Announcements

- Project #5 extended until Dec. 10
- Reading: start 7.4
- HW#2 (due Tuesday Dec. 7)

Project Notes

- Need to use ar to build a library out of project
  - keep other driver in a separate directory
  - define $(OBJS) as all of your project files

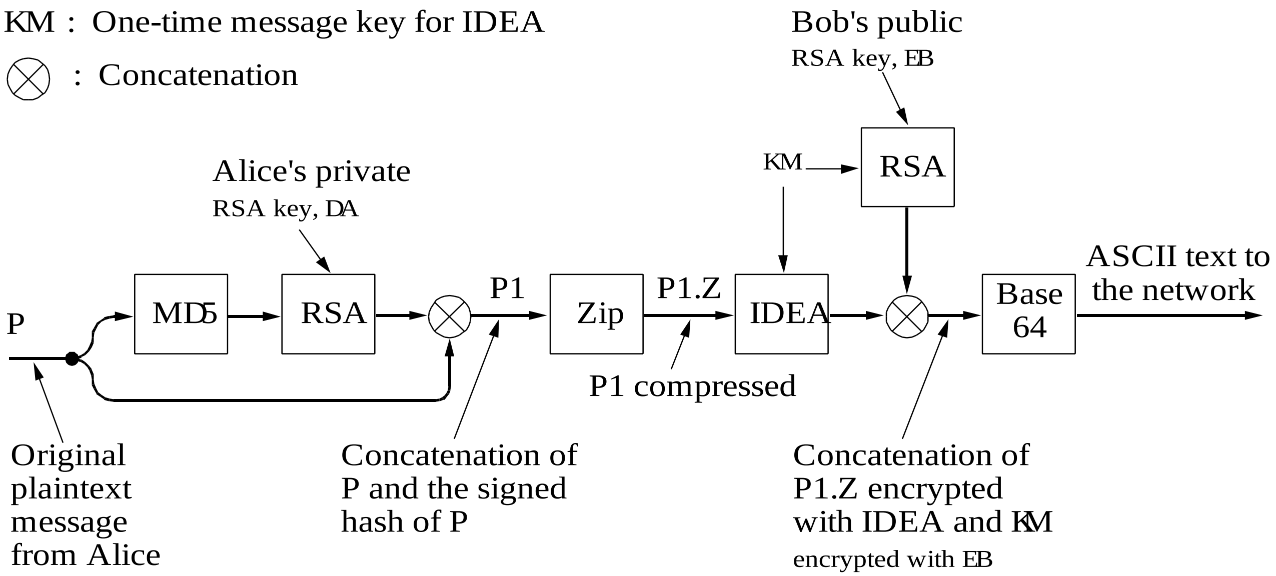
```
libIPv6.a: $(OBJS)
        $(AR) rc libIPv6.a $(OBJS)
```

Transferring Messages

- SMTP Agents listen on TCP port 25
- Protocol consists of a series of 4 character commands
  - HELO: exchange identity
  - MAIL FROM: indicate origin of mail
  - RCPT TO: destination for mail
  - DATA: start of mail message (envelop and body)
  - QUIT: end of mail message
- Email gateways
  - Still many other mail systems out there
    - may use other formats
  - May want only a limited number of “public” mail servers
    - provides application level firewalls
    - hides interior topology of network

Pretty Good Privacy: PGP

- Developed by a single person
  - uses RSA, IDEA, and MD5
- Provides: privacy, compression, and digital signatures
- Has a collection of key servers for public key registration
- Uses three different key lengths (384, 512, and 1024 bits)



From: *Computer Networks*, 3rd Ed. by Andrew S. Tanenbaum, (c)1996 Prentice Hall.

Privacy Enhanced Email (PEM)

- Internet Standard
- Uses MD5 for hashing and DES for encryption
- Key Management:
  - collection of certificate authorities
  - authorities are certified by Policy Certificate Authorities
    - define policies to be followed by certificate authorities
  - PCAs are certified by Internet Policy Registration Authority

News

- Large Collection of newsgroups
  - currently a hierarchalnamespace (used to be rather flat)
  - can be moderated: must be approved before being posted
- Messages
  - have a unique id
  - are associated with one or more newsgroups
  - contain a superset of RFC822 fields
- Transport of news
  - a site a list of one or more sites it gets is newsfeed from
    - a site periodically polls its newsfeeds for news
    - newsfeeds can also push new news out
  - UUCP: Unix-to-Unix CoPy
    - historical path using dialup modems
  - NNTP: Net News Transfer Protocol (TCPport 119)

NNTP

- Provides end-users with news (ala POP for email)
  - LIST and NEWSGROUPS commands
  - GROUP: list all articles in a group
  - NEWNEWS: all news since a specific time
  - ARTICLE: give me a specific article
    - note that this is done by id, not local number
  - POST: post a news article
- Supports moving news between servers
  - all commands from above plus..
  - IHAVE: supports flooding articles around the net
- Performance Problem
  - almost a gigabyte per day of news
  - protocol is stop and wait (limited for round-trip latency)

Naming in the World Wide Web

- Uniform resource locator
  - a single namespace for all objects on the Internet
- <protocol>:<port>//<dns name>/<page reference>
  - protocol: http, ftp, gopher, wais, file, news
  - port: optional - defaults to well known port for protocol
  - dns name: often an alias for a host name
    - also can be an IP address
  - page reference: usually a file path name
    - servers can define default translations
      - default file suffix (e.g. .html)
      - default page for a directory: index.html
      - ~ to expand to a user’s home page