APPLICATION LAYER AND ELECTRONIC MAIL
Outline

→ Application layer
→ Mail delivery architecture
→ Mail transfer protocol
→ Mail access protocols
APPLICATION LAYER
In the Protocol Architecture

- Application
  - NFS
  - XDR
  - RPC
- Presentation
- Session
- Transport
- Network
- Data link

Protocols:
- Telnet
- FTP
- SMTP
- HTTP
- RTP
- SNMP
- Telnet
- FTP
- SMTP
- HTTP
- ICMP
- IGMP
- ARP
- Routing protocols
Client-Server Paradigm

→ Server always in execution
→ Waiting for requests
  → Client initiates communication
Known IP address (name) and port
  → Static port
  → Standard port
Traditional model on the Internet
  → FTP, WWW, e-mail
Peer-to-peer (P2P) Paradigm

→ No pre-defined role
→ Each host can contact and be contacted
   → I.e., running both client and server
Server (or super peer) might be needed to know others

Newer model

VoIP, emule, Skype
Text-based Protocols

→ Inefficient encoding
→ Easy to troubleshoot
→ No need for protocol analyzer support
MAIL DELIVERY ARCHITECTURE
MAIL TRANSFER PROTOCOL
SMTP: Simple Mail Transfer Protocol

→ Text based
→ Client-server
→ TCP - port 25
  → Opened by client
→ Command-response
  → Status code
SMTP Session

Handshaking

Open TCP

220 polito.it

HELO zeit.polito.it

250 ...

MAIL FROM: baldi@polito.it

250 baldi@polito.it sender OK

RCPT TO: box@baldi.info

250 box@baldi.info recipient OK
This is an e-mail message. It contains multiple lines.

354 Enter mail, end with “.” by itself

250 message accepted

221 polito.it closing connection
Anti-spamming Measures

Open TCP

220 polito.it

HELO baldi.info

250 ...

MAIL FROM: box@baldi.info

250 box@baldi.info sender OK

RCPT TO: baldi@gmail.com

571 baldi@gmail.com prohibited. We do not relay
Anti-spamming Measures

Open TCP

HELO baldi.info

220 polito.it

250 ...

MAIL FROM: box@baldi.info

250 box@baldi.info sender OK

RCPT TO: baldi@polito.it

250 baldi@polito.it recipient OK
Anti-spamming Measures

Open TCP

220 polito.it

HELO zeit.polito.it

250 ...

MAIL FROM: baldi@polito.it

250 baldi@polito.it sender OK

RCPT TO: baldi@gmail.com

250 baldi@gmail.com recipient OK
Anti-spamming, Anti-spoofing Measures

Check Client IP

Open TCP

220 polito.it
HELO zeit.polito.it
250 ...
MAIL FROM: baldi@polito.it
250 baldi@polito.it sender OK
RCPT TO: baldi@gmail.com
473 baldi@gmail.com relaying prohibited. You should authenticate first
Message Format

→ ASCII character sequence
→ Possibly limited length lines

From: <sender>
To: <addresses>
CC: <carbon copied>
Subject: <subject line>
...

Body
How about images?

- Can be encoded as character sequence
- E.g. base64
- Recipient must know
Multipurpose Internet Mail Extensions: MIME

Additional headers

MIME-Version: 1.0
Content-Type: image/png; name="image001.png"
Content-Description: image001.png
Content-Transfer-Encoding: base64

iVBORw0KGgoAAAANSUhEUgAAAKgAAABDCA
xAAADsQBlSsOGwAAABl0RVh0U29mdhcm
EEQXBBxR19URQF3OeZRo0rKvoeCYm4xJen
Content-Type

→ text
  → plain, html
→ image
  → jpeg, gif, png
→ audio
→ video
MAIL ACCESS PROTOCOLS
→ Web server running on mail server host
→ Providing access to messages through web interface
→ Messages remain on server
Pros and Cons

→ Ideal when not using own PC
→ Available from everywhere
→ Available only with Internet connection
Post Office Protocol: POP

→ Mono-PC users
  → Messages moved to client
→ Available for off-line access
→ Character-based
→ TCP on port 110
POP Session

Authorization

Open TCP
+OK POP3 serv ready
USER baldi
+OK
PASS whatever_it_is
+OK Congratulations!
Internet Message Access Protocol: IMAP

→ Multi-PC users
   → E.g. 1 PC at work, 1 PC at home

→ Character-based

→ TCP on port 143
Best of both worlds

→ Available for off-line access
→ Messages remain on server
  → In folder hierarchy
→ Synchronize with local copy