3   Hardware Requirements

Before you install or upgrade to Windows 7, you will need to ensure that your computer meets the hardware requirements for Windows 7. Hardware installed in the computer needs to be compatible with Windows 7 and have device drivers available to work with Windows 7. A device driver is software which provides the interface allowing Windows 7 to communicate with the hardware. As well as the minimum requirements for Windows 7, this chapter looks at a number of real world examples of systems to give you an idea of what kind of system you will need to buy to meet your needs.

Windows 7 Logo

When trying to determine if a computer meets the requirements to run Windows 7, it is worth your time to have a quick look at the computer to see if it has a Windows 7 sticker on it as shown on the left. Computers that have this sticker have been tested with Windows 7 to ensure they are compatible with Windows 7 as well as meet a number of requirements given by Microsoft.

In some cases a computer may have the Windows 7 logo but be running a different operating system. For example, it is not uncommon in the business world for companies to buy a computer and install a different operating system on the computer like Windows XP. This is referred to as downgrade rights. If the computer you want to install Windows 7 on has been downgraded the good news is it will not cost you anything to install Windows 7. If however the computer did not originally come with Windows 7 you will need to purchase an upgrade or new version of Windows 7. Refer to the following link for more information on downgrade rights.

http://www.microsoft.com/oem/en/licensing/sblicensing/pages/downgrade_rights.aspx

Minimum Requirements

Before you start installing Windows 7, you should first check to ensure that the computer meets the minimum requirements to run Windows 7. Listed in the table below are the minimum requirements to run Windows 7. As stated above, if the computer has a Windows 7 sticker on it, it will already meet or exceed these requirements.

CPU	1 Gigahertz (GHz) or faster 32bit or 64bit CPU
RAM	1 gigabyte (GB) RAM 32 bit or 64 bit
Hard disk	32bit 16 GB hard disk space or 64bt 20 GB Hard Disk Space
Video card	DirectX 9 graphics device with WDDM 1.0 higher driver
Optical drive	For installation only
BitLocker	TPM 1.2 (Optional. Only required if using drive encryption)

Refer to the following web page for more information about minimum requirements.

http://windows.microsoft.com/en-us/windows7/products/system-requirements

CPU

The Central Processing Unit (CPU) requirements for Windows 7 are very low compared to CPU's currently available on the market. Any new CPU on the market will exceed the minimum requirements for Windows 7. Windows 7 supports any CPU that has more than one core. CPU's with multiple cores have identical processing units inside the same chip referred to as dual core, quad core, hexa-core or octa-core depending on how many cores they have. All editions of Windows 7 will run CPU's with any number of cores. If you have a computer that supports two physical CPU's with any number of cores, you will require Windows 7 professional or greater in order for Windows 7 to use both of these CPU's.

RAM

The amount of RAM that is in the computer can have a significant impact on the performance of the computer. Although the minimum requirement for Windows 7 of 1GB is quite low considering the current price of new RAM, in a lot of cases it is worth buying more than 1GB of RAM to get better performance. Keep in mind that certain editions of Windows 7 have different limitations on the amount of RAM that can be used. Listed below are limits of RAM that can be used in each edition of Windows 7.

Version	Limit on 64bit Windows	Limit on 32bit Windows
Windows 7 Ultimate	192GB	4GB *
Windows 7 Enterprise		
Windows 7 Professional		
Windows 7 Home Premium	16 GB	
Windows 7 Home Basic	8 GB	
Windows 7 Starter	N/A	2 GB

* On a 32bit system with 4GB of RAM installed, the operating system will only be able to use anywhere on average from 3.3GB to 3.6GB of RAM depending on the hardware in the computer. This is due to other devices, mainly the video card, that share the RAM space.

Hard Disk

The amount of space given in the minimum requirements is enough to install Windows 7 but does not leave much free space to do much else. It is always best to have more space than the 16GB and 20GB that Microsoft suggests. The amount of space required will ultimately be determined by how much data you will need to store on the computer. Microsoft lists a hard disk as a requirement, but a solid state drive, a style of drive on the market which works like a flash drive, will work equally well with Windows 7.
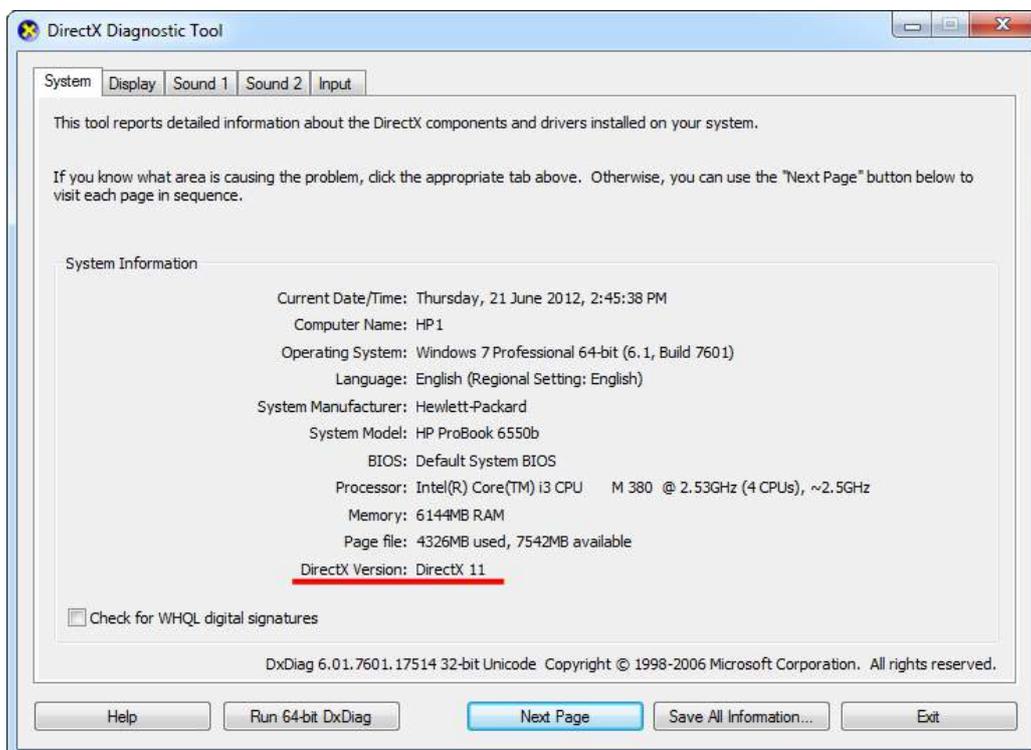
Video Card

Windows 7 requires a video card that supports DirectX 9 and Windows Display Driver Model (WDDM) device driver. DirectX is a standard that determines how software can access features on the video card. DirectX 9 was released in 2002, so it more than likely any video card in today's market will meet this standard. Since this has been a standard for ten years, it is unlikely that you will be installing Windows 7 on a computer with a graphics card that does not support DirectX 9. Since a computer that doesn't would be close to being ten or more years old.

WDDM is a standard for device drivers first introduced in Windows Vista. Even though WDDM is listed as a requirement, Windows 7 will work with a graphics card that does not have this kind of device driver. Without a WDDM driver, advanced features like the looking glass desktop will not be available. It is up to the manufacturer of the graphics card to supply a WDDM driver. All graphics cards on the current market and any other cards that have been on the market since Windows Vista should meet this requirement.

## Identifying Graphics Card Characteristics

The three main manufacturers of graphics processing units are NVIDIA, ATI and Intel. To find out more information on your graphics card, run the command DXDiag from the search start menu. This will launch the DirectX Diagnostic Tool.

As shown below, on the first Tab will be information about the computer, such as its CPU, memory and which operating system is installed. In regards to the video card, it is important to note which version of DirectX is being used, in this example version 11 of DirectX is being used. This is underlined in red below. The DirectX Version Number will determine what video hardware features and special effects are available to the operating system and software. With some software, such as in graphic intensive games, they may require a particular version of DirectX in order to run.

As shown below, additional information about the graphics card can be found on the display tab. The video card in this system is an Intel(R) HD Graphics card. If the graphics card was an NVIDIA or ATI Graphics card the model of the card would be given in the name, for example NVIDIA GeForce GTX 470.

The next important piece of information is found under the heading DAC type. In the example below the DAC type is listed as internal. This means the graphics card is sharing the system RAM of the computer. The DAC type can also be listed as Integrated. Integrated means that internal memory installed on the graphics card is for its video use and nothing else. Later in the chapter I will discuss the differences between having dedicated video RAM and shared video RAM.
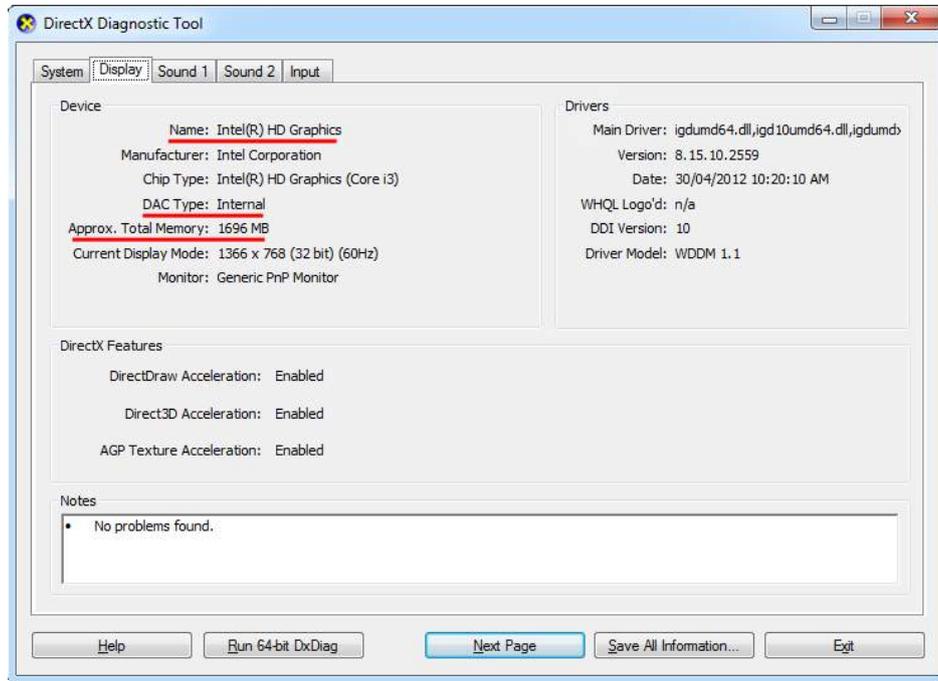
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The last important piece of information that you want to get from DXDiag is the Approx. Total Memory. In the example below the memory is listed as 1696MB. Graphics Cards with high amounts of RAM can support multiple monitors and can offer better performance when the graphics card working hard. 128MB of video ram will support one monitor with a resolution of 1600x1200 dpi. To add an additional monitor with the same resolution you will need to double the RAM. A lot of video cards support more than 1GB of onboard RAM. Video cards like these should be able to run two monitors at a resolution of 2560x1600 dpi without a problem. The extra video RAM on the video card will improve performance particularly when running graphics intensive applications or running 3D games.

If you're after additional specifications for NVIDIA, ATI or Intel Graphics cards, information can be found at the following Wikipedia Web addresses. The dedicated Wiki pages will also tell you which version of DirectX that video card supports.

http://en.wikipedia.org/wiki/Comparison_of_Nvidia_graphics_processing_units
http://en.wikipedia.org/wiki/Comparison_of_AMD_graphics_processing_units
http://en.wikipedia.org/wiki/Comparison_of_Intel_graphics_processing_units

Dedicated vs. Shared Memory

Video Cards either have Dedicated or Shared Memory. Dedicated Memory refers to memory that is used solely for the video card. Shared Memory refers to a video card utilizing the same system RAM used by the computer to run the operating system and applications. A video card that is integrated into the motherboard often utilizes Shared Memory. Shared video RAM is very common in laptops. Laptops often utilize shared RAM as it helps reduce the size and number of components required in the laptop and reduces its overall cost.

If your system has shared video memory, you should consider the effect this will have on your computers performance. When system memory is being used by the video card it is no longer available to the system. Shared RAM generally works well with desktop applications that do not require a lot of 3D processing. When running 3D games or graphic intensive applications, shared RAM does not work as well. This is because the path the data must travel over between the memory and video processor is the same path that is used by the CPU and other devices. When the graphics processor is put under a lot of load it must compete with other devices for access to the system memory.

In most cases it is better to have dedicated video memory, however due to the higher cost you may have to purchase a system with shared video memory. If you find that performance on the system is too slow, you may need to install additional system ram to make up for the RAM that is being used by the video card.

Optical Drive

The optical drive is only required for the install of Windows 7. This is any optic device that can read DVD's. You can also use a USB optical drive if your computer supports it. Any new computer on the current market should support USB optical drives for installing Windows 7. If you find the USB optical drive is not working correctly you may need to upgrade the bios on the computer.

BitLocker

BitLocker is hard drive encryption technology that enables you to encrypt the entire hard disk, protecting the data if the computer is lost or stolen. The encryption keys are stored inside a chip on the motherboard, called Trust Platform Module or TPM. You can also elect to store the BitLocker key on a USB key.

In order to use Bitlocker with a TPM, the TPM must be version 1.2 or higher. The computer will meet BitLocker requirements if a TPM chip is installed and the computer is labeled with a Windows 7 or Windows Vista compatible sticker. BitLocker also requires Windows 7 enterprise or Ultimate edition. Lastly it should also be remembered that a TPM cannot be later added to a computer that was purchased without TPM support.

Recommended Requirements

Although the minimum requirements will get you going with Windows 7, you may find it just doesn't give you the best experience running everything. Whenever possible you should try and install Windows 7 on a computer that exceeds the minimum requirements. But as is often the case, you may not have the funds to build the most wiz bang system you desire. So here are some hardware recommendations based on common computer usage requirements.

Basic Internet, Email and Document Editing

If you are only using your computer to perform basic tasks like creating small documents, emails and web browsing you will find the minimum requirements for Windows 7 should be more than enough. A 100GB hard disk should be enough to run Windows 7, with 50GB the barest minimum. Windows 7 can be installed on as little as 16GB hard disk for the 32bit operating system but this gives you little room to expand. Certain features in Windows 7 will switch themselves off if the hard disk space starts to run out. With a 16GB system, once you start storing some documents, emails or installing additional programs this space will soon be gone. Whenever possible it is a good idea to install a larger hard disk than you think you will need, to give you room to grow.

Although you can get by with 1GB of RAM for basic internet and word processing use, if your budget allows it you should consider 1.5 to 2GB. With 1GB of RAM, if you have multiple applications running at the same time, you may find the system is sluggish when switching between applications. If you start creating documents with lots of pictures in them, the system may slow down while trying to edit the document.

Video Editing

Any type of video editing can place the system under a lot of load. If you are using basic software like Windows Movie Maker with low resolution video you will be able to do this with only 1GB of RAM. If you are working with HD video you will need at least 2GB of RAM. Video editing software like Adobe Editing Suite and Sony Vegas will need 2GB of RAM as a minimum, but at least 4GB is recommended. Adobe CS4 was the last version of Premiere Pro that would run on a 32bit system. Sony Vegas still supports 32bit. Remember that on a 32bit system as outlined in the last chapter, if you install the maximum of 4GB of RAM, just over 3GB of the RAM will be useable.

Video editing systems can be real memory hogs. If you are using additional plugins and software the memory requirements may go up. It is not uncommon for professional editing systems to have over 10GB of RAM in them.

The video files used in video editing can be quite large and will use a lot of hard disk space. If you plan on editing a lot of video files it may be worth investing in a second hard disk to hold these files. The hard disk that is installed for such video editing should run at 7200 RPM (Revolutions per minute) or greater. Any slower and you'll find it will hinder the system's ability to handle video editing, especially when editing High Definition video files.

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Gaming Requirements

Although some games will run on fairly low hardware specifications the majority will require more RAM than the minimum requirements for Windows 7. Below you can see two examples of hardware requirements for games released in 2012. A lot of games on the market will make good use of additional RAM and video if they are available.

Game	CPU	RAM	Video
Diablo 3	2.4GHz single core AMD Athlon 64 X2 4400+	2GB	NVIDIA GeForce 7800 GT or ATI Radeon X9150 or better
Mass Effect 3	1.8 Ghz Intel Core 2 Duo	2GB	Video card with at least 256MB of ram and Pixel Shader 3.0 support

If you want your computer to run the latest 3D games, you should consider getting a graphics card that supports DirectX 11. DirectX is software on the computer that handles tasks relating to fast hardware access which is particularly important in games. Newer versions of DirectX support newer features and offer better performance. Even though DirectX is software, different versions of DirectX require certain features on the video card to work. Thus the choice of which video card you buy will determine which version of DirectX you can run.

The list of games that support DirectX 11 is growing and many new games are being released now that support DirectX 11. Ultimately the type of video card you choose to install with Windows 7 will be determined by your future computer usage.