Email Architecture

with sendmail and postfix

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Table of Contents

Organisation

- Say example is an example organisation
  - cs is an autonomous suborganisation
  - bio is a managed suborganisation
    - inf is an autonomous part of bio
    - po is a managed part of bio

Structure of the organisation

- example
  - cs
  - bio
    - inf
    - po

DNS mirrors the structure

- Where are the cuts?
- example.edu.
  - cs.example.edu.
  - bio.example.edu.
    - inf.bio.example.edu.
    - po.bio.example.edu.

Email mirrors the structure

mail.* are mail relays and servers

- mail.example.edu.
  - mail.cs.example.edu.
  - mail.bio.example.edu.
    - mail.inf.bio.example.edu.
    - mail.po.bio.example.edu.

MX records (1)

example.edu.	MX	0	mail.example.edu.
cs.example.edu.	MX	0	mail.cs.example.edu.
		10	mail.example.edu.
bio.example.edu.	MX	0	mail.bio.example.edu.
		10	mail.example.edu.

MX records (2)

inf.bio.example.edu.	MX	0	mail.inf.bio.example.edu.
		5	mail.bio.example.edu.
		10	mail.example.edu.
po.bio.example.edu.	MX	0	mail.po.bio.example.edu.
		5	mail.bio.example.edu.
		10	mail.example.edu.

Email addresses

- Employee “The Boss” working in department “inf”
  - boss@inf.bio.example.edu
  - The.Boss@bio.example.edu
  - emp0@example.edu

Email forwarding

- emp0@example.edu is forwarded to
  - The.Boss@bio.example.edu, which is in turn forwarded to
    - boss@inf.bio.example.edu
- Forwarding can be
  - user based (.forward)
  - system based (alias file or database)

SMTP flow (inbound) (1)

- Directly to mailhost in MX record
  - emp0@example.edu enters at top
  - boss@inf.bio.example.edu enters at leaf

SMTP flow (inbound) (2)

- Always to mail.example.edu.
  - Requires “split” DNS
    - Different outside MX record for inf.bio.example.edu., pointing to mail.example.edu.
  - Alternatively block port 25 from the outside
    - What is your opinion about this solution?

SMTP flow (outbound)

- Directly to outside world
  - No "corporate" policy
  - Needs smart hosts decentrally
- Flowing up the tree step by step
  - Uses the "smart host" option
- Directly to the top of the tree
  - Uses the "smart host" option

Mail access

- Only leaf mail servers supply mail access
- Intermediate servers are relay only
- In case you want to deliver higher in the tree
  - Create an extra child for mail delivery
  - Separate SMTP relay from local delivery and IMAP access
  - Possibly separate outgoing and incoming email, much like separating authoritative and caching name servers

sendmail configuration (for Ubuntu 12.04 LTS)

- Debian specific (based on sendmail 8.14.4)
- Has an extensive init script to control sendmail execution
- Uses a separate sendmail.conf file to source inside init script
- Uses a helper program (sendmailconfig) to generate the main configuration file sendmail.mc

sendmail configuration directory

- /etc/mail as configuration directory
  - sendmail.mc, which is used to generate
    - sendmail.cf
    - using the m4 macro processor
  - local-host-names
  - aliases
  - access
  - ...

m4 macros

- Inside /usr/share/sendmail/cf
  - m4 source files m4/*
    - cf.m4, cfhead.m4, proto.m4
  - debian/*, domain/*, feature/*, ...
  - hack/*, mailer/*, ostype/*, ...

sendmail.mc

- OSTYPE(debian)
- DOMAIN(debian-mta)
- DAEMON_OPTIONS(...)
- FEATURE(...)
  - no_default_msa
  - access_db
  - ...
- MAILER
  - local
  - smtp

debian.m4

- define(conf...)
- Lots of configuration parameters, to name a few
  - confSMTP_LOGIN_MSG
  - confCW_FILE
  - confDEF_USER_ID

debian-mta.m4

- Many more conf... options
  - confMAX_HOP
  - confDONT_BLAME_SENDMAIL
  - All kinds of TimeOut(TO)-timers
    - confTO_MAIL
    - confTO_QUIT
    - ...

sendmail.cf macros

- Macros
  - C<class>
    - referenced as $=<class>
  - F<class_in_file>
    - for example Fw/etc/mail/local-host-names
    - also referenced as $=<class_in_file>
  - D<name>
    - referenced as $<name>
  - Classes and names are often single letter identifiers

sendmail.cf hostnames

- sendmail -bt -d0.4
  - for debugging local hostname(s)
  - Dj$w.$m (set internally; automatically)
    - hence $j=$w.$m
- What is inside $=w class?
  - Many "hostnames", also numeric

sendmail.cf map lookup

- K<mapname> <type> <detail>
  - mailertable hash -o /etc/mail/mailertable.db
  - generics hash -o /etc/mail/genericstable.db
  - virtuser hash -o /etc/mail/virtusertable.db

sendmail.cf options

- AliasFile
- ForwardPath
- DaemonPortOptions (UseMSP)
- Timeout
- *LA (Queue, Refuse, Delay)
- SmtpGreetingMessage
- ...

sendmail.cf headers

- HReceived:
  - $?sfrom $s $.$?_($?s$|from $.$_)$.
  - $?{auth_type}(authenticated$?{auth_ssf} bits=${auth_ssf}$.)$.
  - by $j ($v/$Z)$?r with r. id $i
  - $?{tls_version}(version=${tls_version} cipher=${cipher} bits=${cipher_bits} verify=${verify})$.
  - $?u for $u; $|; $.$b

sendmail.cf mailers

- M<mailer> <attributes>
  - local (maybe procmail as MDA)
  - prog, *file*, *include* (builtin)
  - smtp, esmtp, smtp8, relay, bsmtp, fido
  - procmail (as mail filter, called with "-m")

sendmail.cf rulesets and rules

- S<name>=<number> indicates a ruleset
  - canonify=3 (always first)
  - parse=0 (resolves <mailer,host,user>)
  - check_relay (to disable open relaying)
  - check_mail (checks MAIL FROM:)
  - check_rcpt (checks RCPT TO:)
- R<LHS> <RHS> <comment> indicates a rule

sendmail.cf rules

- LHS (Left Hand Side)
  - $*, $+, $- (token matching)
  - $@ (matching zero tokens, used for empty input)
  - $=, $~ (class matching, positive or negative)
- RHS (Right Hand Side)
  - $1, $2, ... (substitution of matched parts)
  - $:, $@ (control flow)
  - $>, $?$|$. (recursion; conditional)
  - $[...$], $(...$) (IP lookup; map lookup)

Sendmail ruleset testing

Command	Use for
=S<ruleset>, =M	showing rulesets and mailers
$<m>, $=<c>	evaluating macros
/parse <address>	address parsing
/try <mailer> <address>	address given to mailer
/map <map> <lookup>	map lookup

Table: Some sendmail -bt commands

Postfix

- (Mostly) compatible with sendmail
  - supplies /usr/{lib,sbin}/sendmail emulation
- Good performance
- Safe and secure
- Modular and flexible

General postfix features

- Support for multiple transports
- Easy virtual domain configuration
- Extensive UCE/SPAM control
- Rewriting through table lookups

Postfix modular setup

- One resident master process
  - compare to inetd super server
- Some semi-resident daemons
  - started via master.cf file
  - something like inetd.conf

Postfix queues

- maildrop (local incoming)
- incoming (after cleanup)
- active (being worked on)
  - deferred (temporary failure)
  - hold (needs human intervention)
  - corrupt (needs human inspection)

Postfix security

- Runs not setuid root
- Uses chroot environment
- Is modular and not monolithic
- Filtering of outside information

Postfix daemons

- pickup (mail from maildrop via postdrop ("sendmail"))
- smtpd (remote mail from the Internet)
- cleanup (repairs incoming mail)
- qmgr (processes mail queues)
- local (local delivery)
- smtp (remote delivery)

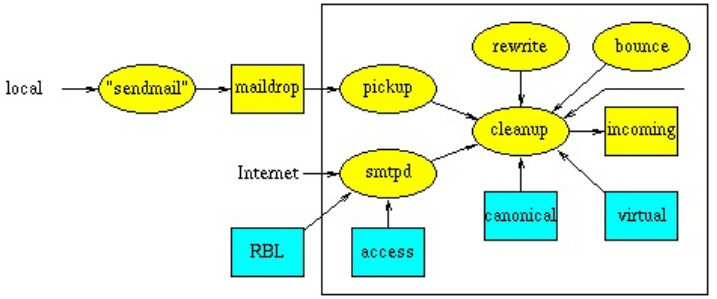
Postfix assistants

- (trivial-)rewrite
  - canonicalisation (compare "ruleset 3")
  - resolving (compare "ruleset 0")
- bounce
  - error mailer
  - defer messages

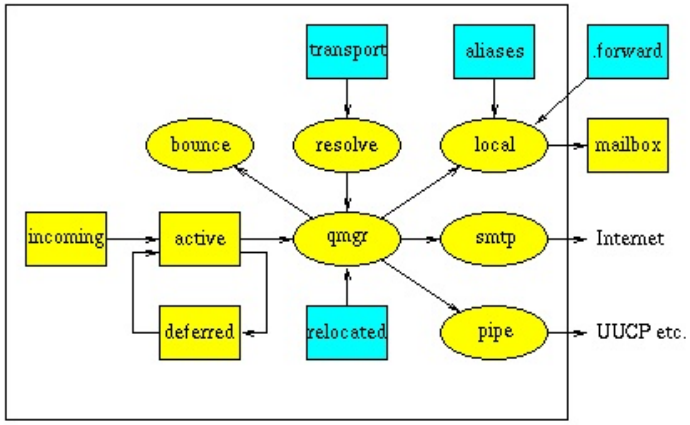
Postfix/Sendmail tables

Postfix	Sendmail
virtual	virtusertable
canonical	genericstable
transport	mailertable
access	access
relocated	- (aliases)

Postfix architecture inbound



Postfix architecture outbound



qmail

- Who looked at qmail and wants to explain?

Exim

- Who looked at Exim and wants to explain?