**Evolution of Microprocessors**

* The first Microprocessor (4004) was designed by Intel Corporation which was founded by Moore and Noyce in 1968.
* In the early years, Intel focused on developing semiconductor memories (DRAMs and
* EPROMs) for digital computers.
* In 1969, a Japanese Calculator manufacturer, Busicom approached Intel with a design for a small calculator which need 12 custom chips. Ted Hoff, an Intel Engineer thought that a general purpose logic device could replace the multiple components.
* This idea led to the development of the first so called microprocessor. So, Microprocessors started with a modest beginning of drivers for calculators.
* With developments in integration technology Intel was able to integrate the additional chips like 8224 clock generator and the 8228 system controller along with 8080 microprocessors with in a single chip and released the 8 bit microprocessor 8085 in the year 1976. The 8085 microprocessor consisted of 6500 MOS transistors and could work at clock frequencies of 3-5 MHz. It works on a single +5 volts supply. The other improved 8 bit microprocessors include Motorola MC 6809, Zilog Z-80 and RCA COSMAC.
* In 1978, Intel introduced the 16 bit microprocessor 8086 and 8088 in 1979. IBM selected the Intel 8088 for their personal computer (IBM-PC).8086 microprocessor made up of 29,000 MOS transistors and could work at a clock speed of 5-10 MHz. It has a 16-bit ALU with 16-bit data bus and 20-bit address bus. It can address up to 1MB of address space. The pipelining concept was used for the first time to improve the speed of the processor. It had a pre-fetch queue of 6 instructions where in the instructions to be executed were fetched during the execution of an instruction. It means 8086 architecture supports parallel processing. The 8088 microprocessor is similar to 8086 processor in architecture, but the basic difference is it has only 8-bit data bus even though the ALU is of 16-bit.It has a pre-fetch queue of 4-instructions only.
* In 1982 Intel released another 16-bit processor called 80186 designed by a team under the leadership of Dave Stamm. This is having higher reliability and faster operational speed but at a lower cost. It had a pre-fetch queue of 6-instructions and it is suitable for high volume applications such as computer workstations, word-processor and personal computers. It is made up of 134,000 MOS transistors and could work at clock rates of 4 and 6 MHz. This is also comes under first generation of Microprocessors.
* Intel released another 16 bit microprocessor 80286 having 1, 34,000 transistors in 1981. It was used as CPU in PC-ATs in 1982. It is the second generation microprocessor, more advanced to 80186 processor. It could run at clock speeds of 6 to 12.5 MHz .It has a 16-bit data bus and 24- bit address bus, so that it can address up to 16MB of address space and 1GB of virtual memory. It had a pre-fetch queue of 6 instructions. Intel introduced the concept of protected mode and virtual mode to ensure proper operation. It also had on-chip memory management unit (MMU) .This was popularly called as Intel 286 in those days.
* In 1985, Intel released the first 32 bit processor 80386, with 275,000 transistors. It has 32- bit data bus and 32-bit address bus so that it can address up to a total of 4GB memory also a virtual memory space of 64TB.It could process five million instructions per second and could work with all popular operating systems including Windows. It has a pre-fetch queue of length 16-bytes with extensive memory management capabilities. It is incorporated with a concept called paging in addition to segmentation technique. It uses a math co-processor called 80387.
* Intel introduced 80486 microprocessor with a built-in maths co-processor and with 1.2 million transistors. It could run at the clock speed of 50 MHz This is also a 32 bit processor but it is twice as fast as 80386.The additional features in 486 processor are the built-in Cache and built-in math co-processors. The address bus here is bidirectional because of presence of cache memory.
* On 19th October, 1992, Intel released the Pentium-I Processor with 3.1 million transistors. So, the Pentium began as fifth generation of the Intel x86 architecture. This Pentium was a backward compatible while offering new features. The revolutionary technology followed is that the CPU is able to execute two instruction at the same time. This is known as super scalar technology. The Pentium uses a 32-bit expansion bus, however the data bus is 64 bits.
* The 7.5 million transistors based chip, Intel Pentium II processor was released in 1997. It works at a clock speed of 300M.Hz. Pentium II uses the Dynamic Execution Technology which consists of three different facilities namely, Multiple branch prediction, Data flow analysis, and Speculative execution unit. Another important feature is a thermal sensor located on the mother board can monitor the die temperature of the processor. For thermal management applications.
* Intel Celeron Processors were introduced in the year 1999. Pentium-III processor with 9.5 million transistors was introduced in 1999. It also uses dynamic execution micro-architecture, a unique combination of multiple branch prediction, dataflow analysis and speculative execution. The Pentium III has improved MMX and processor serial number feature. The improved MMX enables advanced imaging, 3D streaming audio and video, and speech recognition for enhanced Internet facility.
* Pentium-IV with 42 million transistors and 1.5 GHz clock speed was released by Intel in November 2000. The Pentium 4 processor has a system bus with 3.2 G-bytes per second of bandwidth. This high bandwidth is a key reason for applications that stream data from memory. This bandwidth is achieved with 64 –bit wide bus capable of transferring data at a rate of 400 MHz. The Pentium 4 processor enables real-time MPEG2 video encoding and near real-time MPEG4 encoding, allowing efficient video editing and video conferencing.
* Intel with partner Hewlett-Packard developed the next generation 64-bit processor architecture called IA-64. This first implementation was named Itanium. Itanium processor which is the first in a family of 64 bit products was introduced in the year 2001.The Itanium processor was specially designed to provide a very high level of parallel processing, to enable high performance without requiring very high clock frequencies .Key strengths of the Itanium architecture include ,up to 6 instructions/cycle. The Itanium processor can handle up to 6 simultaneous 64 –bit instructions per clock cycle.
* The Itanium II is an IA-64 microprocessor developed jointly by Hewlett-Packard (HP) and Intel and released on July 8,2002. It is theoretically capable of performing nearly 8 times more work per clock cycle than other CISC and RISC architectures due to its parallel computing micro-architecture. The recent Itanium processor features a split L2 cache, adding a dedicated 1MB L2 cache for instructions and thereby effectively growing the original 256KBL2 cache, which becomes a dedicated data cache. The first Itanium 2 processor (code named McKinley) was more powerful than the original Itanium processor, with approximately two times performance.
* Pentium 4EE was released by Intel in the year 2003 and Pentium 4E was released in the year 2004. The Pentium Dual-Core brand was used for mainstream X86-architecture microprocessors from Intel from 2006 to 2009 The 64 bit Intel Core2 was released on July 27,2006. In terms of features, price and performance at a given clock frequency, Pentium Dual-Core processors were positioned above Celeron but below Core and Core 2 microprocessors in Intel's product range. The Pentium Dual-Core was also a very popular choice for over clocking, as it can deliver optimal performance (when over clocked) at a low price.
* The Pentium Dual Core, which consists of 167 million transistors was released on January 21, 2007. Intel Core Duo consists of two cores on one die, a 2 MB L2 cache shared by both cores, and an arbiter bus that controls both L2 cache and FSB access.
* Core 2 Quad processors are multi-chip modules consisting of two dies similar to those used inCore 2 Duo, forming a quad-core processor. While this allows twice the performance to a dualcore processors at the same clock frequency in ideal conditions, this is highly workload specific and requires applications to take advantage of the extra cores.
* In September.2009, new Core i7 models based on the Lynnfield desktop quad-core processor and the Clarksfield quad-core mobile were added, and models based on the Arrandale dualcore mobile processor have been announced. The first six-core processor in the Core lineup is the Gulftown, which was launched on March 16, 2010. Both the regular Core i7 and the Extreme Edition are advertised as five stars in the Intel Processor Rating.