Computer Systems
External Hardware II

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Contents

1 Video Cards

Nowadays, graphic cards are one of the most important devices in computers because of rising of gaming computers and the demanding for graphic of the game software or some others kinds of software as video-editing programs, etc...

The video card, also called display card, graphics card, display adapter, or graphics adapter is an expansion card which is able to receive the data processed from CPU and adapt them so that the output devices as monitor, television or projector could represent them. Normally, the video card is wrongly called GPU since they use a processor called Graphic Processor Unit (GPU)

Graphic cards are not used just in computers; it is possible to find them in others devices as PlayStation, Xbox One , Nintendo Switch...

Depending of the integration, it is possible to have the following models:

- Integrated into the chipset: they are used by systems with a low graphics demand.

- Integrated on the motherboard: a chip on the motherboard makes the functions of the graphic card. The power is limited. It is common in laptops and netbooks. They normally use RAM.

- Integrated into the CPU: New generations of CPU give the functionality of the graphic card because it is integrated in it. It has lower price, and lower consumption but nowadays it has not a good 3 D performance.

- Expansion Cards: they are widely used in order to gain performance and adapt monitors.

1.1 Video cards components

- GPU: Graphic Processing Unit is the processor of the graphic card which is in charge of making all the mathematical calculations and reduces the workload of the CPU. That processor is optimized floating point computing. The most important companies of the GPU graphic cards are nVidia and ATI.

- GRAM: it is the component which store and transmit the information which is processed in the card. On the other hand, this component is not vital for the card performance but a reduced memory can limit the performance. There are 2 versions:

  - RAM o shared: RAM is used, so the RAM is shared.
  - Dedicated: it is the most efficient since the memory is exclusively for itself.

- RAMDAC (Random Access Memory Digital Analogical Converser): it is in charge of making the conversion of digital data from the computer to analogical data to monitors. But nowadays it is out of date because all monitors are digital.

- Drivers: it is the software provided by the manufacturer in order to take full advantage of the card.

1.2 Video mode

It is the combination of the numbers of colours and resolution. The most resolution the less colour and the other way around:

- Number of colors or color depth is the different colors that can be representated in each pixel. It is expressed in number of bits, nowadays the minimum is 65.536 (16 bits) different colours although 24 or 32 bits are used.

- Resolution: it is the number of pixels in each dimension that can be displayed. For example, 1280x1024 will be the number of columns and the number of rows. The greater resolution the more detail will be on display. Resolution and the type of the monitor go together:

  - With a very high resolution the objects will be displayed too small.
  - LCD monitors have a fixed dot matrix called native resolution, these monitors can represent other resolutions than natives ones but with much poorer quality.
  - Any graphics card can handle very high resolutions in 2D and 3D static (photos), but in dynamic 3D (games) any increased resolution is a sudden drop in performance to unbearable limits.

  On the other hand, the aspect ratio is the ratio of the horizontal size and vertical size of the image which should be identical to the display device. The most common aspect ratio: 4:3 (1024x768) and 5:4 (1280x1024) called also square or 16: 9 (1366x768) and 16:10 (1680x1050), valled the panoramic.

1.3 Connectors

Graphic cards are connected to the motherboard through PCIe. On the other hand there are several types of connexions in order to connect the devices to the video card:

- VGA (Video Graphics array): it was the analogical standard in the nineteenths in order to connect analogical monitors. It suffers some kind of interferences but it is one of the most widespread connectors. RAMDAC video card is in charge of making the conversion in order to be able to use that connector. Nowadays VGA is being replaced by DVI connector .

- DVI (Digital Visual Interface): it was designed to obtain the maximum quality in digital monitors and projectors. It has better tolerance to interferences although nowadays HDMI is gaining ground because DVI is not able to transmit audio. There are three types:

  - DVI-D: with 18 or 24 pins that supports only digital signals
  - DVI-I: with 22 or 28 pins that supports digital or analogical signals
  - DVI-A: 16-pin connector that supports only analogical signals
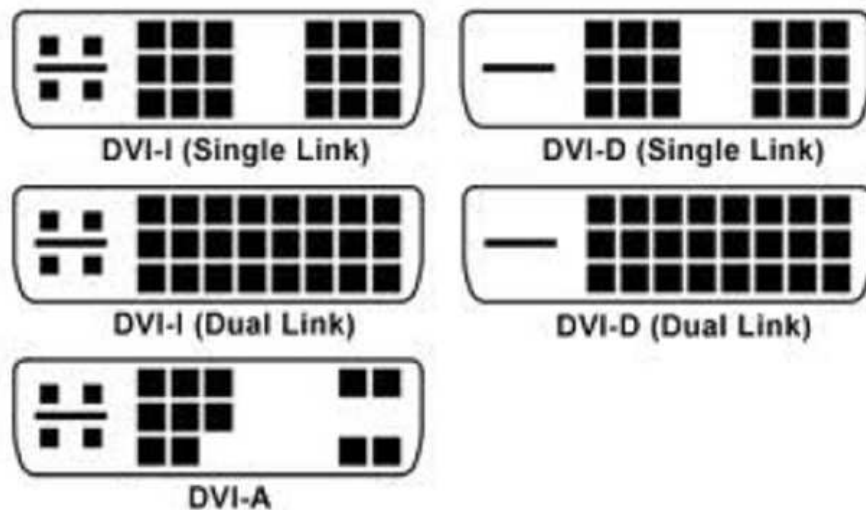
- HDMI (High-Definition Multimedia Interface): it is a technology which transmits high definition audio and digital video. It was designed for televisions at the beginning.

1.4   How is the graphic card chosen?

The first point to keep in mind is what functionality it is going to have. As it is known the video graphs are used for:

- To play video games: it is the most wellknown graphic video gaming card. They are expensive.

- Mining bitcoins: it is because video graphs have a powerful processor (GPU).

- 3D design.

- To improve the resolution of the computer.

Once the goal of the graphic card is known, there are some points to take into account :

- Size of the graphic card: today's graphic cards have a large size and it is necessary to make sure that the graphic card fits into the box of the computer.

- Power supply connectors: depending on the model chosen, the most powerful cards need dedicated power supply connectors. It is pretty important to make sure that the power supply can offer that connexions.

- On the other hand, it is neecessary to check power and speed specifications of the graphic card. There is a lot of data in the specifications which talk about performance but the most direct values are:

  - TFLOPS
  - CUDA core
  - Speed or frequency.
    The bigger values, the better.
  - Memory: AMD uses HBM/HBM2 (High Bandwith Memory) memory. That kind of memory is designed exclusively for graphic cards and it is a RAM of high performance. It reaches a higher bandwidth and it reduces its power consumption more than GDDR6. HBM2 is the second generation of that memory. Normally HBM and HBM2 are in the higher gamma while GDDR5/GDDR5X/GDDR6 are in the lower gamma.

- Finally, as in the processor, it is possible to see the numerical value passmark in the Internet of the grahic card.