



# Cloud Native Storage Evolution, Ecosystem, & What's New



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# Agenda

Introduction & Why This Matters

Evolution of Cloud-Native  
Storage

Cloud Native Storage Building  
Blocks

Ecosystem

Now, New, Next...

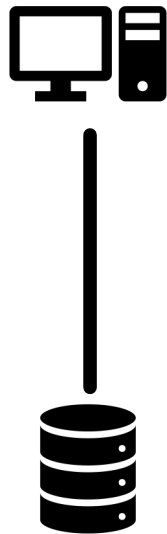
# Evolution of Cloud-Native Storage

# Pre-Cloud Native – How we got here?

Still very much here today...

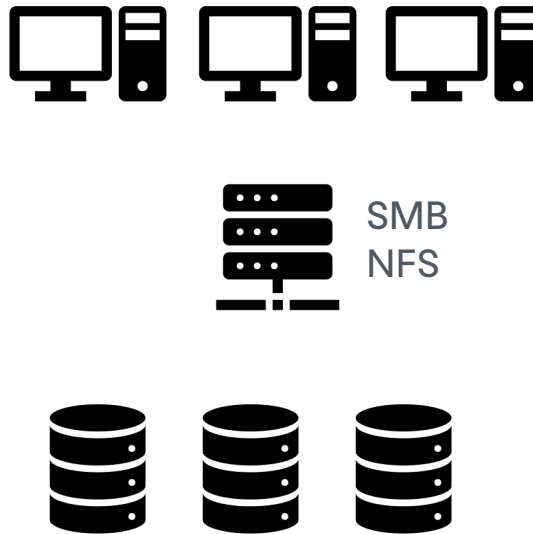
## Direct Attached Storage

DAS



## Network Attached Storage

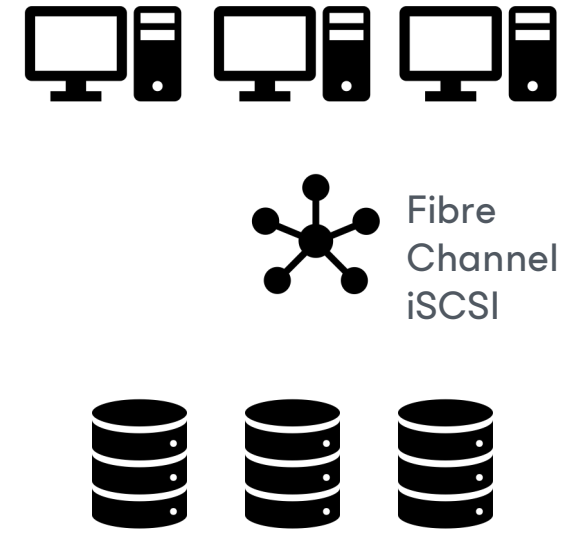
NAS



SMB  
NFS

## Storage Area Network

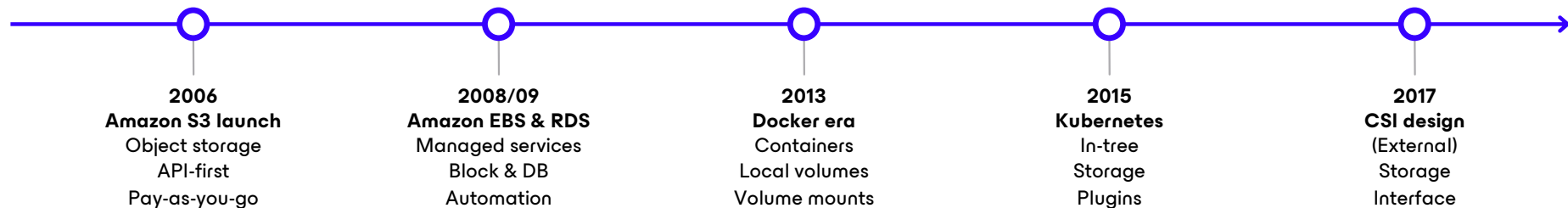
SAN



Fibre  
Channel  
iSCSI

# Early Cloud Native Storage

Cloud Native Storage  $\neq$  Just Kubernetes

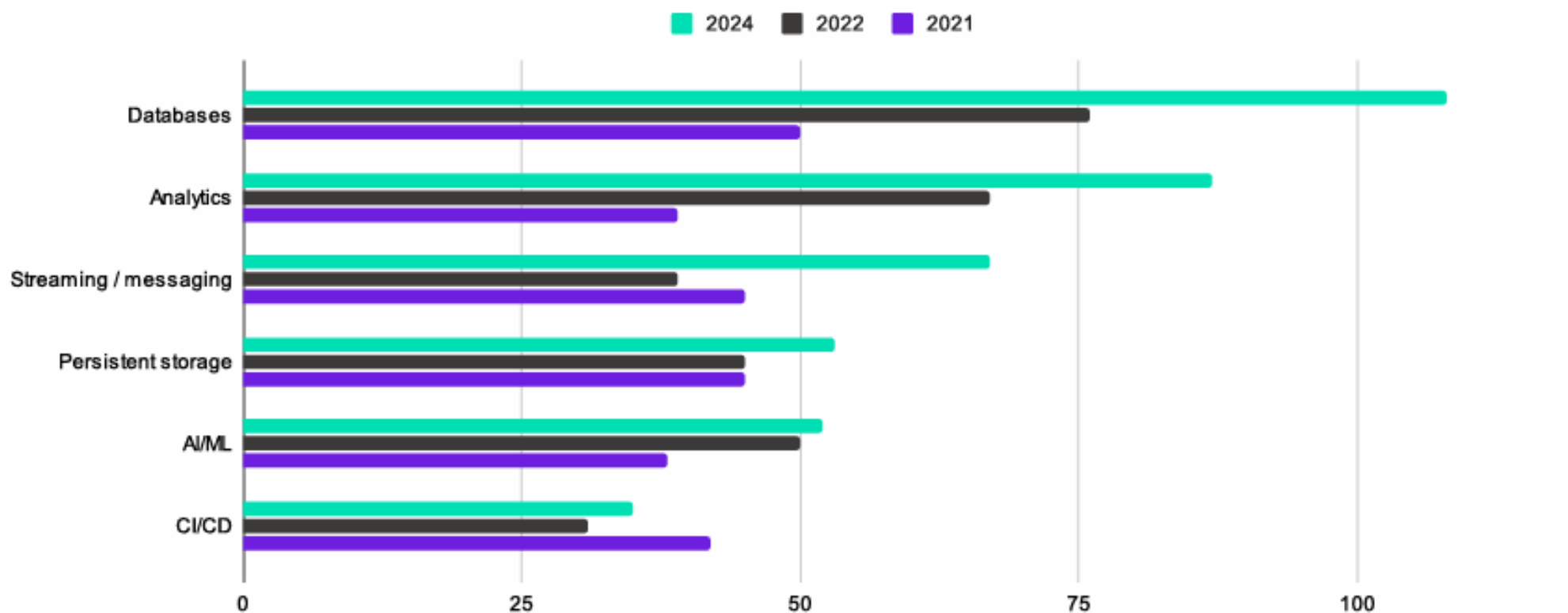


## Storage evolution:

- From hardware-centric  $\rightarrow$  API-driven
- From manual  $\rightarrow$  Automated/Managed
- From fixed  $\rightarrow$  Pay-as-you-go
- From limited scale  $\rightarrow$  Infinite scale

# Kubernetes as a Catalyst, Not the Centre

One of the platforms that drove cloud-native storage evolution



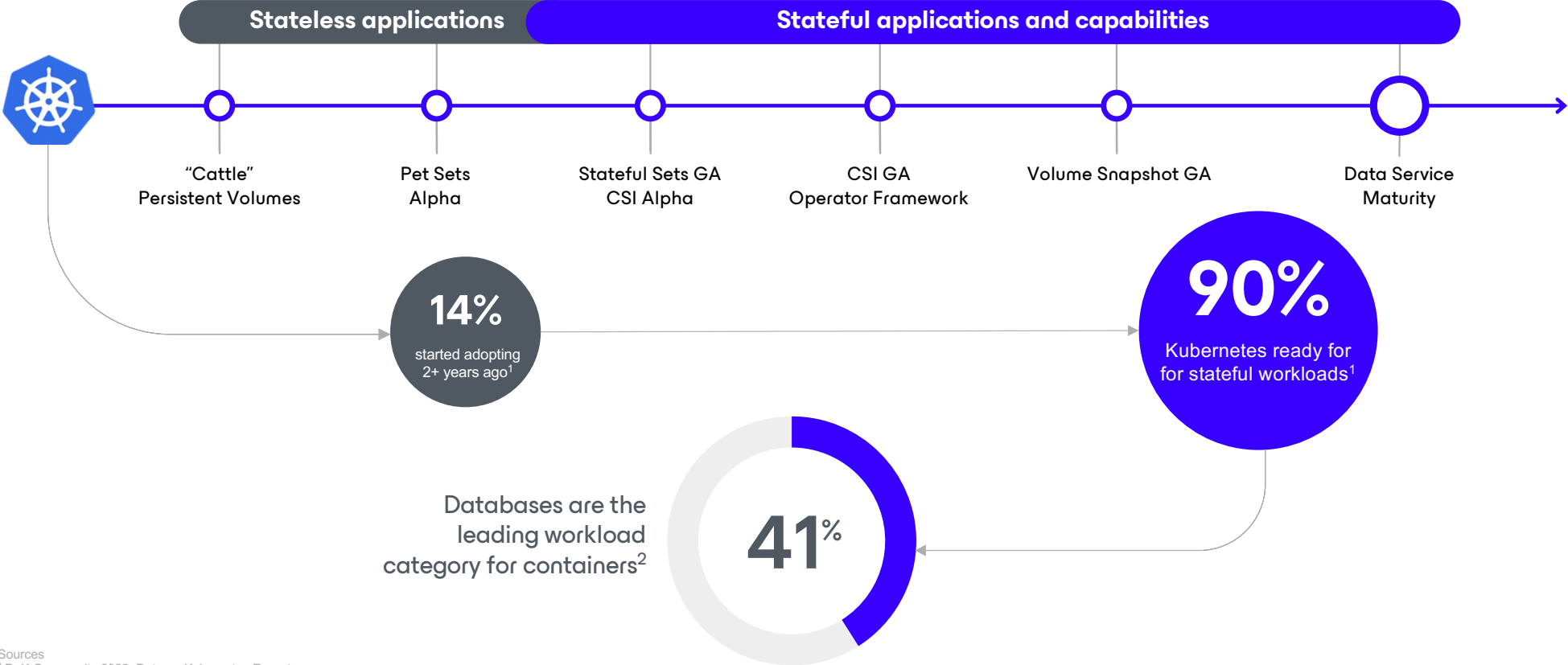
Data on Kubernetes 2024

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# Maturing Kubernetes

## From stateless to stateful

TODAY



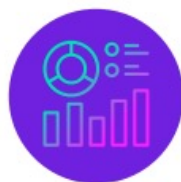
Sources  
<sup>1</sup> DoK Community 2022, Data on Kubernetes Report  
<sup>2</sup> Datadog 2023, 10 Insights on Real-World Container Use

# The Evolution of Data On Kubernetes



**2021**

Early focus on basic stateful workloads, with databases leading adoption



**2022**

Emergence of analytics and early AI/ML adoption



**2024**

Full spectrum of data workloads, with AI/ML growing

---

**Our data shows the continuing evolution of workload types on Kubernetes:**



**Databases**

Maintaining their #1 position as the most commonly deployed workload across all three years



**Analytics**

Moving up to #2 in 2024 from a lower position in previous years



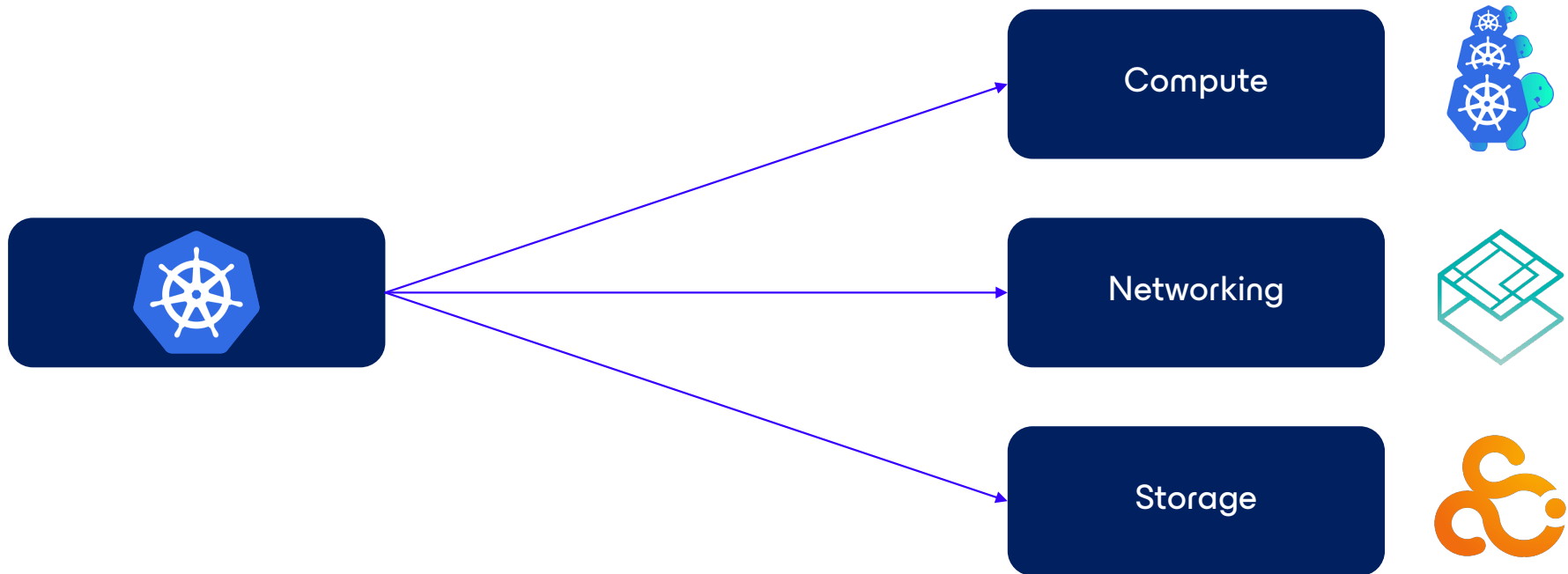
**Streaming/messaging**

Now #3, showing significant growth



# Kubernetes is just another platform

It's Compute, Networking & Storage



# Cloud providers followed and enabled storage for Cloud Native

Abstracting complexity, enabling innovation

## 1. Infrastructure abstraction

- From: Physical storage planning
- To: API call and console clicks

## 2. Management abstraction

- From: Storage admin expertise required
- To: Developer-friendly interfaces

## 3. Integration abstraction

- From: Complex storage orchestration
- To: Managed services integration

```
aws ebs create-volume --size 100 --volume-type gp3

new ebs.Volume(this, 'MyVolume', {
  S
  v
});

apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: ebs-sc
provisioner: ebs.csi.aws.com
```

Cloud providers simplified storage through code-first management, unified access, automation, and native integrations.

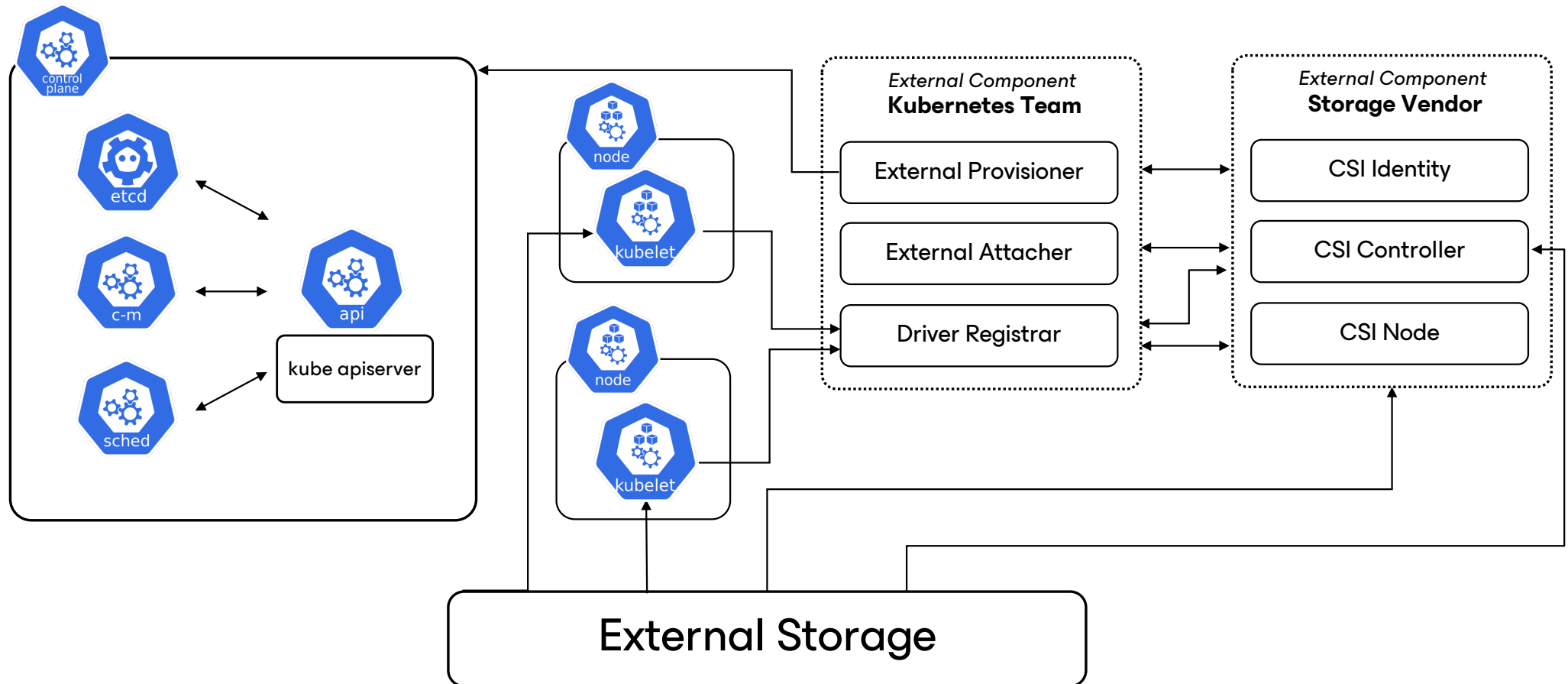
How many people are running Stateful workloads within the cluster?



# Cloud Native Building Blocks

# CSI (Container Storage Interface)

Containerised storage plugin deployed using standard Cloud Native primitives



# Ecosystem

# The Cloud Native Storage Landscape

A diverse vending machine of options

Cloud Native Storage  

 <b>CubeFS</b> CNCF GRADUATED	 <b>ROOK</b> CNCF GRADUATED	 <b>LONGHORN</b> CNCF INCUBATING	 afi.ai	 Alibaba Cloud File Storage	 Alibaba Cloud File Storage CPFS	 ALLUXIO	 Amazon Elastic File System (EFS)	 arctera	 Arrikto	 Azure Disk Storage	 Carina	 ceph	 cloudcasa by ceph			
			 COMMVAULT	 CSI	 Curve	 DATACORE BOLT	 DatenLord	 DATERA	 DELL EMC	 DIAMANTI	 DriveScale	 ExponTech	 GLUSTER			
 Google Persistent Disk	 HITACHI	 Hewlett Packard Enterprise	 HUAWEI	 HwameiStor	 IBM	 INFINIDAT	 inspur 浪潮	 IO Mesh	 ionir	 JuiceFS	 k8up	 KANISTER	 KASTEN by Veeam	 LINESTOR	 MINIO	 MooseFS
 NetApp	 NUTANIX	 ondat	 OpenEBS	 OpenIO	 ORAS	 鹏云网络 pengyunetwork	 Piraeus	 portworx by Pure Storage	 portworx by Red Hat	 QINGSTOR	 Qumulo	 Quobyte	 ROBIN	 杉岩数据 SANDSTONE	 SANGFOR 深信服科技	 ScaleFlash
 RING	 simplyblock	 soda foundation	 Stash	 StorPool	 SWIFT	 TRILIO	 TRITON Object Storage	 VELERO	 Vineyard	 XSKY	 炎融云 YAN RONG YRCLOUDFILE	 ZENKO				

# Want to know more about the Data Services ecosystem?

Shameless Plug

**13:35 - 14:00**

Stockholm  
**Cloud Native &  
Container Day**

Sweden's #1 cloud native, Kubernetes, and container  
technology event

**Room 1 O2 Södra**

**Cloud Native Deployment Models, Operators, Protection & Mobility**

Michael Cade, Field CTO, Veeam Software and Gunnar Grosch, Principal Developer Advocate at AWS

**Cloud Native Deployment Models, Operators, Protection & Mobility**

Let's talk about how we deploy, protect, and move workloads in cloud-native environments. We'll cover deployment models, operators, and what's working (or not) when it comes to keeping things secure and available.

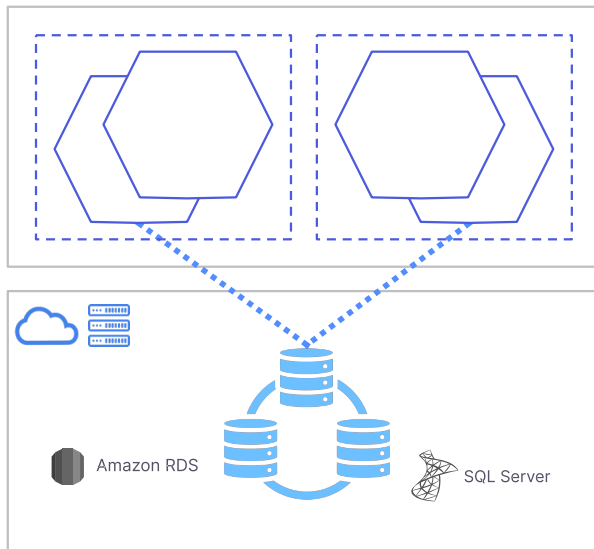


Now, New, Next...

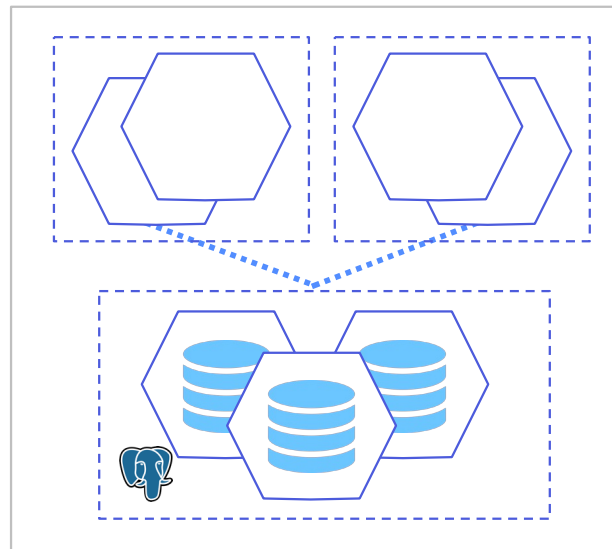
# Cloud Native Deployment Patterns

## Multiple paths to providing data persistence

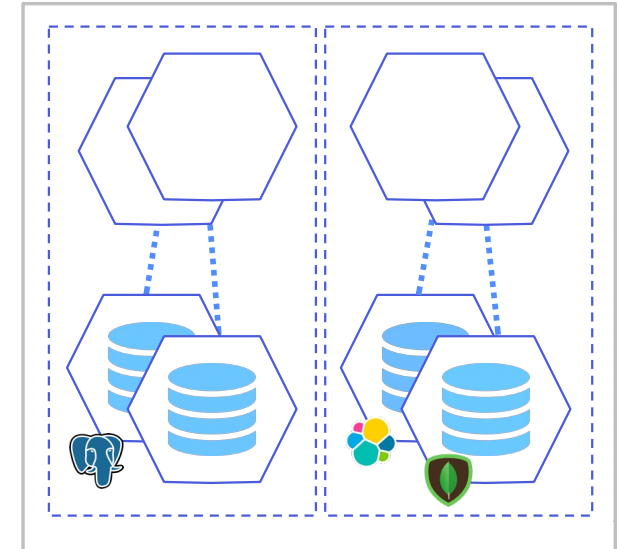
Application using data services outside of Kubernetes



Data services in Kubernetes – separate from Application



Application includes data services – all in Kubernetes



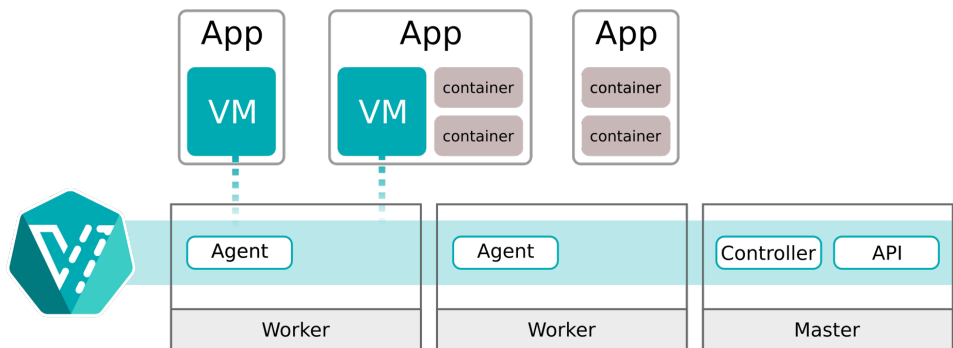
KASTEN  
K10



Kanister.io

# Recent Innovations

## VMs on Kubernetes



## Workflow Convergence

Converging VM management into container management workflows

Using the same tooling (kubectl) for containers and Virtual Machines

Keeping the declarative API for VM management (just like pods, deployments, etc...)

# Recent Innovations

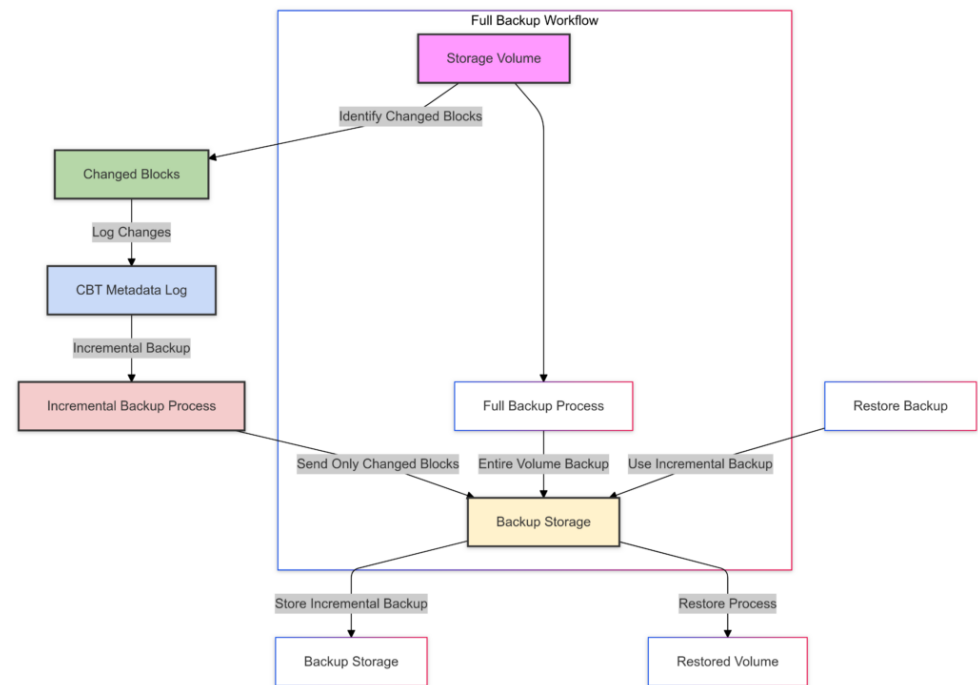
Kubernetes 1.32 introduces **Change Block Tracking (CBT)**

Storage efficiency in cloud-native environments

Reduces costs and improves performance

CBT requires updates to CSI drivers

CBT ensures data is encrypted during transfer



Available as an **alpha feature**

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# What else came with Kubernetes 1.32 (December 2024)

Automatic Deletion of PVCs for StatefulSets

Dynamic Memory-Backed Volume Sizing

Recovery from Volume Expansion Failures

Enhancements to Dynamic Resource Allocation (DRA)

Volume Group Snapshot

# Kubernetes 1.33 (maybe)

Things are not slowing down

KEP-4876 – Mutable CSINode Allocatable Property

KEP-3314 – CSI Changed Block Tracking

Title	Status	Stage
🕒 Add storage capacity scoring #4049	Tracked for enhancements freeze	Alpha
🕒 Generic data populators #1495	Tracked for enhancements freeze	Stable
🕒 Portworx file in-tree to CSI driver migration #2589	Tracked for enhancements freeze	Stable
🕒 Always Honor PersistentVolume Reclaim Policy #2644	Tracked for enhancements freeze	Stable
🕒 Mutable CSINode Allocatable Property #4876	Tracked for enhancements freeze	Alpha
🕒 Remove gitRepo volume driver #5040	Tracked for enhancements freeze	Alpha
🕒 Speed up recursive SELinux label change #1710	Tracked for enhancements freeze	Beta
🕒 VolumeSource: OCI Artifact and/or Image #4639	Tracked for enhancements freeze	Beta
🕒 CSI Differential Snapshot for Block Volumes #3314	Tracked for enhancements freeze	Alpha
🕒 Recursive Read-only (RRO) mounts #3857	Tracked for enhancements freeze	Stable

# Future Directions

What might we see in the cloud native storage space futures?

**Event-driven storage** (auto-provisioned, short-lived volumes)

**AI-native storage solutions** (e.g., AI-driven storage tiering, caching)

**Decentralized storage architectures** (IPFS, blockchain-backed storage)

**Confidential computing** (encryption-in-use to prevent unauthorized access)

Storage is becoming more intelligent, ephemeral, and regulation-aware.

# Resources







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Thank you!

