COMPSCI 340 and SOFTENG 370 Operating Systems

Lecturer

Robert Sheehan (r.sheehan@auckland.ac.nz)

Rm 303.488

office hours – Tuesday 10am
Thursday 11am

Textbook

Operating System Concepts (9th edition) – Silberschatz, Galvin and Gagne. The ebook version from au.wiley.com is $55.00AUD.
http://au.wiley.com/WileyCDA/WileyTitle/productCd-EHEP002013.html

Test (10%)

Tuesday 23rd August, during the lecture time

Exam (70%)

TBA

Three Assignments (20%)

You have to pass the assignments and exams separately, and get an overall pass.

Assignment pass grade >25%.

Tutorials

Wednesday 10am 201N-346 (HSB)

Some of the lecture sessions may be tutorials as well.

Start 27th of July

Not compulsory

Sample topic:

Setting up VMWare player and installing Ubuntu – use multiple cores
Install dev packages

What is an Operating System?

https://www.youtube.com/watch?v=V5S8kFvXpo4

Examples

MacOS X
Windows
Linux
UNIX
Plan9
Amoeba
OpenVMS (Virtual Memory System)
VM/CMS (Conversational Monitor System)
z/OS (IBM)
Symbian
Android
iOS

The software which makes the computer usable.

It is *impossible* to use modern machines without an OS.

The collection of software sold (or freely available) as an OS.

Are these things part of the OS?

file system
communication system
process manager
security manager
memory manager
graphical user interface
backup system
web browser
media player
compiler
Java (or .Net) environment

Extreme approaches

Minimalist understanding

OS software is the minimum amount of software required to allow the computer to function.

kernel – usually in memory always

process/thread management

communications

memory management

file management

monolithic and micro-kernels.

Maximalist understanding

All the software which comes with a standard release of the OS.

many utilities and programs

Usable vs Efficient

Some OSs are designed for specific needs

factory control systems

aircraft control

database servers

phones

Others are general purpose

desktop computers

phones

A trade off between usability and efficiency.

Usable – for whom?

the developer of the system

a software engineer or computer scientist

a data entry operator

a child

a person with a disability

an “ordinary” user

Efficient

real-time systems

dealing with many thousands of transactions a second

battery life

OS Themes

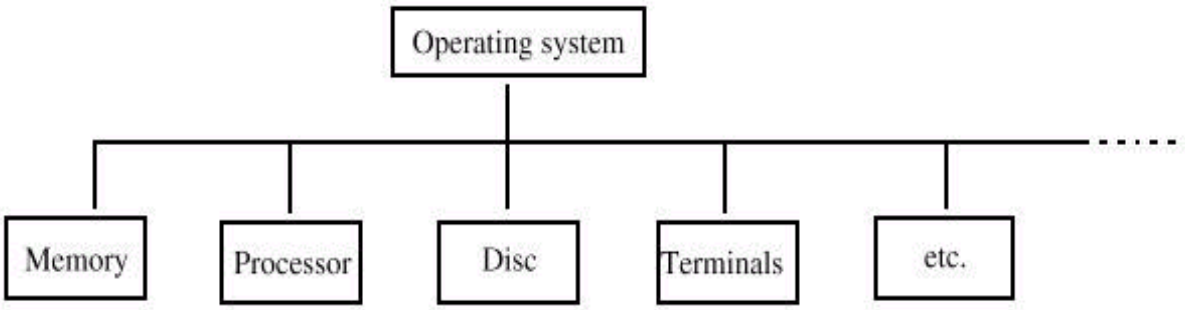
Manager model

The OS is a collection of managers.

It prevents improper use of devices.

Each manager is independent

and maintains tables of information

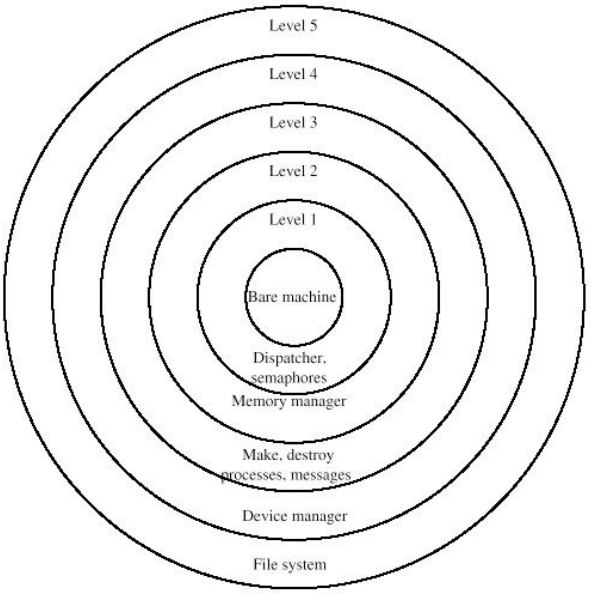


Onion model

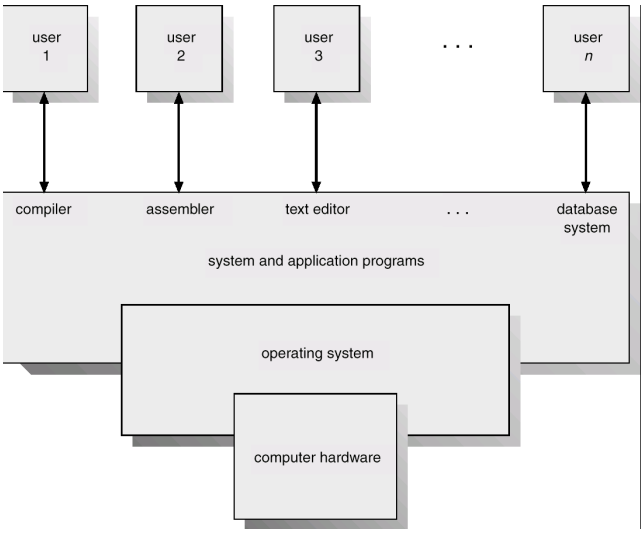
The OS is a series of layers.

Outer layers can access resources contained in inner layers.

But not vice-versa.



OS Themes (cont.)



Resource allocator model

Related to the manager model.

The emphasis is on providing the services programs need.

Must be fair. (Whatever that means.)

Dustbin model

This sees the OS as all the bits no one else wants to do.

Getting work done model

We only use computers to do something else:

write an essay

calculate a mortgage repayment

find information

download a song

play a game

make a phone call

The OS has to help us to get our work done.

Things I expect you to know.

You should have some idea of

- interrupts
- security & protection
- file systems
- virtual memory
- processes and threads

The first assignment will require Python programming. You need to get comfortable with Python.

Things you should know by the end.

You should be able to discuss questions like these intelligently by the end of the course.

How does typing a key cause a character to appear in a window on the display?

How does your computer safely keep several applications running at once?

How do remote files look as though they are local?

How does processing get distributed over multiple cores?

How does the failure of a computing resource get handled to minimize the disruption to the wider system?

What happens when you plug a new USB device into your computer?

OS DESIGN

All in one – all OS components can freely interact with each other.

MS-DOS

Early UNIX

Separate layers – see the Onion model.

This simplifies verification and debugging.

Very hard to get the design correct.

Can be inefficient – lots of layers to go through to get work done.

THE

OS/2

Modules – like the all-in-one but only loaded when necessary

Linux, Windows

Microkernels

Use client/server model.

Many modern general-purpose OSs use this approach (although that doesn't mean they are microkernel OSs)

Mach (basis for MacOS X)

QNX RT-OS

Exokernels - more radical microkernels

Virtual Machines

VM/CMS

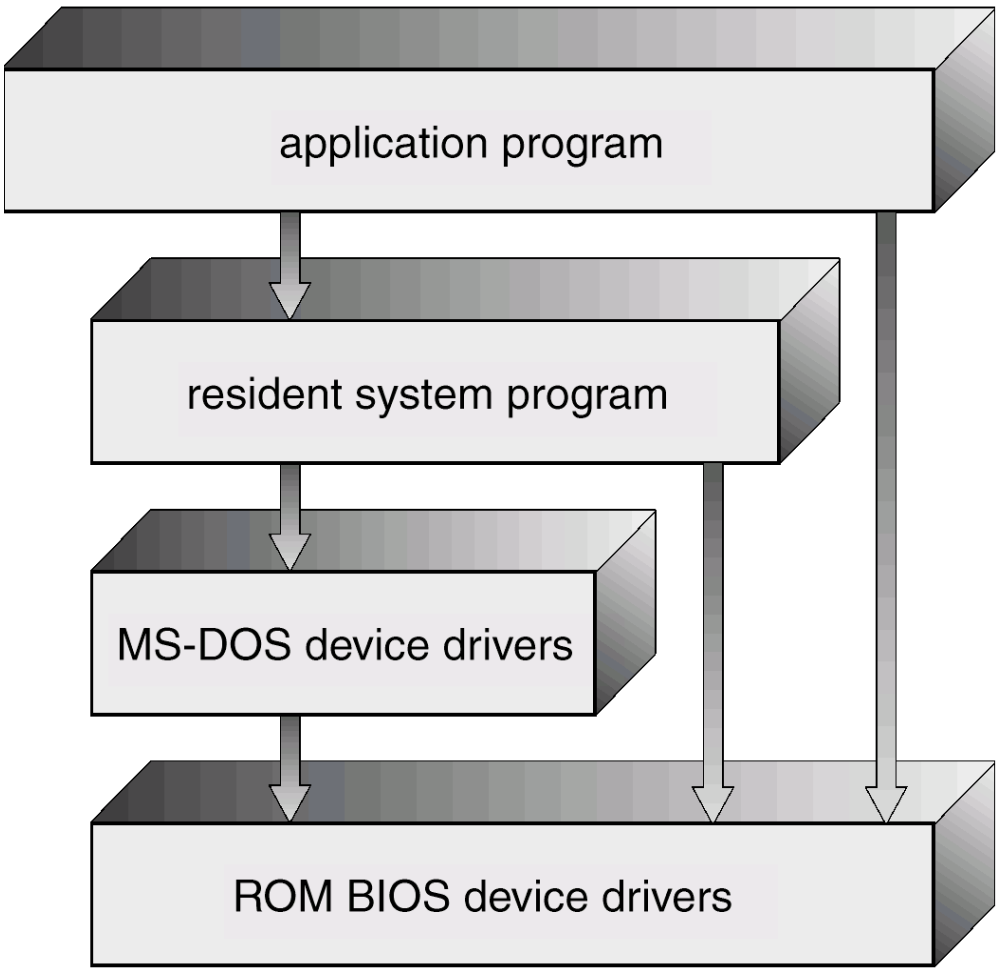
Java

MS-DOS

Written to provide the most functionality in the least space

not divided into modules

Although MS-DOS has some structure, its interfaces and levels of functionality are not well separated



Early UNIX

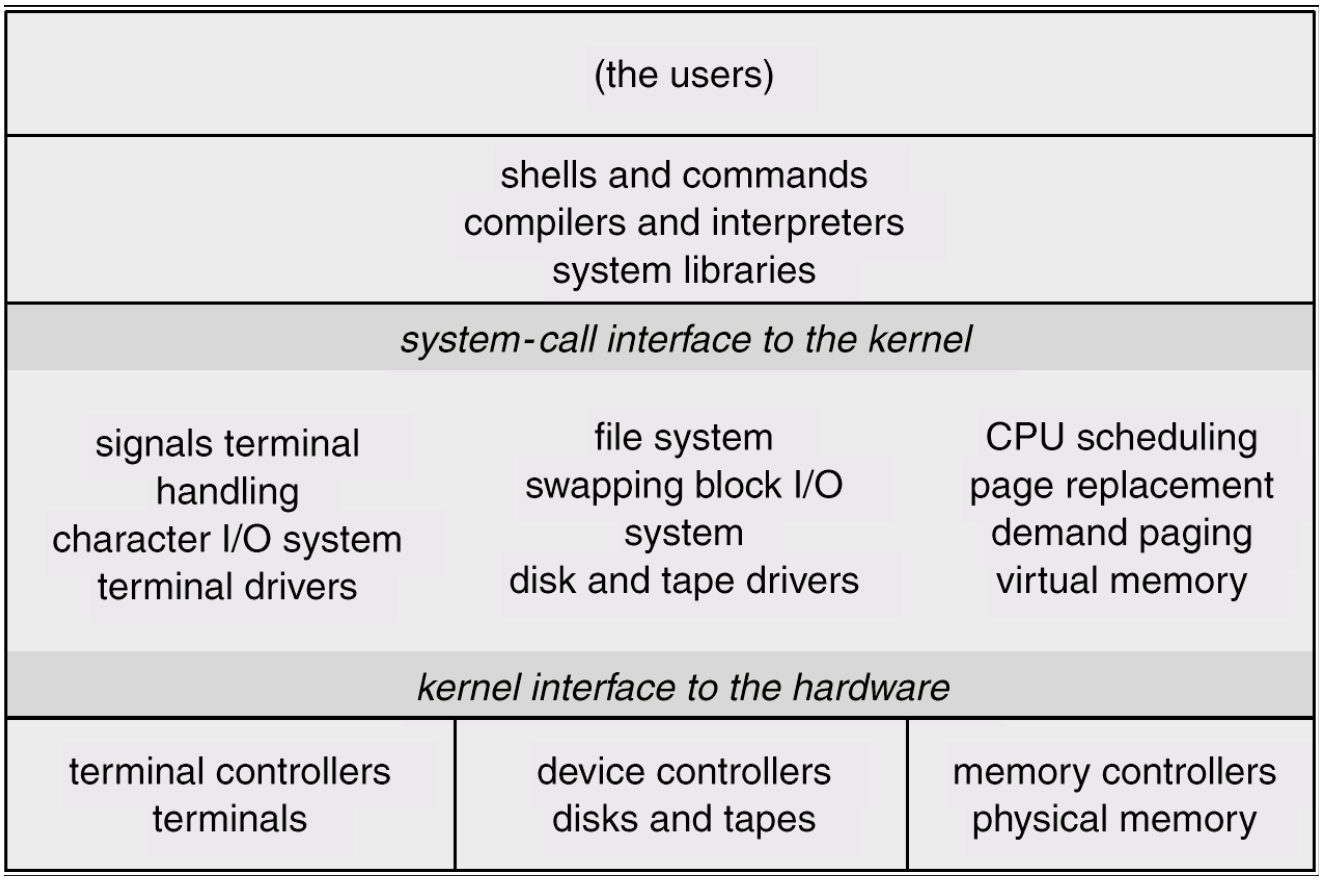
The UNIX OS consists of two separable parts.

Systems programs

The kernel

Consists of everything below the system-call interface and above the physical hardware

Provides the file system, CPU scheduling, memory management, and other operating-system functions; a large number of functions for one level.



THE Multiprogramming system

A layered design was first used in the THE operating system.
Its six layers were:

layer 5:	user programs
layer 4:	buffering for input and output
layer 3:	operator-console device driver
layer 2:	memory management
layer 1:	CPU scheduling
layer 0:	hardware

Windows NT client/server

Windows NT provided environmental subsystems to run code written to different OS APIs.

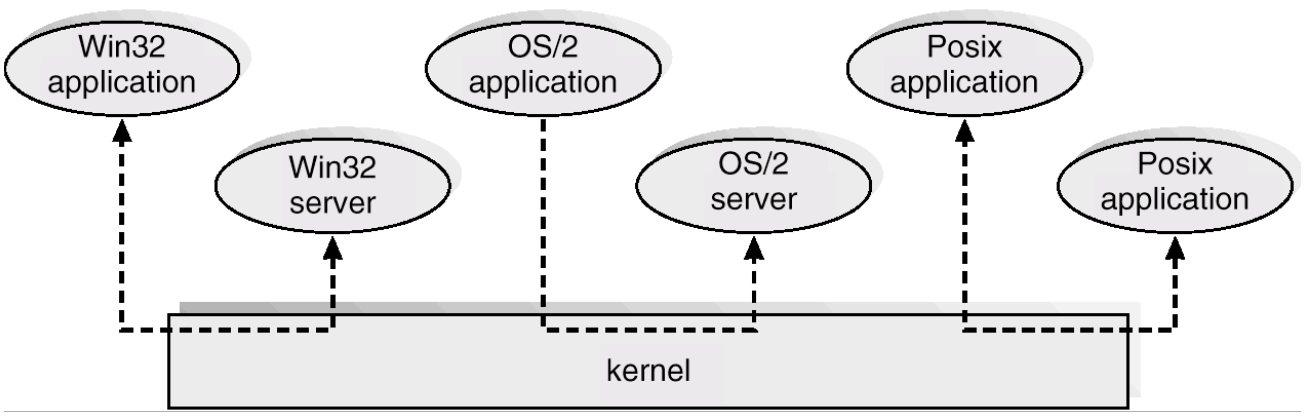
Windows NT (and successors) is a hybrid system.

Parts are layered but some of the layers have been merged to improve performance.

Many OS services are provided by user-level servers

e.g. the environmental subsystems.

The POSIX subsystem is now called Interix and includes open source programs and libraries (not after Windows 8)



Before the next lecture

Read textbook

What Operating Systems Do 1.1

Operating System Structure 2.7

Linux 18.1, 18.2

Windows 7 19.1, 19.2

Preparation for next time

1.2 Computer-System Organization

1.4 Operating-System Structure

1.5 Operating-System Operations