Plan

1. Computer Networks and the Internet
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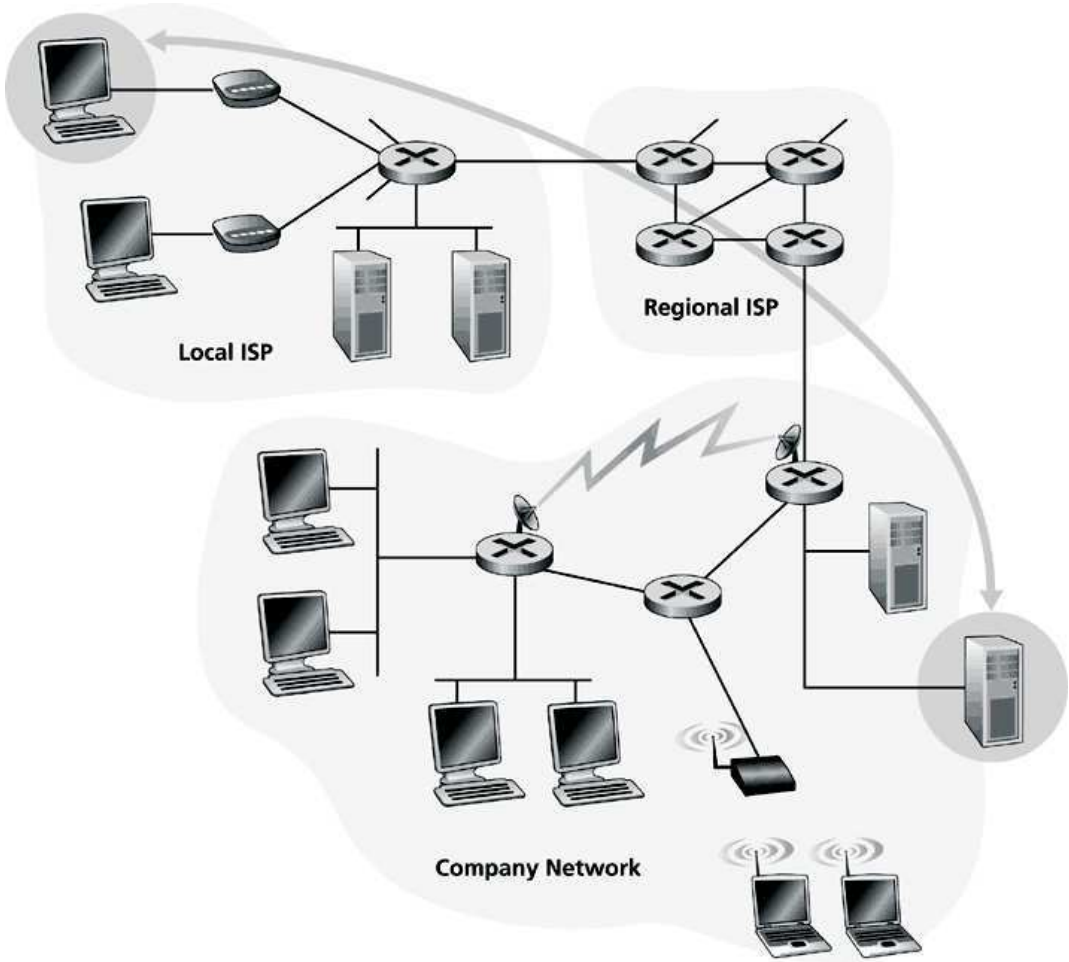
The network edge

End users may interact directly with the host (e.g., a Mac) or indirectly (e.g., a web server).

A **client program** runs on a host that requests and receives a service from a **server program** running on another host. This is the **client/server model**.

In the **peer-to-peer model**, there is little or no use of servers.

The network edge (cont)



The network edge/Connection-oriented service

The goal is to transfer data between two end systems in the following manner:

- First, **handshaking** takes place: the two systems agree on the forthcoming exchange. This is like the 'Hi/Hi (back)' in human protocols. Both hosts set their internal state in accordance, i.e., they record the fact that they are communicating with a known peer. Then data is transmitted.
- This is summarized in figure page 14: the two first messages consist in the handshaking and the two following (`GET` and the response containing the file) are the data communication itself.
- In the Internet the connection-oriented service is the **Transmission Control Protocol** (**TCP**), used by most of the applications (like telnet, SMTP, ftp, http).

The network edge/TCP added-services

The TCP has been designed to carry *more* than connection-oriented service, but also

- **reliability**: the (byte stream) data delivery, in order and in its entirety is guaranteed. As a coarse approximation, reliability is achieved by way of **acknowledgment** and **retransmission**: each time a packet is received, a special packet is sent back to acknowledge the receipt; when such acknowledgment is missing, the sender assumes the packet got lost and retransmits it.
- **flow control**: the sender slows down and avoids overwhelming the receiver by sending too many packets too fast;
- **congestion control**: the sender slows down when the routers start loosing packets because they are congested by a too heavy traffic.

The network edge/Connectionless service

In connectionless services, the goal is still data transfer between hosts but there is no handshaking.
In the Internet, the **User Datagram Protocol** (**UDP**) provides a connectionless service to the applications. This means:

- no reliable transfer (the data can arrive too soon, i.e., when the receiver is not expecting it),
- no flow control,
- no congestion control.

The applications must handle themselves these aspects.
Internet phone and video conferencing, streaming, DNS rely on UDP.