Identification and authentication

WSPC, Chapter 6

Identification, authentication, authorisation

Three closely related concepts:

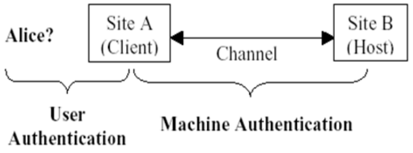
- **Identification:** associating an identity with a subject (“Who are you?”)
- **Authentication:** establishing the validity of something, such as an identity (“Are you indeed the entity you claim you are?”)
- **Authorisation:** associating rights or capabilities with a subject (“What rights (authority) do you have?”)

Authentication

- **Authentication** is the process of verifying the identity of a user, device, or other entity in a computer system, often as a prerequisite to allowing access to resources in the system
- Authentication is used for the purpose of performing **trusted communications** between parties for computing and telecommunications applications.

Authentication

- **Machine-by-machine** authentication
- **Human-by-machine** authentication (user authentication)



(Picture by Lawrence O’Gorman, Proc. of IEEE , Dec 2003)

User vs Machine authentication

- User authentication is much less secure than machine authentication
- Example:
  - encryption algorithm in AES standard uses the keys up to 256 bits long;
  - a 256-bit key is too long for most humans to remember, so in practice this key is stored in a computer file protected by a more memorable password;
  - Here is the problem: human tend to choose an easily guessable password
- In many cases humans are “weakest links” of otherwise secure systems

Authentication techniques

Authentication techniques can be based on

- Passwords (knowledge-based, “what you know”)
- Tokens (object-based, “what you have”)
- Biometrics (ID-based, “who you are”)

Password-based techniques

- **Password:** a word,a phrase, or personal identification number that is kept as a secret and is used for authentication;
- Very popular and for many purposes adequate techniques, which don’t need a special hardware;
- The main problem:
  - short memorable password can be guessed or searched by by attacker;
  - Long and random password is difficult to remember

Other problems with passwords

- Before one can use a computer system, or a service, one needs a password
- Password may be intercepted on its way to the system
- Password may be forgotten
- Password may be passed to other people

Although these problems can be dealt with, there is no absolute solution

New type of attack – acoustical spying

- Researches at UC Berkley have demonstrated how one can recover up 96 percent of text using using an audio recording of the sounds generated by typing on a computer keyboard (September, 2005)
- Each keystroke makes a relatively distinct when hit. Using statistical learning theory, the program can categorize the sounds of each key and produce a good first guess, which then improved by using spelling and grammar checks
- Having a small microphone nearby a computer allows one to find out what password (for example) has been used.

Token-based authentication

Physical token (identity token, security token) is physical device which perform or help authentication, such as:

- Door key
- Magnetic, or radio-frequency based access cards
- Bankcard
- Smartcard
- Etc

Authentication is based on what you have

Types of tokens

- This can be a secure storage device containing

passwords, such as a bankcard, remote garage door opener, or smart card.

- This can also be an active device that yields *one-time passcodes (machine generated passwords)*, either
  - *time-synchronous*
  - or *challenge-response*

Problems with tokens

- The token doesn't really "prove" who an owner of the token is – anybody who has possession of the token can gain access
- If the token is lost, the owner can not have an access, despite his/her identity has not changed
- Some tokens may be easily copied or forged

To increase security In some applications tokens are combined with other means of identification, such a passwords (PINs).

Example: banking cards as tokens, and PINs as passwords

Biometrics-based techniques

A ***biometric*** is a feature measured from the human body that is distinguishing enough to be used for user authentication. (L.O'Gorman)

- Images of a person face, retina, or iris
- Fingerprints
- Footprints and gait (walking style)
- Voice patterns
- Handwriting characteristics
- Smell
- Hand geometry

Biometrics

Advantages

- Biometrics can't readily be shared, copied, or stolen
- Biometrics (in normal circumstances) can 't be lost

Disadvantages

- Complicated technology
- Specialized hardware
- High-cost (yet, it has been going down)

Problems with biometrics

- Certain level of
  - False positives, and
  - False negatives

  To deal with this problem one may combine biometric technique with password- or token-based techniques
- If measuring equipment is not specially protected, the equipment is vulnerable to sabotage and fraud.

Recent advances: authentication by brainwaves

John Chuang et al.

"I think, therefore I am: Usability and Security of Authentication Using Brainwaves", a 2013 paper available at

people.ischool.berkeley.edu/~chuang/pubs/usec13.pdf

Authentication using Brainwaves

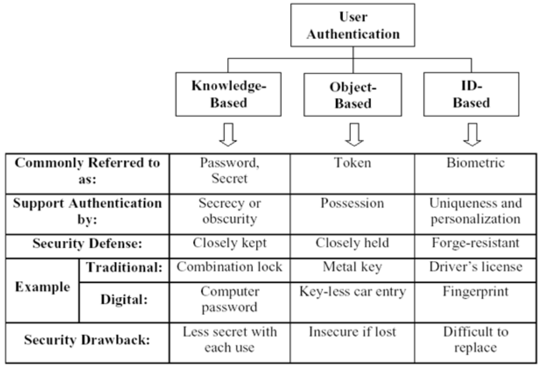
Experimental study:

- using single channel EEG sensors embedded in wireless headsets (Neurosky MindSet ~100 USD) fro authentication
- 99% accuracy is achieved

Authentication using Brainwaives (cont.)

- Seven different (mental) tasks are used in the experiments:
  - Breathing, simulated finger movement, sport tasks, etc each taking 10 seconds
  - Brainwaives were measured and processed to distinguish the participants
  - Self-similarity and cross-similarity measures are used
- Possible MSc project:
  - re-implement and to develop further EEG based authentication

User authentication


User Authentication
Knowledge-Based
Object-Based
ID-Based

		Knowledge-Based	Object-Based	ID-Based
Commonly Referred to as:		Password, Secret	Token	Biometric
Support Authentication by:		Secrecy or obscurity	Possession	Uniqueness and personalization
Security Defense:		Closely kept	Closely held	Forge-resistant
Example	Traditional:	Combination lock	Metal key	Driver's license
	Digital:	Computer password	Key-less car entry	Fingerprint
Security Drawback:		Less secret with each use	Insecure if lost	Difficult to replace