



AWS
re:Invent

CON415-R

Auto scale Kubernetes workload by GPU

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Amazon Web Services

Agenda

Introduction to AWS container services

Amazon Elastic Kubernetes Service (Amazon EKS) overview

Machine learning on Amazon EKS

GPU autoscaling on Amazon EKS

Demo

Q&A

Related breakouts

CON415-R1 Auto scale Kubernetes workload by GPU

Wednesday, Dec 4, 4:00 p.m.–5:00 p.m. – Mirage, Events Center C1 Table 3

CON415-R2 Auto scale Kubernetes workload by GPU

Thursday, Dec 5, 2:30 p.m.–3:30 p.m. – Mirage, Events Center C1 Table 3

CON415-R3 Auto scale Kubernetes workload by GPU

Friday, Dec 6, 11:30 a.m.–12:30 p.m. – Mirage, Grand Ballroom B Table 2

AWS container services landscape

Management

Deployment, scheduling, scaling, & management of containerized applications



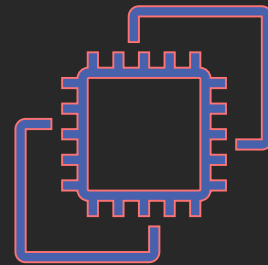
Amazon Elastic Container Service (Amazon ECS)



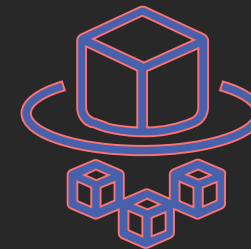
Amazon Elastic Kubernetes Service (Amazon EKS)

Hosting

Where the containers run



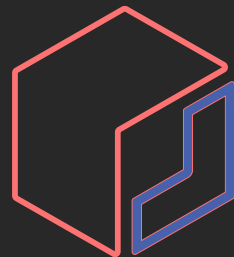
Amazon Elastic Compute Cloud (Amazon EC2)



AWS Fargate

Image registry

Container image repository



Amazon Elastic Container Registry (Amazon ECR)

Amazon EKS: A year in review

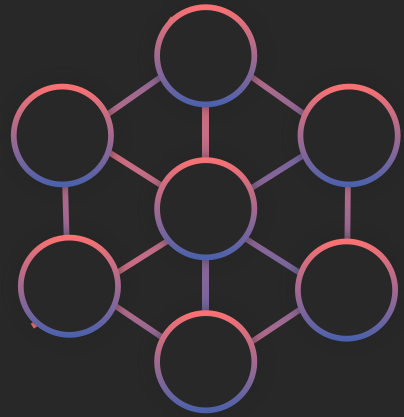
June – December 2018

- Amazon EKS achieves K8s conformance, HIPAA eligibility, generally available
- Amazon EKS AMI build scripts and AWS CloudFormation templates available in GitHub
- Support for GPU-enabled EC2 instances; support for HPA with custom metrics
- Amazon EKS launches in Dublin, Ireland
- Amazon EKS simplifies cluster setup with `update-kubeconfig` CLI command
- Amazon EKS adds support for Dynamic Admission Controllers (Istio), ALB support with the AWS ALB ingress controller
- Amazon EKS launches in Ohio, Frankfurt, Singapore, Sydney, and Tokyo
- Amazon EKS adds managed cluster updates and support for Kubernetes version 1.11, CSI driver for Amazon EBS

2019

- Amazon EKS launches in Seoul, Mumbai, London, and Paris
- Amazon EKS achieves ISO and PCI compliance, announces 99.9% SLA, cluster creation limit raised to 50
- API server endpoint access control, AWS App Mesh controller
- Windows support (preview), Kubernetes version 1.12
- CSI drivers for Amazon EFS, Amazon FSx for Lustre, control plane logs, A1 (ARM) instance support (preview)
- Deep Learning Benchmark Utility, public IP address support
- Simplified cluster authentication, SOC compliance, Kubernetes 1.13, pod security policies
- Container Insights, CNI 1.5.0, Amazon ECR, AWS PrivateLink support

How are customers using Amazon EKS?



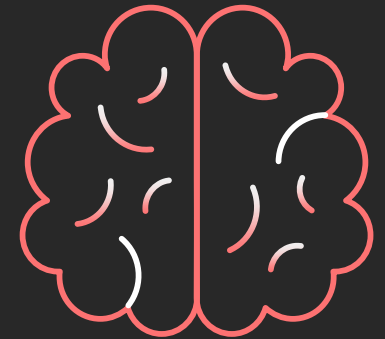
Microservices



Platform as a service



**Enterprise app
migration**



Machine learning

Open-source roadmap

<https://github.com/aws/containers-roadmap/>

aws / containers-roadmap

Code Issues 213 Pull requests 0 Projects 1 Security Insights

containers-roadmap
Updated an hour ago

label:EKS

Watch 355 Star 1,370 Fork 37

Fullscreen Menu

19 Researching 8 results

- [EKS]: Managed Cluster Addons
#252 opened by tabern
EKS
- [EKS] [Requesting Feedback] Support for Deploying to Kubernetes from CloudFormation
#254 opened by christopherhein
EKS Under consideration
- [EKS] Install AWS-Service-Operator on master nodes
#47 opened by JordanDeBeer
EKS Proposed
- [EKS] Install AWS EBS CSI Driver as Part of EKS cluster creation
#247 opened by leakingtapan
EKS
- [EKS] [request]: allow to configure ipvs kube-proxy mode
#142 opened by dawidmalina
EKS Proposed
- [EKS] [request]: Security Groups per Pod
#177 opened by mike-stewart
EKS Proposed
- [EKS] [request]: Ability to configure pod-eviction-timeout
#159 opened by ChrisCooney
EKS Proposed
- [EKS] Enable HPA with CloudWatch metrics and alarms
#120 opened by joshuabaird
EKS Proposed

40 We're Working On It 18 results

- #166 opened by jaxstorm
EKS Proposed
- [EKS] [Security]: Allow restricting EKS API Access via Security Groups
#108 opened by jmt30
EKS Proposed
- [EKS] Cloudformation support for control plane logging and endpoint access control
#242 opened by tabern
EKS
- EKS-Optimized AMI Metadata SSM Parameter
#231 opened by tabern
EKS
- [EKS] [request]: EKS Support for Kubernetes 1.14
#212 opened by whereisaaron
EKS Proposed
- New EKS Region : Beijing
#219 opened by wholroyd
EKS Proposed
- DNS resolution for EKS Private Endpoints
#221 opened by tabern
EKS
- Support for PodSecurityPolicy Admission Controller
#174 opened by gavinbunney
EKS Proposed
- Fargate for EKS
#200 opened by joshuabaird
EKS

15 Coming Soon 6 results

- [EKS] : Kubernetes v1.10 Deprecation
#300 opened by tabern
EKS
- [EKS]: Release CNI v1.5.0
#284 opened by mogren
EKS
- [EKS]: Service Linked Role for Amazon EKS
#243 opened by tabern
EKS
- EKS Support for Kubernetes 1.13
#30 opened by uprightvinyl
EKS
- New EKS region: São Paulo
#112 opened by abby-fuller
EKS
- New EKS Region: Canada Central
#113 opened by tabern
EKS

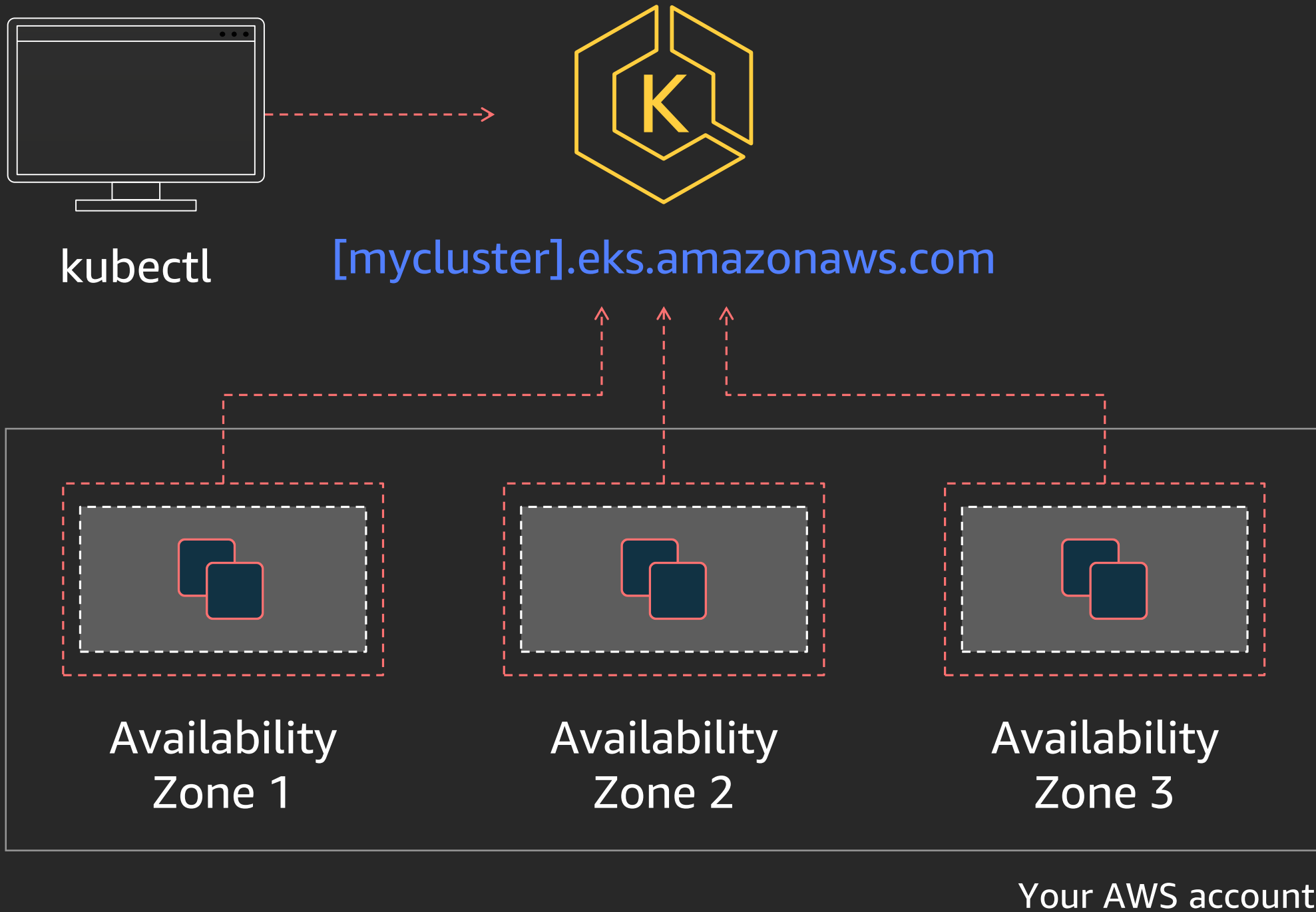
2 Developer Preview 2 results

- EKS Windows Nodes (preview)
#69 opened by ofiliz
Developer Preview EKS
- [EKS]: Support for Arm Nodes - EC2 A1 Instances
#264 opened by tabern
Developer Preview EKS

50 Just Shipped 31 results

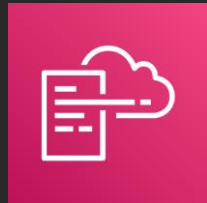
- SOC compliance for EKS
#296 opened by abby-fuller
EKS
- EKS: Get-Token CLI Subcommand
#292 opened by tabern
EKS
- Support for Public IP space in VPC with EKS
#181 opened by tabern
EKS
- [EKS] [request]: Release CNI Plugin 1.4 for EKS
#149 opened by mogren
EKS
- EKS / Kubernetes: Add support for using AWS Fleet to atlasian/escalator
#270 opened by tabern
EKS
- Control Plane Metrics Endpoint
#182 opened by tabern
EKS
- Amazon EKS: Deep Learning Benchmarking Utility
#275 opened by tabern
EKS
- EKS: Documentation for using Kubeflow on AWS
#271 opened by tabern
EKS
- EKS Control Plane Logs
#276 opened by tabern
EKS

Architecture



Configuration and setup

Provisioning worker nodes



AWS CloudFormation

eksctl

eksctl

Terraform
Pulumi
Rancher

And more

Partners

Amazon EKS-optimized GPU AMI

Includes NVIDIA packages to support Amazon P2 and P3 instances

Easily run TensorFlow on Amazon EKS

Now supporting P3dn.24xlarge instances

CUDA 10 with NVIDIA v410 coming soon

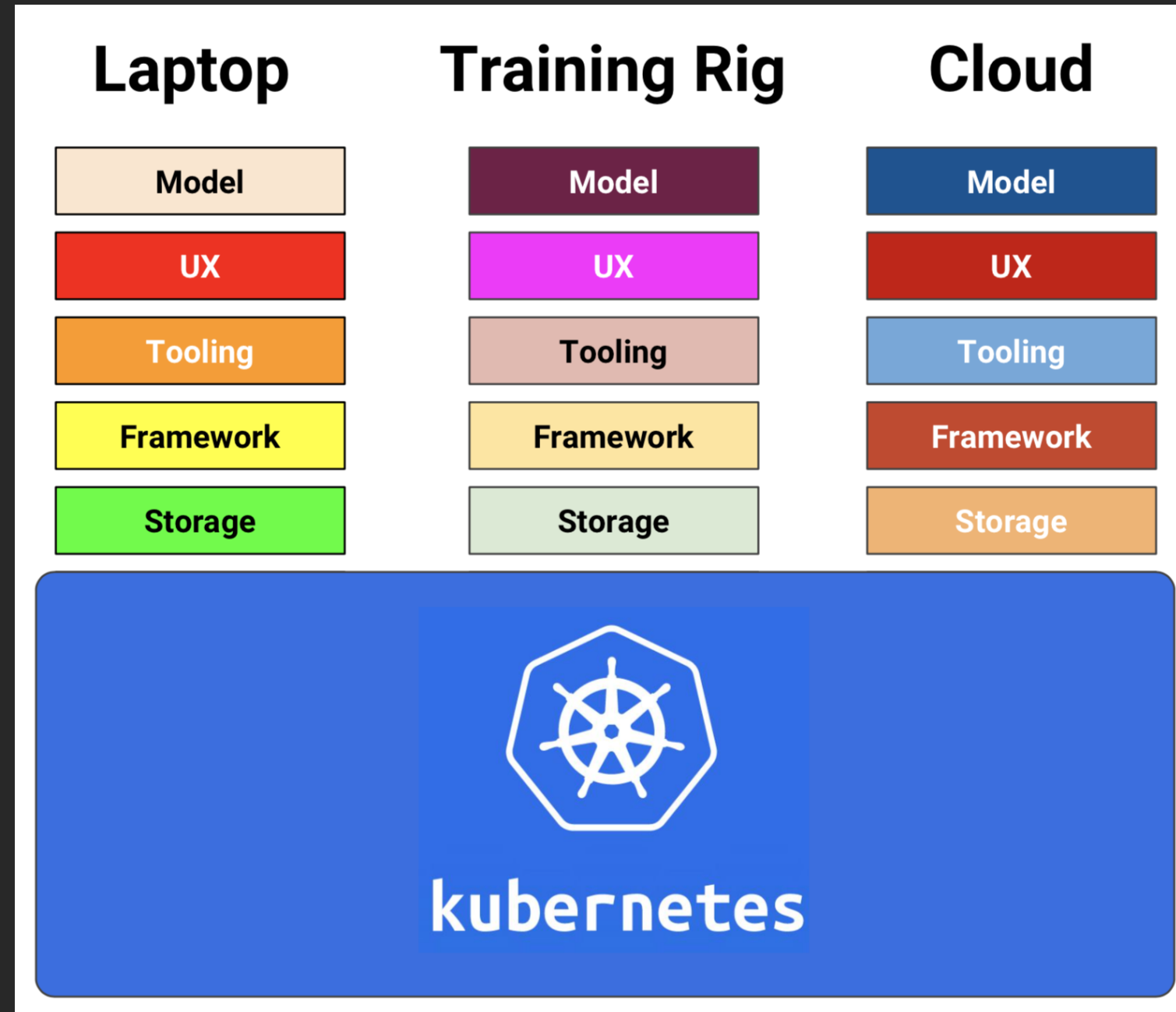


End-to-end ML framework

Why machine learning on Kubernetes?

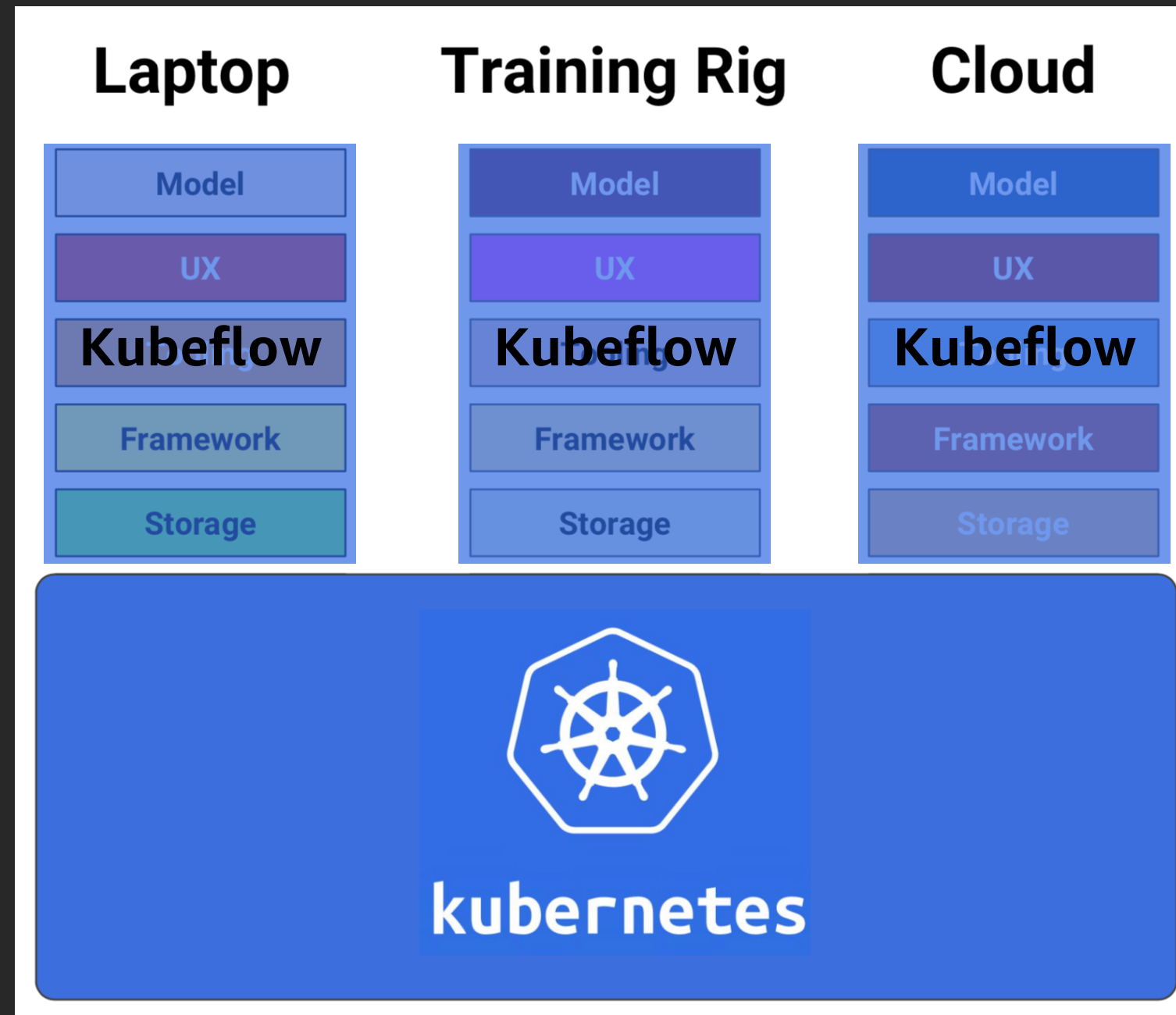
- ✓ Composability
- ✓ Portability [On-Premises and Cloud]
- ✓ Scalability

ML on K8s—without Kubeflow



Credits: @aronchik

ML on K8s—with Kubeflow



Credits: @aronchik



Notebook for collaborative
& interactive training



Serving deployment
& training controller



For workflows

What's in Kubeflow?



For complex inference
and non TF models



Framework operators

ReverseProxy (Ambassador)

Wiring to make it work
on any K8s anywhere

Kubernetes autoscaling

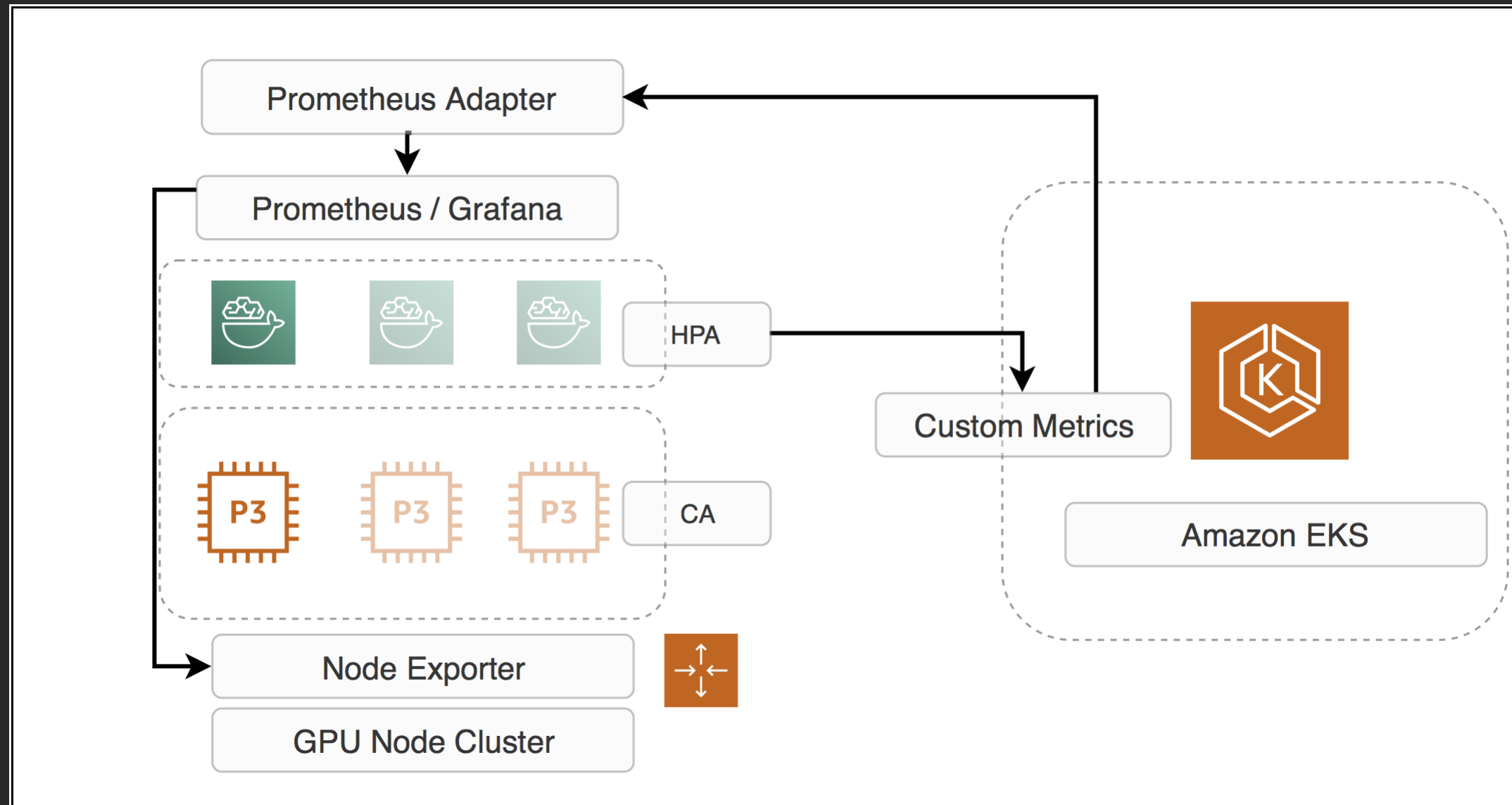
Horizontal Pod Autoscaler (HPA)

Scales the pods in a deployment or replica set. It is implemented as a K8s API resource and a controller. The controller manager queries the resource utilization against the metrics specified in each HorizontalPodAutoscaler definition. It obtains the metrics from either the resource metrics API (for per-pod resource metrics), or the custom metrics API (for all other metrics)

Cluster Autoscaler (CA)

This is the default K8s component that can be used to perform pod scaling as well as scaling nodes in a cluster. It automatically increases the size of an Amazon EC2 Auto Scaling group so that pods have a place to run. And it attempts to remove idle nodes—that is, nodes with no running pods

GPU autoscaling



Steps

- ✓ Ensure an Amazon EKS cluster has been created
- ✓ Label your GPU nodes
- ✓ Install the Nvidia device plugin
- ✓ Install Helm
- ✓ Install Prometheus and GPU Node Exporter
- ✓ Install the Prometheus adapter to generate custom metrics
- ✓ Deploy the GPU stress-testing application
- ✓ Configure Horizontal Pod Autoscaler (HPA)
- ✓ Test the scaling
- ✓ Configure Cluster Autoscaler (CA)
- ✓ Test the scaling

Demo

Thank you!

Pradyumna Dash

pradyd@amazon.co.uk



Please complete the session
survey in the mobile app.