Deploying ECS Applications using Ansible and CloudFormation

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Introduction

ECS System Resources

- CPU and Memory
- Port Mappings

ECS CloudFormation Resources

- ECS cluster
- ECS task definitions
- ECS services

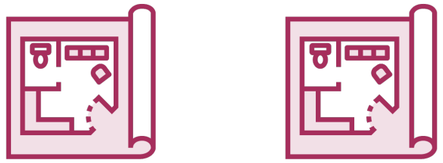
Stack Deployment

- Deploying to AWS
- Troubleshooting deployment issues

ECS System Resources

Microtrader Application Stack

ECS Task Definitions



Route 53 Private DNS

dev-microtrader.dockerproductionaws.org

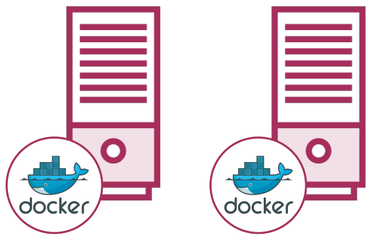
Public Load Balancer
(Internet Facing)

Dashboard Endpoint

Portfolio Service

Audit Service

Dashboard Service



Autoscaling Group

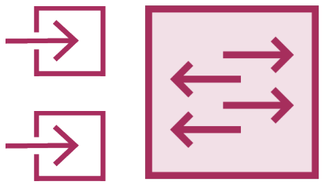
Quote Service

ECS Cluster

Application Load Balancer
(Internal)

Audit Endpoint

Quote Endpoint

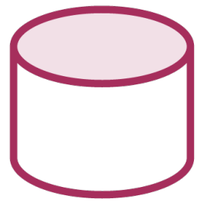


CloudWatch Log Groups

System Logs

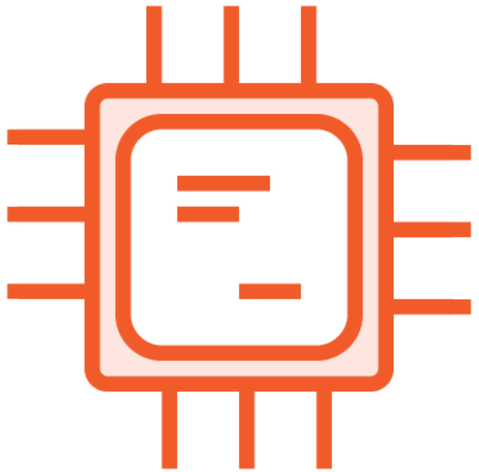
Container Logs

RDS Instance

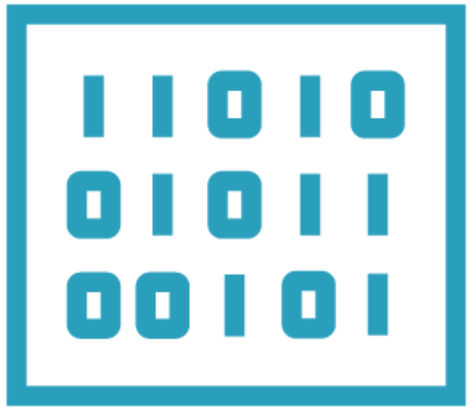


Audit Database

ECS System Resources



CPU

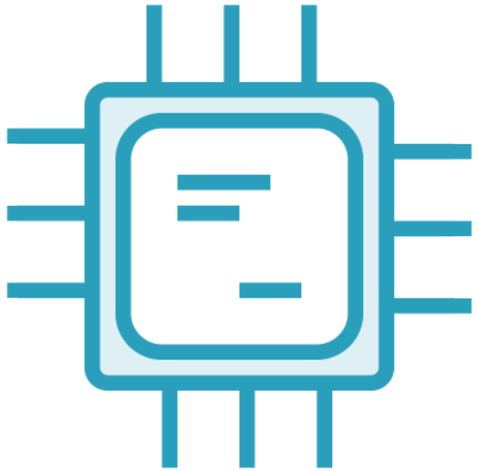


Memory

Port Mappings

ECS CPU Reservations

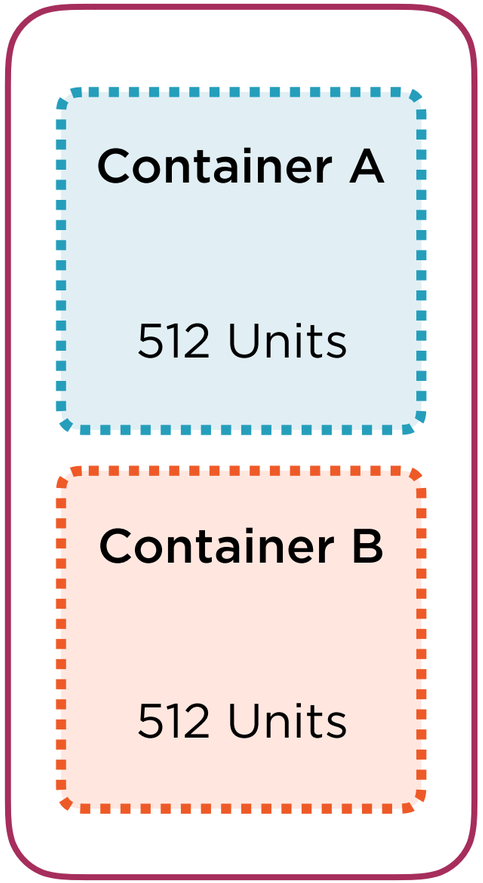
CPU Units



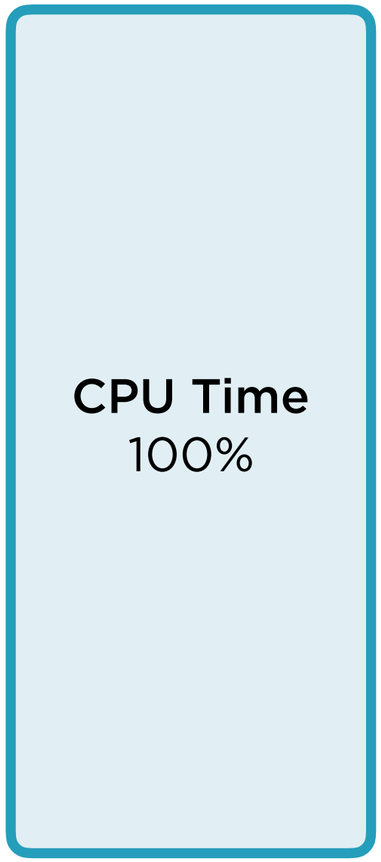
1024 Units per Core

Used under CPU Load

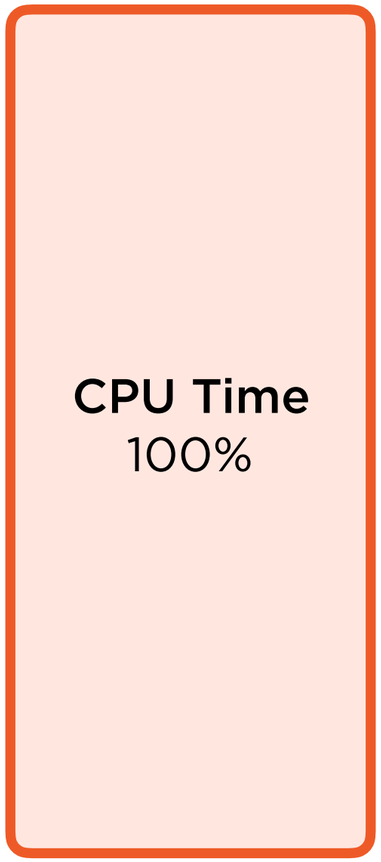
ECS CPU Resource Allocation



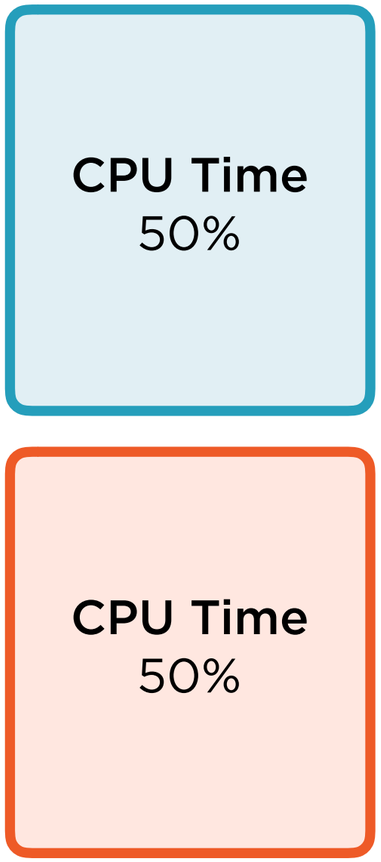
ECS Container Instance
(Single Core - 1024 Units)



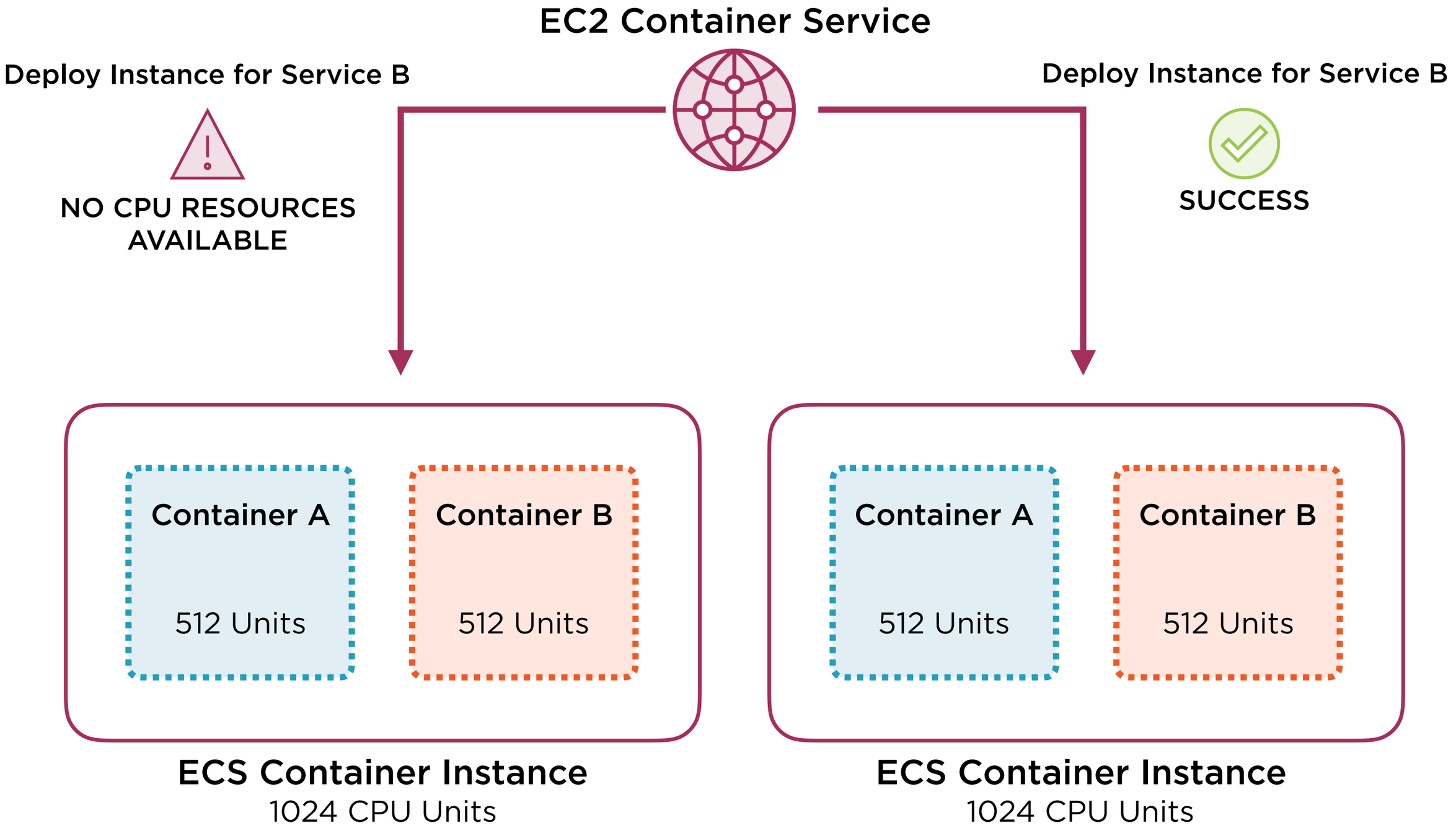
Scenario 1
Container A Busy
Container B Idle

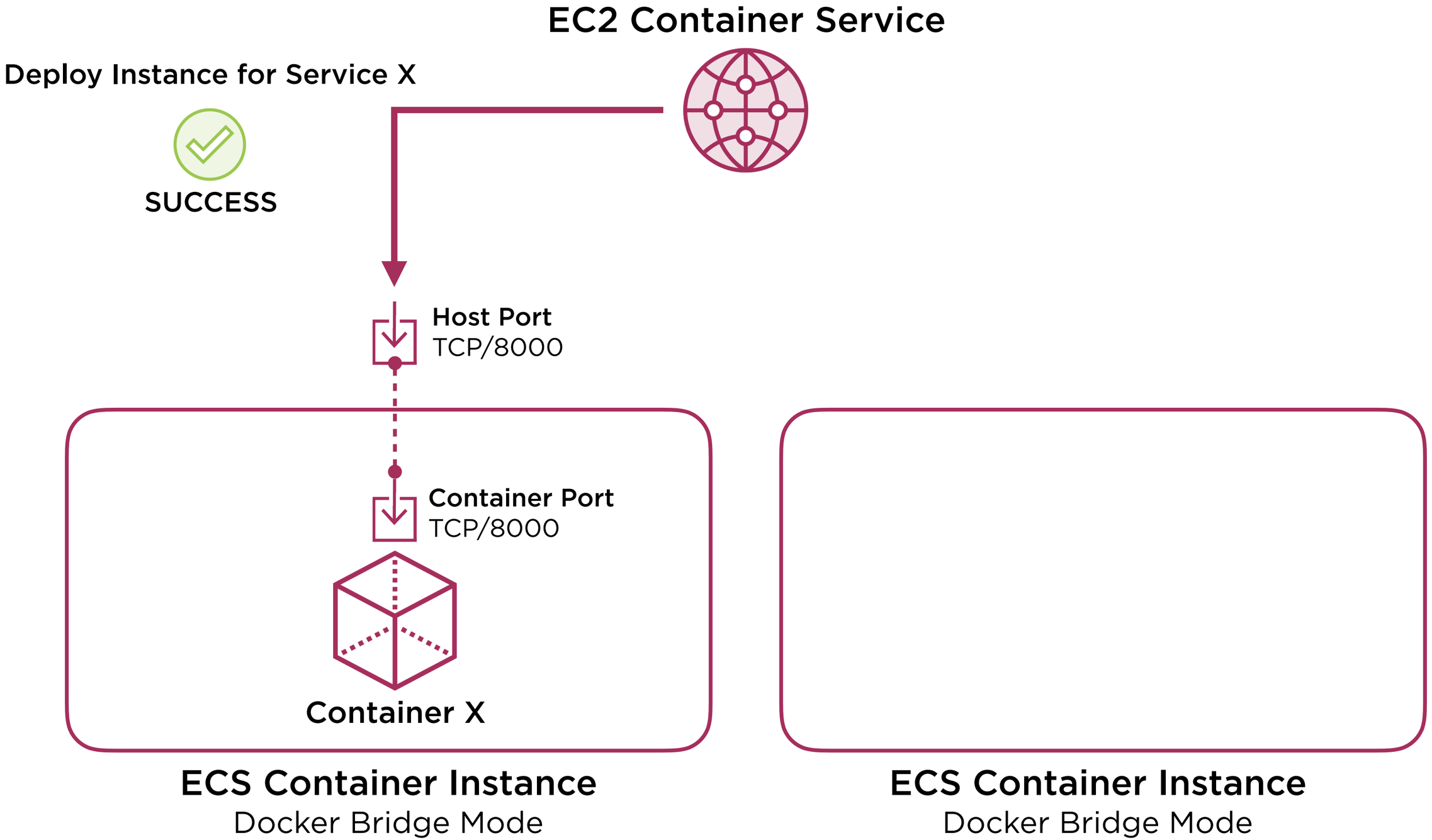


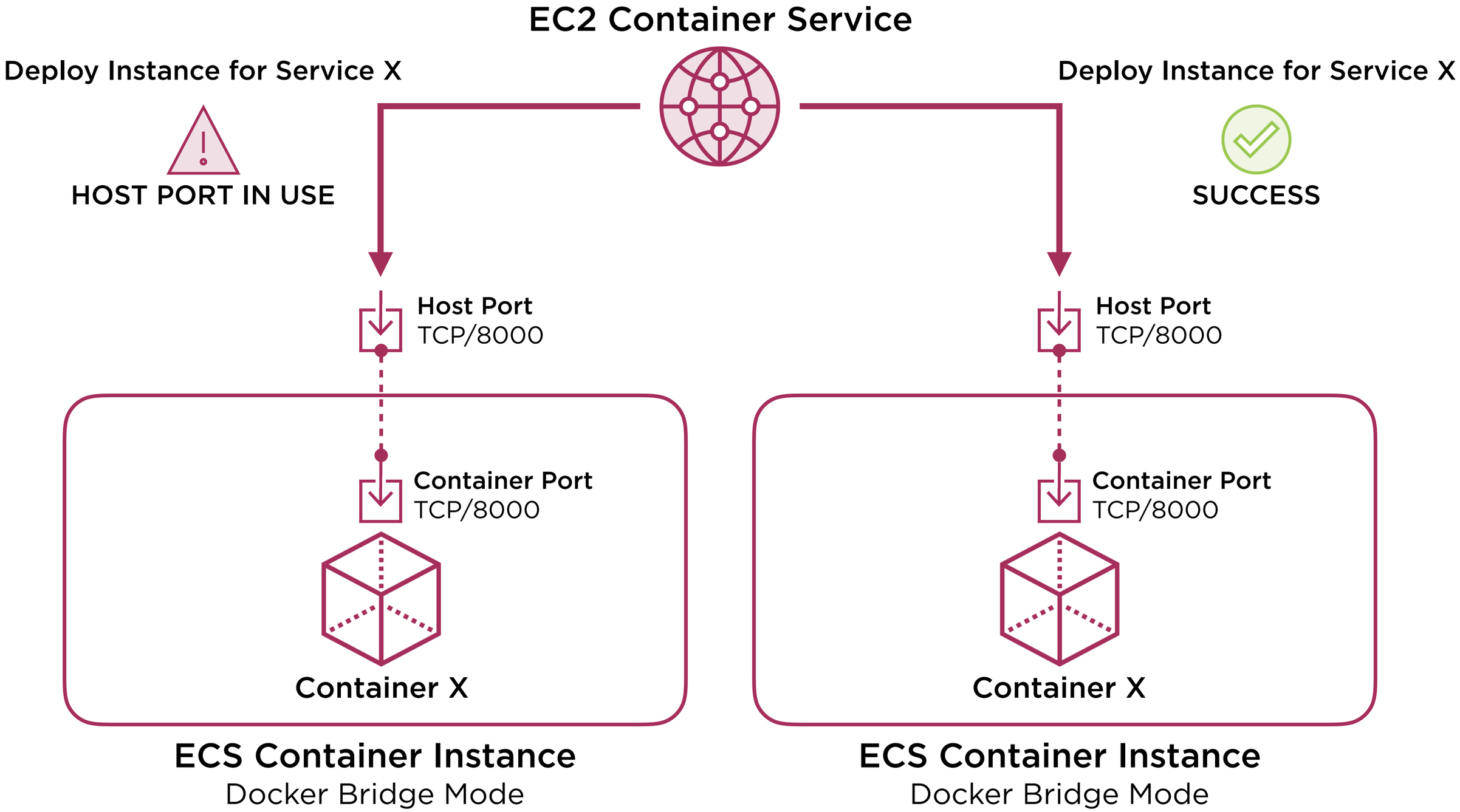
Scenario 2
Container A Idle
Container B Busy

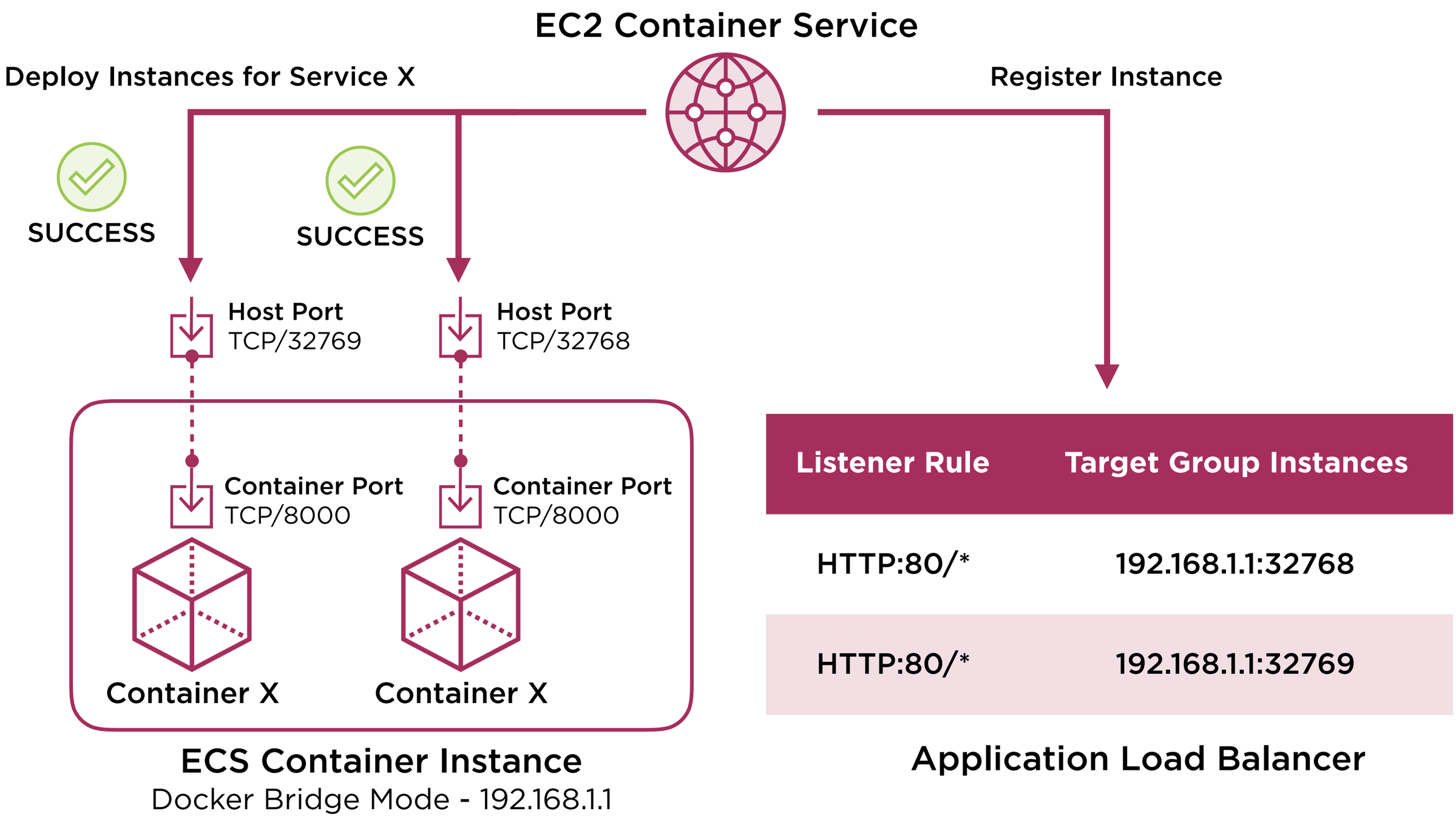


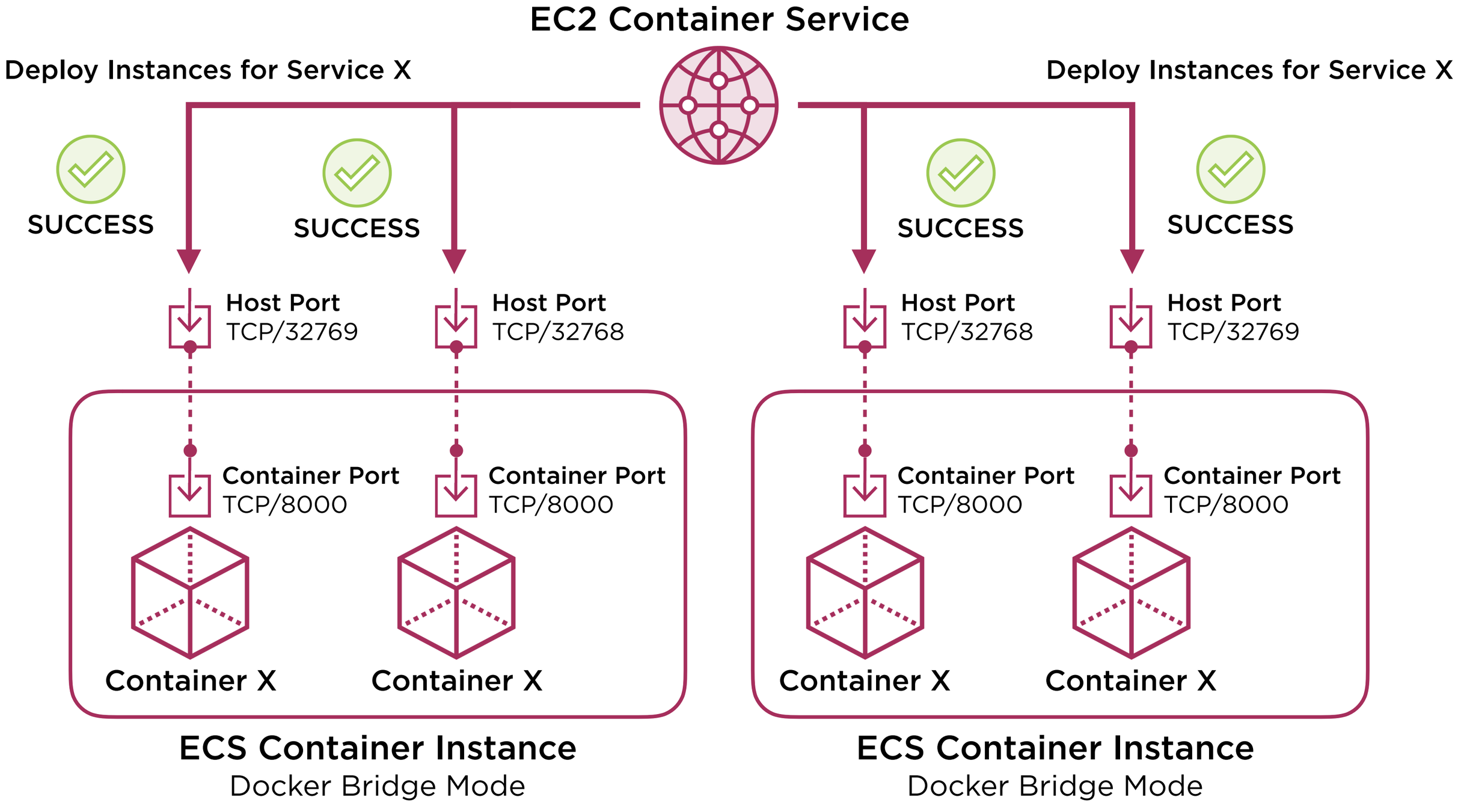
Scenario 3
Container A Busy
Container B Busy

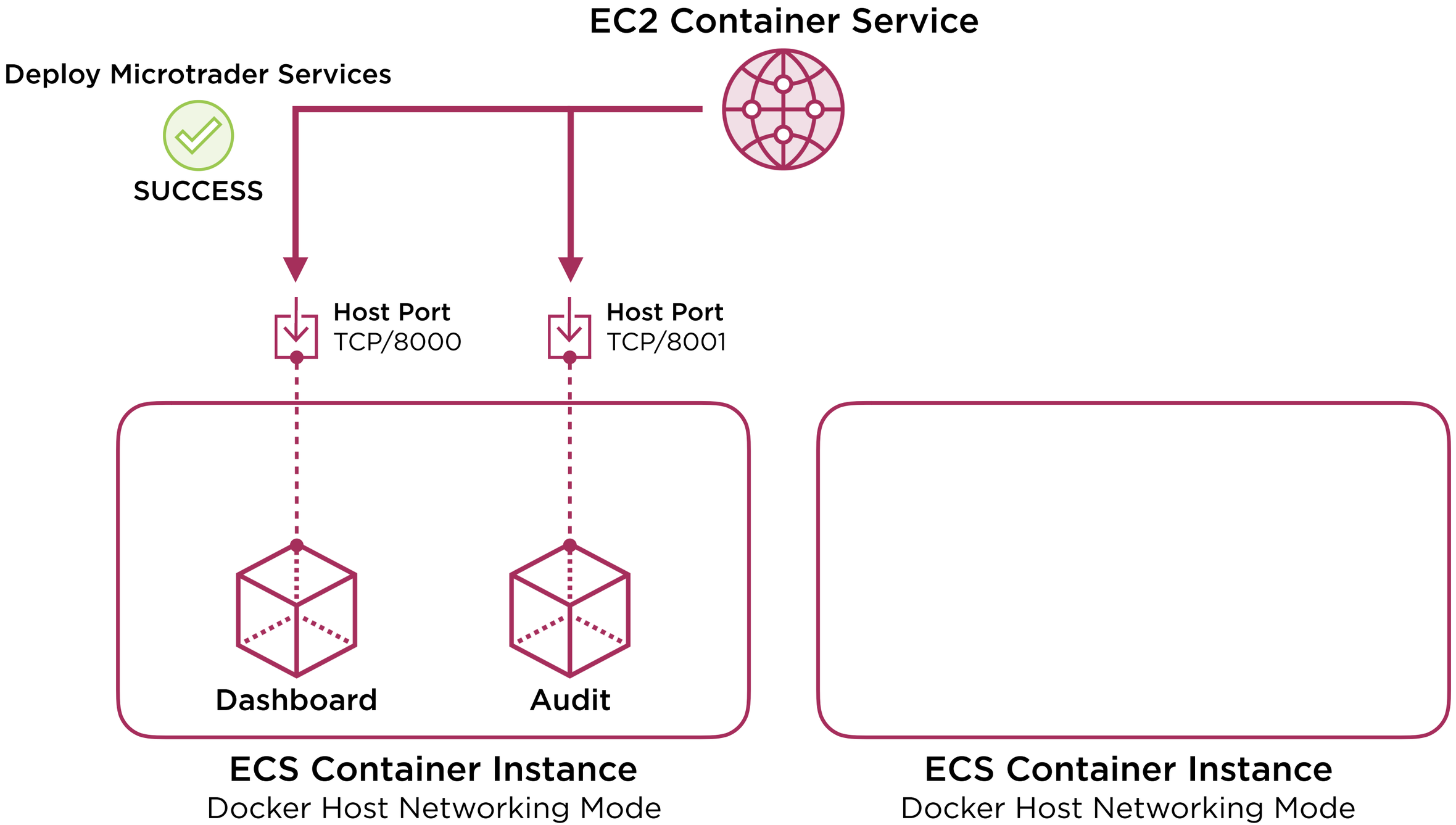

EC2 Container Service
Deploy Instance for Service B
NO CPU RESOURCES AVAILABLE
Deploy Instance for Service B
SUCCESS
Container A
512 Units
Container B
512 Units
ECS Container Instance
1024 CPU Units
Container A
512 Units
Container B
512 Units
ECS Container Instance
1024 CPU Units

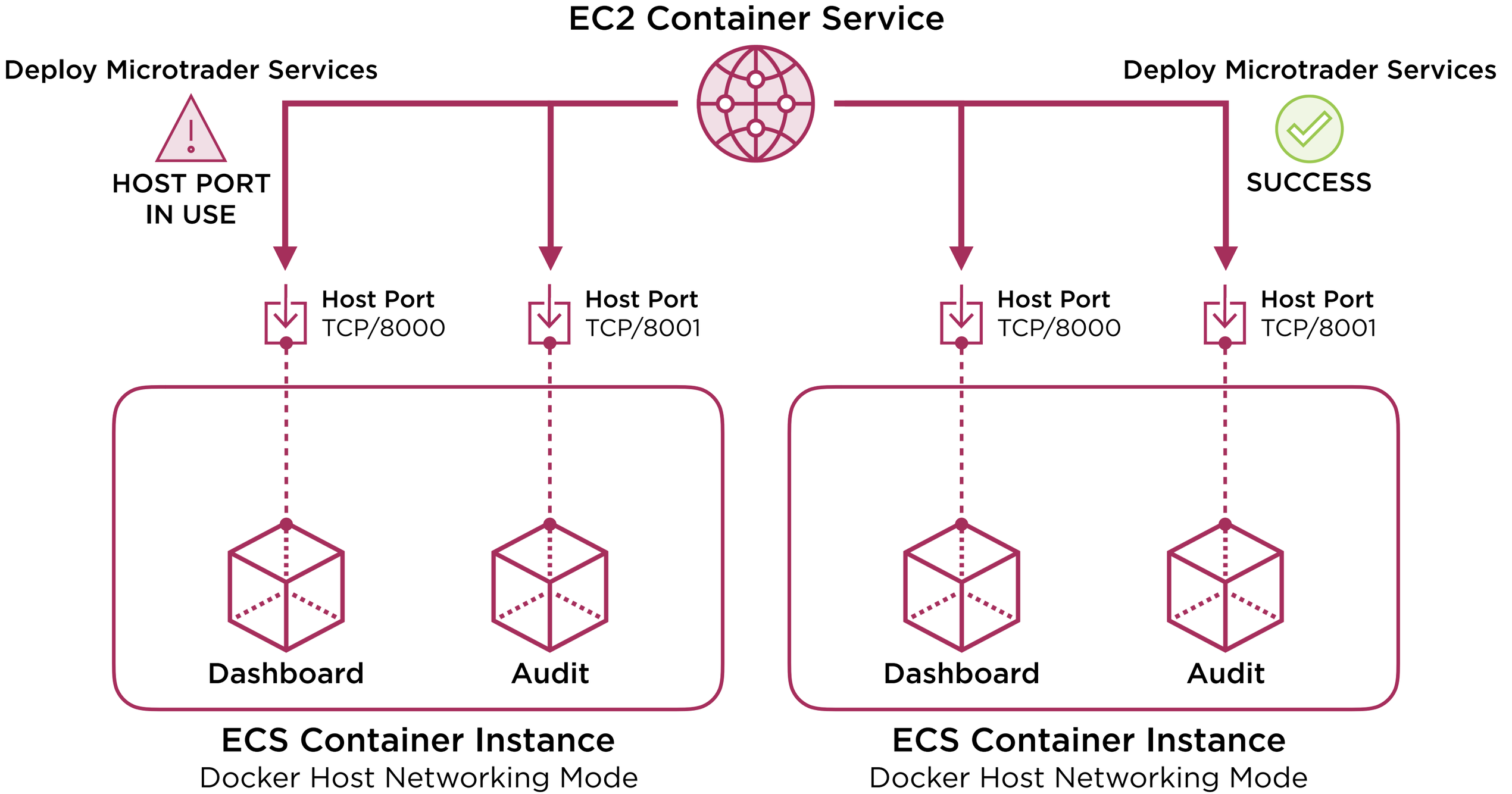

EC2 Container Service
Deploy Instance for Service X
SUCCESS
Host Port
TCP/8000
Container Port
TCP/8000
Container X
ECS Container Instance
Docker Bridge Mode
ECS Container Instance
Docker Bridge Mode


EC2 Container Service
Deploy Instance for Service X
HOST PORT IN USE
Deploy Instance for Service X
SUCCESS
Host Port
TCP/8000
Container Port
TCP/8000
Container X
ECS Container Instance
Docker Bridge Mode
Host Port
TCP/8000
Container Port
TCP/8000
Container X
ECS Container Instance
Docker Bridge Mode


EC2 Container Service
Deploy Instances for Service X
Register Instance
SUCCESS
SUCCESS
Host Port
TCP/32769
Host Port
TCP/32768
Container Port
TCP/8000
Container Port
TCP/8000
Container X
Container X
ECS Container Instance
Docker Bridge Mode - 192.168.1.1
Listener Rule
Target Group Instances
HTTP:80/*
192.168.1.1:32768
HTTP:80/*
192.168.1.1:32769
Application Load Balancer

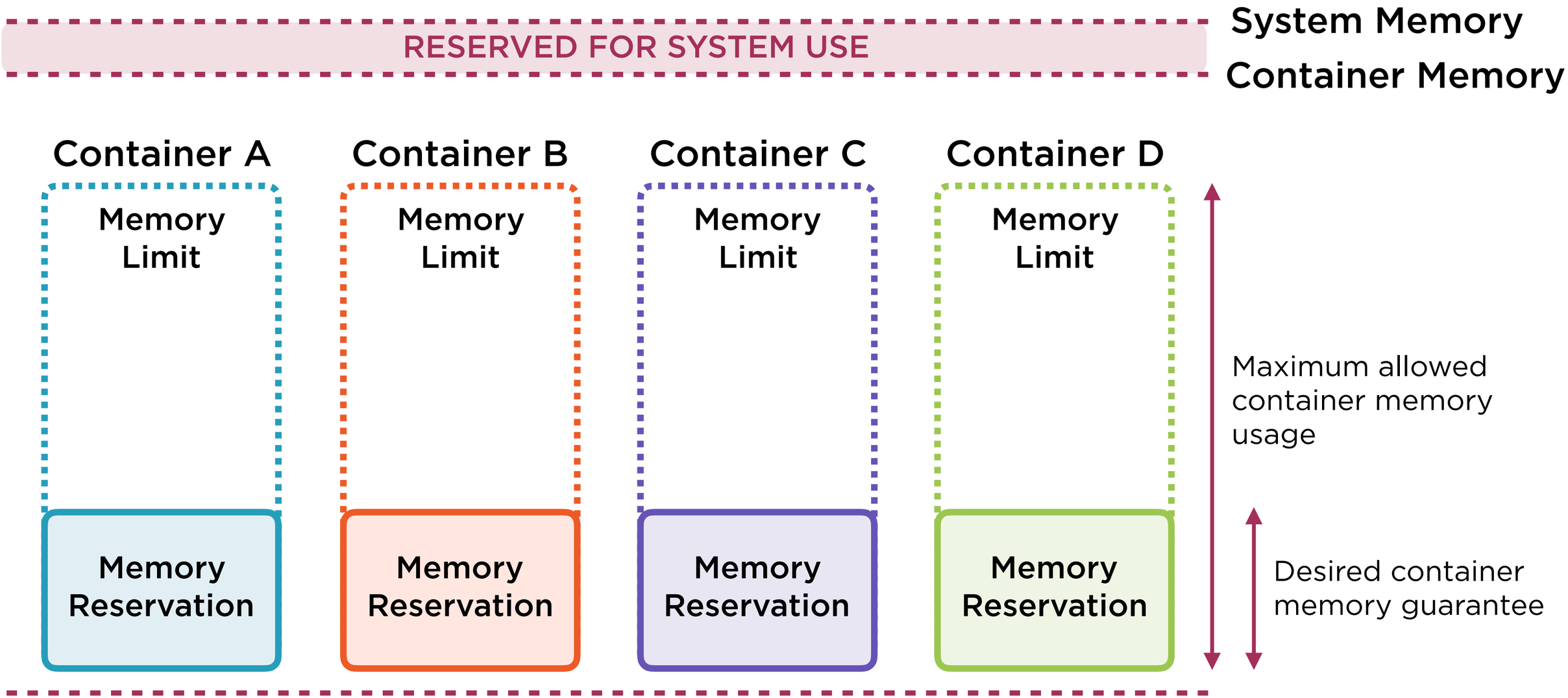

EC2 Container Service
Deploy Instances for Service X
Deploy Instances for Service X
SUCCESS
SUCCESS
SUCCESS
SUCCESS
Host Port
TCP/32769
Host Port
TCP/32768
Host Port
TCP/32768
Host Port
TCP/32769
Container Port
TCP/8000
Container Port
TCP/8000
Container Port
TCP/8000
Container Port
TCP/8000
Container X
Container X
Container X
Container X
ECS Container Instance
Docker Bridge Mode
ECS Container Instance
Docker Bridge Mode


EC2 Container Service
Deploy Microtrader Services
SUCCESS
Host Port
TCP/8000
Host Port
TCP/8001
Dashboard
Audit
ECS Container Instance
Docker Host Networking Mode
ECS Container Instance
Docker Host Networking Mode


EC2 Container Service
Deploy Microtrader Services
HOST PORT
IN USE
Deploy Microtrader Services
SUCCESS
Host Port
TCP/8000
Host Port
TCP/8001
Host Port
TCP/8000
Host Port
TCP/8001
Dashboard
Audit
Dashboard
Audit
ECS Container Instance
Docker Host Networking Mode
ECS Container Instance
Docker Host Networking Mode

Understanding ECS Memory Allocation

ECS Memory Allocation



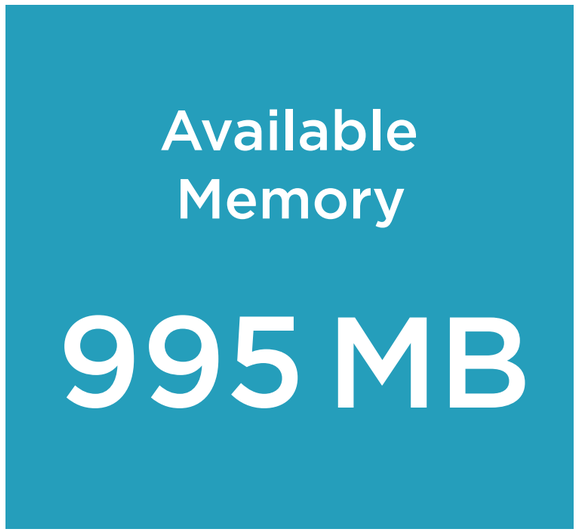
ECS Container Instance Memory

Instance Type	System Memory (GB)	Container Memory (MB)
t2.micro	1	995
t2.small	2	2001
t2.medium	4	3953
t2.large	4	7986
m4.large	4	7986
c4.large	3.75	3765

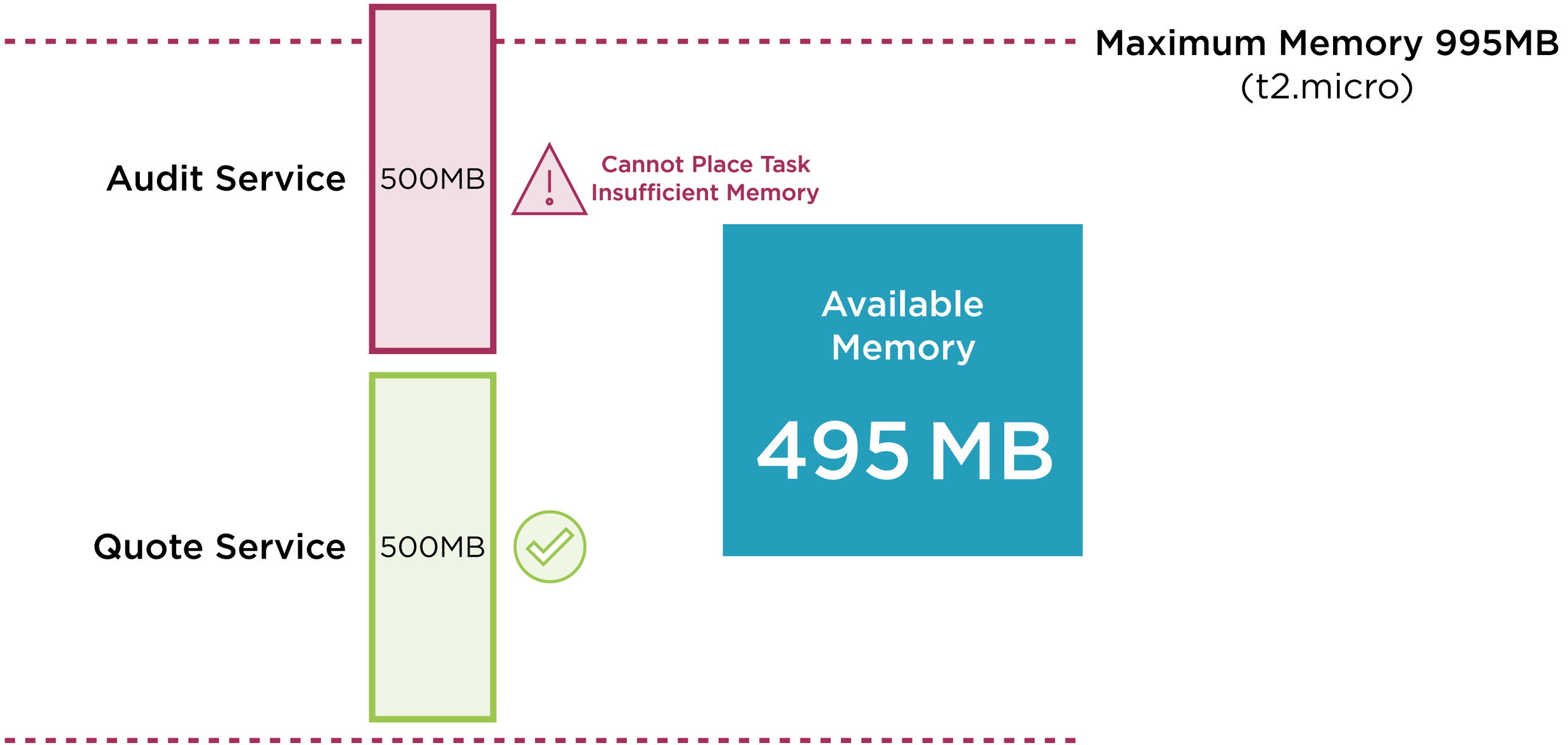
ECS Memory Reservation Allocation

Maximum Memory 995MB
(t2.micro)

Quote Service



ECS Memory Reservation Allocation



ECS Memory Reservation Allocation

Maximum Memory 995MB
(t2.micro)

Audit Service Failure

Quote Service 500MB

Available Memory

495 MB

ECS Memory Reservation Allocation

ECS Memory Reservation Allocation

Maximum Memory 995MB
(t2.micro)

Available Memory	Allocated Memory
995 MB	000 MB

Quote Service 195MB

ECS Memory Reservation Allocation

Maximum Memory 995MB
(t2.micro)

Available Memory
800 MB

Allocated Memory
195 MB

Audit Service 195MB

Quote Service 195MB

ECS Memory Reservation Allocation

Maximum Memory 995MB
(t2.micro)

Portfolio Service 195MB

Audit Service 195MB

Quote Service 195MB

Available Memory
605 MB

Allocated Memory
390 MB

ECS Memory Reservation Allocation

Maximum Memory 995MB
(t2.micro)

Dashboard Service 195MB

Portfolio Service 195MB

Audit Service 195MB

Quote Service 195MB

Available Memory
410 MB

Allocated Memory
585 MB

ECS Memory Reservation Allocation

Maximum Memory 995MB
(t2.micro)

Adhoc Task 195MB

Dashboard Service 195MB

Portfolio Service 195MB

Audit Service 195MB

Quote Service 195MB

Available Memory

215 MB

Allocated Memory

780 MB

ECS Memory Reservation Allocation

Maximum Memory 995MB
(t2.micro)

Adhoc Task 195MB

Dashboard Service 195MB

Portfolio Service 195MB

Audit Service 195MB

Quote Service 195MB

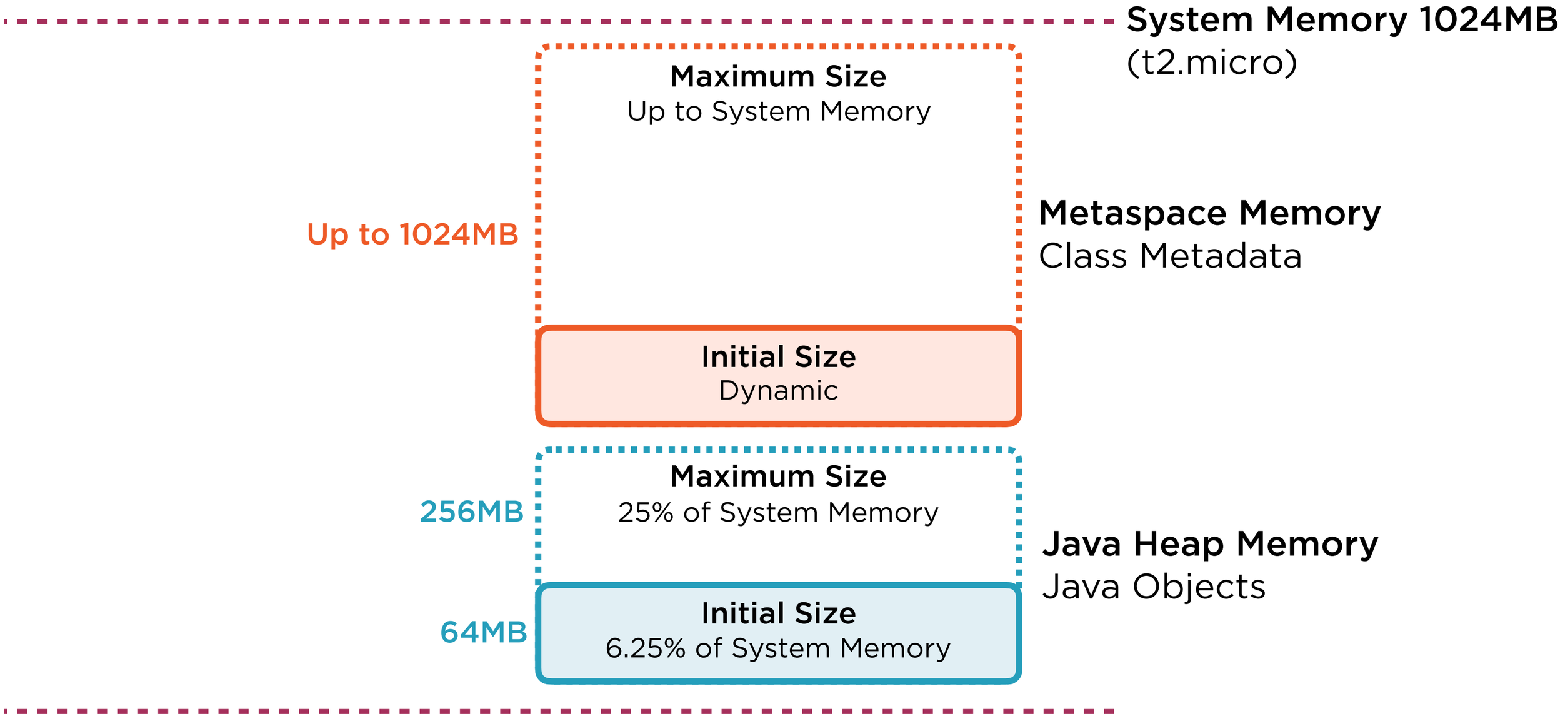
Available Memory

020 MB

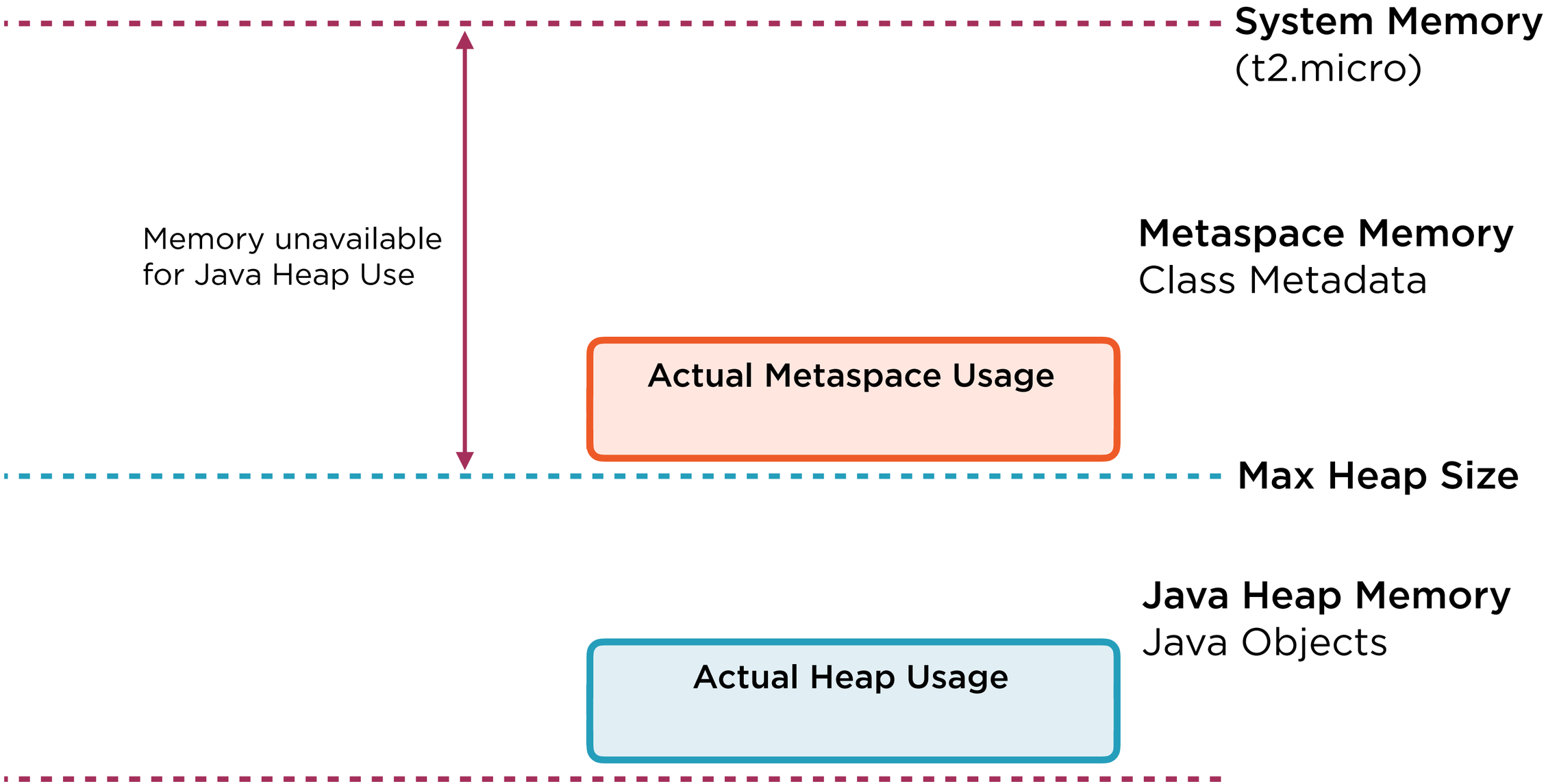
Allocated Memory

975 MB

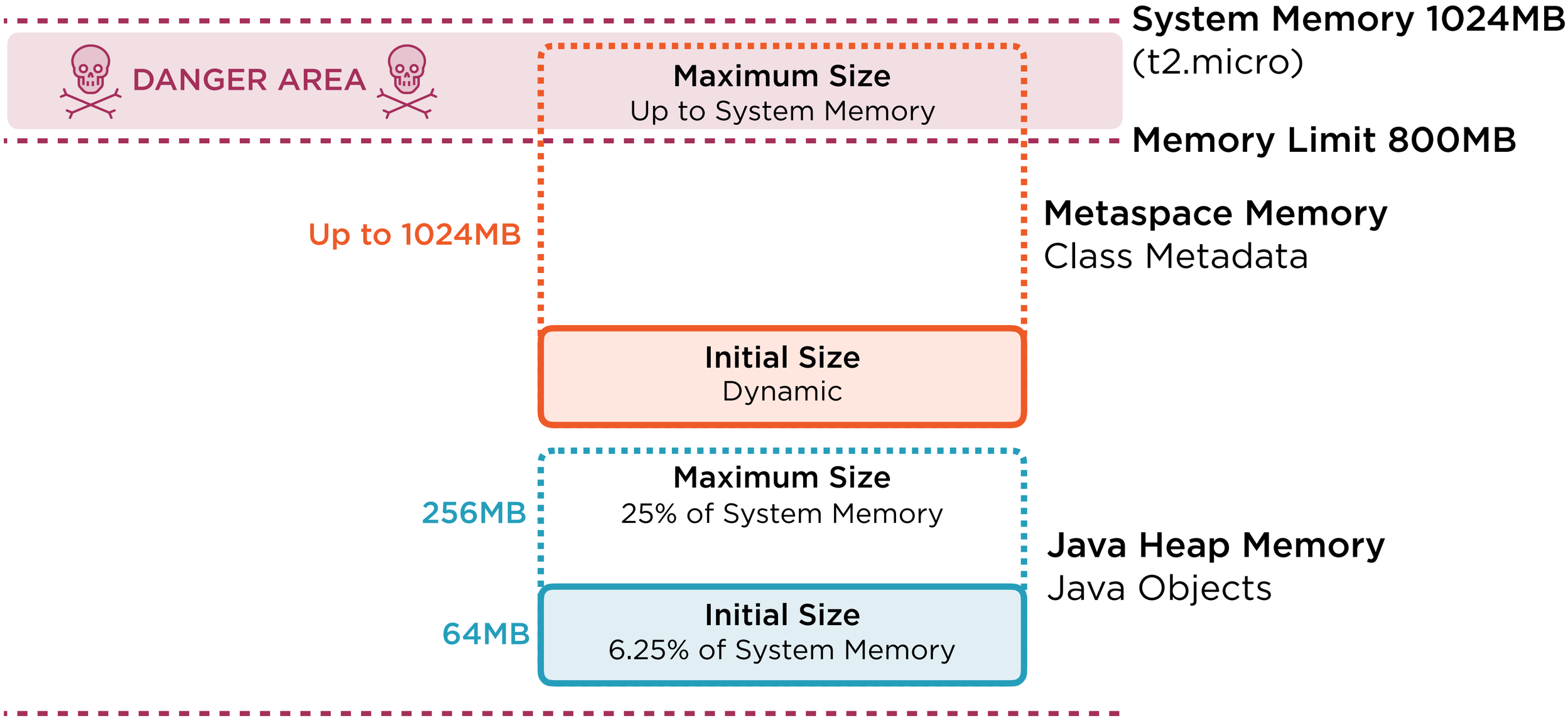
JVM Memory Defaults



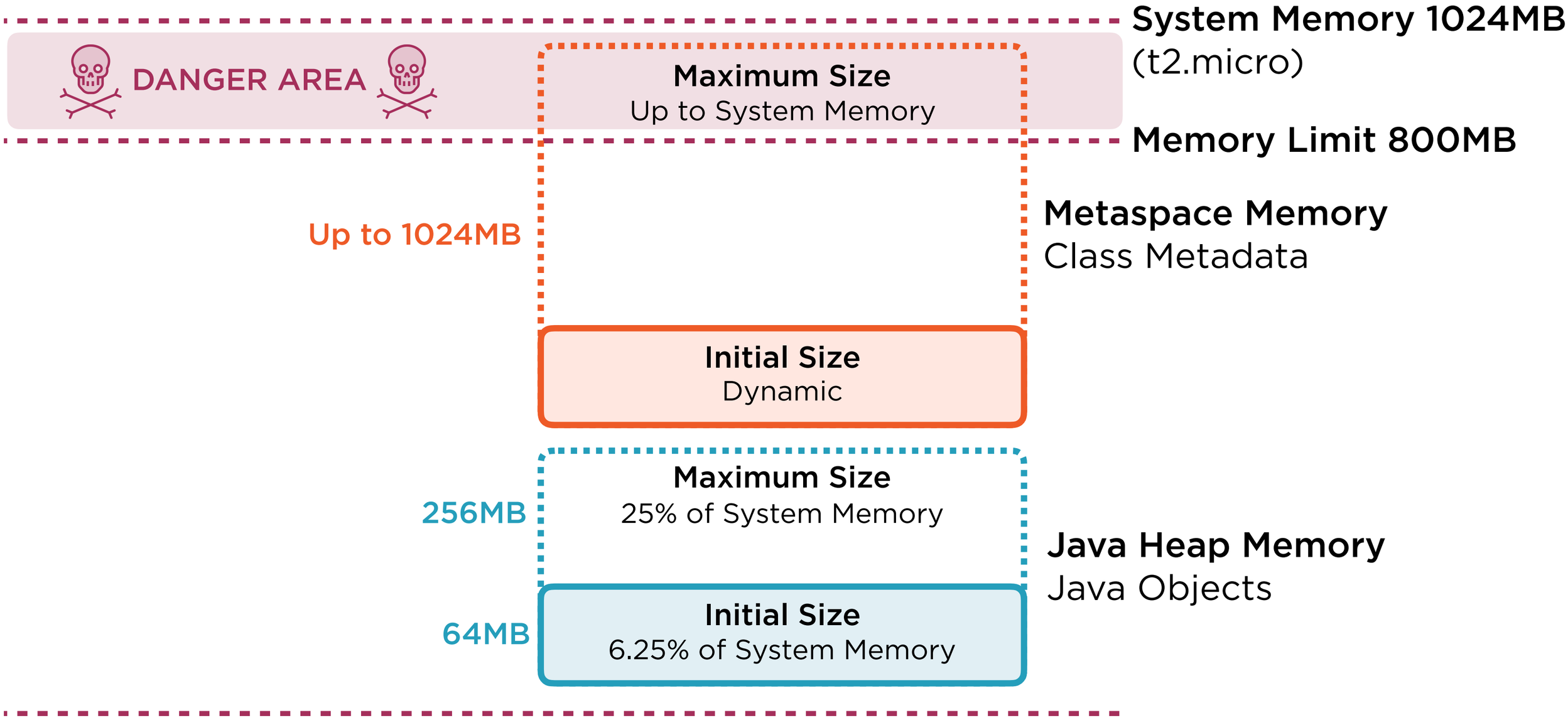
JVM Memory Defaults



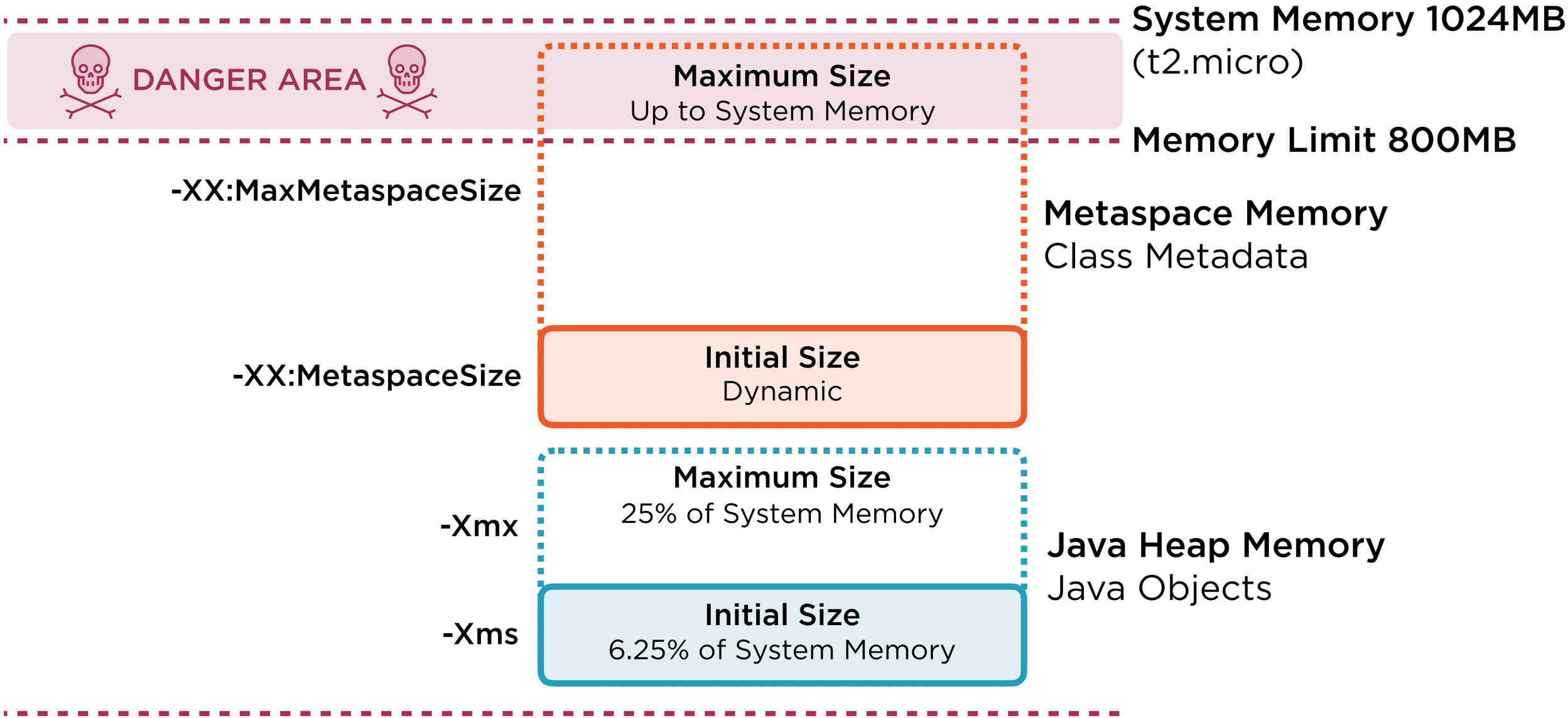
JVM Memory Defaults



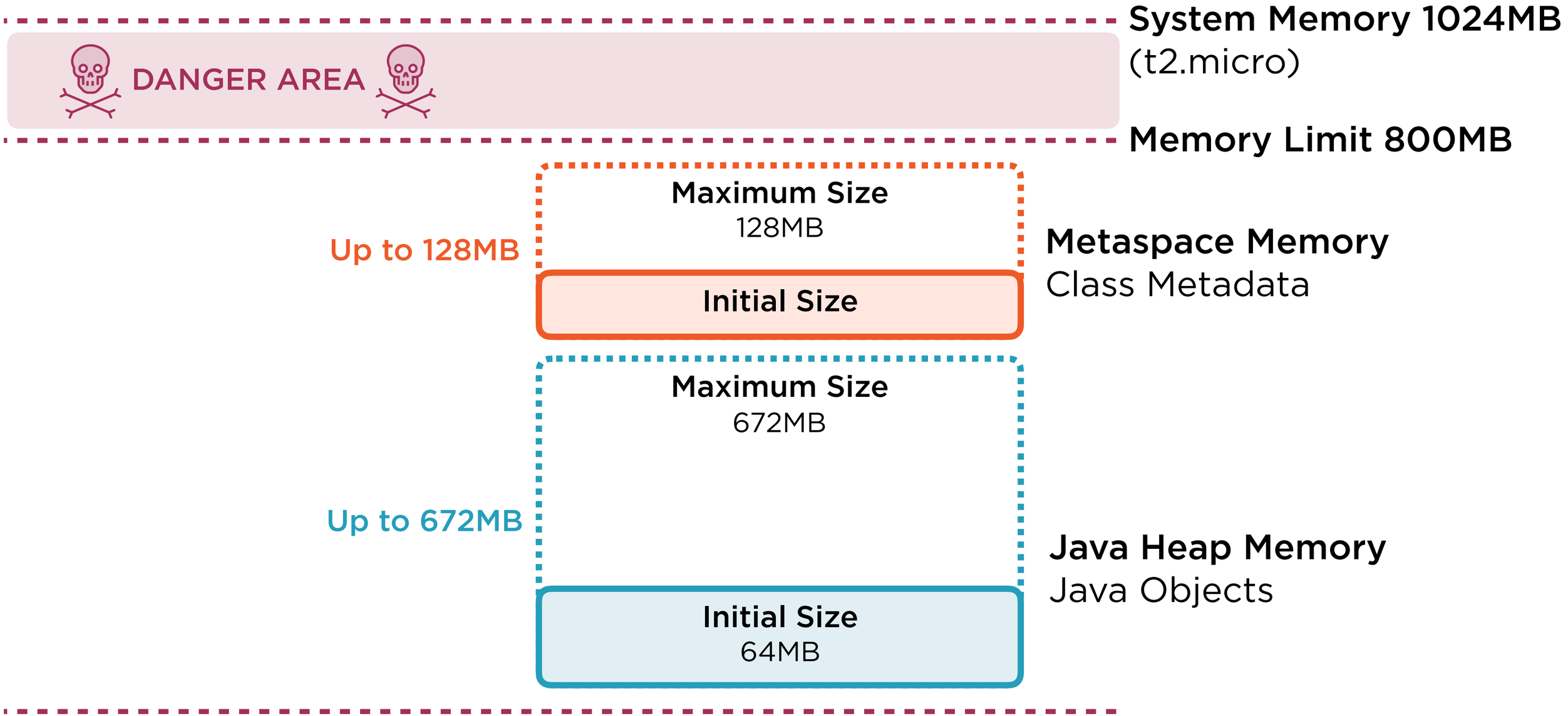
JVM Memory Defaults



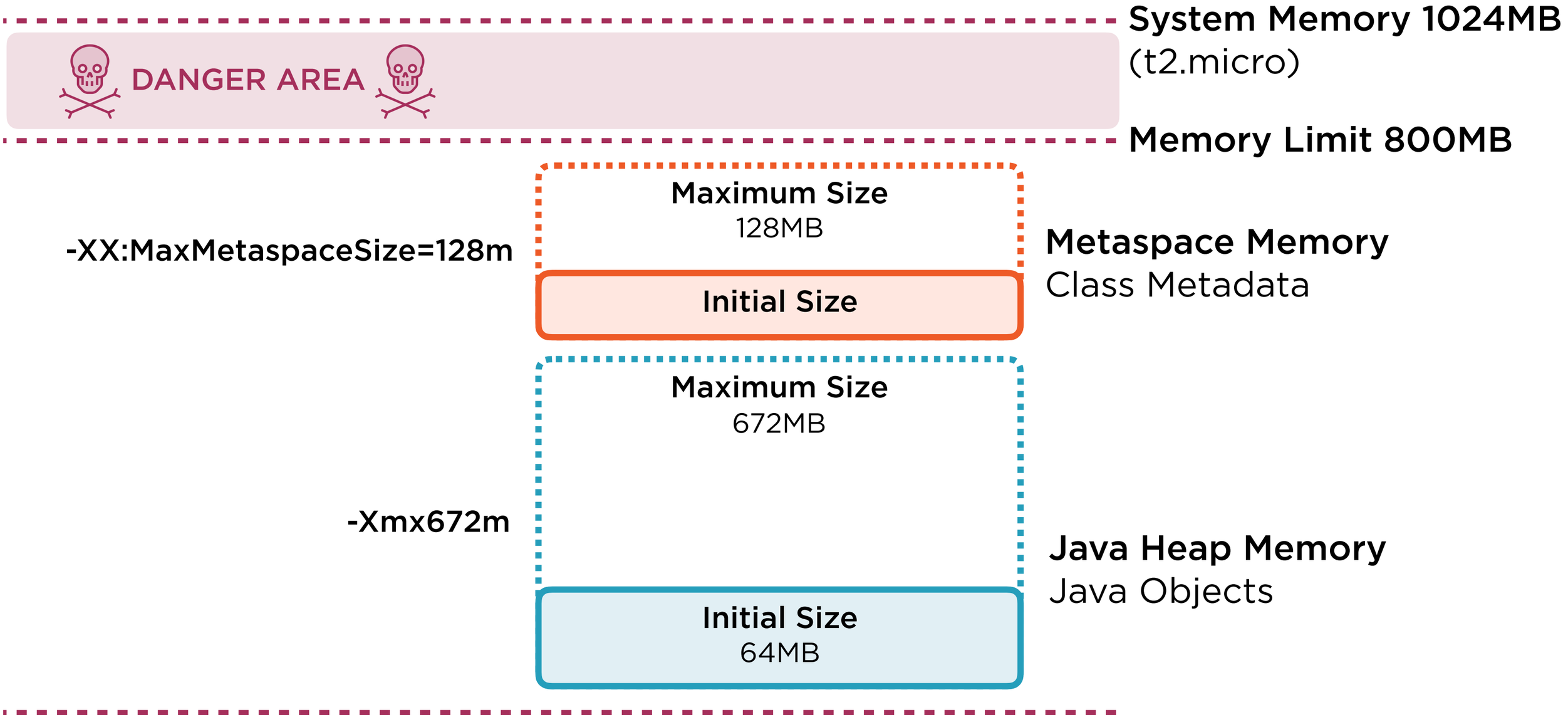
JVM Memory Defaults



Microtrader JVM Memory Settings

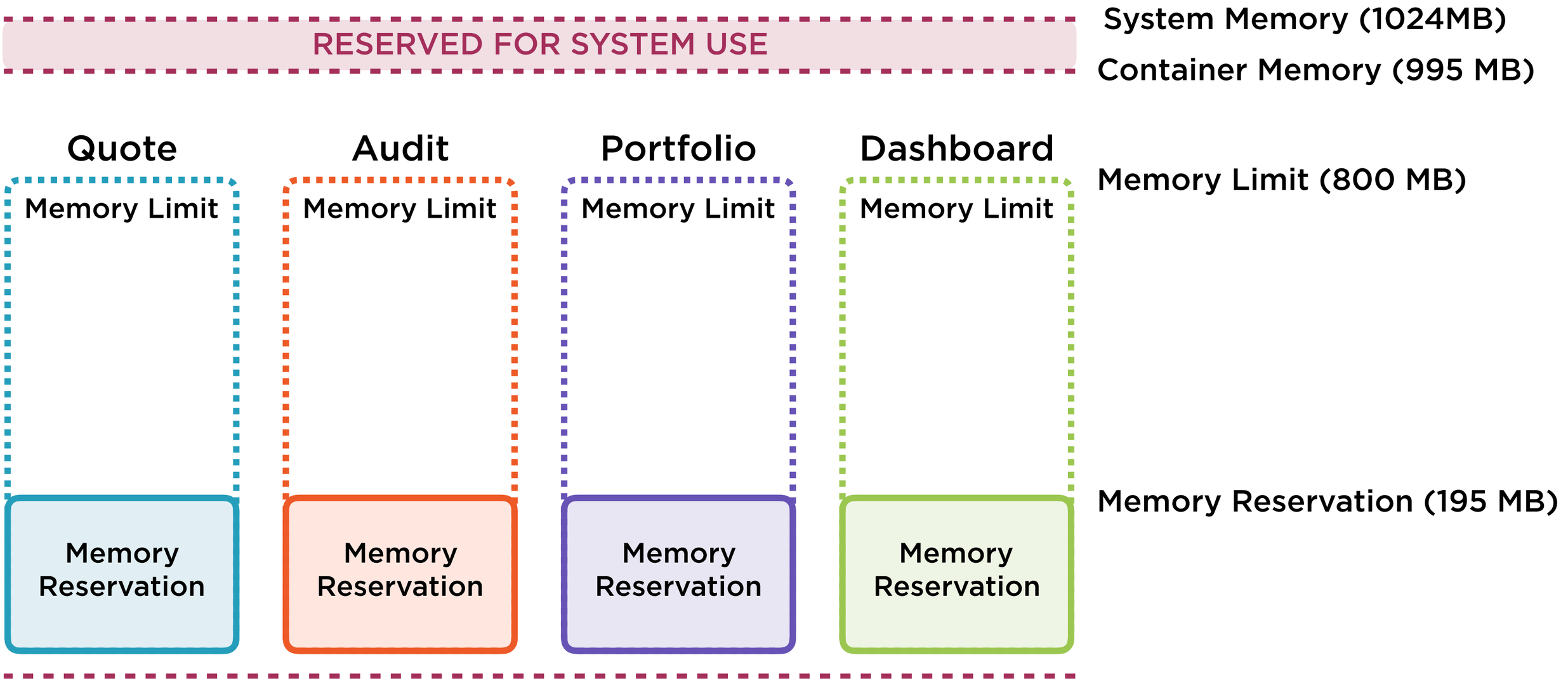


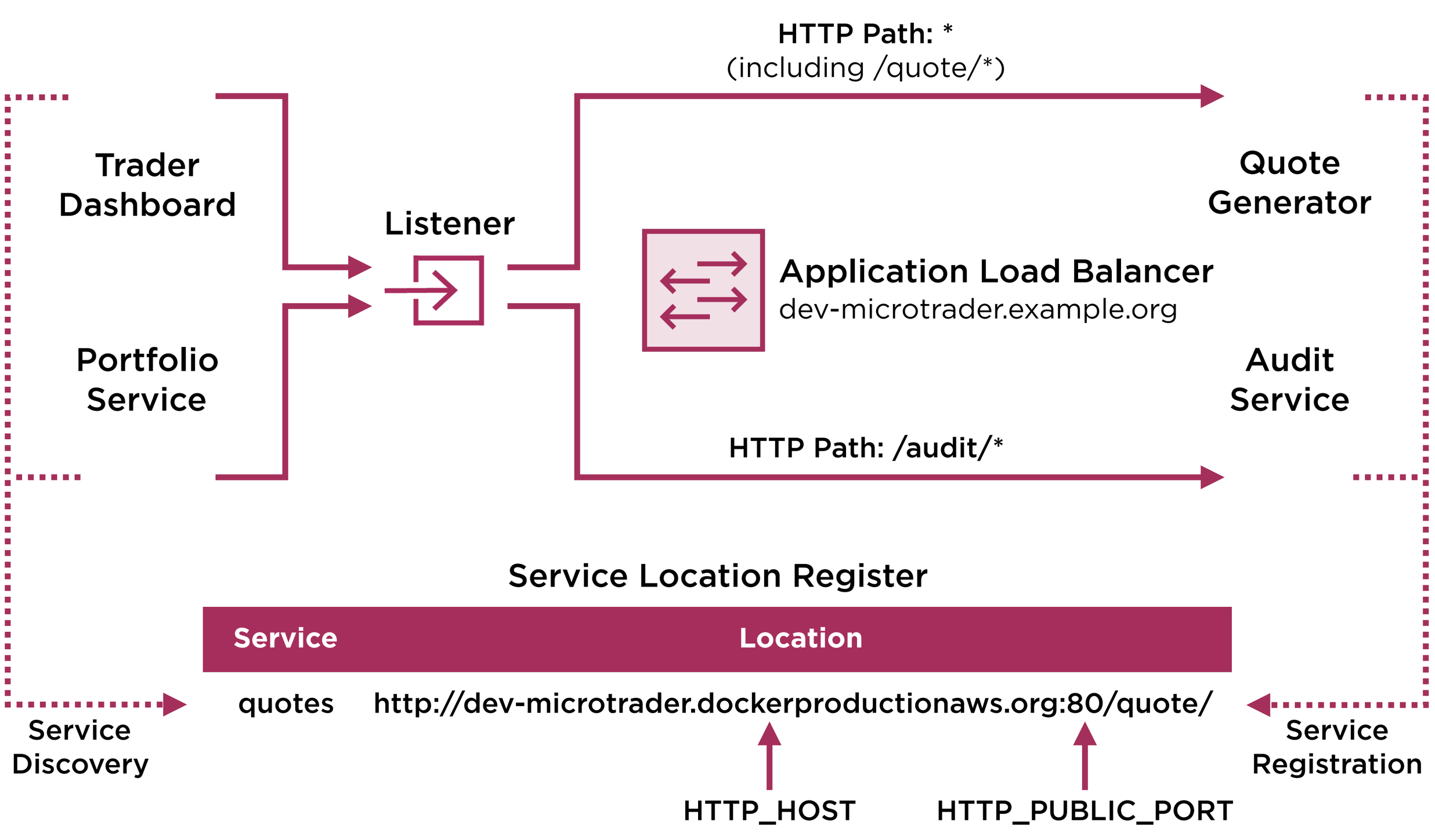
Microtrader JVM Memory Settings



Configuring ECS Task Definitions

ECS Memory Limits and Reservations

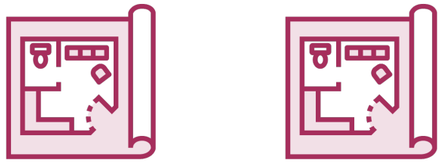



HTTP Path: *
(including /quote/*)
Trader Dashboard
Portfolio Service
Listener
Application Load Balancer
dev-microtrader.example.org
Quote Generator
Audit Service
HTTP Path: /audit/*
Service Location Register
Service
Location
quotes
http://dev-microtrader.dockerproductionaws.org:80/quote/
Service Discovery
Service Registration
HTTP_HOST
HTTP_PUBLIC_PORT

Understanding ECS Service Deployment

Microtrader Application Stack

ECS Task Definitions



Route 53 Private DNS

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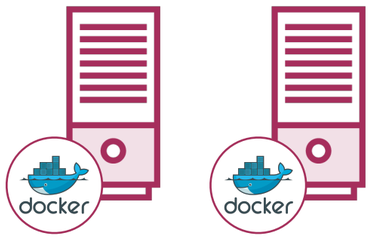
Public Load Balancer
(Internet Facing)

Dashboard Endpoint

Portfolio Service

Audit Service

Dashboard Service



Autoscaling Group

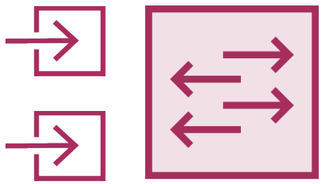
Quote Service

ECS Cluster

Application Load Balancer
(Internal)

Audit Endpoint

Quote Endpoint

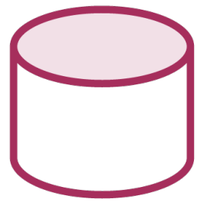


CloudWatch Log Groups

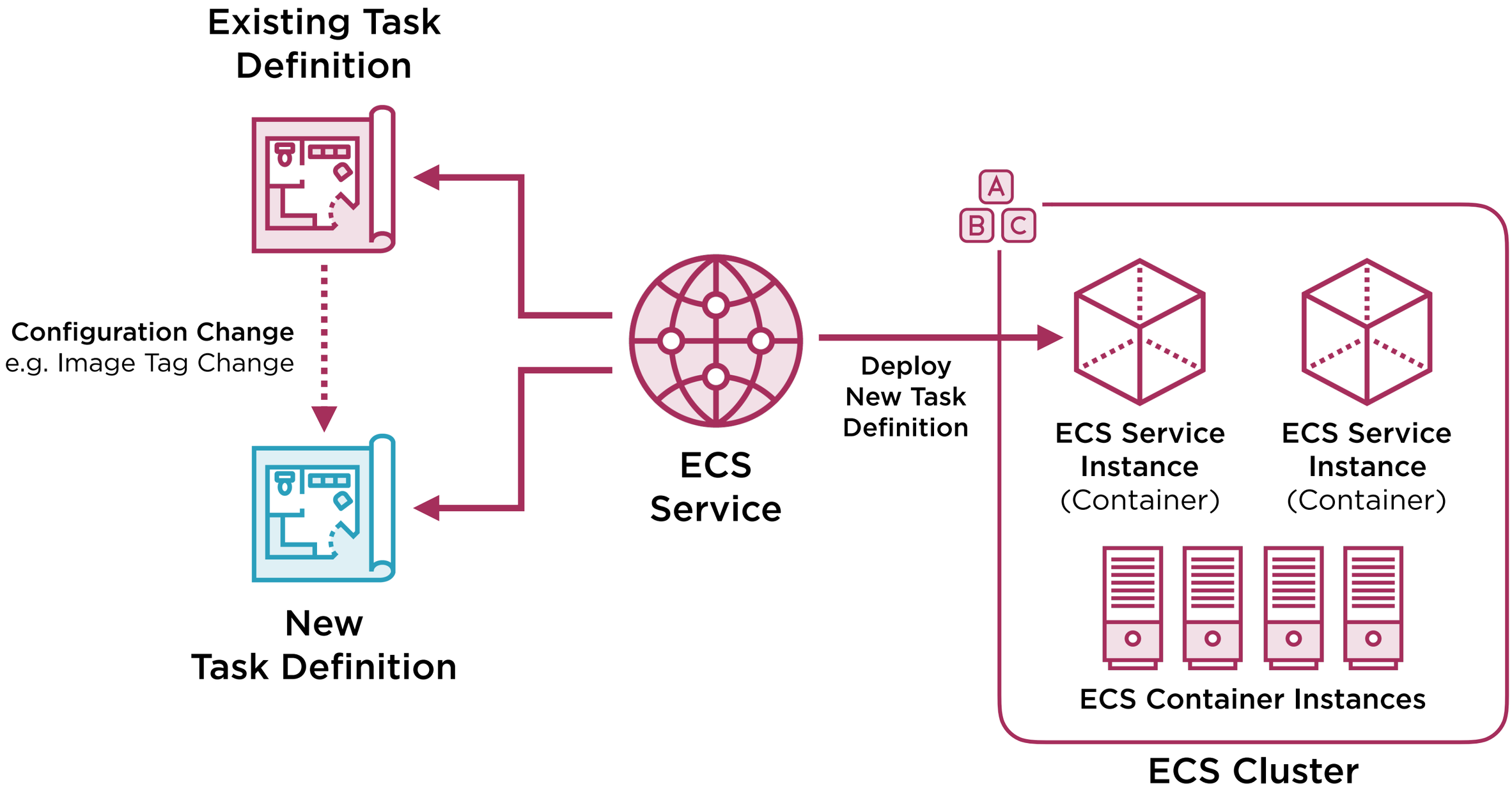
System Logs

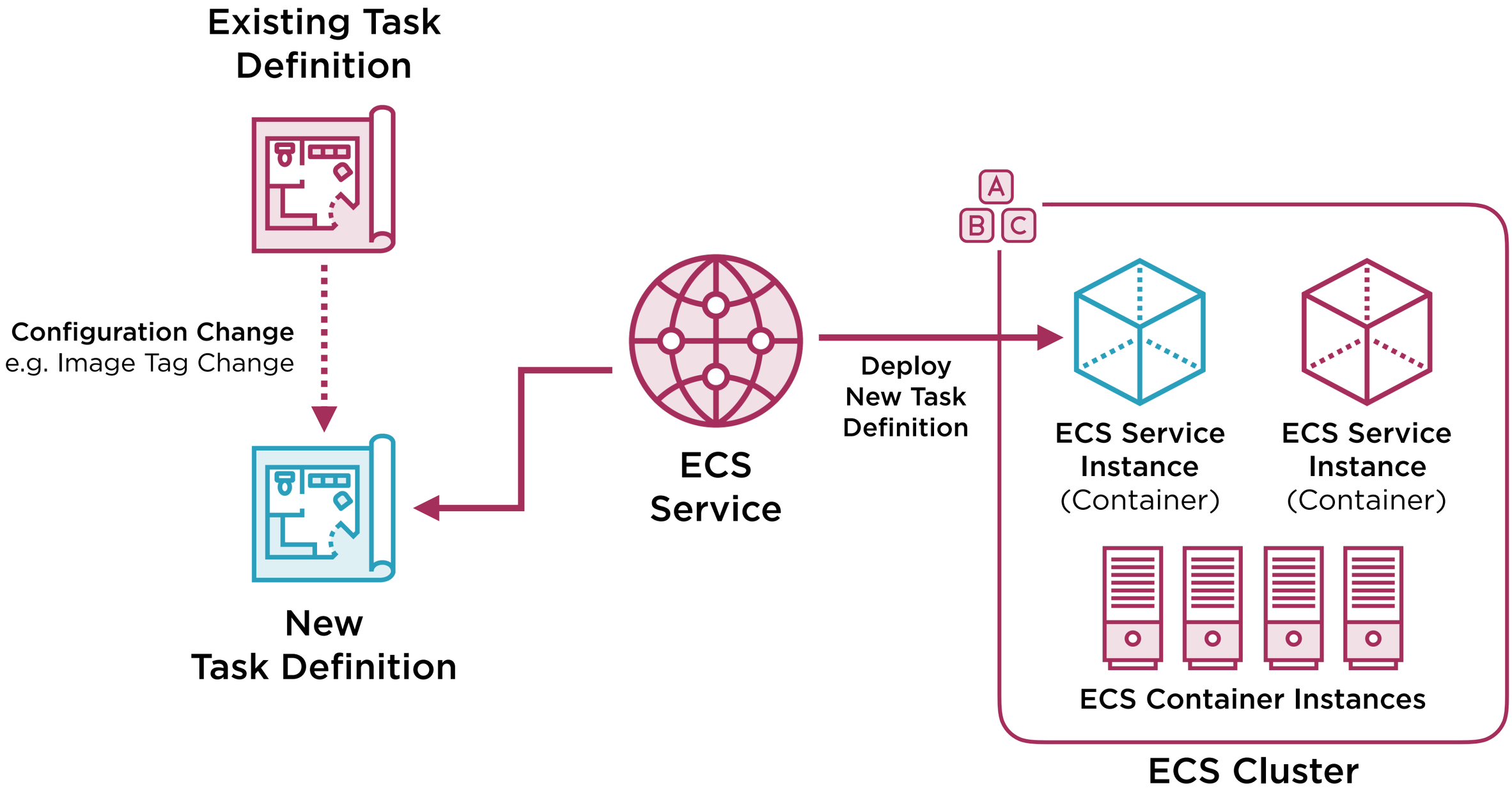
Container Logs

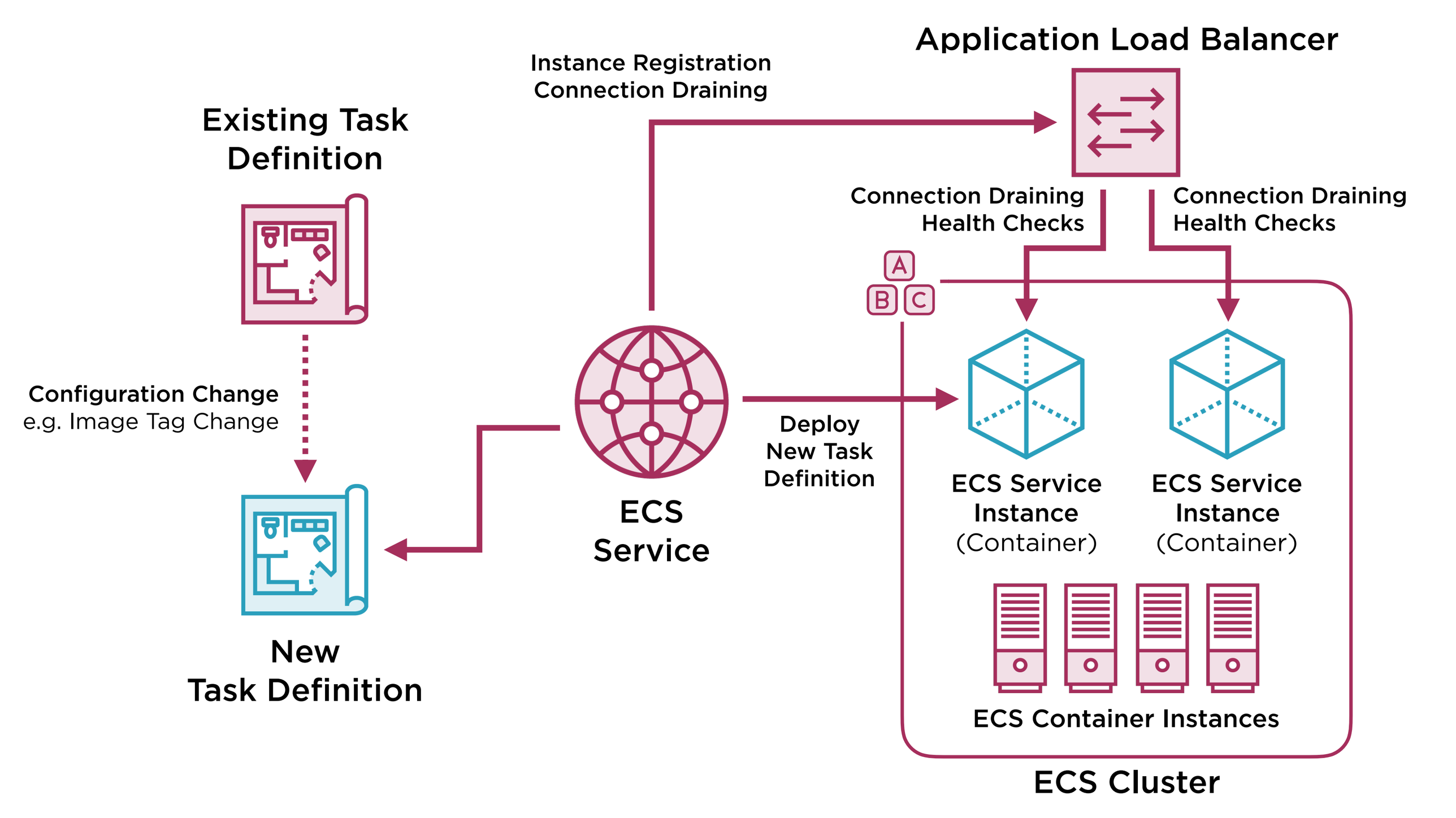
RDS Instance

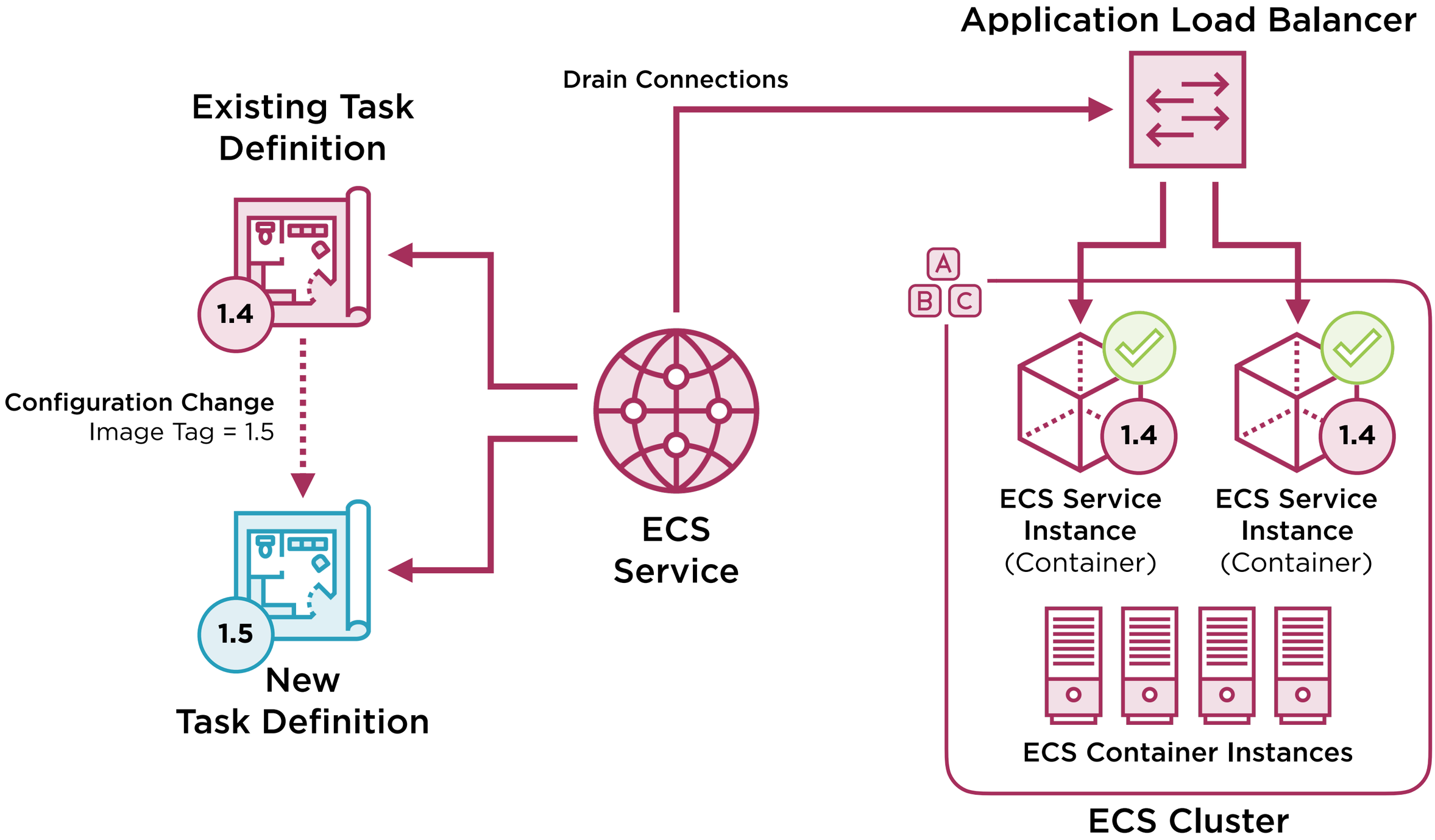


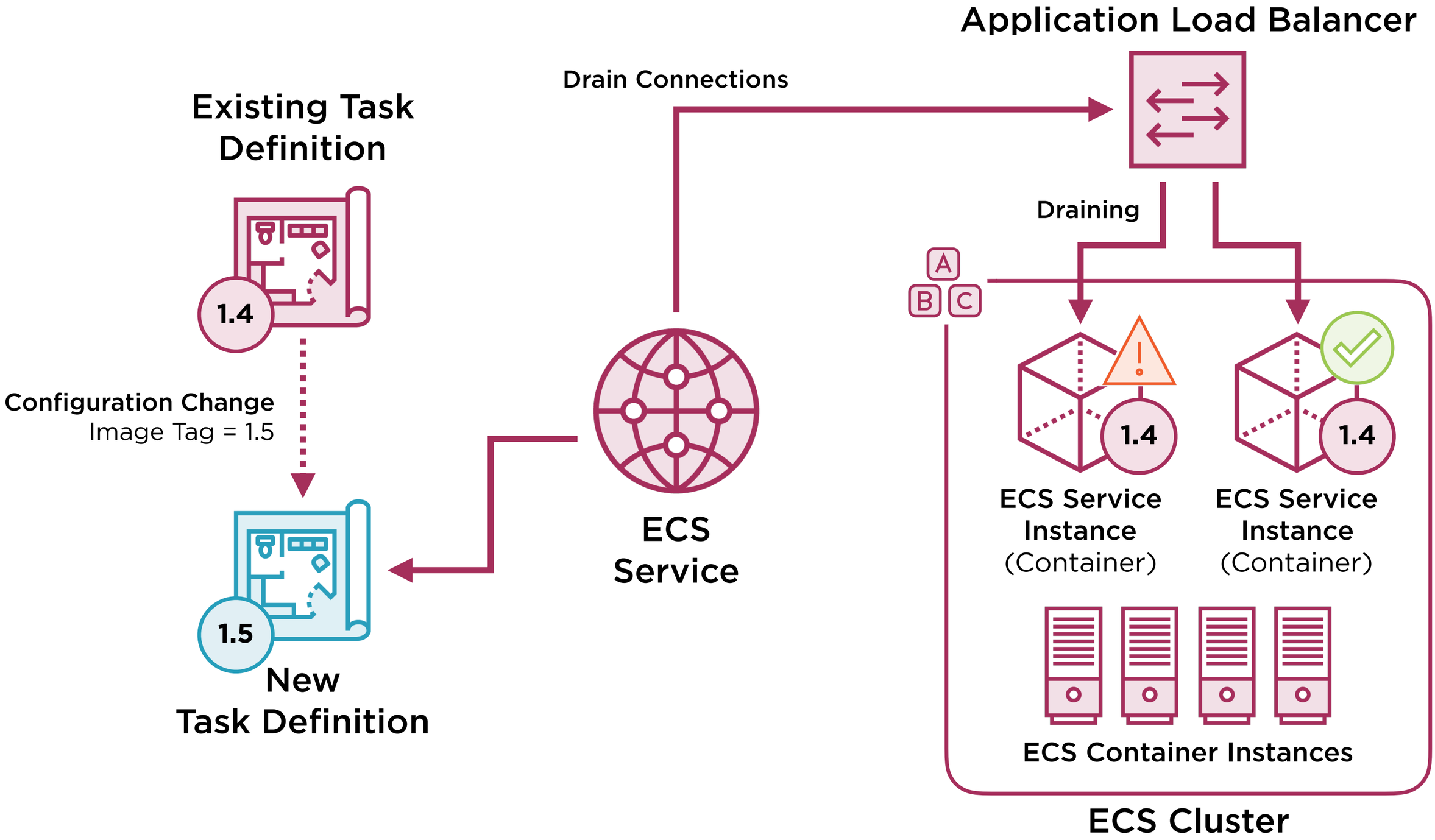
Audit Database

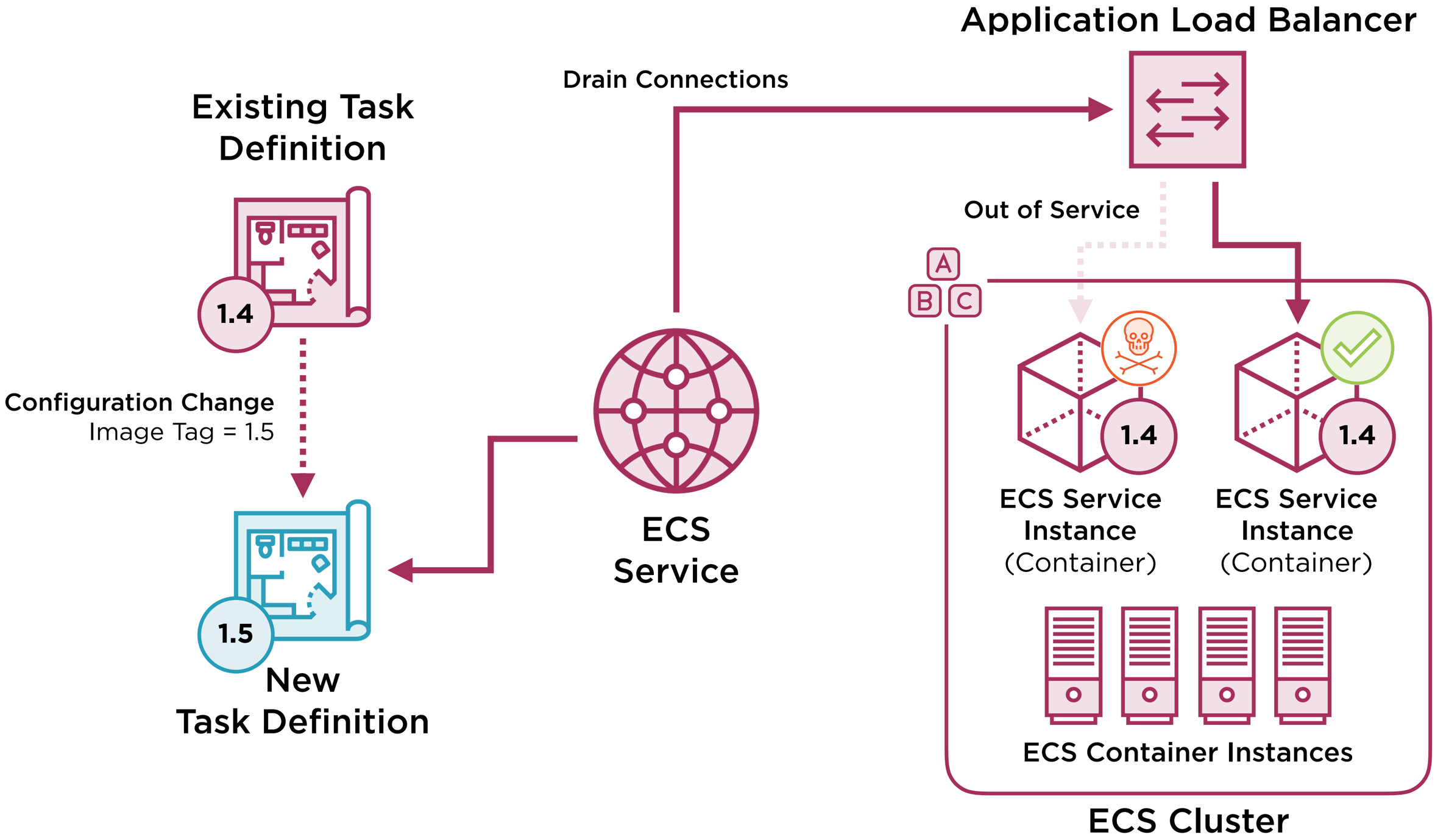

Existing Task Definition
Configuration Change
e.g. Image Tag Change
New Task Definition
ECS Service
Deploy New Task Definition
A
B
C
ECS Service Instance (Container)
ECS Service Instance (Container)
ECS Container Instances
ECS Cluster

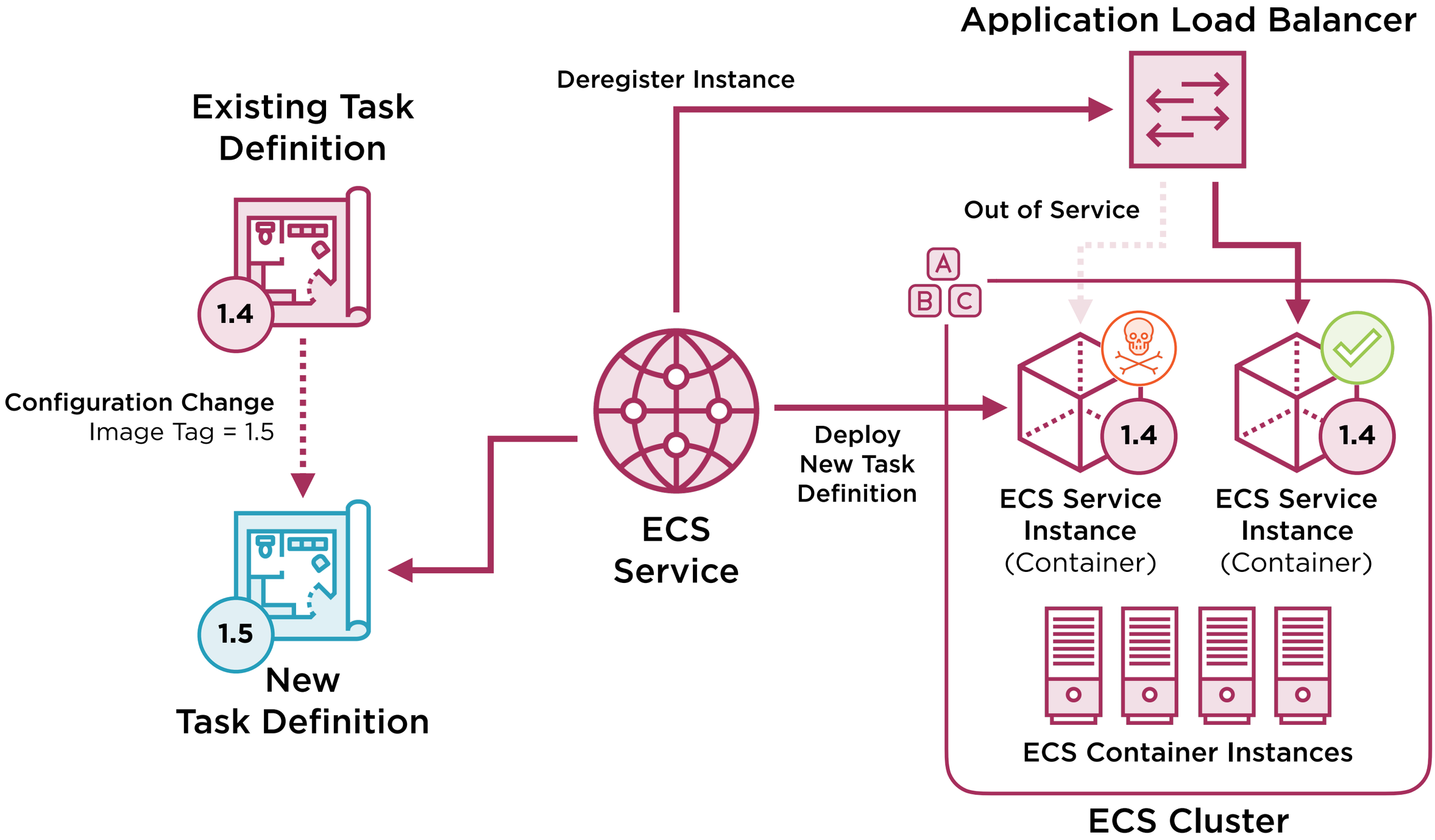

Existing Task Definition
Configuration Change
e.g. Image Tag Change
New Task Definition
ECS Service
Deploy New Task Definition
A
B
C
ECS Service Instance (Container)
ECS Service Instance (Container)
ECS Container Instances
ECS Cluster

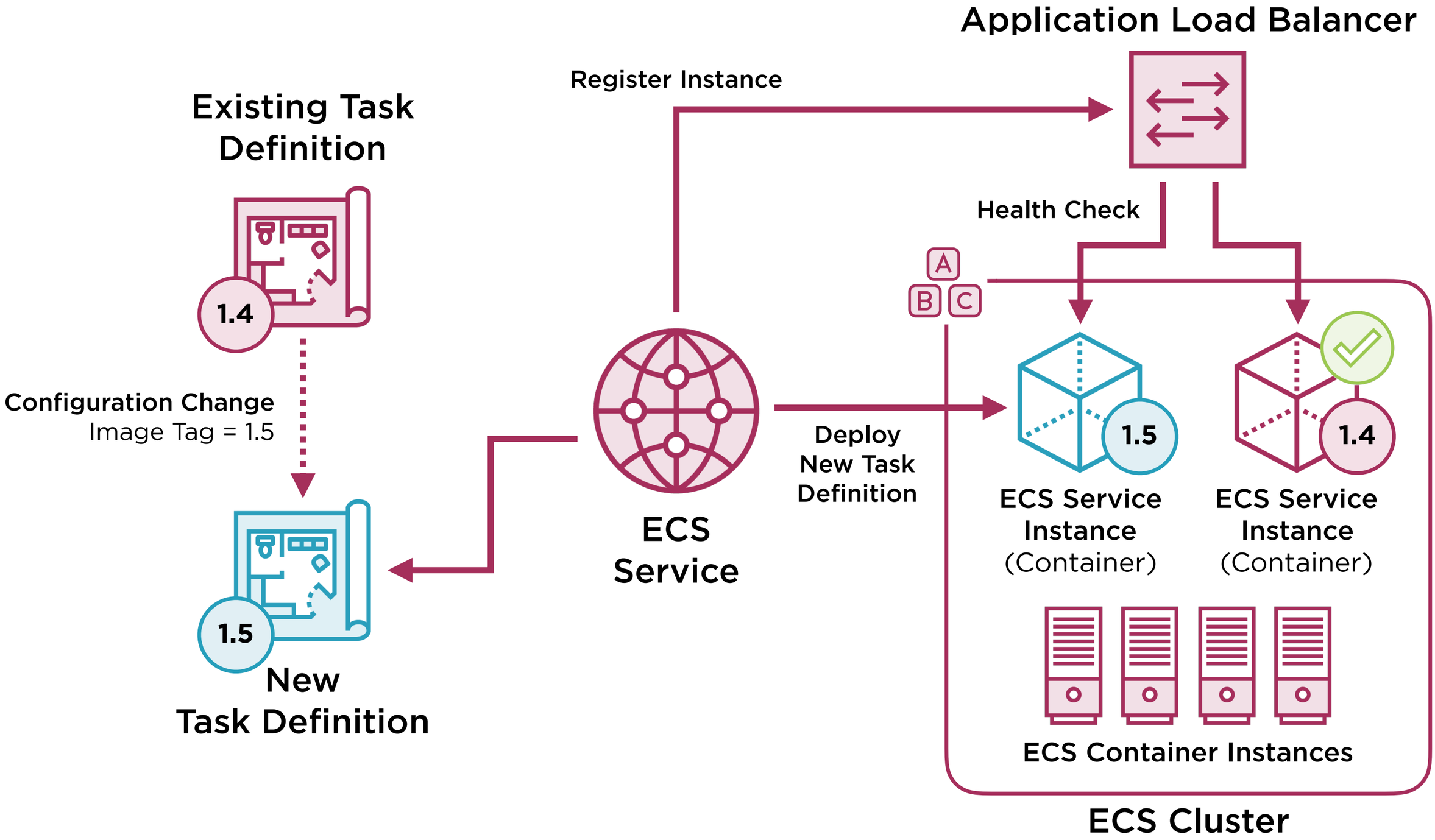

Application Load Balancer
Instance Registration
Connection Draining
Existing Task
Definition
Connection Draining
Health Checks
Connection Draining
Health Checks
A
B
C
Configuration Change
e.g. Image Tag Change
Deploy
New Task
Definition
ECS
Service
ECS Service
Instance
(Container)
ECS Service
Instance
(Container)
New
Task Definition
ECS Container Instances
ECS Cluster

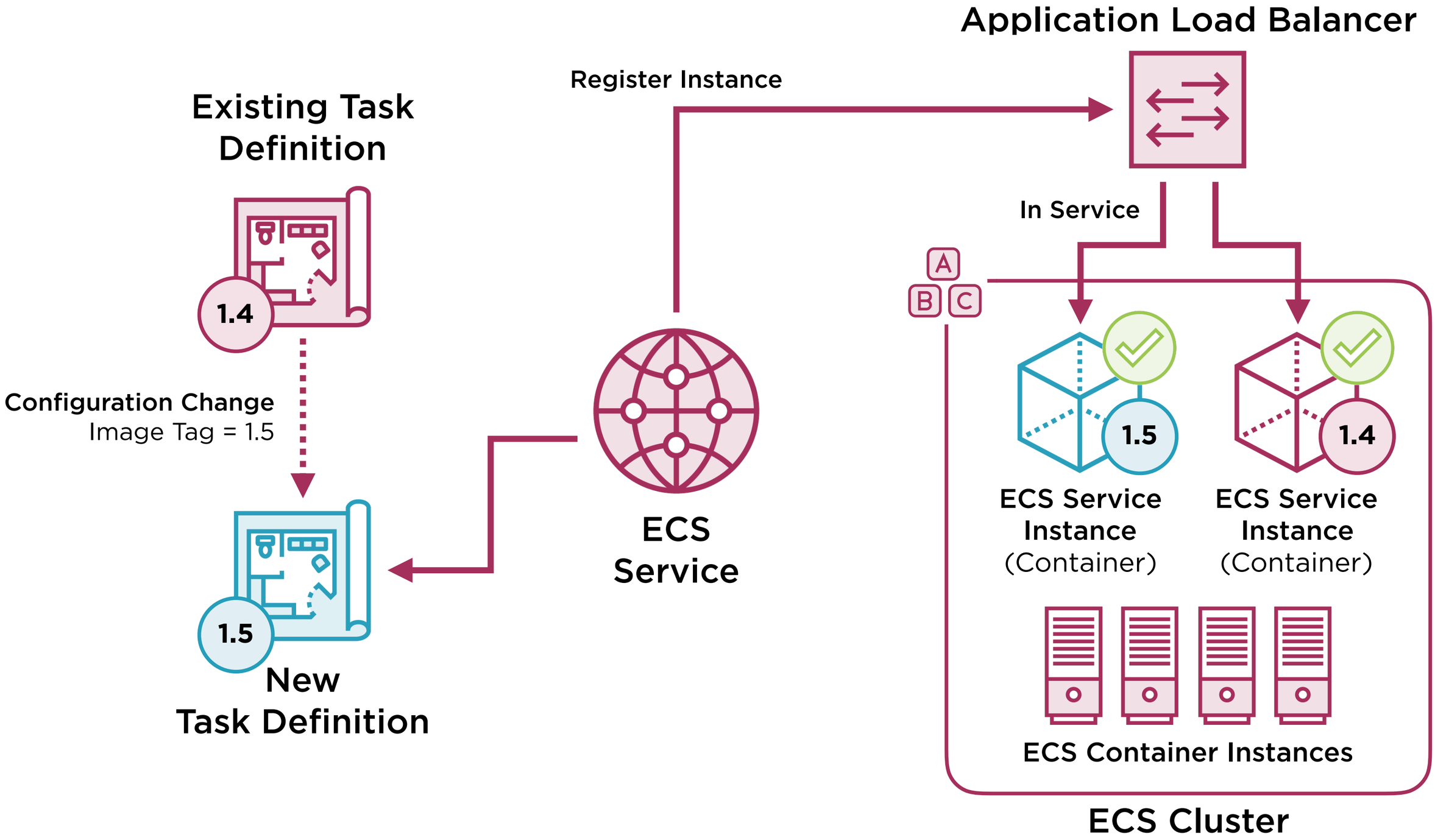

Application Load Balancer
Drain Connections
Existing Task Definition
1.4
Configuration Change
Image Tag = 1.5
1.5
New Task Definition
ECS Service
A
B
C
1.4
1.4
ECS Service Instance (Container)
ECS Service Instance (Container)
ECS Container Instances
ECS Cluster

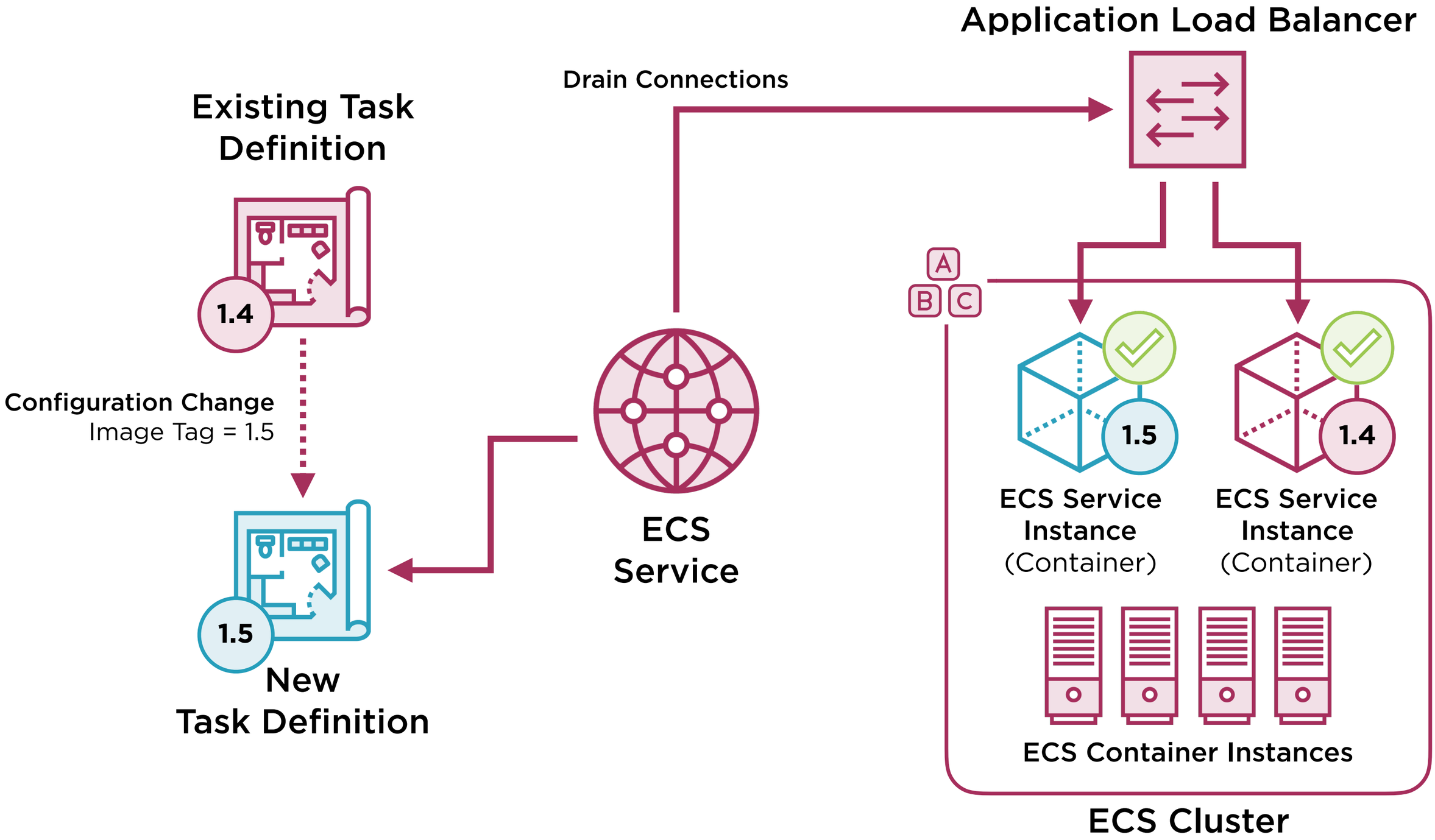

Application Load Balancer
Drain Connections
Existing Task Definition
1.4
Draining
A
B
C
Configuration Change
Image Tag = 1.5
ECS Service
1.4
1.4
ECS Service Instance (Container)
ECS Service Instance (Container)
1.5
New Task Definition
ECS Container Instances
ECS Cluster

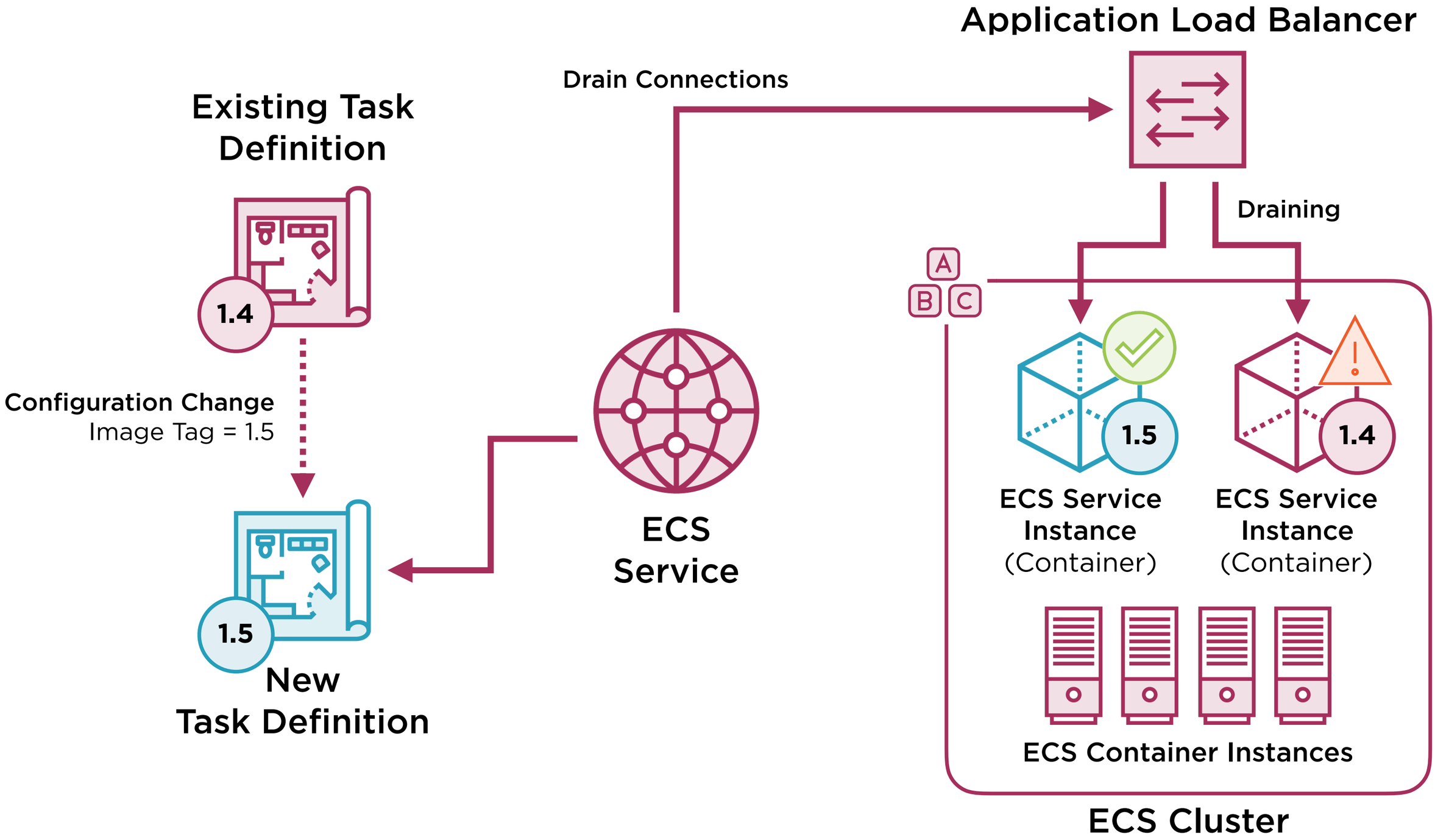

Application Load Balancer
Drain Connections
Existing Task Definition
1.4
Out of Service
A
B
C
Configuration Change
Image Tag = 1.5
ECS Service
1.4
1.4
ECS Service Instance (Container)
ECS Service Instance (Container)
1.5
New Task Definition
ECS Container Instances
ECS Cluster

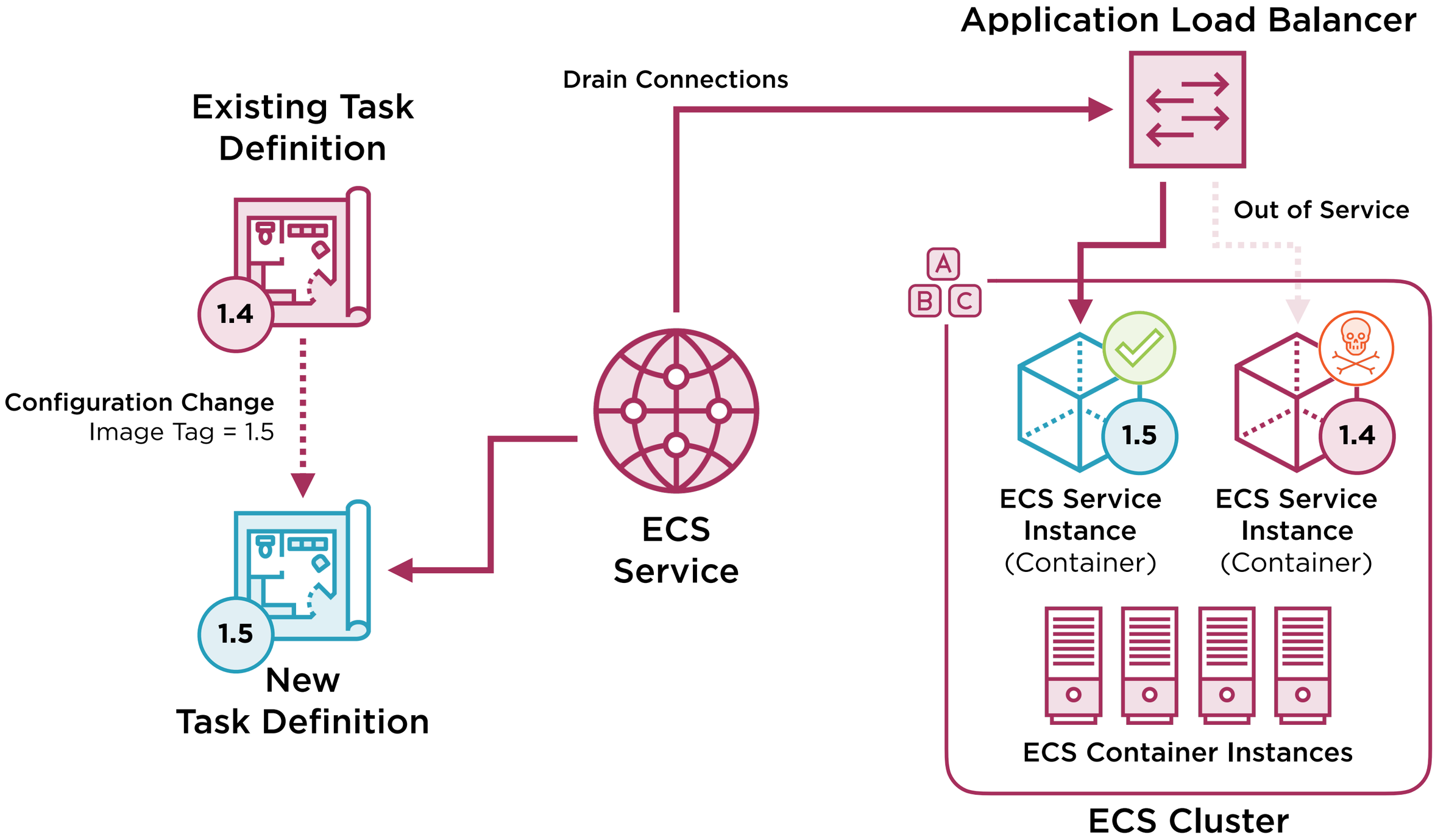

Application Load Balancer
Deregister Instance
Existing Task Definition
1.4
Out of Service
A
B
C
Configuration Change
Image Tag = 1.5
ECS Service
Deploy New Task Definition
1.4
1.4
ECS Service Instance (Container)
ECS Service Instance (Container)
1.5
New Task Definition
ECS Container Instances
ECS Cluster

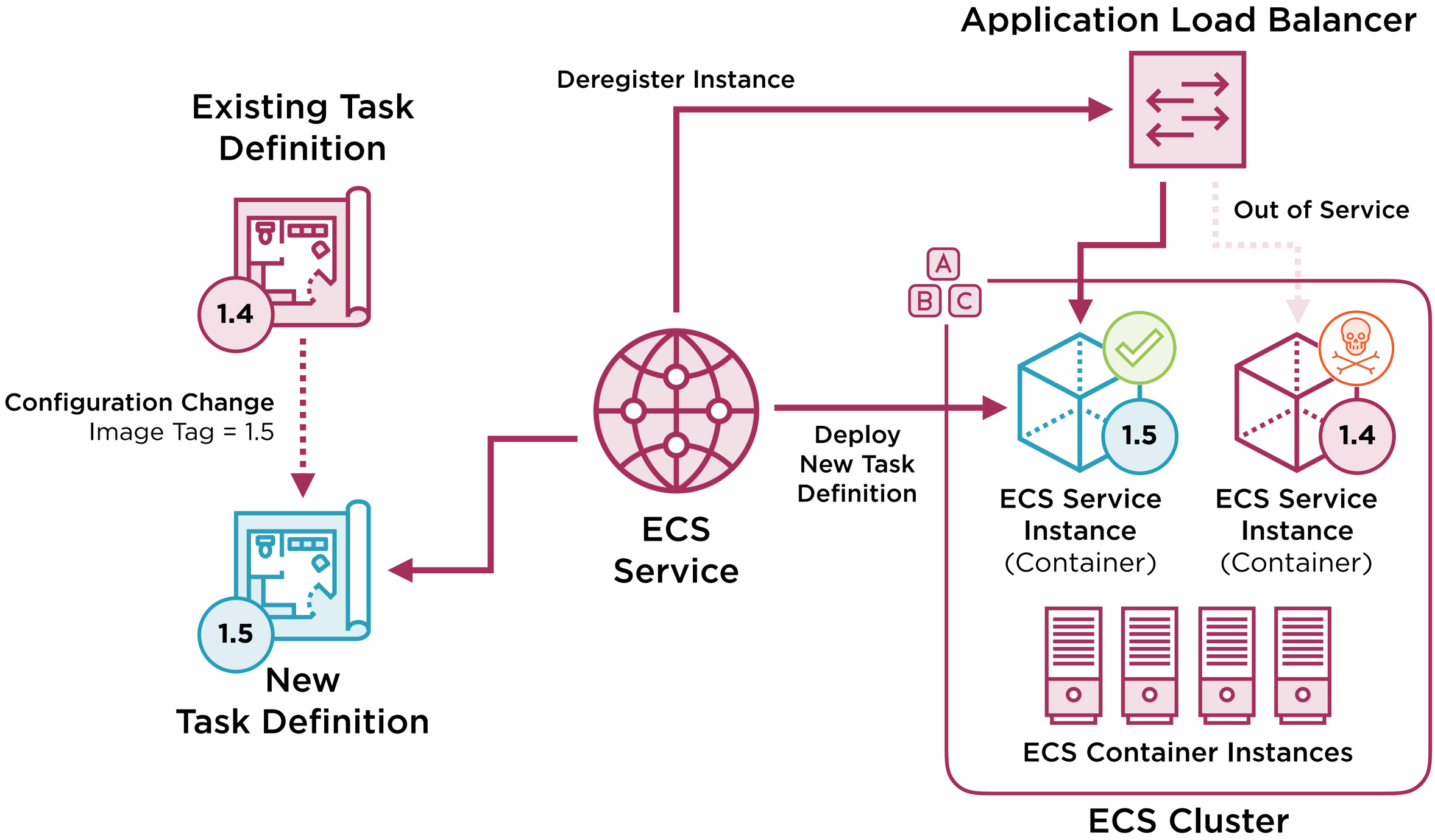

Application Load Balancer
Register Instance
Existing Task Definition
1.4
Health Check
A
B
C
Configuration Change
Image Tag = 1.5
ECS Service
Deploy New Task Definition
1.5
ECS Service Instance (Container)
1.4
ECS Service Instance (Container)
1.5
New Task Definition
ECS Container Instances
ECS Cluster

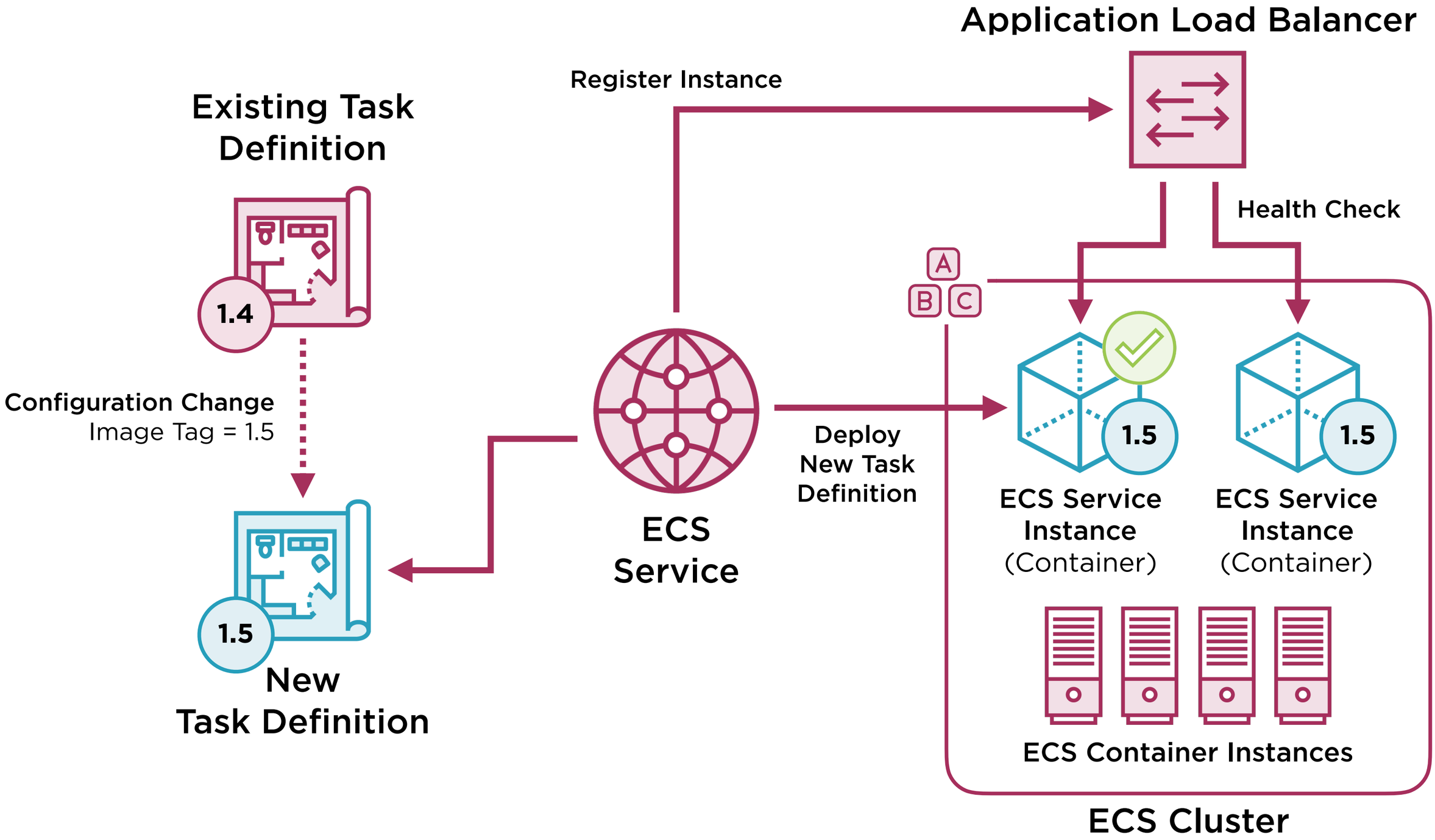

Application Load Balancer
Register Instance
Existing Task Definition
1.4
In Service
A
B
C
Configuration Change
Image Tag = 1.5
1.5
1.4
ECS Service
Instance
(Container)
ECS Service
Instance
(Container)
ECS Service
1.5
New
Task Definition
ECS Container Instances
ECS Cluster

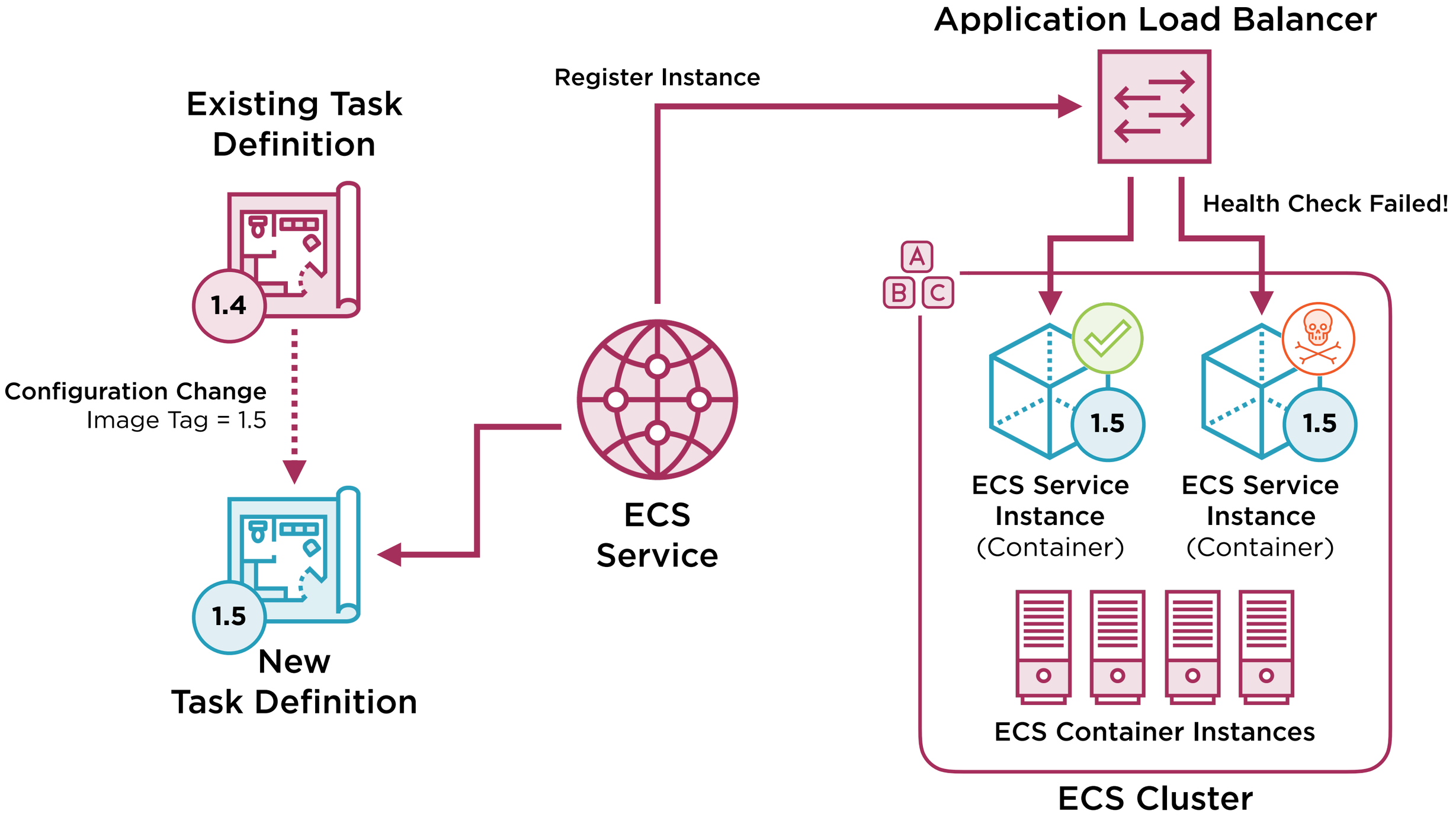

Application Load Balancer
Drain Connections
Existing Task Definition
1.4
Configuration Change
Image Tag = 1.5
1.5
New Task Definition
ECS Service
A
B
C
1.5
1.4
ECS Service Instance (Container)
ECS Service Instance (Container)
ECS Container Instances
ECS Cluster

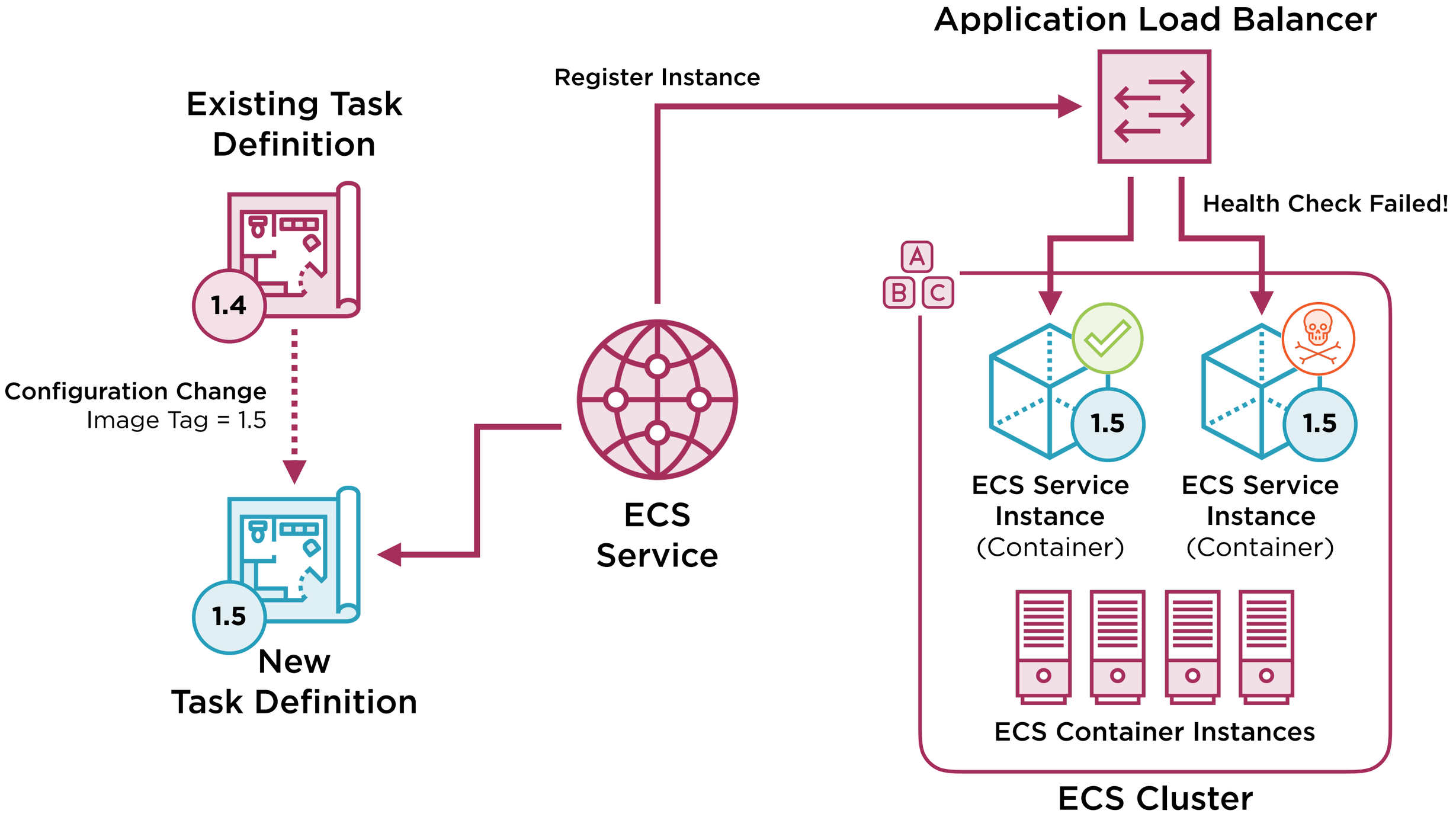

Application Load Balancer
Drain Connections
Existing Task Definition
1.4
Configuration Change
Image Tag = 1.5
1.5
New Task Definition
ECS Service
Draining
A
B
C
1.5
1.4
ECS Service Instance (Container)
ECS Service Instance (Container)
ECS Container Instances
ECS Cluster

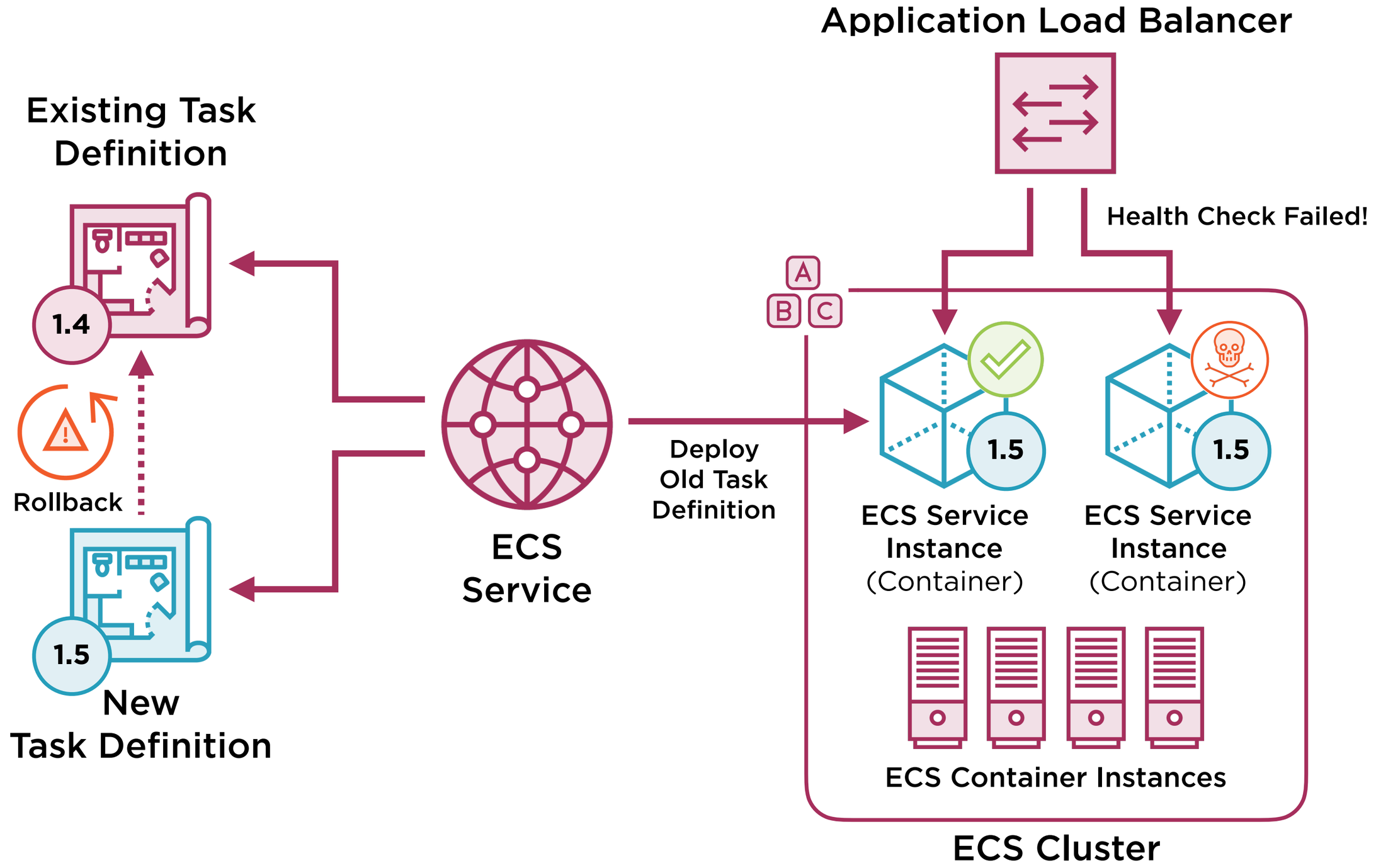

Application Load Balancer
Drain Connections
Existing Task Definition
1.4
Out of Service
Configuration Change
Image Tag = 1.5
A
B
C
1.5
1.4
ECS Service Instance (Container)
ECS Service Instance (Container)
ECS Service
1.5
New Task Definition
ECS Container Instances
ECS Cluster

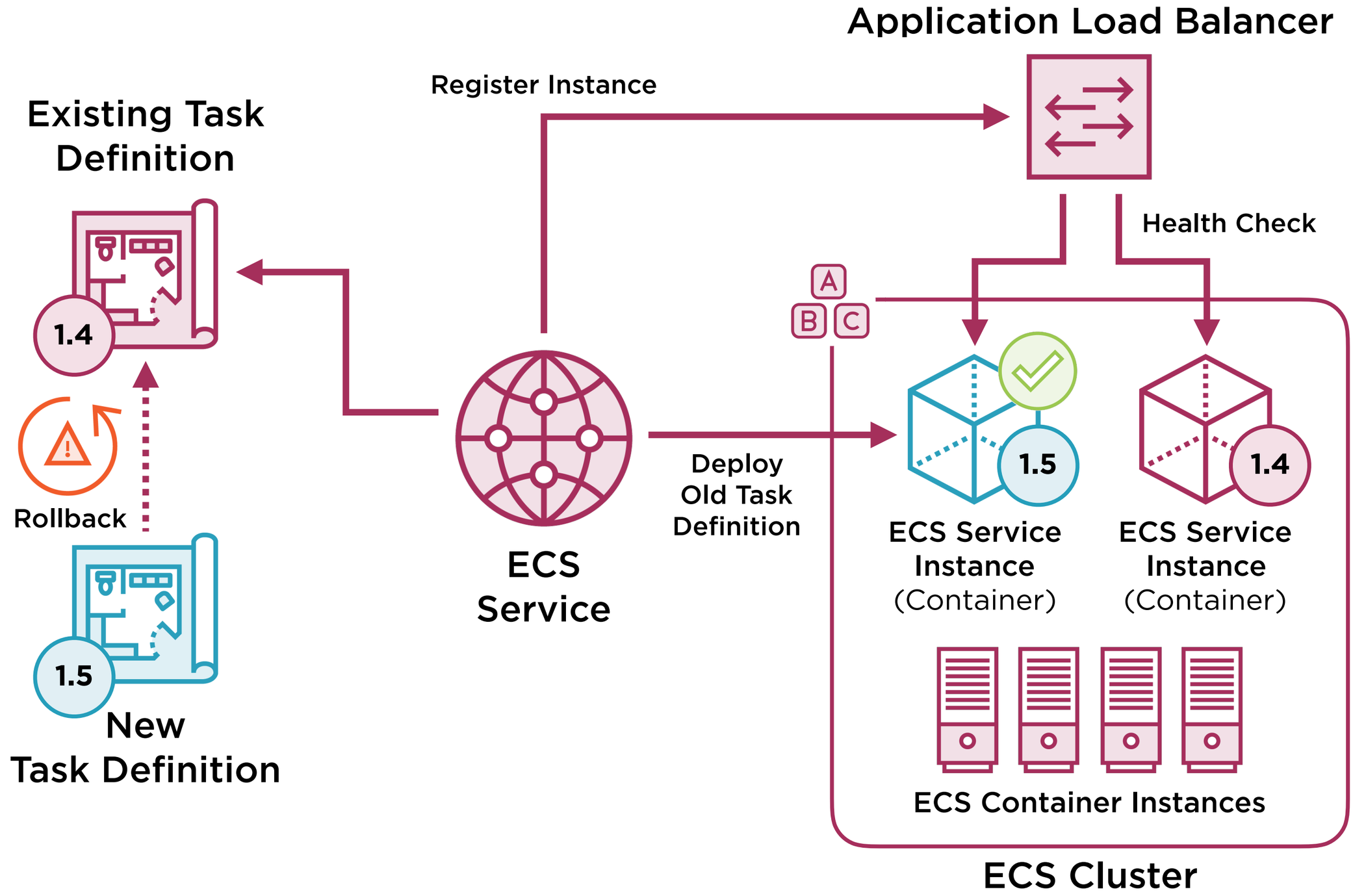

Application Load Balancer
Deregister Instance
Existing Task Definition
1.4
Out of Service
A
B
C
Configuration Change
Image Tag = 1.5
ECS Service
Deploy New Task Definition
1.5
1.4
ECS Service Instance (Container)
ECS Service Instance (Container)
1.5
New Task Definition
ECS Container Instances
ECS Cluster

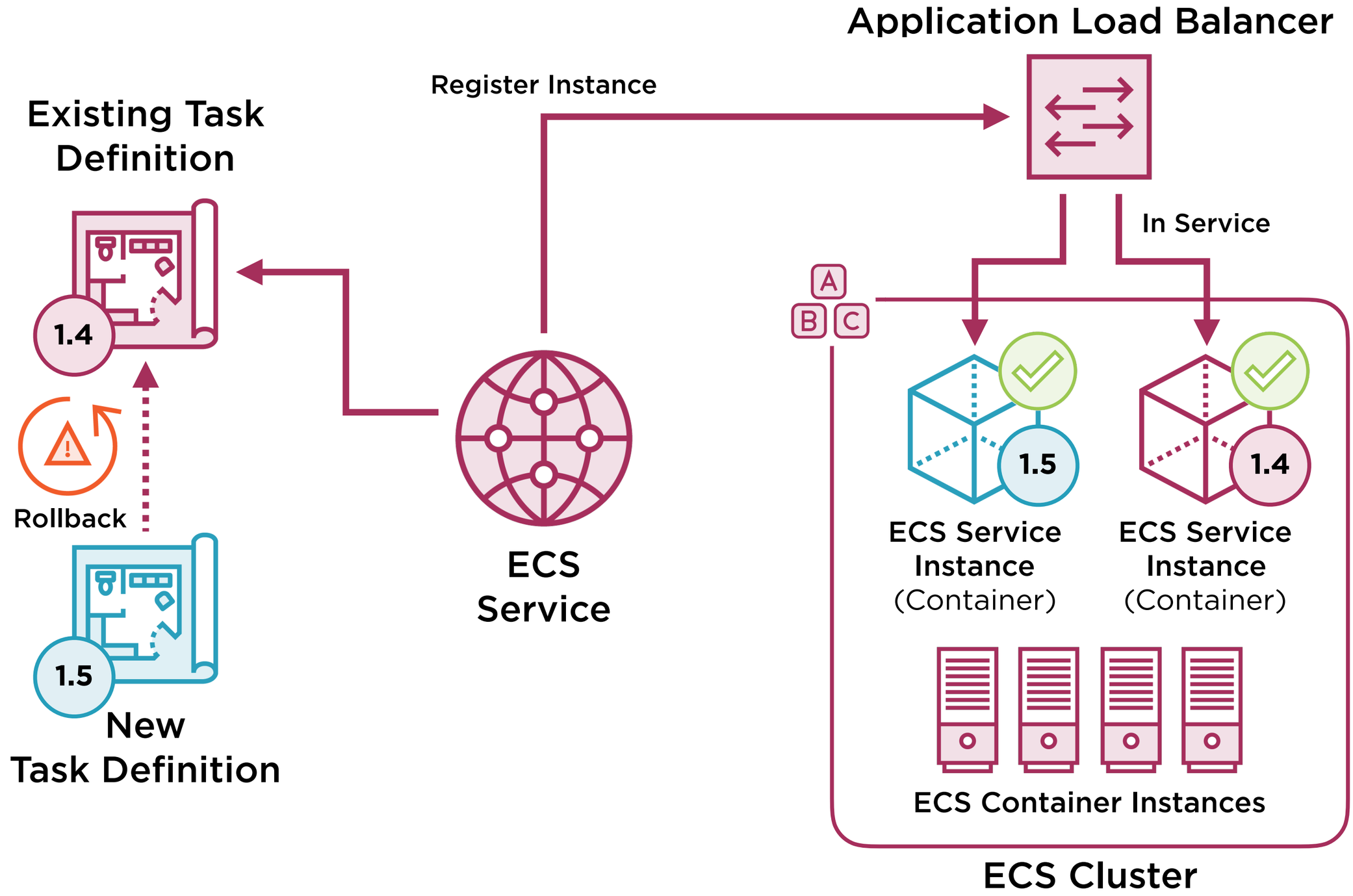

Application Load Balancer
Register Instance
Existing Task Definition
1.4
Configuration Change
Image Tag = 1.5
Health Check
A
B
C
1.5
1.5
ECS Service Instance (Container)
ECS Service Instance (Container)
ECS Service
Deploy New Task Definition
1.5
New Task Definition
ECS Container Instances
ECS Cluster

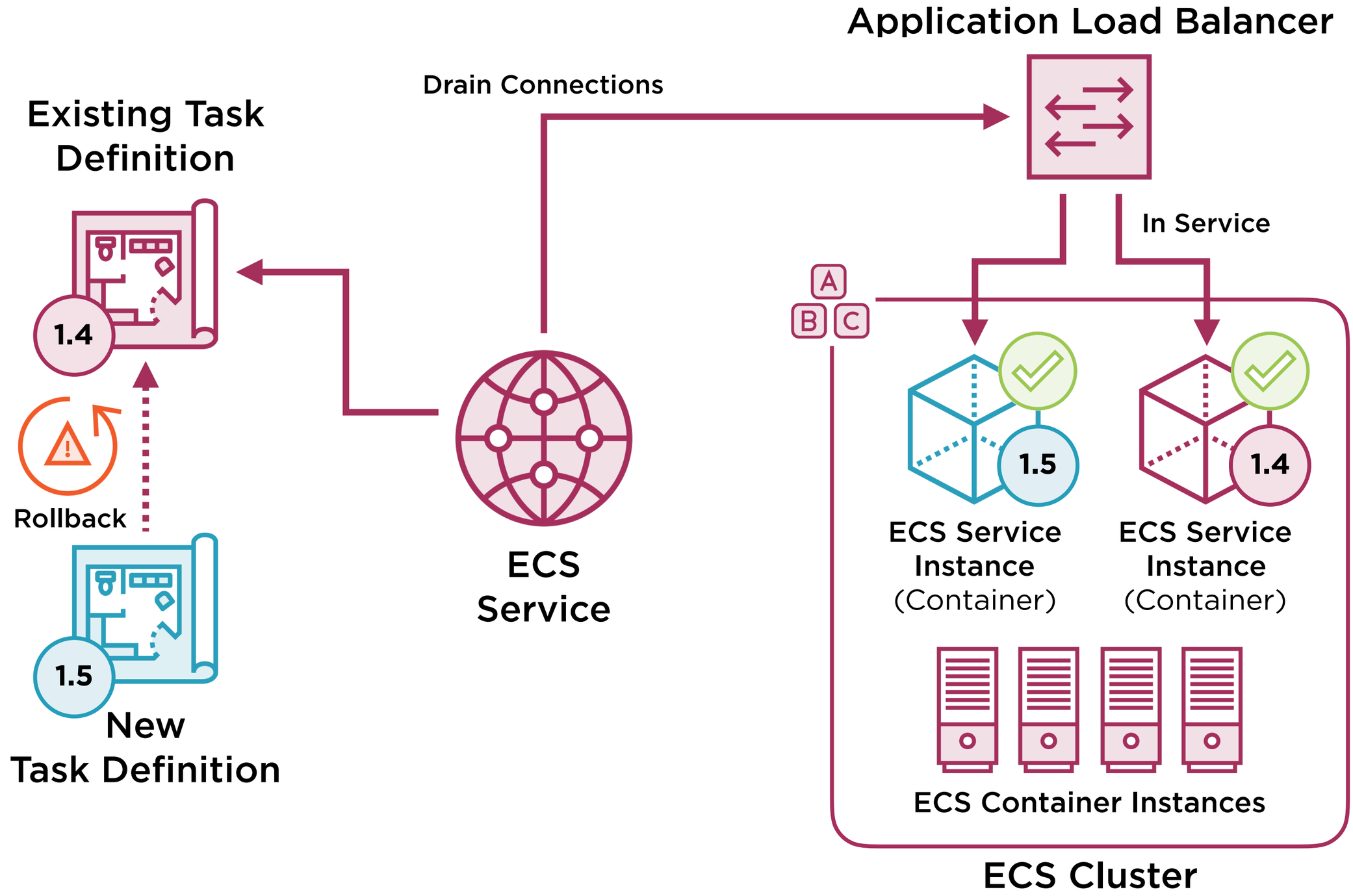

Application Load Balancer
Register Instance
Existing Task Definition
1.4
Configuration Change
Image Tag = 1.5
1.5
New Task Definition
ECS Service
Health Check Failed!
A
B
C
1.5
1.5
ECS Service Instance (Container)
ECS Service Instance (Container)
ECS Container Instances
ECS Cluster

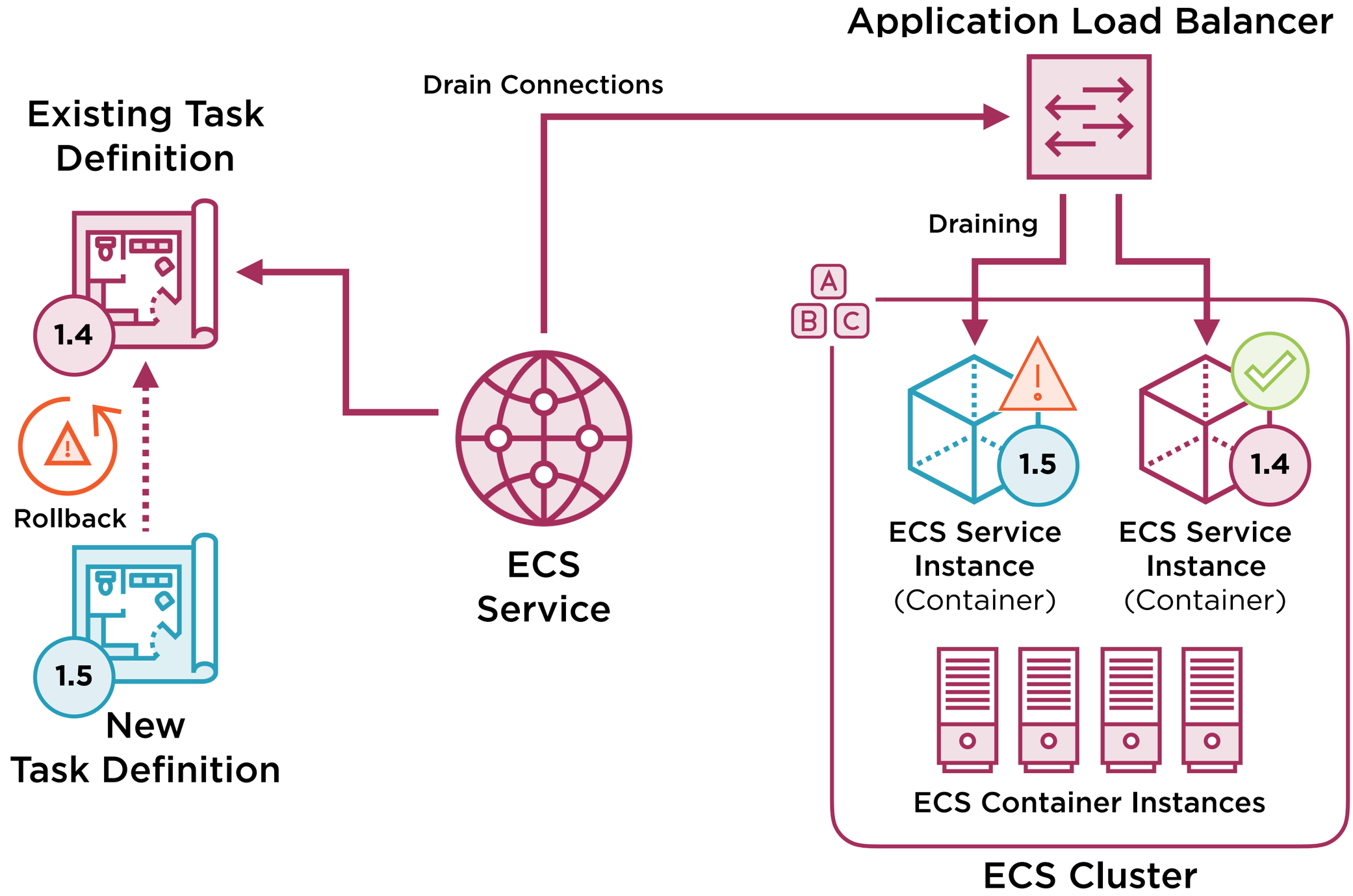

Application Load Balancer
Register Instance
Existing Task Definition
1.4
Configuration Change
Image Tag = 1.5
1.5
New Task Definition
ECS Service
Health Check Failed!
A
B
C
1.5
1.5
ECS Service Instance (Container)
ECS Service Instance (Container)
ECS Container Instances
ECS Cluster

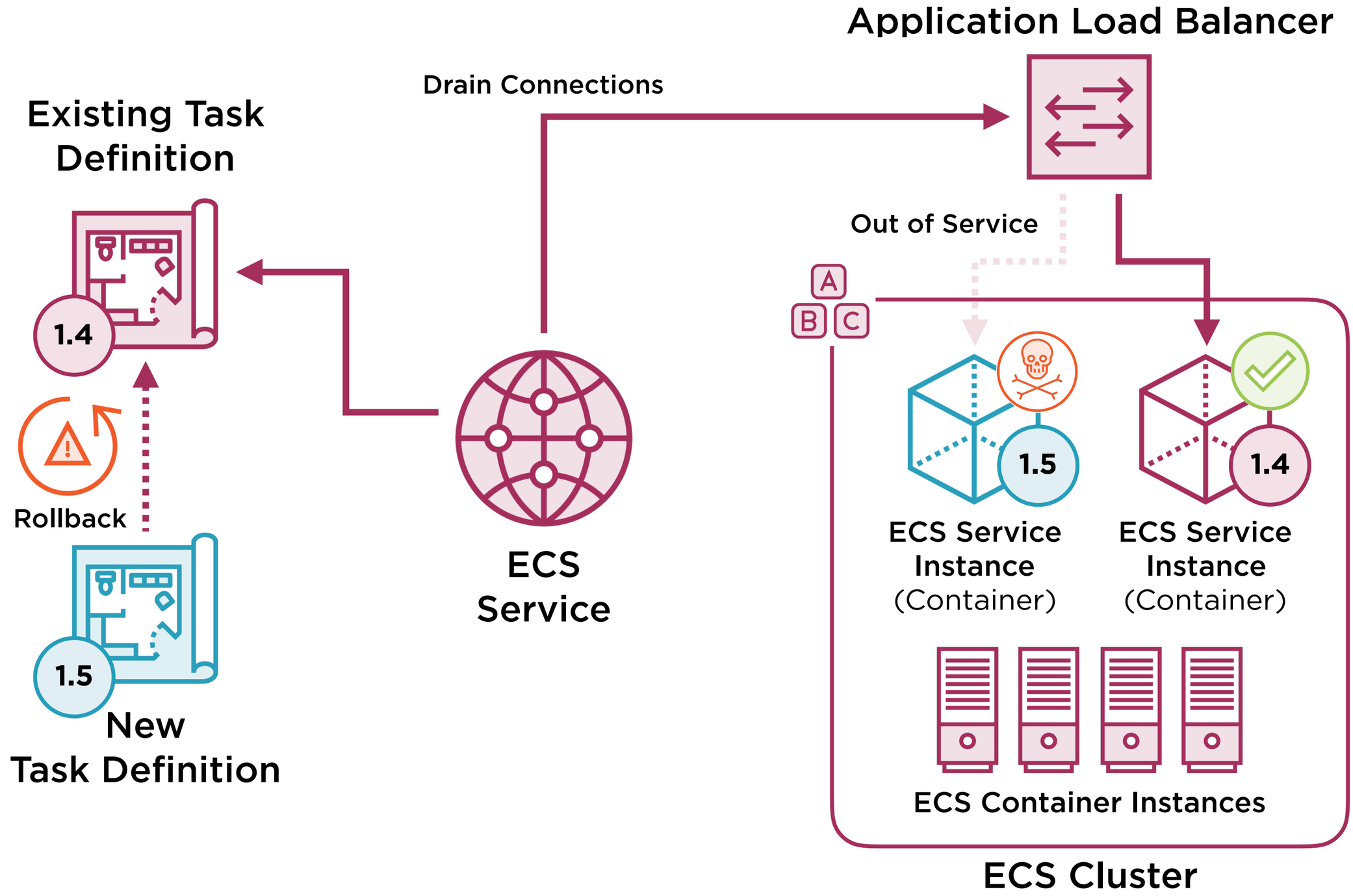

Application Load Balancer
Existing Task Definition
1.4
Rollback
1.5
New Task Definition
ECS Service
Deploy Old Task Definition
A
B
C
Health Check Failed!
1.5
1.5
ECS Service Instance (Container)
ECS Service Instance (Container)
ECS Container Instances
ECS Cluster

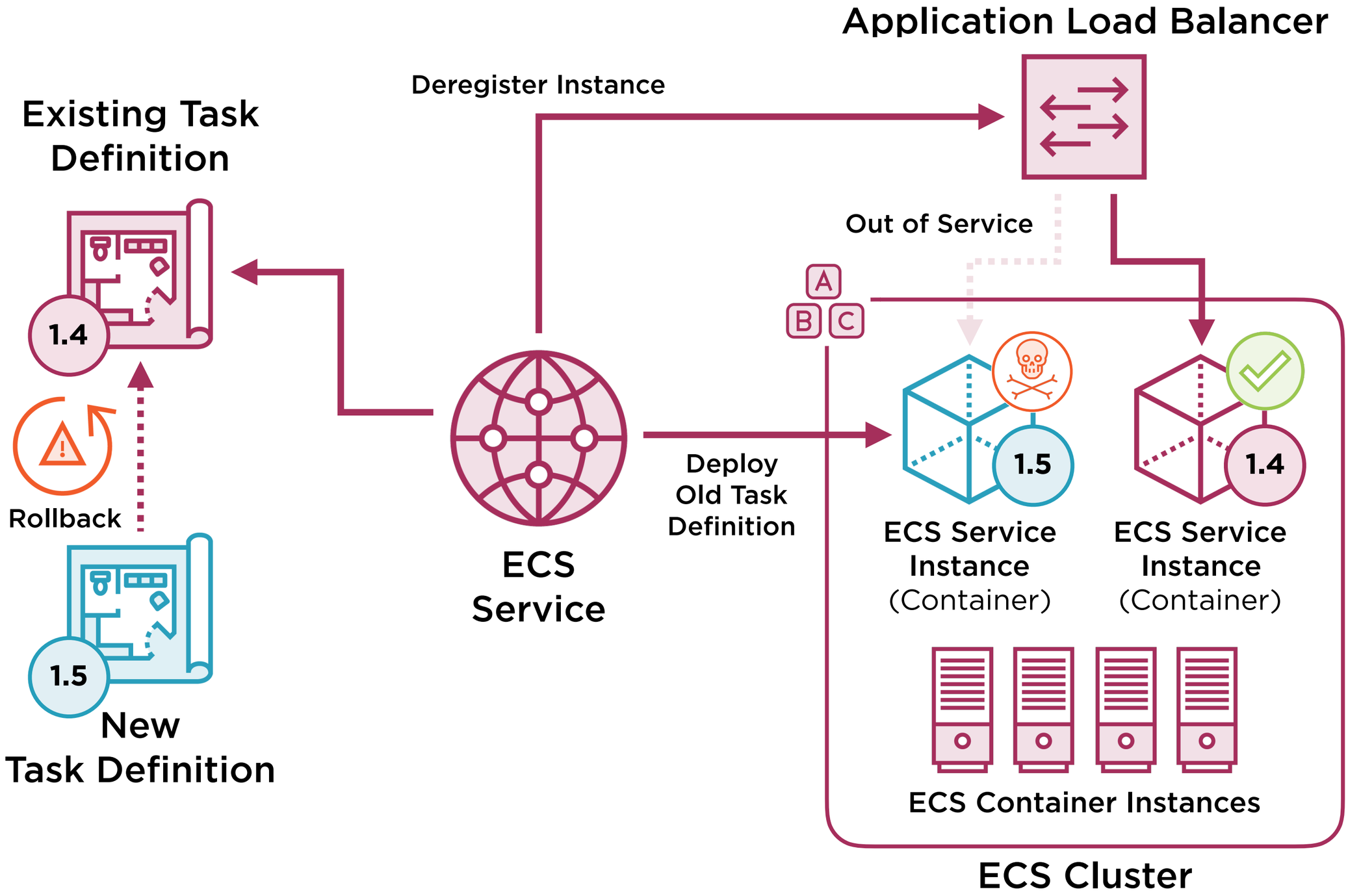

Application Load Balancer
Register Instance
Existing Task Definition
1.4
Health Check
A
B
C
Rollback
ECS Service
Deploy Old Task Definition
1.5
1.4
ECS Service Instance (Container)
ECS Service Instance (Container)
1.5
New Task Definition
ECS Container Instances
ECS Cluster

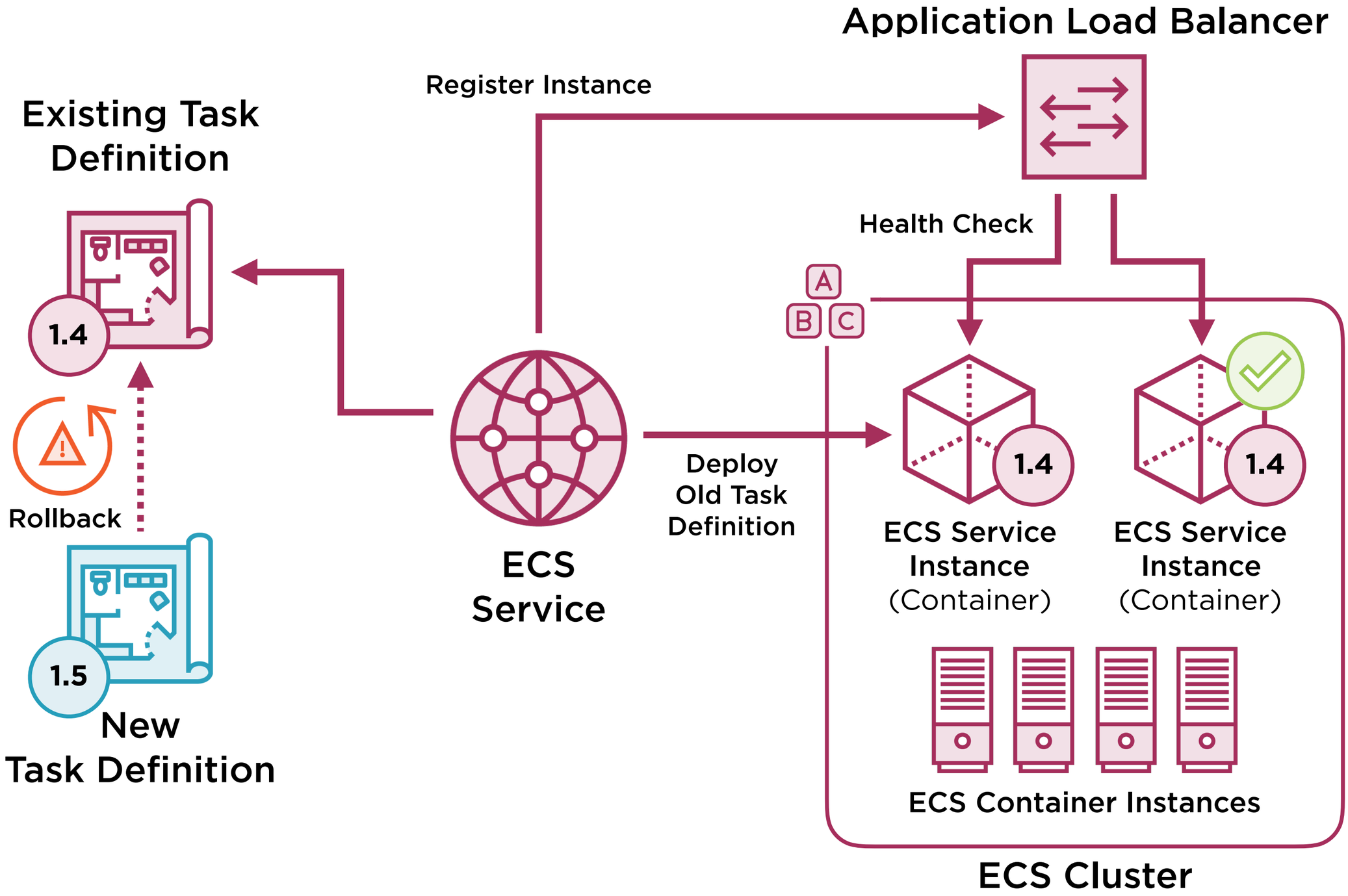

Application Load Balancer
Register Instance
Existing Task Definition
1.4
In Service
A
B
C
Rollback
ECS Service
1.5
1.4
ECS Service Instance (Container)
ECS Service Instance (Container)
1.5
New Task Definition
ECS Container Instances
ECS Cluster

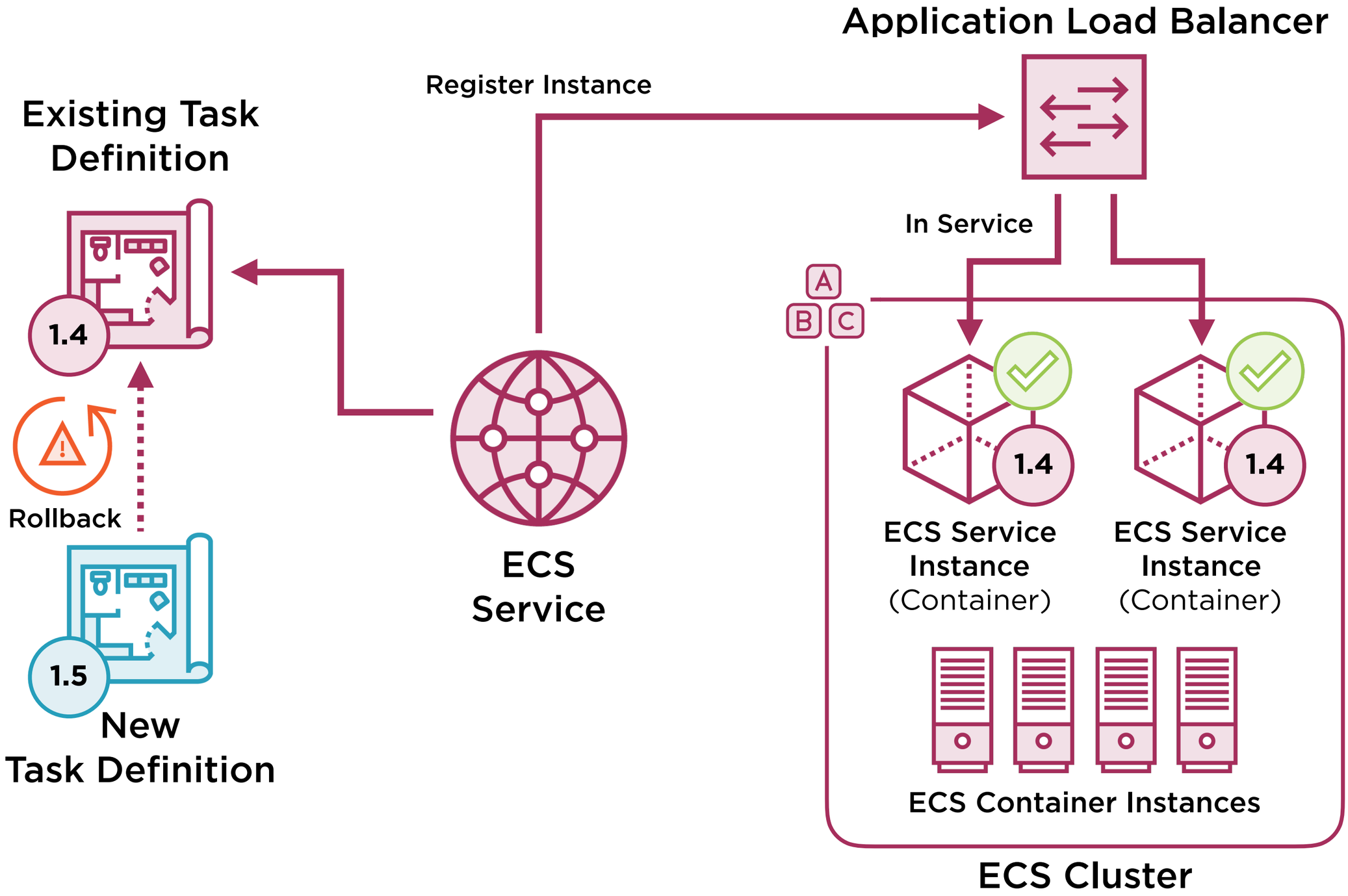

Application Load Balancer
Drain Connections
Existing Task Definition
1.4
In Service
A
B
C
Rollback
1.5
1.4
ECS Service
ECS Service Instance (Container)
ECS Service Instance (Container)
1.5
New Task Definition
ECS Container Instances
ECS Cluster

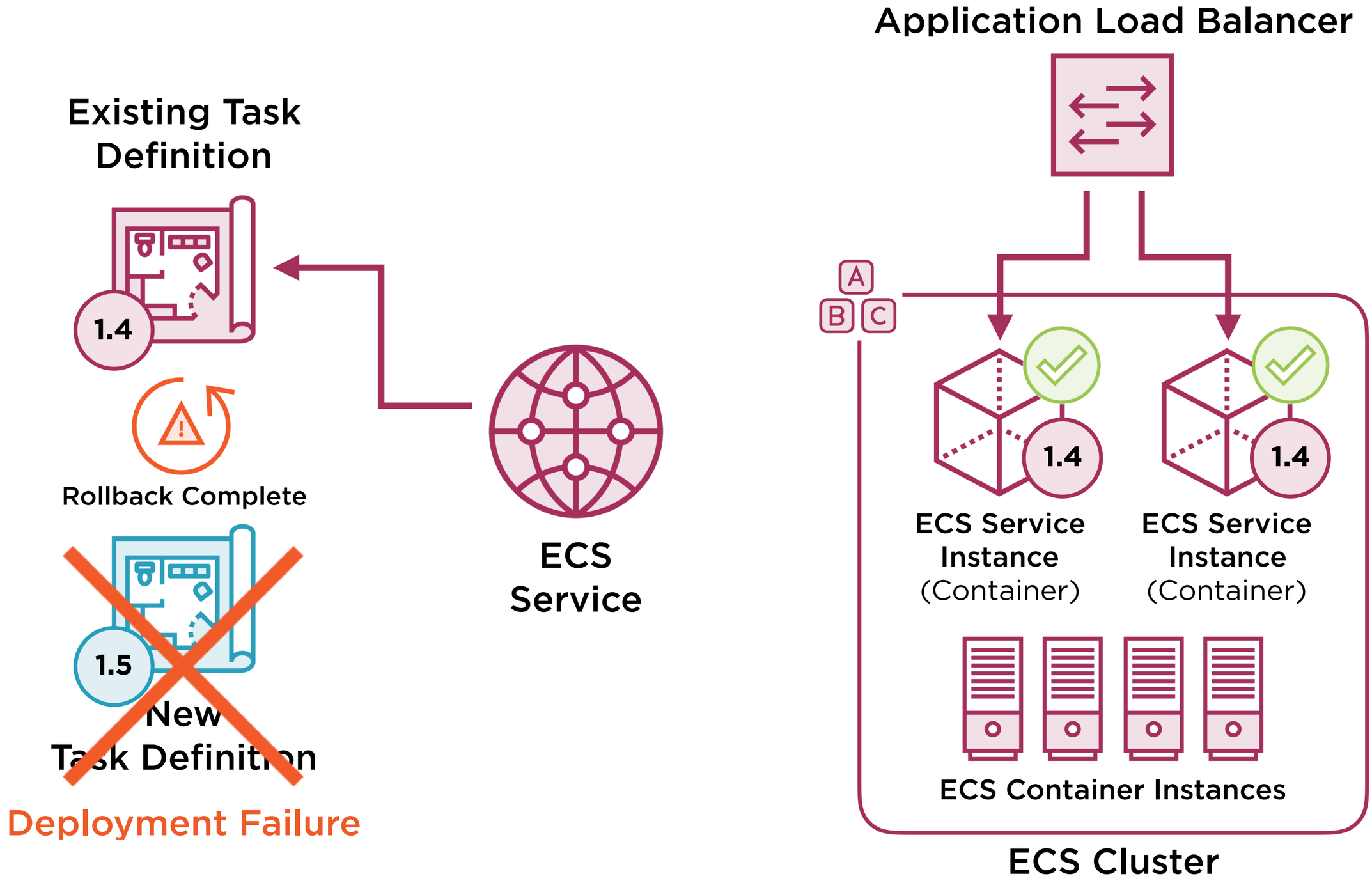

Application Load Balancer
Drain Connections
Existing Task Definition
1.4
Draining
A
B
C
Rollback
1.5
1.4
ECS Service
ECS Service Instance (Container)
ECS Service Instance (Container)
1.5
New Task Definition
ECS Container Instances
ECS Cluster


Application Load Balancer
Drain Connections
Existing Task Definition
1.4
Out of Service
A
B
C
Rollback
1.5
1.4
ECS Service
ECS Service Instance (Container)
ECS Service Instance (Container)
1.5
New Task Definition
ECS Container Instances
ECS Cluster


Application Load Balancer
Deregister Instance
Existing Task Definition
1.4
Out of Service
A
B
C
Rollback
ECS Service
Deploy Old Task Definition
1.5
1.4
ECS Service Instance (Container)
ECS Service Instance (Container)
1.5
New Task Definition
ECS Container Instances
ECS Cluster


Application Load Balancer
Register Instance
Existing Task Definition
1.4
Health Check
A
B
C
Rollback
ECS Service
Deploy Old Task Definition
1.4
1.4
ECS Service Instance (Container)
ECS Service Instance (Container)
1.5
New Task Definition
ECS Container Instances
ECS Cluster

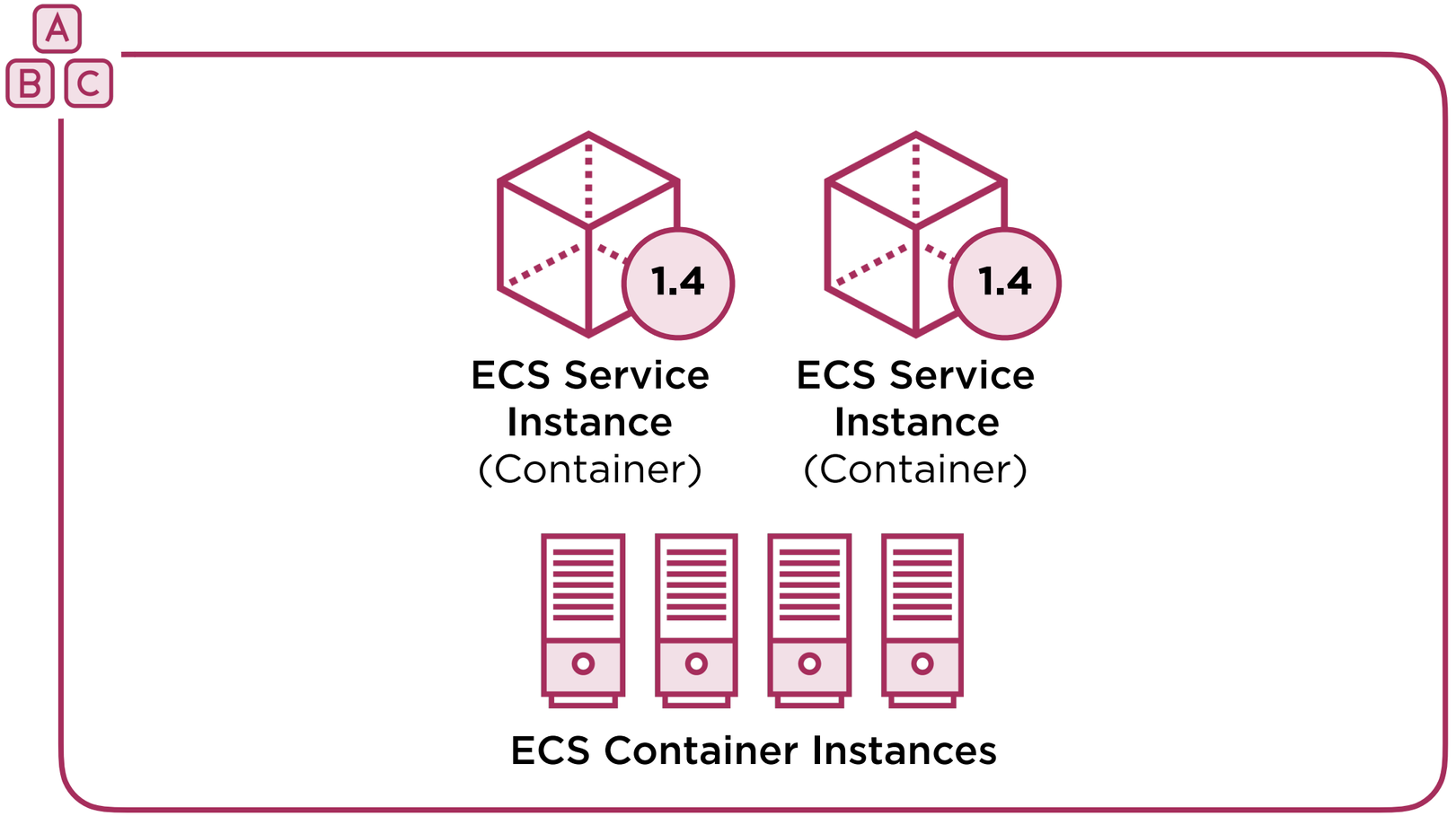

Application Load Balancer
Register Instance
Existing Task Definition
1.4
In Service
A
B
C
Rollback
ECS Service
1.4
1.4
ECS Service Instance (Container)
ECS Service Instance (Container)
1.5
New Task Definition
ECS Container Instances
ECS Cluster


Application Load Balancer
Existing Task Definition
1.4
Rollback Complete
ECS Service
1.5
New Task Definition
Deployment Failure
A
B
C
1.4
1.4
ECS Service Instance (Container)
ECS Service Instance (Container)
ECS Container Instances
ECS Cluster

Configuring ECS Services

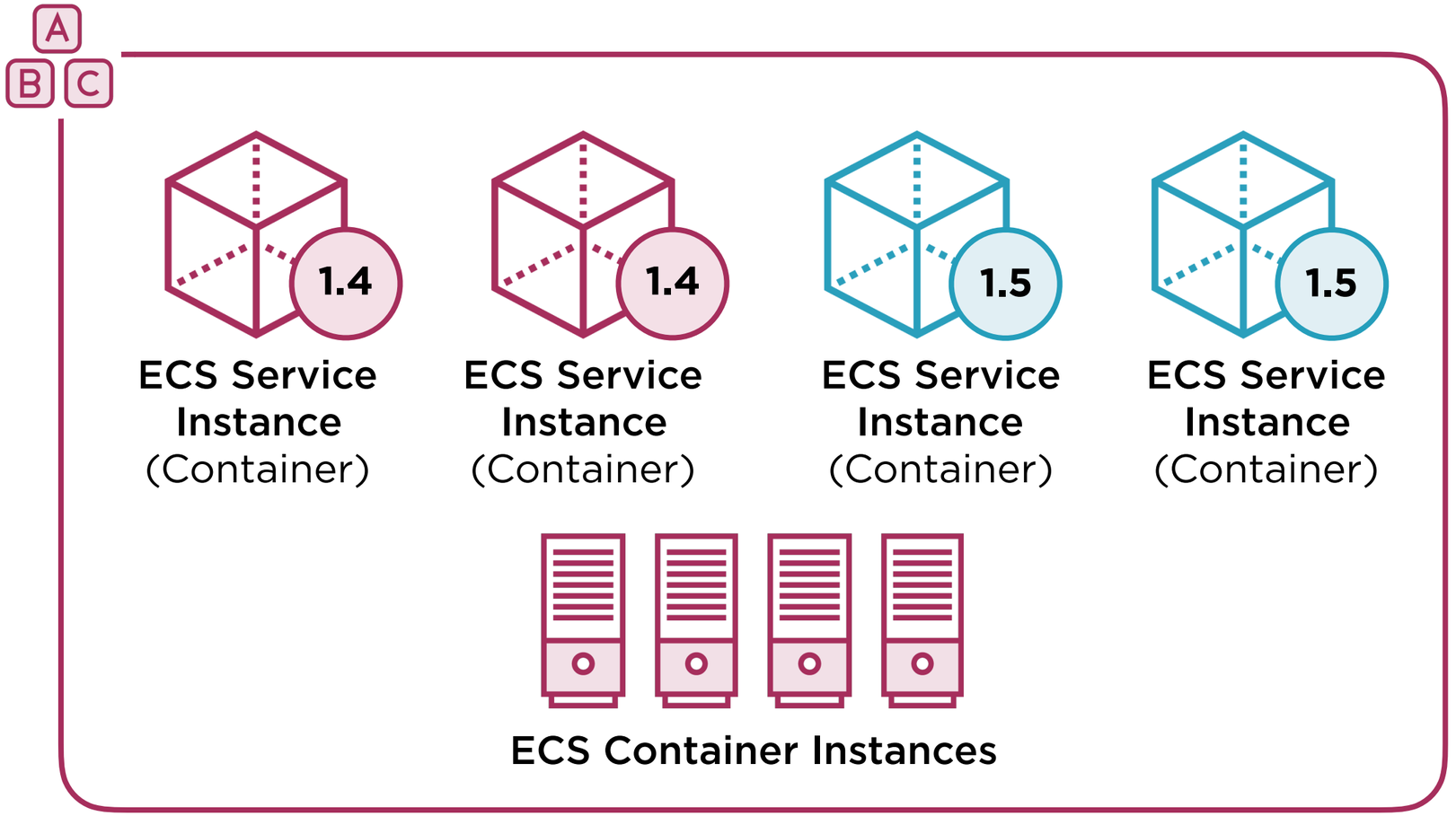
Temporarily Increasing ECS Service Count

1. Temporarily increase instance count to 4 (200%)
2. Deploy new service instances



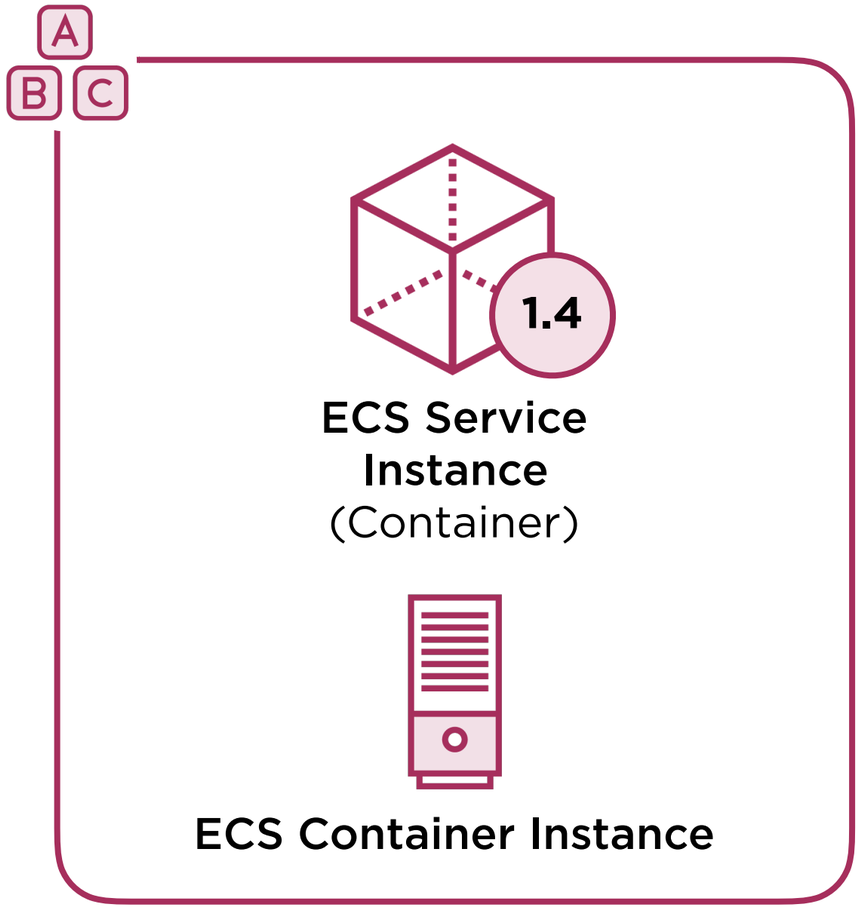
Temporarily Increasing ECS Service Count

1. Temporarily increase instance count to 4 (200%)
2. Deploy new service instances
3. Stop remaining old service instances



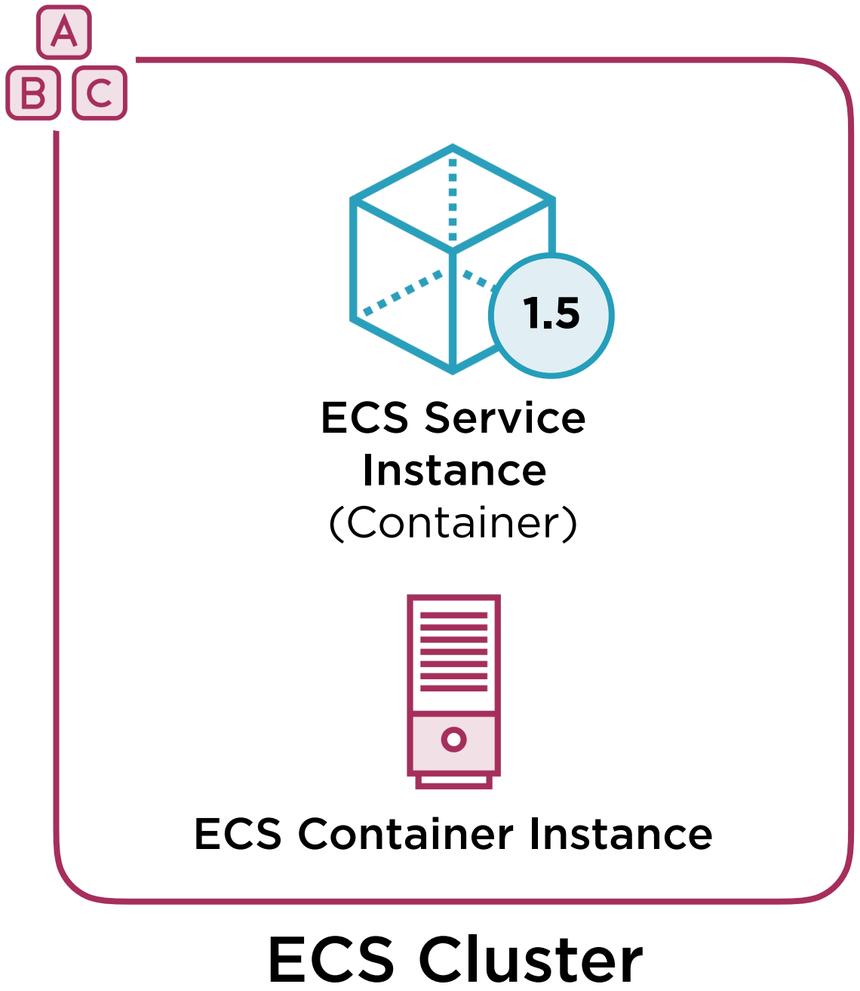
Single Instance Deployments

1. Temporarily reduce instance count to 0 (0%)
2. Deploy new service instance



Single Instance Deployments

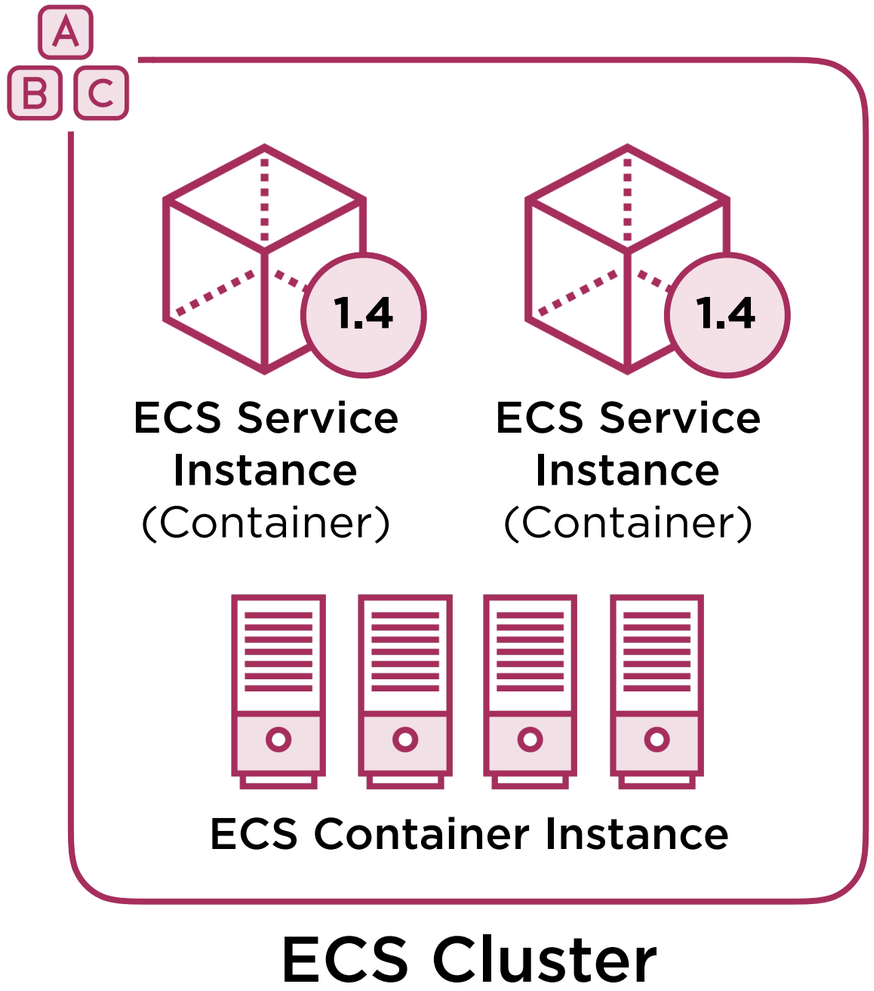
1. Temporarily reduce instance count to 0 (0%)
2. Deploy new service instance



ECS Cluster

Multi Instance Deployments

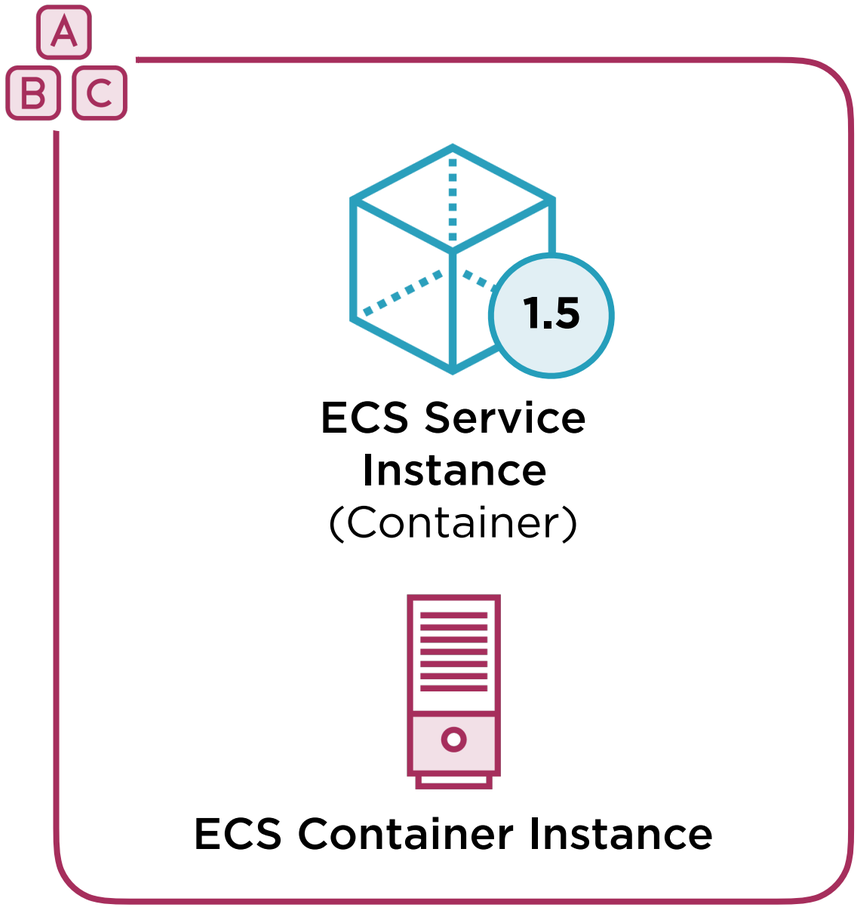
1. Temporarily reduce instance count to 1 (50%)
2. Deploy new service instance



ECS Cluster

Single Instance Deployments

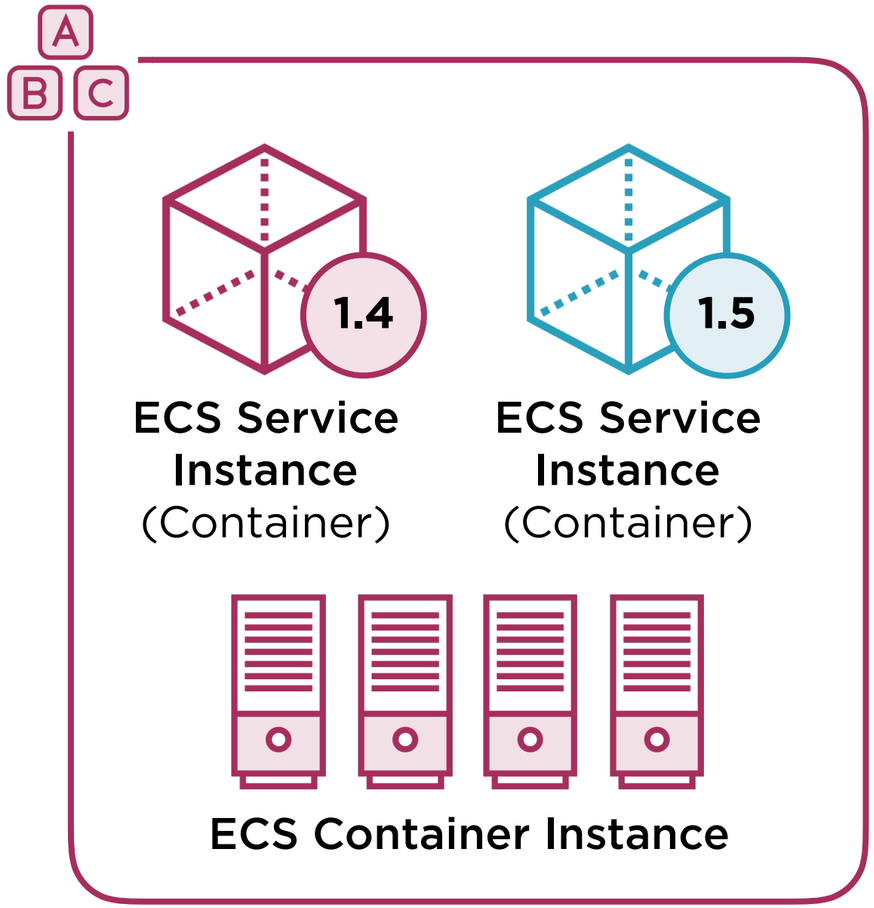
1. Temporarily reduce instance count to 0 (0%)
2. Deploy new service instance



ECS Cluster

Multi Instance Deployments

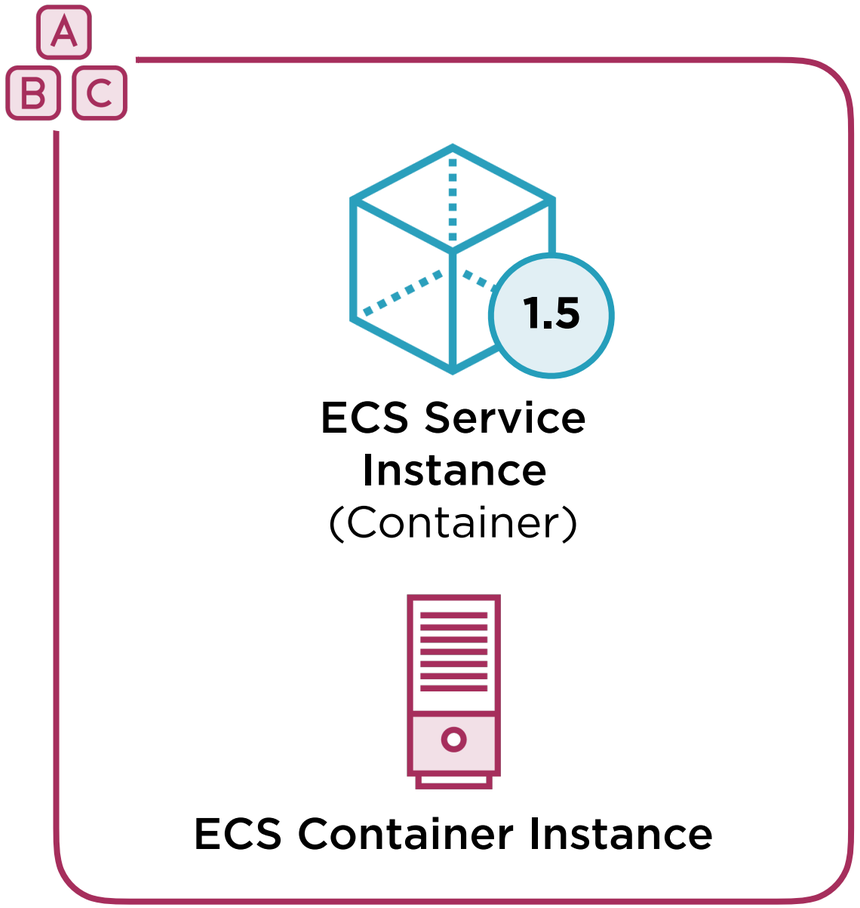
1. Temporarily reduce instance count to 1 (50%)
2. Deploy new service instance
3. Stop remaining old service instance
4. Deploy new service instance



ECS Cluster

Single Instance Deployments

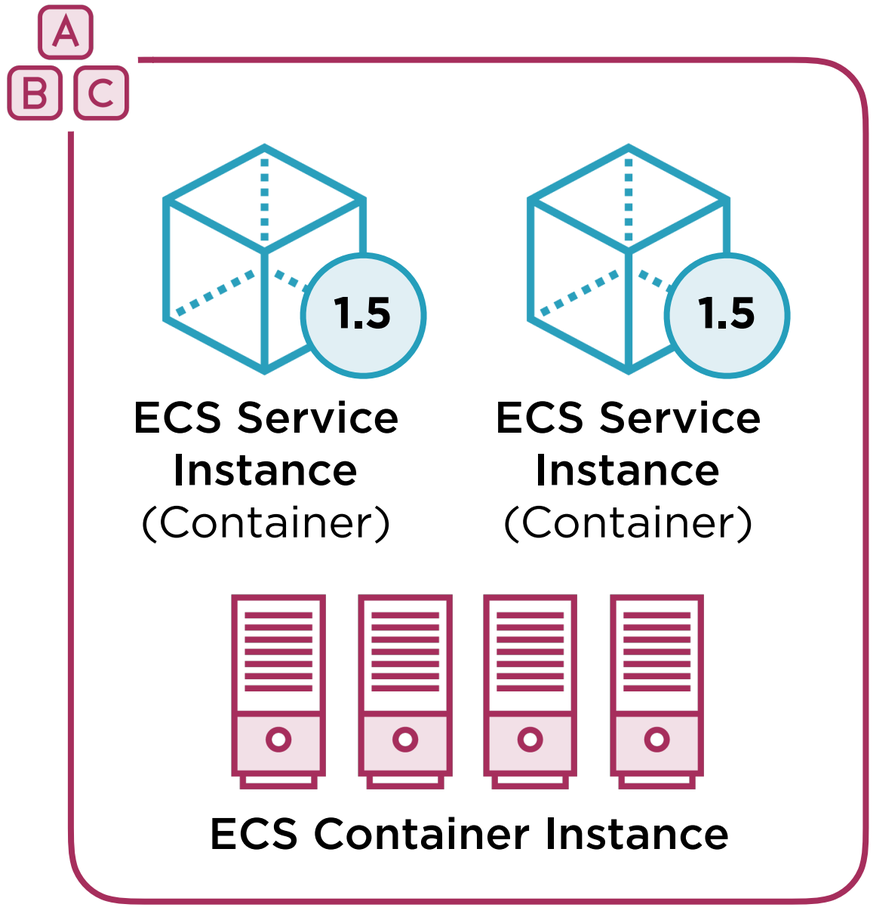
1. Temporarily reduce instance count to 0 (0%)
2. Deploy new service instance



ECS Cluster

Multi Instance Deployments

1. Temporarily reduce instance count to 1 (50%)
2. Deploy new service instance
3. Stop remaining old service instance
4. Deploy new service instance



ECS Cluster

Deploying the Microtrader Stack

CloudFormation Template

```
Parameters:
  ApplicationImageId:
    Type: String
  ApplicationDesiredCount:
    Type: Number
  VpcName:
    Type: String
    Default: Development
  DatabaseUser:
    Type: String
```

Ansible Playbook Settings

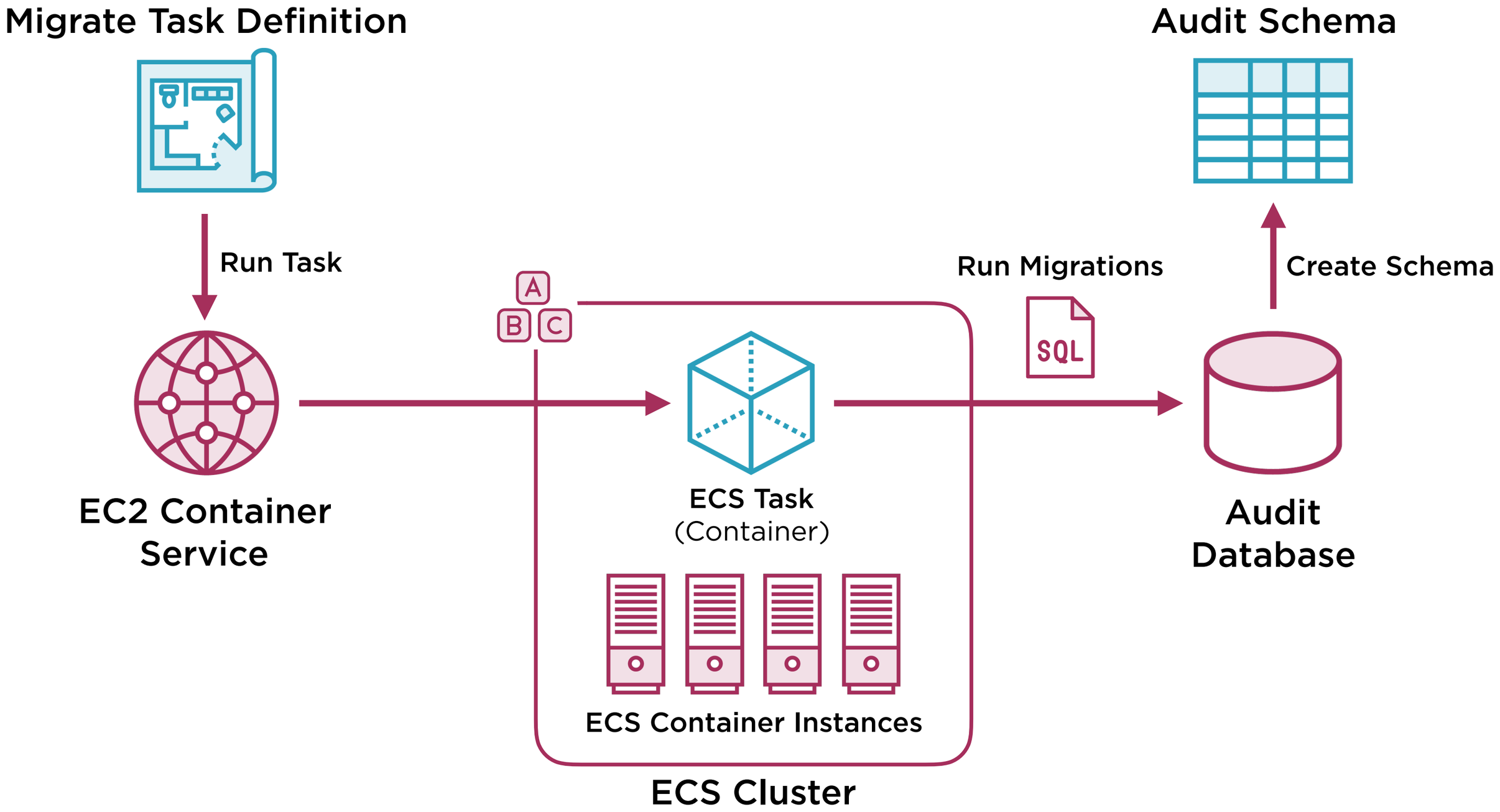
`config_application_image_id: ami-12341234`

`config_application_desired_count: 4`

Defaults to default value of “Development”

Playbook returns error if not defined

Troubleshooting the Microtrader Application


Migrate Task Definition
Audit Schema
Run Task
Run Migrations
Create Schema
A
B
C
SQL
EC2 Container Service
ECS Task (Container)
Audit Database
ECS Container Instances
ECS Cluster

Summary

Deploying ECS Applications using Ansible and CloudFormation

ECS System Resources

- CPU reservations
- Memory reservations/limits
- JVM memory tuning

ECS CloudFormation Resources

- ECS Clusters
- ECS Task Definitions
- ECS Services

Deployment and Troubleshooting