



Operating System Concepts

Che-Wei Chang

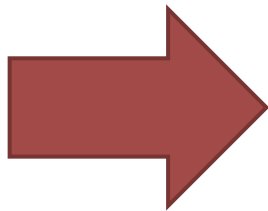
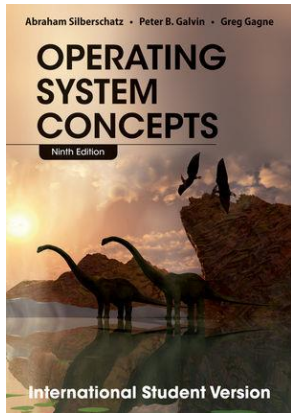
chewei@mail.cgu.edu.tw

Department of Computer Science and Information Engineering, Chang Gung University



Homework 1 – Exercise on Virtual Machines

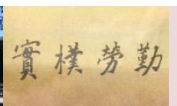
OS Experiments



What Do We Need?



A Computer & Google™



We might have to sacrifice the computer



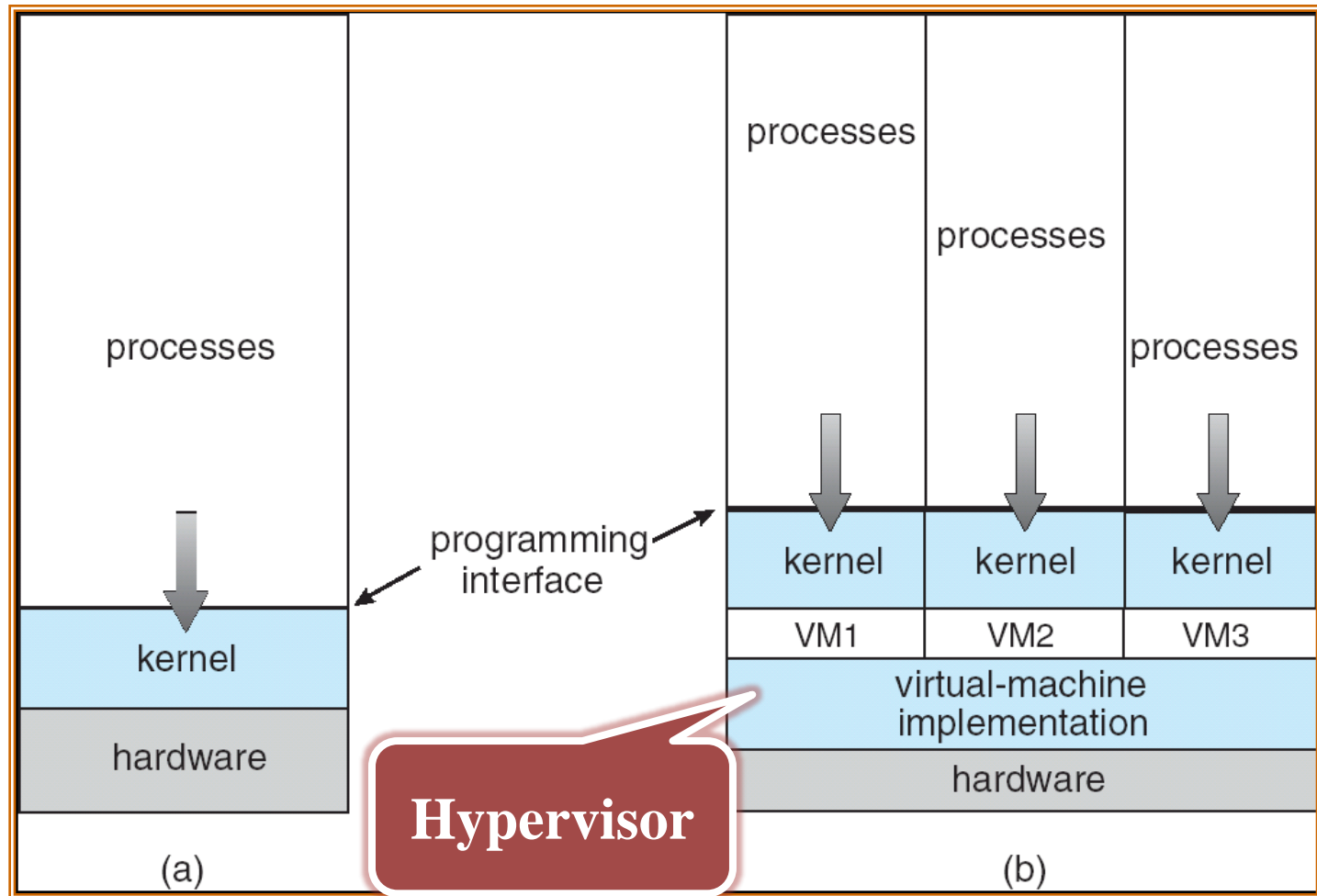
What? You have only a computer?



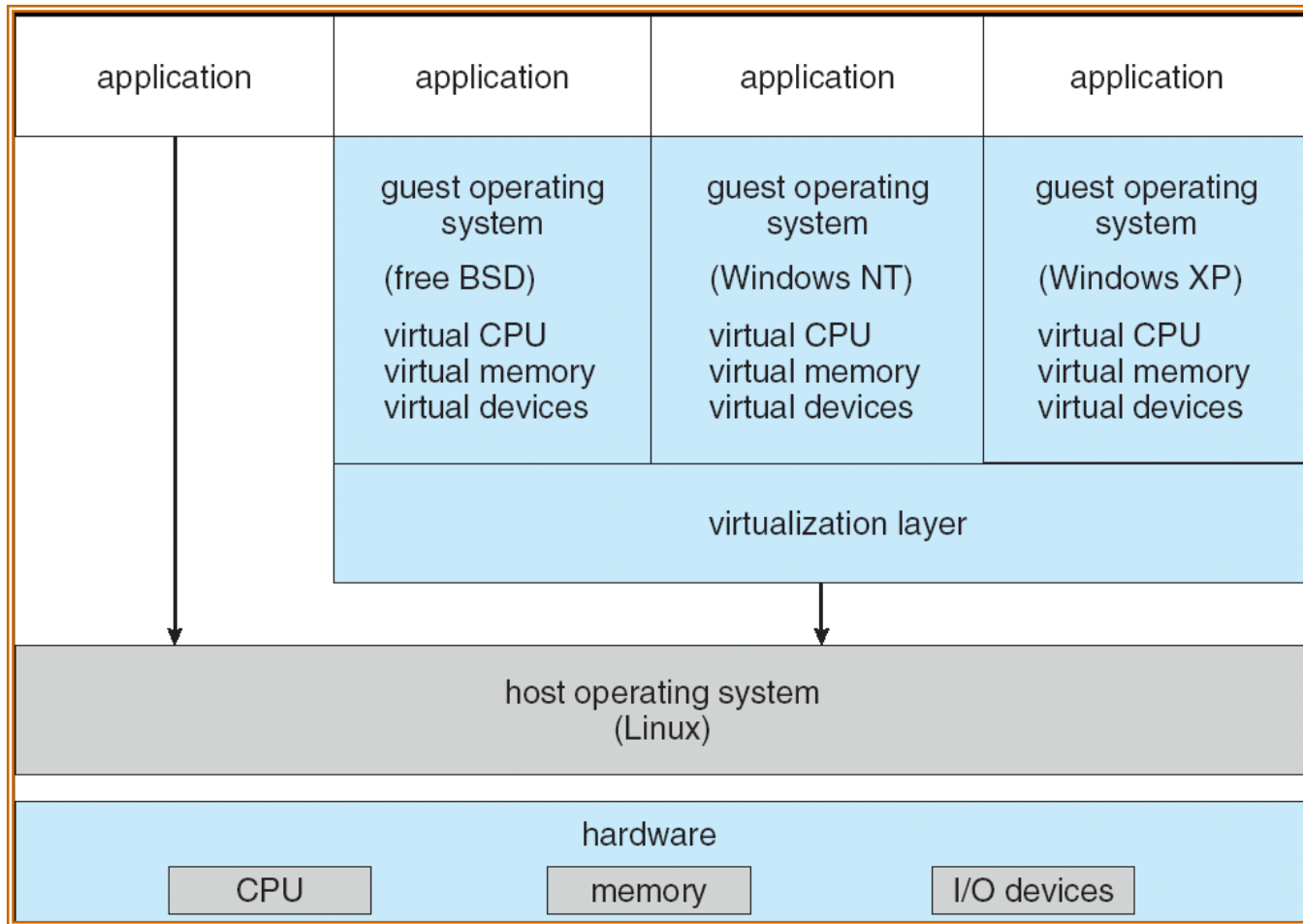
You Need Virtual Machines



Virtual Machines on Hypervisor



Virtual Machines on Host OS



VM Managers

- ▶ Oracle VirtualBox
- ▶ VMWare Player
- ▶ Parallels Desktop for Mac
- ▶ QEMU (Quick EMUlator)





Homework Details– Build a Linux Kernel Module

Commands to Download Tools

► On Ubuntu12.04

- *sudo apt-get update*
- *sudo apt-get install make*
- *sudo apt-get install build-essential*
- *sudo apt-get install vim*
- *sudo apt-get install linux-headers-\$(uname -r)*



Makefile

obj-m = hello.o

KVERSION = \$(shell uname -r)

all:

make -C /lib/modules/\$(KVERSION)/build M=\$(PWD) modules

clean:

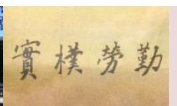
make -C /lib/modules/\$(KVERSION)/build M=\$(PWD) clean

Note: You have to use “tab” instead of “space” in the Makefile



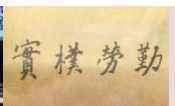
hello.c

```
#include <linux/init.h>
#include <linux/module.h>
#include <linux/sched.h>
MODULE_LICENSE("Dual BSD/GPL");
static int hello_init(void)
{
    return 0;
}
static void hello_exit(void)
{
    printk(KERN_ALERT "Goodbye, cruel world\n");
}
module_init(hello_init);
module_exit(hello_exit);
```



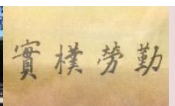
Compile and Use It

- ▶ *make*
- ▶ *sudo insmod hello.ko*
- ▶ *sudo modprobe hello.ko*
 - ➔ try to also load other modules for undefined symbols
- ▶ *sudo rmmod hello*
- ▶ *dmesg*



Requirements

- ▶ Install a virtual machine on your computer
- ▶ Install Linux and Windows 10 (or any other OS) on the virtual machine
- ▶ Implement a device driver
 - Print “Hi, I am Student-ID, 2023” to the kernel buffer when inserting the module
 - Print “Bye!” to the kernel buffer when removing the module
 - Hint: you can use the command *dmesg* to read the buffer



Report

1. The steps for your implementation
 2. The problem you met, and how you solved it
 3. **The reference of this homework**
- The report is limited within 4 pages in or PDF



Grading

- ▶ Implementation
 - The VM: 20%
 - The OS: 20% (10% for each)
 - The kernel module: 20%
- ▶ Report
 - 20%
- ▶ Demo Q&A
 - 20%



Submission

- ▶ Homework 1 deadline: at 20:00 on 2023-11-01

➔NO DELAY!

- ▶ Upload to e-learning system

➔Not the source files

- ▶ The file name: OSHomework1StudentID.zip
 - Including the report and the kernel module
- ▶ The title of the report: OS_StudentID_Name
- ▶ The title of the module: Module_StudentID.ko
- ▶ **Point deduction for wrong format: 10%**

➔DEMO will be arranged!

