**FTP**

FTP (File Transfer Protocol) is a way to move files between your computer and another remote computer. When you want to use FTP, you provide your username and password to access the remote computer. Your computer then connects to the remote computer using a TCP connection. After you're authorized, you can transfer files back and forth between your computer and the remote computer.

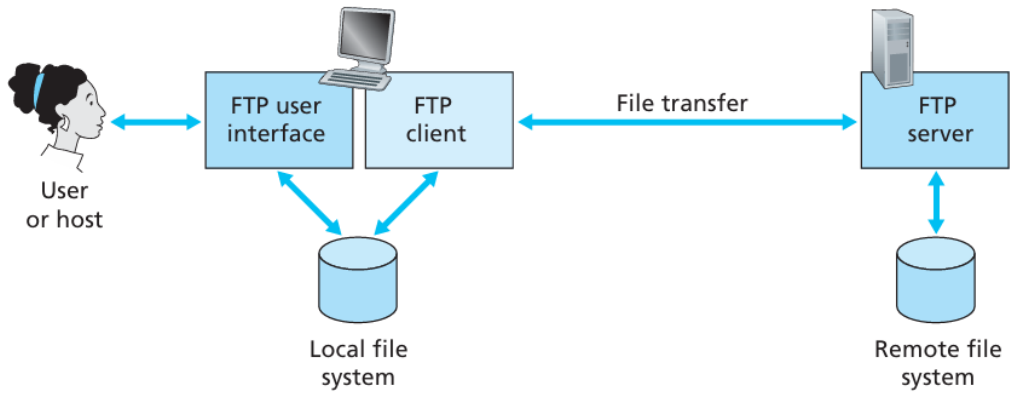



**Figure 2.14** ♦ FTP moves files between local and remote file systems

See117

how FTP works:

1. **User Authorization**: You, the user, want to transfer files between your computer and another computer (let's call it the remote host). To do this, you need to provide your username and password to access the remote host.
2. **Establishing Connection**: Once you provide your username and password, your computer (local host) connects to the remote host's FTP server using a TCP connection. This connection allows communication between your computer and the remote host.
3. **Transferring Files**: After the connection is established and you're authorized, you can start transferring files. You can copy files from your computer's file system to the remote host's file system, or vice versa. This transfer is done using FTP commands sent over the TCP connection.
4. **FTP vs HTTP**: Both are file transfer protocols that use TCP, but FTP uses two connections (control and data) while HTTP uses one.
5. **FTP Control Connection**: Used for sending user identification, passwords, and commands like changing directories.

6. **FTP Data Connection**: Used for actually transferring files.
7. **Connection Handling**: FTP maintains an open control connection throughout the session but opens a new data connection for each file transfer.
8. **Server State**: FTP servers need to keep track of user state (like user accounts and directories) throughout the session, which limits the number of simultaneous sessions. HTTP, however, is stateless and doesn't need to track user state.

Here's a simplified explanation:

- **FTP Commands**: These are instructions sent from the client to the server in ASCII format. They include:
  - **`USER`**: Sends the user identification.
  - **`PASS`**: Sends the user password.
  - **`LIST`**: Asks the server to send a list of files in the current directory.
  - **`RETR`**: Retrieves a file from the remote host.
  - **`STOR`**: Stores a file into the remote host's directory.
- **FTP Replies**: These are responses sent from the server to the client, consisting of three-digit numbers with optional messages:
  - **`331`**: Username OK, password required.
  - **`125`**: Data connection already open; transfer starting.
  - **`425`**: Can't open data connection.
  - **`452`**: Error writing file.

These commands and replies facilitate communication between the client and server during file transfers over FTP.

### SMTP

SMTP stands for Simple Mail Transfer Protocol. It is a communication protocol used to transfer electronic mail (email) messages between servers. SMTP is responsible for sending outgoing mail from the sender's email client or mail server to the recipient's mail server. It operates on the

application layer of the TCP/IP protocol stack and uses port number 25 by default. SMTP enables the reliable delivery of email messages over the Internet by establishing connections between mail servers and transferring messages in a standardized format.

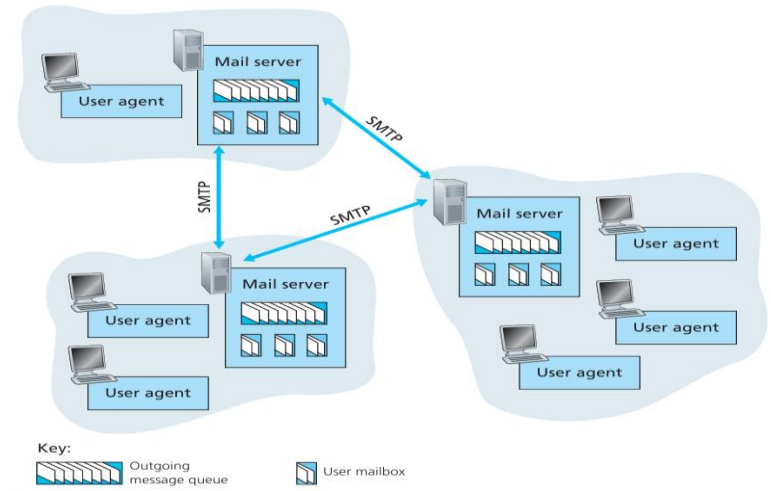
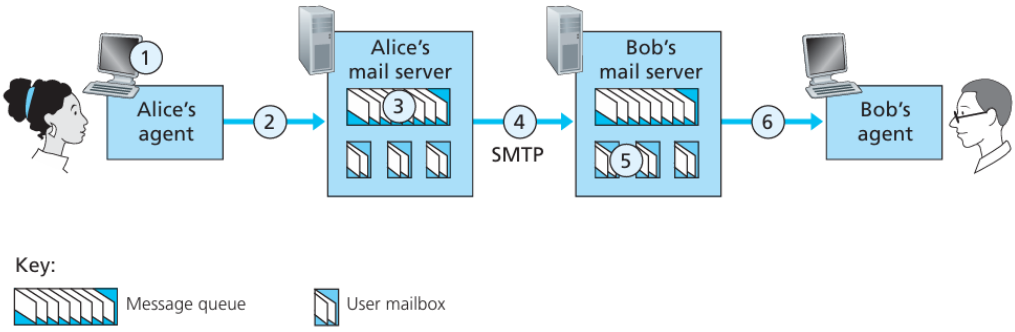



**Figure 2.16** ♦ A high-level view of the Internet e-mail system

1. **Alice Sends Email to Bob**: Alice wants to send an email to Bob. She uses her email client to compose the message, provides Bob's email address, and sends the message.
2. **Email Sent to Alice's Mail Server**: Alice's email is sent to her mail server and placed in a message queue.
3. **SMTP Connection Established**: The SMTP client on Alice's mail server establishes a TCP connection with Bob's mail server, which runs an SMTP server.
4. **Message Sent to Bob's Mail Server**: Alice's message is then sent over the TCP connection to Bob's mail server using SMTP.
5. **Message Received by Bob's Mail Server**: Bob's mail server receives the message and places it in Bob's mailbox.
6. **Bob Reads Email**: Bob can then use his email client to read the message at his convenience.




Sure, here's a detailed explanation of both POP (Post Office Protocol) and IMAP (Internet Message Access Protocol):

1. **POP (Post Office Protocol):**
   - POP is an email retrieval protocol that allows an email client to download messages from a mail server to the user's device.
   - When an email client connects to the server using POP, it typically downloads all messages from the inbox to the local device.
   - By default, POP removes the messages from the server after downloading, although some configurations allow users to leave a copy on the server.
   - POP operates in two modes: POP3 and POP2. POP3 (Post Office Protocol version 3) is the most commonly used version today.
   - Advantages of POP include offline access to emails and reduced server storage space usage since messages are typically removed from the server after downloading.
   - However, one of the limitations of POP is that it doesn't synchronize changes made to emails (e.g., read/unread status, deletions) across multiple devices.

2. **IMAP (Internet Message Access Protocol):**
   - IMAP is an email access protocol that allows an email client to access and manage messages stored on a remote mail server.
   - Unlike POP, IMAP enables users to view messages directly on the server without downloading them to the local device.
   - IMAP maintains a two-way synchronization between the email client and the server, ensuring that changes made to messages (e.g.,

read/unread status, deletions, folder organization) are reflected across all devices.

- IMAP supports multiple folders on the server, allowing users to organize their messages into different categories.
- With IMAP, users can access their emails from multiple devices (e.g., desktop, laptop, smartphone) and have a consistent view of their inbox and folders across all devices.
- However, since IMAP relies on server-side storage, users may encounter storage limitations imposed by their email service provider.

In summary, while both POP and IMAP serve the purpose of accessing email messages, IMAP offers more advanced features and flexibility, especially for users who access their emails from multiple devices and require synchronization of changes across all devices. POP, on the other hand, may be preferred by users who prioritize offline access to emails and have limited server storage space.

MAIL MESSAGE FORMAT

From: alice@crepes.fr

To: bob@hamburger.edu

Subject: Searching for the meaning of life.