Course Information 課程資訊

- 講師介紹：
  - 國網中心　王耀聰　副研究員 / 交大電控碩士
  - jazz@nchc.org.tw
- 所有投影片、參考資料與操作步驟均在網路上
  - 由於雲端資訊變動太快，愛護地球，請減少不必要之講義列印。
- 礙於缺乏實機操作環境，故以影片展示與單機操作為主
  - 若有興趣實機操作，請參考國網中心雲端運算課程錄影
  - http://trac.nchc.org.tw/cloud
  - http://www.classcloud.org/media
  - http://www.screentoaster.com/user?username=jazzwang
- 若需要實驗環境，可至國網中心雲端運算實驗叢集申請帳號
  - http://hadoop.nchc.org.tw
- Hadoop 相關問題討論：
  - http://forum.hadoop.tw

淺談雲端運算的新趨勢

Overview the trend of Cloud Computing

Jazz Wang

Yao-Tsung Wang

jazz@nchc.org.tw

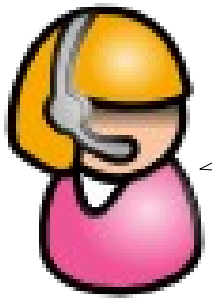
Powered by DRBL

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

On-demand self-service.
隨需自助服務

Broad network access
隨時隨地用任何網路裝置存取

Resource pooling
多人共享資源池

Rapid elasticity
快速重新佈署靈活度

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

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

Public Cloud
公用雲端

amazon web services™
Microsoft
Google

Target Market is S.M.B.
主要客戶為中小企業

Hybrid Cloud

以大型企業為主要客戶
Enterprise is key market

IBM

私有雲端
Private Cloud

Community Cloud
社群雲端

Academia 學術為主

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

Everything as a Service 啥米鬼都是一種服務

- AaaS Architecture as a Service
- BaaS Business as a Service
- CaaS Computing as a Service
- DaaS Data as a Service
- DBaaS Database as a Service
- EaaS Ethernet as a Service
- FaaS Frameworks as a Service
- GaaS Globalization or Governance as a Service
- HaaS Hardware as a Service
- IMaaS Information as a Service
- **IaaS Infrastructure or Integration as a Service**
- IDaaS Identity as a Service
- LaaS Lending as a Service
- MaaS Mashups as a Service
- OaaS Organization or Operations as a Service
- **SaaS Software or Storage as a Service**
- **PaaS Platform as a Service**
- TaaS Technology or Testing as a Service
- VaaS Voice as a Service

Customer-Oriented

客戶導向，服務至上

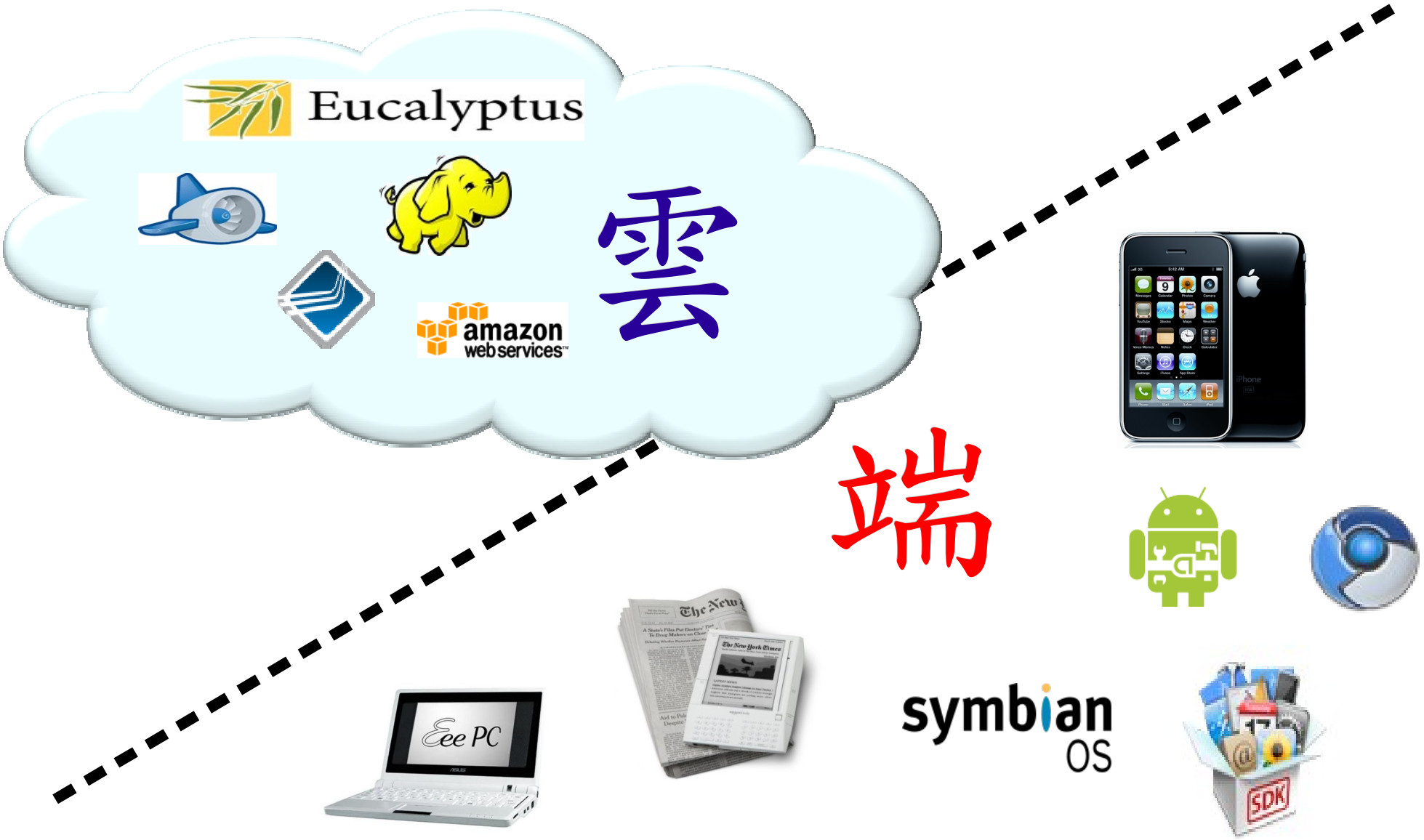
能把 AAA 做好就很強了！

Authentication
Authorization
Accounting
as
a
Service

引用自： https://www.ibm.com/developerworks/mydeveloperworks/blogs/sbose/entry/gathering_clouds_of_xaas

2 R&D directions : Cloud or Device

兩大研究方向：你該選「雲」還是「端」？



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

Key spirit of Cloud ~

形成服務才是重點！！

Everything as a Service !!

With Any Devices 使用任何裝置

Accessing Services 存取各種服務

Cloud Computing =~ Network Computing

雲端運算 =~ 網路運算

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

When did the Cloud come ?!

這朵雲幾時飄過來的？!

Brief History of Computing (1/5)

Source: http://pinedakrch.files.wordpress.com/2007/07/

1960 PDP-1

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1965 PDP-7

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1969 1st Unix

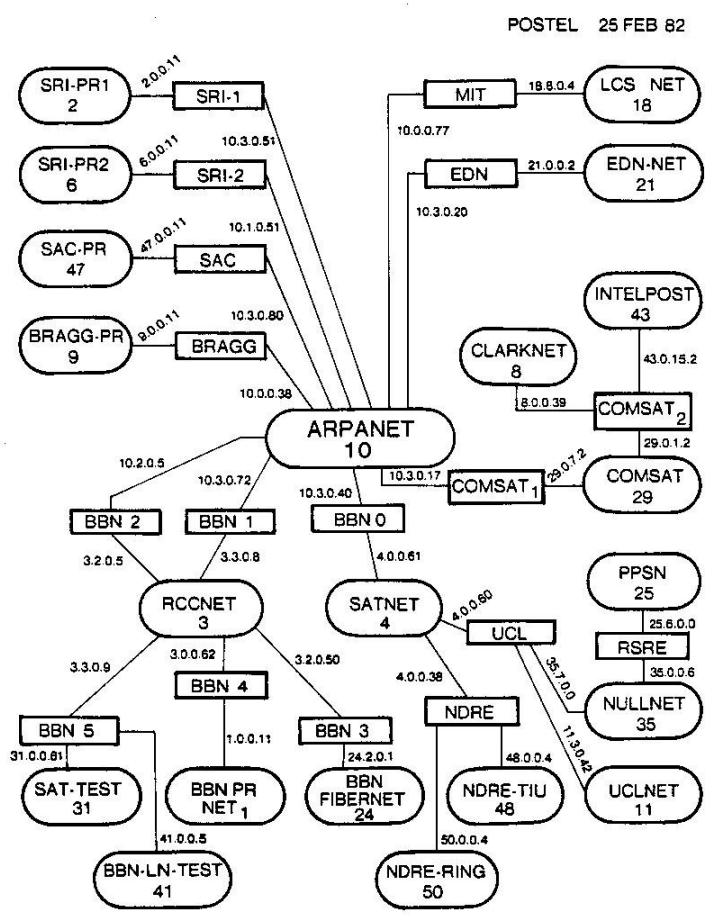
Mainframe
Super Computer

1977 Apple II

1981 IBM 1st PC 5150

Back to Year 1970s …

1982 TCP/IP



1983 GNU

1991 Linux

Back to Year 1980s ...

Brief History of Computing (2/5)

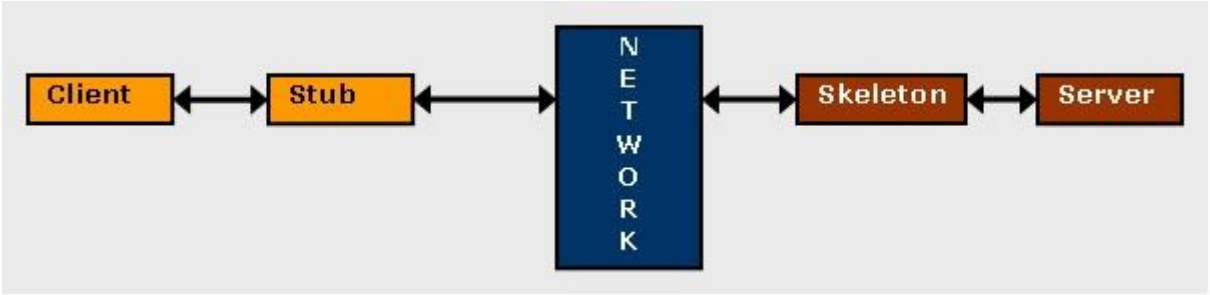
Source: http://www.nchc.org.tw

Mainframe
Super Computer

PC / Linux
Cluster Parallel

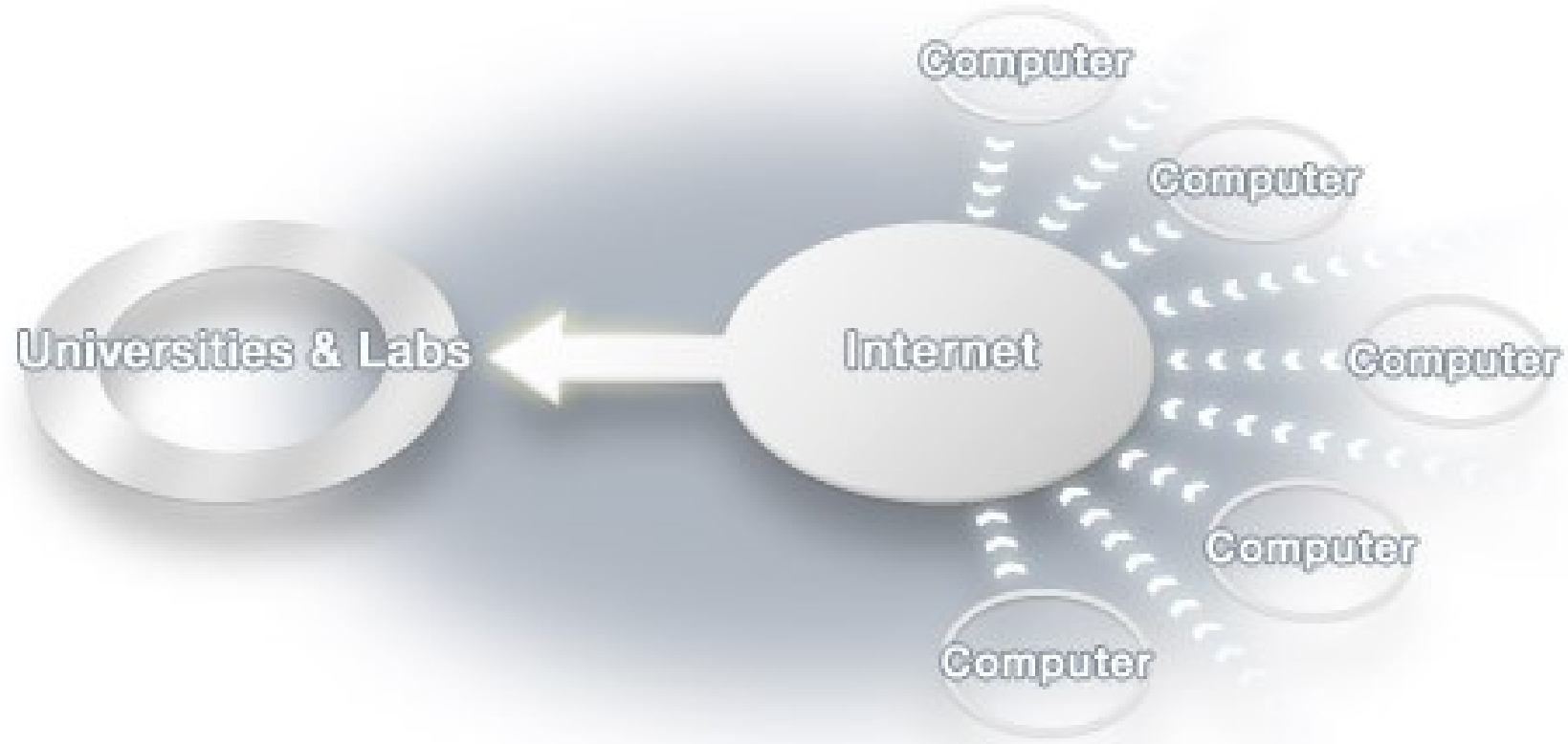
1990 World Wide Web
by CERN
…
…
1993 Web Browser
Mosaic by NCSA

1991 CORBA
…
Java RMI
Microsoft DCOM
…
Distributed Objects



Back to Year 1990s …

Brief History of Computing (3/5)



Source: http://www.scei.co.jp/folding/en/dc.html

Mainframe
Super Computer

PC / Linux
Cluster Parallel

Internet
Distributed Computing

1997 Volunteer Computing
1999 SETI@HOME

2003 Globus Toolkit 2

SETI HOME

the globus toolkit®
www.globustoolkit.org

2002 Berkley BOINC

2004 EGEE gLite

BOINC!

gLite
Lightweight Middleware for Grid Computing

Back to Year 2000s …

Brief History of Computing (4|5)

Source: http://gridcafe.web.cern.ch/gridcafe/whatisgrid/whatis.html

Mainframe
Super Computer

PC / Linux
Cluster Parallel

Internet
Distributed Computing

Virtual Org.
Grid Computing

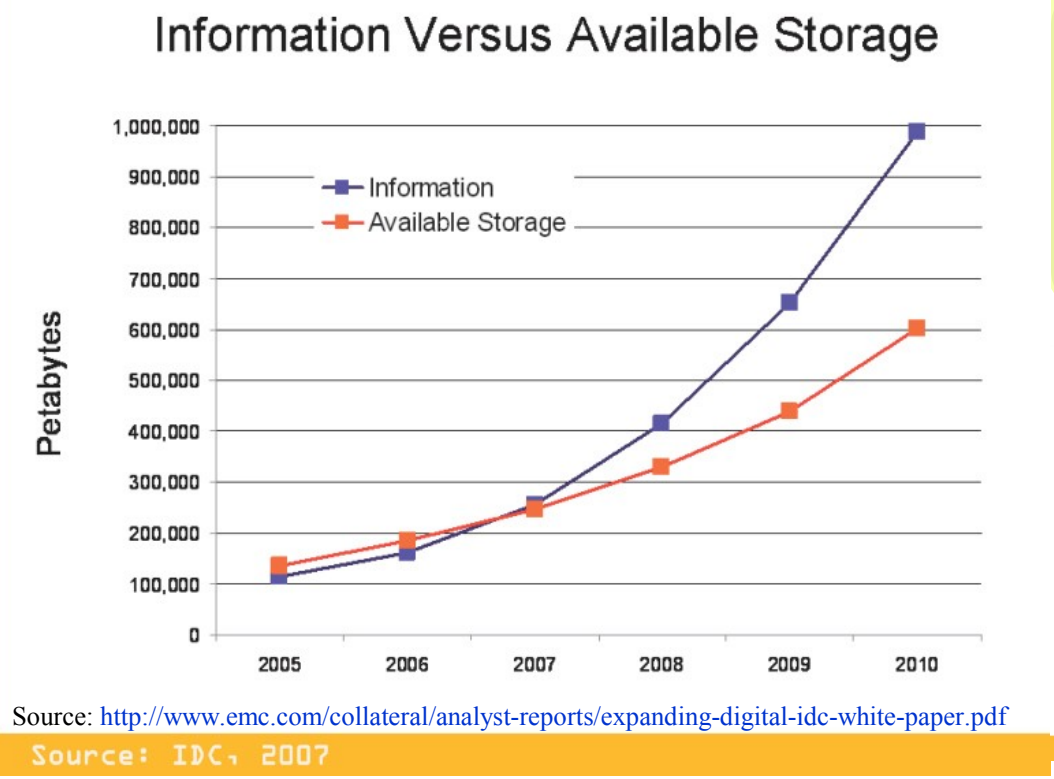
2001 Autonomic Computing
IBM

2006 Apache Hadoop

2005 Utility Computing
Amazon EC2 / S3

2007 Cloud Computing
Google + IBM

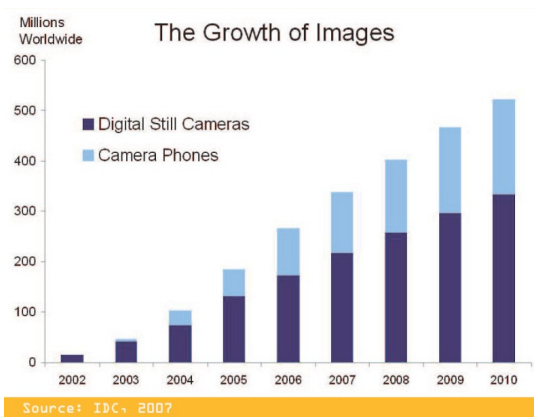
Back to Year 2007 ...

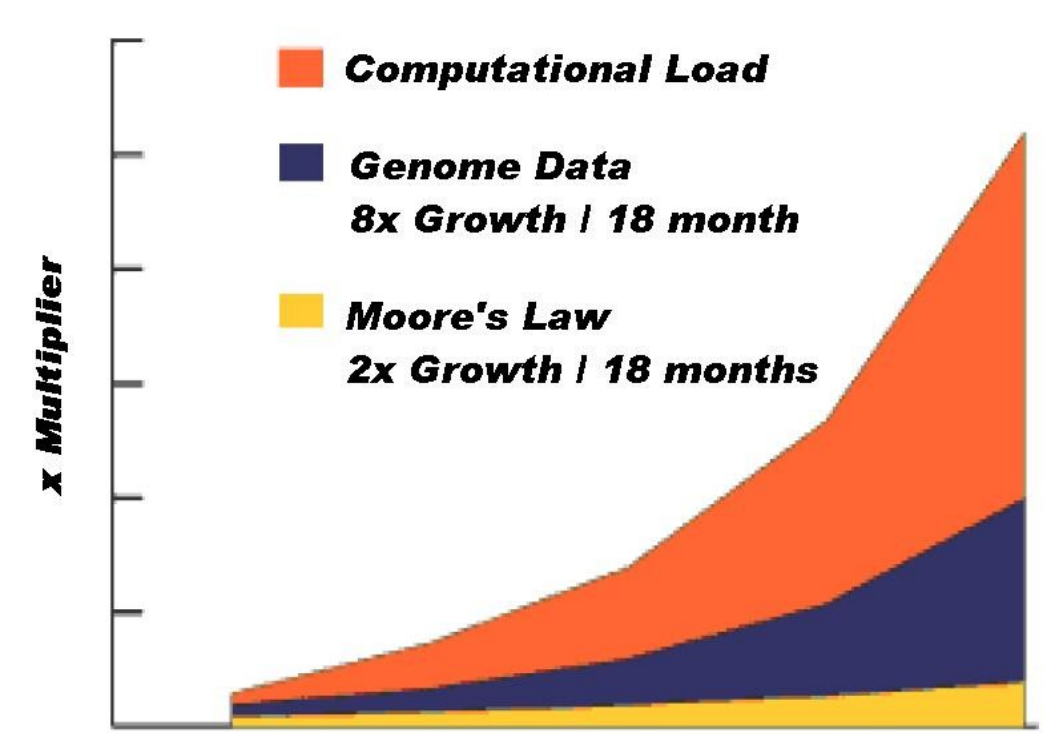


Source: http://www.emc.com/collateral/analyst-reports/expanding-digital-idc-white-paper.pdf

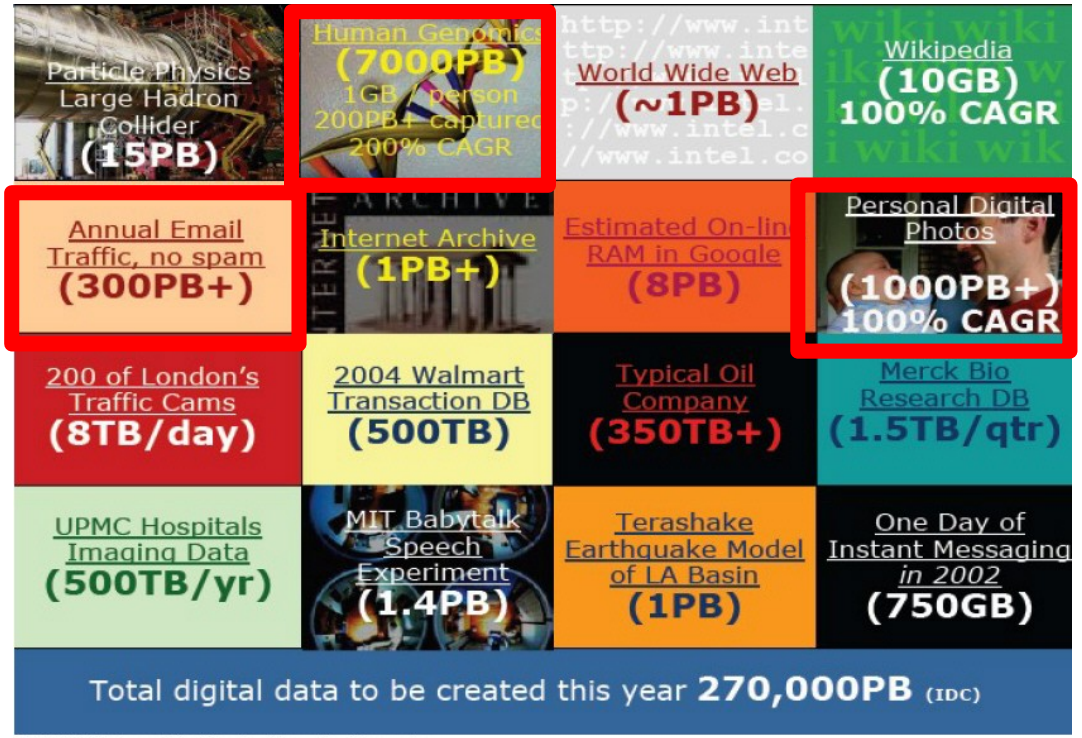
2007 Data Explore

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



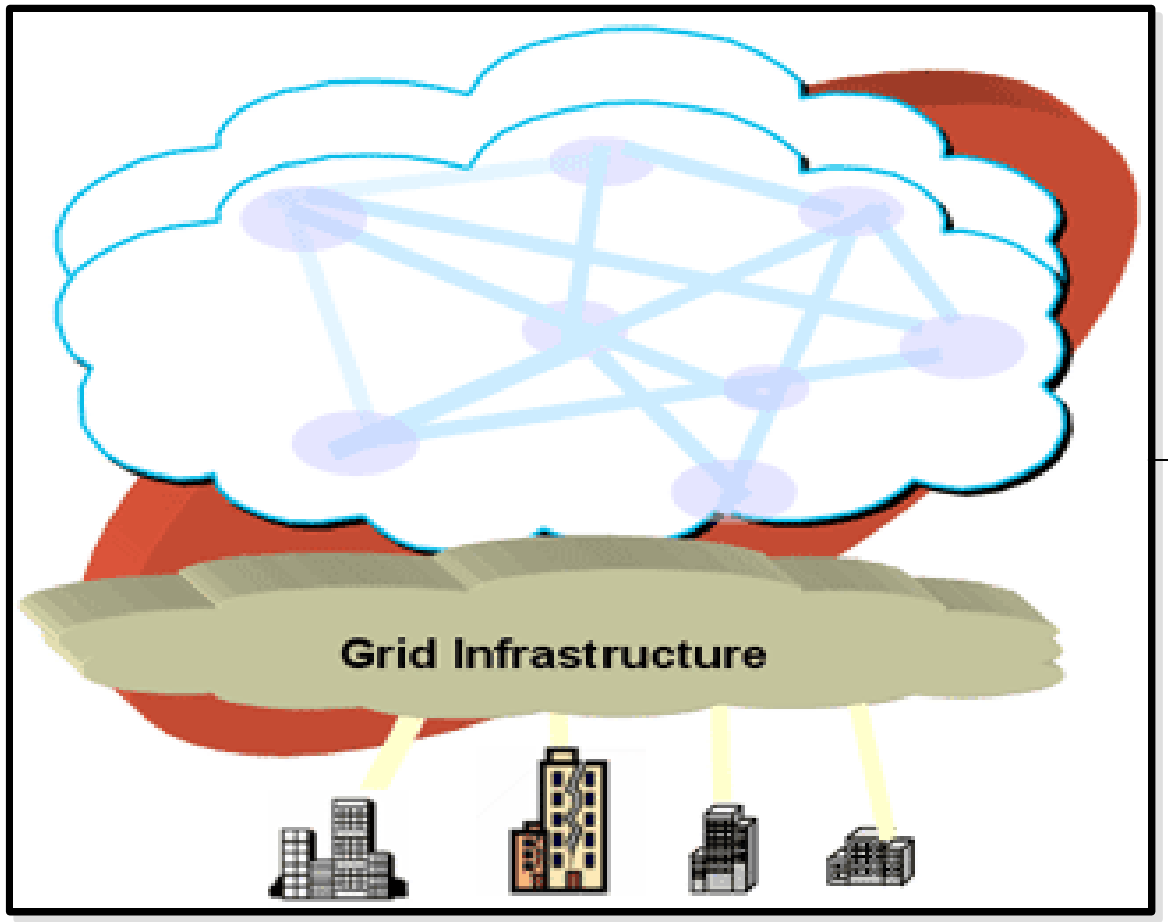


Source: http://lib.stanford.edu/files/see_pasig_dic.pdf



Phillip B. Gibbons, Data-Intensive Computing Symposium

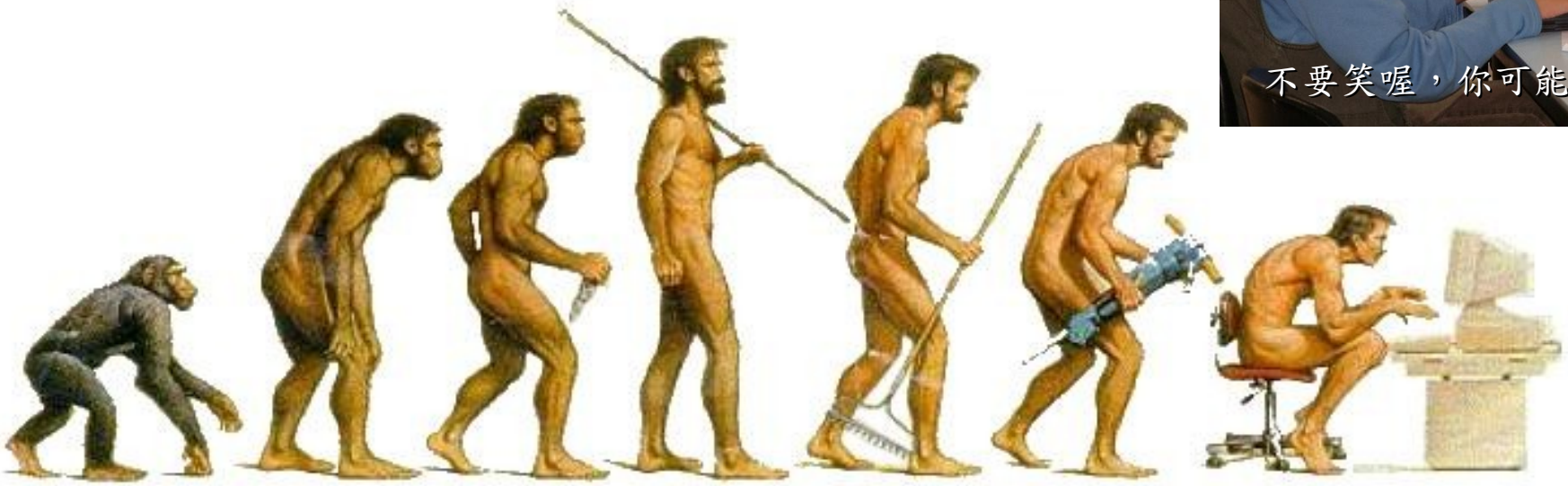
Brief History of Computing (5/5)



Source: http://mmdays.com/2008/02/14/cloud-computing/

nframe per puter	**PC / Linux** Cluster Parallel	**Internet** Distributed Computing	**Virtual Org.** Grid Computing	**Data Explode** Cloud Computing

Evolution



(or is it?)

What can we learn from the past ?!

在這漫長的演化中，我們到底學到些什麼 ?!

Source: http://cyberpingui.free.fr/humour/evolution-white.jpg

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

This is why Cloud Computing matters ?!
這就是為什麼雲端運算變得熱門?!

What are the trend of next 10 years ?

什麼是下個十年的熱門技能？

Google trends

distributed computing, grid computing, cloud com | Search Trends

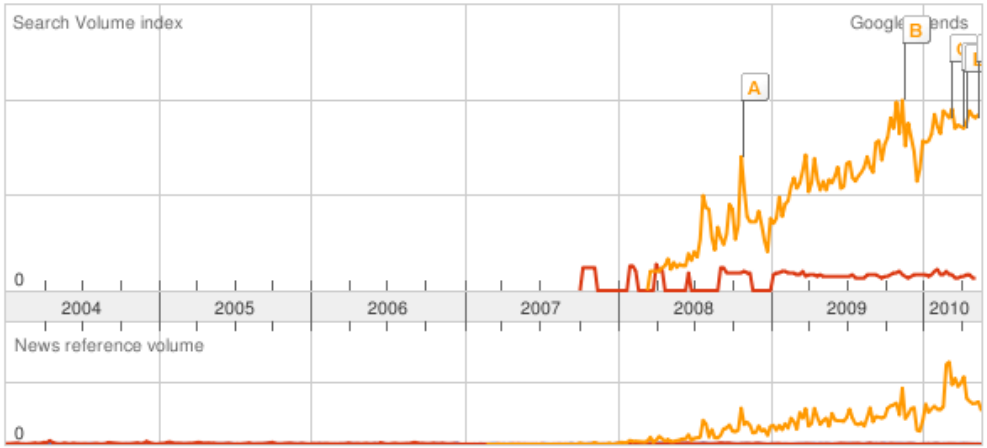
Tip: Use commas to compare multiple search terms.

Sign in to see and export additional Tren

Searches Websites

All regions | All years

distributed computin... grid computing cloud computing



A Microsoft to rent Web "cloud" computing space
Canada.com - Oct 28 2008

B Microsoft's cloud computing system is growing up
Philadelphia Inquirer - Nov 17 2009

C Google looks to be 'cloud-computing' rainmaker for other online business services
Winnipeg Free Press - Mar 10 2010

D Host Analytics Named to 2010 AlwaysOn OnDemand Top 100 List Recognizing the Leading Sa
Cloud Computing Companies
MarketWatch - Apr 6 2010

E Cloud computing and the economy
CNET - Apr 13 2010

F Cloud computing for lean local governments
Globe and Mail - May 12 2010

More news results »

Rank by cloud computing

Regions

1. India
2. Singapore
3. South Korea
4. Hong Kong
5. Taiwan
6. Ireland

Cities

1. Bangalore, India
2. Mahape, India
3. Mumbai, India
4. Chennai, India
5. San Jose, CA, USA
6. Delhi, India

Languages

1. English
2. Dutch
3. German
4. Chinese
5. Portuguese
6. Italian

似乎亞洲國家特別熱愛雲端?! **Too Hot in Asia ?!**

Trend #1: Data are moving to the Cloud
趨勢一：資料開始回歸集中管理

Access data anywhere anytime 為了隨時存取

Reduce the risk of data lost 降低資料遺失風險

Reduce data transfer cost 減少資料傳輸成本

Enhance team collaboration 促進團隊協同合作

How to store huge data ?!

如何儲存大量資料呢?!

Trend #2: Web become default Platform!
趨勢二：網頁變成預設開發平台

Open Standard 網頁是開放標準

Open Implementation 實作不受壟斷

Cross Platform 瀏覽器成為跨平台載具

Web Application 網頁程式設計成為顯學

Browser difference become entry barrier ?!

瀏覽器的差異造成新的技術門檻?!

Trend #3: HPC become a new industry
趨勢三：高速計算已悄悄變成新興產業

Parallel Computing 平行運算的技能

Distributed Computing 分散運算的技能

Multi-Core Programming 多核心程式設計

Processing Big Data 處理大資料的技能

Education and Training are needed !!

為了讓這些技能與產業接軌，亟需教育訓練！！

Source: http://media.photobucket.com/image/falling%20ground/preeto_f10/falling.jpg

該使用別人打造的雲端，還是自己打造專屬雲端呢？

Let's Talk about Public Cloud
讓我們先來談談公用雲端服務

Public Cloud
公用雲端

amazon web services™
Microsoft
Google

Target Market is S.M.B.
主要客戶為中小企業

Hybrid Cloud

以大型企業為主要客戶
Enterprise is key market

IBM

私有雲端
Private Cloud

Community Cloud
社群雲端

Academia 學術為主

Public Cloud #1: Amazon 亞馬遜網路書店

- Amazon Web Service (AWS)
- 虛擬伺服器：Amazon EC2
  - Small (Default) $0.085 per hour(L) - $0.12 per hour(W)
  - All Data Transfer $0.15 per GB
- 儲存服務：Amazon S3
  - $0.15 per GB – first 50 TB / month of storage used
  - $0.15 per GB – all data transfer in
  - $0.01 per 1,000 PUT, COPY, POST, or LIST requests
- 觀念：Paying for What You Use

參考來源：http://eblog.cisanet.org.tw/post/Cloud-Computing.aspx
http://aws.amazon.com/ec2/pricing/
http://aws.typepad.com/aws/2010/02/aws-data-transfer-prices-reduced.html
http://aws.amazon.com/s3/#pricing

Public Cloud #2: Google 谷歌

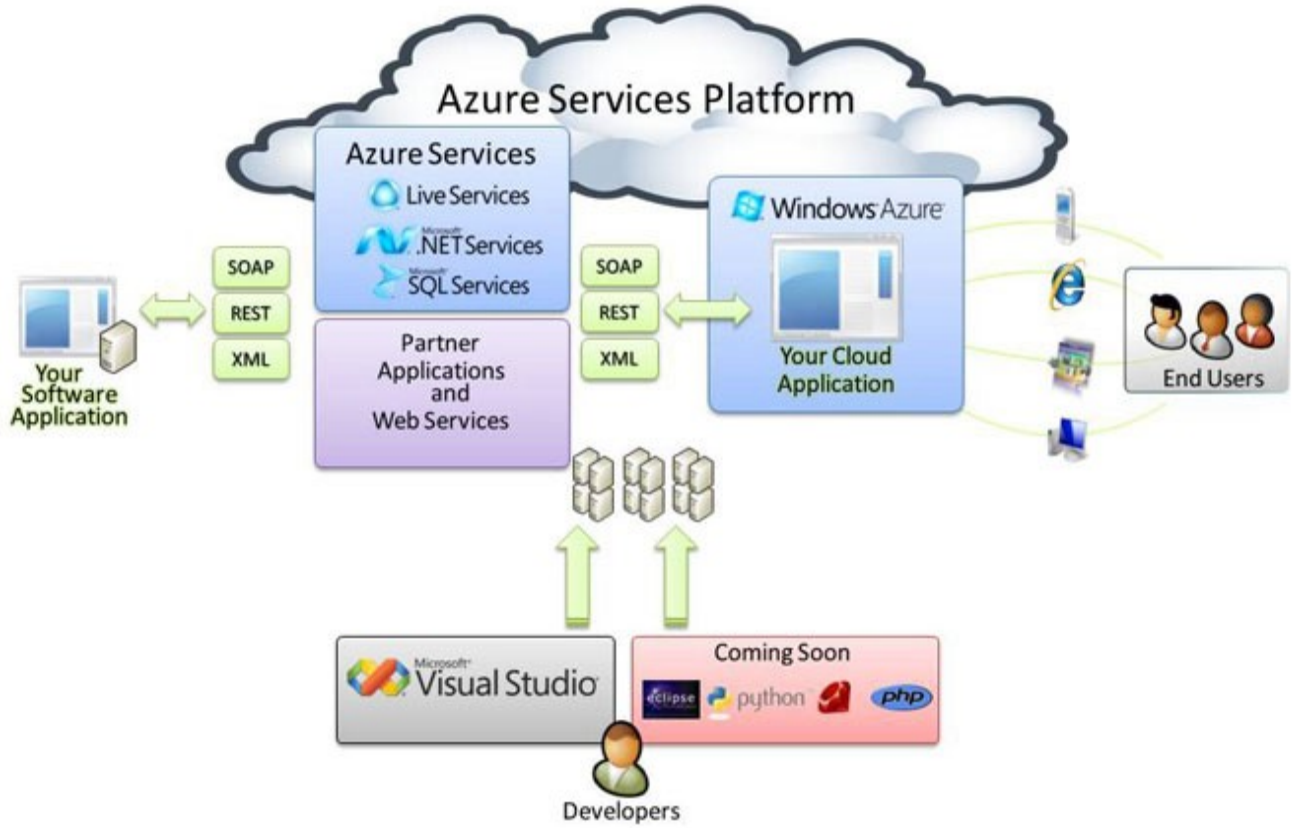
- Google App Engine (GAE)
- 讓開發者可自行建立網路應用程式於 Google 平台之上。
- 提供：
  - 500MB of storage
  - up to 5 million page views a month
  - 10 applications per developer account
- 限制：
  - 程式設計語言只能用 Python 或 Java

- 計費標準：
  - 連出頻寬 $0.12 美元/GB, 連入頻寬 $0.10 美元/GB
  - CPU 時間 $0.10 美元/時
  - 儲存的資料 $0.15 美元/GB-每月
  - 電子郵件收件者 $0.0001 美元/每個收件者

參考來源： http://code.google.com/intl/zh-TW/appengine/
http://code.google.com/intl/zh-TW/appengine/docs/billing.html

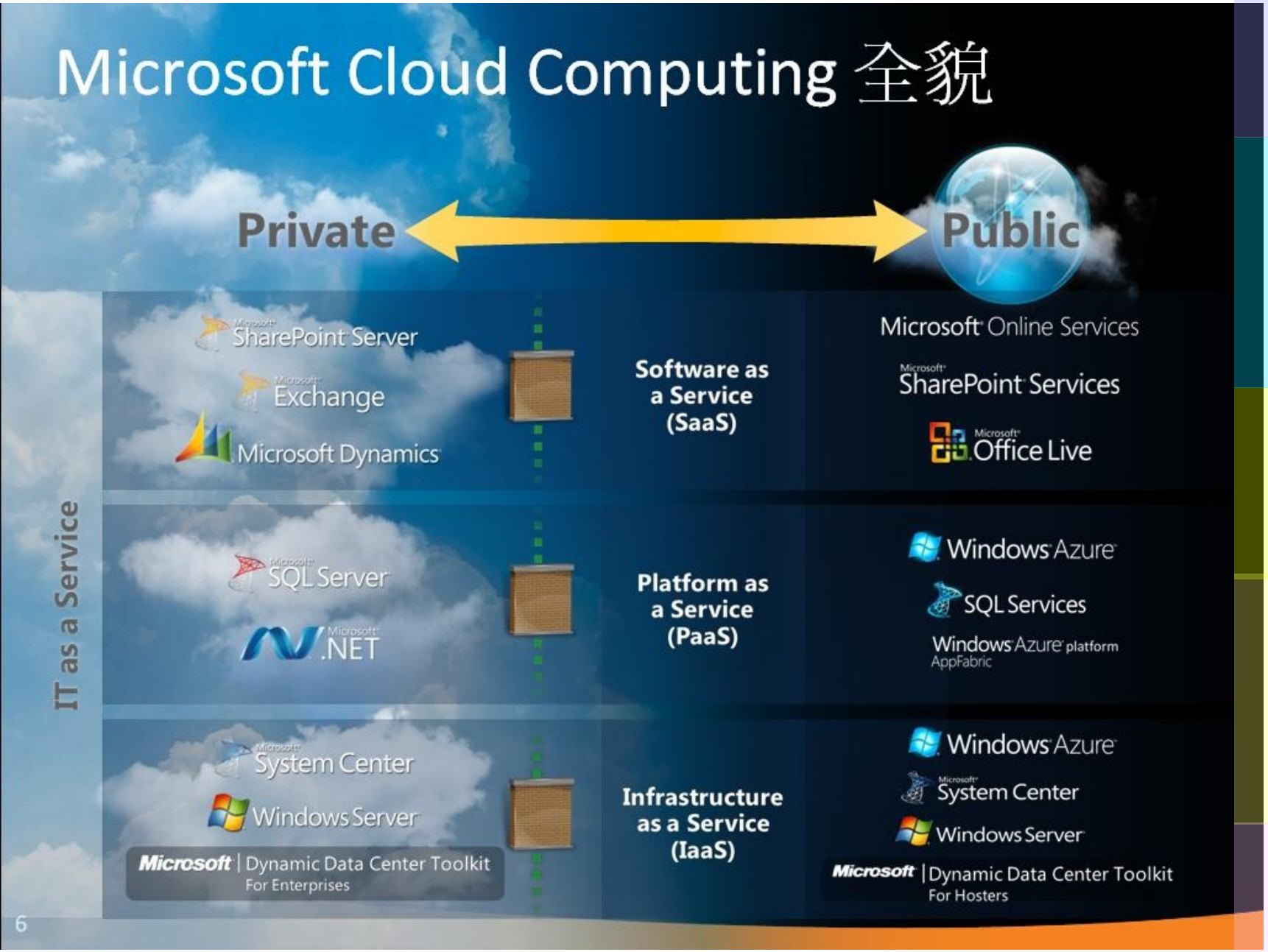
Public Cloud #3: Microsoft 微軟

- Microsoft Azure 是一套雲端服務作業系統。
- 作為 Azure 服務平台的開發、服務代管及服務管理環境。
- 服務種類：
  - .Net services
  - SQL services
  - Live services



參考來源： http://tech.cipper.com/index.php/archives/332

Public Cloud #3: Microsoft 微軟



Dallas → DaaS

Azure AppFabric → PaaS (類似 GAE)

SQL Azure → PaaS (雲端 SQL)

Window Azure → PaaS (類似 EC2)

Hyper-V → IaaS (虛擬化)

參考來源：微軟雲端運算的策略與產品藍圖，台灣微軟李匡正， 2010-02-24

Public Cloud Comparison: 公用雲端的比較

	On-Premises Apps	Small-to-Medium Web Apps	Large Web Apps	Parallel Processing Apps	Web Apps with Back-end Processing	Store Blob Data
GoGrid, Flexiscale, Others	X	X				
Amazon Web Services	X	X	X	X	X	X
Windows Azure 2009 July CTP		X	X	X	X	X
Google AppEngine			X			
Salesforce.com Force Platform			X			

25

參考來源：微軟雲端運算的策略與產品藍圖，台灣微軟李匡正， 2010-02-24

How can we build our Private Cloud ??
那我們如何打造私有雲端呢 ??

Public Cloud
公用雲端

amazon web services™
Microsoft
Google

Target Market is **S.M.B.**
主要客戶為
中小企業

Hybrid Cloud

以**大型企業**
為主要客戶
Enterprise is key market

IBM

私有雲端
Private Cloud

Community Cloud
社群雲端

Academia **學術**為主

Reference Cloud Architecture
雲端運算的參考架構

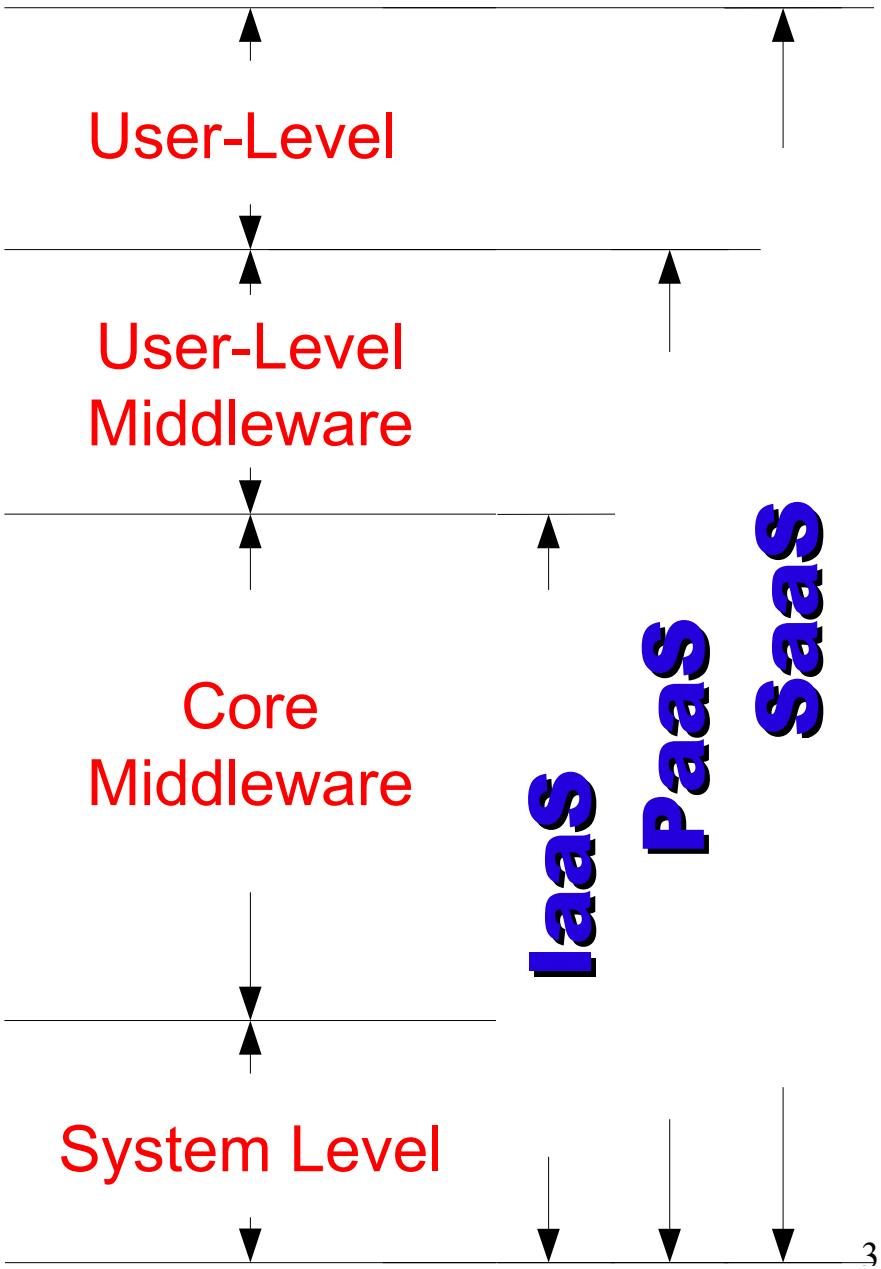
應用
Social Computing, Enterprise, ISV,…

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

控制
Qos Neqotiation, Ddmission Control, Pricing, SLA Management, Metering…

虛擬化
VM, VM management and Deployment

硬體設施
Infrastructure: Computer, Storage, Network



Open Source for Private Cloud
建構私有雲端運算架構的自由軟體

應用
Social Computing, Enterprise, ISV,…

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

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

Hadoop (MapReduce), Sector/Sphere, AppScale

控制
Qos Neqotiation, Ddmission Control, Pricing, SLA Management, Metering…

OpenNebula, Enomaly, Eucalyptus , OpenQRM, ...

虛擬化
VM, VM management and Deployment

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

Open Cloud #1: Eucalyptus

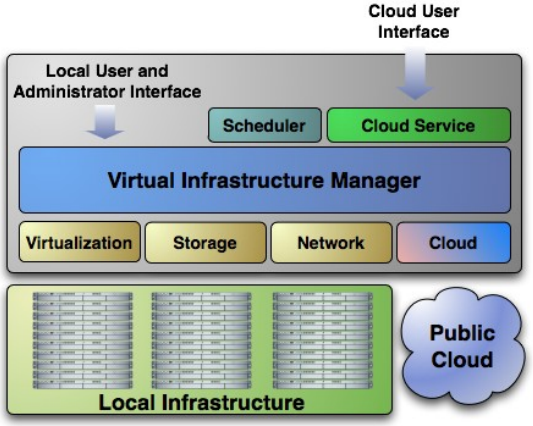
- http://open.eucalyptus.com/
- 原是加州大學聖塔芭芭拉分校 (UCSB) 的研究專案
- 目前已轉由 Eucalyptus System 這間公司負責維護
- 創立目的是讓使用者可以**打造自己的 EC2**
- 特色是相容於 Amazon EC2 既有的用戶端介面
- 優勢是 Ubuntu 9.04 已經收錄 Eucalyptus 的套件
- Ubuntu Enterprise Cloud powered by Eucalyptus in 9.04
- 目前有提供 Eucalyptus 的官方測試平台供註冊帳號
- 缺點：目前仍有部分操作需透過指令模式

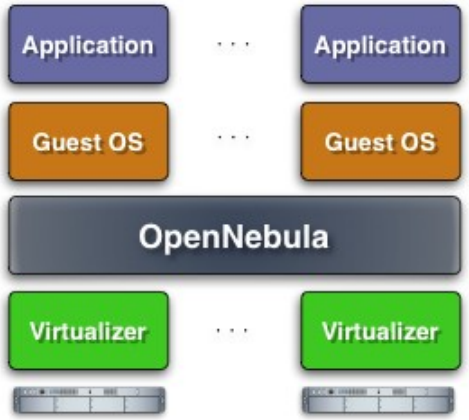
關於 Eucalyptus 的更多資訊，請參考
http://trac.nchc.org.tw/grid/wiki/Eucalyptus

Open Cloud #2: 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





Open Cloud #3: 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 。

Open Cloud #4: 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MalStone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/

What we learn today ?

WHAT	隨時隨地用任何裝置存取各種服務！！ Accessing services with any device anytime anywhere!!
WHO	亞馬遜、谷歌、微軟等！ 什麼都可以是服務 ~ Amazon, Google, Microsoft and more! Everything as a Service!
WHEN	雲端運算是 2007 年繼格網運算之後的新趨勢！！ Cloud Computing become new trend since year 2007 !!
WHY	資料集中、虛擬化、異業資源共享 Data-intensive, Virtualization, Heterogeneous
HOW	採用自由軟體也能打造私有雲端 Hadoop, Sectore/Sphere, Eucalyptus, and more ....

Questions?

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

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NCHC Cloud Computing Research Group
團隊小檔案：國網中心雲端運算研究小組

- 主要研究雲端運算的基礎架構組成元件
- http://trac.nchc.org.tw/cloud, http://trac.nchc.org.tw/grid
- 團隊成員：6 名
  - 王耀聰－ drbl-xen / drbl-hadoop (~6 Years) 架構
  - 陳威宇－ Hadoop / NutchEz / ICAS (~3 Years) 應用
  - 郭文傑－ Xen / OpenNebula / Eucalyptus (~3 Years) 元件
  - 涂哲源－ Xen GPU / OpenMP / VirtualGL (~3 Years) 元件
  - 鄭宗碩－ Google App Engine (~2 Years) 新技術
  - 鄧偉華－ AMQP / OpenID (~2 Years) 新技術
- 定位：
  - 研發快速佈建軟體，提供實驗平台服務，開辦訓練課程育才
- 獨特性：
  - 基於企鵝龍 (DRBL)，可快速佈署雲端運算的叢集環境

更多相關的開放教材－生物叢集、GAE...

- 陽明生資所 97 年度暑期學分班 格網及平行運算 (實驗課程) http://trac.nchc.org.tw/course/
- 陽明生資所 98 年度暑期學分班 格網及平行運算 (實驗課程) http://bio.classcloud.org
- 雲端運算基礎課程 (一) Hadoop 簡介、安裝與範例實作 http://www.classcloud.org/media/
- 「 Ruby on Rails 初學」電子書 by 鄭立竺 http://nchcrails.blogspot.com
- Google App Engine 電子書 by 鄭宗碩 http://nchc-gae.blogspot.com/
- More to come .....