6.033 Computer System Engineering

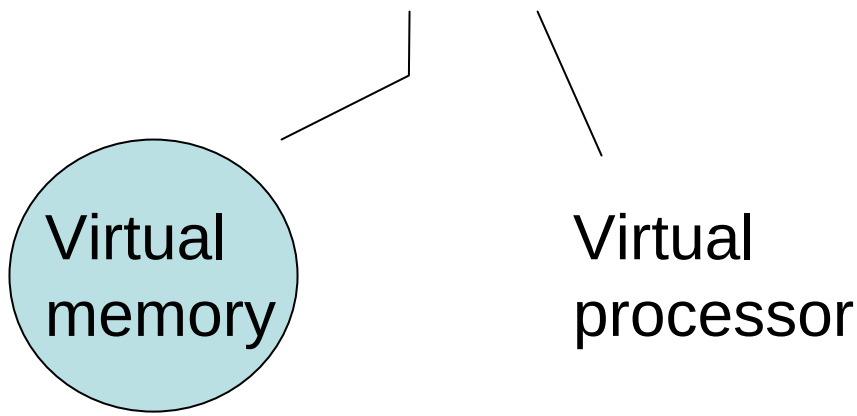
Spring 2009

Enforcing Modularity

Client / Service

module per computer

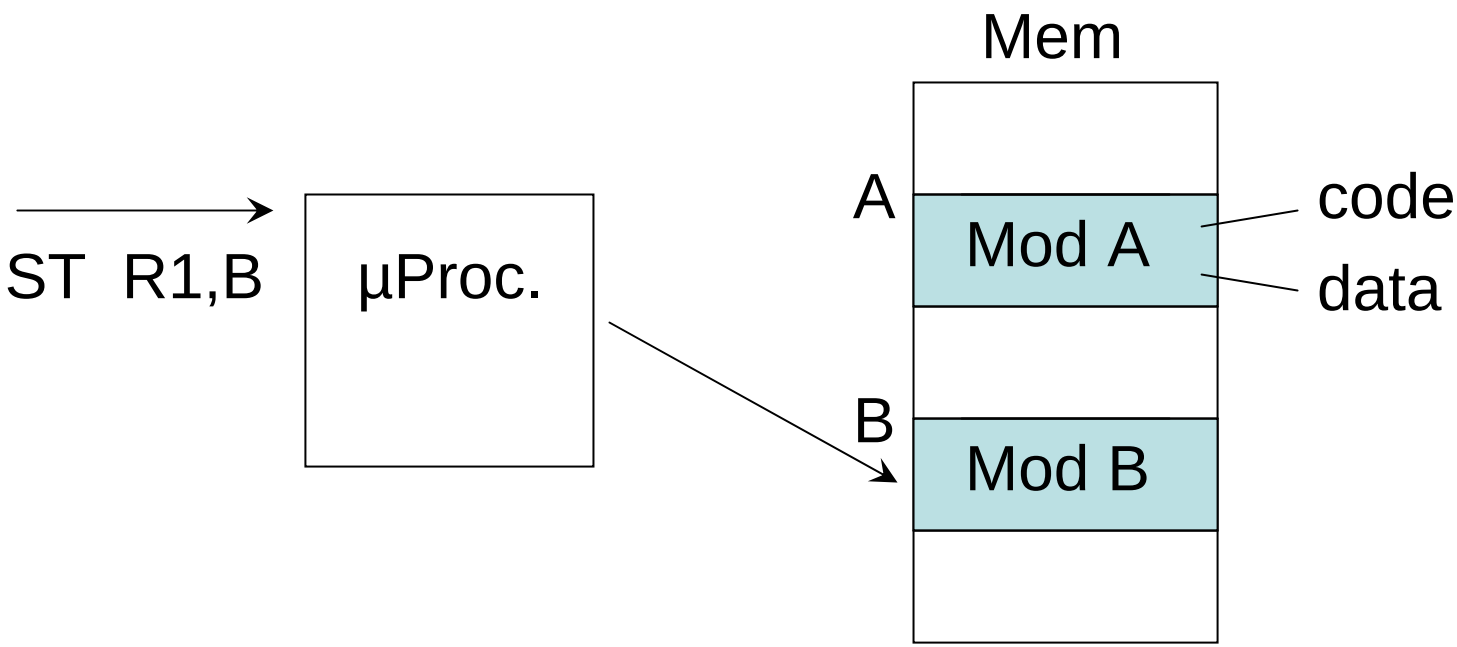
module per virtual computer

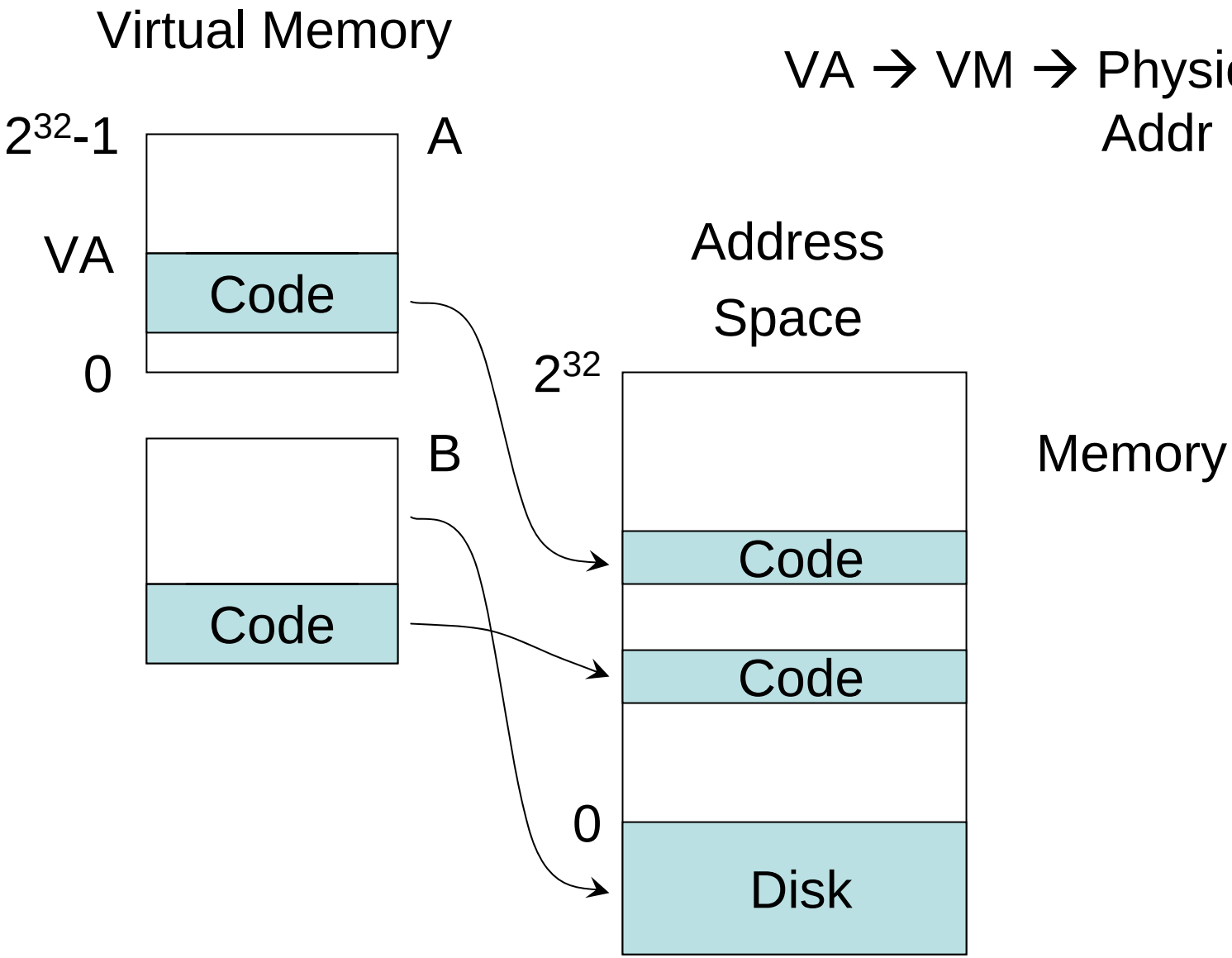


Kernel

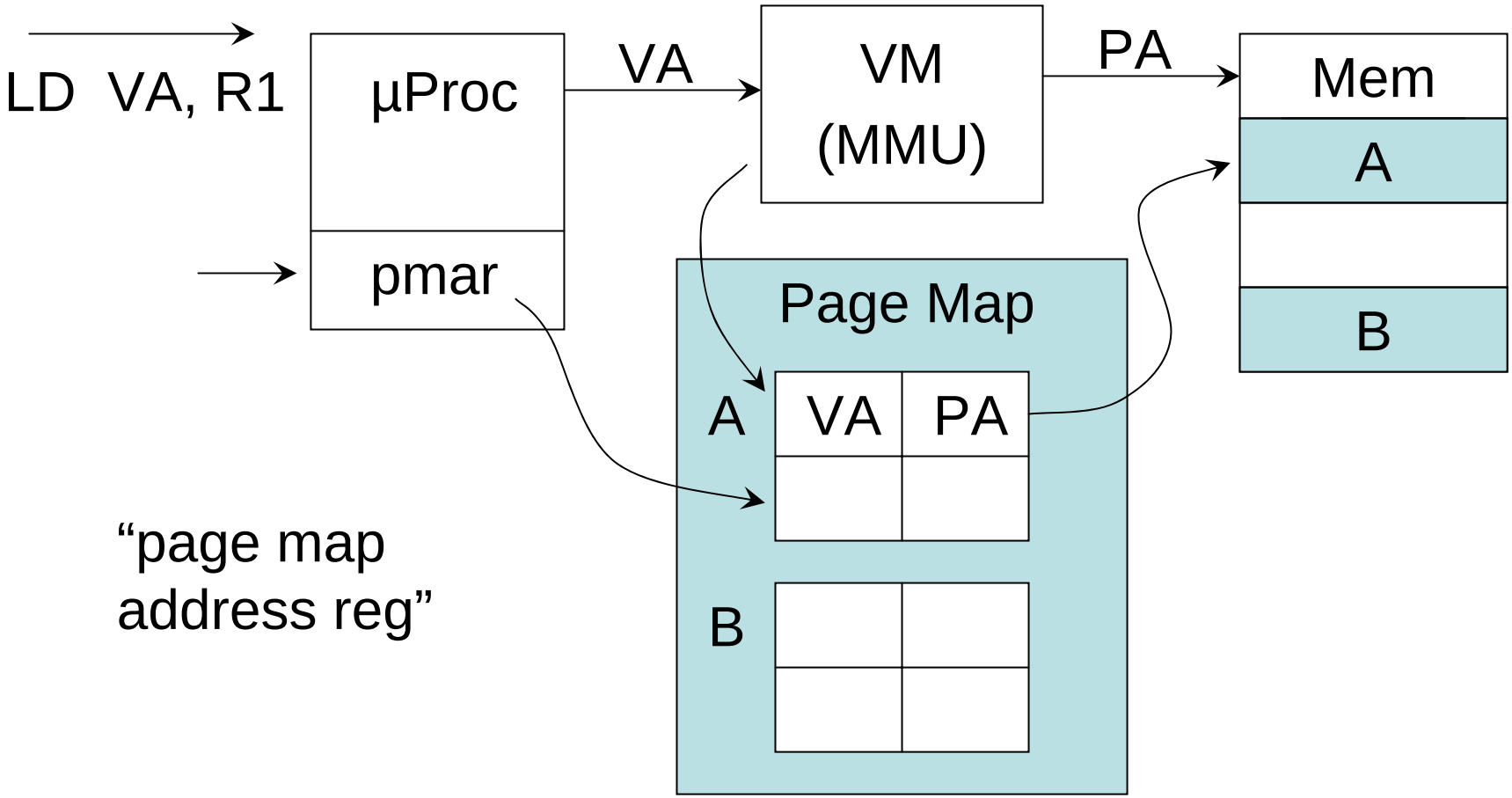
Why VM:

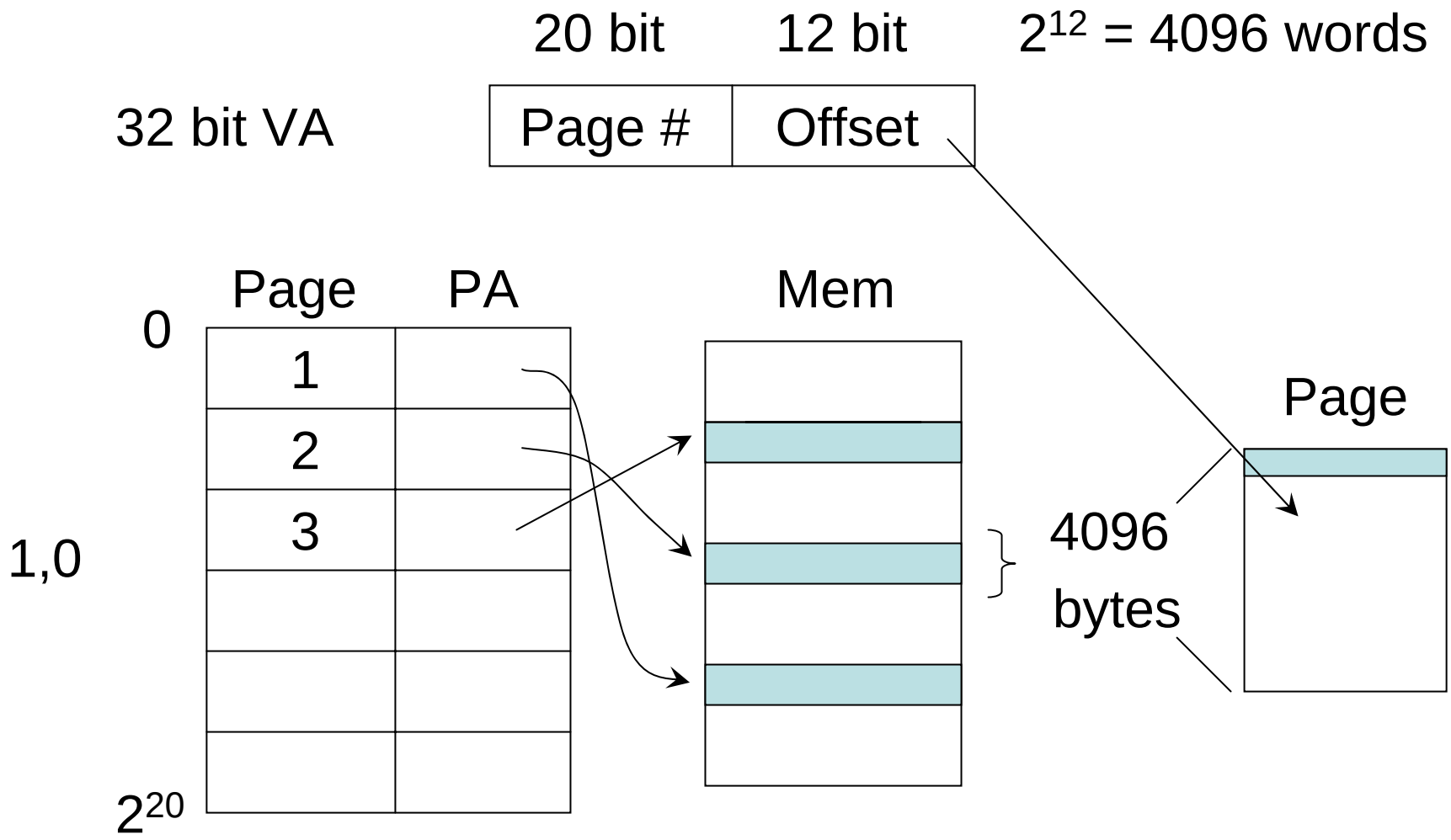
- A can overwrite B's memory



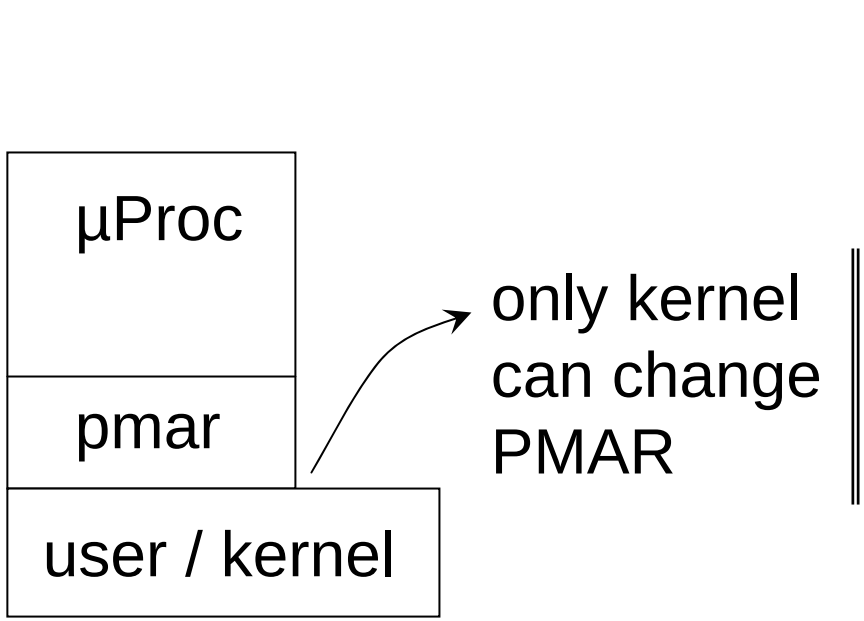

Virtual Memory
VA → VM → Physical Addr
2^{32}-1
A
VA
Code
0
B
Code
Address Space
2^{32}
Memory
Code
Code
0
Disk

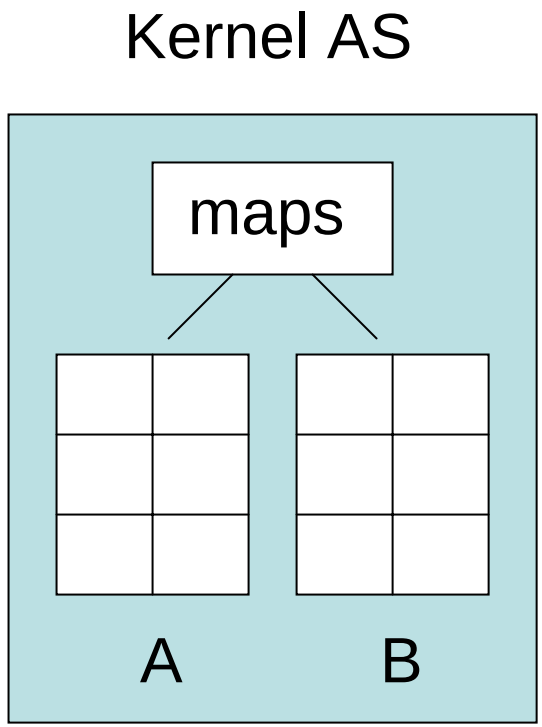
Simplified VM Hardware



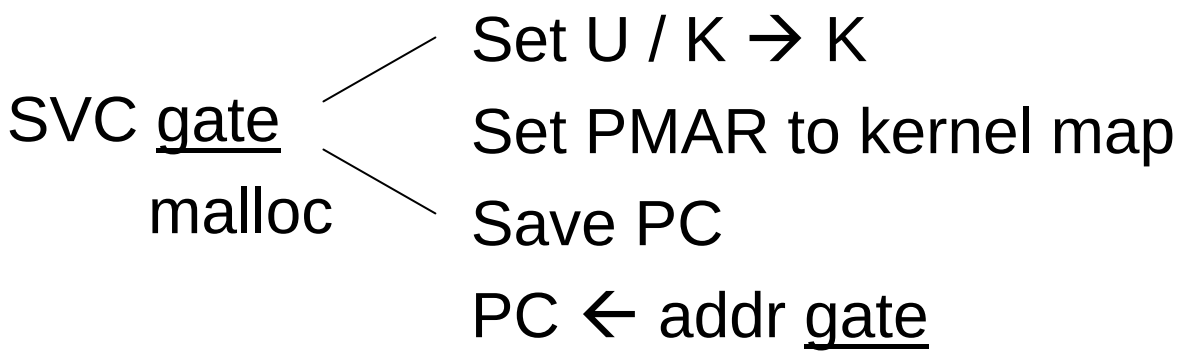

20 bit
12 bit
2^{12} = 4096 words
32 bit VA
Page #
Offset
Page
PA
Mem
0
1
2
3
1,0
2^{20}
Page
4096
bytes

Supervisory Module - Kernel

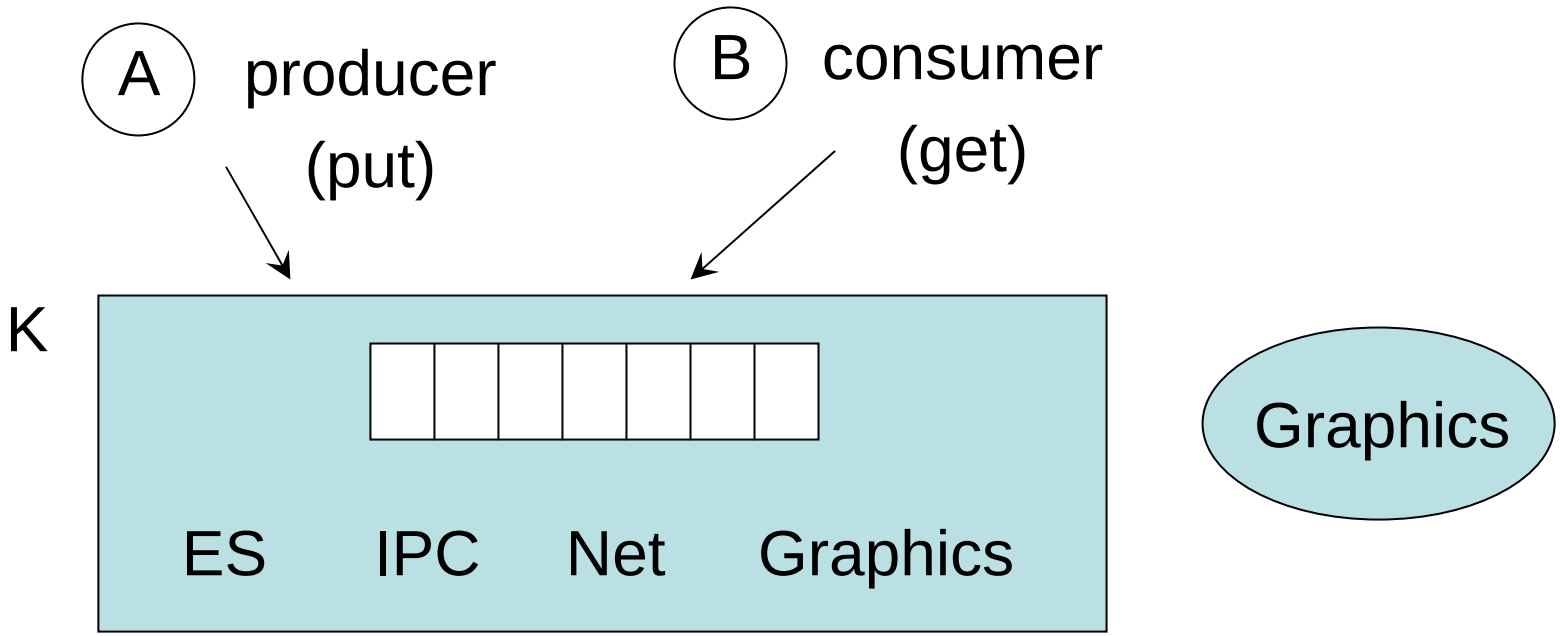


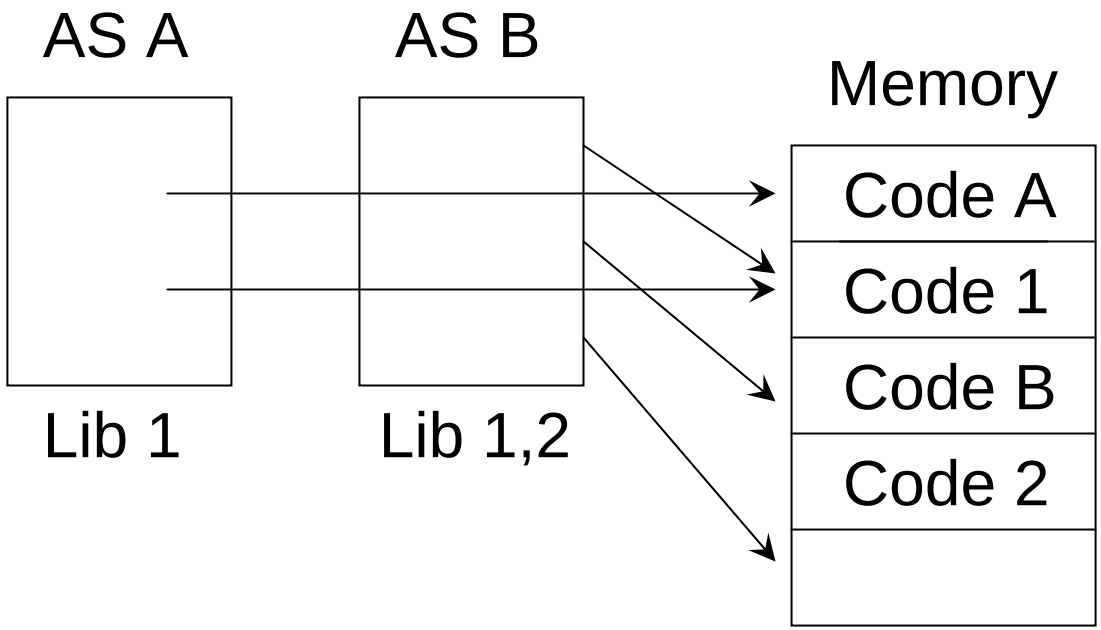


Supervisor Call - SVC



Kernel – Trusted intermediary




AS A
AS B
Memory
Code A
Code 1
Code B
Code 2
Lib 1
Lib 1,2