The Exim Mail Transfer Agent

(A brief introduction)

http://www.exim.org

Configuration file

- Exim’s runtime configuration file is 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
  - This provides 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 (take decisions)
- Transport configuration
  - Specify how actual deliveries are done (implement decisions)
- 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_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
bounce_return_size_limit = 65535
```

Router overview

- Exim contains a number of different routers

  Examples: 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 they are used

  - Under what conditions they are used

  Example: routers are often restricted to specific domains

- The order in which routers are defined is important

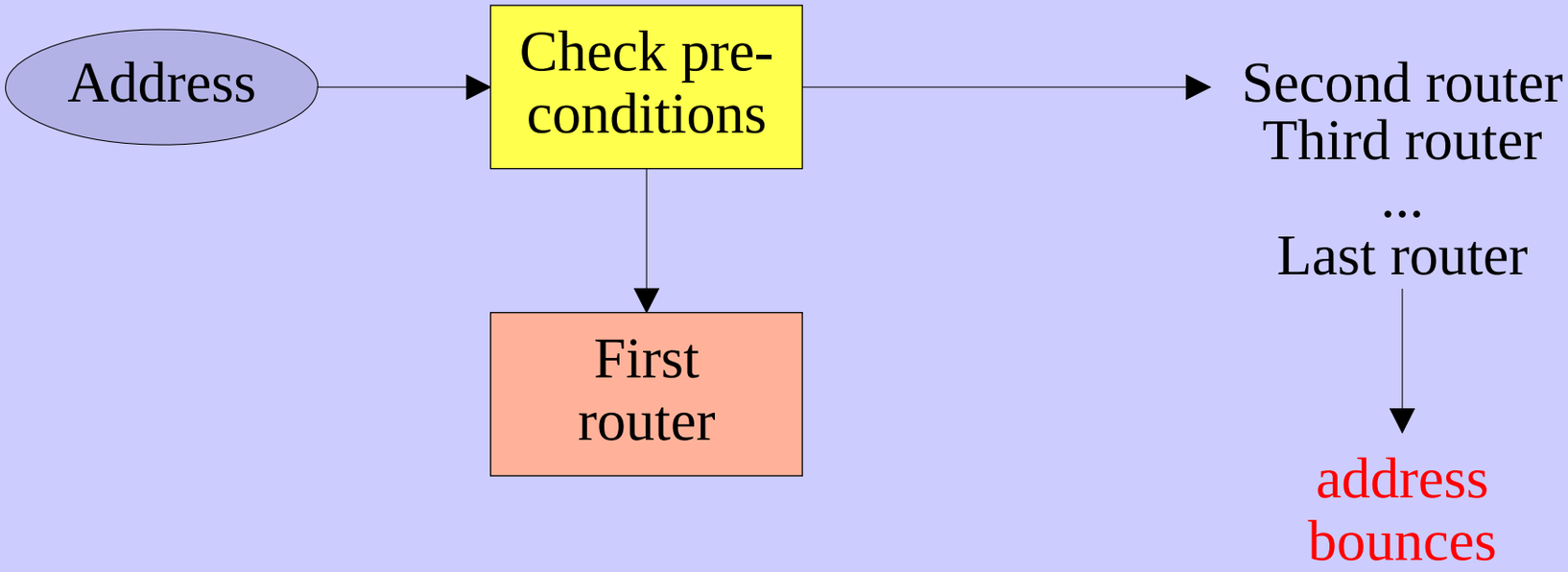
- The same router may appear more than once

  Different appearances usually have different configurations

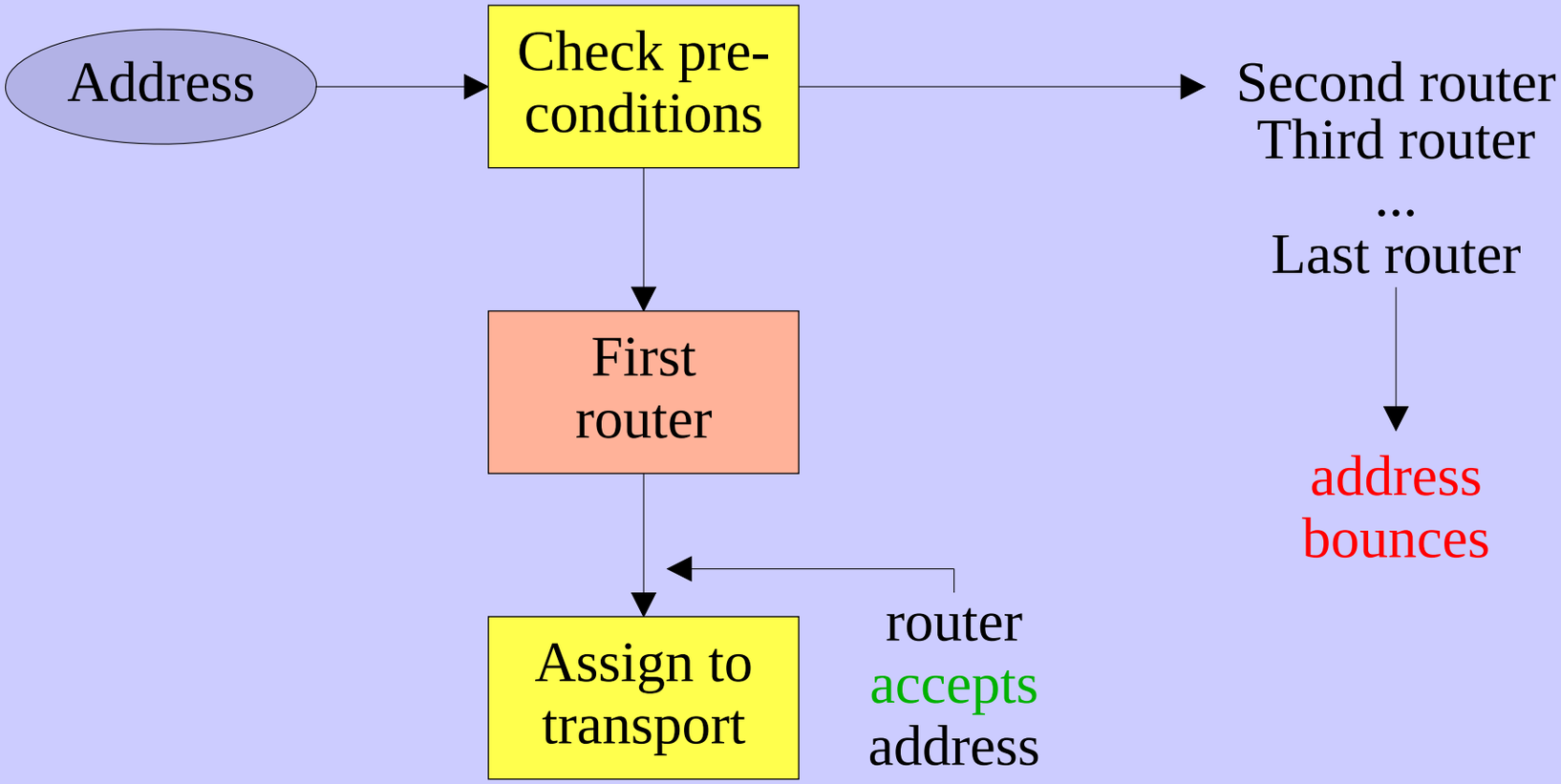
  Example: One **redirect** router for aliasing, and another for forwarding

Exim routing

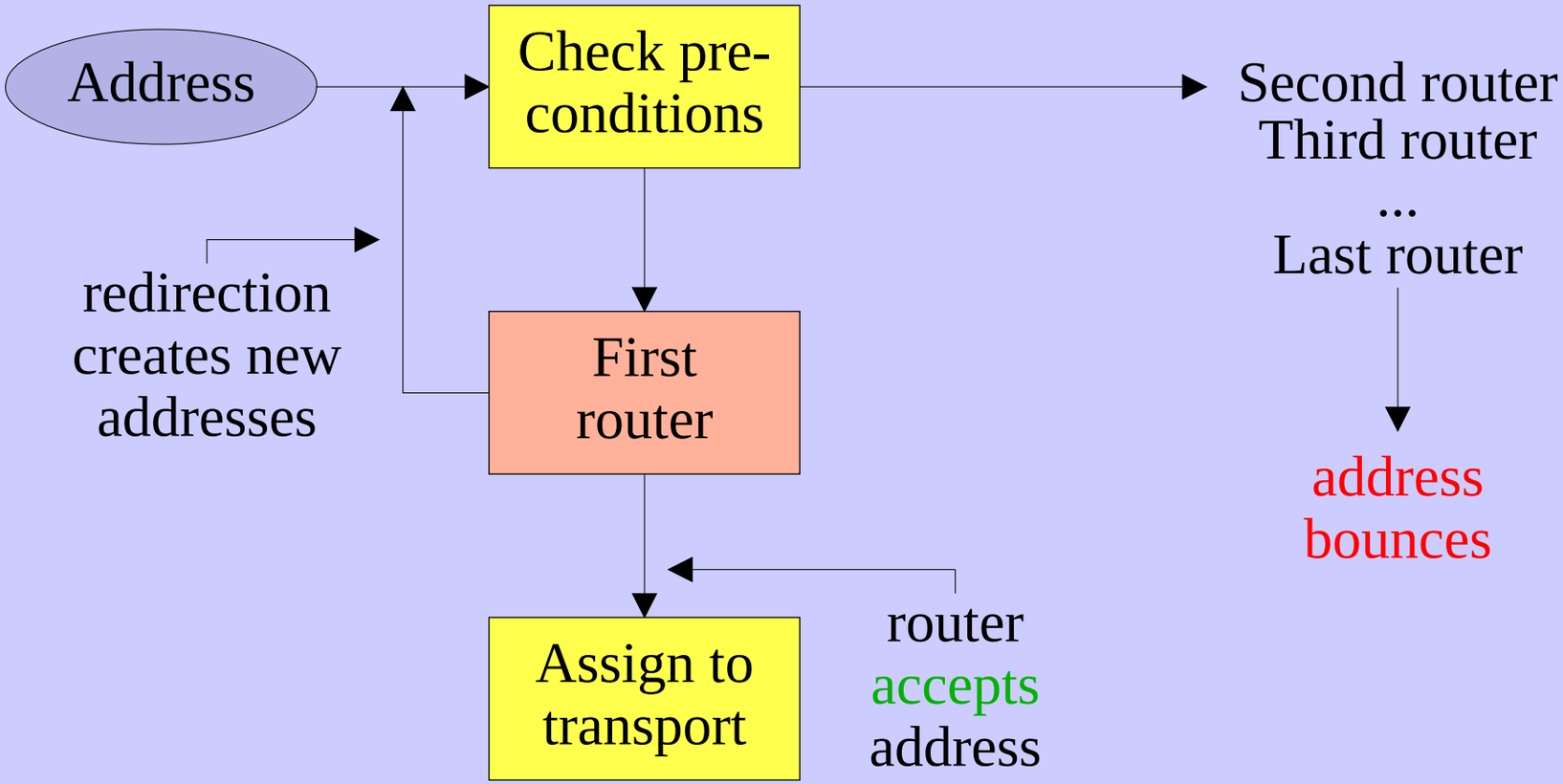
Exim routing



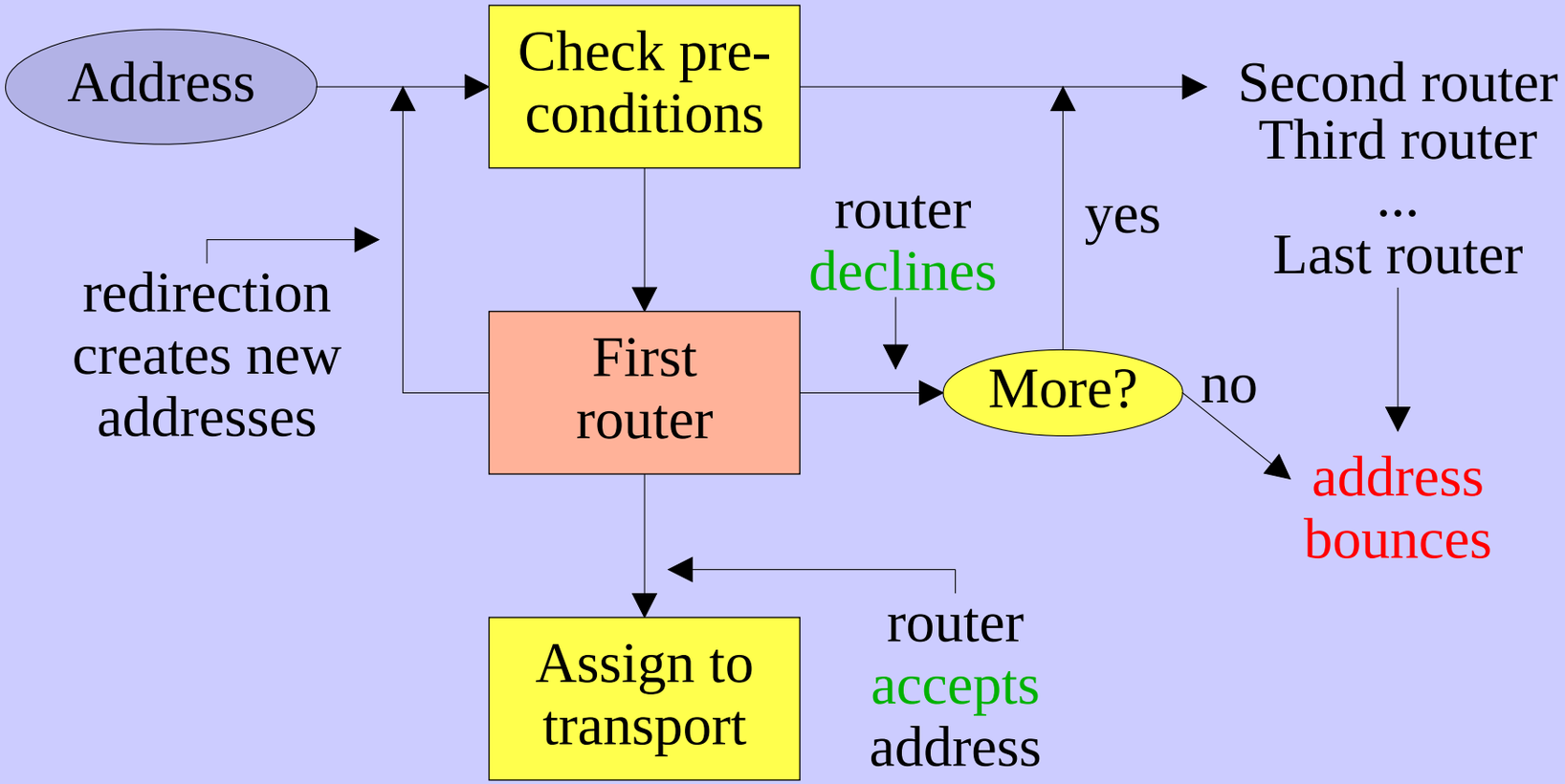
Exim routing



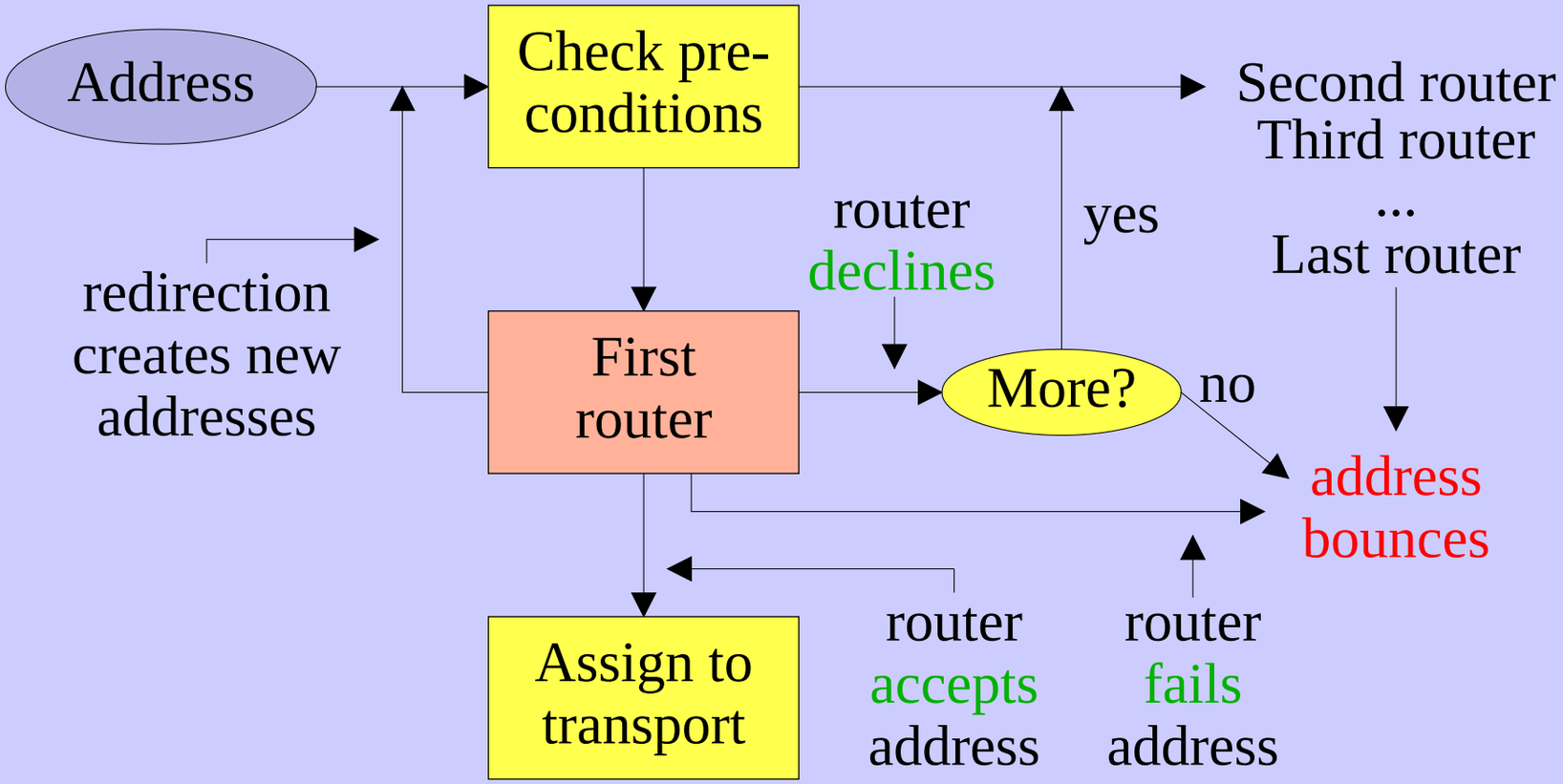
Exim routing



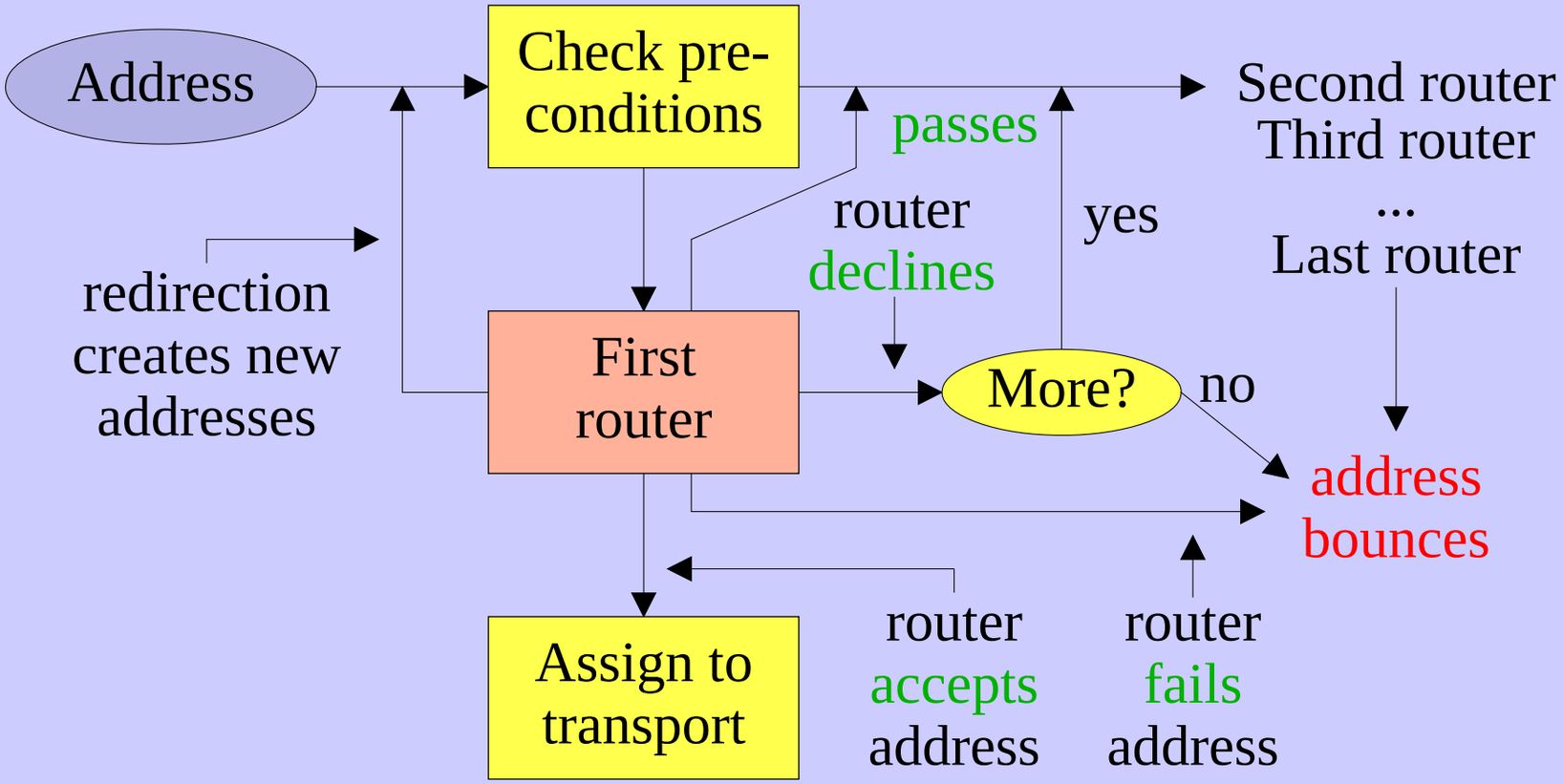
Exim routing



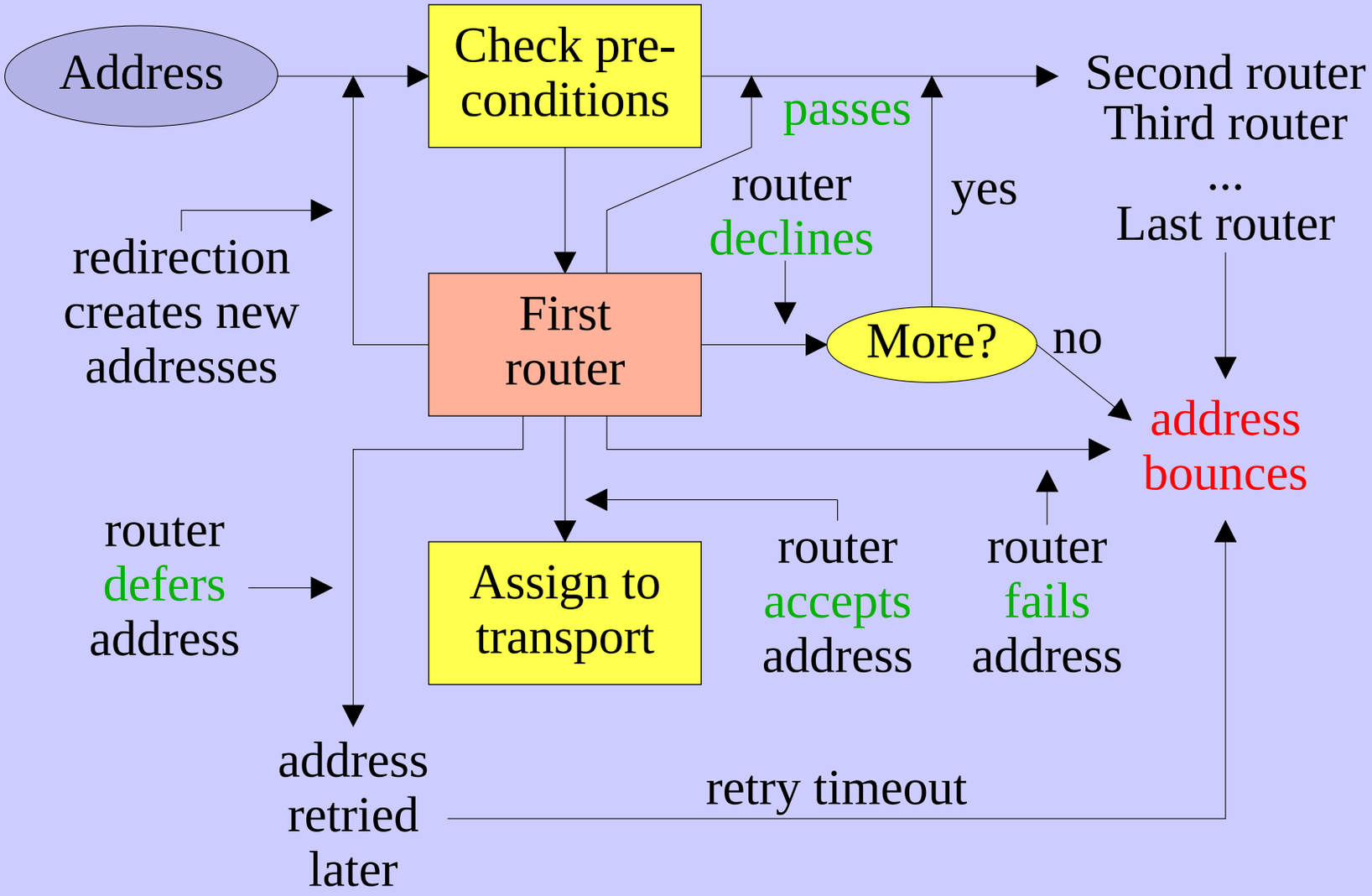
Exim routing



Exim routing



Exim routing



Simple routing configuration

- Check for non-local domain: if yes, run a **dnslookup** router

  Accept: assign to **smtp** transport
  Decline: “no_more” set

- Handle system aliases: run a **redirect** router

  Accept: generates new address(es)
  Decline: passed to next router

- Handle local user forwarding: run another **redirect** router

  Accept: generates new address(es)
  Decline: passed to next router

- Check for local user: if yes, run an **accept** router

  This router always accepts: assign to **appendfile** transport

- No more routers: address bounces

Exim transports

- Transports are the components of Exim that actually deliver 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 the same, using the LMTP protocol
  - The **autoreply** transport is anomalous –
    - 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 after all routing has been done
  - Each transport is run under its own uid
- For remote deliveries, multiple subprocesses may be used

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 a plus

```
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 by doing a DNS lookup

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

- The **domains** precondition checks for a non-local domain

  If the domain is local, this router is skipped

- If the DNS lookup succeeds, the **transport** option is activated

  The email address is assigned to the **remote_smtp** transport

- Silly DNS entries are ignored

- If the domain is not found, **no_more** changes “decline” into “fail”

Default routers (2)

- The second router handles system aliases

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

- 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
  cannot_route_message = Unknown user
```

- Recap: an address is routed like this:

Remote address	=> **remote_smtp** transport, fail
System alias	=> new address(es), fail, defer, pass
User's *.forward*	=> new address(es), pass
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
```

Local delivery in maildir format

- This is supported by the **appendfile** transport

```
maildir_delivery:
  driver = appendfile
  maildir_format
  directory = /var/mail/$local_part
  ...
```

- Each message is delivered into a separate file
  - A directory rather than a file is specified
  - Messages are written into a subdirectory called *tmp*
  - Once written, they are moved into a subdirectory called *new*
  - The MUA moves a message into *cur* once it has seen it
- MUAs and POP/IMAP servers must support maildir
- Maildir allows multiple simultaneous deliveries and removals
  - No locking is required
- Downside: it is more expensive to calculate disk space usage

Routing to smarthosts

- Replace the first router with

```
send_to_smarthost:
  driver = manualroute
  domains = ! +local_domains
  route_list = * host1.example:host2.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**

Message filtering

- Exim supports three kinds of filtering
  - User filter: run while routing (“.*forward* with conditions”)
  - System filter: run once per message per delivery attempt
  - Transport filter: external program added to transport
- User and system filters are run for each delivery attempt
  - Simple control language, designed for end users
  - Exim also supports Sieve filtering (RFC 3028)
  - If delivery is deferred, filters run more than once
  - Filter can detect first time run
- System filters and users’ Exim filters use the same syntax
  - Documented separately for the benefit of end users
  - The system filter has some additional commands (**fail**, **freeze**)

User Exim filter example (1)

```
# Exim filter

# Don't touch bounces
if error_message then finish endif

# Throw away junk
if
  $sender_address matches \N^\d{8}@\N or
  $h_Subject: contains "Make money" or
  $h_X-Spam_bar: contains "+++++" or
  $message_body contains "this is not spam"
then seen finish endif

# Conditional forwarding
if $h_subject: does not contain "(personal)"
  then unseen deliver my.secretary@example.com
endif
```

User Exim filter example (2)

```
# Sort mailing list messages
if $h_List-Id:
  contains "<exim-users.exim.org>" then
    save $home/Mail/exim-list
    finish
elif $h_List-Id:
  contains "<exim-dev.exim.org>" then
    save $home/Mail/exim-dev
    finish
endif

# Auto-reply
if personal alias phil@cam.ac.uk then
  mail subject "Re: $h_subject:"
  file $home/auto-reply/message
  log  $home/auto-reply/log
  once $home/auto-reply/once
endif
```

Exim Filter commands

- **deliver** does “true” forwarding (sender does not change)
- **save** delivers to a named file or directory
- **pipe** delivers via a pipe to a given command
- **mail** generates a new mail message
- **logwrite** writes to a log file, defined by **logfile**
- **deliver**, **save**, and **pipe** are *significant* by default
  - Normal deliveries are bypassed if anything significant is done
  - Can be made not significant by **unseen**
- **logwrite** happens during filtering
- The others are set up during filtering, but happen later
  - This means the result of **pipe** is not available during filtering
- The sysadmin can lock out certain facilities in user filters
  - The **save**, **pipe**, **mail**, and **logwrite** commands
  - File existence tests, lookups, calling Perl
  - Expansion features such as **readfile**, **readsocket**, and **run**

Exim Filter command conditions

- String tests

  begins, **ends**, **is**, **contains**, and **matches**

  Caseless by default, use (e.g.) `CONTAINS` for caseful

- Numeric tests

  is above, **is not above**, **is below**, **is not below**

```
if $message_size is not above 10K then ...
```

- Test for significant delivery

```
if not delivered then
  save mail/anomalous
endif
```

- **error_message** tests for error (bounce) message
- **personal** tests for a personal message

Testing a list of addresses

- The **foranyaddress** condition applies a test to a list

```
if foranyaddress "$h_to:, $h_cc:"
  ( $thisaddress matches \N^\d{8}@ )
then ...
```

- The **$thisaddress** variable takes on each address in turn
- The overall condition is true if any address matches
- **$thisaddress** remains set for the subsequent commands
- The parentheses are required

  The inner condition can be arbitrarily complex

The system filter (1)

- Runs once per message, at every delivery start
  - Use **first_delivery** to detect the very first time
  - Can see all recipients in **$recipients**
- Can add to recipients or completely replace recipients
  - Non-significant delivery adds, significant delivery replaces
- Can add header lines that are visible to routers, transports, and user filters
- Can remove header lines
- Can freeze a message, or bounce a message
- The system filter is set up by options like these

```
system_filter = /etc/exim/sysfilter
system_filter_file_transport = address_file
system_filter_pipe_transport = address_pipe
system_filter_user = exim
```

The system filter (2)

- Not powerful enough to do detailed spam checking
- Useful for per-message logging or archiving tasks
- Example

```
# Exim filter
if first_delivery and
  ${mask:$sender_host_address/24}
  is 192.168.34.0/24
then
  noerror unseen save
    /var/mail/archive/${substr_0_10:$tod_log}
endif
```

- Cannot use for per-recipient tasks, but can see all recipients

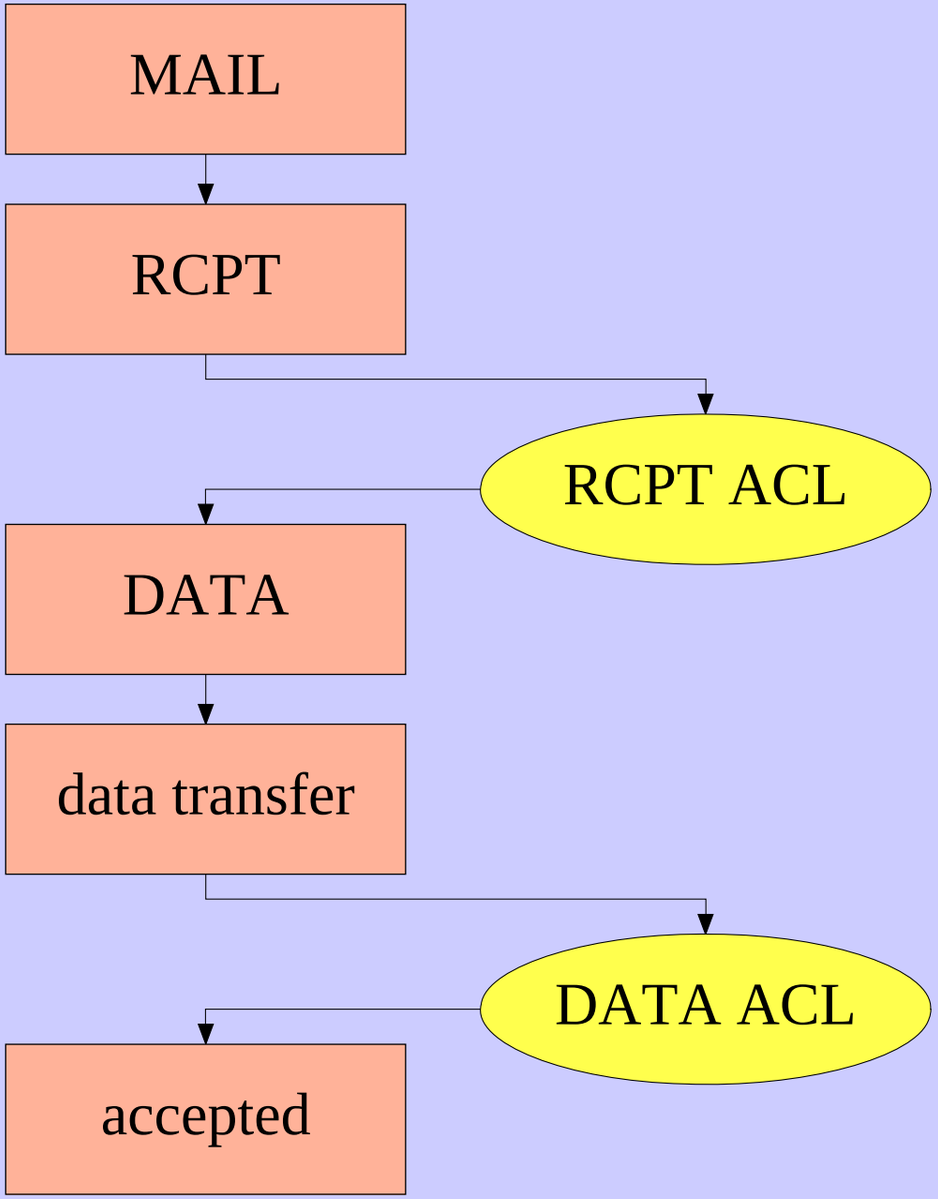
Incoming message control features

- 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

Access control lists

- Most ACLs are relevant for SMTP input
  - They do apply to local (*stdin/stdout*) SMTP (Exim's **-bs** option)
  - Three ACLs are 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 command
    - Default is "deny"
  - **acl_smtp_data** defines the ACL to be run after the data is received
    - Default is "accept"
- Tests on message content can be done only after the data is received, or in a non-SMTP ACL (or in a MIME ACL – see later)
- Other ACLs can be used for AUTH, ETRN, EXPN, EHLO, MAIL, STARTTLS, QUIT, VRFY, for the AUTH parameter of MAIL, at the start of DATA, and at the start of an SMTP session (the "connect" ACL)

ACL flow diagram



Can check host, sender, recipient. Can reject individual recipients.

Can check header lines and body. Can only reject entire message.

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

  The conditions are written one per line

  verb *condition 1*
  condition 2
  ...

- If all the conditions are satisfied

accept	Accepts SMTP command or non-SMTP message
defer	Gives a temporary rejection (= **deny** for non-SMTP)
deny	Rejects SMTP command or non-SMTP message
discard	Like **accept** but discards recipients
drop	Like **deny** but drops an SMTP connection
require	Passes to the next ACL statement
warn	Takes some warning action (e.g. write log, set variable, add header)

- If any condition is not satisfied, control passes to the next ACL statement
- Exception: **require** rejects on condition failure
- For **warn**, control always passes to the next statement

ACL modifiers

- Modifiers do not affect accept/reject decisions
  - They just change some of the details
- **message** defines a custom message (usually for denial)

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

- **log_message** defines a custom log message for denial

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

- **log_reject_target** selects log(s) for rejection
  - Default is both main and reject logs
  - An empty setting suppresses logging

```
deny    log_reject_target = reject
        hosts = spamspewer.example
```

The default ACL (1)

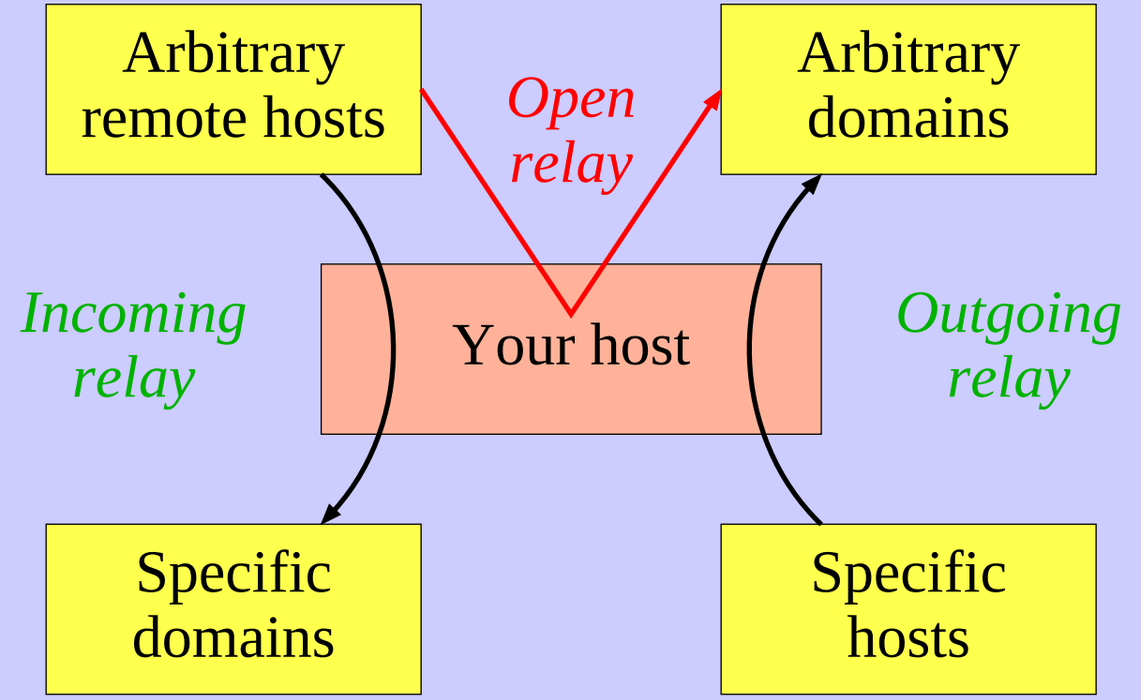
```
acl_check_rcpt:

  accept  hosts         = :

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

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

  accept  local_parts   = postmaster
          domains       = +local_domains

  require verify        = sender
```

(continued)

The default ACL (2)

```
accept  hosts           = +relay_from_hosts
        control         = submission

accept  authenticated = *
        control         = submission

require message         = relay not permitted
        domains         = +local_domains : \
                          +relay_to_domains

require verify          = recipient

accept
```

Good and bad relaying



relay_to_domains

relay_from_hosts
+
Authenticated hosts

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 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  spam = nobody
      add_header = \
        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
```

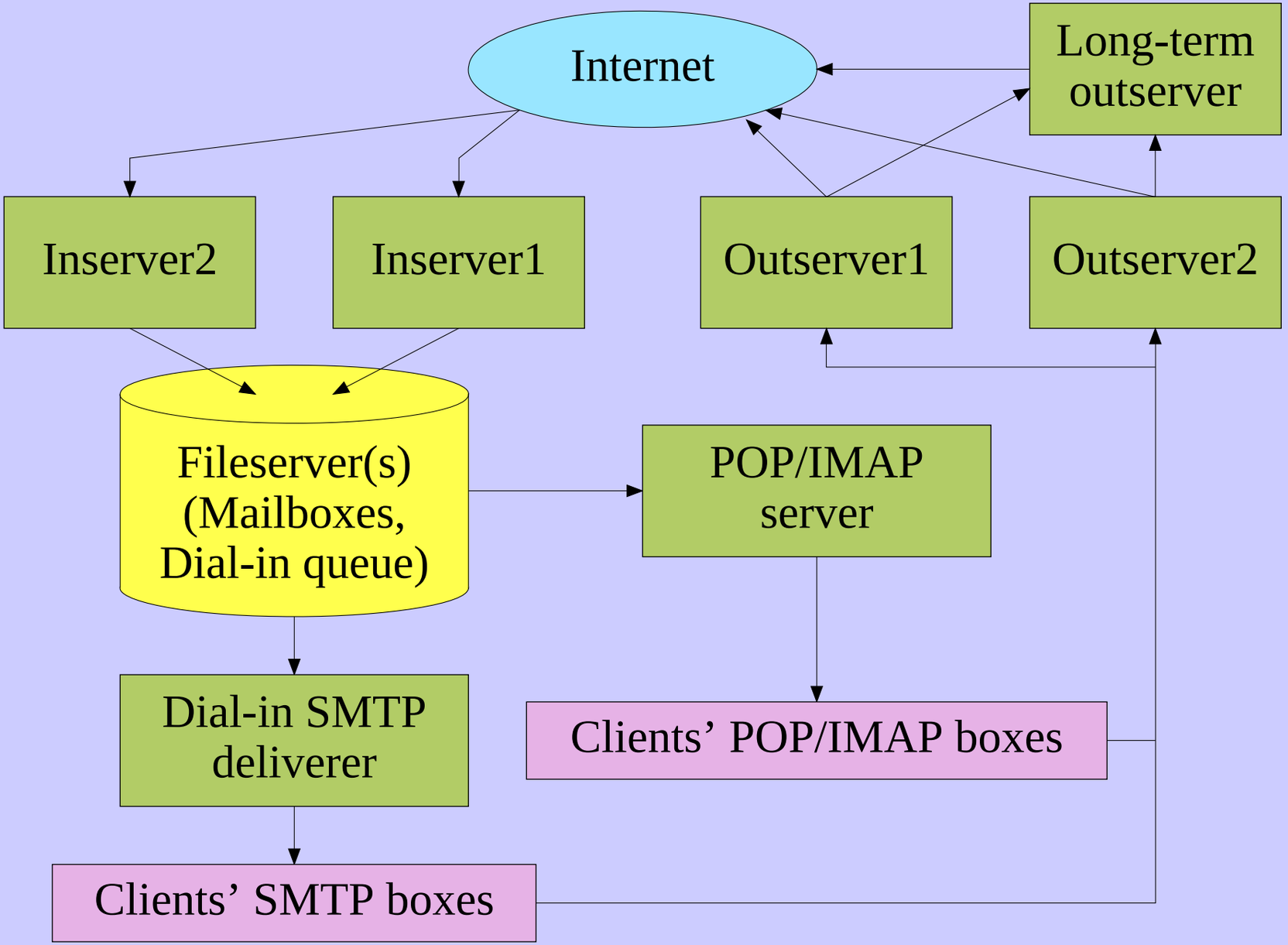
- In the MIME ACL:

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

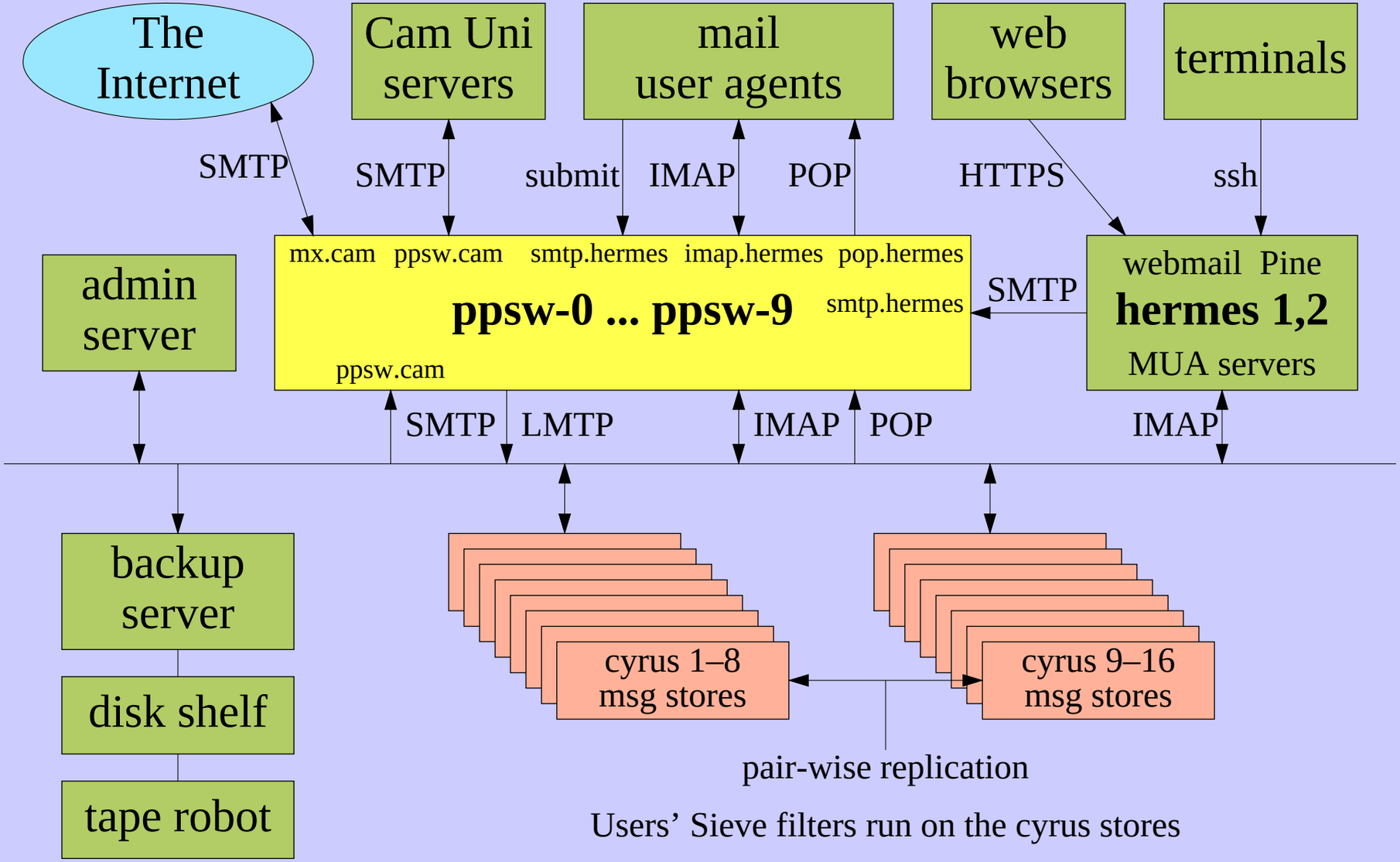
Large installations

- 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-uxsup.csx.cam.ac.uk/~fanf2/hermes/doc/talks/2005-02-eximconf/
- See also

  http://www-uxsup.csx.cam.ac.uk/~fanf2/hermes/doc/talks/2004-02-ukuug/

  http://www-uxsup.csx.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

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/**