**Q1: Notes on HTTP, HTTPS, WWW, URL, Email**

**HTTP (HyperText Transfer Protocol):** HTTP is an application-layer protocol used for transmitting hypermedia documents, such as HTML. It follows a request-response model where a client sends a request to a server, and the server responds with the requested resource. HTTP is stateless, meaning each request from a client to server is independent.

**Example:** When you type "[http://www.example.com](http://www.example.com/)" into your browser, an HTTP request is sent to the server where the website is hosted, and the server returns the webpage to your browser.

**HTTPS (HyperText Transfer Protocol Secure):** HTTPS is an extension of HTTP and uses encryption protocols such as SSL/TLS to secure communications between the client and server. This ensures that data exchanged is encrypted and cannot be easily intercepted or tampered with by third parties.

**Example:** "HTTPS://www.bank.com" ensures that any data sent between your browser and the bank's server is encrypted, protecting sensitive information such as login credentials and financial details.

**WWW (World Wide Web):** The WWW is a system of interlinked hypertext documents and multimedia accessible over the internet using a web browser. It was invented by Tim Berners-Lee in 1989. The WWW allows documents to be connected via hyperlinks, enabling easy navigation between related pieces of information.

**Example:** When you browse websites like Wikipedia or YouTube, you are accessing content on the World Wide Web.

**URL (Uniform Resource Locator):** A URL is the address used to access a resource on the internet. It consists of several components, including the protocol (HTTP/HTTPS), domain name ([www.example.com](http://www.example.com/)), and the path to the specific resource (/page1.html).

**Example:** In the URL "https://www.example.com/page1.html", "https" is the protocol, "[www.example.com](http://www.example.com/)" is the domain name, and "/page1.html" is the path to the specific page on the website.

**Email (Electronic Mail):** Email is a method of exchanging digital messages between people using electronic devices. Emails can contain text, files, images, and other attachments and are sent using protocols such as SMTP (Simple Mail Transfer Protocol) and retrieved using protocols like IMAP or POP3.

**Example:** When you send an email to someone@example.com, your email client uses SMTP to send the message to the recipient's email server, which then delivers it to their email client using IMAP or POP3.

**Q2: Domain Name Service (DNS)**

**Domain Name Service (DNS):** DNS is a hierarchical system that translates human-readable domain names (like [www.example.com](http://www.example.com/)) into machine-readable IP addresses (like 192.0.2.1). This translation is essential for locating and accessing websites and services on the internet.

**How DNS Works:**

1. **User Request**: A user types a domain name into their browser's address bar.
2. **DNS Resolver**: The browser sends a query to a DNS resolver, typically provided by the user's Internet Service Provider (ISP).
3. **Recursive Querying**:
   * **Root Server**: The resolver queries a root DNS server, which responds with the address of a TLD (Top-Level Domain) server (e.g., .com, .org).
   * **TLD Server**: The resolver then queries the TLD server, which responds with the address of the authoritative DNS server for the specific domain.
   * **Authoritative DNS Server**: The resolver queries this server, which responds with the IP address of the domain.
4. **IP Address Return**: The resolver returns the IP address to the user's browser.
5. **Page Load**: The browser uses the IP address to request the webpage from the web server, and the server responds with the content of the page.

**DNS Diagram:**

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User -> Browser -> DNS Resolver -> Root Server -> TLD Server -> Authoritative Server -> IP Address -> Browser -> Web Server -> Web Page

**Q3: Web Browser**

**Web Browser:** A web browser is a software application that enables users to access, retrieve, and view content on the World Wide Web. Common web browsers include Google Chrome, Mozilla Firefox, Safari, and Microsoft Edge.

**How a Web Browser Works:**

1. **User Input**: The user enters a URL or clicks on a hyperlink.
2. **DNS Resolution**: The browser resolves the domain name into an IP address using DNS.
3. **Connection Establishment**: The browser establishes a TCP connection with the web server using the resolved IP address.
4. **HTTP/HTTPS Request**: The browser sends an HTTP/HTTPS request to the web server.
5. **Server Response**: The server processes the request and responds with the requested resource, such as an HTML page, image, or video.
6. **Rendering**: The browser parses the HTML, CSS, and JavaScript code to render the web page on the user's screen.

**Example:** When you enter "[www.example.com](http://www.example.com/)" in the browser, it sends an HTTP request to the server hosting the website. The server responds with the HTML content, which the browser then renders and displays.

**Q4: Web Crawler**

**Web Crawler:** A web crawler, also known as a spider or bot, is an automated program that systematically browses the web to index web pages for search engines.

**How a Crawler Works:**

1. **Seed URLs**: The crawler starts with a list of initial URLs.
2. **Fetching**: It fetches the content of these URLs.
3. **Parsing**: The crawler parses the fetched pages to extract links to other web pages.
4. **Queueing**: New URLs are added to a queue of pages to be fetched.
5. **Indexing**: The content of the fetched pages is indexed, making it searchable by the search engine.

**Types of Crawlers:**

1. **General Web Crawlers**: These index the entire web and are used by major search engines like Google and Bing.
2. **Focused Crawlers**: These target specific topics or domains, focusing on a subset of the web.
3. **Incremental Crawlers**: These only fetch pages that have changed since the last crawl, improving efficiency.
4. **Deep Web Crawlers**: These access pages not indexed by standard crawlers, such as dynamic content generated by web applications.

**Example:** Googlebot, the crawler used by Google, continuously scans the web, fetching pages and following links to build a vast index of web content, which is then used to provide search results.

**Q5: Search Engine**

**Search Engine:** A search engine is a software system designed to search for information on the web. Examples include Google, Bing, and Yahoo.

**How Search Engines Work:**

1. **Crawling**: Using web crawlers to discover and fetch web pages.
2. **Indexing**: Storing and organizing the content found during crawling in a searchable database.
3. **Ranking**: Using algorithms to rank web pages based on relevance and quality factors like keywords, backlinks, and user engagement.
4. **Retrieving**: Displaying search results in response to user queries, typically sorted by relevance.

**Difference Between Search Engine and Web Browser:**

* **Search Engine**: A search engine indexes and retrieves information from the web. It helps users find specific content based on keywords and phrases.
* **Web Browser**: A web browser displays web pages. It is a tool used to access and view content found by search engines and other online sources.

**Example:** When you search for "best pizza near me" on Google, the search engine scans its index for relevant web pages and ranks them based on factors like location, reviews, and content quality. The results are then displayed to you in your web browser.

**Q6: Security Concepts**

**(a) Firewall:** A firewall is a network security device that monitors and controls incoming and outgoing network traffic based on predetermined security rules. It establishes a barrier between a trusted internal network and untrusted external networks, such as the internet.

**Example:** A corporate firewall might block access to certain websites, prevent unauthorized access to the company’s network, and monitor traffic for malicious activities.

**(b) Sniffing:** Sniffing involves intercepting and monitoring network traffic. It can be used for legitimate purposes like network management or malicious activities like stealing sensitive data.

**Example:** Network administrators might use packet sniffers to diagnose network issues, while attackers could use them to capture login credentials transmitted over a network.

**(c) Spoofing:** Spoofing is the act of disguising communication from an unknown source as being from a known, trusted source. Common types include email spoofing, where the sender address is forged, and IP spoofing, where the source IP address in a packet is falsified.

**Example:** In an email spoofing attack, an attacker sends an email that appears to come from a trusted source like a bank, tricking the recipient into providing sensitive information.

**(d) Viruses:** A virus is a type of malicious software that attaches itself to a legitimate program or file and spreads when the infected host is executed. It can damage data, corrupt systems, and spread to other computers.

**Example:** A macro virus might be embedded in a Word document, which activates when the document is opened, potentially spreading to other documents and corrupting them.

**(e) Trojan Horses:** A Trojan horse is a type of malware that disguises itself as legitimate software. Users are tricked into installing it, allowing it to perform malicious actions like stealing data or providing remote access to the attacker.

**Example:** A user might download what appears to be a free game, but it secretly installs a Trojan that records keystrokes, capturing sensitive information such as### Q1: Notes on HTTP, HTTPS, WWW, URL, Email

**HTTP (HyperText Transfer Protocol):** HTTP is a protocol used to transfer data over the web. It operates on the client-server model where the client (typically a web browser) sends a request to the server, and the server sends back the requested resource. HTTP uses port 80 by default.

**Example:** When you type "[http://www.example.com](http://www.example.com/)" into your browser, an HTTP GET request is sent to the server hosting the website, and the server responds with the HTML of the webpage.

**HTTPS (HyperText Transfer Protocol Secure):** HTTPS is an extension of HTTP. It uses SSL/TLS protocols to encrypt data transferred between the client and server, ensuring secure communication. HTTPS uses port 443 by default.

**Example:** "HTTPS://www.bank.com" ensures that any data sent between your browser and the bank’s server is encrypted, protecting sensitive information like login credentials.

**WWW (World Wide Web):** The World Wide Web is a collection of interconnected documents and multimedia content accessed via the internet using web browsers. It allows users to navigate between pages using hyperlinks.

**Example:** When you browse websites like Wikipedia or YouTube, you are accessing content on the World Wide Web.

**URL (Uniform Resource Locator):** A URL specifies the address of a resource on the internet. It includes the protocol (e.g., HTTP/HTTPS), domain name, and the path to the specific resource.

**Example:** In "https://www.example.com/page1.html", "https" is the protocol, "[www.example.com](http://www.example.com/)" is the domain, and "/page1.html" is the path to the resource.

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**Q2: Domain Name Service (DNS)**

**Domain Name Service (DNS):** DNS translates human-readable domain names into IP addresses, allowing users to access websites using easy-to-remember names rather than numerical IP addresses. It acts like a phone book for the internet.

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