

## Disk Analysis

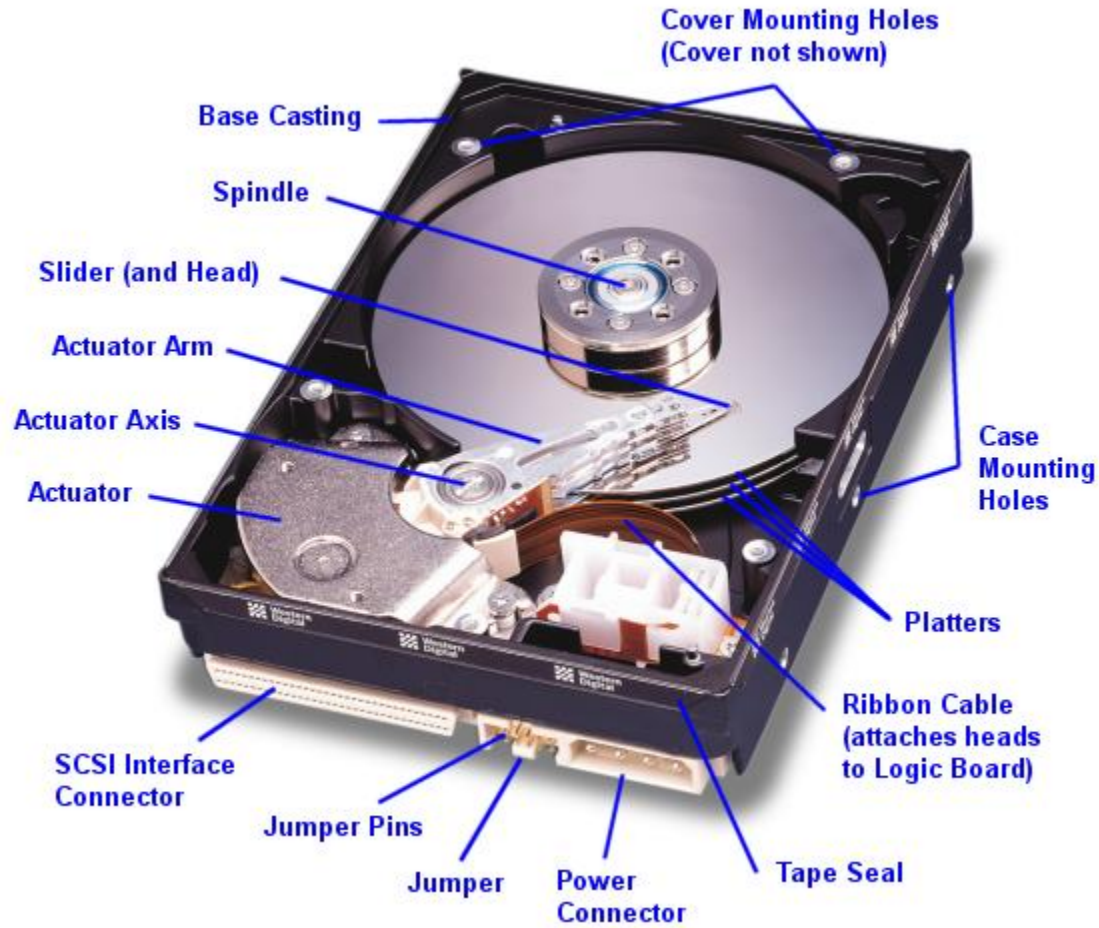
There was a time when the performance of disk drives was one of the most underrated aspects of overall system performance. Disk was considered only "a place to keep stuff" and little heed given to how they affected the operation of the server as a whole. Over the last few years this has changed dramatically, 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. An even weeks in many cases!d the technology changes so rapidly that what is the "fastest" today will probably be "second best" within a few months--or e

This StorFacts™ Report analyzes various System p, p5, OpenPower, pSeries and IntelliStation disk drives. Specifications discussed include the following:

1. MTBF ratings
2. SCSI protocol and interface
3. Operations per Second
4. Rotational Speed
5. Average Seek times
6. Data Buffers
7. Media transfer rates
8. Sustained data rates
9. Burst data rates
10. Connectivity and Replacement Drives (FRU).



For more information - <http://www.gstinc.com/store/Disk-C154.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

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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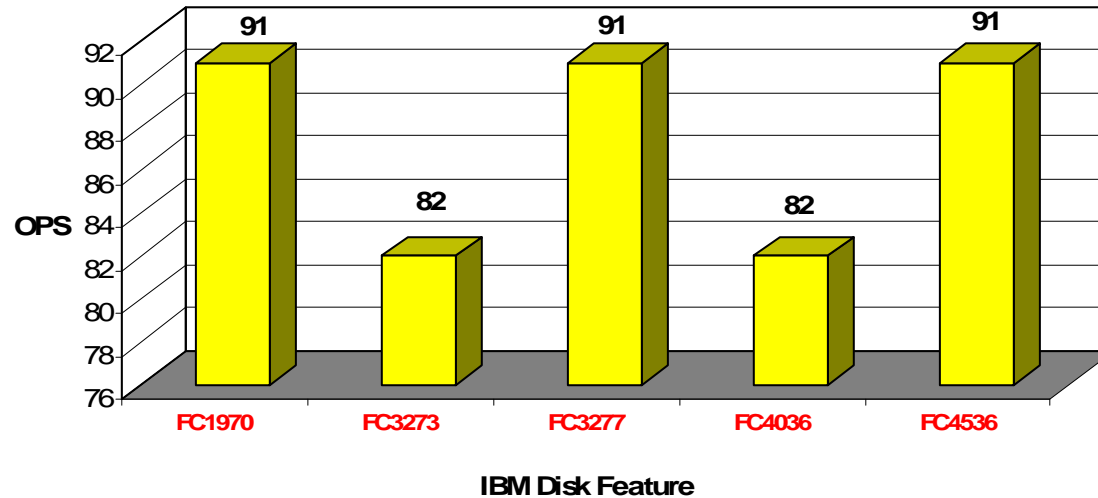
## 35GB Disk Drives

Disk Feature	FC1970	FC3273	FC3277	FC4036	FC4536
<b>Configuration</b>					
Capacity - (GB)	35	35	35	35	35
MTBF - (hours)	1,400,000	1,000,000	1,400,000	1,000,000	1,400,000
SCSI Protocol	Ultra320	Ultra320	Ultra320	Ultra320	Ultra320
<b>Performance</b>					
Operations per Second	91	82	91	82	91
FAST Technology	-	Yes	-	Yes	-
Rotational speed - (RPM)	15,000	10,000	15,000	10,000	15,000
Average Seek Time - (MS)	3.5	2.15	3.5	2.15	3.5
Data Buffer - (MB)	8	8	8	8	8
Media Transfer Rate - (MB/s)	87 - 143	86 - 108	87 - 143	86 - 108	87 - 143
Sustained Data Rate - (MB/s)	58 - 96	68 - 89	58 - 96	68 - 89	58 - 96
Burst Data Rate - (MB/s)	320	320	320	320	320
<b>Connectivity</b>					
Base System	Yes	Yes	Yes	-	-
7031, 7040 and 7311 I/O Drawer	-	Yes	Yes		
2104 Storage Drawer	-	-	-	Yes	Yes



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35GB Disk - Operations per Second



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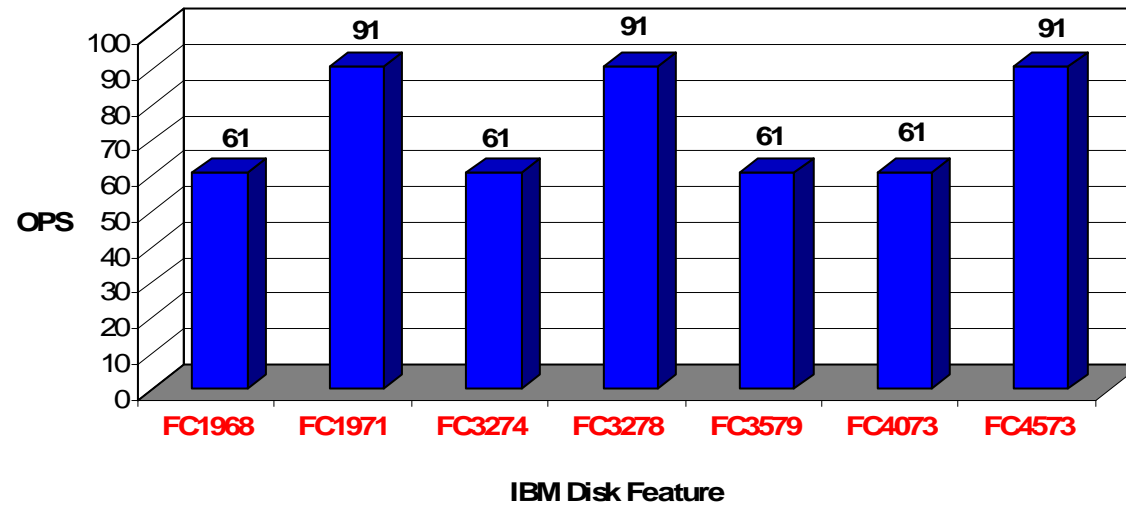
## 73GB Disk Drives

Disk Feature	FC1968	FC1971	FC3274	FC3278	FC3579	FC4073	FC4573
<b>Configuration</b>							
Capacity - (GB)	73	73	73	73	73	73	73
MTBF - (hours)	1,000,000	1,400,000	1,000,000	1,400,000	1,000,000	1,000,000	1,400,000
SCSI Protocol	Ultra320	Ultra320	Ultra320	Ultra320	Ultra320	Ultra320	Ultra320
<b>Performance</b>							
Operations per Second	61	91	61	91	61	61	91
Rotational speed - (RPM)	10,000	15,000	10,000	15,000	10,000	10,000	15,000
Average Seek Time - (MS)	4.3	3.5	4.3	3.5	4.3	4.3	3.5
Data Buffer - (MB)	8	8	8	8	8	8	8
Media Transfer Rate - (MB/s)	65 - 108	87 - 143	65 - 108	87 - 143	65 - 108	65 - 108	87 - 143
Sustained Data Rate - (MB/s)	47 - 89	58 - 96	47 - 89	58 - 96	47 - 89	47 - 89	58 - 96
Burst Data Rate - (MB/s)	320	320	320	320	320	320	320
<b>Connectivity</b>							
Base System	Yes	Yes	Yes	Yes	Yes	-	-
7031, 7040 and 7311 I/O Drawer	-	-	Yes	Yes	-	-	-
2104 Storage Drawer	-	-	-	-	-	Yes	Yes



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73GB Disk - Operations per Second



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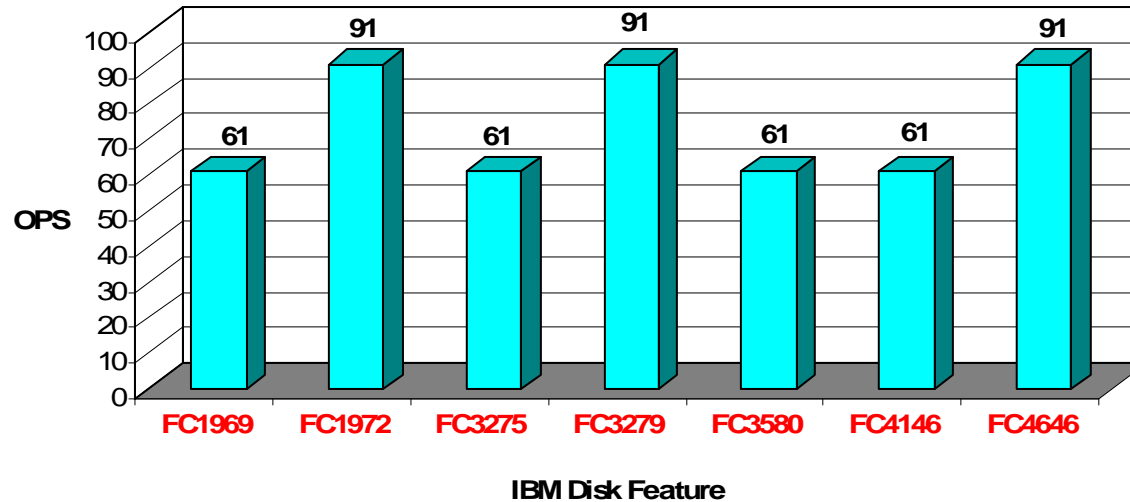
## 146GB Disk Drives

Disk Feature	FC1969	FC1972	FC3275	FC3279	FC3580	FC4146	FC4646
<b>Configuration</b>							
Capacity - (GB)	146	146	146	146	146	146	146
MTBF - (hours)	1,000,000	1,400,000	1,000,000	1,400,000	1,000,000	1,000,000	1,400,000
SCSI Protocol	Ultra320	Ultra320	Ultra320	Ultra320	Ultra320	Ultra320	Ultra320
<b>Performance</b>							
Operations per Second	61	91	61	91	61	61	91
Rotational speed - (RPM)	10,000	15,000	10,000	15,000	10,000	10,000	15,000
Average Seek Time - (MS)	4.5	3.5	4.5	3.5	4.5	4.5	3.5
Data Buffer - (MB)	8	8	8	8	8	8	8
Media Transfer Rate - (MB/s)	65 - 108	87 - 143	65 - 108	87 - 143	65 - 108	65 - 108	87 - 143
Sustained Data Rate - (MB/s)	47 - 89	58 - 96	47 - 89	58 - 96	47 - 89	47 - 89	58 - 96
Burst Data Rate - (MB/s)	320	320	320	320	320	320	320
<b>Connectivity</b>							
Base System	Yes	Yes	Yes	Yes	Yes	-	-
7031, 7040, 7311 I/O Drawer	-	-	Yes	Yes	-	-	-
2104 Storage Drawer	-	-	-	-	-	Yes	Yes



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146GB Disk - Operations per Second



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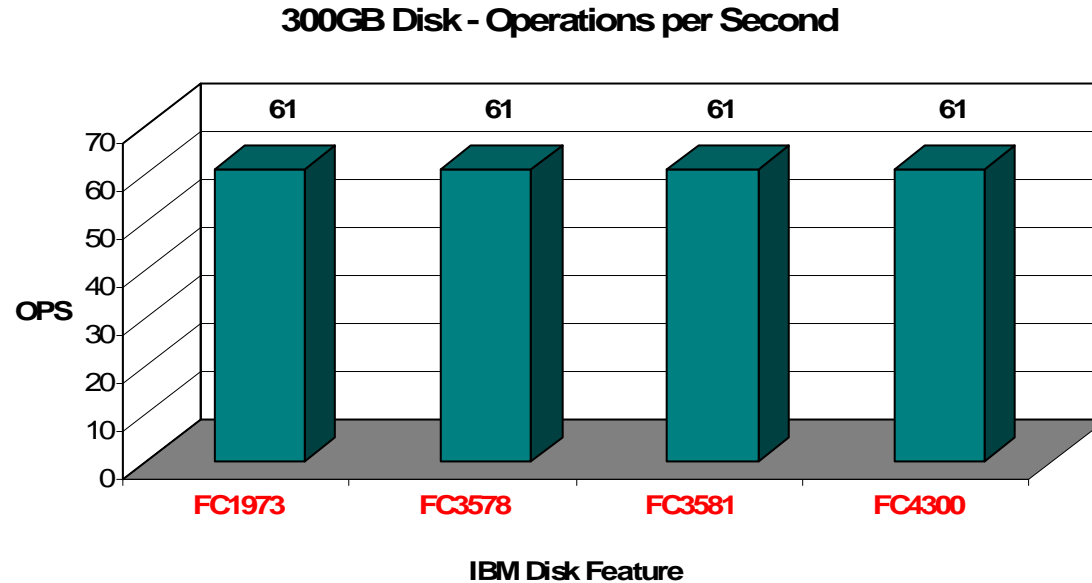
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## 300GB Disk Drives

Disk Feature	FC1973	FC3578	FC3581	FC4300
<b>Configuration</b>				
Capacity - (GB)	300	300	300	300
MTBF - (hours)	1,000,000	1,000,000	1,000,000	1,000,000
SCSI Protocol	Ultra320	Ultra320	Ultra320	Ultra320
<b>Performance</b>				
Operations per Second	61	61	61	61
Rotational speed - (RPM)	10,000	10,000	10,000	10,000
Average Seek Time - (MS)	4.7	4.7	4.7	4.7
Data Buffer - (MB)	8	8	8	8
Media Transfer Rate - (MB/s)	108	108	108	108
Sustained Data Rate - (MB/s)	47 - 89	47 - 89	47 - 89	47 - 89
Burst Data Rate - (MB/s)	320	320	320	320
<b>Marketing</b>				
Base System	Yes	Yes	Yes	-
7031, 7040, 7311 I/O Drawer	-	Yes	-	-
2104 Storage Drawer	-	-	-	Yes



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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.



# StorFacts™ Report

## Maximum Disk Configurations > p5 Servers

p5 Servers	Max Disk > Base System		Max Disk > I/O Drawers		Max Disk > Combined	
	Disk Bays	Capacity > TB's	Disk Bays	Capacity > TB's	Disk Bays	Capacity > TB's
7037-A50	3	0.90	-	-	3	0.90
9115-505	2	0.60	-	-	2	0.60
9110-510	4	1.20	-	-	4	1.20
9110-51A	4	1.20	-	-	4	1.20
9111-520	8	2.40	48	14.40	56	16.80
9131-52A	8	2.40	48	14.40	56	16.80
9113-550	8	2.40	96	28.80	104	31.20
9133-55A	8	2.40	96	28.80	104	31.20
9116-561	12	3.60	-	-	12	3.60
9117-570	24	7.20	240	72.00	264	79.20
9118-575	2	0.60	16	4.80	18	5.40
9119-590	-	-	128	38.40	128	38.40
9119-595	-	-	192	57.60	192	57.60



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## Maximum Disk Configurations > pSeries Servers

pSeries	Max Disk > Base System		Max Disk > I/O Drawers		Max Disk > Combined	
	Disk Bays	Capacity > TB's	Disk Bays	Capacity > TB's	Disk Bays	Capacity > TB's
7026-B80 (640)	5	1.50	-	-	5	1.50
7028-6C1 (610)	6	1.80	-	-	6	1.80
7028-6C4 (630)	4	1.20	24	7.20	28	8.40
7028-6E1 (610)	6	1.80	-	-	6	1.80
7028-6E4 (630)	4	1.20	-	-	4	1.20
7029-6C3 (615)	8	2.40	-	-	8	2.40
7029-6E3 (615)	8	2.40	-	-	8	2.40
7038-6M2 (650)	4	1.20	96	28.80	100	30.00
7039-651 (655)	2	0.60	16	4.80	18	5.40
7040-671 (670)	-	-	48	14.40	48	14.40
7040-681 (690)	-	-	128	38.40	128	38.40



# StorFacts™ Report

## Maximum Disk Configurations

OpenPower	Max Disk > Base System		Max Disk > I/O Drawers		Max Disk > Combined	
	Disk Bays	Capacity > TB's	Disk Bays	Capacity > TB's	Disk Bays	Capacity > TB's
9123-710	4	1.20	-	-	4	1.20
9124-720	8	2.40	96	28.80	104	31.20

IntelliStation	Max Disk > Base System		Max Disk > I/O Drawers		Max Disk > Combined	
	Disk Bays	Capacity > TB's	Disk Bays	Capacity > TB's	Disk Bays	Capacity > TB's
7047-185	3	0.90	-	-	3	0.90
9111-285	4	1.20	-	-	4	1.20
9112-265	10	3.00	-	-	10	3.00
9114-275	4	1.20	-	-	4	1.20

I/O Drawer	Max Disk > I/O Drawers	
	Disk Bays	Capacity > TB's
2104-DS4	14	4.20
7031-D24	24	7.20
7040-61D	16	4.80
7311-D20	12	3.60
9119-5791	16	4.80
9119-5794	8	2.40