

Computación en Internet I

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1 Electronic Mail in the Internet

- Introduction
- SMTP
- Mail message format
- Mail access protocols

2 Workshop

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Main features

- An asynchronous communication medium.
- Fast, easy to distribute, and inexpensive.
- Many powerful features, including messages with attachments, hyperlinks, HTML-formatted text, and embedded photos.

Major Components

- User agents.
- Mail servers.
- Simple mail transfer protocol: SMTP.

User agent

- a.k.a. “mail reader”.
- Composing, editing, reading mail messages.
- e.g., Outlook, iPhone mail client.
- Outgoing, incoming messages stored on server.

Mail server

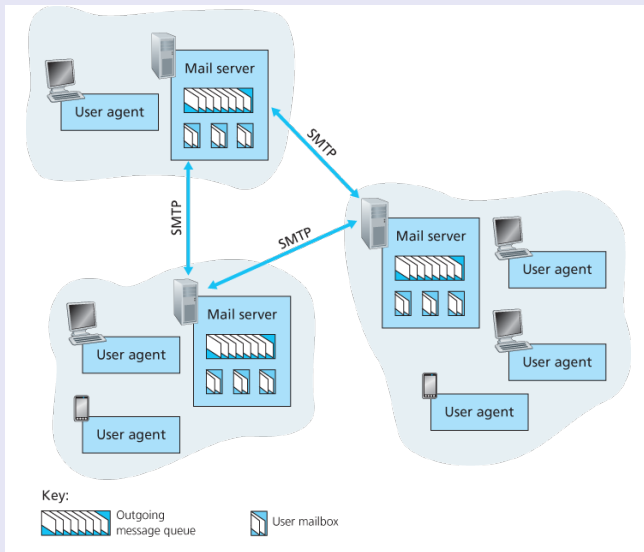
- Mailbox contains incoming messages for user.
- Message queue of outgoing (to be sent) mail messages.

SMTP protocol

- Between mail servers to send email messages.
- Client: sending mail server.
- Server: receiving mail server.

Introduction

Main components



How user agents work?

- When Alice finishes composing her message her user agent sends the message to her mail server.
- The message is placed in the mail server's outgoing message queue.
- When Bob wants to read a message, his user agent retrieves the message from his mailbox in his mail server.

How mail servers work?

- Each recipient, such as Bob, has a mailbox located in one of the mail servers.
- Bob's mailbox manages and maintains the messages that have been sent to him.
- A typical message starts its journey in the sender's user agent, then travels to the sender's mail server, and then travels to the recipient's mail server, where it is deposited in the recipient's mailbox.
- When Bob wants to access the messages in his mailbox, the mail server containing his mailbox authenticates Bob (with his username and password).
- Alice's mail server must also deal with failures in Bob's mail server.
- If Alice's server cannot deliver mail to Bob's server, Alice's server holds the message in a message queue and attempts to transfer the message later.
- Reattempts are often done every 30 minutes or so.
- If there is no success after several days, the server removes the message and notifies the sender (Alice) with an e-mail message.

What about SMTP?

- It is the principal application-layer protocol for Internet electronic mail.
- It uses the reliable data transfer service of TCP to transfer mail from the sender's mail server to the recipient's mail server.
- It has two sides: a client side, which executes on the sender's mail server, and a server side, which executes on the recipient's mail server.
- Both the client and server sides of SMTP run on every mail server.
- When a mail server sends mail to other mail servers, it acts as an SMTP client.
- When a mail server receives mail from other mail servers, it acts as an SMTP server.

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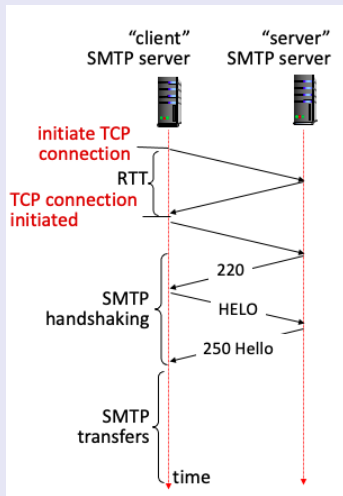
More about SMTP

- It is at the heart of Internet electronic mail.
- SMTP is much older than HTTP.
- Possesses certain archaic characteristics.
 - ▶ It restricts the body (not just the headers) of all mail messages to simple 7-bit ASCII.
 - ▶ It made sense in the early 1980s when transmission capacity was scarce.
 - ▶ But today, in the multimedia era, the 7-bit ASCII restriction is a bit of a pain.
 - ▶ It requires binary multimedia data to be encoded to ASCII before being sent over SMTP.
 - ▶ It requires the corresponding ASCII message to be decoded back to binary after SMTP transport.

More about SMTP

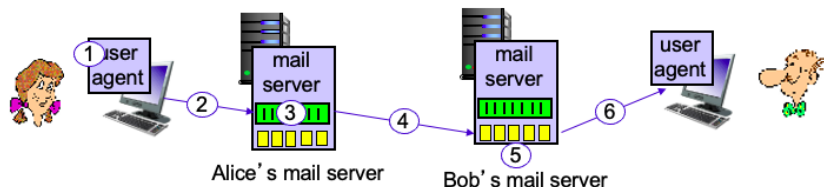
- Uses TCP to reliably transfer email message from client to server, port 25.
 - ▶ Direct transfer: sending server to receiving server.
- Three phases of transfer:
 - ▶ Handshaking (greeting).
 - ▶ Transfer of messages.
 - ▶ Closure.
- Command/response interaction (like HTTP).
 - ▶ Commands: ASCII text.
 - ▶ Response: status code and phrase
- Messages must be in 7-bit ASCII.

SMTP Protocol



Example

- 1) Alice uses UA to compose message "to" `bob@someschool.edu`
- 2) Alice's UA sends message to her mail server; message placed in message queue
- 3) client side of SMTP opens TCP connection with Bob's mail server
- 4) SMTP client sends Alice's message over the TCP connection
- 5) Bob's mail server places the message in Bob's mailbox
- 6) Bob invokes his user agent to read message



SMTP Commands

● HELO/EHLO

- ▶ The HELO command initiates the SMTP session conversation.
- ▶ The client greets the server and introduces itself.
- ▶ As a rule, HELO is attributed with an argument that specifies the domain name or IP address of the SMTP client.
- ▶ Example: HELO client.net.
- ▶ EHLO is an alternative to HELO for servers that support the SMTP service extensions (ESMTP).
- ▶ If the server does not support ESMTP, it will reply with an error.
- ▶ Example: EHLO client.net.
- ▶ HELO or EHLO is a MUST command for the SMTP client to commence a mail transfer.
- ▶ Used in handshake.
- ▶ The server responds with an opening message, expressed with code 250.

SMTP Commands

- MAIL FROM
 - ▶ The MAIL FROM command initiates a mail transfer.
 - ▶ As an argument, MAIL FROM includes a sender mailbox (reverse-path).
 - ▶ For some types of reporting messages like non-delivery notifications, the reverse-path may be void.
 - ▶ Optional parameters may also be specified.
 - ▶ Example: MAIL FROM "test@client.net".

SMTP Commands

- RCPT TO
 - ▶ The RCPT TO command specifies the recipient.
 - ▶ As an argument, RCPT TO includes a destination mailbox (forward-path).
 - ▶ In case of multiple recipients, RCPT TO will be used to specify each recipient separately.
 - ▶ Example: RCPT TO "user@recipient.net".

SMTP Commands

• DATA

- ▶ With the DATA command, the client asks the server for permission to transfer the mail data.
- ▶ The response code 354 grants permission, and the client launches the delivery of the email contents line by line.
- ▶ This includes the date, from header, subject line, to header, attachments, and body text.
- ▶ A final line containing a period (".") terminates the mail data transfer.
- ▶ The server responds to the final line.
- ▶ Example:

DATA

354 (server response code)

Date: Wed, 30 July 2019 06:04:34

From: test@client.net

Subject: How SMTP works

To: user@recipient.net

Body text

SMTP Commands

- NOOP
 - ▶ The NOOP command is used only to check whether the server can respond.
 - ▶ “250 OK” reply in response.
 - ▶ Example: NOOP

SMTP Commands

- QUIT
 - ▶ The QUIT command send the request to terminate the SMTP session.
 - ▶ Once the server responses with 221, the client closes the SMTP connection.
 - ▶ This command specifies that the receiver **MUST** send a “221 OK” reply and then closes the transmission channel.
 - ▶ Example: QUIT.

Sample SMTP interaction

```
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
```


Final observations

- SMTP uses persistent connections.
- SMTP requires message (header & body) to be in 7-bit ASCII.
- SMTP server uses CRLF.CRLF to determine end of message.

Comparison with HTTP

- HTTP: client pull.
- SMTP: client push.
- Both have ASCII command/response interaction, status codes.
- HTTP: each object encapsulated in its own response message.
- SMTP: multiple objects sent in multipart message.

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Mail message format

SMTP: protocol for exchanging email messages

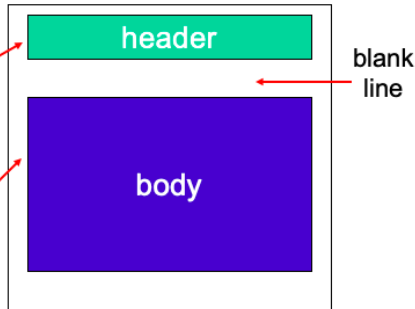
RFC 822: standard for text message format:

- header lines, e.g.,

- To:
- From:
- Subject:

different from SMTP MAIL
FROM, RCPT TO:
commands!

- Body: the “message”
 - ASCII characters only

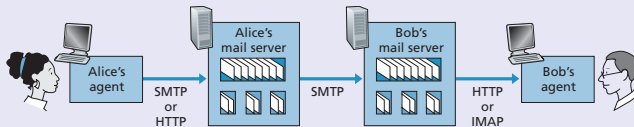


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E-mail protocols and their communicating entities



- Alice's user agent uses SMTP or HTTP to deliver the e-mail message into her mail server.
- Alice's mail server uses SMTP (as an SMTP client) to relay the e-mail message to Bob's mail server.
- Bob's user agent can't use SMTP to obtain the messages because obtaining the messages is a pull operation, whereas SMTP is a push protocol.
- Both the HTTP and IMAP approaches allow Bob to manage folders, maintained in Bob's mail server.

What about the HTTP alternative?

- If Bob is using Web-based e-mail or a smartphone app (such as Gmail), then the user agent will use HTTP to retrieve Bob's e-mail.
- This case requires Bob's mail server to have an HTTP interface as well as an SMTP interface (to communicate with Alice's mail server).

What is IMAP?

- The Internet Message Access Protocol is a protocol for receiving emails from a server.
- Since IMAP allows access to emails from multiple locations simultaneously, it keeps the email on the server after being delivered.
- It doesn't download the entire email until the recipient opens it.
- Currently, the 4th version of the IMAP protocol is in use, and it is one of the most used protocols for email receiving.

How does IMAP work?

- When using the IMAP protocol, the client connects to the server, checks for new messages, and saves them in the cache as temporary files.
- Only the date, sender, and subject are initially downloaded from the server.
- The content will only be downloaded when you open the message.
- So, it is possible to access the email's content without downloading the attached files using this protocol.
- When an email is modified, deleted, or status changes from unread to read, the changes are reflected on the server.
- This process helps to reflect the status of emails on multiple devices in real-time.

What are IMAP's advantages?

- Not affected by local machine failures since the emails are stored in the server.
- Can be accessed through multiple devices at the same time.
- It supports keyboard-based email searching.
- Local storage use is minimal.

What are IMAP's disadvantages?

- Accessing emails is a little slower than POP3 because all folders are synchronized every time there is a send or a receive.
- Emails will not work unless you have an active internet connection.
- If you use email frequently, you will need a larger mailbox storage space, which may be more costly.

What is POP3?

- Post Office Protocol is a more user-friendly method of accessing mailboxes.
- Version 3 is the most widely used version of this standard, and it is popular among users due to its low reliance on Internet connections.
- POP3 transfers emails from the server to the client, allowing you to read them even if you are not connected to the internet.

How does POP3 work?

- When a user checks for a new email, the client makes a connection to the POP3 server.
- The email client then provides the server with its username and password for authentication.
- When the client connects, it issues text-based commands to retrieve all email messages.
- It then saves the downloaded messages as new emails on the user's local system, deletes the server copies, and disconnects from the server.

What are POP3's advantages?

- Popular, simple to set up and use.
- Emails are downloaded to the user's computer, and messages can be viewed even if the user is not connected to the internet.
- Opening attachments is quick and simple because they have already been downloaded.
- Requires less server storage space because all emails are stored on the local machine.

What are POP3's disadvantages?

- Email attachments may contain viruses that may cause harm to the user's PC.
- Hard to export the local mail folder to another email client or physical machine.
- Email folders can become corrupted, potentially resulting in the loss of the entire mailbox.

Workshop

Complete workshop for today's class. To be handed in at the end of the class.