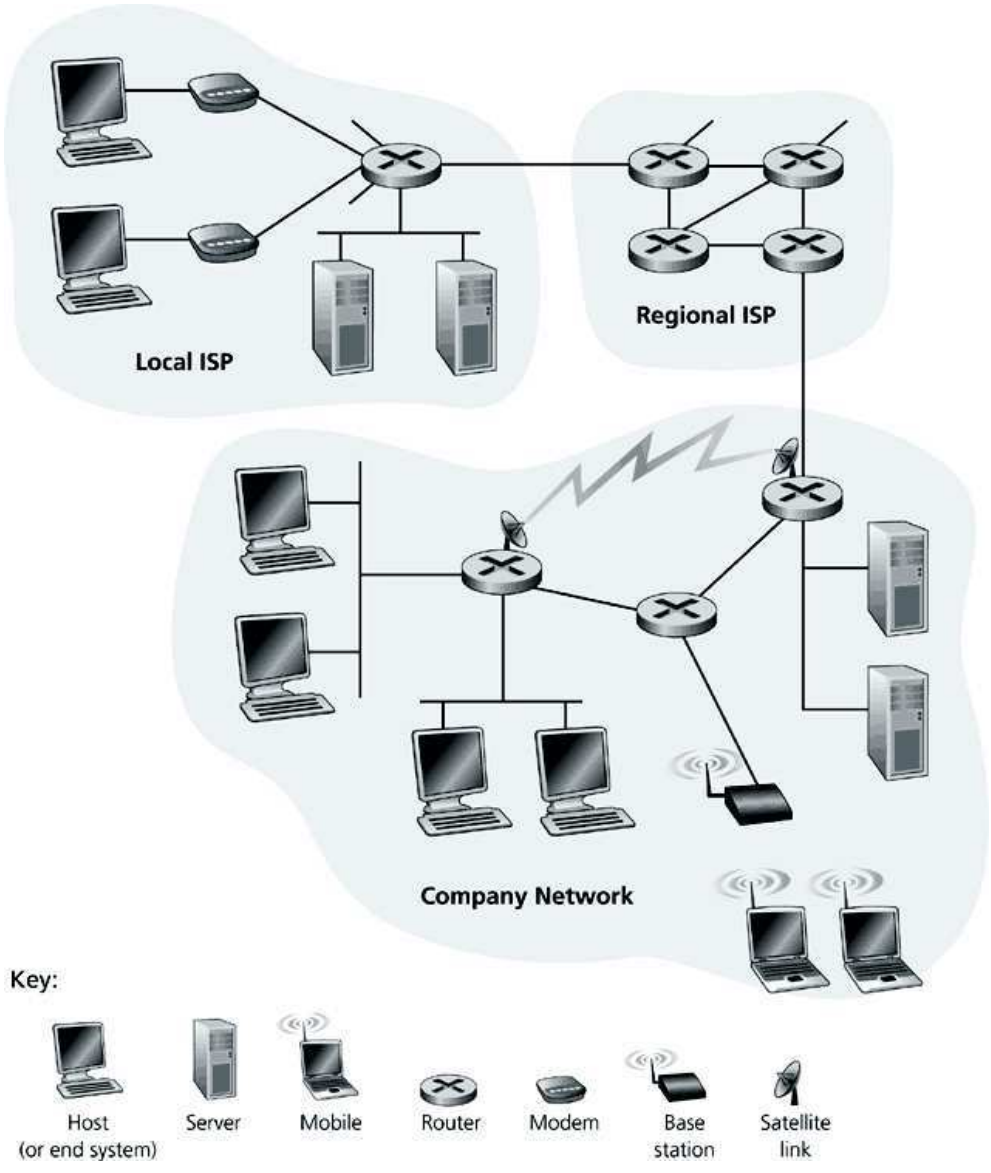
What is the Internet?

Millions of connected computing devices, called **end systems** (PCs, workstations, servers, PDAs, phones, game consoles etc.), running network applications, i.e., software for accessing and using the network.

End systems are also called **hosts**. Hosts are sometimes divided into **clients** and **servers**.

What is the Internet? (cont)

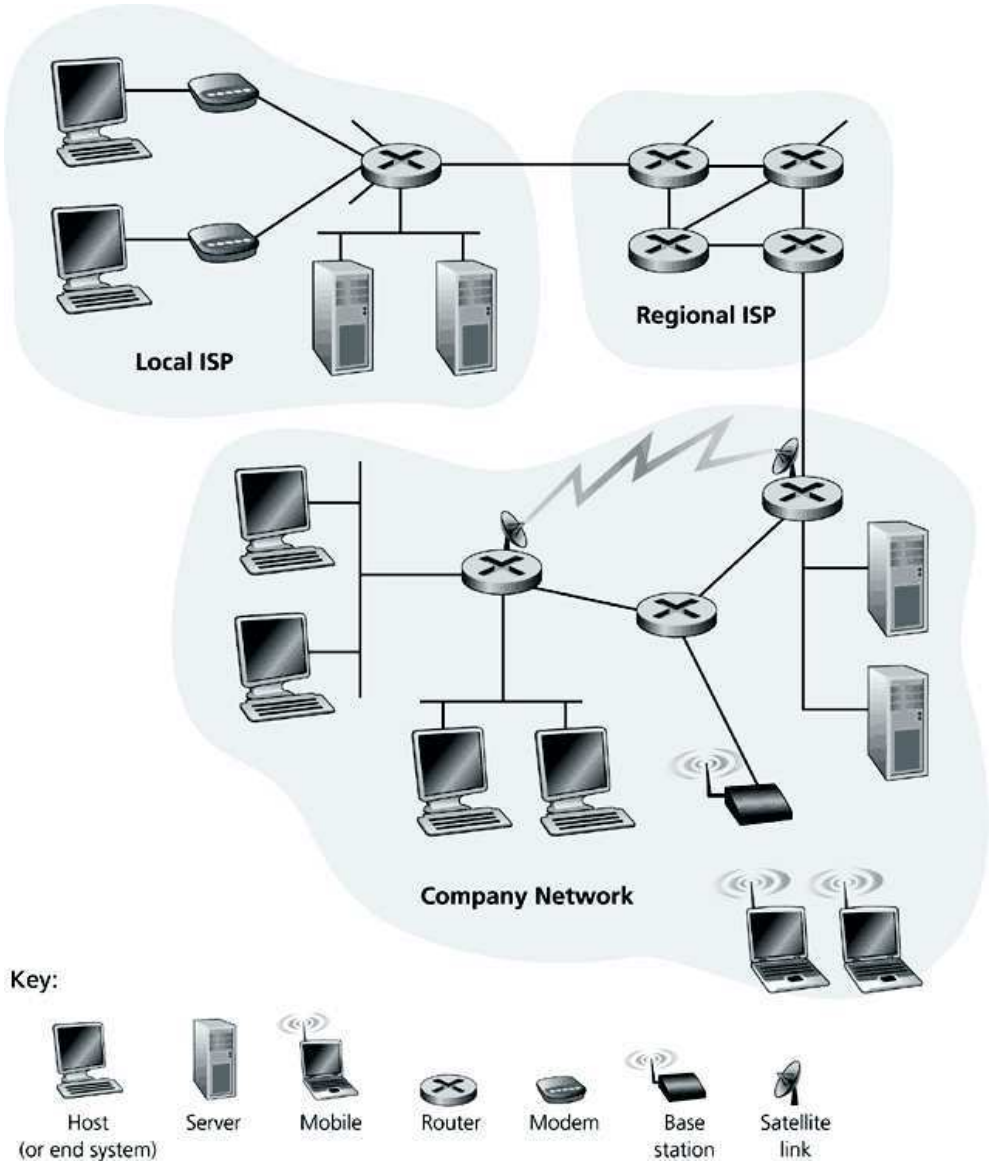


What is the Internet? (cont)

Communication links, e.g., fiber optics, copper wire, radio wave, satellite, connect hosts to each other; the transmission rate is called **bandwidth** (measured in bits per seconds, or "bit/sec").

The **routers** are located between hosts; they receive **packets** (chunks of data) from originating hosts and forward them to their destination hosts.

What is the Internet? (cont)

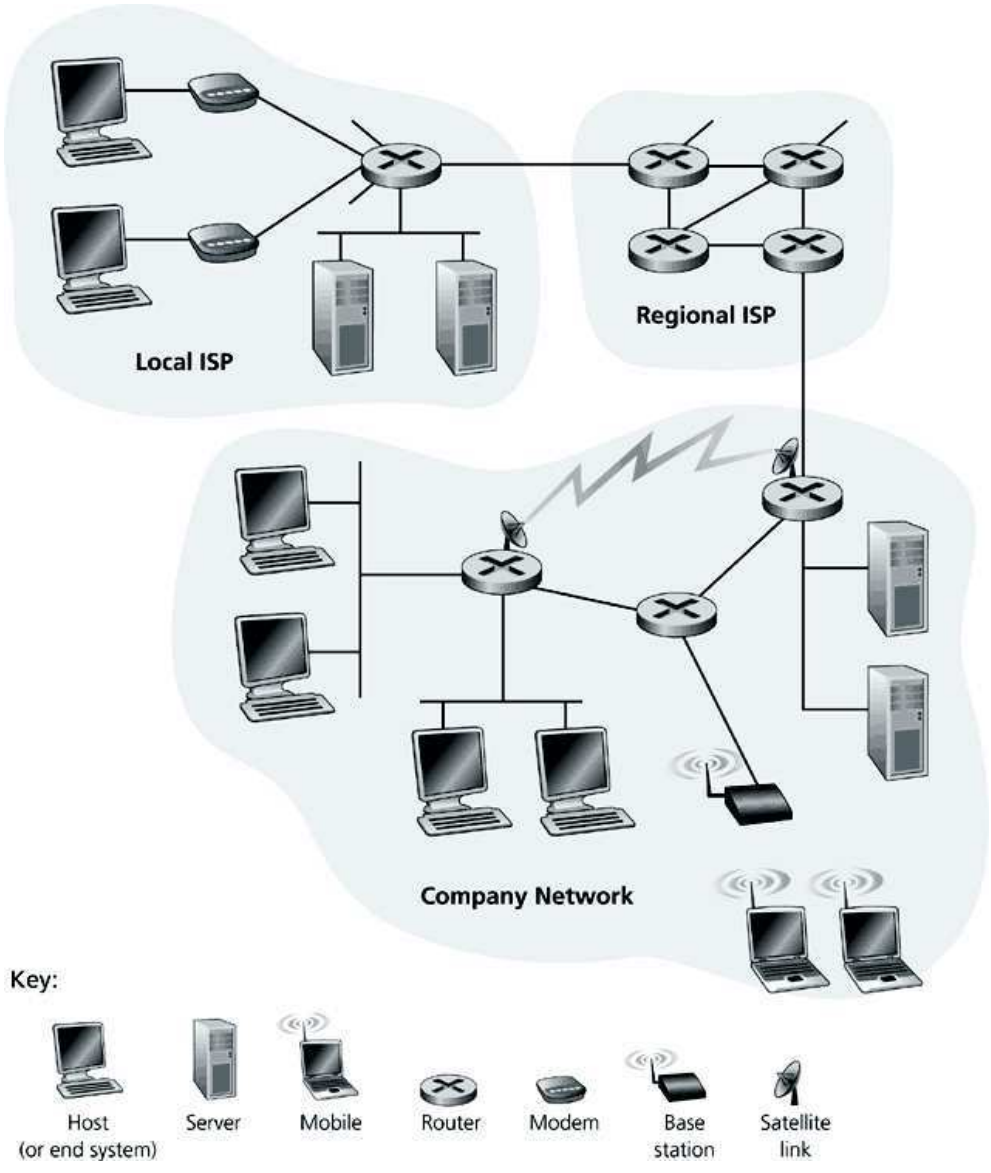


What is the Internet? (cont)

Hosts access the Internet through **Internet Service Providers** (ISP), which are networks proposing many different kinds of connections to the users: dial-up modem, cable modem (DSL), high-speed Local Area Network (LAN) access, wireless access.

There are ISPs in universities, companies and for residents.

What is the Internet? (cont)



What is the Internet? (cont)

ISPs are connected to others ISPs in a hierarchy: at the bottom lie the content providers ISPs and, at the top, the international ISPs (such as UUNet and Sprint) with high-speed routers interconnected with high-speed fiber-optics links.

So, what is the Internet?

- As the name tells it (*Inter*connected *net*works), it is a worldwide system of computer networks: **a network of networks** with a loose hierarchy.
- These networks share the same **protocols**, i.e., ways of representing information (packets) and rules for accepting, refusing or sending messages.

What is the Internet? (cont)

- This network of networks is called **public Internet**.
- Many companies have developed private networks based on the same hosts, links, routers and protocols as the public Internet: they are called **intranets**.
- These intranets are connected to the (public) Internet through **firewalls**, which filter and restrict the information flows in and out.

What is the Internet? (cont)

- Some Internet protocol names are HTTP (for the Web), TCP, IP, FTP (file transfer protocol), PPP (for modem connection), SMTP (e-mails) etc.
- Internet standards are developed by the **Internet Engineering Task Force** (IETF).
- The IETF standards documents are called **Requests For Comments** (RFC).

What is the Internet?/A service view

- The Internet allows applications that inter-operate to run on the hosts. These are called **distributed applications** and include remote login, e-mail, web surfing, instant messaging, audio and video streaming, Internet telephony, distributed games, peer-to-peer (P2P) file sharing, voting, databases etc.
- The network provides services to the distributed applications, i.e., networking-oriented features that programmers can use when they write such an application. Typically there are **connection-oriented services** and **connectionless services**.
- A connection-oriented service is **reliable**: it guarantees that the data is delivered in order and entirely. A connectionless service is **unreliable**: it guarantees nothing about delivery.

What is the Internet?/Protocols

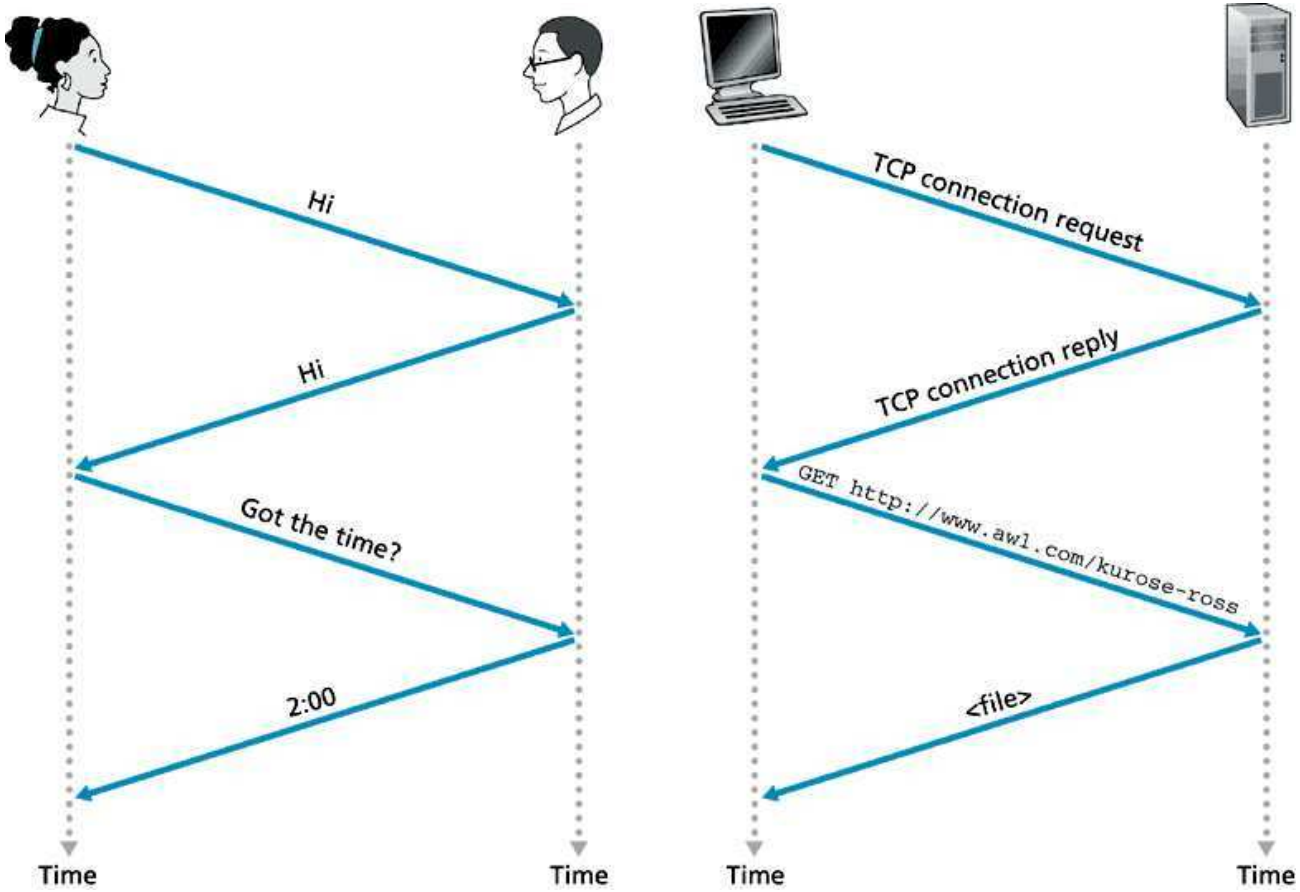
What is a protocol?

- Protocols are part of human relationships. When we meet a friend we start greeting him ('Hi!') and wait for the similar greeting. If it does not come or if some unpleasant words come back, we understand that the communication will not be possible or not good. Otherwise, we go on talking.
- The machine counterpart of this introduction is a connection-oriented service: first the sending application informs the remote application that it wants to communicate (i.e., exchange data). The remote application must acknowledge that before data is sent.

What is the Internet?/Protocols (cont)

- The conversation between friends is similar to the data transmission, from one application to another.
- So, in human protocols, some specific messages are exchanged (e.g., greetings, goodbyes) and some specific actions are taken when messages are received or other events happen.
- Similarly network protocols define format and order of messages exchanged between hosts as well as actions to be taken upon message receipt or transmission.

What is the Internet?/Protocols (cont)



A closer look at the network structure

- The **network edge** is made of the hosts and their applications.
- The **network core** is made of the routers and the protocols that enable the network of networks.
- The **access network** is the communication links.