Electronics and Computer Science
University of Southampton

CM214-COMP2008
Data Communications and Networks

Application Level Protocols

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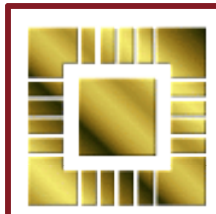
Protocols, Formats, Encodings

- Consider the World Wide Web
  - RFC2616 describes the HTTP protocol
    - Host to host interaction (request, response etc.)
  - MIME type (in HTTP header) gives format
    - The type (and sub-type) of the data
    - HTML is one of many possible formats
  - MIME headers also give encoding
    - How the data has been supplied (e.g. Base64)
    - The character set (maps data to “glyphs”)



E-Mail

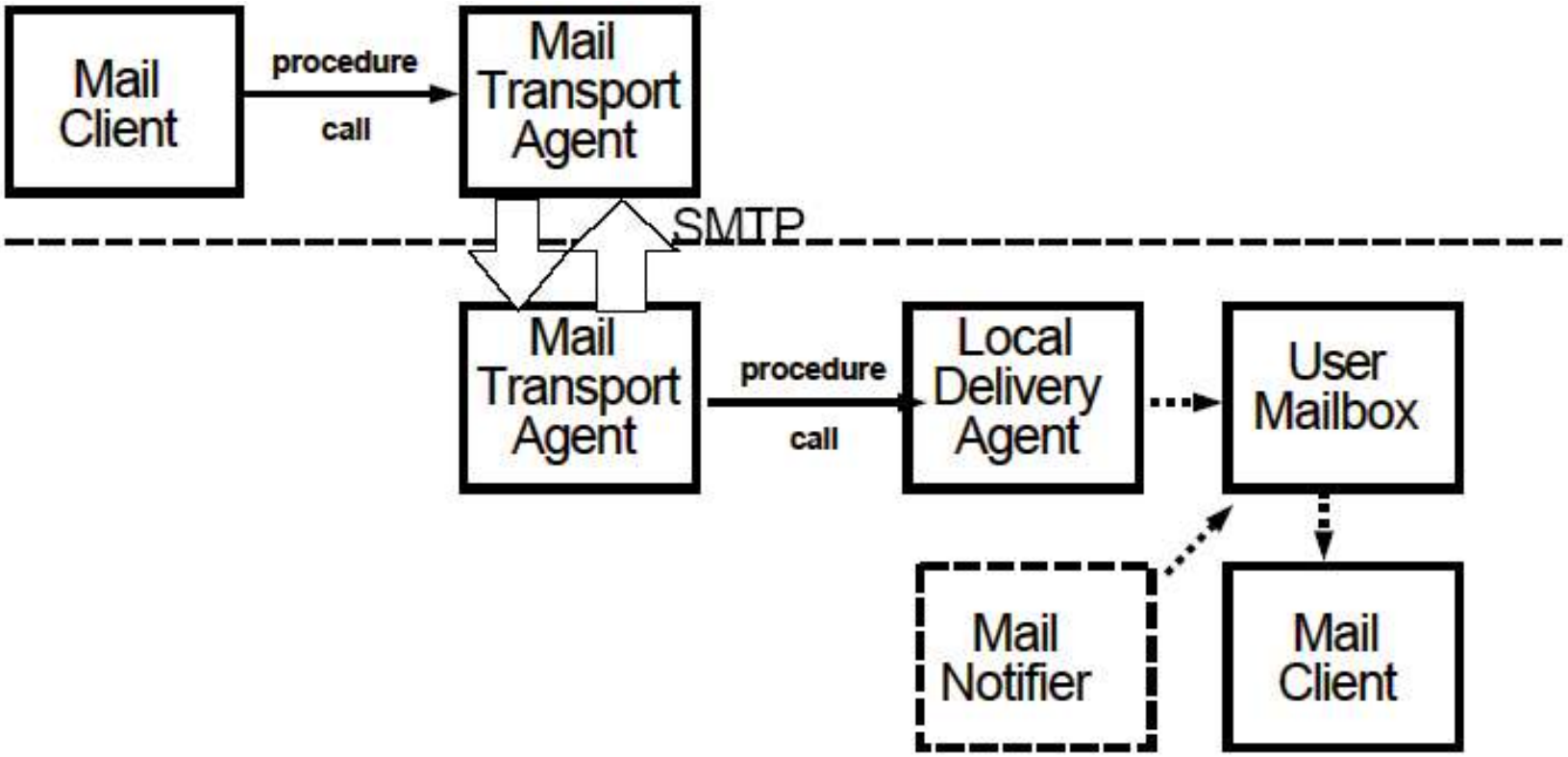
- RFC821 defines SMTP
  - Protocol between Mail Transport Agents
- RFC822 defines content of above
  - A set of mail headers and a body
- RFC822 headers include MIME description of body
  - Exactly as MIME used in HTTP

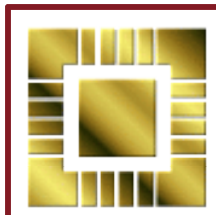
MIME

- Specifies content type & sub-type
  - E.g. image/jpeg, application/postscript
- Specifies character set encoding
  - E.g. charset=us-ascii
- Specifies content transfer encoding
  - E.g. normal 7 bit ascii text
  - E.g. base64
    - 3 bytes (3x8 bits) over 4 chars (4x6 bits)

Simple Mail Transfer

- Two machines, permanently connected



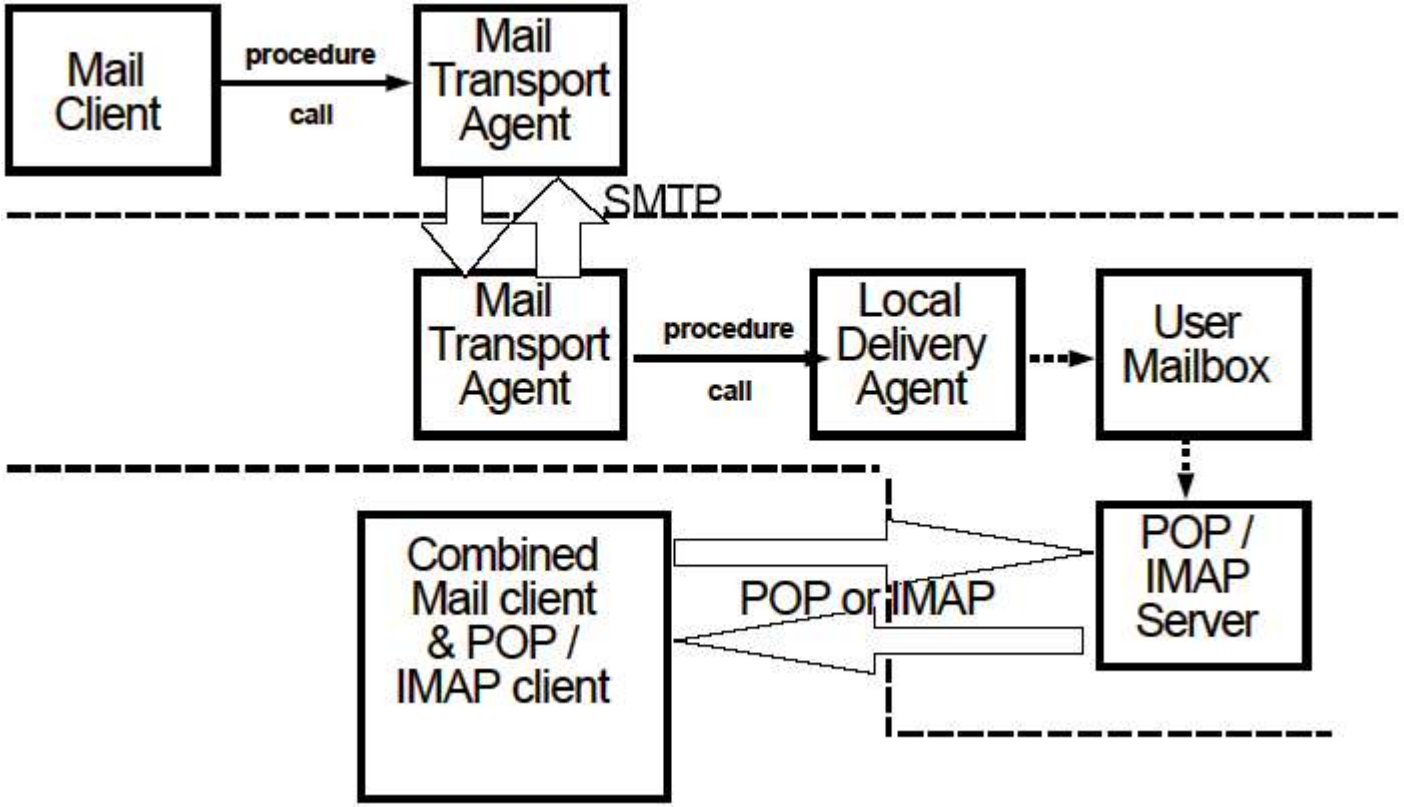


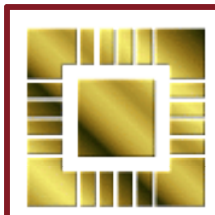
Transfer Protocol

```
S: MAIL FROM:<alice@wonderland.com>
R: 250 OK
S: RCPT TO:<bob@dobbs.com>
R: 250 OK
S: DATA
R: 354 Start mail input; end with <CRLF>.<CRLF>
S: From: "Alice" <alice@wonderland.com>
S: Message-Id: <199711131704.MAA18447@wonderland.com>
S: Subject: Have you seen my white rabbit?
S: To: bob@dobbs.org (Bob)
S: Date: Thu, 13 Nov 1997 12:04:05 -0500 (EST)
S: Content-Type: text
S:
S: I'm most concerned.  I fear he may have fallen down a hole.
S: --
S:                                                    >>alice>>
S: .
R: 250 OK
```

Complex Mail Transfer

- Receiver connected part-time (dial-up)





POP Protocol

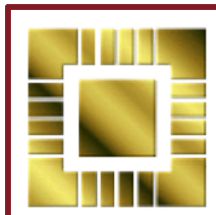
```
     S: <client connects to service
port 110>
       R:     +OK POP3 server ready
<1896.697170952@mailgate.dobbs.org>
       S:     USER bob
       R:     +OK bob
       S:     PASS redqueen
       R:     +OK bob's maildrop has
2 messages (320 octets)
       S:     STAT
       R:     +OK 2 320
       S:     LIST
       R:     +OK 2 messages (320
octets)
       R:     1 120
       R:     2 200
       R:     .
       S:     RETR 1
       R:     +OK 120 octets
       R:     <the POP3 server sends
message 1>
       R:     .
       S:     DELE 1
       R:     +OK message 1 deleted
       S:     RETR 2
       R:     +OK 200 octets
       R:     <the POP3 server sends
message 2>
       R:     .
       S:     DELE 2
       R:     +OK message 2 deleted
       S:     QUIT
       R:     +OK dewey POP3 server
signing off (maildrop empty)
       S:  <client hangs up>
```

Why SMTP & POP?

- Why not just use SMTP?
  - i.e. make the mailer an SMTP client
- Because it is a “push” protocol
  - The sender pushes the e-mail
  - Client may not be connected
- SMTP has limited features

Other Mail Protocols

- IMAP adds features to:
  - Store mail on the server
  - Share mail folders between users
  - Open up security vulnerabilities
- Other proprietary e-mail protocols exist
  - Microsoft Exchange / Outlook
  - IBM / Lotus Notes



Web Protocols

- Are not covered in lectures
  - Except Caching (next unit)
- You should have an adequate understanding from assignment
  - Or re-read assignment briefing

Summary

- Application level protocols rely on streamed TCP connections
- TCP connections rely on IP to connect heterogeneous networks
- IP relies on underlying network technology