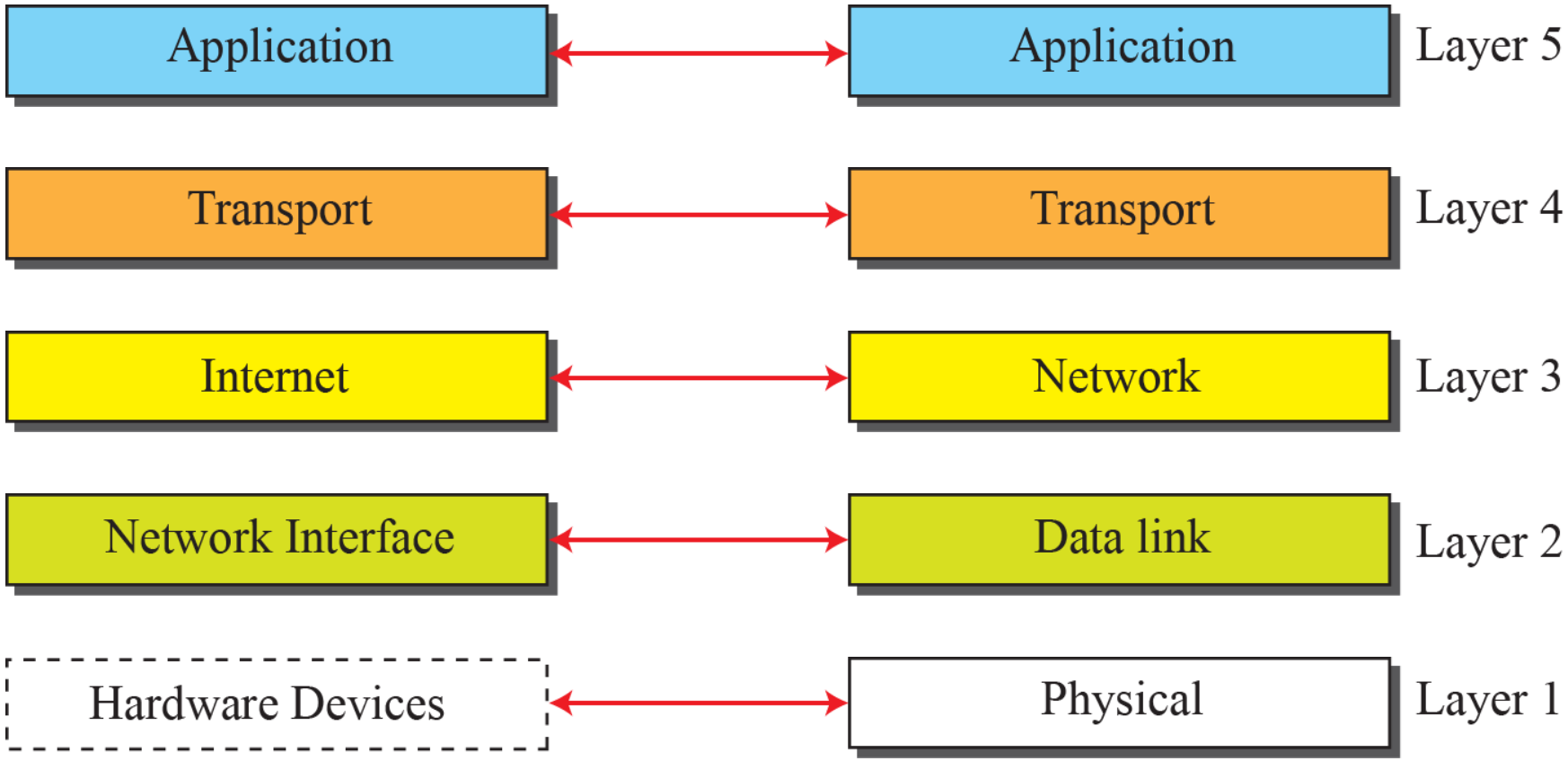
Application Layer

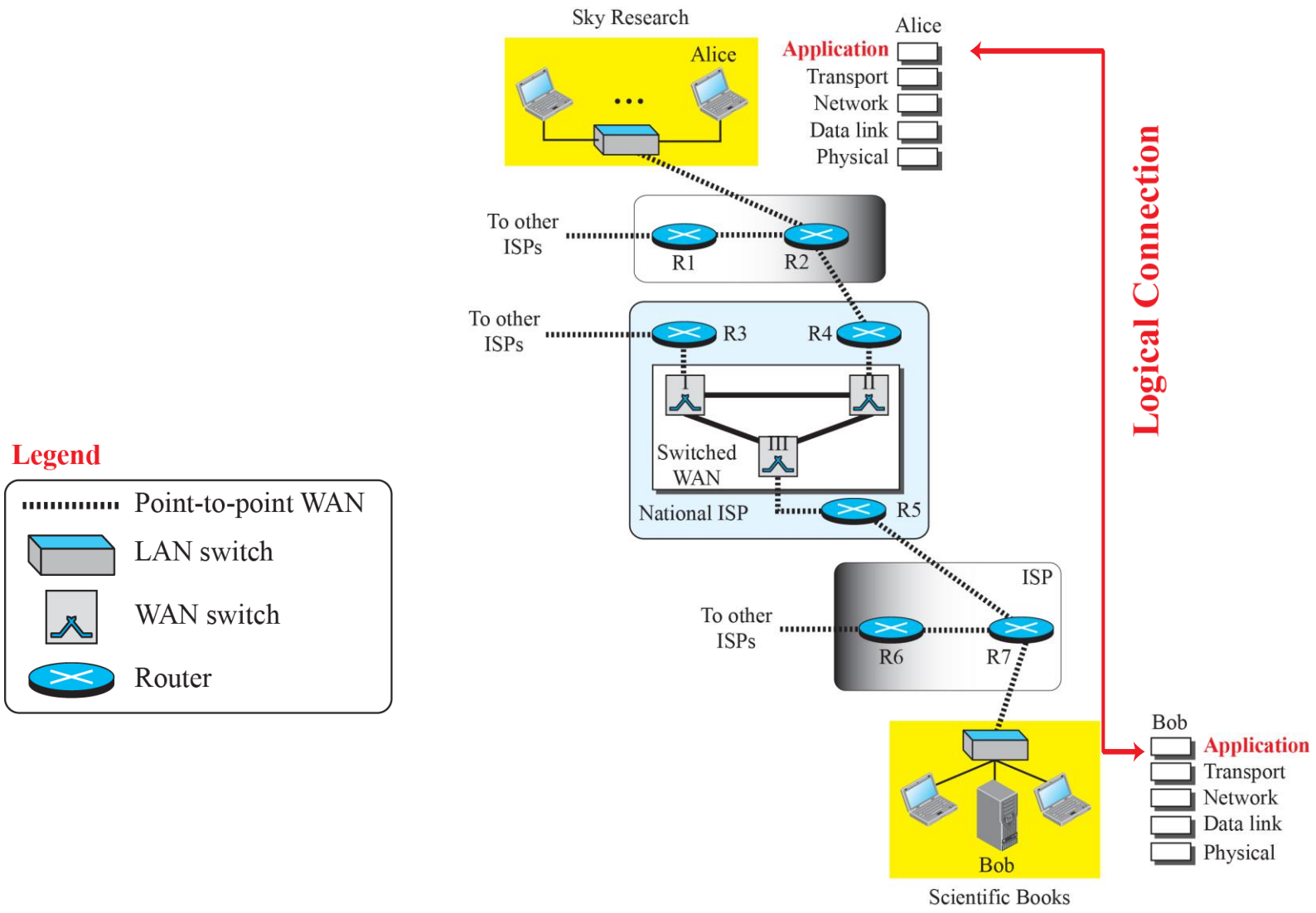
Layers in the TCP/IP Protocol Suite



Introduction

- The application layer provides services to the user.
- Communication is provided using a logical connection, which means that there is an imaginary direct connection through which they can send and receive messages.

Logical connection at the application layer



Application layer includes the following functions

- **Identifying communication partners**: The application layer identifies the availability of communication partners for an application with data to transmit.
- **Determining resource availability**: The application layer determines whether sufficient network resources are available for the requested communication.
- **Synchronizing communication**: All the communications occur between the applications requires cooperation which is managed by an application layer.

Services of Application Layers

- **Network Virtual terminal**: An application layer allows a user to log on to a remote host. To do so, the application creates a software emulation of a terminal at the remote host. The user's computer talks to the software terminal, which in turn, talks to the host. The remote host thinks that it is communicating with one of its own terminals, so it allows the user to log on.
- **File Transfer, Access, and Management (FTAM):** An application allows a user to access files in a remote computer, to retrieve files from a computer and to manage files in a remote computer. FTAM defines a hierarchical virtual file in terms of file structure, file attributes and the kind of operations performed on the files and their attributes.

Services of Application Layers

- **Addressing**: To obtain communication between client and server, there is a need for addressing. When a client made a request to the server, the request contains the server address and its own address. The server response to the client request, the request contains the destination address, i.e., client address. To achieve this kind of addressing, DNS is used.

Services of Application Layers

- **Mail Services:** An application layer provides Email forwarding and storage.
- **Directory Services**: An application contains a distributed database that provides access for global information about various objects and services.
- **Authentication**: It authenticates the sender or receiver's message or both.

Providing Services

- The Internet was originally designed to provide service to users around the world.
- Since the application layer is the only layer that provides services to the Internet user, it allows new application protocols to be easily added to the Internet, which has been occurring during the lifetime of the Internet.
- When the Internet was created, only a few application protocols were available to the users; today we cannot give a number for these protocols because new ones are being added constantly.

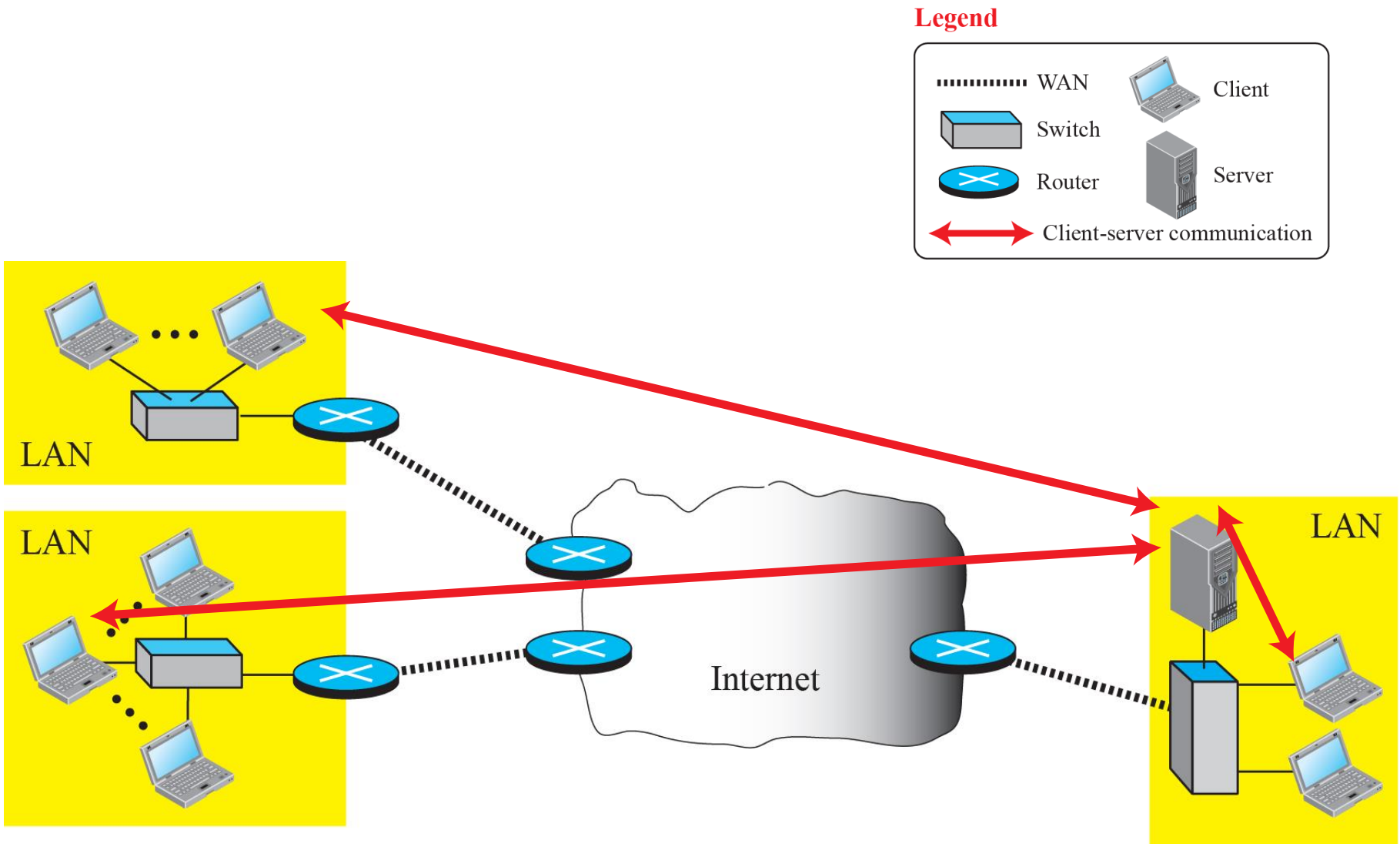
Application-Layer Paradigm

- It should be clear that to use the Internet we need two application programs to interact with each other:
  - one running on a computer somewhere in the world.
  - the other running on another computer somewhere else in the world.
- The two programs need to send messages to each other through the Internet infrastructure.
- However, we have not discussed what the relationship should be between these programs. Should both application programs be able to request services and provide services, or should the application programs just do one or the other?

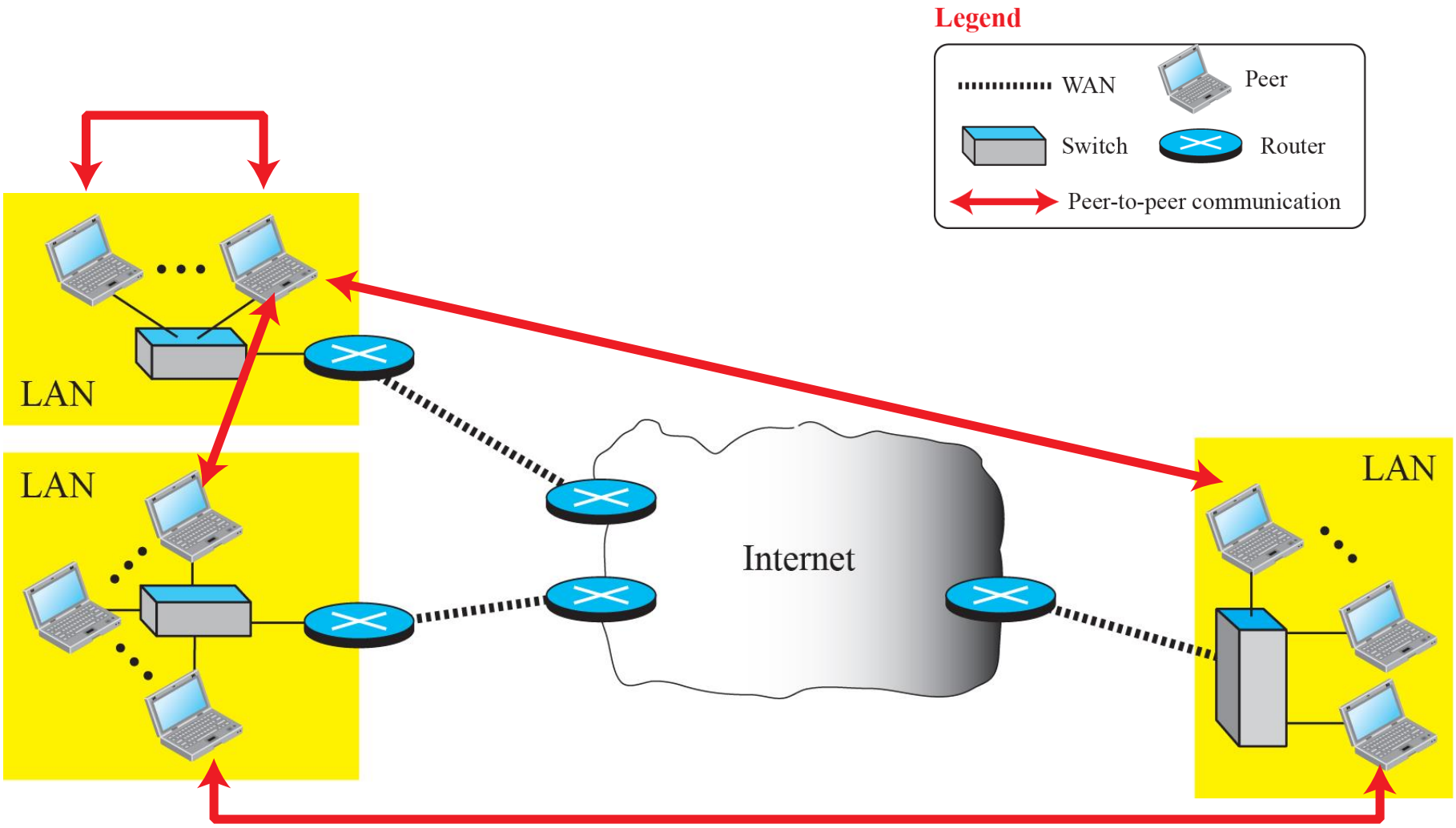
Application-Layer Paradigm

- Traditional Paradigm: Client-Server
- New Paradigm: Peer-to-Peer
- Mixed Paradigm

Example of a client-server paradigm

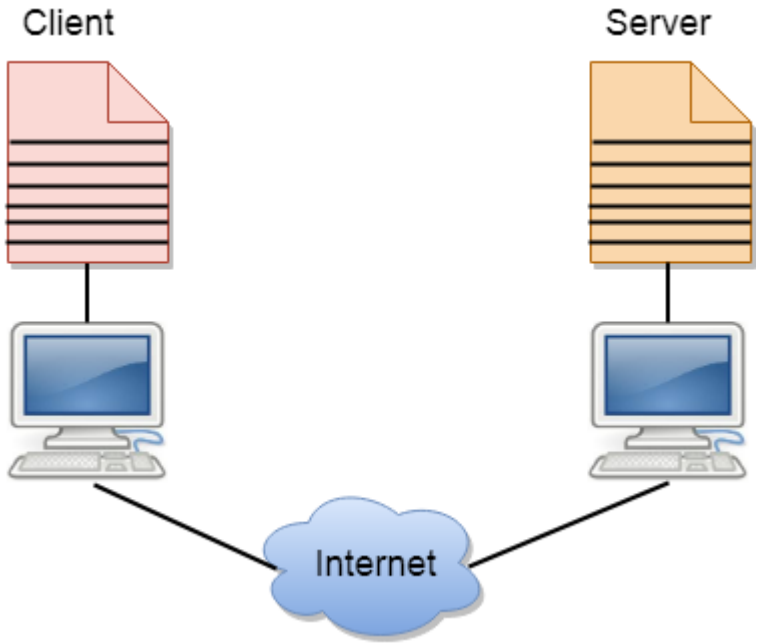


Example of a peer-to-peer paradigm



Client and Server model

- A client and server networking model is a model in which computers such as servers provide the network services to the other computers such as clients to perform a user based tasks. This model is known as client-server networking model.
- The application programs using the client-server model should follow the given below strategies:



Client and Server model

- An application program is known as a client program, running on the local machine that requests for a service from an application program known as a server program, running on the remote machine.
- A client program runs only when it requests for a service from the server while the server program runs all time as it does not know when its service is required.

Client and Server model

- A server provides a service for many clients not just for a single client. Therefore, we can say that client-server follows the many-to-one relationship. Many clients can use the service of one server.
- Services are required frequently, and many users have a specific client-server application program. For example, the client-server application program allows the user to access the files, send e-mail, and so on.

Client

- A client is a program that runs on the local machine requesting service from the server. A client program is a finite program means that the service started by the user and terminates when the service is completed.

Server

- A server is a program that runs on the remote machine providing services to the clients. When the client requests for a service, then the server opens the door for the incoming requests, but it never initiates the service.
- A server program is an infinite program means that when it starts, it runs infinitely unless the problem arises. The server waits for the incoming requests from the clients. When the request arrives at the server, then it responds to the request.

Advantages of Client-server networks:

- **Centralized**: Centralized back-up is possible in client-server networks, i.e., all the data is stored in a server.
- **Security**: These networks are more secure as all the shared resources are centrally administered.
- **Performance**: The use of the dedicated server increases the speed of sharing resources. This increases the performance of the overall system.
- **Scalability**: We can increase the number of clients and servers separately, i.e., the new element can be added, or we can add a new node in a network at any time.

Disadvantages of Client-Server network:

- **Traffic Congestion** is a big problem in Client/Server networks. When a large number of clients send requests to the same server may cause the problem of Traffic congestion.
- It does not have a robustness of a network, i.e., when the server is down, then the client requests cannot be met.