Daffodil International University

Topic 7:
Authentication

Topic 7 – Lecture 1:

An Overview of Authentication and Passwords

Network Security and Cryptography

Authentication Topic 7- 7.2

Scope and Coverage

This topic will cover:

01 Overview of Authentication

02 Passwords

03 Multi-factor Authentication

04 Biometrics

Authentication Topic 7- 7.3

Learning Outcomes

By the end of this topic students will be able to:

- Explain the different authentication mechanisms;
- Describe multifactor authentication;
- Describe biometrics and their issues.

Authentication Overview

- We are taking a network-based view of user authentication
- User authentication is the first line of defence of a network
- It aims to prevent unauthorised access to a network
- It is the basis of setting access controls
- It is used to provide user accountability

Verifying User Identity

- User authentication has two steps:
  - ***Identification*** – presenting the user to the security system
  - ***Verification*** – providing information that binds the entity to the identity

- Identification is the means by which a user claims to be a specific identity

- Verification is the method used to prove that claim

Means of Authentications

- Something the individual knows
  - E.g. password, PIN
- Something the individual possesses (tokens)
  - E.g. cryptographic key, smartcard
- Something the individual is
  - E.g. fingerprint, retina
- Something the individual does
  - E.g. handwriting pattern, speech pattern

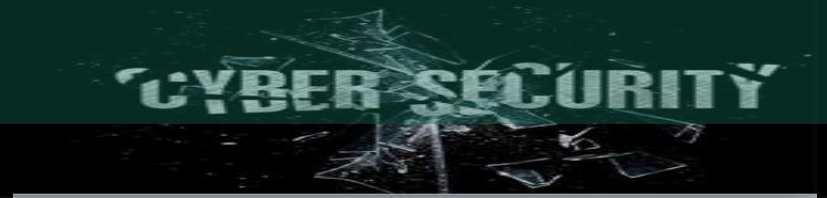
Authentication Problems

- Guess or steal passwords, PIN, etc
- Forget passwords, PIN
- Steal or forge smartcards
- Lose smartcard
- False positives in biometrics
- False negatives in biometrics
- The most common method of network authentication uses passwords and cryptographic keys

Smartcards

- Tamper-resistant devices
- Have a small amount of memory
- Have a small processor
  - Simple computations, e.g. encryption/decryption, digital signatures

- Difficult to duplicate
- Easily transferable
- Can be used with PIN/password



Smartcard Examples

- Bank/ATM cards
- Credit cards
- Travel cards
- Pass cards for a workplace

Password

- Most common means of authentication
- Require no special hardware
- Typical authentication by password

1. User supplies a username and password
2. System looks up the username in the relevant database table
3. Checks that username, password pair exists
4. Provides system access to the user

Password Strength

- Users tend to pick weak passwords if allowed
- Easy to crack via dictionary attack
- Users can be forced to create more complex passwords
- System can supply users with a strong password
- Many users will write down a stronger password and this can be a greater security risk than a weak password

Attacks on Password Security

- Eavesdropping may allow an attacker to “listen” in and gain password information
  - Encrypting messages will prevent this
- A direct attack on the database storing passwords can be used to discover or change passwords
- Sessions can be hijacked the attacker disconnects the user but remains connected themselves
- ***Never use the same password for different applications***

Losing Passwords

- Not uncommon for a user to lose or forget a password
- Can be dealt with by regularly changing passwords
- Password generators can be used to change passwords
  - Automatically generate new passwords based upon a master secret

Challenge - Response

- Systems are used that request specific characters in a password rather than the whole password.
- Commonly used in online banking
- Example
  - The password is “MyPassword”
  - The system asks for the 2nd, 3rd and 8th characters
  - The user enters “y”, “P” and “o”
- The idea is that it would take an eavesdropper many sessions to determine the whole password

Hash Functions

- A database of plaintext passwords makes stealing all passwords more likely
  - Sony!!
- A level of protection is supplied by using a one-way hashing function on the passwords
  - Public function
  - Easy to compute
  - Hard to invert
- All passwords stored in the database are encrypted

Hashing Passwords

- MD5 and SHA-1 are commonly used hashing algorithms
- User sends a username, password pair to the system
- The system hashes the password
- The database stores a username, h(password) pair
  - h(password) is the result of applying the hashing function to the password

Cracking Hashed Passwords

- Hashing works on the principal that it would take a very long time to crack the hashed password via trial and error
- If users use short and simple passwords this is not the case
- Strong passwords are still required for the hashing function to provide a good level of security

Break

Daffodil International University

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Topic 7 – Lecture 2:

Multifactor Authentication and Biometrics

Network Security and Cryptography

Multi-Factor Authentication

- An identity is verified and authenticated using more than one verification method
- User/password authentication is single factor authentication
  - Only one verification method, the password
- A stronger form of identity verification
- Used for applications where security is more important
  - E.g. bank ATM – card and PIN

Multi-Factor Systems

- This does not mean using two or three different passwords but two or three different methods
- ATM – Two-factor authentication
  - Something you possess – bank card
  - Something you know – PIN
- Three-factor systems exist for financial transactions via mobile phone
  - Something you possess – mobile phone
  - Something you know – PIN
  - Something you do – voice recognition

Disadvantages

- Cost
  - Cost of supplying smartcards, USB tokens, etc.
  - Cost of hardware/software to read the tokens
- Inconvenience
  - Users may not like the inconvenience of having to carry around a token
- A balance has to be made between the cost and inconvenience of security and the sensitivity of the data and transactions being protected

Increased Security - Probability

- Combining two or more verification methods greatly decreases the probability of randomly producing the correct verification information
- Voiceprint
  - There is around a 1 in 10000 chance of matching
- PIN
  - There is a 1 in 10000 chance of guessing a PIN
- Combined
  - There is a 1 in 100,000,000 chance of matching both

Biometrics

- Automated methods used to recognise the unique characteristics of humans

- Uses one or more traits:
  - Physical traits (static biometrics)
  - Behavioural traits (dynamic biometrics)

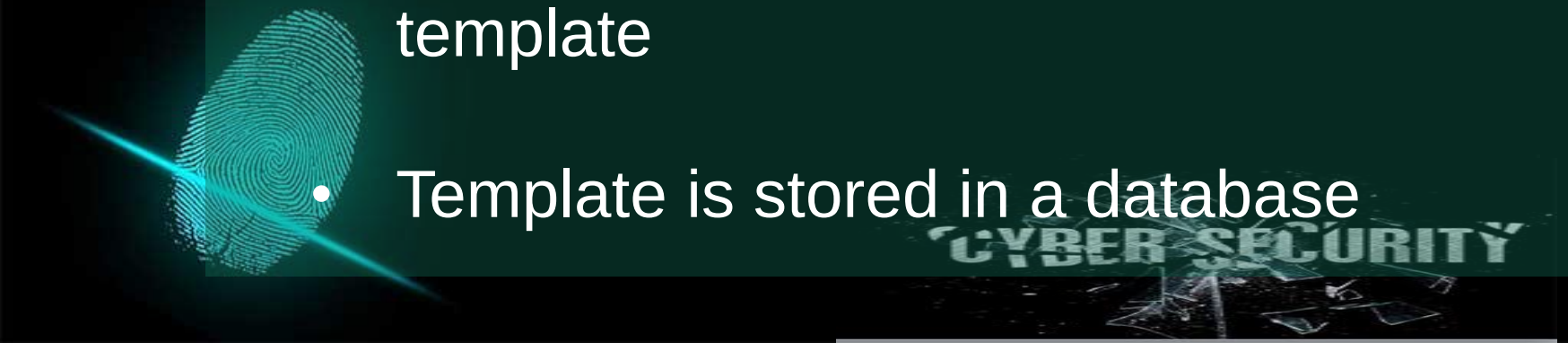
- Biometric authentication aims to provide a non-transferable authentication method
  - Someone else could use your ATM card
  - Can someone else use your finger?

Biometric Types

- Physical characteristics:
  - Fingerprints
  - Retinas
  - Irises
  - Facial patterns
  - Hand measurements
- Behavioural characteristics
  - Signature
  - Typing patterns
  - Voice recognition

Registering Biometric Data

- User registers with the biometric system
- Measurements of biometric data are taken
- Can take several measurements of biometric data if required
- Algorithm is applied to the measurement to obtain a template
- Template is stored in a database



Authenticating Biometric Data

- User identifies themself to the system (e.g. username)
- Biometric data measurement of the user is taken
- Again processed into a digital template
- This template is compared to template in database
- See if there is a match
- Matching process is approximate
- If biometric data matches the stored template the user is authenticated

Matching Biometric Data

- Not an exact science
  - No two measurements of biometric data will match exactly
- Multiple measurements are taken when a user first enrols in the system
- Matching with template is a success
- Tolerances are built into the algorithm that matches the templates

Fingerprints

- Fingertips have ridges and valleys that are unique to that fingertip
  - Used by police for a long time
- Most common biometric method
- Available for laptops and PCs
- Access to systems provided via touch technology

Face Recognition

- Capture facial image in the visible spectrum
  - **Use a standard camera**
  - **Use central portion of face**
  - **Extract features that remain constant over time**
  - **Avoid changing features, e.g. hair**
- An alternative version captures an infra-red image of the heat emitted by a face
- Most users accept use of such systems
- Problems caused by lighting, masks, etc.

Speech Recognition

- Some features of speech differ between individuals
- These patterns produced reflect the anatomy of the speaker
- These patterns reflect the patterns of speech learned as a result of:
  - Location
  - Peers
  - Language

Iris Recognition

- Iris is the coloured area around the pupil
- Iris patterns are thought to be unique
- Video systems are used to capture an image of the iris
- Becoming economically viable as equipment prices have lowered
- Works with glasses and contact lenses

Hand Geometry

- Can utilise measures of fingers or whole hands
  - Length
  - Width
  - Thickness
  - Surface area
- Used for access control in commercial and residential premises

Written Signatures

- Uses measurement of the way the signature is written not just the final signature

- Can measure a range of parameters:
  - Speed
  - Pressure
  - Angle of writing

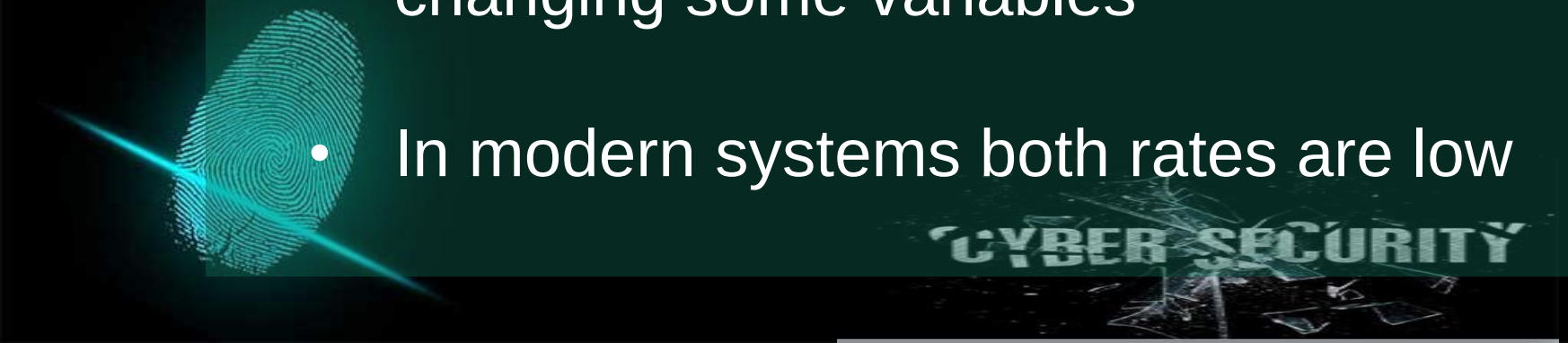
- Used in business applications where a signature is commonly used to identify a user

Typing Patterns

- Similar to the recognition of written signatures
- Uses a standard keyboard
- Recognises the password that is typed
- Recognises the way the password is typed:
  - Intervals between characters
  - Speed of typing

Errors in Biometric Systems

- Has a ***false accept rate*** (FAR): measures the rate at which an invalid user is accepted by the system
- Has a ***false rejection rate*** (FRR): measures the rate at which a valid user is rejected by the system
- In many systems it is possible to adjust both rates by changing some variables
- In modern systems both rates are low

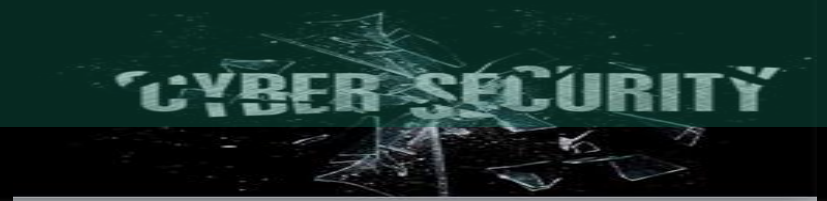


Concerns with Biometric Systems

- ***Privacy***
  - All transactions in different systems are linked to a real identity
  - For passwords etc. different identities can be presented to different systems
- ***Injury***
  - Hygiene concerns about equipment
  - Criminals chopping off fingers to use!!
- ***Exclusion***
  - An amputee may have no fingers

The Market Leader

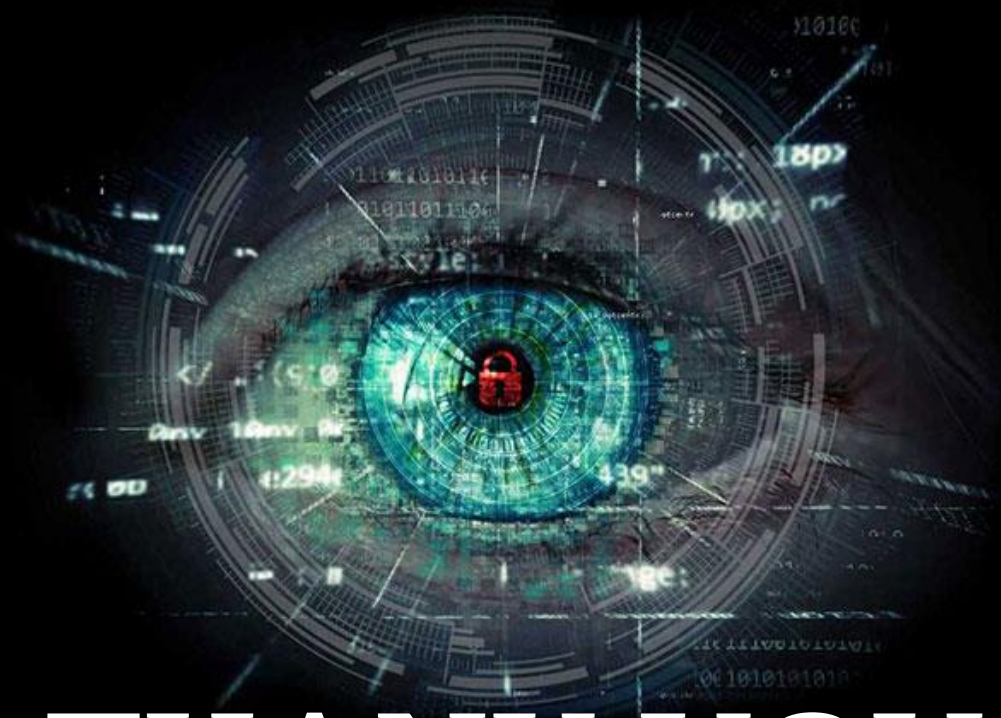
- Fingerprint authentication is widely used
- Laptops and computer peripherals come with built-in fingerprint readers
- They are relatively inexpensive
- Allow user to authenticate by putting finger on the reader
- May be used with a password or PIN for two-factor authentication.



References

Stallings, W. (2010). *Cryptography and Network Security: Principles and Practice*. Pearson Education.

Scambrey, J., McClure, S. and Kurtz, J. (2001). *Hacking Exposed: Network Security Secrets & Solutions, 2nd Edition*. McGraw Hill.



THANK YOU
Any Question?

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