Postfix

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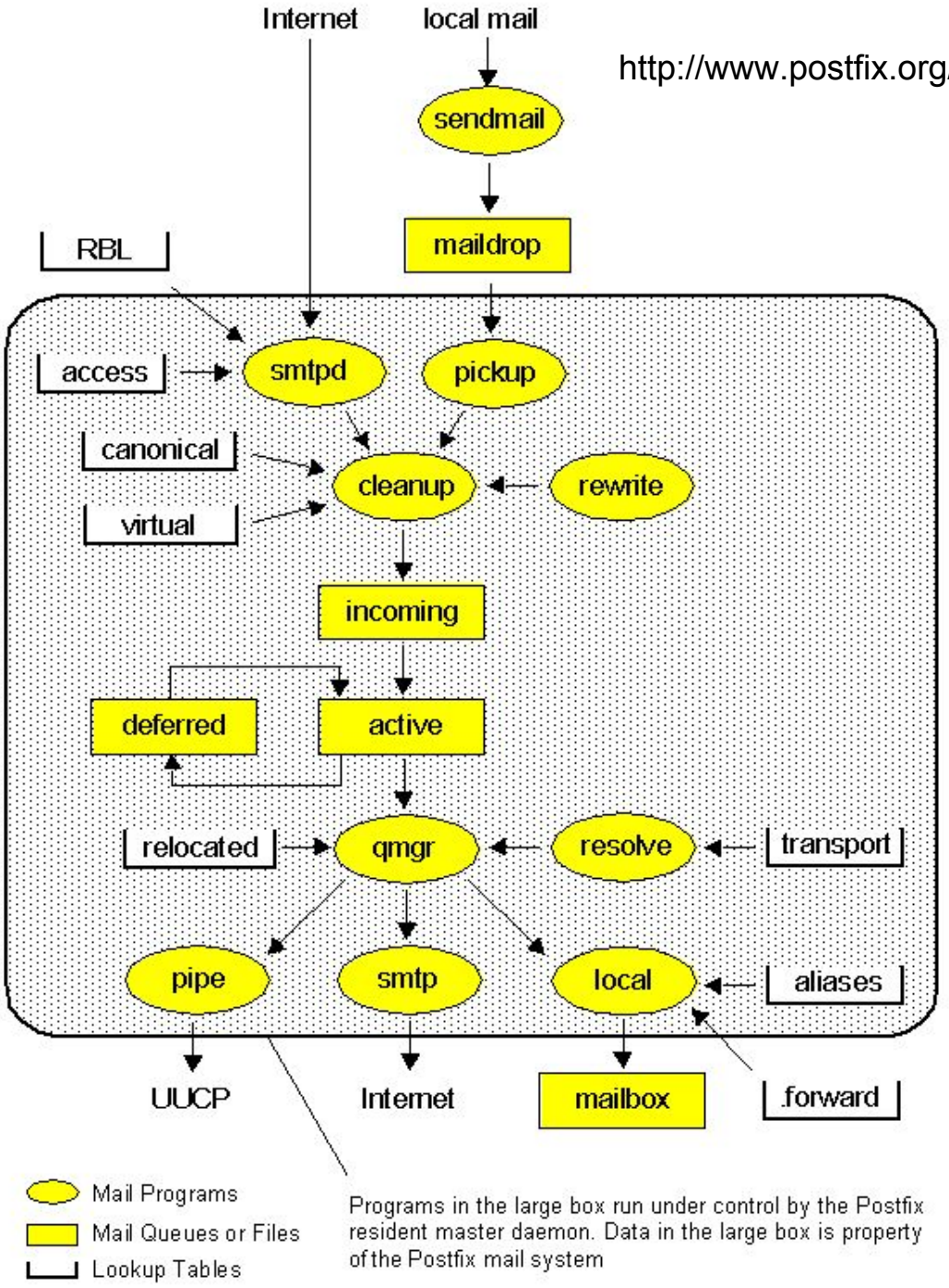
Outline

- A very long topic
- Step-by-step examples after brief introduction
- Outline
  - Brief introduction to Postfix
  - Step by step examples
    - Build a basic MTA that can send mails to other domain
      - Clients from localhost only
    - Add authentication to MTA so that other host can send with your host
    - Add encryption
    - Basic MTA/MDA/MAA that you can receive mails from other domain
  - Detailed Postfix configuration

Postfix

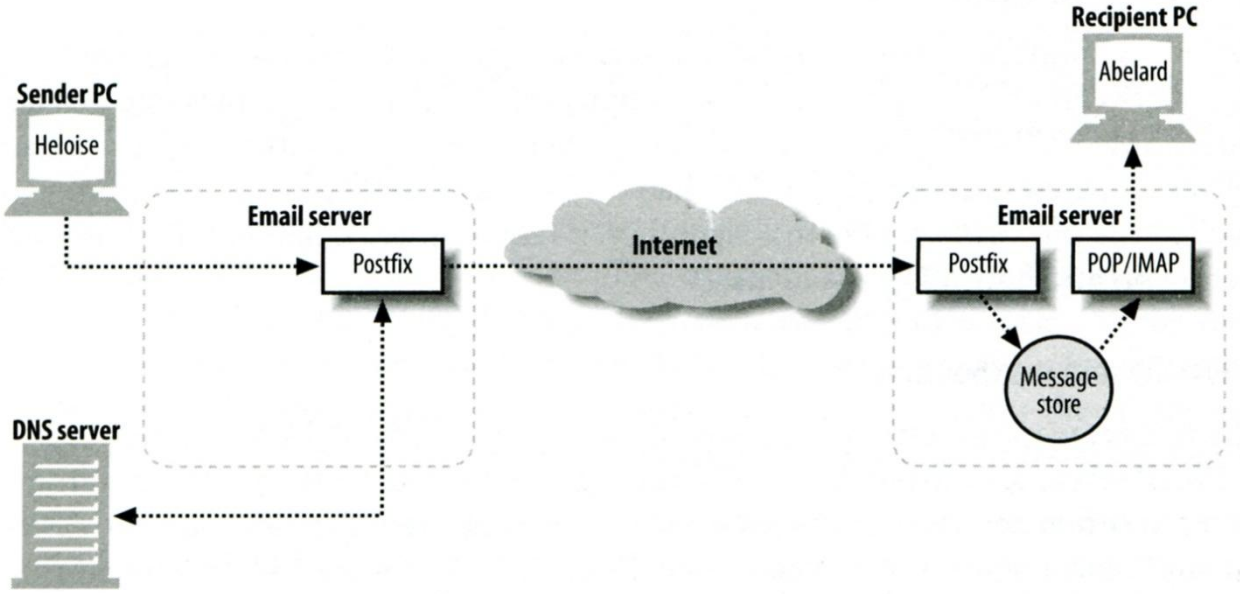
- Free and open source mail transfer agent (MTA)
  - For the routing and delivery of email
  - Intended as a fast, easy-to-administer, and secure alternative to the widely-used Sendmail
  - Formerly VMailer / IBM Secure Mailer
    - By Wietse Venema at the IBM Thomas J. Watson Research Center
  - IBM Public License
- First released in mid-1999
- http://www.postfix.org
  - http://www.postfix.org/documentation.html

http://www.postfix.org/OVERVIEW.html



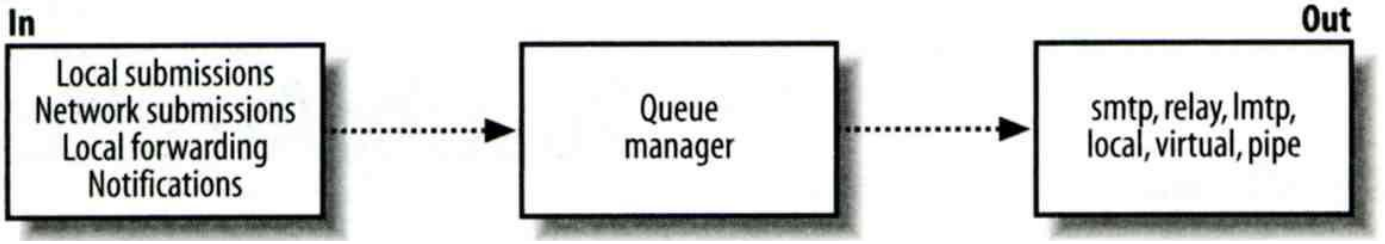
Role of Postfix

- MTA that
  - Receive and deliver email over the network via SMTP
  - Local delivery directly or use other mail delivery agent



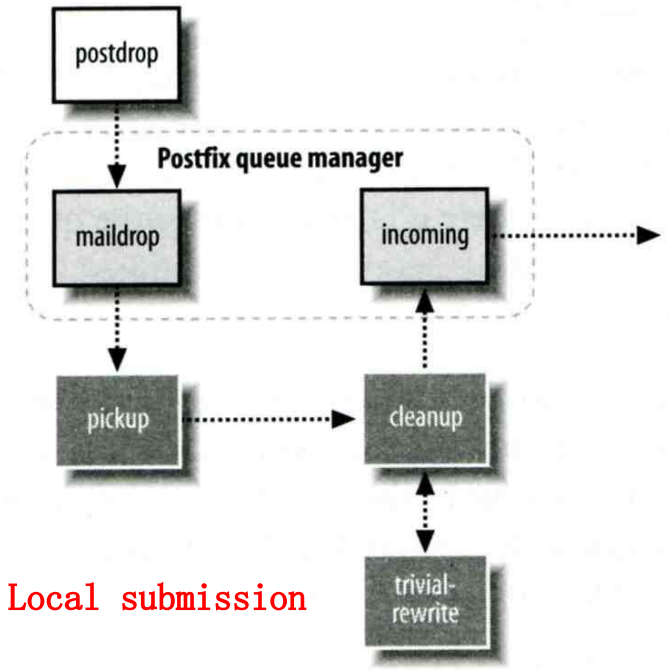
Postfix Architecture

- Modular-design MTA
  - Not like sendmail of monolithic system
  - Decompose into several individual program that each one handle specific task
  - The most important daemon: `master` daemon
    - Reside in memory
    - Get configuration information from master.cf and main.cf
    - Invoke other process to do jobs
- Major tasks
  - Receive mail and put in queue
  - Queue management
  - Delivery mail from queue

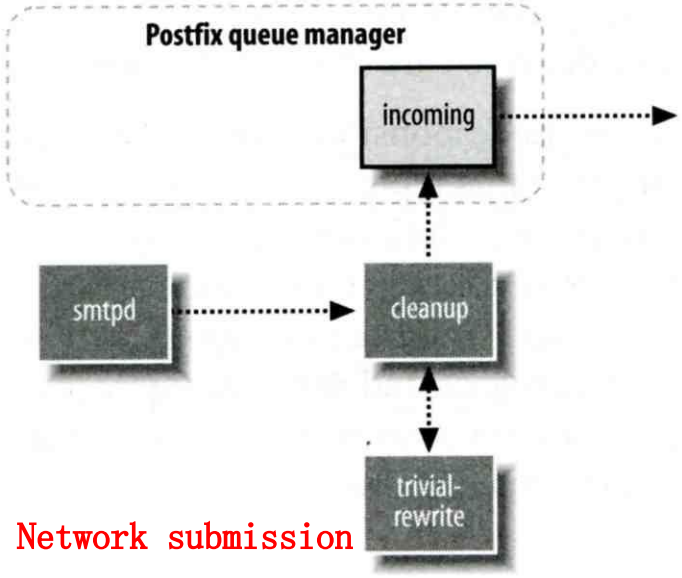


Postfix Architecture – Message IN

- Four ways
  - Local submission
    - postdrop command
    - maildrop directory
    - pickup daemon
    - cleanup daemon
      - Header validation
      - address translation
    - incoming directory
  - Network submission
    - smtpd daemon
  - Local forwarding
    - Resubmit for such as .forward
  - Notification
    - defer daemon
    - bounce daemon



Local submission



Network submission

Postfix Architecture – Queue

- Five different queues
  - incoming
    - The first queue that every incoming email will stay
  - active
    - Queue manager will move message into active queue whenever there is enough system resources
    - Queue manager then invokes suitable DA to delivery it
  - deferred
    - Messages that cannot be delivered are moved here
    - These messages are sent back either with bounce or defer daemons
  - corrupt
    - Used to store damaged or unreadable message
  - hold

    Used to hold message and wait admin to manually process

http://www.postfix.org/QSHAPE_README.html#queues

Postfix Architecture – Message OUT (1)

- Address classes
  - Used to determine which destinations to accept for delivery
  - How the delivery take place
- Main address classes
  - Local delivery
    - Domain names in "mydestination" is local delivered
    - Ex:
      - mydestination = nabsd.cs.nctu.edu.tw localhost
    - It will check alias and .forward file to do further delivery
  - Virtual alias
    - Ex:
      - virtual-alias.domain
      - user1@virtual-alias.domain address1
  - Virtual mailbox
    - Each recipient address can have its own mailbox
    - Ex:
      - virtual_mailbox_base = /var/vmail
      - /var/mail/vmail/CSIE, /var/mail/vmail/CS
  - Relay
    - Transfer mail for others to not yours domain
    - It is common for centralize mail architecture to relay trusted domain
  - Deliver mail to other domain for authorized user
    - The queue manager will invoke the smtp DA to deliver this mail

Postfix Architecture – Message OUT (2)

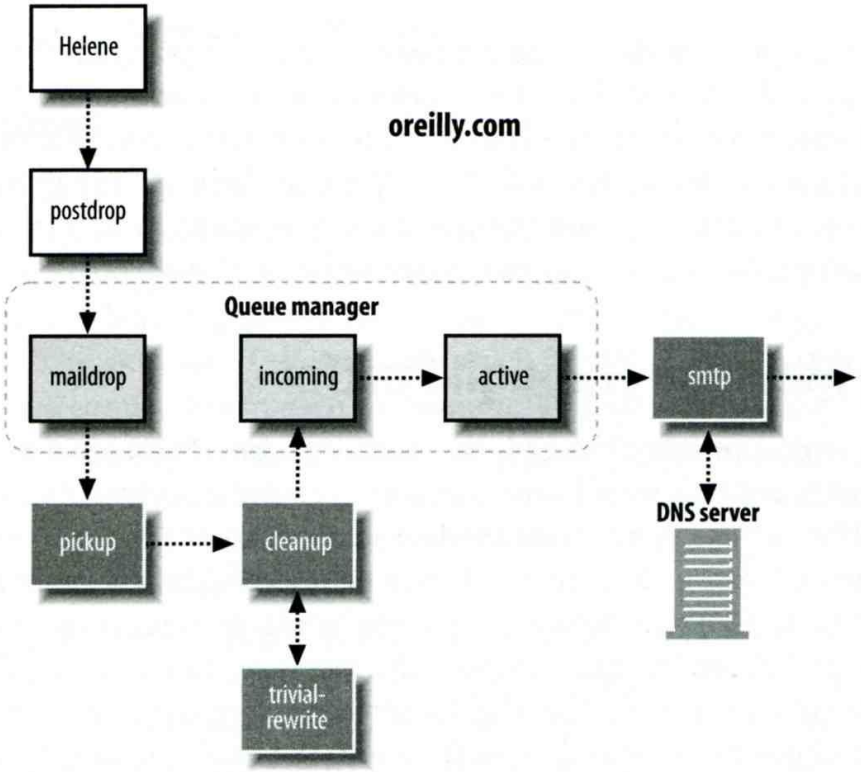
- Other delivery agent (MDA)
  - Specify in /usr/local/etc/postfix/master.cf
    - How a client program connects to a service and what daemon program runs when a service is requested

```
pickup    fifo  n       -       n       60      1       pickup
cleanup   unix  n       -       n       -       0       cleanup
bounce    unix  -       -       n
```

  - lmtp
    - Local Mail Transfer Protocol (Replaced by ESMTP)
    - Used for deliveries between mail systems on the same network even the same host
      - Such as postfix → POP/IMAP to store message in store with POP/IMAP proprietary format
  - pipe
    - Used to deliver message to external program

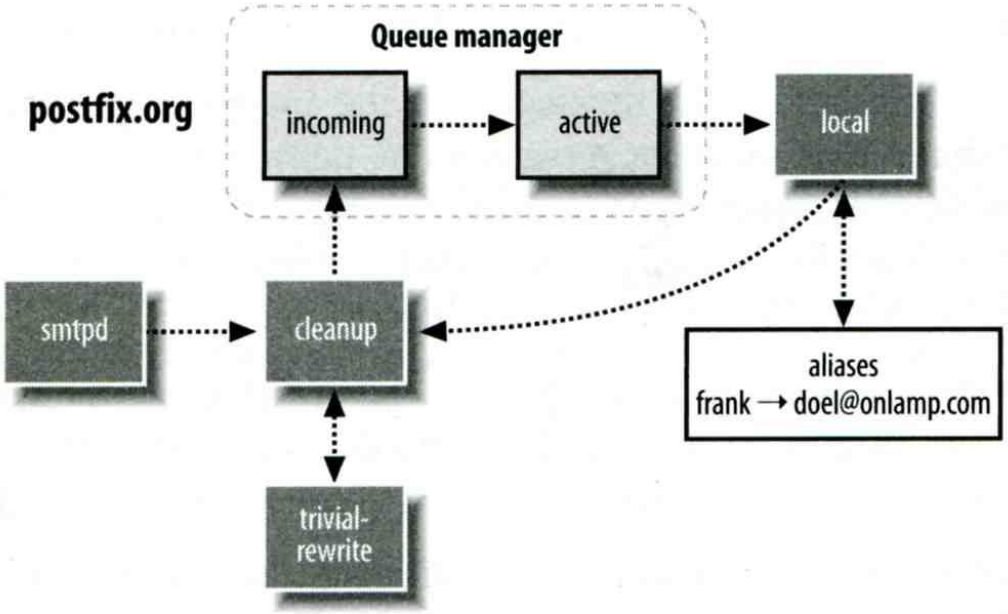
Message Flow in Postfix (1)

- Example
  - helene@oreilly.com → frank@postfix.org (doel@onlamp.com)
  - Phase1:
    - Helene compose mail using her MUA, and then call postfix's sendmail command to send it



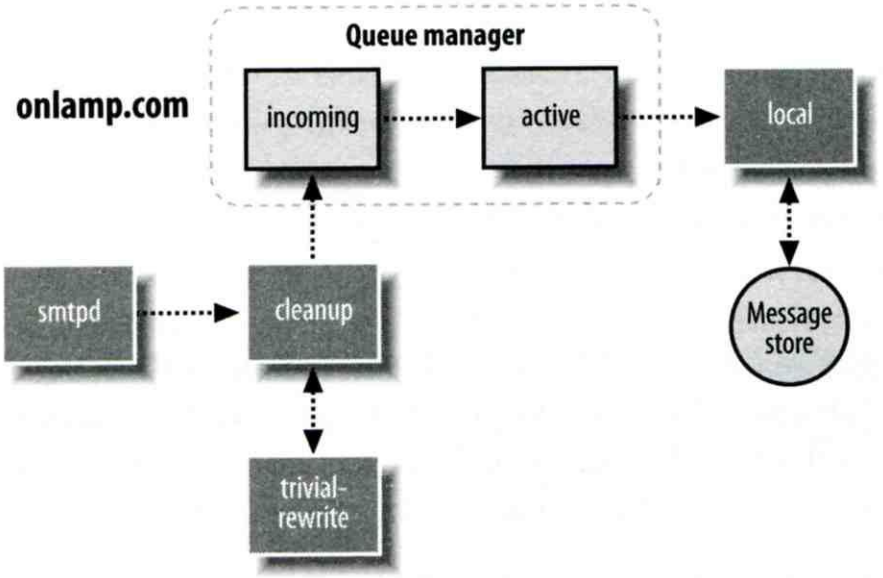
Message Flow in Postfix (2)

- Phase2:
  - The smtpd on postfix.org takes this message and invoke cleanup then put in incoming queue
  - The local DA find that frank is an alias, so it resubmits it through cleanup daemon for further delivery



Message Flow in Postfix (3)

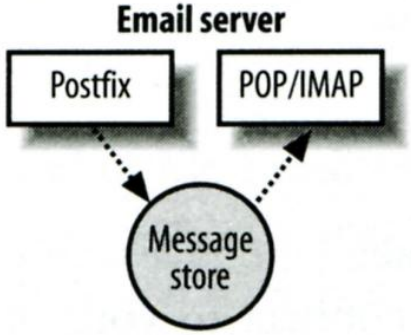
- Phase3
  - ➢ The smtpd on onlamp.com takes this message and invoke cleanup then put in incoming queue
  - ➢ Local delivery to message store



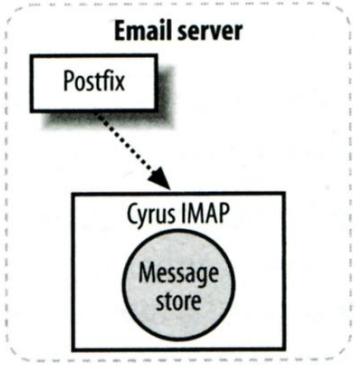
Message Store Format

- The Mbox format
  - Store messages in single file for each user
  - Each message start with “From ” line and continued with message headers and body
  - Mbox format has file-locking problem
- The Maildir format
  - Use structure of directories to store email messages
  - Each message is in its owned file
  - Three subdirectories
    - cur, new and tmp
  - Quick in locating and deleting
- Related parameters (in main.cf)
  - mail_spool_directory = /var/spool/mail (Mbox)
  - mail_spool_directory = /var/spool/mail/ (Maildir)

Postfix and POP/IMAP



- POP vs. IMAP
  - Both are used to retrieve mail from server for remote clients
  - POP has to download entire message, while IMAP can download headers only
  - POP can download only single mailbox, while IMAP can let you maintain multiple mailboxes and folders on server
- Cooperation between Postfix and POP/IMAP
  - Postfix and POP/IMAP must agree on the type of mailbox format and style of locking
    - Standard message store
    - Unstandard message store (using LMTP)
      - Such as Cyrus IMAP or Dovecot



Postfix Configuration

- Two most important configuration files
  - /usr/local/etc/postfix/main.cf
    - Core configuration
  - /usr/local/etc/postfix/master.cf
    - Which postfix service should invoke which program
- Edit configuration file
  - Using text editor
  - postconf
    - % postconf -e myhostname=nabsd.cs.nctu.edu.tw
    - % postconf -d myhostname (print default setting)
    - % postconf myhostname (print current setting)
- Reload postfix whenever there is a change
  - # postfix reload
  - # /usr/local/etc/rc.d/postfix reload

Step by Step Examples

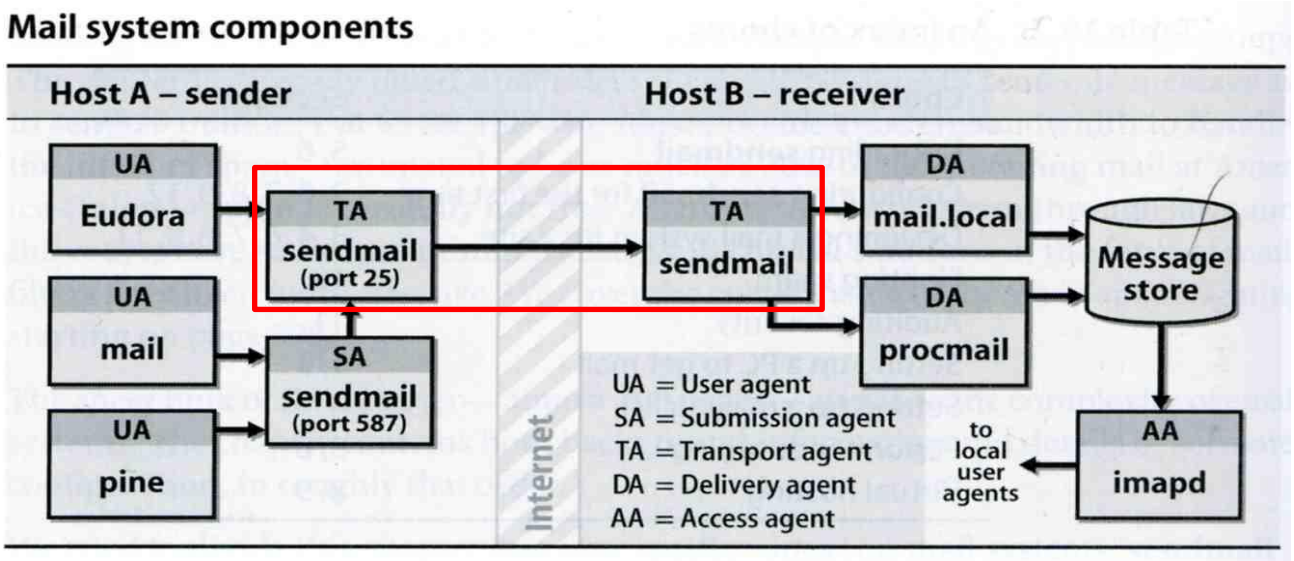
Let’s learn from examples

Step by Step Examples

- Build a Basic MTA
  - Send test mails to verify your MTA
  - Check whether your mail is sent or not
- MTA Authentication
- MTA Encryption
- MAA for POP3 and IMAP

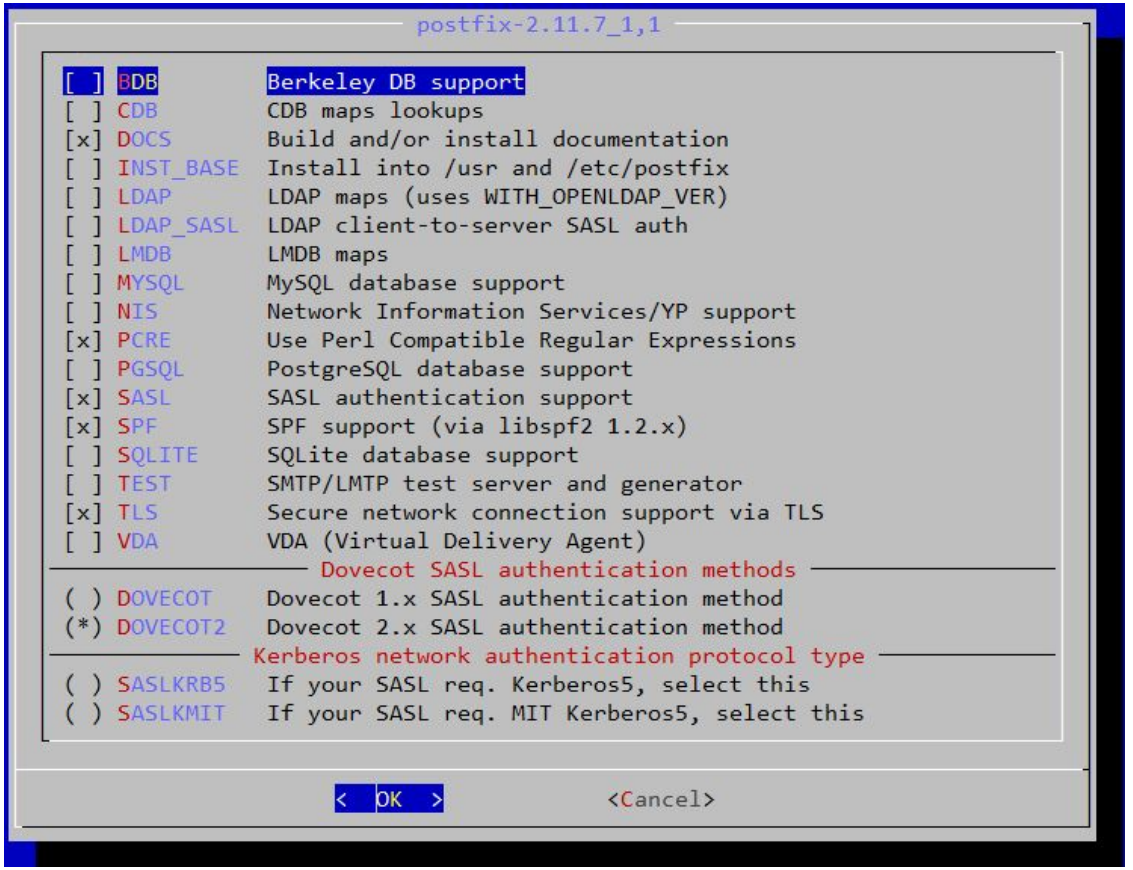
Build a Basic MTA

Can send mails to other domain



Build a basic MTA(1)

- Can send mails to other domain
- Install Postfix from port (need customization) (version 2.11)
  - mail/postfix
    - ➢ mail/postfix211
  - SASL
  - DOVECOT2



Build a basic MTA(2)

- The default version of Postfix is changed to 3.1
- You can install them from package
- There may be some compatibility issue
  - All configuration in this slide is based on Postfix 2.11
  - Postfix can run in backwards-compatible mode
- Reference: http://www.postfix.org/COMPATIBILITY_README.html

Build a basic MTA(3)

- During installation
  - Would you like to activate Postfix in /etc/mail/mailer.conf [n]?
  - Answer “y” here
- After installation
  - Disable “sendmail” program
    - service sendmail stop
    - In /etc/rc.conf

```
sendmail_enable="NONE"
```

    - In /etc/periodic.conf (create if not exists)

```
daily_clean_hoststat_enable="NO"
daily_status_mail_rejects_enable="NO"
daily_status_include_submit_mailq="NO"
daily_submit_queuerun="NO"
```

Build a basic MTA(4)

- After installation
  - Enable postfix
    - Edit /etc/rc.conf

```
postfix_enable="YES"
```

    - service postfix start
- Set up DNS records
  - Some domains will reject mails from hosts without DNS record
  - Suppose the hostname is “demo1.nasa.lctseng.nctucs.net”
  - Set up these records
    - (A record) demo1.nasa.lctseng.nctucs.net
    - (A record) nasa.lctseng.nctucs.net
    - (MX record) nasa.lctseng.nctucs.net
      - Points to “demo1.nasa.lctseng.nctucs.net”

Build a basic MTA(5)

- Set up MTA identity
  - See Postfix Configuration: MTA identity
  - In main.cf

```
myhostname = demo1.nasa.lctseng.nctucs.net
mydomain = nasa.lctseng.nctucs.net
myorigin = $myhostname
mydestination = $myhostname, localhost.$mydomain,
          localhost, $mydomain
```

- Reload or restart postfix to apply changes
  - postfix reload

Send test mails to verify your MTA(1)

- "telnet" or "mail" command

```
> telnet localhost 25
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
220 demo1.nasa.lctseng.nctucs.net ESMTP Postfix
EHLO localhost
250-demo1.nasa.lctseng.nctucs.net
250-PIPELINING
250-SIZE 10240000
250-VRFY
250-ETRN
250-ENHANCEDSTATUSCODES
250-8BITMIME
250 DSN
MAIL FROM: lctseng@nasa.lctseng.nctucs.net
250 2.1.0 Ok
RCPT TO: lctseng@cs.nctu.edu.tw
250 2.1.5 Ok
DATA
354 End data with <CR><LF>.<CR><LF>
Subject: This is test mail

DATA
.
250 2.0.0 Ok: queued as 3C868150
```

telnet

Send test mails to verify your MTA(2)

- The "mail" command

```
> mail -s "test from nasa" lctseng@gmail.com
This is test mail from NASA
regards,
admin
(Press Ctrl+D)
```

mail

  - See man page for more details

- Result (gmail)

Send test mails to verify your MTA(3)

- Mail source text of last example

```
Delivered-To: lctseng@gmail.com
Received: by 10.129.125.135 with SMTP id y129csp874822ywc;
        Sun, 6 Mar 2016 02:39:22 -0800 (PST)
X-Received: by 10.98.87.90 with SMTP id l87mr25639644pfb.70.1457260762400;
        Sun, 06 Mar 2016 02:39:22 -0800 (PST)
Return-Path: <lctseng@nasa.lctseng.nctucs.net>
Received: from demo1.nasa.lctseng.nctucs.net ...(omitted)
        by mx.google.com with ESMTP id bz6si20406744pad.30.2016.03.06.02.39.21
        for <lctseng@gmail.com>;
        Sun, 06 Mar 2016 02:39:21 -0800 (PST)
Received-SPF: neutral (google.com: 140.113.168.238 is neither permitted ...(omitted)
Authentication-Results: mx.google.com;
       spf=neutral (google.com: 140.113.168.238 is neither permitted ...(omitted)
Received: by demo1.nasa.lctseng.nctucs.net (Postfix, from userid 1001)
     id 6D916162; Sun,  6 Mar 2016 18:38:04 +0800 (CST)
To: lctseng@gmail.com
Subject: test from nasa
Message-Id: <20160306103804.6D916162@demo1.nasa.lctseng.nctucs.net>
Date: Sun,  6 Mar 2016 18:38:04 +0800 (CST)
From: lctseng@nasa.lctseng.nctucs.net (lctseng)

This is test mail from NASA
regards,
admin
```

Check whether your mail is sent or not (1)

- Sometimes, we do not receive mails immediately
- There may be some errors when your MTA sending mails to other domain
- Mails will stay in queues
  - Contain information about each mail
- Tools to management mail queues
  - See Postfix Configuration: Queue Management - Queue Tools

Check whether your mail is sent or not (2)

- Example for rejected mails

```
-Queue ID- --Size-- ----Arrival Time---- -Sender/Recipient-------
3C868150        377 Sun Mar  6 18:23:11  lctseng@nasa.lctseng.nctucs.net
(host csmx3.cs.nctu.edu.tw[140.113.235.119] said: 450 4.1.8
<lctseng@nasa.lctseng.nctucs.net>: Sender address rejected: Domain not found
 (in reply to RCPT TO command)) lctseng@cs.nctu.edu.tw

-- 0 Kbytes in 1 Request.
```

  - Problem
    - ➢ The destination MX cannot verify the domain of sender host
  - Reason
    - ➢ You may forget to set up correct DNS record
  - This mail will NOT be delivered until you set up your DNS record

Check whether your mail is sent or not (3)

- Example for deferred mails

```
-Queue ID- --Size-- ----Arrival Time---- -Sender/Recipient-------
3C868150        377 Sun Mar  6 18:23:11  lctseng@nasa.lctseng.nctucs.net
(host csmx1.cs.nctu.edu.tw[140.113.235.104] said: 450 4.2.0
<lctseng@cs.nctu.edu.tw>: Recipient address rejected: Greylisted,
 see http://postgrey.schweikert.ch/help/cs.nctu.edu.tw.html
 (in reply to RCPT TO command))    lctseng@cs.nctu.edu.tw

-- 0 Kbytes in 1 Request.
```

  - Problem
    - The mail is deferred for a short time
  - Reason
    - Destination host wants to examine our server is a spamming host or not
  - The mail will be delivered after a short time
    - Generally within 30 minutes

MTA Authentication

We don’t want unauthorized user to access our MTA

MTA authentication(1)

- In previous example, only localhost can send mail to other domain
- If you try telnet on other host, when you try to send mails to other domain, you will get:

```
> telnet demo1.nasa.lctseng.nctucs.net 25
Trying 140.113.168.238...
Connected to demo1.nasa.lctseng.nctucs.net.
Escape character is '^]'.
220 demo1.nasa.lctseng.nctucs.net ESMTP Postfix
MAIL FROM: lctseng@demo1.nasa.lctseng.nctucs.net
250 2.1.0 Ok
RCPT TO: lctseng@gmail.com
454 4.7.1 <lctseng@gmail.com>: Relay access denied
```

- That is because you have following lines in main.cf

```
mynetworks_style = host
```

  - So Postfix only trust clients from localhost
  - See Postfix Configuration: Relay Control

MTA authentication(2)

- How to let SMTP clients outside from trust networks get the same privileges as trusted hosts?
  - Can send mails to other domain, not only `$mydestination`
  - We need authentication (account and password)
- SASL Authentication
  - Simple Authentication and Security Layer
  - RFC 2554, RFC 4954
- To configure SASL for Postfix, we need another daemon
  - Dovecot SASL (we use it in our example)
  - Cyrus SASL
- References
  - http://wiki2.dovecot.org/
  - http://www.postfix.org/SASL_README.html

MTA authentication(3) - Dovecot SASL

- Installation
  - mail/dovecot2
  - Should be installed when you install Postfix (dependency)
  - Note: dovecot still have version 1.x, but it is obsolete
- Enable Dovecot SASL daemon
  - In /etc/rc.conf

```
dovecot_enable="YES"
```

  - Copy configuration files

```
cp -R /usr/local/etc/dovecot/example-config/* \
                /usr/local/etc/dovecot
```

  - Create SSL keys for Dovecot (self-signed or use Let's Encrypt)
    - Change path for SSL files in /usr/local/etc/dovecot/conf.d/10-ssl.conf
    - In fact, these are mainly for POP3s and IMAPs, not SASL in Postfix
  - service dovecot start

MTA authentication(4) - Postfix with Dovecot SASL

- Set up Dovecot SASL authenticate (using system account)
  - In /usr/local/etc/dovecot/conf.d/10-master.conf:

```
service auth {
  ...
  unix_listener /var/spool/postfix/private/auth {
    mode = 0660
    user = postfix
    group = postfix
  }
  ...
}
```

  - In /usr/local/etc/dovecot/conf.d/10-auth.conf

```
auth_mechanisms = plain login
```

MTA authentication(5) - Postfix with Dovecot SASL

- Set up Dovecot SASL in Postfix
  - In main.cf

```
# Set SASL to Dovecot
smtpd_sasl_type = dovecot
# Specify the UNIX socket path
smtpd_sasl_path = private/auth
# Enable SASL
smtpd_sasl_auth_enable = yes
# For client capability
broken_sasl_auth_clients = yes
# Allow SASL authenticated clients
smtpd_recipient_restrictions = permit_mynetworks,
                               permit_sasl_authenticated,
                               reject_unauth_destination
```

- Restart/Reload Dovecot and Postfix

MTA authentication(6)

- Now you can authenticate your identity in SMTP

```
> telnet demo1.nasa.lctseng.nctucs.net 25
Trying 140.113.168.238...
Connected to demo1.nasa.lctseng.nctucs.net.
Escape character is '^]'.
220 demo1.nasa.lctseng.nctucs.net ESMTP Postfix
EHLO linuxhome.cs.nctu.edu.tw
250-demo1.nasa.lctseng.nctucs.net
250-PIPELINING
250-SIZE 10240000
250-VRFY
250-ETRN
250-AUTH PLAIN LOGIN
250-AUTH=PLAIN LOGIN
250-ENHANCEDSTATUSCODES
250-8BITMIME
250 DSN
```

MTA authentication(7)

- The account and password are encoded in Base64
  - If you have perl installed, suggest your account is test and password is testpassword

```
perl -MMIME::Base64 -e 'print encode_base64("\000test\000testpassword");'
```

  - It will generate encoded account and password
    - For example: AHRlc3QAdGVzdHBhc3N3b3Jk

MTA authentication(8)

- Use the encoded account and password to authenticate it

```
> telnet demo1.nasa.lctseng.nctucs.net 25
Trying 140.113.168.238...
Connected to demo1.nasa.lctseng.nctucs.net.
Escape character is '^]'.
220 demo1.nasa.lctseng.nctucs.net ESMTP Postfix
AUTH PLAIN AHRlc3QAdGVzdHBhc3N3b3Jk
235 2.7.0 Authentication successful
MAIL FROM: lctseng@nasa.lctseng.nctucs.net
250 2.1.0 Ok
RCPT TO: lctseng@gmail.com
250 2.1.5 Ok
DATA
354 End data with <CR><LF>.<CR><LF>
To: lctseng@gmail.com
Subject: This is authenticated client
Message-Id: <20160307120109.861A9154@demo1.nasa.lctseng.nctucs.net>
Date: Mon,  7 Mar 2016 15:01:09 +0800 (CST)
From: lctseng@demo1.nasa.lctseng.nctucs.net (lctseng)

Test Mail
.
250 2.0.0 Ok: queued as F3D59171
```

MTA Encryption

The Internet is dangerous.
We need to protect ourselves from sniffing.

MTA encryption(1)

- In previous example, all SMTP sessions are in plain text
  - Your encoded authentication information is in danger!
- We need encryption over SSL/TLS
  - Like HTTP can be enhanced to HTTPs
  - Postfix supports two kinds of encryption
    - SMTP over TLS
    - SMTPs
- Before we enable SMTP over TLS (or SMTPs), you need SSL keys and certificates
  - Again, just like HTTPs
  - Self-signed or use Let's Encrypt
  - You can use the same certificates/keys as Dovecot's
    - In main.cf

```
smtpd_tls_cert_file = /path/to/cert.pem
smtpd_tls_key_file = /path/to/key.pem
```

MTA encryption(2-1) - Set up SMTP over TLS

- Recommended for SMTP encryption
- Use the same port as SMTP (port 25)
- No force encryption
  - Client can choose whether to encrypt mails or not
  - But server can configured to force encryption
- In main.cf
  - No force encryption

```
smtpd_tls_security_level = may
```

  - Force encryption

```
smtpd_tls_security_level = encrypt
```

- Reload Postfix

MTA encryption(2-2) - Set up SMTP over TLS

- Now your server supports SMTP over TLS

```
 > telnet demo1.nasa.lctseng.nctucs.net 25
Trying 140.113.168.238...
Connected to demo1.nasa.lctseng.nctucs.net.
Escape character is '^]'.
220 demo1.nasa.lctseng.nctucs.net ESMTP Postfix
EHLO linuxhome.cs.nctu.edu.tw
250-demo1.nasa.lctseng.nctucs.net
250-PIPELINING
250-SIZE 10240000
250-VRFY
250-ETRN
250-STARTTLS
250-ENHANCEDSTATUSCODES
250-8BITMIME
250 DSN
```

- If you use force encryption, you must STARTTLS before sending mails

```
MAIL FROM: lctseng@nasa.lctseng.nctucs.net
530 5.7.0 Must issue a STARTTLS command first
```

MTA encryption(3-1) - Set up SMTPs

- Alternative way to encrypt SMTP sessions
- Use different port: 465(deprecated,but still using) , 587
- Force encryption
- Can coexist with SMTP over TLS
- In master.cf
  - Uncomment these lines

```
smtps     inet  n       -       n       -       -       smtpd
   -o syslog_name=postfix/smtps
   -o smtpd_tls_wrappermode=yes
```

  - This will open port 465 for SMTPs and use “smtps” as syslog name
- Reload Postfix

MTA encryption(3-2) - Set up SMTPs

- Now you can use SSL clients to use SMTPs
  - telnet may not work in encrypted sessions
  - SSL client:

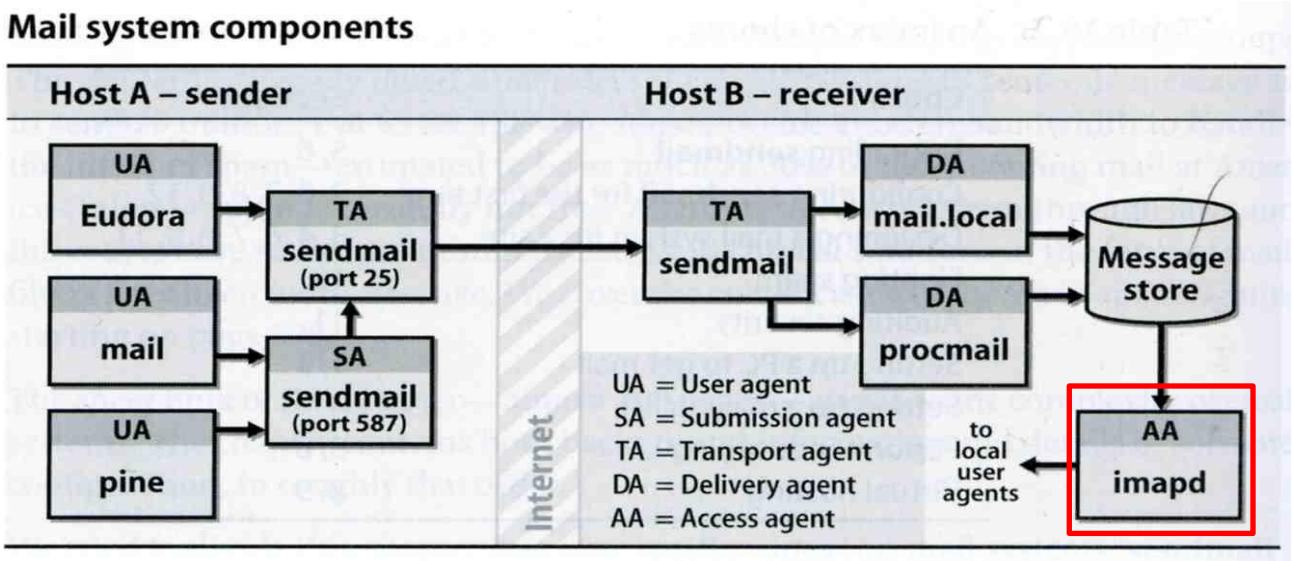
```
openssl s_client -connect host:port
```

  - Important note
    - In openssl s_client, DO NOT use capital character "R"
      - "R" is a special command in openssl s_client (for renegotiating)
    - So use "rcpt to" instead of "RCPT TO"
      - For SMTP, they are all the same
    - If you use "R", you will see following output (NOT a part of SMTP)

```
RENEGOTIATING
depth=2 O = Digital Signature Trust Co., CN = DST Root CA X3
verify return:1
depth=1 C = US, O = Let's Encrypt, CN = Let's Encrypt Authority X1
verify return:1
depth=0 CN = nasa.lctseng.nctucs.net
verify return:1
```

MAA for POP3 and IMAP

Read mails from remote host



MAA for POP3 and IMAP (1) - Read mails from terminal

- In fact, you mail server can receive mails now
  - But all messages are store in local disk
- To read mails, you must login via ssh
  - Built-in command to read mail: “mail”
  - Friendly command-line MUA: “mutt”
    - Packages:
      - zh-mutt (Chinese version)
      - mutt (English version)
    - Ports:
      - chinese/mutt
      - mail/mutt
- How to read mails from remote host?
  - MUA like Outlook, Thunderbird, or even Gmail
  - We need MAA

MAA for POP3 and IMAP (2)

- Fortunately, the Dovecot already provides POP3 and IMAP services
  - Include SSL versions: POP3s, IMAPs
    - That why we need SSL certificates and keys for Dovecot
- When you activate Dovecot service, these MAA services are also brought up.
- But you cannot access mail directly, you need some configuration
  - Configuration files are in : /usr/local/etc/dovecot/
  - There are many files included by dovecot.conf
    - In conf.d directory
    - Splitting configuration files is easier to management
  - Reference: http://wiki2.dovecot.org/QuickConfiguration

MAA for POP3 and IMAP (3) - Dovecot Configuration

- Allow GID = 0 to access mail (optional)
  - By default, Dovecot do not allow users with GID = 0 to access mail. If your users are in wheel group, you need following settings
  - In dovecot.conf

```
first_valid_gid = 0
```

- Specify the mail location
  - In conf.d/10-mail.conf

```
mail_location = mbox:~/mail:INBOX=/var/mail/%u
```

- Add authenticate configuration to use PAM module
  - Dovecot use system PAM module to authenticate
  - Allow system users to access mails
  - Create a new file: /etc/pam.d/dovecot

```
auth    required        pam_unix.so
account required        pam_unix.so
```

MAA for POP3 and IMAP (4)

- After restart Dovecot, your MAA is ready
- To check these services, you can use “telnet” or “openssl s_client”
  - POP3: 110
  - POP3s: 995
  - IMAP: 143
  - IMAPs: 993
- Messages for these services when you connect to the server
  - POP3

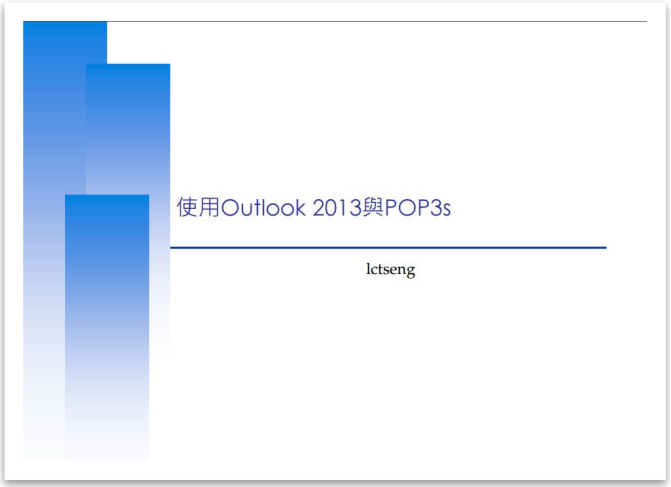
```
+OK Dovecot ready.
```

  - IMAP

```
* OK [CAPABILITY IMAP4rev1 LITERAL+ SASL-IR LOGIN-REFERRALS
  ID ENABLE IDLE AUTH=PLAIN AUTH=LOGIN] Dovecot ready.
```

MAA for POP3 and IMAP (5)

- Set up MUAs like Outlook or Thunderbird
  - You can see the tutorial in CS mail server, they should be similar to set up your server
  - Settings for Gmail is also available
  - https://mail.cs.nctu.edu.tw/



Postfix Configuration

Reference: http://www.postfix.org/postconf.5.html

Postfix Configuration – Lookup tables (1)

- Parameters that use external files to store values
  - Such as mydestination, mynetwork, relay_domains
  - Text-based table is ok, but time-consuming when table is large
- Lookup tables syntax
  - Key values
- postmap command
  - % postmap /etc/access (generate database)
  - % postmap –q 140.113.235.150 /etc/access (query)

```
140.113.235.150 REJECT
140.113.235     OK
```

/etc/access

```
> postmap -q 140.113.235.150 /etc/access
REJECT
> postmap -q 140.113.235 /etc/access
OK
```

Postfix Configuration – Lookup tables (2)

- Database format
  - % postconf –m
    - ➢ List all available database format
  - % postconf default_database_type
- Use databased-lookup table in main.cf
  - syntax

    Parameter = type:name

    or

    Parameter = option type:name

```
% postconf -m
btree
cidr
environ
hash
pcre
proxy
regexp
static
unix
% postconf default_database_type
default_database_type = hash
```

Postfix Configuration – Lookup tables (3)

- Example: Reject SMTP clients
  - In main.cf

```
smtpd_client_restrictions =
    check_client_access hash:/etc/access
```

  - Try SMTP clients from rejected host

```
rcpt to: lctseng@nasa.lctseng.nctucs.net
554 5.7.1 <linuxhome.cs.nctu.edu.tw[140.113.235.150]>:
          Client host rejected: Access denied
```

Postfix Configuration – Lookup tables (4)

- Regular expression tables
  - More flexible for matching keys in lookup tables
  - Two regular expression libraries used in Postfix
    - POSIX extended regular expression (regexp, default)
    - Perl-Compatible regular expression (PCRE)
  - Usage
    - /pattern/ value
    - It is useful to use regular expression tables to do checks, such as
      - header_checks parameters
      - body_checks parameters

Postfix Configuration – system-wide aliases files

- Using aliases in Postfix
  - alias_maps = hash:/etc/aliases
  - alias_maps = hash:/etc/aliases, nis:mail.aliases
  - alias_database = hash:/etc/aliases
    - ➢ Tell newaliases command which aliases file to build
  - alias_maps: may not control by Postfix (may be NIS)
  - alias_database: under control by Postfix
- To Build alias database file
  - % postalias /etc/aliases
- Alias file format (same as sendmail)
  - RHS can be
    - ➢ Email address, filename, |command, :include:
- Alias restriction
  - allow_mail_to_commands = alias, forward
  - allow_mail_to_files = alias, forward

Postfix Configuration – MTA Identity

- Four related parameters
  - myhostname
    - myhostname = nabsd.cs.nctu.edu.tw
    - If un-specified, postfix will use 'hostname' command
  - mydomain
    - mydomain = cs.nctu.edu.tw
    - If un-specified, postfix use myhostname minus the first component
  - myorigin
    - myorigin = $mydomain (default is myhostname)
    - Used to append unqualified address
  - mydestination
    - List all the domains that postfix should accept for local delivery
    - mydestination = $myhostname, localhost.$mydomain $mydomain
      - This is the CS situation that mx will route mail to mailgate
    - mydestination = $myhostname, localhost.$mydomain

Postfix Configuration – Relay Control (1)

- Open relay
  - A mail server that permit anyone to relay mails
  - Often abused by spammer
    - ➢ Denied by other domains due to blacklist mechanism
  - By default, postfix is not an open relay

- A mail server should
  - Relay mail for trusted user
    - ➢ Such as smtp.cs.nctu.edu.tw trust all authenticated users
  - Relay mail for trusted domain
    - ➢ Such as smtp.csie.nctu.edu.tw trust nctu.edu.tw

Postfix Configuration – Relay Control (2)

- Restricting relay access by mynetworks_style
  - mynetworks_style = subnet
    - Allow relaying from other hosts in the same subnet
  - mynetworks_style = host
    - Allow relaying for only local machine
  - mynetworks_style = class
    - Any host in the same class A, B or C

- Restricting relay access by mynetworks
  - List individual IP or subnets in network/netmask notation
  - Ex: in /usr/local/etc/postfix/mynetworks
    - 127.0.0.0/8
    - 140.113.0.0/16
    - 10.113.0.0/16

- Relay depends on what kind of your mail server is
  - smtp.cs.nctu.edu.tw will be different from csmx1.cs.nctu.edu.tw

Postfix Configuration – master.cf (1)

- /usr/local/etc/postfix/master.cf
  - Define what services the master daemon can invoke
  - Each row defines a service and
  - Each column contains a specific configuration option

```
# ==========================================================================
# service type  private unpriv  chroot  wakeup  maxproc command + args
#               (yes)   (yes)   (yes)   (never) (100)
# ==========================================================================
smtp      inet  n       -       n       -       -       smtpd
pickup    fifo  n       -       n       60      1       pickup
cleanup   unix  n       -       n       -       0       cleanup
qmgr      fifo  n       -       n       300     1       qmgr
tlsmgr    unix  -       -       n       1000?   1       tlsmgr
rewrite   unix  -       -       n       -       -       trivial-rewrite
bounce    unix  -       -       n       -       0       bounce
flush     unix  n       -       n       1000?   0       flush
127.0.0.1:10025 inet    n       -       n       -       -       smtpd
```

Postfix Configuration – master.cf (2)

- Configuration options
  - Service name and transport type
    - inet
      - Network socket
      - In this type, name can be combination of IP:Port
    - unix and fifo
      - Unix domain socket and named pipe respectively
      - Inter-process communication through file
  - private
    - Access to this component is restricted to the Postfix system
  - unpriv
    - Run with the least amount of privilege required
      - y will run with the account defined in “mail_owner”
      - n will run with root privilege

Postfix Configuration – master.cf (3)

- chroot
  - chroot location is defined in “queue_directory”
- wakeup
  - Periodic wake up to do jobs, such as pickup daemon
- maxproc
  - Number of processes that can be invoked simultaneously
  - Default count is defined in “default_process_limit”
  - 0: no limitation
- command + args
  - Default path is defined in “daemon_directory”
  - /usr/libexec/postfix

Postfix Configuration – Receiving limits

- Enforce limits on incoming mail
  - The number of recipients for single delivery
    - smtpd_recipient_limit = 1000
  - Message size
    - message_size_limit = 10240000
  - The number of errors before breaking off communication
    - Postfix keep a counter of errors for each client and increase delay time once there is error
      - E.g. No such user
    - smtpd_error_sleep_time = 1s
      - Delay all responses if there are too many errors
      - Between soft and hard limit
    - smtpd_soft_error_limit = 10
    - smtpd_hard_error_limit = 20
      - Force disconnect if exceeds

Postfix Configuration – Rewriting address (1)

- For unqualified address
  - To append "myorigin" to local name.
    - append_at_myorigin = yes
  - To append "mydomain" to address that contain only host.
    - append_dot_mydomain = yes
- Masquerading hostname
  - Hide the names of internal hosts to make all addresses appear as if they come from the mail gateway
  - It is often used in out-going mail gateway
    - masquerade_domains = cs.nctu.edu.tw
    - masquerade_domains = !chairman.cs.nctu.edu.tw cs.nctu.edu.tw
    - masquerade_exceptions = admin, root
  - Rewrite to all envelope and header address excepts envelope recipient address
    - masquerade_class = envelope_sender, header_sender, header_recipient

Postfix Configuration – Rewriting address (2)

- Canonical address
  - Rewrite both header and envelope recursively invoked by cleanup daemon
  - Configuration
    - canonical_maps = hash:/usr/local/etc/postfix/canonical
    - canonical_classes = envelope_sender, envelope_recipient, header_sender, header_recipient
  - /usr/local/etc/postfix/canonical

    lctseng@cs.nctu.edu.tw lctseng.NETADM@cs.nctu.edu.tw
  - Simlar maps
    - sender_canonical_maps
    - recipient_canonical_maps

Postfix Configuration – Rewriting address (3)

- Relocated users
  - Used to inform sender that the recipient is moved
  - relocated_maps = hash:/usr/local/etc/postfix/relocated
  - Ex:

    @nabsd.cs.nctu.edu.tw nasa.cs.nctu.edu.tw

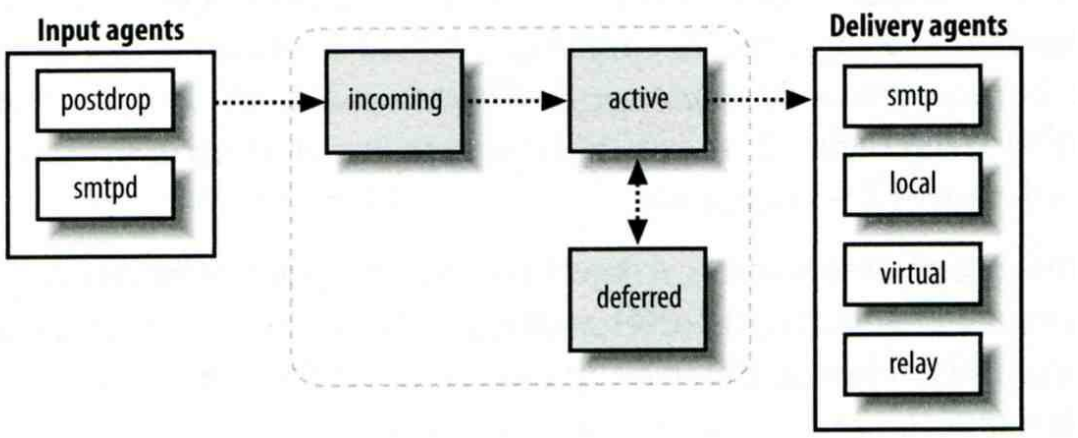
    alice@nasa.cs.nctu.edu.tw bob@abc.com

```
rcpt to: alice@nasa.lctseng.nctucs.net
550 5.1.6 <alice@nasa.lctseng.nctucs.net>:
   Recipient address rejected: User has moved to bob@abc.com
```

- Unknown users
  - Not local user and not found in maps
  - Default action: reject

Queue Management

- The queue manage daemon
  - qmgr daemon
  - Queue directories (under /var/spool/postfix)
    - active, bounce, corrupt, deferred, hold
- Message movement between queues
  - Temporary problem → deferred queue
  - qmgr takes messages alternatively between incoming and deferred queue to active queue



Queue Management – Queue Scheduling

- Double delay in deferred messages
  - Between
    - minimal_backoff_time = 1000s
    - maximal_backoff_time = 4000s
  - qmgr daemon periodically scan deferred queue for reborn messages
    - queue_run_delay = 1000s
- Deferred → bounce
  - maximal_queue_lifetime = 5d
    - Exceeds → this messages is undeliverable
    - Set to 0: mail delivery should be tried only once

Queue Management – Message Delivery

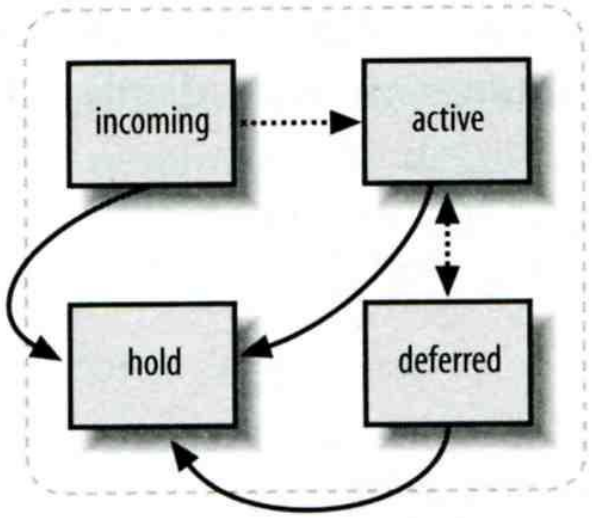
- Controlling outgoing messages
  - When there are lots of messages in queue for the same destination, it should be careful not to overwhelm it
  - If concurrent delivery is success, postfix can increase concurrency between:
    - initial_destination_concurrency = 5
    - default_destination_concurrency_limit = 20
    - Under control by
      - maxproc in /usr/local/etc/postfix/master.cf
      - default_process_limit
    - You can override the default_destination_concurrency_limit for any transport mailer:
      - smtp_destination_concurrency_limit = 25
      - local_destination_concurrency_limit = 10
  - Control how many recipients for a single outgoing message
    - default_destination_recipient_limit = 50
    - You can override it for any transport mailer in the same idea:
      - smtp_destination_recipient_limit = 100

Queue Management – Error Notification

- Sending error messages to administrator
  - Set notify_classes parameter to list error classes that should be generated and sent to administrator
    - Ex: notify_classes = resource, software
  - Error classes

Error Class	Description	Noticed Recipient (all default to postmaster)
bounce	Send headers of bounced mails	bounce_notice_recipient
2bounce	Send undeliverable bounced mails	2boucne_notice_recipient
delay	Send headers of delayed mails	delay_notice_recipient
policy	Send transcript when mail is reject due to anti-spam restrictions	error_notice_recipient
protocol	Send transcript that has SMTP error	error_notice_recipient
resource	Send notice because of resource pro.	error_notice_recipient
software	Send notice because of software pro.	error_notice_recipient

Queue Management – Queue Tools (1)



- postqueue command
  - postqueue –p
    - Generate sendmail mailq output
  - postqueue –f
    - Attempt to deliver all queued mail
  - postqueue –s cs.nctu.edu.tw
    - Schedule immediate delivery of all mail queued for site
- postsuper command
  - postsuper –d DBA3F1A9 (from incoming, active, deferred, hold)
  - postsuper –d ALL
    - Delete queued messages
  - postsuper –h DBA3F1A9 (from incoming, active, deferred)
  - postsuper –h ALL
    - Put messages "on hold" so that no attempt is made to deliver it
  - postsuper –H DBA3F1A9
  - postsuper –H ALL
    - Release messages in hold queue
  - postsuper –r DBA3F1A9
  - postsuper –r ALL
    - Requeue messages into maildrop queue

Queue Management – Queue Tools (2)

- postcat
  - Display the contents of a queue file

```
nabsd [/home/lctseng] -lctseng- sudo postqueue -p
-Queue ID- --Size-- ----Arrival Time---- -Sender/Recipient-------
DEC003B50E2     344 Tue May  8 19:58:37  lctseng@nabsd.cs.nctu.edu.tw
        (connect to chbsd.cs.nctu.edu.tw[140.113.17.212]: Connection refused)
                                         lctseng@chbsd.cs.nctu.edu.tw

-- 0 Kbytes in 1 Request.

nabsd [/home/lctseng] -lctseng- sudo postcat -q DEC003B50E2
*** ENVELOPE RECORDS deferred/D/DEC003B50E2 ***
message_size:            344           252             1             0           344
message_arrival_time: Tue May  8 19:58:37 2007
create_time: Tue May  8 19:58:37 2007
named_attribute: rewrite_context=local
sender_fullname: Tsung-Hsi Weng
sender: lctseng@nabsd.cs.nctu.edu.tw
original_recipient: lctseng@chbsd.cs.nctu.edu.tw
recipient: lctseng@chbsd.cs.nctu.edu.tw
*** MESSAGE CONTENTS deferred/D/DEC003B50E2 ***
Received: by nabsd.cs.nctu.edu.tw (Postfix, from userid 1001)
 id DEC003B50E2; Tue,  8 May 2007 19:58:37 +0800 (CST)
To: lctseng@chbsd.cs.nctu.edu.tw
Subject: Testing Mail
Message-Id: <20070508115837.DEC003B50E2@nabsd.cs.nctu.edu.tw>
Date: Tue,  8 May 2007 19:58:37 +0800 (CST)
From: lctseng@nabsd.cs.nctu.edu.tw (Liang-Chi Tseng)

hello
*** HEADER EXTRACTED deferred/D/DEC003B50E2 ***
*** MESSAGE FILE END deferred/D/DEC003B50E2 ***
```

Mail Relaying – Transport Maps (1)

- Transport maps
  - It override default transport types for delivery of messages
  - transport_maps = hash:/usr/local/etc/postfix/transport
  - Ex:

domain_or_address	transport:nexthop
csie.nctu.edu.tw	smtp:[mailgate.csie.nctu.edu.tw]
cs.nctu.edu.tw	smtp:[csmailgate.cs.nctu.edu.tw]
cis.nctu.edu.tw	smtp:[mail.cis.nctu.edu.tw]
example.com	smtp:[192.168.23.56]:20025
orillynet.com	smtp
ora.com	maildrop
kdent@ora.com	error:no mail accepted for kdent

Mail Relaying – Transport Maps (2)

- One usage in transport map
  - Postponing mail relay
    - ➢ Such as ISP has to postpone until customer network is online
  - Ex:

    I am an ISP, and I has a mail server that is MX for abc.com

    In /usr/local/etc/postfix/transport
    abc.com ondemand

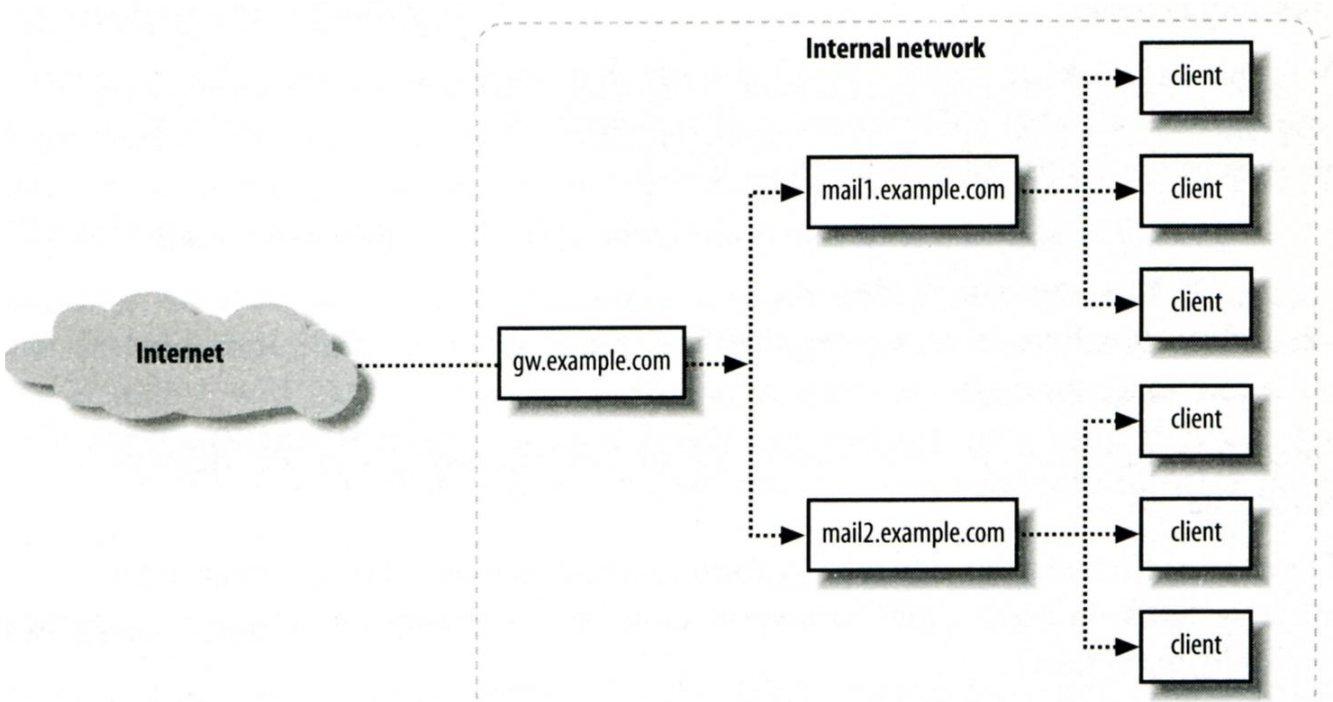
    In /usr/local/etc/postfix/master.cf
    ondemand unix - - n - - smtp

    In /usr/local/etc/postfix/main.cf
    defer_transports = ondemand
    transport_maps = hash:/usr/local/etc/postfix/transport

    Whenever the customer network is online, do
    $ postqueue −f abc.com

Mail Relaying – Inbound Mail Gateway (1)

- Inbound Mail Gateway
  - Accept all mail for a network from the Internet and relays it to internal mail systems
  - Ex:
    - csmx1.cs.nctu.edu.tw is a IMG
    - csmailgate.cs.nctu.edu.tw is internal mail system



Mail Relaying – Inbound Mail Gateway (2)

- To be IMG, suppose
  - You are administrator for cs.nctu.edu.tw
  - You have to be the IMG for secureLab.cs.nctu.edu.tw and javaLab.cs.nctu.edu.tw

1. The MX record for secureLab.cs.nctu.edu.tw and javaLab.cs.nctu.edu.tw should point to csmx1.cs.nctu.edu.tw
2. In csmx1.cs.nctu.edu.tw,

   relay_domains = secureLab.cs.nctu.edu.tw javaLab.cs.nctu.edu.tw

   transport_maps = hash:/usr/local/etc/postfix/transport

   secureLab.cs.nctu.edu.tw relay:[secureLab.cs.nctu.edu.tw]

   javaLab.cs.nctu.edu.tw relay:[javaLab.cs.nctu.edu.tw]
3. In secureLab.cs.nctu.edu.tw (and so do javaLab.cs.nctu.edu.tw)

   mydestination = secureLab.cs.nctu.edu.tw

Mail Relaying – Outbound Mail Gateway

- Outbound Mail Gateway
  - Accept mails from inside network and relay them to Internet hosts on behalf of internal mail servers
- To be OMG, suppose
  - You are administrator for cs.nctu.edu.tw
  - You have to be the OMG for secureLab.cs.nctu.edu.tw and javaLab.cs.nctu.edu.tw

1. In csmailer.cs.nctu.edu.tw
   mynetworks = hash:/usr/local/etc/postfix/mynetworks
   secureLab.cs.nctu.edu.tw
   javaLab.cs.nctu.edu.tw
2. All students in secureLab/javaLab will configure there MUA (ex. outlook) to use secureLab/javaLab.cs.nctu.edu.tw to be the SMTP server
3. In secureLab/javaLab.cs.nctu.edu.tw,
   relayhost = [csmailer.cs.nctu.edu.tw]

Advanced Aliasing – Virtual Alias Maps

❑ Virtual Alias Map

- It rewrites recipient addresses for all local, all virtual, and all remote mail destinations.
  - ➢ Route virtual email addresses to real users on the system
- virtual_alias_maps = hash:/usr/local/etc/postfix/virtual
- Ex:

src-address	dst-address
lctseng@csie.nctu.edu.tw	@chbsd.cs.nctu.edu.tw
@csie.nctu.edu.tw	@cs.nctu.edu.tw
lctseng	lctseng@gmai1.com

- Applying regular expression
  - ➢ virtual_alias_maps = pcre:/usr/local/etc/postfix/virtual

/lctseng@csie\.nctu\.edu\.tw/	@chbsd.cs.nctu.edu.tw
/@csie\.nctu\.edu\.tw/	@cs.nctu.edu.tw
/(\S+)\.(\S+)@cs\.nctu\.edu\.tw/	$1@cs.nctu.edu.tw

Multiple Domains

- Use single system to host many domains
  - Ex:
    - We use csmailgate.cs.nctu.edu.tw to host both
      - cs.nctu.edu.tw
      - csie.nctu.edu.tw
  - Purpose
    - Can be used for final delivery on the machine or
    - Can be used for forwarding to destination elsewhere
- Important considerations
  - Does the same user id with different domain should go to the same mailbox or different mailbox ?
    - YES (shared domain)
    - NO (Separate domain)
  - Does every user require a system account in /etc/passwd ?
    - YES (system account)
    - NO (virtual account)

Multiple Domains –

Shared Domain with System Account

- Situation
  - The mail system should accept mails for both canonical and virtual domains and
  - The same mailbox for the same user id
- Procedure
  - Modify “mydomain” to canonical domain
  - Modify “mydestination” parameter to let mails to virtual domain can be local delivered
  - Ex:
    - mydomain = cs.nctu.edu.tw
    - mydestination = $myhostname, $mydomain, csie.nctu.edu.tw

※ In this way, mail to both lctseng@cs.nctu.edu.tw and lctseng@csie.nctu.edu.tw will go to csmailgate:/var/mail/lctseng

- Limitation
  - Can not separate lctseng@cs.nctu.edu.tw from lctseng@csie.nctu.edu.tw

Multiple Domains –

Separate Domains with System Accounts

- Situation
  - The mail system should accept mails for both canonical and virtual domains and
  - Mailboxes are not necessarily the same for the same user id
- Procedure
  - Modify “mydomain” to canonical domain
  - Modify “virtual_alias_domains” to accept mails to virtual domains
  - Create “virtual_alias_maps” map
  - Ex:
    - mydomain = cs.nctu.edu.tw
    - virtual_alias_domains = abc.com.tw, xyz.com.tw
    - virtual_alias_maps = hash:/usr/local/etc/postfix/virtual
    - In /usr/local/etc/postfix/virtual
      - CEO@abc.com.tw andy
      - @xyz.com.tw jack
- Limitation
  - Need to maintain UNIX account for virtual domain user

Multiple Domains –

Separate Domains with Virtual Accounts (1)

- Useful when users in virtual domains:
  - Do not need to login to system
  - Only need to retrieve mail through POP/IMAP server
- Procedure
  - Modify "virtual_mailbox_domains" to let postfix know what mails it should accepts
    - Or simply included in "virtual_mailbox_maps" map
  - Modify "virtual_mailbox_base" and create related directory to put mails
  - Create "virtual_mailbox_maps" map
  - Ex:
    - Create /var/vmail/abc-domain and /var/vmail/xyz-domain

```
virtual_mailbox_base = /var/vmail
virtual_mailbox_maps = hash:/usr/local/etc/postfix/vmailbox
```

- In /usr/local/etc/postfix/vmailbox

```
abc.com.tw      this-text-is-ignore
xyz.com.tw      this-text-is-ignore
CEO@abc.com.tw   abc-domain/CEO
CEO@xyz.com.tw   xyz-domain/CEO/
```

MailBox format

MailDir format

Multiple Domains –

Separate Domains with Virtual Accounts (2)

- Ownerships of virtual mailboxes
  - Simplest way:
    - The same owner of POP/IMAP Servers
  - Flexibility in postfix
    - virtual_uid_maps and virtual_gid_maps
    - Ex:
      - virtual_uid_maps = static:143
      - virtual_gid_maps = static:6
      - virtual_uid_maps = hash:/usr/local/etc/postfix/virtual_uids
      - virtual_uid_maps = hash:/usr/local/etc/postfix/virtual_uids static:143
      - In /usr/local/etc/postfix/virtual_uids
        - CEO@abc.com.tw 1004
        - CEO@xyz.com.tw 1008
  - How to let virtual users authenticate and retrieve their mails?
    - You need other mechanism or modules (out of scope now)

Handling Spam in Postfix

Nature of Spam

- Spam – **S**imultaneously **P**osted **A**dvertising **M**essage
  - UBE – Unsolicited Bulk Email
  - UCE – Unsolicited Commercial Email
- Spam
  - There is no relationship between receiver and
    - Sender
    - Message content
  - Opt out instruction
  - Conceal trail
    - False return address
    - Forged header information
  - Use misconfigured mail system to be an accomplice
  - Circumvent spam filters either encode message or insert random letters

Problems of Spam

- Cost
  - Waste bandwidth and disk space
  - DoS like side-effect
  - Waste time and false deletion
  - Bounce messages of nonexistent users
    - Nonexistent return address
    - Forged victim return address
- Detection
  - Aggressive spam policy may cause high false positive

Anti-Spam – Client-Based Detection (1)

- Client-blocking
  - Use IP address, hostnames or email address supplied by clients when they connect to send a message
  - Compared with Spammer list
  - Problems
    - IP address, hostname, email address are forged
    - Innocent victim open relay host
- DNSBL (DNS-based Blacklist)
  - Maintain large database of systems that are known to be open relays or that have been used for spam
- Grey Listing
- SPF – Sender Policy Framework
- …

Anti-Spam – Client-Based Detection (2)

- What DNSBL maintainers do
  - Suppose csie has a Blacklist DNS database
    - ➢ Suppose DNSBL Domain "dnsbl.cs.nctu.edu.tw"
  - If 140.112.23.118 is detected as open relay
    - ➢ There will be a new entry in cs's blacklist DB
      - 118.23.112.140.dnsbl.cs.nctu.edu.tw
  - When we receive a connection from 140.112.23.118
    - ➢ Compose 118.23.112.140.dnsbl.cs.nctu.edu.tw
    - ➢ DNS query for this hostname
      - Successful means this IP address is suspicious
      - Failed means ok
- Using DNSBL
  - Review their service options and policies carefully

Anti-Spam – Content-Based Detection

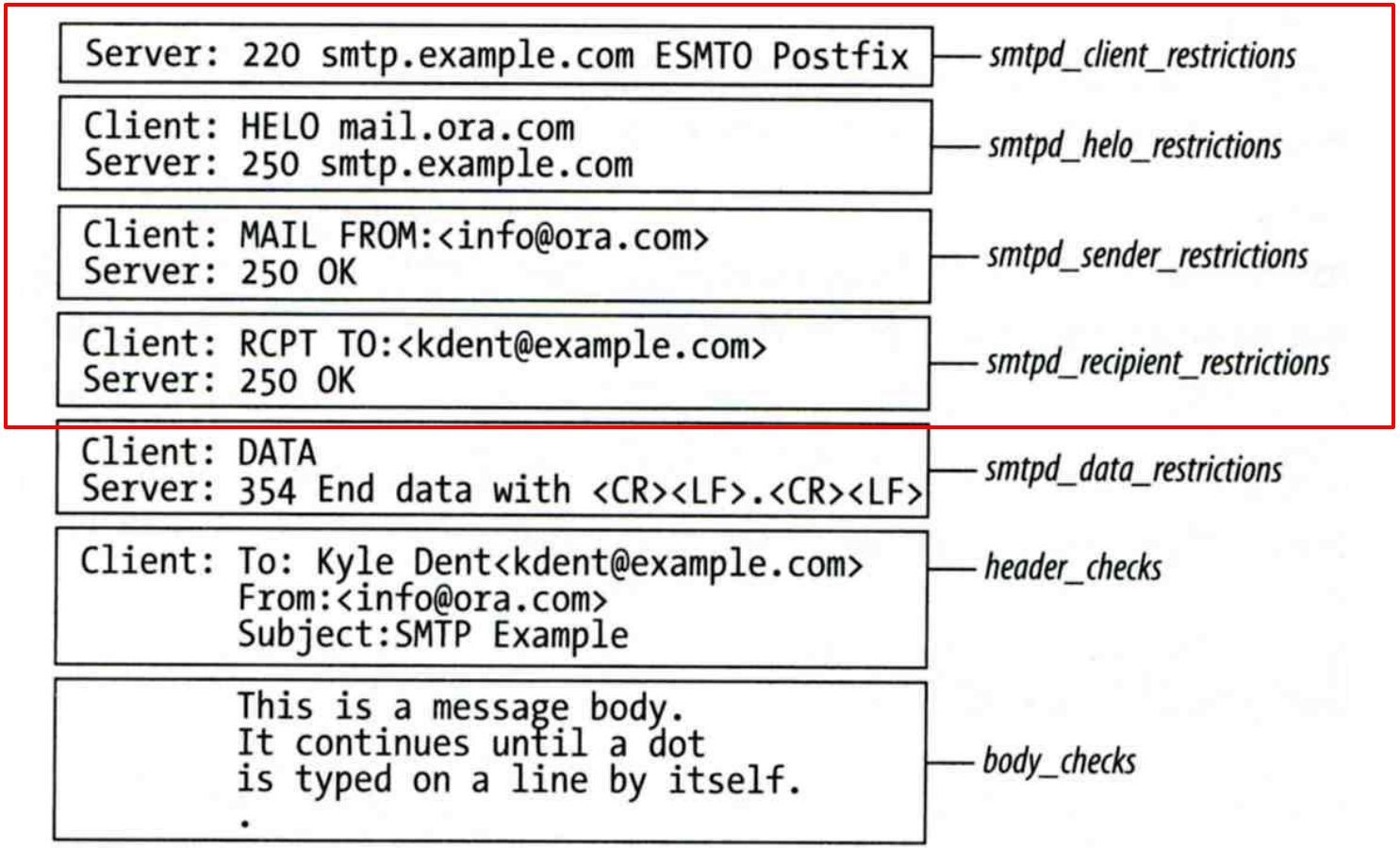
- Spam patterns in message body
- Detection difficulties
  - Embed HTML codes within words of their message to break up phrases
  - Randomly inserted words
  - Content-based detection is slower

Anti-Spam – Action

- When you detect a spam, you can:
  - Reject immediately during the SMTP conversation
  - Save spam into a suspected spam repository
  - Label spam and deliver it with some kind of spam tag
  - Ex:
    - X-Spam-Status: Yes, hits=18.694 tagged_above=3 required=6.3
    - X-Spam-Level: **********
    - X-Spam-Flag: YES

Postfix Anti-Spam configuration

- The SMTP Conversation
  - info@ora.com → smtp.example.com → kdent@example.com



Postfix Anti-Spam configuration – Client Detection Rules (1)

- Four rules in relative detection position
  - Rules and their default values
    - smtpd_client_restrictions =
    - smtpd_helo_restrictions =
    - smtpd_sender_restrictions =
    - smtpd_recipient_restrictions =
      permit_mynetworks, reject_unauth_destination
  - Each restriction check result can be:
    - OK (Accept in this restriction)
    - REJECT (Reject immediately without further check)
    - DUNNO (do next check)
  - There are 5 types of restrictions

Postfix Anti-Spam configuration – Client Detection Rules (2)

1. Access maps
   - List of IP addresses, hostnames, email addresses
   - Can be used in:

```
smtpd_client_restrictions = check_client_access hash:/etc/access
smtpd_helo_restrictions = check_helo access hash:/usr/local/etc/postfix/helohost
smtpd_sender_restrictions = check_sender_access hash:/usr/local/etc/postfix/sender_access
smtpd_recipient_restrictions = check_recipient_access hash:/usr/local/etc/postfix/recipient_access
```

   - Actions
     - OK, REJECT, DUNNO
     - FILTER (redirect to content filter)
     - HOLD (put in hold queue)
     - DISCARD (report success to client but drop)
     - 4xx message or 5xx message

Postfix Anti-Spam configuration – Client Detection Rules (3)

- Example of access maps
  - check_client_access hash:/etc/access

```
nctu.edu.tw  OK
127.0.0.1          OK
61.30.6.207  REJECT
```

  - check_helo access hash:/postfix/helohost

```
greatdeals.example.com   REJECT
oreillynet.com           OK
```

  - check_sender_access hash:/usr/local/etc/postfix/sender_access

```
viagra.com   553 Please contact +886-3-5712121-54707.
aaa@         553 Invalid MAIL FROM
sales@       553 Invalid MAIL FROM
hchen@       553 Invalid MAIL FROM
```

  - check_recipient_access hash:/usr/local/etc/postfix/recipient_access

```
bin@cs.nctu.edu.tw      553 Invalid RCPT TO command
ftp@cs.nctu.edu.tw      553 Invalid RCPT TO command
man@cs.nctu.edu.tw      553 Invalid RCPT TO command
```

Postfix Anti-Spam configuration – Client Detection Rules (4)

2. Special client-checking restrictions
   - permit_auth_destination
     - ➢ Mostly used in "smtpd_recipient_restrictions"
     - ➢ Permit request if destination address matches:
       - – The postfix system's final destination setting
         - » mydestination, inet_interfaces, vitual_alias_maps, virtual_mailbox_maps
       - – The postfix system's relay domain
         - » relay_domains
     - ➢ Found ➔ OK, UnFound ➔ DUNNO
   - reject_unauth_destination
     - ➢ Opposite to permit_auth_destination
     - ➢ Found ➔ REJECT, UnFound ➔ DUNNO
   - permit_mynetworks
     - ➢ Allow a request if interest IP match any address in "mynetworks"
       - – Used in smtpd_recipient_restrictions
       - – Used in smtpd_client_restrictions

Postfix Anti-Spam configuration – Client Detection Rules (5)

3. Strict syntax restrictions
   - Restrictions that does not conform to RFC
   - reject_invalid_hostname
     - Reject hostname with bad syntax
   - reject_non_fqdn_hostname
     - Reject hostname not in FQDN format (HELO or EHLO)
   - reject_non_fqdn_sender
   - reject_non_fqdn_recipient
     - For "MAIL FROM" and "RCPT TO" command respectively

Postfix Anti-Spam configuration – Client Detection Rules (6)

4. DNS restrictions
   - Make sure that clients and email envelope addresses have valid DNS information
   - reject_unknown_client
     - Reject if the client IP has no DNS PTR record
       - 215.17.113.140 IN PTR nabsd.cs.nctu.edu.tw.
     - False detection: many normal MTAs have A records only
   - reject_unknown_hostname
     - Reject if EHLO hostname has no DNS MX or A record
   - reject_unknown_sender_domain
     - Reject if MAIL FROM domain name has no DNS MX or A record
     - Spammers don't want to receive return mails
   - reject_unknown_recipient_domain
     - Reject if RCPT TO domain name has no DNS MX or A record

Postfix Anti-Spam configuration – Client Detection Rules (7)

5. Real-time blacklists
   - Check with DNSBL services
   - reject_rbl_client domain.tld
     - ➢ Reject if client IP is detect in DNSBL
   - reject_rhsbl_client domain.tld
     - ➢ Reject if client hostname has an A record under specified domain
   - reject_rhsbl_sender domain.tld
     - ➢ Reject if MAIL FROM domain in address has an A record under specified domain
   - smtpd_client_restrictions =
     hash:/etc/access, reject_rbl_client relays.ordb.org
   - smtpd_sender_restrictions =
     hash:/usr/local/etc/postfix/sender_access, reject_rhsbl_sender dns.rfc-ignorant.org

Postfix Anti-Spam configuration – Client Detection Rules (8)

6. Policy Service
   - Postfix SMTP server sends in a delegated SMTPD access policy request to one special service (policy serivce).
   - Policy service replies actions allowed in Postfix SMTPD access table.
   - Usage:
     - check_policy_service *servicename*
   - Example: Grey Listing (Using Postgrey)
     - Postgrey daemon runs on port:10023
     - Don't need to specify it in master.cf
     - In main.cf:

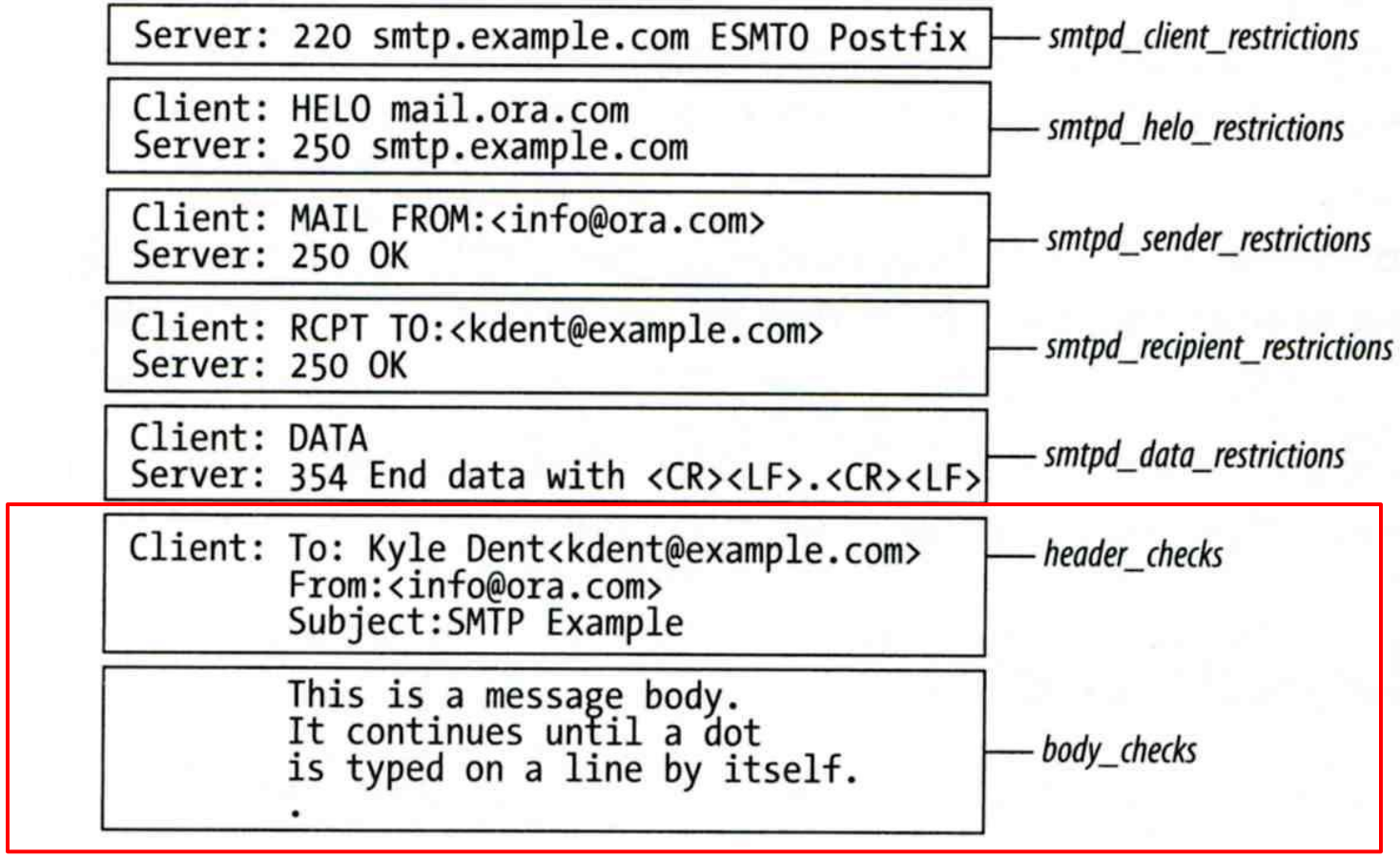
       smtpd_recipient_restrictions = check_policy_service inet:127.0.0.1:10023

Postfix Anti-Spam configuration – Client Detection Rules (8)

- smtpd_client_restrictions
  - check_client_access
  - reject_unknown_client
  - permit_mynetworks
  - reject_rbl_client
  - reject_rhsbl_client
- smtpd_helo_restrictions
  - check_helo_access
  - reject_invalid_hostname
  - reject_unknown_hostname
  - reject_non_fqdn_hostname
- smtpd_sender_restrictions
  - check_sender_access
  - reject_unknown_sender_domain
  - reject_rhsbl_sender
- smtpd_recipient_restrictions
  - check_recipient_access
  - permit_auth_destination
  - reject_unauth_destination
  - reject_unknown_recipient_domain
  - reject_non_fqdn_recipient
  - check_policy_service

Postfix Anti-Spam configuration

- The SMTP Conversation
  - info@ora.com → smtp.example.com → kdent@example.com



Postfix Anti-Spam configuration – Content-Checking rules (1)

- 4 rules
  - header_checks
    - Check for message headers
  - mime_header_checks
    - Check for MIME headers
  - nested_header_checks
    - Check for attached message headers
  - body_check
    - Check for message body
- All rules use lookup tables
  - Ex:

```
header_checks = regexp:/usr/local/etc/postfix/header_checks
body_checks = pcre:/usr/local/etc/postfix/body_checks
```

Postfix Anti-Spam configuration – Content-Checking rules (2)

- Content-checking lookup table
  - Regular_Expression Action
- Actions
  - REJECT message
  - WARN message
    - Logs a rejection without actually rejecting
  - IGNORE
    - Delete matched line of headers or body
  - HOLD message
  - DISCARD message
    - Claim successful delivery but silently discard
  - FILTER message
    - Send message through a separate content filter (may be external program)

Postfix Anti-Spam configuration – Content-Checking rules (3)

- Example of header check
  - header_checks = regexp:/usr/local/etc/postfix/header_checks
  - In /usr/local/etc/postfix/header_checks

    /take advantage now/ REJECT

    /repair your credit/ REJECT
- Example of body check
  - body_checks = regexp:/usr/local/etc/postfix/body_checks
  - In /usr/local/etc/postfix/body_checks

    /lowest rates.*\!/ REJECT

    /[:alpha:]<!--.*-->[:alpha:]/ REJECT

External Filters

- Filtering can be done on
  - MTA
  - MDA
  - MUA

  ※ Combination of MTA and MUA
    - ➢ Adding some extra headers or modifying subject in MTA, and filtering in MUA.

- External filters for postfix
  - Command-based filtering
    - ➢ New process is started for every message
    - ➢ Accept message from STDIN
  - Daemon-based filtering
    - ➢ Stay resident
    - ➢ Accept message via SMTP or LMTP

MDA Filter: Procmail (1)

- Install procmail (port or package)
- Enable Procmail in Postfix
  - In main.cf

```
mailbox_command = /usr/local/bin/procmail
```

- Create configuration file
  - Create /usr/local/etc/procmailrc
- Create log files
  - touch /var/log/procmail.log
- Create directories (optional)
  - mkdir -p /tmp/trash

```
VERBOSE=off
LOGFILE=/var/log/procmail.log

:0b
* ^Subject:.*GGWP.*
/dev/null

:0b
* ^Subject:.*LOL.*
/tmp/trash
```

procmailrc

MDA Filter: Procmail (2-1) - Filter Chinese Text

- Encoding problem
  - We need to set two types of encoded Chinese text
  - Base64 and Quote-Printable
- Tool: mmencode (port or package)
- Generate encoded text
  - Filter "減肥"
  - Generate Base64 code

```
> echo -n "減肥" | mmencode
5rib6IKl
```

  - Generate QP code

```
> echo -n "減肥" | mmencode -q
=E6=B8=9B=E8=82=A5=
```

MDA Filter: Procmail (2-2) - Filter Chinese Text

- Write two rules to filter Chinese text

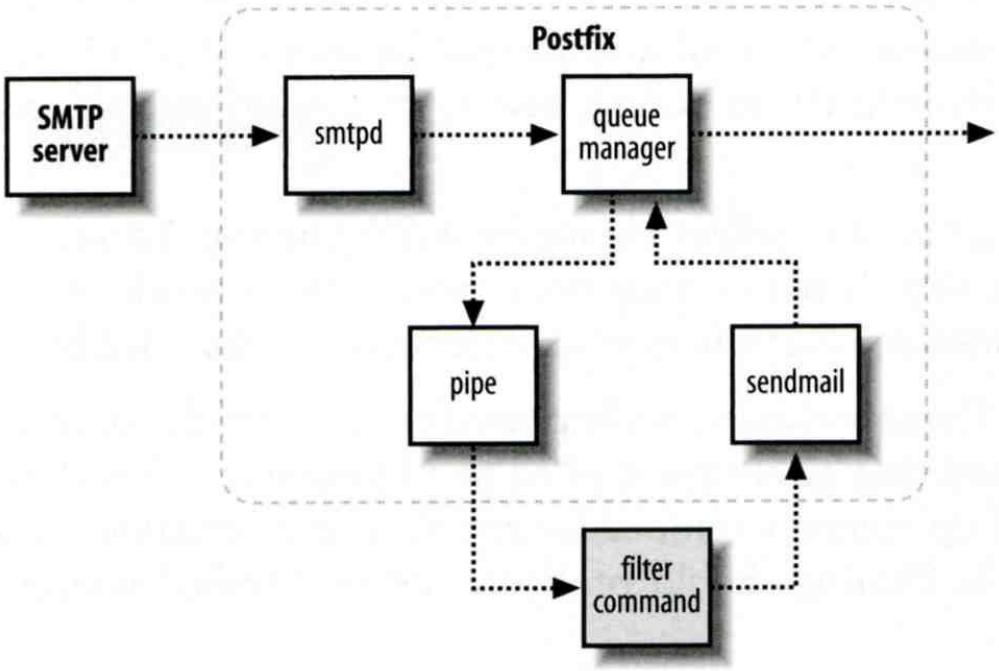
```
# Base64
:0b
* ^Subject:.*5rib6IKl.*
/dev/null

# Quote-Printable
:0b
* ^Subject:.*=E6=B8=9B=E8=82=A5=.*
/dev/null
```

- Log file

```
From lctseng@nasa.lctseng.nctucs.net  Wed Mar  9 12:14:46 2016
 Subject: =?UTF-8?B?5rib6IKl?=
  Folder: /dev/null                                        1
```

Command-Based Filtering (1)

- Usage
  - Postfix delivers message to this filter via "pipe" mailer
  - Program that accepts content on its STDIN
  - Program gives the filtered message back to Postfix using the "sendmail" command (with same queue ID)



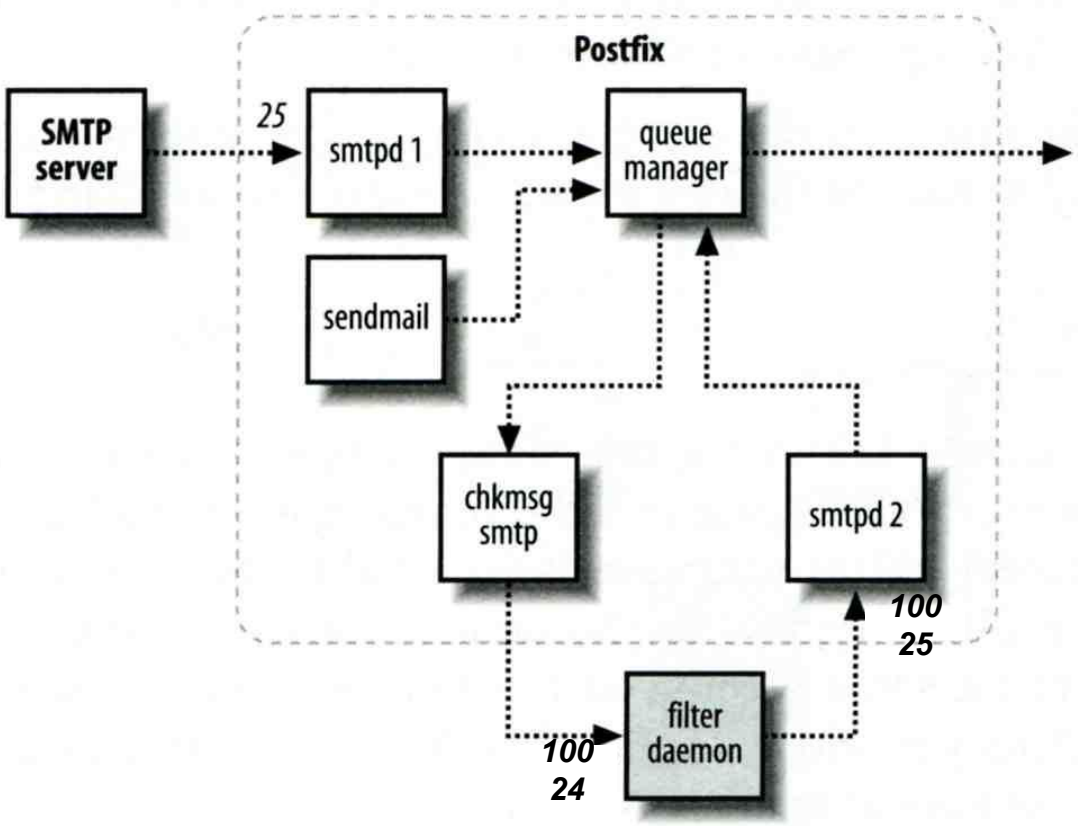
Command-Based Filtering (2)

- Configuration
  - Prepare your filter program (/usr/local/bin/simple_filt)
  - Modify master.cf

```
#==========================================================================
# service type  private unpriv  chroot  wakeup  maxproc command + args
#==========================================================================
filter  unix  -  n       n     -       -       pipe
        flags=Rq user=filter argv=/usr/local/bin/simple_filt -f ${sender} - -${recipient}
smtpd   inet  n       -       n       -       -       smtpd
        -o content_filter=filter:
```

Daemon-Based Filtering (1)

- Usage
  - Message is passed back and forth between Postfix and filtering daemon via SMTP or LMTP



Daemon-Based Filtering (2) - amavisd-new

- Primary daemon: amavisd-new
  - Cooperate with other programs
  - Clamav (anti-virus), SpamAssassin (anti-spam)
- Configuration for amavisd
  - Install and configure your content filter
    - security/amavisd-new (port or package)
    - Modify amavisd.conf to send message back

```
$forward_method = 'smtp:127.0.0.1:10025';
```

  - Edit /etc/rc.conf

```
amavisd_enable="YES"
```

  - Edit main.cf to let postfix use filtering daemon

```
content_filter = smtp-amavis:[127.0.0.1]:10024
```

Daemon-Based Filtering (3) - amavisd-new

- Configuration
  - Edit master.cf to add two additional services

```
smtp-amavis unix -      -       n       -       10       smtp
    -o smtp_data_done_timeout=1200s
    -o smtp_never_send_ehlo=yes
    -o notify_classes=protocol,resource,software
127.0.0.1:10025 inet n  -       n       -       -       smtpd
    -o content_filter=
    -o mynetworks=127.0.0.0/8
    -o local_recipient_maps=
    -o notify_classes=protocol,resource,software
    -o myhostname=localhost
    -o smtpd_client_restrictions=
    -o smtpd_sender_restrictions=
    -o smtpd_recipient_restrictions=permit_mynetworks,reject
    -o smtpd_tls_security_level=
```

Daemon-Based Filtering (4) - amavisd-new

- Now, your amavisd-new is ready
  - With SpamAssassin installed
  - Run “sa-update” to update the SpamAssassin rules
  - Edit SpamAssassin configuration in amavisd.conf
    - E.g. Change spam detect level

```
$sa_tag2_level_deflt = 3.0;
```

Daemon-Based Filtering (5) - amavisd-new

- The mail source in SPAM-detected mail

```
Received: from demo1.nasa.lctseng.nctucs.net (localhost [127.0.0.1])
     by localhost (Postfix) with ESMTP id 1A945274
     for <lctseng@nasa.lctseng.nctucs.net>; Wed,  9 Mar 2016 14:14:39 +0800
(CST)
X-Virus-Scanned: amavisd-new at nasa.lctseng.ncatucs.net
X-Spam-Flag: YES
X-Spam-Score: 4.85
X-Spam-Level: ****
X-Spam-Status: Yes, score=4.85 tagged_above=2 required=3
     tests=[FREEMAIL_ENVFROM_END_DIGIT=0.25, FREEMAIL_FROM=0.001,
     HTML_FONT_LOW_CONTRAST=0.001, HTML_MESSAGE=0.001,
     RCVD_IN_DNSWL_LOW=-0.7, RCVD_IN_MSPIKE_H3=-0.01,
     RCVD_IN_MSPIKE_WL=-0.01, T_REMOTE_IMAGE=0.01, URIBL_ABUSE_SURBL=1.948,
     URIBL_BLACK=1.7, URIBL_WS_SURBL=1.659] autolearn=no autolearn_force=no
Authentication-Results: demo1.nasa.lctseng.nctucs.net (amavisd-new);
     dkim=pass (2048-bit key) header.d=gmail.com
Received: from demo1.nasa.lctseng.nctucs.net ([127.0.0.1])
     by demo1.nasa.lctseng.nctucs.net (demo1.nasa.lctseng.nctucs.net
[127.0.0.1]) (amavisd-new, port 10024)
     with SMTP id CjRyliYl5l6x for <lctseng@nasa.lctseng.nctucs.net>;
     Wed,  9 Mar 2016 14:14:38 +0800 (CST)
```

Daemon-Based Filtering (6) - amavisd-new + ClamAV

- amavisd-new supports lots of anti-virus scanner
- Anti-virus with ClamAV
  - Install security/clamav (port or package)
  - Edit /etc/rc.conf

```
clamav_clamd_enable="YES"
```

  - Update virus database
    - Run “freshclam”
  - Specify to use clamav in amavisd.conf

```
@av_scanners = (

['ClamAV-clamd',
   \&ask_daemon, ["CONTSCAN {}\n", "/var/run/clamav/clamd.sock"],
   qr/\bOK$/m, qr/\bFOUND$/m,
   qr/^.*?: (?!Infected Archive)(.*) FOUND$/m ],
);
```

Daemon-Based Filtering (7) - amavisd-new + ClamAV

- Set alias for “virusalert” user
  - When there is an infected mail, it will send a notification to this user
  - Alias to “root” or “postmaster”
- Start ClamAV and restart amavisd-new
  - service clamav-clamd start
  - service amavisd restart
- Send a test virus by EICAR organization
  - Plain text

```
X5O!P%@AP[4\PZX54(P^)7CC)7}$EICAR-STANDARD-ANTIVIRUS-TEST-FILE!$H+H*
```

  - Reference: https://en.wikipedia.org/wiki/EICAR_test_file

Daemon-Based Filtering (8) - amavisd-new + ClamAV

- Result of sending EICAR test mail

從 Content-filter at demo1.nasa.lctseng.nctucs.net <virusalert@nasa.lctseng.nctucs.net>
主旨 VIRUS (Eicar-Test-Signature) in mail FROM [127.0.0.1] <lctseng@nasa.lctseng.nctucs.net>
給 virusalert@nasa.lctseng.nctucs.net

```
A virus was found: Eicar-Test-Signature

Scanner detecting a virus: ClamAV-clamscan

Content type: Virus
Internal reference code for the message is 93683-01/SIxGUR_-RBuT

First upstream SMTP client IP address: [127.0.0.1]

Received trace: ESMTPSA://140.113.209.205

Return-Path: <lctseng@nasa.lctseng.nctucs.net>
From: Liang-Chi Tseng <lctseng@nasa.lctseng.nctucs.net>
Message-ID: <56DFCCE9.2010608@nasa.lctseng.nctucs.net>
Subject: CC
The message has been quarantined as: virus-SIxGUR_-RBuT

The message WAS NOT relayed to:
<lctseng@nasa.lctseng.nctucs.net>:
   250 2.7.0 ok, discarded, id=93683-01 - infected: eicar-test-signature

Virus scanner output:
  p001: Eicar-Test-Signature FOUND
```