

Operating System Concepts

Che-Wei Chang

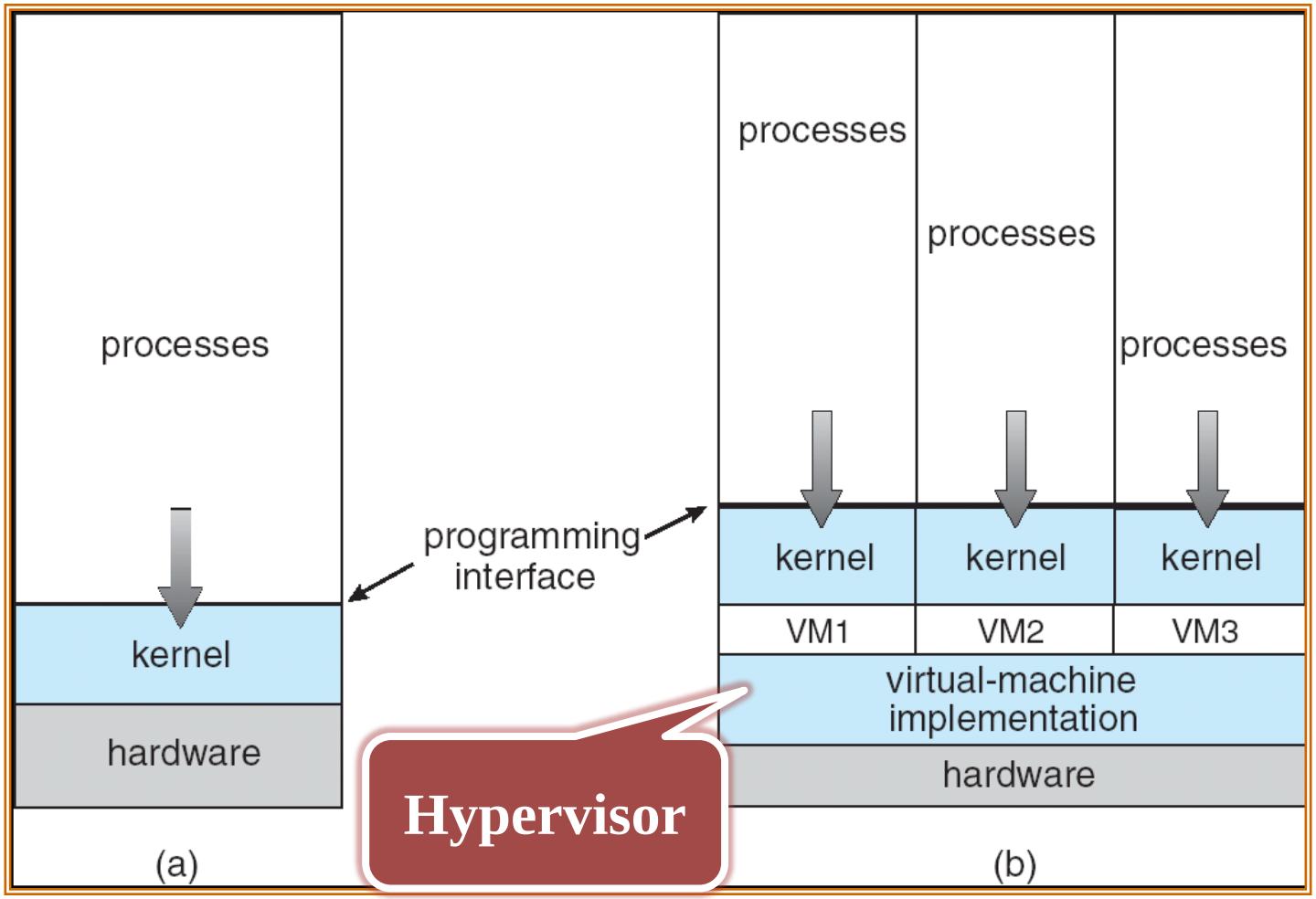
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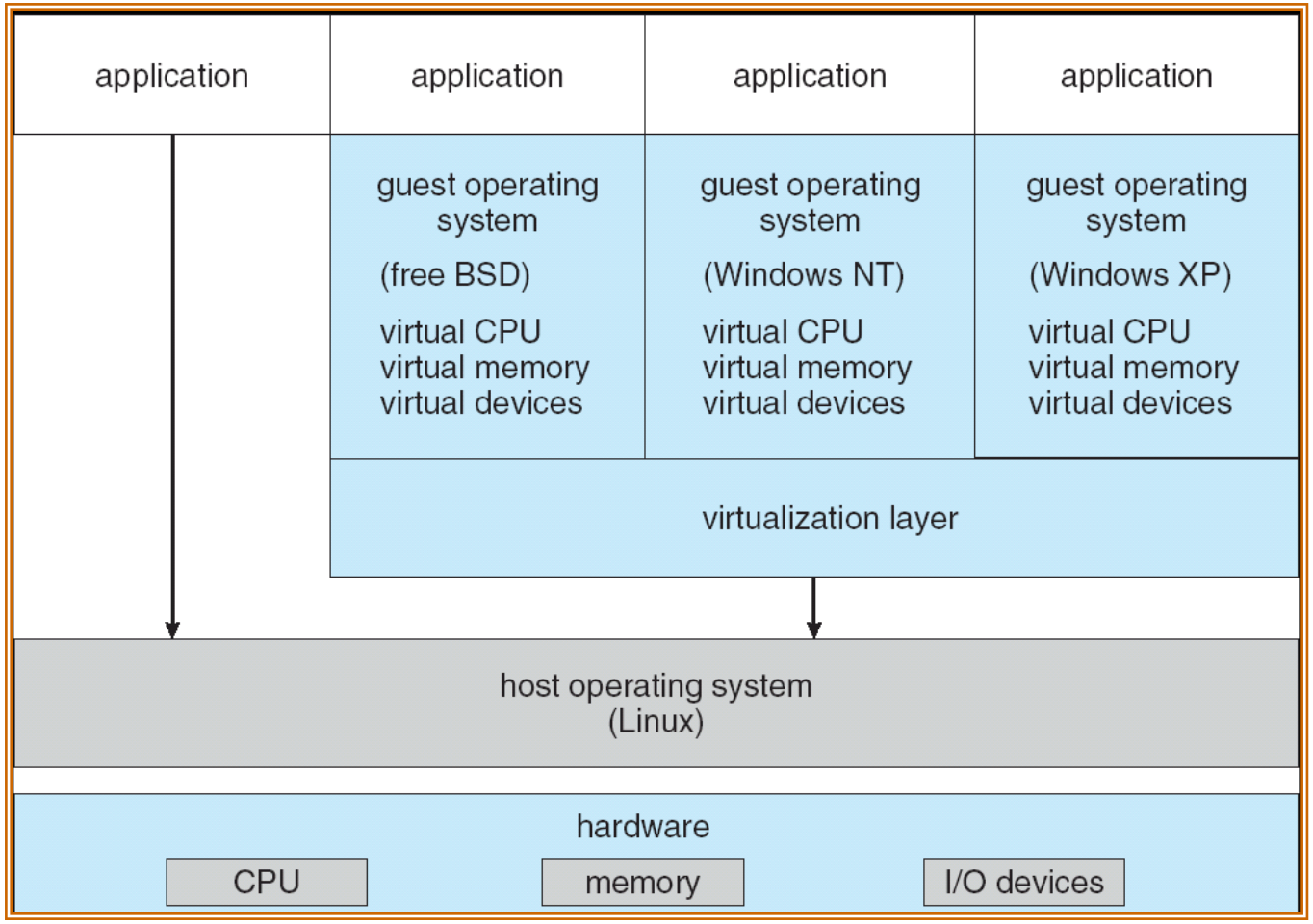
Homework 1 – Exercise on Virtual Machines

Virtual Machines on Hypervisor



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Virtual Machines on Host OS



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VM Managers

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

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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)*

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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

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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);
```

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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*

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Requirements

- Install a virtual machine on your computer
- Install Linux and Windows 11 (or any other OS) on the virtual machine
- Implement a device driver
  - Print “Hi, I am Student-ID, 2026” 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

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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 2 pages in PDF

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Grading

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

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Submission

- Homework 1 deadline: at 23:00 on 2026-11-24

➔**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!

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