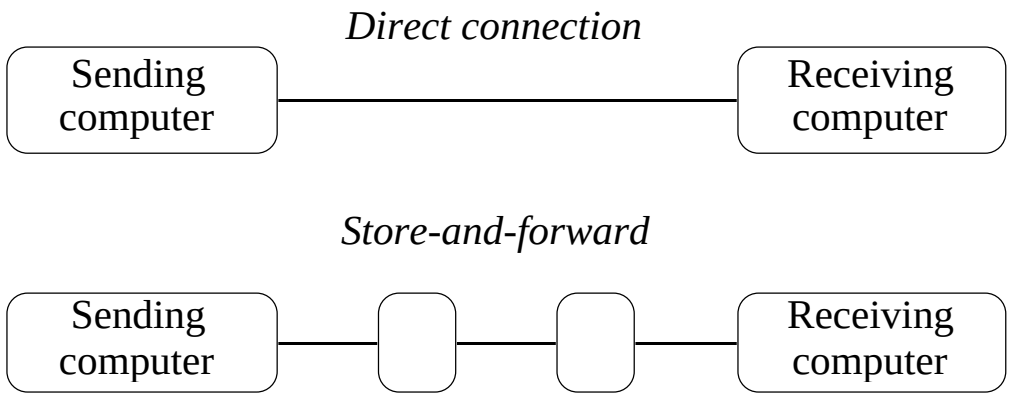
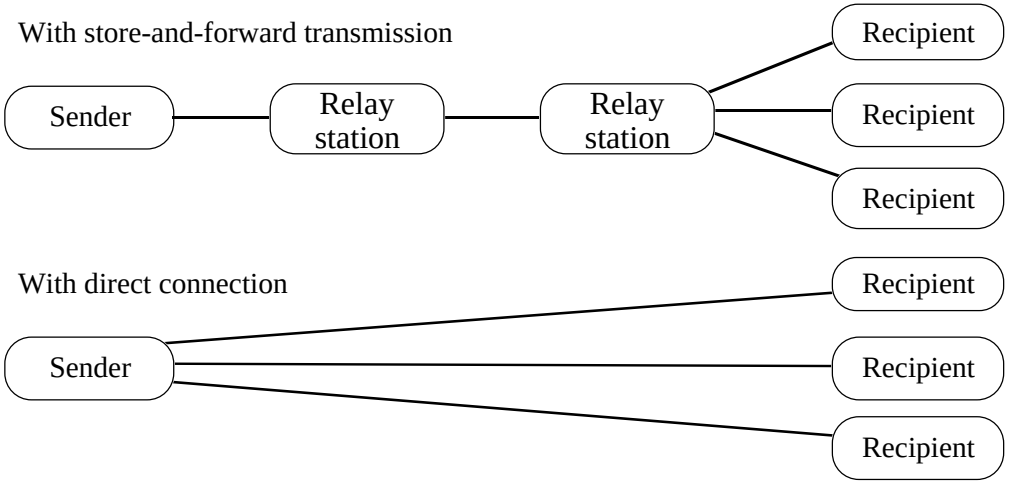
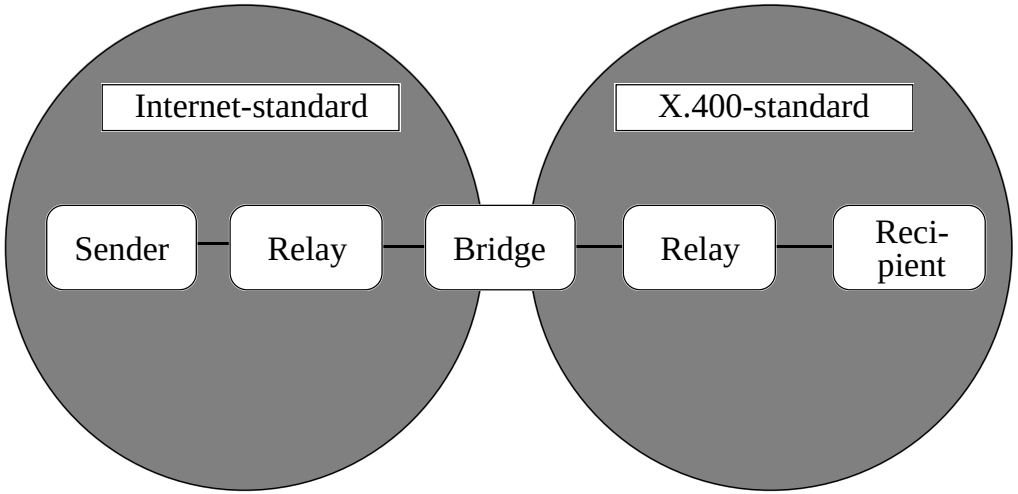
Direct connection and store-and-forward



Many distant recipients



Gateways' use of store-and-forward



Store-and-forward pros and cons

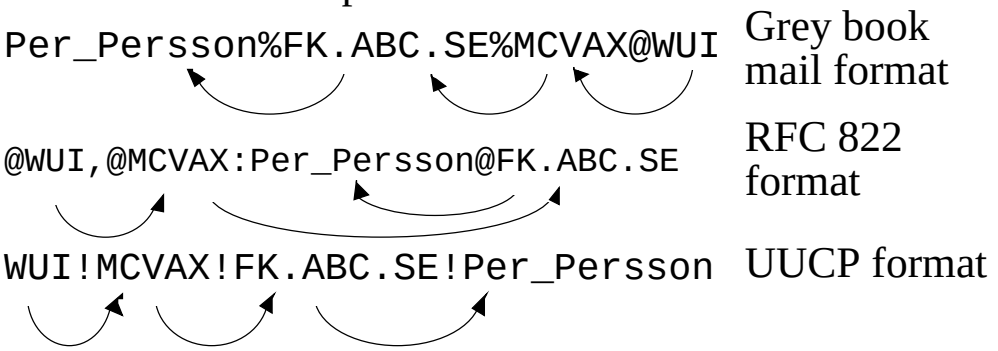
+ Distribution of tasks between specialized servers. But direct transmission can employ special routing information servers.
+ Reduced cost for message to many distant recipients.
+ Gateways usually store-and-forward-based.
– Reliability
– Can be more expensive because relayers must be paid.

Spooling - a limited kind of store-and-forward

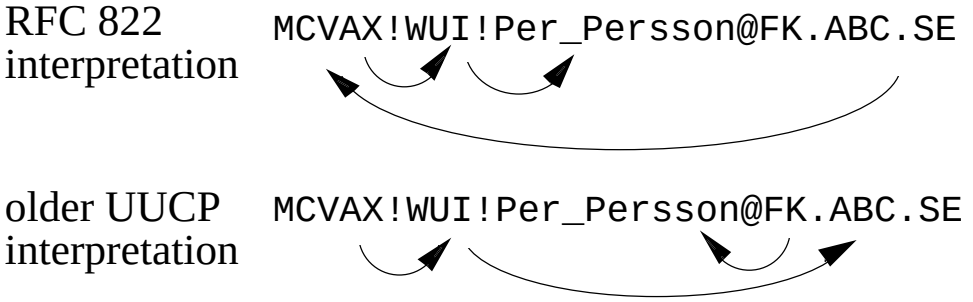
– No direct and immediate confirmation that the message has been delivered.
+ The sender need not wait during the transmission.
+ Temporary connection problems hidden from the user.

Absolute and relative addresses

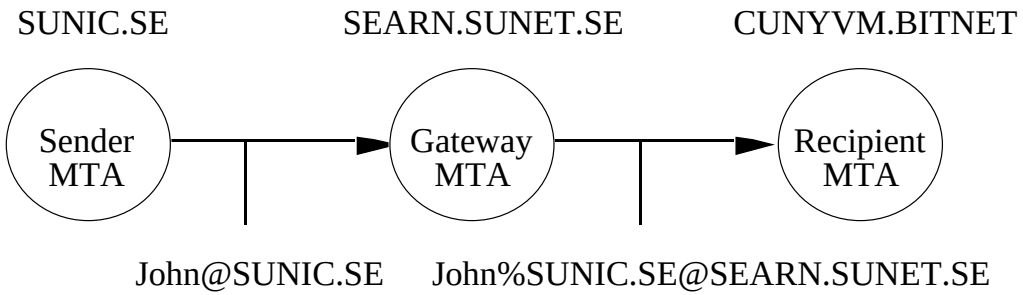
An *absolute address* is the same address for a certain recipient, irrespective of where the message is sent from. A *relative address* indicates one or more relay stations on the route to the recipients.



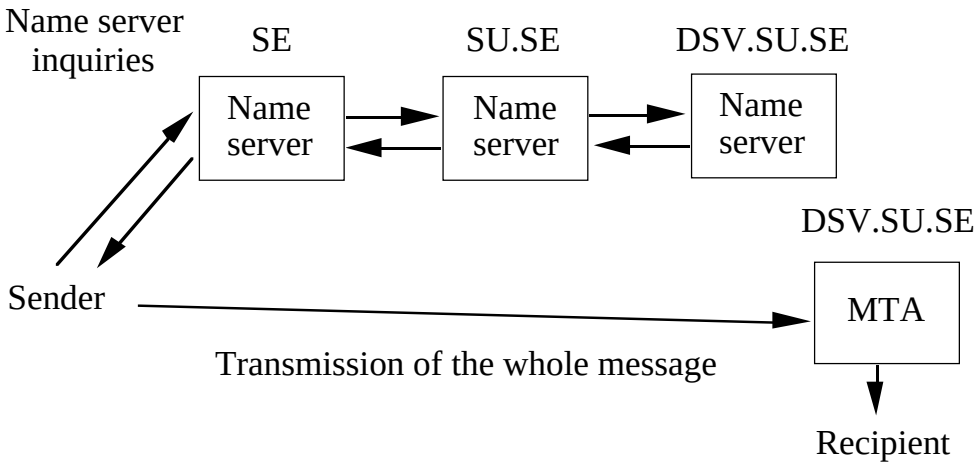
Mixed relative addressing



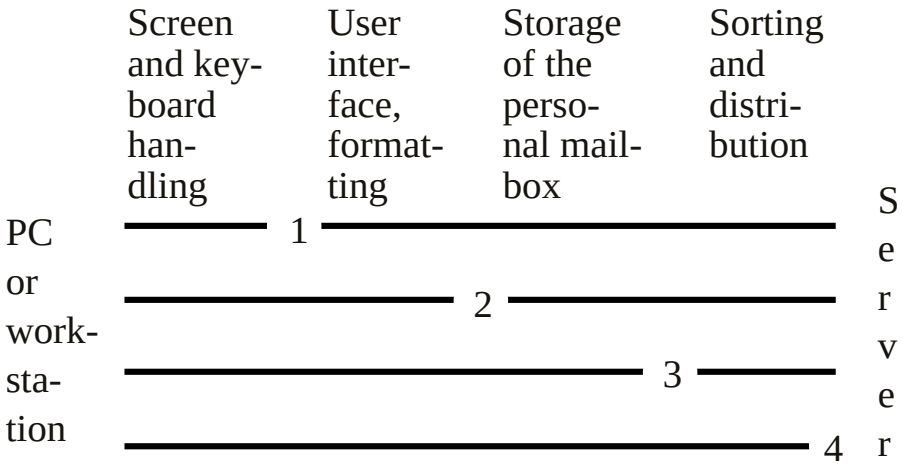
Why gateways produce relative addresses



Use of name servers for routing

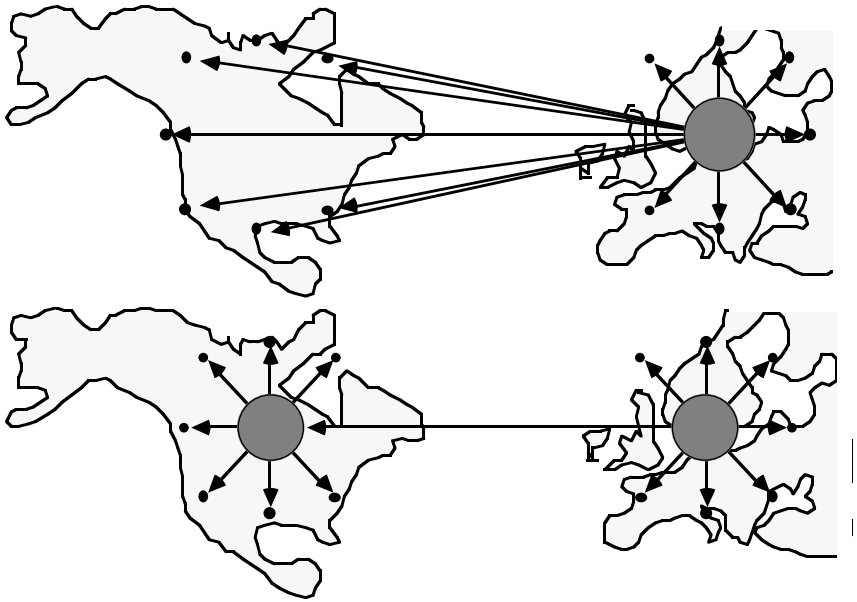


PC-Server E-mail Architectures

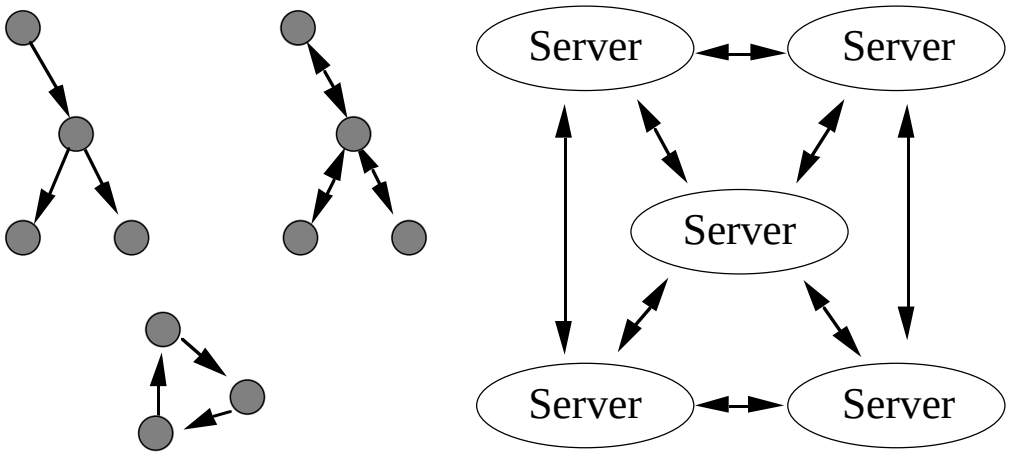


Protocols: POP (3), IMAP (2, 3)

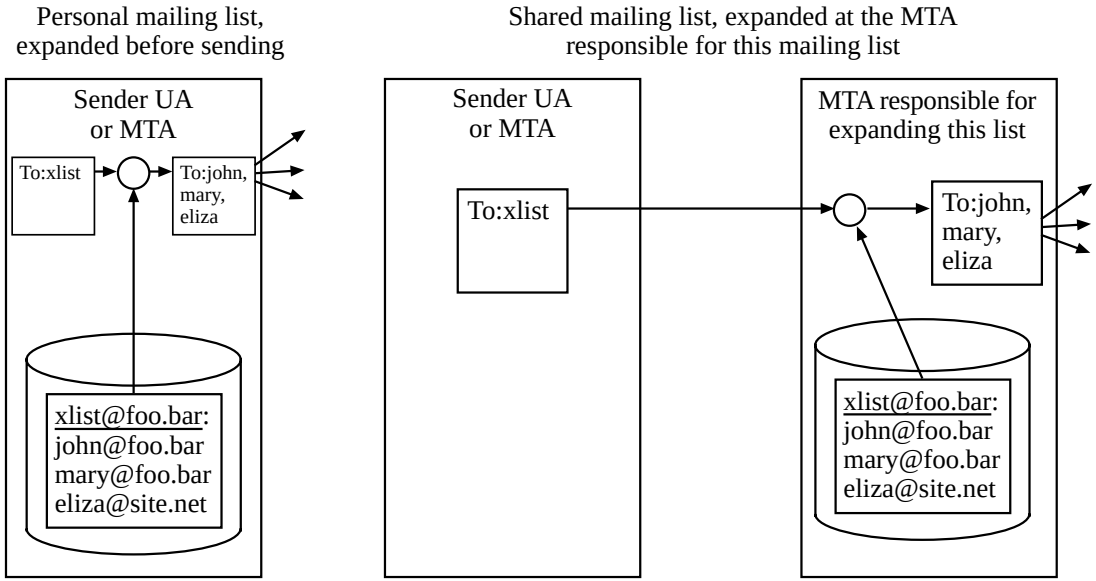
Nested distribution lists



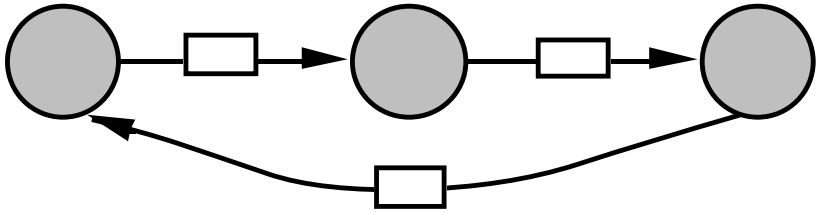
Modes of distribution to many recipients



Expansion of Nested Mailing Lists



Loop control for Nested Distribution Lists

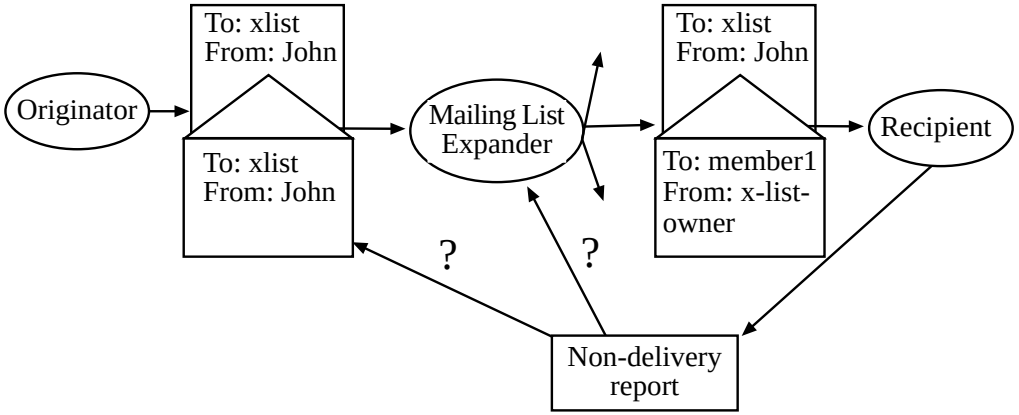


(1) Full expansion by the originating UA or MTA.
(2a) Trace list on the envelope, use to stop incoming messages.
(2b) Trace list on the envelope, use to stop outgoing messages.
(3) Registration system.
(4a) Storing Message-ID-s with DL expanders.
(4b) Storing content checksums with DL expanders.

X.400: Primarily 2a, Listserv: 4a and 4b, Usenet News: 4a

Distribution Lists in Internet Mail

- No standardized loop control for nested lists
- "-request"-convention
- SMTP sender = address of list maintainer
- Non-delivery reports sent to SMTP sender



List Headers (RFC 2369)

Meta-standard! Not specify a protocol, but specify how a mail header can specify a protocol for common actions on mailing lists:

```
List-Subscribe: <mailto:ietf-xml-mime-request@imc.org?body=subscribe>
List-Unsubscribe: <mailto:ietf-xml-mime-request@imc.org?body=unsubscribe>
List-Help:<http://www.imc.org/ietf-xml-mime/>
List-Archive: <http://www.imc.org/ietf-xml-mime/mail-archive/>
List-ID: <ietf-xml-mime.imc.org>
```

Public/secret key encryption

encrypted text = f_1(original text)
original text = f_2(encrypted text)
Can f_2 be derived from f_1?

Pros and cons of public key encryption

+ Solves partly key transportation problem
– More CPU-time consuming

Authentication, authorization

- To verify the sender of a message
- Payments, agreements
- UA-UA or MTA-MTA

Authentication methods

(a) Passwords
(b) Specially designed networks
(c) Public key cryptography

Three levels of protection of message transmission:

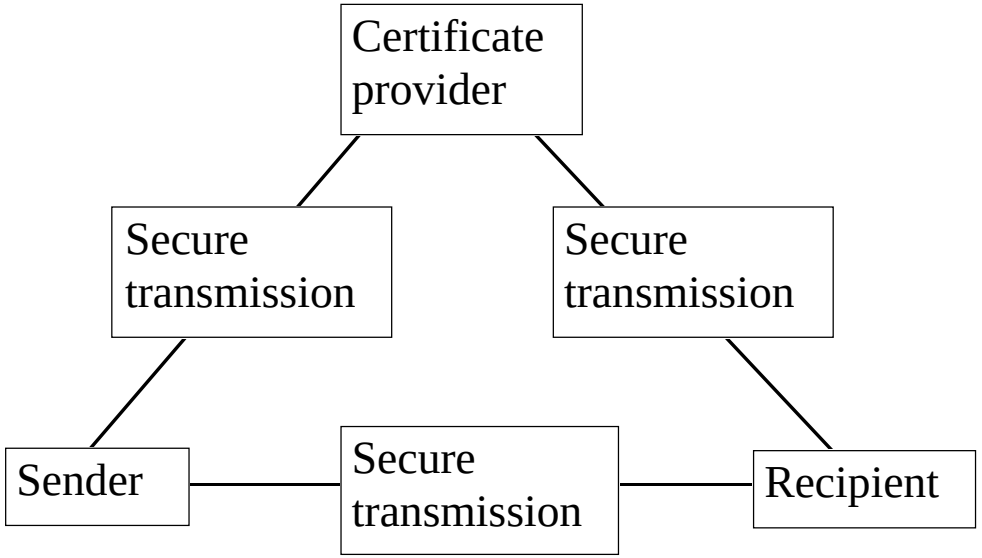
(1) The agents identify each other using noninvertible forms of ordinary passwords. This is called *weak authentication*.
(2) The agents identify each other using public key encryption algorithms. This is called *strong authentication*.
(3) Strong authentication is combined with encryption of all messages during the whole transmission.

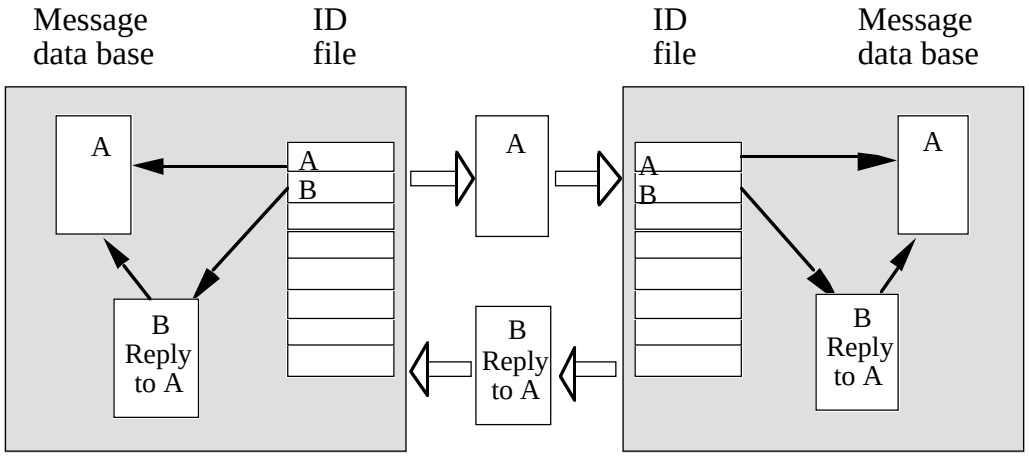
Digital Signatures and Digital Seals

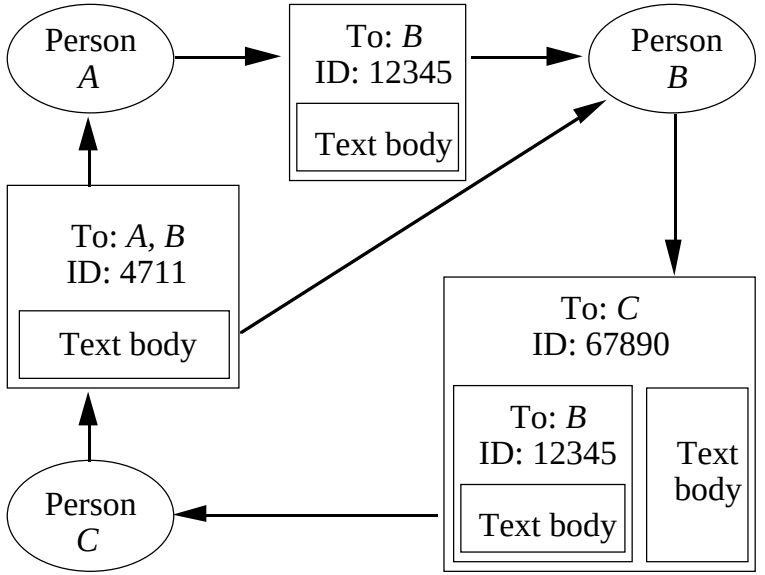
Methods: Secret key encryption of signature or checksum, which anyone can decrypt with public key

- Number of interactions
- Need of a neutral third party
- Bilateral or open to groups

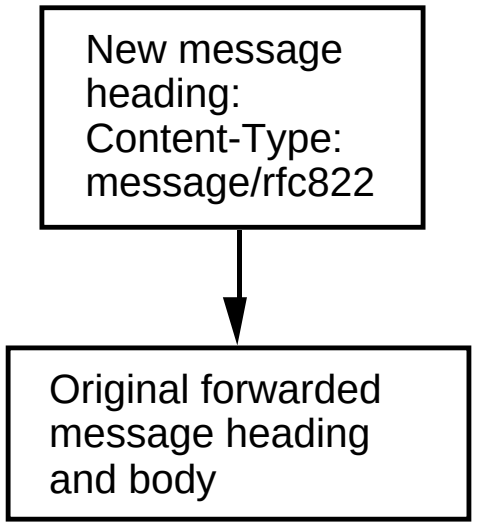
Certificate Authorities



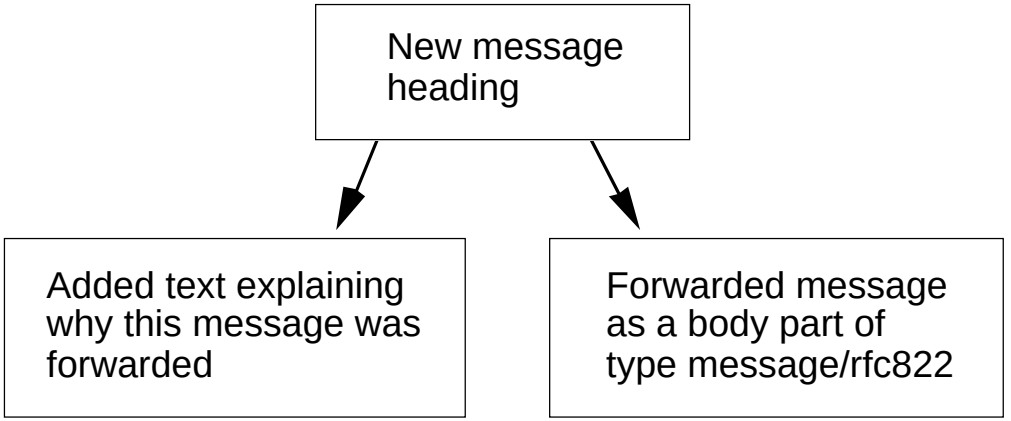




Forwarding with a MIME Message/rfc822



Forwarding with a MIME multipart message



Methods of e-mail forwarding

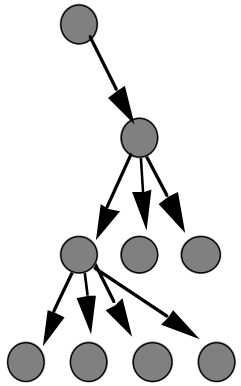
(a) Add new Resent-headers to the original message. Example of a message header with Resent-headers:

(b) The forwarded message is made into a body part of type message/rfc822 in a new multipart message:

(c) The text of the forwarded message is simply copied into the text of the new message.

Which method is best if the forwarded message had a digital seal?

Distribution lists



Usenet News distribution method