31268 Web Systems

Faculty of Information Technology

Week 6

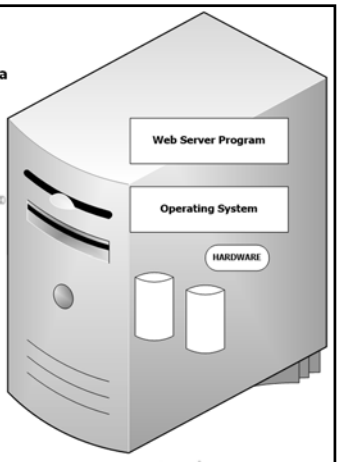
Week 6: Operating Systems 3
Part 2 – Resource Management

1

Recap: The web...

A bunch of computers and a network of networks...

... and a whacking **big** computer running the web site program on an operating system running on HARDWARE



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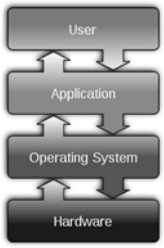
Recap: Operating System

- Manages your computer
- Runs programs
- Interface between user and hardware
- Provides services to programs & users
- Protects users and programs from each other….



- **Today we will look at how O/S provides resources to running processes**

wikipedia

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Operating Systems - Outline

- *Operating Systems*
- *file systems and file manipulation*
  - *Disk physical structure*
  - *Disk logical structures*
  - *File allocation methods*
  - *Unix: files, directories and redirection*
- *Scripting and regular expressions*
  - *Unix and the Command-Line interface*
  - *Variables and bash scripts*
- **processes, threads, piping and redirection**
  - Programs vs processes, IPC, deadlocks
- memory and process management
  - Physical, Logical & Virtual memory

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Process Management

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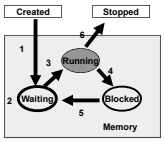
- Recall
  - Processes are programs in execution.
  - Operating System loads program into MEMORY to execute
  - Processes run in 4 main states
    - Waiting
    - Running
    - Blocked
    - Stopped



- Operating System will manage resource usage of processes
- Processes are Blocked when waiting for resources

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Resource Management

- Resources are things that processes might need to run
  - E.g. files, network, human interface devices (mice, keyboard, display …)
- The kernel manages all other system resources
  - E.g. interrupts, I/O, system devices
- Many resources require mutually exclusive access
  - → i.e. if one process is using the resource, no other process can use it until the first process is done
  - Results in "resource contention"

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Two-way IPC and Resource Contention

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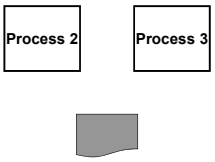
- Resource Contention:
  - 2 processes want to alter the same resource at the same time
- Types of Resources:
  - Memory, Files, Hardware.



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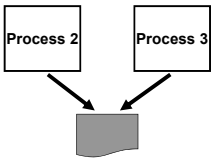

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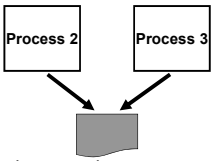

- Solutions to this "DeadLock":
  - Semaphores - a flag held by the process changing the memory
  - Lock files - a file is not readable/writeable while data is being written to it.

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What is a Deadlock?

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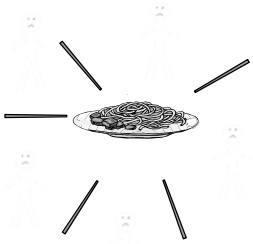
"Dining Philosphers problem"
- A number of philosophers are sitting around a table eating noodles.



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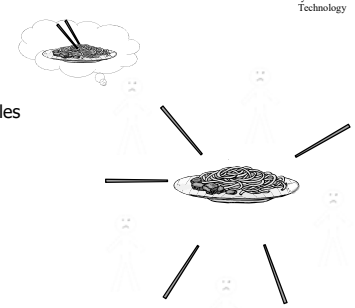

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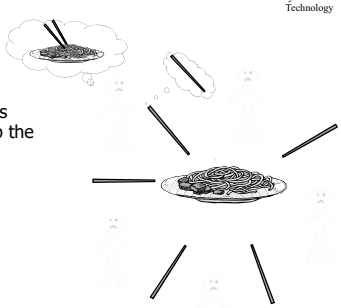

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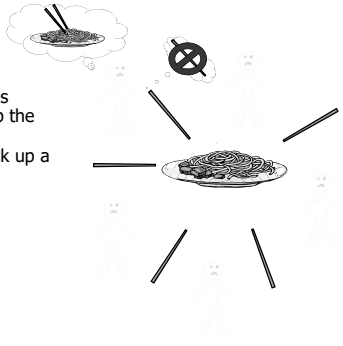

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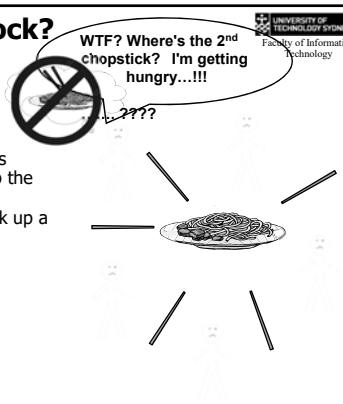

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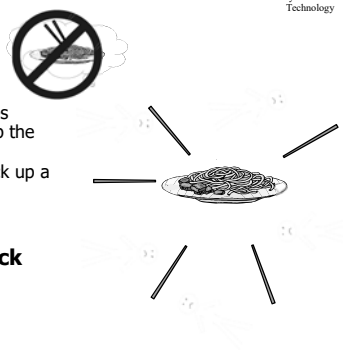
This is a classical deadlock situation.



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What is deadlock ?

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- Processes compete for a limited number of resources.
- Sometimes a process has to wait for some resource which is held by another process
- If that resource will never get released for one or another reason, this situation is called **Deadlock**

E.g. 2 users try to edit the same file at the same time!!!

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What causes Deadlock ?

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Deadlock can occur if all of the following conditions hold simultaneously:

1. **Mutual exclusion:** there exists a resource, that can be accessed by only one process at a time
2. **Hold and wait:** there exists a process, that holds at least one resource and is waiting for another resource

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Dealing with Deadlocks

- **1. Avoidance/Prevention:** O/S decides which processes may use resources, and when.
- **2. Detection/Management:** Allows deadlocks to form; then finds and breaks them.

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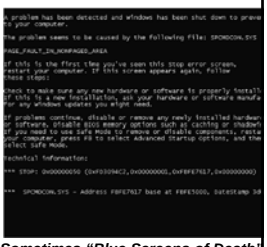
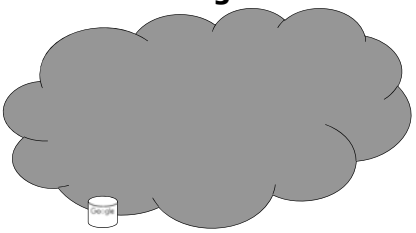


Sometimes "Blue Screens of Death" are because of deadlock issues

Process management & The Web



- **Google scale computing**
- Estimated to have 1million ++ computers
  - –But running as if 1 system ➔ "googleplex"
  - –Run's Linux as a CLUSTER of computers
  - – *Process scheduling needs network information!*

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Process Management and the web

- ➔ convergence of operating system, "distributed computing", networking and web design
- ➔ new technologies:
  - –"cloud computing"
  - –"software defined networking"
- Question:
  - –What about Internet of Things?
    - *How to write operating systems to deal with trillions of devices, processes, resources etc??*

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Summary

- We learnt about resources and how they can cause deadlocks & how to resolve it

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