

The evolution of intel microprocessor engineering essay



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Abstract- Microprocessor acts as controller or brain for electronic devices. Without it, even the most high technology devices cannot be self functioning. One of company that invented the microprocessor is Intel that established in USA and that first microprocessor invented in 1971. Microprocessor is a revolution of the transistor which was invented in 1947 and from the invention of integrated circuit which was invented in 1958. This document shows the evolution of Intel microprocessor from year 1997 to year 2012. The scopes are covering about the evolution of the Intel processor that used in desktop personal computer only. Besides that, this document also covering the specification and comparison between past microprocessor and next microprocessor.

Introduction

Microprocessor is combination of two words which are micro and processor. Micro is unit for size. This unit used to show the size of transistor that been used in the processor. Usually, to allow human's eyes to see this micro transistor, the oscilloscope need be use. While the processor that also called the Central Processing Unit (CPU) is a brain of computer. The main function of processor is to control and execute all the process in the computer system.

Microprocessor is an evolution of the transistor and integrated circuit [1]. Microprocessor industry growth rapidly as we can see. Latest microprocessor is quiet different with the first microprocessor. As comparison, the first Intel microprocessor which is 4004 has 2300 of transistors and clock speed of 108 kHz [2]. While the one of the latest Intel microprocessor which is Intel core i7

950 has 731 million of transistors and clock speed of 3.06 GHz [3].

Nowadays, the microprocessor used widely, not just in high technology device such as computer, but the microprocessor also used simple electronic device such as in toys.

The topic that related to the microprocessor is widely such as the invention of microprocessor, the company that producing the microprocessor, the application of microprocessor and the operation of the microprocessor. As mention in the main title, this document discusses about the evolution of Intel microprocessor that be used in desktop personal computer from year 1997 to the year 2012. This is to easier do a comparison between past generations of microprocessor with the next generation of microprocessor. It is not fair comparison between the generation of microprocessor that be used in personal computer and the generation of microprocessor that be used in high technology application such as server.

In this section, the document discussed about the evolution of Intel microprocessor that was invented from transistor and integrated circuit. Beside of that, this document gives a little comparison between first Intel micro processor with one of the latest Intel microprocessor.

The Section II will describe about the generations of Intel microprocessor based on timeline. The generations of microprocessor that will cover in this session are generation of microprocessor that be used for personal computer only.

In Section III, the document will show the differences of processor in that year and the next year.

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The discussions topic that has made for this document will cover in Section IV. This discussion included the specification and feature improvement of each generation of Intel microprocessor.

The section V is about the conclusion that has made about this topic based on the writer view and supported by the facts that was analyse.

Evolution of Intel Microprocessor

Every technology that created by human will through the evolution process. That also happens in microprocessor technology that was evolved from generation to the next generation. Commonly, there are four factors that cause the microprocessors are evolved from one generation to next generation. Those factors are technology (constraint or opportunity), theory and design ingenuity, user demand, and economics and commercial pressure [4].

There are eight family of Intel microprocessor that involve in evolution process along year 1997 to year 2012. Along these years, there are improvement and changes of the microprocessor. These improvements include the clock speed, number of core, number of transistor, cache, addressable memory, bus type and bus speed. Even there are a lot of type improvements in microprocessor evolution, but only the improvements that were stated before will be covered in this document. Table 1 shows the evolutions of Intel microprocessor from year 1997 to year 2012.

Each processor depends on small quartz crystal circuit that known as the system clock to synchronize processing activities. The clock speed is

specified in megahertz (MHz), which is millions of cycles per seconds, or gigahertz (GHz), which is billions of cycles per seconds [5]. The smallest unit of time that processor can recognize is a cycle. The faster speed of the clock, the more instructions and operations that can be execute per second.

The number of core in a microprocessor means the number of processor that has in a single product of chip. Single core processor chip mean there has only one processor in a single chip. While multi-core processor mean there two or more separate processor in a single chip. Multi-core chip operates at a slower speed compared with single-core chip, but multi-chips typically increase overall performance [6]. This is because multi-core used two or more processor simultaneously in processing instruction, so the multi-core chip need lower processing speed compared a single-core chip to do a task. The other advantages of multi-core processor are required less power consumption and emitting less heat in the system compared single core processor.

One of main component in architecture of processor is a transistor [7].

Transistors in the processor influence the performance of that processor. The higher number of transistor will increase size of cache, number of register, and clock speed. One of advantages from this improvement is reduce the average time for executing an instruction [8].

Larger the size of cache used, faster the performance of processor [9]. Cache memory is a very high-speed memory that stores temporarily the frequently used memory location [10]. An addressable memory is complex array that used to select the remainder of the data to be read or write through the

addressing [11]. The Intel chips set limit the addressable memory space to 64GB. However, in fact, the Intel chip sets able to address “ multiple-terabytes” of memory [12].

There are two type buses that used in Intel processor along 1997 to 2012 which are Front Side Bus (FSB) and Direct Media Interface (DMI). Front Side Bus consists of electronic pathway that connects between the processor and other bus system in sending and receiving data [13]. The processor speed relies with the Front Side Buses speed [14]. Front Side Bus speed is measured by megahertz unit (MHz) which means one million cycles per second [15].

The Direct Media interface was introduced in 2008 by Intel. This type of buses used to transfer data between the processor to the input/output Hub (IOH), a Peripheral Computer Interconnect (PCI), and Random Access Memory (RAM) [16]. The unit that used for this bus is gigatransfer per second (GT/s) Higher the buses speed, better performance of the processor.

Comparison between Processor

This section will show the differences of the desktop processor specification between that year and the next year. Any factors that cause the issue such as issue of downgrade processor will discussing in the Section IV. All the comparison based on Table I only.

In Table I, there show only one model of processor for each year. These processors come from eight family of Intel processor that starting from Intel Pentium Processor Family, Intel Pentium II Processor, Intel Pentium III Xeon

Processor, Intel Celeron Processor, Intel Pentium 4 Processor, Intel Pentium D Processor, Intel Core 2 Processor, and Intel Core Processor.

The polar of clock speed that been used in processor is increasing since year 1997 to year 2005 before it decreasing in year 2006. Then in year 2007, the clock speed that been used is increasing back in year 2008 before decreasing in year 2009. The polar is increasing of the clock speed that be used in processor in year 2009 to 2012.

In year 1997 to year 2005, the processor used only single core, then in year 2006 to 2009 included in year 2012, it used four cores. Model i3-560 that introduced in year 2010 used two cores for the processor while model i7-3960x that be launched in year 2012 used six cores. The model that used lowest transistor in its architecture along year 1997 to 2012 is model Pentium MMX 233 which used 4.5 million of transistor, while the model that used highest transistor is Core i7-3960x extreme which used 2270 million of transistors.

The lowest size of cache used for model Celeron 700 while biggest size of cache used for model Core i7-3960x extreme. The whole of processor model used 64 GB of addressable memory except for model Pentium MMX 233 which used 4 GB of addressable memory. The Front Side Buses (FSB) used for processor model in year 1997 to year 2007. Starting year

TABLE

Generations of Intel Microprocessor

Launched

Family

Sample of Processor

Clock Speed

Core/s

Transistor

Cache

Addressable Memory

Bus Type

June 1997

Intel Pentium Processor Family

Pentium MMX 233

233 MHz

1

4. 5 million

512 KB

L2 Cache

4 GB

FSB

August 1998

Intel Pentium II Processor

Pentium II 450

450 MHz

1

7.5 million

512 KB

L2 Cache

64 GB

FSB

August 1999

Intel Pentium III Xeon Processor

Pentium III Xeon 600

600 MHz

1

9.5 million

512 KB

L2 Cache

64 GB

FSB

June 2000

Intel Celeron Processor

Celeron 700

700 MHz

1

28 million

128 KB L2 Cache

64 GB

FSB

October 2001

Intel Celeron Processor

Celeron 1400

1.4 GHz

1

44 million

256 KB L2 Cache

64 GB

FSB

May 2002

Intel Pentium 4 Processor

Pentium 2 2.8

2.8 GHz

1

55 million

512 KB L2 Cache

64 GB

FSB

May 2003

Intel Pentium 4 Processor

Pentium 4 HT 3.4

3.4 GHz

1

55 million

512 KB L2 Cache

64 GB

FSB

June 2004

Intel Pentium 4 Processor

Pentium 4 HT 570

3.8 GHz

1

125 million

1 MB L2 Cache

64 GB

FSB

May 2005

Intel Pentium D Processor

Pentium D 800

3. 2 GHz

1

230 million

1 MB L2 Cache

64 GB

FSB

July 2006

Intel Core 2 Processor

Core 2 Extreme X6800

2. 93 GHz

4

291 million

4 MB

L2 Cache

64 GB

FSB

July 2007

Intel Core 2 Processor

Core 2 QX9650

3.0 GHz

4

820 million

12 MB L2 Cache

64 GB

FSB

November 2008

Intel Core Processor

Core i7-965 Extreme (first generation)

3.2 GHz

4

731 million

8 MB

Smart Cache

64 GB

DMI

September

2009

Intel Core Processor

Core i5-750 (first generation)

2. 66 GHz

4

774 million

8 MB

Smart Cache

64 GB

DMI

August 2010

Intel Core Processor

Core i3-560 (first generation)

3. 33 GHz

2

382 million

4 MB

Smart Cache

64 GB

DMI

October 2011

Intel Core Processor

Core i7-3960x extreme (second generation)

3.3 GHz

6

2.270 million

15 MB

Smart Cache

64 GB

DMI

April 2012

Intel Core Processor

Core i5-3570k (second generation)

3.4 GHz

4

1450 million

6 MB

Smart Cache

64 GB

DMI

From 2008 to year 2012, the Direct Media Interface (DMI) is used as buses for the processor. The model of processor Pentium MMX 233 and Celeron 700 has lowest speed of buses which is 66MHz, while processor Core i7-965 has highest speed of buses.

Discussion

This section discusses about the issues that come up in this document. The issues that will be discussed are about the brand of the processor, type of processor, the model of processor, and why there are downgrade models of a processor in the market.

Intel is the inventor company of microprocessor [17]. Nowadays, Intel is a world's leading chip manufacturer [18]. It has produced hundreds of models of

processor for the market. That is why the product of Intel was chosen in this document.

In a year, Intel introduces tens of processor models, however only one was selected for each year in this document. This is to equilibrate with the evolution period that needs to cover in this short document. This model processor is among of desktop's processor to avoid injustice comparison if we compare to lower type of processor such as notebook's processor or highest type of processor such as for server usage.

Why there are downgrade model after the impressive processor model such as model i5 and i3 that introduced after i7 model? One of the factors that cause this happen is a user demand. The market for the computer microprocessor is around the world. In this market there are few categories of computer user such as gaming user and standard school user. That is why Intel introduces a few type of processor a year. Beside of that, the commercial pressure factor also acts as main role for the production of downgrade processor model. In fact, there are still group of user that need the mid range of processor. That is why many distributors and retailers interested to market this type of processor. Indirectly, this trend gives the pressure to the manufacturer to introduced mid-range model of processor.

Conclusion

Intel is a company that was invent the first microprocessor and it also the largest microprocessor manufacturer. The evolutions of desktop microprocessor happen once for a few months. The performance is a one of the main aspect that improving in microprocessor evolution. The factors of <https://assignbuster.com/the-evolution-of-intel-microprocessor-engineering-essay/>

microprocessor evolution are technology, theory and design ingenuity, user demand, and economics and commercial pressure. Even there are high performance of processor, Intel still introduce mid-range of processor because of the user demand.

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