

# Processor is the heart of the computer

[Technology](#), [Computer](#)



A microprocessor or processor is the heart of the computer and it performs all the computational tasks, calculations and data processing etc. inside the computer. Microprocessor is the brain of the computer. In the computers, the most popular type of the processor is the Intel Pentium chip and the Pentium 1V is the latest chip by Intel Corporation. The microprocessors can be classified based on the following features.

Computer memory stores data temporarily for rapid retrieval. When most computer users refer to the term, they are talking about the main memory of the computer. This is also called the random access memory (or RAM for short). However, memory chips of varying types are integrated into just about every electronic device you can think of, including coffee machines, microwaves, network routers, and cell phones.

## 2. 0 Question 1

Nowadays, the cost of the computer continues to drop dramatically while the performance and capacity of the system continue to rise equally dramatically. I am going to write about the evolution of microprocessor system.

I will start from the 1st microprocessor Intel 4004 to Pantium4.

### Intel 4004

The 4004 is the world's first microprocessor. The 4004 was created at Intel with Ted Hoff and Federico Faggin as the lead designers. The 4004 provided a new tool to the world. Up to that time and semiconductors and IC's were

built for a specific purpose. The 4004 was the first semiconductor device that provided, at the chip level, the functions of a computer.

The 4004 contains the two basic architectural building blocks that are still found in today's microcomputers: the arithmetic and logic unit and the control unit. The Intel 4004 ran at a clock speed of 108 kHz and contained 2300 transistors. By the time it was in production the clock speed was increased to 500kHz and later to 740kHz. It processed data in 4 bits, but its instructions were 8 bits long. The 4004 addressed up to 1 Kb of program memory and up to 4 Kb of data memory (as separate entities). It had sixteen 4-bit (or eight 8-bit) general purpose registers, and an instruction set containing 45 instructions.

The 4004 family is also referred to as the MCS-4.

### Intel 8008

The first 8-bit microprocessor, Intel 8008 (i8008) was released 5 months after Intel 4004. The 8008 was available in two speed grades – 500 KHz and 800 KHz. Because it took the CPU from 5 to 8 cycles to execute each instruction, the effective rate of instruction execution was from 45, 000 to 100, 000 instructions per second for Intel 8008 and from 72, 000 to 160, 000 instruction per second for Intel 8088-1

These numbers assume that the CPU uses fast memory and doesn't require wait states to access the memory. Although the effective speed in instructions per second of the 8008 microprocessor sometimes is lower than the effective speed of the 4004 CPU, overall performance of the i8008 was

greater due to faster effective speed of some instructions, 8-bit architecture and more efficient instruction set. The 8008 had other advantages over the 4004, for example: the processor supported of 16 KB of memory (ROM and RAM combined), the size of internal CPU stack was 7 levels in contrast to 3 level-stack for the i4004, and the Intel 8008 could handle interrupts.

Intel 8008 microprocessor was used in Mark-8 computer, which is considered to be the first personal computer.

### Intel 8080

The Intel 8080 was an early microprocessor designed and manufactured by Intel. The 8-bit CPU was released in April 1974 running at 2 MHz, and is generally considered to be the first truly usable microprocessor CPU design. It was used in many early computers, forming the basis for machines running the CP/M operating system (the later, compatible, Zilog Z80 processor would capitalize on this, CP/M becoming the dominant OS of the period much like MS-DOS for the PC a decade later). Shortly after the 8080, the Motorola 6800 competing design was introduced.

The Intel 8080 was the successor to the Intel 8008 (with which it was assembly language compatible because it used the same instruction set developed by Computer Terminal Corporation). The 8080's large 40 pin DIP packaging permitted it to provide a 16-bit address bus and an 8-bit data bus. It had seven 8-bit registers (six of which could be combined into three 16-bit registers), a 16-bit stack pointer to memory (replacing the 8008's internal stack), and a 16-bit program counter.

The 8080 had 256 I/O ports (allowing I/O devices to be connected without the need to allocate memory space – as is required for memory mapped devices – but at the expense of separate I/O instructions). The first single-board micro computer was built on the basis of the 8080

## Intel Pentium

Intel Pentium microprocessor was the first x86 superscalar CPU. The processor included two pipelined integer units which could execute up to two integer instructions per CPU cycle. Redesigned Floating Point Unit considerably improved performance of floating-point operations and could execute up to 1 FP instruction per CPU cycle.

Other enhancements to Pentium core included:

To improve data transfer rates the size of data bus was increased to 64 bits.

At first Pentium processors featured separate 8 KB code and 8 KB data caches. The size of both data and code L1 caches was doubled in Pentium processors with MMX technology.

Intel Pentium CPU used branch prediction to improve effectiveness of pipeline architecture. Branch prediction was enhanced in Pentium MMX processors.

Many desktop Pentiums could work in dual-processor systems.

To reduce CPU power consumption the core voltage was reduced on all Pentium MMX, and many mobile and embedded Pentium processors.

Intel manufactured desktop, mobile and embedded versions of Pentium microprocessors. Distinguishing between different versions of Pentiums is not always easy because desktop, mobile and/or embedded Pentiums often used the same part numbers. In some cases Pentium processors with the same part and S-spec numbers were offered as desktop and embedded, or mobile and embedded microprocessors.

Later versions of Pentium processors – Pentium MMX – included 57 new instructions. These instructions could be used to speed up processing of multimedia and communication applications. Like the Pentium processors, the Pentium MMX CPUs were also produced in three different versions – desktop, mobile and embedded processors.

## Pentium II

Intel Corporation's successor to the Pentium Pro. The Pentium II can execute all the instructions of all the earlier members of the Intel 80? 86 processor family. There are four versions targeted at different user markets. The Celeron is the simplest and cheapest. The standard Pentium II is aimed at mainstream home and business users. The Pentium II Xeon is intended for higher performance business servers. There is also a mobile version of the Pentium II for use in portable computers.

All versions of the Pentium II are packaged on a special daughterboard that plugs into a card-edge processor slot on the motherboard. The daughterboard is enclosed within a rectangular black box called a Single Edge Contact (SEC) cartridge. The budget Celeron may be sold as a card only

without the box. Consumer line Pentium II's require a 242-pin slot called Slot 1. The Xeon uses a 330-pin slot called Slot 2. Intel refers to Slot 1 and Slot 2 as SEC-242 and SEC-330 in some of their technical documentation. The daughterboard has mounting points for the Pentium II CPU itself plus various support chips and cache memory chips. All components on the daughterboard are normally permanently soldered in place. Previous generation Socket 7 motherboards cannot normally be upgraded to accept the Pentium II, so it is necessary to install a new motherboard.

All Pentium II processors have Multimedia Extensions (MMX) and integrated Level One and Level Two cache controllers. Additional features include Dynamic Execution and Dual Independent Bus Architecture, with separate 64 bit system and cache busses. Pentium II is a superscalar CPU having about 7.5 million transistors.

The first Pentium II's produced were code named Klamath. They were manufactured using a 0.35 micron process and supported clock rates of 233, 266, 300 and 333 MHz at a bus speed of 66 MHz. Second generation Pentium II's, code named Deschutes, are made with a 0.25 micron process and support rates of 350, 400 and 450 MHz at a bus speed of 100 MHz.

### Pentium III

The Pentium III is a microprocessor designed by Intel as a successor to its Pentium II. The Pentium III is faster; especially for applications written to take advantage of its "Katmai New Instructions" (the code name for the Pentium III during development was "Katmai"). The 70 new computer instructions

make it possible to run 3-D, imaging, streaming video, speech recognition, and audio applications more quickly . In addition, the Pentium III offers clock speeds up to 800 MHz.

The Katmai New Instructions are similar to the instructions optimized for multimedia applications called MMX and now included in most Pentiums. However, unlike the MMX instruction set, the Katmai instructions support floating point units as well as integer calculations, a type of calculation often required when still or video images are modified for display. The Katmai instructions also support Single Instruction Multiple Data instructions. These allow a single instruction to cause data to be modified in multiple memory locations simultaneously, a kind of parallel processing.

For 3-D applications, changing values in parallel for a given 3-D scene means that users can see smoother and more realistic effects. Application developers can create effects that the slower instructions could not support, such as scenes with subtle and complex lighting. Animated effects and streaming video should also be less choppy for the viewer. The new instructions also specifically include some that will make speech recognition faster and more accurate and allow the creation of more complex audio effects.

#### Pentium IV

The Pentium 4 is a seventh-generation x86 architecture microprocessor produced by Intel and is their first all-new CPU design since the Pentium Pro of 1995. The original Pentium 4, codenamed “ Willamette”, ran at 1.4 and 1.



5 GHz and was released in November 2000. Unlike the Pentium II, Pentium III, and various Celerons, the architecture owed little to the Pentium Pro design, and was new from the ground up.

To the surprise of most industry observers, the Pentium 4 did not improve on the old P6 design in either of the normal two key performance measures: integer processing speed or floating-point performance. Instead, it sacrificed per-cycle performance in order to gain two things: very high clockspeeds, and SSE performance. As is traditional with Intel's flagship chips, the Pentium 4 also comes in a low-end Celeron version (often referred to as Celeron 4) and a high-end Xeon version intended for SMP configurations.

The Pentium 4 performs much less work per cycle than other CPUs (such as the various Athlon or older Pentium III architectures) but the original design objective – to sacrifice instructions per clock cycle in order to achieve a greater number of cycles per second.

Above are the evolution of microprocessor, I just explain some of it, because there are too many types of microprocessor. Following the microprocessor above, it showing that microprocessors is getting better and run faster year by year.

## 2. 0 Question 2

Memory is one of the most important things that is incorporated into computers, be it computers or PCs. There are various computer memory types installed, depending upon the actual need for functioning and specifications of the system. The computer memory relates to the many

devices and components that are responsible for storing data and applications on a temporary or a permanent basis. It enables a person to retain the information that is stored on the computer. Without it, the processor would not be able to find a place which is needed to store the calculations and processes. There are different types of memory in a computer that are assigned a task of storing several kinds of data. Each has certain peculiarities and capacities.

### Random Access Memory (RAM)

RAM is a location within the computer system which is responsible for stacking away data on a temporary basis, so that it can be promptly accessed by the processor. The information stored in RAM is typically loaded from the computer's hard disk, and includes data related to the operating system and certain applications. When the system is switched off, RAM loses all the stored information. The data remains stored and can be retained only when the system is running.

When the RAM gets full, the computer system is more likely to operate at a slow speed. The data can be retrieved in any random order. Generally, there are two types of RAM; namely Static RAM (SRAM) and Dynamic RAM (DRAM). When many programs are running on the computer simultaneously, the virtual memory allows the computer to search in RAM for memory portions which haven't been utilized lately and copy them onto the hard drive. This action frees up RAM space and enables the system to load different programs.

RAM, or Random Access Memory, is “volatile.” This means that it only holds data while power is present. RAM changes constantly as the system operate, providing the storage for all data required by the operating system and software. Because of the demands made by increasingly powerful operating systems and software, system RAM requirements have accelerated dramatically over time. For instance, at the turn of the millennium a typical computer may have only 128Mb of RAM in total, but in 2007 computers commonly ship with 2Gb of RAM installed, and may include graphics cards with their own additional 512Mb of RAM and more.

#### Read Only Memory (ROM)

Read only memories (ROMs) are used in computer systems to provide a permanent storage of program instructions. A read only memory (ROM) structure comprises a matrix of intersecting bit lines and word lines with memory cells at select intersections. A read only memory (ROM) consists of an array of semiconductor devices (diodes, bipolar or field-effect transistors), which interconnect to store an array of binary data. A ROM basically consists of a memory array of programmed data and a decoder to select the data located at a desired address in the memory array. A ROM array of memory cells is defined by a number of transistors generally arranged in a grid pattern having a plurality of rows and columns. Each individual transistor of each memory cell of the ROM array is placed between a column of the series of columns and a voltage bus. A resistive ROM typically includes a planar array of parallel word lines, which is perpendicular to and insulated from a planar array of parallel bit lines. A designated number of the memory cells in

the ROM have a resistive, element connecting a node of one word line with a node of one bit line. Each memory cell, consisting of a single transistor per bit of storage, is hardware pre-programmed during the integrated circuit (IC) fabrication process and is capable of maintaining the stored data indefinitely. ROM memory is used to hold and make available data or code that will not be altered after IC manufacture. Data or code is programmed into ROM memory during fabrication. The values stored within the ROM are “ read” (i. e., output) by measuring a sense current flowing through each bit line from the memory cells of successive word lines. Three basic types of ROMs are mask-programmable ROM, erasable programmable ROM (EPROM) and field-programmable ROM (PROM).

## Cache

Cache is a kind of RAM which a computer system can access more responsively than it can in regular RAM. The central processing unit looks up in the cache memory before searching in the central memory storage area to determine the information it requires. This rule out the need for the system to search for information in larger and bigger memory storage areas, which in turn leads to a faster extraction of data.

Cache memory is random access memory (RAM) that a computer microprocessor can access more quickly than it can access regular RAM. As the microprocessor processes data, it looks first in the cache memory and if it finds the data there, it does not have to do the more time-consuming reading of data from larger memory.

Cache memory is sometimes described in levels of closeness and accessibility to the microprocessor. An L1 cache is on the same chip as the microprocessor. (For example, the PowerPC 601 processor has a 32 kilobyte level-1 cache built into its chip.) L2 is usually a separate static RAM (SRAM) chip. The main RAM is usually a dynamic RAM (DRAM) chip.

In addition to cache memory, one can think of RAM itself as a cache of memory for hard disk storage since all of RAM's contents come from the hard disk initially when you turn your computer on and load the operating system (you are loading it into RAM) and later as you start new applications and access new data. RAM can also contain a special area called a cache that contains the data most recently read in from the hard disk.

### Computer Hard Drive

A hard disk is part of a unit, often called a “ disk drive,” “ hard drive,” or “ hard disk drive,” those stores and provides relatively quick access to large amounts of data on an electromagnetically charged surface or set of surfaces. Today's computers typically come with a hard disk that contains several billion bytes (gigabytes) of storage.

A hard disk is really a set of stacked “ disks,” each of which, like phonograph records, has data recorded electromagnetically in concentric circles or “ tracks” on the disk. A “ head” (something like a phonograph arm but in a relatively fixed position) records (writes) or reads the information on the tracks. Two heads, one on each side of a disk, read or write the data as the disk spins. Each read or write operation requires that data be located, which

is an operation called a “ seek.” (Data already in a disk cache, however, will be located more quickly.)

A hard disk/drive unit comes with a set rotation speed varying from 4500 to 7200 rpm. Disk access time is measured in milliseconds. Although the physical location can be identified with cylinder, track, and sector locations, these are actually mapped to a logical block address (LBA) that works with the larger address range on today’s hard disks.

### Flash Memory

Flash memory (sometimes called “ flash RAM”) is a type of constantly-powered non-volatile memory that can be erased and reprogrammed in units of memory called blocks. It is a variation of electrically erasable programmable read-only memory (EEPROM) which, unlike flash memory, is erased and rewritten at the byte level, which is slower than flash memory updating. Flash memory is often used to hold control code such as the basic input/output system (BIOS) in a personal computer. When BIOS needs to be changed (rewritten), the flash memory can be written to in block (rather than byte) sizes, making it easy to update. On the other hand, flash memory is not useful as random access memory (RAM) because RAM needs to be addressable at the byte (not the block) level.

Flash memory gets its name because the microchip is organized so that a section of memory cells are erased in a single action or “ flash.” The erasure is caused by Fowler-Nordheim tunnelling in which electrons pierce through a thin dielectric to remove an electronic charge from a floating gate associated

with each memory cell. Intel offers a form of flash memory that holds two bits (rather than one) in each memory cell, thus doubling the capacity of memory without a corresponding increase in price.

Flash memory is used in digital cellular phones, digital cameras, LAN switches, PC Cards for notebook computers, digital set-up boxes, embedded controllers, and other devices.

These are just the common and main computer memory types which facilitate memory and data storage. However, there are many subtypes which are sorted out according to the memory-related functionalities they perform and the requirements they serve.

#### 4. 0 Conclusion

In the assignment, I have completed it by myself and I was doing research in internet, reference books and some of the notes that giving by lecturer. In question, I was explaining the evolution of the microprocessor, from the 1st generation to Pentium 4. I was choosing some of the microprocessors randomly and explain it with detail. Through the question, I know the microprocessors are getting better year by year. In question 2, I was requested to compare the various types of memories. So I have explained and compare in my question 2. For example: RAM, ROM, Hard drive, cache and so on. I learn a lot of knowledge through the assignment. It will be helpful for my examination.