Cryptography

A (nearly) complete survey

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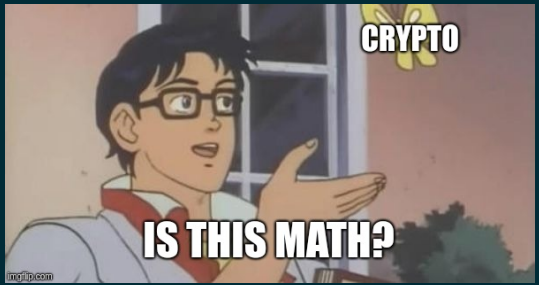
Warning!

In this lesson we will use *maths*!



It wasn't always like that though ...

Why cryptography?

Cryptography yesterday

(a) Cesare Chiper

(b) Scitala

Cryptography today

The needs, as well as the resources available, have evolved and today we can divide cryptography into:

(EN|DE)CRYPTION	**ASYMMETRIC (RSA, ECC, ...)** **SYMMETRIC (DES, AES, ...)**
KEY EXCHANGE	**RSA, DH, ECDH, ...**
AUTHENTICATION	**RSA, DSA, ECDSA, ...**
HASHING	**MD5, SHA-1, SHA-256, ...**

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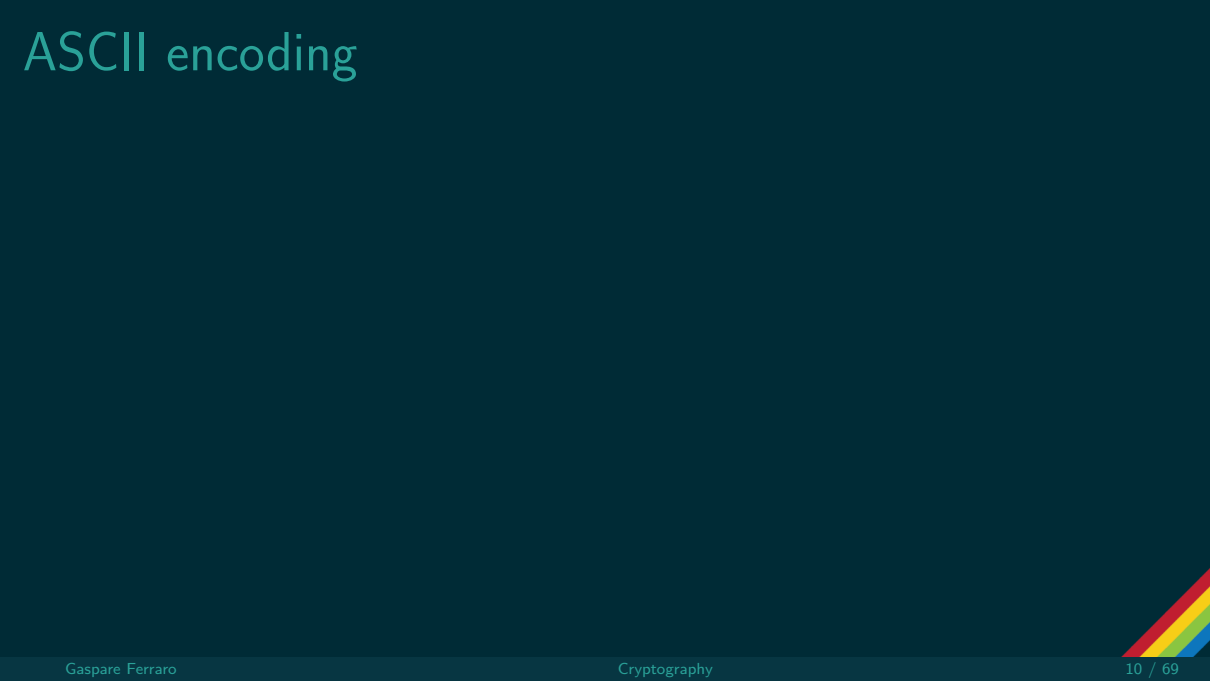
What is a message?

ASCII encoding



Unicode encoding

Base64

Base65536

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Caesar cipher

ROT13

Substitution cipher

Cryptanalysis

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Symmetric-key cryptography

Shannon principle

XOR cipher

One-time pad

Many-time pad

XorTool

Block vs Stream ciphers

DES

AES

Padding a message (PKCS#5 & PKCS#7)

Block cipher mode of operation

ECB (Electronic Codebook)

How to break ECB (padding-oracle attack)

CBC (Cipher Block Chaining)

How to break CBC (bit-flipping attack)

Stream ciphers (Salsa & Cha-Cha)

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Public-key cryptography

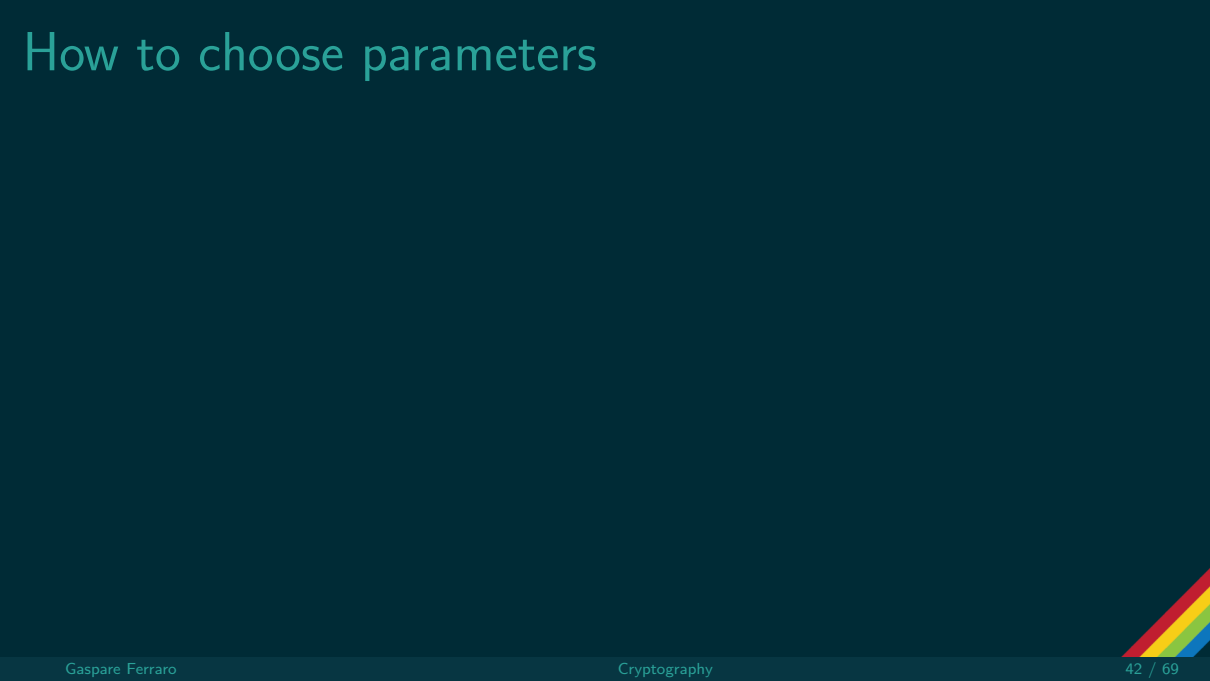
Modular arithmetic

RSA pt.1

RSA pt.2

An example...

How to choose parameters



Break RSA (online approach)

Break RSA (offline approach)

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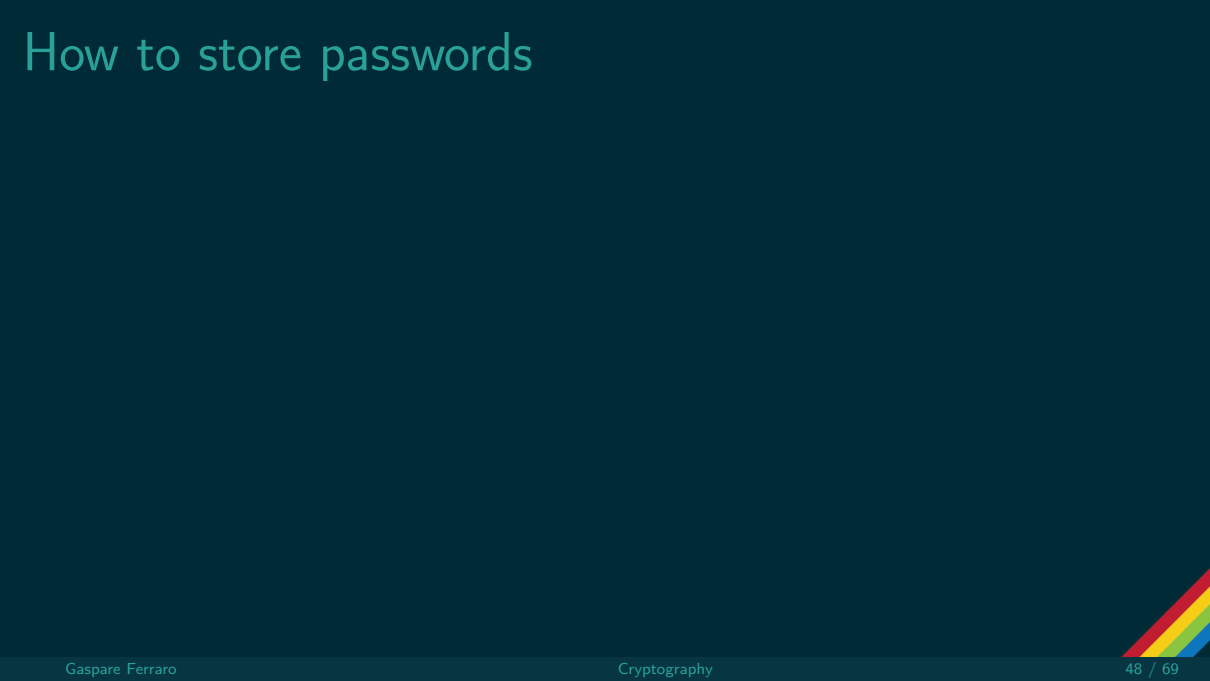
Hash function

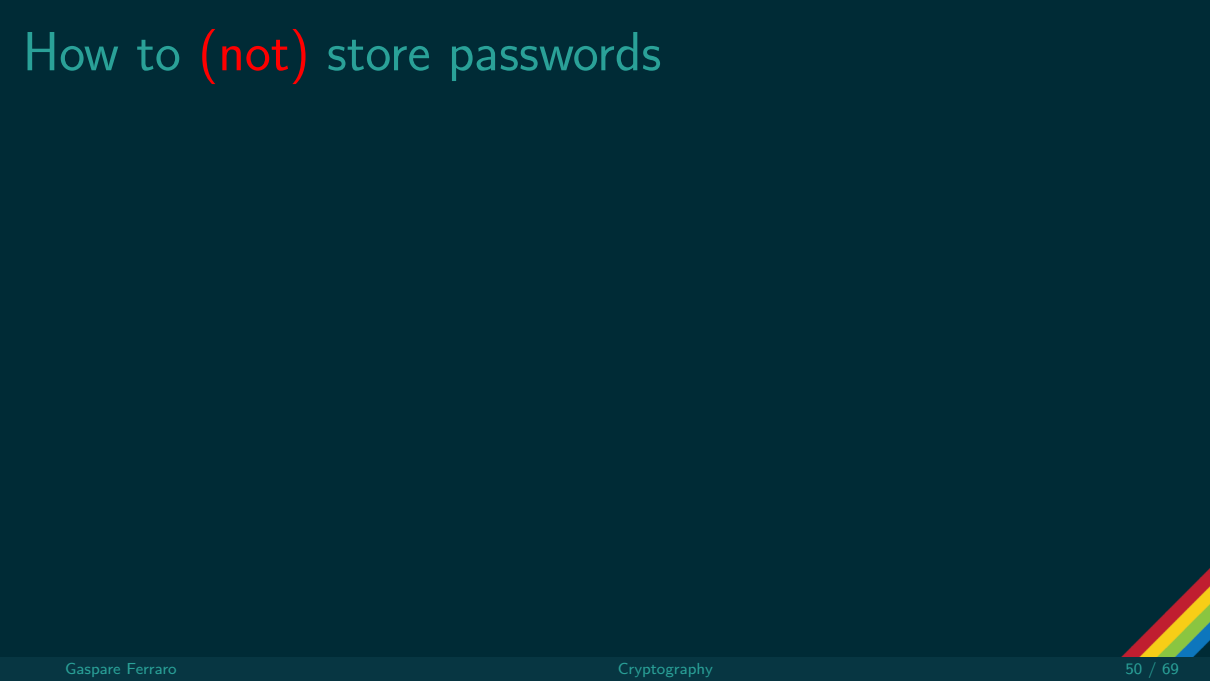
Why hash

How to store passwords



How to store passwords[2]

How to (not) store passwords



Proof of Work

MD5

SHA{0, 1, 2}

Finding collision

Reverse an hash function (online approach)

Reverse an hash function (offline approach)

fcrackzip

JohnTheRipper

Hashcat

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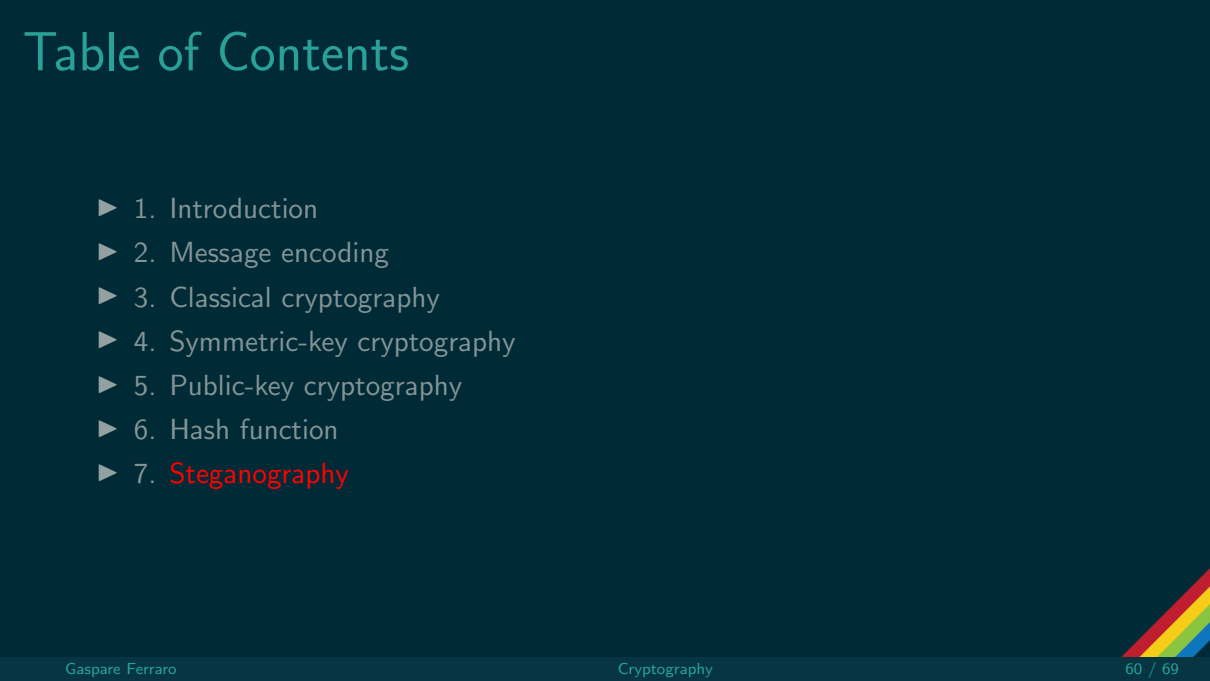


Steganography

File stego (file, binwalk, exiftool, strings)

Image stego

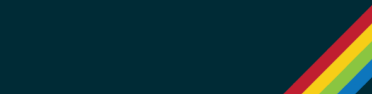
Layer stego

Audio stego

Morse code

Spectography analysis (audacity))

AudioStego



DeepSound