Electronic Mail

- Uses TCP to transfer email messages from client to server on port 25
- Direct transfer - sending server to receiving server
- 3 phases of direct transfer
  - Handshaking (greeting)
  - Transfer of messages
  - Closure
- Command/response interaction
  - Commands: ASCII text
  - Response: status code and phrase
- Messages must be in 7-bit ASCII (due to historical reasons)

E-mail Message Format

- Messages have two parts
  - A header (7-bit US ASCII)
  - A body (7-bit US ASCII)
- Header
  - Series of lines ending in carriage return and linefeed
  - Each line contains a type of value which is separated by “:”
  - Several blank lines before the body begins
- Body
  - Series of text lines with no additional structure/meaning

Mail Message Format

- Header
  - Header different from the SMTP commands
- Body
  - The “message” must be only in ASCII characters

Limitation: Sending Non-Text Data

- E-mail body is 7-bit U.S. ASCII
  - What about non-English text?
  - What about binary files (e.g., images and executable)?
• Convert non-ASCII data into ASCII data
  • Base64 encoding - group three bytes into four printable US ASCII characters
  • Uuencode widely used

Limitations: Sending Multiple Items
• Users often want to send multiple pieces of data
  • Email body is a single, uninterpreted data chunk
  • Email digests: multiple emails grouped as one
  • Separated with well known separator strings

Additional Heading:
• MIME version
• Encoding method
• type

E-Mail Addresses
• Components of an email address
  • Local mailbox (e.g., prof or the username)
  • Domain name (e.g., cs.edu - not necessarily the email server of the domain)
• Multiple servers may exist to tolerate failures
• Identify mail server with a DNS query for MX

Electronic Mail
• 3 Major components
  • User agents
  • Mail servers
  • SMTP (simple mail transfer protocol) - runs over TCP on port 25

Electronic Mail: Mail Servers
• Mail Servers
  • Mailbox - contains a big file - usually messages
  • Message Queue - Not put in mailboxes, outgoing messages queued up
  • SMTP protocol - between mail servers to send email messages
    • Client - sending
    • Server - receiving

SMTP (RFC 2821)
• Principal app layer protocol
• Let you send an email without user agent.

Email header
• Every received email will have a header
• Header lines are a series of text line and are added by entities (mail program, servers, etc)
Understanding SMTP commands

- **HELO**
  - Identifies sending machine
  - Sender can lie (using a fake domain name)
    - Receiver can reverse DNS lookup for the real identity of the sender
- **MAIL FROM**
  - Initiates email processing
  - Address does not have to be the same as sender's email address
  - Turns into the from address in the Received header
- **RCPT TO**
  - Dual of MAIL FROM
  - Send to desired user
- **DATA**
  - Actual mail entry
  - No form restriction
  - Line consisting only of a period terminates the message
- **QUIT**
  - End SMTP connection

**Mail Access Protocols**

- 3 Protocols to retrieve email
  - POP - Post Office Protocol
  - IMAP - Internet Mail Access Protocol
  - HTTP: Hotmail, Yahoo! Mail, etc

**Retrieving E-Mail From the Server**

- Server stores incoming email by mailbox
- Users need to retrieve email to view/reply and organize/store messages
- Users used to log into email servers directly
- Then users got PCs

**POP3 Protocol**

- Authorization phase
  - Client commands
    - User: username
    - Pass: password
  - Server response
    - +OK
    - -ERR
  - Transaction phase
- list
- retr
- dele
- quit

Limitations of POP
- Does not handle multiple mailboxes easily
- Not designed to keep messages on the server
  - Download messages to client
- High network bandwidth overhead
  - Transfers all email messages before reading them

IMAP: Interactive Mail Access Protocol
- Supports being connected or disconnected from the server
- Supports multiple clients (records state of access)
- Access to MIME
- Supports multiple mailboxes

Web Based Email
- User agent = web browser
  - Eg. Gmail, yahoo, Hotmail
- Read in browser
- Easy to send spam e-mails (anonymously)