

VIRTUALIZATION

虛擬化

WHAT IS VIRTUALIZATION?

把一台系統切成很多獨立的小系統

WHY VIRTUALIZE?

有什麼好處?

MULTI PLATFORM

一台電腦可以同時跑不同的作業系統

ISOLATION

隔離不同的使用者或服務

小明寫系程作業把工作站 搞爆了

大家一起死

小明把系上分給他的VM 搞爆了

只有小明交不出作業

CONSOLIDATION

增加硬體使用率、降低成本

小公司架了WEB, MAIL, FTP,
SCM, 每台機器只用5%

花很多冤枉錢

所有服務集中到一台，總 共用20%

只買一台，省了75%的花費

硬體也是要人照顧的

少點機器，少點人力

EASY DEPLOYMENT

一個映像檔跑天下

HIGH AVAILABILITY

硬體壞了，VM馬上搬到下一台去跑

VIRTUALIZE WHAT?

硬體、儲存空間、網路

HARDWARE VIRTUALIZATION

三大宗

FULL VIRTUALIZATION

完全模擬一台機器必備的硬體

VMware, VirtualBox, Hyper-V, KVM, QEMU.....

FULL VIRTUALIZATION 之 HARDWARE ASSISTED

Full Virtualization很吃資源，有CPU幫忙比較好

Xen HWM

PARAVIRTUALIZATION

透過軟體 (Hypervisor) 處理需要虛擬化的指令。
效能高，但OS要客製化。

Xen, VMware VMI

OS-LEVEL VIRTUALIZATION

OS裡面隔出不同的房間

同個屋簷下，會被鄰居吵到

同一棟房子 (同一種OS)

LXC, OpenVZ, FreeBSD Jails....

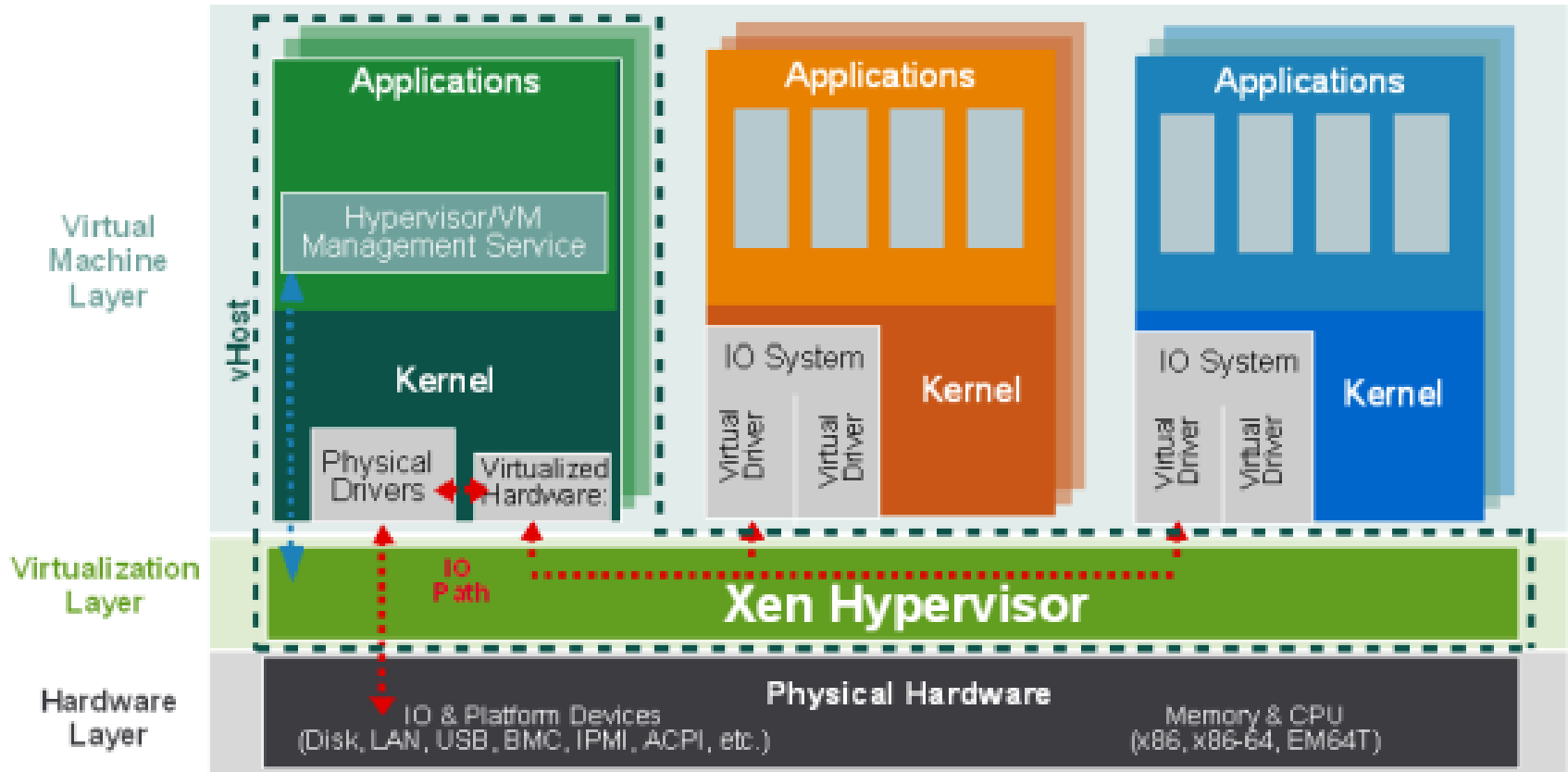
NO VIRTUALIZATION

大通鋪，床位先搶先贏，搶輸了站門外

XEN

External Hypervisor

Xen



WHAT'S GOOD ABOUT XEN?

Mature products and 3rd party support

Can also be installed with Linux

API and easy to use tools

THE NOT SO GOOD

Can only use tools

RedHat dropped support

XEN PRODUCTS

Citrix XenServer

Citrix Cloud Platform

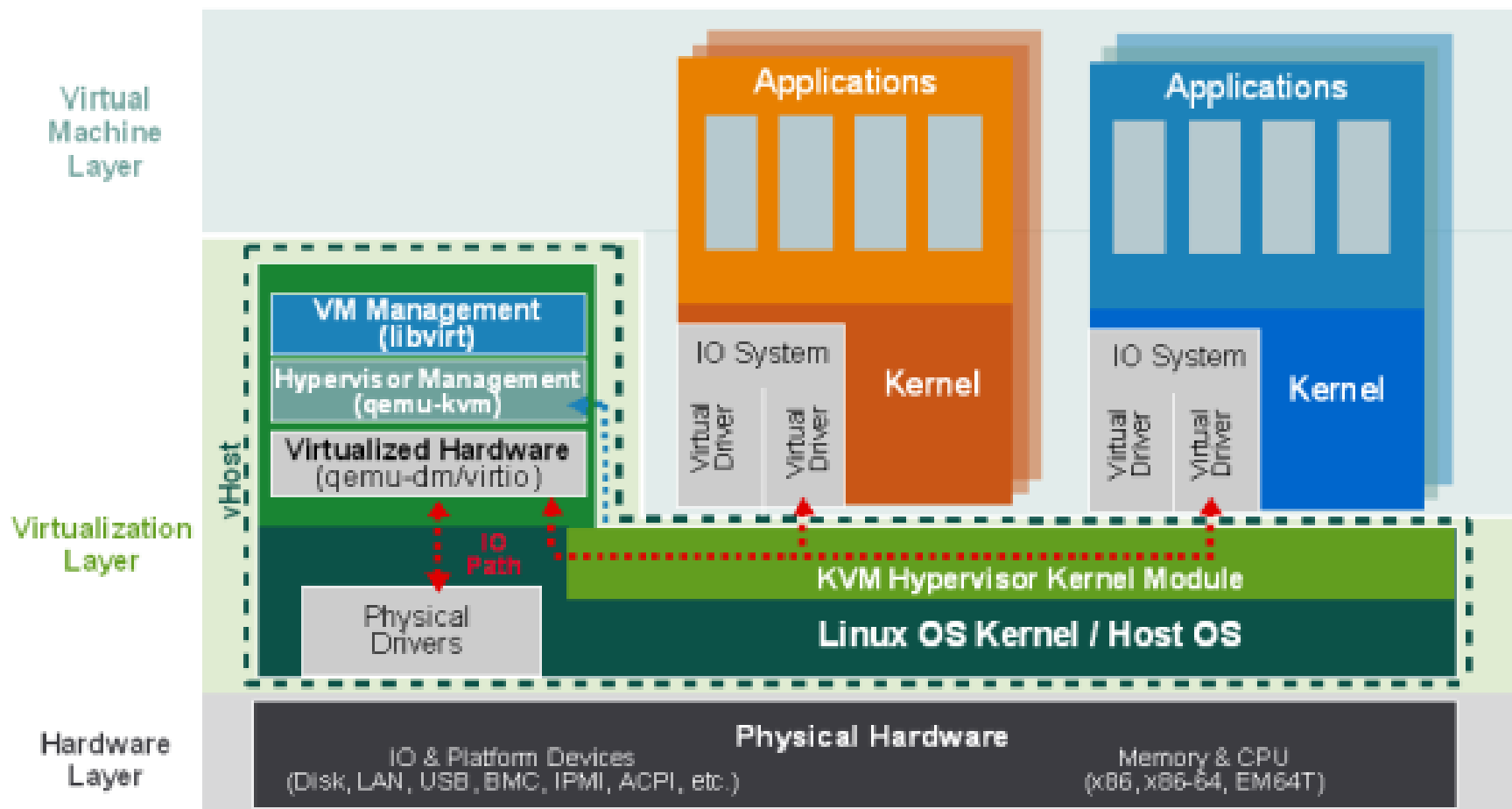
Oracle VM

KVM

KERNEL VIRTUAL MACHINE

Included in mainstream Linux Kernel

KVM



MAINSTREAM KERNEL

Get it with every Linux kernel

A set of kernel interfaces and APIs

QEMU frontend

EACH VM IS A PROCESS

Each virtual CPU core is a thread

VM Scheduling, Memory management, Hardware drivers – all provided by Linux

Take advantage of Linux features: KSM, Hugepages

HOW TO USE KVM?

```
/usr/bin/kvm -enable-kvm -m 1024 -smp 1 -drive  
file=linux.img
```

SERIOUSLY?

```
/usr/bin/kvm -S -M pc-1.1 -enable-kvm -m 1024 -smp 1,sockets=1,cores=1,threads=1 -name list -uuid 6865eebb-e6aa-c7f8-499a-d3ba663b5dd4 -nographic -nodefconfig -nodefaults -chardev socket,id=charmonitor,path=/var/lib/libvirt/qemu/list.monitor,server,nowait -mon chardev=charmonitor,id=monitor,mode=control -rtc base=utc -no-shutdown -device piix3-usb-uhci,id=usb,bus=pci.0,addr=0x1.0x2 -drive file=/mnt/qcow/list.qcow2,if=none,id=drive-virtio-disk0,format=qcow2 -device virtio-blk-pci,scsi=off,bus=pci.0,addr=0x4,drive=drive-virtio-disk0,id=virtio-disk0,bootindex=1 -netdev tap,fd=26,id=hostnet0 -device rtl8139,netdev=hostnet0,id=net0,mac=52:54:00:5f:68:2a,bus=pci.0,addr=0x3 -chardev pty,id=charserial0 -device isa-serial,chardev=charserial0,id=serial0 -device virtio-balloon-pci,id=balloon0,bus=pci.0,addr=0x5
```

WAY TOO UGLY!!

Anything better?

LIBVIRT

A toolkit to interact with many common virtualization systems.

VIRSH

CLI tool included with Libvirt

Manipulate libvirt and underlying VMs with
commands and XML files

EXAMPLE: STOP VM

```
# virsh stop test-vm
```

EXAMPLE: CREATE VM

Create definition XML file

<http://libvirt.org/formatdomain.html>

```
# virsh create VM.xml
```

DON'T LIKE XML?

VIRT-INSTALL

CLI tool for creating/importing and installing VMs

EXAMPLE: CREATE VM

```
# virt-install \  
    --name demo \  
    --ram 512 \  
    --disk /home/user/VMs/mydisk.img \  
    --import
```

CREATE AND INSTALL

```
# virt-install \  
    --virt-type kvm \  
    --name demo \  
    --ram 512 \  
    --disk path=/vm/demo.img,size=20 \  
    --cdrom /dev/cdrom
```


DON'T LIKE CLI?

Are you serious?

VIRT-MANAGER

GUI frontend for libvirt

Virtual Machine Manager

File Edit View Help

View: All virtual machines

Name	ID	Status	CPU usage	Memory usage
localhost	qemu	Active	0.00 %	0.00 MB 0 %
test-vm	-	Shutoff	0.00 %	128.00 MB 0 %
localhost	test	Active	6.25 %	2.00 GB 66 %
test	1	Running	6.25 %	2.00 GB 66 %



Delete



New



Details

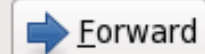


Open

Creating a new virtual system

This assistant will guide you through creating a new virtual system. You will be asked for some information about the virtual system you'd like to create, such as:

- A **name** for your new virtual system
- Whether the system will be **fully virtualized** or **para-virtualized**
- The **location** of the files necessary for installing an operating system on the virtual system
- **Storage** details - which disk partitions or files the system should use
- **Memory** and **CPU** allocation



EXTRA STUFF TO MANAGE

Networking

LVM storage

Libvirt can do it for you

References

- <http://libvirt.org/>
- <http://www.linux-kvm.org/page/HOWTO>

Homework

- Install a virtual machine host
 - Xen, KVM, or even ESXi is OK. You pick.
- Use libvirt to manage it
 - Create and install a Linux guest.
 - You decide the parameters (CPU, disk, etc.).
 - You can use the tools mentioned today, or anything else.

Homework Submission

- Mail the following (as content, not attachment) to me
 - Libvirt domain (guest) xml file
 - # virsh dumpxml YOUR_DOMAIN
 - Command outputs from guest
 - # lspci
 - # dmidecode -t system
 - File contents from guest
 - /proc/cpuinfo

Homework Grading

- This is an all or nothing assignment.
 - The purpose of this assignment is to let you exercise building and managing a VM host and guest.
 - If something is wrong with the data you submitted, I can not confirm you did so, hence no credit.
- **1 grade lower if you give me wrong format (as attachment)**