CPSC 457
Operating Systems

Lecture 8

Memory Management: Virtual Memory

Last Time

Memory Management
- Address Space
- Base and Limit Registers
- How do we store processes
- Swapping
- Free Memory Management

Midterm Review

This Time

Midterm

Virtual Memory
- Fragmentation
- Paging
- Page Tables
- Translation Look-aside Buffers
- Page Faults
- Locality

Memory Fragmentation

External

Internal

Virtual Memory

Paging

Frame

- Fixed-Sized block of Physical Memory

Page

- Fixed-Sized block of Logical Memory

Page Table

- Maps the Pages on to the Frames

Page Address

Page Number

Page Offset

Paging can be EXPENSIVE

Translation Look-aside Buffer

Associative High Speed Memory
high speed lookup cache

Big Page Tables

Hierarchical Page Tables

- Lookups for the page table

Hashed / Clustered Paging

- Hash Table entries, possibly gather related pages

Inverted Page Table

- Track all frames and which pages are assigned to them

Virtual Memory

How to Implement Virtual Memory

Demand Paging

- Load pages into memory only when you need them

Page Fault

- When you access memory and discover no page

Next Time

Memory Management

- Page Replacement Algorithms

Concurrency

- How to manage the problems when processes run at the same time
- Classical problems of Computer Science