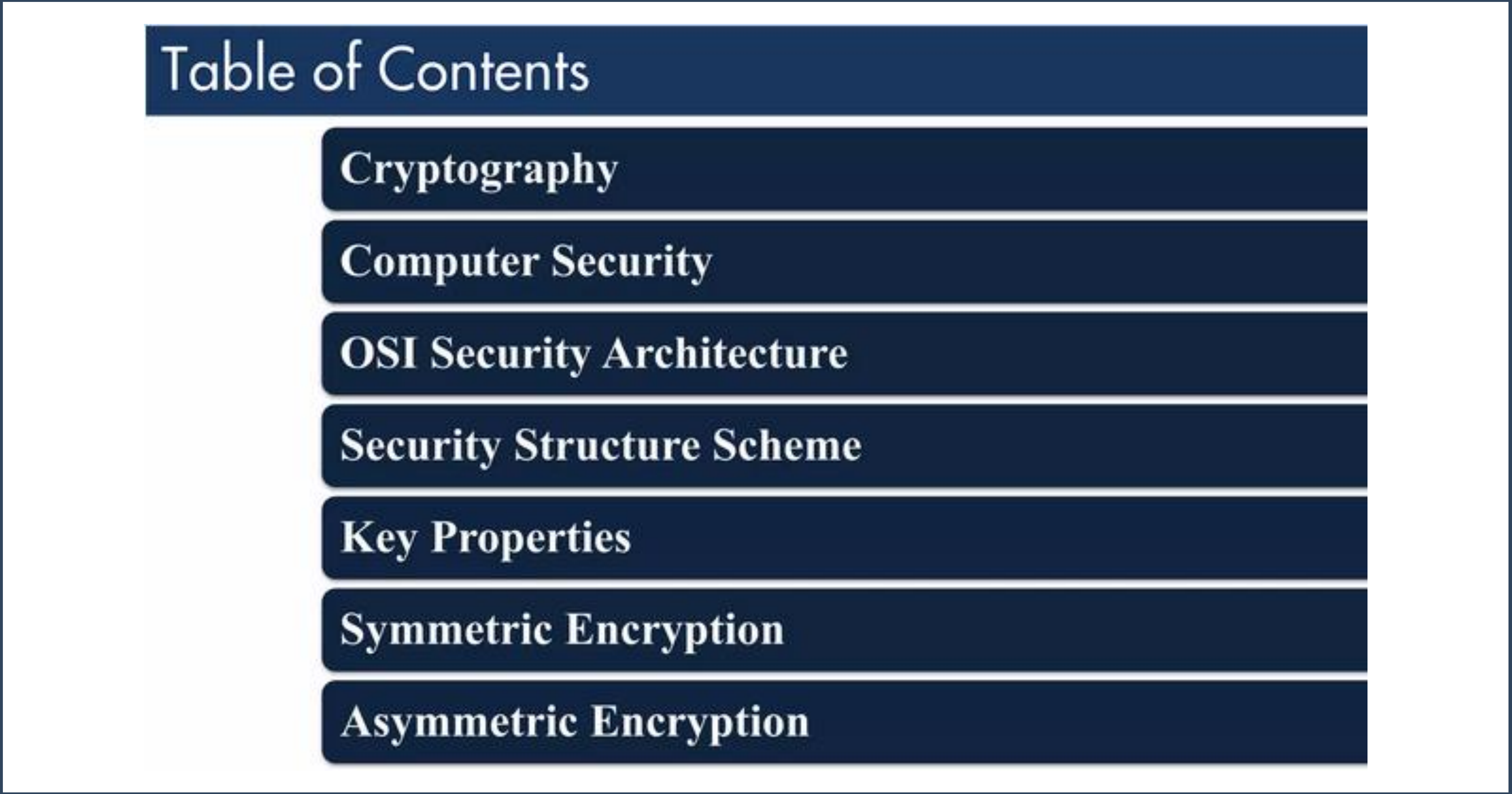
Computer Security

Lecture 3

Dr/ Hanan Hamed



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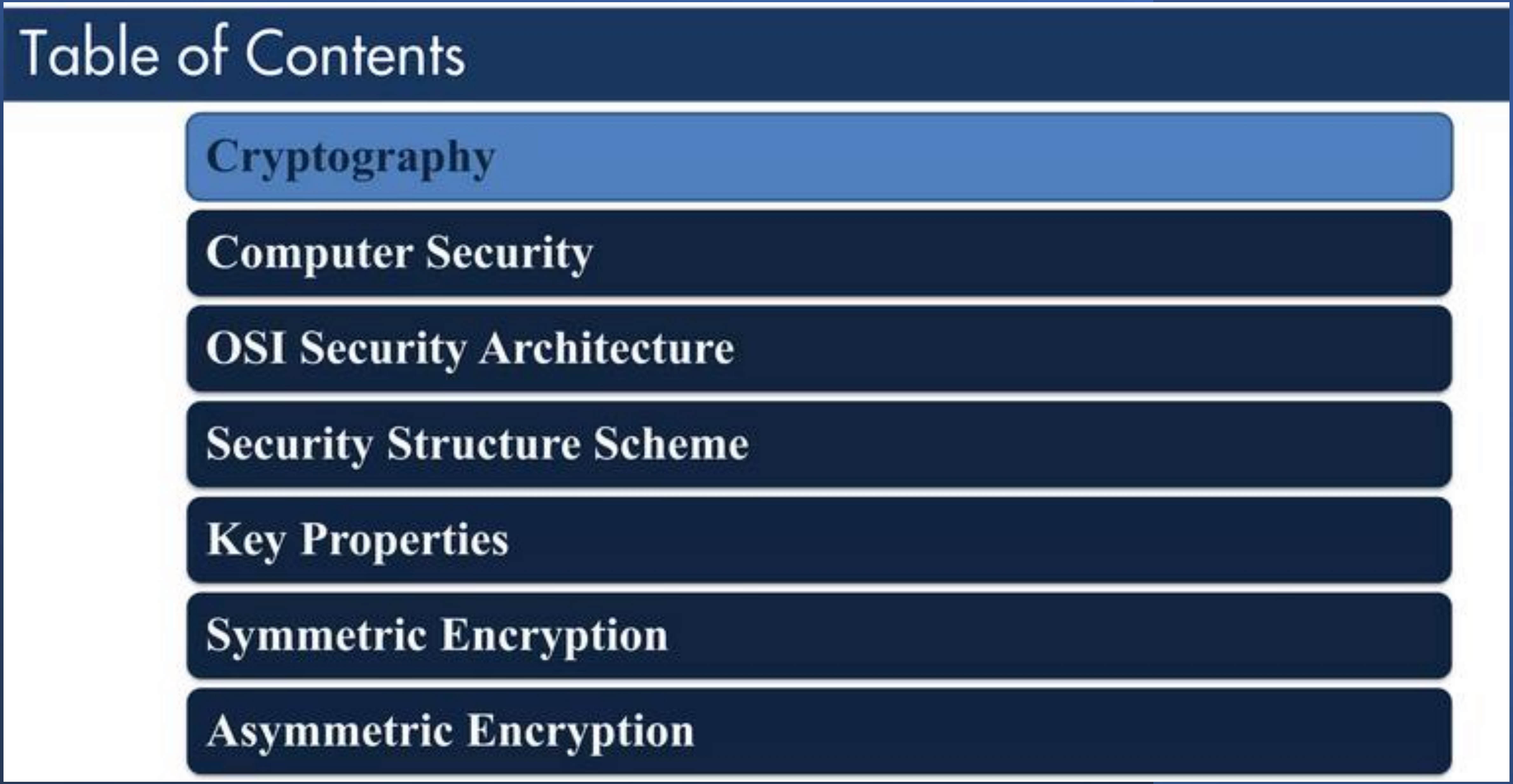
- Cryptography
- Computer Security
- OSI Security Architecture
- Security Structure Scheme
- Key Properties
- Symmetric Encryption
- Asymmetric Encryption



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Cryptography

- □ Cryptography: is the science of secret writing and is an ancient art; the first documented use of cryptography in writing dates back to 1900 B.C. when an Egyptian scribe used non-standard hieroglyphs in an inscription (handwriting).

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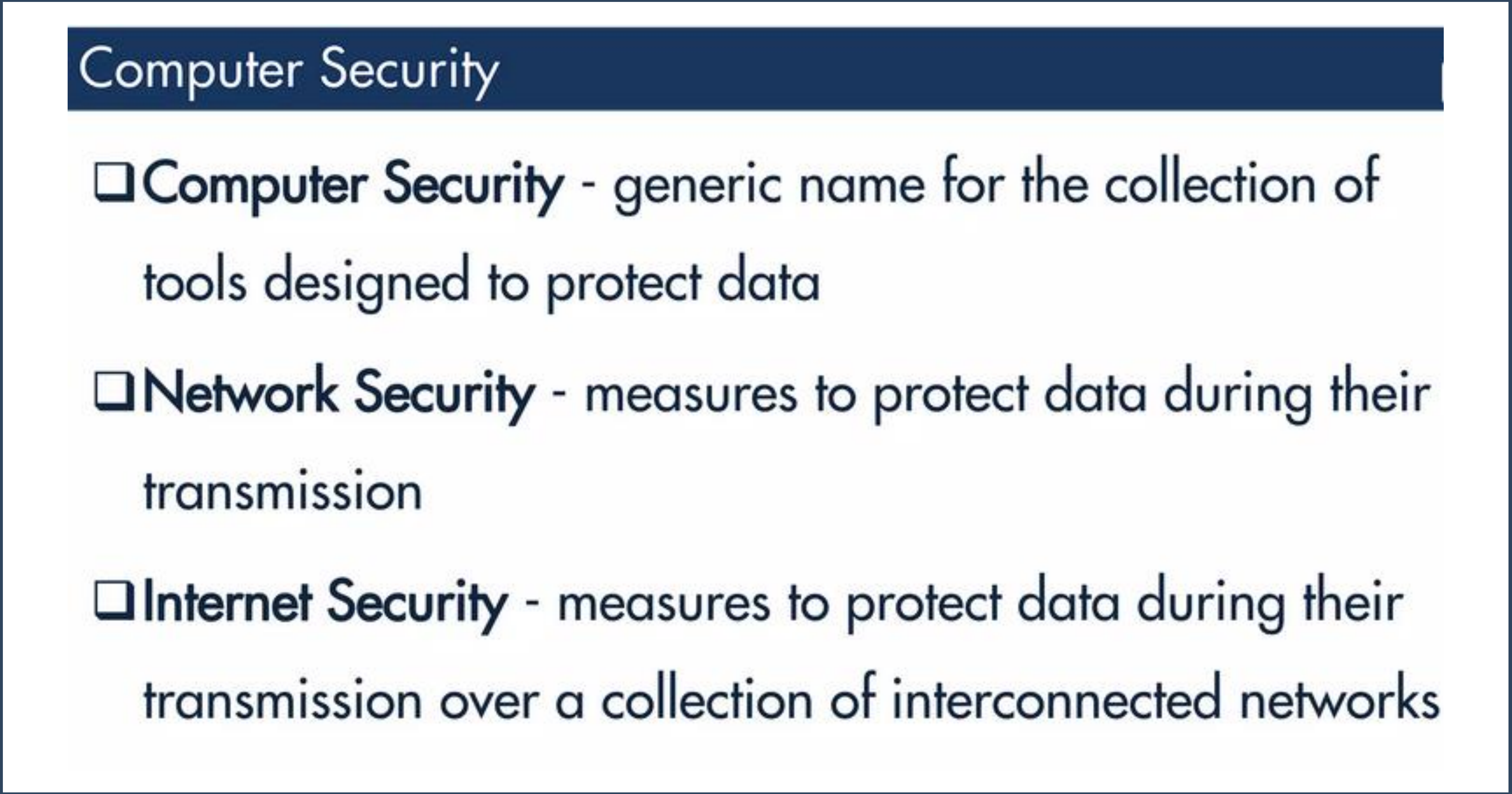
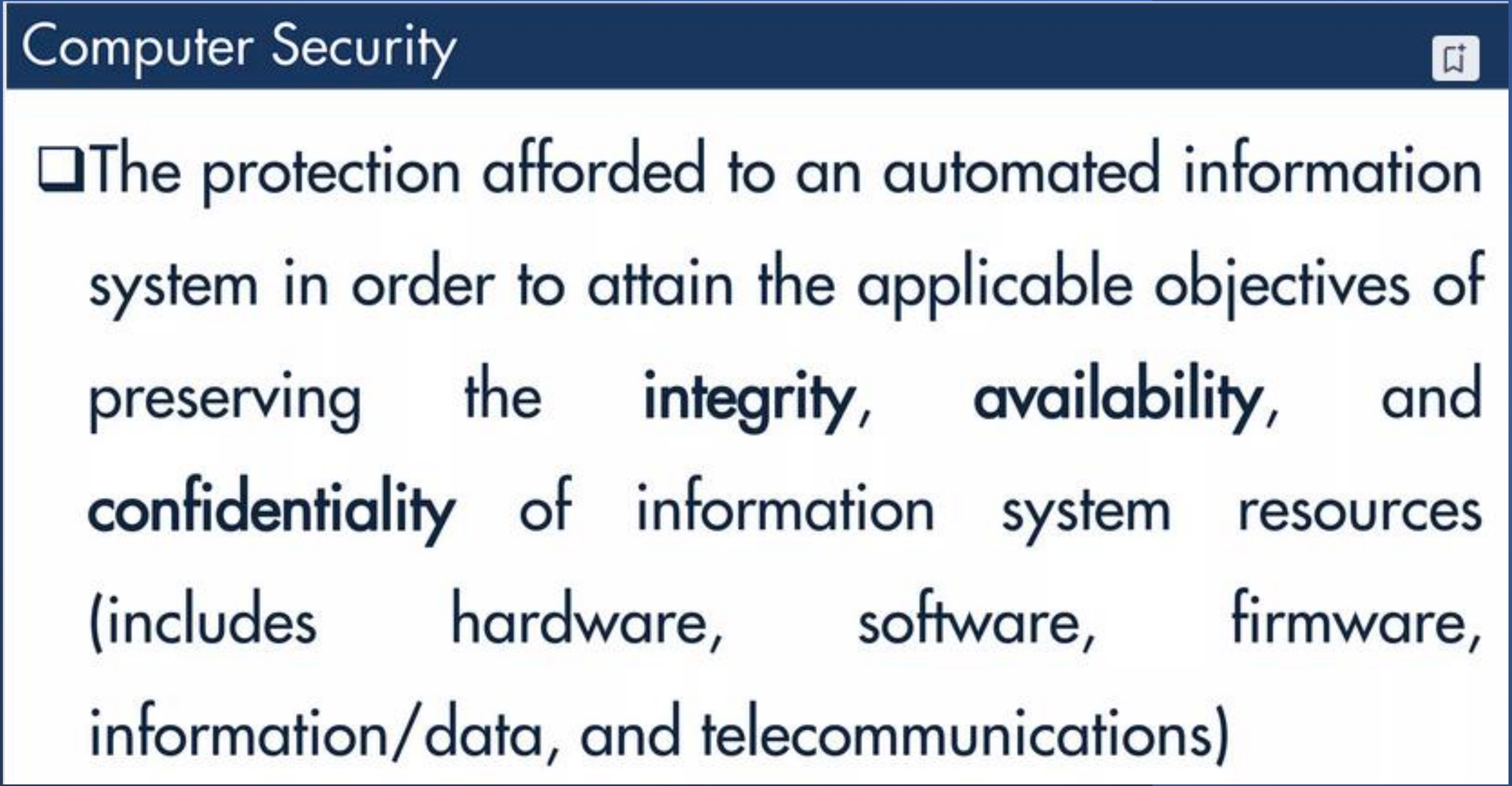


Computer Security

❑ **Computer Security** - generic name for the collection of tools designed to protect data

❑ **Network Security** - measures to protect data during their transmission

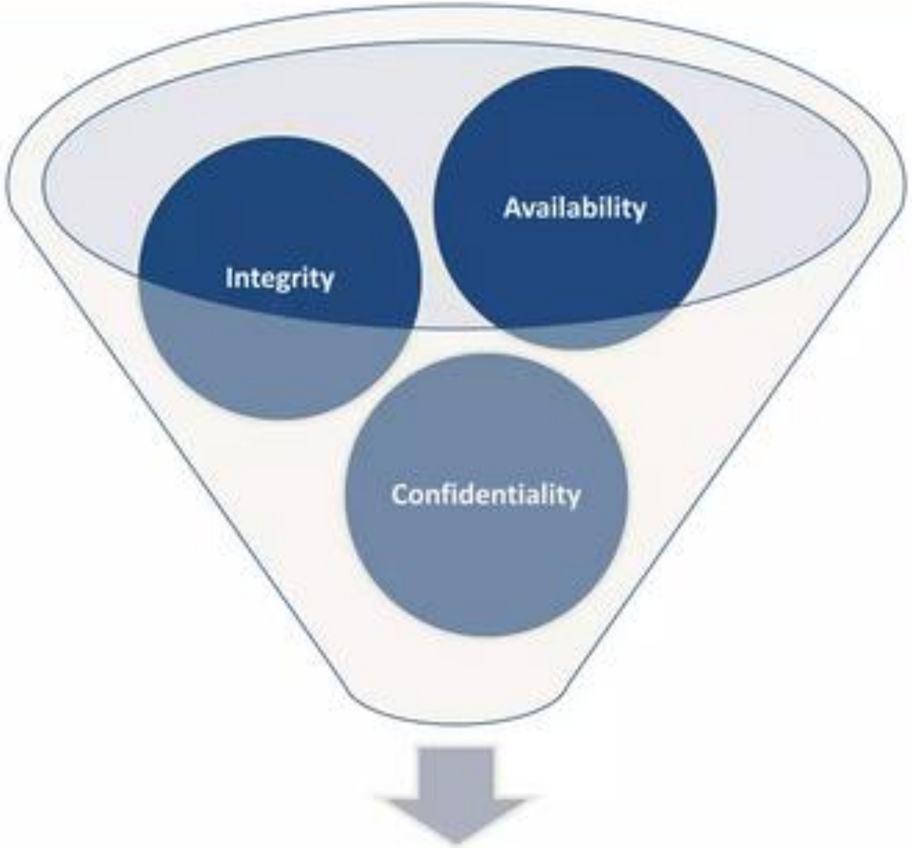
❑ **Internet Security** - measures to protect data during their transmission over a collection of interconnected networks



Computer Security

❑The protection afforded to an automated information system in order to attain the applicable objectives of preserving the **integrity**, **availability**, and **confidentiality** of information system resources (includes hardware, software, firmware, information/data, and telecommunications)

Computer Security

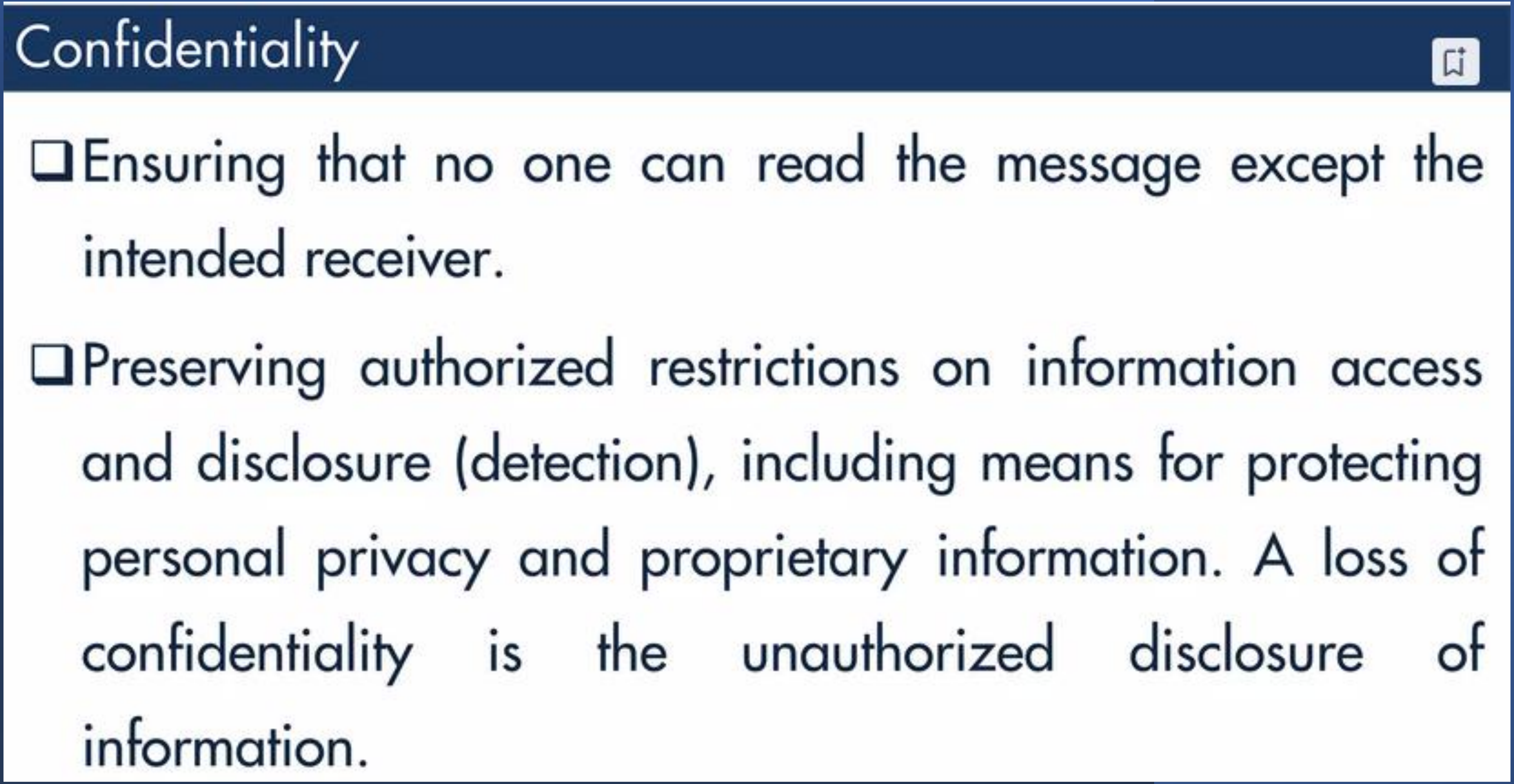


Integrity

Availability

Confidentiality

CIA triad

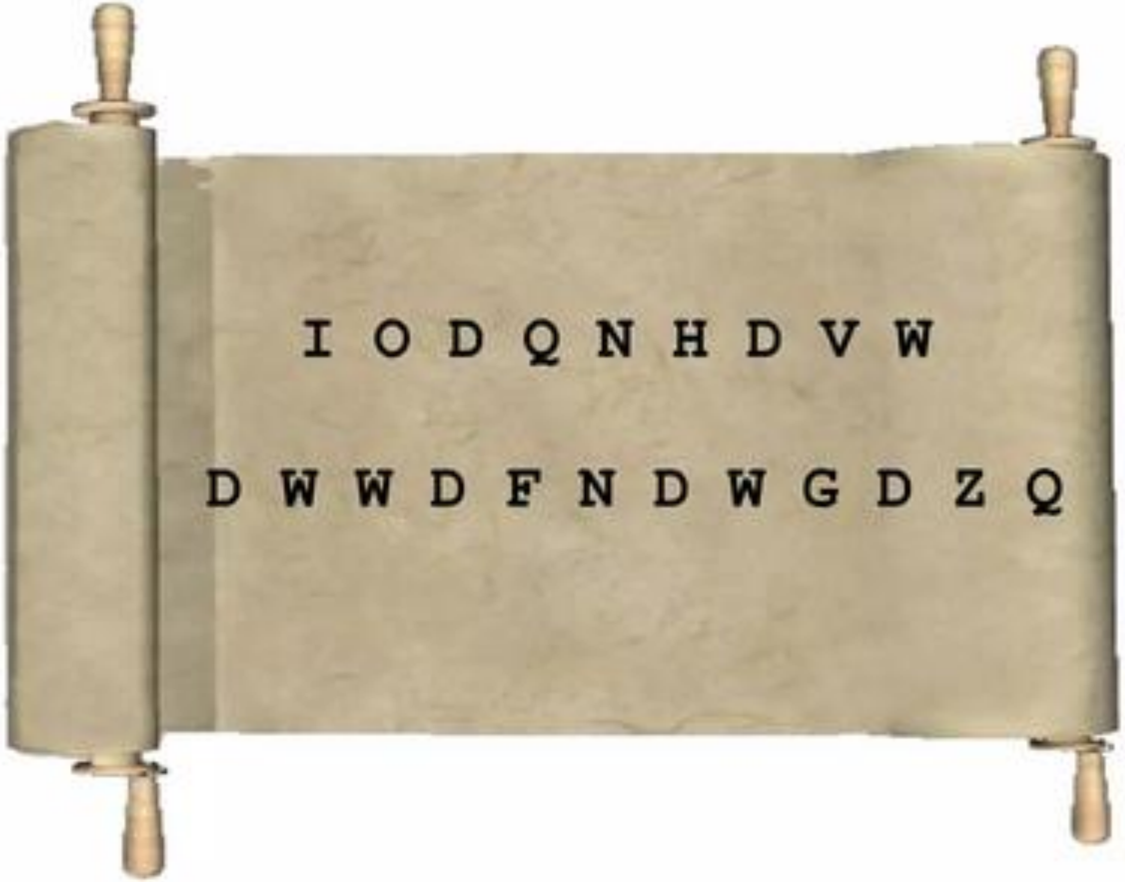


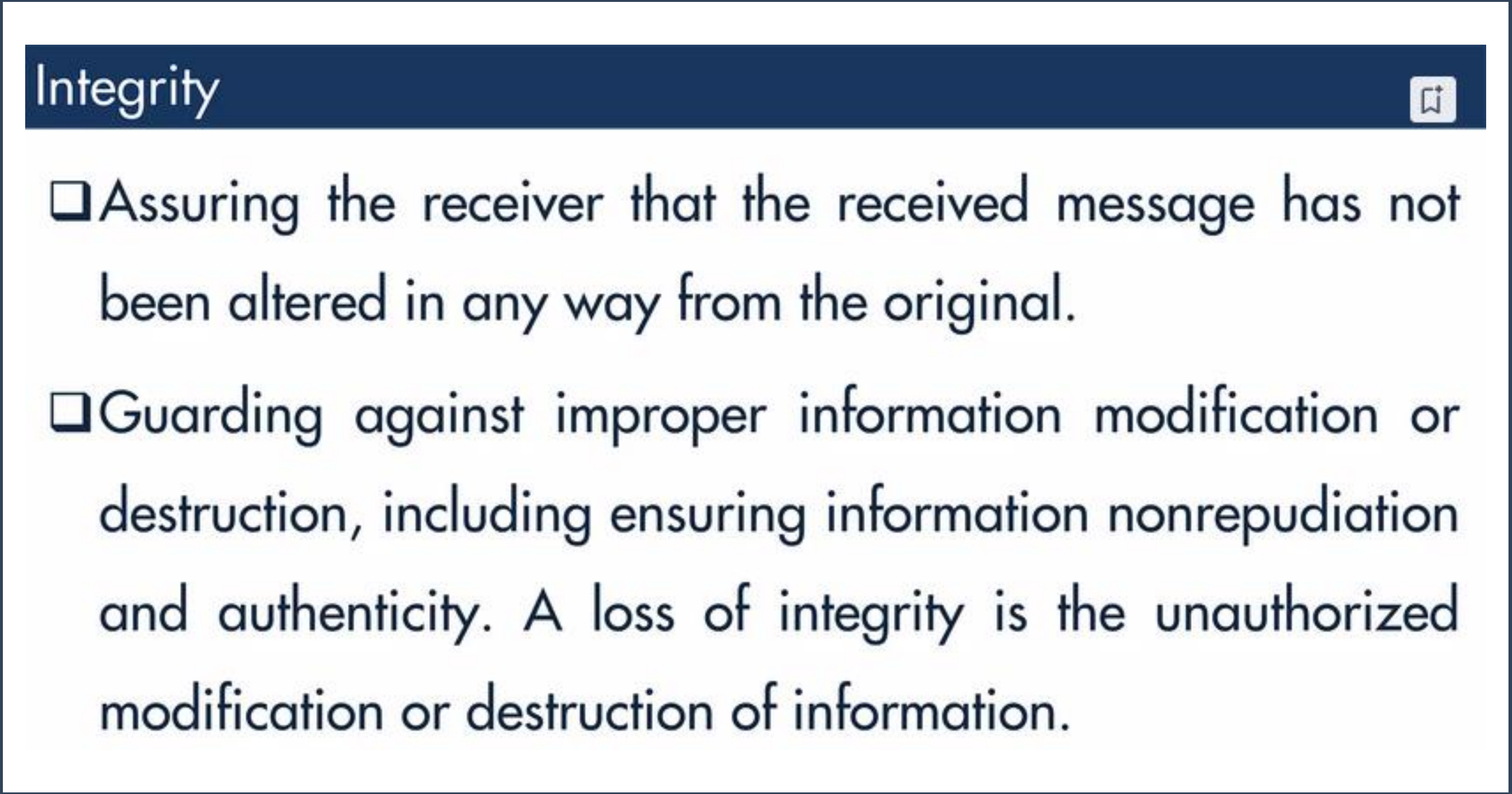
Confidentiality

❑ Ensuring that no one can read the message except the intended receiver.

❑ Preserving authorized restrictions on information access and disclosure (detection), including means for protecting personal privacy and proprietary information. A loss of confidentiality is the unauthorized disclosure of information.

Confidentiality

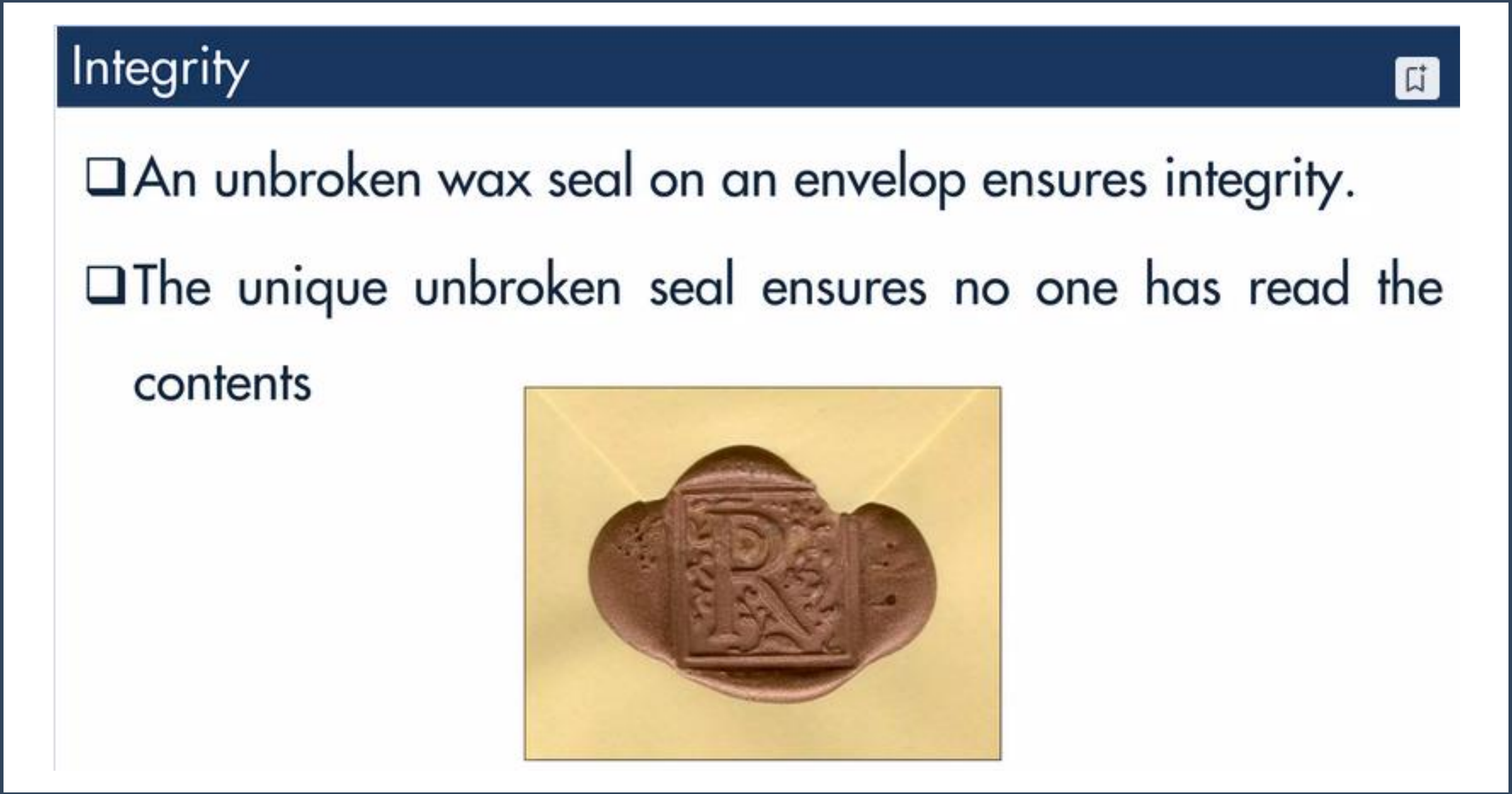




Integrity

❑ Assuring the receiver that the received message has not been altered in any way from the original.

❑ Guarding against improper information modification or destruction, including ensuring information nonrepudiation and authenticity. A loss of integrity is the unauthorized modification or destruction of information.



Integrity

□ An unbroken wax seal on an envelop ensures integrity.

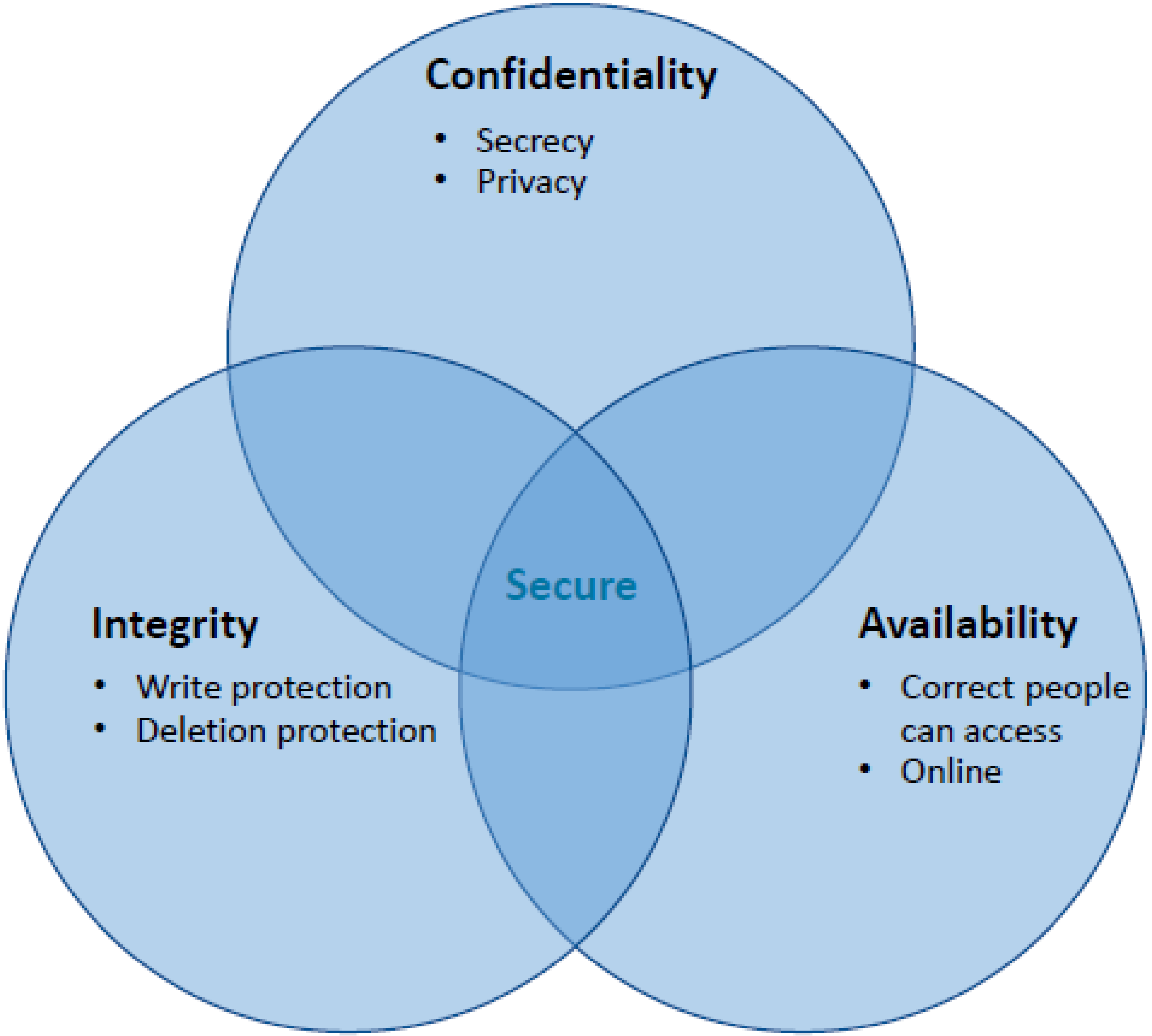
□ The unique unbroken seal ensures no one has read the contents

Availability

- Ensuring timely and reliable access to and use of information. A loss of availability is the disruption (confusion) of access to or use of information or an information system.

Defining Security

- Confidentiality
  - Ensures that computer-related assets are accessed only by authorized parties.
- Integrity
  - Assets can be modified only by authorized parties or only in authorized ways.
- Availability
  - Assets are accessible to authorized parties at appropriate times.



Confidentiality

- Secrecy
- Privacy

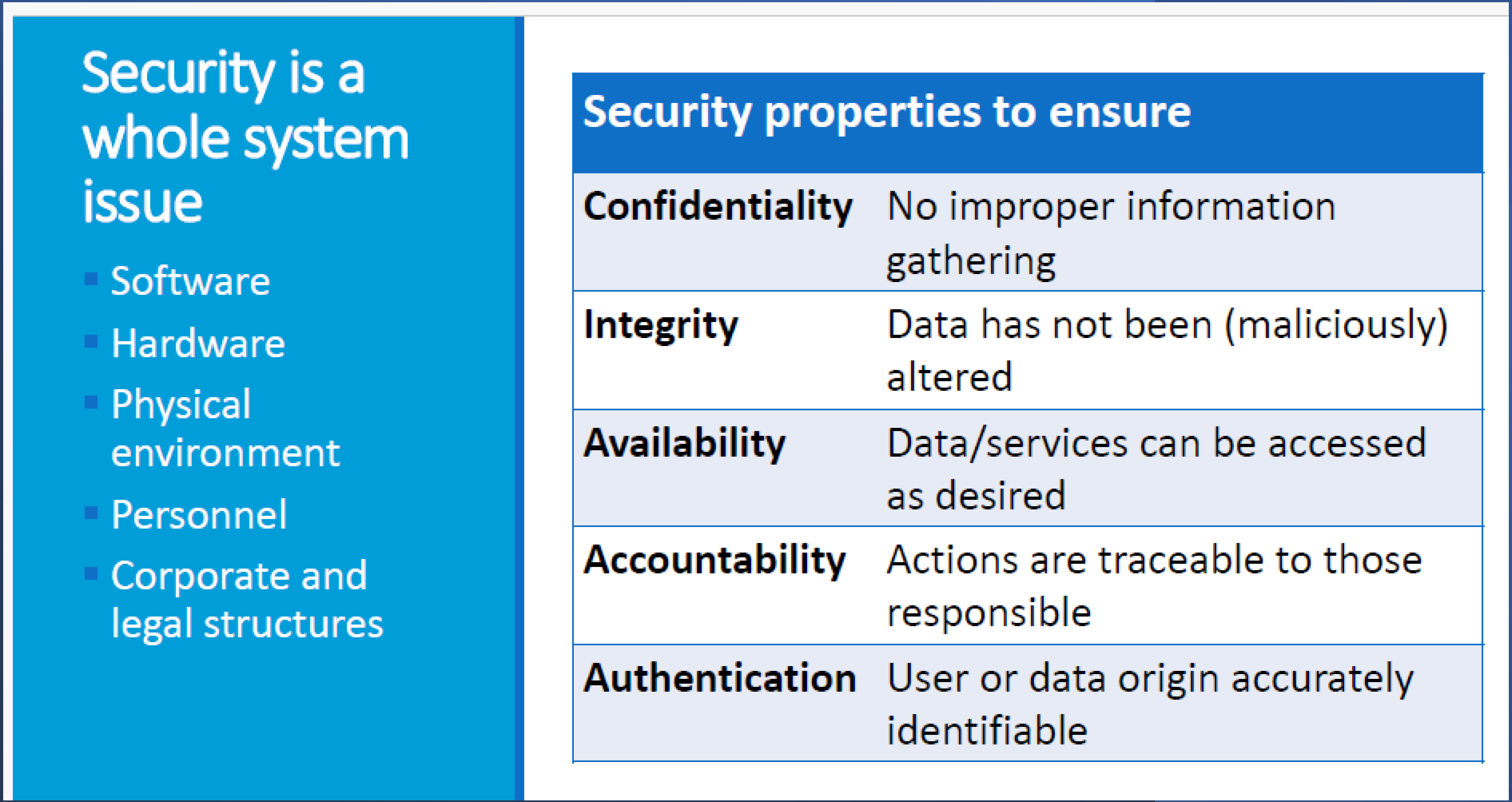
Integrity

- Write protection
- Deletion protection

Availability

- Correct people can access
- Online

Secure



Security is a whole system issue

- Software
- Hardware
- Physical environment
- Personnel
- Corporate and legal structures

Security properties to ensure	
Confidentiality	No improper information gathering
Integrity	Data has not been (maliciously) altered
Availability	Data/services can be accessed as desired
Accountability	Actions are traceable to those responsible
Authentication	User or data origin accurately identifiable

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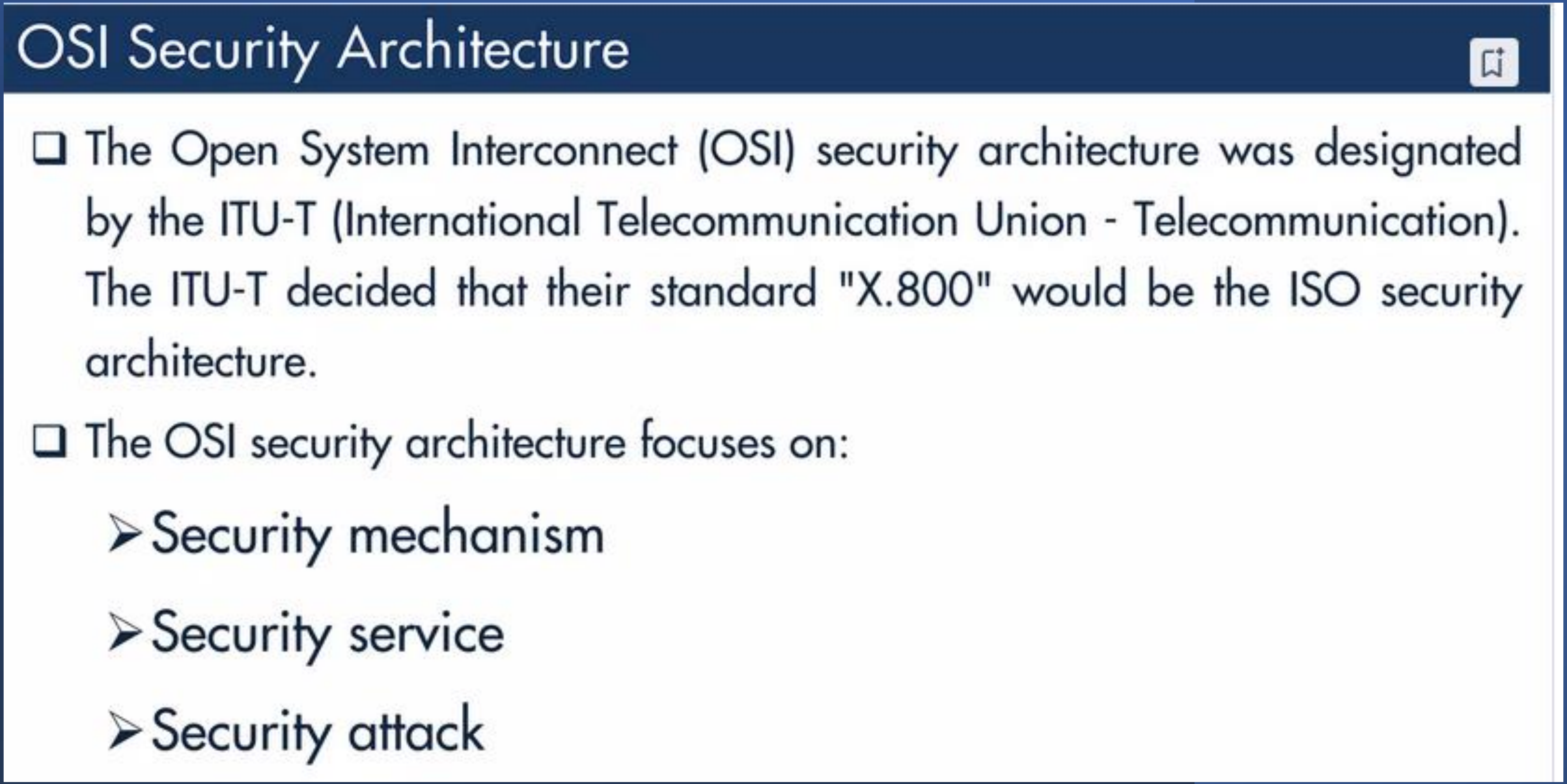
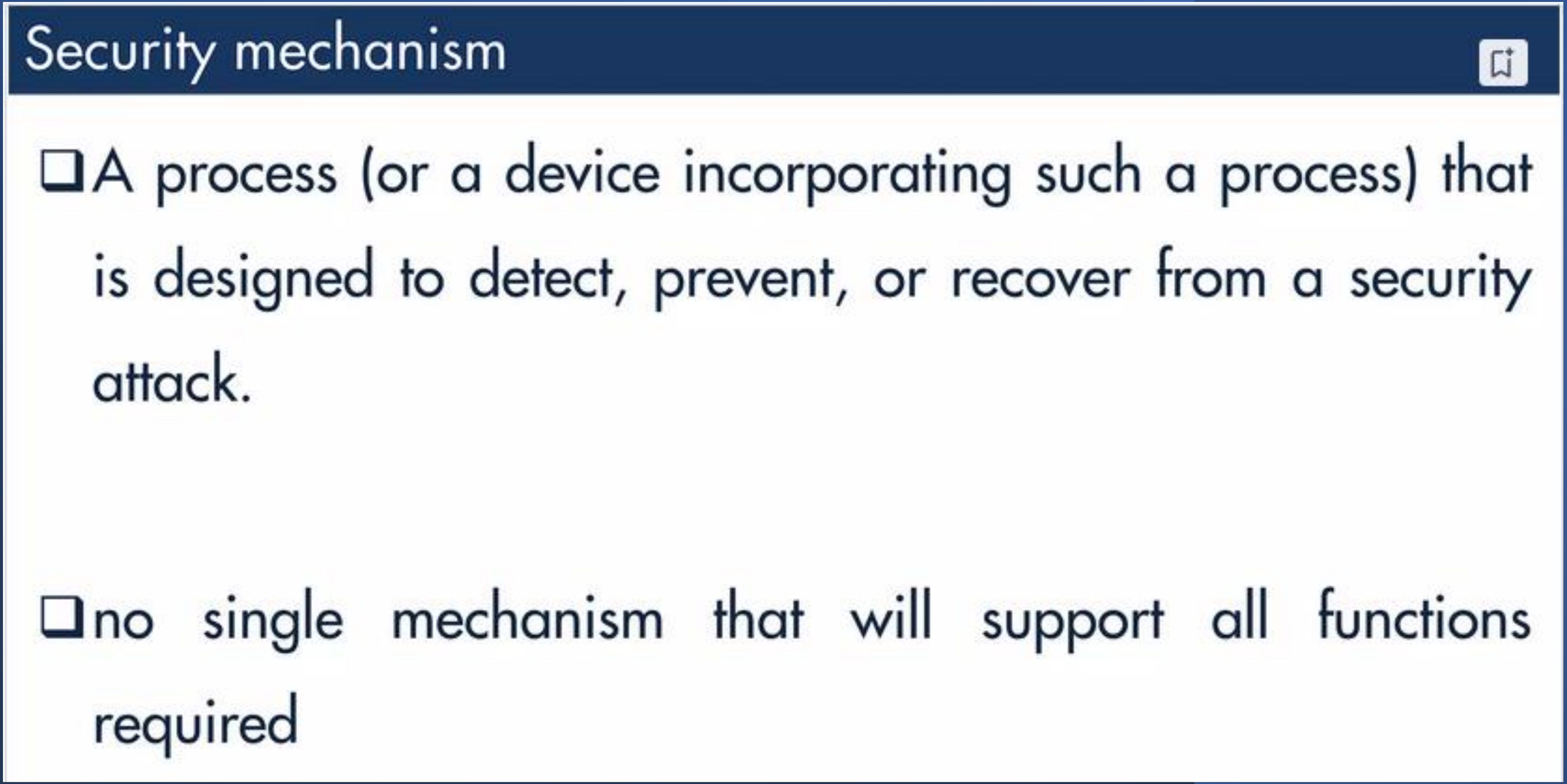


OSI Security Architecture

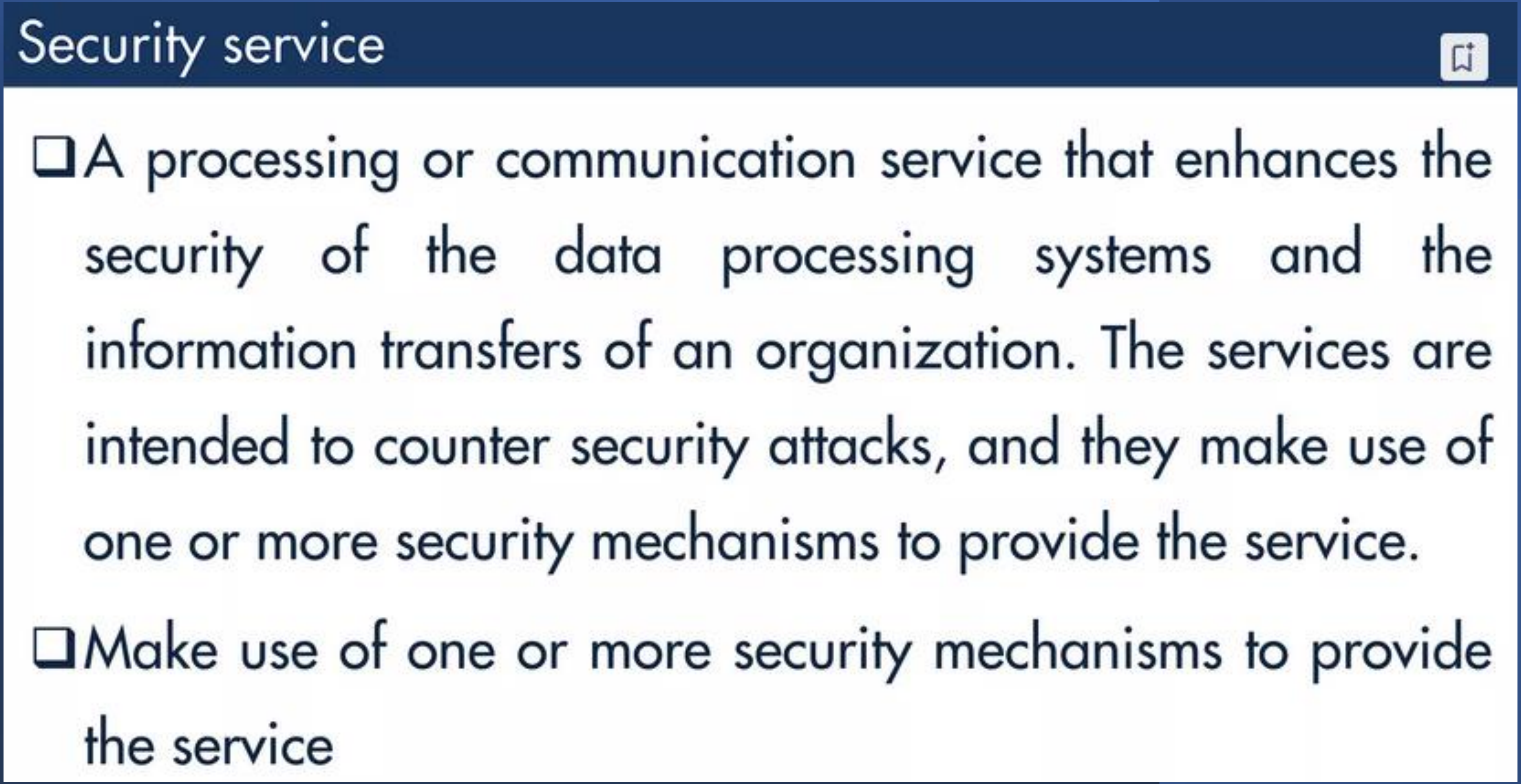
- ❑ The Open System Interconnect (OSI) security architecture was designated by the ITU-T (International Telecommunication Union - Telecommunication). The ITU-T decided that their standard "X.800" would be the ISO security architecture.
- ❑ The OSI security architecture focuses on:
  - ➢ Security mechanism
  - ➢ Security service
  - ➢ Security attack



Security mechanism

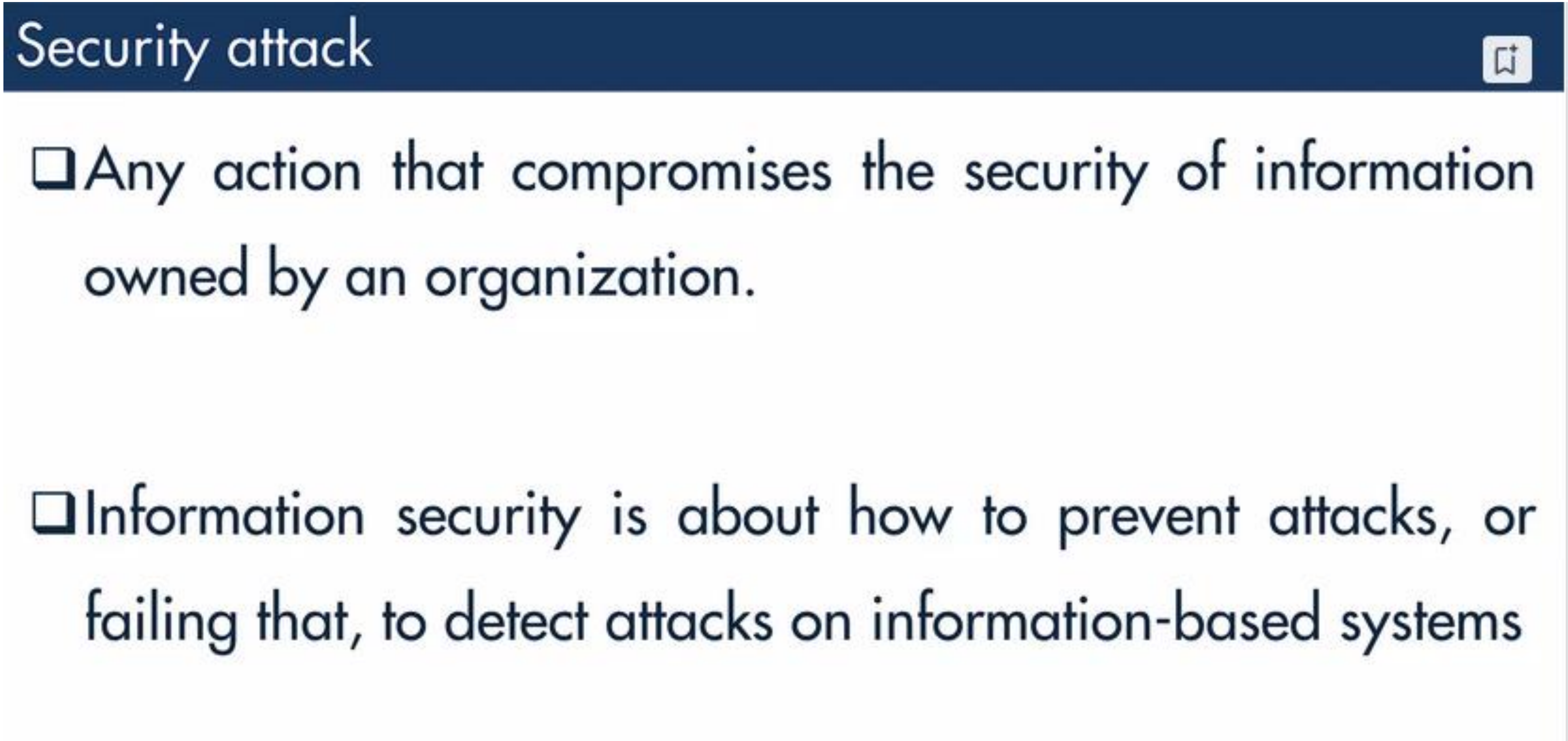
❑ A process (or a device incorporating such a process) that is designed to detect, prevent, or recover from a security attack.

❑ no single mechanism that will support all functions required



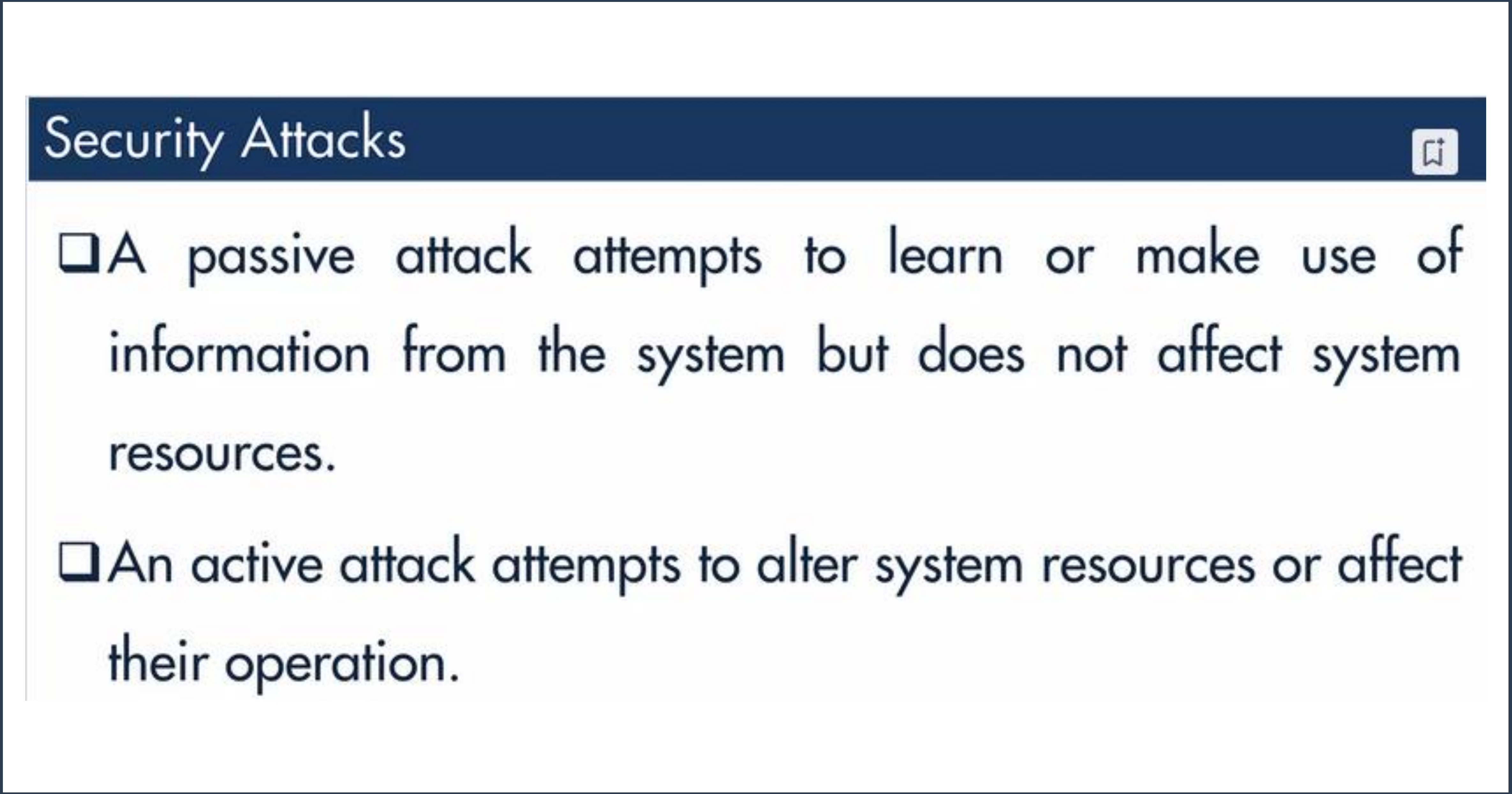
Security service

- ❑A processing or communication service that enhances the security of the data processing systems and the information transfers of an organization. The services are intended to counter security attacks, and they make use of one or more security mechanisms to provide the service.
- ❑Make use of one or more security mechanisms to provide the service



Security attack

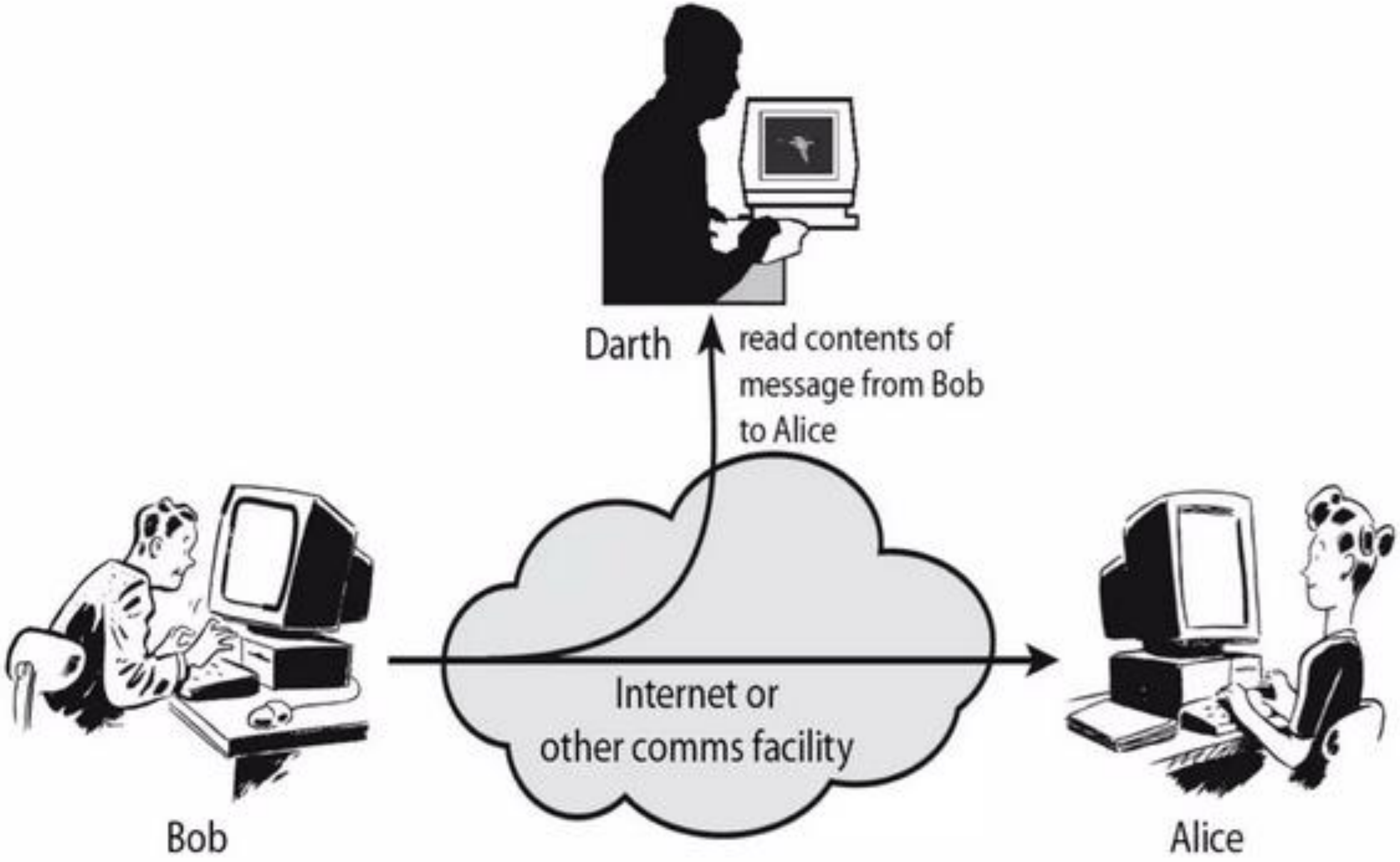
- Any action that compromises the security of information owned by an organization.
- Information security is about how to prevent attacks, or failing that, to detect attacks on information-based systems



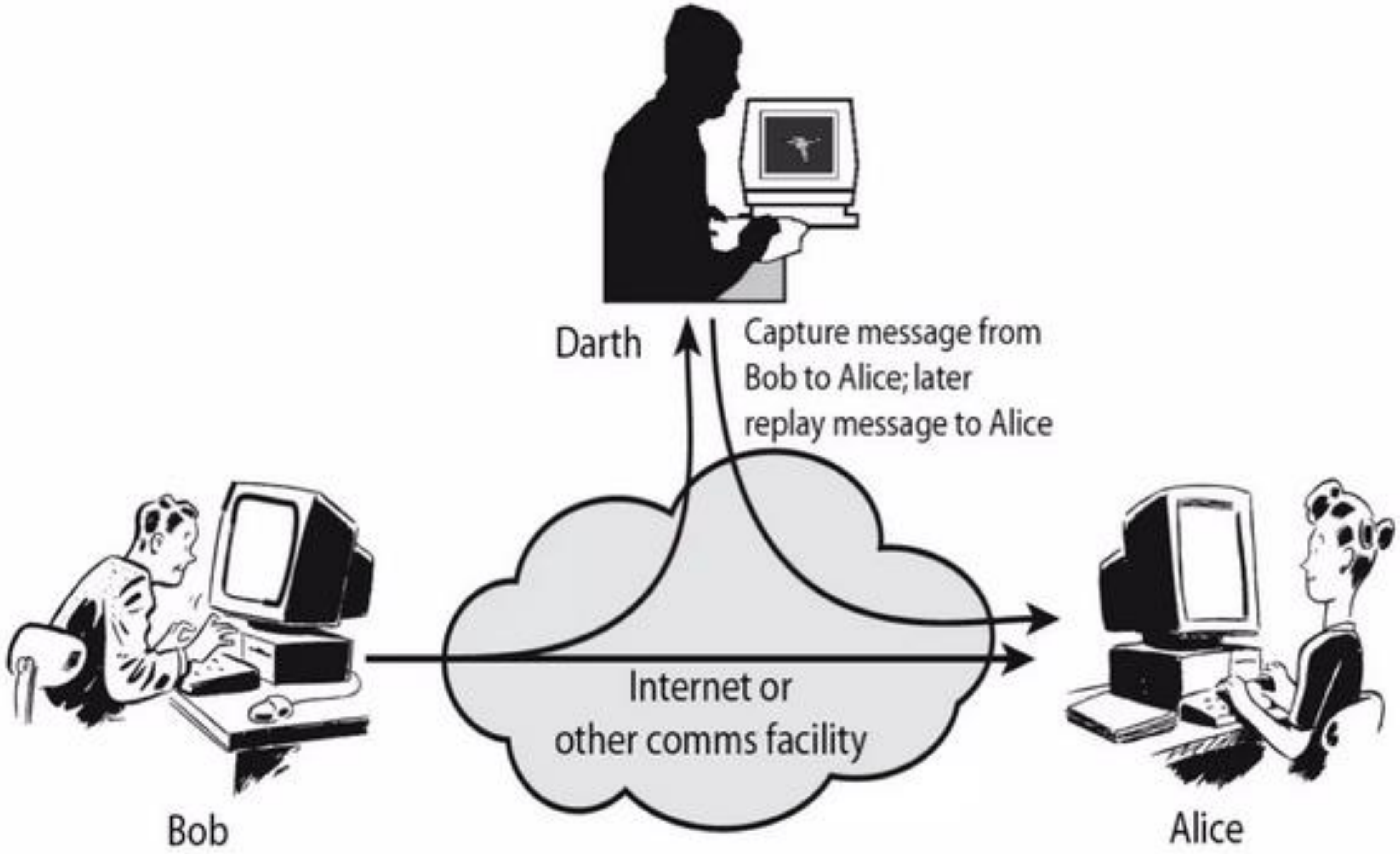
Security Attacks

- ❑ A passive attack attempts to learn or make use of information from the system but does not affect system resources.
- ❑ An active attack attempts to alter system resources or affect their operation.

Passive Attack


Darth
read contents of message from Bob to Alice
Internet or other comms facility
Bob
Alice

Active Attack



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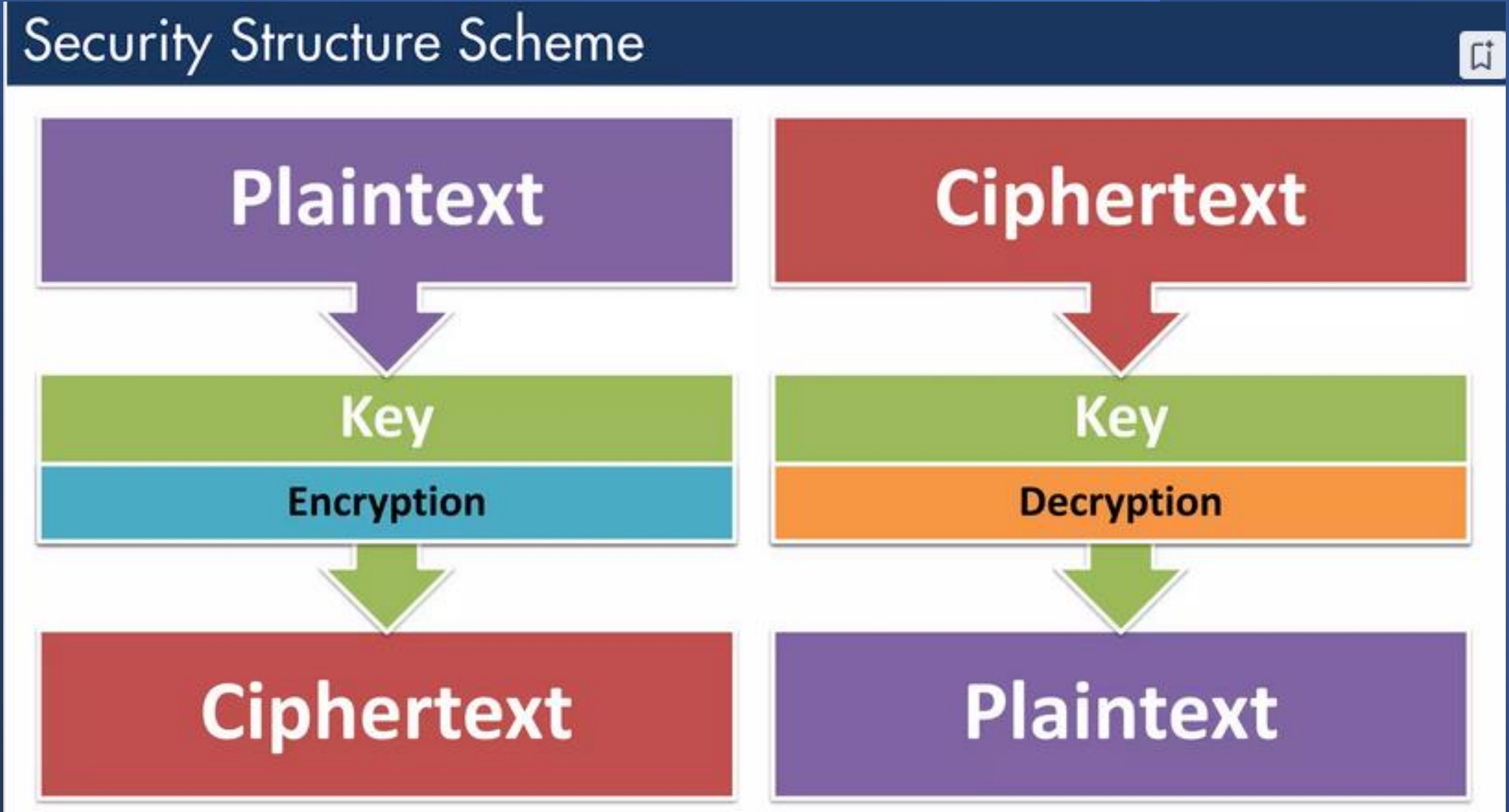


Security Structure Scheme

Plaintext

Key

Encryption

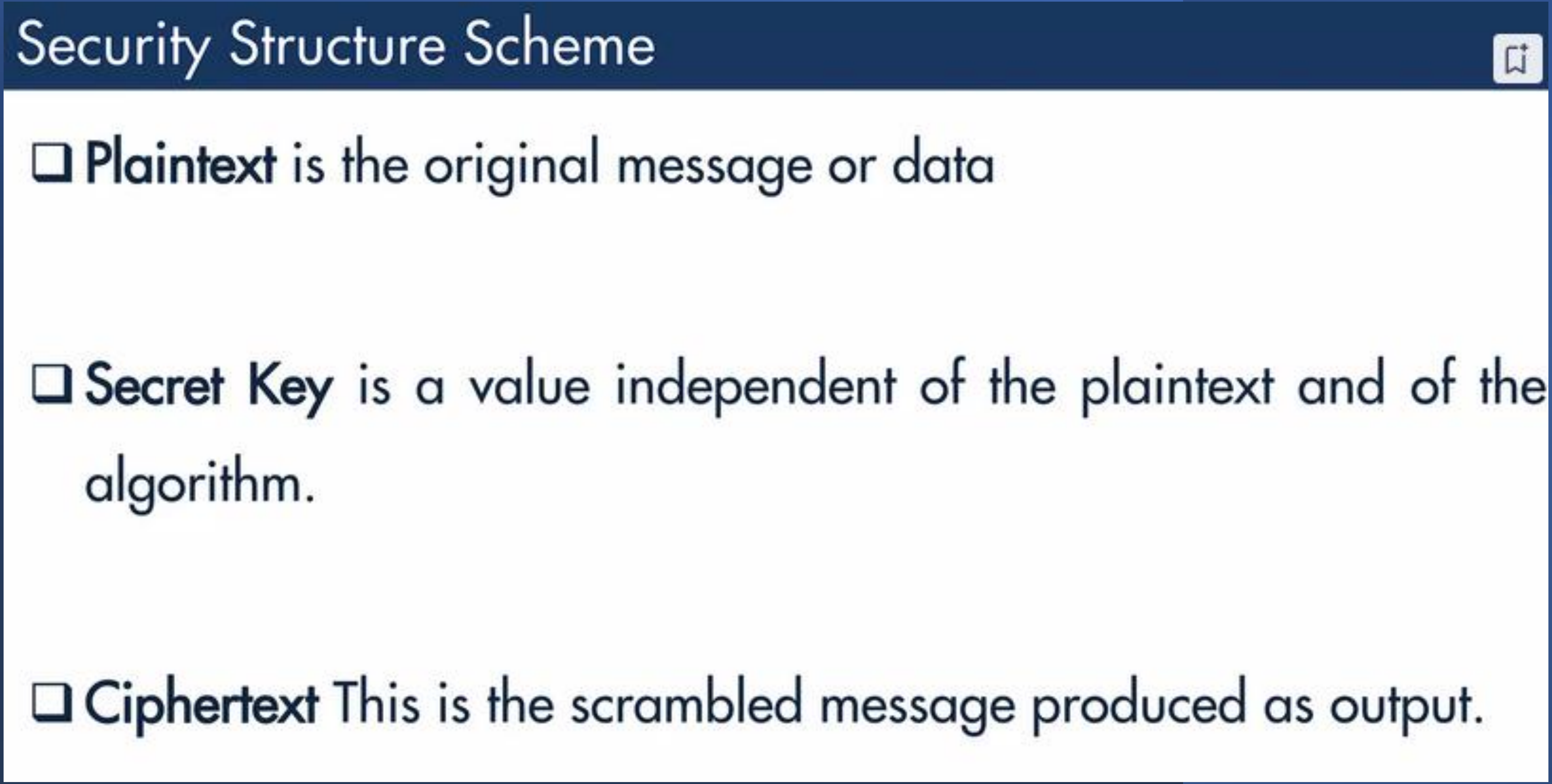
Ciphertext

Ciphertext

Key

Decryption

Plaintext

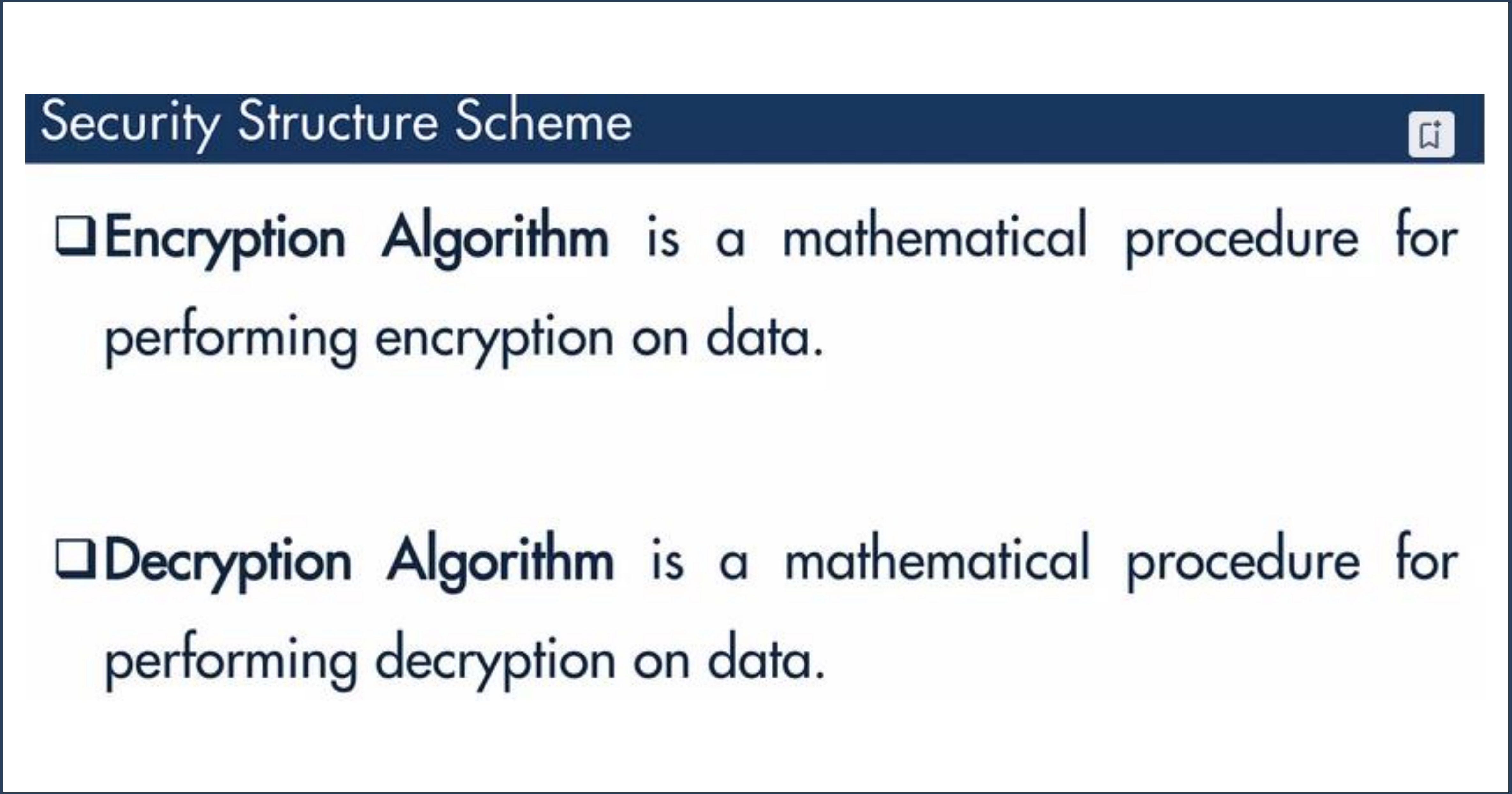


Security Structure Scheme

□ **Plaintext** is the original message or data

□ **Secret Key** is a value independent of the plaintext and of the algorithm.

□ **Ciphertext** This is the scrambled message produced as output.



Security Structure Scheme

❑ **Encryption Algorithm** is a mathematical procedure for performing encryption on data.

❑ **Decryption Algorithm** is a mathematical procedure for performing decryption on data.

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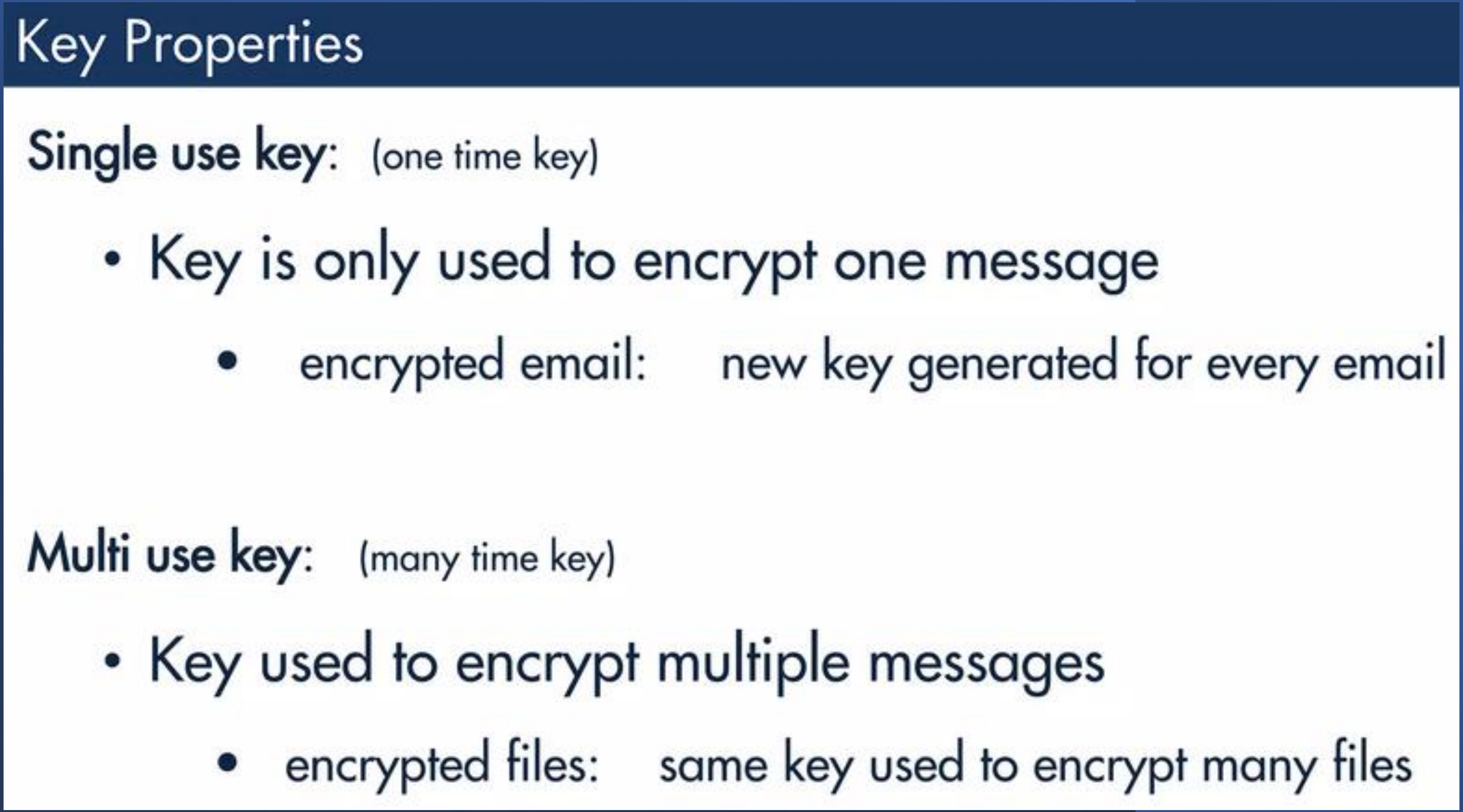
Key Properties

Shorter keys = faster processing, but less secure

Longer keys = slower processing, but more secure



Key Properties

Single use key: (one time key)

- Key is only used to encrypt one message
  - encrypted email: new key generated for every email

Multi use key: (many time key)

- Key used to encrypt multiple messages
  - encrypted files: same key used to encrypt many files

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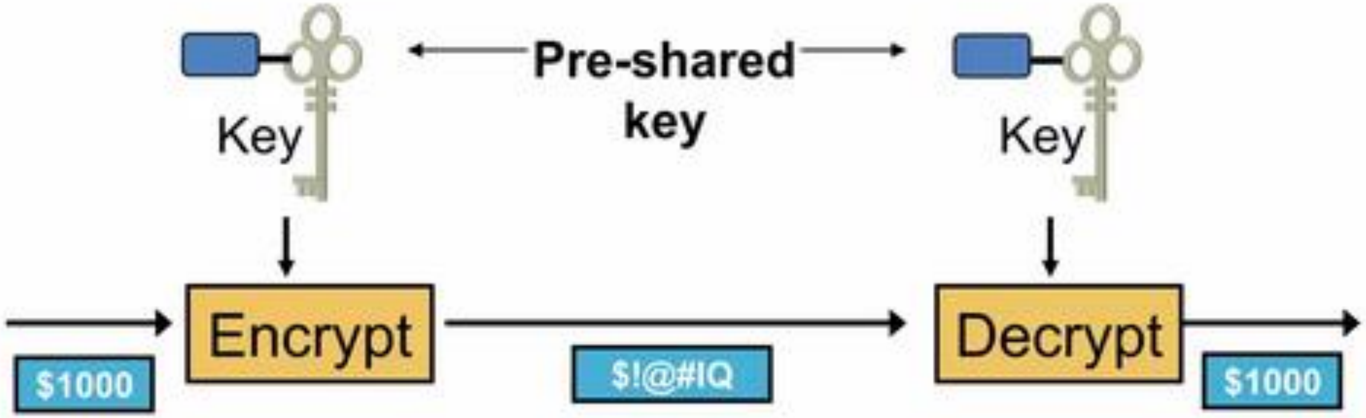
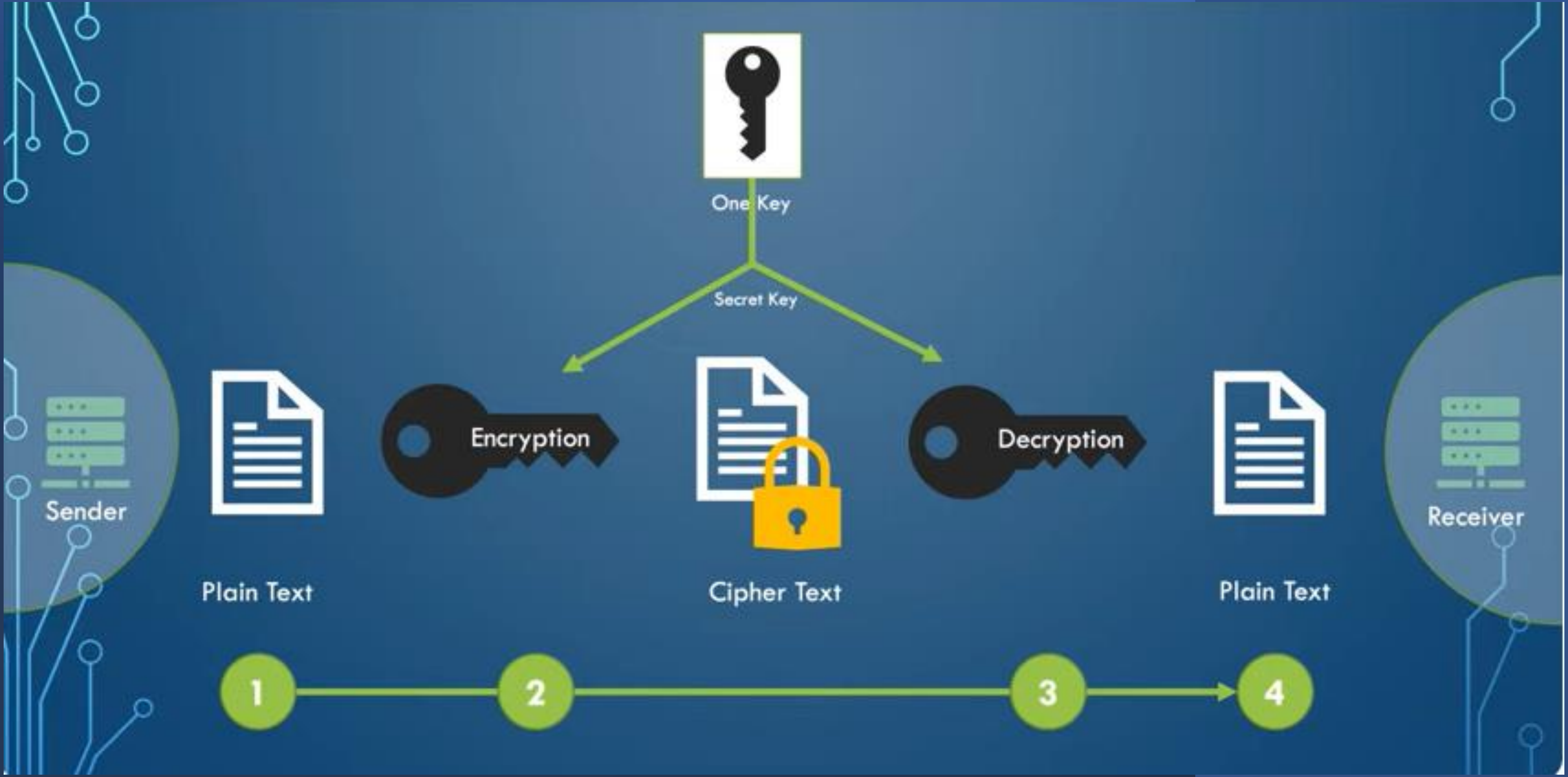
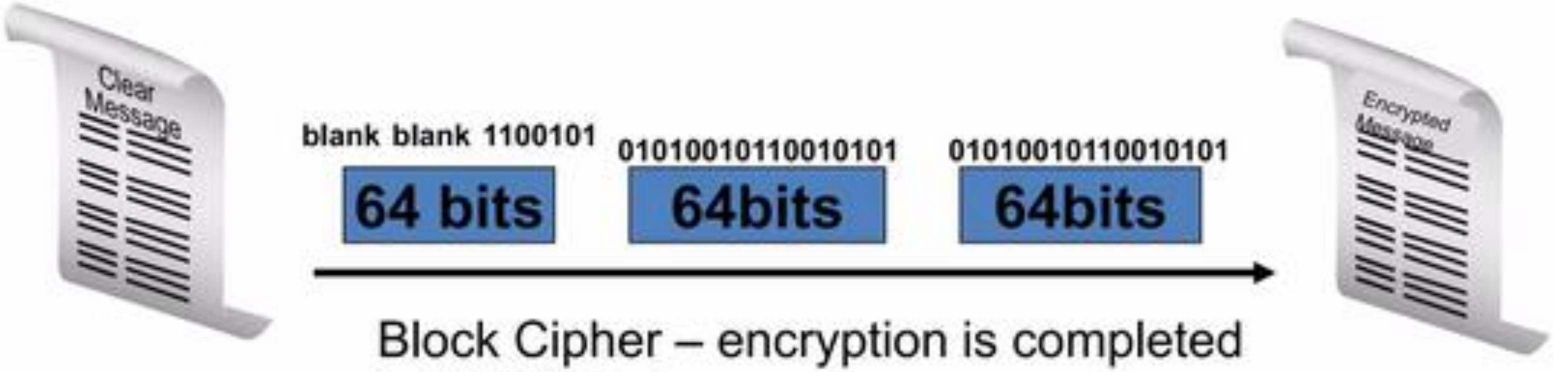
Symmetric Encryption



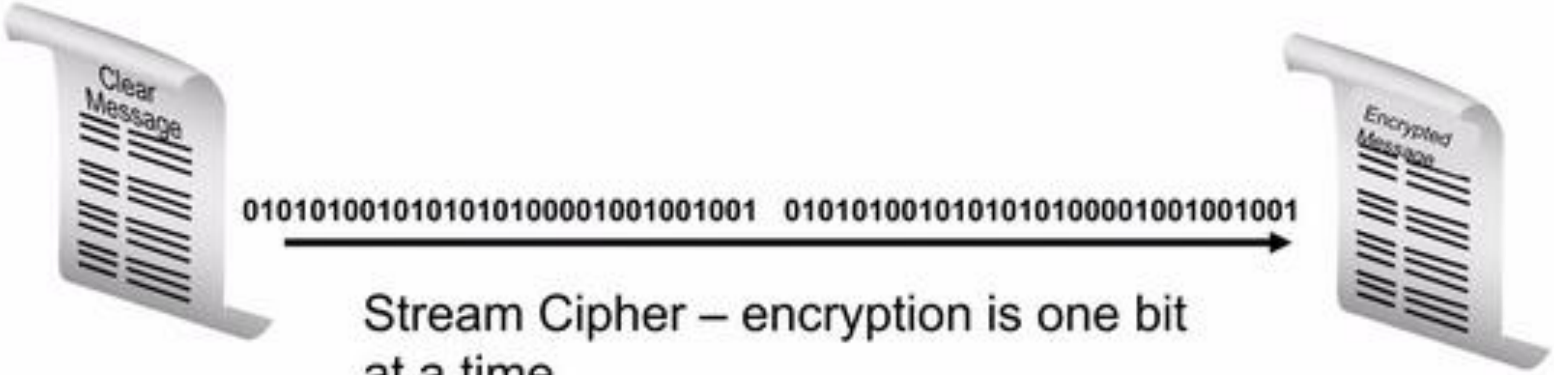
- Best known as shared-secret key algorithms
- The usual key length is 80 - 256 bits
- A sender and receiver must share a secret key
- Faster processing because they use simple mathematical operations.
- Examples include DES, 3DES, AES, IDEA, RC2/4/5/6, and Blowfish.


One Key
Secret Key
Sender
Plain Text
Encryption
Cipher Text
Decryption
Plain Text
Receiver
1
2
3
4

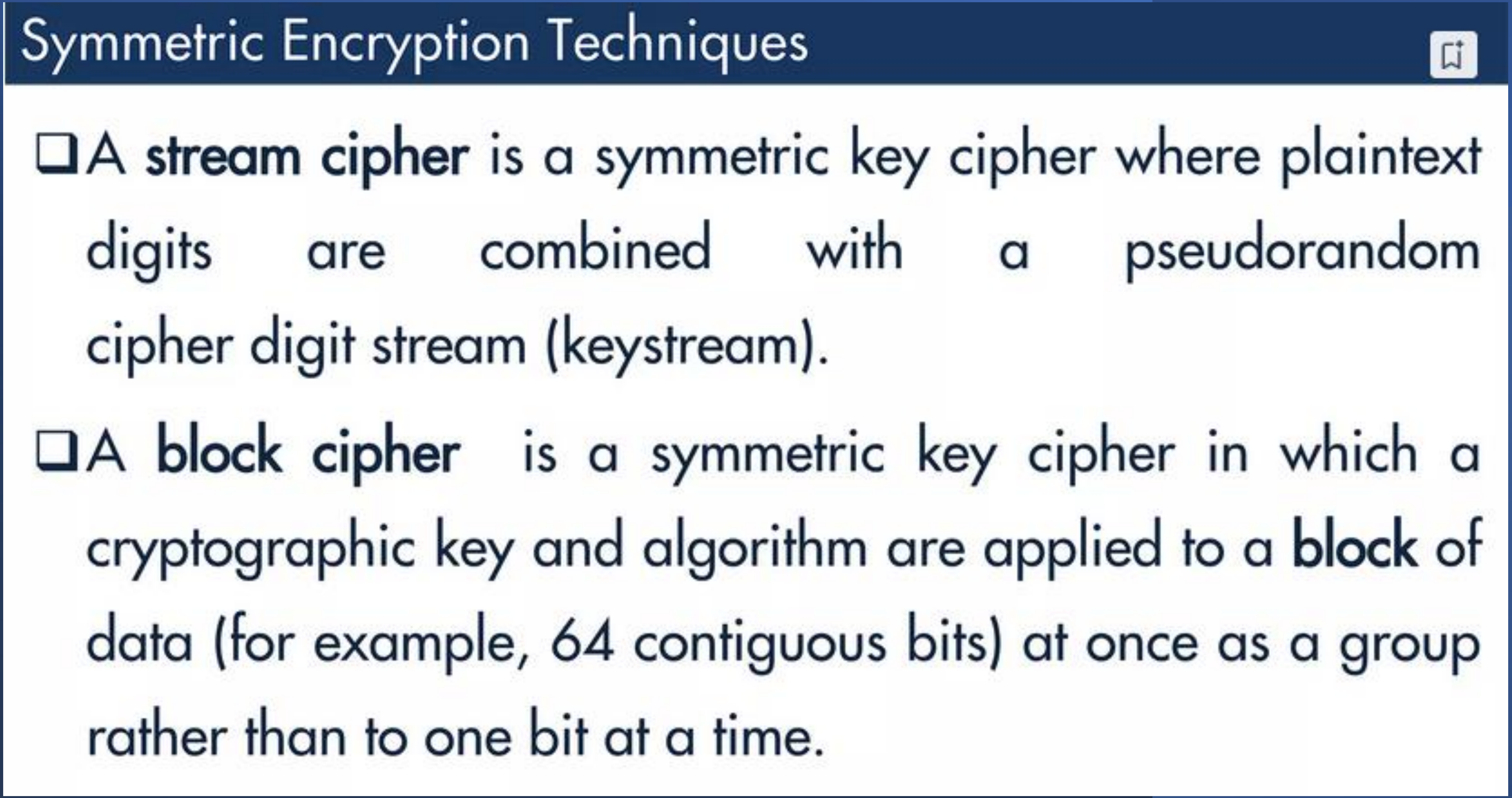
Symmetric Encryption Techniques



Block Cipher – encryption is completed in 64 bit blocks



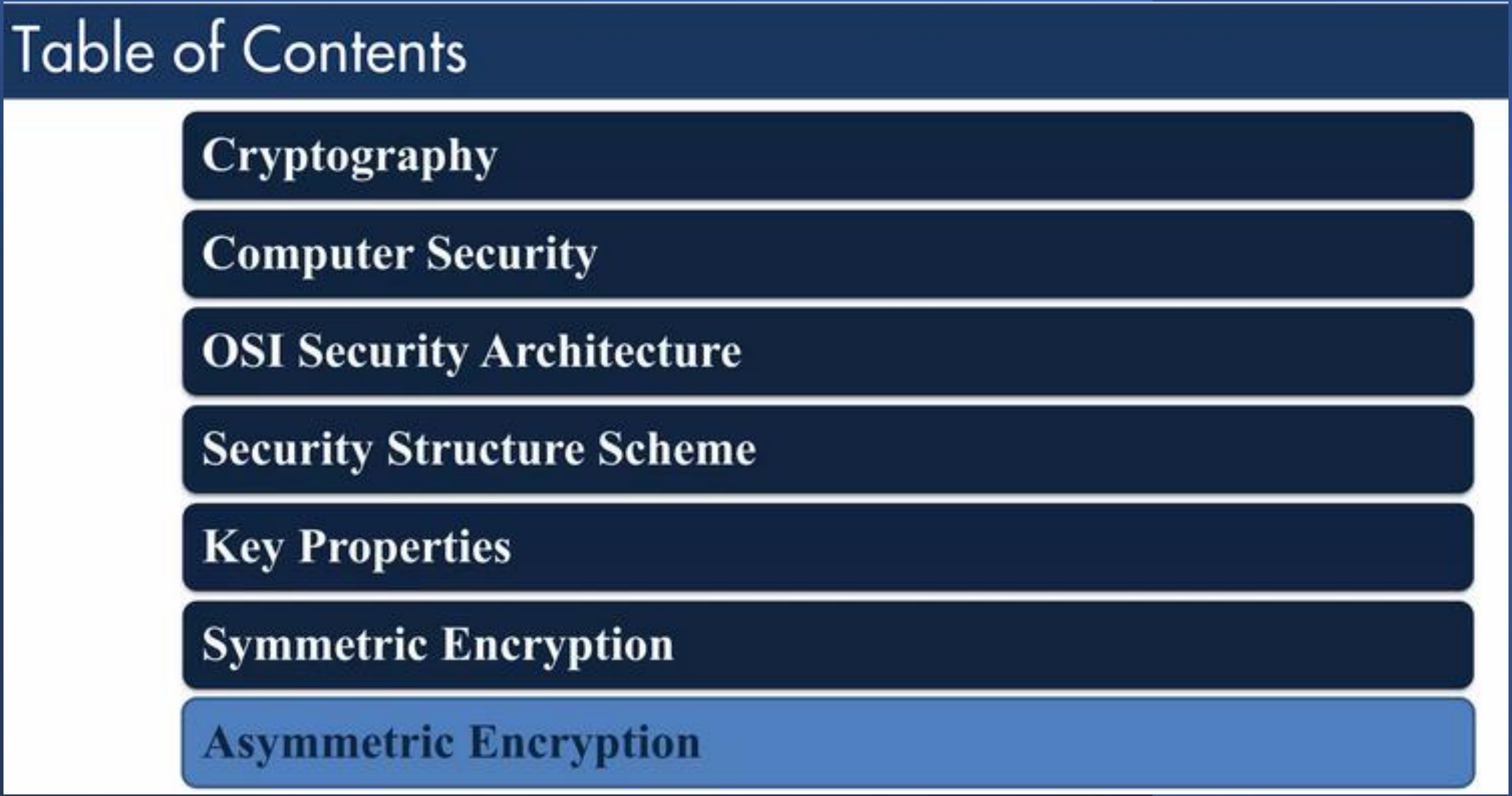
Stream Cipher – encryption is one bit at a time



Symmetric Encryption Techniques

❑ A **stream cipher** is a symmetric key cipher where plaintext digits are combined with a pseudorandom cipher digit stream (keystream).

❑ A **block cipher** is a symmetric key cipher in which a cryptographic key and algorithm are applied to a **block** of data (for example, 64 contiguous bits) at once as a group rather than to one bit at a time.



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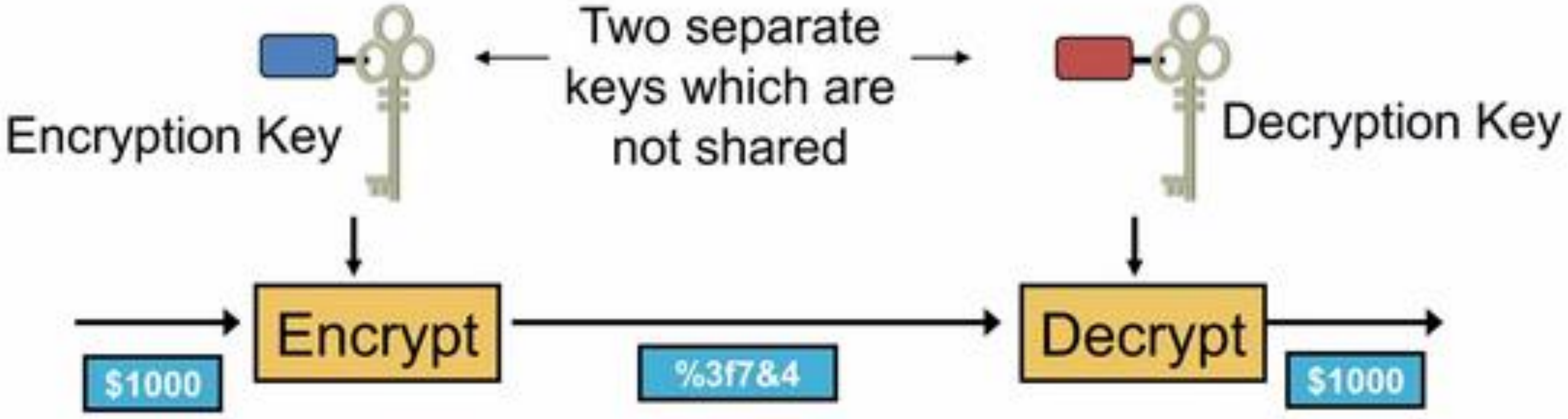
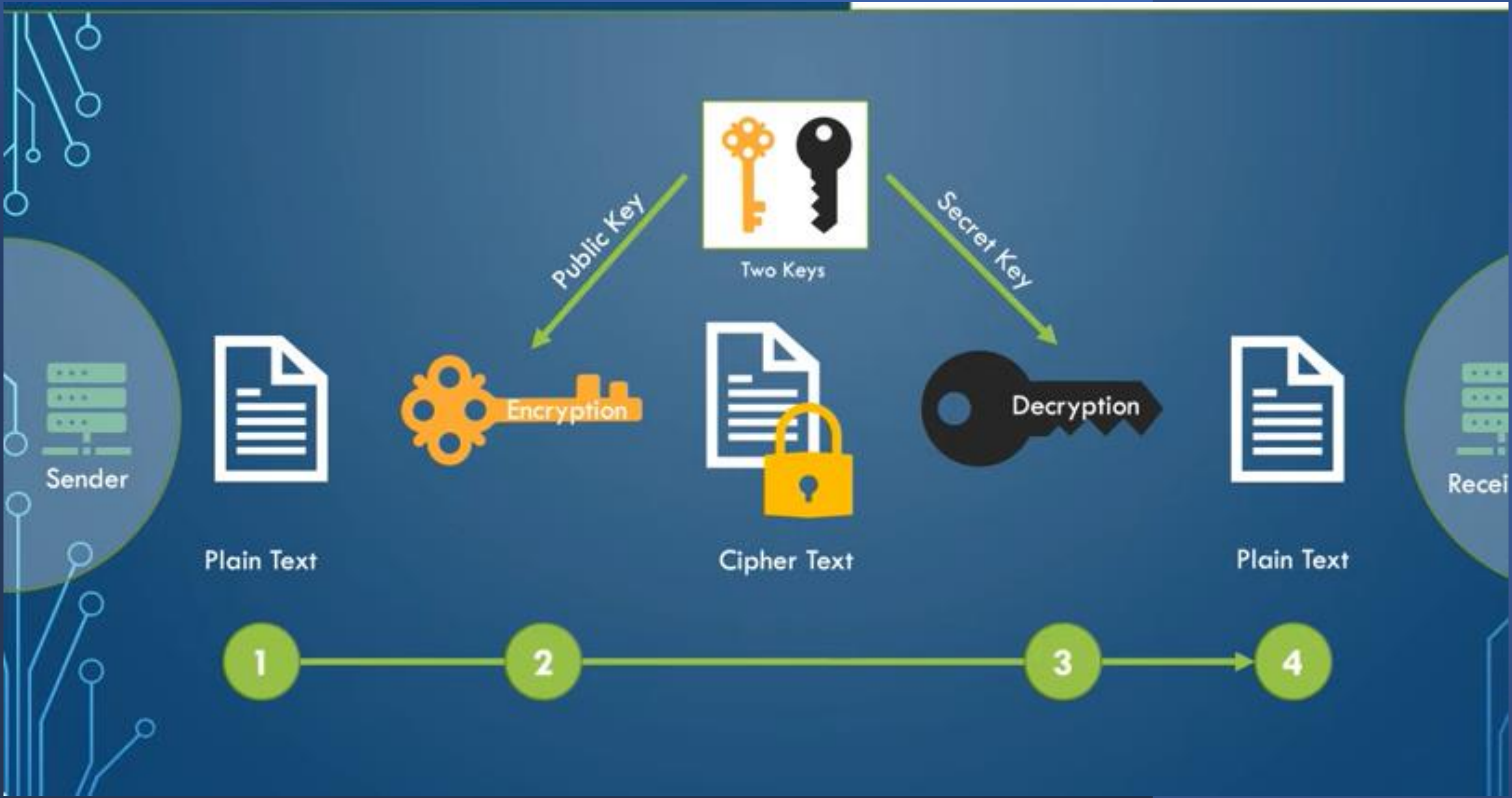
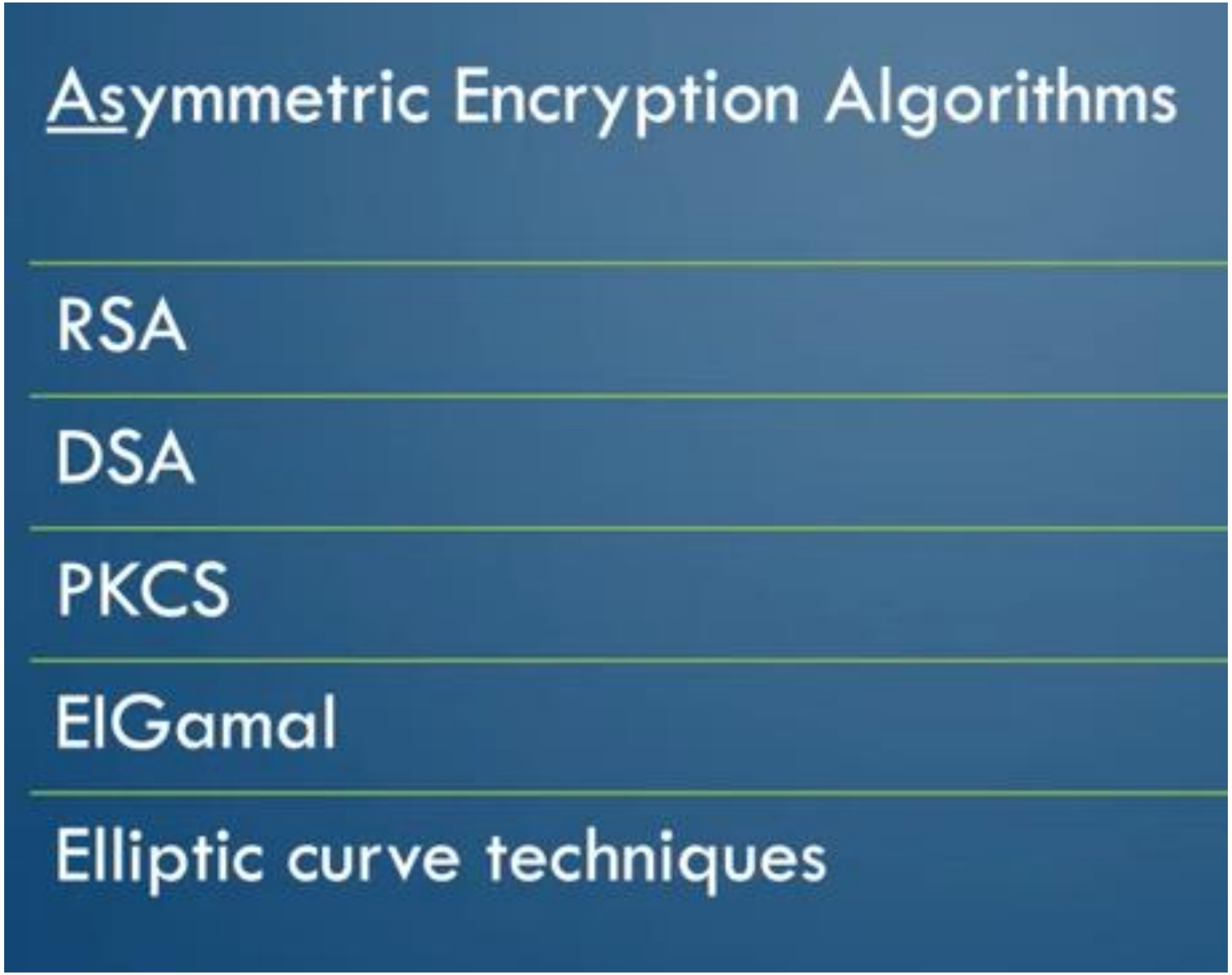
Asymmetric Encryption



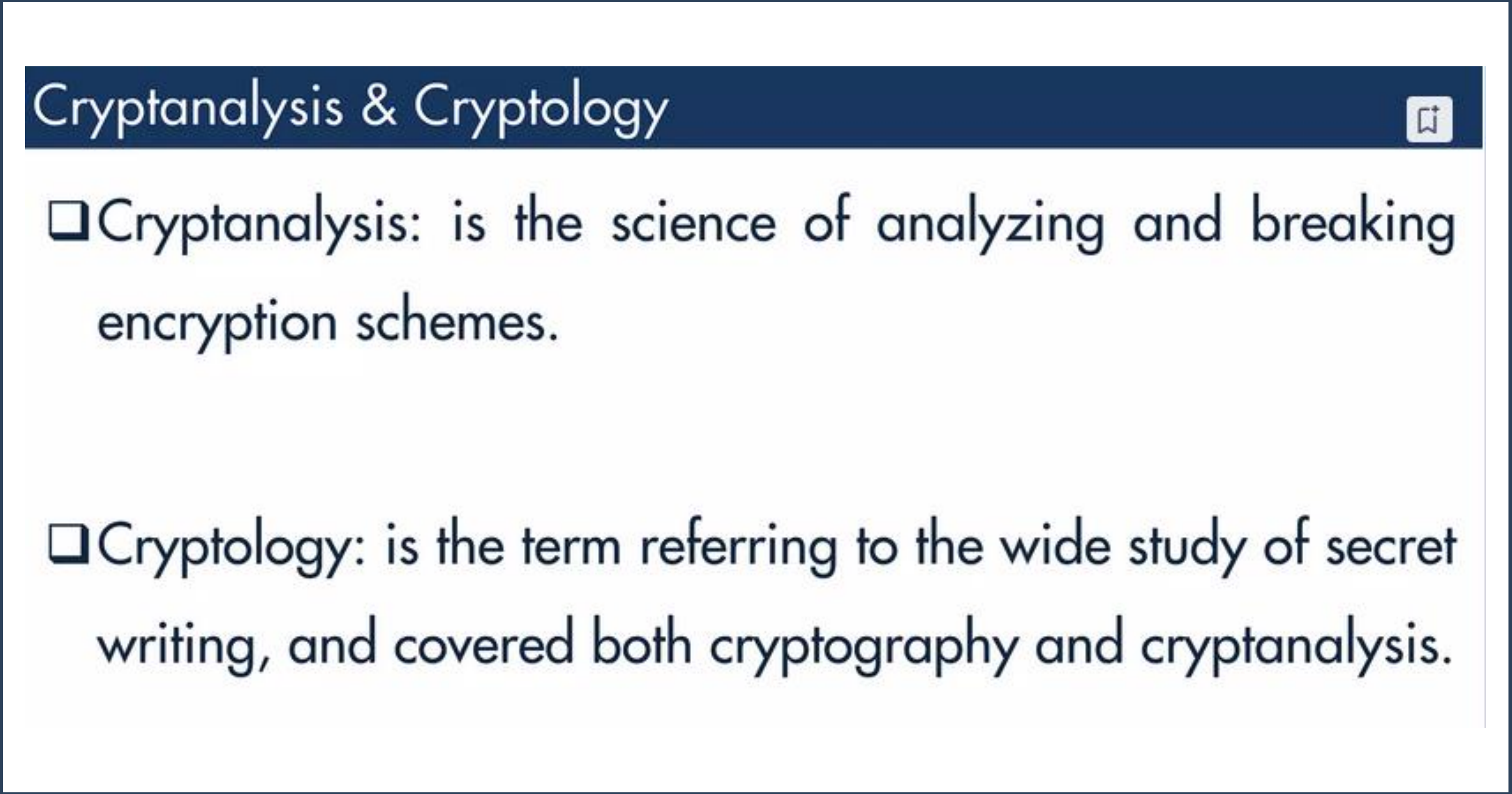
- Also known as public key algorithms
- The usual key length is 512–4096 bits
- A sender and receiver do not share a secret key
- Relatively slow because they are based on difficult computational algorithms


Two Keys
Public Key
Secret Key
Sender
Plain Text
Encryption
Cipher Text
Decryption
Plain Text
Recei
1
2
3
4



Asymmetric Encryption Algorithms

- RSA
- DSA
- PKCS
- ElGamal
- Elliptic curve techniques



Cryptanalysis & Cryptology

❑ Cryptanalysis: is the science of analyzing and breaking encryption schemes.

❑ Cryptology: is the term referring to the wide study of secret writing, and covered both cryptography and cryptanalysis.