Assignment

On

Future Processor Architecture

Course Name: Computer Architecture

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Introduction:

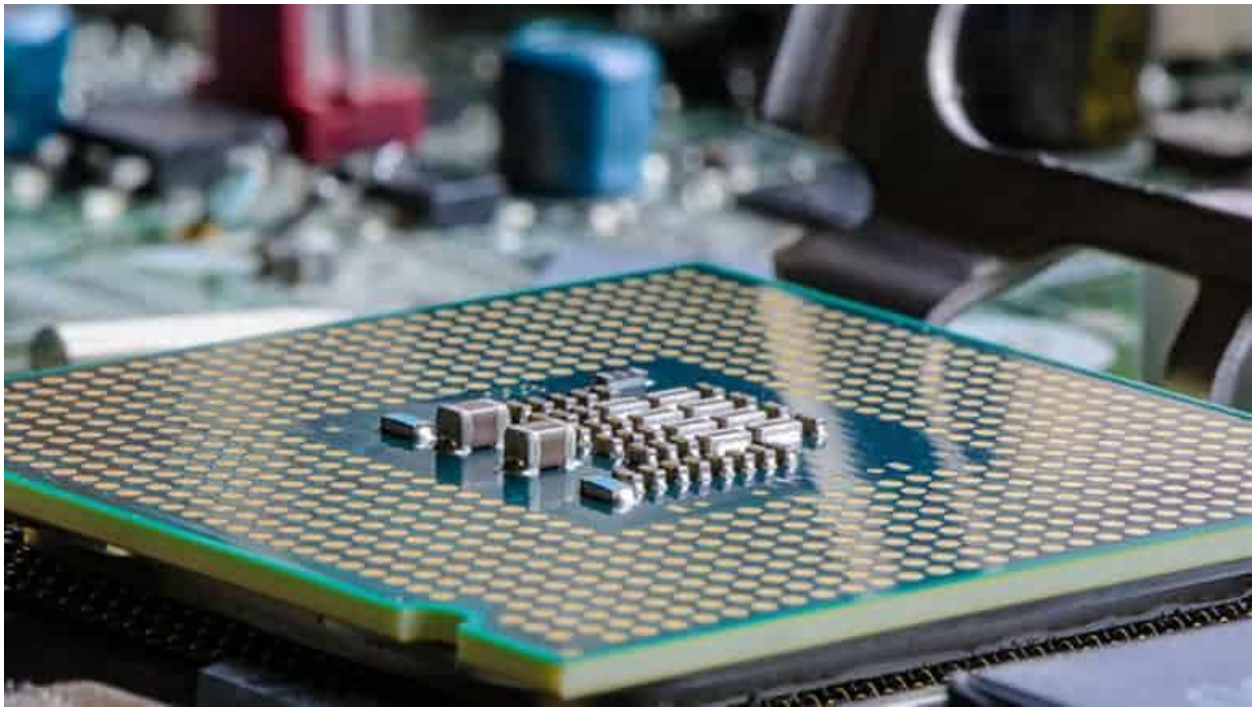
The **processor** (**CPU**, for *Central Processing Unit*) is the computer's brain. It allows the processing of numeric data, meaning information entered in binary form, and the execution of instructions stored in memory.

The first **processor** (Intel 4004) was invented in 1971. It was a 4-bit calculation device with a speed of 108 kHz. Since then, processor power has grown exponentially. So what exactly are these little pieces of silicone that run our computers?

What is computer Processor:

A processor is a small chip that resides in computers and other electronic devices. Its basic job is to receive input and provide the appropriate output. While this may seem like a simple task, modern processors can handle trillions of calculations per second.

The central processor of a computer is also known as the CPU, or "central processing unit." This processor handles all the basic system instructions, such as processing mouse and keyboard input and running applications. Most desktop computers contain a CPU developed by either Intel or AMD, both of which use the x86 processor architecture. Mobile devices, such as laptops and tablets may use Intel and AMD CPUs, but can also use specific mobile processors developed by companies like ARM or Apple.



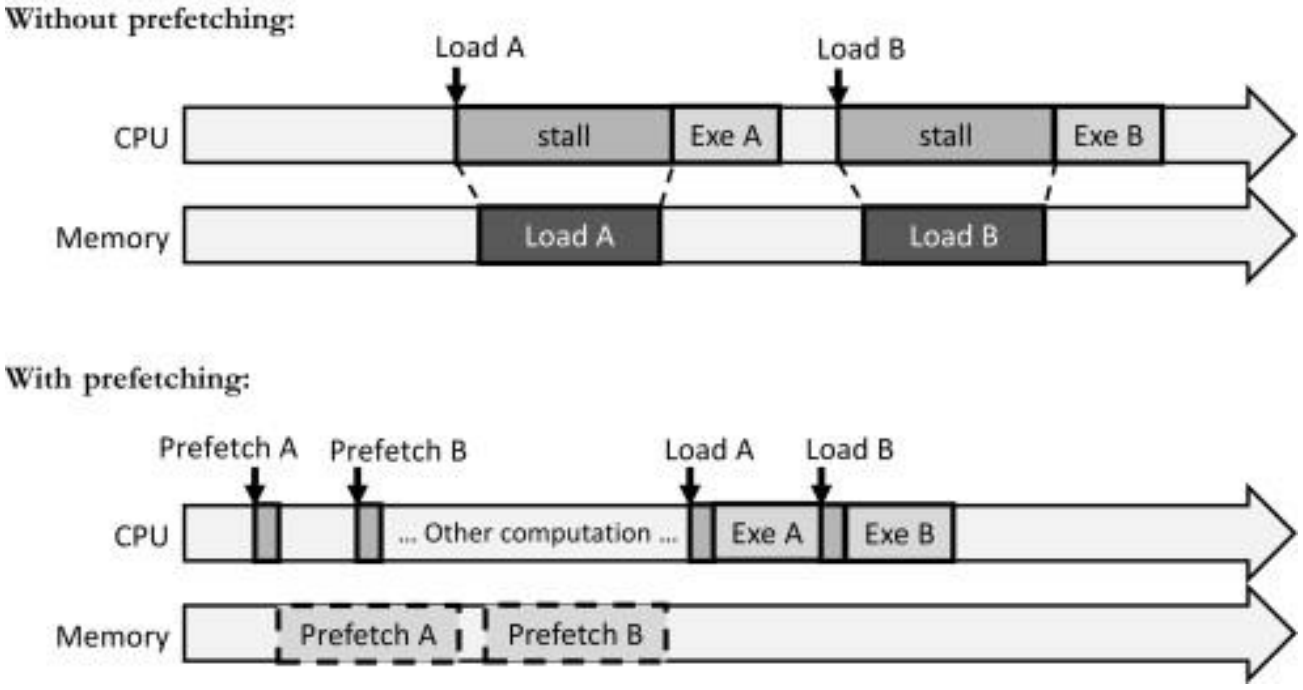
First computer processor:

Intel with the help of Ted Hoff introduced the **first** processor, the Intel 4004 on November 15, 1971. The 4004 had 2,300 transistors, performed 60,000 OPS (operations per second), addressed 640 bytes of memory, and cost $200.00. Intel introduced the 8008 **processor** on April 1, 1972.

Modern computer Processor:

Modern processor architectures generally include some level of prefetching support in their memory hierarchies via combinations of hardware, software (compiler-guided), and intrinsic for application developers. Perfecting aims to issue data accesses before an application actually needs that data thereby reducing the observed memory latencies and lowering the number of cache misses.

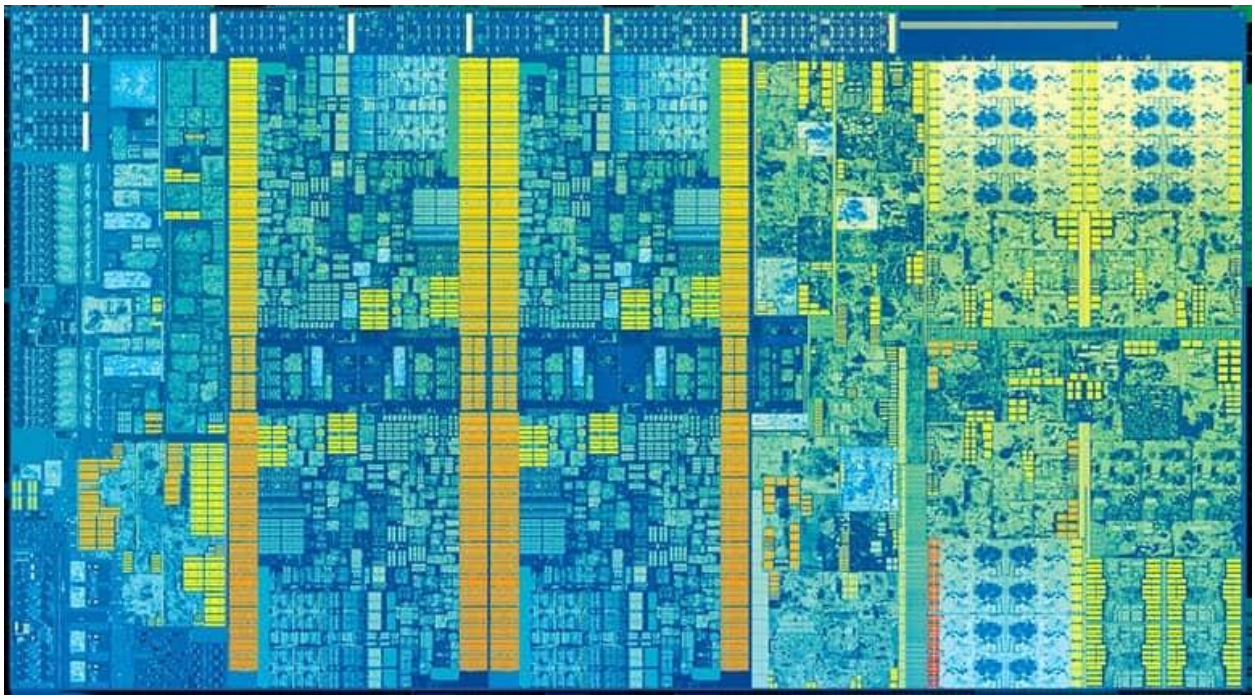
This may significantly improve the application performance by effectively hiding memory access latencies while other useful work is done on the processor. Figure illustrates how prefetching overlaps memory latency with computation. Sophisticated prefetchers detect patterns in workload access streams, tune their aggressiveness, and throttle each other dynamically.



There are multitudes of factors that the designer takes into account to make optimal implementations including throttling so that aggressive pursuits do not result in

kicking useful data out of the caches, bringing in data too far ahead of time, or even in plain wasted useless prefetches. It is a balancing act to maximize benefits while using architectural resources efficiently in tune with the access patterns and workload needs.

Processors Look Like In 2018:



Nearly all processors in 2018 are multi-core.

Having a multi-core processor improves the performance of a computer and reduces power consumption. With improved performance, a multi-core processor can easily and effectively process a number of tasks at the same time.

A multi-core processor works in exactly the same as two or more single processors would. However, as a multi-core processor only uses one socket within the system, there is a much faster connection between the processor and computer. The majority of mainstream personal laptops and computers come with either a dual-core or quad-core processor.

More powerful processors are usually found in gaming computers: these are typically 4-core or 6-core.

There are two main competitors in the processor market, Intel and AMD. Both companies are battling to get ahead in terms of value and efficiency.

However, Intel definitely holds a much stronger market presence. Intel's portfolio is massive, almost saturating the market.

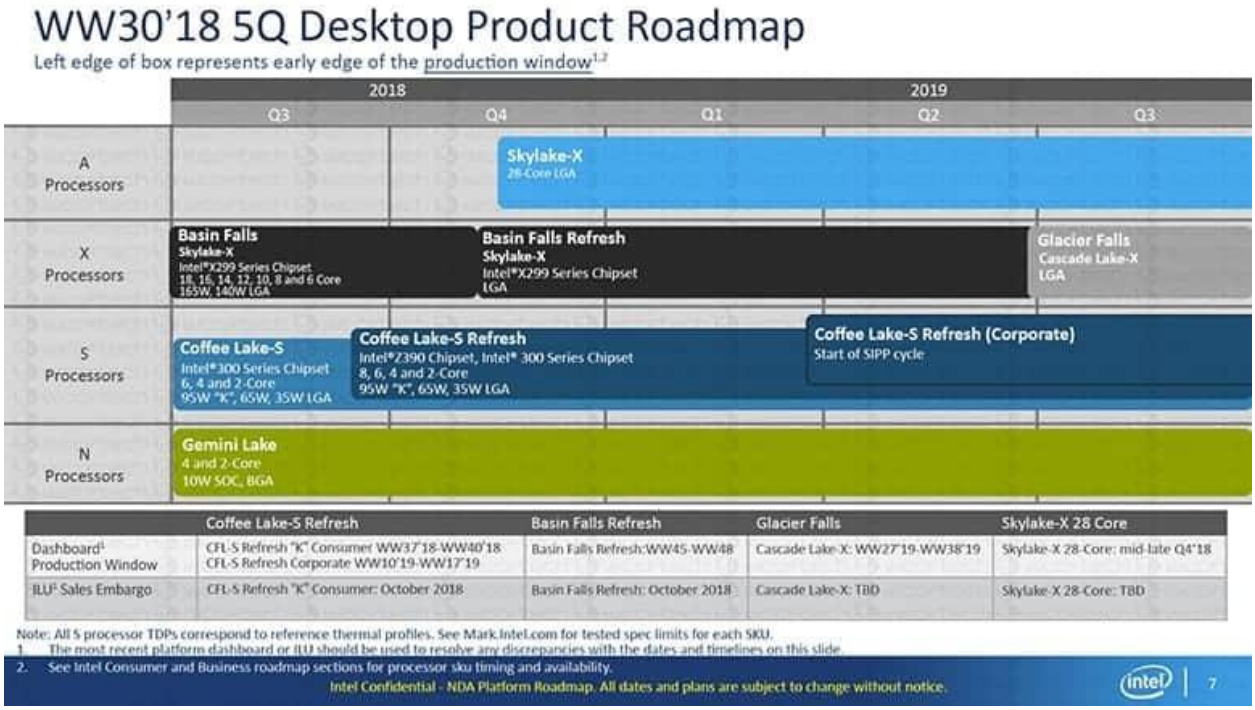
Processor Features:

Looking at the best processors of 2017-2018 there are some great options from both Intel and AMD. Intel's Skylake-X range of processors offers insane core counts. One of their most basic in the line is the Core i9-7900X, which has a phenomenal 10 cores.

The power continues to grow, however, with their most powerful processor to date, the Core i9-7980XE. This mighty processor features an unbelievable 18 cores. The release of this processor last year completely blew away any competition from AMD.

AMD did put up a good fight though. They released their Ryzen Thread ripper range, which comes with a great deal of power too. The line features 8, 12 and 16-core processors, respectively.

I Expect future Processors In 2020:



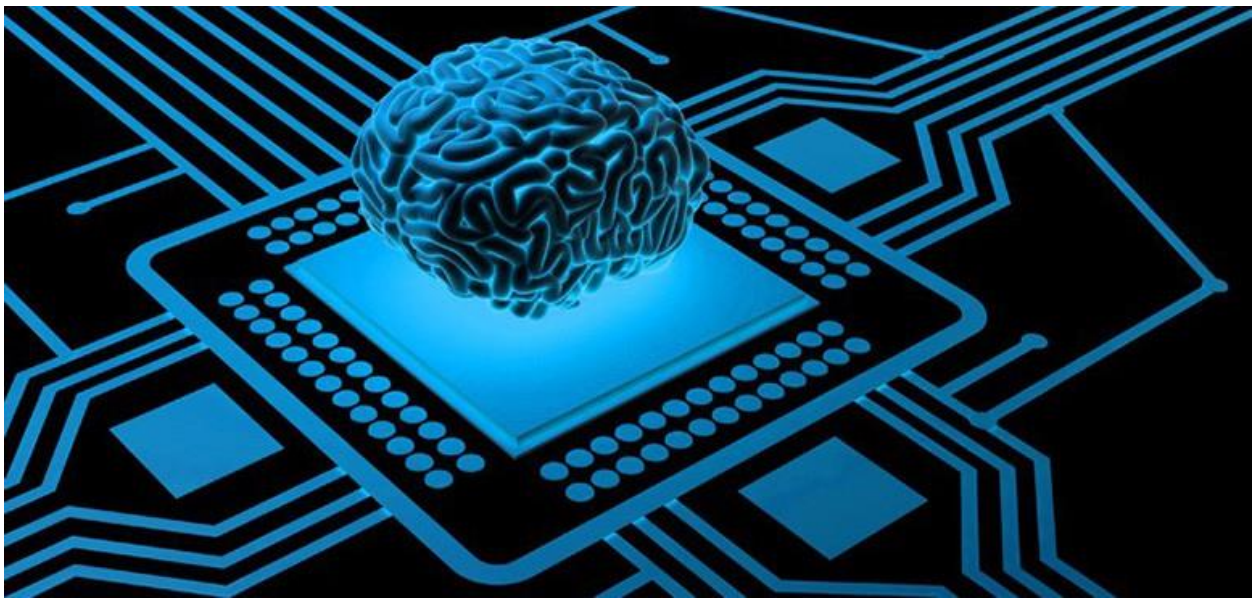
Source: WCFtech

AMD and Intel are both working towards developing and improving their processors further for 2020. In both camps, the main improvement we expect to see is an even bigger increase in cores.

We could see processors **almost double** in basic core count and power by 2020. Intel appears to be developing the power of their processors, with plans to continue to improve on their Sky lake-X processors. We may also see a shift in price to make them more accessible to the mainstream computer market.

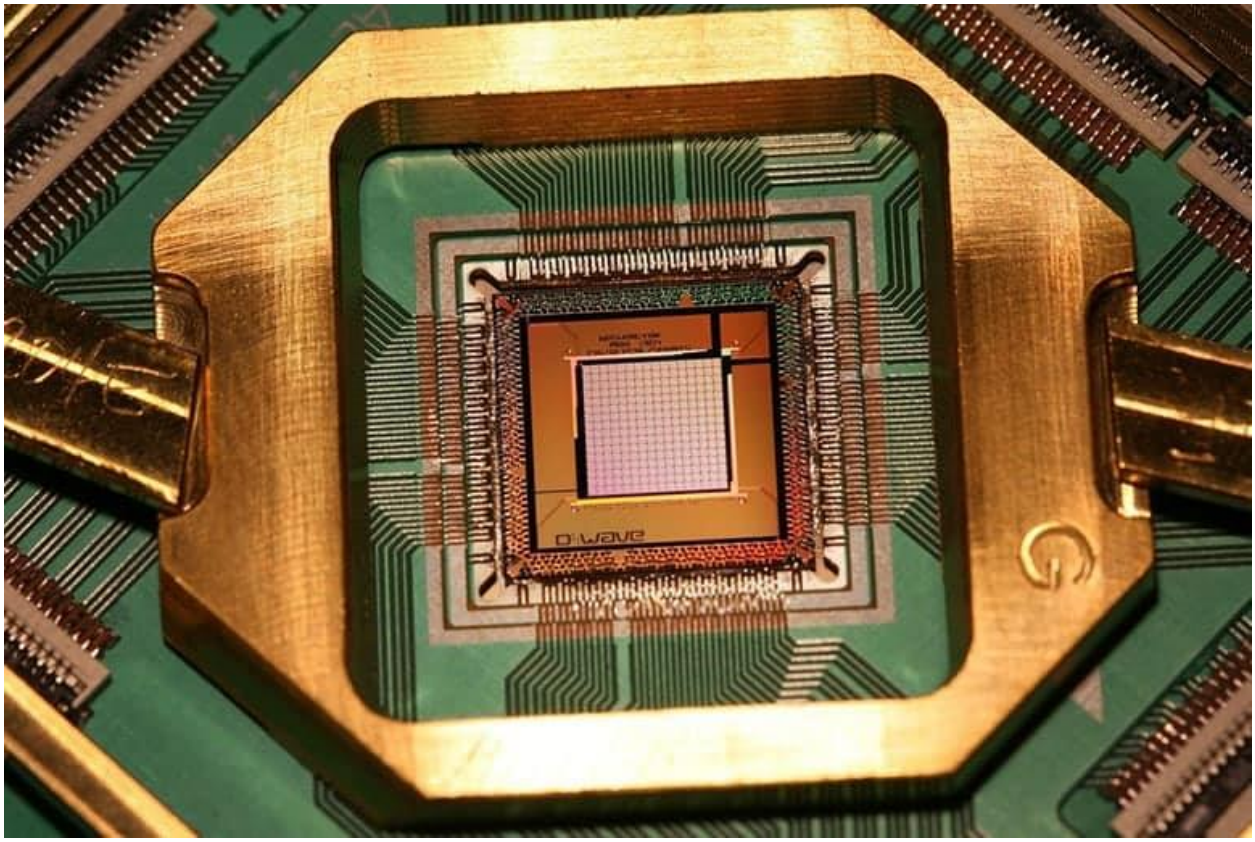
If this level of processor goes mainstream, all users will benefit from the extra speed and power.
Looking at the future of AMD future, there is talk of catching up with Intel's mighty i9-7980XE.
AMD are developing a 16-core processor that is compatible with its AM4 socket. This figure is double its existing size. It is looking likely that 16-core processors will be a central feature of the mainstream AMD market in 2020. This new set of specs will see a 10-15% improvement of inter-process communication and overall speed.

AMD are not going to stop there. There is talk of them working towards processors that are up to 36-core. With such a powerful processor in the pipeline, there are no doubt users, looking for high computer power, who will be lining up to get one.



Intel and AMD both have different and exciting things in store for the future of processors.
During Intel's keynote at CES 2018, they highlighted that there are two key areas in their focus for the future. They see quantum and neuromorphic computing as the real future for computing.
During the same keynote, they revealed two processors that have been designed specifically for these areas of computing. Their neuromorphic processor features a total shakeup in terms of architecture.
Intel have designed this processor to mimic a human brain, with an ability to learn and grow independently.

Intel will be sharing this prototype chip with different research institutions and universities to advance development. We do not know how long it will take for a usable processor like Loihi to be available in our laptops. However, with the right development it won't be long before this kind of processor will be part of our everyday computers.



Looking at Intel's other main prediction for future processors saw Krzanich reveal "Tangle Lake". Their latest quantum computing revelation is a powerful 49 quadbit test chip. A quantum bit chip has the ability to hold more information than other chips.

AMD's future has some equally revolutionary ideas on the horizon. They have been working with Qualcomm to develop high-performance processors for mobile devices.

The result of this will be an increase to the power of the 2-in-1 devices and lightweight and portable laptops that hit the market.

This type of development is arguably something the consumer market will see sooner than Intel's developments.

AMD may really be on the right track for instant success by targeting this section of the laptop market. This will also help to make extremely powerful computers accessible to the mainstream consumer.

Final Thoughts:

With such powerful processors already available on the market and in production, it raises the question of where Intel and AMD can go next.
The future of processors will see a continued increase in size and power. A feature that will only be met by a continued growth in the number of cores within the processor.
With that said, there are arguably more revolutionary changes on the horizon for processors. With Intel's focus on changing their approach for the future, we could see a totally different kind of processor soon.
Depending on how long it takes to develop processors like Tangle Lake and Loihi, the market may soon be full of unrecognizable CPUs.
As with most things in the tech world, with high power comes a high price. There is a continuing growth and variety of processor powers and speeds, but for a high cost. High power and multi-core CPUs are definitely not marketed to the mainstream user yet.

This may not be the case for long though, as more powerful multicore processors will become the prerequisite in personal laptops. The future of processors really will mean more power for everyone.

We predict that, when it comes to their processors, 2020 will bring upgrades in power to all kinds of computers and mobile devices.

Conclusion:

The past 20 years were truly the great old days for Moore's Law scaling and processor performance; dramatic improvements in transistor density, speed, and energy, combined with architecture and memory-hierarchy techniques delivered 1,000-fold processor performance improvement.

The next 20 years—the pretty good new days, as progress continues—will be more difficult, with Moore's Law scaling producing continuing improvement in transistor density but comparatively little improvement in transistor speed and energy.

As a result, the frequency of operation will increase slowly. Energy will be the key limiter of performance, forcing processor designs to use large-scale parallelism with heterogeneous cores, or a few large cores and a large number of small cores operating at low frequency and low voltage, near threshold.

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