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Generic Ethernet Simulator

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Abstract: Ethernet is irresistible due to its availability and low cost. Ethernet's underlying protocol has the most significant method of network optimization and detailed evaluation for modeling and simulation. The main objective of this paper is to eliminate the dependency on any external systems as much as possible in project integration phase and to build completely Generic Ethernet Data Simulator which we can use in the absence of actual system. Generic Ethernet Simulator is a tool where all protocol simulation and transference of data is done. Hence this tool helps in illustrating the transmission of Unicast, Multicast and Broadcast. This tool is developed using Qt application software.

Keywords: Simulation; Ethernet; Qt Application software; UDP/IP; socket

I. INTRODUCTION

In 70's Ethernet was designed for computer networks. Later it was bought to a standard IEEE 802.3 form. Today, Ethernet is worldwide and implies its availability and low implementation cost. Ethernet's underlying protocol has the most significant method of network optimization and detailed evaluation for modeling and simulation.

Generic Ethernet Simulator is a tool where all protocol simulation and transference of data is done. Hence this tool helps in illustrating the transmission of Unicast, Multicast and Broadcast.

The widely used and favoured protocol TCP/IP is said to be reliable, but it could not provide proper time determinism due to retransmission of lost packets. The number of retransmitted packets is not obvious which leads to time non-determinism.

UDP/IP protocol is the best approach for simulation and data transfer, since it is deterministic in the sense of packet retransmission due to its inadequate reliability. For the meaning full transference of packet, UDP/IP needs to be combined with upper layer.

Ethernet is being used by several communication protocols. Some are built on top of TCP such as Modbus TCP,ProfiNet, some on top of UDP namely NDDS and some are directly on Ethernet. This protocol uses time division scheme for delivery of data where every node is allotted a time slot to send its data. This mechanism helps in avoiding collision on Ethernet.

NDDS (Network Data Delivery Service) is network middleware for real-time application built on top of UDP/IP stack and provides deterministic and fast distribution of data over standard IP network. Someimportant functionalities is added in this real-time enhancement for example (reliability control, delivery timing control, request reply semantics, etc.,).

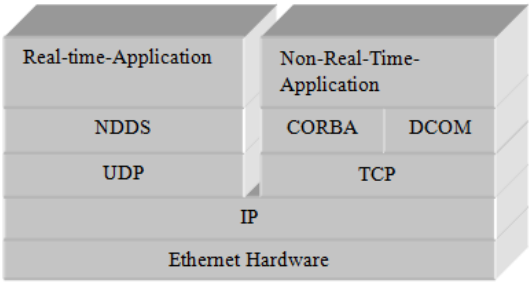

Fig 1. NDDS network layers

Data is transported over a network by three simple methods known as Unicast, Broadcast and Multicast.

Unicast: From one source to one destination i.e. One-to-One. Traffic, many streams of IP packets that move across networks flow from a single point, such as a website server, to a single endpoint such as a client PC. This is the most common form of information transference on networks.

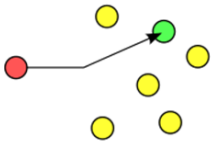

Fig 2. Unicast

Broadcast: From one source to all possible destinations i.e. One-to-All. Here, traffic streams from a single point to all possible endpoints within reach on the network, which is generally a LAN. This is the easiest technique to ensure traffic reaches to its destinations. This mode is mainly utilized by television networks for video and audio distribution.

Multicast: From one source to multiple destinations stating an interest in receiving the traffic i.e. One-to-Many. It means that only the destinations that openly point to their requisite to accept the data from a specific source to receive the traffic stream.

On an IP network, destinations do not regularly communicate straight to sources, because the routers between source and destination must be able to regulate the topology of the network from unicast or multicast side to avoid disordered routing traffic. Multicast routers replicate packets received on one input interface and send the replicas out on multiple output interfaces.

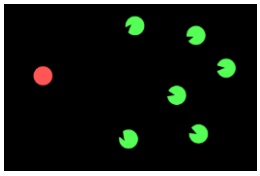

Fig 3. Broadcast

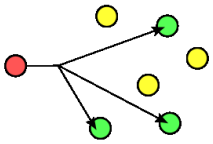

Fig 4. Multicast

II. OVERVIEW

We propose our Ethernet simulator as a protocol simulator which can be used during integration of any Ethernet interfaces. This tool can simulate and transfer data in unicast, multicast and broadcast according to requirement. The flowchart shown below depicts the working of the simulator tool.

A. UDP Socket creation

UDP (User Datagram Protocol) is a datagram-oriented, unreliable, lightweight, connectionless protocol. This protocol can be used when reliability is not important. To establish a connection, QUdp Socket is used. It allows sending and receiving UDP datagrams.

B. Packets captured and dropped

Packet analyzer is a computer program that interrupts and logs traffic passing over a digital network. Packet capture determines the computer networking term for checking the data packet that is moving or crossing over a particular computer network. Packet loss/dropped occurs when there is a network congestion and router discards them instead of relaying.

III. CONCLUSION

Use of Ethernet simulator tool for data transfer is studied. It may take time waiting for the external system to be available for testing. Instead of waiting for it, we can test the protocol using this tool. There might be a situation where some packets can be lost, and hence the top layer has to take care of data retransmission if needed.

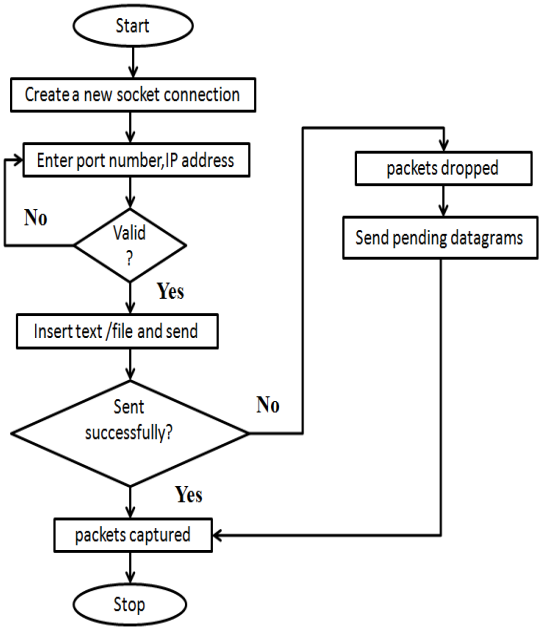

Fig 5. Flowchart of Generic Ethernet Simulator

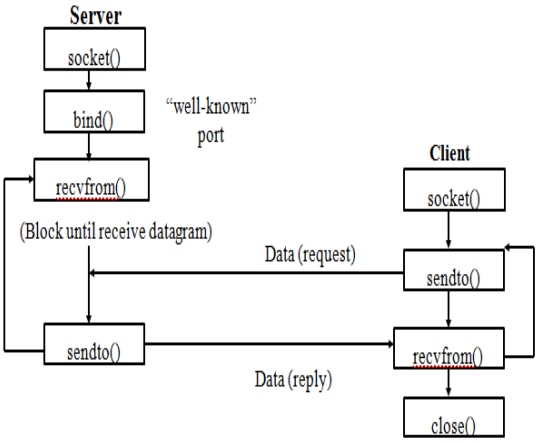

Fig 6. Example of UDP client server socket creation

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