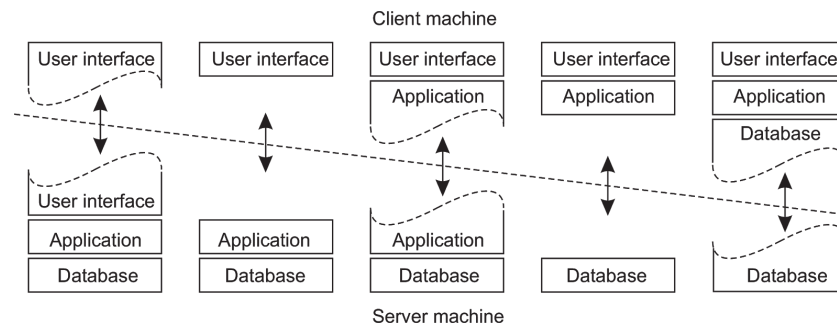


What is meant by the terms thin and fat clients?

Thin and fat clients is a concept that exists in the context of a client-server architecture. In a fat client most of the processing and data storage is handled by the client. In a thin client most of the processing and data storage is handled by the server. Consider the image below. As we move from the left to the right image we move from a thin to a fat client.



Cloud computing employs a measured service model. Define this model.

In cloud computing clients outsource their software usage, data storage and computing infrastructure to third-party companies (e.g. Amazon). The main advantage of this to the client is that they need not acquire or maintain expensive hardware, software or technical staff. The client pays the cloud service provider for this service on a pay-per-use basis; this is known as a measured service model.

Low-level communication facilities of computer networks do not offer distribution transparency. Justify this statement.

In computer networks, communication is based on low-level message-passing primitives. Middleware systems offer a higher level of abstraction that make it easier to communicate. Consequently, middleware communication helps achieve distribution transparency. A particular type of distribution transparency is location transparency which aims to hide where an object is located; here an object can be a resource or a process. Low-level communication facilities of computer networks do not offer location transparency because when communicating the IP addresses and port numbers of the communicating parties must be specified.

Describe how a SOAP web service works.

Simple Object Access Protocol (SOAP) is a web service protocol; that is, it is a framework for implementing web-services. All messages are encoded using XML and delivered using any transportation protocol (e.g. HTTP). The Web Service Description Language (WSDL) is an XML language for defining interfaces to web services. Each SOAP web service will have a WSDL file describing how a client should communicate with the web service in question.

If a single machine in a distributed system has a UTC receiver, how can the problem of achieving process synchronization be solved?

In this context one could employ the Network Time Protocol. Here the machine with the UTC receiver acts as a time server. The other machines or clients contact the time server to request the current time and update their local clocks appropriately. However this solution may not provide perfect process synchronization because when contacting the server, message delays will have outdated the reported time.

What is the main difference between a symmetric (secret-key) cryptosystem and an asymmetric (public-key) cryptosystem?

In a symmetric (secret-key) cryptosystem, the same key is used to encrypt and decrypt a message. In an asymmetric (public-key) cryptosystem, the encryption and decryption keys are different but form a unique pair.

Describe the peer-to-peer (P2P) system architecture.

In a client-server architecture there are two types of processes - the clients and the servers. In a P2P architecture no such distinction exists and instead all processes are equal; that is, all processes act as both client and server.

There are three main types of cloud computing. What are these?

The following are the three main types of cloud computing services:

Software-as-a-service (SaaS) – allows the usage of cloud apps e.g. Google Docs.

Platform-as-a-service (PaaS) – virtualized environment with OS installed is rented.

Infrastructure-as-a-service (IaaS) – includes hardware, storage, IP addresses and firewalls.

Give an example of a hybrid system architecture?

BitTorrent is an example of a hybrid system architecture. It is a hybrid architecture in the sense that it combines a client-server architecture and a peer-to-peer (P2P) architecture.

Why is cloud computing an important application of virtualisation?

Generally a client of a cloud computing service provider will rent virtual resources from the service provider. For example, consider Infrastructure-as-a-Service (IaaS). Instead of renting a physical machine, a client will rent a virtual machine. In order to create these virtual resources the service provider will use virtualisation.

How might one use Universal Coordinated Time (UCT) to achieve process synchronization in a distributed system?

Use a clock synchronization algorithm whereby one machine is given a UTC receiver and the goal is to keep all the other machines synchronized to it. This could be achieved using the Network Time Protocol which was briefly described above.

Mutual exclusion is a challenge when designing a distributed system. Describe this challenge.

In many cases different processes will want to simultaneously access the same resource. Concurrent accesses may corrupt the resource or make it inconsistent. Solutions are needed to grant mutual exclusive access by processes. Algorithms for achieving mutual exclusion include centralized coordinator and token-ring algorithms.