CH1

CH2

CH3

CH4 Process Management, Thread Management

Process

process state diagram

- New
- Ready
- Running
- Waiting
- Terminal

PCB

1.Pocess state 2.Program counter 3.CPU registers 4.CPU-scheduling information 5.Memory-management information 6.Accounting information 7.I/O status information (8.Process ID)

scheduling criteria

- CPU utilization
- Throughput
- Turnaround time
- Waiting time
- Response time

CPU Scheduling Algorithm

- **FCFS**
- SJF
  - Non-preemptive SJF->**SJF**
  - Preemptive SJF->**SRJF**
- **RR**
- **priority**
  - aging
- **multilevel queues**
- **multilevel feedback queues**

Multiple-Processor scheduling

- ASMP(沒什麼好設計的)
- SMP
  - load balancing
    - push migration
    - pull migration
  - processor affinity
    - soft affinity
    - hard affinity

Real-Time system scheduling

若有Priority Inversion,用Priorify Inheritance解決

- Hard real-time(preemptive kernel)
  - Rate-Monotonic scheduling
  - EDF scheduling
- Soft real-time(preemptive kernel)
  - 不提供aging

Threads

- private

  - program counter
  - CPU registers set
  - stack
  - local variables
  - thread ID

- shared

  - code section
  - data section(global data)
  - heap
  - static local variables
  - other OS resources(open files, signals, I/O resources,etc.)

- Benefits

  - **responsiveness**
  - **resource sharing**
  - **economy**
  - **scalability**(utilization of multiprocessors architecture)

- Thread management

  - user thread
    - provide a library entirely in user space with no kernel support
    - implement a kernel-level library supported directly by the OS
  - kernel thread

- multithreading models

    - Many-to-One model
    - One-to-One model
    - Many-to-Many model

- 2 strategies of creating multiple threads

    - Asynchronous threading(父,兒之thread concurrently execute)
    - Synchronous threading(父thread要等兒thread做完)

- Pthreads library

    - Pthreads is a specification
    - Run on UNIX
    - Can't run on windows os

CH5 Deadlock Management

CH6

CH7 Main Memory

Binding Time

- compile time
- loading time
- execution time

Memory Management methods in OS

- **Contiguous Memory Allocation**
    - external fragmetation
        - First Fit
        - Best Fit
        - Worst Fit
- **Page**
    - internal fragmentation
    - page table
        - hierarchical paging
        - hashed page table
        - inverted page table
- **Segment**
    - external fragmentation
    - Base and Limit
- Paged Segment

CH8 Virtual Memory

- 實現Virtual Memory 技術: Demand Paging -pure demand paging -prepaging

Page Replacement Algorithm(沒有最差，只有最佳)

- **FIFO**(belady's anomaly)

- **OPT**(stack property)

- **LRU**(stack property)

- LRU-approximation(stack property)

    - **Additional regerence bits usage**
    - **Second cance**
    - **Enhanced second chance**

- **LFU**(belady's anomaly)

- **MFU**(belady's anomaly)

- **Thrashing**

    - CPU utilization down
    - Paging I/O devices 異常忙碌
    - processes spends more time on paging I/O than normal execution
        - technique to handle Thrashing
            - **decrease multiprogramming degree**(已經thrashing)
            - **page fault frequency control**
            - **working set model**

- Allocation Kernel Memory

    - Buddy system
    - Slab allocation(has no internel,externel fragmentation)

CH9 Massive Storage System

Hard Disk

- cylinder
- tracks
- sectors(磁碟控制器控制read,write之基本單位)
- Disk Access Time
    - Seek Time
    - Rotatinal latency
    - Transfer Time

Free-Space Management

- Bit vector
- Linked List
    - Grouping
    - Counting

File Allocation Methods

- Contiguous Allocation
- Linked Allocation
    - 變形: FAT
- Indexed Allocation
    - Linked scheme
    - Multilevel index
    - Combined scheme(UNIX i-Node structure)

HDD scheduling(沒有最好與最差之法則)

- **FCFS**
- **SSTF**
- **SCAN**
    - elevator
- **C-SCAN**
- **LOOK**
    - elevator
- **C-LOOK**

RAID

- improvement of <u>reliability</u> via reduncance

    - mirror
    - parity chech

- improvement in <u>performance</u> via parallelism

    - data striping
        - bits-level
        - block-level

- RAID0(N部)

    - block-level striping

- RAID1(mirror)(N/2部)

- RAID2(ECC-Error-Correcting Code)

    - 沒有實際產品

- RAID3(ECC-Error-Correcting Code)(N+1部)

    - bit-level striping
    - parity check

- RAID4(ECC-Error-Correcting Code)(N+1部)

    - block-levle striping
    - parity check

- RAID5(ECC-Error-Correcting Code)(N+1部)

- RAID6(ECC-Error-Correcting Code)(N+2部)

- RAID1+RAID0(更好)

- RAID0+RAID1

File Directory Structure

- Tree-structured Directory
- Acyclic Graph Directory
- General Graph Directory(允許有cycle)

File Access Control

- Owner, Group, Other
- RWX(Read, Write, eXecute)
- command: `chmod 755 file`

Consistency Semantic

- UNIX semantic
    - 訂票系統
- Session semantic
    - 網站上的檔案提供下載讓user填寫
- Immutable-Shared-Files semantic
    - 總經理公告文件第3009號

NAS(Network-Attached Strage)

- File-based operation
- 會占用網路頻寬

SAN(Storage-Area Network)

- Block-based operation
- private network
- 不佔用一般網路頻寬