

# The Need of Meta-VMM and Resource Catalog in Education Cloud

@ 2012-12-11

Cloud Plugfest 2012

National Center for High-performance Computing

Software Technology Division / Ezilla Team

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# DECLAIM

- We are quite newbie to OCCl community.
- We heard about OCCl at OGF 26, 2009.
- We start to use OCCl since March 2012.
- We're currently working on the implementation of Meta-VMM and Resource Catalog base on OCCl server and client builded in OpenNebula.
- My presentation today is more like a USE CASE of the needs in education cloud of Taiwan.

# Why am I here ?

- Make friends
  - Connecting people involved with Cloud Interop
- Be an observer
  - Join the standard development of Cloud Interop
  - Learn from experts
- Be a developer
  - Implement OCCl related software in near future
  - Contribute back to the open source community

# Agenda

- About NCHC and Education Cloud in Taiwan
- The need of Micro Data Center
- The need of Meta-VMM
- The need of Resource Catalog
- Brief Introduction to Ezilla Project

# About NCHC and Education Cloud in Taiwan

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# About NCHC

## NCHC

**To Become a World-class Supercomputing Center  
To Promote Global Scientific Discoveries & Technical Innovation**

### Fundamental Role

- Provide HPC, storage, and networking Facilities
- Infuse innovative technology;  
Foster growth of HPC professionals

### Enabling Role

- Provide customized “total solution” to users
- Perform collaborative research with other institutes; Create technology breakthroughs

# HPC Services

- Open for academic, research, and Industrial users.
- Windrider (a.k.a. ALPS system)- newly deployed supercomputer in 2011; peak performance: 177 TFLOPS, 442.00 MFLOPS/W



御風者  
WINDRIDER

- 25,600 Cores
- 73,728 GB Memory
- 1,074 TB Disk

Jun. 2011:

Top500 Ranking: No. 42

Green500 Ranking: No. 60

Nov. 2011:

Top500 Ranking: No. 60

Green500 Ranking: No. 64

Advanced Large-scale Parallel Supercluster

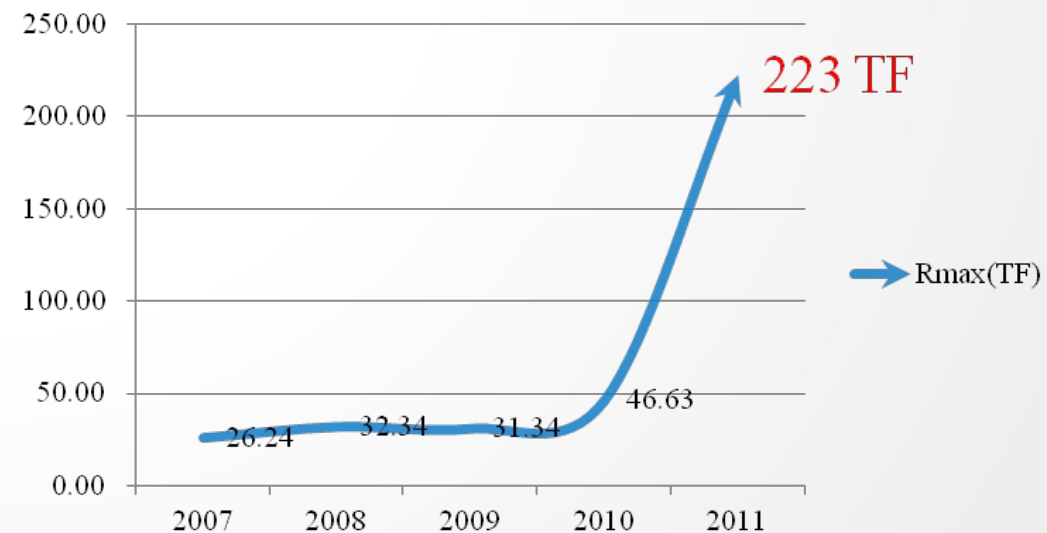


IBM Cluster 1350 / 19.91TF



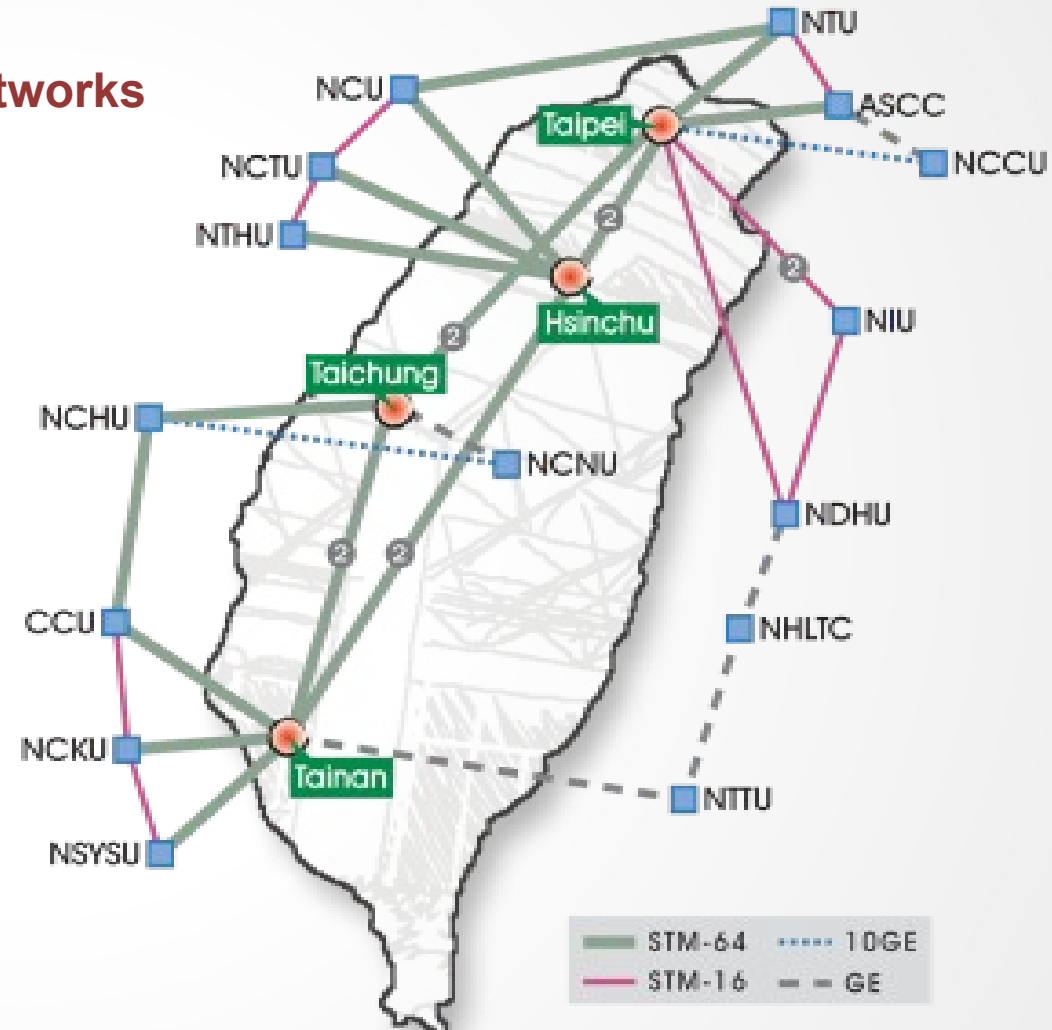
HP Superdome2

NCHC Total Computing Capacity



# Research and Education Network

- Provides research network, education network (TANet), and optical Lightpath services
- Peering with 35 IPv4 and 24 IPv6 networks worldwide
- Network availability rate up to 99.991%
- Enables dynamic circuit provisioning





# Education Cloud Project in Taiwan

- MOE (Ministry of Education) in Taiwan aim to provide services, such as
  - 3 Data Center for Education
  - E-learning portal like MIT OpenCourseWare
  - Unified Access via OpenID
  - Wiki to share educational content
  - Mini Security Operation Center (MiniSOC)

# The need of Micro Data Center

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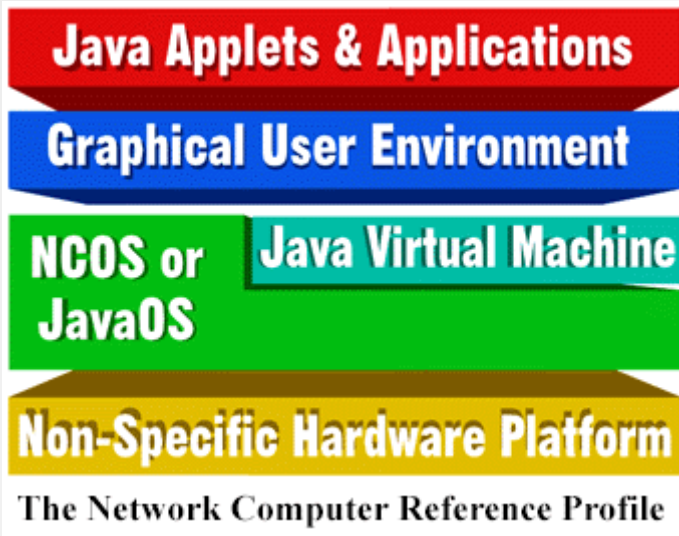
National Center for High-performance Computing

Software Technology Division / Ezilla Team

Jazz Yao-Tsung Wang

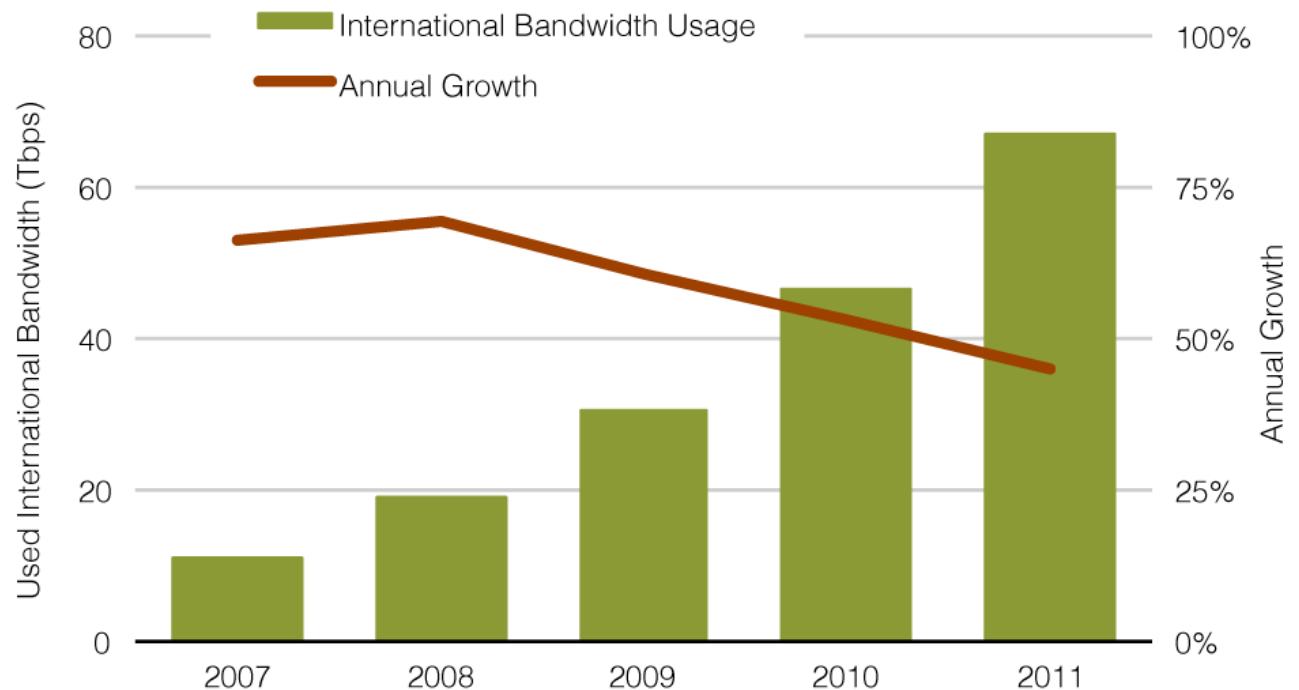
[jazz@nchc.narl.org.tw](mailto:jazz@nchc.narl.org.tw)

# Bandwidth is NOW enough for Cloud Era



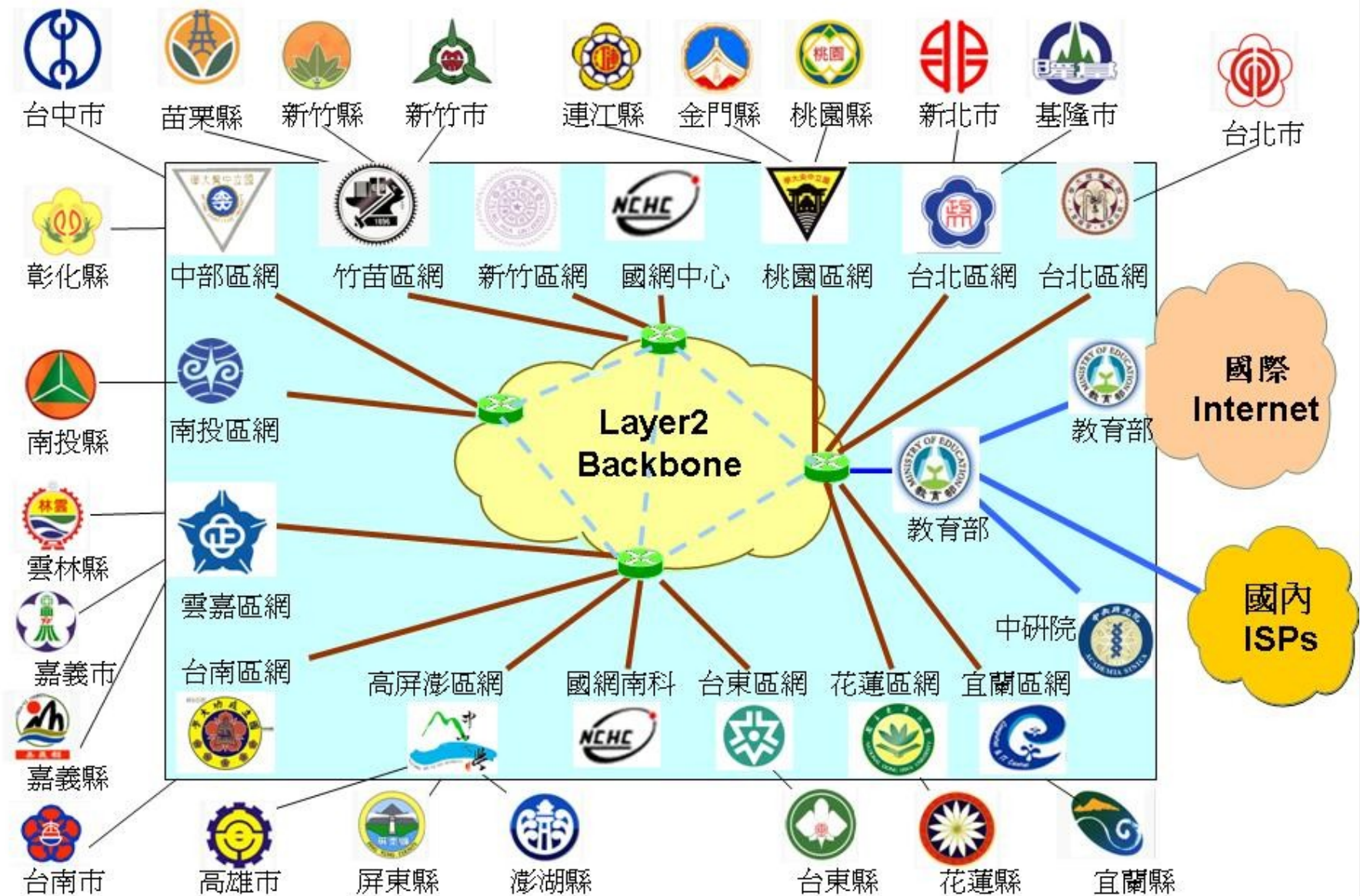
In 1996, Sun Microsystems proposed 'Network Computer', such as JavaStation

In 2010, Cloud Computing become part of US CIO policy.

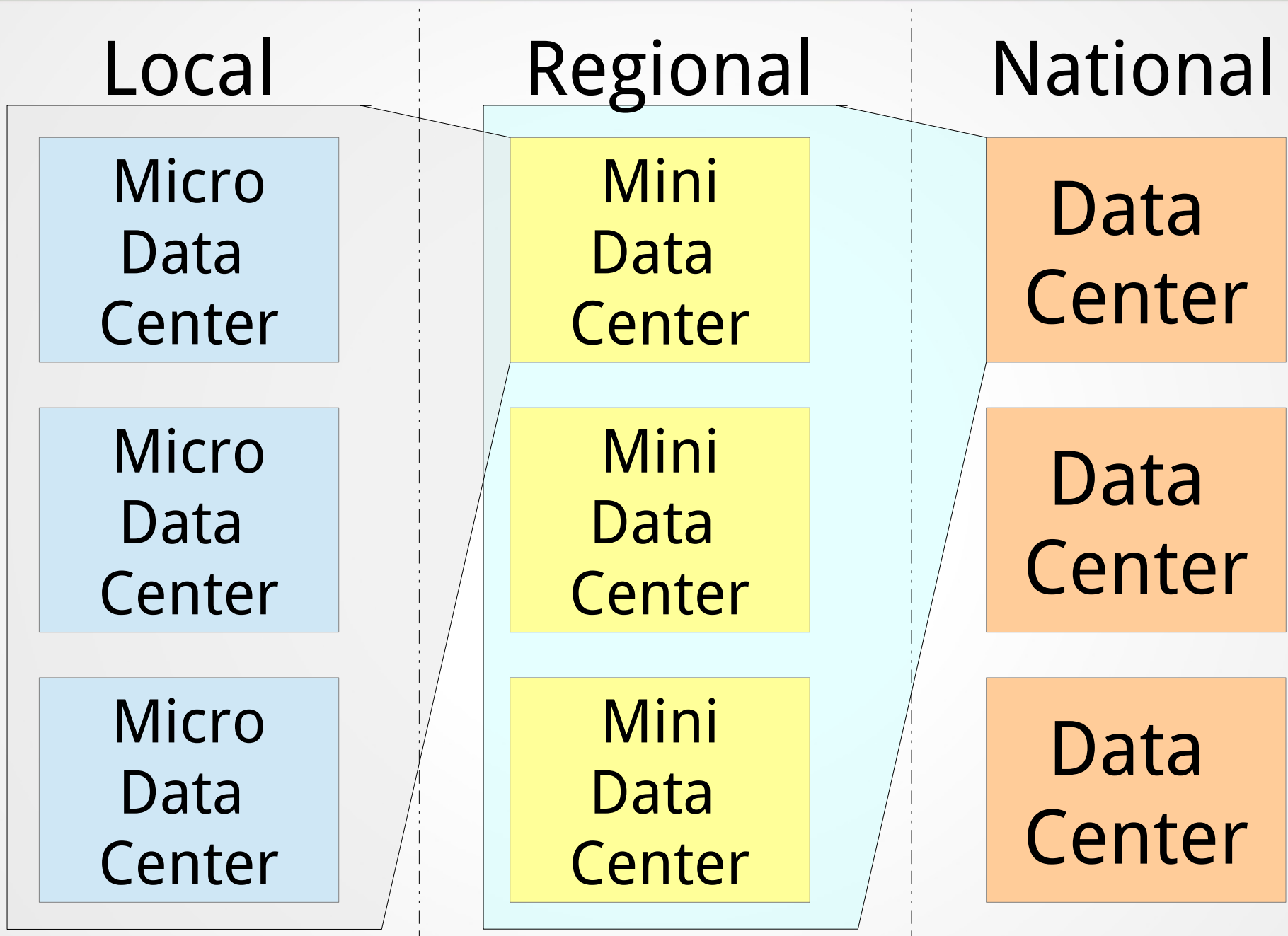


# But last mile is **STILL** the problem

## 2011年學術網路TANet骨幹網路架構圖

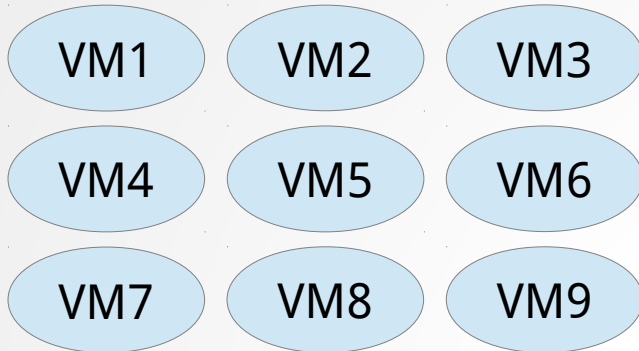


# Resources are not born equally



# Hybrid Cloud will be the answer !

## Class Room #1



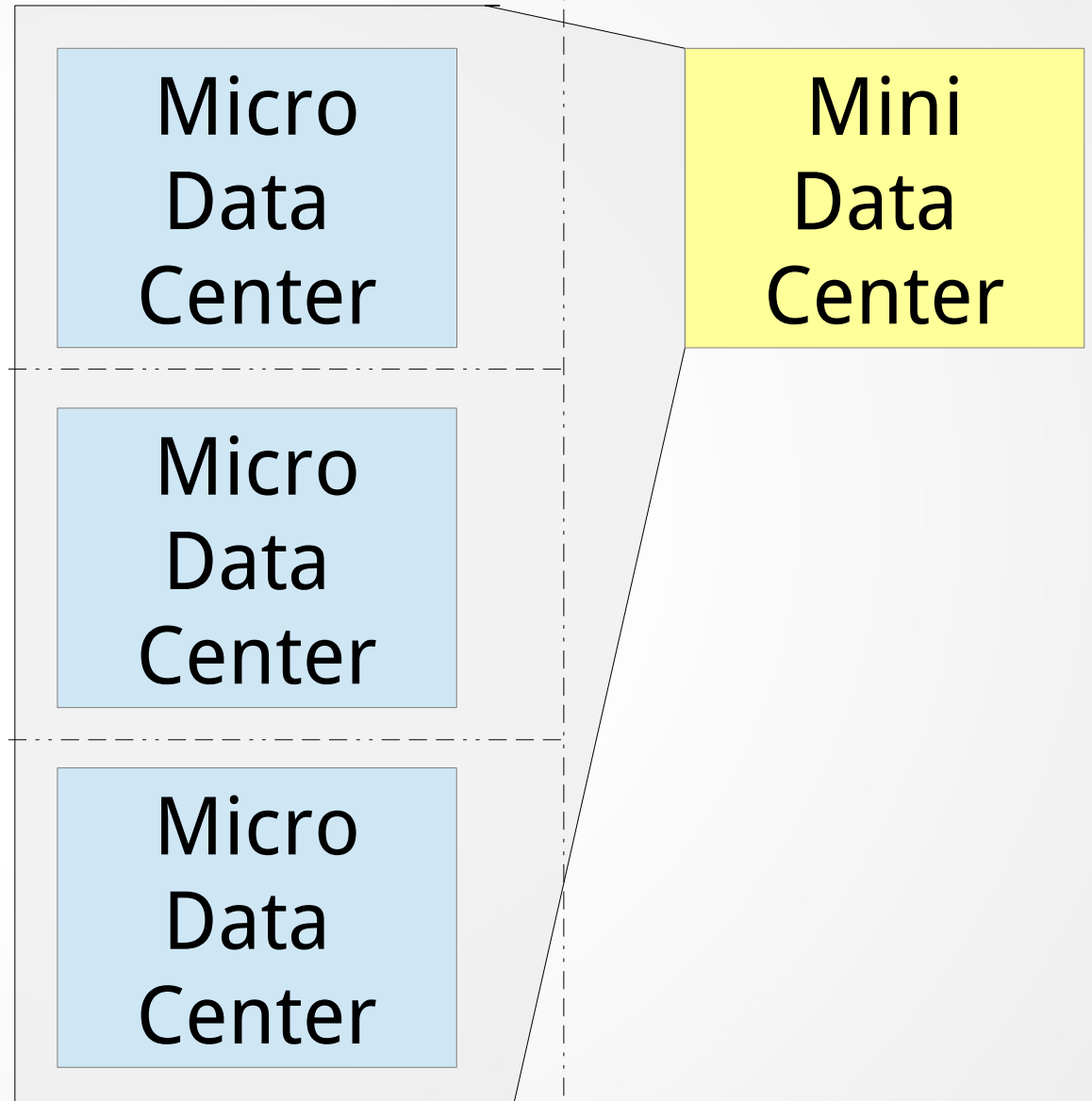
## Class Room #2



## Class Room #3



## Local



# The need of Meta-VMM

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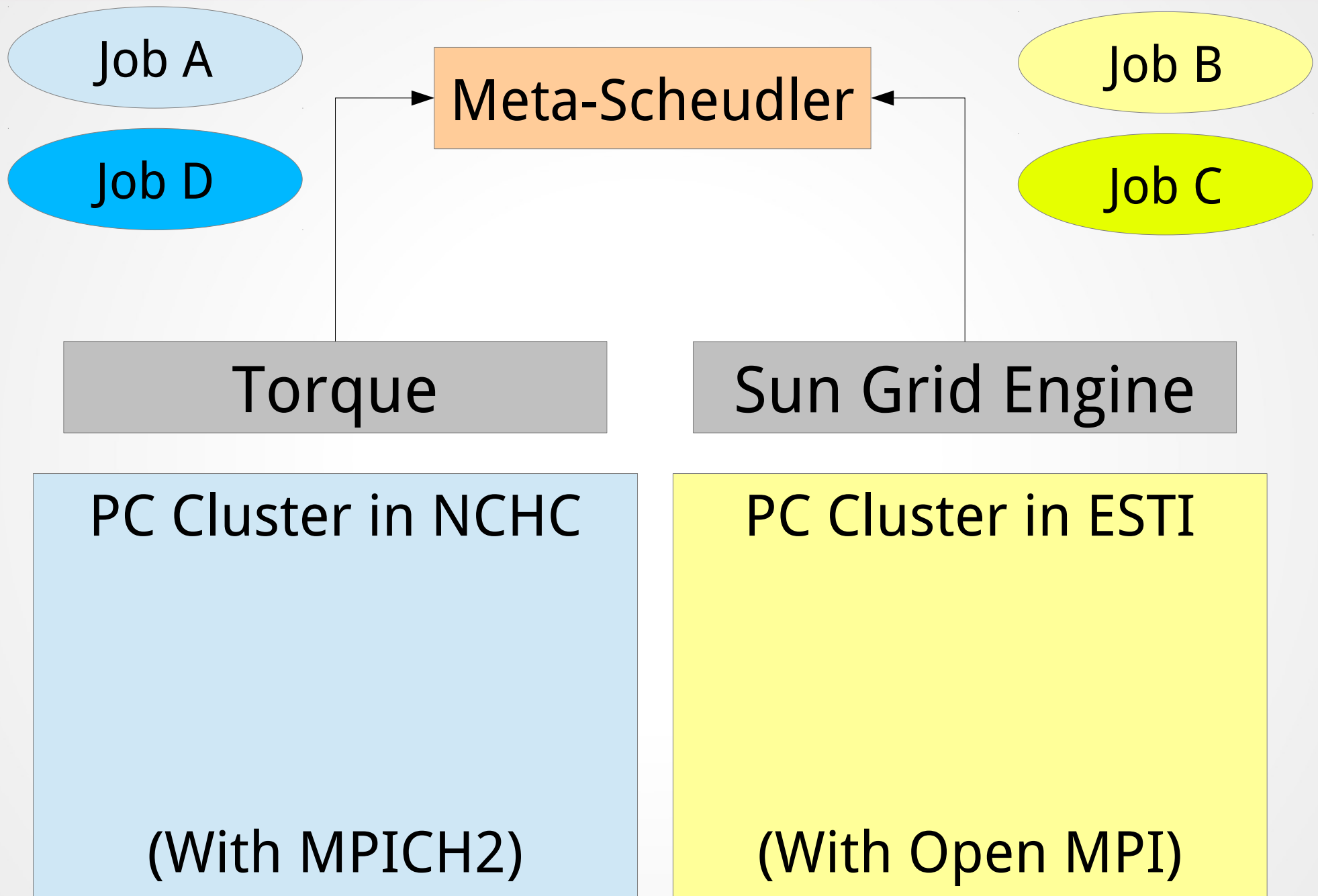
[jazz@nchc.narl.org.tw](mailto:jazz@nchc.narl.org.tw)

# Existing VMMs

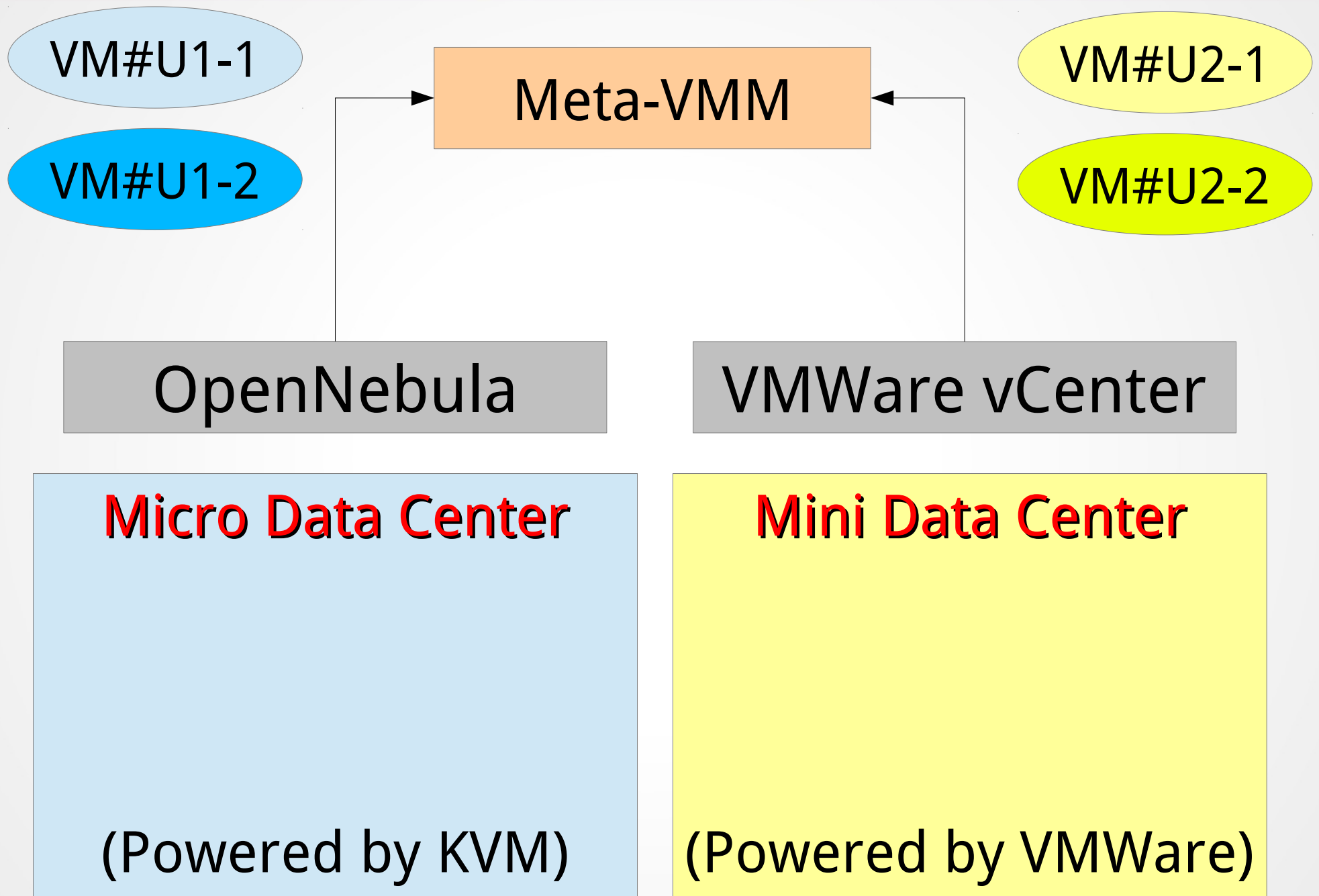
- Commercial :
  - VMWare vCenter
  - Microsoft System Center
- Open Source :
  - OpenStack
  - OpenNebula
  - Eucalyptus
- VMM does not include
  - Mac Parallels
  - Oracle VirtualBox (Win, Linux, Mac OS X, Solaris)



# Meta-Scheduler in Grid Computing



# Meta-VMM in Cloud Computing



# Existing Meta-VMM (Commercial)

## Microsoft System Center support Hyper-V and VMWare

	VMware vSphere 4	Microsoft WS08 Hyper-V R2/SMSE
實體和虛擬管理	✗	✓ SMSE
VMWare 和 Microsoft 管理	✗	✓ SMSE
客體作業系統監視	✗	✓
端對端作業系統監視	✗	✓ SMSE OpsMgr
應用程式/服務監視	✗	✓ SMSE, PRO
主機/虛擬機器層級的最佳化	✓ DRS	✓ SMSE, PRO
集中式 HV 管理	✓ Virtual Center	✓ SMSE, VMM
客體作業系統修補/管理	✓	✓ SMSE, SCCM
虛擬機器的高可用性/容錯移轉	✓ Virtual Center	✓ WS08 叢集 + VMM
虛擬機器移轉	✓ vMotion	✓ 即時移轉
儲存體虛擬機器移轉	✓	✓ <sup>1</sup>

WS08 = Windows Server 2008

SMSE = System Center Server Management Suite Enterprise

PRO = 效能與資源最佳化

VMM = Virtual Machine Mgr

SCCM = System Center Configuration Manager

<sup>1</sup> 快速

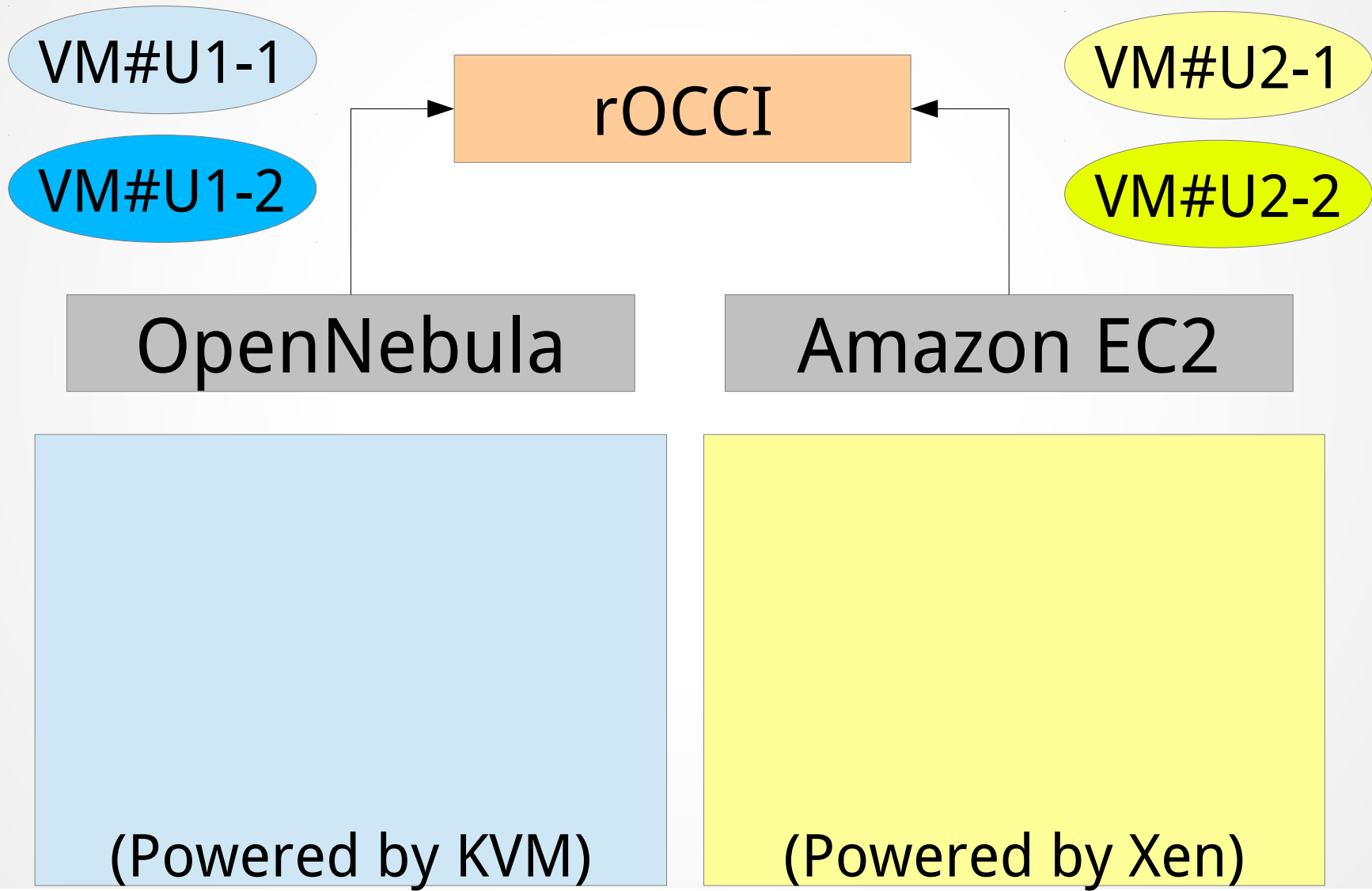
	vSphere Standard	vSphere Advanced	vSphere Enterprise	vSphere Enterprise Plus	System Center Server Management Suite Enterprise
價格 = Hypervisor 和管理軟體的成本	\$7,950 + \$4,995 = \$12,945	\$22,450 + \$4,995 = \$27,445	\$28,750 + \$4,995 = \$33,745	\$34,950 + \$4,995 = \$39,945	\$0 + \$6,753 = \$6,753
成本差異	1.9x more	4x more	5x more	5.9x more	—
vSMP support	4-way	4-way	4-way	8-way	4-way
Physical memory	256GB	256GB	256GB	512MB	1TB
Offline VM/OS updates	✓	✓	✓	✓	✓
HA/Clustering	✓	✓	✓	✓	✓
VM live migration	✗	✓	✓	✓	✓
Backup/Recovery	✓	✓	✓	✓	✓
Hot add	✗	✓	✓	✓	✓ <sup>1</sup>
Fault tolerance	✗	✓	✓	✓	✗
Storage VM migration	✗	✗	✓	✓	✓ <sup>2</sup>
DRS/PRO	✗	✗	✓	✓	✓
vNetwork/Host profiles	✗	✗	✗	✓	✗
Physical management	✗	✗	✗	✗	✓
In-guest monitoring	✗	✗	✗	✗	✓
Cross hypervisor	✗	✗	✗	✗	✓

<sup>1</sup> Storage  
<sup>2</sup> Quick

<http://www.microsoft.com/taiwan/virtualization/compare/>

# The Basic Meta-VMM (Open Source)

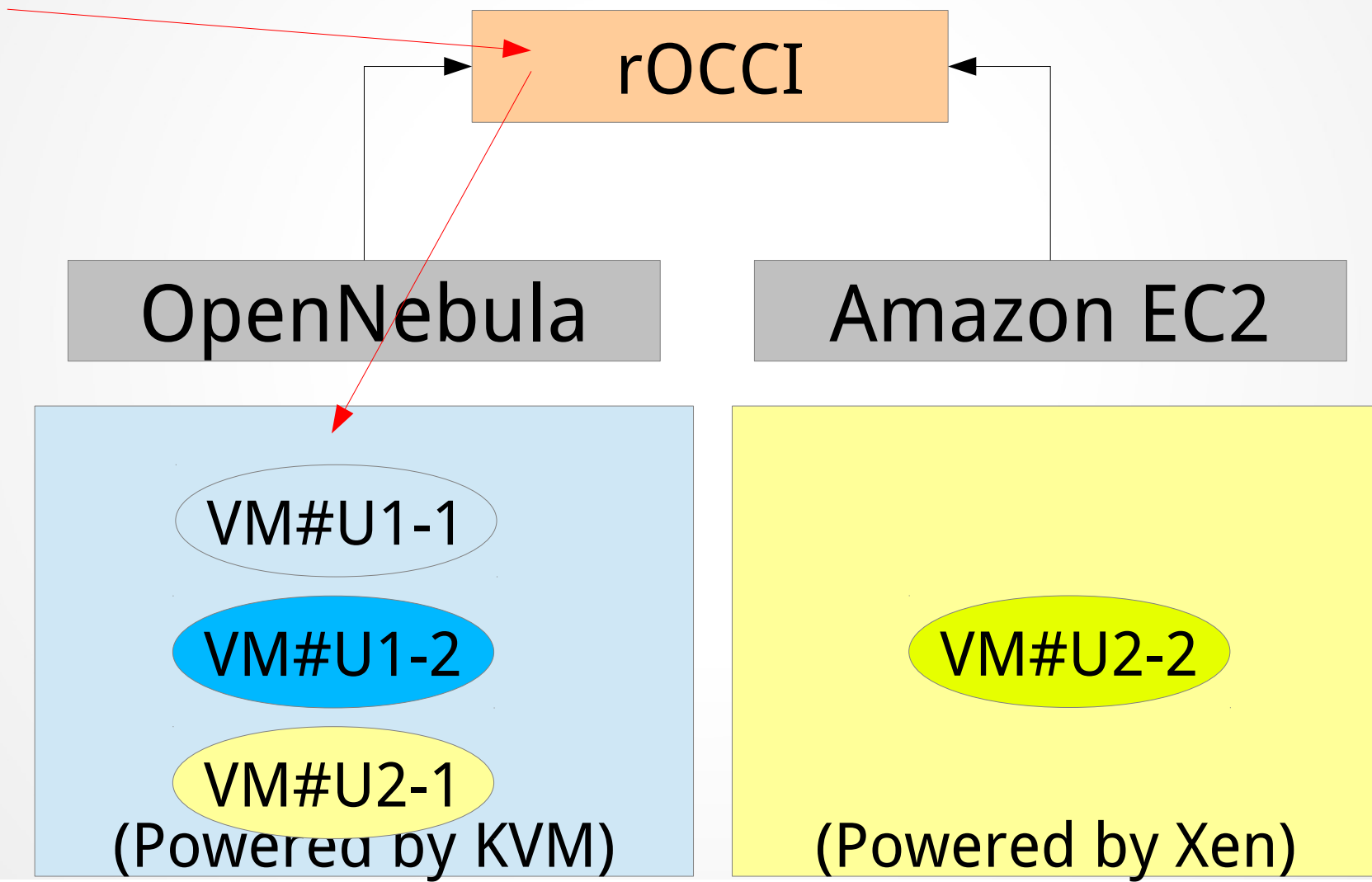
- rOCCI might be one of the example



# The powerful Meta-VMM

- rOCCI had done some tricks

1. Support Cold Migration
2. Support Live Migration



# Known Problems of Powerful Meta-VMM

- How to share/copy VM Disk Image between VMM?

Existing Answer: SCP, NFS, etc.

- How to convert between VM Disk Image Types?  
(such as RAW, VMDK, VDI, VHD, etc.)

Existing Answer: OVF standard

More problem: Virt-I/O, Single Disk Image → Multiple Image

- How to fix VM Disk Image for different CPU architecture?  
(HW level: such as Intel 64bit CPU → AMD 32bit CPU)

Existing Answer: ??????

- How to fix VM Disk Image for different Hypervisor?  
(OS level: such as KVM to Xen, Xen to KVM)

Existing Answer: Virt-V2V (might not solve all the case)

# Known Problems of Powerful Meta-VMM

➤ How to fix the network topology issue?

(Network Level: such as IP, DNS, routing, uniq MAC)

**Existing Answer: Open vSwitch (might solve some problem)**

# virt-v2v : make Xen to KVM migration easy

[http://fedoraproject.org/wiki/Features/Xen\\_to\\_KVM\\_migration](http://fedoraproject.org/wiki/Features/Xen_to_KVM_migration)

## Xen to KVM migration

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### Summary

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Provide nearly effortless automatic translation of Xen virtual machines to KVM virtual machines.

### Owner

---

- Name: [Richard Jones](#), [Matthew Booth](#)

### Current status

---

- Targeted release: [Fedora 14](#)
- Last updated: 2010-01-26
- Percentage of completion: 80%

### Detailed Description

---

virt-v2v is a command line tool that enables Xen domUs (ie. guests) to be migrated to use KVM. Usage will be:

```
virt-v2v xen_domain -o kvm_domain
```

(for a libvirt-managed domain called `xen_domain`).

The process will automatically install the correct kernel and driver(s) and make any configuration changes necessary so that the KVM domain will run with virtio drivers.

The process will also be reversible - if the KVM transition doesn't work out, then system administrators can go back to the original, untouched Xen domain, via a snapshot.




# Windows VM from AMD to Intel within VMWare

**AMD Truth Squad: Cold Migration Between AMD and Intel**

AMDUprocessed + 訂閱 445 部影片 ▾

- Cold Migration
- Move VMs between 2 types of servers
- Less resources
- Quicker than live migration



2,500

AMDUnprocessed 於 2011-06-16 上傳

Can AMD and Intel work together in the datacenter? Can VMs migrate between an AMD-based server and an Intel-based server? Many have strong views on the topic, but are they based on the facts?

28 人喜歡, 0 人不喜歡

影片出處:  
[Business Blog](#)

<http://www.youtube.com/watch?v=eNEiCv3pj18>

# Discussion Needed

Should different VMMs  
describe itself with  
more metadata ?

(Hardware, Hypervisor, etc)

# The need of Resource Catalog

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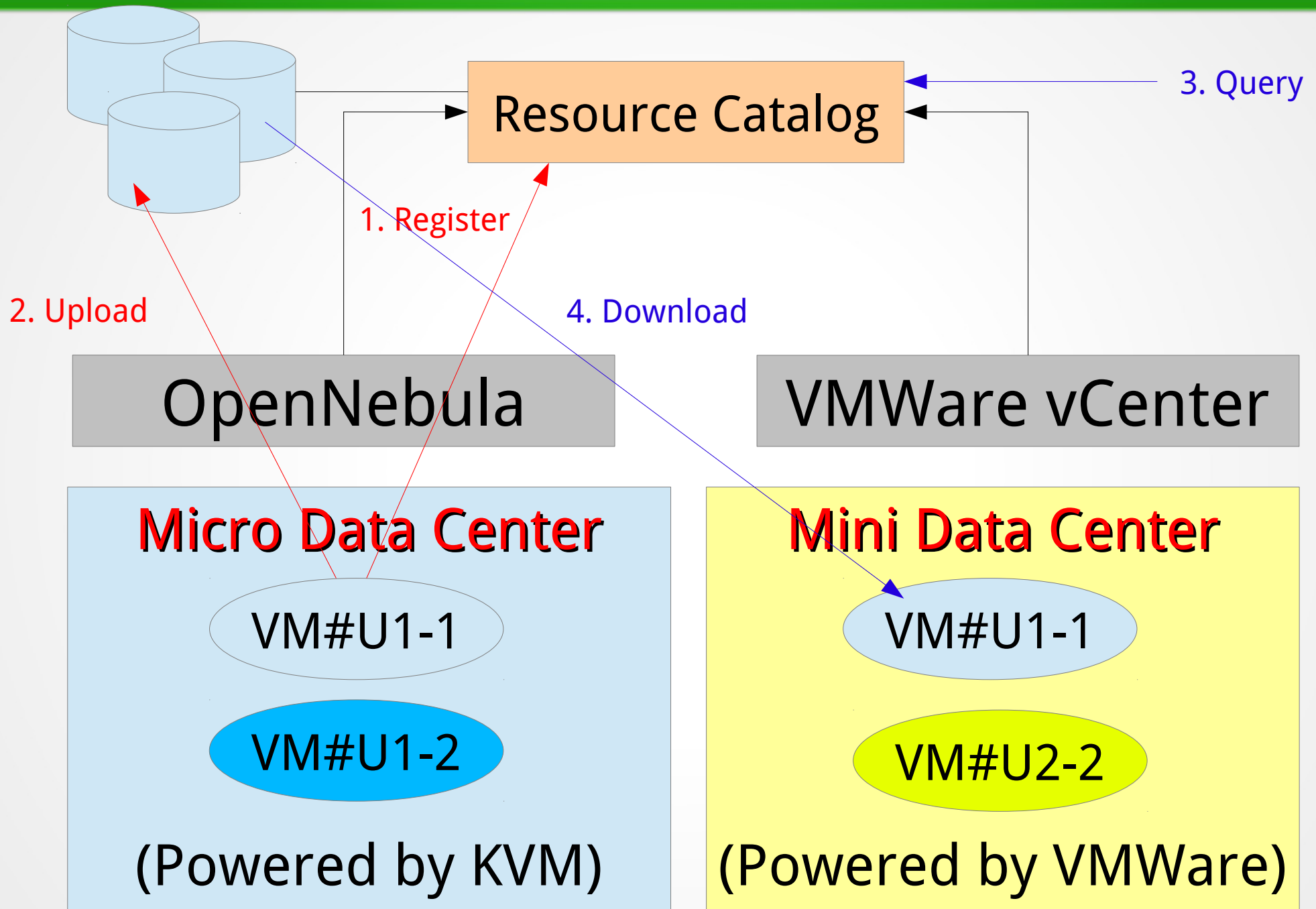
Jazz Yao-Tsung Wang

[jazz@nchc.narl.org.tw](mailto:jazz@nchc.narl.org.tw)

# Use Case : Save Teacher's Time

Teachers in different schools  
prepare the same disk image  
for the same course !

# Concept of Resource Catalog



# C12G Labs might be one example

## New OpenNebulaApps Suite

Simplify and optimize the management of services on your OpenNebula cloud



Define software configurations for your applications and share them with other users



Manage multi-tiered applications as a single entity and provide them from a catalog



Build a private repository to share and distribute appliances across cloud instances

## Which OpenNebula is Right for Me?

OpenNebulaPro increases IT productivity, speeds time to deployment, and reduces business and technical risks

### OpenNebula.org

OpenNebula.org is an open-source community project, managed by C12G Labs, aimed at building **OpenNebula - the open-source industry standard for data center virtualization**, with the latest innovations for cutting-edge cloud infrastructures and solutions.

### OpenNebula.pro

OpenNebula.pro is a support portal, managed by C12G Labs, aimed at providing **OpenNebulaPro - the commercially supported distribution of OpenNebula**, and the professional support services and tools to integrate, build, certificate and manage production-ready cloud

<http://www.c12g.com/>

# Brief Introduction to Ezilla Project

@ 2012-12-11



**Ez**illa

# What is Ezilla ?

- Ezilla is designed to
  - A Toolkit to build your **Private Cloud**
  - A Toolkit to build **Infrastructure as a Service**
- Ezilla provide user a simple web interface to create and access personal **virtual desktop**
- Ezilla is based on:
  - (1) DRBL (Diskless Remote Boot in Linux)
  - (2) Web Interface
  - (3) Cloud Middleware
  - (4) Moosefs
  - (5) Clonezilla



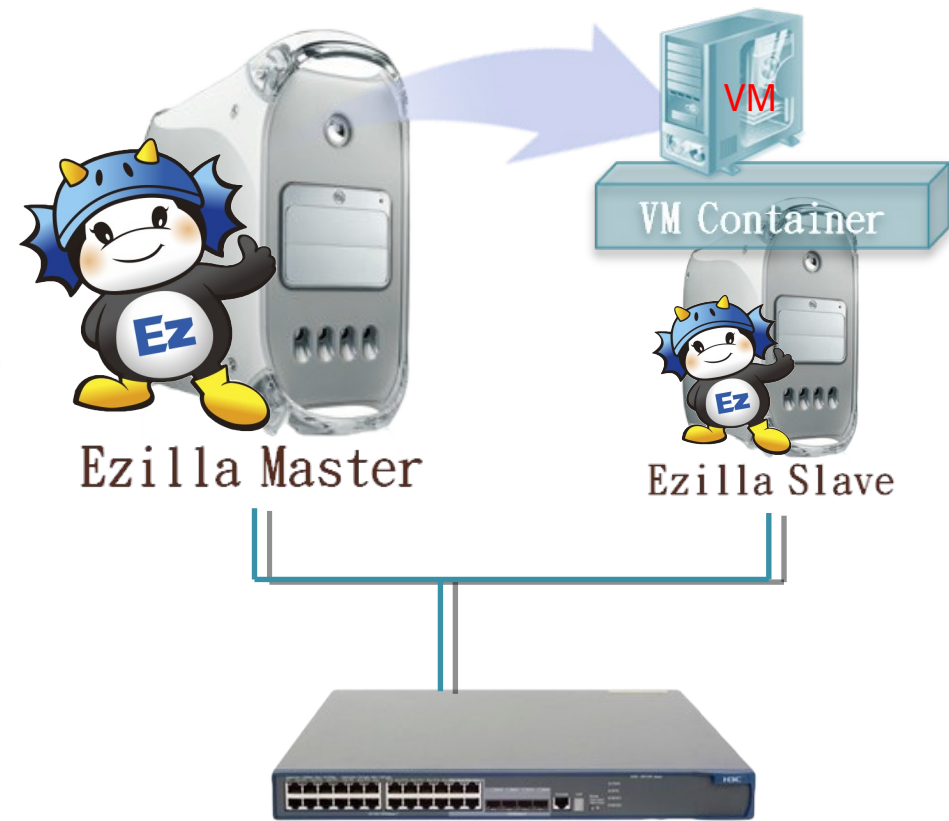


# Architecture of Ezilla

Pervasive Computing Lab

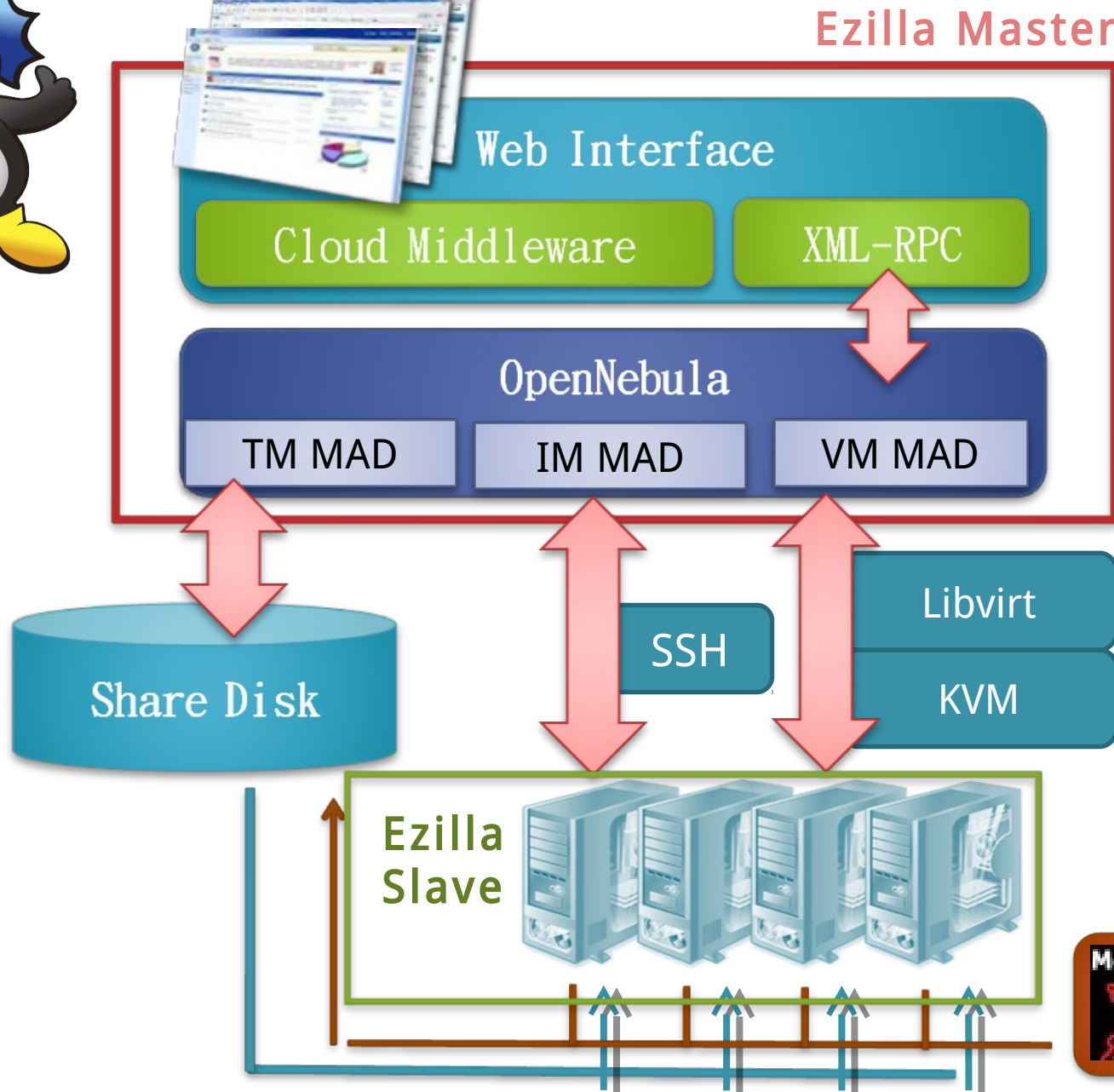


VM Request



# System Blocks of Ezilla

Pervasive Computing Lab



# Feature #1: Unattended Installation

Pervasive Computing Lab



無人值守  
(Unattended Install)  
Ezra 中介軟體自動安裝

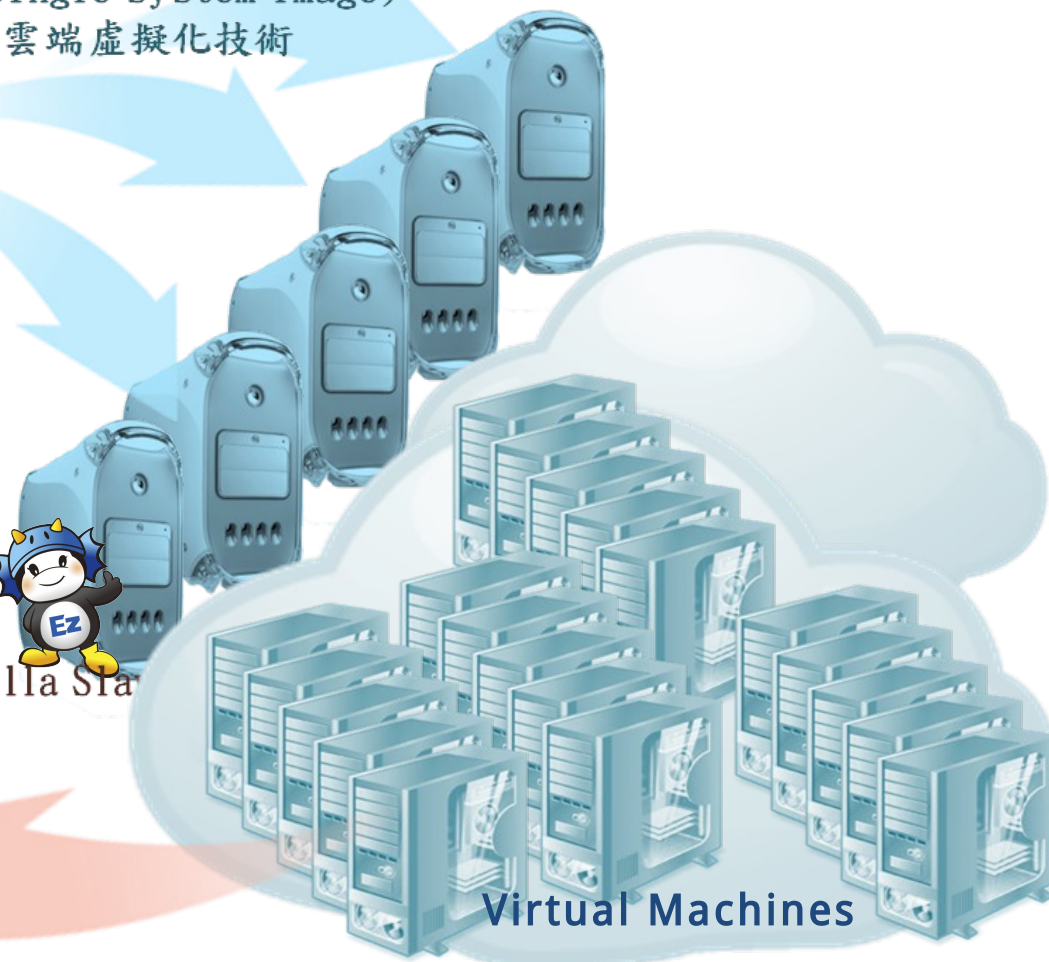
DRBL SSI (Single System Image)  
模式+ 雲端虛擬化技術



Ezra Master



Ezra Slave



Virtual Machines



Ezra WebOS



# Feature #2: Parallel File System



# Based on Sun Stone

Pervasive Computing Lab



**Username**

**Password**

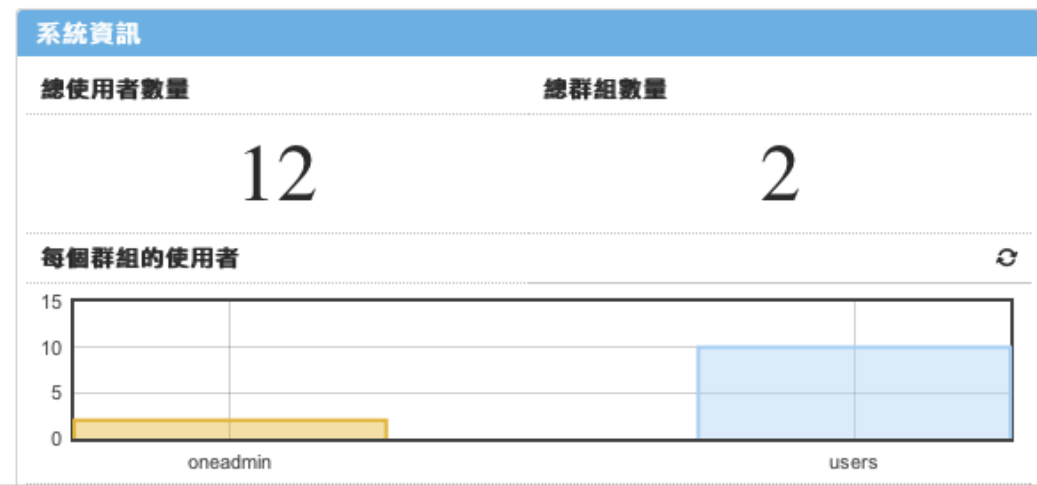
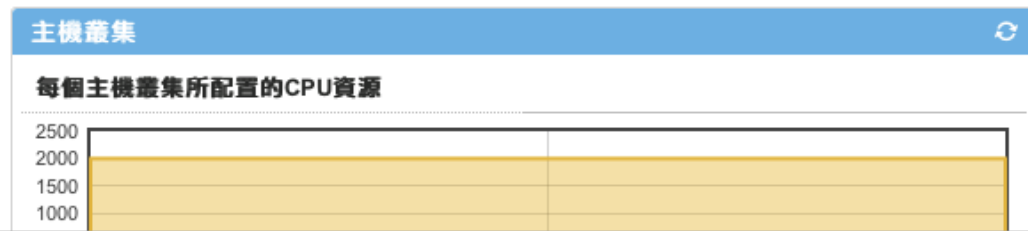
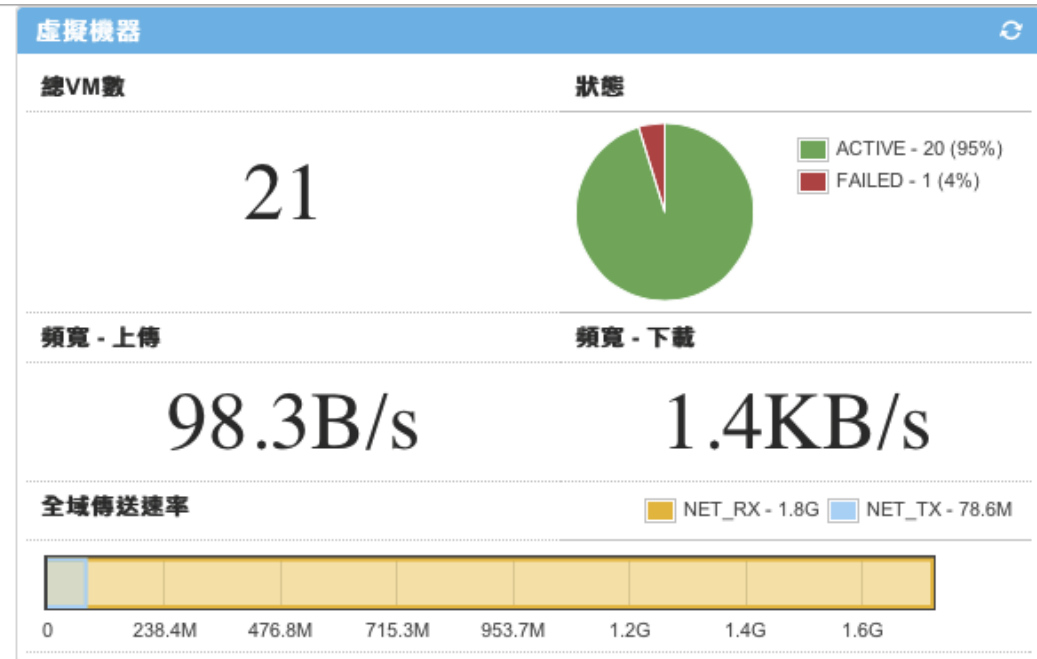
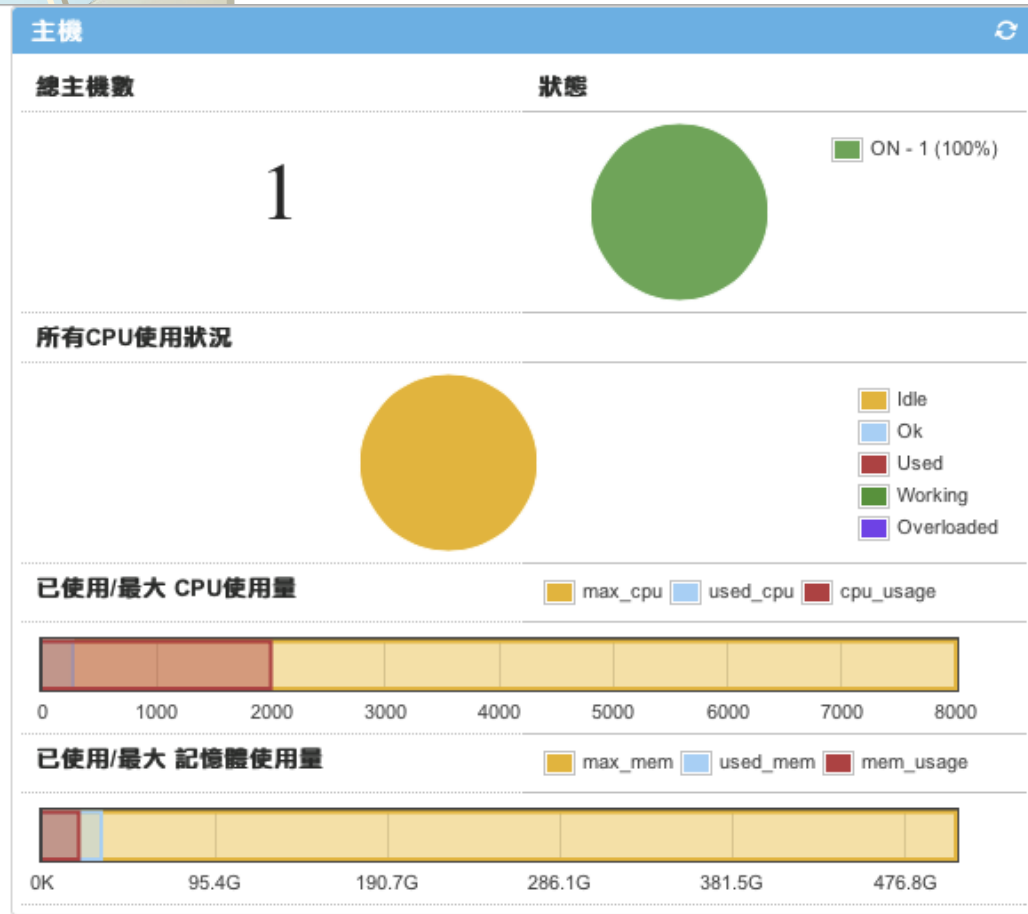
Remember me

**Login**

- 主控台
- 設定
- 系統
  - 使用者
  - 群組
  - ACLs
- 虛擬化資源
  - 虛擬機器
  - 範本
  - 磁碟影像檔
- 基礎設施
  - 主機叢集
  - 主機
  - 資料存放區
  - 虛擬網路
- Marketplace



# Normal User Dashboard



# Feature #3: Enhanced Web interface

The screenshot displays the 'Create Virtual Machine' interface in the NCHC Ezilla Cloud Service. The interface is titled 'myVM' and is divided into three main sections: 'Image', 'Network', and 'Graphics'. On the left, there is a list of available images, with 'ubuntu-10.10-desktop X86\_64 virtio' selected. The 'Network' section shows two network cards, and the 'Graphics' section shows a graphics card. On the right side, there are configuration options: VM Name (WINDOWS\_Serena), CPU (3), Memory (4096 MB), Password for VM, Confirm password, and Deploy # VMs (3). There are 'Create' and 'Reset' buttons at the bottom right of the dialog. The background shows the main dashboard with a sidebar menu and a table of virtual machines.



Drag and Drop to define your VMs.

# Feature #4: Port Redirect Middleware

Virtual Machines


Refresh New Resume Stop Restart Reboot Reset Delete Help

Show 10 entries 顯示/隱藏 欄位 Search:

<input type="checkbox"/>	Status	ID	Name	CPU	Memory	OStype	Start Time	VNC Access	Remote Access
<input type="checkbox"/>	●	741	hadoop	1	0K	UBUNTU	06:15:01 12/11/2012		
<input type="checkbox"/>	●	742	hadoop	1	0K	UBUNTU	06:15:01 12/11/2012		

Showing 1 to 2 of 2 entries

**Redirect Port Information**



Connecting information

To connect to the Virtual Machine , you can use SSH tools to connect. copy above connect information,and paste to your SSH tools

Copyright 2012 © NCHC Pervasive Computing Lab. All Rights Reserved.





# EasyCloud : Virtual Classroom Service

首頁 使用情境 資源規格 用戶註冊 用戶登入 新手上路 常見問題 討論區 聯絡我們 Home

 國網中心簡單龍雲端服務 - EasyCloud

<http://easycloud.nchc.org.tw>

- **主要服務:** 提供使用者快速產生虛擬機器以建置個人化的實驗、研究、教學的平台。
- **主要目的:** 建立、整合並管理虛擬電腦資源，服務研究、教學及各方專業人士。
- **適用對象:** 研究學者、知識教育者、IT管理員及各方專業人士。

  
EasyCloud  
優點(4省6高)

  
EasyCloud  
使用情境

  
EasyCloud  
效能評比

重要紀事/最新消息 EasyCloud使用示範影片



# Marketplace

The screenshot shows the OpenNebula Marketplace interface. The left sidebar contains navigation options: Dashboard, Configuration, System (Users, Groups, ACLs), Virtual Resources (Virtual Machines, Templates, Images), Infrastructure (Clusters, Hosts, Datastores, Virtual Networks), and Marketplace (highlighted). The main content area displays a table of virtual machine images:

Name	Publisher	Hypervisor	Arch	Format
Ezilla Virtual Cluster - Head node	NCHC Pervasive Computing Labs	KVM	x86_64	raw
Ezilla Virtual Cluster - Computing node	NCHC Pervasive Computing Labs	KVM	x86_64	raw
F-Motif App Image	NCHC Pervasive Computing Labs	KVM	x86_64	raw

Below the table, the 'Appliance information' section provides details for the selected 'F-Motif App Image':

Field	Value	Description
ID	4fcf5d0a8fb81d1bb8000003	
URL	http://10.0.0.254:5555/appliance/4fcf5d0a8fb81d1bb80	
Publisher	NCHC Pervasive Computing Labs	
Downloads	0	
OS	Ubuntu 12.04	
Arch	x86_64	
Size	546M	
Hypervisor	KVM	
Description	F-Motif uses clustering of sequence information represented by numerical features that exploit the statistical information hidden in some foreground data	

## ◆ Status Report :

- Once an image is added into the “Marketplace”, users should be able to choose in the D&D, in the near future.



# More information

- Official Website
  - <http://ezilla.nchc.org.tw>
  - <http://ezilla.info>
- Public IaaS portal
  - <http://easycloud.nchc.org.tw>
- Sourceforge
  - <http://ezilla-nchc.sf.net>
- Developers
  - <http://percomp.nchc.org.tw>

