



# Operating System Concepts

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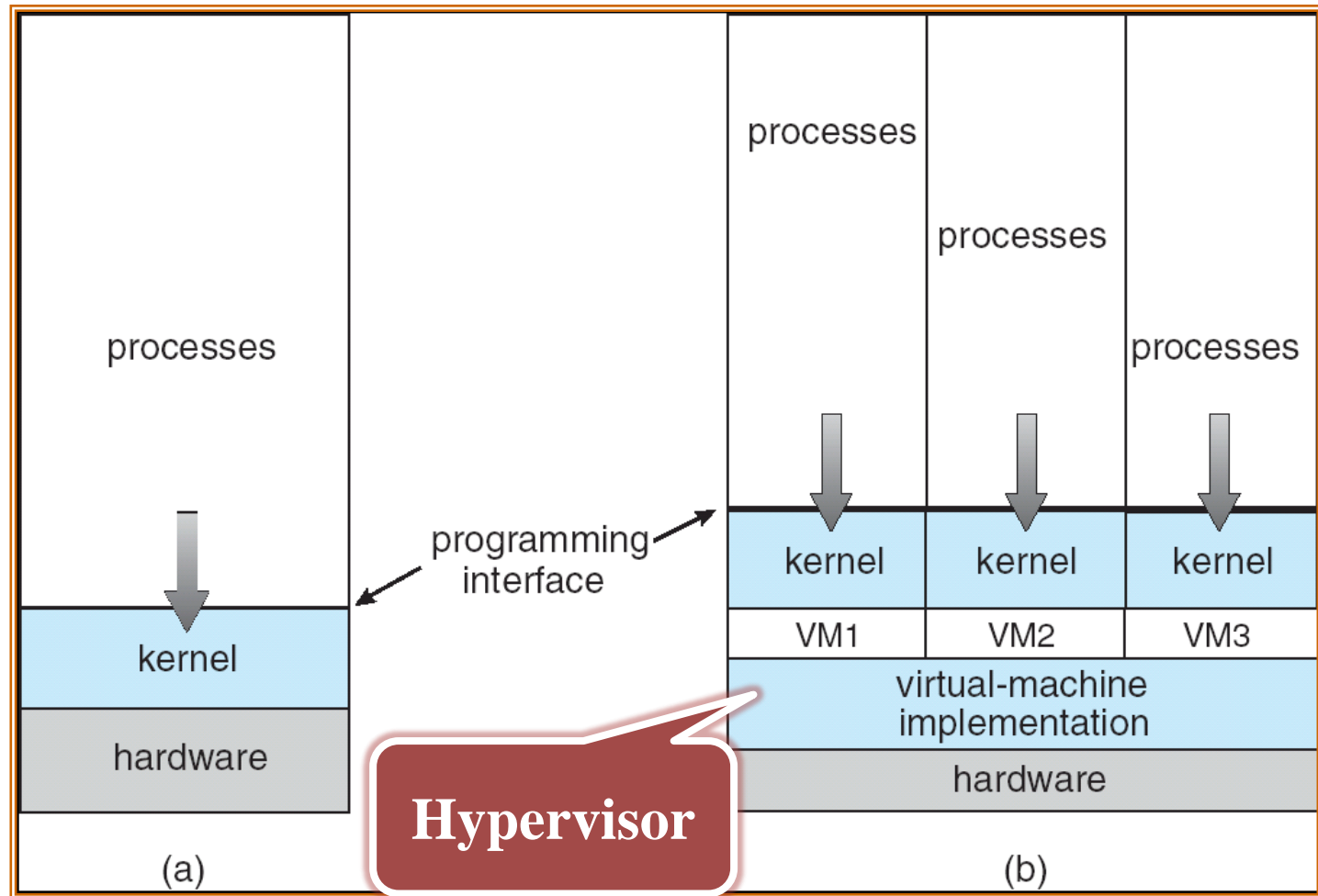
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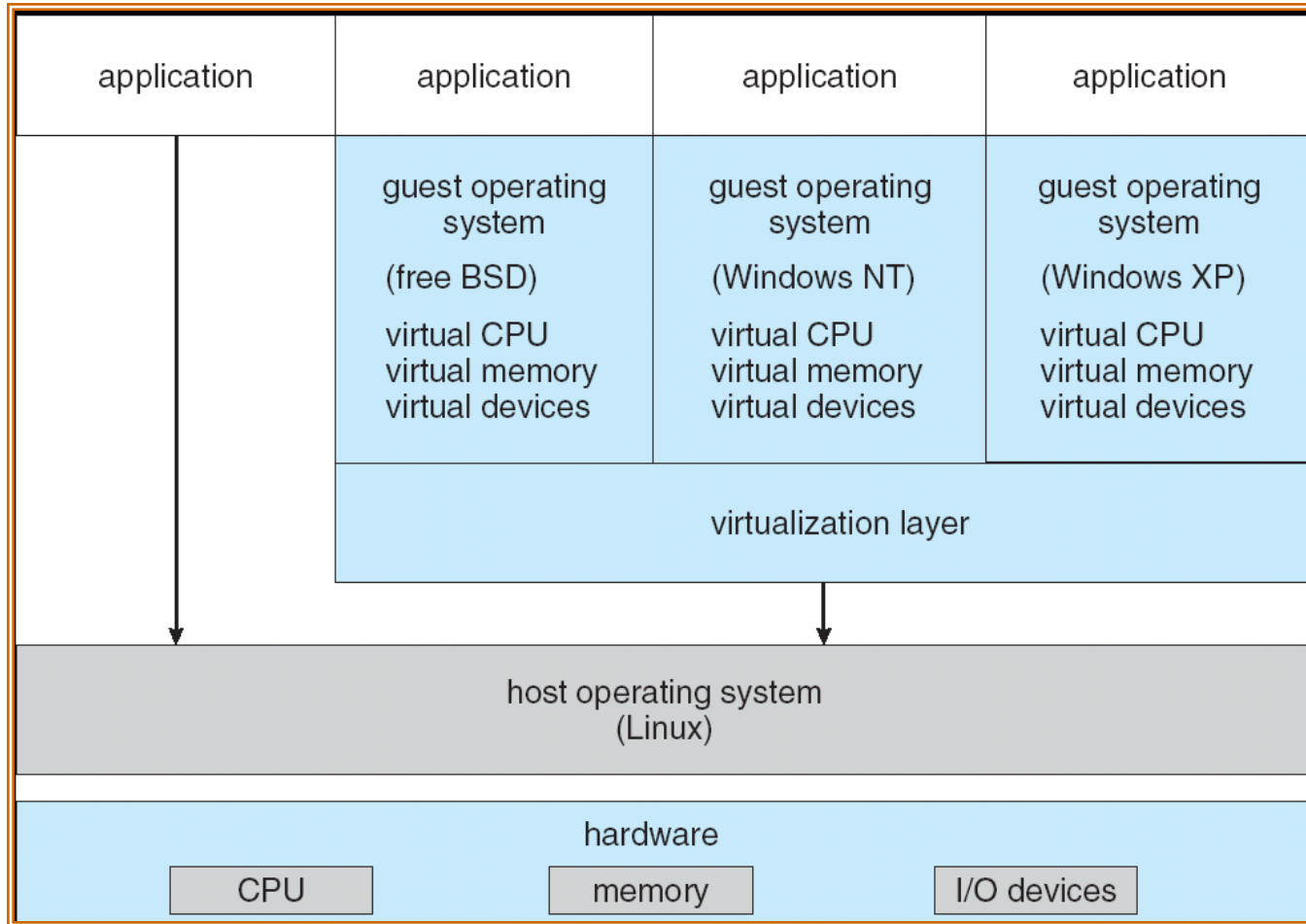


# Final Project– Exercise on Virtual Machines

# Virtual Machines on Hypervisor



# Virtual Machines on Host OS



# VM Managers

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





# Project 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

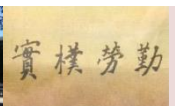
KVERSION = \$(shell uname -r)

all:

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

clean:

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





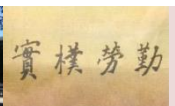
# hello.c

```
#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 7 (or Windows XP) on the virtual machine
- ▶ Implement a device driver
  - Print “Hi, I am Student-ID” 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 bonus you have done
  4. **The reference of this project**
- The report is limited within 4 pages (Word or PDF)



# Grading

## ► Implementation

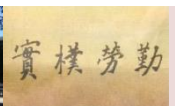
- The VM: 20%
- The OS: 20% (10% for each)
- The kernel module: 20%

## ► Report

- 30% (Baseline is 20%)

## ► Bonus

- Recompile the Linux kernel on the VM: 20%
- Implement a system call on the Linux kernel: 20%



# Submission

- ▶ Project deadline: at 15:00 on 2016-01-05  
**→NO DELAY!**
  - ▶ Send your report and the compiled kernel module to  
TA: 哈穰遠 [haboy0428@gmail.com](mailto:haboy0428@gmail.com)  
**→Not the source files**
  - ▶ The title of the email: OS Project of StudentID
  - ▶ The title of the report: OS\_Name\_StudentID
  - ▶ The title of the driver: Module\_StudentID.ko
  - ▶ **Point deduction for wrong format: 10%**
- DEMO might be requested**

