*Assignment 7: **Application of Raw Sockets***
Ping Application

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Objective:

The objective of this assignment is to use Raw Sockets to create a Ping Application.

To compile and run Ping:

g++ ping.cpp -o ping.out

sudo ./ping.out <address to ping>

Functions and their utility:

- ***checksum():*** The function simply calculates the checksum value for the ICMP header and returns the value as short int.
- ***display():*** The function displays the entire packet received – the IP and the ICMP headers – both. Note : The global variable ***show_packet*** could be set to false to turn off this functionality
- ***sig_handler():*** Gets activated at the arrival of SIGINT (- ^C) command- displays the statistics of the Round Trip Time (RTT) – average, min and max; and then exits the program
- ***listener():*** does the simple job of receiving the packet, checking whether it is in response to the right ping and displays the basic info – the RTT value, and the sequence number.
- ***ping_and_receive():*** The most important part of the whole application. Does the following jobs:
    - Creates and attaches the IP header: uses ***memcpy()*** call to add the IP header fields to the char array that forms the top part of the packet structure.
    - Creates and attaches the ICMP header: uses ***memcpy()*** as before to add the fields one-by-one to the char array that forms the part of the ICMP header in the packet
    - Adds Time stamp : Maintains 2 copies of the timestamp – one in the data part of the ICMP packet and another in an independent array ***time_sent[].*** This part has only been done as an expirement to check whether the message part gets returned as-it-is. In all trial runs, it did get returned as-is.
    - Sends the packet to the designated address destination address over a *connectionless* socket.

Observations / Other specifics of Implementation :

- The application has to run on connectionless socket – hence binding and another connection – establishment activities are never used.
- The ***setsocketopt()*** call has been used to set HDRINCL option to indicate to the kernel that **no IP header is to be added by the kernel.** The header is manually created and added to the packet.
- Source address and IP checksum have been left blank to indicate that the kernel may add these values in the packet by itself.
- A ***sleep()*** has been included after sending each packet to emulate the real linux ping command.
- The ICMP packets generated and those received were captured by **Wireshark** to check them. The RTT values generated by the application and those recorded by Wireshark were found to be in close agreement. A difference of a few microseconds, does exit and could be attributed to the fact that some instructions before

recording the time may have taken some time and that the process – running on multiprocessing environment may not immediately respond.

- The pings may not work with sites out of the AS as the proxy server only relays the HTTP and HTTPS messages - and hence, pinging was only done to *iitkgp.ac.in* which responds to the pings – as the server is within the AS.

Screenshot: