

# Operating System: Virtual Memory

By: Vishvadeep Gothi



# VISHVADEEP GOTHI SIR

**AIR- 19, 119, 440, 682  
in GATE**



**ME from IISc Bangalore  
Mtech BITS Pilani in Data  
Science**



**14+ Years of Teaching Experience,  
10+ Years in GATE/IES**



**Subjects Taken:**  
Computer Organization & Architecture,  
data structure, operating system,  
C-Programming, Data science,  
Machine Learning, Python,  
coding interview problems,





# Vishvadeep Gothi

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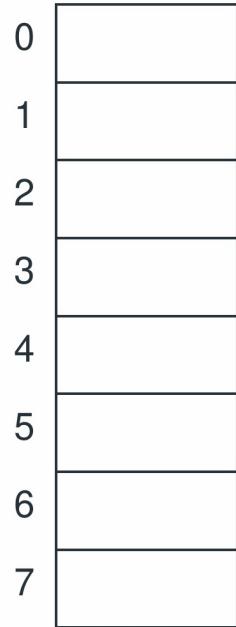
# Virtual Memory

- ◎ Feature of OS
- ◎ Enables to run larger process with smaller available memory



# Virtual Memory

Process



Page Table

0	0
1	0
2	1
3	2
4	X
5	3
6	0
7	1

Garbage value

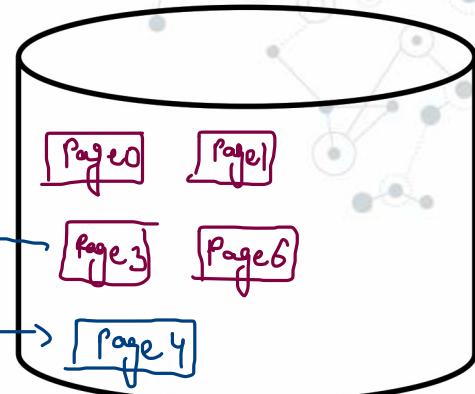
8 Pages

m. m.

Physical Memory

0	Page 2
1	Page 7
2	Page 3
3	Page 5

Secondary Memory



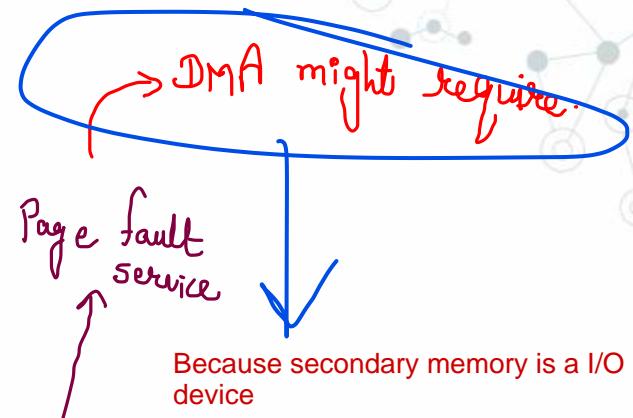
# Demand Paging

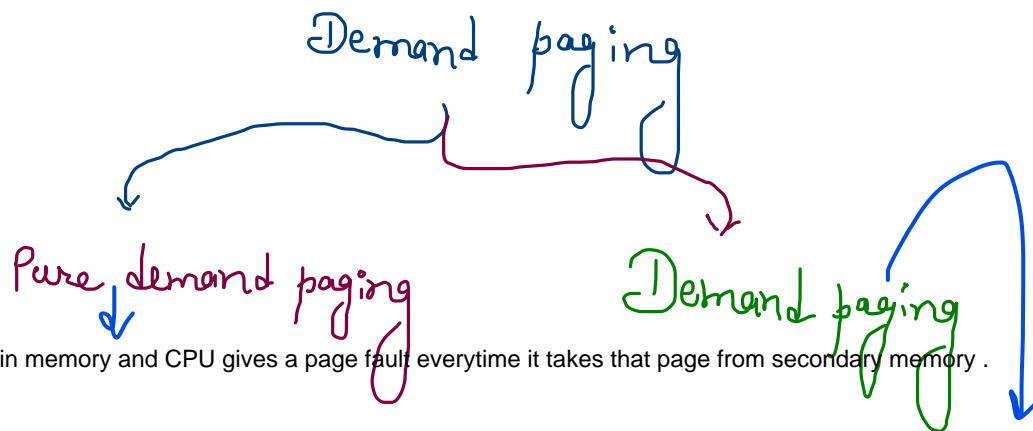
Bring pages in memory when CPU demands

- If CPU demands a page which is not available in main-memory, then it is known as  $\Rightarrow$  page fault.

Internal Interrupt

In case of page fault OS brings faulted page from sec-memory to mm by replacing a page (if needed) & updates the page-table.





Effective  
memory  
access time  
for virtual memory

$$= (1-p) * \frac{\text{effective mem access time}}{\text{service time}} + p * \text{page fault}$$

Similiar to pure demand pages but we have some initial pages for starting the process.

$p$  = page fault rate

$$E \cdot M \cdot A \cdot T = 2 * t_m$$

or

$$= t_{mm} \quad \text{when page table is stored in registers.}$$

or

$$= H * (t_{TLB} + t_{mm}) + (1-H) (t_{TLB} + 2t_{mm})$$

when TLB used

# Protection of pages

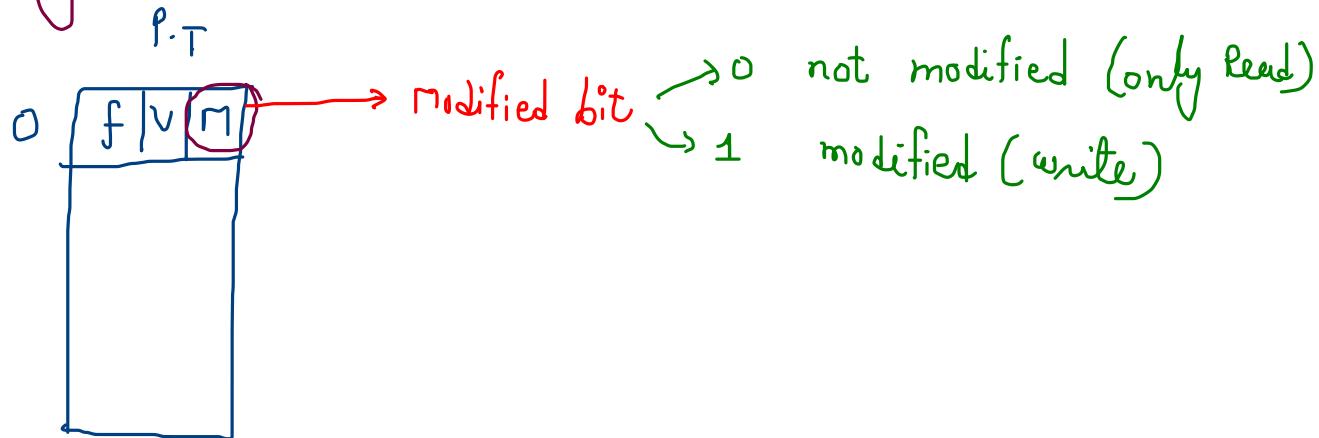
Page table

0	f
1	
2	
3	
4	
5	
6	
7	

Protection bits

Valid bit  
→ 0 Invalid  
→ 1 Valid

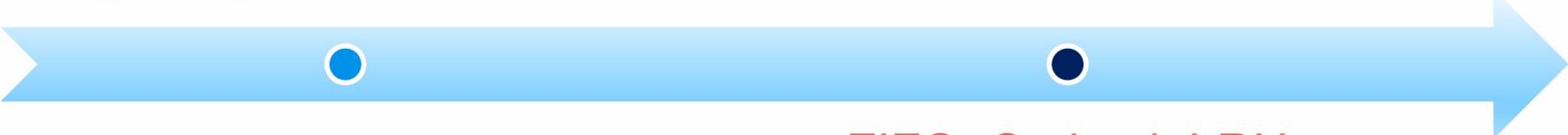
# Concept of dirty bit or Modified bit



$M = 0$  means while replacement a page  
is replaced from mm directly  
it back to secondary w/o copying  
It saves time.

# Next Class

Page Replacement Policies



FIFO, Optimal, LRU

# NEW INITIATIVE: FAQS OF GATE ASPIRANTS

SESSIONS ON:

**LIST OF REFERENCE BOOKS**

**LIST OF IMPORTANT TOPICS**

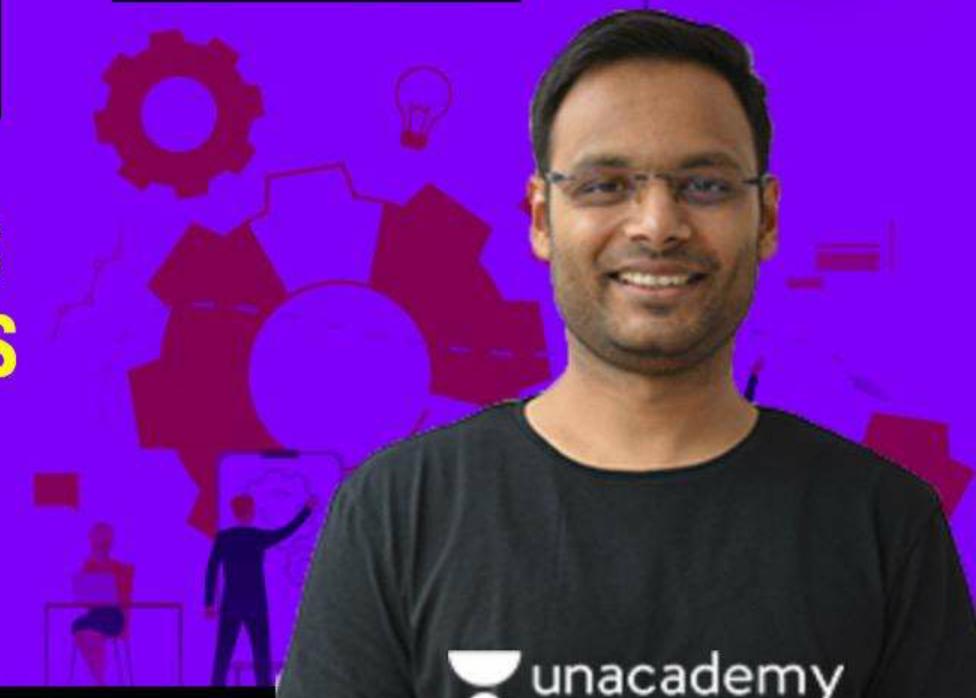
**REVISION STRATEGY**

**HOW TO MAKE NOTES**

STARTING FROM: 12 JULY

VISHVADEEP GOTHI SIR

TIME:  
**9:00AM**  
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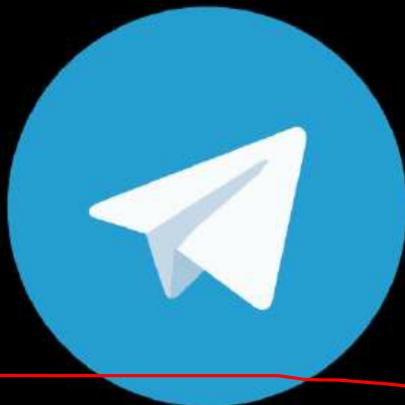
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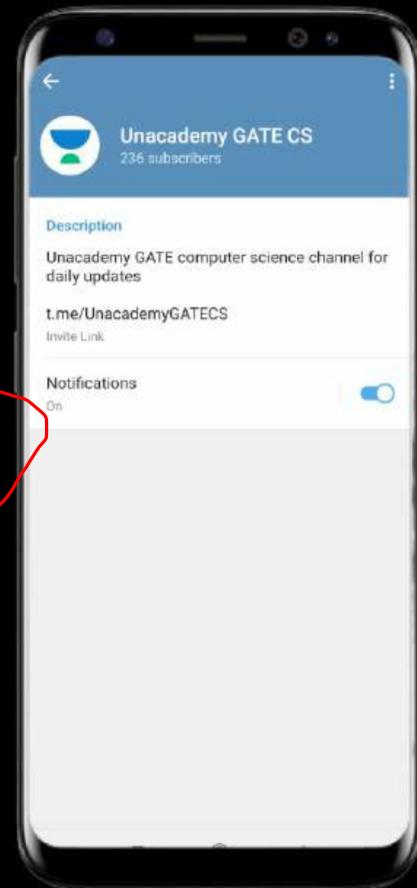
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