Introduction to Pintos

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Welcome to Pintos!

- **What is Pintos?**
  - An instructional operating system
  - Developed by Ben Pfaff @ Stanford U.
  - A real, bootable OS for 80x86 architecture
    - Run on a regular IBM-compatible PC or an x86 simulator

  - The original structure and form was inspired by the Nachos instructional OS from UC Berkeley (Java-based)

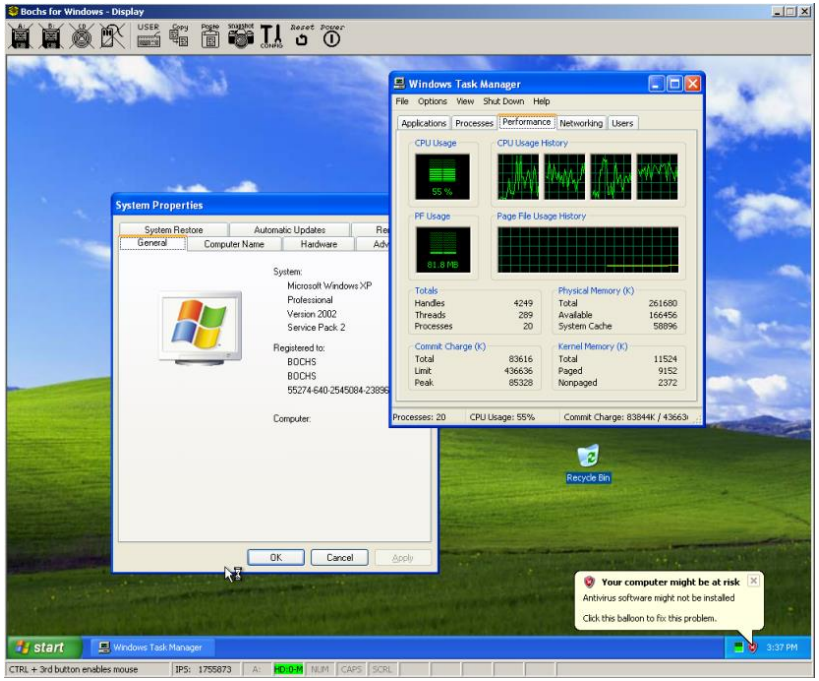
  - A few of the sources files are derived from code used in the MIT's advanced operating systems course
  - Written in C language (with minimal assembly code)

Bochs (1)

- **What is Bochs?**
  - Open-source IA-32 emulator
  - Simulates a complete Intel x86 computer in software
    - Interprets every instruction from power-up to reboot
    - Has device models for all of the standard PC peripherals: keyboard, mouse, VGA card/monitor, disks, timer, network, …
    - Supports many different host platforms: x86, PowerPC, Alpha, Sun, and MIPS
  - Runs most popular x86 OSes:
    - Windows 95/98/NT/2000/XP/Vista/7, Linux, BSDs, …
  - Written in C++
  - Emulation, not virtualization

Bochs (2)

- **Linux + Bochs**
  - We will run Pintos using Bochs on Linux
  - Bochs makes it easy to develop and debug Pintos projects



Bootstrapping Pintos

- Step 1: Get Linux ready
- Step 2: Get Pintos ready
- Step 3: Get Bochs ready
- Step 4: Test if everything works fine

Step 1: Linux (1)

- **Install a Linux distribution on your machine**
  - Ubuntu, Fedora, Debian, …
- **Recommended platform for this semester**
  - Ubuntu Desktop 13.04 LTS 32-bit version
  - Easier to get help from TA & instructor
  - Available from http://www.ubuntu.com/download/desktop
  - Installation manual: http://www.ubuntu.com/download/help/install-ubuntu-desktop

Step 1: Linux (2)

- **Installation on a native machine**
  - Allocate a dedicated partition for Linux
  - Can co-exist with Windows
  - Fast!
- **Installation on a virtual machine**
  - VMware Player (free) or VMware Workstation ($$$)
  - Available from http://www.vmware.com
  - Pre-installed VM images are available on the Internet
    - VMware virtual appliances: https://solutionexchange.vmware.com/store/category_groups/19
    - e.g., Ubuntu 12.04 LTS image: http://www.trendsigma.net/vmware/ubuntu1204.htm
  - (cf.) http://csl.skku.edu/CSE2003S09/Linux

Step 1: Linux (3)

- **Install basic development tools**

```
$ sudo apt-get install <package>
```

  - build-essential
  - vim, ctags, cscope
  - patch, diff
  - wget
  - perl
  - subversion, git
  - …

Step 2: Pintos

- **Installing Pintos**
  - Available from http://csl.skku.edu/SSE3044F13/Resources
    - Use this version only
  - Use the following command to download Pintos

```
$ cd ~
$ wget http://csl.skku.edu/uploads/SSE3044F13/
pintos.tar.gz
```

  - Untar Pintos

```
$ tar xvzf pintos.tar.gz
```

  - Now, Pintos source code is in `~/pintos/src`

Step 3: Bochs (1)

- **You need Bochs to run Pintos**
  - Do not install the Bochs package from Ubuntu repositories
  - If you did, it should be removed

- **Install prerequisites for building Bochs**
  - Install X windows development libraries

```
$ sudo apt-get install xorg-dev
```

  - Install curses development libraries

```
$ sudo apt-get install libncurses5-dev
```

Step 3: Bochs (2)

- **Install pre-built GCC 4.1.2 for Bochs**
  - Bochs is not compiled with the default compiler in Ubuntu (gcc-4.6.3)
  - We have pre-built gcc/g++ version 4.1.2 for you
  - Use our installation script

```
$ wget http://csl.skku.edu/uploads/SSE3044F13/
sse-gcc-installer-v3
$ chmod a+x sse-gcc-installer-v3
$ sudo ./sse-gcc-installer-v3
```

  - The script will fetch and untar `sse-gcc-4.1.2-[32bit|64bit].tar.gz` file in your system
    - `/usr/local/bin/sse-gcc`, `/usr/local/bin/sse-g++`
  - `/usr/local/bin` should be in your PATH

Step 3: Bochs (3)

- **Download Bochs**
  - From http://bochs.sourceforge.net
  - Make sure you are downloading `bochs-2.2.6.tar.gz`
  - You don't have to untar the source code
- **Installing Bochs**
  - Must patch the Bochs source code for Pintos
    - Patches are available in `~/pintos/src/misc`
  - Use the installation script provided by Pintos:
    - `~/pintos/src/misc/bochs-2.2.6-build.sh`
    - This will untar, patch, configure, compile, and install Bochs
  - You need to be a superuser (root) to install Bochs in the system directory (e.g., `/usr/local/bin`)

Step 3: Bochs (4)

- **Running the script**

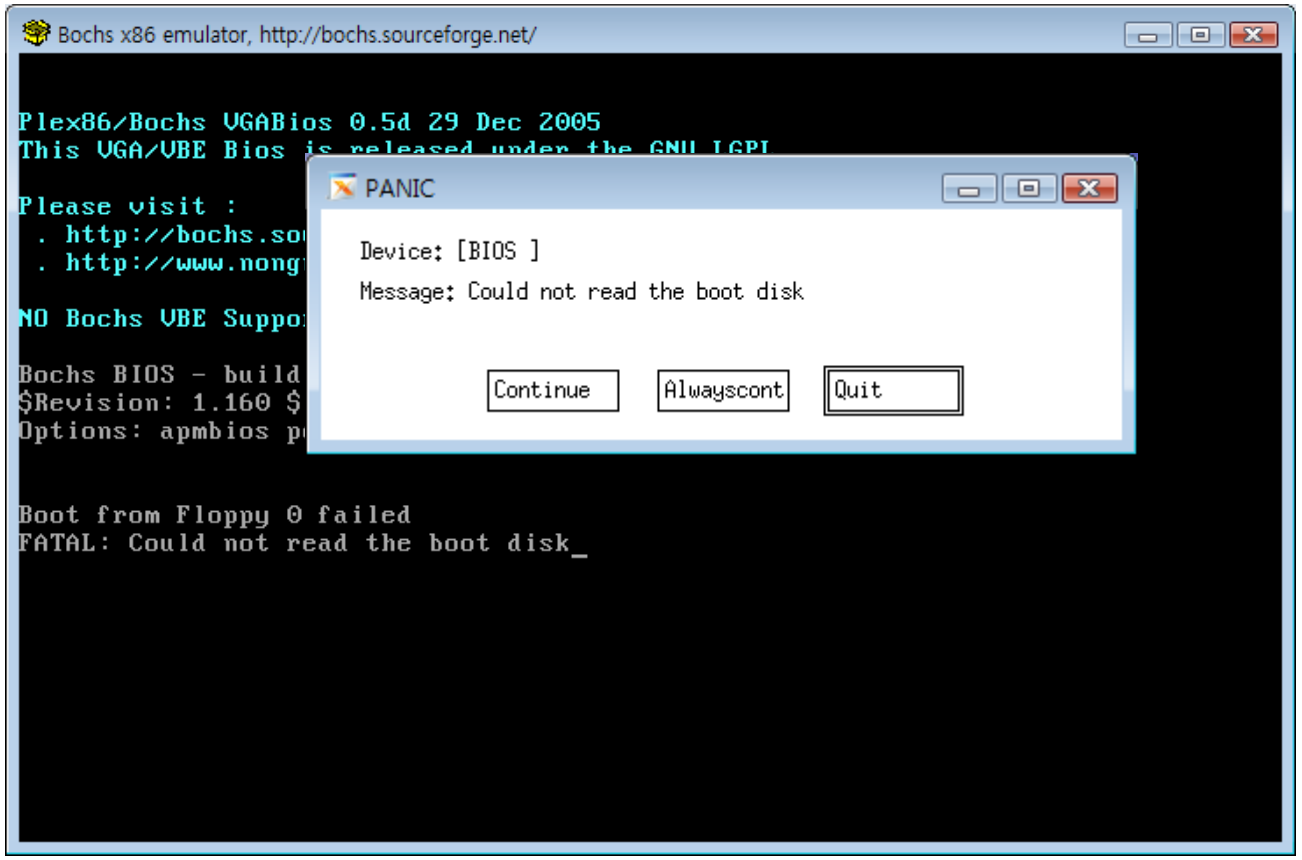
```
$ cd ~/pintos/src/misc
$ sudo env SRCDIR=/home/jinsoo PINTOSDIR=/home/jinsoo/pintos
DSTDIR=/usr/local CC=sse-gcc CXX=sse-g++ ./bochs-2.2.6-build.sh
```

  - `SRCDIR`: The directory where the bochs-2.2.6-tar.gz is located
  - `PINTOSDIR`: The base directory of Pintos
  - `DSTDIR`: The target directory where Bochs will be installed
  - `CC=sse-gcc`, `CXX=sse-g++`: Use sse-gcc/sse-g++ for C/C++ compiler

Step 4: Testing (1)

- **Testing Bochs**

  `$ bochs` ; Put `$DSTDIR/bin` into your PATH



Step 4: Testing (2)

- **Building Pintos**
  - Specify `sse-gcc` in `~/pintos/src/Make.config`
    - At line 14 & 19: gcc → sse-gcc
    - (cf.) http://csl.skku.edu/SSE3044F12/GCCPintos

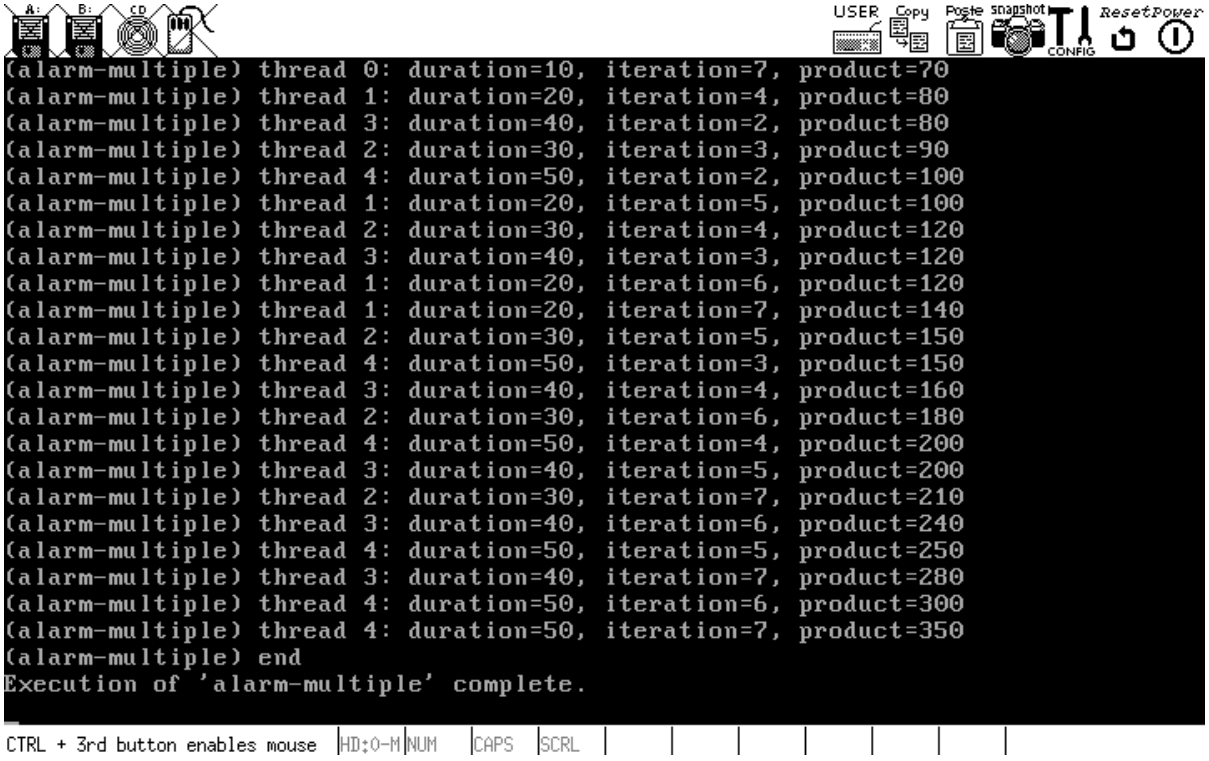
```
$ cd ~/pintos/src/threads
$ make
```

  - This will create the kernel image (`kernel.bin`) and the final OS disk image (`os.dsk`) in `~/pintos/src/threads/build`
  - `os.dsk` = `loader.bin` + `kernel.bin`

Step 4: Testing (3)

- **Run Pintos**

```
$ cd pintos/src/threads
$ ../utils/pintos run alarm-multiple
```



Project -1: Warming Up

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Project -1 (1)

- **Set up your own project environment**
  - Install Linux
  - Install all the required tools
  - Install Pintos
  - Install Bochs
  - Capture the screen shot of working Pintos

    ```
    $ pintos run alarm-multiple
    ```

Project -1 (2)

- **Documentation**
  - Specification of your environment
    - Hardware info
    - Linux distributions
    - Output of the following commands:
      ```
      $ uname -a
      $ lscpu
      ```
    - A screen shot of "`alarm-multiple`"
- **Due:**
  - Sep. 6 (Fri), 11:59PM (firm deadline)
  - Submit via e-mail to sse3044@csl.skku.edu
  - Note: This is an individual project