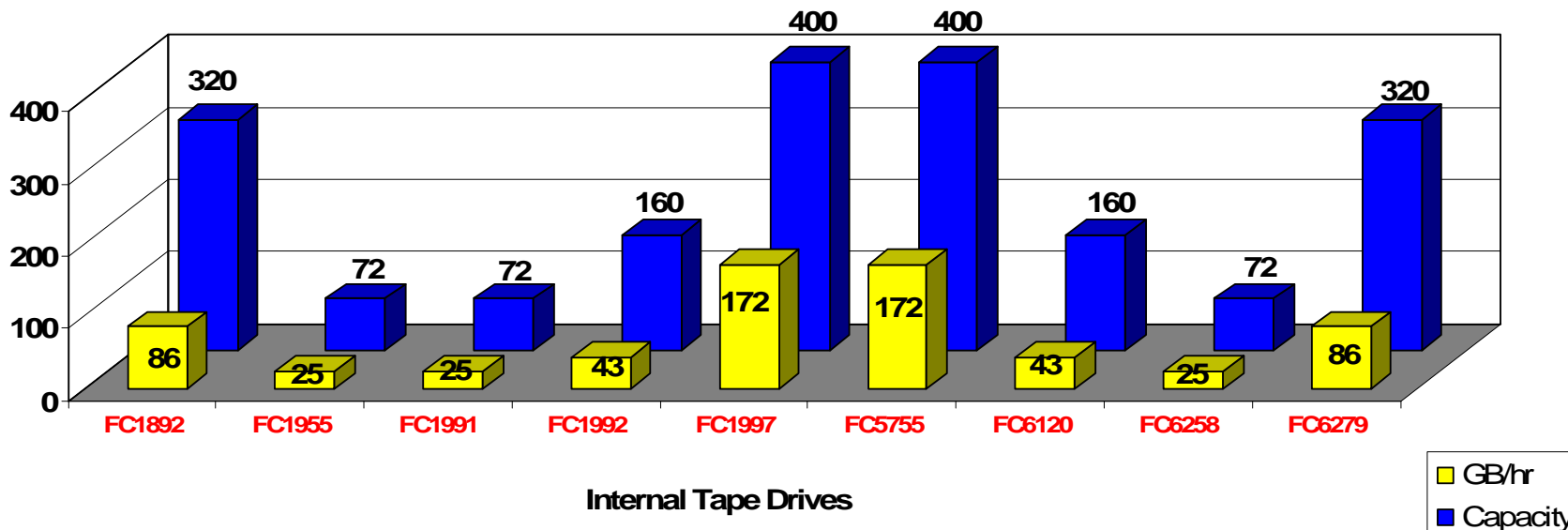
The IBM 160/320 GB Internal Tape Drive with VXA* Technology is a 5.25-inch, half-high, Ultra2 LVD 16-bit tape drive, which provides a high capacity for save/restore and archive functions. The tape drive uses "X" media VXAtape* data cartridges and is compression capable, providing a capacity of up to 320 GB - a significant increase in capacity, and data transfer rate over the previous internal tape drives.

Characteristics

- Capacity: 160 GB native mode
- Capacity: 320 GB compress mode, typical
- Form Factor: 5.25-inch half high
- Media: uses VXAtape "X" media data cartridges
- Technology: Helical scan, rotating head
- Operation: Streaming
- Data Transfer Rate: 12 MBps native mode, 24MBps (typical) compression
- Interface: SCSI-2, SCSI-3 Ultra 160 (LVD) asynchronous/synchronous
- VXA-320 is read/write capable on X23, X10 and X6 media
- Compatibility: VXA-2 format (Read/Write) on X6, X10, and X23, VXA-320 format (Read/Write) on X6, X10, and X23.
- Attributes provided: One 160/320GB internal tape drive
- Attributes required: One 1.6-inch (41mm) half-high media bay and one SCSI-2 internal 16-bit address



Capacity and Performance



The investment in a high-performance tape drive does not guarantee a high-performance backup or restore operation. Other condition must be present, along with a high-performance tape subsystem, autoloader or library to assure faster backups and restores. The IT professional must look hard for ways to improve the performance of backup processes to protect needed production time and to complete backups in a timely manner.