Installing a Second Operating System

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Overview

This document outlines the key concepts and steps necessary to install a second operating system (OS) on a computer with one or more operating systems in place, without compromising the existing operating systems. The information in this document requires a basic knowledge of partitioning, file systems, and OS installation.

Key Terms and Information

This document begins with a simple review of key topics in hard disk partitioning and OS installation. Most installation procedures have the following requirements in common:

- A primary FAT16 or FAT32 partition located within the first 1024 cylinders of the hard disk (usually the first 2 GB).

  FAT is an acronym for File Allocation Table; a file allocation table is a table the OS uses to locate files on a hard disk or floppy.

- A boot disk and access to the installation media (this may be a local CD-ROM, in which case appropriate CD-ROM drivers must be on the boot disk, or a network drive where the OS installation files have been copied).

- An active partition on the first physical hard disk (Although this requirement is not always necessary, this document will not detail the process to install Windows NT or OS2 on a logical partition.)

  A primary partition is referenced in the Master Boot Record partition table and is normally used to contain operating systems and their associated application files. One primary partition on a drive is active at a time. Any others are typically hidden and inaccessible to prevent data corruption between operating systems; the Extended Partition is an exception to this rule. Modern hard disks are limited to four primary partitions; one of these primary partitions may be an extended partition, which can contain any number of logical partitions.

There are exceptions to these requirements. For example, when installing Linux, we recommend installing it to a logical partition on the first or second hard disk. Windows NT and Windows 2000 may also be installed to a logical partition as long as the Windows boot files are located in a primary partition on the first physical hard disk.

Operating Systems and File Systems

An OS performs basic tasks on your computer, acting as an interface between the hardware and software on the system. Its primary purpose is to support the programs that perform tasks on your computer, such as word processing, e-mail, and database management. The OS is the software that controls the allocation and usage of hardware resources such as memory, central processing unit (CPU) time, disk space, and peripheral devices. The OS is the foundation on which applications are built, and provides a software platform on top of which other programs can run. Every computer must have an OS to function, even if it is simply the boot files from DOS or Windows 98. Different operating systems will use different file systems to access the storage media and keep track of the locations in which data has been stored; the file system is the way the OS organizes and accesses the files on a disk.

A file system is defined as the methods and data structures used by an OS to keep track of the locations of files on a partition. The file systems covered here are FAT, FAT32, HPFS, NTFS, and Linux Ext2.

FAT16

The FAT16 file system is the system used by MS-DOS to organize and manage files. The FAT (file allocation table) is a data structure that MS-DOS creates on the disk when the disk is formatted. FAT16 partitions can be up to 2 GB in size; the size of the partition determines the size of the cluster in which data is stored and can result in a large amount of wasted space in partitions more than 1 GB in size. FAT16 partitions are used by most versions of DOS and Windows 95; they are supported by: Windows 95, Windows 98, Windows NT, Windows 2000, DOS (including MS-DOS, PC-DOS and DR-DOS), OS/2, Linux, and many other operating systems.

FAT32

FAT32 is a file system extension developed by Microsoft for Windows 95 version B (OSR2). It provides the ability to manage 32-bit cluster addresses and can support partitions up to 8 GB with only a 4 K cluster size. Partitions up to 16 GB in size can be maintained with an 8 K cluster size, greatly reducing the wasted space that can be a result of inefficient cluster usage (such as that used by the FAT12 file system). FAT32 partitions are used only by Windows 95B or later, Windows 98, Windows 2000, Windows Me, and newer versions of Linux.

HPFS

(High Performance File System) HPFS is the file system for OS/2 versions 1.2 and later. It is designed to access the hard disk faster than the FAT system and in a less wasteful manner. HPFS allocates data in sectors, avoiding the waste caused by inefficient cluster usage. HPFS partitions are used only by OS/2 and some implementations of Windows NT 3.51.

NTFS

(New Technology File System) NTFS was developed by Microsoft for use specifically with Windows NT and supports the enhanced security available through that OS. NTFS supports full security access control, file system recovery, and extremely large storage media. NTFS partitions are used only by Windows NT (Workstation and Server), and Windows 2000.

Ext2

The Ext2 file system is the default system for Linux. Linux Ext2 partitions are used only by Linux installations.

Managing Multiple Operating Systems

You can manage multiple operating systems in several different ways:

- By a boot management program, such as BootMagic by PowerQuest or Boot Manager from IBM

- With a dual-boot configuration managed by an OS, such as Windows NT's boot loader or LILO in Linux

- Manually by setting an OS "active" either through a utility such as PQBoot or by manually editing the master boot record.

This document focuses on using a boot management program or utility to switch between operating systems and will not cover the use of operating system utilities or procedures necessary to manually edit the boot record to change the active partition.

BootMagic is a PowerQuest application (included with the retail version of PartitionMagic) you can use to manage multiple operating systems on a single computer. After BootMagic is installed, each time the computer is started or rebooted, BootMagic presents a list of operating systems, allowing you to select the OS to which you wish the computer to boot.

BootMagic operates by replacing the system's master boot record (MBR) with its own custom master boot record, retaining all the current partition table information on the computer's existing operating systems. BootMagic also creates and saves a backup copy of the original MBR, should you wish to uninstall or disable BootMagic.

BootMagic may be installed any time after the first OS has been installed on your computer. After a new OS is added, the BootMagic configuration program allows you to easily add the new OS to the BootMagic menu so it will be presented as an available OS next time you reboot the computer. BootMagic must be installed in a FAT16 or FAT32 partition

Boot Manager is a utility developed by IBM. (Boot Manager was available with older versions of PartitionMagic and IBM's operating system, OS/2.) It also provides a menu of available operating systems each time the computer is rebooted, but it manages multiple operating systems from a small, dedicated primary partition. After an available operating system's partition is selected, Boot Manager activates that partition and boots to the OS.

PQBoot is a command-line utility that presents you with a list of the primary partitions on the first physical hard disk and allows you to choose which one to set active. After a partition is chosen, PQBoot reboots the computer, allowing that OS to load. PQBoot is a useful utility for users who only wish to change operating systems occasionally (not at every system reboot).

Installing a Second Operating System

The installation of a second OS consists of three main steps:

1 Preparing the system for the new OS

2 Setting the new partition Active and rebooting the computer

3 Installing the OS

These steps are detailed below.

Preparing the System

Preparing your system for a second OS consists of creating a new partition and preparing that partition for use as a host to the new OS. Most operating systems require a primary partition within 2 GB or the first 1024 cylinders of the hard disk. This range can be different on various machines, partially depending on the computer's BIOS. To ensure compatibility with the majority of systems, we recommend you create a second primary partition within the first 2 GB of the primary hard disk.

Computers that come with the OS and utilities installed do not usually include an empty primary partition—or even unallocated space from which to create a new primary partition. Therefore, you must resize or delete existing partitions to free up the necessary space. A step-by-step description for accomplishing this is beyond the scope of this document; however the PartitionMagic user guide contains several examples of scenarios for resizing partitions with an existing OS or data.

After you have sufficient unallocated space, use PartitionMagic to create the required partition for the OS you wish to install. Some operating systems require a partition type not supported by PartitionMagic. For those, you will need to consult your OS documentation and use that operating system's partitioning utility (such as FDISK) to create and format a partition from the unallocated space.

When you have created the new partition, add it to your boot management utility's boot menu. Keep in mind, however, that if you choose to boot to this partition before the new OS has been installed, you will need to have a bootable diskette in the floppy drive, otherwise the computer system will not boot. If you are using BootMagic, before you begin to install your new OS, make certain you have a BootMagic rescue disk available. When installing Windows 95, Windows 98, or Windows 2000, the OS will disable BootMagic, and you must boot to the rescue disk to re-enable BootMagic. (Note: if you want to install Windows NT to an NTFS partition, first create a FAT partition. Then during the install of Windows NT, use the installation process to convert the file system to NTFS.)

Preparing the system also includes obtaining the necessary media for installing the new OS. Typically, this will be one or more floppy diskettes and/or a CD. Windows NT 4, for example, has three installation diskettes that analyze the computer system and load the necessary drivers for accessing peripheral devices such as the CD-ROM and hard disks; once you have followed the on-screen prompts with the diskettes, Windows NT installs the remaining OS files from the CD. If you are installing an OS over a network, you must create a network boot disk and map a drive letter to the source files. See your system administrator for details or questions concerning this process.

To summarize:

1 Resize/move existing partitions on first physical hard disk with PartitionMagic.

2 Create enough unallocated space to host the second OS.

3 Create a primary partition, and add it to the boot management utility menu.

4 Obtain necessary boot diskettes and installation media.

Setting the New Partition Active and Rebooting the Computer

This step is necessary to install the new OS without damaging the functionality of the current OS. The active partition is the partition from which the computer boots. After creating the new partition with PartitionMagic, you must set the new partition active for the computer to boot to that partition for OS installation. Step-by-step instructions for setting a partition active with PartitionMagic are included in *Appendix B* of this document. After you set the partition active, PartitionMagic forces a reboot.

Installing the New Operating System

Each OS has its own requirements for installation. In general, you will need to boot with a system diskette or the OS boot diskette, access the installation media (frequently this is a CD), then follow the on-screen prompts to complete installation. Following is a summary of installation issues that need to be addressed for each of the major operating systems.

DOS

DOS must be installed in a primary partition on the first hard disk. If the drive is larger than 2 GB, the DOS partition must reside completely within the first 2 GB, or it will not boot. When installing other operating systems, we recommend you place the DOS partition as the first primary partition on the hard disk. If another OS partition already occupies this location, you can use PartitionMagic to resize and then move the partition. Some versions of DOS will boot from any location within the first 1024 cylinders, but this is not always the case.

If you are prompted during installation to format the partition or configure the disk partition, do not select to format. If you do so, especially with MS-DOS, the entire hard disk will be formatted and you will lose the previously installed OS and any data present. If this prompt appears, exit the installation program and, at a DOS prompt (with the first installation disk in the floppy drive), type `SYS C:`. This will place the system files on the partition, informing DOS that the partition has had a file system in place. Run the installation program again; this time DOS will prompt you to replace the existing OS (which is simply the system files placed by the SYS command). When you choose to replace it, the installation will continue.

Windows 95/98

Windows 95 must be installed to a primary FAT16 partition on the first physical hard disk, whereas later versions of Windows can be installed to a FAT32 partition, also on the first physical hard disk. After the OS has been installed, or during the installation process, you may convert the partition to FAT32 if the OS supports it. On a system with extended BIOS functionality, the partition may be placed within the first 8 GB of the hard disk, and it will

remain bootable. If, however, the system BIOS does not have extended BIOS capability, then the partition must start within the first 2 GB of the hard disk. The majority of the partition can reside beyond the 2 GB boundary, but the beginning of the partition, and all the operating systems boot code, must reside within the first 2 GB to be bootable. For specific information regarding your computer system, please refer to your system BIOS documentation.

Windows NT

Windows NT can be installed using one of two methods: in its own primary partition, or by using a method known as "bootstrapping" or "dual-boot." If you install Windows NT in its own primary partition, it must be installed to a primary FAT partition on the first physical hard disk. After the OS has been installed, or during the installation process, you can convert the partition to NTFS to take advantage of the additional features inherent in that file system.

Note: Only Windows NT and Windows 2000 can read data from an NTFS partition; should Windows NT or Windows 2000 become unbootable, you will not be able to access your data on the NTFS partition by booting to a system diskette. There are utilities that allow you to read and copy data from an NTFS partition if Windows NT suffers a catastrophic failure and cannot be repaired, but there is no guarantee of the utilities' reliability.

If Windows NT is installed using the method known as bootstrapping, only the boot code is placed on the existing primary partition, and the majority of the OS code can be located on a logical partition or a primary partition on another hard disk. Using bootstrapping, the Windows boot files, such as NTLDR, NTDETECT.COM, and BOOT.INI, are contained in a primary partition that resides within the first 2 GB of the primary hard disk. If this method is used, it is not necessary to create a separate primary partition on the first hard disk and set it active. If you run the Windows NT setup program from within Windows 95/98, the bootstrapping method is used by default. This process will use the NT Loader menu to select which OS to which you want to boot. To install NT to a separate primary partition, use the steps outlined on page 6, boot to the first installation disk, and follow the on-screen prompts.

Windows 2000

The Windows 2000 installation program will enable you to install Windows 2000 along with an existing version of Windows, keep both operating systems functional, and choose between one or the other when you boot your computer. However, the process only works when you have enough unused hard disk space to install Windows 2000 or when you don't mind replacing an existing partition with Windows 2000. PartitionMagic makes it possible

to install Windows 2000 without disturbing the operating system and data that are already on your hard disk. PartitionMagic also makes it possible to install Windows 2000 to a second hard disk.

If you keep multiple operating systems, the NT Loader menu will allow you to select which operating system you want to use when you boot up, or you can use PowerQuest BootMagic to boot from the OS you choose.

Linux

Linux can be installed on any drive and in any primary or logical Ext2 partition. We recommend that Linux be installed to a logical partition to preserve your MBR partition table entries for other operating systems which require a primary partition.

Tips: When installing Linux, create two partitions, one for the Linux Native or Root partition, and one for the Linux Swap partition. Make sure that you do not set up these partitions with Linux FDISK or with Disk Druid. (These programs render partition tables unreadable to other operating systems. They can be used to change partition types and/or set partition mount points. Newer versions of Linux FDISK and Disk Druid will not cause these problems; consult your OS documentation for detail.) When installing Linux, make sure that LILO is installed to the root superblock (boot sector equivalent) of the Linux partition, not the master boot record.

OS/2

OS/2 can be installed to any primary or logical partition within the first 2 GB of the hard disk. For drives larger than 4 GB, make sure that you have applied the updated driver that allows OS/2 to work with large IBM hard disks. This driver can be downloaded from IBM's web site.

Upon Completion of the Installation

Upon completion of the installation process, you will have a second functional OS in its own partition. After all the appropriate programs have been loaded into your new OS, and all configuration has been completed, you will need to decide how to manage the multiple operating systems on your computer. If you have already installed a boot management utility, such as BootMagic or Boot Manager, you simply need to add the new partition to the configuration menu of the appropriate program. If you have not installed a boot management application, you may wish to consider doing so, or you may use PQBoot or PartitionMagic to change your active OS partition whenever you choose. When using PartitionMagic to change your active partition, you will need to be careful to never have multiple visible primary partitions that have operating systems installed. Often when this

happens, cross-partition corruption occurs and can render one or both operating systems unbootable. PartitionMagic is designed to automatically hide all other primary partitions when one is set active, so you will not end up with multiple visible primary partitions.

Conclusion

Following the body of this document are several Appendices presenting additional information about formatting floppies and using PartitionMagic, as well as several walk-through scenarios for using PartitionMagic to install specific operating systems. This information is provided as a demonstration of the capabilities of using multiple operating systems on one machine and is not intended to cover every OS combination possible.

Appendix A: Creating a Boot Disk

From MS-DOS and Windows 95

1 *(From DOS)* With a blank floppy disk in the A: drive, type `format a: /s` at the command prompt.

   (From Windows 95) Open a DOS Command Prompt, and type `format a: /s` at the command prompt. This instructs DOS to format the floppy disk with basic boot files.

   Typically, four files will be copied to the diskette, COMMAND.COM, IO.SYS, MSDOS.SYS, and DRVSPACE.BIN. Of these four files, the latter three are copied with the Hidden, System, and Read-Only attributes. Unless the hard disk has been formatted with compression, DRVSPACE.BIN can be deleted from the floppy disk, freeing up space for other, more useful, files.

2 After the floppy disk has been formatted, you will need to copy your CD-ROM or network drivers to the diskette to boot the computer with access to the installation media.

   The CD-ROM drivers will typically be found in a subdirectory set up by the CD-ROM installation program, for example, C:\MTM. You can also contact the hardware manufacturer to obtain CD-ROM and network drivers. To create a network boot disk, consult your network administrator.

3 With the CD-ROM drivers in place, create a CONFIG.SYS file that loads the CD-ROM drivers. For example:

   ```
   DEVICE=A:\MTM\MTMCDAI.SYS /D:MTMIDE01
   ```

This command will load the MTMCDAI.SYS driver from the MTM directory on the A: drive; the last half of the line loads a specific driver for the machine's CD-ROM.

4 Create an AUTOEXEC.BAT file on the floppy to load the MSCDEX.EXE file. For example:

```
A:\MSCDEX.EXE /D:MTMIDE01 /M:10
```

This command loads the MSCDEX file and assigns values to it that are compatible with the CD-ROM driver loaded in the CONFIG.SYS file.

From Windows 98

1 With a blank floppy disk in the A: drive, go to the Start Menu ➤ Settings ➤ Control Panel.

2 In the Control Panel, select **Add/Remove Programs**, then click the **Startup Disk** tab, and click **Create Disk**.

This will begin the Windows 98 Create Disk program; it will format the floppy, add several useful DOS commands, and load the most common CD-ROM drivers automatically. This is a simple way to create a boot disk with CD-ROM drivers.

Appendix B: Setting a Partition Active with PartitionMagic

The Set Active operation allows you to change the partition from which the computer boots. Only one partition may be active at any time, and to boot your computer from a partition, the partition must be a primary partition on the first physical hard disk, and, of course, it must contain an operating system's boot code. When PartitionMagic sets a partition as active, it will hide other primary partitions to avoid data corruption between any OS that may be present on the other primary partitions.

1 Select the partition you wish to make active.

2 Click **Operations ➤ Advanced ➤ Set Active**.

You can also right-click the partition, then click **Advanced ➤ Set Active**.

Appendix C: Adding MS-DOS to Windows 95/98 with PartitionMagic

1 Start PartitionMagic.

2 Select the partition to resize.

3 Click **Operations ➤ Resize/Move**.

You can also right-click the partition and select **Resize/Move** from the context menu.

4 In the Resize/Move Partition window, resize the partition until the unallocated space after the partition is approximately the size you need the new partition to be.

5 Click **OK**.

6 Select the unallocated space.

7 Click **Operations ➤ Create**.

You can also right-click the partition and select **Create** from the context menu.

8 In the Create Partition window, select Primary Partition in the Create as: section, leave the Partition Type as FAT, and give the partition a label. Leave the Position at Beginning of free space, and use the PartitionMagic default settings for everything else.

9 Click **OK** to return to the main screen.

10 Select the new partition you created in step 7.

11 Click **Operations ➤ Advanced ➤ Set Active**.

This will make the new partition the active, bootable partition from which your computer will attempt to boot. You will need to have bootable media (such as a floppy diskette or CD) available for installing MS-DOS.

12 Click **Apply**.

PartitionMagic will now resize your partition and create the new primary partition. PartitionMagic will first ask for your confirmation to set the new partition active; once you select OK, it will inform you that it will shut down the OS to finish these tasks.

13 Click **OK** to have PartitionMagic perform the changes.

14 Reboot the system.

15 When PartitionMagic finishes its operations, make certain the DOS boot disk is in the floppy drive. The computer will be booting to an empty FAT partition, so it is necessary to have a bootable diskette in the floppy drive, preferably the first setup diskette for the MS-DOS operating system.

16 Boot to the A: prompt.

17 Setup will begin. Follow the on-screen prompts.

18 If you receive a message asking you to format the hard disk, select no, and exit the setup program by pressing F3. If you do not receive this message, skip to step 22.

19 At the A: prompt, type SYS: C:

20 This will transfer the system files from the floppy diskette to the hard disk and will prevent DOS from attempting to format the entire hard disk.

21 Run the DOS setup program by typing SETUP at the A: prompt.

22 Follow the on-screen prompts until DOS asks to replace the existing OS (the system files you just copied with the SYS command). Select Yes, then continue.

When setup is finished, you will have MS-DOS installed in its own dedicated partition.

23 Reboot the computer to the BootMagic rescue diskette.

24 Add the DOS partition to the BootMagic menu and re-enable BootMagic. Reboot.

25 When the BootMagic menu is displayed, select the OS you wish to use.

Appendix D: Installing Windows NT or Windows 2000 to an Existing Windows 95/98 System

One of the most common scenarios is to install Windows NT to an existing installation of Windows 95 or Windows 98. When installing Windows NT there are decisions that need to be made preparatory to the manipulation of the partitions on the drive.

If you are installing Windows NT, first you will need to decide whether Windows NT will be installed to the existing partition or to an additional primary partition not yet created. The advantage to installing NT to an independent primary partition, is that you can take

advantage of the security features provided by the NTFS file system. If you install NT to a logical partition, "bootstrapping" to the existing partition; you must leave the C: partition formatted in the FAT file system.

If you are installing Windows 2000, you need to decide whether to treat it as an upgrade to the existing operating system or as an additional operating system.

To configure your system to boot Windows 95/98 and Windows NT/Windows 2000 in two distinct primary partitions, complete the following:

1 Start PartitionMagic.

2 From the **Disk** drop-down list, ensure the first disk is selected.

   Under Windows, you can select the partition directly from the tree view on the left. You do not need to select a disk first.

3 Select the Windows 95/98 partition.

4 Click **Operations ➤ Resize/Move** on the menu bar.

   You can also right-click the partition and click **Resize/Move** on the context menu.

   The Resize/Move dialog appears.

5 Click the left partition handle and drag it until the unallocated space before equals the desired size for the Windows NT installation.

   The minimum hard disk space required for Windows NT Workstation is 125MB; 500 MB recommended.

   Windows 2000 requires a minimum of 650 MB of hard disk space, with 2 GB recommended.

6 Click on the newly created unallocated space.

7 Click **Operations ➤ Create** on the menu bar.

   You can also right-click the unallocated space and click **Create** on the context menu.

   The Create Partition dialog appears.

8 In the **Create as** box, click **Primary Partition**.

9 From the **Partition Type** drop-down list, select **FAT** for Windows NT or **NTFS** for Windows 2000.

   For Windows NT, the partition can be converted to NTFS after or during the install.

10 Type a label for the partition.

11 In the **Size** box, make sure that the size reported is equal to the amount of unallocated space, then click **OK**.

12 Right-click the newly created partition, then click **Advanced ➤ Set Active**.

13 Click **OK**.

14 Click **General ➤ Apply**.

PartitionMagic forces a reboot.

15 After the OS is installed, run the BootMagic configuration program and add the new OS to its menu.

Appendix E: Installing Linux as a Second Operating System

Linux can be installed to any primary or logical partition except for the partition where BootMagic is installed. We recommend installing Linux to a logical partition to conserve valuable partition table entries. To install Linux as a second OS, to a logical partition, complete the following steps:

1 Start PartitionMagic.

2 From the **Disk** drop-down list, ensure the first disk is selected.

Under Windows, you can select the partition directly from the tree view on the left. You do not need to select a disk first.

3 Select the Windows 95/98 or NT partition.

4 Click **Operations ➤ Resize/Move** on the menu bar.

You can also right-click the partition and click **Resize/Move** on the context menu.

The Resize/Move dialog appears.

5 Place the pointer on the right partition handle. Click and drag the handle until the free space to the right of the existing partition equals the desired size for the Linux installation.

You should allow for two partitions: a native Linux partition and a swap partition. You will get performance on most machines if the swap partition is nearer to the front of the hard disk.

6 Click the newly created unallocated space, then click **Operations ➤ Create**.

You can also right-click the unallocated space, then click **Create** on the context menu.

The Create Partition dialog appears.

7 In the **Create as** box, click **Logical Partition**. From the **Partition Type** drop-down list, select **Linux Ext2**. In the Size box, make sure that the size is equal to the amount you want to allocate to the Linux Native partition. Click **OK**.

8 Select the remaining unallocated space and click **Operations ➤ Create** on the menu bar.

You can also right-click the unallocated space and click **Create** on the context menu.

9 If the **Create as** box allows you to select a type, select **Logical Partition**.

10 From the **Partition Type** drop-down list, select **Linux Swap**.

You should create a 129 MB Linux Swap partition; if you will not need a swap partition this large, resize it smaller. For information on the amount of space to allocate to the Linux Swap partition, consult your Linux documentation.

11 Click **General ➤ Apply**.

12 Reboot and install Linux, making sure that LILO is installed to the root superblock (boot sector) of the Linux Native partition, not the master boot record.

13 Run the BootMagic configuration program, and add Linux to its menu.

IMPORTANT! Do not set up partitions with Linux FDISK or Disk Druid; they may render partition tables unreadable to other operating systems. You can use them to change partition types and set partition mount points, but that is all.