RESEARCH AND REVIEW

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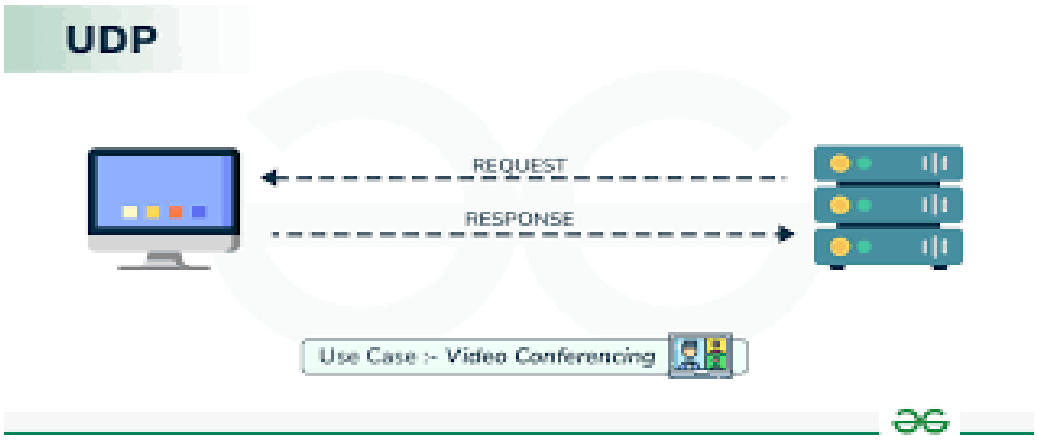
UDP Protocol



What is UDP Protocol?

In computer networking, the **User Datagram Protocol** (**UDP**) is one of the core communication protocols of the Internet protocol suite used to send messages (transported as datagrams in packets) to other hosts on an Internet Protocol (IP) network.

It is a communications protocol for time-sensitive applications like gaming, playing videos, or **Domain Name System (DNS)** lookups. UDP results in speedier communication because it does not spend time forming a firm connection with the destination before transferring the data.

How UDP operates?

When compared to other networking protocols, UDP's operation is rather straightforward. The "datagrams," or packets of data, are sent to a designated target computer. Nothing is set up to specify which order the packets should arrive in. Additionally, there is no way to verify that the datagrams arrived at their intended location.

The absence of a mandatory handshake in UDP poses an issue, even though it has checksums to guarantee data integrity and port numbers to distinguish the role data plays at source and destination. With UDP, the user exposes the program they are running to unreliable aspects of the underlying network.

Common use cases for UDP

1. The straightforward request/response communication of relatively small amounts of data, eliminating concerns regarding controlling errors or the flow of the packets.
2. Multicasting because UDP works well with packet switching.
3. Routing update protocols such as Routing Information Protocol (RIP).

4. Real-time applications in which the information needs to be delivered quickly and smoothly

Advantages and disadvantages of using UDP

Advantages:

- It uses small packet size with small header (8 bytes). This fewer bytes in the overhead makes UDP protocol need less time in processing the packet and need less memory.
- It does not require connection to be established and maintained.
- Also, absence of acknowledgement field in UDP makes it faster as it need not have to wait on ACK or need not have to hold data in memory until they are ACKed.
- It can be used in events where a single packet of data needs to be exchanged between the hosts.

Disadvantages

- It is a connectionless and unreliable transport protocol. There is no windowing and no function to ensure data is received in the same order as it was transmitted.
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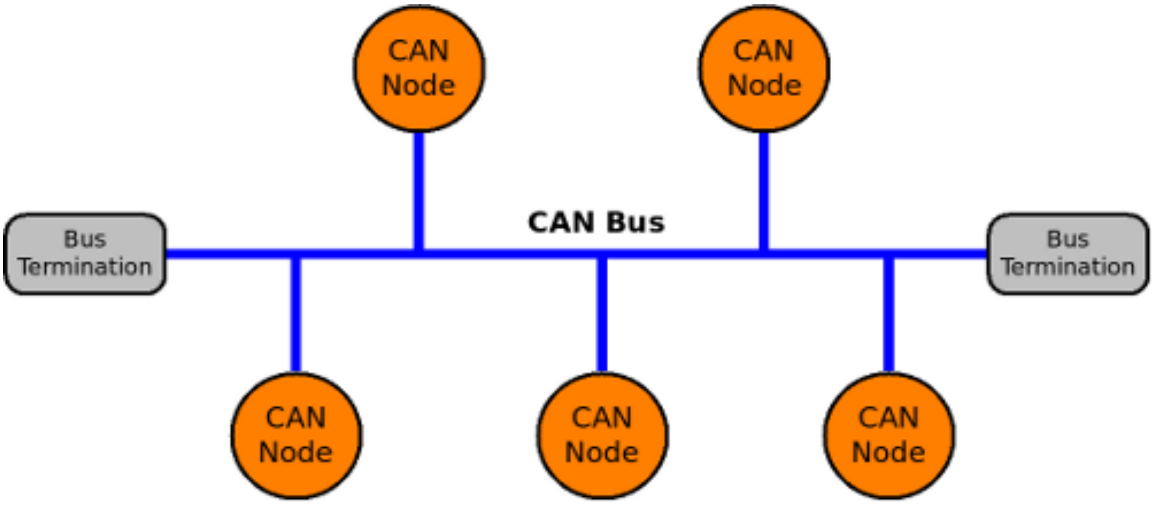
- Only the application layer deals with error recovery. Hence applications can simply turn to the user to send the message again.
- Routers can be careless with UDP. They do not retransmit a UDP datagram after collision and will often discard UDP packets before TCP packets.

CAN protocol



What is CAN protocol?

CAN stands for Controller Area Network protocol. It is a protocol that was developed by Robert Bosch in around 1986. The CAN protocol is a standard designed to allow the microcontroller and other devices to communicate with each other without any host computer.

The feature that makes the CAN protocol unique among other communication protocols is the broadcast type of bus. Here, broadcast means that the information is transmitted to all the nodes. The node can be a sensor, microcontroller, or a gateway that allows the computer to communicate over the network through the USB cable or ethernet port.

How Can operate?

The CAN bus is a network communication system where devices, called nodes, share data. Each node includes a CPU, CAN controller, and transceiver to handle data transmission and reception. Instead of direct communication, nodes broadcast their data to the network, making it accessible to all other nodes.

CAN uses bitwise arbitration to prioritize messages, ensuring that the highest-priority message is transmitted first when multiple nodes try to send data simultaneously. Data is organized into frames, which are structured messages that can transfer data, request information, report errors, or signal overloads. The message identifier, which can be 11 or 29 bits long, determines priority.

CAN operates with reversed logic, where a logical 1 is a low voltage and a logical 0 is a high voltage. This setup ensures that the bus defaults to an idle state when no data is being transmitted.

CAN Applications

Initially, CAN protocol was designed to target the communication issue that occurs within the vehicles. But later, due to the features it offers, it is used in various other fields. The following are the applications of CAN protocol:

- Automotive Industry:
    - The majority of applications as CAN was developed for automobiles.
    - In use by most domestic and international car manufacturers.
- Building Automation:
    - Elevators and escalators
    - Access control, secure doors
    - Light control
- Medical Equipment:
    - X-ray generators and patient tables
    - Dose measurement system
    - CT scanners

Advantages and disadvantages of using CAN

Advantages

- CAN is a fast way of communication between microcontrollers and devices.
- CAN is low cost because the number of wires used is less as compared to the old network.
- The errors in the network can be better diagnosed and fixed quickly.
- If any message is not received to any device, then the same message can be retransmitted again.
- Controller area network can work in different electrical environments.

Disadvantages

- There is a limit to the number of nodes or devices to be connected. You can connect a maximum of 64 nodes in CAN.
- The nodes communicate in an undesirable fashion.
- CAN is established to be up to 40 meters in length. It will have trouble if the vehicle or machine has more than 40 meters of length.
- To develop CAN the cost of software development and maintenance is high.
- Due to different voltage levels, CAN produces a lot of electric noise.