Accelerating Containerized Workloads With EC2 Spot

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Agenda

Recap of EC2 Spot

- What is EC2 Spot? & Why use Spot?
- Best Practices

Provision EC2 Spot

Handling Interruptions

Container workloads with EC2 Spot

- ECS
- EKS
- Batch

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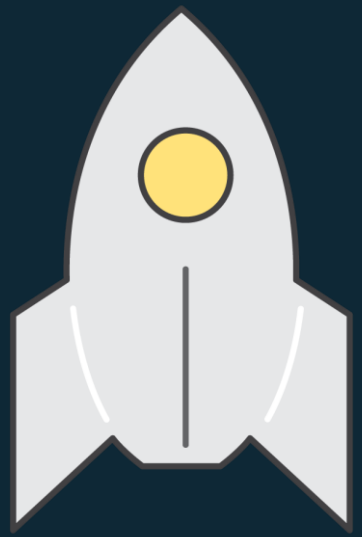
Recap of EC2 Spot Concepts

What is EC2 Spot & Why Spot

Spare EC2 Capacity that AWS can reclaim with 2-minutes notice

Savings up to 90% off the On Demand Price



Turbo Boost your Results

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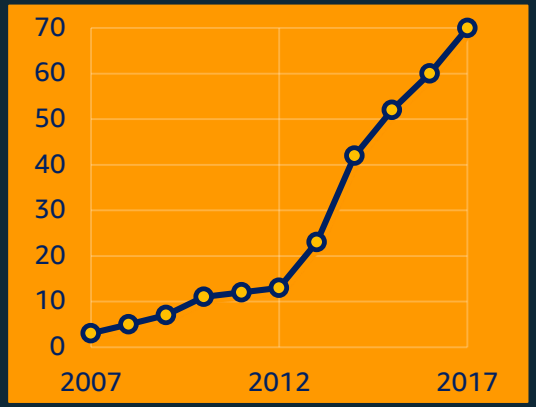
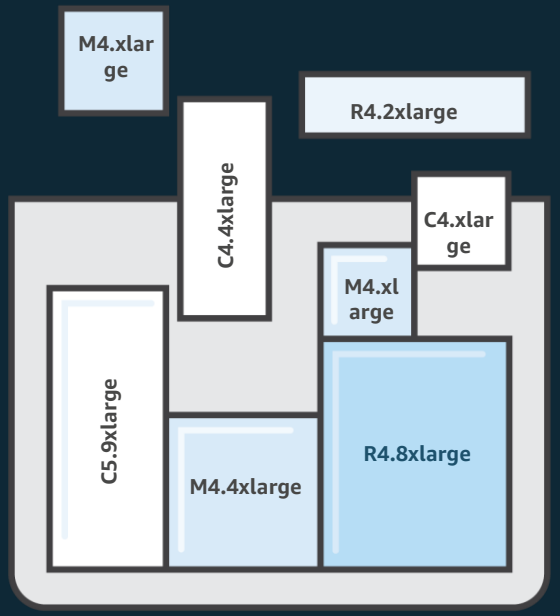
Understanding EC2 Capacity & Spot Pools

Each instance family, each instance size, in each Availability Zone, in every Region is a ***separate*** Spot pool



100s of Instance Options



Instance Flexibility and Diversification Made Easy with Spot Fleet

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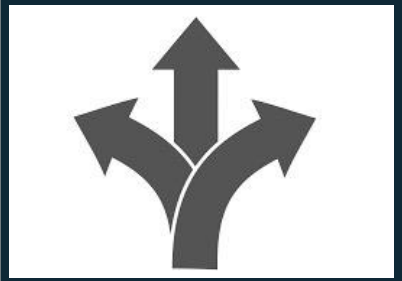
Best Practices for Running Apps on Spot Instances

Save more on distributed and flexible applications

Stateless

Fault-Tolerant

Can you Restart ?



Flexible

Multi-AZ and Instance Flexibility

Loosely Coupled

Distributed? Do you Checkpoint?

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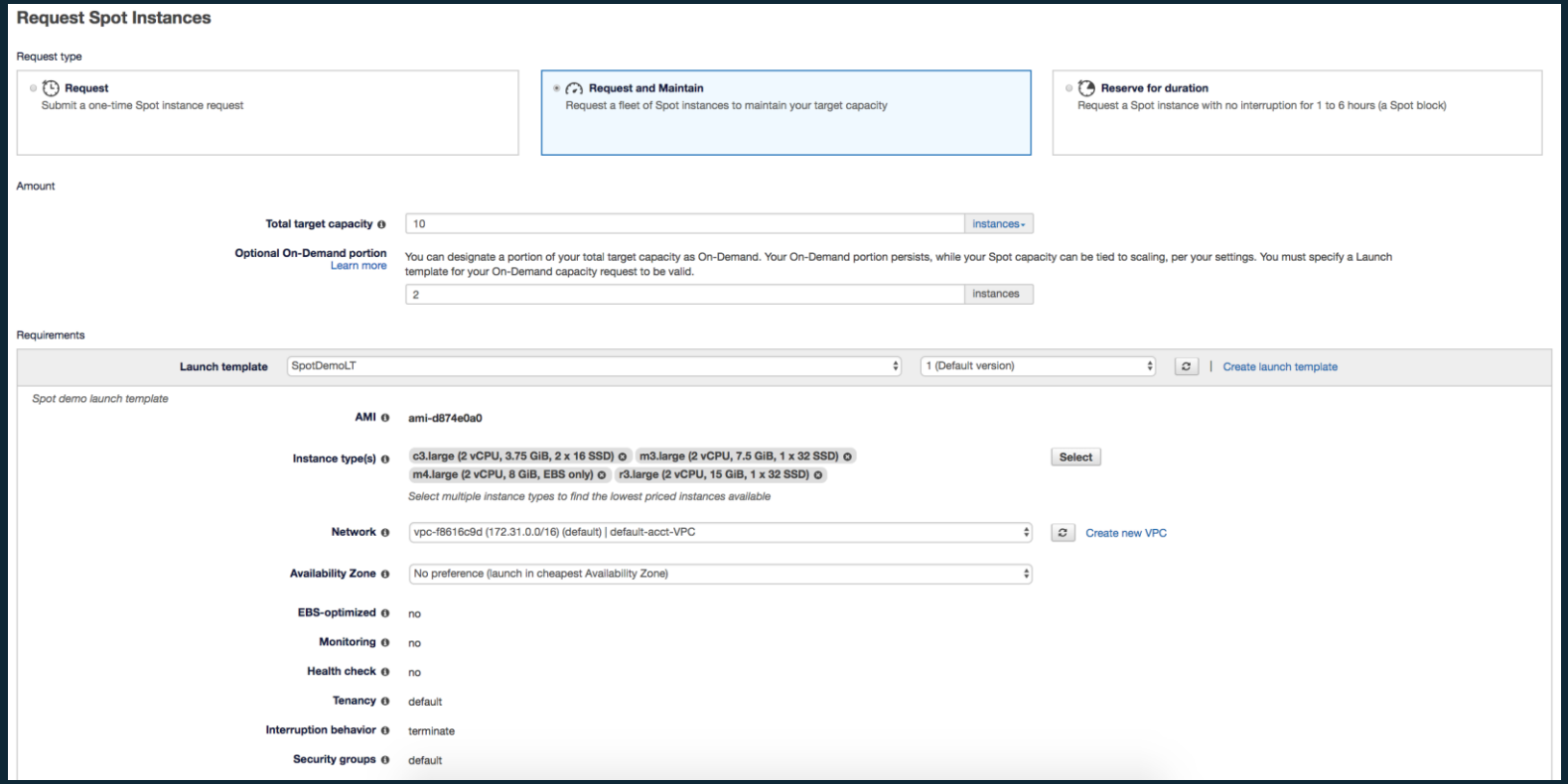
Spot Provisioning - EC2/Spot Fleet



Spot Provisioning - RunInstances

```
acbc32918437:~ mperi$ aws ec2 run-instances --image-id ami-f2d3638a --count 1 --instance-type c3.large --key-name spotinst -
--security-groups default --instance-market-options file:///Users/mperi/Desktop/spotconfig.json --region us-west-2
```

```
{
  "MarketType": "spot",
  "SpotOptions": {
    "MaxPrice": "1.0",
    "SpotInstanceType": "persistent",
    "InstanceInterruptionBehavior": "stop"
  }
}
```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Spot Interruptions

EC2 Spot is interrupted when

- On-Demand requires capacity back
- EC2 Spot price exceeds specified *Max Price* in the request

Notified of interruptions in 2 ways

- CloudWatch events
- Instance metadata

```
[ec2-user@ip-192-168-133-1 ~]$ curl http://169.254.169.254/latest/meta-data/instance-action/
none[ec2-user@ip-192-168-133-1 ~]$
```


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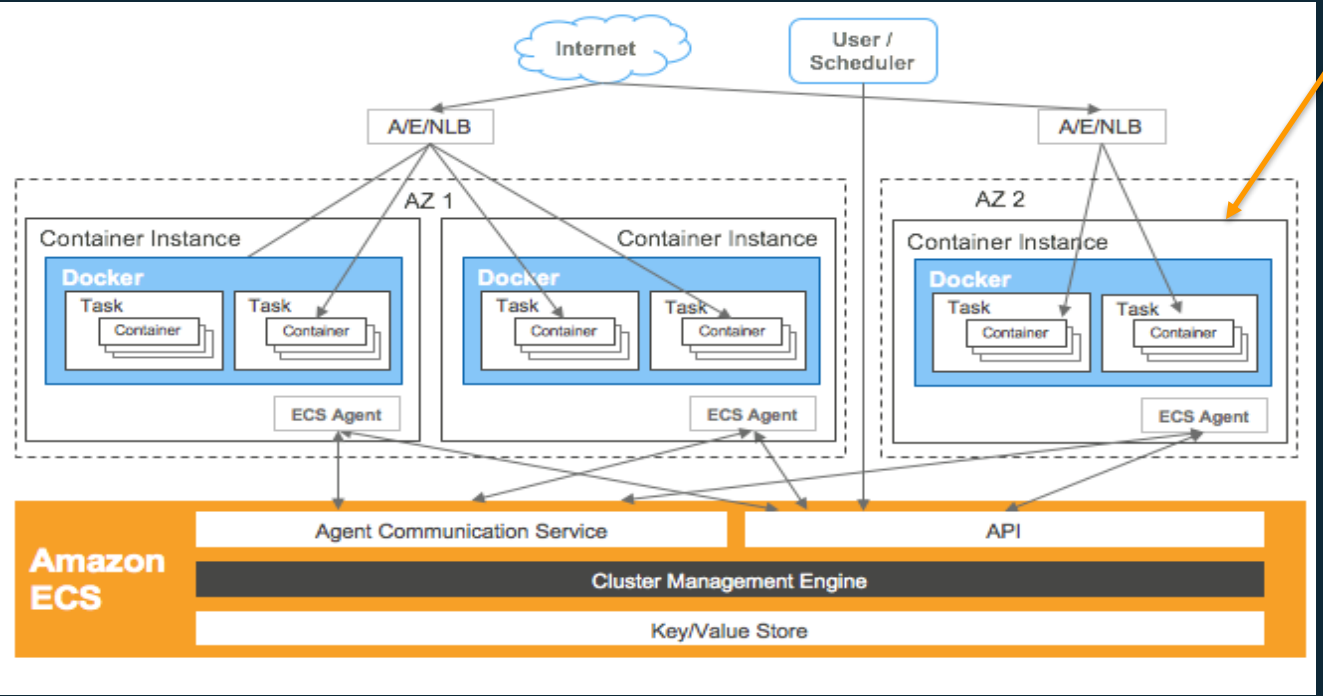
ECS with EC2 Spot

ECS concept (recap)

Worker nodes on EC2 Spot or On-Demand



ECS with EC2 Spot - Provisioning

- ECS is integrated via Console with Spot Fleet
- Spot Fleet launches instances
  - Each EC2 Instance registers with ECS Cluster

```
#!/bin/bash
# Set any ECS agent configuration options
echo "ECS_CLUSTER=default" >> /etc/ecs/ecs.config
```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ECS with EC2 Spot - Scaling

- 2 dimensions to scaling
  - EC2 Instance and Container
- EC2 Instance via Automatic Scaling
  - 2 scaling policies
    - Target tracking scaling
    - Step scaling

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ECS with EC2 Spot – Scaling (cont…)

- Target tracking scaling
  - Select a metric, set target value
  - Spot Fleet creates & manages CW alarms that trigger scaling policy
  - Adds/removes capacity to keep metric at/close to target value specified.

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ECS with EC2 Spot - Scaling (cont…)

- Step scaling
  - You specify the CloudWatch alarms or trigger the scaling policies

ECS with EC2 Spot – Termination/Interruption

- ECS Service availability is maintained
- Need interruption to be managed
  - Stop sending new traffic to terminating instance
  - Active connections are drained
  - Place a new copy on another running EC2 instance

Termination/Interruption (cont…)

- Spot Fleet will make new requests to fulfill target capacity
- ECS
  - Move EC2 instance to DRAINING state
  - This prevents any new tasks to be scheduled on the host.
- Service scheduler will place tasks on other hosts in cluster

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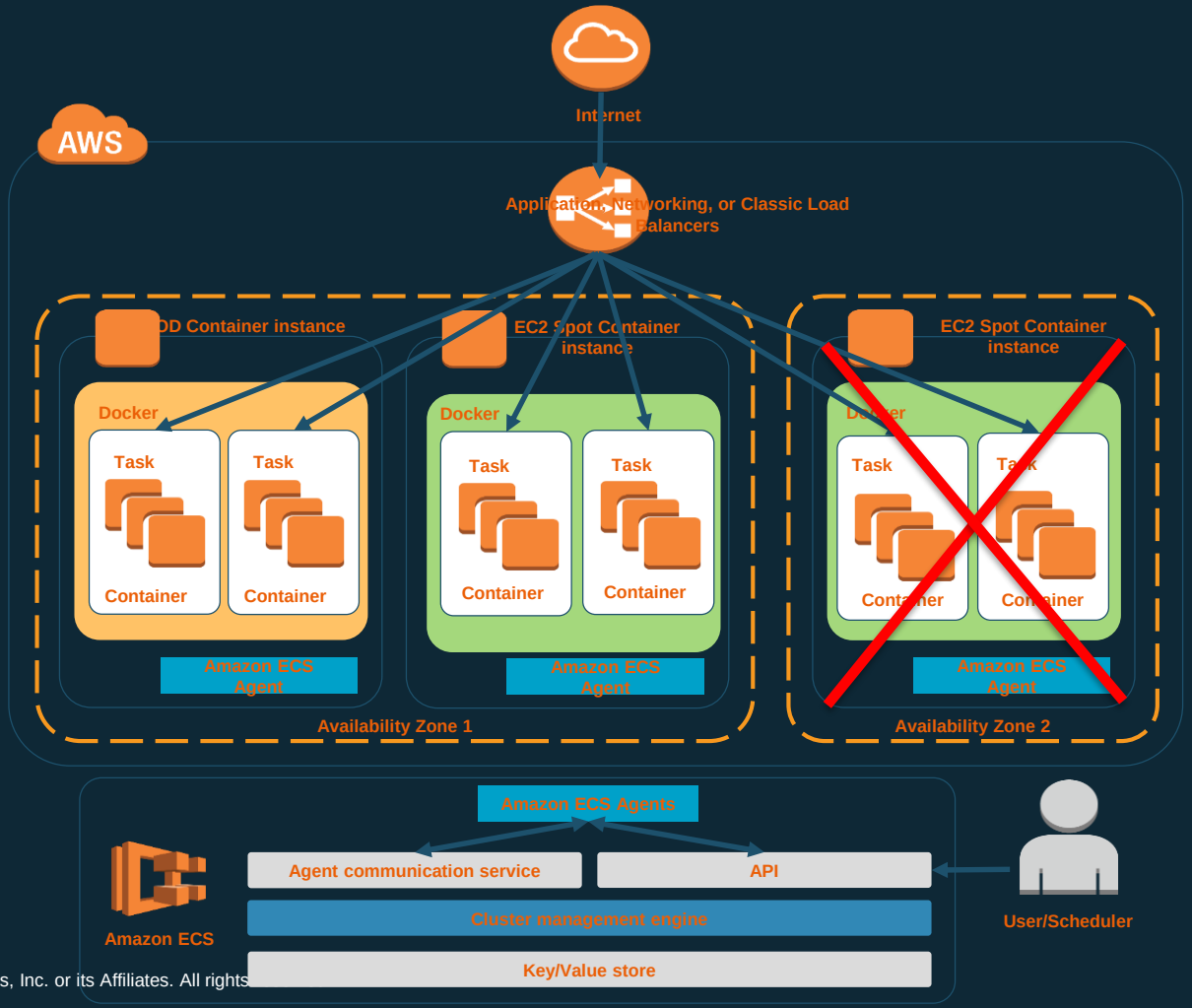
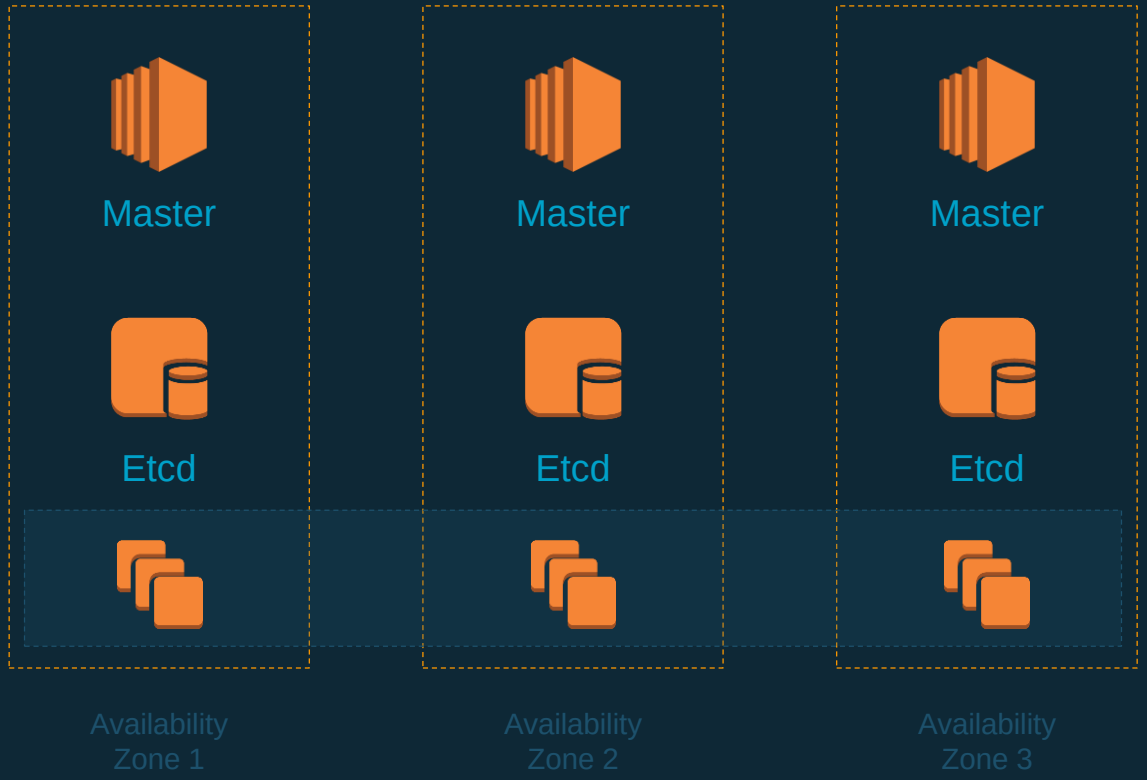


EKS with EC2 Spot

EKS – Master Nodes (Recap)



EKS – Logical layout of Master Endpoint and Worker Nodes

EKS with EC2 Spot - Provisioning

- Worker node user data needs to connect to the Master node endpoint
  - If you use Cloudformation EC2::Instance, then EC2 Spot instance is requested via RunInstances API
  - If you use LaunchConfig, then EC2 Spot instance is requested via ASG.
    - ASG makes the Spot Instance Request (*sir-**) on your behalf
- K8's optionally uses *label* to manage pod placement
  - --node-labels *lifecycle=Ec2Spot*

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EKS Spot provisioning (cont…)

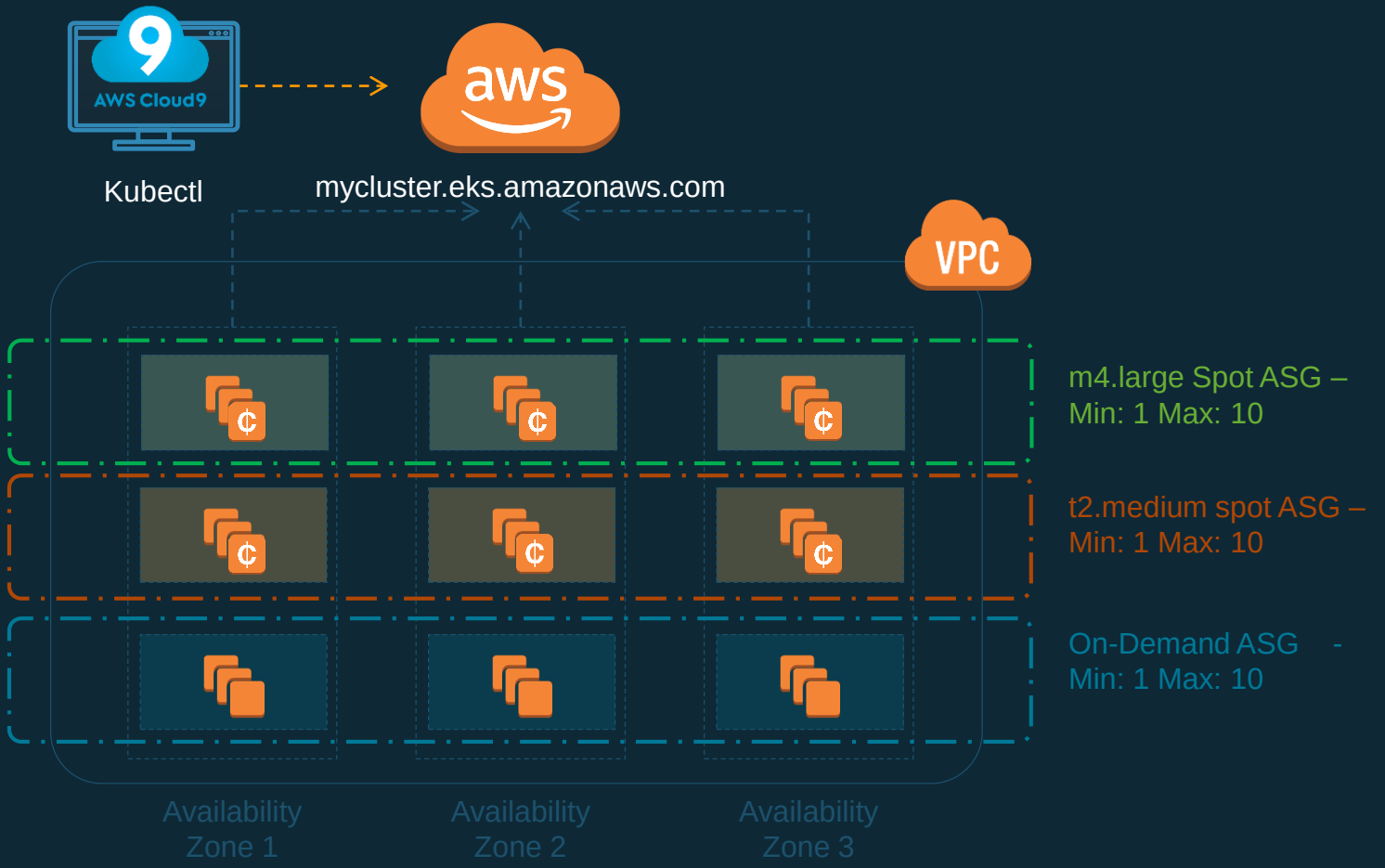
- BUT Wait……..
- Remember EC2 Spot best practice?...
    - Use Instance flexibility!!

Spot provisioning (cont…)

- Put each of the instance type in a separate ASG with EC2 Spot.
  - Gives you multiple instance types – best practice.
  - ASG makes additional requests to replace interrupted instances

EKS – Scaling

- Horizontal *pod* scaling
  - Automatically scales number of pods in replication controller
- Cluster scaling (Scaling EC2 Instances)
  - Adjusts the number of nodes in the cluster when
    - Pods failed to run in cluster due to insufficient resources
    - Nodes are underutilized, for an extended period of time
    - And pods could be placed elsewhere on other nodes



EKS – EC2 Spot scaling

```
spec:
  serviceAccountName: cluster-autoscaler
  containers:
    - image: gcr.io/google_containers/cluster-autoscaler:v1.2.2
      name: cluster-autoscaler
      resources:
        limits:
          cpu: 100m
          memory: 300Mi
        requests:
          cpu: 100m
          memory: 300Mi
      command:
        - ./cluster-autoscaler
        - --v=4
        - --stderrthreshold=info
        - --cloud-provider=aws
        - --skip-nodes-with-local-storage=false
        - --expander=least-waste
        - --nodes=1:10:eks-DemoSpotClusterScale-workers-NodeGroup-1T05UYPCM91ZI
        - --nodes=1:10:eks-DemoSpotClusterScale-workers-OnDemandNodeGroup-1N7U1LX3MAXDK
        - --skip-nodes-with-system-pods=false
      env:
        - name: AWS_REGION
          value: us-west-2
```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EKS with EC2 Spot – Termination/Interruptions

- Catch interruption on EC2 Instance
- Have a pod running in daemon mode on each Spot Node
    - Pod will intercept the interruption notice
    - Set K8 Node to *drain* state
        - Marks Node unschedulable
        - Graceful termination
        - Vacates pods via eviction API

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AWS Batch with EC2 Spot

Batch with EC2 Spot

- With Batch you have 3 main aspects:
  - Jobs/Job definitions
  - Job queues
  - Compute environments

Batch with EC2 Spot

- Managed compute
- Unmanaged compute

Batch with EC2 Spot - Managed Compute

- Managed Compute
  - AWS Batch manages configuring & scaling of instances
  - Under the hood, uses ECS cluster with EC2 instances
  - You define the compute provisioning model
    - On-Demand or EC2 Spot

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Batch Managed Compute with EC2 Spot

- Uses Spot Fleet
- You define the instance types or leave it as optimal
- If Optimal,
    - Batch chooses best fit based on vCPU, mem requirements
    - Match job with most-appropriate instance
    - For example –
        - 2 vCPU, and 16GB for each job, and 300 jobs
        - Picks biggest instance type that can fit most # of jobs

Batch Managed Compute with EC2 Spot

- If single instance type, then doesn’t align with Spot Fleet best practices
- Override optimal setting*
    - Assign multiple Managed CE to same job queue with order
    - Up to 5 can be assigned

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Batch Un-Managed Compute with EC2 Spot

- You configure & manage scaling of the ECS Cluster
- ECS integrated with Spot Fleet directly

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Batch with EC2 Spot – Manage interruptions

- Managed compute – optimal setting
  - If interruption was because OD needed capacity, no progress
- Managed compute – multiple CE
  - Diversified instance types likely to have capacity, jobs progress
- Unmanaged compute – Spot Fleet
  - Diversified instance types likely to have capacity, jobs progress

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Thank you!