Slide 1

COMP 3410 – I.T. in Electronic Commerce

E-Trading

5. Alternative Architectures

Roger Clarke

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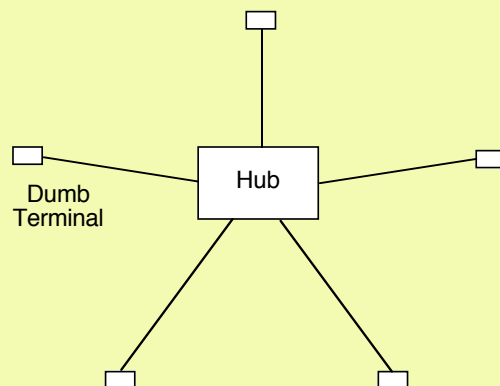**{ETIntro.html#L5, OhdsET5.ppt}**

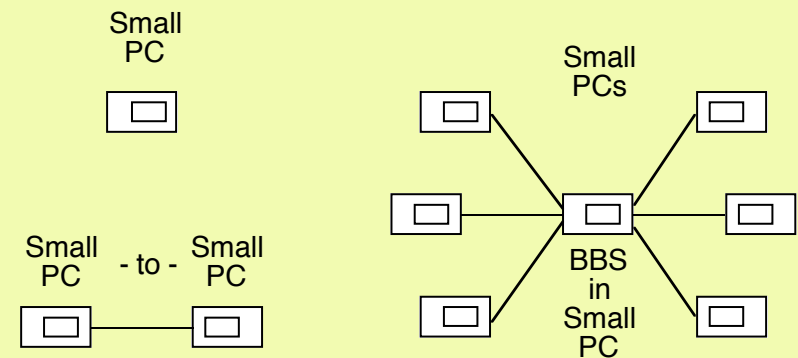**ANU RSCS, 9 October 2012**

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Slide 2

Alternative Architectures

Agenda

1. Master-Slave Architecture
2. Client-Server Architecture
3. Peer-to-Peer (P2P) Architecture
4. eSharing Digital Objects using P2P
5. eTrading Digital Objects using P2P
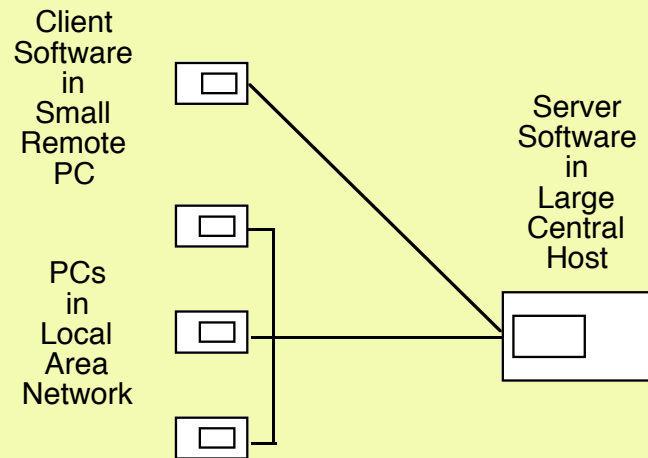
6. 'The Cloud'

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Slide 3

1. Master-Slave Architecture
Star Topology

3

Slide 4

Multi-Personal Client-Server
The 'PC' Era – Mid-Late 1970s Onwards

4

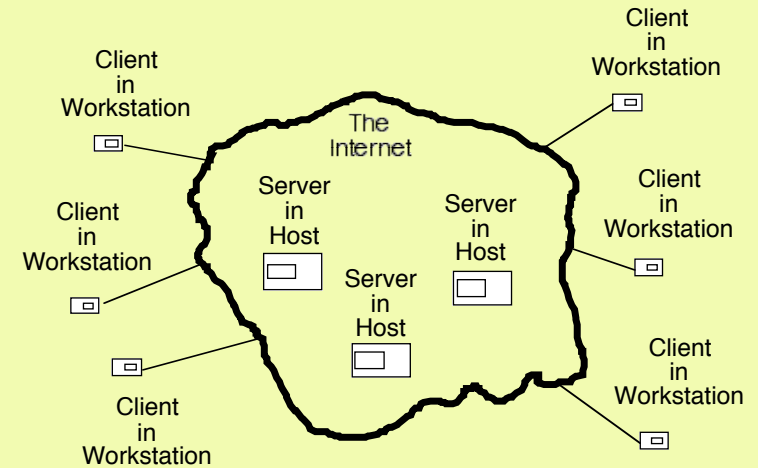## 2.   Client-Server Architecture Mid-1980s Onwards

Client Software in Small Remote PC

PCs in Local Area Network

Server Software in Large Central Host

Client-Server Architecture – Internet-Mediated Mid-1990s Onwards

Client in Workstation

Client in Workstation

The Internet

Client in Workstation

Server in Host

Server in Host

Client in Workstation

Client in Workstation

Server in Host

Client in Workstation

Client in Workstation

Mobiles
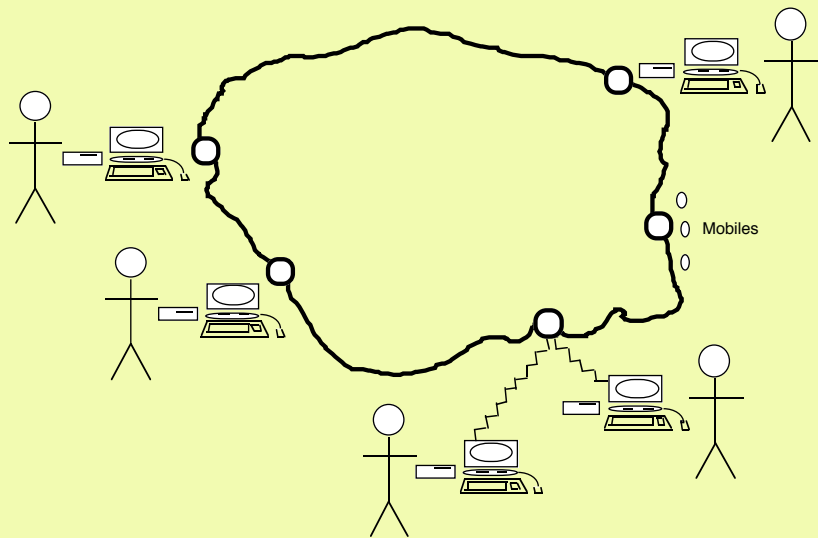
Computing Power 'at the Edge'

Key Developments Since the Mid-1990s

- **Workstation Capacity** (now rivals Hosts)
- **Workstation Diversity** (vast, expanding)
  desktops, laptops, handhelds, smartcards, ...
  phones ==> smartphones, PDAs ==> tablets, cameras,
  ... carburettors, fridges, ... RFID tags, ...
- **Broadband Connectivity** (widespread)
  This enables dispersion and replication
  of devices capable of providing services
- **Wireless Connectivity** (increasingly widespread)
  This enables Mobility
  which means Devices change networks
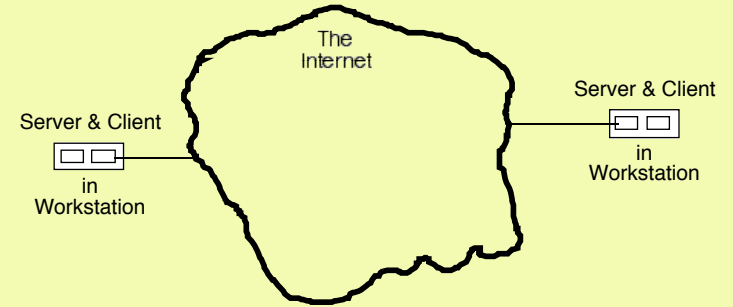 which means their IP-addresses change

3. Peer-to-Peer (P2P) Architecture

P2P Architecture
Cooperative Use of Resources at the Edge

The Internet

Server & Client
in Workstation

Server & Client
in Workstation

The ARPANet's Peer-to-Peer Topology
1969 Onwards
Multi-Organisational

Slave 'Dumb Terminals'

Peer Computer

Peer Computer

Peer Computer

Peer Computer

Peer Computer

Peer Computer
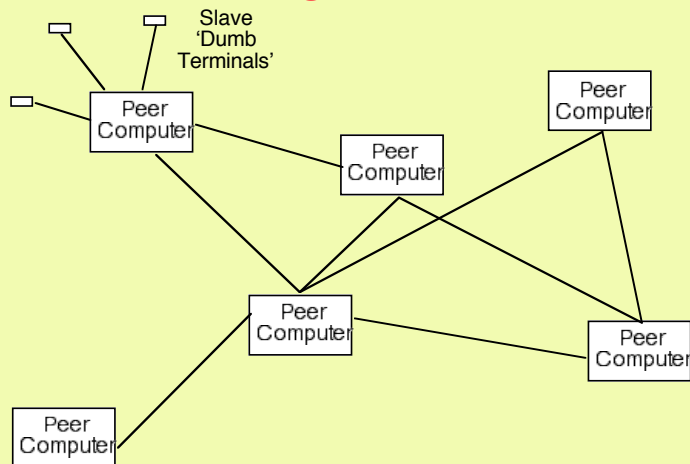
P2P – The Motivation

- Take advantage of resources that are available at the edges of the Internet
- **To do so, make each participating program both a Client and a Server**
  so each workstation acts as a host as well, e.g.
  - a music playstation can be a mixer too
  - your PC can host part of a music repository
  - your PDA can host part of a music catalogue

The P2P Server-Component's Multiple Functions

The Internet

Server & Client in Workstation

Server & Client in Workstation

Network Management
Directory Management
Object Management
Process Management
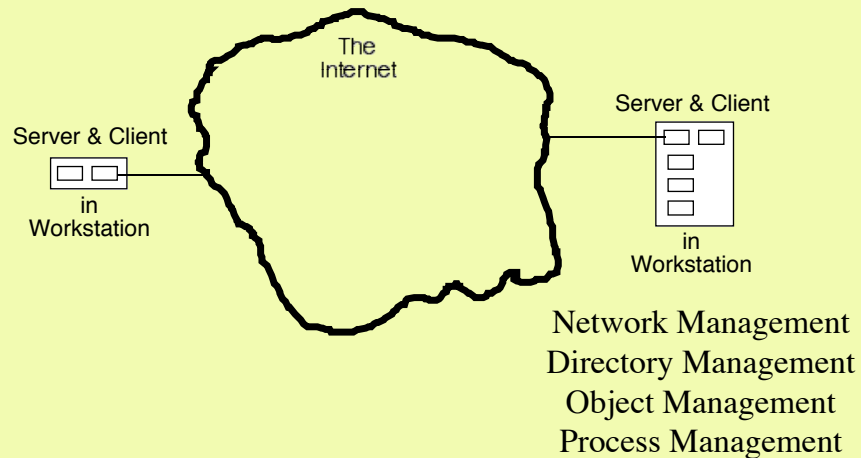
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P2P – Towards a Technical Definition

P2P is a network architecture
in which each node
is capable of performing
each of the functions
necessary to support the network

and in practice many nodes do
perform many of the functions

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Important Characteristics of P2P

- Collaboration is inherent
- Clients can find Servers
- **Enough Devices with Enough Resources act as Servers for discovery, and as Servers for services**
- 'Single Points-of-Failure' / Bottlenecks / Chokepoints are avoided by means of networking dynamics
- **'Free-Riding' / 'Over-Grazing' of the 'Commons' is restrained through software and psych. features**

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The Scale of the Undertaking

- The DNS grew to c. 30 million names in 18 years from its establishment in 1984 to 2002
- Napster achieved that many in 2 years
- The top 3 distributed-catalogue services combined quickly exceeded Napster at its peak
- AOL Instant Messaging is also very large
- **By 2005, the total of all P2P names probably exceeded the number in the DNS by a factor of 10**

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Why P2P Is Attractive

- **Much-Reduced Dependence** on individual devices and sub-networks (no central servers)
- **Robustness not Fragility** (no single point-of-failure)
- **Resilience / Quick Recovery** (inbuilt redundancy)
- **Resistance to Denial of Service (D)DOS Attacks** (no central servers)

- **Much-Improved Scalability** (proportionality)
- **Improved Servicing of Highly-Peaked Demand** (more devices on the demand-side implies there are also more server-resources)

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Technical Concerns about P2P

- **Address Volatility**: old addresses may not work (hence trust based on repetitive dealings is difficult)
- **Absence of Central Control** (hence risk of anarchy)
- **Inadequate Server Participation** (over-grazing)
- **Security Challenges**:
  - Malware, embedded or infiltrated
  - Surreptitious Enlistment (at least potential)
  - Vulnerability to Masquerade
  - Vulnerability to Pollution Attacks (decoys)

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P2P Applications for Access to Digital Objects

- **Software**:
  - Fixes/Patches
  - Releases
- **Virus Signatures**
- **Announcements**, e.g. of technical info, business info, entertainment 'info', sports results, promotional messages, advertisements
- **News Reports**, by news organisations, and by members of the public

- **Emergency Services Data**
- **Backup and Recovery Data**
- **Games Data**, e.g. scenes and battle configurations
- **Archived Messages**, for conferencing/chat/IM, and cooperative publishing
- **Learning Materials**, in various formats
- **Entertainment Materials**, in various formats

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4.   eSharing Files using Peer-to-Peer (P2P)

MP3	CD-quality digital sound in files sized 1 MB/minute
Napster	a central catalogue of a distributed database, to facilitate sharing of MP3 files
Gnutella, KaZaA, et al.	a distributed catalogue of a distributed database, to facilitate sharing of (MP3?) files

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5. The Scope for eTrading in Music

- **Identify price resistance-points in the various customer-segments** i.e. 'what the market will bear'
- Set prices accordingly (and hence sustain payment morality)
- **Make backlists and new releases available via for-fee P2P channels**
- Discourage and prosecute breaches where the purpose is commercial
- Take no action over breaches by consumers (esp. time-shifting, format-change, even sharing?)

The Evidence

- Since 2003, Apple iTunes charges USD 0.99 / track!?
- Copyright-Owners get USD 0.70
- In 2005-06, they asked for more
- And argued with Jobs about variable track-pricing

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eBusiness Era Revenue Sources

- **Direct and Immediate Reciprocity**
  - Low prices for volume sales
  - Higher prices for services that are value-added / differentiated / customised
- **Indirect and/or Deferred Reciprocity**
  - Donations, sponsorship, advertising
  - The-artist-pays / vanity press
  - 'Shareware' – use now, maybe pay later
- **'The After-Market'**
  - Accessories
  - Enhancements
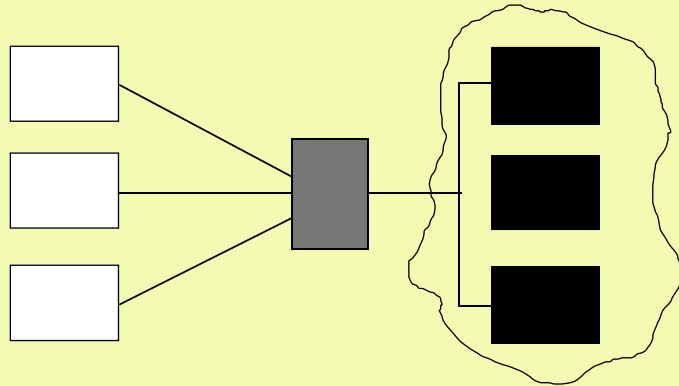 - Upgrades
  - Extensions

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6. 'The Cloud'

- Outsourcing
  - of IT Infrastructure
  - of IT platform, i.e. software environment
  - if Applications
- 'Server Virtualisation'
- Cloudsourcing

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From Insourcing to Outsourcing

Off-Site Hosting

Outsourced Facility
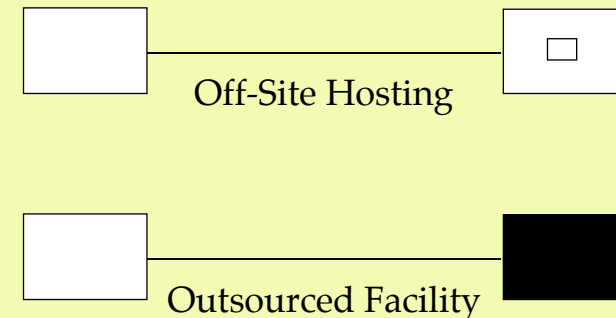
From Outsourcing to Cloudsourcing

CloudSourced Facilities

Cloud Computing is a Form of Outsourcing
How is it different from earlier forms?

- **Scalability ('there when it's needed)**
- **Flexible Contractual Arrangements ('pay per use')**
- **Opaqueness ('let someone else worry about details')**
  - which means less user control:
    - of the application, through commoditisation
    - of service levels, through SLA dependence (assuming there's an SLA, and it's negotiable)
    - of host location, through resource-virtualisation
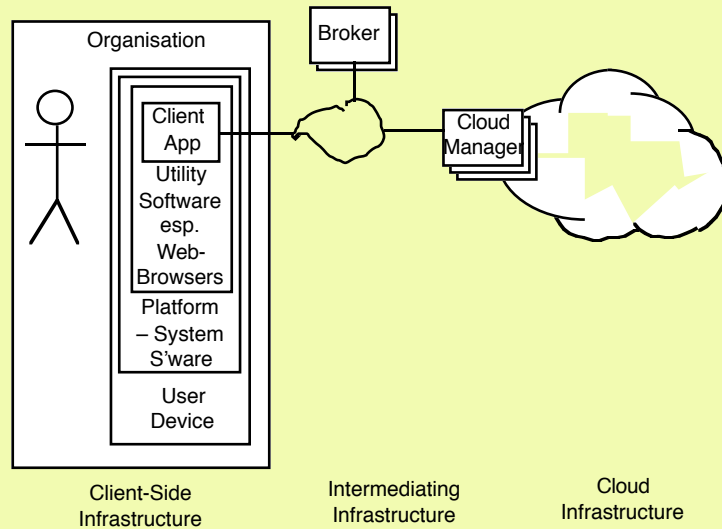

Levels of Cloudsourcing

- **Infrastructure as a Service (IaaS)**
  Amazon EC2, Rackspace, ...

- **Platform as a Service (PaaS)**
  MS Azure, Sware Dev Environments, ...

- **Software as a Service (SAAS)**
  Google Gmail, **Google Docs** / Apps
  MS Office 365
  Dropbox
  Salesforce
  MYOB LiveAccounts, Intuit Online

Levels of Cloudsourcing
and What is and isn't Outsourced

	SaaS			PaaS	IaaS
	Generic App	Customised Generic App	Own App		
Service Delivery and Management	CP	CP	CP	**Org**	**Org**
Application	CP	CP + **Org**	**Org**	**Org**	**Org**
Platform	CP	CP	CP	CP	**Org**
Infrastructure	CP	CP	CP	CP	CP

CC Architecture – The User Organisation Perspective

Organisation

Broker

Client App

Utility Software esp. Web-Browsers

Platform – System S'ware

User Device

Cloud Manager

Client-Side Infrastructure

Intermediating Infrastructure

Cloud Infrastructure

Reliability – The First Few Years
Inferences from Media Reports

(1) Outages are not Uncommon

(2) Outages Arise from Multiple Causes

(3) Providers' Safeguards are Sometimes Ineffective

(4) Failure Cascades are Prevalent

(5) Providers have had to be Forced to be Responsive

(6) Providers have often been Uninformative

(7) Outages may Affect Important Ancillary Services

(8) The Direct Impacts have sometimes been Significant

(9) Indirect Impacts have often been Even More Significant

(10) Few Customers are Recompensed

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