

Cryptography and Network Security

2nd Edition

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Note:

Lecture slides by Lawrie Brown and Henric Johnson,

Modified by Andrew Yang

Chapter 1 – 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

Background

- Information Security requirements have changed in recent times
- traditionally provided by physical and administrative mechanisms
- computer use requires automated tools to protect files and other stored information
- use of networks and communications links requires measures to protect data during transmission

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

Aim of Course

- our focus is on **Internet Security**
- consists of measures to deter, prevent, detect, and correct security violations that involve the transmission of information

Information security

- Assets
- Threats
- Attacks
- Vulnerabilities
- Controls

Security 'components'

- Also known as security goals, objectives, etc.
 1. Confidentiality
 2. Data integrity
 3. Origin integrity (aka. Authenticity)
 4. Non-repudiability
 5. Availability

Services, Mechanisms, Attacks

- need systematic way to define requirements
- consider three aspects of information security:
 - **security attack**
 - **security mechanism**
 - **security service**

Security Service

- is something that enhances the security of the data processing systems and the information transfers of an organization
- intended to counter security attacks
- make use of one or more security mechanisms to provide the service
- replicate functions normally associated with physical documents
 - eg have signatures, dates; need protection from disclosure, tampering, or destruction; be notarized or witnessed; be recorded or licensed

Security Mechanism

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

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
- have a wide range of attacks
- can focus of generic types of attacks
- note: often *threat* & *attack* mean same

Security Attacks

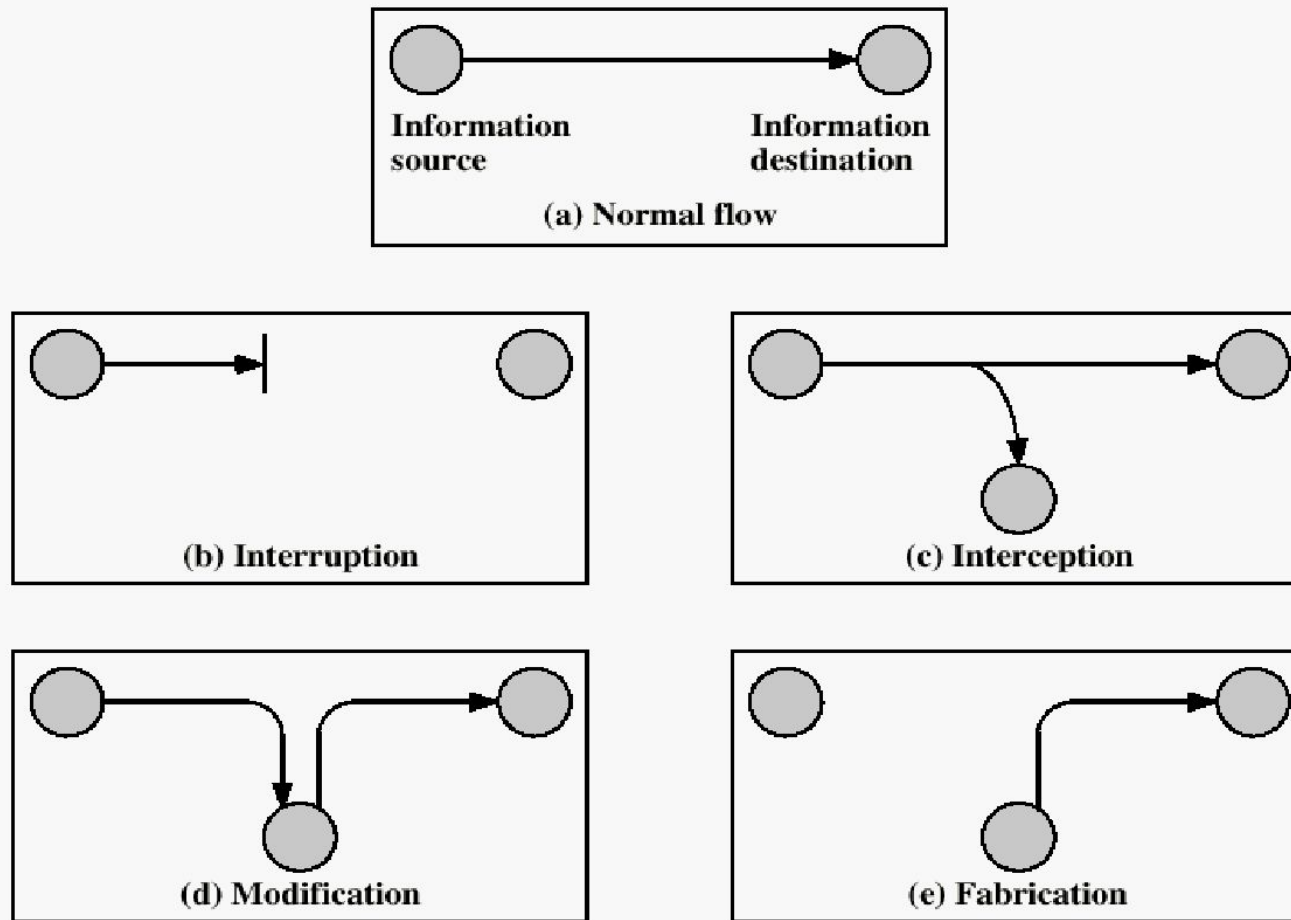


Figure 1.1 Security Threats

OSI Security Architecture

- ITU-T X.800 Security Architecture for OSI
[local copy](#)
- defines a systematic way of defining and providing security requirements
- for us it provides a useful, if abstract, overview of concepts we will study

Security Services

- **X.800** defines it as: a service provided by a protocol layer of communicating open systems, which ensures adequate security of the systems or of data transfers
- **RFC 2828** defines it as: a processing or communication service provided by a system to give a specific kind of protection to system resources
- X.800 defines it in 5 major categories

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

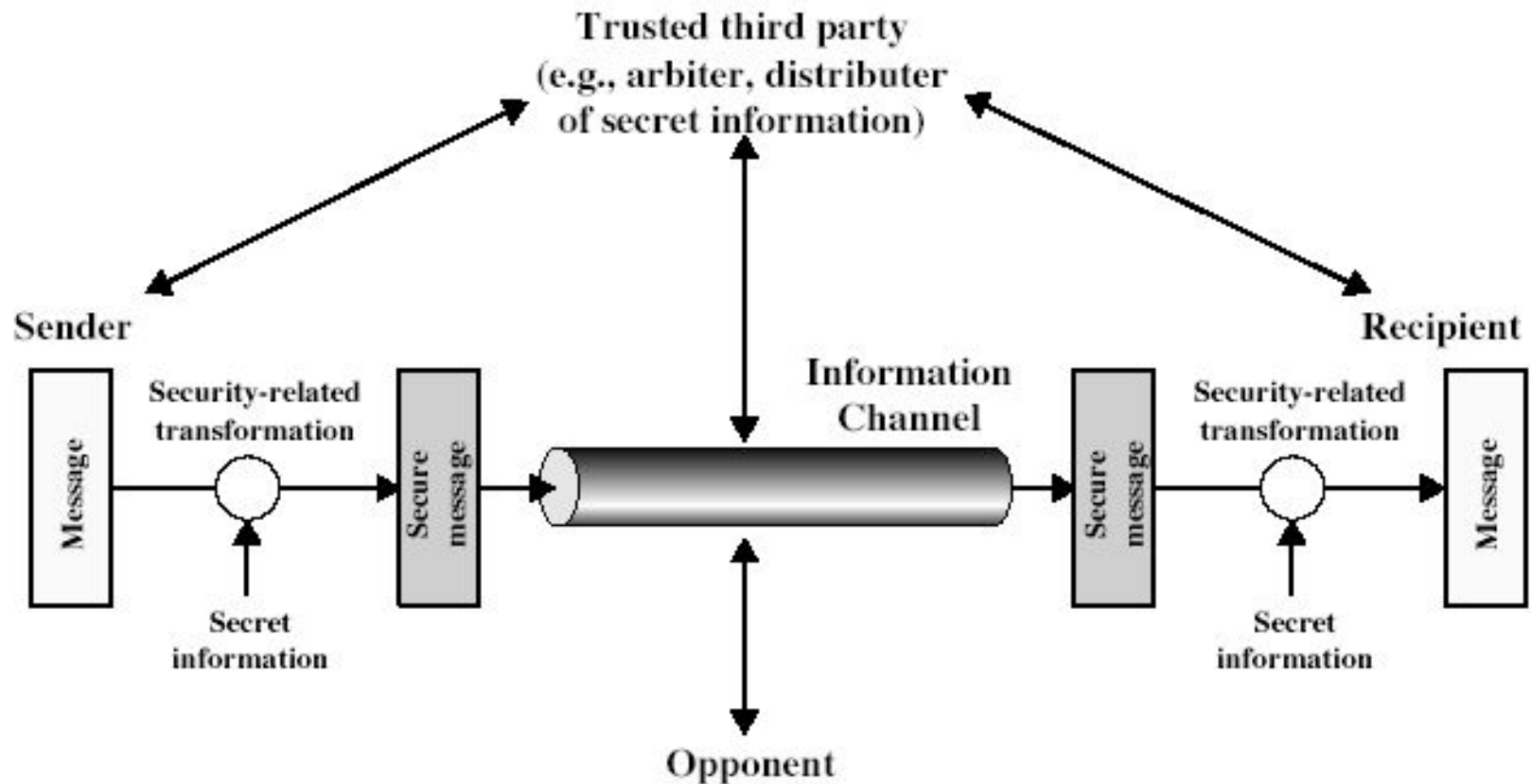
Security Mechanisms (X.800)

- 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

Classify Security Attacks as

- **passive attacks** ([fig. 1](#)) - eavesdropping on, or monitoring of, transmissions to:
 - obtain message contents, or
 - monitor traffic flows
- **active attacks** ([fig. 2a](#), [2b](#)) – modification of data stream to:
 - masquerade of one entity as some other
 - replay previous messages
 - modify messages in transit
 - denial of service

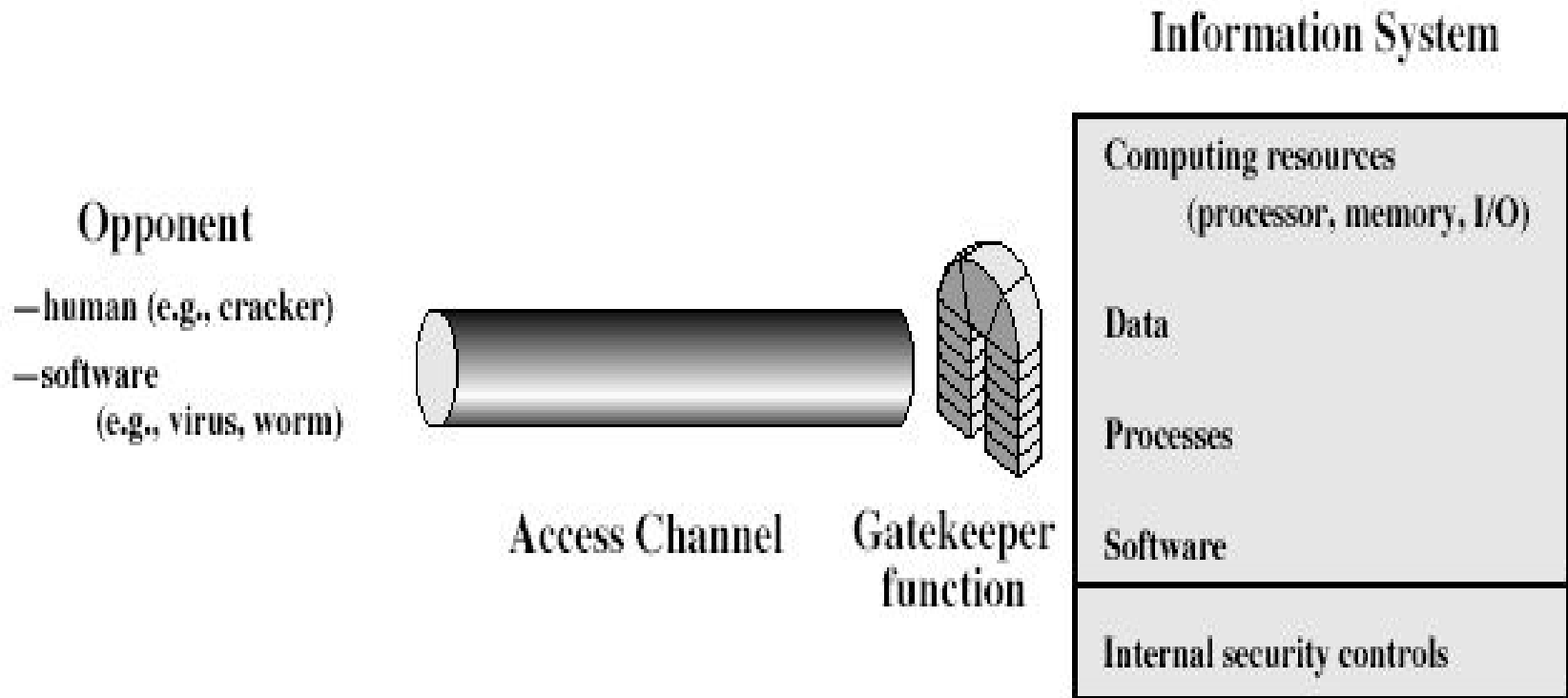
Model for Network Security



Model for Network Security

- using this model requires us to:
 - design a suitable algorithm for the security transformation
 - generate the secret information (keys) used by the algorithm
 - develop methods to distribute and share the secret information
 - 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:
 - select appropriate gatekeeper functions to identify users
 - implement security controls to ensure only authorised users access designated information or resources
- trusted computer systems can be used to implement this model

Summary

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