

CSC 258 – Distributed Systems

Spring 2019



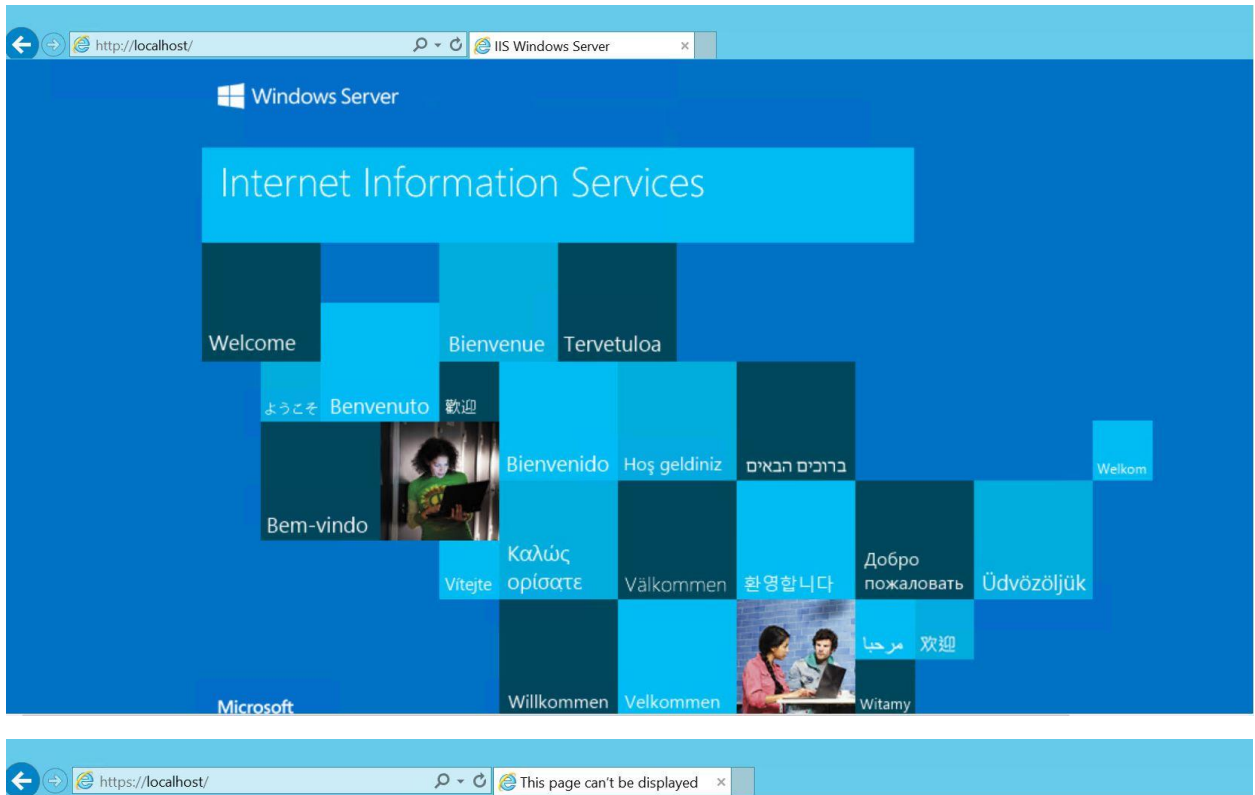
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Project Report on AWS Cloud & Chat Application

Jeet Shah (220267750)

HTTP to HTTPS :-

You can see now my EC2 published Application is running on http but not on https, which is in my localhost called MlaWebApi application.

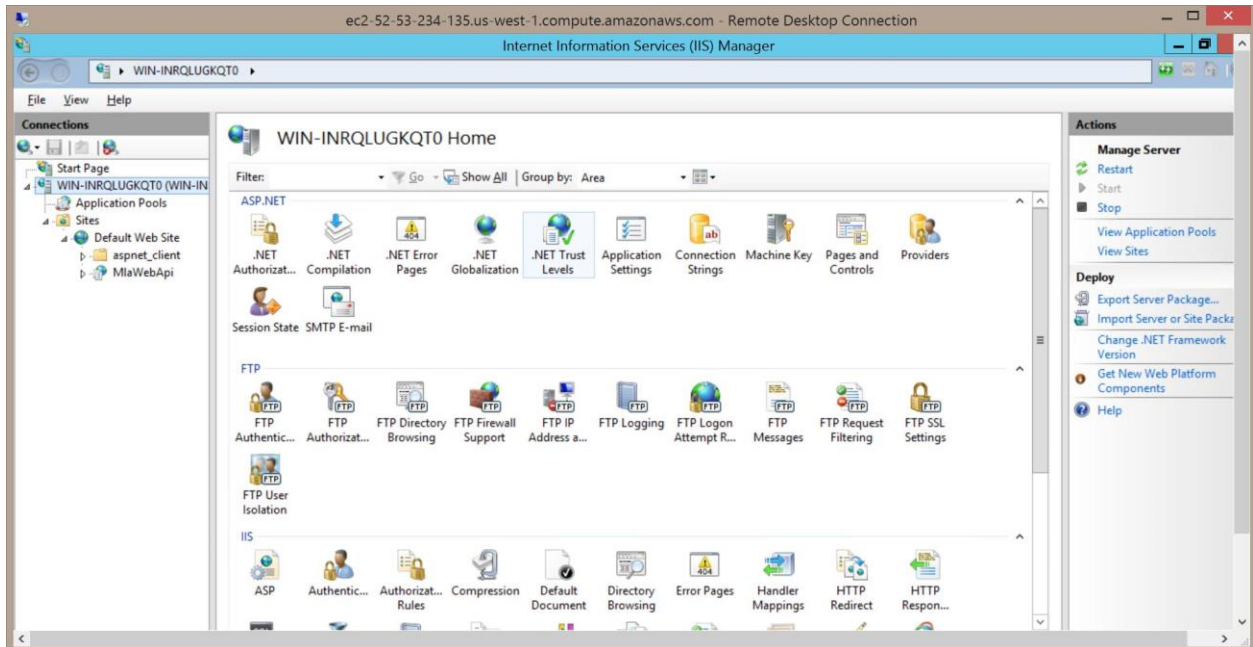


This page can't be displayed

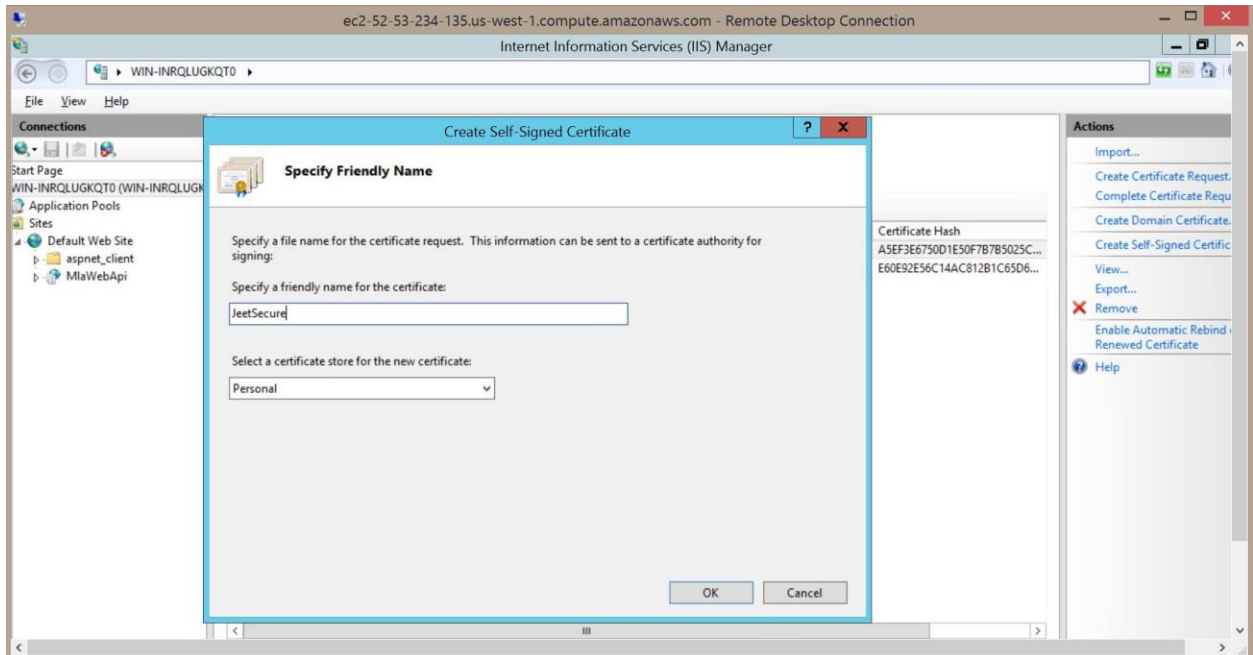
- Make sure the web address https://localhost is correct.
- Look for the page with your search engine.
- Refresh the page in a few minutes.

[Fix connection problems](#)

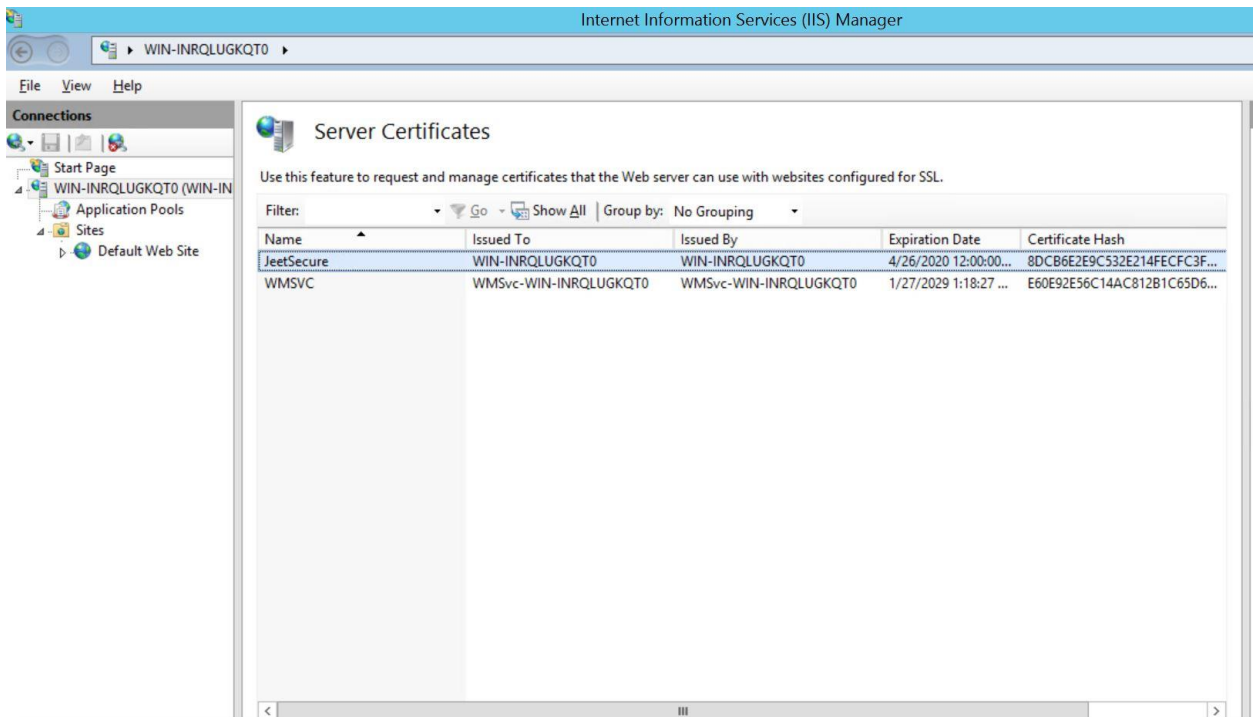
1. First step was to go to Server Certificates from the IIS & create a Self Signed Certificate.



2. To create a Self Sign Certificate go to Server Certificates which located under the IIS block in WIN-INRQLUGKQT0 Home localhost. After that click on Create Self-Signed Certificate located on the right side under the Actions panel. After clicking a Pop-Up box will appear. Now just give Any name you want for the certificate. Like, I have given JeetSecure as my certificate name. and then select personal for storing the certificate and then press OK.

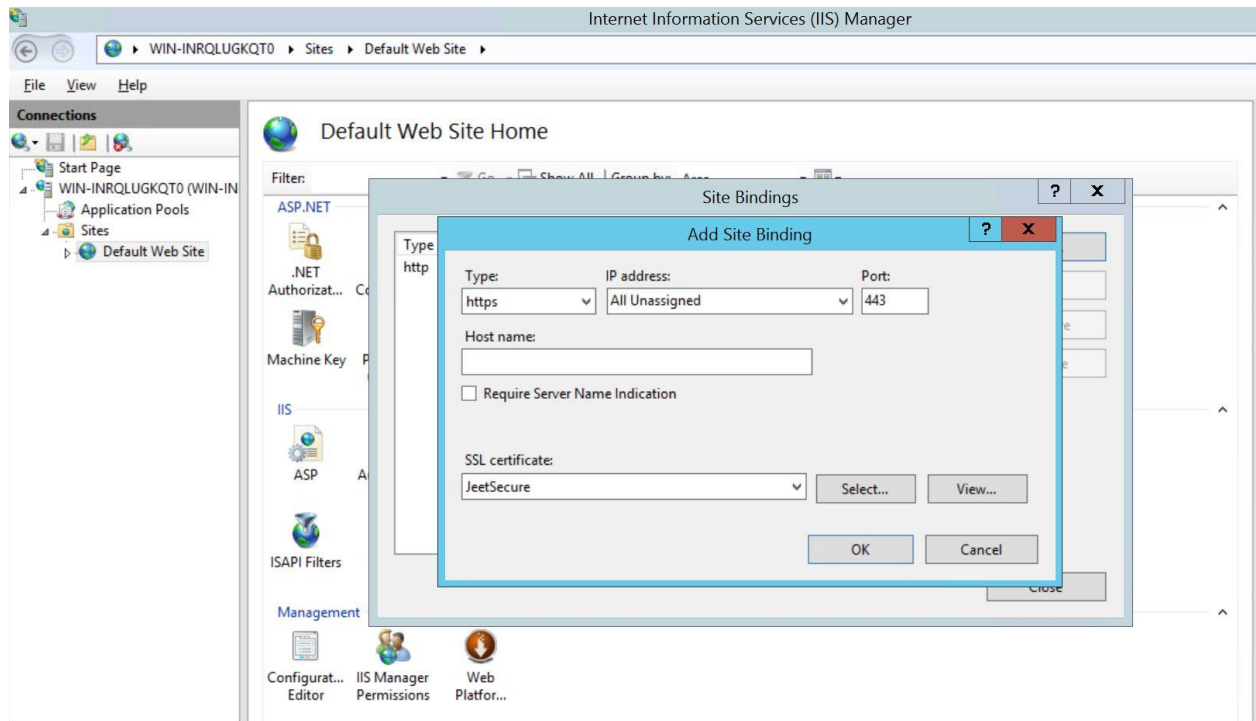


Now your Self-Signed Certificate is generated. You can see it in the Server Certificates.

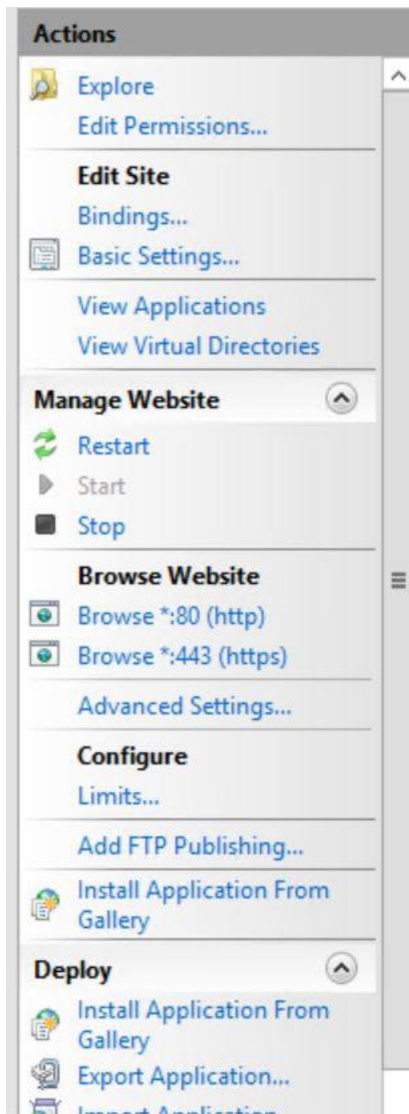


3. Now, We need to add binding for the HTTPS. For that, go to DefaultWebSite from the left side toolbar. And you can see Bindings on the right side toolbar. Then Click on Add on the Site Binding box

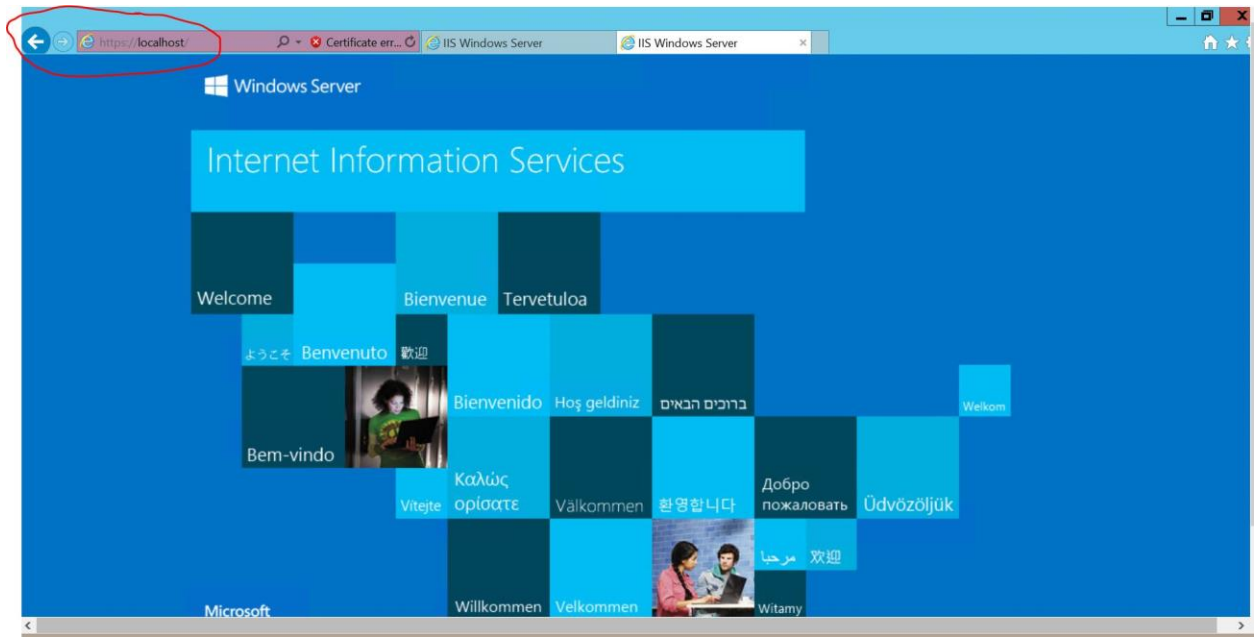
which is opened after you clicked the Bindings. Then, fill the fields as shown as below and in SSL certificate give your certificate which is you have just created and then press OK.



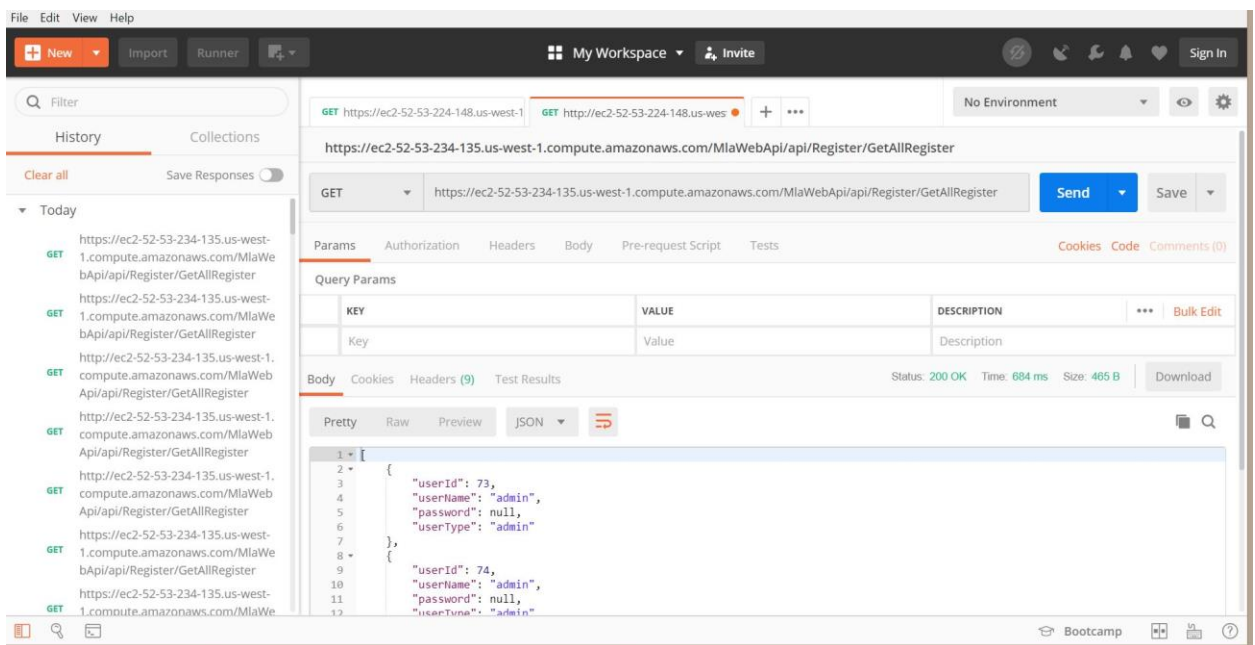
Now You can see that Bindings are added to your DefaultWebSite in your localhost.



Now you are ready to run on application on Secure Server. So, check URL by writing HTTPS on your localhost. And you can see from below picture that it is working now.



I have also tested on Postman by using HTTPS with my EC2 URL on my MlaWebApi application and you can see it is working correctly.



So, These are the steps to run your application securely even if you do not have Domain for your website or if you are working on localhost.

Load Balancer Implementation :-

- One of the most commonly used applications of load balancing is to provide a single Internet service from multiple servers.
- There are 3 types of Load Balancer.
 - Application Load Balancer
 - Network Load Balancer
 - Classic Load Balancer

Application Load Balancer :

- An Application Load Balancer makes routing decisions at the application layer (HTTP/HTTPS), supports path-based routing, and can route requests to one or more ports on each container instance in your cluster. Application Load Balancers support dynamic host port mapping.

Network Load Balancer :

- A Network Load Balancer makes routing decisions at the transport layer (TCP/SSL). It can handle millions of requests per second. After the load balancer receives a connection, it selects a target from the target group for the default rule using a flow hash routing algorithm.

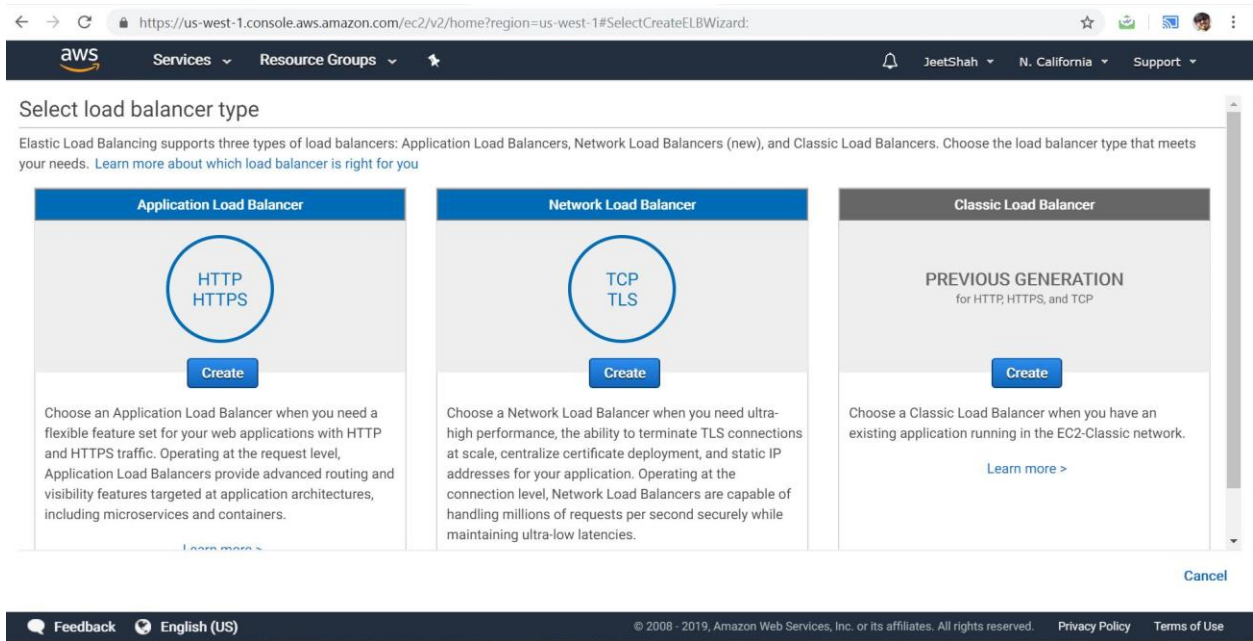
Classic Load Balancer :

- A Classic Load Balancer makes routing decisions at either the transport layer (TCP/SSL) or the application layer (HTTP/HTTPS). Classic Load Balancers currently require a fixed relationship between the load balancer port and the container instance port.

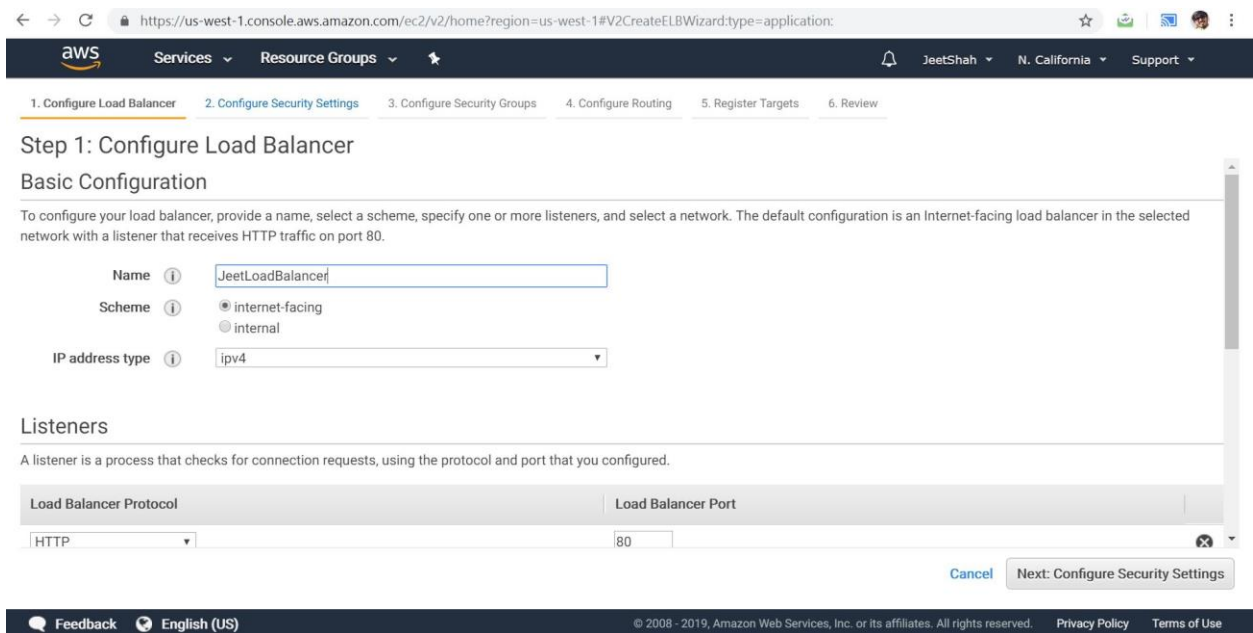
Implementation of Load Balancer :

- I have implemented Application Load Balancer because of this advantages.
- Support for path-based routing. You can configure rules for your listener that forward requests based on the URL in the request. This enables you to structure your application as smaller services, and route requests to the correct service based on the content of the URL.
- Support for host-based routing. You can configure rules for your listener that forward requests based on the host field in the HTTP header. This enables you to route requests to multiple domains using a single load balancer.
- Support for routing based on fields in the request, such standard and custom HTTP headers and methods, query parameters, and source IP addresses.
- Support for routing requests to multiple applications on a single EC2 instance. You can register each instance or IP address with the same target group using multiple ports.
- Support for redirecting requests from one URL to another.
- Support for returning a custom HTTP response.
- Support for registering targets by IP address, including targets outside the VPC for the load balancer.

Now to Implement Load Balancer, First of all you need to create an instance of EC2, Like we have created at the starting of AWS setup. Then, you have to go the Load Balancer from services menu. Then you can see window like below snapshot.



- Now, as I am implementing Application Load Balancer, click on create button.



- In this step, You just to Name your Load Balancer and I have kept default value for Scheme & IP address type.

← → ↻ <https://us-west-1.console.aws.amazon.com/ec2/v2/home?region=us-west-1#V2CreateELBWizard:type=application:> ☆ 📧 📄 👤 ⋮

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1. Configure Load Balancer 2. Configure Security Settings 3. Configure Security Groups 4. Configure Routing 5. Register Targets 6. Review

Step 1: Configure Load Balancer

Name ⓘ

Scheme ⓘ ☒ internet-facing ☐ internal

IP address type ⓘ

Listeners

A listener is a process that checks for connection requests, using the protocol and port that you configured.

Load Balancer Protocol	Load Balancer Port
<input type="text" value="HTTP"/>	<input type="text" value="80"/>

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Step 1: Configure Load Balancer

Availability Zones

Specify the Availability Zones to enable for your load balancer. The load balancer routes traffic to the targets in these Availability Zones only. You can specify only one subnet per Availability Zone. You must specify subnets from at least two Availability Zones to increase the availability of your load balancer.

VPC ⓘ

Availability Zones

☒ us-west-1a

IPv4 address ⓘ Assigned by AWS

☒ us-west-1c

IPv4 address ⓘ Assigned by AWS

▸ Tags

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- I have kept default value for each of this. Then, click on Next.

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1. Configure Load Balancer 2. Configure Security Settings 3. Configure Security Groups 4. Configure Routing 5. Register Targets 6. Review

Step 3: Configure Security Groups

A security group is a set of firewall rules that control the traffic to your load balancer. On this page, you can add rules to allow specific traffic to reach your load balancer. First, decide whether to create a new security group or select an existing one.

Assign a security group: ☐ Create a new security group ☒ Select an existing security group

Filter VPC security groups ▾

	Security Group ID	Name	Description	Actions
<input type="checkbox"/>	sg-b2e975c8	default	default VPC security group	Copy to new
<input type="checkbox"/>	sg-0da5154a9b8ef1079	launch-wizard-1	launch-wizard-1 created 2019-01-24T16:24:13.091-08:00	Copy to new
<input checked="" type="checkbox"/>	sg-0252961eef48f36a	launch-wizard-2	launch-wizard-2 created 2019-05-14T04:04:18.758-07:00	Copy to new

Cancel Previous Next: Configure Routing

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- Then, choose EC2 instance which you created for Load Balancer, in which you will add Security Groups for it.

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1. Configure Load Balancer 2. Configure Security Settings 3. Configure Security Groups 4. Configure Routing 5. Register Targets 6. Review

Step 4: Configure Routing

Your load balancer routes requests to the targets in this target group using the protocol and port that you specify, and performs health checks on the targets using these health check settings. Note that each target group can be associated with only one load balancer.

Target group

Target group ⓘ New target group ▾

Name ⓘ server10

Target type ☒ Instance ☐ IP ☐ Lambda function

Protocol ⓘ HTTP ▾

Port ⓘ 80

Health checks

Protocol ⓘ HTTP ▾

Cancel Previous Next: Register Targets

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- Then, just give Name for Target Group and click on Next.

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1. Configure Load Balancer 2. Configure Security Settings 3. Configure Security Groups 4. Configure Routing 5. Register Targets 6. Review

Step 5: Register Targets

Register targets with your target group. If you register a target in an enabled Availability Zone, the load balancer starts routing requests to the targets as soon as the registration process completes and the target passes the initial health checks.

Registered targets

To deregister instances, select one or more registered instances and then click Remove.

<input type="checkbox"/>	Instance	Name	Port	State	Security groups	Zone
<input type="checkbox"/>	i-069eb07fda159fa20		80	● running	launch-wizard-2	us-west-1a

Instances

To register additional instances, select one or more running instances, specify a port, and then click Add. The default port is the port specified for the target group. If the instance is already registered on the specified port, you must specify a different port.

on port

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- Now you need to select the EC2 security group or instance in which you want to set up your Load Balancer. Then, click on Next which is Review of details of your Load Balancer.

← → ↻ <https://us-west-1.console.aws.amazon.com/ec2/v2/home?region=us-west-1#V2CreateELBWizard:type=application:> ☆ 📧 📞 👤 ⋮

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1. Configure Load Balancer 2. Configure Security Settings 3. Configure Security Groups 4. Configure Routing 5. Register Targets 6. Review

Step 6: Review

Please review the load balancer details before continuing

▼ Load balancer Edit

Name JeetLoadBalancer
Scheme internet-facing
Listeners Port:80 - Protocol:HTTP
IP address type ipv4
VPC vpc-67083c00
Subnets subnet-ec20c78a, subnet-c021129b
Tags

▼ Security groups Edit

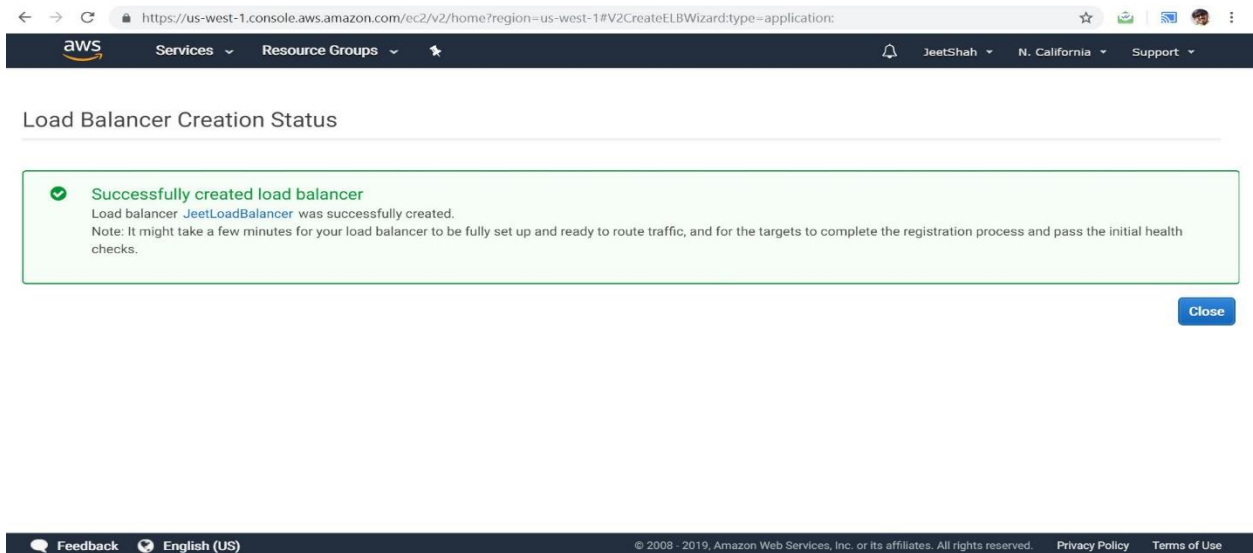
Security groups sg-0252961eef4f8f36a

▼ Routing Edit

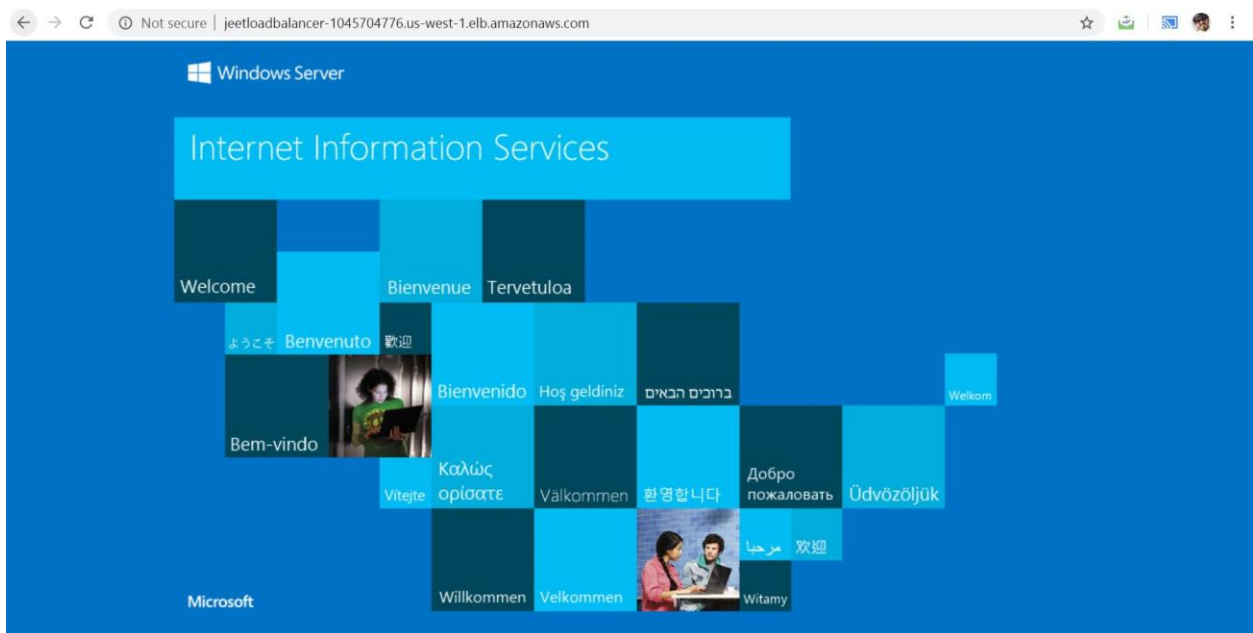
Target group New target group
Target group name server10

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- After reviewing click on Create button.



- This will show you Successful Creation of the Load Balancer.
- Now you will need to install IIS on your EC2 instance using Remote Desktop.
- After Installing you can see your Load Balancer is working or not by just writing the DNS of your Load Balancer in Google Chrome and if it is working correctly then you will see like below snapshot.



- This is how you will implement Load Balancer for EC2 instance.

Transaction Processing :

- Transaction processing is a logical unit of database processing which either includes one or more access operations which are either succeeded or failed as a complete unit.
- A transaction is made up of many steps, every step in the transaction must succeed for the transaction to be successful.
- If any one part of the transaction fails, then the entire transaction fails and when this happens the system needs to return to the state that it was before the transaction started. This is known as rollback.
- If the transaction is successfully executed, then the transaction is committed that means it transits to another state and the changes are saved. Such changes are reflected in database.
- It follows the four key ACID properties of a transaction: atomicity, consistency, isolation and durability.
- In my project MlaWebApi I have implemented transaction processing for all the Post Methods in all the Controllers.
- I have implemented transaction processing for DELETE queries.

Need of transaction processing?

- Transaction processing is used to provide data consistency and concurrency control in our system. Due to concurrency control it ensures that data is updated correctly and appropriately, when the multiple transactions are executed concurrently.
- Data consistency ensures that the transaction must change specific data only in the allowed ways.
- In our project the MVC framework is implemented.

➤ The MVC framework is explained below

Model

- Model objects are the parts of the application that implement the logic for the application.
- Model is also known as POJO classes known as Plain Old Java Object.
- It consists of getter setter methods.

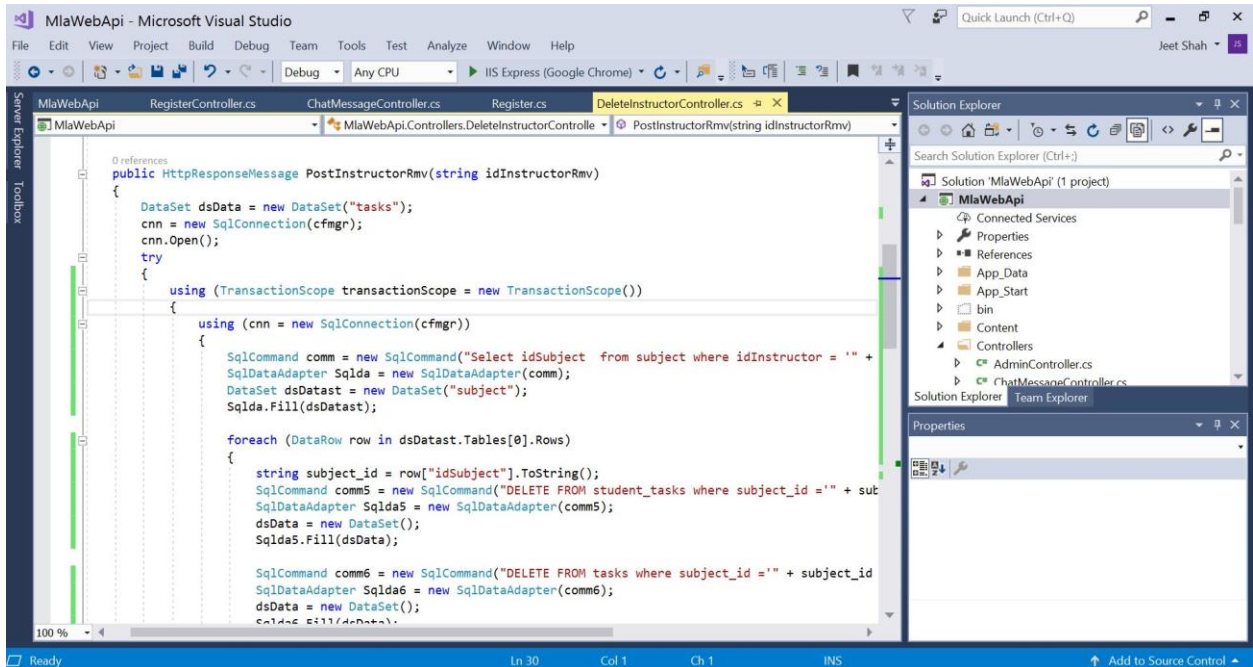
View

- View is responsible for displaying the contents of data to the end user.

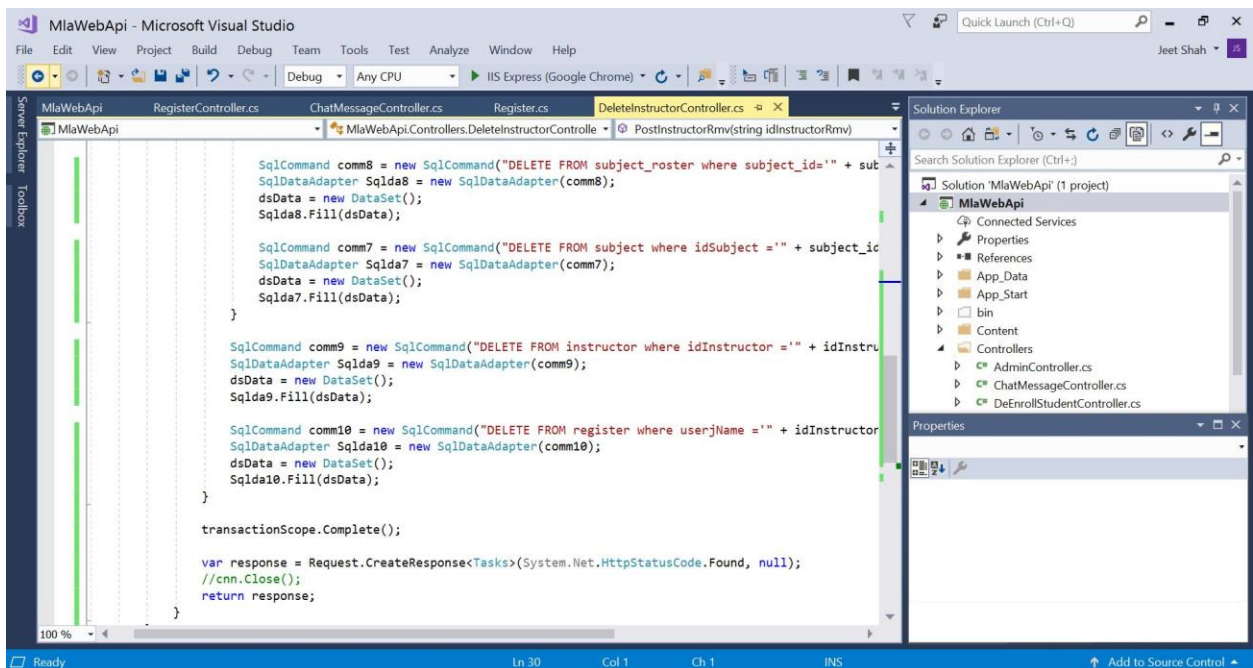
Controllers

- Controllers process incoming requests handles user input, interactions and execute appropriate application logic. They are the component which communicates with the database and determines what responses need to send back to an end user who makes a browser request.
- Implemented transaction processing in every controllers at the method level.
- The controller is discussed here such as Instructor Controller.

Instructor Controller :



- This snapshot shows I have used `TransactionScope` for removing Instructor (`PostInstructorRmv`) method.

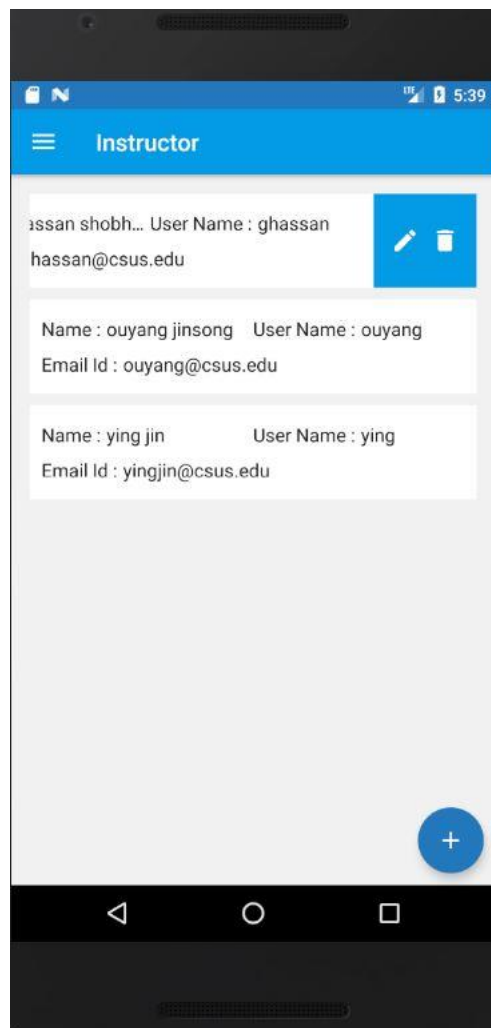


- From this snapshot we can see that I have written Incorrect Query whenever I am deleting Instructor from register table.

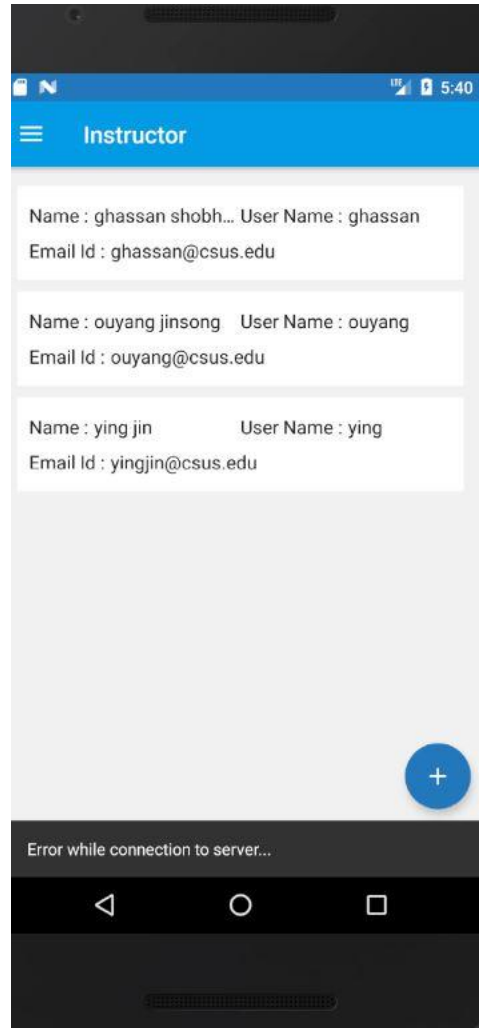
You can see that I have written userjName instead of userName. This leads to error and after that I have completed TransactionScope.

TransactionScope :

- What TransactionScope does is whenever there is error occurs while doing operation, TransactionScope.complete method Rollback the whole operation that was done or need to be done. Otherwise It will commit Transaction and will updated in database.



- Now I am trying to connect Instructor which will goes to that PostInstructorRmv method in which we have written wrong query and defined under TransactionScope.



- You can see that it is showing “Error while connection to server..” which goes to catch block of this defined method. I does not leads to Terminate the Application or Success of some other queries above wrong query. Whole PostInstructorRmv method is Rollbacked.

The screenshot displays the Microsoft SQL Server Enterprise Manager interface. The Object Explorer on the left shows the database structure. The central pane shows a SQL query executed successfully, returning three rows of data from the `Instructor` table. The Properties window on the right provides details about the connection.

Query:

```
USE [MiaDatabase]
GO

SELECT [idInstructor]
      ,[firstName]
      ,[lastName]
      ,[userId]
      ,[telephone]
      ,[address]
      ,[aliasMailId]
      ,[emailId]
      ,[skypeId]
      ,[publicKey]
FROM [dbo].[Instructor]
GO
```

Results:

	idInstructor	firstName	lastName	userId	telephone	address	aliasMailId	emailId	skypeId
1	ghassan	ghassan	shobhaki	79	9878789090	6000 J street	ghassan@csus.edu	ghassan@csus.edu	ghassan34
2	ouyang	ouyang	jinsong	78	2345678978	6000 J street	ouyang@csus.edu	ouyang@csus.edu	ouyang12
3	ying	ying	jin	80	1212343422	6000 J street	yingjin@csus.edu	yingjin@csus.edu	ying

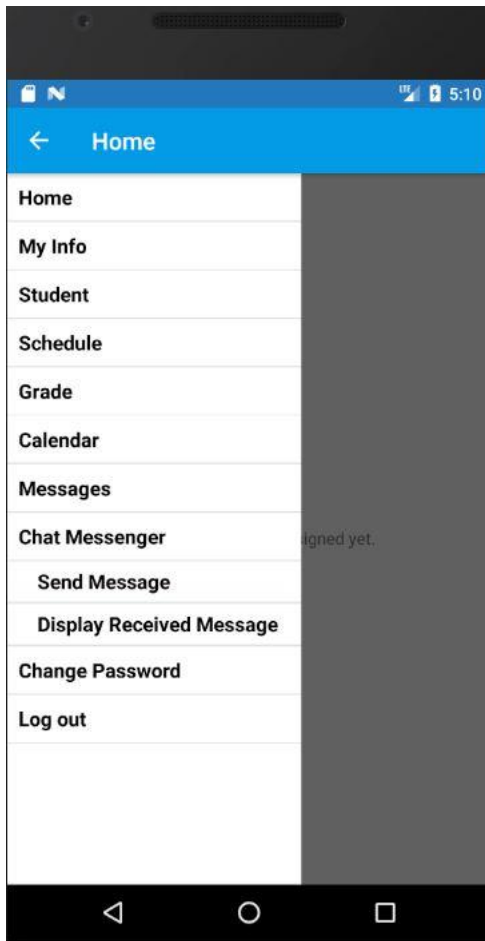
Properties - Connection Details:

- Connection name: mia...ase (JeetShah (72))
- Server name: mladatabase.cthkz3z7r...
- Display name: mladatabase.cthkz3z7r...
- Login name: JeetShah
- Server name: mladatabase.cthkz3z7r...

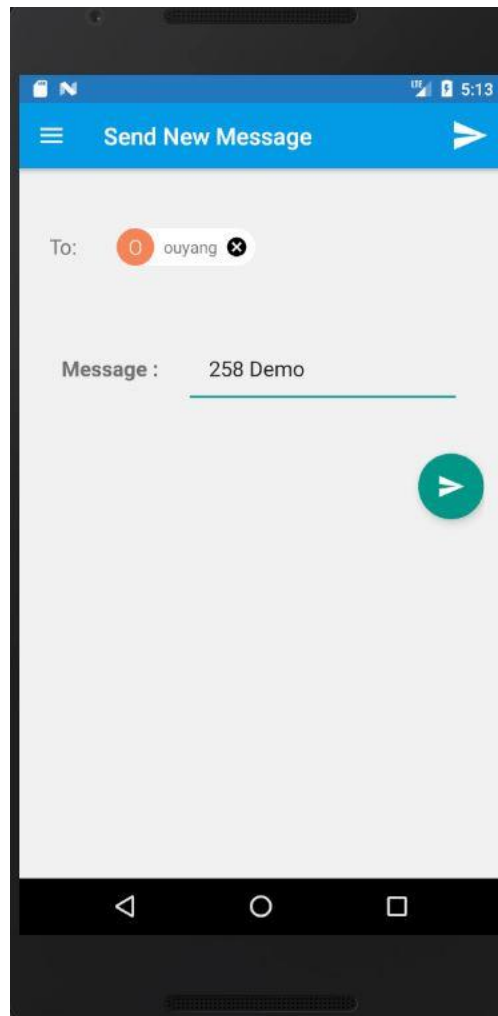
- You can see in database that Instructor was not removed from the Instructor table. However, we have written wrong query for the removing instructor for register table.
- So, It shows that whenever error occurs for certain query followed by other queries, TransactionScope rollbacks whole queries within that method.

Chat Application :-

- For Chat Application, I have add new Chat Messenger in listview for Student, Instructor and Admin as a parent. And as a Child clicking I have added Send Message & Display Receiver Message. You can see UI from below snapshot.



- Now currently, I am logged in Instrctor called Ying-Jin's account. And I want to send message so, I will click on Send Message.

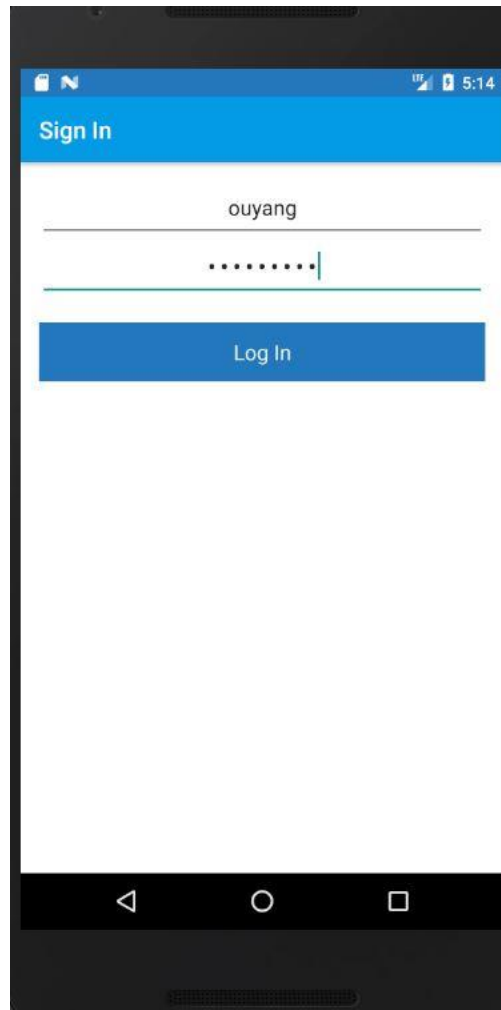


- After clicking Send Message, I want to send a message to Jinsong Ouyang. So, I will send a message like that to him. And after clicking floating button it will show “Message Sent Successfully” message.

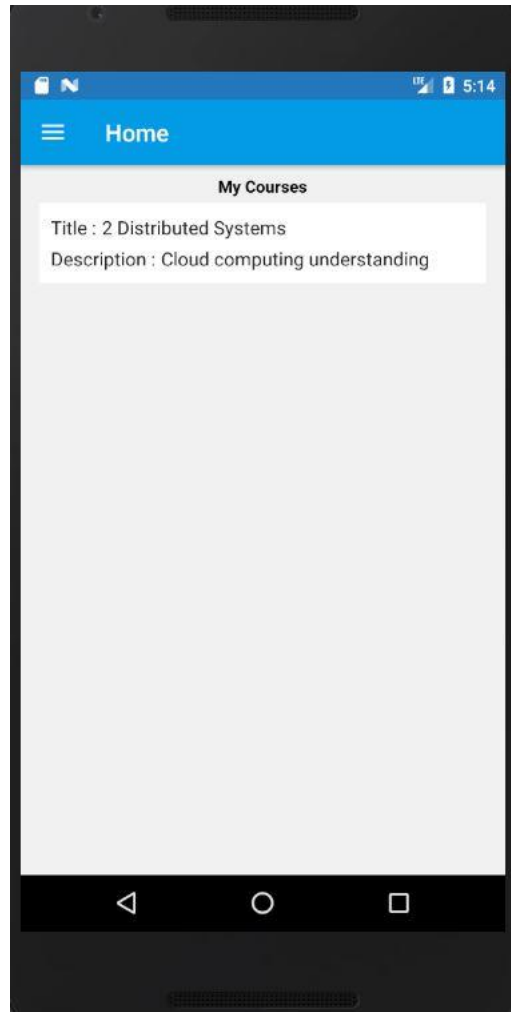
Results		Messages			
	messageId	creationDate	messageBody	toList	fromList
1	18	2019-05-09 18:59:51.000	h9WGOhn/bmQ3yMxgk7gmJ+vw5hDp3QiMd24gfm8wlp2Gha8...	johnyjoe@gmail.com	jeetshah@csus.edu
2	19	2019-05-14 05:12:57.000	Xzf9xMn5TKmbEJB4TnGuor5yIFEVDeobkuC15wZF0raZaQfTA...	ouyang@csus.edu	yingjin@csus.edu

Query executed successfully. | mladatabase.cthkz3z7rpm3.us... | JeetShah (83) | MlaDatabase | 00:00:00 | 2 rows

- Now, You can see that message I have sent to Ouyang from Ying-jin was stored in Database. But, you can't be able to see message that actually sent by Ying-Jin. Because I have Encrypted it using "RSA" algorithm.
- What does "RSA" algorithm will do is, I have assigned public key and private key whenever the user will login into their account by using "RSA" algorithm and KeyStore keypairgenerator method. And after assign public key and private key, I have stored public key of that user in Database, because Public Key can take any user wants to.
- And for Private Key, I have used "AndroidKeyStore" because Private Key is Secret and It only can be seen by User that have same Private Key. No one else can see it.
- So, You can see that whenever user send a message it will Encrypted by Public Key of user that he wants to send a message. And you will see Encrypted Message in Database.



- Now, I will Log in account of Ouyang.



- And You can see Home Screen of that User and now I will click on Display Received Message and It will shows me like that.



- So, You can see that Ying-Jin has sent a message at particular time and actual message. It's because I have Decrypted a message using Ouyang's Private Key which is stored in "AndroidKeyStore" and converted it to original message.

So, this is How I implemented Chat Application with the Encryption and Decryption of message.