TECHNOLOGY CAMP

DAY 1 : CYBER SECURITY

Authentication & Encryption

Session 3

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Teacher Lesson Plan

Authentication & Encryption

Session Name:

Authentication & Encryption

Summary:

Authentication is the way a computer understands who it is interacting with. There are three common factors used for authentication: Something you know (such as a password), something you have (such as a smart card or secret token), something you are (such as a fingerprint or other biometric method). Similar to buying a lock to protect your things in your locker at school, you need a lock to protect your Cyber Identity with Authentication.

Encryption is widely used on the internet to protect user information being sent between a browser and a server, including passwords, payment information and other personal information that should be considered private. Organizations and individuals also commonly use encryption to protect sensitive data stored on computers, servers and mobile devices like phones or tablets.

Time Allotment:

65 minutes

Learning Objectives:

- *What is authentication, and process involved*
- *Multi-factor authentication*
- *Importance of strong passwords*
- *New generation of authentication methods (biometrics)*
- *History of Encryption*
- *Introduce students to simple codes*
- *Symmetric encryption and decryption workings*
- *The relationship between encryption and decryption*

- *Types of Encryption*

Supplies:

- *Scrap paper / notepad to take notes*
- *Top worst passwords worksheet (print)*
- *Public Key/Private Key box*
- *Binary cipher activity worksheet (print)*
- *Cipher strips (print)*
- *Laptop / computer with Internet access for research activities*

Learning Activities:

- **(3 minutes) - Session overview**

  Authentication is the way a computer understands who it is interacting with. There are three common factors used for authentication: Something you know (such as a password), something you have (such as a smart card or secret token), something you are (such as a fingerprint or other biometric method). Similar to buying a lock to protect your things in your locker at school, you need a lock to protect your Cyber Identity with Authentication.

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- **(5 minutes) - What is authentication?**

  Authentication is the process of determining whether someone or something is, in fact, who or what it is declared to be. It is a process in which the credentials provided are compared to those on file in a database of authorized users' information on a local operating system or within an authentication server. If the

credentials match, the process is completed and the user is granted authorization for access.

Discuss with students: things that make strong authentication:

- *Something You Know (Shared Secrets-something known only to you and the "gatekeeper") - Password, PIN number*
- *Something You Are - Biometrics-pictures, voice, fingerprints, retina scan*
- *Something You Have: Tokens-Phone App, Chip Card, Yubikey*

- **(5 minutes) - Video: What is Two-Factor Authentication? (2FA)**

  https://www.youtube.com/watch?v=0mvCeNsTa1g

- **(5 minutes) - Video Discussions**
  - *How does two-factor authentication make you safer online?*
  - *What are potential problems with two-factor passwords?*
  - *What would I tell my friends or family to do to make their passwords more secure?*

- **(3 minutes) – What is Encryption?**

  In computing, encryption is the method by which plaintext or any other type of data is converted from a readable form to an encoded version that can only be decoded by another entity if they have access to a decryption key. Encryption is one of the most important methods for providing data security, especially for end-to-end protection of data transmitted across networks.

  Encryption is widely used on the internet to protect user information being sent between a browser and a server, including passwords, payment information and other personal information that should be considered private. Organizations and

individuals also commonly use encryption to protect sensitive data stored on computers, servers and mobile devices like phones or tablets.

- **(7 minutes) - Student Activity: Simple encoding with binary & review**
    - *Pass binary encoding worksheets to students*
    - *Instruct students to use the table to come up with their own encrypted word*
    - *After 5 minutes, have the students pass the worksheet to different student*
    - *Now it is time to decrypt the word*
    - *Have students use the table to figure out encrypted word*
    - *Take a few minutes to review how binary code replaced the original word and how number, letters, and/or symbols can be used to encrypt messages*
- **(5 minutes) - Video : Nova Lab / Cyber Codes**

  Codes (ciphers) are used to keep messages secret

  https://www.youtube.com/watch?v=q6FanLhvsEs
- **(3 minutes) - Types of Encryption discussion**

  Unencrypted data, often referred to as plaintext, is encrypted using an encryption algorithm and an encryption key. This process generates ciphertext that can only be viewed in its original form if decrypted with the correct key. Decryption is simply the inverse of encryption, following the same steps but reversing the order in which the keys are applied. Today's most widely used encryption algorithms fall into two categories: symmetric and asymmetric.
- **(7 minutes) - Video: Symmetric Key and Public Key Encryption**

  https://www.youtube.com/watch?v=AQDCe585Lnc
- **(5 minutes) - Student Activity: Symmetric Key Cipher**

  Pass out Create your own cipher worksheet

- *Provide instructions to students on how to use top row by substituting letters or symbols for each of the letters*
- *Have students work in pairs (or groups) to complete the first row by assigning a number, letter or symbol to each on the first strip (row)*
- *Have each student write and encode a message using their common symmetric cipher*
- *Have students trade their encoded messages and decode the message using the common symmetric cipher*

- **(10 minutes) - Public Key / Private Key Demo & Discussion**

  Give a brief overview of PKI to students, and show how Public Key/Private Key Works

  Display the Public Key/Private Key box.

  Explain that the top lock uses the public key to encrypt messages.

  Explain that once message is encrypted (in the box), it cannot be decrypted with the public key.

  Explain that the only way that the message can be decrypted is by decrypting the message (opening the box) using the private key (the lock on the front).

  1. *Have 2 students write their favorite color, team, or other neutral message on a small piece of paper*
  2. *Give the 2 students each a public key (key to top lock)*
  3. *Have students unlock the public key lock, roll up the message, place the message in the slot, and lock the lock.*
  4. *Demonstrate that once the message is encrypted (in the box) the public key can't decrypt the message.*

5. *Use the public key to unlock the Public Key lock and turn the box over and show the message won't shake out*
6. *Allow students to try an unlock the Private Key lock with their keys*
7. *Demonstrate the use of the Private Key for decryption by opening the box and reading the messages.*

Explain that PKI can be complex to implement, but it still relies on keys and encryption to secure messages

- **(3 minutes) - Video: What is your password?**

  https://www.youtube.com/watch?v=opRMrEfAIiI

  Stop video at 2:40 to avoid show advertisement

- **(5 minutes) - Student Activity: How secure is my password?**

  Have volunteers pass top worst passwords sheet

  In groups or as individuals, students can practice password selection.

  - *https://howsecureismypassword.net/*

  Discuss activity with students

  - *What makes password more secure?*

- **(2 minutes) - Wrap Up**

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entity if they have access to a decryption key. Encryption is one of the most important methods for providing data security, especially for end-to-end protection of data transmitted across networks.

- **(1 minutes) - What's next?**

  Inform students to head back to the cafeteria for snacks / break, and remind them to use the restroom before next session starts.