

Nachos Overview

Project 1 – Thread Management

Chien Wen, Huang.

Advisor: Farn, Wang.

Outline

- Introduction of Nachos.
- Installation of Nachos.
 - Linux 32-bit for Nachos.
- Project 1 – Thread Management.
- Some tips for Nachos.

Introduction of Nachos

What is Nachos?

- Not Another Completely Heuristic Operating System



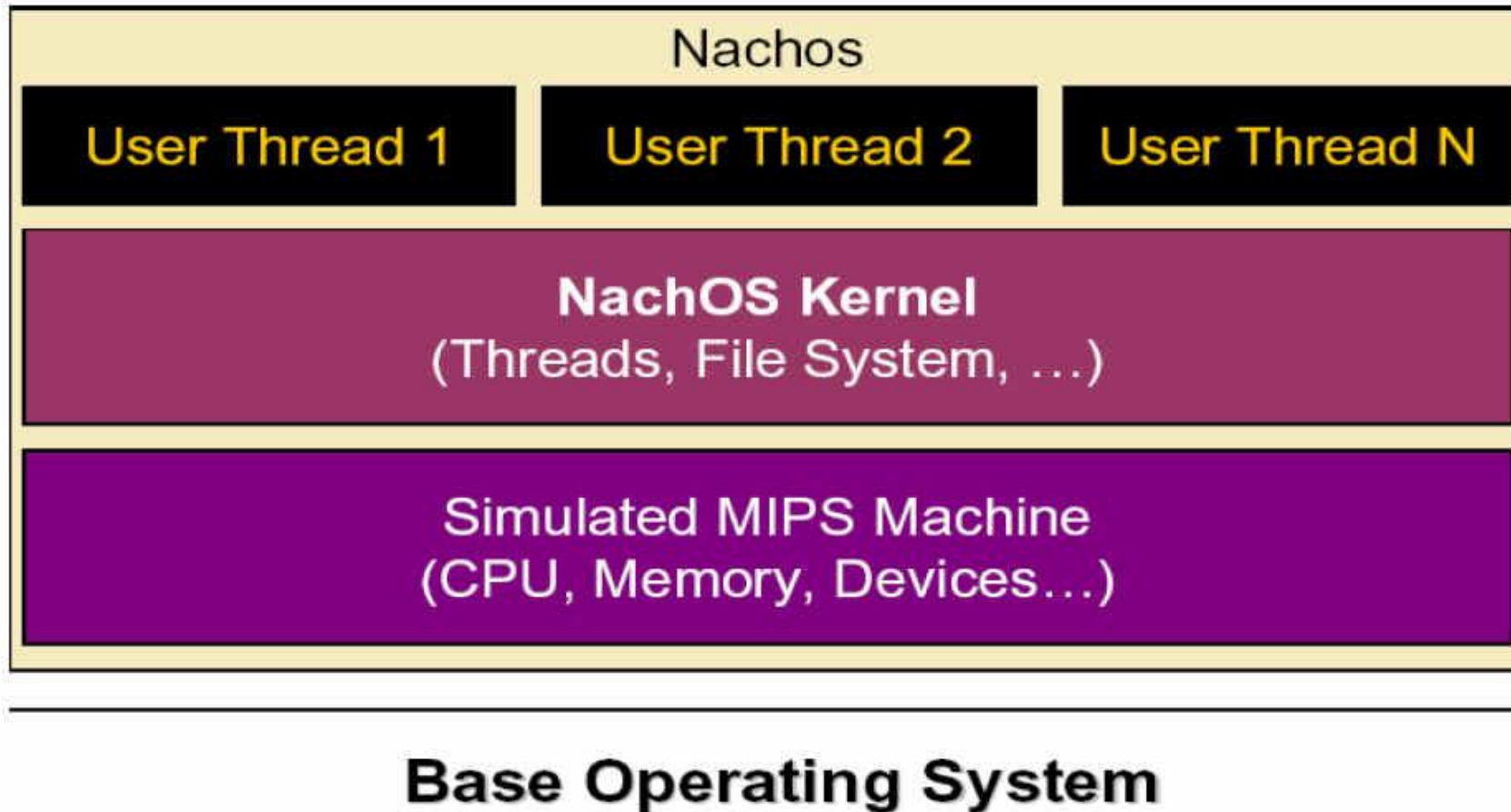
What is Nachos?

- Designed by Thomas Anderson at UC Berkeley in 1992.
- Written in C++, but Danial Hattena has rewritten Nachos in JAVA.
 - We use the **C++** version here.
- Educational OS that some components can be implemented by users.
 - **Process management.**
 - **CPU scheduling.**
 - **Memory management.**
 - File system management.
 - Networking.

Why Nachos?

- Nachos has basic functionality even at the beginning.
 - Implement one part at a time.
- Too hard and dangerous to handle real hardware.
- Nachos is just a **UNIX process** runs on real OS.
- And real OS runs on real machine.
- Simulator makes debug more easier.

Structure of Nachos



Installation of Nachos

Linux only...

Linux 32-bit machine only

- Theoretically, You can use any Linux distribution as your platform.
 - Ubuntu, Fedora, Debian...
 - Remember to use 32-bit instead of 64-bit.
- Recommended choice, **32-bit Ubuntu 14.04 or older version.**
- So how can I set up the environment exactly?

Virtual Machine & Image

- Virtual machine runs on your current OS.
 - virtual box, vmware...
- Ubuntu Desktop
 - <http://www.ubuntu.com/download/desktop/>
- Download the image (.iso file).
- Remember to choose **32-bit** version!
- Load the image into your virtual machine.
 - Or you can set up your own new virtual machine of course.

Nachos installation on Ubuntu 14.04 (32bit)

- Download the Nachos package and the cross compiler package from <http://cc.ee.ntu.edu.tw/~farn/courses/OS/OS2015/index.htm>
- Install g++ and csh
 - `sudo apt-get install g++`
 - `sudo apt-get install csh`
- Untar packages
 - `tar -zxvf nachos-4.0.tar`
 - `mv mips-x86.linux-xgcc.tar /`
 - `tar -zxvf /mips-x86.linux-xgcc.tar`
- Make
 - `cd ~/nachos-4.0/code`
 - `make`

File Hierarchy of Nachos

- bin
- filesys
 - File system
- **lib**
 - Many useful data structures.
 - E.g. bitmap, hash, list...
- Machine
 - Hardware and virtual memory.

File Hierarchy of Nachos

- network
- ports
- **test**
 - Some test cases here.
- threads
 - thread managements, synchronizations.
- **userprog**
 - Process and memory management for users.
 - The first project focus on here.

Project 1

Thread Management

Project 1

- `cd ./userprog`
- `./nachos -e ../test/test1`
 - Print integer:9
 - Print integer:8
 - Print integer:7
 - Print integer:6
- `./nachos -e ../test/test2`
 - Print integer:20
 - Print integer:21
 - Print integer:22
 - Print integer:23
 - Print integer:24
 - Print integer:25
- The programs execute correctly

Project 1

- `./nachos -e ../test/test1 -e ../test/test2`
 - Print integer:9
 - Print integer:8
 - Print integer:7
 - Print integer:20
 - Print integer:21
 - Print integer:22
 - Print integer:23
 - Print integer:24
 - Print integer:6
 - Print integer:7
 - ...
- The result is wrong. And we are going to fix it.

Trace code and fix the issue

- Trace the following files and find out why the result is wrong
 - nachos-4.0/code/userprog/addrspace.h
 - **nachos-4.0/code/userprog/addrspace.cc**
 - nachos-4.0/code/userprog/userkernel.cc
 - nachos-4.0/code/userprog/translate.h
 - nachos-4.0/code/userprog/translate.cc
- After you fix the bug, recompile Nachos and see if the result is correct.
- (Optional) Design your own test program and see what's the difference.
- Tell us anything interesting you find by your report.

Format of Source code & Report

- Report
 - Why the result is not congruent with expected.
 - The plan you take to fix the problem in Nachos.
 - How you really modified Nachos, including some (not all) important code segments and comments.
 - Experiment result and some analysis.
- Please saved as **[Student ID]_NachOS_report.pdf**
 - E.g. r04942044_NachOS_report.pdf

Hand in source code & report

- Source Code
 - **tar zcvf [Student ID]_Nachos1.tar.gz ./nachos-4.0**
 - E.g. r04942044_Nachos1.tar.gz
- Mail your source code and report to r04942044@ntu.edu.tw
 - **One pdf file** as report and **one tar.gz file** as source code.
- Deadline: **Nov.18.2015, 23:59:59.**

Presentation

- Choose **one** of these three projects to present:
 - **Nov.18.2015**
 - **Dec.16.2015**
 - **Jan.20.2016**
- Register your choice in the following link before **Oct.28.2015.**
- <http://goo.gl/forms/6xQSr5MqBn>
- About **11** people to present in each project.
 - **Randomly assigned from first wish to last.**
 - If not registered, I will randomly assign you to each of the three.
- About **10 minutes**(not including Q&A) in your presentation.

Presentation Details

- What's your contribution to this project.
- **Not necessary** to make ppt.
 - You can just use your report and source code to present.
- The main point is...
 - Problem analysis and what's you plan to solve it.
 - What you do with this project.
 - Extra observation.
 - Some presentation skill.

Grading Policy

- With presentation:
 - Nachos source code: (30%)
 - Report: (30%)
 - Correct format: (20%)
 - Presentation: (20%)
- Without presentation:
 - Nachos source code: (40%)
 - Report: (40%)
 - Correct format: (20%)

Late Policy

- **10%** penalty per day.
- Late penalty only holds for a week
 - After 7 days, you will get 70% penalty, but no more penalty after that.
 - That is, after $n(n \geq 7)$ days, you will still get 70% penalty.
 - **Don't give up!**
- **No plagiarism.**

Some tips for Nachos

- **Design** before coding.
 - Better create your own test program to get the idea.
- **Trace** before coding.
 - Some IDE or text editor is useful if you are not a professional vim/emacs user.
 - No need to trace all the code in single project.
- Some useful **data structure** has been implemented in Nachos.
 - See the **lib** directory.
- **Google** is your best friend.
 - Copy and paste the error message to Google is useful.
 - You are not alone 😊

TODO

- Register your choice in the following link before **Oct.28.2015.**
 - <http://goo.gl/forms/6a5COlMGuB>
- Install the environment and Nachos.
- See what's the problem.
- Fix the bug.
- Write the report.
- Send the code and report to TA with correct format.
- Prepare the presentation if you should.

Reference

- Nachos wiki:
 - https://en.wikipedia.org/wiki/Not_Another_Completely_Heuristic_Operating_System
- Nachos official site:
 - <http://homes.cs.washington.edu/~tom/nachos/>
- Ubuntu desktop:
 - <http://www.ubuntu.com/download/desktop>
- Nachos Beginner's Guide:
 - <https://www.ida.liu.se/~TDDI12/material/begguide/>