Hard Drive
Restoration
Procedure

Hard Drive Restoration Procedure

Introduction

The following documents a method of hard drive restoration.

This procedure mirrors Symbol technical bulletin N4A12KS1.

Background

The PC world has evolved beyond the initial DOS days. When DOS was the only operating system, it was fairly easy to build a drive from scratch. All you needed was a bootable DOS diskette that contained a few programs, and you had only to FDISK and FORMAT to get the operating system installed.

The new PC based operating systems have become more complex. Operating systems, like OS/2, UNIX, NOVEL, NT, and others, can no longer be built from a single disk. These operating systems can take from 10 to 60 diskettes just to get to the point you did with one bootable DOS floppy.

The other area of concern is the rapid change in PC hardware. It wasn't too long ago that a 40MB drive was considered large. Today, you probably cannot even buy drives of this size. Daily, we see drive sizes increase, prices fall, and smaller sizes become obsolete.

The problems with trying to provide service in this environment are:

- How do I build these complex operating systems?
- How do I spare for all the different drive sizes, and what happens when a needed drive size is not available?

The following is meant to show some service methodologies that solve these two problems. It documents a procedure that will:

- Allow you to CLONE/BUILD ANY system in less than 5 minutes.
- Allow you to stock only ONE drive that can replace ANY drive from 20MB to 540MB.

This will be done with industry standard parts and a procedure that can be handled even by non-technical personal.

IDE Drives

These methodologies revolve around the IDE drive spec. This is currently the most popular drive format. It has replaced the ST-506 drive standard and accounts for about 80% of all drives in use today and 100% of the drives used by Connect, Inc.

The methods described in this document relate to IDE drives and rely on two characteristics of this drive technology.

These characteristics are:

- ALL IDE DRIVES HAVE PERFECT ERROR MAPS. This doesn't mean they don't have errors, because most do have flaws. IDE drives hide this by intercepting a request for a flawed sector and redirecting it to a re-mapped area.

- ALL IDE DRIVES ARE TRANSLATING DRIVES. By this, we mean that you can key in ANY geometry (Geometry is the Head, Cylinder, and Sector Combination) that's within its rated capacity and it will re-map its physical geometry to match.

These two characteristics allow us implement two important techniques, which are:

- Image Copies
- Stocking of One Drive Size to Replace any Drive

Image Copies

Image copying is the method of duplicating a drive sector by sector. This method has the effect of making an exact image of the source. This method doesn't care or need to know if the source is UNIX, DOS, OS/2, etc.

To make image copies possible, the drives need to be identical in geometry and the target must have a perfect error map.

Drive image copying was either not possible or practical with ST-506 technology because of the error-mapping scheme. If the target drive had an error in a location the source didn't, you couldn't make an image copy. You were still able to do image copies, but it required a destination drive with a perfect error map, which was rare.

Since IDE drives always have perfect error maps, this technique is now practical.

Drive Replacement

The characteristic that IDE drives are translating drives mean that we could settle on one drive size that could be used to replace any drive of equal or smaller size.

If you needed to replace 40MB drive, you could use a 540MB and use the same geometry in the CMOS setting as the 40MB, and you would, in effect, have a 540MB drive that works as a 40MB.

Your first reaction might be "That sure is a waste to use a 540MB to replace a 40MB". This is true to an extent, but the prices of drives have fallen so rapidly, it is now possible to purchase 540MB drives for around $150.00. The little bit of money you'd save is lost in the logistics of trying to locate and stock differing sizes and the loss of flexibility of having smaller sizes in stock.

With this background set, we'll now describe a procedure for building and using a hardware-based "Cloning Station".

This will enable you to make image copies and also has the capability to clone a 40MB drive to a 540MB drive.

Procedure

Bus Logicä is an established provider of IDE drive controllers. They produce a variety of IDE controller types. They have one family of controllers that allow for on-board drive cache, 4 drive operation (2 is the IDE standard), and mirrored drive operation.

- ISA Bus   (Bus Logicä Model KT-510A)
- VLB Bus   (Bus Logicä Model KT-410A)
- PCI Bus   (Bus Logicä Model KT-910A)

Drive mirroring is a method of gaining reliability by having two drives work in tandem where reads and writes are serviced by two drives at the same time. This allows redundancy and backup. If one drive fails, the backup takes over and there is no outage.

For drive mirroring to work, you need a method of making an image of the drive you want to mirror. This Bus Logicä controller family has this capability. These controllers have an on board BIOS that contain easy, menu driven software for doing this.

Below is the procedure for building and using a "Hardware based Cloning Station."

Step One - Constructing a "Cloning Station"

This will require:

- PC or Portable with ISA, VLB, or PCI bus capability
- Bus Logicä controller to match Bus
- 1MB of SIMMS for controller Cache (Controller will not function without on-board memory.)

It is recommended that the "Cloning Station" be constructed on a portable platform (Toshiba, etc.), as this will allow you to ship this easily to remote locations.

1. Install memory on Bus Logicä card and install in PC or portable.

   - This board will accept from 1MB to 16MB of memory. We recommend that you use the smallest SIMMS available (256KB). This memory is required for operation, but will not benefit from more. It clones just as fast with 1MB as 16MB.

   - You must remove or defeat any existing drive controller.

2. Connect a cable to each of the controllers IDE Bus's.

Note:

1. These Bus Logicä controllers contain two IDE Bus's. This allows operation of 4 IDE Drives. Each Bus supports a Master and a Slave drive.

2. For Cloning purposes, we'll bring out a cable for each IDE Bus. This will allow us to keep both our SOURCE and TARGET drives configured as Master Drives. This makes the cloning process easier, as this is the default strapping on IDE Drives.

3. Label cables "SOURCE (BUS1 - D0)" and "TARGET (BUS2 - D1)".

4. Bring out a power connection for each drive. This is easiest done with a power "Y" cable.

5. Hot glue the IDE and Power connectors for strength. The IDE and Power cables are crimped connections and will pull apart after time, if not secured.

6. Reassemble PC or Portable and route the IDE and power cables to the outside.

7. Set PC or Portable CMOS settings for both Primary and Secondary drives to TYPE 1. The Bus Logicä controller BIOS will intercept and modify this CMOS entry, based on the actual drive(s) installed.

Step Two - Using the Cloning Station

1. Connect SOURCE drive to cable marked: "SOURCE (BUS1 - D0)".

2. Connect TARGET drive to cable marked: "TARGET (BUS2 - D1)".

3. Connect Power to both drives.

4. Power on PC.

5. Press F2 or F6 when prompted on screen. This invokes the On-Board BIOS routines.

6. Enter the "Disk Parameter Setup" option.

7. Match TARGET geometry with SOURCE geometry. This needs to be keyed into two areas.

Note:

1. This controller does a query of the IDE Drive to get the recommended factory settings. You'll also notice toward the bottom of the screen a display of the manufacturer's name. Use this to confirm that you have the right drive (SOURCE, TARGET) on the right cables.

2. The TARGET drive can be any drive equal to or larger than the SOURCE. This is the technique that allows us to replace any drive type with one spare drive (540MB drive to replace 120MB, 80MB, 40MB, etc.).

Caution:

1. You CANNOT assume that the source drive was built using the parameters drawn out of the drive during an IDE query. Possibly, the factory may have built this drive using some other parameters. We recommend that in EVERY case in which you are cloning a drive, you check the PC's CMOS setting to ensure that you know the Geometry.

2. This will require that the service person bring a monochrome monitor adapter, monitor, and keyboard. Once this information is known, the same label you put on the target drive should also be put on the source drive.

3. If the CMOS settings for Source drive are different, this needs to be changed in the setup also.

4. Save and Reboot.

5. Press F2 or F6 when prompted.

6. Check setup in "Disk Parameter Setup" to ensure that it is still keyed in setup.

7. Exit "Disk Parameter Setup". Enter "Disk Image Copy" option.

8. Using the Up/Down arrows, highlight the SOURCE drive and press the space bar for SOURCE.

9. Using the Up/Down arrows, highlight the TARGET drive and press the space bar for TARGET.

Caution: Use extreme care in step 9.

1. It is possible to clone in the wrong direction and clone a blank image onto your source drive. You should double check the direction by using the manufacturer's name and IDE Bus.

2. Start Image Copy by pressing the Enter key and answering yes to the next questions.

3. After Image copy is complete, you can execute "Disk Image Compare" to ensure that the copy is valid.

Important Note

If the target drive was built not using its true geometry, it is important that this drive be labeled. It should be labeled as follows:

CLONED DRIVE
DO NOT USE FACTORY GEOMETRY
-Use these values for CMOS Setup-
HD xx CYLINDERS xx SECTORS xx

where xx is the geometry used for the cloning. This geometry is the values that you use for the CMOS drive setup of the cloned drive.

Proactive Drive Servicing Methodology

Now that we have the capability to quickly and painlessly make images of drives, no matter how complex the operating system, we should capitalize on this capability.

When a drive fails in these complex systems, it is one thing to clone a working drive, but if the drive is bad, you can't.

What we recommend is that, as part of the service function, we proactively clone the drive while the system is working.

If you build into the support agreement the cost of a hard drive, the first support action would be to clone the working drive in these systems. This cloned drive would be kept on-site and bolted into the system.

Later when the drive fails, the service person moves power and data cables to the back-up drive and they're in operation in just minutes. Then later, or at the time of service, you make another clone for a backup drive.

Important Notice

The process of drive cloning relies on the translation capability of IDE drives. We have found through experience that some drives do not perform this function correctly.

They will clone and even verify, but will not operate correctly in the target system. You will usually get a message like "Boot sector not found or Seek error".

Before purchasing any quantities of drives for cloning, buy a small quantity first to ensure that they will work correctly.

A good technique is to clone the drive, boot, and check for errors. Then run:

fsck -y

Ensure that it completes without fatal errors. It is normal for this utility (fsck) to find problems (It is similar to running chkdsk under DOS), but it should complete without any fatal errors.

Currently, we are aware of a drive that does not remap:

Seagate Model ST3120A

Other Drive Duplication Information

1. Card by DTC (Raid I card) UPS Number 2347501119 about 75.00 duplicates in 15 minutes.

2. HD Dup Company WEB Address: www.ics-iq.com, Phone Number: (818) 998-5805. They make standalone Duplication Stations.

Rob Greenfield at Supply Chain Logic at (888) 722-6269 is doing research on this.

About This Document

This document is based on the following Technical Document in our Lotus Notes database that has been made obsolete: T1026.

Please let us know about any errors in this document at:
http://207.241.78.223/isoxpert/calltrak.nsf/WebTracking?OpenForm.