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MICHELIN-GRADE IT

A 3-Course Meal for Modern Platforms Powered by OpenShift & NetApp



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11.11.2026

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Agenda

- Starter – Run it:
  One Platform, for all your workloads
- Main Course – Store it:
  The best data management platform
- Desert – Protect it:
  The Cloud Native data protection you need

- Chefs Secret:
  Worried about the hard way from the Kitchen to the Table?

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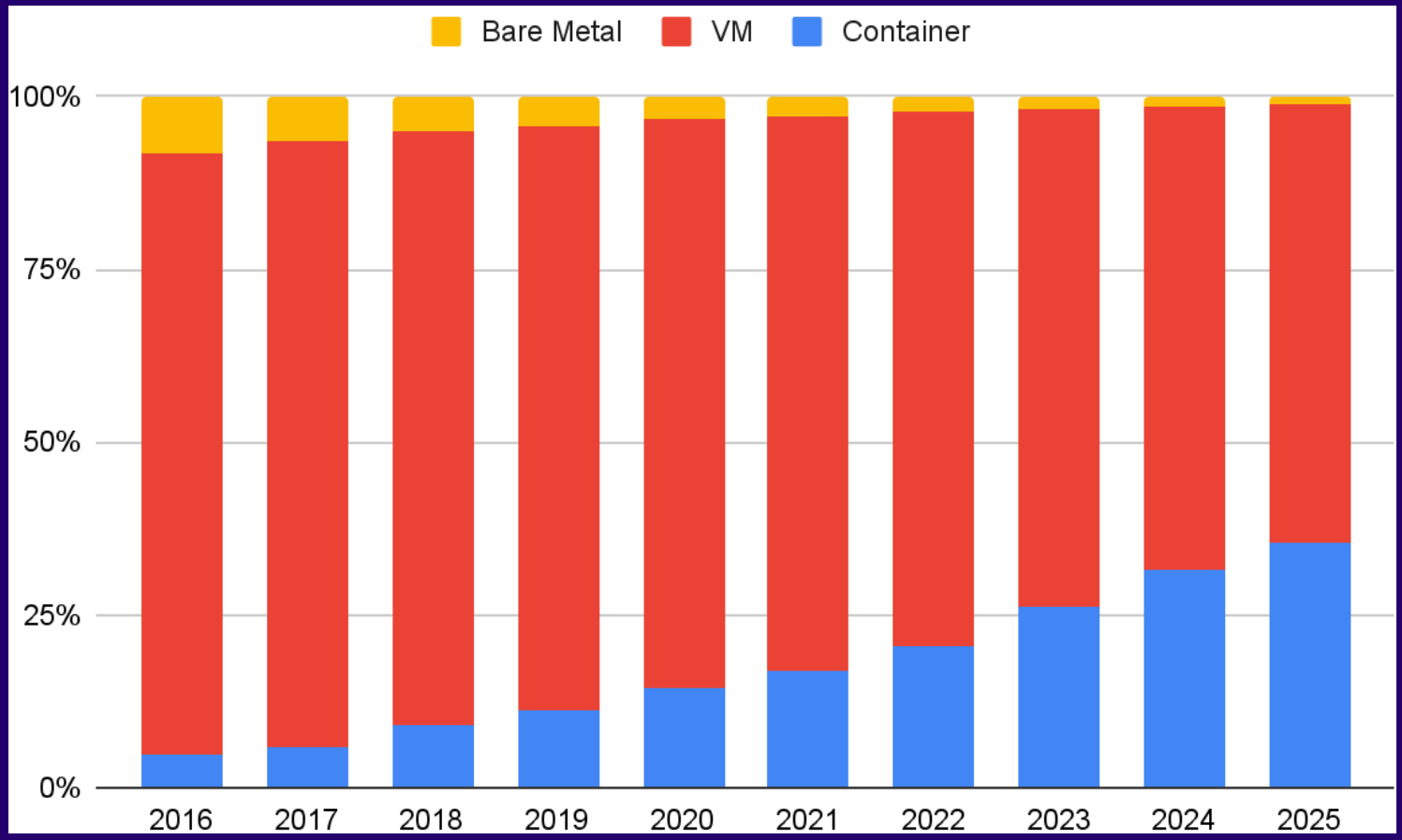
STARTER – RUN IT

One Platform, for all your workloads

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Our Landscape is changing – Applications are evolving



Source: IDC Container Infrastructure Software Market Assessment: Container Deployment Forecast, 2022–2025 (IDC #US48670722, January 2022)

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But it‘s more than just the applications

Modernization

Microservice based/ containerized applications are the way to go

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Virtualization

Broadcom disrupted the virtualization infrastructures heavily

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But it‘s more than just the applications

Modernization

Microservice based/ containerized applications are the way to go

Virtualization

Broadcom disrupted the virtualization infrastructures heavily

AI

A new, fascinating but also beasty workload that needs to be satisfied

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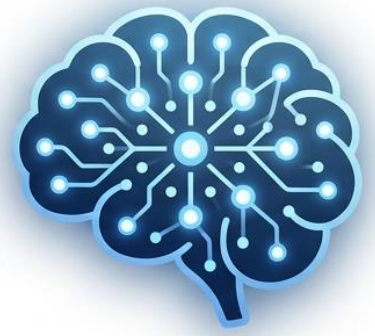
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Container



VMs



AI

Red Hat OpenShift

NetApp

9 ONTAP

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Red Hat | NetApp



20+ years of collaboration

- Global and strategic level partnership
- Executive alignment
- Engineering and products
- Customer support
- Solution development
- Field enablement programs
- Marketing campaigns
- Ecosystem of partners
- NetApp & Red Hat internal IT and Dev teams

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MAIN COURSE – STORE IT

The best data management platform

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CSI: container storage interface

Open standard for attaching storage to containers based on file and block storage
CNCF standard
(though mostly used with K8s)



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Kubernetes 1.17: Stability

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Container Storage Interface (CSI) for Kubernetes GA

By **Saad Ali (Google)** | Tuesday, January 15, 2019



RSS Feed

Submit a Post

@Kubernetesio

on GitHub

#kubernetes-users

Stack Overflow

Forum

Kubernetes

- Enabled SVM-scoped users for ONTAP backends.
- Switched to using vserver-show-aggr-get-iter API for ONTAP 9.0 and later to get aggregate media type.
- Added support for E-Series.
- Upgraded the etcd version to v3.1.3.
- Added release notes (CHANGELOG.md).

▸ **Assets** 3

Dec 23, 2016

kangarlou

v1.0

44272ba

Compare

v1.0

Trident v1.0 provides storage orchestration for Kubernetes, acting as an external provisioner for NetApp ONTAP and SolidFire systems. Additionally, through its REST interface, Trident can provide storage orchestration for non-Kubernetes deployments.

▸ **Assets** 3

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KUBERNETES IS THE MODERN OS

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BUT HOW DO YOU DEAL WITH ALL THE DIFFERENT REQUIREMENTS?

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How do you deal with all the different requirements?

The NetApp Way

- Block, File and Object storage out of the same storage system and delivered by one unified CSI driver
- All volume modes
- All access modes
- Strong built-in multitenancy – no need for seperate instances or systems
- Usable directly or via csi driver

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HYBRID-MULTI-CLOUD IS REALITY

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BUT HOW DO YOU DELIVER A PERSISTENT EXPERIENCE?

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How do you deliver a persistent experience?

The NetApp Way

- Support for multiple locations and distributions including OpenShift, ARO, ROSA, OSD, Vanilla K8s, Rancher, OpenShift, KKP, AKS, EKS, GKE, …
- 1P offerings for storage in Azure, AWS, GCP and OCI
- IaaS-like Marketplace offering
- Support for any flavour of ONTAP

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PERSISTENT WORKLOADS ARE REALITY

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BUT K8S WAS NEVER DESIGNED FOR THIS

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But K8s was never designed for this

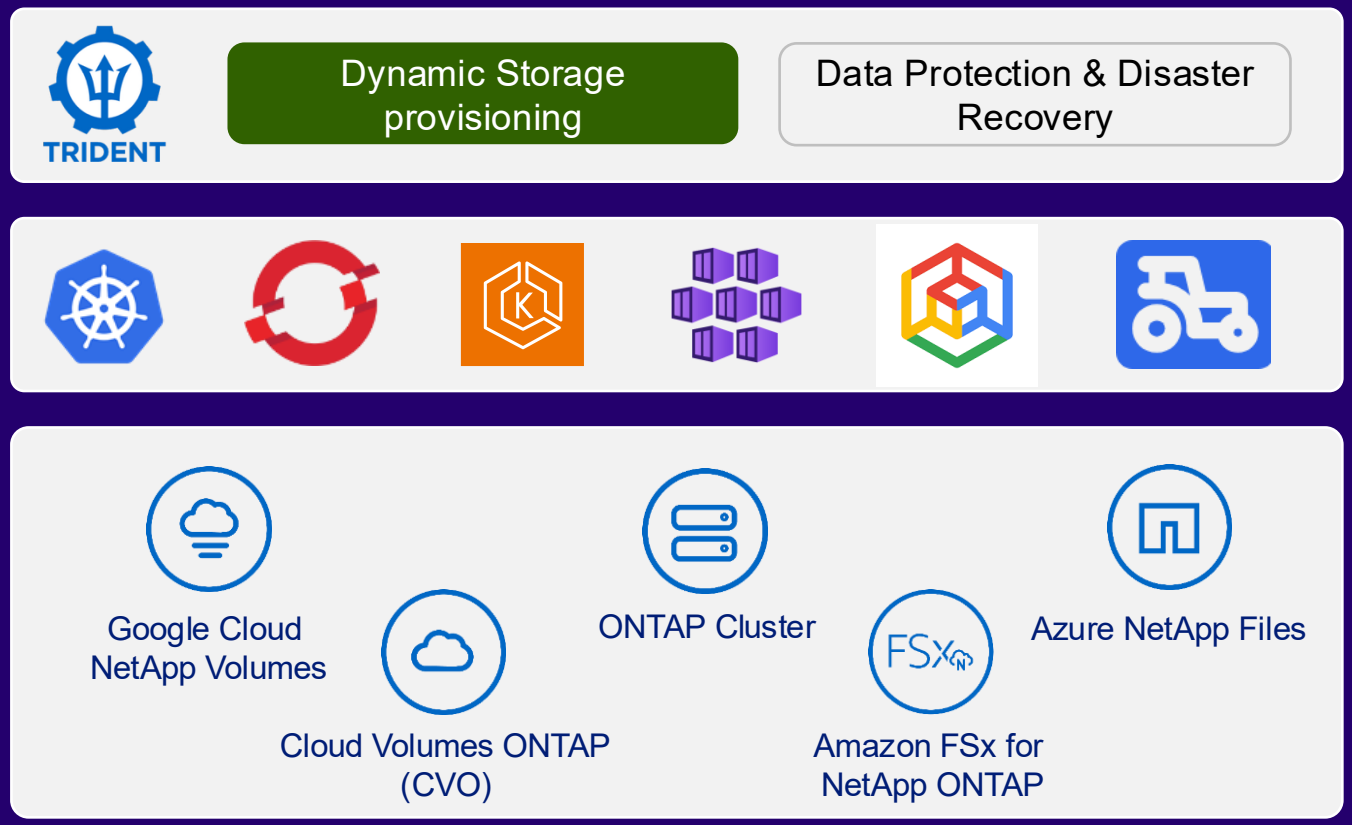
The NetApp Way

- Storage stays where it should be – outside of K8s
- Strong commitment for delivering the best CSI driver on the market
- Snapshot & Cloning offload
- Maintenance and tech refresh is a NDO
- Full supported and maintained by NetApp

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NetApp Trident

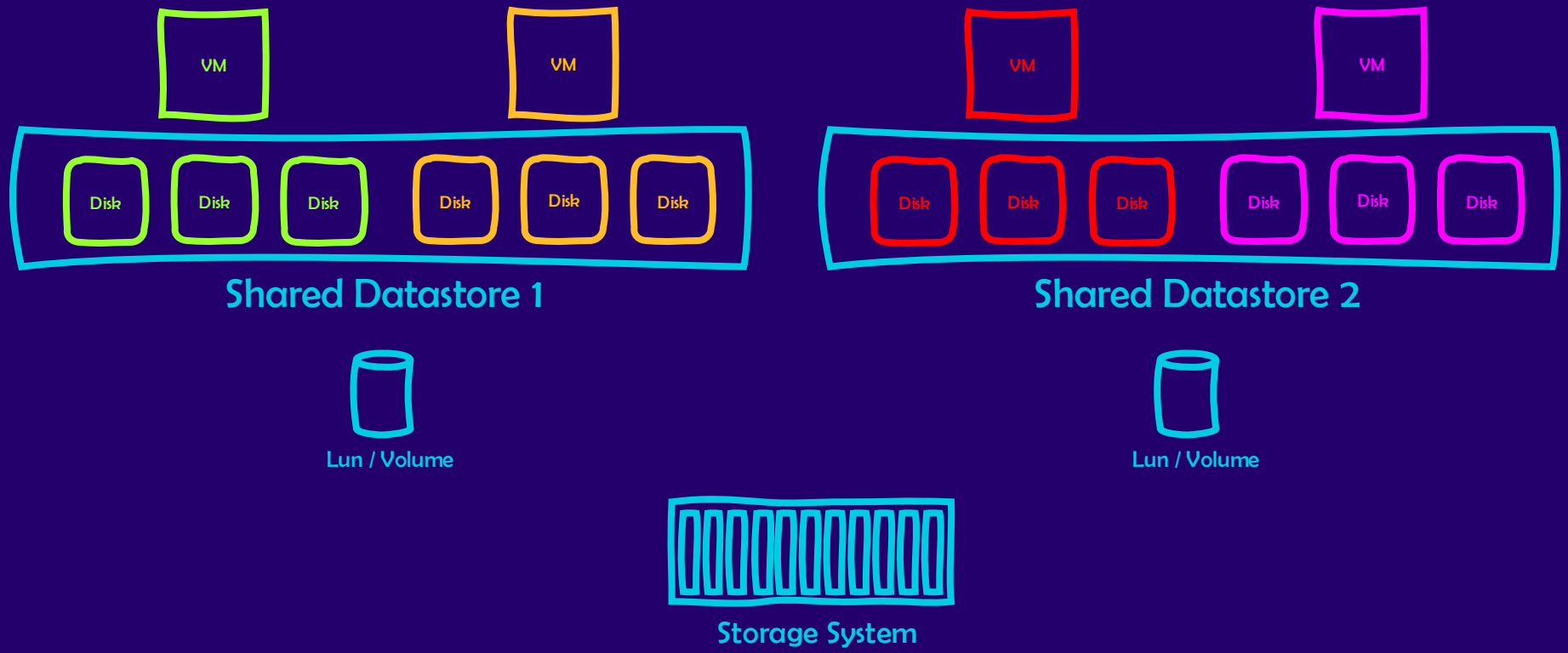
Solving persistent Storage for Containers since 2016



- First commit almost 2 years before CSI was GA in K8s
- Open Source and free-of-charge
- CSI compliant
- Extended Features
- Multi-protocol support
- Multi-location support

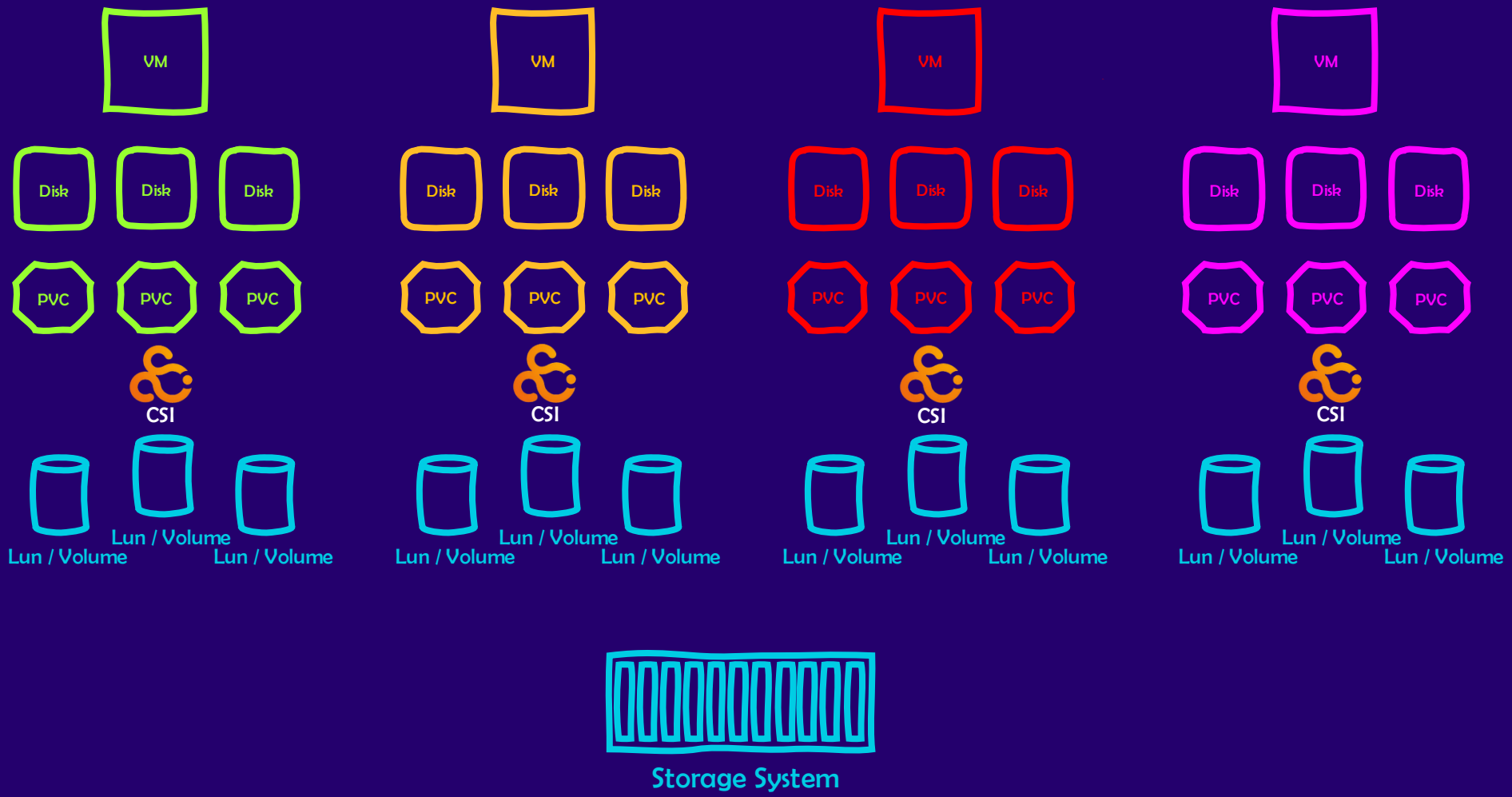
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Datastore Concept Classical Hypervisors



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Datastore Concept KubeVirt



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Trident Parallelism

Up to 11x performance for storage operations!





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Trident Parallelism Benchmarking

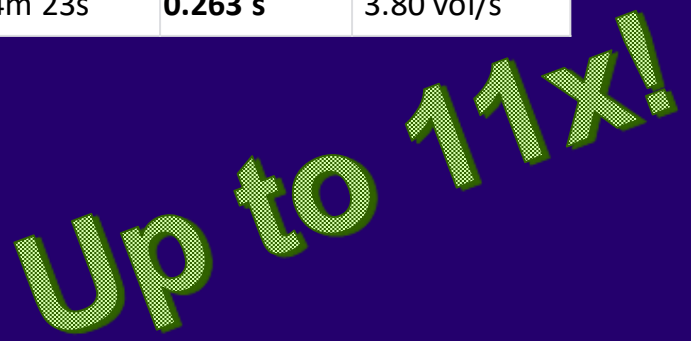
Trident 26.06 - ontap-san - iSCSI - 1000 PVs - 1 ONTAP backend

Serial Core

Operation	Count	Duration	**Per Vol (s)**	Throughput
Create Volume	1000	27m 28s	**1.648 s**	0.61 vol/s
Publish (Attach)	1000	12m 57s	**0.777 s**	1.29 vol/s
Unpublish (Detach)	1000	3m 53s	**0.233 s**	4.29 vol/s
Create Snapshot	1000	30m 03s	**1.803 s**	0.55 vol/s
Clone from Snapshot	1000	56m 24s	**3.384 s**	0.30 vol/s
Delete Clone	1000	24m 14s	**1.454 s**	0.69 vol/s
Delete Snapshot	1000	20m 38s	**1.238 s**	0.81 vol/s
Delete Volume	1000	20m 38s	**1.238 s**	0.81 vol/s

Parallel Core

Operation	Count	Duration	**Per Vol (s)**	Throughput
Create Volume	1000	7m 57s	**0.477 s**	2.10 vol/s
Publish (Attach)	1000	2m 35s	**0.155 s**	6.45 vol/s
Unpublish (Detach)	1000	2m 37s	**0.157 s**	6.37 vol/s
Create Snapshot	1000	2m 44s	**0.164 s**	6.10 vol/s
Clone from Snapshot	1000	13m 25s	**0.805 s**	1.24 vol/s
Delete Clone	1000	4m 17s	**0.257 s**	3.89 vol/s
Delete Snapshot	1000	2m 03s	**0.123 s**	8.13 vol/s
Delete Volume	1000	4m 23s	**0.263 s**	3.80 vol/s



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DESERT – PROTECT IT

The Cloud Native data protection you need

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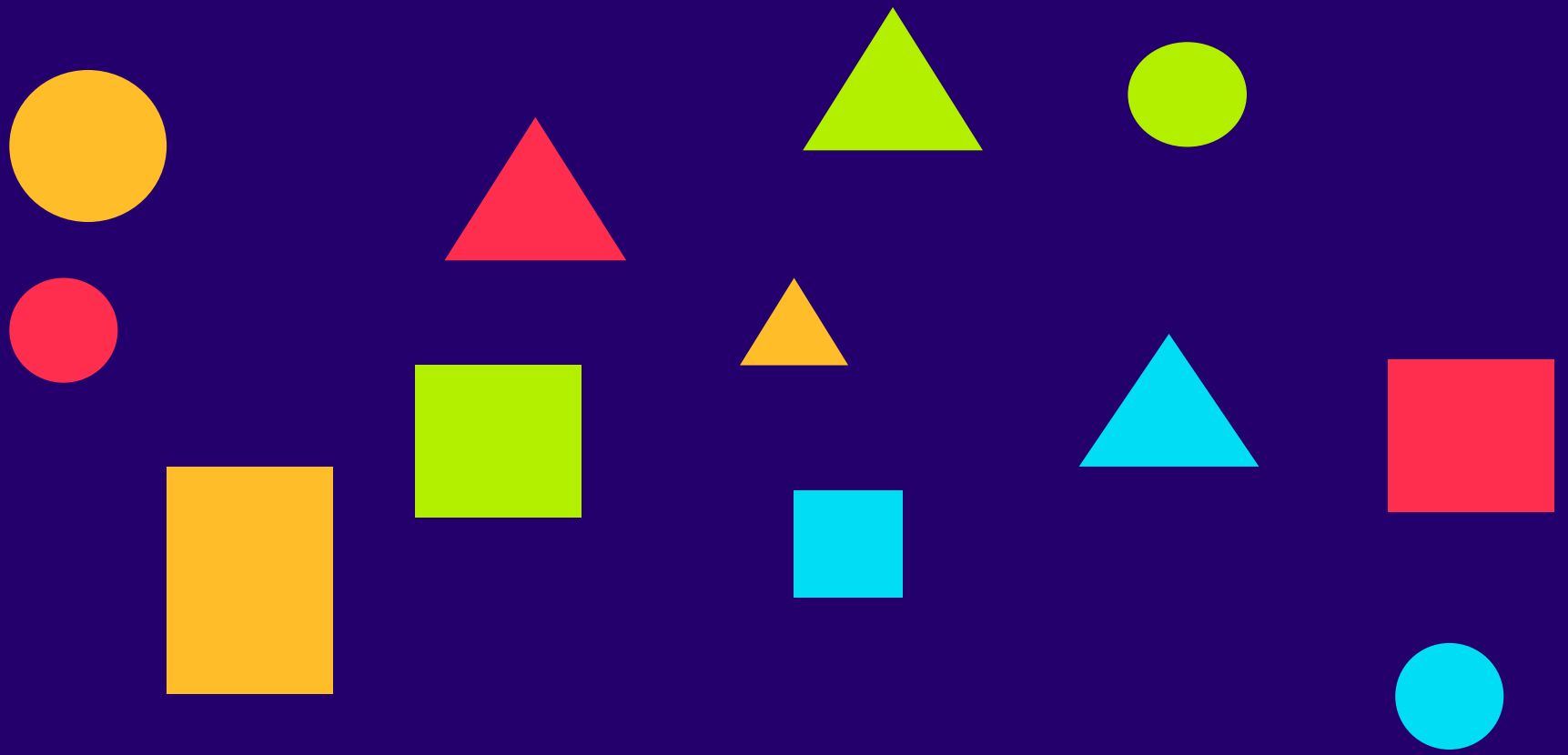
Kubernetes data management is hard!



https://www.esg-global.com/research/esg-master-survey-results-data-protection-considerations-for-containers

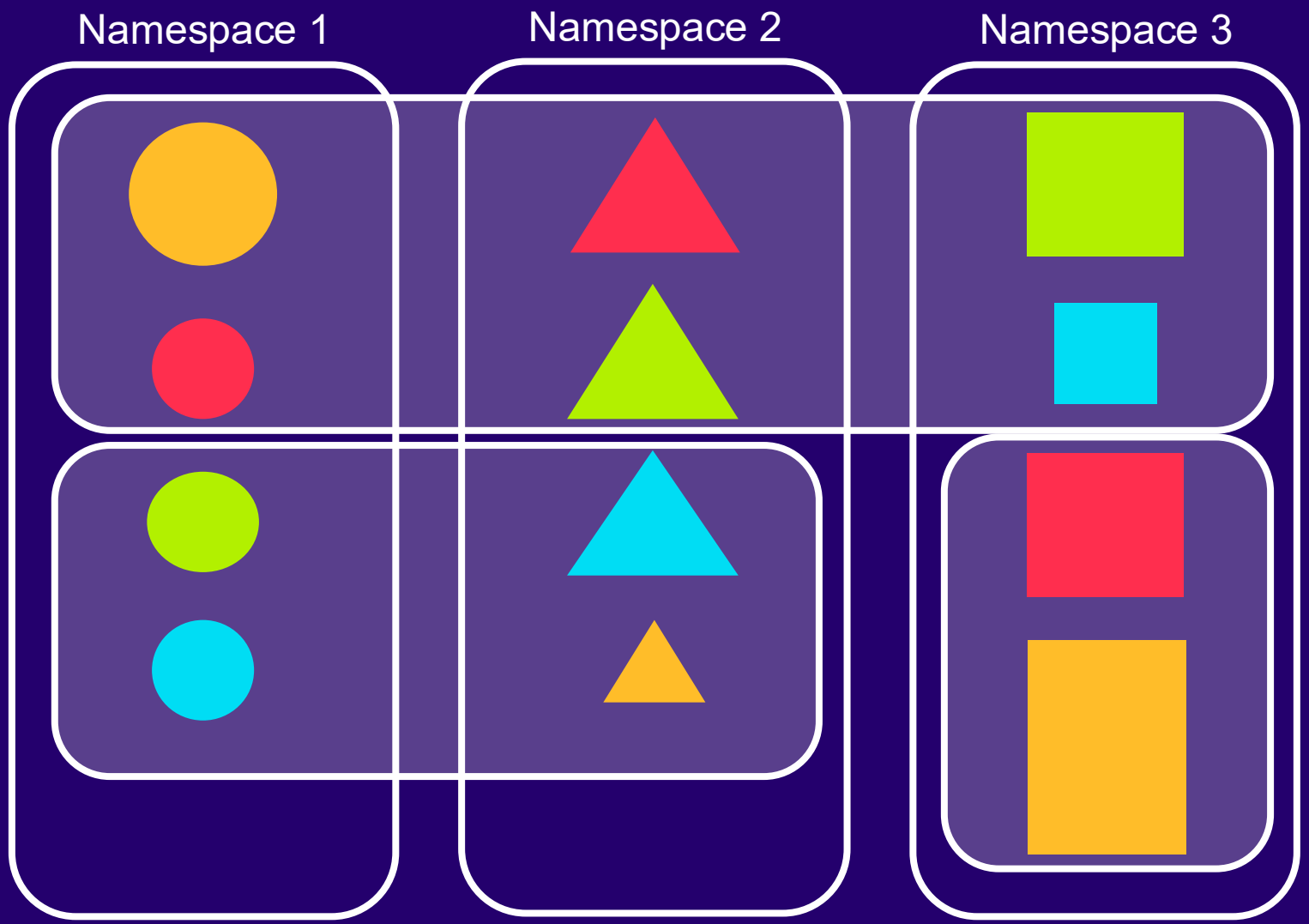
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Kubernetes data management is hard!



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Kubernetes data management is hard!



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Our Solutions for Backup & DR



Trident Protect

Kubernetes-native CRDs for snapshots, backups, restores, and async DR via storage replication

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Trident protect - Create a Backup

- **Ad-hoc backup application – apply manifest:**

```
apiVersion: protect.trident.netapp.io/v1
kind: Backup
metadata:
  name: wp-bkup-1
```

```
ress

ket1
ordpress-app
```

ommand:

```
 create backup wp-bkup-1 --app
vault bucket1 –n wordpress
```

tion

up

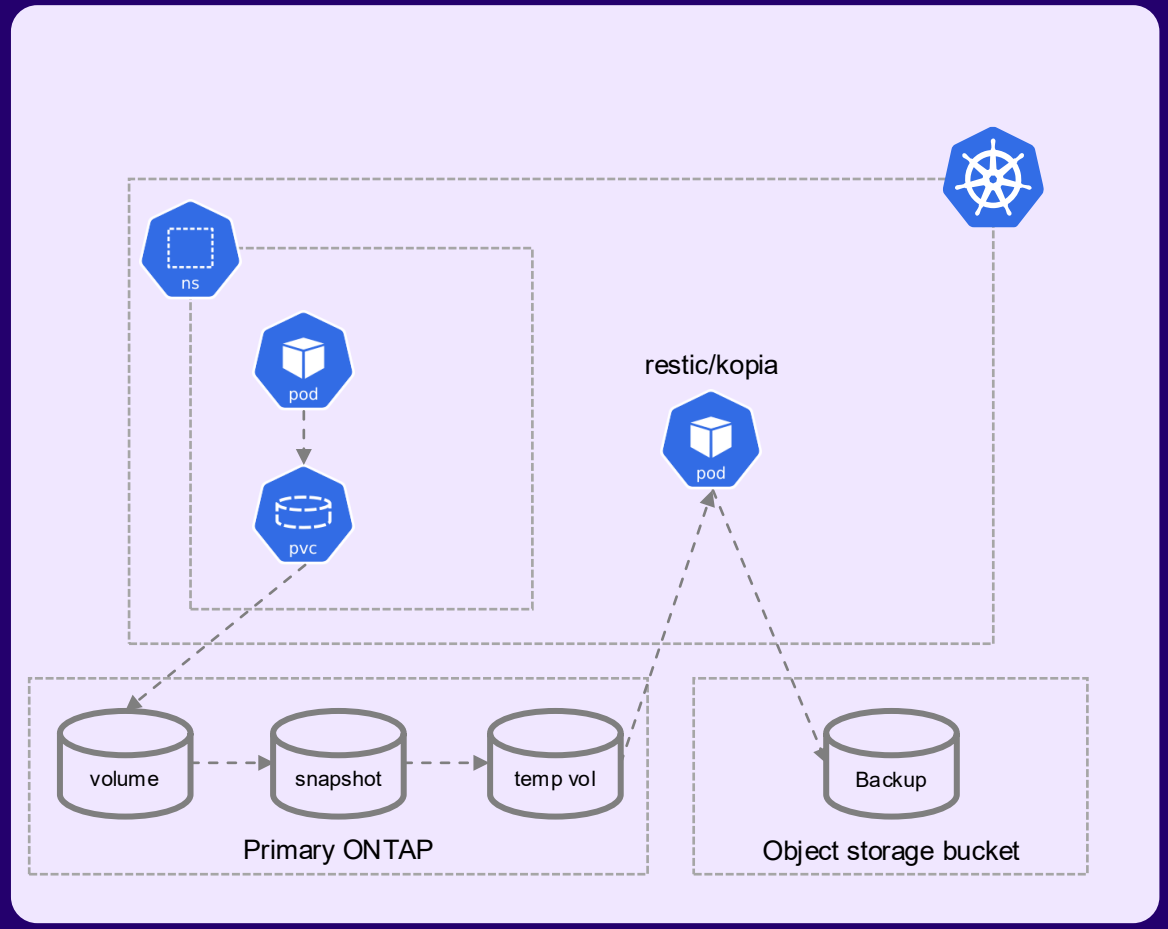
- **Create backup schedule – apply manifest:**

```
apiVersion: protect.trident.netapp.io/v1
kind: Schedule
metadata:
  generateName: daily-wordpress-app-
  namespace: wordpress
spec:
  appVaultRef: bucket1
  applicationRef: wordpress-app
  backupRetention: '3'
  dayOfMonth: ''
  dayOfWeek: ''
  granularity: daily
  hour: '12'
  minute: '12'
  snapshotRetention: '3’
```

- **Or run protectctl command:**

```
$ tridentctl-protect create schedule daily-wordpress-app-1
--app wordpress-app --granularity daily --hour 12 --minute
12 --backup-retention 3 --snapshot-retention 3 --vault
bucket1 –n wordpress
```

Typical Backup Workflow for K8s



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Our Solutions for Backup & DR



Trident Protect

Kubernetes-native CRDs for snapshots, backups, restores, and async DR via storage replication



NetApp Backup and Recovery

Simple, secure, and cost-effective data protection service for NetApp ONTAP-based applications



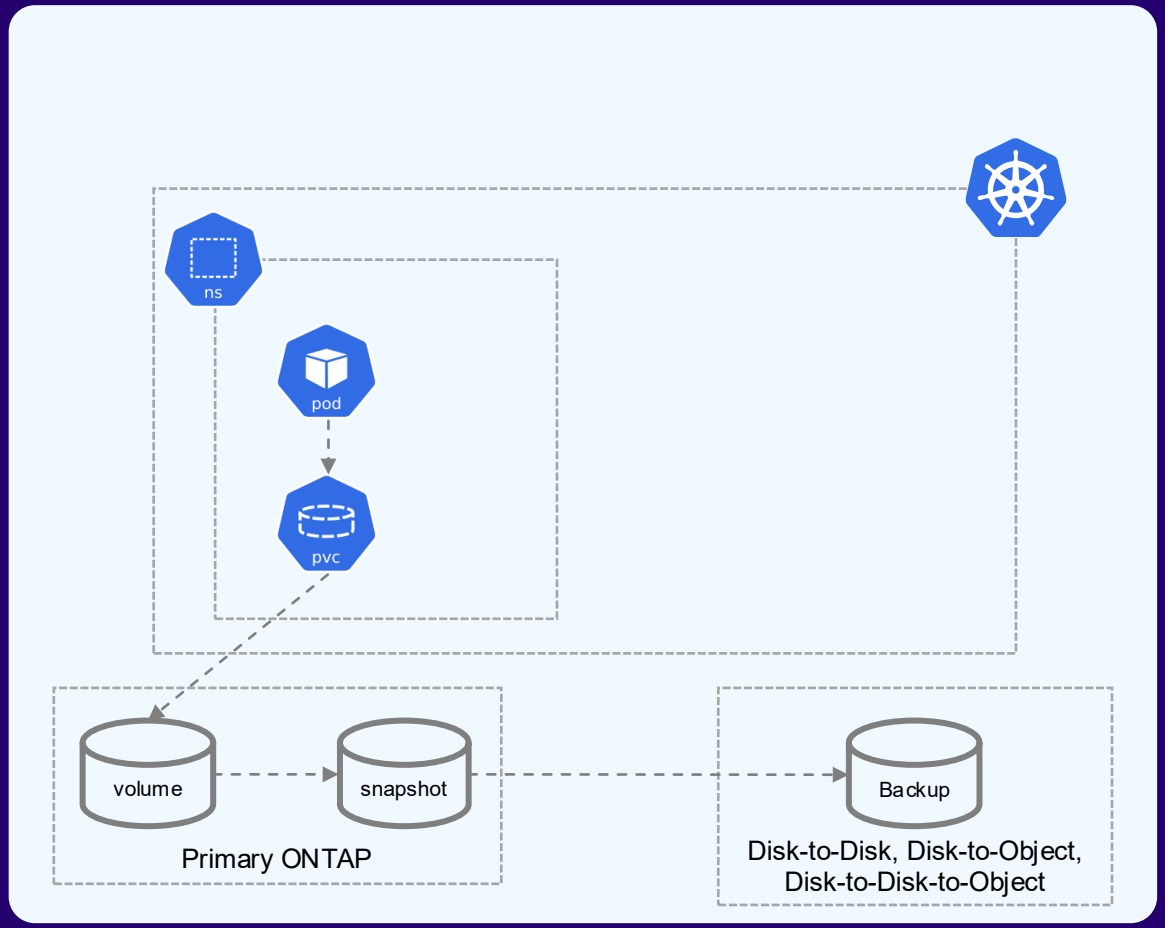
NetApp Disaster Recovery

Cross-site failover and failback for OpenShift and VMware workloads with automated DR plans

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Our Approach with Backup & Recovery



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CHEFS SECRET

Worried about the hard way from the Kitchen to the Table?

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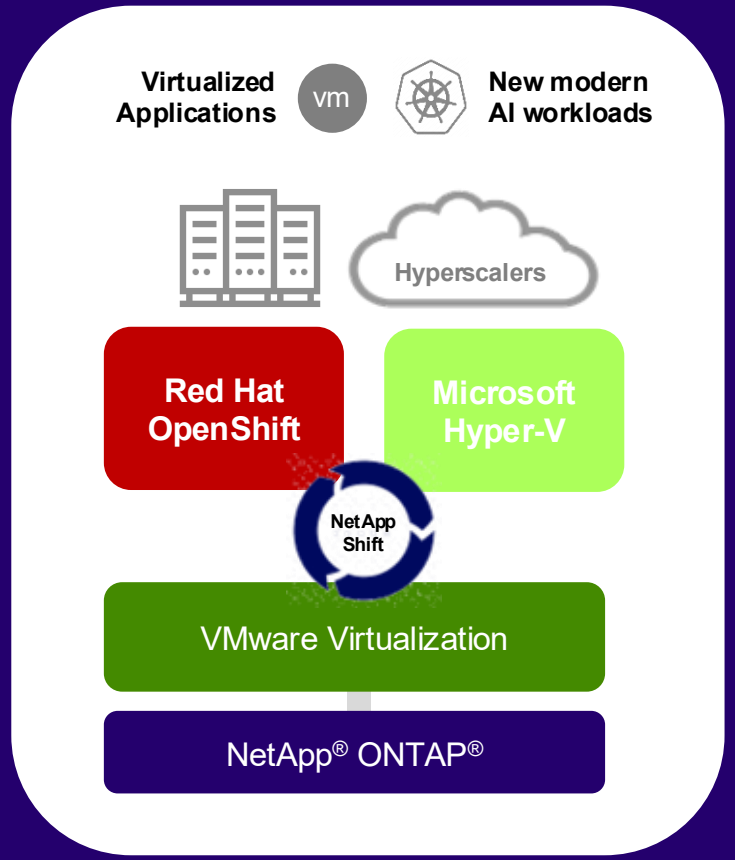


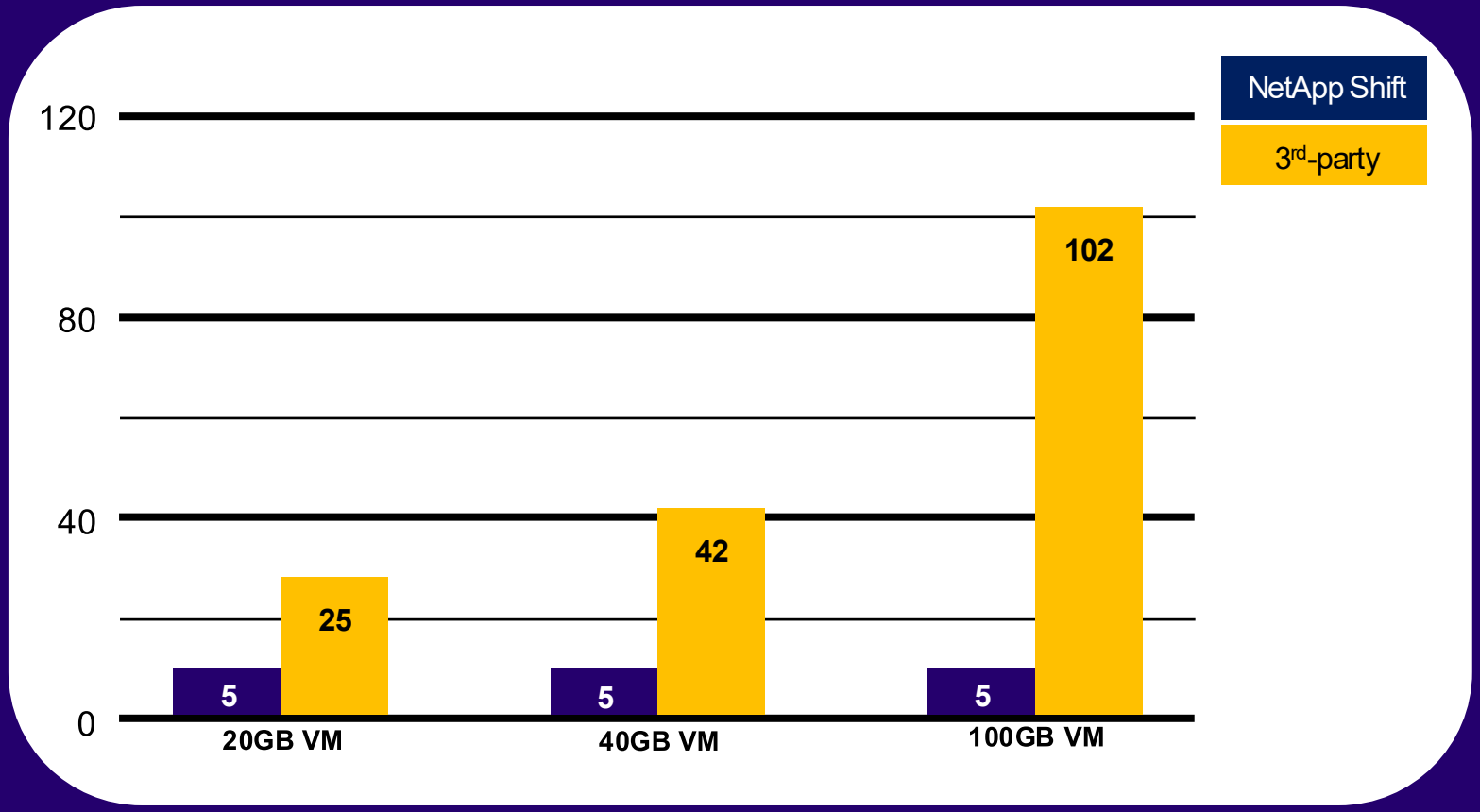
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NetApp Shift Toolkit – Hypervisor independent VM migration

Fully integrated with Red Hat Migration Toolkit for Virtualization (MTV)





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KEY TAKEAWAYS

01

Stop thinking and building in silos – Red Hat OpenShift & NetApp ONTAP enable you to have ONE platform for Containers, VMs and AI.

02

A reliable, fast and modern CSI driver is crucial for the success of a project like this. NetApp Trident is your solution.

03

We are happy to help you with the protection of the workloads and also bringing them into the new platform.

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