

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
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- 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>



雲端運算的關鍵技術概述

Part 1 : Overview Core Technologies of Cloud Computing

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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.**
主要客戶為
中小企業

**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**
為主要客戶
**Enterprise is
key market**

Community Cloud
社群雲端

Academia 學術為主



私有雲端
Private Cloud

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」？



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

Cloud Computing =~ Network Computing

雲端運算 =~ 網路運算

Key spirit of Cloud ~

形成服務才是重點！！

Everything as a Service !!

What are the trend of next 10 years ?

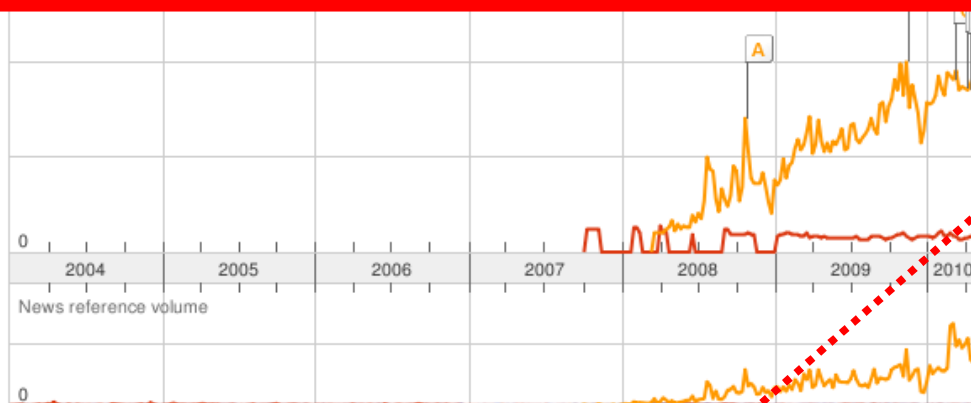
什麼是下個十年的熱門技能？

● distributed computin... ● grid computing ● cloud computing

[Sign in](#) to see and export additional Tren

All regions All years

Search Volume index



Rank by cloud computing

- [" cloud" computing space](#)
Canada.com - Oct 28 2008
- [Microsoft's cloud computing system is growing up](#)
Philadelphia Inquirer - Nov 17 2009
- [Google looks to be 'cloud-computing' rainmaker for other online business services](#)
Winnipeg Free Press - Mar 10 2010

Regions

- [India](#)
- [Singapore](#)
- [South Korea](#)
- [Hong Kong](#)
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- [Ireland](#)

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Cities

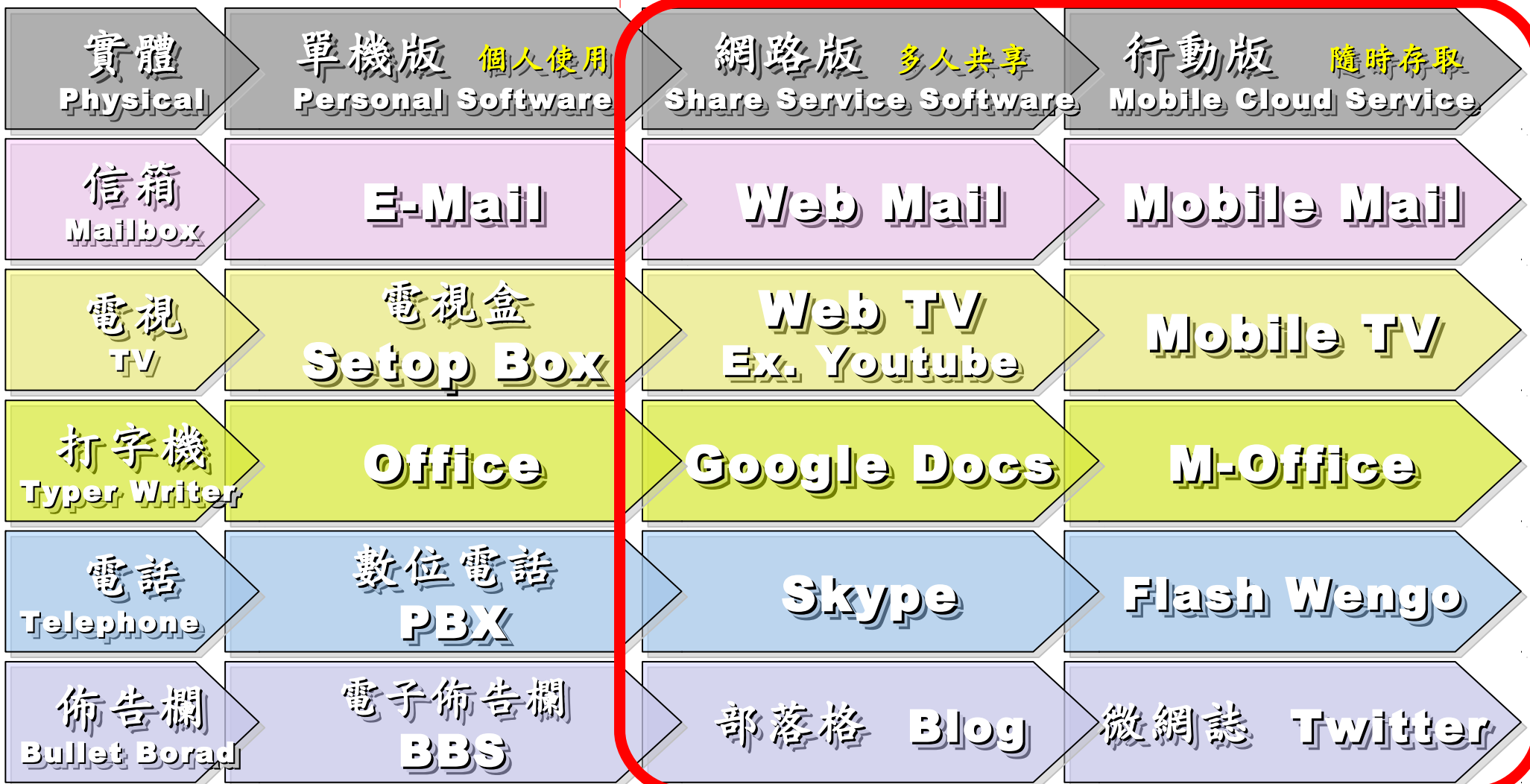
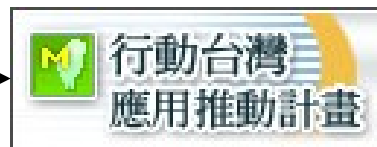
- Bangalore, India
- Mahape, India
- Mumbai, India
- Chennai, India
- San Jose, CA, USA
- Delhi, India

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



Key Driving Forces of Cloud Computing

雲端運算的關鍵驅動力

端

隨需
行動服務

Mobile Service

用任何連網裝置
都可以存取資料

租賃取代買斷
動態隨需付費

降低
經營成本

Cost Down

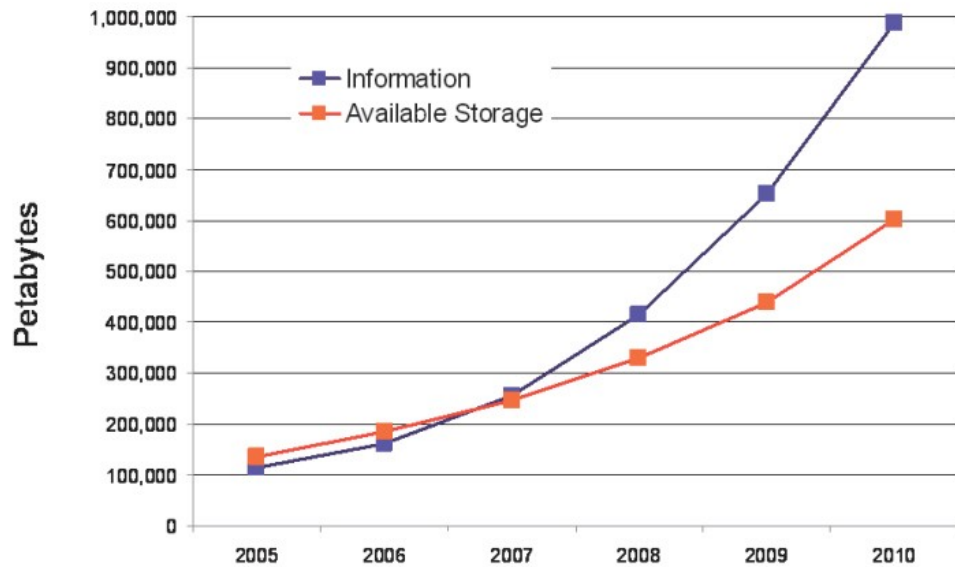
資料往雲擺
減少資料傳輸

因應
資料爆炸

Data Explore

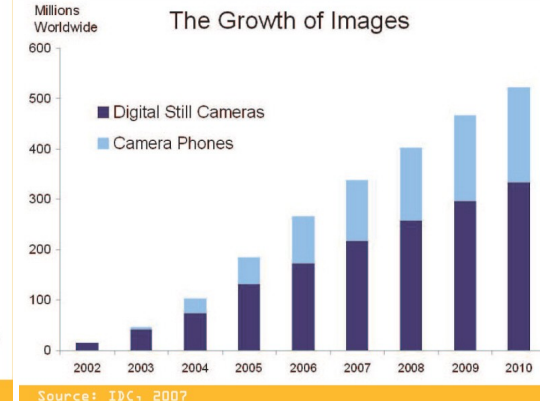
雲

Information Versus Available Storage



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

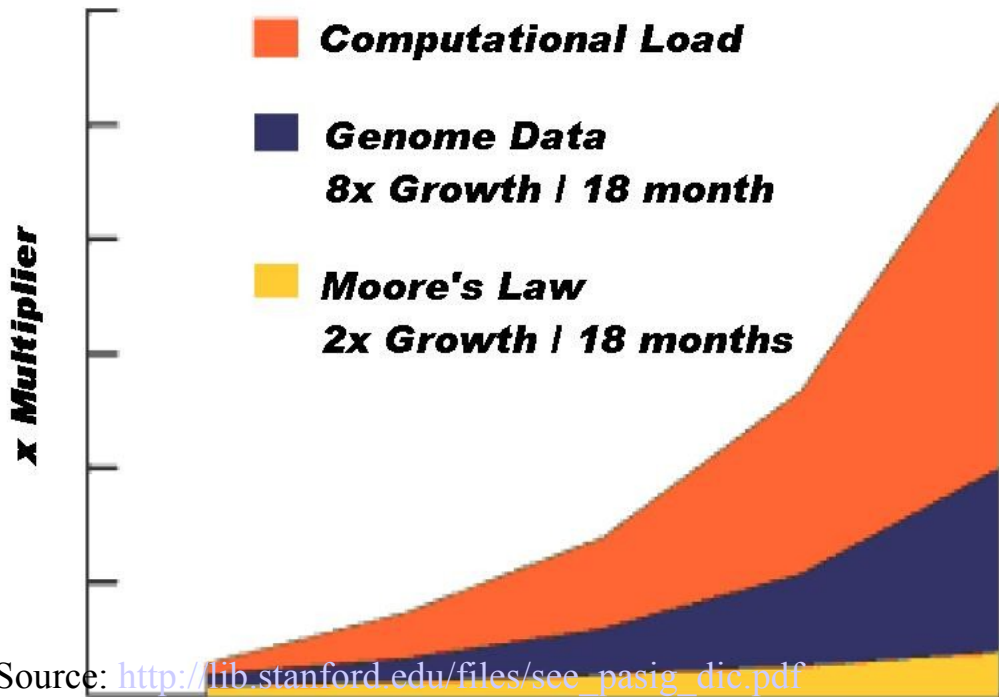


Source: <http://www.emc.com/collateral/analyst-reports/expanding-digital-idc-white-paper.pdf>

Source: IDC, 2007

Source: IDC, 2007

Source: IDC, 2007



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

Particle Physics Large Hadron Collider (15PB)	Human Genomics (7000PB) 1GB / person 200PB+ captured 200% CAGR	World Wide Web (~1PB)	Wikipedia (10GB) 100% CAGR
Annual Email Traffic, no spam (300PB+)	Internet Archive (1PB+)	Estimated On-line RAM in Google (8PB)	Personal Digital Photos (1000PB+) 100% CAGR
200 of London's Traffic Cams (8TB/day)	2004 Walmart Transaction DB (500TB)	Typical Oil Company (350TB+)	Merck Bio Research DB (1.5TB/qtr)
UPMC Hospitals Imaging Data (500TB/yr)	MIT Babytalk Speech Experiment (1.4PB)	Terashake Earthquake Model of LA Basin (1PB)	One Day of Instant Messaging in 2002 (750GB)
Total digital data to be created this year 270,000PB (IDC)			

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！！

How can we build Cloud Services ??

觀察雲端關鍵提供者，找尋打造雲端服務的模式

Public Cloud
公用雲端

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



可敬的對手
Reference Model

Hybrid
Cloud

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

Community Cloud
社群雲端

Academia **學術**為主



私有雲端
Private Cloud



- 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.cisnet.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>

Amazon Web Services 亞馬遜的網頁服務

E-Commerce

Fulfillment Web Service (FWS)

Support

AWS Premium Support

Database

SimpleDB, Rational DB Service

Payment / Billing

Amazon DevPay

Compute

EC2, Elastic MapReduce (EMR)

Messaging

Simple Queue / Notification Service

Network

VPC, Elastic Load Balance

Web Traffic

Alexa Web Info / Top Sites

Storage

S3, Elastic Block Storage (EBS)

Content Delivery

Amazon CloudFront

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 介面, 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

User-Level

User-Level
Middleware

Core
Middleware

System Level

SaaS
SaasP
SaaS

Open Source to build Cloud Service

建構雲端服務的 自由軟體

應用軟體 Application

Social Computing, Enterprise, ISV, ...

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

程式語言 Programming

Web 2.0 介面, 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

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,
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