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Longhorn: Introduction and Deep Dive

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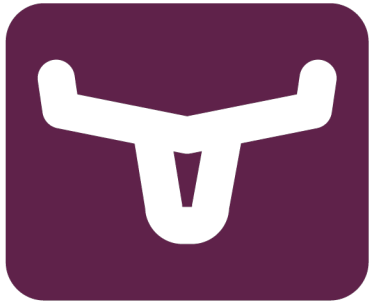


LONGHORN

One click to add persistent storage support to any Kubernetes cluster

Open Source
Distributed Storage Software for Kubernetes
https://longhorn.io/

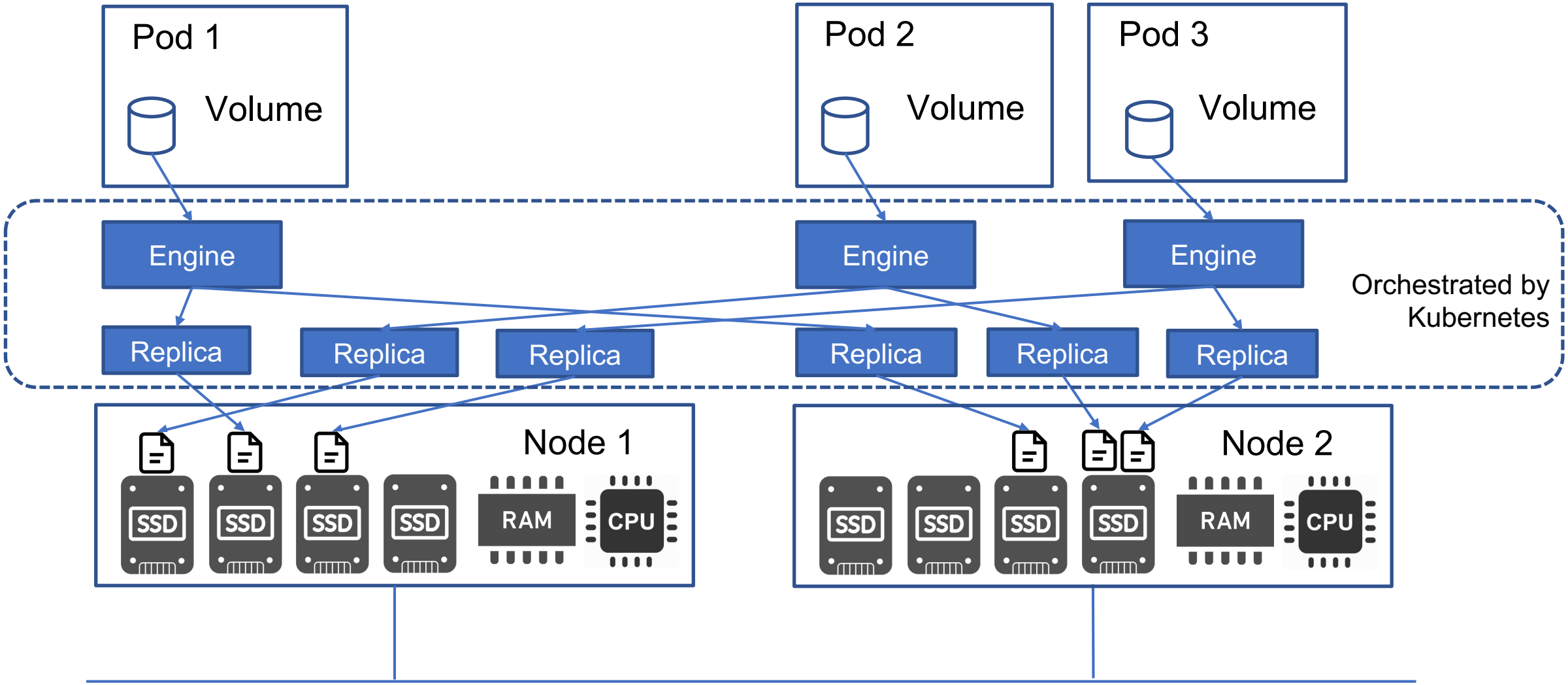
Design Principles

- Reliability
  - Crash consistent
  - Multiple layers of protection against data loss, including built-in snapshot and backup support
- Usability
  - One click installation
  - Polished user experience
- Maintainability
  - Easy to understand
  - Easy to recover even in the worst-case scenario
  - Upgrade without interrupting the workload

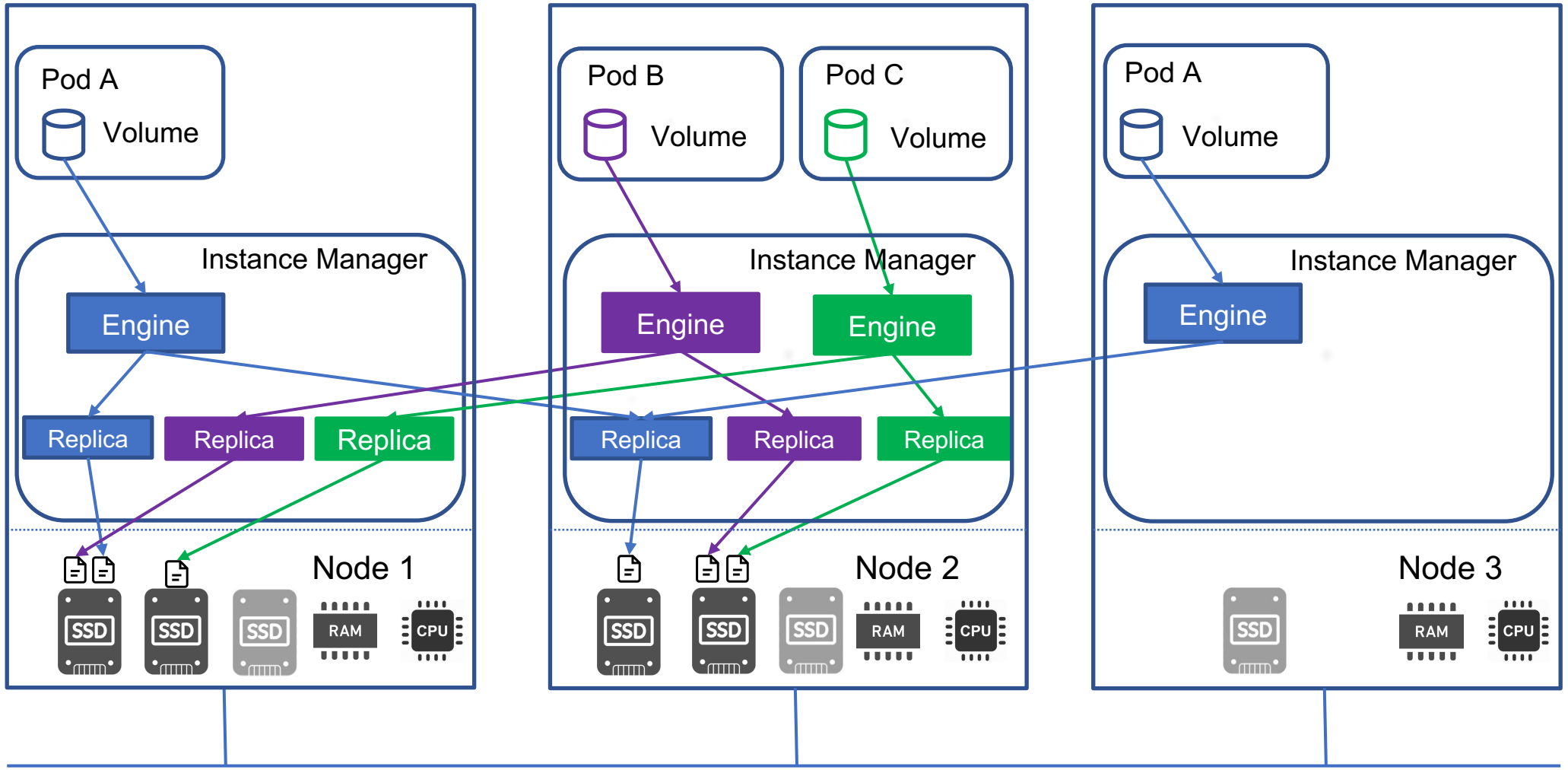
Latest Feature Release: v1.5 (July 2023)

- Enterprise-grade distributed storage software for Kubernetes
- One click to install and run
  - Support x86_64, ARM64, and S390x
- Volume
  - Thin-provisioning
  - Snapshots with schedule
  - Expansion & Clone
  - End to end encryption
  - Cross-availability-zone scheduling
  - Bit rot detection
  - TRIM
  - RWX
  - Data locality
- Disaster Recovery
  - Backup and restore with schedule
  - Cross-cluster disaster recovery volume with defined RTO and RPO
- Operation
  - Intuitive UI
  - Live upgrade of Longhorn software without impacting running volumes
  - Prometheus support
  - Storage Tag for node and disk selection
- Kubernetes
  - CSI
  - CSI Snapshotter
  - Automatic recovery for Kubernetes managed workload
- **Preview: Longhorn Engine v2 based on SPDK**

Architecture - Engine

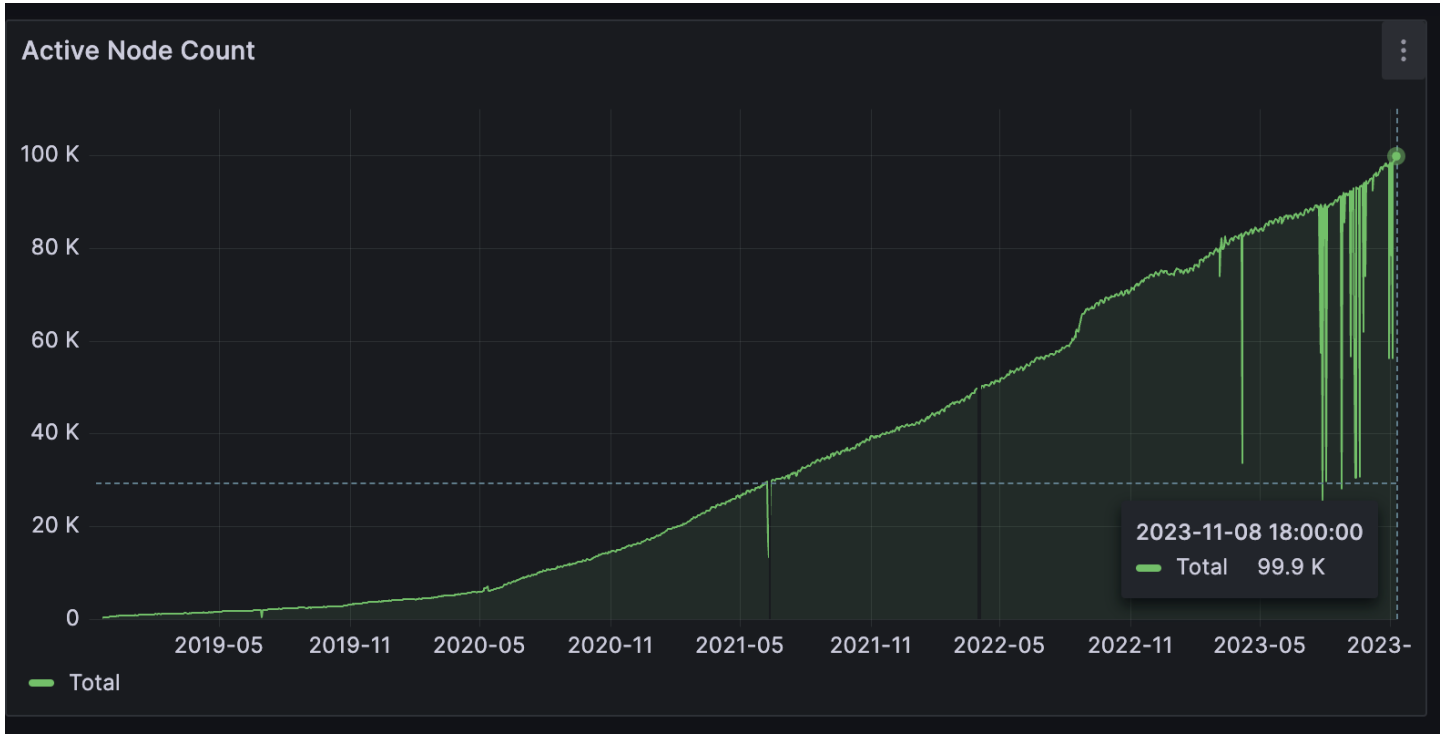


Architecture – Engine Details



Community Update

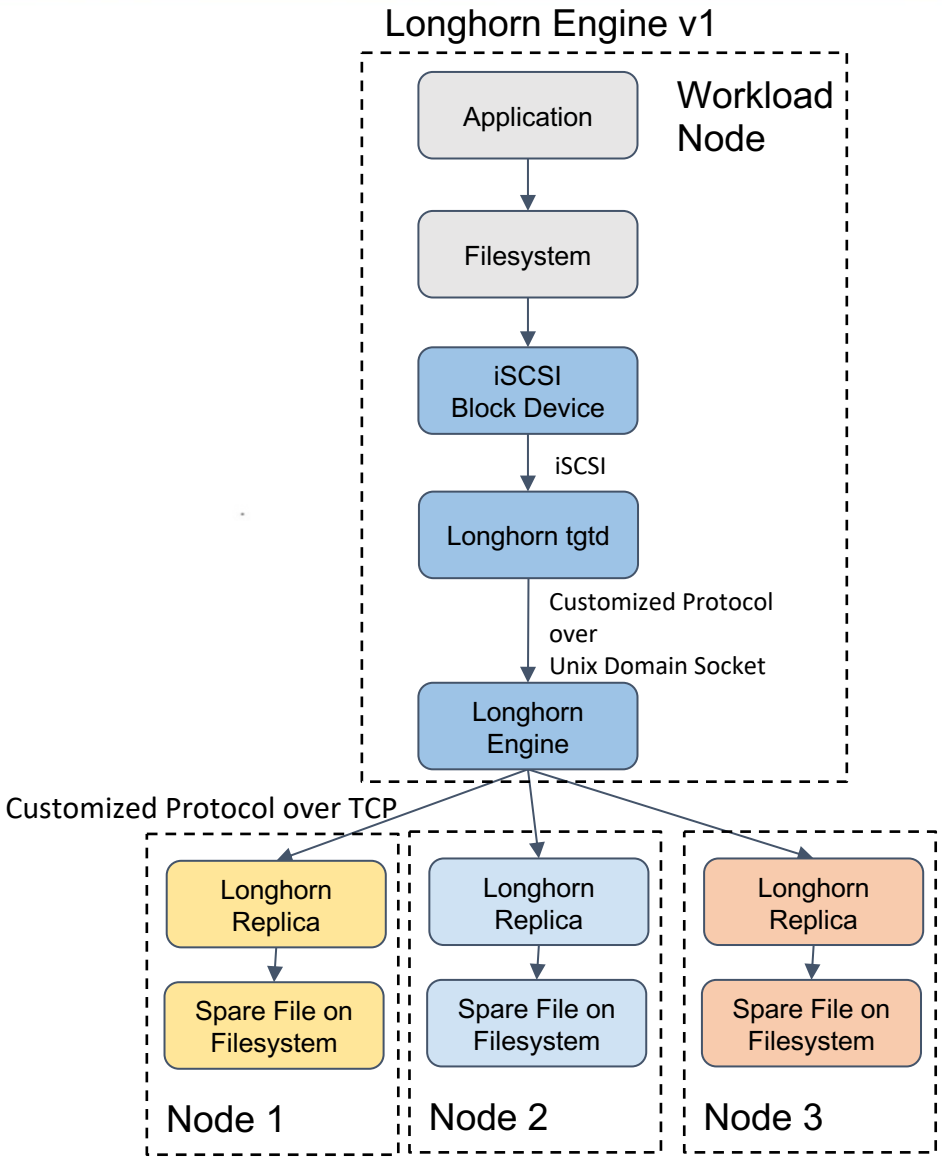
- 99,900+ worldwide live node count reached and counting!
  - 50%+ growth year over year
  - Adoption metrics available at https://metrics.longhorn.io/
- 3,000+ users in the Slack channels
- GitHub star: 5.1k

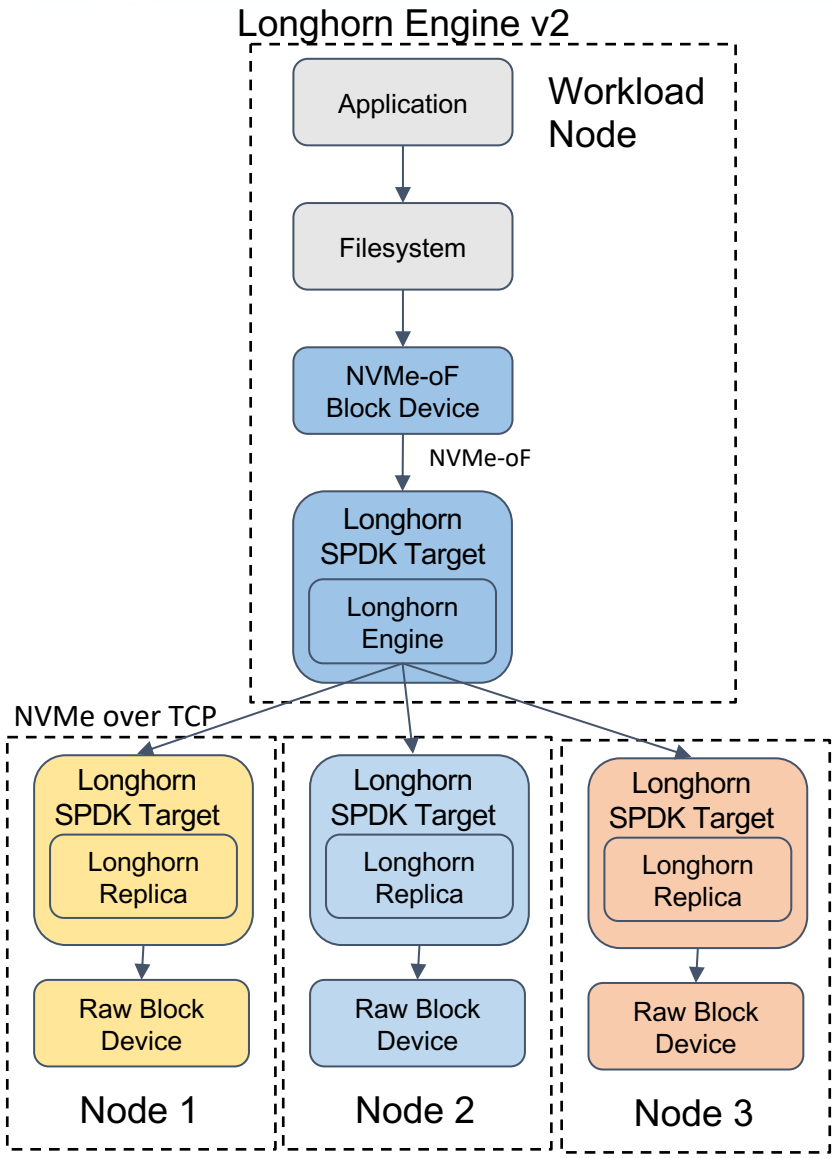


Upcoming Longhorn v1.6.0

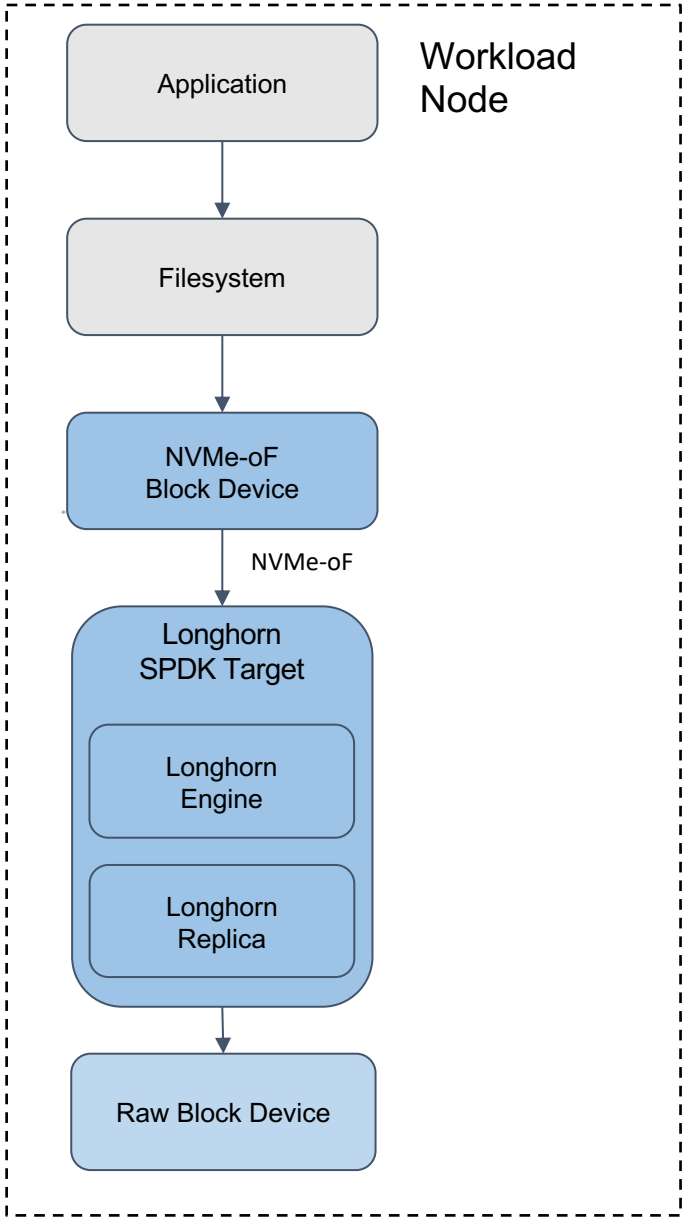
- Longhorn Engine v2 (Experimental)
  - Based on SPDK and NVMe-oF
  - Achieved near-native performance
  - Core feature parity
- Object Storage Volume (Experimental)
- See https://github.com/longhorn/longhorn/wiki/Roadmap for the latest roadmap

Longhorn Engine v1 vs v2



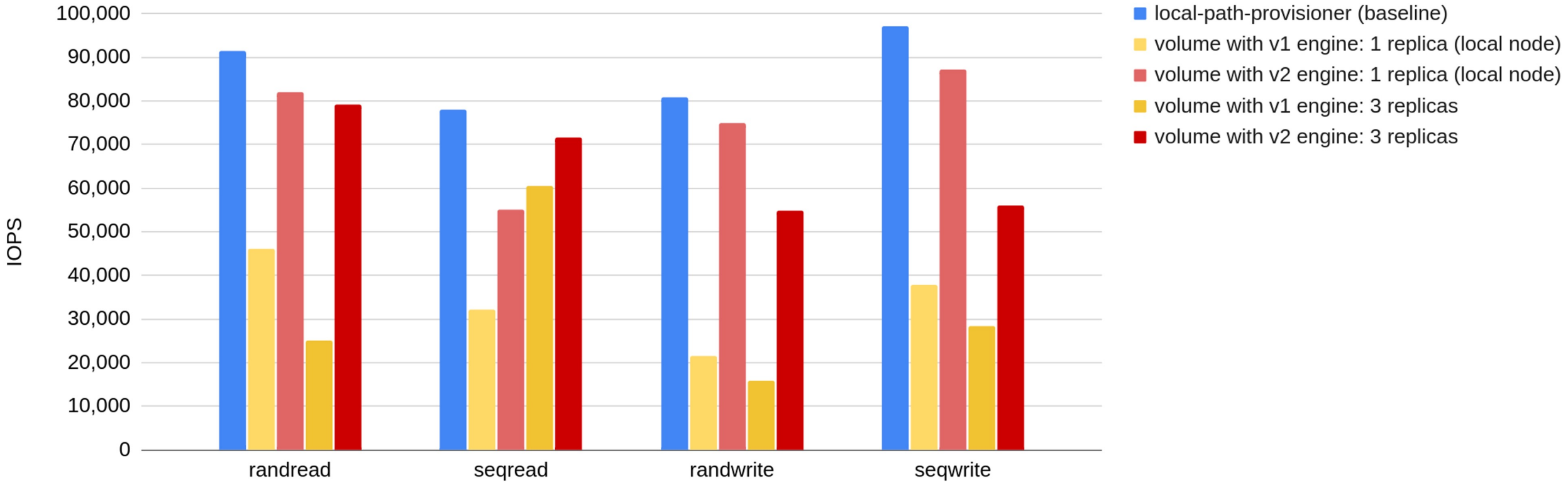


Longhorn Engine v2 – Local Replica



- Near-native performance
- Same features for volume management
  - Snapshot
  - Backup
  - Expansion
  - And more…
- Best for distributed stateful workload
  - Doesn’t require HA from Longhorn
  - Distributed database
  - Distributed data store

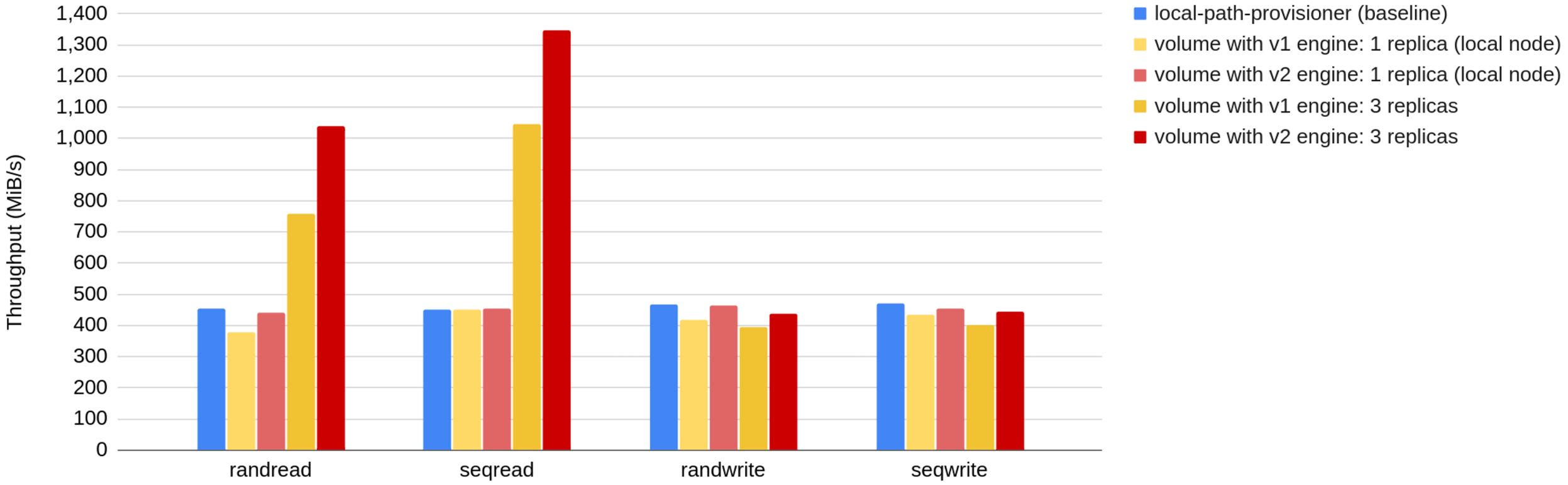
Longhorn Engine v2 - IOPS



- Near native performance for single local replica
- Near native performance for read IOPS

* From https://longhorn.io/docs/1.5.2/spdk/performance-benchmark/

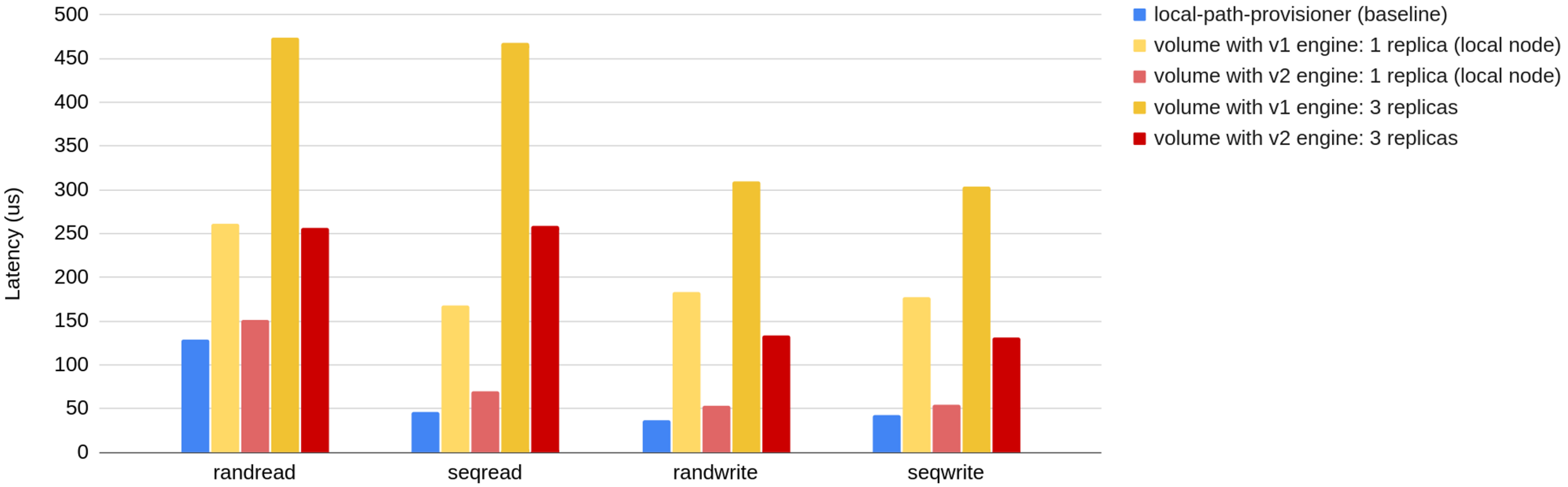
Longhorn Engine v2 – Throughput



- Reaching the maximum possible read throughput via multiple replicas

* From https://longhorn.io/docs/1.5.2/spdk/performance-benchmark/

Longhorn Engine v2 – Latency



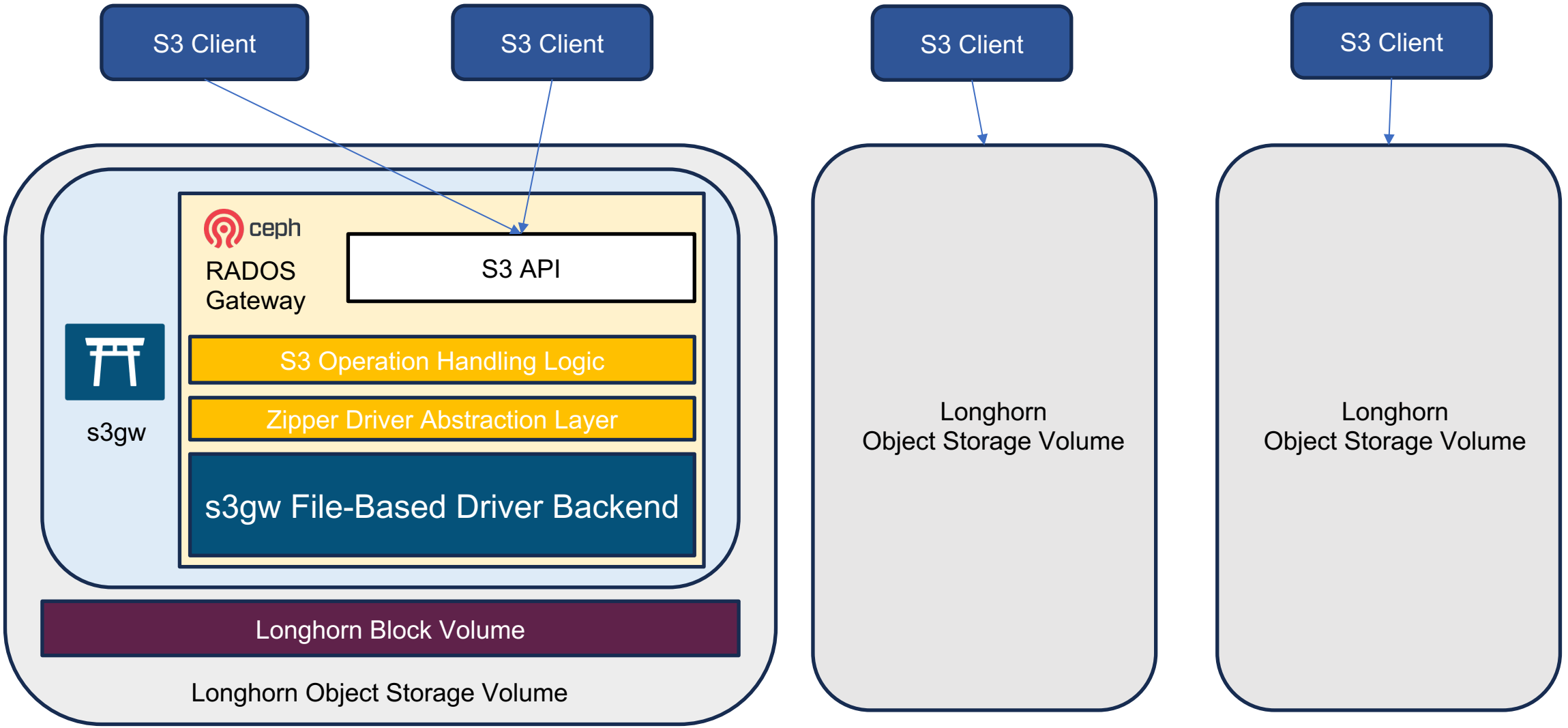
- Single node latency overhead is less than 30 microsecond

* From https://longhorn.io/docs/1.5.2/spdk/performance-benchmark/

Object Storage Volume

- Providing S3 endpoint out of box
- Based on S3 Gateway project
  - Which is based on RADOS gateway from Ceph
- Longhorn v1.6 supports features including
  - GET/PUT/DELETE
  - Multipart Uploads
  - Bucket Object Versioning
  - Object Locking
  - And more to come

Object Storage Volume (cont.)



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