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Title

Working of TCP & UDP Protocols, working of HTTP, HTTPs & ICMP Protocol

Introduction

In the field of computer networking, various protocols are used to help systems communicate and change data reliably and securely. These protocols define how data should be transferred, how fast it can be delivered, how reliable the connection is, and how secure the communication remains.
Protocols:
1. TCP (Transmission Control Protocol)
2. UDP (User Datagram Protocol)
3. HTTP (HyperText Transfer Protocol)
4. HTTPS (HyperText Transfer Protocol Secure)
5. ICMP (Internet Control Message Protocol)

1. TCP – Transmission Control Protocol

TCP is a dependable, connection-oriented protocol. It establishes a connection between devices before data is changed, ensuring everything is delivered correctly and in the correct order. Similar to a phone call where both parties are connected before talking.

Working of TCP:

Step 1: Connection Establishment
TCP uses a three-step process to begin communication:
The sender sends a SYN (synchronize) signal.
The receiver responds with SYN + ACK (acknowledge).
Finally, the sender replies with ACK to confirm the connection is established.

Step 2: Data Transmission
Information is broken down into smaller units called segments.
Each segment is numbered, so the receiver can put them back in order.
After each segment is received, the receiver sends an acknowledgment (ACK).

Step 3: Handling Errors
If a segment is lost or damaged, the receiver does not send an ACK.
TCP then resends the missing or incorrect segment.

Step 4: Ending the Session
When the data transfer is complete, both sides send a FIN (finish) signal to close the connection securely.

Example :

TCP is commonly used in situations where accuracy is critical, such as downloading files, logging into accounts, or sending important emails.

2. UDP – User Datagram Protocol

UDP is a fast but it is less reliable protocol that does not establish a connection before sending the data. It sends packets called datagrams without checking whether they reached the destination.

Working of UDP:
No connection is made between sender and receiver.
Data is sent directly without waiting for acknowledgment.
There's no error correction or reordering.
Packets may arrive out of order or get lost, but the protocol does not resend them.

Example :
UDP is ideal for activities where speed is more important than perfect delivery, like:
Live video or audio calls
Online multiplayer games
Streaming real-time content

3. HTTP – HyperText Transfer Protocol

HTTP is the web-based communication protocol that allows web browsers and servers to exchange information like webpages, images, and other content.

Working of HTTP:
The user types a URL in the browser.
The browser sends an HTTP request to the website's server.
The server responds with HTML content and other data.
The browser renders and displays the webpage to the user.

Example :
Whenever you browse websites, read articles, or load media from the web, your browser is using HTTP to get that information from the server.

4. HTTPS – HyperText Transfer Protocol Secure

HTTPS is the enhanced version of HTTP that adds encryption and security to protect the data being sent and received.

Working of HTTPS:
HTTPS uses SSL/TLS protocols to encrypt the connection between your browser and the website.
Before exchanging data, a secure session is established using a certificate issued by a trusted

authority.
All data transmitted during this session is encrypted, so even if intercepted, it cannot be understood.

Example :
HTTPS is essential for secure transactions and is used in:
Banking websites
E-commerce portals
Login forms and personal data forms

5. ICMP – Internet Control Message Protocol

ICMP is not used for sending user data. Instead, it is used by devices to report errors and network-related issues.

Working of ICMP:
ICMP helps network devices communicate about problems such as:
Host unreachable
Time exceeded (timeout)
Packet too big
It is commonly used by tools like ping to check whether a device or server is active and how long it takes to respond.

Example :
When you use the ping command, your computer sends ICMP echo requests. If Google replies, you know it's reachable and see how long it took.

Conclusion

In short, all the network protocols that have been discussed play an important role in the efficient operation of computer communication systems. TCP provides reliable, ordered, and error-checked data delivery and is therefore perfect where accuracy is critical. On the other hand, UDP offers a quicker and more lightweight option for real-time applications where occasional data loss is tolerated. HTTP is the base protocol for accessing and displaying web content, with its secure variant, HTTPS, providing encryption to safeguard sensitive user data during online transactions. Though ICMP does not transfer data, it plays a vital role in error reporting and network diagnosis. Knowing how these protocols function allows us to appreciate the underlying processes that enable internet communication to be efficient, responsive, and secure.