COMPUTER COMMUNICATION NETWORKS

Prajeesha

Department of Electronics and Communication Engineering

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Electronic Email in the Internet

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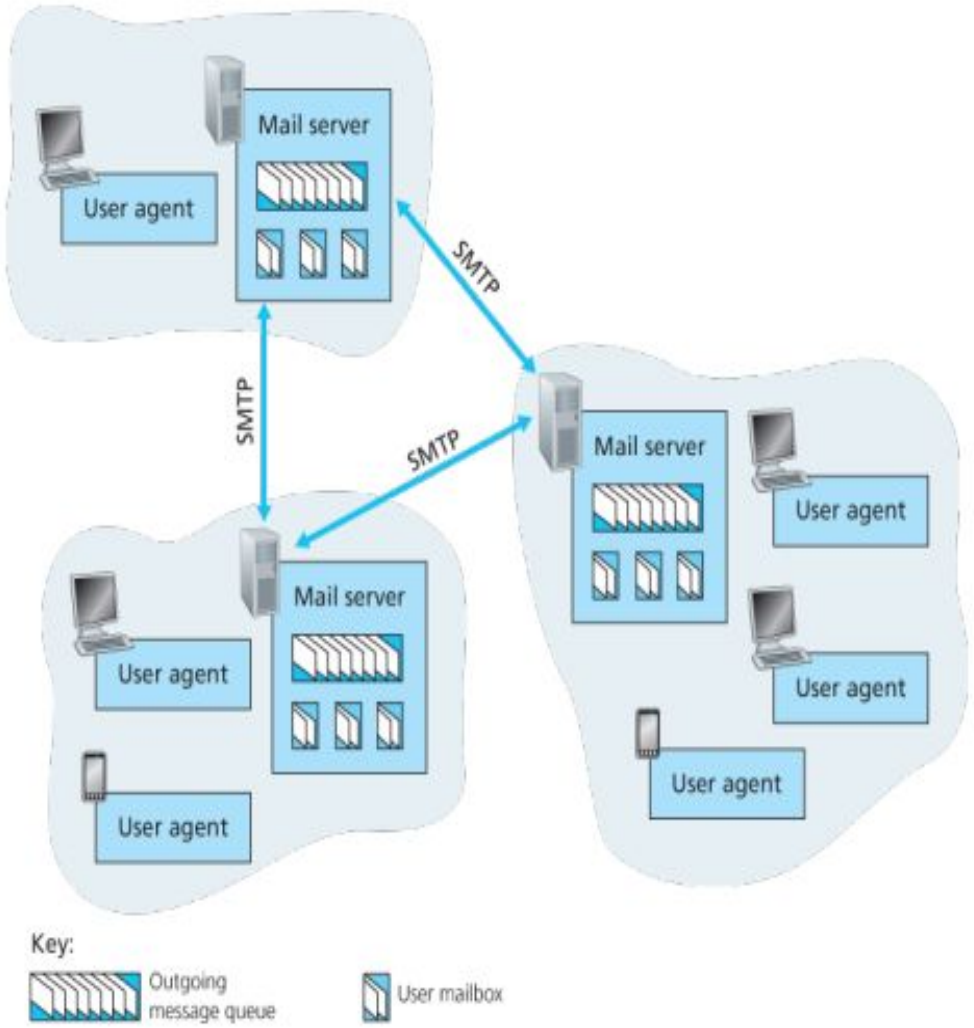
Internet mail system:

Three major components:

- User agents
- Mail servers
- Protocols

User Agent:

- a.k.a. "**mail reader**"
- Used for composing, editing, reading email messages
- User agent runs **processes** to send/receive email messages to/from mail servers
- E.g., Outlook, Thunderbird, iPhone mail client



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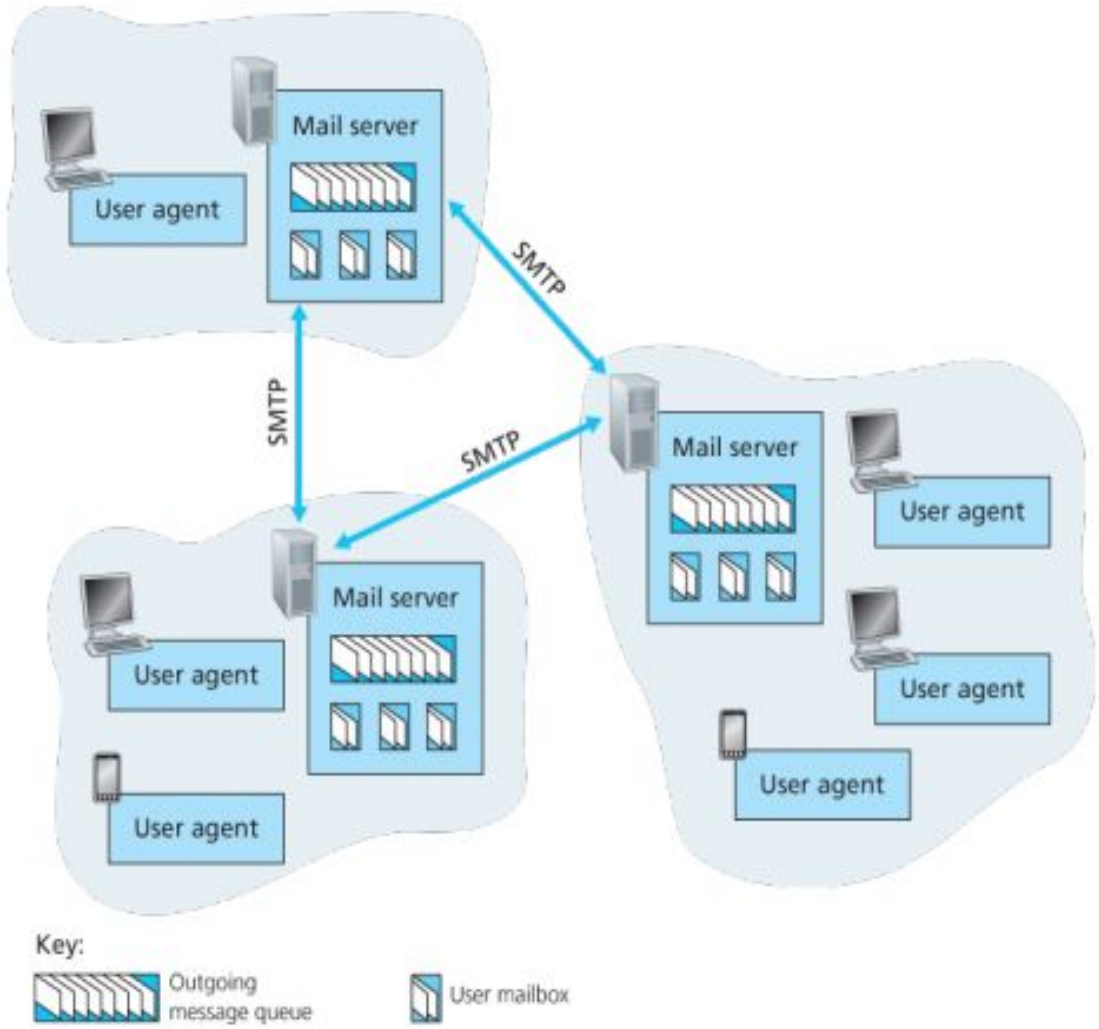
Mail servers:

- Hosts user accounts and their
- mailboxes
- A **mailbox** stores incoming messages for a user
- Outgoing messages are queued to be transferred to the mail servers of the receipients



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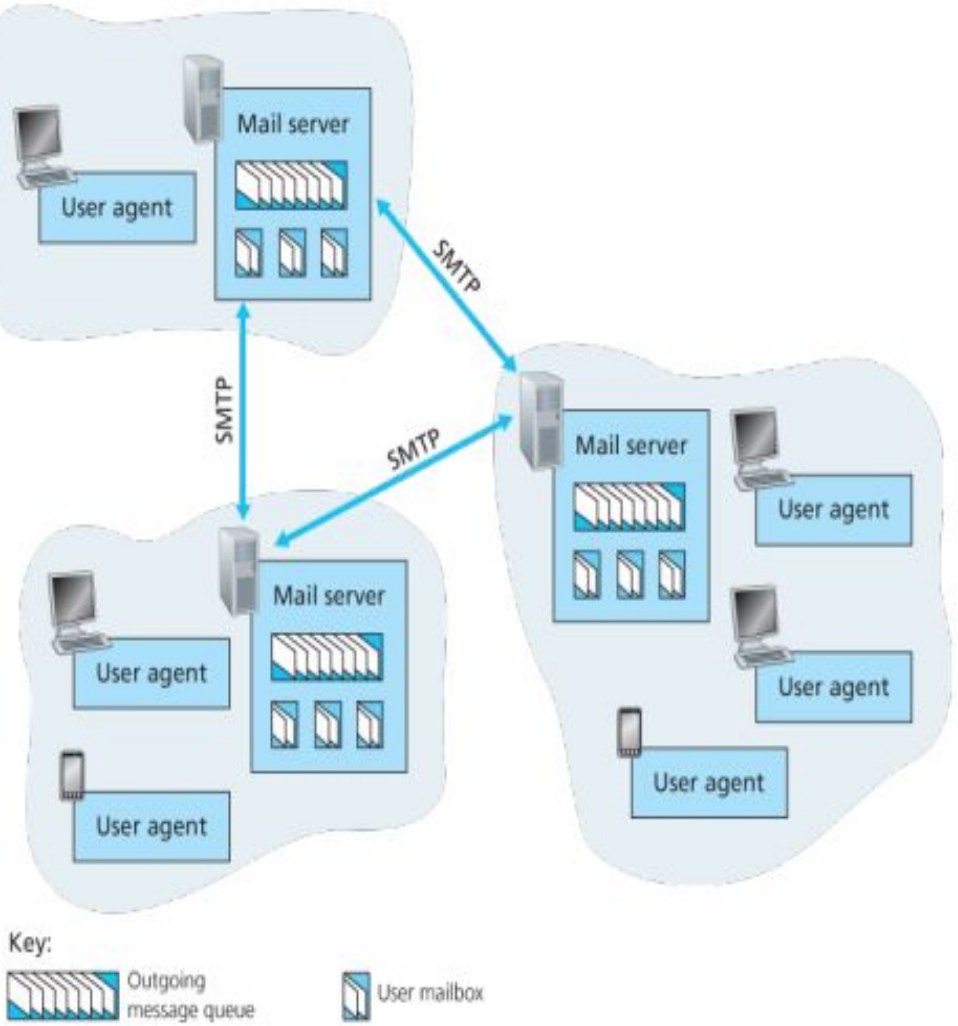
Protocols:

- Two sets of protocols are needed for electronic email
- **Simple Mail Transfer Protocol (SMTP)** is used for the process communication between mail servers
- **POP3, IMAP or HTTP** is used for process communication between user agent and the user's mail server
- All the above protocols use the client-server model

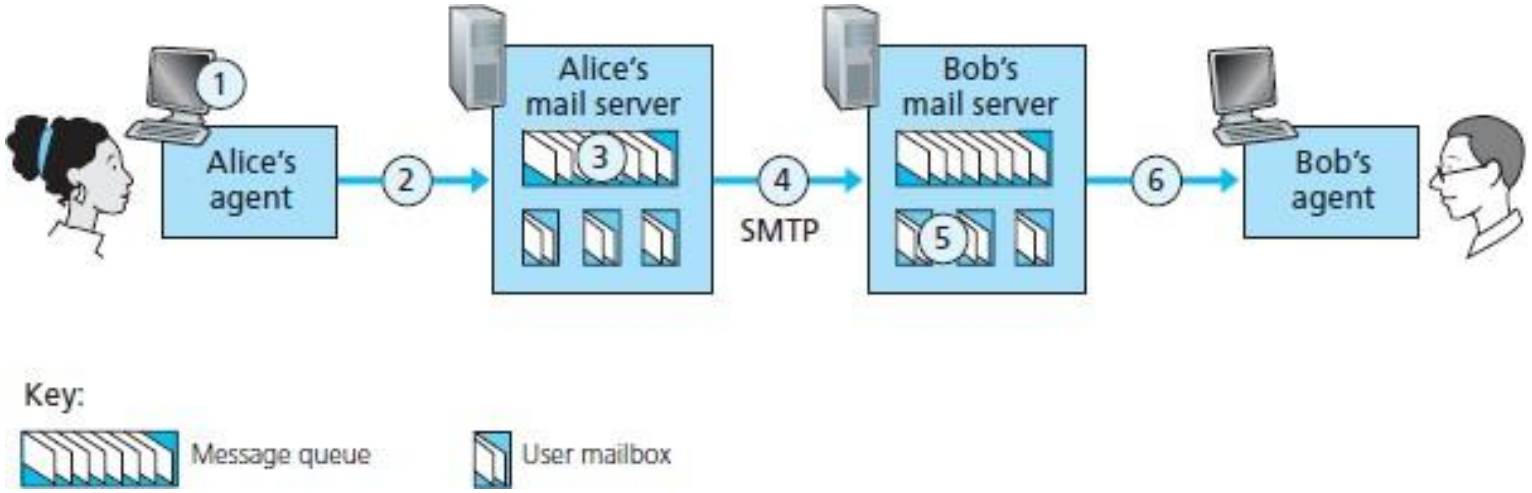


SMTP – Introduction

- Uses TCP for reliable transfer of email message across mail servers
- Mail server sending outgoing messages runs the client process and mail server receiving the incoming messages runs the server process.
- The server process is identified by socket (aka port) 25
- Messages from client process are expressed in ASCII and replies from server process carry status code and phrase
- Messages from client include commands and outgoing email messages from the mail server

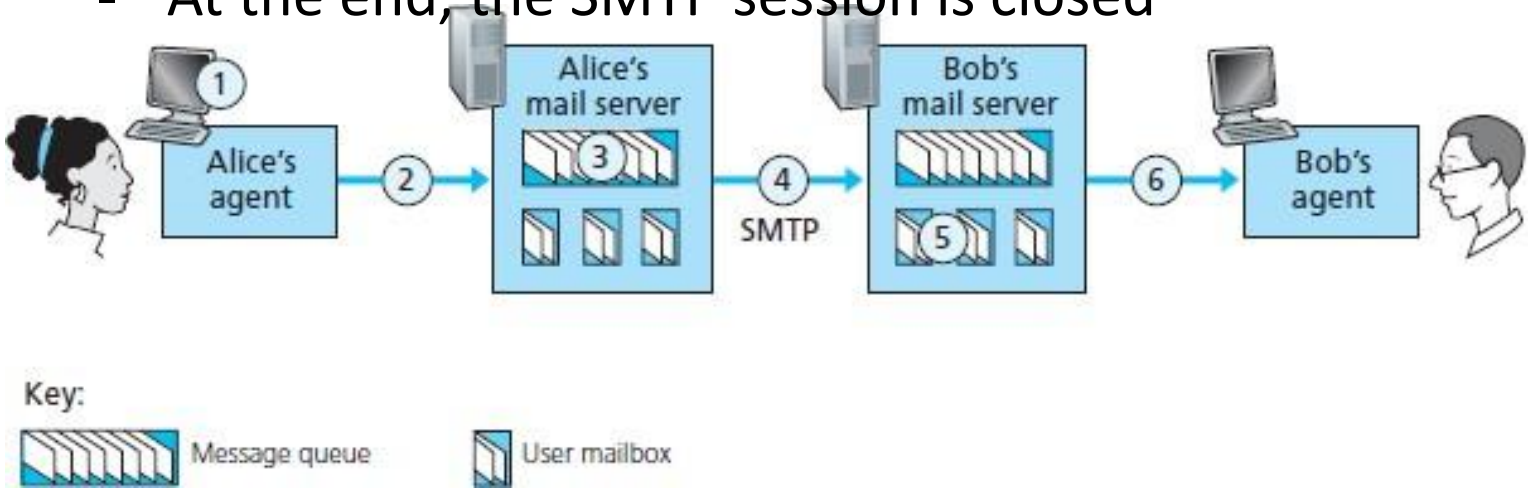
SMTP operations

- Example: Let Bob be the recipient of an email from Alice
- SMTP involves three steps
  - When Alice's mail server detects an outgoing email on her mailbox, the client process initiates a TCP connection to the server process running on Bob's mail server on port 25



SMTP operations (contd.)

- Upon establishing the connection, the client and the server process on the respective mail servers exchange SMTP messages carrying the following:
  - Authentication of mail servers
  - Authentication of user accounts
  - Delivery of email messages
- At the end, the SMTP session is closed



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SMTP message exchange

```
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
```

Comparison between SMTP and HTTP

Similarities

SMTP	HTTTP
SMTP transfers files (e-mail messages) from one mail server to another mail server	HTTP transfers files (objects) from a Web server to a Web client
Use persistent connections for transferring files	Use persistent connections for transferring files

Comparison between SMTP and HTTP

Differences

SMTP	HTTP
SMTP is a push protocol	HTTP is a pull protocol
SMTP requires each message, including the body of each message, to be in 7-bit ASCII format	HTTP data does not impose any restriction
SMTP places all of the message's objects into one message	HTTP encapsulates each object in its own HTTP response message

Mail access protocols

- Post Office Protocol—Version 3 (POP3)
- Internet Mail Access Protocol (IMAP)
- HTTP

Post Office Protocol version 3(POP3)

- Defined in RFC1939
- Maintains the state information over a session
- User agent (client process) connects to the user's mail server (server process) on TCP socket (port) 110
  - Port 995 for secure connection
- Follows three phases:
  - Authorization
  - Transaction
  - Update
- Operates in two modes:
  - Download and delete mode
  - Download and keep mode

POP3 (contd.)

- Download and delete mode
  - Messages are retrieved into the client process
  - The messages are deleted in the mail server
  - Does not carry state information across POP3 sessions
- Download and keep mode
  - Allows user to maintain messages on the mail server
  - Does not carry state information across POP3 sessions

POP3 (contd.)

- Download and delete mode message exchange

```
C: list
S: 1 498
S: 2 912
S: .
C: retr 1
S: (blah blah ...
S: ..................
S: ..........blah)
S: .
C: dele 1
C: retr 2
S: (blah blah ...
S: ..................
S: ..........blah)
S: .
C: dele 2
C: quit
S: +OK POP3 server signing off
```

Internet Mail Access Protocol (IMAP)

- Defined in RFC3501
- User agent (client process) connects to the user's mail
  - server (server process) on TCP socket (port) 143
    - Port 993 for secure connection
- Allows user to create folders and designate them on mail
  - server
    - Maintains folder hierarchy
- Allows user to delete, move and search for messages
- Allows users to maintain state across sessions
- Allows users to retrieve parts of a MIME message
  - Useful for low bandwidth connections

THANK YOU

Prajeesha

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