

# **Applied A.I. Solutions**

## **Foundations of Data Management**

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## Cloud Services Platform

### Amazon Elastic Compute Cloud User Guide for Windows Instances Features of Amazon EC2

#### What is Amazon EC2?

Amazon Elastic Compute Cloud (Amazon EC2) provides scalable computing capacity in the Amazon Web Services (AWS) Cloud.

Using Amazon EC2 eliminates your need to invest in hardware up front, so you can develop and deploy applications faster.

You can use Amazon EC2 to launch as many or as few virtual **servers** as you need, configure **security** and **networking**, and manage **storage**.

Amazon EC2 enables you to **scale** up or down to handle changes in requirements or spikes in popularity, reducing your need to forecast traffic.

For more information about cloud computing, see [What is cloud computing](#)



## Features of Amazon EC2

- Virtual computing environments, known as instances
- Preconfigured templates for your instances, known as Amazon Machine Images (AMIs), that package the bits you need for your server (including the operating system and additional software)
- Various configurations of CPU, memory, storage, and networking capacity for your instances, known as instance types
- Secure login information for your instances using key pairs (AWS stores the public key, and you store the private key in a secure place)
- Storage volumes for temporary data that's deleted when you stop, hibernate, or terminate your instance, known as instance store volumes
- Persistent storage volumes for your data using Amazon Elastic Block Store (Amazon EBS), known as Amazon EBS volumes
- Multiple physical locations for your resources, such as instances and Amazon EBS volumes, known as Regions and Availability Zones
- A firewall that enables you to specify the protocols, ports, and source IP ranges that can reach your instances using security groups
- Static IPv4 addresses for dynamic cloud computing, known as Elastic IP addresses
- Metadata, known as tags, that you can create and assign to your Amazon EC2 resources
- Virtual networks you can create that are logically isolated from the rest of the AWS Cloud, and that you can optionally connect to your own network, known as virtual private clouds (VPCs)

For more information about the features of Amazon EC2, see the [Amazon EC2 product page](#)

## What is Amazon Relational Database Service (Amazon RDS)?

Amazon Relational Database Service (Amazon RDS) is a **web service** that makes it easier to set up, operate, and scale a relational database in the AWS Cloud.

It provides cost-efficient, resizable capacity for an industry-standard relational database and manages common database administration tasks.

If you are new to AWS products and services, begin learning more with the following resources at [What is cloud computing](#)

## Overview of Amazon RDS

### Amazon EC2 versus on-premises databases

Amazon Elastic Compute Cloud (Amazon EC2) provides **scalable computing capacity** in the AWS Cloud. It eliminates your need to invest in hardware up front, so you can develop and deploy applications faster.

When you buy an on-premises server, you get CPU, memory, storage, and IOPS, all bundled together. With Amazon EC2, these are split apart so that you can scale them independently. For a database on an Amazon EC2 instance, AWS manages the layers below the operating system.

- **On-premises and on Amazon EC2:** application optimization, scaling, high availability, database backups, database software patching, database software install, operating system (OS) patching, OS installation are **performed by Customer**
- **On-premises performed by Customer and on Amazon EC2 performed by AWS:** server maintenance, hardware lifecycle, power, network, and cooling

**Amazon EC2 isn't a fully managed service.**

## Amazon RDS versus Amazon EC2

**Amazon RDS is a managed database service.** It's responsible for most management tasks. It frees you to focus on your application and your users. We recommend **Amazon RDS over Amazon EC2** as your default choice for most database deployments.

### Management models in Amazon EC2 and Amazon RDS:

- **Performed by the Customer** in both Amazon EC2 and Amazon RDS: application optimization
- **Performed by the Customer in Amazon EC2 and performed by AWS in Amazon RDS:** scaling, high availability, database backups, database software patching, database software install, OS patching, OS installation
- **Performed by AWS:** server maintenance, hardware lifecycle, power, network, and cooling

**Amazon RDS provides** the following specific advantages over database deployments that aren't fully managed:

- Use **database products** you are familiar with: MySQL, MariaDB, PostgreSQL, Oracle, MS SQL Server
- Amazon RDS **manages** backups, software patching, automatic failure detection, and recovery
- You can turn on automated **backups**, or manually create your own backup snapshots to then **restore** a database efficiently
- You can get **high availability** with a primary instance and a synchronous secondary instance that you can **fail over** to when problems occur. You can also use read replicas to increase read scaling
- You can help control who can **access** your RDS databases by using **AWS Identity and Access Management (IAM)** to define users and permissions.
- You can also help protect your databases by putting them in a **virtual private cloud (VPC)**

## Amazon RDS Custom for Oracle and Microsoft SQL Server

Amazon RDS Custom is an RDS management type that gives you full access to your database and operating system.

Use the control capabilities of RDS Custom to access and customize the database environment and OS for legacy and packaged business applications. Meanwhile, Amazon RDS automates database administration tasks and operations.

In this deployment model, you can install applications and change configuration settings to suit your applications. At the same time, you can offload database administration tasks such as provisioning, scaling, upgrading, and backup to AWS. You can take advantage of the database management benefits of Amazon RDS, with more control and flexibility.

For Oracle Database (including MySQL) and Microsoft SQL Server, RDS Custom combines the automation of Amazon RDS with the flexibility of Amazon EC2.

With the **shared responsibility model of RDS Custom**, you get more control than in Amazon RDS, but also more responsibility. To meet your application and business requirements, you **manage everything at or above the OS layer** yourself.



## DB instances

- A DB instance is an **isolated database environment in the AWS Cloud**
- A DB instance can contain one or more user-created databases
- You can access your DB instance by using the same tools and applications that you use with a standalone database instance.
- You can create and modify a DB instance by using the AWS Command Line Interface, the Amazon RDS API, or the AWS Management Console.

## DB engines

- A DB engine is the **specific relational database software that runs on your DB instance**. Amazon RDS currently supports the following engines: MySQL, MariaDB, PostgreSQL, Oracle, Microsoft SQL Server
- Each DB engine has its own supported features, and each version of a DB engine may include specific features. Additionally, each DB engine has a set of parameters in a DB parameter group that control the behavior of the databases that it manages.

## DB instance classes

- A DB instance class **determines the computation and memory capacity of a DB instance**
- Each instance type offers different compute, memory, and storage capabilities. For example, db.m6g is a general-purpose DB instance classes powered by AWS Graviton2 processors.
- You can select the DB instance that best meets your needs. If your needs change over time, you can change DB instances.

## DB instance storage

- DB instance storage **Amazon EBS** provides durable, block-level storage volumes that you can attach to a running instance
- DB instance storage comes in the following types: General Purpose (SSD), Provisioned IOPS (PIOPS), Magnetic
- You can tailor your storage performance and cost to the needs of your database. Each DB instance has minimum and maximum storage requirements depending on the storage type and the database engine it supports. It's important to have sufficient storage so that your databases have room to grow. Also, sufficient storage makes sure that features for the DB engine have room to write content or log entries.

## Amazon Virtual Private Cloud (Amazon VPC)

- You can run a DB instance on a virtual private cloud (VPC) using the Amazon Virtual Private Cloud (Amazon VPC) service.
- When you use a VPC, you have **control over your virtual networking environment**
- You can choose your own IP address range, create subnets, configure routing and access control lists
- The basic **functionality** of Amazon RDS is the same whether it's running in a VPC or not
- Amazon RDS manages backups, software patching, automatic failure detection, and recovery
- Amazon RDS uses Network Time Protocol (NTP) to synchronize the time on DB Instances

## AWS Regions and Availability Zones

**Security:** a security group controls the access to a DB instance. It does so by allowing access to IP address ranges or Amazon EC2 instances that you specify

**Monitoring an Amazon RDS DB instance:** you can use the Amazon CloudWatch service to monitor the performance and health of a DB instance. CloudWatch performance charts are shown in the Amazon RDS console. You can also subscribe to Amazon RDS events to be notified about changes to a DB instance, DB snapshot, DB parameter group, or DB security group

## How to work with Amazon RDS

- **AWS Management Console** is a simple web-based user interface. You can manage your DB instances from the console with no programming required. To access the Amazon RDS console, sign in to the AWS Management Console and open the Amazon RDS console at <https://console.aws.amazon.com/rds/>
- **Command line interface (AWS CLI):** you can use AWS CLI to access the Amazon RDS API interactively. To install the AWS CLI, see Installing the AWS Command Line Interface.
- For application development use one of the **AWS Software Development Kits (SDKs)**

## Determining whether you are using the EC2-VPC or EC2-Classic platform

- Your AWS account and the AWS Region you choose determines which of the two RDS platforms your DB instance is created on: **EC2-VPC or EC2-Classic**
- The type of platform determines if you have a default VPC, and which type of security group you use to provide access to your DB instance.
- The legacy EC2-Classic platform is the original platform used by Amazon RDS. If you are on this platform and want to use a VPC, you must create the VPC using the Amazon VPC console or Amazon VPC API. Accounts that only support the EC2-VPC platform have a default VPC where all DB instances are created, and you must use either an EC2 or VPC security group to provide access to the DB instance.

### Important

You can tell which platform your AWS account is using by looking at the dashboard on the RDS console or EC2 console

- **EC2-VPC platform in the console:** if supported platforms indicates only VPC, as shown following in the RDS console, your AWS account uses the **EC2-VPC platform, and uses a default VPC**

For more information, see the **Amazon Relational Database Service User Guide**.

- Setting up for Amazon RDS (page 114)
- Provide access to your DB instance in your VPC by creating a security group (Page 117)
- Getting started with Amazon RDS (page 120)
- Creating a MySQL DB instance and connecting to a database on a MySQL DB instance (page 137)
- Monitoring an Amazon RDS DB instance (page 471)
- Amazon RDS application programming interface (API) reference (page 2098)

For more information, see **DB instances in a VPC**,

- Working with a DB instance in a VPC (p. 2055)
- Determining whether you are using the EC2-VPC or EC2-Classical platform (p. 2075)
- Scenarios for accessing a DB instance not in a VPC (p. 2077)
- Moving a DB instance not in a VPC into a VPC (p. 2079)

## EC2-VPC platform (default VPC)

A common scenario includes a DB instance in an Amazon VPC, that shares data with a web server that is running in the same VPC. In this tutorial you create the VPC for this scenario (page 2069)

