Cryptography and Network Security: Overview

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Audio/Video recordings of this lecture are available at:
http://www.cse.wustl.edu/~jain/cse571-14/
Overview

1. Computer Security Concepts
2. OSI Security Architecture
3. Security Attacks
4. Security Services
5. Security Mechanisms

Standards Organizations

- National Institute of Standards & Technology (NIST)

- Internet Society (ISOC):
  - Internet Engineering Task Force (IETF), [ietf.org](http://ietf.org)
  - Internet Architecture Board (IAB)

- International Telecommunication Union
  Telecommunication Standardization Sector (ITU-T)
  [http://www.itu.int](http://www.itu.int)

- International Organization for Standardization (ISO)
  [http://www.iso.org](http://www.iso.org)
Security Components

- **Confidentiality**: Need access control, Cryptography, Existence of data
- **Integrity**: No change, content, source, prevention mechanisms, detection mechanisms
- **Availability**: Denial of service attacks
  \[ A = \text{Availability, Authenticity or Accountability} \]
- Confidentiality, Integrity and Availability (CIA)
OSI Security Architecture

- ITU-T X.800 “Security Architecture for OSI”
- Defines a systematic way of defining and providing security requirements
- Provides a useful, if abstract, overview of concepts
Aspects of Security

- Aspects of information security:
  - Security attack
  - Security mechanism
  - Security service

- Note:
  - *Threat* – a potential for violation of security
  - *Attack* – an assault on system security, a deliberate attempt to evade security services
Passive Attacks

Darth reads contents of message from Bob to Alice through the Internet or other comms facility.
Active Attacks

- Examples: Masquerade, Replay, Modify, denial of service
Security Services (X.800)

- **Authentication** - assurance that communicating entity is the one claimed
  - have both peer-entity & data origin authentication
- **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
- **Availability** – resource accessible/usable
Security Mechanism

- Feature designed to detect, prevent, or recover from a security attack
- However one particular element underlies many of the security mechanisms in use:
  - cryptographic techniques
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
  
  *(Not specific to a protocol layer or security service)*
# Services and Mechanisms Relationship

<table>
<thead>
<tr>
<th>Service</th>
<th>Encipherment</th>
<th>Digital signature</th>
<th>Access control</th>
<th>Data integrity</th>
<th>Authentication exchange</th>
<th>Traffic padding</th>
<th>Routing control</th>
<th>Notarization</th>
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<tbody>
<tr>
<td>Peer entity authentication</td>
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<td>Data origin authentication</td>
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<tr>
<td>Confidentiality</td>
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<td>Traffic flow confidentiality</td>
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<td>Data integrity</td>
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<td>Nonrepudiation</td>
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Model for Network Security

1. Algorithm for Security transformation
2. Secret key generation
3. Distributed and share secret information
4. Protocol for sharing secret information
Model for Network Access Security

1. Select appropriate gatekeeper functions to identify users
2. Implement security controls to ensure only authorised users access designated information or resources
NIST, IETF, ITU-T, ISO develop standards for network security

CIA represents the 3 key components of security

ISO X.800 security architecture specifies security attacks, services, mechanisms

Active attacks may modify the transmitted information.

Security services include authentication, access control, …
Lab Homework 2

1. Read about the following tools
      Use ftp client to download in binary mode (do not use browser)
   c. LAN Surveyor, network mapping shareware with 30 day trial, http://www.solarwinds.com/products/lansurveyor/

2. Use advanced port scanner to scan one to three hosts on your local net (e.g., CSE571XPS and CSE571XPC2 in the security lab) to find their open ports.

3. Use network surveyor to show the map of all hosts on your local net

4. Ping www.wustl.com to find its address. Start Wireshark. Set capture filter option “IP Address” to capture all traffic to/from this address. Open a browser window and Open www.wustl.com. Stop Wireshark. Submit a screen capture showing the packets seen.
Security URLs

- Center for Education and Research in Information Assurance and Security, 
  http://www.cerias.purdue.edu/about/history/coast/archive/
- IETF Security area, sec.ietf.org
- Computer and Network Security Reference Index, 
- The Cryptography FAQ, 
  http://www.faqs.org/faq/cryptography-faq/
- Tom Dunigan's Security page, 
  http://www.csm.ornl.gov/%7edunigan/security.html
- IEEE Technical Committee on Security and Privacy, 
  http://www.ieee-security.org/index.html
Security URLs (Cont)

- SANS Institute, http://sans.org/
- Helger Lipmaa's Cryptology Pointers, http://www.adastral.ucl.ac.uk/%7ehelger/crypto/
Newsgroups and Forums

- sci.crypt.research, sci.crypt, sci.crypt.random-numbers
- alt.security
- comp.security.misc, comp.security.firewalls, comp.security.announce
- comp.risks
- comp.virus
- Google groups, http://groups.google.com
- LinkedIn Groups, http://www.linkedin.com