**Week 1: Introduction to Networking & Network Security**

**Objective:** Understand basic network components, models, and security principles.

**Task # 02: Study and write a summary of the OSI and TCP/IP models and their layers.**

**Solution:**

**1. The OSI Model (Open Systems Interconnection)**

The OSI model is a 7-layer conceptual framework developed by the International Organization for Standardization (ISO). It provides a standard way to understand and describe the functions of a telecommunication or computing system without regard to its underlying internal structure and technology. Its primary purpose is to allow diverse systems to communicate.

**The 7 Layers of the OSI Model (from top to bottom):**

* **Layer 7: Application Layer**
  + **Function:** Provides network services directly to end-user applications. It's what the user interacts with.
  + **Examples:** HTTP (web Browse), FTP (file transfer), SMTP (email), DNS (domain name resolution).
* **Layer 6: Presentation Layer**
  + **Function:** Handles data formatting, encryption, decryption, and compression to ensure data is presented in a format the application layer can understand.
  + **Examples:** JPEG, MPEG, ASCII, encryption standards (like SSL/TLS are often thought of here, though they span layers).
* **Layer 5: Session Layer**
  + **Function:** Establishes, manages, and terminates communication sessions between applications. It synchronizes communication and manages checkpoints for data transfer.
  + **Examples:** NetBIOS, RPC (Remote Procedure Call).
* **Layer 4: Transport Layer**
  + **Function:** Provides reliable and unreliable data transfer services between end systems. It segments data for transmission and reassembles it at the receiving end, handling error recovery and flow control.
  + **Examples:** TCP (Transmission Control Protocol - reliable, connection-oriented), UDP (User Datagram Protocol - unreliable, connectionless).
* **Layer 3: Network Layer**
  + **Function:** Deals with logical addressing (IP addresses) and routing of packets across different networks. It determines the best path for data to travel from source to destination.
  + **Examples:** IP (Internet Protocol), ICMP (Internet Control Message Protocol).
* **Layer 2: Data Link Layer**
  + **Function:** Provides reliable data transfer between two directly connected nodes. It handles physical addressing (MAC addresses), error detection, and flow control within a local network segment. Often split into LLC (Logical Link Control) and MAC (Media Access Control) sub-layers.
  + **Examples:** Ethernet, Wi-Fi (802.11).
* **Layer 1: Physical Layer**
  + **Function:** Defines the physical characteristics of the network medium (cables, connectors, radio waves) and the methods for transmitting raw bits (0s and 1s) across it.
  + **Examples:** Ethernet cables (RJ45), Wi-Fi signals, fiber optics, voltages, bit rates.

**2. The TCP/IP Model (Transmission Control Protocol/Internet Protocol)**

The TCP/IP model is a more practical, four-layer model that closely maps to the actual protocols used on the internet. It was developed by the U.S. Department of Defense (DoD) before the OSI model.

**The 4 Layers of the TCP/IP Model (from top to bottom):**

* **Layer 4: Application Layer**
  + **Function:** Combines the functions of the OSI model's Application, Presentation, and Session layers. It handles high-level protocols for specific user applications.
  + **Examples:** HTTP, FTP, SMTP, DNS, SSH, Telnet.
* **Layer 3: Transport Layer**
  + **Function:** Equivalent to the OSI Transport Layer. Provides end-to-end communication services. Manages the reliable delivery of data (TCP) or fast, connectionless delivery (UDP).
  + **Examples:** TCP, UDP.
* **Layer 2: Internet Layer (or Network Layer)**
  + **Function:** Equivalent to the OSI Network Layer. Responsible for logical addressing (IP addresses) and routing of packets across different networks (internetworking).
  + **Examples:** IP (IPv4, IPv6), ICMP, ARP.
* **Layer 1: Network Access Layer (or Link Layer)**
  + **Function:** Combines the functions of the OSI model's Data Link and Physical layers. It deals with the physical transmission of data over a specific network technology and manages physical addressing (MAC addresses).
  + **Examples:** Ethernet, Wi-Fi, device drivers, network interface cards (NICs).