ITEC 352

Computer Organization

Principles of Computer Architecture
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Chapter 1: Introduction

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Some Definitions

- *Computer architecture* deals with the functional behavior of a computer system as viewed by a programmer (like the size of a data type – 32 bits to an integer).

- *Computer organization* deals with structural relationships that are not visible to the programmer (like clock frequency or the size of the physical memory).

- There is a concept of *levels* in computer architecture. The basic idea is that there are many levels at which a computer can be considered, from the highest level, where the user is running programs, to the lowest level, consisting of transistors and wires.

Pascal's Calculating Machine

- **Performs basic arithmetic operations (early to mid 1600's). Does not have what may be considered the basic parts of a computer.**

- **It would not be until the 1800's until Babbage put the concepts of mechanical control and mechanical calculation together into a machine that has the basic parts of a digital computer.**
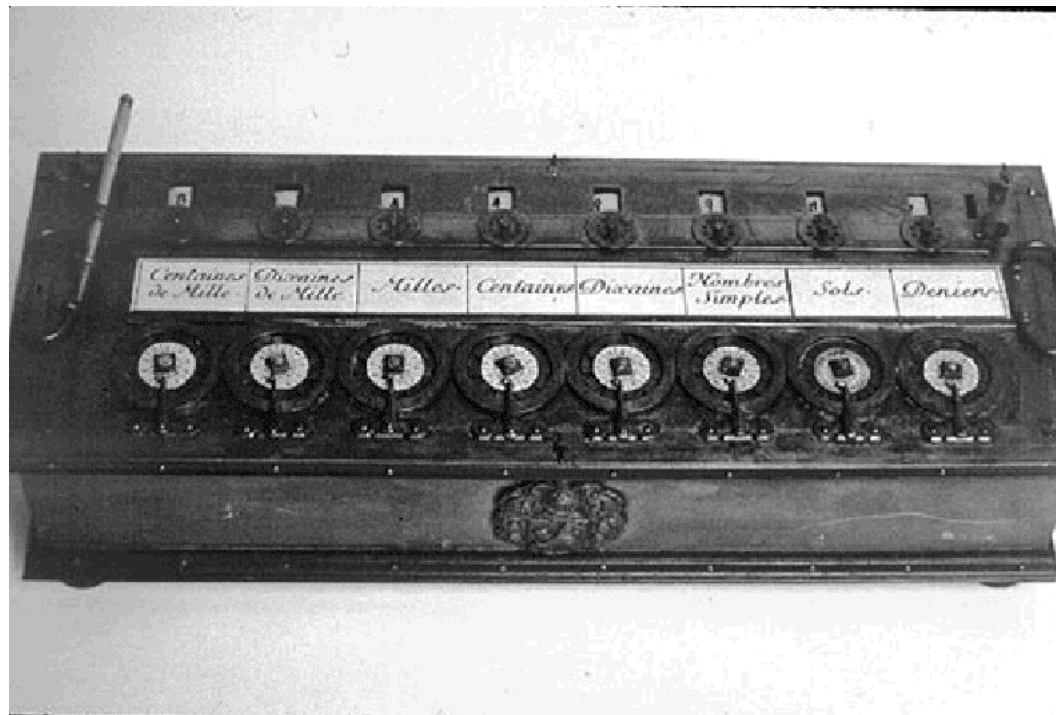
(Source: IBM Archives photograph.)

The von Neumann Model

- **The von Neumann model consists of five major components: (1) input unit; (2) output unit; (3) arithmetic logic unit; (4) memory unit; (5) control unit.**
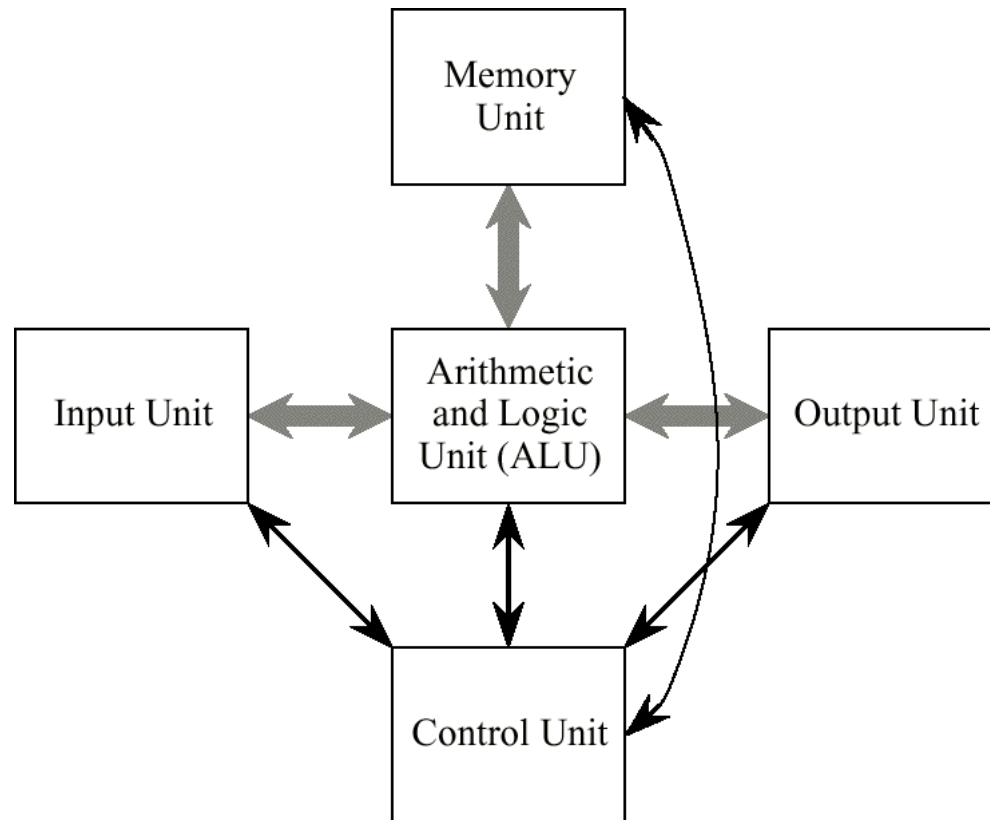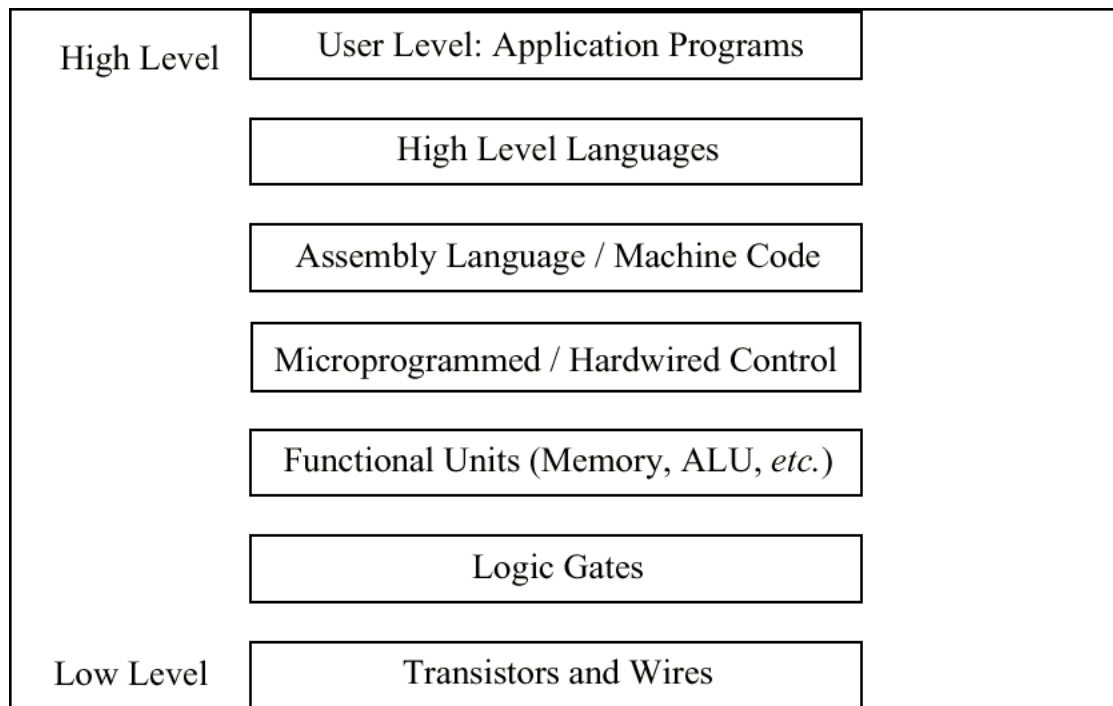
The System Bus Model

- **A refinement of the von Neumann model, the system bus model has a CPU (ALU and control), memory, and an input/output unit.**

- **Communication among components is handled by a shared pathway called the *system bus*, which is made up of the data bus, the address bus, and the control bus. There is also a power bus, and some architectures may also have a separate I/O bus.**
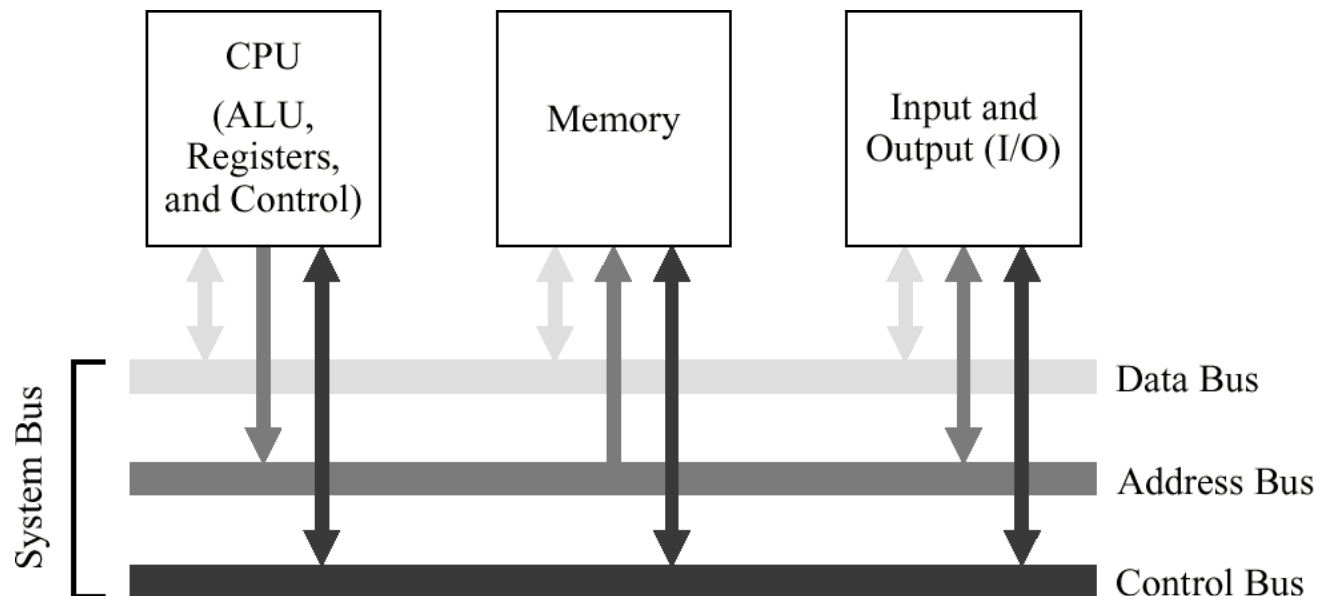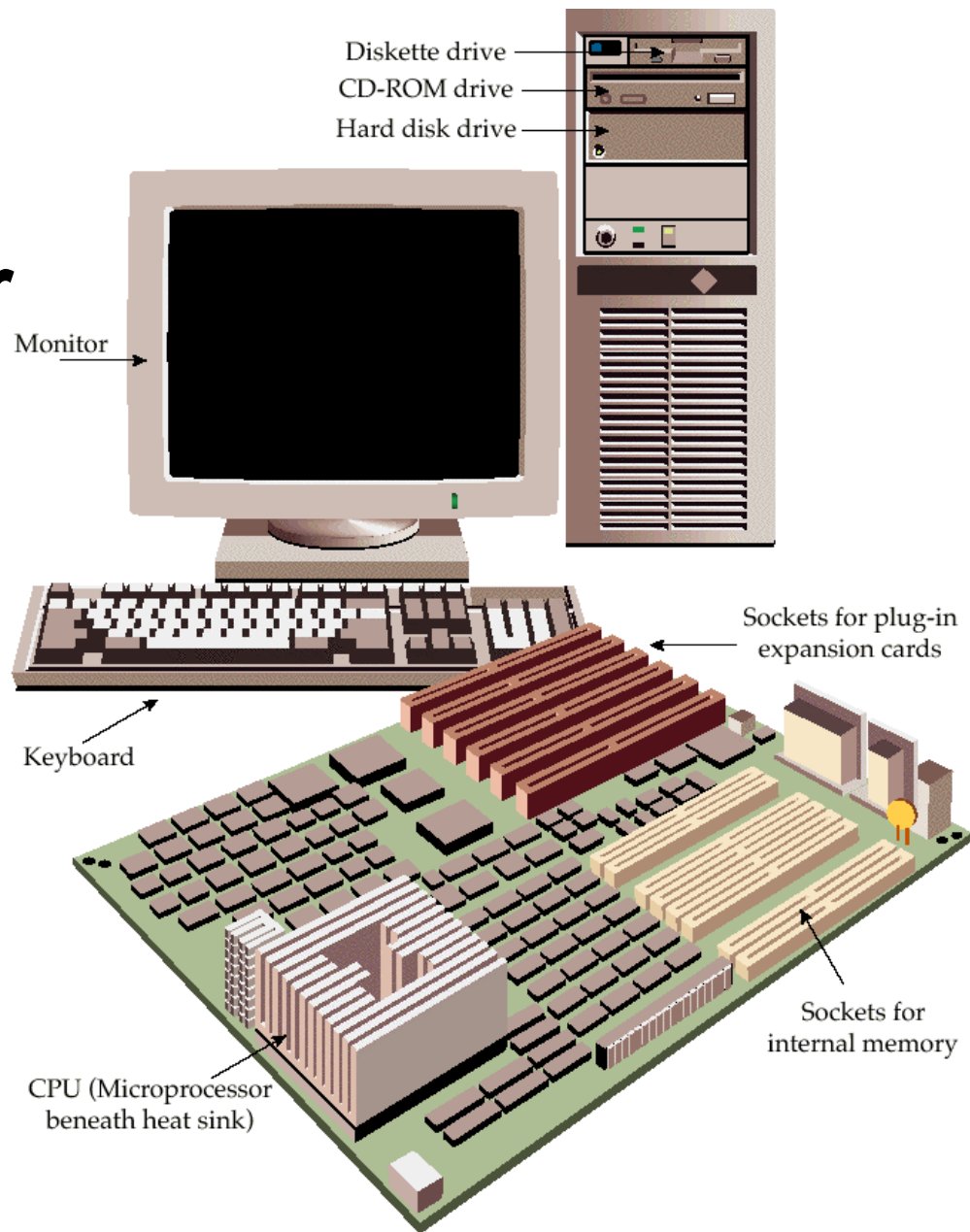
Levels of Machines

• **There are a number of levels in a computer (the exact number is open to debate), from the user level down to the transistor level.**

• **Progressing from the top level downward, the levels become less abstract as more of the internal structure of the computer becomes visible.**

High Level	User Level: Application Programs
	High Level Languages
	Assembly Language / Machine Code
	Microprogrammed / Hardwired Control
	Functional Units (Memory, ALU, *etc.*)
	Logic Gates
Low Level	Transistors and Wires

A Typical Computer System

Diskette drive

CD-ROM drive

Hard disk drive

Monitor

Sockets for plug-in expansion cards

Keyboard

Sockets for internal memory

CPU (Microprocessor beneath heat sink)
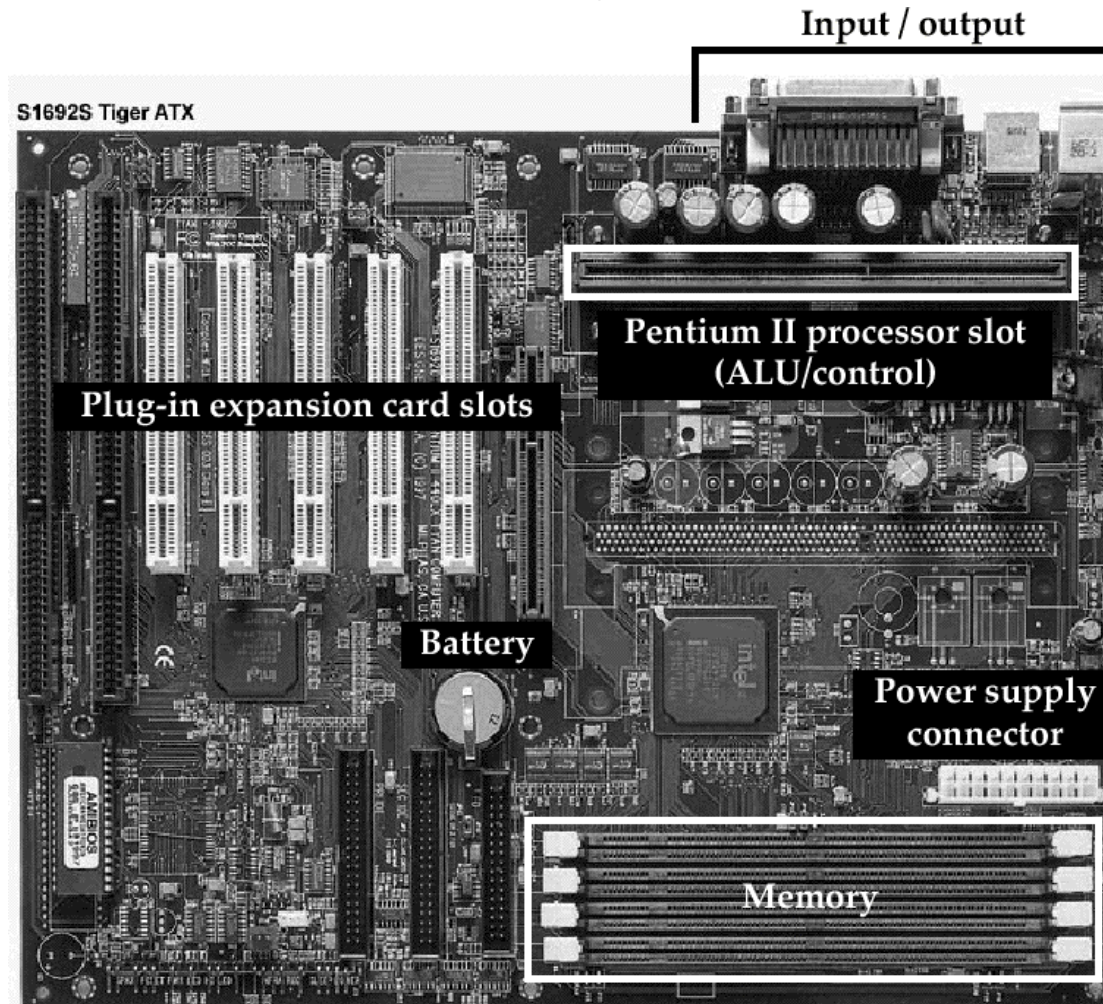
The Motherboard

- **The five von Neumann components are visible in this example motherboard, in the context of the system bus model.**

Source: TYAN
Computer,
www.tyan.com

Manchester University Mark I

- **Supercomputers, which are produced in low volume and have a high price, have been largely displaced by, high-volume low-priced machines that offer a better price-to-performance ratio.**

(Source: http://www.paralogos.com/DeadSuper)

Moore's Law

- **Computing power doubles every 18 months for the same price.**

- **Project planning needs to take this observation seriously: an architectural innovation that is being developed for a projected benefit that quadruples performance in three years may no longer be relevant: the architectures that exist by then may already offer quadrupled performance and may look entirely different from what the innovation needs to be effective.**