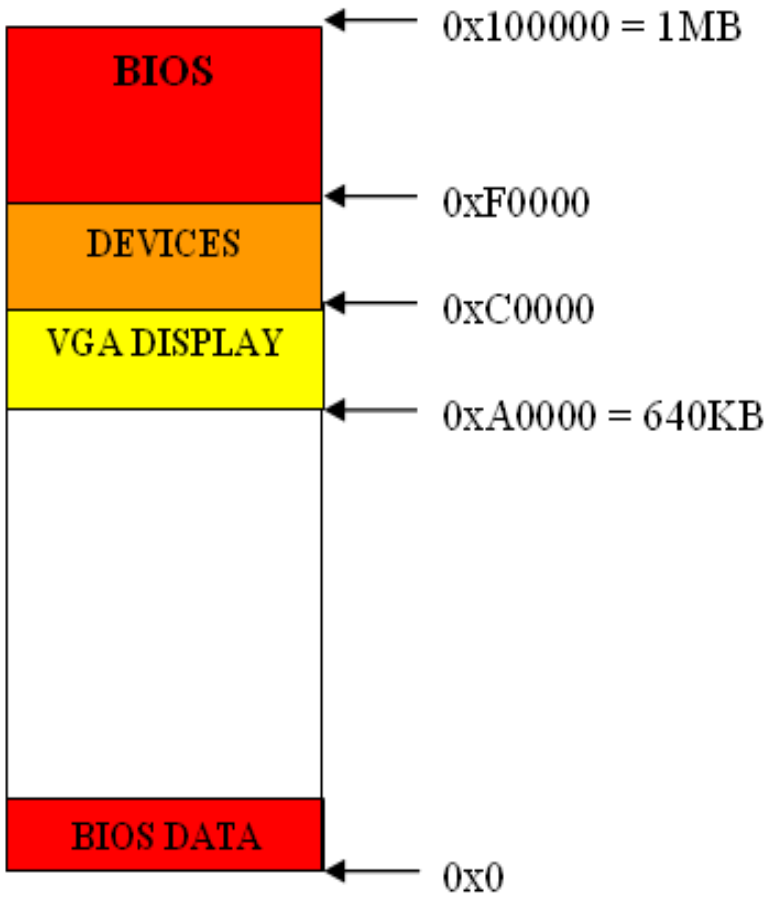
COS318 Project 1
Bootloader

Project Overview

- Bootloader: bootblock.s
  - Understand how the PC boots
  - BIOS, X86 assembly language (tutorial on Thu)
- Create an image for booting: createimage.c
  - Understand ELF format
  - Read files in ELF format and extract the necessary information
- Test: Bochs first, then boot off a USB disk
- Extra credit: loading larger kernels

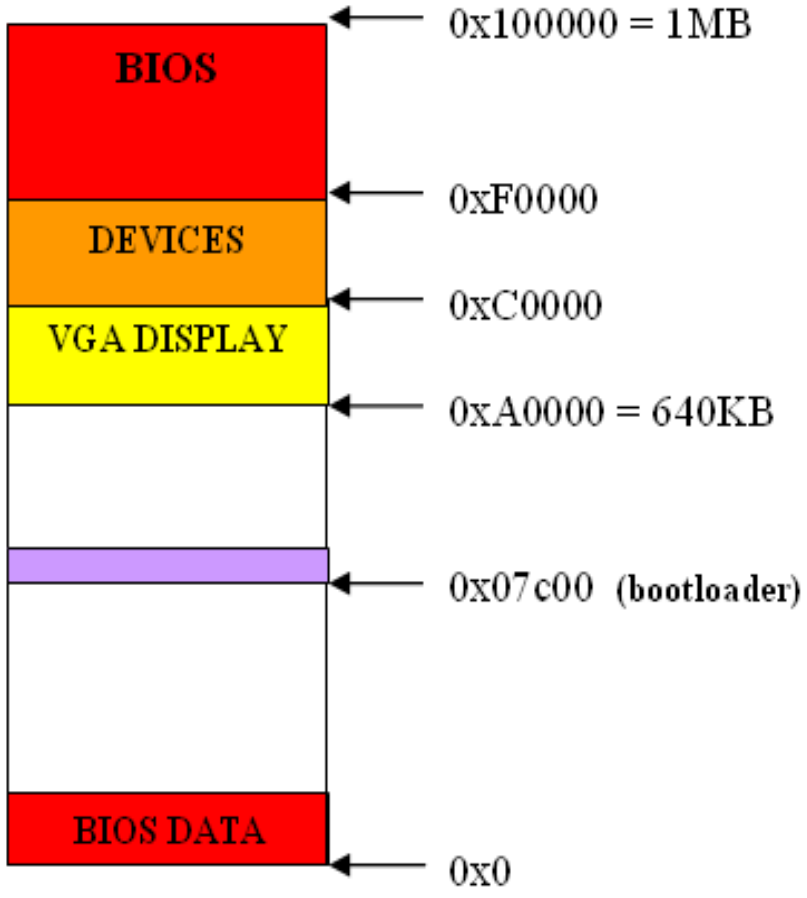
Bootloader

- There's nothing in the memory once turning on the machine
  - Resort to the hardware
- The BIOS is loaded
  - Typically doesn't know anything about the OS
  - Minimal functionality
- Everything starts from here



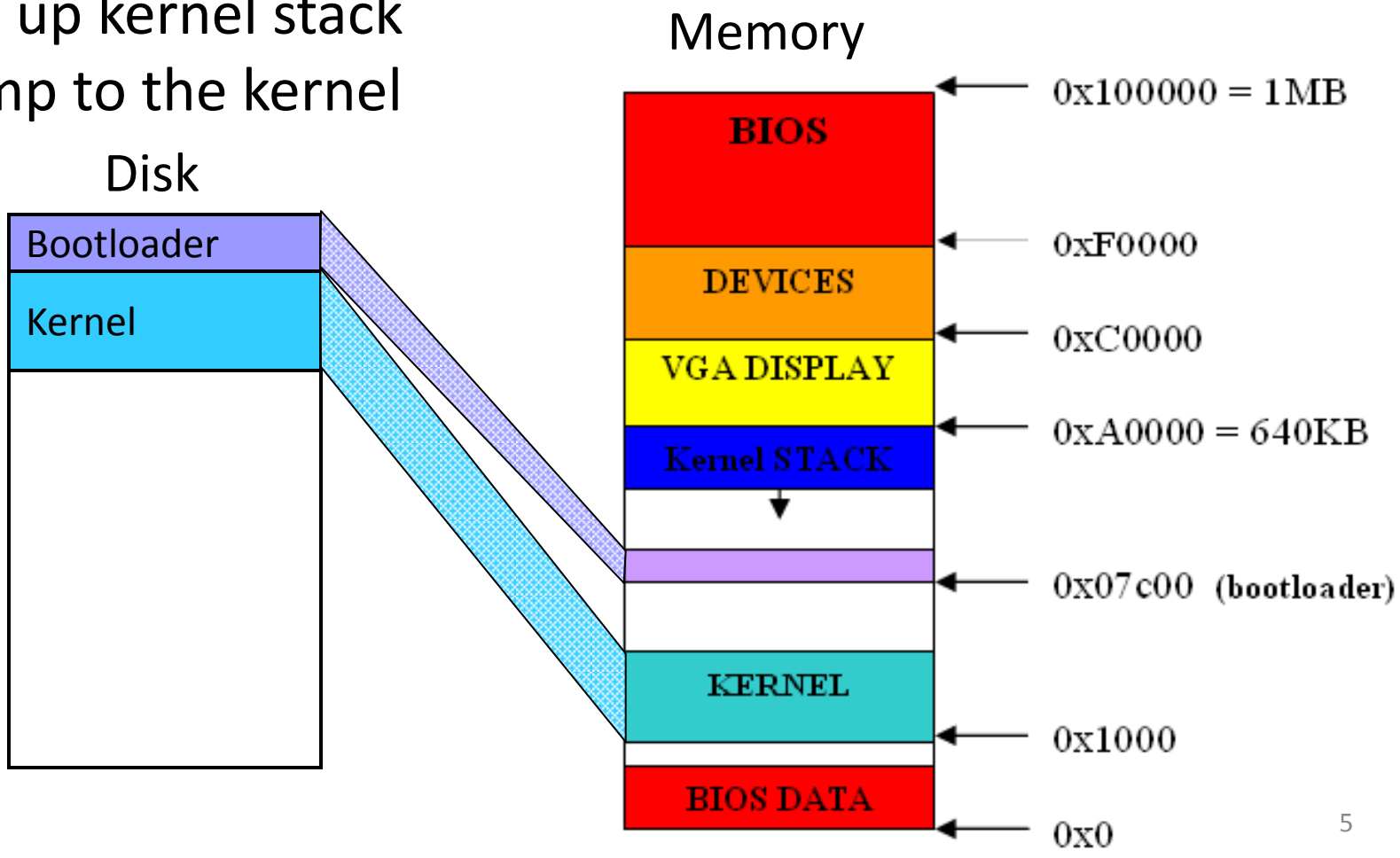
Bootloader

- The BIOS starts at 0xFFFF0
  - Self check, initialization, search for boot devices
  - Load the first sector (512 bytes) of a boot device to 0x7C00
  - Jump to 0x7C00



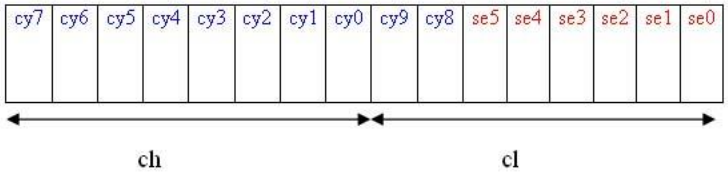
Bootloader

- Load the kernel
- Set up kernel stack
- Jump to the kernel



Read from Disk to Memory

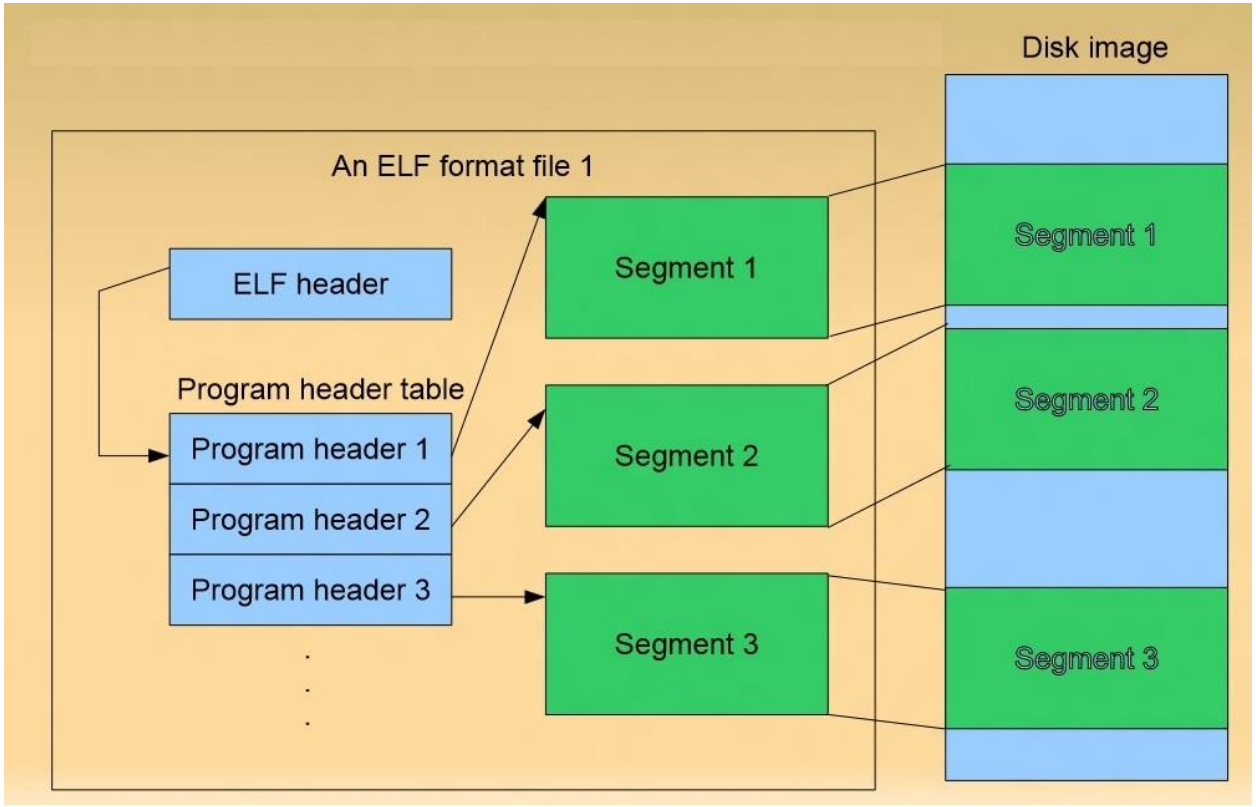
- BIOS Interrupt 0x13, function 2: Disk - Read sector(s) into memory
  - %ah=0x02, function 2
  - %al=#sectors to read (must be nonzero)
  - %ch+bits 6 7 of %cl=cylinder number
  - %cl=sector number (bits 0-5)
  - %dh=head number
  - %dl=drive number (has been set on entering)
  - %es:%bx->data buffer
  - int $0x13



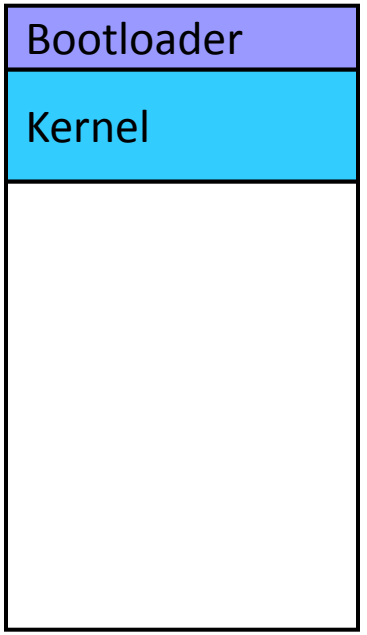
- Details will be covered in the tutorial on Thursday

Createimage

- After compiling and linking



- What we want



Createimage

- Study the ELF format
  - ELF header: Elf32_Ehdr
  - Program header: Elf32_Phdr
- Padding up to a complete sector (512 bytes)
- Mark the image to be bootable
  - Write 0x55 0xAA to the end of the first sector
- Compare your implementation to the given createimage.given
  - Implement --extend to print information
  - Ignore --vm

Test

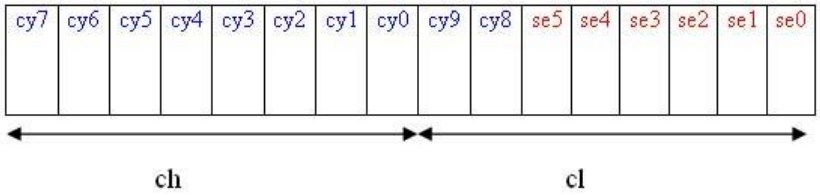
- Use Bochs to do the simulation
  - Installed in the fishbowl machines
  - bochs: run
  - /u/318/bin/bochsdbg: debug
- USB boot off
  - On the fishbowl machines: *cat image > /dev/sdf*
  - Boot from a USB disk on the fishbowl machines

Extra Credit

- Load larger kernels
  - Relocate the bootloader
  - Read data from more than one head/cylinder
    - Get the device parameters: #max head, #max sector
  - Deal with the cross physical segment reading
    - Data are read to %es:%bx
- Read the kernel sector by sector from the disk

Get Drive Parameters

- BIOS Interrupt 0x13, function 8: Disk – Get drive parameters
  - %ah=0x08, function 8
  - %dl=drive number
  - int $0x13, then if successful you will get:
  - %ch+(bits 6 7 of %cl)=maximum cylinder number, 0-based



  - %cl=maximum sector number (bits 0-5), 1-based
  - %dh=maximum head number, 0-based

Design Review

- Monday, 9/24 from 10:30am to 10:30pm, signup online
- Answer questions listed in the project description briefly. No more than 10 mins!

Print characters and strings

- Code based on the given bootblock.s
- Refer to bootblock_example.s
- Use BIOS Interrupt 0x10 function 14
  - %ah=0x0E, function 14
  - %al=character to be printed
  - %bh=active page number (use 0x00)
  - %bl=foreground color (use 0x02)
  - int $0x10

Something else…

- Tutorial of assembly language and bochs debugging will be on Thursday, 9/20
- Use Piazza to ask question (except personal or private issues), I will be generally monitoring through the whole project
- We are working on an OS image that can be used via VirtualBox, so as to relieve the workload of fishbowl machines