SIGPwny

FA2023 Week 07 • 2023-10-12

Crypto I

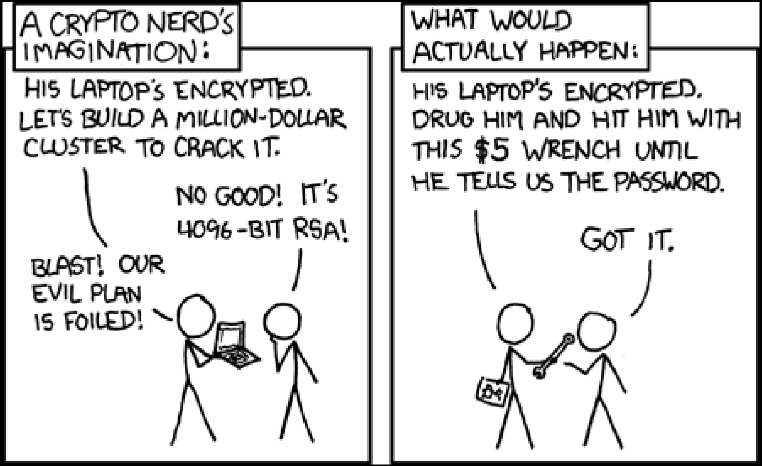
Anakin and Sagnik

Announcements

- Lockpicking Support Group!
  - Come practice lockpicking
  - Mondays 8-9 PM

ctf.sigpwny.com

sigpwny{n0t_that_crypt0_but_th3_0th3r_0n3}



Outline

Basics

XOR

Diffie-Hellman

Scoreboard

Place	User	Score
1	ronanboyarski **+1.5k points**	28035
2	NullPoExc	24515
3	caasher **+4k points**	21290
4	CBCicada **+9k points (up 1 place)**	18015
5	mgcsstywth **+.1k points**	17125
6	EhWhoAmI	8645
7	aaronthewinner **+.4k points**	7655
8	ilegosmaster	6660
9	drizzle **+.1k points**	6225
10	SHAD0WV1RUS	5970

Get Involved Callout

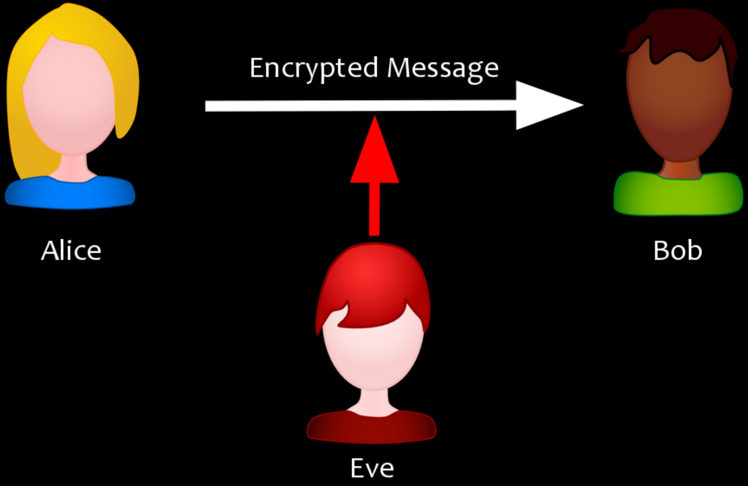
Looking for people to:

- run meetings
- plan events
- create challenges
- get more involved in the club :0
- Let us know if interested!

Section 1

Basics

What is Crypto Anyways?



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  - Many More
    - **All insecure!!**

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- Tip: In Python, always work with bytes / bytestrings, never with normal strings (Python 3.8+)

Conversion Cheatsheet

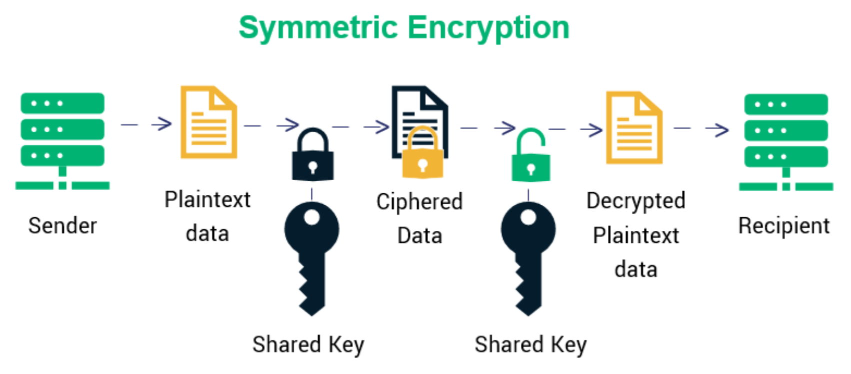
This is hard to read, download the slides!!

Format	Description	From Bytes	To Bytes
base64	uses printable letters to encode more complex binary	base64.b64encode	base64.b64decode
hex	uses symbols 0-9, A-F	bytearray.hex(), binascii.hexlify()	bytes.fromhex(), binascii.unhexlify()
integer	normal integers	Crypto.Util.number.bytes_to_long (PyCryptoDome), int.from_bytes	Crypto.Util.number.long_to_bytes (PyCryptoDome), int.to_bytes

Section 2

XOR

Symmetric Encryption



XOR

A	B	$A \oplus B$
0	0	0
0	1	1
1	0	1
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- All of this means $C \oplus K = M \oplus K \oplus K = M \oplus 0 = M$

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  - Flag Formats: sigpwny{

Section 3

Diffie-Hellman

Modular Arithmetic

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- If we do computation **mod** n that means we will take remainders after division by n

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- Given some random X and a, finding b is really hard to compute for large primes p
- This **Discrete Log Problem (DLP)** is the basis for many modern cryptography standards

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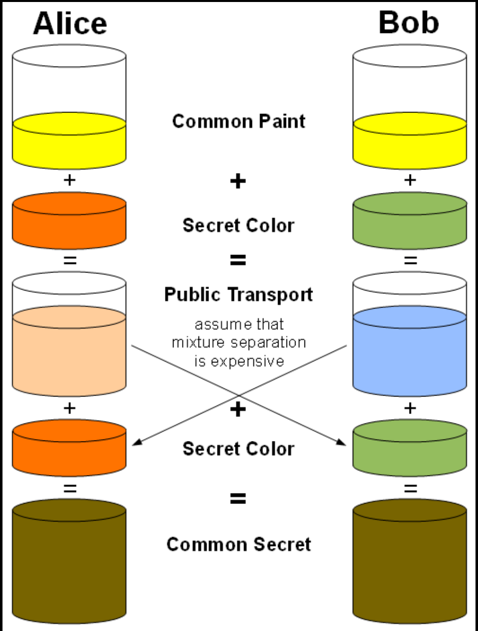
Diffie-Hellman takes advantage of this!


Alice
Bob
Common Paint
+
Secret Color
=
Public Transport
assume that
mixture separation
is expensive
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Common Secret

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Alice and Bob now have the same key!

$$A^b \equiv (g^a)^b \equiv g^{ab} \equiv (g^b)^a \equiv B^a \pmod{p}$$

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  - Write out what do and don't know as equations
  - Do not be afraid of pen and paper

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  - Write out what do and don't know as equations
  - Do not be afraid of pen and paper
- Primes are generated in specific ways
  - "Smooth Primes" p where $p - 1$ has many factors
  - Pohlig-Hellman, Pollard's Rho
  - More on this next week with advanced factoring!

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    - Solve some polynomial equations
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- Strategy: Just try things, look for patterns, more like math-y reverse engineering. Don't be afraid to just start.

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- Installation is annoying, use the CryptoHack Docker

Practice @ CryptoHack

Next Meetings

2023-10-15 – **This Sunday**

- Crypto II
- More Diffie-Hellman + RSA

2023-10-19 – **Next Thursday**

- PWN I with Sam

2022-10-22 – **Next Sunday**

- Pwn II with Kevin

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Thanks for listening!

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