P3 CK2 (et al.)

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Checkpoint Issue Summary

- Page faults are “good news”?
- Tools, tools, tools
- Rambling about debugging
- P3 Reminders
- Book report motivation

Page faults are “good news”?

- Several groups said
  - Our loader must be working...
  - ...we are getting the right page faults!
- There is some truth to this
- But!
  - Page faults are ***expensive***
  - Think: 500 instructions ***just for fault handling***
    - Maybe it's 5000

Page faults are “good news”?

- Page faults are ***expensive***
- Page faults in loader result in new pages
  - loader ⇒ memcpy(...)
  - memcpy(...) ⇒ ***fault***
  - fault ⇒ add_new_page(...)
- Why not cut out the middle man?
  - loader ⇒ add_new_page(...)

Page faults are “good news”?

- When to pre-allocate pages?
- When to “be lazy”?
- “It depends”
  - Code elegance (argues ***against*** pre-allocation)
  - Performance (argues for ***some*** pre-allocation)
    - Every process has ***at least one*** text/rodata/data page!
  - Error handling
    - Hm...

Laziness vs. error handling

- Preallocation
  - System low on memory
  - execv() ⇒ loader
  - Loader tries to allocate page, ***fails***
  - execv() returns -1 (right?)

- Laziness
  - System low on memory
  - execv() ⇒ loader
  - Loader page faults, ***no frame available***
  - execv() ⇒ ***process killed***

Is Laziness ***Ever*** Ok?

- "It depends"
- ***Good*** when you defer work forever
- ***Bad*** when detection/recovery costs paid too often
- ***Harmful*** when optimism hurts stability
- What about P3?
  - Design includes ***considering implications***
  - Multiple reasonable solutions
    - ***If thought through, documented***

Tools, tools, tools

- Good old printf()
  - ***WARNING***
  - "Tsunami" simics logs are ***NOT ACCEPTABLE***
  - (concrete suggestion in P3 handin document)
  - ***WARNING***

Tools, tools, tools

- What you should ***really*** already know
  - Good old printf()
  - Code breakpoints, print
  - Defensive coding, assertions
- Developing your skills
  - 15-410 Simics Command Guide
  - 15-410 Triple-Fault Advice Page

15-410 Simics Command Guide

- (Thank you, Jonathan)
- Read it
- ***Try every command***
  - ***I'm serious***
- If you're stuck later, re-scan it for ideas

15-410 Triple-Fault Advice Page

- “Triple fault” isn't a ***problem***
- “Triple fault” is a ***symptom***
- To determine the problem, need ***other*** symptoms
  - More
  - More-detailed
  - A ***story*** about what's going wrong
- “Help Desk teddy bear”

The Debugging Problem

- Debugging involves
  - An artifact with a problem
  - Your ***flawed*** mental model of the artifact
    - (or, perhaps, of the problem)
  - Finding the flaw ***in your mental model***

ELF loader helper issue

- How can “idle” have ro-data in kernel space???
- Your assumption
  - Every field of the struct is filled in
  - Some merit, but is all of ***your*** code that way?
  - How about ***your partner's*** code?
- ELF loader helper's assumption
  - You can provide a blank struct
- ***Finding*** the misconception is the hard part

ELF loader helper issue

- How did that field get that value???
  - grep e_rodatstart *.c
  - Set breakpoints (better: a watchpoint)
  - Hmm...
- Is this a severe issue?
  - No: rampant in group projects
  - In 15-410 (or open source) you can look inside!
- #include <ibm_mpa_ucode.story>

Building Your Mental Model

- Gritty details (***not*** “general idea”) for each issue
  - You don't really need to understand x86 segmentation
  - You do need to ***really*** understand x86 paging
- Know your code!
  - A couple long “cc -S” sessions may be necessary

Reminder: Sleep

- You will need to protect atomic sequences
- You will need to put processes to sleep (cheaply)
- You will need to awaken processes (cheaply)
- Not just once
- Multiple ways to do it
- ***Design*** something good

Other Reminders

- Preemption
  - Handout section 4.2.6, “Disabling interrupts”
- Registering Processes
  - Handout section 10.2, “User Process Debugging”

Book Report Goals

- Some of you are going to grad. school
- Some of you are wondering about grad. school
- Some of you are ***in*** grad. school
  - You should be able to read a Ph.D. dissertation

- More generally
  - Looking at something ***in depth*** is different
  - Not like a textbook

Book Report Goals

- There's more than one way to do it
  - But you don't have time to try all the ways in 410
  - Reading about other ways is good, maybe fun
- Habituation
  - Long-term career development requires study
- Writing skills (a little!)
  - “Summarizing” a book in a page is tough

Book Report

- Read the “handout”
- Browse the list
- Pick something (soon)
  - Don't make me stop the car...
- Read a bit before you sleep at night
  - or: before you sleep in the morning
  - and/or: Thanksgiving break
- Recommended by Spring OS students!