

Paging ex

Memory Size= 7 bits=> $2^{**7} = 128$ bytes in my memory

Frame/page size=> number of bits per frame=> want 16 bytes/page

=> In base 2 of 16 = 4 bits

Can address up to 2^{**3} VP's

00000000



Page Table P1

VP #	valid	PP
0=000	1	2=010
1=001	1	5=101
2=010	1	3=011
3=011	0	
4	0	
5	:	
6		
7		

Page Table P2

VP #	valid	PP
0=000	1	100
1=001	1	110
2=010	0	
3=011	0	
4	0	
5	:	
6		
7		

Physical memory

000 0000 000 1111	
001 0000 001 1111	
010 0000 010 1111	P1-0
011	P1-2
100	P2-0
101	P1 -1
110	P2-1

What is the valid range of virtual addresses?

For P1 -> 7 bit system, virtual addresses can go from
000 0000->010 1111 (see valid bits)

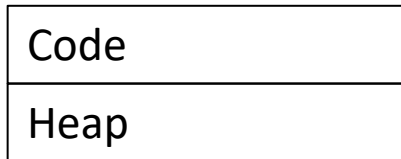
For P2

000 0000->001 1111

For a 32 bit system
20 bits VPN, 12 bits offset

Outer=10 bits	Inner=10 bits	Offset=>12 bits
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0x00000000



1 Meg => how many pages?
 2^{20} pages / 2^{12} bytes/page
= 2^8 or 256 => **256 rows in page table**

If using 4K pages => (2^{12} bits)
 $2^{10} \sim 1000$
 $2^{20} \sim 1,000,000$

If using single page table
 $2^{20} = 1,000,000$ rows
 $2^{20} * 4 = 4\text{MB}$

2^{20} rows $\sim 1,000,000$
 $1,000,000 - 512 =$
 $\sim 999,500$ rows wasted

Then have $2^{(20)}$ potential pages

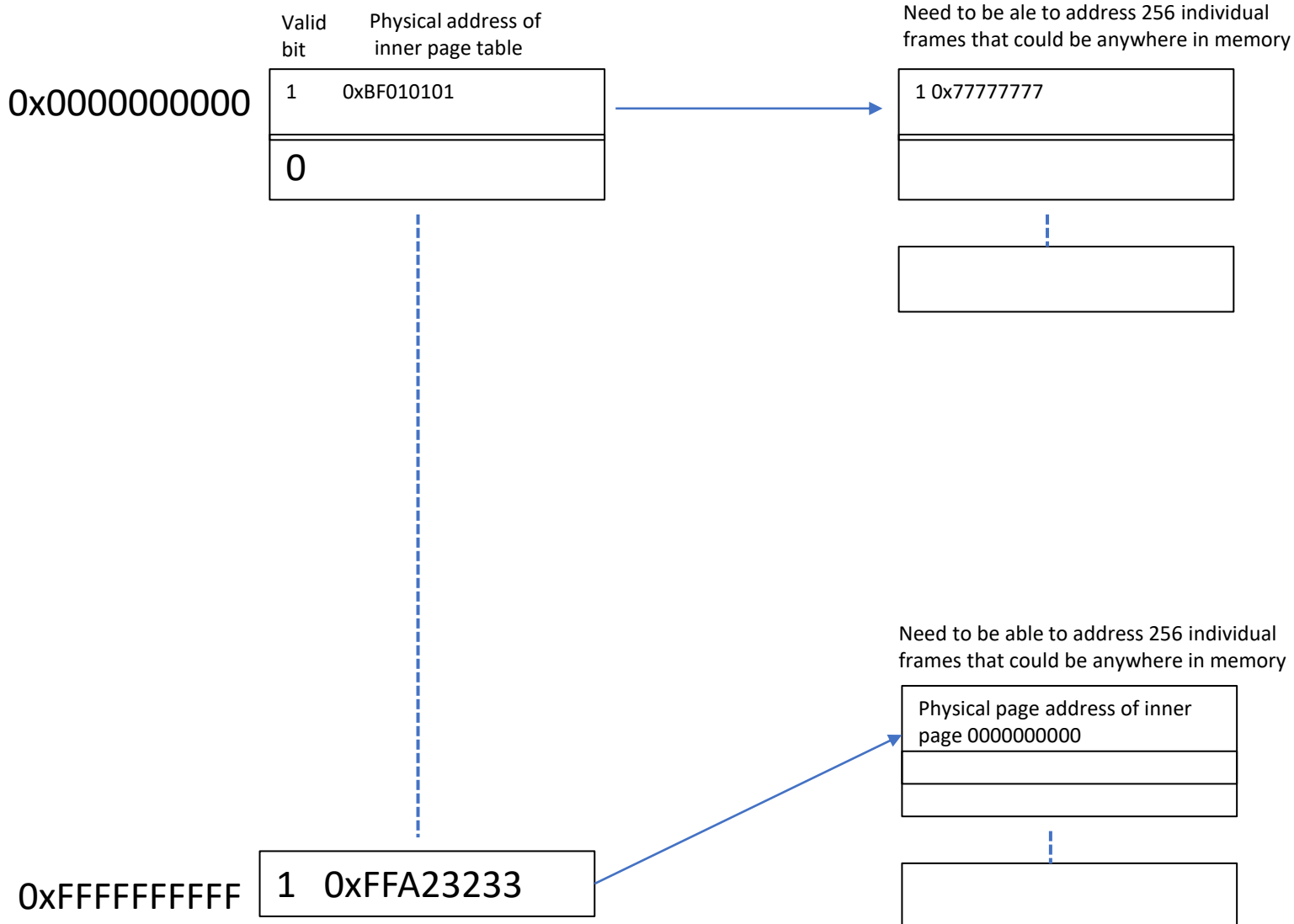
0xFFFFFFFF



1 Meg needs 256 pages => **256 rows in page table**

For a 32 bit system 20 bits VPN, 12 bits offset

Outer=10 bits	Inner=10 bits	Offset=>12 bits
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If using 4K pages=> (2^{12} bits)

$2^{10} \sim 1000$

$2^{20} \sim 1,000,000$

If using multilevel page table

Remember a single level page table uses $2^{20} * 4\text{bytes entry} = 4\text{MB}$

Multilevel page table uses

Outer = $2^{10} * 4\text{bytes} = 4\text{kB}$

Inner? $2 * 2^{10} * 4\text{bytes} = 8\text{kB}$

Tots= 12kB