Autonomous Kubernetes Flash Management with Application Awareness
Introducing Portworx
Portworx is the most widely used data platform on Kubernetes

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<th>CUSTOMERS</th>
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Portworx brings a unique mix of cloud native expertise

**STORAGE & DATA SERVICES**
Years of expertise in enterprise storage
Invented storage orchestration for K8s

**APPLICATION & ORCHESTRATION INTEGRATION**
Deep and early Kubernetes expertise
Co-led the founding of CSI

**MULTI-CLOUD DATA MANAGEMENT**
1st to offer multi-cloud Kubernetes storage
1st to offer migration across environments
What do platform owners want?

YOUR PLATFORM GOALS

- Self service for developers
- Fully automated
- Infrastructure agnostic SLAs
- Simple to adopt
- Low Touch Ops
- Optimization for cost
Portworx completes Kubernetes

Portworx is the **market leading Data Orchestration Platform** that is fully managed from within Kubernetes and also gives you the security, reliability and performance you’d expect from **enterprise class** traditional infrastructure.
Challenges in running Stateful Workloads with NVMe

1. High availability and Data protection requires expensive all-flash arrays
2. Data protection across rack level failure and data center failure does not exist without a custom hardware all-flash SAN solution
3. End to end perf. QoS requires manual configuration and setup
4. Data encryption and key management can get hard to manage
5. Static provisioning can waste a lot of flash space
6. Most K8s provisioners available will do DAS provisioning
7. K8S CSI is still far away from providing end to end data management capabilities
Portworx for NVMe Data Management in Kubernetes

1. Dynamic NVMe Namespace provisioning tied to k8s volume provisioning
   a. Works with all major NVMe drive providers
   b. Integrations with Toshiba Kumoscale and other NVMeOF appliances
   c. End to end hard storage performance guarantees through Kubernetes PVC mapped to NVMe namespace

2. Rack-Aware and Data center aware replication to protect against SPOF in case of NVMe DAS architectures through Portworx Operator called STORK

3. Automatic class of service classification and provisioning that identifies higher performance drives and place data that requires higher performance dynamically on the volumes residing in those pools

4. Dynamic I/O prioritization at a container granular volume level to provide multi-tenant IOPS provisioned Kubernetes volumes

5. Dynamic capacity management through Portworx Operator called Auto-pilot
Stateful Data services with STORK
Motivation

▪ Help run stateful applications more efficiently on Kubernetes
  ▪ Provide Hyper-convergence
  ▪ Advanced health monitoring of stateful apps

▪ Manage lifecycle of stateful applications
  ▪ Application consistent snapshots
  ▪ Migrate applications between clusters
  ▪ Backup Data + K8s resources

▪ Plugin model, can be extended to work with any storage driver
Scheduling stateful services efficiently

1. Kubernetes Scheduler
2. Stork
3. Kubernetes PX Service
4. PX Cluster Status

Steps:
1. Filter Request (N1, N2, N3, N4, N5)
2. Get PX Cluster Status
3. Filter Response (N1, N2, N3)
4. PX Service

Nodes:
N1, N2, N3, N4, N5
Scheduling stateful services efficiently

1. Prioritize Request (N1, N2, N3)
2. Get Nodes for V1 and V2
3. Prioritize Response (N1:100, N2:200, N3:100)
4. Start Pod1 on N2

Kubernetes Scheduler

Stork

Kubernetes PX Service

Pod1

PX

V1

V2

N1

N2

N3

N4

N5
Storage Health Monitoring

- Monitors the health of storage driver on all nodes
- Storage driver offline?
  - Reschedule pods using storage driver
- Rescheduled on another node with volume replica
  - Continue with local disk performance
- Without this, pods will get stuck in Pending, or not able to access storage
- For stateful sets this also deals with scenarios where kubelet reports offline on a node
Application Backup

Backup Applications + Data

Get Applications

Get Data

Stork

K8s API Server

App1

App2

Portworx

V1

V2

S3 (AWS or any compliant)

Azure Blob

Google Cloud Storage

Kubernetes Cluster
Autogrow storage pools with Autopilot
What is autopilot?

Autopilot is a monitor-and-react engine
Autopilot use cases

- Autogrow volumes
- Autogrow Portworx storage pools
- Autoscale applications when load increases
- Rebalance volumes when certain nodes experience latencies
- ...

The Autopilot Operator framework is extensible to watch for any set of metrics and perform user defined actions.