Overview of Authentication Systems

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Audio/Video recordings of this lecture are available at:

http://www.cse.wustl.edu/~jain/cse571-09/

Overview

- Passwords
- Address based authentication
- Key Distribution Center (KDC)
- Certification Authorities (CAs)
- Multiple Trust Domains
- Session Keys
- Delegation

Passwords

- Do not store passwords in clear. Store hashes.
  $\Rightarrow$ Subject to offline attack
- Encrypt the hash storage.
  $\Rightarrow$ Where do you keep the master key?
- Do not transmit passwords in clear.
- Use password as a key to encrypt a challenge.
  $\Rightarrow$ Cryptographic Authentication

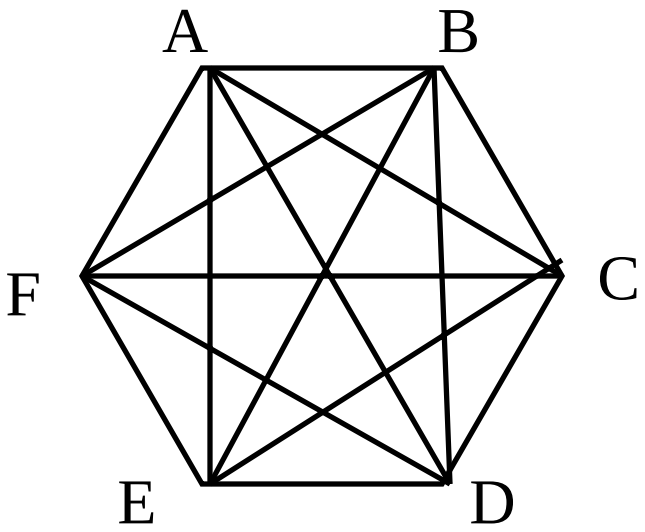
Address based authentication

- /etc/hosts.equiv file in UNIX.
- John Smith can do on B whatever he is allowed to do on A.
  $\Rightarrow$ Users need to have the same name on all machines.
- Per user .rhosts files.
  Lists <address, remote account name>
  that can access this account.
- Issue: Attacker can gain access to all machines
- Attacker can change IP addresses of machines and can access remote resources of all users on that machine.
- Attacker can use source route <A, X, D> to send messages to D (from A).

Machine vs. Person Authentication

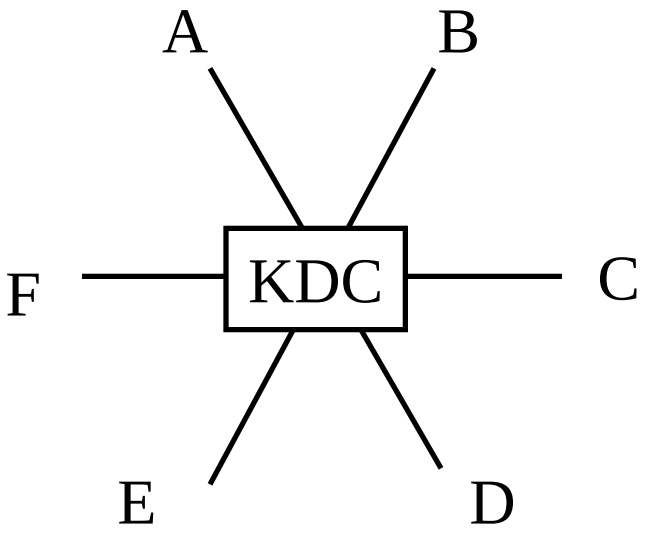
- Machines can store long secret keys.
- Person's password can be used to decrypt a long secret key or private key.

Secret Keys for an N-System Network



- n system need n(n-1)/2 pairs of secret keys
- Each system remembers n-1 keys.
- If a new system comes in n new key are generated.
- If a system leaves, n-1 keys are removed.

Key Distribution Center (KDC)



- Each node is configured with KDC's key
- KDC has all the keys.
- KDC sends a key encrypted with A's key and B's key to A.
- Issues:
  - If KDC is compromised, all systems are compromised.
  - KDC is single point of failure or performance bottleneck.
  - KDC has to be on-line all the time.

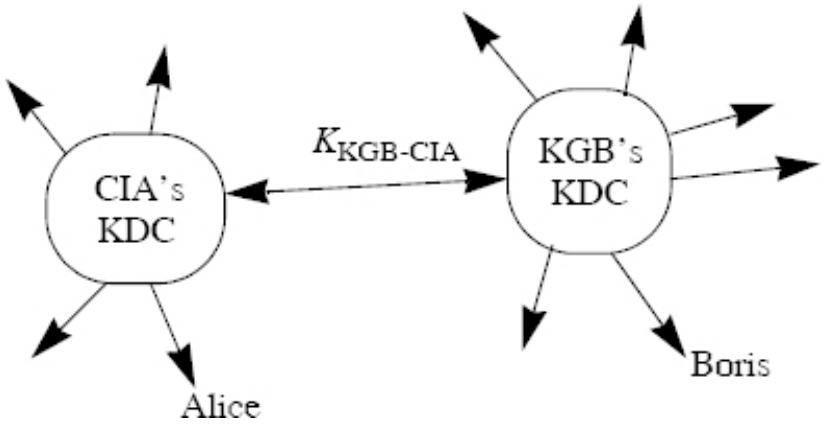
Certification Authorities (CAs)

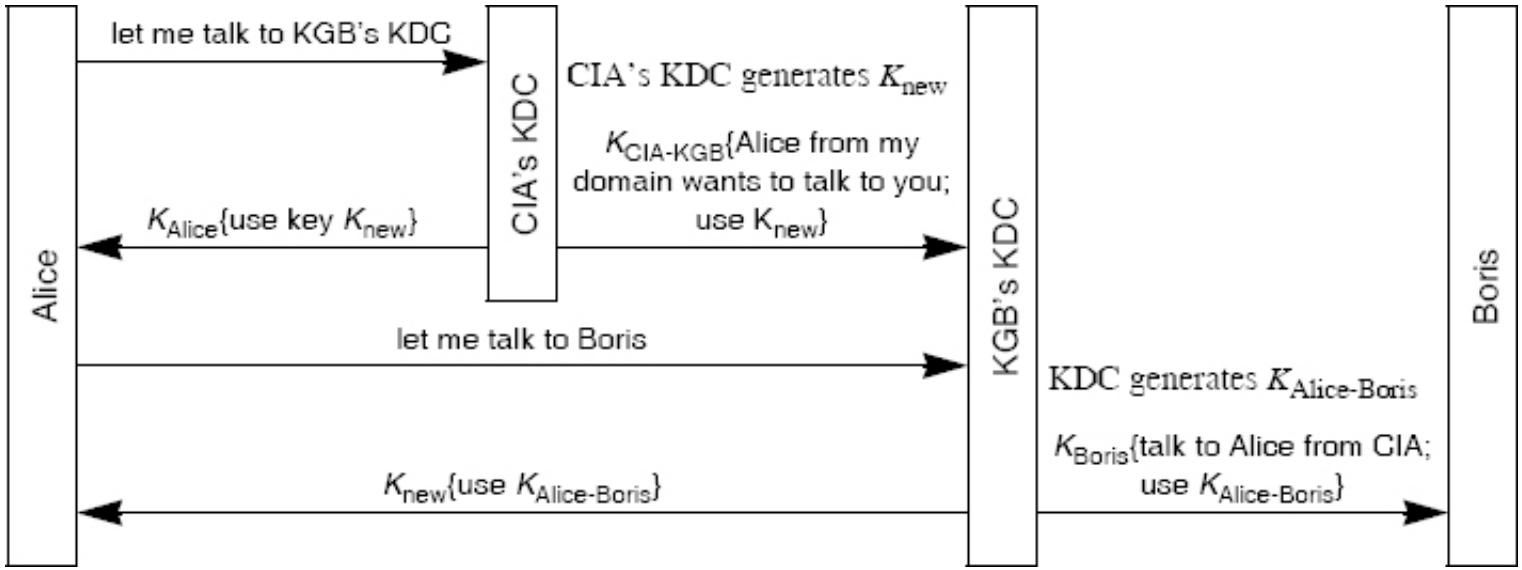
- Unsigned public keys can be tampered.
- Public Keys are signed by CAs ⇒ Certificates.
- Each system is configured with CA's public key.
- CA's don't have to be on-line.
- A compromised CA cannot decrypt conversations.

Certificate Revocations Lists (CRL)

- The lists are published regularly.
- Certificates are checked in a recent CRL.
- Certificate contains user's name, public key, expiration time, a serial number, and CA's signature on the content.

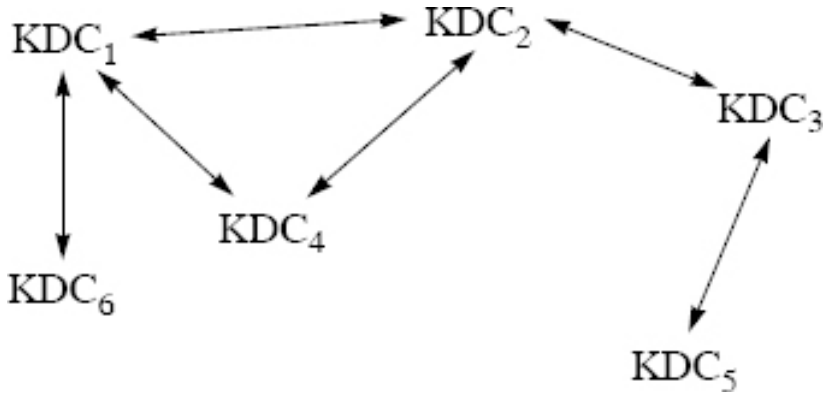
KDCs in Multiple Trust Domains



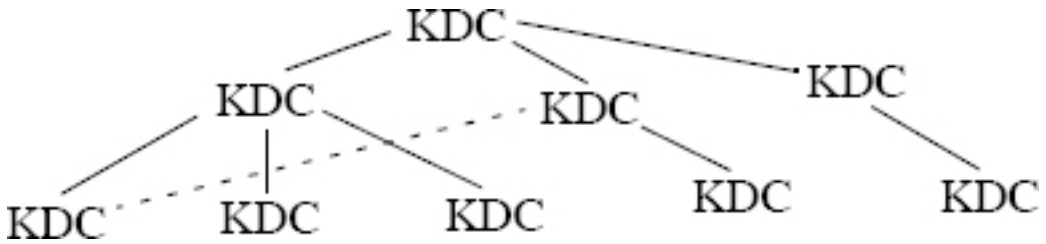


KDCs in Multiple Trust Domains (Cont)

- Some pairs of KDCs have a secret key



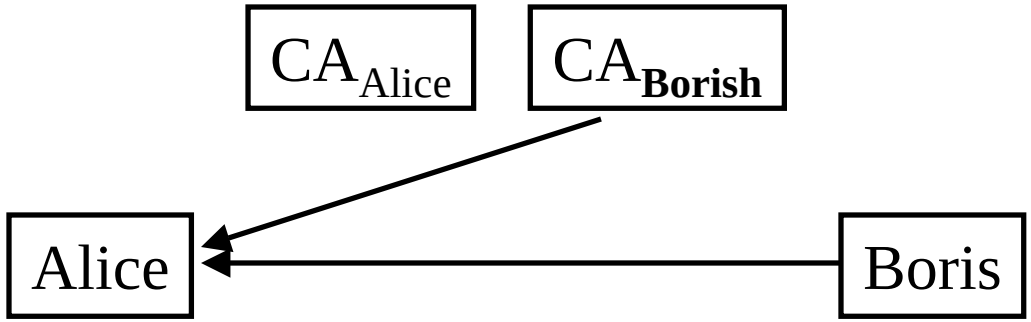
- Issue: Every pair of KDC needs a shared key
  ⇒ KDC hierarchy



- Issue: Every pair of KDC needs a shared key
  ⇒ KDC hierarchy

CA's in Multiple Domains

- Each CA has a certificate from the other.
- Alice with Boris's certificate and Boris's CA's certificate issued by Alice's CA can authenticate Boris



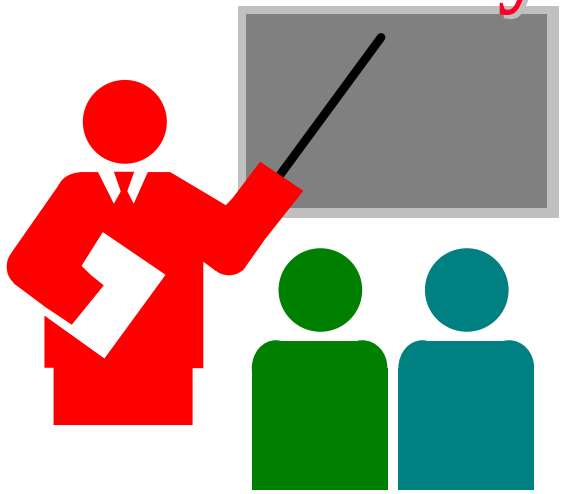
Session Keys

- Public key is used to exchange a secret key.
- Each session should start with a new secret key.

Delegation

- Authentication forwarding
- A signed message with time limit and details of privileges

Summary



- Passwords should not be stored or transmitted in clear
  $\Rightarrow$ Use to generate keys
- Address based authentication is not safe.
- Key Distribution Center (KDC): Single point of failure
- Certification Authorities (CAs) sign public keys.
- Multiple Trust Domains: Hierarchy of KDCs or CAs

Homework 9

- Read Chapter 9 of the textbook
- Submit answers to Exercise 9.3
- Extend the scenario in Section 9.7.4.1 Multiple KDC Domains to a chain of three KDCs. In other words assume that Alice wants to talk to Boris through a chain of three KDCs (Alice's KDC, A KDC that has shared keys with both Alice's KDC and Boris's KDC and finally, Boris's KDC). Give the sequence of events necessary to establish communication.