IT314 - SOFTWARE ENGINEERING
Non-Functional Testing

Topic: Online Scholarship Portal (OSP)

GroupID: **7**
Guided by: **Prof. Saurabh Tiwari**

Load Testing with JMeter

Overview

Load testing in JMeter involves assessing the system's performance under different scenarios. To carry out this testing, a JMeter Test Plan requires a Listener component to record and display the outcomes of the performance test. Listeners offer response data in multiple formats, including trees, tables, graphs, and log files, with the option to save these results for later analysis.

Types of JMeter Listeners

JMeter provides various listener types, including:

- **Summary Report**
- **Aggregate Report**
- **Aggregate Graph**
- **View Results Tree**
- **View Results in Table**

Parameters in a Summary Report

The Summary Report in JMeter offers key metrics and insights into the performance test. Here's an overview of its parameters, explained in a revised format:

1. **Samples**
    - Reflects the number of virtual users or requests executed for a specific task or label.
2. **Label**
    - Denotes the name or URL of the HTTP(s) request being tested.
    - When the "Include group name in label" option is enabled, the Thread Group name appears as a prefix.
3. **Average Response Time**
    - Displays the mean response time (in milliseconds) for all requests under a particular label.
4. **Minimum Response Time (Min)**
    - Shows the shortest time taken by any request for a given label.
5. **Maximum Response Time (Max)**
    - Indicates the longest response time recorded for a request under the label.

6. **Standard Deviation (Std. Dev.)**
    - Measures the variation or inconsistency in response times.
    - A lower standard deviation implies more stable performance.
    - **Best Practice:** Aim for this value to be at most half of the average response time.
7. **Error Percentage (Error%)**
    - Represents the proportion of requests that failed during the test, shown as a percentage.
8. **Throughput**
    - Refers to the number of server requests handled per second.
    - It is calculated based on the total time from the first to the last sample.
    - Higher throughput indicates better server performance.
9. **Data Transfer Rate (KB/Sec)**
    - Reflects the volume of data downloaded from the server in kilobytes per second during test execution.
    - Essentially, this is the throughput expressed in terms of data size.

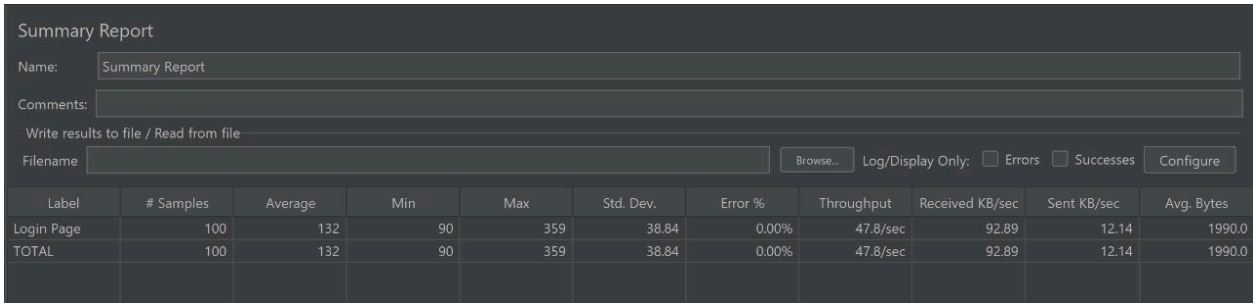
- **Test – HTTP GET Request of all the pages**

Web-Pages:

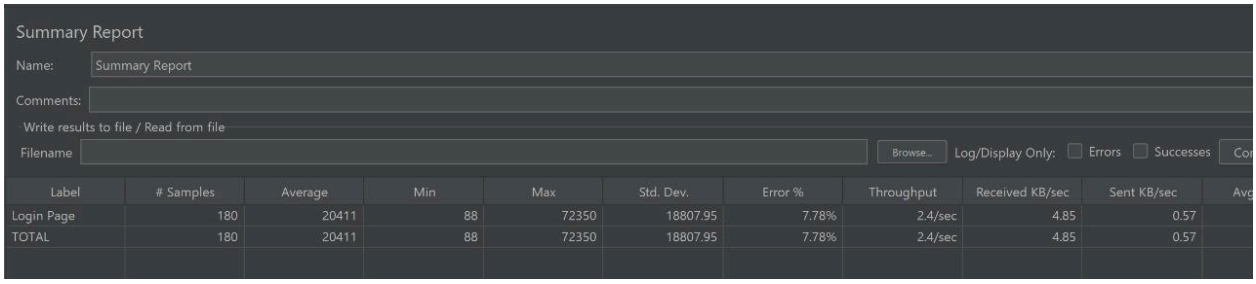
1. login
2. Student Dashboard
3. Apply For Scholarship
4. Student Profile
5. Admin Dashboard
6. Add Scholarship
7. View Applicants

Login page:

a)100 user



b)180 user

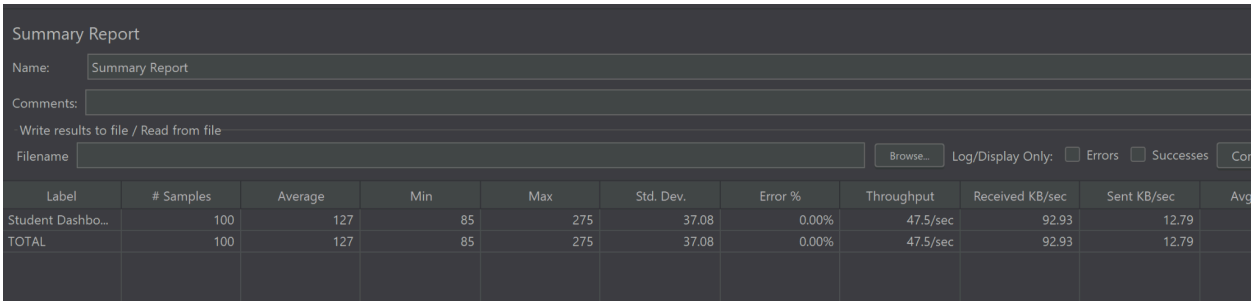


c)200 user

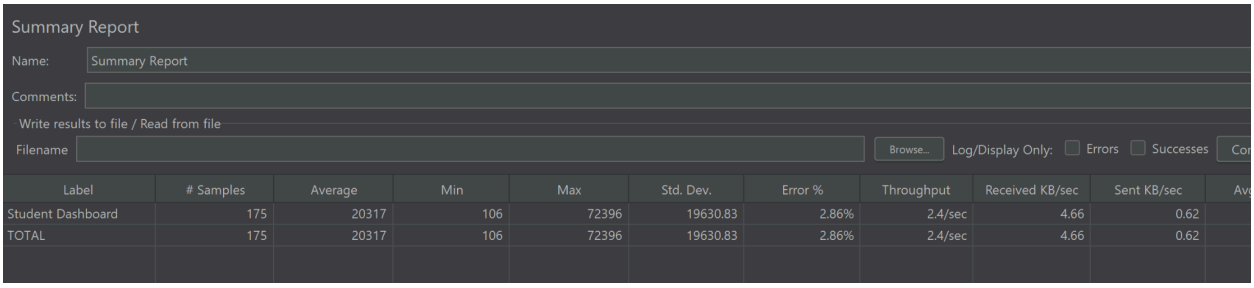
Number of Users	Ramp-up Period	Loop Count	Total Samples(Users*Loops)	Average Error(%)	Throughput
100	2	1	100	0	47.8
180	2	1	180	7.78	2.4
200	2	1	200	19	2.7

Student Dashboard:

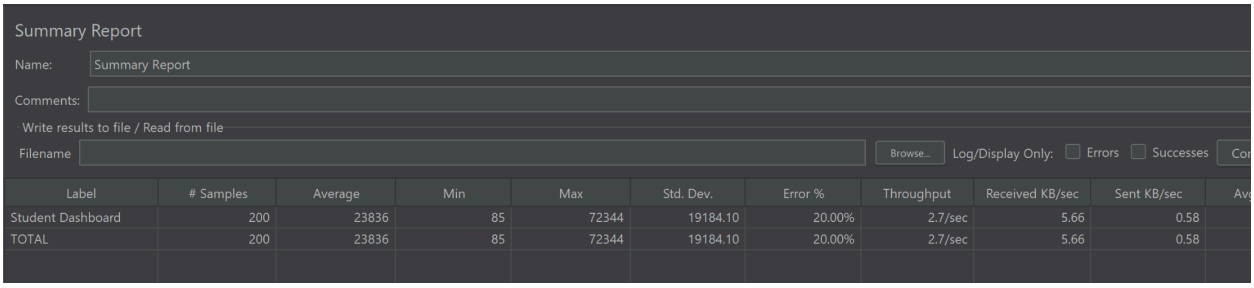
a)100 user



b)175 user



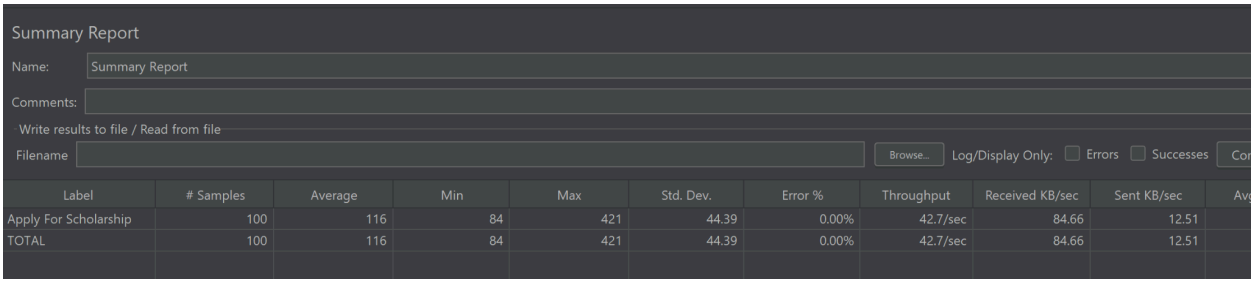
c)200 user



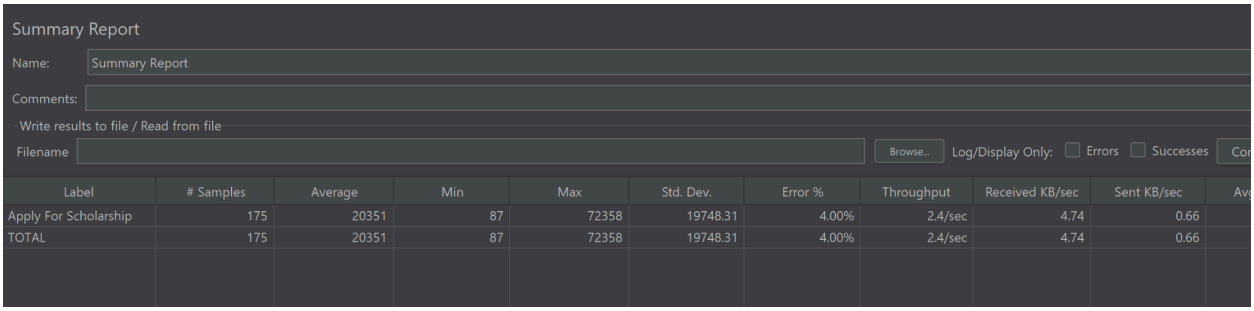
Number of Users	Ramp-up Period	Loop Count	Total Samples(Users*Loops)	Average Error(%)	Throughput
100	2	1	100	0	47.5
175	2	1	175	2.86	2.4
200	2	1	200	20	2.7

Apply For Scholarship:

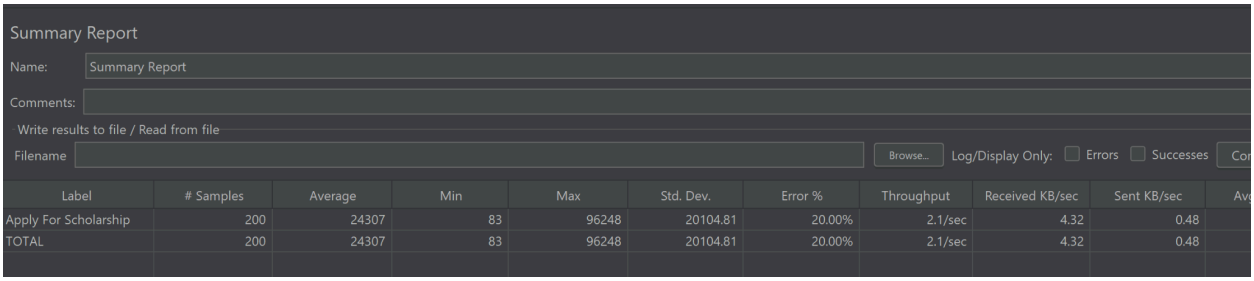
a)100 user



b) 175 user



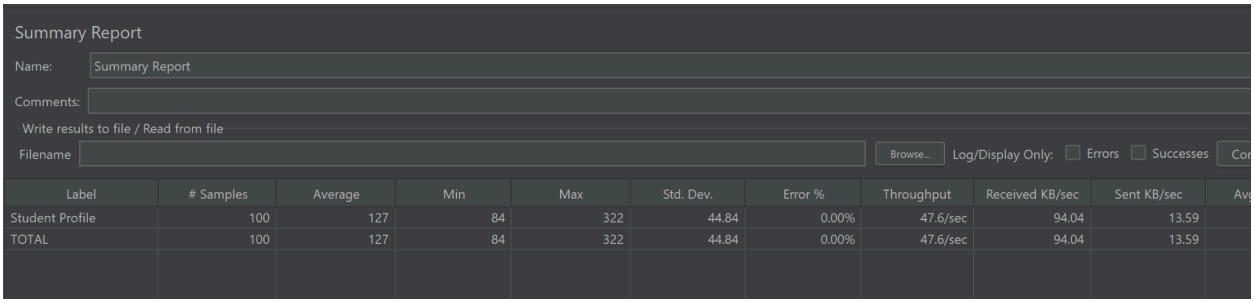
c) 200 user



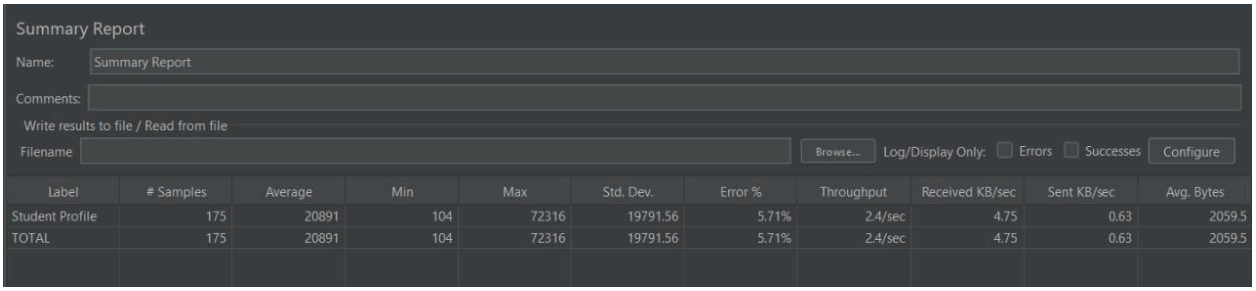
Number of Users	Ramp-up Period	Loop Count	Total Samples(Users*Loops)	Average Error(%)	Throughput
100	2	1	100	0	42.7
175	2	1	175	4	2.1
200	2	1	200	20	2.1

Student Profile:

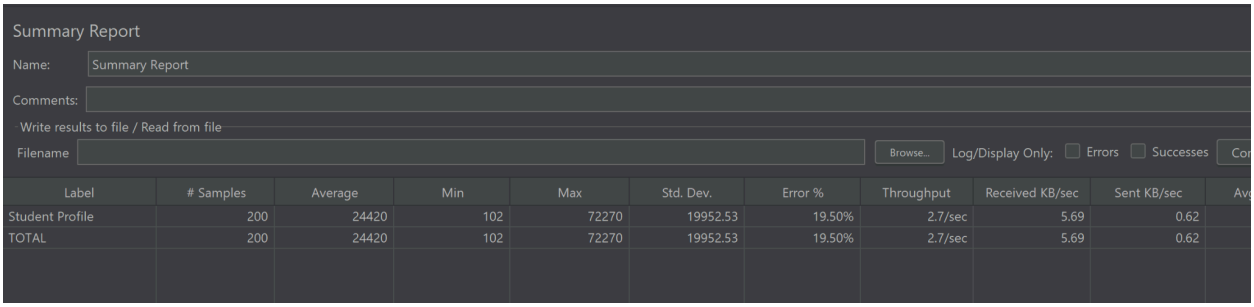
a)100 user



b)175 user



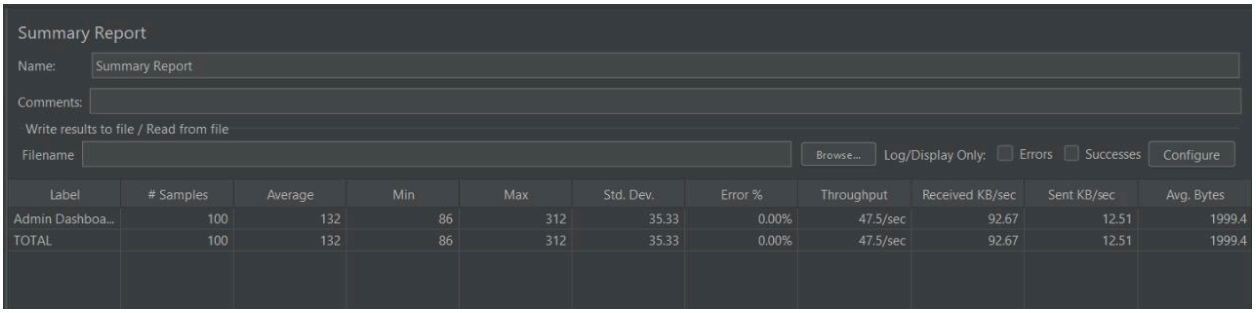
c)200 user



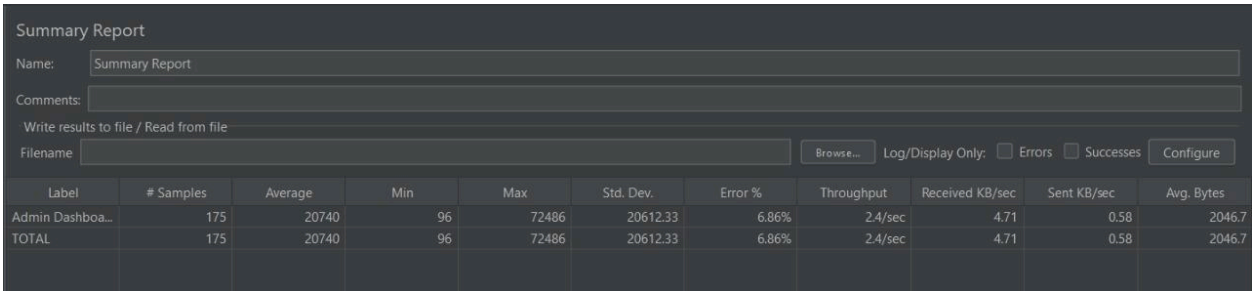
Number of Users	Ramp-up Period	Loop Count	Total Samples(Users*Loops)	Average Error(%)	Throughput
100	2	1	100	0	47.6
175	2	1	175	5.71	2.4
200	2	1	200	19.50	2.7

Admin Dashboard:

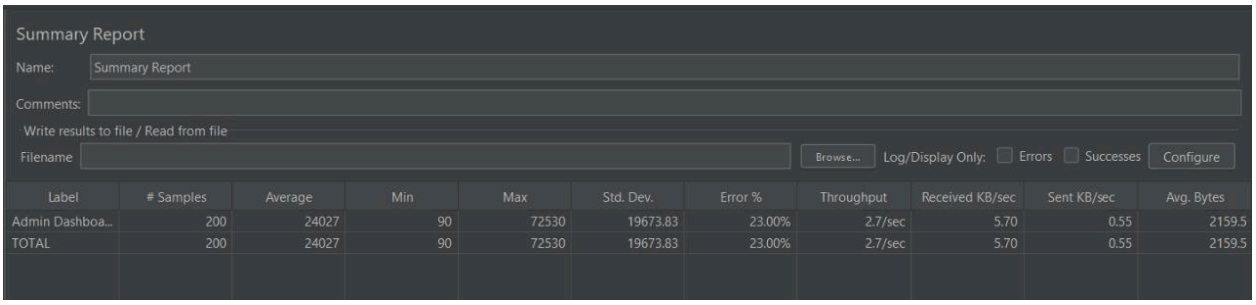
a)100 user



b)175 user



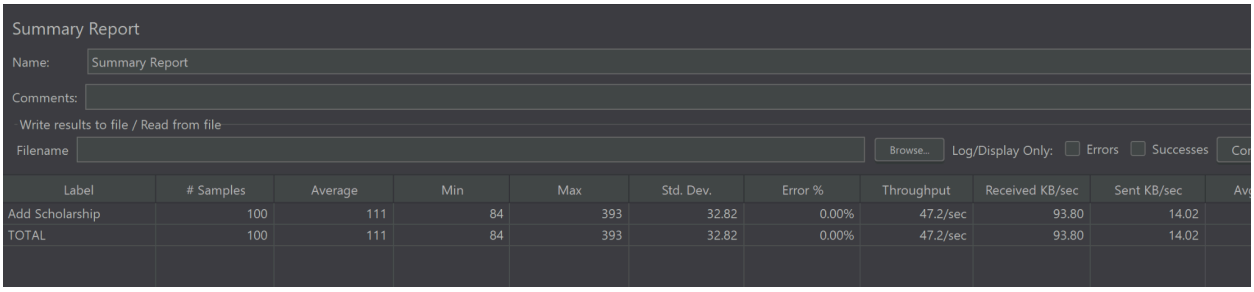
c)200 user



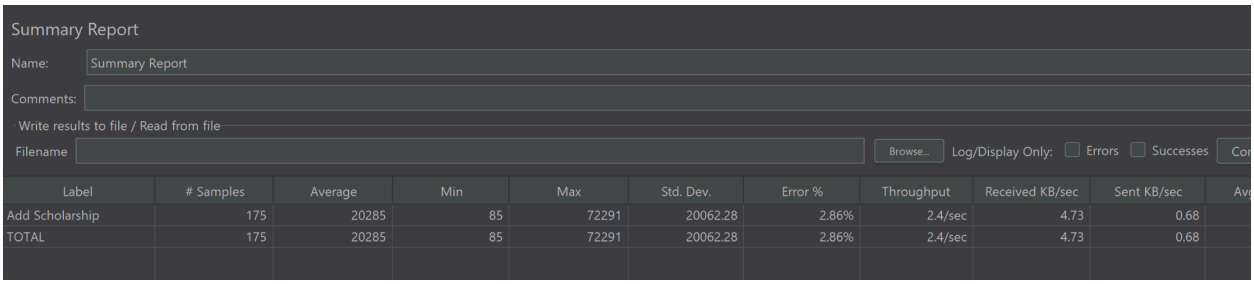
Number of Users	Ramp-up Period	Loop Count	Total Samples(Users*Loops)	Average Error(%)	Throughput
100	2	1	100	0	47.5
175	2	1	175	6.86	2.4
200	2	1	200	23	2.7

Add Scholarship:

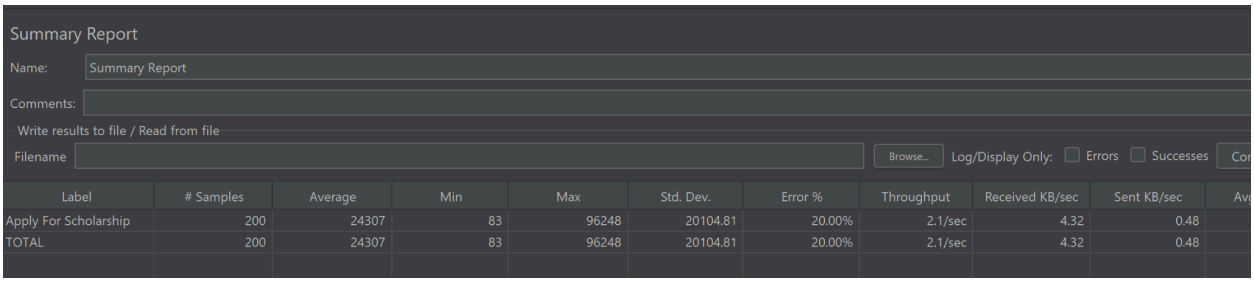
a)100 user



b)175 user



c) 200user

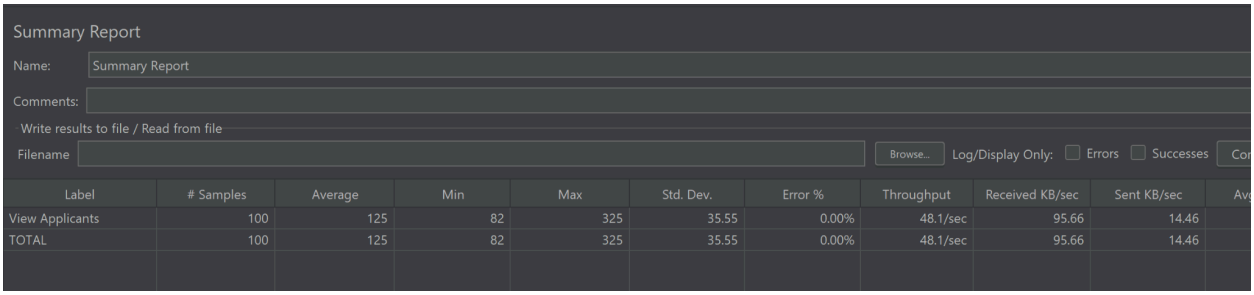


Number of Users	Ramp-up Period	Loop Count	Total Samples(Users*Loops)	Average Error(%)	Throughput
100	2	1	100	0	47.2
175	2	1	175	2.86	2.4

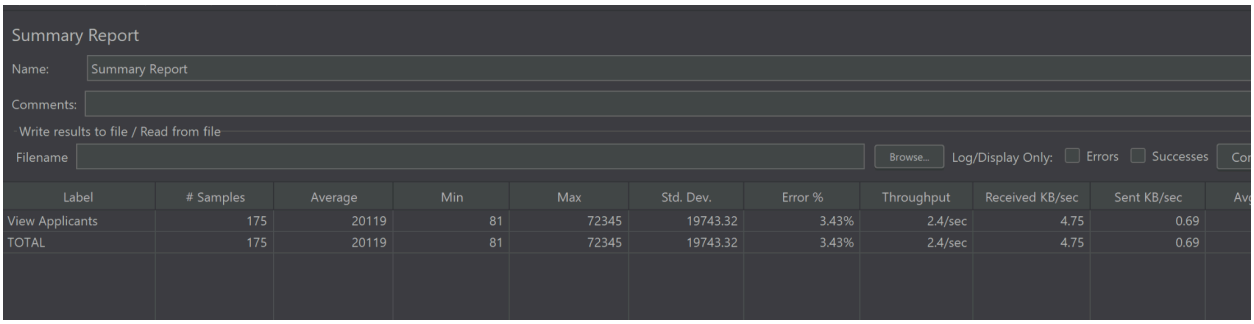
200	2	1	200	20	2.1

View Applicants:

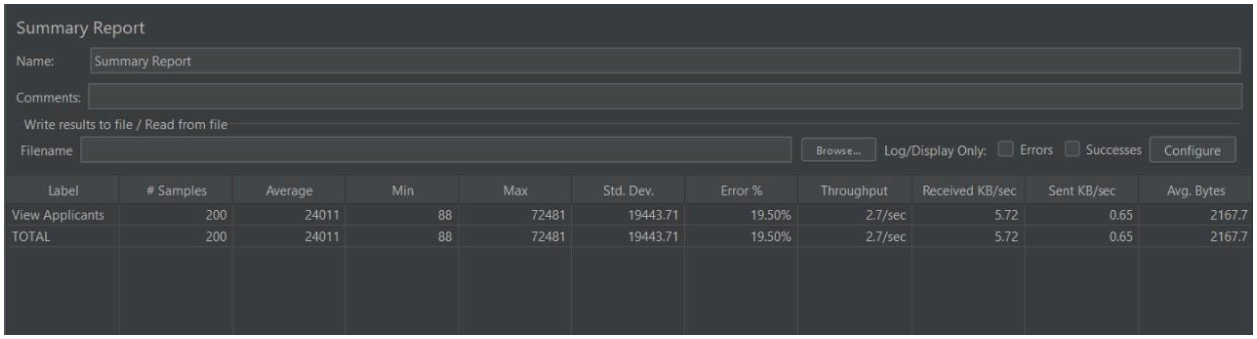
a)100 user



b)175 user



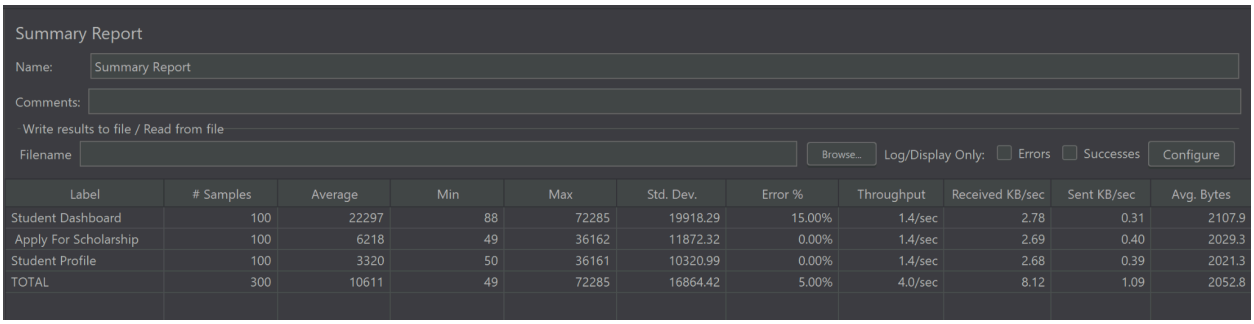
c)200 user



Number of Users	Ramp-up Period	Loop Count	Total Samples(Users*Loops)	Average Error(%)	Throughput
100	2	1	100	0	39.3
175	2	1	175	3.43	2.4
200	2	1	200	19.50	2.7

Average Analysis Student Side:

a)100 user



Summary Report

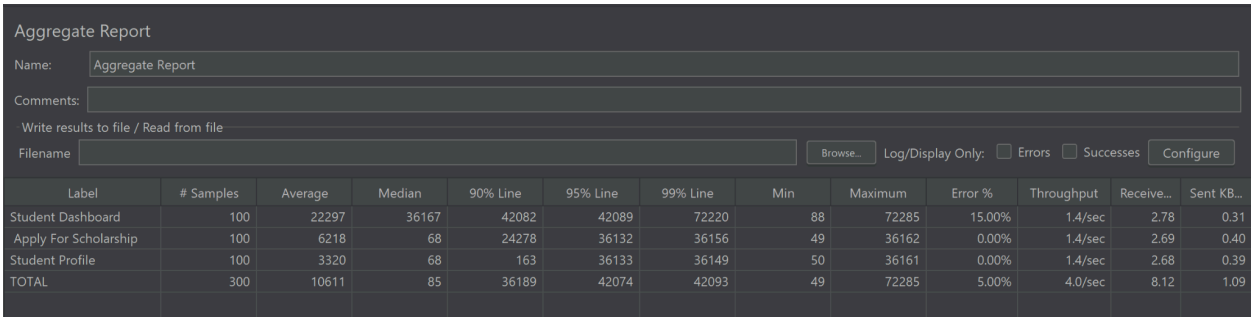
Name: Summary Report

Comments:

Write results to file / Read from file

Filename Browse... Log/Display Only: Errors Successes Configure

Label	# Samples	Average	Min	Max	Std. Dev.	Error %	Throughput	Received KB/sec	Sent KB/sec	Avg. Bytes
Student Dashboard	100	22297	88	72285	19918.29	15.00%	1.4/sec	2.78	0.31	2107.9
Apply For Scholarship	100	6218	49	36162	11872.32	0.00%	1.4/sec	2.69	0.40	2029.3
Student Profile	100	3320	50	36161	10320.99	0.00%	1.4/sec	2.68	0.39	2021.3
TOTAL	300	10611	49	72285	16864.42	5.00%	4.0/sec	8.12	1.09	2052.8



Aggregate Report

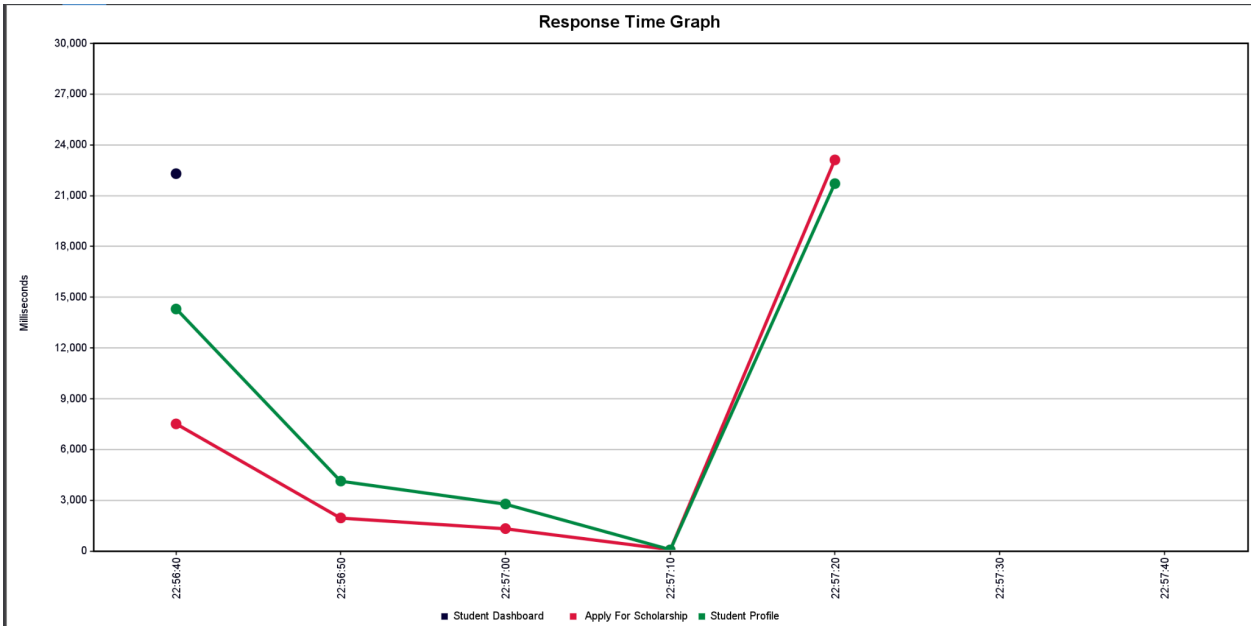
Name: Aggregate Report

Comments:

Write results to file / Read from file

Filename Browse... Log/Display Only: Errors Successes Configure

Label	# Samples	Average	Median	90% Line	95% Line	99% Line	Min	Maximum	Error %	Throughput	Receive...	Sent KB...
Student Dashboard	100	22297	36167	42082	42089	72220	88	72285	15.00%	1.4/sec	2.78	0.31
Apply For Scholarship	100	6218	68	24278	36132	36156	49	36162	0.00%	1.4/sec	2.69	0.40
Student Profile	100	3320	68	163	36133	36149	50	36161	0.00%	1.4/sec	2.68	0.39
TOTAL	300	10611	85	36189	42074	42093	49	72285	5.00%	4.0/sec	8.12	1.09



b)125 user

Summary Report

Name: Summary Report

Comments:

Write results to file / Read from file

Filename Browse... Log/Display Only: Errors Successes Configure

Label	# Samples	Average	Min	Max	Std. Dev.	Error %	Throughput	Received KB/sec	Sent KB/sec	Avg. Bytes
Student Dashboard	125	27448	96	72234	19320.75	37.60%	1.7/sec	3.76	0.29	2262.4
Apply For Scholarship	125	11476	50	36240	13158.98	0.00%	1.7/sec	3.37	0.50	2029.4
Student Profile	125	2973	53	36230	9787.02	0.00%	1.7/sec	3.36	0.49	2021.4
TOTAL	375	13966	50	72234	17804.94	12.53%	5.1/sec	10.47	1.27	2104.4

Aggregate Report

Name: Aggregate Report

Comments:

Write results to file / Read from file

Filename Browse... Log/Display Only: Errors Successes Configure

Label	# Samples	Average	Median	90% Line	95% Line	99% Line	Min	Maximum	Error %	Throughput	Receive...	Sent KB...
Student Dashboard	125	27448	36199	42084	42085	72210	96	72234	37.60%	1.7/sec	3.76	0.29
Apply For Scholarship	125	11476	102	24328	36150	36214	50	36240	0.00%	1.7/sec	3.37	0.50
Student Profile	125	2973	79	209	36149	36224	53	36230	0.00%	1.7/sec	3.36	0.49
TOTAL	375	13966	124	42081	42082	42098	50	72234	12.53%	5.1/sec	10.47	1.27

Response Time Graph

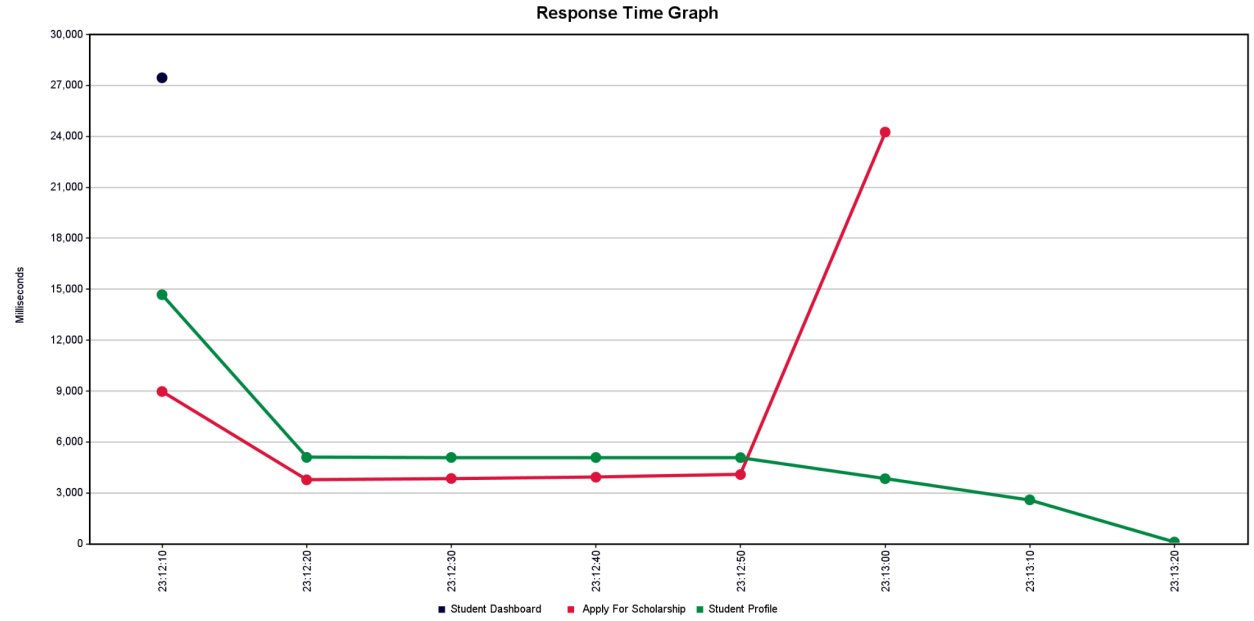
Name: Response Time Graph

Comments:

Write results to file / Read from file

Filename Browse... Log/Display Only: Errors Successes Configure

Settings Graph



c)200 user

Summary Report

Name: Summary Report

Comments:

Write results to file / Read from file

Filename Browse... Log/Display Only: Errors Successes Configure

Label	# Samples	Average	Min	Max	Std. Dev.	Error %	Throughput	Received KB/sec	Sent KB/sec	Avg. Bytes
Student Dashboard	200	34414	99	78211	17288.87	67.00%	2.5/sec	7.04	0.24	2845.9
Apply For Scholarship	200	26327	50	60262	18008.06	42.00%	1.9/sec	4.36	0.33	2306.4
Student Profile	200	10188	50	42098	11714.49	3.00%	1.9/sec	3.86	0.54	2041.4
TOTAL	600	23643	50	78211	18838.67	37.33%	5.8/sec	13.56	1.04	2397.9

Aggregate Report

Name: Aggregate Report

Comments:

Write results to file / Read from file

Filename Browse... Log/Display Only: Errors Successes Configure

Label	# Samples	Average	Median	90% Line	95% Line	99% Line	Min	Maximum	Error %	Throughput	Receive...	Sent KB...
Student Dashboard	200	35410	42062	42093	78197	78267	90	78269	63.00%	2.5/sec	6.16	0.27
Apply For Scholarship	200	25571	24245	42095	42098	42111	54	42111	41.00%	2.0/sec	4.49	0.35
Student Profile	200	14924	15139	42091	42098	51300	53	51377	18.50%	1.5/sec	3.06	0.34
TOTAL	600	25302	24322	42095	42099	78225	53	78269	40.83%	4.4/sec	9.86	0.75

Number of Users	Ramp-up Period	Loop Count	Total Samples(Users*Loops)	Average Error(%)	Throughpu
100	2	1	300	5	4.5
125	2	1	375	12.53	5.1
200	2	1	600	37	5.8

Average Analysis Admin Side:

a)100

Summary Report

Name: Summary Report

Comments:

Write results to file / Read from file

Filename Browse... Log/Display Only: Errors Successes Configure

Label	# Samples	Average	Min	Max	Std. Dev.	Error %	Throughput	Received KB/sec	Sent KB/sec	Avg. Bytes
Admin Dashboard	100	21686	86	42101	18840.45	17.00%	2.3/sec	4.70	0.50	2118.2
Add Scholarship	100	6696	51	36237	12094.36	0.00%	1.4/sec	2.69	0.40	2033.4
View Applicants	100	2237	49	36248	8578.26	0.00%	1.4/sec	2.70	0.42	2043.4
TOTAL	300	10206	49	42101	16149.63	5.67%	4.1/sec	8.17	1.11	2065.0

Aggregate Report

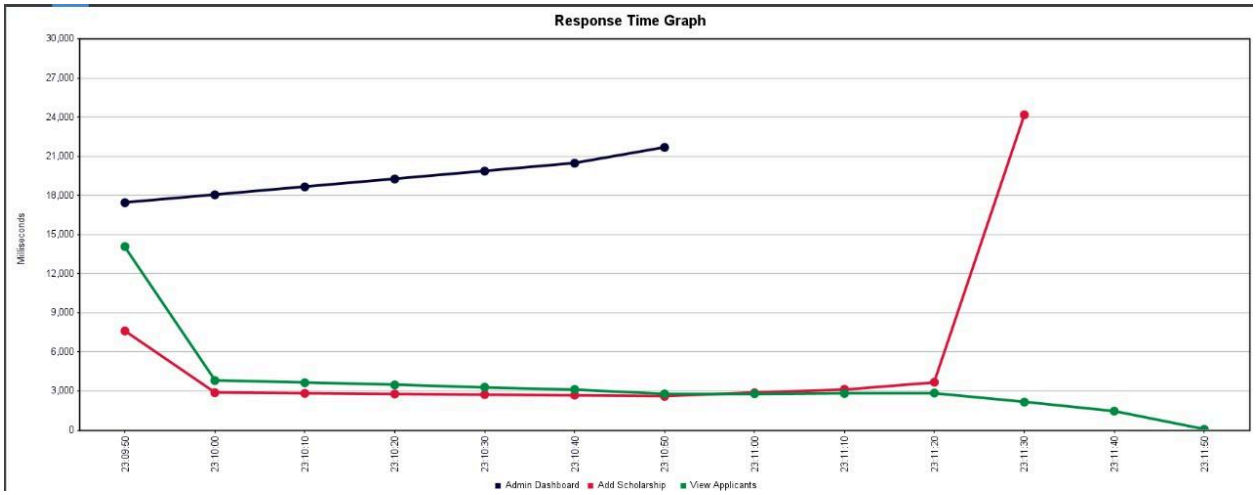
Name: Aggregate Report

Comments:

Write results to file / Read from file

Filename Browse... Log/Display Only: Errors Successes Configure

Label	# Samples	Average	Median	90% Line	95% Line	99% Line	Min	Maximum	Error %	Throughput	Received KB/sec	Sent KB/sec
Admin Dashboard	100	21686	36173	42076	42083	42091	86	42101	17.00%	2.3/sec	4.70	0.50
Add Scholarship	100	6696	69	24214	36145	36237	51	36237	0.00%	1.4/sec	2.69	0.40
View Applicants	100	2237	69	96	36147	36236	49	36248	0.00%	1.4/sec	2.70	0.42
TOTAL	300	10206	85	36223	42066	42088	49	42101	5.67%	4.1/sec	8.17	1.11



b) 125

Summary Report

Name: Summary Report

Comments:

Write results to file / Read from file

Filename | Browse... | Log/Display Only: Errors Successes | Configure

Label	# Samples	Average	Min	Max	Std. Dev.	Error %	Throughput	Received KB/sec	Sent KB/sec	Avg. Bytes
Admin Dashboard	125	26867	97	72242	19044.73	37.60%	1.7/sec	3.75	0.28	2259
Add Scholarship	125	12900	50	36184	13784.17	0.00%	1.7/sec	3.39	0.51	2033
View Applicants	125	2674	50	36187	9325.52	0.00%	1.7/sec	3.40	0.52	2043
TOTAL	375	14147	50	72242	17650.97	12.53%	5.1/sec	10.50	1.31	2112

Aggregate Report

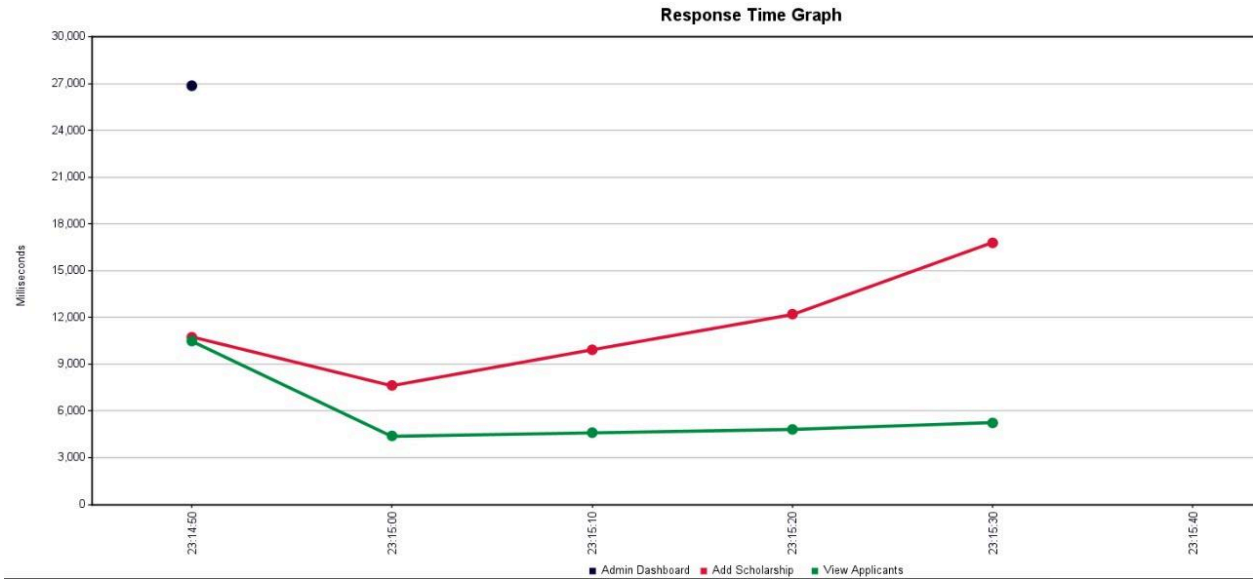
Name: Aggregate Report

Comments:

Write results to file / Read from file

Filename | Browse... | Log/Display Only:

Label	# Samples	Average	Median	90% Line	95% Line	99% Line	Min	Maximum	Error %	Throughput
Admin Dashboard	125	26867	36200	42087	42089	42104	97	72242	37.60%	1.7/sec
Add Scholarship	125	12900	90	24323	36169	36182	50	36184	0.00%	1.7/sec
View Applicants	125	2674	70	133	36135	36172	50	36187	0.00%	1.7/sec
TOTAL	375	14147	121	42063	42081	42096	50	72242	12.53%	5.1/sec



c)200

Summary Report

Name: Summary Report

Comments:

Write results to file / Read from file

Filename | Browse... | Log/Display Only: Errors Successes | Configure

Label	# Samples	Average	Min	Max	Std. Dev.	Error %	Throughput	Received KB/sec	Sent KB/sec	Avg. Bytes
Admin Dashboard	200	34544	100	78203	17253.25	67.00%	2.5/sec	6.15	0.23	2485
Add Scholarship	200	26381	53	60341	18083.70	41.00%	1.9/sec	4.35	0.34	2302
View Applicants	200	10491	51	42079	12019.22	3.00%	1.9/sec	3.90	0.58	2062
TOTAL	600	23805	51	78203	18871.36	37.00%	5.8/sec	12.90	1.09	2283

Aggregate Report

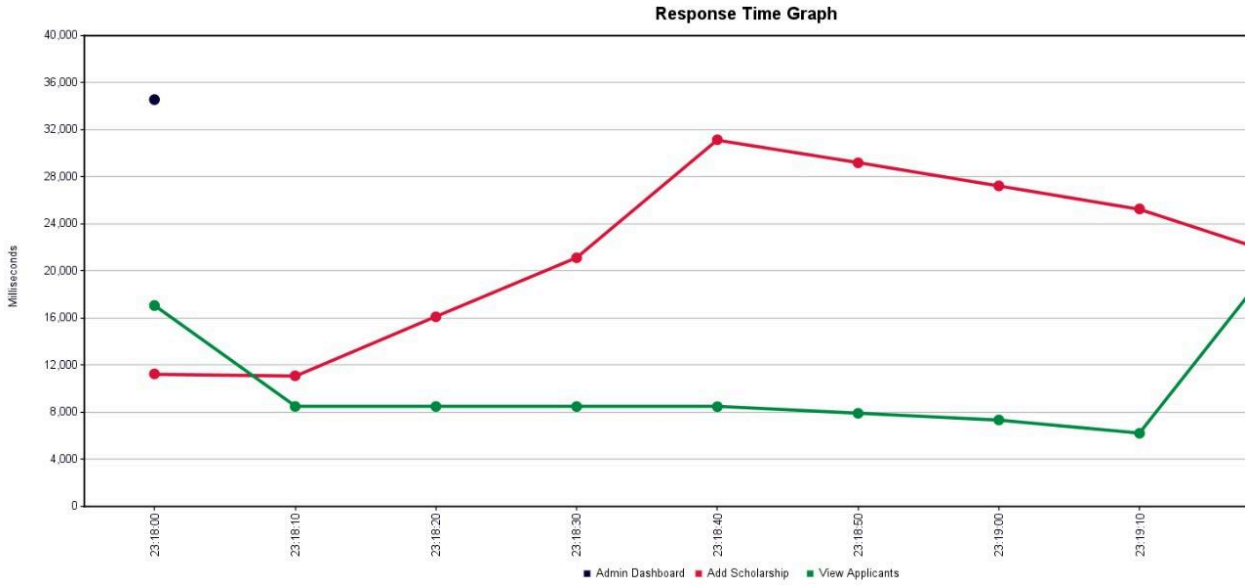
Name: Aggregate Report

Comments:

Write results to file / Read from file

Filename | Browse... | Log/Display Only:

Label	# Samples	Average	Median	90% Line	95% Line	99% Line	Min	Maximum	Error %	Throughput
Admin Dashboard	200	34544	42066	42089	42100	78186	100	78203	67.00%	2.5/sec
Add Scholarship	200	26381	24257	42081	42094	60311	53	60341	41.00%	1.9/sec
View Applicants	200	10491	15263	36132	36187	42076	51	42079	3.00%	1.9/sec
TOTAL	600	23805	24181	42081	42090	60312	51	78203	37.00%	5.8/sec



Number of Users	Ramp-up Period	Loop Count	Total Samples(Users*Loops)	Average Error(%)	Throughput
100	2	1	300	5.67	4.1
125	2	1	375	12.53	5.1
200	2	1	600	37	5.8

➔ At 100 user threads, the system shows a manageable error rate of 5.67%, but at 125 user threads, the error rate rises significantly to 12.53%, indicating the system's stress limit is near 125 users. This suggests the system begins to struggle under increasing load beyond this point, compromising its performance.

Conclusion:

Non-functional testing, such as load and stress testing, was conducted to evaluate the performance of web services using Apache JMeter with HTTP requests (e.g., HTTP GET). The primary objective was to assess the system's efficiency, its ability to handle varying levels of load, and its responsiveness under diverse conditions.