# **Comparing Intel i3, i5 and i7 processors**

Intel’s current core processors are divided into three ranges(Core i3, Core i5 and Core i7), with several models in each range.The differences between these ranges aren’t same on laptop chips as on desktops. Desktop chips follow a more logical pattern as compared to laptop chips, but many of the technologies and terms, we are about to discuss, such as cache memory, the number of cores, Turbo boost and Hyper-Threading concepts is same. Laptop processors have to balance power efficiency with performance – a constraint that doesn’t really apply to desktop chips. Similar is the case with the Mobile processors.  
Let’s start differentiating the processors on the basis of the concepts discussed below!

**Concepts and Technologies**

* + **Total number of cores present:**Out of all differences between the intel processor ranges, this is one that will affect performance the most.  
    Having several cores can also drastically increase the speed at which certain programs run. The Core i3 range is entirely dual core, while Core i5 and i7 processors have four cores.It is difficult for an application to take advantage of the multicore system. Each core is effectively its own processor – your PC would still work (slowly) with just one core enabled. Having multiple cores means that the computer can work on more than one task at a time more efficiently.

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| **PERSONAL COMPUTER** | **INTEL CORE I3** | **INTEL CORE I5** | **INTEL CORE I7** |
| Number of Cores | 2 | 4 | 4 |

* + **What is Turbo Boost in processors?**  
    This may be interesting, **the slowest Core i3 chips runs at a faster speed than the base Core i5 and Core i7.** This is where clock speed comes into the scenario.Let’s first define, What is Clock speed?  
    The GHz represents the number of clock cycles (calculations) a processor can manage in a second. Putting simply, a bigger number means a faster processor.  
    Examples:
  + 2.4GHz means 2,400,000,000 clock cycles.

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| **PERSONAL COMPUTER** | **INTEL CORE I3** | **INTEL CORE I5** | **INTEL CORE I7** |
| Clock Speed Range(Several Models) | 3.4GHz – 4.2GHz | 2.4GHz – 3.8GHz | 2.9GHz – 4.2GHz |

* + Turbo Boost has nothing to do with fans or forced induction but is Intel’s marketing name for the technology that allows a processor to increase its core clock speed dynamically whenever the need arises. Core i3 processors don’t have Turbo Boost, but Core i5 and Core i7s do. Turbo Boost dynamically increases the clock speed of Core i5 and i7 processors when more power is required. This means that the chip can draw less power, produce less heat and only boost when it needs to. For example, although a Core i3-7300 runs at 4GHz compared to 3.5GHz for the Core i5-7600, the Core i5 chip can boost up to 4.1GHz when required, so will end up being quicker. A processor can only Turbo Boost for a limited amount of time. It is a significant part of the reason why Core i5 and Core i7 processors outperform Core i3 models in single-core-optimised tasks, even though they have lower base clock speeds.

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| **PERSONAL COMPUTER** | **INTEL CORE I3** | **INTEL CORE I5** | **INTEL CORE I7** |
| Turbo Boost | No | Yes | Yes |

* + **Note:**  
    If a processor model ends with a K, it means it is unlocked and can be ‘overclocked’. This means you can force the CPU to run at a higher speed than its base speed all the time for better performance.
  + **Cache memory:**A processor’s performance isn’t only determined by clock speed and number of cores, though. Other factors such as cache memory size also play a part. When a CPU finds it is using the same data over and over, it stores that data in its cache. Cache is even faster than RAM because it’s part of the processor itself.  
    Here, bigger is better. Core i3 chips have 3- or 4MB, while i5s have 6MB and the Core i7s have 8MB.

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| **PERSONAL COMPUTER** | **INTEL CORE I3** | **INTEL CORE I5** | **INTEL CORE I7** |
| Cache Memory | 3 – 4MB | 4 – 6MB | 8MB |

* + **What is Hyper-Threading?**  
    It’s one of the concepts which is a little confusing to explain, but also confuses as it’s available on Core i7 and Core i3, but not on the mid-range core i5. A little shocking, right? Normally we assume that we get more features as we go higher towards the processor range, but not here. Back to the concept, A thread in computing terms is a sequence of programmed instructions that the CPU has to process. For example: If a CPU consists of one core, it can process only one thread at once, so can only do one thing at once.  
    **Hyper-Threading is a clever way to let a single core handle multiple threads.**It essentially tricks operating system into thinking that each physical processor core is, in fact, two virtual (logical) cores. A two-core Core i3 processor will appear as four virtual cores in Task Manager, and a four-core i7 chip will appear as eight cores. Whereas, the current Core i5 range doesn’t have Hyper-Threading so can also only process four cores. Due to Hyper-Threading operating system is able to share processing tasks between these virtual cores in order to help certain applications run more quickly, and to maintain system performance when more than one application is running at once.

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| **PERSONAL COMPUTER** | **INTEL CORE I3** | **INTEL CORE I5** | **INTEL CORE I7** |
| Hyper-Threading | Yes | No | Yes |

From these, we conclude why Core i7 processors are the creme de la creme. Not only are they quad cores, they also support Hyper-Threading. Thus, a total of eight threads can run on them at the same time. Combine that with 8MB of cache and Intel Turbo Boost Technology, which all of them have, and you’ll see what sets the Core i7 apart from its siblings.  
On the other side, it totally depends on the requirements, to choose a processor.

**Hyper-Threading**

Hyper-threading was Intel’s first attempt to bring parallel computation to consumer PCs. It debuted on desktop CPUs with the Pentium 4 HT back in 2002. The Pentium 4’s of the day featured just a single CPU core, so it could really only perform one task at a time—even if it was able to switch between tasks quickly enough that it seemed like multitasking. Hyper-threading attempted to make up for that.

A single physical CPU core with hyper-threading appears as two logical CPUs to an operating system. The CPU is still a single CPU, so it’s a little bit of a cheat. While the operating system sees two CPUs for each core, the actual CPU hardware only has a single set of execution resources for each core. The CPU pretends it has more cores than it does, and it uses its own logic to speed up program execution. In other words, the operating system is tricked into seeing two CPUs for each actual CPU core.

Hyper-threading allows the two logical CPU cores to share physical execution resources. This can speed things up somewhat—if one virtual CPU is stalled and waiting, the other virtual CPU can borrow its execution resources. Hyper-threading can help speed your system up, but it’s nowhere near as good as having actual additional cores.



Thankfully, hyper-threading is now a “bonus.” While the original consumer processors with hyper-threading only had a single core that masqueraded as multiple cores, modern Intel CPUs now have both multiple cores and hyper-threading technology. Your dual-core CPU with hyper-threading appears as four cores to your operating system, while your quad-core CPU with hyper-threading appears as eight cores. Hyper-threading is no substitute for additional cores, but a dual-core CPU with hyper-threading should perform better than a dual-core CPU without hyper-threading.

**Multiple Cores**

Originally, CPUs had a single core. That meant the physical CPU had a single central processing unit on it. To increase performance, manufacturers add additional “cores,” or central processing units. A dual-core CPU has two central processing units, so it appears to the operating system as two CPUs. A CPU with two cores, for example, could run two different processes at the same time. This speeds up your system, because your computer can do multiple things at once.

Unlike hyper-threading, there are no tricks here — a dual-core CPU literally has two central processing units on the CPU chip. A quad-core CPU has four central processing units, an octa-core CPU has eight central processing units, and so on.

This helps dramatically improve performance while keeping the physical CPU unit small so it fits in a single socket. There only needs to be a single CPU socket with a single CPU unit inserted into it—not four different CPU sockets with four different CPUs, each needing their own power, cooling, and other hardware. There’s less latency because the cores can communicate more quickly, as they’re all on the same chip.

Windows’ Task Manager shows this fairly well. Here, for example, you can see that this system has one actual CPU (socket) and four cores. Hyperthreading makes each core look like two CPUs to the operating system, so it shows 8 logical processors.

