Outline for May 3, 2005

Reading: §10.4.2, §10.5.2, §10.6, §12

Outline

1. Cryptographic Key Infrastructure
   a. Certificates (X.509, PGP)
   b. Certificate, key revocation

2. Digital Signatures
   a. Judge can confirm, to the limits of technology, that claimed signer did sign message
   b. RSA digital signatures: sign, then encipher

3. Authentication:
   a. Basis: what you know/have/are, where you are

4. Passwords
   a. How UNIX does selection
   b. Problem: common passwords
   c. May be pass phrases: goal is to make search space as large as possible, distribution as uniform as possible
   d. Other ways to force good password selection: random, pronounceable, computer-aided selection
   e. Go through problems, approaches to each, esp. proactive

5. Password Storage
   a. In the clear; MULTICS story
   b. Enciphered; key must be kept available; get to it and it’s all over
   c. Hashed; present idea of one-way functions using identity and sum; show UNIX version, including salt

6. Attack Schemes Directed to the Passwords
   a. Exhaustive search: UNIX is 1-8 chars, say 96 possibles; it’s about 7e16
   b. Inspired guessing: think of what people would like (see above)
   c. Random guessing: can’t defend against it; bad login messages aid it
   d. Scavenging: passwords often typed where they might be recorded (as login name, in other contexts, etc.)
   e. Ask the user: very common with some public access services
   f. Expected time to guess

7. Password aging
   a. Pick age so when password is guessed, it’s no longer valid
   b. Implementation: track previous passwords vs. upper, lower time bounds

8. Ultimate in aging: One-Time Password
   a. Password is valid for only one use
   b. May work from list, or new password may be generated from old by a function
   c. Example: S/Key

9. Challenge-response systems
   a. Computer issues challenge, user presents response to verify secret information known/item possessed
   b. Example operations: \( f(x) = x+1 \), random, string (for users without computers), time of day, computer sends \( E(x) \), you answer \( E(D(E(x)) + 1) \)
   c. Note: password never sent on wire or network
   d. Attack: man-in-the-middle
   e. Defense: mutual authentication