

# Operating Systems

## Lesson 3

### Plan

- Administration
- Multitasking
  - Single task
  - Cooperative multitasking
  - Preemptive multitasking
- Windows
  - Processes
  - Memory management teaser
- Beeper Sample
- Q&A on Assignment #1

### Multitasking: Single-task system

- DOS
- Running program gets full control over computer resources
- Next program(task) couldn't start before previous ended
- Not efficient (CPU is idle while program is printing or waits for keyboard input)

### Cooperative Multitasking

- Windows 3.11
- Program may voluntarily give up CPU time for other programs(e.g. waiting for printing job to finish)
- User may select/activate program to run (pause editor and look into spreadsheet)
- How a program know when to yield CPU to other program and when (if ever) will get it back?

### Multitasking: Some Requirements

- Programmer shouldn't write a program aware of other programs.
- In order to switch between programs (tasks) one should be able to freeze the state of the paused program (e.g. current instruction, register and memory state) and resume its afterwards
- Task shouldn't have access to private memory of other tasks

### Windows: Preemptive multitasking

- OS decides when to run each task and for how long
- Each task gets fair share of CPU time according to task priority
- Windows manages each task states and guard its private memory and manage shared resources (disk)
- Task may enter "waitable/blocking state" (e.g. wait for other task to complete) so OS won't allocate any CPU time at all

## Windows: Task==Process

- A Windows object (has a handle)
- An instance of a program running on a computer
- Two opened notepads are two processes
- Several Internet Explorer windows may be supported by single process

## Process properties

- Identifier
  - 0x0034FE12
- State
  - Running, waiting etc
- Priority
  - Low, high
- Program counter
  - Address in memory of next instruction to execute
- Memory pointers
  - Location of process memory in RAM
- Context data
  - Registers
- Accounting information
  - CPU time used till now

## Memory Management

- How does a programmer know how much free memory is available for his program?
- He shouldn't care. The OS provides virtual memory management for all processes.
- Details: Next class