

Module 9. Methods of Deploying and Operating in AWS

This module covers the following subjects:

- **Automation:** Automation is a crucial driver of cloud technology adoption. This section of the module discusses many of AWS's technologies and the approaches taken to automation.
- **Orchestration:** Orchestration takes automation even further, permitting the coordination and scheduling of many different automation events. This part of the module walks you through some possible AWS orchestration.
- **Management Options:** There are many ways to manage AWS effectively. This section of the module outlines each one in detail.

This module focuses on getting things done in AWS most efficiently and cost-effectively. Automation and orchestration can also dramatically improve performance and security by reducing configuration errors and elevating configuration consistency. This module also ensures you know details about the many methods you can use to manage AWS.

FOUNDATION TOPICS

AUTOMATION

Automation is one of the reasons so many technical engineers like cloud technologies. In the case of AWS, there is a significant emphasis on API calls to configure the architecture, which permits the automation of everything associated with AWS.

Automation incorporates elements such as the following:

- Configuration templates
- Code deployment automation
- Self-healing infrastructures
- Reduction in the need for manual interventions
- Reduction in the potential for errors
- Lowered operating costs for Managed Service Providers (MSPs)

For many organisations relying on AWS nowadays, approaching any challenge for their IT organisation begins with the question, “How can we automate the solution?” Perhaps it is the corporate policy in your organisation that you cannot use any of the default resources created for you in AWS. Sure, you could go to the Management Console and do lots of potentially error-prone mouse-clicking, but things are so much easier (and more accurate) when you can automate such actions with a script.

What are some common areas where automation plays a huge role in AWS? Here are just a few:

- Backup generation and retention
- Security compliance
- Code deployments
- AWS infrastructure changes

Remember, because AWS takes an API-centric approach, there is really nothing you cannot automate. The short list given here is just areas where automation is frequently in use by AWS customers.

ORCHESTRATION

Many engineers new to AWS and cloud technology are confused by the differences between cloud automation and orchestration. One reason is that the two terms are often used interchangeably, which is often incorrect. The differences between these concepts highlight a key challenge for teams looking to improve IT processes.

Let's begin by reviewing automation. *Automation* describes a task or function accomplished without human intervention. So, what is orchestration? Orchestration describes the arranging and coordinating of automated tasks, resulting in a consolidated process or workflow. Automation and orchestration go hand-in-hand, but note that they are technically different concepts.

With AWS, we like to (and are encouraged to) create standard processes to spin up full environments to host new and exciting applications. We accomplish this by orchestrating many automated tasks. These might include the following:

- Automating new instances with Auto Scaling.
- Load balancing with automated ELB configurations.
- Deploying automation using a tool like CodeDeploy in AWS. Figure 9-1 shows the Getting Started page of CodeDeploy in the AWS Management Console.

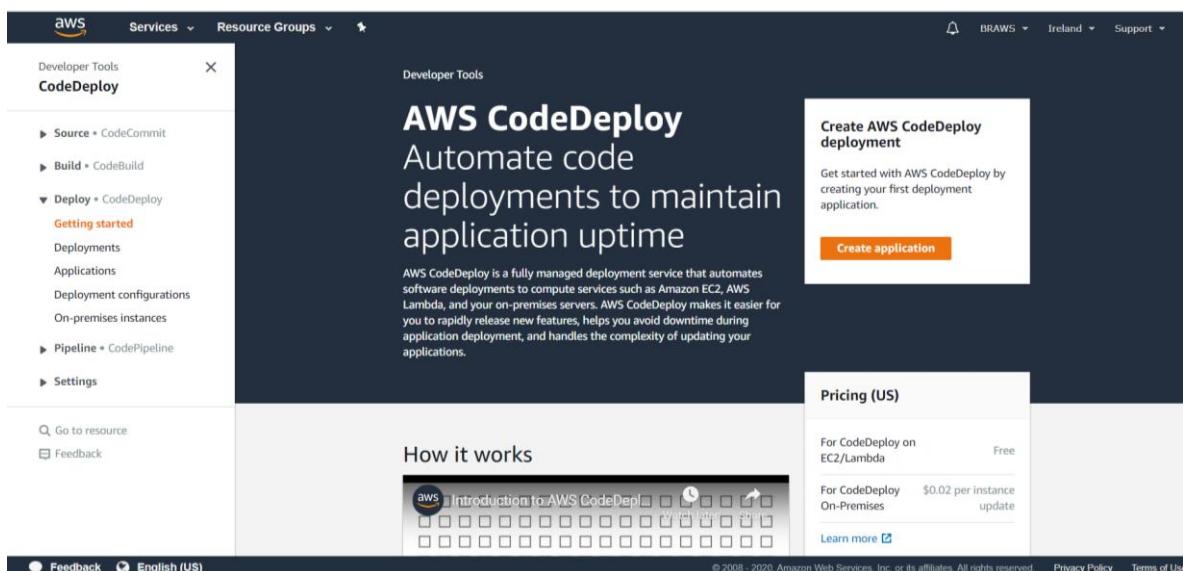


Figure 9-1 CodeDeploy in AWS

- Using Puppet scripts to automate the configuration of the OS.

While the tasks in the preceding list might be pretty simple to automate individually with the robust tools and capabilities of AWS, taken together, they can be very tricky to orchestrate. After all, these activities must occur in a particular order, under specific security groups/tools, and be given roles and granted permissions. In other words, engineers must complete hundreds of manual tasks to deliver the new environment, even when the building blocks of that environment are automated. This is where orchestration is key.

Cloud orchestration tools, whether native to the IaaS (Infrastructure as a Service) platform or third-party software tools, enumerate the required resources, instance types, IAM roles, and other resources. Orchestration can also enumerate the configuration of these resources and the interconnections between them.

AWS engineers can use tools like CloudFormation to create declarative templates that orchestrate these processes into a single workflow, making the “new environment” workflow previously described a single API call.

Well-orchestrated IT processes enable and empower continuous integration and delivery, uniting teams in creating a set of templates that meet developer requirements. Such templates are, in many ways, living documents that embody the celebrated and popular DevOps philosophy.

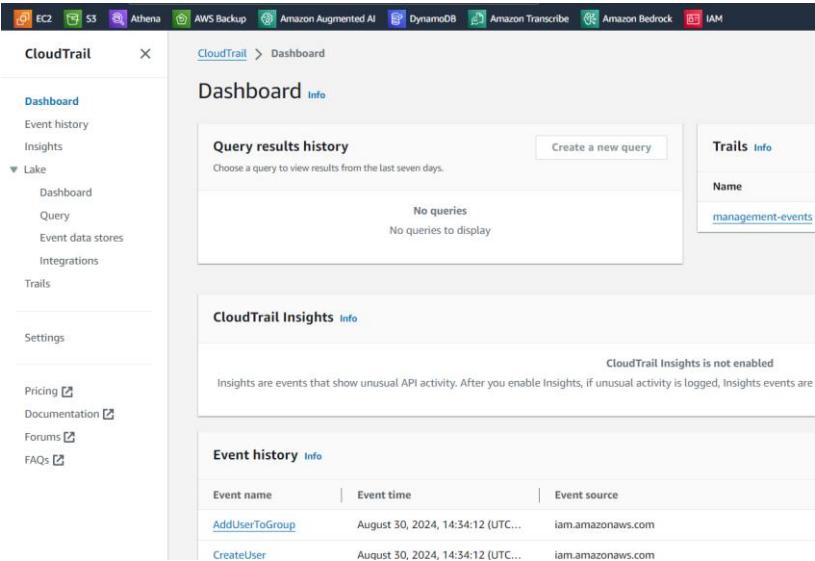
The benefits of orchestration tools far outweigh any potential drawbacks. For organisations today, they celebrate such advantages as the following:

- The lowering of overall IT costs
- Gained time for new or experimental projects
- Improved delivery times to customers
- Reduced friction between system and development teams

MANAGEMENT OPTIONS

There is an imposing range of options when it comes to managing AWS. These tools fall into the following subcategories:

- **Provisioning:** CloudFormation is the primary management service in this category. It provides a common language for you to describe and provision all the infrastructure resources in your cloud environment. CloudFormation allows you to use a simple text file to model and provision all the resources needed for your applications across all regions and accounts. What's more, it can accomplish this in an automated and secure manner. Once everything is modelled in CloudFormation, this text file serves as the single “source of truth” regarding the resources of your cloud environment. Creating a collection of approved CloudFormation files in an AWS Service Catalog would be best to allow your organisation only to deploy approved and compliant resources.
- **Operations Management:** AWS provides systems and operations management services that allow you to control your infrastructure resources with proper governance and compliance. You can use AWS Systems Manager to quickly view and monitor all your resources and automate everyday operational tasks, such as patching and state management. Systems Manager provides a unified user interface, enabling you to manage your cloud operations activities in one place easily. You can also use CloudTrail to log user activities within your organisation and AWS Config to inventory all configurations across your resources. Figure 9-2 shows CloudTrail in AWS.



The screenshot shows the AWS CloudTrail Dashboard. The left sidebar includes links for EC2, S3, Athena, AWS Backup, Amazon Augmented AI, DynamoDB, Amazon Transcribe, Amazon Bedrock, IAM, CloudTrail (selected), Dashboard, Insights, Lake (with sub-links: Dashboard, Query, Event data stores, Integrations, Trails), Settings, Pricing, Documentation, Forums, and FAQs. The main content area has tabs for 'CloudTrail' (selected) and 'Dashboard'. Under 'CloudTrail', there are sections for 'Query results history' (no queries), 'Trails' (management-events selected), 'CloudTrail Insights' (not enabled), and 'Event history'. The 'Event history' table lists two events:

Event name	Event time	Event source
AddUserToGroup	August 30, 2024, 14:34:12 (UTC...)	iam.amazonaws.com
CreateUser	August 30, 2024, 14:34:12 (UTC...)	iam.amazonaws.com

Figure 9-2 CloudTrail in AWS

- **Monitoring and Logging:** CloudWatch is the primary monitoring service for AWS cloud resources and the applications you run on AWS. You can use CloudWatch to collect and track metrics, collect and monitor log files, set alarms, and automatically react to changes in your AWS resources. CloudWatch can monitor AWS resources such as EC2 instances, DynamoDB tables, and RDS DB instances, as well as any custom metrics or log files generated by your applications. CloudWatch also provides a stream of events describing changes to your AWS resources that you can use to react to changes in your applications.

Managed Services for Configuration: AWS offers a range of managed services for configuration that help automate the process of managing and deploying configurations across your cloud infrastructure. These services simplify the management of system configurations, ensure consistency, and provide compliance checks to maintain best practices and security standards. Here's an overview of key AWS managed services for configuration:

1. AWS Config

- **Overview:** AWS Config is a fully managed service that provides a detailed view of the configuration of AWS resources in your account. It continuously monitors and records AWS resource configurations and allows you to automate the evaluation of recorded configurations against desired configurations.
- **Key Features:**
 - Resource Inventory and Configuration History: Tracks changes to your AWS resources and maintains a history of configuration changes over time.
 - Configuration Compliance: Allows you to define rules to check the compliance of your resource configurations. You can use AWS Config rules or create custom rules using AWS Lambda.
 - Remediation Actions: Automatically or manually remediate non-compliant resources using predefined or custom remediation actions.
 - Integration: Integrates with AWS Security Hub, AWS Systems Manager, and AWS CloudFormation to enhance compliance and management capabilities.

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2. AWS Systems Manager Parameter Store

- Overview: AWS Systems Manager Parameter Store is a secure, scalable, and fully managed service for storing configuration data and managing secrets. It enables centralised storage and management of configuration variables, secrets, and other parameters.
- Key Features:
 - Secure Storage: Supports secure, hierarchical storage for configuration data and secrets, with the ability to encrypt parameters using AWS Key Management Service (KMS).
 - Versioning and Change Tracking: Allows versioning of parameters, making it easy to track changes and roll back if needed.
 - Access Control: Use AWS Identity and Access Management (IAM) policies to control access to parameters, ensuring that only authorised entities can view or modify them.
 - Integration: Seamlessly integrates with AWS Lambda, EC2, ECS, and other AWS services to provide dynamic configuration management.

3. AWS Systems Manager State Manager

- Overview: AWS Systems Manager State Manager automates keeping your Amazon EC2 and hybrid infrastructure in a desired state. It provides configuration management using JSON or YAML documents.
- Key Features:
 - Desired State Management: Automatically applies configurations and maintains instances in a consistent state.
 - Flexible Configuration Options: Supports AWS-provided, community, and custom documents for configuration management.
 - Integration with Automation and Run Command: Leverages other AWS Systems Manager capabilities like Automation and Run Command for broader management actions.

4. AWS CloudFormation

- Overview: AWS CloudFormation allows you to model, provision, and manage AWS and third-party resources by treating infrastructure as

code. You define configurations in templates using JSON or YAML, which can then be deployed in an automated and repeatable manner.

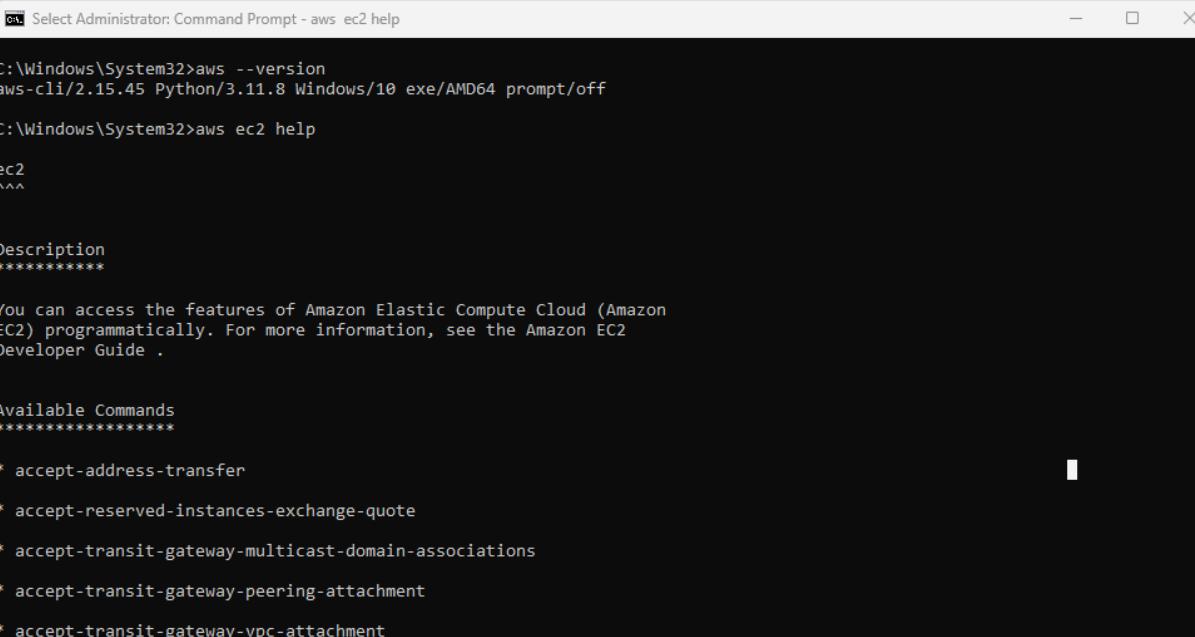
- **Key Features:**

- Infrastructure as Code: Enables you to define your infrastructure and configurations in code, which provides consistency and repeatability.
- Stack Management: Allows you to manage dependencies and update, replicate, or delete resources in a controlled manner.
- Change Sets and Rollbacks: Review proposed changes before applying them and automatically roll back changes if an error occurs during deployment.

These AWS-managed configuration services help ensure that your cloud infrastructure remains consistent, secure, and compliant with best practices. They provide automation, visibility, and control over your AWS environment, making managing and scaling configurations across your resources easier while reducing the operational burden.

Remember, to access your AWS resources from a management perspective, you also have many options. Here are just some of these options:

- The AWS Management Console.
- The AWS CLI. Figure 9-3 shows the AW CLI installed on my local Windows machine being accessed from my local command prompt.



```

Select Administrator: Command Prompt - aws ec2 help

C:\Windows\System32>aws --version
aws-cli/2.15.45 Python/3.11.8 Windows/10 exe/AMD64 prompt/off

C:\Windows\System32>aws ec2 help

ec2
^^^

Description
*****
You can access the features of Amazon Elastic Compute Cloud (Amazon EC2) programmatically. For more information, see the Amazon EC2 Developer Guide .

Available Commands
*****
* accept-address-transfer
* accept-reserved-instances-exchange-quote
* accept-transit-gateway-multicast-domain-associations
* accept-transit-gateway-peering-attachment
* accept-transit-gateway-vpc-attachment

```

Figure 9-3 The AWS CLI with two command highlighted

- Programmatic access using SDKs and APIs.

EXAM PREPARATION TASKS

- REVIEW ALL TOPICS
- DEFINE ALL KEY TERMS AND CHECK ANSWERS IN THE GLOSSARY.
- DO THE QUIZ – REPEAT UNTIL YOU PASS IT (100% PASSMARK).

DEFINE KEY TERMS

Define the following key terms from this module and check your answers in the Glossary:

Automation
orchestration

Q & A

- 1.** Name at least two areas where automation is often used in AWS.
- 2.** Name at least two management access options for AWS.