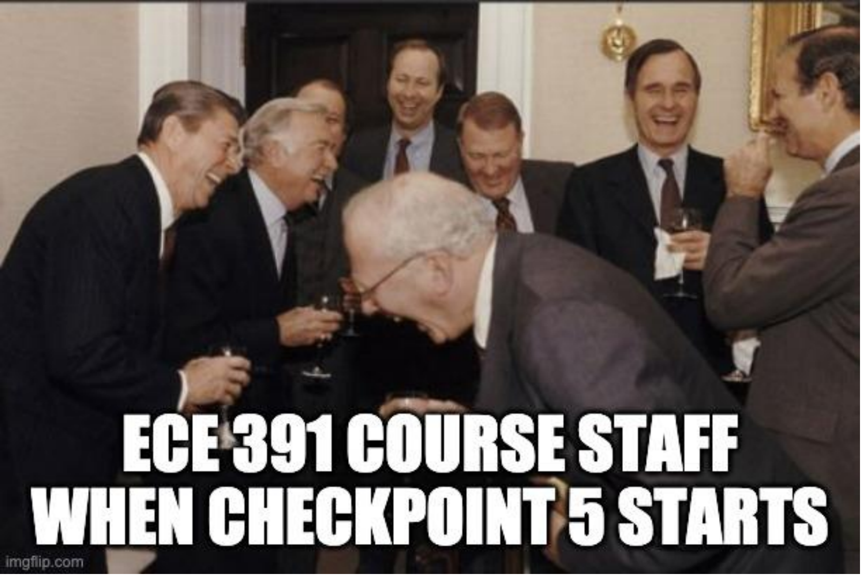
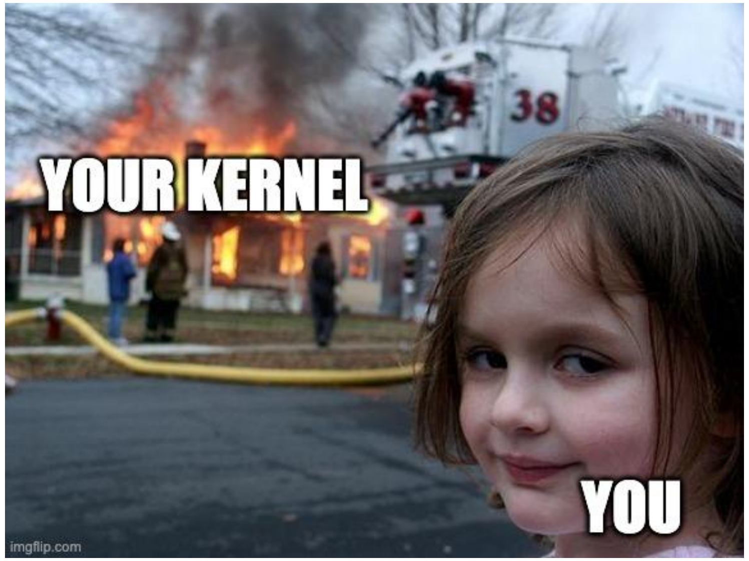
ECE 391 Discussion Week 13


ECE 391 COURSE STAFF WHEN CHECKPOINT 5 STARTS
imgflip.com


YOUR KERNEL
YOU
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WHEN YOU REALIZE THIS IS THE LAST CHECKPOINT FOR MP3
BUT YOU START IMPLEMENTING SCHEDULING
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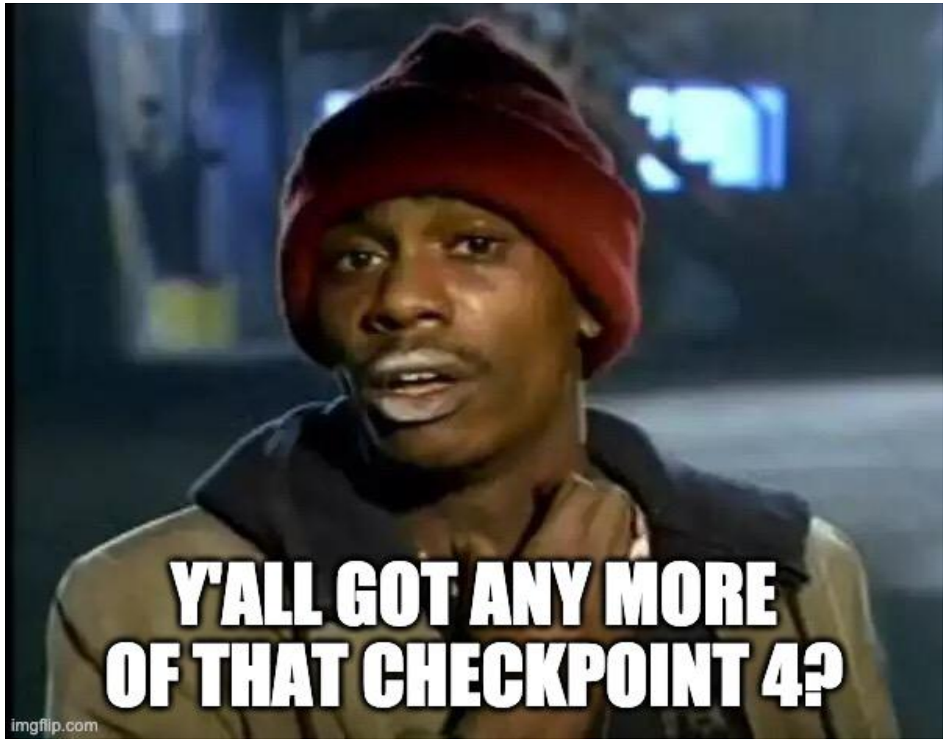
Y'ALL GOT ANY MORE OF THAT CHECKPOINT 4?
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Announcements & Reminders

- MP3.5 is due Sunday (Dec 4th) at 5:59:59pm in gitlab
- Final demo be on Sunday 4th night, Monday 5th and Tuesday 6th
  - Details will be posted later
  - All Team members *MUST* be present at final demo
- Final exam
  - Tuesday (Dec 13th) at 7:00pm to 10:00pm

MP3.5 Multiple Terminals

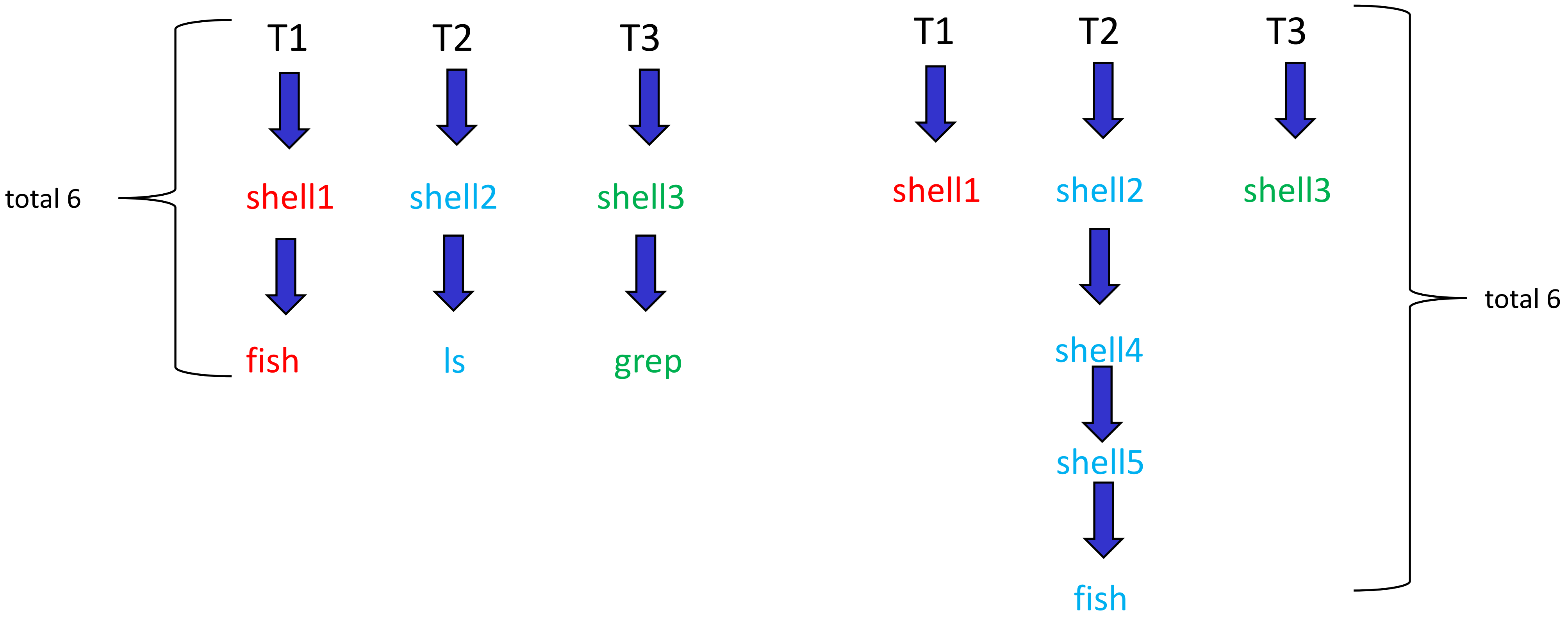
- Support 3 terminals (ALT+F# to switch between)
  - Initial bootup method: have all 3 terminals running shell
  - After bootup method: first time you press ALT+F2/ALT+F3, boot up terminal 2/3
  - Should be able to switch as fast as possible – no crashing!

Example coming up

MP3.5 Multiple Terminals

Support at least 6 processes total

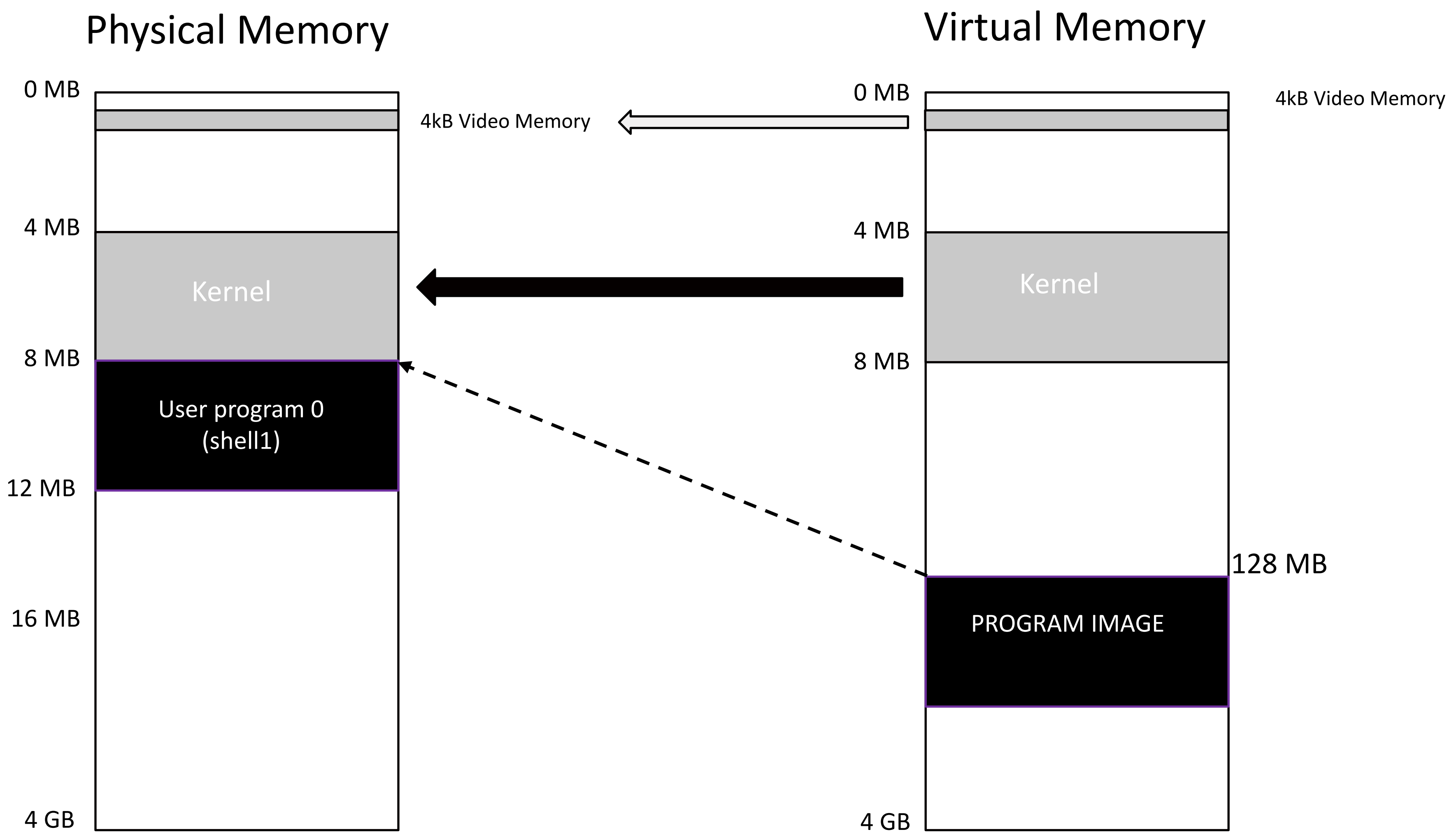
- How to manage 6 processes? Up to you…
- Don't crash or page fault on the 7th



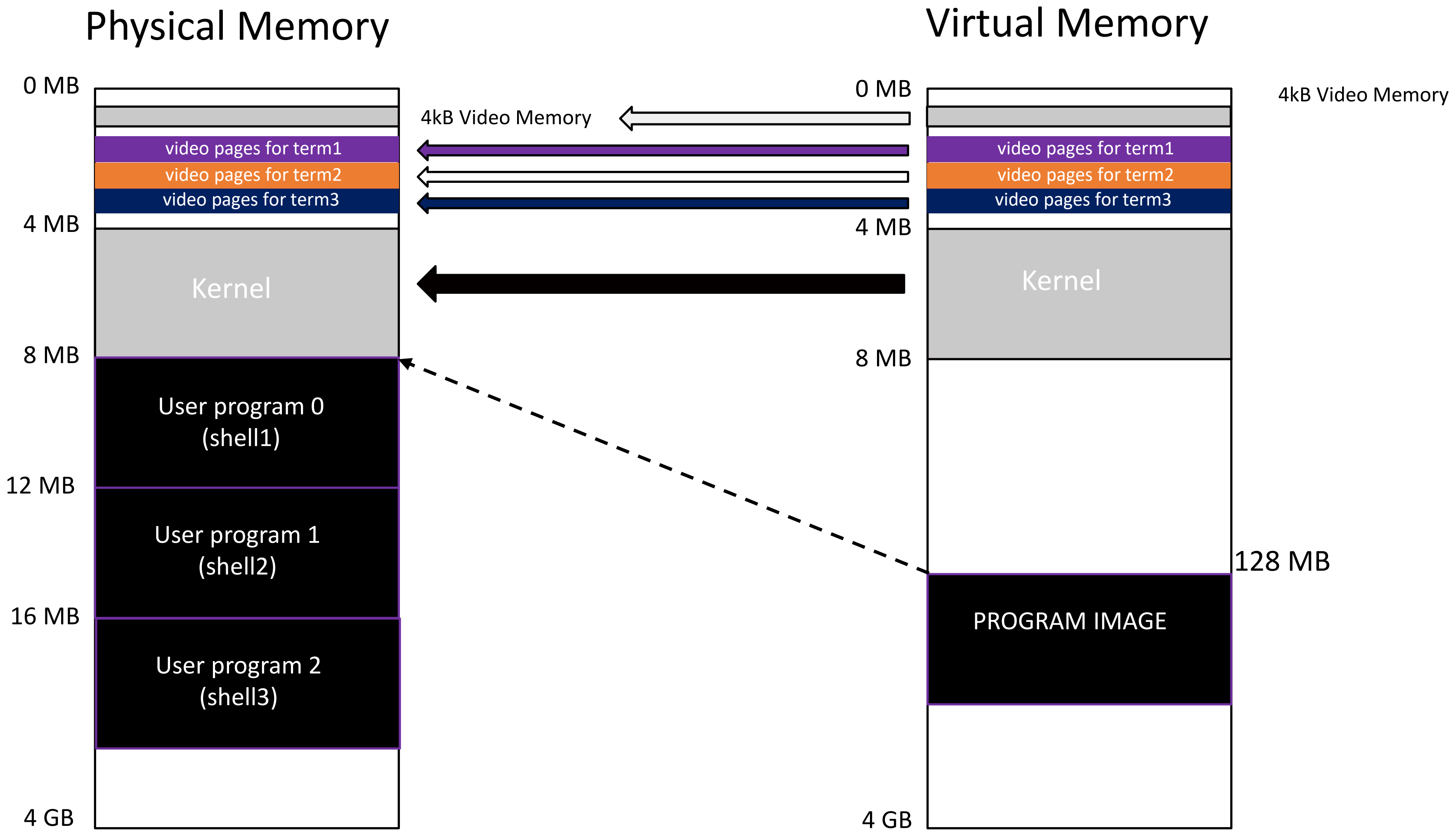
MP3.5 Multiple Terminals

- Separate input buffer per terminal, save current text screen/cursor position/anything relevant to your OS
- Exiting any shell does not exit other shells
- Exiting last shell: re-launch shell or prevent last one from being halted

Single Terminal



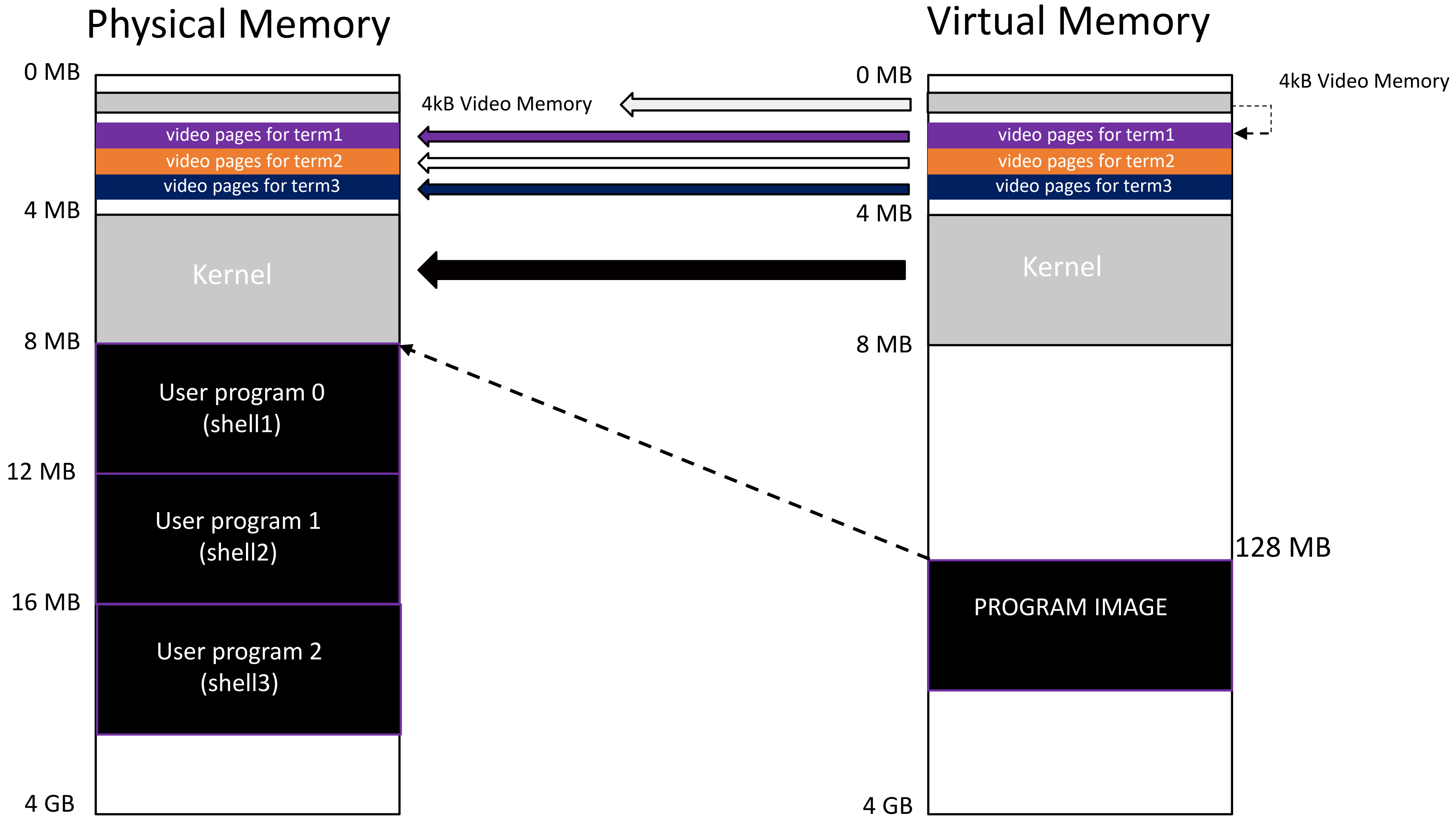
Three Terminals: Terminal 1 in use



What happens when you switch to another terminal?

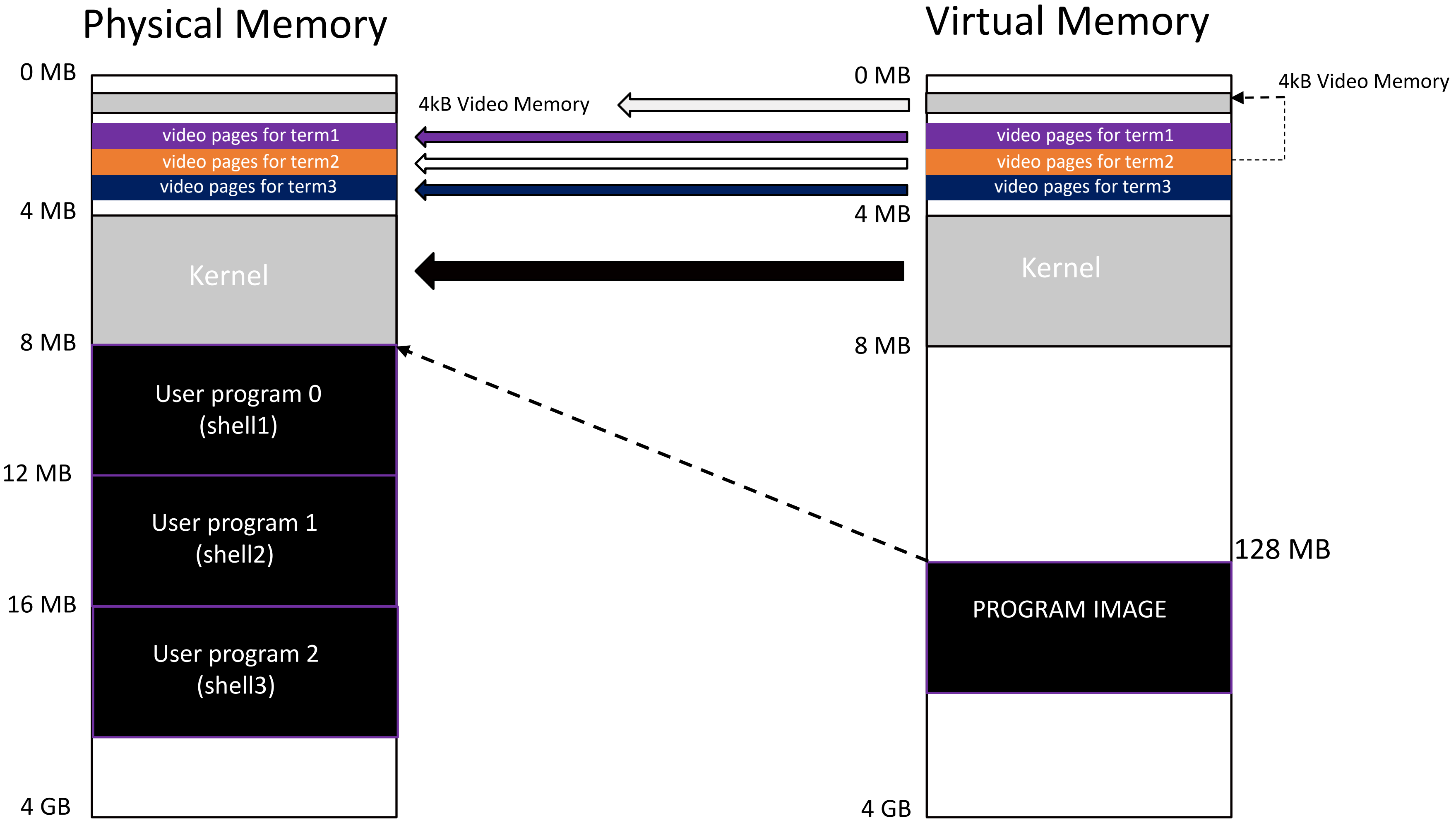
Three Terminals: Terminal 1 -> Terminal 2

1. Save terminal 1 screen to video page assigned for it



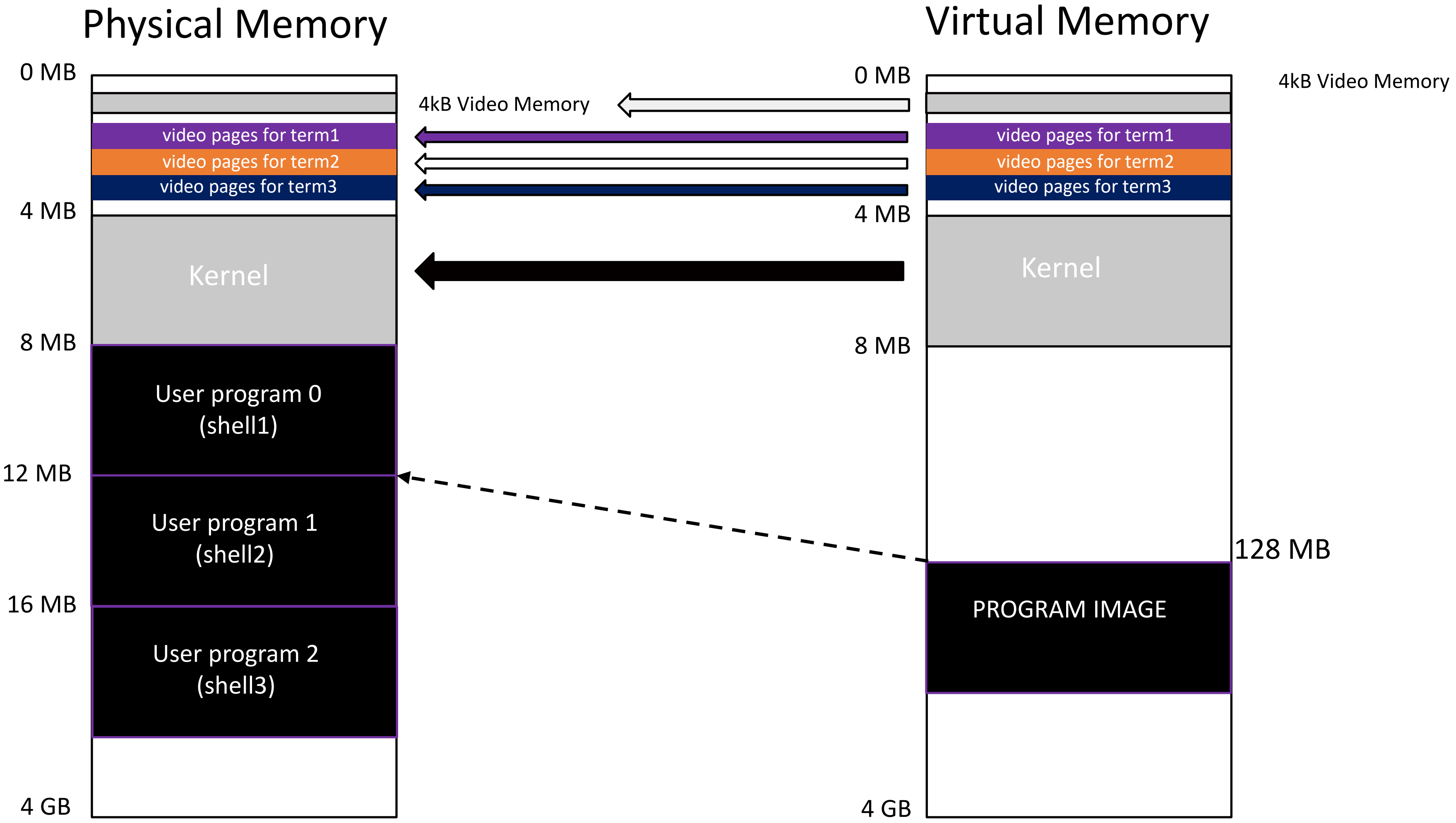
Three Terminals: Terminal 1 -> Terminal 2

2. Restore terminal 2’s screen to video memory



Three Terminals: Terminal 1 -> Terminal 2

3. Switch execution to terminal 2's user program



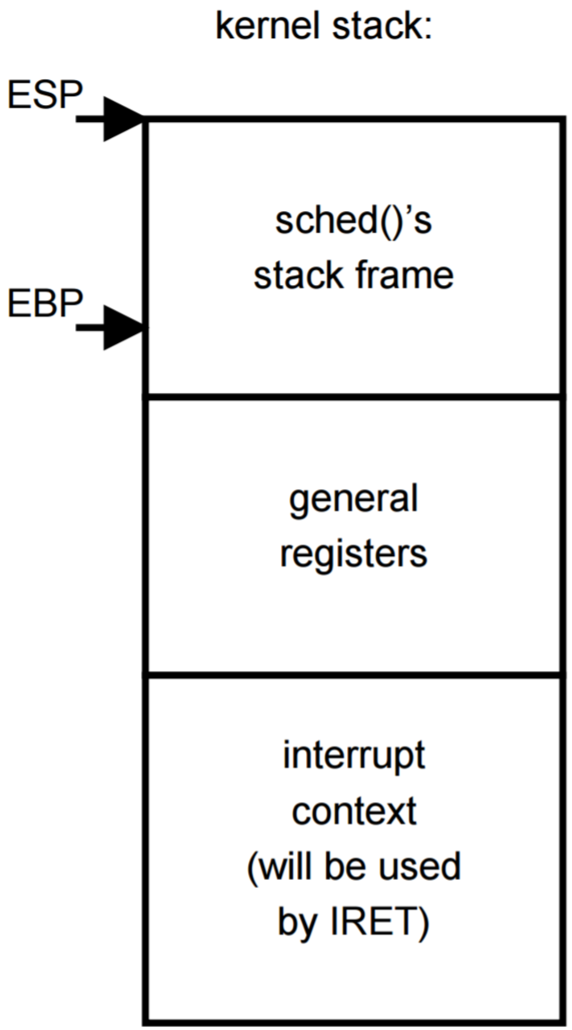
MP3.5 Scheduling

- Fixed/equal time slices with round-robin
- Use PIT (not RTC…why?)
  - Think about device priority and frequencies
- When typing, the characters should appear on the visible terminal (not the scheduled terminal)
- Test with counter, pingpong, fish
- Be mindful of timing/synchronization issues

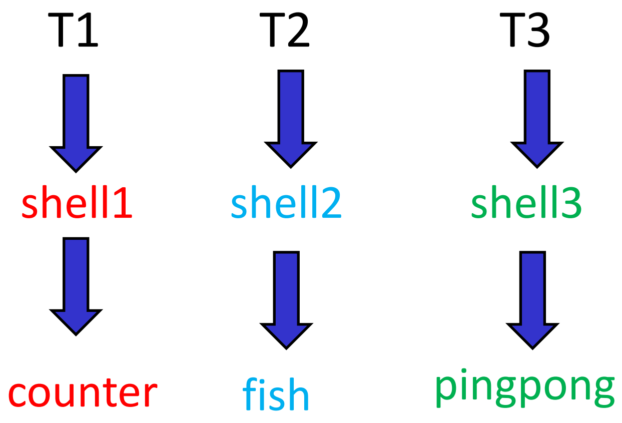
MP3.5 Scheduling

- Utilize the kernel stack (think about what you did for
  - You will be using assembly to do the context switch
  - Switch ESP/EBP to next process’ kernel stack
  - Restore next process’ TSS
  - Flush TLB on process switch

Example coming up



MP3.5 Scheduling

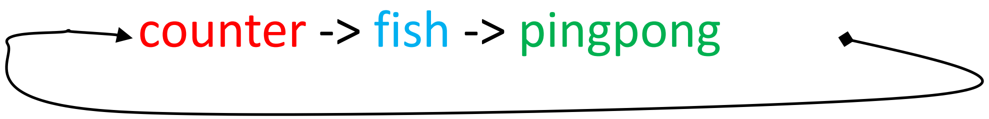


T1 → shell1 → counter

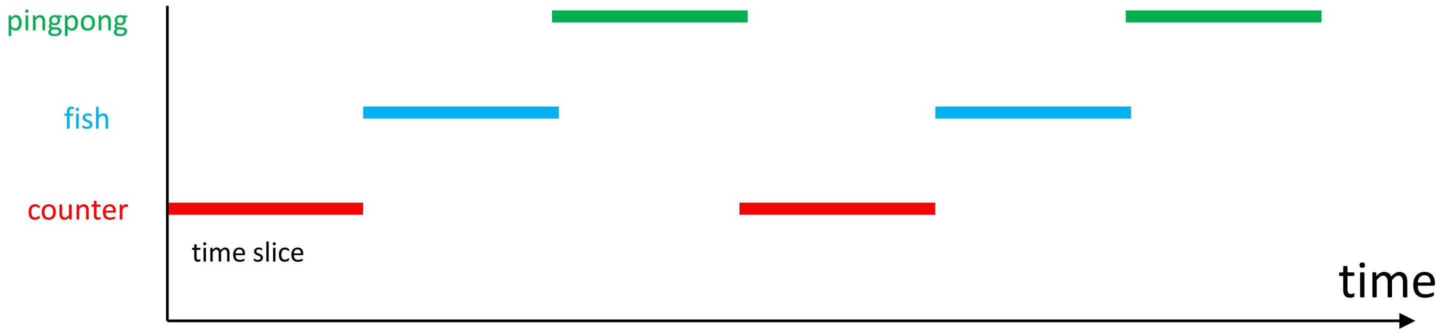
T2 → shell2 → fish

T3 → shell3 → pingpong

Round Robin scheduling



counter -> fish -> pingpong

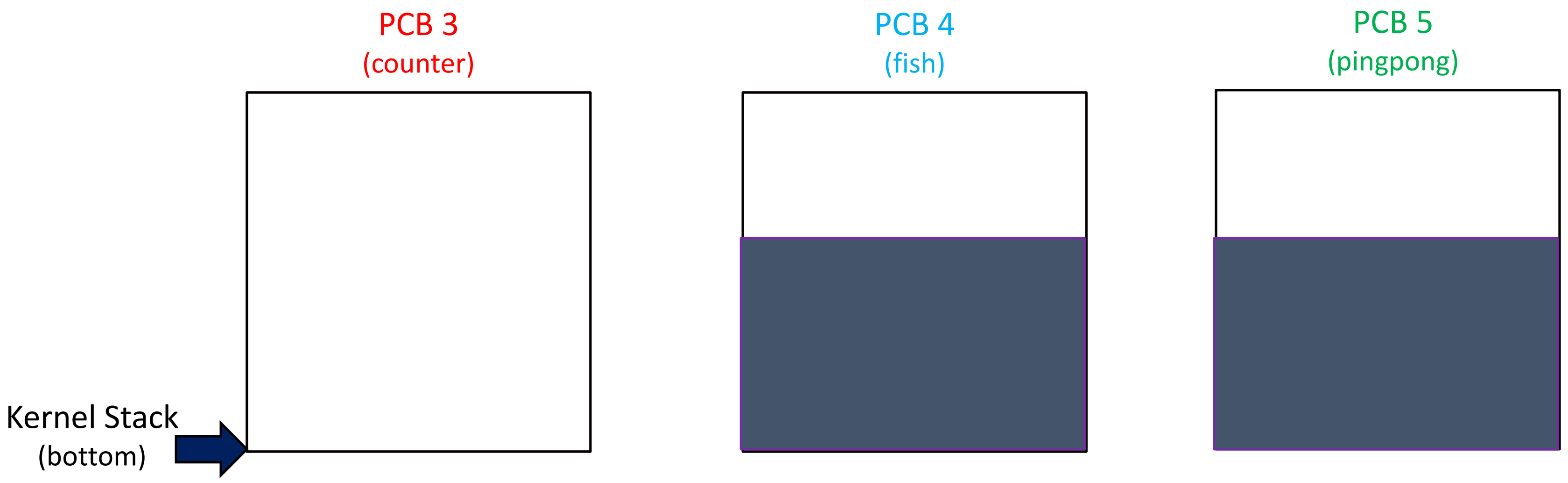


MP3.5 Scheduling

Setup:

Terminal 1: P0 shell -> P3 counter
Terminal 1: P1 shell -> P4 fish
Terminal 1: P2 shell -> P5 pingpong

1) Counter is executing

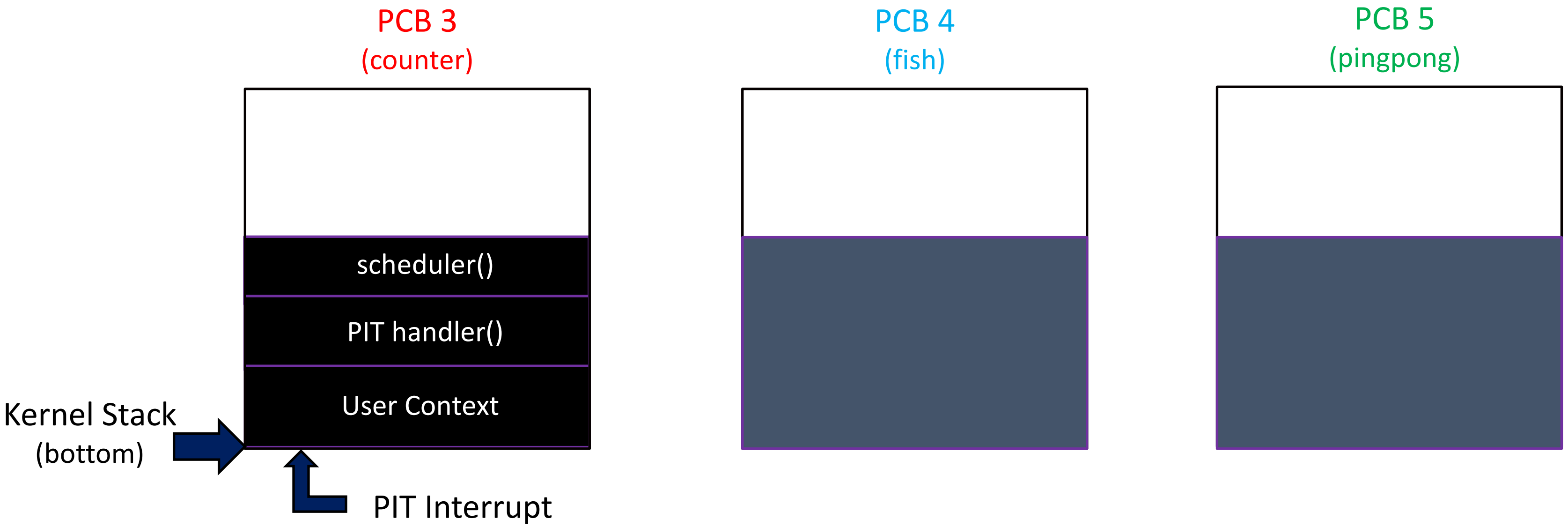


MP3.5 Scheduling

Setup:

Terminal 1: P0 shell -> P3 counter
Terminal 1: P1 shell -> P4 fish
Terminal 1: P2 shell -> P5 pingpong

2) A PIT Interrupt occurs -> PIT handler executes -> Calls scheduling algorithm

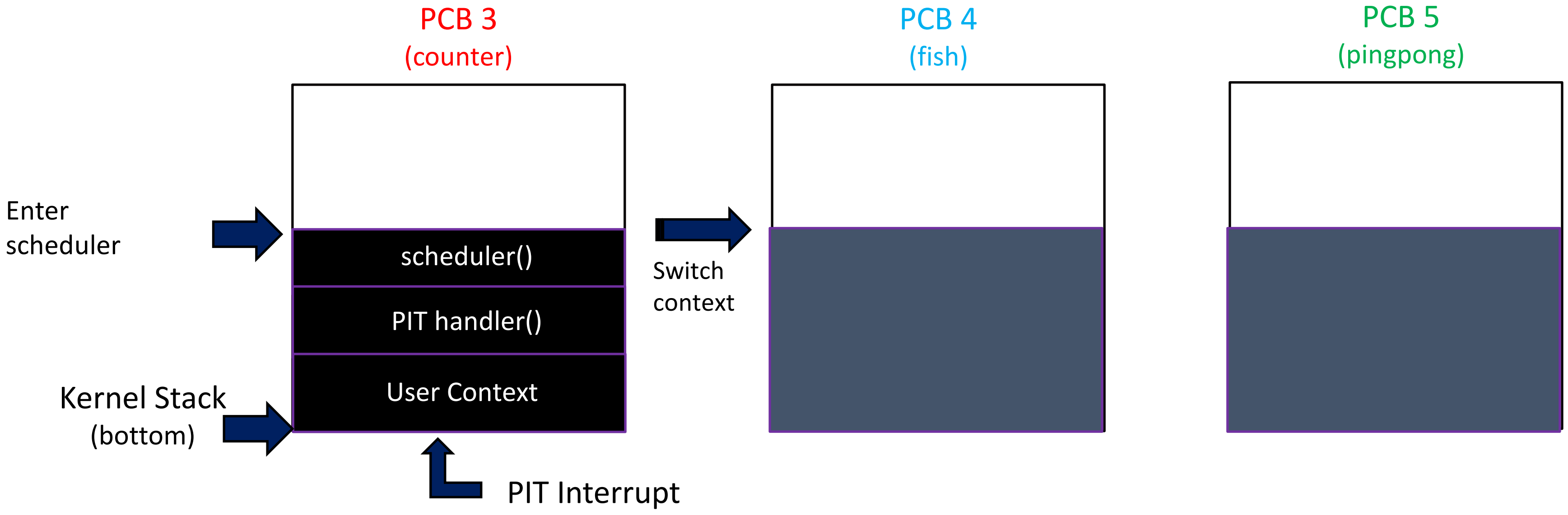


MP3.5 Scheduling

Setup:

Terminal 1: P0 shell -> P3 counter
Terminal 1: P1 shell -> P4 fish
Terminal 1: P2 shell -> P5 pingpong

3) Context switch to next program in scheduling queue



MP3.5 Scheduling

Setup:

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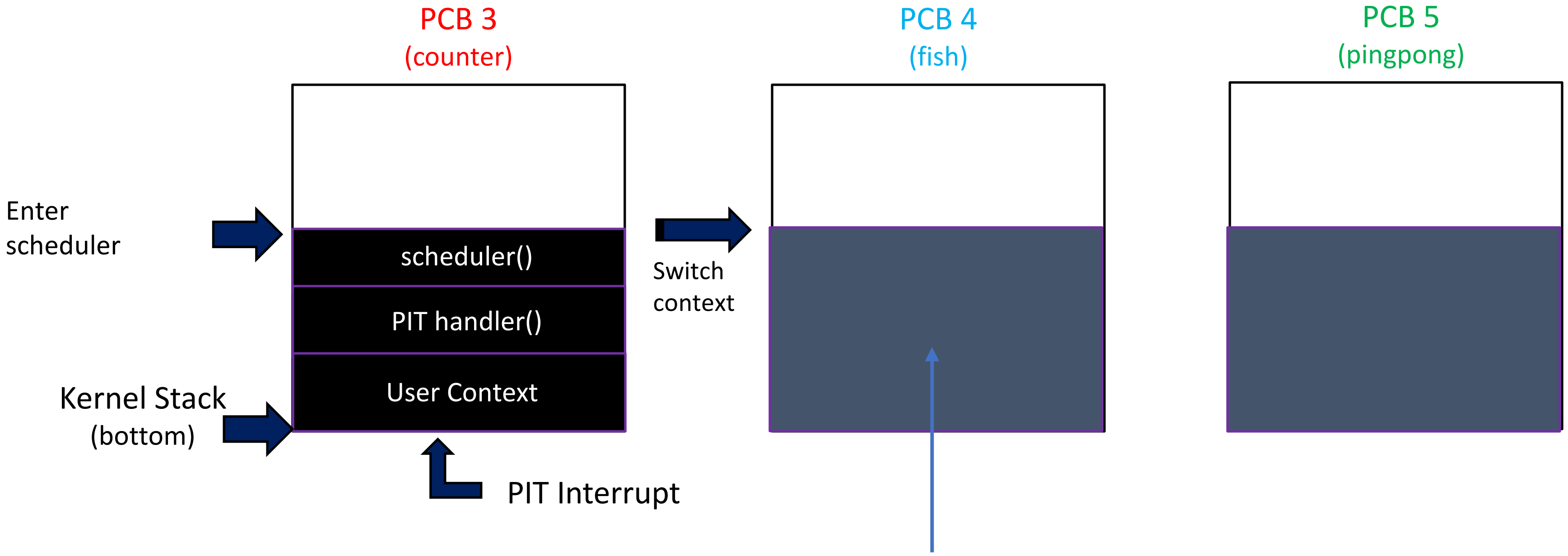


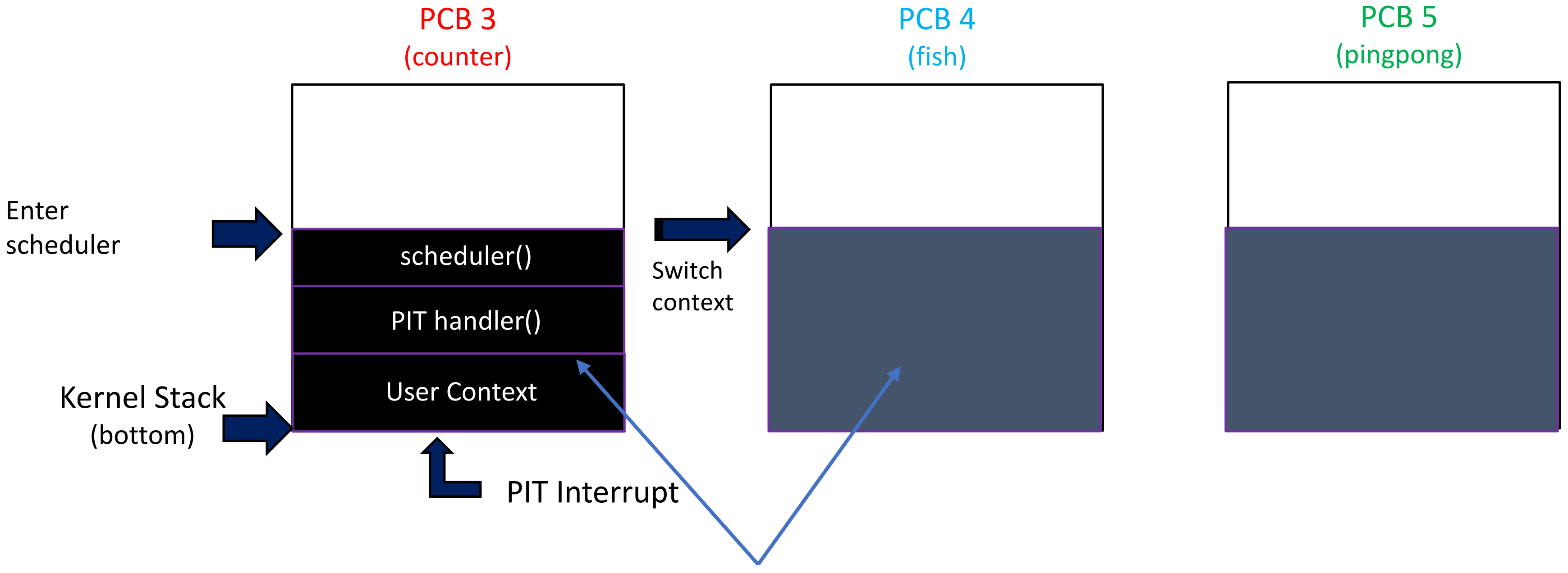
But whats here?

MP3.5 Scheduling

Setup:

Terminal 1: P0 shell -> P3 counter
Terminal 1: P1 shell -> P4 fish
Terminal 1: P2 shell -> P5 pingpong

3) Context switch to next program in scheduling queue



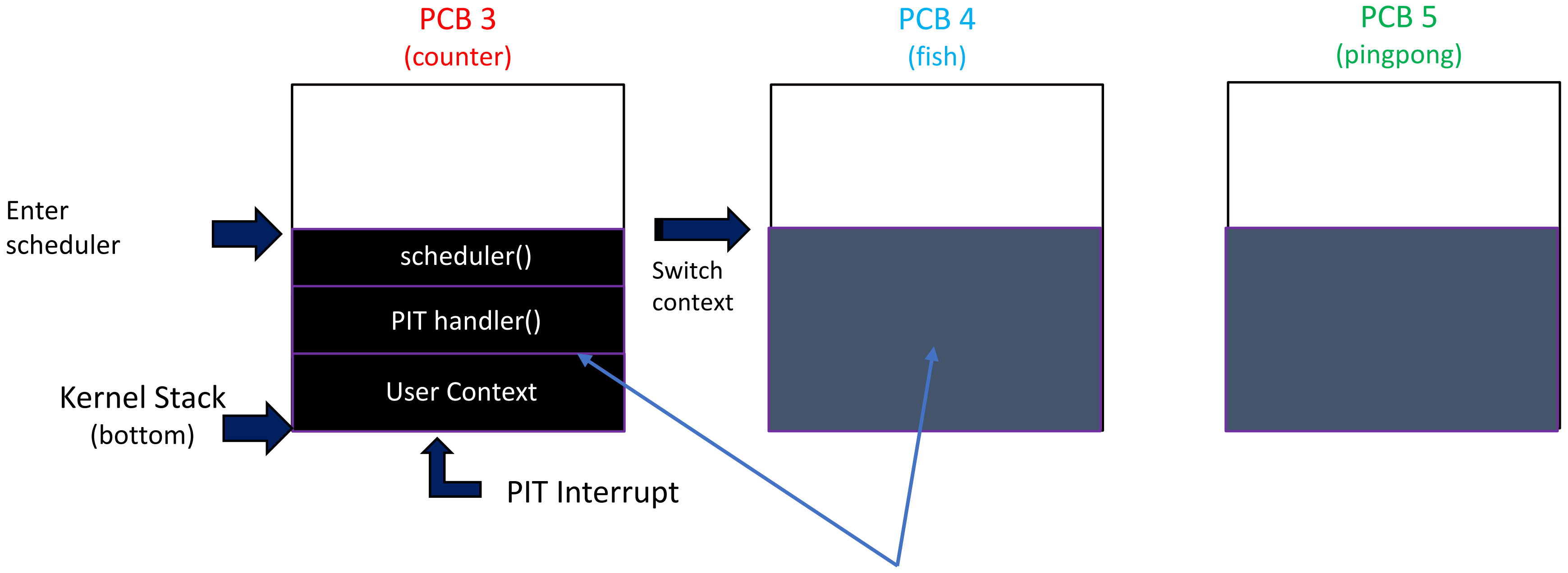
The same thing that’s here. Why?

MP3.5 Scheduling

Setup:

Terminal 1: P0 shell -> P3 counter
Terminal 1: P1 shell -> P4 fish
Terminal 1: P2 shell -> P5 pingpong

3) Context switch to next program in scheduling queue



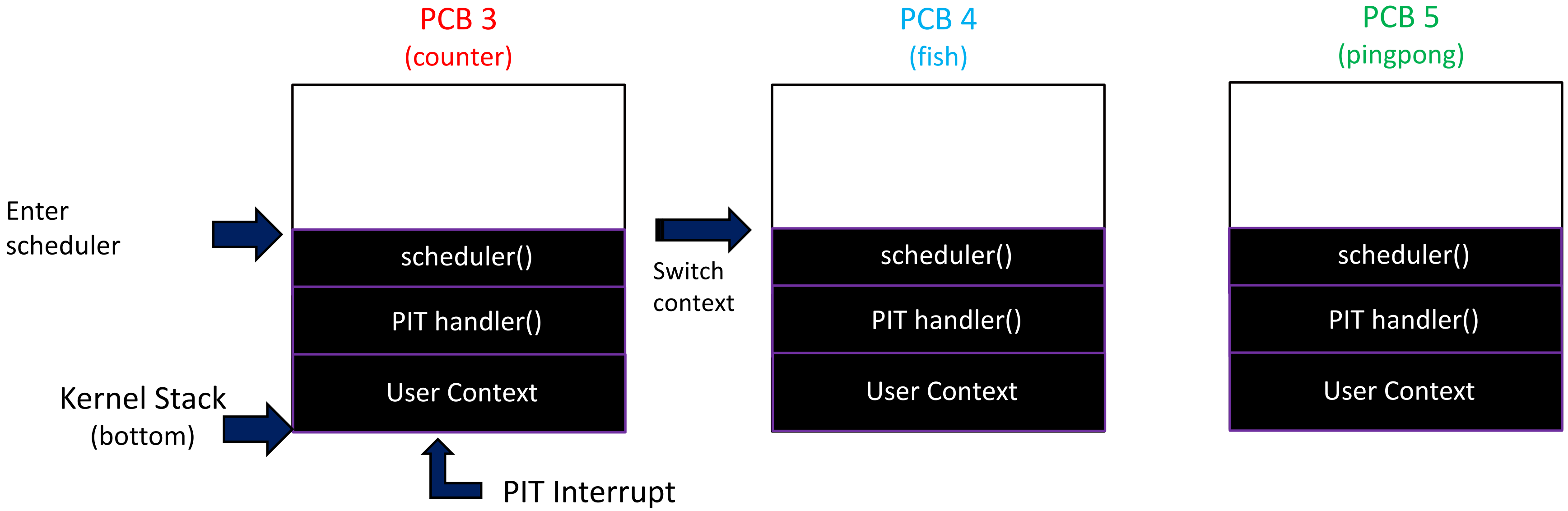
Only one way to get out of a process - the scheduler!

MP3.5 Scheduling

Setup:

Terminal 1: P0 shell -> P3 counter
Terminal 1: P1 shell -> P4 fish
Terminal 1: P2 shell -> P5 pingpong

3) Context switch to next program in scheduling queue

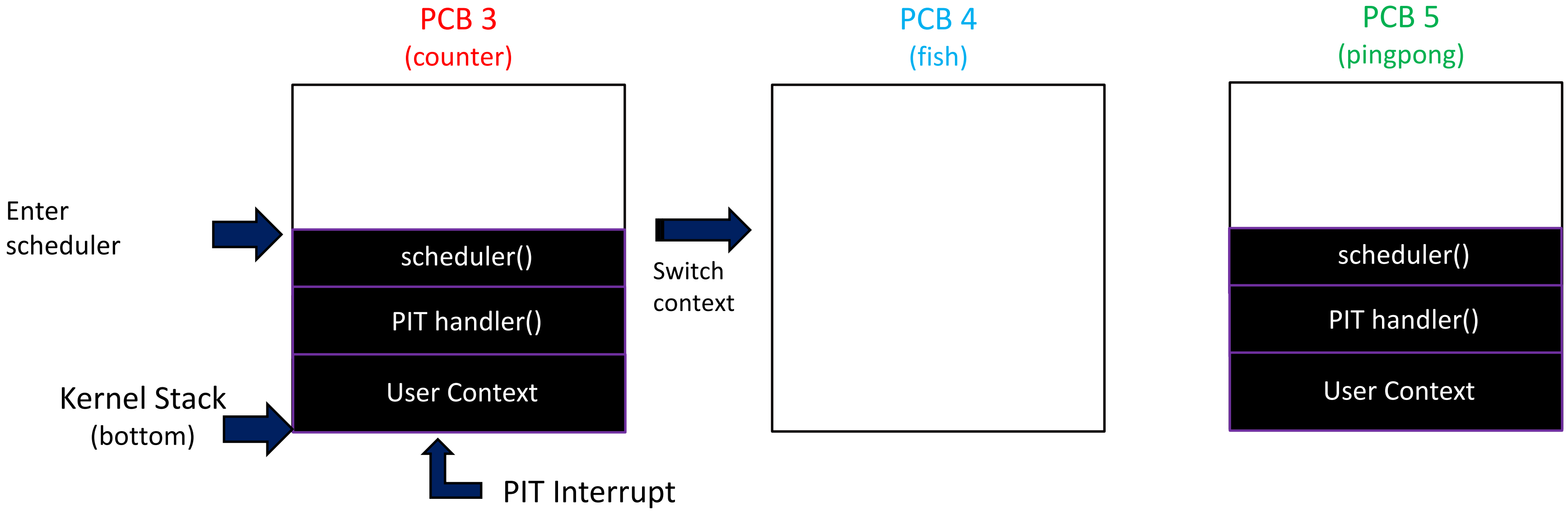


MP3.5 Scheduling

Setup:

Terminal 1: P0 shell -> P3 counter
Terminal 1: P1 shell -> P4 fish
Terminal 1: P2 shell -> P5 pingpong

4) Return from PIT handler and execute fish

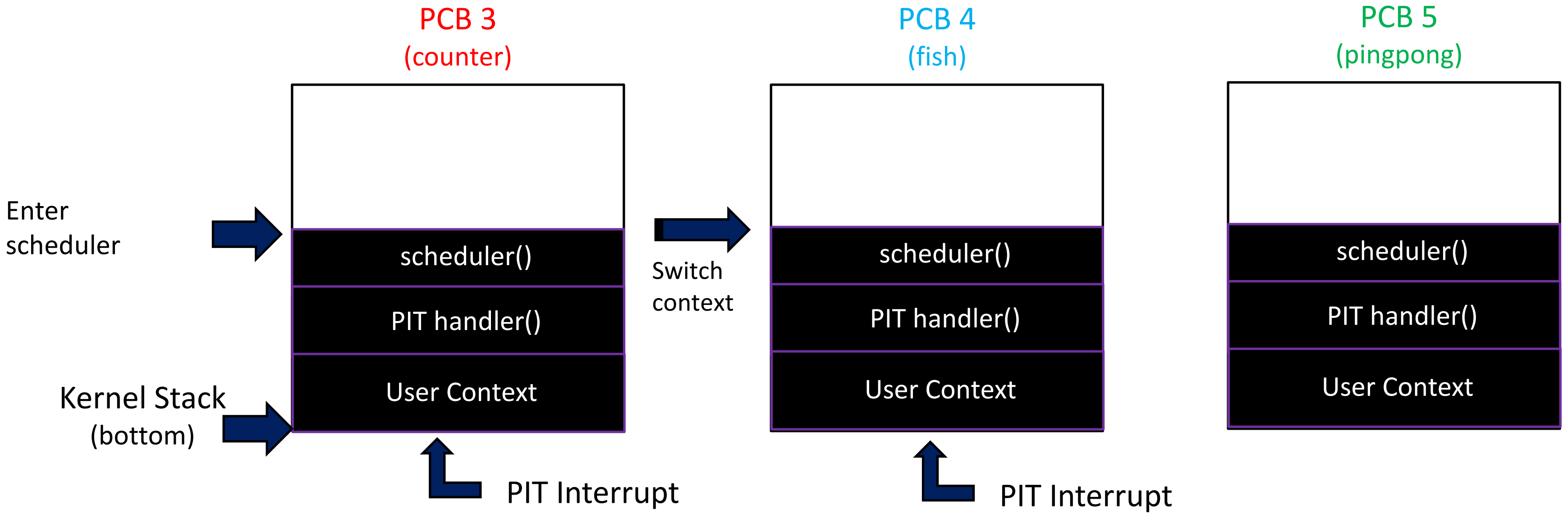


MP3.5 Scheduling

Setup:

Terminal 1: P0 shell -> P3 counter
Terminal 1: P1 shell -> P4 fish
Terminal 1: P2 shell -> P5 pingpong

5) Another PIT interrupt occurs!

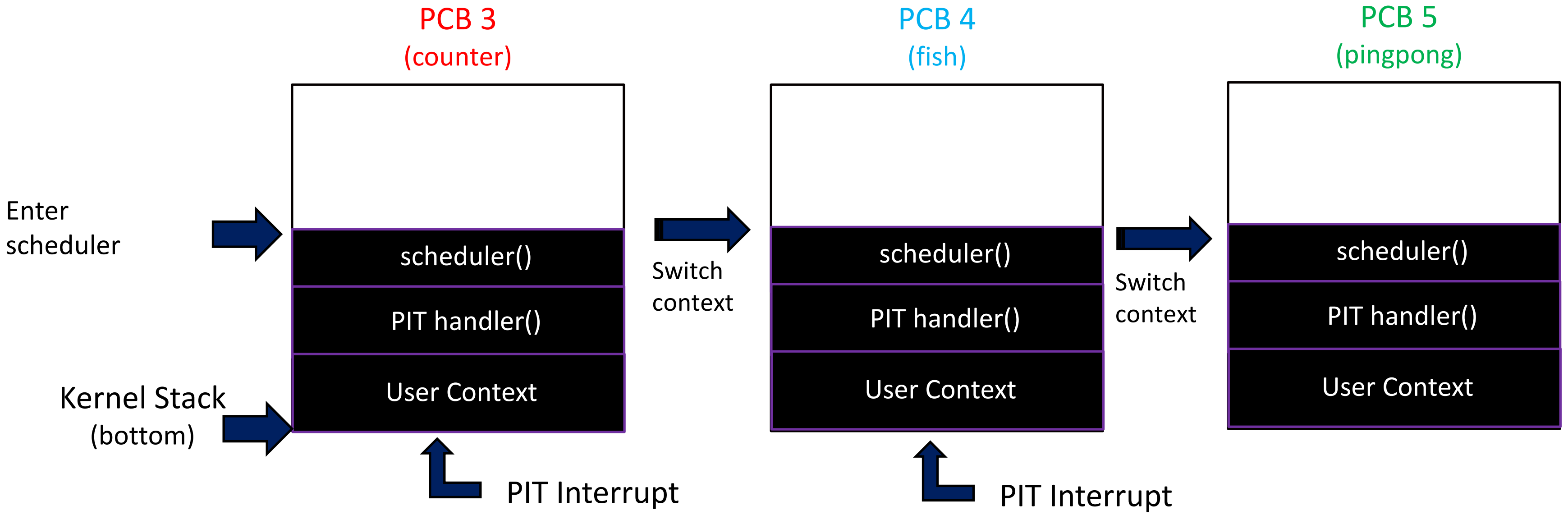


MP3.5 Scheduling

Setup:

Terminal 1: P0 shell -> P3 counter
Terminal 1: P1 shell -> P4 fish
Terminal 1: P2 shell -> P5 pingpong

6) Context switch to pingpong

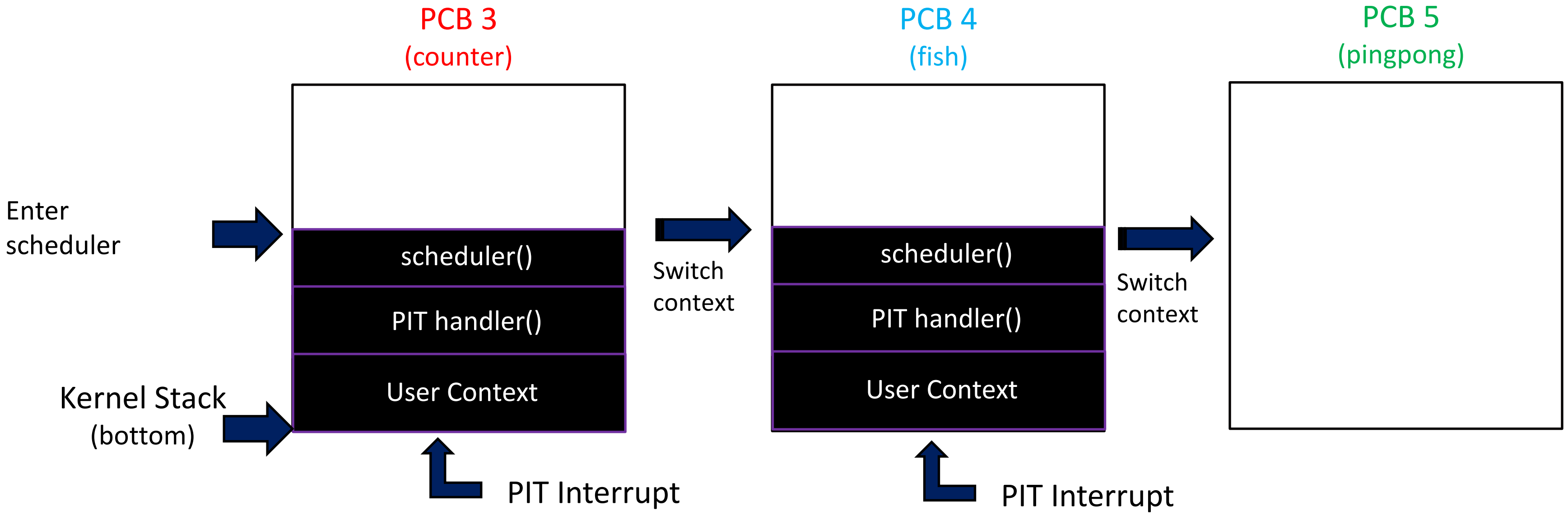


MP3.5 Scheduling

Setup:

Terminal 1: P0 shell -> P3 counter
Terminal 1: P1 shell -> P4 fish
Terminal 1: P2 shell -> P5 pingpong

7) Return from PIT Handler and execute pingpong

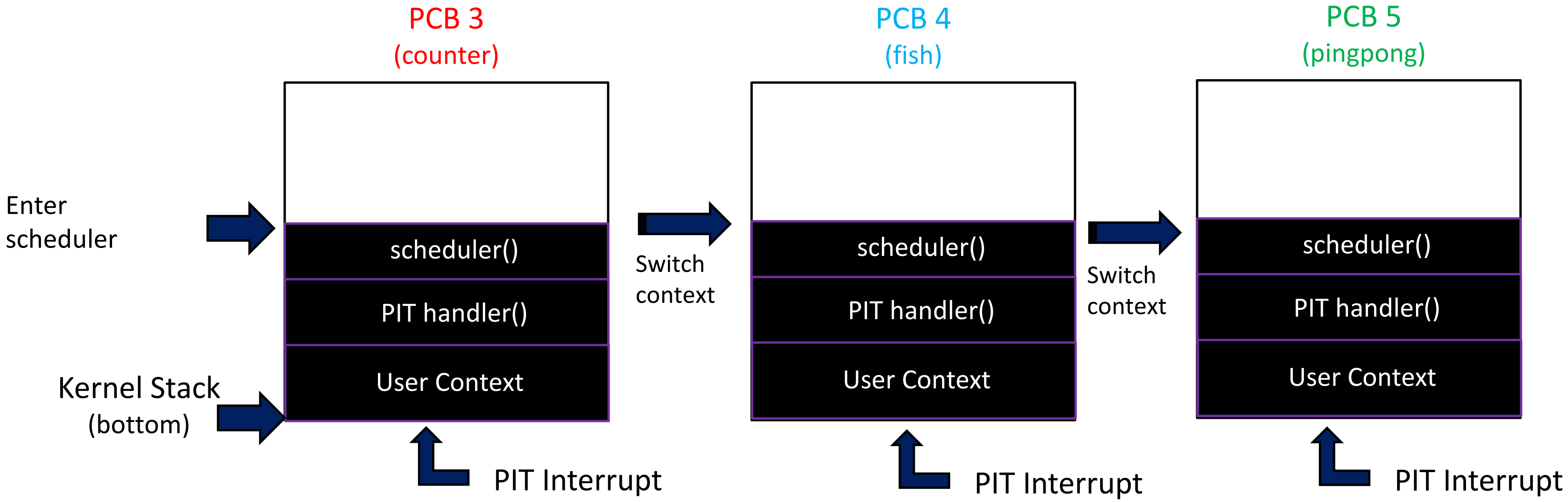


MP3.5 Scheduling

Setup:

Terminal 1: P0 shell -> P3 counter
Terminal 1: P1 shell -> P4 fish
Terminal 1: P2 shell -> P5 pingpong

8) Another PIT Interrupt occurs!

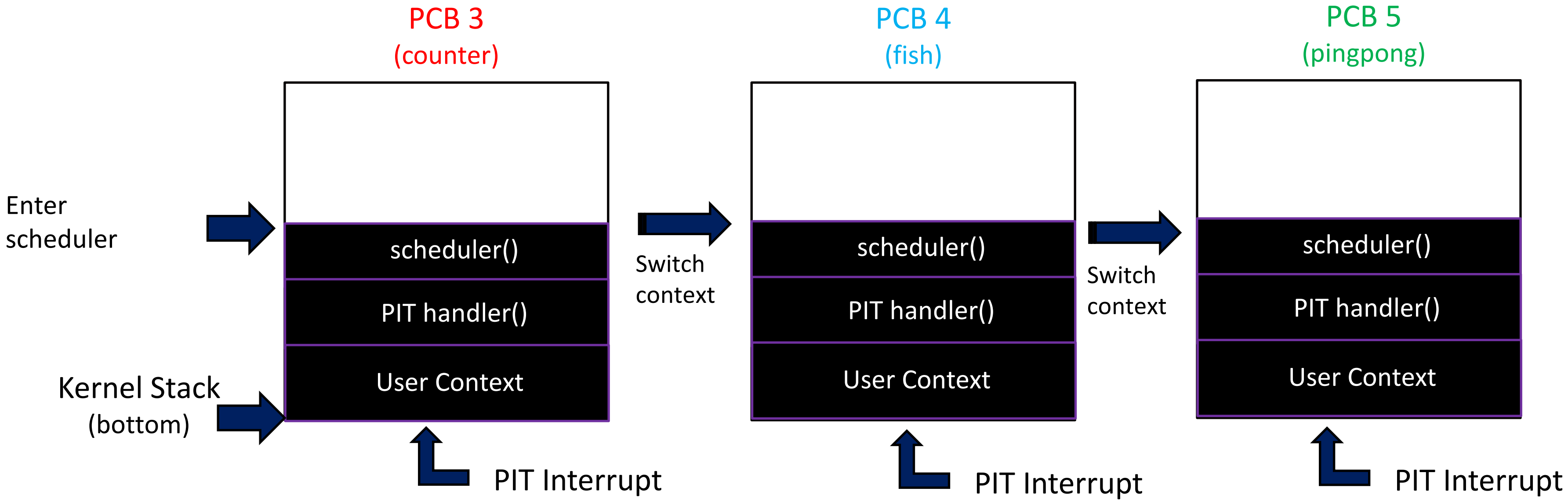


MP3.5 Scheduling

Setup:

Terminal 1: P0 shell -> P3 counter
Terminal 1: P1 shell -> P4 fish
Terminal 1: P2 shell -> P5 pingpong

9) Context switch to counter and execute it



AND
ANOTHER ONE

Sounds hard right?

It is.
Use your 2 weeks wisely

But wait, there's more!

They have to work together

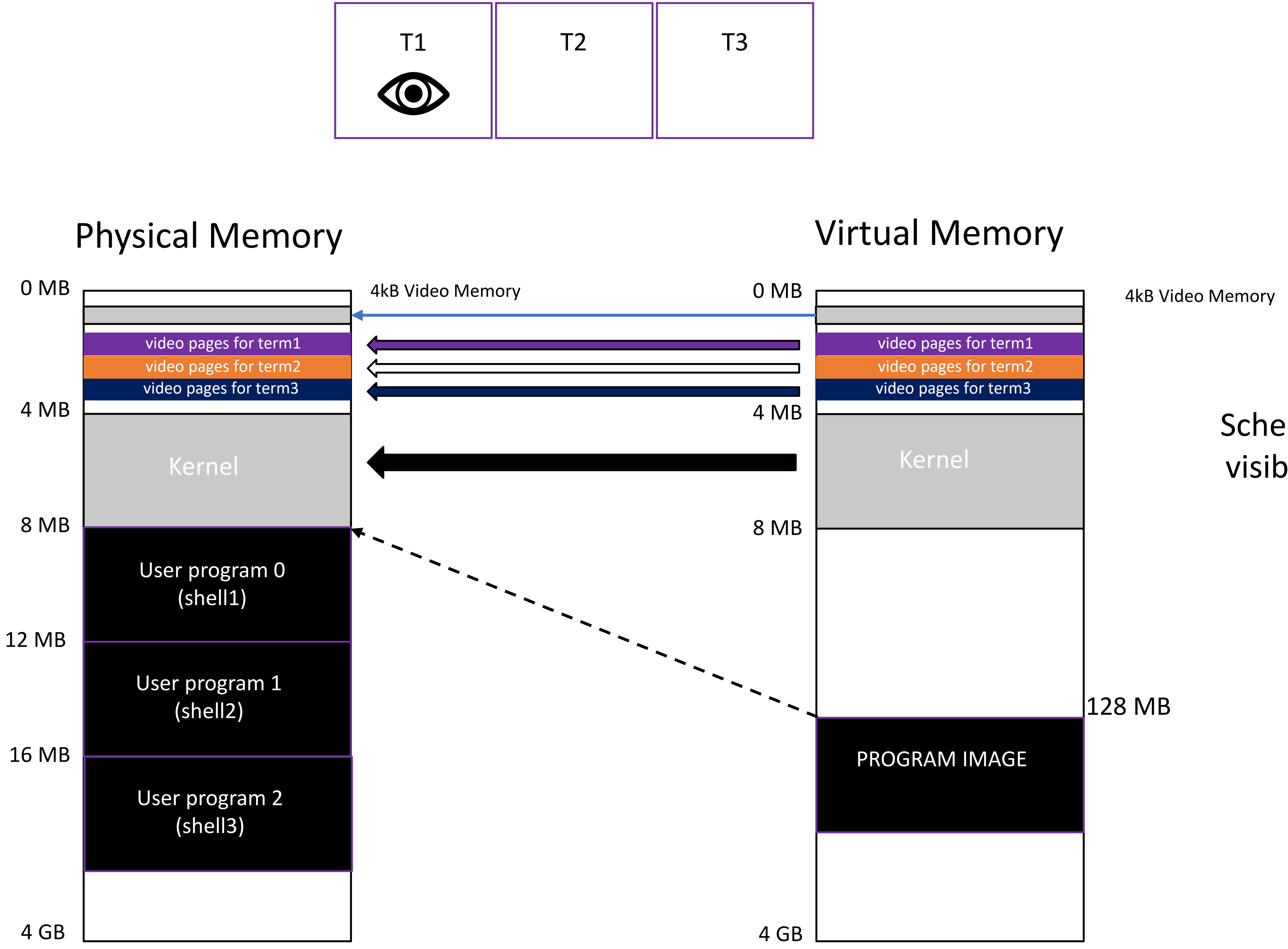
Implement Scheduler and Multiple Terminals separately

Implement Scheduler and Multiple Terminals together

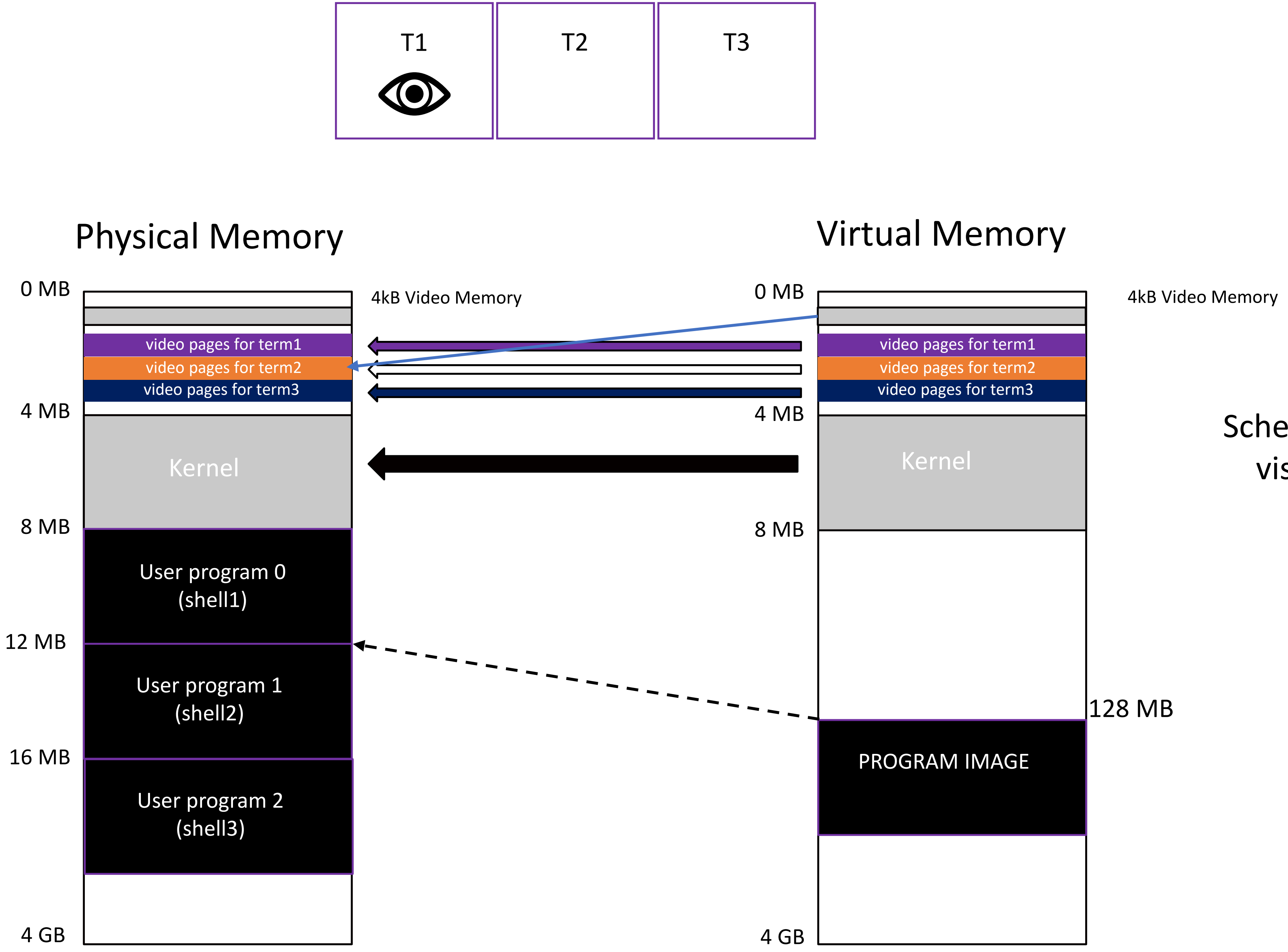
MP3.5

- The current scheduled process DOES NOT have to be the one running on the current terminal
- If currently scheduled process is not visible, write to background, not to main video memory
- Be careful with vidmap!

Example coming up



Scheduled process and visible process are the same



T1

T2

T3

Physical Memory

0 MB

4kB Video Memory

video pages for term1

video pages for term2

video pages for term3

4 MB

Kernel

8 MB

User program 0
(shell1)

12 MB

User program 1
(shell2)

16 MB

User program 2
(shell3)

4 GB

Virtual Memory

0 MB

4kB Video Memory

video pages for term1

video pages for term2

video pages for term3

4 MB

Kernel

8 MB

128 MB

PROGRAM IMAGE

4 GB

Scheduled process and visible process are different