

Unit 12 Video Adapters and Accelerators

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12.1 Introduction

In this unit we shall discuss about video adapters and accelerators. A user gives raw information to the system through the input device and gets the processed information through the output device, usually a visual display unit, also called as monitor. This output display is made possible by a special hardware called video adapter. This video adapter card may be a standalone device or may be integrated into the motherboard. Display adapter, graphics accelerator or graphics card are other names of the video adapter. Modern video cards have most advanced features such as 2D / 3D graphics rendering, video capturing, multiple monitor outputs and MPEG decoding.

In this unit we shall discuss various classifications of video adapters. Also there are a number of factors such as bandwidth, memory etc. which are responsible for the speed of video. This unit also throws light on these factors. Advanced gaming requires powerful 3D accelerators. We shall discuss the steps involved in 3D process and methods to improve 3D performance. Finally we shall discuss various basic troubleshooting techniques for video adapters.

Objectives:

After studying this unit, you should be able to:

- Explain the features of conventional video adapters
- Classify video display hardware based on their functions
- Discuss the issues associated with 3D graphics accelerator
- Resolve the problems in video cards through troubleshooting

12.2 Conventional Video Adapters

A conventional video card gets the processed output from the processor and converts into a form that the monitor can display. Thus it acts in between the processor and the monitor. These cards just accept the data from the processor and send it to the monitor. They did not have any processing power.

IBM (International Business Machines) introduced the first PC configured with a video card called Monochrome Display Adapter (MDA) in 1981 followed by the first commercial 2D/3D Graphics Processing Unit (GPU) in 1995. These cards used the SVGA (Super Video Graphics Array) standards which incorporated 3D functions. Several advanced features and capabilities such as anti-aliasing, MIP mapping, and z-buffering are included in modern graphics cards. The Accelerated Graphics Port or AGP has been introduced by Intel.

Usually a video adapter is a printed circuit board that plugs into a personal computer to give it display capabilities but these capabilities, depend on both the logical circuitry (provided in the video adapter) and the display monitor. For instance, even if the video adapter is very powerful, a monochrome monitor cannot display color.

Components of Graphics/Video Cards

You will find that a standard video or graphics card is composed of several components mounted on a printed circuit board (abbreviated as PCB, which is a thin plate on which chips and other electronic components are placed) which include the following devices:

- **Graphics Processing Units (GPU)** – A Graphics Processing Unit (GPU), also called (Visual Processing Unit (VPU) is a special type of microprocessor that takes up the job of graphics rendering from system CPU. GPUs are used in embedded systems, mobile phones, personal computers, workstations, and game consoles. Modern GPUs are very efficient at manipulating computer graphics, and their highly parallel structure makes them more effective than general-purpose CPUs for a range of complex algorithms. In a personal computer, a GPU can be present on a video card, or it can be on the motherboard. More than 90% of new desktop and notebook computers have integrated GPUs, which are usually far less powerful than those on a dedicated video card. Like CPU (Central Processing Unit), GPU is a dedicated processor designed for accelerating video and 3D graphics rendering.
- **Video BIOS** – Like system BIOS, Video BIOS is the firmware that contains the basic program that controls the basic operations of the video card. This includes the interaction with the computer and the software applications.
- **Video memory** – Video memory provides the memory needs of the GPU and the display unit. Generally video memory ranges from 128MB to 4GB. However new and emerging graphics cards contain more memory.
- **RAMDAC** – Random Access Memory Digital-to-Analog Converter converts digital signals to analog signals. These analog signals were used in old cathode ray tube (abbreviated as CRT, which is a specialized vacuum tube in which images are produced when an electron beam strikes a phosphorescent surface) displays. However new LCD displays do not require the RAMDAC.
- **Outputs** – Modern video cards include the standard outputs such as VGA (Video Graphics Array) connector; DVI (Digital Visual Interface); 9-pin VIVO (Video In Video Out) for S-Video, composite and component

video; HDMI (High-Definition Multimedia Interface); and the advanced DisplayPort that is intended to replace VGA and DVI connectors.

12.2.1 Text& Graphics

Text and graphics are the two basic modes offered by video adapters. In text mode, a monitor can display only ASCII (American Standard Code for Information Interchange) characters. The term graphics represents almost everything on computers that is not text or sound. The representation and manipulation of image data by a computer is also termed as computer graphics. In graphics mode, a monitor can display any bit-mapped image. Within the text and graphics modes, some monitors also offer a choice of resolutions. If the resolution is low, then more colors can be displayed by the monitor. As advanced video adapters contain their own memory, computer memory is not used for storing displays. Additionally, most adapters have their own graphics coprocessor for performing graphics calculations. Such adapters are referred to as graphics accelerators.

12.2.2 Video BIOS

You are aware that the system BIOS (Basic Input Output System) provides a set of functions that are used by software programs to access the system hardware. Likewise, the video BIOS provides a set of video-related functions that are used by programs to access the video hardware. The video BIOS interfaces software to the video chipset in the same way that the system BIOS does for the system chipset.

It should be kept in mind that the BIOS code and the software drivers in the Video BIOS can differ for different cards that use the same video chipset. As there is an increase in the variety of cards available in the market and you need different code to support the BIOSes of different cards, software programming has become difficult. VESA (Video Electronics Standards Association, an international standards body for computer graphics founded in 1989 by NEC Home Electronics and eight other video display adapter manufacturers) has introduced a standard for high-resolution BIOS code called the VESA BIOS Extensions (VBE). You can apply these by means of hardware code or software drivers so as to have more standardized control over the video.

12.2.3 DirectX

DirectX is a technology from Microsoft, which is a collection of Application Programming Interfaces (APIs) for handling tasks related to multimedia, especially game programming and video, on Microsoft platforms. Originally, the names of these APIs all began with the word Direct, such as Direct3D, DirectDraw, DirectMusic, DirectPlay, DirectSound, and so forth. But later on the name DirectX was coined to refer to all of these APIs (the X standing in for the particular API names) and this continued to be the name of the collection. When Microsoft developed a gaming console called 'Xbox', to indicate that the console was based on DirectX technology. The initial X has been used in the naming of APIs designed for the Xbox such as XInput and the Cross-platform Audio Creation Tool (XACT), while the DirectX pattern has been continued for Windows APIs such as Direct2D and DirectWrite.

For the development of video games for Microsoft Windows, Microsoft Xbox, and Microsoft Xbox 360, 3D graphics API within DirectX (Direct3D) is being widely used. Other software applications for visualization and graphics tasks such as Computer Aided Design / Computer Aided Manufacturing engineering use Direct 3D You would have observed that the terms 'Direct3D' and 'DirectX' have been used interchangeably.

The DirectX Software Development Kit (SDK) consists of runtime libraries in redistributable binary form, along with accompanying documentation and headers for use in coding. Originally, the runtimes were only installed by games or explicitly by the user. Windows 95 was not launched with DirectX but it was included with Windows 95 OEM (Original Equipment Manufacturer) Service Release 2 Windows 98 and Windows NT 4.0 both contained DirectX which SDK can be downloaded for free.

The new versions of DirectX such as Direct3D 9Ex, Direct3D 10 and Direct3D 11, available only for Windows Vista and Windows 7 were built to depend upon the new Windows Display Driver Model.

Direct3D 9Ex: this allows full access to the new capabilities of drivers while maintaining compatibility for existing Direct3D applications. The new Vista/Windows Display Driver Model graphics architecture includes a new video memory manager that supports virtualizing graphics hardware to multiple applications and services such as the Desktop Window Manager.

Direct3D 10: It is designed around the new driver model in Windows Vista and featuring a number of improvements to rendering capabilities and flexibility.

Direct3D 11: It has the major features of multithreading support to assist video game developers in developing games that better utilize multi-core processors.

12.2.4 Replacing / Updating an Adapter

It is important to know which type of video adapter can be used in your system as there are three main types of video adapter upgrades available.

Add-on Video Card

Add-on video card can be physically inserted into and taken out of the computer as an individual hardware component. It can be plugged in PCI or AGP slots. In order to upgrade an add-on video card, you have to remove the old card and drivers and install the new video card and drivers.

Motherboard Video-only Chipset

This type has an integrated video along with an open AGP expansion slot. Either you can use the motherboard's integrated video or plug-in your own video card in the AGP slot. Modern PCs are equipped with this setup. You should disable the on-board video and add an AGP video card and install drivers for the new card to upgrade to this type.

Motherboard with Integrated Video

There is only on-board video in this type. You will not find an extra AGP slot that you can use to install a new video card. You may be able to install a slower PCI video card or if you really want an AGP video card you can opt for a motherboard upgrade (to one that offers an AGP slot).

Self Assessment Questions

1. The AGP technology was introduced by _____.
2. DirectX technology is from _____.
3. BIOS stands for _____.

12.3 Classification of Video Display Hardware

A video display adapter is also referred to as graphics accelerator card which is an expansion card whose function is to generate output images to a display. These cards offer added functions, such as rendering of

accelerated 2D and 3D images, video capture, TV-tuner adapter, MPEG-2 decoding, light pen, TV output, or the ability to connect multiple monitors. High performance video cards also support PC games.

Video display adapter hardware is integrated on the motherboard chip in earlier machines. It was also called as video controller or graphics controller. Recent computers use a graphics chipset which is developed along with Northbridge on the motherboard. This chip has embedded memory and some amount of system RAM. This reduces the total RAM available. This is called integrated graphics or on-board graphics and it is used by those who runs 3D applications. A dedicated Graphics Card on the other hand has its own RAM and Processor specifically for processing video images. Almost all of these motherboards allow the disabling of the integrated graphics chip in BIOS, and uses buses like AGP, PCI, or PCI Express slot for adding a higher-performance graphics card in place of the integrated graphics.

There are two broad categories of video display hardware: **non-accelerated** and **accelerated** cards. In the non-accelerated graphics adapters, as the early graphics adapters were, the system CPU did all the work related to processing and calculating. The adapters just received data from the processor and forwarded the signals to the monitor. The computer needed to change each pixel individually to change the image on the screen when using the non-accelerated (un-accelerated) graphics adapters. However, the introduction of Graphical User Interface operating systems such as Windows created some problems. It was then found that systems began to slow down as the CPU was left trying to move large amounts of data from the system RAM to the video card.

Video cards in recent age are accelerated and connected to the system's CPU through high-speed buses such as PCI (Peripheral Computer Interface) or AGP (Accelerated Graphics Port). A graphics accelerator, for example, is a type of video adapter that contains its own processor to boost performance levels. These processors are specialized for computing graphical transformations, so that they can achieve better results than the general-purpose CPU used by the computer. Additionally, they free up the computer's CPU to execute other commands while the graphics accelerator is handling graphics computations. The popularity of graphical applications, and especially multimedia applications and computer games, has made

graphics accelerators not only a common enhancement, but a necessity. Nowadays most computer manufacturers include a graphics accelerator with their mid-range and high-end systems.

Apart from the graphics processor used, other characteristics that differentiate graphics accelerators are:

- **Memory:** Graphics accelerators have their own memory, which is reserved for storing graphical representations. Because of the demands of video systems, video memory needs to be faster than main memory. The amount of memory determines how much resolution and how many colors can be displayed. Some accelerators use conventional DRAM (Dynamic RAM), but others use a special type of Video RAM (VRAM), which enables both the video circuitry and the processor to simultaneously access the memory.
- **Bus:** Each graphics accelerator is designed for a particular type of video bus (AGP or PCI).

Self Assessment Questions

4. Video display hardware can be broadly classified as _____ and _____.
5. DRAM stands for _____.
6. VRAM stands for _____.

12.4 Graphics Accelerators

Graphics accelerators are coprocessors that reside in your computer that assist in drawing graphics. If your system is equipped with a graphics accelerator then it does have to transfer raw pixel data over a slow general bus and chipset. Instead of it will use graphics accelerator for transferring the pixel data over the bus and chipset and draw image. Thus a graphics accelerator works concurrently with a general CPU to improve graphics performance of the system. They are also called as Graphics Processing Units (GPU).

GPU is a single-chip processor with integrated transform, lighting, triangle setup/clipping, and rendering engines. It is capable of processing a minimum of 10 million polygons per second. It was first, defined and popularized by **NVIDIA** in 1999, who marketed the GeForce 256 (name of the GPU model) as the world's first GPU. The release of the Radeon 9700

saw the introduction of the Visual Processing Unit (VPU) by **ATI Technologies** in 2002.

Custom microchips found in graphics accelerators contain special mathematical operations commonly used in graphics rendering. The efficiency of the microchips determines the effectiveness of the graphics accelerator. They are mainly used for playing 3D games or high-end 3D rendering. A GPU implements a number of graphics primitive operations in a way that makes running them much faster than drawing directly to the screen with the host CPU. Modern GPUs also have support for 3D computer graphics, and typically include digital video-related functions. Figure 12.1 shows a modern graphics card. Intel, NVIDIA, AMD (Advanced Micro Devices), S3 Graphics VIA Technologies and Matrox are some of the popular companies manufacturing GPUs.

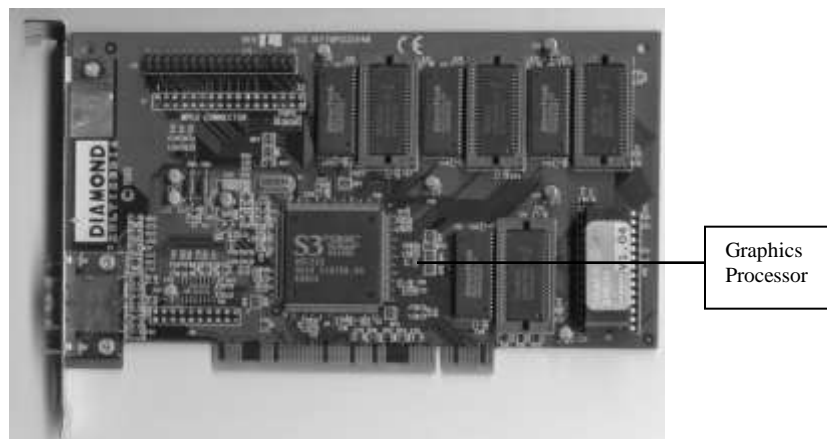


Figure 12.1: A Modern Graphics Processing Unit

Computational functions of GPUs

Modern GPUs use most of their integrated circuits to perform calculations related to 3D computer graphics. They were initially used to accelerate the memory-intensive work of texture mapping and rendering polygons, later adding units to accelerate geometric calculations such as the rotation and translation of vertices into different coordinate systems. Recent developments in GPUs include support for programmable Shaders (A Pixel Shader is a graphics function that calculates effects on a pixel level) which can manipulate vertices and textures with many of the same operations

supported by CPUs, oversampling and interpolation techniques to reduce aliasing, and very high-precision color spaces. Because most of these computations involve matrix and vector operations, engineers and scientists have increasingly studied the use of GPUs for non-graphical calculations. In addition to the 3D hardware, today's GPUs include basic 2D acceleration and frame buffer capabilities (usually with a VGA compatibility mode).

12.4.1 Issues in Video Performance

The following are some of the common hurdles faced regarding video speed performance,

- Graphics memory bandwidth
- Communication between host and graphics accelerator
- Features and host feature emulation
- Monitor refresh

Graphics Memory Bandwidth

The speed at which the accelerator can output its results to memory is one of the biggest challenges in graphics performance. The various techniques used to improve the performance are:

- Using VRAM, a kind of RAM technology that could allow multiple accesses per cycle (one for video refresh, and one for accelerator output)
- Using RAMBUS, wherein the RAM is partitioned over multiple buses
- Slicing the memory in large sequential banks
- Embedding an eDRAM (embedded Dynamic RAM) and splining the on-chip
- Increase the efficiency of memory accesses via tiled addressing

Host, Accelerator Communication

A command queue (or FIFO-First In First Out strategy) helps in communicating operations from the host to the accelerator. The host graphics API (Application Programming Interface) are decomposed to these accelerator specific commands which are then executed by the graphics accelerator and then de-queued by the graphics accelerator in oldest first order. Writing to and arbitration of the graphics queue usually involves writes and reads to memory mapped graphics register locations, or I/O ports. However, writes to ordinary system memory and graphics based DMA strategies are also possible.

Earlier graphics accelerators faced the hurdle of the queue being too small (typically 16 entries) to give the host and the graphics accelerator sufficient opportunity for parallelism. So, the host driver would commonly be stalled waiting for the queue to free up enough space for the next operation. But in modern graphics accelerators, you will not face this problem as the queue has been significantly expanded usually to sizes usually above 512 entries. While a register window retained a small queue, a portion of the graphics memory would be used as an extension queue to the register window queue.

Some accelerators, in order to improve queue access performance use the ploy of memory mapping the queue to contiguous sequential addresses, to use the PCI bursting capabilities of the host chipset.

Features and Host Feature Emulation

There are various factors which influence the marketability of graphics like: price, how well they support games, and how well they conform to standards. Earlier, starting in 1989, PC based graphics acceleration was limited to 2D but with the advent of DirectDraw and Direct3D and availability of 3D accelerated games, 3D is being preferred. 3D is not as simple as 2D for graphic companies to deal with.

Monitor Refresh

Monitor refresh is the last factor in determining the video speed which takes a certain amount of memory bandwidth away just to update the monitor. But 3D applications perform double buffering in order to prevent tearing or flickering. By double buffering we mean that the trace is sent back and forth between two frame buffers and the monitor is alternately refreshed by the buffer. In order to repoint the monitor to refresh from a different section of graphics RAM to avoid tearing, you have to wait until the current refresh (if one is pending) is complete. Typically this is done by "waiting for vertical retrace". This "wait period", however is dictated by the specifications of your monitor, not by the performance of your CPU or graphics accelerator.

Self Assessment Questions

7. The term GPU was coined and popularized by _____.
8. The term VPU was first introduced by _____.
9. GPU stands for _____.

12.5 3D Graphics Accelerator Issues

3D computer graphics requires a lot of computer processing power and a large amount of memory. Until late 1995, 3D acceleration was only found on a small number of high-end products its target applications being high-end rendering packages and supporting engines. However, with the introduction of powerful Pentium chips, the demand for 3D accelerators has increased manifold with all modern PCs incorporating them.

It was found that the initial 3D accelerators were slower than conventional GUI accelerators under Windows, and poor in DOS at a time when most PC games ran on that platform, the main problem lying with software support. Moreover, with 32-bit Super Games Consoles on the increase, the quantity and quality of titles available for the 3D cards was poor.

With Microsoft supporting DirectX and enhancing Windows 95 as a multimedia platform and with the sales of 3D graphics chips exceeding 42 million, in 1997, attitudes changed. There was a phenomenal increase in the demand for 3D graphics chips with sales going up to 140 million by the year 2000.

12.5.1 The 3D Process

The main purpose of a dedicated 3D graphics chip or a dual-purpose 2D/3D graphics chip is to take away load from system CPU and perform the rendering by itself. This rendering, or drawing, is accomplished through the graphics pipeline in two major stages: geometry and rendering. The geometry stage is performed by the CPU. In this the CPU handles all polygon activity and converts the 3D spatial data into pixels. The rendering stage is handled by the 3D hardware accelerator. It manages all the memory and pixel activity and prepares it for painting to the monitor.

Earlier, although for a brief period, the only way a PC user could have access to 3D acceleration was through an add-on card that worked along with a conventional 2D card. The latter was used for day-to-day Windows computing, and the 3D card gained popularity only when a 3D game was launched. As 3D capability rapidly became the standard, these 3D-only cards were replaced by cards with dual 2D/3D capability. These 2D/3D combo cards combine standard 2D functions plus 3D acceleration capabilities on one card and represent the most cost-effective solution for most gamers. Almost all modern-day graphics cards have some kind of

dedicated 3D acceleration, but their performance varies a lot. If you want to upgrade to 3D, you could go in for a dedicated 3D add-on card.

12.5.2 Issues in 3D Speed

A CPU's capabilities are stretched while handling the various 3D rendering techniques involving complex calculations. Even if you have dedicated 3D accelerators to perform many of the functions identified above, the CPU still handles most of the geometry calculations – such as, the positioning of every filtered pixel that appears on-screen. With current 3D accelerators sending out over a 100 million pixels per second, this is beyond the capacity of even the fastest CPU. The 3D accelerator literally has to wait for the CPU to finish its calculations.

12.5.3 Improving 3D Performance

Two very different ways of improving 3D performance have been found. One is the use of dedicated geometry processor which takes over the geometry calculations from the main CPU. Another means is offered by processor manufacturers who have tried to boost the 3D performance of their CPUs because they feared that once geometry processors became standard on graphics boards, it would only take a mediocre processor to perform other functions such as running the operating system and monitoring devices. Hence they provided specialized instruction sets Katmai New Instructions (KNI - The code name for the new multimedia instructions that were built into the Pentium III (Katmai) chip in the case of Intel and 3D Now! (an extension to the 8086 instruction set,) in the case of AMD for improving 3D performance. But, in the long run, the increase in performance provided by these new MMX-style (Multi Media extension) instructions will appear insufficient to cope with the brute power of the new generation of 3D accelerator. Moreover, most users including gamers do not upgrade their systems regularly and have CPUs which are relatively slow. Therefore, dedicated geometry processors are the most preferred.

12.6 Troubleshooting

Some typical problems encountered with video cards are discussed in this section. Most of the problems addressed are related to specific setup issues with the video subsystem. You should always make sure that you are using the correct drivers for your video card. If you have any problems related to

the video subsystem, or even general instability with the system that shows up when you are running Windows, then be sure that it is caused due to the use of faulty or incorrect drivers. The video cards are generally shipped with their drivers in a floppy-disk or CD-ROM from their manufacturers. However the up-to-date drives can be found in their company's website. These will often fix many of the strange problems sometimes seen when installing a new video card.

12.6.1 Avoiding the Basic Problem

Problems Associated with Graphics/Video Cards and Devices

Video cards, graphics cards, and other 2D/3D graphic accelerator cards are bunched with the corresponding device drivers that are essential for the proper function and performance of the graphics device. Sometimes these old device drivers may not work properly if you upgrade your motherboard, processor or operating system. Under these circumstances you need to uninstall the old drivers, download the latest drivers suitable for the upgraded motherboard, processor or operating system and then reinstall it.

Resolving Installation Problems with Driver Detective

The device driver update tool called Driver Detective can be used to update Graphics and video device drivers quickly and accurately. The Driver Detective tool can identify individual graphics and video cards with driver problems. They can also automatically download the most up-to-date drivers suitable for a particular motherboard, processor and/or operating system.

If you encounter difficulties like crashing, hanging, freezing, etc. Then it means that the display adapter has some problem. In case your video card displays some things incorrectly then you may be able to identify the problem by comparing your screen errors with examples screenshots. This section contains some screenshots of video cards which show different kinds of visual problems. But if your video card crashes or hangs then it is often difficult to find the cause because there could be various other reasons displaying the same signs. You could carry out some standard procedures to set right the problem. As a last resort you could seek the help of support forums. But before trying these procedures it is advisable to create a system restore point as described below. A restore point allows you to

undo software changes you make while trying to solve your video card problem.

1. Install the latest motherboard chipset drivers
2. Uninstall your old display drivers and then install the latest display drivers
3. Disable your sound system
4. Disable your AGP port
5. Do physical checks
6. Test your CPU and RAM
7. Check your power supply

12.6.2 Missing Display Options

Missing display is a common problem in which the operating system, such as Windows XP, does not appear on the screen. In other words, the computer starts up but nothing appears on the monitor. Assuming that your monitor is in good condition, your next step should be to take a look at the video card.

This particular problem can be caused from several different things such as a video card that is not properly seated or a loose connection from the video card to the monitor. Troubleshooting this problem will require you to locate the video card inside your computer and verify the following:

- Assuming that the video card adapter is separate from the motherboard, you should check that the card is properly seated. Sometimes one end of the card may creep out of the slot when it is initially screwed in resulting in no display appearing on the monitor.
- Verify the correct jumper settings for video cards that are mounted to the motherboard by checking the documentation that came with the hardware.
- The cable running from the monitor to the video port may also be broken or there may be a loose contact. Examine the monitor cable to ensure that there are no broken or bent pins. A bent pin can usually be straightened using a pair of sharp-nosed pliers. Also check that the cable running from the monitor to the VGA port is secure.

12.6.3 Basic Troubleshooting in Windows OS

Operating System does not appear

Suppose if the initial screen of the startup process appears on the monitor and then if the display goes blank, then there is a possibility of wrong video driver installation. When an incompatible video driver with the operating system is installed these kinds of problems will surface. If your operating system is Windows XP, you can follow procedures given below to resolve the problem.

- In Windows XP, start the computer in Safe Mode by pressing [F8] when the Starting Windows message appears.
- From the boot menu select the Safe Mode option. This will force Windows XP to start using the standard VGA driver, instead of the video driver that is used when the operating system is started normally.
- Once the computer is started in Safe Mode, you can install the correct video driver using Device Manager.

You can get a detailed description of these steps under the section "Updating Video Drivers".

Another cause for the video problem discussed above could be due to overclocking. Although this is a popular method used to get more performance out of a hardware component such as a video card adapter, it could result in display problems. The problem can once again be resolved by starting Windows XP in Safe Mode and configuring the video card to operate at its default speed.

Poor Display

Poor display can cause, besides fuzzy appearance, distorted text, monitor flickering etc. Due to poor display there may be chances of causing headaches and sore eyes after working for long time on the computer. Therefore this problem has to be resolved.

There are a number of causes which lead to poor display. You should first verify that the latest driver for the video adapter has been installed. You can determine which driver version is currently installed in Windows XP by completing the steps outlined below:

1. Right click the Windows desktop and click Properties.
2. From the Display Properties dialog box, click the Settings tab.
3. Click the Advanced button.

4. Click the Adapters tab.
5. Click the Properties button under Adapter Type as shown in Figure 12.2.
6. Click the Driver tab.



Figure 12.2: Verifying device driver

Select the Properties button under Adapter Type to locate specific driver information including the driver version. You can find the version information beside the Driver Version field. Compare this version with the latest version on the manufacturer's Web site. If the driver needs to be updated complete steps four through seven listed under the section entitled “Updating Video Drivers”. If the latest driver is installed, you may need to adjust the resolution and refresh rate (this is the rate at which the video card redraws the screen) for the video adapter card. Incorrect display settings can cause problems with your display.

Screen Resolution

In order to configure display settings, right click the Windows XP desktop and click Properties to open the Display Properties dialog box. Then select the Settings tab as shown in Figure 12.3 to change the resolution settings. Use the slider under Screen resolution to adjust the settings. Normally, a 17 inch monitor will have a default resolution of 800x600.



Figure 12.3: Changing the screen resolution

Use the Settings tab from the Display Properties dialog box to change the resolution. If you are unable to select the desired resolution that should be supported by the video card, you will need to again check that the operating system has correctly identified the card. In Windows, you can use Device Manager to make sure the card has been properly detected. If the card has not been properly identified, you will once again need to check the driver. It is usually recommended that you use the drivers supplied by the manufacturer instead of the drivers included with Windows.

The screen resolution may also be limited if the wrong monitor is selected. To check the monitor selection, once again open the Display Properties dialog box and select the Settings tab. Click the Advanced button and select the Monitor tab. If the monitor listed is not correct, you will need to update the driver for the monitor.

Refresh Rate

If the problem still persists after adjusting the resolution, your next step should be to adjust the refresh rate. Lower refresh rates tend to cause flickering so it is important to verify this setting. You can adjust the refresh rate using the Settings tab from the Display Properties dialog box.

Once again, select the Settings tab and click the Advanced button. Select the Monitor tab as shown in Figure 12.4. Use the drop down arrow to adjust the refresh rate to about 70 MHZ. Remember that a higher refresh rate will reduce the amount of flickering. As with the screen resolution, if you are unable to select the desired refresh rate, go back to the video driver to make sure the latest one is installed. Use the Monitor tab to adjust the refresh rate.

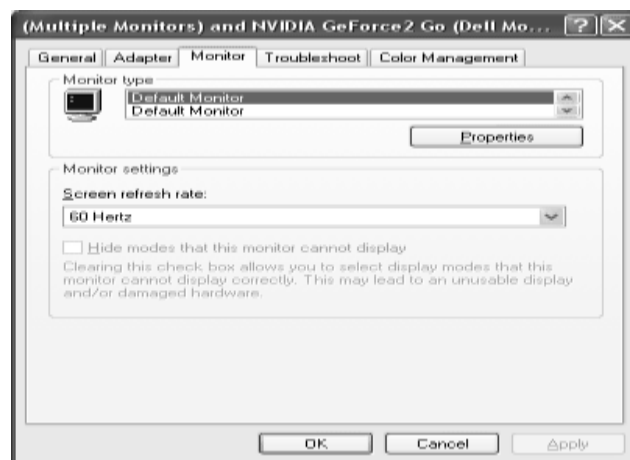


Figure 12.4: Selecting refresh rate for the monitor

It is important to verify that the monitor supports the screen resolution and refresh rate configured in the Display Properties dialog box. You should refer to the documentation or manual that came with your monitor in order to identify the values that are supported.

Problems Displaying Videos or Animations

You will encounter problems with videos and animations, if the display adapter driver does not support DirectDraw. If videos and animations are not correctly displayed on the monitor, you should first determine if the video card adapter driver supports DirectDraw which can be accomplished using the DirectX Diagnostic Tool. Then from the Run command type *DxDiag.exe* and click OK. From the Display tab, click the Test DirectDraw button. Windows XP will perform a series of tests. If your display does not pass each of the tests, you will need to update the video adapter.

If updating the video adapter driver does not solve the problem, verify that your video card is indeed supported by the operating system installed on

your computer. If you are running Windows, you can check the Hardware Compatibility List (HCL) to determine if the video card adapter is supported.

Updating Video Drivers

Faulty or incorrect video drivers can result in such things as operating system instability, video subsystem problems, and so on. Most video cards come with drivers on a floppy disk or a CD-ROM. You can use the drivers that came with the hardware or visit the manufacturer's Web site to obtain a more recent one. The drivers should come with a text file outlining the installation process.

The first step in updating the driver is to identify the make and model of your video card. In Windows XP, you can see a list of all the hardware components within Device Manager. The video card should be listed under Display Adapters as shown in Figure 12.5. However, if it has not been recognized by Windows XP, it may be listed under Unknown Devices. Double click on the video adapter listed to identify the make and model. This information can be used to retrieve the latest driver from the manufacturer's Web site. Device Manager will list the Display Adapter installed in the computer.



Figure 12.5: Device manager screen

If you are running Windows XP, you can update a device driver using the steps listed below:

1. Right click My Computer and click Properties.
2. From the Hardware tab, click Device Manager.
3. Within Device Manager, double-click the video adapter listed under Display Adapters.
4. Click Update Driver as shown in Figure 12.6 to open the Hardware Update Wizard.
5. Accept the default option, Install the Software Automatically. Choose the Install from a List or Specific Location option if you have the updated driver so you can indicate the file location. Click Next.
6. Windows searches for an updated driver and instructs you if an updated driver has been found.
7. Click Finish once the updated driver has been installed.

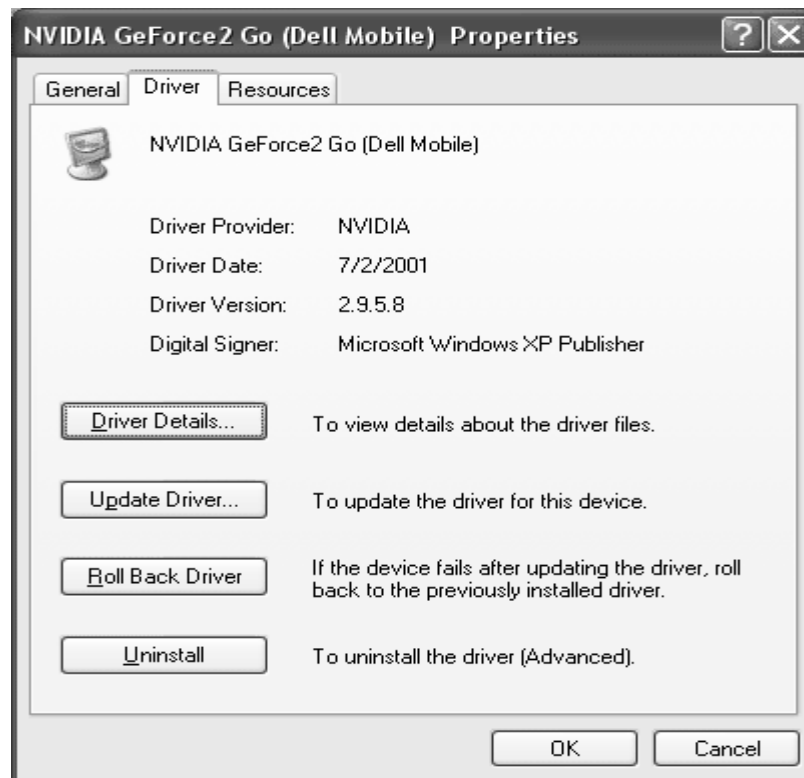


Figure 12.6: Updating device driversscreen

A majority of video adapter card problems can be solved by ensuring that the correct driver is installed and that the display settings are properly configured based on the capabilities of your hardware. However, if you are unable to resolve the problem using the steps discussed in the previous sections then, it might be advisable to contact the manufacturer of the video card.

Self Assessment Questions

10. KNI stands for _____.
11. MMX stands for _____.
12. You need to run _____ file to test whether your monitor supports DirectX or not.

12.7 Summary

Let's recapitulate important concepts discussed in this unit:

- Video adapter is a board that plugs into a personal computer to give it display capabilities. Those capabilities of a computer, however, depend on both the logical circuitry (provided in the video adapter) and the display monitor.
- DirectX is the technology from Microsoft, which is a collection of Application Programming Interfaces (APIs) for handling tasks related to multimedia, especially game programming and video, on Microsoft platforms.
- The video display hardware can be broadly classified into non-accelerated and accelerated cards.
- A Graphics Processing Unit or GPU (also occasionally called visual processing unit or VPU) is a specialized microprocessor that offloads and accelerates graphics rendering from the central processor. It is used in embedded systems, mobile phones, personal computers, workstations, and game consoles.
- Video cards, graphics cards, and other 2D/3D graphic accelerator cards are bundled with the corresponding device drivers that are essential for the proper function and performance of the graphics device.

12.8 Glossary

Term	Description
GPU	GPU (Graphics Processing Unit) is like CPU (Central Processing Unit). It is a dedicated processor designed for accelerating video and 3D graphics rendering.
Video BIOS	This is the firmware that contains the basic program that controls the basic operations of the video card, including interaction with the computer and the software applications.
Video Memory	It provides the memory needs of the GPU and the display unit. Generally video memory ranges from 128MB to 4GB. However new and emerging graphics cards contain more memory.
RAMDAC	RAMDAC (Random Access Memory Digital-to-Analog Converter) converts digital signals to analog signals. These analog signals were used in old CRT displays. However new LCD displays do not require the RAMDAC.
DirectX	DirectX is the technology from Microsoft, which is a collection of Application Programming Interfaces (APIs) for handling tasks related to multimedia, especially game programming and video on Microsoft platforms.
VRAM	VRAM (Video RAM) is a kind of RAM technology that could allow multiple accesses per cycle (one for video refresh, and one for accelerator output).
RAMBUS	RAMBUS is a technology, wherein the RAM is partitioned over multiple buses.

12.9 Terminal Questions

1. Explain the features of conventional video adapters.
2. Briefly explain the major classification of video display hardware.
3. List out the issues associated with video speed.
4. Explain the precautionary measures to be taken to avoid basic problems in video cards.

12.10 Answers**Self Assessment questions**

1. Intel
2. Microsoft
3. Basic Input Output System
4. Accelerated, Non-accelerated
5. Dynamic Random Access Memory
6. Video Random Access Memory
7. NVIDIA
8. ATI Technologies
9. Graphics Processing Unit
10. Katmai New Instructions
11. Multi Media Extension
12. DxDiag.exe

Terminal Questions

1. Refer section 12.2: Conventional Video Adapters
2. Refer section 12.3: Classification of Video Display Hardware
3. Refer section 12.4.1: Issues in Video Performance
4. Refer section 12.6.1: Avoiding the Basic Problem

References:

- Troubleshooting, Maintaining and Repairing PC's by Stephen J. Bigelow, TMH
- The Indispensable PC Hardware Book by Messmer (Addison Wesley-Third Edition)

E-References:

- <http://www.wisegeek.com/what-is-a-graphics-adapter.htm>