

Operating Systems Concept

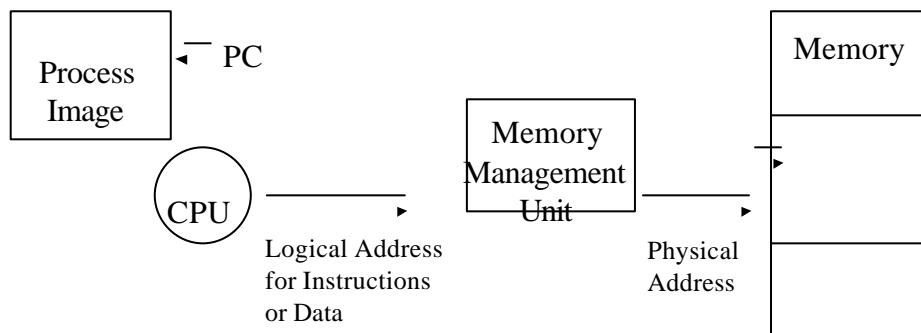
- ✍ What is an operating system?
- ✍ Operating system architecture
- ✍ Process concept
- ✍ CPU scheduling
- ✍ Memory management
- ✍ File and I/O systems



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Memory Management

- ✍ Logical address vs Physical Address

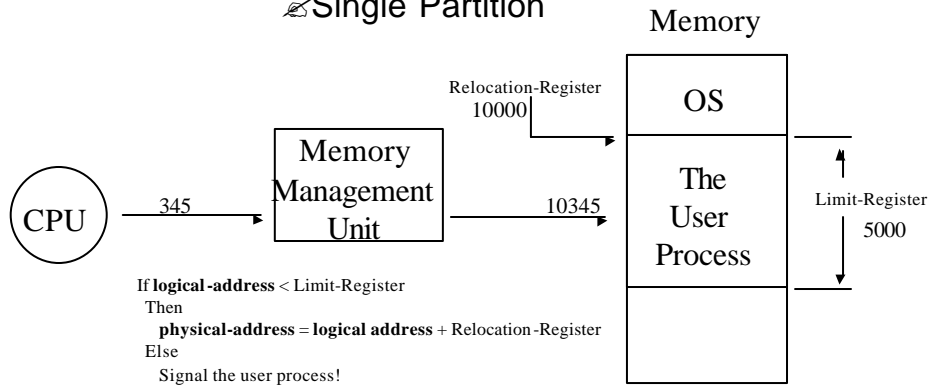


* "Operating system concept", Silberschatz and Galvin, Addison Wesley, pp. 245-246.
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Memory Management

☞ Contiguous Allocation

☞ Single Partition



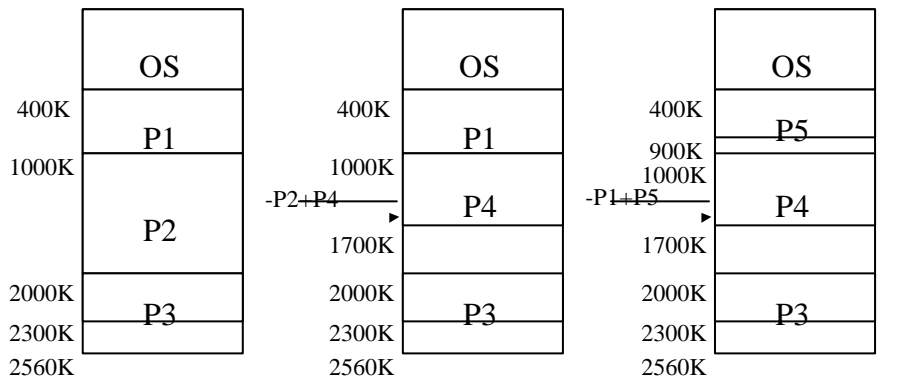
* "Operating system concept", Silberschatz and Galvin, Addison Wesley, pp. 249-264.

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Memory Management

☞ Contiguous Allocation

☞ Multiple Partitions



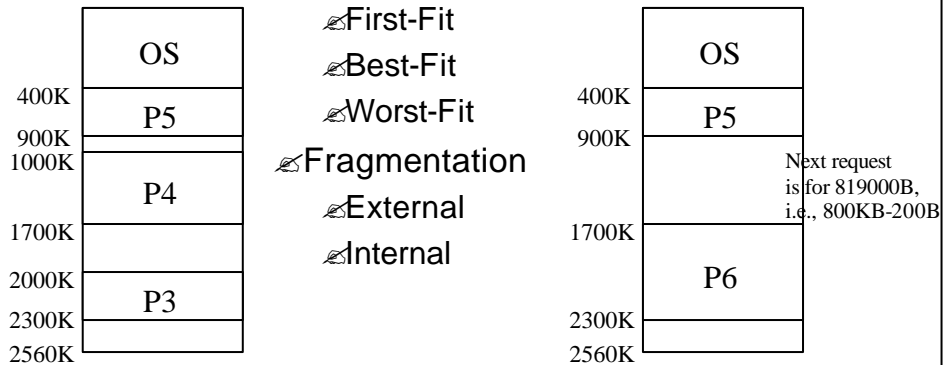
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3holes = 660KB!!!

Memory Management

Contiguous Allocation

Multiple Partitions

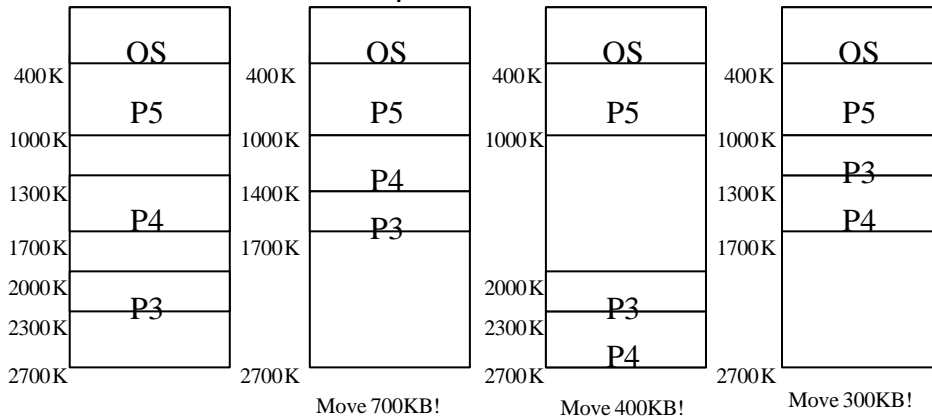


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Memory Management

Solutions to Fragmentation

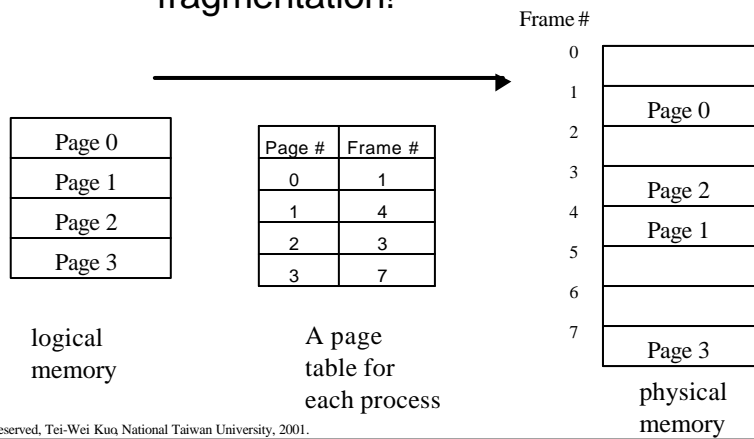
Compaction



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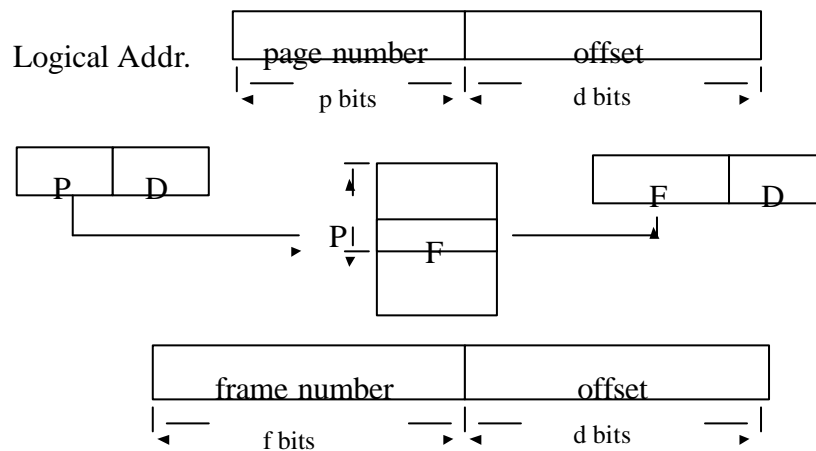
Memory Management

✍ Paging – Another solution to external fragmentation!

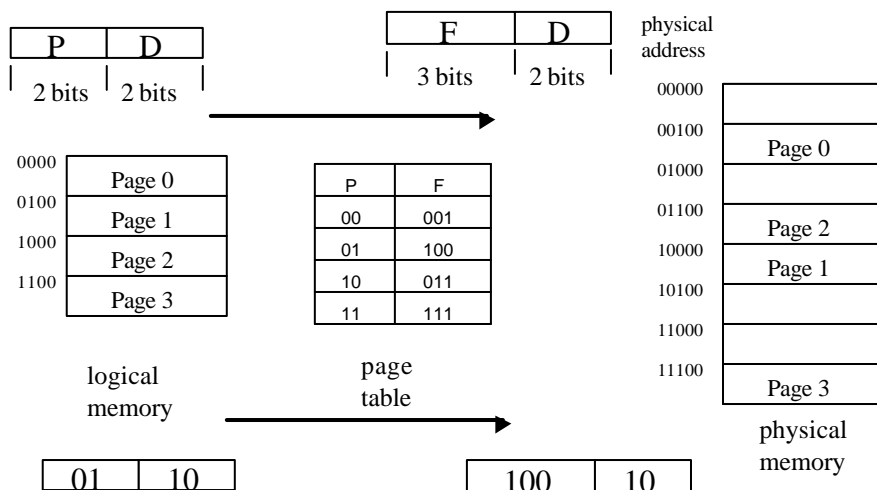


Paging

✍ Address Translation

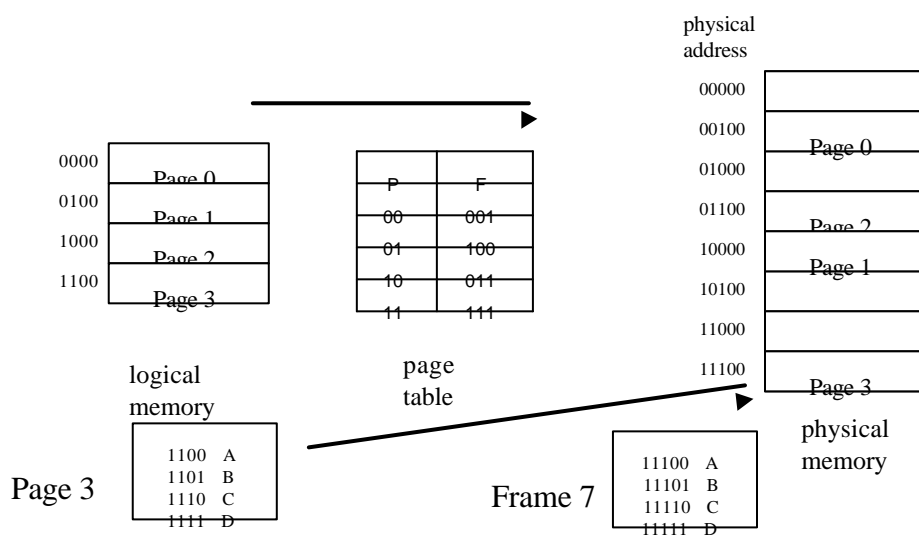


Paging



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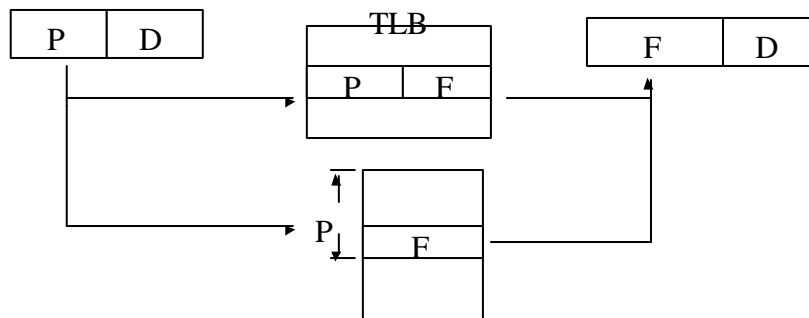
Paging



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Paging

- Hardware Support for Paging
 - Registers as Page Tables
 - Memory-Resident Page Tables
 - Translation Look-aside Buffer (TLB)



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Paging

- Paging-TLB
 - TLB Hit
 - Access time = TLB-access-time + Inst/Data-Memory-Access
 - E.g., 20ns + 100ns
 - TLB Miss
 - Access Time = TLB-access-time + Page-Table-Memory-Access + Inst/Data-Memory-Access
 - E.g., 20ns + 100ns + 100ns
 - Hit Ratio 80%
 - Effective access time = 20ns + 100ns + 0.2 * 100ns = 140ns

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Virtual Memory

☞ Definition

- ☞ A technique that allows the execution of processes that may not be completed in memory.

☞ Swapping

- ☞ Process image may reside in the backing store rather than swap the entire image in.
- ☞ Page fault: occurs when program references a non-memory-resident page.

☞ Thrashing

- ☞ A process is spending more time in page faults than executing.

* "Operating system concept", Silberschatz and Galvin, Addison Wesley, pp. 289,291-293,317.

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Context Switching-Revisiting

☞ Def.

- ☞ Switch the CPU from one process to another process
 - ☞ Save the state (or called context) of the running process
 - ☞ Reload the state of the ready process

☞ Context Switching Time

- ☞ Hardware-dependent!
 - ☞ Multiple register sets!
 - ☞ Special hardware instructions!

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Process Concept-Revisiting

✍ Process Control Block

```
Struct PCB {  
    char p_pid;  
    char p_pri;  
    char p_ppid;  
    int pc; /* program counter */  
    ...  
    int files[NFILE];  
} PCB[NPROC];
```

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