

Norton Ghost™ User's Guide

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NORTON

Ghost

TM

THE FAST PC CLONING SOLUTION

Norton Ghost™ User's Guide

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About Norton Ghost

Norton Ghost is the fast and reliable software solution to satisfy all your PC disk cloning and copying needs: upgrading hard drives, backing up for disaster recovery, or rolling out numerous machines of similar configurations.

Ghost clones either complete disks or specified partitions:

- An entire disk can be either cloned directly from one disk to another or saved into a Ghost image file. The Ghost image file can be used as a template to create copies of the original disk.
- The contents of a partition can be copied to another partition. Selected partitions can be copied to an image file that is used as a template to create copies of the original partitions.

When cloning complete hard drives, procedures such as FDISK and FORMAT are a thing of the past. Ghost dynamically partitions and formats a target disk on the fly. The source and target disks can be different sizes. Ghost adjusts the position and size of the target partitions automatically, FAT12, FAT16, FAT32, and NTFS partitions are expanded or contracted to fit the target. The source and target disk can be on the same computer, or the target disk can be on a different computer providing the two computers are connected by a network or parallel ports.

Ghost copies every required partition, regardless of type, from the source (disk or image file) to the target. If the source and target disks are identical in size and structure, Ghost can perform a sector-by-sector copy. Because this is seldom the case and does not allow the resizing of partitions, Ghost positions each partition or logical drive on the target disk using the same rules as FDISK.

A Ghost image file can be stored on a network server, CD-ROM, Superdisk, JAZ or ZIP drive, or other removable media. This file can be used for backup or for cloning copies of the original disk.

Ghost runs in DOS with a simple graphical interface. Alternatively, Ghost operation can be automated through command-line switches to simplify repetitive tasks.

How Ghost works

Because the Ghost executable is small with minimal conventional memory requirements, it can easily be run from a DOS boot disk or alternative storage location within DOS. Ghost can load a workstation from an image file containing both Windows 95 and the full installation of Office97 in about seven minutes. Not only is Ghost the fastest way to install Windows 95/98, Windows NT, OS/2 and other operating systems, Ghost can make complete backups of disks or partitions. Ghost even copies in-use system files that are missed by other backup utilities, making Ghost a great tool for disaster recovery operations.

The following sections give examples of common ways to use Ghost.

Clone internal hard disk drives and individual partitions

With Ghost you can save all of the contents on one internal hard disk drive or partition to another by cloning local disk-to-disk, or partition-to-partition. The hardware must be installed correctly and have the hard disk drive jumpers and CMOS/BIOS correctly configured. As with all Ghost usage, both the source and destination must be free from file corruption and physical hard disk drive problems prior to cloning.

Note: When cloning an entire hard disk drive, the existing partition configuration is overwritten and need not be set in advance.

Internal transfer operations are one of the fastest methods of cloning, and offer a simple quick hard disk drive backup or migration tool. By using a second hard disk drive as a backup, it can be used to replace the original in the event of its failure or corruption, reducing the downtime of the machine.

Ghost's ability to resize the partitions and file systems it understands while cloning disk-to-disk simplifies upgrading to a larger hard disk drive. By installing the new hard disk drive hardware as required, and running Ghost from a boot disk, the contents of the old drive can be migrated. This leaves the original untouched and available until the new system configuration is completed.

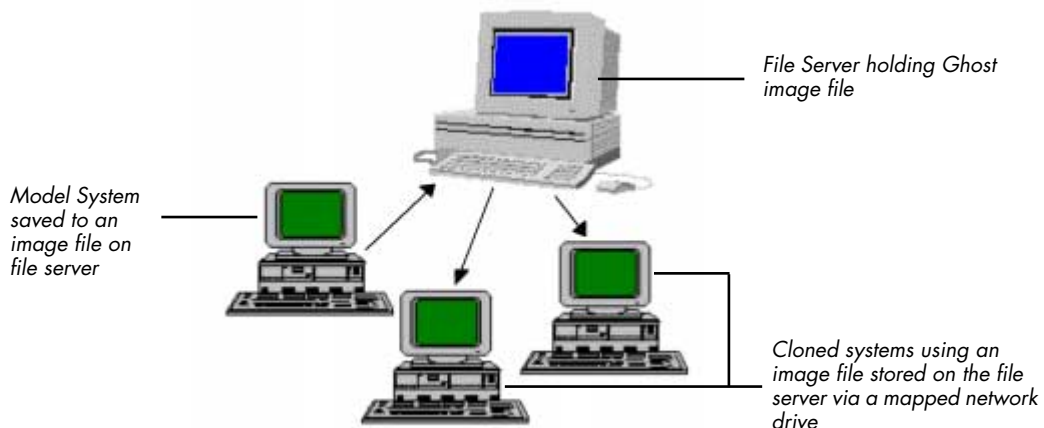
Caution: Make sure you correctly identify and select the source and destination disks as the operation can not be undone.

Save and load image files to and from a file server

Your engineers can create a model configuration on a desktop or laptop. Add the third-party software (office software, web browser, etc.), and save the configuration onto a file server for later recall.

When creating the original model image file that is destined to be used with dissimilar hardware, it is best if you remove the model machine's operating system's software drivers for specific devices such as SCSI devices, network interface cards, proprietary video cards and sound cards.

After the machine has been cloned using Ghost, and is started for the first time, the operating system will do a better job of loading and configuring the hardware drivers. Windows 95, Windows NT, and OS/2 Warp might fail to load due to drivers trying to bind to dissimilar configurations on start-up when system hardware differs. You can add these drivers to the operating system after it loads, or alternatively, include the source files in your model image, so that upon needing drivers and system components, they are already available. For example, include the Windows 95 CAB files or the Windows NT I386 directory.



If all machines are identical in hardware then driver conflicts after cloning are less likely to occur.

When restoring the model onto a machine, it is a simple process of booting the machine in DOS with the network client installed to provide the mapped volume on the file server where the image file is stored and then running Ghost.

Save and load image files to and from removable media

It is possible to burn image files onto a CD-ROM or to save an image file to a ZIP drive, JAZ drive, Superdisk, or other removable media.

For ZIP, JAZ, Superdisk, and removable media, Ghost will write and read directly to and from the device providing that the device is working and has a DOS drive letter.

When creating the image of the model for storage on a CD-ROM, we recommend bringing the image down onto the PC that has the writing software, and then create the CD-ROM. Ghost can be included on the created CD-ROM with its functionality limited as outlined in Appendix H.

To create a CD-ROM image file for later restoration:

- First, the model workstation is created and the hardware-specific drivers removed to reduce driver conflicts when recreating machines with differing hardware.
- Second, save your model hard drive to an image file using Ghost and the split command-line option (onto a network drive, or second drive).
- Finally, you run the CD-ROM writing software and save the image onto the CD-ROM.

For restoration purposes, once the device is working and has a drive letter, Ghost can use that drive to perform the required task.

Clone hard disk drives and partitions peer-to-peer

Peer-to-peer connections are typically used when there is no network - just two computers that you wish to connect. Ghost gives you the choice of connecting via the NetBIOS or via the LPT (printer) parallel port. In both cases, one computer becomes the master, the other the slave. See “[Peer-to-peer connections](#)” on page 24 for more information.

- To connect via the printer port you need a parallel data transfer cable plugged into the LPT port of both computers.

- To connect via NetBIOS you need a network card in each computer, a converted Ethernet cable, and the appropriate networking software. In general, connecting via the network gives two to five times the performance of an LPT connection.

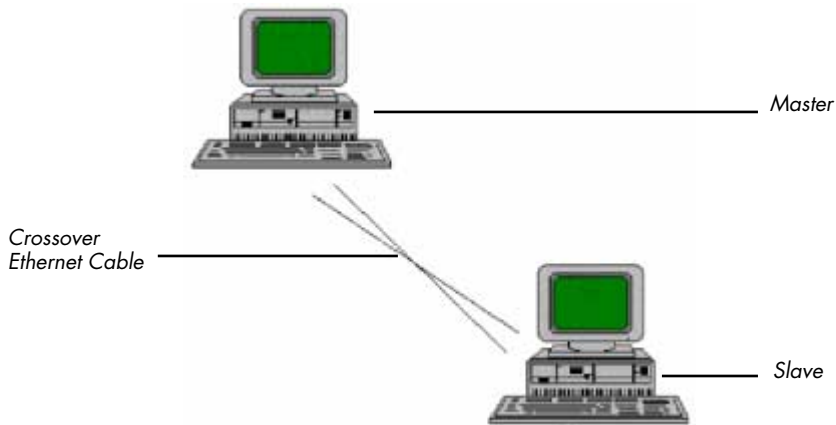
For NetBIOS and LPT connections, one machine must act as the Master and the other the slave. All operator input will be on the master computer.

Using the NETBIOS interface

With Ethernet, or Token Ring, it is possible to clone between two machines, using their network interface cards through the NetBIOS protocol interface. By purchasing, or making a custom connectivity Ethernet crossover cable or using coaxial or a mini-HUB and cables, a PC can connect to another PC. This is a two-node peer-to-peer network. To set up NetBIOS requires five basic Novell networking software components:

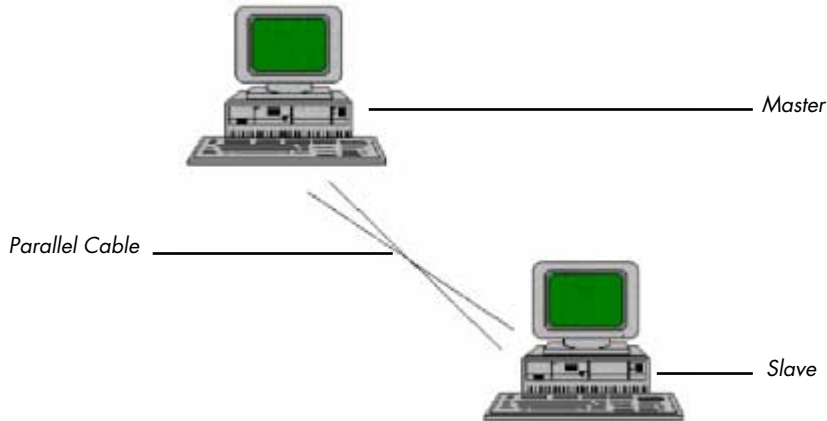
- LSL
- MLID (the Network Interface Card ODI driver)
- IPXODI
- NetBIOS interface
- NET.CFG (configuration)

These components can be loaded from a boot disk to allow Ghost to use NetBIOS to communicate and clone between master and slave.



Using the parallel (LPT) port

With two computers and a parallel data transfer cable (not provided with Ghost) you can clone two computers, master to slave.



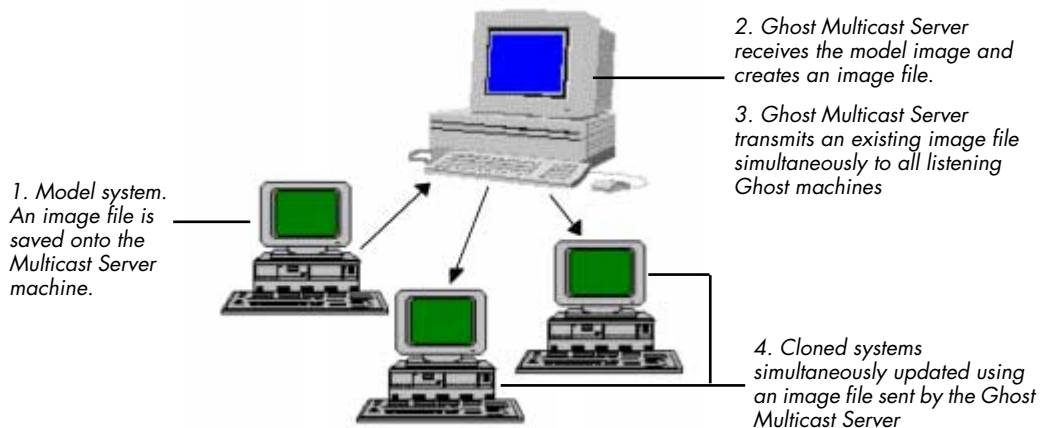
Clone multiple target PCs using multicasting

The replication of a model workstation onto many computers can be a time-consuming task. One-to-one connections with a small number of computers is fast and efficient, but as the number of machines increases, the time for the overall completion of the entire replication task increases in proportion to the number of computers being cloned.

When Ghost is using a one-to-one approach for transferring information, each of the computer drives being replicated receives its own copy of information, and each of these copies needs to be passed through the same network channel. As the number of replications on the same network increases, the time for overall task completion increases due to multiple copies of information being sent through the common information channel.

Ghost Multicasting uses TCP/IP multicasting in conjunction with a reliable session protocol to provide one to many communication. Ghost Multicasting supports both Ethernet and Token Ring Networks and clears away the bottleneck of having multiple copies of data being passed through the network. Ghost multicasting includes support for the

multicasting of both disk images and partition images, as well as automatic multicast server session starting options and image file creation.



A multicasting session consists of one server, a single image file, and a group of similar Ghost clients requiring the identical disk or partition image. The session name is used by Ghost clients to indicate the session they are to join and listen to.

Ghost Multicasting Client is built into the Ghost application software. Ghost operates in conjunction with the Ghost Multicast Server application to provide a fast and easy way of replicating workstations.

Typical usage examples

Ghost's abilities to clone hard drives and partitions provide a flexible and powerful tool that can be used for anything from upgrading the hard drive in your PC at home, right through to managing organization-wide system configuration in large corporations.

Upgrade networked workstations

Your company has decided to upgrade from Windows 3.11 to Windows NT. You have 25 workstations to configure, and only a day to do it.

With Ghost, you can create a model system with all of the necessary software installed (office software, web browser, etc.), and then save an image of the system to a network server. Use Ghost to load the image on to other machines over the network. If you are using Ghost Multicast Server,

you can load multiple machines at once, dramatically reducing installation time and network traffic. Ghost Walker can then be run to provide each Win NT machine with a unique SID, which apparently will be required when Windows 2000 arrives.

Restore non-networked workstations

Windows 95 needs to be restored on several problematic workstations, but the workstations are not currently networked.

Ghost allows you to create a drive image on removable media, such as ZIP disks or JAZ disks. You simply create a model system with all of the necessary software installed (as in the preceding example), and then save the drive image directly to the device. Ghost will prompt you if it runs out of space on the removable disk and will prompt you to either insert another one or save to an alternate location. Alternatively, an LPT port connection could be used.

Install clean systems from CD-ROMS

A university provides notebook computers to all new students and would like an easy way for students to restore the computers to their original state if needed.

Ghost can be used to install a complete Windows 95 system (or other operating system) from a single disk image file held on a CD-ROM. This technique is currently being exploited by many universities, who issue students a CD-ROM containing a Ghost disk image file and Ghost. Students can reload their notebook computers from the CD-ROM at any stage, just by clicking the Ghost icon. No further user input is required.

Burning a Ghost disk image file onto a CD-ROM is a useful technique for any organization that distributes updates on CD-ROMs. The version of Ghost included on the CD-ROM can be configured to limit the functionality it provides to the end user.

Clone networked computers

You want to clone one machine to another machine as quickly as possible, and the machines have network cards.

Ghost allows you to connect two computers directly using NetBIOS. Make sure both computers are connected via a converted Ethernet network

cable, or a mini-hub. Both computers must be running the minimum network software for a NetBIOS connection (as in the example below). One computer is then set up as the master and the other as the slave. Ghost will automatically connect the two computers.

It may prove useful to have a special boot disk that loads just the network software needed by Ghost for the NetBIOS connection.

For example, an NE2000 network card requires the following files (your drivers and protocols might vary).

```
LSL.COM  
NE2000.INS  
NE2000.COM  
IPXODI.COM  
NET.CFG  
NETBIOS.EXE
```

The following files could be called from the autoexec.bat file which would load the network drivers needed for Ghost to work with NetBIOS:

```
LH LSL  
LH NE2000  
LH IPXODI  
LH NETBIOS
```

Clone a machine via parallel cable

You want to clone one machine to another machine using a parallel cable.

Make sure both computers are connected via the LPT port with a parallel data transfer cable. Ghost must be running under DOS on both computers. Select master and slave computers. The parallel port **MUST** be set to bidirectional, EPP or ECP (not unidirectional). You can experiment with the mode for best performance.

Clone disks at optimum speed

In your organization, you will be cloning new systems on a regular basis and you want to set up a system that uses the cloning method with the highest speed possible.

Use the Ghost disk-to-disk cloning option. Set up a system with one drive configured as the model drive to be cloned (as above). Whenever a new drive needs to be cloned, simply attach the new drive to the controller in the model system, run the drive auto-configure option in the BIOS, and then run Ghost with the clone local disk-to-disk option.

Back up disks

You need a complete drive backup solution that won't miss in-use system files and can be run from a command line. Ghost is the perfect solution for making complete backups of disks. It even copies in-use system files that are missed by other backup utilities.

For backups you will generally want to use batch mode. Batch mode can automate backups, and it allows full control via command-line configuration options.

Refresh multiple machines simultaneously

You are in charge of several university multimedia labs running Windows 95 and need to be able to refresh or update the machines with very little notice. There's only one small problem: The labs are located in the basement, the main server is on the top floor of the building, and you want to do it as fast as possible.

With Ghost multicasting, you can establish model configurations of the systems at any stage and save them onto the server machine. When the time comes to restore the labs, you can start up the Ghost Multicast Server with the time you would like the session to start, or a specific client count.

Once this has been arranged, the clients can be started using a floppy disk, or alternative boot-up option, and run Ghost. Ghost can then use DHCP to get its TCP/IP configuration details and connect to the Ghost multicasting session. Once the last PC connects, or the time to start occurs, the multicast session will start automatically and send the contents of the partition or drive to the lab PCs.

Restore systems from removeable media

A system administrator for a midsize, full service, law firm maintains 16 Windows NT servers. A compressed Ghost image file containing the main NT server hard disk drive contents is regularly saved onto JAZ cartridges. The main NT server suffers a huge electrical spike as a result of a major

lightning storm that overwhelmed the Uninterrupted Power Supply (UPS) system.

Following the lightning strike, use Ghost to restore the saved hard disk drive image. The system configuration is returned to how it was when the Ghost image was taken before the disaster. What would normally take more than several, full-time days of work will take only one hour.

Setting up Norton Ghost

Ghost does not need an installation utility. The Ghost application is a stand alone executable that can be run from any location in DOS. For example, ghost.exe can be copied to and run from a hard drive, a 3.5-inch floppy disk, a CD-ROM, or a network drive.

Ghost must be run in DOS. If an operating system such as Windows NT is installed on the computer Ghost is to run on, a DOS boot disk is required.

Minimum system requirements

The system requirements to run Ghost are:

- 386SX processor (486 or above recommended)
- 4MB RAM (8MB RAM for NTFS), 16MB recommended
- DOS 5.0 or above
- VGA monitor

Hardware requirements for Ghost transfer modes

Peer-to-peer LPT/parallel port connection	Parallel connection cable and a bidirectional parallel port with EPP or ECP compatibility on each PC.
Peer-to-peer NetBIOS connection	Ethernet or Token Ring network interface card. Established network connection which includes one of the following: ■ Crossover Ethernet cable (pins 1236 > 3612) ■ Coaxial cable ■ Standard cables with hub or MAU NetBIOS network software
SCSI tape driver	DOS ASPI driver SCSI tape drive Tape media
Multicast	Ethernet or Token Ring NIC Established network connection NIC packet driver or NDIS 2.01 NIC driver Optional multicast-enabled router Optional BOOTP/DHCP software
Removable media	Removable media drive and media Media drivers required to use in DOS
CD-ROM usage	CD-ROM writer CD-ROM writer disk creation software
Mapped network volume	Network interface card Established network connection DOS network client software to provide mapped drives.

Installation

Ghost installation is simply copying the Ghost executable to the location from which it will be run.

To install Ghost to a hard disk:

- 1 Create a directory on the destination drive.

- 2 Copy ghost.exe and associated files to the directory.

Depending upon how you receive Ghost, the source file location varies. For example, the location on the CD-ROM is \Ghost\Client. For example:

```
md c:\ghost  
copy d:\ghost\client\*. * c:\ghost
```

Note: If a Windows drag-and-drop or copy and paste operation is used instead of a DOS command, the files being copied from the CD retain their read-only attributes when copied to a floppy disk or hard drive. You must manually change the attribute on the ghost executable (ghost.exe) and all other files that will be updated or edited.

To remove read-only property on Ghost files in Windows:

- 1 Select the ghost.exe file.
- 2 Right-click the file and select Properties.
- 3 Uncheck the Read-only attribute.
- 4 Click OK.

To uninstall Ghost:

- Delete the single ghost.exe executable file and associated files.

Setting up transfer methods

The following sections summarize the basics to prepare devices and drives for Ghost operation.

Internal drives

To work with internal drives you must ensure that each of the drives is properly configured. This means that if fixed IDE drives are in use, the jumpers on the drives have been set up correctly, and the BIOS of the PC has been configured to the disks and setup arrangement. Both the source and the destination drives must be free from file corruption and physical hard drive defects.

Local devices

To use Ghost with SCSI tape devices, the tape device needs to have an Advanced SCSI Programming Interface (ASPI) driver for DOS installed. The driver is installed in the config.sys file as shown in the example below:

```
device=C:\scsitape\aspi4dos.sys
```

Refer to the documentation included with the SCSI Tape Device for further details.

Peer-to-peer connections

Peer-to-peer connections enable Ghost to run on two machines and allow Ghost to transfer drives, partitions, and to use image files between them.

Action	Master	Slave
Disk to disk copy	PC containing source disk	PC containing destination disk
Disk to file copy	PC containing source disk	PC receiving destination image file
File to disk copy	PC containing destination disk	PC containing source image file
Partition to partition copy	PC containing source partition	PC containing destination partition
Partition to file copy	PC containing source partition	PC receiving destination image file
File to partition copy	PC containing destination partition	PC containing source image file

Peer-to-peer parallel port connections

Connect both computers via the LPT port with a parallel data transfer cable. Ghost must be running under DOS on both computers. The parallel port must be set to bidirectional, or EPP, or ECP, but not unidirectional. You may need to experiment with the mode for best performance.

Select which computer is the master (the machine from which you control the connection), and which is the slave (the other machine participating in the connection). All operator input will be on the master computer. Use the

following table to choose which PC will be the master and which will be slave.

Peer-to-peer NetBIOS network connections

NetBIOS is only available for peer-to-peer Ghost usage. Sample third-party files are available on the Symantec FTP site at:

ftp://ftp.symantec.com/public/english_us_canada/products/ghost/

Sourcing NetBIOS

The following steps explain the NetBIOS setup procedure.

- 1 Install network interface cards.
- 2 Once the network interface cards are installed, the two peer Ghost machines need to be connected using cabling. The type and setup of the connection will depend on your individual network requirements. These can include converted twisted pair cables, coaxial, hub, and MAU-based setups.
- 3 Run the Network Interface Card setup program and configure card.
- 4 Set up NetBIOS. An example is shown below.

Here is an example of loading NetBIOS in your startnet.bat or autoexec.bat:

```
LSL.COM
NE2000.COM
REM (Comment: replace NE2000.COM with your NIC
driver)
IPXODI.COM
NETBIOS.EXE
```

An example of the net.cfg for an NE2000 NIC:

```
#set up the NIC
link driver NE2000
_int 10
_port 300
```

Select which computer is the master (the machine from which you control the connection), and which is the slave (the other machine participating in the connection). All operator input will be on the master computer. See “[Peer-to-peer connections](#)” on page 24 to choose which will be the master and which will be slave.

Mapping to a network MS Windows volume

When running Ghost in DOS the network file server access available while in Windows will be unavailable. To access a network file server a network boot disk must be created. A network boot disk will contain the appropriate network drivers and network client software to allow connection to a network.

Creating an NT Server 4.0 network boot disk for DOS

Because you can't create a system (boot) disk under Windows NT, use Windows 95/98:

To create a system disk from Windows 95/98:

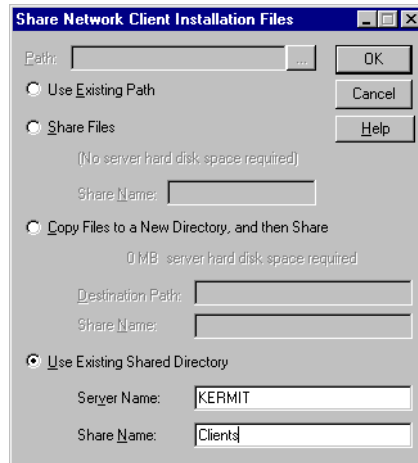
- 1 Start Windows 95 or 98.
- 2 Double-click the My Computer icon, right-click the floppy drive, and choose Format
- 3 Choose Copy System Files to create the bare minimum boot disk.

Add the networking files to the system disk to allow access to the file server.

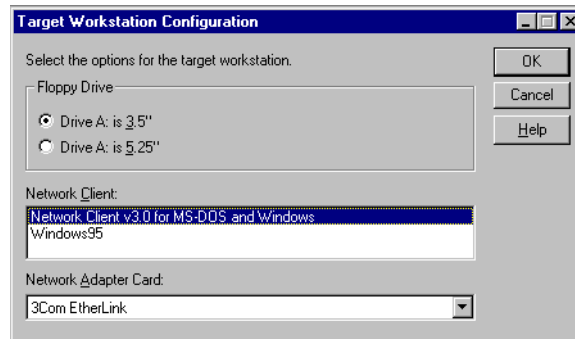
To add Networking files:

- 1 Go into Administrative Tools on NT Server and start the Network Client Administrator.
- 2 Choose Make Network Installation Startup Disk. This option will set up the disk to access the client installation for NT Server. This process will configure the components to connect to the file server.
- 3 Choose the location of the client installation files. This is done either by setting up the NT Server CD Client directory as a share,

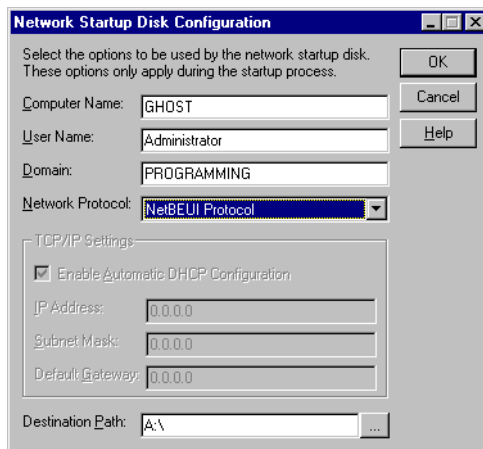
or by copying the NT Server CD Client directory onto the server and setting up this directory as a share.



- 4 Choose Network Client v3.0. You must also choose your network interface card. If your network interface card is not on the list, temporarily pick something similar.



- 5 To log on to the NT server you need to provide some basic information needed for NT networking.



- 6 Make sure that the system disk that you created is in the drive. NT will add all of the networking files.
- 7 Modify the network boot disk to log into the network and map a drive. Make the following changes to your autoexec.bat file:

```
path=a:\net
a:\net\net start
net use z: \\KERMIT\images
```

(change the \\KERMIT\images to your \\server\share location)

- 8 If the network interface card that you selected in Step 4 was incorrect, go on to the next step. If you think you have the right card but the network boot disk gives you an error message about binding, there is a problem with the card configuration.
- 9 The following explains how to add an NDIS driver for NIC cards that were not originally included in the Network Client Administrator. This is an excerpt from article Q142857 (How to Create a Network Installation Boot Disk) in the Microsoft Knowledge Base.

This example is for the Intel EtherExpressPro NIC card; however, this example can serve as a template for all NDIS compatible drivers.

- Copy the epro.dos driver to the A:\Net directory.
- Modify the net\protocol.ini file and change the [EPRO\$] section to drivename=EPRO\$.

The drivename= information is included on most manufacturers' disks in the sample protocol.ini file that comes with the network interface card.

- Modify the net\system.ini file and change the [network drivers] section to netcard=Epro.dos

The driver file that the netcard= equals is also on the manufacturer's disk.

Additional drivers can be found on the Windows NT Server compact disc in the Clients\Wdl\Update directory. For more information, see article Q128800 (How to Provide Additional NDIS2 Drivers for Network Client 3.0) in the Microsoft Knowledge Base.

You are now finished. If you get an error message stating an inability to bind, the network interface card is not configured properly. Check your interrupt and address settings on your card and in your protocol.ini. Also make certain you have customized properly as explained in Step 9.

Using Norton Ghost

This chapter describes how to perform Ghost operations. The procedures assume that all hardware is configured properly and Ghost communications are established. See “[Setting up transfer methods](#)” on page 23 for more information.

Information on the following topics is provided:

- Starting Ghost
- Navigating in Ghost without a mouse
- Cloning disks
- Cloning partitions
- Managing image files

What you need to do

The following section gives a quick overview of the ways you can use Ghost to perform everyday tasks.

- 1 Identify what you want Ghost to do and how many machines are involved.
 - Disk duplication
 - Disk image file creation
 - Disk creation from image file
 - Partition duplication
 - Partition Image file creation
 - Partition creation from Image file
- 2 Select the hardware setup method you will use to perform the Ghost operation.

Internal disk drives and:

- No other devices
 - Other peripheral devices not needing additional setup (for example, Jaz or Zip drive)
 - SCSI tape drive requiring DOS ASPI driver setup
 - Third-party device requiring DOS driver setup
 - Mapped network volume accessibility
 - Peer-to-peer connection using LPT printer port
 - Peer-to-peer connection using NetBIOS and network interface cards connection
 - Multicast TCP/IP network
- 3** Set up the hardware and system for the method chosen.
- On PCs to be running Ghost, ensure all hard drives are installed correctly and the BIOS of the system is configured and correctly displays the valid parameters of the drives.
 - Set up additional drivers required for other devices:
 - SCSI Tape Drive requiring DOS driver setup**

Install the SCSI ASPI DOS driver in the config.sys file as outlined in SCSI Tape Drive documentation.
 - Third Party device requiring DOS driver setup**

Install the DOS driver as outlined in device documentation.
 - Mapped network drive**

Install Network Interface Card (NIC)
Connect up cabling
Set up NIC using manufacturer's installation program
Run NIC test program to check NIC and cabling
Install DOS network volume connectivity software
Map the network volume to a local drive letter.
 - Peer to Peer connection: LPT**

Using a parallel connection cable, connect up the two PCs. Decide which machine is the Master and which is the Slave.
 - Peer to Peer connection: NetBIOS**

Install network interface card (NIC)
Connect cabling
Set up NIC using manufacturer's installation program
Run NIC test program to check NIC and cabling

Install NetBIOS networking software

Select which machine is the master and which is the slave.

Multicast TCP/IP Network

Install Network Interface Card (NIC)

Connect cabling

Set up NIC using Manufacturer's installation program

Run NIC Test program to check NIC and cabling

Set up multicasting and perform multicast operations as detailed in [“Preparing for Ghost multicasting”](#) on page 56.

- Test Hardware and DOS driver setup.
- 4 Start Ghost. Optionally, add command-line switches. For information on the Ghost command-line switches, see [“Command-line switches”](#) on page 79.
- 5 Select the transfer method and Ghost operation from menu.
- 6 Select source hard disk drive, partitions, or image file.
- 7 Select destination hard disk drive, partition, or image file.

Warning: Choose carefully. Make sure you select the correct destination to overwrite. In most cases, you will not be able to recover from an incorrectly selected destination drive.

- 8 Provide any details required.
- 9 Check all details provided are correct and proceed with clone.
- 10 Reboot the machine.

Starting Ghost

Ghost is a DOS-based application and should run in DOS-only mode, if possible. If you run Ghost from Windows 95/98, note the following:

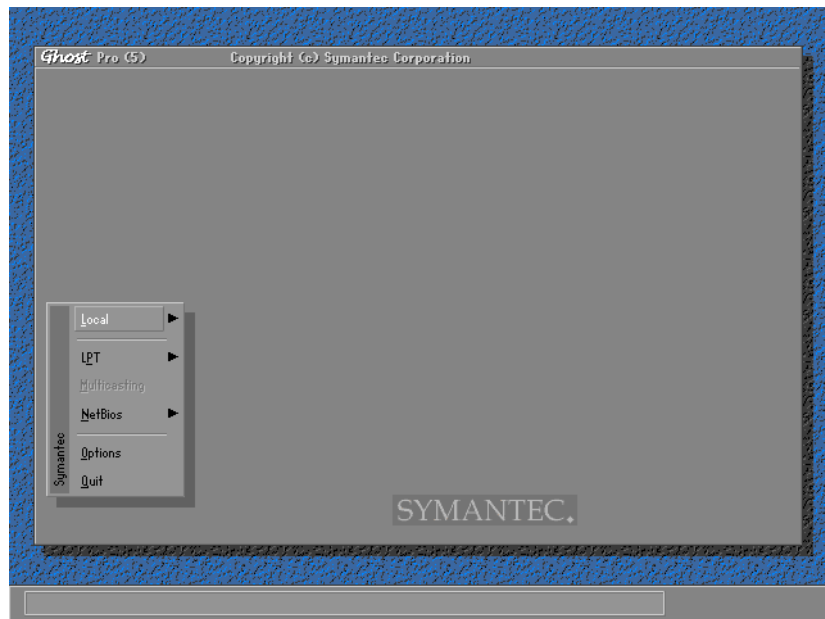
- Files may be in an open or changing state. If these files are cloned, the resulting destination files will be left in an inconsistent state.
- The operating system's volume must not be overwritten.
- If you overwrite a drive or partition, the system must be restarted.
- LPT connection operation is not available.
- Ghost client multicast operation is not available.
- Ghost will not automatically reboot the system.

Ghost should never be run within Windows NT, Windows 2000, OS/2 or other non-DOS operating systems. To run Ghost on a PC running non-DOS operating systems, use a DOS boot diskette.

To start Ghost:

- From the DOS prompt, type:
`C:\> ghost.exe`

Alternatively, boot the machine using a DOS boot disk. A DOS boot disk can be created on a PC running Windows or DOS. Running Ghost in DOS may require additional DOS drivers to be started to allow Ghost to access and use some hardware. See “[Setting up transfer methods](#)” on page 23 for more information.



Navigating in Ghost without a mouse

Depending upon how Ghost is started, mouse support may not be available.

To use Ghost without a mouse:

- Use arrow keys to navigate the Ghost menu.

- Press Tab to move from button to button.
- Press Enter to activate the selected button.
- Press Enter to select an item in a list.

Cloning disks

The following disk cloning procedures are accessed from the Ghost main menu.

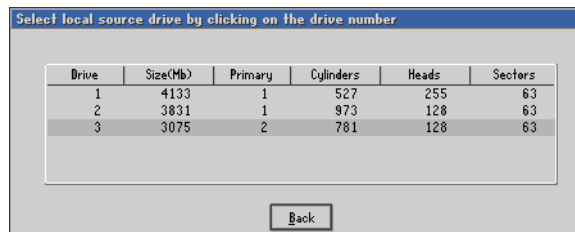
To specify the transfer method, select one of the following:

- Local
- LPT > Master
- NetBIOS > Master.

Cloning from disk to disk

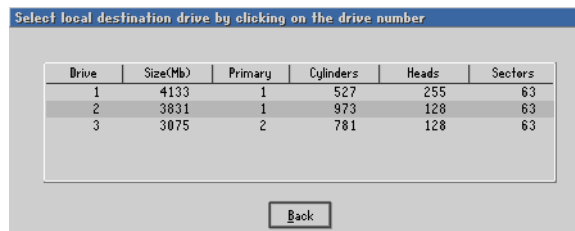
To clone disk to disk:

- 1 From the Ghost menu, select Disk>To Disk, then select the source drive.



Ghost displays the details of every disk it can find on the local PC and allows you to select the disk you wish to copy from.

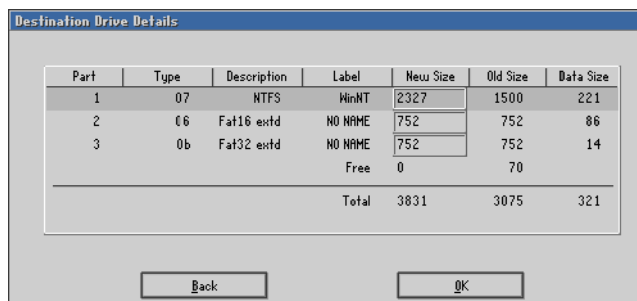
- 2 From the dialog box, select the destination drive.



Ghost displays the details of every disk it can find on the destination PC and allows you to select the disk you wish to copy to. If a peer-to-peer connection is established this will be the slave PC's drives. (If this is a local disk-to-disk copy, then the source disk will be unavailable for selection.)

Warning: Choose carefully as this is the disk that is going to get overwritten.

- 3 Ghost displays a suggested partition layout for the target disk to confirm destination drive details.



The image shows a dialog box titled "Destination Drive Details". Inside, there is a table with 7 columns: Part, Type, Description, Label, New Size, Old Size, and Data Size. The table contains 4 rows of data, including a total row at the bottom. The "New Size" column has input fields for each row.

Part	Type	Description	Label	New Size	Old Size	Data Size
1	07	NTFS	WinNT	2327	1500	221
2	06	Fat16 extd	NO NAME	752	752	86
3	0b	Fat32 extd	NO NAME	752	752	14
		Free		0	70	
Total				3831	3075	321

At the bottom of the dialog box are two buttons: "Back" and "OK".

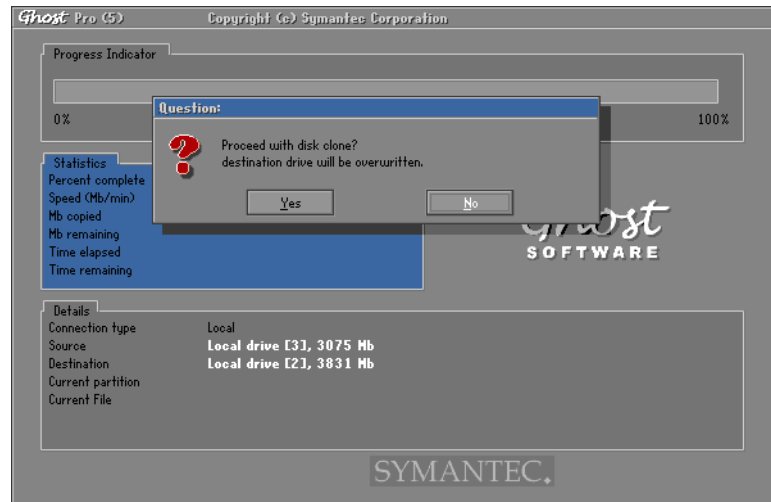
By default Ghost allocates any extra space that the new disk has to the first FAT or NTFS partition that it discovers.

You can change the size of any target FAT or NTFS partition at this stage simply by entering the new size in megabytes.

You cannot enter a value that either exceeds the available space or that is not large enough to contain the data held in the source partition.

- 4 When the details are correct, select OK to continue.

Ghost displays the source and destination details. Look at the details displayed and ensure you have chosen the correct options. This is your last chance to back out.



5 Do one of the following:

- Select Yes to proceed with the disk cloning.

The system performs a quick integrity check on the file structure and then copies the files to the new drive. If you need to abort the process use Ctrl-C, but be aware that this leaves the destination drive in an unknown state.

Warning: Only select Yes if you are really sure. The destination drive will be completely overwritten with no chance of recovering any data.

- Select No to return to the menu.

When the process is complete, run Norton Disk Doctor, ScanDisk, or similar utility to verify the integrity of the destination drive.

6 When the disk clone is complete, reboot the machine.

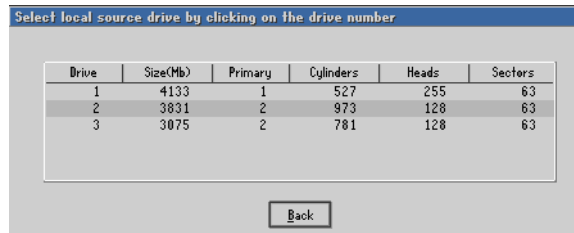
Cloning a disk to image file

To clone a disk to an image file:

- 1** From the Ghost menu, select Disk > To Image.

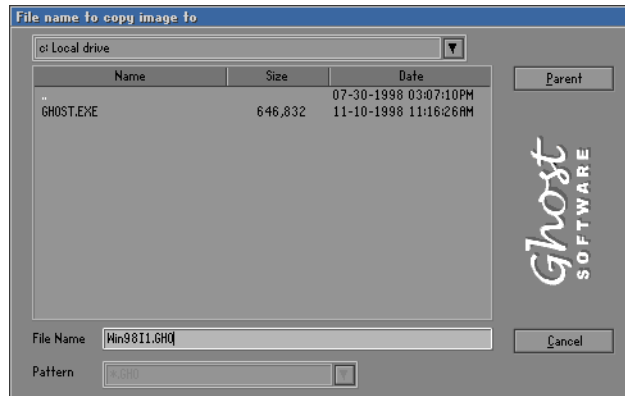
Ghost displays the details of every disk it can find on the local PC.

- 2 From the dialog box select the source drive.



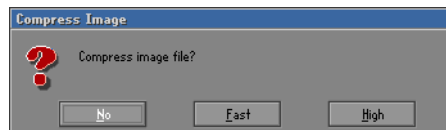
- 3 Do one of the following:
- Type the filename for the disk image file.
 - Browse to locate the image file.

Specify the drive or device, and specify the full path name.



The image file may reside on either a locally mapped network file server volume (the most common option) or a local drive (but not the one that is being copied from). When using peer-to-peer connections, the file is located on the slave Ghost machine.

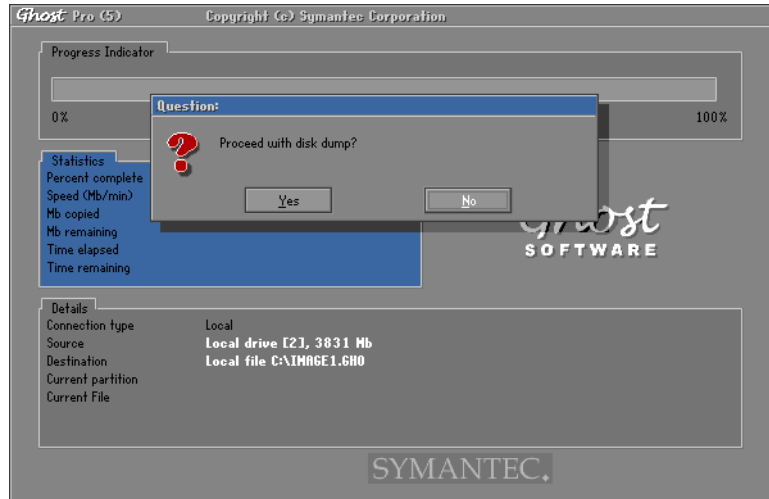
- 4 Proceed with the disk copy and select the compression type.



- Select No for no compression (high speed)
- Select Fast for low compression (medium speed)
- Select High for high compression (slower speed)

When compression is used, copying operations are slower.

Before starting to dump the disk contents to the image file, Ghost displays the source and destination details and gives you a chance to back out. (The default is to back out.)



The system checks the directory structure and then proceeds to dump the files to the selected image file. A progress indicator displays the status of the process.

If spanning is enabled, Ghost prompts for the additional disks and volumes. See [“Image files and volume spanning”](#) on page 49 for more information.

Cloning a disk from an image file

To clone a disk from an image file:

- 1 From the Ghost menu, select Disk > From Image.

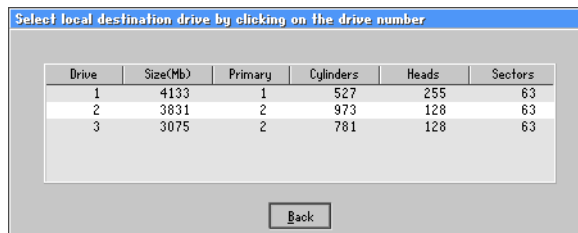
Ghost displays the details of every disk it can find on the local PC.

- 2 Do one of the following:
 - Type the filename of the disk image file.
 - Browse to locate an existing image file.

Specify the drive or device and select the full path name. Note that the image file may reside on either a locally mapped network file server volume (the most common option), or a local drive (but not the one that is being copied from). When using peer-to-peer connections, the file will be located on the slave Ghost machine.

- 3 Select the destination drive.

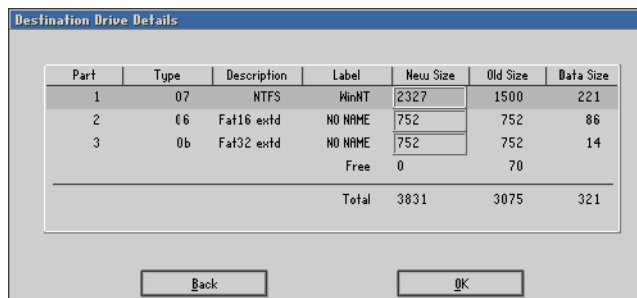
Ghost displays the details of every disk it can find on the local PC and allows you to select the disk you wish to copy to.



The disk containing the source image file is not available for selection.

Warning: Choose carefully as this is the disk that is going to get overwritten. See [“Managing image files”](#) on page 48.

- 4 Ghost displays a suggested partition layout for the destination disk and allows alteration and confirmation of destination drive details.
By default Ghost allocates any extra space that the new disk has to the first FAT or NTFS partition that it discovers.



You can change the size of any target FAT or NTFS partition at this stage, simply by entering the new size in megabytes.

Ghost does not allow you to enter a value that either exceeds the available space or is not large enough to contain the data held in the source partition.

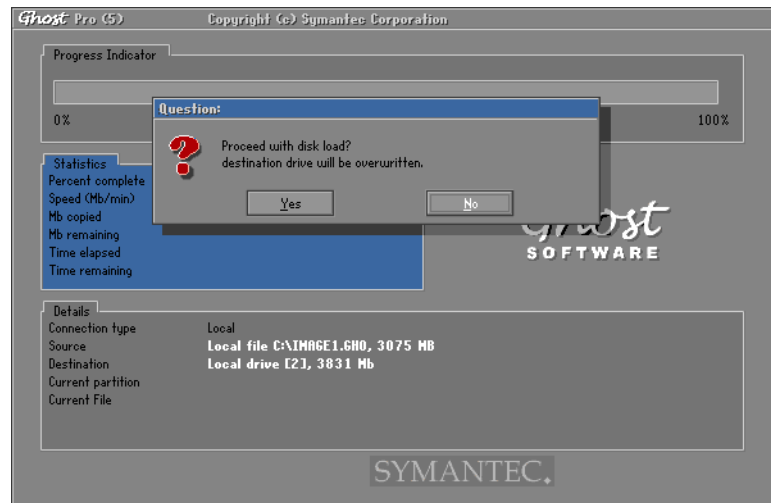
- 5 When you are satisfied with the allocation of space between partitions, select OK.
- 6 Do one of the following:
 - Select Yes to proceed with the disk cloning.

The system performs a quick integrity check on the file structure and then copies the files to the new drive. If you need to abort the process use Ctrl-C, but be aware that this leaves the destination drive in an unknown state.

Warning: Only select Yes if you are really sure. The destination drive will be completely overwritten with no chance of recovering any data.

- Select No to return to the menu.

When the process is complete, run Norton Disk Doctor, ScanDisk, or similar utility to verify the integrity of the destination drive.



Note: Spanned and split image files are handled as outlined in the Image File Management section. See [“Managing image files”](#) on page 48.

- 7 When the disk image load is complete, reboot the machine.

Cloning partitions

The following partition cloning procedures are accessed from the Ghost main menu. To specify a transfer method, select one of the following:

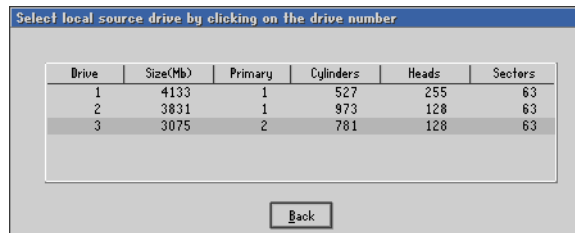
- Local
- LPT > Master

- NetBIOS > Master.

Cloning from partition to partition

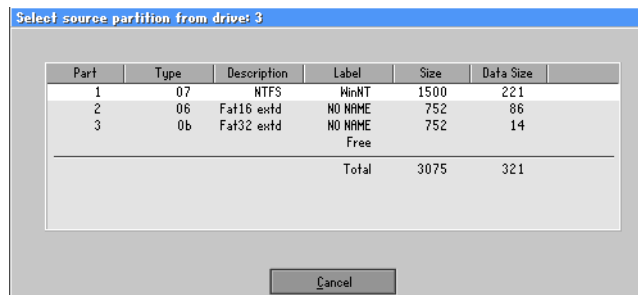
To clone from partition to partition:

- 1 From the Ghost menu, select Partition>To Partition.



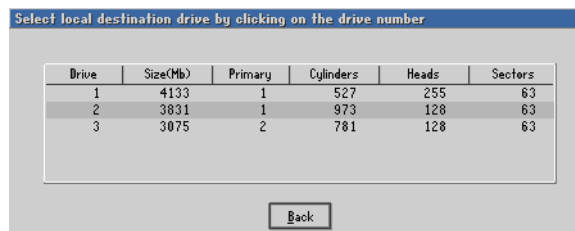
Ghost displays the details of every disk it can find on the local PC and allows you to select the disk you wish to copy from.

- 2 Select the source drive.
- 3 Select the source partition.



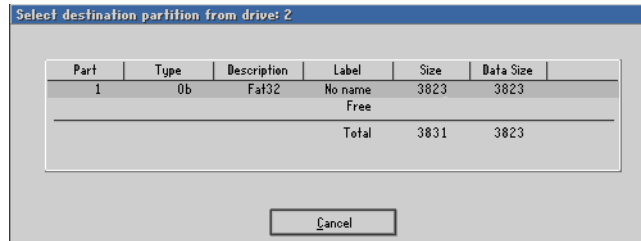
Ghost displays the details of all partitions it can find on the selected source drive and allows you to select the partition you wish to copy from.

- 4 Select the destination drive.



Ghost displays the details of every disk it can find on the destination PC and allows you to select the disk you wish to copy the partition to. For peer-to-peer connections, the slave Ghost machine is the destination.

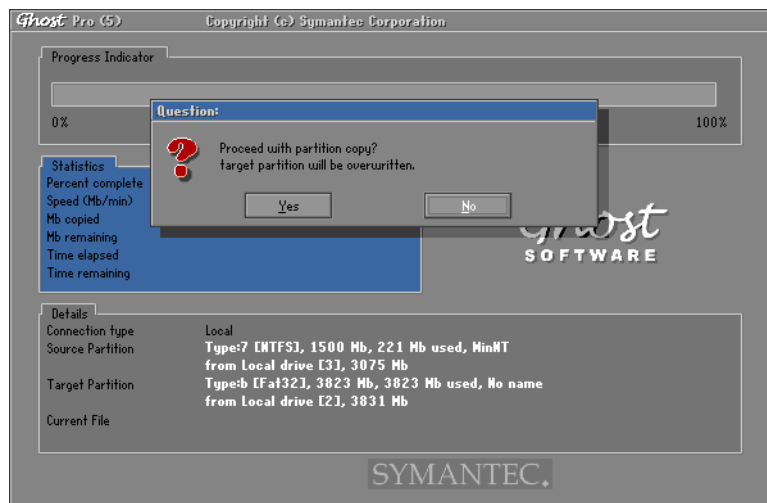
- 5 Select the destination partition.



Ghost displays the details of all the partitions it can find on the selected destination drive and allows you to select the partition you wish to copy to.

Warning: Choose carefully as this is the partition that is going to be overwritten.

- 6 Before starting to overwrite the destination partition, Ghost displays the source and destination details and gives you a chance to back out. The default is to back out.



- 7 Do one of the following:
 - Select Yes to proceed with the partition copy.

If you need to abort the process use Ctrl-C, but be aware that this leaves the destination drive in an unknown state.

Warning: Only select Yes if you are really sure. The destination drive will be completely overwritten with no chance of recovering any data.

- Select No to return to the menu.
- 8 When the partition copy is complete, reboot the destination PC.

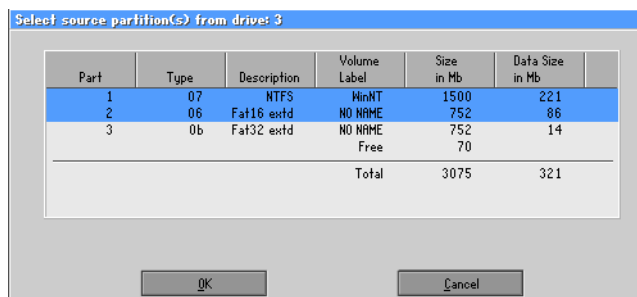
Cloning from partition to image file

To clone a partition to an image file:

- 1 From the Ghost menu, select Partition>To Image.
- 2 Select the source drive.

Ghost displays the details of every disk it can find on the local PC and allows you to select the disk you wish to copy from.

- 3 Select the source partitions.



Ghost displays the details of all the partitions it can find on the selected source drive and allows you to select the partitions you wish to include in the partition image file. Highlight partitions you wish to include.

- 4 Enter the filename to copy the partition image to.

Specify the drive or device and select the full path name.

The image file may reside on either a locally mapped network file server volume (the most common option) or a local drive (but not the one that is being copied from). When using peer-to-peer connections, the file will be located on the slave Ghost machine.

- 5 Proceed with the partition dump and select the compression type.

- Select No for no compression (high speed)
- Select Fast for low compression (medium speed)
- Select High for high compression (slower speed)

When compression is used, copying operations may be slower.

Before starting to dump the partition contents to the image file, Ghost displays the source and destination details and gives you a chance to back out. The default is to back out.

Cloning a partition from an image file

A destination drive's partition must exist before Ghost can load an image file to it.

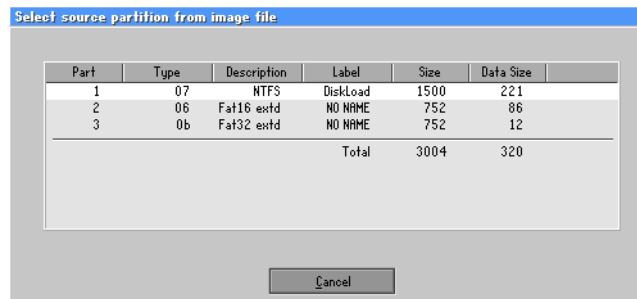
To clone a partition from an image file:

- 1 From the Ghost menu, select Partition>From Image.
- 2 Enter filename to load the partition image from.

Specify the drive or device and select the full path name.

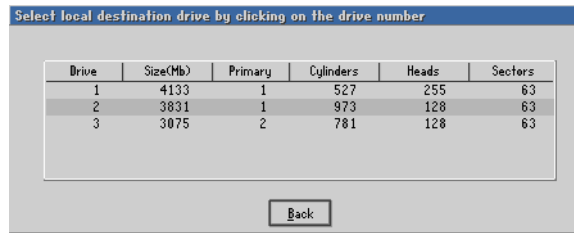
The image file may reside on either a locally mapped network file server volume (the most common option) or a local drive (but not the one that is being copied from). When using peer-to-peer connections, the file will be located on the slave Ghost machine.

- 3 Select the source partition from the image file.



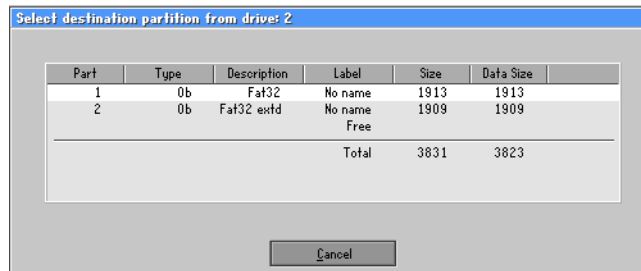
Ghost displays the details of the partitions it can find in the image file and allows you to select the partition you wish to copy from.

- 4 Select the destination drive.



Ghost displays the details of every disk it can find on the local PC and allows you to select the disk you wish to copy the partition to.

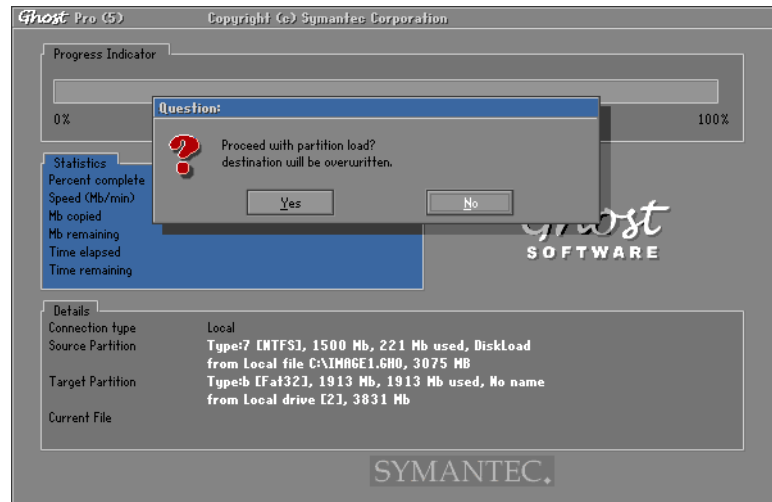
- 5 Select the destination partition.



Ghost displays the details of all the partitions it can find on the selected destination drive and allows you to select the partition you wish to write the image file partition to.

Warning: Choose carefully as this is the partition that is going to be overwritten.

- 6 Before starting to overwrite the destination partition, Ghost displays the full source and destination details and gives you the chance to back out. The default is to back out.



- 7 Do one of the following:
- Select Yes to proceed with the partition copy.
If you need to abort the process use Ctrl-C, but be aware that this leaves the destination drive in an unknown state.

Warning: Only select Yes if you are really sure. The destination drive will be completely overwritten with no chance of recovering any data.

- Select No to return to the menu.
- 8 When the partition copy is complete, reboot the destination PC.

Managing image files

Ghost includes the capability to create a file that contains all the information required to recreate a complete disk or partition. This file is known as the Ghost image file and has a .gho extension. Image files are a useful way to store and reliably compress images of model system configurations, or to create backup copies of complete drives or partitions.

The image files created with Ghost not only contain the entire disk or partitions in the disk, but also offer:

- Various levels of compression
- CRC32 data integrity checking
- Splitting of media files
- Spanning across volumes

If you also use the Ghost-Explorer application, a Ghost image file companion utility, individual files from these image files can be recovered and restored without the need for the complete partition or disk to be restored.

Image files and compression

Image files created in Ghost support several levels of data compression. When using Ghost in interactive mode, three compression options are provided: none, fast and high. The Ghost command-line switches provide access to nine levels of compression. The compression switch -Z is detailed in Appendix A.

As a general rule, the more compression you use, the slower Ghost will operate. However, compression can improve speed when there is a data transfer bottleneck. There is a big difference in speed between high compression and no compression when creating an image file on a local disk. Over a network or NetBIOS connection, fast compression is often as fast as, or faster than, no compression. Over a parallel cable, high compression is often faster than no compression because fewer bytes need to be sent over the cable. Decompression of high-compressed images is much faster than the original compression. The level of compression you should select depends on your own individual requirements.

Image files and CRC32

Cyclic Redundancy Checking (CRC) is a data error checking technique. CRC ensures that the original data that was written to the image file is the same as the data that is being used from the image file. The 32 value in CRC32 indicates the CRC technique uses a 32-bit value to store error checking information. The use of CRC32 increases detection of errors in the image file.

When image files are created, CRC32 details are embedded into the file to ensure image file corruption can be detected when it is being restored to disk. CRC32 is currently included on a file-by-file basis with FAT partitions and on a MFT table basis for NTFS partitions.

In addition to image file error detection, the CRC values can be used to verify that image files and partitions or disks are identical. This can offer an additional detection method against bad sector writes and other drive anomalies that may be missed during normal imaging checks.

A text file containing CRC values and associated file attributes can be generated using the -CRC32 Ghost command line switch. These switches and functions are detailed in Appendix A.

Image files and volume spanning

Standard image files

Standard image files consist of a single file that contains the contents of the complete disk or required partitions. This type of image file is used for storing system configurations on server network drives for later restoration, or on other hard disk drives and tape drives where the volume is large enough and capable of holding the complete image file in one piece.

Size-limited, multi-segment image files

There are situations where it may not be practical to have a standard image file. Ghost offers the ability to split up an image file into segments (known as spans) that are limited to a user-specified size. For example, you may wish to keep files created on your network drive limited to 100 MB in size so you can transfer them more easily in the future. This option is most commonly used to limit span sizes to 550 MB for later transfer onto CD-ROM.

Spanned image files

Spanned image files are similar to size-limited multi-segment image files. The difference is that each segment file (or span) of the image file is limited by the actual volume size of the media the image is being saved to. This allows you to specify a drive and filename and let Ghost sort out when to request another volume or location for the remaining data. For example, this is very useful when using ZIP, JAZ, LS120 Superdisk, and other disk drive types.

Ghost also allows size limiting of spans when spanning volumes, ensuring no span exceeds the maximum size.

With all image files, the only constraint on the selection of the destination volume is that it must not be part of the source selection; for example it cannot be on a source disk or partition if that disk or partition is being included in the image.

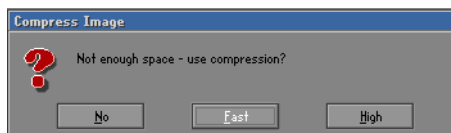
Creating an image file

An image file can be created using the Disk-to-Image file and Partitions-to-Image file options in Ghost. For more information, see [“To clone a disk to an image file:”](#) on page 37 and [“To clone a partition to an image file:”](#) on page 44.

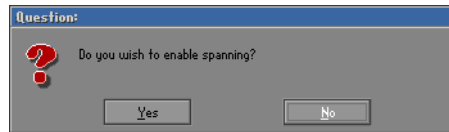
How to span an image across multiple volumes and limit span sizes

When performing a disk-to-image file or a partition-to-image file and the destination drive does not have sufficient free space to accommodate the image, you are informed that there is not enough space on the destination volume and asked whether the image file is to be compressed. Ghost assumes compression will reduce the size of the image by one-third when determining whether the image will fit. (Alternatively, the `-span` and `-split` Ghost command-line switches can be used to configure Ghost on start up to use image file splitting. See [“Norton Ghost command-line switches”](#) on page 79 for more information.

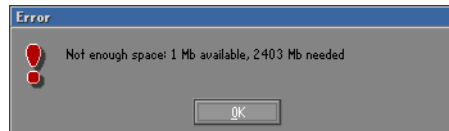
The following message displays:



If you select compression and there is still a possibility of insufficient space, the following message displays:



If spanning is not enabled, an error message displays:



Before starting to dump the disk contents to the image file, Ghost displays the source and destination details and gives you a chance to back out. The default is to back out.

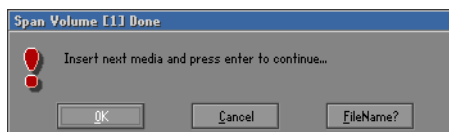
Once the process starts, the dump continues until the destination volume is filled up. You are prompted to either select Enter to continue or specify where the next span of the image file is to be located. Select OK to continue on the same form of media or enter a filename to span to a different location.

For example, if you started spanning onto a JAZ drive and wish to span a 3.0 Gigabyte drive onto just JAZ disks, just select Enter to continue on JAZ disks. If you wish to span across different forms of media, selecting Filename gives you the option to span onto a different location.

Caution: Record where you save your segments of the span. Also record what filename each span segment is. Ghost will not record where and what filename you have selected.

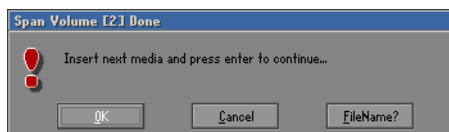
If you have a single partition on a drive, or if you are imaging a single partition, Ghost will end on the last-spanned volume with no user intervention. However, if you are imaging a hard drive with multiple partitions, Ghost needs to record boundary information onto the first span of the image file. This boundary information is recorded to the location of the partition amongst the spanned set. You are prompted to confirm that the first span is ready to be updated.

The screen below shows how Ghost will prompt you for span set disk one and for subsequent volumes.



How to load from a spanned image

When loading a disk or partition from an image file, the process is the same as loading from an unspanned image file. The loading procedure is the reverse of the dumping procedure. You are prompted to provide details of each portion of the spanned image, as shown in the screen below.



Do one of the following:

- Select OK to continue on the same form of media. For example, if you originally spanned onto a JAZ drive and wish to restore a 3.0 gigabyte drive from just JAZ disks, replace the disk and hit Enter to continue from JAZ disks.
- If you wish to restore from different forms of media, selecting Filename gives you the option to restore from a different location.

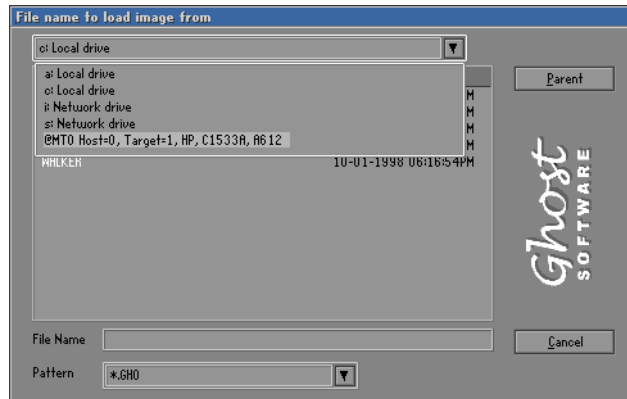
Caution: You need to know where you saved your segments of the span. You must also know each filename and path, for each span segment.

When the disk image load is complete, the target PC will need to be rebooted.

Image files and tape drives

Ghost's support of SCSI tape drives allows it to store a single image file onto a tape. When written onto the tape, there is no associated file system used and this means that you are unable to access the tape from a drive letter as if it were another storage drive. SCSI tapes only support Standard Image files.

When using tape drives with Ghost, the tape drive can be selected as the source or destination device in the File Locator Window. Each SCSI tape device is shown as MTx, where x is a number starting at 0 and increases incrementally for each drive present. For example, the following screen shows a tape drive MT0 available for use.



For Ghost to be able to access SCSI tape drives, a DOS ASPI driver must be installed prior to use. See [“Setting up transfer methods”](#) on page 23 for more information.

Ghost in its default mode performs well with most SCSI tape devices. In some situations with older style SCSI tape devices and possibly with unreliable tapes, Ghost may need to be configured to slow down, or alter the way it uses the tape device. These options are listed in Appendix A.

Viewing image file content/Selective file restoration

Ghost-Explorer is a Ghost companion Windows 95 program that looks similar to Windows Explorer. It can open a Ghost image file and restore individual files, or entire directory structures from it. It can also launch Ghost in batch mode to create an image file, using Windows dialog boxes

to prompt for the disk and partition to dump. A sample screen is shown below:



Ghost Version 4.0a, and beyond, creates an index in the image file as it works that allows Ghost-Explorer to create a display of files very quickly. Image files created by earlier versions of Ghost can still be viewed with Ghost-Explorer, but there is a possibly lengthy delay while Ghost-Explorer reads through the image file to build an index.

Norton Ghost multicasting

Ghost multicasting technology allows you to be more efficient with migrations and rollouts when preparing multiple workstations by almost eliminating replicated network traffic.

Ghost multicasting supports:

- Ethernet networks
- Token Ring networks
- Image file creation
- Multicast-enabled routers
- Automatic IP address selection using BOOTP or DHCP
- Session start scheduling
- Partition-only multicasting
- Multiple sessions

Ghost multicasting can be used through the Graphical User Interface (GUI), command-line switches, batch files, or a combination of the three.

What you need to do to use Ghost multicasting

The following section gives a quick overview of the what you need to do to use multicasting.

- 1 Set up network hardware.
 - Install the Network Interface Card (NIC)
 - Connect cabling correctly
 - Set up NIC using manufacturer's installation program
 - Run NIC test program to check NIC and cabling
- 2 Decide on TCP/IP and networking settings.
 - Networking setup

- IP address assignment scheme
- BOOTP/DHCP vs. manual configuration
- NIC driver selection
- Overall requirements

For more information, see “[IP addresses and Ghost multicasting](#)” on page 57.

3 Set up the Ghost Multicast Server.

Windows (ghostsrv.exe).

- Copy ghostsrv.exe onto the Windows machine.
- In Windows, install a TCP/IP network stack.
- If using Windows 95 as the server, install the Winsock2 update and reboot. See “[Upgrading Windows 95 winsock to version 2](#)” on page 103 for more information.

DOS (dosghsrv.exe).

- Copy dosghsrv.exe onto the boot disk.
- Create the DOS packet driver boot disk. See “[Setting up DOS-based multicast client and server](#)” on page 62.

4 Set up Ghost Client (ghost.exe).

- Copy ghost.exe onto the boot disk.
- Create the DOS packet driver boot disk. See “[Setting up DOS-based multicast client and server](#)” on page 62.

5 Start and configure the Ghost Multicast Server.

See “[Deploying the Windows Ghost Multicast Server](#)” on page 66 and “[Deploying the DOS Ghost Multicast Server](#)” on page 74.

6 Start the Ghost clients and begin multicast session.

7 Restart the cloned machines when the session is completed.

Preparing for Ghost multicasting

Multicasting allows multiple Ghost machines to receive the same information over a computer network through the use of a single transmission of the information. Two applications are used in Ghost multicasting: one at the server and another at every client workstation to be cloned.

The multicast server supplies image file contents to multiple clients or can create an image file from a single connected client. The multicast server can be run on two platforms, Windows and DOS:

- Windows Ghost Multicast Server (ghostsrv.exe)
- DOS Ghost Multicast Server (dosghsrv.exe)

Note: If using Windows 95 as the server platform, you need to install the Microsoft Winsock2 update. See [“Upgrading Windows 95 winsock to version 2”](#) on page 103 for more information.

At a workstation:

- DOS Ghost Multicast Client: The DOS application ghost.exe receives and writes the image file to the local disk drive.

Windows applications TCP/IP settings are assigned in the Windows network settings. DOS applications TCP/IP settings are customized in the wattcp.cfg configuration file and require a packet driver interface to be set up.

IP addresses and Ghost multicasting

Each computer on an IP network needs a unique IP address. Associated with an IP address is a subnet mask. The subnet mask indicates the range of IP addresses that are locally accessible to the computer. Each of these locally accessible computers becomes a member of the local subnet. If the address of another computer is outside the range of IP addresses specified by the subnet mask, then this computer is known to be on a different subnet.

To communicate with a computer on another subnet, the local computer sends the information to the default gateway. It is the default gateway's responsibility to forward information to the correct receiver. The default gateway of a computer needs to be on the same subnet as that computer. These values can be one of the following:

- Specified locally on a computer in a configuration file.
- Specified automatically using a BOOTP or DHCP system.

Allowed addresses for internal private internets:

10.0.0.0	- 10.255.255.255	(1 class A)
172.16.0.0	- 172.31.255.255	(16 class B addresses)
192.168.0.0	- 192.168.255.255	(255 Class C addresses)

Locally specified IP address

An IP Network using locally specified addresses requires each machine to be manually set up to have:

- a unique IP address
- the correct subnet mask
- the default gateway (optional)

The Windows Ghost Multicast Server receives its locally specified IP address, subnet mask, and default gateway from the TCP/IP parameters in the Network option of the control panel in Windows.

The DOS-based Ghost Multicast Server and clients receive their IP address, subnet mask, and default gateway from the configuration file named `wattcp.cfg` that is usually located in the same directory as the Ghost executable file.

Note: If a DOS boot disk is used to start up Ghost multicasting with locally specified IP addresses, each PC requires a different `wattcp.cfg` file to be specified to make sure every boot disk for the workstations is unique.

The following are examples of `wattcp.cfg` client configuration files:

Windows 95 PC #1 running Windows Ghost Multicast Server (ghostsrv.exe):

IP address:	192.168.100.10
Subnet mask:	255.255.255.0
Default gateway:	192.168.100.1

Uses Windows TCP/IP stack configuration so there is no need for `wattcp.cfg` file.

DOS PC #2 running Ghost client (ghost.exe):

IP address: 192.168.100.3
Subnet mask: 255.255.255.0
Default gateway: 192.168.100.1

DOS PC #2 wattcp.cfg file is as follows:

```
IP = 192.168.100.3  
NETMASK = 255.255.255.0  
GATEWAY = 192.168.100.1
```

DOS PC #3 running Ghost client (ghost.exe):

IP address : 192.168.100.44
Subnet mask: 255.255.255.0
Default gateway: 192.168.100.1

DOS PC #3 wattcp.cfg file is as follows:

```
IP = 192.168.100.44  
NETMASK - 255.255.255.0  
GATEWAY = 192.168.100.1
```

Any address other than 192.168.100.0 to 192.168.100.255 is on another subnet and needs to be passed on to the default gateway (192.168.100.1 in this example).

If the computers do not need to communicate with another machine outside their subnet, a default gateway is not required.

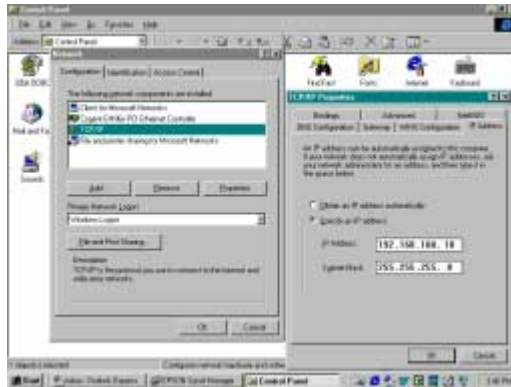
Automatically-generated IP address using DHCP/BOOTP

If a BOOTP or DHCP server is installed on the network, you may take advantage of Dynamic Host Configuration Protocol (DHCP) or BOOTP for IP address assignment. A DHCP server is included in Windows NT Server release 4.0. Other DHCP and BOOTP applications are available for various operating systems and can be used with Ghost multicasting.

For multicasting to many clients, not having to edit a unique wattcp.cfg file on every client may be advantageous. Balanced against this is the additional complexity of the DHCP setup. See [“BOOTP/DHCP automatically defined IP address”](#) on page 60 for more information.

Example of locally-specified IP address for Windows 95

Note: If the network administrator provides default addresses, these addresses should be entered instead of the addresses in the following example.



To configure Windows 95 TCP/IP settings:

- 1 Choose Desktop > My Computer > Control Panel > Network.
- 2 Confirm that the network TCP/IP entry is selected and double click that entry. The TCP/IP properties dialog box displays.
- 3 Select the IP address tab and enter the numerical values supplied by the system administrator. If no predefined values are available, use these default values:

IP address	192.168.100.10
Subnet mask	255.255.255.0

- 4 If a router is being used, select the Gateway tab and enter the appropriate IP address, in this example 192.168.100.1. Otherwise leave this entry field empty.

The above procedure has assigned default values for the example Windows 95 Multicast Server machine that will be used in this document.

BOOTP/DHCP automatically defined IP address

Specifying a local configuration for every computer on an IP network is sometimes inconvenient or impractical. Ghost Multicasting supports the

automatic, or remote, definition of IP addresses and network parameters using BOOTP and DHCP systems.

To use BOOTP or DHCP to specify a computer's IP address requires the running of a BOOTP or DHCP server on the network. This BOOTP/DHCP server listens on the network for computers requesting an IP address be provided, and replies with the address the DHCP/BOOTP server is configured to provide. The BOOTP/DHCP server needs to be configured to provide the IP address, subnet mask, and (optionally) the default gateway.

The following examples demonstrate DHCP/BOOTP operation:

Windows NT 4.0 server #1 running Ghost Multicast Server ghostsrv.exe and DHCP server:

IP address:	172.16.5.10
Subnet mask:	255.255.255.0
Default gateway:	172.16.5.1

DOS PC #2 running Ghost client ghost.exe:

IP address:	supplied via DHCP
Subnet mask:	supplied via DHCP
Default gateway:	supplied via DHCP

DOS PC #2 wattcp.cfg file is empty or does not exist because Ghost Multicasting defaults to using BOOTP and DHCP if no local specified network TCP/IP parameters are supplied.

DOS PC #3 running Ghost client ghost.exe:

IP address:	supplied via DHCP
Subnet mask:	supplied via DHCP
Default gateway:	supplied via DHCP

DOS PC #3 wattcp.cfg file is empty or does not exist since Ghost multicasting defaults to using BOOTP and DHCP if no local specified network parameters are supplied.

The controlling element for DHCP is the DHCP server that serves the requests of clients and ensures no duplicate IP addresses exist on the network. Since many DHCP servers can be placed on a network, measures must be taken to avoid duplicate address generation and its attendant problems.

Setting up DOS-based multicast client and server

Creating a DOS client boot disk

To create a DOS client boot disk:

- 1 Do one of the following:
 - Insert a blank formatted floppy disk into A: drive and transfer the system files by the following DOS command:

```
C:\> sys c: a:
```

- Insert a floppy disk into A: drive and transfer the system files by the following DOS command:

```
C:\> format a: /s
```

- 2 Set up the Packet Driver Interface.

Follow the instructions in the Packet Driver Setup section. Ensure all files are installed on the disk. With most network interface card dependent packet drivers, only one file, the packet driver, will be required to be copied onto the disk. For example:

```
C:\> copy ne2000pd.com a:\
```

- 3 Copy ghost.exe and wattcp.cfg to the floppy disk.

Optionally, copy a Ghost Batch Switch file onto the disk as required.

- 4 Edit the wattcp.cfg file.

The wattcp.cfg file stores the TCP/IP stack configuration details and specifies the IP address and subnet mask of the machine.

Sample wattcp.cfg file:

```
IP = 192.168.100.44
NETMASK = 255.255.255.0
```

For a detailed description of the wattcp.cfg configuration file keywords see [“The wattcp.cfg network configuration file”](#) on page 105.

- 5 Edit the autoexec.bat startup file as required.

Following the packet driver documentation, add the command line for the packet driver into the autoexec.bat file. For example:

```
ne2000pd.com 0x60 10 0x280
ghost.exe
```

Additional Ghost command line switches can be added to automate the cloning process. See [“Command-line switches”](#) on page 79 for more details.

Setting up a a DOS packet driver

The DOS-based Ghost Multicast Client and DOS-based Ghost Multicast Server require an Ethernet-based or Token Ring-based packet driver to be loaded prior to running. The Windows version of the Ghost Multicast Server does not require a packet driver as it uses the standard TCP/IP windows network support.

The NDIS driver setup is more complex to set up than the packet driver.

The selection of NDIS 2.01 and Shim, or a network interface card specific packet driver will depend on factors such as availability of the driver, reliability, ease of use, and speed.

By running a system test you can choose the best alternative for your NIC (that is, the specific packet driver or the NDIS 2.01 driver and Shim).

Note: Do not use the network client administrator from Windows NT 4 or the Microsoft Network Client Installation program to create a Ghost multicast boot disk as they are not compatible.

There are several options available to install the packet driver interface. The option selected will depend on your individual requirements and resources.

- Network interface card dependent packet driver.
- NDIS version 2.01 driver with supplied packet driver shim.
- Third-party NIC driver and packet driver shim. These have not been tested or documented with Ghost's multicasting feature. This includes ODI-based packet driver shim like odipkt.com.

Packet drivers have the advantage of being relatively quick to set up and require minimal configuration.

To setup a Network interface card dependent packet driver:

- 1 Locate packet driver designed for your network interface card.
Packet Drivers are usually supplied on the installation disk included with a network interface card and usually have a .com filename extension. Alternatively, packet drivers may be available from your network interface card manufacturer's web site.
- 2 Start packet driver.
Follow the instructions included with the packet driver and install it.

The command line arguments vary slightly from driver to driver. The variation is due to the fact that each board configuration varies slightly.

3Com 590 PCI network interface card packet driver:

```
A:\> 3c59xpd.com
```

3Com509 ISA network interface card packet driver:

```
A:\> 3c5x9pd.com 0x60
```

NE2000 compatible using software interrupt 0x60 at IRQ10 and IObase 0x280

```
A:\> ne2000pd.com 0x60 10 0x280
```

The syntax of the ne2000pd command is an example of an average ISA driver command line. The IRQ and IO base address values can be found using the setup program included with the network interface card and the software interrupt can be between 0x60 - 0x7f.

To setup a NDIS 2.01 NIC Driver with supplied packet driver shim:

- 1 Locate NDIS 2.01 driver for network interface card.

NDIS (version 2.01) drivers are usually supplied on the installation disk included with a network interface card and usually have a .dos filename extension. Alternatively, NDIS (version 2.01) drivers may be available from the network interface card manufacturer's web site.

- 2 Copy and modify protocol.ini, config.sys, and autoexec.bat.

Base configuration files ready for editing are included in the Ghost multicasting installation files. Extract these configuration files and edit as shown.

PROTOCOL.INI

Sample protocol.ini file:

```
[PROTMAN]
drivename = PROTMAN$
```

```
[PKTDRV]
drivename = PKTDRV$
bindings = PC_CARD
intvec = 0x60
chainvec = 0x66
```

```
[PC_CARD]
drivename = PNPND$
```


The [PC_CARD] module drivename should be changed to correspond to the NDIS driver in use for your network interface card. For example if a 3Com 509 card is used then the change required would be:

```
drivename = ELNK3$
```

Any additional required options for the network interface card configuration can be entered in the [PC_CARD] module. Refer to the documentation or example protocol.ini of the NDIS driver for the network interface card in use if required. For example, the 3Com 509 card allows you to optionally specify the IO Base address:

```
[PC_CARD]
drivename = ELNK3$
IOADDRESS = 0x300
```

CONFIG.SYS

Sample config.sys file:

```
device=protman.dos /I:\
device=dis_pkt.dos
device=pnwnd.dos
```

The last line reflects the driver for the network interface card. For example if the a 3COM509 was used the last line of the config.sys file would be replaced by:

```
device=ELNK3.DOS
```

- The /I: indicates the location of the protocol.ini file and must be present. For example: /I:\ specifies root directory and /I:A:\NET specifies A:\NET.

AUTOEXEC.BAT

Sample autoexec.bat file:

```
prompt $p$g
netbind
```

- NETBIND binds the NDIS drivers together and installs the packet driver interface.

3 Locate and copy the following files:

- protman.dos
- protman.exe

- netbind.com
- dis_pkt.dos

dis_pkt.dos is included with the Ghost multicasting installation files. Netbind and protman files can be sourced from MS Network Client 3.0 that is included in Windows NT 4.0 server and is downloadable from:

<ftp://ftp.microsoft.com/bussys/clients/msclient/>

Note: Boot disks created automatically using MS Network Client will not work with Ghost Multicasting.

Your directory or floppy disk should now contain the following files:

System files	Configuration files	NDIS files
command.com	config.sys	dis_pkt.dos
msdos.sys (hidden)	autoexec.bat	netbind.com
io.sys (hidden)	protocol.ini	protman.dos
drvspace.bin (hidden)		protman.exe
		*.dos

- To provide more space on the boot disk drvspace.bin can be deleted.
- protman.exe is used during the NETBIND and does not need to be included in the autoexec.bat file.
- *.dos is the network interface card specific driver (for example, ELNK3.DOS).

Reboot the machine using the configuration files created. The packet driver interface should now be ready for Ghost to use.

Deploying the Windows Ghost Multicast Server

The Ghost Multicast Server application, ghostsrv.exe, distributes a copy of an image file to one or more Ghost clients listening to the server's session. The Ghost Multicast Server also can create an image file based on a connected client Ghost machine. A session consists of one server, a single image file, and a group of similar Ghost clients requiring the identical disk or partition image. The session name acts as a key, identifies the session,

and must be unique. The session name is used by Ghost clients to indicate the session they are to join and listen to.

The server runs under Windows NT 4, Windows 95, and Windows 98, and requires the Windows network settings to include a valid TCP/IP stack.

Note: If you are using Windows 95 as the server you need to install the Microsoft Winsock2 update. See [“Upgrading Windows 95 winsock to version 2”](#) on page 103 for further information. This must be completed before using ghostsrv.exe.

To start a multicast session:

- 1 Enter a session name for the Multicast session in the Session Name text field.

A multicast session name can be any alphanumeric sequence of characters. Spaces are accepted in graphical mode but may not be used with command-line switches. The case of characters is ignored.

- 2 Do one of the following to specify the type of session:

- Select Dump From Client to upload and create an image file.

Enter the full path of the disk image file in the Image File text box. The Browse button may be used to assist finding the destination location. The image file will be created at the location and filename specified. If the file already exists, ghostsrv prompts you if you wish to overwrite. Either the entire disk image (or an image including selective partitions) can be created. For the entire disk image, select the disk option.

If you require the ability to select which partitions on the Ghost model client are to be included in the image file, select the partition option. On connection, the Ghost client will allow the selection of which partitions of a hard disk drive on the machine are to be included in the image file.

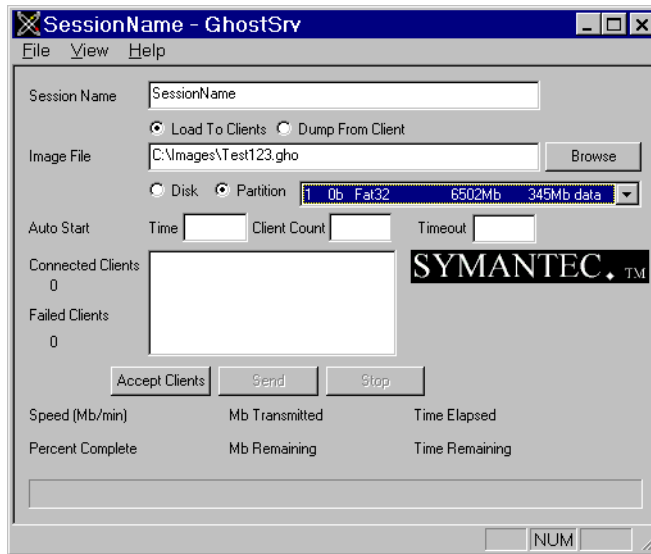
- Select Load To Clients to send an image file to all connecting ghost clients.

Enter the full path of the disk image file in the Image File text box. The Browse button may be used to locate the file. Either the entire disk image or a selective partition image can be transmitted to the client Ghost machines. For the entire disk image, select the disk option.

If you wish to transmit a single partition from an image file, select the partition option and select the partition from the image file.

The disk or partition settings must be selected. If the file selected is not a valid image file, step 4 will fail.

Note: The Ghost image file can be created by ghost.exe through the use of the disk to image file option in either local mode or using the multicast Dump From Client mode.



3 Specify optional Auto-Start parameters.

The server can be optionally set up to start sending to clients connected to the session automatically. The start time can be based on:

- A specified time within the next 24-hour time period
- The number of clients connected to the session
- A number of minutes after the last client joined
- A logical “OR” combination of the criteria.

The Auto-Start Time box allows a 24 hour time between 00:00 and 23:59 to be specified. The format of the time is hours:minutes. For example 5:30 a.m. would be 05:30, and 5:30 p.m. would be 17:30.

The Auto-Start Client Count box allows the threshold number of joined clients to be specified. For example, if the threshold was set to ten (10), then the server would wait and accept clients until the tenth client. Once the tenth client is accepted, the server would stop

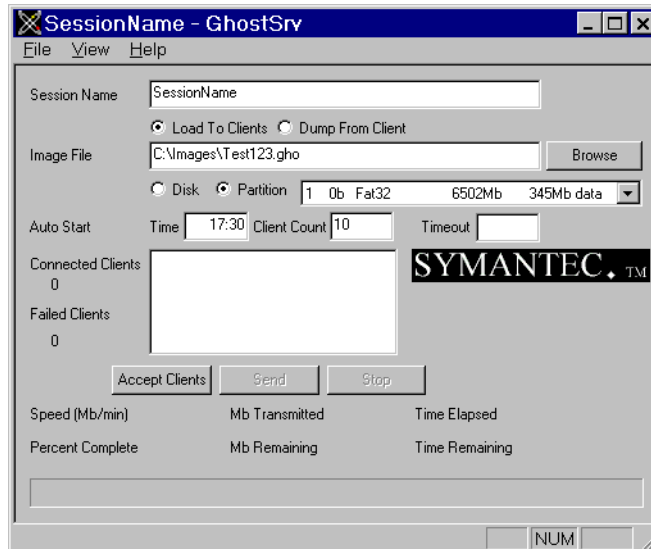
accepting any more clients and start sending out to the connected Ghost machines.

The Auto-Start Timeout box sets the maximum number of minutes the server will wait for a new client to connect before starting the session. For example, if the timeout was set to fifteen (15), the server will wait indefinitely until the first client is accepted. After the first client joins, the 15 minute count down is started. If no more clients join, the session will start 15 minutes later. If another client joins before the 15 minutes timeout, the timeout counter will reset to 15 minutes and start counting down again.

Note: The Ghost Multicast Server can also be restarted to reuse the autostart parameters. See “[Ghost multicast server options](#)” on page 71.

When more than one of the autostart parameters are specified, the first TRUE criterion specifies the start time. For example, if the start time is 17:30 and the client count is 10, then the server will start the session when the 10th client joins or if the time is 17:30. There must be one or more clients logged to the session for the time option to operate.

These Auto-Start values become active when the session starts accepting clients. Auto-Start can be overridden either by using the stop button or by starting the send session earlier.



- 4 Click Accept Clients to accept the client Ghost machines into the session

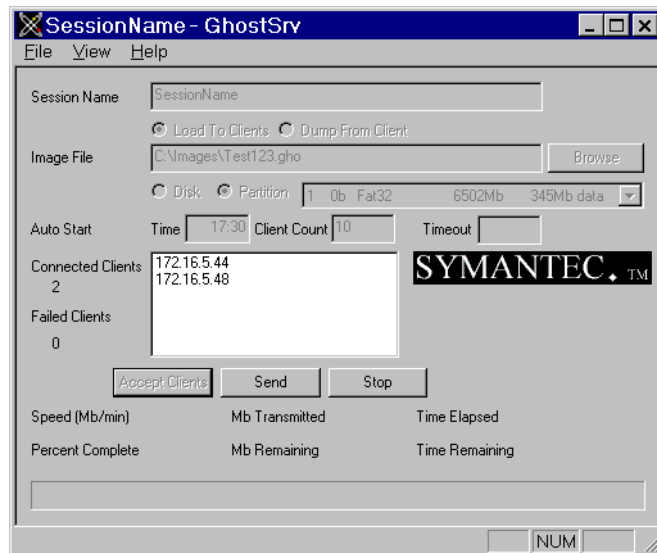
The Accept Clients button becomes active following the completion of steps 1 and 2. Check that the following are correct:

- Session name
- Transfer option (load vs. dump)
- Disk image filename
- Image file disk or partition selection
- Optional autostart details

When Accept Clients is clicked, the type of the file is checked and then the server starts listening for clients on the network that are requesting to join the session.

If the server is set up to dump from client, the server will accept the first client to join the session as the model Ghost machine and start automatically.

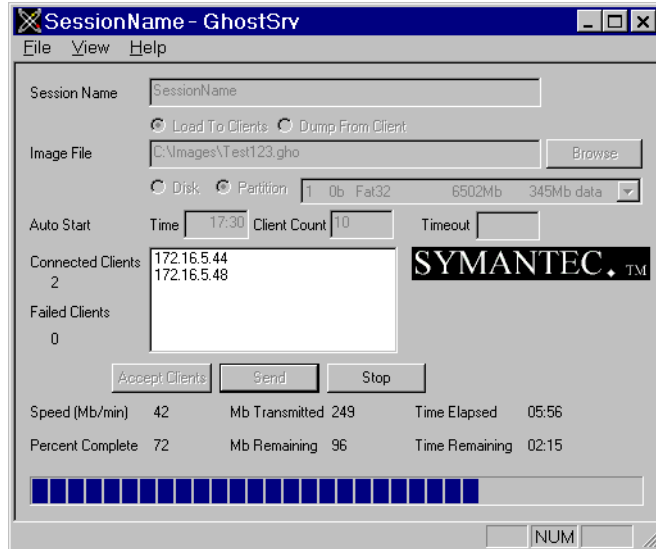
The Autostart parameters become active once this step has been completed. To override the Autostart parameters, press the Start or Stop button as required.



The IP addresses of the client Ghost machines that are connected and waiting for the Multicast session to start will appear in the Connected Clients list. See [“Deploying the Ghost Multicast Client”](#) on page 77 for more information.

- 5 Click Send to send the image file to the client Ghost machines

When all Ghost clients have connected and are waiting for the Multicast session to start and the autostart option is not required, this starts the transmission of the disk image file.



The progress indicator shows the status of the multicast session as it proceeds, along with other image file transfer details. Note that the statistics shown are based on the image file size and do not represent the internal compressed data of the image file. The speed shows the actual amount of data being sent over the network in Megabytes per minute from the image file.

Ghost multicast server options

The Ghost Multicast Server options can be viewed by selecting the File > Options menu item.

- Buffer Size: Sets the amount of memory used for the Multicast buffer.
- Log Level And Log File: Indicates the level of diagnostic multicast logging and the destination log file location. See Appendix G for further details.
- Restart On Completion: The multicast server restarts accepting clients using the same autostart parameters if this option is selected.

- Close Ghostsrv On Completion: The Ghost Multicast Server application closes once the session has completed.

Ghost Multicast Server for Windows platform command-line syntax

The Windows-based Ghost Multicast Server can be run from the command line enabling it to be started using a batch file or third-party scheduler application.

Syntax

`ghostsrv filename session [options]`

`filename` Specifies the path and filename of disk image file.

`session` Specifies the session name.

Options

`-Ncount` Starts the multicast transmission after count clients have joined the session.

`-Ttime` Starts sending to session automatically after specified time (24 hour hh:mm format).

`-Ominutes` Starts transmission 'minutes' after last client connection.

`-Llevel` Creates log file with log level specified (E,S,W,I, or A).

`-Ffilename` Specifies log file for the -L option.(by default ghostlog.txt).

`-C` Closes ghostsrv application after multicast session completion.

`-D` Uses dump from client mode (load to client is default).

`-Bn` Sets the multicast data buffer size to n MB

`-R` Restarts the multicast session on completion.

`-P` Specifies partition mode operation. If loading to clients, the partition number must be given. If dumping from client no partition number is required.

Examples

To upload a complete disk image file from a client Ghost machine:

```
ghostsrv c:\test123.gho TestSession -d
```

Starts a Multicast session called TestSession and creates or overwrites the file c:\test123.gho. The first connecting client's IP address will be displayed on screen, and the session will start automatically. The client PC indicates the drive to use for the image creation.

To upload partitions from a client Ghost machine to an image file:

```
ghostsrv c:\test123.gho TestSession -d -p
```

Starts a multicast session called TestSession and creates or overwrites the file c:\test123.gho. The first connecting client's IP address will be displayed on screen, and the session will start automatically. The Client PC indicates the drive and partitions to be included in the image created.

To specify partition use:

```
ghostsrv c:\test123.gho TestSession -p2
```

Starts the ghostsrv application and configures a multicast session called TestSession and uses the second partition in the file c:\test123.gho. Once the Accept button has been pressed, the connecting client's IP address will be displayed on screen. Once all clients have connected, press the Start button to begin the session transmission.

To specify the number of clients to autostart:

```
ghostsrv -n10 c:\test123.gho TestSession
```

Starts a Multicast session called TestSession and uses the file c:\test123.gho. The connecting client's IP address will be displayed on screen. Once 10 clients have connected, the session transmission is started automatically.

To specify a time for autostart:

```
ghostsrv c:\test123.gho TestSession -t13:30
```

Starts a multicast session called TestSession and uses the file c:\test123.gho. The connecting client's IP address will be displayed on screen. At half past one in the afternoon (1:30 p.m.) the session transmission is started automatically.

To specify time-based and client count autostart:

```
ghostsrv c:\test123.gho TestSession -t13:30 -n10
```

Starts a multicast session called TestSession and uses the file c:\test123.gho. The connecting client's IP address will be displayed on screen. At either half past one in the afternoon (1:30 p.m.), or after 10 clients join the session, transmission is started automatically. Note that ghostsrv does not wait for both conditions to be met.

To specify time-based and client count autostart and automatic closing:

```
ghostsrv c:\test123.gho TestSession -t13:30 -n10 -c
```

Starts a multicast session called TestSession and uses the file c:\test123.gho. The connecting client's IP address will be displayed on screen. At either half past one in the afternoon (1:30 p.m.), or after 10 clients join the session, transmission is started automatically. Ghostsrv does not wait for both conditions to be met. Once the multicast session is completed, ghostsrv is closed down as requested.

To isolate problems:

```
ghostsrv -la -ferrlog.txt -n10 c:\test123.gho TestSession
```

Starts a multicast session called TestSession and uses the file c:\test123.gho. Connecting clients IP address are displayed on screen. Once 10 clients have connected, the session transmission starts automatically and a log file errlog.txt is created for debugging. Using a log file reduces the performance of the multicast transmission.

Deploying the DOS Ghost Multicast Server

The DOS Ghost Multicast Server:

- Uses identical files to the DOS application disk described in the setup instructions in “[Setting up DOS-based multicast client and server](#)” on page 62. However, the file ghost.exe is removed and replaced by dosghsrv.exe.
- Uses the packet driver interface.
- Provides a command line user interface.
- Offers a DOS command line alternative to the Windows-based Ghost Multicast Server.
- TCP/IP configured through wattcp.cfg.

Dosghsrv.exe uses the same packet driver setup as the Ghost Multicast Client. For further information, refer to “[Setting up a a DOS packet driver](#)” on page 63.

Syntax

DOSGHSRV filename session [options]

filename specifies the path and name of image file.

session specifies the session name.

Options

- D Dumps an image of the first client to connect to the server to the image file indicated in filename.
- P Partition load or dump. If loading to clients, the partition number in the image file must be given. If dumping from a client no partition number needs to be specified.
- Ncount Starts the transmission when ‘count’ clients are connected.
- Ttime Starts the transmission at the ‘time’ specified in 24 hour format.
- Ominutes Starts transmission ‘minutes’ after last connection.
- Bsize Sets the multicast data buffer size to ‘size’MB
- Llevel Produces multicast log ‘rmllog.txt’, where level is A,I,W,S or E.

Examples

To upload a complete disk image file from a client Ghost machine:

```
dosghsrv c:\test123.gho TestSession -d
```

Starts a multicast session called TestSession and creates or overwrites the file c:\test123.gho. The first connecting client’s IP address will be displayed on screen, and the session will start automatically. The client PC indicates the drive to use for the image creation.

To upload partitions from a client Ghost machine to an image file:

```
dosghsrv c:\test123.gho TestSession -d -p
```

Starts a multicast session called TestSession and creates or overwrites the file c:\test123.gho. The first connecting client's IP address will be displayed on screen, and the session will start automatically. The client PC indicates the drive and partitions to be included in the image created.

To multicast a disk image file:

```
dosghsrv.exe c:\test123.gho TestSession
```

Starts a multicast session called TestSession and uses the file c:\test123.gho. The connecting client's IP address will be displayed on screen. To start the session transmission, press any key when all clients have connected.

To specify partition use:

```
dosghsrv c:\test123.gho TestSession -p2
```

Starts a multicast session called TestSession and uses the second partition in the file c:\test123.gho. The connecting client's IP address will be displayed on screen. Once all clients have connected, pressing any key starts the session transmission.

To specify client count autostart:

```
dosghsrv.exe -n10 c:\test123.gho TestSession
```

Starts a multicast session called TestSession and uses the file c:\test123.gho. The connecting client's IP address will be displayed on screen. The session transmission is started automatically when 10 clients have connected.

To specify time-based autostart:

```
dosghsrv c:\test123.gho TestSession -t13:30
```

Starts a multicast session called TestSession and uses the file c:\test123.gho. The connecting client's IP address will be displayed on screen. At half past one in the afternoon (1:30 p.m.) the session transmission is started automatically.

To specify time-based and client count autostart:

```
dosghsrv c:\test123.gho TestSession -t13:30 -n10
```

Starts a multicast session called TestSession and uses the file c:\test123.gho. At either half past one in the afternoon (1:30 p.m.), or after 10 clients join the session, transmission is started automatically. Dosghsrv does not wait for both conditions to be met.

To isolate problems:

```
dosghsrv.exe -la -n10 c:\test123.gho TestSession
```

Starts a multicast session called TestSession and uses the file c:\test123.gho. The connecting client's IP address will be displayed on screen. The session transmission is started automatically when 10 clients have connected. A log file rmllog.txt will be created for debugging purposes. Note that using a log file will reduce the performance of the multicast session.

Deploying the Ghost Multicast Client

When using Ghost multicasting the Ghost client application ghost.exe receives a multicast copy of an image file by joining and listening to a server's session. Alternatively, the Ghost client can upload an image file to the multicast server.

The Ghost application runs under DOS and uses a packet driver interface to the network card. The TCP/IP settings are stored in a configuration file titled wattcp.cfg that should be located in the directory where ghost.exe is run.

As with all Ghost applications, DHCP, BOOTP, and manual setting of IP addresses are supported. See [“The wattcp.cfg network configuration file”](#) on page 105 for more information on the wattcp.cfg file and IP address assignment. For further information on setting up Ghost for multicasting, see [“Preparing for Ghost multicasting”](#) on page 56.

The Ghost multicast command-line switches are listed in [“Norton Ghost command-line switches”](#) on page 79. They include:

- CLONE
- JS
- JL

The selection of the partition or drive to be written or read on the Ghost client for the multicasting session is specified on the Ghost client. Follow the online prompts or see the appropriate sections in [“Cloning disks”](#) on page 35 and [“Cloning partitions”](#) on page 41



Norton Ghost command-line switches

Ghost can be run:

- Interactively with no Ghost command-line switches
- Interactively with selected switches
- Automated in batch files (batch mode)

The Ghost command line switches are used to alter ghosts behavior and automate ghost procedures. To list switches from Ghost, type:

```
ghost.exe -h.
```

All switches apart from @ must be preceded with a hyphen (-) or a slash (/). Switches are not case sensitive. They can be entered in upper, lower or mixed case.

Command-line switches

@filename

Specifies a file containing additional ghost switches that should be read. *filename* indicates the path and file name of the ghost switch file. The ghost switch file can include any ghost command line switches, except for -afile and -dfile. The ghost command line switch file must be a text file with each switch on a new line. This feature allows the command line limit of 150 characters to be exceeded.

Example:

```
ghost.exe @ghswitch.txt
```

Example Ghost switch file contents:

```
-clone,mode=pdump,src=1:2,dst=g:\part2.gho  
-fcr  
-sure
```

-#e=filename

Stand-alone switch to bind a Ghost license environment file to Ghost. Useful when installing or upgrading Ghost to a newer version. If the filename is not given, it will default to ghost.env. The ghost environment file is created when ghost was first licensed.

-afile=filename

Overrides the default abort error log file (ghost.err) to the directory and file given in filename

-autoname

Automatically name spanned image files during creation. Avoids the user prompt asking for confirmation of the next destination location for the remainder of the image file.

-batch

Batch mode switch. Prevents abort messages waiting for user acknowledgment, and removes user interaction prompts. The return value from Ghost must be checked to identify if the operation was successful. Ghost returns 0 on success and 1 or higher on failure or error. See Example 14 of the Clone switch.

-bfc=x

Handles bad FAT clusters when writing to disk. If this switch is set, and the target partition is FAT, Ghost will try to work around bad sectors. The “x” value indicates the maximum number of bad sectors allowed to be handled by Ghost. The default value is 500. Ghost will abort when a bad sector is encountered in a non-FAT partition; after the maximum number of bad clusters is exceeded; or if the switch is not selected.

-chkimg,filename

Checks the integrity of the image file indicated by filename.

-clone

The full syntax for this switch is:

-clone,MODE={copy|load|dump|pcopy|pload|pdump},SRC={drive|file|drive:partition|@MCsessionname|@MTx},DST={drive|file|drive:partition|@MCsessionname|@MTx},SIZE{E|F|L|n={nnnnM|nnP|F|V}}

Clone operation switch. Note that no spaces are allowed in the command line. This switch allows automation of Ghost operations and has a series of arguments that define the operation parameters:

MODE={copy | load | dump | pcopy | pload | pdump}

MODE defines the type of clone command:

copy	- disk to disk copy
load	- file to disk load
dump	- disk to file dump
pcopy	- partition to partition copy
pload	- file to partition load
pdump	- partition to file dump

SRC={drive | file | drive:partition | @MCsessionname | @MTx}

SRC defines the source for the operation selected by the clone mode option:

Mode	Description of SRC option
copy/dump	Source disk number. For example, disk one is represented by SRC=1
load	The image file source location drive, path and file name or device. If using a tape drive device set to @MTx (x=0...) If multicast set to @MCsessionname
pcopy/pdump	Source partition number. 1:2 indicates the second partition on drive one
pload	Partition image filename or device and partition number. g:\images\disk1.img:2 indicates the second partition in the imagefile.

Multicasting @MCsessionname where @MC indicates multicast and sessionname indicates the session name of multicast server sending the required file image.

DST={drive | file | drive:partition | @MCsessionname | @MTx}

DST defines the destination location for the operation:

Mode	Meaning
copy/load	Destination drive. For example, disk two is represented by DST=2
dump	Disk image filename, for example g:\images\system2.img. If using a tape drive set to @MTx(x=0...)
pcopy/pload	Destination partition, e.g, 2:2 indicates the LOAD second partition on drive two.
pdump	Partition image filename e.g, g:\images\part1.img:2
Multicasting	@MCsessionname where @MC indicates multicast and sessionname indicates the session name for Multicast Server creating image file.

SZE{E | F | L | n={nnnnM | nnP | F | V}}

SZE is used to set the size of the destination partitions for either a disk load or disk copy operation.

Available Options:

E	The size of all partitions except the last partition will remain fixed. The last partition will be resized to the maximum allowed size.
F	Resizes the first partition to maximum size allowed based on file type. If additional space remains, other partition sizes will be increased.
L	Resizes the last partition to maximum size allowed based on file type. If additional space remains, other partition sizes will be increased.

n=xxxxM	Indicates that the n'th destination partition is to have a size of xxxx Mb. (e.g, SZE2=800M indicates partition two is to have 800 Mb.)
n=mmP	Indicates that the n'th destination partition is to have a size of mm percent of the target disk.
n=F	Indicates that the n'th destination partition is to remain fixed in size.
n=V	Indicates that the partition will be resized according to the following rules:

Rule 1: If the destination disk is larger than the original source disk, then the partition(s) will be expanded to have the maximum amount of space subject to the free space available and the partition type (for example, FAT16 partitions will have a maximum size of 2047Mb.)

Rule 2: If the destination disk is smaller than the original source disk, (but still large enough to accommodate the data from the source disk), the free space left over after the data space has been satisfied will be distributed between the destination partitions in proportion to the data usage in the source partitions.

Examples of switch usage

To copy drive one to drive two on a PC, without final prompt if OK to proceed:

```
ghost.exe -clone,mode=copy,src=1,dst=2 -sure
```

To connect via NetBIOS to another PC running Ghost in slave mode, and dump a disk image of local drive two to the remote file c:\drive2.gho:

```
ghost.exe -clone,mode=dump,src=2,dst=c:\drive2.gho -nbm
```

The slave Ghost can be started with `ghost.exe -nbs`

To copy the second partition of drive one on a PC to the first partition of drive two on the same PC, without the final warning prompt:

```
ghost.exe -clone,mode=pcopy,src=1:2,dst=2:1 -sure
```

To load the disk image file savedsk.gho held on the server drive mapped locally to drive E: onto drive one of the local PC without the final warning prompt.

```
ghost.exe -clone,mode=load,src=E:\savedsk.gho,dst=1 -sure
```

This example is typical of a ghost command line included in a batch file to automate workstation installations from a network file server.

To dump the second partition of drive one to an image file on a mapped network drive g:

```
ghost.exe -clone,mode=pdump,src=1:2,dst=g:\part2.gho
```

To load partition two from a two-partition image file on a mapped drive g: onto the second partition of the local disk

```
ghost -clone,mode=pload,src=g:\part2.gho:2,dst=1:2
```

To load drive two from an image file and resize the destination partitions into a 60:40 allocation

```
ghost.exe -clone,mode=load,src=g:\2prtdisk.gho,dst=2  
,size1=60P,size2=40P
```

To clone a three partition disk and keep the first partition on the destination drive the same size as on the source disk, but divide up the remaining space between the other partitions leaving no unallocated space

```
ghost.exe -clone,mode=copy,src=1,dst=2,size1=F,size2=V,size3=V
```

To load drive one from an image file and resize the first partition to 450 Mb, the second to 1599 Mb and the third to 2047 Mb.

```
ghost.exe -clone,mode=load,src=g:\3prtdisk.gho,dst=1  
,size1=450M,size2=1599M,size3=2047M
```

To load a disk from an image file and resize the last partition to its capacity. The first partition utilizes the remaining space.

```
ghost.exe -clone,mode=load,src=g:\2prtdisk.gho,  
dst=1,sizeL
```

To load drive one from an image file being sent from the multicast server with the session name "SESSIONNAME" without final prompt if OK to proceed.

```
ghost.exe -clone,src=@mcSESSIONNAME,dst=1 -sure
```

To create an image file of drive one to an image file being created by the multicast server with the session name "SESSIONNAME" without final prompt if OK to proceed.

```
ghost.exe -clone,src=1,dst=@mcSESSIONNAME -sure
```

To create an image file of drive two's partitions to an image file being created by the multicast server with the session name "SESSIONNAME".

```
ghost.exe -clone,src=2,dst=@mcSESSIONNAME
```

To load drive one from an image file sent by the multicast server:

This example loads drive one from an image file sent by the multicast server using session name SESSIONNAME and resizes the first partition to 450MB, the second to 1599MB, and the third 2047MB. This is done in a batch file with no user intervention. The batch file commands alter depending on Ghost's completion.

Batch file contents:

```
@ECHO OFF
ghost.exe
-cclone,src=@mcSESSIONNAME,dst=1,size1=450M,size2=1599,size3=2047M
-batch
IF ERRORLEVEL 1 GOTO PROBLEM
ECHO Ghost exited with value 0 indicating success.
REM ** Add any commands required to be run if Ghost
REM succeeds here**
GOTO FINISH

:PROBLEM
ECHO GHOST returned with an Error value 1 or higher.
ECHO Ghost operation was not completed successfully
REM **Add any commands required to be run if Ghost
REM fails here **

:FINISH
ECHO Batch File Finished
```

-CRC32

The -CRC32 switch allows making a list of the files on a disk or partition or in an image file with CRC values for each, and to verify that list against the original or a clone. The purpose is to allow both quick listing of the

contents of an image file and verification that a disk created by Ghost contains the same files as the original. CRC checking works file-by-file with FAT partitions. NTFS partitions are CRC checked within a dump file by each MFT table. It is not possible at present to obtain a list of files failing a CRC check with an NTFS file system. When a CRC file is created for an NTFS partition, only a single CRC value is generated. You can also create a CRC file from an image file, and verify against a disk.

The full syntax for this switch is:

```
-CRC32,action={create|verify|pcreate|pverify|  
dcreate|dverify},src={{Disk Spec}|{Part Spec}|  
{File}},{crcfile={File}|vlist={File}|vexcept=  
{File}}
```

Note that no spaces are allowed in the command line.

crcfile={File}::ASCII CRC file - default=ghost.crc

vlist={File}::Verification list file - default=ghost.ls

vexcept={File}::Verification exception file - no default

The possible actions (with descriptions) are:

create

Create an ASCII CRC file from a disk

verify

Verify a disk from a CRC file

pcreate

Create an ASCII CRC file from a partition

pverify

Verify a partition from an ASCII CRC file

dcreate

Create an ASCII CRC file from a dump file

dverify

Verify a dump file from an ASCII CRC file

Examples of -CRC32 usage

To create a CRC file (called ghost.crc) while making a dumpfile:

```
ghost.exe -fcr
```

To create a list of files and CRC values for a disk:

```
ghost.exe -CRC32,action=create,src=1,crcfile=ghost.crc
```

To verify the list against a dumpfile:

```
ghost.exe -crc32,action=dverify,src=x:dumpfile.gho,  
crcfile=ghost.crc
```

To create an ASCII CRC32 file from the primary hard drive:

```
ghost.exe -crc32,action=create
```

Note that the default disk is the primary drive, the default ASCII CRC32 file is ghost.crc.

To create an ASCII CRC32 file:

```
ghost.exe -CRC32,action=create,src=2,crcfile=myfile.txt
```

Same as previous except you specify the disk and ASCII CRC32 file. This example uses disk 2 as the source drive and the outfile myfile.txt.

To verify the contents of the primary drive against CRC32 file:

```
ghost.exe -CRC32,action=verify
```

Once again, the default disk is the primary drive and the default ASCII CRC32 file is ghost.crc (in the current directory). In addition the default verification list file is ghost.ls.

To verify the contents of the primary drive against CRC32 file:

```
ghost.exe -CRC32,action=verify,src=1,crcfile=myfile.txt,  
vlist=myfile.out
```

Same as previous but specify the disk, CRC file and list file. This example uses disk 1 as the source drive, myfile.txt as the ASCII CRC32 file and myfile.out as the verification list file.

To verify the contents of the primary drive against CRC32 file:

```
ghost.exe -CRC32,action=verify,src=1,  
crcfile=myfile.txt,vlist=myfile.out,vexcept=myfile.exc
```

Same as above with the inclusion of the EXCEPTION argument that excludes compared files based upon its entries.

VEXCEPT

The VEXCEPT argument specifies files that are not checked with CRC. This is normally used to exclude files that are always changed on boot. A sample exception file follows:

```
[ghost exclusion list]  
\PERSONAL\PHONE  
[partition:1]  
\WINDOWS\COOKIES\*. *  
\WINDOWS\HISTORY\*  
\WINDOWS\RECENT\*  
\WINDOWS\USER.DAT  
\WINDOWS\TEMPOR~1\CACHE1\*  
\WINDOWS\TEMPOR~1\CACHE2\*  
\WINDOWS\TEMPOR~1\CACHE3\*  
\WINDOWS\TEMPOR~1\CACHE4\*  
[partition:2]  
*\*.1  
[end of list]
```

The exclusion list is case-sensitive; all files should be specified in upper case. The *wildcard follows Unix rule, it is more powerful than the MS-DOS *. In particular it matches the . as well as any other character, but other characters can follow the *. Thus a wildcard of *br* will match any files containing the letters “br”, for example, brxyz.txt, abr.txt, abc.dbr.

The specification of \WINDOWS\COOKIES*. * in the example above means match all files in the subdirectory \WINDOWS\COOKIES that have an extension. To match all files with or without an extension, WINDOWS\COOKIES* should be used.

Short filenames should be used in exclusion files.

Files specified before the first [Partition:x] heading will be used to match files in any partition.

A directory of * matches any subdirectory, regardless of nesting. The above exclusion file will match any file with an extension of .1 in any subdirectory on the second partition. Apart from this, wildcards should be used for files, not for directories.

-crcignore

Ignores CRC errors. CRC errors indicate data corruption. This switch overrides the CRC error detection to allow a corrupted image file to be used. Note that using this switch will leave the corrupted files in an unknown state.

-dd

Dumps disk metrics information to the dump log file ghststat.dmp. The file location can be altered using the -dfile=filename switch.

-dfile=filename

Changes the path and filename of the dump log file created using the -dd switch. This switch can not be included in the @ ghost switch text file.

-di

Displays Diagnostics. This is useful for Technical Support purposes. For each disk present on the PC, the physical attributes such as drive, cylinders, heads, sectors per track, and total sectors are displayed. For each partition present on each disk, the number, type, physical/logical flag, starting sector and number of sectors are displayed. The diagnostics may be redirected to a file and given to Technical Support to assist with problem solving.

Example:

```
ghost.exe -di > diag.ls
```

will output disk diagnostics to the file diag.ls.

-dl=number

Specifies the highest BIOS fixed disk slot to attempt to detect. Solves problems where some Phoenix BIOS based systems may hang when Ghost attempts to detect disks or when all disks do not appear in the Ghost display. This switch may also assist when tape drives are incorrectly reported as drives. Valid values for number are 128 to 255.

-f32

Allows Ghost to convert all FAT16 volumes to FAT32 volumes when the destination partition is larger than 2047MB in size. Caution: ensure that the installed operating systems requiring access to the volumes that will be converted support FAT32.

-f64

Allows Ghost to resize FAT16 partitions to be greater than 2047MB using 64K clusters. This is only supported by Windows NT. Do not use on systems including other operating systems.

-fatlimit

Limits the size of NT FAT16 partitions to 2047MB. Useful when Windows NT OS FAT16 partitions are present on the disk, and 64K clusters are not wanted.

-fcr

Creates a CRC file (called ghost.crc) while creating an image file.

-ffi

Forces the use of direct IDE access for IDE hard disk operations. By default, direct IDE access is only used for disks greater than 1024 cylinders when Extended Int13 is not supported. This switch does not have any effect when running ghost in Windows 95/98.

-ffs

Prefer the use of Direct ASPI/SCSI disk access for SCSI hard disk operations.

-ffx

Prefer the use of Extended Interrupt 13h disk access for hard disk operations.

-finger

Displays the fingerprint details written on a hard disk drive created by Ghost. The fingerprint displays the Ghost process used to create the drive or partition and the time, date, and disk the operation was performed on.

-fnf

Disables the creation of a fingerprint when cloning hard disk drives or partitions. Similar to the functionality environment switch FPRNT=N.

-fni

Disables direct IDE Access support for IDE hard disk operations.

-fns

Disables direct ASPI/SCSI access support for SCSI hard disk operations.

-fnw

Disables writing to FAT disks or partitions. Similar to the functionality environment switch WRITE=N. This switch does not work with NTFS volumes.

-fnx

Disables Extended INT13 support during cloning and disk geometry detection.

-fro

Forces to continue cloning even if source contains bad clusters.

-fx

Flag Exit. Causes Ghost to exit to DOS after operation completion. By default, Ghost prompts the user to reboot or exit when the Ghost operation has finished. If Ghost is being run as part of a batch file it is sometimes useful to exist back to the DOS prompt after completion so that further batch commands may be processed. See -rb for rebooting on completion.

-h

Displays the Ghost switch help page.

-ia

Image All. The Image All switch forces Ghost to do a sector by sector copy of all partitions. When copying a partition from a disk to an image file or to another disk, Ghost examines the source partition and decides whether to copy just the files and directory structure, or to do an sector by sector copy. If it understands the internal format of the partition it defaults to

copying the files and directory structure. Generally this is the best option, but occasionally if a disk has been set up with special hidden security files that are in specific positions on the partition, the only way to reproduce them accurately on the target partition is via a sector-by-sector copy.

-ib

Image Boot. Copies the entire boot track including the boot sector when creating a disk image file or copying disk to disk. Use this switch when installed applications such as boot-time utilities use the boot track to store information. By default, Ghost copies only the boot sector, and does not copy the remainder boot track. You cannot perform partition to partition or partition to image functions with the -IB switch.

-id

Image Disk. Similar to -IA (Image All), but also copies the boot track, as in -ib (ImageBoot); extended partition tables; and unpartitioned space on the disk. When looking at an image made with -ID, you will see the unpartitioned space and extended partitions in the list of partitions. The -ID switch is primarily for the use of law enforcement agencies who require 'forensic' images.

When Ghost restores from a -ID image, it relocates partitions to cylinder boundaries and adjusts partition tables accordingly. Head, sector and cylinder information in partition tables is adjusted to match the geometry of the destination disk. Partitions are not resizeable, and you will need an identical or larger disk than the original to restore to.

Ghost does not wipe the destination disk when restoring from a -ID image. Geometry differences between disks may leave some tracks on the destination disk with their previous contents.

Use the -IA (Image All) switch instead of the -ID switch when copying partition to partition or partition to image. An individual partition can be restored from an image created with -ID.

-j|x=filename

Creates a multicast log file to assist diagnosing multicasting problems. The amount of information logged is set by the log level 'x'. The log level 'x' can be either E(errors), S (statistics), W (warnings), I (information) or A (all) in increasing order of logging detail. The filename indicates the path and file where the log will be created. In general, the error and statistic

levels do not effect session performance. All other levels may reduce performance and should be used for diagnostic purposes only.

-js=*n*

Sets the maximum number of router hops Ghost is allowed to cross in an attempt to find the Multicast server to *n*. (Default is 10).

-lpm

LPT master mode. This switch causes Ghost to automatically go into LPT master mode, and is the equivalent of selecting LPT Master in the Ghost menu. See Peer-to-Peer connections, Connecting via LPT in Chapter 4, “Peer-to-peer connections” on page 24, for more information.

-lps

LPT slave mode. This switch causes Ghost to automatically go into LPT slave mode, and is the equivalent of selecting LPT slave in the Ghost menu. See “Peer-to-peer connections” on page 24, for more information.

-memcheck

Activates internal memory usage checking for technical support.

-nbm

NetBIOS master mode. This switch causes Ghost to automatically go into NetBIOS master mode, and is the equivalent of selecting the NetBIOS Master option from the Connection type menu. See Peer to peer connections, Connecting via NetBIOS in Chapter 4, “Peer-to-peer NetBIOS network connections” on page 25, for more information.

-nbs

NetBIOS slave mode. This switch causes Ghost to automatically go into NetBIOS slave mode, and is the equivalent of selecting NetBIOS slave in the Ghost menu. See Connecting via NetBIOS “Peer-to-peer connections” on page 24, for more information.

-nd

Disables NetBIOS.

-nofile

Disables the Ghost image file selection dialogue box. Useful when opening directories with large numbers of files and overly slow links.

-ntc-

Disables NTFS contiguous run allocation.

-ntd

Enables NTFS internal diagnostic checking.

-ntic

Ignores the NTFS volume CHKDSK bit. Ghost checks the CHKDSK bit on a NTFS volume before ghost operations. When Ghost indicates the CHDSK bit is set, We recommend CHKDSK is run on the volume to ensure the drive is in a sound state before cloning.

-ntil

Ignores non-empty NTFS log file check (inconsistent volume).

-ntn

Inhibits the CHKDSK on first NTFS volume boot. Ghost automatically sets the CHKDSK bit on an NTFS volume to force NT to check the volume structure when it boots for the first time after cloning. This is done to demonstrate Ghost has left the volume in an integral state and to detect if an error exists in the created volume structure. We recommend that this switch is not used.

-ntx:y

Specifies Ghost's NTFS volume memory cache to be y Kb in size.

-or

Override. Allows the override of Ghost internal space and integrity checks. Use of this switch should be avoided.

-pwd and -pwd=x

Specifies password protection to be used when creating an image file.

x indicates the password for the image file. If no password is given in the switch Ghost will prompt for one.

-quiet

Quiet mode. Disables status updates and user intervention.

-rb

Reboots after finishing a load or copy. After completing a load or copy operation, the target PC must be rebooted so that the operating system can load the new disk/partition information. Normally Ghost prompts the user to reboot or exit. -rb tells Ghost to automatically reboot after completing the clone, and is useful when automating Ghost in a batch command file. See also -fx switch.

-skip=x

Skip file. Causes Ghost to exclude the indicated files during a ghost operation. A skip entry can specify a single file, directory, or multiple files using the *wildcard. File names must be given in short file name format and all path names are absolute. Only FAT system files are able to be skipped. It is not possible to skip files on NTFS or other file systems. The skip switch may only be included in the Ghost command line once. To specify multiple skip entries, they must be included in a text file indicated using -skip=@skipfile. The format of the skip text file 'skipfile' matches the format used with the CRC vexcept option.

Examples:

-skip=\windows\user.dll

Skips the file user.dll in the windows directory

-skip=*\readme.txt

Skips any file called readme.txt in any directory.

-skip=\ghost*.dll

Skips any file ending with .dll in the ghost directory

-skip=\progra~1

Skips the whole program files directory (note the short file name).

-skip=@skipfile.txt

Skips files as outlined in the skipfile.txt file. For example, the skipfile.txt contains:

```
*\*.tmt  
[partition:1]  
\windows\  
*\*.exe  
[Partition:2]  
*\*me.txt
```

This would skip all *.tmt files on any partition, the windows directory and any *.exe files on the first partition, and any file that ended with the me.txt on the second partition

-sleep=x

Slows ghost operation. The greater the x value, the slower ghost will operate.

-span

Enables spanning of image files across volumes.

-split=x

Splits image file into “x” Mb spans. Use this to create a forced size volume set. For example, if you would like to force smaller image files from a 1024 Megabyte drive, you could specify 200 megabyte segments. For example,
ghost.exe -split=200

will divide the image into 200 Megabyte segments.

-sure

Use the -sure switch in conjunction with -clone to avoid being prompted with the final ‘Proceed with disk clone- destination drive will be overwritten?’ This command is useful in batch mode.

-tapebuffered

Default tape mode. Sets the ASPI driver to report a read/write as successful as soon as the data has been transferred to it. Useful when using older or unreliable tape devices or sequential media.

-tapeject

Forces Ghost to eject the tape following a tape operation. Earlier versions ejected the tape by default. By default Ghost does not eject the tape and rewinds the tape before exiting to DOS.

-tapesafe

Sets the ASPI driver to report a read/write as successful only when the data has been transferred to the physical medium. Useful when using older or unreliable tape devices or sequential media.

-tapespeed=x

Allows control of tape speed. Where x equals 0 to F. 0 is default, 1-F increase speeds. Only use this when the tape does not work correctly at the speed used by Ghost.

-tapeunbuffered

Sets the ASPI driver to report a read/write as successful only when the data has been transferred to the tape drive. (It is possible that this occurs before the data is actually physically written to the medium.)

-vdw

If this switch is set, Ghost will use the disk's verify command to check every sector on the disk before it is written. The action Ghost takes if a sector fails the verify, depends on the -bfc switch.

-ver and -ver=n

Displays the version number of Ghost running. If a version number n is specified, ghost will check the running version and abort if the specified version number is greater than the running version.

-wd-

Disables disk caching on destination disk.

-ws-

Disables disk caching on source disk.

-z

Compress when dumping a disk or partition to an image file.

- -z or -z1 low compression (Fast)
- -z2 high compression (Medium)
- -z3 thru -z9 higher compression (Slower)

Norton Ghost multicast server command-line switches

The switch references covered in this Appendix are:

- Windows Ghost Multicast Server command line options
- DOS Ghost Multicast Server command line options.

Windows Ghost multicast server command-line switches

The command line syntax is as follows:

```
ghostsrv filename session [options]
```

where:

filename Path and filename of disk image file

session Session name to use

and options:

- Ncount Starts the multicast transmission after count clients have joined the session
- Ttime Starts sending to session automatically after specified time (24 hour hh:mm format)
- Ominutes Starts transmission 'minutes' after last connection.
- Llevel Creates log file with log level specified (E,S,W,I, or A)

-Ffilename	Specifies log file for the -L option.(by default ghostlog.txt)
-C	Closes ghostsrv application after multicast session completion
-D	Uses dump from client mode (load to client is default)
-Bn	Sets the multicast data buffer size to n MB
-R	Restarts the multicast session on completion.
-P	Specifies partition mode operation. If loading to clients, the partition number must be given. If dumping from client no partition number is required.

DOS Ghost multicast server command-line switches

The command line syntax is:

DOSGHSRV filename session [options]

Where:

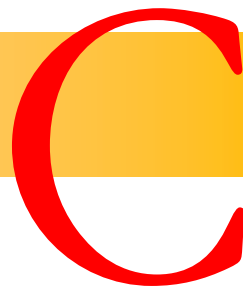
filename Specifies the path and name of image file.

session Specifies the session name.

valid options:

-D	Dumps an image of the first client to connect to the server to the image file indicated in filename.
-P	Partition load or dump. If loading to clients, the partition number in the image file must be given. If dumping from a client no partition number needs to be specified.
-Ncount	Starts the transmission when 'count' clients are connected.
-Ttime	Starts the transmission at the 'time' specified in 24 hour format.
-Ominutes	Starts transmission 'minutes' after last connection.
-Bsize	Sets the multicast data buffer size to 'size'MB

-L level Produces multicast log 'rmllog.txt', where level is A,I,W,S or E.



Upgrading Windows 95 winsock to version 2

The Windows Ghost Multicast Server, `ghostsrv.exe`, uses Winsock 2 to provide the multicasting features in Windows95, Windows98, and Windows NT.

Winsock 2 is included in the distribution of Windows NT4 and Windows 98.

There are no additional installation steps required to install `ghostsrv.exe` in Windows 98 and Windows NT4. However, to run the Ghost Multicast server, `ghostsrv.exe` on a Windows95 machine, the following steps are required:

- 1 You can acquire the Microsoft Windows 95 Winsock2 update by pointing your Web browser to:
<http://www.microsoft.com/windows/downloads/contents/Updates/W95Sockets2/>
- 2 Make sure you read the associated documentation and text files.
- 3 Run the update names `ws2setup.exe`.
- 4 Reboot the Windows95 machine.

The update copies several files into the Windows directories, and updates the networking stack to Winsock2 as detailed in the documentation.

Caution: If you are running Windows NT or Windows98, DO NOT install the Windows 95 Winsock 2 update `ws2setup.exe`. Winsock2 is built into Windows98 and Windows NT version 4 and is not available for earlier versions of Windows NT.

The wattcp.cfg network configuration file

The wattcp.cfg configuration file contains the TCP/IP networking configuration details for Ghost and dosghsrv running in DOS. The wattcp.cfg file is not required for the Windows-based Ghost Multicast server ghostsrv.exe.

The wattcp file:

- specifies the IP address of the machine
- specifies the subnet mask
- allows the setting of other optional network parameters
- should be located in the same directory where ghost.exe is started unless otherwise configured.

Comments in the file start with a semicolon (;). Options are set using the format: option = value. For example:

```
receive_mode=5;set receive mode
```

The keywords in the wattcp.cfg configuration file are the following:

IP

Specifies the IP address of the local machine. Each machine must have a unique IP address. Ghost supports the use of DHCP and BOOTP servers and defaults to using them when the IP address is left blank or is invalid. DHCP and BOOTP provide automatic assignment of IP addresses to machines. This allows identical boot disks to be used on machines with similar network cards.

Netmask

Specifies the network IP subnet mask.

Bootpto (optional)

overrides the time-out value (in seconds) for BOOTP/DHCP.

Gateway (optional)

Specifies the IP address of the Gateway. This option is required when routers are present on the network and when participating PC's are located on different subnets.

Receive_Mode (optional)

Overrides the automatically configured packet driver mode used by Ghost. The modes, in order of preference are 4, 5, and 6.

Some packet drivers misrepresent their abilities in receiving multicast information from the network and allow the use of packet receive modes that they do not correctly support. Ideally, the packet driver should be set to mode 4 so that it only accepts the multicast packets required. If the packet driver does not support this mode, mode 5 can be used to collect all multicast packets. The final option, mode 6, configures the packet driver to provide all packets being sent on the network.

Frequently asked questions

When I compare the contents of the original source disk to the disk ghost created there is a difference in the number of files. Why?

In addition to files skipped using the -skip switch, some temporary files are not included when cloning a FAT volume. These include SWAPPER.DAT, WIN386.SWP, SPART.PAR, PAGEFILE.SYS, HYBERN8, 386SPART.PAR, GHOST.DTA, and DOS DATA SF.

Can I run Ghost inside Windows 95/98, Windows NT, or OS/2?

It is best to run Ghost in DOS mode only. Ghost should not be run in Windows NT or OS/2. Ghost will run in a DOS box of Windows 95/98 but caution should be observed. When the operating system is running there may be files open or in a changing state which if cloned will result in the destination being in an unknown state. In addition, if you overwrite partitions, the system must be restarted before using them.

If I shouldn't run Ghost inside the Operating System, how should I launch Ghost?

It is best to execute Ghost at the true DOS level, not a DOS window inside the O.S. Hitting F8 at Starting Windows 95... works well or you can create a floppy boot disk and then launch GHOST

I know I should launch Ghost outside the OS, but then I don't have access to the Network, JAZ, ZIP or CD-ROM drive for saving and loading disk images. How do I work around this?

Create a bootable disk with the DOS-based drivers or network stack required for access to these devices.

Can Ghost compress an image file?

Yes. Ghost includes several levels of compression offering a range of performance and storage gains.

Does Ghost support writing and reading image files directly to a SCSI tape drive?

Versions 3.2 and greater support writing and reading directly to SCSI tape devices

I'm using Ghost to save an image file up to a server using a network client boot disk as suggested. I'm running TCP/IP. Ghost takes a long time to save and load an image to and from the server. Why?

Ghost rides the network layer or stack created. Not all stacks work the same as the next. Ghost only goes as fast as the network layer that you've created. The stack may work well normally, saving files normally. Ghost will really ride the stack aggressively. Try experimenting with different clients. In addition, there are several settings which can effect network performance. MS network client 3.0 TCP settings can be altered in the protocol.ini settings. Try adjusting the tcpwindow size and tcpconnections values to improve performance.

Does Ghost support all networking protocols?

For Ghost to access files on a file server, DOS network client software is required. Ghost will be able to access the network volume if the a drive letter is available. The protocols supported depend on the DOS network client software. The network client software will map a drive letter to the network file server volume. In addition, Ghost supports peer to peer communications using NetBIOS. Ghost Multicasting uses Internet protocol suite known as TCP/IP. This is able to be run in conjunction with other protocols running on the network.

After cloning and restarting Windows95. Windows95 keeps finding a new NIC card. The NIC card is the same as on my model machine. Why?

Plug and Play, at times will see and find devices twice or more. To avoid this, remove the device and all the protocols from the model BEFORE saving the image or cloning. After cloning, restart, Windows95 will detect the card for the first time, and request the drivers. These drivers can be saved in the image file for easy access after cloning.

Does Ghost support Macintosh?

No.

If I accidentally specify the wrong destination drive, is there any way to restore the original contents?

No. Ghost completely overwrites the target hard disk or partition. Be careful when selecting the destination and ensure the operation you have selected is correct when Ghost asks if you are sure you want to proceed.

Does Ghost support spanning multiple JAZ or ZIP drives?

Yes.

Can I use Windows NT 4.0 Client Administrator to create a multicast boot disk?

No. A TCP/IP boot disk created using the NT 4.0 Client Administrator is NOT compatible with Ghost Multicasting. Ghost includes its own internal TCP/IP stack which cannot be run while another TCP/IP stack is loaded. Steps required to make a Multicast Boot Disk are included in "Setting up DOS-based multicast client and server" on page 62.

Why does Ghost need a packet driver for Ghost Multicasting?

Ghost's internal TCP/IP stack uses a packet driver to communicate to the network card. The multicast documentation outlines two methods for installing a packet driver interface so Ghost multicasting can be used.

Which packet driver setup option is best to use with Ghost Multicasting?

The two documented options are:

- 1 NDIS drivers with a packet driver shim.
- 2 Network card dependent packet driver.

Option 1: Network card dependent packet drivers

Network card dependent packet drivers require less effort to set up. They are not always supplied with some network cards. Some older packet drivers are not completely compatible with multicasting and may require additional configuration to work correctly.

Option 2: NDIS drivers and a packet Driver Shim

NDIS drivers are included with network cards more often than packet drivers. The setup of a NDIS boot disk currently requires more steps to be carried out.

What is a Packet Driver Shim and why do I need it?

There are several types of drivers available for network cards. These include the Microsoft/3Com defined NDIS drivers, Novell ODI drivers, and Packet Drivers as well as several others. A Packet Driver shim allows the user to use a non-packet driver to provide access to the network interface cards services and

uses this driver to give Ghost Multicasting and other applications a packet driver interface to communicate to.

The Multicasting option is grayed out in Ghost. Why can't I use Ghost Multicasting?

The Multicasting option is not available if there is no packet driver interface setup on the computer Ghost is running on. Alternatively, the option is disabled when the version of Ghost being used, or the license of Ghost, does not include Ghost Multicasting as an available feature.

To enable Ghost Multicasting, set up the System to have a packet driver interface installed as described in "Setting up DOS-based multicast client and server" on page 62.

I have set up the packet driver for my Network Interface Card (NIC) and Ghost is unable to contact or connect to the Ghost Multicast Server. What do I do next?

Use the following procedure:

- 1 Ensure you are using the latest version of the Ghost Multicast Client and Ghost Multicast Server. Check that they are both the same version.
- 2 Check that all NIC's and cables are correctly connected.
- 3 Check that the NIC has been set up correctly using the setup program included with the NIC.
- 4 Check the setup of the driver. Read the documentation for the driver you are using, and note if there are any special options needed to be used for your network setup.
- 5 Check the wattcp.cfg file and DHCP/BOOTP Settings. Check all TCP/IP configuration settings. Ensure both the server and client have valid IP addresses and are on the same subnet with the correct subnet mask. If routers are present between the client and server, ensure the gateway is set up on the local subnet and is specified in the wattcp.cfg file or the BOOTP/DHCP response.
- 6 If you are running the Ghost Multicast Server on Windows95 and you have not already installed the Winsock 2 update, then do so now.
- 7 Start the Ghost Multicast Server and set up the session name and file name for the multicast session. Press accept clients.
- 8 Start the Ghost Multicast Client and attempt to contact the multicast session. Check the session names are identical.

- 9 If this fails, retest with an alternative receive mode of the Packet Driver. Add the line `RECEIVE_MODE=x` in the `wattcp.cfg` file. (where `x` can be 4, 5 or 6. 4 is default.) See “The `wattcp.cfg` network configuration file” on page 105 for more information.
- 10 Try an alternative packet driver setup for the NIC. For example, if you are trying to use the NIC’s packet driver, then set up the NDIS 2.0.1 DOS driver and the Ghost supplied NDIS Packet Driver shim.
- 11 Start the Ghost Multicast server and Ghost Multicast client with full multicast logging (ALL logging setting). For details on how to do this, see “Diagnostics” on page 117. Multicast Logs will assist technical support in further diagnosing the problem.

Troubleshooting

Browse through the “Frequently asked questions” on page 107 for answers to commonly asked questions. If an error code is reported, find its meaning and possible resolution in the following table.

Ghost error codes

A Ghost error message consists of an error number, a description, and possibly a suggestion of what can be done to remedy the problem.

Below is a list of the more common errors that Ghost versions 5.1c and above may report. Make sure you are running the latest version as many errors have been fixed through Ghost revisions

Refer to the Diagnostics appendix for information on the ghost.err file generated when an abort error occurs.

Further information is included on Symantec’s Norton Ghost technical support website.

8005, 8012

Ghost is being run in a non-DOS environment. Either boot the system to DOS or create a DOS boot disk with required device drivers to start the system and run Ghost.

8006, 8007, 8008

The trial period of the evaluation has expired. Visit the Symantec website at <http://www.symantec.com> for details on how to purchase Ghost.

10002

The trial version of Ghost is unable to be registered. To register Ghost, source a non-trial version and apply your license details as described in the getting started section and the versions release notes.

10003, 10009, 10012, 10016, 10018, 10030

Ghost was unable to communicate with the Ghost Multicast Server. Check that the multicast session name is correct. Also review the “Frequently asked questions” on page 107.

10098, 12412

The partition number must be included in the command line switches. See “Norton Ghost command-line switches” on page 79 for further information.

11010, 10013, 10014, 10016, 10017, 10019, 10032, 10041, 10042, 11000

Incorrect path/file syntax. Ensure path and filename are correct and complete. Also make sure you have the proper user rights to read or create the image file on the network.

14030

An unregistered version of Ghost has encountered a file with a date beyond its expiration date. Scan your system for files beyond this date and temporarily remove them from the system to allow Ghost to continue. You can locate the offender by looking at the drive:\path\filename at the bottom of the Ghost window when this error occurs. Visit the Symantec website at www.symantec.com for details on how to purchase Ghost.

15150

Probable corrupt image file. Run the check image file integrity... option from the Local/Server menu.

15170

Due to an unformatted or invalid partition on the source hard drive. Make certain the source drive is completely allocated as Ghost looks for 100% viable media.

19900, 19901

The multicast session is incorrectly setup. Check that the TCP/IP settings are correct. See the “Frequently asked questions” on page 107 for more information.

CDR101: Not ready reading drive X, Abort, Retry, Fail

A system error message. This error is not caused by Ghost. It is caused by malfunctioning hardware or software configurations. The image file on the CD is not readable. To verify this, try going into DOS and copying the image file off the CD-ROM using copy verification.

Diagnostics

This appendix contains information that may be helpful for diagnostic purposes.

Ghost hard drive detection and diagnostic information

Ghost has the ability to generate several different diagnostic reports outlining the hard drive devices detected, other system related information, and error conditions when they are detected.

Ghost abort error file (ghost.err)

An error message consists of an error number, a description, and possibly a suggestion of what can be done to remedy the problem.

The Ghost abort error file includes these details along with additional drive diagnostics and details required to assist technical support diagnosing the cause of the problem.

The Ghost abort error file is generated when an erroneous condition is detected by the software which Ghost is unable to recover from or work around. In version 5.1c and above, the ghost.err file is generated in the directory where the ghost executable resides. If this location is read only, the ghost.err file output location should be redirected. The location and file name of the Ghost abort file generated by Ghost during an abort can be altered using the -afile=drive:\path\filename command line switch.

Refer to the Troubleshooting appendix for suggestions on Ghost troubleshooting when you experience an Ghost abort message.

Hard disk geometry diagnostics

A list of all hard drives Ghost has detected on the system and their associated geometry values can be reported to screen using the Ghost command line switch -di. To generate a file containing the details, the DOS redirect output can be used as shown in the following example:

```
c:\ > ghost -di > drives.txt
```

Full Ghost diagnostic statistics dump summary

A full Ghost diagnostic statistics dump summary file contains the detected hard disk geometry details along with other Ghost statistics. The full Ghost Diagnostic statistics dump can be created using the Ghost command line switch -dd. The location and file name of file generated by Ghost can be altered by adding the -dfile=drive:\path\filename command line switch.

Elementary network testing techniques

TCP/IP

There are several basic testing utilities available in Microsoft's TCP/IP application suite. An example of two Windows 95 TCP/IP utilities, **ping.exe** and **winipcfg.exe** is included below. On Windows NT, the equivalent utilities are **ping.exe** and **ipconfig.exe**.

The ping utility shows computer reply and can be used to show connectivity between computers. For a mapped network volume connection, a client can ping the server and vice versa to check that they are contactable. For multicast connections, Ghost clients will only respond to a ping request sent from another computer when they are in multicast mode. Ping local host shows basic local TCP/IP functionality. The address used in the following example is a special address which identifies the local host on the network.

Note: ping utilities do not indicate multicast packets are able to traverse between two points on a network. For example, a ping test may indicate successful TCP/IP operation between two machine on differing subnets, while multicast packets may not be able to cross the non-multicast enabled router which separates the subnets.

Pinging a local host

In a Windows DOS prompt dialogue box on a Windows 95 machine with a computer name Win95PC1 the follow command was entered:

```
c:\> ping LocalHost
Pinging Win95PC1 [127.0.0.1] with 32 bytes of data:
Reply from 127.0.0.1: bytes=32 time<10ms TTL=128
Reply from 127.0.0.1: bytes=32 time<10ms TTL=128
Reply from 127.0.0.1: bytes=32 time<10ms TTL=128
Reply from 127.0.0.1: bytes=32 time<10ms TTL=128
```

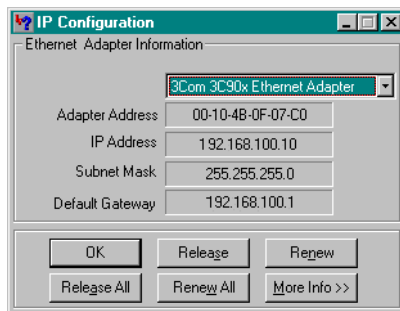
This test indicates that the TCP/IP stack is installed and is operating.

Pinging a Ghost multicast client

On the Ghost Multicast Server's computer a Windows 95 DOS prompt dialog box is run with the following session run:

```
C:\> Ping 192.168.100.3
Pinging [192.168.100.3] with 32 bytes of data:
Reply from 192.168.100.3: bytes=32 time<10ms TTL=128
Reply from 192.168.100.3: bytes=32 time<20ms TTL=128
Reply from 192.168.100.3: bytes=32 time<20ms TTL=128
Reply from 192.168.100.3: bytes=32 time<20ms TTL=128
C:\>winipcfg
```

The first command indicated the Ghost client using the IP address 192.168.100.3 received the ping request and replied back. This indicates basic TCP/IP operation between the two machines. This does not indicate multicast packets can traverse between the two machines. Winipcfg then verifies the Windows 95 PC's IP Configuration Parameters to be as follows:



Multicasting diagnostic logging options

Generating a Ghost multicast log file

A Ghost Multicast log file can be generated for Technical Support diagnostic purposes. It should be noted that logging can slow down the Multicasting process and should be used to assist in diagnosing problems noted during normal use.

The diagnostic levels in order of increasing detail are:

- **Error** reports any unrecoverable error that occurs during the multicast session. Use of this level should not effect session performance.
- **Statistics** reports all errors and additional statistic information on completion of the session. Use of this level should not effect session performance.
- **Warning** reports all statistic level details and includes any addition warning messages. Use of this level may effect session performance.
- **Information** includes all warning level details and adds additional diagnostic information. Using this level will reduce the multicast session performance
- **All** includes all logging messages and will reduce the multicast session performance.

Logging in the Windows Ghost multicast server

There are four steps to generate a log file:

- 1 Select the Options item from the File menu.
- 2 Select the desired logging level for the log file.
- 3 Enter the log file location and name.
- 4 Use Multicast server application: logging options are engaged.

Step 1 - Select the Options item in the File menu

The Options dialogue is accessible through the File menu.

Step 2 - Select the logging level for the log file

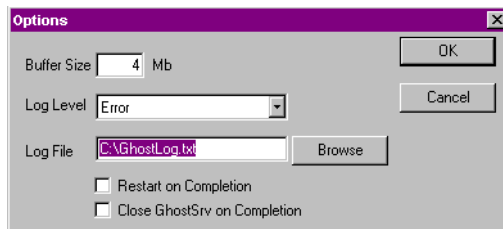
The Ghost Multicast log file allows various levels of diagnostic information to be provided. Selection of the logging level is completed through the log level combo box. The diagnostic levels in order of increasing detail are:

- Error
- Statistical
- Warning
- Information
- All

Step 3 - Enter the log file location and name

Specify a filename and path where the log file should be generated in the Log File box. The Browse button can be used to assist in finding a location for the file. A sample screen is shown in Figure 5:

Figure G-5



Step 4 - Use Multicast server as required

The Ghost Multicast server can be used for normal operation and the log file inspected upon completion.

Logging in the DOS Ghost Multicast Server

There are two steps to generate a log file while using dosghsrv:

- 1 Use the Command line switch to activate logging.
- 2 Use the Multicast server application.

Step 1 - Use the command line switch to activate logging

To activate Ghost Multicast logging, add the logging switch **-Lloglevel** where **loglevel** specifies the diagnostic reporting level and can be any of the following, E, S, W, I, or A.

Step 2 - Use the Multicast Server Application

Use other command line options as required.

Example:

```
dosghsrv.exe c:\test123.gho TestSession -la -n10
```

starts a Ghost Multicasting session called TestSession and uses the file c:\test123.gho. The connecting client's IP address will be displayed on screen. The session transmission is started automatically when 10 clients have connected. A log file **rmllog.txt** will be created for debugging purposes. Please note that using a log file will reduce the performance of the Ghost Multicast transmission.

Logging in the Ghost Multicast Client

There are two steps to generate a multicast log file in Ghost:

- 1 Use the Command line switch to activate logging.
- 2 Use the Multicast Ghost application as normal.

Step 1 - Use the command line switch to activate logging

To activate Ghost Multicast logging, add the logging switch **-Lloglevel** where **loglevel** specifies the diagnostic reporting level and can be any of the following, E, S, W, I, or A.

To activate Ghost Multicasting diagnostic logging on Ghost, add the multicast logging command line switch when starting Ghost.

```
ghost.exe -jl:x=d:\filename
```

The log file location specified should be a location to a drive other than the one being written to by Ghost with sufficient space to create the file.

For example, to create a statistic level Ghost Multicast log file d:\logs\client.log while using Ghost Multicasting in interactive mode:

```
ghost.exe -jl:E=d:\logs\multi.log
```

Step 2 - Use the Multicast Client Application

The ghost application can be used as normal. On completion, the log will be written to the location specified.

Customizing Norton Ghost functionality

Functionality options

Ghost includes the ability for the licensed user to tailor Ghost's functionality provided to the end user. In some situations, the holder of a Ghost license may want to provide editions of the Ghost executable that has some features disabled to users within their licensing scheme.

To limit the functionality provided in Ghost, the Ghost license environment file is required. The Ghost environment file includes:

- the licensed user's details
- the maximum number of licensed concurrent users
- additional product licensing information
- functionality switches.

The Ghost executable is configured with the environment file to allow it to be used as detailed in the Getting Started chapter.

The optional switches parameter line in the environment file is the only line that should be altered. Each feature apart from **IMGTMO** can be activated with switchname=y or deactivated switchname=n in the bound executable.

The following switches are available:

LOAD

Load disk or partition from image file actions

DUMP

Dump disk or partition to image file actions

WRITE

Stops Ghost from actually writing to destination partition or disk

DISK

Disk-to-disk and partition-to-partition actions

PEER

LPT, NetBIOS and Multicasting options

FPRNT

Creation of fingerprint. A fingerprint is a hidden mark on a cloned drive or partition that details the following:

- the Ghost process used to create the drive or partition
- the time the operation was performed
- the date the operation was performed
- the disk number

IMGTMO

Image Time-out Value. Sets the maximum age of an image file in days.

TIMEOUT

Disables Ghost until a valid license is reapplied to it.

Examples

To enable image file restoration only:

A company may have 100 laptops in use by their sales staff, with the IT System Administrator controlling the organization and maintenance of these laptops. Each of these laptops in use could include a copy of Ghost and model image file burnt in on a CD-ROM for fast system restoration by the users. The System Administrator can configure the Ghost edition that is burnt onto the CD-ROM to enable only image file restoration, thus

removing the possibility of the end users attempting to use the other functions of Ghost.

The Administrator's version of Ghost has all options available after binding, using the original environment file, and the CD-ROM Ghost version is bound with:

```
KeyNum      : 12345
License     : BM-512
MaxUsers    : 10
Name        : ABC Inc
Address1    : 200 John Wayne Blvd.
Address2    : Irvine, CA 1024
Switches    : load=y,dump=n,disk=n,peer=n
```

To use Ghost as a backup tool:

Ghost can be used as a backup tool. In this case, it may be advisable to disable the load option so that image file creation procedures can be carried out, without the possibility of users accidentally overwriting their local drive. Restoration would require the availability of another executable, or used in conjunction with Ghost-Explorer.

Switches: load=n,dump=y,disk=n,peer=n

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CompuServe	Type GO SYMANTEC to access the Symantec forum.
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Automated fax retrieval system	To receive general product information, fact sheets and product upgrade order forms directly to your fax machine, please call our Customer Service fax retrieval system at (800) 554-4403 or (541) 984-2490. For technical application notes, please call our Technical Support fax retrieval system at (541) 984-2490 and select option 2.
StandardCare Support	If you can't access the Internet, take advantage of your 90 days of free telephone technical support (from the date of your first call) at no charge to all registered users of Symantec software. Please see the back of this manual for the support telephone number for your product.

**PriorityCare and
PlatinumCare
Support**

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Norton Ghost™

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Name

Company Name

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City State Zip/Postal Code

Country* Daytime Phone

Software Purchase Date

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