

Preview

- What is operating system
- Macroscopic view of computer system
- Computer Structure – Von Newmann
- Von Newmann Bottleneck
- Instruction cycle
- History of Computer system
 - First Generation -vacuum tubes and plugboards
 - Second Generation – Transistors and Batch System
 - Third Generation – IC and multiprogramming
 - Fourth Generation – Personal computer and LSI
 - Fifty Generation – Mobile Computers

What is Operating System?

- Modern Complex Computer System
 - processor, memory, disk, printer, keyboard, monitor, network interface, other I/O devices
 - Macroscopic view: Processor, Memory, I/O Devices
- Imagine!
 - If we need consider all devices for writing a program, it is extremely hard job.
- Operating system –
 - An protected software provide interface between hardware and software.
 - Linux or Window OS : more than 5 million lines of code

Computer Systems (Macroscopic view)

Computer Systems (Macroscopic view)

A Computer System

Hardware


- **Physical devices** – IC chips (CPU, Memory, IO devices ..), wires, power supplies, CRT (cathode ray tubes),
- **Micro-architecture** – physical devices are grouped together to form a functional units
Ex) registers internal to CPU, a data path containing an ALU.
- **Machine language** – the purpose of the data path is to execute some set of instructions. There are typically 50 to 300 instructions in the system written by machine code.

A Computer System

(Computer Structure: Von Newmann)

A Computer System

(Computer Structure: Von Neumann)



- John von Neumann was a Hungarian-American mathematician, physicist, computer scientist, and polymath.
- He made major contributions to a number of fields, including mathematics, physics, economics, computing, and statistics.
- Born: December 28, 1903, Budapest, Hungary
- Died: February 8, 1957,

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A Computer System

(Computer Structure: Von Neumann Bottleneck)

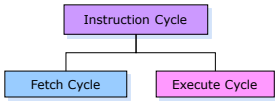
- In the von Neumann architecture, programs and data are held in memory; **the processor and memory are separate and data moves between the two.**
- The von Neumann bottleneck is a limitation on **throughput** caused by the standard personal computer architecture.
 - Throughput is a measure of how many units of information a system can process in a given amount of time.
- Since processor calculation speeds are much faster than data movement between memory and CPU, it cause bottleneck!

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A Computer System

(Instruction Cycle)

- The microprocessor's (CPU) main task is to execute instructions.
- The **instruction cycle** is therefore at the heart of understanding the function and operation of the microprocessor. (controlled by OS)



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A Computer System

(Instruction Cycle: Fetch Cycle)

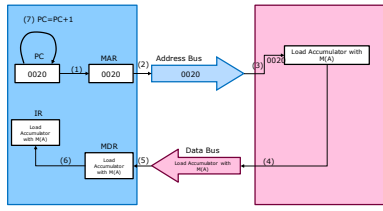
Fetch cycle

1. Reading the address of the instruction in (PC) to be executed from the memory and
2. Loading it into the Instruction register (IR).
3. Program Counter register (PC) is modified to point at the next valid instruction.

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A Computer System

(Instruction Cycle: Fetch Cycle)



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A Computer System

(Instruction Cycle: Execute Cycle)

Execute cycle

- The contents of the IR are decoded and executed.
- The execution may result in a variety of actions depending on the type of instruction.
- It may be a self contained instruction, or it can involve interaction with memory and ALU.

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What is an Operating System?

We can consider OS as

- an **extended machine**
 - Since operating system provide interface between user and hardware, computer users could use computer hardware (CPU, Memory and I/O devices) without knowing the messy details, which must be performed.
 - We can consider operating system as a part of computer system (extended machine)
- a **resource manager**
 - Computer consist of CPU, RAM and I/O devices. Operating system manages these resources to implement an application software through process management, memory management, file management, I/O management and deadlock management.

History of Computer Systems

- A Computer System belongs to one of generation based on what technology is used to build the system.



Vacuum Tube



Transistor



IC (Integrated Circuit)



LSI or VLSI
IC (Large Scaled Integrated Circuit, Very Large Scaled Integrated Circuit)

History of Operating Systems

The First Generation (1945 ~ 1955): Vacuum Tubes

The First Generation (1945 ~ 1955) - **vacuum tubes and plugboards**

- Use **vacuum tubes** to build calculating engines
- All programs were done by **machine language** written by wiring up **plugboard** to control the machine's basic functions.
- A programmer sign up for a block of time, come down to the machine room, insert **plugboard** and wait for calculation
- **No operating system: Human operate a computer!!**

History of Operating Systems

The First Generation (1945 ~ 1955): Vacuum Tubes



History of Operating Systems

The First Generation (1945 ~ 1955): Vacuum Tubes



- IBM SSEC (1948)
- Speed: 50 multiplications/sec
- Input/output: plugboard, cards, punched tape
- Memory type: punched tape, vacuum tubes, relays
- Technology: 20,000 relays, 12,500 vacuum tubes
- Floor space: 25 feet by 40 feet

History of Operating Systems

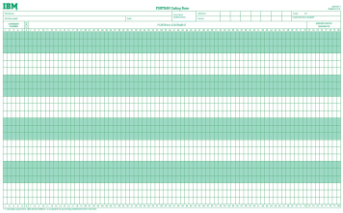
The Second Generation (1955 ~ 1965): Transistor & Batch System

The Second Generation (1955 ~ 1965) - Transistors and Batch system

- **Transistor** was invented in the mid 1950s. Computer become more reliable since **vacuum tubes are replaced by transistors (smaller, faster)**-mainframes
- To run a job (batch system)- for machine efficiency
 1. Programmer write a program on paper (coding paper)
 2. Punch a program on cards (one card for one line of program)
 3. Brings cards to the input room and submit to one of operator.
 1. Card reader: read card and save in magnetic tape.
 2. Load into memory.
 4. If FORTRAN compiler is needed, operator bring the compiler from the cabinet and load into the computer.
 5. Wait for output. (output will be written to a tape then printer print output)

History of Operating Systems

The Second Generation (1955 ~ 1965): Transistor & Batch System

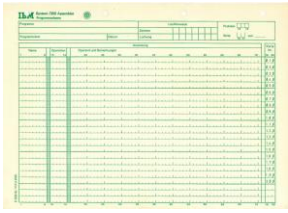


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History of Operating Systems

The Second Generation (1955 ~ 1965): Transistor & Batch System



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History of Operating Systems

The Second Generation (1955 ~ 1965): Transistor & Batch System

LINE NUMBER	FORTRAN STATEMENT	MARK	MARK
C	PROGRAM FOR FINDING THE LARGEST VALUE		
C	ATTAINED BY A SET OF NUMBERS		
I	DIMENSION A(500)		
I	FREQUENCY 3012,1,430, -341000		
I	READ 1, N, M, SA(1), I, L, M		
I	FORMAT (10F10.6,2I)		
I	STOP		
5	DO 20 I = 1, 2, N		
10	IF (ABS(A-I(1)) > 10, 20, 20)		
20	CONTINUE		
2	PRINT 1, N, SA		
2	FORMAT (20H THE LARGEST OF THESE 1, 2, N NUMBERS IS F, 2)		
	STOP *****		

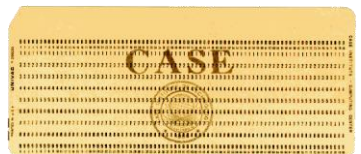
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History of Operating Systems

The Second Generation (1955 ~ 1965): Transistor & Batch System

- The figure to below shows one of the early 80 column IBM cards.
- Each card contains 12 rows of 80 columns, and each column is typically used to represent a single piece of data such as a character.




Punch Card

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History of Operating Systems

The Second Generation (1955 ~ 1965): Transistor & Batch System

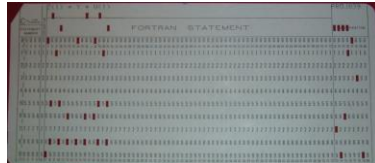


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History of Operating Systems

The Second Generation (1955 ~ 1965): Transistor & Batch System



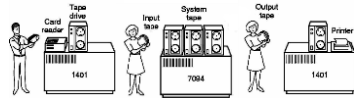
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History of Operating Systems

The Second Generation (1955 ~ 1965): Transistor & Batch System

Batch System - to optimize the usage of expensive computer



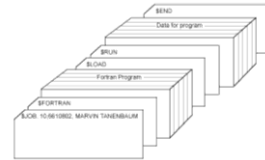
- Collect a tray full of Jobs
- Bring cards to 1401 (cheap machine)
- Read cards to tape
- Put tape on 7094 which does computing (expensive)
- Put tape on 1401 which prints output

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History of Operating Systems

The Second Generation (1955 ~ 1965): Transistor & Batch System



Structure of a typical FMS (Fortran Monitor System) job

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History of Operating Systems

The Second Generation (1955 ~ 1965): Transistor & Batch System



IBM 7030 (1959)

- IBM's 7000 series mainframes were the company's first transistorized computers.
- significantly faster and more dependable than vacuum tube machines

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History of Operating Systems

The Third Generation (1965 ~ 1980): IC & Multiprogramming

The Third Generation (1965 ~ 1980)- IC and Multiprogramming

- Maintaining two completely different product (IBM 7094, IBM 1401) was expensive proposition for the manufacturers (second generation)
- IBM introduces **IBM System/360** – for **scientific** and **commercial**.
- The idea was that all software, including the operating system, OS/360 had to work on all model – need very complex operating system with assembly code.

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History of Operating Systems

The Third Generation (1965 ~ 1980): IC & Multiprogramming



IBM System/360 (1964)

- IBM announced the System/360, a family of six mutually compatible computers and 40 peripherals that could work together.
- The initial investment of \$5 billion was quickly returned as orders for the system climbed to 1,000 per month within two years.
- At the time IBM released the System/360, the company was making a transition from discrete transistors to integrated circuits, and its major source of revenue moved from punched-card equipment to electronic computer systems.

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History of Operating Systems

The Third Generation (1965 ~ 1980): IC & Multiprogramming

Major feature of the third generation operating system

- IBM System/360 was the first major computer to use IC (integrated circuit)
 - To improve CPU utilization
 - Uses **multiprogramming** technique to save CPU time.
 - Uses **spooling** (Simultaneous Peripheral Operation On Line) technique to CPU time
 - Uses **time sharing** system to share CPU time between users using terminal.

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History of Operating Systems

The Third Generation (1965 ~ 1980): IC & Multiprogramming

- Multiprogramming –**
 - Multiple jobs (processes) are loaded into RAM and run concurrently.
 - Once CPU become available, one of job are selected by short term scheduler, load its current status to CPU and start to run.
 - OS need keep each job's current status.

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History of Operating Systems

The Third Generation (1965 ~ 1980): IC & Multiprogramming

The diagram shows a vertical stack of four boxes representing memory partitions. From top to bottom, they are labeled 'Job₃', 'Job₂', 'Job₁', and 'Operating System'. To the right of these boxes, the text 'Memory Partitions' is written, with dashed lines pointing to each of the four boxes.

- Multiprogramming system**
 - several jobs in memory – 3rd generation

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History of Operating Systems

The Third Generation (1965 ~ 1980): IC & Multiprogramming

- Spooling**
 - Spooling is a kind of buffering mechanism or a process in which data is temporarily held as a file to be used and executed by a device, program or the system.
 - Example: Network printer**
 - The process in which information to be printed is stored temporarily in a file, the printing being carried out later.
 - It is used to prevent a relatively slow printer from holding up the system at critical times, and to enable several computers or programs to share one printer.

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History of Operating Systems

The Third Generation (1965 ~ 1980): IC & Multiprogramming

The diagram shows a vertical list of slots for file names, numbered 4 through 7. Slot 4 contains 'abc', slot 5 contains 'prog.c', and slot 6 contains 'prog.n'. To the left, 'Process A' is connected to slot 5 and 'Process B' to slot 6. To the right, there are two boxes: 'out = 4' and 'in = 7'. Text on the right explains that when a process wants to print a file, it enters a file name in a special spooler directory, and a printer daemon periodically checks this directory for files to be printed.

- When a process want to print a file, it enter a file name in a special spooler directory
- Printer daemon periodically check spooler directory any file need to be printed.

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History of Operating Systems

The Third Generation (1965 ~ 1980): IC & Multiprogramming

The diagram shows a central 'Host computer' connected to eight terminals labeled 'Terminal 1' through 'Terminal 8'. The terminals are arranged in two rows of four. Red lines connect the host computer to each terminal, representing a time-sharing system.

Time sharing system

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History of Operating Systems

The Fourth Generation (1980 ~ Present): LSI & PC

The Fourth Generation (1980 ~ Present) – Personal Computer built with LSI(Large Scale IC),VLSI, ULSI

- The development of LSI circuit (contain thousands of transistors) make reduce the price of computer, which make available to built personal computer
- User typing in commands from the keyboard
 - CP/M
 - DOS (Microsoft)
- Graphic User Interface (GUI)
 - Apple with GUI,
 - LINUX- SUSE, Ubuntu, Red Hot, ...
 - Mac – macOS X
 - MS – Window95, 98, 2000, XP, Window Vista, Window 7, Window8, Window10

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History of Operating Systems

The Fifth Generation (1990 ~ Present): Mobile Computers

The Fifth Generation (1990 ~ Present) – Mobile Computers

- Since the real smartphone appears mid-1990s, there are several operating systems for smartphone.
 - Symbian OS
 - RIM's Blackberry OS
 - Android OS by Google
 - iOS by Apple

The Operating System Zoo

- Mainframe operating systems
- Server operating systems
- Multiprocessor operating systems
- Personal computer operating systems
- Real-time operating systems
- Embedded operating systems
- Smart card operating systems
- Smart phone operating systems