BILL, RECORD LECTURE!!!!

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When Hackers Attack!

September 28, 2020
Ciphertext and Plaintext

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**Ciphertext** What Alice sends Bob. The hope is that if Eve sees it she will **not** learn the plaintext. E.g.

PHHWP HDIWH UFODV V
Types of Attacks

We will describe several different types of attacks Eve can use. They depend on:

1. What information Eve has access to.
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Eve’s goal is to find out something about the plaintext she did not already know.
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4. More WWII History Turing and his gang cracked the German Enigma Code, guessing that ein (German for one) would be in messages.
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Dictionary Attack

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1. Have database of X decodes to Y and pattern match.
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qazwsz: Similar keyboard shenanigans.
trusno1: I like that one, I think I’ll use it :-)

**Note:**
- **X** and **Y** are placeholders for actual values.
- **123456** and **12345678** are examples of passwords.
- **qwerty** is a common password.
- **trusno1** is a creative choice.
Brute Force Attacks (BFA)

Guess all possible keys.

Only effective if either:
1. The key space is small enough for Eve's computing power.
2. Some cleverness can cut down the key space before you do BFA.

Easy to thwart
Use a bigger key space!
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Timing and Power Attacks

Use how much time or power a cryptosystem is using to figure out information about the key and narrow down the keyspace.

1. Scary!

   Alice and Bob are using cryptosystem $C$ such that Eve can crack $C$ with a CPA attack iff Eve can solve the ERIC problem. The mathematical proof of this does not take timing attacks into account.

   Alice and Bob can easily thwart timing/power attacks by padding. But there was a time before this attack was known when it may have been effective.

2. There may be other attacks that we do not know about like Timing/Power was. It may be hard (impossible?) to prove that there is no such attack that works. This involves issues outside of the Mathematical realm.

3. Look up the Maginot Line.
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Examples of Timing Attacks

1. Spectre
   A vulnerability that affects modern microprocessors that perform branch prediction (guessing which branch of a future IF statement will be executed, and executing it ahead of time to save time).
   [https://en.wikipedia.org/wiki/Spectre_(security_vulnerability)]

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1. Make the point that Security (CMSC 414) is an important partner to Crypto.
2. My own fascination with the concept. I normally teach and work in:
   2.1 Discrete Math
      No claim to real world applications.
   2.2 Elementary Theory of Comp
      Mostly theoretical.
   2.3 Ramsey Theory and its "Applications"
      Need I say more?
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