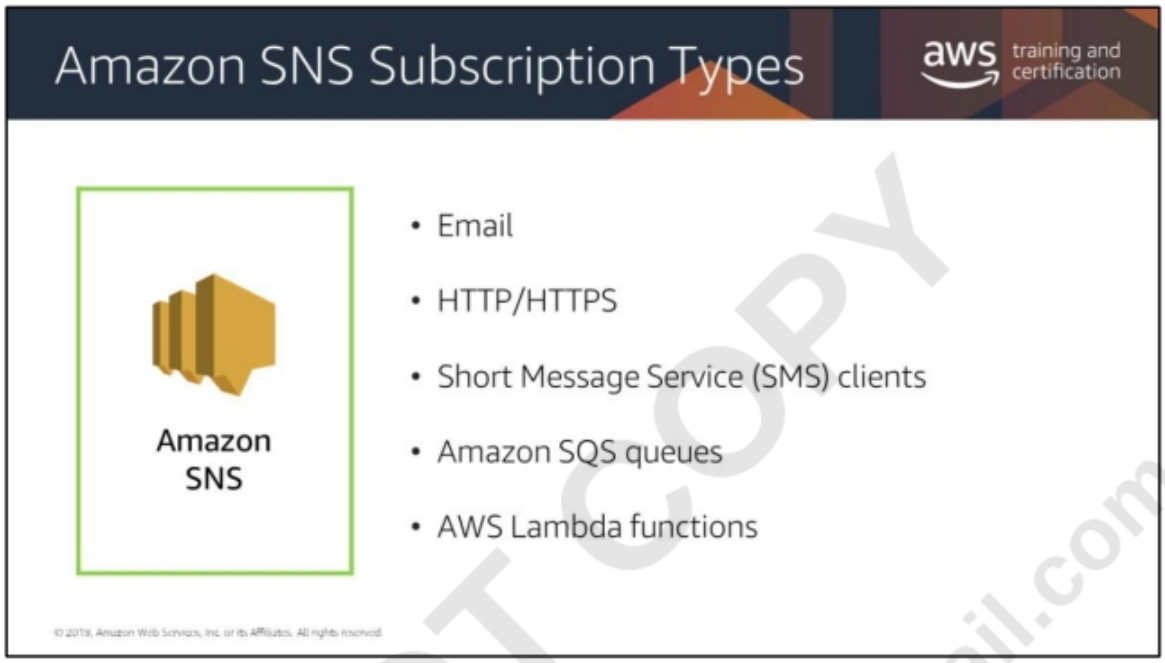

Customers can select one the following transports as part of the subscription requests:

"Email" or "Email-JSON" – Messages are sent to registered addresses as email. Email-JSON sends notifications as a JSON object, while Email sends text-based email.

"HTTP" or "HTTPS" – Subscribers specify a URL as part of the subscription registration; notifications will be delivered through an HTTP POST to the specified URL.

"SMS" – Messages are sent to registered phone numbers as SMS text messages.

"SQS" – Users can specify an SQS standard queue as the endpoint; Amazon SNS will enqueue a notification message to the specified queue. Note that FIFO queues are not currently supported.

Furthermore, messages can also be delivered to AWS Lambda functions for handling message customizations, enabling message persistence or communicating with other AWS service.

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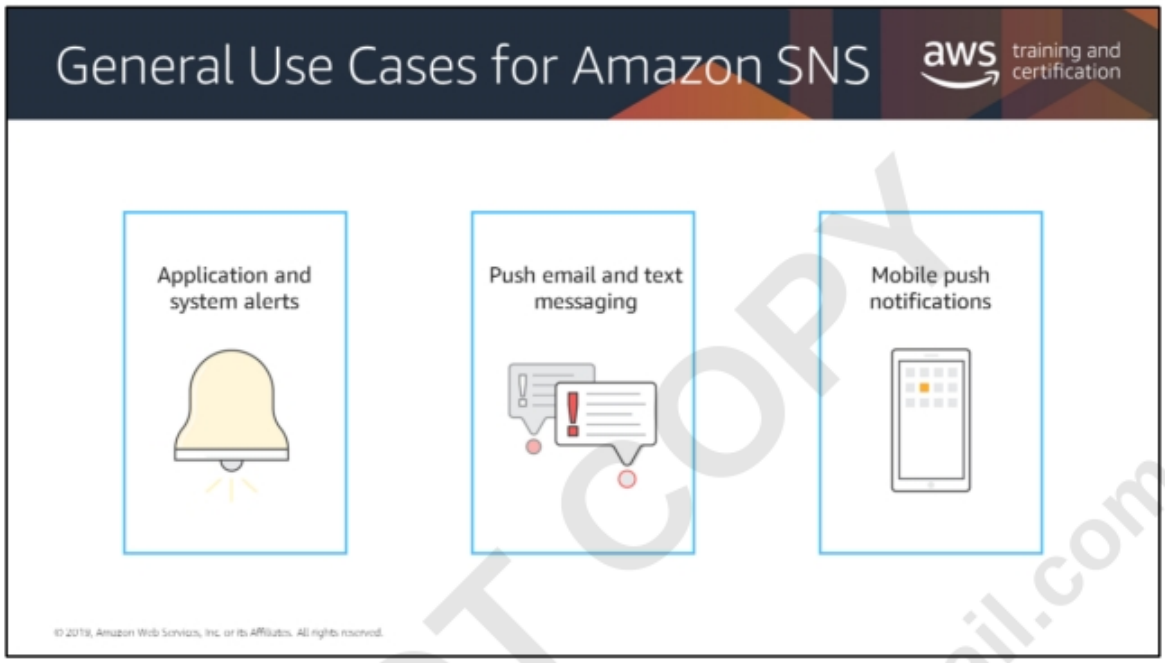

There are many ways to use Amazon SNS notifications.

- You could receive immediate notification when an event occurs, such as a specific change to your AWS Auto Scaling group.
- You could use Amazon SNS to push targeted news headlines to subscribers by email or SMS. Upon receiving the email or SMS text, interested readers could then choose to learn more by visiting a website or launching an application.
- You could send notifications to an app, indicating that an update is available. The notification message can include a link to download and install the update.

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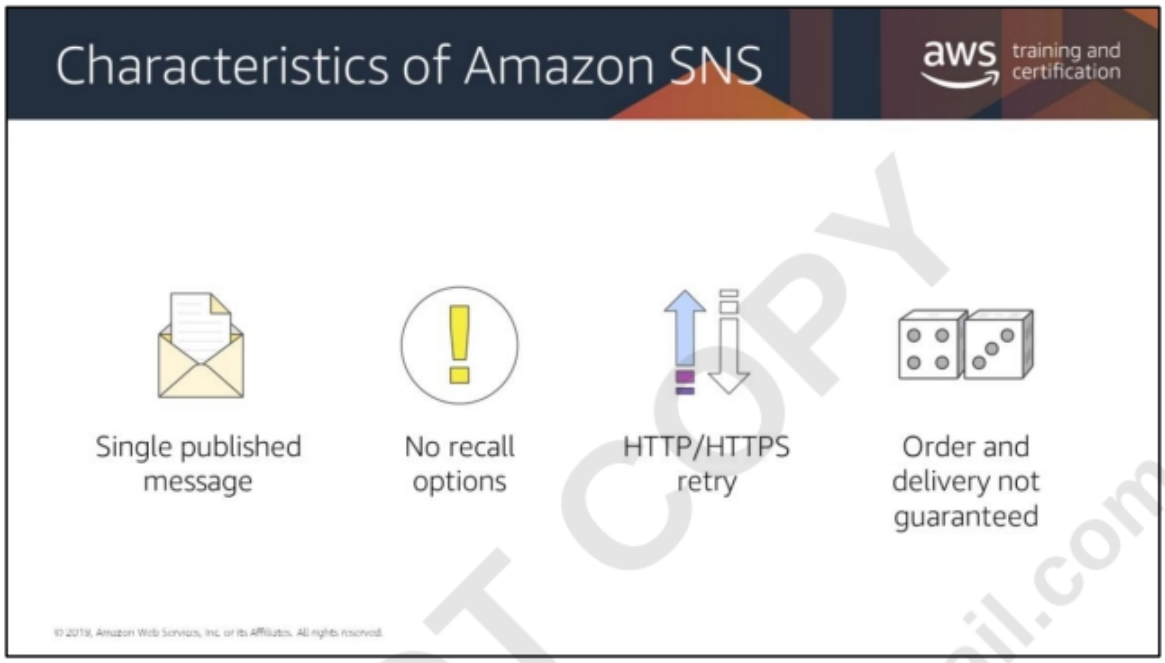

All notification messages will contain a single published message.

Amazon SNS will attempt to deliver messages from the publisher in the order they were published into the topic. However, network issues could potentially result in out-of-order messages at the subscriber end.

When a message is delivered successfully, there is no way to recall it.

An Amazon SNS Delivery Policy can be used to control the retry pattern (linear, geometric, exponential back off), maximum and minimum retry delays, and other parameters.

To prevent messages from being lost, all messages published to Amazon SNS are stored redundantly across multiple servers and data centers.

Amazon SNS is designed to meet the needs of the largest and most demanding applications, allowing applications to publish an unlimited number of messages at any time.

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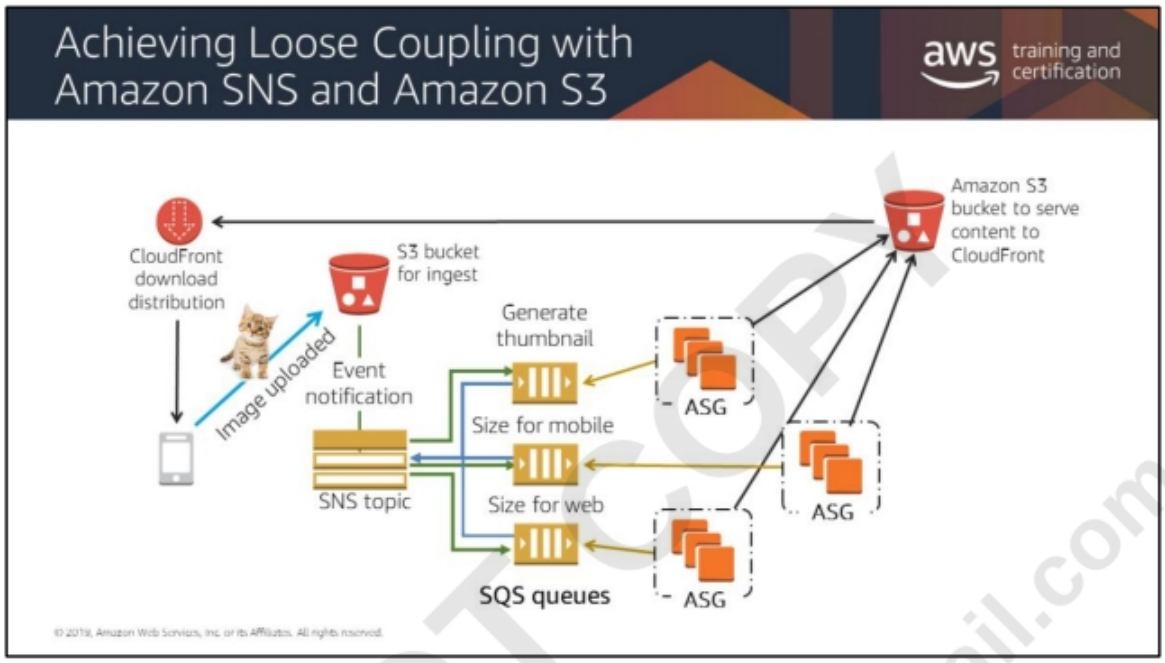
Amazon SNS allows applications and end-users on different devices to receive notifications via Mobile Push notification (Apple, Google and Kindle Fire Devices), HTTP/HTTPS, Email/Email-JSON, SMS or Amazon Simple Queue Service (SQS) queues, or AWS Lambda functions.

Amazon SNS provides access control mechanisms to ensure that topics and messages are secured against unauthorized access. Topic owners can set policies for a topic that restrict who can publish or subscribe to a topic. Additionally, topic owners can ensure that notifications are encrypted by specifying that the delivery mechanism must be HTTPS.

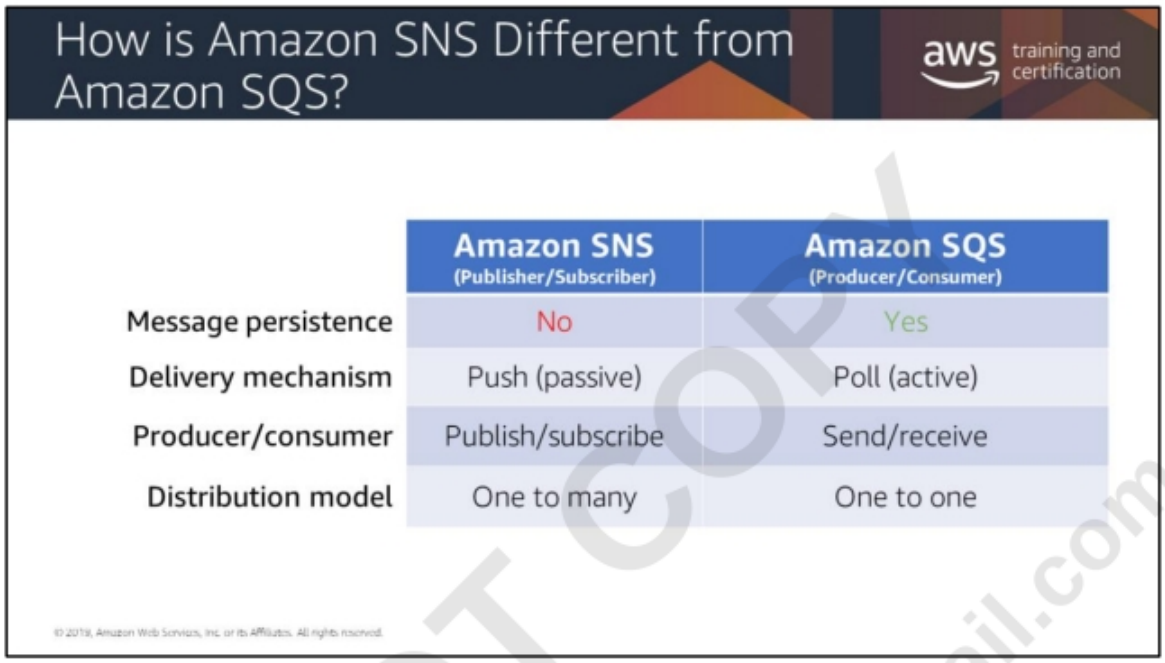


With SNS, you can use topics to decouple message publishers from subscribers, fan-out messages to multiple recipients at once, and eliminate polling in your applications.

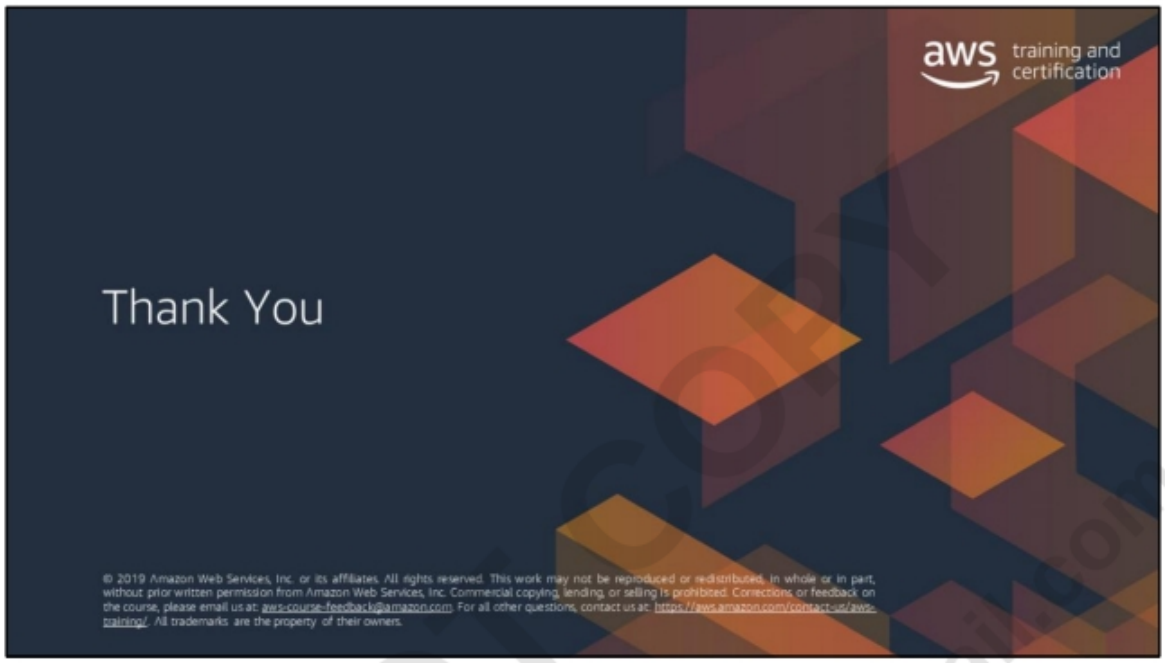
SNS can be used to send messages within a single account or to resources in different accounts to create administrative isolation.

AWS services, such as Amazon EC2, Amazon S3 and Amazon CloudWatch, can publish messages to your SNS topics to trigger event-driven computing and workflows.

In this alternative scenario, uploading the image to Amazon S3 triggers an event notification, which sends the message to the SNS topic automatically.



- Amazon SNS allows applications to send time-critical messages to multiple subscribers through a push mechanism.
- Amazon SQS exchanges messages through a polling model: sending and receiving components are decoupled.
- Amazon SQS provides flexibility for distributed components of applications to send and receive messages without requiring each component to be concurrently available.



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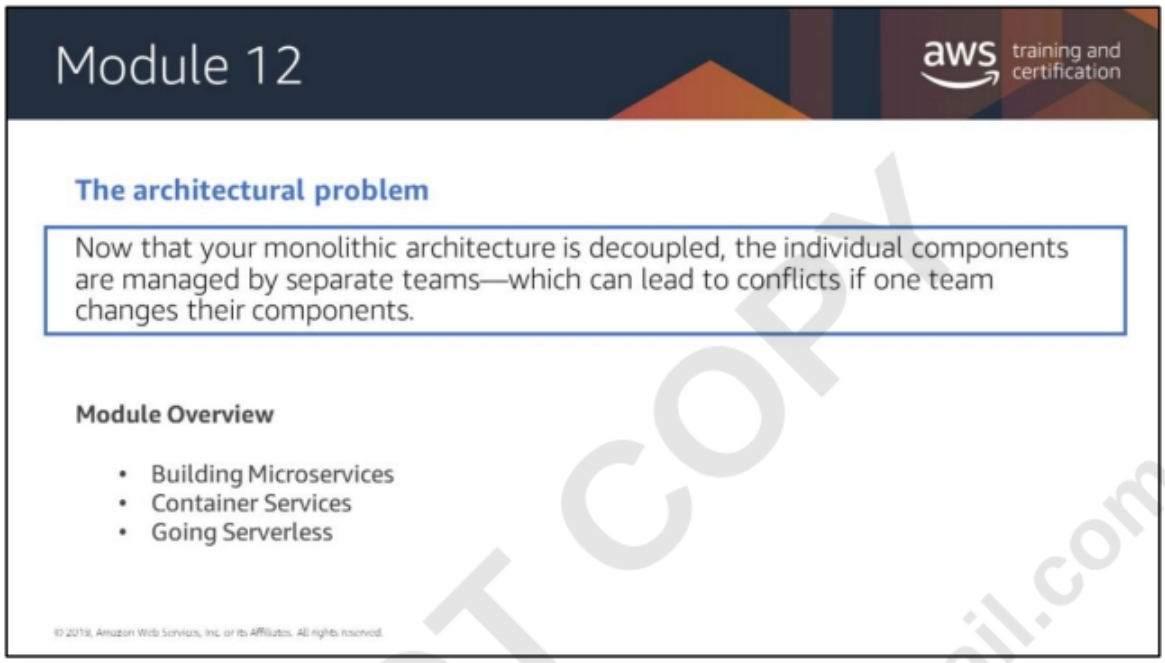

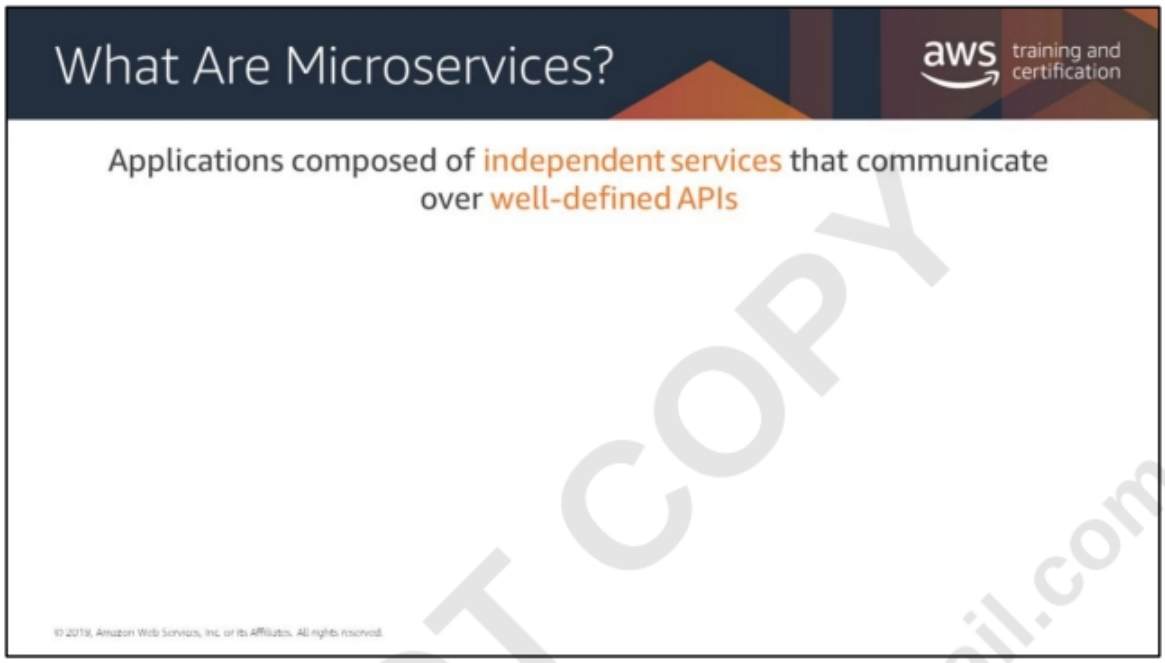

The traditional monolithic application contains all the moving and working pieces, which are tightly bound together. If one piece were to fail, the entire application would crash. If there was a spike in demand, the entire architecture must be scaled. Adding features to a monolithic application becomes more complex as time wears on. Pieces of the codebase must interweave with each other to sync properly.

With a microservices architecture, an application is built as independent components that run each application process as a service. These services communicate via a well-defined interface using lightweight APIs. Services are built for business capabilities, and each service performs a single function. Because they are independently run, each service can be updated, deployed, and scaled to meet demand for specific functions of an application.

For an overview of microservices on AWS, see https://aws.amazon.com/microservices/

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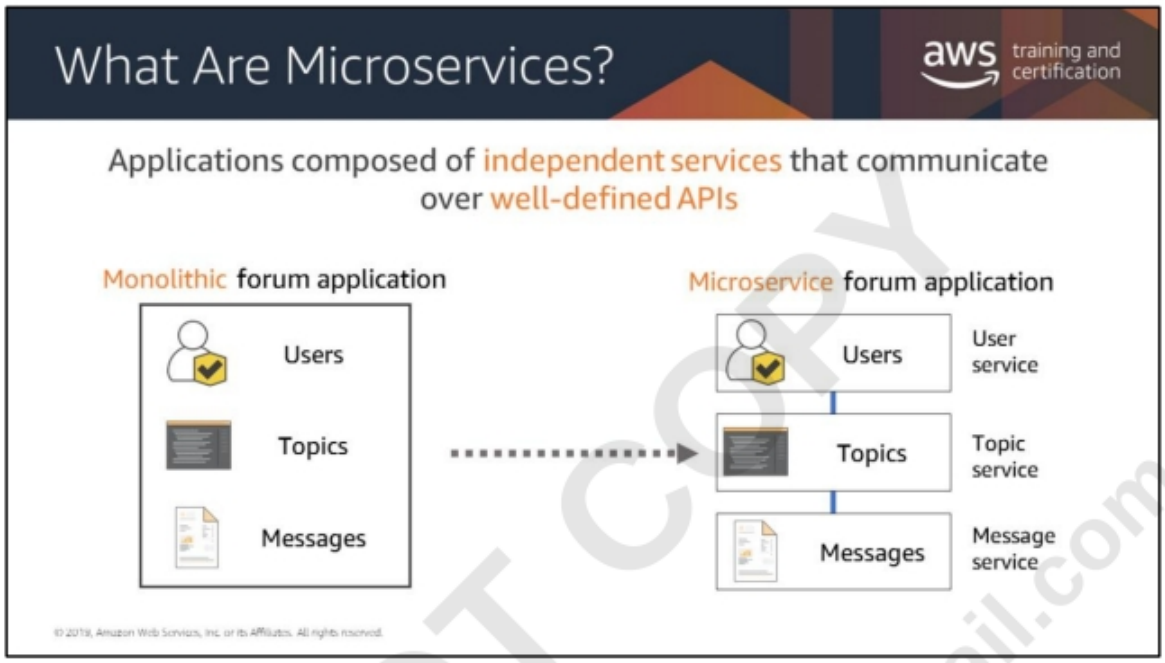

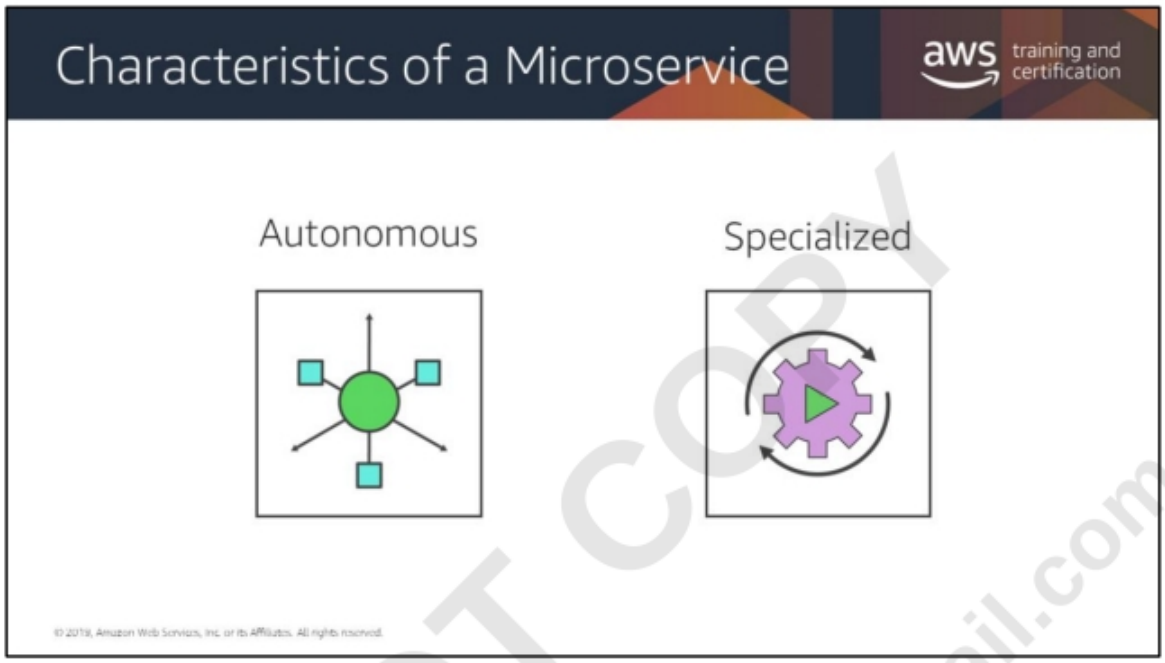

Autonomous
Each component service in a microservices architecture can be developed, deployed, operated, and scaled without affecting the functioning of other services. Services do not need to share any of their code or implementation with other services. Any communication between individual components happens via well-defined APIs.

Specialized
Each service is designed for a set of capabilities and focuses on solving a specific problem. If developers contribute more code to a service over time and the service becomes complex, it can be broken into smaller services.

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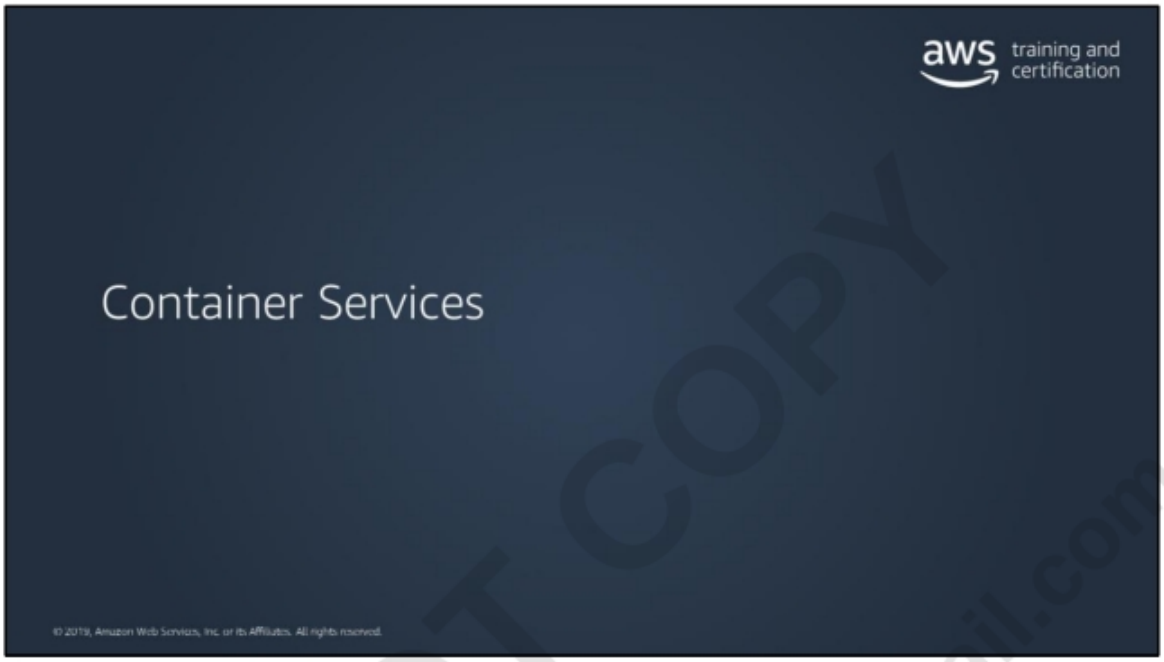

If you need help creating your container solution, consider the AWS Container Competency program

The AWS Container Competency recognizes APN Technology Partners with a product or a solution that integrates with AWS to improve customers' ability to run workloads on containers on AWS. This will help users optimize orchestration and scheduling, infrastructure, application build/test, and deployment on containers, as well as with monitoring, logging, and security of containers.
To receive the AWS Competency designation, APN partners must undergo rigorous technical validation related to industry-specific technology. The validation gives customers complete confidence in choosing APN partner solutions from the tens of thousands in the AWS Partner Network.

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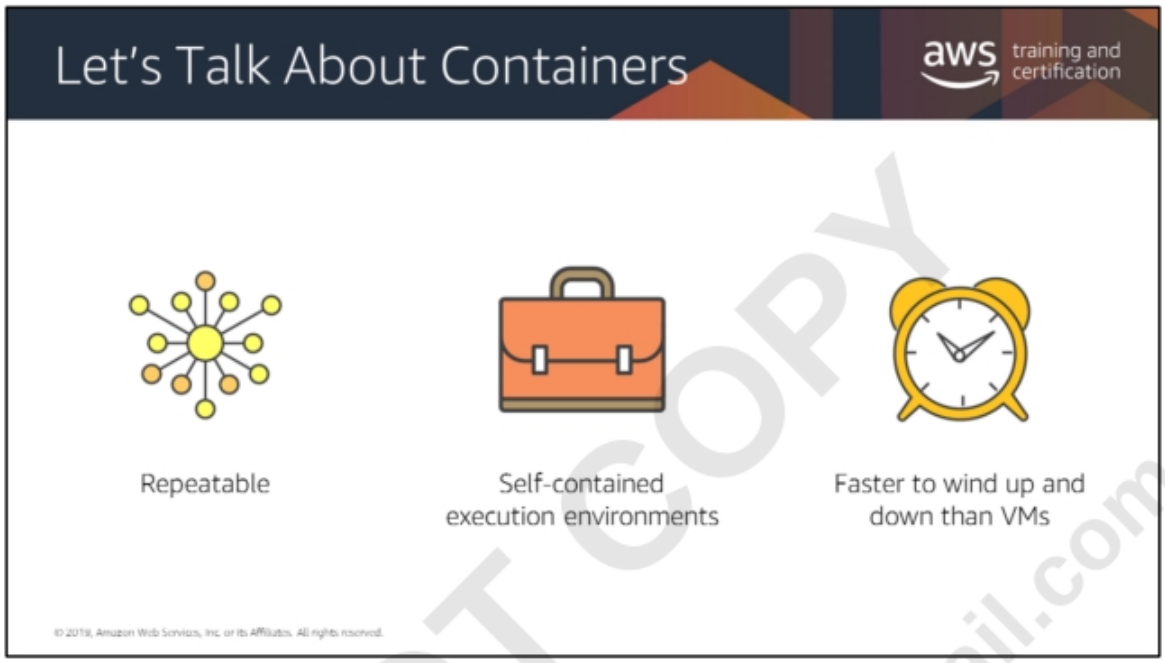

The benefits of a microservice-oriented architecture should trickle down also at an infrastructure level, where—up to this point of the course—you are still using virtual machines as your execution environment. While running VMs in the cloud gives you a dynamic, elastic environment, you may want to further reduce friction.

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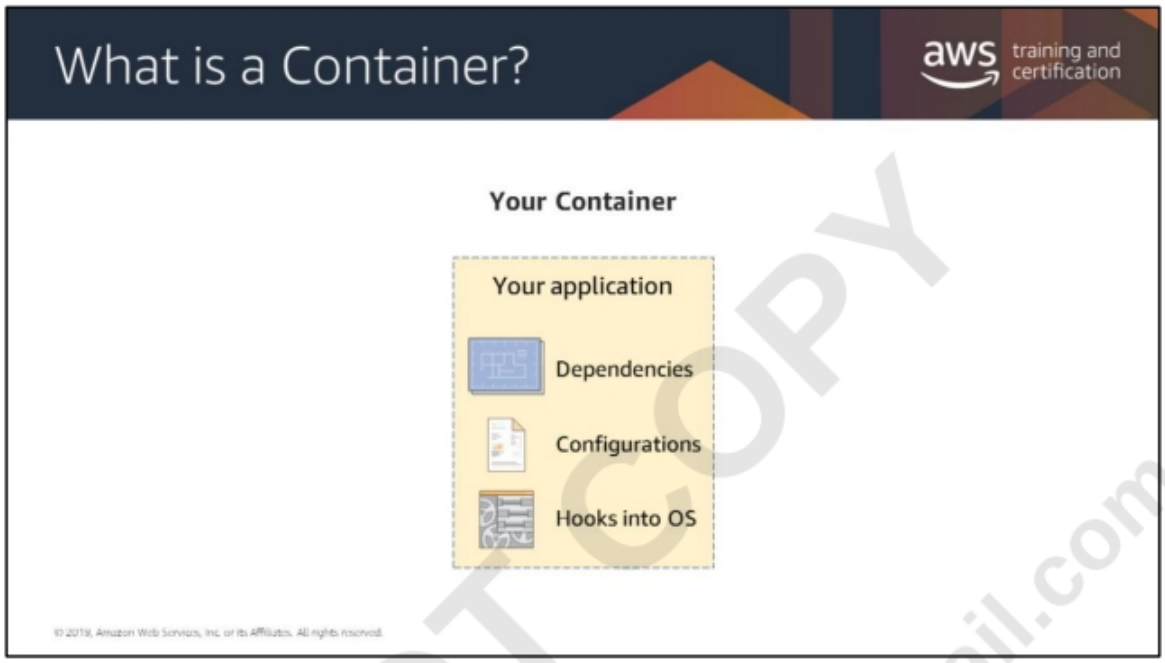

Containers are a method of operating system virtualization that allow you to run an application and its dependencies in resource-isolated processes. By using containers, you can easily package an application's code, configurations, and dependencies into easy-to-use building blocks that deliver environmental consistency, operational efficiency, developer productivity, and version control.

A container image is the snapshot of the file system available to the container. For example, you could have the Debian operating system as a container image: when running such container, you will effectively have a Debian operating system available in the container. You could also package all your code dependencies in the container image and use that as your code artifact. It is worth noting that container images are usually an order of magnitude smaller than virtual machines in terms of space. Spinning up a container is a matter of hundreds of milliseconds.

So by using containers, you can use a fast, portable, infrastructure agnostic execution environment.

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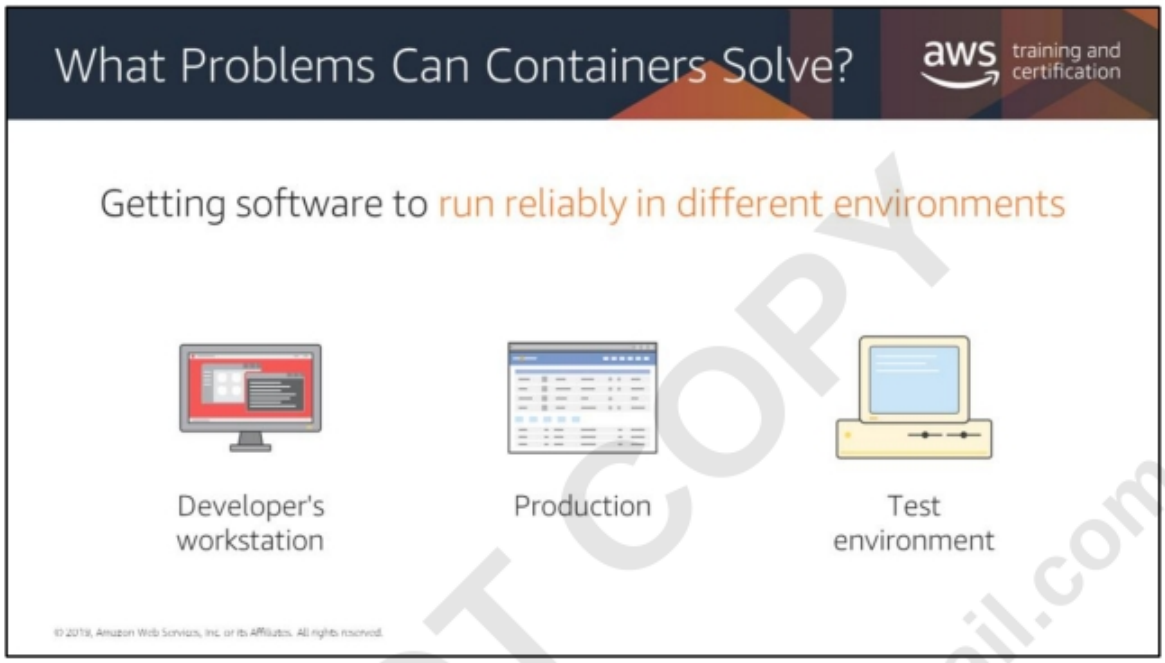
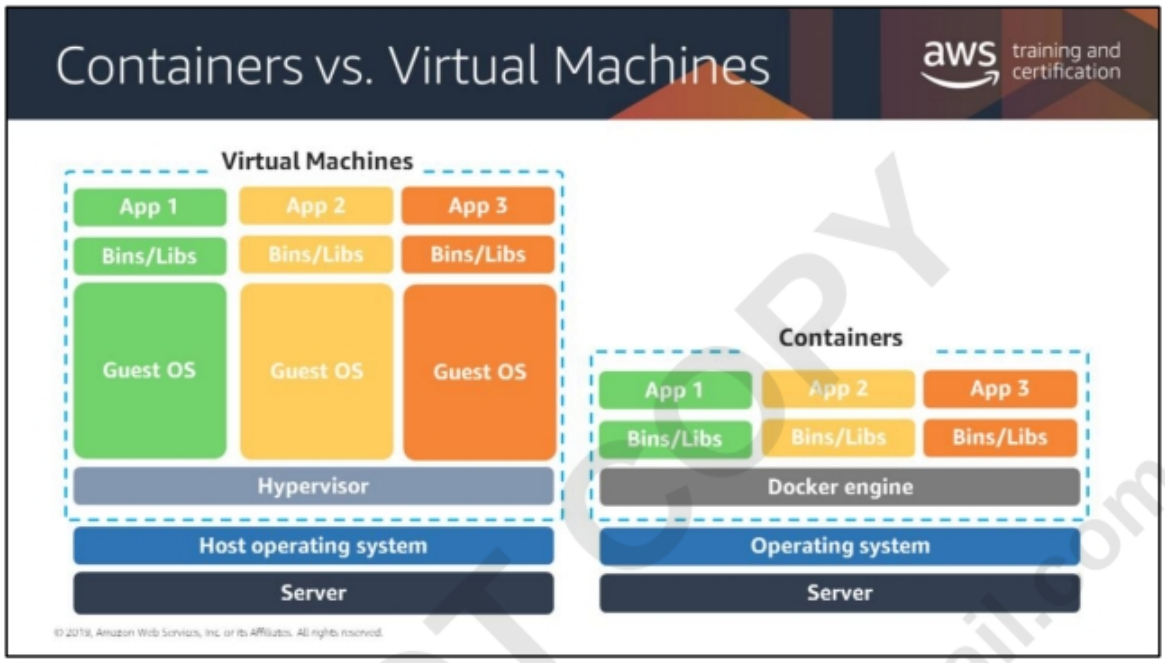


Containers can help ensure that applications deploy quickly, reliably, and consistently, regardless of deployment environment. Containers also give you more granular control over resources, which gives your infrastructure improved efficiency.

If you are looking for premade container solutions, you may want to visit the AWS Marketplace for Containers, which helps you to find and buy container products from independent software vendors through both the Amazon ECS console and AWS Marketplace. These verified and commercially-supported products run on Docker-compatible AWS container services such as Amazon ECS, AWS Fargate, and Amazon EKS. You can choose from product categories, such as high-performance computing, security, and developer tools. In addition, SaaS products that manage, analyze, or protect container applications are available. For more information, see https://aws.amazon.com/marketplace/features/containers.



When hearing the capabilities of containers, it is somewhat intuitive to think that it sounds just like a virtual machine. However, the differences are in the details. The number one difference is the lack of a hypervisor requirement. Containers can run on any Linux system with appropriate kernel feature support and the Docker daemon present. This makes them extremely portable. Your laptop, your VM, your EC2 instance, and your bare metal server are all potential hosts.

The lack of a hypervisor requirement also results in almost no noticeable performance overhead. The processes are talking directly to the kernel and are largely unaware of their container silo. Most containers boot in just a couple of seconds.

Within the Enterprise there are many questions about the use cases of Containers and Virtual Machines and what the differences might be. As well, within AWS, Containers are now becoming a key part of the infrastructure through the utility of Elastic Container Services, Docker and Elastic Beanstalk. This is a quick overview of the differences between Docker and Containers, with VMs.

For an overview of Dockers, Containers, VMs, and ECS, see:
http://crmtrilogix.com/Cloud-Blog/AWS/Docker-Containers-VMs-and-ECS---an-overview/219

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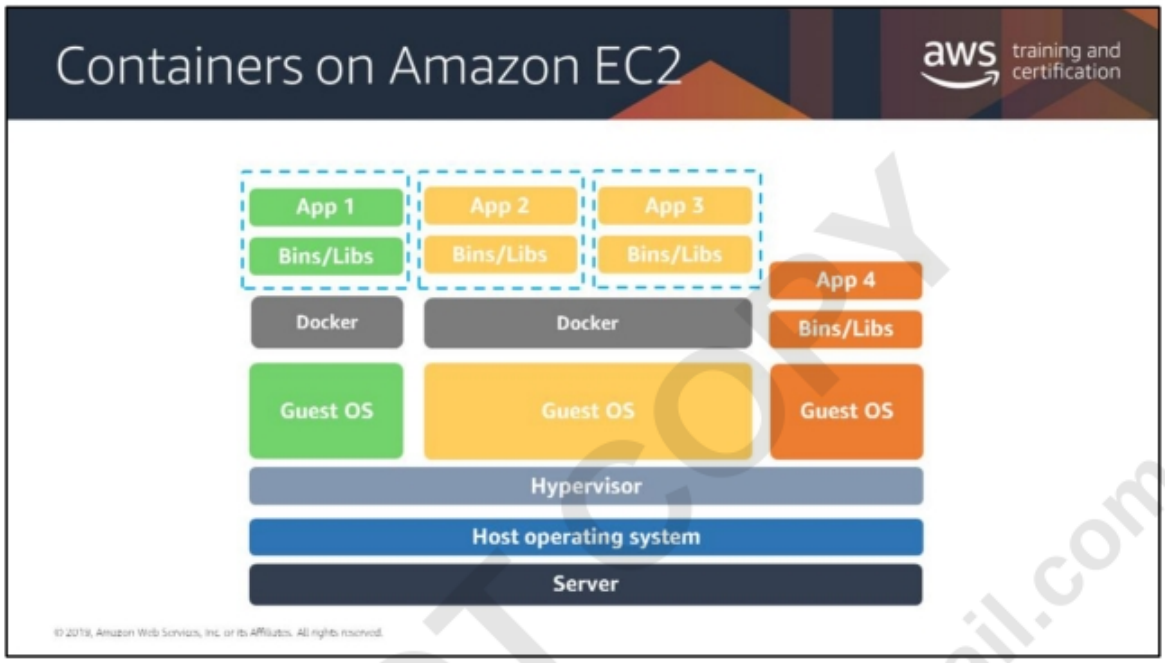
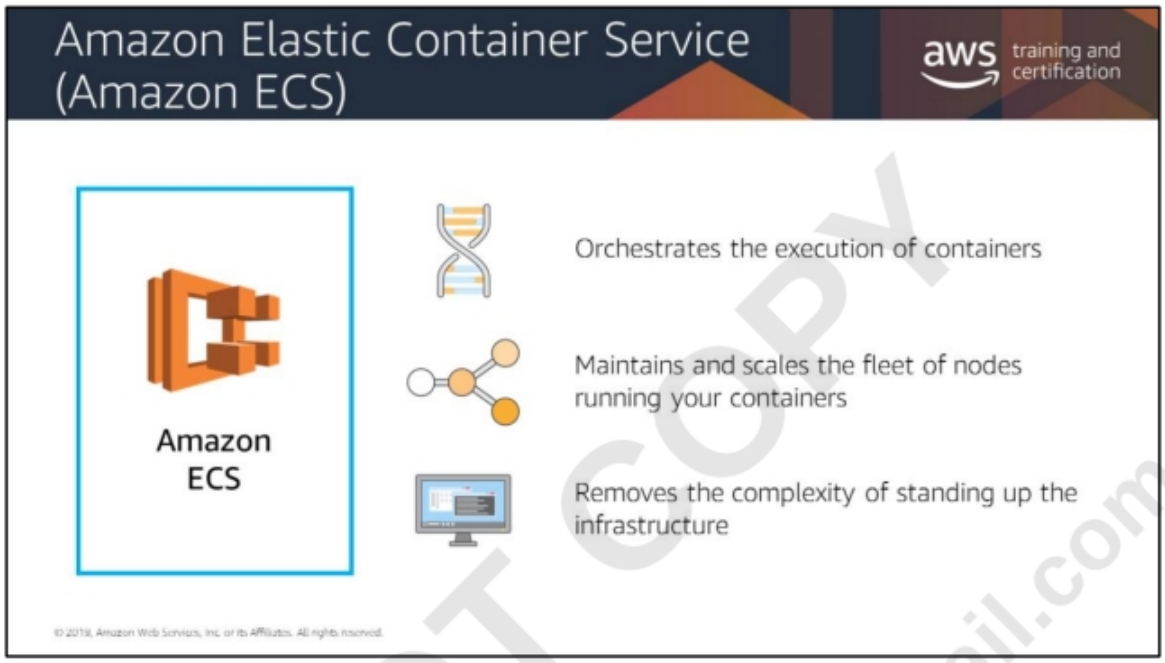


Containers on Amazon EC2 within the virtual machine.



Amazon Elastic Container Service (Amazon ECS) is a highly scalable, high-performance container management service that supports Docker containers and allows you to easily run applications on a managed cluster of Amazon EC2 instances.

Amazon ECS is a scalable cluster service for hosting containers that:

- Can scale up to thousands of instances
- Monitors deployment of containers
- Manages complete state of cluster
- Schedules containers using built-in scheduler or a third-party scheduler (e.g., Apache Mesos, Blox)
- Is extensible by using APIs
- Can be launched with either Fargate or EC2 launch types

Clusters can leverage Spot and Reserved Instances.

For more information on launch types, see
https://docs.aws.amazon.com/AmazonECS/latest/developerguide/launch_types.html

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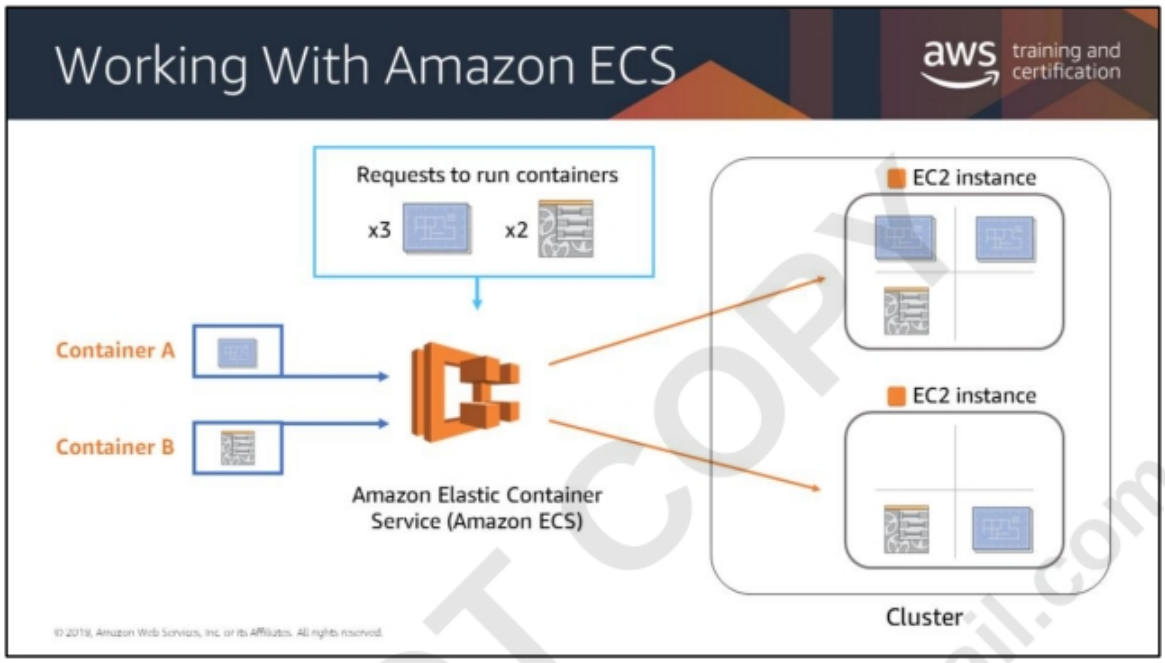

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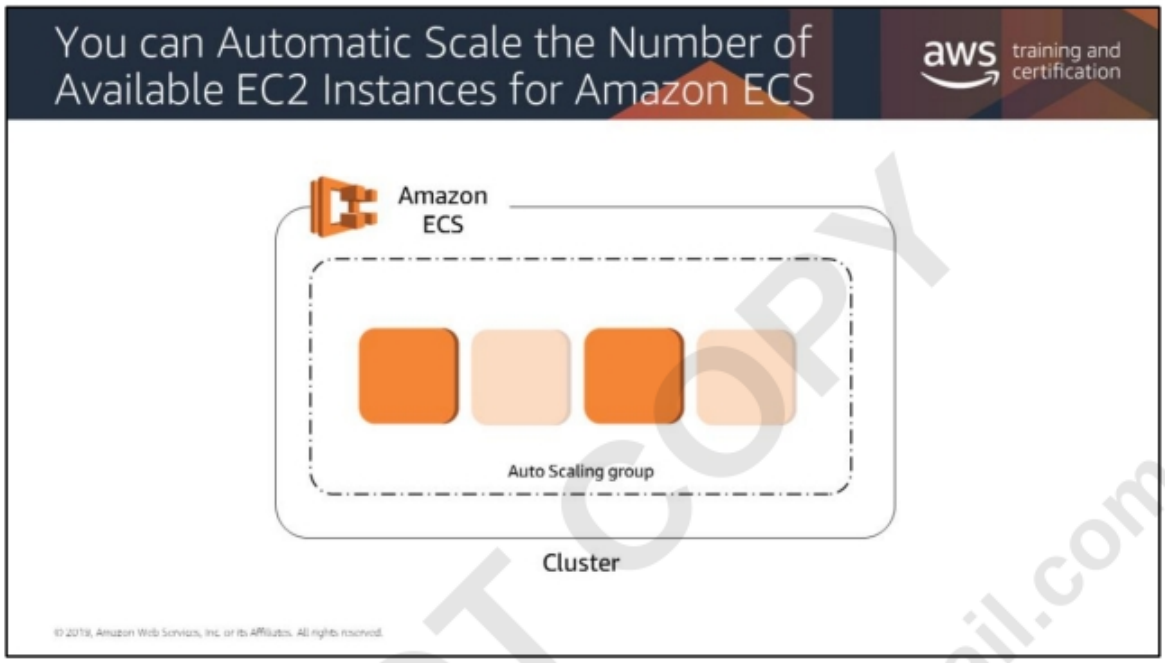

If you configure your Auto Scaling group to remove container instances, any tasks running on the removed container instances are killed. If your tasks are running as part of a service, Amazon ECS restarts those tasks on another instance if the required resources are available (CPU, memory, ports); however, tasks that were started manually will are not restarted automatically.

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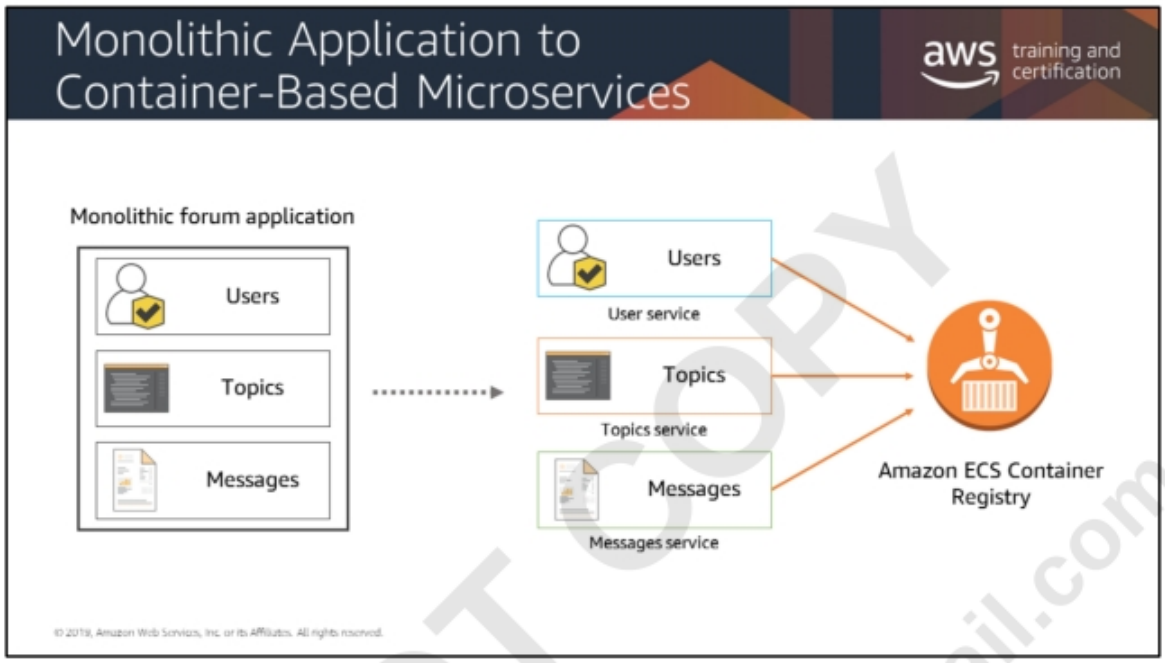

To shift this monolithic forum application into a microservice approach, you can break apart the code into individual encapsulated services. Make sure these each perform their function perfectly, and then register these services with the Amazon ECS Container Registry.

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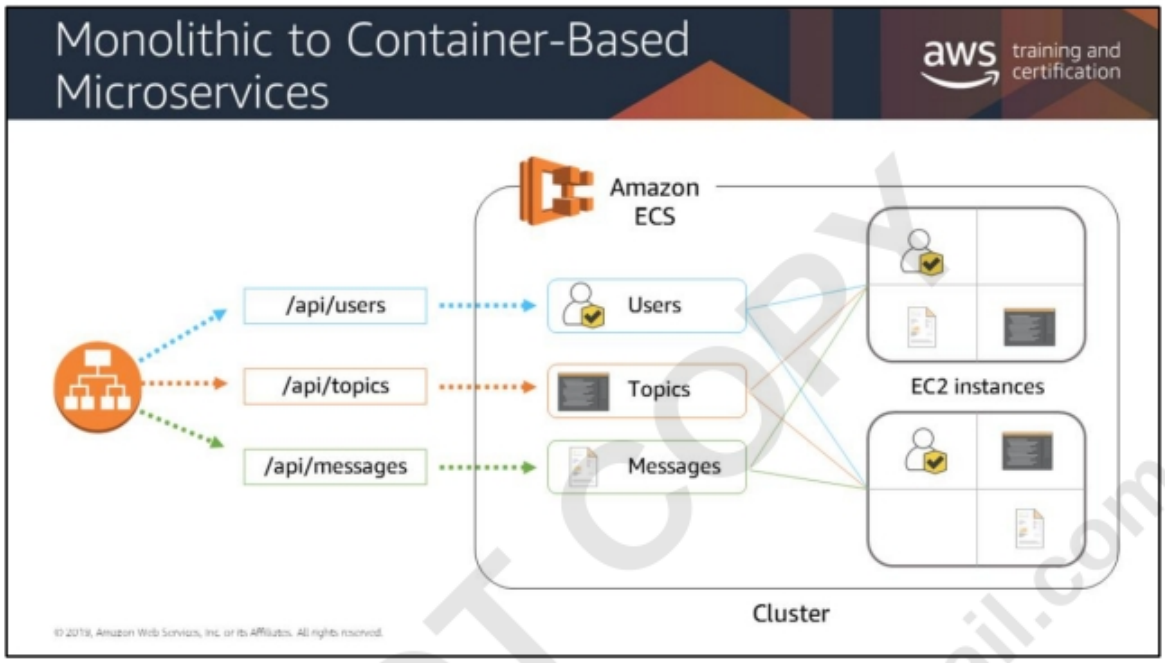

Next, inside Amazon ECS, create a service for each of these pieces of your original application. Then register the target group instances for these services. Finally, create an Application Load Balancer with target groups that point toward your Amazon ECS app services.

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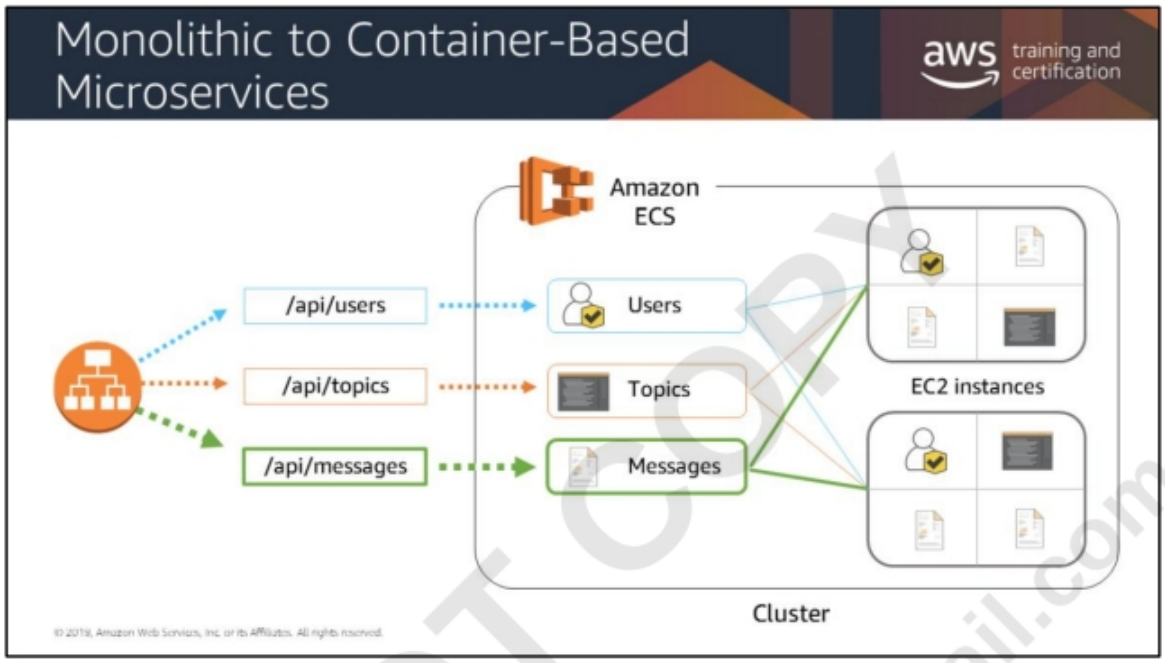

AWS Cloud Map and AWS App Mesh can assist you in building and troubleshooting your architectures.

AWS Cloud Map is a fully managed service that allows you to register any application resources (such as databases, queues, microservices, and other cloud resources) with custom namespaces. AWS Cloud Map then constantly checks the health of resources to make sure the location is up-to-date, allowing you to add and register any resource with minimal manual intervention of mappings. AWS Cloud Map assists with service discovery, continuous integration, and health monitoring of your microservices and applications. For more information, see:

- https://aws.amazon.com/blogs/aws/aws-cloud-map-easily-create-and-maintain-custom-maps-of-your-applications/
- https://aws.amazon.com/cloud-map/
- https://www.youtube.com/watch?v=qTE1PbdY3hY

AWS App Mesh captures metrics, logs, and traces from every microservice which you can export to Amazon CloudWatch, AWS X-Ray, and compatible AWS partner and community tools for monitoring and tracing. It also provides custom control over traffic routing between microservices to assist with deployments, failures, or scaling of your application.

App Mesh lets you configure microservices to connect directly to each other via a proxy instead of requiring code within the application or using a load balancer. App Mesh uses Envoy, an open source service mesh proxy which is deployed alongside your microservice containers. For more information, see:

- https://aws.amazon.com/app-mesh/features/
- https://www.youtube.com/watch?v=qTE1PbdY3hY

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AWS Fargate is a technology for Amazon ECS and Amazon Elastic Container Service for Kubernetes (Amazon EKS) that allows you to run containers without having to manage servers or clusters. With AWS Fargate, you no longer have to provision, configure, and scale clusters of virtual machines to run containers. This removes the need to choose server types, decide when to scale your clusters, or optimize cluster packing. AWS Fargate eliminates the need for you to interact with or think about servers or clusters. Fargate lets you focus on designing and building your applications instead of managing the infrastructure that runs them.

The service supports Amazon ECS.

For more information about AWS Fargate, see https://aws.amazon.com/fargate/
For more information about integration with Amazon EKS, see: https://aws.amazon.com/about-aws/whats-new/2018/11/aws-fargate-and-amazon-ecs-now-integrate-with-aws-cloud-map/

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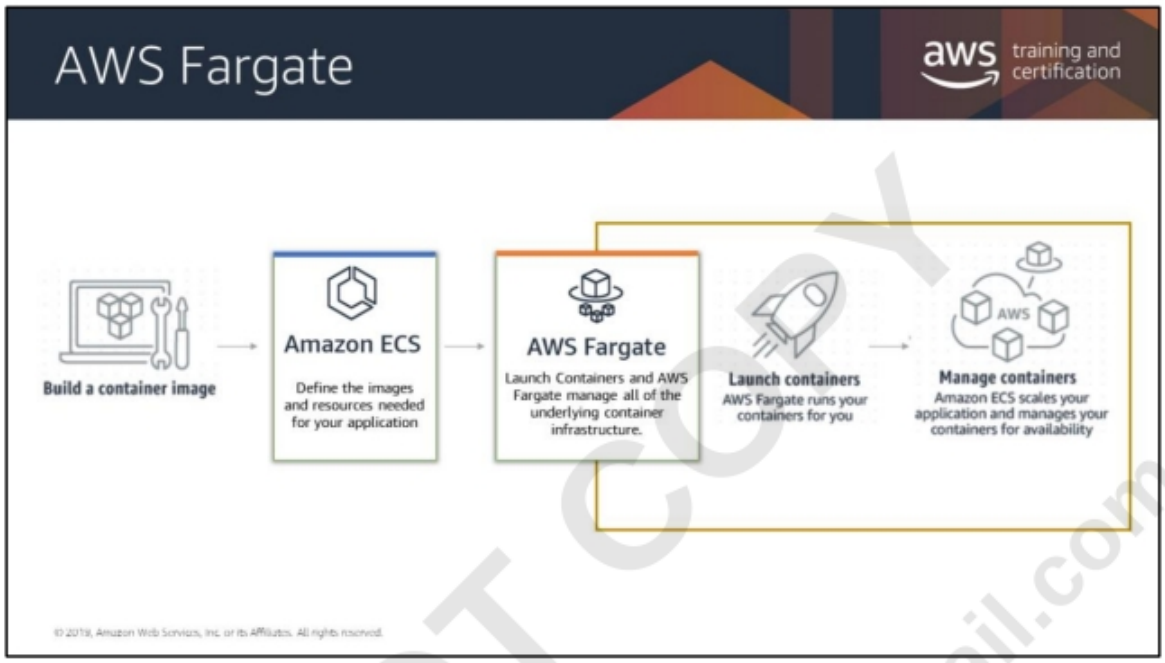

Amazon ECS has two modes: Fargate launch type and EC2 launch type. With Fargate launch type, all you have to do is package your application in containers, specify the CPU and memory requirements, define networking and IAM policies, and launch the application. EC2 launch type allows you to have server-level, more granular control over the infrastructure that runs your container applications. With EC2 launch type, you can use Amazon ECS to manage a cluster of servers and schedule placement of containers on the servers. Amazon ECS keeps track of all the CPU, memory and other resources in your cluster, and also finds the best server for a container to run on based on your specified resource requirements.

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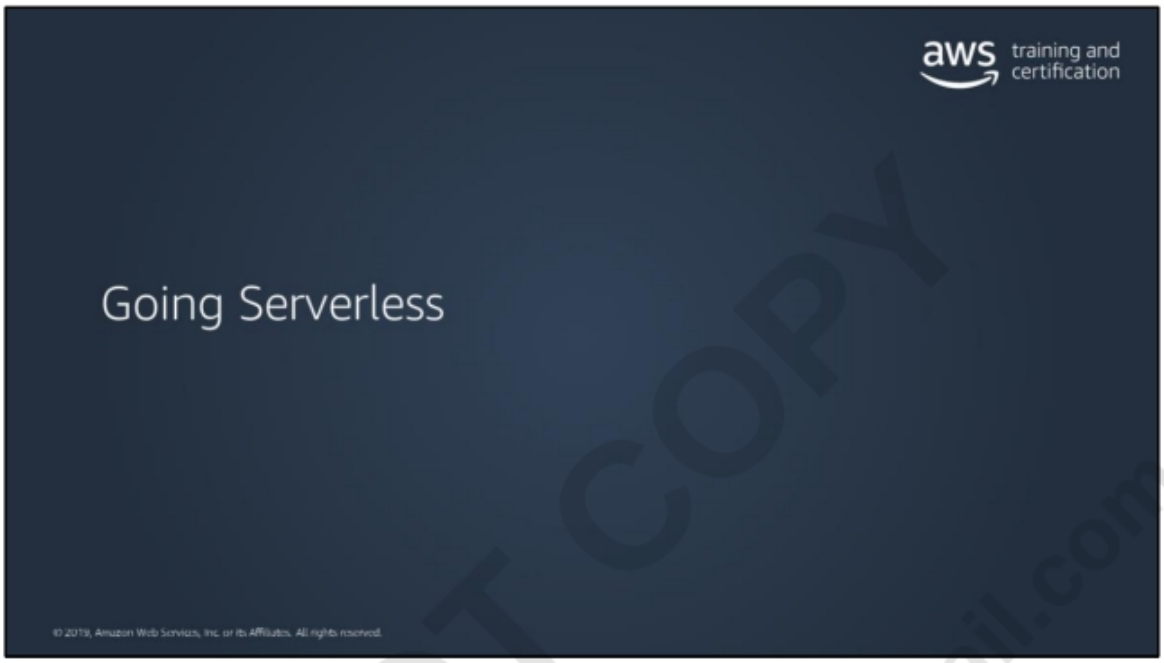

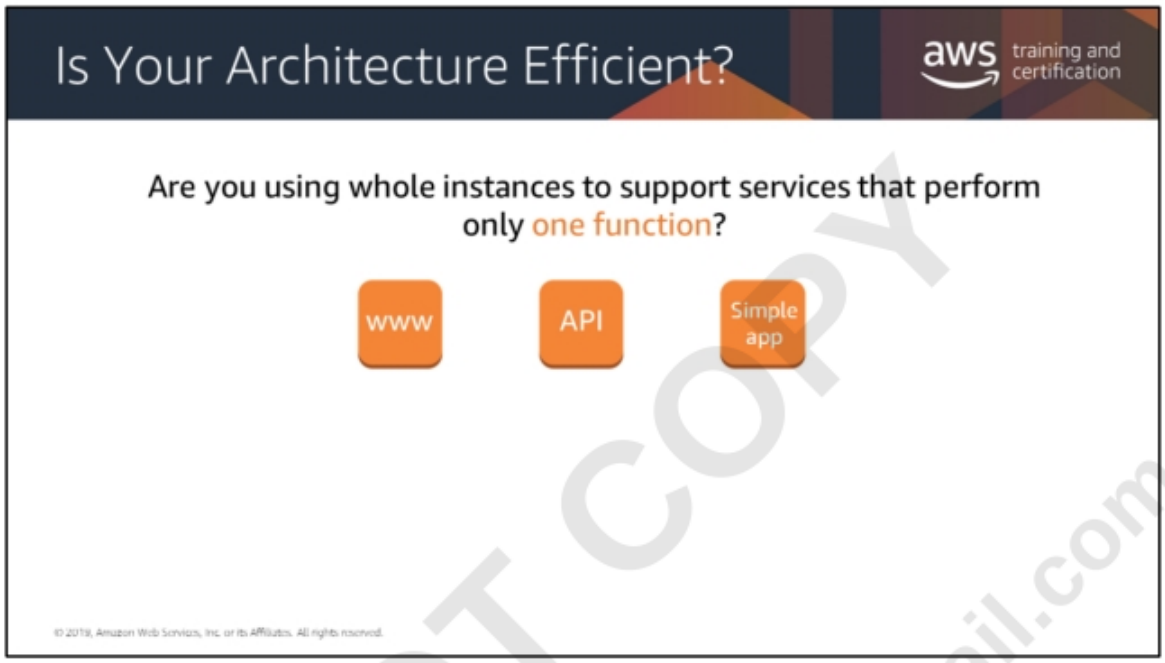

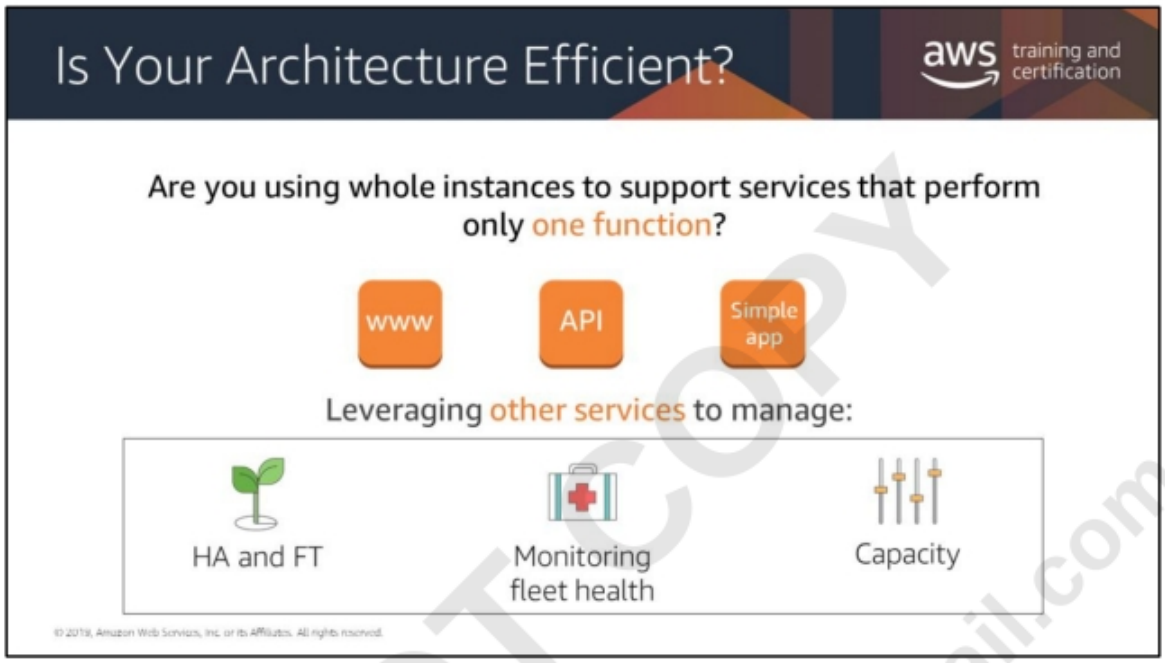

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What is serverless computing?
Serverless computing allows you to build and run applications and services without thinking about servers. Serverless applications don't require you to provision, scale, and manage any servers. You can build them for nearly any type of application or backend service, and everything required to run and scale your application with high availability is handled for you.

Why use serverless computing?
Building serverless applications means that your developers can focus on their core product instead of worrying about managing and operating servers or runtimes, either in the cloud or on-premises. This reduced overhead lets developers reclaim time and energy that can be spent on developing great products which scale and that are reliable.

For more information, see: https://aws.amazon.com/serverless/

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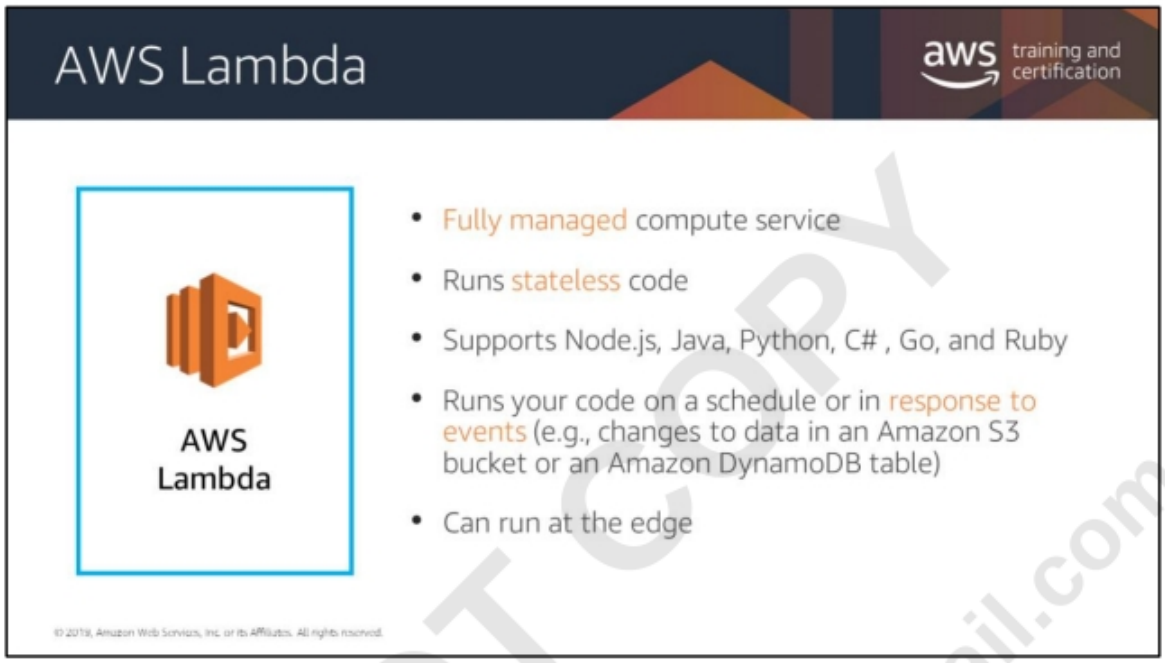

AWS Lambda lets you run code without provisioning or managing servers. The service runs your code on a high-availability compute infrastructure and performs all of the administration of the compute resources, including server and operating system maintenance, capacity provisioning and automatic scaling, code monitoring and logging. All you need to do is supply your code in one of the languages that AWS Lambda supports (currently Node.js, Java, C#, Python, and Ruby).

Lambda@Edge provides the ability to execute a Lambda function in response to events generated by the Amazon CloudFront CDN and scale your code with high availability at an AWS edge location closest to end users. You can use Lambda functions to change CloudFront requests and responses at the following points:

- Viewer request
- Origin request
- Origin response
- Viewer response

...to increase website security and privacy, build dynamic applications at the edge, SEO, real-time image transformation, user authentication and authorization, user tracking and analytics and other use cases.

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Lambda@Edge only support Node.js

For more information, see:

- https://aws.amazon.com/lambda/edge/
  https://docs.aws.amazon.com/lambda/latest/dg/lambda-edge.html
- https://aws.amazon.com/blogs/networking-and-content-delivery/adding-http-security-headers-using-lambdaedge-and-amazon-cloudfront/

You can also develop your AWS Lambda functions in PowerShell Core 6.0 using the .NET Core 2.1 runtime. As a PowerShell developer, you can manage your AWS resources and craft rich automation scripts from within the PowerShell environment using AWS Lambda.

For more information, see:

- https://aws.amazon.com/about-aws/whats-new/2018/09/aws-lambda-supports-powershell-core/

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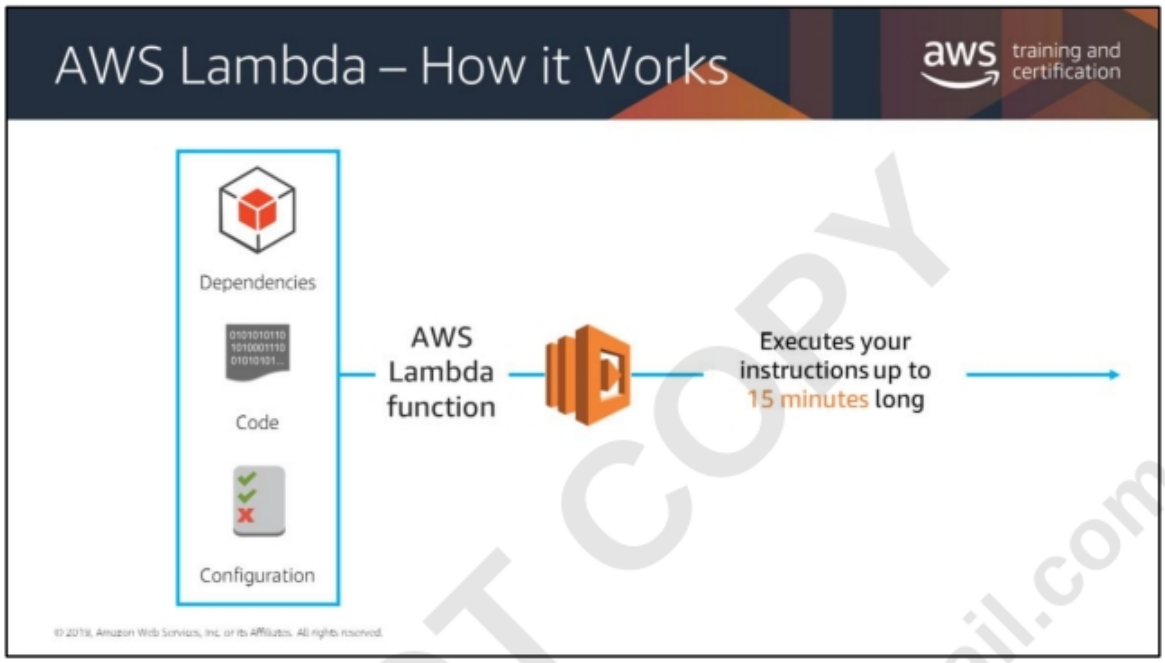

The core components of AWS Lambda are the *event source* and the *Lambda function*. Event sources publish events, and a Lambda function is the custom code that you write to process the events. Lambda executes your Lambda function on your behalf.

A Lambda function consists of your code, associated dependencies, and configuration. Configuration includes information such as the handler that will receive the event, the IAM role AWS Lambda can assume to execute the Lambda function on your behalf, the compute resource you want allocated, and the execution timeout.

Layers enable AWS Lambda function developers to maintain packages, binaries, runtimes, and other files needed for their Lambda functions as components separate from their function code. When creating a Lambda function, you have the option to specify one or more layers that will be included with the function's execution environment. This removes the need to maintain copies of the same files that are distributed across multiple Lambda functions. For example, a serverless application written in Python could use a package such as PyMySQL to query an Amazon RDS MySQL database. With layers, only a single copy of the PyMySQL package needs to be maintained, and can be consumed by any function in the application.

Lambda Layer Restrictions:

- A single function can consume up to 5 layers at a time.
- The total unzipped size of the function (including layers) can't exceed the unzipped deployment package size limit of 250 MB.

Lambda layers support resource-level permissions, and can be shared across specific AWS accounts, AWS Organizations, or all accounts. Layers can be added to a function either during creation or later, and can be updated as needed. The AWS Serverless Application Model (SAM) also supports management of layers across functions.

Similar to function versions, layers support individual versions and corresponding permissions. A published version of a layer cannot be updated (other than changing the version permissions). To update a layer, a new version must be published. This way, you can control the rollout of new layers across multiple functions.

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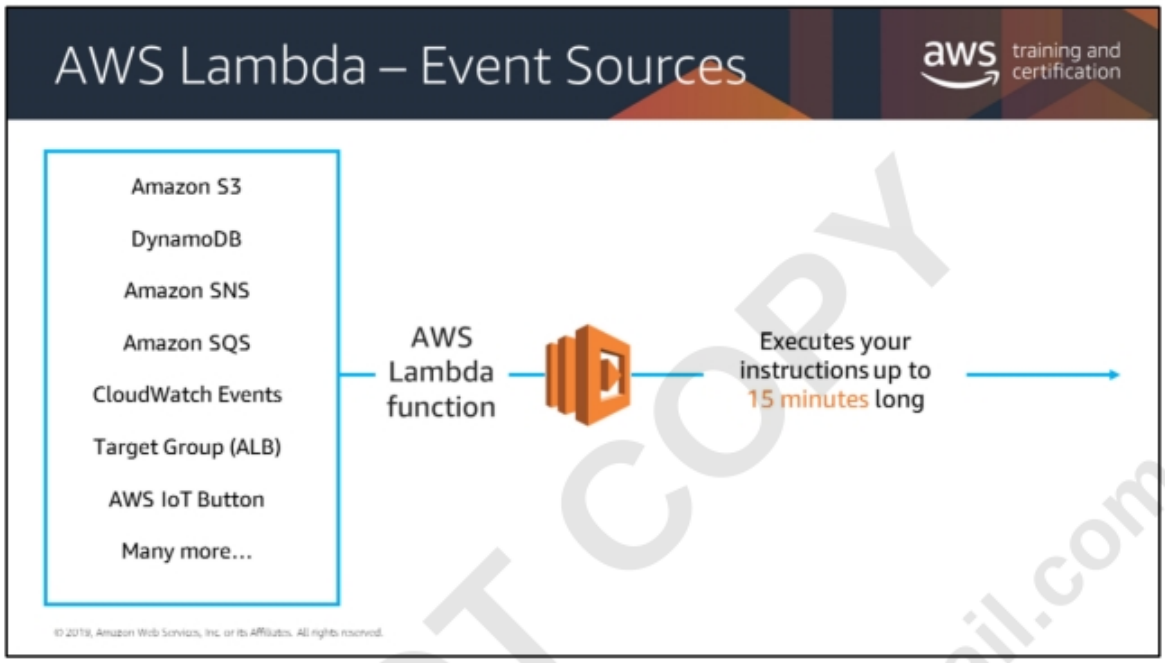

You can use the ALB to send traffic to your Lambda functions via HTTP/HTTPS. Or, because it is content-based routing, you can choose to send traffic to different Lambda functions based on a host or a host and URL path in the requests that come to the ALB. By registering your Lambda functions as targets to your ALB, the load balancer forwards the content to your Lambda function in a JSON format. By default, health checks are disabled for target groups of type lambda.
https://docs.aws.amazon.com/elasticloadbalancing/latest/application/lambda-functions.html

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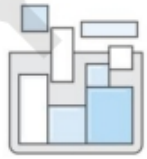
Benefits of Serverless Computing

aws training and certification

Focus on your application, not configuration

Use compute resources only upon request



Build a microservice architecture

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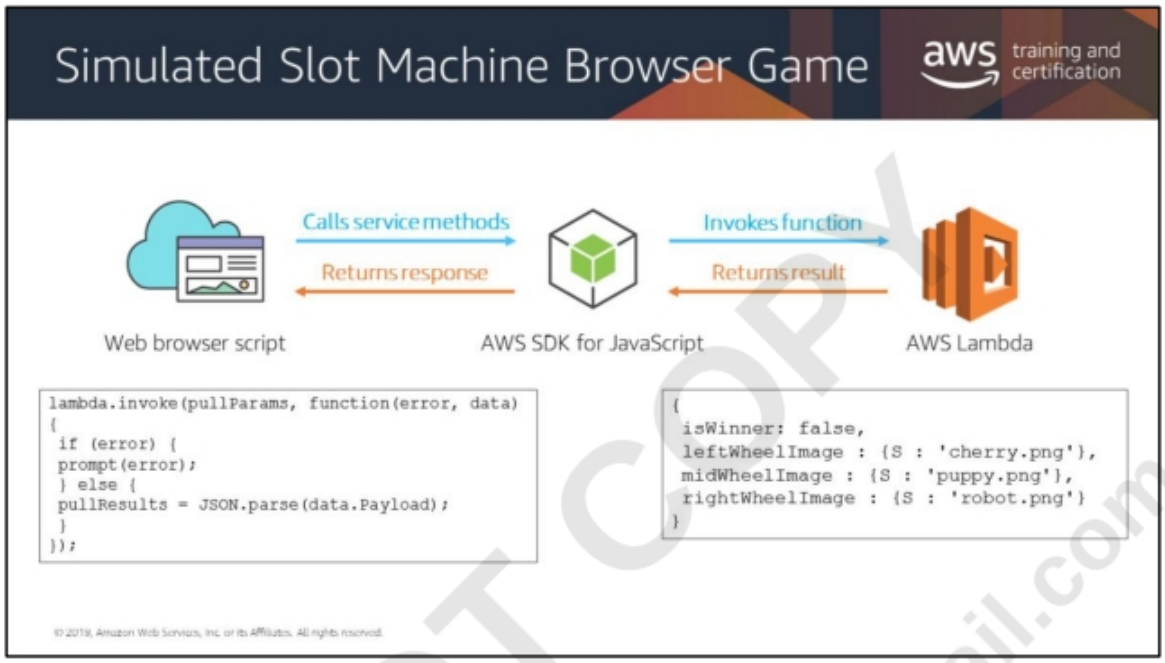
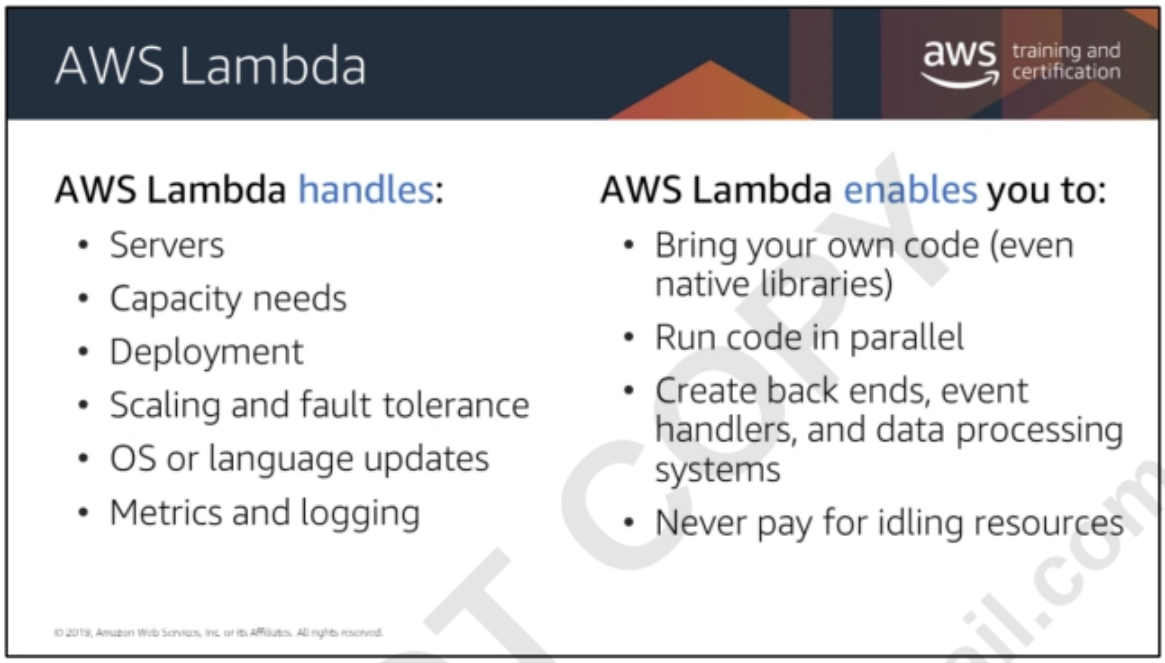
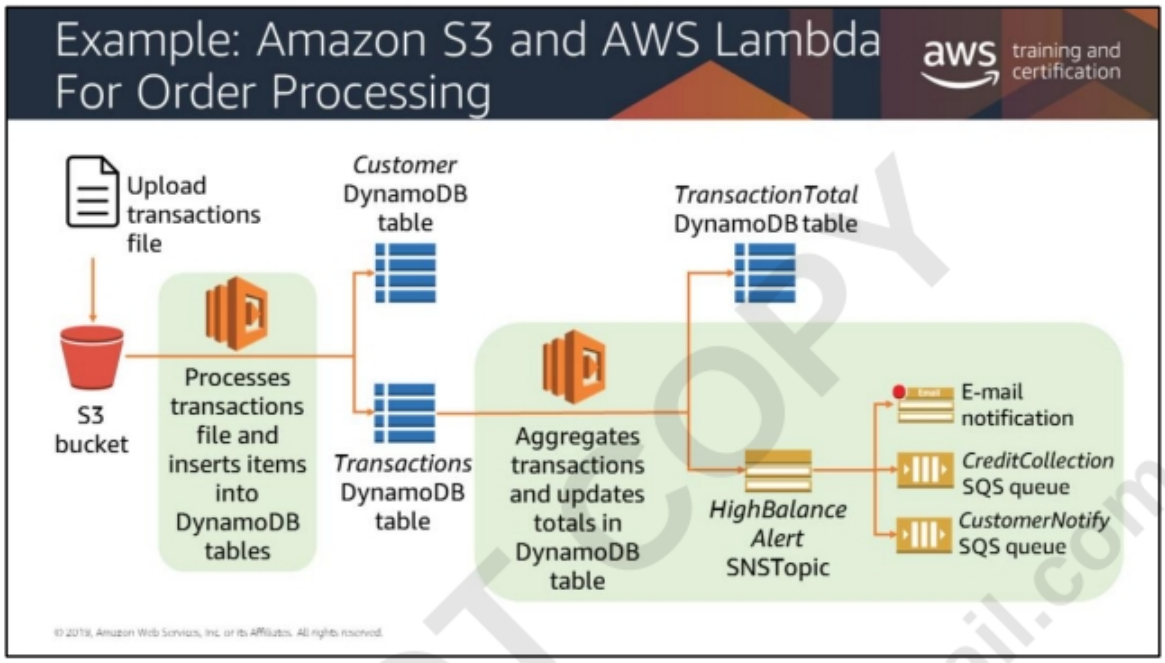


In this example, a simulated slot machine browser-based game invokes a Lambda function that generates the random results of each slot pull, returning those results as the file names of images used to display the result. The images are stored in an Amazon S3 bucket that is configured to function as a static web host for the HTML, CSS, and other assets needed to present the application experience.

For more information, see https://docs.aws.amazon.com/sdk-for-javascript/v2/developer-guide/lambda-examples.html





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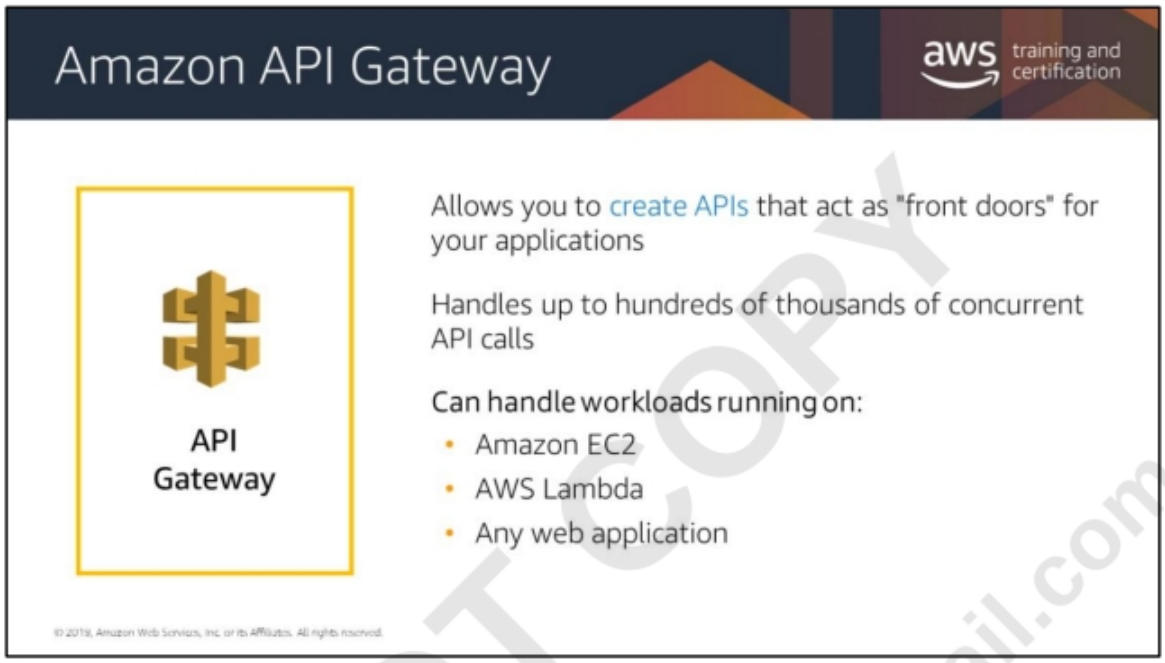

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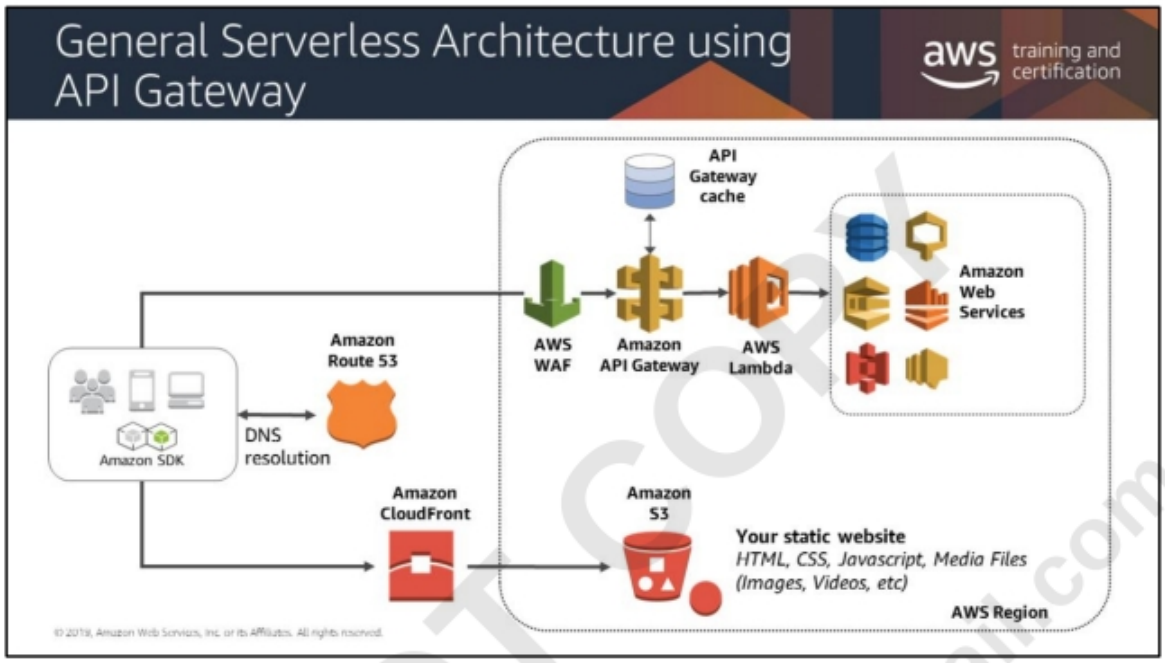

Containers introduce a new paradigm of software delivery, and Amazon ECS/Fargate make it easy to manage them—but you still need to stand up infrastructure and consume resources.