



## 2. Cloud Service Models:

### **Software as a Service (SaaS):**

Software as a Service provides you with a completed product that is run and managed by the service provider. In most cases, people referring to Software as a Service are referring to end-user applications. With a SaaS offering you do not have to think about how the service is maintained or how the underlying infrastructure is managed; you only need to think about how you will use that particular piece software. A common example of a SaaS application is web-based email where you can send and receive email without having to manage feature additions to the email product or maintaining the servers and operating systems that the email program is running on.

Example: Google Apps, Salesforce, Workday, Concur, Citrix, Cisco WebEx...

### **Platform as a Service (PaaS):**

Platforms as a service remove the need for organizations to manage the underlying infrastructure (usually hardware and operating systems) and allow you to focus on the deployment and management of your applications. This helps you be more efficient as you don't need to worry about resource procurement, capacity planning, software maintenance, patching, or any of the other undifferentiated heavy lifting involved in running your application.

Example: Beanstalk

### **Infrastructure as a Service (IaaS):**

Infrastructure as a Service, sometimes abbreviated as IaaS, contains the basic building blocks for cloud IT and typically provide access to networking features, computers (virtual or on dedicated hardware), and data storage space. Infrastructure as a Service provides you with the highest level of flexibility and management control over your IT resources and is most similar to existing IT resources that many IT departments and developers are familiar with today.

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Example: AWS EC2, Microsoft Azure, Google Compute Engine, Joyent..

### 3. Advantages and Disadvantages of Cloud Computing

#### Advantages:

- **Easy Implementation:** Cloud hosting allows business to retain the same applications and business processes without having to deal with the backend technicalities. Readily manageable by the Internet, a cloud infrastructure can be accessed by enterprises easily and quickly.
- **Accessibility:** Access your data anywhere, anytime. An Internet cloud infrastructure maximizes enterprise productivity and efficiency by ensuring your application is always accessible. This allows for easy collaboration and sharing among users in multiple locations.
- **No hardware required:** Since everything will be hosted in the cloud, a physical storage center is no longer needed. However, a backup could be worth looking into in the event of a disaster that could leave your company's productivity stagnant.
- **Cost per head:** Overhead technology costs are kept at a minimum with cloud hosting services, enabling businesses to use the extra time and resources for improving the company infrastructure.
- **Flexibility for growth:** The cloud is easily scalable so companies can add or subtract resources based on their needs. As companies grow, their system will grow with them.
- **Efficient recovery:** Cloud computing delivers faster and more accurate retrievals of applications and data. With less downtime, it is the most efficient recovery plan.

#### Disadvantages:

- **No longer in control:** When moving services to the cloud, you are handing over your data and information. For companies who have an in-house IT staff, they will be unable to handle issues on their own. However, Stratosphere Networks has a 24/7 live help desk that can rectify any problems immediately.
- **May not get all the features:** Not all cloud services are the same. Some cloud providers tend to offer limited versions and enable the most popular features only, so you may not receive every feature or customization you want. Before signing up, make sure you know what your cloud service provider offers.
- **Doesn't mean you should do away with servers:** You may have fewer servers to handle which means less for your IT staff to handle, but that doesn't mean you can let go of all your servers and staff. While it may seem costly to have data centers and a cloud infrastructure, redundancy is key for backup and recovery.
- **No Redundancy:** A cloud server is not redundant nor is it backed up. As technology may fail here and there, avoid getting burned by purchasing a redundancy plan. Although it is an extra cost, in most cases it will be well worth it.
- **Bandwidth issues:** For ideal performance, clients have to plan accordingly and not pack large amounts of servers and storage devices into a small set of data centers.

## 4. What is AWS?

Amazon Web Services (AWS) is a secure cloud services platform, offering compute power, database storage, content delivery and other functionality to help businesses scale and grow. Explore how millions of customers are currently leveraging AWS cloud products and solutions to build sophisticated applications with increased flexibility, scalability and reliability.



## 5. Regions and Availability Zones

Amazon cloud computing resources are hosted in multiple locations world-wide. These locations are composed of regions and Availability Zones. Each region is a separate geographic area. Each region has multiple, isolated locations known as Availability Zones. For most of the AWS services that you use, you will be prompted to select a region in which you want to deploy the service. Each region is completely isolated from the other and runs independently as well.

A list of regions and availability zones are given below for reference:

| Region                         | Name       | Endpoint  |
|--------------------------------|------------|---|
| US East (N. Virginia) Region   | us-east-1  | <a href="https://rds.us-east-1.amazonaws.com">https://rds.us-east-1.amazonaws.com</a>   |
| US East (Ohio) Region          | us-east-2  | <a href="https://rds.us-east-2.amazonaws.com">https://rds.us-east-2.amazonaws.com</a>   |
| US West (N. California) Region | us-west-1  | <a href="https://rds.us-west-1.amazonaws.com">https://rds.us-west-1.amazonaws.com</a>   |
| US West (Oregon) Region        | us-west-2  | <a href="https://rds.us-west-2.amazonaws.com">https://rds.us-west-2.amazonaws.com</a>   |
| Asia Pacific (Mumbai) Region   | ap-south-1 | <a href="https://rds.ap-south-1.amazonaws.com">https://rds.ap-south-1.amazonaws.com</a> |

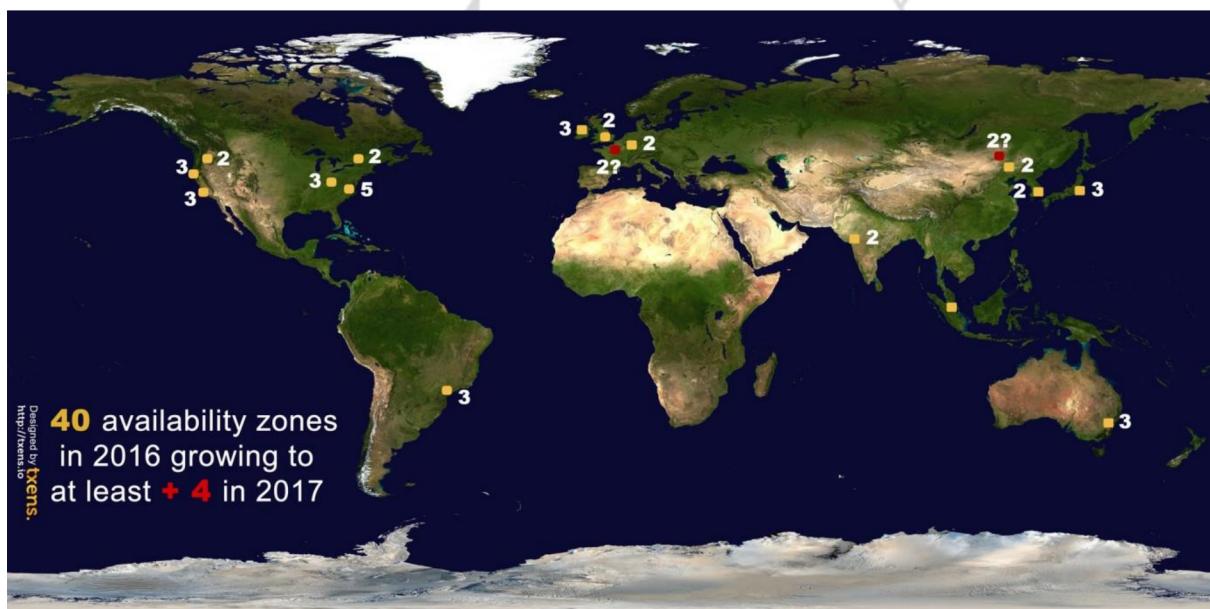
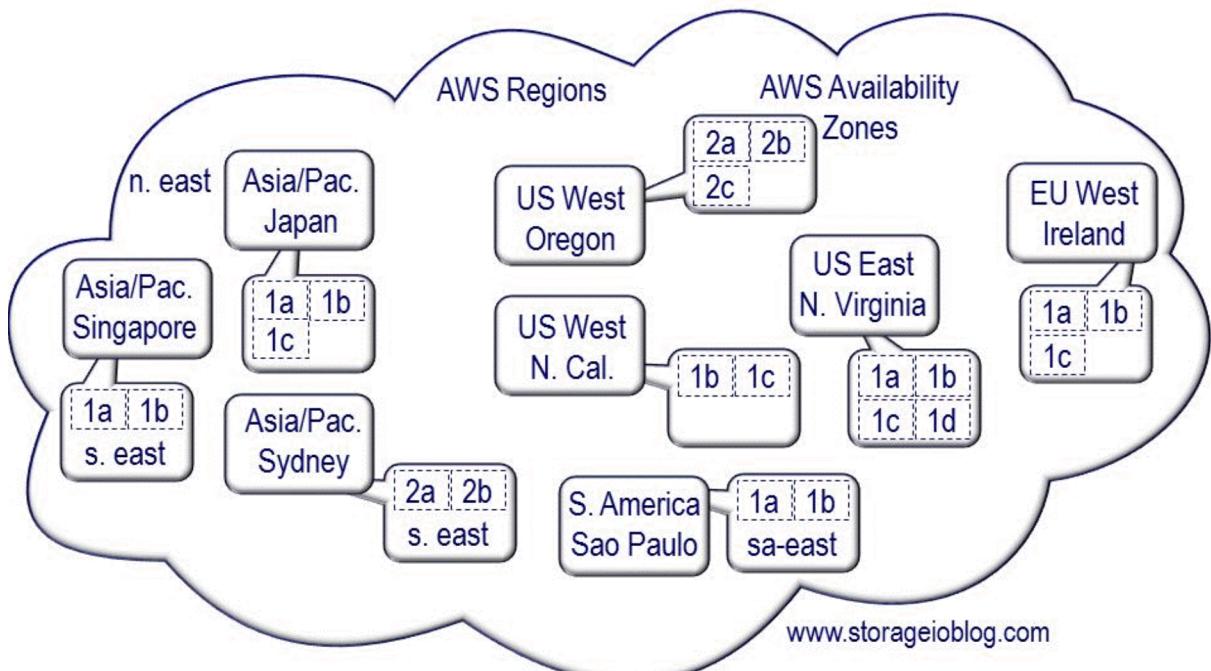
|                                  |                |   |
|----------------------------------|----------------|---|
| Asia Pacific (Seoul) Region      | ap-northeast-2 | <a href="https://rds.ap-northeast-2.amazonaws.com">https://rds.ap-northeast-2.amazonaws.com</a> |
| Asia Pacific (Singapore) Region  | ap-southeast-1 | <a href="https://rds.ap-southeast-1.amazonaws.com">https://rds.ap-southeast-1.amazonaws.com</a> |
| Asia Pacific (Sydney) Region     | ap-southeast-2 | <a href="https://rds.ap-southeast-2.amazonaws.com">https://rds.ap-southeast-2.amazonaws.com</a> |
| Asia Pacific (Tokyo) Region      | ap-northeast-1 | <a href="https://rds.ap-northeast-1.amazonaws.com">https://rds.ap-northeast-1.amazonaws.com</a> |
| Canada (Central) Region          | ca-central-1   | <a href="https://rds.ca-central-1.amazonaws.com">https://rds.ca-central-1.amazonaws.com</a>     |
| China (Beijing) Region           | cn-north-1     | <a href="https://rds.cn-north-1.amazonaws.com.cn">https://rds.cn-north-1.amazonaws.com.cn</a>   |
| EU (Frankfurt) Region            | eu-central-1   | <a href="https://rds.eu-central-1.amazonaws.com">https://rds.eu-central-1.amazonaws.com</a>     |
| EU (Ireland) Region              | eu-west-1      | <a href="https://rds.eu-west-1.amazonaws.com">https://rds.eu-west-1.amazonaws.com</a>           |
| EU (London) Region               | eu-west-2      | <a href="https://rds.eu-west-2.amazonaws.com">https://rds.eu-west-2.amazonaws.com</a>           |
| South America (São Paulo) Region | sa-east-1      | <a href="https://rds.sa-east-1.amazonaws.com">https://rds.sa-east-1.amazonaws.com</a>           |
| AWS GovCloud (US)                | us-gov-west-1  | <a href="https://rds.us-gov-west-1.amazonaws.com">https://rds.us-gov-west-1.amazonaws.com</a>   |

Each region is split up into one or more Availability Zones (AZs) and pronounced as AZees. An A Z is an isolated location inside a region.

AZs are made up of one or more physical data centers that host AWS services on them. Just as with regions, even AZs have corresponding codes to identify them, generally they are regional names followed by a numerical value. For example, if you select and use us-east-1, which is the North Virginia region, then it would have AZs listed as us-east-1b, us-east-1c, us-east-1d, and so on.

AZs are very important from a design and deployment point of view. Being data centers, they are more than capable of failure and downtime, so it is always good practice to distribute your resources across multiple AZs and design your applications such that they can remain available even if one AZ goes completely offline. An important point to note here is that AWS will always provide the services and products to you as a customer; however, it is your duty to design and distribute your applications so that they do not suffer any potential outages or failures.

The below structure represents the regions and their availability zones



Amazon RDS provides you the ability to place resources, such as instances, and data in multiple locations.

**Note:** AWS does not replicate resources across regions automatically. It is up to the end user to set up the replication process.

## 6. AWS Services

AWS provides us lot of services that we can use to build our infrastructure on AWS cloud.

Our focus being into DevOps will be to leverage SysOps services that AWS provides. There are so many other Services consumed by Developers directly and that's not the focus of this book.

Also AWS has some DevOps related services like codecommit, codedeploy, cloudformation etc, that would be out of the scope for this book to cover.

In this chapter we will look into below mentioned AWS services.

- IAM
- EC2
- VPC
- S3
- RDS
- Beanstalk
- Cloudwatch
- Route53

## 7. IAM

### Security, Identity & Compliance:

AWS Identity and Access Management (IAM) is a web service that enables Amazon Web Services (AWS) customers to manage users and user permissions in AWS. The service is targeted at organizations with multiple users or systems in the cloud that use AWS products such as Amazon EC2, Amazon SimpleDB, and the AWS Management Console. With IAM, you can centrally manage users, security credentials such as access keys, and permissions that control which AWS resources users can access.

### Creating IAM user:

- ❖ Login to AWS account => Services => IAM

The screenshot shows the AWS IAM Management Console interface. At the top, there's a navigation bar with links for IAM Management, Services, Resource Groups, and a search bar. Below the navigation is a main dashboard area with sections for IAM Resources (Users: 1, Groups: 0, Roles: 2, Customer Managed Policies: 0), Security Status (with a progress bar at 3 out of 5 complete), and a Feature Spotlight video titled "Introduction to AWS IAM". On the left, there's a sidebar with links for Dashboard, Groups, Users, Roles, Policies, Identity providers, Account settings, Credential report, and Encryption keys. At the bottom, there are links for Feedback, English, and footer text about copyright and terms of use.

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- ❖ Select users => Add user => username

The screenshot shows the AWS IAM Management Console interface. On the left, there's a sidebar with options like Dashboard, Groups, Users (which is selected), Roles, Policies, Identity providers, Account settings, and Credential report. The main area has tabs for 'Add user' and 'Delete user'. A search bar at the top says 'Find users by username or access key' with 'User name' selected. The results table shows one entry: 'User name' kops, 'Groups' 0, 'Password' N/A, 'Last sign-in' N/A, 'Access keys' 1 active, and 'Creation time' 2017-03-26 13:01 UTC+0530.

- ❖ Select one of the options either **Programmatic access (Key-based access for AWS-CLI)** or **AWS Management Console access**.

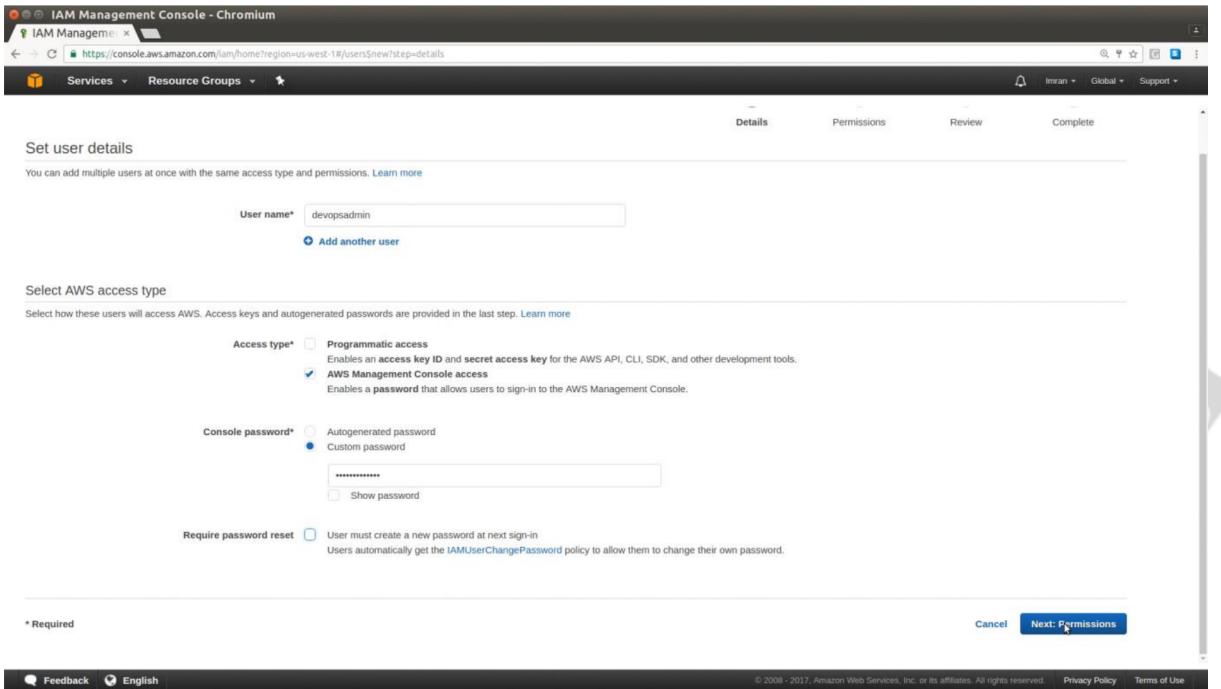
The screenshot shows the 'Add user' wizard. Step 1: Set user details. It has a 'User name' field with 'kops' and a 'Select AWS access type' section. Under 'Access type', 'Programmatic access' is selected, which is described as enabling an access key ID and secret access key for the AWS API, CLI, SDK, and other development tools. There's also an option for 'AWS Management Console access', which enables a password for the AWS Management Console. At the bottom, there are 'Cancel' and 'Next: Permissions' buttons.

- ❖ If you select **AWS Management Console access**, you need to select **Autogenerated password** or **custom password**.

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## ❖ Click on Next Permissions



## Attach Policy to the User.

By default, IAM users don't have permission to create or modify Amazon EC2 resources, or perform tasks using the Amazon EC2 API. (This means that they also can't do so using the Amazon EC2 console or CLI).

When you attach a policy to a user or group of users, it allows or denies the users permission to perform the specified tasks on the specified resources. So while creating user we have to assign the policies which has to be performed by particular user. There are some predefined policies in IAM, we can attach the existing policies or create new policy. Here in this example we are attaching Administrator Access in which the user gets all administrator permissions.

IAM Management Console - Chromium

[https://console.aws.amazon.com/iam/home?region=us-west-1#/users\\$new?step=permissions&login&userNames=devopsadmin&passwordType=manual&permissionType=policies](https://console.aws.amazon.com/iam/home?region=us-west-1#/users$new?step=permissions&login&userNames=devopsadmin&passwordType=manual&permissionType=policies)

Services Resource Groups

Add user to group Copy permissions from existing user Attach existing policies directly

Attach one or more existing policies directly to the user or create a new policy. Learn more

Create policy Refresh

Filter: Policy type Search Showing 254 results

| Policy name   | Type         | Attachments | Description   |
|---|--------------|-------------|---|
| <input checked="" type="checkbox"/> AdministratorAccess       | Job function | 1           | Provides full access to AWS services and resources.   |
| <input type="checkbox"/> AmazonAPIGatewayAdministrator        | AWS managed  | 0           | Provides full access to create/edit/delete APIs in Amazon API Gateway via the AWS Management Console.                   |
| <input type="checkbox"/> AmazonAPIGatewayInvokeFullAccess     | AWS managed  | 0           | Provides full access to invoke APIs in Amazon API Gateway.  |
| <input type="checkbox"/> AmazonAPIGatewayPushToCloudWatchLogs | AWS managed  | 0           | Allows API Gateway to push logs to user's account.  |
| <input type="checkbox"/> AmazonAppStreamFullAccess            | AWS managed  | 0           | Provides full access to Amazon AppStream via the AWS Management Console.  |
| <input type="checkbox"/> AmazonAppStreamReadOnlyAccess        | AWS managed  | 0           | Provides read only access to Amazon AppStream via the AWS Management Console.   |
| <input type="checkbox"/> AmazonAppStreamServiceAccess         | AWS managed  | 0           | Default policy for Amazon AppStream service role.   |
| <input type="checkbox"/> AmazonAthenaFullAccess               | AWS managed  | 0           | Provide full access to Amazon Athena and scoped access to the dependencies needed to enable querying, writing result... |
| <input type="checkbox"/> AmazonCloudDirectoryFullAccess       | AWS managed  | 0           | Provides full access to Amazon Cloud Directory Service.   |
| <input type="checkbox"/> AmazonCloudFrontFullAccess           | AWS managed  | 0           | Provides read only access to Amazon Cloud Front.  |

Feedback English Cancel Previous Next: Review © 2008 - 2017, Amazon Web Services, Inc. or its affiliates. All rights reserved. Privacy Policy Terms of Use

IAM Management Console - Chromium

[https://console.aws.amazon.com/iam/home?region=us-west-1#/users\\$new?step=review&login&userNames=devopsadmin&passwordType=manual&permissionType=policies&policies=arn:aws:iam::aws:policy%2FAdministratorAccess](https://console.aws.amazon.com/iam/home?region=us-west-1#/users$new?step=review&login&userNames=devopsadmin&passwordType=manual&permissionType=policies&policies=arn:aws:iam::aws:policy%2FAdministratorAccess)

Services Resource Groups

Add user

1 Details 2 Permissions 3 Review 4 Complete

**Review**

Review your choices. After you create the user, you can view and download the autogenerated password and access key.

User details

|                        |   |
|------------------------|---|
| User name              | devopsadmin                                     |
| AWS access type        | AWS Management Console access - with a password |
| Console password type  | Custom  |
| Require password reset | No  |

Permissions summary

The following policies will be attached to the user shown above.

| Type           | Name                |
|----------------|---------------------|
| Managed policy | AdministratorAccess |

Cancel Previous Create user



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- ❖ After creating user we get a **Download.csv** file, which contains the credentials of the user and url to login to the AWS console.

The screenshot shows the IAM Management Console interface. At the top, there are tabs for Services and Resource Groups. Below that, a progress bar indicates the 'Add user' process is at step 4, 'Complete'. A 'Success' message box is displayed, stating: 'You successfully created the users shown below. You can view and download user security credentials. You can also email users instructions for signing in to the AWS Management Console. This is the last time these credentials will be available to download. However, you can create new credentials at any time.' It also mentions that users with AWS Management Console access can sign-in at a specific URL. Below the message, a table lists the newly created user 'devopsadmin' under the 'User' category. To the right of the table are buttons for 'Email login instructions' and 'Send email'. At the bottom of the page, there are links for Feedback, English, Privacy Policy, and Terms of Use.

## Setting up MFA:

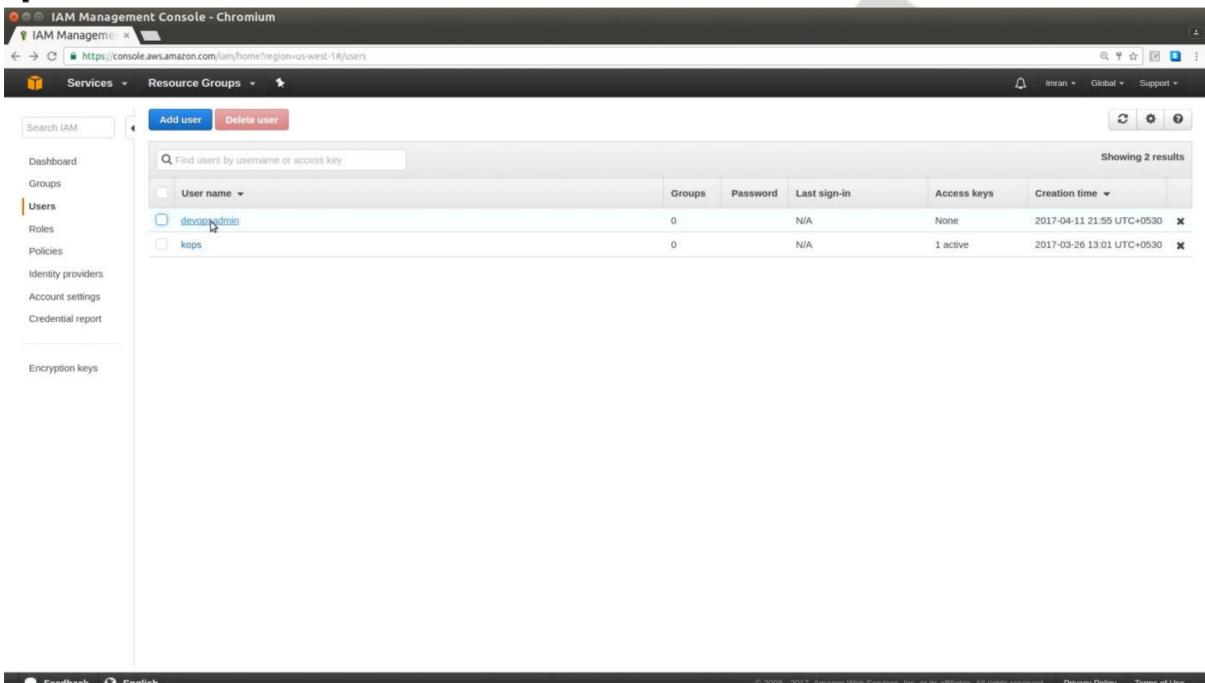
**AWS Multi-Factor Authentication (MFA)** is a simple best practice that adds an extra layer of protection on top of your user name and password. With MFA enabled, when a user signs in to an AWS website, they will be prompted for their user name and password (the first factor—what they know), as well as for an authentication code from their AWS MFA device (the second factor—what they have). Taken together, these multiple factors provide increased security for your AWS account settings and resources.

You can enable MFA for your AWS account and for individual IAM users you have created under your account. MFA can be also be used to control access to AWS service APIs.

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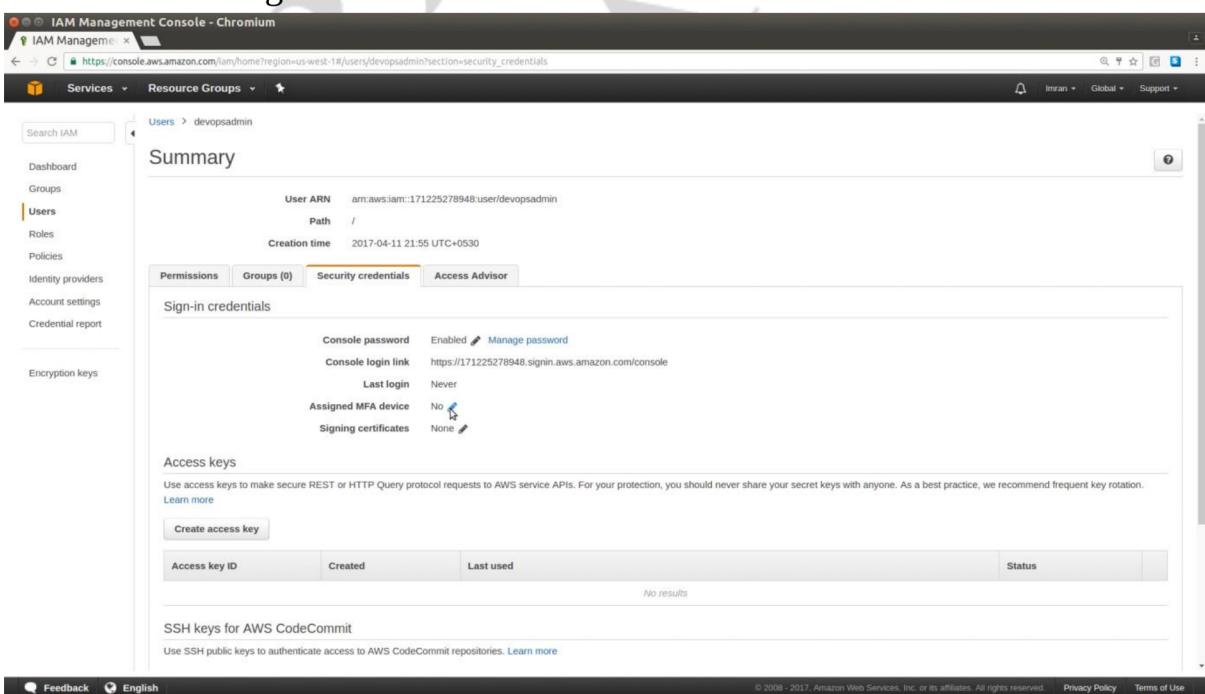
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## ❖ Click on Username



The screenshot shows the AWS IAM Management Console. The left sidebar is collapsed, and the main area displays a table of users. The table has columns for User name, Groups, Password, Last sign-in, Access keys, and Creation time. Two users are listed: 'devopsadmin' and 'kops'. The 'devopsadmin' row is highlighted with a light blue background. A cursor arrow is positioned directly over the 'devopsadmin' user name.

## ❖ Click on Assigned MFA device



The screenshot shows the AWS IAM Management Console with the URL [https://console.aws.amazon.com/iam/home?region=us-west-1#/users/devopsadmin?section=security\\_credentials](https://console.aws.amazon.com/iam/home?region=us-west-1#/users/devopsadmin?section=security_credentials). The left sidebar shows the navigation path: Users > devopsadmin. The main area is titled 'Summary' and contains sections for User ARN, Path, and Creation time. Below these are tabs for Permissions, Groups (0), Security credentials (which is selected), and Access Advisor. The 'Security credentials' section includes 'Sign-in credentials' (Console password, Console login link, Last login, Assigned MFA device, Signing certificates) and 'Access keys' (Create access key button, table for Access key ID, Created, Last used, Status). The 'Assigned MFA device' row in the 'Sign-in credentials' table is highlighted with a light blue background, and a cursor arrow is positioned over the 'No' link next to it.

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Screenshot of the AWS IAM Management Console showing the 'Manage MFA Device' dialog box. The dialog asks to select the type of MFA device, with 'A Virtual MFA device' selected. It also includes a note about supported MFA devices and a 'Next Step' button.

## Steps:

- => Download Google Authenticator in your Smartphone
- => Open Google Authenticator
- => Click plus symbol
- => Scan the barcode
- => Enter Auth code1
- => Enter second auth code.

Screenshot of the AWS IAM Management Console showing the 'Manage MFA Device' dialog box. It displays a QR code for scanning with a smartphone camera. Below the QR code are fields for entering two consecutive authentication codes and a 'Activate Virtual MFA' button.

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- ❖ Use the highlighted URL for your user to login to AWS account with IAM user.

The screenshot shows the AWS IAM Management Console interface. The URL in the browser is [https://console.aws.amazon.com/iam/home?region=us-west-1#/users/devopsadmin?section=security\\_credentials](https://console.aws.amazon.com/iam/home?region=us-west-1#/users/devopsadmin?section=security_credentials). The left sidebar has 'Users' selected. The main area shows the 'Summary' tab for the user 'devopsadmin'. Key details include:

- User ARN: arn:aws:iam::171225278948:user/devopsadmin
- Path: /
- Creation time: 2017-04-11 21:55 UTC+0530

The 'Security credentials' tab is active, showing:

- Console password: Enabled (Manage password)
- Console login link: <https://171225278948.signin.aws.amazon.com/console> (highlighted in red)
- Last login: Never
- Assigned MFA device: No
- Signing certificates: None

The 'Access keys' section shows a table with one row:

| Access key ID | Created | Last used | Status |
|---------------|---------|-----------|--------|
| No results    |         |           |        |

Other sections visible include 'SSH keys for AWS CodeCommit' and 'AWS Lambda functions'.

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## 8. Amazon 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. 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.

### Benefits of EC2:

Elastic Web-Scale Computing  
Completely Controlled  
Flexible Cloud Hosting Services  
Integrated  
Reliable  
Secure  
Inexpensive  
Easy to start

### Amazon EC2 Instance Types

Amazon EC2 provides a wide selection of instance types optimized to fit different use cases. Instance types comprise varying combinations of CPU, memory, storage, and networking capacity and give you the flexibility to choose the appropriate mix of resources for your applications. Each instance type includes one or more instance sizes, allowing you to scale your resources to the requirements of your target workload.

### Different Types of Instances:

#### 7. General Purpose: t2, m4, m3

**T2** - T2 instance receives CPU Credits continuously at a set rate depending on the instance size. T2 instances accrue CPU Credits when they are idle, and use CPU credits when they are active. T2 instances are a good choice for workloads that don't use the full CPU often or consistently, but occasionally need to burst (e.g. web servers, developer environments and databases).

| Model      | vCPU | CPU Credits/hour | Mem(GiB) | Storage  |
|------------|------|------------------|----------|----------|
| t2.nano    | 1    | 3                | 0.5      | EBS-Only |
| t2.micro   | 1    | 6                | 1        | EBS-Only |
| t2.small   | 1    | 12               | 2        | EBS-Only |
| t2.medium  | 2    | 24               | 4        | EBS-Only |
| t2.large   | 2    | 36               | 8        | EBS-Only |
| t2.xlarge  | 4    | 54               | 16       | EBS-Only |
| t2.2xlarge | 8    | 81               | 32       | EBS-Only |

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**M4** - M4 instances are the latest generation of General Purpose Instances. This family provides a balance of compute, memory, and network resources, and it is a good choice for many applications.

| Model       | vCPU | Mem(GiB) | SSD Storage(GB) | Dedicated EBS Bandwidth (Mbps) |
|-------------|------|----------|-----------------|--------------------------------|
| m4.large    | 2    | 8        | EBS-Only        | 450                            |
| m4.xlarge   | 4    | 16       | EBS-Only        | 750                            |
| m4.2xlarge  | 8    | 32       | EBS-Only        | 1,000                          |
| m4.4xlarge  | 16   | 64       | EBS-Only        | 2,000                          |
| m4.10xlarge | 40   | 160      | EBS-Only        | 4,000                          |
| m4.16xlarge | 64   | 256      | EBS-Only        | 10,000                         |

**M3** - This family includes the M3 instance types and provides a balance of compute, memory, and network resources, and it is a good choice for many applications.

| Model      | vCPU | Mem(GiB) | SSD Storage(GB) |
|------------|------|----------|-----------------|
| m3.medium  | 1    | 3.75     | 1 x 4           |
| m3.large   | 2    | 7.5      | 1 x 32          |
| m3.xlarge  | 4    | 15       | 2 x 40          |
| m3.2xlarge | 8    | 30       | 2 x 80          |

## 8. Compute Optimized: c4, c3

**C4** - C4 instances are the latest generation of Compute-optimized instances, featuring the highest performing processors and the lowest price/compute performance in EC2.

| Model      | vCPU | Mem(GiB) | Storage  | Dedicated EBS Bandwidth (Mbps) |
|------------|------|----------|----------|--------------------------------|
| c4.large   | 2    | 3.75     | EBS-Only | 500                            |
| c4.xlarge  | 4    | 7.5      | EBS-Only | 750                            |
| c4.2xlarge | 8    | 15       | EBS-Only | 1,000                          |
| c4.4xlarge | 16   | 30       | EBS-Only | 2,000                          |
| c4.8xlarge | 36   | 60       | EBS-Only | 4,000                          |

**C3** - C3 instances will provide you with the highest performance processors and the lowest price/compute performance compared to all other Amazon EC2 instances. C3 instances also feature Enhanced Networking and SSD-based instance storage.

| Model      | vCPU | Mem(GiB) | SSD Storage(GB) |
|------------|------|----------|-----------------|
| c3.large   | 2    | 3.75     | 2 x 16          |
| c3.xlarge  | 4    | 7.5      | 2 x 40          |
| c3.2xlarge | 8    | 15       | 2 x 80          |
| c3.4xlarge | 16   | 30       | 2 x 160         |
| c3.8xlarge | 32   | 60       | 2 x 320         |

## 9. Memory Optimized: x1, r4, r3

**X1** - X1 Instances are optimized for large-scale, enterprise-class, in-memory applications and have the lowest price per GiB of RAM among Amazon EC2 instance types.

| Model       | vCPU | Mem (GiB) | SSD Storage (GB) | Dedicated EBS Bandwidth (Mbps) |
|-------------|------|-----------|------------------|--------------------------------|
| x1.32xlarge | 128  | 1,952     | 2 x 1,920        | 10,000                         |
| x1.16xlarge | 64   | 976       | 2 x 1,920        | 5,000                          |

**R4** - R4 instances are optimized for memory-intensive applications and offer better price per GiB of RAM than R3.

| Model       | vCPU | Mem (GiB) | Networking Performance | SSD Storage (GB) |
|-------------|------|-----------|------------------------|------------------|
| r4.large    | 2    | 15.25     | Up to 10 Gigabit       | EBS-Only         |
| r4.xlarge   | 4    | 30.5      | Up to 10 Gigabit       | EBS-Only         |
| r4.2xlarge  | 8    | 61        | Up to 10 Gigabit       | EBS-Only         |
| r4.4xlarge  | 16   | 122       | Up to 10 Gigabit       | EBS-Only         |
| r4.8xlarge  | 32   | 244       | 10 Gigabit             | EBS-Only         |
| r4.16xlarge | 64   | 488       | 20 Gigabit             | EBS-Only         |

**R3** - R3 instances are optimized for memory-intensive applications and offer lower price per GiB of RAM.

| Model      | vCPU | Mem (GiB) | SSD Storage (GB) |
|------------|------|-----------|------------------|
| r4.large   | 2    | 15.25     | 1 x 32           |
| r4.xlarge  | 4    | 30.5      | 1 x 80           |
| r4.2xlarge | 8    | 61        | 1 x 160          |
| r4.4xlarge | 16   | 122       | 1 x 320          |
| r4.8xlarge | 32   | 244       | 2 x 320          |

## 10. Accelerated Computing Instances: p2, g2, f1

**P2** - P2 instances are intended for general-purpose GPU compute applications.

| Model       | GPUs | vCPU | Mem (GiB) | GPU Memory (GiB) |
|-------------|------|------|-----------|------------------|
| p2.xlarge   | 1    | 4    | 61        | 12               |
| p2.8xlarge  | 8    | 32   | 488       | 96               |
| p2.16xlarge | 16   | 64   | 732       | 192              |

**G2** - G2 instances are optimized for graphics-intensive applications.

| Model      | GPUs | vCPU | Mem (GiB) | SSD Storage (GB) |
|------------|------|------|-----------|------------------|
| g2.2xlarge | 1    | 8    | 15        | 1 x 60           |
| g2.8xlarge | 4    | 32   | 60        | 2 x 120          |

**F1** - F1 instances offer customizable hardware acceleration with field programmable gate arrays (FPGAs).

| Model       | FPGAs | vCPU | Mem (GiB) | SSD Storage (GB) |
|-------------|-------|------|-----------|------------------|
| f1.2xlarge  | 1     | 8    | 122       | 470              |
| f1.16xlarge | 8     | 64   | 976       | 4 x 940          |

## 11. Storage Optimized: i3, d2

### I3 – High I/O instances

This family includes the High Storage Instances that provide Non-Volatile Memory Express (NVMe) SSD backed instance storage optimized for low latency, very high random I/O performance, high sequential read throughput and provide high IOPS at a low cost.

| Model       | vCPU | Mem (GiB) | Networking Performance | Storage (TB)       |
|-------------|------|-----------|------------------------|--------------------|
| i3.large    | 2    | 15.25     | Up to 10 Gigabit       | 1 x 0.475 NVMe SSD |
| i3.xlarge   | 4    | 30.5      | Up to 10 Gigabit       | 1 x 0.95 NVMe SSD  |
| i3.2xlarge  | 8    | 61        | Up to 10 Gigabit       | 1 x 1.9 NVMe SSD   |
| i3.4xlarge  | 16   | 122       | Up to 10 Gigabit       | 2 x 1.9 NVMe SSD   |
| i3.8xlarge  | 32   | 244       | 10 Gigabit             | 4 x 1.9 NVMe SSD   |
| i3.16xlarge | 64   | 488       | 20 Gigabit             | 8 x 1.9 NVMe SSD   |

**D2** - D2 instances feature up to 48 TB of HDD-based local storage, deliver high disk throughput, and offer the lowest price per disk throughput performance on Amazon EC2.

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| Model      | vCPU | Mem (GiB) | Storage (TB)  |
|------------|------|-----------|---------------|
| d2.xlarge  | 4    | 30.5      | 3 x 2000 HDD  |
| d2.2xlarge | 8    | 61        | 6 x 2000 HDD  |
| d2.4xlarge | 16   | 122       | 12 x 2000 HDD |
| d2.8xlarge | 36   | 244       | 24 x 2000 HDD |

## Amazon EC2 Pricing

Amazon EC2 is free to try. There are four ways to pay for Amazon EC2 instances: On-Demand, Reserved Instances, and Spot Instances. You can also pay for Dedicated Hosts which provide you with EC2 instance capacity on physical servers dedicated for your use.

**On-Demand** - On-Demand instances are recommended for:

- Users that prefer the low cost and flexibility of Amazon EC2 without any up-front payment or long-term commitment.
- Applications with short-term, spiky, or unpredictable workloads that cannot be interrupted.
- Applications being developed or tested on Amazon EC2 for the first time.

**Spot Instances** - Amazon EC2 Spot instances allow you to bid on spare Amazon EC2 computing capacity for up to 90% off the On-Demand price.

Spot instances are recommended for:

- Applications that have flexible start and end times
- Applications that are only feasible at very low compute prices
- Users with urgent computing needs for large amounts of additional capacity

**Reserved Instances** - Reserved Instances provide you with a significant discount (up to 75%) compared to On-Demand instance pricing. In addition, when Reserved Instances are assigned to a specific Availability Zone, they provide a capacity reservation, giving you additional confidence in your ability to launch instances when you need them.

Reserved Instances are recommended for:

- Applications with steady state usage.
- Applications that may require reserved capacity.
- Customers that can commit to using EC2 over a 1 or 3 year term to reduce their total computing costs.

**Dedicated Hosts** - A Dedicated Host is a physical EC2 server dedicated for your use. Dedicated Hosts can help you reduce costs by allowing you to use your existing server-bound software licenses, including Windows Server, SQL Server, and SUSE Linux Enterprise Server.

- Can be purchased On-Demand (hourly).
- Can be purchased as a Reservation for up to 70% off the On-Demand price.

## **Security Groups:**

Security Group act as a firewall for associated Amazon EC2 instances, controlling both inbound and outbound traffic at the instance level. When you launch an instance, you associate one or more security groups with the instance. You add rules to each security group that allow traffic to or from its associated instances. You can modify the rules for a security group at any time; the new rules are automatically applied to all instances that are associated with the security group. When we decide whether to allow traffic to reach an instance, we evaluate all the rules from all the security groups that are associated with the instance.

## **Key Pairs:**

Amazon EC2 uses public–key cryptography to encrypt and decrypt login information. Public–key cryptography uses a public key to encrypt a piece of data, such as a password, then the recipient uses the private key to decrypt the data. The public and private keys are known as a key pair.

To log in to your instance, you must create a key pair, specify the name of the key pair when you launch the instance, and provide the private key when you connect to the instance. Linux instances have no password, and you use a key pair to log in using SSH. With Windows instances, you use a key pair to obtain the administrator password and then log in using RDP.

## **Creating Ec2 Instance.**

AWS Marketplace contains different types of Amazon Machine Images (AMIs) like Centos, Ubuntu, Amazon Linux, Windows,...etc

- Login to **AWS Management Console** and set up your root account.
- Launch an Amazon EC2 instance.
- In the Amazon EC2 Dashboard select “Launch Instance” to create and configure your virtual machine.
- **Configure the instance**
- In the AWS Marketplace select your required AMI (Ex: Centos 6 AMI)

**Step 1: Choose an Amazon Machine Image (AMI)**

An AMI is a template that contains the software configuration (operating system, application server, and applications) required to launch your instance. You can select an AMI provided by AWS, our user community, or the AWS Marketplace; or you can select one of your own AMIs.

Quick Start

My AMIs

AWS Marketplace

Community AMIs

Categories

- All Categories
- Software Infrastructure (155)
- Developer Tools (7)
- Business Software (5)

Operating System

- Clear Filter
- All Linux/Unix
- Amazon Linux (6)
- CentOS (150)

Search bar: centos

Product listing:

- CentOS 7 (x86\_64) - with Updates HVM**
  - ★★★★★ (44) | 1602 | Sold by Centos.org
  - \$0.00/hr for software + AWS usage fees
  - Linux/Unix, CentOS 7 | 64-bit Amazon Machine Image (AMI) | Updated: 2/26/16
  - This is the Official CentOS 7 x86\_64 HVM image that has been built with a minimal profile, suitable for use in HVM instance types only. The image contains just enough packages to ...
  - [More info](#)
- CentOS 6 (x86\_64) - with Updates HVM**
  - ★★★★★ (32) | 1602 | Sold by Centos.org
  - \$0.00/hr for software + AWS usage fees
  - Linux/Unix, CentOS 6 | 64-bit Amazon Machine Image (AMI) | Updated: 2/26/16
  - This is the Official CentOS 6 x86\_64 HVM image that has been built with a minimal profile. The image contains just enough packages to run within AWS, bring up an SSH Server and ...
  - [More info](#)
- CentOS 6.5 (x86\_64) - Release Media**
  - ★★★★★ (55) | 6.5 - 2013-12-01 | Sold by Centos.org

Buttons: Select (for each item), Cancel and Exit

❖ **Choose an instance type:** In the wizard choose an instance type, we recommend t2.micro (free-tier eligible).

**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 ▾ Current generation ▾ Show/Hide Columns

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

Note: The vendor recommends using a t2.micro instance (or larger) for the best experience with this product.

| Family          | Type       | vCPUs | Memory (GiB) | Instance Storage (GB) | EBS-Optimized Available | Network Performance | IPv6 Support |
|-----------------|------------|-------|--------------|-----------------------|-------------------------|---------------------|--------------|
| General purpose | t2.nano    | 1     | 0.5          | EBS only              | -                       | Low to Moderate     | Yes          |
| General purpose | t2.micro   | 1     | 1            | EBS only              | -                       | Low to Moderate     | Yes          |
| General purpose | t2.small   | 1     | 2            | EBS only              | -                       | Low to Moderate     | Yes          |
| General purpose | t2.medium  | 2     | 4            | EBS only              | -                       | Low to Moderate     | Yes          |
| General purpose | t2.large   | 2     | 8            | EBS only              | -                       | Low to Moderate     | Yes          |
| General purpose | t2.xlarge  | 4     | 16           | EBS only              | -                       | Moderate            | Yes          |
| General purpose | t2.2xlarge | 8     | 32           | EBS only              | -                       | Moderate            | Yes          |
| General purpose | m4.large   | 2     | 8            | EBS only              | Yes                     | Moderate            | Yes          |

Buttons: Cancel, Previous, Review and Launch, Next: Configure Instance Details

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