

Module 20: Security

- The Security Problem
- Authentication
- Program Threats
- System Threats
- Threat Monitoring
- Encryption

The Security Problem

- Security must consider external environment of the system, and protect it from:
 - unauthorized access.
 - malicious modification or destruction.
 - accidental introduction of inconsistency.
- Easier to protect against accidental than malicious misuse.

Authentication

- User identity most often established through *passwords*, can be considered a special case of either keys or capabilities.
- Passwords must be kept secret.
 - Frequent change of passwords.
 - Use of “non-guessable” passwords.
 - Log all invalid access attempts.

Program Threats

- Trojan Horse
 - Code segment that misuses its environment.
 - Exploits mechanisms for allowing programs written by users to be executed by other users.
- Trap Door
 - Specific user identifier or password that circumvents normal security procedures.
 - Could be included in a compiler.

System Threats

- Worms – use spawn mechanism; standalone program.
- Internet worm
 - Exploited UNIX networking features (remote access) and bugs in *finger* and *sendmail* programs.
 - Grappling hook program uploaded main worm program.
- Viruses – fragment of code embedded in a legitimate program.
 - Mainly effect microcomputer systems.
 - Downloading viral programs from public bulletin boards or exchanging floppy disks containing an infection.
 - *Safe computing*.

Threat Monitoring

- Check for suspicious patterns of activity – i.e., several incorrect password attempts may signal password guessing.
- Audit log – records the time, user, and type of all accesses to an object; useful for recovery from a violation and developing better security measures.
- Scan the system periodically for security holes; done when the computer is relatively unused.

Threat Monitoring (Cont.)

- Check for:
 - Short or easy-to-guess passwords
 - Unauthorized set-uid programs
 - Unauthorized programs in system directories
 - Unexpected long-running processes
 - Improper directory protections
 - Improper protections on system data files
 - Dangerous entries in the program search path (Trojan horse)
 - Changes to system programs; monitor checksum values

Encryption

- Encrypt *clear text* into *cipher text*.
- Properties of good encryption technique:
 - Relatively simple for authorized users to encrypt and decrypt data.
 - Encryption scheme depends not on the secrecy of the algorithm but on a parameter of the algorithm called the *encryption key*.
 - Extremely difficult for an intruder to determine the encryption key.
- *Data Encryption Standard* substitutes characters and rearranges their order on the basis of an encryption key provided to authorized users via a secure mechanism. Scheme only as secure as the mechanism.

Encryption (cont.)

- *Public-key encryption* based on each user having two keys:
 - *public key* – published key used to encrypt data.
 - *private key* – key known only to individual user used to decrypt data.
- Must be an encryption scheme that can be made public without making it easy to figure out the decryption scheme.
 - Efficient algorithm for testing whether or not a number is prime.
 - No efficient algorithm is known for finding the prime factors of a number.