NGINX Modern Reference Architecture

(Scalability, Portability, Resiliency, Agility)

Shawn K.

What is “Modern Application”

- It MUST be
  - Microservices
  - Containerized
  - Cloud Native

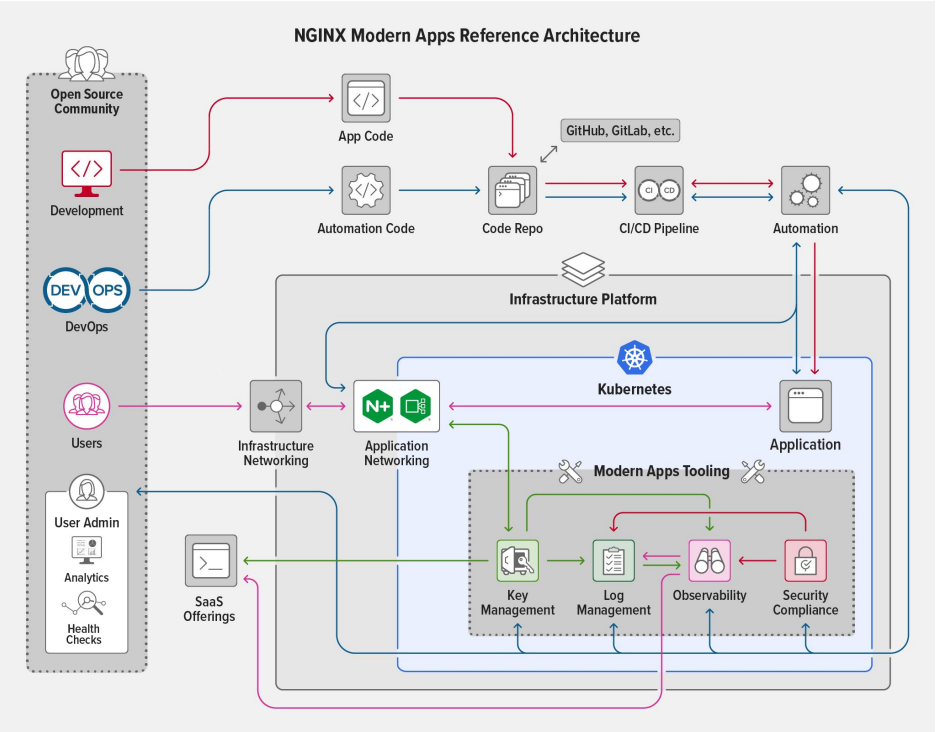
- It CAN’T be
  - Monolith
  - Baremetal

What a Modern Application Architecture Provides

- **Scalability**
  - Quickly and seamlessly scale up or down to accommodate spikes or reductions in demand, anywhere in the world
- **Portability**
  - Runs on multi-clouds/on-prem, multi-devices
- **Resiliency**
  - Can failover to newly spun-up or virtual environments in different available regions, clouds, or data centers
- **Agility**
  - Ability to update through automated CI/CD pipelines with higher code velocity and more frequent code pushes

What a Modern Application Architecture Provides

- **What are we trying to build**
  - Easy deployable K8s architecture
  - Easy button for KIC build & deploy
  - Stealable examples of how to do things
  - Modern app design principles
  - Pluggable deployment framework
- **What do have today**
  - Open source
  - Infrastructure as code w/ Pulumi
  - KIC image is built
  - K8s is deployed via AWS EKS
  - Log mgmt. Using Elastic tools
  - TLS enabled via Cert Manager
  - Demo app: Bank of Sirius (Google)

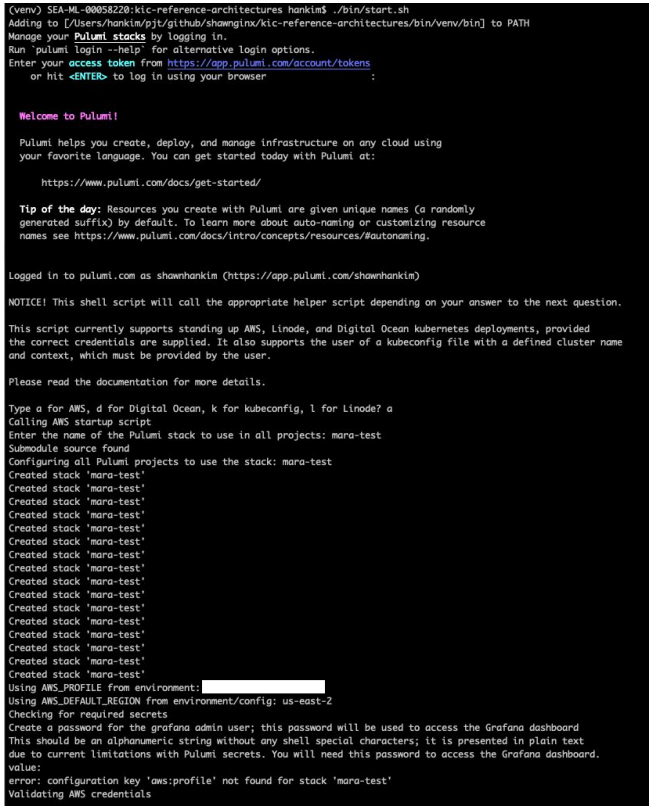


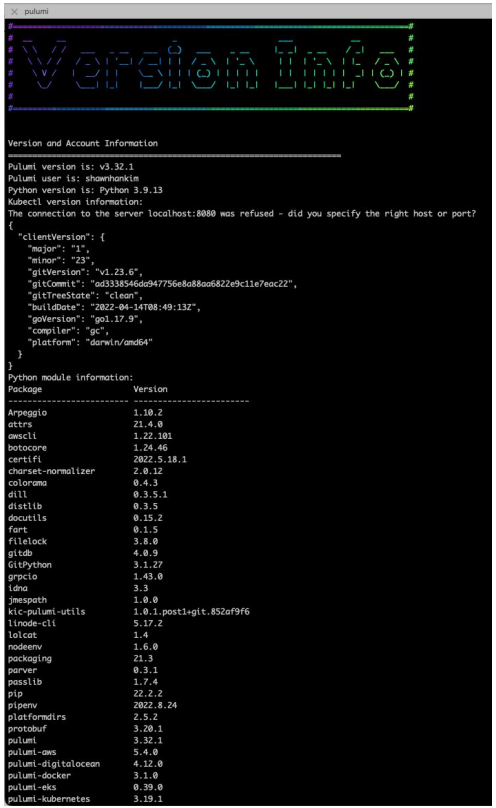
What Does Reference Architecture Do Today?

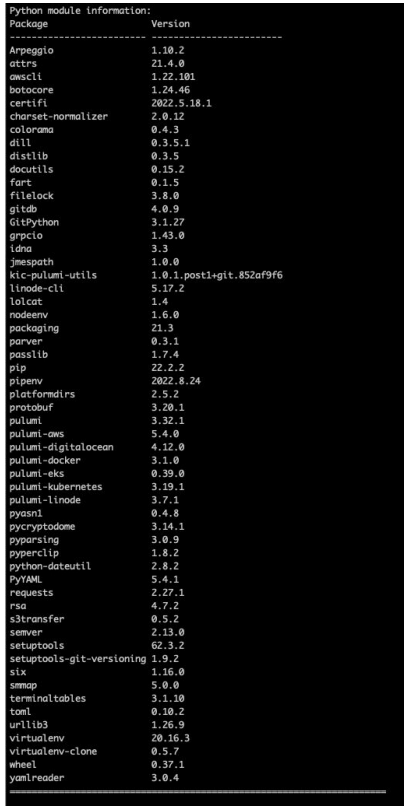
```
vpc - defines and installs the VPC and subnets to use with EKS
  └eks - deploys EKS
    └ecr - configures ECR for use in the cluster
      └kic-image-build – builds KIC image for NGINX Plus
        └kic-image-push - pushes KIC image built in previous step to ECR
          └kic-helm-chart - deploys NGINX Ingress Controller to the EKS cluster
            └logstore - deploys a logstore (elasticsearch) to the EKS cluster
              └logagent - deploys a logging agent (filebeat) to the EKS cluster
                └certmgr - deploys the open source cert-manager.io helm chart to the EKS cluster
                  └sirius - deploys a fork of Google's Bank of Anthos application to the EKS cluster
```

- **TODO**
  - **Observability**: provided by Open Telemetry w/ Prometheus for metric storage & Grafana for visualization
  - CD Examples
  - Performance testing framework
  - Admin cluster & app cluster segmentation

Getting Started w/ Pulumi for AWS







vpc - defines and installs the VPC and subnets to use with EKS

eks - deploys EKS

```
#==================================================================#
#                                                                  #
#                        AWS VPC                                   #
#                                                                  #
#==================================================================#

Previewing update (mara-test)

View Live: https://app.pulumi.com/shawnhankim/aws-vpc/mara-test/previews/93c642a3-95d3-47ec-9154-c010b59a154c

[resource plugin aws-5.4.0] installing
Downloading plugin: 0 B / 103.68 MiB [--------------------------------]   0.00%[resource plugin eks-0.39.0] installing
Downloading plugin: 679.83 KiB / 679.83 KiB [======================] 100.00% 0s
[resource plugin kubernetes-3.19.1] installing
[resource plugin digitalocean-4.12.0] installing
Downloading plugin: 0 B / 17.13 MiB [--------------------------------]   0.00%[resource plugin linode-3.7.1] installing
Downloading plugin: 1.12 MiB / 25.83 MiB [>--------------------]   4.35% 00m30s[resource plugin docker-3.1.0] installing
Downloading plugin: 16.43 MiB / 16.43 MiB [======================] 100.00% 5s
Downloading plugin: 17.13 MiB / 17.13 MiB [======================] 100.00% 26s
Downloading plugin: 25.83 MiB / 25.83 MiB [======================] 100.00% 36s
Downloading plugin: 30.03 MiB / 30.03 MiB [======================] 100.00% 39s
Downloading plugin: 103.68 MiB / 103.68 MiB [====================] 100.00% 1m0s
     Type                               Name                                                     Plan
 +   pulumi:pulumi:Stack                aws-vpc-mara-test                                        create
 +   ├─ aws:ec2:Vpc                     eks-aws-vpc-mara-test                                    create
 +   ├─ aws:ec2:InternetGateway         vpc-ig-aws-vpc-mara-test                                 create
 +   ├─ aws:ec2:RouteTable              vpc-route-table-aws-vpc-mara-test                        create
 +   ├─ aws:ec2:Subnet                  us-east-2a-k8s-public-aws-vpc-mara-test-0                create
 +   ├─ aws:ec2:Subnet                  us-east-2b-k8s-public-aws-vpc-mara-test-1                create
 +   ├─ aws:ec2:Subnet                  us-east-2a-k8s-private-aws-vpc-mara-test-0               create
 +   ├─ aws:ec2:Subnet                  us-east-2c-k8s-public-aws-vpc-mara-test-2                create
 +   ├─ aws:ec2:Subnet                  us-east-2b-k8s-private-aws-vpc-mara-test-1               create
 +   ├─ aws:ec2:Subnet                  us-east-2c-k8s-private-aws-vpc-mara-test-2               create
 +   ├─ aws:ec2:SecurityGroup           eks-cluster-sg-aws-vpc-mara-test                         create
 +   ├─ aws:ec2:RouteTableAssociation   route-table-assoc-public-us-east-2b-1                    create
 +   ├─ aws:ec2:RouteTableAssociation   route-table-assoc-public-us-east-2a-0                    create
 +   ├─ aws:ec2:RouteTableAssociation   route-table-assoc-private-us-east-2a-aws-vpc-mara-test-0 create
 +   ├─ aws:ec2:RouteTableAssociation   route-table-assoc-public-us-east-2c-2                    create
 +   ├─ aws:ec2:RouteTableAssociation   route-table-assoc-private-us-east-2b-aws-vpc-mara-test-1 create
 +   └─ aws:ec2:RouteTableAssociation   route-table-assoc-private-us-east-2c-aws-vpc-mara-test-2 create

Resources:
    + 17 to create
```

```
Updating (mara-test)

View Live: https://app.pulumi.com/shawnhankim/aws-vpc/mara-test/updates/1

     Type                               Name                                                     Status
 +   pulumi:pulumi:Stack                aws-vpc-mara-test                                        created
 +   ├─ aws:ec2:Vpc                     eks-aws-vpc-mara-test                                    created
 +   ├─ aws:ec2:InternetGateway         vpc-ig-aws-vpc-mara-test                                 created
 +   ├─ aws:ec2:Subnet                  us-east-2a-k8s-public-aws-vpc-mara-test-0                created
 +   ├─ aws:ec2:Subnet                  us-east-2c-k8s-public-aws-vpc-mara-test-2                created
 +   ├─ aws:ec2:Subnet                  us-east-2b-k8s-public-aws-vpc-mara-test-1                created
 +   ├─ aws:ec2:Subnet                  us-east-2b-k8s-private-aws-vpc-mara-test-1               created
 +   ├─ aws:ec2:Subnet                  us-east-2a-k8s-private-aws-vpc-mara-test-0               created
 +   ├─ aws:ec2:SecurityGroup           eks-cluster-sg-aws-vpc-mara-test                         created
 +   ├─ aws:ec2:Subnet                  us-east-2c-k8s-private-aws-vpc-mara-test-2               created
 +   ├─ aws:ec2:RouteTable              vpc-route-table-aws-vpc-mara-test                        created
 +   ├─ aws:ec2:RouteTableAssociation   route-table-assoc-private-us-east-2a-aws-vpc-mara-test-0 created
 +   ├─ aws:ec2:RouteTableAssociation   route-table-assoc-private-us-east-2b-aws-vpc-mara-test-1 created
 +   ├─ aws:ec2:RouteTableAssociation   route-table-assoc-private-us-east-2c-aws-vpc-mara-test-2 created
 +   ├─ aws:ec2:RouteTableAssociation   route-table-assoc-public-us-east-2a-0                    created
 +   ├─ aws:ec2:RouteTableAssociation   route-table-assoc-public-us-east-2b-1                    created
 +   └─ aws:ec2:RouteTableAssociation   route-table-assoc-public-us-east-2c-2                    created

Outputs:
    azs: [
        [0]: "us-east-2a"
        [1]: "us-east-2b"
        [2]: "us-east-2c"
    ]
    vpc: {
        arn                              : "arn:aws:ec2:us-east-2:641222230151:vpc/vpc-041a70230f358677f"
        assign_generated_ipv6_cidr_block : false
        cidr_block                       : "10.100.0.0/16"
        default_network_acl_id           : "acl-02e743d480b3ffd42"
        default_route_table_id           : "rtb-02b17ff0add4451f2"
        default_security_group_id        : "sg-0958add5644d79811"
        dhcp_options_id                  : "dopt-840002ed"
        enable_classiclink               : false
        enable_classiclink_dns_support   : false
        enable_dns_hostnames             : true
        enable_dns_support               : true
        id                               : "vpc-041a70230f358677f"
        instance_tenancy                 : "default"
        ipv6_netmask_length              : 0
        main_route_table_id              : "rtb-02b17ff0add4451f2"
        owner_id                         : "641222230151"
        tags                             : {
            Project         : "aws-vpc"
            Stack           : "mara-test"
            f5:blueops:owner: "H.Kim3@F5.com"
        }
        tags_all                         : {
            Project         : "aws-vpc"
            Stack           : "mara-test"
            f5:blueops:owner: "H.Kim3@F5.com"
        }
        urn                              : "urn:pulumi:mara-test::aws-vpc::aws:ec2/vpc:Vpc::eks-aws-vpc-mara-test"
    }

Resources:
    + 17 created

Duration: 29s
```

vpc - defines and installs the VPC and subnets to use with EKS

eks - deploys EKS

ecr - configures ECR for use in the cluster

```
Previewing update (mara-test)

View Live: https://app.pulumi.com/shawnhankim/aws-eks/mara-test/previews/0e2f15c4-45bb-4862-b7fd-084a4129a762

     Type                                 Name                                                  Plan       Info
 +   pulumi:pulumi:Stack                  aws-eks-mara-test                                     create     2 warnings; 3 messages
 +   ├─ aws:iam:Role                      ec2-nodegroup-iam-role                                create
 +   ├─ aws:iam:Role                      eks-iam-role                                          create
 +   ├─ aws:iam:RolePolicyAttachment      eks-workernode-policy-attachment                      create
 +   ├─ aws:iam:RolePolicyAttachment      ec2-container-ro-policy-attachment                    create
 +   ├─ aws:iam:RolePolicyAttachment      eks-cni-policy-attachment                             create
 +   ├─ aws:iam:RolePolicyAttachment      eks-cluster-policy-attachment                         create
 +   ├─ aws:iam:RolePolicyAttachment      eks-service-policy-attachment                         create
 +   ├─ aws:iam:InstanceProfile           node-group-profile-aws-eks-mara-test                  create
 +   └─ eks:index:Cluster                 aws-eks-mara-test                                     create
 +      ├─ eks:index:ServiceRole          aws-eks-mara-test-instanceRole                        create
 +      │  ├─ aws:iam:Role                aws-eks-mara-test-instanceRole-role                   create
 +      │  ├─ aws:iam:RolePolicyAttachment aws-eks-mara-test-instanceRole-3eb088f2              create
 +      │  ├─ aws:iam:RolePolicyAttachment aws-eks-mara-test-instanceRole-03516f97              create
 +      │  └─ aws:iam:RolePolicyAttachment aws-eks-mara-test-instanceRole-e1b295bd              create
 +      ├─ eks:index:RandomSuffix         aws-eks-mara-test-cfnStackName                        create
 +      ├─ aws:ec2:SecurityGroup          aws-eks-mara-test-eksClusterSecurityGroup             create
 +      ├─ aws:ec2:SecurityGroupRule      aws-eks-mara-test-eksClusterInternetEgressRule        create
 +      ├─ aws:eks:Cluster                aws-eks-mara-test-eksCluster                          create
 +      ├─ pulumi:providers:kubernetes    aws-eks-mara-test-eks-k8s                             create
 +      ├─ eks:index:VpcCni               aws-eks-mara-test-vpc-cni                             create
 +      ├─ aws:ec2:SecurityGroup          aws-eks-mara-test-nodeSecurityGroup                   create
 +      ├─ aws:iam:InstanceProfile        aws-eks-mara-test-instanceProfile                     create
 +      ├─ kubernetes:core/v1:ConfigMap   aws-eks-mara-test-nodeAccess                          create
 +      ├─ aws:ec2:SecurityGroupRule      aws-eks-mara-test-eksExtApiServerClusterIngressRule   create
 +      ├─ aws:ec2:SecurityGroupRule      aws-eks-mara-test-eksNodeIngressRule                  create
 +      ├─ aws:ec2:SecurityGroupRule      aws-eks-mara-test-eksClusterIngressRule               create
 +      ├─ aws:ec2:SecurityGroupRule      aws-eks-mara-test-eksNodeInternetEgressRule           create
 +      ├─ aws:ec2:SecurityGroupRule      aws-eks-mara-test-eksNodeClusterIngressRule           create
 +      ├─ aws:ec2:LaunchConfiguration    aws-eks-mara-test-nodeLaunchConfiguration             create
 +      ├─ aws:cloudformation:Stack       aws-eks-mara-test-nodes                               create
 +      └─ pulumi:providers:kubernetes    aws-eks-mara-test-provider                            create

Diagnostics:
  pulumi:pulumi:Stack (aws-eks-mara-test):
    vpc id: vpc-041a70230f358677f
    warning: aws:ec2/getSubnetIds:getSubnetIds verification warning: Deprecated Resource
    public subnets: ['subnet-059cb47a8858c7fc6', 'subnet-08fdf5f6035468c09', 'subnet-0322839cabbc62b9e']
    warning: aws:ec2/getSubnetIds:getSubnetIds verification warning: Deprecated Resource
    public subnets: ['subnet-0a633e4ab38385031', 'subnet-0bc572ce9741ecce7', 'subnet-025408ad9835964aa']
```

```
Updating (mara-test)

View Live: https://app.pulumi.com/shawnhankim/aws-eks/mara-test/updates/1

     Type                                 Name                                                  Status          Info
 +   pulumi:pulumi:Stack                  aws-eks-mara-test                                     created         2 warnings; 3 messages
 +   ├─ aws:iam:Role                      ec2-nodegroup-iam-role                                created
 +   ├─ aws:iam:Role                      eks-iam-role                                          created
 +   ├─ aws:iam:RolePolicyAttachment      eks-workernode-policy-attachment                      created
 +   ├─ aws:iam:RolePolicyAttachment      eks-cni-policy-attachment                             created
 +   ├─ aws:iam:RolePolicyAttachment      ec2-container-ro-policy-attachment                    created
 +   ├─ aws:iam:InstanceProfile           node-group-profile-aws-eks-mara-test                  created
 +   ├─ aws:iam:RolePolicyAttachment      eks-service-policy-attachment                         created
 +   ├─ aws:iam:RolePolicyAttachment      eks-cluster-policy-attachment                         created
 +   ├─ eks:index:Cluster                 aws-eks-mara-test                                     created
 +   │  ├─ eks:index:ServiceRole          aws-eks-mara-test-instanceRole                        created
 +   │  │  ├─ aws:iam:Role                aws-eks-mara-test-instanceRole-role                   created
 +   │  │  ├─ aws:iam:RolePolicyAttachment aws-eks-mara-test-instanceRole-3eb088f2              created
 +   │  │  ├─ aws:iam:RolePolicyAttachment aws-eks-mara-test-instanceRole-e1b295bd              created
 +   │  │  └─ aws:iam:RolePolicyAttachment aws-eks-mara-test-instanceRole-03516f97              created
 +   │  ├─ eks:index:RandomSuffix         aws-eks-mara-test-cfnStackName                        created
 +   │  ├─ aws:ec2:SecurityGroup          aws-eks-mara-test-eksClusterSecurityGroup             created
 +   │  ├─ aws:iam:InstanceProfile        aws-eks-mara-test-instanceProfile                     created
 +   │  ├─ aws:ec2:SecurityGroupRule      aws-eks-mara-test-eksClusterInternetEgressRule        created
 +   │  ├─ aws:eks:Cluster                aws-eks-mara-test-eksCluster                          created
 +   │  ├─ aws:ec2:SecurityGroup          aws-eks-mara-test-nodeSecurityGroup                   created
 +   │  ├─ eks:index:VpcCni               aws-eks-mara-test-vpc-cni                             created
 +   │  └─ pulumi:providers:kubernetes    aws-eks-mara-test-eks-k8s                             created
     └─ kubernetes:core/v1:ConfigMap      aws-eks-mara-test-nodeAccess                          **failed**      1 error

Diagnostics:
  kubernetes:core/v1:ConfigMap (aws-eks-mara-test-nodeAccess):
    error: failed to initialize discovery client: exec plugin: invalid apiVersion "client.authentication.k8s.io/v1alpha1"

  pulumi:pulumi:Stack (aws-eks-mara-test):
    vpc id: vpc-041a70230f358677f
    warning: aws:ec2/getSubnetIds:getSubnetIds verification warning: Deprecated Resource
    public subnets: ['subnet-059cb47a8858c7fc6', 'subnet-08fdf5f6035468c09', 'subnet-0322839cabbc62b9e']
    warning: aws:ec2/getSubnetIds:getSubnetIds verification warning: Deprecated Resource
    public subnets: ['subnet-0a633e4ab38385031', 'subnet-0bc572ce9741ecce7', 'subnet-025408ad9835964aa']

Resources:
    + 23 created

Duration: 10m27s
```

References

- Cloud Engineering Summit 2021: Building a Modern App Reference Architecture for Kubernetes
- What is Infrastructure as Code? Introduction To Pulumi: Create an AWS S3 Website in under 5 min
- MARA: Running on a Workstation Near You

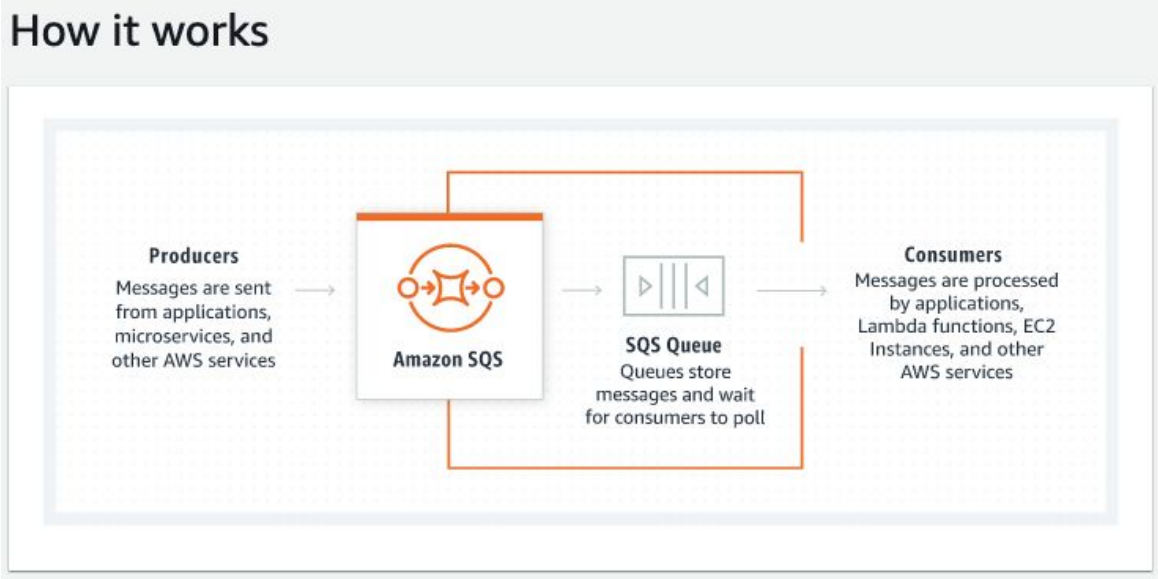
AWS AI Service

(Serverless Image Recognition System - Crawler)

Shawn K.

Amazon SQS: A message queuing service

- Amazon SQS provides queues for high-throughput, system-to-system messaging. You can use queues to decouple heavyweight processes and to buffer and batch work. Amazon SQS stores messages until microservices and serverless applications process them.



Amazon SQS: Benefits and Features

- Highly scalable Standard and FIFO queues
  - Queues scale elastically with your application. Nearly unlimited throughput and no limit to the number of messages per queue in Standard queues. First-In-First-Out delivery and exactly once processing in FIFO queues.
- Durability and availability
  - Your queues are distributed on multiple servers. Redundant infrastructure provides highly concurrent access to messages.
- Security
  - Protection in transit and at rest. Transmit sensitive data in encrypted queues. Send messages in a Virtual Private Cloud.
- Batching
  - Send, receive, or delete messages in batches of up to 10 messages or 256KB to save costs.

Amazon SQS: Use Cases

EMS

Petroleum retailers in Australia are improving the performance and safety of their service stations with an AWS IoT–enabled solution called Fuelsuite from EMS. Fuelsuite schedules messages to and from the edge devices by using Amazon SQS.

Learn more

NASA

The NASA image & video library provides easy access to thousands of images, audio recordings and videos, documenting NASA's more than half a century of achievements in exploring the vast unknown. The architecture includes Amazon SQS to decouple incoming jobs from pipeline processes.

Learn more