Mail

AAU
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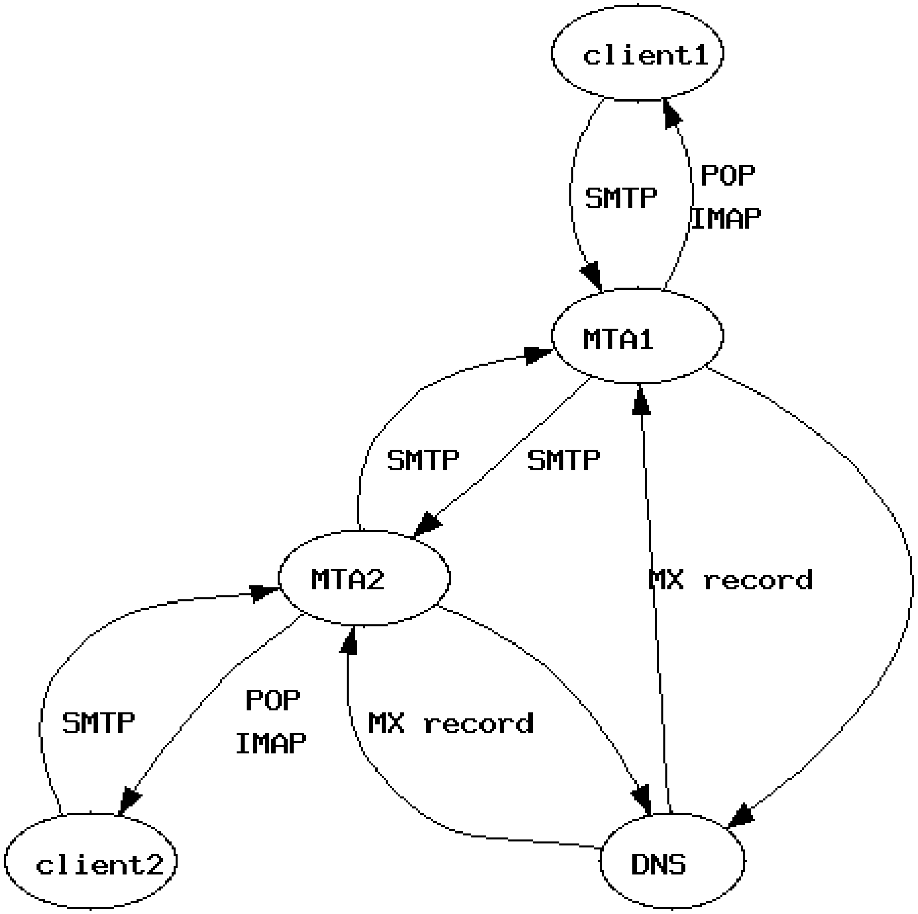
History of Email

- 1971: Ray Tomlinson invented SENDMSG and READMAIL for Arpanet. Used the user@host addressing.
- 1977: RFC733 unions various email formats
- 1982: RFC822 revised version of RFC733
- 1982: Relaying done with UUCP
- 1984: Eric Allman invented sendmail
- 1993: AOL connected their mail to the Internet
- 2000: Spam becomes a threat to email

Background

- Open Standards makes the Internet tick
- System Administration is all about knowing the fundamental protocols
- Study Standards, then products!

The Big Picture



DNS MX Records

```
; <<>> DiG 9.3.0 <<>> karthy.net mx
;; global options:  printcmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 61523
;; flags: qr rd ra; QUERY: 1, ANSWER: 2, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;karthy.net.                    IN      MX

;; ANSWER SECTION:
karthy.net.             42658   IN      MX      20 mail-relay.tele2adsl.dk.
karthy.net.             42658   IN      MX      10 mail.karthy.net.

;; Query time: 0 msec
;; SERVER: 127.0.0.1#53(127.0.0.1)
;; WHEN: Tue Apr 19 13:31:06 2005
;; MSG SIZE  rcvd: 83
```

SMTP

- RFC 821 - Simple Mail Transfer Protocol
  - Obsoleted by RFC2821 – Simple Mail Transfer Protocol
  - How MTA's exchange messages
- RFC 822 - Standard for the format of ARPA Internet text messages
  - obsoleted by RFC2822 – Internet Message Format
  - What a message looks like

RFC821
Simple Mail Transfer Protocol

A Mail Session

```
karthy@karthyws$ telnet mail.netic.dk 25
Connected to mail.netic.dk.
Escape character is '^]'.
220 netic.dk ESMTP
ehlo karthyws.netic.dk
250-netic.dk
250-STARTTLS
250-PIPELINING
250-8BITMIME
250 AUTH LOGIN PLAIN CRAM-MD5
mail from:<karthy@netic.dk>
250 ok
rcpt to:<karthy@karthy.net>
250 ok
data
354 go ahead
From: Karsten Thygesen <karthy@netic.dk>

Here is a mail...
.
250 ok 1113913050 qp 15175
quit
221 netic.dk
Connection closed by foreign host.
```

Sending
Receiving

SMTP reply codes

```
karthy@karthyws$ telnet mail.netic.dk 25
Connected to mail.netic.dk.
Escape character is '^]'.
220 netic.dk ESMTP
ehlo karthyws.netic.dk
250-netic.dk
250-STARTTLS
250-PIPELINING
250-8BITMIME
250 AUTH LOGIN PLAIN CRAM-MD5
mail from:<karthy@netic.dk>
250 ok
rcpt to:<karthy@karthy.net>
250 ok
data
354 go ahead
From: Karsten Thygesen <karthy@netic.dk>

Here is a mail...

.
250 ok 1113913050 qp 15175
quit
221 netic.dk
Connection closed by foreign host.
```

Only codes matters
Text is for humans
All defined in RFC821

220 <domain> Service Ready
221 <domain> Service closing transmission channel
250 Requested mail action ok, completed
354 Start mail input; end with <CRLF>.<CRLF>

First digit:
1-3: success
4: temp. negative
5: failure

SMTP Extensions

- Use EHLO instead of HELO
- Server will answer with list of extensions
- If the server gives a failure, the client must revert to HELO
- Defined in RFC1651(EHLO), RFC1652 (8BITMIME), RFC1653 (SIZE)

RFC822
Email Headers

RFC821 Headers #1/2

```
X-Gmail-Received: 78a3a1844aa57e94f797d0dcc2eab0667426acea
Delivered-To: karthy@gmail.com
Received: by 10.39.2.25 with SMTP id e25cs10291rni;
        Wed, 20 Apr 2005 00:50:40 -0700 (PDT)
Received: by 10.38.125.1 with SMTP id x1mr725496rnc;
        Wed, 20 Apr 2005 00:50:40 -0700 (PDT)
Return-Path: <hosthist@dk-hostmaster.dk>
Received: from netic.dk (goto.netic.dk [192.38.202.205])
        by mx.gmail.com with ESMTP id 71si1598305rnc.2005.04.20.00.50.38;
        Wed, 20 Apr 2005 00:50:40 -0700 (PDT)
Received-SPF: fail (gmail.com: domain of hosthist@dk-hostmaster.dk does not designate
192.38.202.205 as permitted sender)
Received: (qmail 338 invoked by uid 1099); 20 Apr 2005 07:50:38 -0000
Received: from 83.72.2.91 by goto (envelope-from <hosthist@dk-hostmaster.dk>, uid 89)
with qmail-scanner-1.23
 (clamdscan: 0.80. spamassassin: 3.0.2.
 Clear:RC:1(83.72.2.91):.
 Processed in 0.023527 secs); 20 Apr 2005 07:50:38 -0000
Received: from 83.72.2.91.ip.tele2adsl.dk (HELO karthy.net) (83.72.2.91)
  by netic.dk with (DHE-RSA-AES256-SHA encrypted) SMTP; 20 Apr 2005 07:50:38 -0000
```

RFC821 Headers #2/2

```
Received: (qmail 30220 invoked by uid 1000); 20 Apr 2005 09:49:52 +0200
Delivered-To: karthy@karthy.net
Received: (qmail 30212 invoked from network); 20 Apr 2005 09:49:51 +0200
Received: from fitch5.uni2.net (130.227.212.5)
  by 192.168.0.2 with SMTP; 20 Apr 2005 09:49:51 +0200
Received: from tornado.dk-hostmaster.dk (tornado.dk-hostmaster.dk [193.163.102.19])
by fitch5.uni2.net (Postfix) with ESMTP id 1ACBFD1743
for <karthy@karthy.net>; Wed, 20 Apr 2005 09:50:36 +0200 (CEST)
Received: by tornado.dk-hostmaster.dk (Postfix, from userid 5001)
id B8EBFC10; Wed, 20 Apr 2005 09:50:05 +0200 (CEST)
To: karthy@karthy.net
Subject: Onlinebetaling gennemf   rt
From: DK Hostmaster A/S <info@dk-hostmaster.dk>
Mime-Version: 1.0
Content-type: text/plain; charset=iso-8859-1
Message-Id: <20050420075005.B8EBFC10@tornado.dk-hostmaster.dk>
Date: Wed, 20 Apr 2005 09:50:05 +0200 (CEST)
```

HELO Verification

- Some mailers check to see that the domain name in the HELO matches the reverse DNS entry

HELO DNS

```
Received: from netic.dk (goto.netic.dk [192.38.202.205])
        by mx.gmail.com with ESMTP id 71si1598305rnc.2005.04.20.00.50.38;
        Wed, 20 Apr 2005 00:50:40 -0700 (PDT)
```

- RFC1123 – Requirements for Internet Hosts – claims that mailers MUST accept the mail even if the HELO does not match DNS

The Crucial Message-ID field

- The Message-ID is optional but always used
- Crucial to detect mail loops
- No specified format, but must be unique
- Added by the handling (sending) server

MIME – Multipurpose Internet Mail Extension

- RFC1561, RFC1562 and *many* more
- MIME encapsulates arbitrary binary material so that it can be transferred over the Internet
- MIME labels identifies content types, so useragents can do clever stuff
- Uses BASE64 encoding

MIME example

```
From: Karsten Thygesen <karthy@netic.dk>
User-Agent: Mozilla Thunderbird 1.0.2 (X11/20050403)
X-Accept-Language: en-us, en
MIME-Version: 1.0
To:  karthy@gmail.com
Subject: Attachment for class
Content-Type: multipart/mixed;
 boundary="------------080300030102000500020108"

This is a multi-part message in MIME format.
--------------080300030102000500020108
Content-Type: text/plain; charset=ISO-8859-1; format=flowed
Content-Transfer-Encoding: 7bit

Here is my vinum config file

--------------080300030102000500020108
Content-Type: text/plain;
 name="vinum.conf"
Content-Transfer-Encoding: 7bit
Content-Disposition: inline;
 filename="vinum.conf"

drive a device /dev/ad0s2g
drive b device /dev/ad1s1e

--------------080300030102000500020108--
```

Quoted Printable

- Encodes 8bit ISO-8859-1 text to 7bit
- Nickname: Quoted Unreadable :)
- ALL headers MUST be 7bit!

```
Subject: =?ISO-8859-1?Q?=F8l_og_bl=E5_tuborg_til_l=E6reren?=
```

POP/IMAP

- Offline (POP)
  - Mail is fetched by client and deleted from server
- Online (IMAP old model)
  - Mail is stored on server and client connects while reading mail
- Disconnected (IMAP as of today)
  - Mail is synchronized between server and (multiple) clients.
  - Can be read both online and offline

Reading vs. Sending

- POP and IMAP protocols are ONLY for reading mail
- Clients sends mail using SMTP
- Client must be configured with both a POP/ IMAP server and a SMTP server

A simple POP session

```
telnet mail.netic.dk pop3
Trying 192.38.202.205...
Connected to mail.netic.dk.
Escape character is '^]'.
+OK Hello there.
user what@about.dk
+OK Password required.
pass Brian
+OK logged in.
list
+OK POP3 clients that break here, they violate STD53.
1 2231
.
list 1
+OK 1 2231
stat
+OK 1 2231
quit
+OK Bye-bye.
Connection closed by foreign host.
```

No security – cleartext password!

Message 1 occupies 2231 bytes

Total mailbox size is 1 mail and 2231 bytes

POP Security

- Invented when security was no big deal
- APOP later added – challenge response
- POP over SSL/TLS
- Kerberos authentication (limited)
- Cleartext still most common authentication method!!

IMAP is superior to POP

- Interactive Message Access Protocol
- Online, Offline, Disconnected mode
- Folders
- Better authentication (Kerberos and more!)
- Full MIME support (partial fetch)
- Serverside sort
- Serverside search
- Access Control Lists (ACL)
- IMAP still not deployed by many ISPs due to storage requirements, load and complexity

IMAP Session

```
* OK [CAPABILITY IMAP4rev1 UIDPLUS CHILDREN NAMESPACE
THREAD=ORDEREDSUBJECT THREAD=REFERENCES SORT QUOTA
IDLE ACL ACL2=UNION STARTTLS] Courier-IMAP ready. Copyright
1998-2004 Double Precision, Inc.  See COPYING for distribution
information.
a login what@about.dk Brian
a OK LOGIN Ok.
a select inbox
* FLAGS (\Draft \Answered \Flagged \Deleted \Seen \Recent)
* OK [PERMANENTFLAGS (\* \Draft \Answered \Flagged \Deleted
\Seen)] Limited
* 1 EXISTS
* 1 RECENT
* OK [UIDVALIDITY 1113998983] Ok
* OK [MYRIGHTS "acdilrsw"] ACL
a OK [READ-WRITE] Ok
```

IMAP Session continued

```
c fetch 1 full
* 1 FETCH (FLAGS () INTERNALDATE "20-Apr-2005 13:46:45 +0200"
RFC822.SIZE 2231 ENVELOPE ("Wed, 20 Apr 2005 13:46:37 +0200"
"test" (("Karsten Thygesen" NIL "karthy" "gmail.com")) (("Karsten Thygesen"
NIL "karthy" "gmail.com")) ((NIL NIL "karthy" "karthy.net")) ((NIL NIL "what"
"about.dk")) NIL NIL NIL
"<35b813da05042004465dcfcde6@mail.gmail.com>") BODY (("text"
"plain" ("charset" "iso-8859-1") NIL
NIL "quoted-printable" 33 3)("text" "html" ("charset" "iso-8859-1") NIL NIL
"quoted-printable" 45 3) "alternative"))
c OK FETCH completed.
d fetch 1 body
* 1 FETCH (BODY (("text" "plain" ("charset" "iso-8859-1") NIL NIL "quoted-
printable" 33 3)("text" "html" ("charset" "iso-8859-1") NIL NIL "quoted-
printable" 45
3) "alternative"))
d OK FETCH completed.
```

Relay and SPAM

- Open relays abused by spammers
- Relay for your own users only
  - Based on IP segments (local nets)
  - Based on relay-after-pop
  - Based on ASMTP – authenticated SMTP (RFC2554)
- ORDB.org lists open relays
- Many ISP blocks port 25!
- SPF will potentially limit relaying
- SRF invented to help but hard to implement

ASMTP – Authenticated SMTP

- Defined in RFC2554
- Recommended for all ISP to implement (RFC3013 Nov 2000)

```
S: 220 smtp.example.com ESMTP server ready
C: EHLO jgm.example.com
S: 250-smtp.example.com
S: 250 AUTH CRAM-MD5 DIGEST-MD5
C: AUTH CRAM-MD5
S: 334
PENCeUxFREJoU0NnbmhNWitOMjNGNndAZWx3b29kLmlubm9zb2Z0LmNv
bT4=
C: ZnJlZCA5ZTk1YWVlMDljNDBhZjJiODRhMGMyYjNiYmFlNzg2ZQ==
S: 235 Authentication successful.
```

SPAM

- Only longterm effective weapon is prohibition by law!
- Difficult due to regional boundaries
- spamhaus.org ROKSO
- 28 feb 07: NZ got antispam law

Jeremy Jaynes Gets 9 Years for Spamming

Spammer Jeremy Jaynes, who operated using the alias 'Gaven Stubberfield' and was listed by Spamhaus as the 8th most prolific spammer in the world, has been convicted of spamming using deceptive routing information to hide the source. A Virginia court recommended Jaynes spend nine years in prison for sending hundreds of thousands of unsolicited bulk emails.

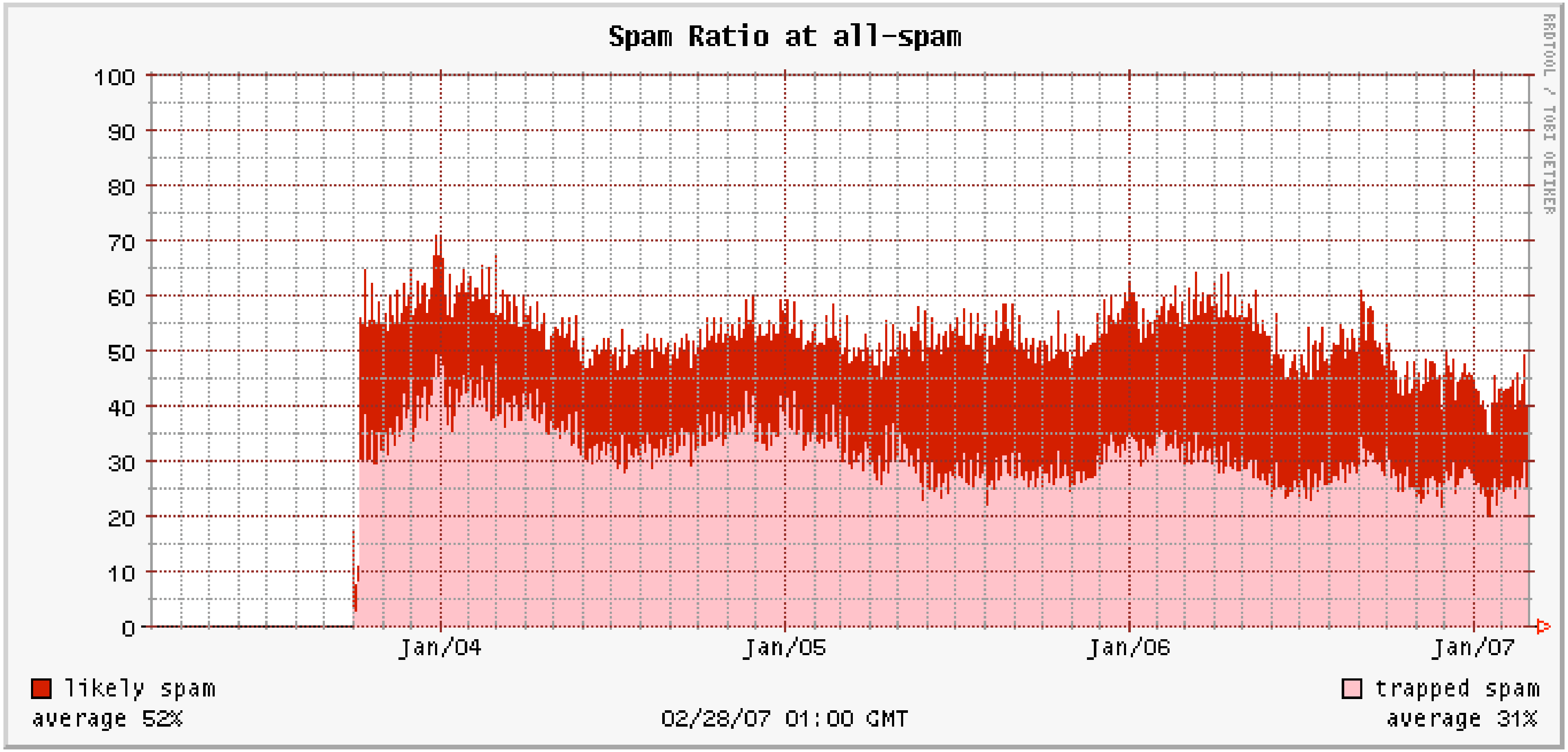
SPAM Countries

Country	Current spam issues
US	2060
China	406
Russia	265
UK	175
Japan	167

Source: spamhaus as of 27 feb 2007

Spam statistics

- Subject to mush debate!
- High numbers (+80%) from anti-spam providers
- Approx 75% reported by many sources

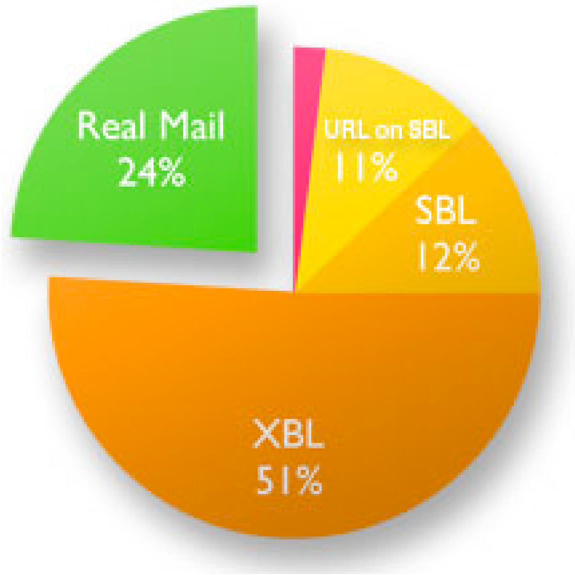


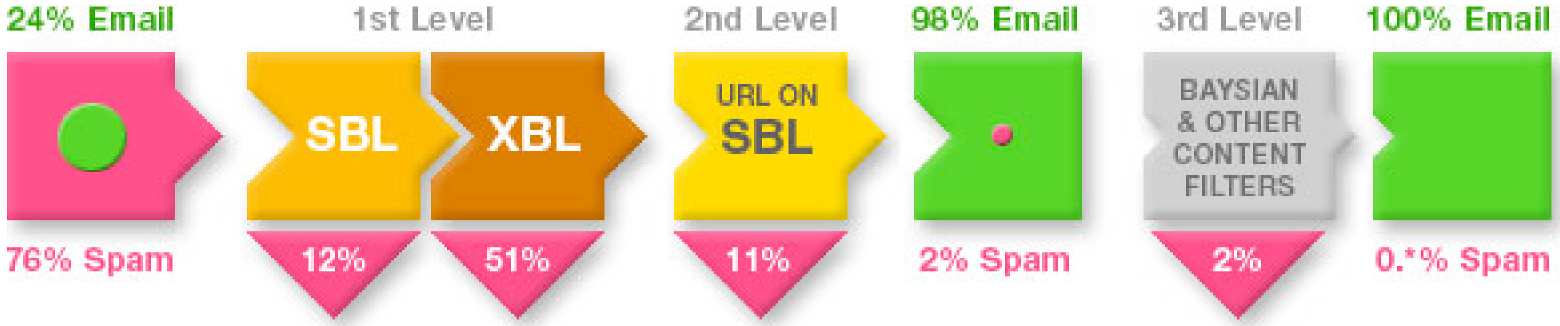
Anti spam technics

- DNS checks (can we return a mail?)
- Realtime Blocking Lists (RBL)
  - Blocks known open relays, known spammers
- Signature matching (Razor)
  - Compares hash of content to database of know spam
- Heuristics (Spamassassin)
  - Scoring based on pattern matching
- Neural networks (DSPAM, Many)
- SPF – Sender Policy Framework
- OCR for images

Realtime Blocking Lists (RBL)

- Spamhaus most popular
- SBL: IP addr. of verified spam sources
- XBL: Exploits, open proxy, worms/viruses
- URL: known advertised URLs





Spam Technics

- No single method finds all spam
- Scoring over multiple methods necessary
- Spammers gets more clever – so does the tools.
- The problem with false positives
  - How to migrate backward in the toolchain?
- The danish law prohibits deletion of spam!
  - Tagging, folders, web interfaces

How many ways can you spell Viagra?

SPF – Sender Policy Framework

- SPF allows the owner of an Internet domain to use special DNS records to specify which machines are authorized to transmit e-mail for that domain
- example.org. IN TXT "v=spf1 a mx -all"
- Supported by Amazon, AOL, EBay, Google, GMX, Hotmail, W3C and Netic :-)
- 2007: 5% of .com/.net domains have SPF records
- RFC4408 (28 april 2006)

Virus and Worms

- Easy (relative) and fairly reliable to catch (but virus also intrudes by other means than email)
- Must keep signature database current
- Danish law allows deletion
- Potential very dangerous
  - Full or partial destruction of systems
  - Service Interruptions
  - Privacy disclosures
  - Global Internet Shutdown

One firm estimates that the projected damage from the two Code Red viruses has risen to more than US$2 billion -- and is mounting at the rate of $200 million per day. (aug 2001)

Current situation

February 21, 2007

Sydney, Australia – Marshal's Threat Research and Content Engineering (TRACE) Team today announced total spam volume is at its **highest peak ever** and has **increased 280 per cent since October last year**.

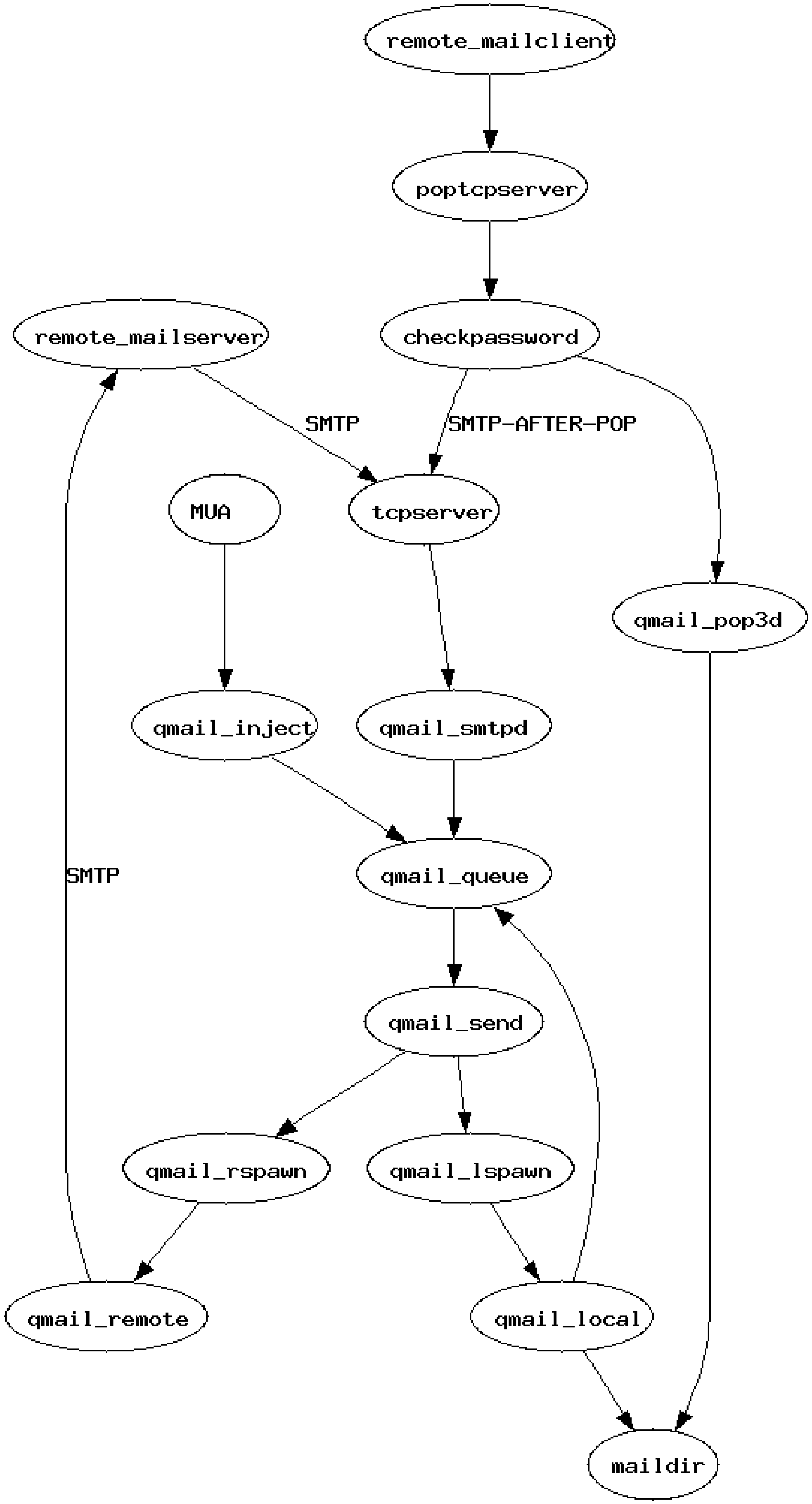
According to the TRACE Team, spam levels **increased 30 per cent in the past week**, coinciding with a resurgence of spam coming out of **China and South Korea**.

"The increase in spam coming out of the regon is likely the result of a **newly activated botnet** running off computers in Asia", said Anstis. "This shows yet again the importance of having adequate malware protection on your home and business computers."

According to the TRACE team, users now receive eight spam messages for every 10 emails they receive in their inbox.

"**Approximately 85 per cent of all emails received are spam**. If the current increases in spam volumes continue in 2007, users can expect at least 90 per cent of all emails received to be spam by the end of the year.

Qmail Overview



netic

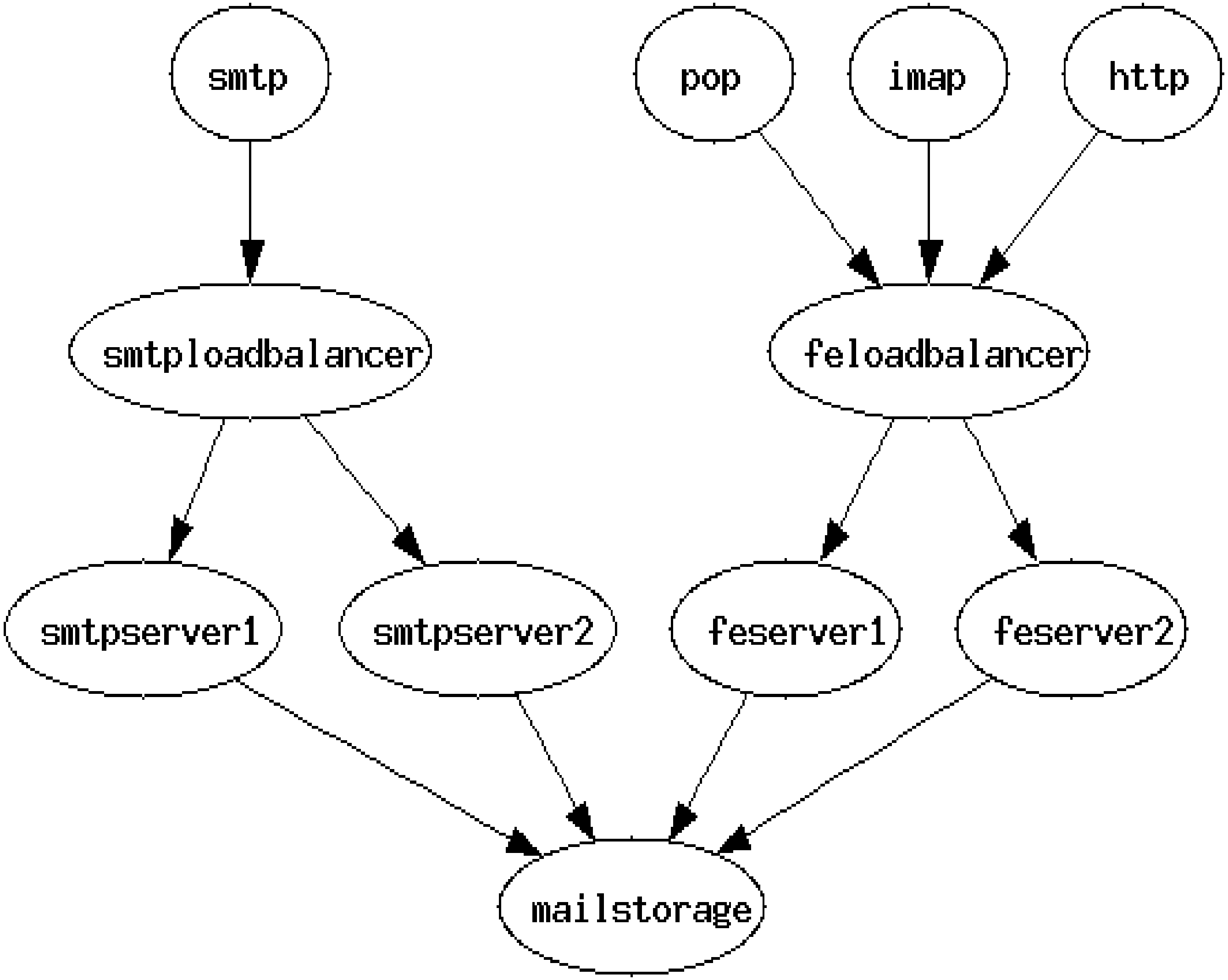
Challenges in mail implementation

- Do log rotation based on size – not time!
- Spam and Virus requires daily maintenance
- “suspected” False Positive spam is a problem
- Expect user to go crazy
  - Plan for zillions of mail/day
  - Expect users to mail a copy of their harddisk
  - Do effective monitoring
    - full partitions
    - Queue size
    - Mail flow (both too mush and too little)
    - Enforce quotas
- Adhere to standard! Do not blackhole mail!

Security

- Most basic mail software is pretty secure (latest qmail is from 1998 – bounty since 1997)
- Webmail (particularly PHP based) have many problems
- Do security segmentation (users and vservers)
- Plan for DOS
  - Limit number of incoming connections both SMTP and POP/IMAP
  - Limit connection time
  - Do tar pitting on illegal users
  - Check for users existence during SMTP
- Be careful when handling virus!

Redundant setup



Other mailsystem

- Qmail (vpopmail, netqmail etc)
- Exim
- Postfix
- Sendmail
- Iplanet
- Gmail, Hotmail, yahoo
- Oracle Collaboration Suite (unified mail)
- MS Exchange
- Lotus Notes
- Cc mail

The future of email?

- Spam a threat - no easy solution
- Virus / spyware makes people
- Amount of spam is a capacity problem
- Malware also attacks IM, forums etc
- Most private people will use web based email
- SPF, Sender-ID is far from critical mass
- Long term merge of mail, IM, VOIP, Skype, forum etc
- Anti-spam industry is growing fast

Questions?

Links

- http://www.faqs.org/rfcs/ (RFCS)
- http://www.spamhaus.org - news on spam
- https://spam.abuse.net – clearinghouse, RBL
- http://cr.yp.to - qmail

Exercises

- Browse the referred RFC's (especially RFC821, RFC822)
- Send a mail to your self or what@about.dk (passwd: Brian) using only telnet
- Send a mail to your self using mail.netic.dk as mailserver. Relay problems?
- Read the same mail using only telnet
  - Using the POP3 protocol
  - Using the IMAP4 protocol
  - Read and understand the headers you see!

Exercises-2

- Send a mail with a binary attachment (using your favorite email program) and study the raw mail (perhaps fetch it using telnet)
- Try authenticated SMTP to mail.netic.dk – perhaps port 1025 if port 25 is blocked
- Does your domain list SPF records? What is the meaning of them?
- Visit spamhaus.org and read about ROKSO