

15-213

# Introduction to Computer Systems

With Your TAs!

# Exam 2 Review Session

Sunday April 4th, 2010

# Schedule

- Tshlab review
- Virtual Memory review
- Exam Administrivia
- Exam Review

# Tshlab

- Error Conditions
- Race Conditions
- Waiting on Jobs
  - Not Waiting on Jobs
- Signals
- Magic Numbers

# Error Conditions

- Child errors vs. Parent errors
- What are your options?
  - Print a message?
  - Retry the system call?
  - Kill yourself
  - Let the user fix the problem



# open()

## RETURN VALUE

open and creat return the new file descriptor, or -1 if an error occurred (in which case, errno is set appropriately).

- What does it mean when open fails?
  - /bin/foo > /root/bar ?
  - /bin/foo > /home/studnet/bar ?
  - A truck drives through your hard drive.
- What can you do about it?
- What should you do about it?

# fork()

## RETURN VALUE

On success, the PID of the child process is returned in the parent's thread of execution, and a 0 is returned in the child's thread of execution. On failure, a -1 will be returned in the parent's context, no child process will be created, and errno will be set appropriately.

- What does it mean for fork() to fail?
- What is the purpose of a shell?
- How would you like it if your shell up and quit on you?
  - The putty window just closes!!

# sigprocmask()

## ERRORS

EINVAL An invalid signal was specified. This will also be generated if an attempt is made to change the action for SIGKILL or SIGSTOP, which cannot be caught.

EFAULT act, oldact, set, oldset or mask point to memory which is not a valid part of the process address space.

- What does it mean if this fails?
- How can you react during runtime?
- PEBKAC!



# How to actually handle the error?

- Wrapper function?
  - Good for printing error messages
  - BAD for actually handling the error
  - csapp.c = WRONG
- Handling inline
  - Looks less than wonderful
  - Allow more flexibility
- goto error
  - More correct

# Race Conditions

```
kill(-pid, SIGCONT);  
job->state = BG;  
printf("[%d] (%d) %s\n", jid, pid, job->cmdline);
```

- Think about all the possible interleavings of process execution!
- What effect does sending a signal to another process have on this process?

# Waiting on Jobs

- Why is this wrong?
  - `while (fgpid(job_list) == pid);`
- Why is this also wrong?
  - `while (fgpid(job_list) == pid)`  
`{ sleep(1); }`
- Why does this work?
  - `while (fgpid(job_list) == pid)`  
`{ sigsuspend(&emptyMask); }`

# Signals

- When can you get a signal?
- What happens to getting multiple signals?
- Why should you block a signal?
- What are the consequences to blocking a signal that you don't need to?
- Why does `sigsuspend` work?

# Magic Numbers

```
if(tok.builtins == BUILTIN_JOBS)
{
    if(tok.outfile){
        outfile=fopen(tok.outfile,"w");
        listjobs(job_list,fileno(outfile));
        fclose(outfile);
    }else{
        listjobs(job_list,1);
    }
}
```

- STDOUT\_FILENO
- STDIN\_FILENO

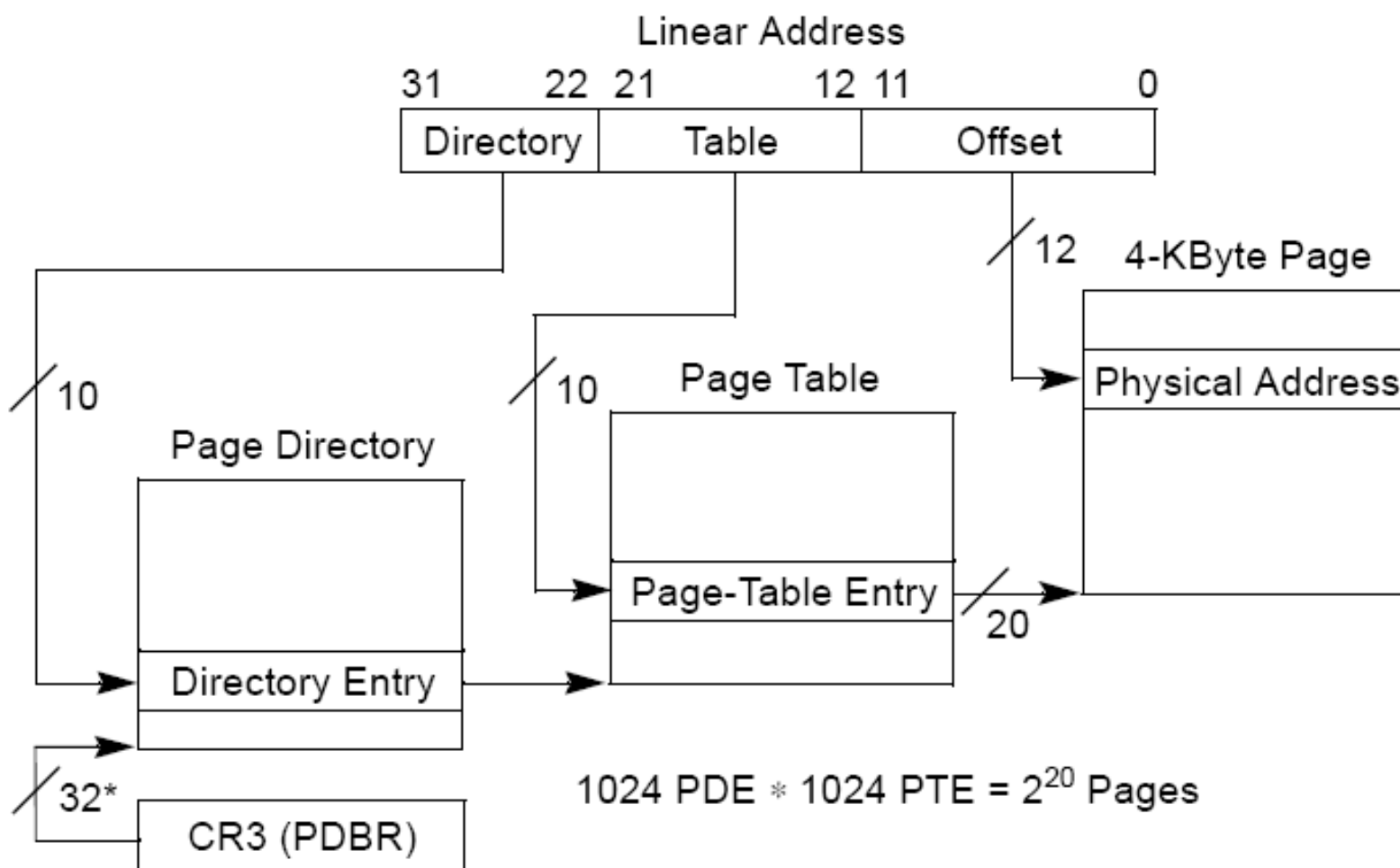
```
switch(tok.builtins){
case 0:
    break;
case 1:
    exit(0);
case 2:
    listjobs(job_list, 1);
    return;
case 3:
    break;
case 4:
    break;
}
```



# Virtual Memory

- Protect processes from each other
- Seamlessly use secondary storage when physical memory runs out
- Allows processes to use 32/64 bit address space no matter how much physical memory there actually is
- Why 2 levels? reduces the amount of space necessary for mapping structure.

# X86 VM Structure



\*32 bits aligned onto a 4-KByte boundary.

# Spring 2008 #4

- Virtual Address Format
  - Bits 0-11: Virtual Offset (Physical Offset)
  - Bits 12-21: Page Table Index
  - Bits 22-31: Page Directory Index
- Page Directory Entry Format
  - Bit 0: Present
  - Bits 12-31: Page Table Base Address
- Page Table Entry Format
  - Bits 0,1,2: Present, Writable, User-mode
  - Bits 12-31: Page Address

# News

- Tuesday in lecture
- No book/notes/computers/calculators
- We will provide tissues if you start crying

# Topics

- Signals
- Processes (Processi?)
- Basic malloc stuff
  - Difference between implicit and explicit list
- Caching
- System level IO
- Virtual Memory



# Questions?