Better HPC Better Living
為更好的生活努力

自由軟體在雲端科技發展趨勢中的角色與貢獻

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

淺談雲端運算的定義與驅動力

Part 1 : Overview of Cloud Computing

Jazz Wang
Yao-Tsung Wang
jazz@nchc.org.tw

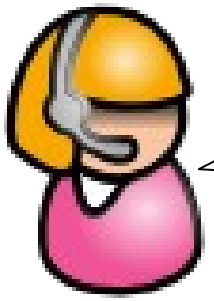
Powered by DRBL

什麼是雲端運算啊？可以個簡單的定義嗎？

What is Cloud Computing ?

雲端運算怎麼聽起來要買一些新硬體、新軟體啊？

Is it about buying NEW Hardware and Software?



雲端運算可能只是拿來振興經濟的幌子吧？

Is it a trap to another bubble economy ?

我聽你們在那裡講五四三 . . . . .

Cloud Computing is as simple as 5..4..3..2..1...

National Definition of Cloud Computing
美國國家標準局 NIST 給雲端運算所下的定義

5 Characteristics 五大基礎特徵

4 Deployment Models 四個佈署模型

3 Service Models 三個服務模式

1. On-demand self-service.
隨需自助服務

2. Broad network access
隨時隨地用任何網路裝置存取

3. Resource pooling
多人共享資源池

4. Rapid elasticity
快速重新佈署靈活度

5. Measured Service
可被監控與量測的服務

4 Deployment Models of Cloud Computing
雲端運算的四種佈署模型

Public Cloud
公用雲端

Target Market
is **S.M.B.**
主要客户爲
中小企業

amazon web services™
Microsoft
Google

Dynamic Resource Provisioning between public and private cloud
私有雲端動態根據計算需求
調用公用雲端的資源

Hybrid Cloud

以大型企業
爲主要客户
Enterprise is
key market

IBM

私有雲端
Private Cloud

Community Cloud
社群雲端

Academia 學術爲主

3 Service Models of Cloud Computing
雲端運算的三種服務模式

IaaS
Infrastructure as a Service
架構即服務

PaaS
Platform as a Service
平台即服務

SaaS
Software as a Service
軟體即服務

2 R&D directions : Cloud or Device

兩大研究方向：你該選「雲」還是「端」？

集中，大廠

Centerized ,
Enterprise

端

symbian
OS

多元，中小廠

Diversify ,
SMB

One key spirit of Cloud Computing
用一句話說明雲端運算！服務才是王道！

Anytime 隨時

Anywhere 隨地

With Any Devices 使用任何裝置

Accessing Services 存取各種服務

Key spirit of Cloud ~

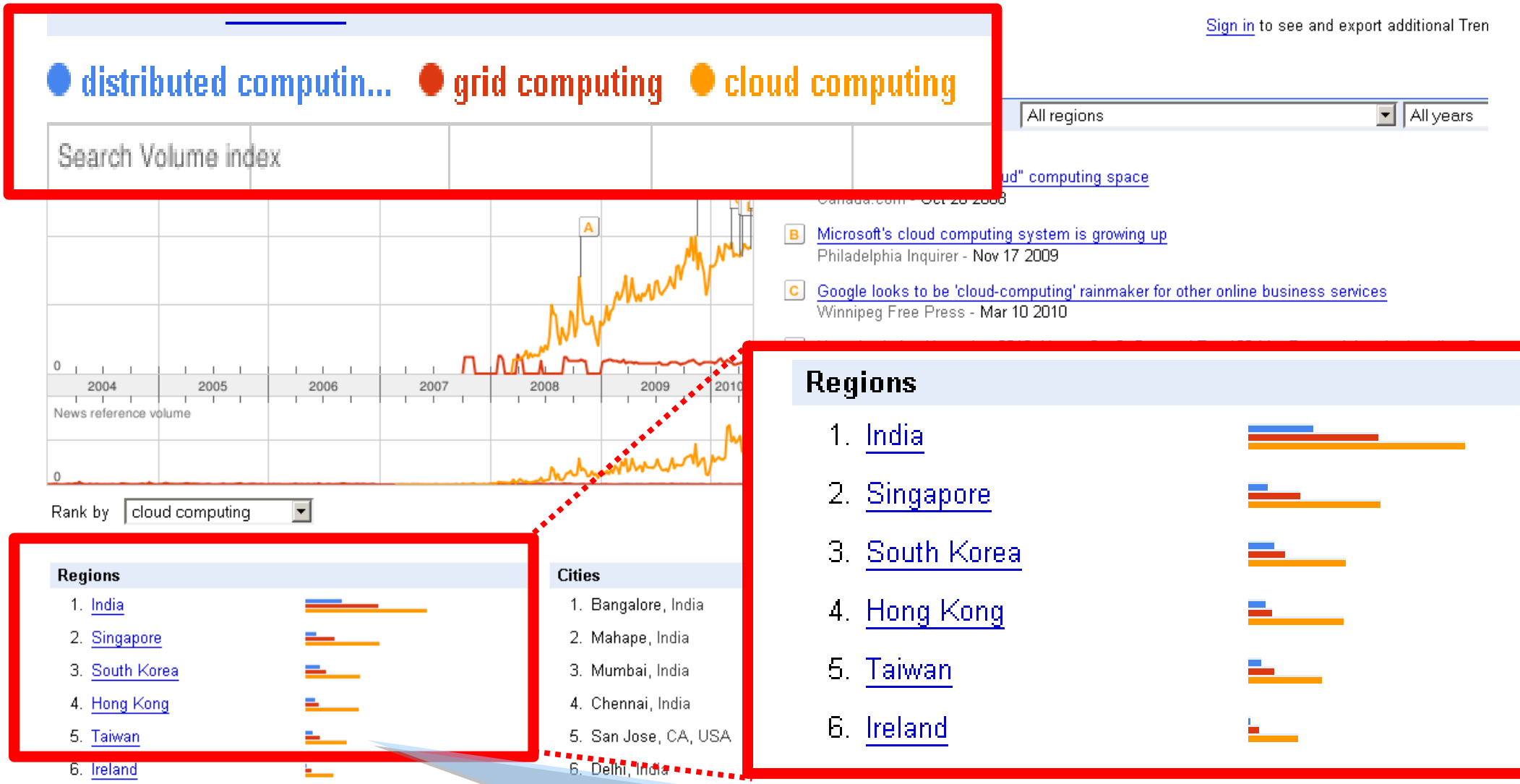
形成服務才是重點！！

Everything as a Service !!

Cloud Computing =~ Network Computing

雲端運算 =~ 網路運算

What are the trend of next 10 years ?
什麼是下個十年的熱門技能？



似乎亞洲國家特別熱愛雲端 ?! **Too Hot in Asia ?!**

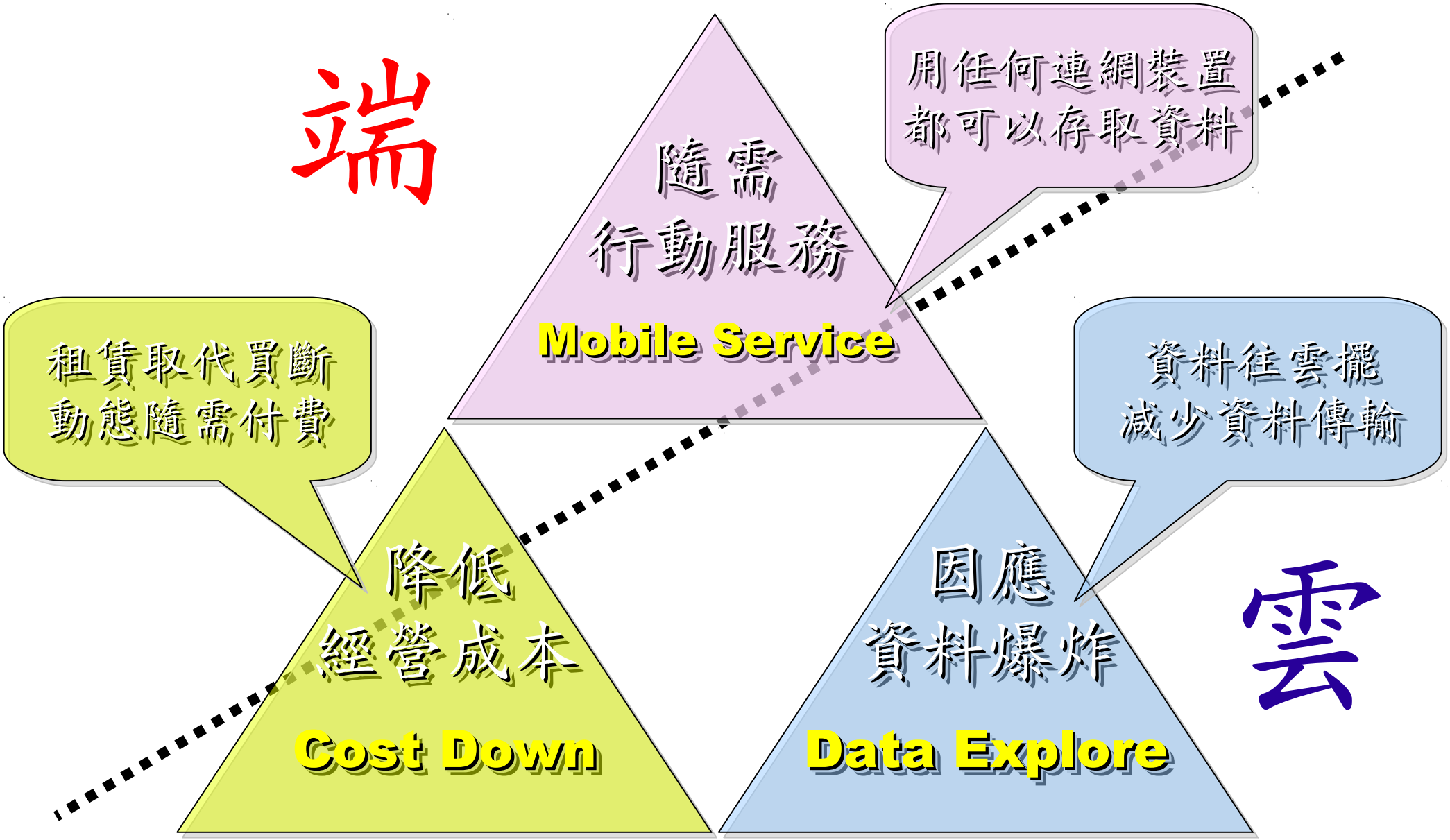
Evolution of Cloud Services

雲端服務只是軟體演化史的必然趨勢

數位化 → e-Taiwan 成果系列報導 → 行動台灣 應用推動計畫 → 發展優質網路社會 (U-Taiwan) 計畫

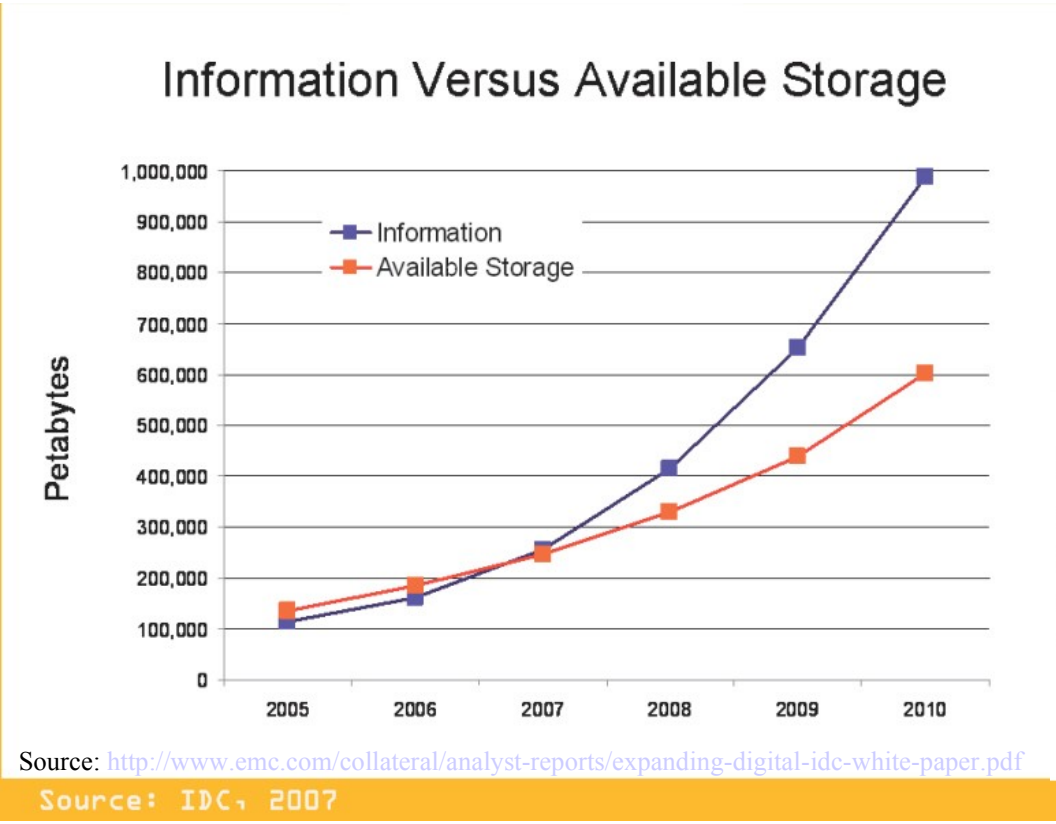
實體 Physical	單機版 個人使用 Personal Software	網路版 多人共享 Share Service Software	行動版 隨時存取 Mobile Cloud Service
信箱 Mailbox	E-Mail	Web Mail	Mobile Mail
電視 TV	電視盒 Setop Box	Web TV Ex. Youtube	Mobile TV
打字機 Typer Writer	Office	Google Docs	M-Office
電話 Telephone	數位電話 PBX	Skype	Flash Wengo
佈告欄 Bullet Borad	電子佈告欄 BBS	部落格 Blog	微網誌 Twitter

Key Driving Forces of Cloud Computing
雲端運算的關鍵驅動力

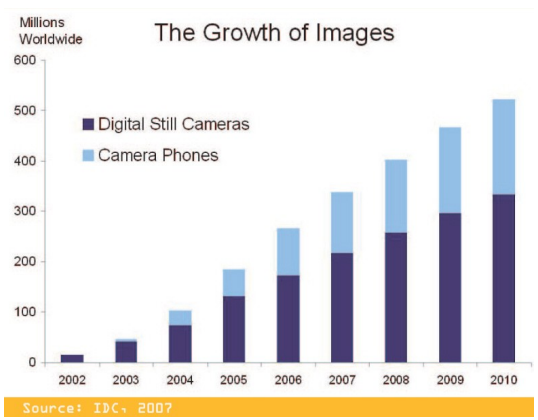


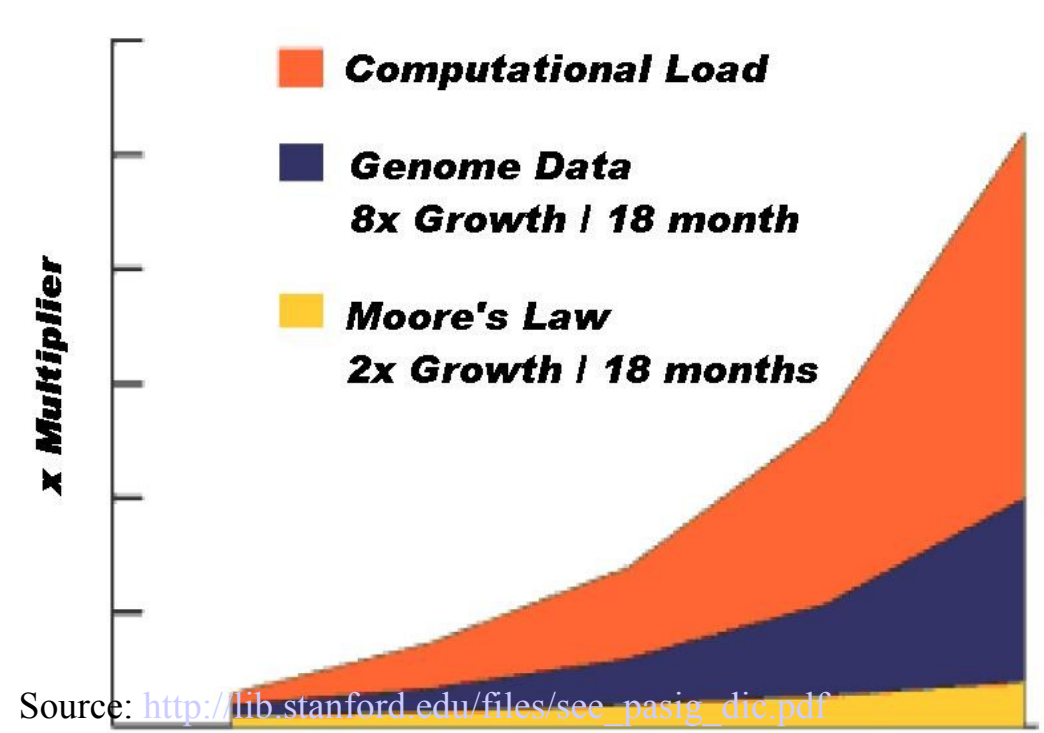
2007 Data Explore

Top 1 : Human Genomics – 7000 PB / Year
Top 2 : Digital Photos – 1000 PB+/ Year
Top 3 : E-mail (no Spam) – 300 PB+ / Year

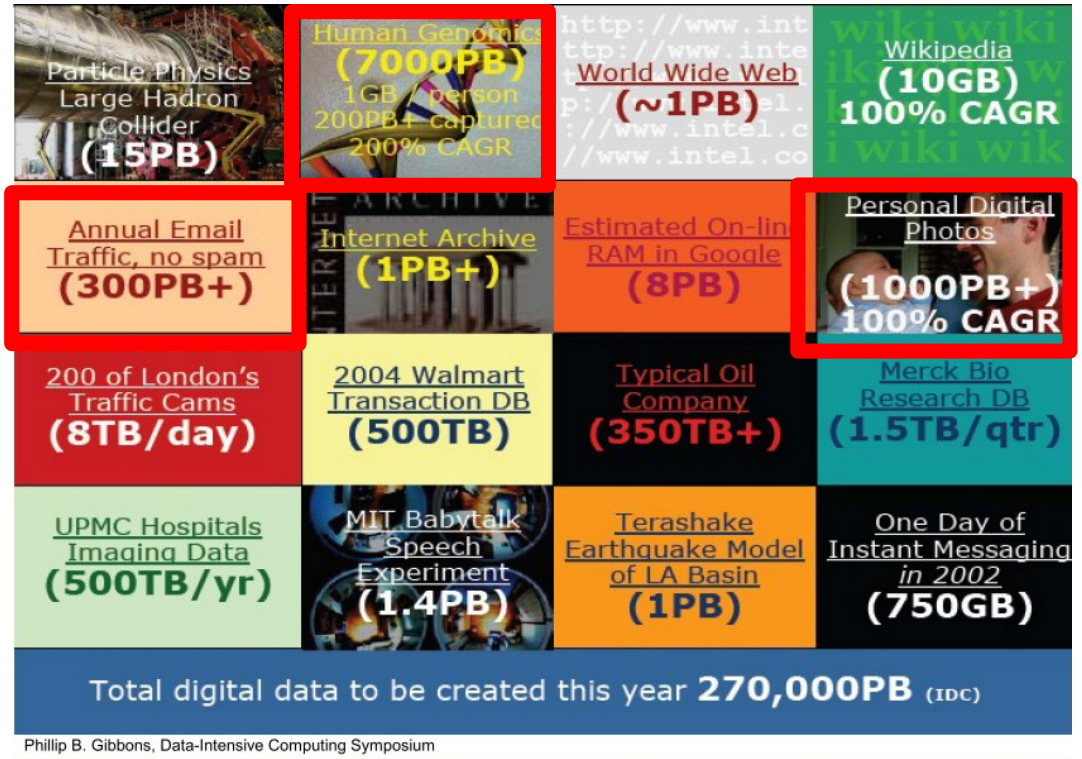


Source: http://www.emc.com/collateral/analyst-reports/expanding-digital-idc-white-paper.pdf





Source: http://lib.stanford.edu/files/see_pasig_dic.pdf



Phillip B. Gibbons, Data-Intensive Computing Symposium

Lesson #1: One cluster can't fit all !
教訓一：叢集的單一設定無法滿足所有需求！

Answer #1: Virtual Cluster 新服務：虛擬化叢集

Lesson #2: Grid for Heterogeneous Enterprise !
教訓二：格網運算該用在異業結盟的資源共享！

Answer #2: Peak Usage Time 尖峰用量發生時間點

Lesson #3: Extra cost to move data to Grid !
教訓三：資料搬運的網路與時間成本！

Answer #3: Total Cost of Ownership 總擁有成本

Cost Down is the Key Drive !!
降低營運成本才是企業導入雲端運算的關鍵考量！！

自由軟體在雲端科技發展趨勢中的角色與貢獻

Part 2 : Roles and contributions of Open Source in Cloud Computing Era

Jazz Wang

Yao-Tsung Wang

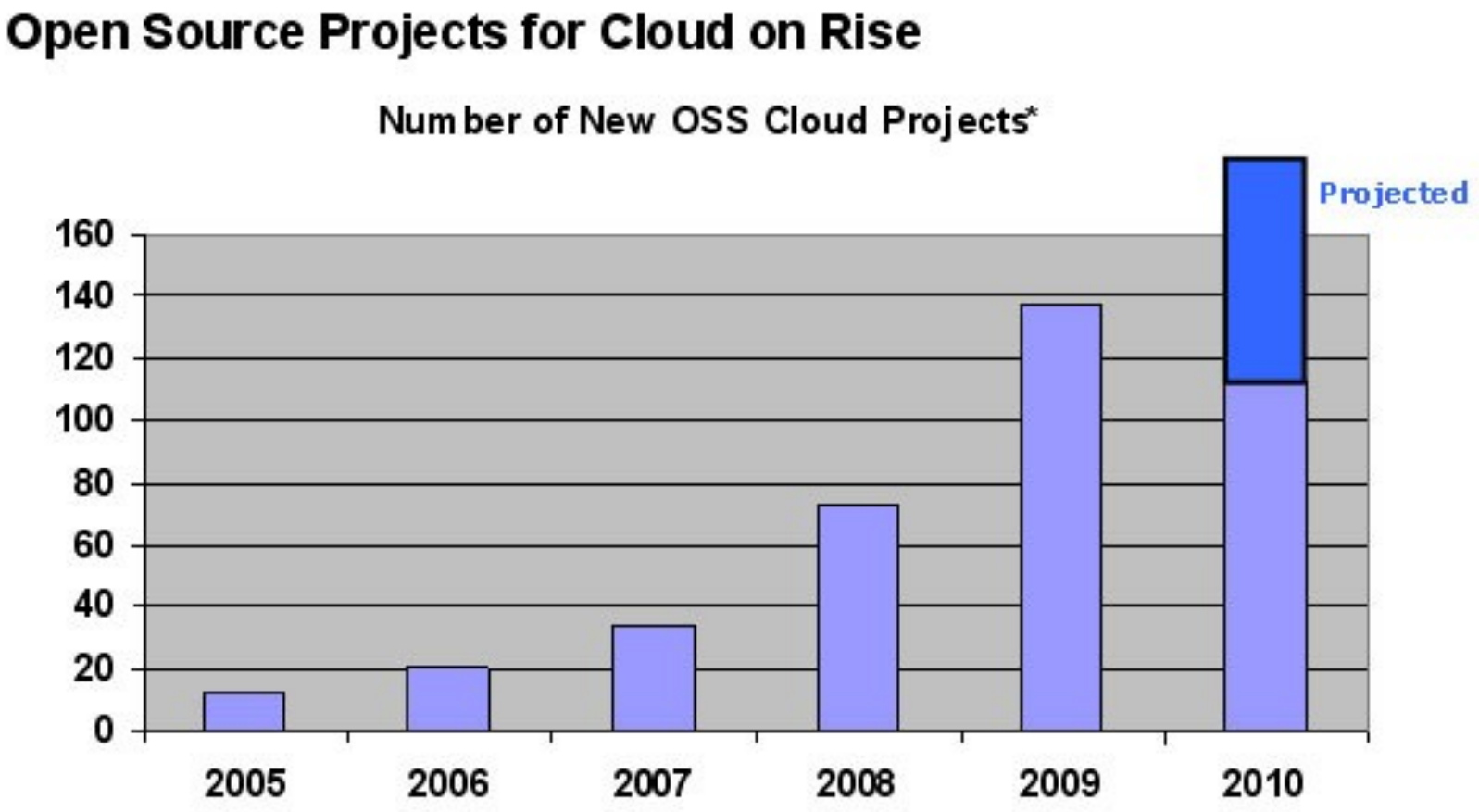
jazz@nchc.org.tw

Powered by DRBL

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



* 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

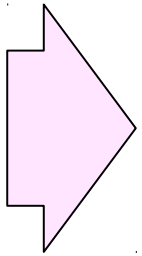
Role #2: Interoperability Standard between Clouds !
角色二：跨越不同雲端服務的互通標準！

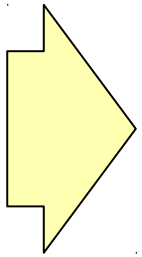
Contribution #2: Less Vendor Lock-In 貢獻二：減少技術壟斷

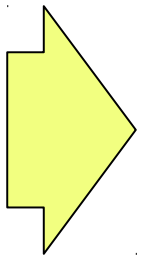
Role #3: Open Platform for Open Education !
角色三：雲端人才培育需要開放平台！

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







Reference Cloud Architecture
雲端運算的參考架構

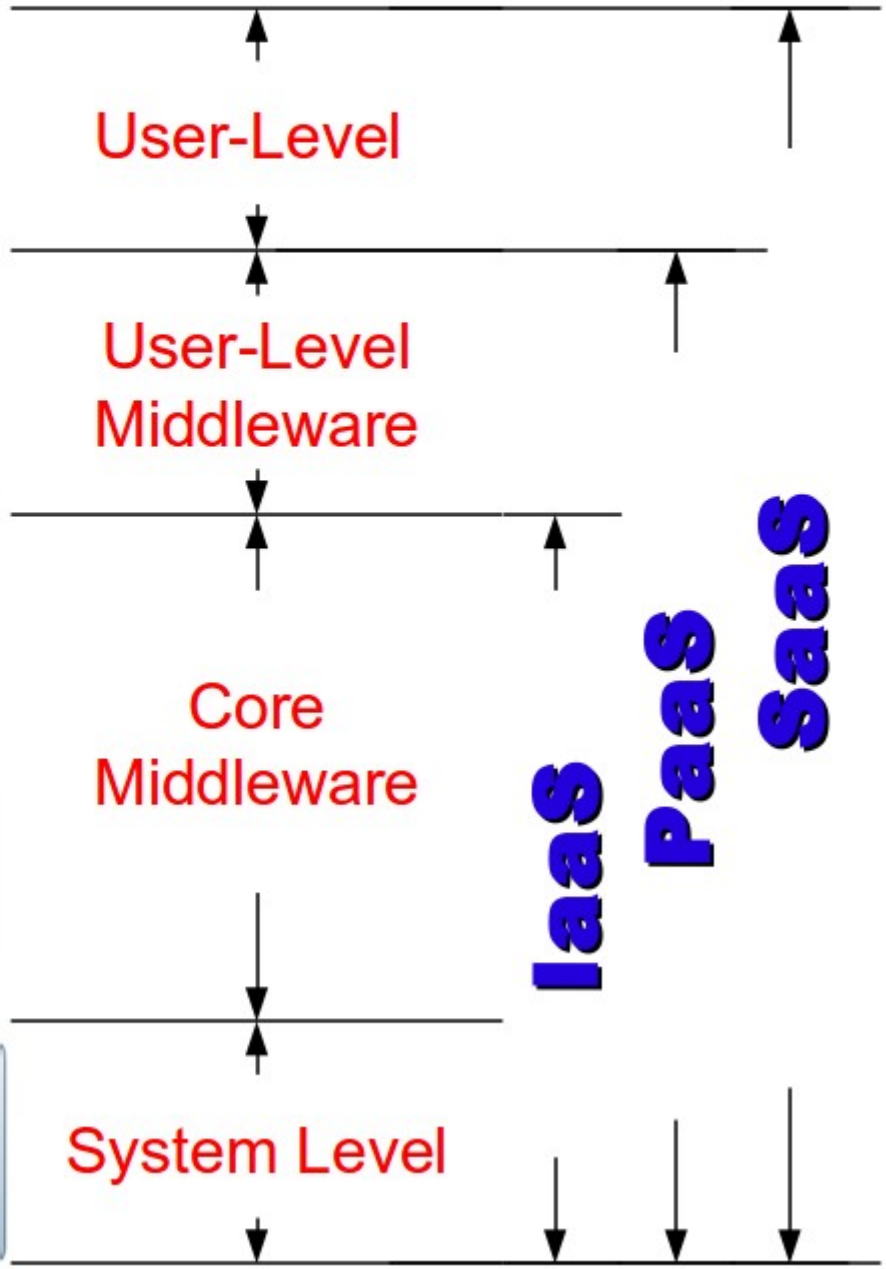
應用軟體 Application
Social Computing, Enterprise, ISV,…

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

控制管理 Control
Qos Neqotiation, Ddmission 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 (1) 虛擬化

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 Neqotiation, Ddmission Control, Pricing, SLA Management, Metering…	OpenNebula, Enomaly, Eucalyptus , OpenQRM, ...
虛擬化 Virtualization VM, VM management and Deployment	**Xen, KVM, VirtualBox, QEMU, OpenVZ, ...**

What is Virtualization ??
虛擬化技術有哪些呢 ??

Application Virtualization 應用程式虛擬化

Desktop Virtualization
Client Virtualization 桌面虛擬化

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

Data Virtualization 資料庫虛擬化

Data Virtualization 資料虛擬化

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
Deskto Clien	Redhat SPICE
Presentat	VNC, FreeNX
OS-level Virtualization	Xen, KVM, OpenVZ
Network Virtualization	OpenFlow vSwitch
Storage Virtualization	Lessfs, SDFS

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！！

Building IaaS with Open Source
用自由軟體打造 IaaS 服務 (2) 虛擬叢集控制

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 Neqotiation, Ddmission Control, Pricing, SLA Management, Metering…	OpenNebula, Enomaly, Eucalyptus , OpenQRM, ...
虛擬化 Virtualization VM, VM management and Deployment	Xen, KVM, VirtualBox, QEMU, OpenVZ, ...

Eucalyptus

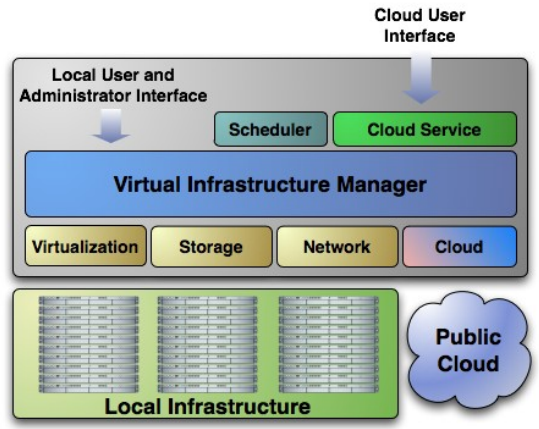
- http://open.eucalyptus.com/
- 原是加州大學聖塔芭芭拉分校 (UCSB) 的研究專案
- 目前已轉由 Eucalyptus System 這間公司負責維護
- 創立目的是讓使用者可以打造自己的 EC2
- 特色是相容於 Amazon EC2 既有的用户端介面
- 優勢是 Ubuntu 9.04 已經收錄 Eucalyptus 的套件
- Ubuntu Enterprise Cloud powered by Eucalyptus in 9.04
- 目前有提供 Eucalyptus 的官方測試平台供註冊帳號
- 缺點：目前仍有部分操作需透過指令模式

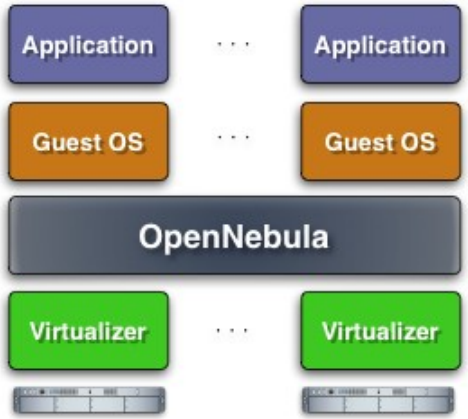
關於 Eucalyptus 的更多資訊，請參考
http://trac.nchc.org.tw/grid/wiki/Eucalyptus

OpenNebula

- http://www.opennebula.org
- 由歐洲研究學會 (European Union FP7) 贊助
- 將實體叢集轉換成具管理彈性的虛擬基礎設備
- 可管理虛擬叢集的狀態、排程、遷徙 (migration)
- 優勢是Ubuntu 9.04 已經收錄 OpenNebula 的套件
- 缺點：需下指令來進行虛擬機器的遷徙 (migration) 。

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





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 Neqotiation, Ddmission 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
- 目前主要由 Yahoo! 資助、開發與運用
- 創始者是 Doug Cutting，參考 Google Filesystem，以 Java 開發，提供 HDFS 與 MapReduce API。
- 2006 年使用在 Yahoo 內部服務中
- 已佈署於上千個節點。
- 處理 Petabyte 等級資料量。
- Facebook、Last.fm、Joost … 等

著名網路服務均有採用 Hadoop。

Sector / Sphere

- http://sector.sourceforge.net/
- 由美國資料探勘中心 (National Center for Data Mining) 研發的自由軟體專案。
- 採用 C/C++ 語言撰寫，因此效能較 Hadoop 更好。
- 提供「類似」 Google File System 與 MapReduce 的機制
- 基於UDT高效率網路協定來加速資料傳輸效率
- Open Cloud Consortium的 Open Cloud Testbed，有提供測試環境，並開發了Ma1Stone效能評比軟體。

Sector-Sphere

National Center for Data Mining
University of Illinois at Chicago

UIC

open data

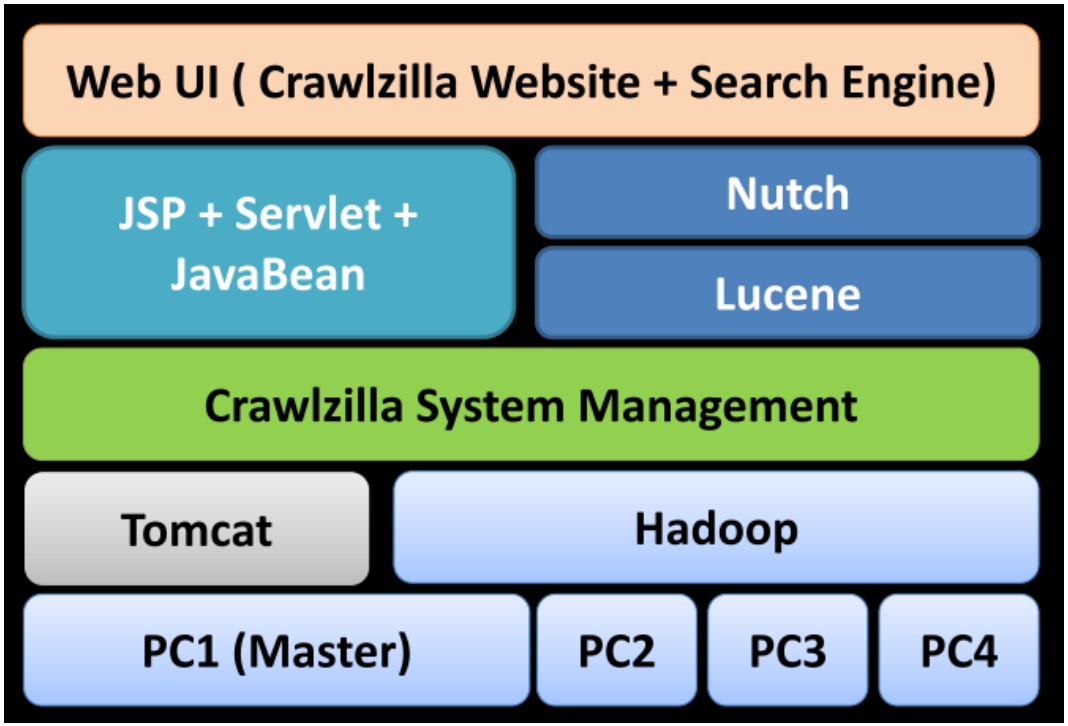
Open Data Group
http://www.opendatagroup.com/

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 Neqotiation, Ddmission Control, Pricing, SLA Management, Metering…	OpenNebula, Enomaly, Eucalyptus , OpenQRM, ...
虛擬化 Virtualization VM, VM management and Deployment	Xen, KVM, VirtualBox, QEMU, OpenVZ, ...

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），希望爲雲端運算建立標準，確保業者間的相容性，讓客户更容易轉換平台。

「客户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

Search

News
Announcement Archive
News Archive

OGF Newsletter
Newsletter Archive

Calendar

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Nebul 像，目前也存放在Nebula平台上，可用Mi

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。

資料來源：

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 ...

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

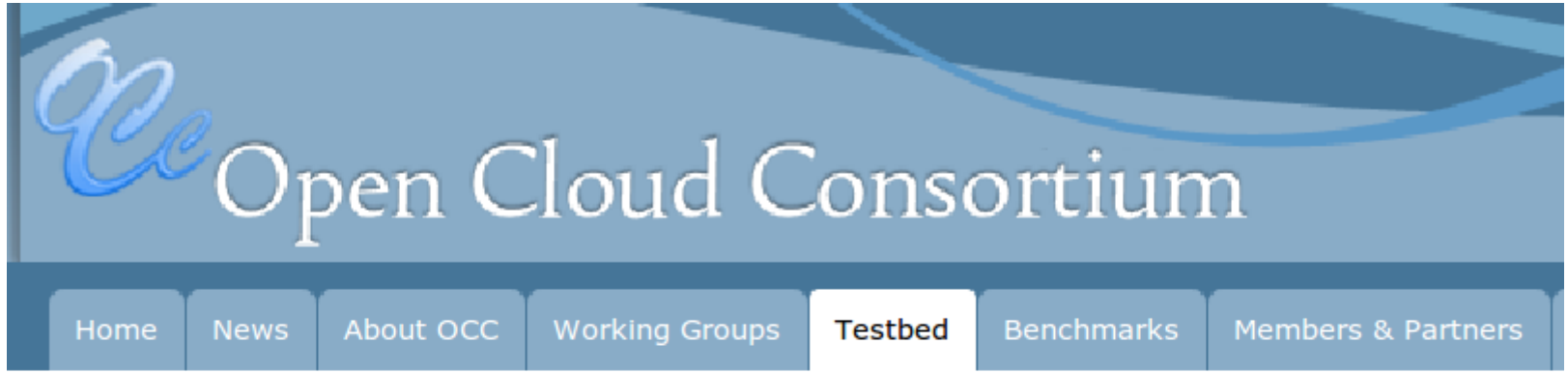
建再多的資料中心也是要有人管

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

美國結合產學資源，成立 Open Cloud Consortium，並建立 Open Cloud Testbed，作爲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.

圖片來源：http://opencloudconsortium.org/testbed/

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爲交通大學、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 Ferng, 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 sub-graph 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 Flickr550 dataset, containing 540,321 Flickr photos.

Categories and Subject Descriptors: H.3.5 [Informa-

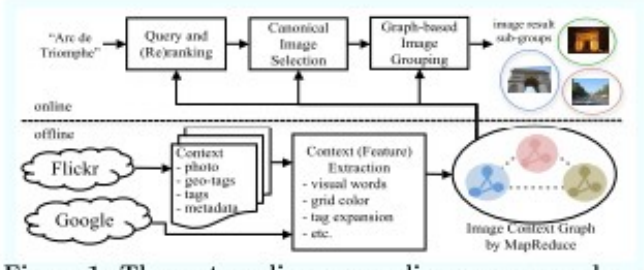
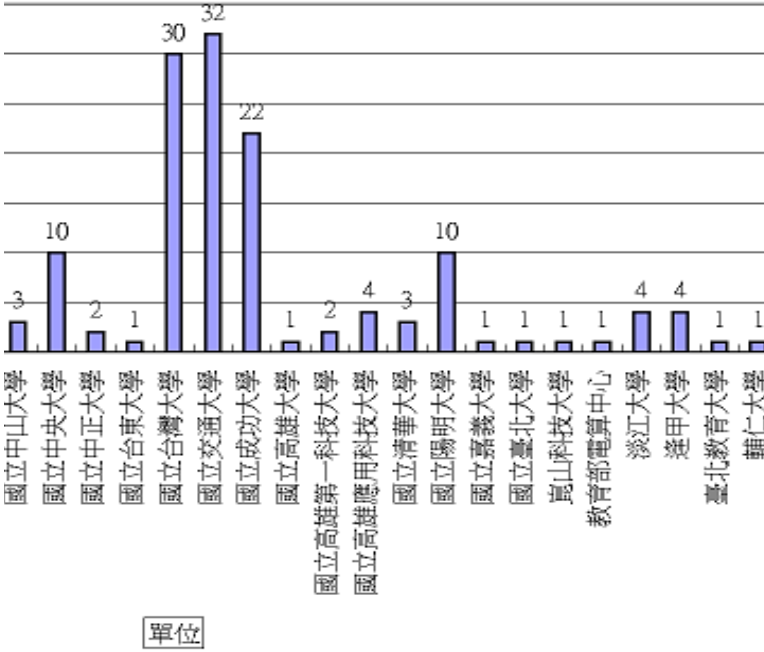
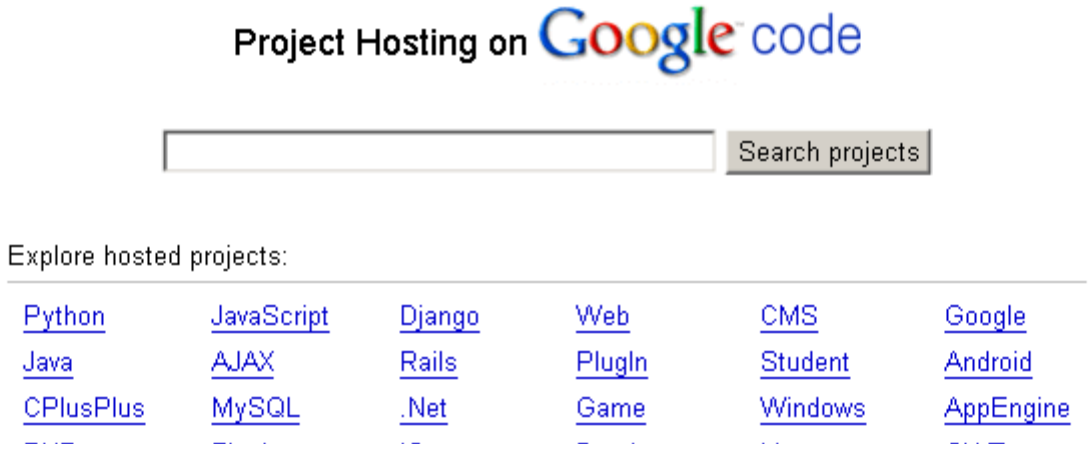


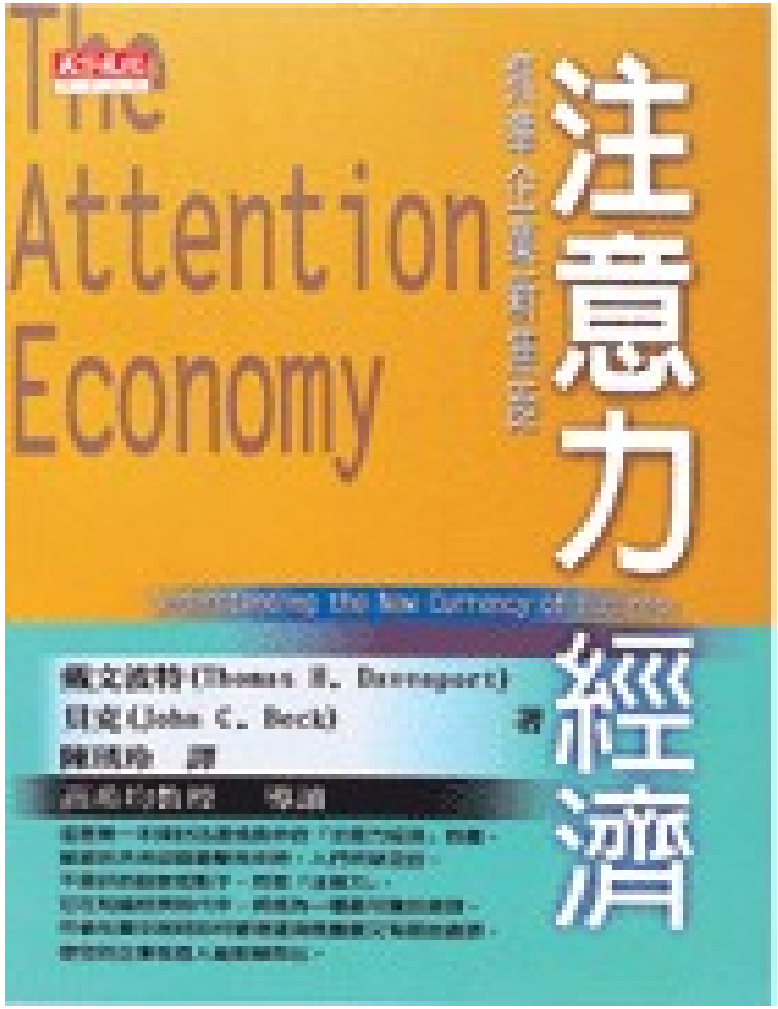
Figure 1: The system diagram: online query reranking, canonical image selection, and image result grouping are based on the image context graph, constructed offline by Hadoop MapReduce over rich context features in Flickr photos.



Conclusion: Open Source as a Strategy !!
未來自由軟體將成爲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！！





Questions?

Slides - http://trac.nchc.org.tw/cloud

Jazz Wang

Yao-Tsung Wang

jazz@nchc.org.tw