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Scaling AKS Nodes

Kubernetes & Cloud Native Berlin Meetup New Year 2024 Edition

Who am I?

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- Husband & Father of 2
- Doing Cloud Native, Kubernetes & Azure
- Microsoft MVP
  - Microsoft Azure (Cloud Native)
- GitLab Hero

Agenda

- Kubernetes Scheduler
- Kubernetes Cluster Autoscaler (CA)
- Karpenter
- Karpenter on Azure

Kubernetes Scheduler

- is one of the main components of the control plane, responsible for managing pod scheduling
- is responsible for resource allocation within a cluster
- schedulers are swappable (currently not with AKS)
- you can also have multiple (currently not with AKS)
- “kube-scheduler” is the default one
  - customizable and extendable scheduling in a two-step process (filtering & storing)
  - does not reschedule!
- https://kubernetes.io/docs/concepts/scheduling-eviction

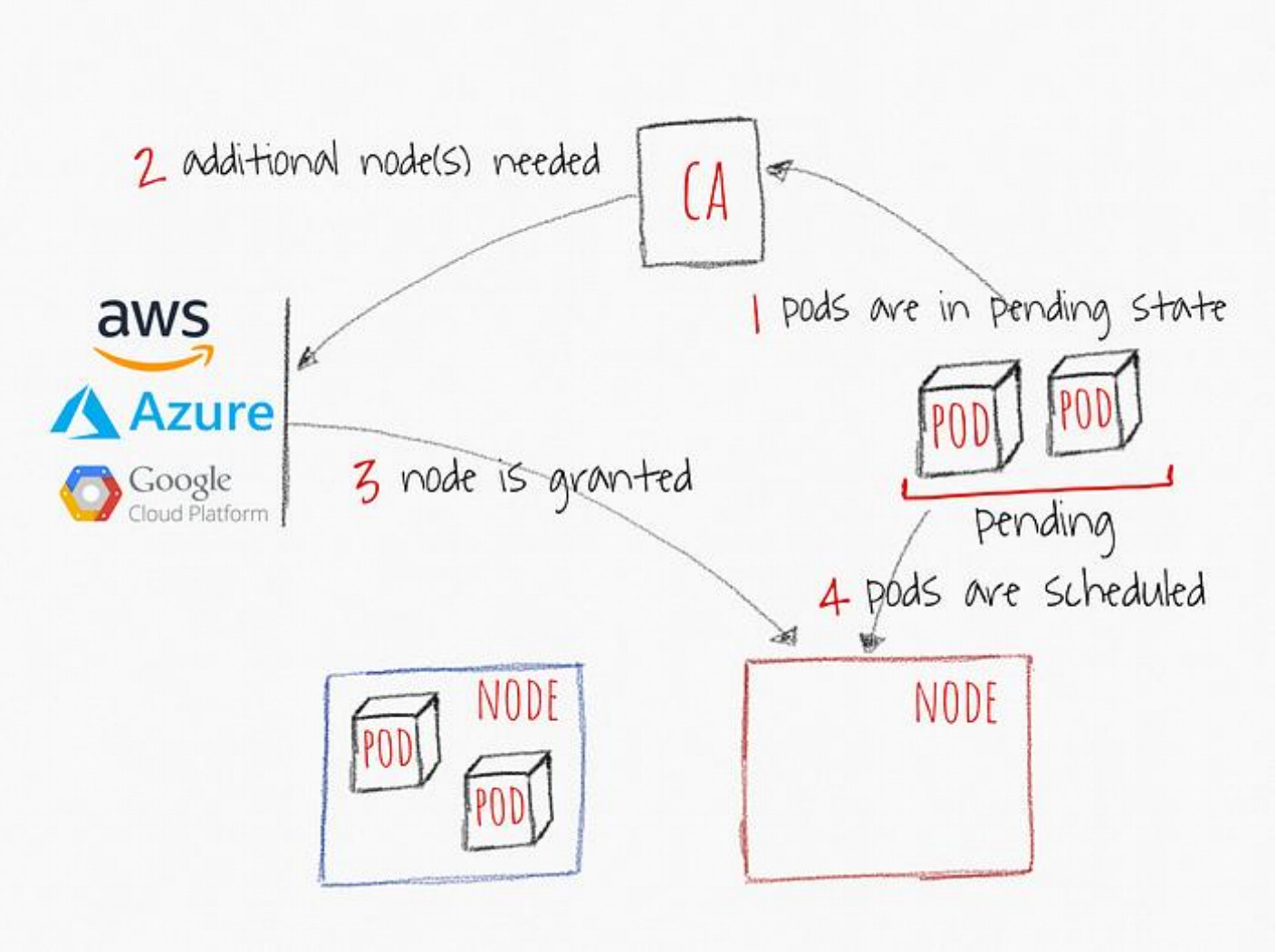
Scheduling details

- resource quotas
- taints and tolerations
- selectors and affinity (node & inter-pod affinity and anti-affinity)
- pod distribution across zones
- disk dependencies/limitations

Kubernetes Cluster Autoscaler (CA)

- automatically resizes a cluster based on demand by scaling nodes up/down
- is key when using HPA, VPA, KEDA or any other autoscaler
- acts on
  - pods that failed to run in the cluster due to insufficient resources (pod pending)
  - nodes in the cluster that are underutilized, and pods can be rescheduled
- uses VMMS
  - Nodes are created from the same base OS image and configuration
  - scales Nodes to and from zero on AKS

Kubernetes Cluster Autoscaler (CA)



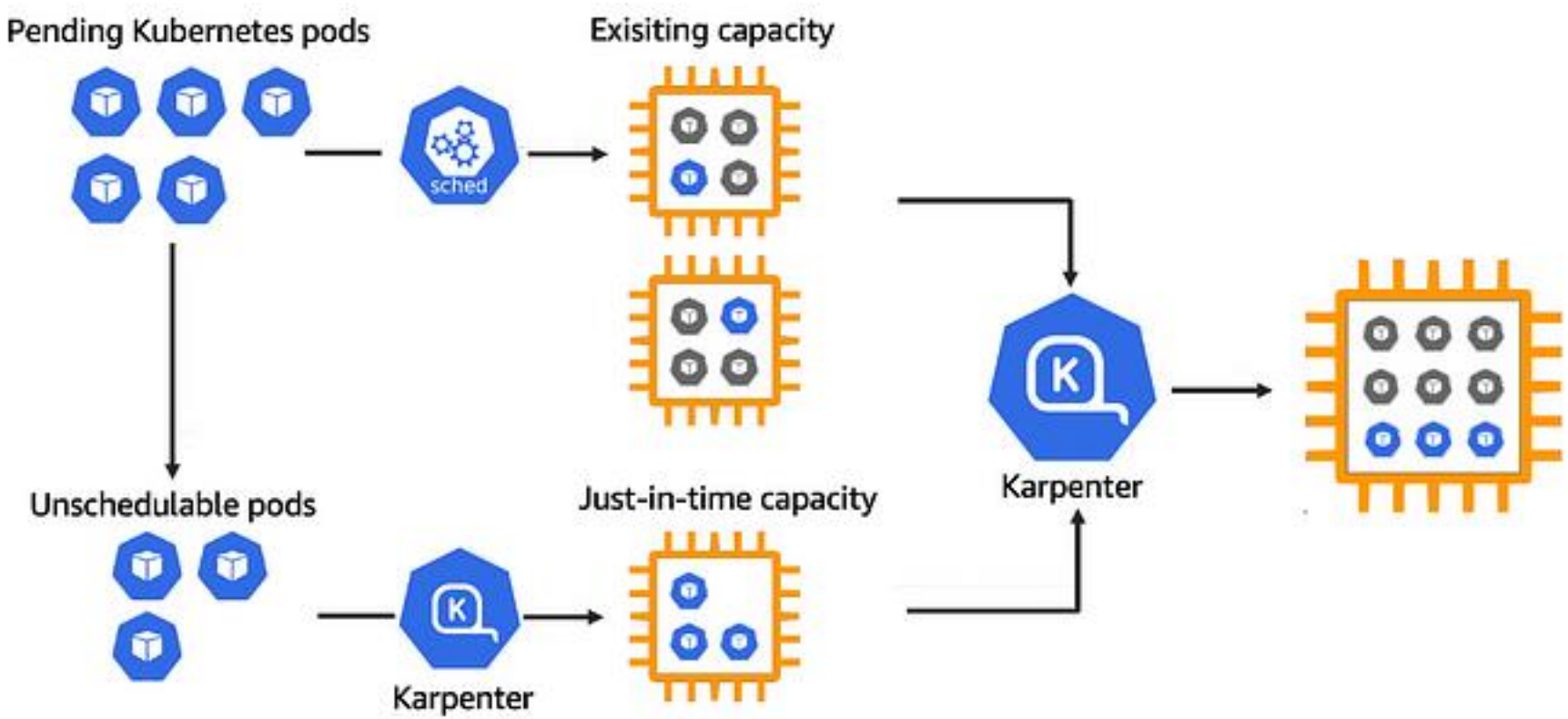
Demo: Cluster Autoscaler in action

- explore cluster-autoscaler
- scale an app to trigger cluster-autoscaler
- view related events

Karpenter

- offers a more granular approach than traditional cluster autoscaler
- scaling lifecycle
  - watching for pods that the scheduler has marked as unschedulable
  - evaluating scheduling constraints (requests, selectors, affinities, tolerations, …)
  - provisioning nodes that meet the requirements of the pods
    - node pool, node classes
  - removing the nodes when the nodes are no longer needed
    - expiration, consolidation, drift
- Karpenter Core is now part of SIG Autoscaling
  - https://github.com/kubernetes-sigs/karpenter

Karpenter


Pending Kubernetes pods
sched
Exisiting capacity
Unschedulable pods
Karpenter
Just-in-time capacity
Karpenter

Karpenter on Azure

- available (alpha) on AKS since Nov 23 – preview
  - self-hosted
  - node autoprovision
- does not rely on AKS node pools / VMMS
- is "cloud aware"
- adds an Azure provider to Karpenter Core
  - any project can do the same
- Azure Karpenter provider is open source and contributions are welcome!
  - https://github.com/Azure/karpenter

Karpenter on Azure

- node pools follow Control Plane K8s version
- automated image updates through drift detection
- GPU support
- Self-hosted
  - installed trough Helm (Karpenter Core & Azure Provider)
  - out-of-the-box observability
- Node autoprovision
  - "managed Karpenter"
  - based on self-hosted
  - comes with default and surge node pools / node classes

Demo: Node autoprovision in action

- explore NAP resources
- scale an app
- view related events
- further play around with scaling

Karpenter on Azure – Preview limitations

- no support for Azure Linux (coming) and Windows
- passing configuration to kubelet is not yet supported
- can be only enabled on new clusters
- currently the provider only supports (and is tested with) Azure Overlay with Cilium dataplane
- not tested on private clusters
- NAP does not support start/stop the Cluster

Conclusion

- Cluster autoscaler
  - ease-of-use
  - well adopted and battle tested
  - good for static or predictable workload
    - else; create new node pools for specific workload can be cumbersome
  - prone for overprovisioning
- Karpenter / NAP
  - (can be) more complex
    - your workload must deal with disruptions
  - great for staying up-to-date
    - drift detection
  - effective and granular scaling based on actual usage
  - good for dynamic or large-scale workload
    - likewise for static / predictable workload as it picks the cheapest node based on actual usage

Questions?

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- Q&A
- Slides & Demos
  - https://github.com/philwelz/scaling-aks-nodes


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Thank you!