

# CSCI 5408 (Winter 2017)

# Assignment 2 Tutorial

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# Agenda

- To learn concepts of Distributed Database Systems running on Clouds
- To learn load balancing and scalability on mission critical applications
- To learn fault tolerance and performance tuning using Clouds
- To learn Cassandra database system and firewall concepts on Clouds

# Centralized Database Systems

- Data stored centrally
- DBMS processes queries originating from multiple remote sites
- Easy to store, organize and manage data

# Disadvantages of Centralized Databases

- Ever growing volume of data
- Difficult to scale
- Cant effectively cope with high request traffic
- Limited fault tolerance
- Limited Data redundancy

# Distributed Databases

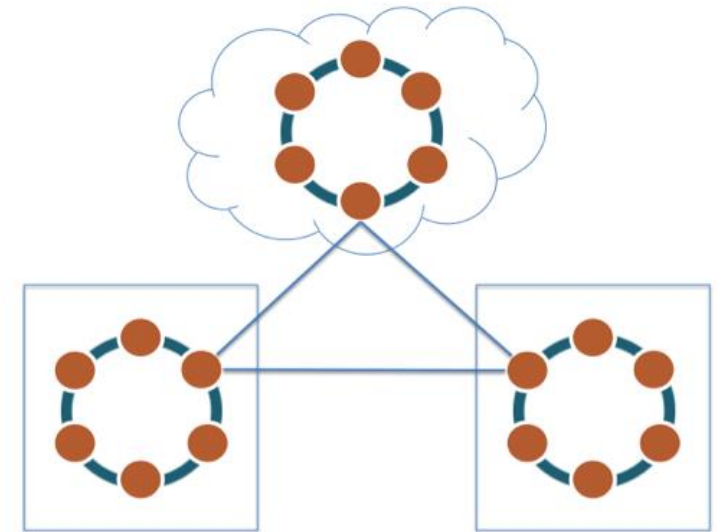
- Set of interconnected sites which host a Database system
- Communicate over a network
- Logically interrelated but physically separate systems
- Managed by Distributed DBMS
- Data split into fragments which may be replicated at multiple sites
- Increases data redundancy

# Cassandra

- Distributed and decentralized Database system
- Originated at Facebook and subsequently open sourced
- Highly Scalable with no Single Point of Failure
- Linear scalability
- Uses Cassandra Query Language similar to SQL !!

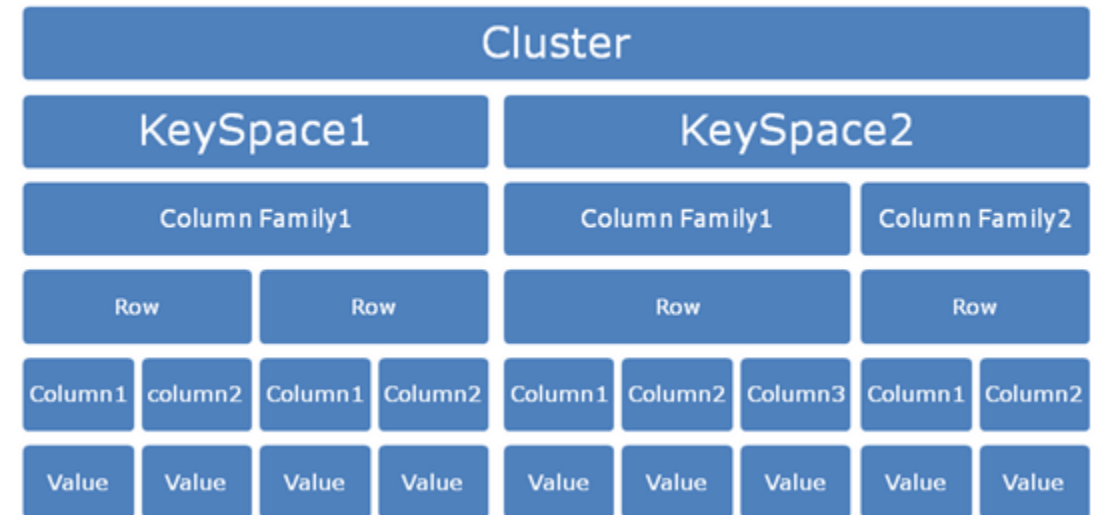
# Cassandra

- Master-less Ring architecture
- No concept of master node
- Data replicated across one or more nodes in cluster
- Nodes communicate via **Gossip** Protocol
- Cluster may encompass several datacenters
- Data distributed over several data centers



# Cassandra

- Column-family Data model
- *Keyspace*: stores several Column Families
- *Column-Family*: Container for collection of rows
- *Columns*: can be dynamically added to column families
- *Row*: a unit of replication in Cassandra
- Fetch data as an ordered key-value pair comprising (*row,column-column-value*)





# Installing Cassandra Cluster


- We are going to install a managed Cassandra cluster in Instaclustr which has a 14 day trial period
- Sign up for the free account at :  
<https://console.instaclustr.com/user/signup>

# Installing Cassandra Cluster

- Once the account is created, login and create new Cassandra Cluster

14 Day Free Trial available  
You are eligible to setup a free trial cluster! [Terms & conditions](#)


**Name:**


**Network:**  


Maximum 16,378 nodes per rack, per data centre.  
Maximum 16 data centres.


Applications


**Cassandra:**

 **cassandra**  
Apache Cassandra

 **SCYLLA**  
Scylla



**Add-ons:** ☐  **Spark**  
Apache Spark



— 

# Installing Cassandra Cluster

- Choose Data Centre

## Data Centre

Infrastructure  
Provider:

 Amazon Web Services (VPC)	Microsoft Azure	 Google Compute Engine Google Cloud Platform <small>beta</small>	<b>SOFTLAYER</b> an IBM Company Softlayer <small>beta</small>
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Region:

US West (Oregon)

Custom Name:

AWS\_VPC\_US\_WEST\_2

Node Size:

Developer

☒ **Starter — t2.small · Free Trial**  
\$20.00 / month / node · 5 GB SSD disk · 2000 MB RAM · 1 × CPU cores.

☐ **Professional — t2.medium**  
\$80.00 / month / node · 30 GB SSD disk · 4000 MB RAM · 1 × CPU cores.

Production

# Installing Cassandra Cluster

- Create Cluster

## Summary

	Item	Price
<b>Cluster</b>	3 × Developer Starter — t2.small · Free Trial · 15 GB total storage Amazon Web Services (VPC) · US West (Oregon) Apache Cassandra 3.7 (patched v2)	\$60.00
<b>Add-ons</b>		\$0.00
<b>Total Cost</b>		\$60.00 / month

**Free Trial:** This cluster will be covered by your free trial until Wednesday, December 28, 2016.

☒ I accept the Instaclustr [Terms & Conditions](#).

Create Cluster

# Installing Cassandra Cluster

- Provisioning Cassandra Cluster

<div><div></div></div>							
ID	Size	Cassandra Version	DC	Rack	Public Address	Private Address	Status
2a2bc224-8eca-4851-b7c5-bf2a53de0faa	Starter (t2.small)	Not available	AMS_VPC_US_WEST_2	us-west-2a	Not available	Not available	Provisioning
<div><div></div></div>							Provisioning: Provisioning node. 25.0% complete
<div><div></div></div>							
a8c2fdb2-8551-49f8-adb9-c676f6134cc6	Starter (t2.small)	Not available	AMS_VPC_US_WEST_2	us-west-2b	Not available	Not available	Provisioning
<div><div></div></div>							Provisioning: Provisioning node. 25.0% complete
<div><div></div></div>							
2a09946d-3d85-47ee-88c3-13ffe63bc653	Starter (t2.small)	Not available	AMS_VPC_US_WEST_2	us-west-2c	Not available	Not available	Provisioning
<div><div></div></div>							Provisioning: Provisioning node. 25.0% complete
<div><div></div></div>							

# Installing Cassandra Cluster

- Configure Firewall rules

## Firewall Rules

Cassandra Allowed  
Addresses:

```
173.212.66.193/32
0.0.0.0/0
```

IPv4 CIDR addresses, one per line.

Addresses listed here are permitted to connect to all Cassandra ports (9042-9160) in the cluster.

Addresses without a prefix are assumed to be individual hosts (i.e. `/32`).

e.g. `23.34.56.78` (host), `10.20.0.0/16` (network)

AWS Security Groups can connect to this cluster by [submitting a support request](#).

Save Cluster Settings

# Installing Cassandra Cluster

- Node Addresses

[Details](#) [Monitoring ▾](#) [Settings](#) [Connection Info](#) [Add ▾](#) [Delete...](#)

## Cassandra

### Node Addresses (Per Data Centre)


Provide one or more node addresses to your Cassandra client to connect to your cluster.

AWS\_VPC\_US\_WEST\_2 US West (Oregon) · Amazon Web Services (VPC)

<b>Name:</b>	<input type="text" value="AWS_VPC_US_WEST_2"/>
	Use this name when identifying this Data Centre within Cassandra. For example, as a parameter to <code>NetworkTopologyStrategy</code> when <a href="#">creating a keyspace</a> .
<b>Public:</b>	<input type="text" value='"35.162.248.3", "35.166.91.213", "35.166.56.174"'/>
	Node addresses accessible from outside the Data Centre. Ensure your client's IP address is added to the <a href="#">cluster firewall</a> .
<b>Private:</b>	<input type="text" value='"10.224.43.246", "10.224.111.114", "10.224.147.196"'/>
	Node addresses accessible from <i>within</i> the Data Centre.
<b>Cassandra Client Encryption:</b>	Disabled
<b>Password Auth:</b>	Enabled
	Clients will need to provide credentials to connect.
<b>User Authz:</b>	Enabled
	Client actions are restricted by permissions granted by superusers.

# Installing Cassandra Cluster

- Credentials for authentication

 **Default Credentials for Password Authentication**

This cluster has one or more data centres with Password Authentication enabled. Clients must provide credentials to connect.

The *default* superuser credentials are:

Username: `icassandra`  
Password: `7394ca84ceceb1d3595a49f23a0a6670`

For additional security, confirm that you have recorded the default password for the `icassandra` user, to **remove** it from our records.

[Remove Stored Password](#)

It is *highly recommended* that as part of configuring your cluster you:

- Change the password for the `icassandra` user to something other than `7394ca84ceceb1d3595a49f23a0a6670`.
- Create a *non-superuser* account for your client.

Refer to the [Apache](#) or [Datastax](#) CQL reference documentation for details on how to change passwords and add additional users.

Refer to the client driver documentation and the examples below for details on how to provide credentials when establishing a connection.

**IMPORTANT**  
If you drop the `icassandra` user without clicking the "Remove Stored Password" button, we may re-create it. This password will be automatically removed from our management system, 5 days after cluster provisioning.



# Installing Cassandra Cluster

- Cluster builder and connection strings

[cqlsh](#) [Java](#) [Python](#) [Ruby](#) [Other](#)

For more information on connecting to Cassandra with the DataStax Cassandra Driver for Java refer to:

- [DataStax Java Driver for Apache Cassandra \(GitHub\)](#)
- [DataStax Java Driver for Apache Cassandra - 3.0 API\(JavaDoc\)](#)
- [Java Driver 3.0 for Apache Cassandra \(Reference Manual\)](#)

```
final Cluster.Builder clusterBuilder = Cluster.builder()
    .addContactPoints(
        "35.162.248.3", "35.166.91.213", "35.166.56.174" // AWS_VPC_US_WEST_2 (Amazon Web Services (VPC))
    )
    .withLoadBalancingPolicy(DCAwareRoundRobinPolicy.builder().withLocalDc("AWS_VPC_US_WEST_2").build()) // your local data centre
    .withPort(9042)
    .withAuthProvider(new PlainTextAuthProvider("icassandra", "7394ca84ceceb1d3595a49f23a0a6670"));

try (final Cluster cluster = clusterBuilder.build()) {
    final Metadata metadata = cluster.getMetadata();
    System.out.printf("Connected to cluster: %s\n", metadata.getClusterName());

    for (final Host host: metadata.getAllHosts()) {
        System.out.printf("Datacenter: %s; Host: %s; Rack: %s\n", host.getDatacenter(), host.getAddress(), host.getRack());
    }
}
```

# Connecting to Cassandra

- CQLSH utility to connect to Cassandra and upload data comes as part of Cassandra distribution
- The Cassandra distribution can be downloaded from <http://cassandra.apache.org/download/>
- The command to connect to Cassandra via CQLSH is
  - `cqlsh public_ip_of_your_node 9042 -u your_username -p your_password`

```
C:\Program Files\DataStax-DDC\apache-cassandra\bin>cqlsh.bat 35.162.248.3 9042 -u iccassandra -p 7394ca84ceceb1d3595a49f23a0a6670

WARNING: console codepage must be set to cp65001 to support utf-8 encoding on Windows platforms.
If you experience encoding problems, change your console codepage with 'chcp 65001' before starting cqlsh.

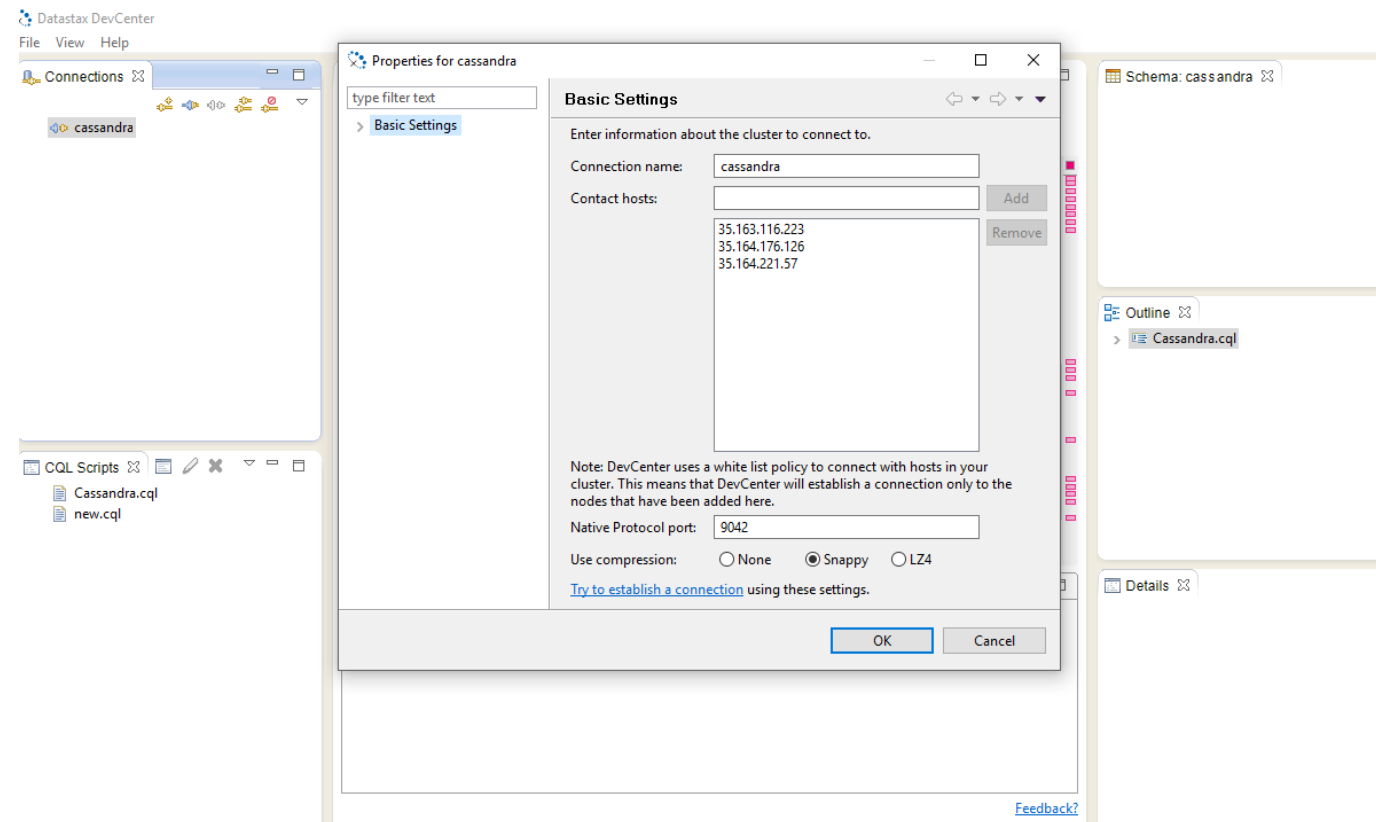
Connected to myCluster at 35.162.248.3:9042.
[cqlsh 5.0.1 | Cassandra 3.7.2 | CQL spec 3.4.2 | Native protocol v4]
Use HELP for help.
WARNING: pyreadline dependency missing. Install to enable tab completion.
iccassandra@cqlsh> select * from iccassandra;
```

# Querying Cassandra

- Cassandra Cluster can be queried from CQLSH.
- Alternatively, DataStax DevCenter is a graphical UI to query Cassandra
- It can be downloaded from:  
<https://www.datastax.com/products/datastax-devcenter-and-development-tools#DataStax-DevCenter>
- You can use either CQLSH or DevCenter to create your keyspace, table and try out your queries and learn.

# Querying Cassandra

- Create a connection to your Cassandra Instance in DataStax DevCenter
- Provide the login credentials and Public IP address



# Loading Data

- Once the key space and table is defined, import the Philadelphia crime data CSV file to Cassandra
- You may have to perform data cleaning and preprocessing
- Bulk copy from CQLSH : `cqlsh> copy <keyspace>.<table> from <Directory>/<filename>.csv with delimiter='';`

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Dc Dist	Psa	Dispatch_Date_Tin	Dispatch_Date	Dispatch_Hour	Dc_Key	Location	UCR_Gen	Text_Gen	Police_Dis	Month	Lon	Lat	
2	18	3	2009-10-02 14:24	2009-10-02	14:24:00	14	2.01E+11 S 38TH ST	800	Other Assaults		Oct-09			
3	14	1	2009-05-10 0:55	2009-05-10	0:55:00	0	2.01E+11 8500 BLOC	2600	All Other Offenses		May-09			
4	25 J		2009-08-07 15:40	2009-08-07	15:40:00	15	2.01E+11 6TH CAME	800	Other Assaults		Aug-09			
5	35 D		2009-07-19 1:09	2009-07-19	1:09:00	1	2.01E+11 5500 BLOC	1500	Weapon V	20	Jul-09	-75.1305	40.03639	
6	9 R		2009-06-25 0:14	2009-06-25	0:14:00	0	2.01E+11 1800 BLOC	2600	All Other i	8	Jun-09	-75.1664	39.96953	
7	17	1	2015-04-25 12:50	2015-04-25	12:50:00	12	2.02E+11 800 BLOC	600	Thefts	13	Apr-15	-75.1664	39.94007	
8	23 K		2009-02-10 14:33	2009-02-10	14:33:00	14	2.01E+11 2200 BLOC	800	Other Ass	16	Feb-09	-75.1711	39.97959	
9	77 A		2009-04-02 18:30	2009-04-02	18:30:00	18	2.01E+11 TERMINAL	500	Burglary Non-Reside		Apr-09			
10	35 D		2009-03-18 1:14	2009-03-18	1:14:00	1	2.01E+11 N 5TH SOM	2600	All Other Offenses		Mar-09			
11	23 L		2009-06-14 20:30	2009-06-14	20:30:00	20	2.01E+11 N 2828 W	2600	All Other Offenses		Jun-09			
12	22 P		2009-01-19 16:44	2009-01-19	16:44:00	16	2.01E+11 N 2800 ST	400	Aggravated Assault f		Jan-09			
13	1 J		2009-02-09 22:52	2009-02-09	22:52:00	22	2.01E+11 2700 BLOC	800	Other Assaults		Feb-09			
14	22	3	2015-10-06 18:18	2015-10-06	18:18:00	18	2.02E+11 1500 BLOC	600	Thefts	16	Oct-15	-75.1602	39.97613	
15	22	3	2015-10-09 0:49	2015-10-09	0:49:00	0	2.02E+11 1500 BLOC	600	Thefts	16	Oct-15	-75.1631	39.97787	
16	77 A		2015-05-03 20:39	2015-05-03	20:39:00	20	2.02E+11 GATE C-18	600	Thefts		May-15			
17	2	1	2015-11-30 8:39	2015-11-30	8:39:00	8	2.02E+11 6500 BLOC	600	Thefts	2	Nov-15	-75.0756	40.04127	

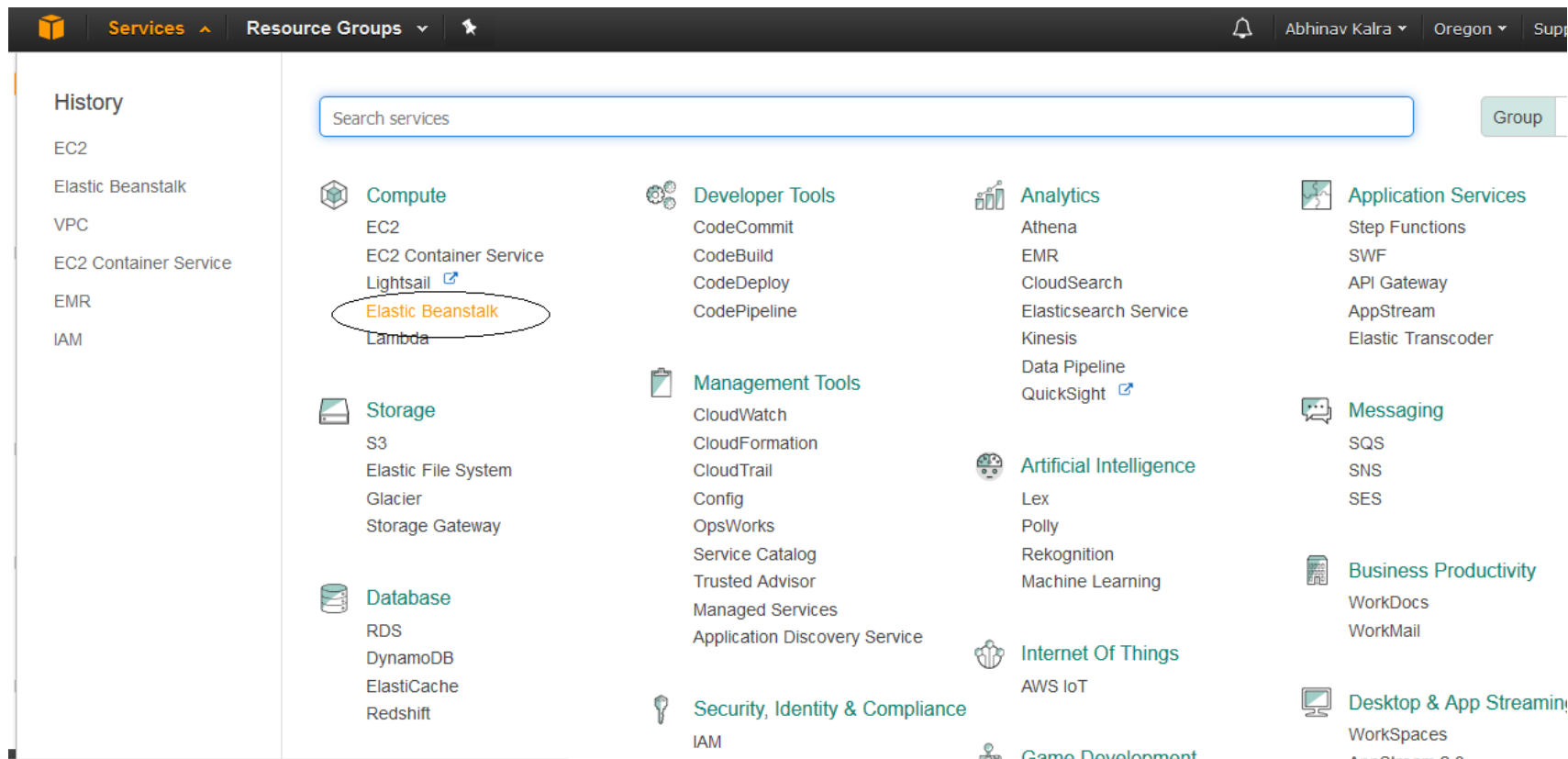
- Please refer to below two tutorials for bulk insertion of data:
  - <http://code-mix.blogspot.ca/2013/08/import-data-from-csv-file-to-cassandra.html>
  - <http://prashantguptaimpetus.blogspot.ca/2013/02/bulk-insert-in-cassandra.html>

# Query Data

- Cassandra uses Cassandra Query Language to query data
- The reference to CQL is available at:
  - [https://cassandra.apache.org/doc/latest/getting\\_started/index.html](https://cassandra.apache.org/doc/latest/getting_started/index.html)
  - [http://docs.datastax.com/en/cql/3.1/cql/cql\\_intro\\_c.html](http://docs.datastax.com/en/cql/3.1/cql/cql_intro_c.html)
- For the UI application, drivers for Cassandra can be downloaded from Datastax or from link below:
  - [http://cassandra.apache.org/doc/latest/getting\\_started/drivers.html](http://cassandra.apache.org/doc/latest/getting_started/drivers.html)
  - <http://docs.datastax.com/en/developer/driver-matrix/doc/common/driverMatrix.html>

# Deploying Web Service

- Deploy your web service on AWS through Elastic Beanstalk



# Deploying Web Service



## Create a web app

Create a new application and environment with a sample application or your own code. By creating an environment, you allow AWS Elastic Beanstalk to manage AWS resources and permissions on your behalf. [Learn more](#)

Application name

Up to 100 Unicode characters, not including forward slash (/).

Tier

Web Server ([Choose tier](#))

Platform

Tomcat

Choose [Configure more options](#) for more platform configuration options.

Application code

☐ Sample application

Get started right away with sample code.

☒ Upload your code

Upload your .war file

Upload a source bundle from your computer or copy one from Amazon S3.

Upload

casswebserv-1

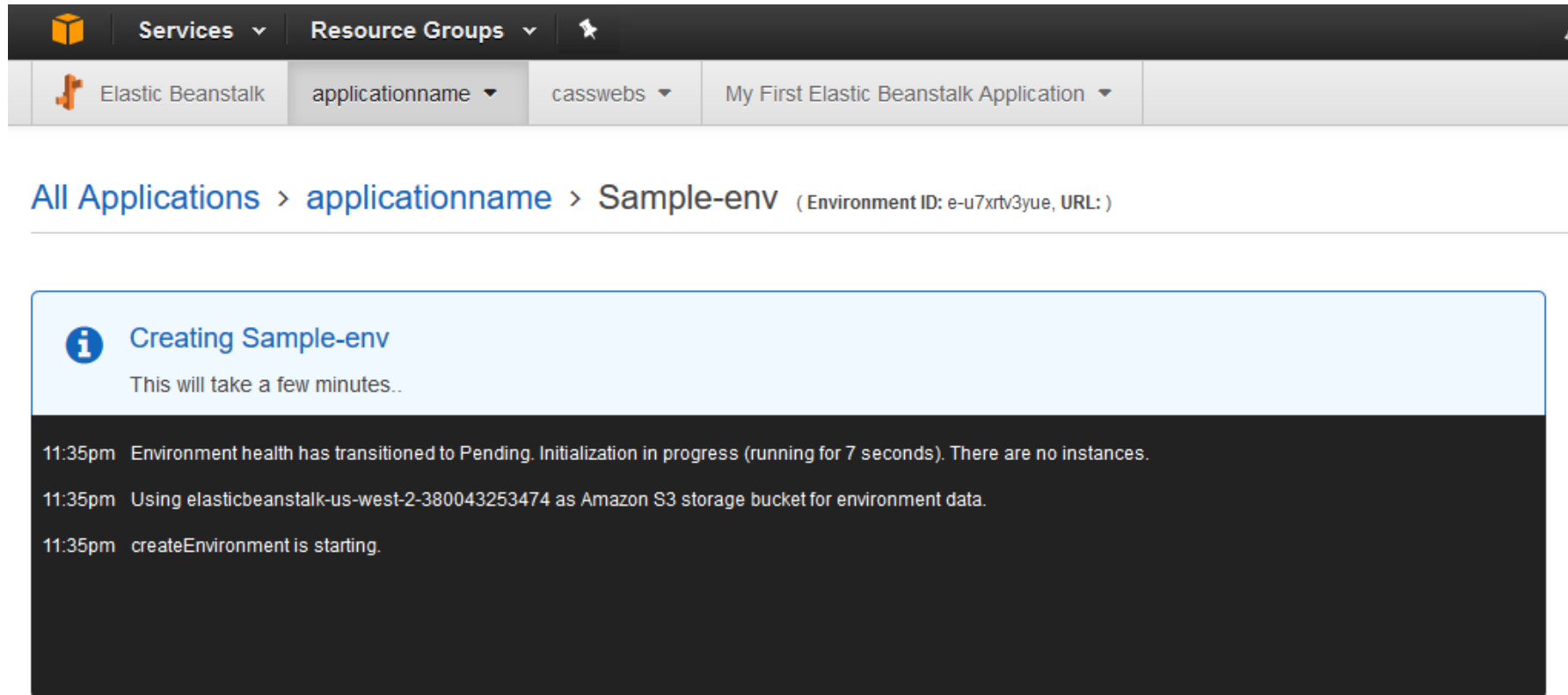
[Cancel](#)

[Configure more options](#)

[Create application](#)



# Deploying Web App



The screenshot displays the AWS Elastic Beanstalk console interface. At the top, there is a navigation bar with tabs for 'Services', 'Resource Groups', and a star icon. Below this, a breadcrumb trail shows 'Elastic Beanstalk' followed by 'applicationname', 'casswebs', and 'My First Elastic Beanstalk Application'. The main content area shows the path 'All Applications > applicationname > Sample-env' with the environment ID 'e-u7xrtv3yue' and its URL. A light blue notification box titled 'Creating Sample-env' indicates that the process will take a few minutes. Below this, a log of events shows the environment health transitioning to 'Pending', the use of an Amazon S3 bucket for data, and the start of the 'createEnvironment' process at 11:35pm.

Services ▾ Resource Groups ▾ ★

Elastic Beanstalk applicationname ▾ casswebs ▾ My First Elastic Beanstalk Application ▾

[All Applications](#) > [applicationname](#) > [Sample-env](#) (Environment ID: e-u7xrtv3yue, URL: )

**i** Creating Sample-env  
This will take a few minutes..

11:35pm Environment health has transitioned to Pending. Initialization in progress (running for 7 seconds). There are no instances.

11:35pm Using elasticbeanstalk-us-west-2-380043253474 as Amazon S3 storage bucket for environment data.

11:35pm createEnvironment is starting.

# Deploying Web App

Services ▾

Resource Groups ▾

Abhinav Kalra ▾

Oregon ▾

Support ▾

Elastic Beanstalk

applicationname ▾

casswebs ▾

My First Elastic Beanstalk Application ▾

Create New Application

All Applications > applicationname > Sample-env ( Environment ID: e-u7xrtv3yue URL: Sample-env.6ivx7njmfv.us-west-2.elasticbeanstalk.com )

Actions ▾

Dashboard

Configuration

Logs

Health

Monitoring

Alarms

Managed Updates <sup>NEW</sup>


Events

Tags

Overview

your web service DNS path : DNS/webservicepath

Refresh



Health


Ok

Causes

Running Version

casswebserv-1

Upload and Deploy



Configuration

64bit Amazon Linux 2016.09  
v2.5.0 running Tomcat 8 Java 8

Change

to update your application .war file

Show All

Recent Events

Time	Type	Details
2016-12-24 23:38:56 UTC-0400	INFO	Environment health has transitioned from Pending to Ok. Initialization completed 53 seconds ago and took 2 minutes.
2016-12-24 23:38:37 UTC-0400	INFO	Successfully launched environment: Sample-env

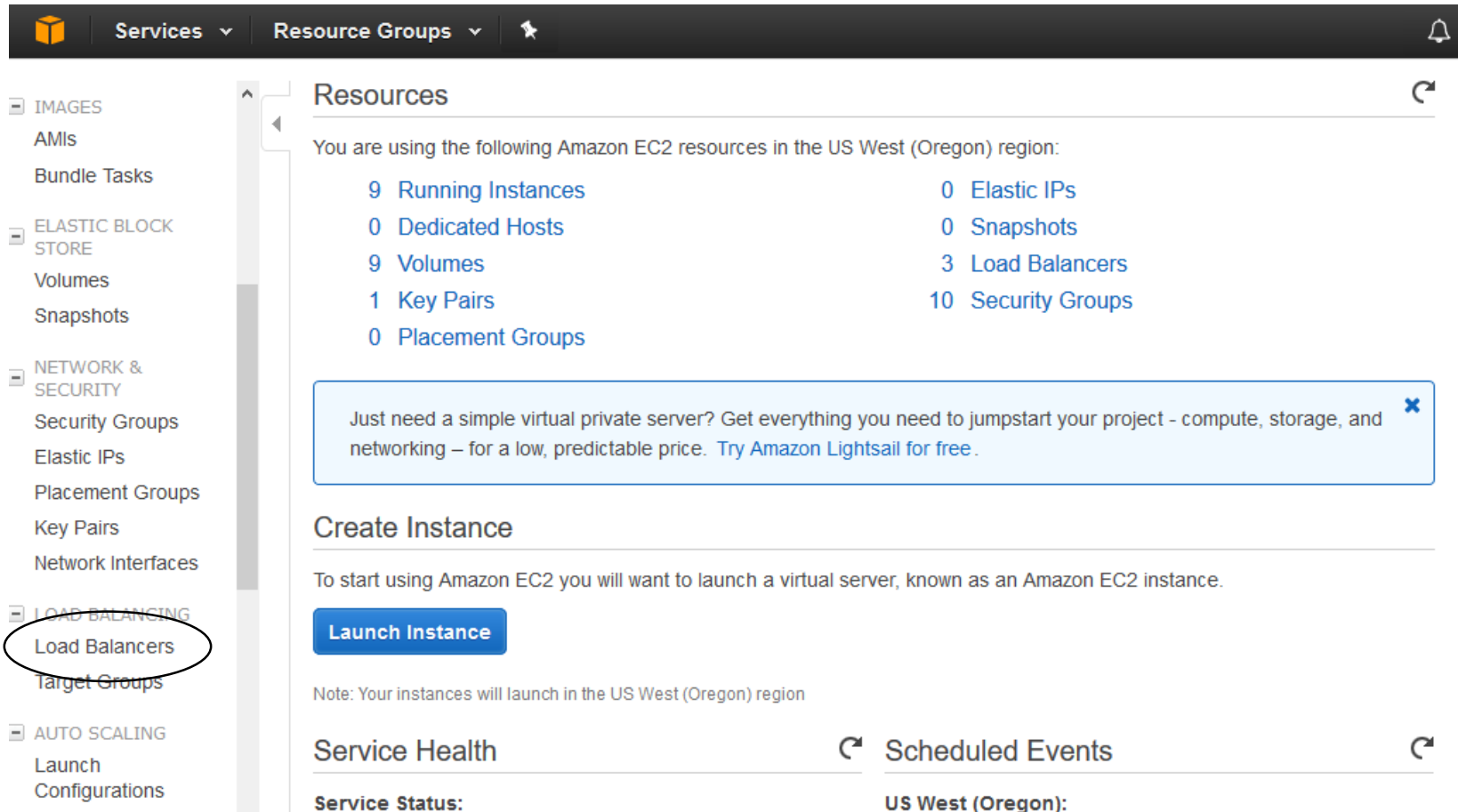
# Deploying Web App

- Alternately, the .war file can be copied to the Tomcat server's *webapps* directory on your EC2 instance.
- For this, you should create a Free tier EC2 instance and install JRE and Tomcat7 on it.

```
ubuntu@ip-172-31-24-201: /var/lib/tomcat7/webapps
ubuntu@ip-172-31-24-201:/var/lib/tomcat7$ ls
common  conf  logs  server  shared  webapps  work
ubuntu@ip-172-31-24-201:/var/lib/tomcat7$ cd webapps
ubuntu@ip-172-31-24-201:/var/lib/tomcat7/webapps$ ls
casswebservice  casswebservice.war  NewWebServices  NewWebServices.war  ROOT
ubuntu@ip-172-31-24-201:/var/lib/tomcat7/webapps$
```

# Creating Load Balancer on AWS

\* Load Balancer service incurs a small charge



The screenshot shows the AWS Management Console interface. The top navigation bar includes 'Services', 'Resource Groups', and a search icon. The left sidebar lists various AWS services, with 'LOAD BALANCING' expanded and 'Load Balancers' circled. The main content area is titled 'Resources' and shows a summary of EC2 resources in the US West (Oregon) region. A blue box contains a promotional message for Amazon Lightsail. Below this is the 'Create Instance' section, which includes a 'Launch Instance' button and a note about the region. At the bottom, there are sections for 'Service Health' and 'Scheduled Events'.

**Resources**

You are using the following Amazon EC2 resources in the US West (Oregon) region:

9 Running Instances	0 Elastic IPs
0 Dedicated Hosts	0 Snapshots
9 Volumes	3 Load Balancers
1 Key Pairs	10 Security Groups
0 Placement Groups	

Just need a simple virtual private server? Get everything you need to jumpstart your project - compute, storage, and networking – for a low, predictable price. [Try Amazon Lightsail for free.](#)

**Create Instance**

To start using Amazon EC2 you will want to launch a virtual server, known as an Amazon EC2 instance.

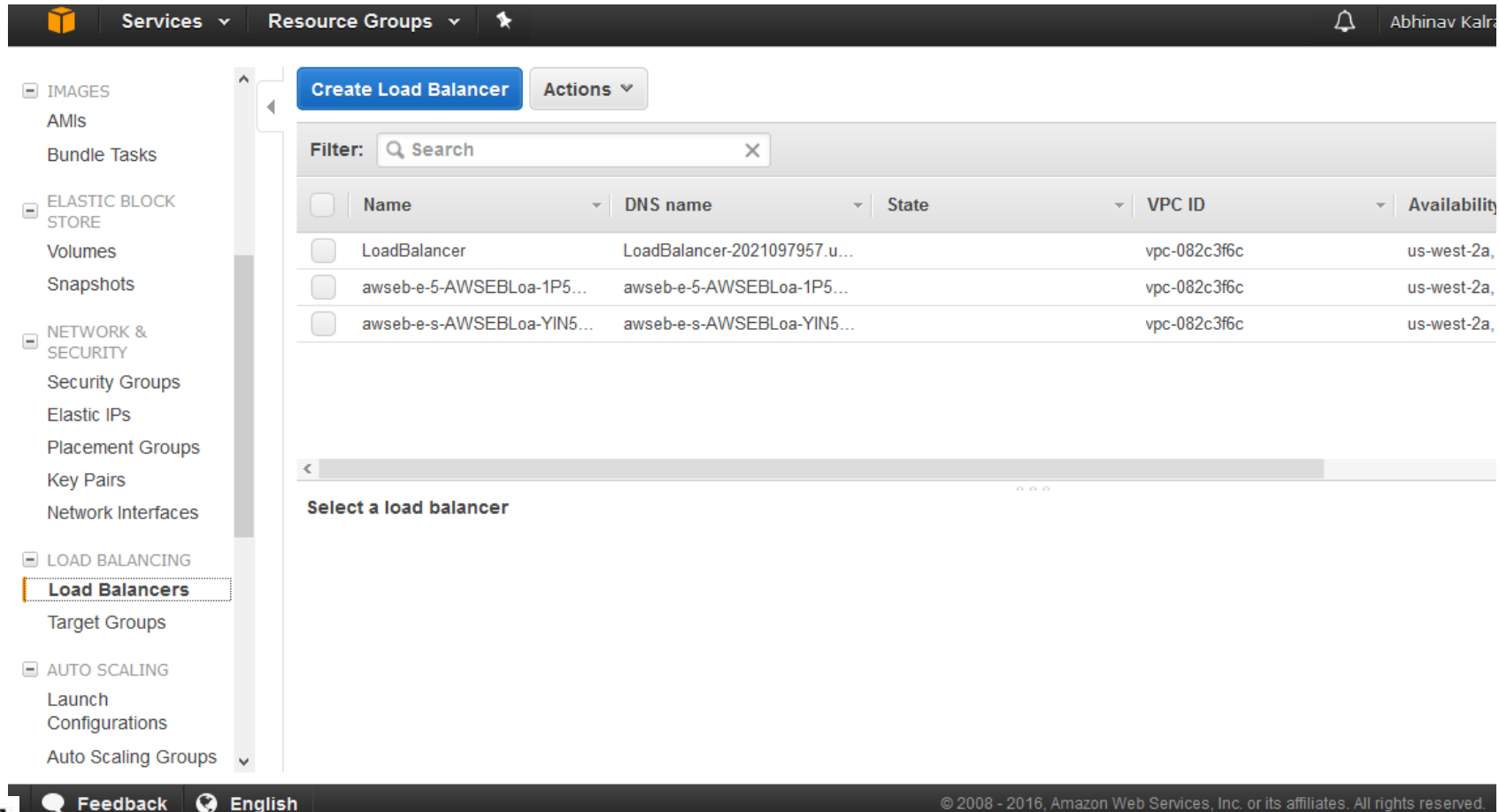
[Launch Instance](#)

Note: Your instances will launch in the US West (Oregon) region

**Service Health** **Scheduled Events**

**Service Status:** **US West (Oregon):**

# Creating Load Balancer on AWS





The screenshot displays the AWS Management Console interface for creating a new load balancer. The top navigation bar includes 'Services', 'Resource Groups', and a user profile 'Abhinav Kalra'. The left sidebar shows the navigation menu with 'Load Balancers' selected under the 'LOAD BALANCING' category. The main content area features a 'Create Load Balancer' button and an 'Actions' dropdown. Below this is a search filter and a table of existing load balancers.

<input type="checkbox"/>	Name	DNS name	State	VPC ID	Availability
<input type="checkbox"/>	LoadBalancer	LoadBalancer-2021097957.u...		vpc-082c3f6c	us-west-2a,
<input type="checkbox"/>	awseb-e-5-AWSEBLoa-1P5...	awseb-e-5-AWSEBLoa-1P5...		vpc-082c3f6c	us-west-2a,
<input type="checkbox"/>	awseb-e-s-AWSEBLoa-YIN5...	awseb-e-s-AWSEBLoa-YIN5...		vpc-082c3f6c	us-west-2a,

Below the table, there is a 'Select a load balancer' section with a horizontal scrollbar and three dots indicating more options.

# Creating Load Balancer on AWS

 Services ▾ Resource Groups ▾ 

Abhinav Kalra ▾ Oregon ▾ Support ▾

## Welcome to Elastic Load Balancing

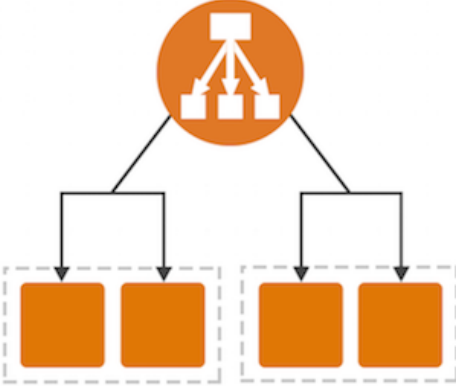
### Select load balancer type

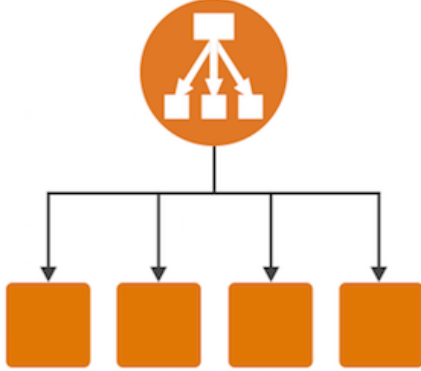
Elastic Load Balancing supports two types of load balancers: Application Load Balancers (new) and Classic Load Balancers. Choose the load balancer type that meets your needs. [Learn more.](#)

☐ Application Load Balancer

☒ Classic Load Balancer

☒ Preferred for HTTP/HTTPS





Cancel Continue

# Creating Load Balancer on AWS

1. Define Load Balancer   2. Assign Security Groups   3. Configure Security Settings   4. Configure Health Check   5. Add EC2 Instances   6. Add Tags   7. Review

## Step 1: Define Load Balancer

### Basic Configuration

This wizard will walk you through setting up a new load balancer. Begin by giving your new load balancer a unique name so that you can identify it from other load balancers you might create. You will also need to configure ports and protocols for your load balancer. Traffic from your clients can be routed from any load balancer port to any port on your EC2 instances. By default, we've configured your load balancer with a standard web server on port 80.

Load Balancer name:

Create LB Inside:

Create an internal load balancer: ☐ [\(what's this?\)](#)

Enable advanced VPC configuration: ☐

#### Listener Configuration:

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

Add

[Cancel](#)

[Next: Assign Security Groups](#)

# Creating Load Balancer on AWS

[1. Define Load Balancer](#) [2. Assign Security Groups](#) [3. Configure Security Settings](#) **[4. Configure Health Check](#)** [5. Add EC2 Instances](#) [6. Add Tags](#) [7. Review](#)

## Step 4: Configure Health Check

Your load balancer will automatically perform health checks on your EC2 instances and only route traffic to instances that pass the health check. If an instance fails the health check, it is automatically removed from the load balancer. Customize the health check to meet your specific needs.

Ping Protocol	<input type="text" value="HTTP"/>
Ping Port	<input type="text" value="8080"/>
Ping Path	<input type="text" value="/"/>

### Advanced Details

Response Timeout	<input type="text" value="5"/>	seconds
Interval	<input type="text" value="30"/>	seconds
Unhealthy threshold	<input type="text" value="2"/>	
Healthy threshold	<input type="text" value="10"/>	



[Cancel](#)

[Previous](#)

[Next: Add EC2 Instances](#)



# Creating Load Balancer on AWS

 Services ▾ Resource Groups ▾ 

Abhinav Kalra ▾ Oregon ▾ Support ▾

1. Define Load Balancer

2. Assign Security Groups

3. Configure Security Settings

4. Configure Health Check

5. Add EC2 Instances

6. Add Tags

7. Review

## Step 5: Add EC2 Instances

The table below lists all your running EC2 Instances. Check the boxes in the Select column to add those instances to this load balancer.

VPC vpc-082c3f6c (172.31.0.0/16)

Select instances

<input checked="" type="checkbox"/>	i-0f7f9689e... Default-Environment	running	awseb-e-52q42q6wsq-stack-AWSEBSecurityGroup-1...	us-west-2b	subnet-8ff9c2eb	172.31.16.0/20
<input type="checkbox"/>	i-0dd73efe2...	running	ElasticMapReduce-slave	us-west-2a	subnet-a7b1e3d1	172.31.32.0/20
<input type="checkbox"/>	i-0d179138...	running	ElasticMapReduce-slave	us-west-2a	subnet-a7b1e3d1	172.31.32.0/20
<input type="checkbox"/>	i-0162db3f6...	running	ElasticMapReduce-slave	us-west-2a	subnet-a7b1e3d1	172.31.32.0/20
<input type="checkbox"/>	i-048b7354...	running	ElasticMapReduce-slave	us-west-2a	subnet-a7b1e3d1	172.31.32.0/20
<input type="checkbox"/>	i-031adc6d...	running	launch-wizard-3	us-west-2b	subnet-8ff9c2eb	172.31.16.0/20
<input type="checkbox"/>	i-0df99bd2d...	running	ElasticMapReduce-master	us-west-2a	subnet-a7b1e3d1	172.31.32.0/20
<input checked="" type="checkbox"/>	i-0b98219b... casswebs-env	running	awseb-e-sbcgez3fhn-stack-AWSEBSecurityGroup-SQ...	us-west-2c	subnet-3a960162	172.31.0.0/20



**Availability Zone Distribution**

1 instance in us-west-2b  
1 instance in us-west-2c

☒ Enable Cross-Zone Load Balancing ⓘ

Cancel Previous Next: Add Tags

# Creating Load Balancer on AWS

 Services ▾ Resource Groups ▾ 

Abhinav Kalra ▾ Oregon ▾ Support ▾

[1. Define Load Balancer](#) [2. Assign Security Groups](#) [3. Configure Security Settings](#) [4. Configure Health Check](#) [5. Add EC2 Instances](#) **[6. Add Tags](#)** [7. Review](#)

## Step 6: Add Tags

Apply tags to your resources to help organize and identify them.

A tag consists of a case-sensitive key-value pair. For example, you could define a tag with key = Name and value = Webserver. [Learn more](#) about tagging your Amazon EC2 resources.

Key	Value
<input type="text" value="abhiDAL"/>	<input type="text" value="abhinav"/>

Create Tag

[Cancel](#) [Previous](#) [Review and Create](#)

# Creating Load Balancer on AWS

The screenshot displays the AWS Management Console interface for configuring a load balancer. The left-hand navigation pane shows the 'LOAD BALANCING' section expanded, with 'Load Balancers' selected. The main content area shows the configuration for a Classic Load Balancer named 'awseb-e-5-AWSEBLoa-1P5KMUQEC2VXF'. The 'Instances' tab is active, showing a table of instances currently associated with the load balancer. Two instances are listed, both with a status of 'InService'. The 'Status' column in the instance table is circled in black. The top navigation bar includes the AWS logo, 'Services', 'Resource Groups', and user information.

**Services** ▾ **Resource Groups** ▾ Abhinav Kalra ▾ Oregon ▾ Support ▾

**Create Load Balancer** **Actions** ▾

Filter:

<input type="checkbox"/>	Name	DNS name	State	VPC ID	Availability Zones	Type
<input checked="" type="checkbox"/>	awseb-e-5-AWSEBLoa-1P5...	awseb-e-5-AWSEBLoa-1P5...		vpc-082c3f6c	us-west-2a, us-west-2b...	classic
<input type="checkbox"/>	awseb-e-s-AWSEBLoa-YIN5...	awseb-e-s-AWSEBLoa-YIN5...		vpc-082c3f6c	us-west-2a, us-west-2b...	classic
<input type="checkbox"/>	casslb	casslb-1744581709.us-west-...		vpc-082c3f6c	us-west-2a, us-west-2b...	classic

Load balancer: **awseb-e-5-AWSEBLoa-1P5KMUQEC2VXF**

**Description** **Instances** **Health Check** **Listeners** **Monitoring** **Tags**

**Connection Draining:** Disabled ([Edit](#))

**Edit Instances**

Instance ID	Name	Availability Zone	Status	Actions
<a href="#">i-0f7f9689e845280f8</a>	Default-Environment	us-west-2b	InService	<a href="#">Remove from Load Balancer</a>
<a href="#">i-0b98219bd3c9a8049</a>	casswebs-env	us-west-2c	InService	<a href="#">Remove from Load Balancer</a>

# Creating Load Balancer on AWS

Limits

INSTANCES

INSTANCES

Spot Requests

Reserved Instances

Scheduled Instances

Dedicated Hosts

IMAGES

AMIs

Bundle Tasks

ELASTIC BLOCK STORE

Volumes

Snapshots

NETWORK & SECURITY

Security Groups

Elastic IPs

Placement Groups

Key Pairs

Create Load Balancer

Actions

Filter: Search

1 to 1 of 1

	Name	DNS name	State	VPC ID	Availability Zones	Type
<input checked="" type="checkbox"/>	loadbalancer	loadbalancer-352662065.us-...		vpc-082c3f6c	us-west-2a, us-west-2b...	classic

Load balancer: loadbalancer

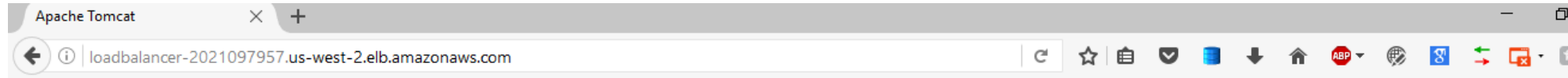
DescriptionInstancesHealth CheckListenersMonitoringTags

The following listeners are currently configured for this load balancer:

Load Balancer Protocol	Load Balancer Port	Instance Protocol	Instance Port	Cipher	SSL Certificate
HTTP	80	HTTP	8080	N/A	N/A

Edit

# Load Balancer



## It works !

If you're seeing this page via a web browser, it means you've setup Tomcat successfully. Congratulations!

This is the default Tomcat home page. It can be found on the local filesystem at: `/var/lib/tomcat7/webapps/ROOT/index.html`

Tomcat7 veterans might be pleased to learn that this system instance of Tomcat is installed with `CATALINA_HOME` in `/usr/share/tomcat7` and `CATALINA_BASE` in `/var/lib/tomcat7`, following the rules `/usr/share/doc/tomcat7-common/RUNNING.txt.gz`.

You might consider installing the following packages, if you haven't already done so:

**tomcat7-docs:** This package installs a web application that allows to browse the Tomcat 7 documentation locally. Once installed, you can access it by clicking [here](#).

**tomcat7-examples:** This package installs a web application that allows to access the Tomcat 7 Servlet and JSP examples. Once installed, you can access it by clicking [here](#).

**tomcat7-admin:** This package installs two web applications that can help managing this Tomcat instance. Once installed, you can access the [manager webapp](#) and the [host-manager webapp](#).

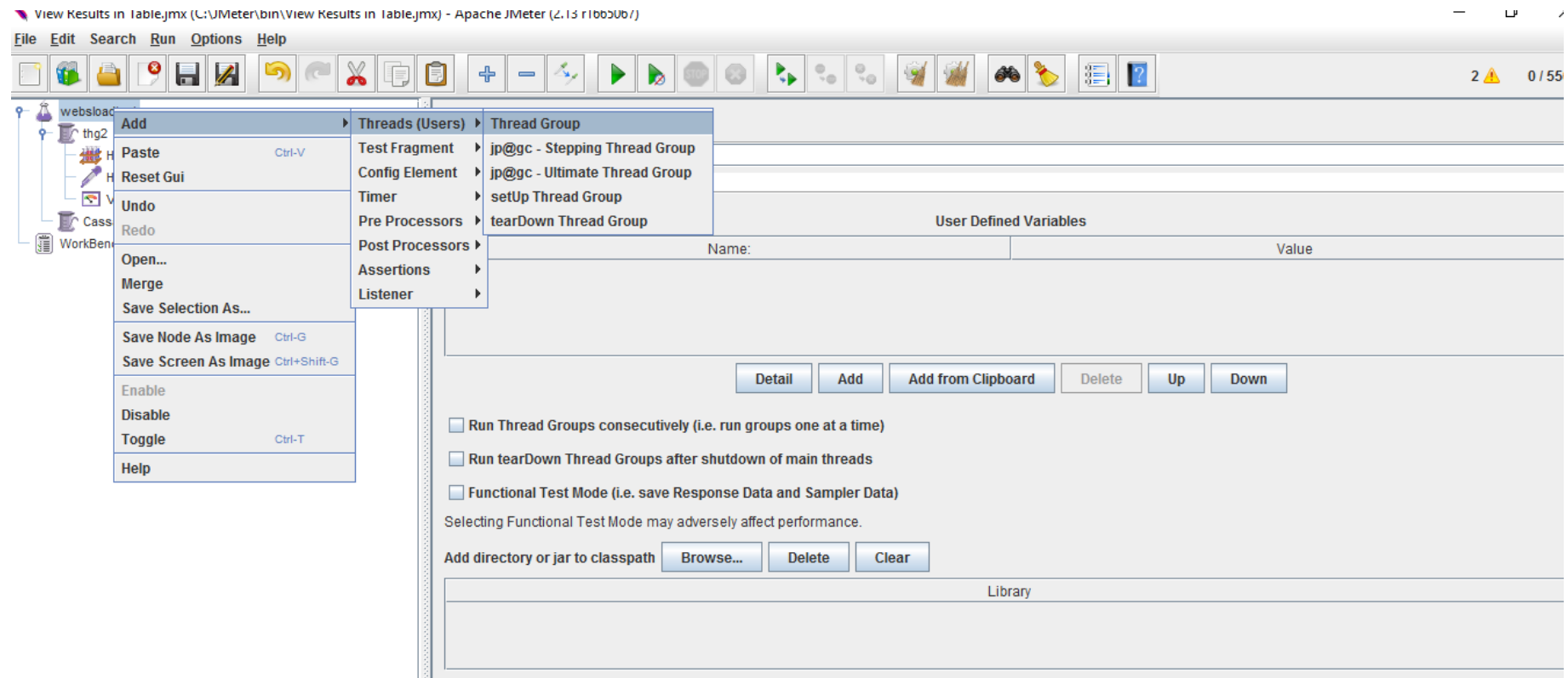
NOTE: For security reasons, using the manager webapp is restricted to users with role "manager-gui". The host-manager webapp is restricted to users with role "admin-gui". Users are defined in `/etc/tomcat-users.xml`.

# Stress Testing with JMeter

- In this tutorial we are using Apache JMeter
  - Download at : <http://jmeter.apache.org/>
- To perform stress testing and evaluate load balancing, ensure that your web services are deployed on more than one cloud instance
- These instances will be incrementally added or removed from load balancer while performing stress test.

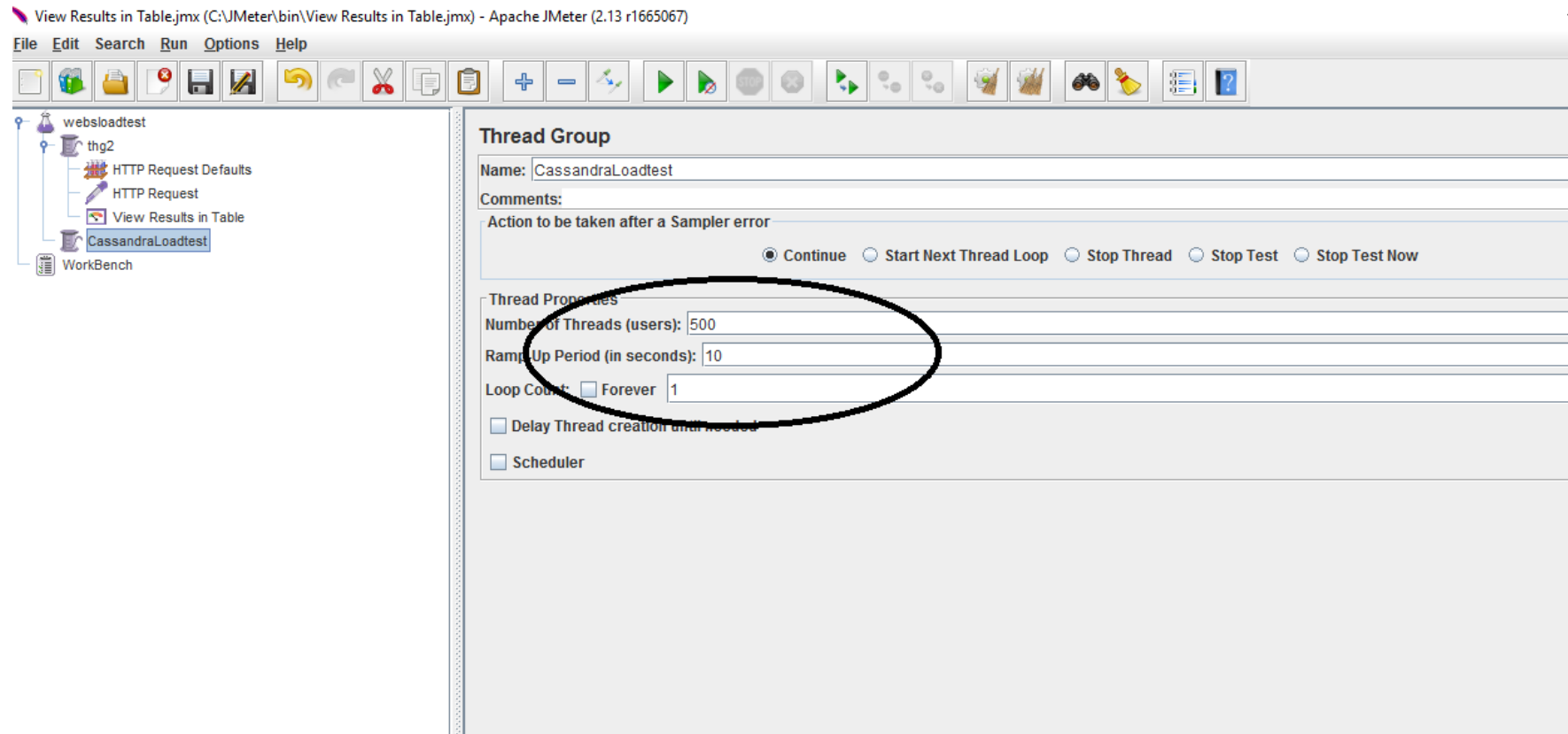
# Running test on JMeter

- Create a thread group



# Running test on JMeter

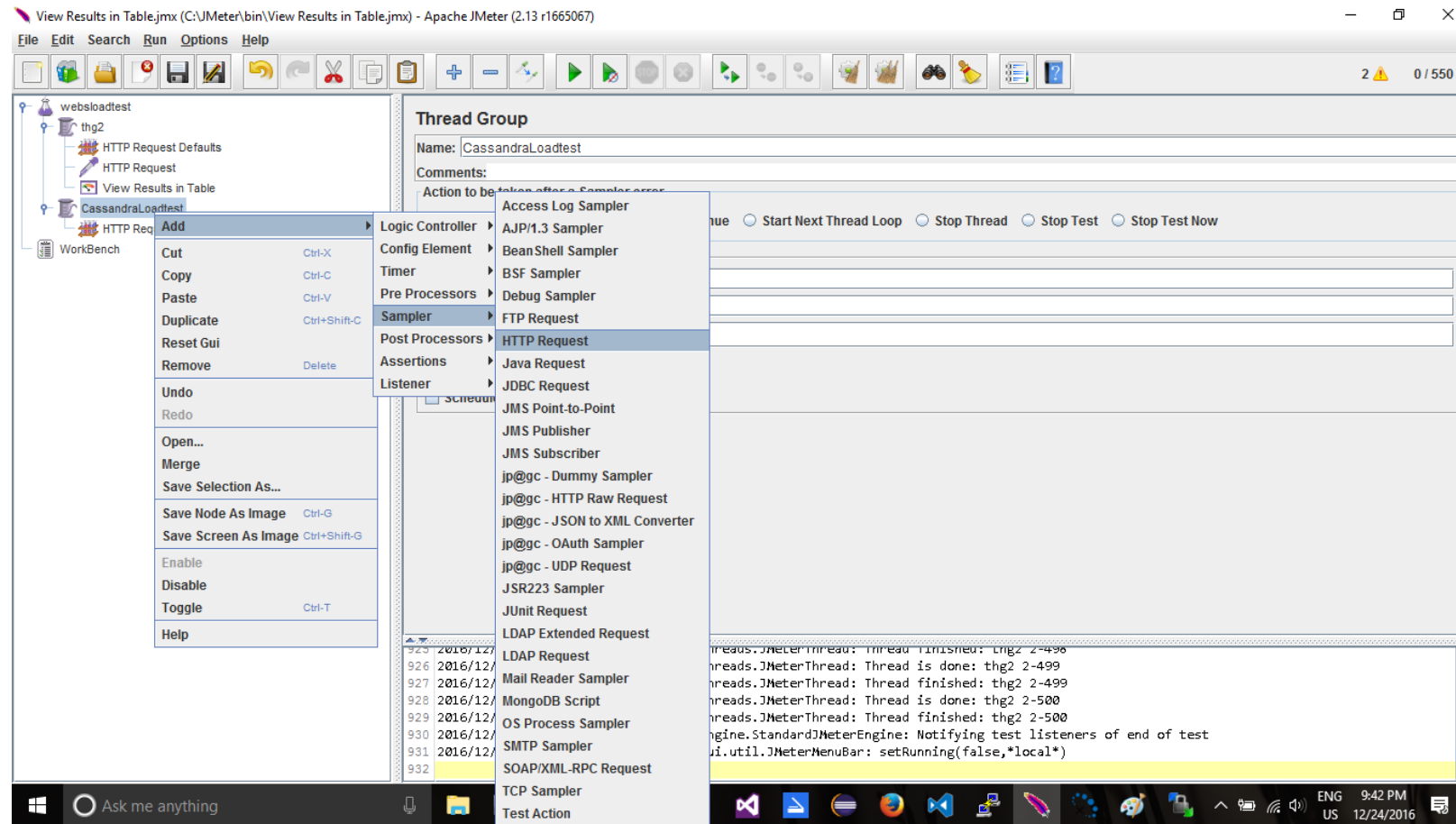
- Specify threads





# Running test on JMeter

- Add HTTP Request



# Running test on JMeter

- Specify parameters and URI path

**HTTP Request**

Name: HTTP Request

Comments:

Web Server

Server Name or IP: **Load Balancer IP** Port Number: Timeouts (milliseconds) Connect: Response:

HTTP Request

Implementation: Protocol [http]: Method: GET Content encoding:

Path: **Your Path to web service**

☐ Redirect Automatically ☒ Follow Redirects ☒ Use KeepAlive ☐ Use multipart/form-data for POST ☐ Browser-compatible headers

**Parameters** Body Data

Send Parameters With the Request:

Name:	Value	Encode?	Include Equals?
-------	-------	---------	-----------------

Detail Add Add from Clipboard Delete Up Down

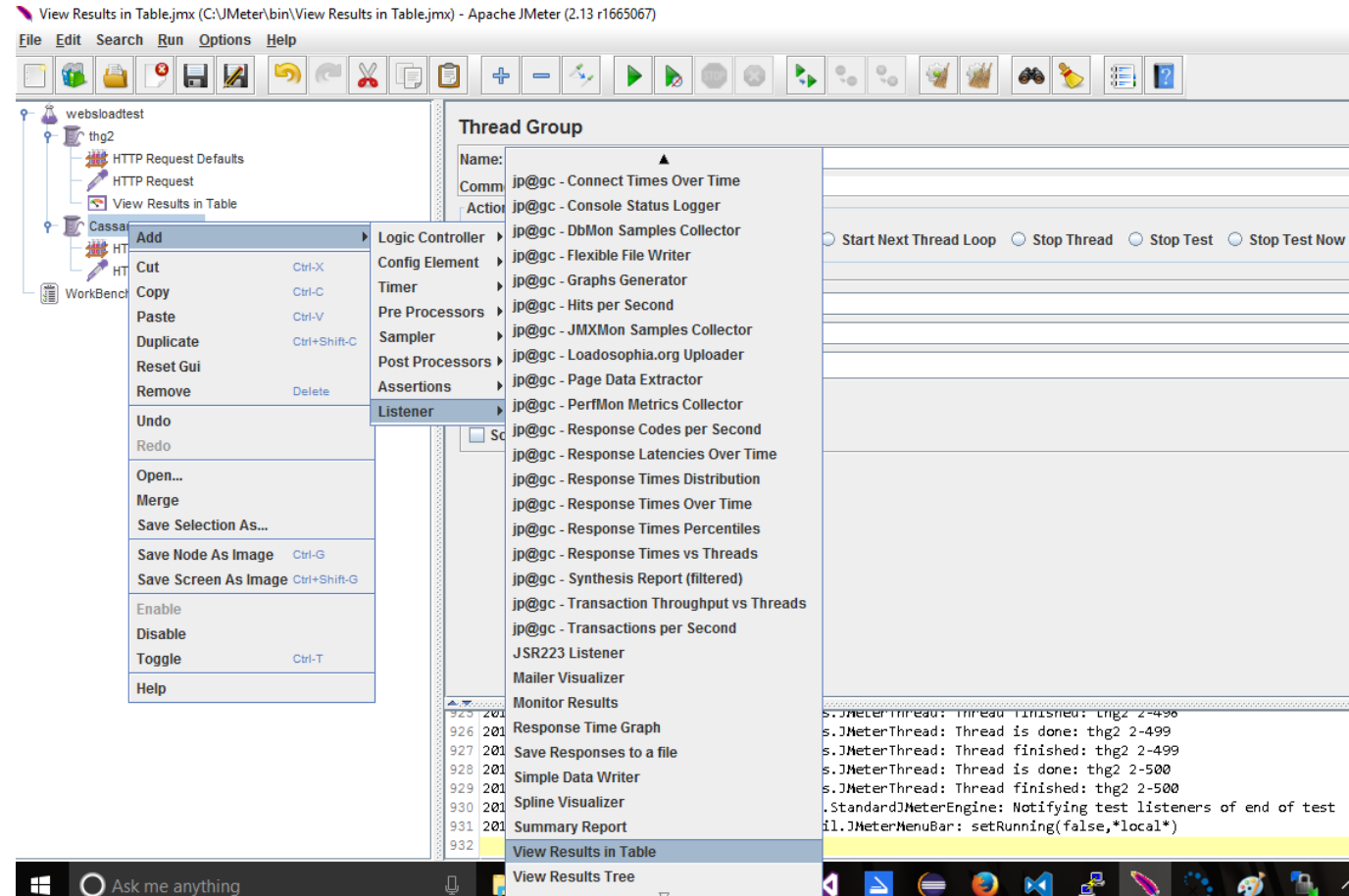
Send Files With the Request:

File Path:	Parameter Name:	MIME Type:
------------	-----------------	------------

Add Browse... Delete

Proxy Server

# Running test on JMeter



# Running test on JMeter

nts.jmx (C:\JMeter\bin\nts.jmx) - Apache JMeter (2.13 r1665067)

File Edit Search Run Options Help

To run the test

Log/Display Only: ☐ Errors ☐ Successes

Sample #	Start Time	Thread Name	Label	Sample Time(...)	Status	Bytes	Latency	Connect Time(m.
14	23:07:42.493	Cassandratest 2-4	HTTP Request	8146	🟢	366	8146	11
15	23:07:42.653	Cassandratest 2-12	HTTP Request	7986	🟢	366	7986	11
16	23:07:42.533	Cassandratest 2-6	HTTP Request	8106	🟢	366	8106	9
17	23:07:43.215	Cassandratest 2-40	HTTP Request	7424	🟢	366	7424	14
18	23:07:42.574	Cassandratest 2-8	HTTP Request	8068	🟢	384	8068	10
19	23:07:43.049	Cassandratest 2-32	HTTP Request	7593	🟢	384	7593	11
20	23:07:42.854	Cassandratest 2-22	HTTP Request	7792	🟢	366	7792	11
21	23:07:43.074	Cassandratest 2-33	HTTP Request	7572	🟢	384	7572	10
22	23:07:42.834	Cassandratest 2-21	HTTP Request	7813	🟢	366	7813	11
23	23:07:43.336	Cassandratest 2-46	HTTP Request	7311	🟢	384	7311	15
24	23:07:42.793	Cassandratest 2-19	HTTP Request	7854	🟢	366	7854	10
25	23:07:42.445	Cassandratest 2-2	HTTP Request	8202	🟢	366	8202	12
26	23:07:42.914	Cassandratest 2-25	HTTP Request	7733	🟢	366	7733	10
27	23:07:42.466	Cassandratest 2-3	HTTP Request	8181	🟢	384	8181	11
28	23:07:43.229	Cassandratest 2-41	HTTP Request	7418	🟢	366	7418	11
29	23:07:43.290	Cassandratest 2-44	HTTP Request	7357	🟢	366	7357	17
30	23:07:43.157	Cassandratest 2-37	HTTP Request	7490	🟢	366	7490	13
31	23:07:43.357	Cassandratest 2-47	HTTP Request	7290	🟢	366	7290	13
32	23:07:42.554	Cassandratest 2-7	HTTP Request	8093	🟢	384	8093	10
33	23:07:42.890	Cassandratest 2-24	HTTP Request	7757	🟢	384	7757	11
34	23:07:42.727	Cassandratest 2-16	HTTP Request	7920	🟢	366	7920	11
35	23:07:43.109	Cassandratest 2-35	HTTP Request	7538	🟢	366	7538	14
36	23:07:42.513	Cassandratest 2-5	HTTP Request	8134	🟢	366	8134	10
37	23:07:42.613	Cassandratest 2-10	HTTP Request	8034	🟢	366	8034	10
38	23:07:42.774	Cassandratest 2-18	HTTP Request	7873	🟢	366	7873	9

☐ Scroll automatically? ☐ Child samples? No of Samples 50 Latest Sample 7658 Average 7421 Deviation 702

```
2016/12/24 23:07:52 INFO - jmeter.threads.JMeterThread: Thread finished: CassandraLoadTest 1-495
2016/12/24 23:07:52 INFO - jmeter.threads.JMeterThread: Thread finished: CassandraLoadTest 1-498
2016/12/24 23:07:52 INFO - jmeter.threads.JMeterThread: Thread finished: CassandraLoadTest 1-499
2016/12/24 23:07:52 INFO - jmeter.threads.JMeterThread: Thread is done: CassandraLoadTest 1-500
2016/12/24 23:07:52 INFO - jmeter.threads.JMeterThread: Thread finished: CassandraLoadTest 1-500
2016/12/24 23:07:52 INFO - jmeter.engine.StandardJMeterEngine: Notifying test listeners of end of test
2016/12/24 23:07:52 INFO - jmeter.gui.util.JMeterMenuBar: setRunning(false,*local*)
```

# Assignment Tasks

1. Create a hosted Cassandra cluster
2. Download the dataset
3. Create your schema in Cassandra and upload data
4. Define your application scenario and queries
5. Test your queries by executing them on the server
6. Create a UI client to query data from Cassandra
  - Use Java/.Net/Python
7. Run queries in UI client and return results

# Assignment Tasks

8. Create a RESTful web service to query Cassandra DB
9. Use deployed web service to query Cassandra and fetch results.
10. Deploy web service on additional cloud instances for further tasks
11. Create your load balancer and add cloud instances to it
12. Perform stress test with varying values
13. Remove/stop a cloud instance and repeat step 12
14. Evaluate performance and analyze results

# Submission Requirements

1. Task description, application scenario and requirements
2. Dataset description
3. Overview of configuration steps with screenshots
4. Brief explanation of application queries
5. CQL syntax of the queries together with execution time
6. Results returned from the query
7. Public DNS and service endpoint URL of web services
8. Test results from Load Balancing task

# Submission Requirements

9. Analysis and observations
10. Comments and recommendation on using the software tools
11. Alongside report submit :
  - I. Source code for UI and web service
  - II. Scripts for Cassandra setup/schema definition etc.
  - III. Output from queries
  - IV. Any files/ statistics generated from load test tool
  - V. README file detailing installation and execution instructions with additional dependencies/requirements (if any)



# References

- "A Brief Introduction To Apache Cassandra | Datastax Academy: Free Cassandra Tutorials And Training". *Academy.datastax.com*. N.p., 2016.
- "Cassandra Tutorial". *www.tutorialspoint.com*. N.p., 2016.
- "Java Driver For Apache Cassandra - Home". *Docs.datastax.com*. N.p., 2016. Web. 14 Dec. 2016.
- "Documentation". *Cassandra.apache.org*. N.p., 2016.