Jaslie's Aplus Notes



DOMAIN1
Installation, Configuration, and Upgrading

**1.1: Identify basic terms, concepts, and functions of system modules.**

- **Motherboard:** The motherboard is the large primary board in the PC to which all other devices directly or indirectly connect. The motherboards is also known as the System board, main logic board, planar board, or main board.
- **Processor (CPU):** The "brains" of the computer. Performs all math and control functions in the PC.
- **Memory:** Temporary, fast access data storage usually in the form RAM or ROM. 1 byte= 8 bits 1bit = binary digit  nibble: 4 bits a byte is a word (not a character)
- **Storage Devices:** Permanent, slower access data storage. Hard drives, floppy disks, and tape drives fit in this category.
- **Modem:** Communicates with other PCs via a telephone line.
- **Firmware:** Software which is stored on a ROM chip.
- **Boot process:** The process of self-checks and Power-On Self Test (POST) performed upon boot-up of a PC.
- **BIOS (or ROM BIOS):** Stored in the CMOS, the Basic Input/Output System (BIOS) is the software for communications between the PC and its peripherals.
- **CMOS:** Chip which contains the system BIOS, setup configuration information, and the date/time.
- **Breakout box:**  box which enables you to individually accesspins on an interface port or cable

**1.2: Identify basic procedures for adding and removing field replaceable modules.**

- A Field Replaceable Unit (FRU) is a component of a PC which can be replaced in the field, which takes no special devices (such as a soldering iron) to install. The following are some common FRUs:
  - Motherboard
  - H-D
  - System board; board that plugs into ISA bus;
  - Socketed integrated circuit
  - RAM; level 2 cache SIMM; SIMM

- Floppy drive
- Storage device (hard disk, tape drive, etc.)
- Power supply ; battery
- Processor /CPU ; co-processor
- Memory
- Input devices (peripherals)

NOT FRUS à DMA controller; soldered IC; power supply regulator; surface mounted integrated circuit, chassis

**1.3: Identify available IRQs, DMAs, and I/O addresses and procedures for configuring them for device installation.**

- In Windows 95, System Resources are automatically configured by Plug and Play, or they can be manually configured by going to Control Panel > System > Device Manager, then highlight the device and go to Properties.
- In Windows 3.x, System resources are usually assigned by jumpers or DIP switches on the hardware, or using configuration software which accompanies the hardware.

**INTERRUPTS**

I/O is a 2 way communication, but how does a mouse say to CPU that it has moved, need an interrupt wire (INT wire), which becomes charged, CPU stops what it is doing , and try communicate with device. But with many devices, you need a controller: 8259 chip with interrupt requests on it. No two devices can share an IRQ. Mostly IRQ have conflicts instead of I/O addresses because they are more I/O addresses than IRQs.

Polling: I/O method where microprocessors examines status of the peripheral under program control

Standard 8 bit ISA bus: has 8 IRQs (irq 1 is not available) : PC-XT

**Error! Bookmark not defined.Standard Interrupt Requests (IRQs) for 16 bits ISA bus PC-AT**

| | |
|---|---|
| 0 | System Timer |
| 1 | Keyboard |
| 2 (9) | Video card |
| 3 | COM2, COM4 |
| 4 | COM1, COM3 |
| 5 | Available (usually Sound card or LPT2) |
| 6 | Floppy disk controller |
| 7 | LPT1 |
| 8 | Real-time clock |

| | |
|---|---|
| 9 | Redirected IRQ2 |
| 10 | Available |
| 11 | Available (or USB) |
| 12 | PS/2 mouse port |
| 13 | Math coprocessor |
| 14 | Primary IDE Hard disk controller |
| 15 | Available (or Secondary IDE Hard disk controller) |

**DMA (direct memory addresses)**

Accessing the memory without using the CPU à direct memory access

What if many devices need DMA ?

install chip 8237 to control all DMA functions

No two devices can share DRQ's or DMA channels

**Limitations:**

designed to run from cards installed on ISA bus (max speed 8Mhz)

can only handle byte wide data

There are only 2 types of DMA transfers: 8 bits and 16 bits.

If a device wants to use 8 bit transfers, it should use a lower DMA channel : 0 -3

If a device wants to use a 16 bit transfer, high DMA channel (5-7)

Bus mastering: using DMA without using the 8237 chip, popular in HD (ultra DMA).

XT have only 4 DMA channels (0-3); ISA, MCA, & EISA have 8 DMA channels (0-7)

On a PC, there is 2 controllers, each controls 4 DMAs

Who uses DMA : mostly sound cards and floppy

**Error! Bookmark not defined.Standard Direct Memory Addresses (DMAs)**

| | | |
|---|---|---|
| 0 | Available (ISA/AT and above) | 8 bit |
| 1 | Available (HD controller XT only, avail isa/at | 8 bit |
| 2 | Floppy Disk Controller | 8 bit |
| 3 | Available | 8 bit |
| 4 | DMA controller (cascade from DMA 1) | 16 bit |
| 5 | Available | 16 bit |
| 6 | Available | 16 bit |
| 7 | Available | 16 bit |

**Error! Bookmark not defined.Standard Input/Output ranges (I/O ports)**

| | |
|---|---|
| COM1 | 3F8H |
| COM2 | 2F8H |
| COM3 | 3E8H |
| COM4 | 2E8H |
| LPT1 | 378H |
| LPT2 | 278H |

**I/O addresses**

*All devices respond to more than one pattern*

The I/O address is a range of patterns

*All devices must have an I/O address*: how the CPU talks to them (it is either preset address or have to set it)

*Once a device is using an i/o address, no other device can use it*

I/O : hexadecimal, 0F10 : drop leading 0, when talking about a range of I/O address we drop the last range (1f0-1FF would be 1F0), can put “h” at then end to say hexadecimal : 3F0h

070-07F real time clock

060 keyboard

1F0 - 1F8 AT disk controller

3C0 - 3DA VGA adapter

3F0 - 3FF Floppy controller

360 NIC card

# Memory addresses

A0000 - AFFFF EGA adapter
A0000 - BFFFF VGA adapter
B8000 - BBFFF CGA adapter
C8000 - C8FFF Disk controller
F0000 - FFFFF System BIOS (in reserved memory area)

All devices gave I/O. Most have IRQ. Few have DMA

**1.4: Identify common peripheral ports, associated cabling, and their connectors.**

- External ports send in an asynchronous fashion
- Due to interference, transfer rates must be reduced the longer a cable becomes
- When connecting a ribbon cable, the striped edge always connects to pin 1

**CONNECTORS:**

1. DB : oldest; 9-37 pins; m/f sockets
2. DIN : round; 2 sizes : DIN & MINI-DIN; female sockets
3. CENTRONICS : similar DB; wings; female socket
4. RJ: phone; RJ11 (same size RJ14, 2 pairs of wire) à modem
5. RJ45 (4 pairs of wire inside single jacket) à network
6. BNC : like back of TV (with pin out)
7. AUDIO : mini audio

To test serial and parallel ports: loop back plugs

Flat data cables: red or blue stripe connected to PIN 1

Input devices: keyboard; mouse; scanner; digital camera

Output device: monitor; printers

Both : modem; sound, video, TV

- **Parallel ports** (LPT ports) (Input and output device)
  - Printers and some scanners use the parallel port
  - 25 pin female D-shell connector
  - Sends and receives 8 bits of data at a time
  - Sometimes referred to as "Centronics" or DB-25
  - Older PCs used 36-pin D-shell Centronics connector
  - Most PCs have 1 parallel port
  - Example: ECP
- **Parallel cables**
  - 10 feet is the industry-accepted maximum length for a parallel cable
  - Printer Cable- 36pin centronics to DB-25 (Parallel cable).
  - Bi directionnal parallel cable à IEEE1284

- **Serial ports** (COM ports)
  - External modems and some mice use the serial port
  - 9- or 25-pin male D-shell connector
  - Sends and receives data 1 bit at a time
  - Sometimes referred to as RS-232 or DB-9
  - Most PCs have 2 serial ports
  - Max. # active pins: 9
  - Normally : 9 pin male DB
- **Serial cables**
  - 50 feet is the industry-accepted maximum length for a serial cable (longer lengths cause com errors & garbage characters)
  - A serial port transfers 1bit at a time at 57KB/sec
  - Null modem cables (serial cables) are used to transmit data between 2 DTE (Data Terminal Equipment) devices.
- **Keyboard**
  - AT style connects to female DIN-5 & PS/2 female style to MiniDIN
  - 6 pin keyboard à pin 1 is used for data
  - input device
  - Key switched (more prone to failure) and capacitive are the 2 modern keyboards methods.
  - Deboucing: cleans up electrical noise
  - Has a microprocessor in it
- **Modem**
  - uses RJ-11
  - input and output device
- **Joystick**
  - 15 pin female DB
- **MIDI port**
  - 15 pin female DB
- **Mouse**

- 1Connects to 9-pin serial port or PS/2 (MiniDIN) connector (had a bit of  a cable à dongle)
- Input device ; relative pointing device
- If works on DOS but not in W à look system.ini file
- connects to COM1
- Modern mice use optical and opto-mechanical methods (uses ball; led; slotted plastic disk, rollers to produce input)

- **Video**
  - Older monochrome, CGA, HGA, and EGA adapters used 9-pin female D-shell connectors
  - VGA and SVGA use 15-pin female D-shell connectors (3 rows of holes)
  - Monitor:  output device
- **Network**
  - Twisted pair cables (10BaseT & 100BaseT) use RJ45 connectors. RJ45 connectors resemble large phone jacks.
  - Coaxial cable (10Base5) uses a coaxial BNC connector
  - RJ11 jack are US telephone plugs
- **SCSI**
  - Tape drives, hard disks, optical drives (CD-ROM), and scanners can all use SCSI connections
  - Up to eight devices (including the controller) can be chained off a SCSI port (SCSI ID 0-7). The adapter itself is usually ID 7
  - 18 feet is the industry-accepted maximum length for a SCSI cable
  - Most external SCSI devices have Centronics-50 or 25-pin D-shell connector
  - Input and output device
  - All female
- **FLOPPY**  (2 square holes on top)
  - 34 pin cable (twisted); can have 2 on 1 cable
  - write protected: 2 holes uncovered
  - clean with isopropyl alcohol
  - floppy cable put backwards: inoperable (not destroy)

    2 TYPES:

5.25 inch (360K (double density) 1.2MB (high density)) and 3.5 inch (720K (double density),1.44MB (high density),2.88MB)

34 pin cable, 7 wire-twist floppy at the end of drive: A; in the middle connector: B drive 34th wire on cable: drive change signal : see same directory all the time power connector is called berg connector at boot up: 601 error à problem floppy drive or controller (either power cable or floppy ribbon cable upside down) type of connector : mini-molex

- **HARD DRIVE**
  - IDE: 40 pin cable, 2 HD per controller
  - SCSI : 50 pin cable; more than 2

**JUMPERS & SWITCHES**

ROLE: turn on/off circuitry

switches : lego block, toggle them

jumpers : tiny pins, a shunt on top connected shunt : shorted, closed, on

no shunt: open or off

-highest binary # on a 3 position jumper block: in this mode, left most bit: 4, middle bit: 2, right bit : 1, so jumper usage, a 1 indicates closed, so then 111=4+2+1=7

- 2 position jumper block : highest binary # : 3

**Cables**

Cable type // Connectors // Maximum length

Modem cable RS - 232 DB-9F, DB-25M 25 feet

Modem cable RS - 232 DB-25F, DB-25M 25 feet

Printer cable DB-25M, Centronics 36 10 feet

External SCSI cable Centronics 50M, Centronics 50M 10 feet

VGA cable DB-15M, DB-15M 3 feet

### 1.4.1 : Power supplies

truly standard piece

power converter, AC à DC, 110Volts

unique to every manufacturer

most popular: AT power supply

Output of voltage PC power supply : DC

Voltage for motor: +- 12V ;  voltage for circuitry: +-5V

Most circuit boards: +5V

**Types connectors :**

1. molex : most common
2. mini-connectors:  on 3.5 floppy
3. sub-mini: display “200 Mhz”
4. P8 & P9 connectors
5. Berg connectors
6. Motherboard connectors

   Voltage: +5; -5 ; +12 ; -12

   Connecting P8-P9: keep black wires together (face each other in the inside)

**Molex:**

- chamfers or notches ensure proper orientation
- delivers 5 or 12 V DC
- inserted incorrectly can destroy device
- different voltage on each side

  Types switches : plunger and rocker : power wires are not interchange able; easy to replace; cheap

  Electricity à flow of electrons through matter; amount of electrons moving past a certain point on a wire is called current and is measured in Amps; voltage is measures in Volts and is considered the pressure in which electrons move through a wire

  AC outlets à have 3 connections : small, round hole à ground (black)

  large rectangular hole à neutral

  small, rectangular hole à hot

  Power supply wires - yellow=+12v, blue=-12v, red=+5v, & white=-5v

  AC plugs:  smaller prong: phase ; larger prong: neutral

**Fuses :** wire inside the fuse will melt if more than a certain amount of current flows through it; have an amperage rating; can be tested for their continuity

**Capacitor :** similar to rechargeable batteries used to even out current flow

**Transformer:** a way to create a difference in voltages by passing electricity from one wire-wrapped coil to another

**Electrostatic discharge (ESD) :** static electricity stops resting and moves toward ground

**UPS (uninterrupted power supply):** always on; feeding power to the computer; protect the computer from brownouts, blackouts, power sags, spikes; never plug a laser printer to it

Multimeters : AC and DC voltages, continuity and resistance

- ohmmeter: remove power to circuit b4 attaching the meter
- multimeter:
    1. resistance : measured with ohmmeter, circuit power off
    2. unknown V : start with highest range
    3. measuring current: off power; break current path; connect meter in series; put power on
- reduce static : rubber carpet (nto nylon, plastic or vinyl)
- reduce risk of ESD : ion generator; wrist-strap grounded; humidifier
- CMOS more susceptible to EDS à cause it is smaller
- Diff. Between ESD and EMI (electro magnet interference) : EMI is recoverable
- Static jolt of 30V or less can damage
- Human cannot feel static discharge as high as 200V
- Static elect. Thrives on environment : cold and dry (low humidity promotes ESD)
- CRT : voltage as high as 15000V
- Capacitor à stores electric charges
- Power supply: pin1 (wire white or orange has V between 2.5-5V)
- Spike (surge): sudden, sharp rise in V, measured in milliseconds à surge suppressor

- Brownout(power sag): slightly decreased V lasting seconds to minutes or more à UPS

- Resistance: measured in Ohms; measured after breaking the circuit

- Capacitance: measured in Farads

- Voltage is measured in paralell

- Current measured in Amps : turn device off; connect meter in series; power on

- Polarity tester: checks line-voltage sags

- Line analyzer : checks line surges; warns of voltage spikes

- Line conditioners produce perfect power of 110V AC/60Hz.

- Bad fuse: reads high , good fuse : reads 0 in ohms, resistance

- Home outlet : 104-130 V AC

- Output power supply: +24;+12;+5; -5 (not –24)

- Protection against surges: power conditioner and UPS

- UPS and SPS : good read outs à sine wave

- Watts capacity # à maximum wattage that can be provided

- Transient: overvoltage condition

- **SPS (standby power supply) :** battery connected between AC line and computer. AC line simultaneously charges battery and supplies power to the computer. When AC line voltage is lost, battery quickly switches so it, instead of the AC line,powers the computer;; does not provide surge protection

- Ground diagram :

- Volt-ohm meter is set to : ohms

- Ohm’s Law - V=IR (I=current in amps, V=volts, R=resistance in ohms)

- Watts/Volts = Amperes

- When checking power supply, should be set at DC

- Faraday Cage - antistatic bag

- When measuring AC with multimeter, is it important to maintain proper polarity è FALSE

- Test for AC ripple in a PC power supply, set volt/ohm meter to: AC voltage

- Test a fuse: set to ohms
- Checking circuit, do we set the meter to lowest setting è FALSE
- Wall outlet can be tested for correct polarity with a VOM
- Work with right hand to route any shock away from heart (which is on left side)
- High humidity: electric current to bleed around the cips causing shorts
- Anti-static bags are conductive7
- Electrostatic discharge (ESD) can damage the component at as little as 80 volts. CMOS chips are most susceptible to ESD. Static electricity builds up more in cold and dry places. Use humidifiers to keep room humidity at 50% to prevent static build up.
- When working on computers, use special ESD wrist strap. Do not use a piece of wire to ground yourself. An ESD wrist strap has built-in resistor to prevent electric shock. Use specially designed grounded ESD mats. Do not wear synthetic clothing. Place all electronic components into antistatic bags. Antistatic bags can be reused. Keep your workplace clean.
- When repairing a monitor, do not wear an ESD wrist strap. The capacitor inside the monitor can retain high voltage charge.
- To put out an electrical fire use type C extinguisher or multipurpose ABC type extinguisher.
- Do not disassemble power supplies. They need to be replaced.
- Discharge CRT: high voltage probe
- Ohms for speaker: 0 ohms
- Best protection against ESD: ESD grounding wrist-strap + anti-static mat

**ENVIRONMENT:**

- wash plastic cover monitor or PC à lint free clothe
- clean dust : non-static compressed air
- clean power supply: compressed air
- clean k-board: remove bezel; blow out dust or with general purpose cleaner
- clean external plastic cabinets+periph: damp clothe, mild detergent
- cleaning laser toner : cloth and cool water

- To clean a keyboard soak it in a distilled demineralized water as soon as possible after the spill.

- Clean the inside of the PC with compressed Air. Compressed Air do not create ESD.

- Most difficult to dispose of: CRT easiest : ink jet cartidge

- Cooling spray can be used on chips to diagnose erratic problems

## POWER MANAGEMENT

**SMM:** system management mode; allows CPU to slow down or stop its clock without erasing the register information

**APM :** advanced power management; requires an SMM capable CPU, APM compliant BIOS, have peripherals that will accept to be shut off. Different levels of usage :

1. full on : full power management
2. APM enabled : cpu and ram running full power, unused device may be shut off
3. APM standby: cpu is stopped, RAM still stores programs, all peripherals are shut down, config. options are stored
4. APM suspend: everything on PC shut off or at lower level (hibernation)

Can be set up in W95 : monitor settings in control panel right clicking desktop

## VIDEO MONITOR COMPONENTS:

area of monitor that holds the most voltage: anode

adjustments to monitors: pin cushioning; keystoning; brightness, contrast

**CRT à** cathode ray tube, one end has 3 electrical guns ; other end has the screen; has yoke inside (ring of electromagnets), electron beam

**REFRESH RATE:** electron guns make a series of horizontal sweeps across the display à sweeps are called raster lines

Speed of electron beam à HRR horizontal refresh rate

VRR: vertical refresh rate : amount of time takes to draw the entire screen and get electron gun back on top left corner

## RESOLUTION:

most monitors contain dots of phosphorous or some other light sensitive compound that will glow either red, green or blue when an electron gun sweeps over them à each dot is called a phosphor

Higher intensity à brighter color prevent from one color bleeding to another à shadow mask

Pixel à picture elements ; the area of phosphors lit at one instant when the group of guns is turned on.

Monitor resolution is shown as # horiz pixels by # vertical pixels (multiply those 2 #, equals the # of pixel on screen)

A pixel must be made up of : 1 red , 1 green , 1 blue à triad

**DOT PITCH**

diagonal distance between phosphorous dots of the same color à mm

**INTERLACING**

monitor sweeps or refreshes alternate lines of pixels, takes 2 sweeps to make one image.

Tends to flicker and be hard on eyes

**BANDWITH**

in Mhz, maximum of times an electron gun can be turned on and off (how fast can the monitor put an image on the screen)

- Interlaced monitor - skips every other line during scans
- Interlaced monitor - skips every other line during scans
- Non-interlaced - scans all lines in one pass eliminating flicker
- The standard refresh cycle for monitors is 60Hz; some use 72Hz, which is of higher quality.
- Some monochrome monitors use color emitting phosphors
- Normal text mode, monitor display: 80 columns X 25 lines

**VIDEO CARDS**

brain of the PCs video

Most common color depths

| | |
|---|---|
| 2 colors | 1 bit (mono) |
| 4 colors | 2 bits |
| 16 colors | 4 bits |
| 256 colors | 8 bits |
| 64K colors | 16 bits |
| 16MB colors | 24 bits |

**STANDARD VGA: 256 x 240**

- **MDA** - first video card produced, text only monochrome display adapter (MDA). first video card produced, text only monochrome display adapter (MDA). 9 pin female socket. first video card produced, text only monochrome display adapter (MDA).
- **CGA -** color graphics adapter. supports color, but detriment of resolution; 9 pin female.
- **EGA (digital)** - enhanced graphics adapter. late 1984. difficult backward compatible. 9 pin female
- **PGA** - professional graphics adapter
- **VGA -** video graphics array, can support 640X480 resolutions, 16 colors. offered more colors, using analog signal instead of digital
- **SVGA** - super video graphics array, can support 640X480 resolutions, 16 colors

| ADAPTER TYPE | RESOLUTION | COLORS |
|---|---|---|
| XGA (extended graphics array) | 640X480 | 65 536 standard |
| | 1024X768 | 256 |
| SVGA (super VGA) (best one) | 640X480 | 65 536 |
| Analog | 600X800 | 256 standard |
| | 1024X768 | 16 |
| CGA (color graphics adapter) | 320X200 | 4 standard |
| | 640X200 | 2 |
| EGA (enhanced graphics adapter)<br>Digital | 640X350 | 16 |
| VGA (video graphics adapter)<br>Analog | 640X480 | 16 standard |
| | 320X200 | 256 |

- monochrome monitor can not be attached to an SVGA adapter card
- to support 1024*768 65000 colors, video card needs at least 2MB RAM

## 1.46 PORTABLES PC's

LCD: liquid crystal displays: work by having molecules in the screen that "line-up" to prevent light from passing through

Best quality: active matrix (can view from any angle)

Do not use ISA slots but PCMCIA

**BATTERIES:**

1. nickel cadmium : first ones used, need to be completely discharged b4 being recharged, lose their ability to recharge, they have toxic components
2. nickel metal hybrid: commonly used
3. lithium ion: most common used, cannot be overcharged, immune to memory problems
4. smart batteries: tells a computer when needs to be charged

A battery on the system board provides power to CMOS when the computer is off in order to keep configuration information

**PC CARDS:**

known by older term PCMCIA; easy to use; inexpensive, convenient, are hot-swappable

| | LENGTH | WIDTH | THICKNESS | RECOM USE |
|---|---|---|---|---|
| TYPE I | 85.6 MM | 54 MM | 3.3 MM | FLASH MEMOR |
| TYPE II | 85.6 MM | 54.0 MM | 5 MM | I/O (modem/lan) |
| TYPE III | 85.6 MM | 54.0 MM | 10.5 MM | H-D |

Type II is the most common;

More advanced: PCMCIA Enhanced 32 bits

They use proprietary connectors à laptop docking station

How many type 2 cards can you fit in type 3 : 1

PCMCIA standard defines 2 levels of software drivers to support PC cards. The first, lower level is know as socket services, which are device drivers that support PC card socket, allowing the system to detect when a PC card has been inserted or removed, and providing the necessary i/o to the device.

The second, higher level is known as card services, which recognizes the function of the card and provides the specialized drivers necessary to make a particular PC card work.

All these cards require : card and socket services OR integrated OS

## 1.47 HARD DRIVES

Low level formatting is done at the factory. It organizes the hard drive into tracks and sectors. It's possible to do a low level format on the drive but not recommended. To prepare the hard drive for installation of the operating system, you must first create a partition and set it as an active partition. Boot up with a DOS boot disk and use FDISK command to create partitions. Hard drive can have 3 primary and 1 extended partition. Extended

partition can be deviled into up to 23 logical partitions.

Typical IDE drive supports up to 528 Mb of storage. EIDE drive supports 2gb and larger partitions. A modern motherboard has 2 HDD controllers, each supports 2 devices. When installing a second hard drive, set the jumper on it as a slave drive and the jumper on the first drive as a master drive. To improve performance, choose the faster drive to be a master drive. If you only have 2 IDE devices like hard drive and CD ROM, you can disable a secondary controller in BIOS to free up an IRQ and to speed up the boot process.

- Smallest increment HD used for storage : cluster
- Cluster is comprised of sectors
- Concentric circles on disk : tracks
- IDE can have 1 or 2 channels (controllers). For 1 channel - master & slave, for 2 channel - Primary master & secondary master
- RAID - Redundant Array of Independent Disks
- RAID 1 - disk mirroring (2 drives with same exact data
- RAID 5 - striping with parity; minimum 3 devices, maximum 16
- How many primary partitions can you have on a HD - 3 primary and also one extend that can have up to 23 logical drives. One primary partition can be set as active.
- Before DOS 3.3 only one partition with max size of 32 MB was possible
- After DOS 3.3 two partitions (primary and extended) could be used and max partition size is 2 GB
- MFM and RLL drives are affected by changes in temperature and require low level formats. RLL drives use built in data compression. Data encoding schemes.
- Interleave (EX 1:1 or 1:2) is a way of enabling the hard drive circuitry is able to transfer information fast enough. Normal for IDE : 1:1
- Logical Sectors are like pieces of the pie and Tracks are pieces of slices that get smaller as they are cut towards the middle.
- Number of possible logical drives - 23 (C reserved for first partition on first drive, A & B reserved for disk drives
- Is it possible to delete an extended partition with logical drives - no, logical drives must be deleted first
- The HDD is managed and allocated in clusters. FAT16= 32KB clusters; FAT32=4KB clusters. A group of clusters is called a chain.
- Heavily segmented HD : use temporary swap file
- HDD info put in CMOS: # heads; # cylinders; # sectors

- Display is lit but HD led is on:  CMOS settings are wrong
- Read write head: at 50 microinches over the HD
- Type of HD: SCSI; EIDE; ESDI
- ST506 HD : has data, control and power cable
- IDE : first interface to embed the controller within drive housing
- SCSI can exchange data without use of microprocessor
- ROM-BIOS shadowing: in CMOS set up, puts copy of BIOS in RAM.  Instructions stored in various ROM chips are copied into extended memory.  ROM is copied to RAM.
- Compressed drive: normally H
- HD: 2 primary performance restraints for mass storage: disk access time & rate of transfer
- HDI: head to disk interference
- HD: time fo rsector to move under read-write head: latency period Time to read on the head : seek time. Time to find data: access time

If you need to have more then 4 devices, you must use SCSI devices with a SCSI card. SCSI cards can be SCSI 1, SCSI 2, and SCSI 3 (ultra SCSI). SCSI 1 supports up to 8 devises including the SCSI card. The devices in a SCSI chain must have unique SCSI IDs. SCSI card typically have ID7. SCSI 2 is a more popular adapter and supports up to 16 devices, also has higher transfer speed. Modern SCSI cards a combination SCSI2/SCSI3 cards. Internal SCSI cable is a 50 pin ribbon cable (not compatible with SCSI 3 devices). External SCSI cable is a shielded cable with Centronics-50 or female DB-25 connector. If the question on the exam does not mention what category  a SCSI adapter is, assume they are talking about category 1 ( 8 devices ). The SCSI chain must have terminators at both ends. Terminators are resistors. SCSI card usually has a built in terminator.

- What drive is confirmed with jumpers – SCSI
- Using single cable where is 2nd SCSI device connected - SCSI port of first SCSI device
- Some SCSI devices don't use a physical terminator, but a DIP or jumper setting that terminates it.
- On PC SCSI, the higher the SCSI ID number, the higher the priority.
- SCSI hard drives are more expensive than EIDE hard drives but offer higher access speed.
- SCSI up to 7 devices connected in parallel format, daisy chained with 50-pin straight ribbon cable

- SCSI ID - 0=bootable drive, 7=controller, 1-6=any other devices
- SCSI 3 ultra-wide - 16 devices, 0=bootable drive, 15=controller
- 2 biggest problems with SCSI - each drive must have a unique number & the SCSI bus must be terminated at each end of the chain

**GEOMETRY:**

1. HEADS : total number of sides of all platters used to store data if 4 platters, then 8 heads
2. CYLINDERS: each head has tracks, all the tracks à cylinder One cylinder is the set of all tracks of the same diameter on every head of the HD
3. SECTORS PER TRACK: the sectors/track value is the number of slices in the HD, describes the number of sectors in each track. A sector stores 512 bytes of data. The atom of all HD.
4. WRITE PRECOMPENSATION CYLINDER. correct shifting of the magnetism, when data closely together
5. LANDING ZONE : parking place for the read/write head; obsolete. MB= cyl * heads * sectors per track/2048

**IDE/EIDE**

IDE: integrated drive electronics (should be ATA : AT attachment) need 40 pin flat ribbon to attach IDE controller volume measured in MB or GB, limited to 504 MB (528 million bytes) can have 4 IDE drives on a system some improvements gave : EIDE : enhanced IDE

# Feature of EIDE: ATAPI

40 pin cable and controller; 2 controllers in system; each controller can accommodate 2HD need to set HD to master or slave with jumpers no matter where primary and slave are on cable plug in drive properly (pin 1 with corresponding pin) à not recogn HD then need to enter config of HD in CMOS nowadays, autodetection:

1. auto: update every time computer starts
2. IDE autodetection option: access CMOS screen (have 3 options: ECHS, normal, LBA)

**LBA/ECHS**

EIDE can be larger than 504MB via LBA/ECHS à HD lying to the computer about its geometry, an advanced type of sector translation

sector translation: the IDE specification was designed to have 2 geometries: the physical was the real layout of the CHS inside the drive; and the logical is what the drive tells the CMOS. When data is being transferred to and from the drive, the on-board circuitry of the drive, translates the logical geometry into the physical geometry. How to lie ?

LBA à logical block addressing : uses up to 256 heads

ECHS à enhanced CHS, maximum size of 8.4GB

To go over the limit of 8.4GB ?

INT13 extensions, most drives since 1998 have this

## PIO MODES

ATA drives transfer data from the HD and memory via standardized protocols called PIO (programmable input/output) modes. The fastest PIO mode you can set is limited by the weakest link. Need a third party application to set it.

| PIO MODE | CYCLE TIME (NS) | TRANSFER RATE (MB/S) |
|---|---|---|
| 0 | 600 | 3.3 |
| 1 | 383 | 5.2 |
| 2 | 240 | 8.3 |
| 3 | 180 | 11.1 |
| 4 | 120 | 16.6 |

## LOW-LEVEL FORMATTING

Once the CMOS has been updated with the HD geometry, a program must be run to tell the controller to read the CMOS information and organize the HD. Low level formatting performs : creates and organizes the sectors making them ready to accept data; set the proper interleave; establishes the boot sector.

**done only on pre-IDE drives. All IDE/EIDE drives are done at factory.

1. SECTOR ORGANIZATION : 574 bytes per sector (512bytes, difference to organize), read over error spots
2. INTERLEAVE : when HD spins, not to miss data since it goes fast, the buffer can be ready instead of waiting for HD to turn and come back with data that was missed

## PARTITIONING

logical divisions of a HD to allow larger physical HD and to use other OS extended partitions: divided into logical drives, start at D until Z

## HIGH LEVEL FORMATTING

referred to as formatting creating and configuring FAT (file allocation tables)

and creating root directory

**FAT ALLOCATION TABLE (FAT)**

card catalog that keeps track of which parts of a file are stored in which sectors. Each partition has 2 FATs stored near the beginning of the partition. Are carbon copies. The FAT is like 2 column excel spreadsheet : left column are hexadecimal (gives each sector a number) and right gives the status.

Fat is located at sector 0 of the HD

But with larger HD, needed something different and backward compatible, lead to clustering : combine a set of contiguous sectors and treat them as a single unit in the FAT. The number of sectors in a cluster is calculated by FDISK. More powerful FAT is FAT32, uses 32 bits to describe each cluster.

Finished drive:

1. make physical connection
2. CMOS à use autodetection and LBA
3. use FDISK make primary partition. Extended partitions are optional.
4. use FORMAT with /s to make bootable drive

**SCSI**

unique ID settings; parity, active termination; passive termination, limited cable length

- internal + external : both use ID7 with diff. IRQ
- need drivers for SCSI drives
- SCSI2 works fine with SCSI 1
- SCSI controller : is an input and output device
- Fastest device to access large video files
- SCSI ID binary:

| | |
|---|---|
| 0 | 000 |
| 1 | 001 |
| 2 | 010 |
| 3 | 011 |
| 4 | 100 |
| 5 | 101 |
| 6 | 110 |
| 7 | 111 (host adapter) |

## SCSI CHAINS

can be divided in internal (connect with 50 pin) and external when plugged wrong way, can damage (IDE , will not work). The maximum number of devices on SCSI chain is 8 uses, I/O addresses & ROM addresses for their onboard BIOS

## SCSI Ids

each device has an ID, unique identifier, from 0 to 7 no two devices can share same ID Host adapter set to : 7 done with jumpers, shunts or DIP switches ID 0 to boot from HD

LUN: logical unit numbers : to support more than one device per ID
Termination: putting something on the ends of the wire to prevent echo normally pull down resistors can be done by jumpers or software first and last device must be terminated.

## SCSI FLAVORS

- **SCSI-1** - 8 bit, 5Mhz bus , supporting up to 8 SCSI devices
- **SCSI-2** - 32 bit bus; 50 pins. include commands for CD-ROM, HD, tape drives. defined standard connectors. works well with SCSI-1 adapters. there is also Ultra and FAST-20 SCSI : high speed 20Mhz; Ultra2 and FAST-40 à 40Mhz, Ultra3 and FAST80 defined 80Mhz
- **SCSI-3:** - to come all speeds of Ultra will be incorporated in here include optional hot swap (unplug without rebooting). 3 types of cabling:
    1. IEEE1394 (firewire)
    2. fiber channel
    3. serial storage architecture (SSA)

## TYPE OF EXTERNAL CONNECTORS

all female

1. 50 pin centronics, obsolete
2. 50 pin HD D-type, SCSI-2
3. 68 pin HD D-type, wide SCSI-2
4. 25 pin standard D-type; SCSI-2, on Macs

## CABLE/BUS LENGHT

The cable bus/ length is the total distance between the devices at either end of the chain Maximum length of SCSI : 18 feet

1. SCSI-1 AND SCSI-2 (5Mhz, single ended) à 6 meters
2. SCSI-2 and up (10 Mhz, single ended, up to 3 devices) à 3m
3. SCSI-2 and up (10 Mhz, more 3 devices) à 1.5 m
4. high voltage differential SCSI bus : 25 meters
5. low voltage differential SCSI bus : 12 meters
    - - flat data cable: red or blue stripe is on pin 1

**ASPI**

Advanced SCSI programmer interface mandates a standard way to write BIOS device drivers for SCSI devices

## 1.5: Identify proper procedures for installing and configuring IDE/EIDE devices.

- 2 IDE/EIDE devices can be on each channel
- IDE drive that does not use its own controller card: slave
- When adding a slave drive, the slave jumper must be set on the second drive, and the master jumper may need to be set on the first
- The primary partitions on the drives will always take first drive letters, then letters are assigned to logical drives
- A new drive must be partitioned, then formatted to use, or an "Invalid media" error may occur. A low-level format (before partitioning) is rarely needed.
- FORMAT /Q performs a Quick format
- FORMAT /S copies system files to the disk after formatting

Physical drives are separate drives, while logical drives are partitions on a disk