Reach for the Stars

Get the portability of Kubernetes with the performance of local flash by using Lightbits Labs LightOS and Intel® technology.

eBook

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Contents:

Businesses are embracing containerization and Kubernetes

More and more businesses are turning to Kubernetes as a convenient way to deploy applications as containerized microservices. Kubernetes orchestration brings portability, scalability, and ease of management to containers, in addition to portability for cloud-native applications that support web-based and service-oriented architectures.

But how you manage storage for your containerized apps is critical. If you want to deploy stateful apps, like MySQL, MongoDB, Redis, or Apache Spark in Kubernetes pods, you need to provide storage with high input/output operations per second (IOPS) and low latency in order to support hundreds of clusters with thousands of database instances.

29%

expected compound annual growth rate (CAGR) for the container market over the next five years[1]

48%

Kubernetes adoption rate over the next five years (up from 27% today)[1]

Managing persistent storage can be challenging

When SQL, NoSQL, and in-memory database applications are deployed on bare metal, application vendors recommend using local NVM Express (NVMe) flash. That's because this configuration offers the low latency and high bandwidth performance that these applications crave.

But local flash creates a problem when you're working with Kubernetes: when persistent storage is in the application server, you lose application portability, which—in turn—can result in poor flash storage utilization.

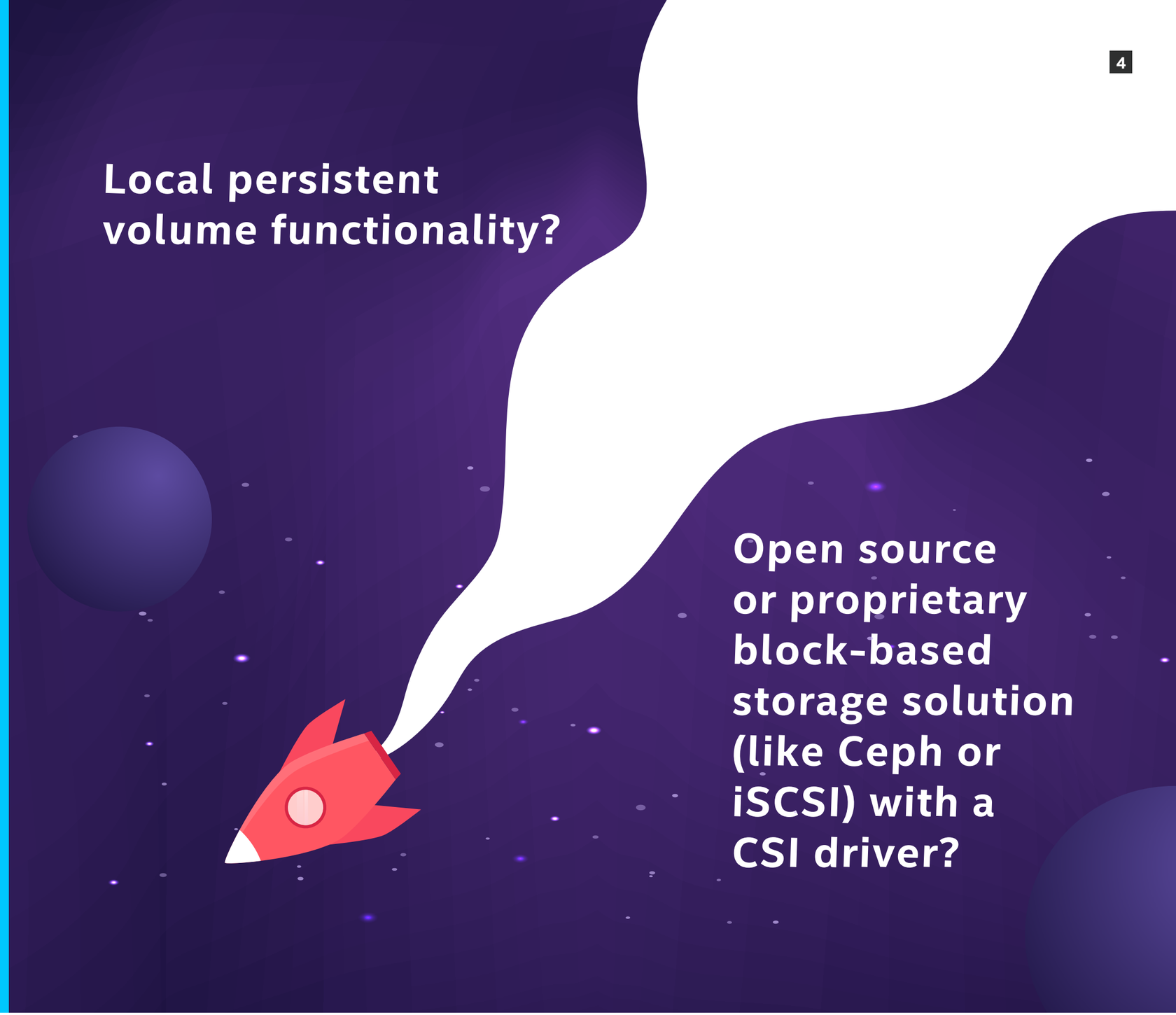
Searching the galaxy for the best solution

How do you get performance and portability for your stateful apps in Kubernetes? The options might seem limited.

One option is local persistent volume functionality. But this can lead to compromised application portability, and it can introduce poor flash storage utilization. For example, adding dedicated local flash drives to every Kubernetes server could result in 50 percent or more wasted storage.[2]

Another option is open source or proprietary block-based storage solutions, like Ceph or iSCSI, that use a Container Storage Interface (CSI) driver. But these can lead to increased complexity and reduced performance, while introducing vendor lock-in.

Given these limitations, how can you make full use of persistent-storage Kubernetes, without compromise, and benefit from rich data services and a lower total cost of ownership (TCO)?



Start your journey with LightOS, Kubernetes, and Intel technologies

Many have already plotted a successful Kubernetes journey by using high-performance, software-defined block storage and Intel technologies to power their modern cloud-native applications.

Lightbits LightOS software-defined storage—optimized for a breadth of high-performance Intel technologies, including Intel® Xeon® Scalable processors, Intel® Optane™ technology, Intel Ethernet adapters, and low-cost quad-level cell (QLC) NAND solid state drives (SSDs)—offers a complete cost-effective solution for powering high-performance databases in Kubernetes environments today.

Lightbits LightOS + Kubernetes + Intel technologies align with Kubernetes values

Performance

High IOPS and low latency enabled by LightOS and Intel Xeon Scalable processors, Intel Optane technology, and Intel Ethernet Adapters

Flexibility

Persistent storage over standard TCP/IP networks

Lower TCO[2]

Coupling LightOS, optimized for Intel's high-performance hardware platform, with low-cost SSDs

A solution powered by advanced technologies

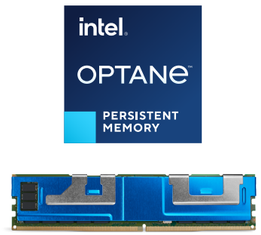
NVMe performance over TCP/IP
Benefit from persistent volumes with performance like—or even better than—local NVMe flash, running over TCP/IP networks. The solution is enabled by seamless integration of LightOS with optimization for high-performance hardware platforms, including Intel Xeon Scalable processors with Intel Deep Learning Boost (Intel DL Boost), Intel Optane persistent memory (PMem), and 100Gb Intel Ethernet 800 Series network adapters with Application Device Queues (ADQ) technology.

Portability with rich data services
The disaggregated solution enables application portability. LightOS uses the CSI to allow Kubernetes pods to move between servers on the network. The solution also provides rich data services for data protection, compression, replication, volume snapshots and clones, elastic RAID, and role-based access control (RBAC) for multitenant environments.

Cost-efficient storage
Coupling Intel's high-performance hardware platform with LightOS, optimized for low-cost QLC NAND SSDs, delivers a scalable solution that reduces overall TCO.[2]

Intelligent flash management helps improve flash endurance, while data-reduction features dramatically improve efficiency of the NVMe/TCP storage solution. In addition, the simple and flexible disaggregated architecture helps improve resource utilization.

Intel Ethernet 800 series network adapters with ADQ technology



Intel Optane PMem

Intel Xeon Scalable processors

LightOS and Intel are light years ahead

Land with no-compromise performance, light years ahead of other software-defined or storage array solutions.

LightOS, optimized for Intel's high-performance hardware platform and low-cost QLC NAND SSDs, delivers a high-IOPS and low-latency solution with performance that is equivalent to local flash—all with fewer nodes and a lower TCO than many competing technologies.[2]

Up to
4x higher throughput for 4K reads[3,*]

Up to
17x more throughput for 4K writes[3,*]

Up to
14x more throughput for 8K read/write workloads[3,*]

Up to
10x more throughput for 16K read/write workloads[3,*]

Up to
5x more throughput for 32K read/write workloads[3,*]

*See backup for workloads and configurations. Results may vary.

A universe of possibility awaits you

LightOS with Intel technologies delivers a powerful platform for Kubernetes environments.

Why wait? **Start navigating your way to better storage architecture**.

To learn more about Intel technologies, explore these pages:

- 3rd Generation Intel Xeon Scalable processors
- Intel Ethernet 800 Series network adapters
- Intel Optane PMem

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[1] Research and Markets. "Application Container Market - Growth, Trends, COVID-19 Impact, and Forecasts (2021 - 2026)." January 2021. researchandmarkets.com/reports/4845968/application-container-market-growth-trends

[2] LightOS can help lower your TCO both for the initial purchase and over time, with greater operational efficiency. Published claims are based on comparisons to Ceph. Source: Lightbits Labs. "Kubernetes and LightOS: Performance, Persistence, Simplicity." June 2021. lightbitslabs.com/ty-solutions-brief-kubernetes/.

[3] Performance of Lightbits LightOS and the Intel technology platform compared to Ceph storage on Red Hat OpenShift container platform. Source: Internal testing by Lightbits Labs. **Configurations: Lightbits LightOS platform:** Intel Xeon Gold 6338 processor (2.00 GHz), 256 GB RAM, 8 x 14 TB Intel QLC NAND SSDs, and Intel Ethernet Network Adapter E810 (single port used in 25 gigabit Ethernet [GbE] mode). **Ceph on Red Hat OpenShift container storage platform worker nodes:** Intel Xeon Platinum 8173M processor (2.00 GHz), 96 GB RAM, Intel Ethernet Network Adapter XXV710 (single port used in 25 GbE mode). **Workload description:** Software: vdbench50407. 12 worker nodes; each worker node has 12 pods running vdbench, and each pod has 1 TB persistent volume claim (PVC). All PVCs are first fully written, and then the different types of workloads (block size and read/write ratio) run for 45 minutes (nine times each), where the first 15 minutes out of the 45 are considered warm up, so the performance measurement is from minute 16 to 45.

Performance varies by use, configuration and other factors. Learn more at www.Intel.com/PerformanceIndex.

Performance results are based on testing as of dates shown in configurations and may not reflect all publicly available updates. See backup for configuration details. No product or component can be absolutely secure.

Your costs and results may vary.

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