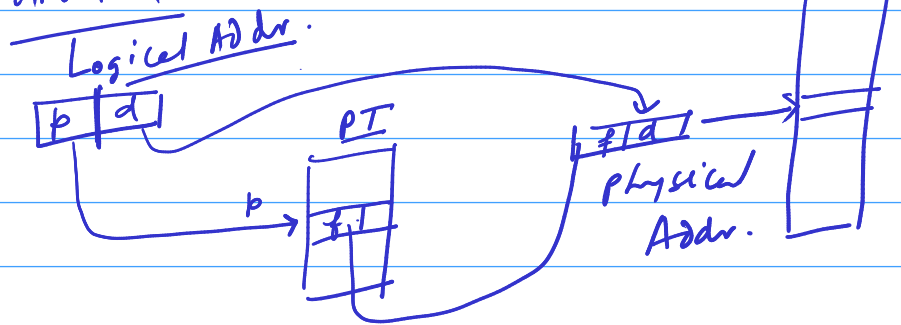


Single Level Paging

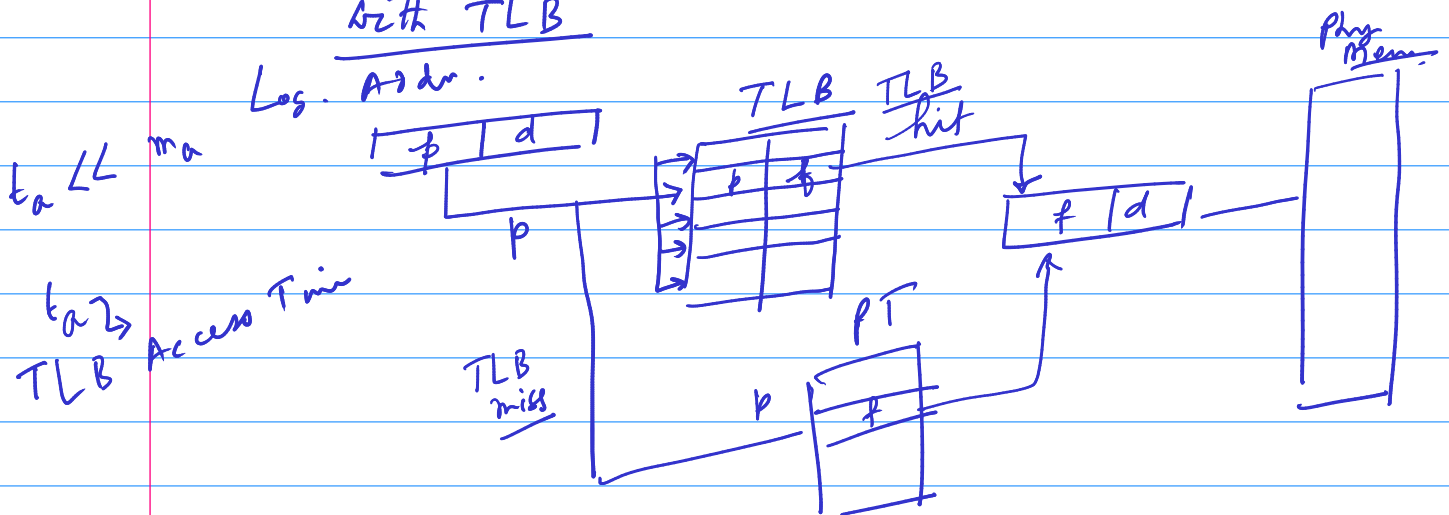
without TLB.



$m_a \rightarrow$ mem. access time

$$\text{Effective mem. access time EMAT} \\ = m_a + m_a = 2m_a$$

With TLB



Hit Ratio $(\alpha) = 90\%$

$$\text{EMAT} = \underbrace{\alpha (t_a + m_a)}_{\text{TLB hit}} + \underbrace{(1-\alpha) (t_a + m_a + m_a)}_{\text{TLB miss.}} \\ = \alpha (t_a + m_a) + (1-\alpha) (t_a + 2m_a)$$

Multi Level Paging.

Size of each PT entry
= 4B

$$\text{Logical Addr. Space} = 2^{32} \text{ B} = 4 \text{ GB.}$$

$$\text{Page Size} = 4 \text{ KB} = 2^{12} \text{ B}$$

Single Level PT

Page No.	offset
Log. Addr.	
20 bit	12 bit

$$\text{Page No.} = 20 \text{ bit.}$$

$$\text{No. of Pages} = 2^{20}$$

$$\text{No. of entries in PT} = 2^{20}$$

$$\text{Size of PT} = 2^{20} \times 2^2 \text{ B}$$

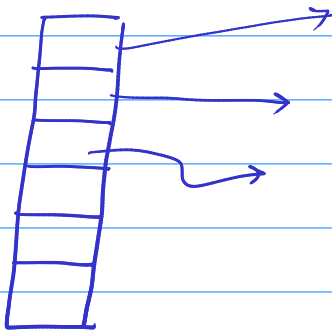
$$= 2^{22} \text{ B}$$

$$\text{Single level PT} \rightarrow \text{Size} = 2^{22} \text{ B} = 2^{12} \times 2^{10} \text{ B}$$

$$= 2^{10} \text{ pages}$$

Single Level PT need to be stored in consecutive 2^{10} pages

Two Level PT



Single Level PT

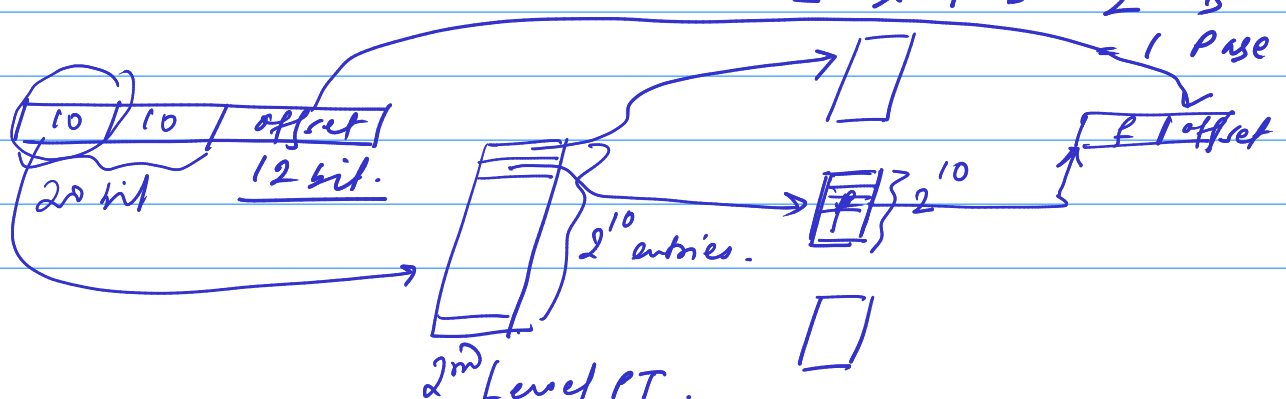
Pages of single level PT are stored in different frames.

Second level PT keeps info about pages of First level PT.

$$\begin{aligned} \text{No. of entries in Second Level PT} \\ = \text{No. of pages of First level PT} \\ = 2^{10} \end{aligned}$$

Size of Second level PT

$$= 2^{10} \times 4 \text{ B} = 2^{12} \text{ B}$$



Two Level PT.

$$EMAT \text{ without TLB} = m_a + m_a + m_a = 3m_a$$

$\downarrow \qquad \qquad \qquad \downarrow \qquad \qquad \qquad \downarrow$
2nd Level PT 1st Level PT Phy Addr. Access.

$$\underline{EMAT \text{ with TLB}} = \alpha (t_a + m_a) + (1-\alpha)(t_a + 3m_a)$$

Inverted Page Table.

Log. Addr.

