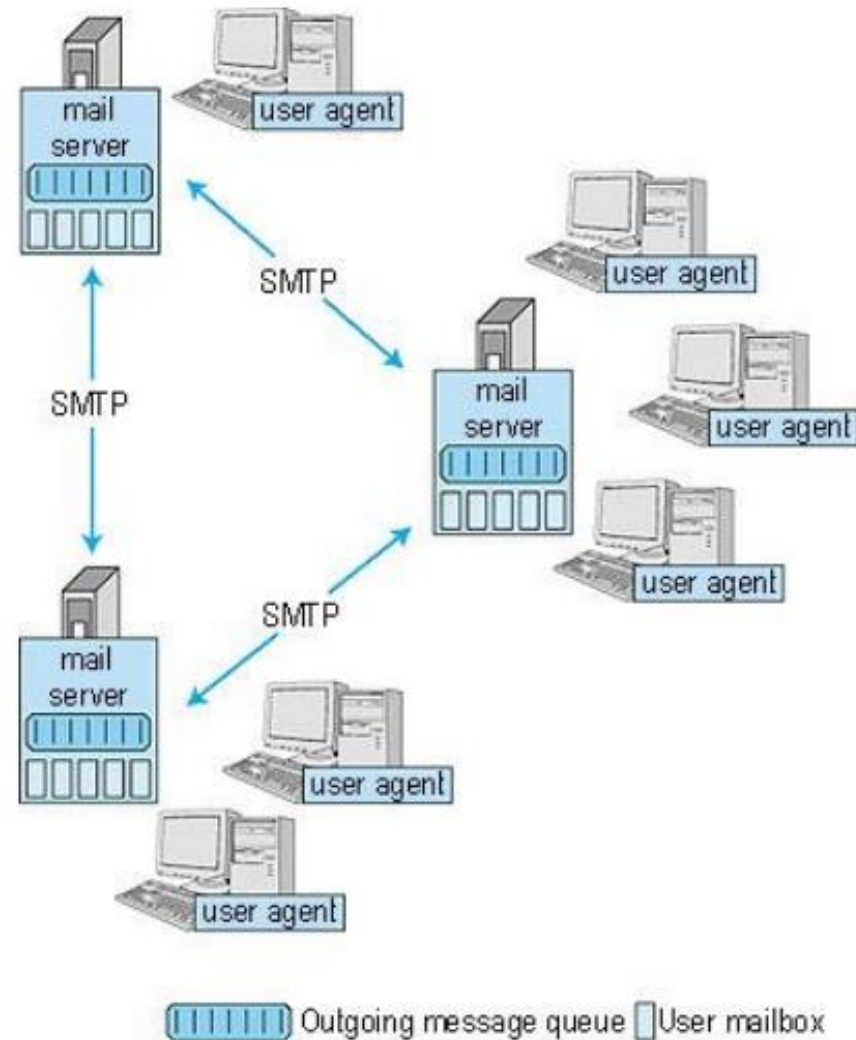# CSC 402 – Internet Technology

Recap

- DNS
- HTTP
- FTP

Electronic Mail (e-mail)

- **Three major components**
  - User agents
  - Mail servers
  - Simple Mail Transfer Protocol (SMTP)

SMTP

- The Simple Mail Transfer Protocol (SMTP) is the principal application-layer protocol for Internet electronic mail.
- Uses TCP to transfer mail from the sender's mail server to the recipient's mail server.
- End – to – End communication: Sender (SMTP client) talks directly to receiver (SMTP server).
- Client – Server principle. SMTP has two sides:
  - Client side, executing on the sender's mail server.
  - Server side, executing on the recipient's mail server.
- Both client and server run on every mail server.
- A mail server sending mail (to other servers) acts as an SMTP client.
- A mail server receiving mail (from other servers) acts as an SMTP server.

SMTP

- Restricts the body (not just the headers) of all mail messages to be in simple seven-bit ASCII.
  - It made sense in the early 1980s, with low transmission rates and little storage space availability.
  - No one was e-mailing large attachments with image, audio, or video files.
- Today, the seven-bit ASCII restriction is obsolete.
- Requirements:
  - Binary multimedia data to be encoded to ASCII before being sent over SMTP.
  - The corresponding ASCII message to be decoded back to binary after SMTP transport.

SMTP

- Suppose A wants to send B a simple ASCII message.
- A invokes the user agent for e-mail, provides B's e-mail address (for example, b@someschool.edu), composes a message, and instructs the user agent to send it.
- A's user agent sends the message to A's mail server, where it is placed in a message queue.
- The client side of SMTP, running on A's mail server, sees the message in the queue. It opens a TCP connection to SMTP running on B's server.
- After initial SMTP handshaking, the SMTP client sends A's message.
- At B's mail server host, the server side of SMTP receives the message and places it in B's mailbox.
- B invokes his user agent to read the message (contacting B's mail server host).

SMTP

- Important SMTP things
  - SMTP does not normally use intermediate mail servers for sending mail, even when the two mail servers are located at opposite ends of the world.
  - If B's mail server is down, the message remains in A's mail server and waits for a new attempt - the message is not placed in an intermediate mail server.
- The client repeats the sending process over the same TCP connection if it has other messages to send to the server.

SMTP Vs. HTTP

- Both protocols are used to transfer files from one host to another.
  - HTTP transfers files (objects) from Web server to Web user agent (that is, the browser).
  - SMTP transfers files (e-mail messages) from one mail server to another mail server.
- When transferring the files, both HTTP and SMTP use persistent connections.
  - The protocols have some common characteristics.
- HTTP is principally a pull protocol.
  - Someone loads information on a Web server and users use HTTP to pull the information from the server at their convenience.
  - In particular, the TCP connection is initiated by the machine that wants to receive the file.
- SMTP is primarily a push protocol.
  - The sending mail server pushes the file to the receiving mail server.
  - In particular, the TCP connection is initiated by the machine that wants to send the file.

SMTP Vs. HTTP

- SMTP requires each message, including the body of each message, to be in seven-bit ASCII format.

- Handling a document consisting of text and images (along with possibly other media types).
  - HTTP encapsulates each object in its own, separate HTTP message.
  - Internet mail places all of the message's objects into one message.

MIME

- While the message headers described in RFC 822 are enough to send ASCII text, they are not sufficient for multimedia.
  - Messages with images, audio, and video.
  - Carrying non-ASCII text formats.
    - E.g. characters used by languages other than English.
- To send content different from ASCII text, the sending user agent must include additional headers in the message.
  - These extra headers are defined.
    - RFC 2045 and RFC 2046.
    - The MIME (Multipurpose Internet Mail Extensions) is an extension to RFC 822.

MIME

- It is a mechanism for specifying and describing the format of message bodies (content – type) in a standardized way but leaves the message body as ASCII text.
- Because of MIME emails contain:
  - Images, audio/video content, HTML pages, etc.
- There are two key MIME headers for supporting multimedia.
- "Content-Type:" header
  - Allows the receiving user agent to take an appropriate action on the message
  - E.g. by indicating that the message body contains a JPEG image, the receiving user agent can direct the message body to a JPEG decompression routine
- "Content-Transfer-Encoding:" header
  - Alerts the receiving user agent that the message body has been ASCII-encoded and about the type of encoding used
  - When the user agent receives a message with these two headers, it uses
    - The value of the Content-Transfer-Encoding: header to convert the message body to its original non-ASCII format
    - And then uses the Content-Type: header to determine what actions it should take on the message body

MIME Example

- Suppose A wants to send B a JPEG image.

- To do this, A invokes the user agent for e-mail, specifies B's e-mail address, subject, and inserts the JPEG image into the message body.

- A's user agent then generates a MIME message, which might look something like this.
    - From: a@deerwalk.edu.np
    - To: b@deerwalk.com
    - Subject: Picture
    - MIME-Version: 1.0
    - Content-Transfer-Encoding: base64
    - Content-Type: image/jpeg
    - (base64 encoded data ....base64 encoded data)