Welcome to Week 1

Cloud Accelerator Program

CloudFormation, IAM, and AWS SAM

DevelopIntelligence

A PLURALSIGHT COMPANY

Hello

About me...

- 26+ years in the industry
- 21+ years in teaching
- Certified Cloud architect
- Passionate about learning
- Also, passionate about Reese's Cups!

Why study these subjects?

In modern software engineering, our ability to quickly deploy incremental innovation, ensure its quality, and scale to meet customer demand proves critical to our success

- Cloud is everywhere and it’s not going away
- As with many topics in technology, there are multiple options and multiple dimensions to those options
- Building a deeper understanding of Cloud and its offerings helps prepare you for modern IT
- Included in that is the importance of learning about key foundational concepts like Infrastructure-as-Code (IaC) and Identity & Access Management (IAM)

My pledge to you

I will...

- Make this interactive
- Ask you questions
- Ensure everyone can speak
- Use an on-screen timer

Agenda

- Speaking the language of Cloud
- CloudFormation – one of the Infrastructure-as-Code (IaC) options in AWS
- Identity & Access Management (IAM) – key to securing workloads in AWS
- The AWS SAM (Serverless Application Model) – one of the newer serverless offerings available in AWS

How we're going to work together

- Slides and words to highlight key concepts
- Demos to bring those concepts "to life"
- Lab work (which will take place in sandboxes provided by "A Cloud Guru") for hands-on reinforcement
- NOTE: I welcome being interrupted – if you need more info, or clarification, or anything else, just break in and ask. I am here to help you.

Open Discussion

What is “the Cloud”?

How does “the Cloud” factor into modern IT?

Speaking the Language of Cloud

Infrastructure Options

Infrastructure Options

Infrastructure is the hardware & software that run our IT workloads and that provide our business users and customers a way to interface with the applications required to complete their daily jobs

What Are the Options?

On-Premise (in a Data Center)

Public Cloud

At the Edge

Hybrid Cloud

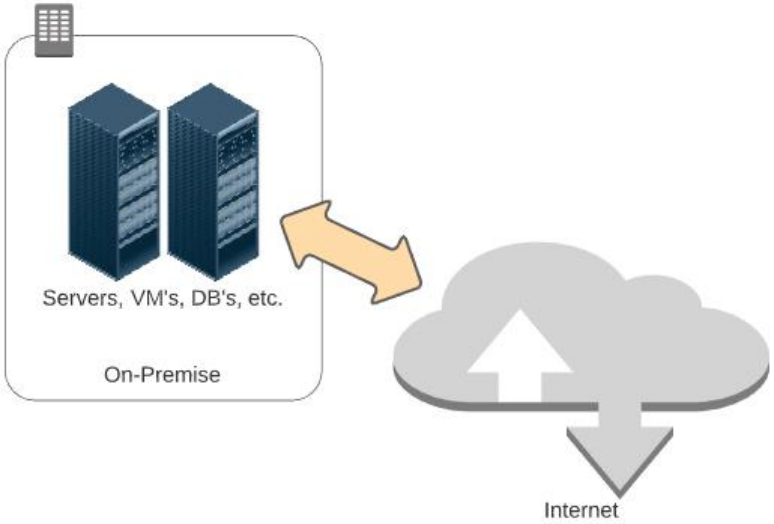
What do they all mean?

On-Premise

Can mean a few different things:

- In a wholly-owned Data Center
- In a COLO (or co-location Data Center)
- Sometimes called a “private cloud”

On-Premise



On-Premise

Why and What?

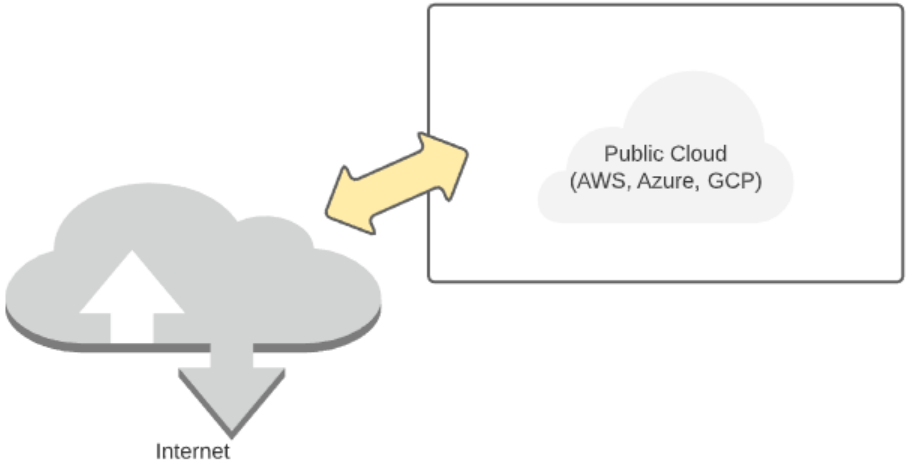
- How infrastructure has traditionally been done
- With this model, companies try and estimate current & future hardware capacity needed to support business operations

On-Premise

Why and What?

- Stakeholders plan out expected levels of consumption for the next 3 – 5 years (capacity to handle current volumes as well as expected growth)
- Some critical workloads may not be suitable for anything but a physical and directly-managed implementation (e.g., mainframe)

Public Cloud



Public Cloud

Why and What?

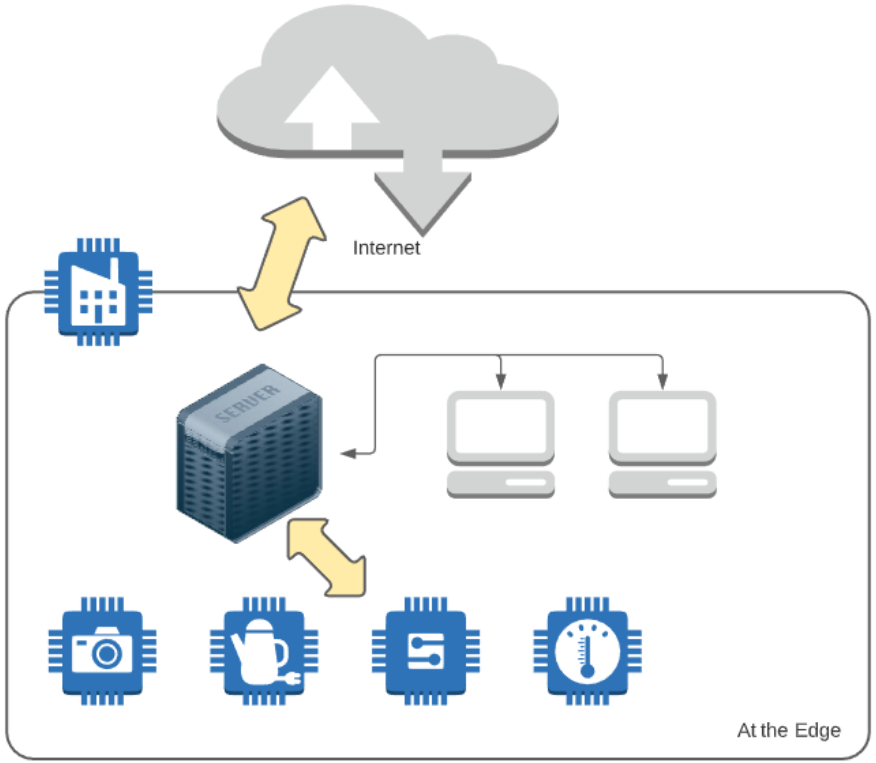
- Platform using the standard “Cloud computing model” to provide infrastructure and application services
- Accessed and integrated via the Internet
- May provide a few different types of services – IaaS, PaaS, etc.

Public Cloud

Why and What?

- Usually supports a subscription or “pay as you go” (on-demand) pricing model
- Largest players in this space include Azure, AWS and GCP

At the Edge



At the Edge

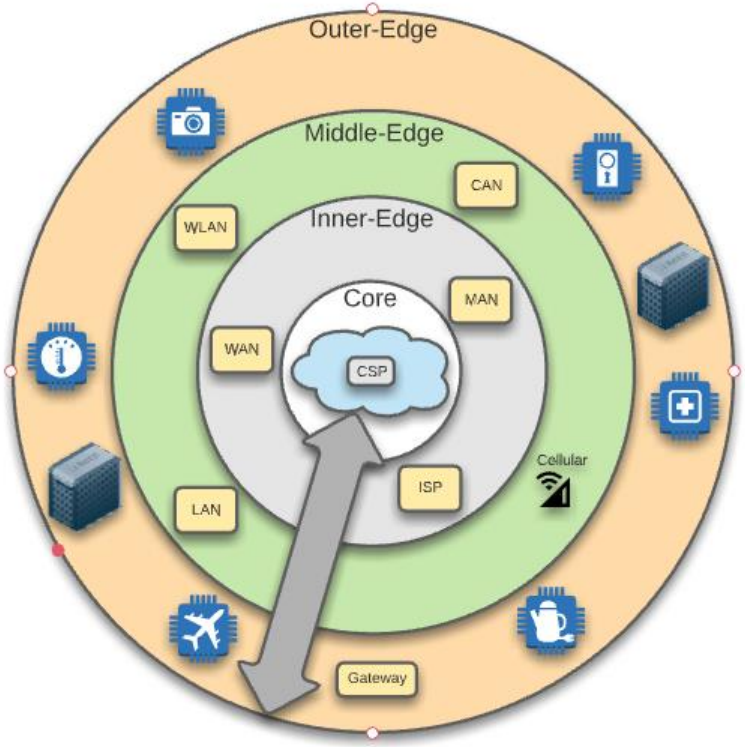
Can include 3 distinct layers:

Inner or Near Edge

Middle Edge

Outer or Far Edge

At the Edge – Layers



CSP – Cloud Service Provider
WAN – Wide Area Network
ISP – Internet Service Provider
MAN – Metropolitan Area Network
LAN – Local Area Network
WLAN – Wireless Local Area Network
CAN – Campus Area Network

At the Edge

Why and What?

- It’s about bringing the power of Cloud computing to you
- Enables additional processing closer to the sources of data while still supporting the offload of higher order processing to the Cloud
- Often involves setting up “Cloud-in-a-box” facilities on-premise

At the Edge

Why and What?

- IoT (Internet of Things) is a good example – devices in a facility reading massive amounts of data can incorporate processing at the edge to improve overall efficiency
- Helps inject lower latency, increased security and improved bandwidth into systems used to aggregate critical data for an enterprise

Hybrid Cloud

Why and What?

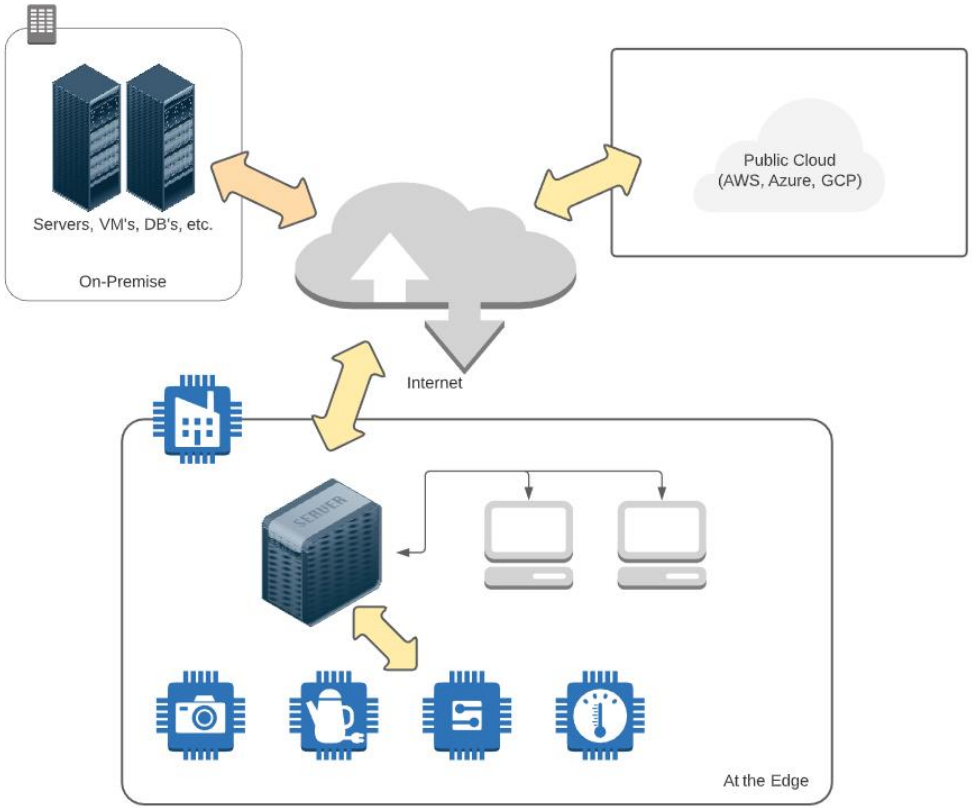
- In many ways, an amalgamation of the other options
- Supports distribution of system processing across on-premise infrastructure and the public Cloud

Hybrid Cloud

Why and What?

- Allows an enterprise to keep workloads that are best-suited for on-premise running on-premise while allowing migration of components that can move to the public Cloud
- Can help make an enterprise’s move to the Cloud more gradual and planful

Hybrid Cloud



Application Hosting

Application Hosting

By Application Hosting, we mean the target infrastructure and runtime platform used for deployment and execution of an application or system; can include compute (CPU and server resources), storage, network, data and operating system

Application Hosting – An “Interesting” Example?

Here’s an example of someone thinking “outside-of-the-box” when it comes to application hosting!

https://mashable.com/article/pregnancy-test-doom/

What Are the Hosting Options with Cloud?

- IaaS
- PaaS
- Serverless / FaaS
- SaaS
- Containers

What do they all mean?

Infrastructure-as-a-Service (IaaS)

- Involves the building out (and management) of virtual instances of:
  - Compute
  - Network
  - Storage

- Akin to spinning up a server (physical or virtual) in your location or data center complete with disks and required network connectivity

Infrastructure-as-a-Service (IaaS)

- The difference is in the where – instead of in your data center, it is created in a data center managed by one of the public Cloud providers

- Your organization is responsible for patching the OS, ensuring all appropriate security updates are applied and that the right controls are in place to govern interaction between this set of components and other infrastructure

Platform-as-a-Service (PaaS)

- Involves leveraging managed services from a public Cloud provider
- With this model, an enterprise can focus on management of their application and data vs. focusing on management of the underlying infrastructure
- Patching and security of the infrastructure used to back the managed services falls to the CSP (Cloud Service Provider)

Platform-as-a-Service (PaaS)

- Many managed services support automatic scale up or down depending on demand to help ensure sufficient capacity is in place
- Can be considered synonymous with the term “Cloud native”

Serverless / Functions-as-a-Service (FaaS)

- Also represents a type of managed service provided by the CSP
- Cost structure is usually consumption-based (i.e., you only pay for what you use)
- Supports many different coding paradigms (C#/.NET, NodeJS, Python, etc.)

Serverless / Functions-as-a-Service (FaaS)

- Typically, with Serverless (and PaaS), the consumer is only concerned with the application code and data – elements of the CSP's "backbone" used to support are managed by the CSP

- Includes more sophisticated automated scaling capabilities – built for Internet scale

Software-as-a-Service (SaaS)

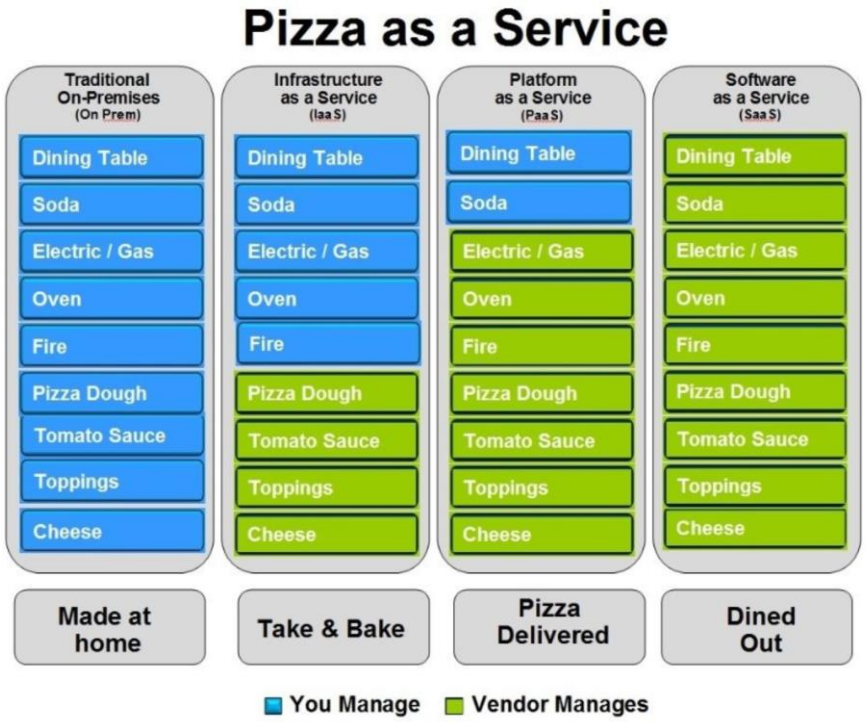
- Subscription-based application services
- Licensed for utilization over the Internet / online rather than for download and install on a server or client machine
- Fully-hosted and fully-managed by a 3rd party

Software-as-a-Service (SaaS)

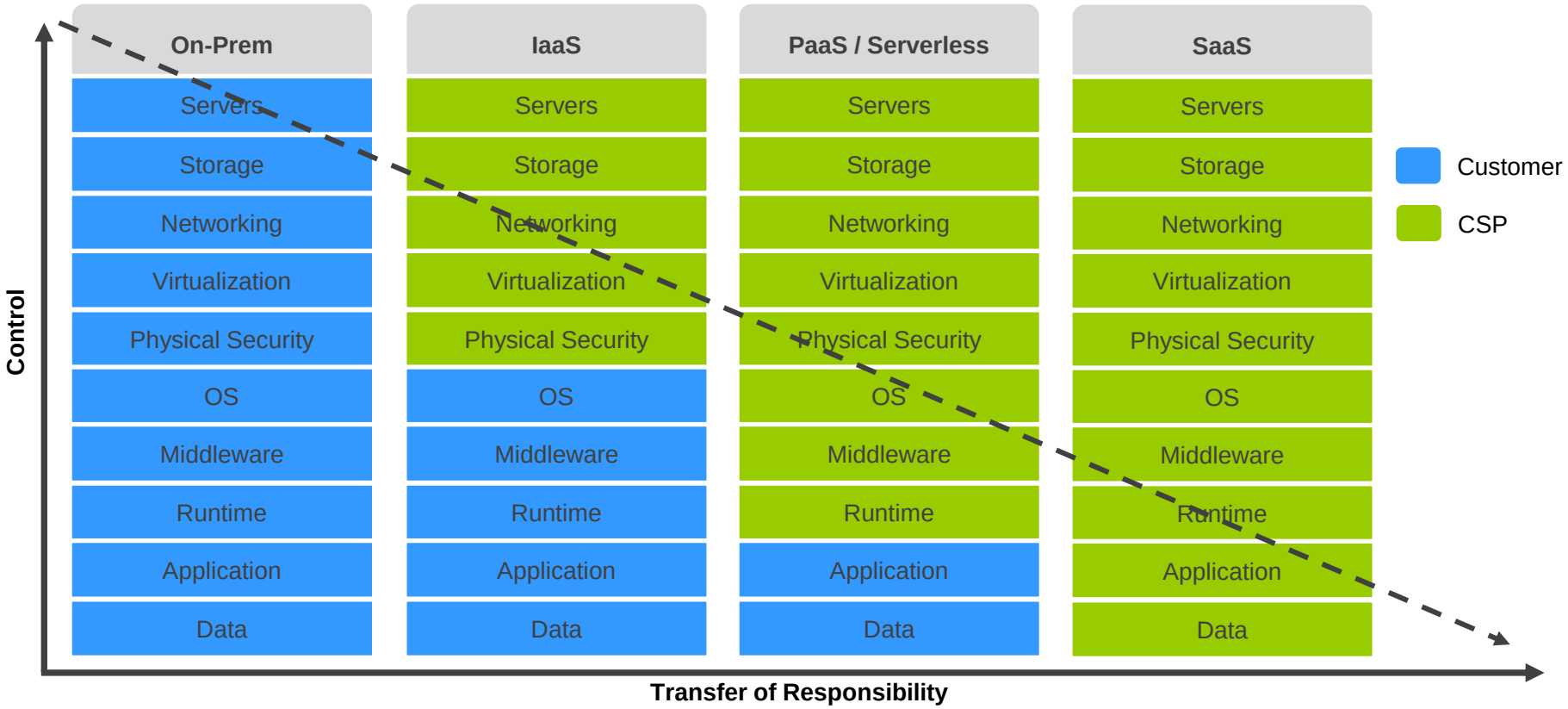
- Of those discussed, often the cheapest option for service consumers
- However, also offers minimal (or no) control, outside of exposed configuration capabilities

Pizza-as-a-Service

From a LinkedIn post by Albert Barron from IBM (https://www.linkedin.com/pulse/20140730172610-9679881-pizza-as-a-service/**)**



Side-by-Side Comparison



Containerization in the Cloud

- One option includes standing up VM’s (IaaS) and installing / managing a Kubernetes cluster on those machines or
- Another option includes leveraging a managed service (PaaS) provided by the CSP
- Options in AWS include Elastic Container Service (ECS), Elastic Container Registry (ECR), and EKS (Elastic Kubernetes Service)

Which One is Better?

- The answer is “it depends”
- It depends on the type of application
- It depends on the enterprise

Which One is Better?

- It depends on the skillset and expertise within the organization
- It depends on whether you have budget and opportunity to modernize an application environment (in some cases)
- The best option might be a combination of multiple approaches – right tool for the right job

Group Discussion:

Cloud Options

Scenario: Your company uses a sophisticated system for global scheduling of flights and flight reservations. The infrastructure used to power this critical system is currently hosted in an on-premise Data Center. This includes a mainframe for primary business functions (customer management, flight management, staff management, account management, etc.), several Web Apps (for customer and staff interaction), several Web APIs providing backend data and functionality to the UIs, and a system used to manage data feeds from several IoT devices present in the aircraft for reporting on equipment status.

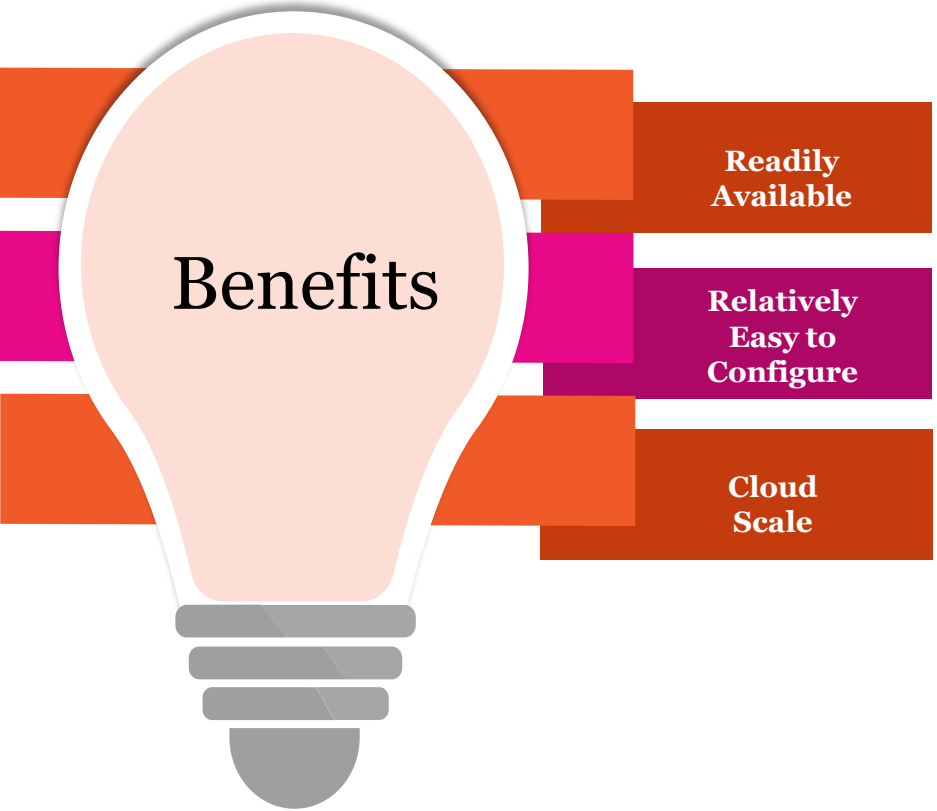
As a member of the technical staff, you have been asked to provide thoughts and recommendations on moving from the Data Center to the Cloud.

In your assigned breakout room, discuss as a group and be prepared to provide the following: 1) Potential options for infrastructure in the Cloud for the different types of workload, 2) potential options for hosting of each component type, and 3) considerations that the company should keep in mind as they make the move to ensure awareness and proactive planning.

Nominate someone (or volunteer) to share your group’s ideas.

Cloud Service Options in AWS

Cloud Native Services



The offers much in the way of capability and services

Cloud Native Services

- Sophisticated services that bring business value
- Enable expansion of the services ecosystem of your enterprise into new areas of differentiation and segmentation
- Key thing to remember – just because a service is available does not mean that you must use it (or even should use it)
- There should be an architectural vision in place for leverage of the Cloud that is directly aligned with business value

Cloud Native Services

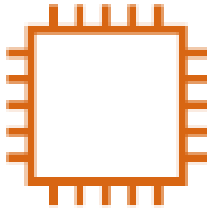
- Why? Because Cloud services will have  associated
- The  must be accounted for and justified as operating expense against business drivers
- With good alignment and a good plan, sophisticated Cloud services can help accelerate business mission

Developing for Cloud

- Compute
- Storage
- Networking
- Database

Compute in AWS

Includes



EC2

AWS Lambda

Elastic Beanstalk

Storage in AWS

Includes

Simple Storage Service (S3)

Elastic Block Store (EBS)

AWS Snowball

Networking in AWS

Includes

Virtual Private Cloud (VPC)/Subnets

API Gateway

Route 53

Database in AWS

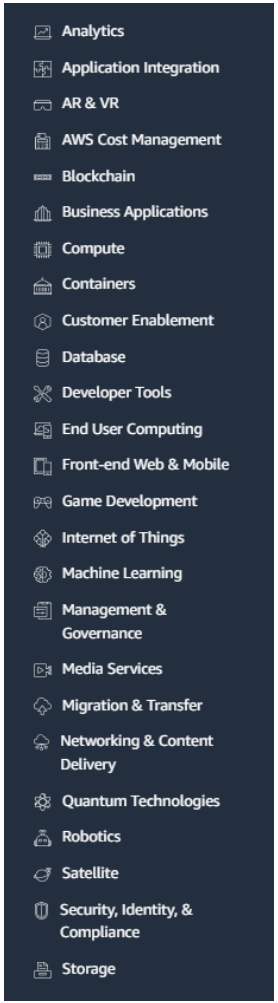
Includes

Relational Database Service (RDS)

DynamoDB

Aurora

Other in AWS


Analytics
Application Integration
AR & VR
AWS Cost Management
Blockchain
Business Applications
Compute
Containers
Customer Enablement
Database
Developer Tools
End User Computing
Front-end Web & Mobile
Game Development
Internet of Things
Machine Learning
Management & Governance
Media Services
Migration & Transfer
Networking & Content Delivery
Quantum Technologies
Robotics
Satellite
Security, Identity, & Compliance
Storage

CloudFormation

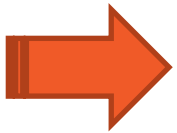
Infrastructure-as-Code (IaC)

IaC – What is it?

- As the name implies, the definition & configuration of our infrastructure IN code
- Instead of manually creating (inefficient) → automated in scripts that run “at the push of a button”

IaC – Why is it valuable?

- If only creating a handful of resources, manual is (probably) fine
- Creating hundreds (or even thousands), not so much!
- Modern DevOps is built around automation – quickly tearing down and rebuilding entire sets of infrastructure as and when required



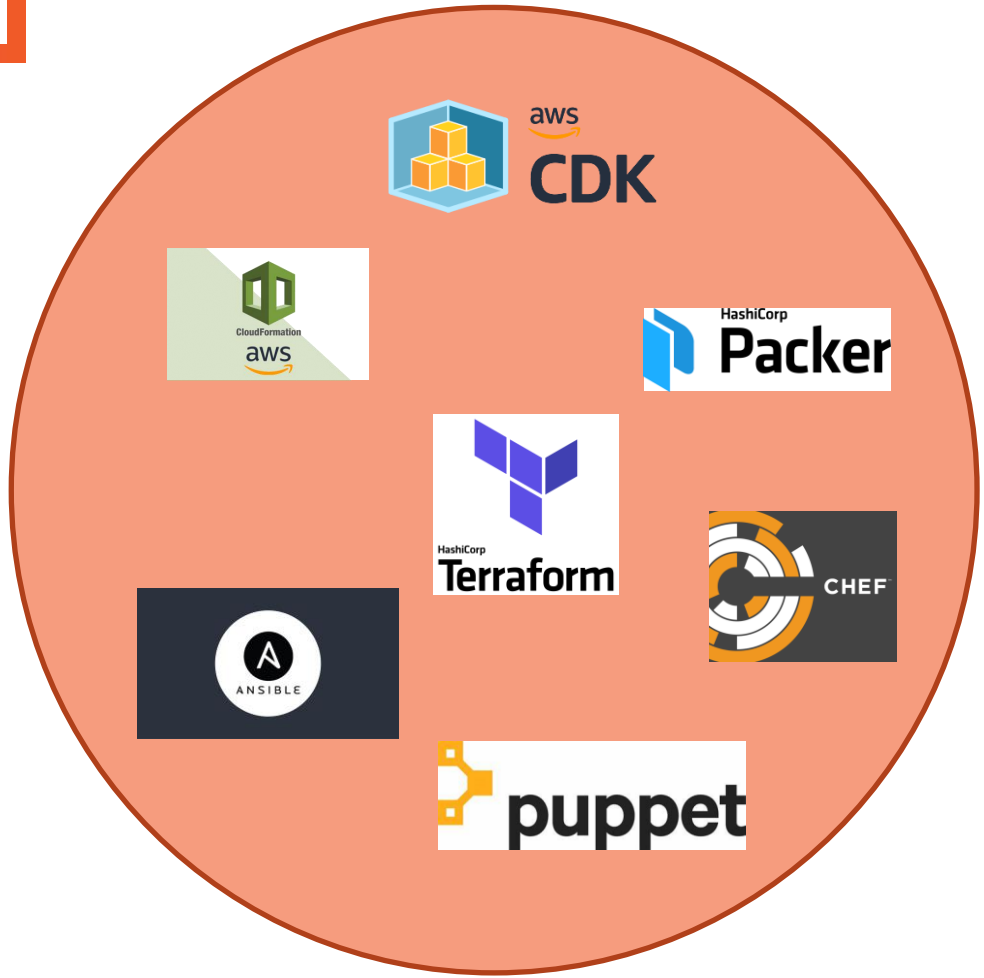
IaC – Advantages?

Testable

Repeatable

Auditable

IaC – Options?


aws
CDK
CloudFormation
aws
HashiCorp
Packer
HashiCorp
Terraform
CHEF
ANSIBLE
puppet

AWS CloudFormation

AWS CloudFormation

Works off 3 main concepts:

- Templates
- Stacks
- Change Sets

AWS CloudFormation

Works off 3 main concepts:

Formatted text files written in JSON or YAML that describe the “blueprint” for the AWS resources to be built

- Templates
- Stacks
- Change Sets

AWS CloudFormation

Works off 3 main concepts:

Templates

Stacks

Change Sets

A grouping of the complete set of resources provisioned by execution of a CloudFormation template

AWS CloudFormation

Works off 3 main concepts:

Templates

Stacks

Change Sets

Provides a summary of proposed changes that will be made to a set of running resources through execution of an updated template – before those updates are made

LAB:

AWS CloudFormation

Execute the “Hands-On” lab available at
https://learn.acloud.guru/handson/8a73c444-d5a3-461a-81fd-0cb4f0a56103

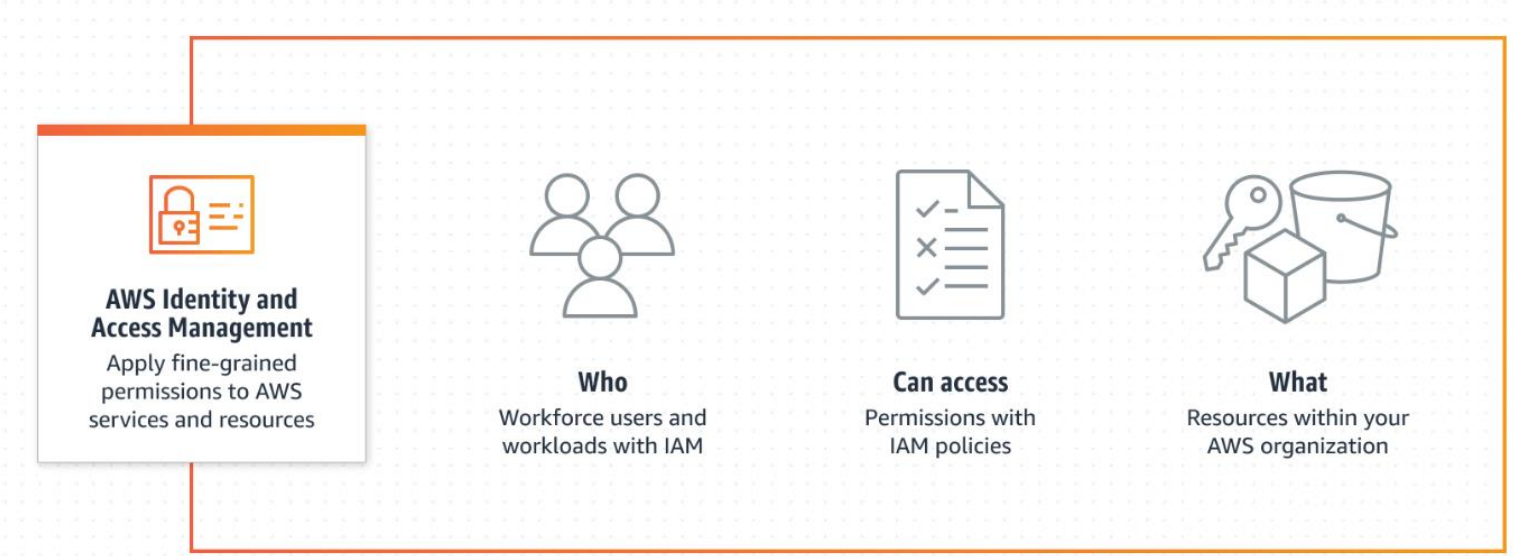
LAB:

AWS CloudFormation

Execute the “Hands-On” lab available at
https://learn.acloud.guru/handson/db9222f4-e0a0-4844-a110-d9225474c6e1

Identity & Access Management (IAM)

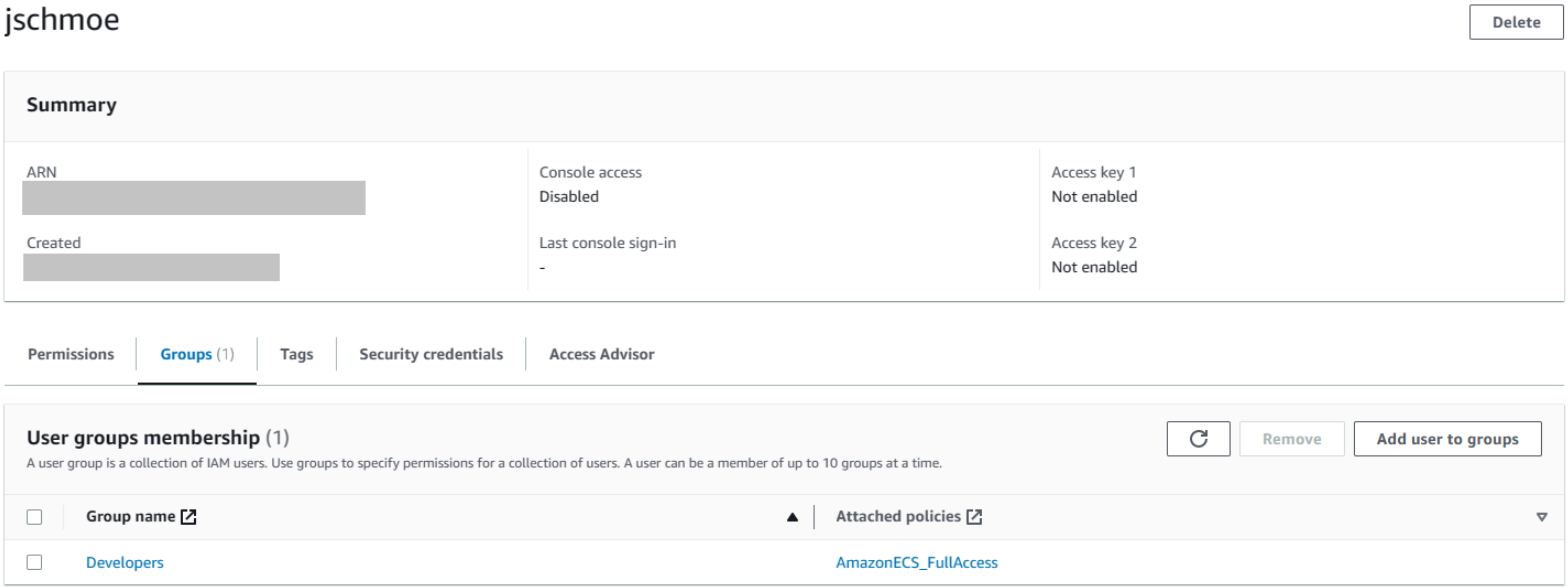
IAM – What is it?



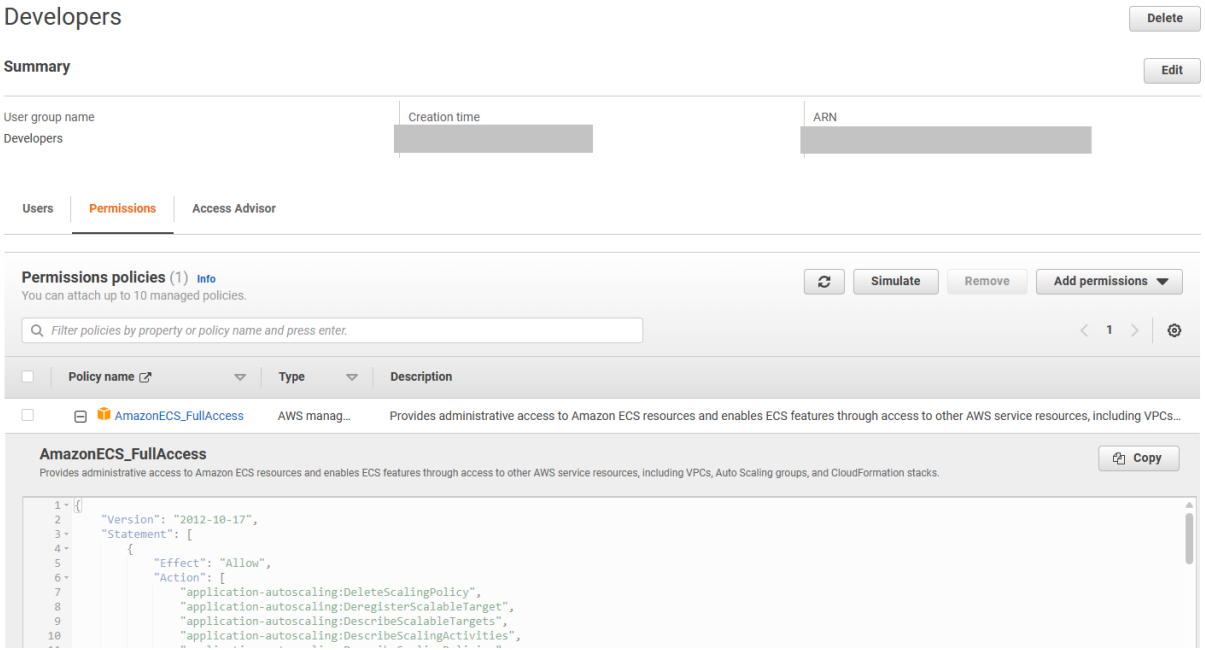
Source: https://aws.amazon.com/iam/

IAM – What is it?

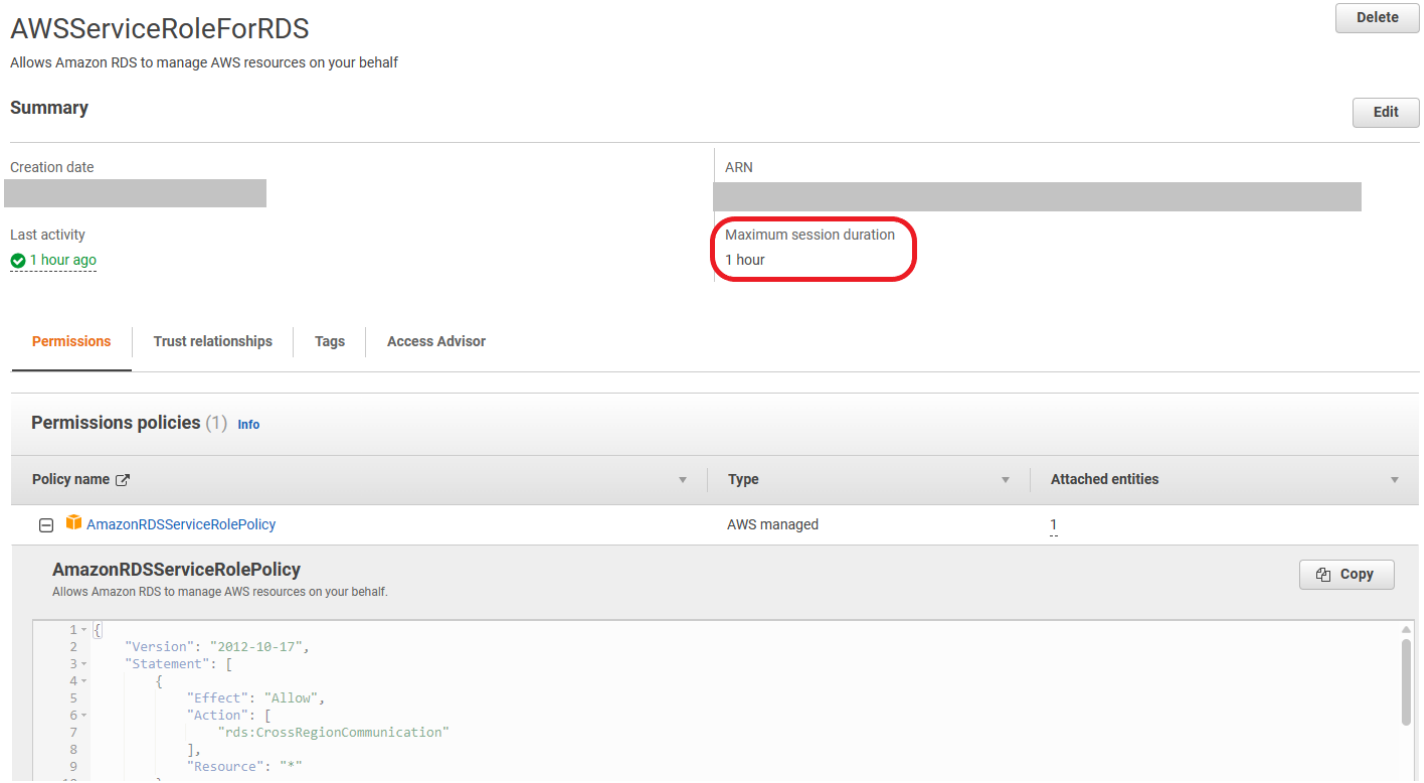
IAM – Users


jschmoe
Delete
Summary
ARN
Console access
Disabled
Access key 1
Not enabled
Created
Last console sign-in
-
Access key 2
Not enabled
Permissions
Groups (1)
Tags
Security credentials
Access Advisor
User groups membership (1)
A user group is a collection of IAM users. Use groups to specify permissions for a collection of users. A user can be a member of up to 10 groups at a time.
Remove
Add user to groups
Group name
Attached policies
Developers
AmazonECS_FullAccess

IAM – Groups


Developers
Delete
Summary
Edit
User group name
Developers
Creation time
ARN
Users
Permissions
Access Advisor
Permissions policies (1) Info
You can attach up to 10 managed policies.
Simulate
Remove
Add permissions
Filter policies by property or policy name and press enter.
1
Policy name
Type
Description
AmazonECS_FullAccess
AWS manag...
Provides administrative access to Amazon ECS resources and enables ECS features through access to other AWS service resources, including VPCs...
AmazonECS_FullAccess
Provides administrative access to Amazon ECS resources and enables ECS features through access to other AWS service resources, including VPCs, Auto Scaling groups, and CloudFormation stacks.
Copy
{
"Version": "2012-10-17",
"Statement": [
{
"Effect": "Allow",
"Action": [
"application-autoscaling:DeleteScalingPolicy",
"application-autoscaling:DeregisterScalableTarget",
"application-autoscaling:DescribeScalableTargets",
"application-autoscaling:DescribeScalingActivities",

IAM – Roles


AWSServiceRoleForRDS
Allows Amazon RDS to manage AWS resources on your behalf
Delete
Summary
Edit
Creation date
ARN
Last activity
1 hour ago
Maximum session duration
1 hour
Permissions
Trust relationships
Tags
Access Advisor
Permissions policies (1) Info
Policy name
Type
Attached entities
AmazonRDSServiceRolePolicy
AWS managed
1
AmazonRDSServiceRolePolicy
Allows Amazon RDS to manage AWS resources on your behalf.
Copy
{
"Version": "2012-10-17",
"Statement": [
{
"Effect": "Allow",
"Action": [
"rds:CrossRegionCommunication"
],
"Resource": "*"

IAM – Policies

AWSCloudFormationReadOnlyAccess

Provides access to AWS CloudFormation via the AWS Management Console.

Policy details

Type	Creation time	Edited time	ARN
AWS managed			

Permissions | Entities attached | Policy versions | Access Advisor

Permissions defined in this policy Info

Permissions defined in this policy document specify which actions are allowed or denied. To define permissions for an IAM identity (user, user group, or role), attach a policy to it.

Copy | Summary | JSON

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "cloudformation:Describe*",
                "cloudformation:EstimateTemplateCost",
                "cloudformation:Get*",
                "cloudformation:List*",
                "cloudformation:ValidateTemplate",
                "cloudformation:Detect*"
            ],
            "Resource": "*"
        }
    ]
}
```

IAM – Policies

AWSCloudFormationFullAccess

Provides full access to AWS CloudFormation.

Policy details

Type	Creation time	Edited time	ARN
AWS managed			

Permissions | Entities attached | Policy versions | Access Advisor

Permissions defined in this policy Info

Permissions defined in this policy document specify which actions are allowed or denied. To define permissions for an IAM identity (user, user group, or role), attach a policy to it.

Copy | Summary | JSON

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "cloudformation:*"
            ],
            "Resource": "*"
        }
    ]
}
```

LAB:

AWS IAM

Execute the “Hands-On” lab available at
https://learn.acloud.guru/handson/2b676662-301f-4797-a22a-e13d48d4ca92

DEMO:

AWS CloudFormation

Review the examples at
https://github.com/KernelGamut32/Mastering-AWS-CloudFormation

AWS SAM (Serverless Application Model)

AWS SAM – What is it?

AWS SAM Template Specification

AWS SAM CLI (Command-Line Interface)

AWS SAM – What is it?

- Open-source framework
- An extension of CloudFormation
- Enables use of abstract, short-hand syntax to define infrastructure
- Transforms short-hand syntax into code to define and create resources

AWS SAM Template Specification

AWS SAM CLI (Command-Line Interface)

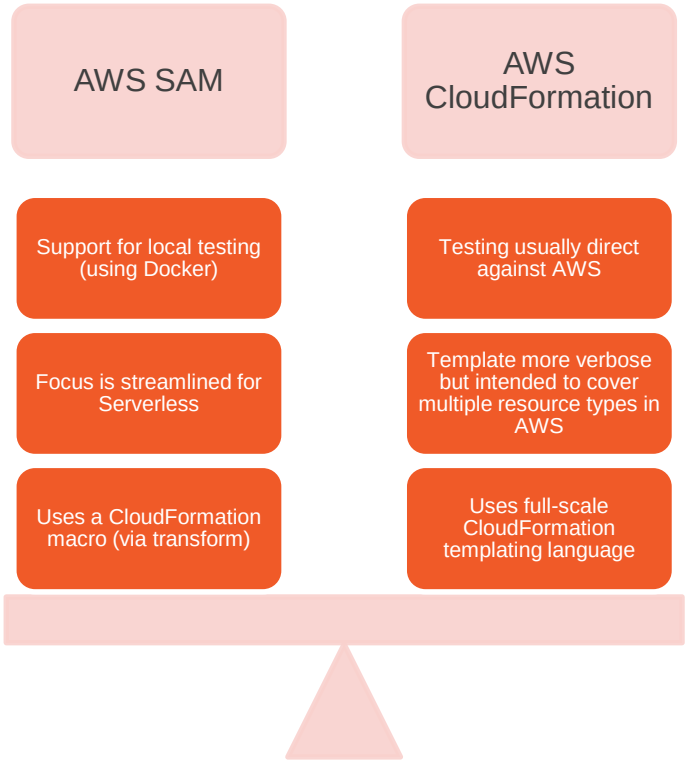
AWS SAM – What is it?

AWS SAM Template Specification

AWS SAM CLI (Command-Line Interface)

- Separately installed command line tool
- Used to initialize a new project, build, test, deploy, and monitor
- Supports sync of local changes to the Cloud
- Can be used (alongside a Docker installation) to test the application locally!

“Differences” Between AWS SAM and CloudFormation



DEMO:

AWS SAM

Thank you!

If you have additional questions, please reach out to me at:
asanders@gamuttechnologysvcs.com

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