Introductory notes

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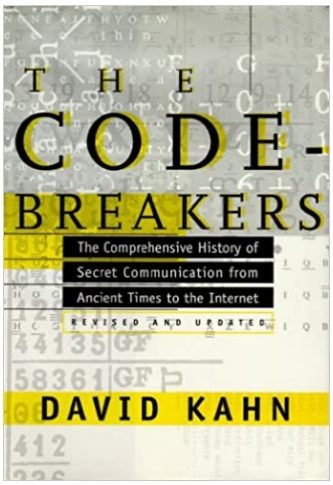
Historical perspective



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Don't invent your own crypto, but use well-established ones

Applied Cryptography

secret writing

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Why are secrets so important?

- Because they are everywhere
  - Secure communication
    - Web traffic: HTTPS
    - Wireless traffic: 802.11i WPA2, GSM, Bluetooth
  - Encrypting files on disks
    - EFS, TrueCrypt
  - Content protection
    - DVD (CSS); Blu-ray (AACS)
  - User authentication
    - Pwd, 2FA,…
  - …and much more

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Why “applied” cryptography?

- Don’t invent your own crypto-but use well-established ones
- *“Anyone who tries to create his or her own cryptographic primitive is either a genius or a fool. Given the genius/fool ratio of our species, the odds aren't very good.”* — Bruce Schneier, Secrets and Lies: Digital Security in a Networked World

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Why “applied” cryptography?

- Use cryptography as a building block
- We will learn to
  - Understand and use crypto-primitives
    - Ciphers, hash functions, digital signatures, key exchange
  - Reason about security
    - Whether and why primitives and protocols are secure
  - Analyze, design and implement protocols
    - Authentication protocols
    - Key management protocols
    - Crypto-protocols in general

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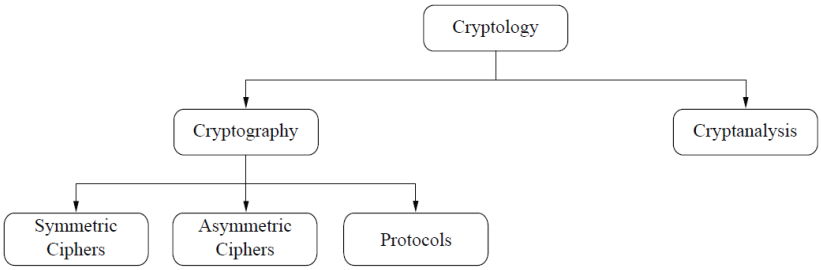
Cryptology



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The adversary

- There is an *intelligent* adversary, with an *objective, resources* and *abilities*

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A security engineer thinks differently

- Unfair competition against the adversary
- Security vs. performance and usability
- What's the ROI?
- Devil hides in details

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What does "security" mean?

- Many very smart, highly motivated people tried to break it but couldn't **3**
- There are 834 quadrillions possible keys so it must be secure **4**
- Here is a mathematical proof, accepted by experts, that shows it is secure **1**
- Here is a strong argument why breaking it is as hard as solving a problem we believe is hard **2**

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Things to remember

- Cryptography is
  - a very useful tool
  - the basis for many mechanisms
- Cryptography is not
  - "the silver bullet" for all security problems
    - Software bugs, social engineering
  - reliable if not designed, implemented and used properly
    - WEP, Heartbleed,…
  - Something you should try to invent yourself

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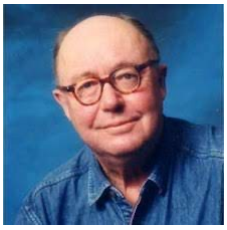
Cryptography isn't the silver bullet

- "*Whoever thinks his problem can be solved using cryptography, doesn't understand his problem and doesn't understand cryptography*." – Attributed by Roger Needham and Butler Lampson to each other



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The Clusit Report

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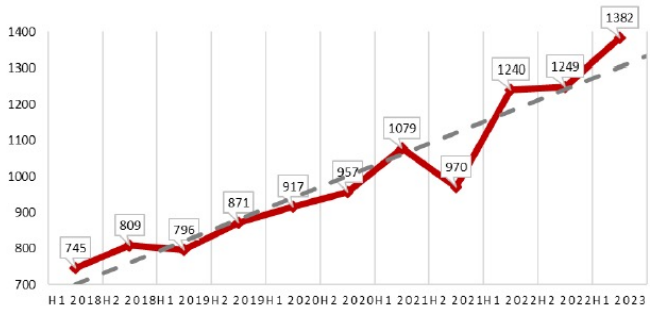
Number of attacks 2018 – 2024



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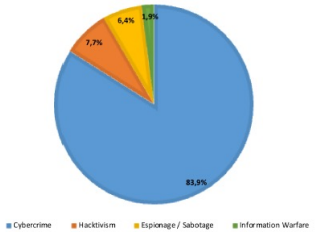
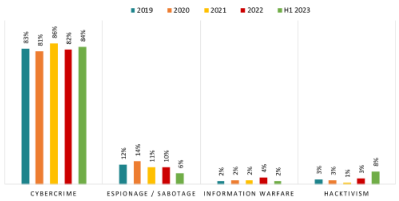
Who are the adversaries?





84% is cybercrime, i.e., attackers for money

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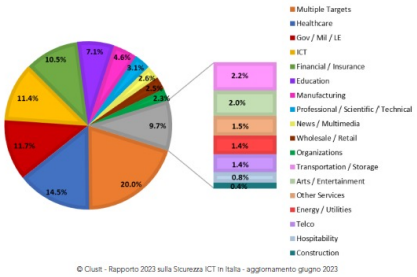
Who are the victims?



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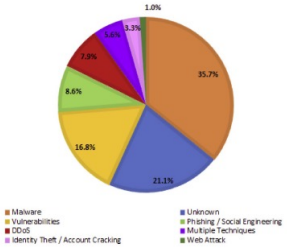
What are the attack techniques?



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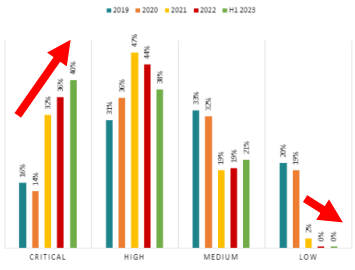
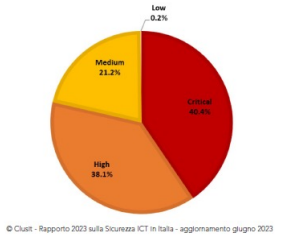
What is the severity of attacks?





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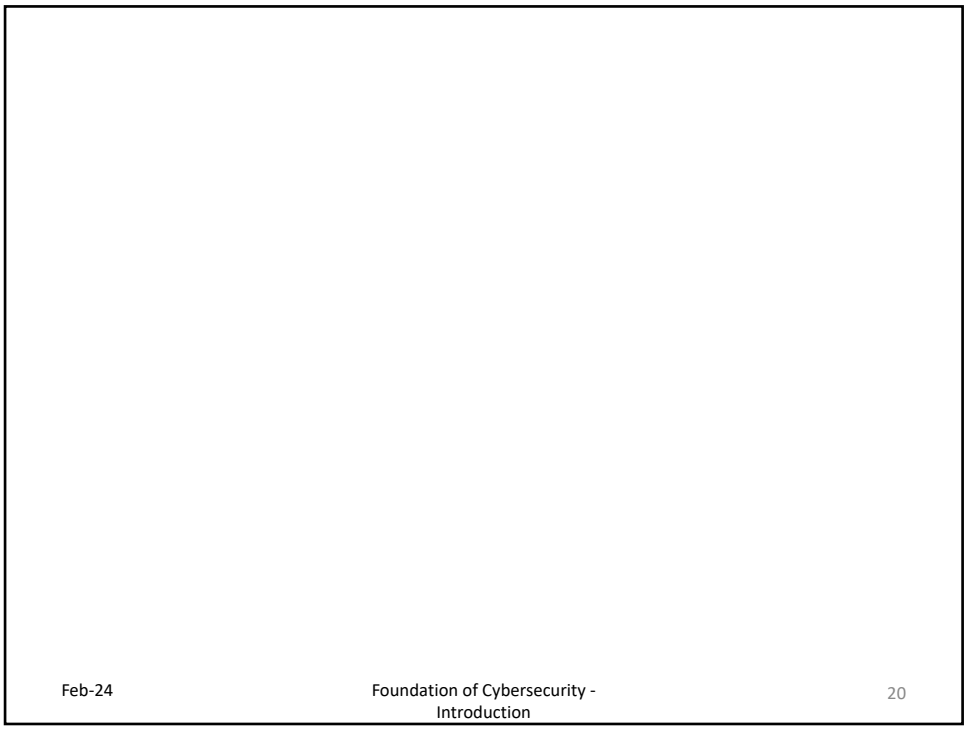

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