CS321: Computer Networks

FTP

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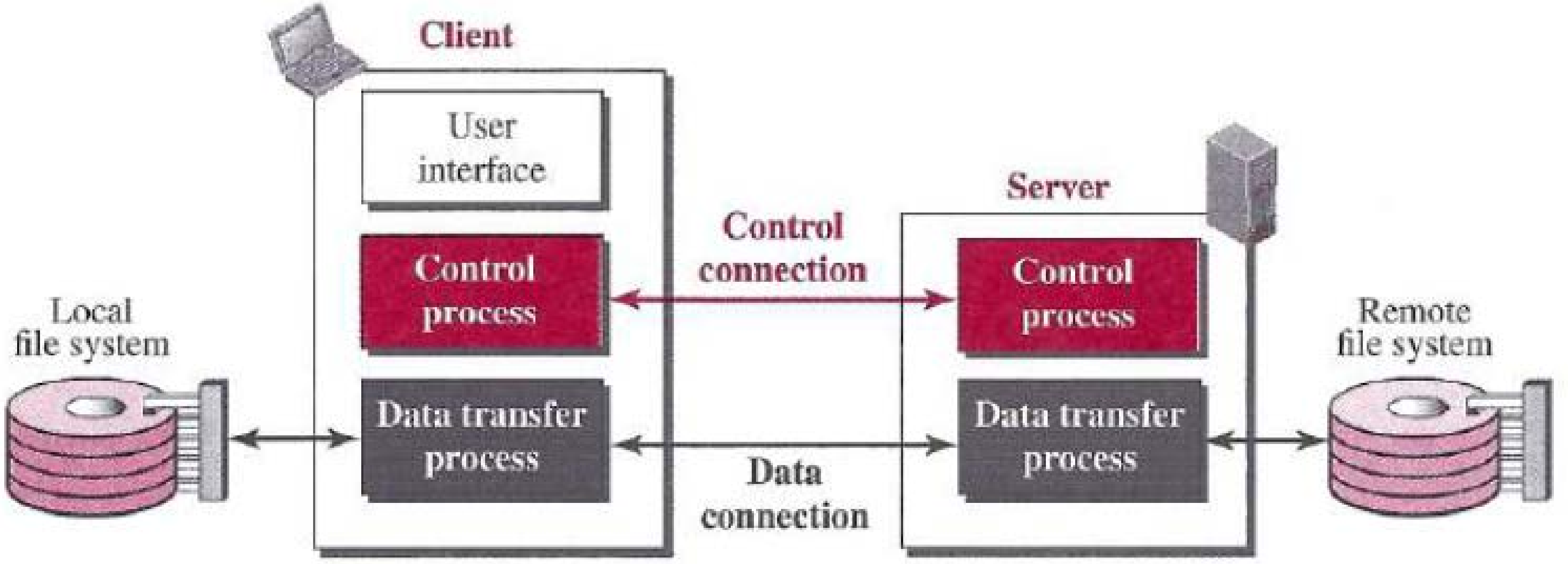
FTP

- File Transfer Protocol (FTP) is the standard protocol provided by *TCP/IP*

- It must address the following:
  - two systems may use different file name conventions
  - two systems may have different ways to represent data
  - two systems may have different directory structures

Basic Model of FTP



- The client has three components: the user interface, the client control process, and the client data transfer process.
- The server has two components: the server control process and the server data transfer process.
- There are two connects: control and data connection

Cont…

- The two connections in FTP have different lifetimes.
  - The control connection remains connected during the entire interactive FTP session.
  - The data connection is opened and then closed for each file transfer activity

- FTP server uses two well-known TCP ports:
  - port 21 is used for the control connection,
  - port 20 is used for the data connection.

- Benefits for having two separate connections:
  - No need for complicated framing on the control connection.
  - Handling special cases, like cancelling a data connection, is simpler.
  - You can have multiple transfers running at a time without having to establish multiple control connections.
  - It enables a trick, known as FXP, that can allow you to make two FTP servers exchange data directly between each other.

Control Connection

- Control communication is achieved through commands and responses.
- During this control connection, commands are sent from the client to the server and responses are sent from the server to the client.
- Commands are in the form of ASCII uppercase, which mayor may not be followed by an argument.

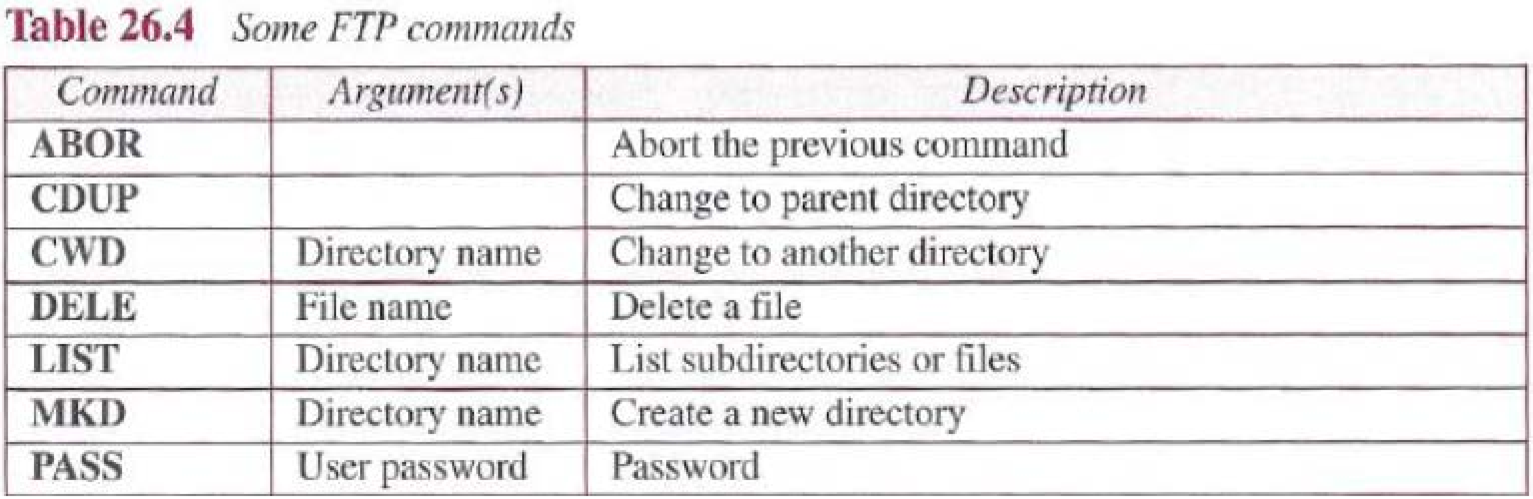


Table 26.4 *Some FTP commands*

Command	*Argument(s)*	*Description*
ABOR		Abort the previous command
CDUP		Change to parent directory
CWD	Directory name	Change to another directory
DELE	File name	Delete a file
LIST	Directory name	List subdirectories or files
MKD	Directory name	Create a new directory
PASS	User password	Password

Cont…

- Every FTP command generates at least one response
- A response has two parts:
  - Three-digit number : defines the code
  - Text : defines needed parameters or further explanations

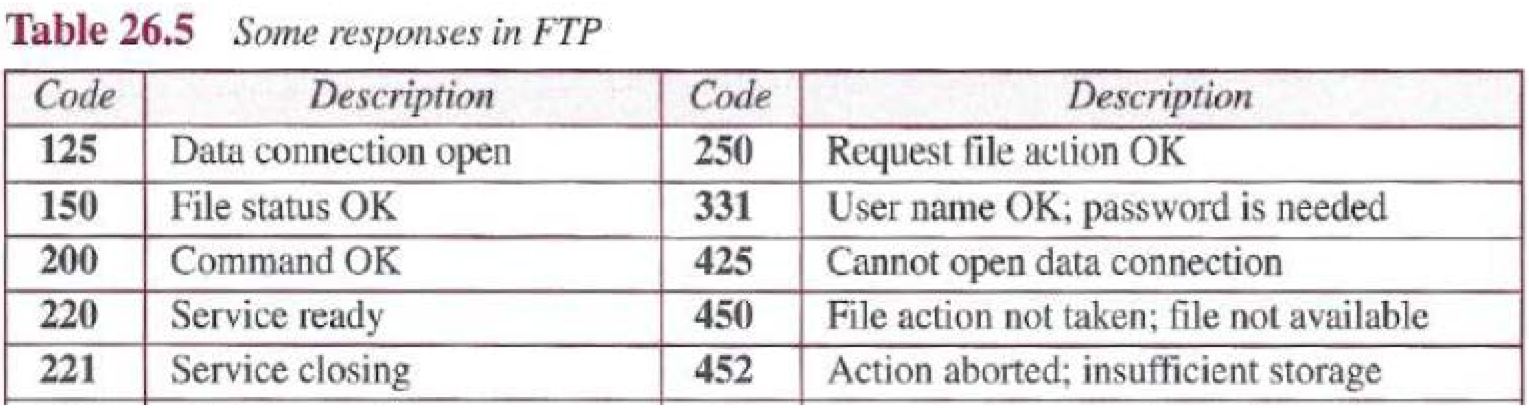


Table 26.5 *Some responses in FTP*

Code	*Description*	*Code*	*Description*
125	Data connection open	250	Request file action OK
150	File status OK	331	User name OK; password is needed
200	Command OK	425	Cannot open data connection
220	Service ready	450	File action not taken; file not available
221	Service closing	452	Action aborted; insufficient storage

Data Connection

- the creation of a data connection is different from the control connection.
- Data connection steps:
  - The client, not the server, issues a passive open using an ephemeral port (>1023).
  - Using the PORT command the client sends this port number to the server.
  - The server receives the port number and issues an active open using the well-known port 20 and the received ephemeral port number.

Communication over Data Connection

- We prepare for data transmission through the control connection.

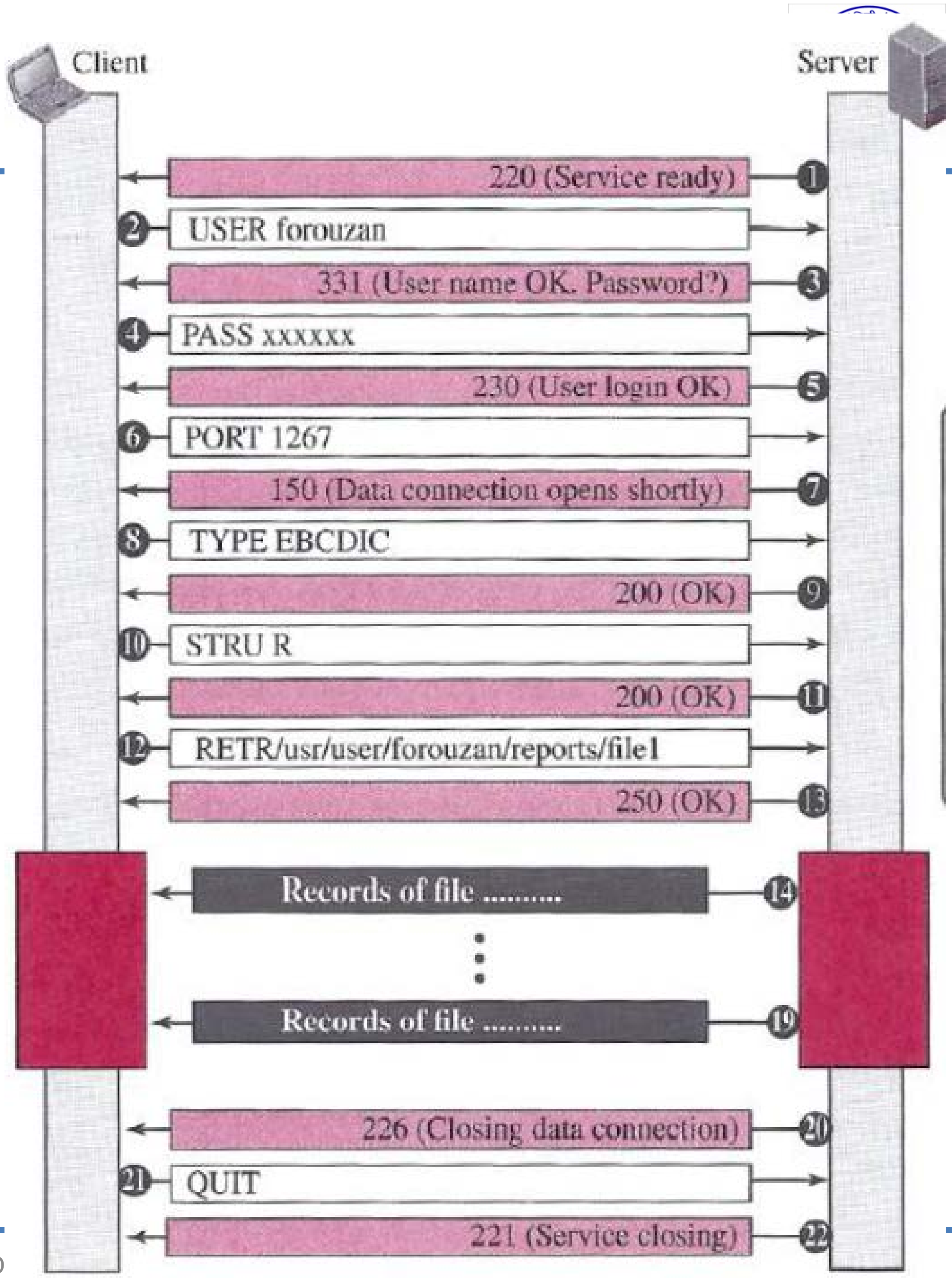
- The heterogeneity problem is resolved by defining three attributes of communication:
  - file type: *ASCII*, *EBCDIC*, or *image* file.
  - data structure: *file, record,* or *page* structure
  - transmission mode: *stream, block,* or *compressed* mode

- The file structure format (used by default) has no structure. It is a continuous stream of bytes.
- In the record structure, the file is divided into *records.* This can be used only with text files.
- In the page structure, the file is divided into pages, with each page having a page number and a page header.

Example

Legend

- ⬜ Control process (port 21)
- 🟥 Data tranfer process (port 20)
- ▨ Command
- □ Response
- ■ Data transfer



Client

Server

1 220 (Service ready)

2 USER forouzan

3 331 (User name OK. Password?)

4 PASS xxxxxx

5 230 (User login OK)

6 PORT 1267

7 150 (Data connection opens shortly)

8 TYPE EBCDIC

9 200 (OK)

10 STRU R

11 200 (OK)

12 RETR/usr/user/forouzan/reports/file1

13 250 (OK)

14 Records of file ....

⋮

19 Records of file ....

20 226 (Closing data connection)

21 QUIT

22 221 (Service closing)

Security for FTP

- The FTP protocol was designed when security was not a big issue.
- Although FTP requires a password, the password is sent in plaintext (unencrypted)
- To be secure, one can add a Secure Socket Layer between the FTP application layer and the TCP layer. In this case FTP is called SSL-FTP

Thanks!