CS4287-5287: Principles of Cloud Computing

**Fall 2017 Programming Assignment #3: Load Balancing, High Availability and Cloud Federation**

**Handed out:** October 9, 2017 **Due:** October 22, 2017 in BrightSpace

The purpose of this assignment is to extend your assignment #2 but now include a high availability proxy service (called HAProxy) that balances load across two MySQL instances. Thus, instead of your webserver sending a SQL query to the DBServer as you did in your assignment #2, it will send it to a HAProxy. This HAProxy will run as a separate process in the same machine as the Webserver. The HAProxy then balances the load using round robin, i.e. requests are served alternately by the two dbservers. We will also demonstrate the high availability properties of HAProxy by killing the primary dbserver in which case the HAProxy will failover to backup dbserver for all requests.

In order to use the dbserver2 and also to get accustomed to cloud federation, here we will be using the NSF Chameleon Cloud to host the replica (i.e., second) database server. Since that is the only instance you will run in the Chameleon Cloud, it will have a floating IP address which is known to the HAProxy and the original dbserver in the Horizon Cloud. Note that any new records populated in dbserver1 should be replicated into dbserver2 otherwise the dbserver2 will not be consistent with the original dbserver.

Shown below is a schematic of the final runtime behavior in the proposed assignment.



Steps to be performed:

1. As in Assignment #2, just repeat all the steps so that everything in Assignment #2 is up and running. This means that there will not be any HAProxy and DB2 at this time. Client requests should be serviced as in Assignment #2.
2. Now log into the laptop VM and run a different Ansible playbook that you will write to install a HAProxy on the webserver VM and a backup replica of MySQL on Chameleon cloud. But do not use the same approach to populate DB2 as you did for DB1. Instead, DB1 should replicate all its contents to DB2. HAProxy is configured to use round robin. Demonstrate that the HAProxy and load balancing works.
3. Now use another Ansible playbook that you execute from Laptop VM that goes ahead and kills the DB1 on Horizon. Thereafter, HAProxy should failover gracefully to DB2 and that all client requests get served from DB2.

HAProxy is available from <http://www.haproxy.org/>. Ubuntu installation is using apt-get install command as is the case with other packages. Some tutorials on load balancing using HAProxy can be found here: <https://www.digitalocean.com/community/tutorials/an-introduction-to-haproxy-and-load-balancing-concepts>. Using HAProxy with Apache is discussed here: <http://dasunhegoda.com/apache-load-balacing-haproxy/659/> while load balancing with MySQL is discussed here: <http://dasunhegoda.com/mysql-load-balancing-haproxy/646/>. We need the latter.

Note that because we are using cloud federation, you will probably need to use different key pairs, security groups, etc when handling the two clouds.

To get started on Chameleon cloud, please see: <https://www.chameleoncloud.org/docs/getting-started/>. You will need to first create an account. Thereafter you will need to request being added to a project. To that end, you will need to send the instructor your user name, and he will add you to the project.

A few additional and useful tutorial links are given below

<https://www.digitalocean.com/community/tutorials/how-to-use-haproxy-to-set-up-mysql-load-balancing--3>

<https://www.digitalocean.com/community/tutorials/how-to-set-up-master-slave-replication-in-mysql>

<https://www.digitalocean.com/community/tutorials/how-to-set-up-highly-available-haproxy-servers-with-keepalived-and-floating-ips-on-ubuntu-14-04#install-and-configure-the-web-server>

***Submission:***

Fill the survey form below (questions will be sent later), and demonstrate the working of your VMs to TA Travis Brummet. Submit the survey documentation.

Please post in Piazza for any doubt. This assignment will require you to learn about HAProxy and also be able to work on NSF Chameleon Cloud

**SURVEY Questions will be sent out later.**