# Welcome to the CoGrammar

## Cryptography

### The session will start shortly...

Questions? Drop them in the chat. We'll have dedicated moderators answering questions.

# Cyber Security Session Housekeeping

- The use of disrespectful language is prohibited in the questions, this is a supportive, learning environment for all - please engage accordingly. **(Fundamental British Values: Mutual Respect and Tolerance)**
- No question is daft or silly - **ask them!**
- There will be a **Q&A** at the end of the session, should you wish to ask any follow-up questions.
- If you have any questions outside of this lecture, or that are not answered during this lecture, please do submit these for upcoming Academic Sessions. You can submit these questions here: **Questions**

# Cyber Security Session Housekeeping cont.

- For all **non-academic questions**, please submit a query: **www.hyperiondev.com/support**
- We would love your **feedback** on lectures: **Feedback on Lectures**
- Find all the lecture **content** in you **Lecture Backpack** on GitHub.
- If you are **hearing impaired**, please kindly **enable captions** on Google chrome/Microsoft Edge via the accessibility settings.

# Safeguarding & Welfare

We are committed to all our students and staff feeling safe and happy; we want to make sure there is always someone you can turn to if you are worried about anything.

If you are feeling upset or unsafe, are worried about a friend, student or family member, or you feel like something isn't right, speak to our safeguarding team:

Ian Wyles
Designated Safeguarding Lead

Simone Botes

Nurhaan Snyman

Rafiq Manan

Ronald Munodawafa

Tevin Pitts

**Scan to report a safeguarding concern**

or email the Designated Safeguarding Lead:
Ian Wyles
safeguarding@hyperiondev.com

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# *Stay Safe Series*:

Mastering Online Safety One Week/step at a Time

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**While the digital world can be a wonderful place to make education and learning accessible to all, it is unfortunately also a space where harmful threats like online radicalisation, extremist propaganda, phishing scams, online blackmail and hackers can flourish.**

**As a component of this BootCamp the *Stay Safe Series* will/is designed to guide you through essential measures in order to protect yourself & your community from online dangers, whether they target your privacy, personal information or even attempt to manipulate your beliefs.**

# Download with Caution: Avoiding Dangerous Files

- Use Trusted Sources Only
- Look for HTTPS
- Avoid Clicking on Pop-ups
- Scan Downloads with Antivirus
- Keep Software Updated
- Beware of Free Downloads
- Check File Extensions

# Learning Objectives & Outcomes

- Define Cryptography
- Identify the Purposes of Cryptography
- Understand Key Cryptographic Concepts such as encryption, decryption, and hashing
- Recognise Real-World Applications of Cryptography

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# Cryptography

January 2025

# Cryptography

What are some reasons to want to hide information or data?

# What is Cryptography?

Cryptography is the process of hiding or coding information so only the person who the message was intended for can read it.

# Why do we use Cryptography?

- Privacy and Confidentiality
- Authentication
- Non-repudiation

# Encryption

- Process of changing data, through mathematical processes, making it unreadable. The data can only be changed back by someone who has the correct key.

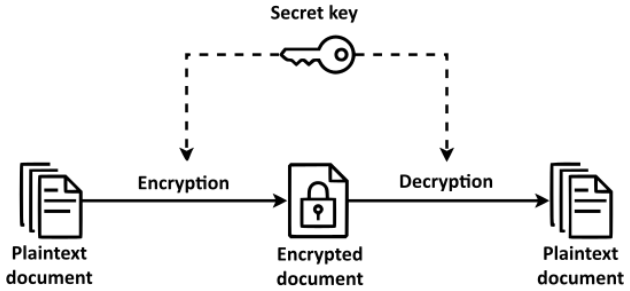
Encryption can be divided in 2 categories:

- Symmetrical
  - Uses the same key for both encryption and decryption
- Asymmetrical
  - Uses a private/public key pair for encryption and decryption.

# Symmetrical Encryption

- Symmetrical encryption uses the same key for both encryption and decryption.

- **User A** encrypts a message using a key.
- **User A** can now send the encrypted message to **User B**
- **User B** can then use the key to decrypt the message and read it.

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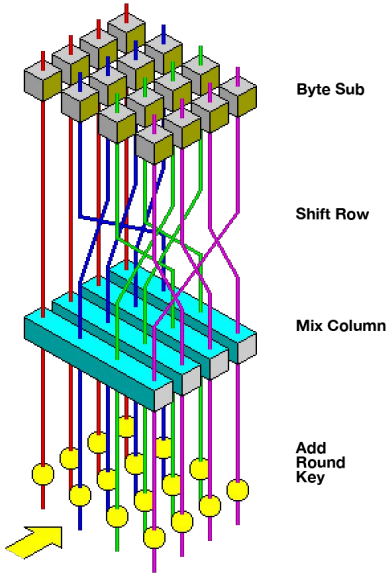
# Advanced Encryption standard

- Block cipher used by the US government to protect classified information.
- Split the message into smaller blocks of 128 bits each.
- Uses same key to encrypt and decrypt.

# Advanced Encryption standard

Transformation Stages

- 1: Involves data substitution with a predefined cipher and a substitution table.
- 2: Data rows get shifted except for the first row.
- 3: Uses the Hill cipher to mix columns.
- 4: Block of data uses a small portion of the encryption key.

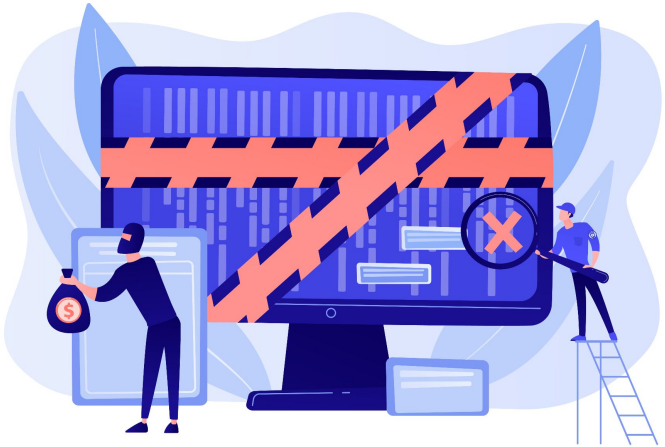


# Advantages of AES

- Security
- Cost
- Implementation

# AES Vulnerabilities

- Incorrect configuration.
- Not enough encryption rounds.
- Side channel attacks.

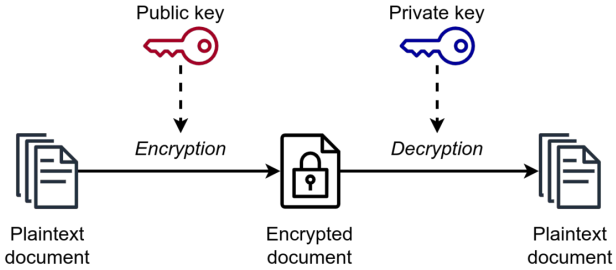


# Asymmetrical Encryption

- Uses a private/public key pair for encryption and decryption.

User A wants to send a message to User B

- **User A** encrypts a message using **User B**'s public key.
- **User A** can now send the encrypted message to **User B**
- **User B** can then use their private key to decrypt the message and read it.

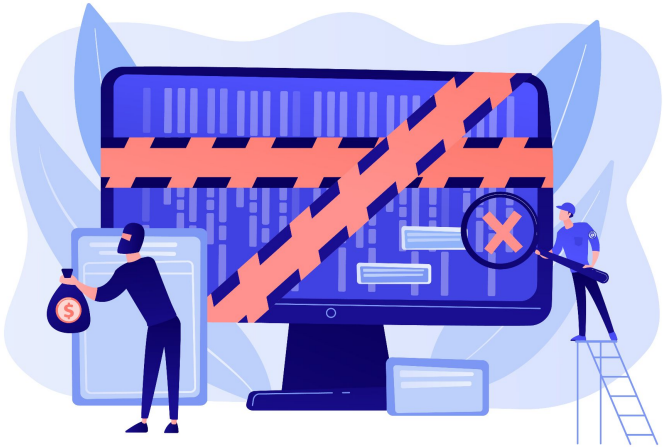


# Rivest Shamir Adleman (RSA)

- Protects data through encryption and decryption with private and public keys.
- Most widely used encryption mechanism in the world.
- Uses 2 very large prime numbers and performs a sequence of steps to produce a private and public key set that can be used.

# Vulnerabilities

- Key sizes
- Future technology
- Side channel attacks
- Weak Random Number Generators



# Use Cases

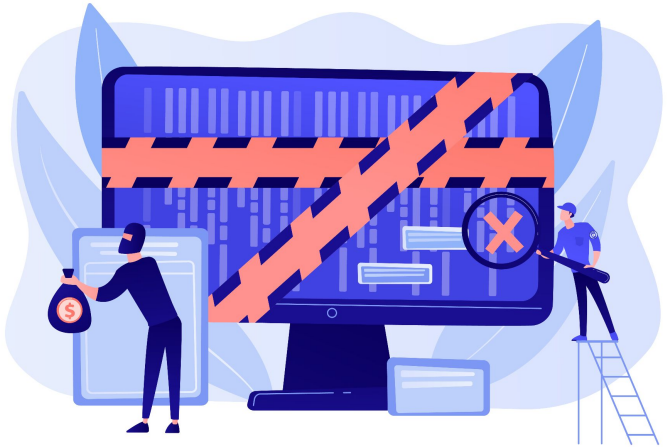
- Digital Signatures
- Digital Certificates
- Secure Communication Protocols

# Keys and Key Management

Keys are at the centre point of our cryptography and protecting them should be off highest priority.

# Vulnerabilities

- Weak keys
- Overused keys
- Using keys for multiple purposes
- Keys stored alongside Data
- Insider threats



# Mitigating Risks

- We can mitigate risks using a key management system.

# Consequences of Key Leaks

- Investigation costs
- Loss of sensitive data
- Financial losses
- Fines
- Reputational damage
- Some cases the business closes.

# Hashing

- Hashing is the process of changing data into a fixed size string value called a hash.

# Benefits

- Data retrieval
- Digital Certificates
- Password storing

# Disadvantages

- Risk of collisions.
- Very difficult to reverse.
- Not very friendly with data that requires sorting.

# Cryptography

How would life change if cryptography didn't exist?

# Polls

Please have a look at the poll notification and select an option.

What is the primary purpose of cryptography?

A. Data compression
B. Data protection
C. Data deletion
D. Data sorting

# Polls

Please have a look at the poll notification and select an option.

What type of key pair is used in asymmetric cryptography?

A. Two public keys
B. Two private keys
C. A public key and a private key
D. No key is required

# Questions and Answers

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# Thank you for attending

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