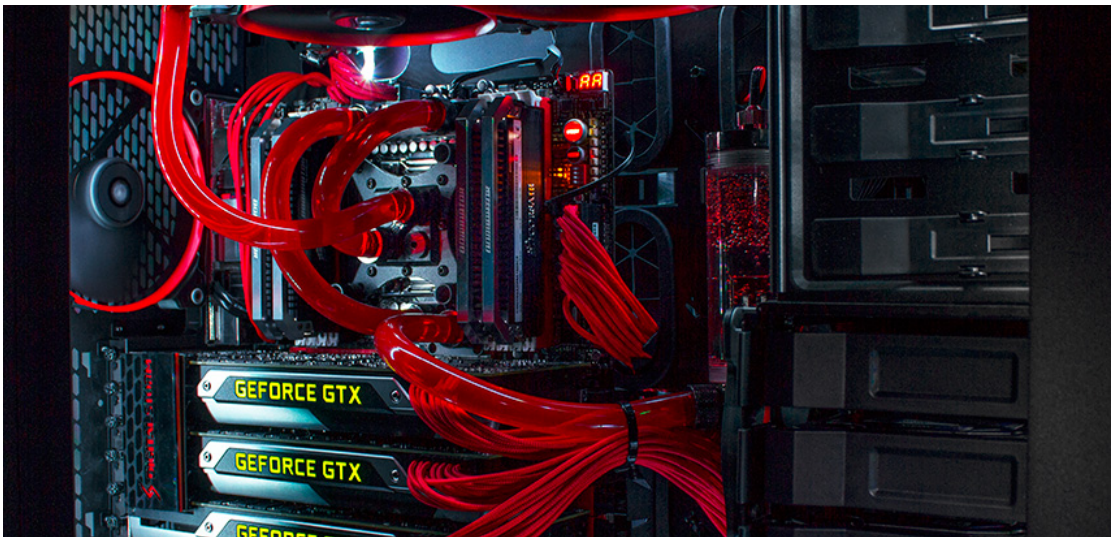
Point of View

Why hardware constipates the potential of VR gaming

The high cost of gaming hardware effectively limits the potential of the next generation gaming market. To succeed in the mass market, the hardware must be much cheaper.



Consoles lose out

Sales generated by PC games are poised to overtake those for video game consoles. By the end of 2016, PC games are expected to reach $29 billion compared with $28 billion in sales for the console market.

The underlying reason is that the PC is the only way to play the best-looking and most popular games in the industry, and to enjoy some of the most cutting-edge features online-gaming has to offer. The PC will be one of the key battlegrounds of new technologies, and today the PC is the only way to play high-quality Virtual Reality (VR) games.

Casual gamers have long since left the consoles in favor of smartphone- and tablet-based gaming.

It's all about graphics

In order to generate high definition graphics on a screen or a VR headset, video data must first be processed. An UHD movie is likely stored in a compressed format such as HEVC/H.265. In order to play the movie on an UHD TV, it must first be decompressed and translated to HDMI, before it is sent over the HDMI cable to the input on the TV.

The same is true for streamed video and games: Video data must first be processed before it can be displayed. Somewhere a piece of hardware, whether it is integrated in a TV or a stand-alone system, must process high performance video so it can be displayed on a screen.

When the previous generation of gaming consoles (mainly the PS3 and the XBOX 360) offered leading edge graphical performance at their launch, the latest consoles were already in the backwater of gaming PC's when they arrived in 2013. The PS4 and the XBOX ONE use similar AMD APU's, that are based on an 8-core Jaguar x86 processor and a Radeon 7000-series GPU. This may sound impressive, but the processing power is still only in parity with a basic gaming-capable PC, albeit to a more attractive retail price.

The problem is that even if the current consoles offer a lot of "bang for the buck", their performance is still not sufficient for the latest games. This is why gaming PC's use powerful graphical cards and generally cost to the north of $1,000. But do they need to be so expensive? No.

GPU offloads the CPU

First we must understand why a Graphics Processor Unit (GPU) is needed. When a game is run on a computer, it requires computational power to process the game rendering input and generate the graphics that are presented on the screen. The different simultaneous processes of the game software contend for the shared memory resources in the Central Processing Unit's (CPU's) intrinsic memory, i.e. the cache memory, and the DRAM memory. Processes end up blocking each other's access to the CPU, which slows down performance dramatically because the CPU is overloaded with conflicting requests.

In Windows, Direct X was introduced to improve performance with separate dedicated libraries to reduce contention for memory resources. A further step was to route time-consuming graphical computations to a separate specialized processor, the GPU. A dedicated GPU such as NVIDIA's K80 is 6 times faster at specific tasks than a recent Intel Haswell processor. Gaming computers achieve high performance by over dimensioning the CPU/GPU processors and the memory. This is why they boast liquid cooled graphics cards, see-through neon-lit chassis, and DRAM memory named after venomous snakes.

What about the CPU?

Current Intel and AMD processors are advanced Systems On a Chip (SOC's), consisting of several CPU's and a GPU. A basic SOC inherently supports the functions and the processing power required to process high performance gaming. However because the CPU is overloaded due to the contention of memory resources, it can only process and forward a fraction of the tasks aimed for the internal SOC GPU. Can this low utilization of the CPU be improved?

Yes. The solution is to avoid using DRAM memory. DRAM memory is 1,500 times slower than the CPU's cache memory. Operating systems commonly used for gaming such as Windows, Linux, Android and OSX are so bloated they use the DRAM memory extensively to execute. The DRAM memory therefore determines the performance of a computer using those operating systems. The CPU works hard on tasks that could be processed much faster. It's very much like breathing through a straw: Your lungs have to work very hard to provide you with the oxygen you need.

A compact operating system that only executes in the CPU cache memory is obviously much faster than the established operating systems. When the DRAM bottleneck is removed, the CPU can process tasks 1,500 times more quickly. Its utilization increases dramatically, which enables it to purvey all graphical computing tasks to the SOC's internal GPU.

So…

An optimal operating system can unleash the inherent gaming capabilities of the SOC processor, rendering the external GPU obsolete. Cheap computers can then be used for high performance gaming.

And we can have leading-edge gaming computers that support UHD and VR, fit in the palm of your hand, and cost $100 or less.

Such a device is the catalyst to VR gaming becoming a mass market.

September 23th 2015