CSci530: Computer Security Systems
Authentication (continued)
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Public Key Cryptography (revisited)

- Key Distribution
  - – Confidentiality not needed for public key
  - – Solves n^2 problem
- Performance
  - – Slower than conventional cryptography
  - – Implementations use for key distribution, then use conventional crypto for data encryption
- Trusted third party still needed
  - – To certify public key
  - – To manage revocation
  - – In some cases, third party may be off-line

Certificate-Based Authentication

Certification authorities issue signed certificates

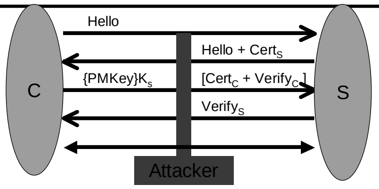
- – Banks, companies, & organizations like Verisign act as CA's
- – Certificates bind a public key to the name of a user
- – Public key of CA certified by higher-level CA's
- – Root CA public keys configured in browsers & other software
- – Certificates provide key distribution

Certificate-Based Authentication (2)

Authentication steps

- – Verifier provides nonce, or a timestamp is used instead.
- – Principal selects session key and sends it to verifier with nonce, encrypted with principal's private key and verifier's public key, and possibly with principal's certificate
- – Verifier checks signature on nonce, and validates certificate.

Secure Sockets Layer (and TLS)



Encryption support provided between
Browser and web server - below HTTP layer
Client checks server certificate
Works as long as client starts with the correct URL
Key distribution supported through cert steps
Authentication provided by verify steps

Trust models for certification

- X.509 Hierarchical
  - – Single root (original plan)
  - – Multi-root (better accepted)
  - – SET has banks as CA's and common SET root
- PGP Model
  - – "Friends and Family approach" - S. Kent
- Other representations for certifications
- No certificates at all
  - – Out of band key distribution
  - – SSH

Global Authentication Service

- Pair-wise trust in hierarchy
  - Name is derived from path followed
  - Shortcuts allowed, but changes name
  - Exposure of path is important for security
- Compared to Kerberos
  - Transited field in Kerberos - doesn’t change name
- Compared with X.509
  - X.509 has single path from root
  - X.509 is for public key systems
- Compared with PGP
  - PGP evaluates path at end, but may have name conflicts

Proxies

- A proxy allows a second principal to operate with the rights and privileges of the principal that issued the proxy
  - Existing authentication credentials
  - Too much privilege and too easily propagated
- Restricted Proxies
  - By placing conditions on the use of proxies, they form the basis of a flexible authorization mechanism

Restricted Proxies

PROXY CERTIFICATE
Proxy
Conditions:
Use between 9AM and 5PM
Grantee is user X, Netmask
is 128.9.x.x, must be able to
read this fine print, can you
Grantor
+
Proxy

- Two Kinds of proxies
  - Proxy key needed to exercise bearer proxy
  - Restrictions limit use of a delegate proxy
- Restrictions limit authorized operations
  - Individual objects
  - Additional conditions

Generic Security Services API

Standard interface for choosing among authentication methods

- Once an application uses GSS-API, it can be changed to use a different authentication method easily.
- Calls
  - Acquire and release cred
  - Manage security context
    - Init, accept, and process tokens
  - Wrap and unwrap

Authentication in Applications

Unix login
Telnet
RSH
SSH
HTTP (Web browsing)
FTP
Windows login
SMTP (Email)
NFS
Network Access

Unix Login (review)

One way encryption of password

- Salted as defense against pre-computed dictionary attacks
- To validate, encrypt and compare with stored encrypted password
- May use shadow password file

Telnet

- A remote login application
  - Normally just an unencrypted channel over which plaintext password is sent.
  - Supports encryption option and authentication options using protocols like Kerberos.

RSH (Remote Shell/Remote Login)

- Usually IP address and asserted account name.
  - Privileged port means accept asserted identity.
  - If not trusted, request unix password in clear.
- Kerberos based options available
  - Kerberos based authentication and optional encryption

Secure Shell (SSH)

- Encrypted channel with Unix login
  - Establish encrypted channel, using public key presented by server
  - Send password of user over channel
  - Unix login to validate password.
- Public key stored on target machine
  - User generate Public Private key pair, and uploads the public key to directory on target host.
  - Target host validates that corresponding private key is known.

Web Browsing (HTTP)

- Connect in the clear, Unix Password
- Connect through SSL, Unix password
- Digest authentication (RFC 2617)
  - Server sends nonce
  - Responds is MD5 checksum of
    - Username, password, nonce URI
- User certificate, strong authentication

File Transfer Protocol

- Password based authentication or
- GSS-API based authentication
  - Including use of Kerberos
  - Authentication occurs and then stream is encrypted

Windows Network Login

- In Win2K and later uses Kerberos
- In Win NT
  - Challenge response
  - Server generates 8 byte nonce
  - Prompts for password and hashes it
  - Uses hash to DES encrypt nonce 3 times

Email

- SMTP – To send mail
  - Usually network address based
  - Can use password
  - Can be SSL protected
  - SMTP after POP

Email

- Post Office Protocol
  - Plaintext Password
  - Can be SSL protected
  - Eudora supports Kerberos authent
- IMAP
  - Password authentication
  - Can also support Kerberos

File System Authentication

- Sun’s Network File System
  - Typically address based
  - Athena Kerberized version
    - Maps authenticated UID’s to addresses
  - NFS bult on ONC RPC
    - ONC RPC has stronger Kerberos/GSSAPI support

File System Authentication

- Andrew File System
  - Based on Andrew RPC
  - Uses Kerberos authentication
- OSF’s DCE File System (DFS)
  - Based on DCE RPC
  - Uses Kerberos authenciation

Network Access Servers

- Radius
  - Problem: Not connected to network until connection established
  - Need for indirect authentication
    - Network access server must validate login with radius server.
    - Password sent to radius server encrypted using key between agent and radius server

Delegated Authentication

- Usually an authorization problem
- How to allow an intermediary to perform operations on your behalf.
  - Pass credentials needed to authenticate yourself
  - Apply restrictions on what they may be used for.