01 Introduction

2020 Spring
Information Security

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January 10, 2020

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Computer Security

In the beginning, there is no Security issue.

Why?

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Why?

How can you attack a network system that crashes with only two characters transmission?

Definition

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 resources** (includes hardware, software, firmware, information/data and telecommunication).

— NIST Computer Security Handbook

CIA

- **Confidentiality**:
  - Data confidentiality.
  - Privacy.
- **Integrity**:
  - Data integrity.
  - System integrity.
- **Availability**

What is an Information System?

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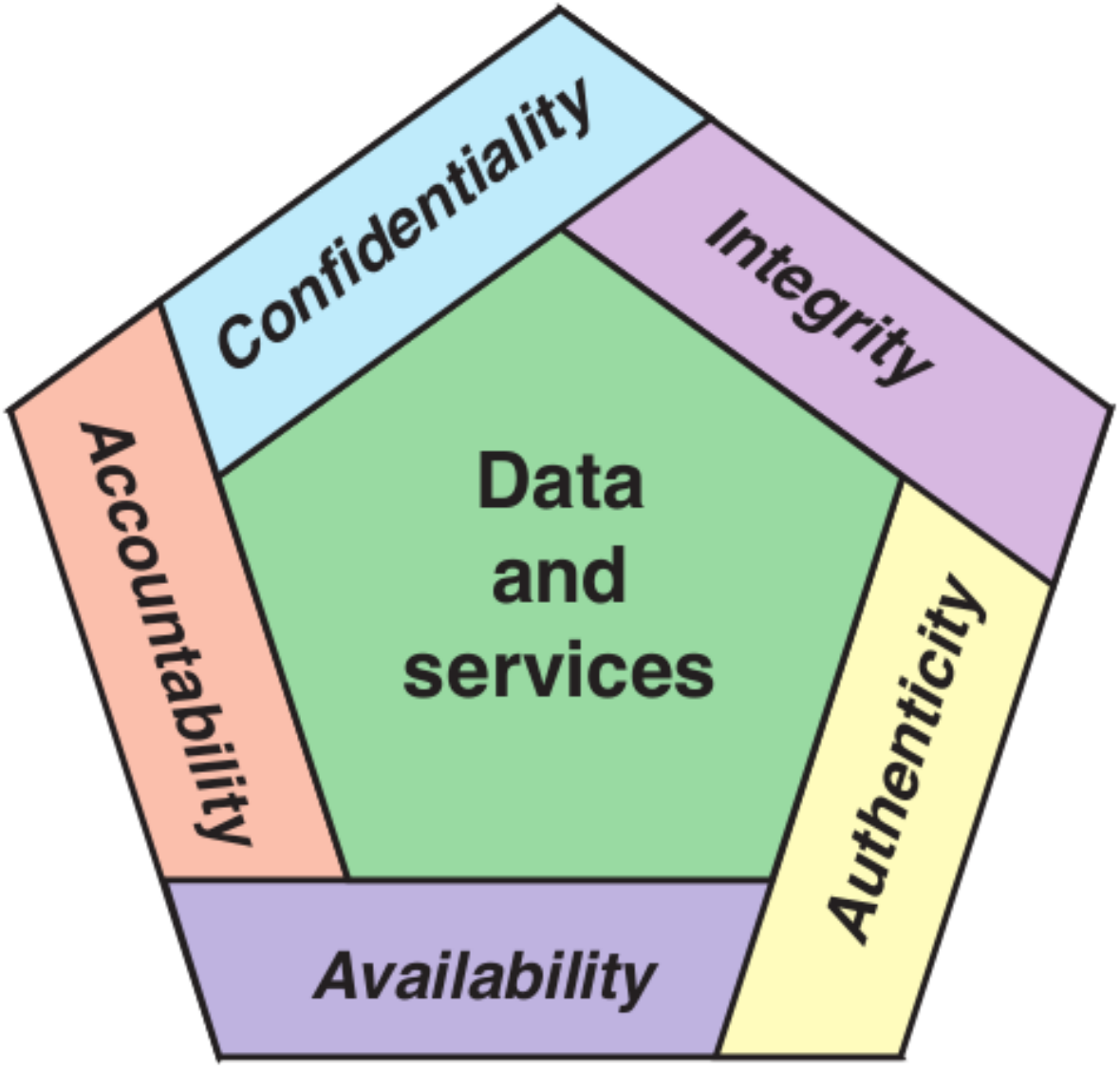
So, if you want to be an information security expert, you have to be an information expert first.

Other Two Security Factors

- **Authenticity**.
- **Accountability**.

Security Requirements



About This Course

- I will give you some tools (cryptography) first.
- Then I will show you how attacks happen against previous five concepts.
- Finally, we will see how to protect with tools I give you.

OSI Security Architecture

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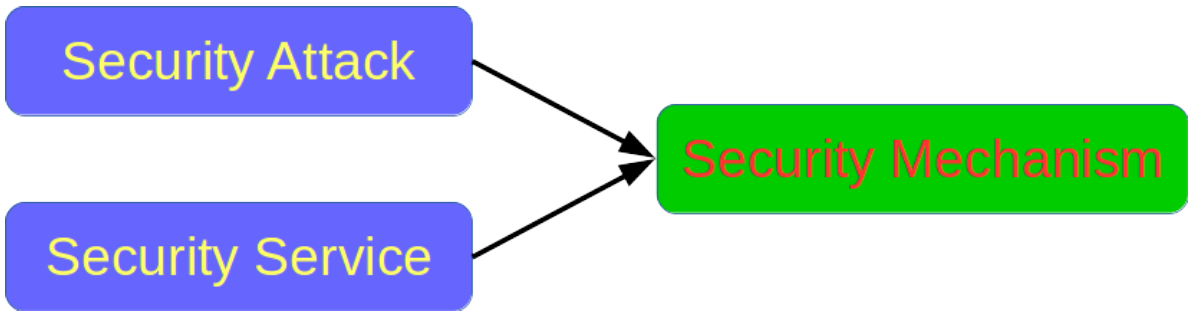
ITU-T [1] Recommendation X.800, Security Architecture for OSI defines systematic way to

- Defining the requirements for security.
- Characterizing the approaches to satisfying those requirements.



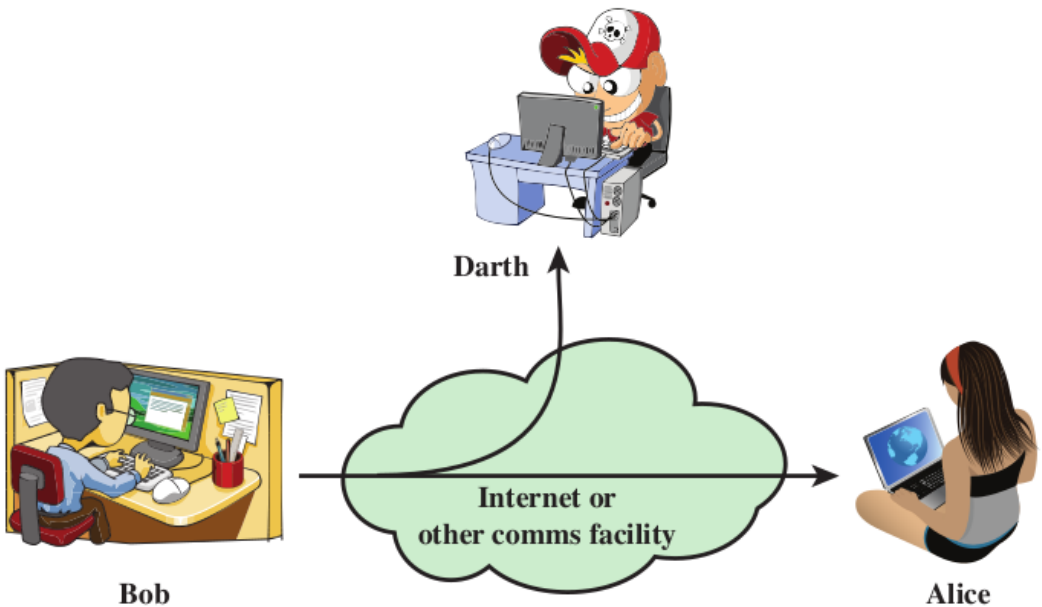
[1] The International Telecommunication Union (ITU) Telecommunication Standardization Sector (ITU-T) is a United Nations-sponsored agency that develops standards, called Recommendations, relating to telecommunications and to open systems interconnection (OSI).

Security Attacks

1. Passive attacks.
2. Active attacks.

Passive Attack

- Common attack:
  - Release of message content.
  - Traffic analysis.
- Hard to detect.
- Common solution: **encryption**.

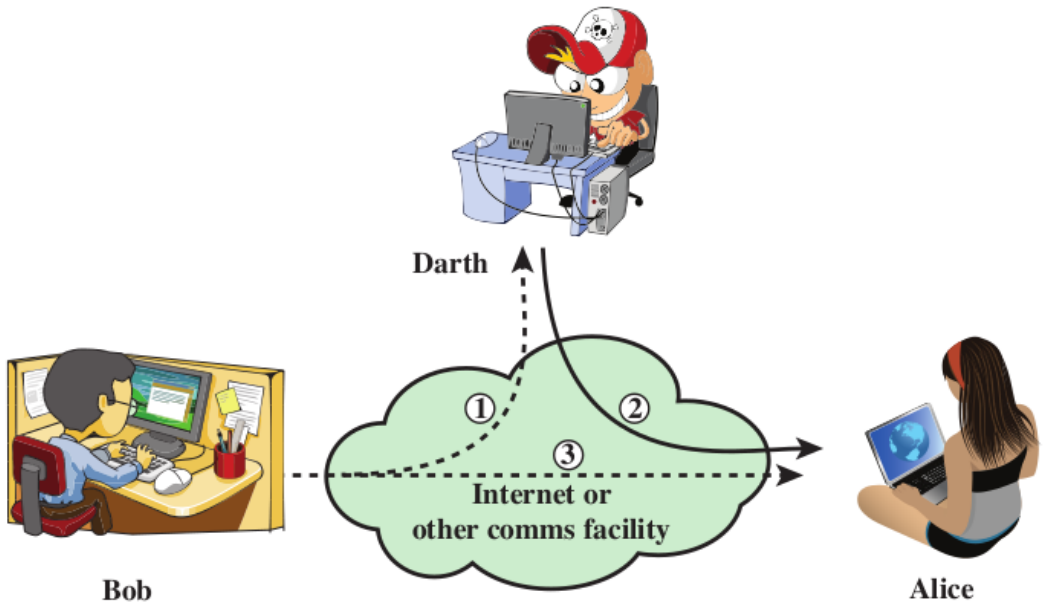


Quiz

Would you please tell me how to eavesdrop the communication between Alice and Bob?

Active Attack

- Common attack:
  - Masquerade.
  - Replay.
  - Message modification.
  - Denial of service.
- Hard to prevent.
- Common solution: **detection** and **recovery**.



Security Service

X.800 Recommendation divides security services into 5 categories:

1. Authentication
2. Access Control.
3. Data Confidentiality.
4. Data Integrity.
5. Non-Repudiation.

Authentication

Make sure who you are and who he/she is.

- Peer entity authentication.
- Data-origin authentication.

Access Control

You can only do what you are allowed.

Data Confidentiality

Data cannot be accessed by unauthorized entities.

- Connection confidentiality.
- Connectionless confidentiality.
- Selective-field confidentiality.
- Traffic-flow confidentiality.

Data Integrity

Data received are exactly as sent.

- Connection integrity with recovery.
- Connection integrity without recovery.
- Connectionless integrity.
- Selective-field connection integrity.
- Selective-field connectionless integrity.

Non-Repudiation

You cannot deny what you have done.

- Non-repudiation source.
- Non-repudiation destination.

Security Mechanism

Specific Security Mechanism:

- Encipherment.
- Digital signature.
- Access control.
- Data integrity.
- Authentication exchange.
- Traffic padding.
- Routing control.
- Notarization.

Pervasive Security Mechanism:

- Trusted functionality.
- Security label.
- Event detection.
- Security audit trail.
- Security recovery.

Fundamental Security Design Principle

Economy of Mechanism

KISS: Keep it simple and stupid.

Fail-safe Defaults

Default setting should be Safe.

EX: Default firewall rule should be **Reject**.

Complete Mediation

Every access should be checked.

EX: sudo cache.

Open Design

The algorithm should be opened so that can be reviewed by other experts.

EX: 國安局。

Separation of Privilege

Multiple attributes are required.

Least Privilege

Should operate using the least set of privileges necessary to perform the task.

EX: Linux root.

Least Common Mechanism

Mechanisms used to access resources should not be shared.

Reduce the amount of HW and SW.

Psychological Acceptability

Frankly speaking $\cdots$almost impossible.

Isolation

EX:

- DMZ.
- Sandbox.
- Hinet data center isolation.

Modularity

Using existed security functions.

Layering

Multiple overlapping protection.

Layering

Multiple overlapping protection.

Quiz: Why one layer protection is not enough??

Least Astonishment

Frankly speaking ···almost impossible.

Should I Remember All These Terms?

- The Above Definitions Come From the Textbook.
- Remember those definitions can let you have common language with others, but nothing good to your skills.
- XXX Security:
  - If you have no knowledge about XXX, how can you know how to attack it or how to protect it?

Appendix: Hacker

Hacker

In computing, a hacker is any skilled computer expert that uses their technical knowledge to overcome a problem.

How to be skilled?

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How to be skilled? **Interests, Interests Interests.**

Hacker Ethics

- Access to computers and **anything** that might teach you something about the way the world works should be unlimited and total.
- All information should be **free**.
- **Mistrust authority**.
- Hackers should be **judged by their hacking**, not bogus criteria such as degrees, age, race, or position.
- You can create **art and beauty** on a computer.
- Computers can change your life for the**better**.

Appendix: 很壞很壞的駭客

Joke

https://blog.longwin.com.tw/2005/05/badbadcrack_joke/

Appendix: How To Ask Questions The Smart Way

Reference Link

http://www.catb.org/~esr/faqs/smart-questions.html

Questions that You Should NOT ASK

- Where can I find program or resource X?
- How can I use X to do Y?
- How can I configure my shell prompt?
- Can I convert an AcmeCorp document into a TeX file using the Bass-o-matic file converter?
- My program, configuration, SQL statement doesn't work
- I'm having problems with my Windows machine. Can you help?
- My program doesn't work. I think system facility X is broken.
- I'm having problems installing Linux or X. Can you help?
- How can I crack root/steal channel-ops privileges/read someone's e-mail?