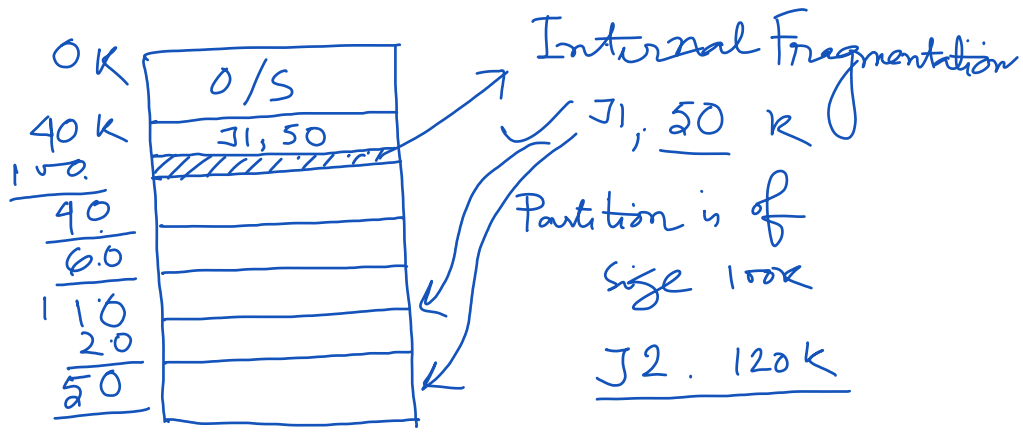
Tuesday, December 14, 2021 10:55 AM

Memory Management

MFT – Multiprogramming with Fixed no. of tasks



External fragmentation

1) First fit ✓
2) Best fit ✓
3) Worst fit ✓ X

MFT suffers from Internal as well as external fragmentation

MVT

Multiprogramming with Variable no. of Tasks

Memory holes will be created

Suffers from external fragmentation

Compaction

logical address

Physical " RAM Address

2 GB

Three problems of memory

— Not enough RAM

— Holes in our address space

— Program writing over each other

Prog 1

0x 1234

value = 3

Prog 2

0x 1234

Value = 7

* 0x 1234 = _____ ?

Virtual Memory

— level of indirection

— How does it solve problem?

— Translation / Page Table

Where does these page table reside?

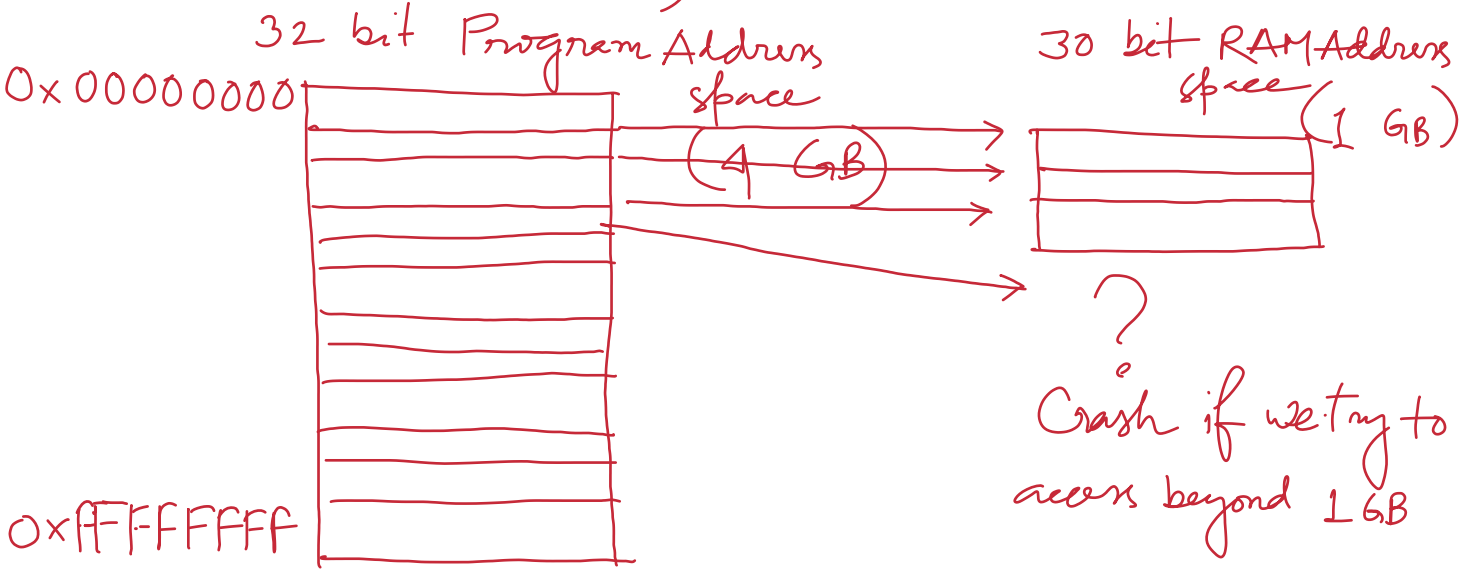
32 bit address

How much memory we can access

i) 2^{30} B

ii) 2^{32} B ✓

iii) 2^{32} words X



Key to problem

Same memory space

Every program has same memory space and actual RAM has same memory space

RAM ⟷ disk

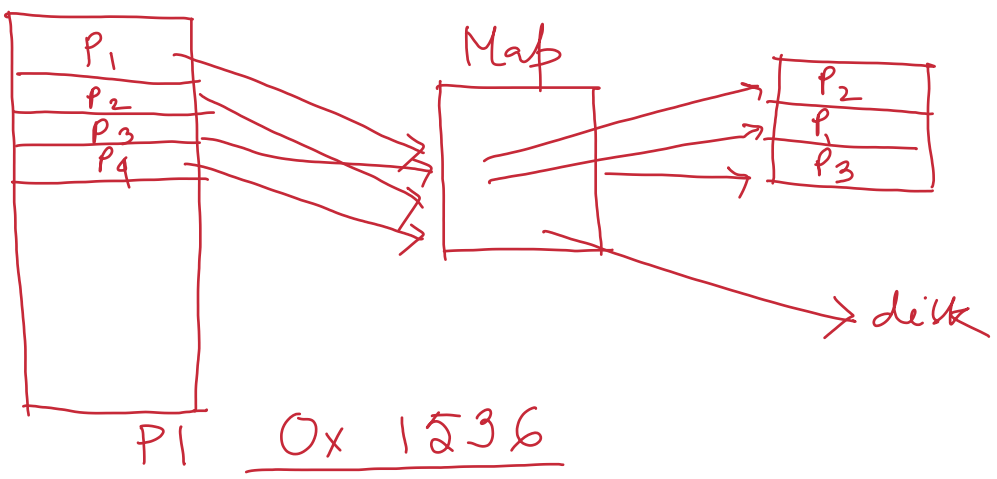
Virtual Memory

RAM — Memory

Disk — Storage

Without Virtual Memory

Program Address = RAM address



0x 1536

i) RAM address 0
ii) RAM " 1536
iii) Need more information

If a program uses more data that can fit into RAM, where does the data go?

Disk

32 bit 2^{32} B = 4 GB

MAP

VA	PA
.	
:	

MIPS

1 Word = 4 B

Word = $\frac{2^{32}}{4} = 2^{30} \simeq 1$ billion

Page Table

Fine grain : Maps each word address to the map

0 – 4095 words

4096 – 8191 words

4096 Words

Coarse grain Fewer mappings

1024 Words 1 Word = 4B

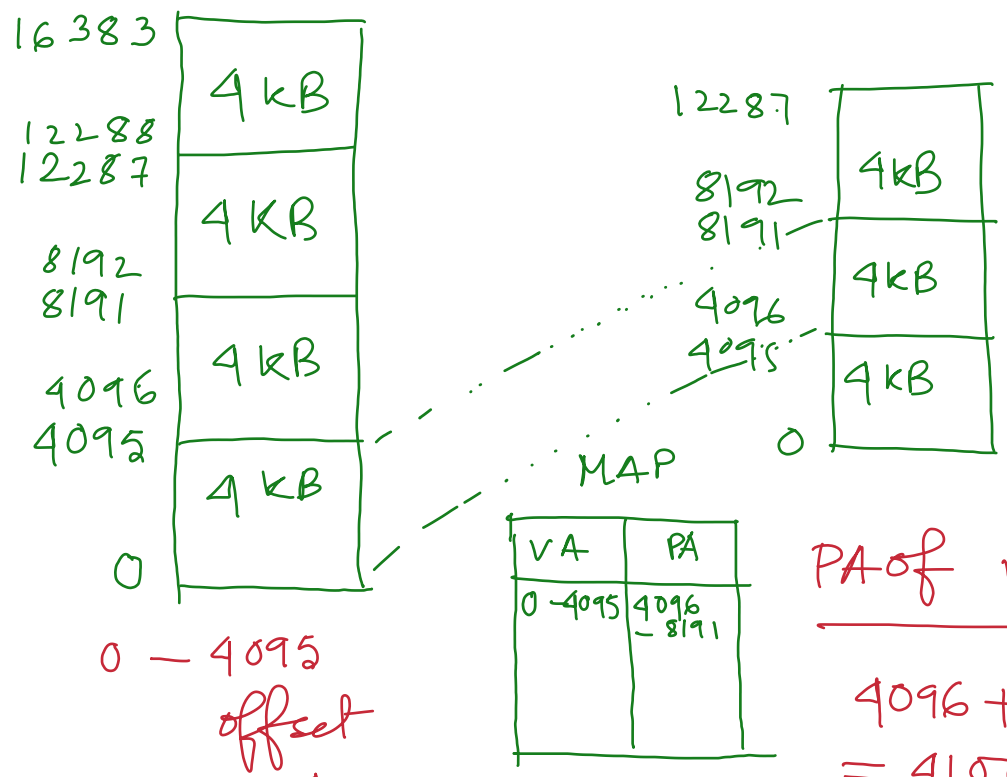
1024 × 4 = 4096 B

1 Page = 4096 B
= 4 KB

2^{30} entries $\simeq$ 1 word

$\frac{2^{30}}{1024} \simeq 2^{20} \simeq$ 1024 words

1 million



0 – 4095

offset

Byte 4

PA of VA 4 ?

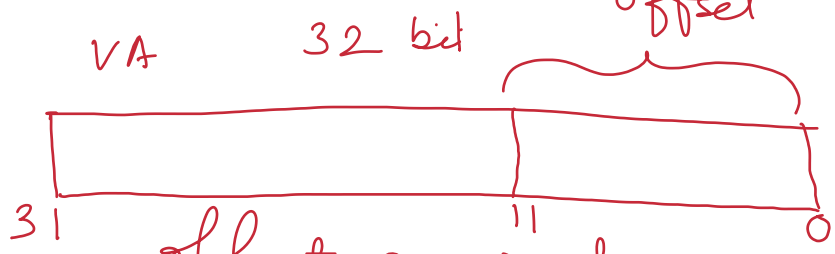
4096 + 4

= 4100 ✓

4 kB

= 4096 B

$= 2^{12}$ B



offset never changes

Can we have a page size of ~~12~~ KB ?

Page Size is power of 2

Page Size → 256 KB

32 bit VA

31 bit ? PA

33 bit

RAM 2 GB $= 2^{31}$ B

RAM 8 GB $= 2^{33}$ B

$256\ kB = 2^8 \times 2^{10}$ B

$= 2^{18}$ B

18 bit offset