



Better HPC Better Living  
為更好的生活努力

# 自由軟體在雲端世代中的角色與貢獻

Roles and contributions of Open Source in Cloud Computing Era

王耀聰 副研究員

jazz@nchc.org.tw

財團法人國家實驗研究院  
國家高速網路與計算中心



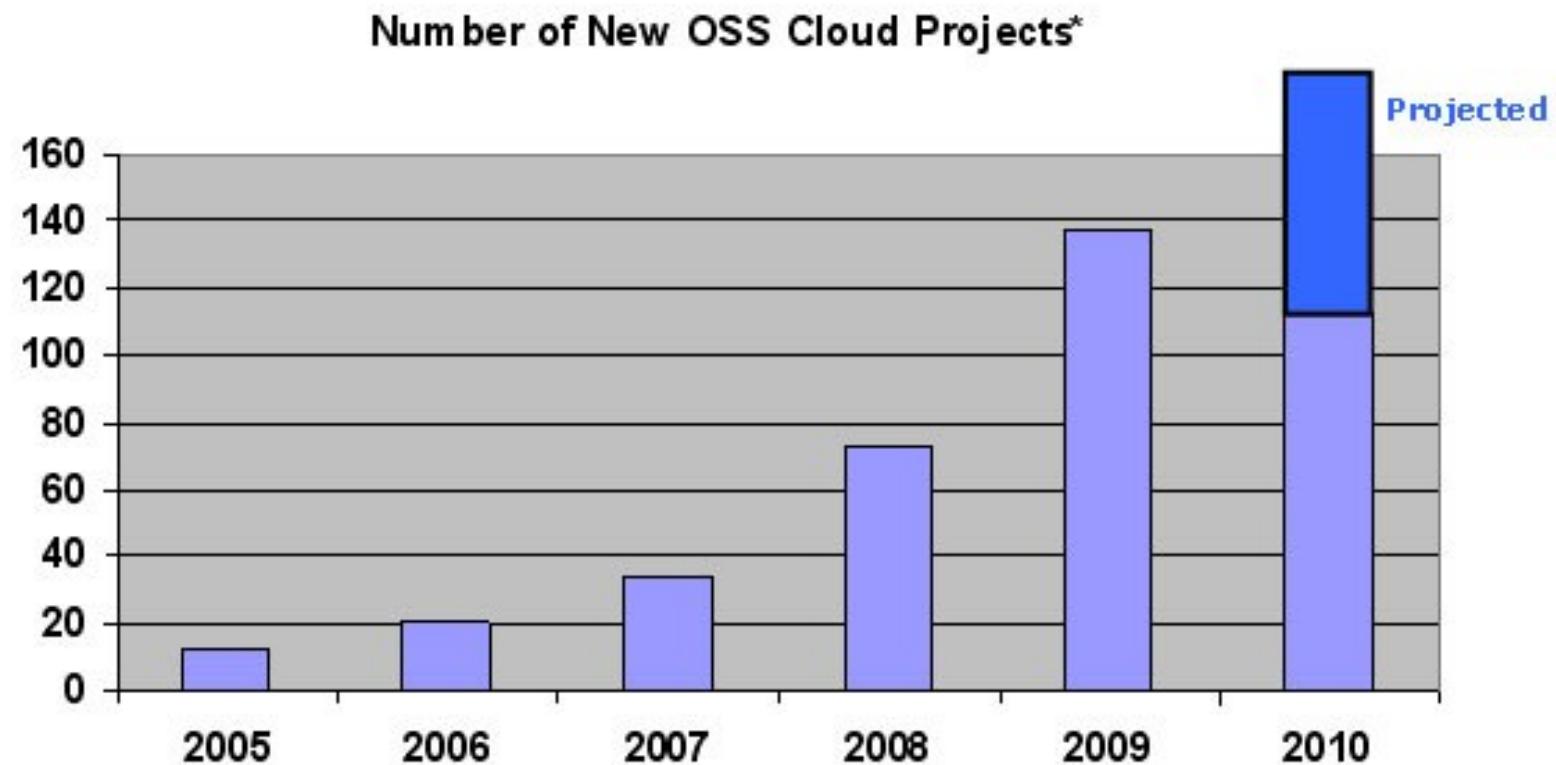
國家實驗研究院  
National Applied Research Laboratories

國家高速網路與計算中心  
National Center for High-Performance Computing

# Rapid Growth of Open Source Projects for Cloud 雲端相關的自由軟體專案於過去三年急速成長

**Open Source Projects for Cloud on Rise, According to Black Duck Software Analysis**  
根據 Black Duck 的分析，近年來雲端相關的自由軟體專案有大幅度的成長

## Open Source Projects for Cloud on Rise



\* Projects specifically referencing cloud. Many OSS projects are suitable for cloud but don't specify it.

圖片來源：<http://www.blackducksoftware.com/oss/projects/>

# **Three Roles and Contribution of Open Source for Cloud**

自由軟體在雲端科技發展中的三大角色與貢獻

**Role #1: The foundation of Cloud Services !**

角色一：自由軟體是雲端服務的幕後技術基石

**Contribution #1: Reduce IT Cost 貢獻一：節省軟體成本**

**Role #2: Interoperability Standard between Clouds !**

角色二：跨越不同雲端服務的互通標準！

**Contribution #2: Less Vendor Lock-In 貢獻二：減少技術壟斷**

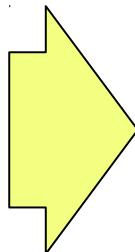
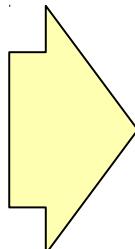
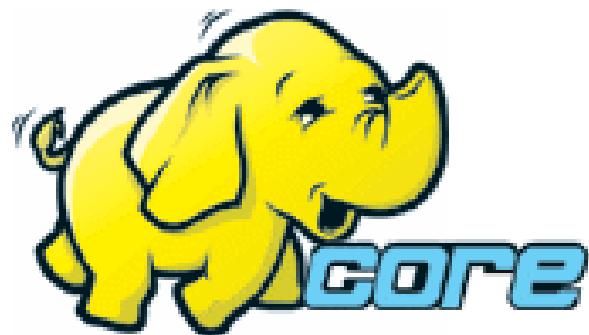
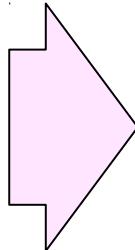
**Role #3: Open Platform for Open Education !**

角色三：雲端人才培育需要開放平台！

**Contribution #3: Open Ladder to Cloud 貢獻三：搭建登雲天梯**

# Role #1: The foundation of Cloud Services !

## 角色一：自由軟體是雲端服務的幕後技術基石



平板行動應用

社交溝通協作

多媒體內容

次世代分析

社交分析

情境感知運算

儲存等級記憶體

無所不在的運算

模組化基礎建設

雲端運算

端



社交網路

評價排行榜

即時搜尋

智慧裝置

大量資訊分析

雲端運算

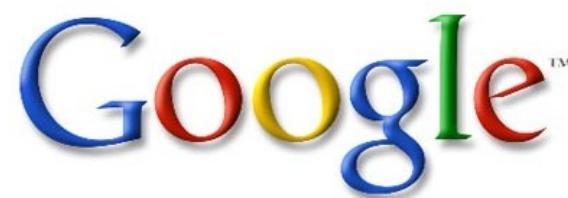
雲

# Two Type of Cloud Architecture ?

## 雲端架構的兩大陣營？



想盡辦法誘你用計算跟網路  
**Computing Intensive**



想盡辦法誘你提供資料作分析  
**Data Intensive**

# Reference Cloud Architecture

## 雲端運算的參考架構

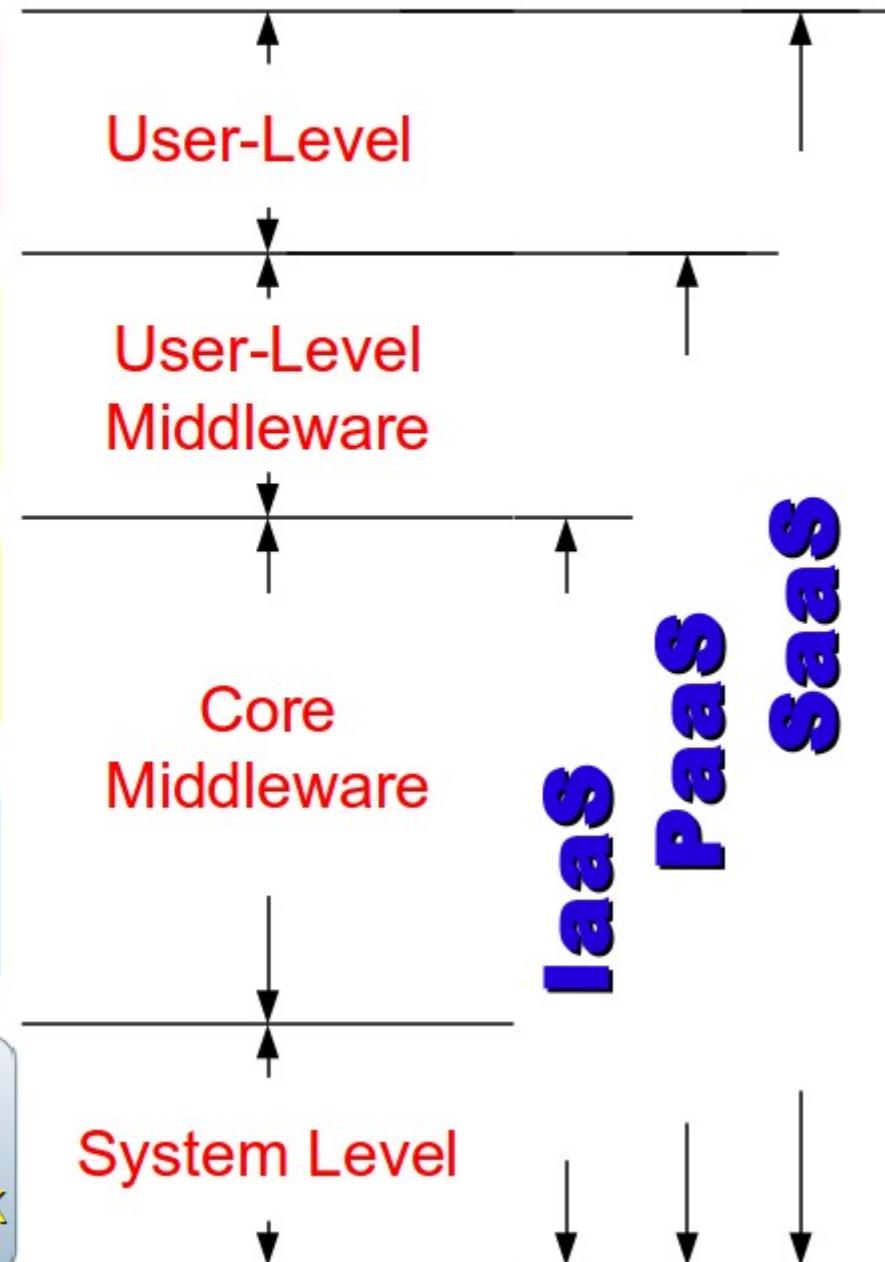
應用軟體 Application  
Social Computing, Enterprise, ISV, ...

程式語言 Programming  
Web 2.0, Mashups, Workflows, ...

控制管理 Control  
QoS Negotiation, Admission Control,  
Pricing, SLA Management, Metering...

虛擬化 Virtualization  
VM, VM management and Deployment

硬體設施 Hardware  
Infrastructure: Computer, Storage, Network



# Building IaaS with Open Source

## 用自由軟體打造 IaaS 服務

應用軟體 Application  
Social Computing, Enterprise, ISV, ...

eyeOS, Nutch, ICAS,  
X-RIME, ...

程式語言 Programming  
Web 2.0, Mashups, Workflows, ...

Hadoop (MapReduce),  
Sector/Sphere, AppScale

控制管理 Control  
QoS Negotiation, Admission Control,  
Pricing, SLA Management, Metering, ...

OpenNebula, Enomaly,  
Eucalyptus , OpenQRM, ...

虛擬化 Virtualization  
VM, VM management and Deployment

Xen, KVM, VirtualBox,  
QEMU, OpenVZ, ...

硬體設施 Hardware  
Infrastructure: Computer, Storage,  
Network

# What is Virtualization ??

## 虛擬化技術有哪些呢 ??

Application Virtualization

應用程式虛擬化

Desktop Virtualization

桌面虛擬化

Client Virtualization

Presentation Virtualization

顯示虛擬化

OS-level Virtualization

作業系統虛擬化

Network Virtualization

網路虛擬化

Storage Virtualization

儲存虛擬化

資料庫虛擬化

Virtualization

Data

資料庫虛擬化

Data Virtualization

大家對虛擬化的  
狹義認知

Source: <http://en.wikipedia.org/wiki/Virtualization>

# Open Source for Virtualization

## 虛擬化技術對應的自由軟體

Application Virtualization

Ex. VMWare ThinApp

Desktop Client

建置虛擬化叢集不可只注重作業系統虛擬化，須同時具備底層支援的網路與儲存虛擬化！！

Redhat SPICE

Presentation

VNC, FreeNX

OS-level Virtualization

Xen, KVM, OpenVZ

Network Virtualization

OpenFlow vSwitch

Storage Virtualization

Lessfs, SDFS

# NIST Mapping of Cloud Technologies

## 美國國家標準局的定義主要鎖定虛擬化技術

### 5. Measured Service

可被監控與量測的服務

Monitoring / AAA

狀態監控與認證收費機制

### 1. On-demand self-service.

隨需自助服務

VM Management Tool

虛擬機器管理平台

### 2. Broad network access

隨時隨地用任何網路裝置存取

OS-level Virtualization

作業系統虛擬化

### 3. Resource pooling

多人共享資源池

Network Virtualization

網路虛擬化

### 4. Rapid elasticity

快速重新佈署靈活度

Storage Virtualization

儲存虛擬化

# NIST Mapping of Open Source Cloud

## 美國國家標準局的定義對應自由軟體技術

**Monitoring / AAA**  
狀態監控與認證收費機制



Ganglia, Nagios  
/ OpenID, SAML

**VM Management Tool**  
虛擬機器管理平台



OpenNebula, Eucalyptus

**OS-level Virtualization**  
作業系統虛擬化



Xen, KVM, OpenVZ

**Network Virtualization**  
網路虛擬化



OpenFlow vSwitch

**Storage Virtualization**  
儲存虛擬化



Lessfs, SDFS, ZFS

- 原是加州大學聖塔芭芭拉分校 (UCSB) 的研究專案
- **It was a research project of UCSB, USA**
- 目前已轉由 Eucalyptus System 這間公司負責維護
- **Now Eucalyptus System provide technical supports.**
- 創立目的是讓使用者可以**打造自己的 EC2**
- **It designed to help user to build their own Amazon EC2**
- 特色是相容於 Amazon EC2 既有的用戶端介面
- **Its feature is compatible with existing EC2 client.**
- 優勢是 Ubuntu 9.04 已經收錄 Eucalyptus 的套件
- **Ubuntu Enterprise Cloud powered by Eucalyptus in 9.04**
- 目前有提供 Eucalyptus 的官方測試平台供註冊帳號
- **You can register trail account at <http://open.eucalyptus.com/>**
- 缺點：目前仍有部分操作需透過指令模式
- **Cons : you might need to type commands in some case**



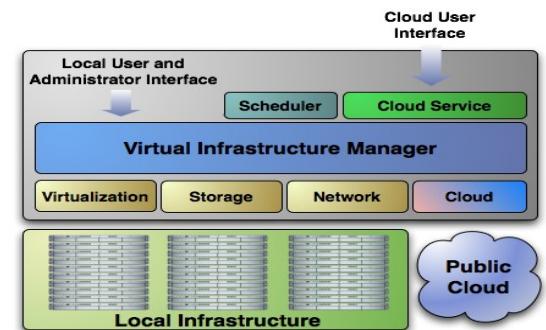
# Eucalyptus

關於 Eucalyptus 的更多資訊，請參考

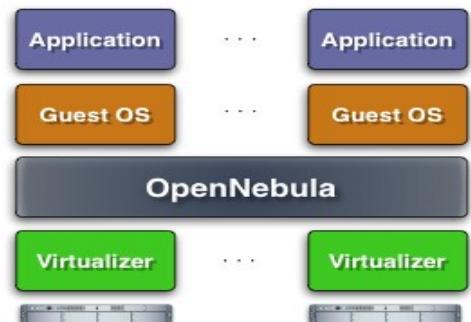
<http://trac.nchc.org.tw/grid/wiki/Eucalyptus>

- <http://www.opennebula.org>
- 由歐洲研究學會 (European Union FP7) 贊助
- **Sponsor by European Union FP7**
- 將實體叢集轉換成具管理彈性的虛擬基礎設備
- Turn Physical Cluster into Virtual Cluster
- 可管理虛擬叢集的狀態、排程、遷徙 (migration)
- manage status, scheduling and migration of virtual cluster
- [Ubuntu 9.04 provide package of opennebula](#)
- 缺點：需下指令來進行虛擬機器的遷徙 (migration)。
- Cons : You need to type commands to check or migration

## OpenNebula.org



關於 OpenNebula 的更多資訊，  
請參考 [http://trac.nchc.org.tw/grid  
/wiki/OpenNEbula](http://trac.nchc.org.tw/grid/wiki/OpenNEbula)



# NIST Mapping of Open Source Cloud

## 美國國家標準局的定義對應自由軟體技術

**Monitoring / AAA**  
狀態監控與認證收費機制

Ganglia, Nagios  
/ OpenID, SAML

**VM Management Tool**  
虛擬機器管理平台

OpenNebula, Eucalyptus

**OS-level Virtualization**  
作業系統虛擬化

Xen, KVM, OpenVZ

**Network Virtualization**  
網路虛擬化

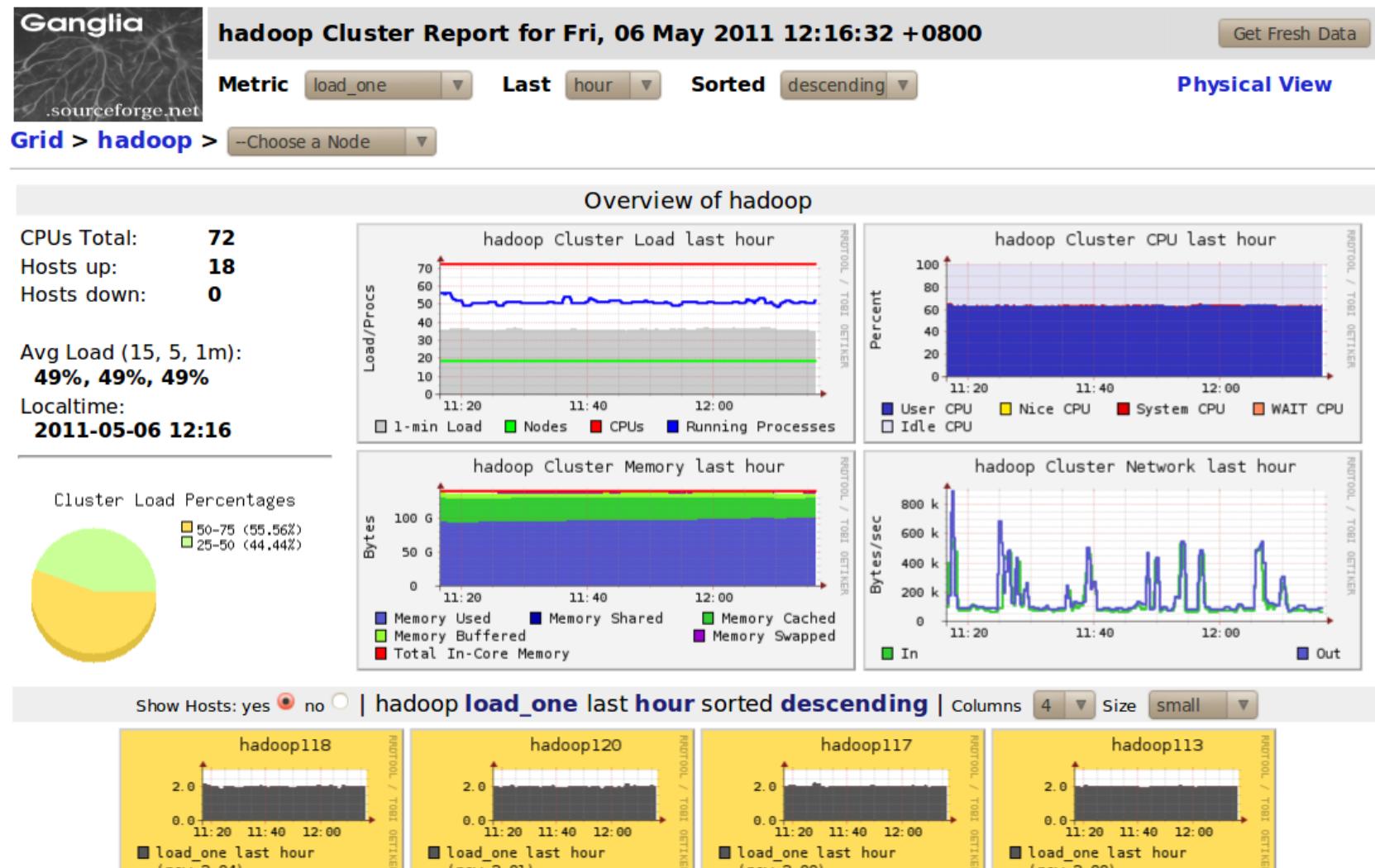
OpenFlow vSwitch

**Storage Virtualization**  
儲存虛擬化

Lessfs, SDFS, ZFS

# 系統狀態監控 Ganglia

- 採用自由軟體 **Ganglia** 來蒐集電腦叢集的負載狀態
- <http://ganglia.sourceforge.net/>**



# 日本政府已開始接受 OpenID

2010 年 3 月 9 日 Nat Sakimura 發表「Government of Japan started accepting OpenID」。

日本經濟產業省開設了一個名為「IdeaBox」的網站，可以使用 mixi 、 Yahoo! 、 Livedoor 和 Google 等的帳號來登錄。 IdeaBox 是經濟產業省用來向國民廣泛徵求意見，以促進國民間政策的討論的網站在該網站上，人們可參與出謀劃策和討論，並進行表決。

經濟產業省是想基於網際網路開設一個向公眾開放的委員會。一個類似網站在去年 10 月到 11 月間運作並收集了 1700 多條政策建議。 IdeaBox 2 月 23 日開放的這個版本，它還有其它各種社交網站的組件，例如可以直接從這個網站發送 tweet 到 twitter 、收藏到 delicious 和 hatena 書籤等。這個版本將運行到 3 月 15 日。

網站地址：<http://open-meti.go.jp/>



A screenshot of the IdeaBox website homepage. The header features the 'IdeaBox' logo and the text '経済産業省アイディアボックス' (Ministry of Economy, Trade and Industry Idea Box). Below the header, there is a large graphic of an open cardboard box with speech bubbles containing exclamation and question marks. A call-to-action button says '新着アイディアのRSSはこちら' (RSS feed for new ideas). The main content area includes sections for 'はじめにお読み下さい' (Please read first), '事務局からのお知らせ' (Announcements from the office), '人材カテゴリ新設と政府等公的サービスアイディア整理アップ' (New category for human resources and consolidation of government services), and 'カテゴリに「IT人材育成」を新設しました。また、「政府等公的サービスのIT活用」のアイディアをマインドマップで整理しました。' (A new category 'IT Human Resource Development' has been added. Additionally, the 'IT application of government services' ideas have been整理成 a mind map.). On the right side, there is a sidebar with various statistics: '現在の登録ユーザ数 3361 人' (Number of registered users 3361), 'アイディア一覧 (総合) 602', '最新コメント (総合) 3581', and a list of categories from 01 to 10. At the bottom, there is a Twitter feed with a message from 'imininashi' about the website.

# Building PaaS with Open Source

## 用自由軟體打造 PaaS 雲端服務

### 應用軟體 Application

Social Computing, Enterprise, ISV, ...

eyeOS, Nutch, ICAS, X-RIME, ...

### 程式語言 Programming

Web 2.0, Mashups, Workflows, ...

Hadoop (MapReduce), Sector/Sphere, AppScale

### 控制管理 Control

QoS Negotiation, Admission Control, Pricing, SLA Management, Metering...

OpenNebula, Enomaly, Eucalyptus, OpenQRM, ...

### 虛擬化 Virtualization

VM, VM management and Deployment

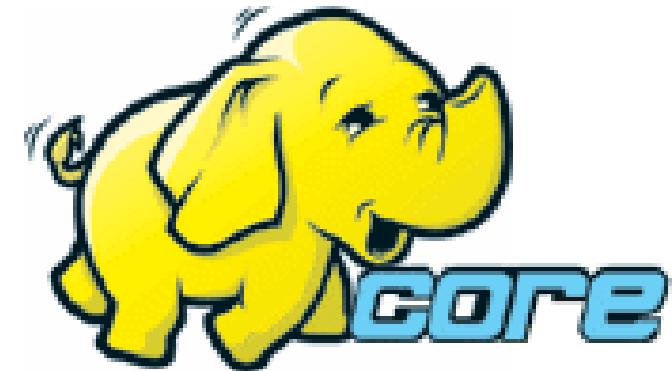
Xen, KVM, VirtualBox, QEMU, OpenVZ, ...

### 硬體設施 Hardware

Infrastructure: Computer, Storage, Network

# Hadoop

- <http://hadoop.apache.org>
- Hadoop 是 Apache Top Level 開發專案
- **Hadoop is Apache Top Level Project**
- 目前主要由 Yahoo! 資助、開發與運用
- **Major sponsor is Yahoo!**
- 創始者是 Doug Cutting，參考 Google Filesystem
- **Developed by Doug Cutting, Reference from Google Filesystem**
- 以 Java 開發，提供 HDFS 與 MapReduce API。
- **Written by Java, it provides HDFS and MapReduce API**
- 2006 年使用在 Yahoo 內部服務中
- **Used in Yahoo since year 2006**
- 已佈署於上千個節點。
- **It had been deploy to 4000+ nodes in Yahoo**
- 處理 Petabyte 等級資料量。
- **Design to process dataset in Petabyte**



Facebook, Last.fm,  
Joost, Twitter  
are also powered  
by Hadoop

# Sector / Sphere

- <http://sector.sourceforge.net/>
- 由美國資料探勘中心研發的自由軟體專案。
- Developed by National Center for Data Mining, USA
- 採用 C/C++ 語言撰寫，因此效能較 Hadoop 更好。
- Written by C/C++, so performance is better than Hadoop
- 提供「類似」Google File System 與 MapReduce 的機制
- Provide file system similar to Google File System and MapReduce API
- 基於UDT高效率網路協定來加速資料傳輸效率
- Based on UDT which enhance the network performance
- Open Cloud Testbed有提供測試環境，並開發MalStone效能評比軟體
- Open Cloud Consortium provide Open Cloud Testbed and develop MalStone toolkit for benchmark



National Center for Data Mining  
University of Illinois at Chicago



Open Data Group  
<http://www.opendatagroup.com/>

# Building SaaS with Open Source

## 用自由軟體打造 SaaS 雲端服務

### 應用軟體 Application

Social Computing, Enterprise, ISV, ...

eyeOS, Nutch, ICAS,  
X-RIME, ...

### 程式語言 Programming

Web 2.0, Mashups, Workflows, ...

Hadoop (MapReduce),  
Sector/Sphere, AppScale

### 控制管理 Control

QoS Negotiation, Admission Control,  
Pricing, SLA Management, Metering...

OpenNebula, Enomaly,  
Eucalyptus , OpenQRM, ...

### 虛擬化 Virtualization

VM, VM management and Deployment

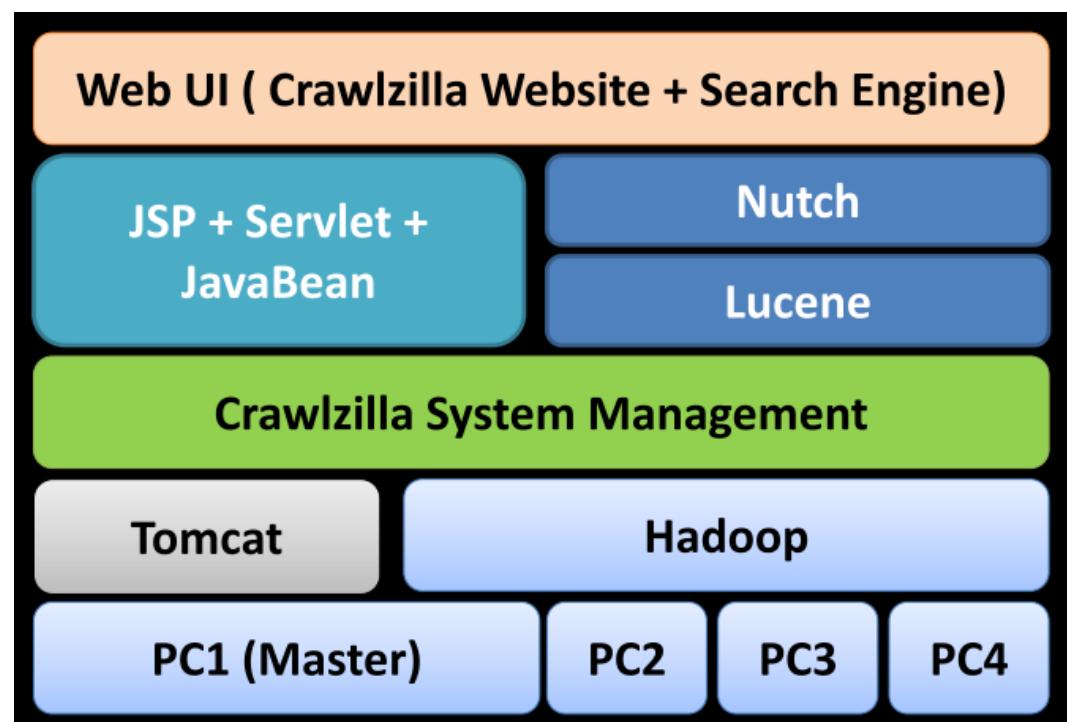
Xen, KVM, VirtualBox,  
QEMU, OpenVZ, ...

### 硬體設施 Hardware

Infrastructure: Computer, Storage,  
Network

# 快速佈署內網搜尋引擎的軟體工具 Crawlzilla

- 雲端運算在大型資料分析、資料探勘方面的示範應用
- 可協助企業或校園建置內網的網站、檔案搜尋
- 支援叢集式安裝、中文分詞，並提供網頁管理介面
- 更多資訊詳見專案網站：<http://code.google.com/p/crawlzilla>



## Role #2: Interoperability Standard between Clouds ! 角色二：跨越不同雲端服務的互通標準！

IBM、思科（Cisco Systems）等 20 多家科技公司於 2009 年 3 月 30 日發佈「開放雲端宣言」（Open Cloud Manifesto），希望為雲端運算建立標準，確保業者間的相容性，讓客戶更容易轉換平台。

「客戶使用雲端運算的經驗愈多，就愈明白相容性有多重要。他們不想被綁死在單一業者。」

— IBM 開放標準部門副總裁諾斯沃西（Karla Norsworthy）



圖片來源：<http://opencloudmanifesto.org/>

2009年四月28日，Open Grid Forum宣佈成立Open Cloud Computing Interface (OCCI)工作小組，以協助制定雲端服務之間的互通國際標準。

 OpenGridForum  
OPEN FORUM | OPEN STANDARDS

ABOUT OGF RESOURCE CENTER EVENTS DOCUMENTS AREAS/GROUPS  
MEMBERS NEWS STANDARDS CONTACT US SITE MAP GRIDFORGE

## OGF ANNOUNCES OPEN CLOUD COMPUTING INTERFACE (OCCI) WORKING GROUP

### OGF Officially Launches Working Group To Create An API For Cloud Infrastructure Services

**CHICAGO, 28 April 2009** The Open Grid Forum (OGF) has officially launched the Open Cloud Computing Interface Working Group (OCCI-WG). Its aim is the rapid development of a clean, open API for cloud infrastructure delivered on-demand. Infrastructure as a Service (IaaS) is one of three primary segments of the emerging cloud industry in which compute, storage and network resources are provided as a service. The API will be based on existing service provider functionality, and will cover management of the entire life-cycle of virtual machines and other similar workloads (including virtual private servers and physical dedicated servers). It will as much as possible complement and build on existing work such as the Open Virtualisation Format (OVF), as well as serving as an integration point for others standards efforts including DMTF and SNIA.

Craig Lee, OGF's President, stated: "OCCI is an extremely important development that will define a much needed, open standard API in the cloud space. This is, however, just the first step of many. We are committed to working with all stakeholders and organizations to move the ball forward. As always, OGF strives to facilitate productive technical environments for work across the spectrum of distributed computing technologies."

Existing specifications for cloud infrastructure services (including the Amazon EC2 API and Sun Cloud APIs) are provided by single vendors and OCCI will be the first multi-vendor initiative to deliver a royalty-free, open standard API. This will improve cloud computing interoperability and increase competition in the space, facilitating the emergence of a marketplace of services, which will in turn increase customer choice and decrease the risk of vendor lock-in. OCCI will also be important enabler for the creation of hybrid cloud architectures that bridge multiple data centers and cloud services, through adapters and tooling that support the open API. This and related open standards will lower the cost of migration to and from public clouds, delivering automated management of peak capacity, minimizing outages and reducing costs.

OCCI will rely heavily on existing Internet standards and work already done by cloud providers, so as it is easy to both implement and consume. This will benefit software vendors and service consumers alike. For example software vendors who wish to deliver their applications as a service

圖片來源：<http://www.ogf.org/News/news.php?id=132>

## 數位時代 Beta 3.0 - Topics and Links新聞精選

全球廿五間科技公司將攜手合作，計畫促進更健全、更開放的雲端科技。

這項稱作OpenStack的合作計畫在今天公布，以IT代管服務公司Rackspace和美國太空總署NASA為首，將以Open Source（開放程式碼）的方式，把雲端平台的技術分享到世界每一個角落。

有了OpenStack以後，任何一個想要提供雲端服務的單位，只要準備好伺服器和網路，就可以下載OpenStack的開放軟體，架設自己的雲端平台。目前這個計畫的網站提供了兩套軟體：OpenStack Compute用來設定和管理大量的伺服器，而OpenStack Storage則提供一套雲端儲存系統，只要使用多台一般市面上出售的伺服器，就可以儲存上千兆個位元組的資料。

Rackspace和NASA在這項計畫中，都有卓著的貢獻。Rackspace開放了自家公司產品「雲端檔案」和「雲端伺服器」的程式碼，這兩項產品是該公司雲端設備的基礎。NASA也將貢獻出他們用以架設「Nebula雲端平台」的技術。

NASA Nebula是目前全世界最強大的雲端平台之一。上週Microsoft Research所公布的最新火星影像，就是在NASA的Nebula平台上，可用Microsoft Research所公布的最新火星影像，目前也存放在Nebula以Nebula平台的。

藉由開放程式碼的方式，增加不同雲端科技產品之間的互通性。

參與這項計畫的公司還有Intel、Dell、Citrix等，而其他知名公司如Microsoft也在陸續洽談中。這個計畫的目標，是希望為雲端科技提供一個良好的開發環境，同時藉由開放程式碼的方式，增加不同雲端科技產品之間的互通性。這樣一來，雲端科技一旦有了新的突破，不同的產品都能夠同時受惠。



Home Projects Community Blog Wiki Documentation

Open source software for building  
private and public clouds.

### Software

OpenStack Software delivers a massively scalable cloud operating system. The three major components are:

Compute

Details & Download ▾

### Community

Join our global community of technologists, developers, researchers, corporations and cloud computing experts.

1004

77



TIM O'REILLY

"Rackspace and NASA are taking an amazing step towards my vision of an open cloud future."

O'REILLY.COM



## OpenStack新版開源軟體Bexar，將在Ubuntu上實現雲端技術

撰文者：戴佳慧

發表日期：2011-02-08

開放原始碼計畫OpenStack上週發表新版雲端軟體Bexar，讓企業用戶能輕鬆在自家伺服器上搭建雲端平台，實現雲端虛擬技術。

OpenStack計畫由積極開發雲端科技的Rackspace和NASA所領導，致力於促進雲端平台的開放。目前OpenStack計畫包含了三個部份：OpenStack Compute雲端運算、Object Store雲端儲存、以及Glance影像傳遞服務。

這次代號Bexar的新版本發佈，是OpenStack自去年夏天成立以來推出的第二版雲端軟體，首度讓新加入的用戶能夠自由部署OpenStack虛擬平台。Bexar加入的新功能包括了IPv6支援、影像傳遞技術、以及Hyper-V和Xen等虛擬伺服器功能。

OpenStack同時宣佈了新夥伴Canonical、Cisco等四家業者的加入。Canonical承諾，會把OpenStack軟體整合進即將在四月發表的Ubuntu伺服器11.04版，協助推廣OpenStack開放雲端平台。

OpenStack也預告了下一個版本Cactus的發行計畫，強調將為大規模部署提供最佳化方案。OpenStack將於四月底在美國加州舉辦設計高峰會，邀請開發人員共同來擬定OpenStack今年下半年的產品規劃藍圖。

# Role #3: Open Platform for Open Education !

## 角色三：雲端人才培育需要開放平台！

第一波雲端運算的成長主要帶動了台灣硬體產業的經濟復甦 ...



建再多的資料中心也是要有  
**人**管

<http://www.captivating-content.com/Hidden%20Treasure.jpg>

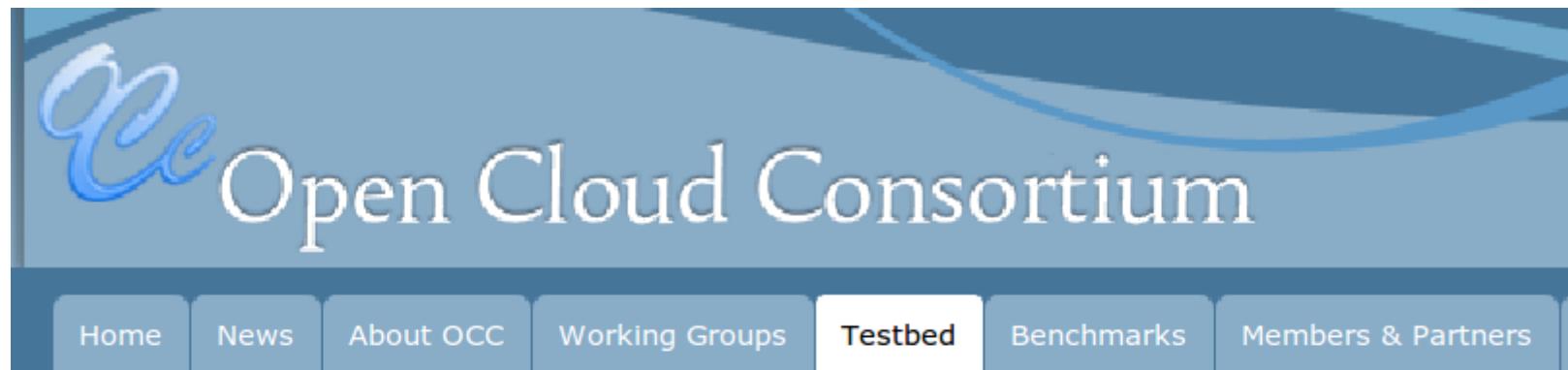


第二波雲端運算的成長將決定於人才培育速度能否快速銜接產業需求

<http://www.sysadminday.com/images/people/136-3697.JPG>

美國結合產學資源，成立 Open Cloud Consortium，  
並建立 Open Cloud Testbed，作為人才培育與研究的開放平台。

會員包括：Aerospace、Booz Allen Hamilton、Cisco、Infoblox、MIT Lincoln Labs、NASA Ames Research Center、Northwestern University、Open Data Group、Raytheon、Sector Project、SIOS、University of Illinois at Chicago、Yahoo、Calit2、Johns Hopkins University、National Lambda Rail、University of Chicago



## Testbed

The Open Cloud Consortium (OCC) operates a wide area testbed for cloud computing called the Open Cloud Testbed. The testbed is being rolled out in phases. We are currently in Phase 2 of the roll out.

As far as we know, the Open Cloud Testbed is the only wide area cloud that utilizes wide area 10 Gb/s networks. If you know of any other such clouds, please let us know.

# 國網中心 2009 年開放實驗叢集間接促成研究成果

- 國網中心於 2009 年四月啓用 Hadoop 實驗叢集，目前共 21 台 PC 服役中。
- 促成台大資工系資訊網路與多媒體研究所發表論文至 ACM Multimedia 2009
- 自 2009 年四月至 2010 年八月，雲端實驗叢集共註冊 937 人，服務 37 個學術單位、5 個研究單位、19 間業界公司、2 所醫院。累計於 14 個月執行 16,424 個 Job。
- 註冊排行前五大依序為交通大學、台灣大學、成功大學、中央大學與陽明大學

## Canonical Image Selection and Efficient Image Graph Construction for Large-Scale Flickr Photos

Liang-Chi Hsieh, Kuan-Ting Chen, Chien-Hsing Chiang, Yi-Hsuan Yang, Guan-Long Wu  
Chun-Sung Feng, Hsiu-Wen Hsueh, Charng-Rurng Tsai, Winston H. Hsu

National Taiwan University, Taipei, Taiwan

viirya@gmail.com, ktchen@cmlab.csie.ntu.edu.tw, {pacifistboy, affige}@gmail.com, {b95109, b95108,  
b95057, b95093, winston}@csie.ntu.edu.tw

### ABSTRACT

Efficient image search clustering is prominent for image search engines for exponentially growing photo collections. In this work, we propose an image search clustering approach which selects multiple canonical images from image search results and constructs image clusters in real time on an image subgraph for the search results. The efficiency is achieved with the help of offline-computed image context graphs by distributed computing methods. Extending our prior works, we demonstrate the results of the proposed canonical image selection and preliminary outcomes of large-scale image graph construction in this proposal. We experiment in Flickr500 dataset, containing 540,321 Flickr photos.

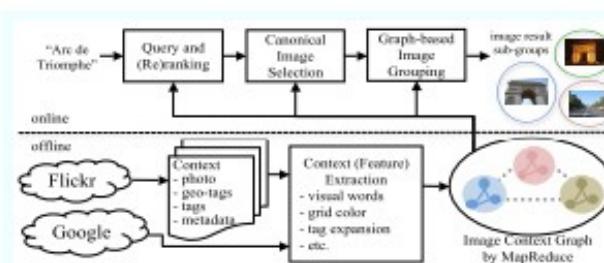
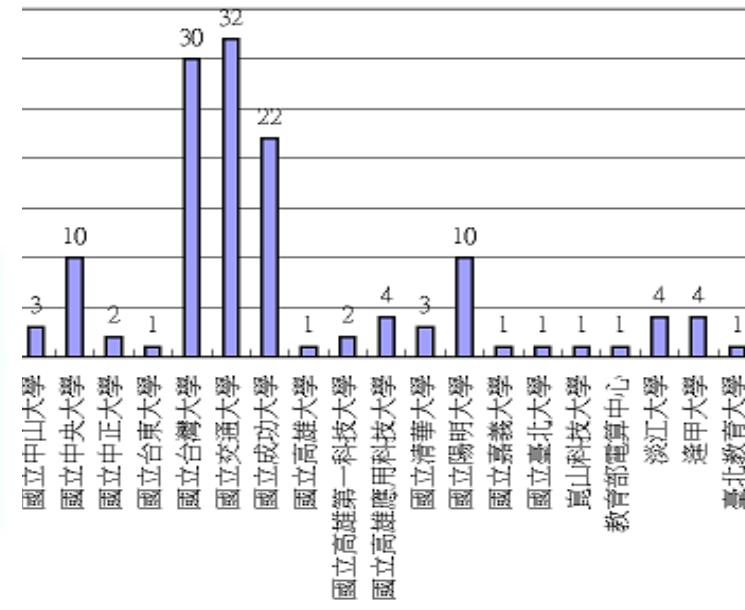


Figure 1: The system diagram: online query reranking, canonical image selection, and image result grouping are based on the image context graph, constructed offline by Hadoop MapReduce over rich context features in Flickr photos.



# Conclusion: Open Source as a Strategy !!

## 未來自由軟體將成為吸引注意力的一種策略

當免費、開放才能吸引使用者或開發者的注意力～  
自由軟體就會變成一種行銷策略，將不得不開放！！

**SOURCEFORGE** FIND AND DEVELOP OPEN SOURCE SOFTWARE

Welcome, Guest! Log In

Find Software | Develop | Create Project | Blog | Site Support | About

**Find free open source software.**

enter keyword  Search

SourceForge is your location to download and develop free open source software.

Learn more about SourceForge > What is open source software?

By default, we'll show you software that runs on Windows  (change)

Browse by category

Clustering

Communications

What's Hot for Windows?

1 XBMC Media Center

XBMC Media Center is a free cross-platform media ...

85% recommend

Project Hosting on Google code

Search projects

Explore hosted projects:

Python	JavaScript	Django	Web	CMS	Google
Java	AJAX	Rails	Plugin	Student	Android
CPlusPlus	MySQL	.Net	Game	Windows	AppEngine

