第33讲 虚拟存储管理技术概述

§3.3 Virtual Memory

Learning Objectives(3.3-3.4)

By the end of this lecture you should be able to:

- **Understand *Virtual Memory Management Techniques***
  - **Virtual-Memory Paging, Virtual-Memory Segmentation.**
  - **Principle of Locality （局部性原理）, Virtual Memory, Thrashing （抖动）.**

Learning Objectives(3.3-3.4)（continue)

By the end of this lecture you should be able to:

- Understand *虚拟存储管理技术中的软件策略*

  - Demand Paging （请求调页） /Prepaging （预调页） .

  - Basic Replacement Algorithms: Optimal Algorithm, Least Recently Used Algorithm, First-in First-out Algorithm, Clock Algorithm.

Simple Memory Management Techniques

当进程运行时，该进程相关的程序和数据全部驻留内存

Hardware and Control Structures

- Memory references are dynamically translated into physical addresses at run time.
  - A process may be swapped in and out of main memory such that it occupies different regions.
- A process may be broken up into pieces that do not need to located contiguously in main memory.
  - All pieces of a process do not need to be loaded in main memory during execution.

Principle of Locality (局部性原理)

- Program and data references within a process tend to cluster （簇） .
- Only a few pieces of a process will be needed over a short period of time.
- Possible to make intelligent guesses about which pieces will be needed in the future.
- This suggests that virtual memory may work efficiently.

Execution of a Program

- Operating system brings into main memory a few pieces of the program.
- Resident set(驻留集) - portion of process that is in main memory.
- An interrupt is generated when an address is needed that is not in main memory.
- Operating system places the process in a blocked state.

Execution of a Program

- **Piece of process that contains the logical address is brought into main memory.**
  - **Operating system issues a disk I/O Read request.**
  - **Another process is dispatched to run while the disk I/O takes place.**
  - **An interrupt is issued when disk I/O complete which causes the operating system to place the affected process in the Ready state.**

Advantages of Breaking up a Process

- ***More processes*** **may be maintained in main memory.**
  - **Only load in some of the pieces of each process.**
  - **With so many processes in main memory, it is very likely a process will be in the Ready state at any particular time.**
- **A process may be *larger* than all of main memory.**

Types of Memory

- **Real memory**
  - Main memory
- **Virtual memory**
  - Memory on disk
  - Allows for effective multiprogramming and relieves the user of tight constraints of main memory.

Virtual Memory

- 使用虚拟存储管理技术，用户将会感觉到系统的内存空间比实际内存大。
- 系统的可用内存空间并非计算机系统中的实际物理内存，它包含物理内存及一部分磁盘空间。
- 习惯上，人们把这种用户感觉上存在但实际上并不存在的内存称为***虚拟内存***。

Thrashing（抖动）

- Swapping out a piece of a process just before that piece is needed.

- The processor spends most of its time swapping pieces rather than executing user instructions.

Support Needed for Virtual Memory

- Hardware must support paging and segmentation .
- Operating system must be able to management the movement of pages and/or segments between secondary memory and main memory.