CCN: Network Applications- Electronic Mail

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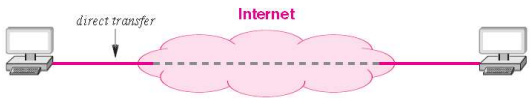
Outline

- Electronic Mail
- Mail Access Protocols
  - ✓ Post Office Protocol—Version 3 (POP3)
  - ✓ Internet Mail Access Protocol (IMAP)
  - ✓ Web based Mail

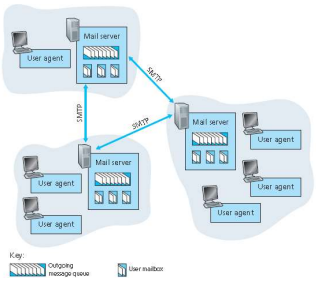
Electronic Mail

Electronic Mail in the Internet

- **Electronic Mail** has been around since the beginning of the Internet.
- **E-Mail** was the most popular application and remains one of the most widely used **Internet applications**.



Electronic Mail in the Internet



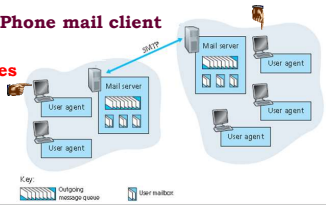
Electronic Mail in the Internet

- **Internet Mail System** has three **Major Components**:
  1. **User Agents,**
  2. **Mail Servers,**
  3. **Simple Mail Transfer Protocol (SMTP).**

User Agents

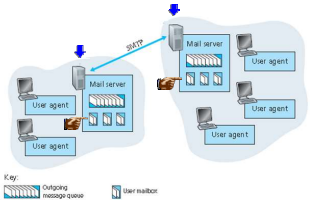
- **User Agent** is usually a **"Mail Reader"**
  - ✓ **Composing, Editing, Reading** the **Mail Messages**
  - ✓ **EX: Outlook, Thunderbird, iPhone mail client**
- **Outgoing, Incoming Messages**

  Stored On **Server**



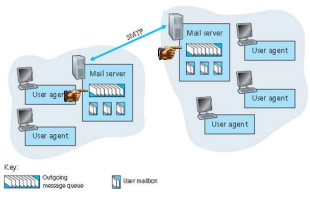
Mail Servers:

- **Mailbox** contains **incoming messages for user**



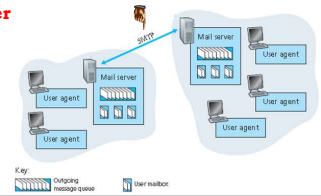
Mail Servers:

- **Message Queue** of **outgoing (to be sent) mail messages**



SMTP Protocol

- **SMTP Protocol** between **mail servers** to send **email messages**
  - ✓ **Client: Sending mail server**
  - ✓ **Server: Receiving mail server**

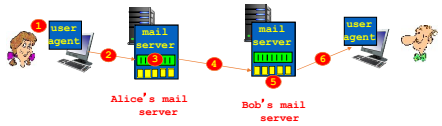


SMTP Protocol

- SMTP is the **principal application-layer protocol** for Internet electronic mail.
- SMTP uses the **reliable data transfer service of TCP, port 25**
  - ✓ **Transferring the mail** from the sender's mail server to the recipient's mail server.
- SMTP is much **older than HTTP.**

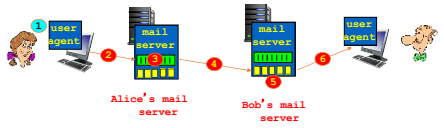
SMTP Protocol Scenario:

- **Alice sends message to Bob**



SMTP Protocol Scenario:

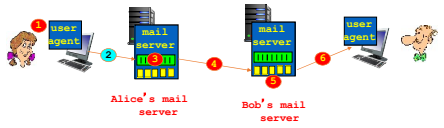
- **Alice sends message to Bob**



1) **Alice uses User Agent** to compose message "to" `bob@someschool.edu`

SMTP Protocol Scenario:

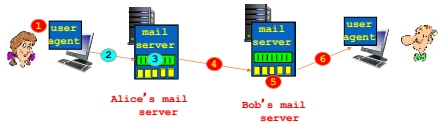
- **Alice sends message to Bob**



2) Alice's User Agent sends message to her **Mail Server**; Message placed in **Message Queue**

SMTP Protocol Scenario:

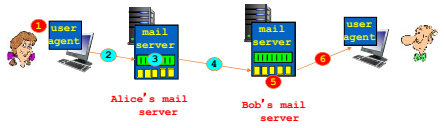
- **Alice sends message to Bob**



3) Client side of SMTP opens **TCP connection with Bob's mail server**

SMTP Protocol Scenario:

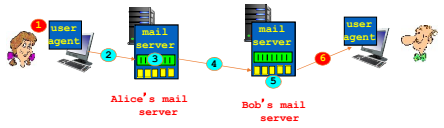
- **Alice sends message to Bob**



4.) SMTP client sends **Alice's message over the TCP connection**

SMTP Protocol Scenario:

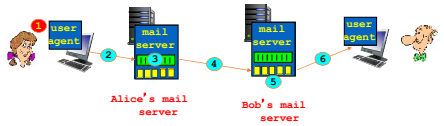
- **Alice sends message to Bob**



5.) Bob's mail server places the **message in Bob's mailbox**

SMTP Protocol Scenario:

- **Alice sends message to Bob**



5.) Bob invokes his **user agent to read message**

Sample SMTP interaction

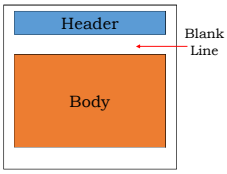
❖ Messages exchanged between an **SMTP client (C) and an SMTP server (S).** The **hostname of the client Is crepes.Fr** and the **hostname of the server is hamburger.Edu.**

```
S: 220 hamburger.edu
C: HELO crepes.fr
S: 250  Hello crepes.fr, pleased to meet you
C: MAIL FROM: <alice@crepes.fr>
S: 250 alice@crepes.fr... Sender ok
C: RCPT TO: <bob@hamburger.edu>
S: 250 bob@hamburger.edu ... Recipient ok
C: DATA
S: 354 Enter mail, end with "." on a line by itself
C: Do you like ketchup?
C: How about pickles?
C: .
S: 250 Message accepted for delivery
C: QUIT
S: 221 hamburger.edu closing connection
```

Mail Message Formats

❖ Every header must have a

- ✓ **From: header line**
- ✓ **To: header line;**
- ✓ **Subject: Header line as well as other optional header lines.**

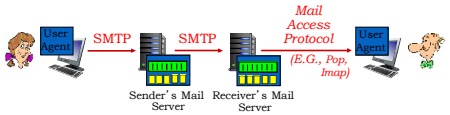



```
From: alice@crepes.fr
To: bob@hamburger.edu
Subject: Searching for the meaning of life.
```

Mail Access Protocols

Mail Access Protocols

- Once **SMTP delivers the message** from Alice's mail server to Bob's mail server, the **message is placed in Bob's mailbox**.



- **SMTP** only delivery to Receiver's Mail Server
- **Mail Access Protocol** are used to retrieval from Mail Server

Mail Access Protocols

- **Access Protocols** have the following characteristics:
  - ✓ Provide access to a user's mailbox
  - ✓ Permit a user to view headers, download, delete, or send individual messages
  - ✓ Client runs on user's personal computer
  - ✓ Server runs on a computer that stores user's mailbox

Mail Access Protocols

- There are **popular mail access protocols**
  - ✓ **Post Office Protocol—Version 3 (POP3)**
  - ✓ **Internet Mail Access Protocol (IMAP)**
  - ✓ **HTTP**

Post Office Protocol-3 (POP3)

- POP3 is an **extremely simple mail access protocol.**
- POP3 **begins**
  - ✓ when the user agent (the client) **opens a TCP connection** to the mail server (the server) on port 110.
  - ✓ With the **TCP connection established.**
- POP3 **progresses through three phases**: **Authorization, Transaction, And Update.**

POP3: Authorization Phase

- During this phase, the user agent sends a **username and a password** to **authenticate the user.**
- **Client commands:**
  - ✓ **User:** Declare username
  - ✓ **Pass:** password
- **Server Responses**
  - ✓ **+OK**
  - ✓ **-ERR**

```
S: +OK POP3 server ready
C: user bob
S: +OK
C: pass hungry
S: +OK user successfully logged on
```

POP3: Transaction Phase

- During this phase,
  - ✓ The user agent **retrieves messages;**
  - ✓ The user agent can also **mark messages** for **deletion, remove deletion marks, and obtain mail statistics.**

POP3: Transaction Phase -Example

```
C: list
S: 1 498
S: 2 912
S: .
C: retr 1
S: <message 1 contents>
S: .
C: dele 1
C: retr 2
S: <message 1 contents>
S: .
C: dele 2
C: quit
S: +OK POP3 server signing off
```

POP3: Update Phase

- This phase occurs **after the client has issued the quit command**, **ending the POP3 session;**
  - ✓ The **mail server deletes the messages** that were marked for deletion.

POP3: Conclusion

- POP3 uses **"download and delete"** mode
  - ✓ Bob cannot **re-read e-mail** if he changes client
- POP3 also uses **"download-and-keep":**
  - ✓ **Maintains** copies of messages on different clients
- POP3 is stateless across sessions
  - ✓ Do not carry **state information** across POP3 sessions

Internet Mail Access Protocol (IMAP)

- The **POP3 protocol does not provide to the user** to create **remote folders and assign messages to folders.**
- **IMAP** is a also mail access protocol, which has many **more features** than POP3.
  - ✓ But, it is also **significantly more complex**

Internet Mail Access Protocol (IMAP)

- An IMAP server will associate each **message with a folder**;
  - ✓ When a **message first arrives at the server**, it is associated with the **recipient's INBOX folder.**
  - ✓ The recipient can then **move** the message into a **new, user-created folder,**
  - ✓ The recipient can **read the message, delete the message,** and so on.

Internet Mail Access Protocol (IMAP)

- The IMAP protocol provides **commands to allow users** to **create folders and move messages** from one folder to another.
- IMAP also provides **commands that allow users** to **search remote folders for messages** matching specific criteria.
- IMAP keeps user **State Across Sessions**

Web based Mail

- One of the **Web based Mail** is **HTTP**
  - ✓ **Gmail, Hotmail, Yahoo! Mail,** etc.
- Suppose,
  - ✓ The **user agent is an ordinary Web browser**, want to communicate with its **remote mailbox via HTTP.**
  - ✓ When a recipient, wants to **access a message** in his **mailbox,**

Web based Mail

- ✓ The e-mail message is **sent from recipient mail server** to **Bob's browser** using the **HTTP protocol** rather than the POP3 or IMAP protocol.
- ✓ When a sender, wants to send an e-mail message,
  - The **e-mail message is sent from her browser to her mail server over HTTP**
- ✓ Sender Alice's **mail server still sends messages** to, and receives messages from, other mail servers using **SMTP.**

Outline

- **Electronic Mail**
- **Mail Access Protocols**
  - ✓ **Post Office Protocol—Version 3 (POP3)**
  - ✓ **Internet Mail Access Protocol (IMAP)**
  - ✓ **Web based Mail**

Thank You