Attack (computing)

In *computer* and *computer networks* an attack is any attempt to destroy, expose, alter, disable, steal or gain unauthorized access to or make unauthorized use of an asset.

> *Any kind of malicious activity that attempts to collect, disrupt, deny, degrade, or destroy information system resources or the information itself.*

The increasing dependencies of modern society on information and computers networks (both in private and public sectors, including military has led to new terms like cyber attack and cyberwarfare.

> *An attack, via cyberspace, targeting an enterprise's use of cyberspace for the purpose of disrupting, disabling, destroying, or maliciously controlling a computing environment/infrastructure; or destroying the integrity of the data or stealing controlled information.*

Types of Attack

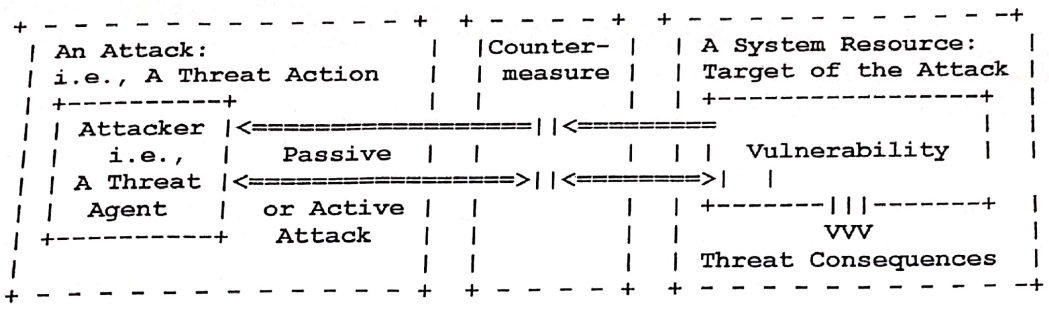
An attack can be *active* or *passive*.

> An "active attack" attempts to alter system resources or affect their operation.
> A "passive attack" attempts to learn or make use of information from the system but does not affect system resources. (E.g., wiretapping.)

An attack can be perpetrated by an *insider* or from *outside* the organization;

> An "inside attack" is an attack initiated by an entity inside the security perimeter (an "insider"), i.e., an entity that is authorized to access system resources but uses them in a way not approved by those who granted the authorization.
> An "outside attack" is initiated from outside the perimeter, by an unauthorized or illegitimate user of the system (an "outsider"). In the Internet, potential outside attackers range from amateur pranksters to organized criminals, international terrorists, and hostile governments.

The term "attack" relates to some other basic security terms as shown in the following diagram



A resource (both physical or logical), called an asset, can have one or more vulnerabilities that can be exploited by a threat agent in a threat action. The result can potentially compromises the confidentiality, integrity or availability properties of resources (potentially different that the vulnerable one) of the organization and others involved parties (customers, suppliers).

The so-called CIA triad is the basis of information security.

The attack can be *active* when it attempts to alter system resources or affect their operation: so it compromises integrity or availability. A "*passive attack*" attempts to learn or make use of information from the system but does not affect system resources: so it compromises confidentiality.

A threat is a potential for violation of security, which exists when there is a circumstance, capability, action, or event that could breach security and cause harm. That is, a threat is a possible danger that might exploit a vulnerability. A threat can be either "intentional" (i.e., intelligent; e.g., an individual cracker or a criminal organization) or "accidental" (e.g., the possibility of a computer malfunctioning, or the possibility of an "act of God" such as an earthquake, a fire, or a tornado).[2]

A set of policies concerned with information security management, the information security management systems (ISMS), has been developed to manage, according to risk management principles, the countermeasures in order to accomplish to a security strategy set up following rules and regulations applicable in a country.[7]

An attack should led to a *security incident* i.e. a *security event* that involves a *security violation*. In other words, a security-relevant system event in which the system's security policy is disobeyed or otherwise breached.

Types of attacks

An attack usually is perpetrated by someone with bad intentions: black hatted attacks falls in this category, while other perform penetration testing on an organization information system to find out if all foreseen controls are in place.

The attacks can be classified according to their origin: i.e. if it is conducted using one or more computers: in the last case is called a distributed attack. Botnets are used to conduct distributed attacks.

Other classifications are according to the procedures used or the type of vulnerabilities exploited: attacks can be concentrated on network mechanisms or host features.

Some attacks are physical: i.e. theft or damage of computers and other equipment. Others are attempts to force changes in the logic used by computers or network protocols in order to achieve unforeseen (by the original designer) result but useful for the attacker. Software used to for logical attacks on computers is called malware.

Cybercrime (Computer Crime)

Cybercrime, or computer crime, is crime that involves a computer and a network.[1] The computer may have been used in the commission of a crime, or it may be the target.[2]DebaratiHalder and K. Jaishankar define cybercrimes as: "Offences that are committed against individuals or groups of individuals with a criminal motive to intentionally harm the reputation of the victim or cause physical or mental harm, or loss, to the victim directly or indirectly, using modern telecommunication networks such as Internet (Chat rooms, emails, notice boards and groups) and mobile phones (SMS/MMS)".[3] Such crimes may threaten a nation's security and financial health.[4] Issues surrounding these types of crimes have become high-profile, particularly those surrounding hacking, copyright infringement, child pornography, and child grooming. There are also problems of privacy when confidential information is intercepted or disclosed, lawfully or otherwise. DebaratiHalder and K. Jaishankar further define cybercrime from the perspective of gender and defined 'cybercrime against women' as "Crimes targeted against women with a motive to intentionally harm the victim psychologically and physically, using modern telecommunication networks such as internet and mobile phones".[3] Internationally, both governmental and non-state actors engage in cybercrimes, including espionage, financial theft, and other cross-border crimes. Activity crossing international borders and involving the interests of at least one nation state is sometimes referred to as cyberwarfare. The international legal system is attempting to hold actors accountable for their actions through the International Criminal Court.[5]

Classification

Computer crime encompasses (has) a broad range of activities.

Fraud and financial crimes

Computer fraud is any dishonest misrepresentation of fact intended to let another to do or refrain from doing something which causes loss. In this context, the fraud will result in obtaining a benefit by:

- Altering in an unauthorized way. This requires little technical expertise and is common form of theft by employees altering the data before entry or entering false data, or by entering unauthorized instructions or using unauthorized processes;
- Altering, destroying, suppressing, or stealing output, usually to conceal unauthorized transactions. This is difficult to detect;
- Altering or deleting stored data;

Other forms of fraud may be facilitated using computer systems, including bank fraud, carding, identity theft, extortion, and theft of classified information.

A variety of internet scams, many based on phishing and social engineering, target consumers and businesses.

Cyber terrorism

Government officials and information technology security specialists have documented a significant increase in Internet problems and server scans since early 2001. But there is a growing concern among federal officials[*who?*] that such intrusions are part of an organized effort by cyberterrorists, foreign intelligence services, or other groups to map potential security holes in critical systems. A cyberterrorist is someone who intimidates or coerces a government or organization to advance his or her political or social objectives by launching a computer-based attack against computers, networks, or the information stored on them.

Cyberterrorism in general, can be defined as an act of terrorism committed through the use of cyberspace or computer resources (Parker 1983). As such, a simple propaganda in the Internet, that there will be bomb attacks during the holidays can be considered cyberterrorism. There are also hacking activities directed towards individuals, families, organized by groups within networks, tending to cause fear among people, demonstrate power, collecting information relevant for ruining peoples' lives, robberies, blackmailing etc.[*citation needed*]

Cyberextortion

Cyberextortion occurs when a website, e-mail server, or computer system is subjected to or threatened with repeated denial of service or other attacks by malicious hackers. These hackers demand money in return for promising to stop the attacks and to offer "protection". According to the Federal Bureau of Investigation, cyberextortionists are increasingly attacking corporate websites and networks, crippling their ability to operate and demanding payments to restore their service. More than 20 cases are reported each month to the FBI and many go unreported in order to keep the victim's name out of the public domain. Perpetrators typically use a distributed denial-of-service attack.[11]

Computer as a target

These crimes are committed by a selected group of criminals. Unlike crimes using the computer as a tool, these crimes require the technical knowledge of the perpetrators. As such, as technology evolves, so too does the nature of the crime. These crimes are relatively new, having been in existence for only as long as computers have—which explains how unprepared society and the world in general is towards combating these crimes. There are numerous crimes of this nature committed daily on the internet:

Crimes that primarily target computer networks or devices include:

- Computer viruses
- Denial-of-service attacks
- Malware (malicious code)

Computer as a tool

When the individual is the main target of cybercrime, the computer can be considered as the tool rather than the target. These crimes generally involve less technical expertise. Human weaknesses are generally exploited. The damage dealt is largely psychological and intangible, making legal action against the variants more difficult. These are the crimes which have existed for centuries in the offline world. Scams, theft, and the likes have existed even before the development in high-tech equipment. The same criminal has simply been given a tool which increases his potential pool of victims and makes him all the harder to trace and apprehend.[14]

Crimes that use computer networks or devices to advance other ends include:

- Fraud and identity theft (although this increasingly uses malware, hacking and/or phishing, making it an example of both "computer as target" and "computer as tool" crime)
- Information warfare
- Phishing scams
- Spam
- Propagation of illegal obscene or offensive content, including harassment and threats

Obscene or offensive content

The content of websites and other electronic communications may be distasteful, obscene or offensive for a variety of reasons. In some instances these communications may be legal.

The extent to which these communications are unlawful varies greatly between countries, and even within nations. It is a sensitive area in which the courts can become involved in arbitrating between groups with strong beliefs.

Combating computer crime

Diffusion of cybercrime

The broad diffusion of cybercriminal activities is an issue in computer crimes detection and prosecution. According to Jean-Loup Richet (Research Fellow at ESSEC ISIS), technical expertise and accessibility no longer act as barriers to entry into cybercrime.[32] Indeed, hacking is much less complex than it was a few years ago, as hacking communities have greatly diffused their knowledge through the Internet. Blogs and communities have hugely contributed to information sharing: beginners could benefit from older hackers' knowledge

and advice. Furthermore, Hacking is cheaper than ever: before the cloud computing era, in order to spam or scam one needed a dedicated server, skills in server management, network configuration and maintenance, knowledge of Internet service provider standards, etc. By comparison, a mail software-as-a-service is a scalable, inexpensive, bulk, and transactional e-mail-sending service for marketing purposes and could be easily set up for spam.[33] Jean-Loup Richet explains that cloud computing could be helpful for a cybercriminal as a way to leverage his attack – brute-forcing a password, improve the reach of a botnet, or facilitating a spamming campaign.[34]

Investigation

A computer can be a source of evidence (see digital forensics). Even where a computer is not directly used for criminal purposes, it may contain records of value to criminal investigators in the form of a logfile. In most countries[*citation needed*] Internet Service Providers are required, by law, to keep their logfiles for a predetermined amount of time. For example; a European wide Data Retention Directive (applicable to all EUmember states) states that all E-mail traffic should be retained for a minimum of 12 months.

Legislation

Due to easily exploitable laws, cybercriminals use developing countries in order to evade detection and prosecution from law enforcement. In developing countries, such as the Philippines, laws against cybercrime are weak or sometimes nonexistent. These weak laws allow cybercriminals to strike from international borders and remain undetected. Even when identified, these criminals avoid being punished or extradited to a country, such as the United States, that has developed laws that allow for prosecution. While this proves difficult in some cases, agencies, such as the FBI, have used deception and subterfuge to catch criminals. For example, two Russian hackers had been evading the FBI for some time. The FBI set up a fake computing company based in Seattle, Washington. They proceeded to lure the two Russian men into the United States by offering them work with this company. Upon completion of the interview, the suspects were arrested outside of the building. Clever tricks like this are sometimes a necessary part of catching cybercriminals when weak legislation makes it impossible otherwise.[35]

President Barack Obama released in an executive order in April 2015 to combat cybercrime. The executive order allows the United States to freeze assets of convicted cybercriminals and block their economic activity within the United States. This is some of the first solid legislation that combats cybercrime in this way.[36]

The European Union adopted directive 2013/40/EU. All offences of the directive, and other definitions and procedural institutions are also in the Council of Europe's Convention on Cybercrime.[37]

Penalties

Penalties for computer related crimes in New York State can range from a fine and a short period of jail time for a Class A misdemeanor such as unauthorized use of a computer up to computer tampering in the first degree which is a Class C felony and can carry 3 to 15 years in prison.[*citation needed*]

However, some hackers have been hired as information security experts by private companies due to their inside knowledge of computer crime, a phenomenon which theoretically could create perverse incentives. A possible counter to this is for courts to ban convicted hackers from using the Internet or computers, even after they have been released from prison – though as computers and the Internet become more and more central to everyday life, this type of punishment may be viewed as more and more harsh and draconian. However, nuanced approaches have been developed that manage cyberoffender behavior without resorting to total computer and/or Internet bans.[38] These approaches involve restricting individuals to specific devices which are subject to computer monitoring and/or computer searches by probation and/or parole officers.[39]

Awareness

As technology advances and more people rely on the internet to store sensitive information such as banking or credit card information, criminals are going to attempt to steal that information. Cyber-crime is becoming more of a threat to people across the world. Raising awareness about how information is being protected and the tactics criminals use to steal that information is important in today's world. According to the FBI's Internet Crime Complaint Center in 2014 there were 269,422 complaints filed. With all the claims combined there was a reported total loss of $800,492,073. But yet cyber-crime doesn't seem to be on the average person's radar. There are 1.5 million cyber-attacks annually, that means that there are over 4,000 attacks a day, 170 attacks every hour, or nearly three attacks every minute. Anybody who uses the internet for any reason can be a victim, which is why it is important to be aware of how one is being protected while online.

Methods of Defense

We investigate the legal and ethical restrictions on computer-based crime. But unfortunately, computer crime is certain to continue for the foreseeable future. For this reason, we must look carefully at controls for preserving confidentiality, integrity, and availability. Sometimes these controls can prevent or mitigate attacks; other, less powerful methods can only inform us that security has been compromised, by detecting a breach as it happens or after it occurs.

Harm occurs when a threat is realized against a vulnerability. To protect against harm, then, we can neutralize the threat, close the vulnerability, or both. The possibility for harm to occur is called risk. We can deal with harm in several ways. We can seek to

- *preventit,* by blocking the attack or closing the vulnerability
- *deterit,* by making the attack harder but not impossible
- *deflectit,* by making another target more attractive (or this one less so)
- *detectit,* either as it happens or some time after the fact
- *recover* from its effects

In 2001, a reporter for *The Wall Street Journal* bought a used computer in Afghanistan. Much to his surprise, he found the hard drive contained what appeared to be files from a senior al Qaeda operative. Cullison [CUL04] reports that he turned the computer over to the FBI. In his story published in 2004 in *The Atlantic,* he carefully avoids revealing anything he thinks might be sensitive.

The disk contained more than 1,000 documents, many of them encrypted with relatively weak encryption. Cullison found draft mission plans and white papers setting forth ideological and philosophical arguments for the attacks of 11 September 2001. There were also copies of news stories on terrorist activities. He also found documents indicating that al Qaeda were not originally interested in chemical, biological, or nuclear weapons, but became interested after reading public news articles accusing al Qaeda of having those capabilities.

Perhaps most unexpected were e-mail messages of the kind one would find in a typical office: recommendations for promotions, justifications for petty cash expenditures, arguments concerning budgets.

The computer appears to have been used by al Qaeda from 1999 to 2001. Cullison notes that Afghanistan in late 2001 was a scene of chaos, and it is likely the laptop's owner fled quickly, leaving the computer behind, where it fell into the hands of a secondhand merchant who did not know its contents.

But this computer illustrates an important point of computer security and confidentiality: We can never predict the time at which a security disaster will strike, and thus we must always be prepared as if it will happen immediately.

Of course, more than one of these can be done at once. So, for example, we might try to prevent intrusions. But in case we do not prevent them all, we might install a detection device to warn of an imminent attack. And we should have in place incident response procedures to help in the recovery in case an intrusion does succeed.

Controls

To consider the controls or countermeasures that attempt to prevent exploiting a computing system's vulnerabilities, we begin by thinking about traditional ways to enhance physical security. In the Middle Ages, castles and fortresses were built to protect the people and valuable property inside. The fortress might have had one or more security characteristics, including

- a strong gate or door, to repel invaders
- heavy walls to withstand objects thrown or projected against them
- a surrounding moat, to control access
- arrow slits, to let archers shoot at approaching enemies
- crenellations to allow inhabitants to lean out from the roof and pour hot or vile liquids on attackers
- a drawbridge to limit access to authorized people
- gatekeepers to verify that only authorized people and goods could enter

Similarly, today we use a multipronged approach to protect our homes and offices. We may combine strong locks on the doors with a burglar alarm, reinforced windows, and even a nosy neighbor to keep an eye on our valuables. In each case, we select one or more ways to deter an intruder or attacker, and we base our selection not only on the value of what we protect but also on the effort we think an attacker or intruder will expend to get inside.

Computer security has the same characteristics. We have many controls at our disposal. Some are easier than others to use or implement. Some are cheaper than others to use or implement. And some are more difficult than others for intruders to override.

In this section, we present an overview of the controls available to us. In later chapters, we examine each control in much more detail.

Encryption

We noted earlier that we seek to protect hardware, software, and data. We can make it particularly hard for an intruder to find data useful if we somehow scramble the data so that interpretation is meaningless without the intruder's knowing how the scrambling was done. Indeed, the most powerful tool in providing computer security is this scrambling or encoding.

Encryption is the formal name for the scrambling process. We take data in their normal, unscrambled state, called cleartext, and transform them so that they are unintelligible to the outside observer; the transformed data are called enciphered text or ciphertext. Using

encryption, security professionals can virtually nullify the value of an interception and the possibility of effective modification or fabrication. Encryption clearly addresses the need for confidentiality of data. Additionally, it can be used to ensure integrity; data that cannot be read generally cannot easily be changed in a meaningful manner. Furthermore, as we see throughout this book, encryption is the basis of protocols that enable us to provide security while accomplishing an important system or network task. A protocol is an agreed-on sequence of actions that leads to a desired result. For example, some operating system protocols ensure availability of resources as different tasks and users request them. Thus, encryption can also be thought of as supporting availability. That is, encryption is at the heart of methods for ensuring all aspects of computer security.

Although encryption is an important tool in any computer security tool kit, we should not overrate its importance. Encryption does not solve all computer security problems, and other tools must complement its use. Furthermore, if encryption is not used properly, it may have no effect on security or could even degrade the performance of the entire system. Weak encryption can actually be worse than no encryption at all, because it gives users an unwarranted sense of protection. Therefore, we must understand those situations in which encryption is most useful as well as ways to use it effectively.

Software Controls

If encryption is the primary way of protecting valuables, programs themselves are the second facet of computer security. Programs must be secure enough to prevent outside attack. They must also be developed and maintained so that we can be confident of the programs' dependability.

Program controls include the following:

- *internal program controls:* parts of the program that enforce security restrictions, such as access limitations in a database management program
- *operating system and network system controls:* limitations enforced by the operating system or network to protect each user from all other users
- *independent control programs:* application programs, such as password checkers, intrusion detection utilities, or virus scanners, that protect against certain types of vulnerabilities
- *development controls:* quality standards under which a program is designed, coded, tested, and maintained to prevent software faults from becoming exploitable vulnerabilities

We can implement software controls by using tools and techniques such as hardware components, encryption, or information gathering. Software controls frequently affect users directly, such as when the user is interrupted and asked for a password before being given access to a program or data. For this reason, we often think of software controls when we think of how systems have been made secure in the past. Because they influence the way users interact with a computing system, software controls must be carefully

designed. Ease of use and potency are often competing goals in the design of a collection of software controls.

Hardware Controls

Numerous hardware devices have been created to assist in providing computer security. These devices include a variety of means, such as

- hardware or smart card implementations of encryption
- locks or cables limiting access or deterring theft
- devices to verify users' identities
- firewalls
- intrusion detection systems
- circuit boards that control access to storage media

Policies and Procedures

Sometimes, we can rely on agreed-on procedures or policies among users rather than enforcing security through hardware or software means. In fact, some of the simplest controls, such as frequent changes of passwords, can be achieved at essentially no cost but with tremendous effect. Training and administration follow immediately after establishment of policies, to reinforce the importance of security *policy* and to ensure their proper use.

We must not forget the value of community standards and expectations when we consider how to enforce security. There are many acts that most thoughtful people would consider harmful, and we can leverage this commonality of belief in our policies. For this reason, legal and ethical controls are an important part of computer security. However, the law is slow to evolve, and the technology involving computers has emerged relatively suddenly. Although legal protection is necessary and desirable, it may not be as dependable in this area as it would be when applied to more well-understood and long-standing crimes.

Society in general and the computing community in particular have not adopted formal standards of ethical behavior. As we see in Chapter 11, some organizations have devised codes of ethics for computer professionals. However, before codes of ethics can become widely accepted and effective, the computing community and the general public must discuss and make clear what kinds of behavior are inappropriate and why.

Physical Controls

Some of the easiest, most effective, and least expensive controls are *physical controls*. Physical controls include locks on doors, guards at entry points, backup copies of important software and data, and physical site planning that reduces the risk of natural disasters. Often the simple physical controls are overlooked while we seek more sophisticated approaches.

Effectiveness of Controls

Merely having controls does no good unless they are used properly. Let us consider several aspects that can enhance the effectiveness of controls.

Awareness of Problem

People using controls must be convinced of the need for security. That is, people will willingly cooperate with security requirements only if they understand why security is appropriate in a given situation. However, many users are unaware of the need for security, especially in situations in which a group has recently undertaken a computing task that was previously performed with lax or no apparent security.

Likelihood of Use

Of course, no control is effective unless it is used. The lock on a computer room door does no good if people block the door open. As Sidebar 1-7 tells, some computer systems are seriously uncontrolled.

- Principle of Effectiveness: Controls must be used—and used properly—to be effective. They must be efficient, easy to use, and appropriate.

This principle implies that computer security controls must be efficient enough, in terms of time, memory space, human activity, or other resources used, that using the control does not seriously affect the task being protected. Controls should be selective so that they do not exclude legitimate accesses.

In 2001, Wilshire Associates, Inc., a Santa Monica, California-based investment company that manages about $10 billion of other people's money, found that its e-mail system had been operating for months with little security. Outsiders potentially had access to internal messages containing confidential information about clients and their investments, as well as sensitive company information.

According to a *Washington Post* article [OHA01], Wilshire had hired an outside security investigator in 1999 to review the security of its system. Thomas Stevens, a senior managing director of Wilshire said, "We had a report back that said our firewall is like Swiss cheese. We plugged the holes. We didn't plug all of them." Company officials were "not overly concerned" about that report because they are "not in the defense business." In 2001, security analyst George Imburgia checked the system's security on his own, from the outside (with the same limited knowledge an attacker would have) and found it was "configured to be available to everyone; all you need to do is ask."

Wilshire's system enabled employees to access their e-mail remotely. A senior Wilshire director suggested that the e-mail messages in the system should have been encrypted.

Overlapping Controls

As we have seen with fortress or home security, several different controls may apply to address a single vulnerability. For example, we may choose to implement security for a microcomputer application by using a combination of controls on program access to the data, on physical access to the microcomputer and storage media, and even by file locking to control access to the processing programs.

Periodic Review

Few controls are permanently effective. Just when the security specialist finds a way to secure assets against certain kinds of attacks, the opposition doubles its efforts in an attempt to defeat the security mechanisms. Thus, judging the effectiveness of a control is an ongoing task. (Sidebar 1-8 reports on periodic reviews of computer security.)

Seldom, if ever, are controls perfectly effective. Controls fail, controls are incomplete, or people circumvent or misuse controls, for example. For that reason, we use overlapping controls, sometimes called a layered defense, in the expectation that one control will compensate for a failure of another. In some cases, controls do nicely complement each other. But two controls are not always better than one and, in some cases, two can even be worse than one. This brings us to another security principle.

- Principle of Weakest Link:Security can be no stronger than its weakest link. Whether it is the power supply that powers the firewall or the operating system under the security application or the human who plans, implements, and administers controls, a failure of any control can lead to a security failure.

The U.S. Congress requires government agencies to supply annual reports to the Office of Management and Budget (OMB) on the state of computer security in the agencies. The agencies must report efforts to protect their computer networks against crackers, terrorists, and other attackers.

In November 2001, for the third edition of this book, two-thirds of the government agencies received a grade of F (the lowest possible) on the computer security report card based on the OMB data. The good news for this edition is that in 2005 only 8 of 24 agencies received grades of F and 7 agencies received a grade of A. The bad, and certainly sad, news is that the average grade was D+. Also disturbing is that the grades of 7 agencies fell from 2004 to 2005. Among the failing agencies were Defense, State, Homeland Security, and Veterans Affairs. The Treasury Department received a D-. A grades went to Labor, Social Security Administration, and the National Science Foundation, among others. (Source: U.S. House of Representatives Government Reform Committee.)

Computer security (Information Security):

Computer security, also known as cyber security or IT security, is the protection of information systems from theft or damage to the hardware, the software, and to the information on them, as well as from disruption or misdirection of the services they provide.

It includes controlling physical access to the hardware, as well as protecting against harm that may come via network access, data and code injection, and due to malpractice by operators, whether intentional, accidental, or due to them being tricked into deviating from secure procedures.

The field is of growing importance due to the increasing reliance on computer systems and the Internet in most societies,[4] wireless networks such as Bluetooth and Wi-Fi - and the growth of "smart" devices, including smartphones, televisions and tiny devices as part of the Internet of Things.

Vulnerabilities and attacks

A vulnerability is a system susceptibility or flaw. Many vulnerabilities are documented in the Common Vulnerabilities and Exposures (CVE) database. An *exploitable* vulnerability is one for which at least one working attack or "exploit" exists.To secure a computer system, it is important to understand the attacks that can be made against it, and these threats can typically be classified into one of the categories below:

Backdoors

A backdoor in a computer system, a cryptosystem or an algorithm, is any secret method of bypassing normal authentication or security controls. They may exist for a number of reasons, including by original design or from poor configuration. They may have been added by an authorized party to allow some legitimate access, or by an attacker for malicious reasons; but regardless of the motives for their existence, they create a vulnerability.

Denial-of-service attack

Denial of service attacks are designed to make a machine or network resource unavailable to its intended users.[6] Attackers can deny service to individual victims, such as by deliberately entering a wrong password enough consecutive times to cause the victim account to be locked, or they may overload the capabilities of a machine or network and block all users at once. While a network attack from a single IP address can be blocked by adding a new firewall rule, many forms of Distributed denial of service (DDoS) attacks are possible, where the attack comes from a large number of points – and defending is much more difficult. Such attacks can originate from the zombie computers of a botnet, but a range of other techniques are possible including reflection and amplification attacks, where innocent systems are fooled into sending traffic to the victim.

Direct-access attacks

An unauthorized user gaining physical access to a computer is most likely able to directly copy data from it. They may also compromise security by making operating system modifications, installing software worms, keyloggers, covert listening devices or using wireless mice.[7] Even when the system is protected by standard security measures, these may be able to be by-passed by booting another operating system or tool from a CD-ROM or other bootable media. Disk encryption and Trusted Platform Module are designed to prevent these attacks.

Eavesdropping

Eavesdropping is the act of surreptitiously listening to a private conversation, typically between hosts on a network. For instance, programs such as Carnivore and NarusInsight have been used by the FBI and NSA to eavesdrop on the systems of internet service providers. Even machines that operate as a closed system (i.e., with no contact to the outside world) can be eavesdropped upon via monitoring the faint electro-magnetic transmissions generated by the hardware; TEMPEST is a specification by the NSA referring to these attacks.

Spoofing

Spoofing, in general, is a fraudulent or malicious practice in which communication is sent from an unknown source disguised as a source known to the receiver. Spoofing is most prevalent in communication mechanisms that lack a high level of security.[8]

Tampering

Tampering describes a malicious modification of products. So-called "Evil Maid" attacks and security services planting of surveillance capability into routers[9] are examples.

Privilege escalation

Privilege escalation describes a situation where an attacker with some level of restricted access is able to, without authorization, elevate their privileges or access level. So for example a standard computer user may be able to fool the system into giving them access to restricted data; or even to "become root" and have full unrestricted access to a system.

Phishing

Phishing is the attempt to acquire sensitive information such as usernames, passwords, and credit card details directly from users. Phishing is typically carried out by email spoofing or instant messaging, and it often directs users to enter details at a fake website whose look and feel are almost identical to the legitimate one. Preying on a victim's trusting, phishing can be classified as a form of social engineering.

Clickjacking

Clickjacking, also known as "UI redress attack" or "User Interface redress attack", is a malicious technique in which an attacker tricks a user into clicking on a button or link on another webpage while the user intended to click on the top level page. This is done using multiple transparent or opaque layers. The attacker is basically "hijacking" the clicks meant for the top level page and routing them to some other irrelevant page, most likely owned by someone else. A similar technique can be used to hijack keystrokes. Carefully drafting a combination of stylesheets, iframes, buttons and text boxes, a user can be led into believing that they are typing the password or other information on some authentic webpage while it is being channeled into an invisible frame controlled by the attacker.