Operating Systems!

Memory: Approaches to Memory Management (Part 5)

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CS 460 - Operating Systems

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https://www.cs.montana.edu/cs460

Some diagrams and notes used in this slide deck have been adapted from Sean Smith's OS courses @ Dartmouth. Thanks, Sean!

Today

- Announcements
  - ~~Yalnix~~ How are projects/proposals going?! ☺
  - *Exam 1: Nice work!*

- Upcoming Deadlines
  - **Sunday [10/18/2020] @ 11:59 PM (MST)** - PA3 (Group Assignment)

    Yalnix teams: *While PA3 == yalnix checkpoint 1, you should plan to be near completing checkpoint 2 at this point!*

  - **Sunday [10/25/2020] @ 11:59 PM (MST)** - Project Proposal

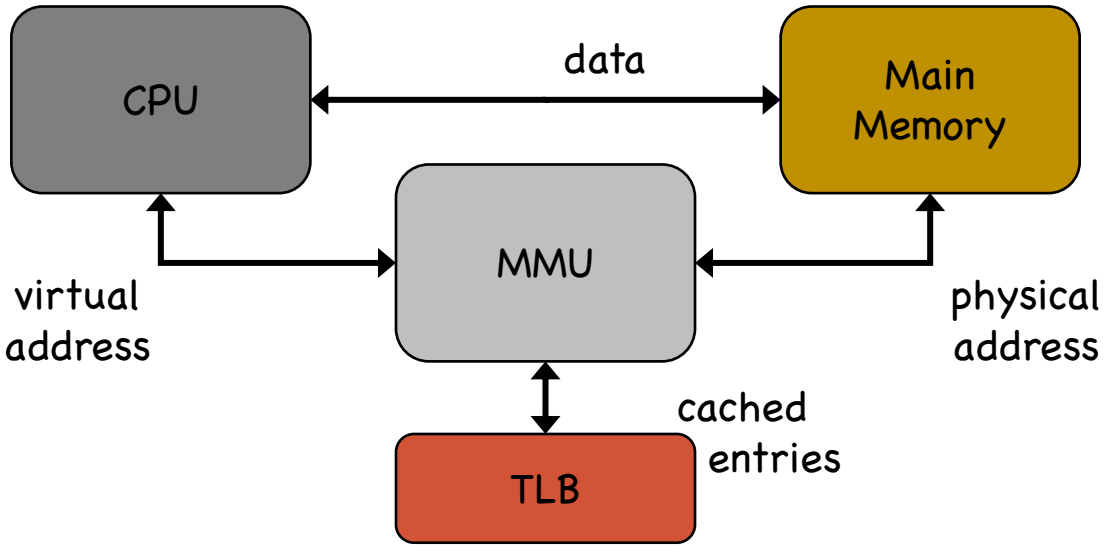
    Yalnix teams: *you should plan to be near completing checkpoint 3 at this point!*

Today *(cont.)*

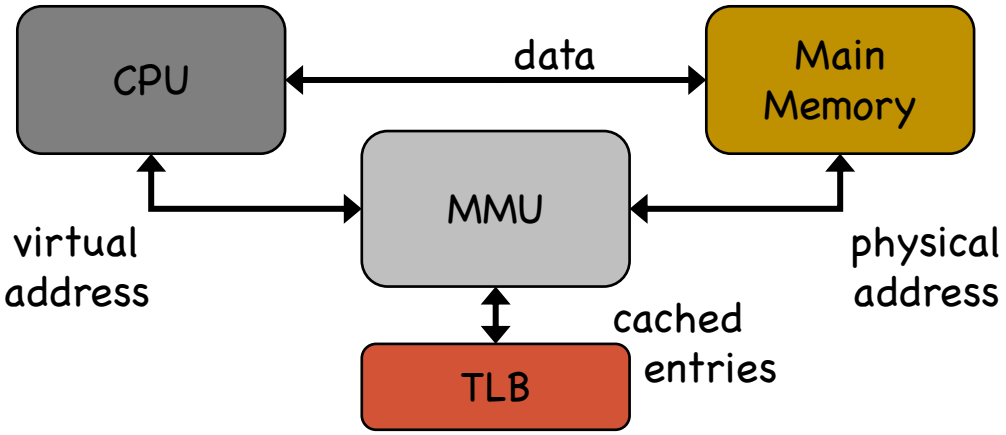
Last Week: Logical vs. Physical Addresses, Paging, Address Translation, ...

- Agenda
  - ~~Page Tables~~
  - ~~Heaps~~ → ~~review fault.c 3,4~~
  - ~~Stacks~~ → ~~(quickly) review fault.c 5,6,7 + sf.c~~
  - ~~Page Tables (Practical Issues)~~
  - ~~The TLB~~
  - Switching Processes & the TLB
  - Revisiting Syscalls
  - Memory Variations
  - Paging to Disk

➔ Virtual Memory



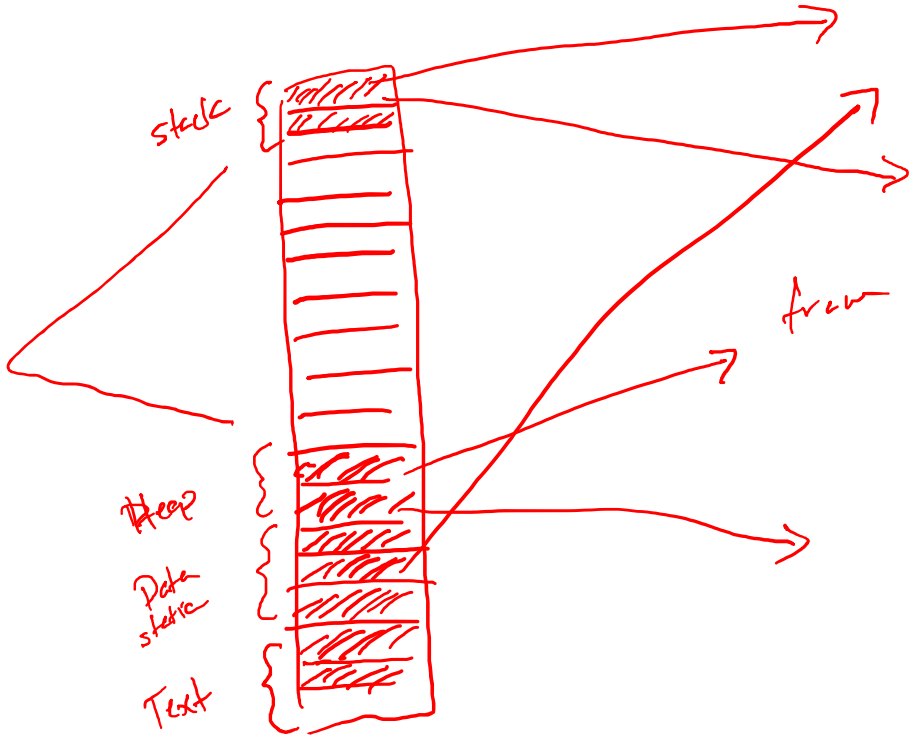
Recap



Fundamental concept #1: the ***logical addresses*** (which the process and CPU see) do not have to be the same as the ***physical addresses*** the memory sees.

Fundamental concept #2: if we break logical address spaces into ***pages*** and physical memory into ***frames***, it can make things a lot easier....

Fundamental concept #3: address translation then consists of the ***MMU*** looking up the ***frame number*** matching a ***page number***. The ***page table*** stores this mapping. TLBs mitigate the increased cost of translation. (But, like toilets, it's important to remember to flush them...)

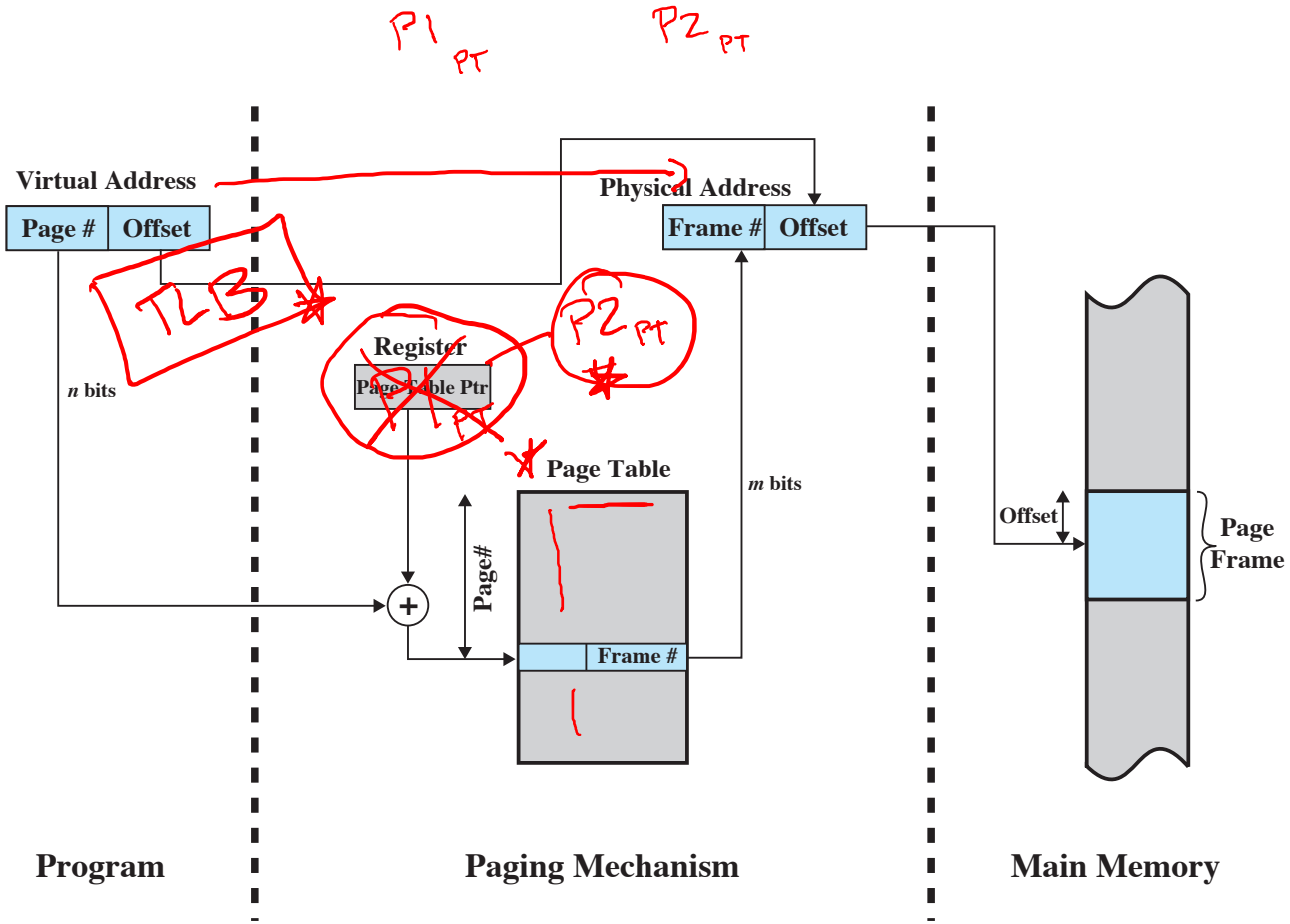


Switching Processes & The TLB

Leftover from last time....

Switching Processes & The TLB

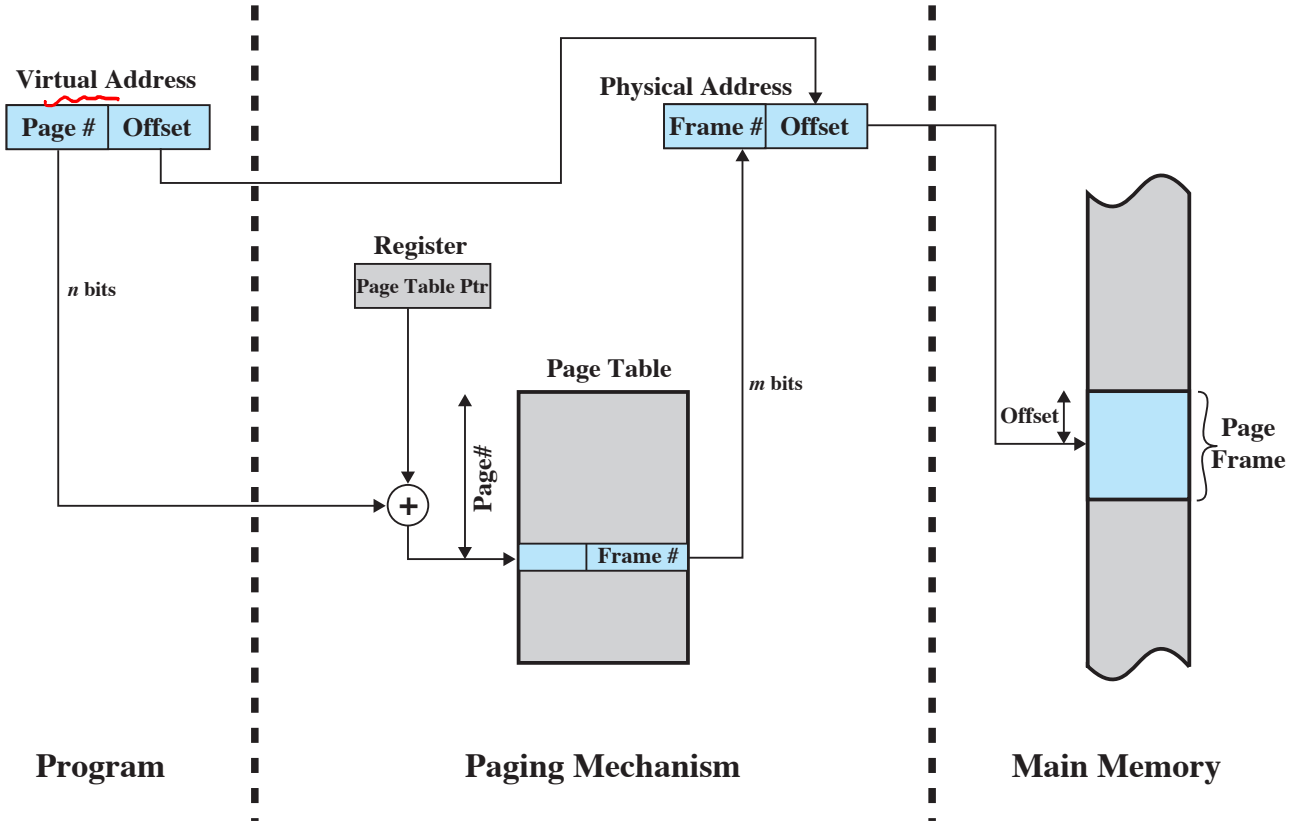
- So what do we need to do when we switch processes?
- Anything else?



Switching Processes & The TLB

- So what do we need to do when we switch processes?
  -> *Switch the page table (registers)!*

- Anything else?
  -> *Flush the TLB! (Why?!)*



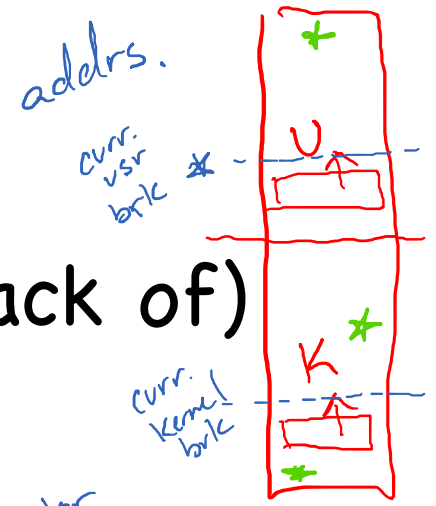
Revisiting Important Syscalls

Using our new knowledge, let us revisit some critical ideas around syscalls

Brk and Sbrk

brk(addr)

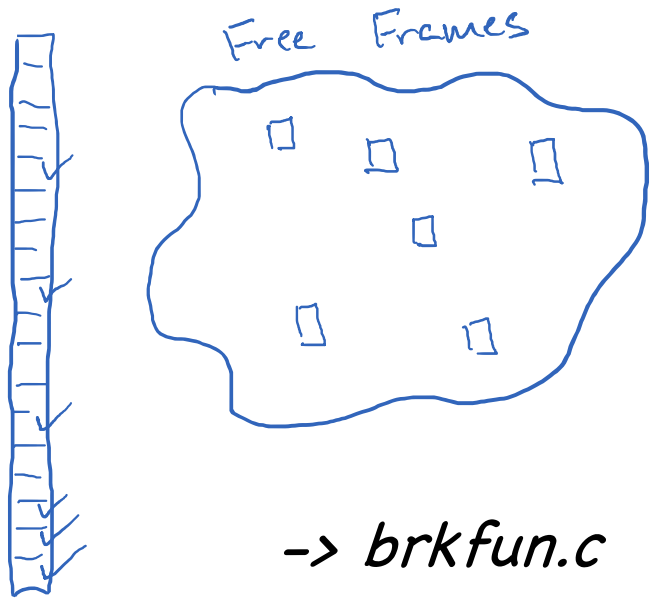
sbrk(delta)



What must the OS need to do (and keep track of) to implement these syscalls?

Error checking + validness checking → failing gracefully

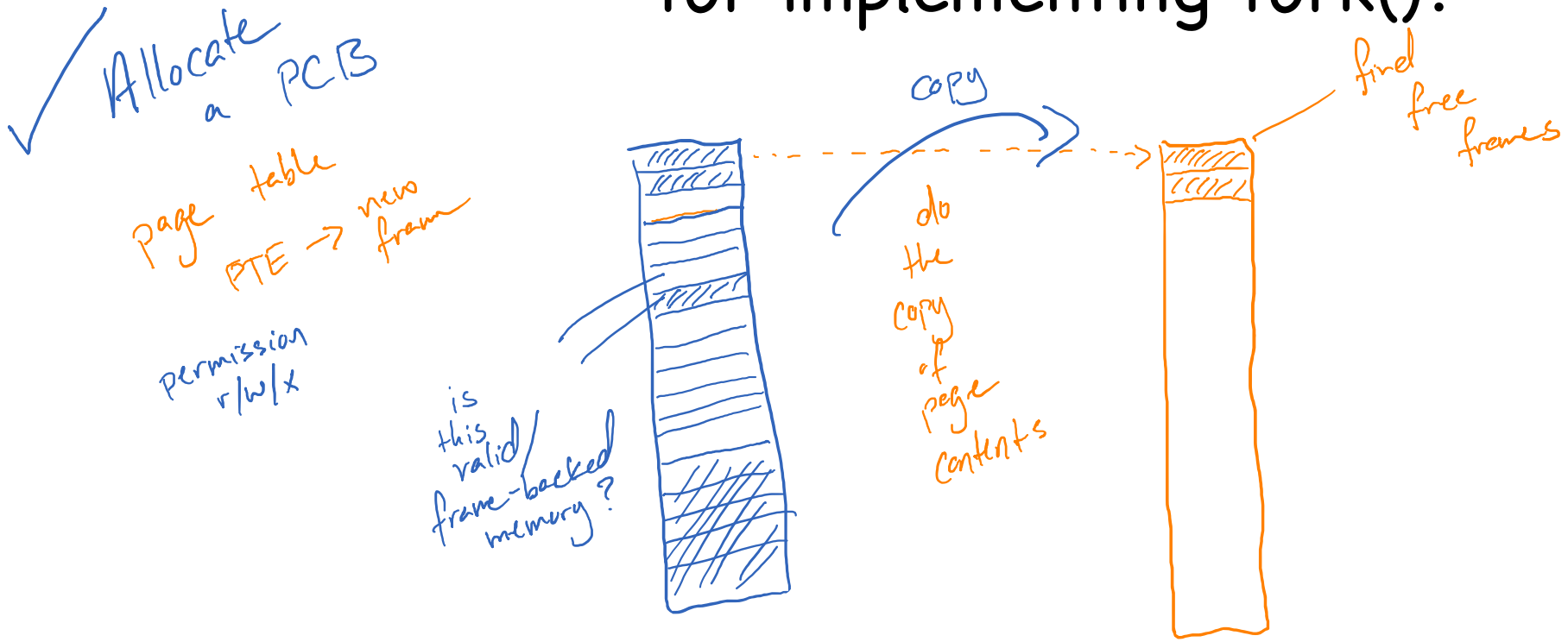
bitvector



-> brkfun.c

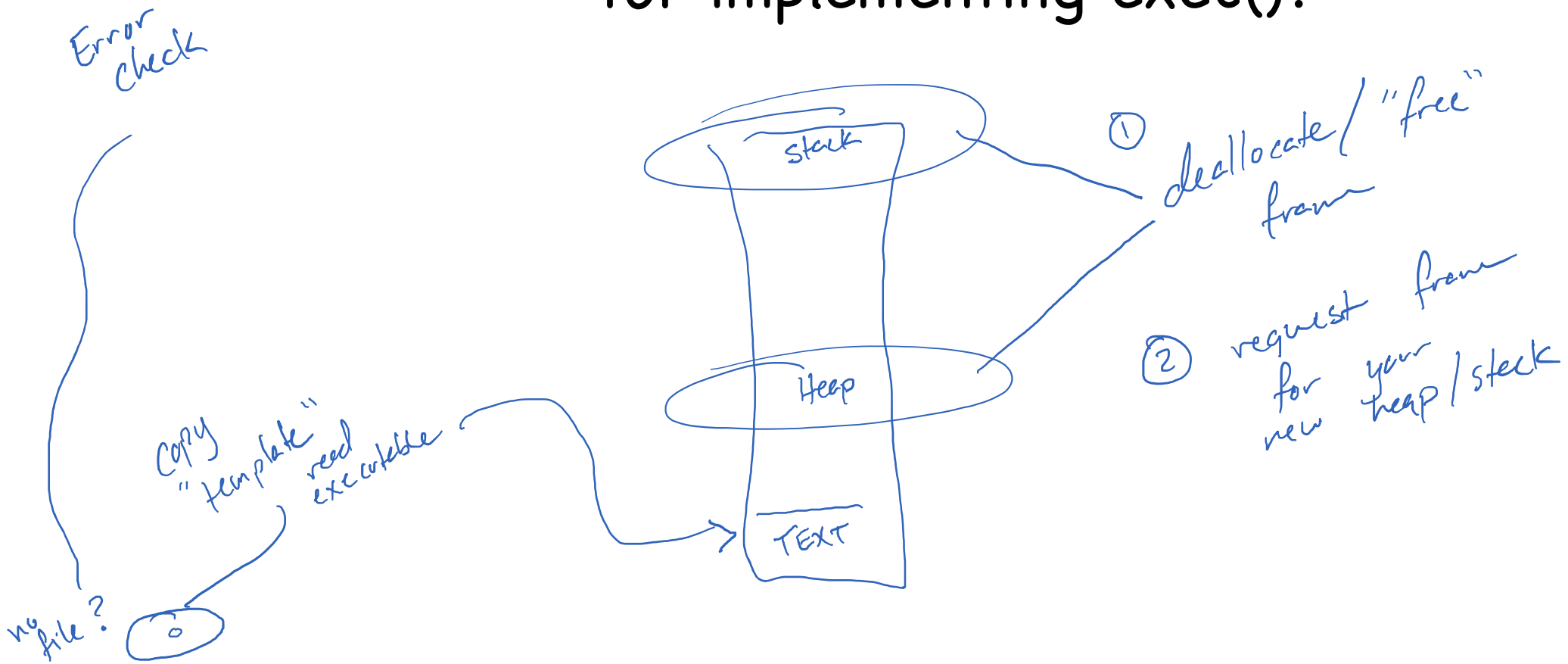
Fork

What are the memory management issues for implementing fork()?



Exec

What are the memory management issues for implementing exec()?



recall:
-> probe.c