15-319 / 15-619
Cloud Computing

Recitation 4
February 3\textsuperscript{rd} & 5\textsuperscript{th}, 2015
Overview

• Administrative issues
  OH hours, Piazza guidelines

• Last week’s reflection
  Project 1.2, OLI unit 2 module 3 and module 4

• This week’s schedule
  OLI Unit 2 module 5 out - Feb 2nd
  Quiz 2 - Feb 6th
  Project 2.1 - Feb 2nd

• Demo
Administrative

- TA office hours are posted on Piazza and Google calendar.
- Suggestions for using Piazza
  - Discussion forum, contribute questions and answers
  - Read the Piazza Post Guidelines (@20) before asking
  - Read Piazza questions & answers carefully to avoid duplicate ones
  - Don’t ask a public question about a quiz question
  - Try to ask a public question if possible
  - Encounter a grading bug, post privately on Piazza

For Piazza to be effective, everyone should contribute!!!
Code Submission Announcements

In your submissions:

**Do include:**
- readme.txt
- References in a file called ‘references’

**Do not include:**
- Packages (jar files)
- Folder structures
- Input or output data
- Pem files
Last Week’s Reflection

• Until now you have completed
  – Sequential Analysis
  – Elastic MapReduce

• You should have learned
  – Why MapReduce for big data
  – How MapReduce works
  – How to program a Mapper and Reducer
  – Performance/cost tradeoff
  – How to narrow down bugs by using logs
Project 1.2 Checkpoint

- We will manually grade Question 1 in P1.2
  - Always make sure that your code is readable
  - Follow style presented in Recitation 2

**Project Grading Penalties**

The following table outlines the violations of the project rules and their corresponding grade penalties for this project.

<table>
<thead>
<tr>
<th>Violation</th>
<th>Penalty of the project grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failing to tag all your instances (including all of the instances in the EMR cluster) for this project</td>
<td>-10%</td>
</tr>
<tr>
<td>Using any instance type in your cluster that has an on-demand pricing higher than m1.large</td>
<td>-10%</td>
</tr>
<tr>
<td>Attempting to hack/tamper the autograder in any way</td>
<td>-100%</td>
</tr>
<tr>
<td>Using more than $15 to complete this project</td>
<td>-10%</td>
</tr>
<tr>
<td>Using more than $30 to complete this project</td>
<td>-100%</td>
</tr>
</tbody>
</table>
Project 1.2 Questions - 1

• Late policy
  – We do not have a late policy!
    • All deadlines are hard. No exceptions.
    • No excuses, and no special cases are allowed.

  – Please **start early**!
    • We are working with a public cloud infrastructure, things are bound to take more time or break. One of the reasons why this experience is so valuable.
    • You get more TA support during the week.
Elastic MapReduce Billing Question

- EC2 cost + EMR cost
- **Elastic MapReduce Pricing** (On demand)
- for US East (N. Virginia)

<table>
<thead>
<tr>
<th>Region: US East (N. Virginia)</th>
<th>Amazon EC2 Price</th>
<th>Amazon Elastic MapReduce Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Purpose - Current Generation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>m3.xlarge</td>
<td>$0.280 per Hour</td>
<td>$0.070 per Hour</td>
</tr>
<tr>
<td>m3.2xlarge</td>
<td>$0.560 per Hour</td>
<td>$0.140 per Hour</td>
</tr>
<tr>
<td><strong>General Purpose - Previous Generation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>m1.small</td>
<td>$0.044 per Hour</td>
<td>$0.011 per Hour</td>
</tr>
<tr>
<td>m1.medium</td>
<td>$0.087 per Hour</td>
<td>$0.022 per Hour</td>
</tr>
<tr>
<td>m1.large</td>
<td>$0.175 per Hour</td>
<td>$0.044 per Hour</td>
</tr>
<tr>
<td>m1.xlarge</td>
<td>$0.350 per Hour</td>
<td>$0.088 per Hour</td>
</tr>
</tbody>
</table>
Project 1.2 Questions - 3

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>EC2 instance type</th>
<th>Count</th>
<th>Request spot</th>
<th>Bid price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master</td>
<td>Master instance group - 1</td>
<td>m1.large</td>
<td>1</td>
<td></td>
<td>0.1</td>
</tr>
<tr>
<td>Core</td>
<td>Core instance group - 2</td>
<td>m1.large</td>
<td>17</td>
<td></td>
<td>0.1</td>
</tr>
</tbody>
</table>

EMR cost

On demand = (\$0.175 + \$0.044) * 1 hour * 17 instances = \$3.723

Spot = (\$0.016 + \$0.044) * 1 hour * 17 instances = \$1.02
Project 1.2 Questions - 4

Please remember to double check the tag if you use spot instances.
What happens this week

• Unit 2: Data Centers
  – Module 3: Data Center Trends
  – Module 4: Data Center Components

• Read and complete:
  – Module 5: Design Considerations
  – Unit 2: Checkpoint Quiz
    • 150 minutes, due February 6th, 2015, Pittsburgh
Module 5: Design Considerations

• Design considerations
  – Requirements and Geographic Location
  – Costs
  – Power and Efficiency
  – Redundancy

• Challenges and Requirements
  – Scalability
  – Network Topologies
  – Utilizations & Resiliency

• Software Defined Data Centers and Networking

• Software Define Storage

Amazon data center
Quiz 2

• Quiz 2 will be open for 24 hours, Friday, Feb 6
  • Quiz 2 becomes available on Feb 6, 00:01 AM ET.
  • Deadline for submission is Feb 6, 11:59 PM ET.
  • Once open, you have 150 min to complete the quiz.
  • Late submissions are NOT accepted.
  • You may not start the quiz after the deadline has passed.
• Maintain your own timer from when you start the quiz.
• Click submit before deadline passes. No Exceptions!

<table>
<thead>
<tr>
<th>Location</th>
<th>Silicon Valley</th>
<th>Pittsburgh</th>
<th>Rwanda</th>
<th>Adelaide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
<td>Feb 5, 09:01 PM</td>
<td>Feb 6, 00:01 AM</td>
<td>Feb 6, 07:01 AM</td>
<td>Feb 6, 03:31 PM</td>
</tr>
<tr>
<td>Deadline</td>
<td>Feb 6, 08:59 PM</td>
<td>Feb 6, 11:59 AM</td>
<td>Feb 6, 06:59 AM</td>
<td>Feb 7, 03:29 PM</td>
</tr>
</tbody>
</table>
- Started with 12 engineers, now 300+ employees
- Monthly active users: 53 Million
- Growth in web traffic from 9/12-9/13: 66.52%
From Unit 1, we know that cloud computing provides several advantages, including:

- Elasticity
- Reduced upfront cost
- Reduced maintenance cost
• Utilizes AWS
  – S3
    • File storage
  – Elastic MapReduce
    • Data analysis
  – Auto Scaling
    • Scale up and down
  – Elastic Load Balancer
    • Distribute traffic
Highlights of this Week’s Project

Objectives:

- What is scaling?
  Horizontal vs Vertical
- Understand how to use AWS APIs and use them to automate the scaling out of servers to handle network traffic.
- Learn how to distribute load uniformly among your servers using Elastic Load Balancing.

Deadline:

- Project 2.1, due on Feb 8, 2015 at 11:59 pm ET
Resources in Cloud Infrastructure

Instance Types

Middleware (Virtualization)

Bare Metal Resources
Load Testing Request & Response Flow

Load Generator

Benchmark Script

Data Center

Small

Medium

Large

requests

responses

requests

responses

requests

responses
Vertical Scaling

- Would a larger instance suffice?
  - If so, which size?
Horizontal Scaling

- Would more instances suffice?
  - If so, how many?

LG

DC1

DC2

................................................

DCn

URL: RPS result each minute for each Data Center
Amazon APIs

Supported APIs
- Command Line Interface API Tools
- AWS SDK for Java
- AWS SDK for Python
Reminders for Project 2.1

- Make sure the Load Generator and Data Center VMs are in the same subnet (availability zone)
Reminders for Project 2.1 (cont’d)

• Terminate instances vs. Stop instances
  – Stop will still charge for VM storage (EBS volumes)
    – Stop is a good idea when you need a break

• DO NOT add your credentials in your submitted code
## Project Grading Penalties

Besides the penalties mentioned in recitation and/or on Piazza, penalties accrue for the following:

<table>
<thead>
<tr>
<th>Violation</th>
<th>Penalty of the project grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spending more than $8 for this project phase</td>
<td>-10%</td>
</tr>
<tr>
<td>Spending more than $16 for this project phase</td>
<td>-100%</td>
</tr>
<tr>
<td>Failing to tag all your instances for this project</td>
<td>-10%</td>
</tr>
<tr>
<td>Submitting your AWS credentials in your code for grading</td>
<td>-10%</td>
</tr>
</tbody>
</table>
Upcoming Deadlines

• **Quiz 2**: Data Centers
  – Due Friday 02/06/15 11:59 PM ET

• **Project 2.1**: Introduction to AWS APIs
  – Due Sunday 02/08/15 11:59 PM ET