

15CSE337

Cloud Computing and Services

AWS Overview

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What have we learnt so far?

- Various distributed computing paradigms
- Basic concepts in large scale network programming
 - APIs
 - Web services
- SaaS – Google APIs in detail
- Now we are going to spend some time on IaaS and PaaS
 - Amazon Web Services as example

Menu



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Sign In to the Console

Compute

Amazon EC2

Amazon EC2 Auto Scaling

Amazon Elastic Container Service

Amazon Elastic Container Service for Kubernetes

Amazon Elastic Container Registry

Amazon Lightsail

AWS Batch

AWS Elastic Beanstalk

AWS Fargate

AWS Lambda

AWS Serverless Application Repository

Elastic Load Balancing

VMware Cloud on AWS

Storage

Amazon Simple Storage Service (S3)

Amazon Elastic Block Store (EBS)

Amazon Elastic File System (EFS)

Amazon Glacier

AWS Storage Gateway

AWS Snowball

AWS Snowball Edge

Networking & Content Delivery

Amazon VPC

Amazon VPC PrivateLink

Amazon CloudFront

Amazon Route 53

Amazon API Gateway

AWS Direct Connect

Elastic Load Balancing

Developer Tools

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AWS CodeCommit

AWS CodeBuild

AWS CodeDeploy

AWS CodePipeline

AWS Cloud9

AWS X-Ray

AWS Tools & SDKs

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Amazon CloudWatch

AWS Auto Scaling

AWS CloudFormation

AWS CloudTrail

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Amazon Comprehend

Amazon Lex

Amazon Polly

Amazon Rekognition

Amazon Machine Learning

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AWS Deep Learning AMIs

Apache MXNet on AWS

TensorFlow on AWS

Analytics

Amazon Athena

Amazon EMR

Amazon CloudSearch

Amazon Elasticsearch Service

Amazon Kinesis

Amazon Redshift

Amazon QuickSight

AWS Data Pipeline

AWS Glue

AR & VR

Amazon Sumerian

Application Integration

Amazon MQ

Amazon Simple Queue Service (SQS)

Amazon Simple Notification Service (SNS)

AWS AppSync

AWS Step Functions

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Amazon Pinpoint

Amazon Simple Email Service (SES)

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Alexa for Business

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Amazon WorkMail

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Amazon WorkSpaces

Amazon AppStream 2.0

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Amazon Redshift

Amazon Neptune

AWS Database Migration Service

Migration

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AWS Application Discovery Service

AWS Database Migration Service

AWS Server Migration Service

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AWS Personal Health Dashboard

AWS Command Line Interface

AWS Management Console

AWS Managed Services

Media Services

Amazon Elastic Transcoder

Amazon Kinesis Video Streams

AWS Elemental MediaConvert

AWS Elemental MediaLive

AWS Elemental MediaPackage

AWS Elemental MediaStore

AWS Elemental MediaTailor

Security, Identity & Compliance

AWS Identity and Access Management (IAM)

Amazon Cloud Directory

Amazon Cognito

Amazon GuardDuty

Amazon Inspector

Amazon Macie

AWS Certificate Manager

AWS CloudHSM

AWS Directory Service

AWS Firewall Manager

AWS Key Management Service

AWS Organizations

AWS Secrets Manager

AWS Single Sign-On

AWS Shield

AWS WAF

AWS Artifact

Mobile Services

AWS Mobile Hub

Amazon API Gateway

Internet of Things

AWS IoT Core

Amazon FreeRTOS

AWS Greengrass

AWS IoT 1-Click

AWS IoT Analytics

AWS IoT Button

AWS IoT Device Defender

AWS IoT Device Management

Game Development

Amazon GameLift

Amazon Lumberyard

Software

AWS Marketplace

AWS Cost Management

AWS Cost Explorer

AWS Budgets

Reserved Instance Reporting

AWS Cost and Usage Report

Overview

- AWS started as a IaaS provider in the beginning
- Over a time, they have started offering a lot more including PaaS and SaaS offerings

IaaS

- EC2
- RDS
- Load Balancing
- Auto scaling

PaaS

- Elastic Beanstalk
- X-Ray
- CodeDeploy

SaaS

- WorkMail
- Chime
- Kinesis

AWS



Compute



Storage



Database



Migration



Networking & Content
Delivery



Developer Tools



Management Tools



Media Services



Security, Identity &
Compliance



Analytics



Machine Learning



Mobile Services



AR & VR



Application Integration



Customer Engagement



Business Productivity



Desktop & App Streaming



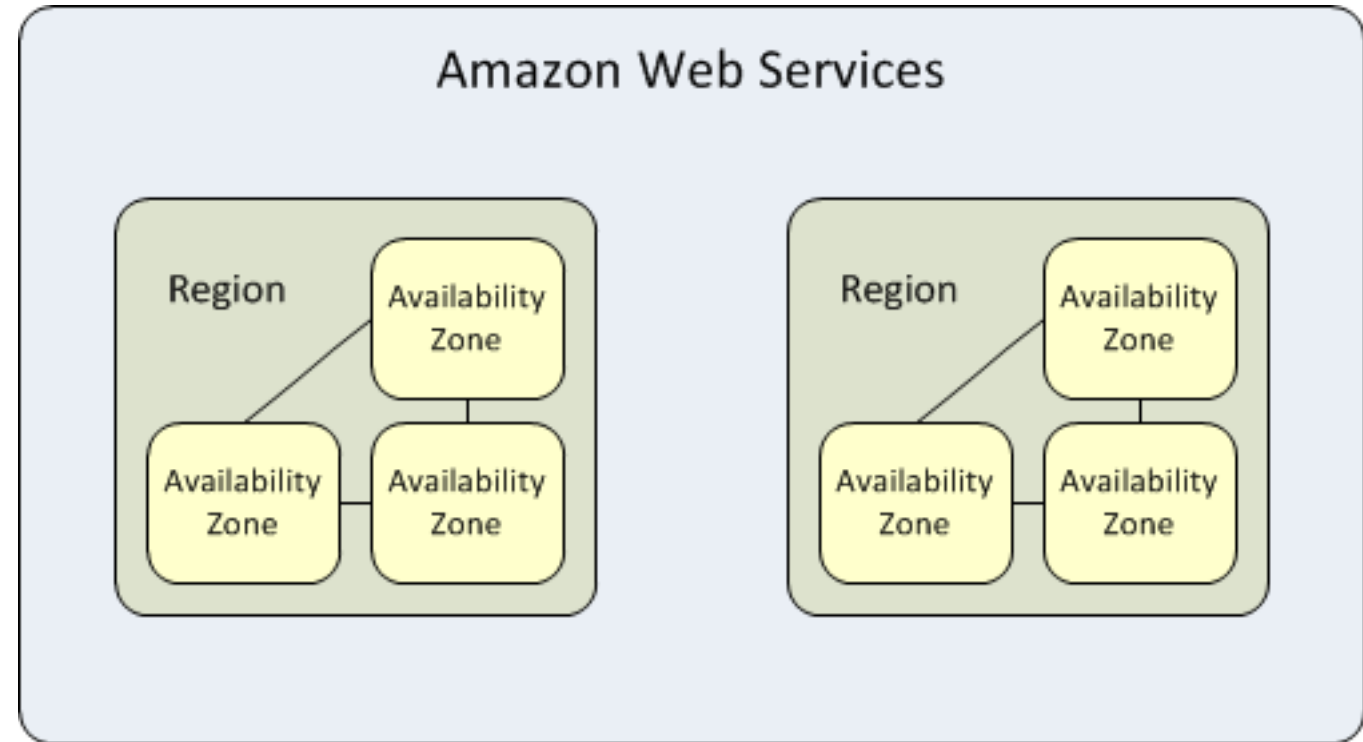
Internet of Things



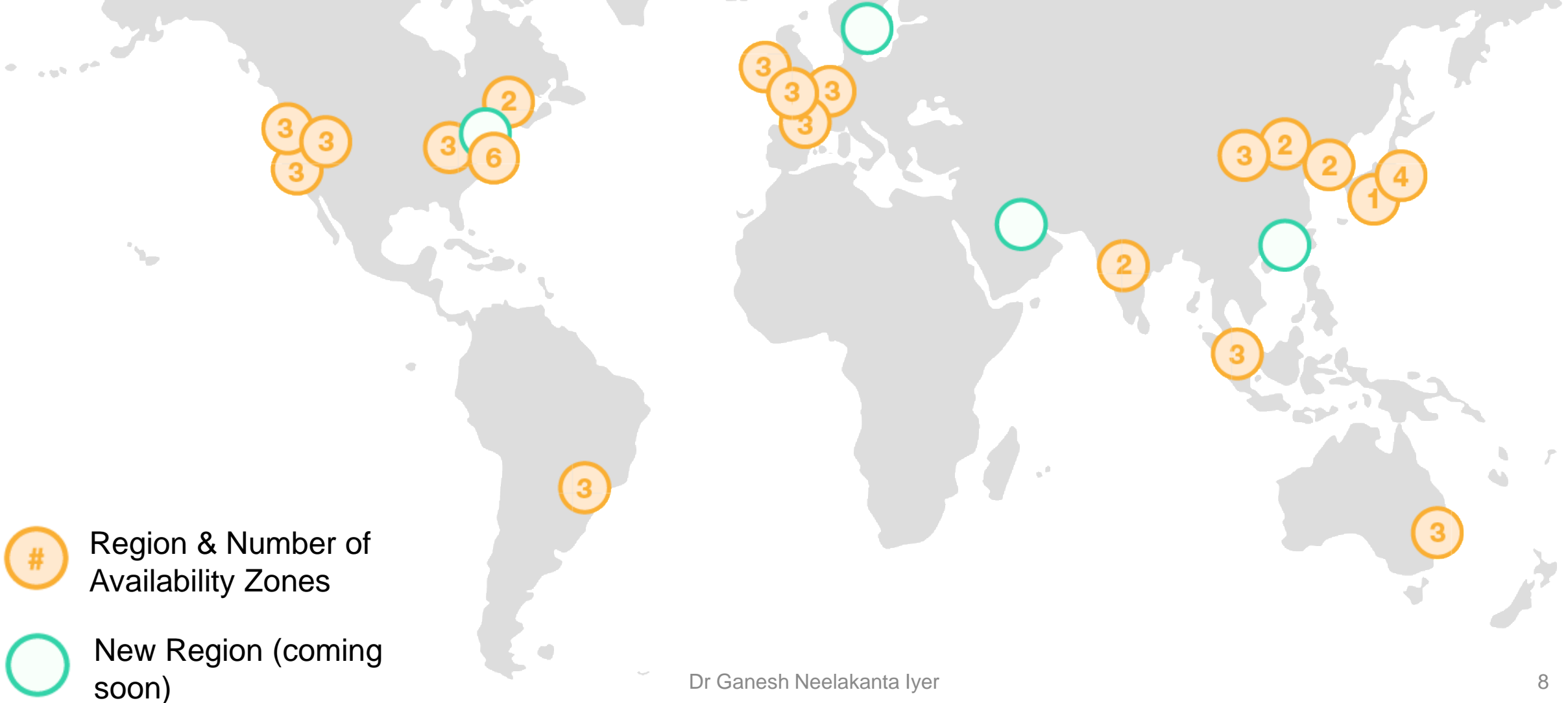
Game Development

Regions and Availability Zones

- Each region is completely independent
- Each Availability Zone is isolated, but the Availability Zones in a region are connected through low-latency links.



Regions and Availability Zones



We start with some IaaS Offerings

EC2

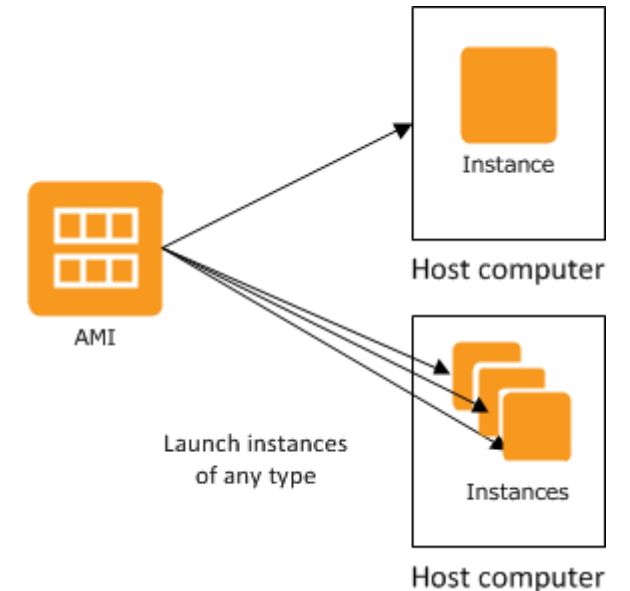
- Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides secure, resizable compute capacity in the cloud. It is designed to make web-scale cloud computing easier for developers
- Amazon EC2's simple web service interface allows you to obtain and configure capacity with minimal friction
- It provides you with complete control of your computing resources and lets you run on Amazon's proven computing environment

EC2

- Amazon EC2 reduces the time required to obtain and boot new server instances to minutes, allowing you to quickly scale capacity, both up and down, as your computing requirements change
- Amazon EC2 changes the economics of computing by allowing you to pay only for capacity that you actually use
- Amazon EC2 provides developers the tools to build failure resilient applications and isolate them from common failure scenarios

AMI

- An *Amazon Machine Image (AMI)* is a template that contains a software configuration (for example, an operating system, an application server, and applications)
- From an AMI, you launch an *instance*, which is a copy of the AMI running as a virtual server on a host computer in Amazon's datacenter
- You can launch multiple instances from an AMI.



Advantages

ELASTIC WEB-SCALE COMPUTING

- Amazon EC2 enables you to increase or decrease capacity within minutes, not hours or days. You can commission one, hundreds, or even thousands of server instances simultaneously

COMPLETELY CONTROLLED

- You have complete control of your instances including root access and the ability to interact with them as you would any machine.

FLEXIBLE CLOUD HOSTING SERVICES

- You have the choice of multiple instance types, operating systems, and software packages

INTEGRATED

- Amazon EC2 is integrated with most AWS services such as Amazon S3, Amazon RDS, and VPC to provide a complete, secure solution for computing, query processing, and cloud storage across a wide range of applications.

Advantages

RELIABLE

- Amazon EC2 offers a highly reliable environment where replacement instances can be rapidly and predictably commissioned

SECURE

- Amazon EC2 works in conjunction with Amazon VPC to provide security and robust networking functionality for your compute resources.

INEXPENSIVE

- You pay a very low rate for the compute capacity you actually consume

EASY TO START

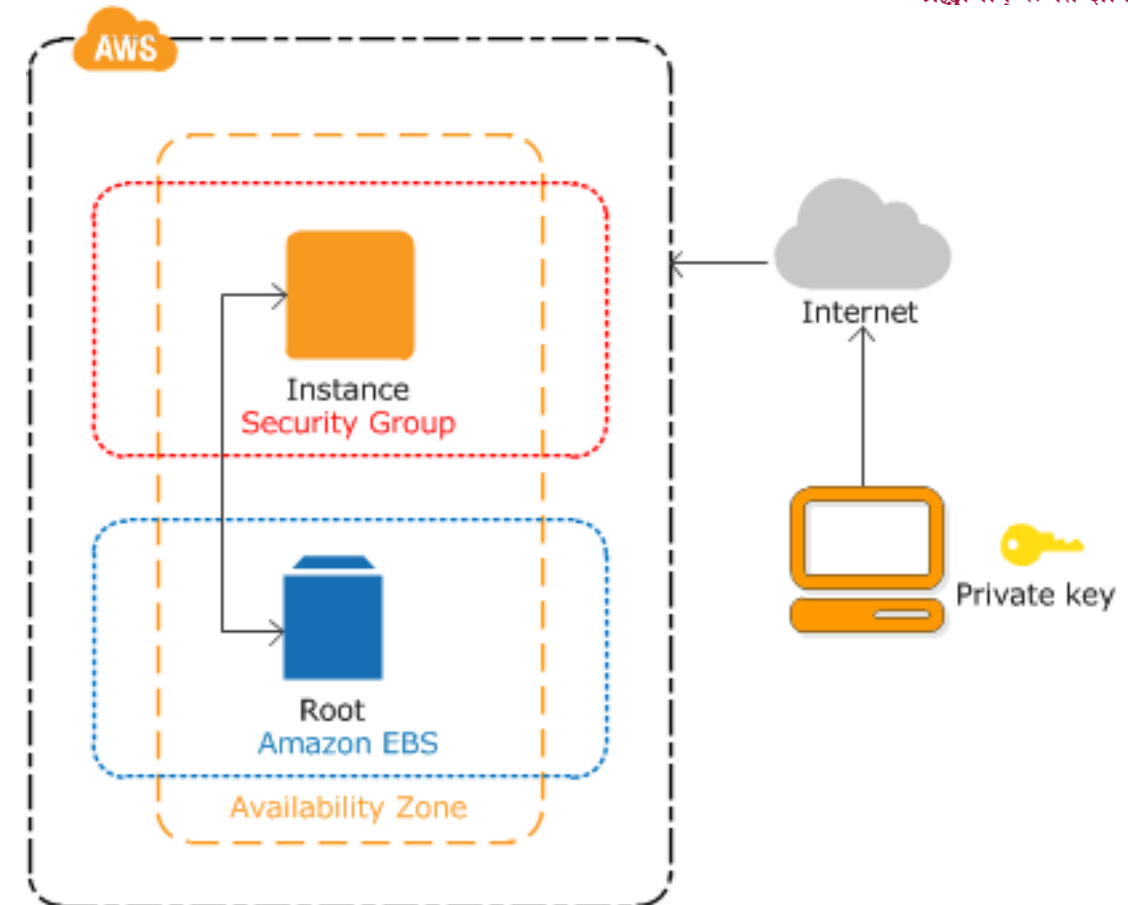
- There are several ways to get started with Amazon EC2. You can use the [AWS Management Console](#), the AWS Command Line Tools (CLI), or [AWS SDKs](#)

Getting Started

- Prerequisite: Your AWS Educate Account is ready
- Then, create a free Linux EC2 instance
- <https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/get-set-up-for-amazon-ec2.html>

Overview

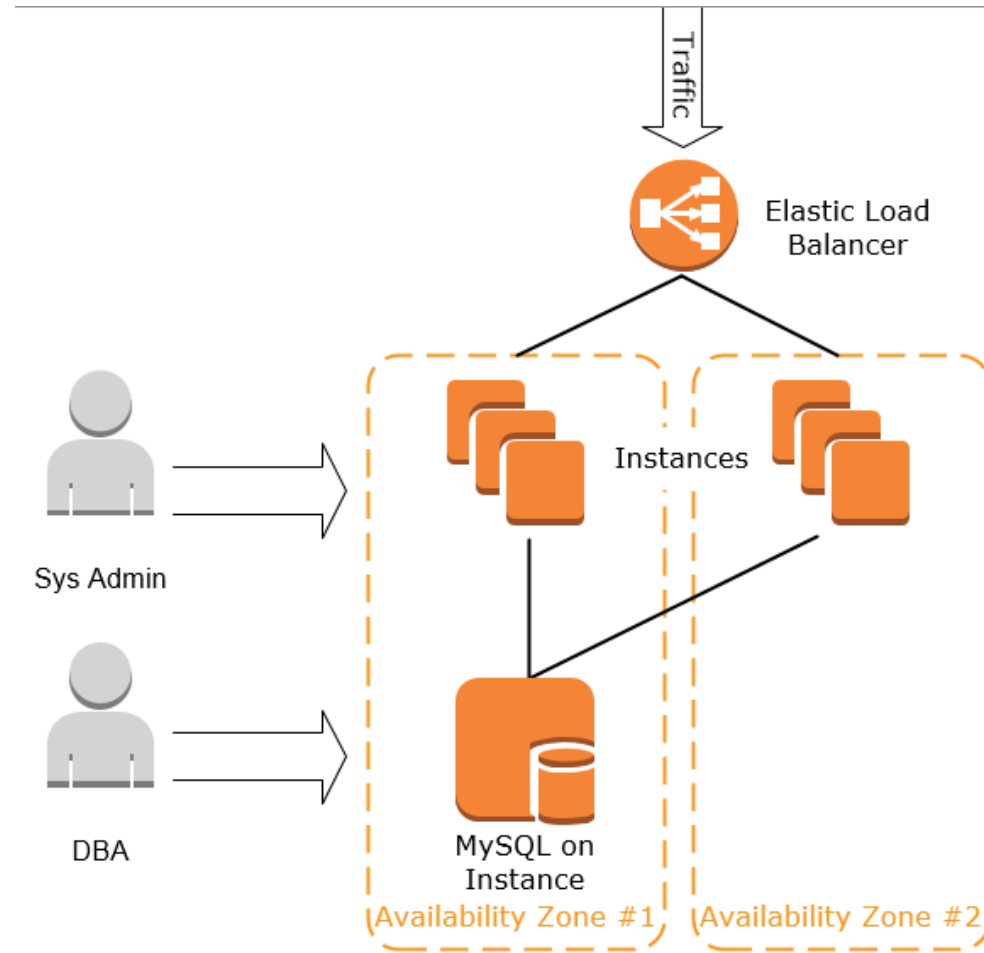
- The instance is an Amazon EBS-backed instance (meaning that the root volume is an EBS volume)
- You can either specify the Availability Zone in which your instance runs, or let Amazon EC2 select an Availability Zone for you
- When you launch your instance, you secure it by specifying a key pair and security group
- When you connect to your instance, you must specify the private key of the key pair that you specified when launching your instance.
- https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/EC2_GetStarted.html



Host a web application in EC2

- Amazon EC2 Windows instances allow customers to deploy Java applications to AWS using their existing application deployment tools and processes, or to integrate Java application deployment with automated deployment tools and services
- Self-managed Amazon EC2 instances offer the flexibility to choose specific operating system, Java, and Java web container versions that an application or a company's IT standards require

Host a web application in EC2



A close-up, black and white photograph of an elephant's skin, showing deep, vertical wrinkles and a rough, textured surface. The lighting creates strong shadows in the creases, emphasizing the texture.

Getting started

Step 1 : Create an AWS free Account

- <https://aws.amazon.com/education/awseducate/>



<https://aws.amazon.com/premiumsupport/knowledge-center/educate-starter-account/>

If you choose Starter account in sign up through AWS Educate, it does not require credit card

You are responsible to choose only free tier eligible services during this course in order to avoid any charges on your credit card.

Example 1 Launch an Ubuntu Virtual Machine Step 1: Create Instance



EC2 Dashboard

Events

Tags

Reports

Limits

INSTANCES

Instances

Spot Requests

Reserved Instances

IMAGES

AMIs

Bundle Tasks

ELASTIC BLOCK STORE

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NETWORK & SECURITY

Security Groups

Elastic IPs

Placement Groups

Key Pairs

Network Interfaces

LOAD BALANCING

Load Balancers

AUTO SCALING

Launch Configurations

Auto Scaling Groups

Resources

You are using the following Amazon EC2 resources in the US East (N. Virginia) region:

0 Running Instances

0 Elastic IPs

0 Volumes

0 Snapshots

0 Key Pairs

0 Load Balancers

0 Placement Groups

1 Security Groups

Easily deploy and operate applications - use Chef recipes, manage SSH users, and more. [Try OpsWorks now.](#)

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 East (N. Virginia) region

Service Health

Service Status:

US East (N. Virginia):
This service is operating normally

Availability Zone Status:

us-east-1a:
Availability zone is operating normally

us-east-1b:
Availability zone is operating normally

us-east-1c:
Availability zone is operating normally

us-east-1e:
Availability zone is operating normally

[Service Health Dashboard](#)

Scheduled Events

US East (N. Virginia):
No events

Step 2: Configure your Instance




Step 1: Choose an Amazon Machine Image (AMI)


AWS Marketplace

Community AMIs


☐ Free tier only ⓘ

**Amazon Linux**
Free tier eligible


Amazon Linux 2 comes with five years support. It provides Linux kernel 4.14 tuned for optimal performance on Amazon EC2, systemd 219, GCC 7.3, Glibc 2.26, Binutils 2.29.1, and the latest software packages through extras.
Root device type: ebs Virtualization type: hvm ENA Enabled: Yes

**Amazon Linux**
Free tier eligible


Amazon Linux AMI 2018.03.0 (HVM), SSD Volume Type - ami-035b3c7efe6d061d5
The Amazon Linux AMI is an EBS-backed, AWS-supported image. The default image includes AWS command line tools, Python, Ruby, Perl, and Java. The repositories include Docker, PHP, MySQL, PostgreSQL, and other packages.
Root device type: ebs Virtualization type: hvm ENA Enabled: Yes

**Red Hat**
Free tier eligible

Red Hat Enterprise Linux 8 (HVM), SSD Volume Type - ami-0c322300a1dd5dc79 (64-bit x86) / ami-03587fa4048e9eb92 (64-bit Arm)
Red Hat Enterprise Linux version 8 (HVM), EBS General Purpose (SSD) Volume Type
Root device type: ebs Virtualization type: hvm ENA Enabled: Yes

**SUSE Linux**
Free tier eligible

SUSE Linux Enterprise Server 15 SP1 (HVM), SSD Volume Type - ami-0b5372ab3202bd20b (64-bit x86) / ami-0072af0151fbe67b9 (64-bit Arm)
SUSE Linux Enterprise Server 15 Service Pack 1 (HVM), EBS General Purpose (SSD) Volume Type. Public Cloud, Advanced Systems Management, Web and Scripting, and Legacy modules enabled.
Root device type: ebs Virtualization type: hvm ENA Enabled: Yes

**Free tier eligible**

Ubuntu Server 18.04 LTS (HVM), SSD Volume Type - ami-026c8acd92718196b (64-bit x86) / ami-0c46f9f09e3a8c2b5 (64-bit Arm)
Ubuntu Server 18.04 LTS (HVM),EBS General Purpose (SSD) Volume Type. Support available from Canonical (<http://www.ubuntu.com/cloud/services>).
Root device type: ebs Virtualization type: hvm ENA Enabled: Yes

Cancel and Exit

☒ 64-bit (x86)

☐ 64-bit (Arm)

Select

64-bit (x86)

Select

☒ 64-bit (x86)

☐ 64-bit (Arm)

Select

☒ 64-bit (x86)

☐ 64-bit (Arm)

Select

☒ 64-bit (x86)

☐ 64-bit (Arm)



Step 3 : Choose Instance Type

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

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 capabilities, giving 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** **Current generation** [Show/Hide Columns](#)

Currently selected: t2.micro (Variable ECUs, 1 vCPUs, 2.5 GHz, Intel Xeon Family, 1 GiB memory, EBS only)

	Family	Type	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance
<input type="checkbox"/>	General purpose	t2.nano	1	0.5	EBS only	-	Low to Medium
<input checked="" type="checkbox"/>	General purpose	t2.micro Free tier eligible	1	1	EBS only	-	Low to Medium
<input type="checkbox"/>	General purpose	t2.small	1	2	EBS only	-	Low to Medium
<input type="checkbox"/>	General purpose	t2.medium	2	4	EBS only	-	Low to Medium
<input type="checkbox"/>	General purpose	t2.large	2	8	EBS only	-	Low to Medium
<input type="checkbox"/>	General purpose	t2.xlarge	4	16	EBS only	-	Medium to High
<input type="checkbox"/>	General purpose	t2.2xlarge	8	32	EBS only	-	Medium to High
<input type="checkbox"/>	General purpose	t3a.nano	2	0.5	EBS only	Yes	Up to 5 Gbps

[Cancel](#)

[Previous](#)

[Review and Launch](#)

Step 4 : Configure Instance

Create a New Default VPC



aws Services ▾ Resource Groups ▾ ☆

ganeshniyer ▾ N. Virginia

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

Step 3: Configure Instance Details

No default VPC found. You have no default VPC, and no subnets in your other VPCs. [Create a subnet](#) or [create a new default VPC](#) in the VPC console.

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,

Number of instances ⓘ 1 [Launch into Auto Scaling Group](#) ⓘ

Purchasing option ⓘ ☐ Request Spot instances

Network ⓘ vpc-07a938889efe3aa75 [Create new VPC](#)

Subnet ⓘ No subnets found [Create new subnet](#)

⚠ A subnet is required when launching into a VPC

Auto-assign Public IP ⓘ Use subnet setting

Placement group ⓘ ☐ Add instance to placement group

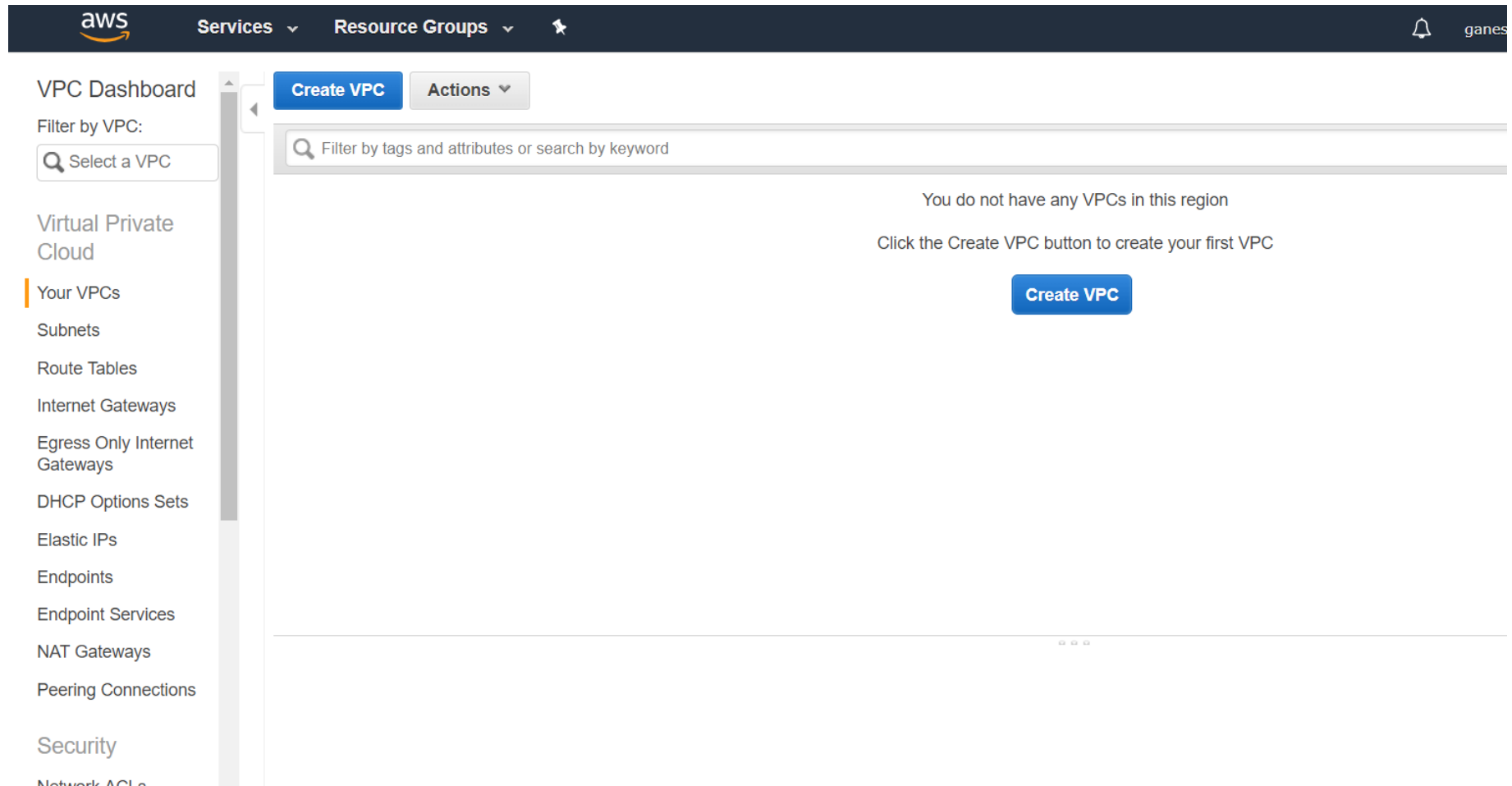
Capacity Reservation ⓘ Open [Create new Capacity Reservation](#)

IAM role ⓘ None [Create new IAM role](#)

Shutdown behavior ⓘ Stop

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

Step 4a: Create New VPC



The screenshot displays the AWS Management Console interface for the VPC (Virtual Private Cloud) service. The top navigation bar includes the AWS logo, 'Services', 'Resource Groups', and a user profile icon labeled 'ganes'. The left sidebar shows a list of services under the 'Virtual Private Cloud' section, including 'Your VPCs', 'Subnets', 'Route Tables', 'Internet Gateways', 'Egress Only Internet Gateways', 'DHCP Options Sets', 'Elastic IPs', 'Endpoints', 'Endpoint Services', 'NAT Gateways', and 'Peering Connections'. The main content area features a 'Create VPC' button and a message: 'You do not have any VPCs in this region. Click the Create VPC button to create your first VPC.' Below this message is another 'Create VPC' button. The bottom of the console shows a pagination bar with '1/1'.

Step 5: Review and Launch

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,

Number of instances	<input type="text" value="1"/>	Launch into Auto Scaling Group
Purchasing option	<input type="checkbox"/> Request Spot instances	
Network	<input type="text" value="vpc-0f0a3d0a51b0de708 (default)"/>	Create new VPC
Subnet	<input type="text" value="No preference (default subnet in any Availability Zone)"/>	Create new subnet
Auto-assign Public IP	<input type="text" value="Use subnet setting (Enable)"/>	
Placement group	<input type="checkbox"/> Add instance to placement group	
Capacity Reservation	<input type="text" value="Open"/>	Create new Capacity Reservation
IAM role	<input type="text" value="None"/>	Create new IAM role
Shutdown behavior	<input type="text" value="Stop"/>	
Enable termination protection	<input type="checkbox"/> Protect against accidental termination	
Monitoring	<input type="checkbox"/> Enable CloudWatch detailed monitoring Additional charges apply.	
Tenancy	<input type="text" value="Shared - Run a shared hardware instance"/>	

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

Step 5: Create a key pair

- Download and Store it in your machine.
- Your house key is used to enter your home

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](#).

Create a new key pair

Key pair name

MyKeyPair

Download Key Pair



You have to download the **private key file** (*.pem file) before you can continue. **Store it in a secure and accessible location.** You will not be able to download the file again after it's created.

Cancel

Launch Instances



Step 6: View Instances

Launch Status



Your instances are now launching

The following instance launches have been initiated: i-██████████ [View launch log](#)



Get notified of estimated charges

Create [billing alerts](#) to get an email notification when estimated charges on your AWS bill exceed an amount you define (for example, if you exceed the free usage tier).

How to connect to your instances

Your instances are launching, and it may take a few minutes until they are in the **running** state, when they will be ready for you to use. Usage hours on your new instances will start immediately and continue to accrue until you stop or terminate your instances.

Click **View Instances** to monitor your instances' status. Once your instances are in the **running** state, you can **connect** to them from the Instances screen. [Find out](#) how to connect to your instances.

▼ Here are some helpful resources to get you started

- [How to connect to your Linux instance](#)
- [Amazon EC2: User Guide](#)
- [Learn about AWS Free Usage Tier](#)
- [Amazon EC2: Discussion Forum](#)

While your instances are launching you can also

[Create status check alarms](#) to be notified when these instances fail status checks. (Additional charges may apply)

[Create and attach additional EBS volumes](#) (Additional charges may apply)

[Manage security groups](#)

[View Instances](#)



Step 7: Make note of IP address

Resource Groups ▾ 🔖

Prakash P ▾ N. Virginia ▾ Support ▾

Launch Instance Connect Actions ▾

Filter by tags and attributes or search by keyword

<input type="checkbox"/>	Name ▾	Instance ID ▴	Instance Type ▾	Availability Zone ▾	Instance State ▾	Status Checks ▾	Alarm Status	Public DNS (IPv4) ▾	IPv4 Public IP ▾	IPv6
<input type="checkbox"/>		i-0527a6c6f0d00ff5b	t2.micro	us-east-1c	● running	✓ 2/2 checks ...	None	ec2-52-201-214-74.co...	52.201.214.74	-

Instance ID: i-0527a6c6f0d00ff5b

Instance state: running

Instance type: t2.micro

Elastic IPs: -

Public DNS (IPv4): ec2-52-201-214-74.co...

IPv4 Public IP: 52.201.214.74


IPv6 IPs: -

Private DNS: ip-172-31-23-30.ec2.internal

Make note of the Public IP address of your AWS instance, you will need this to connect to the instance

Step 8: Download the Git and Install



 **git** --distributed-is-the-new-centralized


Search entire site...

[About](#)
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[Blog](#)
[Downloads](#)
 [GUI Clients](#)
 [Logos](#)

[Community](#)

The entire [Pro Git book](#) written by Scott Chacon and Ben Straub is available to [read online for free](#). Dead tree versions are available on [Amazon.com](#).

Downloading Git



Your download is starting...

You are downloading the latest (**2.6.4**) **64-bit** version of **Git for Windows**. This is the most recent [maintained build](#). It was released **2 days ago**, on 2015-12-14.

If your download hasn't started, [click here to download manually](#).

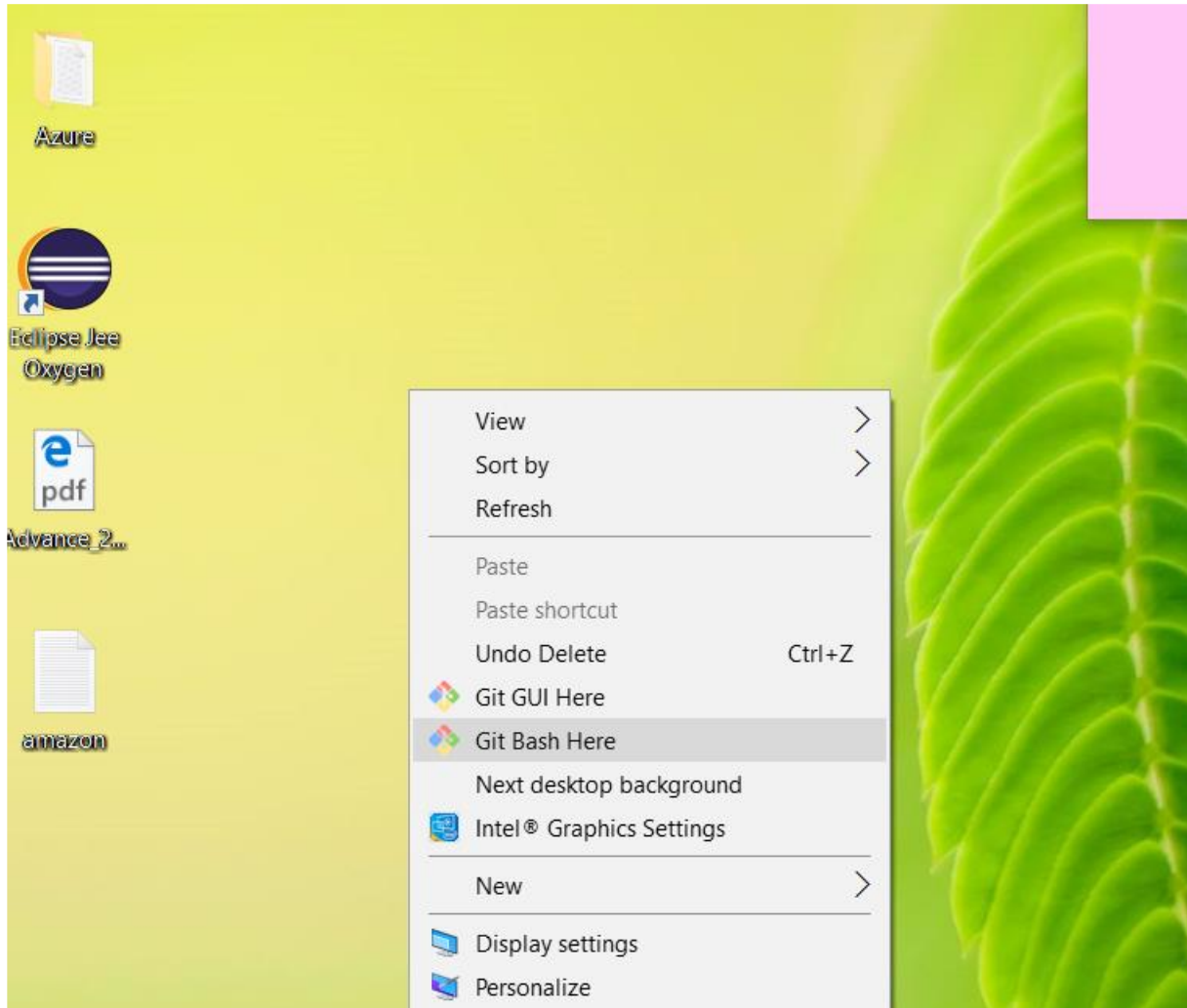
Other Git for Windows downloads

Git for Windows Setup
[32-bit Git for Windows Setup](#).
[64-bit Git for Windows Setup](#).

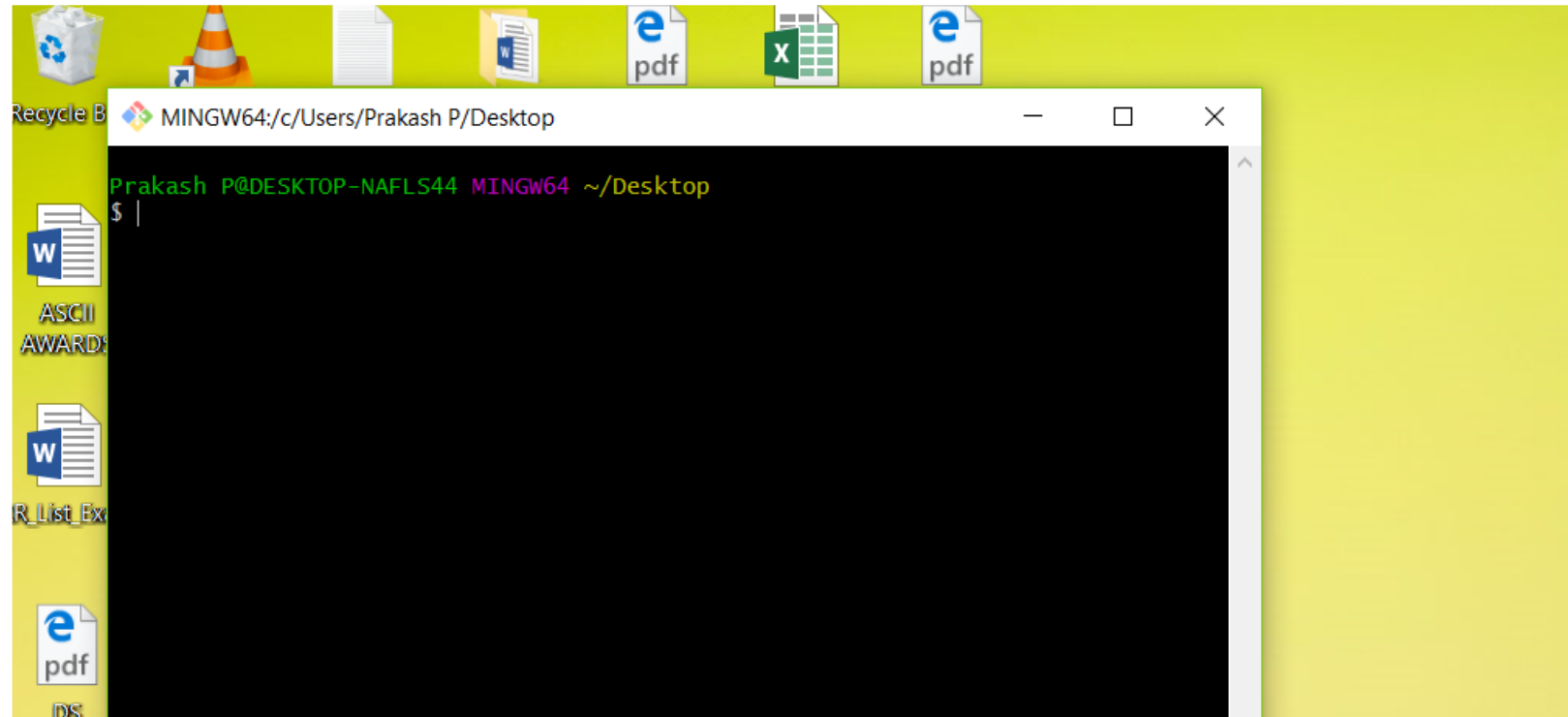
Git for Windows Portable ("thumbdrive edition")
[32-bit Git for Windows Portable](#).
[64-bit Git for Windows Portable](#).

The current source code release is version **2.6.4**. If you want the newer version, you can build it from [the source code](#).

Step 9: Right click → Git Bash Here



Step 9.1 : Opens Git terminal



Step 10 : Use SSH to connect to your instance



- `ssh -i '<PATH>\MyKeyPair.pem' ec2-user@{IP_Address}`

```
Giri@Giri-IyEr MINGW64 ~/Desktop
$ ssh -i "D:\\JideDemo.pem" ubuntu@ec2-52-90-106-181.compute-1.amazonaws.com
```

```
Giri@Giri-IyEr MINGW64 ~/Desktop
$ ssh -i "D:\\JideDemo.pem" ubuntu@ec2-52-90-106-181.compute-1.amazonaws.com
The authenticity of host 'ec2-52-90-106-181.compute-1.amazonaws.com (52.90.106.181)' can't be established.
ECDSA key fingerprint is SHA256:r41mYBWNkfuMIMWersptJWIs7b2/KJ0e4i6T0O4maNI.
Are you sure you want to continue connecting (yes/no)? |
```

instance
T:\>MyKeyPair.pem' ec2-user@{IP_Address}

ssh -i "D:\\JideDemo.pem" ubuntu@ec2-52-90-106-181.compute-1.amazonaws.com

You are now in AWS... 😊

```
system information as of wed Jul 17 06:13:35 UTC 2019

System load:  0.08          Processes:           84
Usage of /:   13.5% of 7.69GB Users logged in:    0
Memory usage: 14%          IP address for eth0: 172.31.35.6
Swap usage:   0%

0 packages can be updated.
0 updates are security updates.

The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

ubuntu@ip-172-31-35-6:~$ |
```



Finally in EC2

- You can now use this as a remote compute resource and use it for anything
- Self-exercise: Deploy and run your first React app from AWS

After using AWS, Never forget to terminate the instance. Otherwise, expect to pay bills.

Thank you!

Dr Ganesh Neelakanta Iyer

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ganesh.vigneswara@gmail.com



Office Hours

– Tuesday 4-445
PM @ My office