HTTP Recap

- Protocol for the World Wide Web
  - Client-server architecture
  - Pull protocol (you request, "pull," the html file you want, the server does not push it onto you)
  - Steps in an HTTP communication
    - Handshaking and connection set-up
    - Types and format of HTTP messages
      - All in ASCII
- New vocabulary
  - Port number, protocol and processes
- Using telnet

Chapter 2: Application layer

- 2.1 Principles of network applications
- 2.2 Web and HTTP
- 2.3 FTP
- 2.4 Electronic Mail
  - SMTP, POP3, IMAP
- 2.5 DNS
- 2.6 P2P file sharing
- 2.7 Socket programming with TCP
- 2.8 Socket programming with UDP
- 2.9 Building a Web server

For Today: Electronic mail

- email major elements
- Main protocols (and port number)
- Types and format of messages
- Steps for email messages to move from sender to receiver, through the Internet
Electronic Mail

Three major components:
1) user agents
2) mail servers
3) SMTP: simple mail transfer protocol
   (and access protocols)

Scenario: Alice sends message to Bob

Discussion Question
- The textbook states "SMTP does not normally use intermediate mail servers for sending mail..."
- Are devices in the network core used in sending mail? Explain.

Sample SMTP interaction
- In the following interaction with SMTP, which lines are
  - Handshaking
  - Transfer of message
  - Closure
Sample SMTP interaction

```
fcapmaster:~ jcardell$ telnet smtp.smith.edu 25
Trying 131.229.64.236...
Connected to baton.smith.edu.
Escape character is '^]'.
220 baton.smith.edu ESMTP Sendmail 8.13.8/8.13.8; Sun, 12 Sep 2017 11:37:00 -0400
C: HELO jbc.edu
S: 250 baton.smith.edu Hello [131.229.102.128], pleased to meet you
C: MAIL FROM: <judy@jbc.edu>
S: 250 2.1.0 <judy@jbc.edu>... Sender ok
C: RCPT TO: <jcardell@smith.edu>
S: 250 2.1.5 <jcardell@smith.edu>... Recipient ok
C: DATA
S: 354 Enter mail, end with "." on a line by itself
C: Hello Me
S: 250 2.0.0 s8GFb0G4007216 Message accepted for delivery
C: QUIT
S: 221 2.0.0 baton.smith.edu closing connection
```
Message format: multimedia extensions

- MIME: multipurpose internet mail extension
- additional lines in message header define the MIME content

Base64 Encoding

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Base64 Encoding

- Original (binary) bit stream
  100110111010001011101001
  100110 .. 111010 .. 001011 .. 101001

- Which corresponds to the 6-bit values
  38, 58, 11 and 41

- Which are encoded as m6Lp

Mail access protocols

- SMTP is a 'PUSH' protocol
- So how do we 'PULL' messages off the mail server?
**SMTP: compared to HTTP**

Comparison with HTTP:
- HTTP: pull (you pull info from a server when desired)
- SMTP: push; POP, IMAP, (HTTP): pull
- both have ASCII command/response interaction, status codes
- SMTP: multiple objects sent in one message, using encoding as needed
  - SMTP requires message (header & body) to be in ASCII
- HTTP: each object encapsulated in its own response message

... and compared to FTP
- File transfer protocol
  - Two connections
    - Control connection (port 21)
      - “Out of band”
    - Data connection (port 20)
  - The control connection maintains state information
    - Login info, location in directory tree...

**Summary**

- New protocols
  - SMTP - email delivery and storage
  - mail access protocols
    - POP3, IMAP, HTTP
- Using telnet to spoof being
  - an HTTP client agent
  - an email client agent