# Agenda

- Overview of the TAG, how to join and how to help
- Overview of storage projects in the CNCF
- Projects that are currently being being reviewed
- Overview of the CNCF Storage Landscape document
- Overview of the Performance and Benchmarking document
- Overview of the DR document

# Meetings

CNCF SIGs were renamed TAGs (Technical Advisory Groups)

Meetings are on the 2nd and 4th Wednesday of every month at 8AM PT (USA Pacific)

- **Home: https://github.com/cncf/tag-storage**
- **Conf call: http://bit.ly/cncf-storage-tag-call**
- **Agenda: http://bit.ly/cncf-storage-tag-minutes**
- **Recordings: http://bit.ly/cncf-storage-tag-recordings**
- **Mail list: https://lists.cncf.io/g/cncf-tag-storage**

*Our calls and membership are open!*

**TAG Storage**

# Who are we

- We are a diverse set of users & developers of Cloud Native technologies with a storage focus
- We are leaders & early adopters
- We are organized as:

| Co-Chairs | Tech Leads | TOC Liaisons |
|---|---|---|
| ■Alex Chircop<br>■Quinton Hoole<br>■Xing Yang | ■Raffaele Spazzoli<br>■Luis Pabón<br>■Sheng Yang<br>■Nick Connolly | ■Saad Ali<br>■Erin Boyd |

**"Scale contributions by the CNCF technical and user community, while retaining integrity and increasing quality in support of the CNCF <u>mission</u> (to make cloud native computing ubiquitous)."**

*...this means we*

- ○ Educate
- ○ Review Storage Project Proposals
- ○ Engage with the user community
- ○ Work directly with the TOC & other TAGs as subject matter experts

# Education

## End User Education

- Provide up-to-date, high quality, unbiased and easy-to-consume material to help end users to understand and effectively adopt cloud-native technologies and practises within the TAG's area, for example:
  - White papers, presentations, videos, or other forms of training clarifying terminology, comparisons of different approaches, available projects or products, common or recommended practices, trends, illustrative successes and failures, etc.
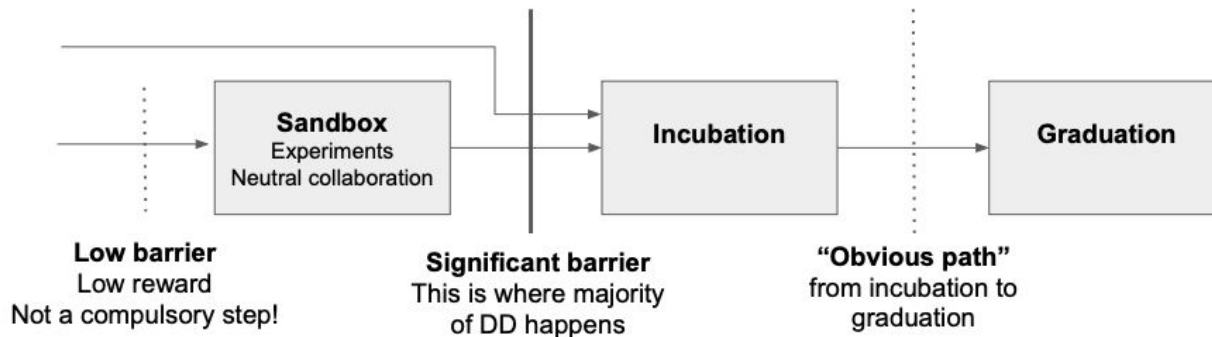
    CNCF Storage White Paper (https://bit.ly/cncf-storage-whitepaperV2)

    CNCF TAG Storage Performance & Benchmarking Whitepaper (https://bit.ly/cncf-tag-storage-performance-benchmarking)

  - As far as possible, information should be based on research and fact gathering
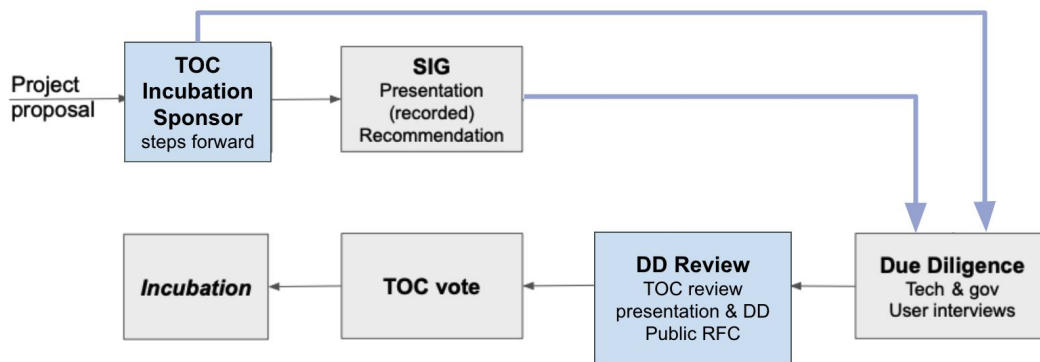
# Project Stages

https://www.cncf.io/projects/



**Sandbox**
Experiments
Neutral collaboration

**Incubation**

**Graduation**

**Low barrier**
Low reward
Not a compulsory step!

**Significant barrier**
This is where majority
of DD happens

**"Obvious path"**
from incubation to
graduation

| Sandbox | Incubation | Graduation |
|---|---|---|
| ■Experiments<br>■IP Policy<br>■Build Community | ■Used successfully in production<br>■Healthy number of committers<br>■Project metrics | ■Mainstream production use<br>■Security audits<br>■Committers from multiple organisations |

# Project Review

- Understand and **document** a high level roadmap of projects within this space, including CNCF and non-CNCF projects.
- For projects that fall within the CNCF, perform **health checks**.
- Perform **discovery** of and **outreach** to candidate projects.
- **Help candidate projects** prepare for presentation to the TOC.
- Every CNCF project will be assigned to one suitable TAG by the TOC.

# Engage

## End User Input Gathering

- Gather useful end user input and feedback regarding expectations, pain points, primary use cases, etc.
- Compile this into easily consumable reports and/or presentations to assist projects with feature design, prioritization, UX, etc.

## Community Enablement

- TAGs are open organizations with meetings, meeting agendas and notes, mailing lists, and other communications in the open.
- The mailing list, TAG meeting calendar, and other communication documents of the TAG will be openly published and maintained.

# TOC

## Trusted Expert Advisors to the TOC

- Perform **technical due diligence** on new and graduating projects, and advise TOC on findings.
- Be involved with, or **periodically check** in with projects in their areas, and advise TOC on health, status and proposed actions (if any) as necessary or on request.

- Note: in all cases, the TOC make the final decisions
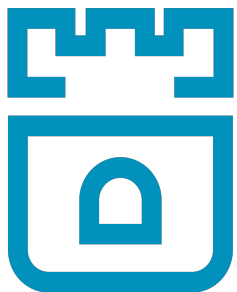
# CNCF Storage Projects

**Graduated**

**Incubating**

ROOK

Vitess

HARBOR

Dragonfly

etcd

TiKV

**CNCF Projects: https://www.cncf.io/projects/**

**Sandbox Projects: https://www.cncf.io/sandbox-projects/**

# Current Projects in Review

- **Sandbox → Incubation**
  - Longhorn
    - https://github.com/longhorn/longhorn
  - ChubaoFS
    - https://github.com/chubaofs/chubaofs
  - OpenEBS
    - https://github.com/openebs/openebs

# Storage projects listed in TAG repo

- **https://github.com/cncf/tag-storage**

## Current CNCF Storage Projects

### Graduated Projects

- etcd
- Rook
- TiKV
- Vitess

### Incubating Projects

- Dragonfly

### Sandbox Projects

- ChubaoFS
- Longhorn
- OpenEBS
- Pravega
- Piraeus
- Vineyard

# CNCF Storage Whitepaper

- **Whitepaper: [https://bit.ly/cncf-storage-whitepaperV2](https://bit.ly/cncf-storage-whitepaperV2)**

- **Definition of the attributes of a storage system**

- **Definition of the layers in a storage solution with a focus on terminology and how they impact the attributes**

- **Definition of the data access interfaces in terms of volumes and application APIs**

- **Definition of the management interfaces**

# Storage Attributes

| Availability | Scalability | Performance | Consistency | Durability |
|---|---|---|---|---|
| ·Failover | ·Clients | ·Latency | ·Delay to access correct data after a commit | ·Data protection |
| ·Moving access between nodes | ·Operations | ·Operations | | ·Redundancy |
| ·Redundancy | ·Throughput | ·Throughput | ·Delay between commit and data being committed to non-volatile store | ·Bit-Rot |
| ·Data Protection | ·Components | | | |

# Storage Layers

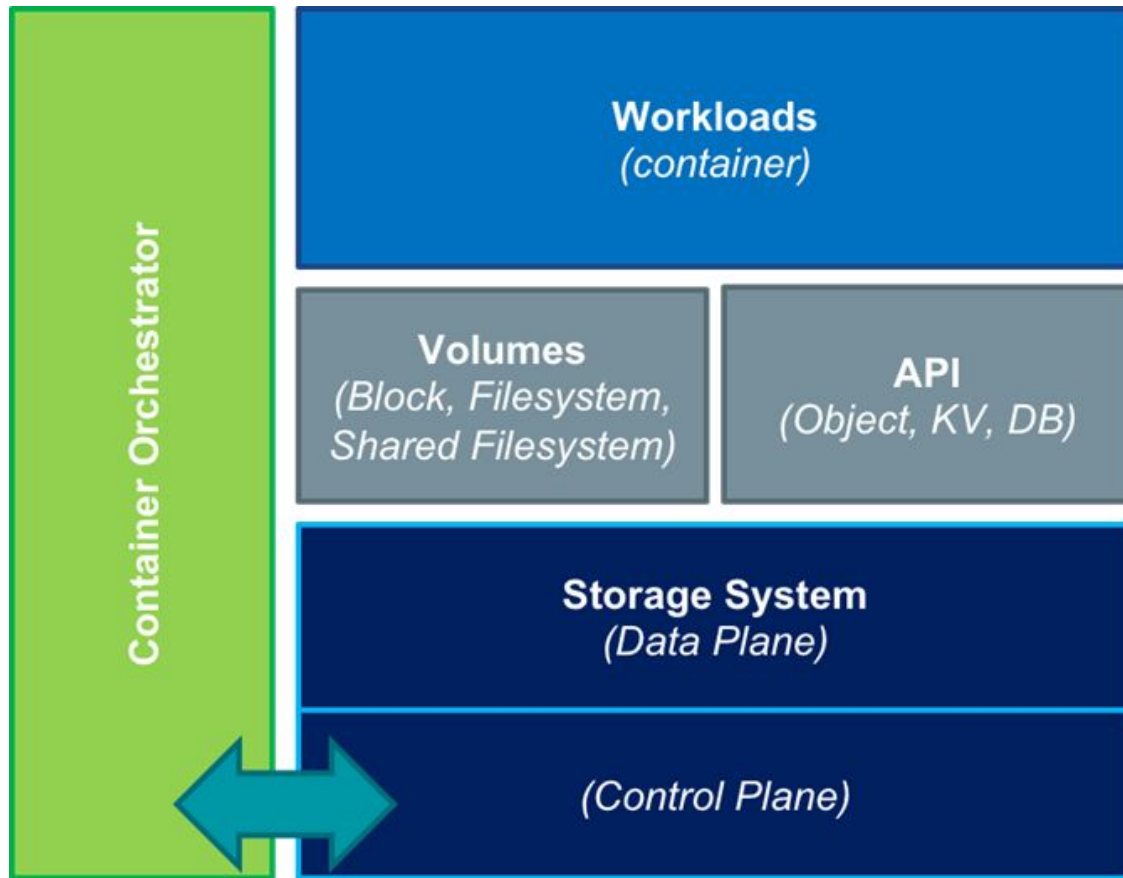| Orchestrator, Host and Operating System |
| :---: |
| **Storage Topology**<br>(centralized, distributed, sharded, hyperconverged) |
| **Data Protection**<br>(RAID, Erasure coding, Replicas) |
| **Data Services**<br>(Replication, Snapshots, Clones, etc.) |
| **Physical, Non-Volatile Layer** |

# Data Access Interfaces

**Workloads**
*(container)*

**Volumes**
*(Block, Filesystem, Shared Filesystem)*

**API**
*(Object, KV, DB)*

**Storage System**
*(Data Plane)*

*(Control Plane)*

**Container Orchestrator**

Storage can be accessed via **Data Access Interfaces**:

- **Volumes** – accessed through a more traditional file interface in a **block** or **filesystem** interface

- **API** – other ways to persist data such as **object stores**, **KV stores** or **databases**
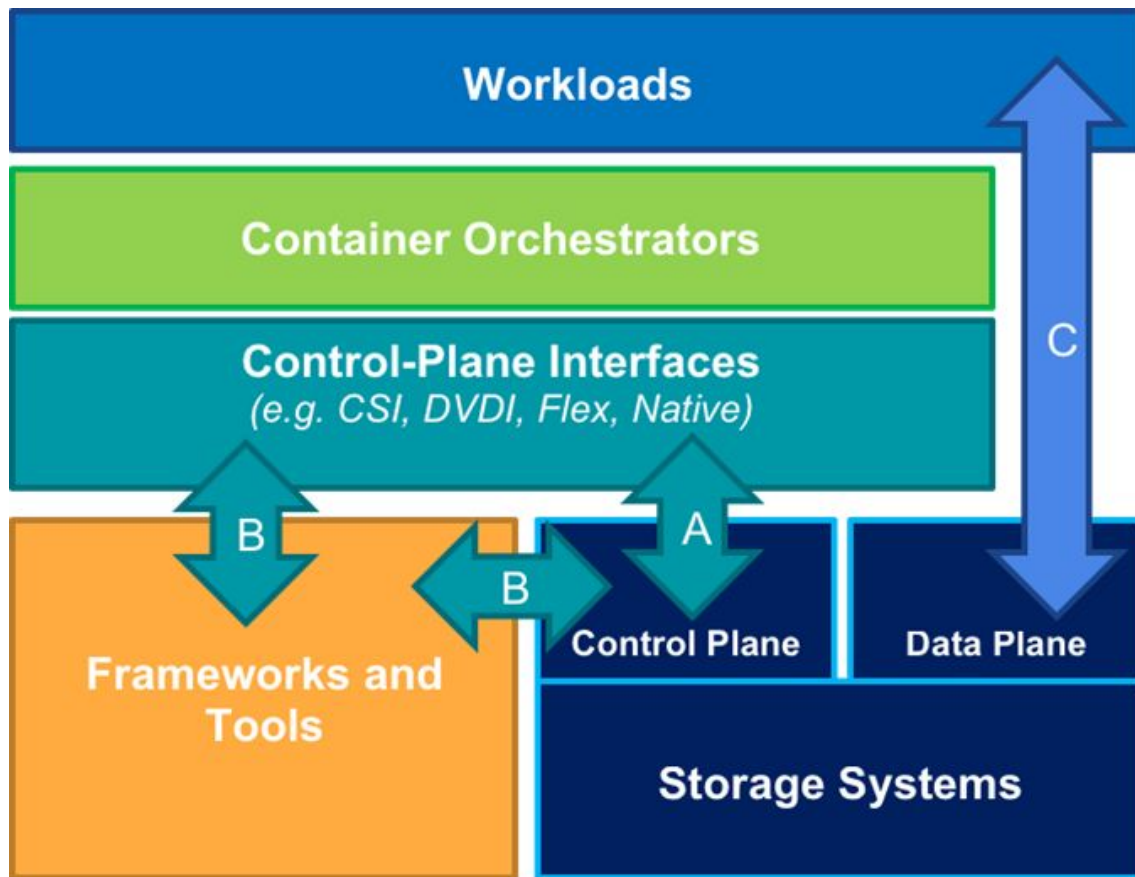
# Management Interfaces

**Container Orchestration** system (**CO**) uses an interface to interact with a storage system

The storage system can:
**(A)** support control-plane API directly
**(B)** interact via an API Framework layer or other Tools

Workloads consume **(C)** storage via a data access interface

# Performance Whitepaper

- **Whitepaper: https://bit.ly/cncf-tag-storage-performance-benchmarking**

- **Definition of common concepts for measuring performance and benchmarking for volumes and databases**

- **Definition of common pitfalls and considerations**
  - **Basics: operations vs throughput**
  - **Topology, Data Protection, Data Reduction, Encryption**
  - **Latency**
  - **Concurrency: queue depths, multiple clients and backends**
  - **Caching at multiple layers**
  - **Managing the environment, Cloud, and Client headroom**

# Performance Whitepaper

- **Whitepaper:
  https://bit.ly/cncf-tag-storage-performance-benchmarking**

- **Important takeaway: published results are not useful for making comparisons - it is hard to compare published results without a deep understanding of the test conditions, so it is always important to run your own test, on your own environment with your own applications**

# Cloud Native Disaster Recovery

- **Whitepaper: http://bit.ly/cncf-cloud-native-DR**

| Concern | Traditional DR | Cloud Native DR |
|---|---|---|
| Type of deployment | active/passive, rarely active/active | Active / active |
| Disaster Detection and Recovery Trigger | Human | Autonomous |
| Disaster Recovery Procedure execution | Mix of manual and automated tasks | Automated |
| Recovery Time Objective (RTO) | From close to zero to hours | Close to zero |
| Recovery Point Objective (RPO) | From zero to hours | Exactly zero for strongly consistent deployments. Theoretically unbounded, practically close to zero for eventual consistent deployments. |
| DR Process Owner | Often the Storage Team | Application Team |
| Capabilities needed for DR | From storage (backup/restore, volume replication) | From networking (east-west communication, global load balancer) |

# CNDR Whitepaper content

- Cloud Native Disaster Recovery (CNDR) definition
- Definitions: Failure Domain, HA, DR
- CAP theorem: Consistency, Availability, Network Partitioning
- Anatomy of Distributed Stateful workloads: Replicas, Shards, API Layer, Storage Layer
- Consensus Protocols: Paxos, Raft, 2PC, 3PC
- CNDR Reference Architectures:
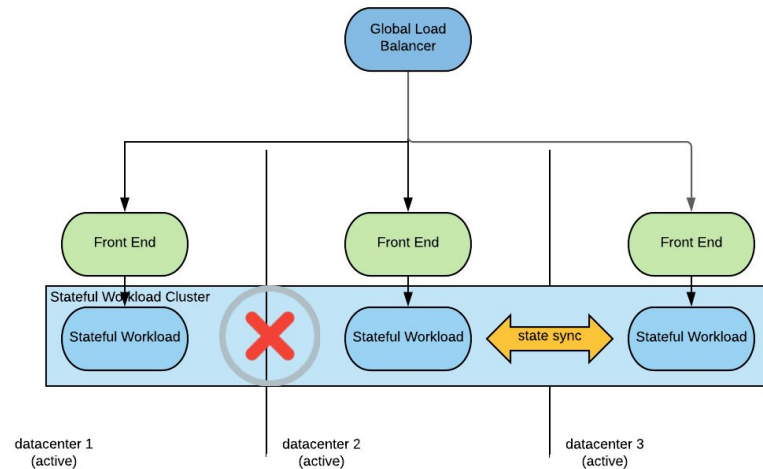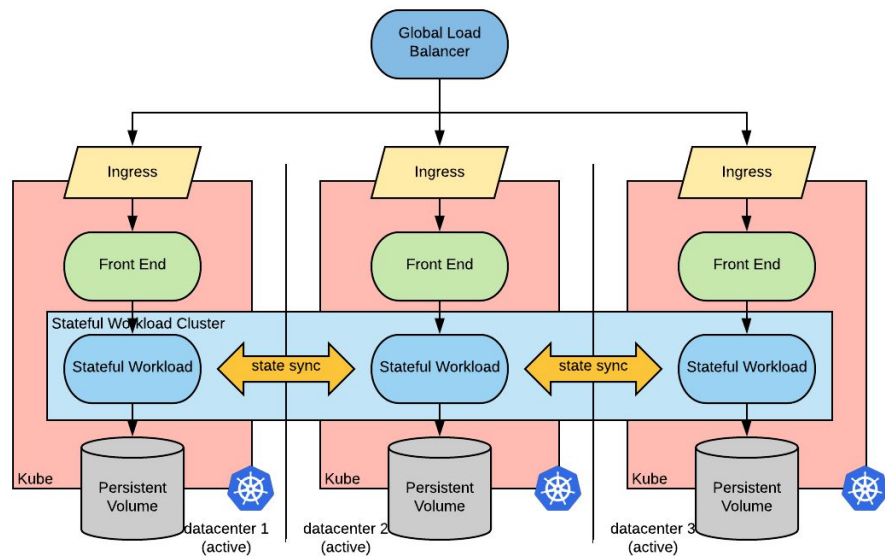  - Strong Consistency
  - Eventual Consistency
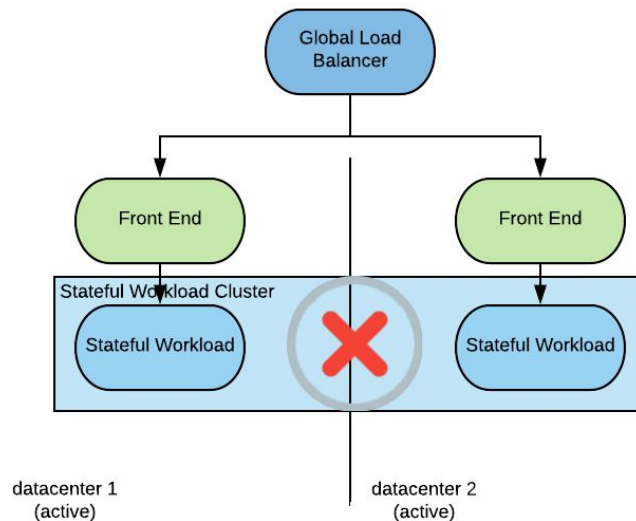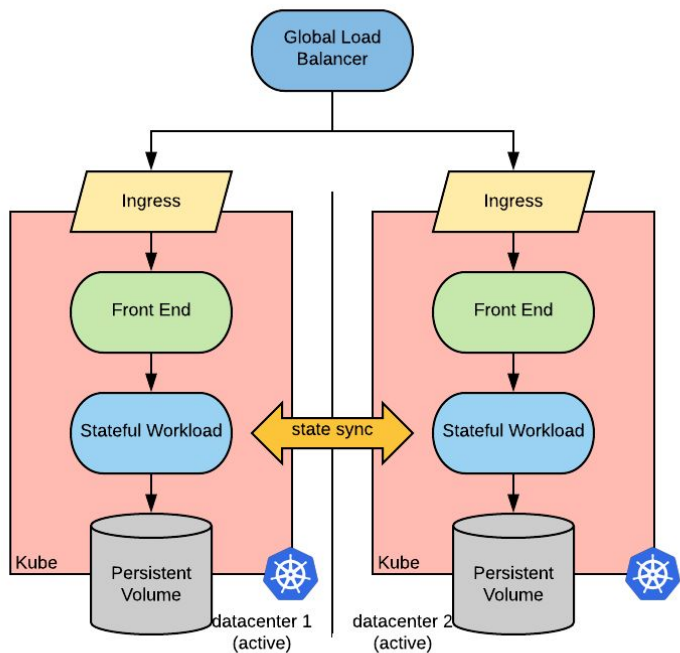
# Examples of Consensus Protocol choices

| Product | Replica consensus protocol | Shard consensus protocol |
|---|---|---|
| Etcd | Raft | N/A (no support for shards) |
| Consul | Raft | N/A (no support for shards) |
| Zookeeper | Atomic Broadcast (a derivative of Paxos) | N/A (no support for shards) |
| ElasticSearch | Paxos | N/A (No support for transactions) |
| Cassandra | Paxos | Supported, but details are not available. |
| MongoDB | Paxos | Homegrown protocol. |
| CockroachDB | Raft | 2PC |
| YugabyteDB | Raft | 2PC |
| TiKV | Raft | Percolator |
| Spanner | Raft | 2PC+high-precision time service |
| Kafka | A custom derivative of PacificA | Custom Implementation of 2PC |

# Community

- How you can get involved?
  - Join our meeting
    - 2nd & 4th Wednesday each month
  - Submit and help review projects for consideration
    - https://github.com/cncf/toc/tree/master/process

- We value community presentations of projects in the cloud native storage space including, but not limited to: *management frameworks, block stores, filesystems, object stores, key-value stores and databases*

- Several projects have presented to the TAG such as: CSI, Rook, REX-Ray, TiKV, Dotmesh, Yugabyte, OpenEBS, Open Services Broker, Vitess, Minio, OpenSDS, Redfish/Swordfish, ChubaoFS, Longhorn, Dragonfly, Harbor, Pravega, Piraeus, Dataset Lifecycle Framework, Linstor, Vineyard

Join us