

MA-04

# SaaS architecture patterns: From concept to implementation

Alex Pulver

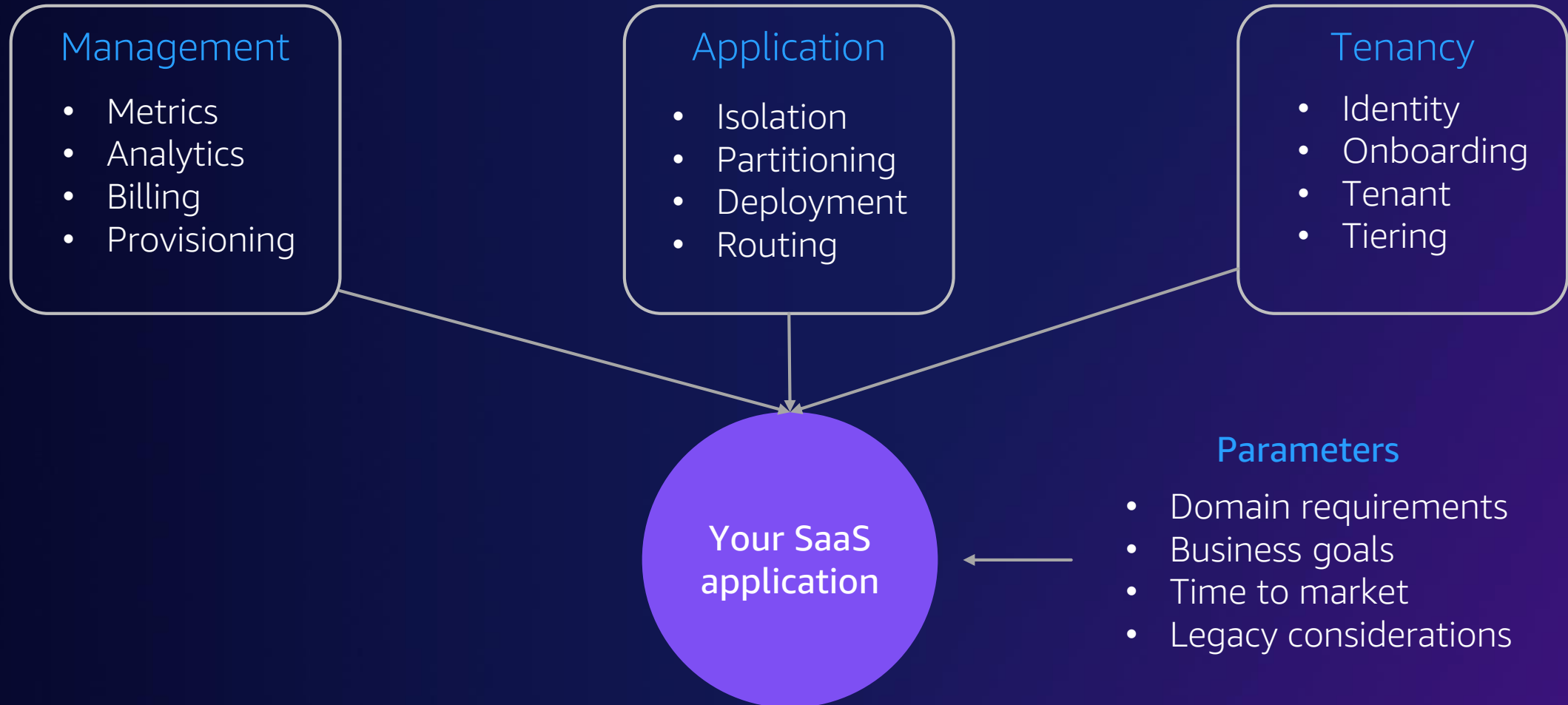
Principal Partner Solutions Architect, SaaS Factory  
AWS



# There's no blueprint for SaaS

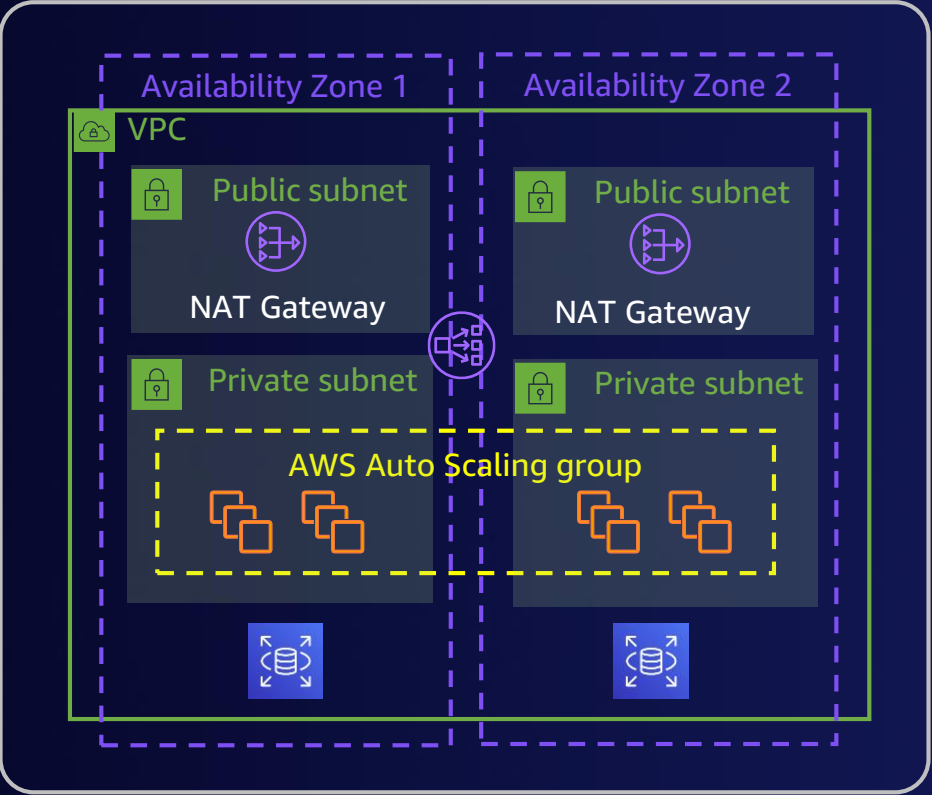


# Composing SaaS from patterns



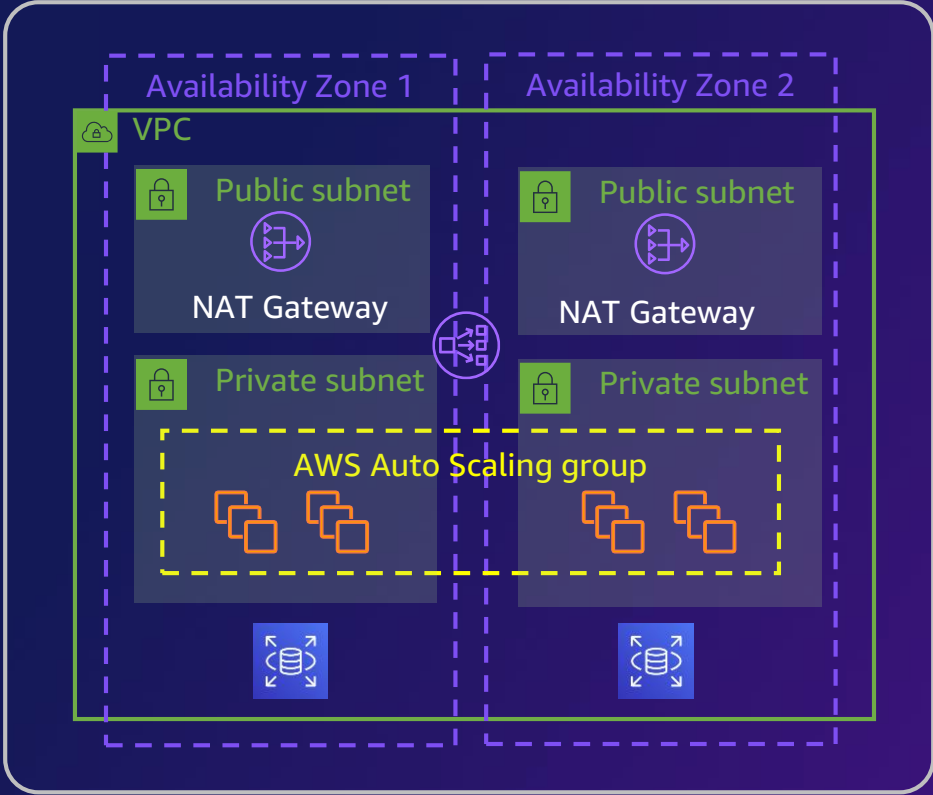
# The two halves of SaaS

Application plane



- Multi-tenant environment
- Home for all tenant functionality

Control plane



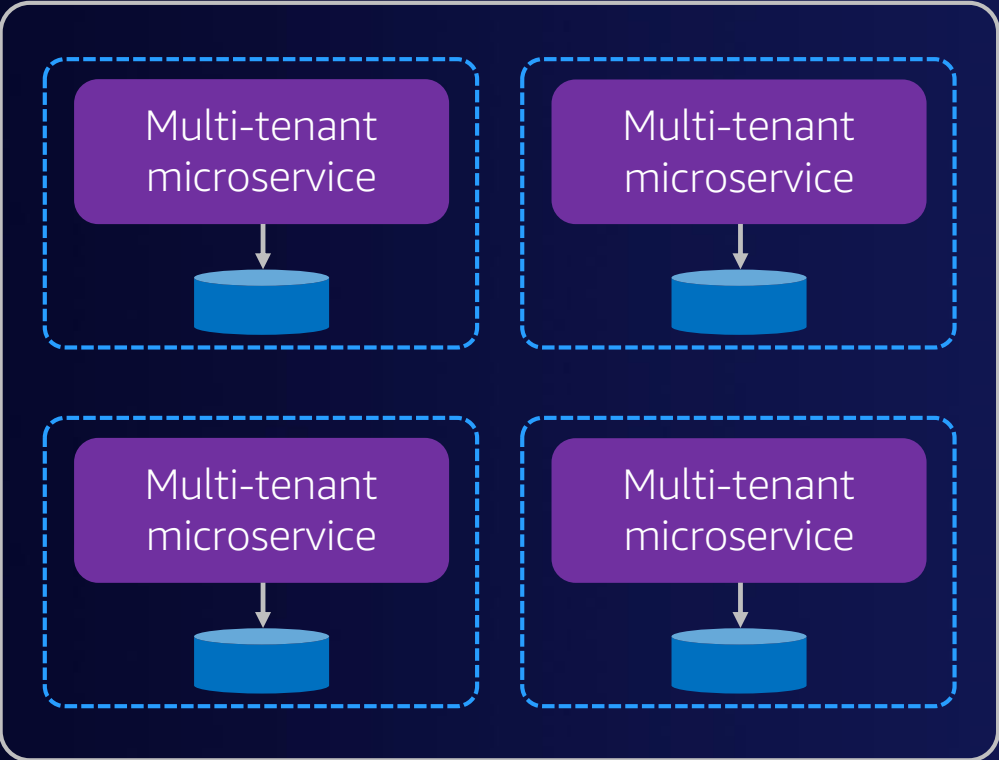
- Operates and manages all tenants
- Home to all shared services

# A multi-tenant application vs. a SaaS service

Application plane

Control plane

 Web tier



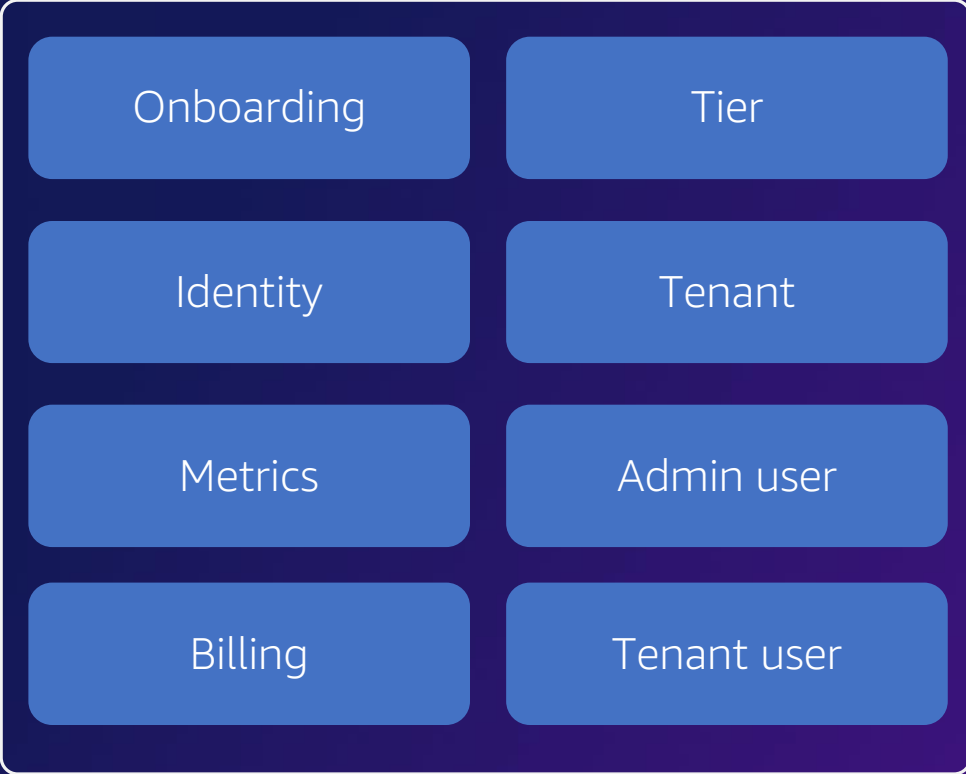
Multi-tenant microservice

Multi-tenant microservice

Multi-tenant microservice

Multi-tenant microservice

Admin console



Onboarding

Tier

Identity

Tenant

Metrics

Admin user

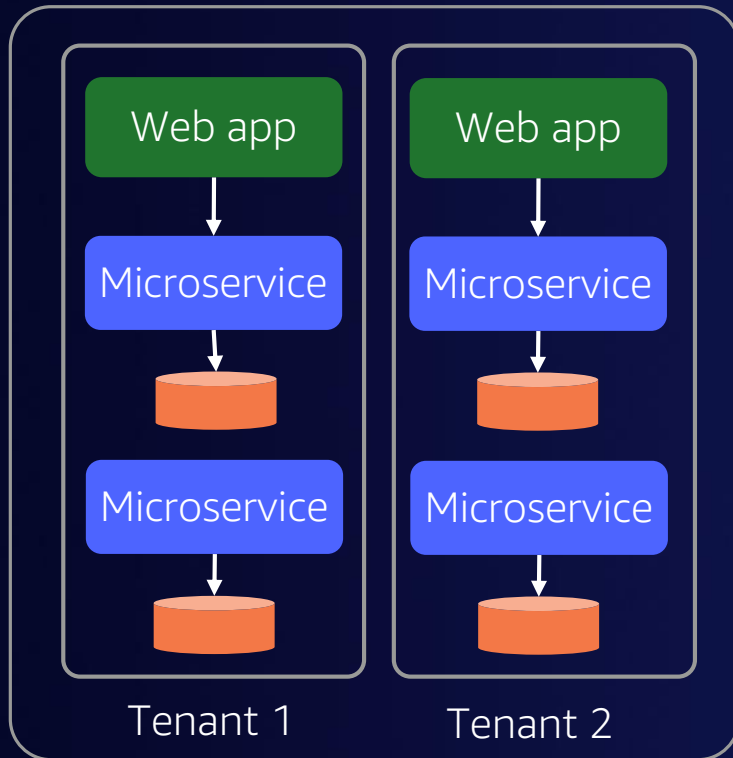
Billing

Tenant user

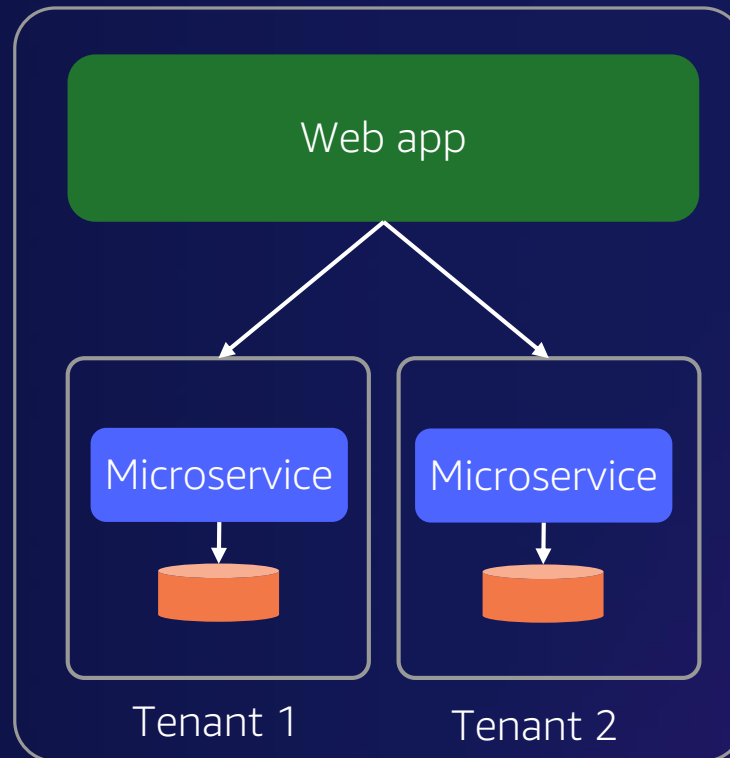


# Describing SaaS environments

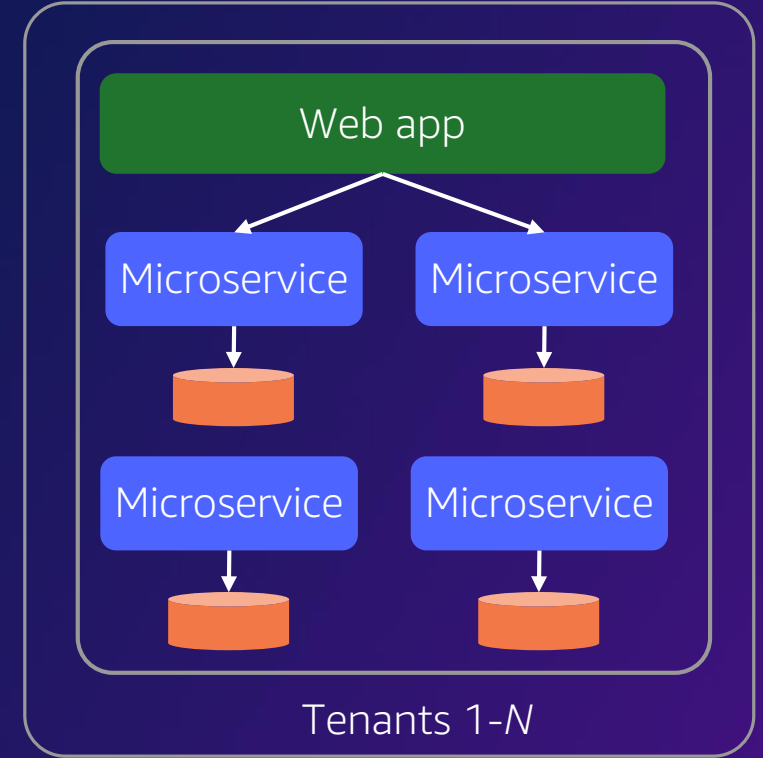
Silo



Bridge

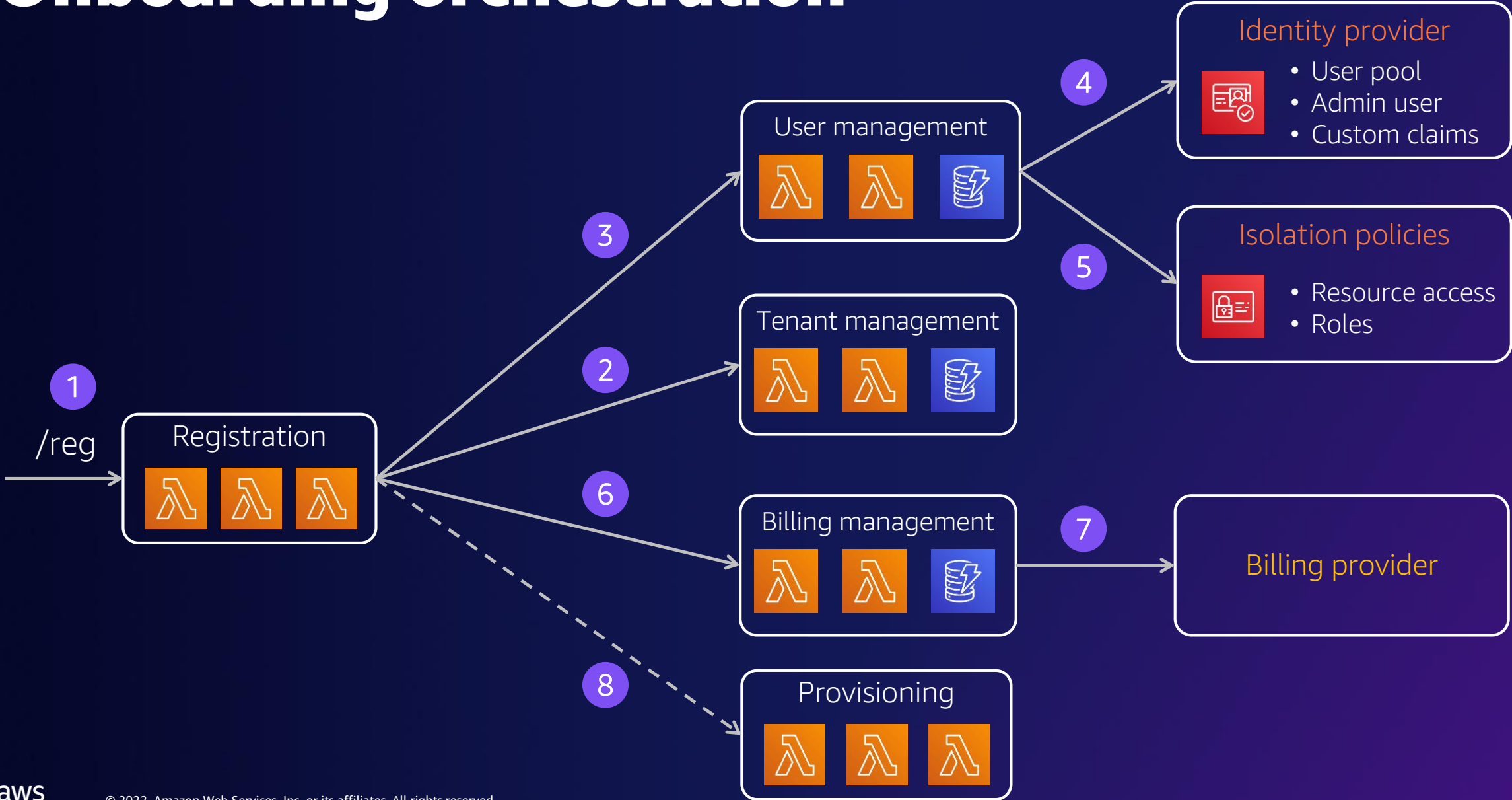


Pool



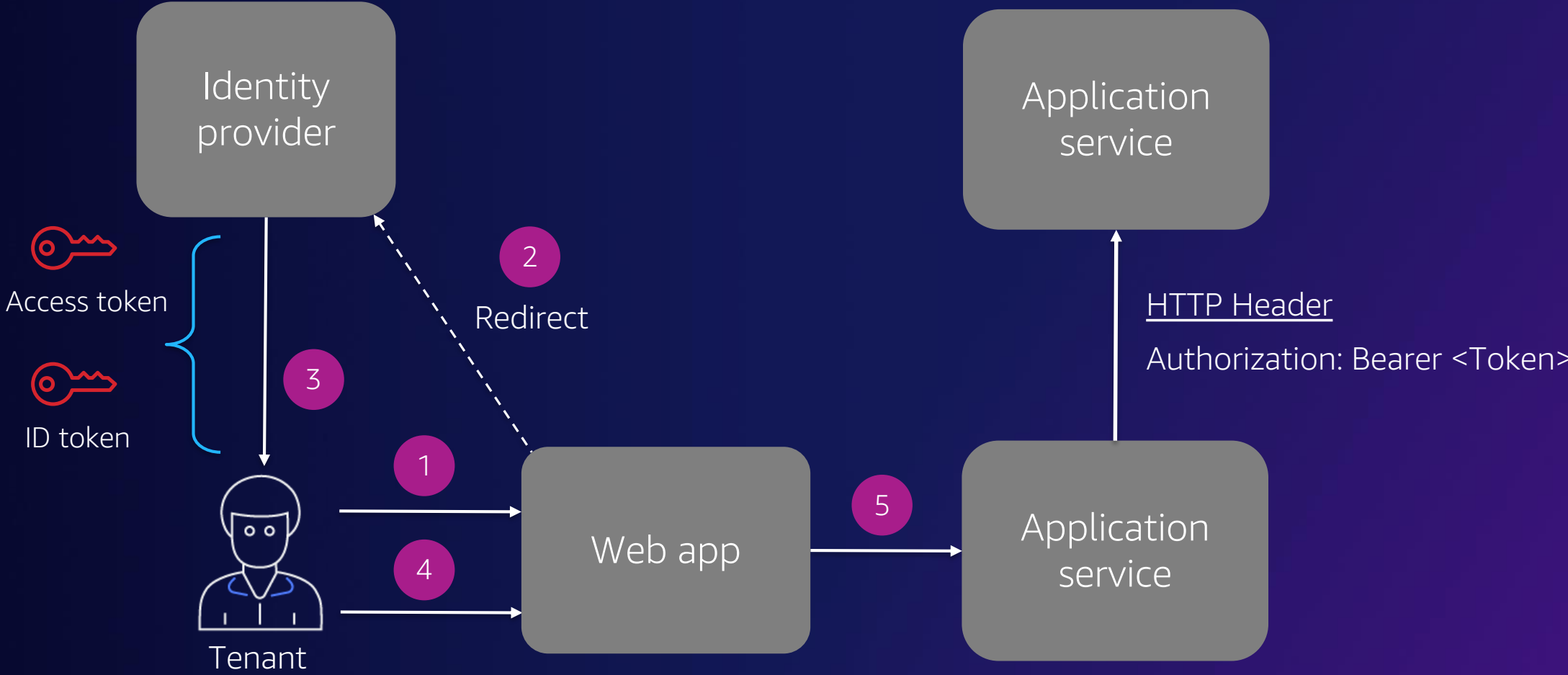
# Control plane patterns

# Onboarding orchestration

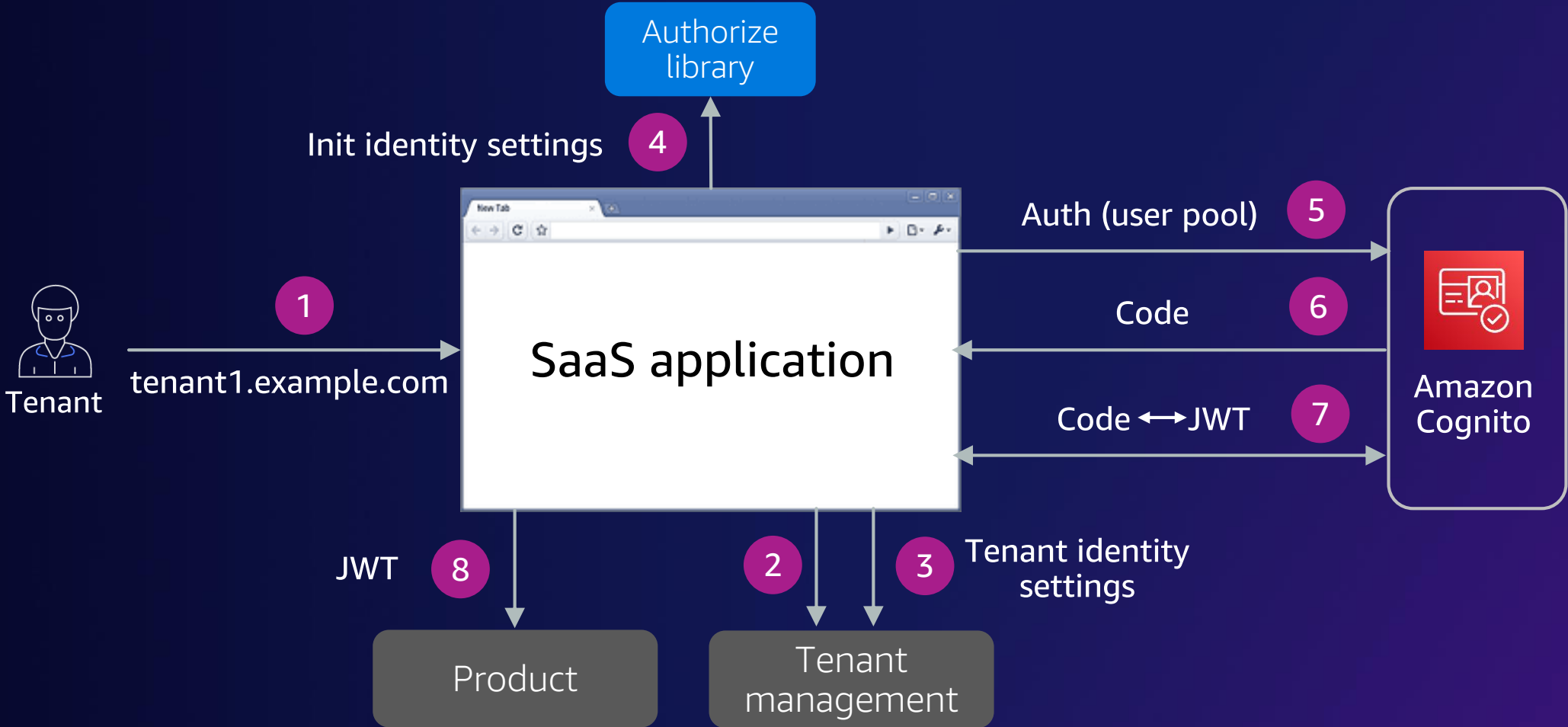




# Tenant-aware identity



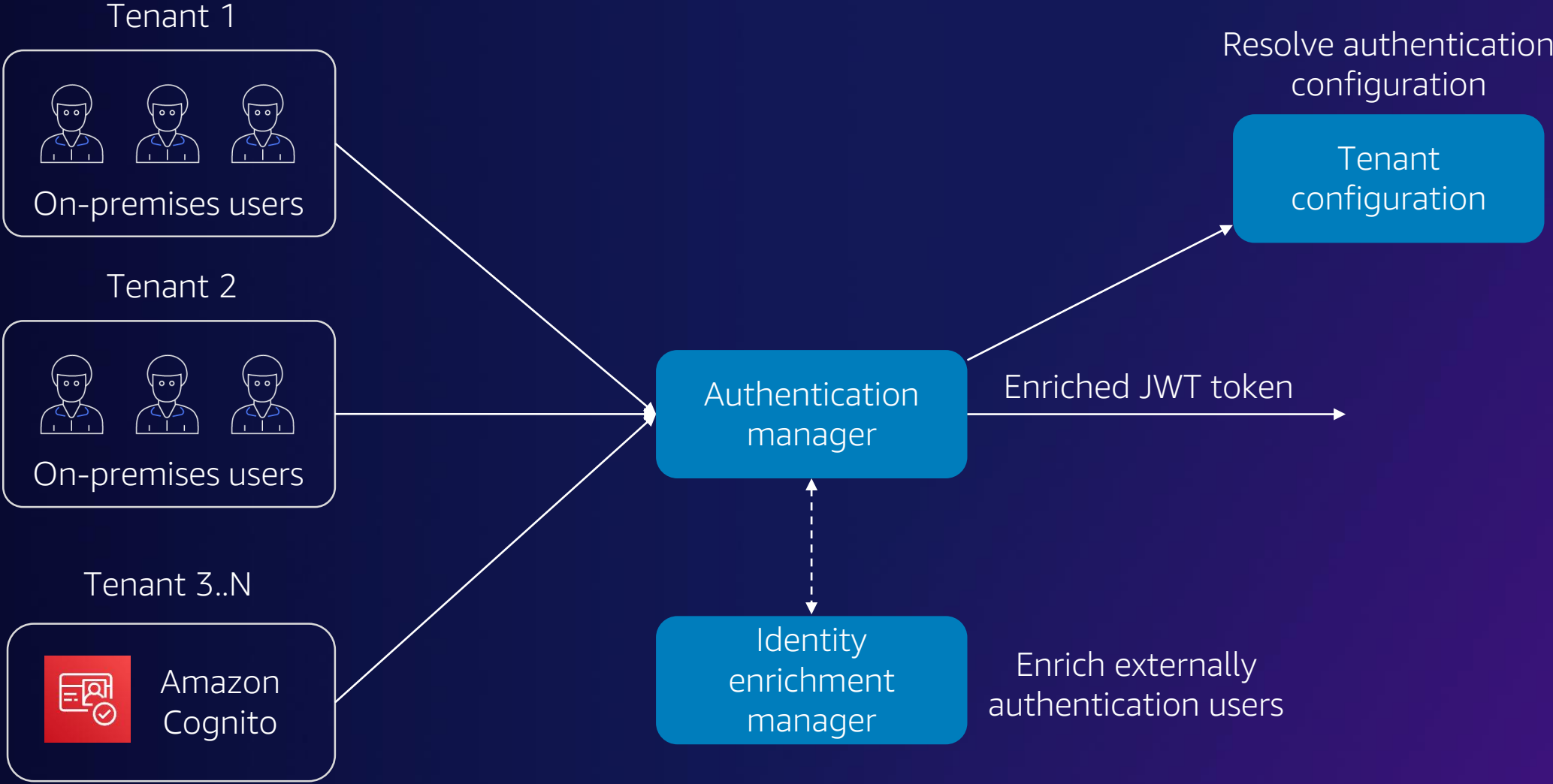
# Tenant-aware identity flow



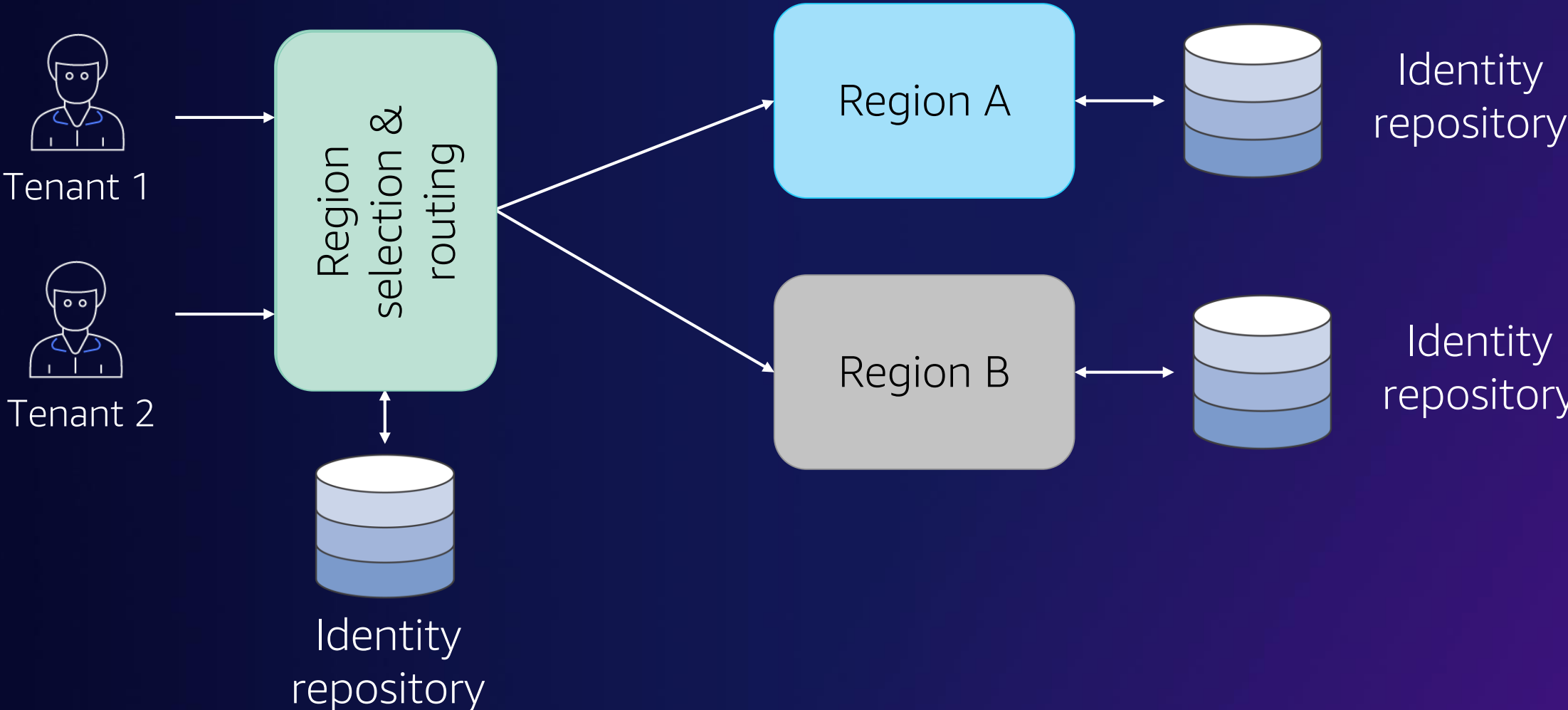
- Origin → company
- User pool mapping
- App ID



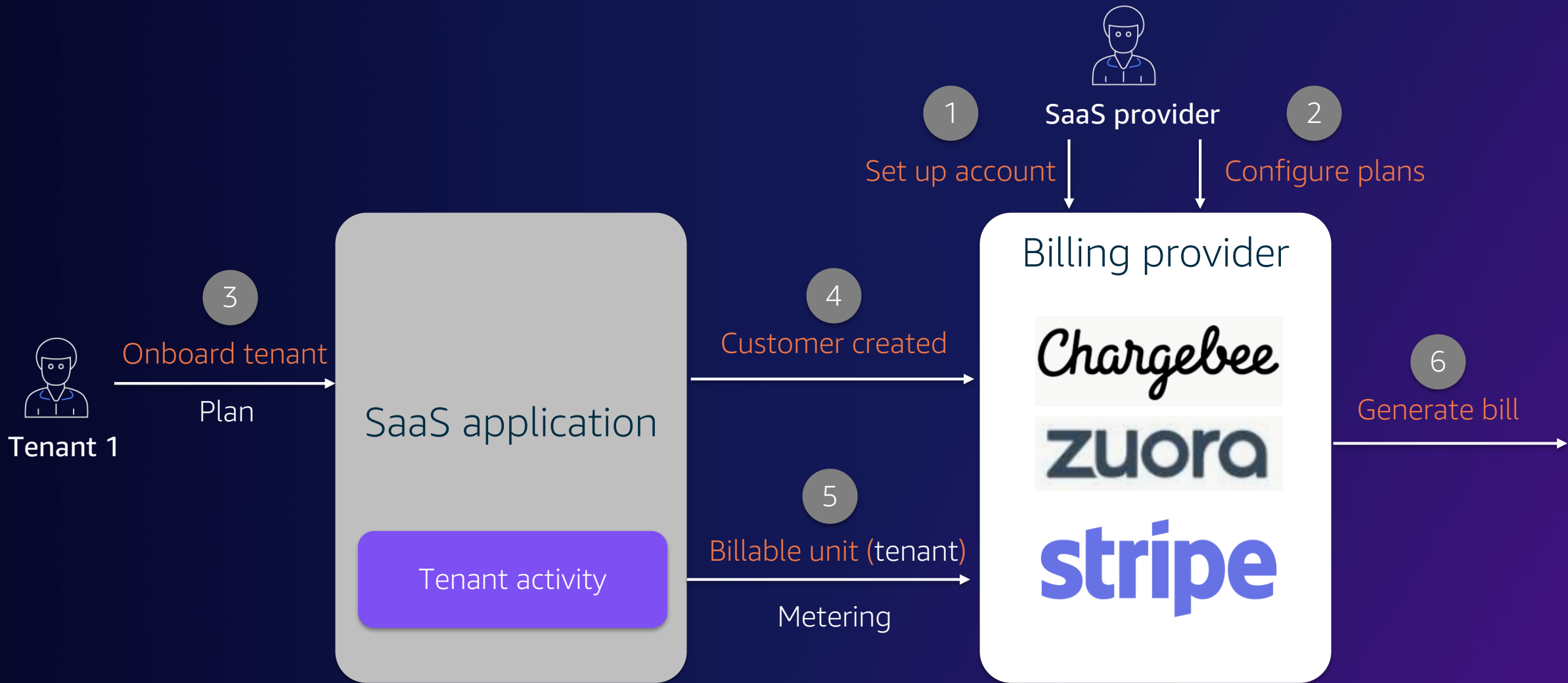
# Hybrid identity model



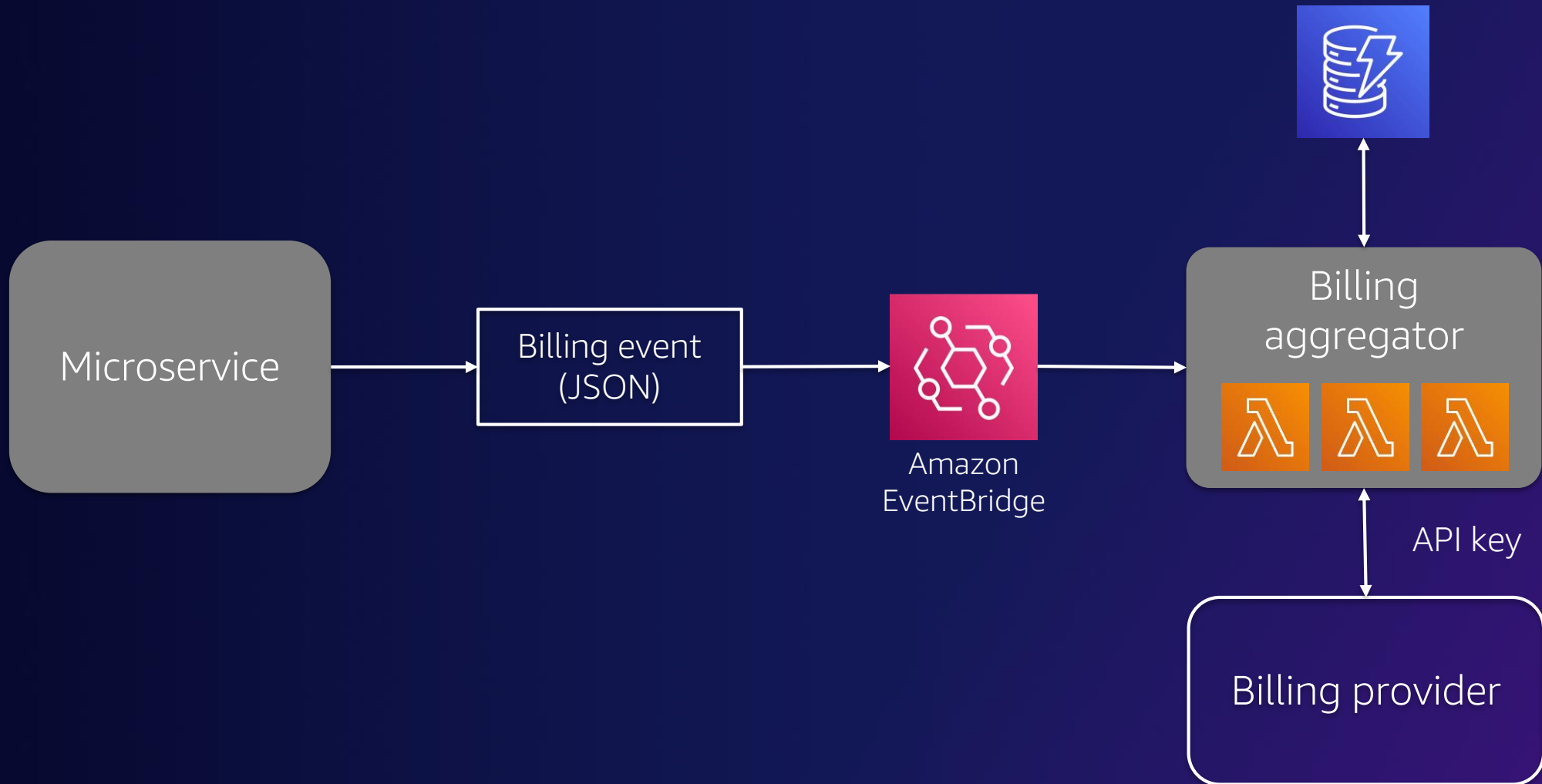
# Multi-Region identity



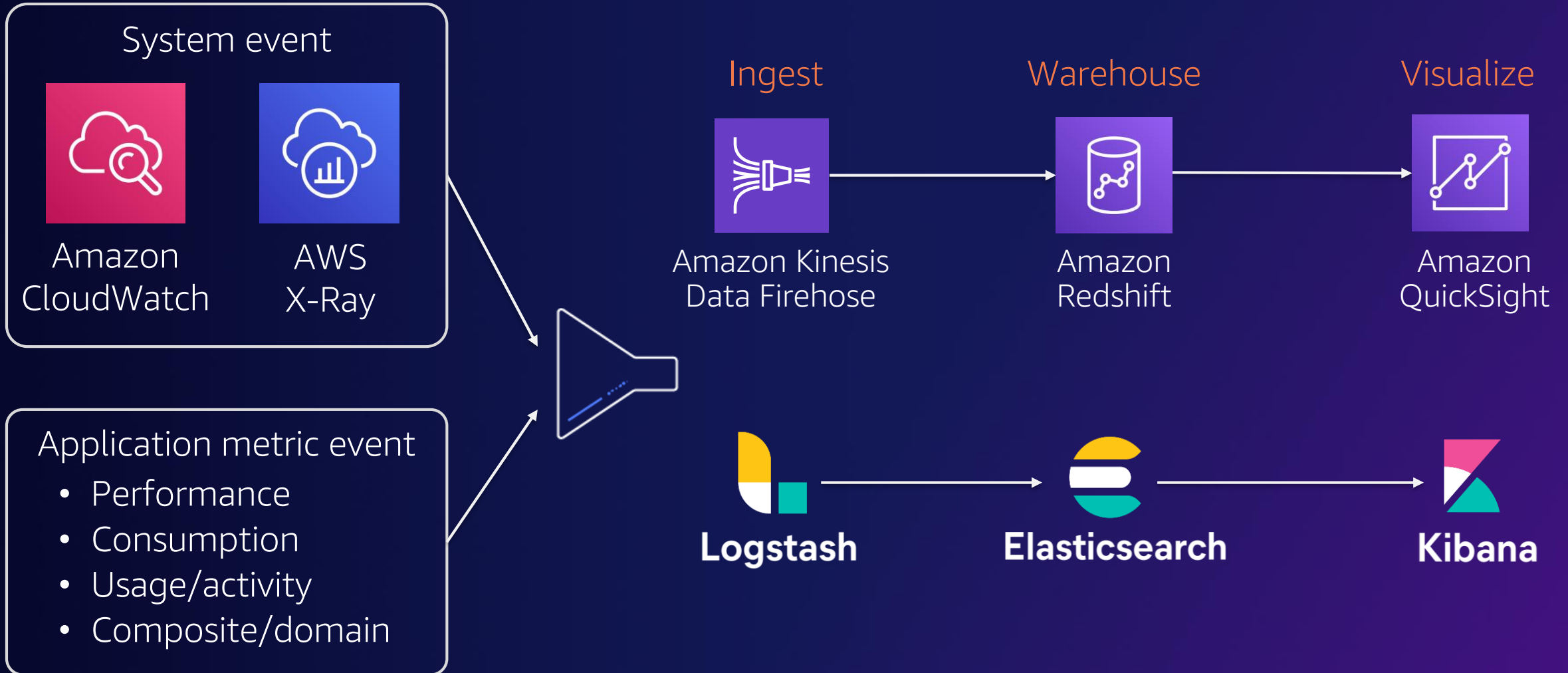
# Billing configuration and instrumentation



# Billable events



# Metrics instrumentation and aggregation



# Working with the open source community

LEVERAGE OPEN SOURCE WITH OUR MANAGED OBSERVABILITY SERVICES

Prometheus  Grafana

Kubernetes  cortex

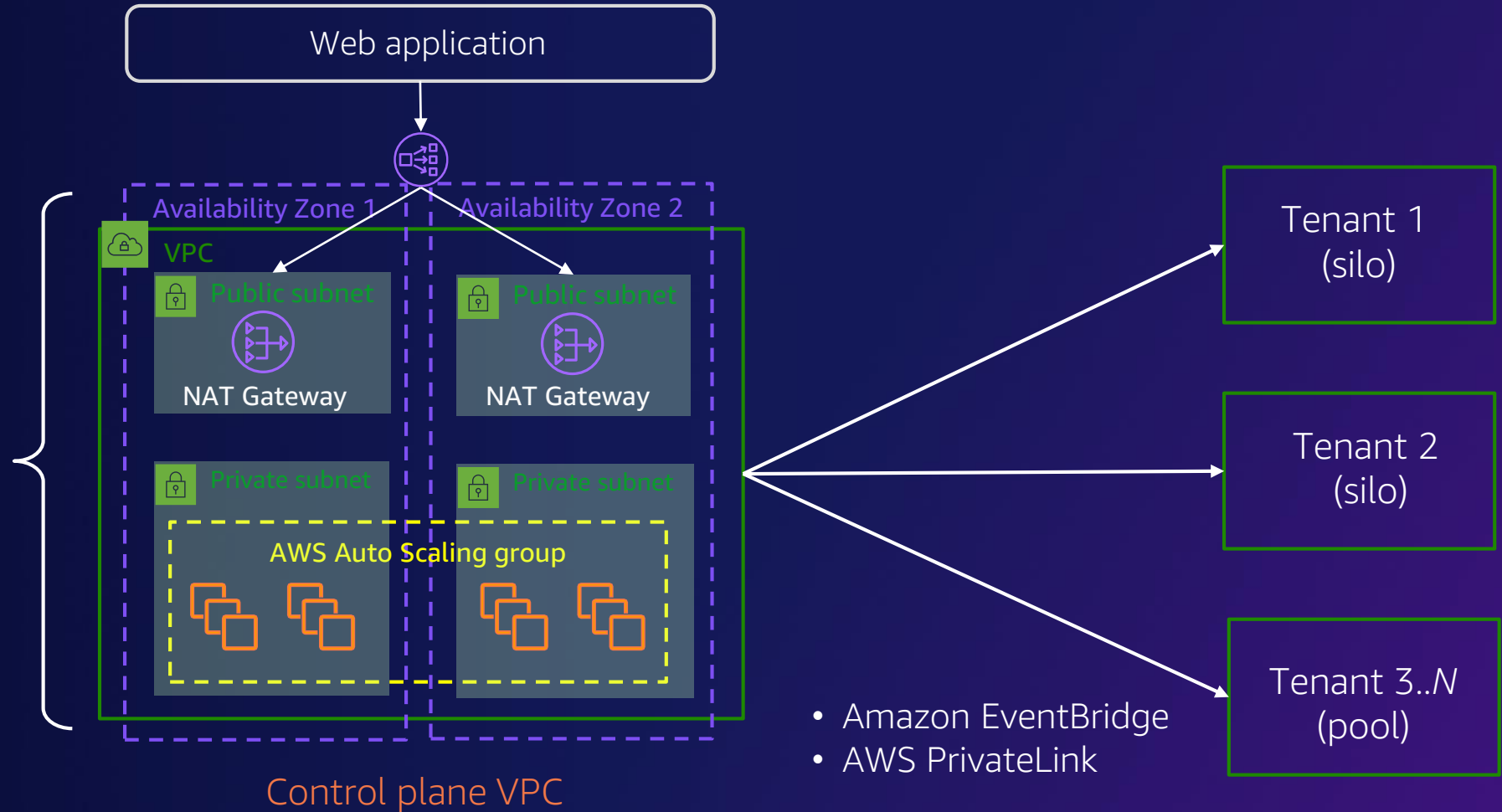
Cloud Native Computing Foundation





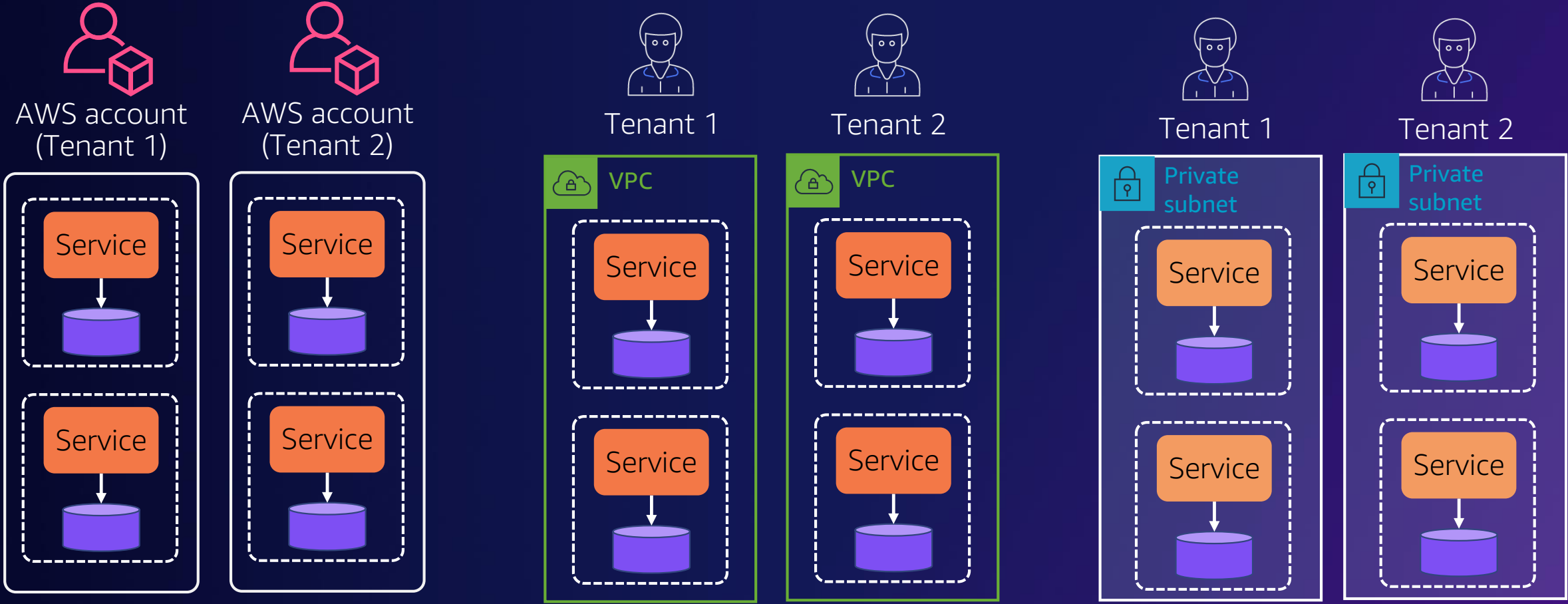
# Application plane integration

- Onboarding
- Identity
- Provisioning
- Management
- Metrics and analytics
- Tenant-aware logging
- Billing



# Application plane patterns

# Coarse-grained full stack silo



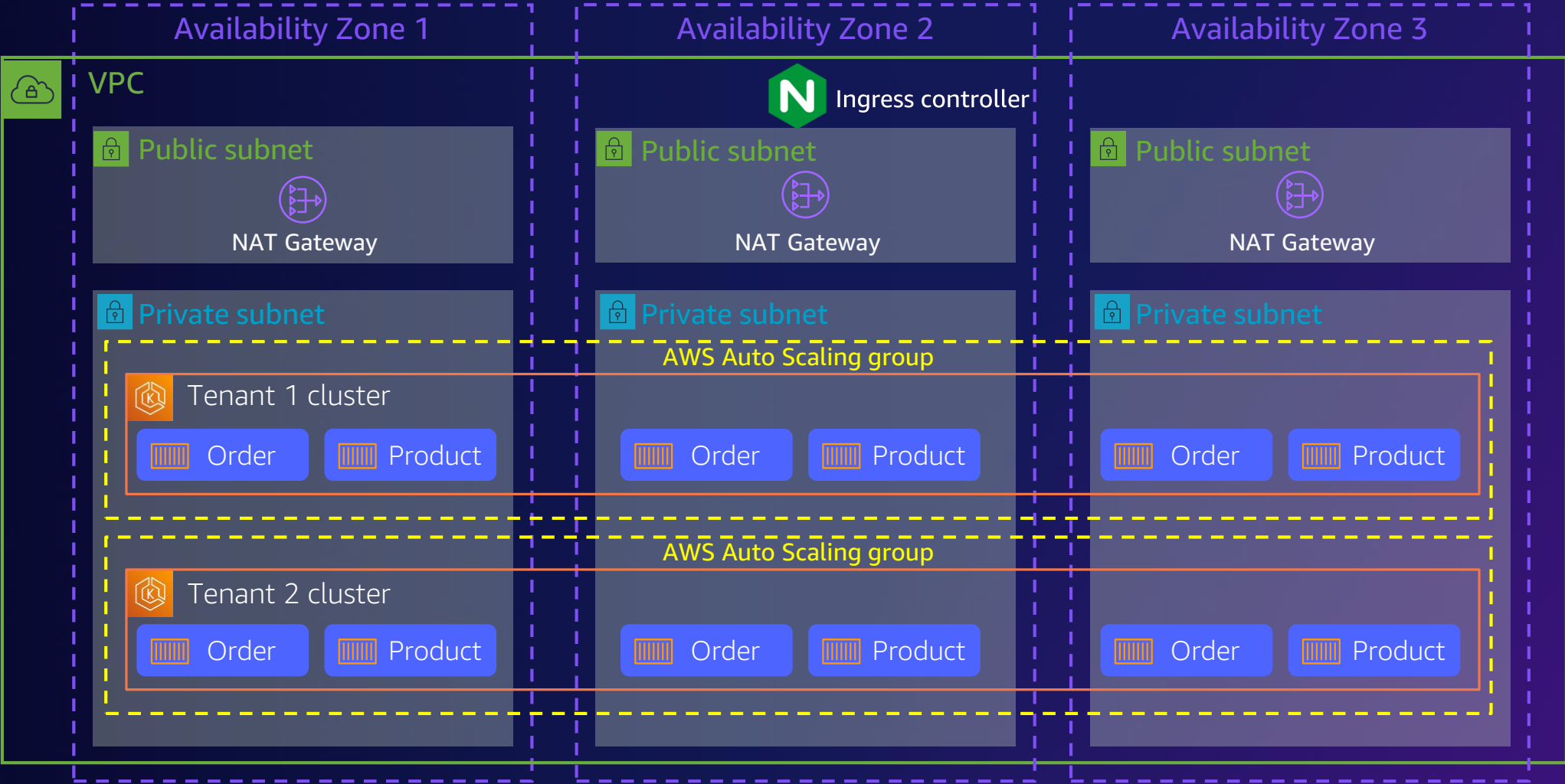
Account per tenant

VPC per tenant

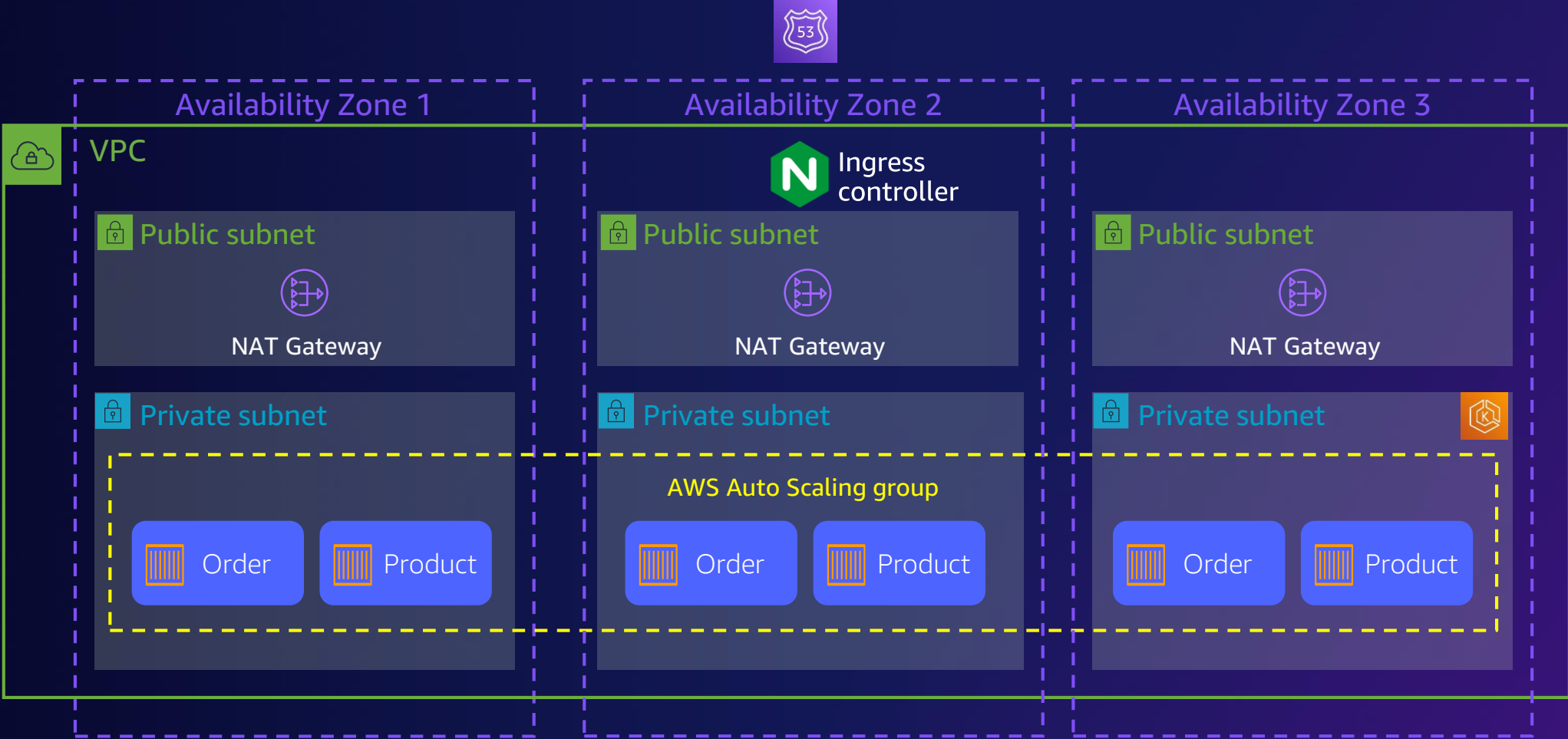
Subnet per tenant



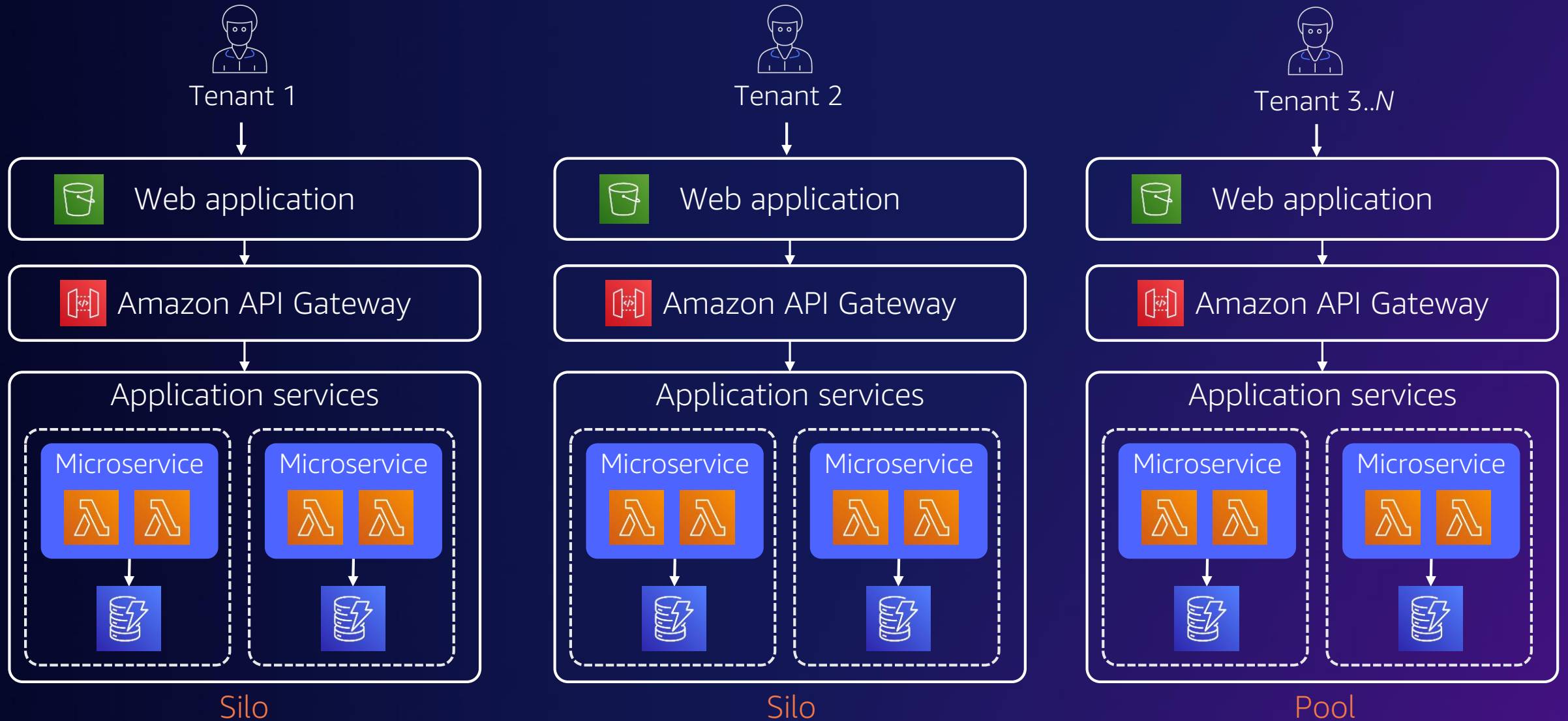
# Amazon EKS compute silo: Cluster per tenant



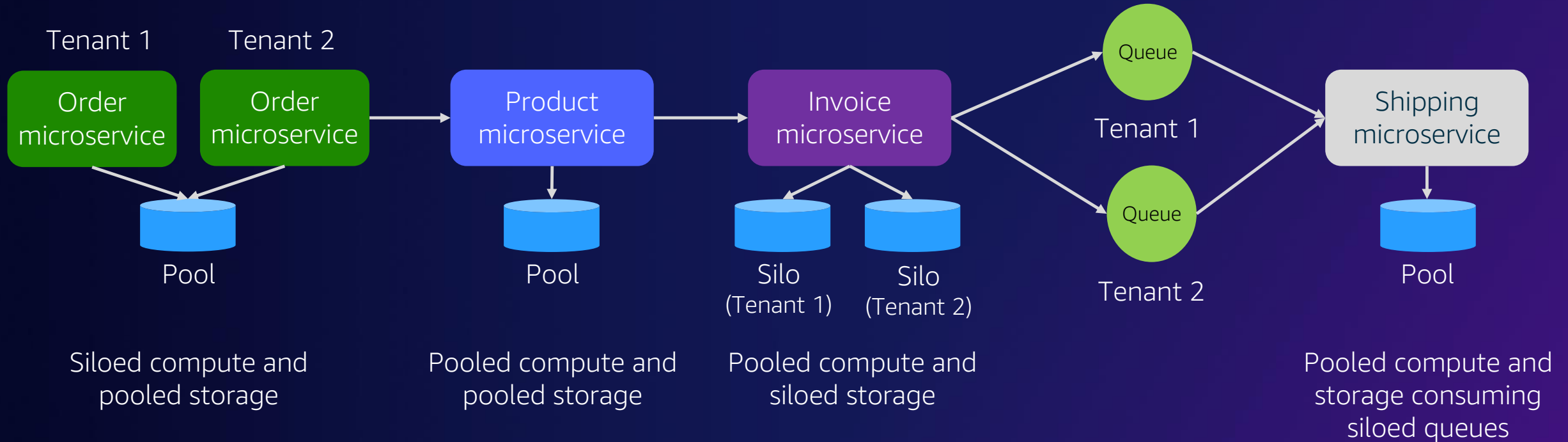
# EKS compute pool



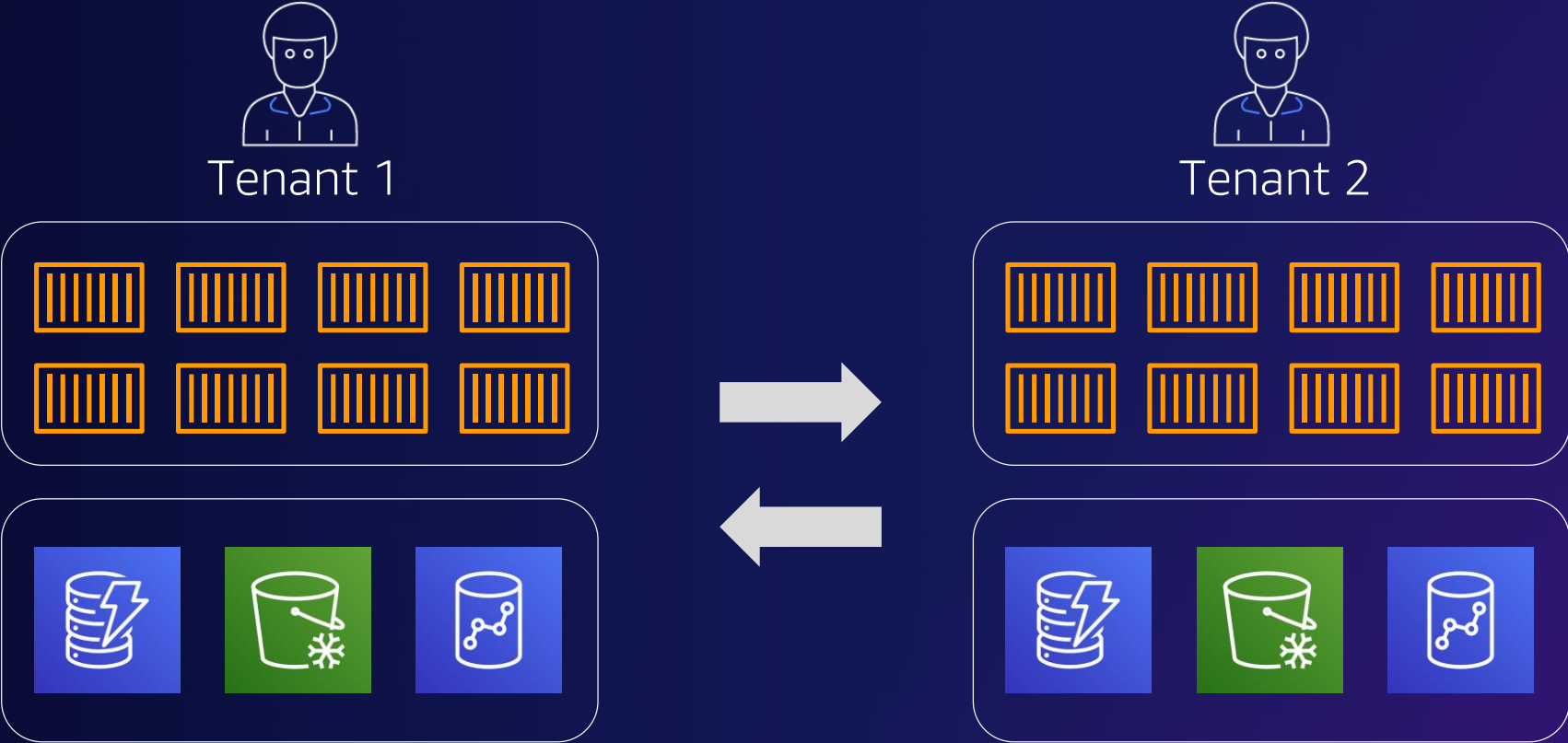
# Full-stack serverless silo and pool



# Resource-based silo and pool deployment



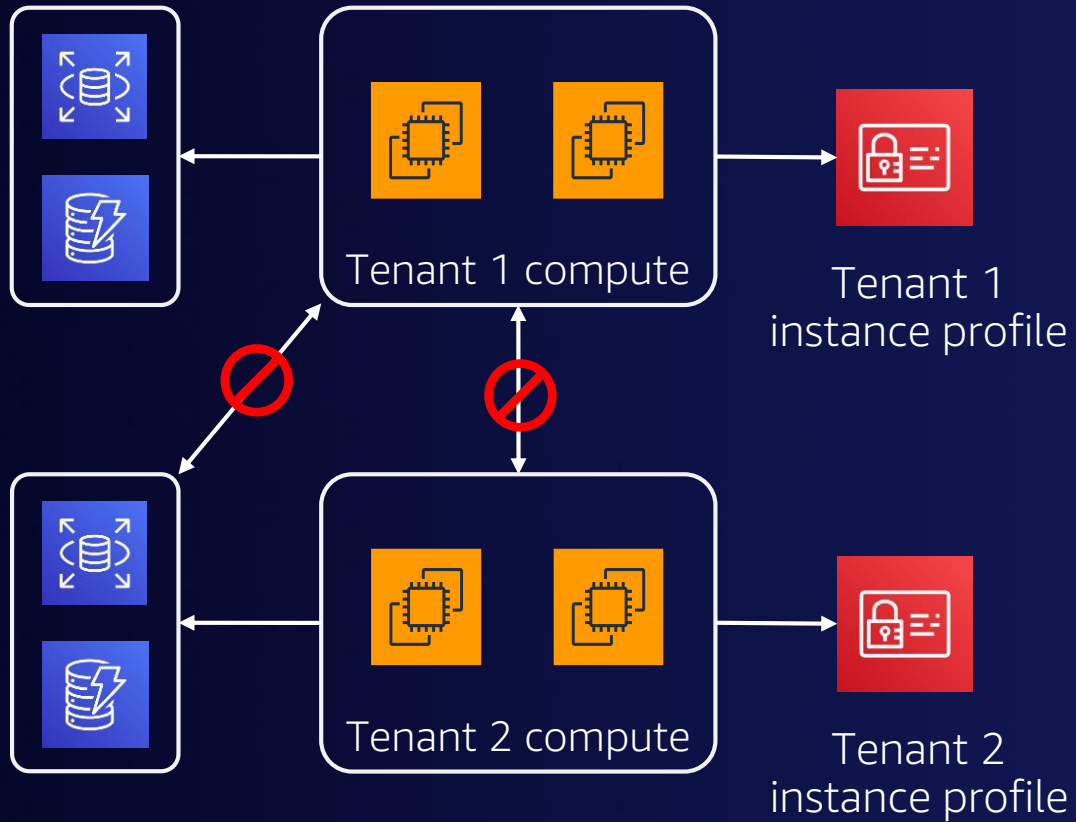
# Tenant isolation



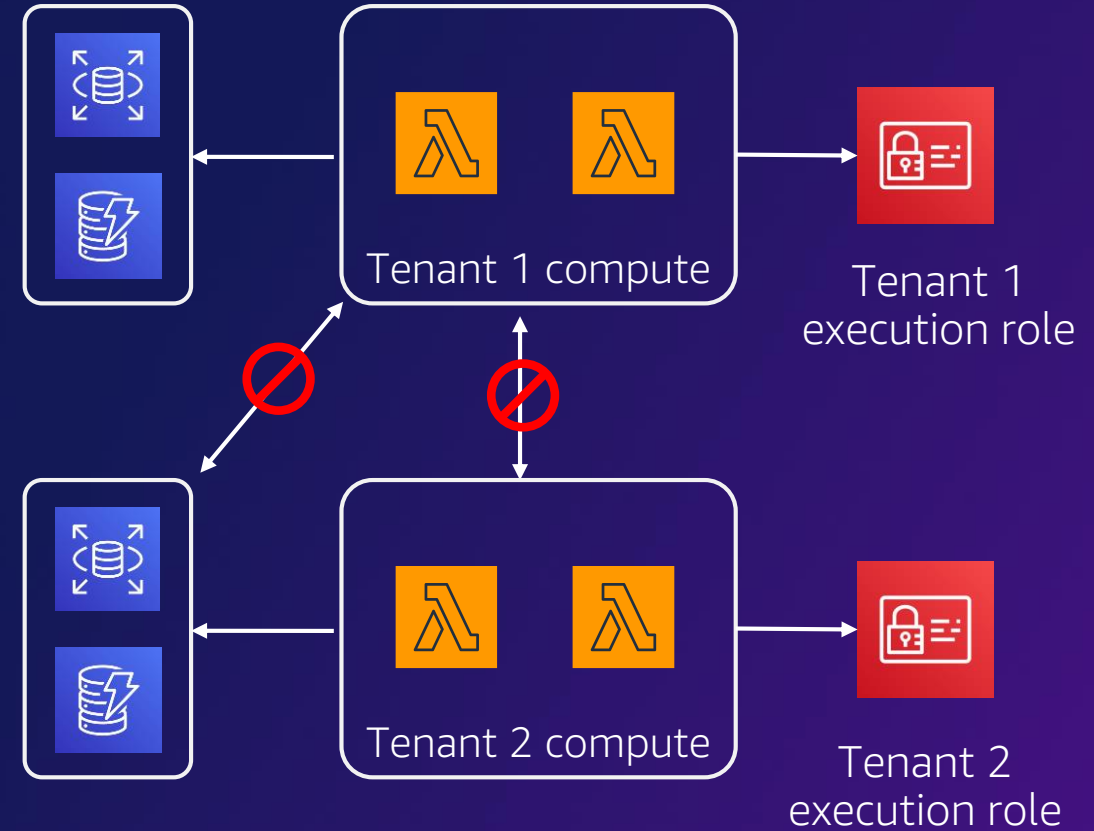


# Deployment-driven resource isolation (silo)

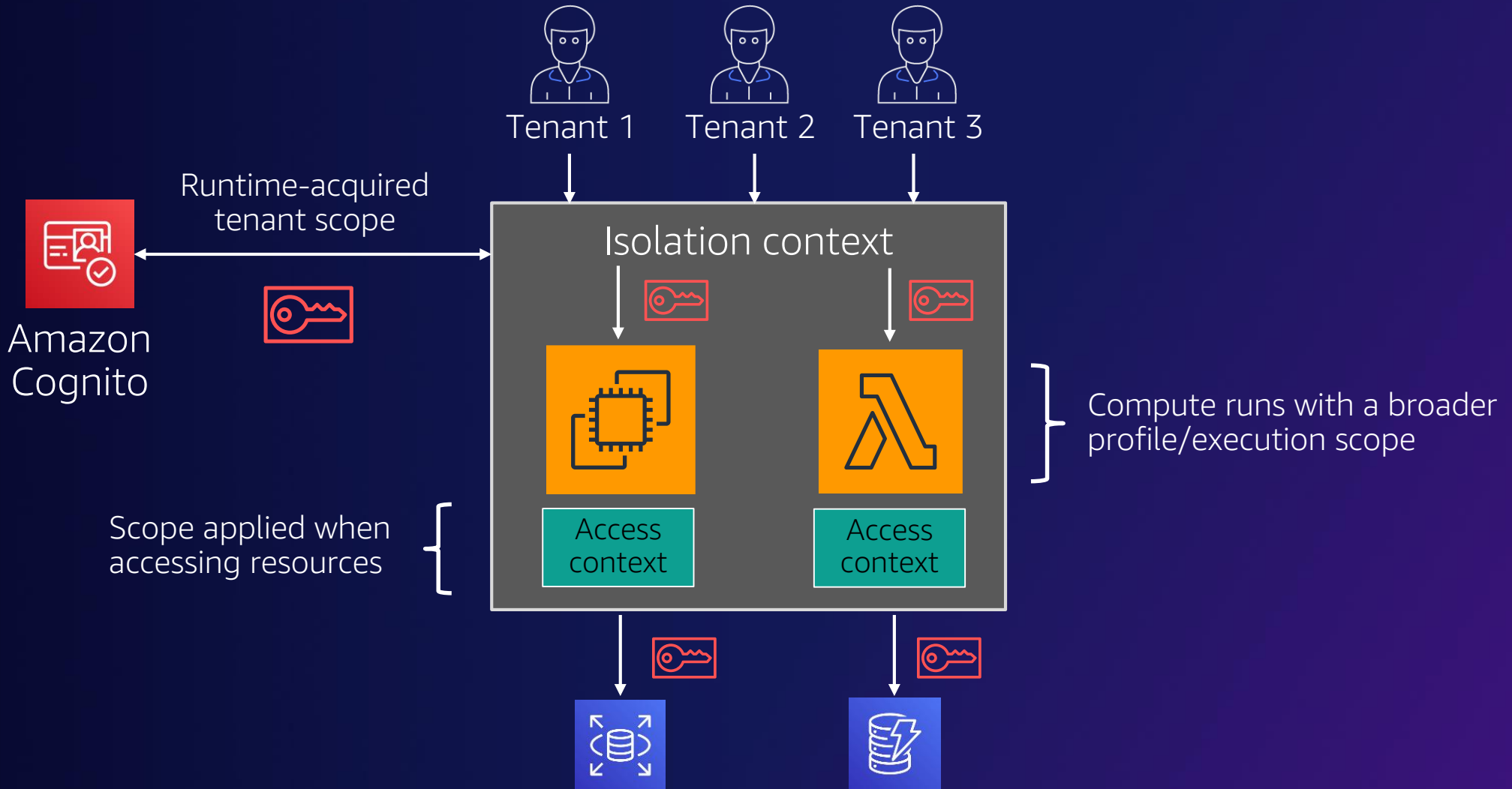
## Silo with Amazon EC2



## Silo with AWS Lambda



# Runtime enforced isolation



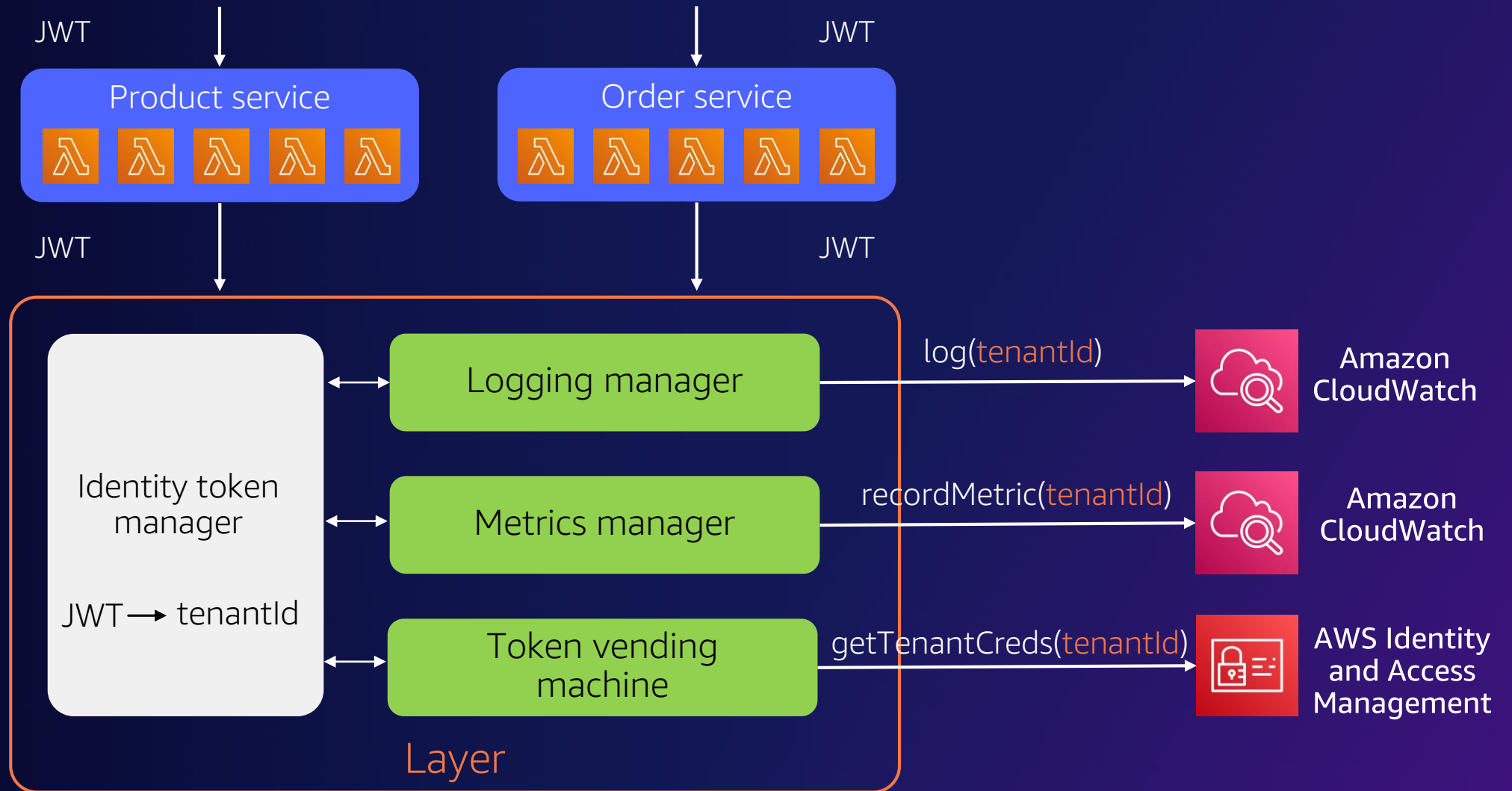
# Item-level isolation with Amazon DynamoDB

```
{
  "Sid": "TenantReadOnlyOrderTable",
  "Effect": "Allow",
  "Action": [
    "dynamodb:GetItem",
    "dynamodb:BatchGetItem",
    "dynamodb:Query",
    "dynamodb:DescribeTable"
  ],
  "Resource": [
    "arn:aws:dynamodb:[region]:table/Order"
  ],
  "Condition": {
    "ForAllValues:StringEquals": {
      "dynamodb:LeadingKeys": [
        "tenant1"
      ]
    }
  }
}
```

DynamoDB table

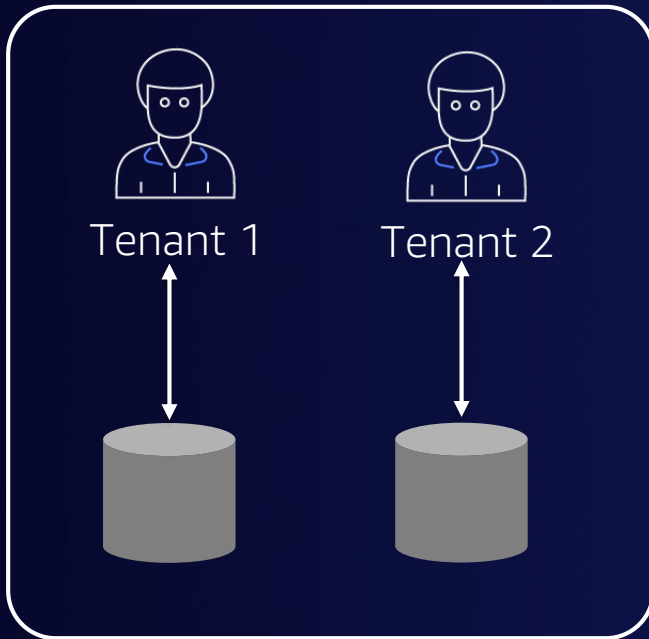
Partition key	SKU	Name
Tenant1	93529-94	Black t-shirt
Tenant2	24411-01	Blue hoodie
Tenant1	76235-92	Wool socks
Tenant3	95419-37	Green polo
Tenant2	88314-99	White hat
Tenant1	24598-72	Tennis shoes

# Multi-tenant microservice libraries

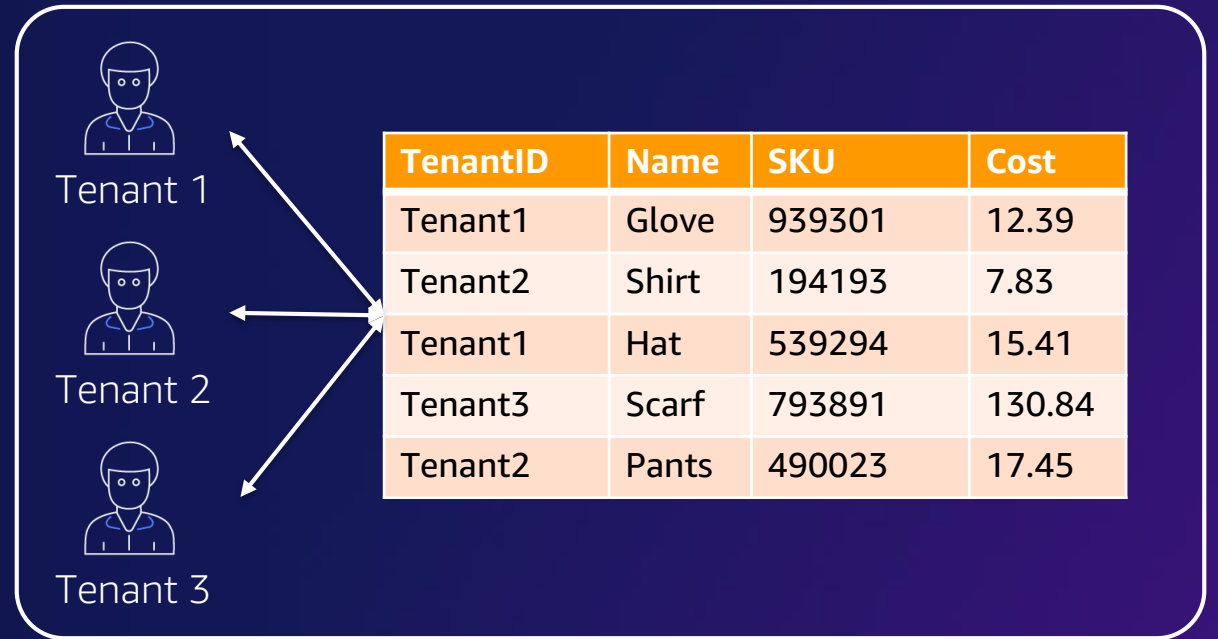


# Data partitioning

Silo model

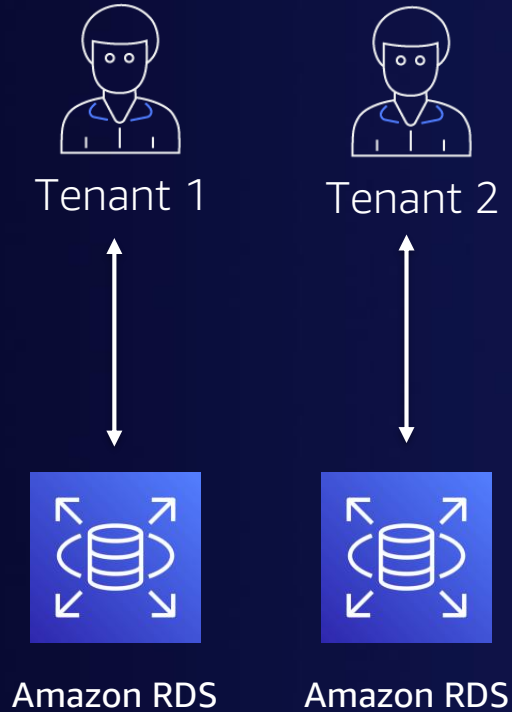


Pool model



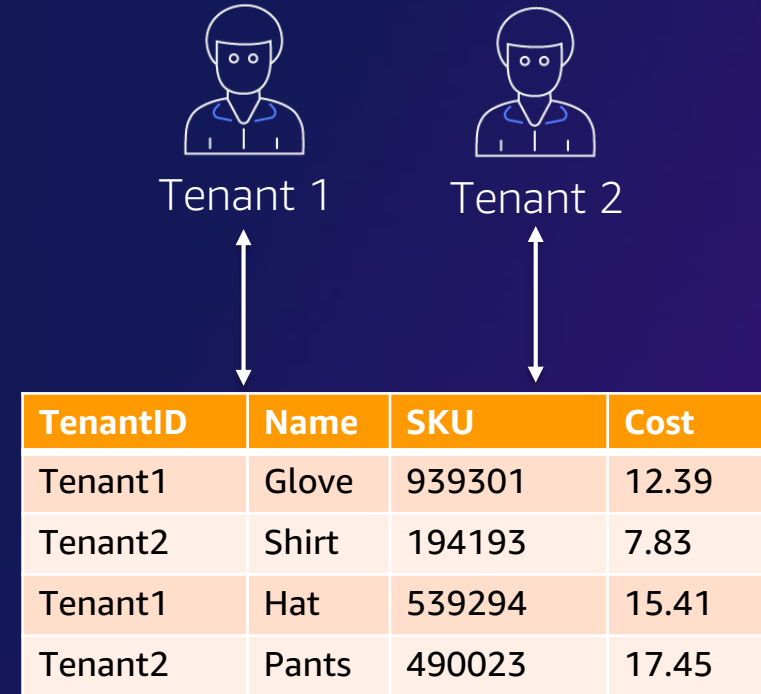
# Data partitioning with Amazon RDS

## Silo model



Separate instance/database per tenant

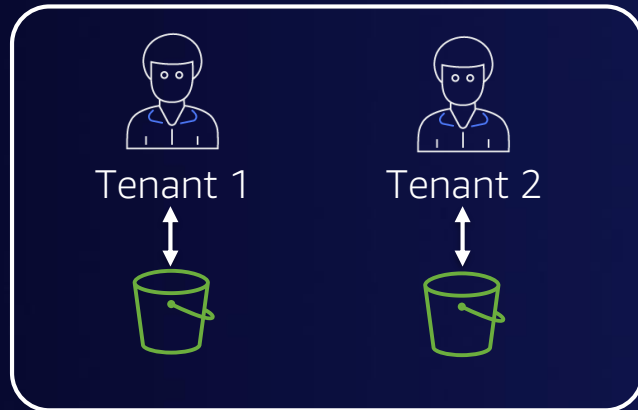
## Pool model



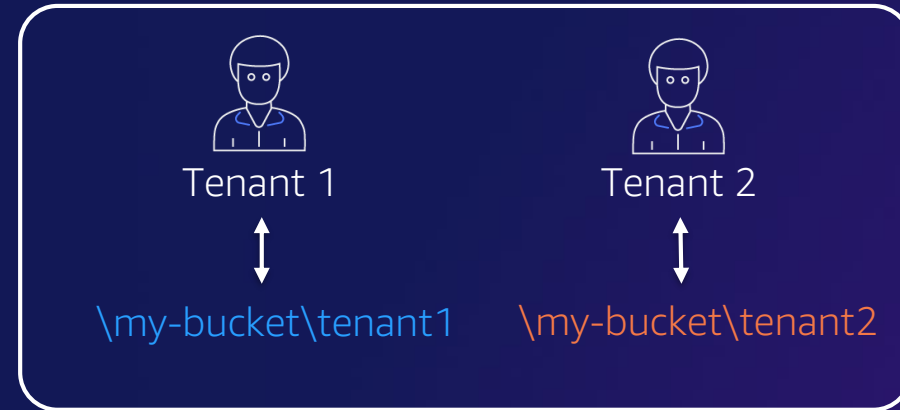
One database with tenant-indexed data

# Data partitioning with Amazon S3

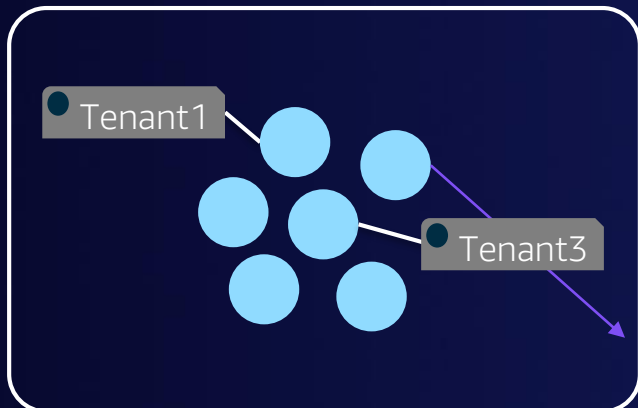
Bucket per tenant



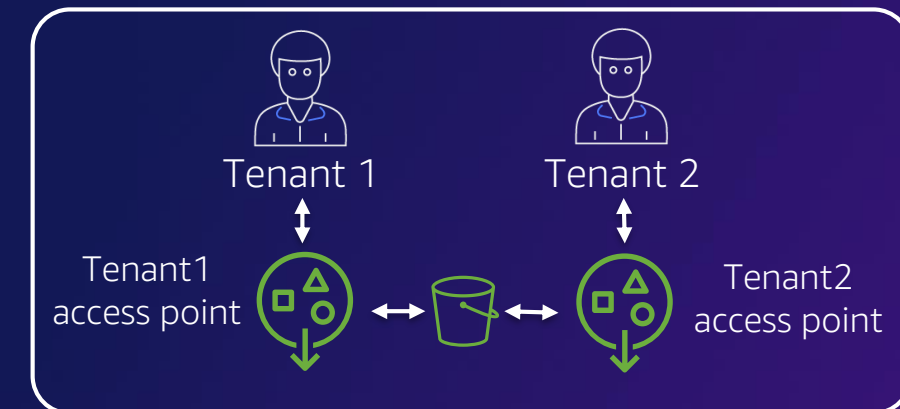
Prefix per tenant



Tag per tenant

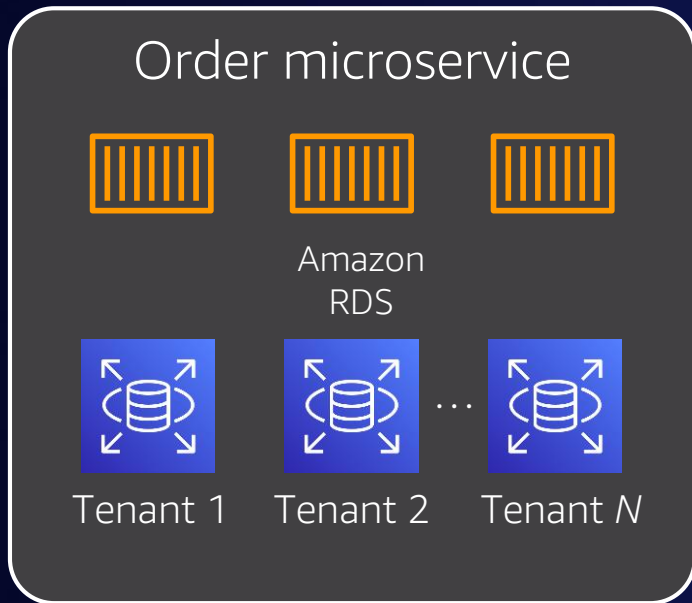


Access point per tenant

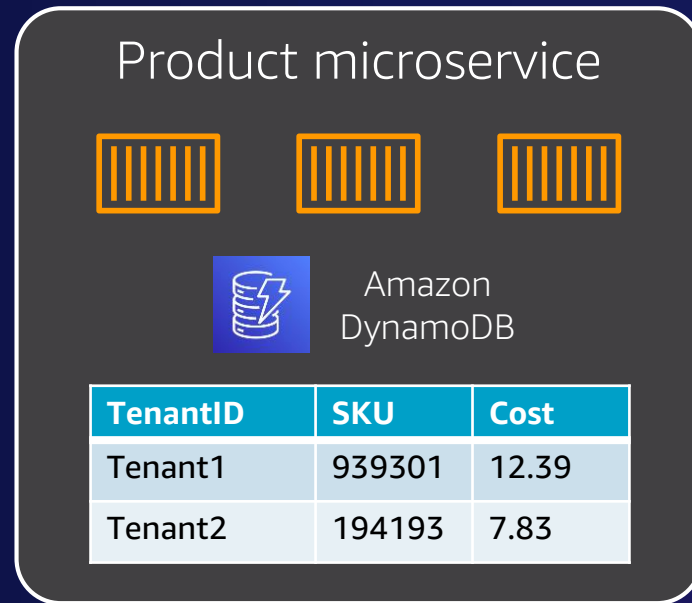


# Domain-driven data partitioning

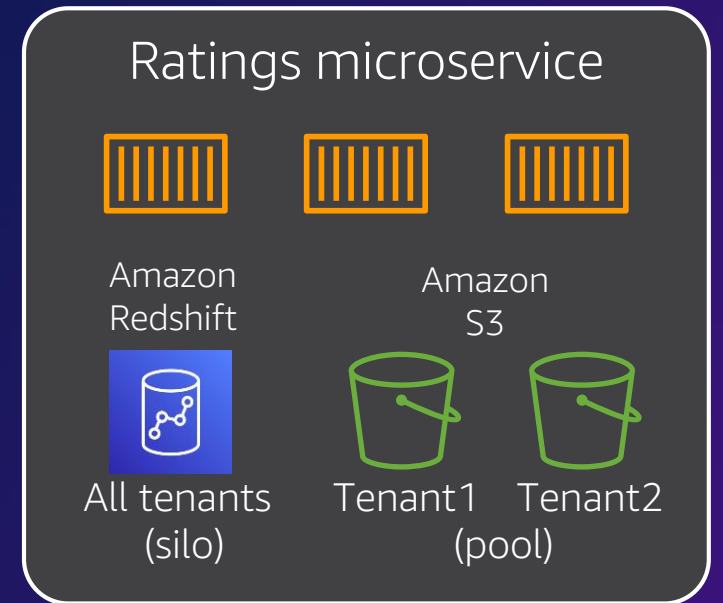
Partitioning and isolation strategy should be decided on a service-by-service basis



Database per tenant (silo)



Shared database for all tenants (pool)



Mixed mode – silo and pool models



# Takeaways

- There's no universal SaaS blueprint
- Multi-tenancy does not require shared infrastructure
- Control plane services are essential to SaaS agility and innovation
- Each AWS stack/service may require a unique approach
- Silo and pool can be applied at the resource/microservice level
- Tiering, performance, and noisy neighbor will shape how and where you apply these patterns
- Find the combination of patterns that best matches your needs

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# Thank you!

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