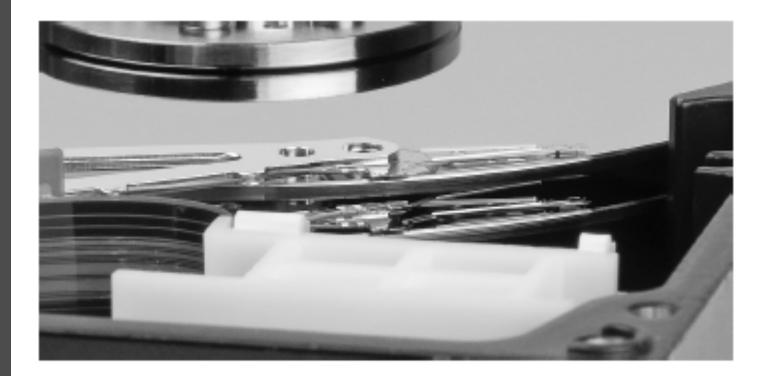
Thomas H. Russell
HARD DRIVE
TECHNOLOGIES

 Hard drives come in two major types: the traditional type with moving parts; and a newer, more expensive technology that has no moving parts

 Magnetic Hard Drives
 A traditional Hard Disk Drive (HDD) is composed of individual disk, or platters, with read/write heads on actuator arms controlled by a servo motor – all contained in a sealed case that prevents contamination by outside air

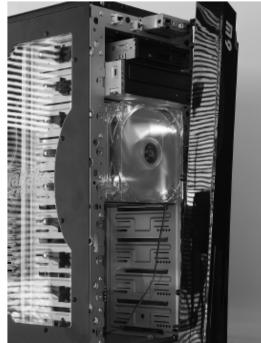


The aluminum platters are coated with a magnetic medium. Two tiny read/write heads service each platter, one to read the top of the platter and the other to read the bottom of the platter. These are called magnetic head drives or platter based hard drives.



 Spindle or rotation speed.
 Hard drives run at a set speed. Older drives run at 3600 RPM, newer ones at 15000. The faster the speed, the faster it can store and retrieve data. Common speeds are 5400, 7200, 10,000, and 15,000

Spindle or rotation speed
 Drives make heat. You can add a drive fan, get a bigger case or both.



Bay Fan

 Solid State Drives (SSD)
 These drives use semiconductors and transistors. No moving parts means no heat.

Solid state drive



- Solid State Drives (SSD) has form factors of 1.8, 2.5 and 3.5
- Some have special slots on the motherboard and can be installed as add-ons PCI cards.



- Hybrid Hard Drives
- These drives combine flash memory spinning platters.
- These drives save boot time and add battery life.

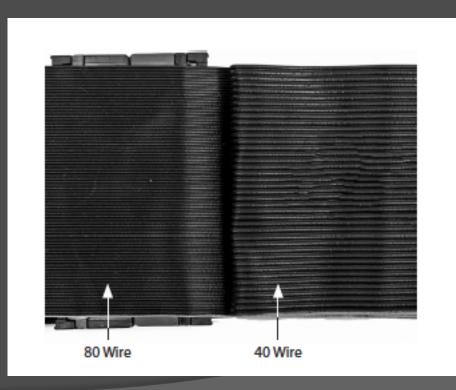
- ATA (advanced technology attachments) hard drives are often called integrated drive electronic (IDE) drives
- There are two types: parallel ATA (PATA) or serial ATA (SATA)

- PATA drives send data in parallel on a wide 40- 0r 80- wire data cable called a ribbon cable.
- SATA drives send data in serial, using only one wire for data transfers.

#### PATA – all PATA Drives use a standard Molex power connector.



#### PATA – drives that go 66 MBps or faster require an 80-wire cable



You can connect up to two PATA drives

 including hard drives, optical drives
 and tape drives – to a single ATA
 controller. You set jumpers on the drive
 to make one master and one slave.

- PATA Flat ribbon cables impeded airflow
- cables had a limited length of only 18 inches
- Drives could not be hot-swapped. You had to shut down the computer before installing or replacing.

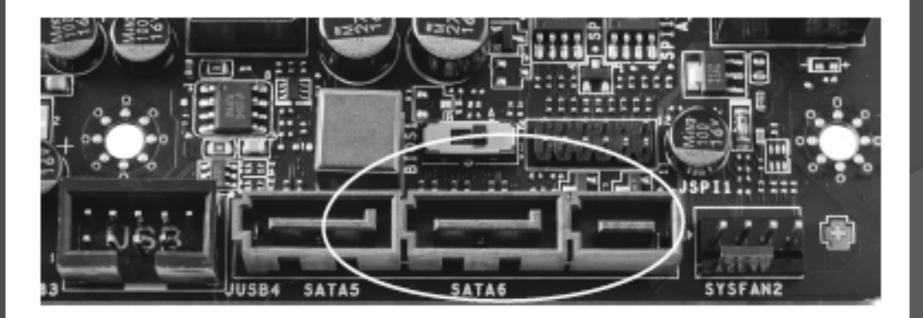
- SATA solved these problems.
- Point-to-point connection to all drives and the *host bus adapter* (HBA)
- Look the same as PATA except power connections



 Because SATA devices send data serially instead of parallel, the SATA interface needs fewer wires – 7 instead of 80. This results in much thinner cabling.

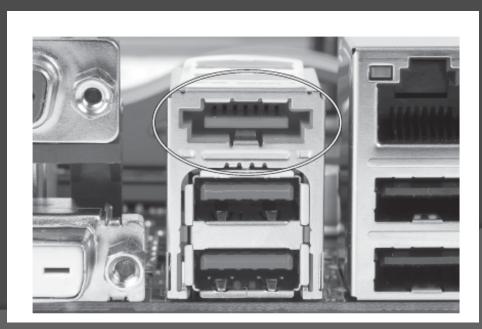
 The latest version of SATA (SATAe) or SATA 3.2, ties cable drive directly to the PCI express bus on motherboards.

 SATAe has unique connectors but provide full backward compatibility with earlier versions of SATA.



 AHCI – Advanced Host Controller Interface unlocks some of the advanced features of SATA, such as hot-swapping and native command queuing.

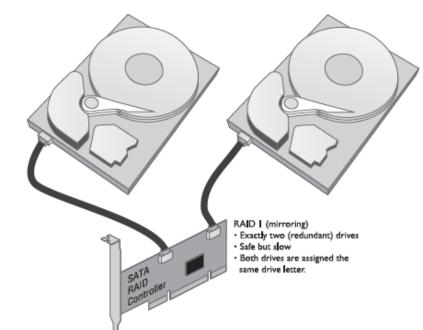
 External SATA (eSATA) drives use connectors similar to internal SATA but are keyed differently so you can't mistake one for the other.



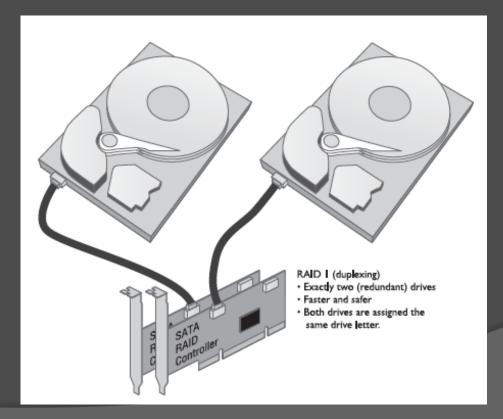
 You can upgrade laptop systems to support external SATA devices by inserting an eSATA ExpressCard



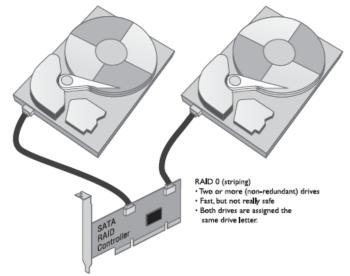
To prevent data loss you can install a hard drive controller that reads and writes data on both drives. This is called disk mirroring.



Or you can use a separate controller for each drive. This is called *disk duplexing*.



 Disk stripping is spreading the data among multiple drives. It provides no redundancy. Files are split into multiple pieces, half to one drive and half to the other.



 The one advantage of disk stripping is speed. But if either drives fails, all data is lost.

RAID uses multiple drives for data protection and increasing speeds. It stands for The *Redundant Array of Independent Disk*, (RAID). An *array* describes two or more drives working together as a unit.

- RAID 0—Disk Striping Disk striping requires at least two drives. It does not provide redundancy to data. If any one drive fails, all data is lost.
- RAID 1—Disk Mirroring/Duplexing RAID 1 arrays require at least two hard drives, although they also work with any even number of drives. RAID 1 is the ultimate in safety, but you lose storage space because the data is duplicated; you need two 2-TB drives to store 2 TB of data.
- RAID 5—Disk Striping with Distributed Parity Instead of dedicated data and parity drives, RAID 5 distributes data and parity information evenly across all drives. This is the fastest way to provide data redundancy. RAID 5 is by far the most common RAID implementation and requires at least three drives. RAID 5 arrays effectively use one drive's worth of space for parity. If, for example, you have three 2-TB drives, your total storage capacity is 4 TB. If you have four 2-TB drives, your total capacity is 6 TB.
- RAID 6—Disk Striping with Extra Parity If you lose a hard drive in a RAID 5 array, your data is at great risk until you replace the bad hard drive and rebuild the array. RAID 6 is RAID 5 with extra parity information. RAID 6 needs at least five drives, but in exchange you can lose up to two drives at the same time. RAID 6 is gaining in popularity for those willing to use larger arrays.
- RAID 10—Nested, Striped Mirrors RAID levels have been combined to achieve multiple benefits, including speed, capacity, and reliability, but these benefits must be purchased at a cost, and that cost is efficiency. Take for instance RAID 10, also called RAID 1+0 and sometimes a "stripe of mirrors." Requiring a minimum of four drives, a pair of drives is configured as a mirror, and then the same is done to another pair to achieve a pair of RAID 1 arrays. The arrays look like single drives to the operating system or RAID controller. So now, with two drives, we can block stripe across the two mirrored pairs (RAID 0). Cool, huh? We get the speed of striping and the reliability of mirroring at the cost of installing two bytes of storage for every byte of data saved. Need more space? Add another mirrored pair to the striped arrays!
- RAID 0+1—Nested, Mirrored Stripes Like RAID 10, RAID 0+1 (or a "mirror of stripes") is a nested set of arrays that works in opposite configuration from RAID 10. It takes a minimum of four drives to implement RAID 0+1. Start with two RAID 0 striped arrays, then mirror the two arrays to each other. Which is better: the RAID 10 or the RAID 0+1? Why not do a bit of research and decide for yourself?

**EXAM TIP** In preparation for the CompTIA A+ 220-901 exam, you'll want to be familiar with common RAID levels, the minimum number of drives in a given level array, and how many failures a given array can withstand and remain functional.

RAID Level	Minimum Drives	Number of Functional Failures
RAID 0	2	0
RAID 1	2	1
RAID 5	3	1
RAID 6	5	2
RAID 10	4	Up to 2
RAID 0+1	4	Up to 2

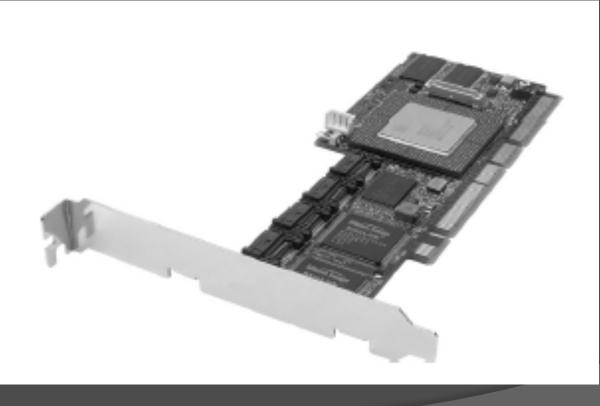
- Implementing RAID
- RAID levels describe different methods of providing data redundancy or enhancing the speed of data throughput to and from groups of hard drives.

 Hardware vs. Software
 Software is used when price takes priority over performance. Hardware is used when you need speed along with data redundancy.

# Disk management tool of computer management n Windows Server

1				Di	isk Managern	ent				_ D X
File Action	View Help									
⊡ (# I										
Volume	Layout	Туре	File Syste	em Status	Capacity	Free Space	% Free	1		
⇒ (Ct) €	Simple	Basic	NTFS	Healthy (8	59.66 GB	46.41 GB	78 %			
Primary Share		Dynamic	NTES	Healthy	5999.62 GB	3999.26 GB				
■ System Resen	ved Simple	Basic	NTFS	Healthy (S.,	350 MB	88 MB	25 %			
Disk 0										
Basic 60.00 GB	System Reserv	ved		(C)						
Online	350 MB NTFS Healthy (Syster	n Active Prim	ary Partit	59.65 GB NTFS Healthy (Boot, Pag	e File, Crash Dun	no. Primary Part	ition)			
			-,		,	T,				
Disk 1									_	_
Dynamic	Primary Shares (E)									
1999.88 GB	1999.87 GB NTFS									
Online	Healthy									
Dkk 2			_							
Dynamic	Primary Shares (E:)								_	
1999.88 G8 Online	1999.87 GB NTFS									
Unine	Healthy									
Disk 3										
Dynamic	Primary Share	s (E:)								
1999.88 GB Online	1999.87 G8 NTFS									
onine	Healthy									
Disk 4										
Dynamic 1999.88 GB	Primary Share	s (E=)								
1999-88 08 Online	1999.87 GB NT Healthy	15								
	Includy									
Unallocated	Primary partition	n 📗 RAID-5 vo	lume							

Hardware RAID centers on an intelligent controller – either a PATA or SATA controller that handles all of the RAID functions



Most RAID setups are hardware based. Almost all of the hardware solutions provide hot-swapping – the ability to replace a drive without without disturbing the operating system.

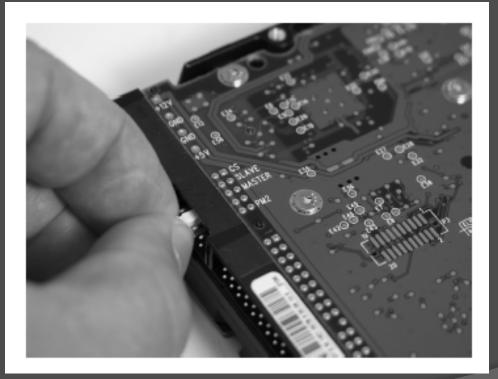
Intel(R) Rapid Storage Technology - Option ROM - 14.5.0.2241 Copyright (C) Intel Corporation. All rights reserved. COREATE VOLUME MENU 1						
Name: Storage RAID Level: RAID10(RAIDO+1) Disks: Select Disks Strip Size: 64KB Capactiy: 4000 GB Sync: N/A Create Volume						
р ————————————————————————————————————						
RAID 10: Mirrors data and stripes the mirror.						
[1]Change [TAB]-Next [ESC]-Pr	vious Menu [ENTER]-Select					

- Decide where you are going to put the drive
- Look for an open ATA connections
- Is it PATA or SATA?.
- Is it a dedicated RAID controller?

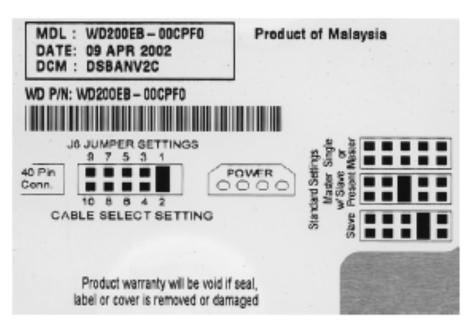
 Many motherboards have built-in RAID controllers that have a CMOS setting that enables you turn the RAID controller on or off.



If you have only one hard drive, set the drives jumpers to master or standalone. If you have two drives, set one to master, the other to slave. Or set both to cable select.

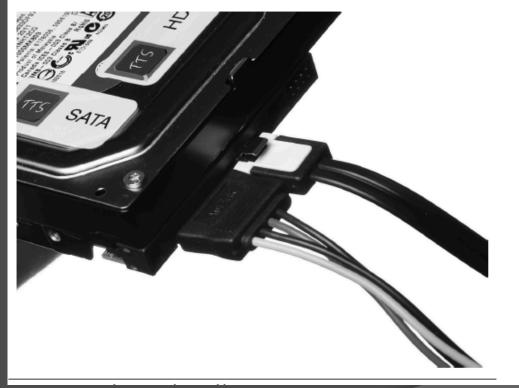


Read the front of the drives, most have a diagram that explains how to set the jumpers.



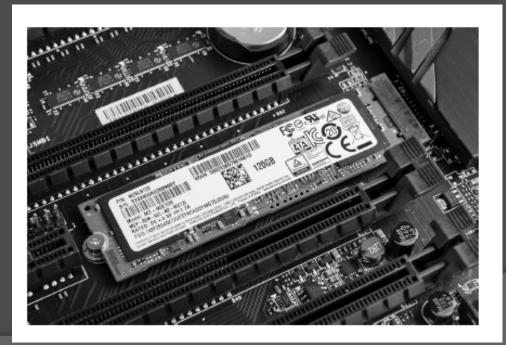
Installing SATA is easier than installing PATA because there is no master, slave or cable select configuration. SATA supports only a single device per controller

channel



#### Connecting solid state drives –

M.2 and mSATA drives slip into their slot o the motherboard or add-on card, then either clip in place or secure with a screw. Both standards are keyed, so you can't install them incorrectly.



 BIOS Support: Configuring CMOS and Installing Drivers.

Motherboards provide support for the ATA hard drive controllers via the system BIOS, but they require configuration in CMOS for the specific hard drives attached.

#### • Configuring the controllers:

• First, make sure they are enabled. Scan through your CMOS settings to locate the controller on/off options.

Storage Configuration	Set [Compatible Mode]	
SATA Configuration Configure SATA as	(Enhanced) LIDE1	When Legacy OS (ite WIN ME, 98, NT4, MS DOS) is used.
Hard Disk Write Protect IDE Detect Time Out (See)	[Disabled] [35] Options — Disabled Compatible	Set [Enhanced Mode] when Native OS (i.e. WIN2000, WIN XP, Vist is used.
	Enhanced	<ul> <li>↔ Select Screen</li> <li>↑↓ Select Iten</li> <li>↔ Change Option</li> <li>F1 General Help</li> <li>F10 Save and Exit</li> <li>ESC Exit</li> </ul>

#### Autodetection – means the drive should appear in CMOS.

Systen Time	12:29:5	Select Menu
Systen Date Language	Tue, Feb 13 2007 [English]	Item Specific Help)
Leagacy Diskette A:	[1.44, 3.5 in.]	Change the internal time.
Primary IDE Master	ENDC ND800JB-00JJ3	
Primary IDE Slave	[None]	
Secondary IDE Master	[CDRW 0937JDJ]	
Secondary IDE Slave	[None]	
Sete 1	[None]	
SATA 2	[None]	
SATA 3	[None ]	
SATA 4	[None]	
HDD SMART Monitoring	[Disabled]	
Installed Memory	256HB	
Usable Henory	256MB	

Motherboards with SATA connections use a numbering system and each motherboard has its own. A common one is the first Boot device is channel 1, the second 2, and so on. So instead of names of drives, you see numbers.

🛛 <sub>н. і.т.</sub> 🕺	System Information Features	Teripherals D Chipse	t 🖗 Managament 🕞 Save & Exit
Back			English Q-Flash
Serial ATA Port 0		Samsung SSD 85	Designates this port as Hot Pluggable.
		(250.0GB)	
Software Preserve		SUPPORTED	
		[Enabled]	
Hot Plug		[Disabled]	
External SATA			
Serial ATA Port 1		NDC WD5000AAKS	
		(500.16B)	
Software Preserve		SUPPORTED	
Port 1			
External SATA			
Serial ATA Port 2		NDC WD1002FAEX	↔: Select Screen ‡: Select Item
		(1000.25B)	Enter: Select
Software Preserva		SUPPORTED	+/-/PU/PD: Change Opt.
Port 2			Fi : General Help
			F5 : Previous Values
		[Disabled]	F7 : Optimized Defaults
Serial ATA Port 3		SONY DVD RM ATAP	F8 : Q-Flash
Software Preserve	:	N/A	F9 : System Information
			F10 ; Save 8 Exit
			F12 : Print Screen(FAT16/32 Format Only)
External SATA			ESC : Exit

#### Boot Order: You assign boot order priority to drives and devices in CMOS.

GIGABYTE'	UEFI DuaiBIOS					
🔘 <sub>н.і.т.</sub>	System Information	BIOS Features	T Peripherals	Chipset	Power Hanagement	B <sub>Save 8 Exlt</sub>
					Englis	h Q-Flash
Boot Option	Priorities			a Se		
Boot Option	#1		(UEFI: Le	war US8		
			Flash Dri			
			Partition			
списки вон п	rive BBS PriorIties					
	BS Priorities					
Bootup NumLo					: Select Screen 11:	Select Item
				E	nter: Select	
					/-/PU/PD: Change Opt.	
					i : General Help	
				I F!	5 : Previous Values	
					7 : Optimized Defaul	
					8 : Q-Flash	
					9 : System Informati	on
					10 : Save 8 Exit	
					12 : Print Screen(FAT	16/32 Format Only)
Network Stap					SC : Exit	

#### Hard Drive Technologies

The End

Thomas Russell Information Technology Teacher