SECURITY BREACHES

A **security breach** is any **incident that results in unauthorized access** to computer data, applications, networks or devices.

It results in information being accessed without authorization.

Typically, it occurs when an intruder is able to bypass **security** mechanisms.

Types of security breaches

There are a number of types of security breaches depending on how access has been gained to the system:

1. An **exploit** attacks a system vulnerability, such as an out of date operating system. Legacy systems which haven't been updated, for instance, in businesses where outdated and versions of Microsoft Windows that are no longer supported are being used, are particularly vulnerable to exploits.
2. **Weak passwords** can be cracked or guessed. Even now, some people are still using the password 'password', and 'pa$$word' is not much more secure.
3. **Malware attacks,** such as phishing emails can be used to gain entry. It only takes one employee to click on a link in a phishing email to allow malicious software to start spreading throughout the network.
4. **Drive-by downloads** use viruses or malware delivered through a compromised or spoofed website.
5. **Social engineering** can also be used to gain access. For instance, an intruder phones an employee claiming to be from the company's IT helpdesk and asks for the password in order to 'fix' the computer.

Threats and Vulnerability

Threat is what an organization is defending itself against, e.g. a DoS attack.

Vulnerabilities are the gaps or weaknesses that undermine an organization's IT security efforts, e.g. a firewall flaw that lets hackers into a network

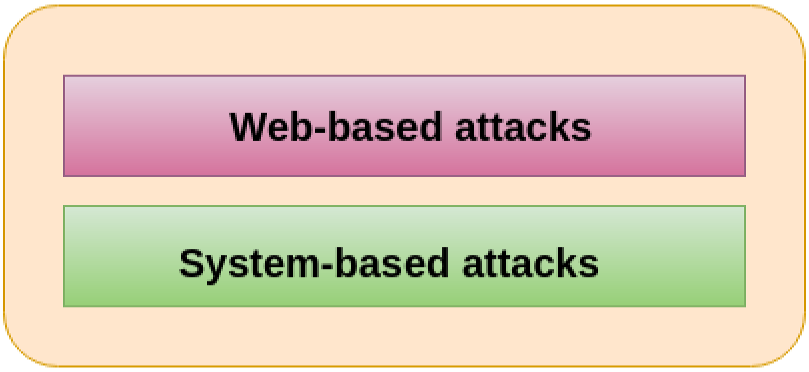
Types of Threats

Threats are named as such because of the negative consequences they can have on the environment. A SecOps threat, can have the undesirable consequence of granting unauthorized access to restricted, secure information. There are three major types of threats:

1. **Natural threats:** acts of nature that can be unpredictable in terms of onset, duration and impact. Examples of natural threats, also known as natural hazards, include earthquakes, floods and forest fires.
2. **Unintentional threats:** these forms of threats can oftentimes be attributed to human error. Unintentional threats can be physical, e.g. leaving the door to IT servers unlocked, or electronic, e.g. leaving the front door to premises containing sensitive information unmonitored.
3. **Intentional threats:** activity done on purpose to compromise an IT system, brought about by threat actors or groups. Examples of intentional threats include injecting malicious code, tampering with a hardware device or stealing an encryption key to access user login credentials.

Types of Cyber Attacks

A cyber-attack is an exploitation of computer systems and networks. It uses malicious code to alter computer code, logic or data and lead to cybercrimes, such as information and identity theft.



Classification of Cyber attacks

Web-based attacks

These are the attacks which occur on a website or web applications. Some of the important web-based attacks are as follows-

1. Injection attacks

It is the attack in which some data will be injected into a web application to manipulate the application and fetch the required information.

Example- SQL Injection, code Injection, log Injection, XML Injection etc.

2. DNS Spoofing

DNS Spoofing is a type of computer security hacking. Whereby a data is introduced into a DNS resolver's cache causing the name server to return an incorrect IP address, diverting traffic to the attacker?s computer or any other computer. The DNS spoofing attacks can go on for a long period of time without being detected and can cause serious security issues.

3. Session Hijacking

It is a security attack on a user session over a protected network. Web applications create cookies to store the state and user sessions. By stealing the cookies, an attacker can have access to all of the user data.

4. Phishing

Phishing is a type of attack which attempts to steal sensitive information like user login credentials and credit card number. It occurs when an attacker is masquerading as a trustworthy entity in electronic communication.

5. Brute force

It is a type of attack which uses a trial and error method. This attack generates a large number of guesses and validates them to obtain actual data like user password and personal identification number. This attack may be used by criminals to crack encrypted data, or by security, analysts to test an organization's network security.

6. Denial of Service

It is an attack which meant to make a server or network resource unavailable to the users. It accomplishes this by flooding the target with traffic or sending it information that triggers a crash. It uses the single system and single internet connection to attack a server. It can be classified into the following-

Volume-based attacks- Its goal is to saturate the bandwidth of the attacked site, and is measured in bit per second.

Protocol attacks- It consumes actual server resources, and is measured in a packet.

Application layer attacks- Its goal is to crash the web server and is measured in request per second.

7. Dictionary attacks

This type of attack stored the list of a commonly used password and validated them to get original password.

8. URL Interpretation

It is a type of attack where we can change the certain parts of a URL, and one can make a web server to deliver web pages for which he is not authorized to browse.

9. File Inclusion attacks

It is a type of attack that allows an attacker to access unauthorized or essential files which is available on the web server or to execute malicious files on the web server by making use of the include functionality.

10. Man in the middle attacks

It is a type of attack that allows an attacker to intercepts the connection between client and server and acts as a bridge between them. Due to this, an attacker will be able to read, insert and modify the data in the intercepted connection.

System-based attacks

These are the attacks which are intended to compromise a computer or a computer network. Some of the important system-based attacks are as follows-

1. Virus

It is a type of malicious software program that spread throughout the computer files without the knowledge of a user. It is a self-replicating malicious computer program that replicates by inserting copies of itself into other computer programs when executed. It can also execute instructions that cause harm to the system.

2. Worm

It is a type of malware whose primary function is to replicate itself to spread to uninfected computers. It works same as the computer virus. Worms often originate from email attachments that appear to be from trusted senders.

3. Trojan horse

It is a malicious program that occurs unexpected changes to computer setting and unusual activity, even when the computer should be idle. It misleads the user of its true intent. It appears to be a normal application but when opened/executed some malicious code will run in the background.

4. Backdoors

It is a method that bypasses the normal authentication process. A developer may create a backdoor so that an application or operating system can be accessed for troubleshooting or other purposes.

5. Bots

A bot (short for "robot") is an automated process that interacts with other network services. Some bots program run automatically, while others only execute commands when they receive specific input. Common examples of bots program are the crawler, chatroom bots, and malicious bots.

Vulnerabilities in IT Systems

A security vulnerability is a flaw that can be in an IT system, application, policy or procedure anything that leaves an organization open to a cyberattack.

Vulnerabilities can be physical or electronic, such as a software or operating system glitch.

They are particularly attractive to hackers because, with the right effort, cybercriminals can perform unauthorized actions to infiltrate and compromise IT assets.

Vulnerabilities can be either intentional or unintentional and, in some cases, automated, eg. when hackers use bots.

Within the context of IT security, vulnerabilities are known weaknesses. Therefore, knowing the factors that impact your vulnerability will help you to better understand your cybersecurity posture, the overall state and strength of your cybersecurity efforts.

How to Reduce IT Infrastructure Vulnerabilities

1. **Keep licenses and security patches up to date:** technology providers provide regular updates to repair patches, so make sure to keep your software and firmware up-to-date with the latest version. Make sure your application licenses are current.

2 **Maintain and enforce a strict cybersecurity policy:** keep data protected, such as with encrypted passwords locked away at an off-site location. Enforce a policy that is consistent with international information security management system standards such as ISO 27001. Make sure your data is backed up and that you have a contingency plan in place in the event of a data breach or system outage.

3 **Reduce vulnerabilities caused by human error:** restrict access to networks, including employee access or the ability to make information changes.

Security Goals

The objective of Cybersecurity is to protect information from being stolen, compromised or attacked. Cybersecurity can be measured by at least one of three goals-

1. Protect the **confidentiality** of data.
2. Preserve the **integrity** of data.
3. Promote the **availability** of data for authorized users.

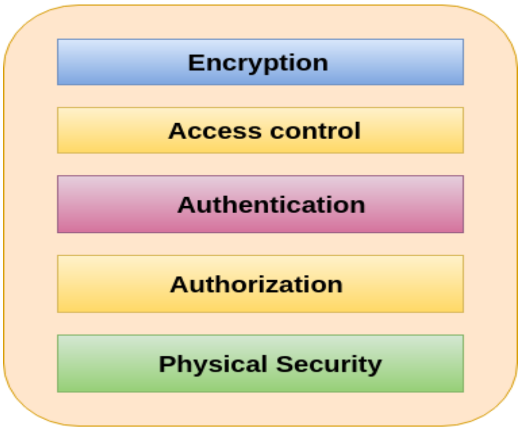
These goals form the confidentiality, integrity, availability (CIA) triad, the basis of all security programs. The CIA triad is a security model that is designed to guide policies for information security within the premises of an organization or company. This model is also referred to as the **AIC (Availability, Integrity, and Confidentiality)** triad to avoid the confusion with the Central Intelligence Agency. The elements of the triad are considered the three most crucial components of security.

The CIA criteria are one that most of the organizations and companies use when they have installed a new application, creates a database or when guaranteeing access to some data. For data to be completely secure, all of these security goals must come into effect. These are security policies that all work together, and therefore it can be wrong to overlook one policy.

Confidentiality

Confidentiality is roughly equivalent to privacy and avoids the unauthorized disclosure of information. It involves the protection of data, providing access for those who are allowed to see it while disallowing others from learning anything about its content. It prevents essential information from reaching the wrong people while making sure that the right people can get it. Data encryption is a good example to ensure confidentiality.

Tools for Confidentiality



Confidentiality Tools

1 Encryption

Encryption is a method of transforming information to make it unreadable for unauthorized users by using an algorithm. The transformation of data uses a secret key (an encryption key) so that the transformed data can only be read by using another secret key (decryption key). It protects sensitive data such as credit card numbers by encoding and transforming data into unreadable cipher text. This encrypted data can only be read by decrypting it. Asymmetric-key and symmetric-key are the two primary types of encryption.

2 Access control

Access control defines rules and policies for limiting access to a system or to physical or virtual resources. It is a process by which users are granted access and certain privileges to systems, resources or information. In access control systems, users need to present credentials before they can be granted access such as a person's name or a computer's serial number. In physical systems, these credentials may come in many forms, but credentials that can't be transferred provide the most security.

3 Authentication

An authentication is a process that ensures and confirms a user's identity or role that someone has. It can be done in a number of different ways, but it is usually based on a combination of-

- something the person has (like a smart card or a radio key for storing secret keys),
- something the person knows (like a password),
- something the person is (like a human with a fingerprint).

Authentication is the necessity of every organizations because it enables organizations to keep their networks secure by permitting only authenticated users to access its protected resources. These resources may include computer systems, networks, databases, websites and other network-based applications or services.

4 Authorization

Authorization is a security mechanism which gives permission to do or have something. It is used to determine a person or system is allowed access to resources, based on an access control policy, including computer programs, files, services, data and application features. It is normally preceded by authentication for user identity verification. System administrators are typically assigned permission levels covering all system and user resources. During authorization, a system verifies an authenticated user's access rules and either grants or refuses resource access.

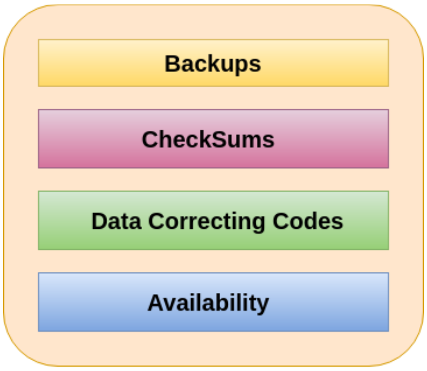
5 Physical Security

Physical security describes measures designed to deny the unauthorized access of IT assets like facilities, equipment, personnel, resources and other properties from damage. It protects these assets from physical threats including theft, vandalism, fire and natural disasters.

Integrity

Integrity refers to the methods for ensuring that data is real, accurate and safeguarded from unauthorized user modification. It is the property that information has not be altered in an unauthorized way, and that source of the information is genuine.

Tools for Integrity



Integrity Tools

1 Backups

Backup is the periodic archiving of data. It is a process of making copies of data or data files to use in the event when the original data or data files are lost or destroyed. It is also used to make copies for historical purposes, such as for longitudinal studies, statistics or for historical records or to meet the requirements of a data retention policy. Many applications especially in a Windows environment, produce backup files using the .BAK file extension.

2. Checksums

   A checksum is a numerical value used to verify the integrity of a file or a data transfer. In other words, it is the computation of a function that maps the contents of a file to a numerical value. They are typically used to compare two sets of data to make sure that they are the same. A checksum function depends on the entire contents of a file. It is designed in a way that even a small change to the input file (such as flipping a single bit) likely to results in different output value.

3. Data Correcting Codes

   It is a method for storing data in such a way that small changes can be easily detected and automatically corrected.

Availability

Availability is the property in which information is accessible and modifiable in a timely fashion by those authorized to do so. It is the guarantee of reliable and constant access to our sensitive data by authorized people.

Tools for Availability

- Physical Protections
- Computational Redundancies

1. Physical Protections

   Physical safeguard means to keep information available even in the event of physical challenges. It ensure sensitive information and critical information technology are housed in secure areas.

2. Computational redundancies

It is applied as fault tolerant against accidental faults. It protects computers and storage devices that serve as fallbacks in the case of failures.