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Concurent and Distributed Programming

Homework 1

The homework consists of a client and server capable of transmitting files between them.

They support TCP implementing streaming and UDP implementing stop and wait.

The TCP mechanism is very basic, the server is listening and when a client connects a new thread is started where the client is transmitting the file name(in binary) then the raw data split in buffers of 64kb. The client is opening a socket, connecting to the server and sending the file found at the path it has received as argument from the command line.

The UDP mechanism is more complex, the server is waiting for the client to connect then starts a thread in which a new datagram socket is open which starts to communicate with the client. A basic acknowledgment system has been set up which consists of confirming each packet. If no confirmation is received in 5 seconds the packet is resent up to 5 retries, then the thread throws an exception and closes the socket. For the acknowledgement system a function “sendAndAwaitResponse “ has been implemented which is present on both the server and the client. Each message is perceived as an acknowledgment such that the client is waiting for server’s acknowledgement message while the server is waiting for the client’s data message(as an acknowledgement for the acknowledgement itself). When the transmission is complete the client uses the same function to send a “FIN” package. The server is sending a last acknowledge message the classic way then closes the socket such that even if the client doesn’t receives the message the server will already have the file stored so the client will simply retry to send the “FIN” package until it reaches the 5th try then close itself.

However a problem has been found while testing on the internet, since the acknowledgement system is very basic it only sends confirmations of a message being received, not confirmation of the package sequence number so a desynchronization of package is likely to happen by not misinterpreting the confirmation. A package number acknowledgment system is required to fix this problem.

The chosen language for this homework is python. Both the TCP and UDP sockets are open simultaneously on separate threads capable of handling clients concurrently.

To start the server use the following command:

Python server.py

To start the client use the following command:

Python client.py (tcp||udp) filename

Metrics:

With read/write from SSD on local area network with 64kb buffer

TCP 500MB:

Server:

Protocol: TCP

Transmission Time: 1.4322550296783447

Number of messages read: 8775

Number of bytes read: 561600000

Number of packages lost: 0

Client:

Transmission Time: 1.3858592510223389

Number of messages sent: 8775

Number of bytes sent: 561600000

Number of packages lost: 0

UDP 500MB:

Server:

Protocol: UDP

Transmission Time: 2.2368855476379395

Number of messages read: 8775

Number of bytes read: 561600000

Number of packages lost: 0

Client:

Transmission Time: 2.2398834228515625

Number of messages sent: 8775

Number of bytes sent: 8985600

Number of packages lost: 0

TCP 1GB:

Server:

Protocol: TCP

Transmission Time: 9.244776487350464

Number of messages read: 16783

Number of bytes read: 1074112000

Number of packages lost: 0

Client:

Transmission Time: 9.239933490753174

Number of messages sent: 16783

Number of bytes sent: 1074112000

Number of packages lost: 0

UDP 1GB:

Server:

Protocol: UDP

Transmission Time: 15.948466539382935

Number of messages read: 16783

Number of bytes read: 1074112000

Number of packages lost: 0

Client:

Transmission Time: 15.97303295135498

Number of messages sent: 16783

Number of bytes sent: 17185792

Number of packages lost: 0

Localhost with 1kb buffer:

500MB file TCP:

SERVER:

Protocol: TCP

Transmission Time: 29.198376178741455

Number of messages read: 548353

Number of bytes read: 561513472

Number of packages lost: 0

CLIENT:

Transmission Time: 29.190091848373413

Number of messages sent: 548353

Number of bytes sent: 561513472

Number of packages lost: 0

500MB file UDP:

SERVER:

Protocol: UDP

Transmission Time: 56.23629713058472

Number of messages read: 548353

Number of bytes read: 561513472

Number of packages lost: 0

CLIENT:

Transmission Time: 56.24071025848389

Number of messages sent: 548353

Number of bytes sent: 561513472

Number of packages lost: 0

From Slovakia:

1mb file TCP:

Server:

Transmission Time: 2.1915316581726074

Number of messages read: 1343

Number of bytes read: 1375232

Number of packages lost: 0

Client:

Transmission Time: 2.1901776790618896

Number of messages sent: 1151

Number of bytes sent: 1178624

Number of packages lost: 0

500bm file:

Server:

Protocol: TCP

Transmission Time: 602.1729528903961

Number of messages read: 595385

Number of bytes read: 609674240

Number of packages lost: 0

Client:

Transmission Time: 955.7064251899719

Number of messages sent: 503878

Number of bytes sent: 515971072

Number of packages lost: 0

UDP: N/A