1.Task Description

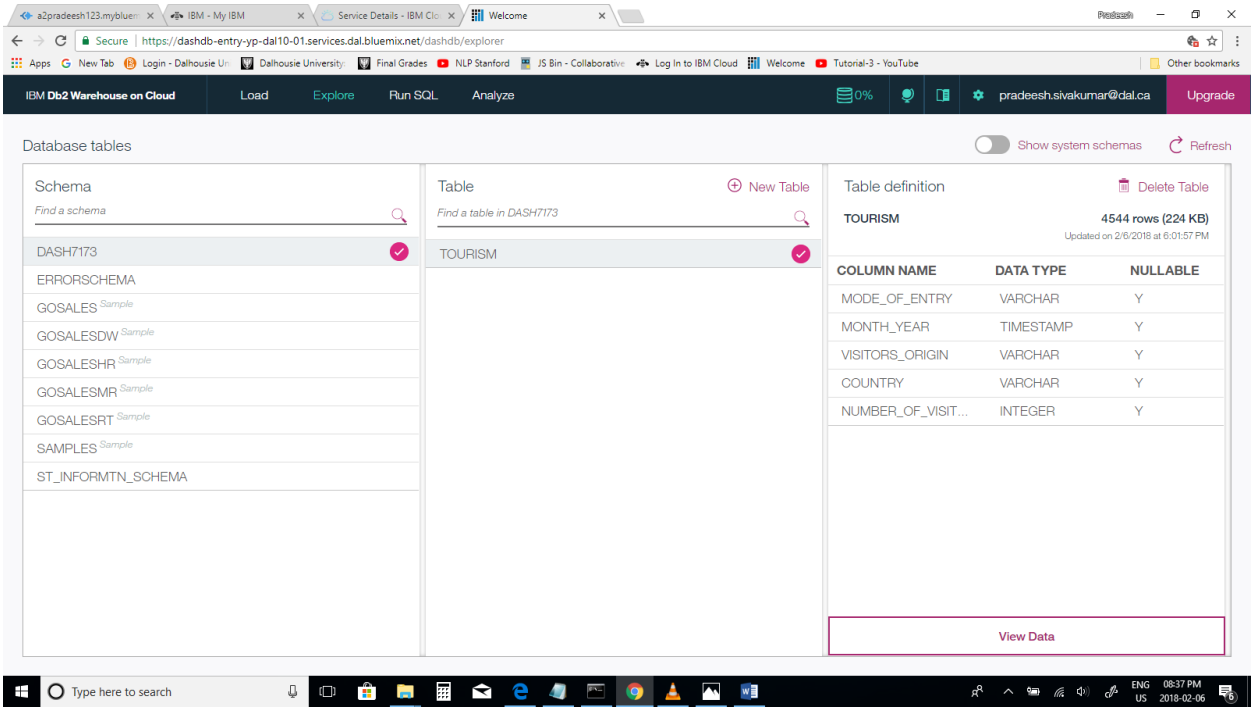
We are supposed to create an account in IBM Bluemix and once logged in we have to use db2 warehouse on cloud to store the given dataset. The dataset given is based on tourism of Nova Scotia from the year starting from 2006 to 2017 and load those dataset in db2 warehouse on cloud. Then we need to write queries which can retrieve first 10 rows from the database, should retrieve number of visitors per year by country, should retrieve number of visitors per year by mode. The next task is to create an application in Node.js or any other application and upload them in Bluemix. Test your web service using Postman Software and comment on the response time that it took for each query. For UI application we need to install Apache JMeter which can send REST service calls to application URL and find the response times. Increase the number of instances to 20,30,40, and 50 and find the five set of requests with the corresponding response time and also draw the graph with number of requests on x axis and response time in y axis. Then we also need to do the horizontal scaling with different instances and find the performance.

2.Database

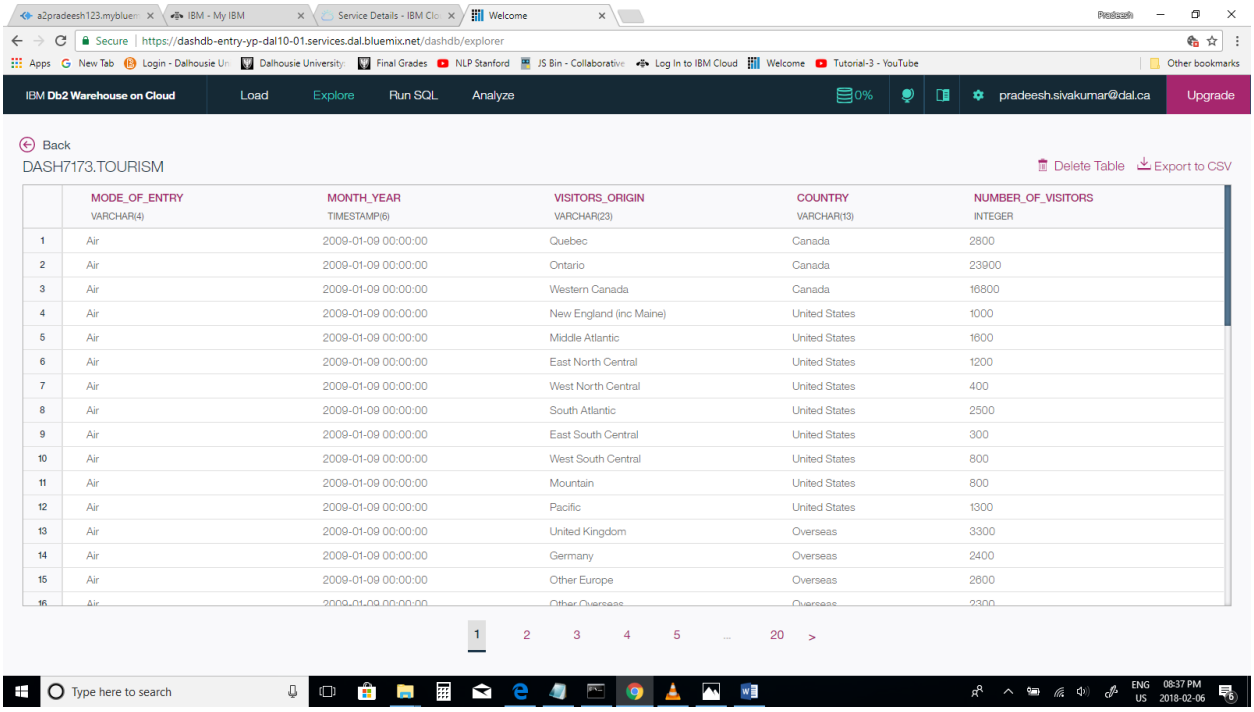
The configuration that are taken while setting up the database.

The screenshots for each steps are given below:

1.Load the dataset



2. After loading the given dataset (Tourism)



IBM Db2 Warehouse on Cloud | Load | Explore | Run SQL | Analyze | pradeesh.sivakumar@dal.ca | Upgrade

Back

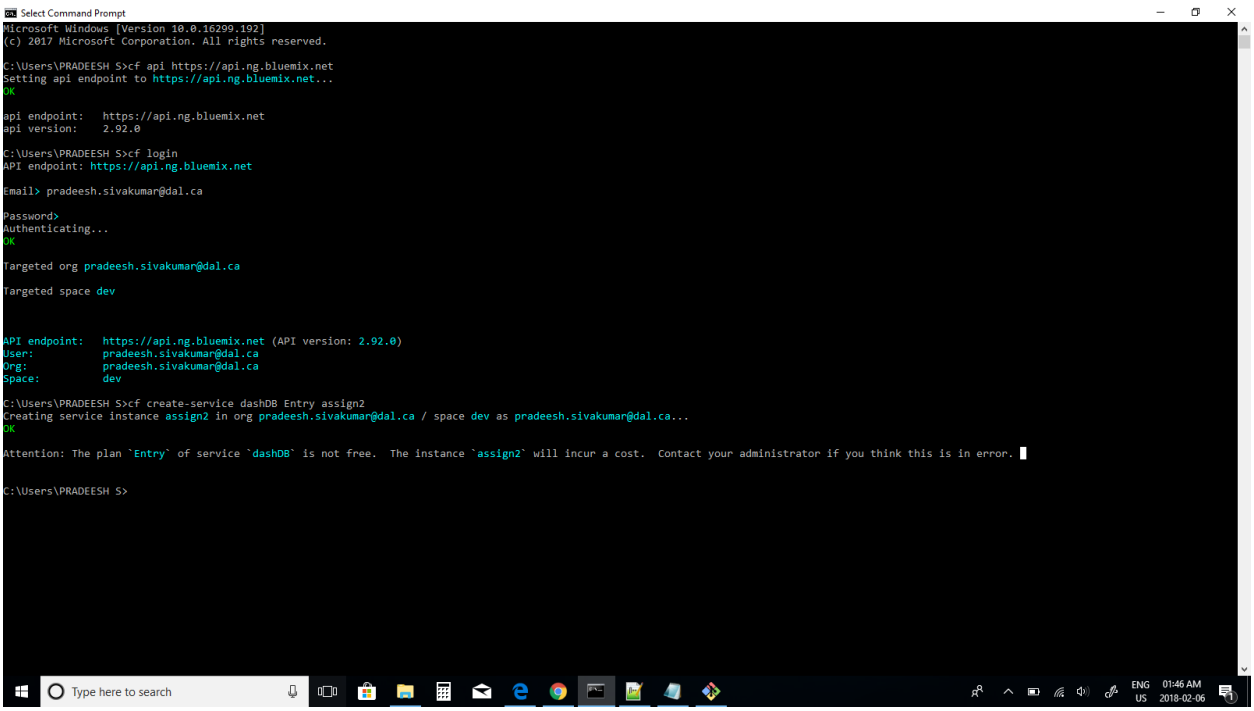
DASH7173.TOURISM

Delete Table | Export to CSV

	MODE_OF_ENTRY VARCHAR(4)	MONTH_YEAR TIMESTAMP(6)	VISITORS_ORIGIN VARCHAR(23)	COUNTRY VARCHAR(13)	NUMBER_OF_VISITORS INTEGER
1	Air	2009-01-09 00:00:00	Quebec	Canada	2800
2	Air	2009-01-09 00:00:00	Ontario	Canada	23900
3	Air	2009-01-09 00:00:00	Western Canada	Canada	16800
4	Air	2009-01-09 00:00:00	New England (inc Maine)	United States	1000
5	Air	2009-01-09 00:00:00	Middle Atlantic	United States	1600
6	Air	2009-01-09 00:00:00	East North Central	United States	1200
7	Air	2009-01-09 00:00:00	West North Central	United States	400
8	Air	2009-01-09 00:00:00	South Atlantic	United States	2500
9	Air	2009-01-09 00:00:00	East South Central	United States	300
10	Air	2009-01-09 00:00:00	West South Central	United States	800
11	Air	2009-01-09 00:00:00	Mountain	United States	800
12	Air	2009-01-09 00:00:00	Pacific	United States	1300
13	Air	2009-01-09 00:00:00	United Kingdom	Overseas	3300
14	Air	2009-01-09 00:00:00	Germany	Overseas	2400
15	Air	2009-01-09 00:00:00	Other Europe	Overseas	2600

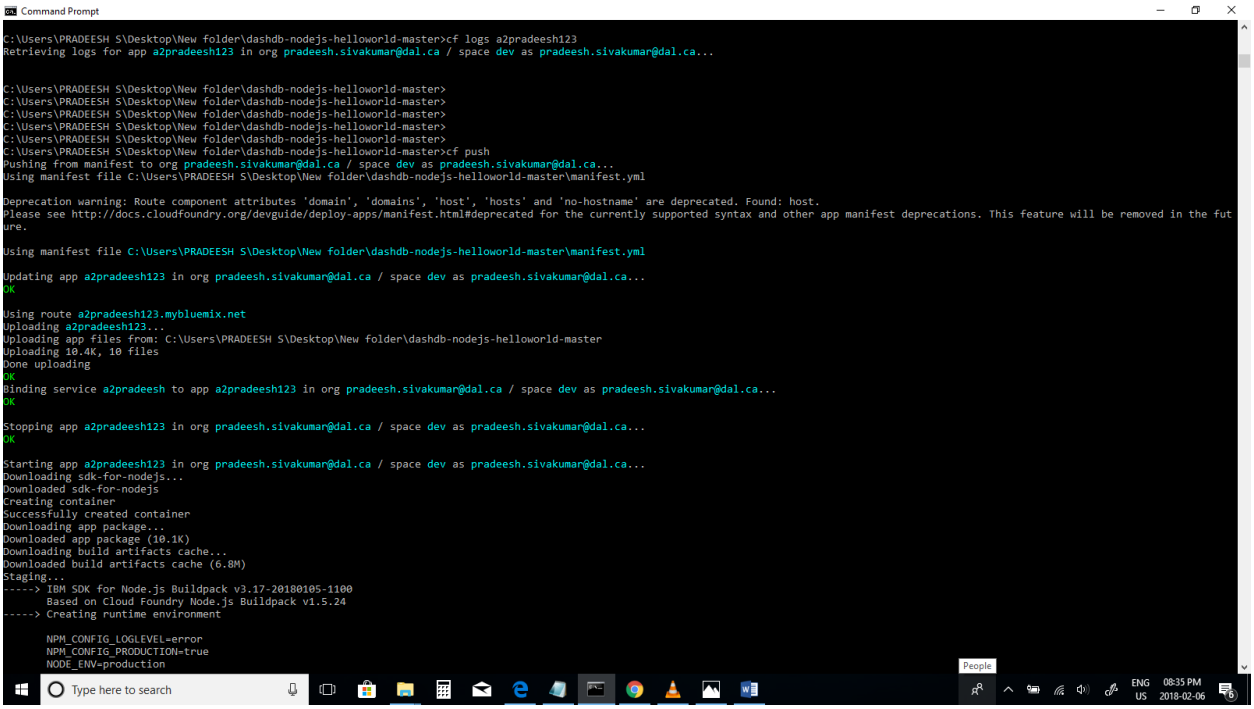
1 2 3 4 5 ... 20 >

3. Connecting the Bluemix using command line tool to login

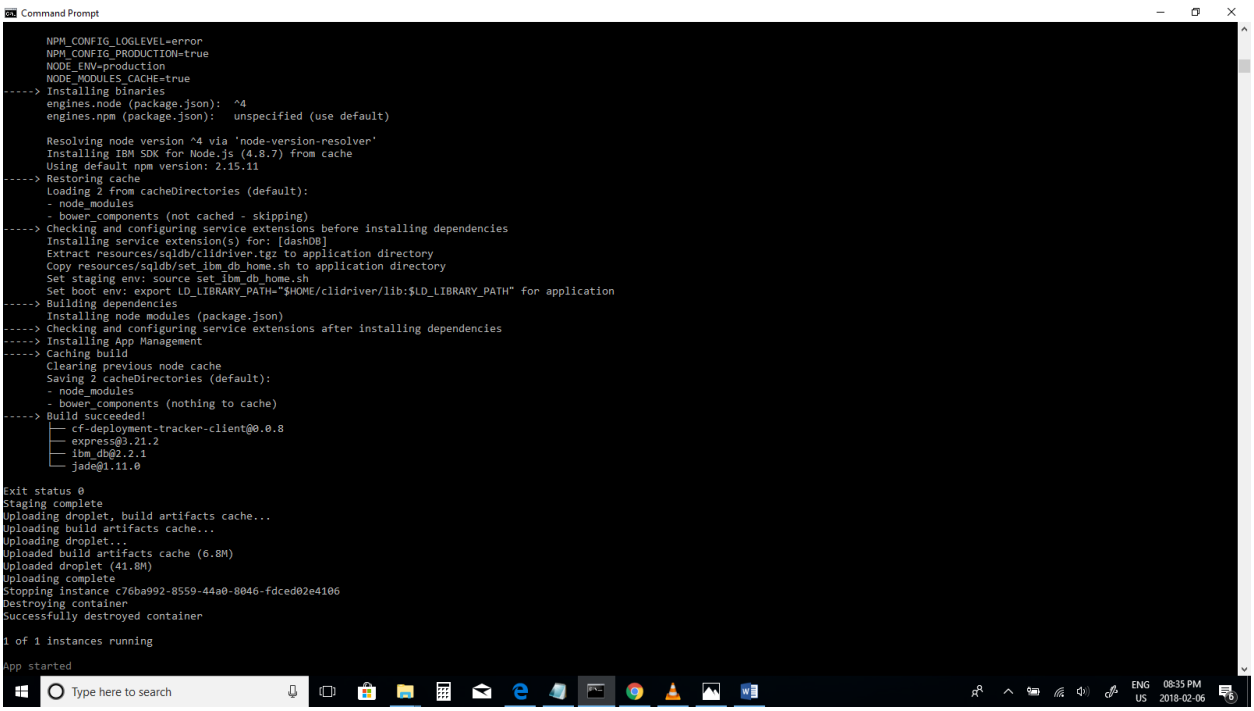


```
Select Command Prompt
Microsoft Windows [Version 10.0.16299.192]
(c) 2017 Microsoft Corporation. All rights reserved.

C:\Users\PRADEESH S>cf api https://api.ng.bluemix.net
Setting api endpoint to https://api.ng.bluemix.net...
OK

api endpoint:   https://api.ng.bluemix.net
api version:    2.92.0

C:\Users\PRADEESH S>cf login
API endpoint: https://api.ng.bluemix.net

Email> pradeesh.sivakumar@dal.ca

Password>
Authenticating...
OK

Targeted org pradeesh.sivakumar@dal.ca

Targeted space dev


API endpoint:   https://api.ng.bluemix.net (API version: 2.92.0)
User:           pradeesh.sivakumar@dal.ca
Org:            pradeesh.sivakumar@dal.ca
Space:          dev

C:\Users\PRADEESH S>cf create-service dashDB Entry assign2
Creating service instance assign2 in org pradeesh.sivakumar@dal.ca / space dev as pradeesh.sivakumar@dal.ca...
OK

Attention: The plan `Entry` of service `dashDB` is not free.  The instance `assign2` will incur a cost.  Contact your administrator if you think this is in error.


C:\Users\PRADEESH S>
```

4. Create dash DB instance using in Bluemix and push the app in Bluemix



Loading...

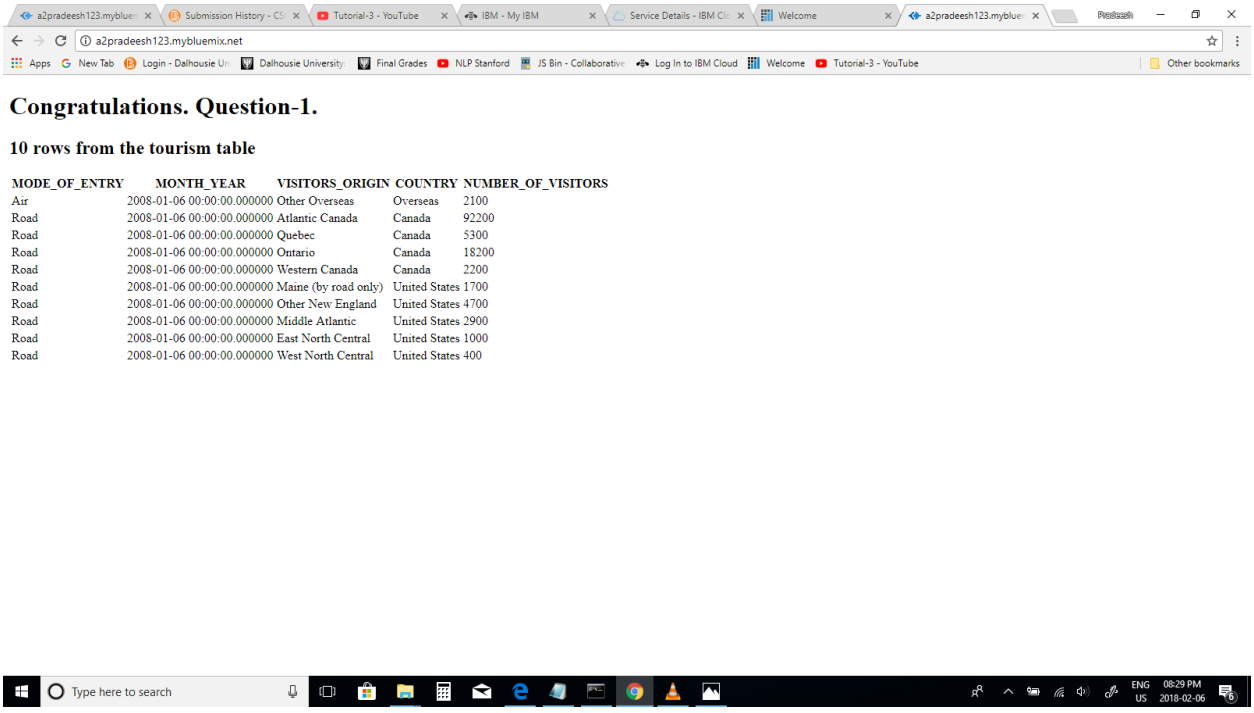


3c) Application Queries

Question-1

SELECT * from tourism FETCH FIRST 10 ROWS ONLY

SELECT * from tourism FETCH FIRST 10 ROWS ONLY displays first 10 rows present in tourism dataset.



Congratulations. Question-1.

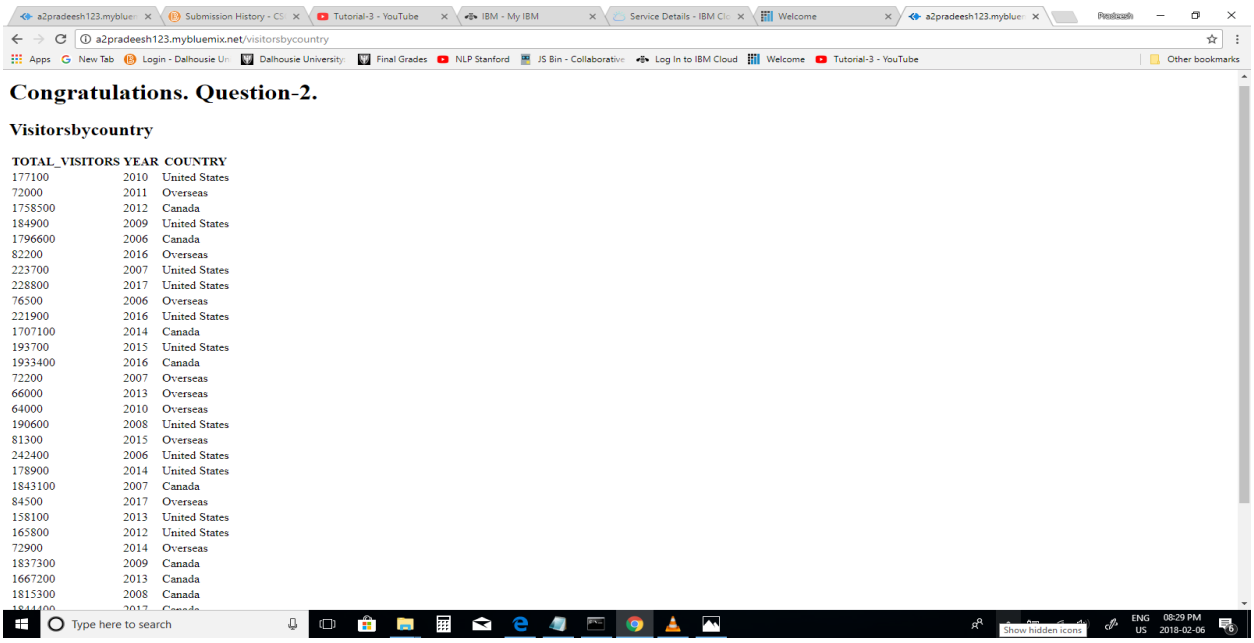
10 rows from the tourism table

MODE_OF_ENTRY	MONTH_YEAR	VISITORS_ORIGIN	COUNTRY	NUMBER_OF_VISITORS
Air	2008-01-06 00:00:00.000000	Other Overseas	Overseas	2100
Road	2008-01-06 00:00:00.000000	Atlantic Canada	Canada	92200
Road	2008-01-06 00:00:00.000000	Quebec	Canada	5300
Road	2008-01-06 00:00:00.000000	Ontario	Canada	18200
Road	2008-01-06 00:00:00.000000	Western Canada	Canada	2200
Road	2008-01-06 00:00:00.000000	Maine (by road only)	United States	1700
Road	2008-01-06 00:00:00.000000	Other New England	United States	4700
Road	2008-01-06 00:00:00.000000	Middle Atlantic	United States	2900
Road	2008-01-06 00:00:00.000000	East North Central	United States	1000
Road	2008-01-06 00:00:00.000000	West North Central	United States	400

Question-2

SELECT SUM(NUMBER_OF_VISITORS) as total_visitors, YEAR(month_year) as year, country FROM TOURISM GROUP BY COUNTRY, YEAR(MONTH_YEAR)

This query retrieves the total number of visitors information which is displayed as total visitors, per year displayed as year, by country from tourism dataset.



a2pradeesh123.mybluemix.net/visitorsbycountry

Congratulations. Question-2.

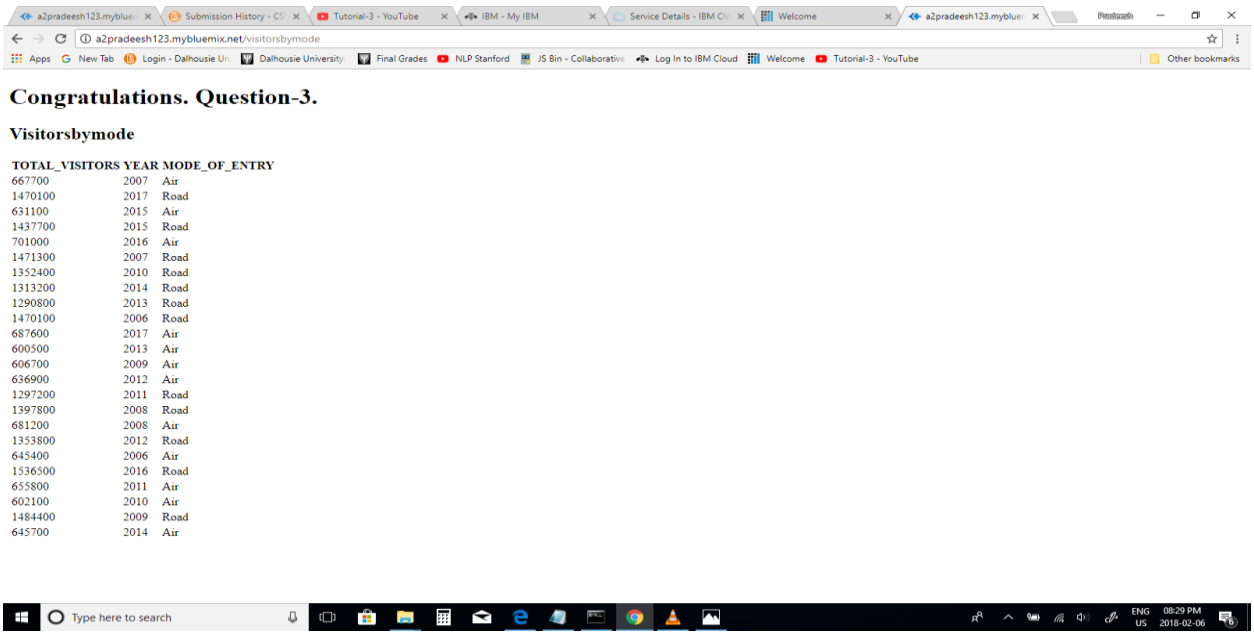
Visitorsbycountry

TOTAL_VISITORS	YEAR	COUNTRY
177100	2010	United States
72000	2011	Overseas
1758500	2012	Canada
184900	2009	United States
1796600	2006	Canada
82200	2016	Overseas
223700	2007	United States
228800	2017	United States
76500	2006	Overseas
221900	2016	United States
1707100	2014	Canada
193700	2015	United States
1933400	2016	Canada
72200	2007	Overseas
66000	2013	Overseas
64000	2010	Overseas
190600	2008	United States
81300	2015	Overseas
242400	2006	United States
178900	2014	United States
1843100	2007	Canada
84500	2017	Overseas
158100	2013	United States
165800	2012	United States
72900	2014	Overseas
1837300	2009	Canada
1667200	2013	Canada
1815300	2008	Canada

Question-3

SELECT SUM (NUMBER_OF_VISITORS) as total_visitors, YEAR(month_year) as year , MODE_OF_ENTRY FROM TOURISM GROUP BY MODE_OF_ENTRY, YEAR(MONTH_YEAR).

This retrieves the total number of visitors information which is displayed as total visitors, per year displayed as year, by mode of entry information from tourism dataset.



a2pradeesh123.mybluemix.net/visitorsbymode

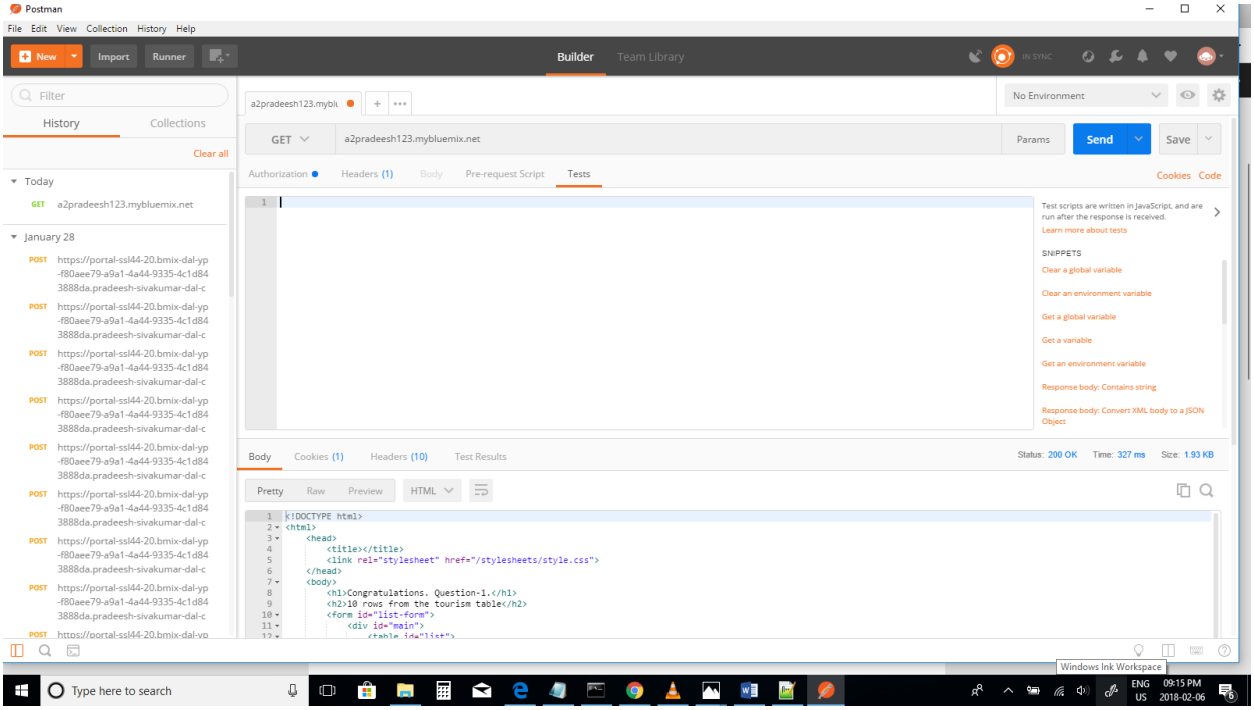
Congratulations. Question-3.

Visitorsbymode

TOTAL_VISITORS	YEAR	MODE_OF_ENTRY
667700	2007	Air
1470100	2017	Road
631100	2015	Air
1437700	2015	Road
701000	2016	Air
1471300	2007	Road
1352400	2010	Road
1313200	2014	Road
1290800	2013	Road
1470100	2006	Road
687600	2017	Air
600500	2013	Air
606700	2009	Air
636900	2012	Air
1297200	2011	Road
1397800	2008	Road
681200	2008	Air
1353800	2012	Road
645400	2006	Air
1536500	2016	Road
655800	2011	Air
602100	2010	Air
1484400	2009	Road
645700	2014	Air

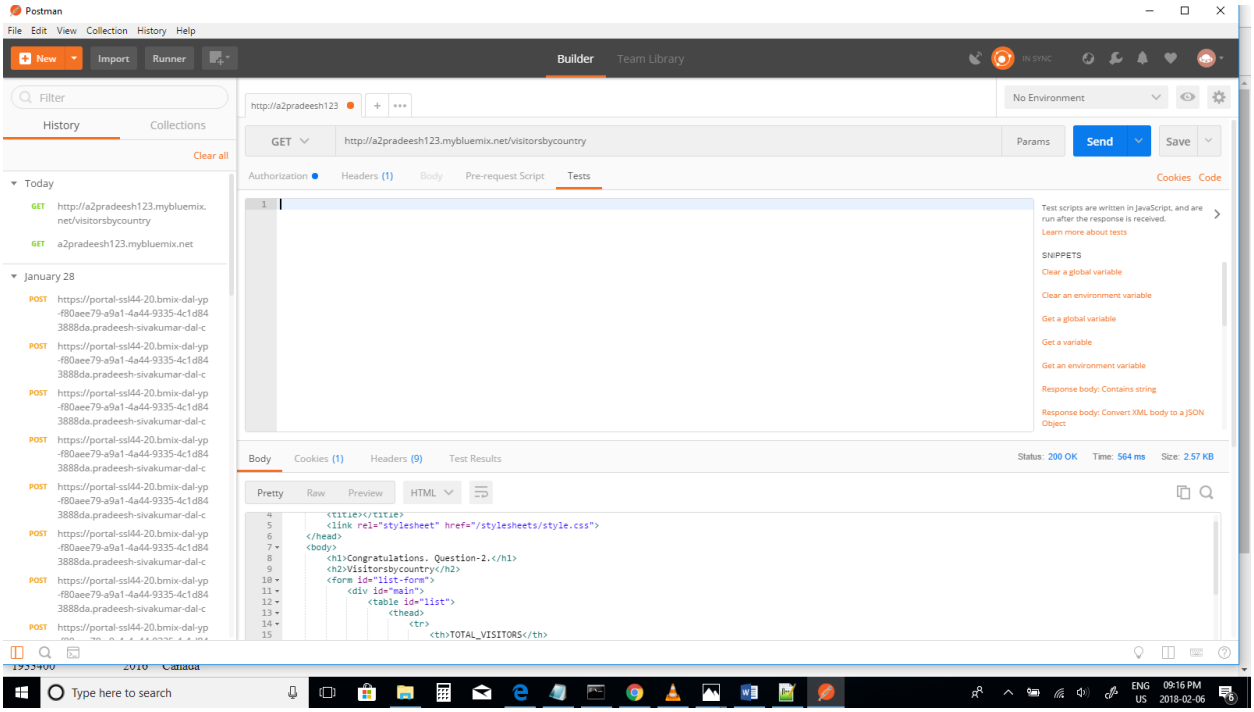
4. Testing Web service through Postman Software

Q-1 URL : a2pradeesh123.mybluemix.net



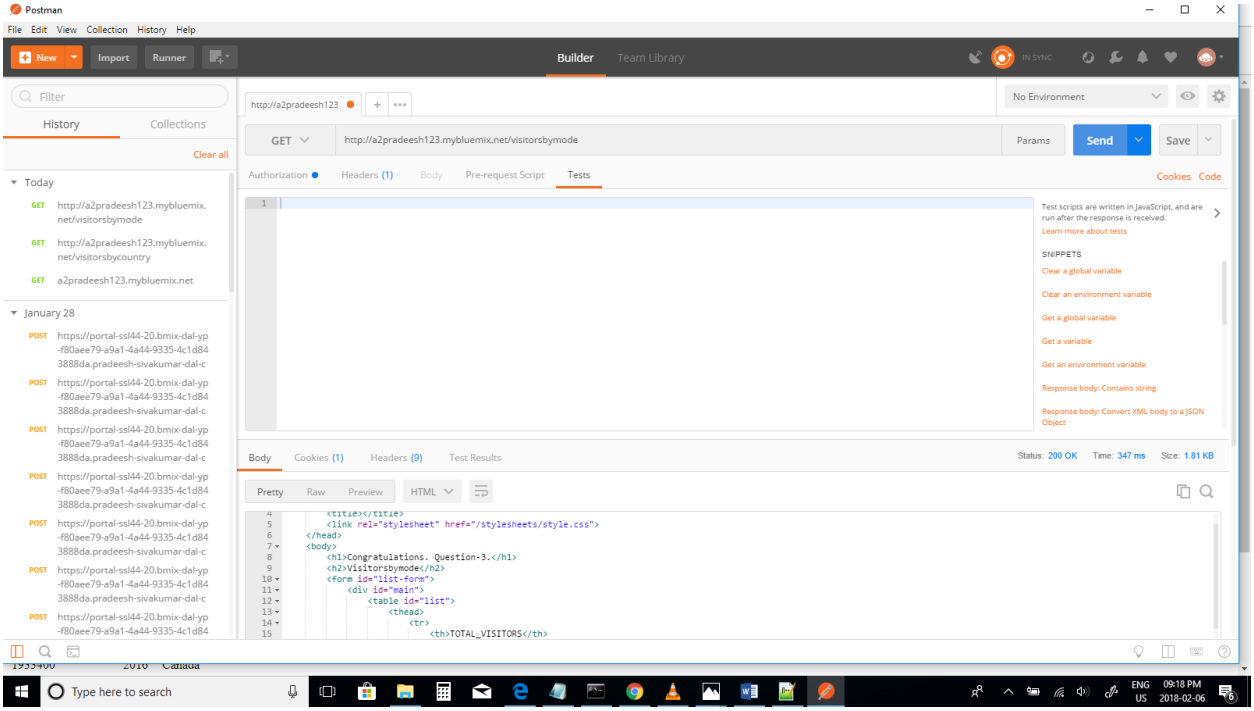
Response Time for the web URL – 327 ms

Q-2 URL : a2pradeesh123.mybluemix.net/visitorsbycountry



Response Time for the web URL – 564 ms

Q-3 URL : a2pradeesh123.mybluemix.net/visitorsbymode



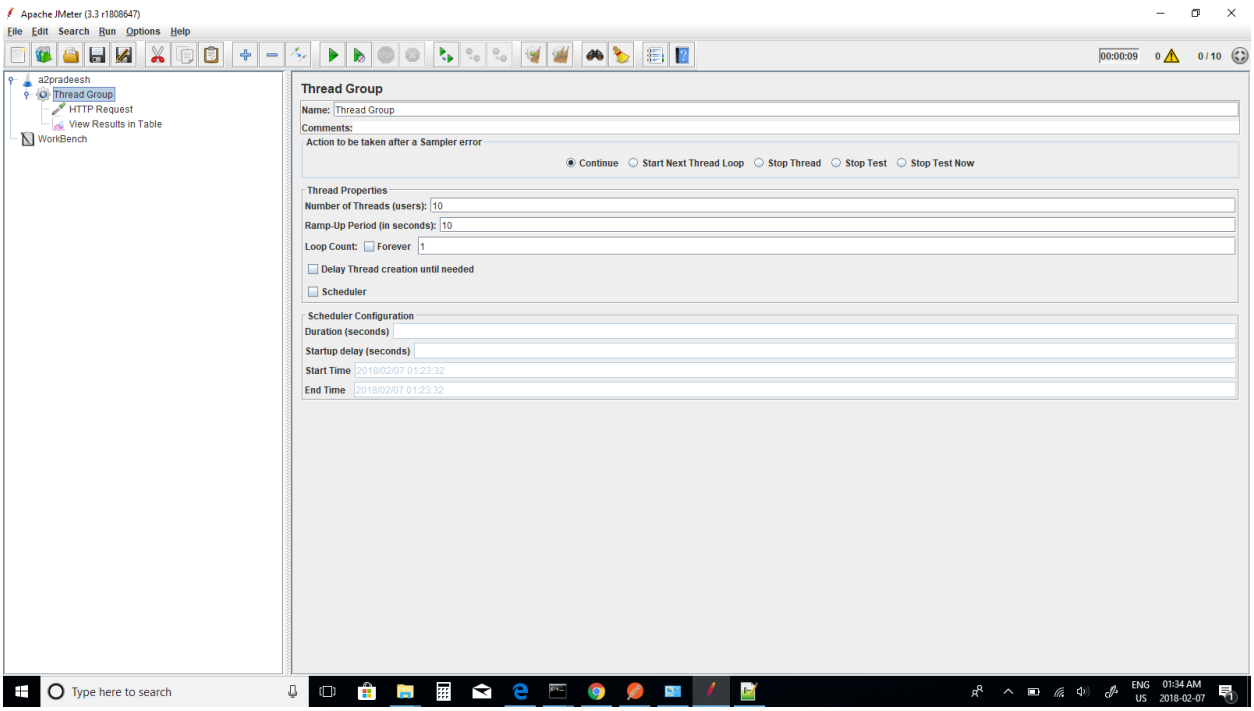
Response Time for the web URL – 347 ms

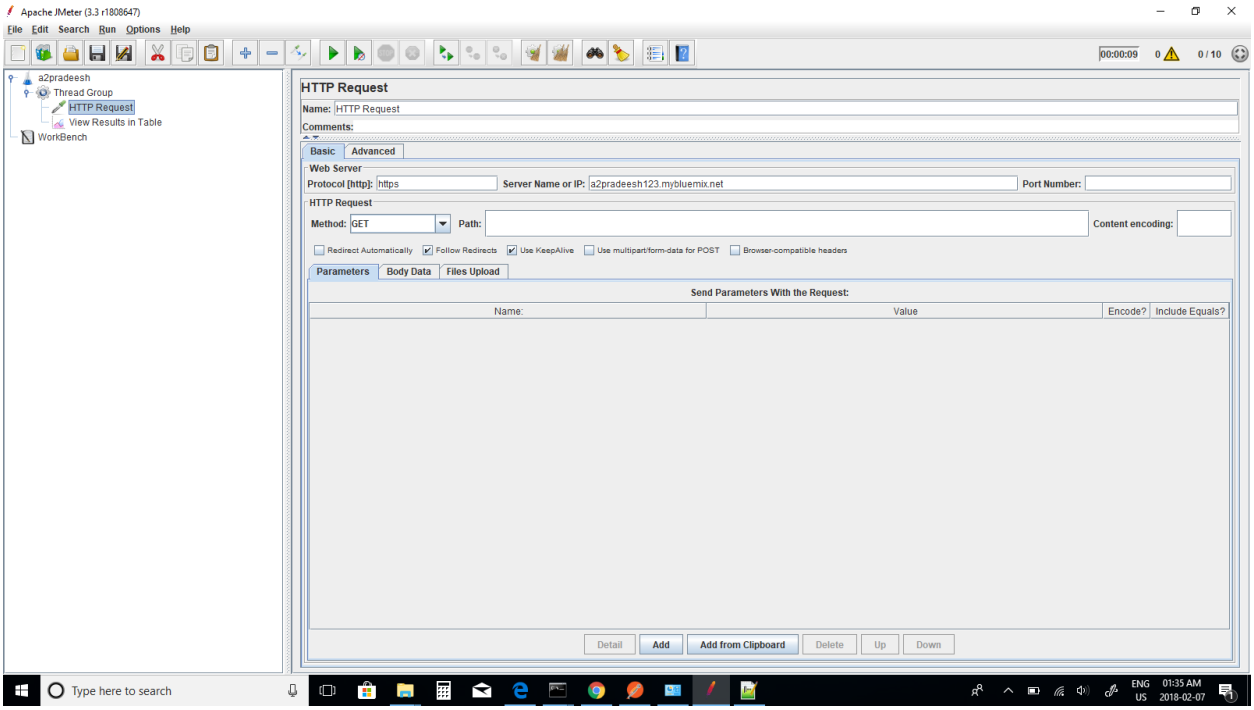
The above results shows that the web service for three URLs using postman software. It has been observed that for all URL the response time is different. The time taken for the first web URL is 327 ms, The time taken for second web URL is 564 ms and the time taken for third web URL is 564ms. This shows the response time for each URL constantly changes.

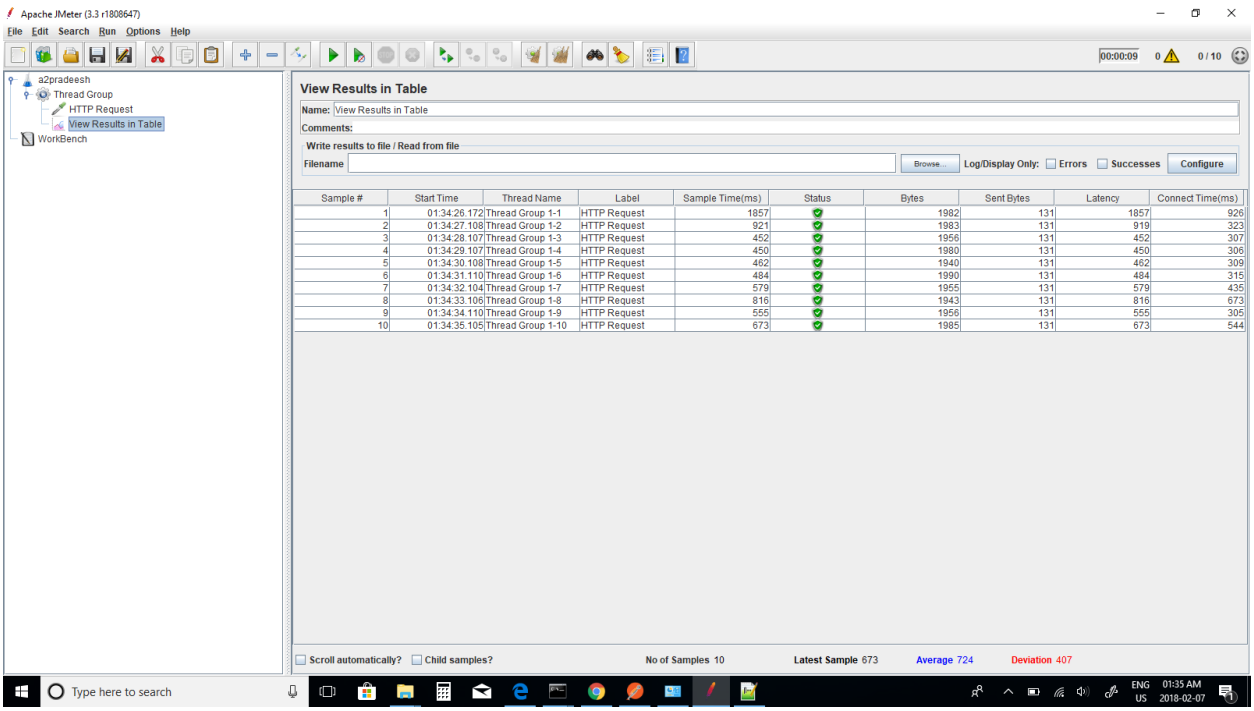
5. UI Application through JMeter

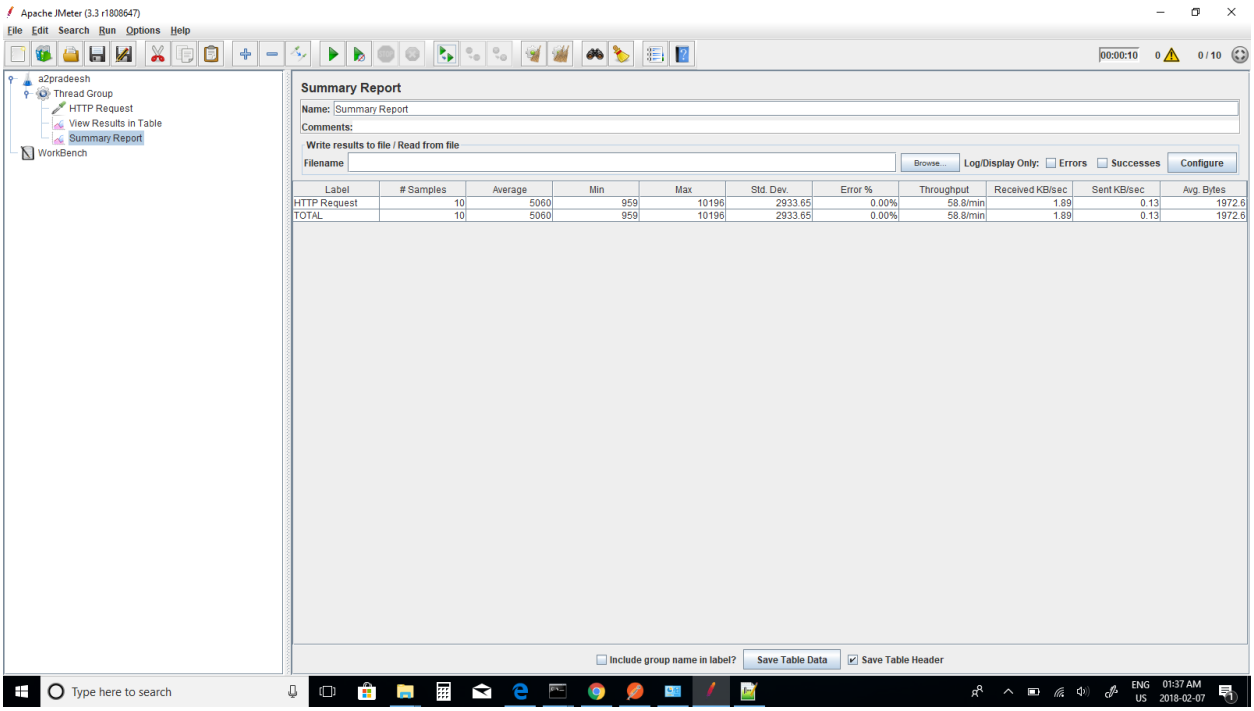
i) URL : a2pradeesh123.mybluemix.net

Number of Threads-10


Apache JMeter (3.3 r1808647)
File Edit Search Run Options Help
00:00:09 0 0 / 10
a2pradeesh
Thread Group
HTTP Request
View Results in Table
WorkBench
Thread Group
Name: Thread Group
Comments:
Action to be taken after a Sampler error
Continue Start Next Thread Loop Stop Thread Stop Test Stop Test Now
Thread Properties
Number of Threads (users): 10
Ramp-Up Period (in seconds): 10
Loop Count: Forever 1
Delay Thread creation until needed
Scheduler
Scheduler Configuration
Duration (seconds)
Startup delay (seconds)
Start Time 2018/02/07 01:23:32
End Time 2018/02/07 01:23:32
Type here to search
ENG US 01:34 AM 2018-02-07

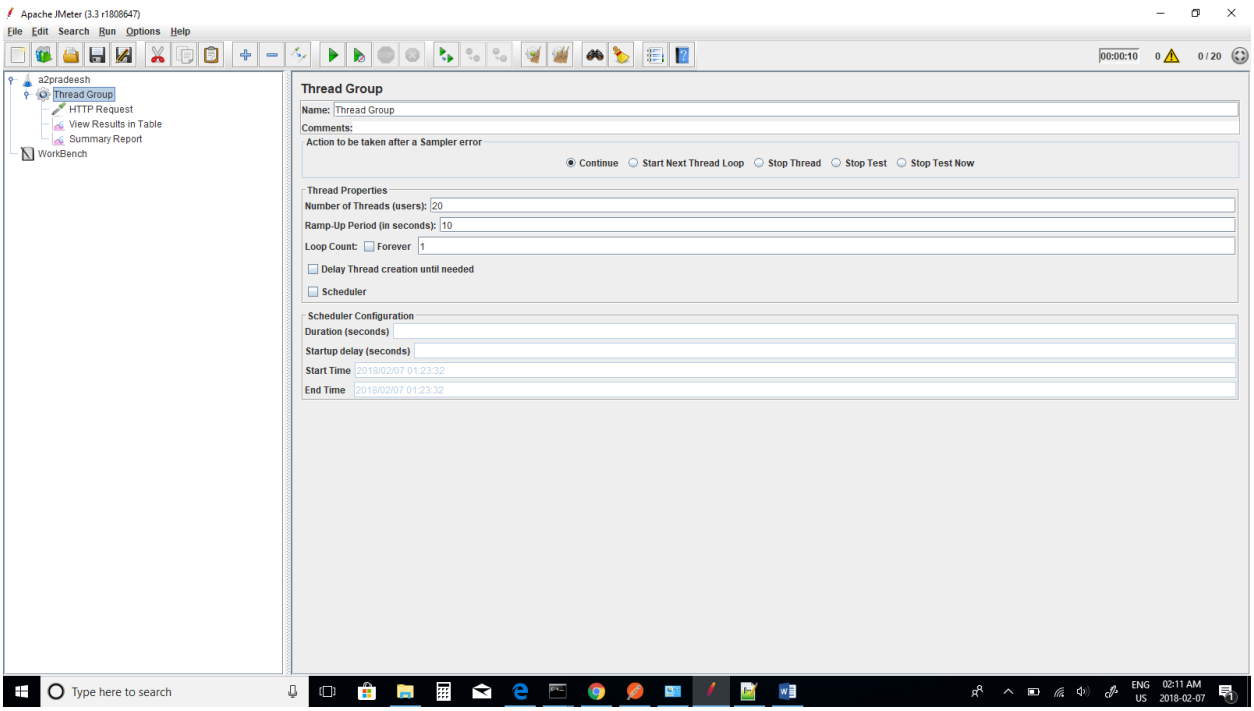

Apache JMeter (3.3 r1808647)
File Edit Search Run Options Help
00:00:09 0 0 / 10
a2pradeesh
Thread Group
HTTP Request
View Results in Table
WorkBench
HTTP Request
Name: HTTP Request
Comments:
Basic Advanced
Web Server
Protocol [http]: https
Server Name or IP: a2pradeesh123.mybluemix.net
Port Number:
HTTP Request
Method: GET
Path:
Content encoding:
Redirect Automatically Follow Redirects Use KeepAlive Use multipart/form-data for POST Browser-compatible headers
Parameters Body Data Files Upload
Send Parameters With the Request:
Name: Value Encode? Include Equals?
Detail Add Add from Clipboard Delete Up Down
Type here to search
ENG US 01:35 AM 2018-02-07

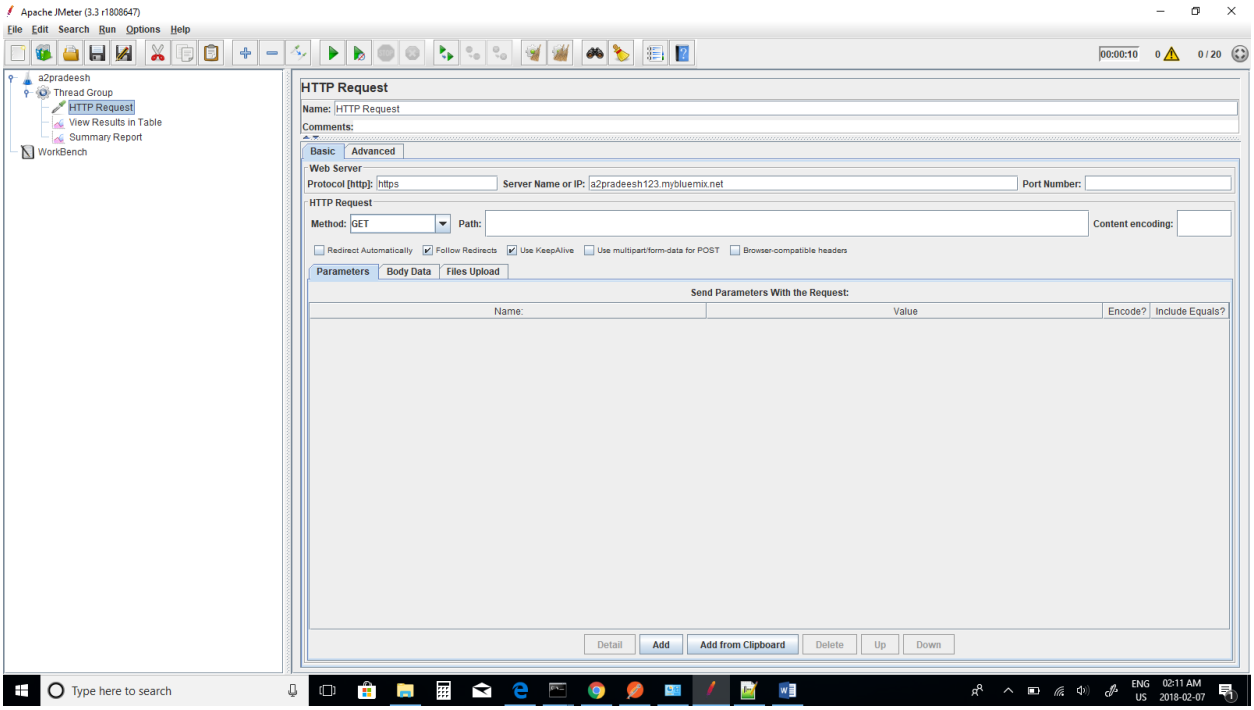


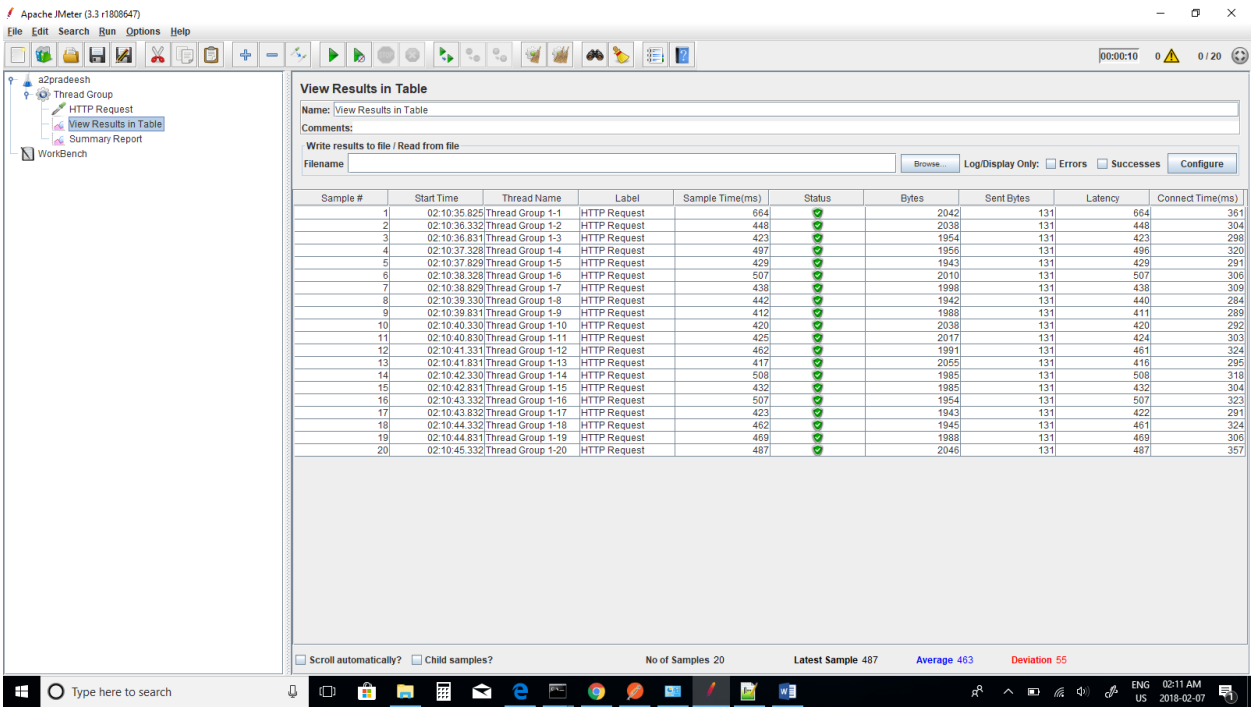


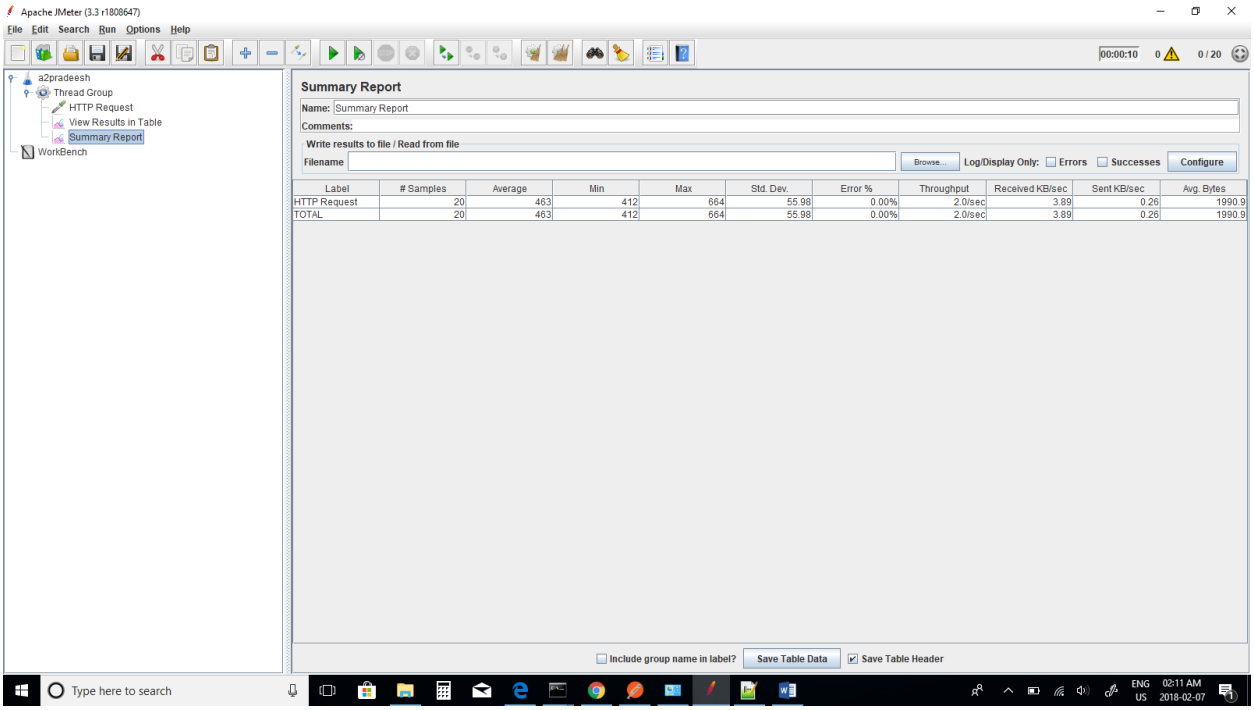
Average Response Time for 10 Threads - 5060ms

Changing number of threads – 20


Apache JMeter (3.3 r1808647)
File Edit Search Run Options Help
00:00:10 0 0 / 20
a2pradeesh
Thread Group
HTTP Request
View Results in Table
Summary Report
WorkBench
Thread Group
Name: Thread Group
Comments:
Action to be taken after a Sampler error
Continue Start Next Thread Loop Stop Thread Stop Test Stop Test Now
Thread Properties
Number of Threads (users): 20
Ramp-Up Period (in seconds): 10
Loop Count: Forever 1
Delay Thread creation until needed
Scheduler
Scheduler Configuration
Duration (seconds)
Startup delay (seconds)
Start Time 2018/02/07 01:23:32
End Time 2018/02/07 01:23:32
Type here to search
ENG US 02:11 AM 2018-02-07

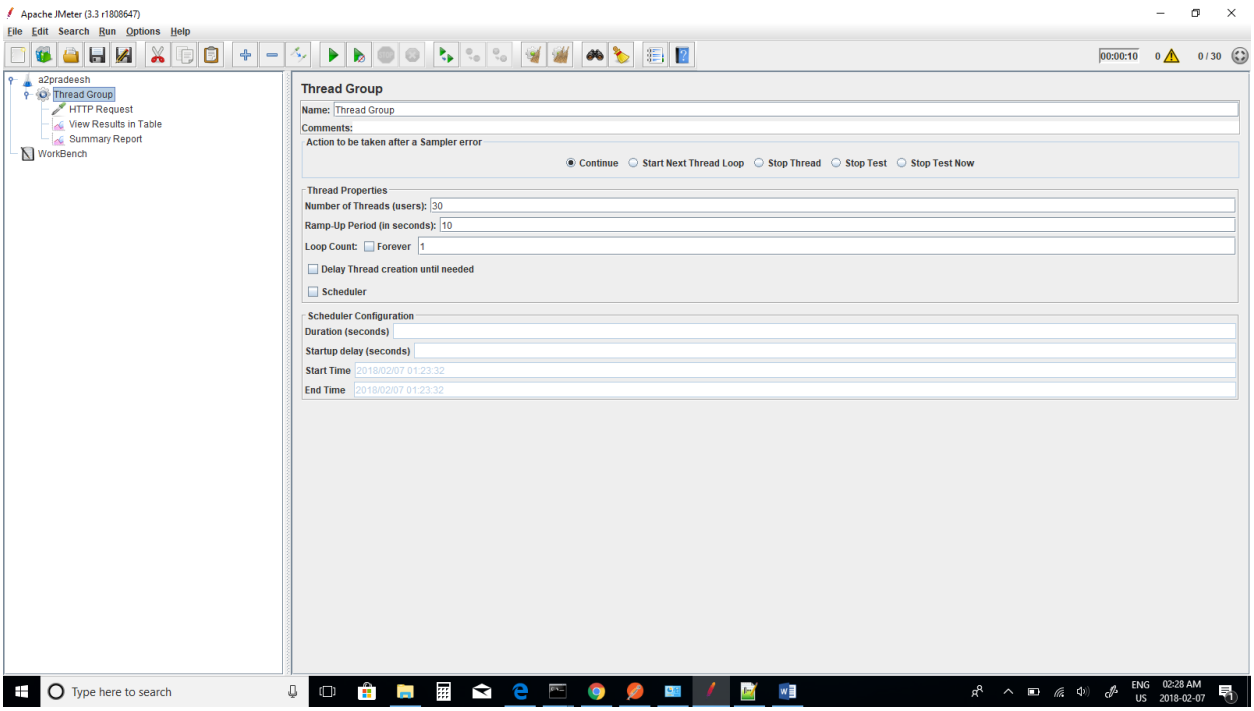

Apache JMeter (3.3 r1808647)
File Edit Search Run Options Help
00:00:10 0 0 / 20
a2pradeesh
Thread Group
HTTP Request
View Results in Table
Summary Report
WorkBench
HTTP Request
Name: HTTP Request
Comments:
Basic Advanced
Web Server
Protocol [http]: https
Server Name or IP: a2pradeesh123.mybluemix.net
Port Number:
HTTP Request
Method: GET
Path:
Content encoding:
Redirect Automatically Follow Redirects Use KeepAlive Use multipart/form-data for POST Browser-compatible headers
Parameters Body Data Files Upload
Send Parameters With the Request:
Name: Value Encode? Include Equals?
Detail Add Add from Clipboard Delete Up Down
Type here to search
ENG US 02:11 AM 2018-02-07

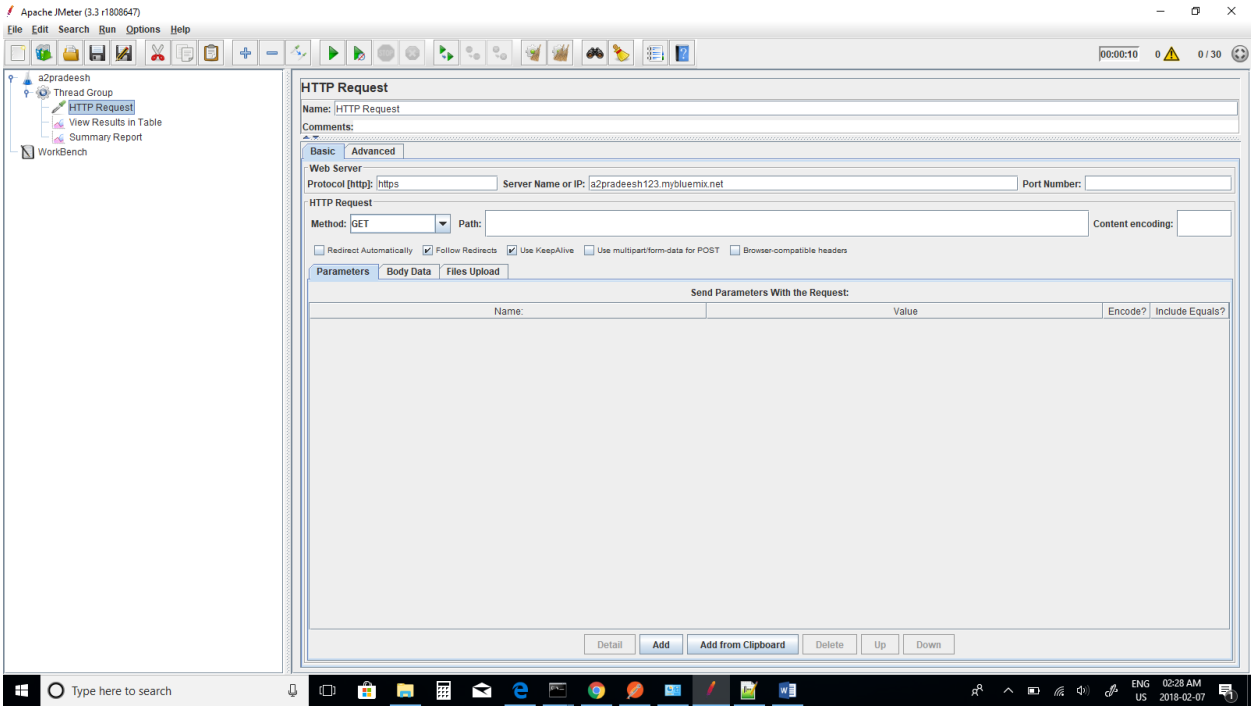


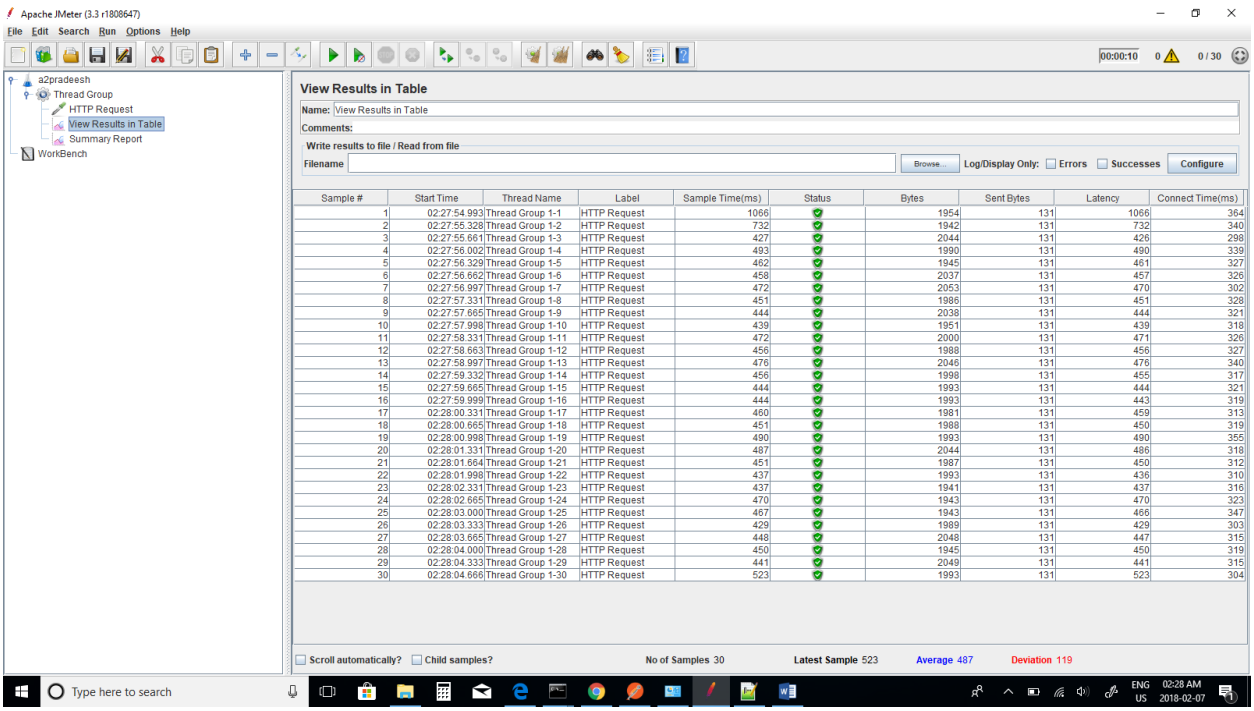


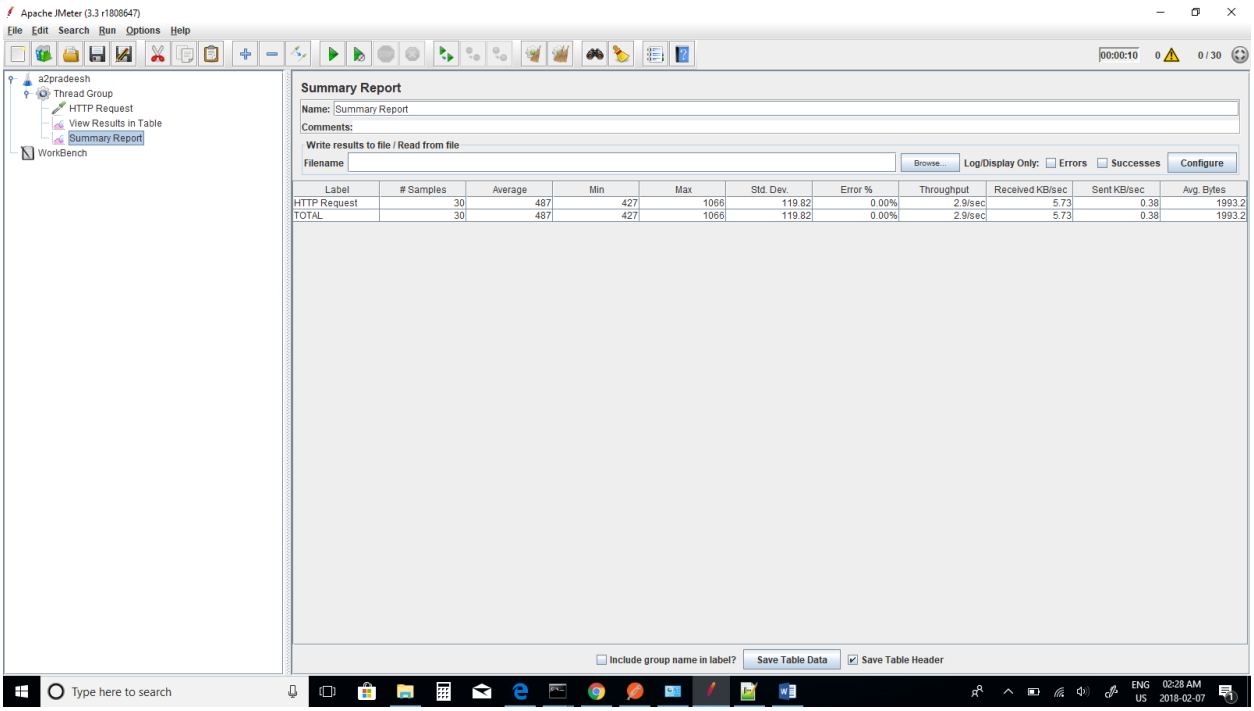
Average Response Time for 20 Threads - 463ms

Changing number of threads – 30


Apache JMeter (3.3 r1808647)
File Edit Search Run Options Help
00:00:10 0 0 / 30
a2pradeesh
Thread Group
HTTP Request
View Results in Table
Summary Report
WorkBench
Thread Group
Name: Thread Group
Comments:
Action to be taken after a Sampler error
Continue Start Next Thread Loop Stop Thread Stop Test Stop Test Now
Thread Properties
Number of Threads (users): 30
Ramp-Up Period (in seconds): 10
Loop Count: Forever 1
Delay Thread creation until needed
Scheduler
Scheduler Configuration
Duration (seconds)
Startup delay (seconds)
Start Time 2018/02/07 01:23:32
End Time 2018/02/07 01:23:32
Type here to search
ENG US 02:28 AM 2018-02-07

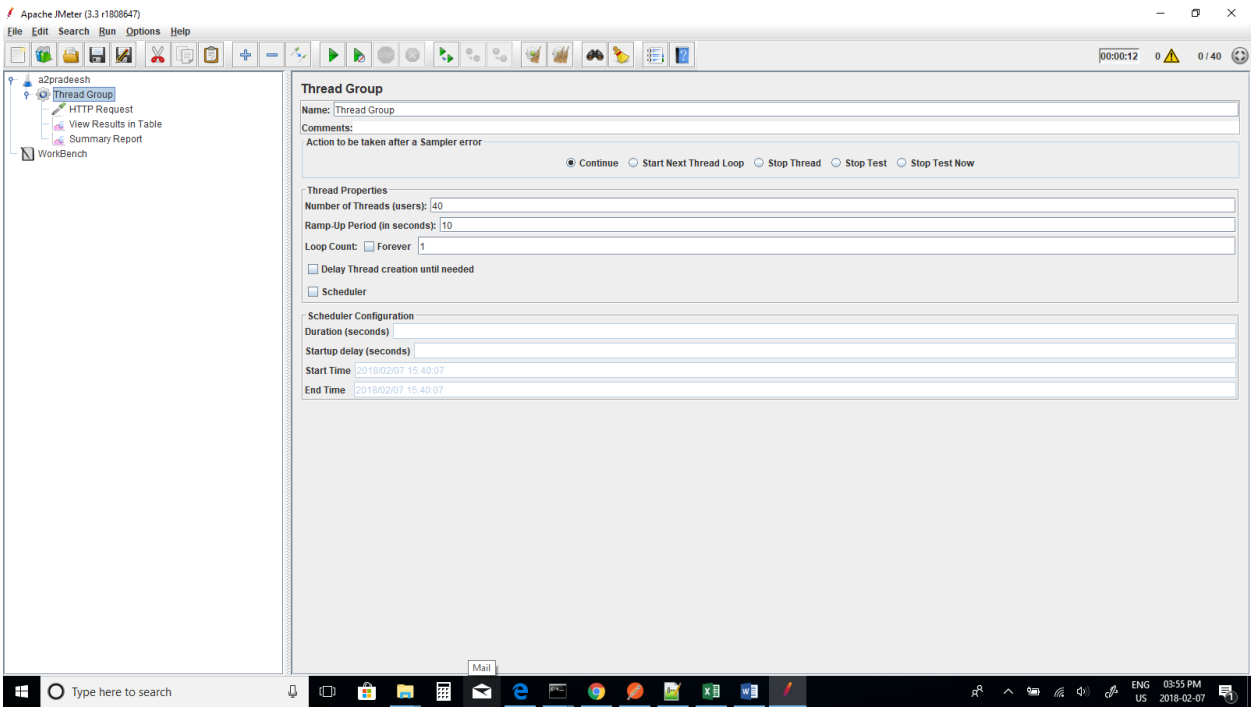

Apache JMeter (3.3 r1808647)
File Edit Search Run Options Help
00:00:10 0 0 / 30
a2pradeesh
Thread Group
HTTP Request
View Results in Table
Summary Report
WorkBench
HTTP Request
Name: HTTP Request
Comments:
Basic Advanced
Web Server
Protocol [http]: https
Server Name or IP: a2pradeesh123.mybluemix.net
Port Number:
HTTP Request
Method: GET
Path:
Content encoding:
Redirect Automatically Follow Redirects Use KeepAlive Use multipart/form-data for POST Browser-compatible headers
Parameters Body Data Files Upload
Send Parameters With the Request:
Name: Value Encode? Include Equals?
Detail Add Add from Clipboard Delete Up Down
Type here to search
ENG US 02:28 AM 2018-02-07

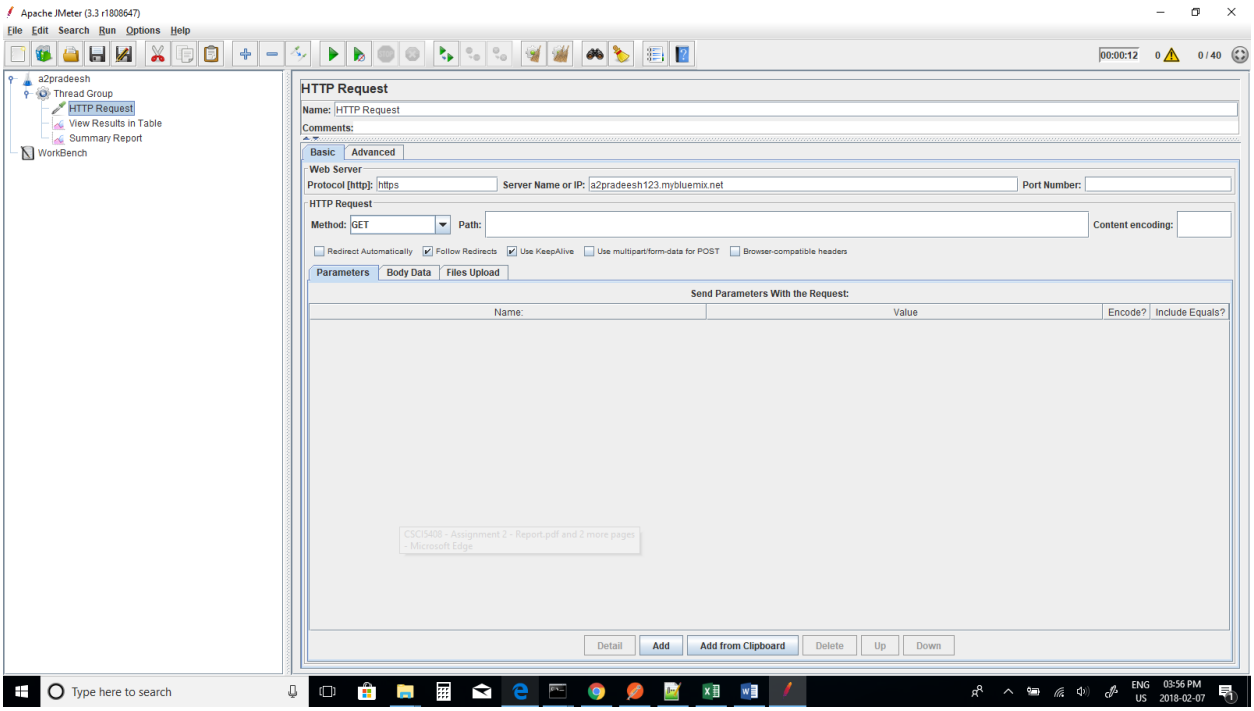


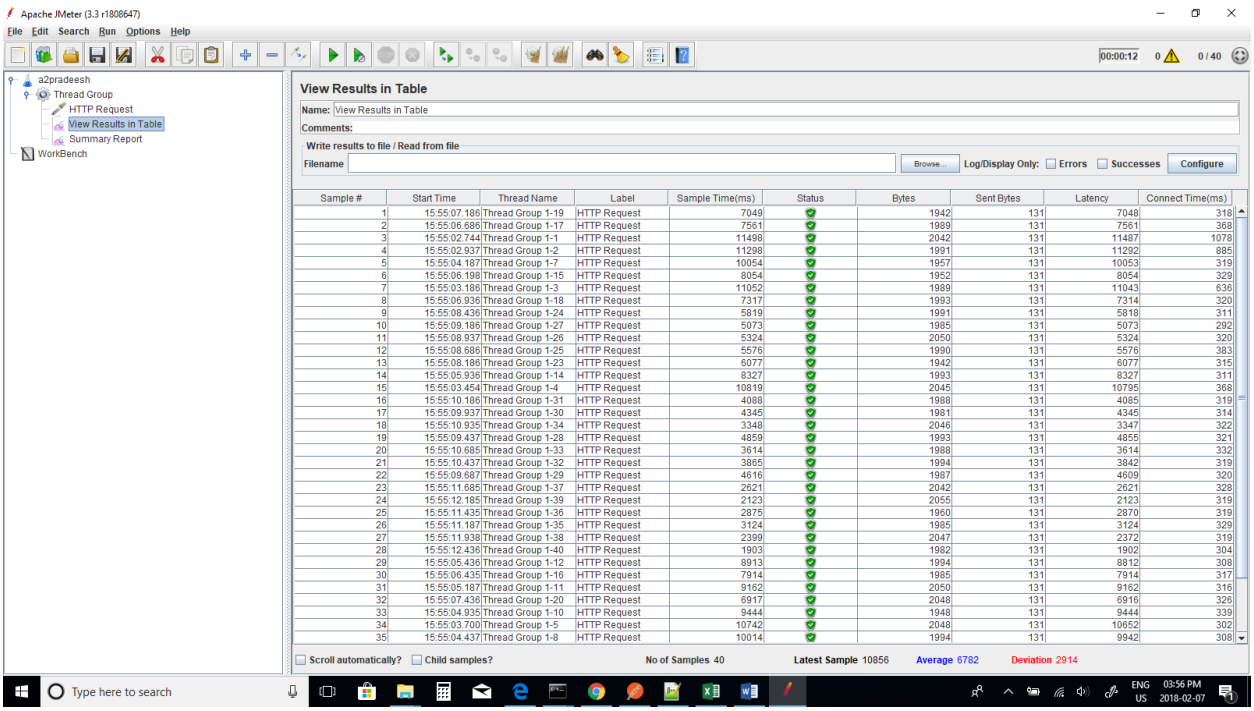


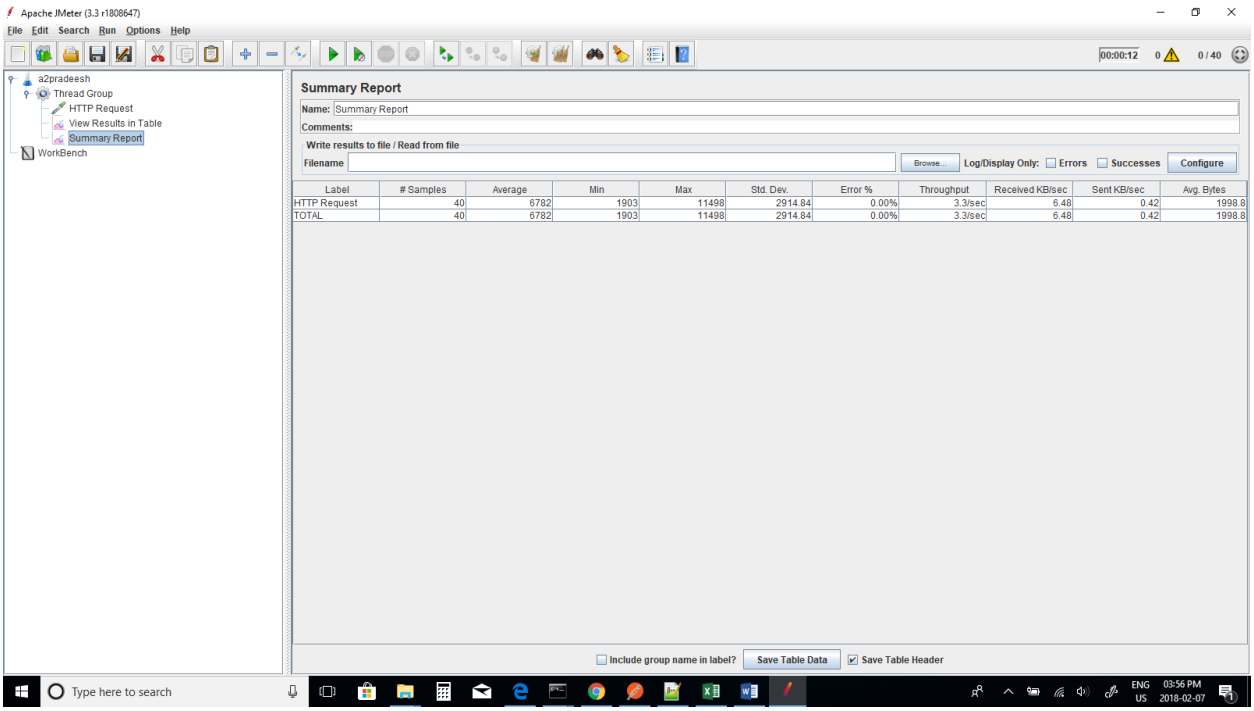
Average Response Time for 30 Threads - 487ms

Changing number of threads – 40


Apache JMeter (3.3 r1808647)
File Edit Search Run Options Help
00:00:12 0 0 / 40
a2pradeesh
Thread Group
HTTP Request
View Results in Table
Summary Report
WorkBench
Thread Group
Name: Thread Group
Comments:
Action to be taken after a Sampler error
Continue Start Next Thread Loop Stop Thread Stop Test Stop Test Now
Thread Properties
Number of Threads (users): 40
Ramp-Up Period (in seconds): 10
Loop Count: Forever 1
Delay Thread creation until needed
Scheduler
Scheduler Configuration
Duration (seconds)
Startup delay (seconds)
Start Time 2018/02/07 15:40:07
End Time 2018/02/07 15:40:07
Mail
Type here to search
ENG US 03:55 PM 2018-02-07

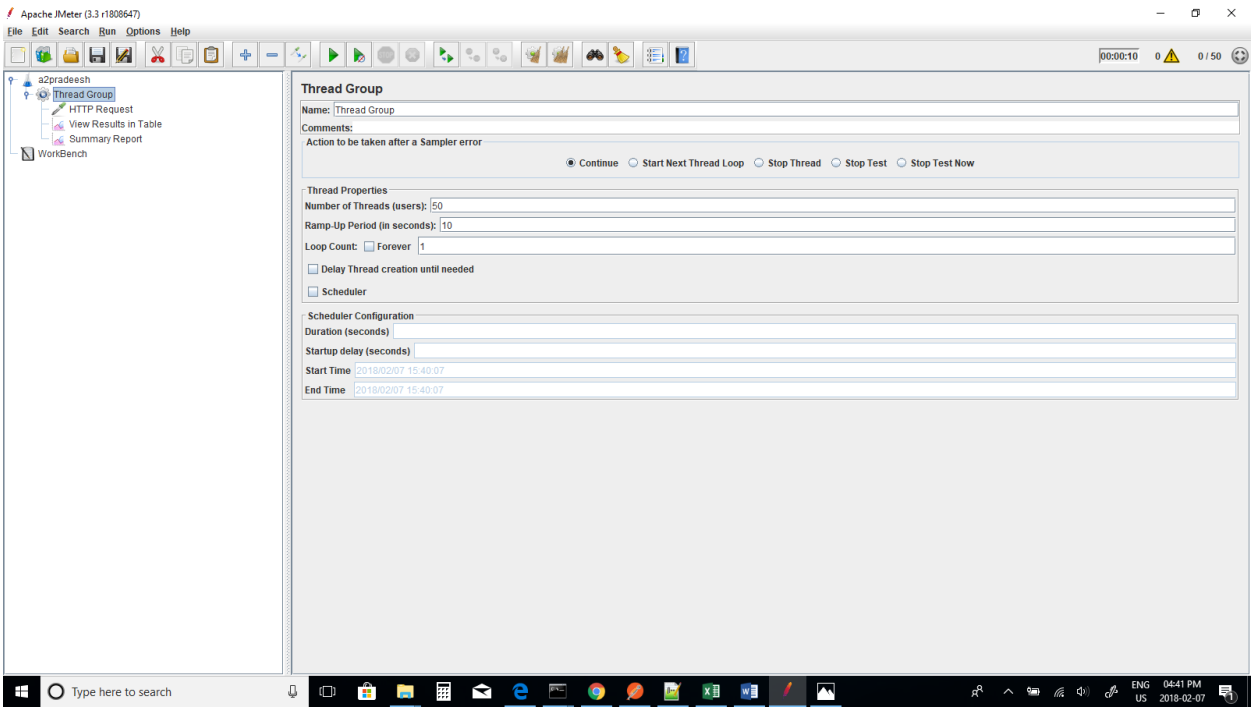

Apache JMeter (3.3 r1808647)
File Edit Search Run Options Help
00:00:12 0 0 / 40
a2pradeesh
Thread Group
HTTP Request
View Results in Table
Summary Report
WorkBench
HTTP Request
Name: HTTP Request
Comments:
Basic Advanced
Web Server
Protocol [http]: https
Server Name or IP: a2pradeesh123.mybluemix.net
Port Number:
HTTP Request
Method: GET
Path:
Content encoding:
Redirect Automatically Follow Redirects Use KeepAlive Use multipart/form-data for POST Browser-compatible headers
Parameters Body Data Files Upload
Send Parameters With the Request:
Name: Value Encode? Include Equals?
Detail Add Add from Clipboard Delete Up Down
Type here to search
ENG US 03:56 PM 2018-02-07

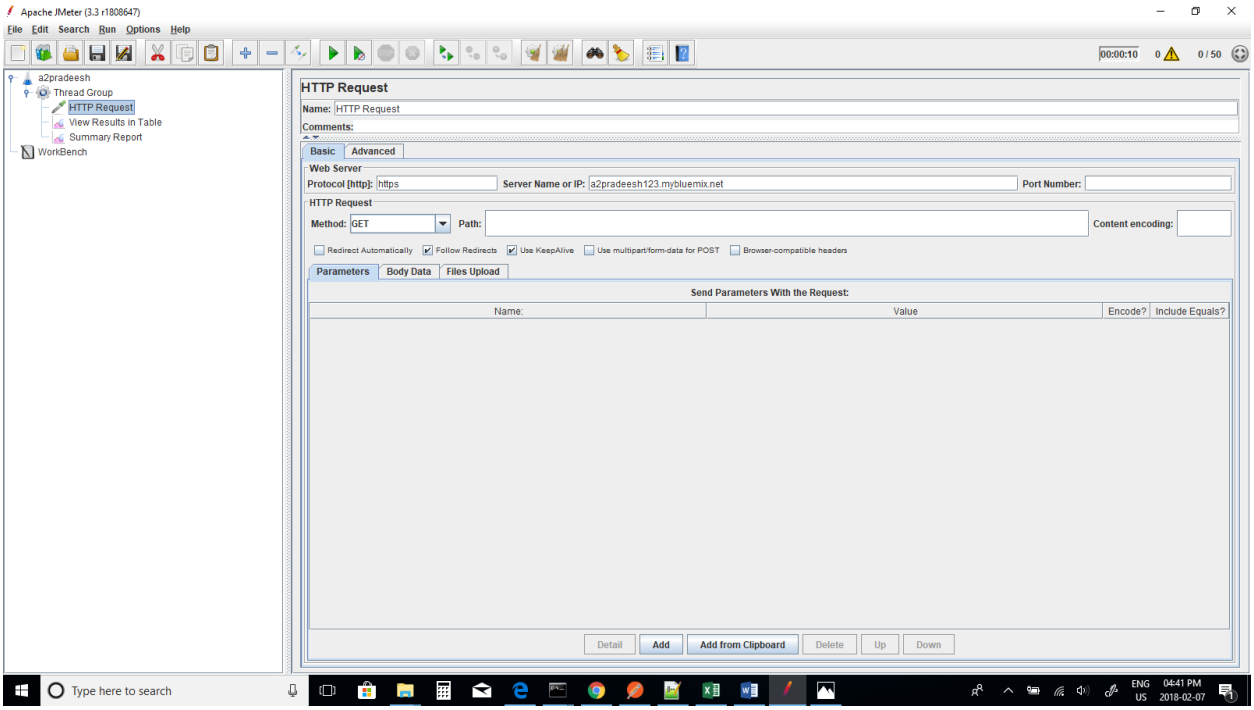


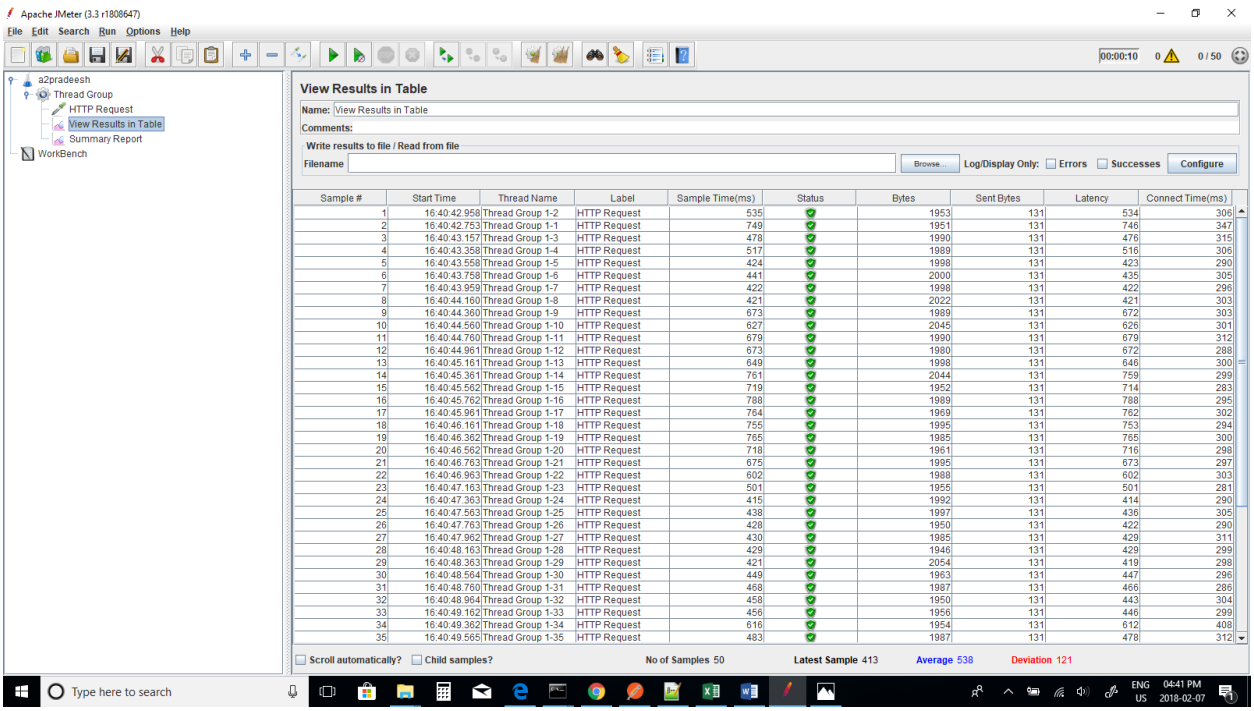


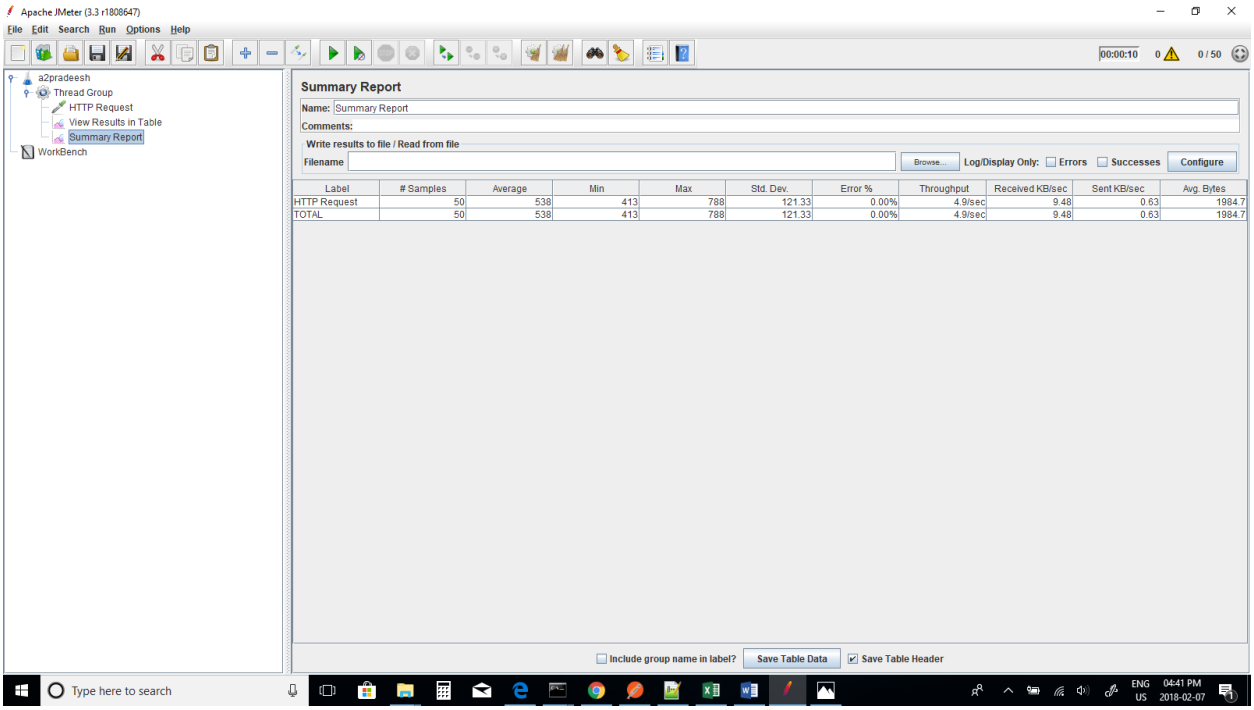
Average Response Time for 40 Threads - 6782ms

Changing number of threads – 50


Apache JMeter (3.3 r1808647)
File Edit Search Run Options Help
00:00:10 0 0 / 50
a2pradeesh
Thread Group
HTTP Request
View Results in Table
Summary Report
WorkBench
Thread Group
Name: Thread Group
Comments:
Action to be taken after a Sampler error
Continue Start Next Thread Loop Stop Thread Stop Test Stop Test Now
Thread Properties
Number of Threads (users): 50
Ramp-Up Period (in seconds): 10
Loop Count: Forever 1
Delay Thread creation until needed
Scheduler
Scheduler Configuration
Duration (seconds)
Startup delay (seconds)
Start Time 2018/02/07 15:40:07
End Time 2018/02/07 15:40:07
Type here to search
ENG US 04:41 PM 2018-02-07


Apache JMeter (3.3 r1808647)
File Edit Search Run Options Help
00:00:10 0 0 / 50
a2pradeesh
Thread Group
HTTP Request
View Results in Table
Summary Report
WorkBench
HTTP Request
Name: HTTP Request
Comments:
Basic Advanced
Web Server
Protocol [http]: https
Server Name or IP: a2pradeesh123.mybluemix.net
Port Number:
HTTP Request
Method: GET
Path:
Content encoding:
Redirect Automatically Follow Redirects Use KeepAlive Use multipart/form-data for POST Browser-compatible headers
Parameters Body Data Files Upload
Send Parameters With the Request:
Name: Value Encode? Include Equals?
Detail Add Add from Clipboard Delete Up Down
Type here to search
ENG US 04:41 PM 2018-02-07





Average Response Time for 50 Threads - 538ms

i) URL : a2pradeesh123.mybluemix.net

No of Threads	Average Response Time (in ms)
10	5060

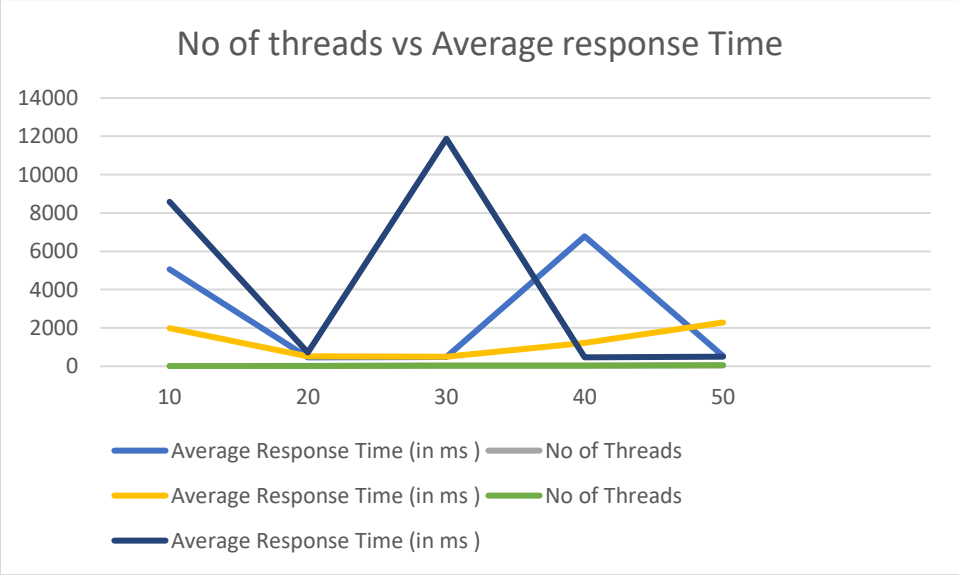
20	463
30	487
40	6782
50	538

ii) URL : a2pradeesh123.mybluemix.net/visitorsbycountry

No of Threads	Average Response Time (in ms)
10	1990
20	509
30	499
40	1220
50	2284

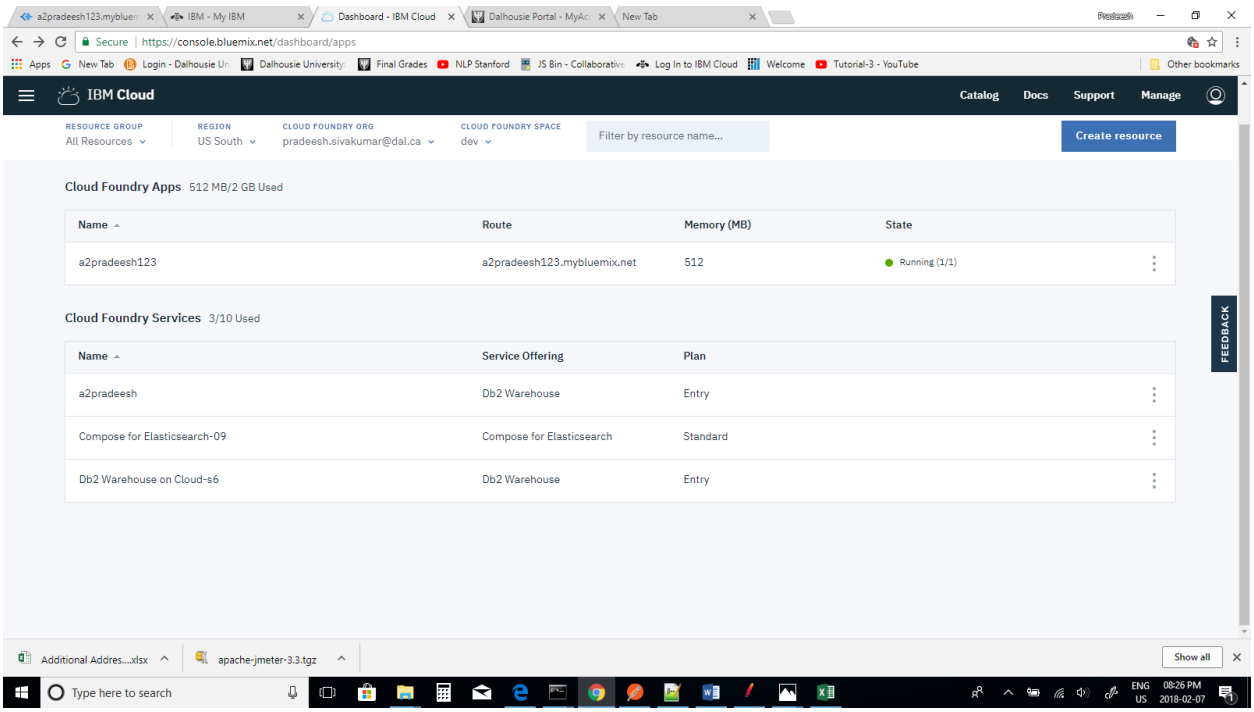
iii) a2pradeesh123.mybluemix.net/visitorsbymode

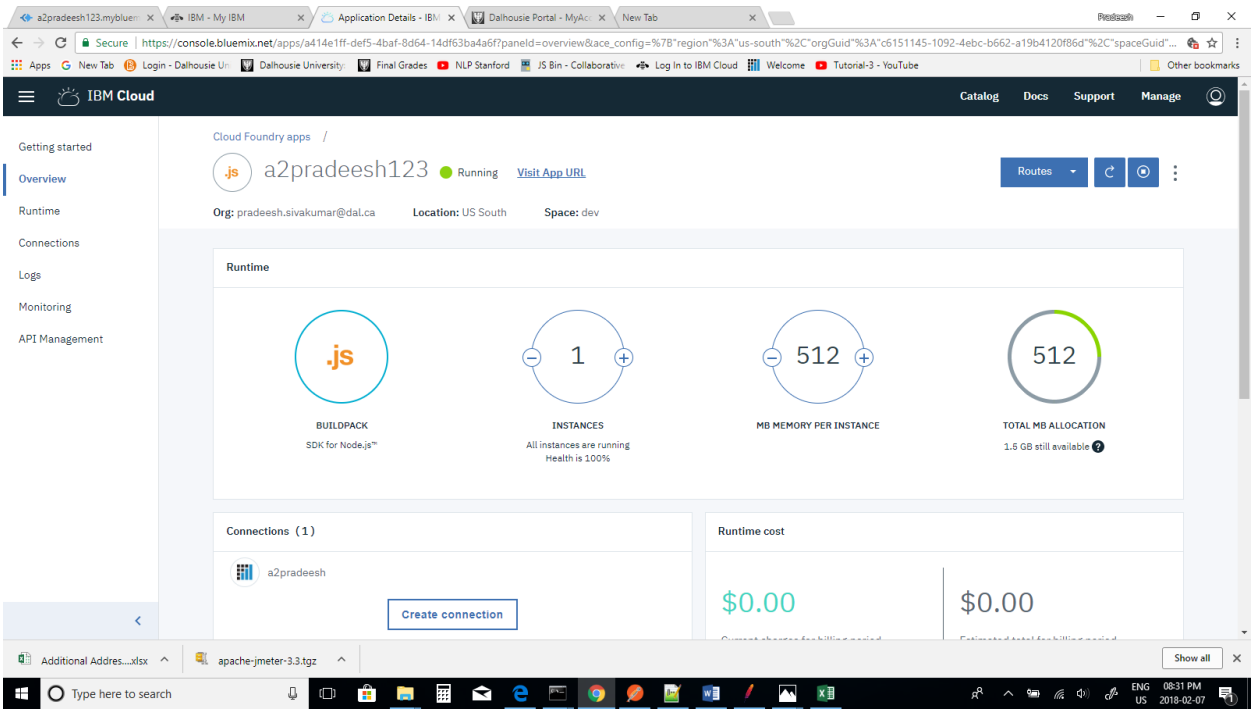
No of Threads	Average Response Time (in ms)
10	8581
20	710
30	11875
40	465
50	499

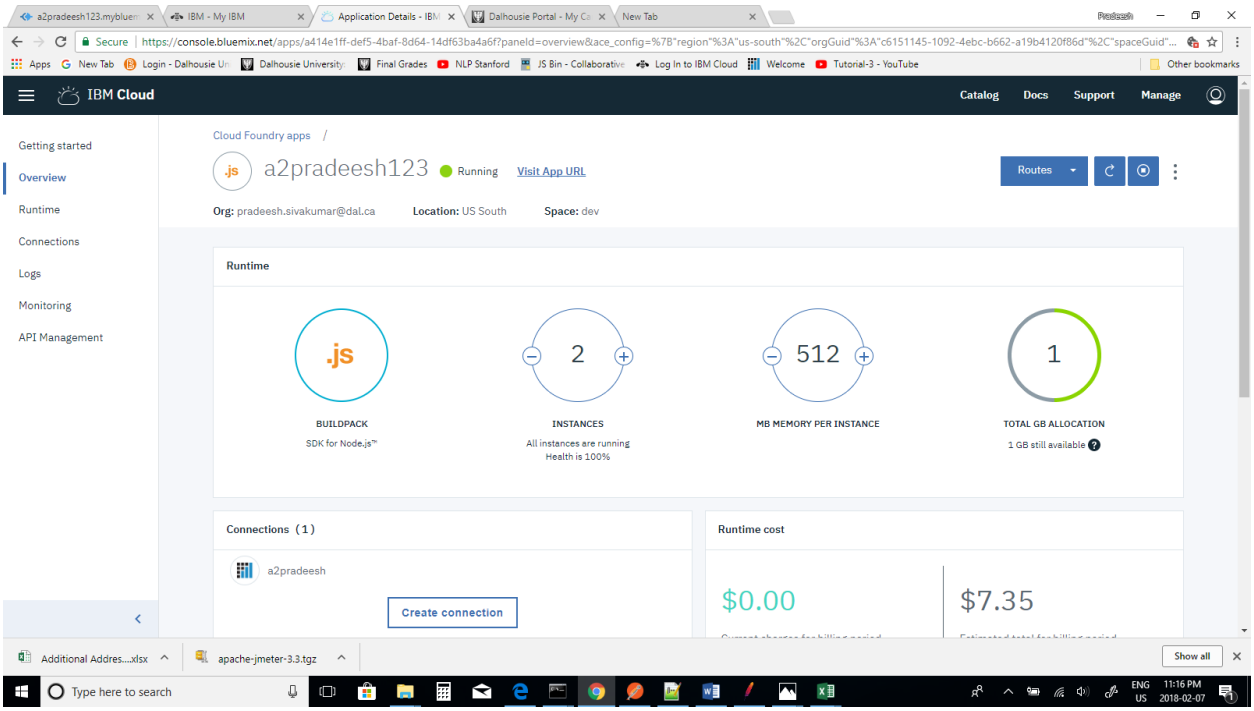


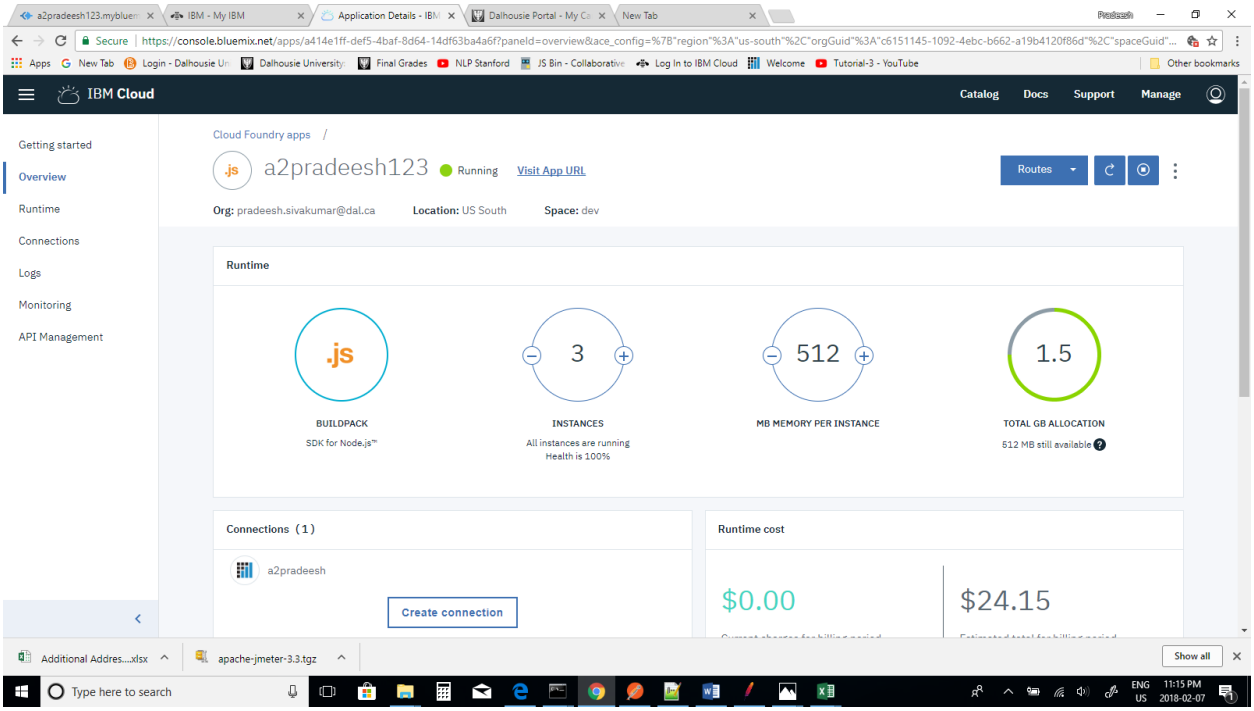
The above graphs displays number of threads with average response time in milli seconds (ms) for three URLs used in the experiment. The performance for all URLs varies in graph for each URL used. The average response time in URL-3 took more time compared to URL-1 and URL-2 and keeps on changing on each instance.

6. Scaling


IBM Cloud
Catalog
Docs
Support
Manage
Create resource
Cloud Foundry Apps 512 MB/2 GB Used
Name
Route
Memory (MB)
State
a2pradeesh123
a2pradeesh123.mybluemix.net
512
Running (1/1)
Cloud Foundry Services 3/10 Used
Service Offering
Plan
a2pradeesh
Db2 Warehouse
Entry
Compose for Elasticsearch-09
Compose for Elasticsearch
Standard
Db2 Warehouse on Cloud-s6
Db2 Warehouse
Entry
FEEDBACK


IBM Cloud
Catalog
Docs
Support
Manage
Getting started
Overview
Runtime
Connections
Logs
Monitoring
API Management
Cloud Foundry apps
a2pradeesh123
Running
Visit App URL
Routes
Org: pradeesh.sivakumar@dal.ca
Location: US South
Space: dev
Runtime
BUILDPACK
SDK for Node.js™
1
INSTANCES
All instances are running
Health is 100%
512
MB MEMORY PER INSTANCE
512
TOTAL MB ALLOCATION
1.5 GB still available
Connections (1)
a2pradeesh
Create connection
Runtime cost
$0.00
$0.00





Q-1 a2pradeesh123.mybluemix.net

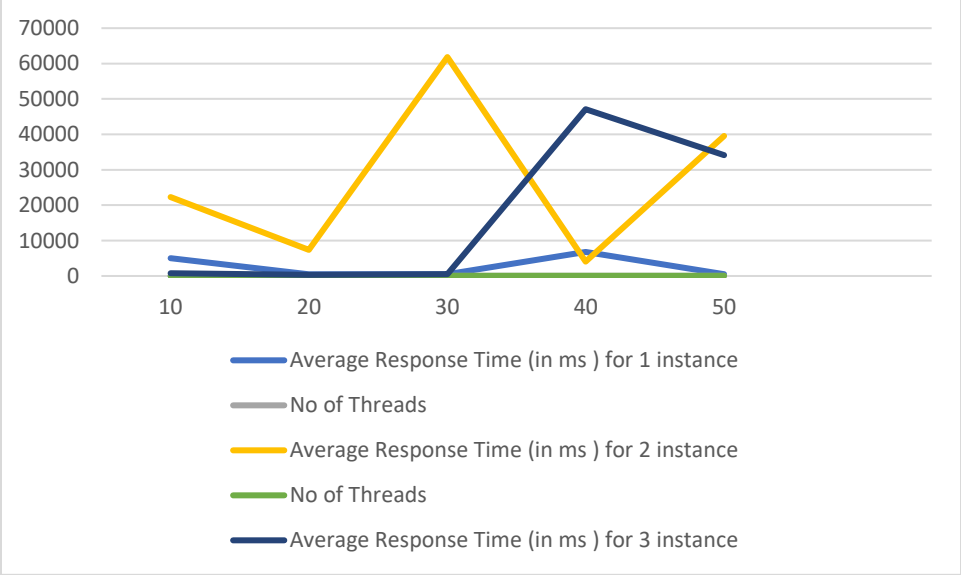
No of Threads	Average Response Time (in ms) for 1 instance
10	5060
20	473
30	488

40	6782
50	538

No of Threads	Average Response Time (in ms) for 2 instance
10	22309
20	7373
30	61834
40	4060
50	39595

No of Threads	Average Response Time (in ms) for 3 instance
10	755
20	319
30	497
40	47108
50	34142

Scaling : Q-1 No of Threads Vs Average Response Time for 1, 2, and 3 instance



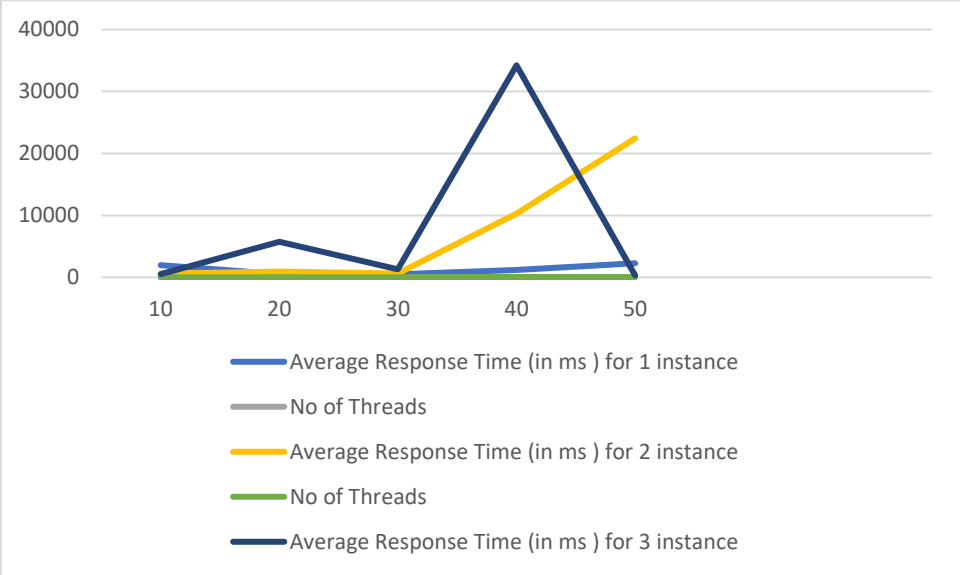
Q-2 a2pradeesh123.mybluemix.net/visitorsbycountry

No of Threads	Average Response Time (in ms) for 1 instance
10	1990
20	509
30	499

40	1220
50	2284
No of Threads	Average Response Time (in ms) for 2 instance
10	606
20	966
30	656
40	10288
50	22439

No of Threads	Average Response Time (in ms) for 3 instance
10	543
20	5743
30	1293
40	34229
50	326

Scaling: Q-2 No of Threads Vs Average Response Time for 1, 2, and 3 instance



Q-3 a2pradeesh123.mybluemix.net/visitorsbymode

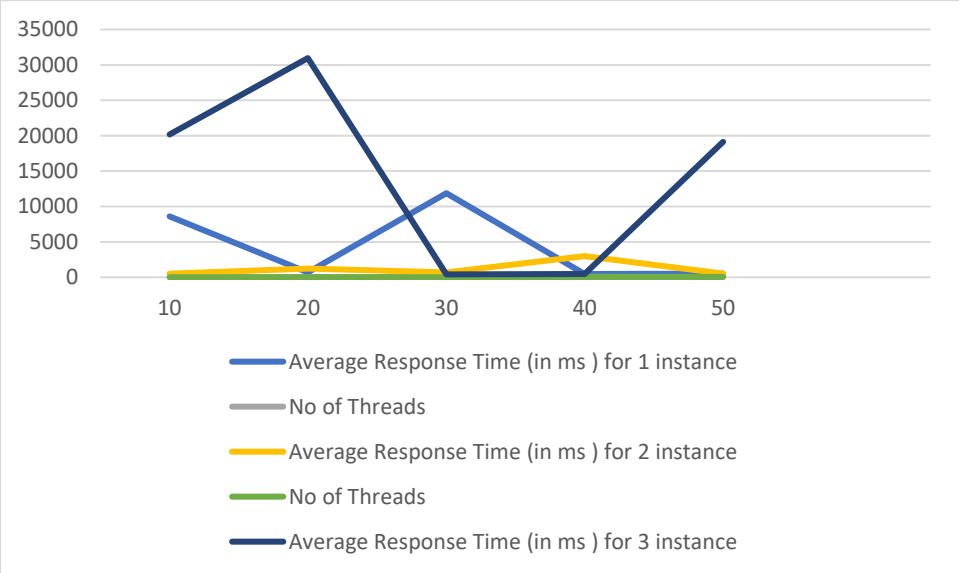
No of Threads	Average Response Time (in ms) for 1 instance
10	8581

20	710
30	11875
40	465
50	499

No of Threads	Average Response Time (in ms) for 2 instance
10	520
20	1244
30	669
40	2988
50	519

No of Threads	Average Response Time (in ms) for 3 instance
10	20165
20	30959
30	406
40	444
50	19118

Scaling: Q-3 No of Threads Vs Average Response Time for 1, 2, and 3 instance



The above graphs displays number of threads and average response time for 1, 2, and 3 instances for each web URL used in the dataset using JMeter. In the graph it has been analyzed that the average response time for instance 3 is more compared to instance 1, and instance 2 for each URL analyzed in the experiment because when more load is given the time gradually increases and keeps on changing.

Summary

We have been given with the visitors dataset of Nova Scotia and we are supposed to use db2 warehouse on cloud to store the dataset. Then we have to retrieve the number of visitors information from the database given for the task. For testing the web service I have used Apache JMeter to test each application given in the assignment. The application is created using NodeJS and have been uploaded in the Bluemix. The performance of multiple threads using UI application (JMeter) is calculated by changing the number of threads to 10,20,30,40, and 50 and measuring average response time in milliseconds. Similarly, for scaling previous steps are repeated by changing the number of instances to 1,2, and 3 and average response for each web URL based on the assignment is measured and the graphs are illustrated. Finally, for each requests on x axis and response on y axis is observed with response times by changing the number of instances to 1,2, and 3.

Software tools Experience

Based on the software tools used such as Jmeter, Postman and Overall it was a good experience. Jmeter is very useful to create multiple threads from UI application to observe response times and mostly for load and performance testing, whereas software like postman is used for testing the web service and mostly for faster and easier API development.

References

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