

CSF641

Peer-to-Peer Computing  
點對點計算

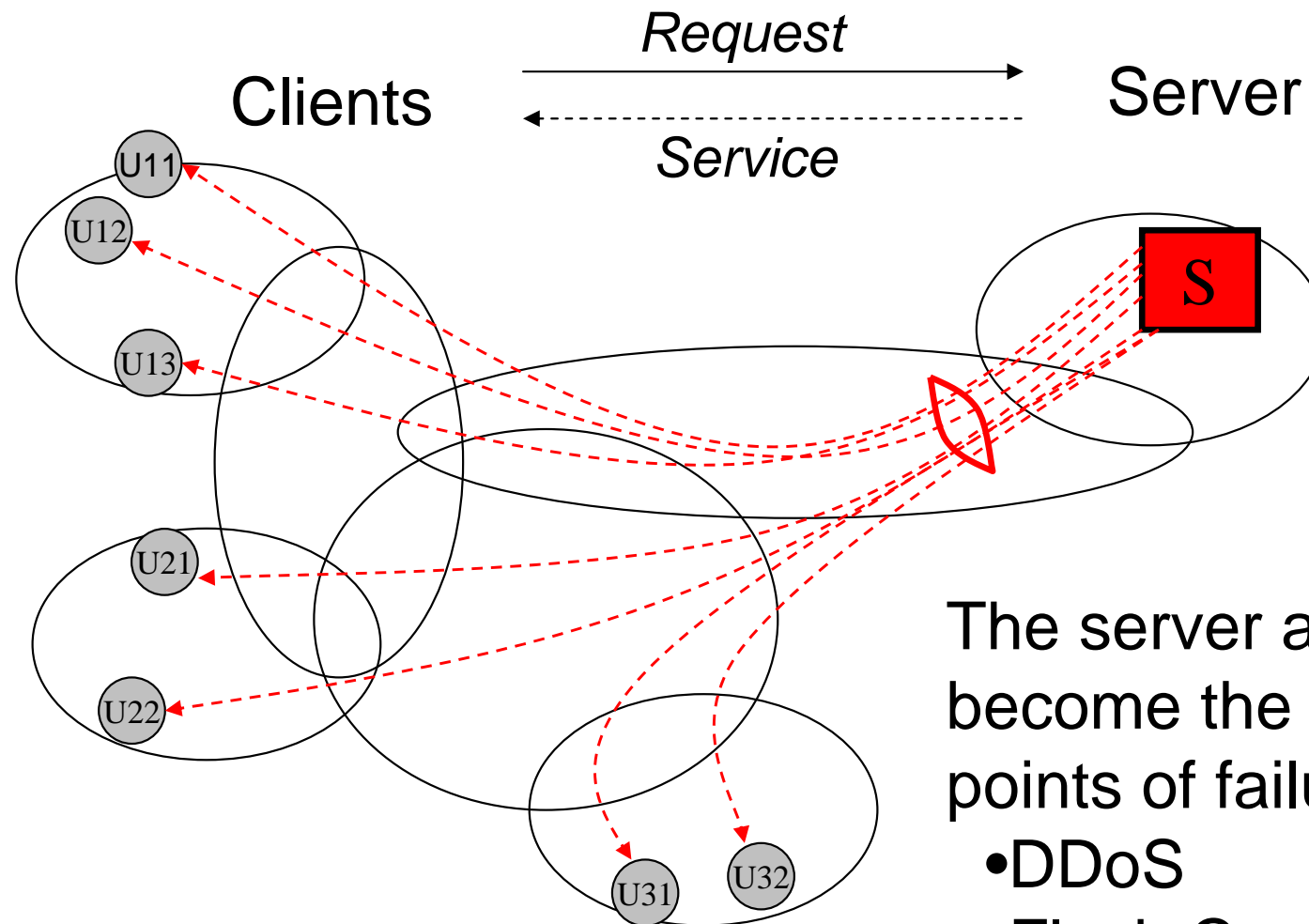
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February 2008

# Client-server Model

Clients and servers each with distinct roles



The server and the network become the bottlenecks and points of failure

- DDoS
- Flash Crowd

# Peer-to-peer Model

“ Peer-to-Peer (P2P) is a way of structuring distributed applications such that the individual nodes have symmetric roles. Rather than being divided into clients and servers each with quite distinct roles, **in P2P applications a node may act as both a client and a server.**”

*Excerpt from the Charter of Peer-to-Peer Research Group,*

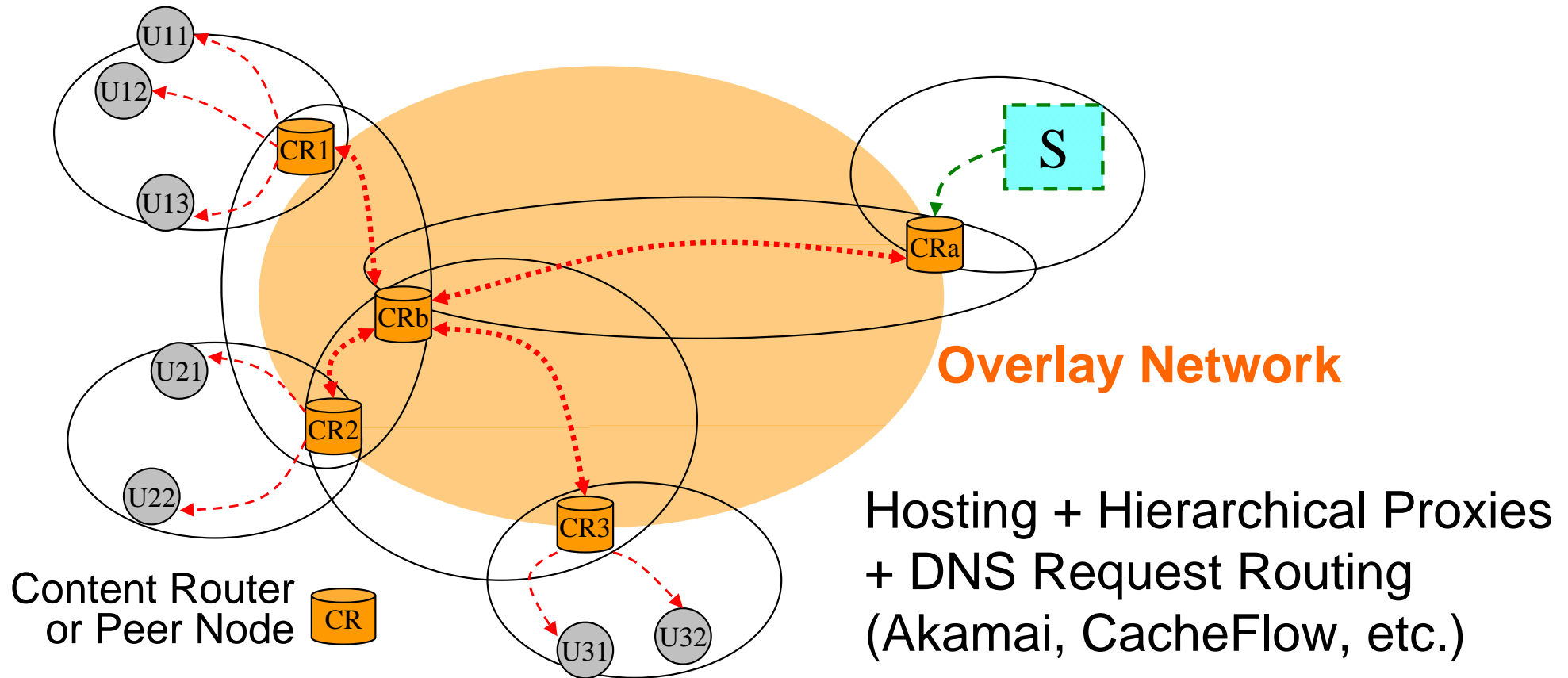
*IETF/IRTF, June 24, 2003*

*<http://www.irtf.org/charters/p2prg.html>*

Peers play similar roles

No distinction of  
responsibilities

# Content Distribution Networks



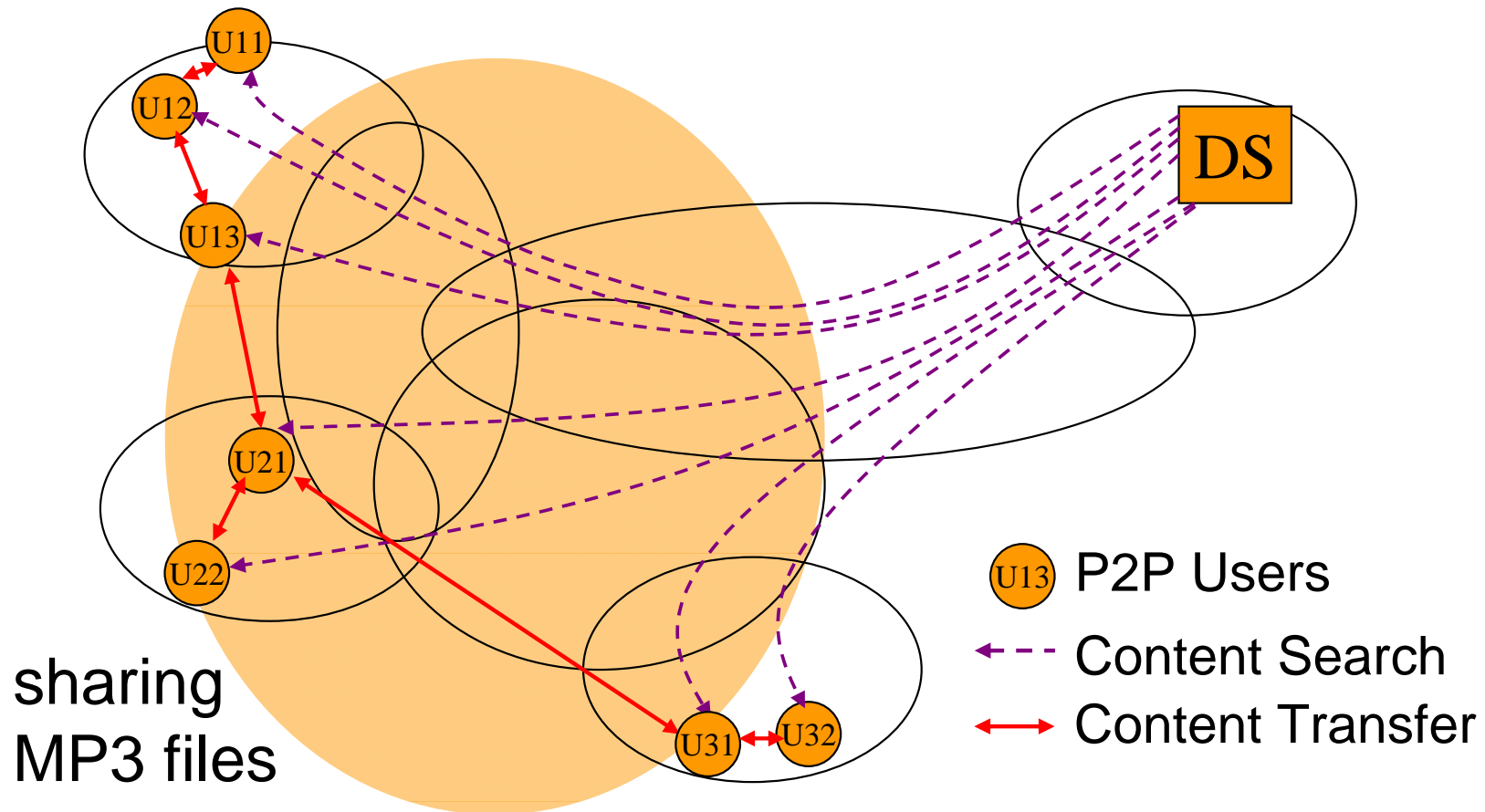
Name: lb1.www.ms.akadns.net  
Addresses: 207.46.20.60, 207.46.18.30, 207.46.19.30, 207.46.19.60, 207.46.20.30  
Aliases: **www.microsoft.com**, toggle.www.ms.akadns.net, g.www.ms.akadns.net

Name: www.yahoo.akadns.net  
Addresses: 66.94.230.33, 66.94.230.34, 66.94.230.35, 66.94.230.39, 66.94.230.40, ...  
Aliases: **www.yahoo.com**

Name: e96.g.akamaiedge.net  
Address: 202.177.217.122  
Aliases: **www.gio.gov.tw**, www.gio.gov.tw.edgekey.net

Name: a1289.g.akamai.net  
Addresses: 203.133.9.9, 203.133.9.11  
Aliases: **www.whitehouse.gov**, www.whitehouse.gov.edgesuite.net

# P2P Example - Napster

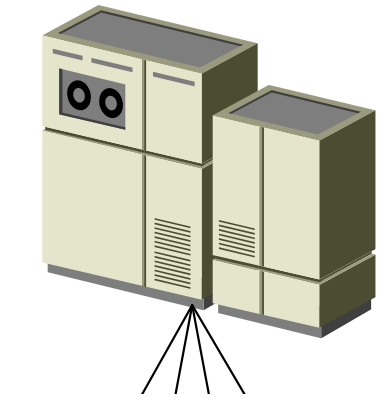


- Any two P2P nodes can exchange contents directly
- + Running P2P software is much easier than maintaining servers
- + Reduce the load of server, even without servers

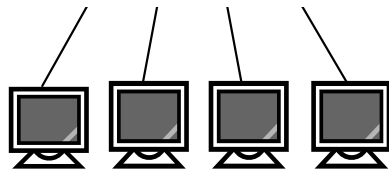
# Paradigm Shift of Computing System Models

1980~

Terminal-Mainframe  
(Super-computing)



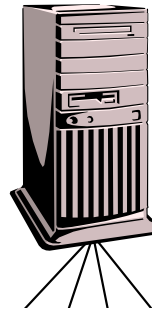
RS-232



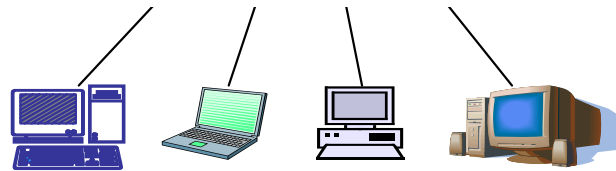
VT100/DOS

1990~

Client-Server  
(Personal Computer)



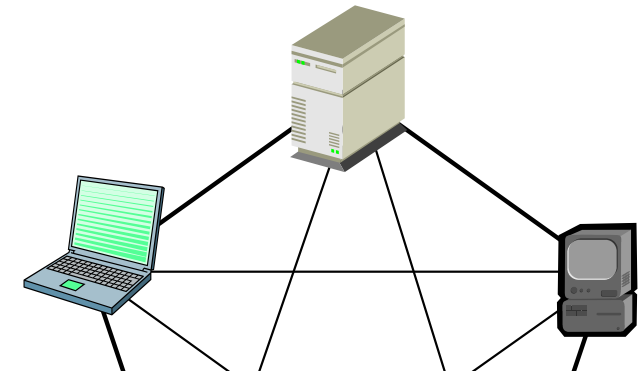
Dialup/10M Ethernet



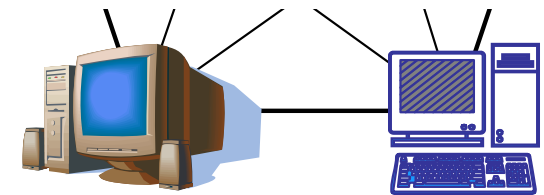
Windows 31/95

2000~

Peer-to-Peer  
(Ubiquitous computing)



ADSL/100M+ Ethernet



Linux/Windows XP

# P2P Applications

- P2P File Swapping (Sharing)
  - Napster, FreeNet, Gnutella, KaZaA, eDonkey/eMule, EZPeer, Kuro, BT, Foxy
- P2P Communication
  - NetNews (NNTP), Instant Messaging (IM), Skype (VoIP)
- P2P Multimedia Streaming (Application-layer Multicast)
  - ESM, CoopNet, Zigzag, Narada, P2Cast, Joost, PPStream, PPLive
- P2P Lookup Services and Their Applications  
(Distributed Hash Tables and Global Repositories)
  - IRIS, Chord/CFS, Tapestry/OceanStore, Pastry/PAST, CAN
- P2P Overlay Networking
  - (Inter-domain Routing – BGP), RON, PDF, Detour, Hamachi
- Proxies and Content Distribution Networks
  - Squid, Akamai, DigitIsland
- Overlay Testbed
  - PlanetLab, NetBed/EmuLab
- Other Areas
  - P2P Gaming, Grid Computing (UniGrid)

# 課程資訊

## 教學目標：

網際網路的普及，除了擴大資訊的傳播外，也增進了人類彼此之間的溝通與分享，已對人類文明發展產生了巨大的影響。傳統網際網路的應用，多以主從架構(client-server)來開發系統，而點對點計算(Peer-to-Peer, P2P)則是新興的網路應用模式，各網路節點能同時扮演用戶端、伺服器或中繼者等多重角色，因此比傳統的應用模式更具多樣性。這幾年來P2P的相關應用都大受歡迎，相關技術也被廣泛應用在主幹架構或企業內部網路系統中。有鑑於此，我們規劃「點對點計算」課程，期能透過課堂學習、分組討論與專題實作，增進學生對於新興點對點網路方面所需具備的技術與能力，並培訓具創新、整合能力的網路應用與服務研發人才。課程兼顧理論基礎及實務應用，並透過資源網站推廣優良教材，以期縮短產學供需的落差、擴大人才培訓成效，並彌補產業人才不足。

## 授課方式：

- 投影片授課暨書報討論
- 學生論文研讀報告及專題製作
- 上機實習
- 期末考

## 課程資訊：

- 上課時間：星期二 13:10 – 16:05
- 上課地點：L02-201

# 教材

## 教科書

無

## 指定論文

上網公布

參考「資通訊科技人才培育先導型計畫」的「點對點通訊協定及應用」推廣教材及相關學術論文。

<http://exodus.cs.ccu.edu.tw/p2p/>

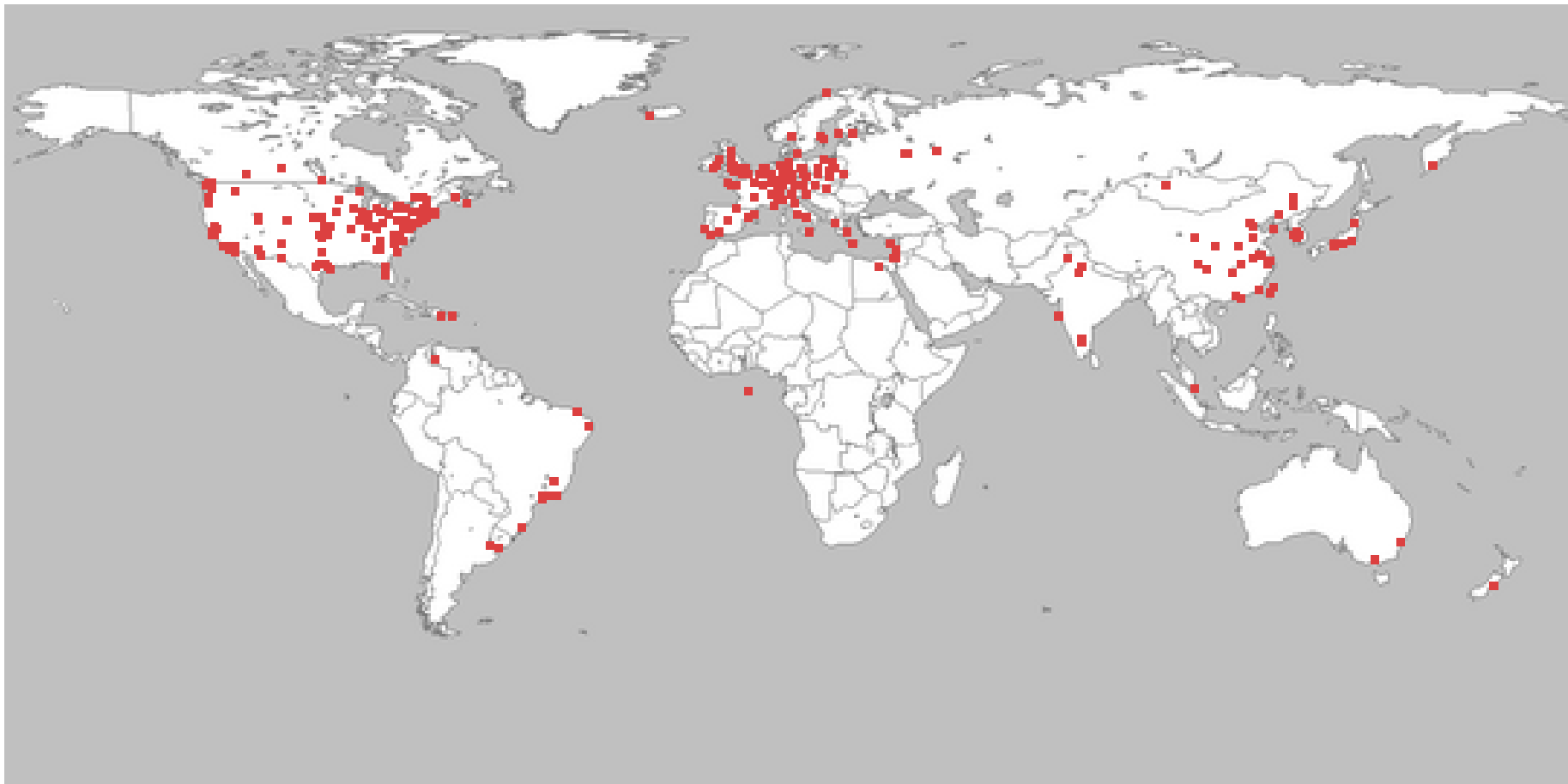
## 參考書

- James F. Kurose and Keith W. Ross, ***Computer Networking: A Top-Down Approach Featuring the Internet, 3rd Ed.***, Addison Wesley (ISBN 0-321-26976-4)
- Larry L. Peterson and Bruce S. Davie, ***Computer Networks: A Systems Approach, 4th Ed.***, Morgan Kaufmann (ISBN 0-12370-548-7)
- R. Stevens, B. Fenner, and A. Rudoff, ***UNIX Network Programming: The Sockets Networking API, Vol. 1, 3rd Ed.***, Addison-Wesley (ISBN: 0-13-123052-2)

# PlanetLab

An open platform for developing, deploying, and accessing planetary-scale services

- Current distribution of 842 nodes over 416 sites (Feb 18, 2008)
- <http://www.planet-lab.org/>



# Taiwan UniGrid Project

Connect cluster systems in colleges and NCHC to build "An Experiment Platform of National Computing Grid"

- 30 organizations (Feb 2008)
- <http://www.unigrid.org.tw/>



The screenshot shows the Taiwan UniGrid Project Portal website. The header features the Taiwan UniGrid logo on the left and the text "Taiwan UniGrid Project Portal" on the right. Below the header is a navigation menu with links: Home, Information, Member, Forums, Monitoring, Workflow Submission, Publications, and Links. The main content area is divided into two columns. The left column is titled "QuickLinks:" and contains a link for "計劃簡介". The right column contains the main text, which is in Chinese and English. The Chinese text reads: "國家高速網路與計算中心學術合作研究計畫" and "國家格網計算實驗平台之建置及應用". Below this is a section titled "摘要 Abstract" with the following text: "The goal of Grid Computing is to coordinate resources under network environment. In this Unigrid project, We will connect cluster systems in colleges and NCHC to build "An Experiment Platform of National Computing Grid". Which is used to popularize the concept of grid computing to academia and industry. We establish our platform using Globus Toolkits, which is in common used of grid computing technology. Globus Toolkits supplies protocols and APIs/SDKs make us set up and handle resources which located everywhere more easily." Below this is another section titled "為什麼要做Grid Computing (格網計算) ? Why use Grid Computing ?" with the following text: "Before we introduce grid computing, we look at some real case under grid computing: SETI@home, SETI@home stands for Search for extra terrestrial intelligence at home, which means to search civilizations out of earth just at home. SETI@home uses idle computing power of computers on the internet to analysis data from the biggest space telescope to help scientist explore aliens. this is a kind of grid". The website is displayed in a browser window with a taskbar at the bottom showing the system clock and network status.

# 課程內容與進度

## 1. Introduction to P2P

- Introduction (what, why)
- Survey of P2P networks (commercial, freeware, research)
- Issues of P2P (infrastructure, search, routing, download)

## 2. Infrastructure of P2P

- Centralized (Napster)
- Unstructured (Gnutella)
- Structured (Chord, CAN, Pastry)
- Hybrid (unstructured + structured, KaZaa, BT)
- Hierarchical

## 3. Performance issues of P2P

(improvement of P2P performance)

- Neighbor selection
- Infrastructure maintenance overhead
- Routing (proximity)

- Searching (keyword, semantic content search)

- Download

- Mobile issues

- Replication (cache)

- Hot spot and Free rider issues

## 4. Applications of P2P

- File sharing

- Storage

- Video Streaming (Live, VOD, P2PTV)

- VoIP over P2P (skype, P2PSIP)

- Wireless (structured or MANET)

- Semantic content search

- Game

## 5. Performance analysis of P2P

- Simulation tool: PeerSim

- Analytical models

## 6. Implementation of P2P

- JXTA

# 修課要求

- 專題製作 (3人一組為原則)
  - 指定論文心得一篇
  - 論文口頭報告與書面心得一篇
    - 口頭投影片報告(報告40分鐘、討論10分鐘)
    - 書面心得報告(摘要、心得討論各500字)
  - 撰寫提案計畫書
    - 口頭投影片報告(報告30分鐘、討論10分鐘)
    - 書面報告(2頁、1200字以上)
  - 撰寫期末論文
    - 口頭投影片報告(報告30分鐘、討論10分鐘)
    - 書面報告(6頁、5000字以上)
- 期末考
- 課堂討論

# 評分標準 (暫定)

## 1. 論文研讀 (25%)

- 指定論文心得一篇(10%)
- 論文口頭報告與書面心得一篇(15%)

## 2. 專題製作 (50%)

- 3人一組
- 計畫提案(proposal)
- 期末報告 (term paper)

## 3. 期末考(25%)

## 4. 課堂討論表現

# Schedule

1	2/19	預備週	10	4/22	計畫提案報告
2	2/26	(加退選)	11	4/29	期末考
3	3/04	分組、題目繳交	12	5/06	(棄選) 論文報告
4	3/11		13	5/13	論文報告
5	3/18		14	5/20	論文報告
6	3/25		15	5/27	論文報告
7	4/01		16	6/03	論文報告
8	4/08		17	6/10	論文報告
9	4/15	指定論文心得繳交 PlanetLab上機實習	18	6/17	期末計畫報告 論文報告資料繳交

# 參考組織與會議

- ACM (Association for Computing Machinery)  
[www.acm.org](http://www.acm.org)
  - SIGCOMM - SIG Data Communication
- IEEE (Institute of Electrical and Electronics Engineers)  
[www.ieee.org](http://www.ieee.org)
  - Communication Society ([www.comsoc.org](http://www.comsoc.org))
  - Computer Society ([www.computer.org](http://www.computer.org))
- IETF (Internet Engineering Task Force)  
[www.ietf.org](http://www.ietf.org)
- Conferences and Journals
  - ACM SIGCOMM
    - HotNets, IMC (Internet Measurement Conference)
  - IEEE INFOCOM
    - IEEE P2P
    - HotP2P (with IPDPS)
  - IPTPS (International Workshop on Peer-to-Peer Systems)
  - IEEE or ACM Journals

# 論文網站

Cite Seer	<a href="http://citeseer.ist.psu.edu">citeseer.ist.psu.edu</a>
Google Scholar	<a href="http://scholar.google.com">scholar.google.com</a>
Elsevier Scirus	<a href="http://www.scirus.com">www.scirus.com</a>
Networked Computer Science Technical Reference Library	<a href="http://www.ncstrl.org">www.ncstrl.org</a>
IEL (IEEE Xplore)	<a href="http://ieeexplore.ieee.org">ieeexplore.ieee.org</a>
ACM Digital Library	<a href="http://portal.acm.org">portal.acm.org</a>
Springer-Verlag Link	<a href="http://www.springerlink.com">www.springerlink.com</a>
Wiley InterScience	<a href="http://www.interscience.wiley.com">www.interscience.wiley.com</a>
Elsevier ScienceDirect (SDOS)	<a href="http://sdos.ejournal.ascc.net">sdos.ejournal.ascc.net</a>
JCR (Journal Citation Report)	<a href="http://isiknowledge.com">isiknowledge.com</a>
CONCERT 電子期刊聯合目錄	<a href="http://ulej.stpi.org.tw">ulej.stpi.org.tw</a>

# 連絡資訊

授課教師：吳俊興

E-mail: w u c h @nuk. edu. tw

Tel: (07) 591-9516

Office: 管理學院館620室

Office hours:

星期三：13:10 - 15:00PM

星期四：13:10 - 15:00PM

by appointment

<http://www.csie.nuk.edu.tw/~wuch/course/csf641/>