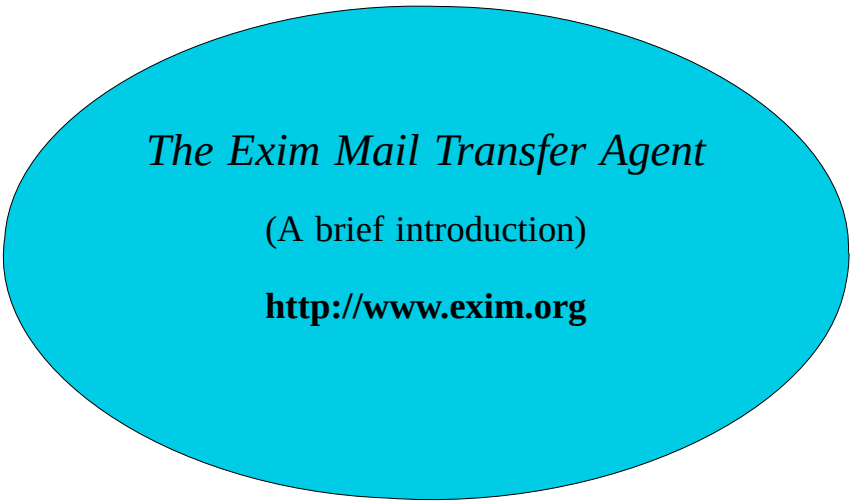


Configuration file

- Exim uses a single runtime configuration file, divided into a number of sections
- The first section contains global option settings
- The other sections start with “begin *sectionname*”
- They are all optional, and may appear in any order
- Comments, macros, if-then-else, and inclusions are available
  Some Debian versions use inclusions to support a multi-file configuration arrangement
- Option settings can refer to auxiliary data files, for example, a file of aliases (traditionally **/etc/aliases**)

Changing the runtime configuration

- Edit **/usr/exim/configure** with your favourite text editor
- New Exim processes will pick up the new file right away
- You need to SIGHUP the daemon (as root) to restart it

```
kill -HUP \
  $(cat /var/spool/exim/exim-daemon.pid)
```

- Check the log to see if it restarted successfully

```
tail /var/spool/exim/log/mainlog
```

Configuration file sections

- Global options
  General and input-related options
- Address rewriting rules
  Specify rewriting of envelope and header addresses
- Retry rules
  Control retries after temporary failures
- Router configuration
  Specify recipient address processing
- Transport configuration
  Specify how actual deliveries are done
- Authenticator configuration
  Specify SMTP authentication methods
- Access Control Lists (ACLs)
  Define policy controls for incoming messages

Default configuration file layout

Global option settings

`begin ACL` — Access control lists — required for SMTP input

`begin routers` — Router configuration

`begin transports` — Transport configuration — required for message delivery

`begin retry` — Retry rules

`begin rewrite` — Rewriting rules

`begin authenticators` — Authenticator configuration

Examples of common global options

- SMTP input limits

```
smtp_accept_max = 200
smtp_accept_queue = 150
smtp_accept_reserve = 10
smtp_accept_reserve_hosts = 192.168.0.0/16
smtp_connect_backlog = 100
```

- Overloading

```
queue_only_load = 5
deliver_queue_load_max = 7
```

- Message size limits

```
message_size_limit = 10M
return_size_limit = 65535
```

Router overview

- Exim contains a number of different routers

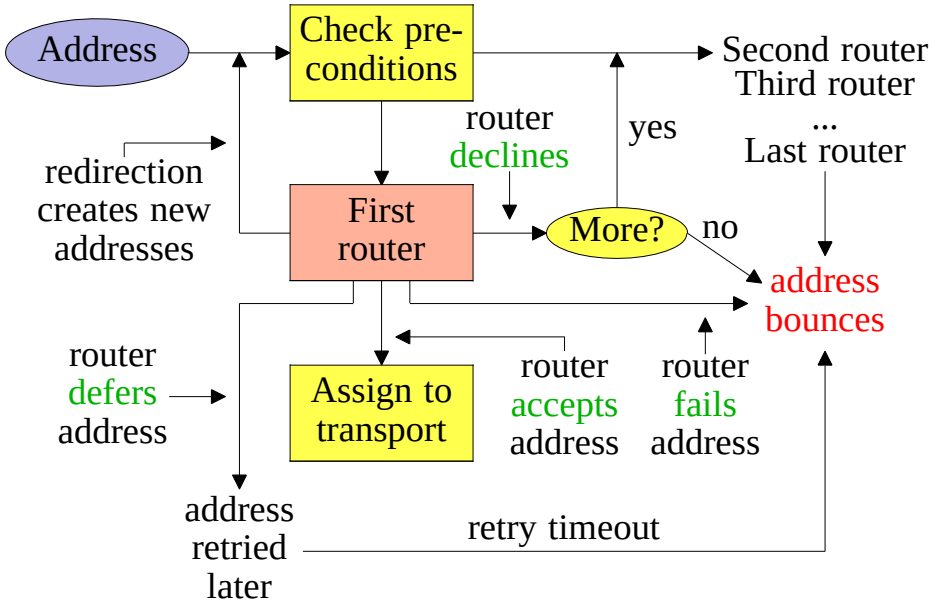
  Example: the *dnslookup* router does DNS processing
  the *redirect* router does address redirection
  (aliasing and forwarding)

- Routers decide how to deliver to addresses
- The configuration defines which routers are used, in which order, and under what conditions

  Example: routers are often restricted to specific domains

- The order in which routers are defined is important
- The same router may appear more than once, usually with different configurations

Exim routing



Simple routing configuration

- Check for non-local domains: run *dnslookup* router
  - Accept: assign to *smtp* transport
  - Decline: “no_more” set, so address bounces
- Check for system aliases: *redirect* router
  - Accept: generates new address(es)
  - Decline: passed to next router
- Check for local user forwarding: another *redirect* router
  - Accept: generates new address(es)
  - Decline: passed to next router
- Check for local user: run *accept* router
  - Accept: assign to *appendfile* transport
- No more routers: address bounces

Exim transports

- Transports are the components of Exim that actually deliver copies of messages
  - The *smtp* transport delivers over TCP/IP to a remote host
  - The *appendfile* transport writes to a local file
  - The *pipe* transport writes to another process via a pipe
  - The *lmtp* transport does likewise, using the LMTP protocol
  - The *autoreply* transport is anomalous, in that it creates an automatic response instead of doing a real delivery
- The order in which transports are defined is not important
- A transport is used only when referenced from a router
- Transports are run in subprocesses, under their own uid, after all routing has been done
- Multiple remote deliveries can happen simultaneously

Named item lists

```
domainlist local_domains = @ : plc.com
hostlist   relay_hosts = 192.168.32.0/24
```

- Abstraction: list is specified in one place only
  References are shorter and easier to understand
- Optimization: matches are cached where possible
  Example: several routers testing the same domain list
  Cannot cache by default if list contains expansion items
- A named list is referenced by prefixing its name with +
  ```
  hosts = 127.0.0.1 : +relay_hosts
  ```
- A named list can be negated
  ```
  domains = !+local_domains
  ```
  This is not possible with macros

Named lists in the default configuration

- The default configuration uses three named lists

```
domainlist local_domains = @
domainlist relay_to_domains =
hostlist   relay_from_hosts = 127.0.0.1
```

- Local domains are going to be delivered on this host
  @ means “the local name of the local host”
- No domains are defined for relaying by default
- The local host is permitted to relay through itself
  Some clients send mail this way
- These lists are used later to set up these controls
  The above settings just define the lists

Default routers (1)

- The first router handles non-local domains

```
dnslookup:
  driver = dnslookup
  domains = ! +local_domains
  ignore_target_hosts = 0.0.0.0 : 127.0.0.0/8
  transport = remote_smtp
  no_more
```

- The **domains** precondition checks for a non-local domain
- Silly DNS entries are ignored
- If the domain is found in the DNS, assign the address to the **remote_smtp** transport for delivery
- Otherwise, **no_more** changes “decline” into “fail”

Default routers (2)

- The second router handles system aliases

```
system_aliases:
  driver = redirect
  data = ${lookup{$local_part}lsearch\
         {/etc/aliases}}
  allow_fail                          allows :fail:
  allow_defer                         allows :defer:
  pipe_transport = address_pipe
  file_transport = address_file
# user = exim
```

- Alias files look like this

```
postmaster:  pat, james@otherdom.example
majordomo:   |/usr/bin/majordom ...
alice:       :fail: No longer works here
```

Default routers (3)

- The third router handles users' *.forward* files

```
userforward:
  driver = redirect
  check_local_user
  file = $home/.forward
  no_verify
  no_expn
  check_ancestor
  pipe_transport = address_pipe
  file_transport = address_file
  reply_transport = address_reply
  allow_filter                    allows filter files
```

- **data** and **file** are mutually exclusive options for **redirect**
  data expands to a redirection list
  file expands to the name of a file containing a redirection list

Default routers (4)

- The final router handles local users' mailboxes

```
localuser:
  driver = accept
  check_local_user
  transport = local_delivery
```

- Recap: an address is routed like this:

Remote address	=> **remote_smtp** transport, fail
System alias	=> new address(es), fail, defer
User's *.forward*	=> new address(es)
Local user	=> **local_delivery** transport
Unrouteable address	=> bounce

- This is just one of many possible configurations
  There are other routers that we have not met yet...

Default transports (1)

- Main transports

```
remote_smtp:
  driver = smtp

local_delivery:
  driver = appendfile
  file = /var/mail/$local_part
  delivery_date_add
  envelope_to_add
  return_path_add
# group = mail
# mode = 0660
```

- Default local delivery assumes a “sticky bit” directory
  Setting **group** and **mode** is an alternative approach

Default transports (2)

- Auxiliary transports

```
address_pipe:
  driver = pipe
  return_output

address_file:
  driver = appendfile
  delivery_date_add
  envelope_to_add
  return_path_add

address_reply:
  driver = autoreply
```

Routing to smarthosts

- Replace the first router with

```
send_to_smarthost:
  driver = manualroute
  domains = ! +local_domains
  route_list = * smarthost1.example:\
                 smarthost2.example
  transport = remote_smtp
```

- A **route_list** rule contains space-separated items
  The first is a single domain pattern: * matches any domain
  The second is a list of hosts for the matching domain
- Not shown in the above example
  The third is **bydns** or **byname** (default tries both)
  A transport name may also be given

Virtual domains

- Straightforward cases are just an aliasing application

```
virtual_domains:
  driver = redirect
  domains = lsearch;/etc/virtual-domains
  data = ${lookup{$local_part}lsearch\
         {/etc/valias/$domain}}
  no_more
```

- Or use a **dsearch** lookup to save having a separate list

```
domains = dsearch;/etc/valias
```

  Ensure Exim is built with **dsearch** support

- For large virtual domains, use something better than *lsearch*

Incoming message control features

- SMTP authentication
- SMTP session encryption using TLS (SSL)
- Local policy is defined in *access control lists* (ACLs)
  - Rules for accepting messages for local delivery
  - Rules for accepting messages for relaying to other hosts
- ACLs can do address verification
  - The delivery routers are used to check envelope addresses
- Content can be scanned from the DATA and MIME ACLs
- You can also link into Exim a **local_scan()** function
  - Supports custom checks on incoming messages
  - Written in C to a documented API

Authentication in SMTP

- Mechanisms are advertised in response to EHLO

```
EHLO client.plc.ex
250-server.plc.ex Hello client.plc.ex
250-SIZE 10485760
250-PIPELINING
250-AUTH PLAIN LOGIN
250 HELP
```

- Command is AUTH <*mechanism*> [*data*]
- Challenges use response code 334
- All data is base64 encoded
  - Thus, any byte value can be included

PLAIN authentication (RFC 2595)

- Client sends a single set of data, containing three items
  - Identity to login as (not relevant for SMTP)
  - Identity whose password is to be checked
  - The password
- Binary zeros (NULs) separate the three data items

```
AUTH PLAIN AG15bmFtZQBteXNlY3JldA==
```

- Unencoded that is

```
AUTH PLAIN <nul>myname<nul>mysecret
```

- The first field is usually empty in SMTP
- Server responds immediately with success or failure
  - Password is transmitted in cleartext if session not encrypted
  - No challenge is issued; only one exchange is needed
  - (Alternate usage has no data with AUTH, and an empty challenge)

LOGIN authentication

- No formal definition; used by Pine and the c-client library
- Separate challenges (prompts) for username and password

```
AUTH LOGIN
334 VXNlcm5hbWU6                    (Username:)
bXluYW1l                            (myname)
334 UGVzc3dvcmQ6                    (Password:)
bXlzZWNyZXQ=                        (mysecret)
235 Authentication successful
```

- The password is again passed in cleartext
  - Three exchanges are required
- Some clients are picky about the exact text of the prompts

SMTP authentication in Exim

- Different authenticator drivers for different mechanisms
  Can be configured for server or client or both
- On an Exim server
  AUTH is advertised if the client matches **auth_advertise_hosts**
  This is expanded, so can depend on circumstances
  For example, it can be empty unless the session is encrypted
- On an Exim client, authentication is attempted if
  The server is in **hosts_require_auth** or **hosts_try_auth**
  (options of the **smtp** transport), and ...
  A client authenticator matches an advertised mechanism
- On failure, Exim delivers unauthenticated for **hosts_try_auth**

The **plaintext** authenticator

```
plain:
  driver = plaintext
  public_name = PLAIN
  server_prompts = :
  server_condition = ${if and{ {eq{$2}
    {myname}} {eq{$3}{mysecret}} } {yes}{no}}
  server_set_id = $2
  client_send = ^myname^mysecret

login:
  driver = plaintext
  public_name = LOGIN
  server_prompts = Username:: : Password::
  server_condition = ${if crypteq{$2}\
   {${lookup{$1}lsearch{/etc/master.passwd}\
   {${extract{1}{:}{$value}}}fail}}{yes}{no}}
  server_set_id = $1
  client_send = : myname : mysecret
```

Encrypted SMTP connections

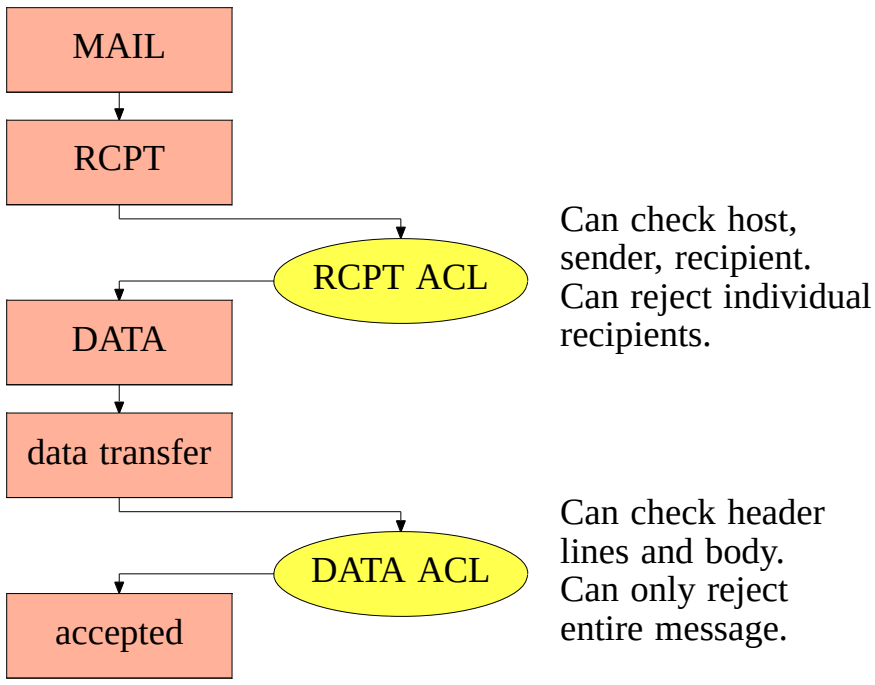
- TLS (transport layer security) aka SSL (secure socket layer)
  Exim uses the OpenSSL or GnuTLS library for TLS support
- Server advertises support for the STARTTLS command
  Client issues STARTTLS
  Server gives positive response
  An encryption key is then negotiated according to TLS rules
  Subsequent data is encrypted before transmission
  Session state is reset; a new EHLO is needed
- Exim can be configured to support the obsolete **smtps** protocol
  TLS is assumed and STARTTLS is not used
  This can be restricted to specific ports (typically 465)
- Messages are not encrypted while in the hosts at either end
  TLS gives protection only against eavesdroppers
  In particular, it provides protection for AUTH passwords
- Client certificates can (alternatively) be used for authentication

TLS on an Exim server

- Three options must be set for TLS to be used at all
  tls_certificate
  the file containing the server's certificate
  tls_privatekey
  the file containing the server's private key
  tls_advertise_hosts
  specifies which clients should be told (default none)
- The *exim* user must be able to read the private key
- To verify client certificates
  tls_verify_certificates
  the file containing the expected certificates
  tls_verify_hosts
  specifies clients that must be verified
  tls_try_verify_hosts
  specifies clients that may be verified

Access control lists

- Most ACLs are relevant for SMTP input
  - They do apply to local (*stdin/stdout*) SMTP (the **-bs** option)
  - An ACL is available for non-SMTP input
- For incoming SMTP messages the main ACLs are these
  - **acl_smtp_rcpt** defines the ACL to be run for each RCPT
    - Default is “deny”
  - **acl_smtp_data** defines the ACL to be run after DATA
    - Default is “accept”
- Tests on message content can be done only after DATA or in a non-SMTP ACL
- Other ACLs can be used for AUTH, ETRN, EXPN, EHLO, MAIL, STARTTLS, VRFY, at the start of DATA, and at the start of an SMTP session



A simple ACL

- In the main section of the configuration

```
acl_smtp_rcpt = acl_check_rcpt
```

- In the ACL section of the configuration

```
acl_check_rcpt:
  accept   local_parts = postmaster
           domains     = +my_domains

  require  verify      = sender

  accept   domains     = +my_domains
           verify      = recipient
```

- Conditions are “anded” together
  - Conditions may be repeated
  - Evaluation is in order
  - Evaluation stops as soon as the outcome is known
- Implicit “deny” at the end

ACL statements

- Each statement contains a verb and a list of conditions

  verb *condition 1* (one per line)
  condition 2
  ...

- If all the conditions are satisfied

accept	Accepts SMTP command or non-SMTP message (else may pass or reject – see later)
defer	Gives a temporary rejection (= **deny** for non-SMTP)
deny	Rejects (else passes)
discard	Like **accept** but discards recipients
drop	Like **deny** but drops an SMTP connection
require	Passes (else rejects)
warn	Takes some warning action (writes log or adds header) Always passes

ACL modifiers

- **message** defines a custom message for a denial or warning

```
deny    message  = You are black listed at \
                   $dnslist_domain
        dnslists = rbl.mail-abuse.org : ...
```

- **log_message** defines a custom log message

```
require log_message = Recipient verify failed
        verify      = recipient
```

- **endpass** is used with **accept** for a 3-way outcome

```
accept  domains = +local_domains
        endpass
        verify  = recipient
```

Above **endpass**, failure causes the next statement to be run
Below **endpass**, failure causes rejection

The default ACL (1)

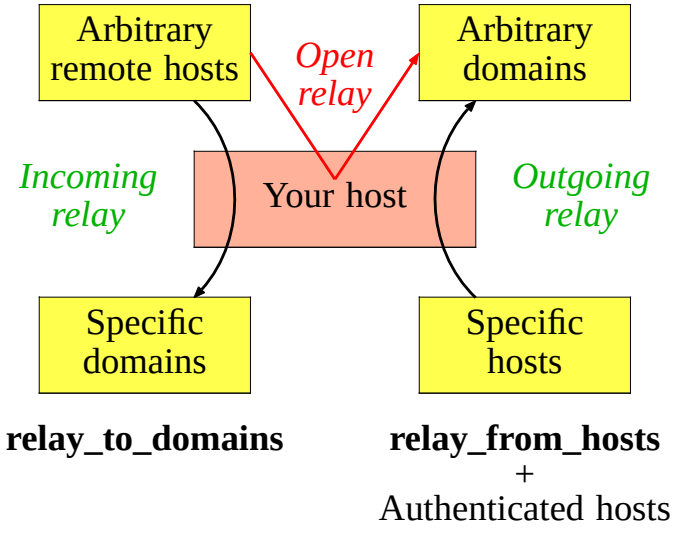
```
acl_check_rcpt:

  accept  hosts         = :

  deny    domains       = +local_domains
          local_parts   = ^[.] : ^.*[@%!/|]

  deny    domains       = !+local_domains
          local_parts   = ^[./|] : \
                          ^.*[@%!] : \
                          ^.*/\\.\\./

  accept  local_parts   = postmaster
          domains       = +local_domains

  require verify        = sender
```

(continued)

The default ACL (2)

```
accept  domains       = +local_domains
        endpass
        message       = unknown user
        verify        = recipient

accept  domains       = +relay_to_domains
        endpass
        message       = unrouteable address
        verify        = recipient

accept  hosts         = +relay_from_hosts

accept  authenticated = *

deny    message       = relay not permitted
```

Good and bad relaying



Content scanning

- These features were created by Tom Kistner
  Originally a separate patch called “Exiscan”
- From release 4.50, Exiscan is part of the main Exim code
  Build-time options control its inclusion in the Exim binary
  Tom Kistner is still the maintainer
- Additional conditions for the DATA ACL
  malware detects viruses and other malware using 3rd party scanners such as ClamAV and Sophos
  spam calls and uses results from SpamAssassin
  regex does regex matches on a message
- Each condition passes back expansion variables that contain useful information
- There is also an additional ACL called **acl_smtp_mime**
  If defined, this is called for each separate MIME part
  Many variables are set to contain data about the MIME part

Content scanning examples

- In the DATA ACL:

```
deny  message = Found $malware_name
      malware = *

warn  condition = ${if <{$message_size}{1M} }
      spam = nobody
      message = X-Spam_score: $spam_score\n\
        X-Spam_score_int: $spam_score_int\n\
        X-Spam_bar: $spam_bar\n\
        X-Spam_report: $spam_report
```

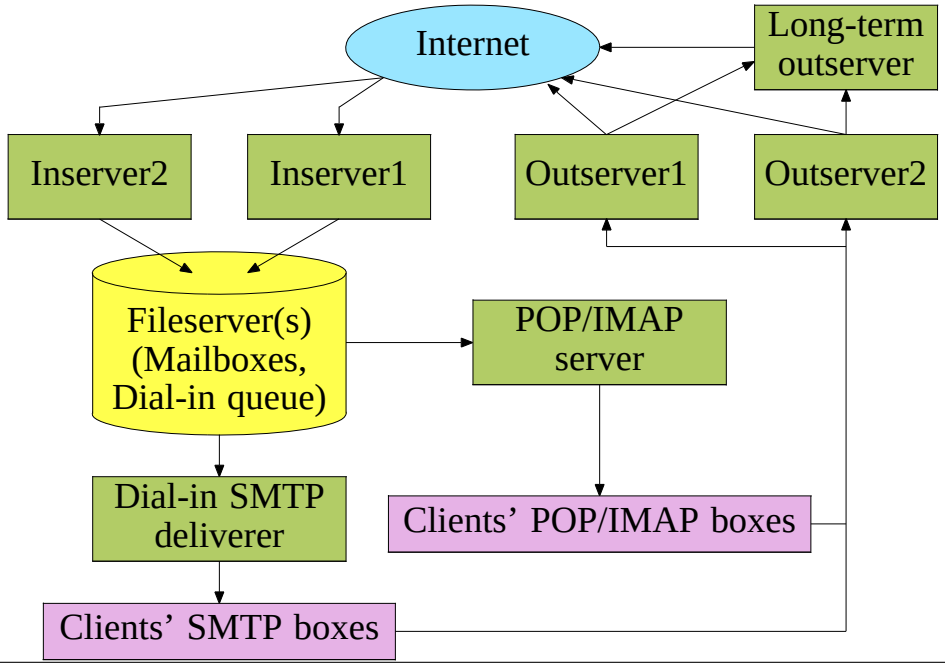
- In the MIME ACL:

```
deny  message = Executable attachments \
                  not permitted
      condition = ${if match{$mime_filename}\
                    {\N\.exe$\N}}
```

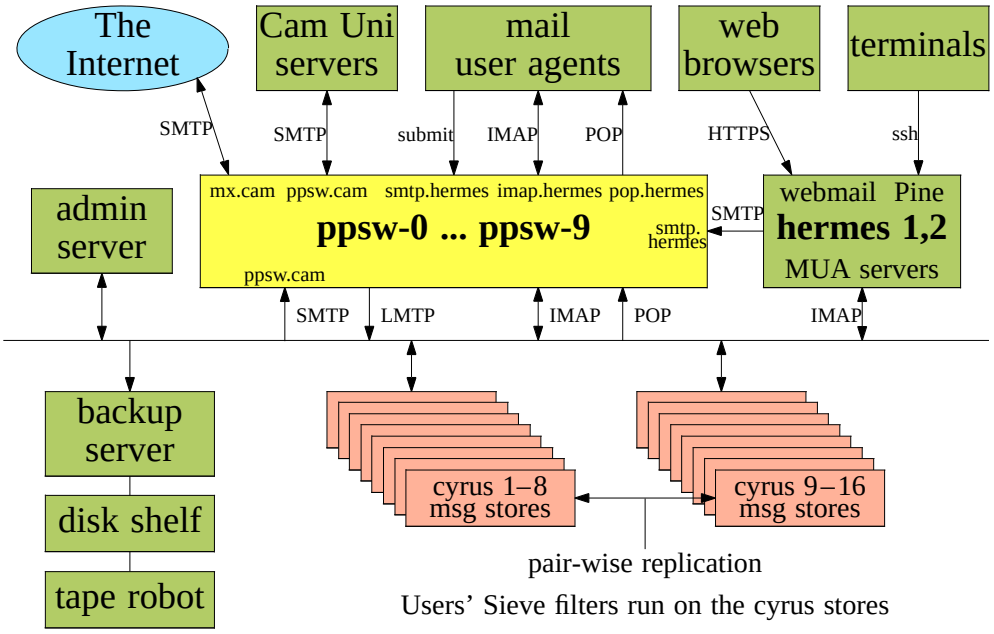
Large installations

- Use a local name server with plenty of memory
- Exim is limited by disk I/O
  - Use fast disk hardware; evaluate hardware/OS/filesystem
  - With Reiserfs, disable disk block sharing
  - Put hints on RAM disk; spool and log files on different disks
  - Disable **msglog** files, **rejectlog**; set **split_spool_directory**
  - Use multiple directories for user mailboxes
- Avoid linear password files
- Use maildir format to allow parallel deliveries
- Plan to expand “sideways” with parallel servers
  - This also helps add more disk access capacity
- Keep output queue as short as possible
  - Use fallback hosts and/or **$message_age** for several levels

Separating mail functions



Not separating mail functions



Using a uniform MTA cluster

- The Cambridge arrangement uses thorough address verification
  This keeps the queues small, which is vital
- My colleague Tony Finch has written some papers about it
- A full description of this configuration is at
  http://www.cus.cam.ac.uk/~fanf2/hermes/doc/talks/2005-02-eximconf/
- See also
  http://www.cus.cam.ac.uk/~fanf2/hermes/doc/talks/2004-02-ukuug/

  http://www.cus.cam.ac.uk/~fanf2/hermes/doc/talks/2005-02-ukuug/

Exim resources

- ASCII documentation is included in the tarball
- Downloadable PostScript, PDF, Texinfo, and HTML versions
- The HTML documentation is online
- FAQ in ASCII and HTML with keyword-in-context index

- Website: **http://www.exim.org/**
- Discussion list: **exim-users@exim.org**
- Development list: **exim-dev@exim.org**
- Announce list: **exim-announce@exim.org**
- Indexed archive: **http://www.exim-users.org/**
- Wiki: **http://www.exim.org/eximwiki/**
- Book: **http://www.uit.co.uk/exim-book/**

Exim is available from

ftp://ftp.csx.cam.ac.uk/pub/software/email/exim/...

.../exim4/exim-4.*xx***.tar.gz** (or **.bz2**)

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