

Lecture-3

FTP,DNS



File Transfer Protocol (FTP)

- ▶ Allows a user to copy files to/from remote hosts
- ▶ Usage:
 - Client connects to the FTP server
 - User provides a login id and password to become authenticated
 - User can explore the directories
 - User can download files from and upload files to the server
- ▶ A predecessor of the Web (RFC 959 in 1985)
- ▶ No URL, hypertext, and helper applications to assist user
 - Requirements for the user:
 - Know the name of the server machine
 - Have an account on the machine
 - Can find the directory where the files are stored
 - Know whether the file is text or binary

How Do You Transfer Files Today?

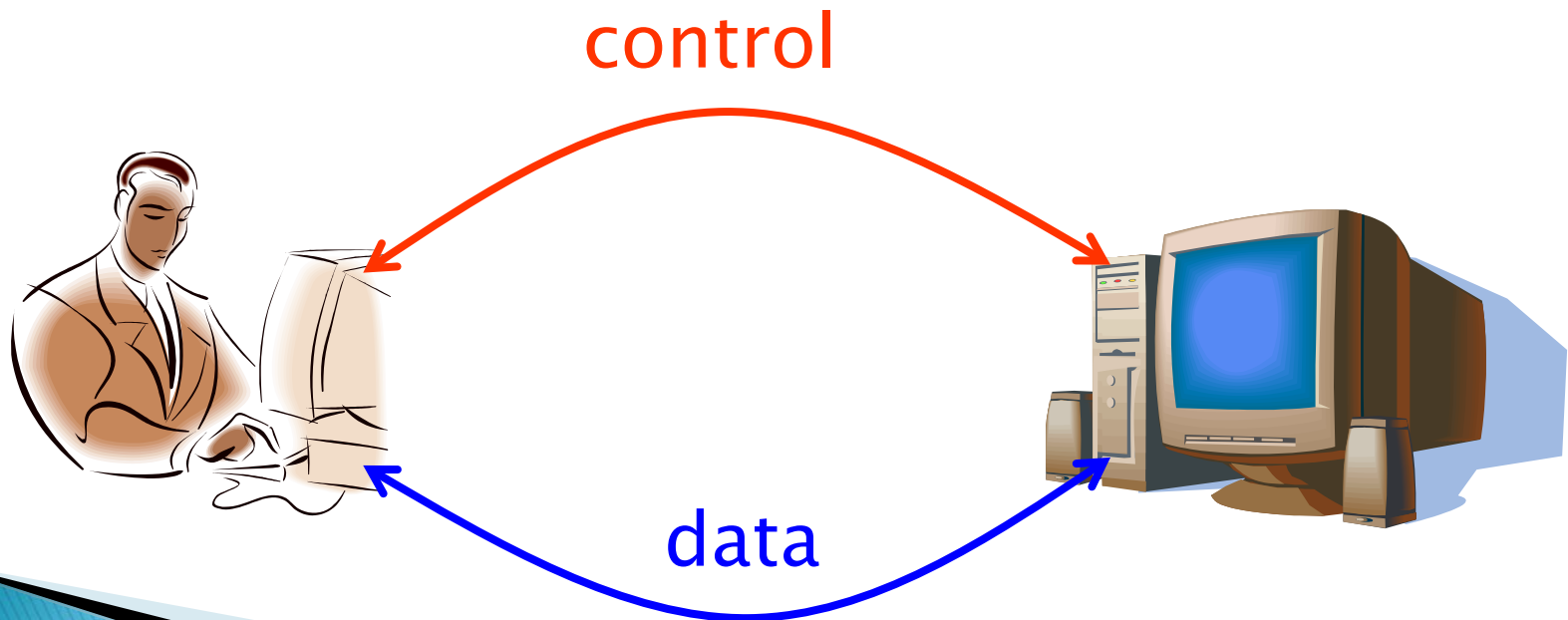
- ▶ HTTP – the usual Web transfer mechanism (`http://`)
- ▶ FTP
 - You may not have realized that you use it
 - `ftp://` links in web pages (e.g.: `www.kernel.org`)
- ▶ sftp
 - E.g.: to upload your project files to EECS inst. machines
- ▶ BitTorrent and other file-sharing software
- ▶ scp
- ▶ Any others?

Why Study FTP?

- ▶ Helps cement familiarity with text/status-code based protocols (similar to SMTP)
- ▶ Illustrates use of **multiple concurrent connections**
 - One for control (commands & replies)
 - Another connection for data (depending on the command)
- ▶ Illustrates **reversal of roles**
 - For data connection, FTP user's process plays the server role, FTP server plays the client role
- ▶ We'll later use FTP as an example when looking at issues with Network Address Translation (**NAT**)

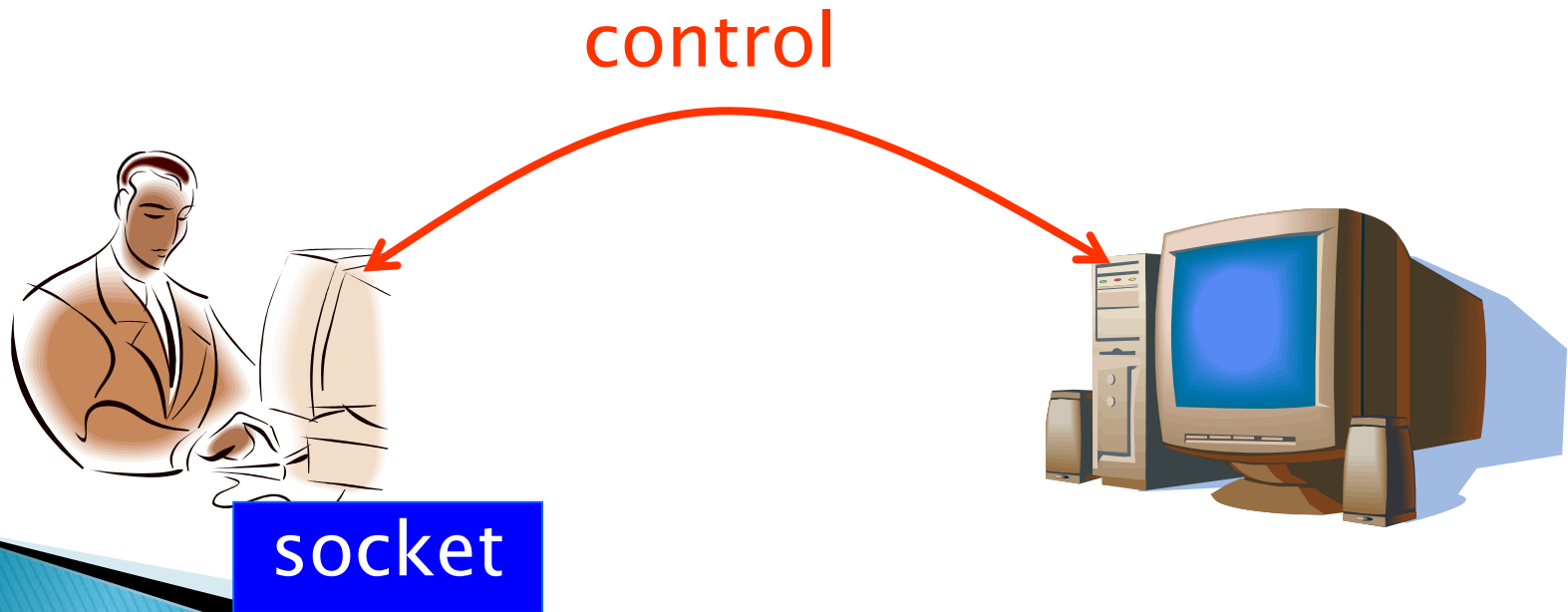
FTP Data Transfer

- ▶ Use separate data connection to:
 - Send lists of files (LIST)
 - Retrieve a file (RETR)
 - Upload a file (STOR)



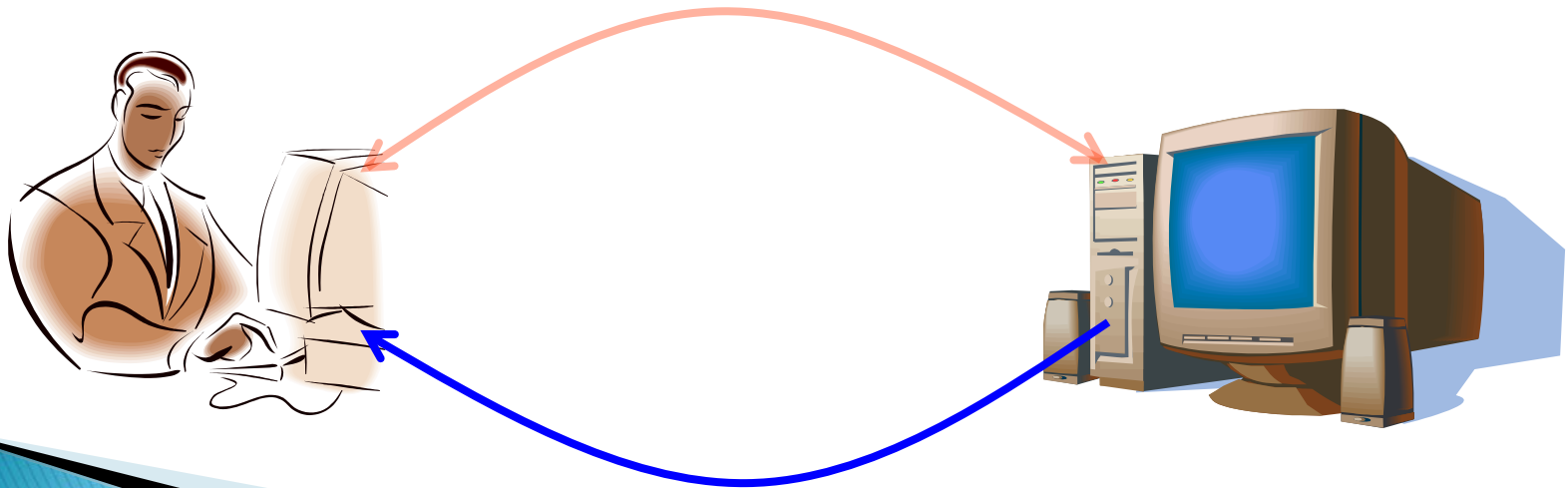
Creating the Data Connection

- ▶ Client acts like a server
 - Creates a socket
 - Assigned an ephemeral port number by the kernel
 - Listens on socket
 - Waits to hear from FTP server

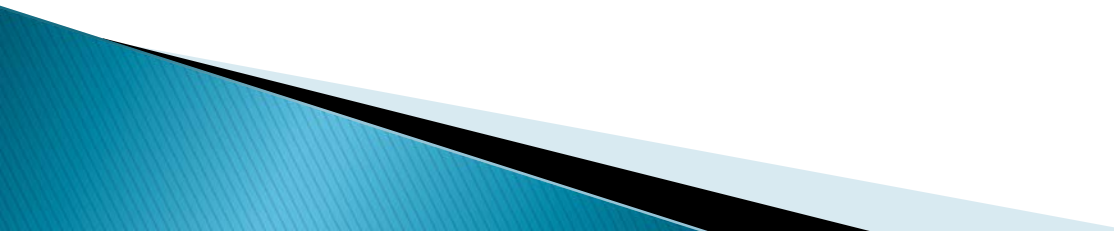


Creating Data Connection (cont)

- ▶ Then, the **server** initiates the data connection
 - Connects to the socket on the client machine
 - Client accepts to complete the connection
- ▶ Data now flows along **second** connection; first connection remains open for more commands/replies



Hostnames

- ▶ IP Addresses are great for computers
 - IP address includes information used for routing.
 - ▶ IP addresses are tough for humans to remember.
 - ▶ IP addresses are impossible to guess.
 - ever guessed at the name of a WWW site?
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The Domain Name

- ▶ A *domain name* is a string used to name Web sites and other servers on computer networks. On the Internet, these strings are managed by the Domain Name System (DNS). The DNS uses a system of multi-level strings separated by dots ('.') to organize domain names. For example, the Web site

compnetworking.about.com

The Domain Name

compnetworking.about.com

uses three levels of naming. The levels are listed in order of lowest to highest when reading from left to right.

- In this example, the first substring ('compnetworking') represents one specific Web site or *sub-domain*. Then,
- the second substring ('about') represents a *organizational domain* that points to a Web site but also contains numerous other sub-sites (sub-domains).
- Finally, the third substring ('.com') represents a *top level domain (TLD)* that encompasses numerous organizations worldwide.

TLDs (*top level domain*)

Common Domain Extensions

.com is the most commonly used top-level domain extension on the Internet. Many others exist, however. These other six TLDs were part of the original Internet specifications for domain extensions:

.net **.edu** **.mil**
.gov **.int**

- ▶ In recent years, many new TLDs have been deployed on the Internet. Some of these are intended for broad use worldwide, while others are designed to serve special interest groups.

.biz **.mobi**
.name **.info.**
jobs **.tel**

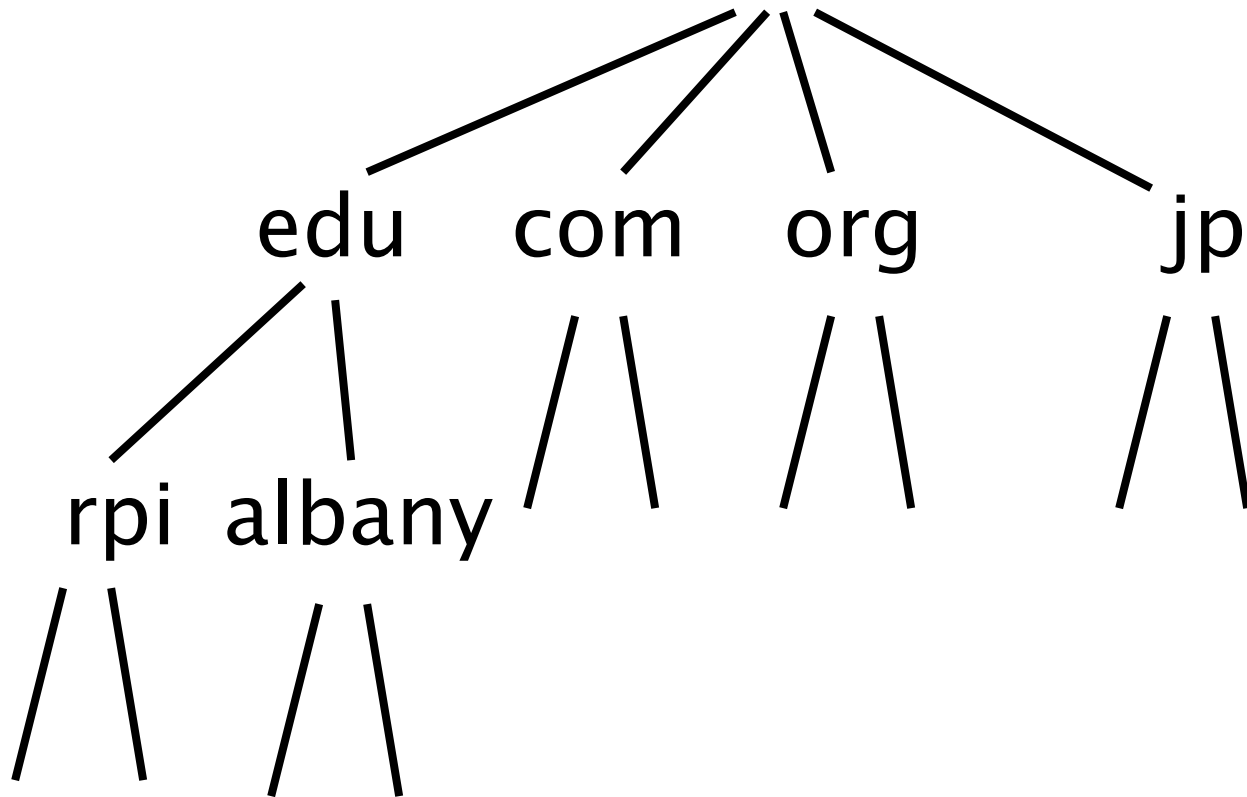
TLDs (*top level domain*)

Country Domain Extensions

Besides the generic TLDs listed above, the Internet also maintains domain extensions for each country to help organize Web sites within each nation. These extensions are named according to worldwide standard two-letter *country codes* similar to those used by the postal system. Examples of country code TLDs include:

- .br (Brazil)
- .ca (Canada)
- .cn (mainland China)
- .fr (France)
- .in (India)
- .jp (Japan)
- .ru (Russian Federation)

DNS Hierarchy



What Is a DNS Server?

The Domain Name System (DNS) is a standard technology for managing the names of Web sites and other Internet domains. DNS technology allows you to type names into your Web browser like *compnetworking.about.com* and your computer to automatically find that address on the Internet. A key element of the DNS is a worldwide collection of *DNS servers*.

A **DNS server** is any computer registered to join the Domain Name System. A DNS server runs special-purpose networking software, features a public IP address, and contains a database of network names and addresses for other Internet hosts.

DNS Root Servers

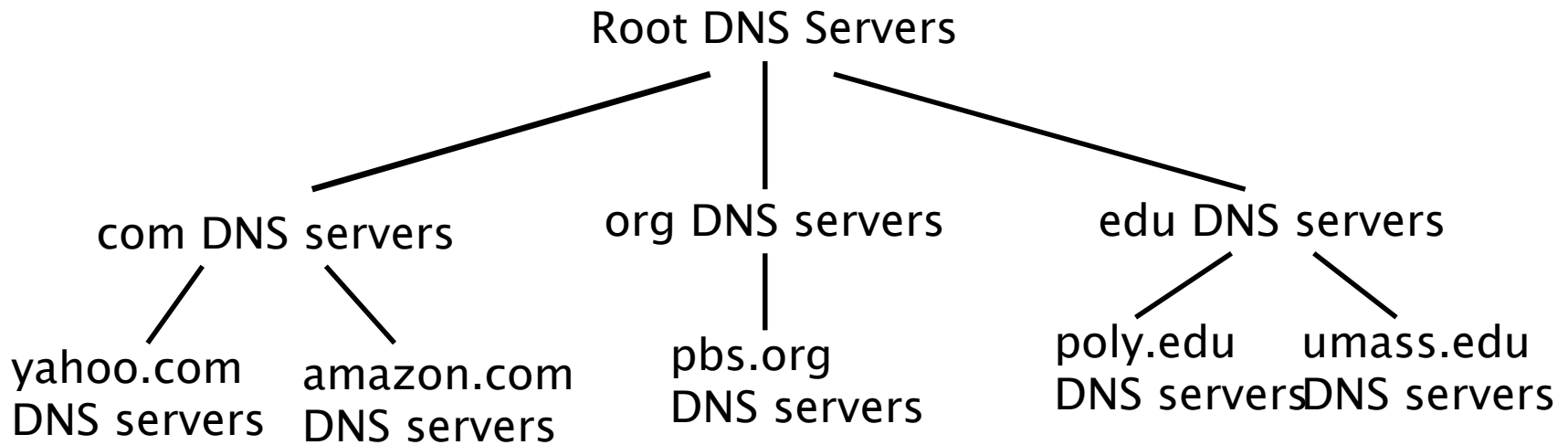
DNS servers communicate with each other using private network protocols. All DNS servers are organized in a hierarchy.

the top level of the hierarchy, so-called *root servers* store the complete database of Internet domain names and their corresponding IP addresses.

The Internet employs 13 root servers that have become somewhat famous for their special role. Maintained by various independent agencies, the servers are aptly named A, B, C and so on up to M.

Ten of these servers reside in the United States, one in Japan, one in London, UK and one in Stockholm, Sweden.

Distributed, Hierarchical Database



Client wants IP for www.amazon.com; 1st approx:

- ▶ client queries a root server to find com DNS server
- ▶ client queries com DNS server to get amazon.com DNS server
- ▶ client queries amazon.com DNS server to get IP address for www.amazon.com

DNS Distributed Database

- ▶ There is one primary server for a domain, and typically a number of secondary servers containing replicated databases.

