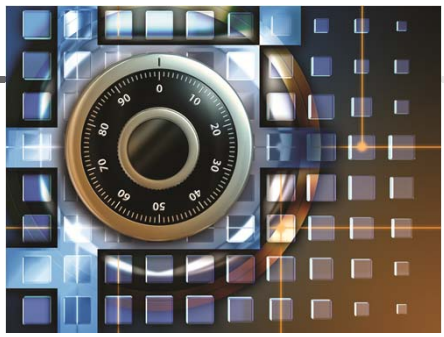
Physical Security



Chapter 8

Background

- Businesses have the responsibility of attempting to secure their profitability.
- They need to secure:
  - Employees
  - Product inventory
  - Trade secrets
  - Strategy information
- All these assets affect the profitability of a company and its future survival.

The Security Problem

- The problem that faces professionals charged with securing a company's network can be stated rather simply:
  - **Physical access negates all other security measures.**
- No matter how impenetrable the firewall and intrusion detection system (IDS), if an attacker can find a way to walk up to and touch a server, he can break into it.
- Physically securing information assets doesn't mean just the servers;
- It means protecting physical access to all the organization's computers and its entire network infrastructure.

The Security Problem Illustrated

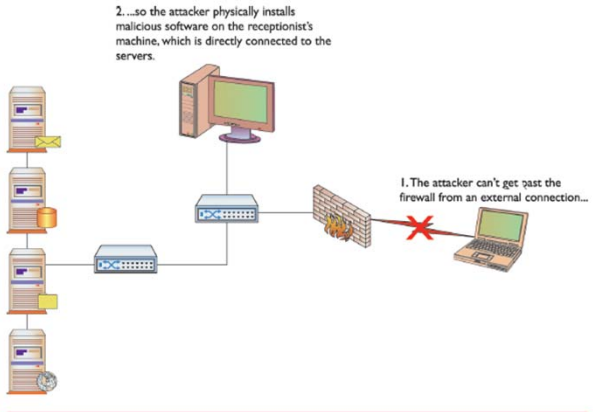


Figure 8.1 Using a lower-privilege machine to get at sensitive information

Using a Lower Privilege Machine to Get Sensitive Information

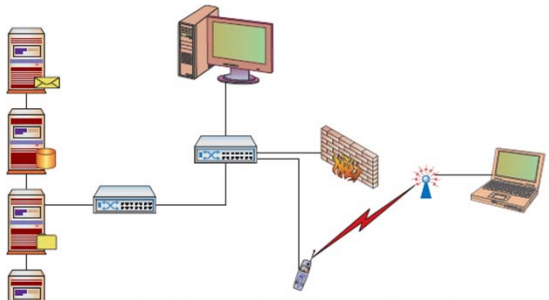


Figure 8.2 A wireless bridge can allow remote access

Personal digital assistants (PDAs) acting as a *wireless bridge*

Bootdisks

- Bootdisk:
  - Any media used to boot a computer into an operating system that is not the native OS on its hard drive
  - These can be in the form of a floppy disk, CD, DVD, or a USB flash drive.
- Boot floppy disks can be used to attack machines with floppy drives.
- Utilities can be installed on the disk to allow for the stealing of password files and other information.

Access to Boot Disk

- A simple attack that can be used with physical access is by using a boot disk.
- Once an attacker is able to read the drive, the password file can be copied off the machine for offline password-cracking attacks.
  - If write access to the drive is obtained, the attacker could alter the password file.
  - The attacker can place a remote control program to be automatically executed upon the next boot.
  - This guarantees continued access to the machine.

Access to Boot Disk

- Bootable CD-ROMs are a threat.
  - May contain a bootable version of an entire operating system complete with drivers for most devices
  - Gives an attacker a greater array of tools than could be loaded onto a floppy disk.
  - Also allows for making an image of the hard drive since some form of bootable media is often used to load the imaging software.
    - The process of taking the entire contents of a hard drive and copying them to a single file on a different media is **called drive imaging.**

LiveCDs

- LiveCD
  - Contains a bootable version of an entire operating system.
  - This is typically a variant of Linux, complete with drivers for most devices.
  - LiveCDs give an attacker a greater array of tools than could be loaded onto a floppy disk.
  - These tools include scanners, sniffers, vulnerability exploits, forensic tools, drive imagers, password crackers, and more.

Drive Imaging

- Drive imaging is the process of copying the entire contents of a hard drive to a single file on a different media.
- This process is often used by people who perform forensic investigations of computers.
  - A bootable media is used to start the computer and load the drive imaging software.
  - It makes a bit-by-bit copy of the hard drive or other attached media.
  - There will be no record of the copy being made.
- The information obtained from drive imaging contains every bit of data that is on the computer: any locally stored documents, locally stored e-mails, and every other piece of information that the hard drive contains.
- This data could be very valuable if the machine holds sensitive information about the company.
- **Protection**
  - Encrypting files or the drive provides protection.
  - Storing files on a files server can also help.

Computer Theft

- Outright theft of computers.
  - A simpler version of the drive imaging attack
- The theft of computers is mostly performed for the financial value of the computers.
- However, stealing computers also allows an attacker to obtain the data contained on them.

Perhaps Better than DoS

- Computer theft can be used to perform a Denial-of-Service (DoS) attack.
  - If the computers (servers) are not on network / not working – it causes denial of service to the concerned user
- The theft of computers, using a boot disk to erase all data on the drives, or unplugging computers is effective for DoS attacks.

Physical Security Safeguards

- Walls and guards
- Policies and procedures
- Access control and monitoring
- Environmental controls
- Fire suppression

Physical Security Safeguards

- While it is difficult to be completely secure, several steps can be taken to mitigate the risk to information systems from a physical threat.
  - Policies & Procedures
  - Access Controls
- Policies and procedures affect two distinct areas that affect:
  - Computers.
  - Users.
- To mitigate the physical security risk to computers physical security should be extended to the computers themselves.

Physical Access

- Physical access negates all other security measures.
- Physical access allows an attacker to plug into an open Ethernet jack.
  - Hand-held devices that run operating systems with full networking support make this attack feasible.
  - Originally, the attacker would have to be in a secluded area with dedicated access to the Ethernet.
    - An attacker can sit with a laptop and run a variety of tools against the network.
    - Being internally based puts them behind the firewall and intrusion detection system.

Boot from Other Devices

- To combat the threat of boot disks:
  - Remove or disable floppy drives on all desktops that do not require them.
  - Disable auto run feature
  - Set the BIOS Password
    - Delays / prevent attacker from resetting the boot sequence to boot from a device other than the hard drive

USB and Security USB Boot

- USB ports
  - expand the ability for users to connect devices
  - have them auto-recognize and work, usually without needing additional drivers or software.
- Remedies:
  - Disallow the USB devices if OS permits
  - Unload / disable the entire USB driver if running an OS that does not support disabling of the device.
  - If these USB devices are allowed, aggressive virus scanning should be implemented.

Theft of Systems

- The final physical access attack that can be performed is outright theft of machines.
  - Frequently the most effective countermeasure is to lock machines with sensitive data.
  - Special access to server rooms should be considered.
  - There should be minimal distribution of sensitive data.

User Responsibility

- Users are the weakest link in the security chain.
- They need to be aware of security issues and also need to be involved in security enforcement.
- Users should know whom to contact when they suspect a security violation.
- They can perform one of the simple security tasks – Locking a workstation immediately when stepping away from it.
- Security guards are not always users. However, they need to be educated about proper network security as well as physical security involving users.

Walls and Guards

- The primary defense against a majority of physical attacks are the barriers between the assets and a potential attacker—walls, fences, gates, and doors.
- Some employ private security staff to attempt to protect their assets.

- The most valuable assets should be contained on company servers.
- To protect the physical servers, you must look in all directions:
  - Doors and windows should be safeguarded and a minimum number of each should be used in a server room.
  - Is there a drop ceiling?
  - Is there a raised floor?

Guards

- Guards are a visible presence with direct responsibility for security, so they provide an excellent security measure.
- Guards can monitor entrances and exits and can maintain access logs of who has entered and departed the building.
- Everyone who passes through security as a visitor should sign the log. It can be useful in tracing who was at what location and why.

Policies and Procedures

- Physical security policies and procedures relate to two distinct areas:
  - Those that affect the computers themselves
  - Those that affect users

Computer Policies

- Remove/disable the floppy disk system.
- Remove/disable the optical drive system.
  - If that is not possible, remove the device from the boot menu and set a BIOS password.
- Disallow USB drive keys, either with active directory or registry settings.
  - If that is not possible, implement aggressive anti-malware scanning.
- Lock up equipment that contains sensitive data.
- Train all employees:
  - To challenge strangers
  - To follow procedures
  - To lock workstations before leaving them

Environmental Controls

- Sophisticated environmental controls are needed for current data centers.
- Fire suppression is also an important consideration when dealing with information systems.
- Heating ventilating and air conditioning (HVAC) systems are critical for keeping data centers cool.
  - Properly securing these systems is important in helping prevent an attacker from performing a physical DoS attack on your servers.

Fire Suppression

- The ability to respond to a fire quickly and effectively is critical to the long-term success of any organization.
- The goal—never to have a fire—however, in the event that one does occur, mechanisms are in place to limit the damage the fire can cause.

- Fire suppression system
  - Water-based
  - Halon-based
  - Clean-agent
  - Handheld fire extinguishers

Fire Detection Devices

- An essential complement to fire suppression systems and devices are fire detection devices (fire detectors).
- Detectors may be able to detect a fire in its very early stages.
- There are several different types of fire detectors.
  - Smoke activated
    - Ionization – Detects ionized particles caused by fire
    - Photoelectric – Detects degradation of light from smoke
  - Heat activated
    - Fixed-temperature – Alerts if temperature exceeds a pre-defined level
    - Rate-of-rise temperature – Detects sudden increases in temperature
  - Flame activated
    - Relies on the flames from the fire to provide a change in the infrared energy that can be detected

Access Controls and Monitoring

- Access control means having control of doors and entry points.
  - Locks
  - Layered access systems
  - Electronic door control systems
  - Closed circuit television (CCTV)

Layered Access

- Physical barriers help safeguard the information infrastructure.
- Layered Access
  - Assets should be protected with several perimeters.
  - Servers should be placed in a separate secure area with a separate authentication mechanism.
  - Access to the server room should be limited to staff with legitimate need.
  - To layer the protection, the area surrounding the server room should also be limited to just the people who work in that area.

Electronic Access Control

- Electronic access control systems manage opening and closing doors.
  - A centralized system can instantly grant or refuse access.
  - The system works with a software package running on a computer.
  - It should not be on a network.

Closed Circuit Television (CCTV)

- Closed circuit television (CCTV) cameras are similar to the door control systems—they can be very effective, but how they are implemented is an important consideration.
- Carefully consider camera placement and the type of cameras used.
- Different iris types, focal lengths, and color or infrared capabilities are all options that make one camera superior over another in a specific location.

Authentication

- Authentication is the process by which a user proves that she is who she says she is.
- Authentication is performed to allow or deny a person access to a physical space.
- The heart of any access control system is to allow access to authorized users and to make sure access is denied to unauthorized people.
- Access controls, network or physical, do not work without some form of authentication.
- During authentication, users prove they are who they claim to be.
- Authentication is done to allow or deny access to a physical space.

Access Tokens (Keys)

- Access tokens are the traditional form of physical access authentication.
- Defined as “something you have.”
- An access token is a physical object that identifies specific access rights. Your house key, for example, is a basic physical access token that allows you access into your home.
- The primary drawback of token-based authentication - Only the token is being authenticated.
  - The theft of the token could grant anyone who possessed the token access to what the system protects.
- Keys have worked as token authentication for over a hundred years, but they have several limitations
- Some of the limitations of tokens are:
  - Keys are paired exclusively with a lock or a set of locks, and they are not easily changed
  - They are easy to copy.
  - They are difficult to invalidate.

Radio Frequency Cards

- When contactless radio frequency cards and readers are passed near a card reader, the card sends out a code via radio.
- The reader picks up this code and transmits it to the control panel.
- The control panel checks the code against the reader it is being read from and the type of access the card has in its database.
- Advantages of Radio Frequency Cards
  - Any card can be deleted from the system.
  - All doors can be segmented to create multiple access areas.

Biometrics

- Biometrics
  - Uses the measurements of certain biological factors to distinguish one specific person from others.
  - These factors are based on parts of the human body that are unique.
  - The most well known of these unique biological factors is the fingerprint.

- Biometric Concerns
  - False positives and false negatives are two issues with biometric scanners.
  - There is a chance of attackers stealing the uniqueness factor the machine scans and reproducing it to fool the scanner.
    - Stolen Factors (Fingerprint from glass).
  - Changes over time can affect the accuracy.

- **A False Positive**
  - When a biometric is scanned and allows access to someone who is not authorized
  - for example, two people who have very similar fingerprints might be recognized as the same person by the computer, which grants access to the wrong person.

- **A False Negative**
  - When the system denies access to someone who is actually authorized
  - for example, a user at the hand geometry scanner forgot to wear a ring he usually wears and the computer doesn't recognize his hand and denies him access.

Multiple-factor Authentication

- Authentication can be separated into three broad categories:
  - What you are (for example, biometrics)
  - What you have (for example, tokens)
  - What you know (for example, passwords)

- Multiple factor authentication is simply the combination of two or more types of authentication.
  - Two-factor authentication combines two factors before granting access.
  - Three-factor authentication combines all the three types.

- Multiple factor authentication makes it very difficult for an attacker to have the correct materials for authentication.
  - This method of authentication reduces risk of stolen tokens.
  - It also enhances biometric security.