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GitHub Repo Under NEU Organization:
https://github.ccs.neu.edu/lisiqi/CS6650-DSBS-Repo

Explanation About Client Structure and How it works:

Total three Packages @ "SuperMarketClient":

- Model: (general utils for both client 1 and 2)
  - Record: the record object used to store all latency results for Client2
  - LogStderr: the error logger for write out system error to err.txt file
  - HttpMethod: Enum for POST and GET
- part1: (package for client 1 to generate requested outputs)
  - Client1:
    - Main for execute all threads by calling SingleThread in package part1
    - Parse command line arguments with designed cmd options
    - Check if command line arguments are valid
    - Generate output results for part 1, print out to console
  - SingleThread:
    - the single runnable object represents as one thread to make purchase requests with remote server
    - Use AtomicInteger to count the total successful/unsuccessful requests
    - Use CountDownLatch to initiate phase 2 and phase 3 threads
    - designed for Client 1 without capture latency of each request
    - use LogStderr to log errors into txt file
- part2: (package for client 2 to generate requested outputs)
  - Clinet2:
    - Main for execute all threads by calling SingleThread in package part2
    - Parse command line arguments with designed cmd options
    - Check if command line arguments are valid
    - Generate output results for part 2, print out to console
  - SingleThread:
    - the single runnable object represents as one thread to make purchase requests with remote server
    - Use AtomicInteger to count the total successful/unsuccessful requests
    - Use CountDownLatch to initiate phase 2 and phase 3 threads
    - designed for Client 2 to capture start and end time of each request, in order to get latency time
    - use LogStderr to log errors into txt file
  - RecordWriter:
    - Runnable object used to generate Records object and write to csv file
    - Using BlockingQueue, and work as a Consumer, when consider each SingleThread are all producers of the queue
  - ReportGenerator:
    - Generate output results for part 2, print out to console

- Read in all Records stored in CSV and get all Latency in to a list and sort list
- Analysis all latency list, and get mean, median, max and p99 response time

Below are the output results for Client 1 and Client 2 and some analysis Charts:

➔ Results based on run Server on EC2, and run client locally

➔ With 32 Threads:

Generate Output Result For Part1.Client1 Based On Following Parameters:
IP Address: 54.166.123.80, Max Store: 32, numOfCustomersPerStore: 1000, maxItemId: 100000
numPurchasesPerHour: 60, numItemsPerPurchase: 5, @ Date: 2021-01-01
==========
1. Total number of successful requests sent: 17280
2. Total number of unsuccessful requests: 0
3. The total run time (wall time) for all phases to complete: 48.301 second
4. Throughput: 357.757 requests/second

Generate Output Result For Part2.Client2 Based On Following Parameters:
IP Address: 54.166.123.80, Max Store: 32, numOfCustomersPerStore: 1000, maxItemId: 100000
numPurchasesPerHour: 60, numItemsPerPurchase: 5, @ Date: 2021-01-01
==========
1. Total number of successful requests sent: 17280
2. Total number of unsuccessful requests: 0
3. Mean response time for POSTs: 85.689 milliseconds
4. Median response time for POSTs: 81.000 milliseconds
5. The total run time (wall time) for all phases to complete: 49.925 second
6. Throughput: 346.119 requests/second
7. P99 (99th percentile) response time for POSTs: 173 milliseconds
8. Max response time for POSTs: 466 milliseconds

➔ With 64 Threads:

Generate Output Result For Part1.Client1 Based On Following Parameters:
IP Address: 54.166.123.80, Max Store: 64, numOfCustomersPerStore: 1000, maxItemId: 100000
numPurchasesPerHour: 60, numItemsPerPurchase: 5, @ Date: 2021-01-01
==========
1. Total number of successful requests sent: 34560
2. Total number of unsuccessful requests: 0
3. The total run time (wall time) for all phases to complete: 47.984 second
4. Throughput: 720.240 requests/second

Generate Output Result For Part2.Client2 Based On Following Parameters:
IP Address: 54.166.123.80, Max Store: 64, numOfCustomersPerStore: 1000, maxItemId: 100000
numPurchasesPerHour: 60, numItemsPerPurchase: 5, @ Date: 2021-01-01

==========
1. Total number of successful requests sent: 34560
2. Total number of unsuccessful requests: 0
3. Mean response time for POSTs: 85.586 milliseconds
4. Median response time for POSTs: 81.000 milliseconds
5. The total run time (wall time) for all phases to complete: 48.779 second
6. Throughput: 708.502 requests/second
7. P99 (99th percentile) response time for POSTs: 177 milliseconds
8. Max response time for POSTs: 486 milliseconds

➔ With 128 Threads:

Generate Output Result For Part1.Client1 Based On Following Parameters:
IP Address: 54.166.123.80, Max Store: 128, numOfCustomersPerStore: 1000, maxItemId: 100000, numPurchasesPerHour: 60, numItemsPerPurchase: 5, @ Date: 2021-01-01
==========
1. Total number of successful requests sent: 69120
2. Total number of unsuccessful requests: 0
3. The total run time (wall time) for all phases to complete: 49.115 second
4. Throughput: 1407.309 requests/second

Generate Output Result For Part2.Client2 Based On Following Parameters:
IP Address: 54.166.123.80, Max Store: 128, numOfCustomersPerStore: 1000, maxItemId: 100000, numPurchasesPerHour: 60, numItemsPerPurchase: 5, @ Date: 2021-01-01
==========
1. Total number of successful requests sent: 69120
2. Total number of unsuccessful requests: 0
3. Mean response time for POSTs: 86.010 milliseconds
4. Median response time for POSTs: 82.000 milliseconds
5. The total run time (wall time) for all phases to complete: 48.636 second
6. Throughput: 1421.170 requests/second
7. P99 (99th percentile) response time for POSTs: 172 milliseconds
8. Max response time for POSTs: 647 milliseconds

➔ With 256 Threads:

Generate Output Result For Part1.Client1 Based On Following Parameters:
IP Address: 54.166.123.80, Max Store: 256, numOfCustomersPerStore: 1000, maxItemId: 100000, numPurchasesPerHour: 60, numItemsPerPurchase: 5, @ Date: 2021-01-01
==========
1. Total number of successful requests sent: 138240
2. Total number of unsuccessful requests: 0
3. The total run time (wall time) for all phases to complete: 49.65 second
4. Throughput: 2784.290 requests/second

Generate Output Result For Part2.Client2 Based On Following Parameters:

IP Address: 54.166.123.80, Max Store: 256, numOfCustomersPerStore: 1000, maxItemId: 100000, numPurchasesPerHour: 60, numItemsPerPurchase: 5, @ Date: 2021-01-01
==========
1. Total number of successful requests sent: 138240
2. Total number of unsuccessful requests: 0
3. Mean response time for POSTs: 89.204 milliseconds
4. Median response time for POSTs: 84.000 milliseconds
5. The total run time (wall time) for all phases to complete: 50.183 second
6. Throughput: 2754.718 requests/second
7. P99 (99th percentile) response time for POSTs: 191 milliseconds
8. Max response time for POSTs: 617 milliseconds

➔ With 512 Threads:

Generate Output Result For Part1.Client1 Based On Following Parameters:
IP Address: 54.166.123.80, Max Store: 512, numOfCustomersPerStore: 1000, maxItemId: 100000, numPurchasesPerHour: 60, numItemsPerPurchase: 5, @ Date: 2021-01-01
==========
1. Total number of successful requests sent: 276480
2. Total number of unsuccessful requests: 0
3. The total run time (wall time) for all phases to complete: 52.526 second
4. Throughput: 5263.679 requests/second

Generate Output Result For Part2.Client2 Based On Following Parameters:
IP Address: 54.166.123.80, Max Store: 512, numOfCustomersPerStore: 1000, maxItemId: 100000, numPurchasesPerHour: 60, numItemsPerPurchase: 5, @ Date: 2021-01-01
==========
1. Total number of successful requests sent: 276480
2. Total number of unsuccessful requests: 0
3. Mean response time for POSTs: 100.661 milliseconds
4. Median response time for POSTs: 86.000 milliseconds
5. The total run time (wall time) for all phases to complete: 59.737 second
6. Throughput: 4628.287 requests/second
7. P99 (99th percentile) response time for POSTs: 444 milliseconds
8. Max response time for POSTs: 6916 milliseconds

➔ With 1024 Threads:

Generate Output Result For Part1.Client1 Based On Following Parameters:
IP Address: 54.166.123.80, Max Store: 1024, numOfCustomersPerStore: 1000, maxItemId: 100000, numPurchasesPerHour: 60, numItemsPerPurchase: 5, @ Date: 2021-01-01
==========
1. Total number of successful requests sent: 552558
2. Total number of unsuccessful requests: 0
3. The total run time (wall time) for all phases to complete: 127.755 second

4. Throughput: 4328.285 requests/second

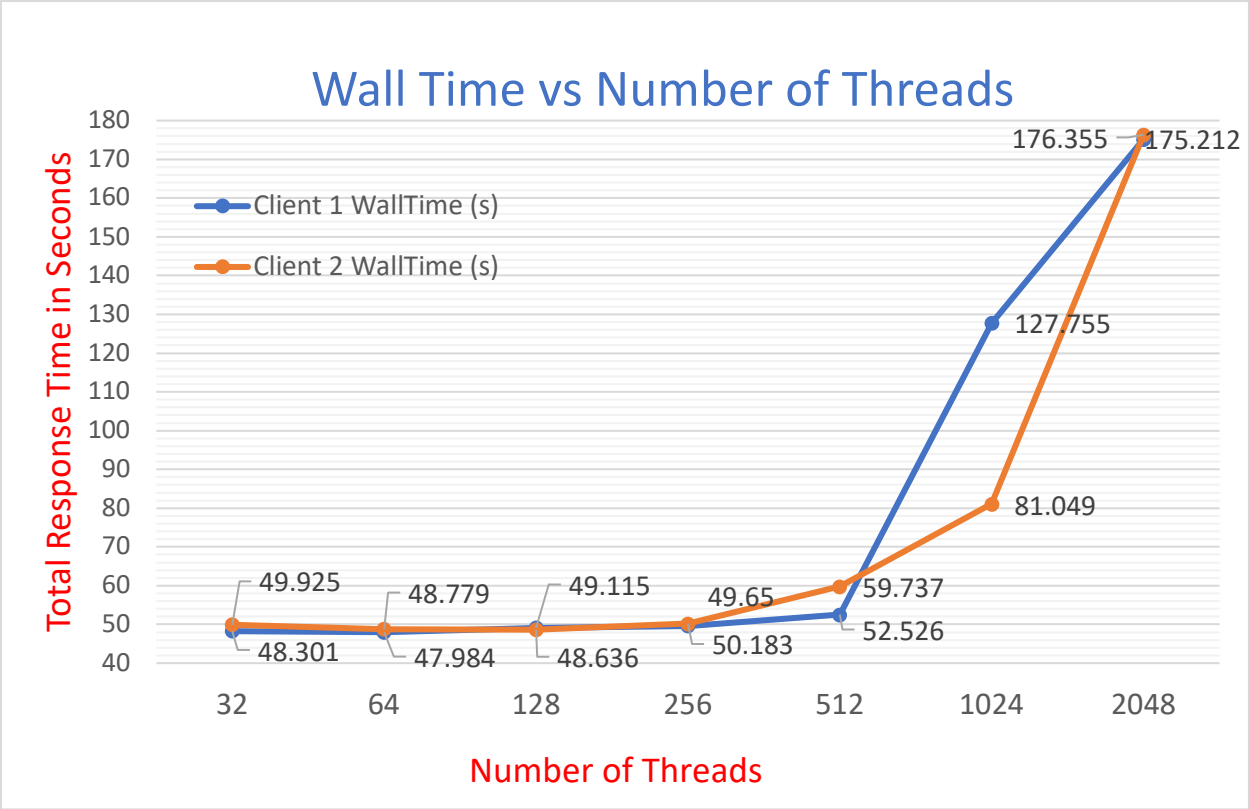
Generate Output Result For Part2.Client2 Based On Following Parameters:
IP Address: 54.166.123.80, Max Store: 1024, numOfCustomersPerStore: 1000, maxItemId: 100000, numPurchasesPerHour: 60, numItemsPerPurchase: 5, @ Date: 2021-01-01
==========
1. Total number of successful requests sent: 552837
2. Total number of unsuccessful requests: 0
3. Mean response time for POSTs: 131.917 milliseconds
4. Median response time for POSTs: 107.000 milliseconds
5. The total run time (wall time) for all phases to complete: 81.049 second
6. Throughput: 6822.539 requests/second
7. P99 (99th percentile) response time for POSTs: 638 milliseconds
8. Max response time for POSTs: 7183 milliseconds

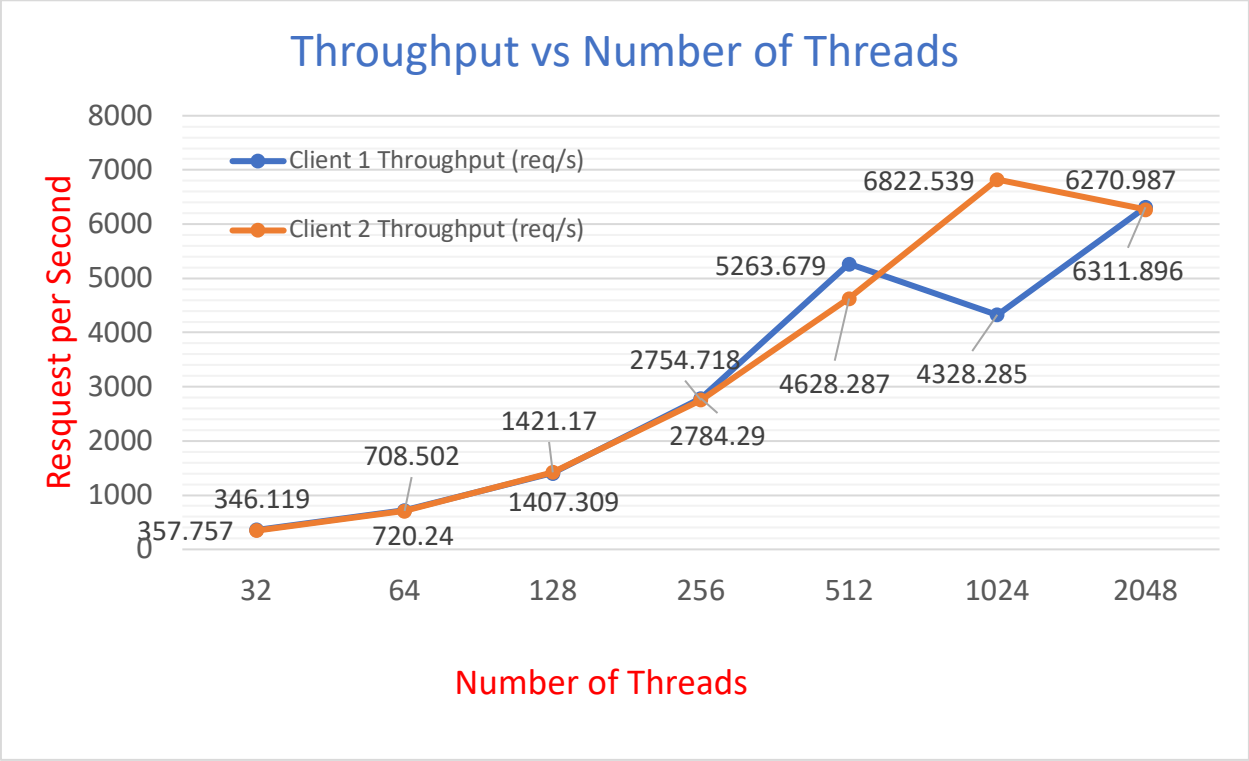
➔ With 2048 Threads:

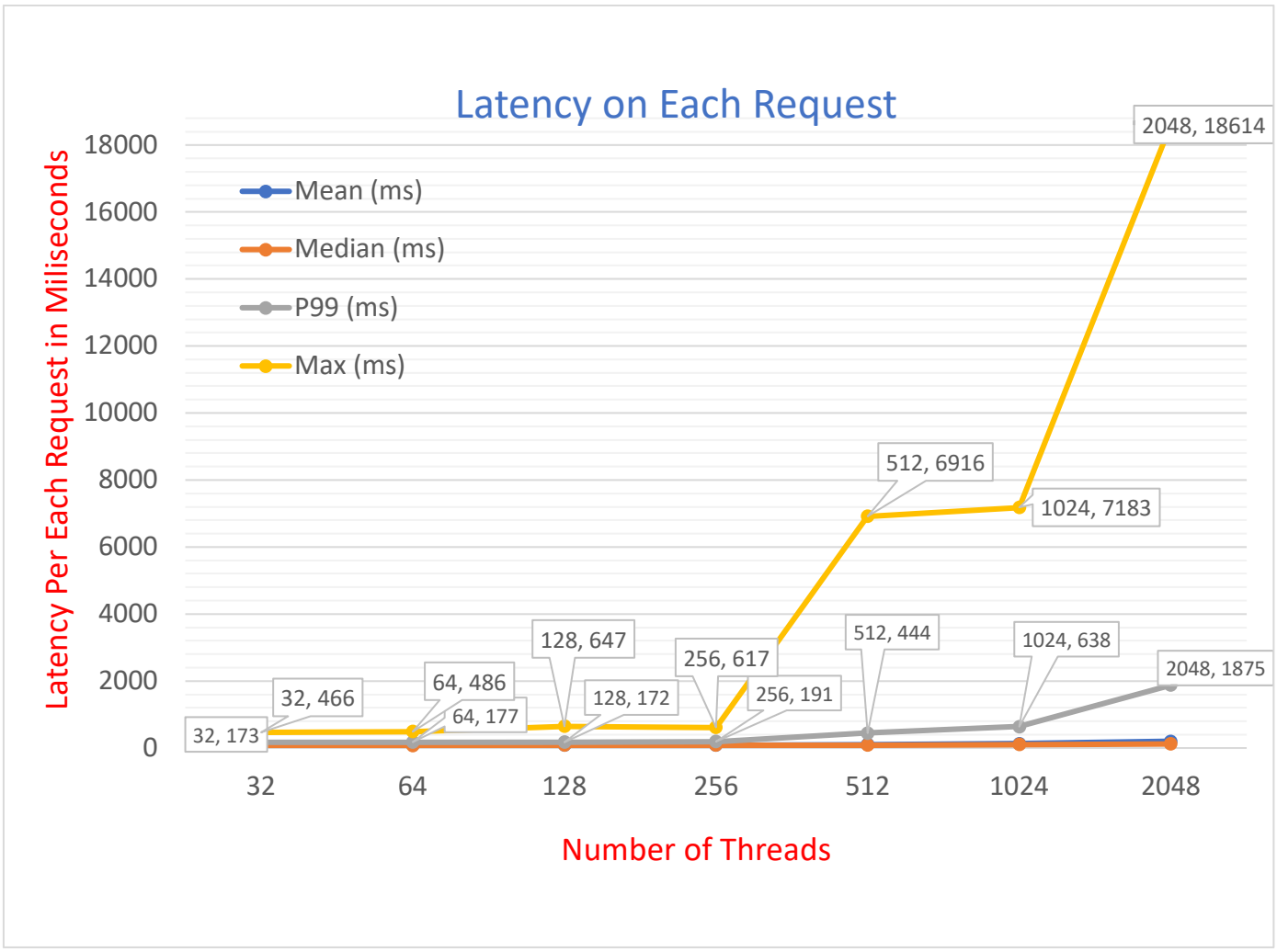
Generate Output Result For Part1.Client1 Based On Following Parameters:
IP Address: 54.166.123.80, Max Store: 2048, numOfCustomersPerStore: 1000, maxItemId: 100000, numPurchasesPerHour: 60, numItemsPerPurchase: 5, @ Date: 2021-01-01
==========
1. Total number of successful requests sent: 1105837
2. Total number of unsuccessful requests: 0
3. The total run time (wall time) for all phases to complete: 175.212 second
4. Throughput: 6311.896 requests/second

Generate Output Result For Part2.Client2 Based On Following Parameters:
IP Address: 54.166.123.80, Max Store: 2048, numOfCustomersPerStore: 1000, maxItemId: 100000, numPurchasesPerHour: 60, numItemsPerPurchase: 5, @ Date: 2021-01-01
==========
1. Total number of successful requests sent: 1101468
2. Total number of unsuccessful requests: 0
3. Mean response time for POSTs: 202.161 milliseconds
4. Median response time for POSTs: 120.000 milliseconds
5. The total run time (wall time) for all phases to complete: 176.355 second
6. Throughput: 6270.987 requests/second
7. P99 (99th percentile) response time for POSTs: 1875 milliseconds
8. Max response time for POSTs: 18614 milliseconds

Charts on Analysis Program Performance:






Latency on Each Request
Latency Per Each Request in Miliseconds
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Mean (ms)
Median (ms)
P99 (ms)
Max (ms)
32, 173
32, 466
64, 486
64, 177
128, 647
128, 172
256, 617
256, 191
512, 6916
512, 444
1024, 7183
1024, 638
2048, 18614
2048, 1875
32
64
128
256
512
1024
2048
Number of Threads