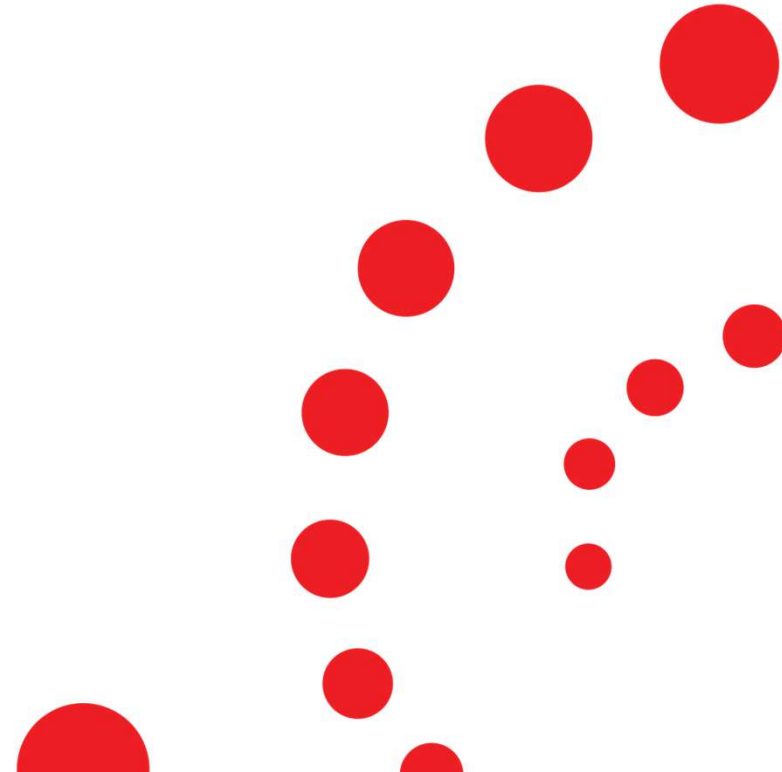




Container Technologies for Storage

Futurewei Intelligent Data Lab

7/2022



New Technologies and Products

Cloud Service Management

- Platform-on-platform
- High automation of deployment, O&M, risk control.
- Crossplane®: next phase for Kubernetes-as-orchestrator. It leverages Kubernetes to orchestrate instances, clusters, ML workloads and VMs.
- Upbound®: leverage Crossplane®, a framework for building cloud native control planes.
- LoftLabs®: leveraged homegrown open-source initiatives, such as DevSpace, vcluster, jsPolicy and kiosk, to provide enterprise-grade cluster management and secure multitenancy.

IoT & Edge

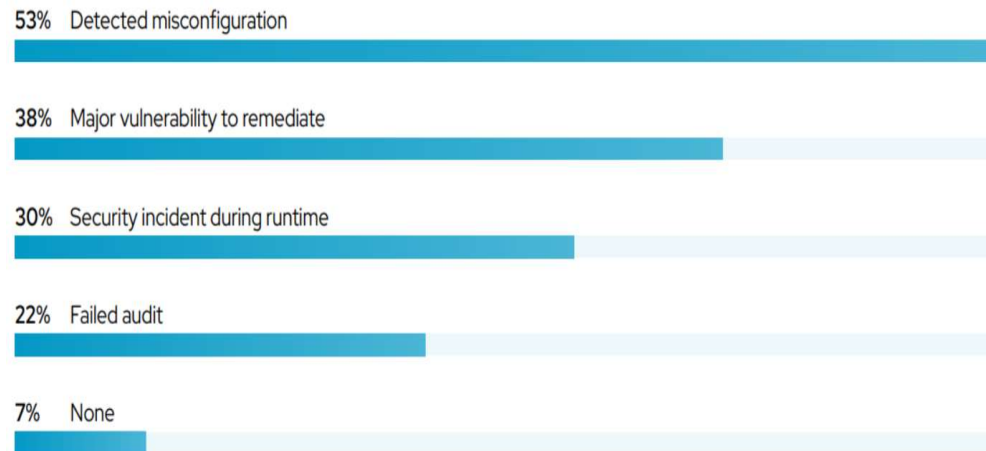
- Cloud-edge integration O&M
- K3s lightweight Kubernetes distribution
- Palette Edge Platform (Spectro Cloud Inc. ®): solution to bring managed Kubernetes to the edge. It registers the edge device, automates the deployment of the full stack, and does the ongoing versioning and patch management.

Service Mesh

- [Linkerd](#): a service mesh for Kubernetes, adopted by major organizations, such as Microsoft® and S&P Global®.
- Istio: open service mesh by Google®.

Security for Enterprise

In the past 12 months, what security incidents or issues related to containers and/or Kubernetes have you experienced? (pick as many as apply)



[Kubernetes adoption, security, and market trends report 2022 \(redhat.com\)](https://www.redhat.com/en/blog/kubernetes-adoption-security-and-market-trends-report-2022)

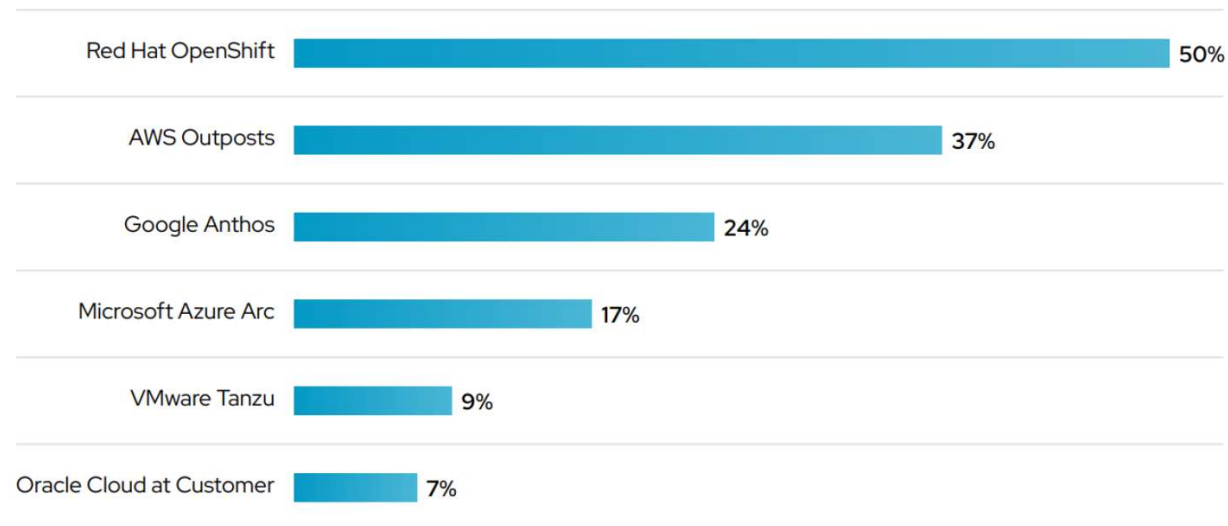
- eBPF: run sandboxed programs in an operating system kernel.
- Container runtime ensures good security isolation: KATA
- Security isolation at the network, disk, image and API level
- Lightweight virtualization: gVisor, Crosvm, Firecracker
- Fairwinds®: security and guardrails to protect against misconfiguration in Kubernetes environments.
- WebAssembly (Wasm): run in a sandboxed environment
- Other startups: Spectro Cloud®, Kubecost®, ARMO®, Komodor®

AI and Machine Learning

- Kubeflow: open-source ML platform to enable using pipelines to orchestrate workflows running on Kubernetes
- A unified cloud-native base for AI and Big Data

Hybrid and Multi-cloud Kubernetes Platforms

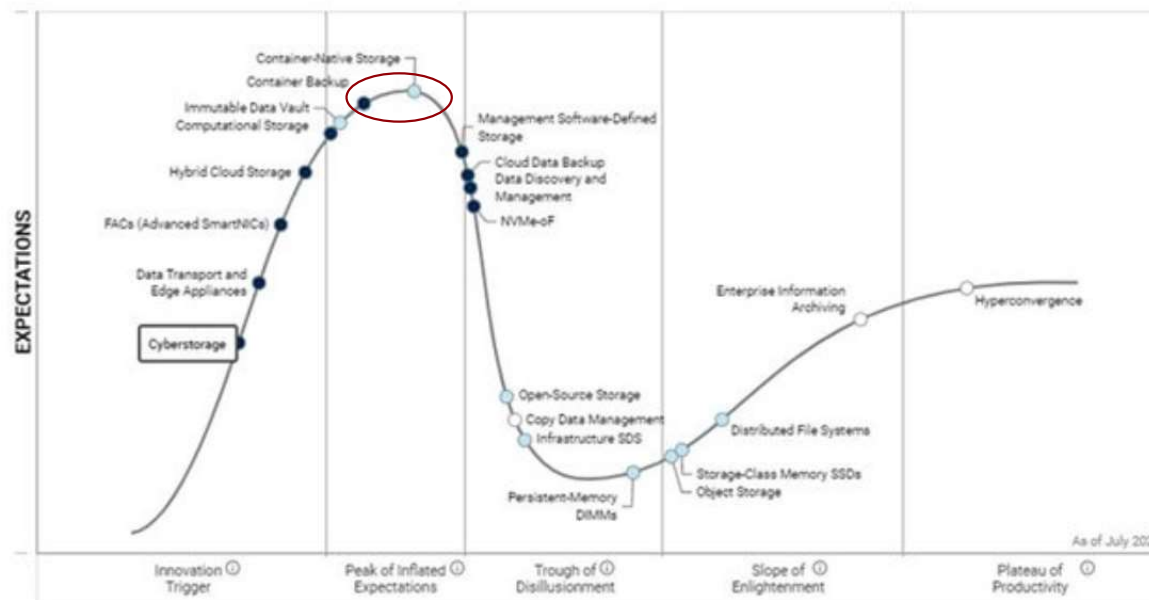
Are you using any solutions for hybrid and multicloud Kubernetes deployments?
(pick as many as apply)



[Kubernetes adoption, security, and market trends report 2022 \(redhat.com\)](https://www.redhat.com/en/blog/kubernetes-adoption-security-and-market-trends-report-2022)

Container Storage

Hype Cycle – Storage & Data Protection



Container-Native Storage:

- Innovation Trigger -> Peak of Inflated Expectation
- 2-5 years

Container Backup:

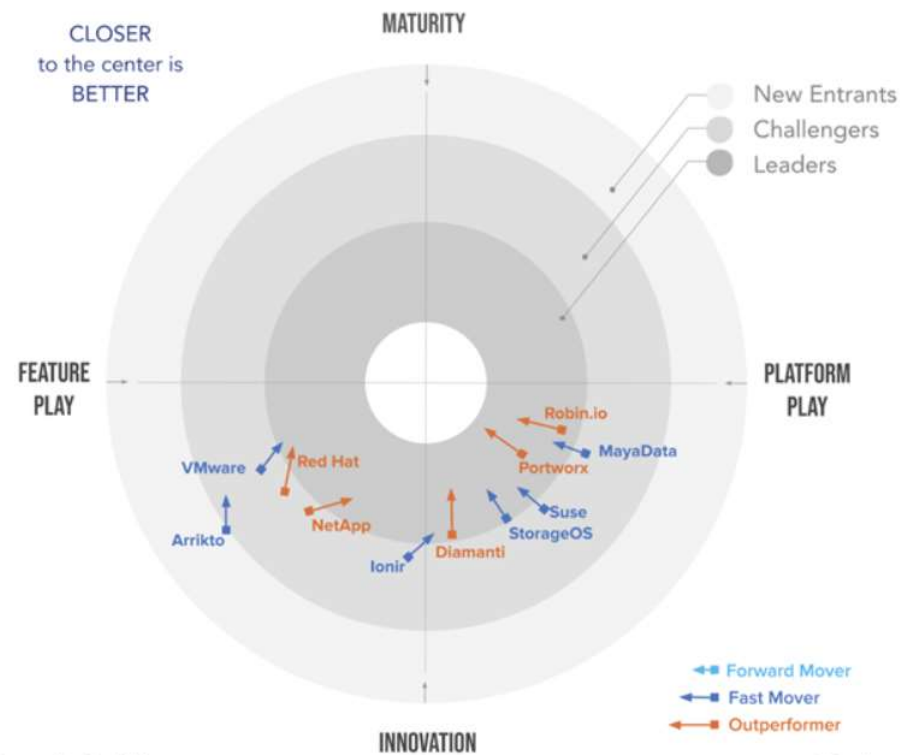
- Innovation Trigger -> Peak of Inflated Expectation
- 5-10 years

Source: Gartner Hype Cycle, 2022

Container-Native Storage

Scale-out, software-defined data storage solution that run inside containers on an orchestration platform.

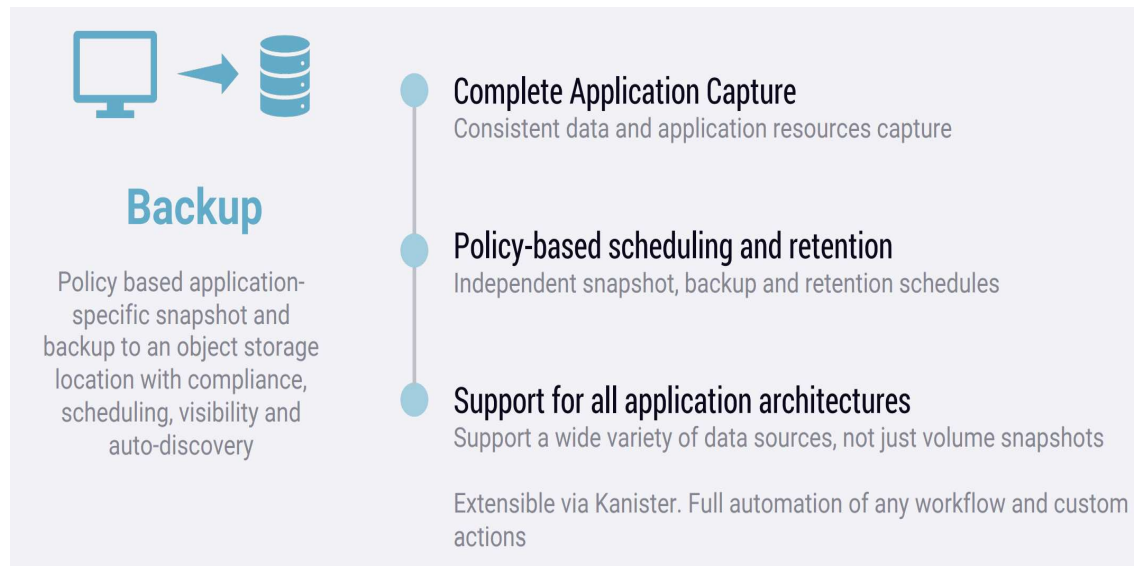
- Portworx®
- Red Hat® OpenShift Data Foundation
- Robin.io®
- StorageOS®
- Netapp® Trident
- OpenEBS®
- Rook®



Source: GigaOm 2021

©GigaOm

Container Backup



[Kasten-CNCF-Webinar- 23Oct2019-1.pdf](#)

Why container-native backup:

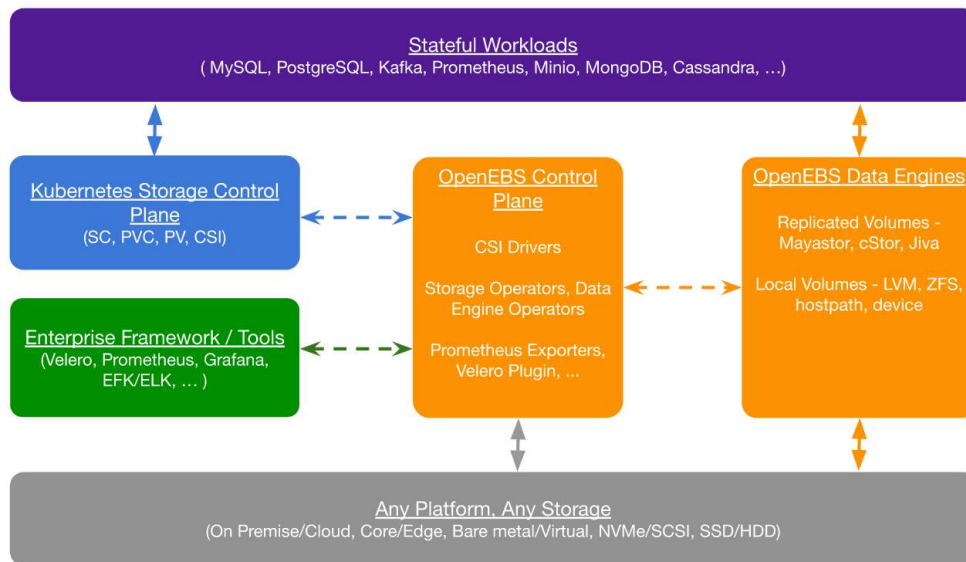
- Kubernetes Deployment Patterns
- DevOps
- Kubernetes Operator Challenges
- Application Scale
- Protection Gaps
- Security
- Ecosystem Integration

Top container backup software:

- Kasten K10®
- Velero®
- Trilio® TrilioVault
- Portworx® PX-Backup
- Metallic®

Open-Source Projects

OpenEBS®



[OpenEBS Architecture](#) | [OpenEBS Docs](#)

- #1 Container Attached Storage (CAS) project
- Open-source version of AWS® EBS
- CAS includes microservice based storage controllers that are orchestrated by Kubernetes
- Each workload has its own storage controller in the container stack with portability and hardware independence

Data Engine:

- Akin to storage controllers and serve IOs to the applications
- Aggregate the capacity in the block devices and carve out volumes for applications
- Provide standard system or network transport interfaces for connecting to local or remote volumes
- Provide volume services: sync replication, compression, encryption, snapshots
- Provide strong consistency while persisting data to storage

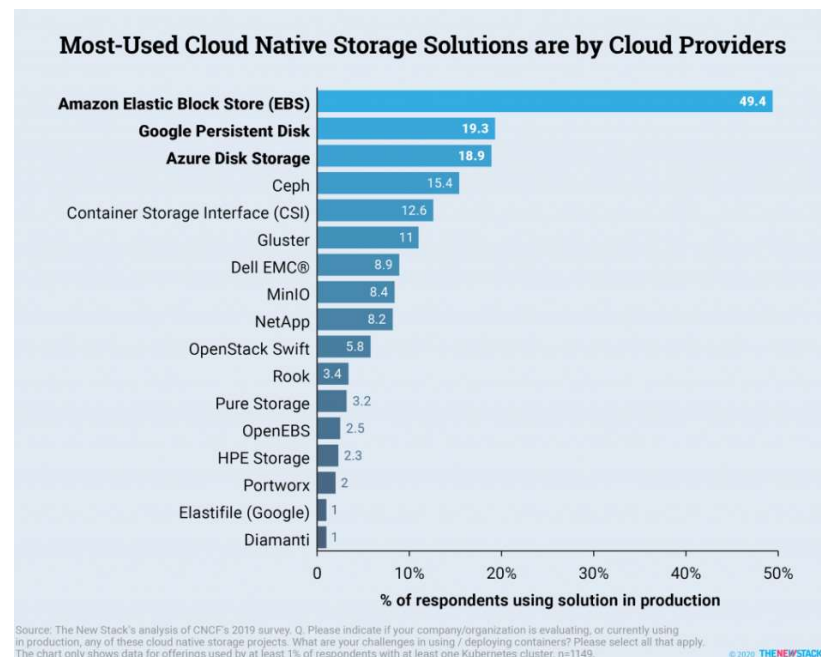
Control Plane:

- Manage the storage available on the worker nodes
- Configure and manage data engines
- Interface with CSI to manage lifecycle of volumes, snapshots, clones, resize, backup, restore, etc
- Integrate into tools like Prometheus/Grafana for telemetry, monitoring and logs

OpenEBS

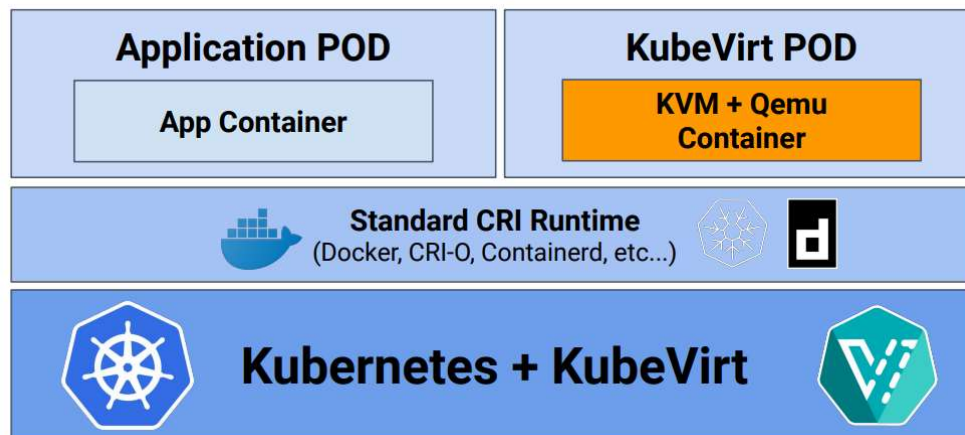
- The top Kubernetes open-source projects are OpenEBS®, Rook®, GlusterFS®, Ceph®, and Longhorn®.

	OpenEBS	PortWorx	Rook	Gluster
License	Open source	Commercial	Open source	Open source / Commercial
Support	Slack Community	Forum Slack Support Portal	Slack Community	RedHat Commercial Support
Active Development	Yes	Yes	Yes	Maintenance
Supported Storage Engines	Mayastor cStor Jiva Local PV		Ceph CockroachDB Cassandra NFS YugabyteDB	



[The Most Popular Cloud Native Storage Solutions – The New Stack](#)

KubeVirt



[Fast_Packet_Processing_v1.pdf \(cncf.io\)](#)

- Kubernetes Virtualization API and runtime in order to define and manage virtual machines.
- KubeVirt provides a unified development platform where developers can build, modify, and deploy applications residing in both Application Containers as well as Virtual Machines in a common, shared environment.

Advantages

- Manage virtual machines for impractical-to-containerize apps
- Combine existing virtualized workloads with new container workloads on the one platform
- Support development of new microservice applications in containers that interact with existing virtualized applications

KubeVirt

- Usage
 - OpenShift ® Virtualization uses [KubeVirt](#) to offer a way for teams to run their VM-based applications side by side with their containerized apps as teams and applications grow and mature. ([OpenShift Virtualization with Portworx – Portworx](#))
 - Google Anthos®
 - CloudFlare®, Apple®, Dell®, NVIDIA®, Lawrence Livermore®, CoreWeave®
 - Platform9® Managed Kubernetes
- Conclusions
 - KubeVirt is going mainstream in 2022.
 - We need to support Tanzu® for VM ecosystem.
 - For Geopolitical reasons, Kubernetes + KubeVirt is a good alternative to Tanzu®

Thank You.

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