name and describe the two types of integrity (Source and data integrity) also how are they generally achieved ?

Here's a clear breakdown:

1. Source Integrity

- **Definition:** Ensures that the data comes from a legitimate and trusted source. It guarantees that the entity sending the data is authentic and authorized.
- **How it is Achieved:**
  - **Digital Signatures:** The sender signs the data using a private key; the receiver verifies it with the sender's public key.
  - **Authentication Mechanisms:** Using passwords, tokens, or certificates to confirm the sender's identity.
  - **Public Key Infrastructure (PKI):** Certificates issued by trusted authorities validate the source.

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2. Data Integrity

- **Definition:** Ensures that the data has not been altered, tampered with, or corrupted during storage or transmission.
- **How it is Achieved:**
  - **Hash Functions:** Compute a hash value (e.g., SHA-256) of the original data and check it at the receiver's end.
  - **Checksums/CRC (Cyclic Redundancy Check):** Detect accidental changes or errors in transmitted data.
  - **Message Authentication Codes (MACs):** Provide both integrity and authentication using a shared secret key.

✅ **Summary:**

- **Source integrity** → confirms *who* sent the data.
- **Data integrity** → confirms *that the data remains unchanged*.

If you want, I can also make a **simple diagram showing both and how they are enforced**, which makes it easier to remember. Do you want me to do that?

What is CVE

CVE stands for **Common Vulnerabilities and Exposures**.

- **Definition:** It is a publicly disclosed list of known cybersecurity vulnerabilities and exposures in software, hardware, and firmware. Each entry is assigned a unique identifier called a **CVE ID** (e.g., CVE-2023-12345).
- **Purpose:**
  - Standardizes the naming of vulnerabilities so that different security tools and organizations can refer to the same issue consistently.
  - Helps security teams track, manage, and patch vulnerabilities efficiently.
- **How it works:**
  1. A security researcher or organization discovers a vulnerability.
  2. It is submitted to a CVE Numbering Authority (CNA).
  3. Once verified, it gets a unique CVE ID and a brief description.
  4. Organizations can then use this CVE ID to apply patches or updates.
- **Example:**
  If a popular web server has a buffer overflow flaw, it may be listed as **CVE-2024-56789**, allowing everyone to reference it easily when discussing patches or mitigation.

It's essentially a **common "dictionary" of security flaws** used worldwide.

If you want, I can also explain how CVE differs from **CWE** and **NVD**, which are closely related. Do you want me to?

> What is CVSS? How is it useful

CVSS stands for **Common Vulnerability Scoring System**.

Definition:

CVSS is a standardized framework used to **quantify the severity of security vulnerabilities**. It assigns a numerical score to a vulnerability, usually ranging from **0 to 10**, where higher values indicate more severe risks.

Components of CVSS:

1. **Base Score:** Reflects the inherent severity of a vulnerability, regardless of environment.
   - Factors include **exploitability** (how easily it can be exploited) and **impact** (effect on confidentiality, integrity, and availability).
2. **Temporal Score:** Adjusts the base score based on factors that change over time, such as availability of a patch or active exploit.
3. **Environmental Score:** Adjusts severity according to a specific organization's environment, such as the value of affected systems.

How it is Useful:

- **Prioritization:** Helps organizations decide which vulnerabilities to fix first based on severity.
- **Standardization:** Provides a uniform way to communicate risk across teams, vendors, and security tools.
- **Risk Assessment:** Guides security policies and patch management decisions.
- **Integration:** Many security tools, scanners, and dashboards use CVSS scores to report vulnerabilities.

✅ **Example:**

- A vulnerability with **CVSS 9.8** is critical and must be patched immediately.
- A vulnerability with **CVSS 3.2** is low severity and may be scheduled for later.

If you want, I can also explain the **difference between CVE and CVSS** to make it easier to remember. Do you want me to do that?

> Explain Salt and Pepper with respect to hashing

Here's a clear explanation of **Salt** and **Pepper** in the context of hashing:

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1. Salt

- **Definition:** A **random value** added to the input (e.g., a password) **before hashing**.
- **Purpose:**
  - Prevents attackers from using **precomputed tables** (rainbow tables) to reverse hashes.
  - Ensures that identical passwords have **different hashes**.
- **How it works:**
  1. User password: `mypassword`
  2. Random salt: `X4f9!`
  3. Hash input: `mypasswordX4f9!` → Hash value stored in database
- **Storage:** The salt is usually stored **along with the hash** in the database.

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2. Pepper

- **Definition:** A **secret value** added to the input **before hashing**, but unlike salt, it is **kept secret** (not stored with the hash).
- **Purpose:**
  - Adds an extra layer of security even if the database is compromised.

  - Protects against brute-force attacks.
- **How it works:**
  1. User password: `mypassword`
  2. Pepper (secret key stored separately, e.g., in application code): `!@P#`
  3. Hash input: `mypassword!@P#` → Hash stored in database
- **Storage:** Pepper is **not stored in the database**, only known to the application.

Summary of Differences

Feature	Salt	Pepper
Randomness	Random per password	Usually the same for all users
Secrecy	Stored with hash	Kept secret, separate from hash
Purpose	Prevents rainbow table attacks	Adds extra security layer
Scope	Unique per user	Common secret for all users

✅ **Takeaway:**

- **Salt** → unique random value per password, protects against precomputed attacks.
- **Pepper** → secret value, protects even if the hash database is leaked.

If you want, I can make a **small diagram showing how salt and pepper are added to a password before hashing**, which makes it easier to visualize. Do you want me to?

> What is randomized MAC address ? what are its 2 uses

Randomized MAC Address

A **randomized MAC address** is a **temporarily generated hardware address** used by a device instead of its real, factory-assigned MAC (Media Access Control) address.

- Normally, a device's MAC address is **unique and permanent**, identifying it on a network.
- **Randomization** changes this address periodically to **enhance privacy and security**.

Two Main Uses

1. **Privacy Protection**
   - Prevents **tracking of devices** across Wi-Fi networks.
   - Example: When a smartphone scans for Wi-Fi networks, using a randomized MAC prevents advertisers or network operators from profiling or tracking it over time.
2. **Security Enhancement**

- Helps avoid **targeted attacks** based on a device's real MAC.
- Example: In public Wi-Fi networks, attackers cannot easily identify or target a device if its MAC keeps changing.

✅ **Key Point:**
Randomized MAC addresses **do not affect network functionality** but improve **user privacy and security**.

If you want, I can also explain the **difference between static and randomized MAC addresses** in a quick table. Do you want me to?

> Describe Supply chain attack, Out-of-band IDS, SQL Injection, Command and control

Supply-chain attack

What it is: An attack that compromises a product or service by targeting a third party in the vendor/supplier ecosystem (software libraries, build systems, hardware components, firmware, cloud services, managed vendors). Instead of attacking the final target directly, the attacker tampers with something the target trusts or consumes.

How it works (examples):

- Injecting malicious code into a popular open-source library or package (typo-squatting / dependency poisoning).
- Compromising a CI/CD pipeline or build server so produced binaries carry malware.
- Tampering with hardware or firmware during manufacturing or distribution.
- Compromising a vendor's update mechanism to push malicious updates.

Why it's dangerous: A single compromise can reach thousands or millions of downstream customers because organizations implicitly trust their suppliers.

Mitigations:

- Vet suppliers, use SBOMs (Software Bill of Materials) and dependency tracking.
- Verify artifacts with signatures and reproducible builds.
- Harden build infrastructure (isolated build environments, least privilege).
- Monitor supply-chain telemetry and implement rapid patch/rollback plans.
- Use multi-factor verification for update channels and code reviewers.

Out-of-Band (OOB) Intrusion Detection / Out-of-Band IDS

What it is: An IDS mode where traffic is monitored **separately** from the live data path — via mirrored/copy feeds (SPAN/mirror ports, network taps, or packet brokers) — so detection/analysis

happens without affecting or being in the inline flow.

How it works & benefits:

- The IDS receives a copy of network traffic; it inspects for anomalies, signatures, or behavioral indicators.
- Because it's passive, it can't block traffic directly (no single point of failure) and has no impact on latency or availability.
- Useful for deep forensics, high-speed networks, and where availability is critical.

Tradeoffs / limitations:

- Cannot prevent/block attacks inline (no active mitigation) — typically connected to a separate prevention system or SIEM for response.
- May miss context if only partial traffic is mirrored; encrypted traffic limits visibility.
- Requires careful scaling to handle mirrored traffic volume.

Typical usage: Network monitoring, log aggregation, threat hunting, and feeding alerts to SOAR/SIEM for automated or manual response.

SQL Injection (SQLi)

What it is: A class of web application vulnerability where an attacker supplies malicious SQL input to an application's database query, causing unintended queries to be executed (data disclosure, modification, authentication bypass, or even RCE in some environments).

Common types:

- **In-band (Classic) SQLi**
  - *Error-based:* attacker provokes database errors that leak information.
  - *Union-based:* attacker uses **`UNION`** to append malicious result sets to legitimate query results.
- **Blind SQLi**
  - *Boolean-based:* infer data by true/false responses from the application.
  - *Time-based:* infer data by latency (e.g., **`IF(condition, SLEEP(5), 0)`**).
- **Out-of-band SQLi:** uses secondary channels (e.g., DNS / HTTP callbacks) for data exfiltration when direct responses aren't available.

Example (vulnerable PHP pseudocode):

```sql

// unsafe concatenation
$query = "SELECT * FROM users WHERE username = '" + $user + "'";
```

If **`user = ' OR '1'='1`**, query becomes **`SELECT * FROM users WHERE username = '' OR '1'='1'`** — returns all rows.

Prevention / best practices:

- Use parameterized queries / prepared statements (no string concatenation).
- Apply input validation and whitelisting for expected formats.
- Use least privilege DB accounts and avoid exposing detailed DB errors.
- Employ ORM safely, use stored procedures carefully, and enable WAF rules as a defense-in-depth measure.
- Regular code review and automated scanning (SAST/DAST).

Command-and-Control (C2 / C&C)

What it is: Infrastructure and protocols used by attackers to remotely control compromised hosts (bots, infected servers, malware implants). The C2 channel lets attackers send commands, exfiltrate data, and orchestrate actions (e.g., lateral movement, ransomware deployment).

How it works (architectural patterns):

- **Centralized C2:** Infected hosts call a central server for instructions (easy to manage for attackers; single point to takedown).
- **Peer-to-peer (P2P) C2:** Infected machines form a resilient mesh; harder to disrupt.
- **Fast-flux / domain fluxing:** Rapidly changing DNS records and domains to evade takedown.
- **Steganographic / covert channels:** Hiding C2 in legitimate services (HTTPS, DNS queries, social media posts) to blend with normal traffic.
- **Out-of-band exfiltration:** Using cloud storage, paste sites, or third-party APIs.

Indicators of compromise (IoCs):

- Unexpected outbound connections to rare domains or IPs, especially on unusual ports.
- Regular beaconing (periodic small requests) to suspicious endpoints.
- DNS anomalies (high frequency of NXDOMAIN, unusual TXT/DNS behavior).
- Encrypted/obfuscated traffic to unknown endpoints.
- Presence of known C2 artifacts (malicious binaries, scheduled tasks, registry keys).

Detection & mitigation:

- Monitor and baseline outbound traffic; flag unusual domain lookups and beaconing patterns.
- Block known malicious IPs/domains, use DNS filtering and proxying.
- Use endpoint detection & response (EDR) to detect suspicious processes, persistence, and lateral movement.
- Isolate infected hosts and perform IR playbooks: contain, eradicate, recover, and hunt for other infected assets.
- Collaborate with threat intel and law enforcement to take down C2 infrastructure.

If you want, I can convert this into a study-card style summary (one sentence each) or provide quick examples/diagrams for any of the four topics — which one should I make a card for?

What is Phishing, Whaling, Vishing in Social Engineering

Here's a clear explanation of the three social engineering attacks:

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1. Phishing

- **Definition:** A technique where attackers **trick users into revealing sensitive information** (like usernames, passwords, or credit card details) by pretending to be a legitimate entity.
- **Typical method:** Fake emails, websites, or messages that look real.
- **Example:** Receiving an email that looks like it's from your bank asking you to "verify your account" by entering login credentials on a fake site.

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2. Whaling

- **Definition:** A **targeted form of phishing** aimed at **high-profile individuals** (executives, CEOs, or key decision-makers).
- **Purpose:** Usually to steal confidential business information or authorize fraudulent transactions.
- **Example:** An email to a CFO pretending to be the company's legal team requesting wire transfer approval.

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3. Vishing

- **Definition: Voice phishing** — attackers use **phone calls or voice messages** to trick victims into revealing sensitive information.
- **Method:** Often uses social engineering techniques like urgency, fear, or authority.
- **Example:** A caller pretending to be from tech support or the IRS asking for your bank details or passwords.

✅ Quick Summary:

Attack	Medium	Target / Focus
Phishing	Email/Message	General users
Whaling	Email/Message	Executives / High-value targets
Vishing	Phone Call	General or specific individuals

If you want, I can also explain **Smishing** and **Spear Phishing** to complete the social engineering picture. Do you want me to do that?

Explain types of 5 malwares

Nice — here are five common types of malware, each explained clearly with how they work, effects, and basic mitigations.

1. Virus

What it is: Malware that attaches itself to legitimate files or programs and spreads when those files are executed.
How it works: Infects host files, replicates by modifying other executables or documents, often requires user action (running the infected program).
Typical effects: Corrupts or deletes files, slows systems, can carry payloads (backdoors, data theft).
Example behavior: Opening an infected attachment executes the virus which then infects other files on disk or on removable drives.
Mitigation: Keep antivirus updated, avoid unknown attachments, use file integrity checks and least-privilege accounts.

2. Worm

What it is: Self-replicating malware that spreads across networks without needing to attach to a program or require user action.
How it works: Exploits network or software vulnerabilities (or uses social mechanisms) to copy itself to other machines and execute automatically.
Typical effects: Rapid network-wide infection, bandwidth exhaustion, deployment of other payloads (ransomware, DDoS bots).
Example behavior: Scans for vulnerable machines and pushes a copy that then repeats the process.
Mitigation: Patch systems promptly, use network segmentation and IDS/IPS, restrict unnecessary services and ports.

3. Trojan (Trojan Horse)

What it is: Malware disguised as legitimate software — it doesn't self-replicate but performs malicious actions once installed.
How it works: Tricks users into installing it (e.g., bundled with useful software), then opens backdoors, steals data, or installs additional malware.
Typical effects: Remote access, credential theft, persistence on host, pivoting inside networks.
Example behavior: A "free" utility installs a hidden backdoor that lets attackers control the machine.
Mitigation: Download from trusted sources, verify digital signatures, run application whitelisting, and use endpoint protection.

4. Ransomware

What it is: Malware that encrypts files or systems and demands payment (ransom) to restore access.
How it works: Gains access via phishing, RDP compromise, or exploiting vulnerabilities; then encrypts

files and drops ransom notes. Some also exfiltrate data for double extortion.
Typical effects: Data loss, business disruption, financial and reputational damage.
Example behavior: Files become unreadable and filenames change; a message instructs victims how to pay for decryption.
Mitigation: Regular offline backups, network segmentation, strong MFA for remote access, patching, user training, and EDR/antivirus.

5. Spyware (including keyloggers)

What it is: Malware designed to secretly monitor user activity and exfiltrate information (credentials, browsing history, keystrokes).
How it works: Installed silently (via trojans, drive-by downloads, malicious extensions) and sends harvested data to attackers. Keyloggers record keystrokes, screen scrapers capture screenshots, trackers gather browsing habits.
Typical effects: Credential theft, privacy invasion, targeted account takeover, espionage.
Mitigation: Use anti-spyware tools and EDR, keep software updated, minimize browser extensions, use MFA and password managers to limit damage from stolen credentials.

Quick common defenses (applies to all types)

- Keep systems, firmware, and apps patched.
- Use reputable endpoint protection / EDR and network monitoring.
- Back up critical data and verify restore procedures.
- Apply least privilege and MFA everywhere.
- Train users to recognize phishing/social engineering.
- Network segmentation, strong logging, and an incident response plan.

Want short flash-cards for each malware type or examples of famous incidents to help remember?

> What is MITM, Spoofing, DoS, DDoS

Here's a clear explanation of the four attacks:

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1. MITM (Man-in-the-Middle Attack)

- **Definition:** An attack where the attacker **intercepts, monitors, or alters communication** between two parties without their knowledge.
- **How it works:** The attacker positions themselves between the sender and receiver (e.g., on Wi-Fi networks, compromised routers, or via ARP poisoning).
- **Effects:** Can steal sensitive information (passwords, credit cards), modify messages, or inject malware.

- **Example:** An attacker intercepts a login request on a public Wi-Fi and captures credentials before forwarding the request to the real server.
- **Mitigation:** Use end-to-end encryption (HTTPS/TLS), VPNs, certificate validation, and strong authentication.

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2. Spoofing

- **Definition:** Pretending to be someone or something else to gain unauthorized access or deceive systems.
- **Types:**
  - **IP Spoofing:** Fakes the source IP address in packets to bypass firewalls or launch attacks.
  - **Email Spoofing:** Sends emails appearing from a trusted source to trick users.
  - **MAC Spoofing:** Changes a device's MAC address to bypass access controls.
- **Effects:** Unauthorized access, phishing, or hiding attacker identity.
- **Mitigation:** Authentication mechanisms, digital signatures, ingress/egress filtering, and network monitoring.

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3. DoS (Denial of Service)

- **Definition:** An attack aimed at **making a system or service unavailable** to legitimate users.
- **How it works:** Overloads the target with traffic or resource requests until it cannot respond normally.
- **Effects:** Service downtime, disruption of business, possible financial loss.
- **Example:** Flooding a web server with thousands of requests per second.
- **Mitigation:** Firewalls, rate limiting, anti-DoS appliances, traffic filtering, and redundancy.

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4. DDoS (Distributed Denial of Service)

- **Definition:** A **DoS attack from multiple compromised systems** (botnet), making it much harder to mitigate.
- **How it works:** Attacker controls many devices to simultaneously send massive traffic or requests to the target.
- **Effects:** Prolonged downtime, service disruption, and difficulty distinguishing legitimate users from attackers.
- **Example:** Botnet-controlled devices flood a website with traffic from hundreds of thousands of IPs.
- **Mitigation:** DDoS protection services (cloud-based mitigation), traffic analysis, load balancing, and scalable infrastructure.

✅ Quick Summary Table

Attack	Medium	Goal / Effect
MITM	Network communication	Intercept/alter messages
Spoofing	Network/email/device	Impersonate to deceive
DoS	Network/server	Make service unavailable
DDoS	Network/server	Large-scale DoS from many sources

I can also make a **simple diagram showing MITM vs Spoofing vs DDoS flow**, which helps to visualize. Do you want me to?