



A Review and Hypothesis on Intel Core™i5 Processors

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ABSTRACT: As we all know that Intel is the renowned company that manufactures the processors since 1940s. Every year they introduce different versions of the processors that have more advanced and the new features as compared to the previous one. After the introducing i3 processors, Intel introduced i5 core processors and increase the family members of I series of the processors. It was invented in 2009 as a result of the advanced theories and for the sake to meet the challenges of the modern and latest technologies.

The CPU is considered (Central Processing Unit) to be the brain of the computer. This analogy is very loose because, for the most part, the CPU cannot keep data stored inside it like a brain. In contrast, it is used to process much of the information needed by the computer, just like our brain thinks and processes information and gives orders to our other body parts. Over the past few years, we have seen the CPU MHz speeds go from 100 MHz to over 2 GHz (1000 MHz = 1 GHz). This is one reason that people need to learn about a CPU. Many people would expect a 1.8 GHz Intel Pentium 4 to be much faster than a 1.4 GHz AMD Athlon because its speed is 0.4 GHz faster. In truth, not only is the Intel Pentium 4 up to three times more expensive than the AMD Athlon, it is either much slower or neck to neck in most "Real world tests", which compares the amount of times that it takes each CPU to perform a certain task. With this information, you know that you should not judge a computer by the "speed ratings". But if one CPU goes at a faster MHz rate and is slower, what factors determine the speed of the CPU? There are a variety of factors. Here we are going to analyze the features of Intel Core™ i5 processors and know how the speed of CPU be affects.

I. FEATURES OF i5

1. The i5 processor are used in intelligent networking and enhance the performance of the working such as gaming, graphics etc
2. i5 processor automatically manage power supply where needed.
3. i5 never break the performance of system.
4. Allow user to run heavy application on it with HD video composing, composing a music and many more.
5. i5 gives the opportunity to the users to use multi-tasking .
6. i5 processor are able to increase the memory of the system
7. Help users to use with good bandwidth and performance.
8. Ability to run two multitasking processors together called dual processors and can speed up the working performance.
9. It allow users to use their regular and important work with the help of heavy applications
10. An i5 processor consists Hyper Threading technology that enables users for multitasking and improves their business or working environments by

doing two different tasks at the same time.

II. TECHNICAL SPECIFICATIONS OF I5 PROCESSORS

1. Have ability to work with integrated memory and enhance the performance of applications. May increase the memory up to 1333 MHz.
2. i5 processors have high speed performance rate so that use maximum CPU rate of 3.6 GHz
3. Turbo technology is now days that boost up the working speed of the systems.
4. This provides the 64 bit architecture for users for the reliable and much faster working.
5. Micro architecture of i5 processors was presented by the Nehalem and have a cache rate up to 8 MB.
6. It have dual processor technology.
7. HD graphics enhance the video graphing and applications related to the same architecture

The Misconception

People usually think that Core i3, i5 and i7 are the processor generations. These are brands of processors

from Intel. They are Pentium, Celeron, Pentium M and Celeron M for mobile devices, Pentium Dual Core, Core Solo, Core Duo, Core 2 Duo, Core 2 Quad, Core i3, i5, i7 Generation of a processors start from core i series. They have been named in order to personalize and differentiate.

1st Generation of Intel Processors – Nehalem

Nehalem is the Intel processor which was successor of initial Core architecture which have some limitations e.g. -it can not increase clock speed, less pipeline etc. Nehalem used 45 nm where 65nm or 90nm are used by previous architectures. Nehalem reuse hyper-threading technology which was not in the initial Core i3 processor models.

These processor have a 64 KB L1 cache, 256 KB per core L2 cache and 4 MB to 12 MB L3 cache which is shared with all the processor cores.

2nd Generation of Intel Processors – Sandy Bridge

Sandy Bridge is came in 2011 to replace Nehalem architecture. Sandy Bridge uses 32 nanometer process. this processor average performance is 11.3% more better than the Nehalem.

This uses the L1 and L2 cache same as Nehalem but uses L3 cache from 1MB to 8 MB. For extreme processors, it was from 10 MB to 15 MB.

3rd Generation of Intel Processors – Ivy Bridge

Ivy Bridge processors is faster than the previous processors and use 22 nanometer process. This use 50% less energy and give 25% to 68% increase in performance as compare to previous one. Problem of these processors is that they emit more heat as compared to previous.

4th Generation of Intel Processors – Haswell

Haswell is the latest generation processor. Uses 22 nm process. it improve the performance 3% to 8%. Many of feature are same as Ivy Bridge with some new features like support of new sockets (LGA 1150, BGA 1364, and LGA 2011-3), DDR4 technology, a completely new cache design etc.

Main benefit of Haswell is it can used in portable devices due to low power consumption.

5th Generation of Intel Processors -Broadwell

Broadwell is latest generation processor and released in September 6, 2014. uses 14 nm chip. Mobile processors are launched in January 2015 and Desktop Core i5 and i7 processors were released in June 2015.

6th Generation of Intel Processors -Skylake

This generation Launched in August 2015. Successor of Broadwell line, it is a redesign using 14 nm process technology, the redesign is better for CPU and GPU performance and reduced power consumption. Disabled over clocking non -K processors.

Overclocking: - Overclocking is the process of manually increasing the speed of the processor

7th Generation Intel Processors -Kaby Lake

Launched in October 2016 (mobile chips) and January 2017 (desktop chips). Using 14nm process technology. Latest generation of microarchitecture, Intel decided to produce Kaby Lake processors without using their "tick tock" manufacturing and design model.

The next generations- (Maybe Coffee Lake or Cannon Lake – A Hypothesis)

This will Launched in late 2017. Intel's 8th Generation processor will have better battery life, less power consumption, less heat, and better performance. It will 15 per cent Faster and consume 25 percent less power and will 35 percent smaller than the 7th Generation Processors. It will be 14nm Process technology.

The Intel has confirmed its eighth generation core CPUs, codenamed will be 'Coffee Lake' and will launch in the mid of 2017. However, this processor not be based on 10nm architecture, it will be once again based on 14nm technology.

This is surprise because Intel has already made a hoo-ha over its move to 10nm technology but they are not using it on its next generation of processor. The some other people are saying the next upcoming processor micro architecture name will be Cannon Lake.

Coffee lake processors will use the Moore technology and updated Intel Optane technology on motherboard with Intel 300 series chipsets.

As per the rumours Intel will advance the Moore technology in 14nm, here advancing the Moore technology means that coffee lake IC's will use more number of transistors than 7th generation for better performance, but it could increase the power consumptions.

8th generation will use the tick-tock design model and will 35 percent smaller than the 7th generation.

Tick-Tock:-tick represents the optimization of the processor technology over earlier micro architectures and tock represents new pattern of microarchitecture.

Coffee lake will come with GT2 and GT3e and GPU on these coffee lake chips allow support DP 1.2 to HDMI 2.0 and HDCP 2.2 connectivity and will use DDR4 2400MHZ memory in dual channel mode.

Although we are not exactly sure about what is coming next from Intel but surely,

We can think of something will come with some enhancements in microarchitecture for the better results than earlier generations.

Core i5(1st Generation)

The first generation of i5 using the Nehalem microarchitecture which was introduced on 8 September 2009. The use of Nehalem micro-architecture in core i5(1st Generation) indicates that it uses all the features of Nehalem architecture as we have discuss in Nehalem processor have a 6 KB L1 cache 256KB per core L2 cache and 4MB to 12MB L3 cache which is shared to all processor core. This processor disabled hyper threading.

Note- Hyper threading is a technology which allows a single processor to act like a two separate processor to the operating system. This used to perform the two task simultaneously, which increase the performance of the operating system.

Core i5 (2nd Generation)

The sandy bridge based core i5 line of processor was released in January 2011. This include quad core-Core i5-2500, 2500K, Core i5-2xxxT (with dual/quad core) and give better results as compare to the earlier generation . As we have discuss in sandy bridge micro-architecture, this uses 6MB for L3 cache, direct media interface and an integrated GPU. Their clocking speed ranges from 1.4Hz to 3.3GHz.

Core i5 (3rd Generation)

Third generation of core i5 uses Ivy Bridge micro-architecture which was released in April 2012. It uses 64KB L1 Cache, 256KB L2 cache and 2MB to 8MB L3 cache per core. Third generation core i5 line of processor based on the 22nm manufacturing process and faster than the previous processor, this use 50% less energy and gives 25% to 68% increase in performance as compare to previous one.

The problem with this processor is that they emit more heat as compared to previous or earlier processor. This processor are best for the business users and users would take benefits from the multitasking ability.

Core i5 (4th Generation)

The fourth generation of core i5 based on Haswell microarchitecture which was released on June 2013, it uses 22nm process. They introduce low power processor design for convertible "hybrid" ultra-books. It uses 4KB L1 cache, 256KB L2 cache, 2 to 40 MB (shared) and 128 MB of eDRAM for the better results from the earlier processors.

It improve the performance 3% to 8% and contain some features of Ivy Bridge with some additional features like supporting of new sockets (LGA 1150, BGA 1354, LGA 2011-3), DDR 4 technology, a completely new cache design etc.

Two main improvements: Due to the use of DDR4 technology the power consumption decreases and the data transfer rate increases.

Core i5 (5th Generation)

This generation based on Broadwell microarchitecture was launched in 2014. Micro-architecture based on the 14 nm process for mobile, desktops, and servers. It uses 64KB L1, 256KB L2 cache, 2-6KMB (shared) L3 cache and 128MB of eDRAM or L4 . Extensions x86-64, SSE, SSE2, SSE3, SSSE3, SSE4, SSE4.1, SSE4.2, AVX, AVX2, TXT, TSX, VT-x, VT-d and Socket-LGA 1150, rPGA 947, BGA 1364, LGA 2011-v3 are use in this microarchitecture. It is a Successor of Skylake (microarchitecture). There are used two TDP classes – 15 W for 2+2 and 2+3 configurations and 28 W for 2+3 configurations.

Core i5 (6th Generation)

this generation based on skylake microarchitecture was launched in 5 august 2015. 14 nm bulk silicon 3D transistors re used in this generation. Extensions are used by x86-64, Intel 64, SSE, SSE2, SSE3, SSE4, SSE4.1, SSE4.2, ADX, AVX, AVX2, AVX-512, MPX, TXT, TSX, SGX, VT-x, VT-d and Socket LGA 1151, BGA 1356, BGA 1515, BGA 1440 are used by this microarchitecture. It is the Successor of Kaby Lake (Optimization). it support two DIMM slots per channel. Skylake-based System may use wireless technics known as Rezence for charging, and other wireless techniques for communication with peripherals device. This microarchitecture need only 4.5 watts. Intel claims that its mobile Skylake chips run up to 60 percent faster and use up to 60 percent less active power than earlier CPU. Have Integrated L4 cache. For desktop-some with Configurable thermal design power (cTDP), selecting 35 W or 95 W modes; High-performance 95 W TDP version (no L4 cache).

Core i5 (7th Generation)

This is the latest generation of processor .this generation is based on kabylake microarchitecture was launched in january 2017. Extensions are used by this are MMX, AES-NI, CLMUL, FMA3, SSE, SSE2, SSE3, SSSE3, SSE4, SSE4.1, SSE4.2, AVX, AVX2, TXT, TSX, SGX, VT-x, VT-d and Socket LGA 1151, BGA 1356, BGA 1440, BGA 1515 are used by this microarchitecture. this is the Successor of Coffee Lake. Kaby Lake's are developed by the Intel's Israeli team. Performance of the seventh generation chips was improved by 12% for applications and 19% for Internet use compared with the sixth generation chips. In Sky Lake we may Increase clock speeds up to 300 MHz. it is fully compatible with most existing x86/x86-64 O/S.

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