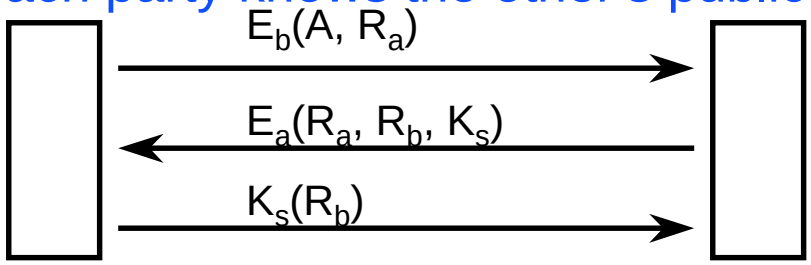
Announcements

- Reading
  - 7.1-7.2
- Midterm #2 re-grade were returned
- Homework #2
  - Ch4: 21, 22
  - Ch 7: 4, 13, 14
- Homework is worth 4% of your grade (2% each)

Authentication using Public Keys

- Assume each party knows the other's public key



- How To learn others Public Key?
  - use a public key server
    - but how do we trust the public key server?
    - have a public key for the public key server
    - possible to have man-in-the-middle attacks
  - interlock protocol
    - only send half the message (odd bits) at a time
    - prevents man-in-the-middle attacks
    - still possible to spoof service

Digital Signatures

- Want to "sign" a message such that:
  - receiver can verify the identity of the sender
  - sender cannot repudiate the contents of the message
  - receiver cannot forge a message
- Central authority (BB)
  - A sends BB A, $K_a(B, R_a, t, P)$
  - BB sends B $K_b(A, R_a, t, P, K_{bb}(A, t, P))$
  - everyone trusts BB
    - BB can be called on to decrypt messages to verify them
    - BB need not store all message that it validates
  - t - timestamp used to prevent replay attacks
- Public Key
  - need E(D(P)) = P **and** D(E(P)) = P
  - A sends B $E_b(D_a(P))$
    - B keeps $D_a(P)$ and third party can use E_a to verify it's from A

Used to prevent replay attacks when t has not changed yet (I.e. slow clock)

Digital Signatures (cont.)

- Problems
  - Repudiation
    - inform police that the key was stolen
    - claim the “bad guy” sent the message
  - Key Changes
    - need to keep records of when keys were in use
- Standards
  - RSA Algorithm
    - popular with many commercial systems
  - El Gamal
    - NSA/NIST Standard
    - too new, and private to have trust

Message Digests

- Goal: Send Signed Plain text
  - can use slow cryptography on signature since its short
- Need:
  - Given P, easy to compute MD(P)
  - Given MD(P), impossible to find P
  - no P and P' exist such that MD(P) = MD(P')
    - use hash functions that produce >= 128 bit digest
- Operation
  - A sends P, D_a(MD(P))
- Digest Functions
  - MD5
    - produces 128 bit digest
  - SHS
    - NSA/NIST effort
    - produces 160 bit output

Naming Hosts In the Internet

- Originally used a single file
  - all hosts had line line with name and IP Address
- Domain Naming System (DNS)
  - introduced in 1986
  - tree based structure to names
  - Names
    - full name must be less than 256 characters
    - each part can be up to 64 characters
    - are case insensitive
  - administration of subtrees can be deligated
    - each administrative region is called a zone

Examples of Domain Names

- Domains can be both roots of subtrees **and** hosts
  - For example: cs.umd.edu
- Top level country codes
  - required by PTTs outside of US