



Comparison of Single-Core and Multi-Core Processor

Sukhdev Singh Ghuman

Assistant Professor, SBDSM Khalsa College, Domeli (Kapurthala),
Punjab, India

Abstract: Processor is the brain of a computer system, so it is very important to concentrate on this component. The processors released by different manufacturers after 2005 are mainly multicore processors because these processor have more than one core for processing instructions. All the cores are placed in the same die. Single core processors are with us since 1971 when first commercial microprocessor was launched by Intel Company. This paper presents the technology behind these two types of processor and their detailed comparison.

Keywords: Single Core, Multi Core, Processor, Frequency, AMD, Intel.

I. INTRODUCTION

The processor is the main component of a computer system. It is a logic circuitry that processes instructions. It is also called CPU (Central Processing Unit). It is the brain of the computer system. Processor is mainly responsible to do all the computational calculations, logical decision making and to control different activities of the system. Central Processing Unit is very complicated chip consisting of billions of electronic components. It is fitted on the motherboard with other electronic parts. The main work of the processor is to execute low level instructions loaded into the memory. The processor can be manufactured using different technologies - Single core processor and multicore processor. According to [1] processors can be divided into three types- multiprocessors, multithreaded processors and multicore processors.

There are new trends in the CPU manufacturing industry which are based on the idea that while clock speeds can only be increased to a limit and there is limit to number of electronic components to be used in a core. Many other technologies are there to speed things up and open ways for better and more powerful central processing units [3].

When we are unable to increase the performance of CPU furthermore by modifying its running frequency, then new technology called multicore architecture helps. In multicore architecture we can put more than one core on a single silicon die. This new approach to enhance the speed came with some additional benefits like better performance, better power management and better cooling as the multi core processors run at a lower speed to dissipate less heat. It also has some disadvantages like existing programs need to be rewritten as per new architecture. If we do not write programs with special focus for running on parallel cores, we will not get advantage of multicores. In this paper section II discusses the single core processor while in section III, multicore processors have been discussed in detail. The section IV gives a detailed comparison to two different types of processor and the last section V, concludes this topic.

II. SINGLE-CORE PROCESSORS

Single core processors have only one processor in die to process instructions. All the processor developed by different manufacturers till 2005 were single core. In today's computers we use multicore processors but single core processor also perform very well. Single core processors have been discontinued in new computers, so these are available at very cheap rates.

Single-core CPU chip

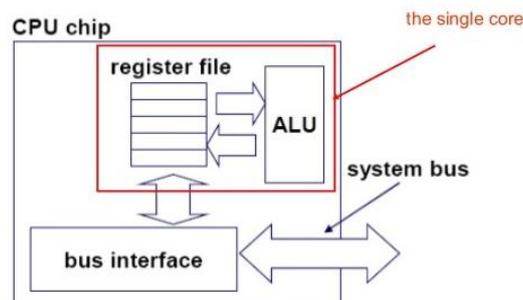


Fig. 1 Single core Processor Architecture

Problems of Single Core Processors:

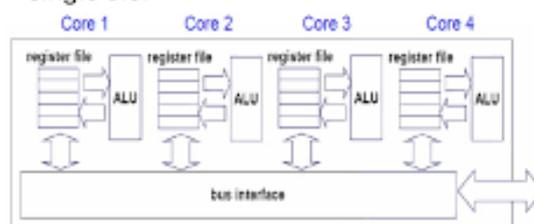
As we try to increase the clock speed of this processor, the amount of heat produced by the chip also increases. It is a big hindrance in the way of single core processors to continue evolving.

III. MULTI-CORE PROCESSORS

Multicore processor are the latest processors which became available in the market after 2005. These processors use two or more cores to process instructions at the same time by using hyper threading. The multiple cores are embedded in the same die. The multicore processor may looks like a single processor but actually it contains two (dual-core), three (tri-core), four (quad-core), six (hexa-core), eight (octa-core) or ten (deca-core) cores. Some processor even have 22 or 32 cores. Due to power and temperature constraint, the multicore processors are only practical solution for increasing the speed of future computers.

Multi-Core Architectures

- Replicate multiple processor cores on a single die.



Multi-core CPU chip

Fig.2 Multicore Processor Architecture

Problems with multicore processors:

According to Amdahl's law, the performance of parallel computing is limited by its serial components. So, increasing the number of cores may not be the best solution[2]. There is need to increase the clock speed of individual cores.

IV. COMPARISON OF SINGLE-CORE PROCESSOR AND MULTI-CORE PROCESSOR

Parameter	Single-Core Processor	Multi-Core Processor
Number of cores on a die	Single	Multiple
Instruction Execution	Can execute Single instruction at a time	Can execute multiple instructions by using multiple cores
Gain	Speed up every program or software being executed	Speed up the programs which are designed for multi-core processors
Performance	Dependent on the clock frequency of the core	Dependent on the frequency, number of cores and program to be executed
Examples	Processor launched before 2005 like 80386,486, AMD 29000, AMD K6, Pentium I,II,III etc.	Processor launched after 2005 like Core-2-Duo, Athlon 64 X2, I3,I5 and I7 etc.

V. CONCLUSIONS

This paper discussed two very important architectures to build processors. One architecture uses single core while the other is using two or more cores on the same die for processing instructions. In today's time people use multicore processors but single core processors are also very important as far as further speed up is required. It the single-core processors which are put together to make a multi-core processor. In conclusion, I can say that for practical purposes multicore processor is best but research should also pay consideration to single core processors [4].

REFERENCES

- [1] Jason Mars, "Multiprocessors and Multithreading"
- [2] Toshinori Sato Hideki Mori Rikiya Yano Takanori Hayashida, "Importance of Single core Performance in Multicore Era", Proceedings of the Thirty-Fifth Australasian Computer Science Conference (ACSC 2012), Melbourne, Australia.
- [3] www.softpaedia.com
- [4] Douglas M Pase and Matthew A. Eckl, "Comparison of Single Core and Dual Core Opteron Processor Performance for HPC", IBM Corporation 2005.