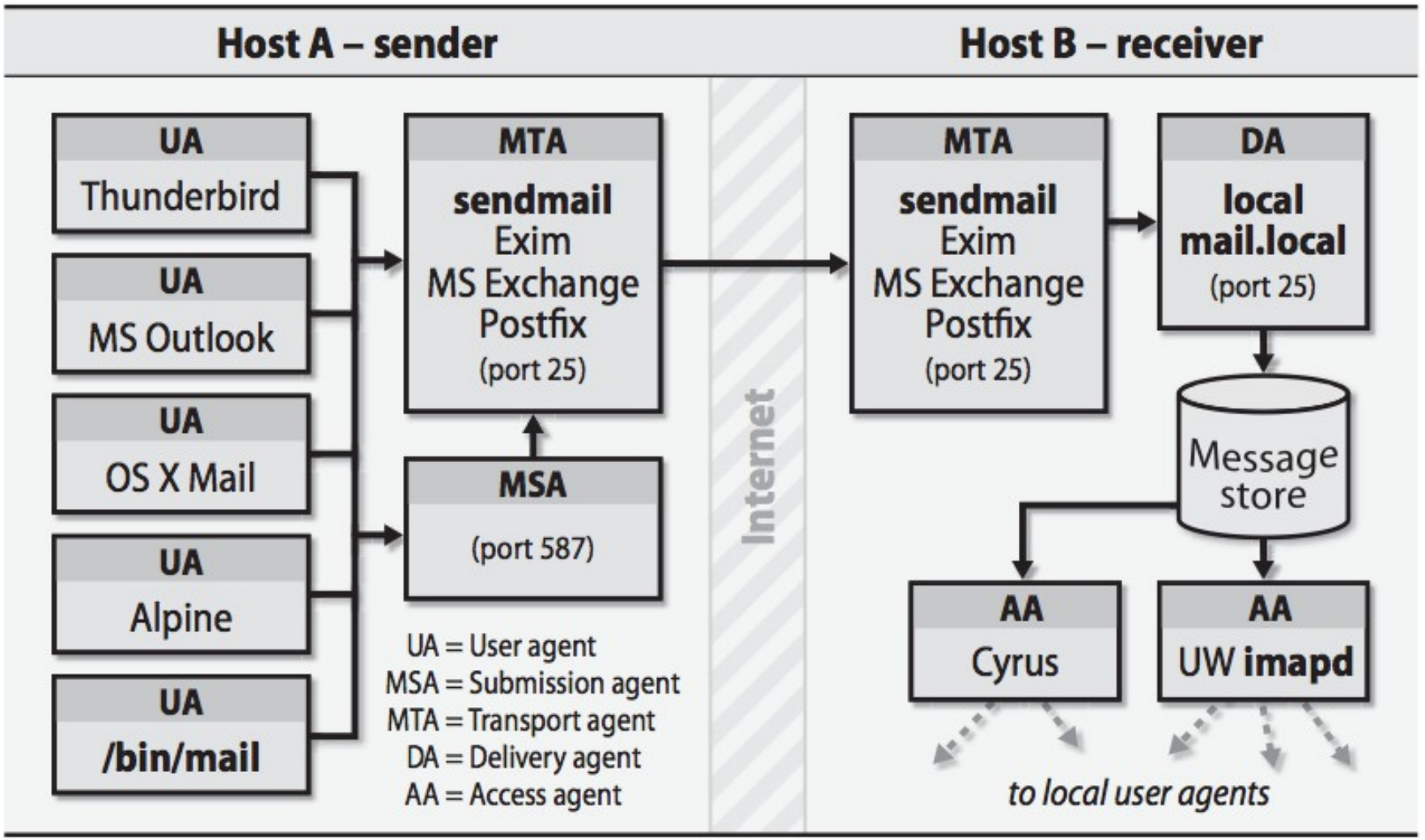
CSE 265: System and Network Administration

- Electronic Mail
  - Mail systems
  - Addressing, mail headers
  - Client/server philosophy, mail homes
  - Aliases, mail routing, mailing list software
  - sendmail
  - Security
  - Performance

Mail systems

- Four components
  - Mail user agent (MUA) to read and compose mail
  - Mail transport agent (MTA) route messages
  - Delivery agent that stores messages for later retrieval by users
  - Optional access agent to connect user agent to message store

The big picture



User agents

- Provide means to read and compose email

  - Outlook, Thunderbird, Eudora, pine, elm, IMP, /bin/mail, emacs, web-based gmail, and more
- Often have system-wide and personal configuration files
- Modern ones support Multipurpose Internet Mail Extensions (MIME) encoding for different text formats and attachments

Transport agents

- Transport agents accept mail from a user agent, and deliver mail to the correct hosts
  - PMDF, **postfix**, smail, Exim, **sendmail**
- Speak the Simple Mail Transport Protocol (SMTP) or Extended SMTP (ESMTP)
- Run on port 25

Delivery agents

- Accepts mail from a transport agent, and delivers to the local recipient
- Delivery can be to
  - a person's mailbox
  - a mailing list
  - a file
  - a program
- Agents include
  - /bin/mail for local users
  - /bin/sh for programs
  - procmail

Access agents

- Agents include
  - imapd – IMAP server
    - insecure, port 143
    - secure, port 993
  - spop – POP server
    - insecure, port 109 (pop2), 110 (pop3)
    - secure, port 995

Mail submission agents (MSA)

- High volume sites may need a separate mail submission agent
- Preprocess messages
  - Ensure hostnames are fully qualified
  - Modify broken headers
  - Log errors
  - Re-write headers
- Usually runs on port 587 or 465 (smtps)
- sendmail can act as an MSA (as well as MTA)

Mail messages

- Three components
  - The envelope
    - Where the message is to be delivered, plus where to return if undeliverable
    - Different from header lines From: and To:
    - Supplied separately to the MSA
  - The headers
    - Collection of property-value pairs
    - Includes date and times and agents through which the message has passed
  - The body
    - Actual contents (in plain text)

Sample mail headers #1

```
From rjd0@lehigh.edu  Wed Sep 26 16:50:49 2001
Received: from rain.CC.Lehigh.EDU (rain.CC.Lehigh.EDU [128.180.39.20])
        by genie.eecs.lehigh.edu (8.9.3/8.9.3) with ESMTP id QAA03440
        for <brian@cse.lehigh.edu>; Wed, 26 Sep 2001 16:50:34 -0400 (EDT)
Received: from lehigh.edu (iceBook.CC.Lehigh.EDU [128.180.3.8])
        by rain.CC.Lehigh.EDU (8.11.5/8.11.5) with ESMTP id f8QKoIT24177
        for <brian@cse.lehigh.edu>; Wed, 26 Sep 2001 16:50:24 -0400
Message-ID: <3BB23F7A.A1005AC8@lehigh.edu>
Date: Wed, 26 Sep 2001 16:50:01 -0400
From: Robin Deily <rjd0@lehigh.edu>
Organization: Lehigh University
X-Mailer: Mozilla 4.75C-CCK-MCD {C-UDP; EBM-APPLE} (Macintosh; U; PPC)
X-Accept-Language: en
MIME-Version: 1.0
To: "Brian D. Davison" <brian@cse.lehigh.edu>
Subject: Re: commercial internet outage
References: <Pine.SOL.3.91.1010926112807.18638A@pan>
Content-Type: text/plain; charset=us-ascii
Content-Transfer-Encoding: 7bit
Status: RO
X-Status:
X-Keywords:
X-UID: 2
```

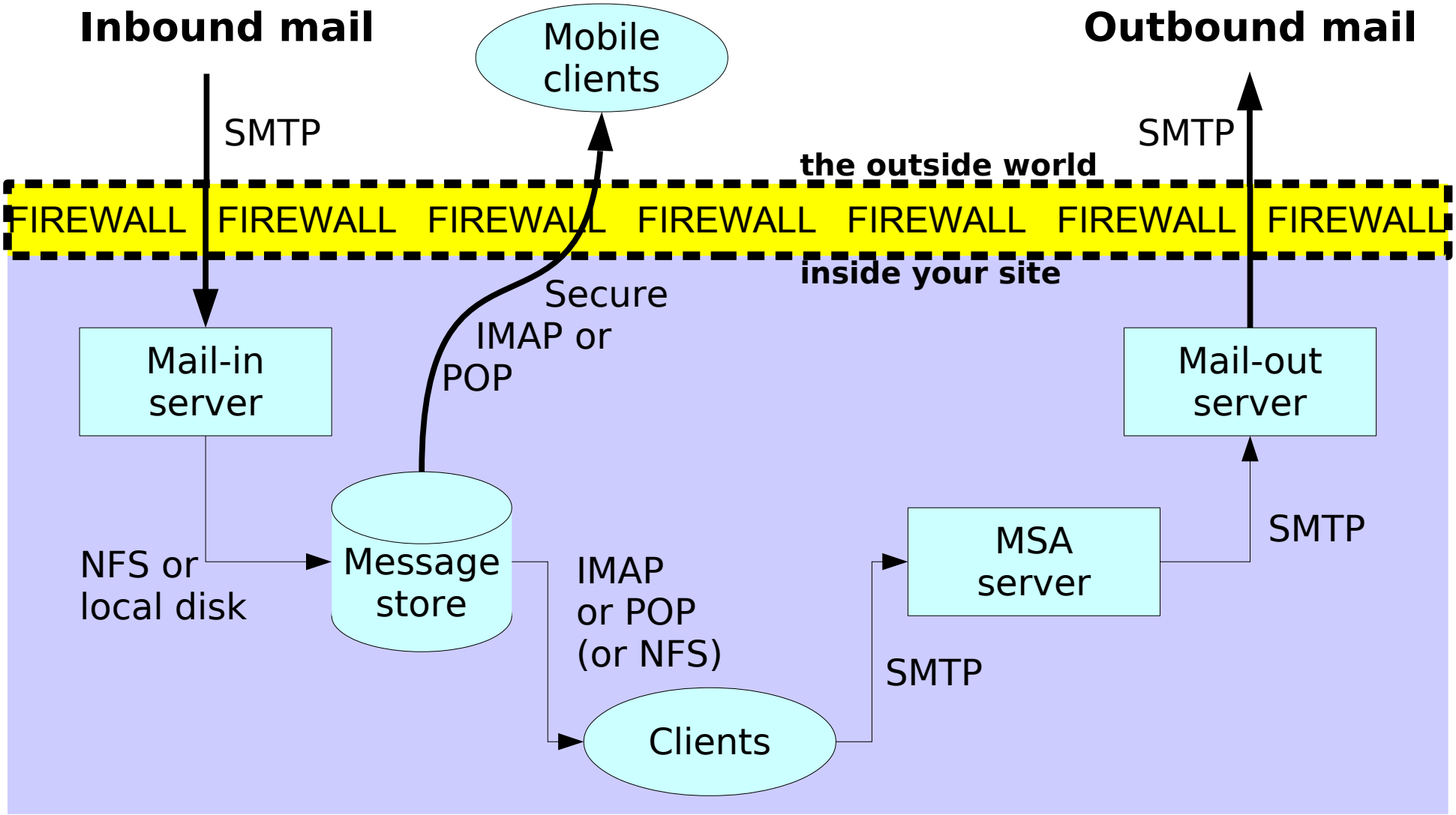

Sample mail headers #2

```
From BBUOVA@yahoo.com Fri Mar 19 12:37:49 2004
Received: from rain.CC.Lehigh.EDU (rain.CC.Lehigh.EDU [128.180.39.20])
        by genie.eecs.lehigh.edu (8.12.10/8.12.10) with ESMTP id i2JHbmN9014501
        for <brian@cse.lehigh.edu>; Fri, 19 Mar 2004 12:37:48 -0500 (EST)
Received: from alias.acm.org (alias.acm.org [199.222.69.90])
        by rain.CC.Lehigh.EDU (8.12.11/8.12.11) with ESMTP id i2JHZ2Sa006893
        for <davison@lehigh.edu>; Fri, 19 Mar 2004 12:35:03 -0500
Received: from 12-219-103-195.client.mchsi.com ([12.219.103.195])
        by alias.acm.org (ACM Email Forwarding Service) with SMTP id COB73880;
        Fri, 19 Mar 2004 12:35:00 -0500
X-Message-Info: EUKNoBG22bAWz/vLgLAarLmRbForUh0F
Received: from deface-l13.besiege.aol.com ([239.93.237.144]) by tp9-h40.hotmail
com with Microsoft SMTPSVC(5.0.2195.6824);
         Sat, 20 Mar 2004 12:23:54 +0300
From: Olin Pack <BBUOVA@yahoo.com>
To: davidlow@acm.org
Subject: wknd-wonder is here! homestead
Date: Sat, 20 Mar 2004 08:19:54 -0100 EST
Message-ID: <75395305408904.00820.60856274@yucatan-t14.aol.com>
Mime-Version: 1.0
Content-Type: multipart/alternative;
        boundary="--735759342820754O603"
Content-Length: 873
```


Mail architecture

- Typical architecture
  - Servers for incoming and outgoing mail
  - A mail home for each user in an organization
  - IMAP or POP for access by users (PCs, Macs, remote clients)
- A mail server needs
  - to accept outgoing mail from user agents and inject into mail system
  - to receive incoming mail from outside world
  - to deliver mail to end-user's mailboxes
  - to allow users to access mail via IMAP or POP

Sample architecture



Aliases and mail forwarding

- Mail can be re-routed by admins or users
  - when sending user's agent config file has a replacement
  - when there is an entry in /etc/aliases
  - when the receiving user has a ~/.forward file
- Sample /etc/aliases entries:

```
webmaster:   steinberg,hodgson
support:     :include:/usr/local/mail/lists/support.ml
help:        support
```

- **newaliases** rebuilds alias database
- Sample .forward files:
  - "| IFS=' ' && exec /usr/bin/procmail -t || exit 75 # brian"
  - user@newaddress.com

Mailing lists

- sendmail treats entries in /etc/aliases that :include: files as mailing lists
- If an alias for owner-mylist exists, sendmail uses the value of that alias as the envelope sender
  - This makes list bounces go to the list owner, rather than to the poster of the message
  - If the bounced message also bounces, then the value of the alias owner-owner gets the message (or postmaster, otherwise)
- Many packages help to maintain mailing lists
  - Majordomo, mailman, ListProc, SmartList, etc.

sendmail

- One standard MTA for Linux
- sendmail does most of the work
  - understands recipients' addresses
  - chooses an appropriate delivery or transport agent
  - rewrites addresses to be understood by delivery agent
  - reformats headers as required
  - generates error messages and returns messages to senders if undeliverable
- System daemon explicitly started at boot

sendmail modes

- -b flag determines modes
  - -bd daemon mode, listen on port 25
  - -bD, but in foreground rather than background
  - -bp print mail queue (same as mailq)
  - -bt address test mode
  - -bv verify mail addresses only (don't send mail)
- -q30m attempts to process the mail queue every 30 minutes

mail queue

- Mail messages are stored in the queue directory /var/spool/mqueue
  - when the system is too busy to deliver them immediately
  - when a destination machine is unavailable
- /usr/bin/mailq to view
  - separate files for headers, body, error messages

```
                /var/spool/mqueue (24 requests)
----Q-ID---- --Size-- -----Q-Time----- ------------Sender/Recipient-----------
i2JKcuR26576     4230 Fri Mar 19 15:38 MAILER-DAEMON
      8BITMIME   (Deferred: Connection timed out with sbcglobal.com.)
                                       <mchohl@sbcglobal.com>
i2K2G7R12880*    3479 Fri Mar 19 21:16 MAILER-DAEMON
                 (Deferred: Connection timed out with 168.com.)
                                       <enxwesbkqen@168.com>
```


sendmail configuration

- /etc/sendmail.cf – only read at startup
- Specifies
  - choice of delivery agents
  - address rewriting rules
  - mail header formats
  - options
  - security precautions
  - spam resistance
- Raw config file is almost **unreadable**
- Use a preprocessor (m4) instead

sendmail and m4

- **m4** is a generic macro preprocessor
  - macros have form
    - name(arg1, arg2, ..., argn)
  - **dnl** is built-in macro to ignore until newline
  - used to convert sendmail.mc to sendmail.cf
  - strings use open and close quote `example'
- Typical process

  1) edit .mc file with changes
  2) rebuild config file
  3) install config file in right directory
  4) restart sendmail

sendmail m4 primitives

- OSTYPE(`linux')
  - OS-specific flags, file locations, etc.
- **define(`ALIAS_FILE',``/etc/aliases,nis:mail.aliases")**
  - Define which sources and ordering of aliases
- MAILER(smtp) and/or MAILER(procmail)
  - Specify which local mailers are enabled
- FEATURE(`use_cw_file')
  - /etc/mail/local-host-names contains all names for system
- FEATURE(`always_add_domain')
  - adds the local hostname to local addresses when needed

Virtual Users

- sendmail supports domain aliasing for incoming mail
  - FEATURE(`virtusertable')
- Examples

```
info@foo.com    foo-info            # route to local user
info@bar.com    bar-info            # another local user
@baz.org        jane@elsewhere.com  # all mail to jane
@zokni.org      %1@elsewhere.com    # same user, dif. domain
```

- Still need
  - MX records for each domain (to receive such mail)
  - cw entries for each domain (to enable relay)

Sample sendmail.mc

```
divert(-1)
dnl This is the sendmail macro config file. If you make changes to this,
dnl generate a new /etc/sendmail.cf by running the following command:
dnl        m4 /etc/mail/sendmail.mc > /etc/sendmail.cf
dnl
include(`/usr/lib/sendmail-cf/m4/cf.m4')
VERSIONID(`linux setup for Red Hat Linux')dnl
OSTYPE(`linux')
define(`confDEF_USER_ID',``8:12'')dnl
define(`confAUTO_REBUILD')dnl
define(`confTO_CONNECT', `1m')dnl
define(`confDONT_PROBE_INTERFACES',true)dnl
define(`ALIAS_FILE', `/etc/aliases')dnl
define(`confUSERDB_SPEC', `/etc/mail/userdb.db')dnl
define(`confPRIVACY_FLAGS', `goaway,authwarnings,restrictqrun')dnl
FEATURE(`no_default_msa',`dnl')dnl
FEATURE(`smrsh',`/usr/sbin/smrsh')dnl
FEATURE(`mailertable',`hash -o /etc/mail/mailertable.db')dnl
FEATURE(`virtusertable',`hash -o /etc/mail/virtusertable.db')dnl
FEATURE(redirect)dnl
FEATURE(always_add_domain)dnl
FEATURE(use_cw_file)dnl
FEATURE(use_ct_file)dnl
```

sample sendmail.cf portions (1)

```
Cwlocalhost
# file containing names of hosts for which we receive email
Fw/etc/mail/local-host-names

##########################
#   Format of headers    #
##########################

H?P?Return-Path: <$g>
HReceived: $?sfrom $s $.$?_($?s$|from $.$_)
        $.$?{auth_type}(authenticated$?{auth_ssf} (${auth_ssf} bits)$.)
        $.by $j ($v/$Z)$?r with $r$. id $i$?{tls_version}
        (using ${tls_version} with cipher ${cipher} (${cipher_bits} bits) verifi
ed ${verify})$.$?u
        for $u; $|;
        $.$b
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
# HPosted-Date: $a
# H?l?Received-Date: $b
H?M?Resent-Message-Id: <$t.$i@$j>
H?M?Message-Id: <$t.$i@$j>
```


sample sendmail.cf portions (2)

```
##############################################
###  Ruleset 3 -- Name Canonicalization  ###
##############################################
Scanonify=3

# handle null input (translate to <@> special case)
R$@                     $@ <@>

# strip group: syntax (not inside angle brackets!) and trailing semicolon
R$*                     $: $1 <@>                       mark addresses
R$* < $* > $* <@>       $: $1 < $2 > $3                 unmark <addr>
R@ $* <@>               $: @ $1                         unmark @host:...
R$* :: $* <@>           $: $1 :: $2                     unmark node::addr
R:include: $* <@>       $: :include: $1                 unmark :include:...
R$* [ IPv6 : $+ ] <@>   $: $1 [ IPv6 : $2 ]             unmark IPv6 addr
R$* : $* [ $* ]         $: $1 : $2 [ $3 ] <@>           remark if leading colon
R$* : $* <@>            $: $2                           strip colon if marked
R$* <@>                 $: $1                           unmark
R$* ;                      $1                           strip trailing semi
R$* < $+ :; > $*        $@ $2 :; <@>                    catch <list:;>
R$* < $* ; >               $1 < $2 >                    bogus bracketed semi
```


sendmail.mc continued

```
define(`PROCMAIL_MAILER_PATH',`/usr/bin/procmail')dnl
FEATURE(local_procmail,`',`procmail -t -Y -a $h -d $u')dnl
FEATURE(`access_db',`hash -o /etc/mail/access.db')dnl
FEATURE(`blacklist_recipients')dnl
FEATURE(dnsbl,`dnsbl.njabl.org',`Message from $&{client_addr} rejected -
    see http://njabl.org/lookup?$&{client_addr}')
FEATURE(`dnsbl', `relays.ordb.org', `"550 Email rejected due to sending
    server misconfiguration - see
    http://www.ordb.org/faq/\#why_rejected"')dnl
FEATURE(`dnsbl', `psbl.surriel.com', `*** SPAM Blocked --
    See http://psbl.surriel.com/')dnl
FEATURE(`dnsbl',`dnsbl.sorbs.net',`"554 Rejected " $&{client_addr} "
    found in dnsbl.sorbs.net"')dnl
FEATURE(`dnsbl',`dnsbl-1.uceprotect.net',`"554 Rejected " $&{client_addr}
    "is BLACKLISTED at LEVEL 1 by UCEPROTECT-NETWORK. To be removed see
    http://www.uceprotect.net"')dnl
EXPOSED_USER(`root')dnl
MAILER(smtp)dnl
MAILER(procmail)dnl
Cwlocalhost.localdomain
```


Debugging

- SMTP is a simple protocol with only 14 commands
  - Can use telnet to connect to an SMTP server and issue commands manually
- sendmail uses syslog – messages get placed into /var/log/maillog (on RHEL)

```
Mar 22 10:55:10 localhost sendmail[26115]: i2MFt9D26115: ruleset=check_relay,
  arg1=mx-01.suga-n-spice.com, arg2=64.201.119.12, relay=mx-01.suga-n-spice.com
  [64.201.119.12], reject=553 5.3.0 *** SPAM Blocked from 64.201.119.12 - See
  http://bl.csma.biz/.
Mar 22 10:55:10 localhost sendmail[26115]: NOQUEUE: mx-01.suga-n-spice.com
  [64.201.119.12] did not issue MAIL/EXPN/VRFY/ETRN during connection to MTA
```


Final comments

- My server/domains were online 1995~2010
  - Well-publicized domains and email addresses
  - Posted to mailing lists, newsgroups, and in Web pages
- Few accounts; each got hundreds of SPAM/day
- Using the **dnsbl** feature with multiple sites has blocked (not filtering) ~2000 messages per day
  - some still get through (perhaps 5%)
- Find list of dnsbl sites at
  - http://www.dnsbl.info/
- Check potential spammer/relay IPs in multiple lists
  - http://multirbl.valli.org/lookup/ or http://www.mxtoolbox.com

