

Disk Analysis - i5/iSeries

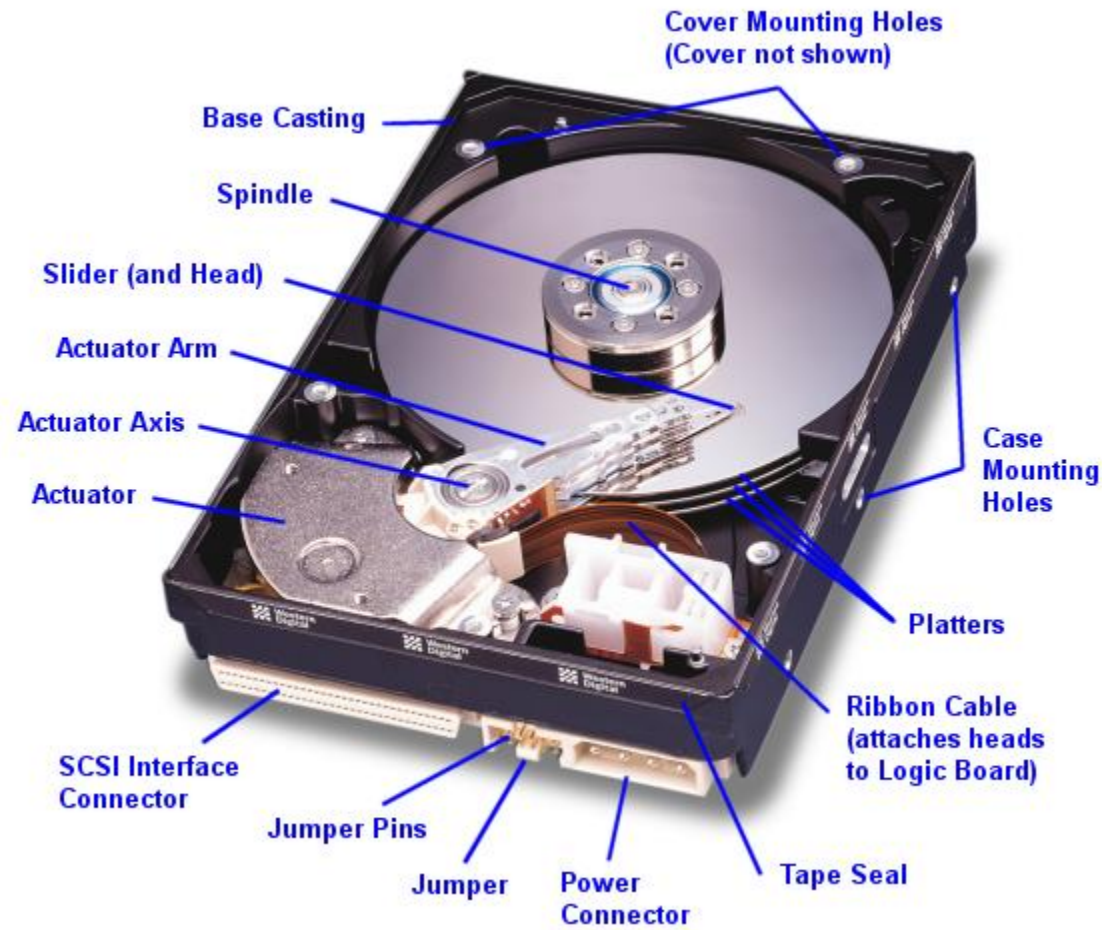
There was a time when the performance of disk drives was one of the most underrated aspects of overall system performance. Disk was considered only "a place to keep stuff" and little heed given to how they affected the operation of the server as a whole. Over the last few years this has changed dramatically, and disk drive performance issues are now getting the attention they deserve. There are many different issues in how performance is assessed and measured. There are interactions between components with which anyone seeking to really grasp hard disk performance must contend. And the technology changes so rapidly that what is the "fastest" today will probably be "second best" within a few months--or even weeks in many cases!

This StorFacts™ Report analyzes current System i, i5, and iSeries disk drives. Specifications discussed include the following:

1. IBM's MSRP
2. Capacity
3. MTBF
4. SCSI Protocol
5. OPS
6. RPM
7. Average Seek Time
8. Data Buffer
9. Media Transfer Rate
10. Sustained Data Rate
11. Burst Data Rate
12. Connectivity



For more information - <http://www.gstinc.com/store/Disk-C143.aspx>





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Key Performance Factors & Definitions

Performance Ranking

GST has ranked drive performance from best (one) to worst (ten). Ranking is based upon Operations per Second (OPS) capability. Check out the surprising results.

OPS

Operations Per Second (OPS) is an estimate of the number of I/O operations that can be performed at 40% disk utilization. At somewhere between 40%-50% utilization, the disk arms hit the knee of the curve; as utilization exceeds this point, response times increase significantly and become erratic and unpredictable. Of all the critical specs for a disk drive, OPS is the most useful for determining required disk configurations based on a known workload. For this reason, OPS ratings have become the defacto standard for evaluating disk drives.

RPM

Short for Revolutions per Minute, RPM is used to help determine the access time on computer hard disk drives. RPM is a measurement of how many complete revolutions a computer's hard disk drive makes in a single minute. The higher the RPM, the faster the data will be accessed. For example, if you were comparing two hard disk drives, one with 10,000 RPM's and another with 15,000 RPM's. The hard disk with a 15,000 RPM will be capable of accessing data much faster than the 10,000 RPM drive.

Average Seek Time

The term *average seek time* is commonly used when describing the time required for a disk drive to locate data from the drive platters.

Data Buffer

The buffer is an alternate location to store data while the disk drive is performing other operations.

Media Transfer Rate

The *media transfer rate* of a drive refers to the actual speed that the drive can read bits from the surface of the platter, or write bits to the surface of the platter. It is normally quoted in units of megabits per second, abbreviated Mbit/sec or Mb/s.



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Sustained Data Rate

The *sustained data rate* is based upon the drive's media transfer rate, but includes the overheads required for head switch time and cylinder switch time. Is normally measured in MB/s and includes only data, not the overhead portions of each sector or track.

Burst Data Rate

The *burst data rate* of a drive refers to the actual speed that the drive can send and receive data from the host server. The two most common rates are Ultra3 (160MB/s) and Ultra320 (320MB/s).

MTBF

Short for Mean Time Between Failure, MTBF is the estimated time it takes before a system or piece of hardware fails or errors out. An example of how MTBF could be used is: Hardware "Product A" has a MTBF of 1,400,000. This indicates that "Product A" will operate 1,400,000 hours before failure.





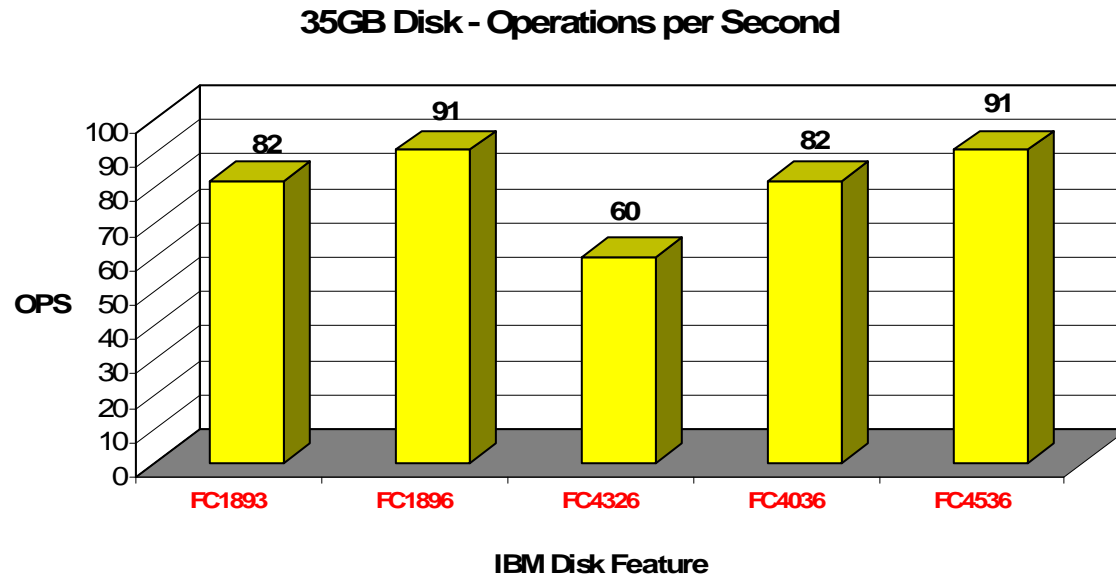
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35GB Disk Drives

i5 / iSeries Disk	Internal			External	
	FC1893	FC1896	FC4326	FC4036	FC4536
Marketing					
MSRP	\$750	\$599	\$1,199	\$750	\$1,199
Cost/GB	\$21	\$17	\$34	\$21	\$34
Configuration					
Capacity - (GB)	35	35	35	35	35
MTBF - (hours)	1,000,000	1,400,000	1,400,000	1,000,000	1,400,000
SCSI Protocol	Ultra320	Ultra320	Ultra320	Ultra320	Ultra320
Performance					
Operations per Second - (OPS)	82	91	60	82	91
Rotational speed - (RPM)	10,000	15,000	15,000	10,000	15,000
Average Seek Time - (MS)	2.15	3.5	3.6	2.15	3.5
Data Buffer - (MB)	8	8	8	8	8
Media Transfer Rate - (MB/s)	86 - 108	87 - 143	87 - 143	86 - 108	87 - 143
Sustained Data Rate - (MB/s)	68 - 89	58 - 96	58 - 96	68 - 89	58 - 96
Burst Data Rate - (MB/s)	320	320	320	320	320
Connectivity					
OS/400	-	-	Yes	-	-
Windows	-	-	Yes	-	-
AIX	Yes	Yes	-	Yes	Yes
Linux	Yes	Yes	-	Yes	Yes



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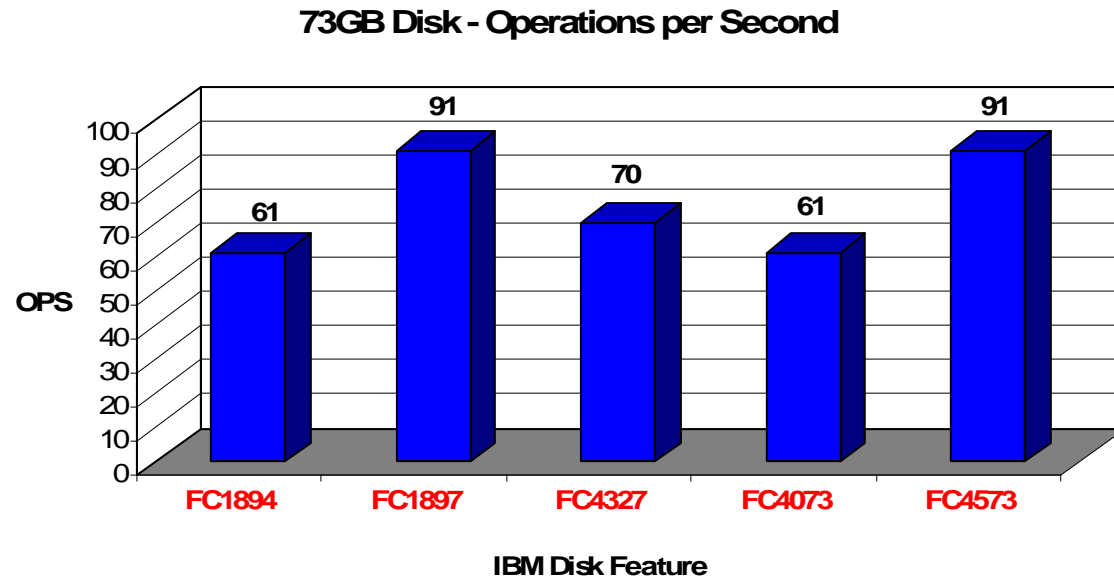
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73GB Disk Drives

i5 / iSeries Disk	Internal			External	
	FC1894	FC1897	FC4327	FC4073	FC4573
Marketing					
MSRP	\$599	\$899	\$1,999	\$439	\$1,999
Cost/GB	\$8	\$12	\$27	\$6	\$27
Configuration					
Capacity - (GB)	73	73	73	73	73
MTBF - (hours)	1,000,000	1,400,000	1,400,000	1,000,000	1,400,000
SCSI Protocol	Ultra320	Ultra320	Ultra320	Ultra320	Ultra320
Performance					
Operations per Second - (OPS)	61	91	70	61	91
Rotational speed - (RPM)	10,000	15,000	15,000	10,000	15,000
Average Seek Time - (MS)	4.3	3.5	3.6	4.3	3.5
Data Buffer - (MB)	8	8	8	8	8
Media Transfer Rate - (MB/s)	65 - 108	87 - 143	87 - 143	65 - 108	87 - 143
Sustained Data Rate - (MB/s)	47 - 89	58 - 96	58 - 96	47 - 89	58 - 96
Burst Data Rate - (MB/s)	320	320	320	320	320
Connectivity					
OS/400	-	-	Yes	-	-
Windows	-	-	Yes	-	-
AIX	Yes	Yes	-	Yes	Yes
Linux	Yes	Yes	-	Yes	Yes



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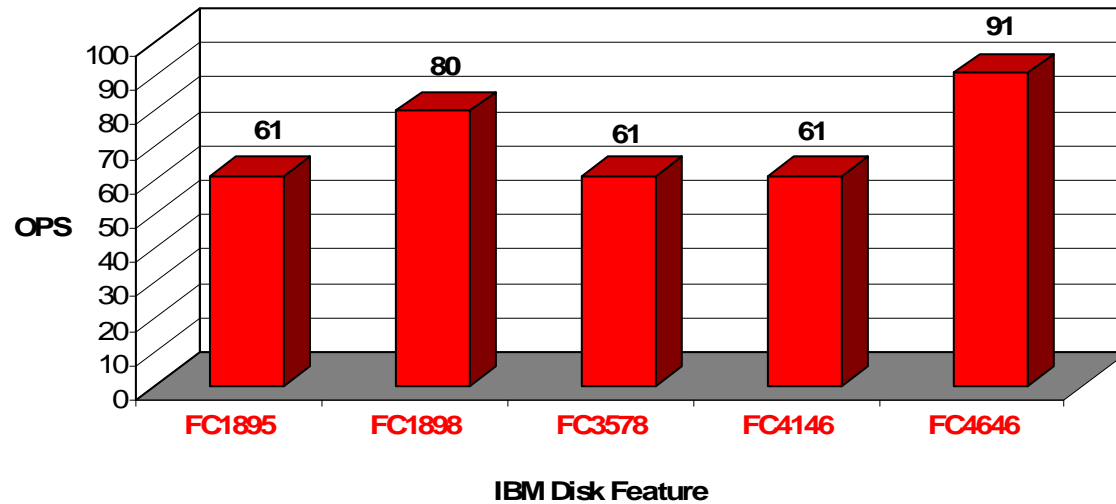
146GB Disk Drives

i5 / iSeries Disk	Internal			External	
	FC1895	FC1898	FC4328	FC4146	FC4646
Marketing					
MSRP	\$699	\$1,499	\$2,999	\$699	\$2,999
Cost/GB	\$5	\$10	\$21	\$5	\$21
Configuration					
Capacity - (GB)	146	146	146	146	146
MTBF - (hours)	1,000,000	1,400,000	1,400,000	1,000,000	1,400,000
SCSI Protocol	Ultra320	Ultra320	Ultra320	Ultra320	Ultra320
Performance					
Operations per Second - (OPS)	61	80	80	61	91
Rotational speed - (RPM)	10,000	15,000	15,000	10,000	15,000
Average Seek Time - (MS)	4.5	3.6	3.6	4.5	3.5
Data Buffer - (MB)	8	8	8	8	8
Media Transfer Rate - (MB/s)	65 - 108	87 - 143	87 - 143	65 - 108	87 - 143
Sustained Data Rate - (MB/s)	47 - 89	58 - 96	58 - 96	47 - 89	58 - 96
Burst Data Rate - (MB/s)	320	320	320	320	320
Connectivity					
OS/400	-	-	Yes	-	-
Windows	-	-	-	-	-
AIX	Yes	Yes	-	Yes	Yes
Linux	Yes	Yes	-	Yes	Yes



StorFacts™ Report

146GB Disk - Operations per Second



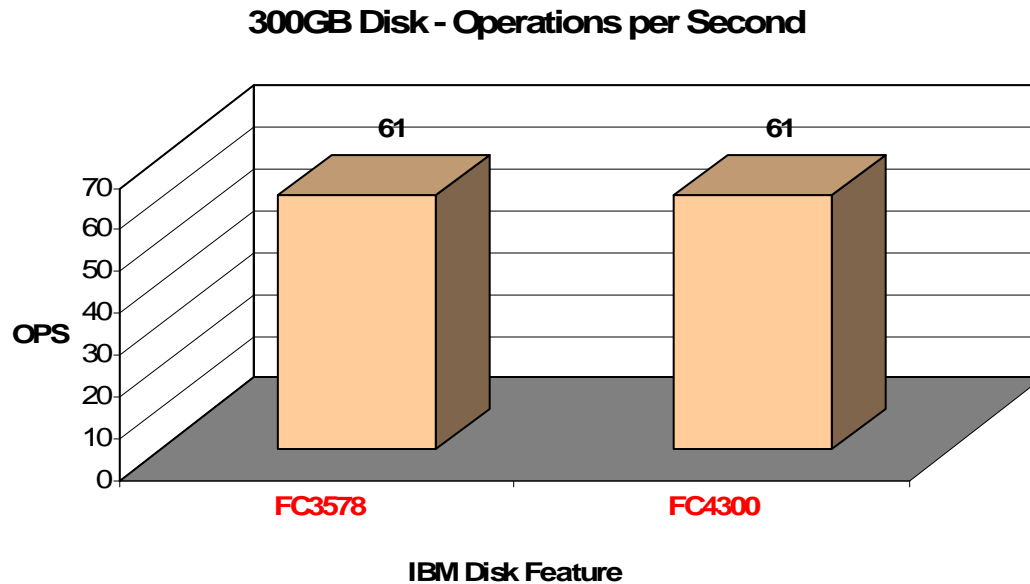
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300GB Disk Drives

i5 / iSeries Disk	Internal	External
	FC3578	FC4300
Marketing		
MSRP	\$1,599	\$1,500
Cost/GB	\$5	\$5
Configuration		
Capacity - (GB)	300	300
MTBF - (hours)	1,000,000	1,000,000
SCSI Protocol	Ultra320	Ultra320
Performance		
Operations per Second - (OPS)	61	61
Rotational speed - (RPM)	10,000	10,000
Average Seek Time - (MS)	4.7	4.7
Data Buffer - (MB)	8	8
Media Transfer Rate - (MB/s)	108	108
Sustained Data Rate - (MB/s)	47 - 89	47 - 89
Burst Data Rate - (MB/s)	320	320
Connectivity		
OS/400	-	-
Windows	Yes	
AIX	Yes	Yes
Linux	Yes	Yes



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