Information systems Security

Computer Security

Computer security deals with [computer related] *assets* that are subject to a variety of **Threats** and /for which/ various**Measures** are taken to *protect* those *assets*

also COMPUTER SECURITY is defined:

- the protection of:
  - **Integrity**
  - **Availability**
  - **Confidentiality**

Network Security

[**Measures to *protect* data *during* their *transmission***].

- Describes the **policie** an **procedures** implemented by **network admin**
  - to avoid and keep track of **unauthorized**:
    - access
    - exploitation
    - modification
    - DON [*Denial Of Network*]
    - DONR [*Denial Of Network Resources*]

Internet Security

[**Measure to *protect* data *during* their *transmission***].

- deals specifically with/ *Internet-based* **Threats**
- including:
  - **hacking** : Unauthorized gain access to system -or- accout.
  - **malware** : viruses or other malicious software.

Network and Internet Security

consists of measures to :

- deter
- prevent
- detect
- correct **security violations** that involves the transmission of information.

Information security [definition]

the protection of **info systems** and it's **resources** *againist*:

1. accidental

2. intentional following actions:

- *disclosure* of **confiential data**
- *modification* of **data** -or- **programs**
- *destruction* of **data**, **software** -or- **hardware**

and **Ensuring non-repudiation**

info security [other def]

the *process* and *methodologies* keeping the info:

- **confidential**
- **available**
- **assuring it's integrity**

Computer Security Objectives [Three main keys]

1. CONFIDENTIALITY 2. INTEGRITY 3. AVAILABILITY

1. Confidentiality

ensure that :

- *Computer-related assets* are **accessed** only by **authorized parties**
- **ONLY** those who **have accesss** to something will *actually* get that **accesss**

confidentiality sometimes are called : `secrecy` or `privacy` **confidentiality covers:**

1. `Data confidentiality`: Assures that *private* or *confidential* info is not made *available* or *disclosed* to **Unauthorized entities**
2. `privacy`: Assures that individuals control or influence what *info* related to them may be **COLLECTED**.

2. Integrity

`Assest` can be **modified** ONLY by **authorized parties** -or- **in authorized ways**. **Data Integrity covers:**

1. `Data integrity`: Assures that info and programs are **modified** only in a *specified* and *authorized* manner.
2. `System integrity`: Assures that system **performs** it's **intended function** in a unimpaired manner.

3. Availability

`Assets` are `accesssible` to **authorized parties** at appropriate times. meaning the service isn't **denied to authorized parties.**

CIA triad

Confidentiality, **Integrity**, **Availability** are often referred to as **CIA triad**.

Additional security concepts besides CIA triad

1. Authenticity `def:` the property of being **genuine**, **verifiable**, and **Trusted**; *confidence* in tthe **Validity** of a transmission. **2. Accountability** `def:` the ability that actions of an **entity** is tracable **uniquely** to `that entity`

- this supports **nonrepudiation**, **deterence** and **fault isolation**

Non-repudiation `def:` the **sender** or **generator** of the info `cannot` deny that he did send or generate that info.

Access control ONLY **Authorized parties** can use specific resources.

Levels of impact from a breach

1. `low`
2. `moderate`
3. `high`

Countermeasures

`def:` is any means taken *to deal* with a **security attack**

> ideally, a countermeasure can be devised to **prevent** attacks

- when **prevention** fail the goal is:
  - **detect** the attack
  - **recover** from the *effects* of the attack.

Means used to deal with security attack

1. `prevention`
2. `detection`
3. `recovery`

Security Terminology

- `Adversary [threat agent]`: an entity that:
  - **attacks** the system
  - is a **threat** to the system
- `Attack`: An **assault** on *system security* that comes from :
  - **intelligent** threat.[could be defined as: *threat in action*]
- `Countermeasure`: An **action**, **device**, **procedure** that
  - reduces a threat, vulnerability
  - preventing or eliminating attacks by minimizing it's harm.
- `Risk`: Expectation of loss expressed as a **probability** that:
  - a particular **threat**
  - will exploit a particular **vulnerability**
  - with a particular **harmful result**
- `security policy`: a set of rules that defines:
  - how a **system** -or- **organization** provides
  - security **services** to
  - protect:

        - sensitive system resources
        - critical system resources
- `System resource[Asset]`:
    - Data store by the system
    - services provided by the system
    - system capabilities:
        - processing power
        - communication bandwidth
    - hardware.
    - housing facility.
- `Threat`: **Potential** violation of security , that exist when a action that could breach security and cause harm.
- `vulnerability`: a **Flaw** or **weakness* in a system's design/implementation, or in system security policy.

Assets

1. `Hardware`
2. `Software`
3. `Data`
4. `Communication facilities and networks`

Computer and network assets with Threats example

	Availability	Confidentiality	Integrity
hardware	stolen, disable	unencrypted disk is stolen	
software	deleted	an authorized copy made	modified to:1. cause faliure 2. unintended task
data	deleted	read,analysis revealing underlying data	modified, fabricated
communication lines and networks	messages :deleted/destroyed [they]:renered unavailable	message: read, traffic pattern: observed	messages:modifies, delayed, reordered, duplicated,fabricated

Network Security Attacks

Types of network security attacks:

1. `passive attacks`: **learn** or **make use** of info from the system, that doesn't have an affect on the system.
2. `active attacks` : **altering** system resource or **affect** their operation

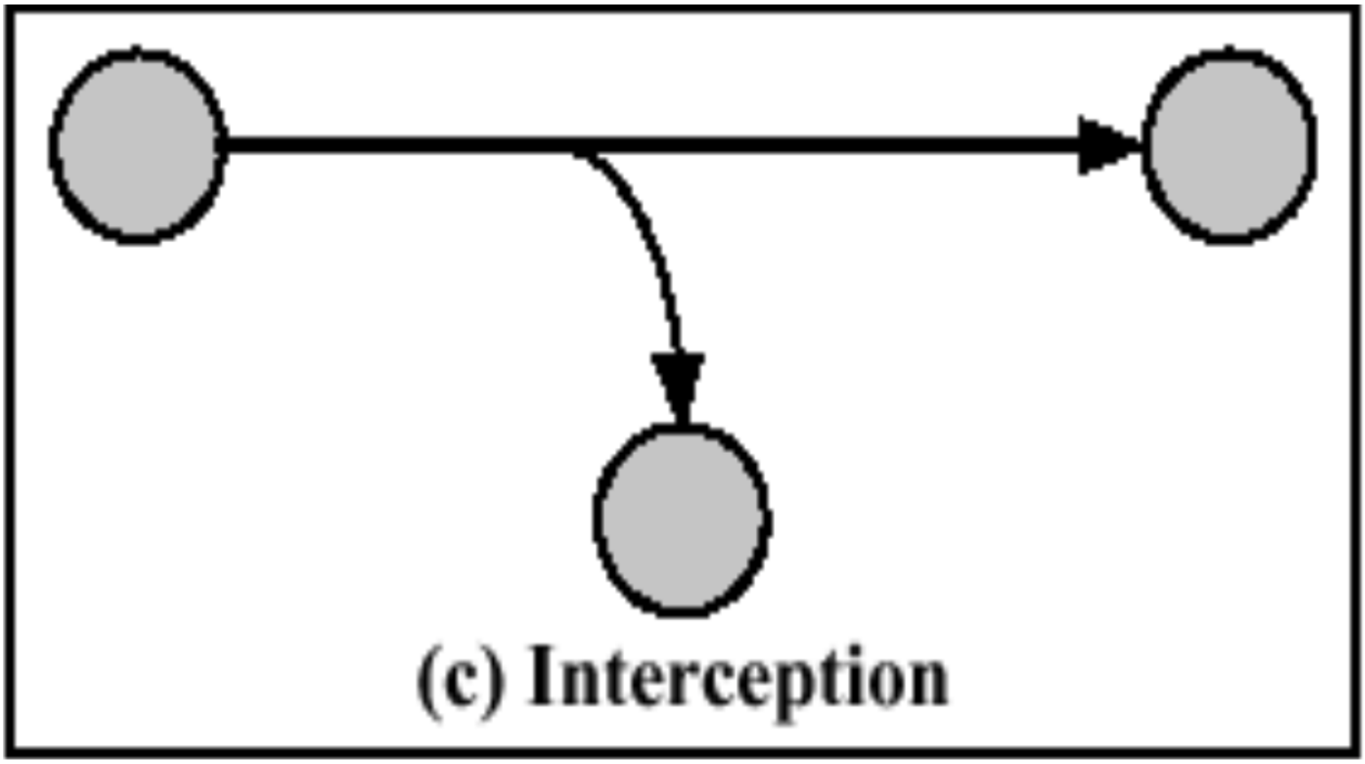
Types of threats:

1. `Interception` [**Passive Attack**]
2. `Interruption`
3. `Modification`
4. `Fabrication`

1. Interception (Eavesdropping)

> Attack on **Confidentiality**

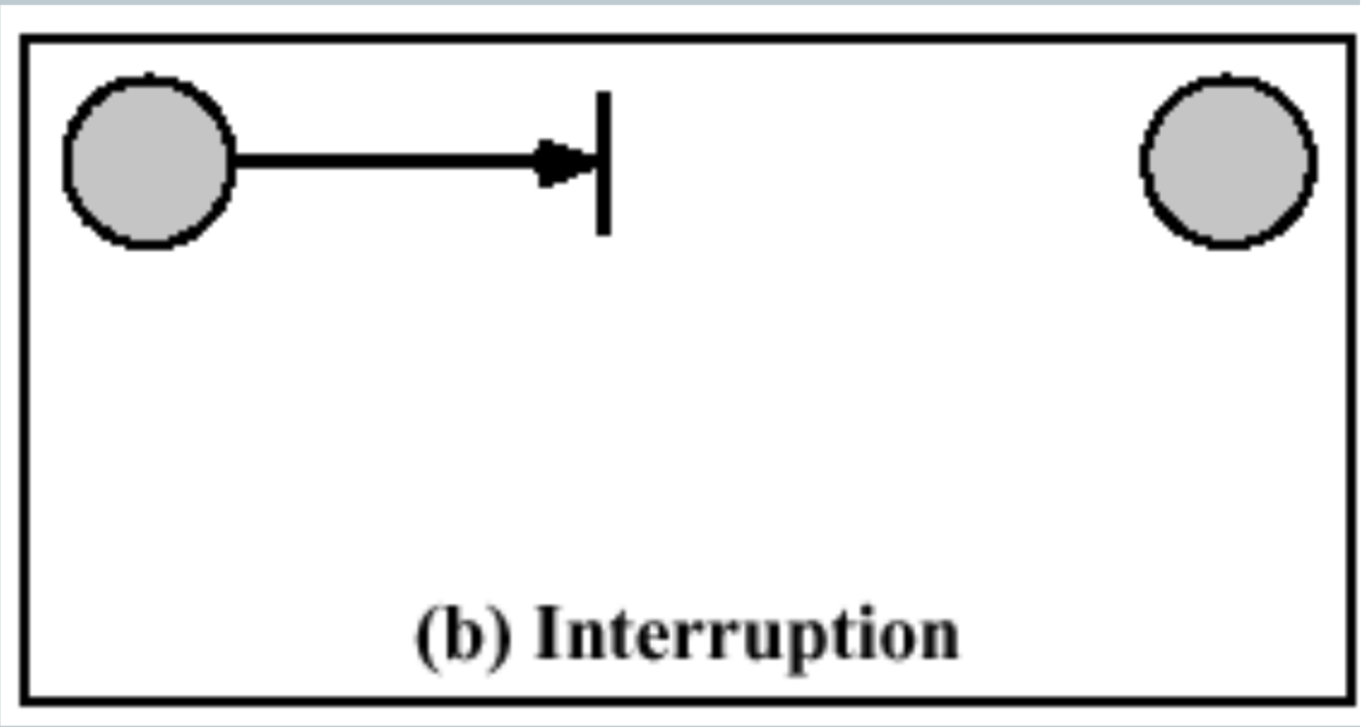
- Information disclosure/leakage. An unauthorized party gains access to an asset.
- unauthorized party could be:
  - `person`
  - `program`
  - `computer`



2. Interruption (Jamming)

> Attack on **Avalability**

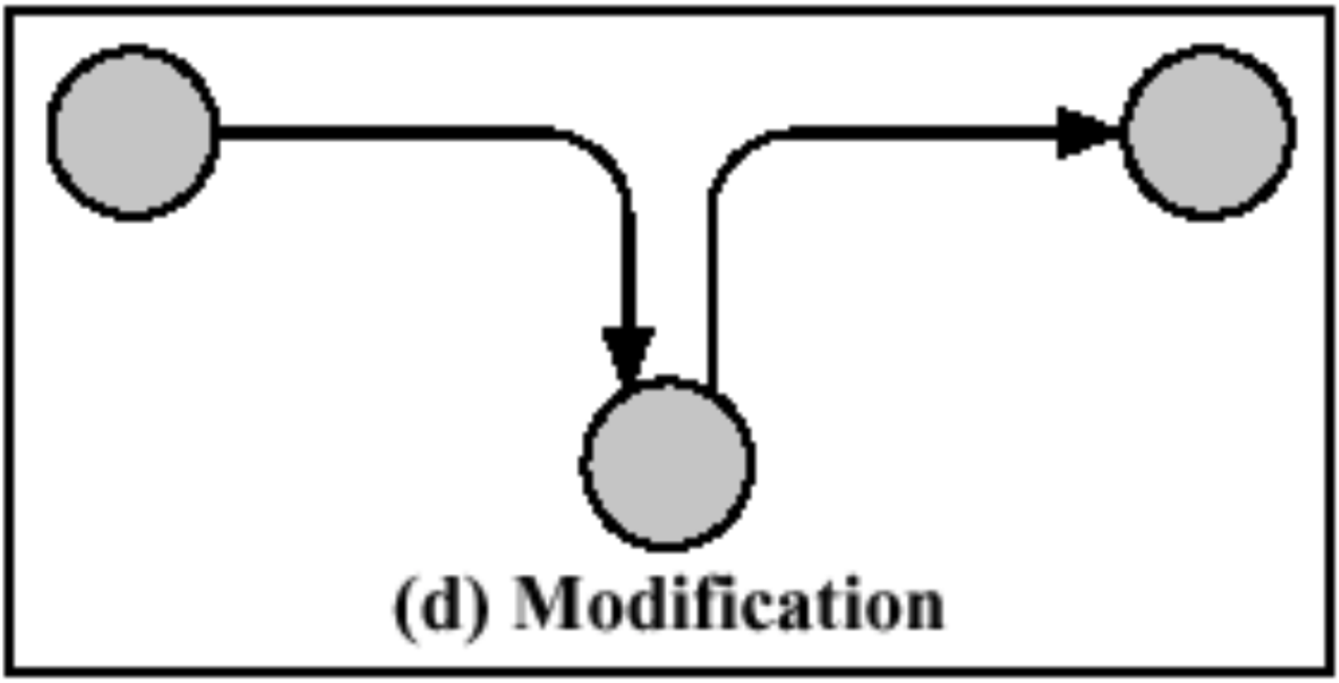
- Action of **preventing** a message from reaching its intended reciptient.
- An **asset** of the system is `destroyed` or becomes [`unavailable` or `unusable`].
- **DOS** - Denial Of Service Attack



3. Modification (Tampering)

> Attack on **Integrity**

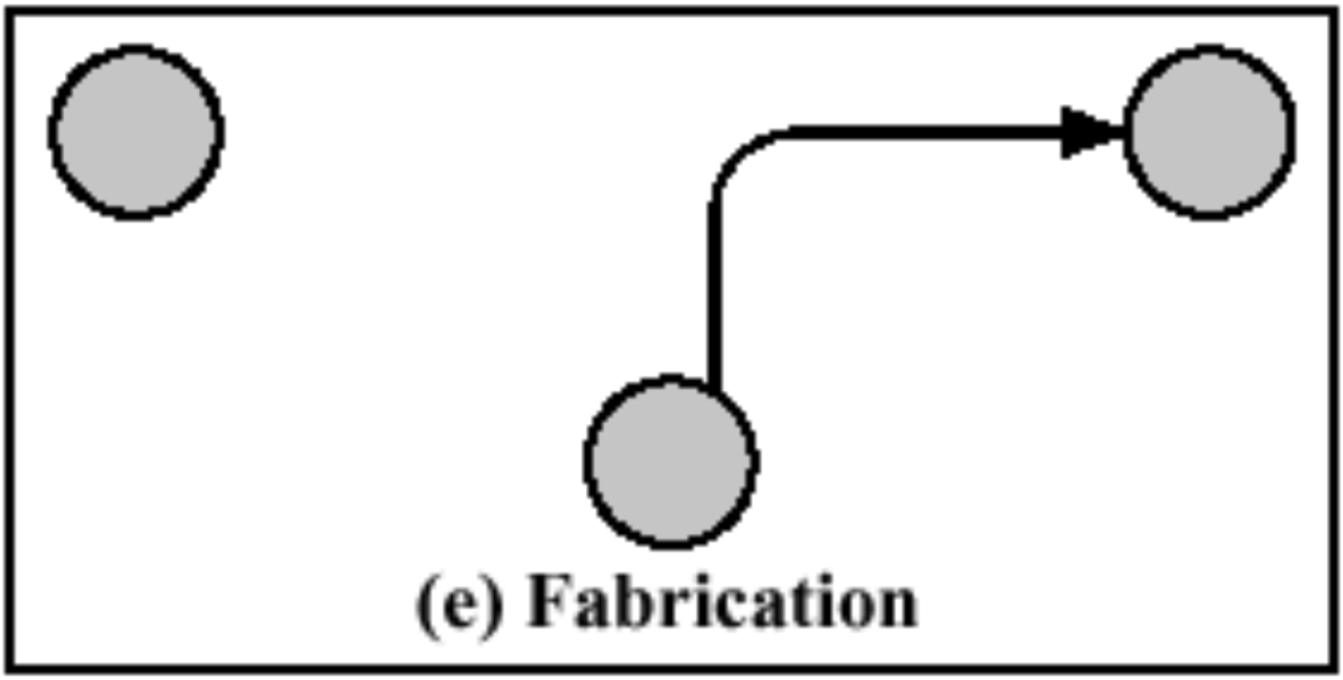
- An **unauthorized party** `gains access` + `tampers`(alter) with assets
- An **unauthorized party** `alters` the content of a *message* which's **transmitted between entities**
- Countermeasure:
    - Cryptographic technique :
        - cehcksums.
        - digital signature.



4. Fabrication (Impersonation)

> Attack on **authenticity**

- an **unauthorized party** `inserts` counterfeit objects into the system.
- **Allows** to bypass the *authenticity check*
- Countermeasure:
  - cryptographic techinque.



Attacks Summary

- the only `passive attack` was the **interception** .
- interception listen and analysis info only.
- `interruption` doesn't care about the info, targets the service/system itself.
- `modification` [with messages/transmition]:
  - intercepts[reads] the connection,
  - interrupts it [stopping other entities from recieving it]
  - fabricates a new message
- `modification` [data/programs]:
  - edits data and programs to change the systems functionality
- `Fabrication` :
  - sends counterfeit objects into the system
  - creates a new object doesn't depend on transmissions or data on the system

attacks can be categorized in two ways:

- **type**/**effect**:
  - `passive`: learn/make use of info
  - `active`: alter system resources/operations
- **source**:
  - `insider`: inside security parameters
  - `outsider`: outside security parameters

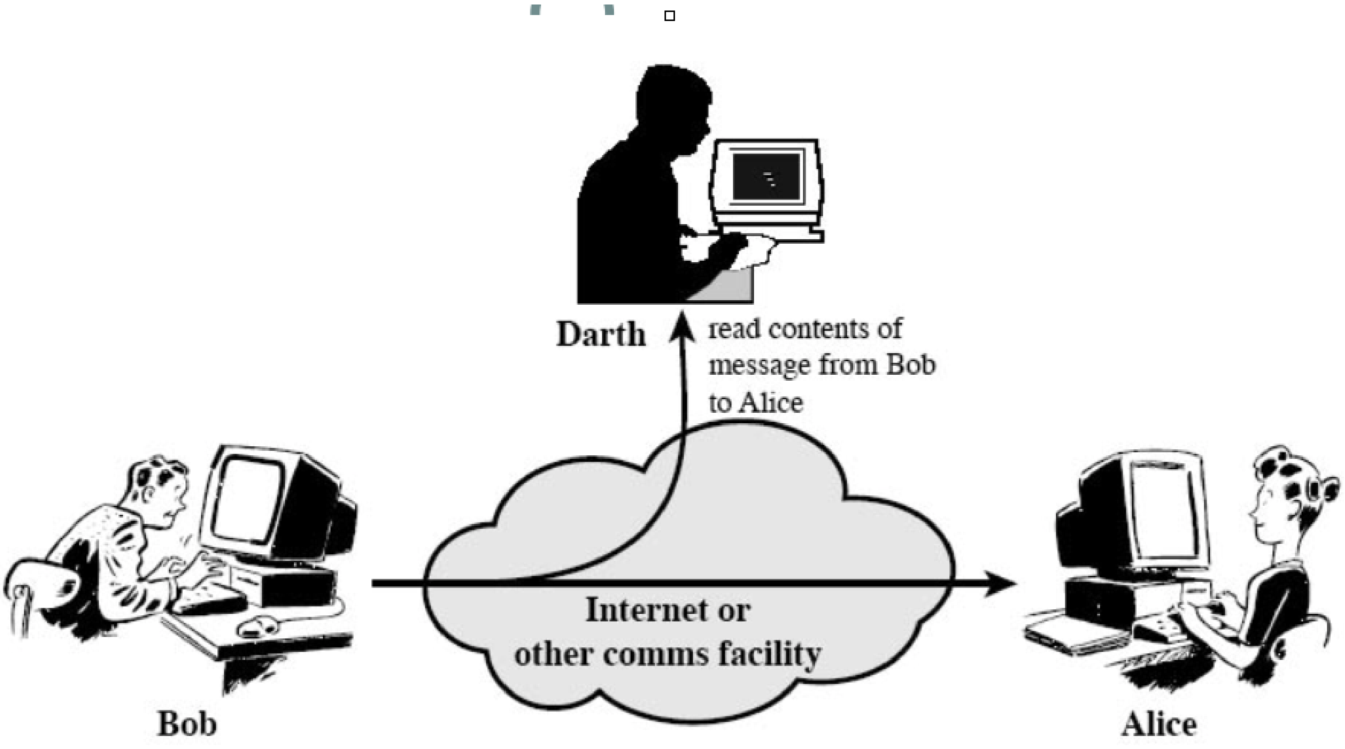
Passive Attacks

all passive attacks are *Interception*, but there is two different types

1. **Release** of *message* **content**
2. Traffic **analysis**

1. Release of message content

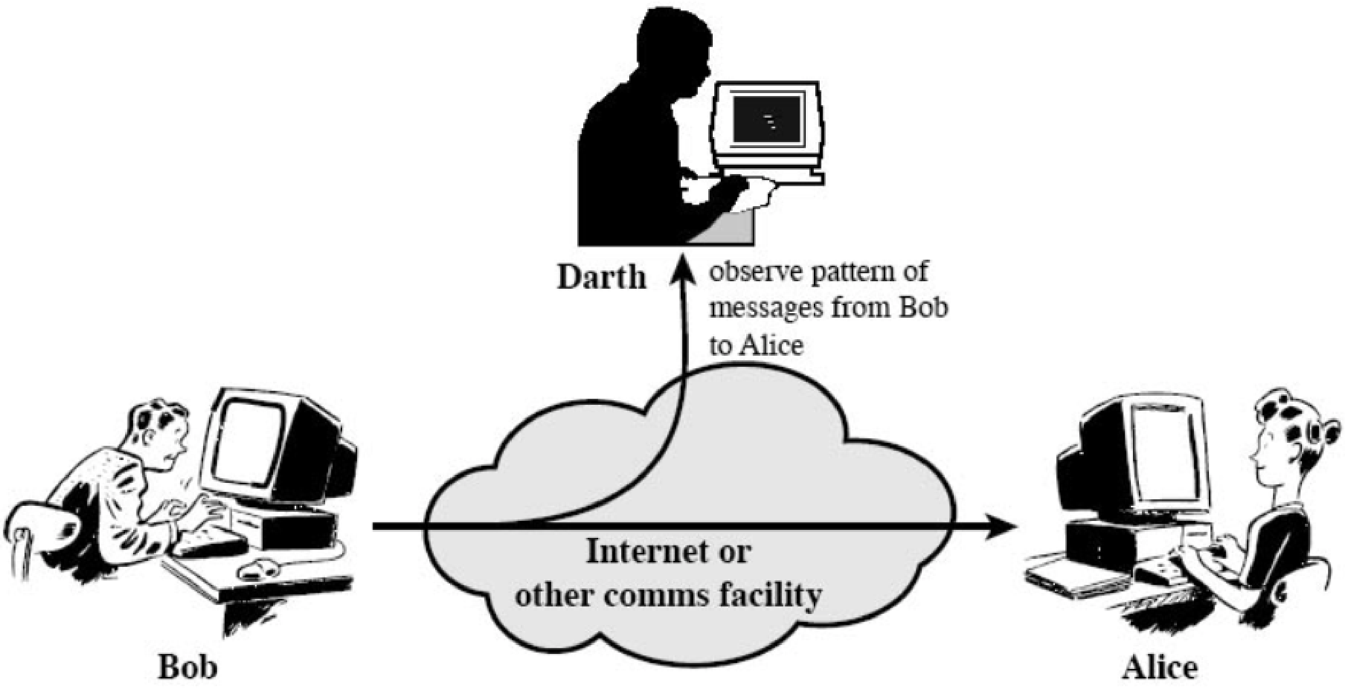
- tapping Conversations, interceting emails/file transfers
- reads contents of messages.


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

(a) Release of message contents

2. Traffic Analysis

- **obvserver** patterns of messages
- used on *masked messages*
- used to get information **traffic**(`frequency`, `location`, `identities`),and extract useful info from it.


Darth
observe pattern of messages from Bob to Alice
Internet or other comms facility
Bob
Alice

(b) Traffic analysis

Passive attack summary

1. release of message content: leak it
2. traffic analysis: stalk

- `passive attacks` are **difficult** to detect; doesn't involve *any* data **alteration**
- `passive attacks` we emphasis
  - **Prevention**
  - `over`
  - **detection**

Active attacks

active attack can be :

1. `interruption`
2. `modification`
3. `fabricaton`

active attacks four categories:

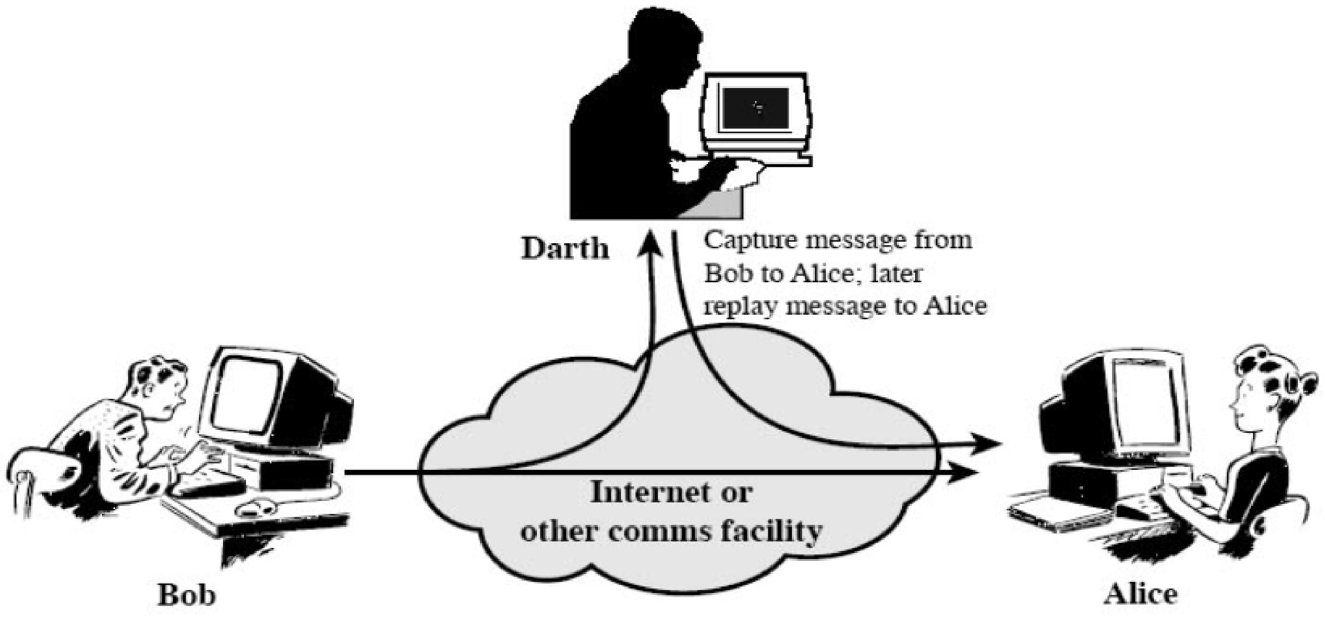
1. `Replay` [Modification]
2. `Masquerade` [fabrication]
3. `Modification of message` [Modification]
4. `Denial Of Service` DOS [Interruption]

1. Replay

involves:

1. the **passive capture** of a data unit
2. it's subsequent **retransmission** (the same message)
3. to produce **unauthorized effect**

- Intercept -> Replay -> Masquerade

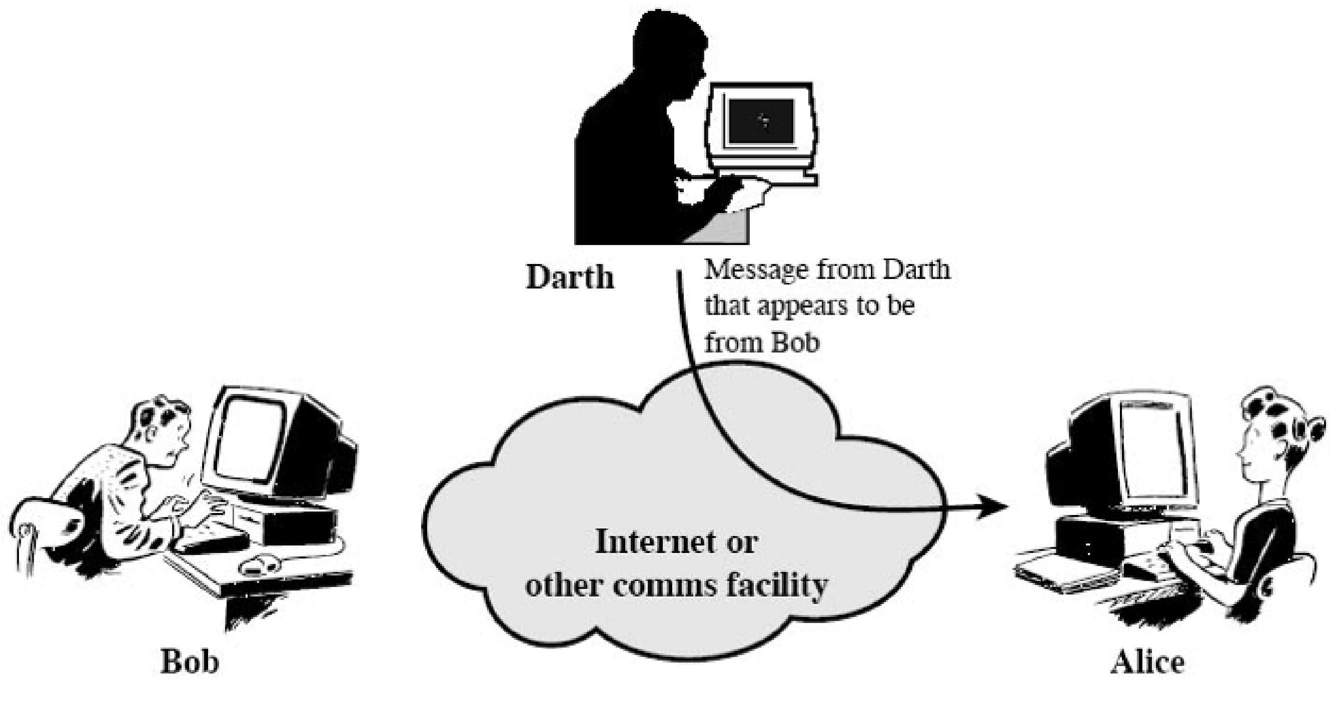

Darth
Capture message from Bob to Alice; later replay message to Alice
Bob
Internet or other comms facility
Alice

(b) Replay

2. Masquerade

one entity **pretends** to be a different entity.

- pretening to be an authorized party.

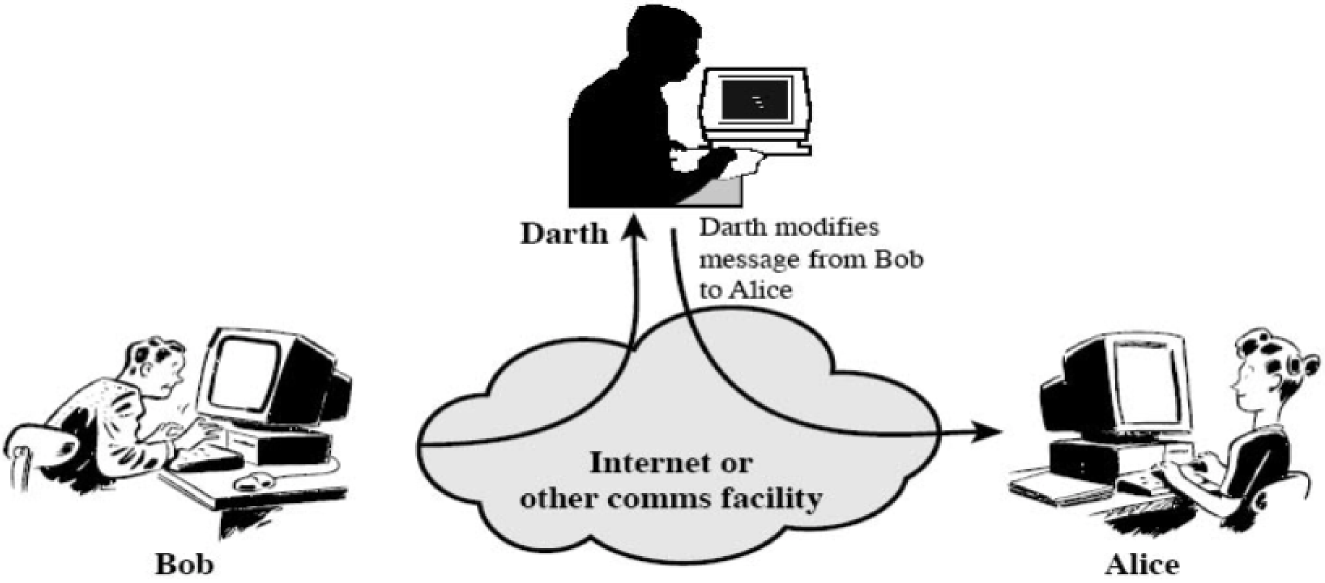
> 
>

Darth
> Message from Darth that appears to be from Bob
> Internet or other comms facility
> Bob
> Alice
>
> (a) Masquerade

3. Modification of message

1. **Portion** of a legitimate message is **altered**
2. the message is **delayed**/**reordered**

- which is meant to produced an **unauthorized effect**

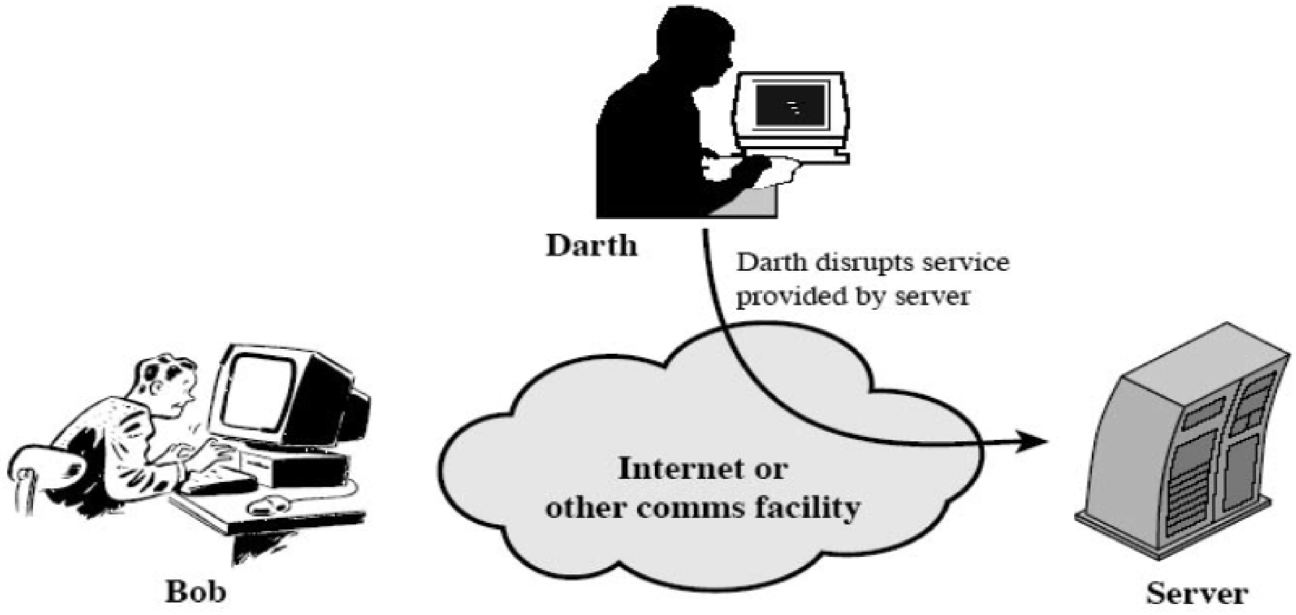

Darth
Darth modifies message from Bob to Alice
Internet or other comms facility
Bob
Alice

(c) Modification of messages

4. Denial Of Service

- prevents the normal use or management of the communication facilities
- has specific targets
    1. all messages directed to a destination
    2. disruption of an entire network:
        - over loading.
        - disabling the network.

`simple def:` an attempt to **stop** a system to *provide services*


Darth
Darth disrupts service provided by server
Internet or other comms facility
Bob
Server

(d) Denial of service

Extra ?

Hacker VS Intruder

Hacker

someone with no malign intent, breaks and enters a computer system

Intruder

someone who seeks to exploit computer assets for their own gain.

Fundamental Security Design

- Economy of Mechanism
- Fail-safe default
- Complete mediation
- Open Design
- Separation of privilege
- Least privilege

- least common mechanism
- psychological acceptability
- Isolation
- Encapsulation
- Modulatrity
- Layering