Operating Systems I

Unit 1 – Introduction

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ISISTAN-CONICET

Normas de la cátedra

- No se admiten condicionalidades (no haber aprobado la cursada de una correlativa)
- Las revisiones de parciales son:
  - en las fechas y horarios establecidos
    - excepciones únicamente con certificado médico
- Consultas sobre la cursada:
  - únicamente en los horarios de clase
- Consultas sobre el final:
  - todos los viernes a partir de las 14:00 en el ISISTAN
    - No en vacaciones, feriados ni fines de semana

Cursada

- 13 teóricos
- 7 trabajos prácticos
  - 1 sobre Linux: ir instalando alguno! (se recomienda Ubuntu)
    - Con nota para el parcial
  - 1 requiere de conocimientos básicos de programación (C, C++, Java, ...)
- Apuntes y Prácticos
  - http://www.exa.unicen.edu.ar/catedras/sisop1/
- Parcial/recuperatorio/prefinal:
  - fechas a definir

Quiénes somos?

- Profesores:
  - Dr. Alejandro Zunino: http://users.exa.unicen.edu.ar/~azunino/
  - Dr. Cristian Mateos: http://users.exa.unicen.edu.ar/~cmateos/
- Auxiliares
  - Dr. Juan Manuel Rodriguez
  - Dr. Alejandro Corbellini
  - Dr. Ana Victoria Rodriguez
  - Dr. Matías Hirsch

Bibliografía

- Bibliografía requerida:
  - Operating system concepts. Abraham Silberschatz, Peter Galvin (>= 5ta edicion):
    - Ed. 1994: 001.6425, Si582 (4 ejemplares)
    - Ed. 1998: 001.6425, Si582-1 (5 ejemplares)
    - Ed. 2004: 001.6425, Si582-2 (1 ejemplar, castellano)
  - The MACH System. Abraham Silberschatz, Peter Galvin: http://www.exa.unicen.edu.ar/catedras/sisop1/
- Programa y más bibliografía en la página

Qué hacemos?

- ISISTAN (Instituto Superior de Ingeniería del Software de Tandil):
  - http://www.isistan.unicen.edu.ar
  - https://www.facebook.com/isistan.conicet/
  - https://twitter.com/ISISTAN_CONICET
- CONICET (Consejo Nacional de Investigaciones Científicas y Técnicas):
  - https://www.conicet.gov.ar

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I S I S T A N

Algunos tips...

- Hacer los prácticos
  - entre el 20% y el 40% desaprueban el parcial por no hacer el práctico de Linux
- Leer con detenimiento los enunciados:
  - muchos desaprueban porque no leen el enunciando del parcial
- Leer el libro durante la cursada:
  - ~ 500 páginas
- Rendir el final lo más pronto posible
- Evitar *delirios de persecución*. Se desaprueba por no saber y no por:
  - Persecución ideológica
  - Ojotas, traje, rastas, cumbia, etc.

Unit 1: Introduction

- What is an Operating System?
- Mainframe Systems
- Desktop Systems
- Multiprocessor Systems
- Distributed Systems
- Clustered System
- Real -Time Systems
- Handheld Systems
- Computing Environments

Qué **no** es la materia?

- Curso de instalación, configuración y uso de Windows/Linux/Mac OS/...
- Curso de desarrollo de sistemas operativos
- Curso de filosofía de software libre, open, free, ...
- Curso de certificación de productos, obtener estrellas, ...

What is an Operating System?

- A program that acts as an intermediary between a user of a computer and the computer hardware.
- Operating system goals:
  - Execute user programs and make solving user problems easier.
  - Make the computer system convenient to use.
  - Use the computer hardware in an efficient manner.
  - Permit effective development, testing, and introduction of new system functions without interfering with service

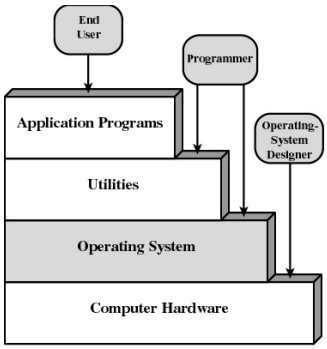
Qué **si** es la materia?

- Curso de introducción a:
  - conceptos de SO
  - estructuras internas
  - factores que influencian el diseño de los SO
  - implicancias del SO en las aplicaciones
  - implicancias de las aplicaciones en los SO
  - implicancias del hardware en los SO
  - cuáles SO, cómo y por qué están hechos así y para qué sirven

Computer System Components

1. Hardware – provides basic computing resources (CPU, memory, I/O devices).
2. Operating system – controls and coordinates the use of the hardware among the various application programs for the various users.
3. Applications programs – define the ways in which the system resources are used to solve the computing problems of the users (compilers, database systems, video games, business programs).
4. Users (people, machines, other computers).

Abstract View of System Components



Computing Environments

- Traditional computer
  - Blurring over time
  - Office environment
    - PCs connected to a network, terminals attached to mainframe or minicomputers providing batch and timesharing
    - Now portals allowing networked and remote systems access to same resources
  - Home networks
    - Used to be single system, then modems
    - Now firewalled, networked

Operating System Definitions

- OS is a **resource allocator**
  - Manages all resources
  - Decides between conflicting requests for efficient and fair resource use
- OS is a **control program**
  - Controls execution of programs to prevent errors and improper use of the computer
- "The one program running at all times on the computer" is the **kernel.**
  - Everything else is either a system program (ships with the operating system) or an application program

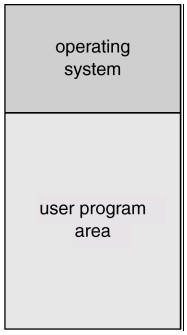
Mainframe Systems

- Reduce setup time by batching similar jobs
- Automatic job sequencing – automatically transfers control from one job to another. First rudimentary operating system.
- Resident monitor
  - initial control in monitor
  - control transfers to job
  - when job completes control transfers pack to monitor

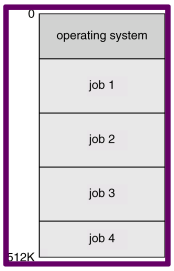
Computer Startup

- **bootstrap program** is loaded at power-up or reboot
- Typically stored in ROM or EPROM, generally known as firmware
- Initializes all aspects of system
- Loads operating system kernel and starts execution

Memory Layout for a Simple Batch System



Multiprogrammed Batch Systems



Desktop Systems

- *Personal computers* – computer system dedicated to a single user.
- I/O devices – keyboards, mice, display screens, small printers.
- User convenience and responsiveness.
- Can adopt technology developed for larger operating system' often individuals have sole use of computer and do not need advanced CPU utilization of protection features.
- May run several different types of operating systems (Windows, MacOS, UNIX, Linux)

OS Features Needed for Multiprogramming

- I/O routine supplied by the system.
- Memory management – the system must allocate the memory to several jobs.
- CPU scheduling – the system must choose among several jobs ready to run.
- Allocation of devices.

Parallel Systems

- Multiprocessor systems with more than one CPU in close communication.
- *Tightly coupled system* – processors share memory and a clock; communication usually takes place through the shared memory.
- Advantages of parallel system:
  - Increased *throughput*
  - Economical
  - Increased reliability
    - graceful degradation
    - fail-soft systems

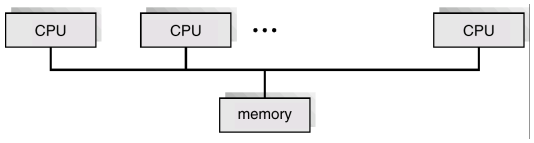
Time-Sharing Systems–Interactive Computing

- The CPU is multiplexed among several jobs that are kept in memory and on disk (the CPU is allocated to a job only if the job is in memory).
- A job swapped in and out of memory to the disk.
- On-line communication between the user and the system is provided; when the operating system finishes the execution of one command, it seeks the next "control statement" from the user's keyboard.
- On-line system must be available for users to access data and code.

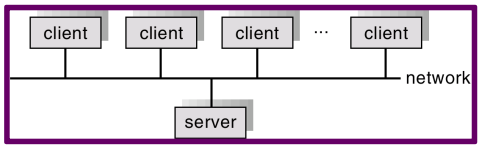
Parallel Systems (Cont.)

- *Symmetric multiprocessing (SMP)*
  - Each processor runs an identical copy of the operating system.
  - Many processes can run at once without performance deterioration.
  - Most modern operating systems support SMP
- *Asymmetric multiprocessing*
  - Each processor is assigned a specific task; master processor schedules and allocates work to slave processors.
  - More common in extremely large systems

Symmetric Multiprocessing Architecture



General Structure of Client/Server



Distributed Systems

- Distribute the computation among several physical processors.
- *Loosely coupled system* – each processor has its own local memory; processors communicate with one another through various communications lines, such as high-speed buses or telephone lines.
- Advantages of distributed systems.
  - Resources Sharing
  - Computation speed up – load sharing
  - Reliability
  - Communications

Clustered Systems

- Clustering allows two or more systems to share storage.
- Provides high reliability.
- *Asymmetric clustering*: one server runs the application while other servers standby.
- *Symmetric clustering*: all N hosts are running the application.

Distributed Systems (Cont.)

- Network Operating System
  - provides file sharing
  - provides communication scheme
  - runs independently from other computers on the network
- Distributed Operating System
  - less autonomy between computers
  - gives the impression there is a single operating system controlling the network.

Real-Time Systems

- Often used as a control device in a dedicated application such as controlling scientific experiments, medical imaging systems, industrial control systems, and some display systems.
- Well-defined fixed-time constraints.

Real-Time Systems

- *Hard real-time system*.
  - Secondary storage limited or absent, data stored in short-term memory, or read-only memory (ROM)
  - Conflicts with time-sharing systems, not supported by general-purpose operating systems.
- *Soft real-time system*
  - Limited utility in industrial control or robotics
  - Useful in applications (multimedia, virtual reality) requiring advanced operating-system features.

Computing Environments

- Traditional computing
- Web-Based Computing
- Embedded Computing
- Mobile Computing

Handheld Systems

- Tablets
- Cellular telephones
- Issues:
  - Limited memory
  - Slow processors
  - Small display screens.
  - Battery powered

Migration of Operating-System Concepts and Features