Authentication

- password-based authentication
- address-based authentication
- cryptographic protocols
- passwords as keys
- eavesdropping
- trusted intermediaries
- session key establishment
- delegation

Password

- proof by knowledge, sharing
- eavesdropping
- needed for dumb end systems
- cellular phone cloning
- single password across multiple hosts

Slide 1

Slide 2
Password Guessing

**on-line:** limit tries, delay, alarm

**off-line:** dictionary attack ➔ capture \( f(p) \)

1. Your first, last, or kid’s name
2. ”secret”
3. stress-related words (”deadline”, ”work”)
4. sports teams or terms (”bulls”, ”golfer”)
5. ”payday”
6. ”bonkers”
7. The current season (”winter”, ”spring”)
8. Your ethnic group

**Slide 3**

9. repeated characters (”aaaaa”, ”bbbb”)  
10. obscenities, sexual terms

**Slide 4**
Storing Passwords

**per-node**: /etc/passwd

**server**: authentication storage server, retrieved by node (yp/NIS)

**facilitator**: server says yes/no

⇒ need to authenticate node asking

- store hash only
- store encrypted with good, protected key
- but: needs to be in non-volatile memory (ROM?)

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Address-Based Authentication

- rcp, rsh: .rhosts ⇒ node, user name
- per user
- reverse-lookup on IP address (in-addr.arpa)
- can use different login names
- /etc/hosts.equiv: trusted hosts
Address-Based Authentication: Threats

- break in one, break in all
- often: A trusts B, B trusts A
- address spoofing; not easy for connections, but “blind” sending
- easy to listen/send on broadcast network
- MAC address spoofing prevention: filter on port, scramble

Source routing to have T spoof A: \(\langle A, T, D \rangle \Rightarrow \langle D, T, A \rangle\)

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Humans and Computers

**humans:** short, memorable key (8 characters, 48 bits)
- directly or as key for longer key (PGP, Netscape)

**computers:** hidden key, directly
Passwords as Keys

- directly as 56-bit key (e.g., use words)
- can’t use for RSA $p, q$:
  - use as seed for rng
  - “simulation-style” rng, until primes found
  - do once, then give offset hints to user

Eavesdropping

- public key: need to secure Alice’s private key
- use random challenge with signing
- difficult to protect against eavesdropping and disclosure ➪ Lamport, S/Key
Trust Intermediaries

- can’t do pairwise authentication with secret keys: key explosion!
- Key Distribution Center (KDC)
  - KDC knows all secrets
  - $\alpha$ asks KDC for secret (securely) to talk to any other node $\beta$
  - hand out session key $R_{\alpha\beta}$: ticket
  - single point of failure
  - bottleneck

Slide 11

Trust Intermediaries: CA

CA: ensure validity of public keys

- small number, preconfigured
- CA: single PoF
- CA: typically off-line, protected
- certificates are not sensitive
- compromised CA cannot eavesdrop
- need revocation list (CRL) must be signed and recent

Slide 12
Multiple KDC Domains

Secret keys:

- KDCs share pairwise key
- topology of KDC: tree with shortcuts

Public keys:

- cross-certification of CAs
- example: Alice with CA_A, Boris CA_B
  - Alice gets CA_B’s certificate signed by CA_A
  - Alice gets Boris’ certificate signed by CA_B

Session Key Establishment

- use public keys to authenticate, generate private key
- trade-off: processing, exposure
- limit lifetime \(\Rightarrow\) limit replay attacks
- only need to expose short-term key to semi-trusted software
Authorization

- authentication: identity (who)
- authorization: capability (what)
- may be implied (physical access)
- network: authentication ➔ access control list (ACL)
- groups: central server, signed certificate
- certificate: unwieldy, CRLs
- hierarchical groups
- typical: hierarchy (DH, director, …) and organization

Solaris ACLs

- `setfacl -r -m user:czen:r-- file`
- default entries per directory
- `getfacl:

  # file: papers
  # owner: hgs
  # group: faculty
  user::rwx
  group::r-x #effective:r-x
  group:irt:r-x #effective:r-x
  mask:r-x
  other:---

Slide 15

Slide 16
Delegation

- short-term authorization for principals
- sign “letter of authority” (delegation)
- limit time, scope