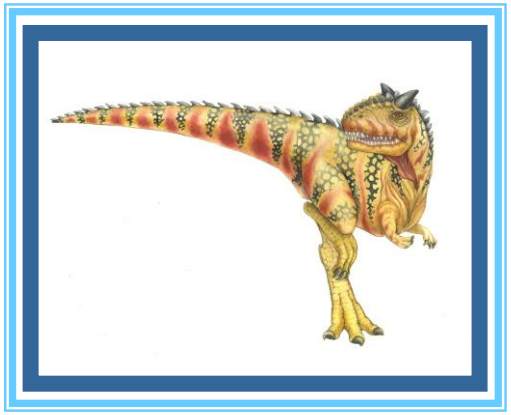
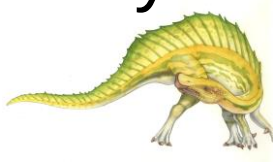
Lecture 1: History of operating systems



History of Operating Systems Development

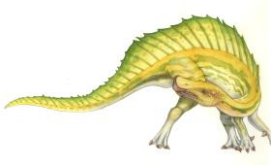
- **1940s: First Generation**
  - Computers based on vacuum tube technology
  - No standard operating system software
  - Typical program included every instruction needed by the computer to perform the tasks requested
  - Poor machine utilization
    - CPU processed data and performed calculations for fraction of available time
  - Early programs
    - Designed to use the resources conservatively
    - Understandability is not a priority



History of Operating Systems

- It all started with computer hardware in about 1940s.

ENIAC 1943

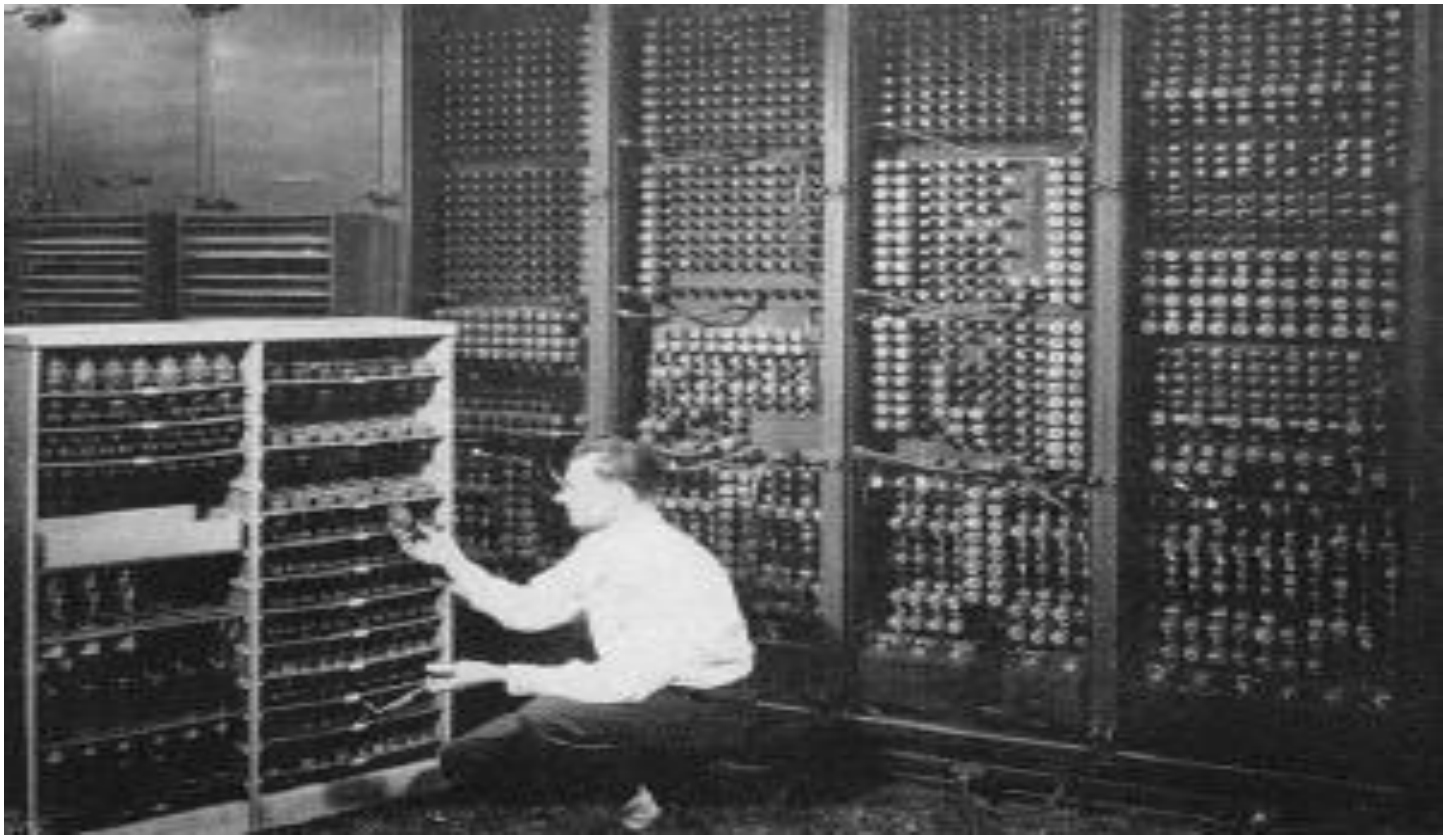


History of Operating Systems

- Computers were using vacuum tube technology.

ENIAC's vacuum tubes

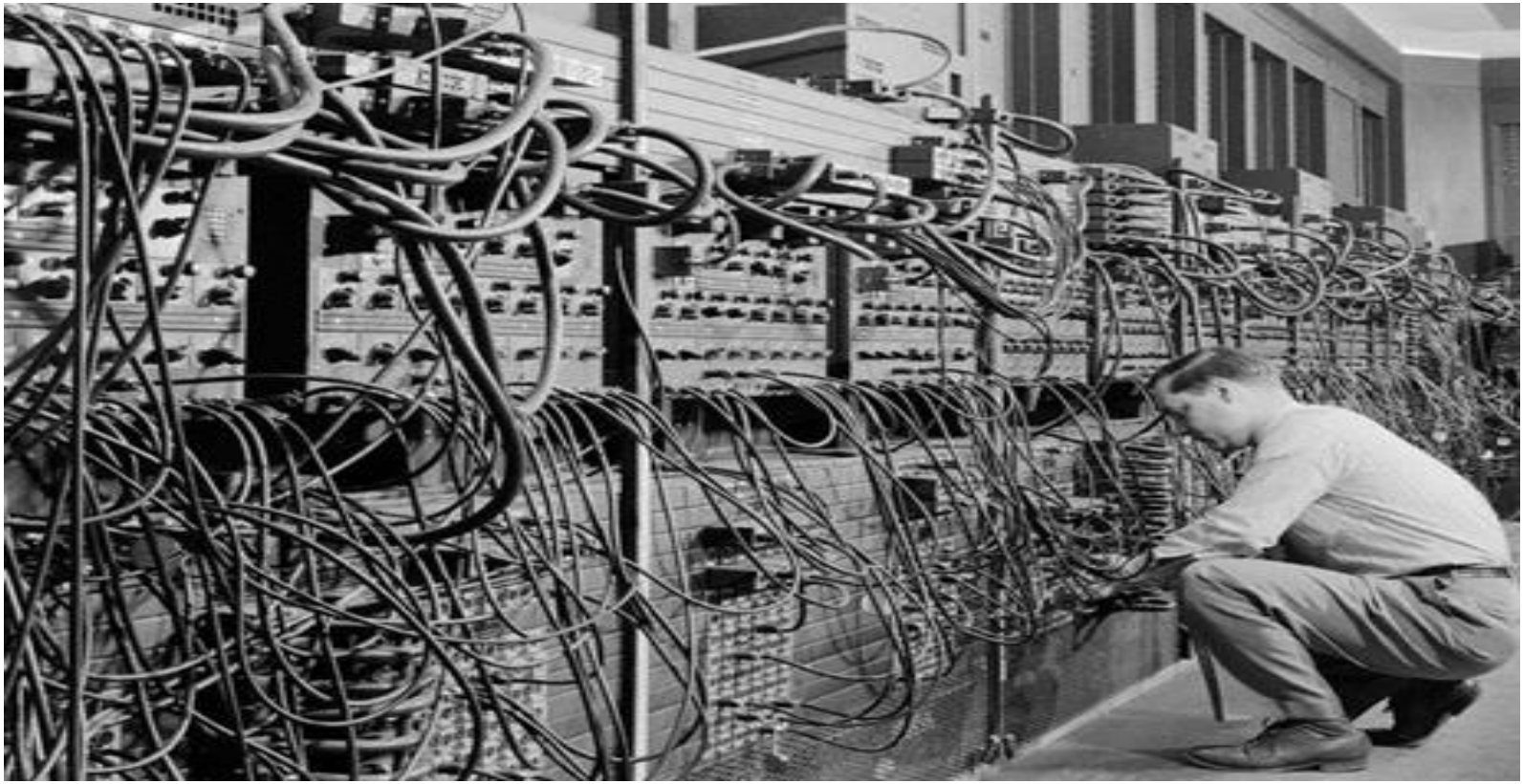
History of Operating Systems



ENIAC's backside

History of Operating Systems

Programs were loaded into memory manually using switches, punched cards, or paper tapes.



ENIAC : coding by cable connections

History of Operating Systems

- *ENIAC* (***Electronic Numerical Integrator and Computer***), at the U.S. Army's Aberdeen Proving Ground in Maryland.
  - built in the 1940s,
  - weighed 30 tons,
  - was eight feet high, three feet deep, and 100 feet long
  - contained over 18,000 vacuum tubes that were cooled by 80 air blowers.

History of Operating Systems

- **1950s: Second Generation**
  - Focused on cost effectiveness
  - Computers were expensive
    - IBM 7094: $200,000
  - Two widely adopted improvements
    - Computer operators: humans hired to facilitate machine operation
    - Concept of job scheduling: group together programs with similar requirements
  - Expensive time lags between CPU and I/O devices

History of Operating Systems

- **1950s: Second Generation (continued)**
  - I/O device speed gradually became faster
    - Tape drives, disks, and drums
  - Records blocked *before* retrieval or storage
  - Access methods developed
    - Added to object code by linkage editor
  - Buffer between I/O and CPU introduced
    - Reduced speed discrepancy
  - Timer interrupts developed
    - Allowed job-sharing

History of Operating Systems

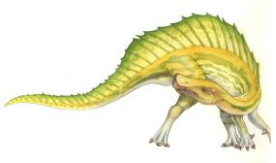
- **1960s: Third Generation**
  - Faster CPUs
  - Speed caused problems with slower I/O devices
  - Multiprogramming
    - Allowed loading many programs at one time
  - Program scheduling
    - Initiated with second-generation systems
    - Continues today
  - Few advances in data management
  - Total operating system customization
    - Suit user's needs

History of Operating Systems

- **1970s**
  - Faster CPUs
  - Speed caused problems with slower I/O devices
  - Main memory physical capacity limitations
    - Multiprogramming schemes used to increase CPU
    - Virtual memory developed to solve physical limitation
  - Database management software
    - Became a popular tool
  - A number of query systems introduced
  - Programs started using English-like words, modular structures, and standard operations

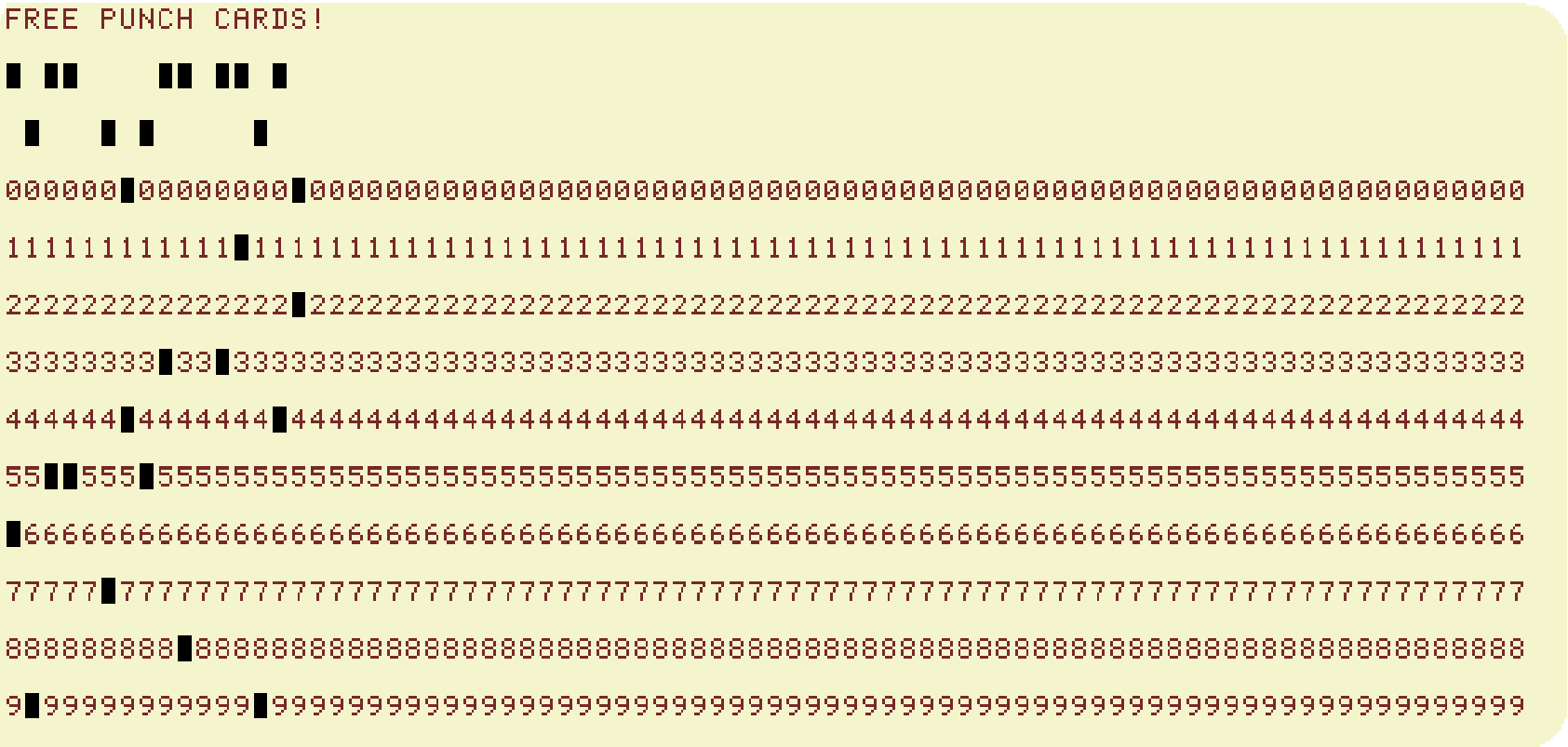
History of Operating Systems

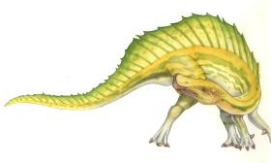
The Cray I supercomputer, introduced in 1976, boasted 8 MB main memory and a world-record speed of 160 million floating-point operations per second. Its circular design meant that no wire was more than 4 feet (1.2 meters) long.



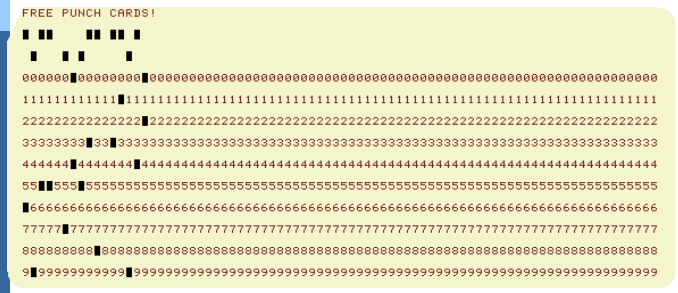
History of Operating Systems

punch card



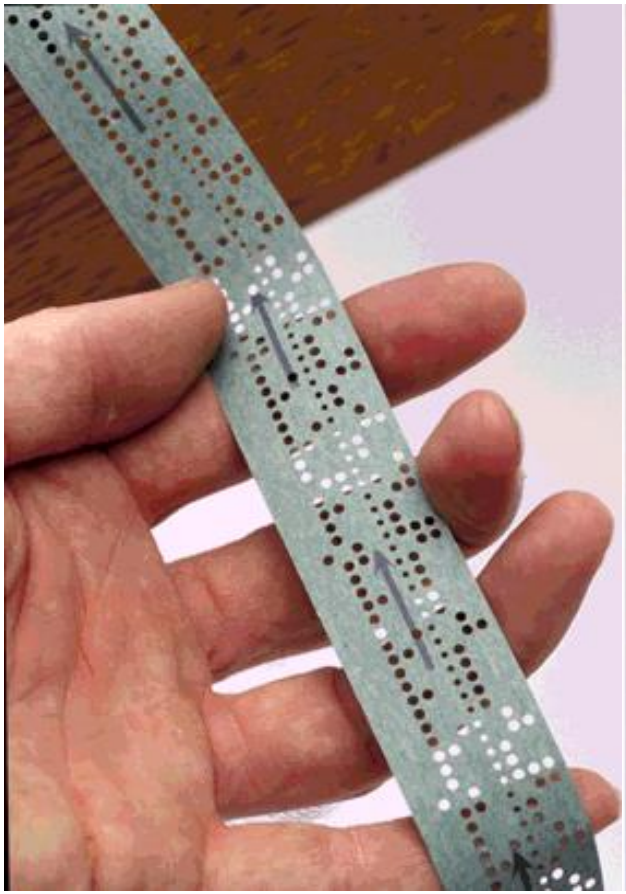


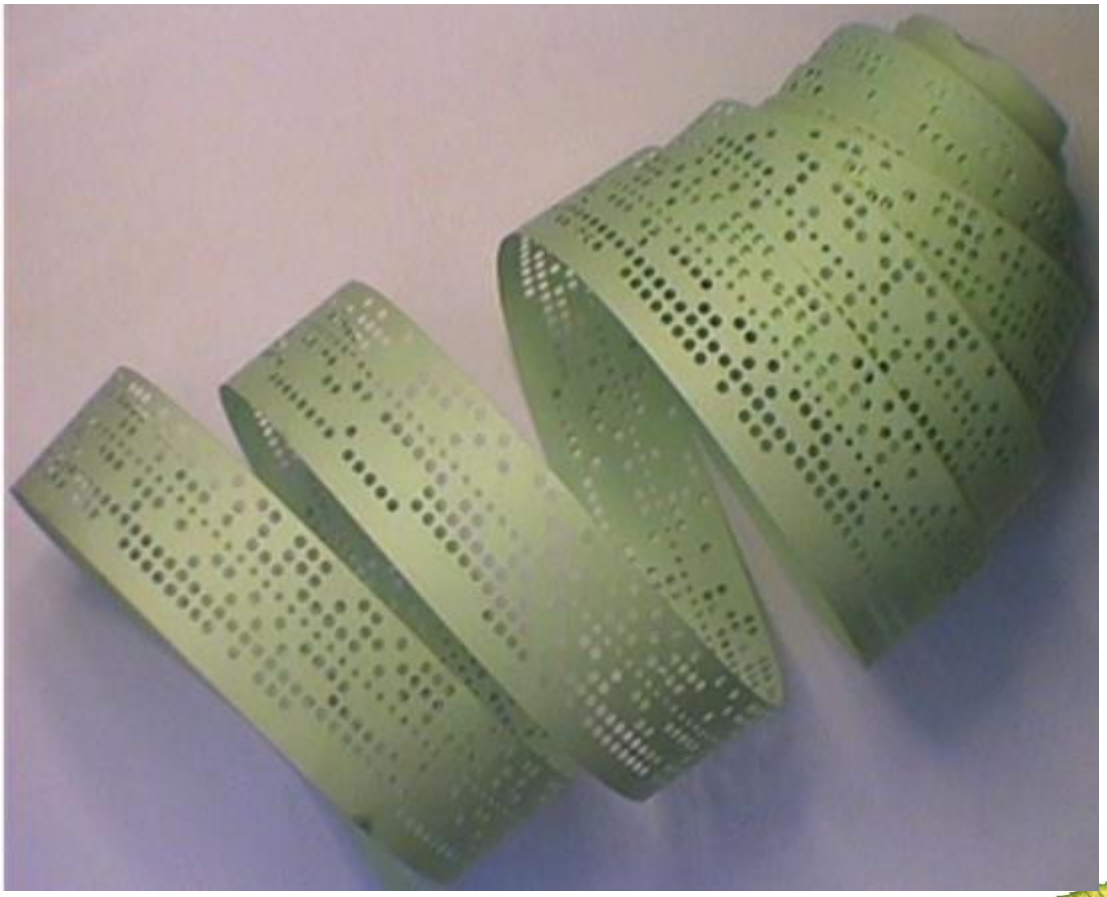
History of Operating Systems



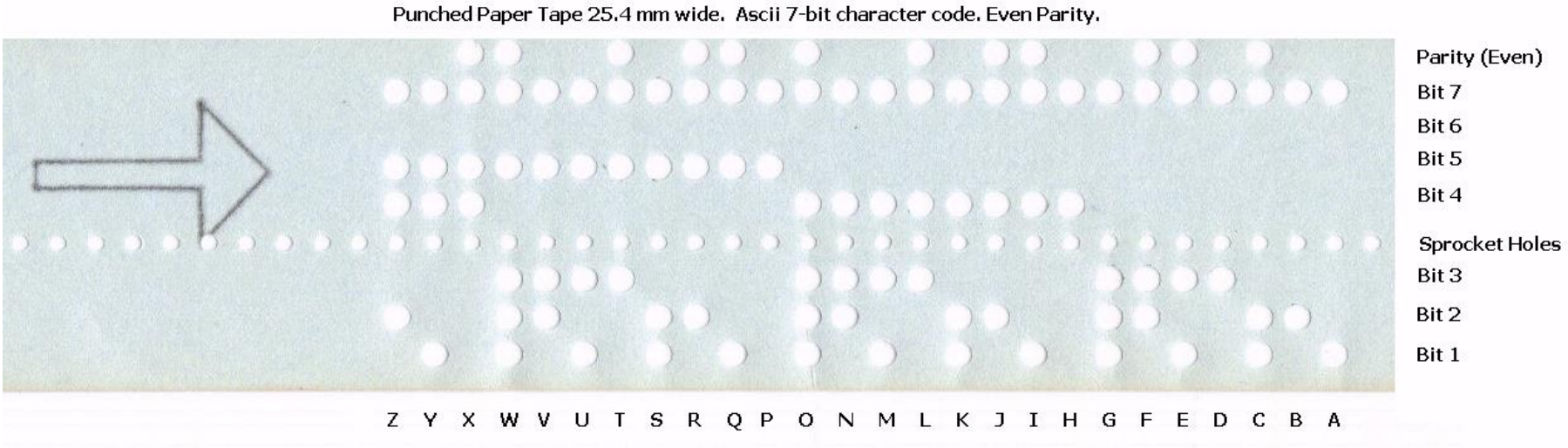
History of Operating Systems

Paper tape

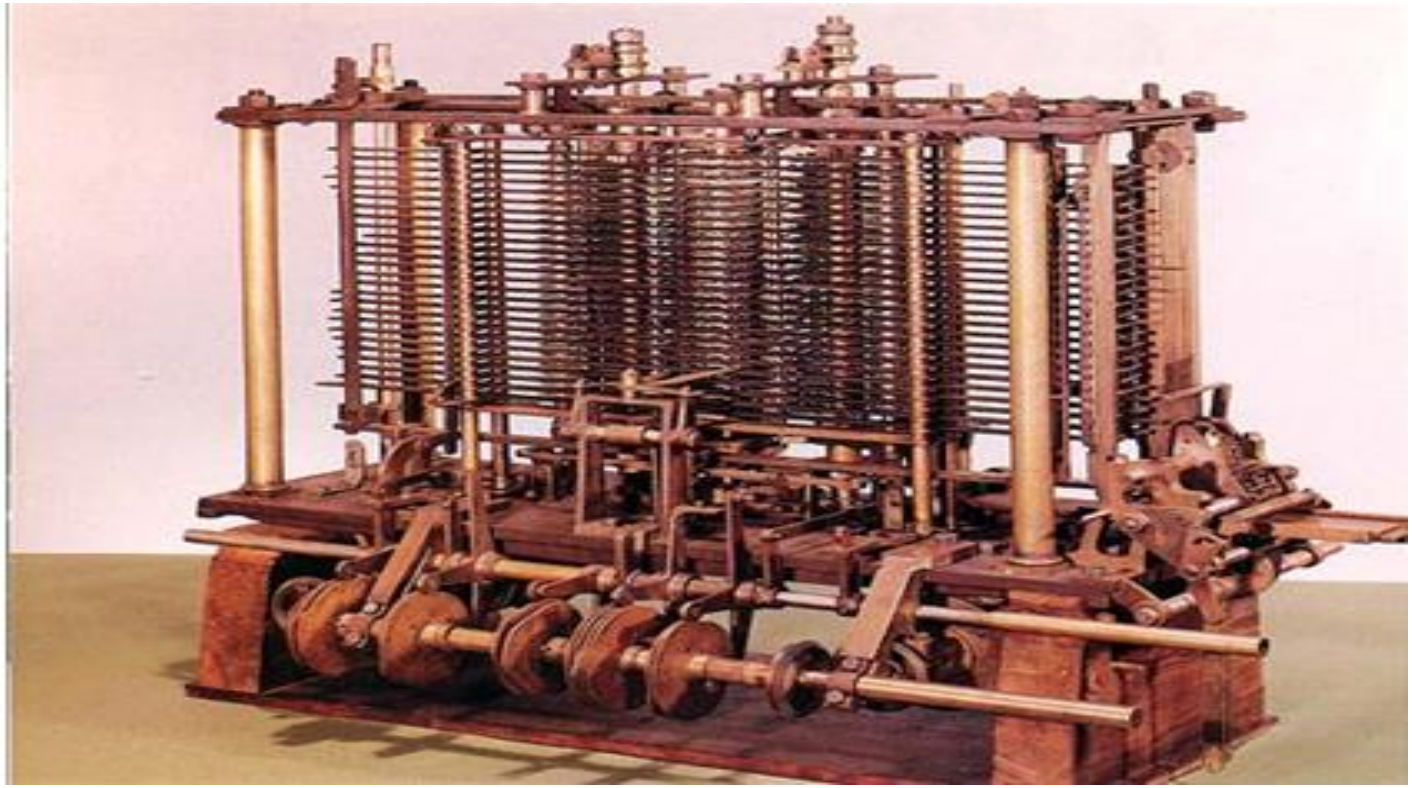




History of Operating Systems



History of Operating Systems

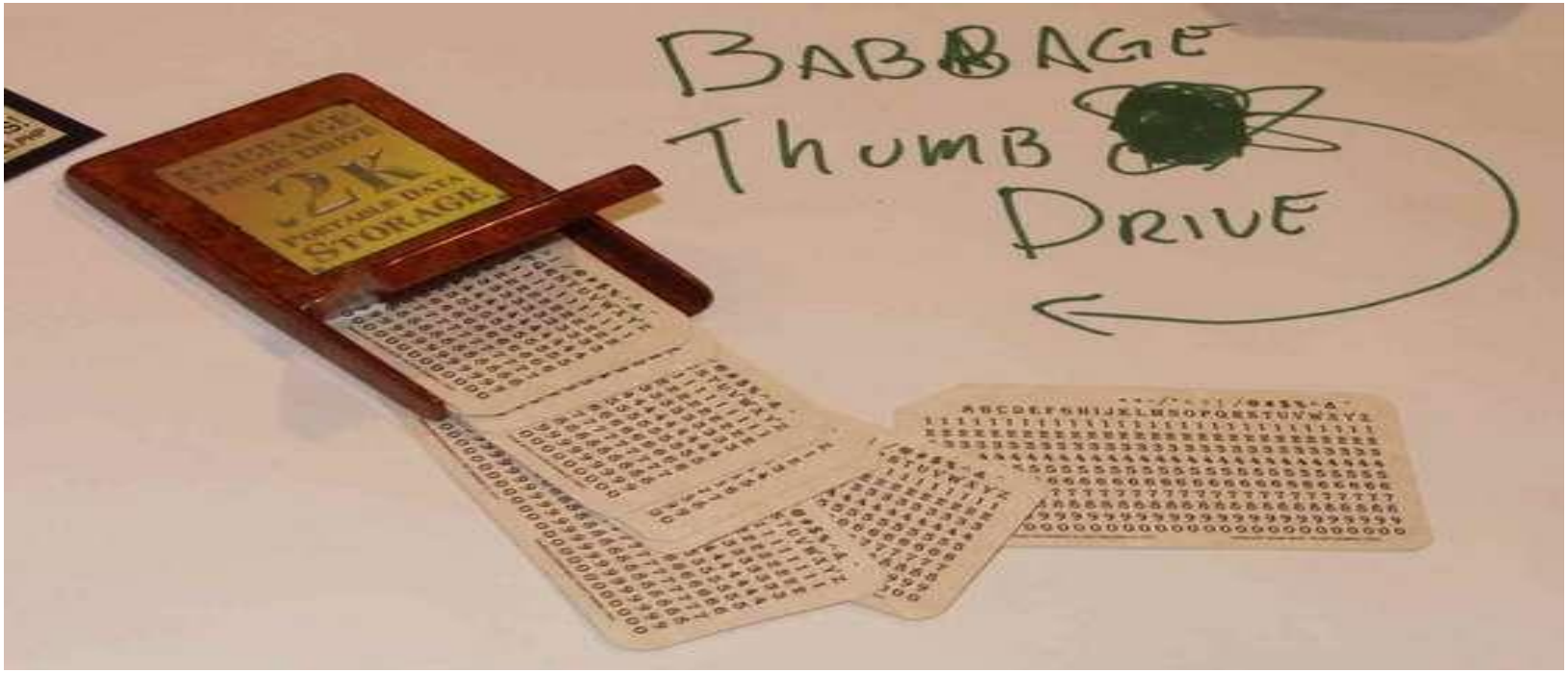


Babbage's analytical engine
(designed in 1840's by Charles Babbage, but cold not be constructed by him. An earlier and simpler version is constructed in 2002, in London)

http://www.computerhistory.org/babbage/

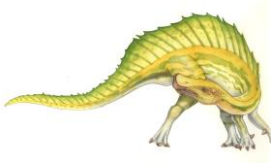
History of Operating Systems

- Ada Lovalence (at time of Charles Babbage) wrote code for analytical engine to compute Bernulli Numbers



History of Operating Systems

Commodore PET, 1977



History of Operating Systems

- With the development of interactive computation in 1970s, **time-sharing systems** emerged.
- In these systems, multiple users have *terminals* (not computers) connected to a *main computer* and execute her task in the main computer.

History of Operating Systems

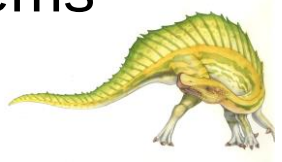
- **1980s**
  - **Cost/performance ratio** improvement of computer components
  - More flexible hardware (firmware)
  - **Multiprocessing**
    - Allowed parallel program execution
  - Evolution of personal computers
  - Evolution of high-speed communications
  - **Distributed processing** and **networked systems** introduced

History of Operating Systems

- **1990s**
  - Demand for Internet capability
    - Sparked proliferation of networking capability
    - Increased networking
    - Increased tighter security demands to protect hardware and software
  - Multimedia applications
    - Demanding additional power, flexibility, and device compatibility for most operating systems

History of Operating Systems

- **2000s**
  - Primary design features support:
    - Multimedia applications
    - Internet and Web access
    - Client/server computing
  - Computer systems requirements
    - Increased CPU speed
    - High-speed network attachments
    - Increased number and variety of storage devices
  - Virtualization
    - Single server supports different operating systems



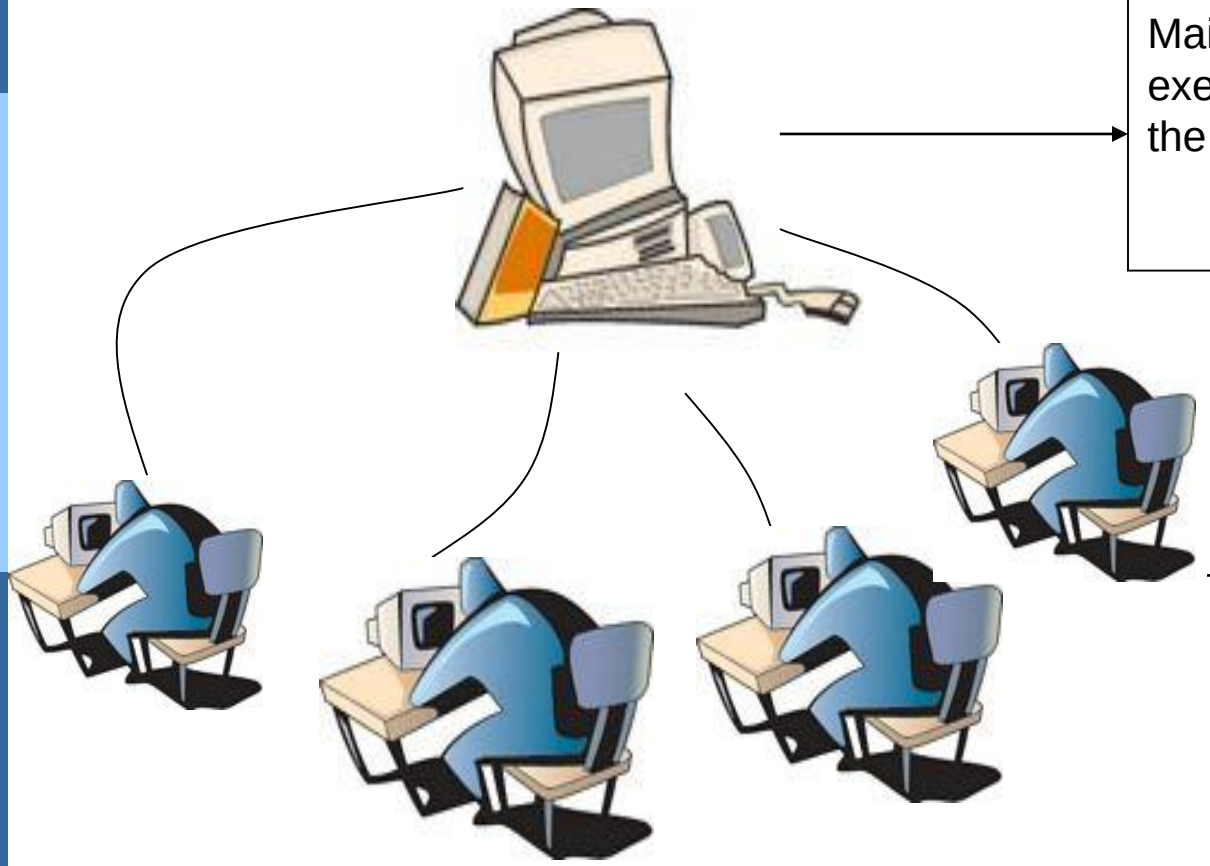
History of Operating Systems

- As time went on, card readers, printers, and magnetic tape units were developed as additional hardware elements.
- Assemblers, loaders and simple utility libraries were developed as software tools.
- Later, off-line spooling and channel program methods were developed sequentially.

History of Operating Systems

- Finally, the idea of **multiprogramming** came.
- Multiprogramming means sharing of resources between more than one processes.
- By multiprogramming the CPU time is not wasted, because, while one process moves on some I/O work, the OS picks another process to execute till the current one passes to I/O operation.

History of Operating Systems



Main computer; having a CPU executing processes by utilization of the OS, (e.g. UNIX).

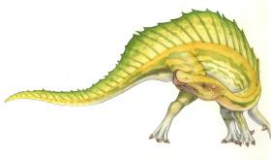
Terminals are connected to the main computer and used for input and output. No processing is made. They do not have CPUs.

History of Operating Systems

- Another computer system is the **multiprocessor system** having multiple processors sharing memory and peripheral devices.
- With this configuration, they have greater computing power and higher reliability.

History of Operating Systems

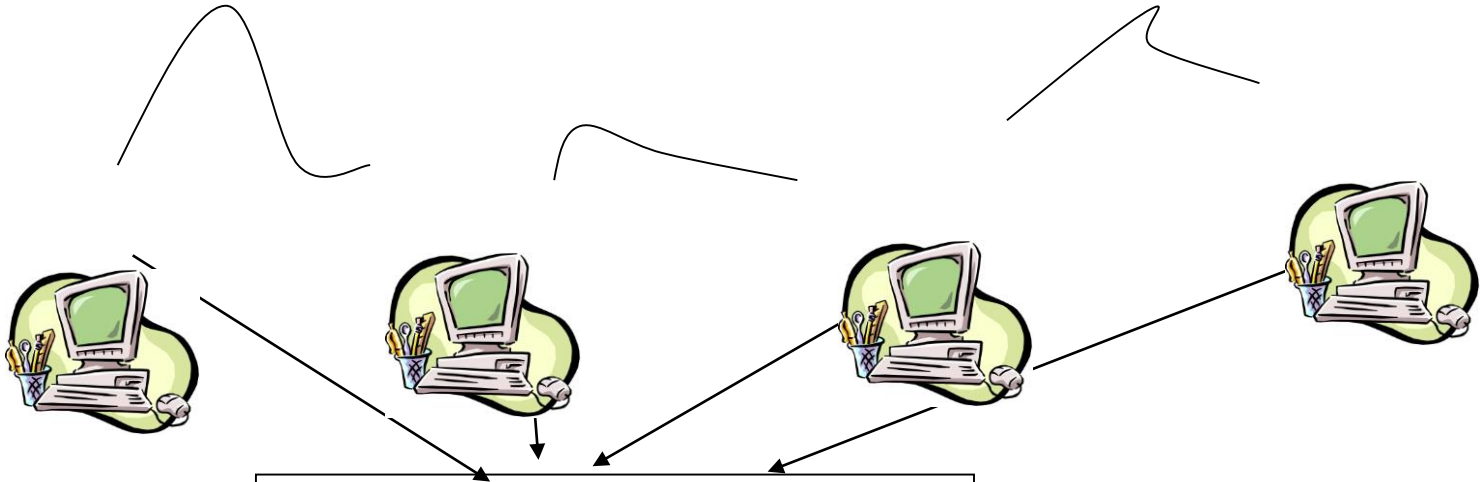
- Multiprocessor systems are classified into two as tightly-coupled and loosely-coupled (distributed).
- In the tightly-coupled one, each processor is assigned a specific duty but processors work in close association, possibly sharing the same memory.
- In the loosely coupled one, each processor has its own memory and copy of the OS.



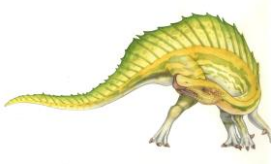
History of Operating Systems

- Use of the networks required OSs appropriate for them.
- In **network systems**, each process runs in its own machine but the OS have access to other machines.
- By this way, file sharing, messaging, etc. became possible.
- In networks, users are aware of the fact that s/he is working in a network and when information is exchanged. The user explicitly handles the transfer of information.

History of Operating Systems

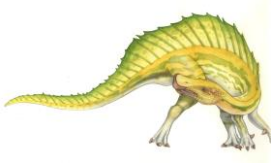


Each is a computer having its own CPU, RAM, etc. An OS supporting networks is installed on them.



History of Machine Hardware

Platform	Operating System
Microcomputers	Linux, UNIX, Windows
Minicomputers	Linux, IBM OS/400, OpenVMS, UNIX
Mainframe computers	IBM OS/390, Linux, UNIX
Supercomputers	IRIX, UNICOS
Workstations, Servers	Linux, UNIX, Windows
Networks	Linux, NetWare, UNIX, Windows
Personal Digital Assistants	Palm OS, Windows Mobile



Types of Operating Systems

- Five categories
  - Batch
  - Interactive
  - Real-time
  - Hybrid
  - Embedded
- Two distinguishing features
  - Response time
  - How data enters into the system