Module 19: 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.

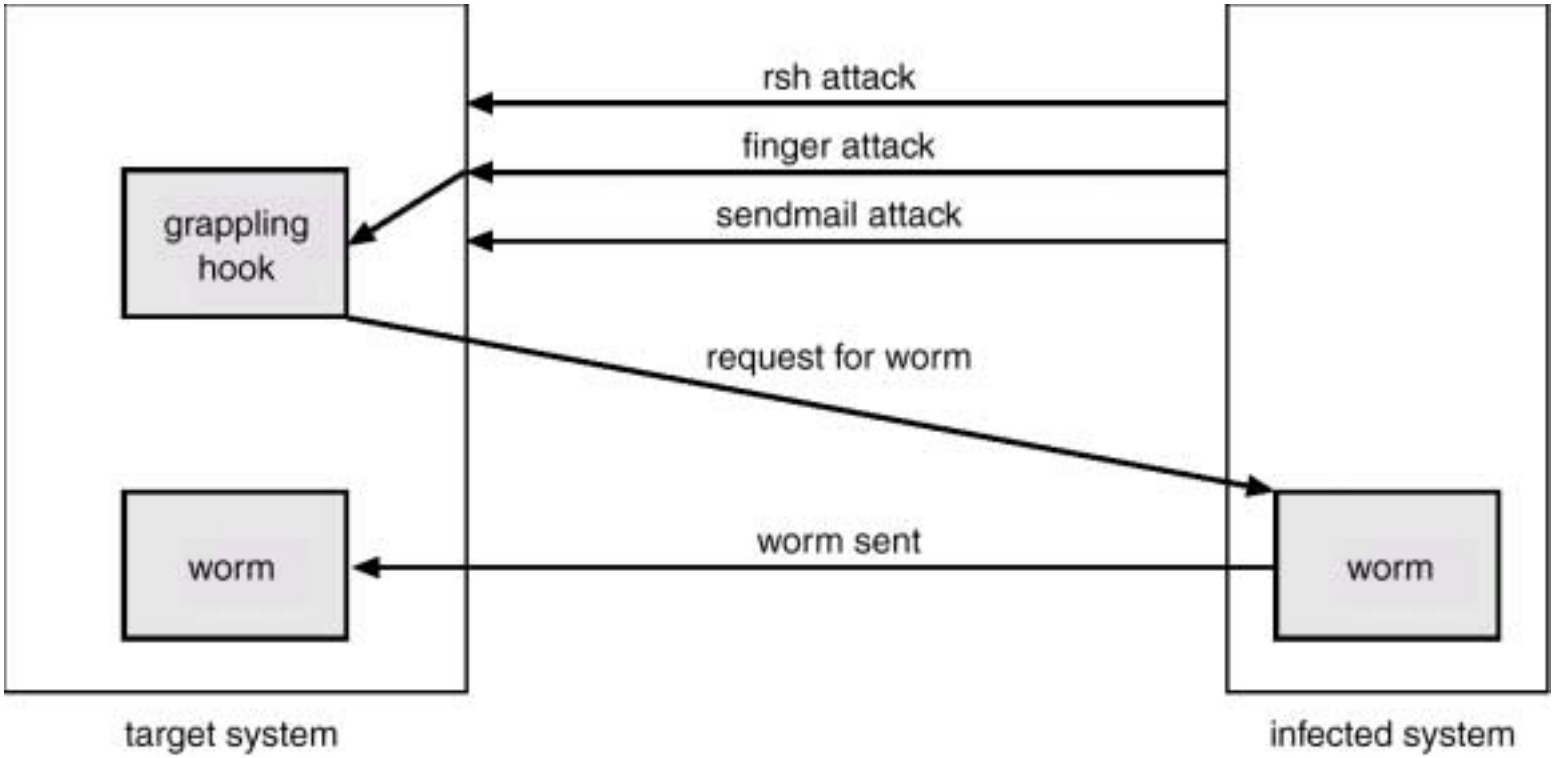
Program Threats

- 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*.

The Morris Internet Worm



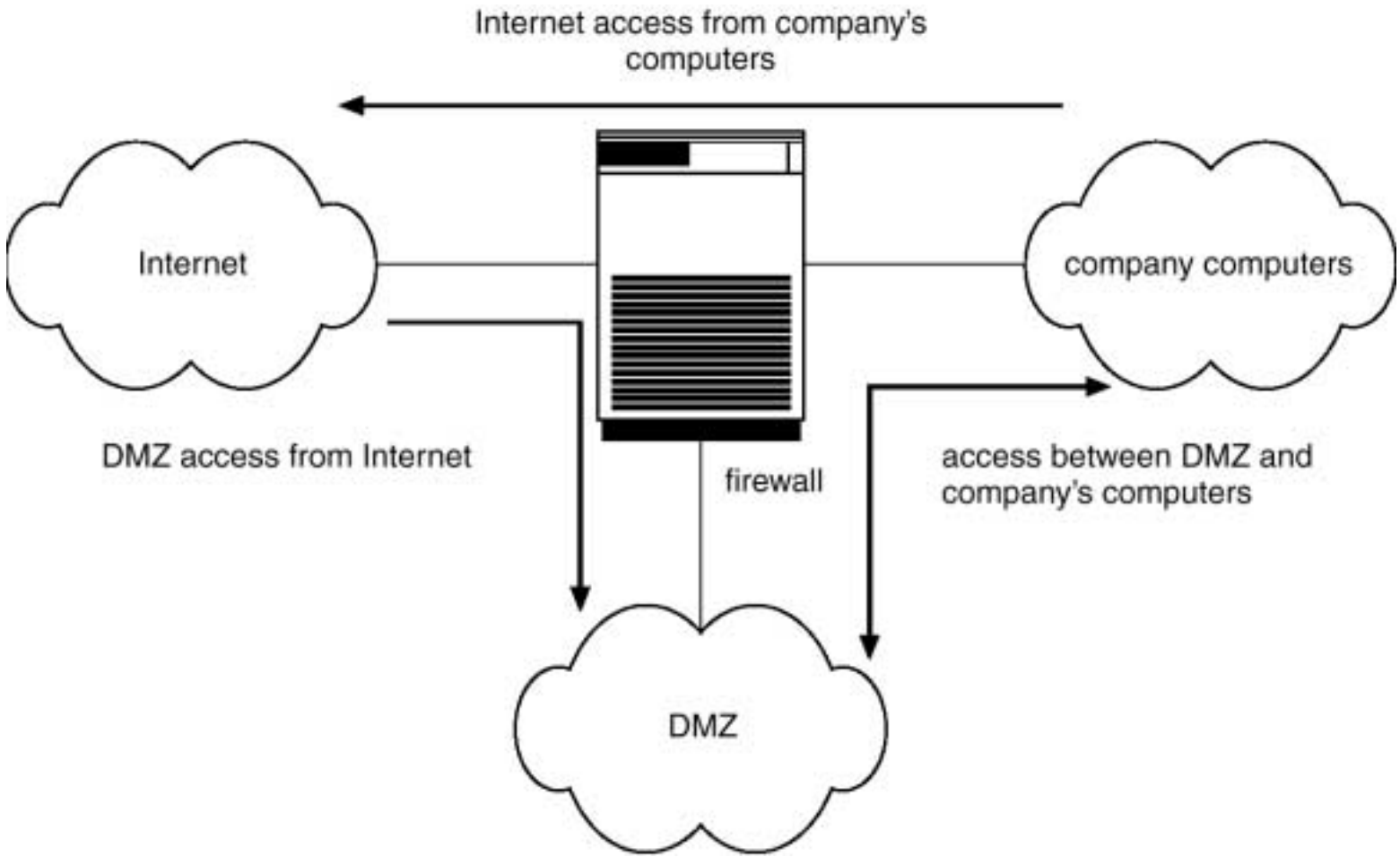
Threat Monitoring

- 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

Network Security Through Domain Separation Via Firewall



Encryption

- Encrypt clear text into cipher text.
- Properties of good encryption technique:
  - Relatively simple for authorized users to incrypt 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 know for finding the prime factors of a number.

Java Security Model