Introduction to Security

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Introduction

The art of war teaches us to rely not on the likelihood of the enemy's not coming, but on our own readiness to receive him; not on the chance of his not attacking, but rather on the fact that we have made our position unassailable.

***—The Art of War,* Sun Tzu**

Information Security

- What is Cryptography
  - “Secret Writing”
  - Refers to the techniques required for protecting data between authorized parties on information communication technologies in the presence of potentially malicious elements.
  - Refers to a range of techniques such as Encryption, Signature, Hash functions, assuring Privacy, Integrity, and Authentication of data in the digital world.
- What is Information Security?
  - A broad topic of exchange and processing of information on modern computers and networks.
  - Confidentiality, Integrity, and Availability.
- What is Cyber Security?
  - Refers to management of attacks and risks by adversarial and malicious elements on computers and networks that support modern businesses and economy involving business, government, and community.

Stallings take: Introduction to Information Security

- What is Information Security?
  - It is a large topic dealing with many aspects of transmission and processing of information in modern day computers, networks and communication systems.
  - It is about ensuring that systems managing information behave exactly way they are constructed and specified to behave.

Components

- Specification and Policy.
- Implementation and Mechanism.
- Correctness and assurance.
- Background and nature of the users.

- We concentrate on Implementation and Mechanism aspects of Information Security.

Three important concerns of Information security:

- Confidentiality
  - In simple terms, confidentiality of information or data ensures that the access is given only to authorized individuals.
- Integrity
  - Information integrity ensures that enough safe guarding mechanisms exists so that authorized individuals get the **right** information and any changes to the information by intentional and un intentional means will be detected.
- Availability
  - Information or data availability ensures that the information is authorized available to the users.

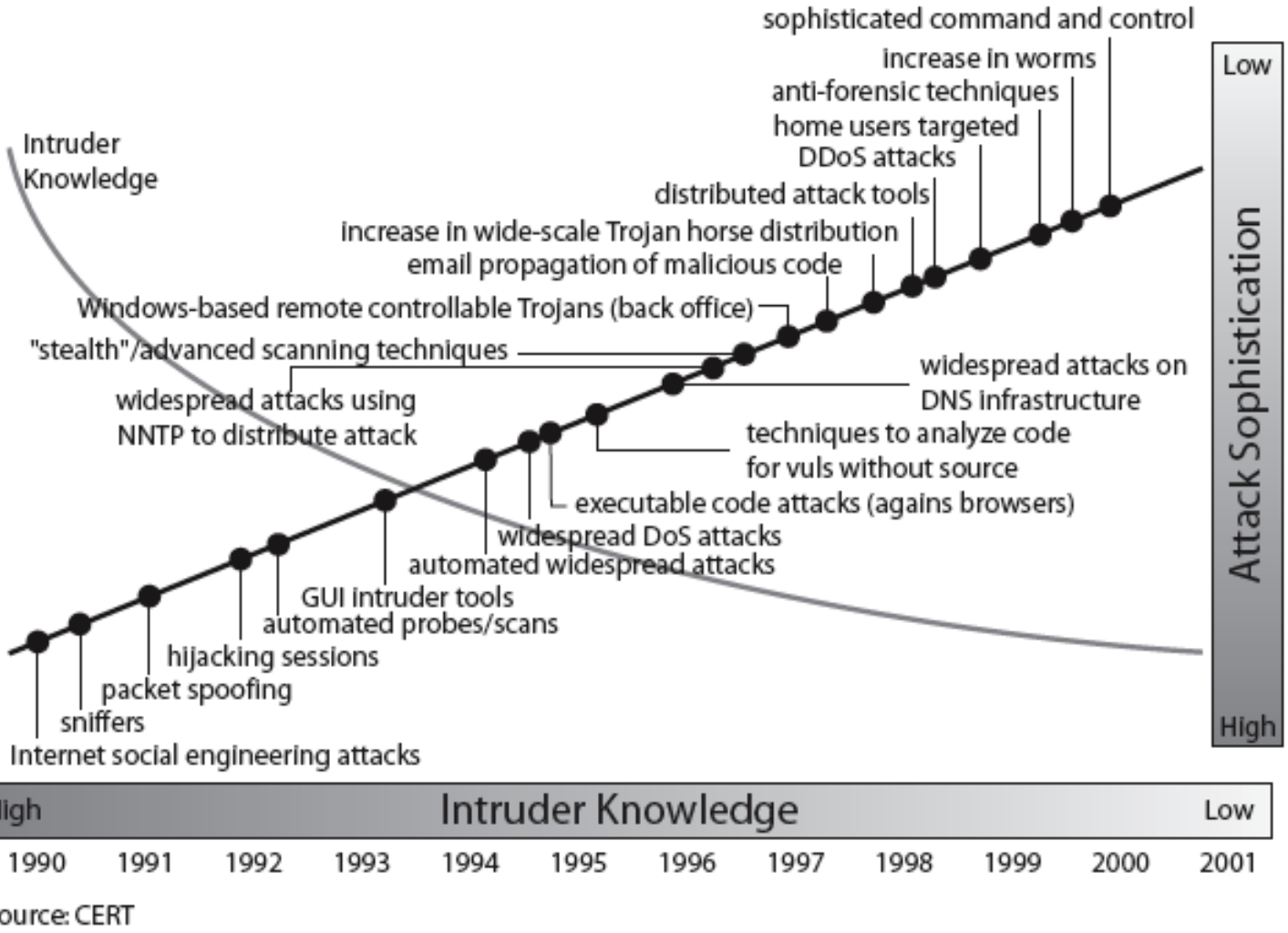
Other Concerns

- Physical Security.
  - This relates to the protection of all computing related products, equipments and facilities. We do not deal in detail this aspect, but should not be neglected.
- Perception of Security.
  - This is about how users feel about the security of their environment.
- Privacy.
  - This relates to the rights of the users.

Definitions

- **Computer Security** - generic name for the collection of tools designed to protect data and to thwart hackers
- **Network Security** - measures to protect data during their transmission
- **Internet Security** - measures to protect data during their transmission over a collection of interconnected networks

Security Trends



Source: CERT

OSI Security Architecture

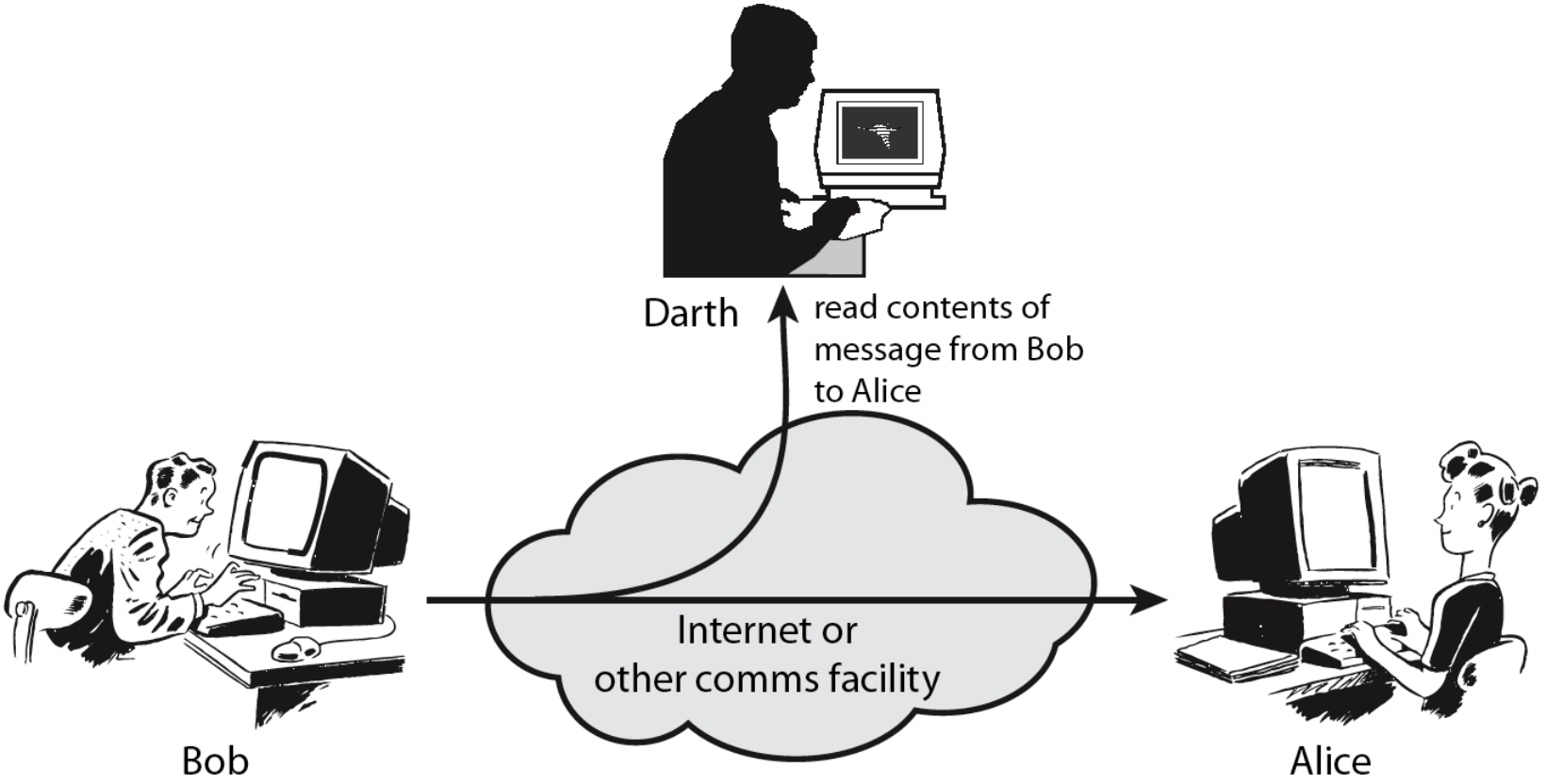
How to define the requirements for security in networked world and characterizing the approaches to satisfy those requirements?

- ITU-T X.800 “Security Architecture for OSI”
- defines a systematic way of defining and providing security requirements
- for us it provides a useful, if abstract, overview of concepts we will study
- Three main aspects:
  - Security attacks
  - Security Mechanisms.
  - Security services.

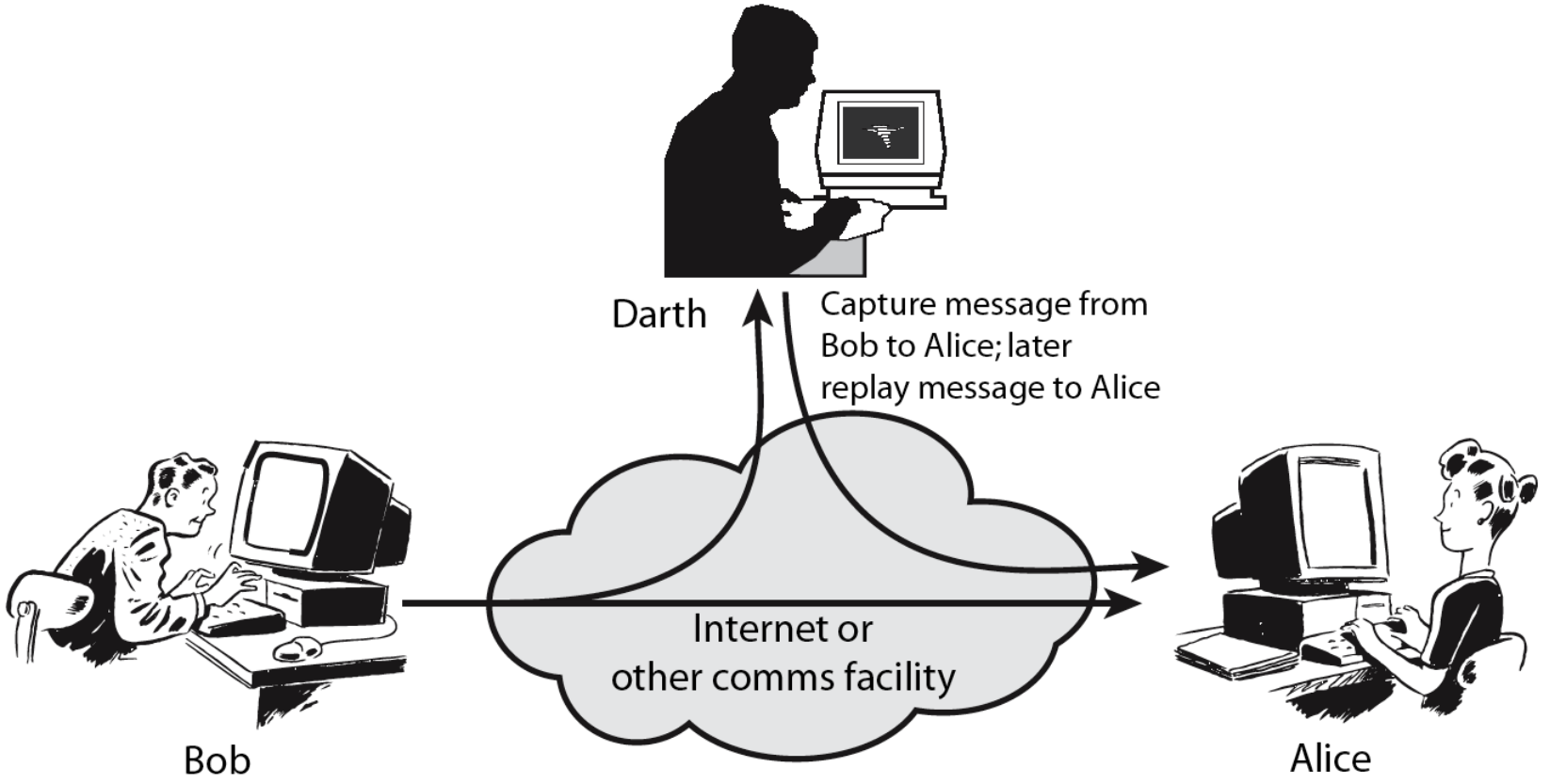
Security Attack

- 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
- Often *threat* & *attack* used to mean same thing (threat is attack in waiting)
- We have a wide range of attacks
- We can focus of generic types of attacks
  - passive
  - active

Passive Attacks



Active Attacks



Security Service

- Enhance security of data processing systems and information transfers of an organization
- Intended to counter security attacks
- using one or more security mechanisms
- often replicates functions normally associated with physical documents
  - which, for example, have signatures, dates; need protection from disclosure, tampering, or destruction; be notarized or witnessed; be recorded or licensed

Security Services

- X.800:

  “a service provided by a protocol layer of communicating open systems, which ensures adequate security of the systems or of data transfers”

- RFC 2828:

  “a processing or communication service provided by a system to give a specific kind of protection to system resources”

Security Services (X.800)

- **Authentication** - assurance that the communicating entity is the one claimed
- **Access Control** - prevention of the unauthorized use of a resource
- **Data Confidentiality** –protection of data from unauthorized disclosure
- **Data Integrity** - assurance that data received is as sent by an authorized entity
- **Non-Repudiation** - protection against denial by one of the parties in a communication

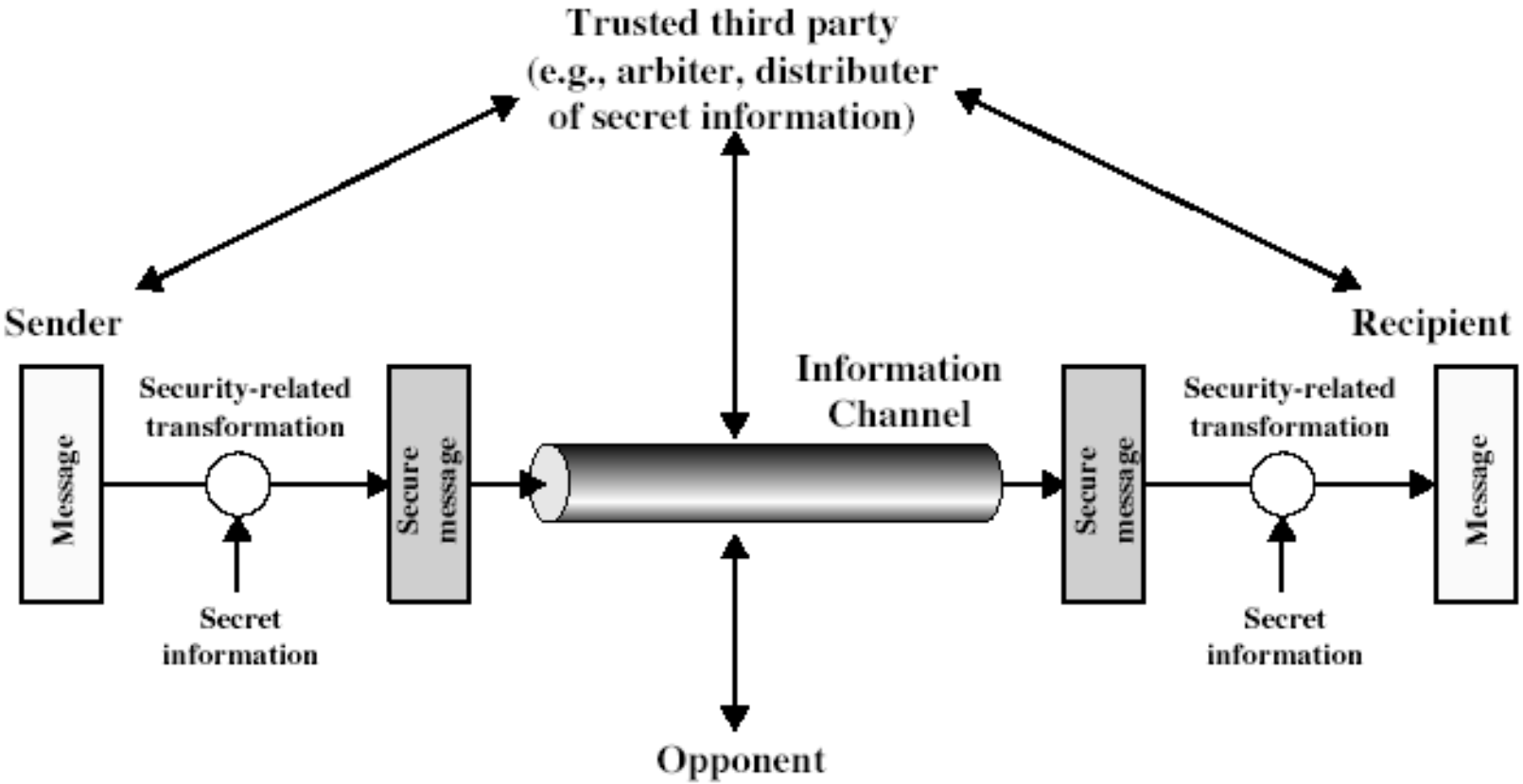
Security Mechanism

- feature designed to detect, prevent, or recover from a security attack
- no single mechanism that will support all services required
- however one particular element underlies many of the security mechanisms in use:
  - **cryptographic techniques**
- hence our focus on this topic

Security Mechanisms (X.800)

- specific security mechanisms:
  - encipherment, digital signatures, access controls, data integrity, authentication exchange, traffic padding, routing control, notarization
- pervasive security mechanisms:
  - trusted functionality, security labels, event detection, security audit trails, security recovery

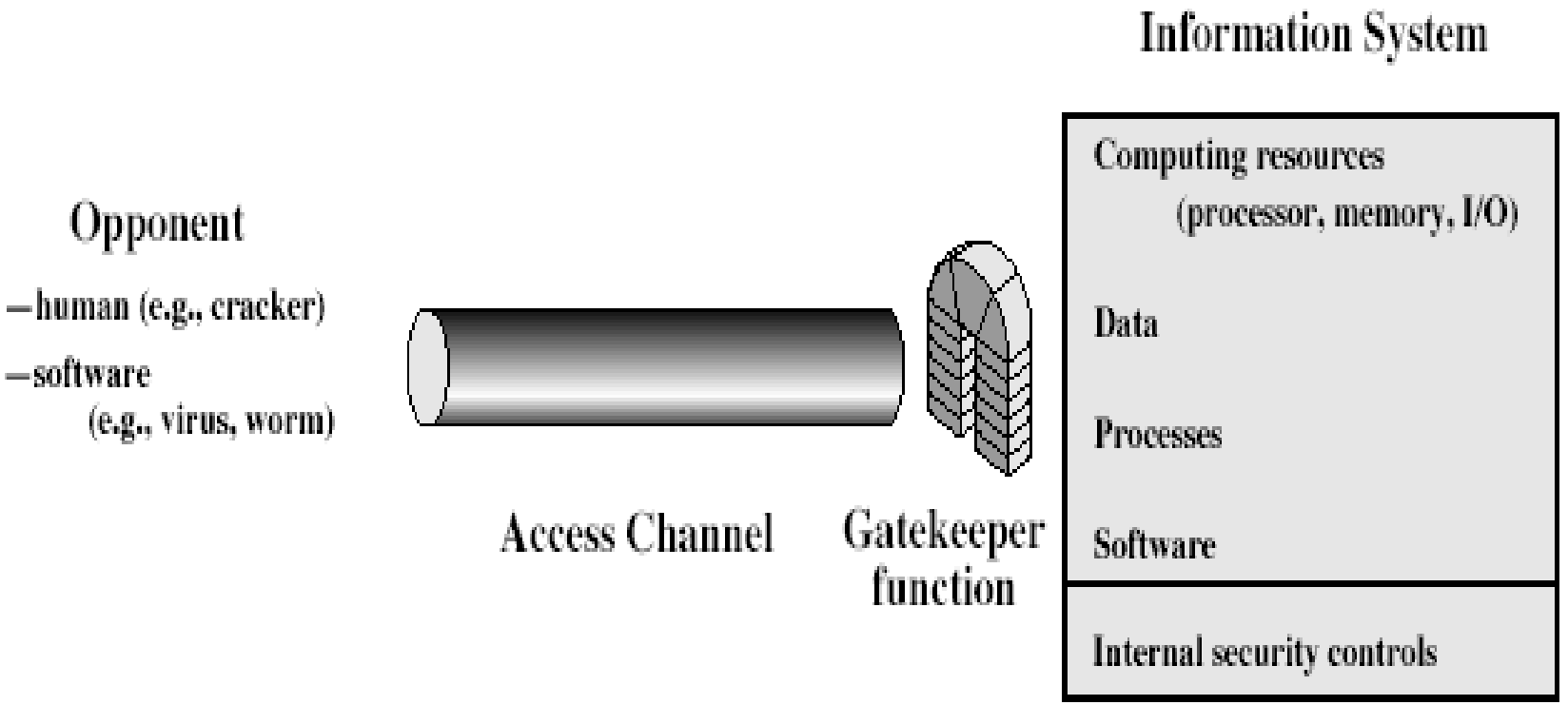
Model for Network Security



Model for Network Security

- using this model requires us to:
  1. design a suitable algorithm for the security transformation
  2. generate the secret information (keys) used by the algorithm
  3. develop methods to distribute and share the secret information
  4. specify a protocol enabling the principals to use the transformation and secret information for a security service

Model for Network Access Security



Model for Network Access Security

- using this model requires us to:
  1. select appropriate gatekeeper functions to identify users
  2. implement security controls to ensure only authorised users access designated information or resources
- trusted computer systems may be useful to help implement this model

Summary

- have considered:
  - definitions for:
    - computer, network, internet security
- X.800 standard
- security attacks, services, mechanisms
- models for network (access) security