

SATA

E155

Project Status

- 11/6: Project Proposal Due
- **11/13:** **TODAY**
- 11/25: Project Status Report Due
- 11/25-12/4: Project Presentations
- 12/9-10: Project Checkoffs
- 12/11: Public Demonstration
- 12/10: Final Report Due

Sources

- Harris and Harris 2nd Ed. Chapter 8
- <http://en.wikipedia.org/wiki/SCSI>
- http://en.wikipedia.org/wiki/Serial_ATA
- Others...

Hard Drive

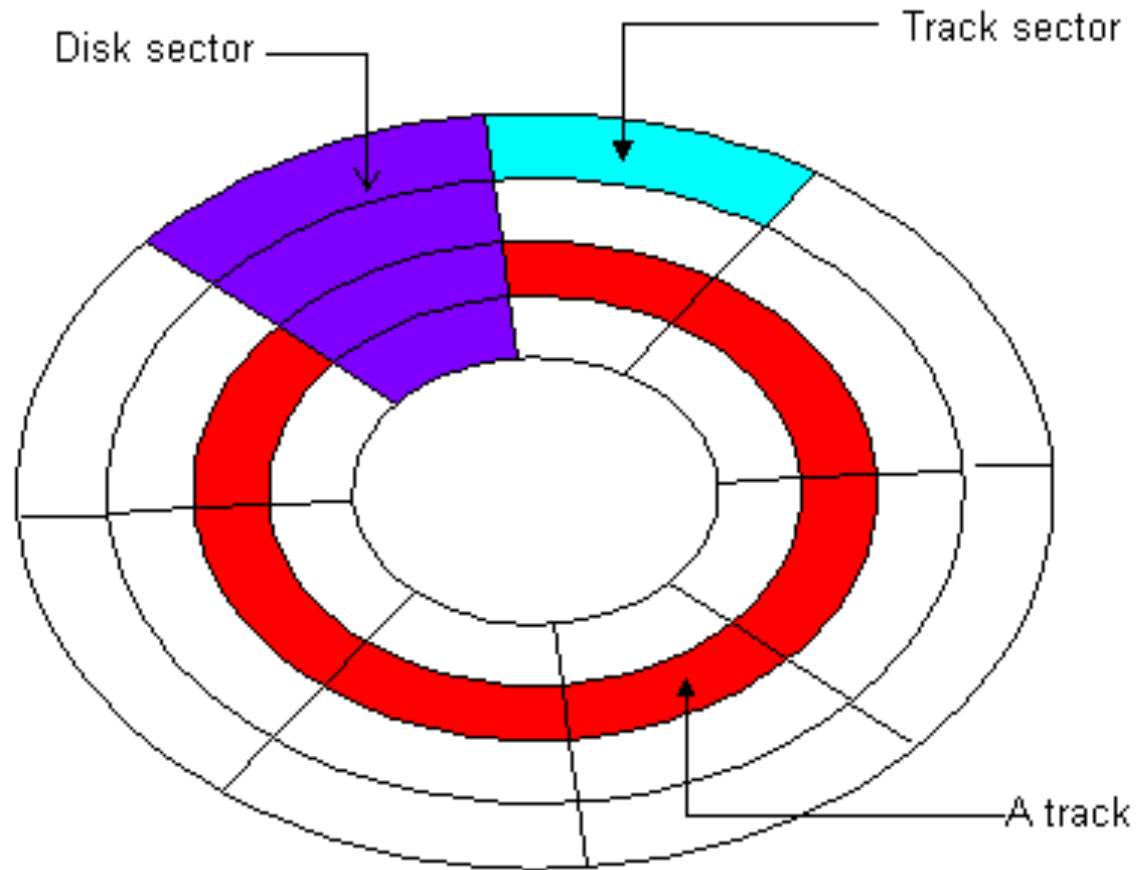


http://en.wikipedia.org/wiki/Hard_disk_drive

Hard Drive Parts

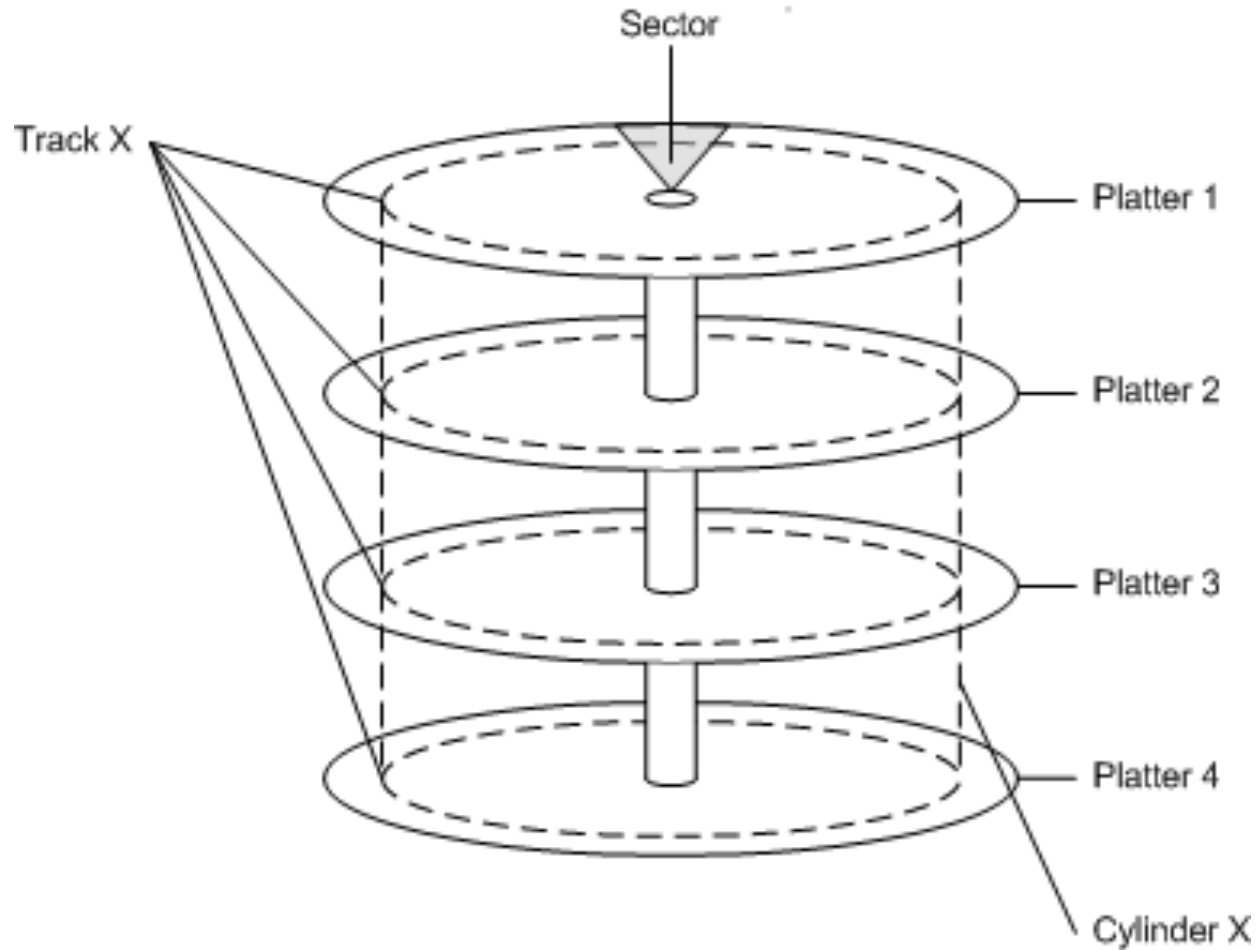
- Arms
- Heads
- Platter
- Track/Cylinder
- Sector

Hard Disk Parts



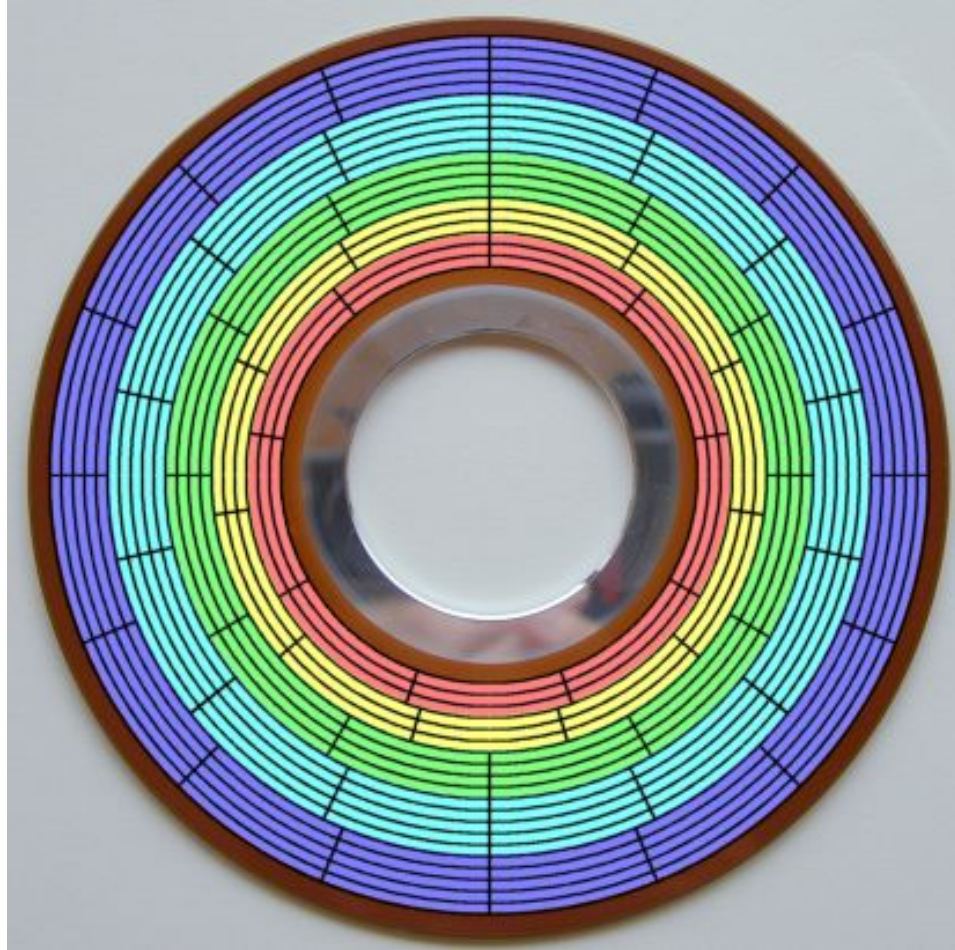
<http://www.installsetupconfig.com/win32programming/windowsdiskapis2.html>

Hard Disk Construction



<http://www.installsetupconfig.com/win32programming/windowsdiskapis2.html>

Zones



Hard Drive Capacities

Form Factor	Width(mm)	Height(mm)	Platters	Cap/Platter	Largest Cap
3.5"	102	25.4	5	1000 GB	4 TB
2.5"	69.9	9.5-15	4	500 GB	2 TB (15 mm)
1.8"	54	8	2	160 GB	320 GB (2009)
1.3"	43		1	40 GB	40 GB (2007)
0.85"	24		1	8 GB	8 GB (2004)
5.25"	146		14	3.36	47 GB (1998)

Seek

- Position head assembly
 - 3-15 ms
- Wait for the relevant sector

Rotation Speeds

Rotation Speed (rpm)	Average Latency (ms)
15,000	2
10,000	3
7,200	4.16
5,400	5.55
4,800	6.25

Hard Drive Interface

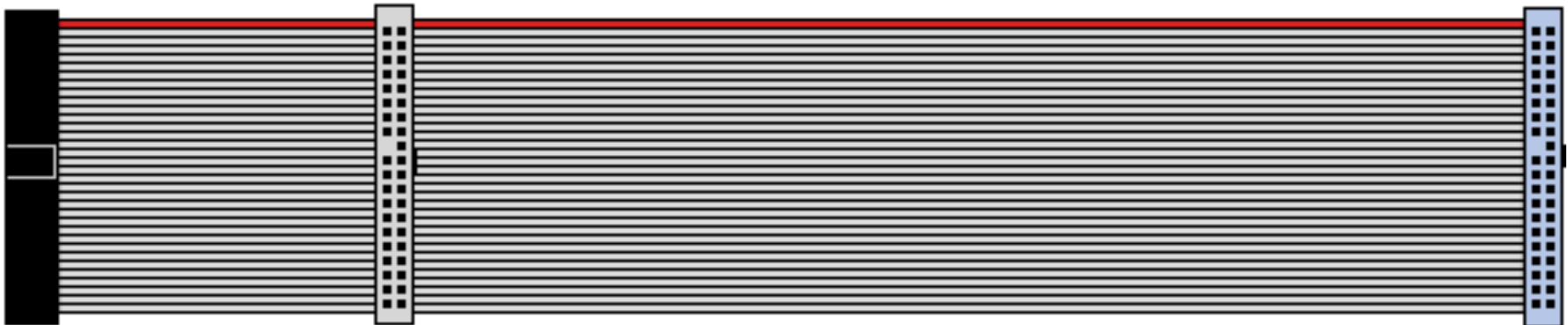
- Integrated Drive Electronics (IDE) interface
 - Western Digital
 - Control Data Corporation
 - Compaq Computer
- AT attachment (ATA) standard
 - Evolved from IDE
 - Renamed PATA after SATA was introduced
- First appeared in 1986

Standards!

- 1986 WD AT Attachment
 - ANSI standard X3.221-1994 (ATA-1)
- 1994 WD Enhanced IDE (EIDE)
 - ANSI standard X3.279-1996 (ATA-2)
 - Officially multiple hard drives

PATA

- 40-pin connectors
- 80-wire version
 - Reduce capacitive coupling
 - Reduce crosstalk
- Maximum length of 18 inches

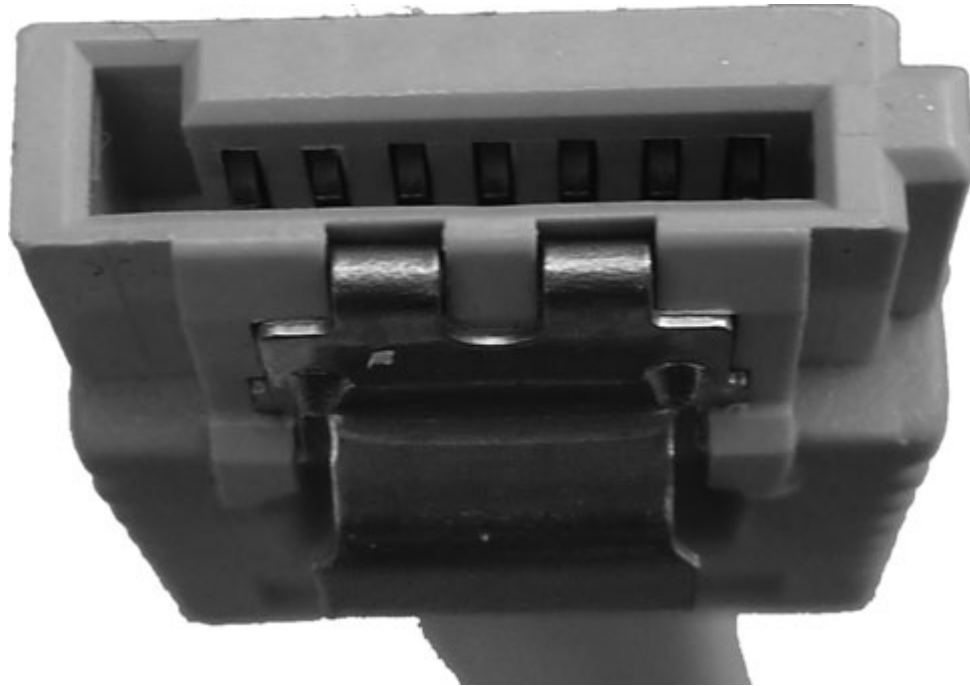


PATA Speeds

Mode	Cycle Time	Transfer Rate (MB/s)
PIO	600-120 ns	3.3-16.7
Single-word DMA	960-240 ns	2.1-8.3
Multi-word DMA	480-80 ns	4.2-25
Ultra DMA	240-24 ns (div 2)	16.7-167

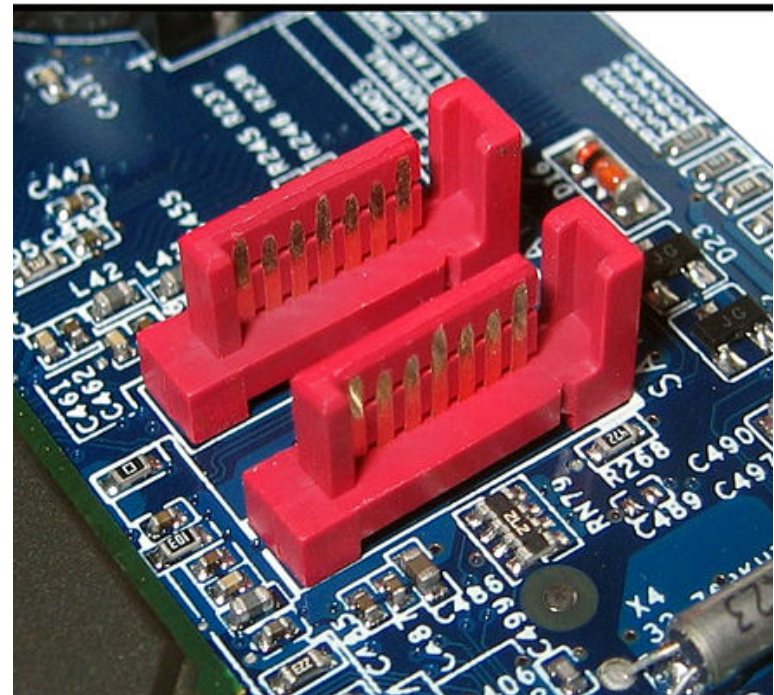
SATA

- Serial!
- 7-conductor cable



SATA

- <http://serialata.org/>
- Up to 1m cables
- eSATA up to 2m



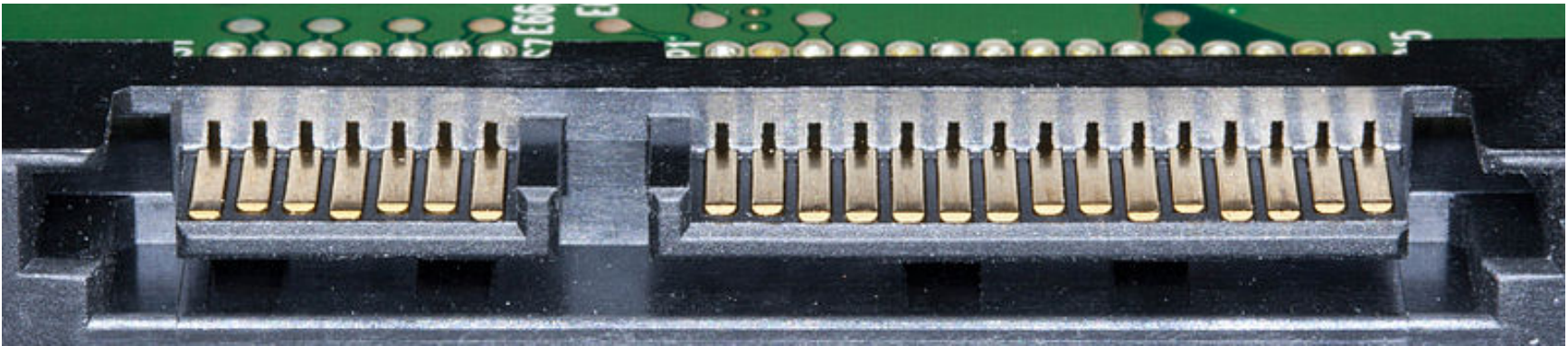
SATA Spec

- https://www.sata-io.org/developers/purchase_spec.asp
- \$25 each revision
- \$40 for all of them!
- Members get it free!

SATA Uses

- Hard drives
- CD drives
- DVD drives
- Blu-ray drives
- Tape devices
- High capacity removable devices
- SSDs

SATA Ports

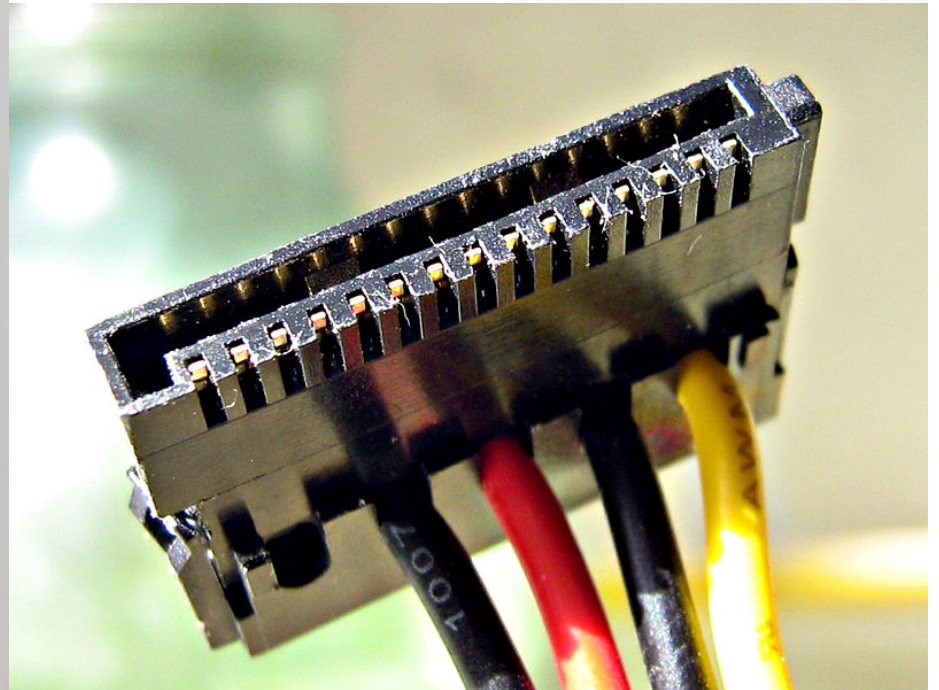


http://en.wikipedia.org/wiki/Serial_ATA

SATA Pins

Pin #	Mating	Function
1	First	Ground
2	Second	A+ (Transmit)
3	Second	A- (Transmit)
4	First	Ground
5	Second	B+ (Receive)
6	Second	B- (Receive)
7	First	Ground

SATA Connectors



http://en.wikipedia.org/wiki/Serial_ATA

SATA Speeds

Name	Max Cable Length	Transfer Speed (MB/s)
SATA 1.0	1 m	150
SATA 2.0	1 m	300
SATA 3.0	1 m	600
eSATA	2 m	300

SCSI

- Small Computer System Interface
- Public in 1981
- 8-16 bit parallel



Modern SCSI

- Serial Attached SCSI (SAS)
- USB Attached SCSI (UAS)
- iSCSI (SCSI over TCP/IP)

SCSI Speeds

Interface	Width (bits)	Clock	Bandwidth (MB/s)
SCSI-1	8	5 MHz	5
SCSI-2	16	10 MHz	20
SCSI-3	16	20-160 MHz	40-640
SAS 1.1	1	3 GHz	300
SAS 2.0	1	6 GHz	600
iSCSI	varies	varies	varies

SCSI Commands

- Test unit ready
- Inquiry
- Request sense – error detection
- Send diagnostic, Receive diagnostic results
- Start/Stop unit
- Read capacity
- Format unit

SCSI Commands

- SCSI Read format capacities
- Read + variants
- Write + variants
- Log sense
- Mode sense
- Mode select

Summary

Name	Raw Bandwidth Mb/s	Real Speed (MB/s)	Max Cable (m)
eSATA	3000	300	2
SATA	1,500-6,000	150-600	1
PATA	1,064	133.5	0.46 (18")
SAS	1,500-6,000	150-600	10
USB	12-5,000	1.5-400	3-5
Fibre	10,520	1,000	2-50,000
InfiniBand	10,000	1,000	5-10,000
Thunderbolt	10,000	1,250	3

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