

The image features a hand typing on a laptop keyboard in the lower-left corner. The background is a dark blue gradient with abstract, glowing white lines that resemble a network or data flow. The text "OPERATING SYSTEMS OVERVIEW" is centered in a bold, yellow, sans-serif font.

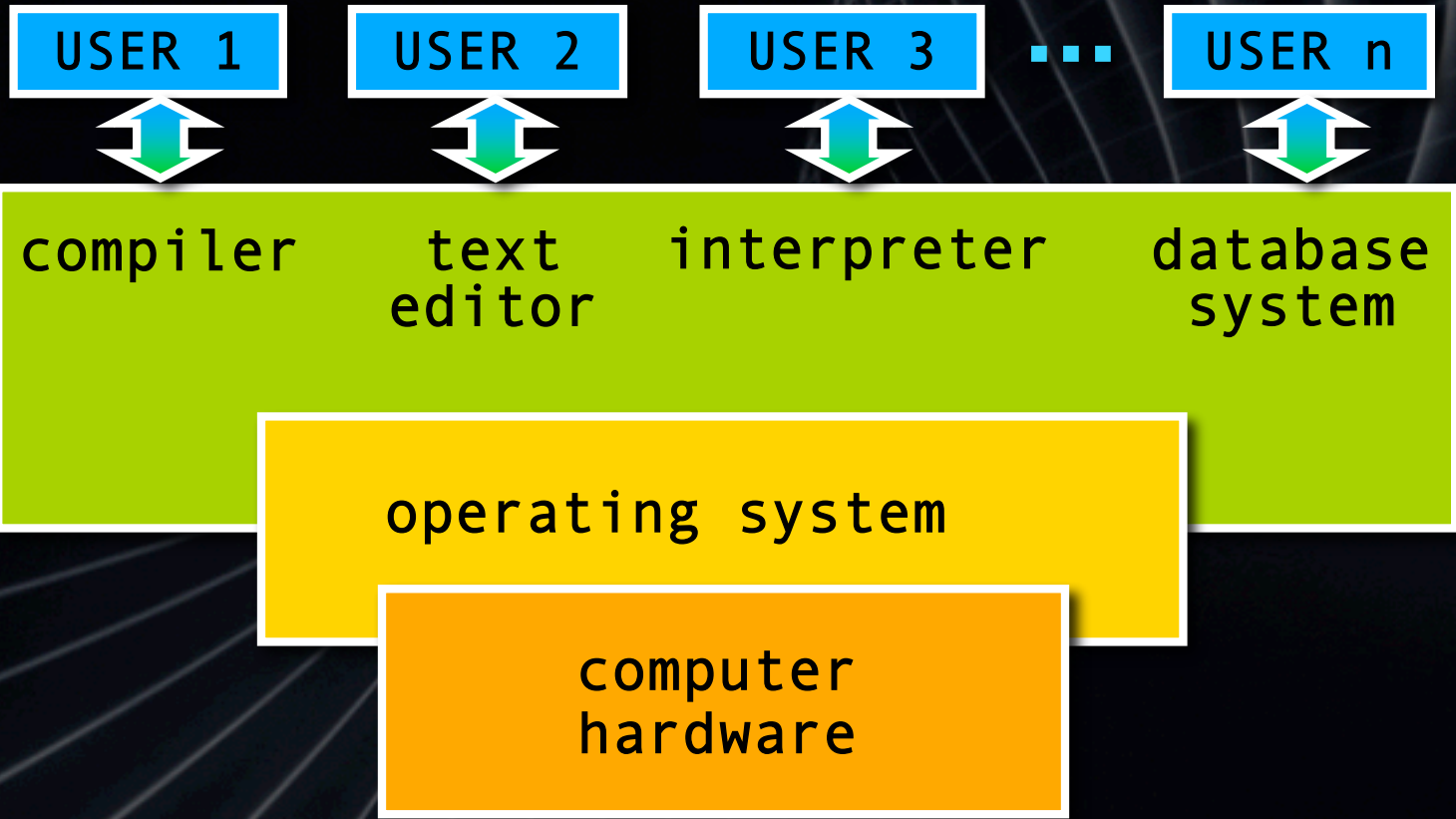
OPERATING SYSTEMS OVERVIEW

Contents

- O.S. Functions
- The Evolution of O.S.
- Characteristics of O.S.
- Basic hardware elements

Contents

- O.S. Components
- System calls
- O.S. Structure





Programming system components

compilers

loader

linker

comand interpreter

(shell)

...

O.S. purposes

- to make a computer more convenient and easier to use
- to allow more efficient operations of the whole computer system

To simplify the program development

The O.S. **masks** the details of the hardware from the programmer and provides the programmer with a **convenient interface** for using system resources (**system calls**)



To simplify the program
development

Definition of an extended
(virtual) machine

VIRTUAL MACHINE

ES: DISK CONTROLLER



- **commands**: read, write, head motion, ecc...
- **parameters**: sector address, number of sectors for each track, ecc...
- **state and error conditions**

A woman with short brown hair, wearing a light pink long-sleeved shirt, is seated at a desk in profile, looking at a computer monitor. The monitor displays a grid of colorful icons. The scene is dimly lit, with light coming from the monitor and a window in the background. Overlaid on the scene is a complex, glowing white wireframe structure that resembles a human figure or a network, with lines radiating from the center. The overall atmosphere is futuristic and technical.

Hardware resource allocation

Access to system resources must be controlled and conflicts for resource contention resolved

A woman with short brown hair, wearing a pink long-sleeved shirt, is seated at a desk in a dimly lit office. She is looking at a computer monitor which displays a grid of icons. Her hands are on a keyboard. A glowing, semi-transparent wireframe grid is overlaid on the scene, particularly around the woman and the desk. The background is dark with some light coming from a window or screen behind her.

Hardware resource allocation

Any user should be provided with required resources, by following suitable policies

The background features a dark blue to black gradient with a complex pattern of glowing white lines. These lines are thin and curved, creating a sense of depth and movement, similar to a topographical map or a network diagram. The lines are most prominent on the right side and fade towards the left.

The details for the
management of hardware
resources must be hidden
to users



System calls provide
the interface between
the application programs
and the O.S.

THE EVOLUTION OF O.S.

CITY	SCHED	FLT	GATE	DEPART
SAN FRANCISCO	11:00	1041	B37	ON T
SAN FRANCISCO	11:30	1521	B42	ON T
SAN FRANCISCO	11:31	1733	W6	CHIC
ALL CUSTOMERS ARE ADVISED TO FLIGHT				
SAN FRANCISCO	12:30	1125	B42	ON T
SAN JOSE	9:45	1033	349	AT
SAN JOSE	11:35	451	349	AT
SAN JOSE	11:30	5501	349	ON T
SEATTLE	11:20	1782	349	ON T
SEATTLE	10:05	1782	349	ON T
SEATTLE	10:00	1111	349	ON T
SEATTLE	11:40	1227	349	ON T
SUN CITY	12:50	6017	349	ON T
SUN FALLS	10:15	5073	349	ON T
SUN FALLS	12:40	1300	349	ON T
SUN FALLS	10:15	1300	349	ON T

CHICAGO
MINNAPOLIS
SAN ANGELES
NEW YORK
SAN FRANCISCO
SEATTLE
WASHINGTON D.C.
CUSTOMERS

Serial processing

- No O.S.
- Control by console
- Scheduling
- Setup time



Simple batch systems

Monitor

- Resident in main memory
- Control of the program execution
- “batch” solution

Uniprogramming systems

Only one program
in main memory

Machine time alternates
between execution
of user programs
and monitor (OS)

Uniprogramming systems

operating system

user program

main memory
organization
in a batch
uni-programming
system


Uniprogramming systems

Hardware and software resources of the computer system are dedicated to only one program
(monouser system)

Uniprogramming systems

low CPU utilization

 CPU utilization

 I/O waiting



Hardware characteristics

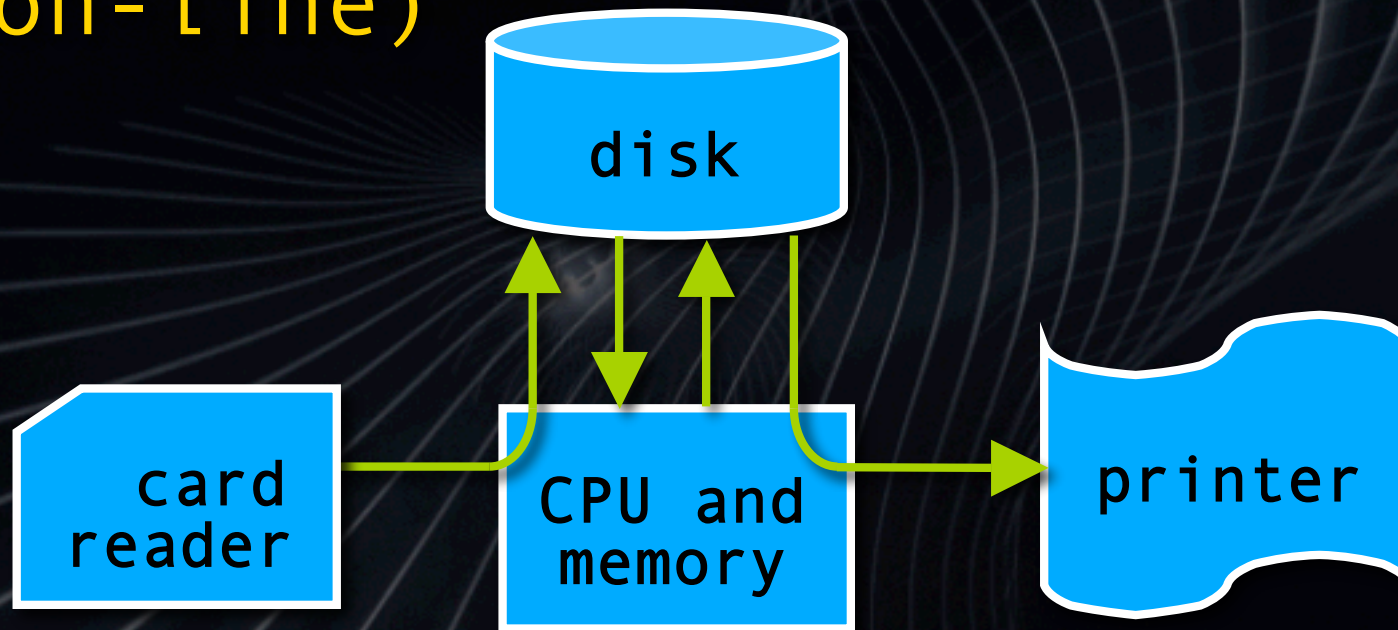
→ Memory protection

→ Timer

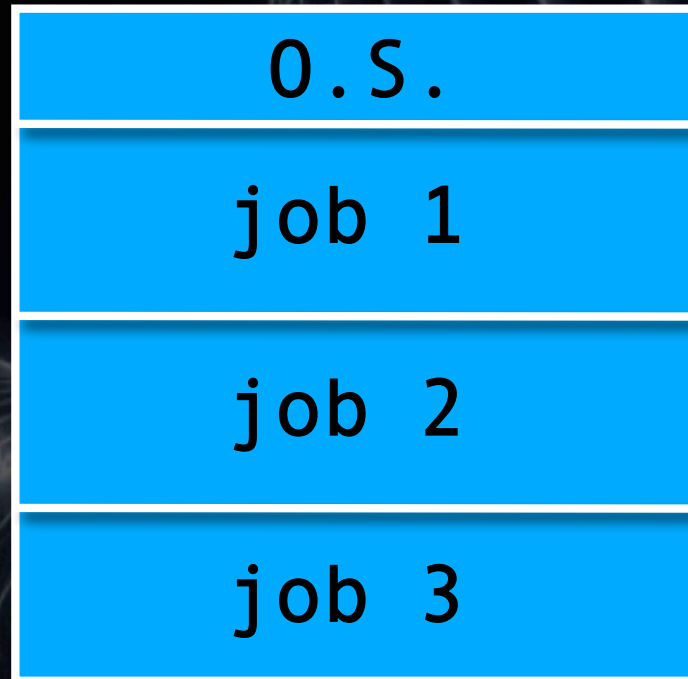
→ Privileged instructions

→ Interrupts

Spooling (simultaneous peripheral operation on-line)



Multiprogrammed Batch Systems



A multiprogramming
system with three jobs
in memory

Multiprogrammed Batch Systems

Increase of resource
utilization



Multiprogrammed Systems

O.S. are more sophisticated

→ Algorithms for resource management
(CPU, memory, I/O)

Multiprogrammed Systems

O.S. are more sophisticated

→ Protection of the environments of different jobs

Multiprogrammed Systems

Scheduling algorithms

Job mix

CPU-bound job

I/O-bound job

Multiprogrammed Batch Systems

Example

OS/360 working on IBM 360
e 370 series

Multiprogrammed Batch Systems

- High efficiency
in resource utilization
- Users cannot directly
interact with the O.S.
- Large response time

Interactive systems

→ direct communication
between the user
and the system

Interactive systems

→ the user gives instruction to the O.S. directly, by using either a keyboard or a mouse and waits for immediate results

Time-sharing systems

Logical extension
of multiprogramming

→ Multiple users
simultaneously access
the system through
terminals

Time-sharing systems

Logical extension
of multiprogramming

→ The O.S. interleaves
the execution of each
user program in a
short burst or **quantum**
of computation

Time-sharing systems

At the end of the quantum (or during the quantum, if the job executes an I/O instruction) the CPU is switched to a different job.

Time-sharing systems

One of the first developed time sharing O.S. was the **CTSS** (Compatible Time Serie System), MIT years 60'

MULTICS, UNIX, ...

Overhead

