

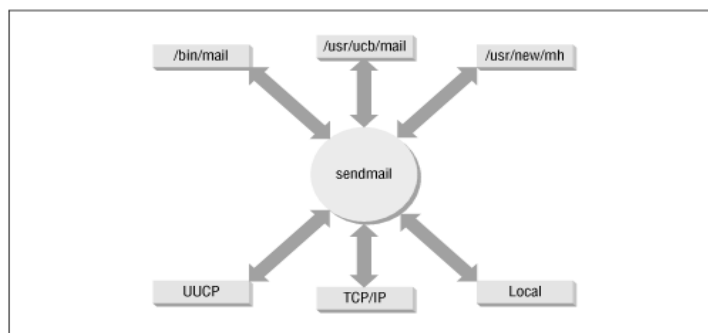
sendmail

- ❑ Widely used
 - But with intimidated complex configuration
- ❑ Other mailservers
 - Exchange, qmail, smail, Postfix, Courier, etc.
- ❑ Why sendmail is complex?
 - To make it SIMPLE for different programs and mail addressing schemes to work together
 - SMTP: over TCP/IP
 - UUCP(Unix to Unix Copy Protocol): over serial line
 - Local mail deliver: sends mail between users on the same system.

Sendmail 10-1

❑ Sendmail's Function

- Routing between user programs and delivery programs based on email address.
- Receives and delivers SMTP (Internet) mail
- Provides system wide mail aliases, which allow mailing lists.



Sendmail 10-2

Sendmail daemon: Receive SMTP mail

- ❑ Listens to port 25 to process incoming mail.
- ❑ Started during system startup,
 - Linux: `/etc/rc.d/init.d/sendmail`
 - Arguments: start, stop, restart, condrestart, status
 - Command line options: `/etc/sysconfig/sendmail`
 - DAEMON=yes # that is -bd
 - QUEUE=1h # that is -q1h
 - Solaris: `/etc/init.d/sendmail`
 - Arguments: start, stop
- ❑ otherwise manually start it by using the command:
`# /use/lib/sendmail -bd -q15m`

Sendmail 10-3

Sendmail Aliases

- ❑ Mail aliases provide
 - Alternate names for individual users
 - Forwarding of mail to other hosts
 - Mailing lists
- ❑ Alias file
 - line format:
alias: recipient[, recipient, ...]
 - alias is the name to which the mail is addressed
 - recipient is the name to which the mail is delivered
 - Username
 - Another aliases
 - Full email address containing both a username and hostname
 - Multiple recipients created a mailing list

Sendmail 10-4

Aliases

❑ Alias file (Cont)

- Default location
 - Solaris: /etc/mail/aliases
 - Linux: /etc/aliases
- Let's take a look at cslserver.csl.mtu.edu's aliases file

```
root: root@cec.mtu.edu
csreq: |"/export/csl/req/etc/req-mailgate"
systems-dist: jdpoisso,ruihong,lesong
```

❑ Rebuild aliases database

- Run the command newaliases
- Or start sendmail with -bi option

Sendmail 10-5

Personal Mail Forwarding

- ❑ ~/.forward
- ❑ Sendmail checks for .forward after using the aliases file before the final delivery
- ❑ Individual user controls
- ❑ Easier

Sendmail 10-6

The sendmail.cf file

- ❑ Other than aliases, .forward, everything else is in /etc/mail/sendmail.cf
 - Defines the sendmail env
 - Rewrite addresses into appropriate syntax for the receiving mailer
 - Maps address into the instructions necessary to deliver the mail
- ❑ Using m4 to build sendmail.cf

Sendmail 10-7

Using m4 to build sendmail.cf

- ❑ Sample mc
 - Linux.mc

```
VERSIONID('.....')
OSTYPE('...')
DOMAIN('wrotethebook.com')
FEATURE('nouucp','reject')
MAILER('local')
MAILER('smtp')
```
 - Domain/wrotethebook.com.m4

```
MASQUERADE_AS(wrotethebook.com)
FEATURE(masquerade_envelope)
FEATURE(genericstable)
```
 - Makemap hash genericstable < realnames
 - #m4 cf.m4 linux.mc > sendmail.cf

Sendmail 10-8

Highlights about sendmail.cf

□ Files used in sendmail.cf

```
[ruihong@cslserver ~]$ grep =/ /etc/mail/sendmail.cf
```

```
#O ErrorHeader=/etc/sendmail.oE
```

```
O HelpFile=/etc/mail/sendmail.hf
```

```
O QueueDirectory=/var/spool/mqueue
```

```
O StatusFile=/etc/mail/sendmail.st
```

```
#O UserDatabaseSpec=/etc/userdb
```

```
#O ServiceSwitchFile=/etc/service.switch
```

```
#O HostsFile=/etc/hosts
```

```
#O SafeFileEnvironment=/arch
```

```
Mlocal, P=/opt/procmail/bin/procmail, F=lsDFMAw5:/|@qSPfh9, S=10/30, R=20/40,
```

```
Mprog, P=/bin/sh, F=lsDFMoqeu9, S=10/30, R=20/40, D=$z:/,
```

Sendmail 10-9

Sendmail's role in Queue management

O QueueDirectory=/var/spool/mqueue

- A mail message can be temporary undeliverable for reasons: remote machine is down, disk problem, ...
- To ensure the a message is eventually delivered, sendmail stores the mail in a queue directory until the message can be delivered successfully.
 - Queue is empty
 - Or a pair of files for each undelivered mail:
 - header info
 - Message
 - Use "sendmail -bp" to check the queue.
- Do not need to process queue too often.
 - -q1h, -q15m for sendmail daemon as command line options

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Sendmail's role in Local Delivery

- ❑ Sendmail deliver mail message.
 - By Appending a message to a file
 - By feeding the mail message to a program.
 - In alias file:

```
csreq: |"/export/csl/req/etc/req-mailgate"
```
 - The | tells sendmail that this is a program to run rather than a file to append to.
- ❑ Mailbox under unix
 - A single file that contains a series of mail messages

Sendmail 10-11

Sendmail's role in Local Delivery

- ❑ In General, sendmail calls other programs to perform delivery

Mlocal, P=/opt/procmail/bin/procmail, F=lsDFMAw5:/@qSPfn9, S=10/30, R=20/40, ...

Mlocal: defines how mail is appended to a user's mailbox file.

/usr/lib/mail.local

/bin/mail

procmail

deliver

Sendmail 10-12

Sendmail's role in Network Transport

- Transporting mail to other machines.
 - A message is transported when sendmail determines that the recipient is not local.
 - Defined delivery agents in the sendmail.cf

```
ruihong@cslserver mail]$ grep Msmtp sendmail.cf
```

```
Msmtp,      P=[IPC], F=mDFMuX, S=11/31, R=21/31, E=\r\n, L=990, ...
```

```
Msmtp8,     P=[IPC], F=mDFMuX8, S=11/31, R=21/31, E=\r\n, L=990, ...
```

- Use other protocols
 - Use Mmac line and /usr/bin/macmail to transport mail to Macintosh machines that are connected on an AppleTalk network.
 - Use Mfax line and /usr/local/bin/faxmail to send a fax using sendmail - a mail message is fed to faxmail for conversion to and transmission as a fax image.

Sendmail 10-13

Sendmail's role in Network Transport

- SMTP function over TCP/IP is internal to sendmail
 - To send a mail
 - Send recipient address to remote site first
 - If remote site accepted the address, sendmail then send the message (header and body together).
 - To receive a mail
 - Start sendmail as a daemon with -bd option.

Sendmail 10-14

How to run sendmail besides daemon mode

❑ With the names of recipients

`%/usr/lib/sendmail george`

`%/usr/lib/sendmail george,truman,teddy`

❑ With other switches started with -

○ -b set operating mode

Couple of example:

• -bd Run as a daemon

• -bi Rebuild alias database

• -bt Test mode: resolve addresses only

– Very useful for testing address transform rule set.

• -bp print the queue

• -bv Verify: don't collect or deliver

– Very helpful, recursively lookup an alias and report the ultimate real name that it found.

○ -v run in verbose mode

○ -d run in debugging mode

Sendmail 10-15

How to run sendmail besides daemon mode

❑ Other names: links to sendmail

○ mailq

○ newaliases

○ purgestat

○ smtpd

❑ Try some commands on

`cslserver.csl.mtu.edu`

1. `sendmail -bv systems-dist`

2. `sendmail -bv root`

Sendmail 10-16

How to run sendmail besides daemon mode

- Try some commands on `cslserver.csl.mtu.edu` (cont)

3. `sendmail -v your-mail-address <<END`

This is a test email

END

Notes: lines begin with numbers and `>>>` constitute a record of the SMTP conversation.

Lines with numbers: reply from remote

Lines with `>>>`: local machine sends to remote

4. `/usr/lib/sendmail -d yourself < /dev/null`

Sendmail 10-17

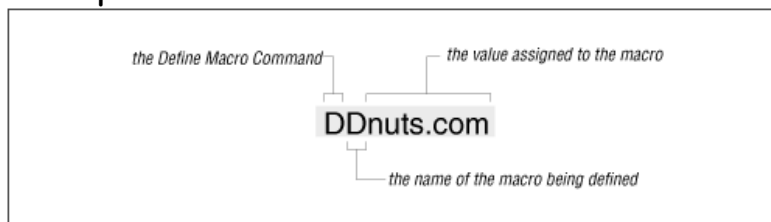
Building a sendmail.cf

- General structure
 - Local information
 - Hostname
 - Mail relay host
 - Mail domain
 - Options
 - Message Precedence
 - Trusted Users
 - Format of Headers
 - Rewriting Rules
 - Mailer Definitions
- Very little of `sendmail.cf` needs to be modified for a typical system.

Sendmail 10-18

Sendmail.cf configuration language

- ❑ Easy to parse for sendmail, not for humans
- ❑ No space between variable and value.



- ❑ Long variable is allowed within braces
D{Domain}wrotethebook.com

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Table: sendmail Configuration Commands

Command	Syntax	Meaning
Version Level	V _{level[/ vendor]}	Specify version level.
Define Macro	D _{xvalue}	Set macro <i>x</i> to <i>value</i> .
Define Class	C _{cword1[word2]...}	Set class <i>c</i> to <i>word1 word2...</i>
Define Class	F _{cfile}	Load class <i>c</i> from <i>file</i> .
Set Option	O _{option=value}	Set <i>option</i> to <i>value</i> .
Trusted Users	T _{user1[user2...]}	Trusted users are <i>user1 user2...</i>
Set Precedence	P _{name=number}	Set <i>name</i> to precedence <i>number</i> .
Define Mailer	M _{name, {field=value}}	Define mailer <i>name</i> .
Define Header	H [? mflag?] _{name:format}	Set header format.
Set Ruleset	S _n	Start ruleset number <i>n</i> .
Define Rule	R _{lhs rhs comment}	Rewrite <i>lhs</i> patterns to <i>rhs</i> format.
Key File	K _{name type [argument]}	Define database <i>name</i> .

Sendmail 10-20

Version Level Command

❑ Vlevel[/vendor]

Example: V8/Berkeley

- Indicates the version level of the configuration syntax
- V command tells sendmail to support certain level of syntax and commands.
- Sendmail will report error message during startup if it can not support the level.

Sendmail 10-21

Define Macro Command

❑ Careful about name confliction

❑ Dxvalue

Example: DSmal.mtu.edu

- Define a macro and stores a value
- A macro can be single character or a word enclosed in curly braces
- Do not use the same name as internal macros when defining user macros
- Reference the value of a macro as \$x

```
DRalmond  
DMnuts.com  
DQ$R.$M
```

- \$%x is used to expand macros at runtime

Sendmail 10-22

Define Macro Command

□ Conditionals

```
DX$g$?x ($x)$.
```

If x has a value set, X=\$g (\$x)

If x does not have a value, X=\$g

```
DX$g$?x text1 $| test2 $.
```

If x is set, X=\$g text1

If x is not set, X=\$g test2

Sendmail 10-23

Defining Classes

□ Classes are used for anything with multiple values.

□ Use C command to define a list of value on one/multiple lines

```
Cwgoober pea
```

```
Or
```

```
Cwgoober
```

```
Cwpea
```

□ Use F command to read from a file

```
Fw/etc/mail/local-host-names
```

□ Special pattern matching

○ \$= matches any value in a class

○ \$~ symbol matches any value not in a class

○ Variable names do not have to be alphabetic characters

Run command `grep '^[CF]' sendmail.cf`

Sendmail 10-24

Setting Options

□ Define sendmail environment

- No user defined options.
- Example:
 - # location of alias file
 - AliasFile=/etc/aliases
 - # temporary file mode
 - TempFileMode=0600
 - # default timeout interval
 - Timeout.queuereturn=5d
- Use `grep '^O' sendmail.cf` to get more

Sendmail 10-25

Defining Trusted Users

□ T command defines a list of users who are trusted to override the sender address using the mailer -f flag.

- Root, uucp, and daemon - must be in /etc/passwd file.
- Do not modify this list - security issue.
- Run `grep "^T" sendmail.cf`

Sendmail 10-26

Defining Mail Precedence

- ❑ Assign priority to messages entering its queue.
The higher the number, the greater the precedence.
- ❑ Pname=number
 - Pfirst-class=0
 - Pspecial-delivery=100
 - Plist=-30
 - Pbulk=-60
 - Pjunk=-100
- ❑ The default precedence of a message is 0
- ❑ To specify a desired precedence, add a precedence header to the outbound messages.

Sendmail 10-27

Defining mail headers

- ❑ The H command defines the format of header lines that sendmail inserts into messages.
 - Only controls header insertion
 - If a header is received in the input, it is passed to the output regardless of header flag settings.
- ❑ H[?mflag?]name:format
- ❑ It's unlikely you'll need to change them

```
grep '^H' sendmail.cf
H?P?Return-Path: <$g>
H?Received: $?sfrom $s $.$?_($?s$|from $.$_)
H?D?Resent-Date: $a
H?D?Date: $a
H?F?Resent-From: $?x$x <$g>$|$g$.
H?F?From: $?x$x <$g>$|$g$.
H?x?Full-Name: $x
H?M?Resent-Message-Id: <$t.$i@$j>
H?M?Message-Id: <$t.$i@$j>
```

Sendmail 10-28

Defining Mailers

- Defines the mail delivery programs.
Mname, {field=value}
- Name is an arbitrary name
 - But, Mailer that delivers local mail to users on the same machine must be called local.
 - And, a mailer named local must be defined in sendmail.cf
 - Other special names are:
 - prog #delivers mail to programs
 - *file* # sends mail to files
 - *include* #directs mail to :include :lists.
- List of "field=value" defines the characteristics of the mailer.

Sendmail 10-29

Field	Meaning	Contents	Example
P	Path	Path of the mailer	P=/bin/mail
F	Flags	sendmail flags for this mailer	F=lsDFMe
S	Sender	Rulesets for sender addresses	S=10
R	Recipient	Rulesets for recipient addresses	R=20
A	Argv	The mailer's argument vector	A=sh -c \$u
E	Eol	End-of-line string for the mailer	E=\r\n
M	Maxsize	Maximum message length	M=100000
L	Linelimit	Maximum line length	L=990
D	Directory	<i>prog</i> mailer's execution directory	D=\$z:/
U	Userid	User and group ID used to run mailer	U=uucp:wheel
N	Nice	nice value used to run mailer	N=10
C	Charset	Content-type for 8-bit MIME characters	C=iso8859-1
T	Type	Type information for MIME errors	T=dns/rfc822/smtp

Sendmail 10-30

Some common mailer definitions

Mlocal, P=/usr/bin/procmail, F=lsDFMAw5:/|@ShP, S=10/30, R=20/40,

T=DNS/RFC822/X-Unix, A=procmail -a \$h -d \$u

Mprog, P=/bin/sh, F=lsDFMoeu, S=10/30, R=20/40, D=\$z:/,

T=X-Unix, A=sh -c \$u

Msmtp, P=[IPC], F=mDFMuX, S=11/31, R=21, E=\r\n, L=990,

T=DNS/RFC822/SMTP, A=IPC \$h

Mesmtpl, P=[IPC], F=mDFMuXa, S=11/31, R=21, E=\r\n, L=990,

T=DNS/RFC822/SMTP, A=IPC \$h

Msmtp8, P=[IPC], F=mDFMuX8, S=11/31, R=21, E=\r\n, L=990,

T=DNS/RFC822/SMTP, A=IPC \$h

Mrelay, P=[IPC], F=mDFMuXa8, S=11/31, R=61, E=\r\n, L=2040,

T=DNS/RFC822/SMTP, A=IPC \$h

Sendmail 10-31

Rewriting the Mail Address

□ Rewrite rules are the heart of sendmail.cf

○ What is rule?

- Used to parse email addresses from user mail programs and rewrite them into the form required by the mail delivery programs.

• Syntax is:

Rpattern transformation comment

○ Pattern is defined using macros, classes, literals, and special metasympols.

Sendmail 10-32

Symbol	Meaning
<code>\$@</code>	Match exactly zero tokens.
<code>\$*</code>	Match zero or more tokens.
<code>\$+</code>	Match one or more tokens.
<code>\$-</code>	Match exactly one token.
<code>\$=x</code>	Match any token in class <i>x</i> .
<code>\$~x</code>	Match any token not in class <i>x</i> .
<code>\$x</code>	Match all tokens in macro <i>x</i> .
<code>\$\$x</code>	Match any token in the NIS map named in macro <i>x</i> . [17]
<code>\$\$!x</code>	Match any token not in the NIS map named in macro <i>x</i> . [17]
<code>\$\$%y</code>	Match any token in the NIS hosts.byname map. [17]

Sendmail 10-33

Pattern matching

- ❑ What is operator?
 - Defined in option `OperatorChars: . % @ [,` , etc.
- ❑ What is token?
 - A string of characters in an email address delimited by an operator.
 - Operators are also counted as tokens
 - For example, `becky@rodent.wrotethebook.com`
 - Contains seven tokens: `becky`, `@`, `rodent`, `.`, `.`, `wrotethebook`, `.`, `com`
 - And match the pattern `$-@$+`

Sendmail 10-34

Pattern matching

- What is indefinite tokens?
 - The strings from the address that match the meta symbols are assigned to indefinite tokens - may contain more than one token value.
 - Identified numerically: \$1, \$2, etc.
 - For example, becky@rodent.wrotethebook.com
 - Contains seven tokens: becky, @, rodent, ., ., wrotethebook, ., com
 - And match the pattern \$-@\$+
 - \$1 has one token, that is bechy
 - \$2 has three tokens, which are rodent, wrotethebook and com.

Sendmail 10-35

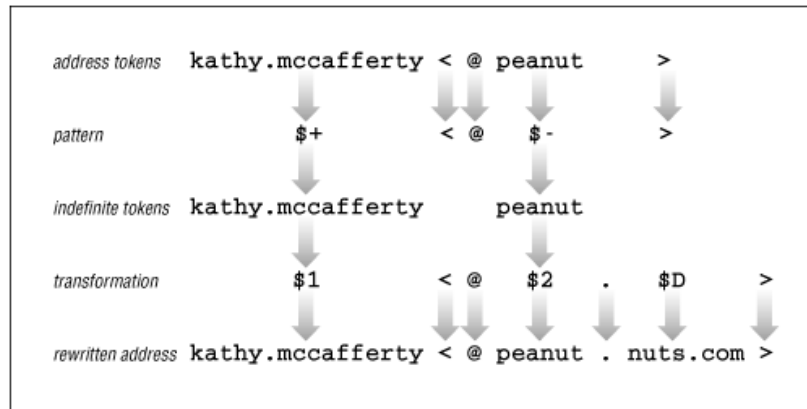
Transforming the Address

- How are rules being used?
 - Pattern matching
 - Repeated process of matching and rewriting
- Transformation field is defined using literals, macros, and special metasymbols
- Addresses are always processed by several rewrite rules.

Symbol	Meaning
$\$n$	Substitute indefinite token n .
$\$[name\$]$	Substitute the canonical form of $name$.
$\$(map\ key\ \$@argument\ \$:default\$)$	Substitute a value from database map indexed by key .
$\$>n$	Call ruleset n .
$\$@$	Terminate ruleset.
$\$:$	Terminate rewrite rule.

Sendmail 10-36

Transforming the address



Note: See page 313-317 for more about transforming

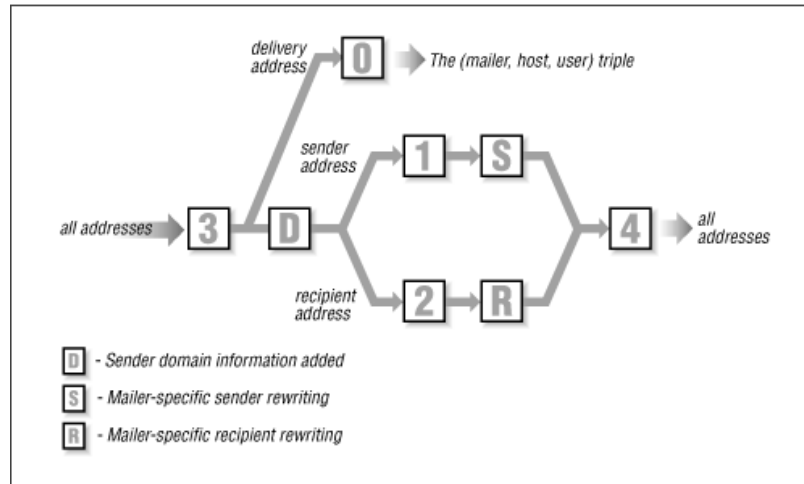
Sendmail 10-37

Set Ruleset command

- ❑ Rulesets are groups of associated rewrite rules that can be referenced by a name or a number.
- ❑ S command marks the beginning of a ruleset and name I.
 - Sname=number
 - or
 - Sn
- ❑ Can be thought of as subroutines designed to process mail addresses
- ❑ Rulesets are called
 - From mailer definition
 - Individual rewrite rules
 - Directly by sendmail

Sendmail 10-38

Special rulesets called directly by sendmail



Sendmail 10-39

Modifying a sendmail.cf

□ Let's work on a example.

On Linux, configure for rodent.wrotethebook.com

Modifying the local information.

- Class w is the full set of hostnames for which this system accepts mail.
- On system crab
Cwlocalhost wtb-gw wtb-gw.writethebook.com
Mail addressed to user@wtb-gw.writethebook.com would be accepted by crab and not rejected as being addressed to the wrong host.
- Test is using "sendmail -bt -d0.4" for some values.
- Change the version number

○ Modifying the options

- Don't modify them if they are right.

Sendmail 10-40

Testing sendmail.cf

Argument Function

-t	Send to everyone listed in To:, Cc:, and Bcc:.
-bt	Run in test mode.
-bv	Verify addresses; don't collect or deliver mail.
-bp	Print the mail queue.
-C file	Use <i>file</i> as the configuration file.
-d level	Set debugging level.
-O option=value	Set <i>option</i> to the specified <i>value</i> .
-e	Defines how errors are returned.
-v	Run in verbose mode.

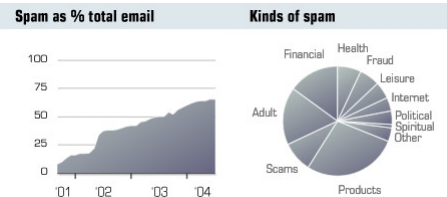
Sendmail 10-41

Spam

❑ MTU spam filter: IronPort

❑ SpamAssassin

- Awarding winning
- Open Source Mail filter
- Features
 - Header tests
 - Body phrase tests
 - Bayesian filtering
 - Automatic address whitelist/blacklist
 - Manual address whitelist/blacklist
 - Collaborative spam identification database
 - DNS blocklists
 - Character sets and Locales



Source: SpamAssassin, IronPort, and other sources.

Sendmail 10-42

Sendmail macros

- ❑ FEATURE(`use_cw_file`)
- ❑ FEATURE(`redirect`)
 - Aliase: smithj: joe@newsite.com.REDIRECT
- ❑ FEATURE(`always_add_domain`)
- ❑ FEATURE(`nocanonify`)
- ❑ FEATURE(`mailertable`)
- ❑ FEATURE(`access_db`, `hash /etc/mail/access`)
- ❑ FEATURE(`virtusertable`)

Sendmail 10-43

Sendmail macros

- ❑ MASQUERADE_AS(`wrotethebook.com`)
- ❑ Define(`MAIL_HUB`, `smtp:mailhub.csl.colorado.edu`)
- ❑ Define(`SMART_HOST`, `smtp:mailhub.csl.colorado.edu`)

Sendmail 10-44

Summary

□ Sendmail

- Sends/receives SMTP mail - daemon
- Process mail aliases - aliase file
- Interfaces between user mail agents, mail delivery agents - sendmail.cf
 - Sendmail.cf has very term command syntax
 - M4 macro processor
 - Interactive testing tool
 - Very little need to be changed from the sample configuration which comes with the package.