Adding a Compute Layer

Module 3

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Adding the Compute Layer

Module 3

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The architectural need

You need to run applications that are going to be used by a consistent, but small number of users.

Module Overview

- Amazon Elastic Compute Cloud (Amazon EC2)
- Instance types and families
- Amazon Elastic Block Store (Amazon EBS) volumes
- Compliance options

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Adding Compute with Amazon EC2

What Needs can Amazon EC2 Address?

Web hosting

Databases

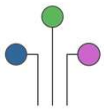
Authentication

Anything a server can do

Virtual Machines vs. Physical Servers

Amazon EC2 can solve some problems that are more difficult with an on-premises server.

When using disposable resources



Data-driven decisions

Quick iterations

Free to make mistakes

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Launching Amazon EC2 Instances with Amazon Machine Images (AMIs)

Amazon EC2 and AMIs

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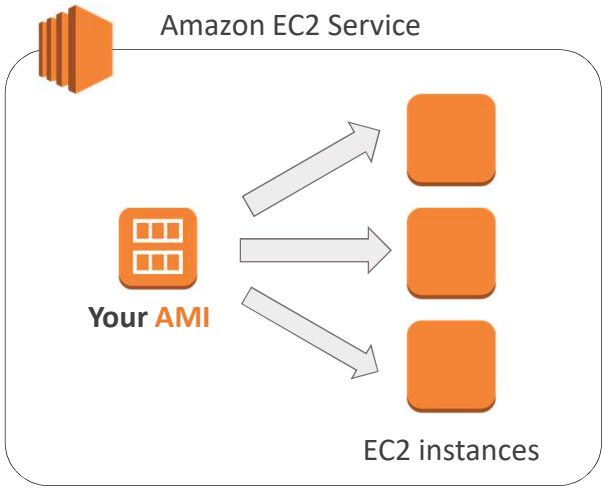
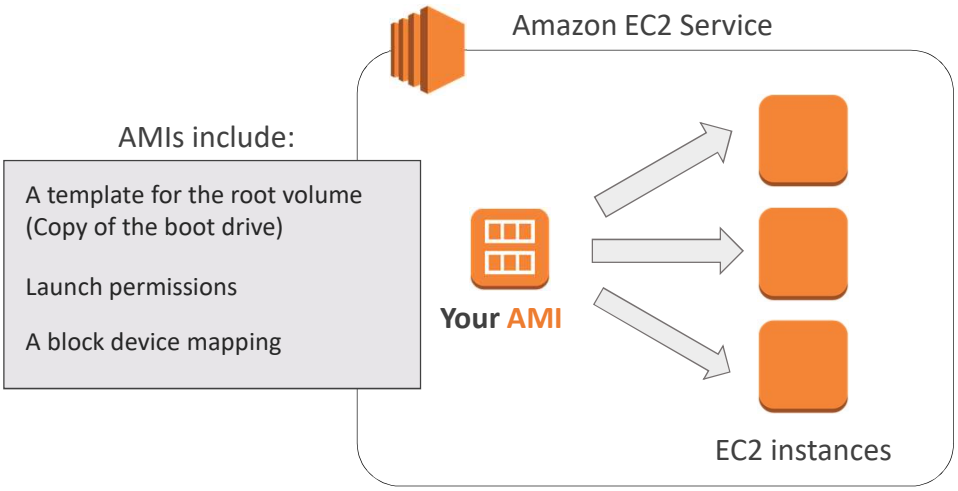
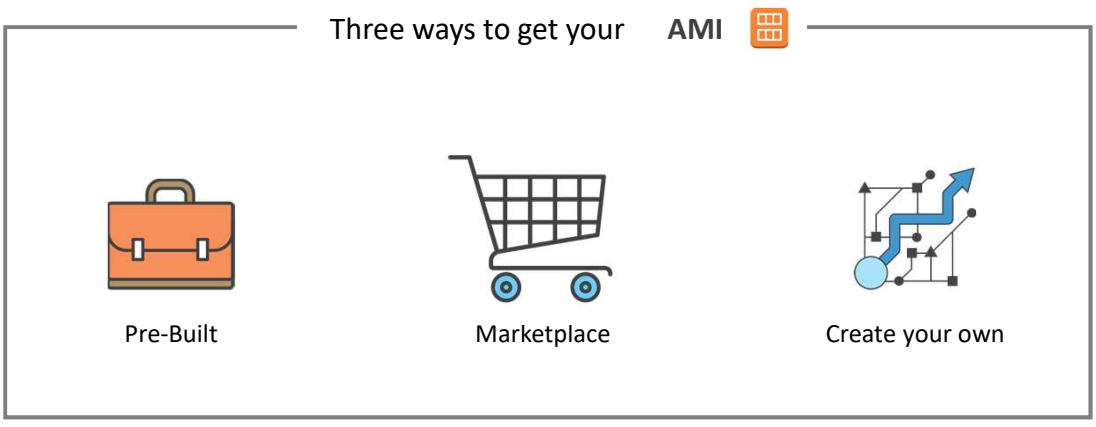


Amazon EC2 and AMIs



Where Do You Get an AMI?



How Do AMIs Help?

Repeatability

How Do AMIs Help?

Repeatability

Reusability

How Do AMIs Help?

Repeatability

Reusability

Recoverability

How Do AMIs Help?

Repeatability

Reusability

Recoverability

Marketplace Solutions

How Do AMIs Help?

Repeatability

Reusability

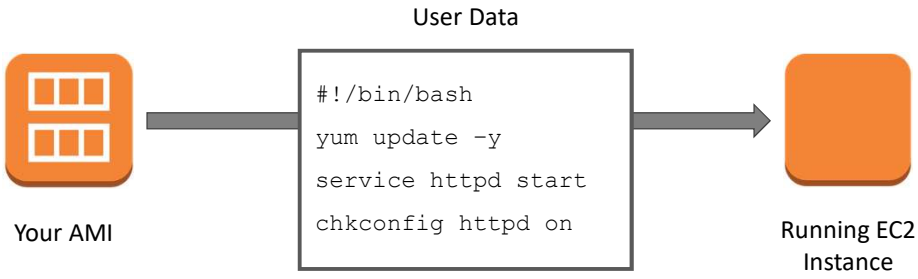
Recoverability

Marketplace Activities

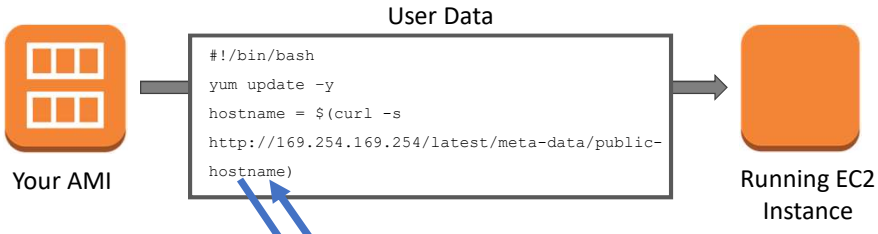
Backups

Launching Amazon EC2 Instances with User Data

Launching EC2 Instances with User Data



Retrieving Information About your EC2 Instance with Instance Metadata



Metadata	Value
instance-id	i-1234567890abcdef0
mac	00-1B-63-84-45-E6
public-hostname	ec2-203-0-113-25.compute-1.amazonaws.com
public-ipv4	67.202.51.223
local-hostname	ip-10-251-50-12.ec2.internal
local-ipv4	10.251.50.12

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Amazon EC2 and Storing Data

What Problems does Amazon Elastic Block Store (Amazon EBS) Solve?

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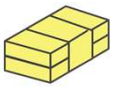

Application needs block level storage

Instance storage is ephemeral

Need data to persist through shutdowns

Need to be able to back up data volumes

Keep in mind: Amazon EBS can only be linked to one instance at a time. It must be in the same Availability Zone as the volume.

Amazon EBS Volume Types

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Solid-State Backed

Volume Type	General Purpose SSD	Provisioned IOPS SSD
Description	General purpose SSD volume that balances price and performance for a wide variety of workloads	Highest-performance SSD volume for mission-critical low-latency or high-throughput workloads
Use Cases	• Recommended for most workloads	• Critical business applications that require sustained IOPS performance • Large database workloads

Amazon EBS Volume Types

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Hard-Disk Backed

Volume Type	Throughput Optimized HDD	Cold HDD
Description	Low cost HDD volume designed for frequently accessed, throughput-intensive workloads	Lowest cost HDD volume designed for less frequently accessed workloads
Use Cases	• Streaming workloads • Big data • Data warehouses • Log processing • Cannot be a boot volume	• Throughput-oriented storage for large volumes of data that is infrequently accessed • Scenarios where the lowest storage cost is important • Cannot be a boot volume

Instances Optimized for Amazon EBS

EBS Optimized Instance

- Optimized configuration stack
- Additional dedicated capacity for Amazon EBS I/O
- Minimizes contention between Amazon EBS and other traffic
- Options between 425 Mbps and 14,000 Mbps

Shared File Systems

What if I have multiple instances that need to use the same storage?

Amazon EBS only attaches to one instance

Amazon S3 is an option but is not ideal

Amazon EFS and FSx are perfect for this task

Amazon EFS and Amazon FSx

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Amazon EFS
(Linux Workloads)

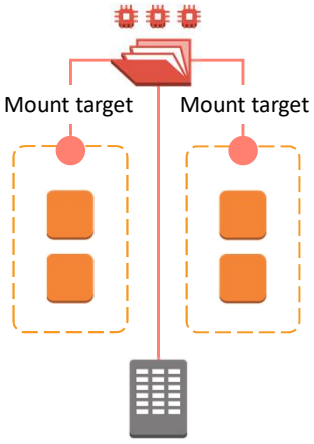
NFSv4 file system

Shared Across
- Availability Zones
- Regions
- VPCs
- Account

Amazon FSx
(Windows Workloads)

NTFS file system

Shared Across
- Availability Zones



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Amazon EC2 Instance Types

EC2 Instances – What's in a Name?

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m5.large

m is the family name

5 Is the generation number

large is the size of the instance

Examples

t2.large

c5.xlarge

p3.2xlarge

EC2 Instances – Sizes

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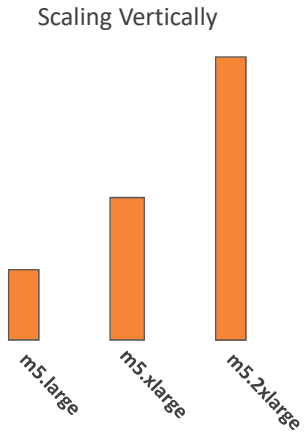
Model	vCPU
m5.large	2
m5.xlarge	4
m5.2xlarge	8
m5.4xlarge	16
m5.12xlarge	48
m5.24xlarge	96



EC2 Instances – Types

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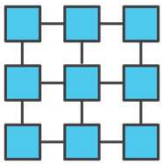
Choosing the correct type is very important for:

Efficient utilization of your instances



Reducing unneeded cost

EC2 Instances – Types

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General Purpose — 6 available selections

Compute Optimized — 3 available Selections

Memory Optimized — 7 available Selections

Accelerated Computing — 4 available Selections

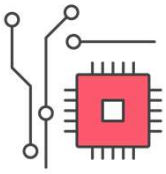
Storage Optimized — 3 available Selections

EC2 – General Purpose Example

Good for burstable workloads like website and web applications

Model	vCPU	CPU Credits / hour	Mem (GiB)	Storage
t3.nano	2	6	0.5	EBS-Only
t3.micro	2	12	1	EBS-Only
t3.small	2	24	2	EBS-Only
t3.medium	2	24	4	EBS-Only
t3.large	2	36	8	EBS-Only
t3.xlarge	4	96	16	EBS-Only
t3.2xlarge	8	192	32	EBS-Only

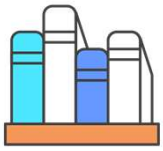
EC2 – Compute Optimized Example



Optimized for **compute-intensive** workloads

Model	vCPU	Mem (GiB)	Storage	EBS Bandwidth (Mbps)
c5.large	2	4	EBS-Only	Up to 2,250
c5.xlarge	4	8	EBS-Only	Up to 2,250
c5.2xlarge	8	16	EBS-Only	Up to 2,250
c5.4xlarge	16	32	EBS-Only	2,250
c5.9xlarge	36	72	EBS-Only	4,500
c5.18xlarge	72	144	EBS-Only	9,000

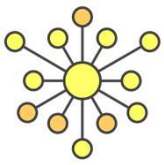
EC2 – Memory Optimized Example



Memory heavy applications or when you need more RAM than CPU

Model	vCPU	Mem (GiB)	Storage (GiB)	Dedicated EBS Bandwidth (Mbps)	Networking Performance (Gbps)
r5.large	2	16	EBS-Only	up to 3,500	Up to 10
r5.xlarge	4	32	EBS-Only	up to 3,500	Up to 10
r5.2xlarge	8	64	EBS-Only	up to 3,500	Up to 10
r5.4xlarge	16	128	EBS-Only	3,500	Up to 10
r5.12xlarge	48	384	EBS-Only	7,000	10
r5.24xlarge	96	768	EBS-Only	14,000	25

EC2 – Accelerated Computing Example

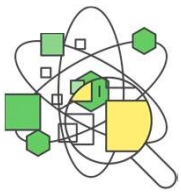


Performant GPU based instances

Commonly used for Machine/Deep Learning

Model	GPUs	vCPU	Mem (GiB)	GPU Mem (GiB)	GPU P2P
p3.2xlarge	1	8	61	16	-
p3.8xlarge	4	32	244	64	NVLink
p3.16xlarge	8	64	488	128	NVLink

EC2 – Storage Optimized Example



Up to 16 TB of HDD-based local storage with **high disk throughput**.

Model	vCPU	Mem (GiB)	Networking Performance	Instance Storage (GB)
h1.2xlarge	8	32	Up to 10 Gigabit	1 x 2,000 HDD
h1.4xlarge	16	64	Up to 10 Gigabit	2 x 2,000 HDD
h1.8xlarge	32	128	10 Gigabit	4 x 2,000 HDD
h1.16xlarge	64	256	25 Gigabit	8 x 2,000 HDD

Intel® Xeon Scalable Processors

Latest generation of Intel Xeon processors

Up to:

- 28 cores per CPU
- 6 memory channels
- 48 PCIe lanes of bandwidth/throughput
- 100 Gbps network bandwidth (C5n.16xlarge)

Intel® Xeon Family and EC2 Instances

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Intel Xeon Scalable Processor Family	Intel Xeon E5 Processor Family	Intel Xeon E7 Processor Family
• High Memory • z1d • C5/C5n • M5 • R5 • T3	• M4 • R4 • P2/P3 • G3 • F1 • H1 • I3 • D2	• X1/X1e

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Amazon EC2 Pricing Options

EC2 Pricing Options

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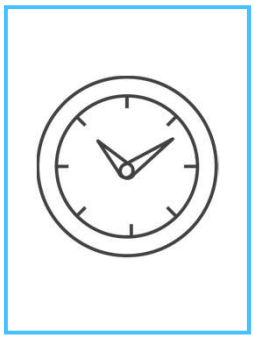
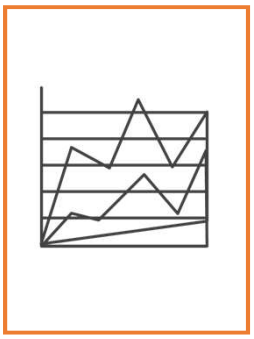
On-Demand Instances



Reserved Instances

Spot Instances



On-Demand Instances

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- Pay for compute capacity per second (Amazon Linux and Ubuntu) or by the hour (all other OS)
- No long-term commitments
- No upfront payments
- Increase or decrease your compute capacity depending on the demands of your application

Solves the need for immediate compute capacity

Reserved Instances

Can provide a significant discount for your architectures.

- Pre-pay for capacity
- Standard RI, Convertible RIs, Scheduled RIs
- Three upfront payment methods
- Can be shared between multiple accounts (within a billing family)

Provides the ability to reserve capacity ahead of time, reducing cost

Spot Instances

- Purchase unused Amazon EC2 capacity
- Prices controlled by AWS based on supply and demand
- Termination notice provided 2 minutes prior to termination
- Spot Blocks: Launch Spot Instances with a duration lasting 1 to 6 hours.

Can provide the steepest discounts as long as your workloads withstand starting and stopping

Amazon EC2 Dedicated Options

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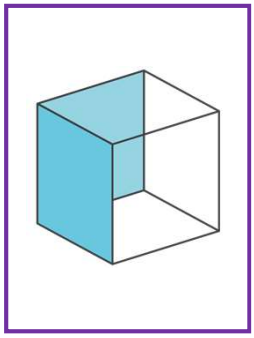
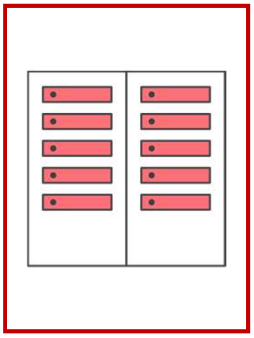
Dedicated Instances



Dedicated Hosts



Amazon EC2 Dedicated Instances

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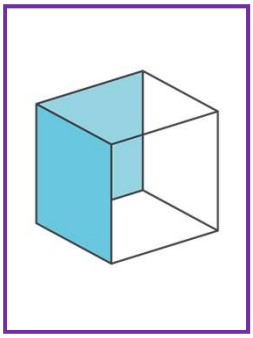
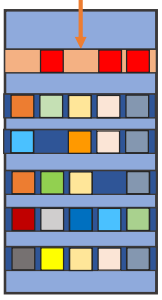
Dedicated Instances

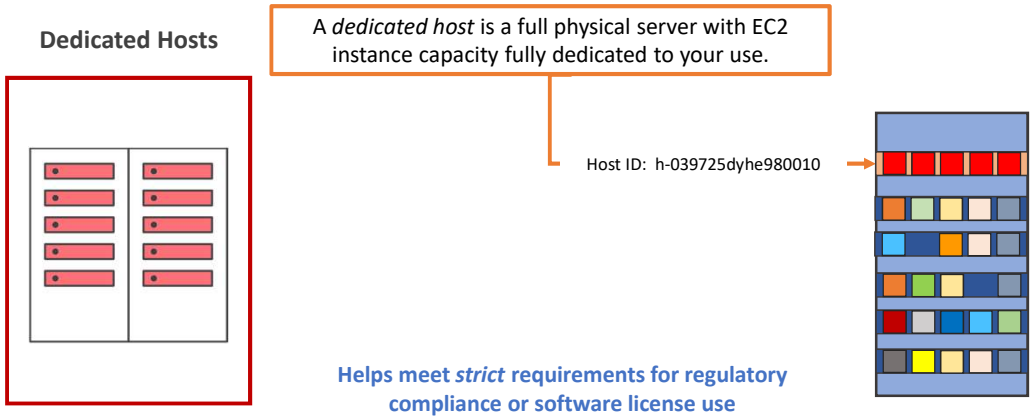


Dedicated instances are physically isolated from other AWS accounts



Helps meet requirements for regulatory compliance or software license use

Amazon EC2 Dedicated Hosts



Amazon EC2 Tenancy

	Only your AWS account on the hardware?	Description
Default	No	Your instance runs on shared hardware.
Dedicated Instance	Yes	Runs on a non-specific piece of hardware.
Dedicated Host	Yes	Runs on a specific piece of hardware of your choosing, over which you receive greater control.

Keeping Track of your Instances

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Assign metadata **tags** to your AWS resources to help you:

Manage

Search

Filter

Tagging Best Practices

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- Standardized, case-sensitive format for tags
- Implement automated tools to help manage resource tags
- Favor using too many tags rather than too few
- Remember, it's easy to modify tags
- Examples: App Version, ENV, DNS Name, App Stack Identifier

Helps you to understand what your resources are doing and their cost impact.

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Amazon EC2 Considerations

Architectural Considerations 1

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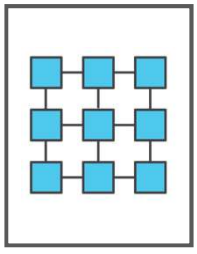
Does your compute layer require the lowest latency and highest packet-per-second network performance possible?

Cluster Placement Groups



Architectural Considerations 2

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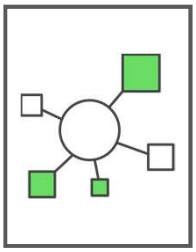
Do you have applications that have a small number of critical instances that should be kept separate from each other?

Spread Placement Groups



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Knowledge Checks

Knowledge Check 4

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What is an AMI?

1. An AMI is an object that stores data about the instance such as Local Hostname, Instance ID, or Public IP address.
2. It provides block-level storage that will disappear on instance shutdown.
3. AMIs are used to create new EC2 instances and contain a template for the root volume.
4. A type of storage bucket for Amazon S3.

Knowledge Check 4: Answer

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What is an AMI?

1. An AMI is an object that stores data about the instance such as Local Hostname, Instance ID, or Public IP address.
2. It provides block-level storage that will disappear on instance shutdown.
3. **AMIs are used to create new EC2 instances and contain a template for the root volume.**
4. A type of storage bucket for Amazon S3.

Knowledge Check 5

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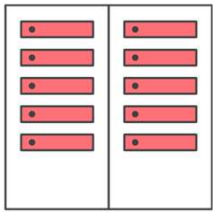
If you wanted to select the host on which an instance would run, which option should you use?



1. Default
2. Dedicated instance
3. Dedicated Host

Knowledge Check 5 : Answer

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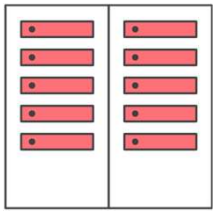
If you wanted to select the host on which an instance would run, which option should you use?



1. Default
2. Dedicated instance
3. **Dedicated Host**

Knowledge Check 6

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What is Amazon EBS?

1. Object storage solution that can scale to incredible sizes to meet demand and storage requirements
2. Block storage device that can connect to multiple instances at the same time.
3. File storage system that can connect to multiple instances at the same time.
4. Block storage device that connects to one instance at a time. Can be backed up to Amazon S3.

Knowledge Check 6 : Answer

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What is Amazon EBS?

1. Object storage solution that can scale to incredible sizes to meet demand and storage requirements
2. Block storage device that can connect to multiple instances at the same time.
3. File storage system that can connect to multiple instances at the same time.
4. **Block storage device that connects to one instance at a time. Can be backed up to Amazon S3.**

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Lab M03-01: Host a Website on Windows Instance

Lab M03-01: Host a Website on Windows Instance

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"I want to host website on Windows Instance"

Technologies used:

- Amazon EC2
- User Data

Lab M03-01: Host a Website on Windows Instance

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You will:

- Install Windows EC2 Instance
- Install web server
- Make your web server publicly accessible

Create EC2 instance

Install Web Server

Duration: 20m

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Lab M03-02: Hosting a Website on Linux Instance

Lab M03-02: Hosting a Website on Linux Instance

aws training and certification

"I want to host website on Instance"

Technologies used:

- Amazon EC2
- User Data

Lab M03-02: Hosting a Website on Linux Instance

aws training and certification

You will:

- Install Linux EC2 Instance
- Deploy your website
- Make your site publicly available

Create EC2 instance

Deploy Web Server

Duration: 20m