



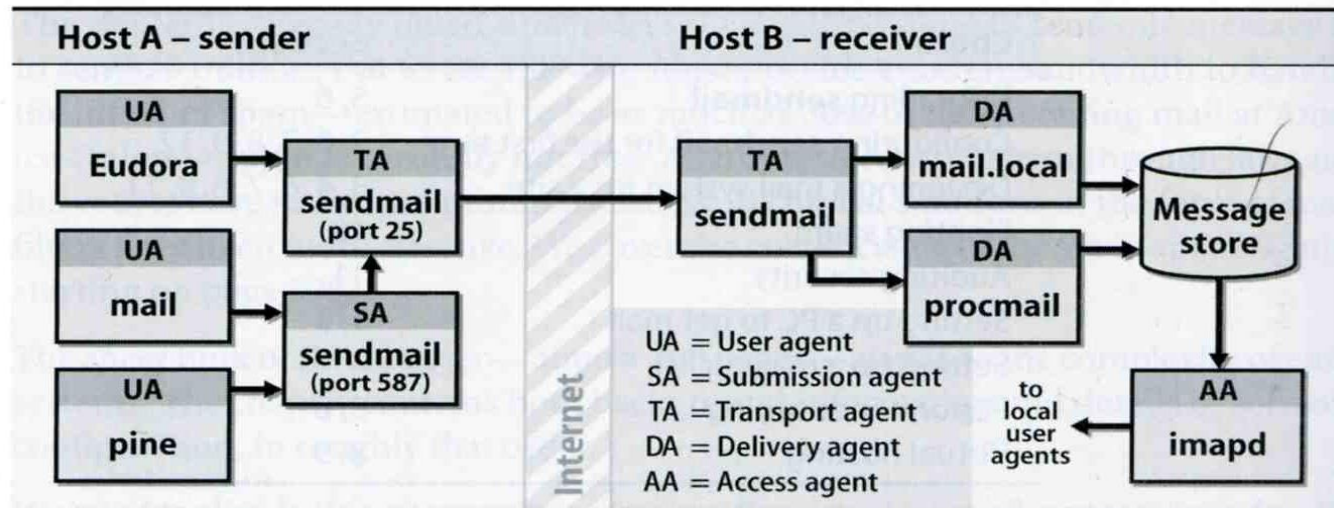
Mail System

Mail System

Major components

- Mail User Agent (MUA)
 - Help user read and compose mails
- 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 POP or IMAP protocols
- Submission Agent (SA)
 - Route mails to local MTA

Mail system components



Mail System

– The Message Stores

- ❑ 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
 - Such as /chwong
 - 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

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, such as image, video, ...

Mail System

- The User Agent (2)

- Popular Mail User Agents

User Agent	System Config.	User Config.	MIME	POP	IMAP	SMTP
bin/mail	mail.rc	.mailrc				
pine	pine.conf	.pinerc	✓	✓	✓	✓
elm	lib/elm.rc	.elm/elmrc	✓	✓	✓	
mutt	/etc/Muttrc	.muttrc	✓	✓	✓	
Netscape	-	-	✓	✓	✓	✓
Eudora	-	-	✓	✓	✓	✓
Outlook Ep.	-	-	✓	✓	✓	✓

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 1869, 1870, 1891, 1985
- Popular transport agents
 - sendmail <http://www.sendmail.org/>
 - Postfix <http://www.postfix.org/>

Mail System

- The Transport Agent (2)

□ Conversation between TAs

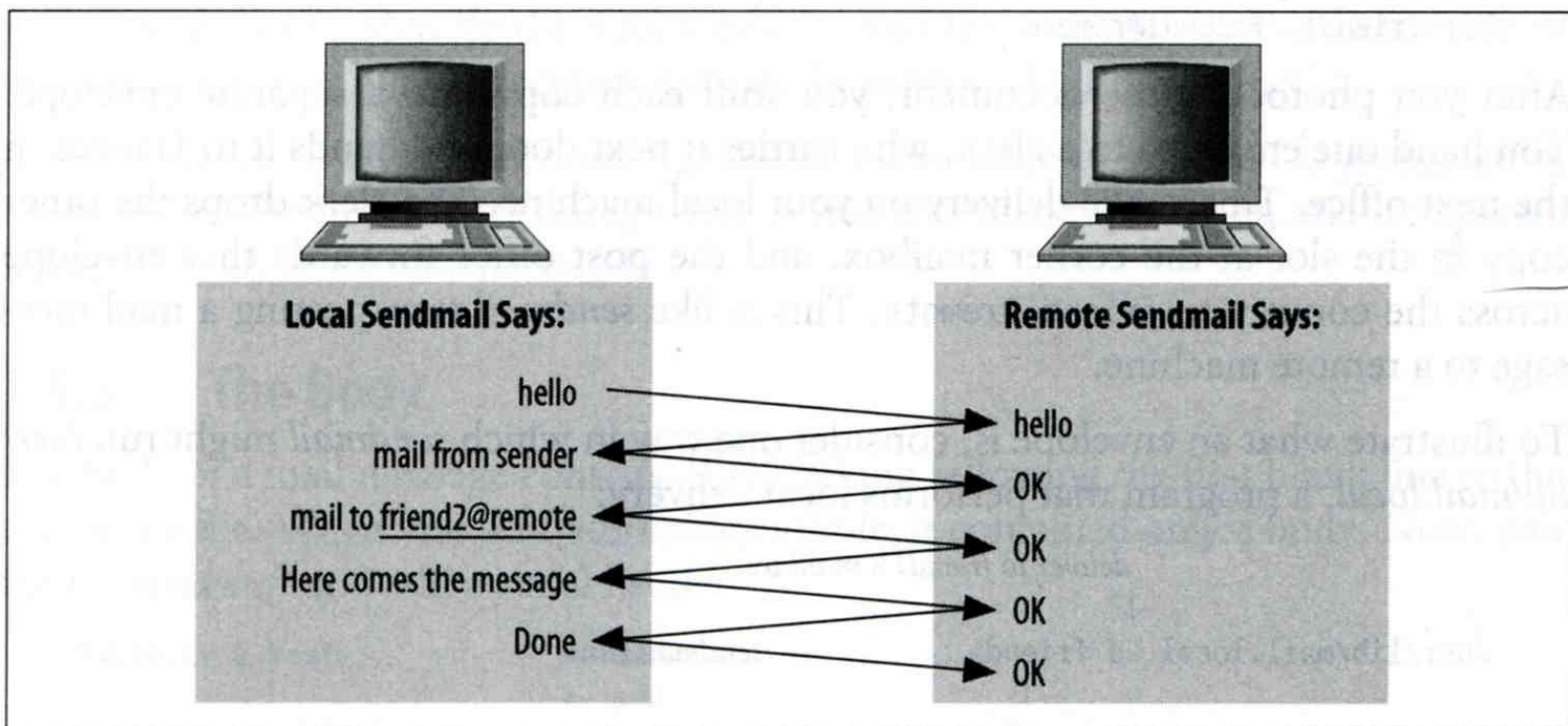


Figure 1-2. A simplified conversation

Mail System

- The Transport Agent (3)

❑ Protocol: SMTP

```
chbsd [/home/chwong] -chwong- telnet chbsd.cs.nctu.edu.tw 25
Trying 140.113.17.212...
Connected to chbsd.cs.nctu.edu.tw.
Escape character is '^]'.
220 chbsd.cs.nctu.edu.tw ESMTP Sendmail 8.13.8/8.13.8; Sun, 15 Apr 2007 13:50:16 +0800 (CST)
HELP
214-2.0.0 This is sendmail version 8.13.8
214-2.0.0 Topics:
214-2.0.0   HELO  EHLO  MAIL  RCPT  DATA
214-2.0.0   RSET  NOOP  QUIT  HELP  VRFY
214-2.0.0   EXPN  VERB  ETRN  DSN   AUTH
214-2.0.0   STARTTLS
214-2.0.0 For more info use "HELP <topic>".
214-2.0.0 To report bugs in the implementation see
214-2.0.0   http://www.sendmail.org/email-addresses.html
214-2.0.0 For local information send email to Postmaster at your site.
214 2.0.0 End of HELP info
HELO chbsd
250 chbsd.cs.nctu.edu.tw Hello chbsd.csie.nctu.edu.tw [140.113.17.212], pleased to meet you
QUIT
221 2.0.0 chbsd.cs.nctu.edu.tw closing connection
Connection closed by foreign host.
```


Mail System

– The Delivery Agent

❑ Place mails in users' mail boxes

- Accept mail from MTA and deliver the mail to the local recipients
- Type of recipients
 - User
 - Program, such as
 - mail.local
 - procmail
- mail.local
 - Read the stdin up to an EOF and appends it to each user's mail file
- procmail
 - Do something between mail coming in and stored in mail box
 - CS: Help → 5 → 2 → 8

<http://www.cs.nctu.edu.tw/help/procmail.htm>

Mail System

– The Access Agent

- ❑ Help user download mail from server
 - Protocols
 - IMAP (Internet Message Access Protocol)
 - POP (Post Office Protocol)

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
 - Logging errors
 - ...
 - RFC2476 introduces the idea of splitting MTA
 - Let SA to share the load

Components of a mail (1)

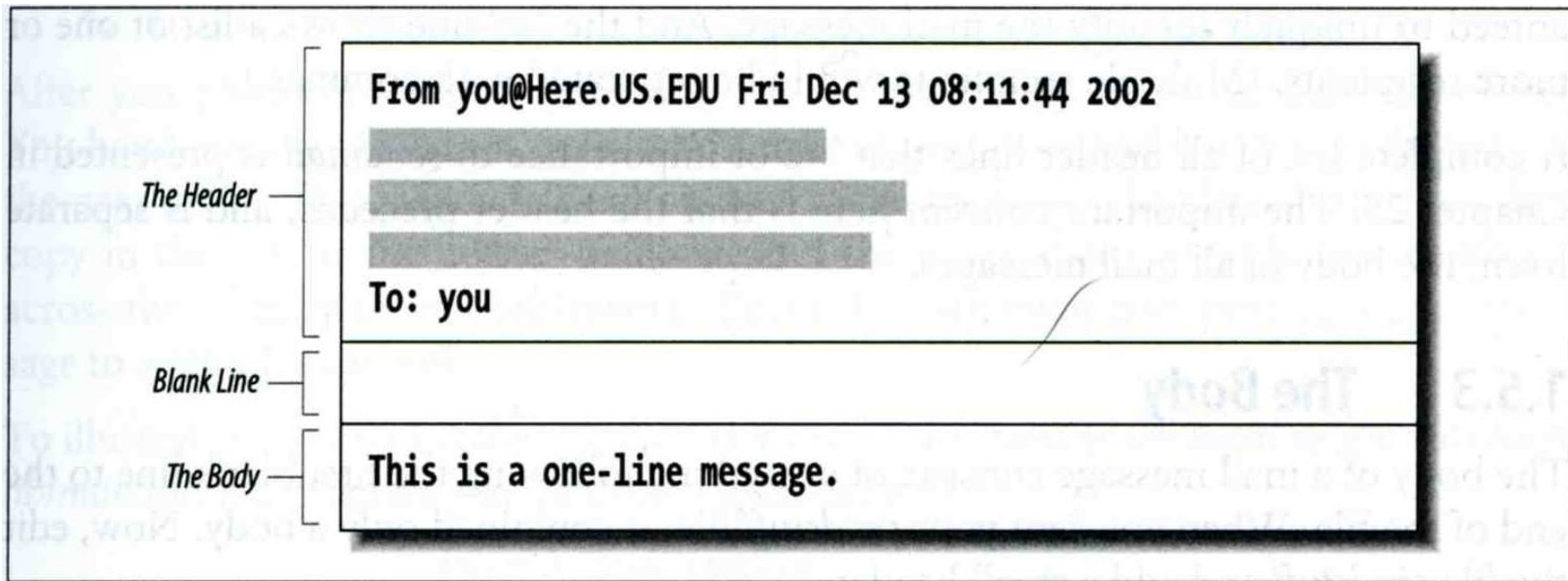


Figure 1-1. Every mail message is composed of a header and a body

Components of A 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 RFC822
 - From, To, Date, Time, MTA, ...
- The message body
 - Plain text only
 - Various MIME contents are encoded as printable characters using radix-64 algorithm

Mail Addressing (1)

□ Two kinds of email addresses:

- Route based address
 - 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: `chwong@nabsd.cs.nctu.edu.tw`

□ Alias

- Map a username to something else, such as
 - To a group of users
 - Ex: `ta` → `liuyh, wmliang, huangwh, ...`
 - To the same user at different machine
 - Ex: `chwong@nabsd.cs.nctu.edu.tw` → `chwong@cs.nctu.edu.tw`
 - To another user
 - Ex: `admin@cs.nctu.edu.tw` → `chwong@cs.nctu.edu.tw`

Mail Addressing (2)

□ Where to send the mail?

- When you want to send the mail to `chwong@cs.nctu.edu.tw`, the MTA will:
 - First, lookup up the mail exchanger of "`cs.nctu.edu.tw`"
 - `% dig mx cs.nctu.edu.tw`

```
nabsd [/home/chwong] -chwong- dig mx cs.nctu.edu.tw

;; ANSWER SECTION:
cs.nctu.edu.tw.  7200  IN  MX  5 csmx2.cs.nctu.edu.tw.
cs.nctu.edu.tw.  7200  IN  MX  10 csmx3.cs.nctu.edu.tw.
cs.nctu.edu.tw.  7200  IN  MX  5 csmx1.cs.nctu.edu.tw.
```

- If there is any servers, choose the higher preference one
- If this preferred one can not be connected, choose another
- If all the mx servers can not be connected (or not available), mail it directly to the host

Mail Addressing (3)

❑ Why using "Mail eXchanger"?

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

Mail Headers (1)

- ❑ Defined by RFC822 which is obsoleted 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: Tsung-Hsi Weng <chwong@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: chwong@nabsd.cs.nctu.edu.tw
Delivered-To: chwong@nabsd.cs.nctu.edu.tw
Received: from chbsd.cs.nctu.edu.tw (chbsd.csie.nctu.edu.tw [140.113.17.212])
    by nabsd.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: Tsung-Hsi Weng <chwong@nabsd.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
```

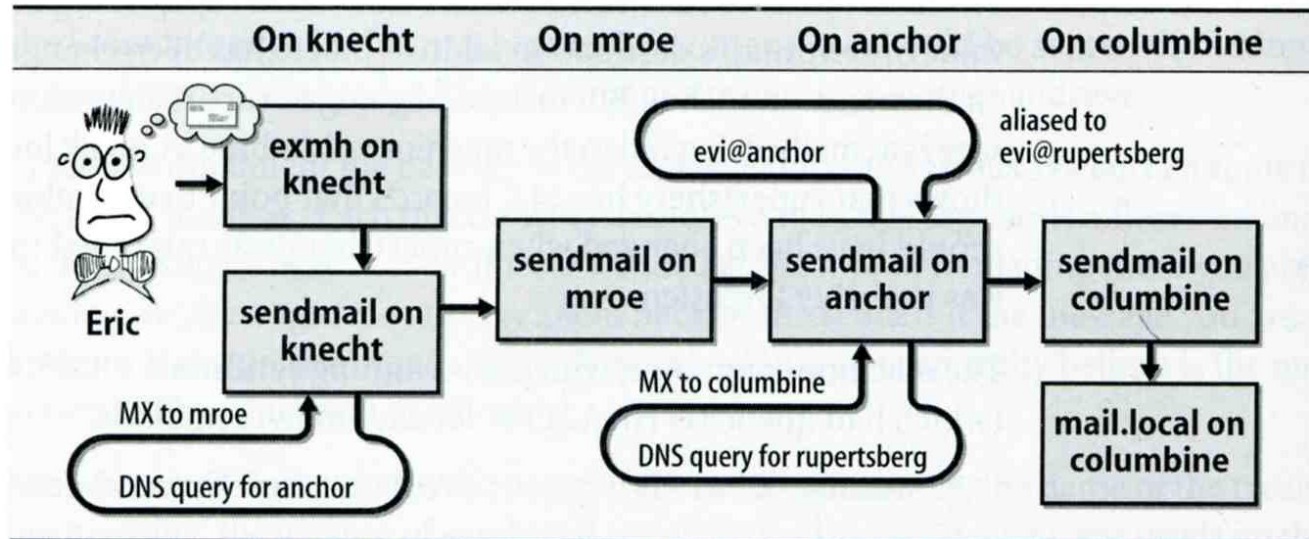
你趕快把牠趕跑好不好？

Mail Headers (3)

□ Example

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

A message from Eric



Mail Headers (4)

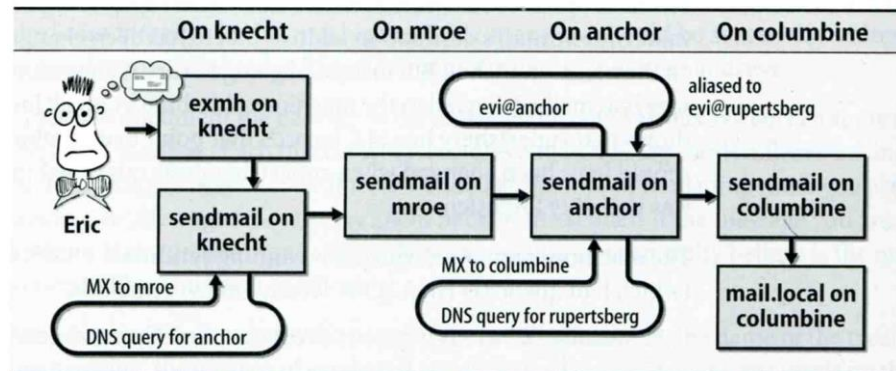
❑ Headers in this example

- 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
 - Used to send the error message to this address
 - May be different to the "From" address
- 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
 - Version of sendmail in receiving machine
 - Message unique identifier in receiving machine
 - Date and time

Mail Headers (5)

- 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 (6)

- 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 System Architecture

❑ Components in a mail system architecture

- Mail servers for incoming and outgoing mails
- Mail home
- IMAP or POP to integrate PC and remote clients

❑ Simplest architecture

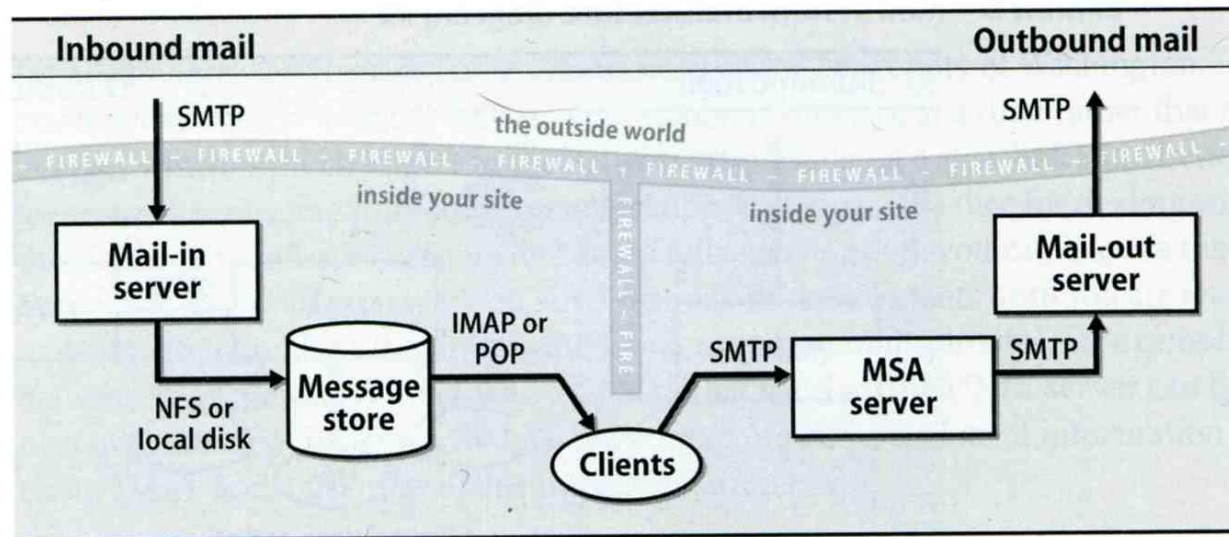
- Only one machine
 - This machine has sendmail to let you send and receive mail
 - This machine is also the mailbox home
 - This machine also provides IMAP or POP to let you download mail from PC

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



Mail Alias

❑ Several mechanisms to define aliases:

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

❑ When the sendmail wants to resolve name

- File-based method
 - sendmail looks up files to resolve it by itself
- LDAP-based method
 - sendmail 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 MTA
 - The path to the system-wide alias file can be specified in sendmail's configuration file
- In user's forwarding file, `~/.forward`
 - Read by MTA 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: chwong,chiahung

➤ chwong: chwong@chbsd.cs.nctu.edu.tw

2. Local-name: :include:another-file

• Ex:

➤ bsdTA: :include:/usr/local/mail/bsdTA

Contents of bsdTA

```
chwong
chiahung
lwhsu
liuyh
huangwh
```

Mail Alias

– Traditional aliasing mechanism (3)

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"

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

Mail Alias

– Traditional aliasing mechanism (5)

- ❑ User maintainable forwarding file
 - In ~/.forward
 - Format: comma-separated
 - Ex:
 - chwong@gmail.com
 - \chwong, chwong@gmail.com, chonsi_wong@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 (.forward)

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

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)`

- `|/usr/bin/vacation`