

Application Lecture 1: Application and Computing Architectures

7COM1030 – Multicast and Multimedia Networking

Dr. Xianhui Che (Cherry)

x.che@herts.ac.uk

School of Computer Science
University of Hertfordshire, UK



7COM1030 – Multicast and Multimedia Networking

University of
Hertfordshire



Topics

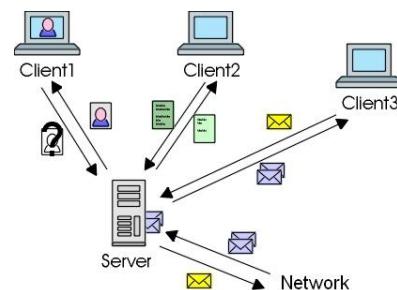
- Server/Client and Peer-to-Peer
- Distributed Computing
- Cloud Computing

Different Types of Application Architectures

- ▶ There are two fundamental types of application architectures over the network:
 - server/client
 - peer-to-peer
- ▶ There is also a three-tier architecture.
- ▶ The rapid development of today's wireless and mobile technologies has led to a new form of architecture called Cloud Computing.

Server/Client Architecture

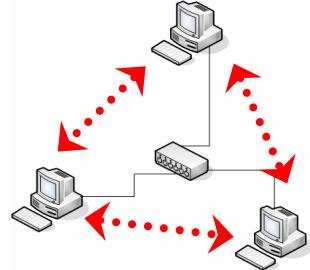
- ▶ Resources are centralized in the server.
- ▶ All the clients can access these resources based on their rights.
- ▶ Security is created, managed and enforced.
- ▶ Examples:
 - Email/database/FTP server systems
 - Login server
 - Score server for game applications



7COM1030 – Multicast and Multimedia Networking University of Hertfordshire 

Peer-to-Peer Architecture

- All terminals are virtually fully interconnected with each other **directly**.
- The terminal has to be turned on if others want to access its information.
- Examples:





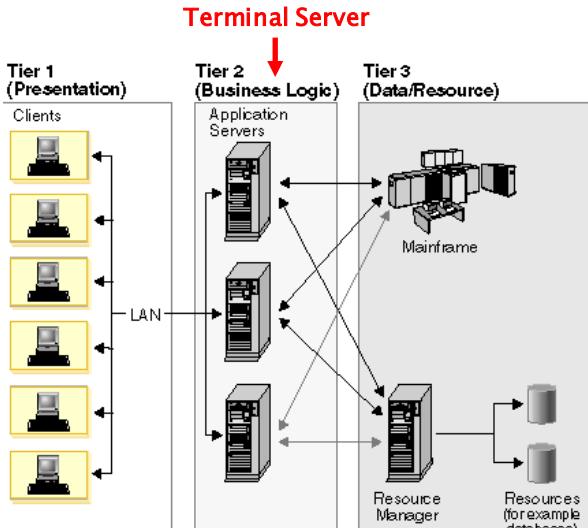



Application Lecture 1 – Application and Computing Architectures

7COM1030 – Multicast and Multimedia Networking University of Hertfordshire 

Three-Tier Server/Client Architecture

Terminal Server



Tier 1 (Presentation)
Clients

Tier 2 (Business Logic)
Application Servers

Tier 3 (Data/Resource)
Mainframe
Resource Manager
Resources (for example databases)

Annotations:

- Tier 1: User interface
- Tier 2: Logical process
- Tier 3: Data storage
- Application servers are used to service data requests between clients and database.
- a.k.a. Multi-tier Architecture

Application Lecture 1 – Application and Computing Architectures

Terminal Server

- ▶ Most today's server/client architecture is a three-tier structure.
 - For example, in case of eBay's network structure, the TS will be the web server that directly interfaces with the users, and other servers (e.g. database server, user profile server, login server maybe) are hiding behind the TS.'
- ▶ Terminal server delivers applications to the clients, where each user sees only its own session, which is managed transparently by the server operating system.
- ▶ The terminal server also functions as the client of other servers.

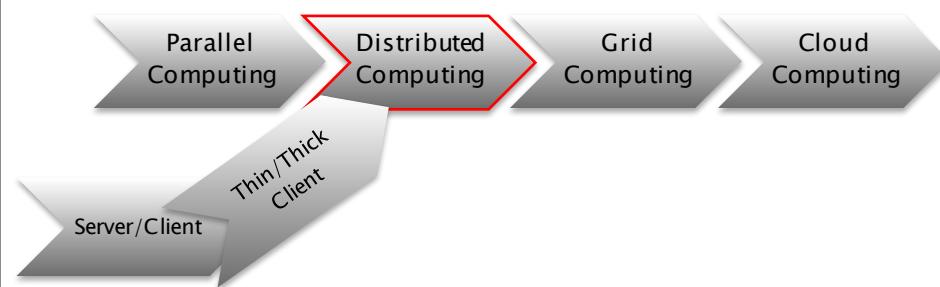
Topics

- Server/Client and Peer-to-Peer
- Distributed Computing
- Cloud Computing

Distributed Computing

- ▶ Many different definitions...
- ▶ Distributed computing is a method of computer processing in which different parts of a program run simultaneously on two or more computers that are communicating with each other over a network.

Evolution



Distributed Computing is a type of Parallel Computing.

a.k.a. Segmented Computing

Distributed Computing	Parallel Computing
<ul style="list-style-type: none"> Both require a program be segmented into sections that can run simultaneously. 	
<ul style="list-style-type: none"> Takes into account the different environments on which the different sections of the program will be running. 	<ul style="list-style-type: none"> Commonly refers to the processing where different parts of a program run simultaneously on two or more processors that are part of the same computer.

Deployment of Distributed Computing System

- ▶ The computers that are in a distributed system can be physically close together and connected by a local network, or they can be geographically distant and connected by a wide area network.
- ▶ A distributed system can consist of any number of possible configurations, such as mainframes, personal computers, workstations, minicomputers, and so on.
- ▶ The goal of distributed computing is to make such a network work as a single computer.

Thin Client & Thick Client

- ▶ Thin client is also called ***Lean Client***.
- ▶ Opposite to ***Thick Client*** (or ***Fat Client***).

Thin client:

- A client computer or client software in client–server architecture networks
- Depends on the server for processing activities
- Focuses on conveying input and output between the user and the remote server.

Fat client

- Does as much processing as possible
- Only passes data to the server for communications and storage purposes

Client/Server and Peer-to-Peer for Distributed Computing

In client/server architecture:

- ▶ Central server organizes jobs allocations.
- ▶ Clients basically don't know each other's progress.

In peer-to-peer architecture:

- ▶ Tasks on different machines have mutual dependencies and require interprocess communications.
- ▶ There is also a server which clients talk to via a logical hub.
- ▶ Data are delivered back to server as a batch job.

Example of Distributed Computing

Internet is a recognizable example.

- ▶ To browse a webpage, many different computers make it happen. Each of them is assigned with a special role within the system.
- ▶ For instance, a home computer is used, to run the browser and to break down the information being sent, making it accessible to the end user. A server at your ISP acts as a gateway between your home computer and the greater Internet. These servers speak with computers that comprise the domain name system, to help decide which computers to talk to based on the URL the end user enters. In addition, each web page is hosted on another computer, etc...

Next Generation: Grid Computing

Relationship between distributed computing and grid computing:

- **Distributed computing** is mainly focused on providing services to users by pooling hundreds of resources.
- **Grid computing** is task-oriented. It emphasizes the computational capabilities.

Your desktop computer is only utilized about 5%.

Grid computing uses the idle time and links many machines together to perform mammoth tasks that previously only super-computers could do.

A very hot topic in the last decade. Then quickly taken over by cloud computing – well, it seems that way....

7COM1030 – Multicast and Multimedia Networking University of Hertfordshire 

Topics

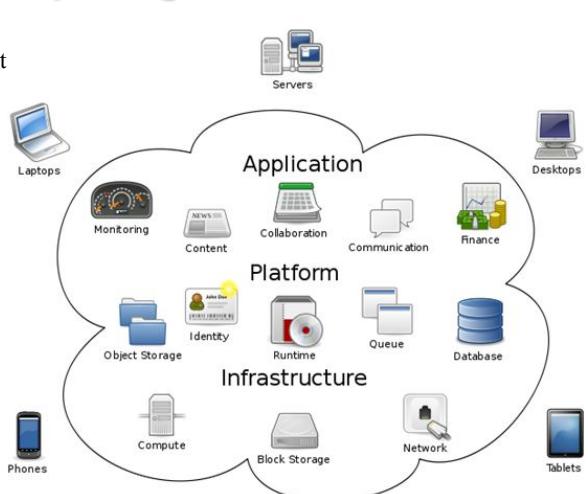
- Server/Client and Peer-to-Peer
- Distributed Computing
- Cloud Computing

Application Lecture 1 – Application and Computing Architectures

7COM1030 – Multicast and Multimedia Networking University of Hertfordshire 

What is Cloud Computing?

- ❖ Cloud represents the internet. It is a data center in the sky.
- ❖ Virtual servers available over the internet.
- ❖ Save in-house investments in hardware and software applications.
- ❖ A platform for a new breed of enterprise apps
- ❖ A way to bring Web-scale computing to small and large businesses.
- ❖ Subscription-based or pay-per-use service.



It is a business revolution as much as the technological revolution.

Application Lecture 1 – Application and Computing Architectures

7COM1030 – Multicast and Multimedia Networking University of Hertfordshire 

Evolution of Cloud Computing

Grid Computing

- Solving large problems with parallel computing



Utility Computing

- Offering computing resources as a metered service



Software as a Service

- Network-based subscriptions to applications



Cloud Computing

- Anytime, anywhere access to virtualized IT resources delivered dynamically as a service.



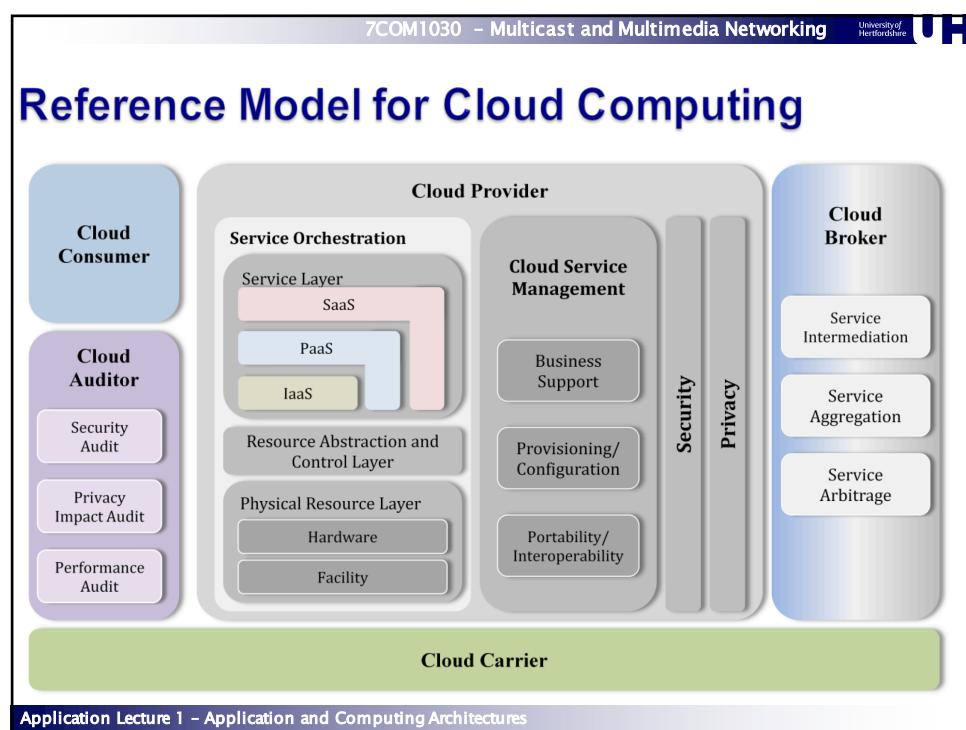
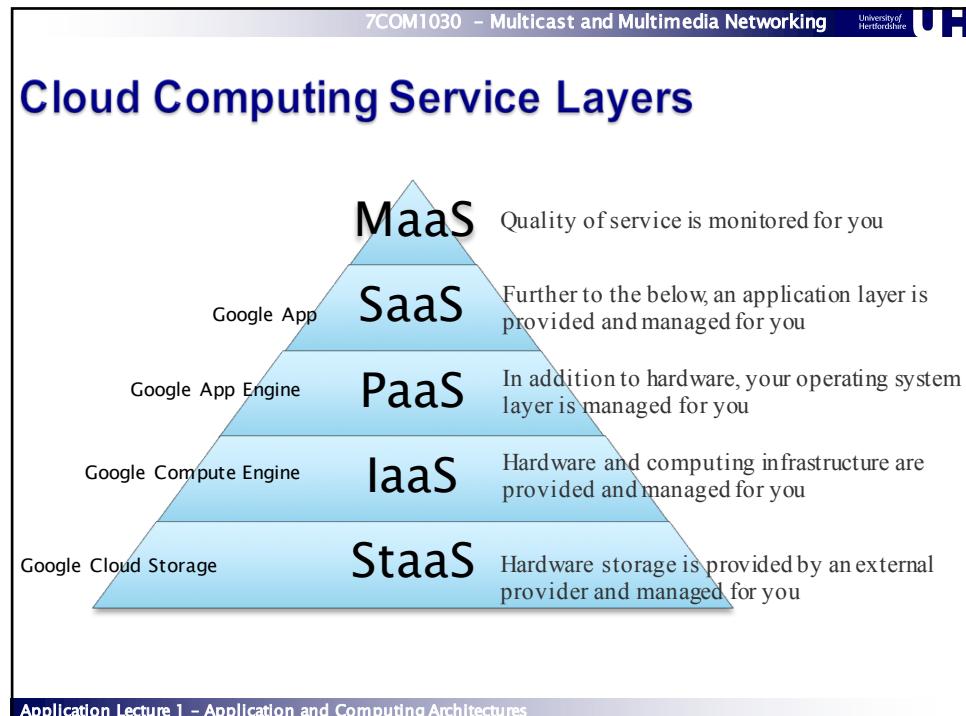
Application Lecture 1 – Application and Computing Architectures

7COM1030 – Multicast and Multimedia Networking University of Hertfordshire 

“Cloud Computing” Defined “as a Service” Types

- ▶ **Everything as a service** (EaaS or XaaS)
- ▶ **Monitoring as a service** (MaaS)
 - Examples: MySQL Enterprise Monitor
- ▶ **Communication as a service** (CaaS)
 - Examples: VoIP, Instant Messaging (IM)
- ▶ **Software as a service** (SaaS)
 - Also including **Application as a service** (AaaS)
- ▶ **Platform as a service** (PaaS)
 - Examples: Google App Engine
- ▶ **Infrastructure as a service** (IaaS)
 - Examples: Google Compute Engine, Amazon Elastic Computing Cloud (EC2@)
- ▶ **Storage as a service** (StaaS)
 - Examples: Google Cloud Storage, Dropbox

Application Lecture 1 – Application and Computing Architectures

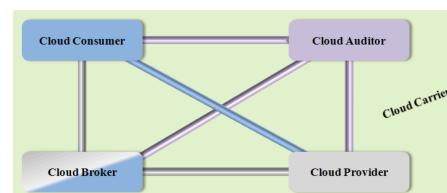


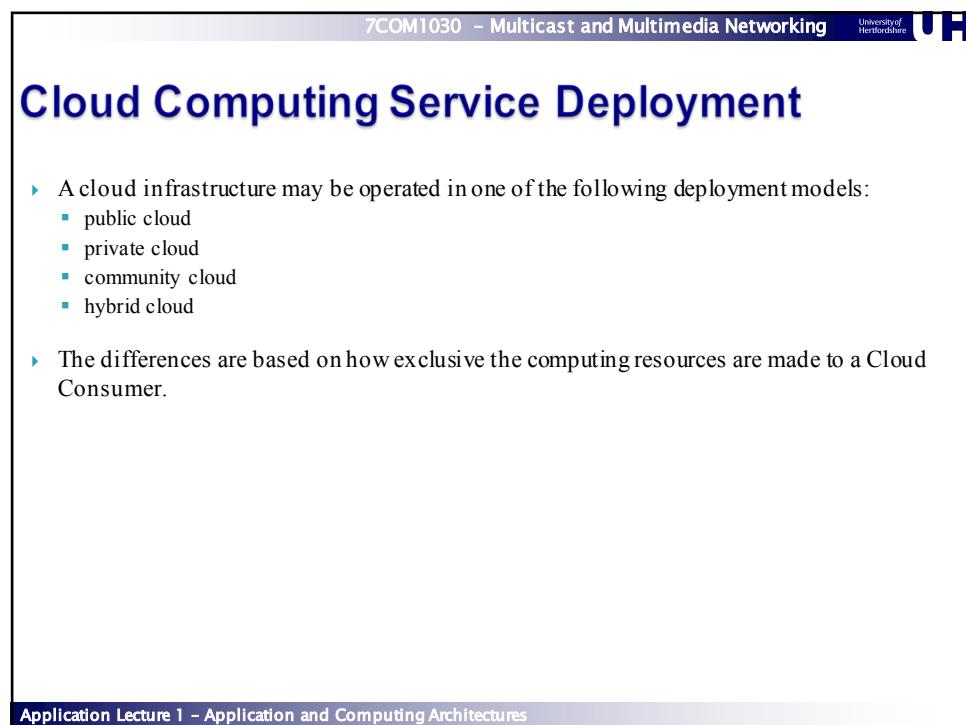
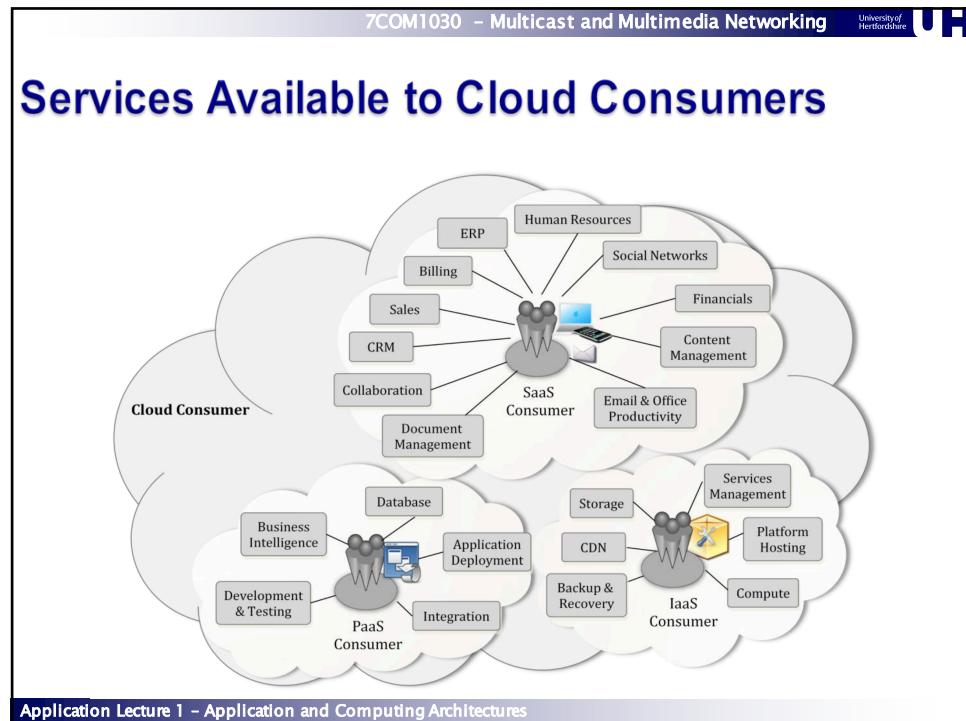
Actors in Cloud Computing

Actor	Definition
Cloud Consumer	A person or organization that maintains a business relationship with, and uses service from, <i>Cloud Providers</i> .
Cloud Provider	A person, organization, or entity responsible for making a service available to interested parties.
Cloud Auditor	A party that can conduct independent assessment of cloud services, information system operations, performance and security of the cloud implementation.
Cloud Broker	An entity that manages the use, performance and delivery of cloud services, and negotiates relationships between <i>Cloud Providers</i> and <i>Cloud Consumers</i> .
Cloud Carrier	An intermediary that provides connectivity and transport of cloud services from <i>Cloud Providers</i> to <i>Cloud Consumers</i> .

Interactions Between Actors

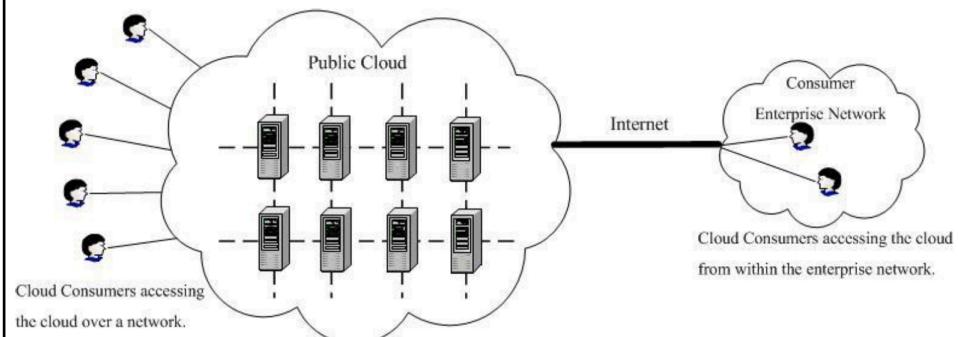
- ▶ A cloud consumer may request cloud services from a cloud provider directly or via a cloud broker. A cloud auditor conducts independent audits and may contact the others to collect necessary information.
- ▶ A cloud consumer may request service from a cloud broker instead of contacting a cloud provider directly. The cloud broker may create a new service by combining multiple services or by enhancing an existing service. In this example, the actual cloud providers are invisible to the cloud consumer and the cloud consumer interacts directly with the cloud broker.





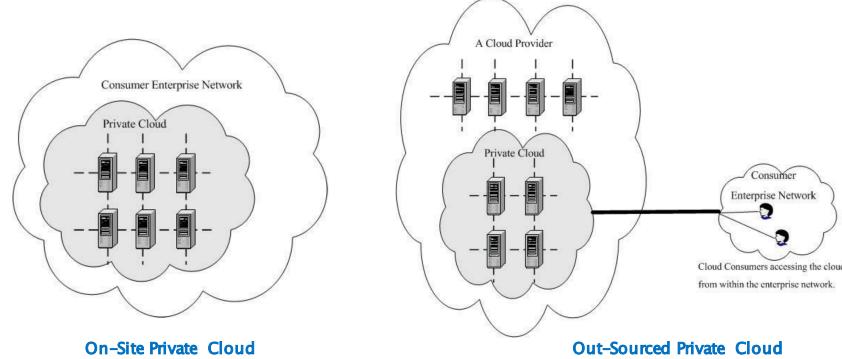
Public Cloud

- ▶ A public cloud is one in which the cloud infrastructure and computing resources are made available to the general public over a public network. A public cloud is owned by an organization selling cloud services, and serves a diverse pool of clients.



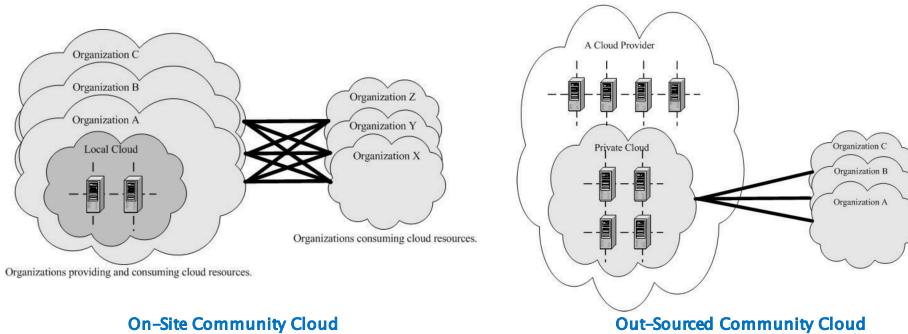
Private Cloud

- ▶ A private cloud gives a single Cloud Consumer's organization the exclusive access to and usage of the infrastructure and computational resources. It may be managed either by the Cloud Consumer organization or by a third party, and may be hosted on the organization's premises (i.e. *on-site private clouds*) or outsourced to a hosting company (i.e. *outsourced private clouds*).



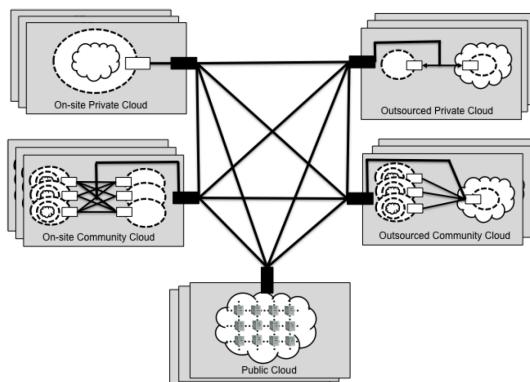
Community Cloud

- ▶ A community cloud serves a group of Cloud Consumers which have shared concerns such as mission objectives, security, privacy and compliance policy, rather than serving a single organization as does a private cloud. Similar to private clouds, a community cloud may be managed by the organizations or by a third party, and may be implemented on customer premise (i.e. *on-site community cloud*) or outsourced to a hosting company (i.e. *outsourced community cloud*).



Hybrid Cloud

- ▶ A hybrid cloud is a composition of two or more clouds (on-site private, on-site community, off-site private, off-site community or public) that remain as distinct entities but are bound together by standardized or proprietary technology that enables data and application portability.



Questions?

- ▶ **Email:** x.che@herts.ac.uk
- ▶ **Office:** LB218
- ▶ **Tel:** 01707 286206