

# Windows

CS 256/456

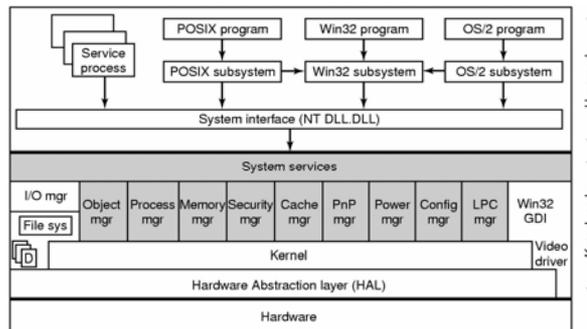
Dept. of Computer Science, University of Rochester

# Windows

Year	AT&T	BSD	MINIX	Linux	Solaris	Win NT
1976	V6 9K					
1979	V7 21K					
1980		4.1 38K				
1982	Sys III 58K					
1984		4.2 98K				
1986		4.3 179K				
1987	SVR3 92K		1.0 13K			
1989	SVR4 280K					
1991				0.01 10K		
1993		Free 1.0 235K			5.3 850K	3.1 6M
1994		4.4 Lite 743K		1.0 165K		3.5 10M
1996				2.0 470K		4.0 16M
1997			2.0 62K		5.6 1.4M	
1999				2.2 1M		
2000		Free 4.0 1.4M			5.8 2.0M	2000 29M

Operating system history and code sizes

# The Structure of Windows 2000

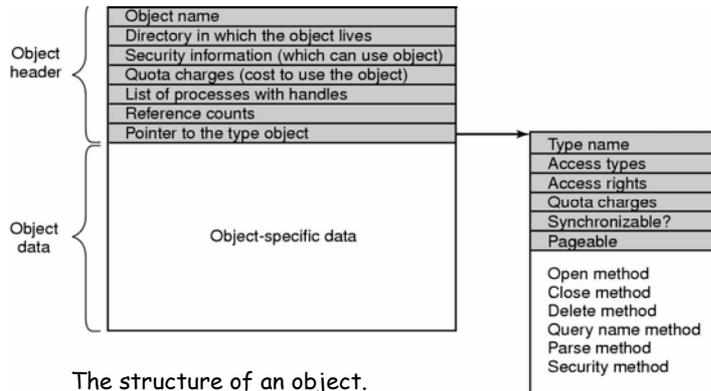


- Shaded area is the executive
- Boxes, D, are device drivers
- Service processes are user-level system daemons

# Main Components of the OS

- Here OS we mean the part of system running in the privileged mode
  - device register addressing/access, interrupt, DMA, timers, spin locks, ... ..
- Hardware abstraction layer (hardware-dependent stuff)
  - more machine-dependent stuff at a higher-level than HAL (such as context switches)
  - some basic system functionalities such as scheduling
- The kernel (in Windows 2000 jargon)
  - process management, memory management, file system, ... ..
- The executive (completely hardware-independent)

## Objects Inside the OS

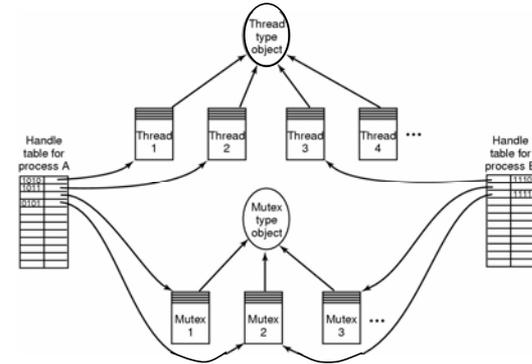


4/18/2007

CSC 256/456 - Spring 2007

5

## Objects & Handles



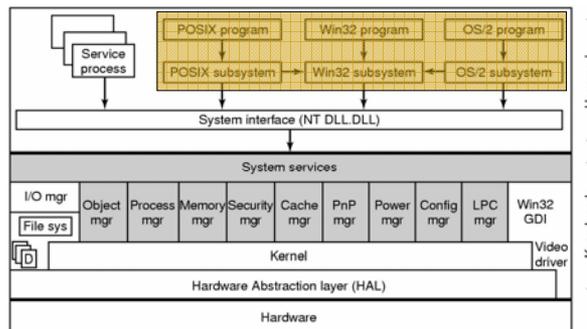
- Handles allow user programs to refer to kernel objectives
  - like file descriptors in UNIX.

4/18/2007

CSC 256/456 - Spring 2007

6

## Environment Subsystems



4/18/2007

CSC 256/456 - Spring 2007

7

## Processes and Threads

Name	Description
Job	Collection of processes that share quotas and limits
Process	Container for holding resources
Thread	Entity scheduled by the kernel
Fiber	Lightweight thread managed entirely in user space

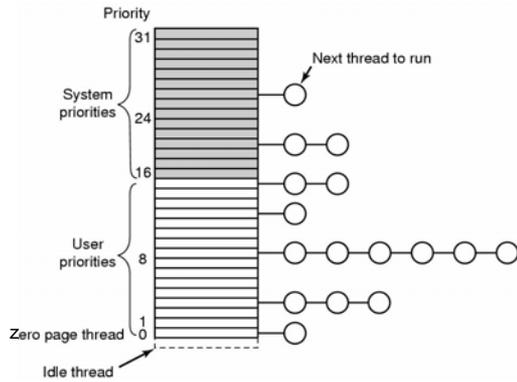
Basic concepts used for CPU and resource management

4/18/2007

CSC 256/456 - Spring 2007

8

## Scheduling



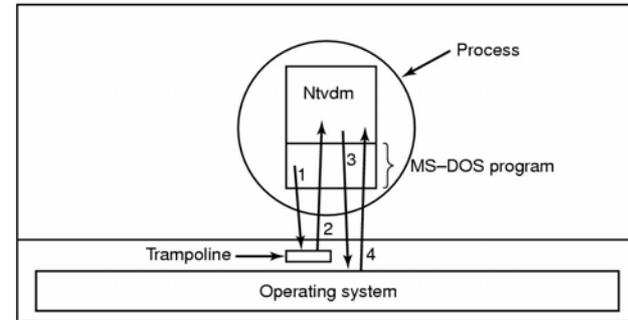
thread priorities are boosted after returning from blocking I/O or synchronization

4/18/2007

CSC 256/456 - Spring 2007

9

## MS-DOS Emulation



How old MS-DOS programs are run under Windows 2000?

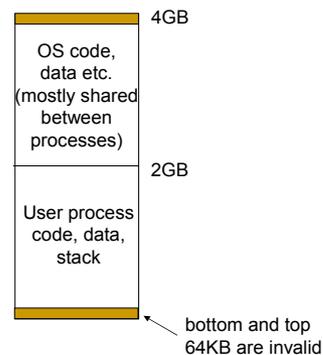
4/18/2007

CSC 256/456 - Spring 2007

10

## Virtual Memory Layout

- Virtual address space for a process
  - a small piece of memory at top/bottom is invalid
  - user process and OS code reside in a single virtual address space



4/18/2007

CSC 256/456 - Spring 2007

11

## Memory Page Replacement

- A "working set"-based page replacement algorithm.
  - Every process has a memory page working set size, adjustable according to its page fault behavior
- Space reclamation (focus on processes who have more pages than their working set sizes):
  - The system scans through memory pages periodically
  - Maintain an un-reference counter for each page
    - the number of scans that show it un-referenced since last time it was referenced
  - Reclaim pages with highest un-reference counts

4/18/2007

CSC 256/456 - Spring 2007

12

## File System

- The fundamental structure of the 2000 file system (NTFS) is a *volume*.
  - Like a logical disk partition.
  - May occupy a portions of a disk, an entire disk, or span across several disks.
- NTFS uses *clusters* as the unit of disk allocation.
  - The cluster size is a tradeoff between management overhead and internal fragmentation.
- A file in NTFS is not a simple byte stream, as in UNIX, rather, it is a structured object consisting of *attributes/value* pairs.
- Journaling FS

## Windows Registry

- Windows registry is where many system configuration information is stored
  - quite complex ⇒ nightmare to configure correctly
- Discovering configuration errors in Windows registry
  - peer pressure [Wang et al. OSDI2004]

## Disclaimer

- Parts of the lecture slides contain original work of Andrew S. Tanenbaum, Abraham Silberschatz, Peter B. Galvin, and Greg Gagne. The slides are intended for the sole purpose of instruction of operating systems at the University of Rochester. All copyrighted materials belong to their original owner(s).