CSci530: Computer Security Systems
Authentication

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Identification vs. Authentication

- Identification
  - Associating an identity with an individual, process, or request
- Authentication
  - – Verifying a claimed identity

Basis for Authentication

- Ideally
  - Who you are
- Practically
  - Something you know
  - Something you have
  - Something about you
    - (Sometimes mistakenly called things you are)

Something you know

- Password or
- Algorithm
  - e.g. encryption key derived from password
- Issues
  - Someone else may learn it
    - Find it, sniff it, trick you into providing it
  - Other party must know how to check
  - You must remember it
  - How stored and checked by verifier

Examples of Password Systems

- Verifier knows password
- Encrypted Password
  - One way encryption
- Third Party Validation

Attacks on Password

- Brute force
- Dictionary
- Pre-computed Dictionary
- Guessing
- Finding elsewhere

Something you Have

- Cards
  - Mag stripe (= password)
  - Smart card, USB key
  - Time varying password
- Issues
  - How to validate
  - How to read (i.e. infrastructure)

Something about you

- Biometrics
  - Measures some physical attribute
    - Iris scan
    - Fingerprint
    - Picture
    - Voice
- Issues
  - How to prevent spoofing
    - Suited when biometric device is trusted, not suited otherwise

Other forms of authentication

- IP Address
- Caller ID (or call back)
- Past transaction information
  - (second example of something you know)

“Enrollment”

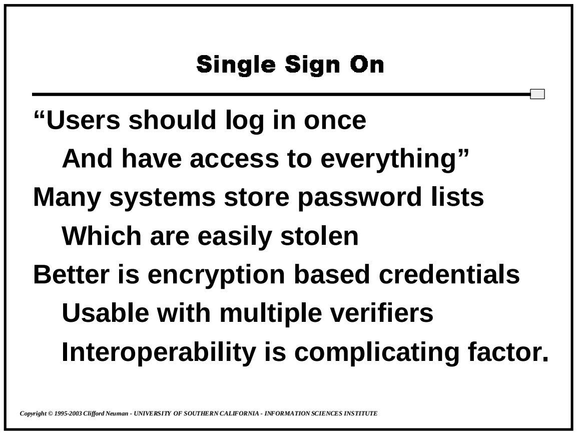
- How to initially exchange the secret.
  - In person enrollment
  - Information known in advance
  - Third party verification
  - Mail or email verification

Multi-factor authentication

- Require at least two of the classes above.
  - e.g. Smart card plus PIN
  - Biometric and password
- Issues
  - Better than one factor
  - Be careful about how the second factor is validated. E.g. on card, or on remote system.

General Problems with Password

- Space from which passwords Chosen
- Too many passwords
  - And what it leads to



Single Sign On

"Users should log in once

And have access to everything"

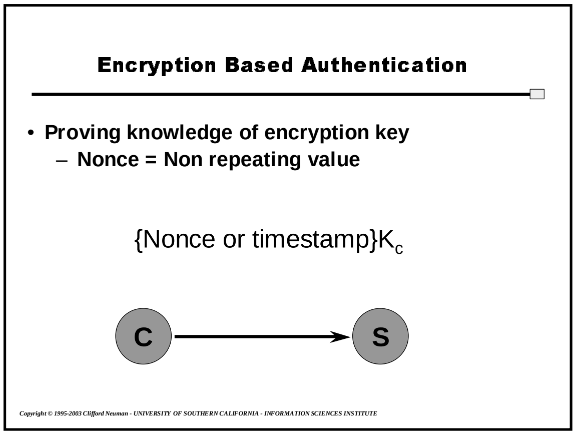
Many systems store password lists

Which are easily stolen

Better is encryption based credentials

Usable with multiple verifiers

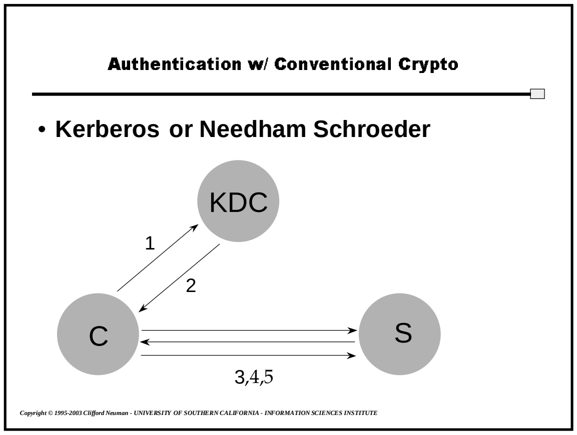
Interoperability is complicating factor.



Encryption Based Authentication

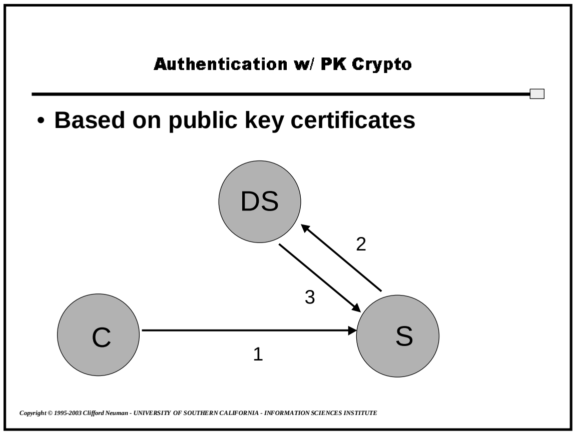
- Proving knowledge of encryption key
  - Nonce = Non repeating value

{Nonce or timestamp}K_c



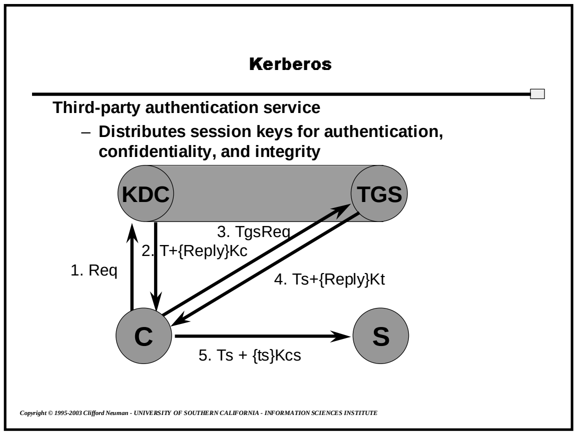
Authentication w/ Conventional Crypto

- Kerberos or Needham Schroeder



Authentication w/ PK Crypto

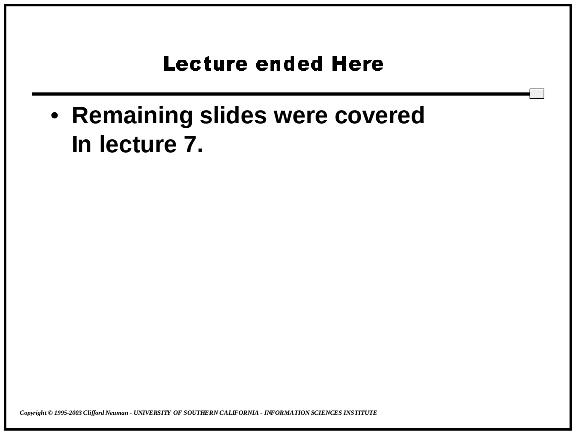
- Based on public key certificates



Kerberos

Third-party authentication service

- Distributes session keys for authentication, confidentiality, and integrity



Lecture ended Here

- Remaining slides were covered In lecture 7.

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

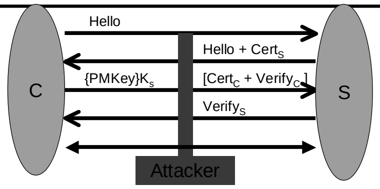
- Banks, companies, & organizations like Verisign act as CA’s
- Certificates bind a public key to the name of a user
- Public key of CA certified by higher-level CA’s
- Root CA public keys configured in browsers & other software
- Certificates provide key distribution

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