

DATA RECOVERY SERVICE TRAINING (WORKSHOP TRAINING)

Module D-1 LOGICAL DATA RECOVERY TRAINING

D1.1 Introduction to Storage Device , Hard disk types , Models and O.S

- HDD Traditional Hard disk drives
- Floppy Disk , Zip Drive, Tape Disk,CD/DVD, USB pen drive, Mobile technology storage
- Types of hard disk 3.5" 2.5" 1.8"
- Different hard disk converter, (1.8 zip, scsi, id, sata , micro sata , sca80,)
- SSD solid state disk
- Different types of Hard disk Converter used
- Difference between HDD & SDD disk drive
- Basic understanding between different OS with different version
- Windows (FAT16, FAT32, NTFS, NTFS5)
- Unix (UFS, EAFS, HTFS, VxFS, FFS)
- Linux (Ext2, Ext3,Ext4 JFS, ReiserFS)
- Apple Macintosh (HFS, HFS+)
- Novell Netware (NWFS, Net386, NSS)
- Difference between FAT & NTFS
- Hard disk different models
- Identify hard disk size from models no

D1.2 Hard Disk Data recovery common problems, with fault

A . LOGICAL DATA RECOVERY PROBLEMS (disk detected in BIOS are mainly logical problems)

Common faults of logical problems

- Failure of Boot Sector.
- Master Boot Record MBR Failure:
- Operating System Malfunction or Crash:
- Partition shows but not access
- Partition automatic loss
- Data loss due to virus
- Format error message
- Your system will not boot. You might get a message. "no boot-up disk available"
- A file may contain no data or just partial, even incorrect data.
- Message hard disk not recognize
- Message that there is no free space available on disk
- Corruption of files on files systems
- Corrupt File System Structure
- Cross Linked Files

- Reformatted or Repartitioned Hard Drive:
- recently accessed the data and suddenly you cannot access it.
We can use logical software for user mistakes for recovery
- ✓ Formatted hard disk
- ✓ Deleted files & folders
- ✓ Accidental Deletion of Data
- ✓ Improper Shutdown:
Memory card error
- Format
- Card error
- No data shown

PHYSICAL PROBLEMS (not detected in bios are main physical problems)

B. HARD DISK ELECTRONICS FAILURE MAIN PROBLEMS

Logic board (controller) failures.

- Totally dead Hard Drive does not spin up
- When hard disk connects to computer, computer does not start or hangs
- Broken power connectors
- Broken data connectors
- Spindle/arm driver chip failure
- You can see a burned component on the hard drive circuit board.
- Connector of motor or head is damaged
- Printed circuit board failures including pre-amplification
- TVS diode blow up
- Protection fuse, 0ohms resistor open
- PCB Damaged due to liquid
- Fire Damage
- Ceramic capacitor short
- Mosfet short, or not giving output
- Data connector resistor open
- Electric shock
- Pcb circuit open / short

C. HARD DISK MECHANICAL FAILURE PROBLEMS

- Clicking hard drive
- Drive not spinning
- Head crash
- Damaged Platters
- Actuator failure
- Stepper motor failure

- Spindle bearing seizure (block)
- More voice from hard disk
- Head stuck on platter
- Liquid Damage
- Fire Damage
- Dropped Hard Drives

D. HARD DISK FIRMWARE FAILURE PROBLEMS

- Hard disk not found in bios at all
- Model of hard disk shows wrong
- Head sticking voice (may be due to firmware if hardware ok)
- Shows up with wrong S/N
- Show up with wrong Model no
- Hard disk spinning but not shown in bios
- Hard disk asked for password
- Bad sector
- Hang up on particular sectors
- Identifies fine but fails to read any data or boot up operating system giving I/O Device errors
- Smart error
- Primary Master Hard Disk Fail
- No operating system found
- USB Device malfunctioned
- S.M.A.R.T. Capable But Command Failed
- Disk boot failure. Insert system disk and press enter
- Hard drive not recognized
- Drive Mount Failure or some other hard drive boot error.
- The hard disk will spin up when powered on, but be incorrectly recognized / not recognized at all by the computer
- The hard disk will spin up & be recognized correctly by the computer but the system will then hang during the boot process

HARD DISK LOGICAL DATA RECOVERY

D1 .3 Understanding Hard Disk Structure

- Hard disk structure
- Disk Platter
- Read Write Head
- Spindle motor
- Head arm

- Head actuator (voice coil actuator)
- Air Filter
- Tracks
- Sectors
- Cylinders
- Cluster
- Cluster size in FAT& NTFS
- CHS cylinder head sector addressing
- ZBR zoned boot record
- Types of connection
- SCSI, SATA, PATA
- LBA& CHS calculation
- Sector Cluster addressing
- Logical & physical addressing

D1.4 INTERNAL PARTS OF HARD DISK DEMO HARD DISK from INSIDE

IDENTIFICATION OF INTERNAL PARTS, DISASSEMBLE SATA 3.5 DRIVE1TB ST31000333AS

- HDA head and disk assembly
- PCB printed circuit board
- MCU micro Controller Unit
- VCM voice coil motor controller
- Buffer Memory
- Flash chips
- Shock sensor
- TVS diode transient voltage suppression diode
- Breath hole
- Head contacts
- Motor Contacts
- Recirculation filter
- Top dumper
- Top platter
- Platter clamp
- Top magnet
- Plate with heads and connectors
- HSA head stack assembly
- HSA stopper
- VCM voice coil motor
- VCM HSA Actuator
- Arm
- HGA Head Gimbals Assembly
- Bearing
- FPC flexible printer circuit

- Gasket
- Sliders
- ABS air bearing surface
- Preamp
- Heater
- Gimbal
- Platter Clamp
- Spacer ring
- WD Internal parts demo

D1.5 Understanding data stored on hard disk & Microsoft files structure

- What is a file system?
- Types of files systems
- DOS 3.3 (FAT12)
- DOS 5.0 (FAT16)
- Windows 3.1 (FAT16)
- Windows 95 (FAT32 OSR 2)
- Windows 98/ME (FAT32)
- Windows NT/2K/XP (FAT32 / NTFS)
- FAT file allocation table
- NTFS New technology files system
- FAT/NTFS COMPARISON
- How FAT works
- How data store in hard disk in fat
- Explaining disk block allocation method
- File slack space
- Linked allocation
- Attributes of files systems
- NTFS File attributes
- MFT files working idea
- Deleting NTFS FILES

D1.6 working concept of Format, Partition & computer booting process,

- Initializing a Hard drive
- Low level Format (factory)
- Initializing a hard drive with FDISK
- Master partition table
- Partition type codes
- Partition table entry
- Single primary partition
- One primary with extended partition
- Boot process

- Hard disk boot sequence (dos)
- Windows 2000 boot process
- Post, MBR, Boot Record
- MBR (Master Boot Record)
- GPT (GUID Partition Table)
- NTFS
- Partition boot sector
- MFT (master file table)
- Used of different software

D1.7 Data recovery Software used for different problems, steps with features

- Data Recovery of MBR corrupted
- Data Recovery of Deleted Files
- Data Recovery from Deleted Partition
- Data Recovery from Reformatted Partition
- Data Recovery from External Drives
- Data Recovery from USB Drive
- Data Recovery from Camera Card
- Data Recovery from CD/DVD
- Data Recovery as RAW Recovery
- Data Recovery from Damaged Sector
- Data Recovery from RAID

Recovery Features

- FAT Support
- NTFS Support
- Quick Scan
- Deep Scan
- Media File Recovery
- Email Files Recovery
- Microsoft Office File Recovery
- Recovers from Unbootable Drive

Search and Recovery Options

- Search by File Extension
- Search by Date
- Search by File Size
- File Preview
- Batch Recovery
- Saves Scan Information
- Network Recovery
- Help & Support
- Supported Configurations
- Windows 7
- Windows Vista

- Windows XP

Top common data recovery software used in market

- Stellar Phoenix
- R Studio
- Data rescue
- Get data back
- Icare
- Power data recovery
- Salvation
- Encase
- Kernel
- Ptools
- Hard disk Stennar
- Hard disk Regenerator

Corrupted files repair software

- Excell repair
- Access repair
- Power point repair
- Jpg repair
- Backup files
- Repair video master avi, divx,xvid,mpeg, rm, rmvb, asf, wmv, wma , ac3

Understanding Basic concept of RAID

D1.8 Pen drive and Memory card logically data recovery concept

- Pen drive data recovery
- Memory card data recovery concept
- Data recovery from Pen drives
- Data recovery from memory card
- Data recovery from Zip drives concept
- Data recovery concept of iPods, Digital cameras, Mobile phone, etc

Module D2 Hard disk PCB repair training

D2.1 SMD Basic electronics for hard disk components and PCB repair

- Basic electronics fast revision
- Working concept of electronics component resistor, capacitor, diode, transistor, fuse, tvs diode, MOSFET, etc.
- Multimeter basic concept, testing different components
- Measuring and Identify ok, Short, Open components

- Introduction to component of hard disk PCB , resistor, capacitor, diode, transistor, MOSFET chips
- Removing and Inserting Different components
- Working concept of chips,

D2. 2 Common problems in hard disk due to pcb fault

- Totally dead Hard Drive does not spin up
- When hard disk connects to computer, computer does not start or hangs
- Broken power connectors
- Broken data connectors
- Spindle/arm driver chip failure
- You can see a burned component on the hard drive circuit board.
- Connector of motor or head is damaged
- Printed circuit board failures including pre-amplification
- TVS diode blow up
- Protection fuse, 0ohms resistor open
- PCB Damaged due to liquid
- Fire Damage
- Ceramic capacitor short
- Mosfet short, or not giving output
- Data connector resistor open
- Electric shock
- Pcb circuit open / short

D2.3 INTRODUCTION HARD DISK PRINTED CIRCUIT BOARD, BLOCK DIAGRAM , SECTION OF PCB

INTRODUCTION TO DIFFERENT SECTION OF HARD DISK

- a. Introduction & Block diagram of hard disk printed circuit board
 - Identify different chips on hard disk
 - Mcu, driver chip, flash ram chip , buffer chip
 - Identify different component on hard disk
 - Resistor, capacitor, tvs diode, transistor, fuse , inductor, rectifier
 - identify circuit types, no models
 - Block diagram of hard disk pcb
 - How pcb work
 - Identify hard disk pcb

HARD DISK SECTION

- b. Hard disk Power section normal molex, sata
- c. Hard disk Dc to dc converter power section

- d. Hard disk Data section connection sata pata
- e. Hard disk Firmware section
- f. Hard disk Ram/ Buffer section
- g. Hard disk Vcm controller section
- h. Hard disk Spindle motor controller
- i. Hard disk Mcu section
- j. Hard disk Pre amplifier section
- k. Hard disk Head contact section
- l. Hard disk Spindle motor section

D2.4 Power section & DC to DC converter, (Mosfet & other smd component working and power detail in hard disk)

- Types of hard disk power connector
- Power input (sata pata)
- Pata old Molex 4 pin (5v & 12v)
- Sata connection 15 pin (5v, 3.3v, 12v)
- Checking hard disk open short thru power connector
- Understanding Protection circuit
- Semi conductor mosfeter transistor Manufacture
- Semi conductor mosfet transistor components
- Tvs diod, 0ohms resistor, fuse,
- Dc to dc converter
- Transistor used as switching
- Step down from 5v to 2.5
- Mosfet working function
- Testing of mosfet in hard disk pcb
- Linear output,
- swithching output
- work of inductor in hard disk
- PWM controller IC
- Power supply to different chips

D2.5 Mcu section, Data section, preamp section head (chip working concept power main signals)

- Data section of hard disk
- Sata connection 7 pin
- Signal detail of sata connection
- Pata connection of hard disk 40pin
- Signal detail of pata connection
- Connection detail of sata and pata connector
- Main control chip MCU manufacture (ardent, agere, pokar, seaglet, oscar, beagle, dsp, lucent, quantum, wdtsiemens, shxxx, tlxxxx)

- Hard disk mcu chips (
- Working detail of MCU chip
- Connection detail of MCU
- Voltage of hard disk MCU chip
- Hard disk head connector
- Pin out detail of hard disk head connector
- Main signals detail of head contact
- Working concept of hard disk preamp
- Hard disk preamp chip manufacture with identify
- Hard disk preamp chips
- Pin detail of hard disk preamp chip
- Connection of head, vcm coil, micro actuator
- Types of hard disk head
- Ferrite heads
- Amr heads
- Thin film heads
- Metal in gap (MIG) heads
- Tunneling magnetoresistive (TMR)
- Perpendicular magnetic recording (PMR)
- Giant magnetoresistive (GMR)

D2.6 Buffer Ram, flash rom section (working concept types and main signals)

- Hard disk RAM BUFFER Chip
- Hard disk RAM BUFFER
- Working function of Buffer chip
- Pin detail voltage supply of buffer chip
- Datasheet study of buffer chip
- Connection of buffer chip with other chip
- Hard disk EEPROM FLASH Chip manufacturer
- Hard disk EEPROM Flash chips
- Working function of EEPROM
- Pin detail of EEPROM
- Connection of Flash EEPROM chip with other chip

D2.7 VCM Motor controller & read channel chip working concept and main signals

- Hard disk Read Channel Chip manufacturer
- Hard disk Read channel chips
- Working function of read channel chip
- Pin detail , voltage supply of read channel chip
- Hard disk motor controller chip manufacturer

- Hard disk motor controller chips
- Working function of motor controller chips
- Pin detail, voltage supply of motor controller chip
- Spindle motor power supply from motor controller chip
- Switching , linear mosfet power controller
- Connection detail of motor controller chip with other chip

D2.8 Live pcb tracing, different volt of pcb, fault finding of hard disk pcb

Online offline

- Offline tracing of hard disk pcb with multimeter
- Testing power connector main volt
- Testing tvs diode
- Testing all capacitor
- Testing spindle motor continuity
- Online Live tracing of PCB with multimeter
- Testing Power of mcu
- Testing Power on buffer chip
- Testing Power on read write chip
- Testing Power on spindle motor

D2.9 Identify hard disk pcb no for donor pcb (Samsung, Seagate, wd, Hitachi, Ibm, Maxtor,)

- Hard disk model no
- Hard disk pcb no
- Hard disk pcb printer no
- Matching criteria of different hard disk
- Seagate Hard Drive PCB Swap Replacement Guide:
- Western Digital PCB Swap Replacement Guide
- Samsung PCB Swap Replacement Guide
- IBM Hitachi PCB Swap Replacement Guide
- Maxtor PCB Swap Replacement Guide
- Hitachi PCB Swap Replacement Guide
- Toshiba PCB Swap Replacement Guide
- When firmware replacement is important
- What is glist, plist on hard disk
- Service area on hard disk platter
- Which models required firmware chip replacement after swapping PCB
- Which models required no firmware replacement after swapping PCB

D2.10 Replacing component and IC`s of hard disk (demo, video)

- Removing and inserting of different component from hard disk PCB
- Removing resistor, mosfet, transistor, diode, fuse demo
- Removing and inserting of different chips from hard disk PCB
- Firmware chip, replacement idea
- Hard disk socket and connector

Module D3 Physical (Mechanical)Data Recovery Training

D3.1 PHYSICAL (MECHANICAL) HARD DISK FAILURE PROBLEMS

- Clicking hard drive
- Drive not spinning
- Head crash
- Damaged Platters
- Actuator failure
- Stepper motor failure
- Spindle bearing seizure (block)
- More voice from hard disk
- Head stuck on platter
- Liquid Damage
- Fire Damage
- Dropped Hard Drives
- Different voice in different hard disk (video)
- Common fault and solution in physical repair

D3.2 DONOUR SELECTION OF DIFFERENT HARD DISK

- Data recovery and donors
- Donors' Recognition: Firmware Donors, PCB Donors, Head Donors
- Matching criteria of Donours for hard disk
- Different models and product detail of hard disk
- Identify hard disk size, types, models, platter, connection etc from models no
- Hard disk vendors with model detail
- Select donor for hard disk to be recover
- Identify from hard disk
- Model no
- Rpm
- DCM drive configuration matrix (western digital hard disk)
- Key (Maxtor)
- Site Code (Seagate hard disk)
- MLC machine level code(Hitachi, IBM)
- Firmware code (Seagate, Samsung hard disk)
- Manufacture dates
- Manufacture in country

- Matching donor for western digital hard drive
- Matching donor for SEAGATE hard drive
- Matching donor for TOSHIBA hard drive
- Matching donor for FUJITSU hard disk
- Matching donor for HITACHI (IBM) hard drive
- Matching donor for HITACHI (Native) hard drive
- Matching donor for SAMSUNG " hard drive
- Matching donor for Maxtor " hard drive
- Matching donor for QUANTUM-MAXTOR 3.5" hard disk

D3.3 Data Recovery Instrument detail and using detail with demo on opening hard disk

- Instrument list demo used for physical data recovery
- Instrument detail used for data recovery
- Motor unstuck tools
- Punching tools
- Clean room concept
- Hand gloves, fingers top cover
- HD HPE PRO
- Different instrument used for data recovery centre
- Replacement of Damaged Heads - Read-Write head change tools
- Replacement of Magnet - Magnet Exchanger Tools
- Platter Transplantation --- Platter Replacement Tools
- Seized Damaged Bearings Replacement -- Spindle motor Replacement Tools
- What are clean room data recovery cases?
- Head swap process for hard drives with or without spacers/bracelet
- Multiple platter exchange process
- Clean room or clean bench
- Hands on practice using HD HPE PRO/ or OTHER INSTRUMENT for data recovery cases.

D3.4 practice on head replacement of hard disk

- Precaution to be taken before opening hard disk
- Step by step removing parts guidelines
- Donor and patient hard disk to be kept ready on bench
- How to open hard disk
- How to use magnet tools for remove top magnet
- How to remove top magnet
- How to take out head from hard disk
- How to swap head from donour to patient
- How to use head tools to keep distance between heads
- How to split head outside

- Removing head form 2.5 and 3.5 hard disk
- Removing and inserting read, write head of different computer hard disk
- Removing and inserting read write head of different 2.5" hard disk

D3.5 practice on Platter replacement of hard disk

- How to open screw of platter
- How to swap platter from donor to patient
- What care to be taken for platter replacement
- Removing platter of hard disk
- Removing and inserting platter of different computer hard disk
- Removing and inserting platter of different laptop 2.5" hard disk

D3.6 practice on Spindle motor changing of hard disk

- How to unstuck spindle motor of hard disk
- How to remove out spindle motor
- How to replace with donor spindle motor
- Removing and inserting spindle motor of different computer hard disk
- Removing and inserting spindle motor of different 2.5" hard disk

D3.7 Basic idea of data recovery from dead pen drive, memory card, flashcard

- Basic internal structure of pen drive
- Concept of Swapping chip of pen drive
- Basic repairing idea of pen drive
- Bios programmer xeltek super pro idea for reading chip

D3.8 Introduction to Hard Disk Firmware repair instrument list

Introduction to Different firmware repair instrument/software list detail

Ace lab original pc3000

- Ace portable usb
- Ace udma
- Ace

DFL Data Recovery Equipments

- (1) DFL - DDP USB3.0 (Data Dr. Pro Usb3.0)
- (2) DFL - URE USB3.0 (USB Recovery Express)
- (3) DFL - DE USB2.0

- (4) DFL - FRP - STII For Seagate
- (5) DFL - FRP - WDII For Western Digital
- (6) DFL - FRP - HT For Hitachi
- (7) High Speed USB Programmer Pro
- (8) DFL - Data Recovery Start-Up Suite
- (9) DFL - Data Recovery Grow-Up Suite

Salvation data product

- Data compass
- HD doctor for Seagate
- HD doctor for WD
- HD doctor for Maxtor
- HD doctor for Hitachi

Pc3000 pci 2.4/2.5 version

Atola

DflwdII

Firmware repair software without hard ware

- Wdr3, wdr5, wdr6
- Str 3000
- Mrt Maxtor repair
- Samsung repair software

D3. 9Data recovery common problems and solution flow chart

- Hard drive does not get detected
- Hard drive gets detected but data is inaccessible
- Hard disk drive displays no sign of power and/or no sound of the drive "winding up
- Hard disk drive powers up & then spins constantly with a loud winding sound
- Hard drive powers up and then winds down, non-responsive
- Hard drive unit emits an OCCASIONAL clicking sound
- Hard drive unit emits a CONSTANT clicking sound
- Hard drive unit powers up, but the drive does not mount, and there is no discernible data read/write sound
- Hard drive powers up and a scraping sound is audible
- Hard drive has been exposed to water damage
- Hard drive unit has been exposed to fire

Module D4 Hard Disk Firmware Basic & Hard Disk Repair Training

D4. 1 Introduction to hard disk firmware

- What is firmware of hard disk
- Micro code of hard disk firmware
- Modules of hard disk firmware
- ·Types of modules in hard disk firmware
- Data modules ,Management Modules ,Techno Modules
- Where firmware store in hard disk
- What is negative cylinder/track of hard disk
- What is service area
- What is inside hard drive System Area?
- System area of hard disk
- UBA Modules (Utility Block Addressing)
- Modules store in which head side
- What happen if hard disk firmware module damage
- when hard disk firmware damage
- Common symptoms of hard disk firmware failures

D4. 2 Introduction to hard disk firmware modules in service area

- Smart Data
- System Logs
- Serial Number
- Model Numbers
- Security Data Passwords for drive – possible encrypted info.
- Bad block table
- P-List (Primary Defects List – manufacture defect info that does not change)
- G-List (Grown Defects Lists – sector relocation table)
- Program Overlays – Firmware, Executable Code, or updates
- Zone Tables
- Servo Parameters
- Specific Tables like RRO – (recalibrate repeatable run-out and head offsets)
- Test Routines
- Factory Defaults Tables
- Recalibration Code Routines
- Translator Data:
 - a. Converts Logical and Physical Address to locations on the drive
 - b. Heads and Track Skewing Info

D4. 3 Problems when hard disk firmware is corrupted

- Drive will not initialize
- Drive is slow responding

- Drive is not running properly
- Drive will not be recognized by the computer
- Head sticking clicking voice (may be due to firmware if hardware ok)
- Shows up with wrong S/N
- Show up with wrong Model no
- Hard disk asked for password
- Hang up on particular sectors
- identifies fine but fails to read any data or boot up operating system giving I/O device errors
- Smart error
- Primary Master Hard Disk Fail
- No operating system found
- USB Device malfunctioned
- S.M.A.R.T. Capable But Command Failed
- Disk boot failure. Insert system disk and press enter
- Drive Mount Failure or some other hard drive boot error.
- The hard disk will spin up when powered on, but be incorrectly recognised / not recognised at all by the computer
- The hard disk will spin up & be recognised correctly by the computer but the system will then hang during the boot process

D4.4 Basic Introduction to Different firmware repair instrument/software list detail

- **PC3000 UDMA**
- **MRT**
- **Dfl wdII**
- **SALVATION data product (now no support from 2012)**
- **Pc3000 pci 2.4/2.5 version (china no further support after 2007)**
- **Atola**
- **Firmware repair software without hard ware**
 - Wdr3, wdr5, wdr6
 - Str 3000
 - Mrt Maxtor repair
 - Samsung repair software

D4.5 Introduction to Seagate firmware repair tools

- Basic idea of seagate tools used with terminal command
- Seagate repair tools
- Seagate models detail
- About seagate models
- How to identify seagate models
- F3 series Seagate hard disk models

- Understand Seagate terminal commands
- Usb to rs232 converter
- How to connect seagate hddisk with terminal connection

D4.6 Introduction to WDR hard disk firmware repair software tools

MODULE D5 MRT DEVICE USE FOR HARD DISK FIRMWARE REPAIR & DATA RECOVERY

D5.1 data copy option on MRT device

D5.2 Segate hard disk firmware repair & data recovery

D5.3 Wd hard disk firmware repair & data recovery