ASSIGNMENT

TOPIC : TECHNOLOGIES FOR BUILDING PROCESSORS AND MEMORY, PERFORMANCE, INSTRUCTIONS

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TECHNOLOGIES FOR BUILDING PROCESSORS AND MEMORY, PERFORMANCE, INSTRUCTIONS

A microprocessor is a computer processor where the data processing logic and control is included on a single integrated circuit, or a small number of integrated circuits. The microprocessor contains the arithmetic, logic, and control circuitry required to perform the functions of a computer's central processing unit.The microprocessor is a multipurpose , clock-driven,register-based,digital integrated circuit that accept binary data as input,processes it according to instructions stored in its memory, and provides the results as output.Microprocessors contain combinational logic and sequential digital logic,and operate on numbers and symbols represented in binary system.

Processors and memory have improved at an incredible rate, because computer designers have long embraced the latest in electronic technology to try to win the race to design a better computer. The table below shows the technologies that have been used over time, with an estimate of the relative performance per unit cost for each technology. Since this technology shapes what computers will be able to do and how quickly they will evolve, we believe all computer professionals should be familiar with the basics of integrated circuits.

A **transistor** is simply an on/off switch controlled by electricity. The integrated circuit (IC)combined dozens to hundreds of transistors into a single chip. When Gordon Moore predicted the continuous doubling of

resources, he was forecasting the growth rate of the number of transistors per chip. To describe the tremendous increase in the number of transistors from hundreds to millions, the adjective very large scale is added to the term, creating the abbreviation VLSI, for very large-scale integrated circuit.

Transistor: An on/off switch controlled by an electric signal

Very large-scale integrated(VLSI) circuit: A device containing hundreds of thousands to millions of transistors.

To understand how manufacture integrated circuits, we start at the beginning. The manufacture of a chip begins with **silicon**, a substance found in sand. Because silicon does not conduct electricity well, it is called a semiconductor. With a special chemical process, it is possible to add materials to silicon that allow tiny areas to transform into one of the three devices:

- ✔ Excellent conductors of electricity .
- ✔ Excellent insulators from electricity.
- ✔ Areas that can conduct or insulate under special conditions .

Transistors fall in the last category . A VLSI circuit, then, is just billions of combinations of conductors, insulators, and switches manufactured in a single small package.

♦ Silicon crystal ingot A rod composed of a silicon crystal that is between 8 and 12 inches in diameter and about 12 to 24 inches long.

♦ Wafer A slice from a silicon ingot no more than 0.1 inches thick, used to create chips.

♦ wafers then go through a series of processing steps, during which patterns of chemicals are placed on each wafer.

♦ die-> The individual rectangular sections that are cut from a wafer, more informally known as chips.

♦ Yield The percentage of good dies from the total number of dies on the wafer.

MICROPROCESSOR PERFORMANCE

The **performance of a microprocessor** is a measure of its efficiency in terms of the amount of useful work it accomplishes.

The performance (time-to-execute) of a certain finite workload is the reciprocal of execution time.

$P \propto 1/T_{exe}$ [program/seconds]

The total execution time, T_{exe} , required to execute a specific finite program is.

T_{exe} = IC * CPI / Clock Rate

where,

- IC is the instruction count
- CPI , the average cycles per instruction

P=clock rate / IC * CPI

This formula makes it clear that the hardware designer can improve performance by reducing the number of clock cycles required for a program or the length of the clock cycle.

INSTRUCTIONS

An instruction is a binary pattern designed inside a microprocessor to perform a specific function.The entire group of instructions that a microprocessor supports is called Instruction Set .

♦ Each instruction is represented by an 8-bit binary value.

♦ These 8-bits of binary value is called **Op-Code** or **Instruction Byte**.

The ISA serves as the boundary between software and hardware.

The instruction set is classified into the following :

- Data Transfer Instruction
- Arithmetic Instructions
- Logical Instructions
- Branching Instructions
- Control Instructions

The performance equations above did not include any reference to the number of instructions needed for the program. However, since the compiler clearly generated instructions to execute, and the computer had to execute the instructions to run the program, the execution time must depend on the number of instructions in a program. One way to think about execution time is that it equals the number of instructions executed multiplied by the average time per instruction. Therefore, the number of clock cycles required for a program can be written as,

CPU clock cycle= instruction of a program * average clock cycles per instructions

The term clock cycles per instruction, which is the average number of clock cycles each instruction takes to execute, is often abbreviated as CPI. Since different instructions may take different amounts of time depending on what they do, CPI is an average of all the instructions executed in the program.

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