

# Lightbits Cloud Data Platform

## High Performance Block Storage

Lightbits™ Cloud Data Platform is high performance software-defined block storage bringing hyperscale efficiency and flexibility to all. It delivers cloud native, high-performance, scale-out and redundant NVMe/TCP storage that performs like local flash.

Lightbits delivers an unmatched combination of performance, resiliency and scalability. It simplifies infrastructure management and operations while simultaneously lowering cost.

### HIGH PERFORMANCE

High IOPs and bandwidth are nice, but NVMe-based storage excels at consistent low latency. This is what makes it the media of choice for databases, analytics and many more modern, scalable cloud-native applications. Lightbits performs at local NVMe latencies even under load. The target servers described above deliver 4K IO response time averages as low as 160µs.

### LOWER TOTAL COST OF OWNERSHIP

Lightbits can lower by up to 80% your total cost of ownership both for the initial purchase, and with greater operational efficiency. Application server environments with local NVMe are often only 15-25% utilized. Moving to a Lightbits clustered, centralized storage service yields vast improvements in capacity and performance utilization.

This means less money is spent on NVMe flash while providing a more operationally efficient environment. High availability features mean servers and applications remain available in light of drive failures and applications are not bound to specific server hardware.

### RICH DATA SERVICES

Lower TCO is not only achieved by improving capacity and performance utilization. Lightbits offers rich data services similar to legacy all-flash-storage but at NVMe performance. All Lightbits logical volumes are thin provisioned and when combined with compression support, Lightbits can achieve up to 4:1 data reduction.

### SNAPSHOTS AND CLONES: ENABLING DEVOPS AT THE SPEED OF NVMe

Lightbits introduced space-efficient snapshots and clones to greatly enhance data manageability. It supports up to 1,024 snapshots and/or clones on a single volume, and up to 64,000 snapshots and clones per cluster. Snapshot and clone volumes perform exactly like regular volumes, providing real-time responsiveness for enhanced management agility.

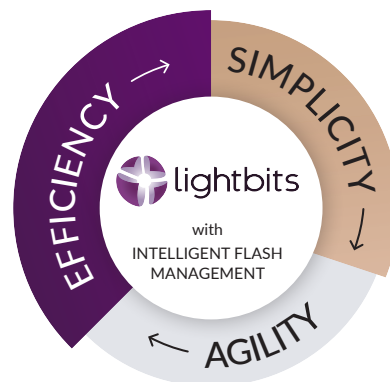
### COMMON USE CASES

**Virtualization Environments** – Manage virtual machine images and datastores in application environments like VMware and OpenStack. Easily replicate your virtual server images and assign them out to virtual machines – with no cumbersome and time/space consuming copying processes required.

**Database DevOps** – Simply clone your database with Lightbits, and utilize the clone to apply the necessary changes, then test and validate. Multi-terabyte databases can be cloned near instantaneously. Databases can be readily cloned for developers seeking a non-disruptive environment to apply and test and validate their changes with minimal storage capacity usage.

**Kubernetes Applications** – Lightbits supports snapshots and clones for persistent volumes via CSI plugin. If you're using a Kubernetes environment with containers and persistent volumes, Lightbits can provide all the aforementioned snapshot/clone functionality – with seamless support for microservices – at local NVMe flash-like performance.

### WHY LIGHTBITS?



Accelerate Databases  
Build Cloud Native Storage  
Manage Big Data Analytics  
Power Your Private Cloud

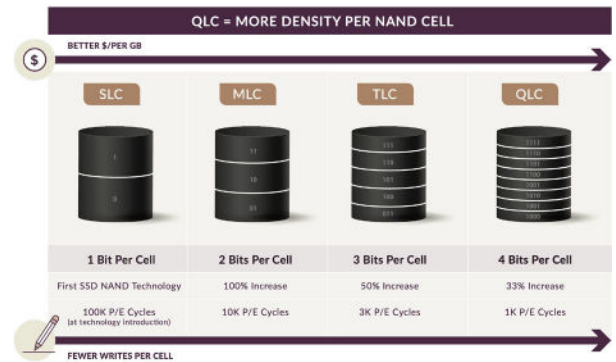


**4:1 TOTAL DATA  
REDUCTION**

## ENABLING QLC FLASH

QLC flash is inexpensive, but not suitable for use locally in application servers where the write pattern is unpredictable. Write performance of QLC flash is poor when compared to more expensive TLC and MLC devices. Lastly, unless write patterns are sequential and in large chunks, it's possible to wear out QLC media quickly. Thus, it's difficult to take advantage of the lower cost of QLC flash directly in application servers, especially in cloud environments.

Lightbits lowers cost by enabling the use of QLC flash in Lightbits targets. Lightbits ensures all writes are staged to the QLC media sequentially and in large chunks, extending the endurance of QLC by up to 20 times. By aggregating writes over multiple devices, Lightbits ensures high write performance with consistent response times. Thus, Lightbits enables the use of low-cost QLC media without compromising performance or flash endurance.

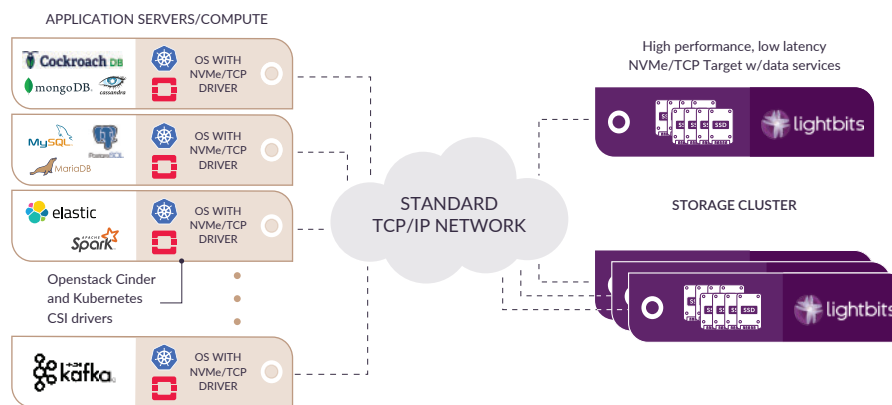


## FLEXIBILITY AND EASE OF DEPLOYMENT

The Lightbits solution is extremely flexible and well suited to integrate with your private cloud, service provider or modern enterprise data center environment. It can be deployed on your existing data center infrastructure without replacing any component of the data center infrastructure.

## STANDARD X86 SERVERS AND NVMe DRIVES

Lightbits provides the freedom to tailor storage server configurations to the unique needs of any environment. Servers can be configured with standard NVMe drives, Network Interface Cards (NICs) and in various form factors. Different Lightbits servers in the same cluster can have varying numbers and sizes of drives, and drives can be added on-the-fly when desired.



*Lightbits on standard servers showing various applications, software components and topology*

## STANDARDS BASED, "NO TOUCH NETWORKING" ON CLIENTS AND SWITCHES

Lightbits implements NVMe over Fabrics (NVMe-oF) utilizing the TCP protocol on Ethernet (NVMe/TCP). Other NVMe-oF solutions that require RDMA protocols (RoCE or iWarp) require special Ethernet NICs from a limited set of vendors and are more expensive than their non-RDMA counterparts. RoCE protocol also requires special network switch settings.

Lightbits NVMe/TCP not only utilizes the same network cards and infrastructure that might be used by protocols like iSCSI, but the application server block driver is also 100% standard and included in all major recent Linux distributions. Upgrades are easy as the required drivers are part of Linux distributions and in the upstream kernel. Network switches don't require any special settings. Lightbits is a target-side only solution that works with the networking hardware and practices already in place and understood in the data center.

## BARE METAL, CONTAINER AND VIRTUAL MACHINE ENVIRONMENTS SUPPORT

Lightbits meets Linux application service needs regardless of the type of deployment. Lightbits is a set of packages that are applied to popular Linux distributions including Red Hat Enterprise Linux and CentOS. For bare metal and image maintenance, Lightbits can be deployed with Ansible playbooks.

Virtualization environments such as Openstack and KVM/QEMU are supported via a Cinder driver. Kubernetes and other container orchestration environments are natively supported with Lightbits persistent storage via CSI.



kubernetes



CSI



openstack



vmware

For cloud (public or private), Openstack and Kubernetes environments, scalability is key and Lightbits meets those scalability challenges by supporting up to 64K client connections per target server and up to 64K logical volumes per cluster. Clients are free to connect to multiple clusters simultaneously, so scalability of capacity and performance is practically limitless.

## SCALABILITY

Lightbits offers unprecedented scalability with options to both scale up and/or scale out. Lightbits target servers need not be deployed with 100% of their drive bays filled. Lightbits Elastic RAID supports hot-plug addition of drives at any time without disruption and immediately adds capacity to that target server's NVMe pool.



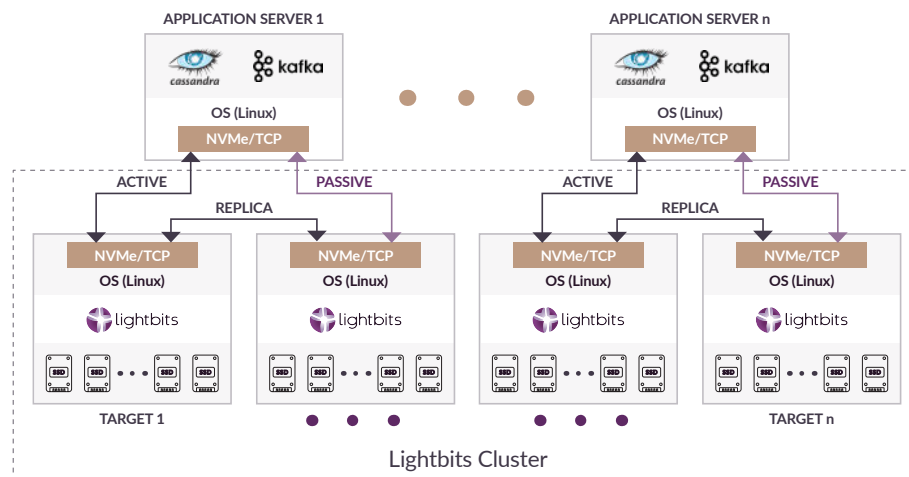
**SCALE TO 75 MILLION IOPS AND  
12 PETABYTES USABLE CAPACITY**

Scale-out is achieved by adding Lightbits target servers to an existing cluster, adding additional performance and capacity for new volumes.

Lightbits clusters can scale to an aggregate 75 million IOPS and as large as petabytes of usable capacity. These numbers are expected to increase over time. As software, Lightbits takes advantage of improvements in CPUs, NVMe drives and networking to constantly evolve to higher levels of performance and reduced latency.

## SELECTABLE HIGH AVAILABILITY ON STANDARD SERVERS

Lightbits is the world's first software-defined NVMe/TCP cloud data storage solution to offer full redundancy against both drive failures as well as storage target server failures. This is achieved via Asymmetric Namespace Access (ANA), more commonly multi-pathing, or multi-path I/O. With Lightbits volumes set to 2x or 3x replication, an application server utilizing the NVMe/TCP driver is aware of multiple network paths to a logical volume (namespace) identifier. One path will be the active (optimized) path and the additional 1 or 2 other paths will be passive (non-optimized).



Network link/path failover can also be facilitated (if desired) with port bonding methods (such as LACP) with Lightbits.

For drives, Lightbits utilizes Elastic RAID within each target server to protect against drive failures. This adaptable erasure coding algorithm adjusts and rebalances in response to drives failing (or being removed) and drives being added.

These features working in unison result in a fully redundant storage solution at extremely high availability levels all built on standard components and servers. No special "dual path" drives, nor special chassis are required to build a highly available, high performance and scalable block storage solution with Lightbits.

## DEPLOYING LIGHTBITS

Lightbits is available as software only or as a preconfigured storage target (SuperSSD).

## SOFTWARE-DEFINED STORAGE

Lightbits as software is licensed per storage server on an annual or 3-year subscription basis. It runs on x86 servers and utilizes standard Ethernet cards and NVMe drives. Target servers, in general, should use 100Gbps Ethernet interfaces. Lightbits Labs can provide reference platform guides and/or consulting on the right server configuration tailored to workload requirements.



**SELECT THE X86 SERVER  
PLATFORM HARDWARE  
AND NVMe DRIVES FROM  
A VENDOR OF CHOICE**

## DEPLOYMENT READY APPLIANCES

For those that value convenience in a heavily tested and optimized platform, Lightbits is available as a SuperSSD appliance. This 2U, 24 drive platform comes in various pre-configured capacities with software and hardware support. This is the fastest and easiest way to get Lightbits deployed and is backed by world-wide warranty and support services.



**SUPERSSD™ MAKES DEPLOYMENT EASY WITH PRE CONFIGURED HARDWARE AND SOFTWARE WITH A CHOICE OF CAPACITIES AND FULL HARDWARE AND SOFTWARE SUPPORT**

## KEY FEATURES

### No Special Client Software Required

- Supports any standard Linux and VMware clients
- NVMeoF 1.1 multipathing (ANA)
- Clients can be connected to multiple storage clusters enabling effectively unlimited capacity

### Clustered/Failover Storage Solution

- Up to 16 storage servers per cluster
- Up to 64K volumes per cluster
- Up to 64K clients per cluster
- Automatic online server Add/Remove
- Distributed and durable cluster management with fast failover handling (2-3 seconds average)
- No single point of failure in Data and Control paths
- Single server deployment (without replication) or clustered deployment from 3-16 servers
- Automatic volume placement to balance capacity and IOPs
- Dynamic data rebalancing
- Per-volume ACLs and IP-ACLs
- Replicas are stored in different failure domains

### Max IOPS per Target Server

- Up to 4.7M IOPS 4K Random Read
- Up to 2.3M IOPS 4K Random Write with single replica
- Up to 767K IOPS 4K Random Write with 2 replicas

### Latency with 2x Replication

- 160µs average 4K Random Read @ 1.27M IOPs per server
- 493µs average 4K Random Write @ 433K IOPs per server

### Max Bandwidth per Target Server

- 21.6GB/s reads
- 9GB/s writes with single replica
- 4.3GB/s writes with 2 replicas

### Maximum Effective Capacity per Server

- 786TB (single replica)
- 393TB (dual replica)

### Enterprise Data Services

- NIC bonding support
- Thin provisioning
- Logical volumes with online resize
- Inline compression/decompression configurable per volume
- Redirect-on-write space/time efficient snapshots and clones
- Thin clones
- Elastic RAID (per target) for protection against SSD failures
- Automatic rebuild
- User-defined failure domains
- Volume replication (1x, 2x or 3x) configurable per volume
- DELTA log recovery (partial rebuild)
- Online, non-disruptive drive additions for scale-up
- Highly available discovery/API service
- Quality of Service Volume Bandwidth Capping
- Multi-tenancy
- Rolling cluster upgrades

### Node Management

- Replication and failover handling
- Rebuild after permanent failure
- Rapid partial rebuild after transient failures for unlimited time
- Network failure handling using NVMe/TCP multipath
- Non-disruptive (for 2x and 3x replicated volumes) cluster upgrades

### Application Environment Support

- VMware ESXi with vCenter plugin
- Kubernetes via CSI
- Openstack Cinder with upstream plugin support
- Bare Metal Linux
- Ansible playbooks for various Linux distributions
- RBAC multi-tenancy support

### Management

- RESTful API provides a standard HTTPS-based interface
- CLI support for scripts and monitoring
- Metrics and Alerts based on Prometheus
- Pre-configured Grafana dashboards

## WHY LIGHTBITS?

Lightbits represents a revolution in high performance, scale-out block storage. The need for special fabrics and/or network protocols to achieve low latency, high IOPs and high bandwidth is a thing of the past. With Lightbits, you can use ubiquitous TCP/IP on Ethernet and achieve higher performance levels than all-flash-arrays while paying a fraction of the cost of those same arrays. Moreover, data services don't have to be sacrificed as Lightbits provides rich data services commonly associated with legacy storage solutions.

Efficiency. Agility. Simplicity. Let Lightbits show you the way.

## FIND OUT MORE

To learn more, please visit our website, [www.lightbitlabs.com](http://www.lightbitlabs.com)

To contact our team, email us at [info@lightbitlabs.com](mailto:info@lightbitlabs.com)