Embedded Operating Systems

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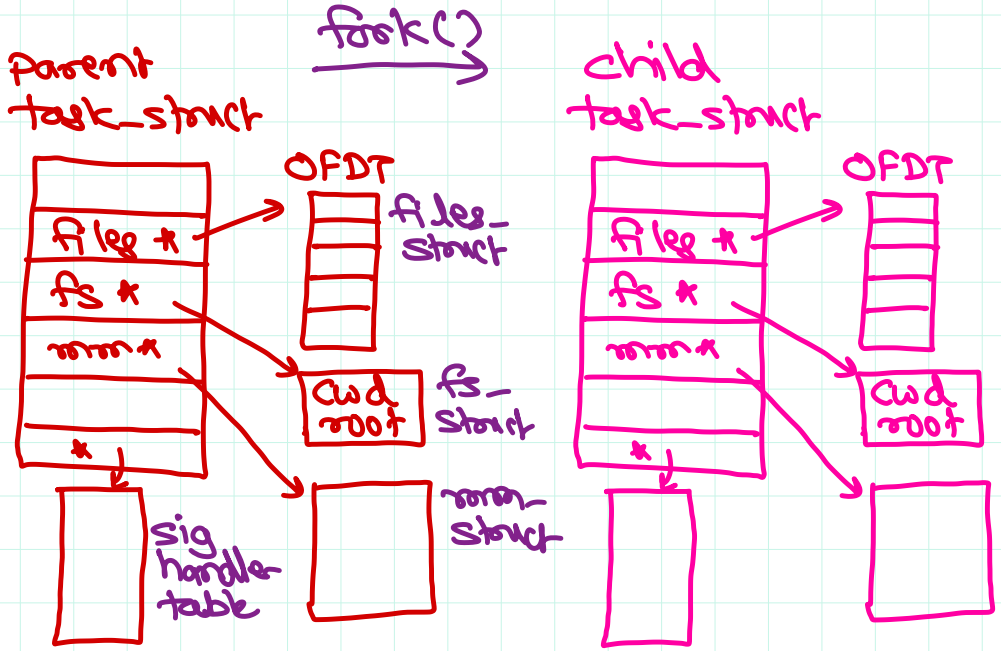
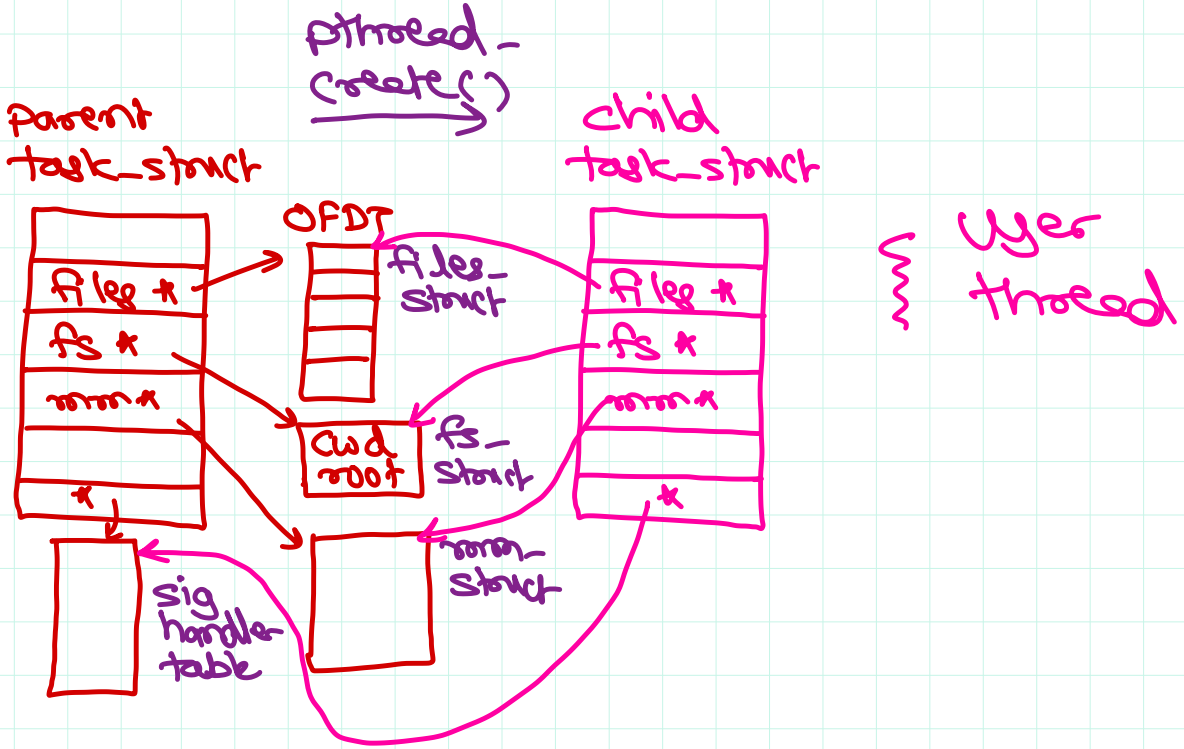
Linux - Process




```
child_task_id =
clone (task_fn, stack, SIGCHLD,
       NULL);
```

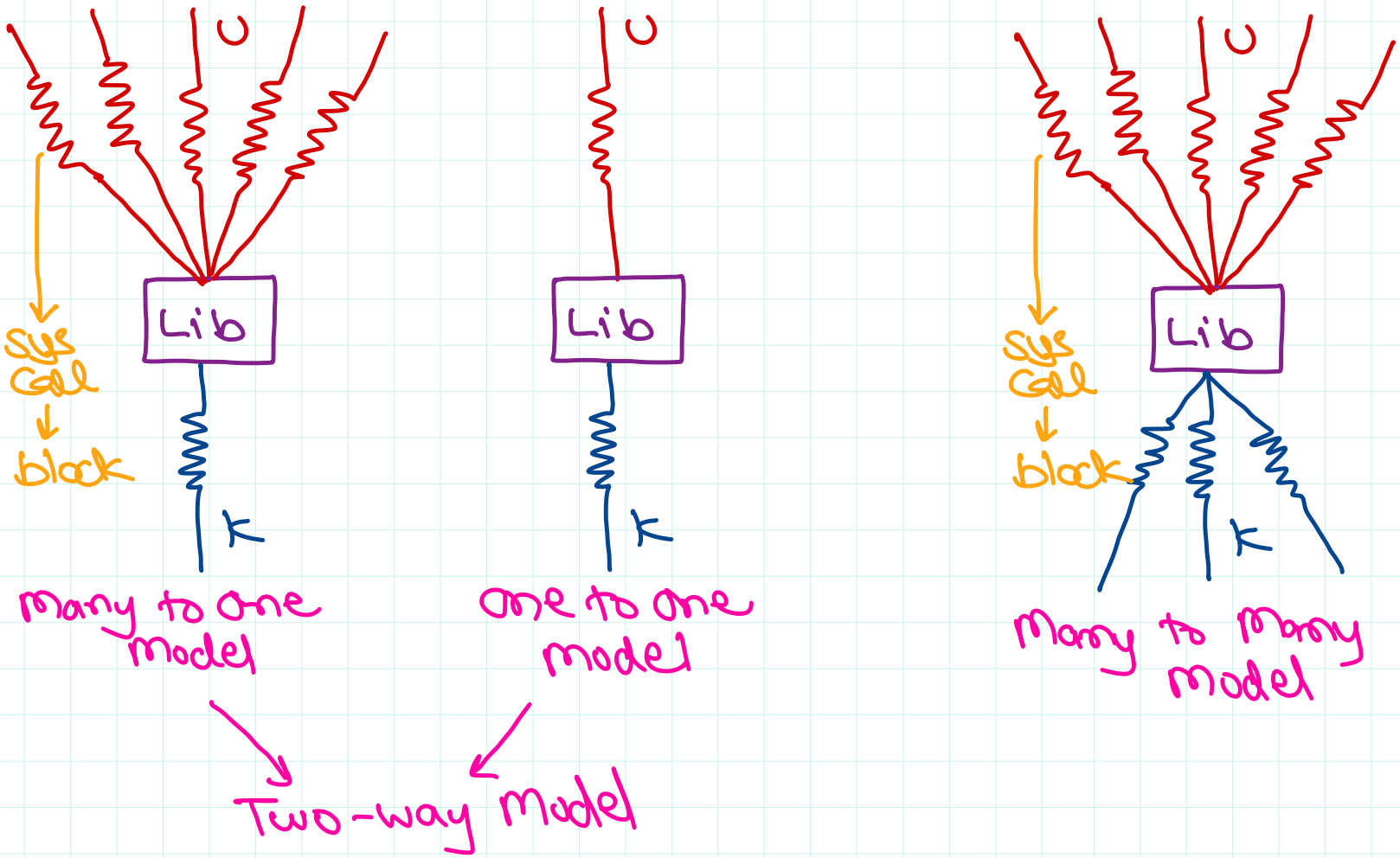
Linux - Thread

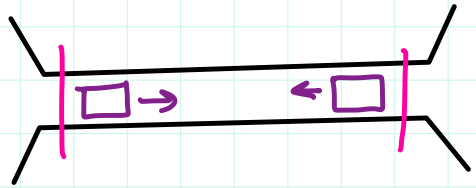



```
child_task_id =
  clone (task_fn, stack, CLONE_VM |
         CLONE_FILES | CLONE_FS |
         CLONE_SIGHAND, NULL);
```

{ Kernel thread

Threading Model





Deadlock Characteristics

1. mutual exclusion
2. no preemption
3. hold & wait
4. circular wait

program 1
1. open file
2. Connect printer
3. print
4. discon printer
5. close file

program 2
1. Connect printer
2. open file
3. print
4. close file
5. discon printer

processes involved in deadlock are permanently blocked (in waiting queue).

Concurrent execution
- process based multitasking - fork()
  - Commun betn processes
    - IPC (msg que, pipe, signals, ...)
      - Slower execution
- thread based multi-tasking
  - race condition
    - Synchronization (semaphore, mutex, cond var, ...)
      - Deadlock

Deadlock Prevention: Design system so that atleast one condn from deadlock char. is never satisfied.

P(S1)	P(S1,S2)
P(S2)	...
...	V(S1,S2)
V(S2)	
V(S2)	

← both sema are decr simultaneously. So hold & wait will never occur. So no deadlock.

e.g. UNIX OP → semget(), semop().

Deadlock Avoidance.

Resource allocation is done in two phases:
1. Get required resources info.
2. Allocate resource on actual request.

If OS maintains info about resources, OS can allocate resource (if avail) or may deny resource (if may cause deadlock).

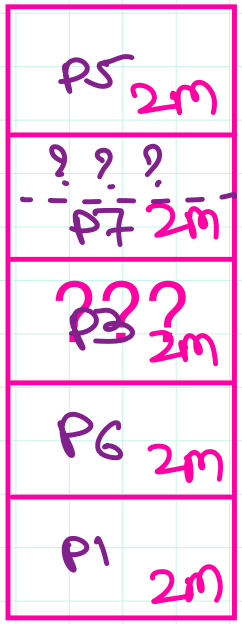
Deadlock avoidance Algo:
1. Safe state
2. Resource alloc graph.
3. Banker's algorithm

Memory Mgmt Schemes

1. Contiguous alloc
2. Segmentation
3. Paging

1) Fixed Partition

RAM (10M) - OS divide RAM into fixed num of fixed sized partitions.



- OS allocate one partition for each process.
- OS keep track of un used partitions.

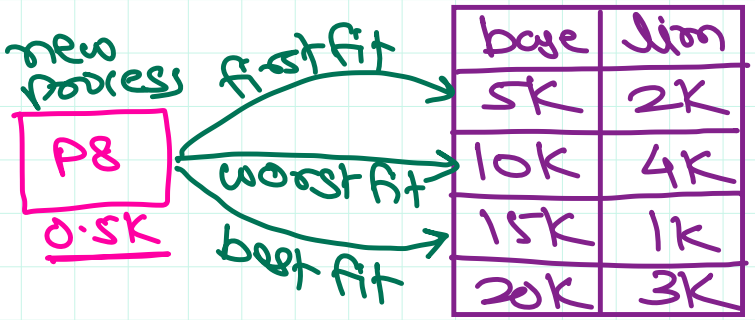
✓ simplest mem mgmt

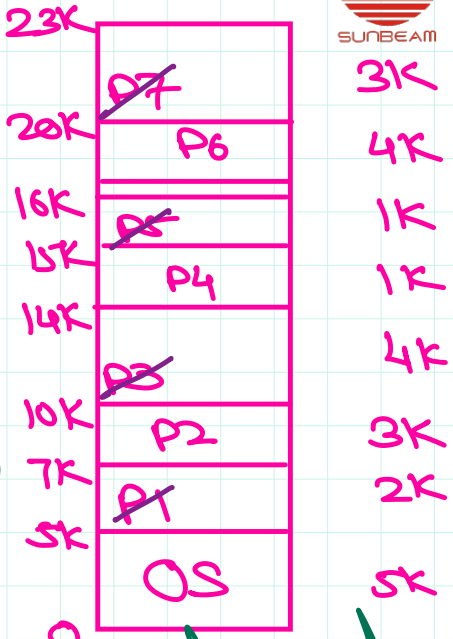
× max num of processes = num of partitions.

× max size of process = size of max avail partition

× internal fragmentation: process is not utilizing full mem allocated to it → mem wastage.

2) Variable partition / dynamic alloc.





✓ better mem utilization than fixed partition.

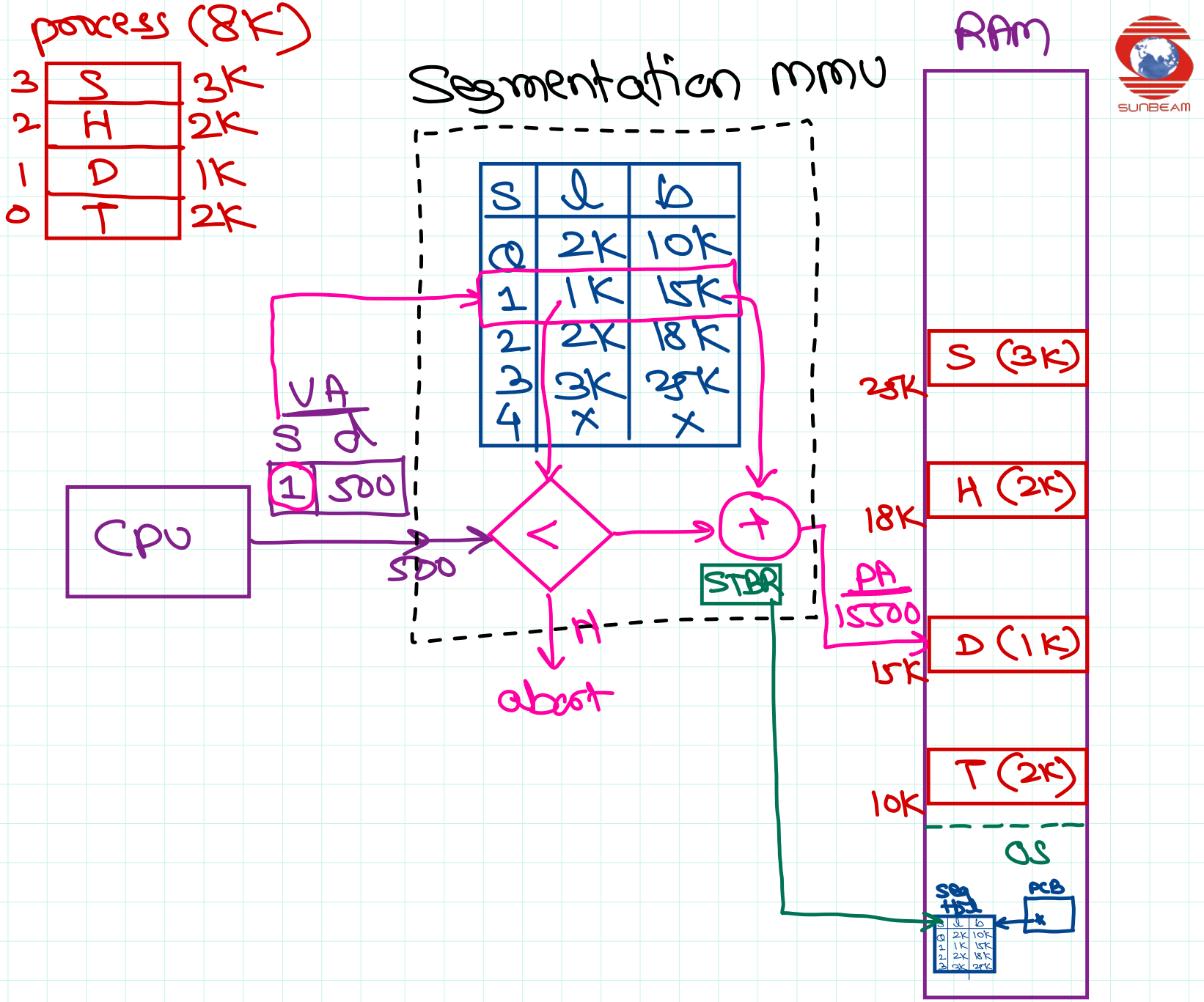
✓ No internal frag.

× max num of processes → depend on avail RAM.

× max size of partition → depend on avail RAM.

× External frag: Mem req for a process is avail but not contiguous.

↳ solution → shift processes in RAM so that max contiguous free space is avail = Compaction.


process (8K)
3
S
3K
2
H
2K
1
D
1K
0
T
2K
Segmentation mmu
RAM
S
L
B
0
2K
10K
1
1K
15K
2
2K
18K
3
3K
25K
4
X
X
VA
S
d
1
500
CPU
500
<
+
STBR
PA
15500
H
abort
S (3K)
25K
H (2K)
18K
D (1K)
15K
T (2K)
10K
OS
SBH
PCB

Thank you!

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