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BTech CSE 4.

PAGE NO.:
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ASSIGNMENT → 2.

1.) Address translation in modern System.
- Each process generates logical (virtual) address.
- MMU (Memory management unit) translates these into physical address

Translation steps:-
a.) CPU generates logical address.
b) MMU checks page table for corresponding frame number.
c). Concatenates frame no + offset → physical address

2.) Memory layout.
Eg: layout

Process A (100 Kb of 120 Kb Block) | free 30Kb | Process B (200Kb).
Internal fragmentation: 20 Kb wasted inside A's block.
External fragmentation: 30 Kb free, but too small for 40Kb.

→ Mitigation techniques:-
Paging (Eliminates external, but many cause small internal)
segmentation with paging hybrid.
Buddy system allocation.
slab allocation (in linux)

3. Paging-based allocation model for a hypothetical OS.
- Memory divided into fixed form.
- Trade-off
  * overhead
  * Speed

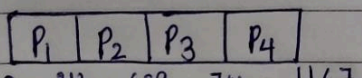
4. OS hardware interaction in virtual memory.
- Page-table in memory.
- MMU translates virtual
- TLB caches recent translations.
- Protection bits

5. 16-bit virtual address, 1KB page size
→ Virtual address = 16 bits = page no + offset
→ Page size = 1 KB = 2^{10} bytes → offset = 10 bits
→ Page no = 16 - 10 = 6 bits
→ * No. of virtual pages = 2^6 = 64
* Page table size = 64 entries × 2 bytes = 128 bytes

6. Process size (KB)

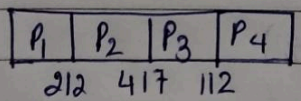
P_1	212
P_2	417
P_3	112
P_4	426

- First-fit



Unused memory = 259 KB.

- Best-fit



P_4 still can't fit Unused = 259 KB

- Worst-fit
P_1 (212) into 1000 → 788 left
P_2 (417) into 788 → 371 left
P_3 (112) into 371 → 259 left
P_4 (426) can't fit

Unused = 259 KB.
All three give same unused memory, but Worst-Fit may delay fragmentation buildup.

7. Page replacement reference string:
7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 3

a)b) FIFO : 9 page faults
Optimal : 7 page faults
- LRU : 10 page faults

c) Best: Optimal (minimum). FIFO worse due to Belady's anomaly.

8. Disk write = 10 ms
Memory write = 100 ms
Dirty pages = 30% of 1000 = 300.
a) Overhead = 300 x 10 ms
= 3000 ms = 3 seconds

b) Optimization: Write-back caching with dirty bit tracking or pre-cleaning (background flush) reduces blocking time.

9a) Working set model + replacement policy
- OS tracks recent active pages per task.
- For object detection: Allocate stable working set
- For infotainment: Allows flexible replacement so it adapts to available memory.

b) Memory allocation strategy.
- Use priority-based dynamic allocation.
- Real-time responsiveness ensured by working set + real time schedule