


Electronic Mail (Email)

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Background

- One of Internet's oldest (1971) and very widely used application
- Provides an asynchronous mode of communication
 - Fast, easy, inexpensive
- Evolved over the years to support many features
 - Attachments, confirmation, group-emails, spam-filters etc

Other Email Services

- CC, BCC, high-priority, alternative recipients
- Mailing lists
- Mailboxes to store and manage emails
- Email forwarding (e.g. when people move away);
automated replies


A diagram illustrating email forwarding. It shows a red '@' symbol followed by a red 'A' above it, a red arrow pointing to the right, a red 'B' above it, and another red '@' symbol followed by a red 'B' below it. This represents the transition of an email address from A to B.
- Filters: Detect spam, Message from friends go to mailbox1 etc

Two Basic Components

- User Agents (Mail Readers)
 - Local programs that help people read, send and manage emails
 - Can be text based or GUI based
 - E.g. pine, [↑]elm, Microsoft Outlook, Mozilla Thunderbird



Microsoft
Office Outlook 2007



Two Basic Components

- Message Transfer Agents
 - Daemons (processes) that run in background to move messages from source to destination host
 - Agents implement required protocols

Message Format

Message: From: Date
To :
Dear Madam,
Sub:
Ref:
Blah Blah
Yours Sincerely,
. . . .
Envelope : Address

- Envelope encapsulates the message
- Envelope contains information needed to transport message
 - Destination address, priority, security level etc
 - Message transfer agents use it to route message to correct destination
- Envelope derived from the header fields in the message

RFC 5322 (old RFC 822)

- Message within envelope contains header and body
 - Both are represented in ASCII text
 - Header contains control information for user agents
 - Body is for human consumption
 - Header separated from message body by blank line
- Header is a series of <CRLF> terminated lines
 - Contains type and value separated by a colon
 - body
 - From: , To: , Date: , Message-ID, , CC: , BCC: , Sender: ,
Subject:, Received: , Return-Path:, Reply-To: etc
 - secondary

Message Body and MIME

- Early days, email was made of English text messages, expressed in ASCII
 - No support for foreign languages
 - No support for non-text attachments (pdf, doc, jpg, audio files etc)
- Solution: Multipurpose Internet Mail Extensions (MIME)
 - Additional headers
 - Define content types and subtypes
 - Add structure to message body
 - Encoding rules for non ASCII messages (convert them to ASCII)

Headers added by MIME

Header	Meaning
MIME-Version	Identifies the MIME Version
Content-Description	ASCII string that tells what is in the message
Content-ID	Unique identifier
Content-Type	Type of data contained in the message
Content-Transfer-Encoding	How the data in message is encoded (e.g. <u>7bit</u> , <u>Base64</u>)

Content-Type:

Text/Plain – Unformatted text

Text/Enriched – Simple formatted text

Image/Jpeg – Picture in jpeg format

Video/Mpeg – Video in mpeg format
Application/Msword – word document
Message/Mixed – Message made of independent pieces (each piece has own header line)

Example

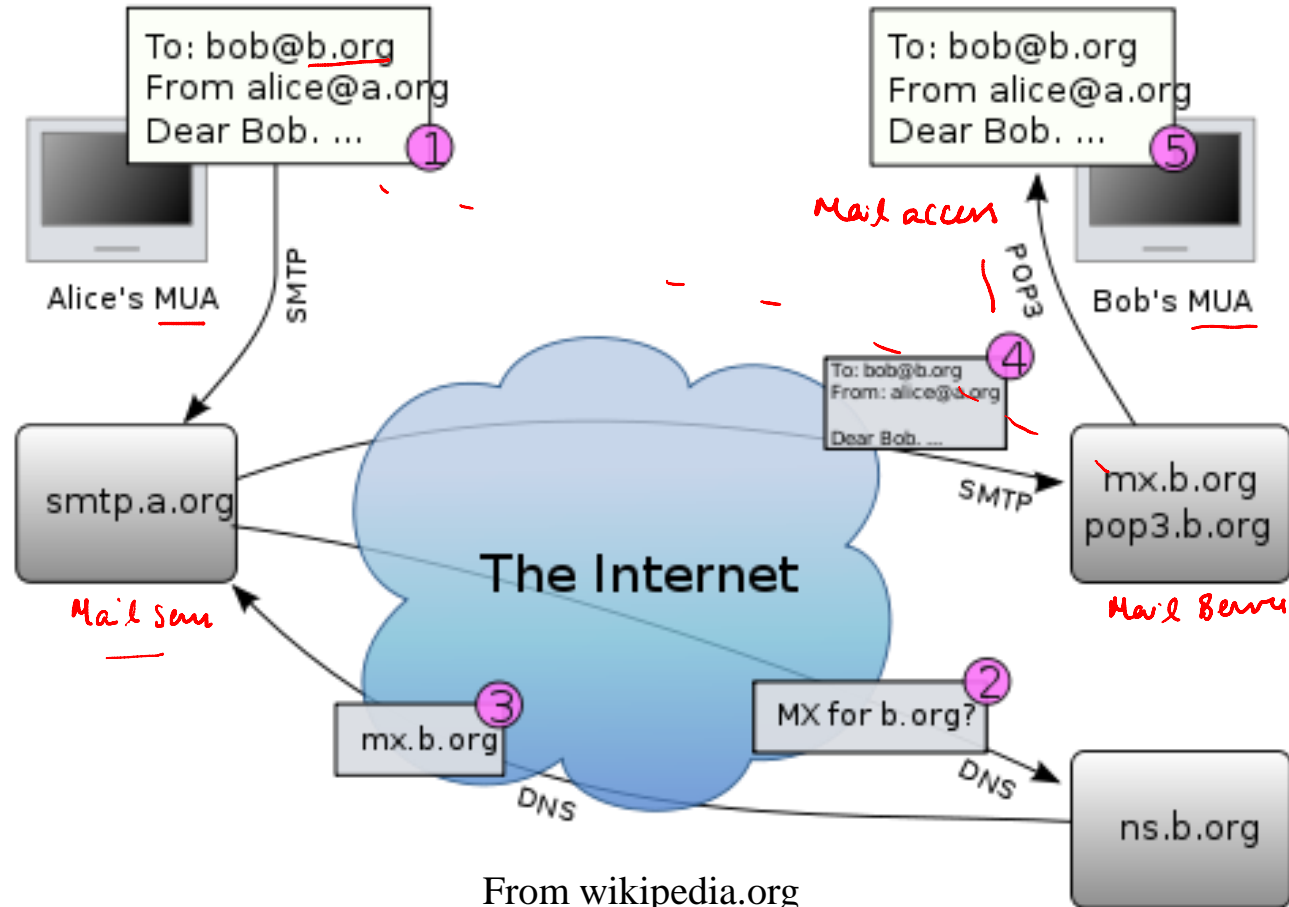
- Look at the uploaded message format

Implementation Choices

- First email system was based on file transfer protocol
 - No internal structure; Many features missing
- How about direct connection between sending and receiving host?
 - Receiver machine may not always be on
 - User may want to retrieve mail from multiple machines
- Need always-on hosts → Shared Mail Servers

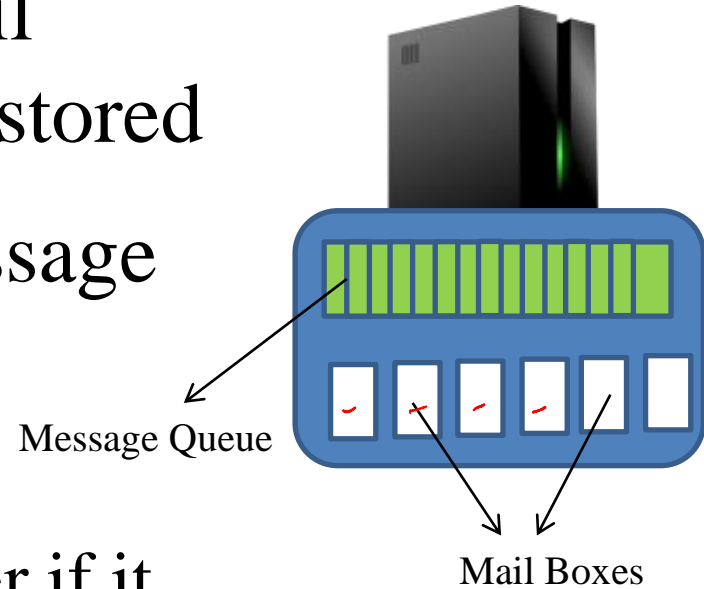
Architecture

- Sending mails is a PUSH operation
 - SMTP protocol
- Receiving mails is a PULL operation
 - POP3, IMAP, HTTP



Mail Servers

- Each user has a mailbox in a mail server, where user messages are stored
- Mail server also maintains a message queue of outgoing messages
 - In case of failure, attempts retransmissions and informs sender if it drops the message
- Both client and server side of SMTP run on a mail server



Summary

- Email is one of the oldest and a very popular application
- Enabled by User agents and Message transfer agents
- Email Messages are ASCII based and made up of header fields and body
- Architecture based on mail servers who move messages between hosts
 - Mail transfer protocol: SMTP
 - Mail access protocol: POP3/IMAP/HTTP