Bus Structures

- There are many ways to connect different parts inside a computer together.
- A group of lines that serves as a connecting path for several devices is called a *bus*.
- System bus-connects major computer components.

  Address Bus-unidirectional

  Data Bus-bidirectional

  Control Bus-regulates the activity sending control signals like memory read,memory write,I/O read I/O write,interrupt request,reset so on.

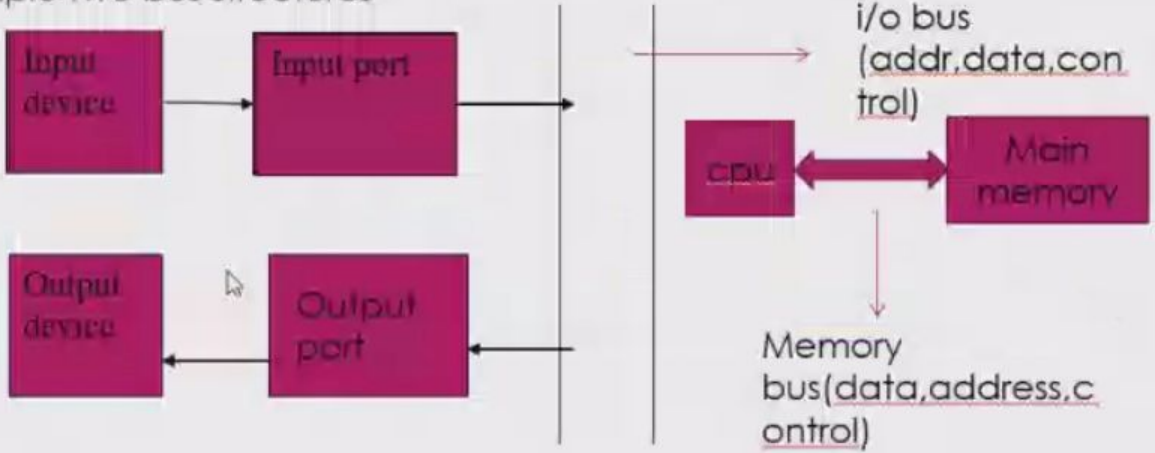
Rodrigo A. Obando

Bapu Pruthvidhar
Different uses

You

Bus Structures

- Simple two bus structures
-



You

Bus Structure

- Single-bus

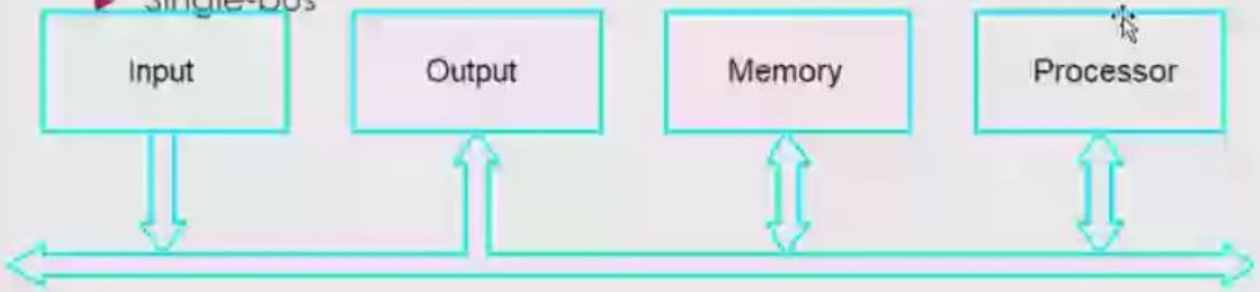


Figure 1.3. Single-bus structure.

You

- All units connected –system bus
- Only 2 device communicate at a time
- Advantage-Low cost,facility to connecting peripheral devices.
- Disadvantage-slow speed.
- Uses-minicomputers

You

Performance

- The most important measure of a computer is how quickly it can execute programs.
- Three factors affect performance:
  - Hardware design
  - Instruction set
  - Compiler

You

Performance

- Processor time to execute a program depends on the hardware involved in the execution of individual machine instructions.

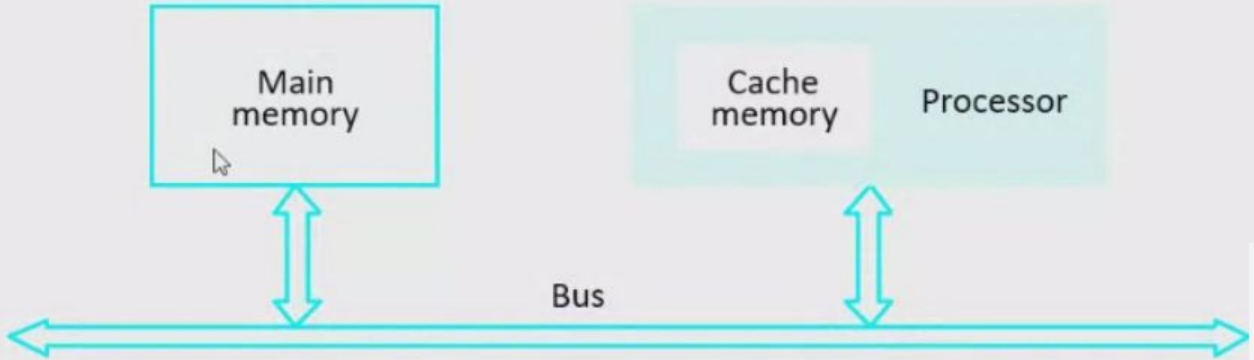


Figure 1.5. The processor cache.

You

Performance

- The processor and a relatively small cache memory can be fabricated on a single integrated circuit chip.
- Speed
- Cost
- Memory management

You

Processor Clock

- Clock, clock cycle, and clock rate
- The execution of each instruction is divided into several steps, each of which completes in one clock cycle.
- Hertz – cycles per second
- LENGTH OG CLOCK CYCLE-P
- **R(CLOCK RATE)=1/P cps**
- **HERTZ**

You

Basic Performance Equation

- **T** – processor time required to execute a program that has been prepared in high-level language
- **N** – number of actual machine language instructions needed to complete the execution (note: loop)
- **S** – average number of basic steps needed to execute one machine instruction. Each step completes in one clock cycle
- R – clock rate
- Note: these are not independent to each other

$$T = \frac{N \times S}{R}$$

How to improve T?

You

Clock Rate

- Increase clock rate
- Improve the integrated-circuit (IC) technology to make the circuits faster
- Reduce the amount of processing done in one basic step (however, this may increase the number of basic steps needed)
- Increases in R that are entirely caused by improvements in IC technology affect all aspects of the processor's operation equally except the time to access the main memory.

You

Instruction Rate

- Simple instruction requires small number
- Complex instruction requires large number
- Processor with simple instruction are called RISC
- Processor with complex instruction are called CISC
- Tradeoff between N and S
- A key consideration is the use of pipelining
- S is close to 1 even though the number of basic steps per instruction may be considerably larger
- It is much easier to implement efficient pipelining in processor with simple instruction sets
- Reduced Instruction Set Computers (RISC)
- Complex Instruction Set Computers (CISC)

You

Performance Measurement

- T is difficult to compute.
- Measure computer performance using benchmark programs.
- System Performance Evaluation Corporation (SPEC) selects and publishes representative application programs for different application domains, together with test results for many commercially available computers.
- Compile and run (no simulation)
- Reference computer

$$SPEC\ \ rating = \frac{\text{Running time on the reference computer}}{\text{Running time on the computer under test}}$$

$$SPEC\ \ rating = \left(\prod_{i=1}^{n} SPEC_i\right)^{\frac{1}{n}}$$

You