Computer Science 305
Operating Systems

- ◆ Course Requirements
- ◆ To Do Now
- ◆ Review Introductory Material (Chap 1-3)
- ◆ SLIDES: Prof. John Hine

Course Requirements

- ◆ http://www.mcs.vuw.ac.nz/courses/COMP305
- ◆ Staff
- ◆ Objectives
- ◆ Textbook
- ◆ Assessment
- ◆ Laboratories

Comp 305 Staff

- ◆ Organiser
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- ◆ Hours tba

Objectives

- ◆ Knowledge of Operating System Algorithms
  - – Concurrency and Synchronization
  - – Resource Management
  - – Process Structures
  - – Information Storage
- ◆ Practical Experience
  - – In depth experience
  - – Implementation Problems

Textbook

- ◆ A. Silberschatz and P. Galvin Operating System Concepts **5th edition**, Addison-Wesley, 1997.
- ◆ 4th edition acceptable See lecture schedule

Assessment

- ◆ 35% Three laboratory exercises
  - – Thread Synchronisation (30 March, 10%)
  - – System Calls & User Programs (6 May, 10%)
  - – File System (27 May, 15%)
- ◆ 20% Occasional problem sets
- ◆ 45% Examination

Laboratory Exercises

- Team works - compulsory
- Groups of 2 or 3
- 4 slip days
- Nachos
- More details in first tutorial

To Do Now

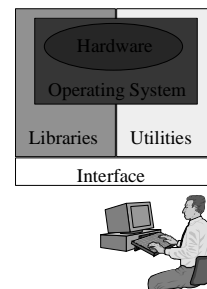- User Code Form
- Read the Web pages
- Create teams and notify C.C.

What Is an Operating System?

- Authors:
  "resource allocator" or "control program"
- Dietel:
  "programs that make the hardware usable"
- Goal:
  "convenience for the user"
- What is usable? What is convenient?

OS Architecture

- Most users see total package: Windows, MacOS8
- Tighter integration in modern systems.

OS Goals

- Efficient Use of Resources
  – Avoid bottlenecks that affect performance.
  – Keep all components as busy as possible.
- Convenience and Productivity for Users
  – The user costs more than the machine.
  – Deliver function as efficiently as possible.
- Availability and Reliability
  – Computer systems are critical.
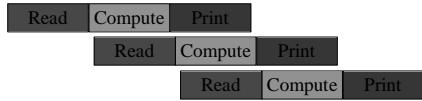 – A failed system can mean a failed company.

Evolution of Operating Systems

- Program Libraries
- Single Batch Systems

Evolution of Operating Systems

◆ Program Libraries
◆ Single Batch Systems with spooling

Read	Compute	Print
Read	Compute	Print
Read	Compute	Print

Evolution of Operating Systems

◆ Program Libraries
◆ Single Batch Systems with spooling
◆ Multiprogrammed Batch Systems

Evolution of Operating Systems

◆ Program Libraries
◆ Single Batch Systems with spooling
◆ Multiprogrammed Batch Systems
◆ Timesharing Systems

Evolution of Operating Systems

◆ Program Libraries
◆ Single Batch Systems with spooling
◆ Multiprogrammed Batch Systems
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◆ Interactive Systems

Evolution of Operating Systems

◆ Program Libraries
◆ Single Batch Systems with spooling
◆ Multiprogrammed Batch Systems
◆ Timesharing Systems
◆ Interactive Systems
◆ Personal Computer Systems

Distributed Operating Systems

◆ "The system is the network."

System Components

- ◆ Process and Thread Management
- ◆ Main Memory Management
- ◆ Secondary Storage Management
- ◆ I/O System Management
- ◆ File System Management
- ◆ Protection and Security
- ◆ Networking
- ◆ User Services

Process and Thread Management

- ◆ A thread executes
- ◆ A process consists of
  - memory, open files, threads
  - state(s) (program counter, registers, etc.)
- ◆ General functions are:
  - Create/delete processes/threads
  - Suspend/resume thread
  - Support synchronisation and ipc
  - Allocate resources

Main Memory Management

- ◆ Problems vary with system and hardware support
- ◆ Delay binding of addresses as long as possible
- ◆ Manage memory - in use, free, clean/dirty
  - Allocate memory to processes

Secondary Storage Management

- ◆ Manage disk storage
  - Storing and retrieving files
  - Free/in use space
  - Scheduling

I/O System Management

- ◆ Hide device peculiarities
- ◆ Components
  - Memory management for buffering, caching and spooling
  - General device driver interface (abstraction)
  - Specific drivers

File System Management

- ◆ Key user interface
  - Create/delete files/directories
  - Manipulate file/directory attributes
  - Mapping to storage
  - Backup and archiving
- ◆ A minimal set of operations -
  - create, delete, open, close
  - read, write, seek
  - get or set attributes

Protection and Security

- ◆ Integrated with other components
- ◆ Own functions
  - – Authentication
  - – Protection
- ◆ Network functions increasingly important

Networking

- ◆ Increasingly a part of the system
- ◆ Four different types of systems:
  - – Stand alone
  - – Multi-processor -- shared clock, UMA
  - – Networked -- no shared clock, NUMA
  - – Distributed
- ◆ Two communication models
  - – Messaging passing
  - – Shared memory.

OS Services

- ◆ User Services
  - – Program execution
  - – I/O
  - – File manipulation
  - – Communications
  - – Error detection
- ◆ Resource allocation
- ◆ Accounting
- ◆ Protection

System Structure - UNIX

USERS

shells and commands compilers and interpreters system libraries		
system call interface to kernel		
signals terminal handling character I/O system terminal drivers	file system swapping block I/O system disk and tape drivers	CPU scheduling page replacement demand paging virtual memory
kernel interface to the kernal		
terminal controllers terminals	device controllers disks and tapes	memory controllers physical memory