Tutorial 1 Chapter 1

Question 1

Give five types of hardware resource and five types of data or software resource that can usefully be shared. Give examples of their sharing as it occurs in distributed systems.

Question 2

Compare and contrast cloud computing with more traditional client-server computing? What is novel about cloud computing as a concept?

Answer to question 1:

In chapter 1, cloud computing is defined in terms of: (1) supporting Internet-based services (whether application, storage or other computing-based services), where everything is a service; and (2) dispensing with local data storage or application software. (1) is completely consistent with client-server computing and indeed client-server concepts support the implementation of cloud computing. (2) highlights one of the key elements of cloud computing in moving to a world where you can dispense with local services. This level of ambition may or may not be there in client-server computing. As a final comment, cloud computing promotes a view of computing as a utility and this is linked to often novel business models whereby services can be rented rather than being owned, leading to a more flexible and elastic approach to service provision and acquisition. This is a key distinction in cloud computing and represents the key novelty in cloud computing.

To summarise, cloud computing is partially a technical innovation in terms of the level of ambition, but largely a business innovation in terms of viewing computing services as a utility.

Answer to question 2:

Hardware:

CPU: compute server (executes processor-intensive applications for clients), remote object server (executes methods on behalf of clients), worm program (shares cpu capacity of desktop machine with the local user). Most other servers, such as file servers, do some computation for their clients, hence their cpu is a shared resource.

memory: cache server (holds recently-accessed web pages in its RAM, for faster access by other local computers)

disk: file server, virtual disk server (see Chapter 8), video on demand server (see Chapter 15).

screen: Network window systems, such as X-11, allow processes in remote computers to update the content of windows.

printer: networked printers accept print jobs from many computers. managing them with a queuing system.

network capacity: packet transmission enables many simultaneous communication channels (streams of data) to be transmitted on the same circuits.

Data/software:

web page: web servers enable multiple clients to share read-only page content (usually stored in a file, but sometimes generated on-the-fly).

file: file servers enable multiple clients to share read-write files. Conflicting updates may result in inconsistent results. Most useful for files that change infrequently, such as software binaries.

object: possibilities for software objects are limitless. E.g. shared whiteboard, shared diary, room booking system, etc.

database: databases are intended to record the definitive state of some related sets of data. They have been shared ever since multi-user computers appeared. They include techniques to manage concurrent updates.

newsgroup content: The *netnews* system makes read-only copies of the recently-posted news items available to clients throughout the Internet. A copy of newsgroup content is maintained at each netnews server that is an approximate replica of those at other servers. Each server makes its data available to multiple clients.

video/audio stream: Servers can store entire videos on disk and deliver them at playback speed to multiple clients simultaneously.

exclusive lock: a system-level object provided by a lock server, enabling several clients to coordinate their use of a resource (such as printer that does not include a queuing scheme).*Distributed*