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Working and Functionality of the TCP/IP Model

1. Title

Working and Functioning of the TCP/IP Model

2. Introduction

The U.S. Department of Defense have created the TCP/IP Protocol model, in order to define the optimal general protocol for a contemporary end-to-end data communication system. This specifies how data must be packetized, addressed, transmitted, routed and entered in the connections between networks of different types.

3. Objectives

3.1 To see how does each of the layer work.
3.2 In order to compare its real time executions with the OSI model.
3.3 To know the role of protocols at every one of the layers.

4. TCP/IP Model
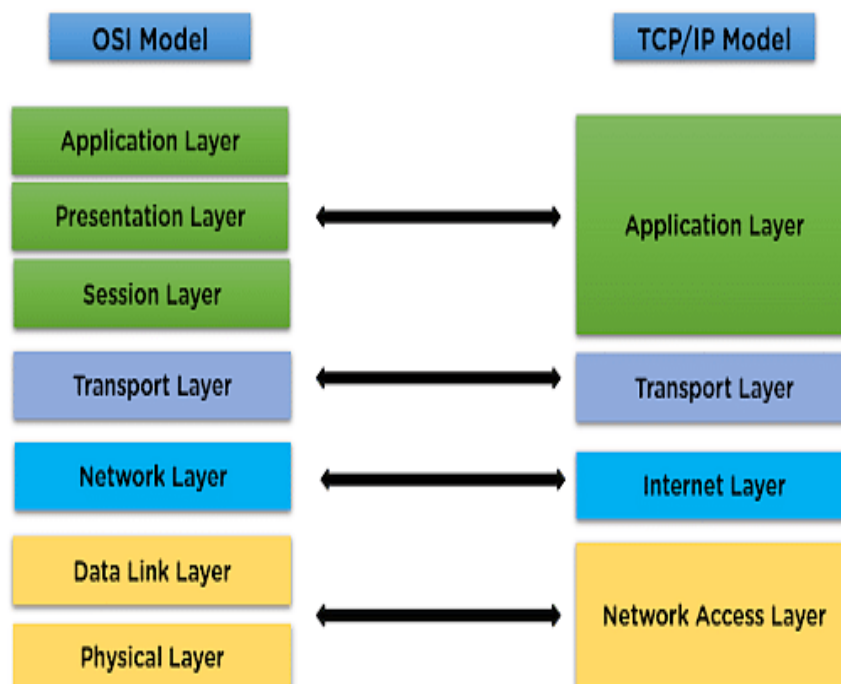
5. Working and Functionality of Each Layer

Layer No.	Layer Name	Function	Examples
4	Application Layer	Provides network services to end-user applications	HTTP, FTP, SMTP, DNS, DHCP, POP3, SNMP
3	Transport Layer	Ensures reliable or fast data transmission between devices	TCP (reliable), UDP (fast but unreliable)
2	Internet Layer	Handles logical addressing, routing, and packet delivery	IP, ICMP, ARP, IGMP
1	Network Access Layer	Defines how data is physically sent through the network hardware	Ethernet, Wi-Fi, PPP, Frame Relay, DSL

5.1 Application Layer
Function: Offers services and interfaces for user applications to interact with the network.
Examples: HTTP (web), FTP (file transfer), SMTP (email), DNS (domain name resolution).

5.2 Transport Layer (TCP or UDP)
Function: Provides reliable and quick data transfer from source to destination.
Examples:
TCP – Reliable, connection-oriented (e.g., file transfer)
UDP – Quick, connectionless (e.g., video streaming)

5.3 Internet Layer (IP)
Function: Deals with addressing, routing, and data packet delivery over networks.
Examples: IP (IPv4/IPv6), ICMP (ping), ARP.

5.4 Network Access Layer
Function: Manages the physical delivery of data across the network medium (cables, Wi-Fi, etc.) and manages devices' access to the network.
Examples: Ethernet, Wi-Fi, DSL, PPP.

6. The Role of the TCP/IP Model
6.1 The foundations of the modern Internet.
6.2 Utilized for IoT, distributed system and cloud computing.
6.3 Guides development of scalable, secure protocols.
6.4 Facilitates IPv6 migration and wireless communication research.

7. Data Flow in TCP/IP Model

Sender Side:
Application layer constructs user data.
Transport layer divides data and assigns source or destination ports as necessary.
IP layer inserts source or destination ip addresses
Network access layer inserts framing and sends data in bits.

Receiver Side:
Network access layer gets the bits and inspects frames.
IP layer retrieves the packets and routes depending on the destination IP address.
Transport layer confirms the data sent to the correct location.
Application layer delivers the data to the user.

8. Conclusion

TCP/IP Model remains the basis of contemporary digital communication. Its comprehension of layered architecture and how it functions is crucial for researchers, developers, and networking experts because it makes global interoperability, robustness, and, above all, data communication efficiency possible.

9. References

[1] https://study-ccna.com/osi-tcp-ip-models/

[2] https://www.geeksforgeeks.org/tcp-ip-model/