



E-Mail System

yca

Components of an E-Mail (1)

- ❑ You can really see ...
 - Headers, which can be forged, altered, etc.
 - Body

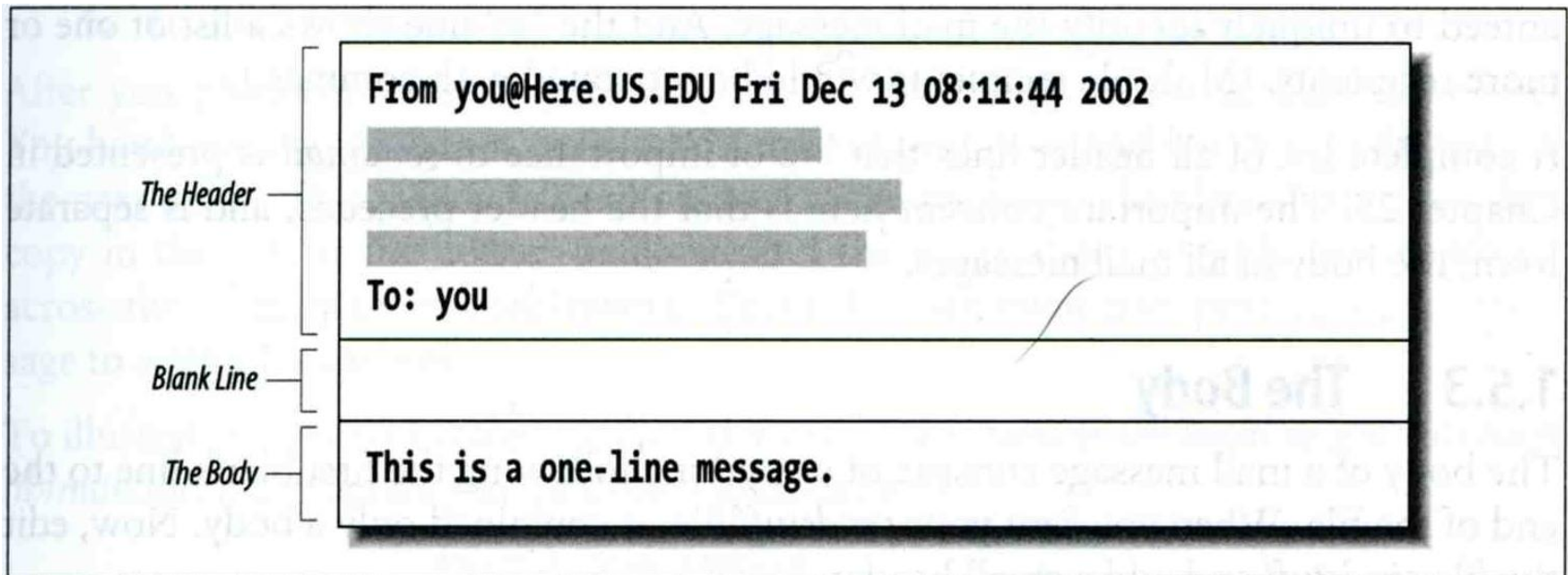


Figure 1-1. Every mail message is composed of a header and a body

Components of an E-Mail (2)

❑ Three major components

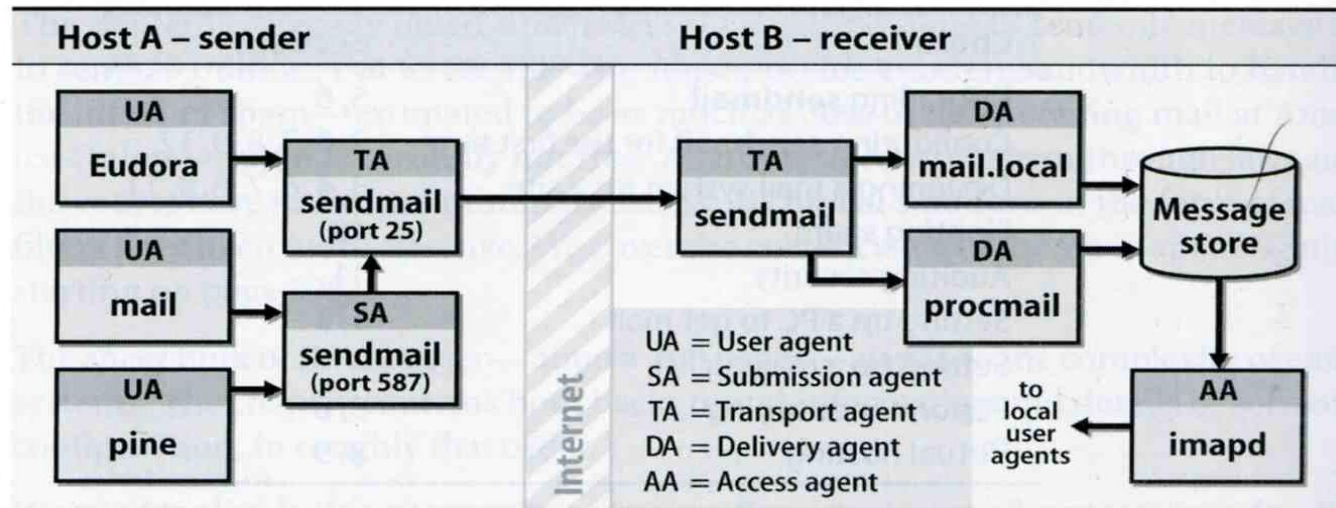
- The envelope
 - Invisible to users
 - Determine where the message should be delivered, or to whom it should be returned
- The headers
 - Information about the messages, defined in RFC2822
 - Date, From, To, Content-Type, charset
 - Content-Length, MessageID, ...
 - No checking consistent “To” in envelope and header
- The message body
 - Plain text only
 - Various MIME contents (attachments)
 - 7bit, quoted-printable, base64
 - 8bit, binary

Mail System

Major components

- **Mail User Agent (MUA)**
 - Help user read and compose mails
- **Submission Agent (SA)**
 - Route mails to local MTA
- **Mail Transport Agent (MTA)**
 - Route mails among machines
- **Delivery Agent (DA)**
 - Place mails in users' mail boxes
- **Access Agent (AA)**
 - Connects the user agent to the mail box using POP3 or IMAP protocols

Mail system components



Mail System

– The User Agent (1)

- ❑ Help user read and compose mails
 - UA must know mail format
 - Originally: Text only
 - Now: MIME

 - ※ MIME (Multipurpose Internet Mail Extensions)
 - Include several types of content that can be encoded in the mail
 - image, video, virus, ...

Mail System

- The User Agent (2)

- Popular Mail User Agents

User Agent	System Config.	User Config.	MIME	POP	IMAP	SMTP
mail	mail.rc	.mailrc				
mutt	/etc/Muttrc	.muttrc	✓	✓	✓	✓
Netscape	-	-	✓	✓	✓	✓
Outlook Ep.	-	-	✓	✓	✓	✓
MS Outlook	-	-	✓	✓	✓	✓
Thunderbird	-	-	✓	✓	✓	✓
In Smartphones	-	-	✓	✓	✓	✓

Mail System

– The Submission Agent

❑ Route mails to local MTA

- Typical works that a MTA must do:
 - Ensuring that all hostname are fully qualified
 - Modifying headers
 - MessageID
 - Date
 - DomainKeys/DKIM
 - Logging errors
 - ...
- RFC2476 introduces the idea of splitting MTA
 - Let SA to share the load

Mail System

– The Transport Agent (1)

❑ Route mails among machines

- Accept mail from UA, examine the recipients' addresses, and delivery the mail to the correct host
- Protocols
 - SMTP (Simple Mail Transport Protocol)
 - RFC 821
 - ESMTP (Extended SMTP)
 - RFC 2821 → ... → 5321 (2008)
- Popular transport agents
 - sendmail <http://www.sendmail.org/>
 - Postfix <http://www.postfix.org/>
 - exim, qmail, ...

Mail System

– The Transport Agent (2)

❑ Conversation between MTAs

- Threat of eavesdropping

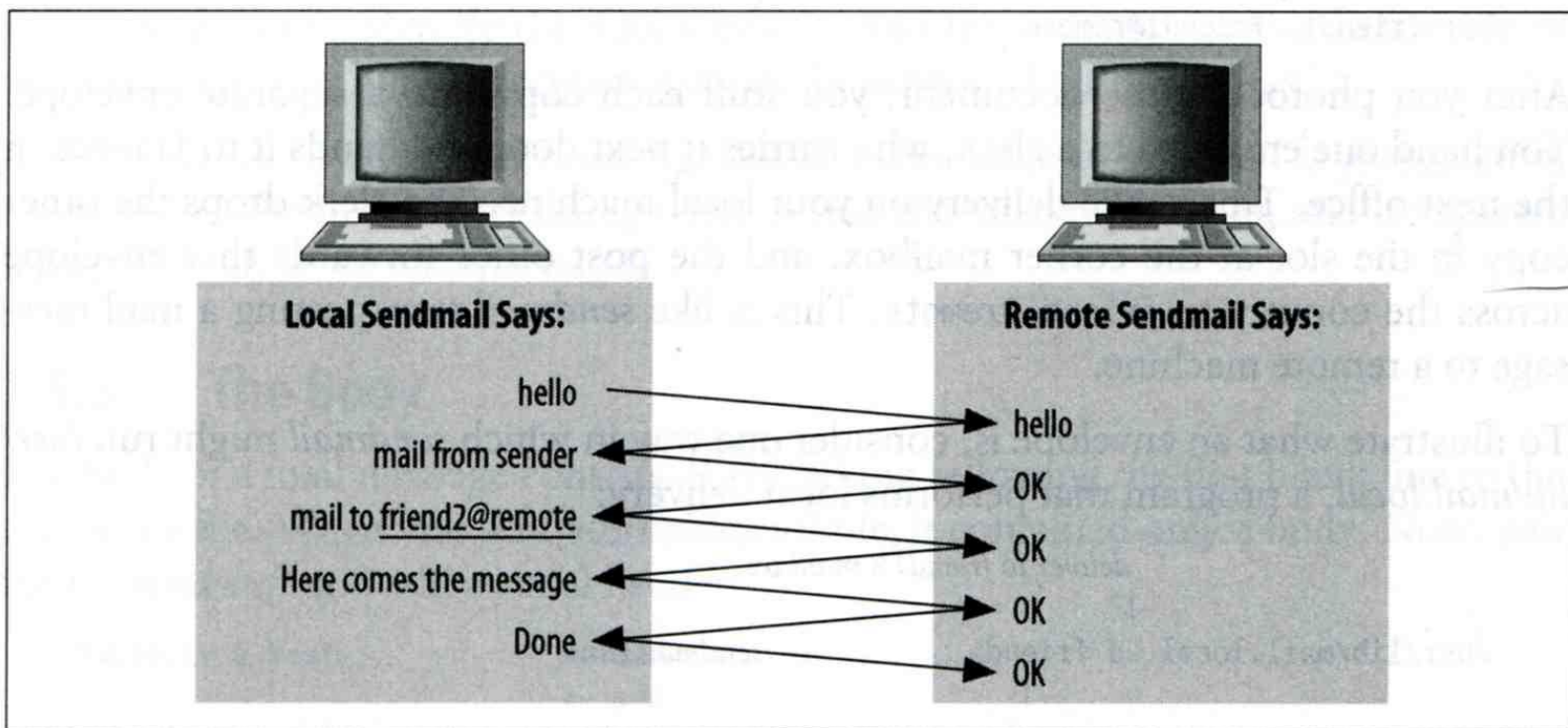


Figure 1-2. A simplified conversation

Mail System

– The Transport Agent (3)

❑ Protocol: SMTP

```
$ telnet csmailgate 25
Trying 140.113.235.103...
Connected to csmailgate.
Escape character is '^]'.
220 csmailgate.cs.nctu.edu.tw ESMTP Postfix
ehlo bsd5.cs.nctu.edu.tw
250-csmailgate.cs.nctu.edu.tw
250-PIPELINING
250-SIZE 204800000
250-VRFY
250-ETRN
250-ENHANCEDSTATUSCODES
250-8BITMIME
250 DSN
```

```
mail from: <liuyh@cs.nctu.edu.tw>
250 2.1.0 Ok
rcpt to: <liuyh@cs.nctu.edu.tw>
250 2.1.5 Ok
data
354 End data with <CR><LF>.<CR><LF>
From: haha <devnull@cs.nctu.edu.tw>
To: admin@hinet.net

hehe... I spammed you!
.
250 2.0.0 Ok: queued as 81BD4FB4
quit
221 2.0.0 Bye
Connection closed by foreign host.
```

```
From: haha <devnull@cs.nctu.edu.tw>
To: admin@hinet.net
Message-Id: <20120501070002.81BD4FB4@csmailgate.cs.nctu.edu.tw>
Date: Tue, 1 May 2012 14:59:53 +0800 (CST)
```

hehe... I spammed you!

Mail System

– The Delivery Agent

❑ Place mails in users' mailboxes

- Accept mail from MTA and deliver the mail to the local recipients
- Type of recipients
 - User
 - Program
 - procmail
 - bogofilter
- procmail
 - Do something between mail coming in and stored in mail box
 - https://help.cs.nctu.edu.tw/help/index.php/設定_-_郵件過濾設定

Mail System

– The Access Agent

- ❑ Help user download mail from server
 - Protocols
 - IMAP (Internet Message Access Protocol)
 - POP3 (Post Office Protocol – Version 3)

Mail Addressing – Domain (1)

❑ Two kinds of email addresses:

- Route based address (obsolete)
 - Message will travel through several intermediate hosts to the destination
 - Format: host!path!user
 - Ex: castle!sun!sierra!hplabs!ucbvax!winsor
 - This mail is sent from “castle” host to the user “winsor” at “ucbvax” host
- Location independent address
 - Simply identify the final destination
 - Format: user@host.domain
 - Ex: liuyh@nasa.cs.nctu.edu.tw

Mail Addressing – Domain (2)

❑ Where to send the mail?

- When you want to send a mail to liuyh@cs.nctu.edu.tw, the MTA will:
 - First, lookup up the mail exchanger of "cs.nctu.edu.tw"

```
$ dig mx cs.nctu.edu.tw
```

```
;; ANSWER SECTION:
```

```
cs.nctu.edu.tw.      3600  IN    MX    5  csmx2.cs.nctu.edu.tw.  
cs.nctu.edu.tw.      3600  IN    MX    10 csmx3.cs.nctu.edu.tw.  
cs.nctu.edu.tw.      3600  IN    MX    5  csmx1.cs.nctu.edu.tw.
```

- If there is any servers, try until success from the **higher preference** one to the lower
- If no MX records, mail it directly to the host (A record)

Mail Addressing – Domain (3)

❑ Why using “Mail eXchanger”?

- We can centralize all the mail tasks to group of servers
- Multiple mail exchangers make it more robust

Mail Addressing – Alias

❑ Alias

- Map a username to something else
 - Be careful of **mail looping**

❑ Several mechanisms to define aliases:

- Traditional method: in files
- Traditional method with NIS
- LDAP (Light-weight Directory Access Protocol)

❑ When the mail server wants to resolve name

- File-based method
 - look up files to resolve by itself
- LDAP-based method
 - call LDAP server to resolve the name and return the results

Mail Alias

– Traditional aliasing mechanism (1)

❑ Aliases can be defined in three places

- In MUA's configuration file
 - Read by MUA and expand the alias before injecting the message into the mail system
- In the system-wide `/etc/mail/aliases` file
 - Read by DA
 - The path to the system-wide alias file can be specified in mail server's configuration file
- In user's forwarding file, `~/.forward`
 - Read by DA after system-wide alias file
 - `forward(5)`

Mail Alias

– Traditional aliasing mechanism (2)

❑ The format of an entry in aliases file

1. Local-name: recipient1,recipient2,...

• Ex:

- admin: huanghs,chiahung,liuyh
- liuyh: liuyh@cs.nctu.edu.tw
- root: ta

2. Local-name: **:include:**filename

• Ex:

- ta: :include:/usr/local/mail/TA

Contents of TA

```
chiahung
huanghs
liuyh
changlp
cychao
wangth
pml
```

Mail Alias

– Traditional aliasing mechanism (3)

□ The format of an entry in aliases file

3. Local-name: absolute-path-file

- Mails will be appended to this file
- Ex:
 - complaints: `/dev/null`
 - troubles: `trouble_admin,trouble_log`
 - trouble_admin: `:include:/usr/local/mail/troadm`
 - trouble_log: `/usr/local/mail/logs/troublemail`

4. Local-name: "|program-path"

- Route mail to stdin of program
- Ex:
 - autoftp: `"|/usr/local/bin/ftpserver"`
 - nahw1: `"|/home/nahw1/receive.pl"`

Mail Alias

– Traditional aliasing mechanism (4)

❑ The hashed aliases DB

- /etc/mail/aliases is the plaintext aliases information
- /etc/mail/aliases.db is the hashed version for efficiency
- Use “newaliases” command to rebuild the hashed version when you change the aliases file
 - The file read from “:include:” is outside the aliases file

Mail Alias

– Traditional aliasing mechanism (5)

- ❑ User maintainable forwarding file
 - In ~/.forward
 - Format: comma-separated
 - Ex:
 - liuyhh@gmail.com
 - \liuyh, liuyhh@gmail.com, liuyhh00@yahoo.com.tw
 - Must be owned by user and with permission of 600
 - The path to .forward file should be writable only to user

Mail Alias

– Traditional aliasing mechanism (6)

❑ Alias must

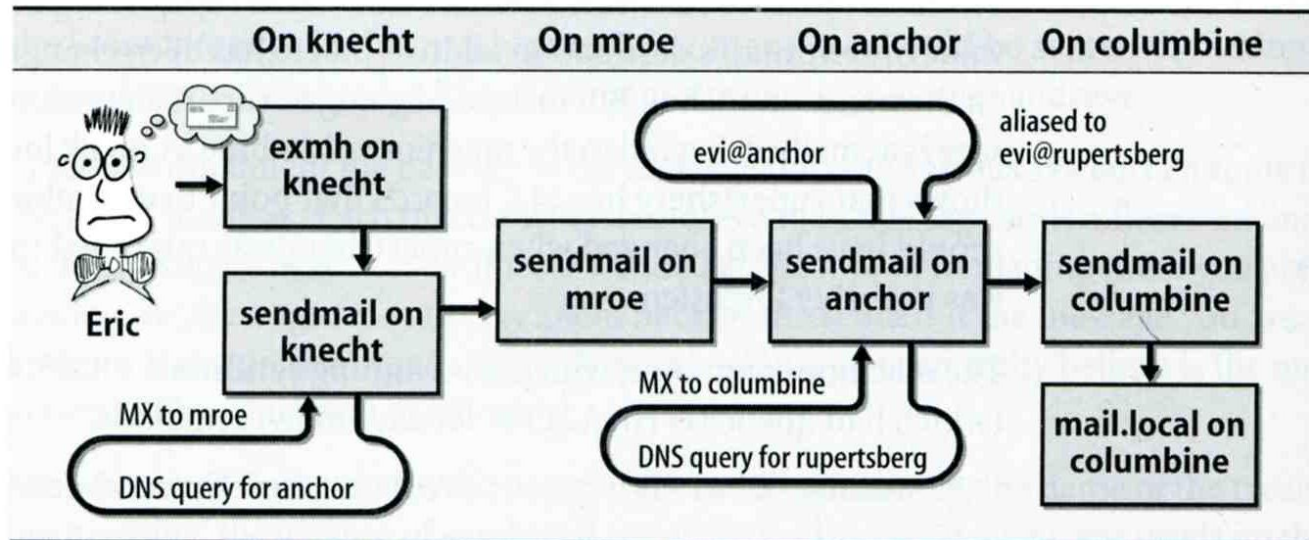
- postmaster and MAILER-DAEMON
 - Mail system maintainer
- bin, sys, daemon, nobody, ...
 - System accounts (root)
- root
 - forward root mail to the administrator
 - /root/.forward
 - aliases

```
MAILER-DAEMON: postmaster  
postmaster: root  
bin:      root  
bind:    root  
daemon:  root  
games:   root  
kmem:    root  
mailnull: postmaster  
nobody:  root  
operator: root  
...
```

Mail Transport Example

- ❑ User eric@knecht.sendmail.org sends a email to user evi@anchor.cs.colorado.edu
 - % dig mx anchor.cs.colorado.edu
 - mroe.cs.colorado.edu

A message from Eric



Mail Headers (1)

❑ Defined by RFC2822

- Mail reader will hide some uninteresting header information

```
Date: Wed, 18 Apr 2007 14:05:04 +0800
From: 大小姐 <lkg-girl@mail.richhome.net>
Subject: 笑狗好可怕
To: Yung-Hsiang Liu <liuyh@nabsd.cs.nctu.edu.tw>
User-Agent: Mutt/1.5.15 (2007-04-06)
```

你趕快把牠趕跑好不好？

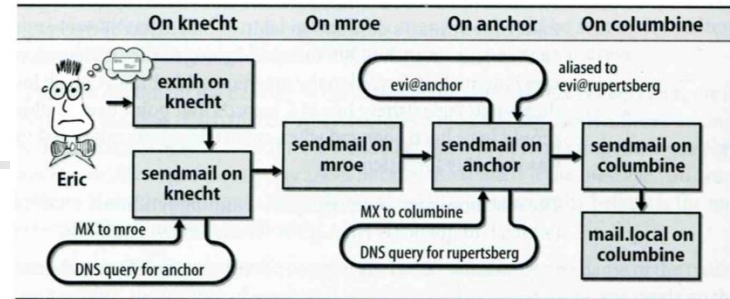
Mail Headers (2)

```
From chwong@chbsd.cs.nctu.edu.tw Wed Apr 18 14:07:21 2007
Return-Path: <chwong@chbsd.cs.nctu.edu.tw>
X-Original-To: liuyh@nasa.cs.nctu.edu.tw
Delivered-To: liuyh@nasa.cs.nctu.edu.tw
Received: from chbsd.cs.nctu.edu.tw (chbsd.csie.nctu.edu.tw [140.113.17.212])
    by nasa.cs.nctu.edu.tw (Postfix) with ESMTP id 22EC73B4D51
    for <chwong@nabsd.cs.nctu.edu.tw>; Wed, 18 Apr 2007 14:07:21 +0800 (CST)
Received: from chbsd.cs.nctu.edu.tw (localhost [127.0.0.1])
    by chbsd.cs.nctu.edu.tw (8.13.8/8.13.8) with ESMTP id I3I654P3060925
    for <chwong@nabsd.cs.nctu.edu.tw>; Wed, 18 Apr 2007 14:05:04 +0800 (CST)
    (envelope-from chwong@chbsd.cs.nctu.edu.tw)
Received: (from chwong@localhost)
    by chbsd.cs.nctu.edu.tw (8.13.8/8.13.8/Submit) id I3I654AY060924
    for chwong@nabsd.cs.nctu.edu.tw; Wed, 18 Apr 2007 14:05:04 +0800 (CST)
    (envelope-from chwong)
Date: Wed, 18 Apr 2007 14:05:04 +0800
From: =?utf-8?B?5aSn5bCP5aeQ?= <lkk-girl@mail.richhome.net>
To: Yung-Hsiang Liu <liuyh@nasa.cs.nctu.edu.tw>
Subject: =?utf-8?B?56yR54uX5aW95Y+v5oCV?=
Message-ID: <20070418060503.GA60903@chbsd.csie.nctu.edu.tw>
MIME-Version: 1.0
Content-Type: text/plain; charset=utf-8
Content-Disposition: inline
Content-Transfer-Encoding: 8bit
User-Agent: Mutt/1.5.15 (2007-04-06)
Status: RO
Content-Length: 23
Lines: 1
```

你趕快把牠趕跑好不好？

Mail Headers (3)

A message from Eric



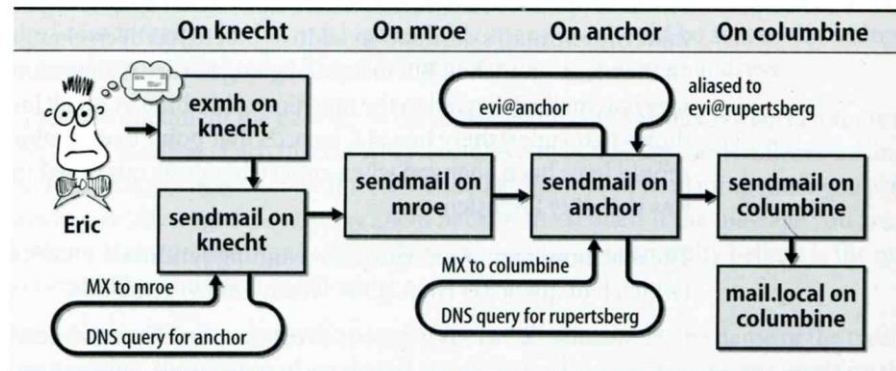
□ Headers in the example

- From `eric@knecht.sendmail.org`
 - Added by mail.local when the mail is put in user's mailbox
 - Used to separate message boundary
- Return-Path: `eric@knecht.sendmail.org`
 - The envelope "mail from"
 - Used to send the error message to this address
 - May be different to the "From" address
- Delivered-To: `evi@rupertsberg`
 - Final envelope "rcpt to"
- Received: from `knecht.sendmail.org (localhost [127.0.0.1])` by `knecht.sendmail.org (8.9.3/8.9.2)` with ESMTP id `GAA18984`; Fri 1 Oct 1999 06:04:02 -800 (PST)
 - Every machine that is ever processed this mail will add a "Received" record in top of headers
 - Sending machine ∙ Receiving machine ∙ Mail server software in receiving machine
 - Unique queue identifier of mail server in receiving machine ∙ Date and time

Mail Headers (4)

- Received: from [anchor.cs.Colorado.EDU](mailto:root@anchor.cs.colorado.edu) (root@anchor.cs.colorado.edu [128.138.242.1]) by columbine.cs.colorado.edu (8.9.3/8.9.2) with ESMTP id HAA21741 for evi@rupertsberg.cs.colorado.edu; Fri, 1 Oct 1999 07:04:25 -0700 (MST)
- Received: from more.cs.colorado.edu (more.cs.colorado.edu [128.138.243.1]) by anchor.cs.colorado.edu (8.9.3/8.9.2) with ESMTP id HAA26176 for evi@anchor.cs.colorado.edu; Fri, 1 Oct 1999 07:04:24 -0700 (MST)
- Received: from knecht.sendmail.org (knecht.sendmail.org [209.31.233.160]) by more.cs.colorado.edu (8.9.3/8.9.2) with ESMTP id HAA09899 fro evi@anchor.cs.colorado.edu; Fri, 1 Oct 1999 07:04:23 -700 (MST)
- Received: from knecht.sendmail.org (localhost [127.0.0.1]) by knecht.sendmail.org (8.9.3/8.9.2) with ESMTP id GAA18984; Fri 1 Oct 1999 06:04:02 -800 (PST)

A message from Eric



Mail Headers (5)

- Message-Id: <199910011404.GAA18984@knecht.sendmail.org>
 - Add by sender's MTA
- X-Mailer: exmh version 2.0.2 2/24/98
 - MUA
 - Non-standard header information
- To: Evi Nemeth <evi@anchor.cs.colorado.edu>
- Subject: Re: hi
- Date: Fri, 1 Oct 1999 06:04:02 -800

Mail Storage

- ❑ The place on the local machine where email is stored
 - Usually the directory: `/var/mail` or `/var/spool/mail`
 - Users' mails are stored in files named with each user's login name
 - Eg. `/var/mail/liuyh`
 - Permission "775" and root:mail as the owner and group owner
 - `drwxrwxr-x 2 root mail 512 Dec 16 15:51 mail/`
 - Using database
 - When the organization is large or for ISP with millions of customers
 - Easy to search, categorize

Mail System Architecture

❑ Simplest architecture

- Only one machine
 - Has MTA to let you send and receive mail
 - Provides storage for mailboxes
 - Provides IMAP or POP3 to let you download mail from PC

❑ Components in a mail system architecture

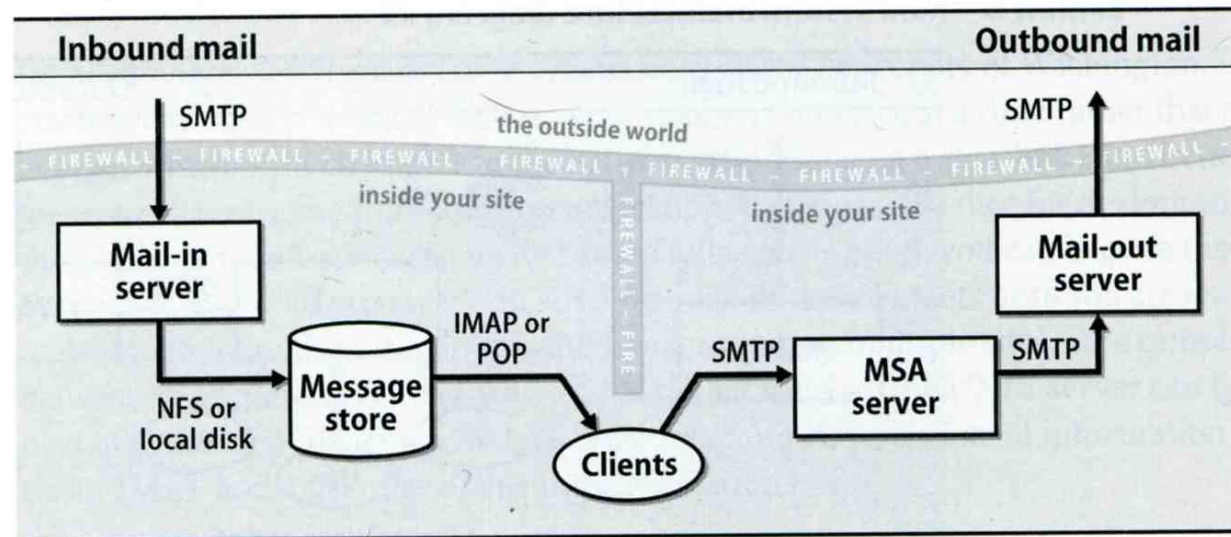
- Mail servers for incoming and/or outgoing mails
- Storage for mailboxes
- IMAP or POP3 to integrate PC and remote clients
 - The issue of file locking

Mail System Architecture – Scalable architecture for medium sites

❑ Centralize

- At least one machine for incoming message and
 - Mail home can be the same host or another one
- At least one machine for outgoing message
 - Each host run MSA and forward mail to the same mail-out server or send the mail directly

Mail system architecture



To, Cc, and Bcc

- ❑ You should always make sure you e-mail the right people
 - The **To field** is for people that the message directly affects, and that you require action from.
 - The **Cc (or carbon copy) field** is for people you want to know about the message, but are not directly involved.
 - The **Bcc field (Blind Carbon Copy)** is used when you want other people to receive the message, but you don't want the other recipients to know they got it.
- ❑ There are “To” and “Cc,” but not “Bcc” in the email headers.
 - **Why** “No checking consistent “To” in envelope and header”

vacation(1)

□ E-mail auto-responder

- returns a message, `~/.vacation.msg` by default
- `~/.vacation.db`
 - default database file for `db(3)`
- `~/.vacation.{dir,pag}`
 - default database file for `dbm(3)`
- `~/.vacation.msg`
 - default message to send

□ Use with `forward(5)`

- `\liuyh, |/usr/bin/vacation`