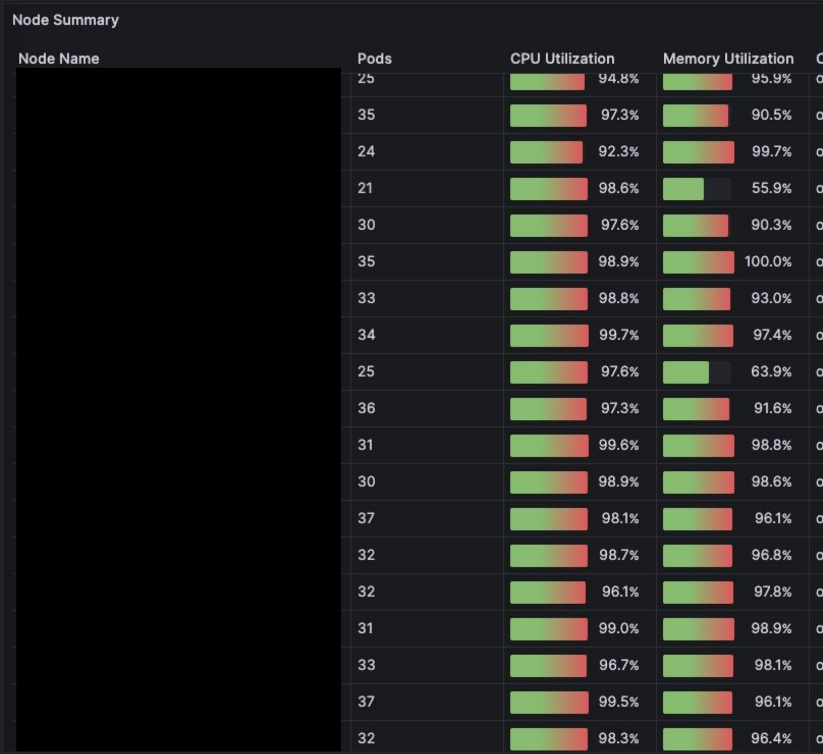
Grafana Labs

Adopting Karpenter for Cost and Simplicity

Logan Ballard
Senior Software Engineer



Node Summary

Node Name	Pods	CPU Utilization	Memory Utilization
[redacted]	25	94.8%	95.9%
[redacted]	35	97.3%	90.5%
[redacted]	24	92.3%	99.7%
[redacted]	21	98.6%	55.9%
[redacted]	30	97.6%	90.3%
[redacted]	35	98.9%	100.0%
[redacted]	33	98.8%	93.0%
[redacted]	34	99.7%	97.4%
[redacted]	25	97.6%	63.9%
[redacted]	36	97.3%	91.6%
[redacted]	31	99.6%	98.8%
[redacted]	30	98.9%	98.6%
[redacted]	37	98.1%	96.1%
[redacted]	32	98.7%	96.8%
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[redacted]	32	98.3%	96.4%

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Optimizing Autoscaling

When Cluster Autoscaler isn’t meeting your needs in EKS, consider Karpenter. We will walk through our journey to Karpenter, alternatives we considered, associated trade offs, and why Karpenter ultimately has helped us reduce costs and complexity to better serve our customers on AWS.

Overview of platform engineering at Grafana Labs

- Company goal: one-stop-shop for observability
  - “Query, visualize, alert on, and understand your data no matter where it’s stored. With Grafana you can create, explore, and share all of your data through beautiful, flexible dashboards.”

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  - GKE (Google)
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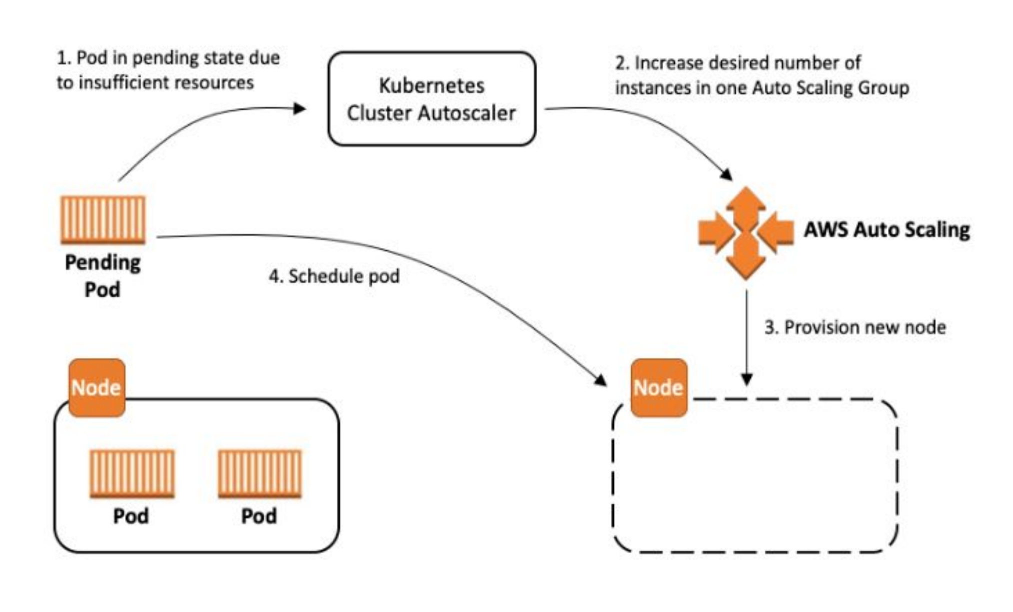
  - AKS (Azure)
- Platform team is further divided into sub-specialties, one of which is capacity

Overview of capacity at Grafana Labs

- Capacity is responsible for engineering around usage optimization as well as reliability
    - Observability into cost and utilization
    - Ownership of scaling tools
    - Company-wide efforts to optimize resource usage
- Today we'll be focusing on autoscaling

Overview of Cluster Autoscaler

- Up until last year, we used Cluster Autoscaler exclusively
- Scaling heuristic:
  - Demand goes up and down in the form of pod resource requests
  - If there is too much CPU or Memory requested, more nodes are added
  - If resource requests scale down, nodes are removed


1. Pod in pending state due to insufficient resources
Kubernetes Cluster Autoscaler
2. Increase desired number of instances in one Auto Scaling Group
AWS Auto Scaling
Pending Pod
4. Schedule pod
3. Provision new node
Node
Pod
Pod
Node

Source: https://aws.github.io/aws-eks-best-practices/cluster-autoscaling/

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- …we already had it

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- No fallback for workloads from spot nodes -> on demand nodes

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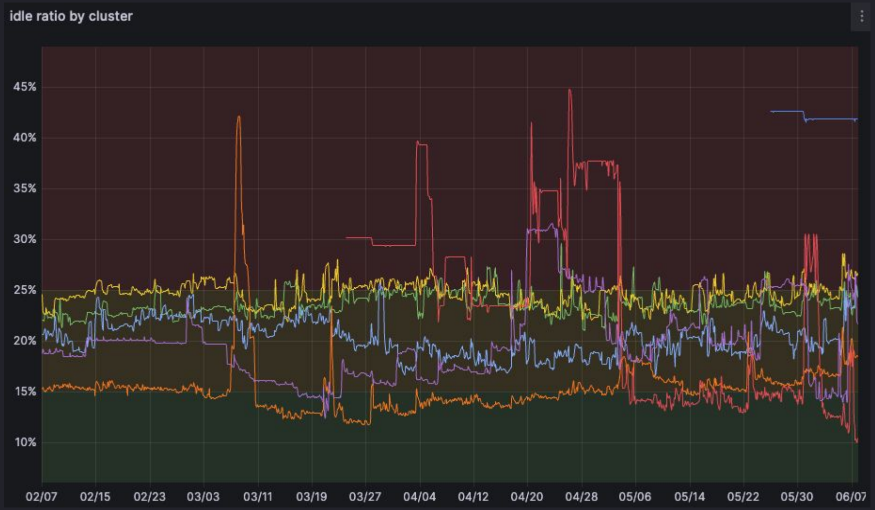
Idle Ratio Visualized

GKE

VS

AWS



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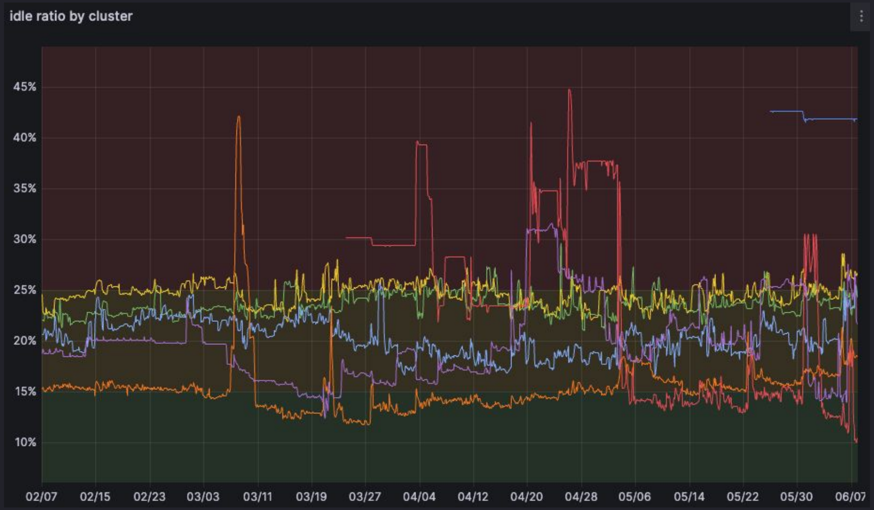

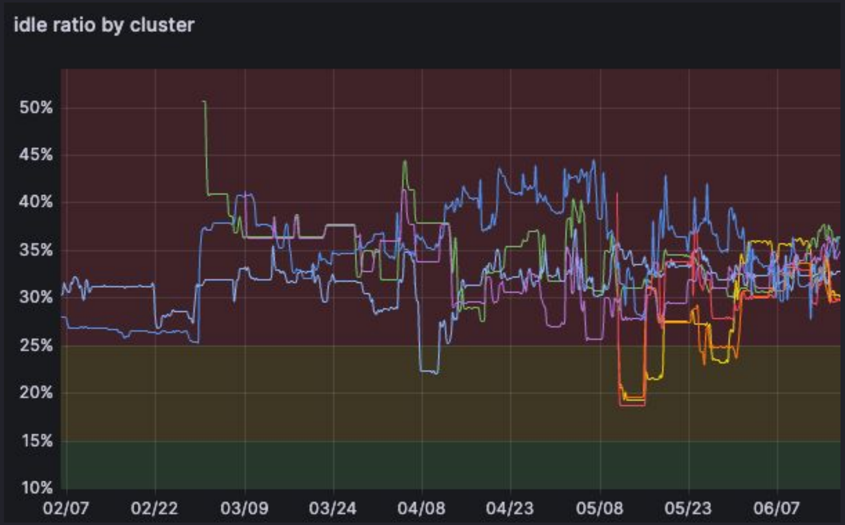

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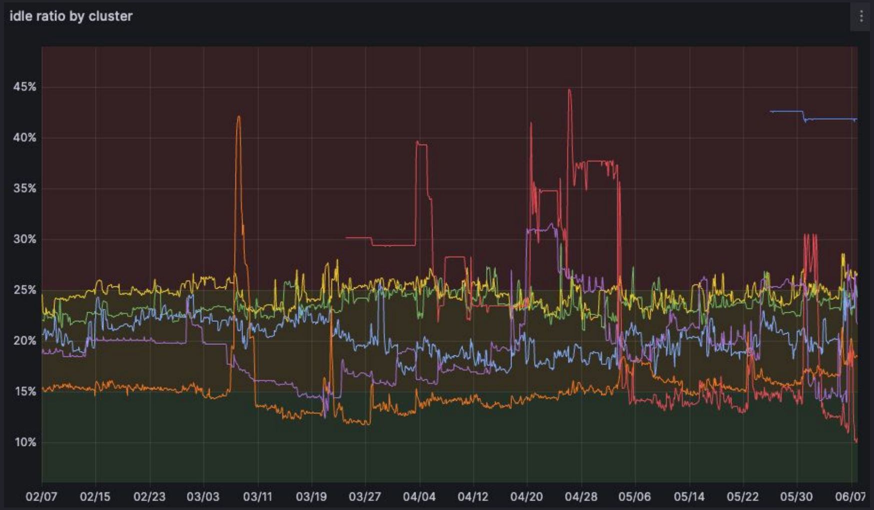

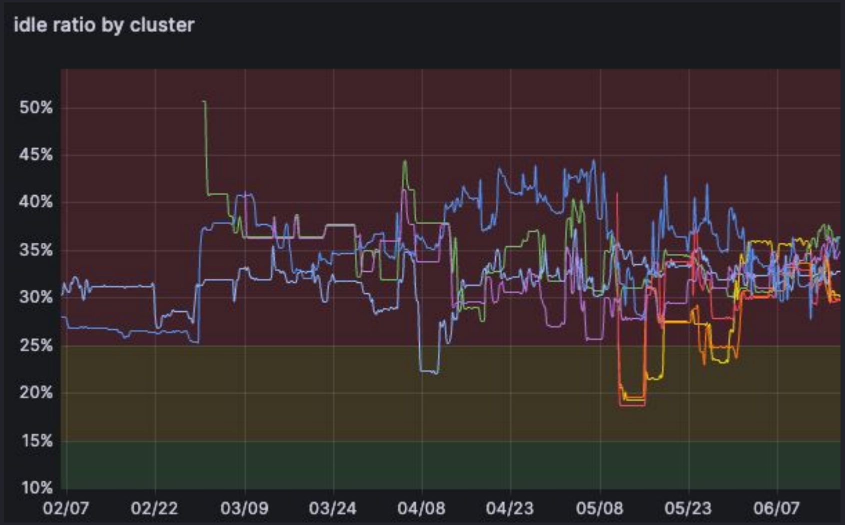

⚠️ Idle ratio in AWS was almost double that of GKE ⚠️

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- Try to replicate the setup of GKE with it’s OPTIMIZE_UTILIZATION autoscaling profile
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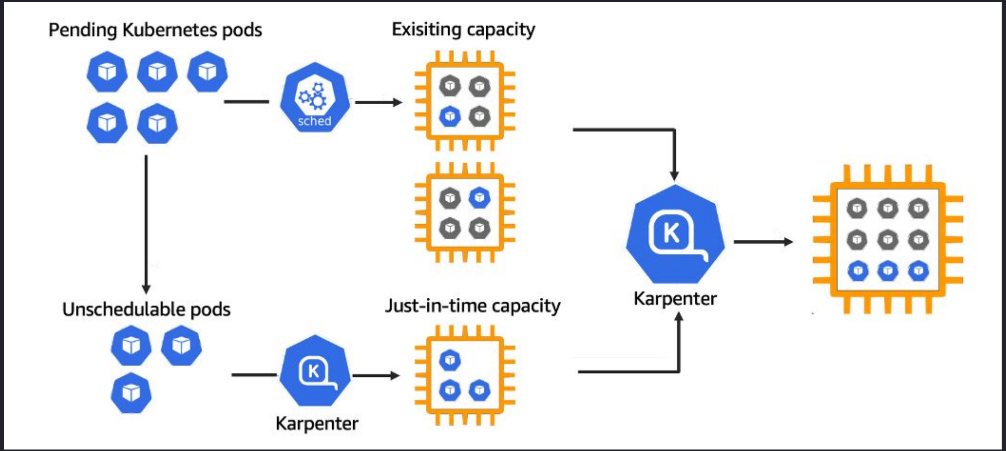
- Manage our own control plane?
    - No
- Karpenter?

Overview of Karpenter

- Open Source
- EKS specific
  - Update: Core logic of Karpenter is now part of the autoscaling SIG, as of November 2023
- “Just in time” model for upscaling
  - Matches workload size and shape to machines
- “Consolidation” model for downscaling
  - Continual bin-packing
- High level of visibility into decisions
- …we were sold



Source:

https://aws.amazon.com/blogs/aws/introducing-karpenter-an-open-source-high-performance-kubernetes-cluster-autoscaler/

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- Reproducible migration across different environments
- Observability in all steps of the migration

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    - Gradually cordon and drain existing nodes
    - Delete existing node groups

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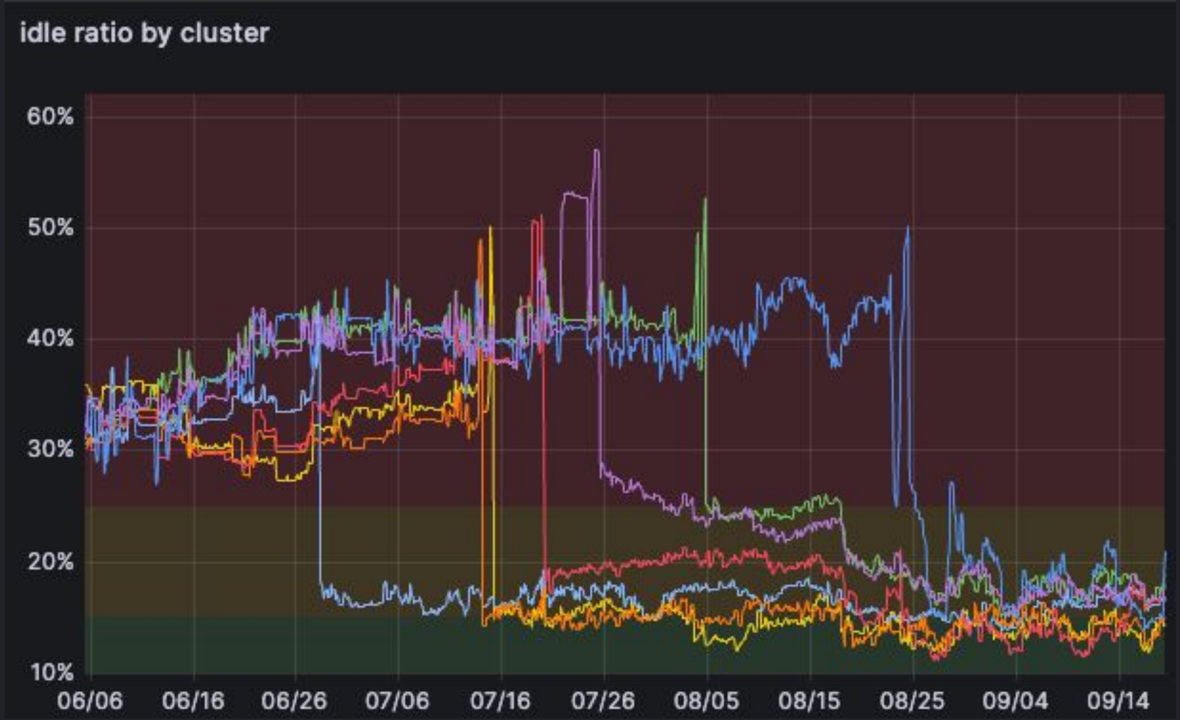
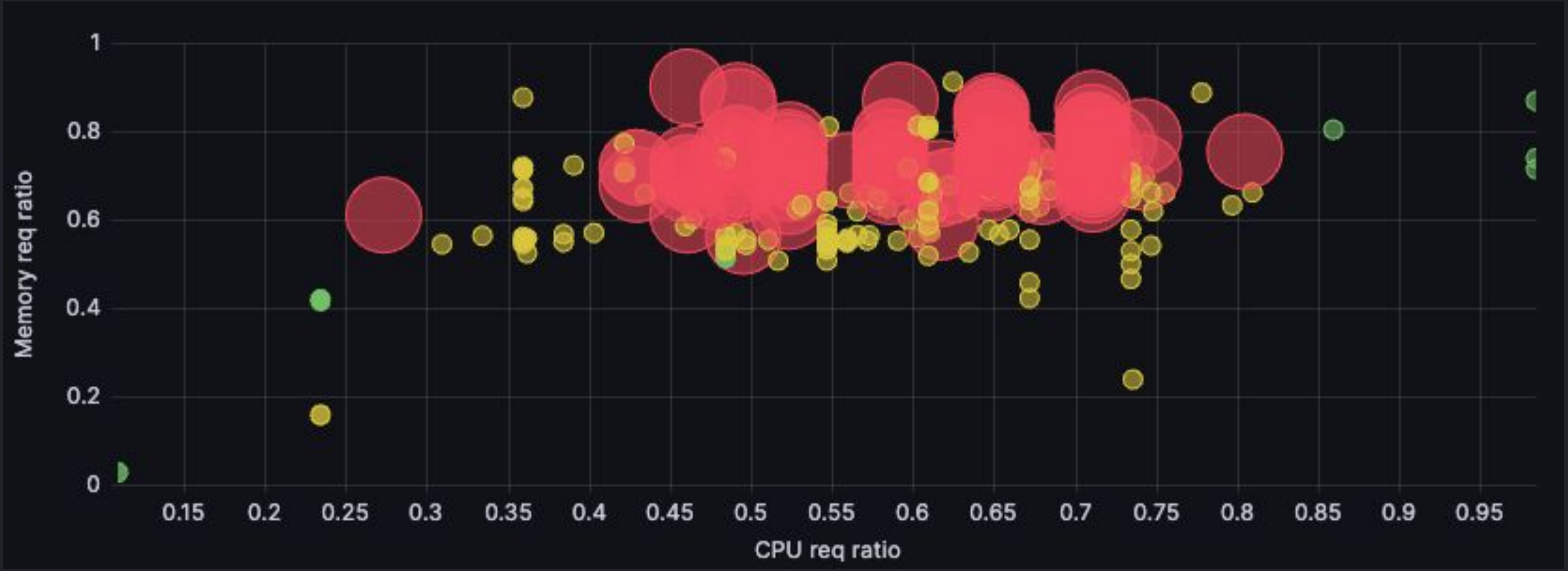
- Simplified infrastructure

Results - idle ratio visualized

- Costs lowered
- Idle ratio lowered



Results: cost efficiency visualized



Large cluster (~350 nodes): pre-Karpenter

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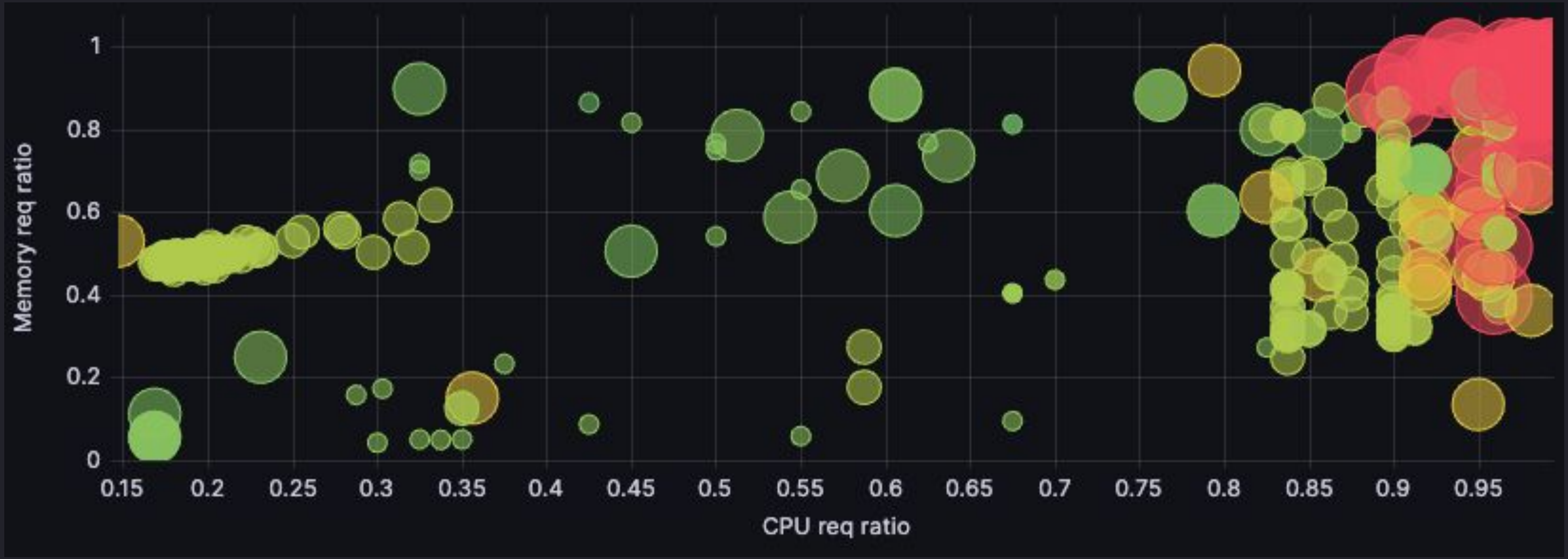

Large cluster (~350 nodes): post-Karpenter

Results - improved reliability

Before

VS

Rigid Options

- Workloads could either require spot or on-demand
- Maxing out autoscaling groups would result in alerts, downtime
- Single instance node groups subject to scarcity

After

More Flexibility

- Workloads can *prefer* spot, but fall back to on-demand
- Fleet is not bounded by autoscaling group limitations
- Wide variety of instance types all but guarantees availability

Results - developer experience

Before

High Barrier to Experimentation

- Trying out new instance types required lots of overhead
- Infrastructure managed in Terraform
- Specialized workloads required specialized node groups

VS

After

Easy to Play Around

- New instance types are easy to try out
- Infrastructure managed by Kubernetes object
- Expressive "requirements" syntax for Karpenter allows workloads to ask for what the want, not peg themselves to a machine type

Results - simplified infrastructure

Before

Slow and Manual

- Upgrades handled on a node group basis
- Definition of cluster in Terraform was largely copy/paste

VS

After

Fast and Automated

- Upgrades can be hands-off
- Definition of cluster in Karpenter is largely programmatic

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- Deprovisioning lacks fine-grained control

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- Karpenter requires buy-in, but is a significant EKS opportunity
- Ensuring a smooth migration was high effort, but worth it
- Passing information on to end-users of the platform yielded and continues to yield high benefits
- We are excited to see where this tool goes!

Questions?

Additional Info

- Contact me
    - loganballard@gmail.com
    - https://github.com/logyball
- Karpenter
    - https://karpenter.sh/
- Grafana
    - *“How Grafana Labs switched to Karpenter to reduce costs and complexities in Amazon EKS”*
    - https://bit.ly/grafana-karpenter

QR code to relevant blog post

Take Grafana Labs Observability Survey