CS 5430: Notes on

Phishing-Resistant Authentication Tokens

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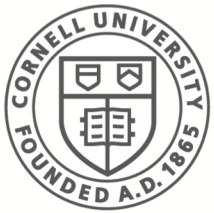

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Phishing Attacks

Phishing attack: User clicks link in email and visits attacker's web site, believing it is a legitimate web site.

Spear-phishing attack: User is misled because email contains PII or other information only known to a trusted individual.

Solution Idea: User U's authentication credentials include a secret known to U and the site name that is intended relying party.

MIM attack for Duo

A → Bad: login as A

Bad → Good: login as A

Good → A's duo: OK?

A's duo: Yes (thinking request is from Good)

… Good thinks Bad is user A.

… Bad can impersonate user A.

Notice: Login credentials do not include identity "Good".

A User's Authentication Token

Token:

- Can communicate with user's nearby laptop/desktop
- Has a button so user can confirm intent
- Has a small memory
  - Stores a token-unique secret sec
- Has crypto hardware:
  - Can generate fresh private/public key pair on demand
  - Can generate AES key for source from f(sec , source)
  - Can encrypt/decrypt AES
  - Can digitally sign with private key

Overall Architecture

- Uses a different public/private key pair for each site and each user.
- Token uses different AES key for each site (key is based on secret sec and site name S).
  - A user U's credentials for a site S is a pair:
    - K(U,S)-Enc(pub/priv key pair) , pub key
- Relying party sends to token a challenge requesting signature to "prove" token knows user's private key for site.
  - Site S sends challenge to U's browser:
    - S includes with challenge U's credentials for site S
  - U's browser forwards: name S and U's credentials for site S.
  - U's token derives AES key to extract private key for site S

User Enrollment for Site S

Site S requests *authenticator* from browser.

U's browser requests authenticator from token.

Token does:

- Generate fresh pub/priv key PK_S / pk_S for site S
- Generate AES key K_S from token's secret and name S
- Generate authenticator for U at S. It includes:
  - K_S-Enc(PK_S / pk_S)
  - PK_S
- Send authenticator to browser and forget K_S , PK_S , pk_S

Browser sends authenticator to site S

Site S stores authenticator with info for user U

Note: Authenitcator might be stored as a cookie at browser. Cookie would be encrypted using site S local key. Cookie would be sent to S whenever U visits S.

User Authentication at S

Site S sends to browser:

- authenticator for U
- fresh challenge r

Browser forwards to token

Token reconstructs AES key K_S from token's secret and name S

- Only name of actual site S will work --- phishing site will have a different name.

Token extracts private key pk_S from authenticator

Token asks user's consent to proceed

Token signs challenge r using pk_S

Token sends signed challenge to browser

Browser forwards signed challenge to site S

Site S checks signature using PK_S from authenticator.