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Section: Gx

Subject : Computer Network Lab (CS 3272)

Assignment 4 extension: UDP Socket Application

Code:

server.cpp

```cpp
// 2020CSB010 GOURAV KUMAR SHAW

#include <iostream>
#include <cstring>
#include <sys/socket.h>
#include <netinet/in.h>
#include <arpa/inet.h>
#include <unistd.h>

#define BUFFER_SIZE 1024

const int MAX_PAYLOAD_SIZE = 1000;

int main(int argc, char * argv[]) {

    if (argc < 2) {
        std::cerr << "Usage: " << argv[0] << " <port>\n";
        return 1;
    }

    int port = atoi(argv[1]);

    int sockfd = socket(AF_INET, SOCK_DGRAM, 0);
    if (sockfd < 0) {
        std::cerr << "Error creating socket.\n";
        return 1;
    }

    struct sockaddr_in servaddr, cliaddr;
    memset(&servaddr, 0, sizeof(servaddr));
```

```
    memset(&cliaddr, 0, sizeof(cliaddr));

    servaddr.sin_family = AF_INET;
    servaddr.sin_addr.s_addr = INADDR_ANY;
    servaddr.sin_port = htons(port);

    if (bind(sockfd, (const struct sockaddr *) &servaddr, sizeof(servaddr)) <
0) {
        std::cerr << "Error binding socket.\n";
        close(sockfd);
        return 1;
    }

    char buffer[BUFFER_SIZE];
    socklen_t len;

    len = sizeof(cliaddr);

    while (true) {
        struct Packet {
            uint16_t sequence_number;
            uint32_t timestamp;
            uint8_t ttl;
            uint8_t payload[MAX_PAYLOAD_SIZE];
        } recv_packet;

        int n = recvfrom(sockfd, &recv_packet, BUFFER_SIZE, MSG_WAITALL,
(struct sockaddr *) &cliaddr, &len);
        if (n < 0) {
            std::cerr << "Error receiving packet.\n";
            continue;
        }

        // Decrement TTL value by one
        recv_packet.ttl--;

        // Send the same packet back to the client
        if (sendto(sockfd, &recv_packet, sizeof(buffer), MSG_CONFIRM, (const
struct sockaddr *) &cliaddr, len) < 0) {
            perror("sendto");
            continue;
        }
    }

    close(sockfd);
    return 0;
}
```

client.cpp

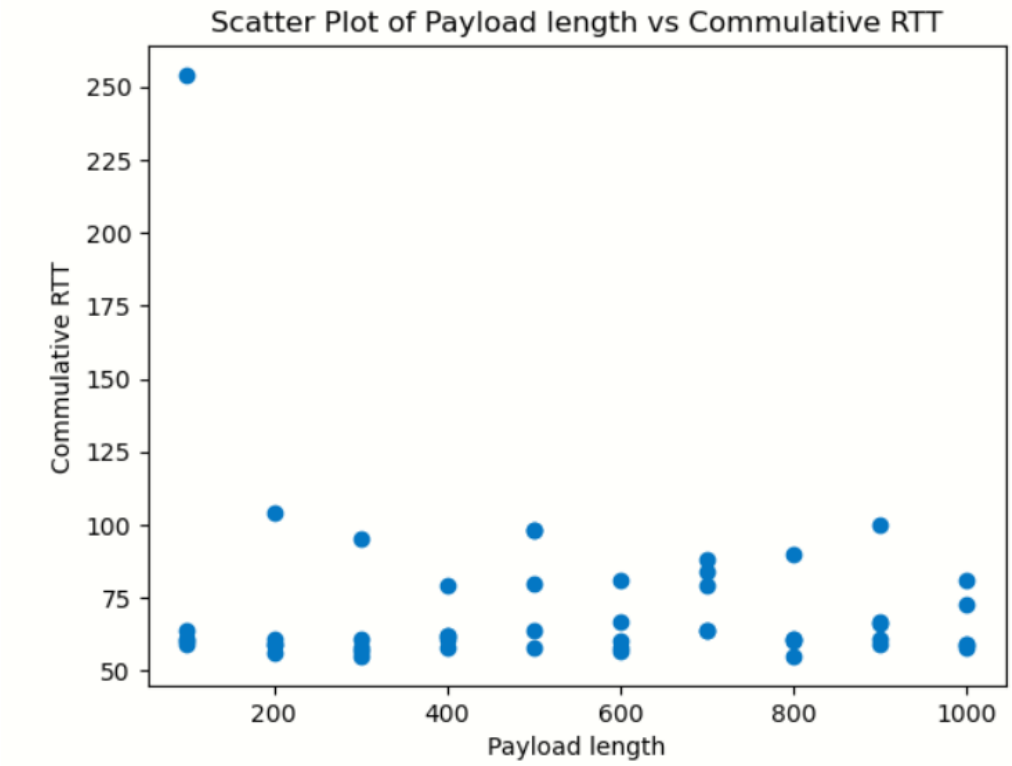
```cpp
// 2020CSB010 GOURAV KUMAR SHAW

#include <bits/stdc++.h>
#include <string.h>
#include <sys/types.h>
#include <sys/socket.h>
#include <arpa/inet.h>
#include <netinet/in.h>
#include <sys/time.h>
#include <stdlib.h>
#include <fcntl.h>
#include <unistd.h>

#define MAXSIZE 1600
using namespace std;
// Driver code
int main(int argc, char *argv[])
{
    // defining the payload

    unordered_map<int, int> m;
    FILE *fp1;
    int k = 100;

    vector<int> vec1;
    vector<int> vec2;
    for (int i = 0; i < 10; i++)
    {
        m[i] = k;
        k += 100;
    }
    if (argc != 6)
    {
        std::cerr << "Use the following arguments: " << argv[0] << "
[ip_address] [port_number] [TTL] [NumPackets] [Filename.csv]\n";
        return 1;
    }
    srand(time(NULL));
    const int PORT = atoi(argv[2]);
    int sockfd;
    char filename[10];
    memcpy(filename, argv[5], sizeof(argv[5]));
    printf("Filename is %s\n", filename);

    struct sockaddr_in servaddr;
    if ((sockfd = socket(AF_INET, SOCK_DGRAM, 0)) < 0)
```

```
    {
        perror("socket creation failed");
        exit(EXIT_FAILURE);
    }

    memset(&servaddr, 0, sizeof(servaddr));

    // Filling server information
    servaddr.sin_family = AF_INET;
    servaddr.sin_port = htons(PORT);
    servaddr.sin_addr.s_addr = inet_addr(argv[1]);


    socklen_t len;
    struct timeval timestamp;
    struct timeval timestamp1;

    int numPacket = atoi(argv[4]);

    fp1 = fopen(filename, "w");
    fprintf(fp1, "%s,", "sl.no");
    fprintf(fp1, "%s,", "payload_length");
    fprintf(fp1, "%s \n", "commulative_rtt");
    for (int i = 0; i < numPacket; i++)
    {
        char buffer[MAXSIZE];
        memset(buffer, '\0', MAXSIZE);
        int payload_length = m[i % 10];
        printf("Payload length made as:%d\n", payload_length);
        int ttl = atoi(argv[3]);
        if (ttl % 2 != 0)
            ttl = ttl - 1;

        cout <<"ttl as: "<< ttl << endl;
        // making payload with random alphabets
        char payload[payload_length + 1];
        for (int j = 0; j < payload_length; j++)
        {
            payload[j] = 'a' + rand() % 26;
        }
        payload[payload_length] = '\0';

        gettimeofday(&timestamp, NULL);
        long int microseconds = timestamp.tv_usec;
        if (i <= 9)
        {
            buffer[0] = '0';
```

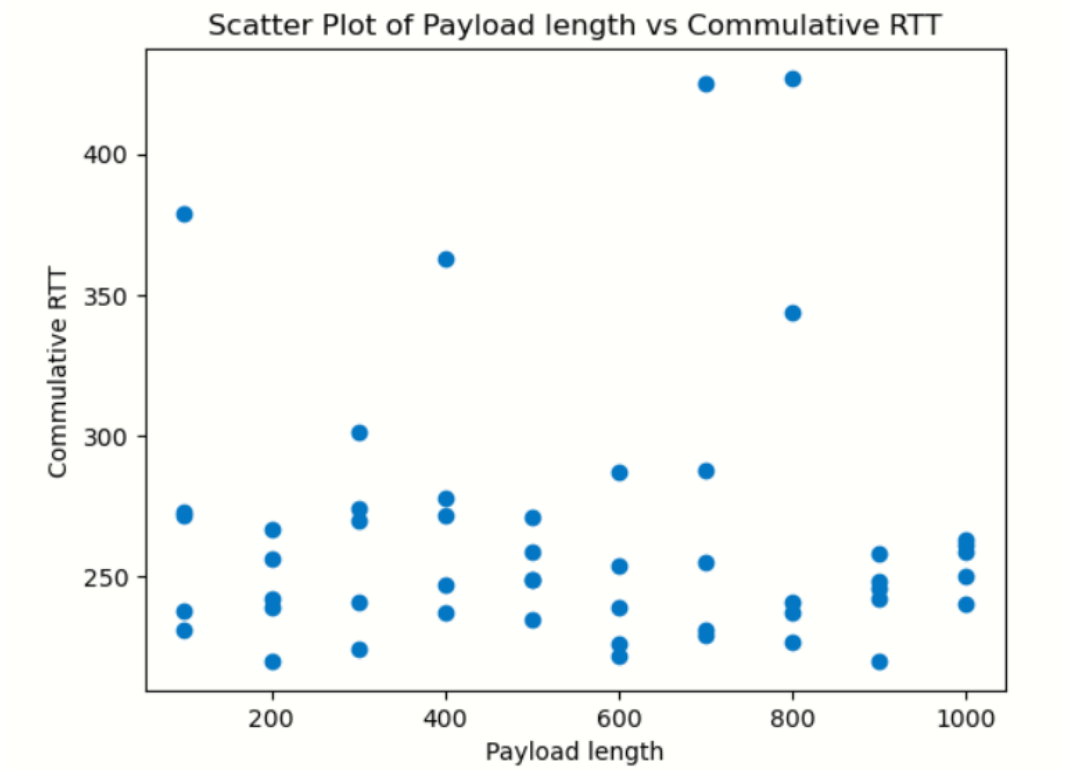
```
            snprintf(buffer + 1, MAXSIZE, "%d%ld", i, microseconds); // i and
microseconds variables, formatting them into a string using the specified
format string, and then writing that string to the buffer starting at the
second position of the buffer
        }
        else
            snprintf(buffer, MAXSIZE, "%d%ld", i, microseconds);

        buffer[8] = ttl;
        buffer[9] = payload_length;


        strcat(buffer, payload);
        strcat(buffer, filename);
        int n;
        while (ttl)
        {
            sendto(sockfd, (const char *)buffer, strlen(buffer),
                   MSG_CONFIRM, (const struct sockaddr *)&servaddr,
                   sizeof(servaddr));
            std::cout << "Client:  "
                      << "Sequence Number:" << buffer[0] << buffer[1] <<
std::endl
                      << "time:" << microseconds << std::endl
                      << "ttl:" << ttl << std::endl;
            std::cout << "above message sent\n";
            n = recvfrom(sockfd, (char *)buffer, MAXSIZE,
                         MSG_WAITALL, (struct sockaddr *)&servaddr,
                         &len);
            ttl = buffer[8];
            ttl--;
            buffer[8] = ttl;
        }

        gettimeofday(&timestamp1, NULL);
        long int microsecond = timestamp1.tv_usec;// gives the time in
microseconds
        ttl = buffer[8];
        buffer[n] = '\0';


        int commulative_rtt = microsecond - microseconds;
        cout << "Starting time is:" << microseconds <<" microseconds"<< endl;
        cout << "ending time is:" << microsecond <<" microseconds"<< endl;
        cout << "This is the commulative rtt-->" << commulative_rtt <<"
microseconds"<< endl;

        vec1.push_back(payload_length);
```

```
        vec2.push_back(commulative_rtt);

        char temp1[5];
        char temp2[5];

        fprintf(fp1, "%d,", i);
        fprintf(fp1, "%d,", payload_length);
        fprintf(fp1, "%d \n", commulative_rtt);
    }
    for (auto it : vec1)
    {
        cout << it << " ";
    }
    cout << endl;
    for (auto it1 : vec2)
    {
        cout << it1 << " ";
    }

    int err = close(sockfd);
    return 0;
}
```

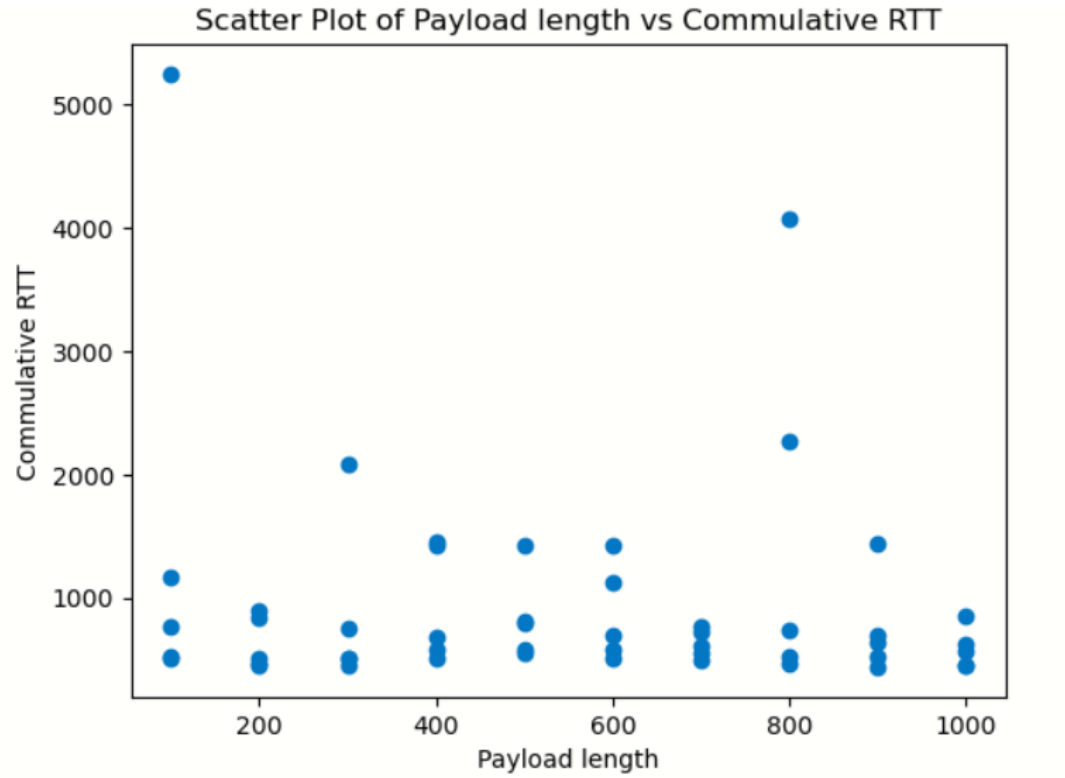
Scatter plot for ttl=2



Scatter Plot for ttl=8



Scatter Plot for ttl= 16



1. Increasing the TTL value from 2 to 8 will allow packets to traverse a greater number of routers or hops before being discarded. This means that packets can travel over a longer distance and may take a longer time to reach their destination.
2. As for the effect on Round-Trip Time (RTT), it may increase or decrease depending on the network conditions. If the network is congested or has a high latency, increasing the TTL value may result in a longer RTT as packets take longer to reach their destination. On the other hand, if the network is not congested and has low latency, increasing the TTL value may have little effect on the RTT.
3. Increasing the TTL value from 8 to 16 will allow packets to traverse a greater number of routers or hops before being discarded. This means that packets can travel over a longer distance and may take a longer time to reach their destination.
4. As for the effect on Round-Trip Time (RTT), it may increase or decrease depending on the network conditions. If the network is congested or has a high latency, increasing the TTL value may result in a longer RTT as packets take longer to reach their destination. On the other hand, if the network is not congested and has low latency, increasing the TTL value may have little effect on the RTT.
5. In general, the effect of changing the TTL value on RTT will depend on various factors, including the network topology, congestion levels, and the distance between the source and destination hosts. However, increasing the TTL value from 8 to 16 is likely to have a smaller impact on RTT than increasing it from 2 to 8 because the number of additional hops that packets can travel is relatively smaller.