

Security, Privacy & Integrity

AS Computer Science • Topic 6

A-Level Computer Science



Security, Privacy & Integrity

What we will cover

- 1 Security, privacy & integrity
- 2 Threats
- 3 Security measures
- 4 Protecting the data
- 5 Data integrity
- 6 Recap



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Three ideas

Security, Privacy & Integrity

└ Three ideas

Three different ideas

security 安全

protect data from
unauthorised
access or change

privacy 隐私

who is allowed to
see personal data

integrity 完整性

data is accurate
& complete,
not corrupted

2

Threats

Security, Privacy & Integrity

└ Threats

Malware

two ways **malware** 恶意软件 behaves

self-spreading 自我传播

- virus 病毒
- worm 蠕虫

spreads copies on its own

hidden / disguised 伪装

- Trojan 木马
- spyware 间谍软件
- ransomware 勒索软件
- adware 广告软件

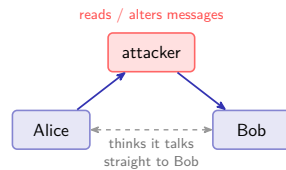
Social and network attacks

Tricking people:

- **phishing** 网络钓鱼 – fake emails/sites
- **pharming** 域名欺骗 – redirect to a fake site

On the network:

- **DoS / DDoS** 拒绝服务 – flood a server
- **man-in-the-middle** 中间人攻击 – relay/alter messages



3 Security measures

Security measures



- **standalone:** password, **antivirus** 杀毒软件, updates, **backup** 备份, **encryption** 加密
- **networked:** + **firewall** 防火墙, permissions, **audit logs** 审计日志
- **internet:** **VPN** 虚拟专用网, HTTPS/TLS, **digital signatures** 数字签名

Match the measure to the threat



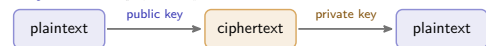
4 Protecting the data

Encryption

symmetric 对称加密



asymmetric 非对称加密



- **symmetric** 对称加密: one shared key locks & unlocks (AES)
- **asymmetric** 非对称加密: **public key** 公钥 locks, **private key** 私钥 unlocks (RSA)

Authentication

Three factors – strongest combined

(two-factor 双因素认证):

- **know** – a password
- **have** – a token or phone code
- **are** – **biometrics** 生物识别 (fingerprint, face)



"something you have"

5 Data integrity

Validation vs verification

validation 验证

"is the data sensible?"

- range / type / format
- check digit

catches nonsense data

verification 核对

"was it copied correctly?"

- double entry
- parity / checksum

catches copying errors

Verification on transfer – parity

even parity:

0	1	1	0	1	1	0	0
---	---	---	---	---	---	---	---

 number of 1s = 4 (even)
parity bit 7 data bits

odd parity:

1	1	1	0	1	1	0	0
---	---	---	---	---	---	---	---

 number of 1s = 5 (odd)

parity check 奇偶校验: count the 1s – a flipped bit changes the count, so the error shows up.

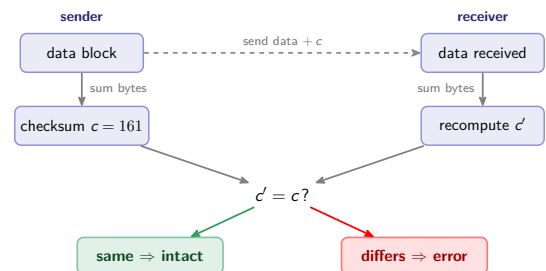
Worked example: locate the flipped bit

	1	2	3	4	5	6	7	8	
byte 1	1	0	1	1	0	1	0	0	
byte 2	0	1	1	0	0	1	1	1	odd!
byte 3	1	1	0	1	1	0	0	0	
byte 4	0	0	1	1	0	1	1	0	
parity byte	0	0	1	1	0	1	0	1	odd!

- sent with **even** parity in every row **and** column
- receiver counts: row 2 odd, column 5 odd
- the error sits **where they cross** – flip it back to 1

One parity bit only **detects** an error; a parity **block** locates it – so it can be corrected.

Verification on transfer – checksum



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Recap

Security, Privacy & Integrity
└─Recap

Topic 6 – key takeaways

1 Three ideas

security, privacy, integrity differ

2 Threats

malware, phishing, DoS, man-in-the-middle

3 Encryption

symmetric (one key) vs
asymmetric (key pair)

4 Integrity

validation = sensible; verification
= copied right

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└─Recap

Check yourself

- 1 Which malware spreads over a network with no user action?
- 2 Which key decrypts in asymmetric encryption?
- 3 Is a range check validation or verification?
- 4 What does a parity bit detect?



Answers 1. a worm 2. the private key 3. validation 4. a single-bit error