

EC2



What is EC2?



Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides resizable compute capacity in the cloud. 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.

What is EC2?



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 themselves from common failure scenarios.

EC2 Options

- On Demand - allow you to pay a fixed rate by the hour (or by the second) with no commitment.
- Reserved - provide you with a capacity reservation, and offer a significant discount on the hourly charge for an instance.1 Year or 3 Year Terms
- Spot - enable you to bid whatever price you want for instance capacity, providing for even greater savings if your applications have flexible start and end times.
- Dedicated Hosts - 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.

On Demand

- Users that want 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

Reserved

- Applications with steady state or predictable usage
- Applications that require reserved capacity
- Users able to make upfront payments to reduce their total computing costs even further
 - Standard RI's (Up to 75% off on demand)
 - Convertible RI's (Up to 54% off on demand) capability to change the attributes of the RI as long as the exchange results in the creation of Reserved Instances of equal or greater value.
 - Scheduled RI's available to launch within the time windows you reserve. This option allows you to match your capacity reservation to a predictable recurring schedule that only requires a fraction of a day, a week, or a month.

Spot

- 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

Dedicated Hosts

- Useful for regulatory requirements that may not support multi-tenant virtualization.
- Great for licensing which does not support multi-tenancy or cloud deployments.
- Can be purchased On-Demand (hourly.)
- Can be purchased as a Reservation for up to 70% off the On-Demand price.

EC2 Instance Types

Family	Speciality	Use case
D2	Dense Storage	Fileservers/Data Warehousing/Hadoop
R4	Memory Optimized	Memory Intensive Apps/DBs
M4	General Purpose	Application Servers
C4	Compute Optimized	CPU Intensive Apps/DBs
G2	Graphics Intensive	Video Encoding/ 3D Application Streaming
I2	High Speed Storage	NoSQL DBs, Data Warehousing etc
F1	Field Programmable Gate Array	Hardware acceleration for your code.
T2	Lowest Cost, General Purpose	Web Servers/Small DBs
P2	Graphics/General Purpose GPU	Machine Learning, Bit Coin Mining etc
X1	Memory Optimized	SAP HANA/Apache Spark etc

EC2 Instance Types

- How I remember them;
 - **D** for Density
 - **I** for IOPS
 - **R** for RAM
 - **T** cheap general purpose (think T2 Micro)
 - **M** - main choice for general purpose apps
 - **C** for Compute
 - **G** - Graphics

EC2 Instance Types

- How I remember them now;
 - **D** for Density
 - **R** for RAM
 - **M** - main choice for general purpose apps
 - **C** for Compute
 - **G** - Graphics
 - **I** for IOPS
 - **F** for FPGA
 - **T** cheap general purpose (think T2 Micro)
 - **P** - Graphics (think Pics)
 - **X** - Extreme Memory



What is EBS?

Amazon EBS allows you to create storage volumes and attach them to Amazon EC2 instances. Once attached, you can create a file system on top of these volumes, run a database, or use them in any other way you would use a block device. Amazon EBS volumes are placed in a specific Availability Zone, where they are automatically replicated to protect you from the failure of a single component.

EBS Volume Types

- General Purpose SSD (GP2)
 - General purpose, balances both price and performance.
 - Ratio of 3 IOPS per GB with up to 10,000 IOPS and the ability to burst up to 3000 IOPS for extended periods of time for volumes at 3334 GiB and above.
- Provisioned IOPS SSD (IO1)
 - Designed for I/O intensive applications such as large relational or NoSQL databases.
 - Use if you need more than 10,000 IOPS.
 - Can provision up to 20,000 IOPS per volume.

EBS Volume Types

- Throughput Optimized HDD (ST1)
 - Big data
 - Data warehouses
 - Log processing
 - Cannot be a boot volume
- Cold HDD (SC1)
 - Lowest Cost Storage for infrequently accessed workloads
 - File Server
 - Cannot be a boot volume.

EBS Volume Types

- Magnetic (Standard)
 - Lowest cost per gigabyte of all EBS volume types that is bootable. Magnetic volumes are ideal for workloads where data is accessed infrequently, and applications where the lowest storage cost is important.

What We'll Cover

- Launch an EC2 Instance
- Security Group Basics
- Volumes and Snapshots
- Create an AMI
- Load Balancers & Health Checks
- Cloud Watch

What We'll Cover

- AWS Command Line
- IAM Roles with EC2
- Bootstrap Scripts
- Launch Configuration Groups
- Autoscaling 101
- EFS

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- EFS
- Lambda Concepts
- Build a serverless webpage with Lambda & API Gateway
- Build a serverless website with Polly
- Build an Alexa skill to help you study
- HPC (High Performance Compute) & Placement Groups

Exam Tips EC2

- Know the differences between;
 - On Demand
 - Spot
 - Reserved
 - Dedicated Hosts
- Remember with spot instances;
 - If you terminate the instance, you pay for the hour
 - If AWS terminates the spot instance, you get the hour it was terminated in for free.

Exam Tips EBS

- EBS Consists of;
 - SSD, General Purpose - GP2 - (Up to 10,000 IOPS)
 - SSD, Provisioned IOPS - IO1 - (More than 10,000 IOPS)
 - HDD, Throughput Optimized - ST1 - frequently accessed workloads
 - HDD, Cold - SC1 - less frequently accessed data.
 - HDD, Magnetic - Standard - cheap, infrequently accessed storage
- You cannot mount 1 EBS volume to multiple EC2 instances,
instead use EFS.

Lab Summary

- Termination Protection is turned off by default, you must turn it on.
- On an EBS-backed instance, the default action is for the root EBS volume to be deleted when the instance is terminated.
- EBS Root Volumes of your DEFAULT AMI's cannot be encrypted. You can also use a third party tool (such as bit locker etc) to encrypt the root volume, or this can be done when creating AMI's (lab to follow) in the AWS console or using the API.
- Additional volumes can be encrypted.

Security Group Lab

- All Inbound Traffic is Blocked By Default
- All Outbound Traffic is Allowed
- Changes to Security Groups take effect immediately
- You can have any number of EC2 instances within a security group.
- You can have multiple security groups attached to EC2 Instances
- Security Groups are **STATEFUL**.
 - If you create an inbound rule allowing traffic in, that traffic is automatically allowed back out again.
 - You cannot block specific IP addresses using Security Groups, instead use Network Access Control Lists.
 - You can specify allow rules, but not deny rules.

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Volumes & Snapshots

- Volumes exist on EBS:
 - Virtual Hard Disk
- Snapshots exist on S3.
- Snapshots are point in time copies of Volumes.
- Snapshots are incremental – this means that only the blocks that have changed since your last snapshot are moved to S3.
- If this is your first snapshot, it may take some time to create.

Snapshots of Root Device Volumes

- To create a snapshot for Amazon EBS volumes that serve as root devices, you should stop the instance before taking the snapshot.
- However you can take a snap while the instance is running.
- You can create AMI's from both Volumes and Snapshots
- You can change EBS volume sizes on the fly, including changing the size and storage type.
- Volumes will ALWAYS be in the same availability zone as the EC2 instance.
- To move an EC2 volume from one AZ/Region to another, take a snap or an image of it, then copy it to the new AZ/Region

Volumes vs Snapshots - Security

- Snapshots of encrypted volumes are encrypted automatically.
- Volumes restored from encrypted snapshots are encrypted automatically.
- You can share snapshots, but only if they are unencrypted.
 - These snapshots can be shared with other AWS accounts or made public.

You can select your AMI based on;

- Region (see Regions and Availability Zones)
- Operating system
- Architecture (32-bit or 64-bit)
- Launch Permissions
- Storage for the Root Device (Root Device Volume)
 - Instance Store (EPHEMERAL STORAGE)
 - EBS Backed Volumes

EBS vs Instance Store

All AMIs are categorized as either backed by Amazon EBS or backed by instance store.

For EBS Volumes: The root device for an instance launched from the AMI is an Amazon EBS volume created from an Amazon EBS snapshot.

For Instance Store Volumes: The root device for an instance launched from the AMI is an instance store volume created from a template stored in Amazon S3.

EBS vs Instance Store - Exam Tips

- Instance Store Volumes are sometimes called Ephemeral Storage.
- Instance store volumes cannot be stopped. If the underlying host fails, you will lose your data.
- EBS backed instances can be stopped. You will not lose the data on this instance if it is stopped.
- You can reboot both, you will not lose your data.
- By default, both ROOT volumes will be deleted on termination, however with EBS volumes, you can tell AWS to keep the root device volume.

Elastic Load Balancers

- Instances monitored by ELB are reported as ;
InService , or OutofService
- Health Checks check the instance health by talking to it
- Have their own DNS name. You are never given an IP address.
- Read the ELB FAQ for Classic Load Balancers
- Want to deep dive on application load balancers? Check out our
deep dive course!

Exam Tips

- Standard Monitoring = 5 Minutes
- Detailed Monitoring = 1 Minute

What can I do with Cloudwatch?

- Dashboards - Creates awesome dashboards to see what is happening with your AWS environment.
- Alarms - Allows you to set Alarms that notify you when particular thresholds are hit.
- Events - CloudWatch Events helps you to respond to state changes in your AWS resources.
- Logs - CloudWatch Logs helps you to aggregate, monitor, and store logs.

What is a Placement Group?

A placement group is a logical grouping of instances within a single Availability Zone. Using placement groups enables applications to participate in a low-latency, 10 Gbps network. Placement groups are recommended for applications that benefit from low network latency, high network throughput, or both.

EC2 Placement Groups

- A placement group can't span multiple Availability Zones.
- The name you specify for a placement group must be unique within your AWS account.
- Only certain types of instances can be launched in a placement group (Compute Optimized, GPU, Memory Optimized, Storage Optimized)
- AWS recommend homogenous instances within placement groups.
- You can't merge placement groups.
- You can't move an existing instance into a placement group. You can create an AMI from your existing instance, and then launch a new instance from the AMI into a placement group.

What is EFS

Amazon Elastic File System (Amazon EFS) is a file storage service for Amazon Elastic Compute Cloud (Amazon EC2) instances. Amazon EFS is easy to use and provides a simple interface that allows you to create and configure file systems quickly and easily. With Amazon EFS, storage capacity is elastic, growing and shrinking automatically as you add and remove files, so your applications have the storage they need, when they need it.

EFS Features

- Supports the Network File System version 4 (NFSv4) protocol
- You only pay for the storage you use (no pre-provisioning required)
- Can scale up to the petabytes
- Can support thousands of concurrent NFS connections
- Data is stored across multiple AZ's within a region
- Read After Write Consistency

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How can I take a Snapshot of a RAID Array?

- Problem - Take a snapshot, the snapshot excludes data held in the cache by applications and the OS. This tends not to matter on a single volume, however using multiple volumes in a RAID array, this can be a problem due to interdependencies of the array.
- Solution - Take an application consistent snapshot.

How can I take a Snapshot of a RAID Array?

- Stop the application from writing to disk.
- Flush all caches to the disk.
- How can we do this?
 - Freeze the file system
 - Unmount the RAID Array
 - Shutting down the associated EC2 instance.

Amazon Machine Images - Exam Tip

AMI's are regional. You can only launch an AMI from the region in which it is stored. However you can copy AMI's to other regions using the console, command line or the Amazon EC2 API.

Exam Tips

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- CloudWatch is for performance monitoring
- CloudTrail is for auditing

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Roles Lab

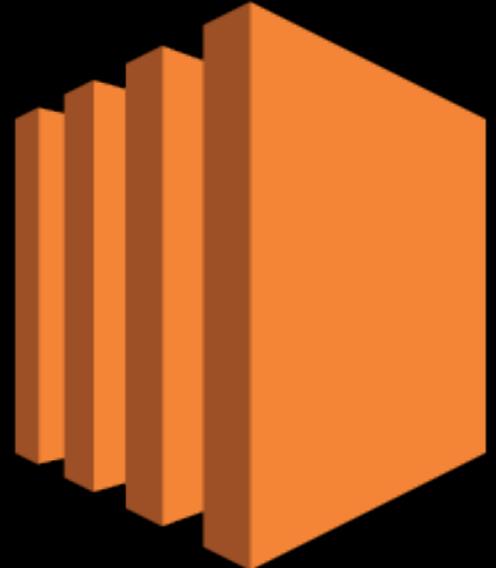
- Roles are more secure than storing your access key and secret access key on individual EC2 instances.
- Roles are easier to manage
- Roles can be assigned to an EC2 instance AFTER it has been provisioned using both the command line and the AWS console.
- Roles are universal, you can use them in any region.

Instance Meta-data

- Used to get information about an instance (such as public ip)
- curl <http://169.254.169.254/latest/meta-data/>

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DEMO