



# StorFacts™ Report

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## Internal Tape Drive Analysis – i5/iSeries

This StorFacts™ Report analyzes current internal tape drive offered by IBM for the i5/iSeries platform. Technologies discussed include the following:

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



For more information – <http://www.gstinc.com/store/Tape-C136.aspx>



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## *Improving i5/iSeries 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. Set Your System to a Restricted State
6. Vary Off Communication Lines
7. Avoid Backups After IPLs
8. Install Additional Memory
9. Apply PTFs Regularly
10. Upgrade Your Network to Gigabit Technology





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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:



## 5. Set Your System to a Restricted State

Placing the iSeries in a Restricted State improves performance of both backup and restore jobs. This is because iSeries does not need to check for object locking or compete with other users for resources. If your system is in a Restricted State when the backup operation or restore operation is performed, the iSeries well remains in a semi-restricted state while the backup or restore is in progress, then will return to a Restricted State once the backup or restore is finished.

## 6. Vary Off Communication Lines

Sometimes, in fact often, backups are run in Restricted State (also used for restores, RCLSTG and other functions). To optimize performance when running in Restricted State, make sure that you vary off all communication lines. This permits all memory to be allocated to the backup job, and prevents unnecessary system processing of retries or reconnects.

For many large organizations with complex server configurations, it is not a simple solution to vary off the lines. The decision has to be made: should you take the time to vary off all the configuration objects along with the time it takes to bring them back online again? Or, should you not vary off the lines and accept the potentially degraded performance when in restricted state, in order to eliminate time required to bring the communication configuration down and back up again? This is a decision that must be based on what is appropriate for your environment.

## 7. Avoid Backups After IPLs

There are certain circumstances that can cause saves to be slower after a backup. This includes setting up temporary working space for each object the first time they are touched after an IPL. Also, parts of an object are paged into memory which makes accessing them faster the next time.

Here's what you can do to avoid or minimize this problem. First, limit your IPLs, or at least don't perform them just prior to a backup. Second, you can use a simple CL program to go out and touch each object after the IPL so that when the backup or restore occurs, the objects will have all been touched.

## 8. 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.



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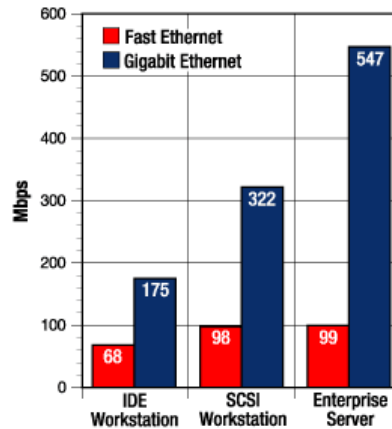
## 9. Apply PTFs Regularly

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.

## 10. Upgrade Your Network to Gigabit Technology

If you are backing up other servers (i5, p5, or Windows based) through your local network, not having the correct network backbone can have a crippling impact on backup performance. Listed below are the best case performance rates for each type of network. ***GST recommends upgrading your network to Gigabit technology.***

1. Ethernet 10BaseT – 4GB/hour
2. Ethernet 100BaseT – 40GB/hour
3. Ethernet 10/100/1000BaseT (Gigabit) – 350GB/hr



GRAPH 2:  
Fast Ethernet vs. Gigabit Ethernet  
Burst Throughput



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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*.



**1889****80/160GB VX2 Tape Drive**

#1889 80GB VXA-2 Tape Drive 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 VXA tape data cartridges and is compression capable, providing a capacity of up to 160 GB.

Characteristics:

- Capacity: 80GB native mode, 160GB (typical) compression mode
- Form Factor: 5.25-inch half high
- Media: uses VXA tape 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
- Compatability: 80GB mode (Read/Write), 160GB compression (Read/Write)
- Attributes provided: One 80GB internal VXA-2 tape drive
- Attributes required: One 1.6-inch (41mm) half-high media bay and one SCSI-2 internal 16-bit address



**4584**

**30/60 GB SLR60 Cartridge Tape**

Mounted in a removable media device slot of a system unit or an expansion tower, these features may be used for save/restore, alternate IPL, program distribution, migration and 1/4-inch cartridge tape exchange.

**Will read/write:**

- 30GB (up to 60GB with compression in SLR60 format) with IBM SLR60-30GB Data Cartridge (19P4209)
- 25GB (up to 50GB with compression in MLR3 format) with IBM MLR3-25GB Data Cartridge (59H4128)
- 16GB (up to 32GB with compression in QIC5010 format) with IBM MLR1-16GB Data Cartridge (59H4175)
- 5GB (up to 10GB with compression in SLR100 format) with IBM SLR100-5GB Data Cartridge (35L0661)
- 2GB (up to 4GB with compression in QIC5010 format) with IBM MLR1-2GB Data Cartridge (35L0589)

**Will read:**

- 4GB (QIC4GB format) with SLR5-4GB Data Cartridge (59H3660)
- 2.5GB (QIC2GB format) with IBM DC9250 Data Cartridge (16G8436)

**Specifications for the primary recording format:**

- Cartridge Capacity (Native) = 30.0GB (1500-ft tape)
- Cartridge Capacity (Compression) = 60.0GB (1500-ft tape)
- Data Rate (Native) = 4.0MB/s
- Data Rate (Compression) = 8.0MB/s



**4585**

**80/160GB VX2 Tape Drive**

#4585 80GB VXA-2 Tape Drive 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 VXA tape data cartridges and is compression capable, providing a capacity of up to 160 GB.

Characteristics:

- Capacity: 80GB native mode, 160GB (typical) compression mode
- Form Factor: 5.25-inch half high
- Media: uses VXA tape 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: 80GB mode (Read/Write), 160GB compression (Read/Write)
- Attributes provided: One 80GB internal VXA-2 tape drive
- Attributes required: One 1.6-inch (41mm) half-high media bay and one SCSI-2 internal 16-bit address



**4587**

## **50/100GB SLR100 Cartridge Tape**

Mounted in a removable media device slot in a system unit, #4587 can be used for save/restore, alternate IPL, program distribution, migration, and 1/4-inch cartridge tape exchange.

### Will READ/WRITE:

- 50GB (up to 100GB with compression in SLR100 format) with IBM SLR100-50GB Data Cartridge (35L0968)
- 30GB (up to 60GB with compression in SLR60 format) with IBM SLR60-30GB Data Cartridge (19P4209)
- 25GB (up to 50GB with compression in MLR3 format) with IBM MLR3-25GB Data Cartridge (59H4128)
- 5GB (up to 10GB with compression in SLR100 format) with IBM SLR100-5GB Data Cartridge (35L0661)

### Will READ:

- 16GB (up to 32GB with compression in QIC5010 format) with IBM MLR1-16GB Data Cartridge (59H4175)
- 4GB (QIC4GB format) with SLR5-4GB data Cartridge (59H3660)
- 2GB (up to 4GB with compression in QIC5010 format) with IBM MLR1-2GB

### Specifications for the primary recording format:

- Cartridge Capacity (Native) = 50.0GB (1500-ft tape)
- Cartridge Capacity (Compression) = 100.0GB (1500-ft tape)
- Data Rate (Native) = 5.0MB/s
- Data Rate (Compression) = 10.0MB/s



**5753**

## **30/60GB SLR60 Cartridge Tape**

Mounted in a removable media device slot in a system unit, the #5753 may be used for save/restore, alternate IPL, program distribution, migration and 1/4-inch cartridge tape exchange.

#5753 will read/write the following tape formats:

- 30GB (up to 60GB with compression in SLR60 format) with IBM SLR60-30GB Data Cartridge (19P4209)
- 25GB (up to 50GB with compression in MLR3 format) with IBM MLR3-25GB Data Cartridge (59H4128)
- 16GB (up to 32GB with compression in QIC5010 format) with IBM MLR1-16GB Data Cartridge (59H4175)
- 5GB (up to 10GB with compression in SLR100 format) with IBM SLR100-5GB Data Cartridge (35L0661)
- 2GB (up to 4GB with compression in QIC5010 format) with IBM MLR1-2GB Data Cartridge (35L0589)

#5753 is capable of read only support of the following tape formats:

- 4GB (QIC4GB format) with SLR5-4GB Data Cartridge (59H3660)
- 2.5GB (QIC2GB format) with IBM DC9250 Data Cartridge (16G8436)

#5753 has the these technical specifications for the primary recording format:

- Cartridge Capacity (Native) = 30.0GB (1500-ft tape)
- Cartridge Capacity (Compression) = 60.0GB (1500-ft tape)
- Data Rate (Native) = 4.0MB/s
- Data Rate (Compression) = 8.0MB/s



**5754**

**50/100GB SLR100 Cartridge Tape**

Mounted in a removable media device slot in a system unit, #5754 can be used for save/restore, alternate IPL, program distribution, migration, and 1/4-inch cartridge tape exchange.

Will READ/WRITE:

- 50GB (up to 100GB with compression in SLR100 format) with IBM SLR100-50GB Data Cartridge (35L0968)
- 30GB (up to 60GB with compression in SLR60 format) with IBM SLR60-30GB Data Cartridge (19P4209)
- 25GB (up to 50GB with compression in MLR3 format) with IBM MLR3-25GB Data Cartridge (59H4128)
- 5GB (up to 10GB with compression in SLR100 format) with IBM SLR100-5GB Data Cartridge (35L0661)

Will READ:

- 16GB (up to 32GB with compression in QIC5010 format) with IBM MLR1-16GB Data Cartridge (59H4175)
- 4GB (QIC4GB format) with SLR5-4GB data Cartridge (59H3660)
- 2GB (up to 4GB with compression in QIC5010 format) with IBM MLR1-2GB

Specifications for the primary recording format:

- Cartridge Capacity (Native) = 50.0GB (1500-ft tape)
- Cartridge Capacity (Compression) = 100.0GB (1500-ft tape)
- Data Rate (Native) = 5.0MB/s
- Data Rate (Compression) = 10.0MB/s



**5755**

**200/400GB LTO2 Tape Drive**

Provides a 200 GB native capacity (400 GB compressed capacity) tape device which installs in a half-high removable media device slot in the system unit. The #5755 can read and write both LTO Gen-1 and LTO Gen-2 tape cartridges.

Specifications:

- Cartridge capacity (native): 200 GB
- Cartridge capacity (compressed): 400 GB
- Data rate (native): 24 MBps
- Data rate (compressed): 48 MBps
- Interface: SCSI-3 low voltage differential (LVD)/single ended (SE)
- Media: LTO Gen-1 or LTO Gen-2 Data Cartridge
- Form factor: 5.25-inch, half-high
- Mounting type: Bolt-in
- Attributes provided: 200GB LTO tape device
- Attributes required: One 5.25-Inch, half-high removable media device slot



**6258****36/72GB DAT72 Tape Drive**

The #6258 4mm 36/72GB tape drive is an internal, bolt-in, 5.25-inch, half-high, single ended SCSI-2 tape drive that provides a high-capacity for save/restore functions.

Characteristics:

- Capacity: 36GB native mode, 72GB (typical) compression mode
- Form Factor: 5.25-inch, half-high
- Media: IBM 4mm DAT72 data cartridge
- Technology: Helical scan, rotating head
- Operation: Streaming
- Data Transfer Rate: 3MBps native mode, 6MBps (typical) compression mode
- Interface: SCSI-2 (single ended)
- Compatibility: Read/Write of DSS3, DSS4 and DAT72 media
- Attributes provided: 4mm 36/72GB internal bolt-in tape drive
- Attributes required: One 5.25-inch half-high media bay, #0140 (Logical Partitioning Specify) and (#0142 (Linux Partition Specify) and/or #0145 (AIX Partition Specify))



**6279****VXA3 160/320GB Tape Drive**

#6279 160GB VXA-320 Tape Drive is a 5.25-inch, half-high, Ultra2 SCSI tape drive, which provides a high capacity for save/restore and archive functions. This tape drive uses VXA tape data cartridges and is compression capable, providing a capacity of up to 320GB.

**Characteristics:**

- Capacity: 160GB native mode, 320GB (typical) compression mode
- Form Factor: 5.25-inch, half-high
- Mounting type: bolt-in (model 520/550 system unit)
- Media: uses VXA tape data cartridges
- Technology: Helical scan, rotating head
- Operation: Streaming
- Data Transfer Rate: 12MBps native mode, 24MBps (typical) compression
- Interface: Ultra2 SCSI, 16-bit (wide), LVD and SE compatible
- Compatibility: VXA-320 and VXA-2 (read/write)
- Attributes provided: One 160GB VXA-320 tape drive
- Attributes required: One half-high media bay and one Ultra2 SCSI 16-bit address and #4278 cables.



6384

## 30/60GB SLR60 Cartridge Tape

Mounted in a removable media device slot of a system unit or an expansion tower, these features may be used for save/restore, alternate IPL, program distribution, migration and 1/4-inch cartridge tape exchange.

### Will read/write:

- 30GB (up to 60GB with compression in SLR60 format) with IBM SLR60-30GB Data Cartridge (19P4209)
- 25GB (up to 50GB with compression in MLR3 format) with IBM MLR3-25GB Data Cartridge (59H4128)
- 16GB (up to 32GB with compression in QIC5010 format) with IBM MLR1-16GB Data Cartridge (59H4175)
- 5GB (up to 10GB with compression in SLR100 format) with IBM SLR100-5GB Data Cartridge (35L0661)
- 2GB (up to 4GB with compression in QIC5010 format) with IBM MLR1-2GB Data Cartridge (35L0589)

### Will read:

- 4GB (QIC4GB format) with SLR5-4GB Data Cartridge (59H3660)
- 2.5GB (QIC2GB format) with IBM DC9250 Data Cartridge (16G8436)

### Specifications for the primary recording format:

- Cartridge Capacity (Native) = 30.0GB (1500-ft tape)
- Cartridge Capacity (Compression) = 60.0GB (1500-ft tape)
- Data Rate (Native) = 4.0MB/s
- Data Rate (Compression) = 8.0MB/s



**6387****50/100GB SLR100 Cartridge Tape**

Mounted in a removable media device slot in a system unit, #6387 can be used for save/restore, alternate IPL, program distribution, migration, and 1/4-inch cartridge tape exchange.

**Will READ/WRITE:**

- 50GB (up to 100GB with compression in SLR100 format) with IBM SLR100-50GB Data Cartridge (35L0968)
- 30GB (up to 60GB with compression in SLR60 format) with IBM SLR60-30GB Data Cartridge (19P4209)
- 25GB (up to 50GB with compression in MLR3 format) with IBM MLR3-25GB Data Cartridge (59H4128)
- 5GB (up to 10GB with compression in SLR100 format) with IBM SLR100-5GB Data Cartridge (35L0661)

**Will READ:**

- 16GB (up to 32GB with compression in QIC5010 format) with IBM MLR1-16GB Data Cartridge (59H4175)
- 4GB (QIC4GB format) with SLR5-4GB data Cartridge (59H3660)
- 2GB (up to 4GB with compression in QIC5010 format) with IBM MLR1-2GB

**Specifications for the primary recording format:**

- Cartridge Capacity (Native) = 50.0GB (1500-ft tape)
- Cartridge Capacity (Compression) = 100.0GB (1500-ft tape)
- Data Rate (Native) = 5.0MB/s
- Data Rate (Compression) = 10.0MB/s



6484

## 30/60GB SLR60 Cartridge Tape

Mounted in a removable media device slot of a system unit or an expansion tower, these features may be used for save/restore, alternate IPL, program distribution, migration and 1/4-inch cartridge tape exchange.

### Will read/write:

- 30GB (up to 60GB with compression in SLR60 format) with IBM SLR60-30GB Data Cartridge (19P4209)
- 25GB (up to 50GB with compression in MLR3 format) with IBM MLR3-25GB Data Cartridge (59H4128)
- 16GB (up to 32GB with compression in QIC5010 format) with IBM MLR1-16GB Data Cartridge (59H4175)
- 5GB (up to 10GB with compression in SLR100 format) with IBM SLR100-5GB Data Cartridge (35L0661)
- 2GB (up to 4GB with compression in QIC5010 format) with IBM MLR1-2GB Data Cartridge (35L0589)

### Will read:

- 4GB (QIC4GB format) with SLR5-4GB Data Cartridge (59H3660)
- 2.5GB (QIC2GB format) with IBM DC9250 Data Cartridge (16G8436)

### Specifications for the primary recording format:

- Cartridge Capacity (Native) = 30.0GB (1500-ft tape)
- Cartridge Capacity (Compression) = 60.0GB (1500-ft tape)
- Data Rate (Native) = 4.0MB/s
- Data Rate (Compression) = 8.0MB/s

