Anton Bertram

Professor S. Haut

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The components of a pc and their function

As a computer science student you have to understand how the software and the hardware of a pc work together. In order to get a deeper insight we explain how the different parts of a pc work and what their functions are. This assignment is about the motherboard, the storage and the cooler.

The motherboard, also called mainboard, belongs to the more important parts of a computer. “It holds together many of the crucial components of a computer, including the central processing unit (CPU), memory and connectors for input and output devices.” 1 There are very thin traces which consists of thin layers of copper or aluminium foil, printed onto the base of a motherboard, a very unyielding sheet of a non-conductive material, mostly plastic. These traces are the circuits between all the separated parts of the components. A view sockets are implemented for other components. One of the sockets is for the CPU (Computer Processing Unit). The socket is in the centre of the mainboard because it is the most important component. A pc can not run at all without a CPU. Another important part is the power connector. It is used to connect the motherboard to the primary power supply which supplies power to the pc through the mainboard.

The storage, not to confuse with memory (RAM), is a hard disk drive where the data is recorded. In contrast to the memory the storage does not forget what was stored in it after you shut your pc down. “Stuff written to disk stays there permanently until it’s erased, or until the storage medium fails.”2 Computers need non-volatile storage so you do not have to re-do everything you have done when you restart a pc. There are two kinds of storage. The hard drive (HDD) or the solid state drive (SSD). It “can be used to store applications, documents, data and all the other stuff you need to get your work done (and your computer needs to operate)”2. When you work with modern pcs RAM will be always faster than a hard drive. The only reason they are still in use is because they are cheap. SSDs are more performant but you get less space for more money. They “use a special type of memory circuitry called non-volatile RAM (NVRAM) to store data, so everything stays in place even when the computer is turned off.”2. Unlike the hard drive a solid state drive does not use mechanical platter to store something but it uses memory chips instead. Even though they are way faster then the HDD SDDs are still much slower than RAM. Nevertheless to improve the performance of a computer is to upgrade your storage to a better one. “Even with plenty of RAM installed, computers need to write information and read it from the storage system – the hard drive or the SSD.”2. There are different speeds and sizes for hard drives. Most operate at 5400 RPM. RPM means that “their central axes turn at 5400 revolutions per minute”2. But you can also get a 7200 RPM drive or a 10 000 RPM drive. And with new technologies we are able to create bigger and faster hard drives. For example instead of air they fill the drive with helium. That causes a reduction of disk platter friction. Or they improve disk density by using heat or microwaves. But SSDs have chips instead of spinning disks so they are still faster and need less power, less space and produce less heat and that is the reason why they are more expensive than hard drives.

A cooler does exactly that what it says. It is “designed to draw heat away from the system CPU and other components in the enclosure” 3 and cool them down. In order to improve the systems stability and efficiency use a cooler. Since it is not silent a cooler increases the noise level of your computer. Only two different types of coolers are mainly used in modern pc systems. One is the air CPU cooler. “The CPU cooler may consist of a heat sink (a component designed to lower the temperature of an electronic device by dissipation heat into the surrounding air) or combination of a heat sink and a fan.” 3 Systems which are designed to improve airflow are often used with air cooling. Then there is also the liquid CPU cooling, called liquid cooling. “Liquid circulates liquid through small pipes in a heat sink, drawing heat from the CPU to a dedicated radiator located on the system case or enclosure, where it is released into the ambient air outside of the system.” ³ To proceed the procedure the cooled liquid goes back through the system to the CPU.

non-conductive:

Non-conductive is an adjective and it is used to describe objects or materials which do not conduct electricity

circuits:

Circuits are a way how electrical parts of an electrical device are connected

non-volatile:

Non-volatile is an adjective mostly used in combination with computer memories. Data does not get deleted even if there is no power.

“Only two different types of coolers are mainly used in modern pc systems.”

The sentence is written in passive voice because there is no action subject and the emphasis is placed on the action.

1 <https://study.com/academy/lesson/what-is-a-motherboard-definition-function-diagram.html>

2 <https://www.backblaze.com/blog/whats-diff-ram-vs-storage/>

3 <https://www.webopedia.com/TERM/C/cpu-cooler.html>

Fabian

Professor S. Haut

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Finding the right Graphic card is a hard task to master. There are so many things you have to consider while evaluating for the most suited piece of hardware. First of all graphic cards should not be exponentially more powerful in comparison to the CPU. Since the processor basically tells the GPU what to process, the processing unit can be a bottleneck. This means that the GPU can handle more than the CPU provides it to process and you are losing a lot of the potential power the Graphic unit could theoretically handle. Another peripheral device you have to combine with the GPU is the monitor. If you are using a display with lower resolution rates, try to consider a less powerful card. An important feature a monitor for high performance displays should have is either NVideas VSync or AMDs counterpart Freesync. These are 2 methods of synchronizing the game’s frame rate to your display’s refresh rate. That is needed to be protected from screen taring. That is the phenomenon that happens if the GPU sends pictures to the monitor halfway through the displaying process and then the displayed image is teared into 2 or maybe more distorted pictures. If either of these techniques is supported by the display go for the suited manufacturer. Or of course go the other way around and buy a monitor that fits the needs of the GPU.  
But what are the differences between AMD and NVIDEA? NVIDEA has the most powerful cards at their repertoire. Nothing of AMDs products comes even close to the sheer performance these high end cards offer. But most importantly NVIDEAs top models can handle Ray tracing. This is a method to display a lot more realistic shadows and reflections on surfaces. This is achieved by calculating how light is hitting an object and how it is reflected by it. But ray tracing is definitely not a new technique. Blockbuster companies like Disney and PIXXAR used this since ages. The real innovation lies in the real time calculation capability of the top RTX cards by NVIDEA. The average price and performance segment has a lot more competition. Both manufacturers offer all kinds of cards here and there is not a great difference in performance. If you consider official tests. But in practical use programs and games are more optimised for one or the other. That is why cards from the opposing brand have some differences in benchmark test for games even though they have comparable specifications.   
Another important point to take into consideration is the size of the card. Some customers want an extra small build and that requires of course a tiny card and a lot of space management. But there are some downsides with a smaller build. The airflow can not be that efficient compared to a larger, more open case. In addition to that smaller variants normally are a bit pricier.

Another important point is that you should avoid using two GPUs in double use. The double use of GPUs does not result in double the performance. This means that you should get the best single card you want to afford. But if you really need to have two GPUs be aware that your motherboard has the respective support. With NVIDEA it is called SLI and with AMD it is Crossfire. But these options are just for the most powerful builds.

To have a better overview of the contrasts of NVIDEA vs. AMD two cards with a similar price range are compared now. The NVIDEA GTX 1080 and the VEGA 64. Both are around 400€ at the time this paper is written. The GTX 1080 has 3 display ports that should be used for connecting a monitor (other ports will be ignored here), has around 1600 to 1700 MHz frequency and 8GB of memory. The Vega 64 in comparison has two display ports, around a 1400 to 1600 MHz frequency and 8GB memory as well. So both specifications are very comparable. But the AMD variant normally uses a bit less power and therefore is a bit more efficient. Whereas the NVIDEA can be tightly faster. So it really comes down what program you are using it for. Thake for example the parallax software to render detailed surfaces. The GTX 1080 only gets around 400 frames per second whereas the VEGA 64 gets up to 530 fps. Opposing results are made in a video game like Witcher 3. The GTX 2080 can handle a average fps count to 100 at high settings whereas the VEGA 64 only gets to an average fps count of 90.   
This leads to the conclusion that neither GPU is superior and neither GPU manufacturer is the best.   
For the future AMD has announced a new technology to attack the best performing NVIDEA GPUs. These cards are probably being available in late 2019 or more realistically in early 2020. This will shake up the GPU market a lot and NVIDEA has to be prepared f they want to continue being the best high end GPU producer.