Project #3 – NetProbe Client-Server Multithreaded Edition

A. Overview and Specifications

In this project, we extend the NetProbe client and server applications developed in Project #2 with new features described below.

(a) NetProbe server: implements multithreading-based concurrent server with one thread per connection. The thread pool model should be implemented with the pool automatically scale with the load.

(b) NetProbe server: implements adaptive thread-pool model where the initial pool size is configurable via command-line parameter (default to 8, excluding main thread) and doubles whenever the pool is exhausted. If the pool utilization falls under 50% for more than one minute then the pool size will be halved.

(c) A new feature, activated by "-response" option on the command line for the NetProbe client, to measure system response time (mean, min, max, average jitter) where the NetProbe server only send back a message of the specified size upon receiving a request message from the NetProbe client. The NetProbe client then measures the time it takes from sending the request to the time it receives the reply message. The request message size can be minimal and the request rate is to be determined by the NetProbe client instead of the NetProbe server. Note that if TCP is used than each request-response transaction is to be delivered via a new TCP connection.

Specification of Command-line Arguments:

NetProbeServer <*more parameters, see below*>

"-stat yyy" set update of statistics display to be once yyy ms. (Default = 0 = no stat display)

"-lhost hostname" hostname to bind to. (Default late binding, i.e., IN_ADDR_ANY)

"-lport portnum" port number to bind to. (Default "4180")

"-sbufsize bsize" set the outgoing socket buffer size to bsize bytes

"-rbufsize bsize" set the incoming socket buffer size to bsize bytes

"-servermodel [select|threadpool]" set the concurrent server model to either select()-based or thread pool

"-poolsize psize" set the initial thread pool size (default 8 threads), valid for thread-pool server model only

NetProbeClient [mode] <*more parameters, see below*>

[mode] : "-send" means sending mode (the client sends packets to the server);

"-recv" means receiving mode (the server sends packets to the client);

"-response" means response time mode (the client sends requests to the server and the server sends reply messages to the client);

For all modes the followings are the supported parameters:

"-stat yyy" set update of statistics display to be once yyy ms. (Default = 500 ms)

"-rhost hostname" server hostname. (Default 'localhost')

"-rport portnum" server port number. (Default '4180')

"-proto [TCP/UDP]" send data using TCP or UDP. (Default "UDP)

"-pktsize bsize" send message of bsize bytes. (Default 1000 bytes including application header)

"-pktrate txrate" send/recv mode: data rate (Bps, default 1000 Bps),
response mode: request rate (per second, default 10/s),
"0" means as fast as possible

"-pktnum num" send a total of num messages/requests. (Default = "0" = infinite)

"-sbufsize bsize" set the outgoing socket buffer size to bsize bytes

"-rbufsize bsize" set the incoming socket buffer size to bsize bytes

Statistics Display:

One-line format for client send mode:

"Elapsed [120s] Rate [3.5Mbps]"

(a) Elapsed: time elapsed for this session

(b) Rate: average throughput since beginning of session

One-line format for client recv mode:

"Elapsed [120s] Pkts [1234] Lost [5, 0.1%] Rate [3.5Mbps] Jitter [5.2ms]"

(a) Elapsed: time elapsed for this session

(b) Pkts: accumulated number of packets/message received

(c) Lost: accumulated number of packets lost and the packet loss rate in percentage, i.e., Lost/Pkts*100%

(d) Rate: average throughput since beginning of session

(e) Jitter: average jitter of inter-packet transmission/reception time (i.e., E[|d-E[d]|] where d is the packet inter-arrival time)

One-line format for client response mode:

"Elapsed [120s] Replies [1234] Min [4.3ms] Max [10.2ms] Avg [8.0ms] Jitter [5.2ms]"

(a) Elapsed: time elapsed for this session

(b) Replies: accumulated number of reply messages received

(c) Min: minimal response time

(d) Max: maximal response time

(e) Avg: average response time

(d) Jitter: jitter time of response time, E[|r-E[r]|] where r is the response time

One-line format for server: "Elapsed [120s] ThreadPool [32|25] TCP Clients [10] UDP Clients [15]"

(a) Elapsed: time elapsed for this serve program

(b) ThreadPool: current thread pool size and number of threads in use

(c) TCP Clients: number of active TCP clients

(d) UDP Clients: number of active UDP clients