



CS 4001/7001 Cloud Computing

Spring 2015

Lab # 1 – AWS Account Setup and Services Overview

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1. Purpose of the Lab

Understand definitions of various Amazon Web Services (AWS) and their use in cloud computing based web applications that are accessible over the Internet through an AWS account.

2. References to guide Lab work

- Chapter 1, *Distributed and Cloud Computing*, Hwang, Fox & Dongarra
- Chapter 1, *Programming Amazon EC2*, Vliet and Paganelli
- AWS Free Usage for Education:
 - o Overview of AWS, http://media.amazonwebservices.com/AWS_Overview.pdf
 - o Services on the free usage tier, <http://aws.amazon.com/free/>
 - o Make the most of your free monthly usage, <http://docs.aws.amazon.com/gettingstarted/latest/awsgsg-freetier/TestDriveFreeTier-monthly.html>
- AWS Documentation: <http://aws.amazon.com/documentation/>
- AWS Reference Architectures: <http://aws.amazon.com/architecture/>
- General AWS Reading: T. Morgan, “A Rare Peek Into The Massive Scale of AWS”, Nov. 2014 - <http://www.enterprisetech.com/2014/11/14/rare-peek-massive-scale-aws/>

3. Lab Steps and output collection guidelines

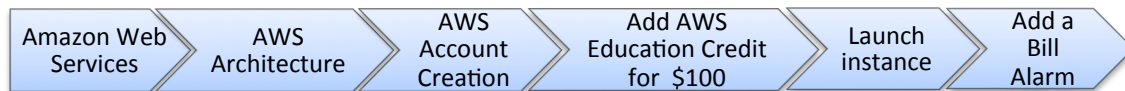


Figure 1: Lab 1 Steps Overview

The Figure 1 shows the required steps to be followed in order to successfully create an account credited with funds for this course. You will need to understand pricing conditions and services documentation related with ‘AWS free usage tier’, understand AWS Architecture, create your ‘AWS account’ and join it to the 4001/7001 Cloud Computing course in order to be granted with \$100 credit. You will launch your first AWS EC2 (Elastic Compute Cloud) instance. Finally, you will use AWS CloudWatch to add a Bill alarm for monitoring and managing your credit.

Let’s get started!

3.1 Amazon Web Services

Take your time in order to understand the conditions of free usage that involve free account availability, restrictions in terms of instance types, pay-as-you-go service rates, operating systems that are under the free usage condition, and free usage accumulation, detailed information can be found on <http://aws.amazon.com/free/>.

AWS Free Tier (Per Month):	
Elastic Compute Cloud (EC2) <ul style="list-style-type: none"> • 750 hours of Amazon EC2 Linux t.2 micro instance usage (1 GiB of memory and 32-bit and 64-bit platform support) – enough hours to run continuously each month* • 750 hours of Amazon EC2 Microsoft Windows Server† t.2 micro instance usage (1 GiB of memory and 32-bit and 64-bit platform support) – enough hours to run continuously each month* • 750 hours of an Elastic Load Balancer plus 15 GB data processing* • 30 GB of Amazon Elastic Block Storage in any combination of General Purpose (SSD) or Magnetic, plus 2 million I/Os (with EBS Magnetic) and 1 GB of snapshot storage* 	Simple Workflow (SWF) <ul style="list-style-type: none"> • 1,000 Amazon SWF workflow executions and a total of 10,000 activity tasks, signals, timers and markers, and 30,000 workflow-days.**
Simple Storage Service (S3) <ul style="list-style-type: none"> • 5 GB of Amazon S3 standard storage, 20,000 Get Requests, and 2,000 Put Requests* 	Simple Queue Service (SQS) and Simple Notification Service (SNS) <ul style="list-style-type: none"> • 1,000,000 Requests of Amazon Simple Queue Service** • 1,000,000 Requests, 100,000 HTTP notifications and 1,000 email notifications for Amazon Simple Notification Service**
DynamoDB <p>25 GB of Storage, 25 Units of Read Capacity and 25 Units of Write Capacity – Enough to handle up to 200M requests per month with Amazon DynamoDB.**</p>	Amazon Elastic Transcoder <ul style="list-style-type: none"> • 20 minutes of SD transcoding or 10 minutes of HD transcoding**
Relational Database Service (RDS) <ul style="list-style-type: none"> • 750 hours of Amazon RDS Single-AZ Micro DB Instances, for running MySQL, PostgreSQL, Oracle BYOL or SQL Server (running SQL Server Express Edition) – enough hours to run a DB Instance continuously each month* • 20 GB of database storage, in any combination of RDS General Purpose (SSD) or Magnetic storage • 10 million I/Os (for use with RDS Magnetic storage; I/Os on RDS General Purpose (SSD) storage are not separately billed) • 20 GB of backup storage for your automated database backups and any user-initiated DB Snapshots 	CloudWatch <ul style="list-style-type: none"> • 10 Amazon Cloudwatch metrics, 10 alarms, and 1,000,000 API requests**
	Data Transfer <ul style="list-style-type: none"> • 15 GB of bandwidth out aggregated across all AWS services*
	Data Pipeline <ul style="list-style-type: none"> • 3 low frequency preconditions running on AWS per month* • 5 low frequency activities running on AWS per month*
	ElastiCache <ul style="list-style-type: none"> • 750 hours of Amazon ElastiCache - enough hours to run a Cache Node continuously each month.*
	Amazon Mobile Analytics <ul style="list-style-type: none"> • 100 million free events per month**

Go through the <http://aws.amazon.com/documentation/> to find detailed information of each service that AWS provides. Pay special attention to the service groups: Getting started with AWS, Compute, Storage & Content Delivery and Database.

3.2. AWS Architecture Center

You will need to understand overall <http://aws.amazon.com/architecture/> to help you build your application architecture customized according to your requirements, and for maximizing the AWS services usage. Web application hosting related customization example is shown below in Figure 1.

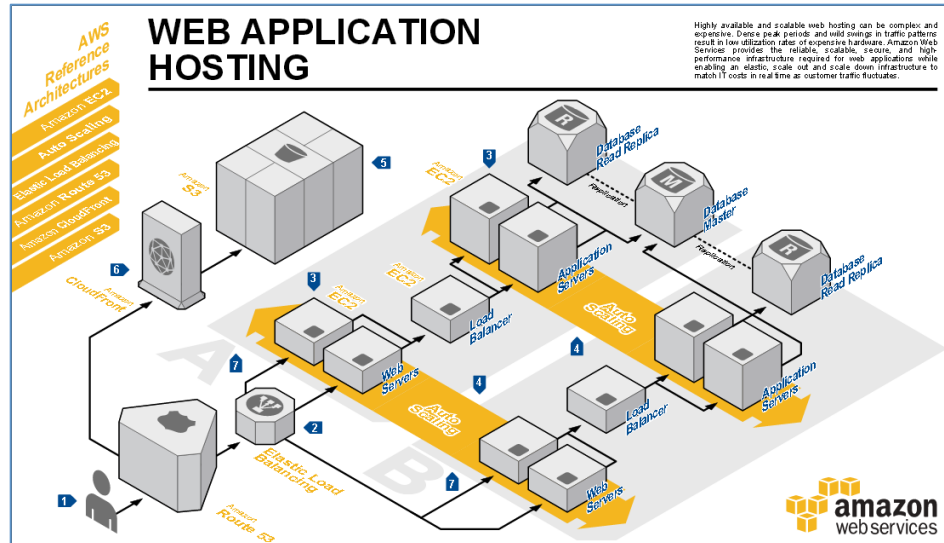
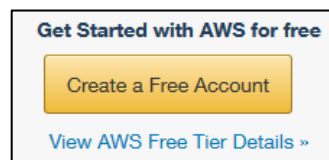


Figure 1: Example application customization of AWS architecture

3.3. AWS Account Creation

Create an (AWS) Amazon Web Service account in <http://aws.amazon.com> by clicking the button 'Create a Free Account' and follow the instructions. A credit/debit card and a cellphone/Landline number is required.



- Follow the instruction to create your account. At some point you will also need to enter your credit/debit card information.
- Don't forget to select 'Basic (Free)' Support plan to access to AWS free services.

Select your AWS Support Plan

All customers receive free support. Choosing a paid support plan will allow you to receive one-on-one technical assistance from experienced engineers and access many other support features. [Click here to compare all Support plans.](#)

☒ **Basic (Free)**
Contact Customer Service for account and billing questions, receive help for resources that don't pass system health checks, and access the AWS Community Forums.

☐ **Developer (\$49/month)**
Get started on AWS – ask technical questions and get a response to your web case within 12 hours during local business hours.

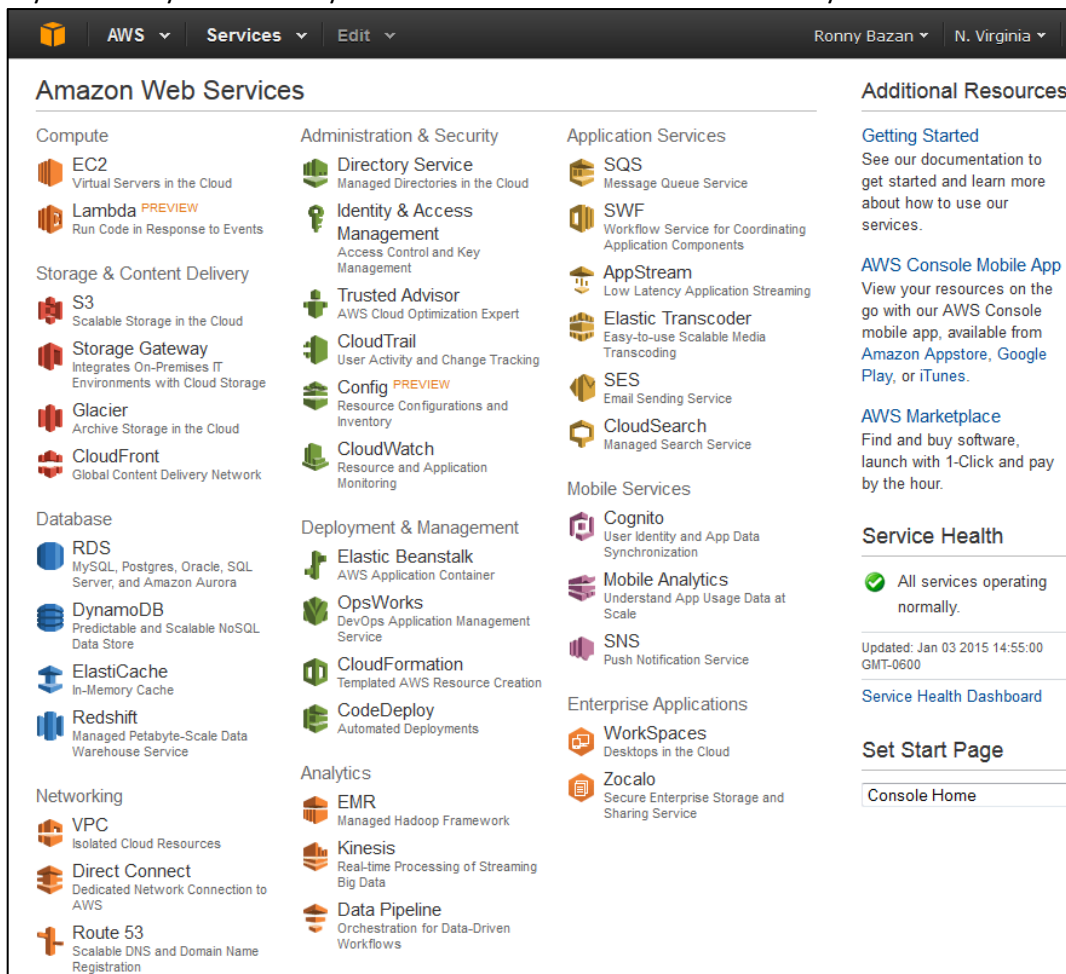
☐ **Business (Starting at \$100/month - Pricing example ☑) - Recommended**
24/7/365 real-time assistance by phone and chat, a 1 hour response to web cases, and help with 3rd party software. Access Trusted Advisor to increase performance, fault tolerance, security, and potentially save money. ([What's this](#) ☑)

☐ **Enterprise (Starting at \$15,000/month - Pricing example ☑)**
15 minute response to web cases, an assigned technical account manager (TAM) who is an expert in your use case, and white-glove case handling that notifies your TAM and the service engineering team of a critical issue.

[Continue](#)

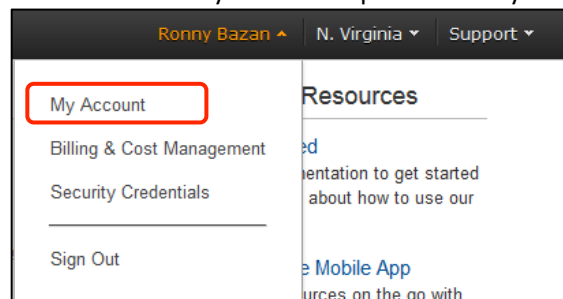


- Once you create your account you will see all AWS services available for you.



3.4. Add AWS Education Credit for \$100 to your Account.

- Click on your user name and Access to 'My Account' option to see your AWS Account Id.



- Send the screenshot similar to the figure below to TA Amit Kumar Akula ar442@mail.missouri.edu with the Subject "Cloud Computing – Spring 2015" in order to receive \$100 Promo Code. Your name and account number need to be clearly visible. (See Section 4 of the manual).



Dashboard AWS Services Edit Ronny Bazan

Account Settings [Edit](#)

Account Id: 22631
Account Name: Ronny Bazan
Password: *****

Contact Information [Edit](#)

Name: Ronny
Address:
City: Columbia
State: Missouri
Postal Code:
Country: US
Phone Number:
Company Name:
Website URL:

- When you receive your Promo Code, select 'Credits' in the menu located in the left side, enter your code and press 'Redeem' button, you will see the following message with \$100 credit confirmed.

Dashboard Credits ?

Please enter your code below to redeem your credits.

Promo Code: [Redeem](#)

Below are all the credits you have redeemed with AWS. Credits will automatically be applied to your bill. Only credits that apply to a specific service can be used.

Expiration Date	Credit Name	Credits Used	Credits Remaining	Applicable Products
2015-12-31	EDU_E_FY2014_Q4_UniversityOfMissouri_Caliam	\$0.00	\$100.00	See complete list

Total Amount of Credits Remaining: \$100.00

- You will be able to see your detailed usage and Credits Balance by accessing 'Bills' option in the menu.

Dashboard Bills ?

Date: January 2015 [Download CSV](#) [Print](#)

Summary	Amount
AWS Service Charges	\$0.00
There are no invoices for the selected month.	

[+ Expand All](#)

Details	Total
AWS Service Charges	\$0.00
▶ SimpleDB	\$0.00
▶ CT to be collected	\$0.00
▶ GST to be collected	\$0.00
▶ US Sales Tax to be collected	\$0.00
▶ VAT to be collected	\$0.00

- Another useful option is to enable 'Receive PDF Invoice my Email' as well 'Receive Billing Alerts' to keep track of the usage.

3.5 Launching your first AWS Instance

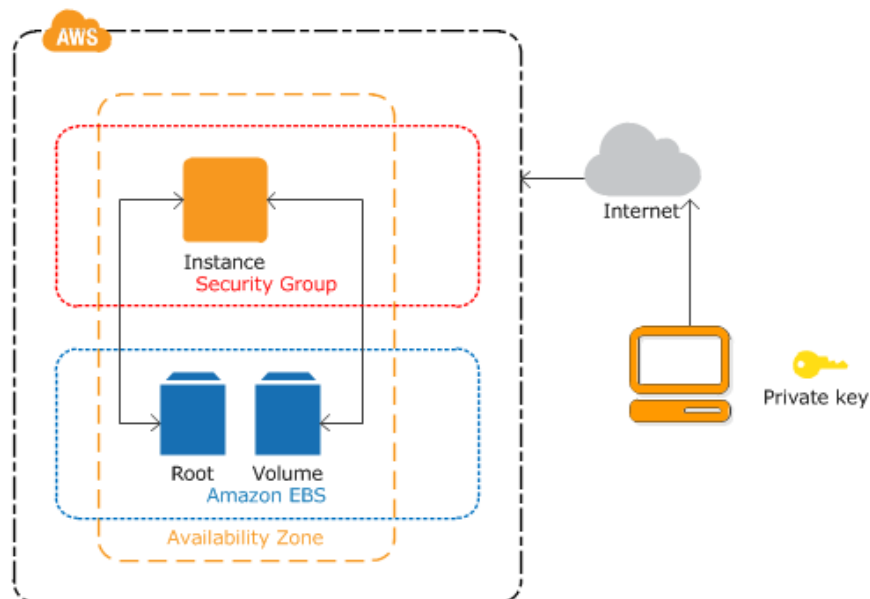
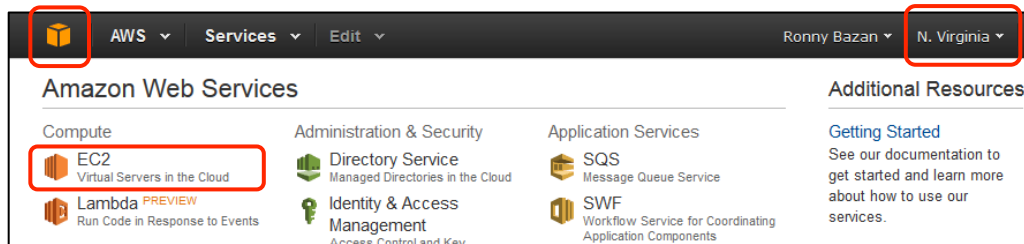


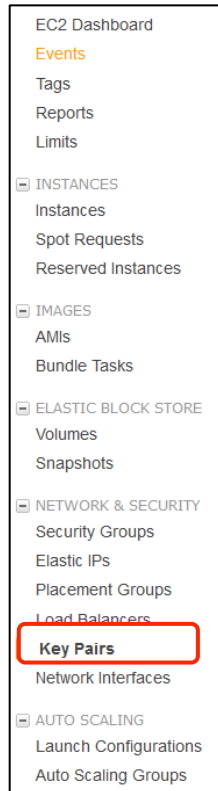
Figure 3: Overview of an AWS Instance

Figure 3 shows the instance architecture to be configured in this Lab. Using your AWS account, you will launch a virtual instance created in a new 'Volume' from an Amazon EBS-backed instance snapshot (called 'Root'), in order to access your reserved infrastructure resources over the Internet; you will need to create key pairs and secure it through a security group; all the infrastructure will be created in a specific zone.

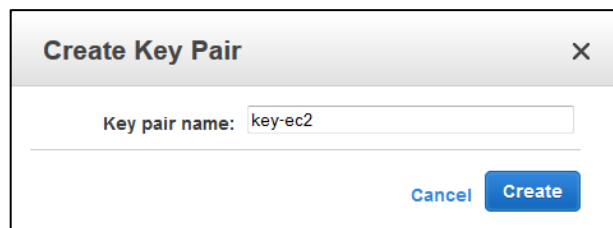
- 3.5.1 Click 'Console Home', make sure to select the US East (N. Virginia) region in the top-right part of your screen and select AWS EC2 service (Elastic Compute Cloud).



3.5.2 In left menu select “Key Pairs”.

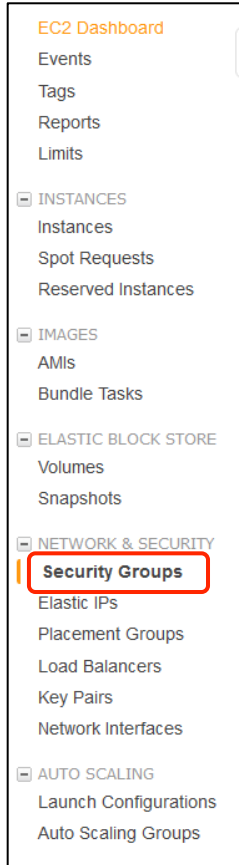


- Create a KeyPair called ‘key-ec2’ and **store it in a safe location**, you will need this key for the future labs.



The image shows a 'Create Key Pair' dialog box. It has a title bar with the text 'Create Key Pair' and a close button (X). Inside the dialog, there is a label 'Key pair name:' followed by a text input field containing the text 'key-ec2'. At the bottom right of the dialog, there are two buttons: 'Cancel' and 'Create'.

- 3.5.3 Select “Security Groups” from the left menu, name a Security Group ‘SG_EC2’, add description and a SSH rule with ‘anywhere’ option selected in source field.



- Example of Security Group creation.

Create Security Group

Security group name: SG_EC2

Description: SSH

VPC: vpc-2a28444f (172.31.0.0/16) *

* denotes default VPC

Security group rules:

Inbound | Outbound

Type	Protocol	Port Range	Source
SSH	TCP	22	Anywhere

Add Rule

Cancel Create

3.5.4 Launch your Instance

- In left menu, launch a new instance in the 'Instances' option Click on the 'Launch Instance' button and select the first 'Amazon Linux AMI 2014.09.1 (PV)' on the list (This AMI is not the first in the list).

Step 1: Choose an Amazon Machine Image (AMI)

Root device type: ebs Virtualization type: hvm

Microsoft Windows Server 2008 Base - ami-b89d0cd0 (64-bit) / ami-969d0cfe (32-bit) **Select**

Windows Free tier eligible Microsoft Windows 2008 R1 SP2 Datacenter edition. [English] 64-bit 32-bit

Root device type: ebs Virtualization type: hvm

Microsoft Windows Server 2003 R2 Base - ami-389a0b50 (64-bit) / ami-029a0b6a (32-bit) **Select**

Windows Free tier eligible Microsoft Windows 2003 R2 SP2 Datacenter edition. [English] 64-bit 32-bit

Root device type: ebs Virtualization type: hvm

Amazon Linux AMI 2014.09.1 (PV) - ami-246ed34c **Select**

Amazon Linux Free tier eligible The Amazon Linux AMI is an EBS backed image. It includes the 3.14 kernel, Ruby 2.1, PHP 5.5, PostgreSQL 9.3, Docker 1.2, the AWS command line tools, and repository access to many other packages. 64-bit

Root device type: ebs Virtualization type: paravirtual

Red Hat Enterprise Linux 6.5 (PV) - ami-1643ff7e (64-bit) / ami-da3d82b2 (32-bit) **Select**

Red Hat Free tier eligible Red Hat Enterprise Linux version 6.5 (PV), EBS-backed 64-bit 32-bit

Root device type: ebs Virtualization type: paravirtual

SUSE Linux Enterprise Server 11 SP3 (PV), SSD Volume Type - ami-88c841e0 (64-bit) / ami-b6aa17de (32-bit) **Select**

SUSE Linux Free tier eligible SUSE Linux Enterprise Server 11 Service Pack 3 (PV), EBS General Purpose (SSD) Volume Type. Amazon EC2 AMI Tools preinstalled; Apache 2.2, MySQL 5.5, PHP 5.3, and Ruby 1.8.7 available. 64-bit 32-bit

Root device type: ebs Virtualization type: paravirtual

- Select the first instance that is 'Free'.

Step 2: Choose an Instance Type

Amazon EC2 provides a wide selection of instance types optimized to fit different use cases. Instances are virtual servers that can run applications. They have varying combinations of CPU, memory, storage, and networking capacity, and give you the flexibility to choose the appropriate mix of resources for your applications. [Learn more](#) about instance types and how they can meet your computing needs.

Filter by: All instance types All generations Show/Hide Columns

Currently selected: t1.micro (Variable ECUs, 1 vCPUs, 0.613 GiB memory, EBS only)

	Family	Type	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance
<input checked="" type="checkbox"/>	Micro instances	t1.micro Free tier eligible	1	0.613	EBS only	-	Very Low

- Configure the instance similar to the following diagram

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Tag Instance 6. Configure Security Group

Step 3: Configure Instance Details

Configure the instance to suit your requirements. You can launch multiple instances from the same AMI, request Spot Instances to take advantage of the lower pricing, assign an access management role to the instance, and more.

Number of instances ⓘ 1

Purchasing option ⓘ ☐ Request Spot Instances

Network ⓘ vpc-2a28444f (172.31.0.0/16) (default) [Create new VPC](#)

Subnet ⓘ No preference (default subnet in any Availability Zone) [Create new subnet](#)

Auto-assign Public IP ⓘ Use subnet setting (Enable)

IAM role ⓘ None

Shutdown behavior ⓘ Stop

Enable termination protection ⓘ ☐ Protect against accidental termination

Monitoring ⓘ ☐ Enable CloudWatch detailed monitoring
[Additional charges apply.](#)

Tenancy ⓘ Shared tenancy (multi-tenant hardware)
[Additional charges will apply for dedicated tenancy.](#)

- Keep default values in the next configuration windows and continue.
- In Tag Instance option, add 'Key' and 'Value' and shown in figure below and click on 'Next: Configure Security Group'.

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Tag Instance 6. Configure Security Group

Step 5: Tag Instance

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 (127 characters maximum) **Value** (255 characters maximum)

Server Name Web Server

[Create Tag](#) (Up to 10 tags maximum)

- Select the Security Group created previously and click on 'Review and Launch'.

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Tag Instance 6. Configure Security Group 7. Review

Step 6: Configure Security Group

A security group is a set of firewall rules that control the traffic for your instance. On this page, you can add rules to allow specific traffic to reach your instance. For example, if you want to set up a web server and allow Internet traffic to reach your instance, add rules that allow unrestricted access to the HTTP and HTTPS ports. You can create a new security group or select from an existing one below. [Learn more](#) about Amazon EC2 security groups.

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-84dd79eb	default	default VPC security group	Copy to new
<input checked="" type="checkbox"/> sg-0dcc0c69	SG_EC2	SSH	Copy to new

- Once you click 'launch' you will be prompted to choose the key pair 'key-ec2' created previously.

Select an existing key pair or create a new key pair

A key pair consists of a **public key** that AWS stores, and a **private key file** that you store. Together, they allow you to connect to your instance securely. For Windows AMIs, the private key file is required to obtain the password used to log into your instance. For Linux AMIs, the private key file allows you to securely SSH into your instance.

Note: The selected key pair will be added to the set of keys authorized for this instance. Learn more about [removing existing key pairs from a public AMI](#).

Choose an existing key pair

Select a key pair

key-ec2

☒ I acknowledge that I have access to the selected private key file (key-ec2.pem), and that without this file, I won't be able to log into my instance.

Cancel Launch Instances

- In a short time your new instance will be deployed and ready to be used.

Instance ID	Instance Type	Availability Zone	Instance State	Status Checks	Alarm Status	Public DNS
i-db9eb337	t2.micro	us-east-1c	terminated		None	
i-ead7db14	t1.micro	us-east-1a	running	2/2 checks ...	None	ec2-54-159-183-6.compute-1.amazonaws.com

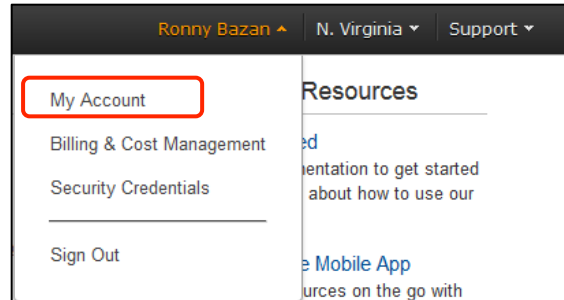
Instance: i-ead7db14 Public DNS: ec2-54-159-183-6.compute-1.amazonaws.com

Description Status Checks Monitoring Tags

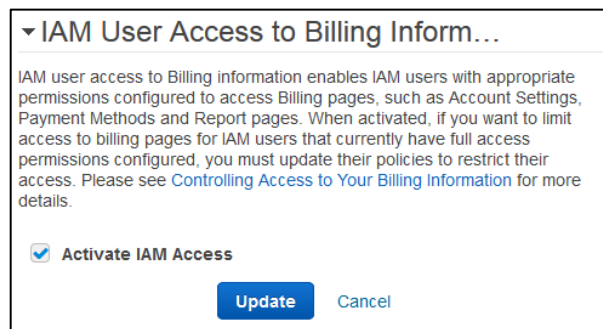
Instance ID	i-ead7db14	Public DNS	ec2-54-159-183-6.compute-1.amazonaws.com
Instance state	running	Public IP	54.159.183.6
Instance type	t1.micro	Elastic IP	-
Private DNS	ip-10-28-32-78.ec2.internal	Availability zone	us-east-1a
Private IPs	10.28.32.78	Security groups	SG_EC2. . view rules
Secondary private IPs	-	Scheduled events	No scheduled events
VPC ID	-	AMI ID	amzn-ami-pv-2014.09.1.x86_64-eb3 (ami-246ed34c)

3.6 Add a Bill Alarm

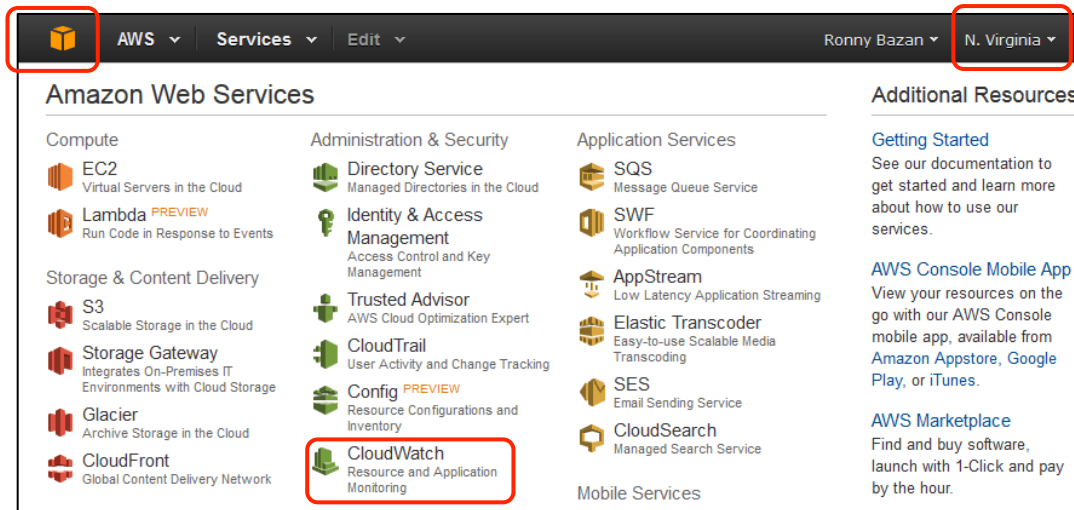
- Click on 'My Account' located in the top right corner of your screen.



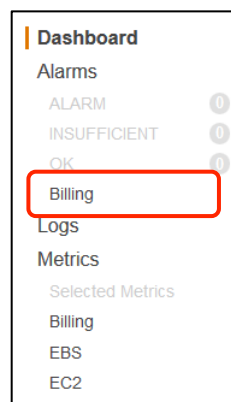
- In 'Account Settings' find 'IAM User Access to Billing inform', Activate IAM Access and click on update button.



- In Console Home, select 'CloudWatch' service and make sure that 'N.Virginia' zone is selected.



- You will find a panel in the left side of your screen, click on 'Billing Alarms'



- After clicking on 'Create Alarm', input \$10 in exceed field and select your e-mail address. Take a screenshot with your name and e-mail address visible for grading purpose. (See Section 4 of manual).

Create Alarm

Billing Alarm

You can create a billing alarm to receive e-mail alerts when your AWS charges exceed a threshold you choose. Simply:

1. Enter a spending threshold
2. Provide an email address
3. Check your inbox for a confirmation email and click the link provided

When my total AWS charges for the month

exceed: \$ USD

send a notification to: [New list](#)

Reminder: for each address you add, you will receive an email from AWS with the subject "AWS Notification - Subscription Confirmation". Click the link provided in the message to confirm that AWS may deliver alerts to that address.

[showing simple options](#) | [show advanced](#)

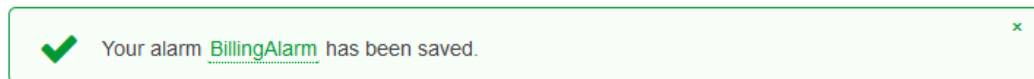
Alarm Preview

This alarm will trigger when the blue line goes above the red line

More resources

- [AWS Billing console](#)
- [Getting started with billing alarms](#)
- [More help with billing alarms](#)
- [AWS Billing FAQs](#)

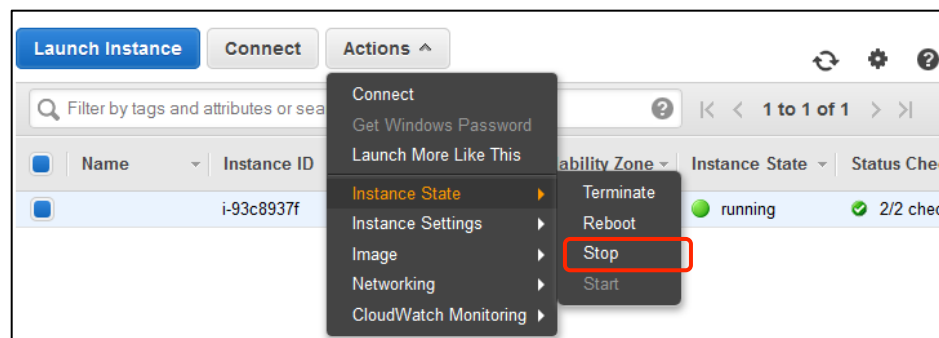
- A message will be displayed after you have successfully setup your alarm.



Note: You should turn off any instances after each session – otherwise this can deplete the credits and start charging your credit card

Stop your instance.

In your AWS EC2 service select 'Instances' under 'INSTANCES' option, select your running instance, click on 'Actions' button and 'Stop' option.



3.7 Manage AWS resources from your mobile device

Through a free Amazon application for smartphones (AWS Console App) you can manage your services and instances and check your billing alarms.



T-Mobile

5:58 PM

100%

<

EC2 Instances

US East (N. Virginia)

≡

All

Filter

×

i-93c8937f

Running

>

Instance: i-93c8937f

T-Mobile

5:59 PM

100%

<

CloudWatch Alarms

US East (N. Virginia)

≡

All

Filter

×

BillingAlarm

11:25 PM 1/3

OK

EstimatedCharges Maximum

> 10 for 360 minutes where

Currency = USD

>



4. What to turn in for Grading?

(Report with answers to below questions should be turned in at the beginning of the class on the due date; don't forget to write your name and title (e.g., Lab X) on the reports)

Note: See first part of Step 3.4 (email screenshot of account setup to ar442@mail.missouri.edu). Once you get e-mail from TA Amit Kumar Akula with your \$100 AWS promotion code, please add that to your account and send acknowledgement back to TA Amit.

1. Provide screenshot of your billing alarm setup as described in Step 3.6.
2. List the 4 AWS services for each of the following categories: Database, Storage & CDN, Cross-Service, Analytics, Compute & Networking, Deployment & Management and App services.
3. Explain the objective of any 8 AWS services.
4. List the specification for the free instance used in this lab (Family, vCPUs, Memory, Storage and Network Performance)
5. Which other storage options are available besides 'Magnetic'?
6. According to 'Amazon Content and Media Service Architecture' why do IT enterprises need to use AWS to handle 'spiky' hour demands?
7. Some AWS services have been built with fault tolerance and high availability in mind. Referring to the AWS Architecture documentation, list the services that are inherently fault tolerant and provide high availability. What other services do not inherently provide these benefits, and how does one add these capabilities within those services?
8. Describe the necessity of 'Amazon Machine Image (AMI)' and 'security group' customization in 'Web Application Hosting' as described in the AWS Architecture documentation.