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# Introduction to Amazon FSx

# Introduction to Amazon FSx

Using FSx, we can launch and run high-performing file systems with just a few clicks while avoiding tasks such as provisioning hardware, configuring software, or taking backups

**AWS FSx provides two file systems to choose from:**

FSx 

Amazon FSx  
for Windows File Server

FSx 

Amazon FSx  
for Lustre

# Introduction to Amazon FSx

## Why should we use AWS FSx?



Simple and fully managed



Fast delivery



Highly available and durable



Pay only for the used resources



Secure and compliant



Easy integration with other  
AWS services



# Amazon FSx for Windows File Server



## For Windows File Server

A native Microsoft Windows file system so that we can move our windows-based apps to this shared storage in AWS. Built on a Windows server, it has great compatibility with Microsoft products

We get full support for the SMB protocol, Windows NTFS, and Microsoft Active Directory (AD) integration. Also, FSx uses SSD for fast performance

## Features of AWS FSx for Windows File Server

01

**Native Windows compatible:** FSx supports all Windows versions starting from Windows 7

02

**Broadly accessible:** It can connect our file system to Amazon EC2, Workspaces, and even VMware cloud on AWS

03

**Fully managed:** It is very simple to launch and use the shared file storage for our Windows applications that run on AWS

04

**Built on SSD storage:** It is designed for fast and consistent delivery and provides up to 2 GB/s of throughput per file system



# Amazon FSx for Windows File Server



## Use Cases

### Lift-and-shift Application Workloads



Windows-based applications and workloads, such as ERP, CRM, and custom-built .NET applications, require shared file storage

### Software Development Environments



Development environments include source code and build repositories residing on shared file storage that support many developers working on the same projects

# Amazon FSx for Windows File Server

## How does FSx for Windows File Server work?



# Amazon FSx for Windows File Server

## Supported Clients, Access methods and Environments

### Clients

1. Amazon EC2 instances
2. Amazon WorkSpaces instances
3. Amazon AppStream 2.0 instances
4. VMware Cloud on AWS

### Access methods

1. Using DNS names
2. Distributed File System Namespaces

### Environments

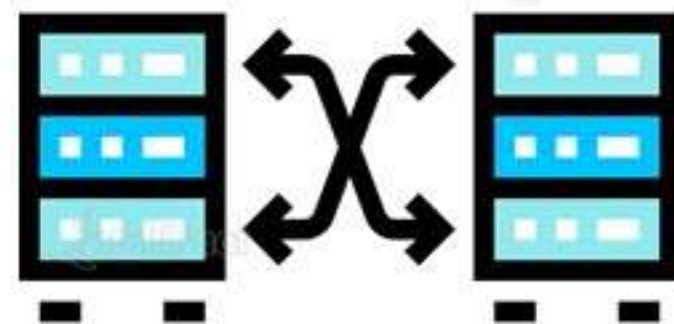
1. From an on-premises environment
2. From an AWS account, another VPC or region

# Amazon FSx for Windows File Server

## Failover Process

The Multi-AZ file system will start failover automatically if any of the below conditions prevail:

1. An availability zone outage
2. The preferred file server is unavailable
3. The preferred file server undergoes planned maintenance





## Failover Process

What exactly happens when a failover process starts?

1. When failing over from a file system server to another, the new file system will start serving all read and write requests
2. Once all resources are available in the required subnet, FSx automatically goes back to the preferred file server
3. For a failover to complete, it takes around 30 seconds from when it detected a failure



# Amazon FSx for Lustre

# Amazon FSx for Lustre



FSx

For Lustre

FSx for Lustre makes it very easy to launch and run the world's most popular file system

Lustre®

The Lustre file system is an open-source, parallel file system that supports many requirements of leadership-class HPC simulation environments

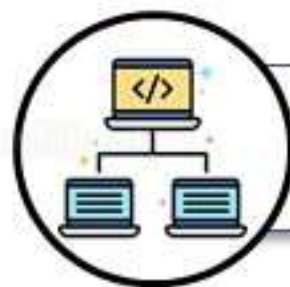
# Amazon FSx for Lustre



## Features of Amazon FSx for Lustre



Most popular high-performance file system



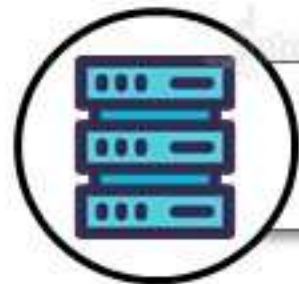
Multiple deployment options



Seamless integration with our Amazon S3 data



Data accessible to other AWS services



Accessible from on-premises



Simple and fully managed

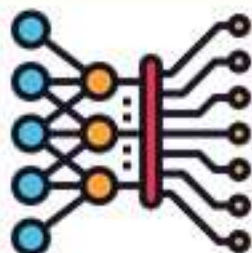
# Amazon FSx for Lustre

We can integrate it with S3 that makes it easier to process datasets. When linked with S3, Lustre shows all S3 objects as files, and any change made will reflect in the S3 bucket as well



## Use Cases

### Machine Learning



ML workloads use massive amounts of training data. Multiple instances need to process this training data simultaneously, so a shared file storage is very helpful

### Media Processing and Transcoding



Media workflows, such as video rendering and visual effects, need compute and storage resources to handle the massive amounts of data being created



# Amazon FSx Pricing



For Windows File Server

For Lustre

## Pricing

Region: US East (N. Virginia) ▾

	Single-AZ Deployment	Multi-AZ-Deployment
SSD storage capacity	\$0.130 per GB-month	\$0.230 per GB-month
HDD storage capacity	\$0.013 per GB-month	\$0.025 per GB-month
Throughput capacity	\$2.200 per MBps-month	\$4.500 per MBps-month
Backup storage	\$0.050 per GB-month	\$0.050 per GB-month

# Amazon FSx Pricing



## Pricing Example

**For Windows File Server**

**For Lustre**

Assume, we want to store 10 TB of general-purpose file share data using HDD storage in the US East (N. Virginia) region. Based on the typical deduplication savings of 50–60%, we provision a 5 TB multi-AZ file system with 16 MBps of throughput capacity. Also, assume that we have an average backup storage of 5 TB during the month

**Total monthly charge:**

**Storage:** 5 TB x \$0.025 GB-month = \$128/mo

**Throughput:** 16 MBps x \$4.50/MBps-month = \$72/mo

**Backup:** 5 TB x \$0.050/GB-month = \$256/mo

**Total monthly charge: \$456 (\$0.045/GB-mo for 10TB of data)**

# Amazon FSx Pricing



For Windows File Server

For Lustre

## Pricing

Region: US East (N. Virginia) ▾

Storage options	Pricing per GB-month
Scratch (200 MB/s/TiB baseline, up to 1.3 GB/s/TiB burst)	\$0.14
Persistent (200 MB/s/TiB baseline, up to 1.3 GB/s/TiB burst)	\$0.29
Persistent (100 MB/s/TiB baseline, up to 1.3 GB/s/TiB burst)	\$0.19
Persistent (50 MB/s/TiB baseline, up to 1.3 GB/s/TiB burst)	\$0.14

## Pricing Example

**For Windows File Server**

**For Lustre**

Assume, we have a scratch file system in the US East (N. Virginia) region, which has been provisioned with 4,800 GB of storage capacity, and we spin up our file system for an 8-hour workload every day and then shut it down. We do this for 30 days (a month)

**Total workload charge:**

$\$0.14 \text{ GB-month} / 30 / 24 = \$0.000194/\text{GB-hour}$

$4800 \text{ GB} \times \$0.000194/\text{GB-hour} \times 8 \text{ hours} \times 30 \text{ days} = \$224$

**Total FSx for Lustre charge for the month: \$224**

# Hands-on: Amazon FSx for Windows File Server



# Hands-on: Amazon FSx for Lustre

# Introduction to Global Accelerator

# Introduction to Global Accelerator

AWS Global Accelerator is a service that improves the availability and performance of our applications with local or global users



It provides static IP addresses that will act as a fixed entry point to our application endpoints on EC2, Beanstalk, or load balancers

# Introduction to Global Accelerator

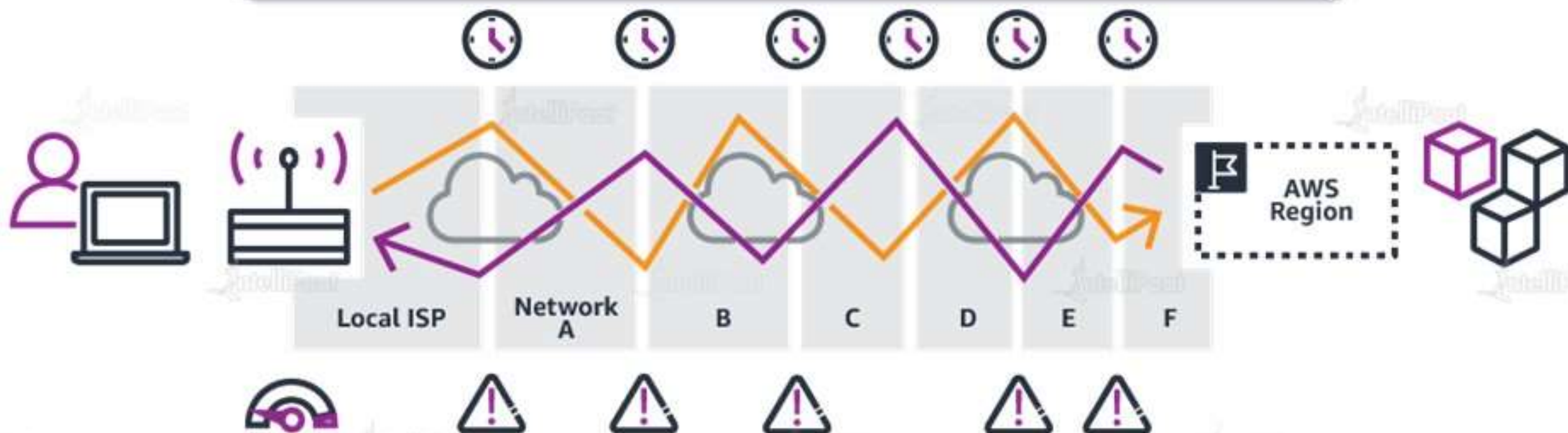
## How does Global Accelerator work?



# Introduction to Global Accelerator

## Without Global Accelerator

It can take many networks to reach the application. Paths to and from the application may differ. Each hop impacts performance and can introduce risks





# Introduction to Global Accelerator

With Global Accelerator

Adding AWS Global Accelerator removes these inefficiencies. It leverages the AWS global network, resulting in improved performance



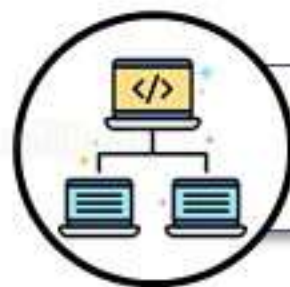
# Introduction to Global Accelerator



## Benefits of Using Global Accelerator



Instant regional failover



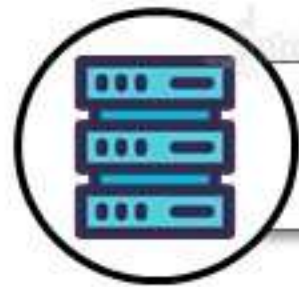
High availability



No variability around clients that  
cache IP addresses



Improved performance



Easy manageability



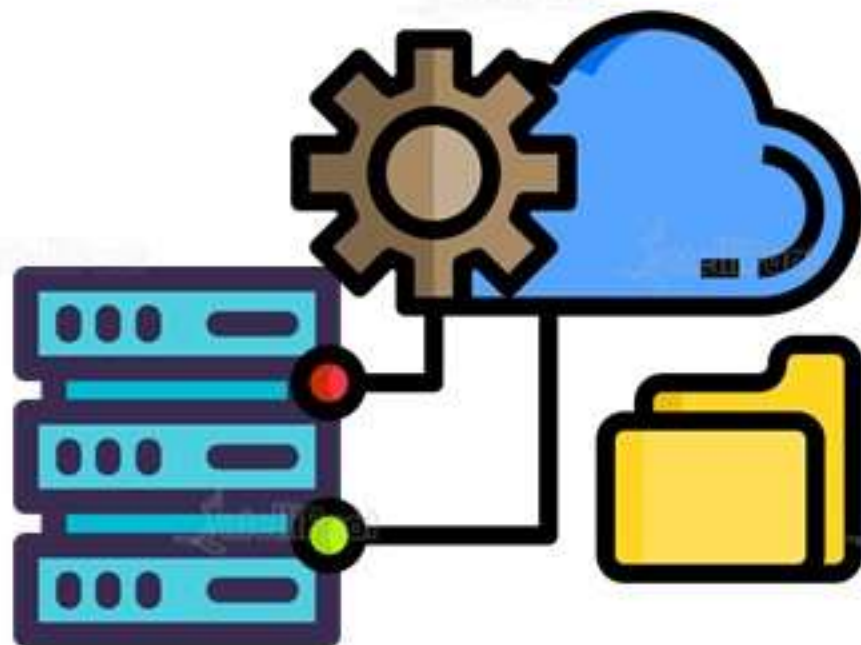
Fine-grained control

# Introduction to Global Accelerator

There is **BYOIP** (Bring Your Own IP address) facility in Global Accelerator. This lets us use our own IP address as the entry point static IP

How does this help?

This allows us to move our on-premises applications that have hardcoded IP address dependencies to AWS, without making any client-facing changes



# Introduction to Global Accelerator



## Use Cases

Scales for Increased Application Utilization



When app usage grows, the number of IPs to manage also increases. Global Accelerator takes care of scaling our network up or down

Protects the Applications



While making our ELB or EC2 instances Internet-facing, the exposure to attacks increases. Using GA, we can use an internal ALB or a private instance as an endpoint

# Global Accelerator Components



# Global Accelerator Components

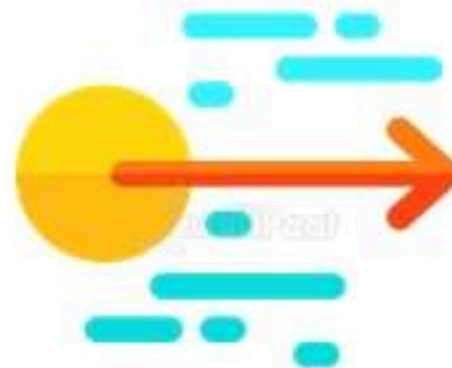
## Static IP Addresses

Global Accelerator provides two static IP addresses as endpoints or we can use a BYOIP address



## Accelerator

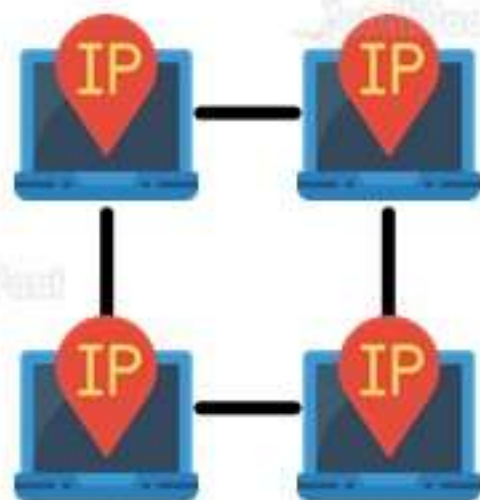
It directs traffic to healthy endpoints over the AWS global network to increase availability and performance



# Global Accelerator Components

## Network Zone

A network zone is an isolated unit with its own set of physical infrastructure, so if an IP becomes unavailable, we can try another IP in another network zone



## Listener

Processes inbound connections from clients to Global Accelerator, based on the port (or port range) and the protocol (TCP and UDP) that we configure

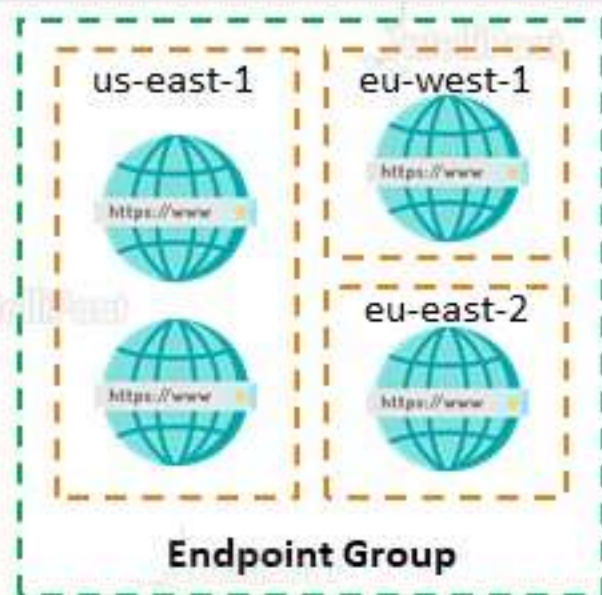


Port 80

# Global Accelerator Components

## Endpoint Groups

Every endpoint group is associated with a region. There will be one or more endpoint groups in a region



## Endpoints

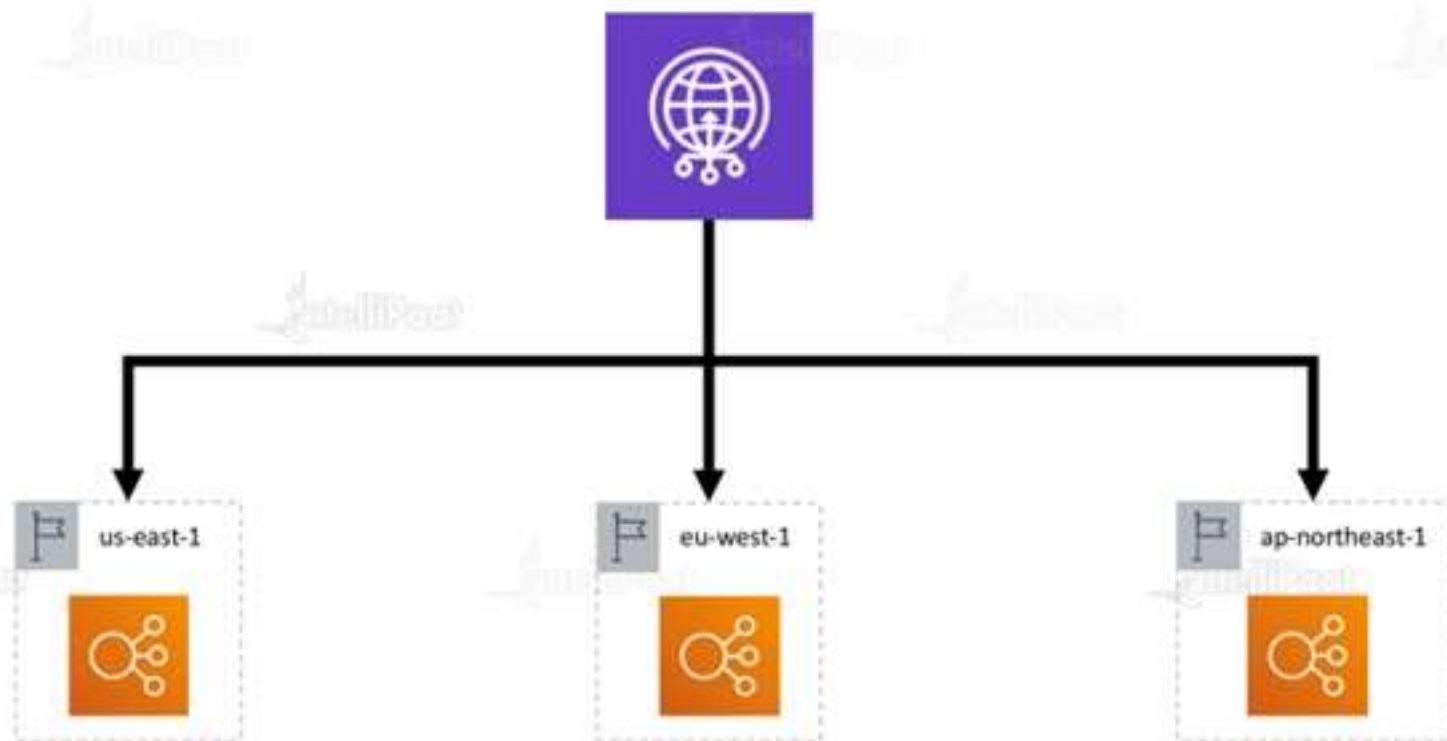
Endpoints can be NLB, ALB, EC2 instances, or Elastic IP addresses. Traffic is routed to the endpoint according to the configuration we provide



# Global Accelerator Components

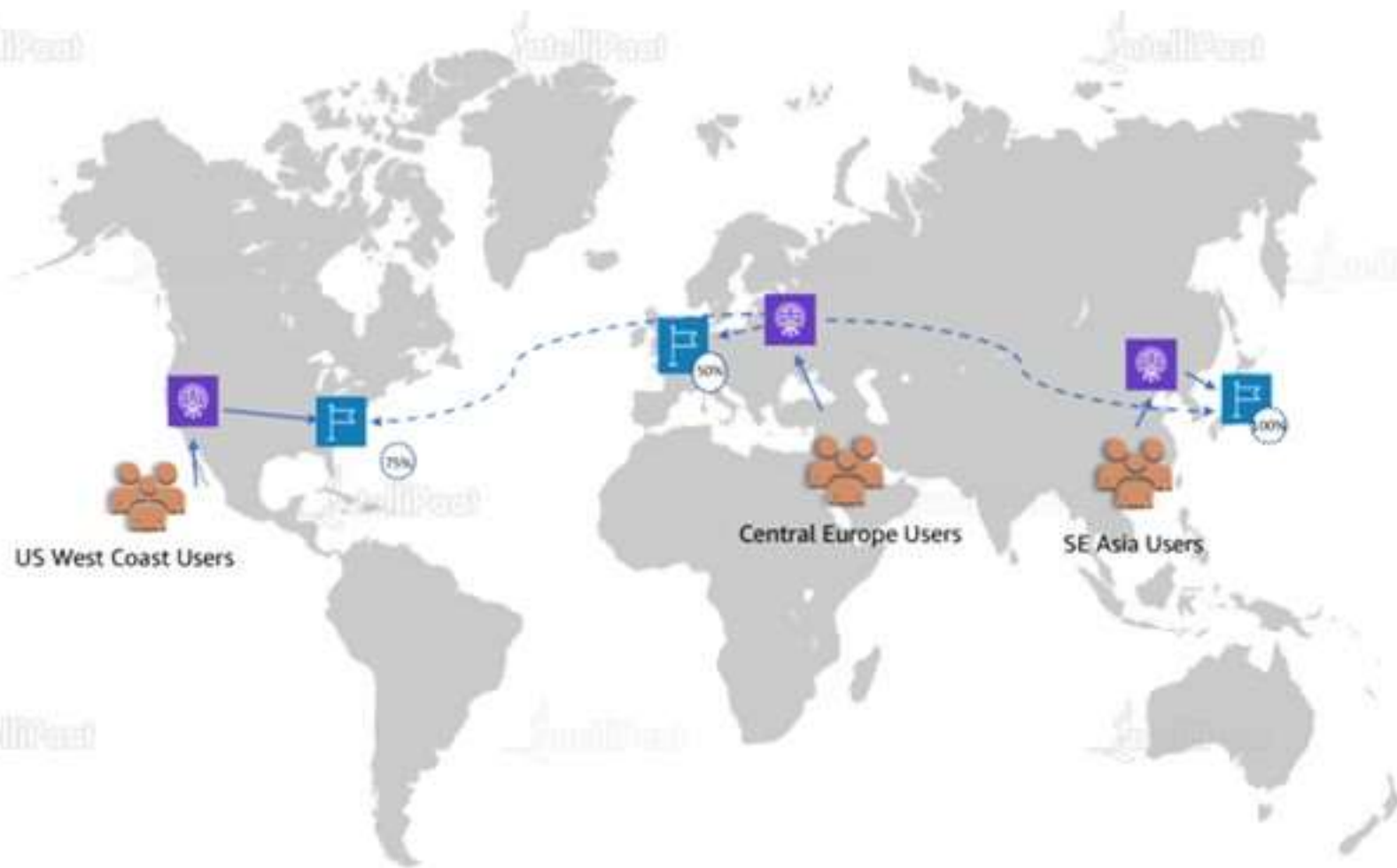
Let's take an example. Here, we are connecting three load balancers, which are in three different locations with common endpoints

## AWS Global Accelerator





# Global Accelerator Components





# Global Accelerator: Quotas and Pricing



## Quotas

- Accelerators for each AWS account: 20
- Listeners for each Accelerator: 10
- Port ranges for each listener: 10
- Endpoints for each endpoint group: 10
- Tags for each Accelerator: 50

## Pricing

- Global Accelerator is not available in the free tier
- There is a fixed fee for a full or partial hour usage of GA with a charge of \$0.025 until it is detected



# Introduction to AWS Organizations

# Introduction to AWS Organizations

AWS Organization is a tool that lets us centrally manage multiple AWS accounts added to our 'organization'



## AWS Organizations

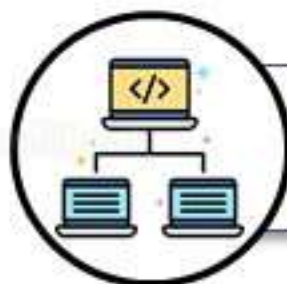
If we are the administrator of an organization, then we can invite the existing AWS accounts to join Organizations or we can create accounts in Organizations directly

# Introduction to AWS Organizations

## AWS Organizations Features



Centralized management



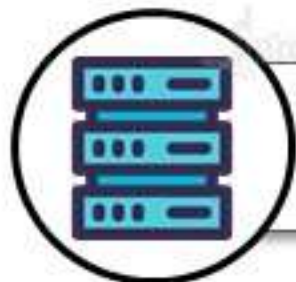
Consolidated billing for all member accounts



Control over the accounts' usage of services or APIs



Integration with AWS IAM



Consistent data replication, eventually



Standardized tags across accounts

# Introduction to AWS Organizations

## Pricing of AWS Organizations

There are no additional charges for AWS Organizations!

The charges apply to only the usage of other AWS resources by all member accounts





# Introduction to AWS Organizations



## Ways to Access AWS Organizations

### AWS Management Console

Organizations can be accessed through the browser-based AWS Management Console to manage resources

### AWS Command-line Tools

With AWS CLI, we can use the system's command line to access Organizations using commands. It is faster than console



# Introduction to AWS Organizations

## Ways to Access AWS Organizations

### AWS SDKs

SDKs have libraries that can be used to write code as well as access AWS Organizations

### HTTPS Query API

It gives programmatic access to AWS Organizations and its services. We can issue HTTPs requests directly to a service



# Introduction to AWS Organizations



## AWS Organizations Quotas

### Max. and Min. Values

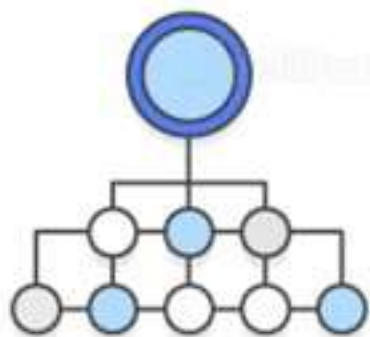
- Number of roots in an Organization: 1
- Number of OUs in an Organization: 1,000
- Number of policies in an Organization: 1,000
- OU maximum nesting in a root: 5
- Number of member accounts that can be created concurrently: 5

### Expiration Time for Handshakes

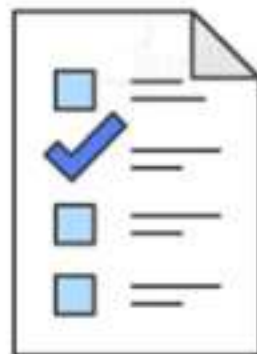
- Invitation to join an Organization: 15 days
- Request to enable all features in an Organization: 90 days
- Handshake is deleted and no longer appears in lists: 30 days

# Introduction to AWS Organizations

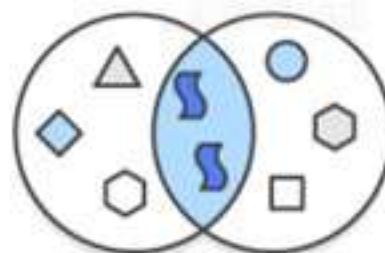
How does AWS IAM work with Organizations?



Creates groups of AWS accounts with AWS Organizations



Attaches service control policies (SCPs) to those groups to centrally control AWS service use



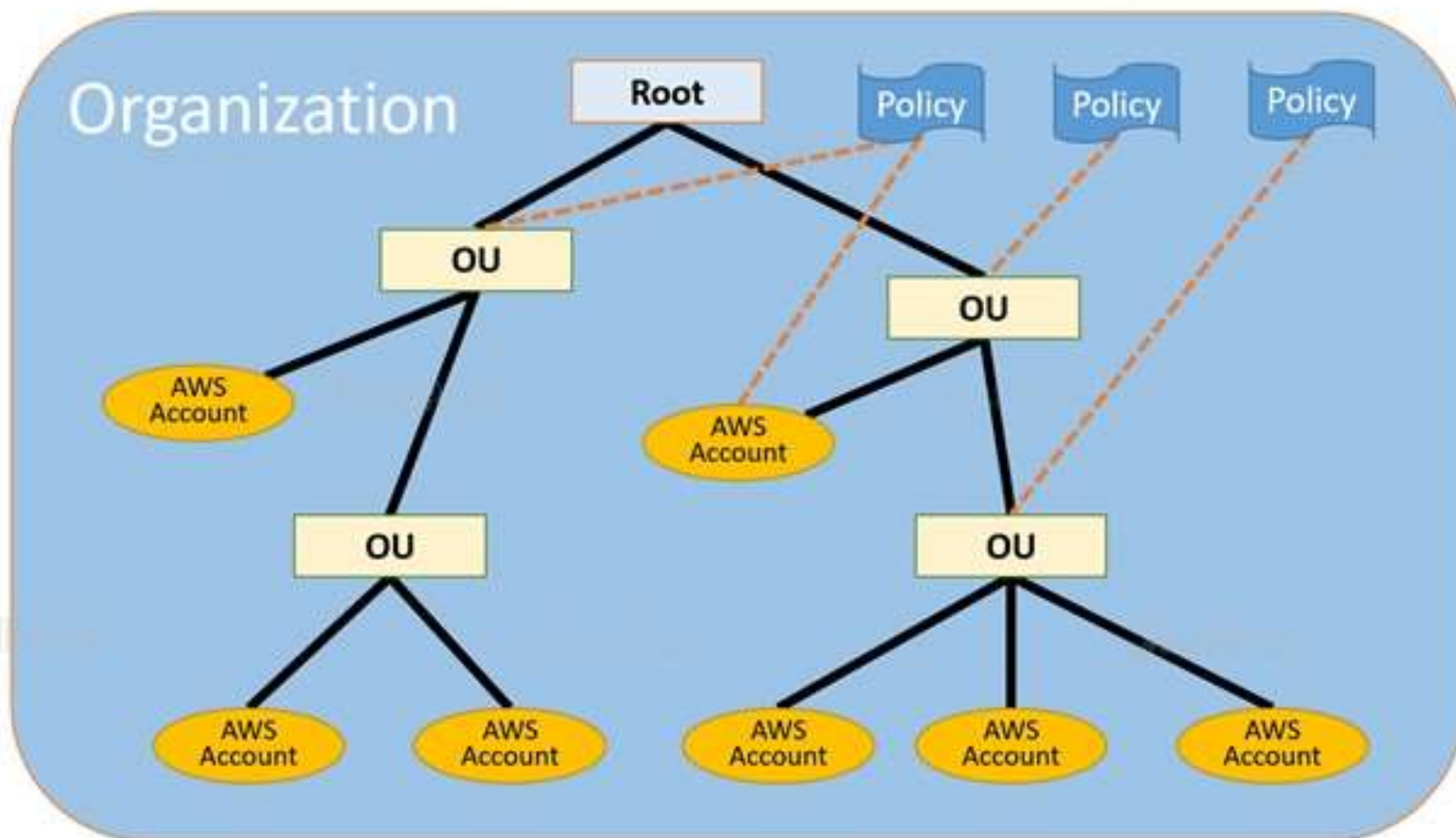
Entities in AWS accounts can only use the AWS services allowed by both SCP and AWS IAM policies for each account

# AWS Organizations Concepts



# AWS Organizations Concepts

An example organization with multiple accounts



# AWS Organizations Concepts

Organization

Root

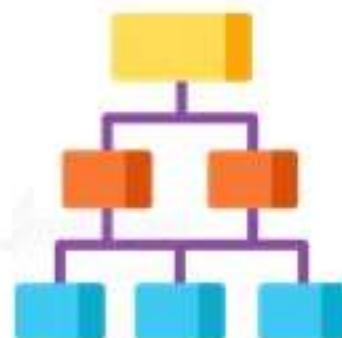
Organization Unit (OU)

Account

Invitation

Handshake

Organizations can be used to consolidate multiple AWS accounts so that we can administer them all as a single unit



An organization will have one master account and zero or more member accounts. We can organize our organization in an hierarchical order with a root on the top

# AWS Organizations Concepts

Organization

Root

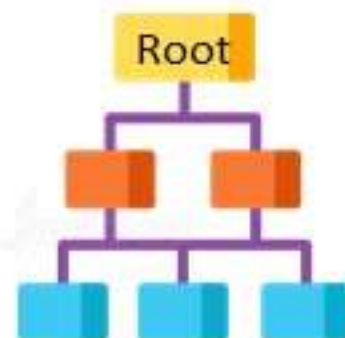
Organization Unit (OU)

Account

Invitation

Handshake

This is the master account for all subaccounts. If we apply a policy to root, it will be applied to all the member accounts and organization units



We can have only one root and that will be automatically created when we create an organization

# AWS Organizations Concepts

Organization

Root

Organization Unit (OU)

Account

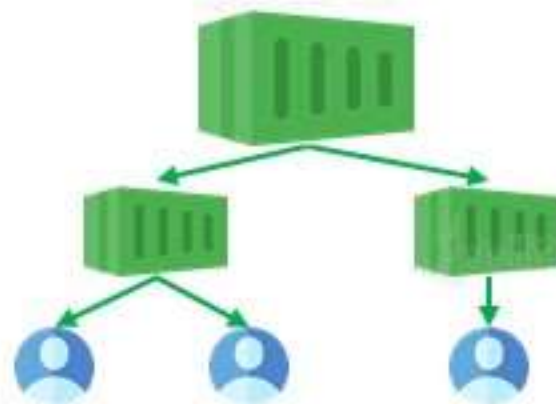
Invitation

Handshake

A container for accounts within a root. An OU can contain other OUs and this is what enables the tree-like hierarchy that ends in accounts



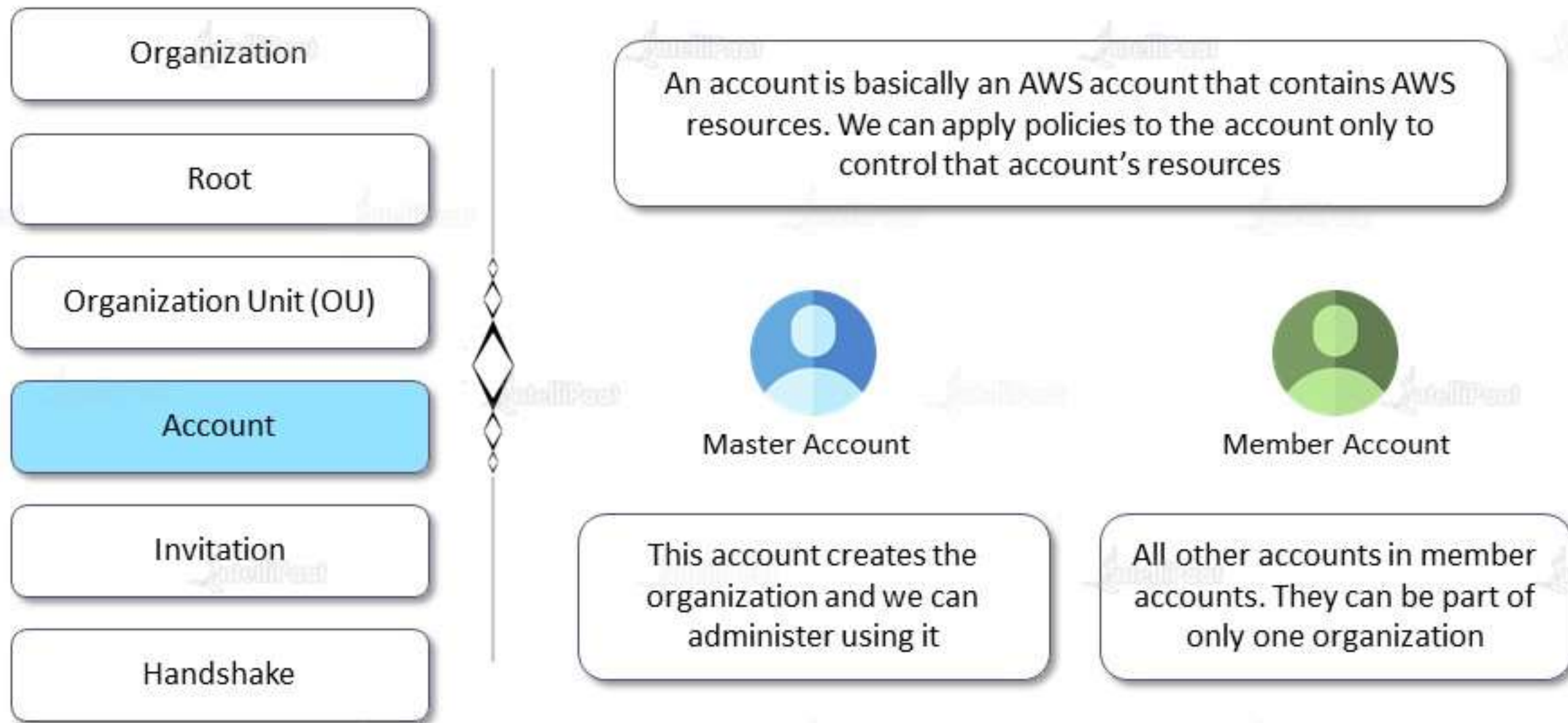
Organization Unit (OU)



If we attach a policy to an OU, this affects all the other OUs under it, as well as to the member accounts



# AWS Organizations Concepts





# AWS Organizations Concepts

Organization

Root

Organization Unit (OU)

Account

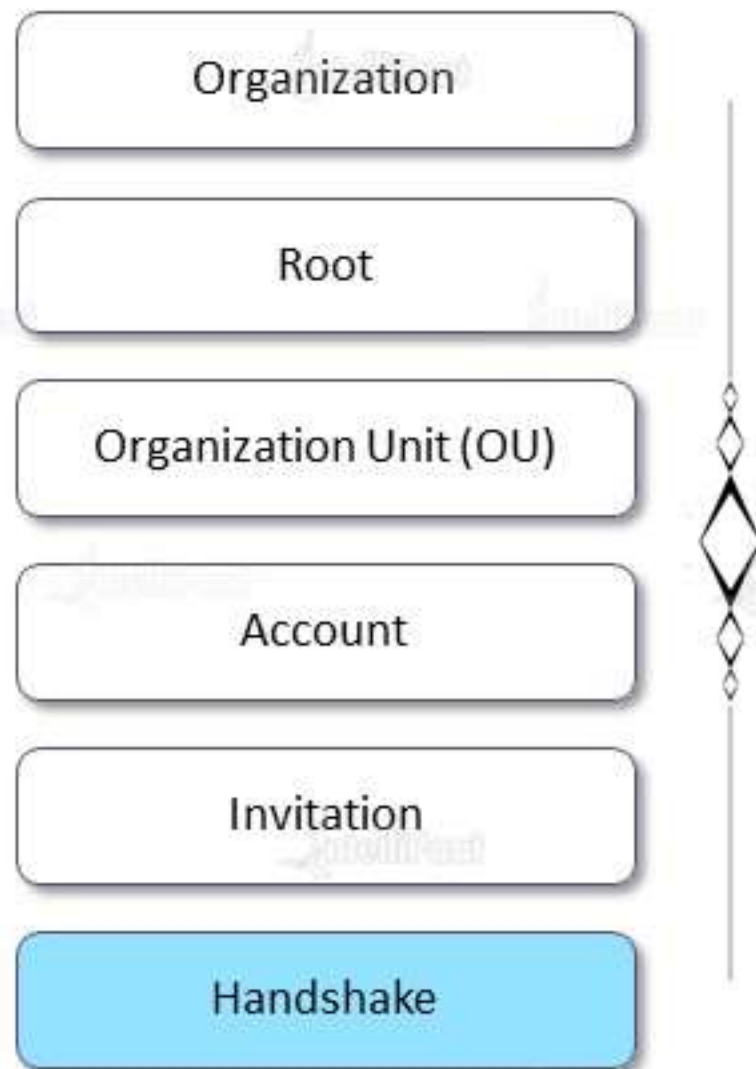
Invitation

Handshake

This is the process of asking another AWS account to join our organization. Only a master account can send out an invite. If they accept, they become a member



# AWS Organizations Concepts



Handshake is a multi-step process of sharing information between two accounts/parties. Handshakes are used to send out invitations and get back acknowledgement



We can work with handshakes directly if we are working with the organization's API or AWS CLI tools

# Starting with Organizations

# Starting with Organizations

## Creating and Configuring an Organization



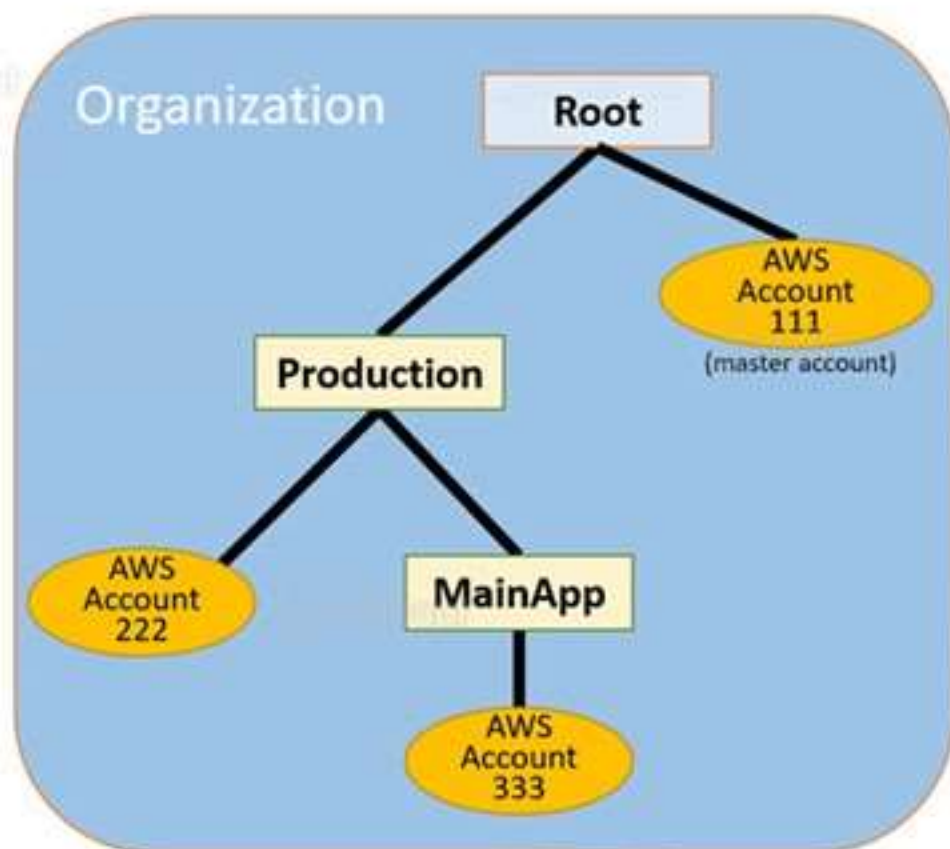
## Step 1: Create an Organization

1. Open the AWS Management Console, and then choose our **account name** from the navigation bar
2. Choose **My Organization**
3. Choose **Create Organization**
4. Choose **Enable all features** or **Enable only consolidated billing**
5. Choose **Create**



# Starting with Organizations

## Step 2: Create Organizational Units



### Create organizational unit

Organizational units allow you to organize your accounts.

Name of organizational unit

Create organizational unit

Root  
• OrganizationalUnit1

TREE VIEW

Filter

Organizational units (1)

+ New organizational unit

☐ OrganizationalUnit1

# Starting with Organizations

## Step 3: Create Service Control Policies

First, enable SCP

Then, check out the SCPs in the IAM console

Service control policies

[Enable](#)

Service control policies

[Disable](#)



## Step 4: Test Restrictions

1. AWS Organizations denies any attempt to perform an action in any service that isn't in the allow list
2. AWS Organizations denies any attempt to perform an action that isn't in the allow list policy and any action that is in the deny list policy
3. Test the master account to check if any of these rules affect the root account; they shouldn't affect the root account

# Elastic Network Interface

# Elastic Network Interface



## Elastic Network Interface

An elastic network interface (ENI) is a logical networking component in a VPC that represents a virtual network card. When we move a network interface from one instance to another, network traffic is redirected to the new instance





# Elastic Network Interface

## IP Addresses per Network Interface per Instance Type

Instance Type	Maximum NIs	Private IPv4 Addresses per Interface	IPv6 Addresses per Interface
a1.xlarge	4	15	15
c1.medium	2	6	IPv6 not supported
t2.micro	2	2	2
t2.small	3	4	4
t2.medium	3	6	6
z1d.metal	15	50	50

**When do we need a network interface?**

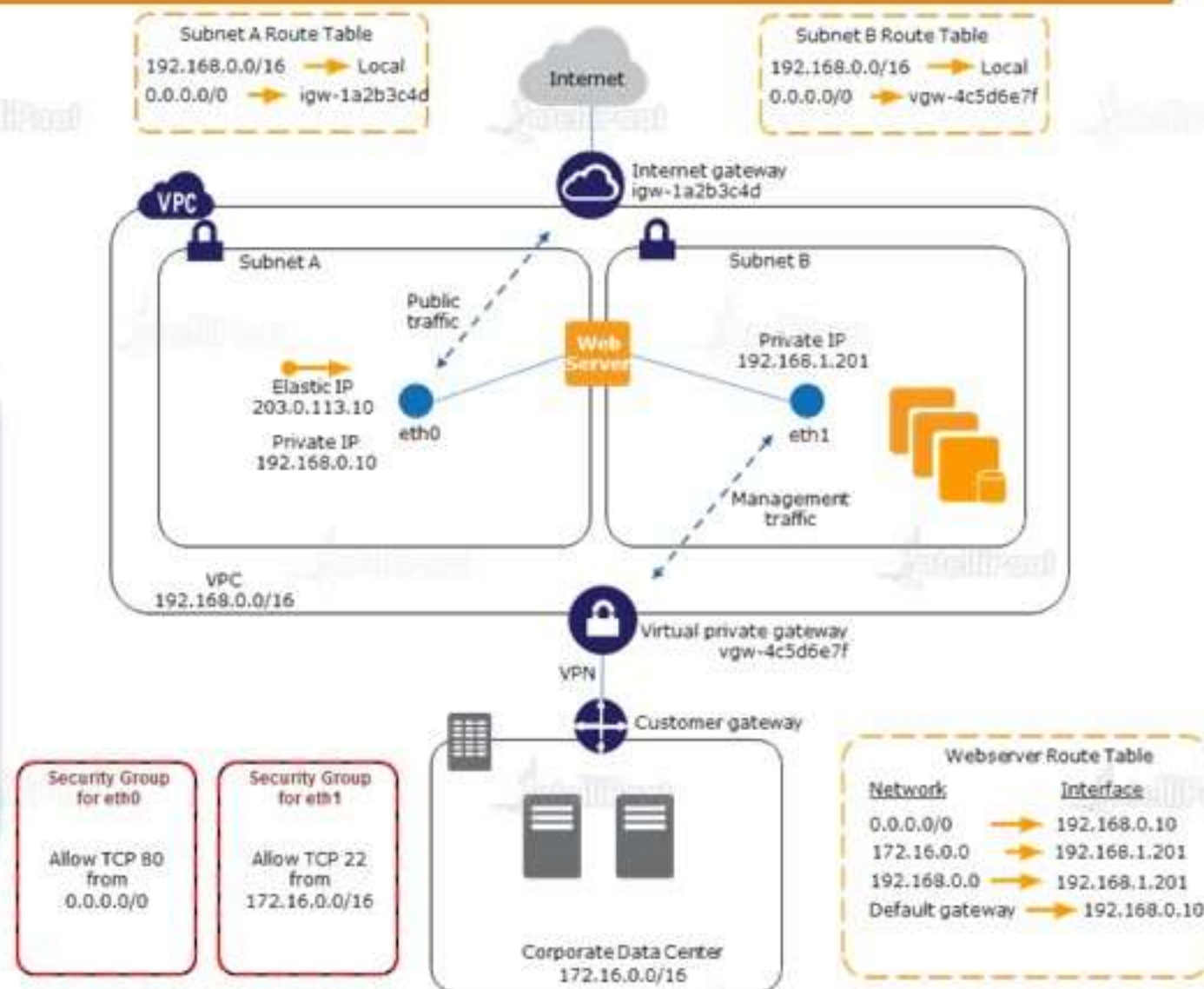
We will have to attach multiple network interfaces in the following scenarios:

1. Creating a management network
2. Using network and security appliances in our VPC
3. Creating dual-homed instances with workloads/roles on distinct subnets
4. Creating a low-budget, high-availability solution

# Elastic Network Interface

## Scenario Example

We can create a management network using network interfaces. In this scenario, the primary network interface (eth0) on the instance handles public traffic, and the secondary network interface (eth1) handles backend management traffic and is connected to a separate subnet in our VPC that has more restrictive access controls



# Elastic Network Adapter

# Elastic Network Adapter

## Elastic Network Adapter

Amazon EC2 provides enhanced networking capabilities through the elastic network adapter (ENA). It supports network speeds up to 100 Gbps for the supported instance types





# Elastic Network Adapter

## All the available instance types

A1, C5, C5d, C5n, F1, G3, G4, H1, I3, I3en, Inf1, m4.16xlarge, M5, M5a, M5ad, M5d, M5dn, M5n, P2, P3, R4, R5, R5a, R5ad, R5d, R5dn, R5n, T3, T3a, u-6tb1.metal, u-9tb1.metal, u-12tb1.metal, u-18tb1.metal, u-24tb1.metal, X1, X1e, and z1d instances

## All the available AMIs

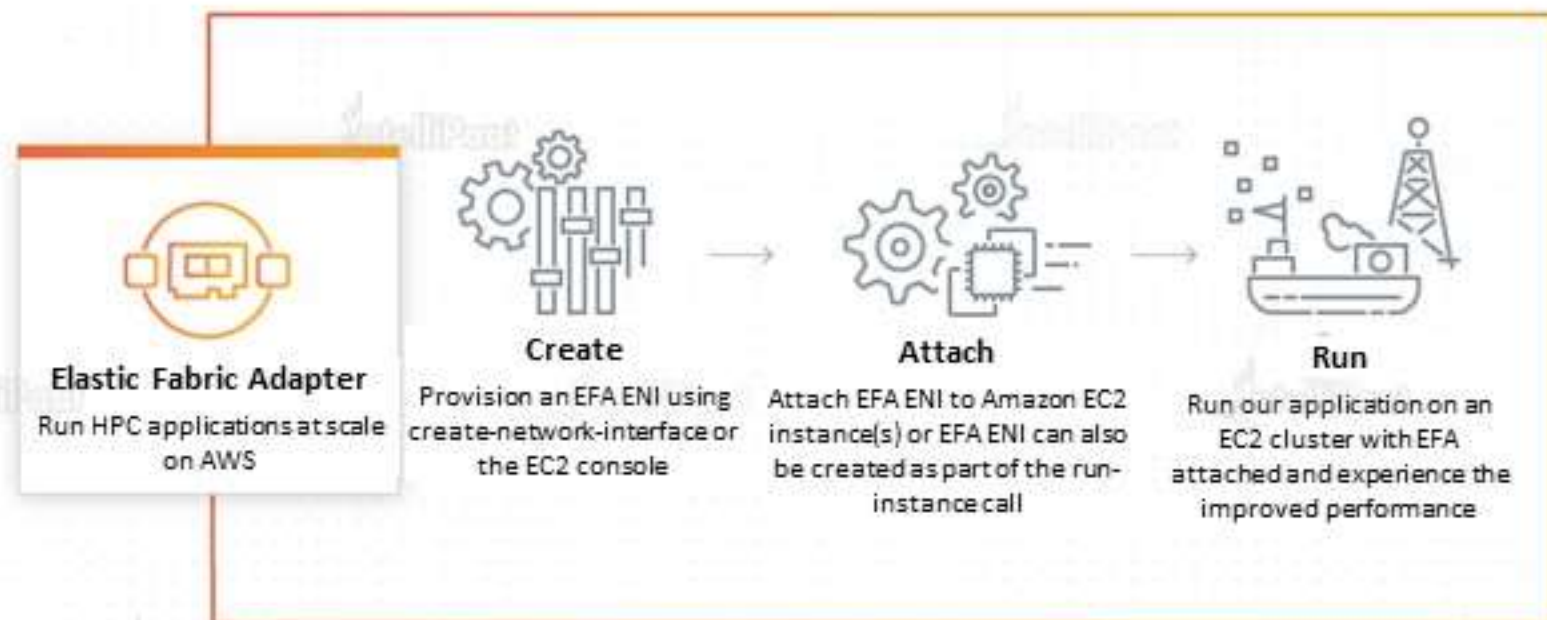
1. Amazon Linux 2
2. Amazon Linux AMI 2018.03
3. Ubuntu 14.04 (with linux-aws kernel) or later
4. Red Hat Enterprise Linux 7.4 or later
5. SUSE Linux Enterprise Server 12 SP2 or later
6. CentOS 7.4.1708 or later
7. FreeBSD 11.1 or later
8. Debian GNU/Linux 9 or later

# Elastic Fabric Adapter

# Elastic Fabric Adapter

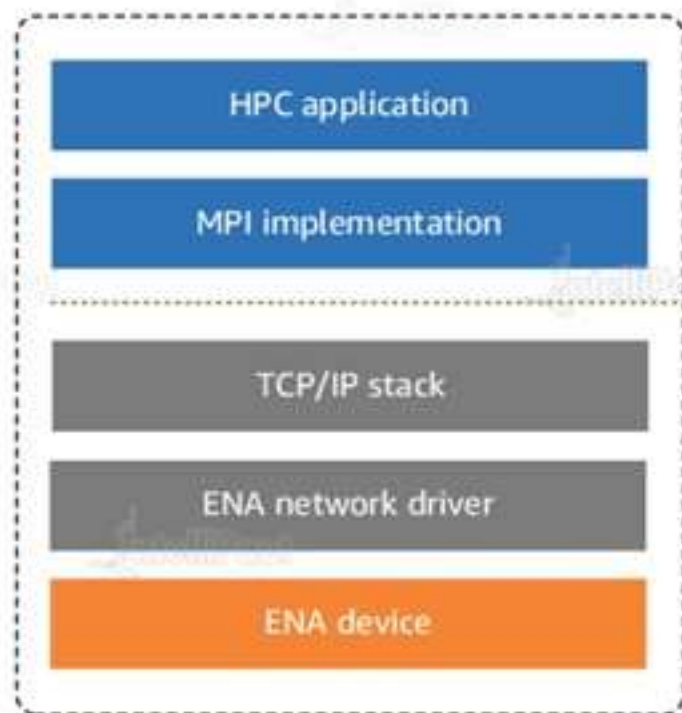
## Elastic Fabric Adapter

The network device that we can attach to our Amazon EC2 instance to accelerate High Performance Computing (HPC) and Machine Learning applications

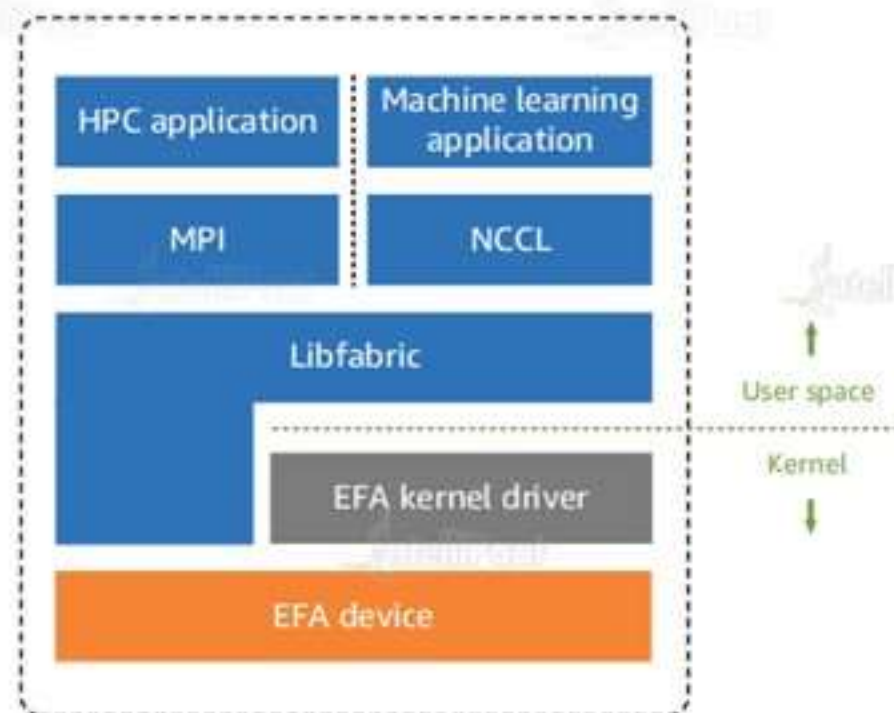


# Elastic Fabric Adapter

To put it simply, an EFA is an ENA with added functionalities. It provides an additional OS-bypass function, which allows HPC and ML apps to directly communicate over a network interface to achieve low latency



Traditional HPC software stack in EC2



HPC software stack in EC2 with EFA

## Difference Between EFAs and ENAs



ENAs provide traditional IP networking features that are required to support VPC networking



EFAs provide all of the same traditional IP networking features as ENAs, and they also support OS-bypass capabilities



## Supported Instance Types

c5n.18xlarge, c5n.metal, i3en.24xlarge, i3en.metal, inf1.24xlarge, m5dn.24xlarge, m5n.24xlarge, r5dn.24xlarge, r5n.24xlarge, and p3dn.24xlarge

## Supported AMIs

1. Amazon Linux 2
2. Amazon Linux
3. RHEL 7.6
4. RHEL 7.7
5. CentOS 7
6. Ubuntu 16.04
7. Ubuntu 18.04

## What are the limitations of EFAs?

- We can attach only one EFA per instance
- We cannot send EFA traffic from one subnet to another subnet. Only the normal IP traffic can be sent. EFA OS-bypass traffic is limited to a single subnet
- EFA OS-bypass traffic cannot be routed, only the IP traffic from EFA can be routed
- A security group that allows inbound and outbound traffic to and from the security group itself should be attached to an EFA



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**US: 1-800-216-8930 (TOLL FREE)**



**[support@intellipaate.com](mailto:support@intellipaate.com)**



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