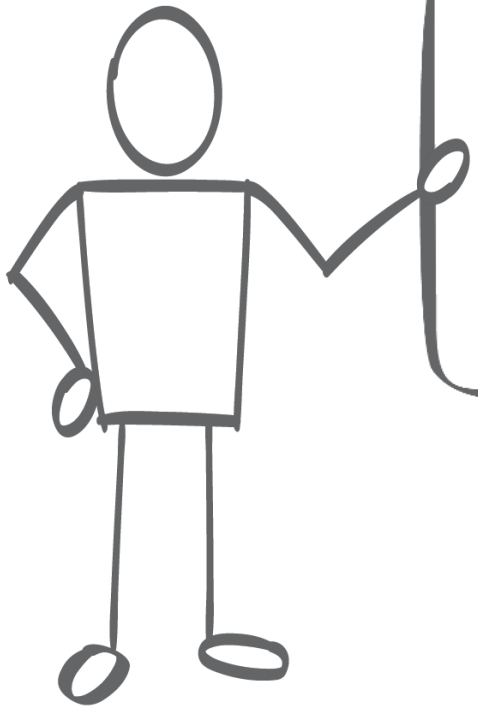
amazon web services | intel

AWSome Day

ONLINE CONFERENCE



Module 2
AWS Infrastructure

Amazon Elastic Compute Cloud (EC2)

Amazon Elastic Compute Cloud (EC2)

Amazon
EC2

- **Resizable** compute capacity
- Complete control of your computing resources
- **Reduces the time required** to obtain and boot new server instances to minutes

Amazon EC2 Facts

- Scale capacity as your computing requirements change
- Pay only for capacity that you actually use
- Choose Linux or Windows
- Deploy across AWS Regions and Availability Zones for reliability

Launching an Amazon EC2 Instance via the Web Console

1. Determine the AWS Region in which you want to launch the Amazon EC2 instance.
2. Launch an Amazon EC2 instance from a pre-configured Amazon Machine Image (AMI).
3. Choose an instance type based on CPU, memory, storage, and network requirements.
4. Configure network, IP address, security groups, storage volume, tags, and key pair.

AMI Details

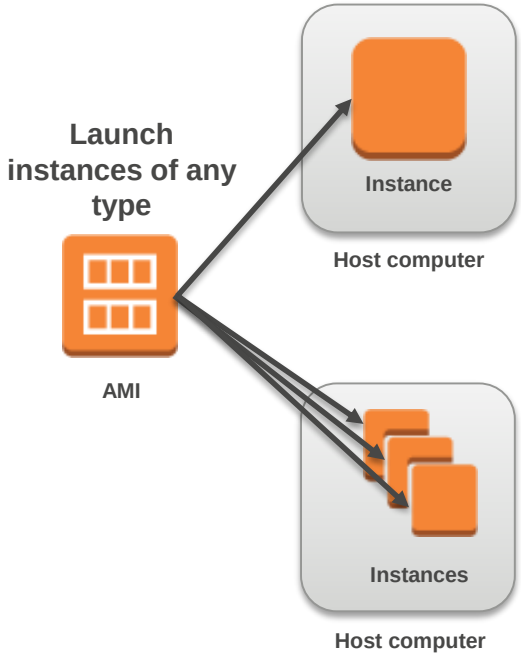
An AMI includes the following:

- A template for the root volume for the instance (for example, an operating system, an application server, and applications).
- Launch permissions that control which AWS accounts can use the AMI to launch instances.
- A block device mapping that specifies the volumes to attach to the instance when it's launched.

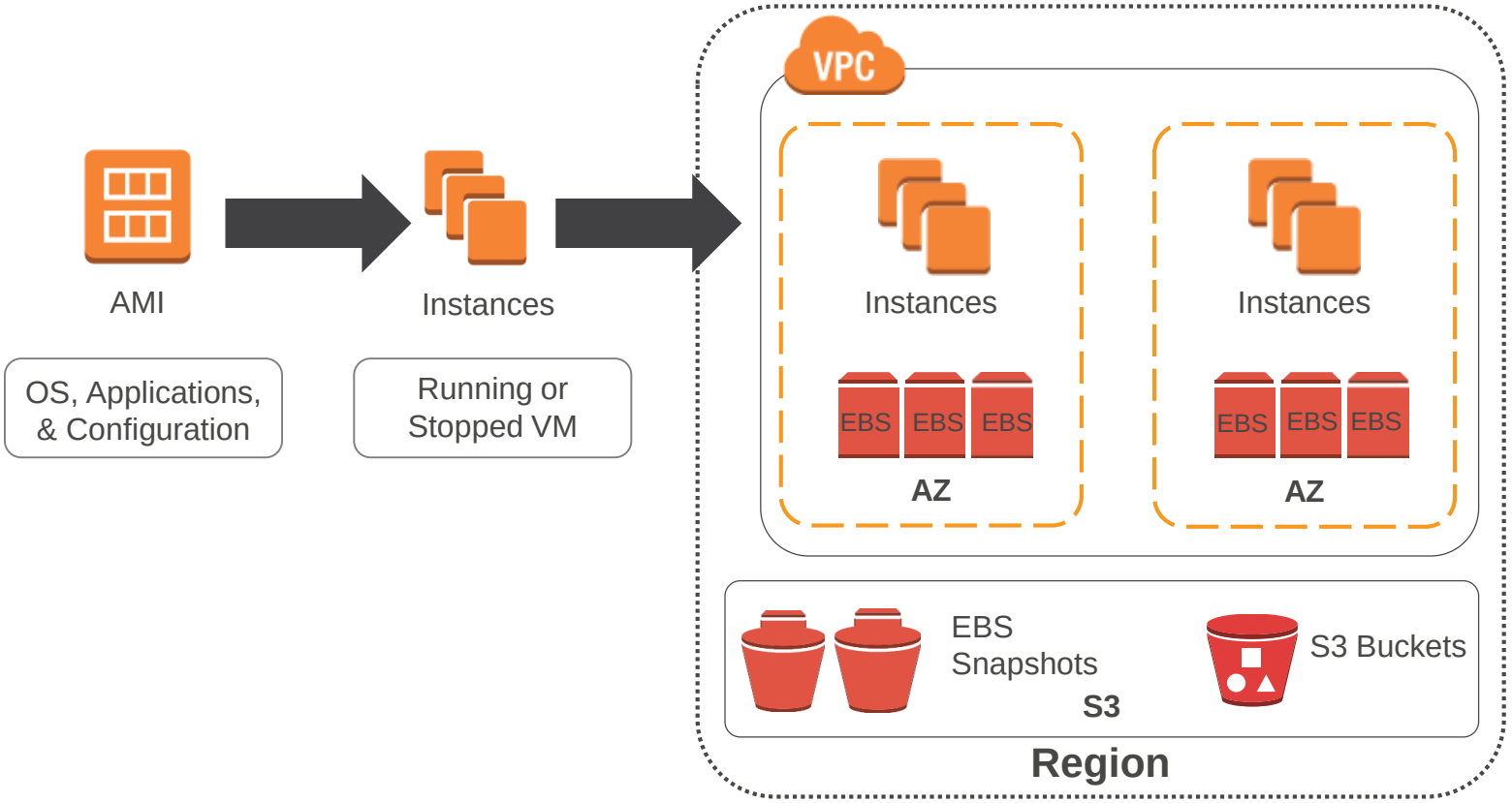
Instances and AMIs

Select an AMI based on:

- Region
- Operating system
- Architecture (32-bit or 64-bit)
- Launch permissions
- Storage for the root device



Amazon EC2 Instances



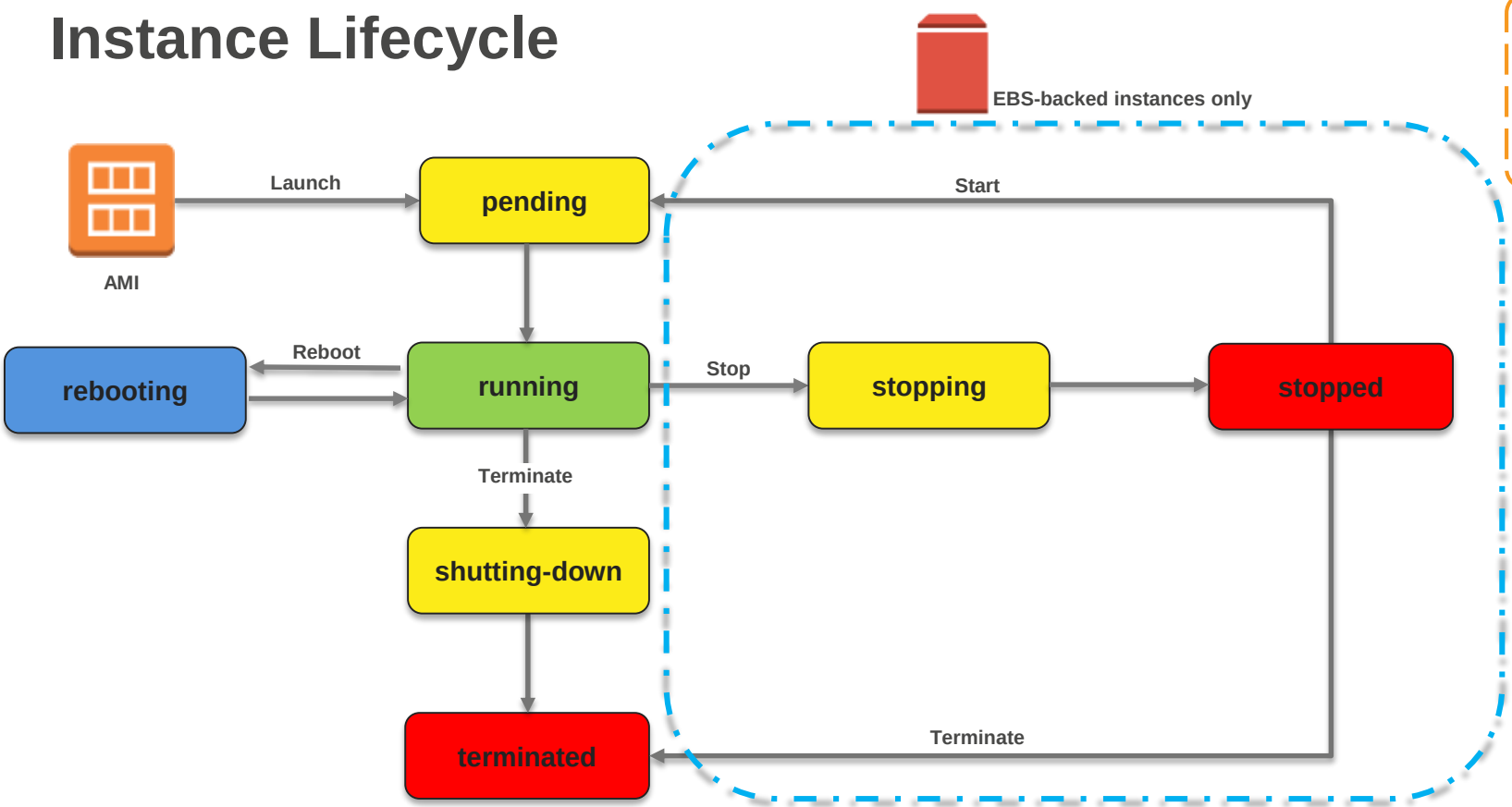
Amazon EBS vs. Amazon EC2 Instance Store

- Amazon EBS
  - Data stored on an Amazon EBS volume can persist independently of the life of the instance.
  - Storage is persistent.
- Amazon EC2 Instance Store
  - Data stored on a local instance store persists only as long as the instance is alive.
  - Storage is ephemeral.

AMI Types - Storage for the Root Device

Characteristic	Amazon EBS-Backed	Amazon Instance Store-Backed
Boot time	Usually < 1 minute	Usually < 5 minutes
Size limit	16 TiB	10 GiB
Data persistence	The root volume is deleted when the instance terminates. Data on any other Amazon EBS volumes persists after instance termination.	Data on any instance store volumes persists only during the life of the instance.
Charges	Instance usage, Amazon EBS volume usage, and storing your AMI as an Amazon EBS snapshot.	Instance usage and storing your AMI in Amazon S3.
Stopped state	Can be stopped.	Cannot be stopped.

Instance Lifecycle

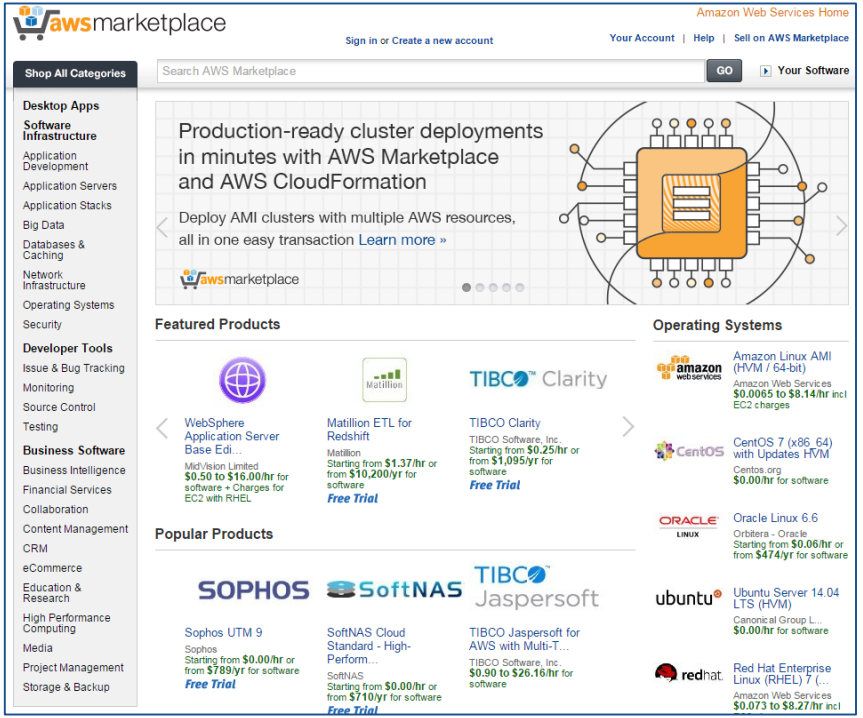


AWS Marketplace – IT Software Optimized for the Cloud

AWS Marketplace:

- Is an online store to discover, purchase, and deploy IT software on top of the AWS infrastructure.
  - Catalog of 2300+ IT software solutions
    - Including Paid, BYOL, Open Source, SaaS, & free to try options
  - Pre-configured to operate on AWS
    - Software checked by AWS for security and operability
  - Deploys to AWS environment in minutes
  - Flexible, usage-based billing models
  - Software charges billed to AWS account
- Includes AWS Test Drive.

https://aws.amazon.com/marketplace



Choosing the Right Amazon EC2 Instance

- EC2 instance types are optimized for different use cases and come in multiple sizes. This allows you to optimally scale resources to your workload requirements.
- AWS uses Intel® Xeon® processors for EC2 instances, providing customers with high performance and value.
- Consider the following when choosing your instances: Core count, memory size, storage size and type, network performance, and CPU technologies.
- Hurry Up and Go Idle - A larger compute instance can save you time and money, therefore paying more per hour for a shorter amount of time can be less expensive.

Get the Intel® Advantage

Intel's latest 22nm Haswell microarchitecture on new C4 instances, with custom Intel® Xeon® v3 processors, provides new features:

- Haswell microarchitecture has better branch prediction; greater efficiency at prefetching instructions and data; along with other improvements that can **boost existing applications**' performance by **30% or more**
- P state and C state control provides the ability to individually tune each cores performance and sleep states to improve application performance
- Intel® AVX2.0 instructions can double the floating-point performance for compute-intensive workloads over Intel® AVX, and provide additional instructions useful for compression and encryption

Intel® Processor Technologies

- **Intel® AVX** – Get dramatically better performance for highly parallel HPC workloads such as life science engineering, data mining, financial analysis, or other technical computing applications. AVX also enhances image, video, and audio processing.
- **Intel® AES-NI** – Enhance your security with these new encryption instructions that reduce the performance penalty associated with encrypting/decrypting data.
- **Intel® Turbo Boost Technology** – Get more computing power when you need it with performance that adapts to spikes in your workload with Intel® Turbo Boost Technology 2.0

EC2 Instances with Intel® Technologies

	Burstable	Balanced	Compute	Memory	GPU	I/O	Storage
AWS Instance Type	T2	M4	C4	R3	G2	I2	D2
Intel® processor	Intel® Xeon® family	Intel® Xeon® E5-2676 v3	Intel® Xeon® E5-2666 v3	Intel® Xeon® E5-2670 v2	Intel® Xeon® E5-2670	Intel® Xeon® E5-2670 v2	Intel® Xeon® E5-2676 v3
Intel® process technology	●	22nm Haswell	22nm Haswell	22nm Ivy Bridge	32nm Sandy Bridge	22nm Ivy Bridge	22nm Haswell
Intel® AVX	●	●	●	●	●	●	●
Intel® AVX2		●	●				●
Intel® Turbo Boost	●	●	●	●	●	●	●
Storage	EBS only	EBS only	EBS only	SSD	SSD	SSD	HDD

Current Generation Instances

Instance Family	Some Use Cases
General purpose (t2, m4, m3)	• Low-traffic websites and web applications • Small databases and mid-size databases
Compute optimized (c4, c3)	• High performance front-end fleets • Video-encoding
Memory optimized (r3)	• High performance databases • Distributed memory caches
Storage optimized (i2, d2)	• Data warehousing • Log or data-processing applications
GPU instances (g2)	• 3D application streaming • Machine learning

Instance Metadata & User Data

Instance Metadata:

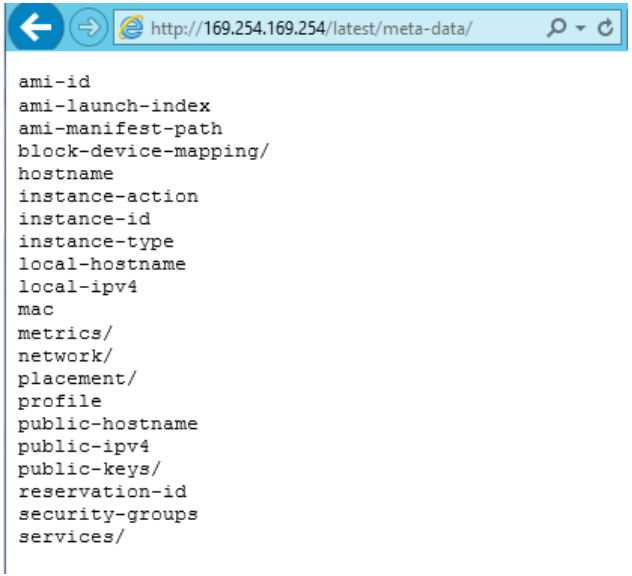
- Is data about your instance.
- Can be used to configure or manage a running instance.

Instance User Data:

- Can be passed to the instance at launch.
- Can be used to perform common automated configuration tasks.
- Runs scripts after the instance starts.

Retrieving Instance Metadata

- To view all categories of instance metadata from within a running instance, use the following URI: http://169.254.169.254/latest/meta-data/
- On a Linux instance, you can use:
  - `$ curl http://169.254.169.254/latest/meta-data/`
  - `$ GET http://169.254.169.254/latest/meta-data/`
- All metadata is returned as text (content type text/plain).



Adding User Data

- You can specify user data when launching an instance.
- User data can be:
  - Linux script – executed by **cloud-init**
  - Windows batch or PowerShell scripts – executed by **EC2Config** service
- User data scripts run once per instance-id by default.

User Data Example Linux

```
#!/bin/sh
```

User data shell scripts must start with the #! characters and the path to the interpreter you want to read the script.

```
yum -y install httpd
chkconfig httpd on
/etc/init.d/httpd
start
```

Install Apache web server
Enable the web server
Start the web server

User Data Example Windows

```
<powershell>
Import-Module ServerManager
```

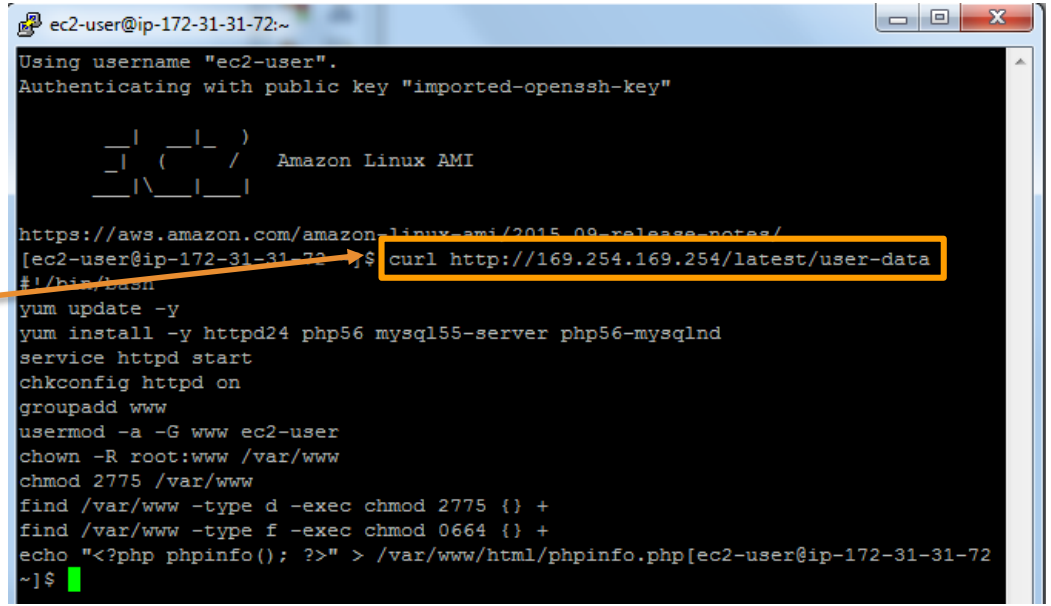
Import the Server Manager module for Windows PowerShell.

```
Install-WindowsFeature web-server, web-webserver
Install-WindowsFeature web-mgmt-tools
</powershell>
```

Install IIS
Install Web Management Tools

Retrieving User Data

- To retrieve user data, use the following URI: http://169.254.169.254/latest/user-data
- On a Linux instance, you can use:
  - `$ curl http://169.254.169.254/latest/user-data/`
  - `$ GET http://169.254.169.254/latest/user-data/`



Amazon EC2 Purchasing Options

On-Demand Instances

Pay by the hour.

Reserved Instances

Purchase at significant discount. Instances are always available.

1-year to 3-year terms.

Scheduled Instances

Purchase a 1-year RI for a recurring period of time.

Spot Instances

Highest bidder uses instance at a significant discount.

Spot blocks supported.

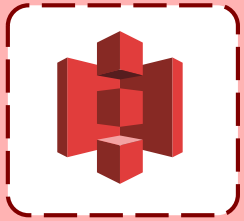
Dedicated Hosts

Physical host is fully dedicated to run your instances. Bring your per-socket, per-core, or per-VM software licenses to reduce cost.

Storage Services

Amazon S3 and Amazon EBS

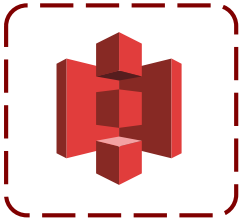
Amazon Simple Storage Service (S3)



Amazon S3

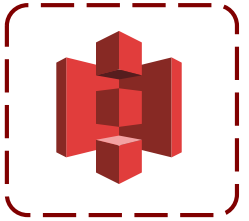
- Storage for the Internet
- Natively online, HTTP access
- Store and retrieve **any amount of data**, any time, from anywhere on the web
- **Highly scalable**, reliable, fast and durable

Amazon S3 Facts



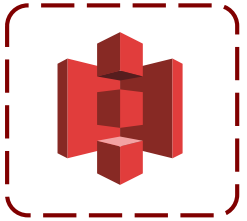
- Able to store an **unlimited number of objects** in a bucket
- Objects **up to 5 TB**; no bucket size limit
- Designed for **99.999999999%** durability and **99.99%** availability of objects over a given year
- **HTTP/S** endpoint to store and retrieve any amount of data, at any time, from anywhere on the web
- Highly scalable, reliable, fast, and inexpensive
- Optional server-side **encryption** using AWS or customer-managed provided client-side encryption
- Access logs for auditing
- Provides standards-based **REST** and SOAP interfaces

Common Use Scenarios



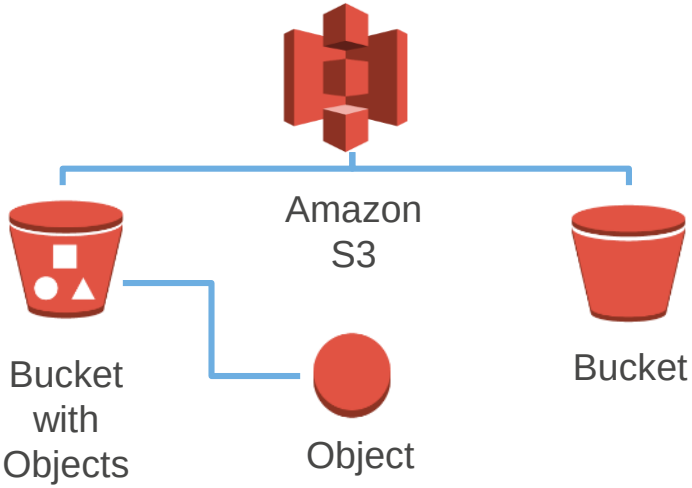
- Storage and Backup
- Application File Hosting
- Media Hosting
- Software Delivery
- Store AMIs and Snapshots

Amazon S3 Pricing



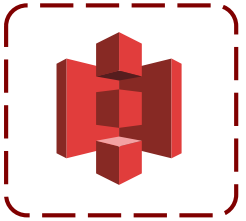
- Pay only for what you use
- No minimum fee
- Prices based on location of your Amazon S3 bucket
- Estimate monthly bill using the **AWS Simple Monthly Calculator**
- Pricing is available as:
  - Storage Pricing
  - Request Pricing
  - Data Transfer Pricing: data transferred out of Amazon S3

Amazon S3 Concepts



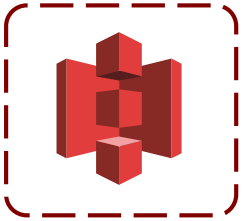
- Amazon S3 stores data as objects within buckets
- An object is composed of a file and optionally any metadata that describes that file
- You can have up to 100 buckets in each account
- You can control access to the bucket and its objects

Amazon S3 Buckets



- Organize the Amazon S3 namespace at the highest level.
- Identify the account responsible for storage and data transfer charges.
- Play a role in access control.
- Serve as the unit of aggregation for usage reporting.
- Have globally unique bucket names, regardless of the AWS region in which they were created.

Object Keys



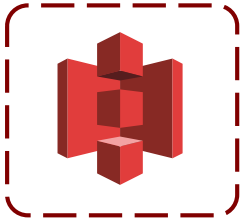
An object key is the unique identifier for an object in a bucket.

http://doc.s3.amazonaws.com/2006-03-01/AmazonS3.html

Bucket

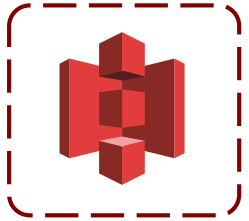
Object/Key

Amazon S3 Security



- You can control access to buckets and objects with:
  - Access Control Lists (ACLs)
  - Bucket policies
  - Identity and Access Management (IAM) policies
- You can upload or download data to Amazon S3 via SSL encrypted endpoints.
- You can encrypt data using AWS SDKs.

Amazon S3 Versioning



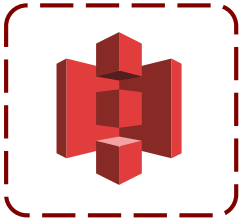
- Protects from accidental overwrites and deletes with no performance penalty.
- Generates a new version with every upload.
- Allows easily retrieval of deleted objects or roll back to previous versions.
- Three states of an Amazon S3 bucket
  - Un-versioned (default)
  - Versioning-enabled
  - Versioning-suspended

Versioning Enabled

Amazon S3 Storage Classes

Storage Class	Durability	Availability	Other Considerations
Amazon S3 Standard	99.999999999%	99.99%	None
Amazon S3 Standard - Infrequent Access (IA)	99.999999999%	99.99%	• Retrieval fee associated with objects • Most suitable for infrequently accessed data
Glacier	99.999999999%	99.99% (after you restore objects)	• Not available for real-time access • Must restore objects before you can access them

Amazon S3 Object Lifecycle



Lifecycle management defines how Amazon S3 manages objects during their lifetime. Some objects that you store in an Amazon S3 bucket might have a well-defined lifecycle:

- Log files
- Archive documents
- Digital media archives
- Financial and healthcare records
- Raw genomics sequence data
- Long-term database backups
- Data that must be retained for regulatory compliance

Amazon Glacier

- Long term low-cost archiving service
- Optimal for infrequently accessed data
- Designed for 99.999999999% durability
- 3-5 hours retrieval time
- Less than $0.01 per GB / month (depending on region)

SoundCloud Case Study

SoundCloud:

- Operates worldwide.
- Enables users to upload **12 hours of audio material** to its platform **every minute**.
  - Each audio file must be transcoded and **stored in multiple formats**.
  - Logs and analyzes **billions of events**.

The AWS Solution:

- SoundCloud uses a storage solution comprised of:
  - Amazon S3
  - Amazon Glacier
- The audio files are:
  - Placed in Amazon S3.
  - Distributed from Amazon S3 via the SoundCloud website.
  - Copied to Amazon Glacier.
- The company currently stores **2.5 PB** of data on Amazon Glacier.

Amazon S3

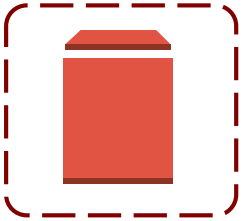
Amazon Glacier

Amazon Elastic Block Store (EBS)

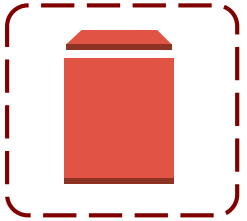
Amazon EBS

- **Persistent block level storage** volumes offering consistent and low-latency performance
- Automatically replicated within its Availability Zone
- Snapshots stored durably in Amazon S3

Amazon EBS Lifecycle

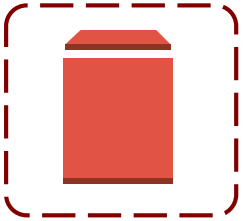


Amazon EBS Facts



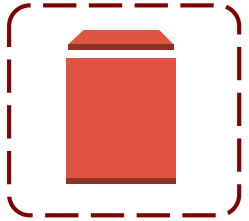
- You can create:
  - **EBS Magnetic** volumes from 1 GiB to 1 TiB in size.
  - **EBS General Purpose** (SSD) and **Provisioned IOPS** (SSD) volumes up to 16 TiB in size.
- You can use encrypted EBS volumes to meet a wide range of data at-rest encryption requirements for regulated/audited data and applications.
- You can create point-in-time snapshots of EBS volumes, which are persisted to Amazon S3.

Amazon EBS Use Cases



- OS – Use for boot/root volume, secondary volumes
- Databases – Scales with your performance needs
- Enterprise applications – Provides reliable block storage to run mission-critical applications
- Business continuity – Minimize data loss and recovery time by regularly backing up using EBS Snapshots
- Applications – Install and persist any application

Amazon EBS Pricing

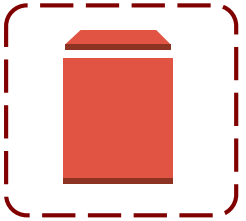


Pay for what you provision:

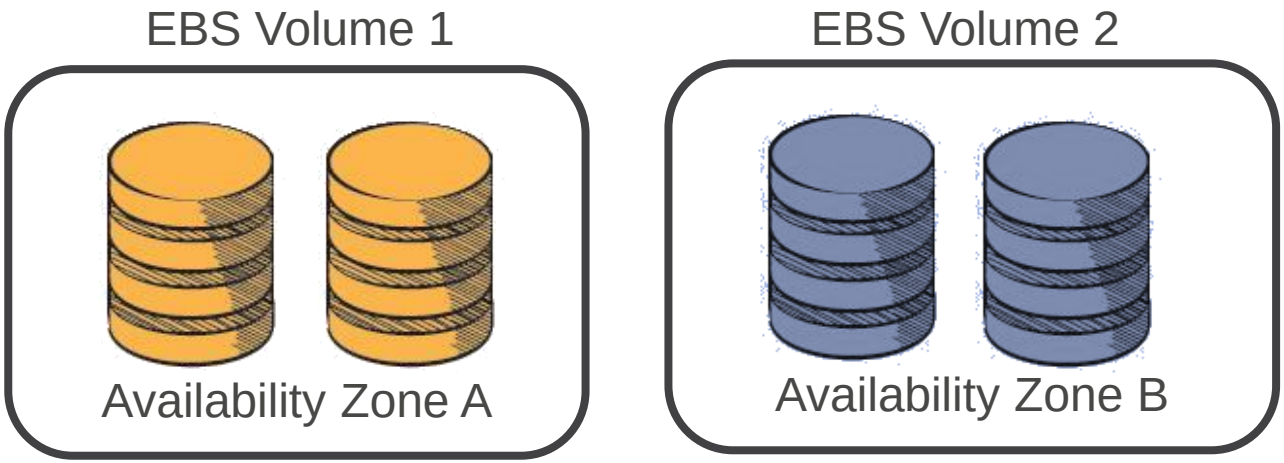
- Pricing based on region
- AWS GovCloud (US) Pricing page
- Review Pricing Calculator online
- Pricing is available as:
  - Storage
  - IOPS

** Check Amazon EBS Pricing page for current pricing for all regions.*

Amazon EBS Scope



Amazon EBS Volumes are in a Single Availability Zone



Volume data is replicated across multiple servers in an Availability Zone.

Amazon EBS and Amazon S3

	Amazon EBS	Amazon S3
Paradigm	Block storage with file system	Object store
Performance	Very fast	Fast
Redundancy	Across multiple servers in an Availability Zone	Across multiple facilities in a Region
Security	EBS Encryption – Data volumes and Snapshots	Encryption
Access from the Internet?	No (1)	Yes (2)
Typical use case	It is a disk drive	Online storage

(1) Accessible from the Internet if mounted to server and set up as FTP, etc.
(2) Only with proper credentials, unless ACLs are world-readable

Amazon EC2 Instance Storage

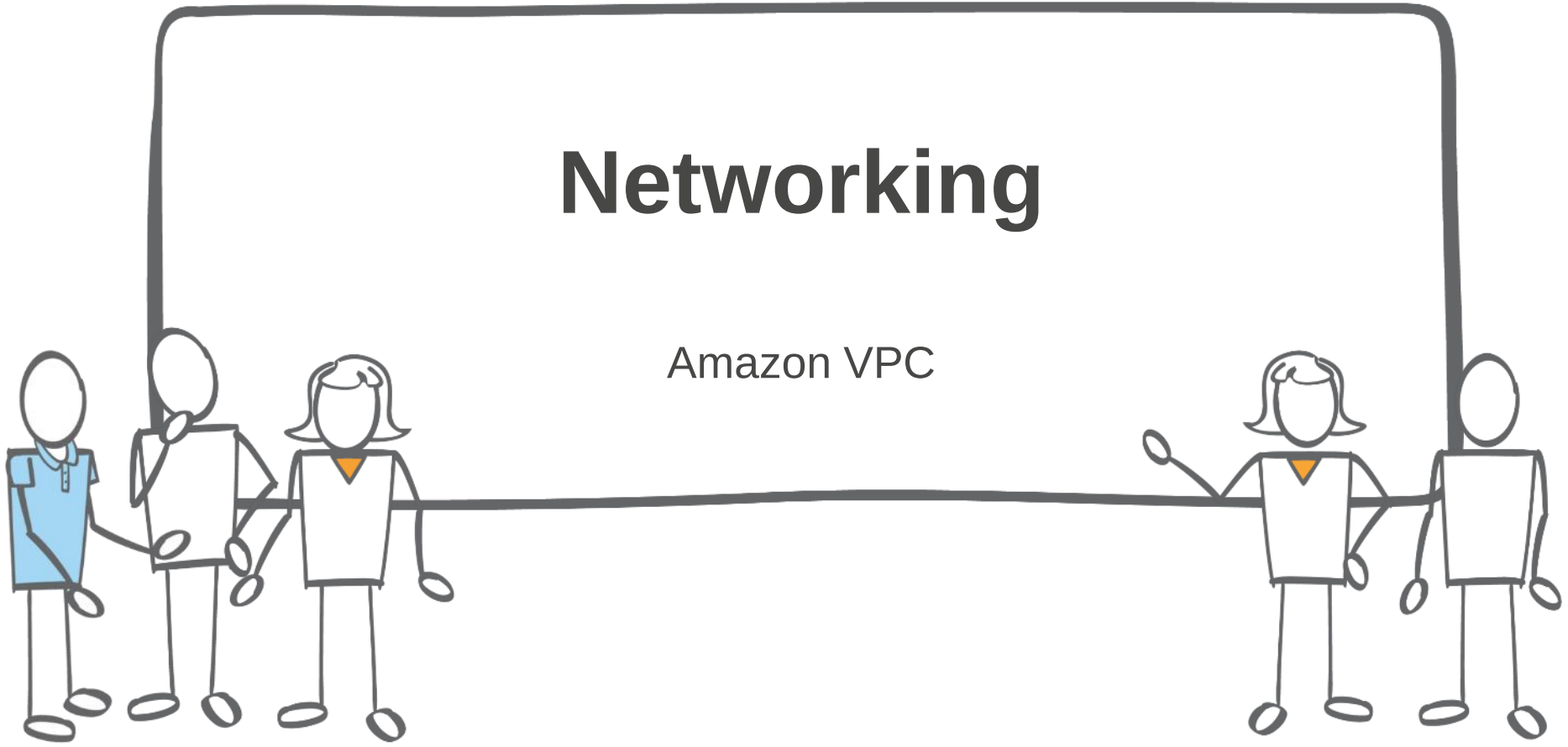
- Local, complimentary direct attached block storage resource.
- Availability, number of disks, and size is based on EC2 instance type.
- Storage optimized instances for up to 365,000 Read IOPS and 315,000 First Write IOPS.
- SSD or magnetic.
- No persistence.
- All data is automatically deleted when an EC2 instance stops, fails or is terminated.

Reboot vs. Stop vs. Terminate

Characteristic	Reboot	Stop/Start (EBS-backed instances only)	Terminate
Host computer	The instance stays on the same host computer.	The instance runs on a new host computer.	N/A
Private and public IP addresses	Stay the same.	Instance keeps its private IP address and gets a new public IP address.	N/A
Elastic IP addresses (EIP)	EIP remains associated with the instance.	EIP remains associated with the instance.	The EIP is disassociated from the instance.
Instance store volumes	The data is preserved.	The data is erased.	The data is erased.
EBS volume	The volume is preserved.	The volume is preserved.	The volume is deleted by default.
Billing	Instance billing hour doesn't change.	You stop incurring charges as soon as state is changed to stopping.	You stop incurring charges as soon as state is changed to shutting-down.

Networking

Amazon VPC



Amazon Virtual Private Cloud (VPC)

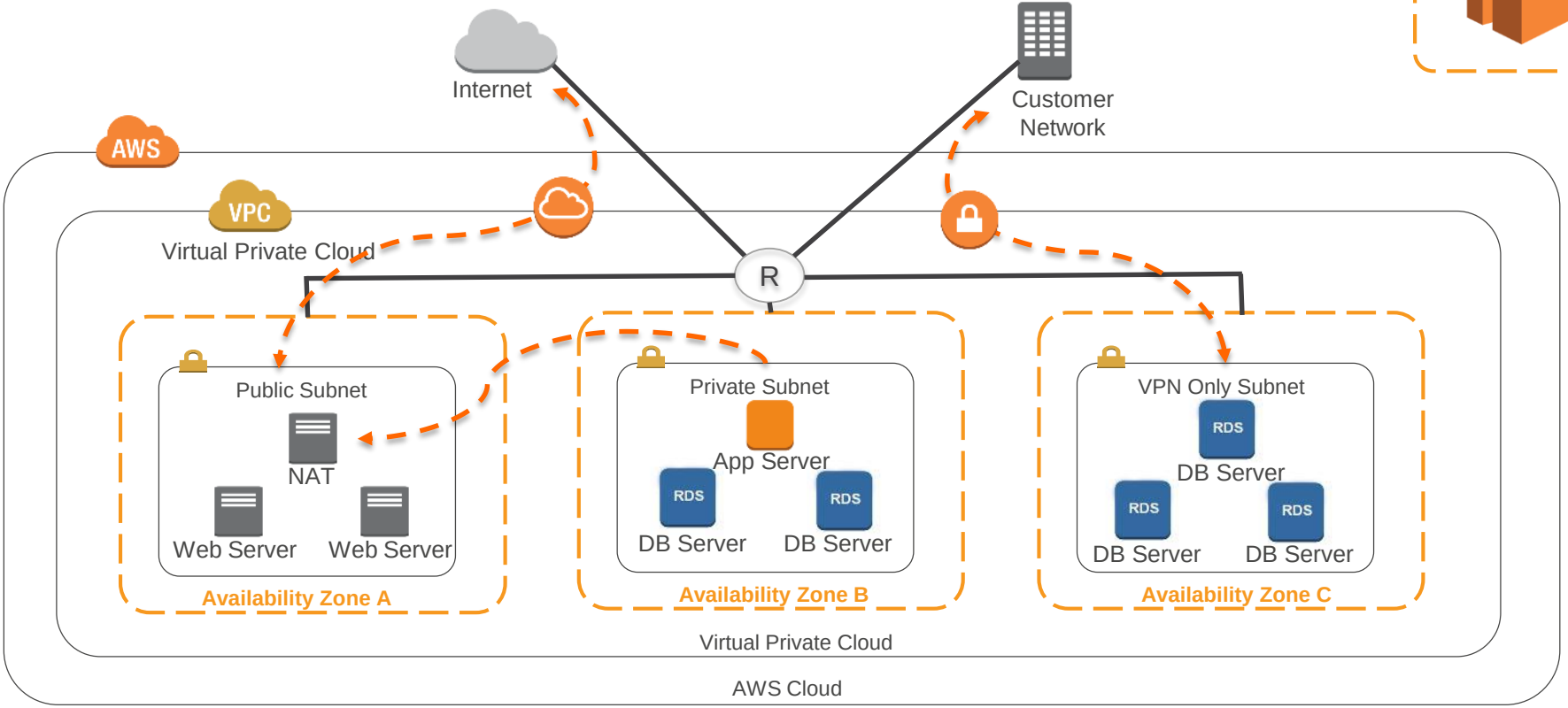
Amazon
VPC

- Provision a **private, isolated virtual network** on the AWS cloud.
- Have complete control over your virtual networking environment.

VPCs and Subnets

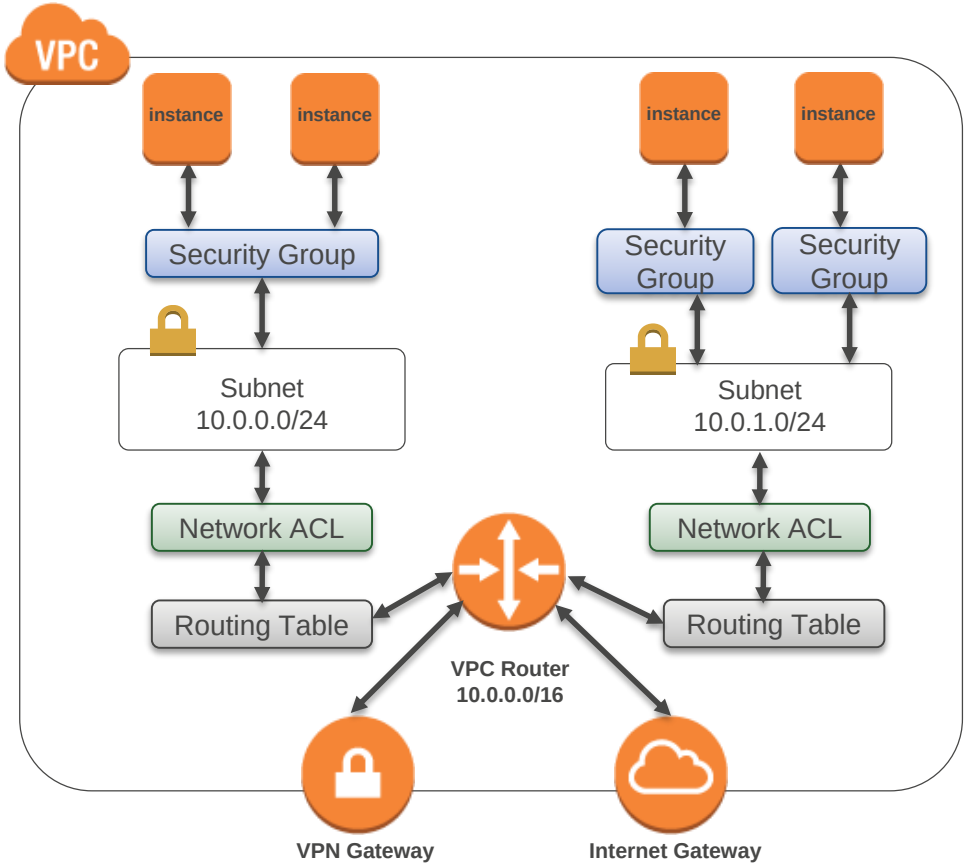
- A **subnet** defines a range of IP addresses in your VPC.
- You can launch AWS resources into a subnet that you select.
- A **private subnet** should be used for resources that won't be accessible over the Internet.
- A **public subnet** should be used for resources that will be accessed over the Internet.
- Each subnet must reside entirely within one Availability Zone and cannot span zones.

Amazon VPC Example



Security in Your VPC

- Security groups
- Network access control lists (ACLs)



VPN Connections

VPN Connectivity option	Description
AWS Hardware VPN	You can create an IPsec, hardware VPN connection between your VPC and your remote network.
AWS Direct Connect	AWS Direct Connect provides a dedicated private connection from a remote network to your VPC.
AWS VPN CloudHub	You can create multiple AWS hardware VPN connections via your VPC to enable communications between various remote networks.
Software VPN	You can create a VPN connection to your remote network by using an Amazon EC2 instance in your VPC that's running a software VPN appliance.

Errors or corrections? Email us at aws-course-feedback@amazon.com.
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