



UNIVERSITA' DEGLI STUDI DI PARMA
Dipartimento di Ingegneria dell'Informazione

Security Introduction

Luca Veltri

(mail.to: luca.veltri@unipr.it)

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<http://www.tlc.unipr.it/veltri>



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Security Introduction

Network Security

- Network are composed of interconnected hosts
- Hosts provide services and store information
- Users access services and exchange/store information
- It is important to assure in a distributed setting
 - privacy/confidentially
 - Integrity/consistency
 - availability
 - etc.

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Security Introduction

Security Service

- is something that enhances the security of the data processing systems and the information transfers of an entity or 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/objects
 - eg. have signatures, dates; need protection from disclosure, tampering, or destruction; be notarized or witnessed; be recorded or licensed

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Security Introduction

Security Services (X.800 and RFC 2828)

- ITU-T Recommendation X.800 (Security Architecture for OSI)
 - defines a systematic way of defining and providing security requirements
 - a useful abstract overview of security concepts
- X.800 defines *Security Service* as
 - a service provided by a protocol layer of communicating open systems, which ensures adequate security of the systems or of data transfers
- IETF RFC 2828 (Internet Security Glossary) defines *Security Service* as
 - a processing or communication service provided by a system to give a specific kind of protection to system resources
 - security services implement security policies, and are implemented by security mechanisms.

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Security Services (X.800)

X.800 defines 5 major categories

- **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

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Security Services (RFC 2828)

- access control
- audit
- data origin authentication
- peer entity authentication
- availability
- data confidentiality
- data integrity
- system integrity
- non-repudiation

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Security Services (RFC 2828) (cont.)

- access control service
 - a security service that protects against a system entity using a system resource in a way not authorized by the system's security policy
 - in short, protection of system resources against unauthorized access
- audit service
 - s security service that records information needed to establish accountability for system events and for the actions of system entities that cause them
- authentication service
 - a security service that verifies an identity claimed by or for an entity
 - in a network, there are two general forms of authentication service:
 - i) data origin authentication service,
 - ii) peer entity authentication service

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Security Services (RFC 2828) (cont.)

- data origin authentication service
 - a security service that verifies the identity of a system entity that is claimed to be the original source of received data
 - this service is provided to any system entity that receives or holds the data
 - this service is usually bundled with connectionless data integrity service
 - (See: data integrity service)
- peer entity authentication service
 - a security service that verifies an identity claimed by or for a system entity in an association
 - this service is used to confirm the identity of one entity to another, thus protecting against a masquerade by the first entity
 - unlike data origin authentication service, this service requires an association to exist between the two entities

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Security Services (RFC 2828) (cont.)

- availability service
 - a security service that protects a system to ensure its availability
 - this service addresses the security concerns raised by denial-of-service attacks
- data confidentiality service
 - data confidentiality is the property that information is not made available or disclosed to unauthorized individuals, entities, or processes (i.e., to any unauthorized system entity)
 - data confidentiality service protects data against unauthorized disclosure

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Security Services (RFC 2828) (cont.)

- data integrity service
 - data integrity is the property that data has not been changed, destroyed, or lost in an unauthorized or accidental manner
 - deals with constancy of and confidence in data values, not with the information that the values represent
 - data integrity service protects against unauthorized changes to data, including both intentional change or destruction and accidental change or loss, by ensuring that changes to data are detectable
 - a data integrity service can only detect a change and report it to an appropriate system entity; changes cannot be prevented unless the system is perfect (error-free) and no malicious user has access
 - however, a system that offers data integrity service might also attempt to correct and recover from changes
 - although data integrity service is defined separately from data origin authentication service and peer entity authentication service, it is closely related to them

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Security Services (RFC 2828) (cont.)

- system integrity service
 - the system integrity is the quality that a system has when it can perform its intended function
 - system integrity service protects system resources in a verifiable manner against unauthorized or accidental change, loss, or destruction
- non-repudiation service
 - a security service that provide protection against false denial of involvement in a communication
 - does not prevent an entity from repudiation; it provides evidence that can be stored and later presented to a third party
 - there are two basic kinds of non-repudiation service:
 - i) "non-repudiation with proof of origin" - this service can be viewed as a stronger version of a data origin authentication service, in that it proves authenticity to a third party
 - ii) "non-repudiation with proof of receipt" - protects the originator against an attempt by the recipient to falsely deny receiving the data

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Security Mechanisms (X.800)

- Security services are provided by means of different security functions/ mechanisms
 - they can be included in appropriate communication layer
- Examples of security mechanisms are
 - encipherment
 - digital signatures
 - access controls
 - data integrity
 - authentication exchange
 - traffic padding
 - routing control
 - notarization (third-party authentication)

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Relationship Between Security Services and Mechanisms

| Service | Mechanism | | | | | | | |
|------------------------------|-------------------|----------------------|-------------------|-------------------|---------------------------------|--------------------|--------------------|-------------------|
| | Enciph- erment | Digital signature | Access control | Data integrity | Authenti- cation exchange | Traffic padding | Routing control | Notari- zation |
| Peer entity authentication | Y | Y | | | Y | | | |
| Data origin authentication | Y | Y | | | | | | |
| Access control | | | Y | | | | | |
| Confidentiality | Y | | | | | | Y | |
| Traffic flow confidentiality | Y | | | | | Y | Y | |
| Data integrity | Y | Y | | Y | | | | |
| Non-repudiation | | Y | | Y | | | | Y |
| Availability | | | | Y | Y | | | |

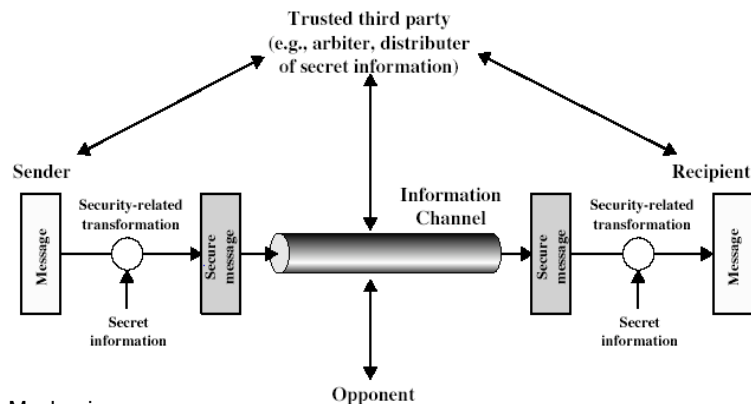
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Classify Security Attacks as

- **passive attacks** (eavesdropping on, or monitoring of transmissions):
 - **Interception**
 - obtain message contents (attacks confidentiality)
 - **Traffic analysis**
 - monitor traffic flows (attacks confidentiality)
- **active attacks** (modification of data stream):
 - **Fabrication**
 - masquerade of one entity as some other (attacks authenticity)
 - **Replay**
 - replay previous messages (attacks authenticity)
 - **Modification**
 - modify messages in transit (attacks integrity)
 - **interruption**
 - denial of service (DoS) (attacks availability)

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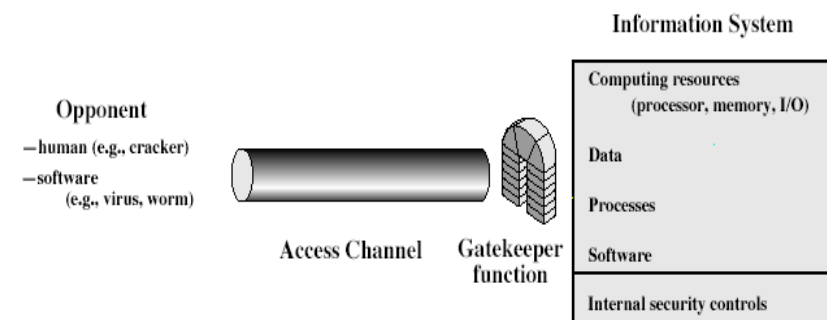
Model for Network Security



- Mechanisms:
 - 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

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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

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Network security: The ideal world

- Strong authentication of both services and users
- Reliable authorization/access control, and effective abuse control
- Flawless protocols, operating systems, and applications
- Perfect policy, perfect policy enforcement
- Every user is a secure expert

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The real world

- Effective security protection are not deployed
- Sites do not install vendor patches
- Sites do not use sufficient AAA for remote access
- Sites do not monitor restrict access to their internal hosts
- Sites do not dedicate staff or sufficient resources to improve and maintain security
- Sites do not implement policies
- ...

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Sicurezza: vari aspetti..

- ✓ matematica (teoria dei numeri, crittografia)
- ✓ protocolli (protocolli di rete, autenticazione, etc)
- ✓ architetture di rete e relative funzioni (nodi, gateways, etc)
- ✓ servizi
- ✓ software (algoritmi, OSs, middleware, banchi)
- ✓ hardware, elettronica, elettromagnetismo, ottica, biomedica, etc
- ✓ aspetti sociali (comportamentali e stimoli esterni)
- ✓ legislazione
- ✓ politica
- ✓ etc.

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