

Samba and Ceph

Release the Kraken!

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Agenda

- Ceph Overview
- State of Samba Integration
 - Performance
- Outlook



Ceph

- Distributed storage system
 - Scalable
 - Fault tolerant
 - Performant
 - Self-healing and self-managing
 - Runs on commodity hardware
 - Mature
- Various client access mechanisms
 - All layered atop a Reliable Autonomic Distributed Object Store (RADOS)



Ceph Architecture

OBJECT



RGW

A web services gateway for object storage, compatible with S3 and Swift

BLOCK



RBD

A reliable, fully-distributed block device with cloud platform integration

FILE



CEPHFS

A distributed file system with POSIX semantics and scale-out metadata management

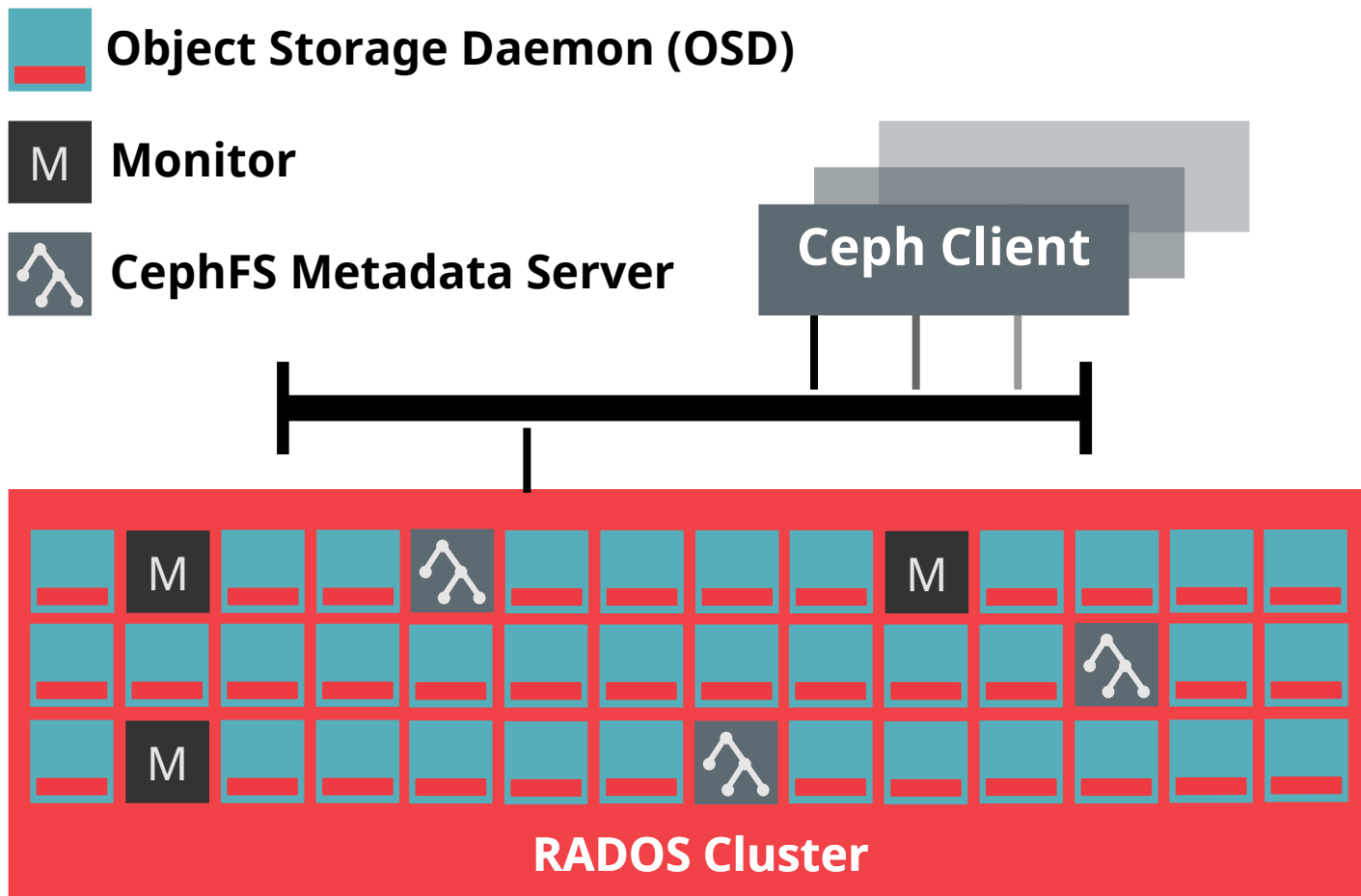
LIBRADOS

A library allowing apps to directly access RADOS (C, C++, Java, Python, Ruby, PHP)

RADOS

A software-based, reliable, autonomous, distributed object store comprised of self-healing, self-managing, intelligent storage nodes and lightweight monitors



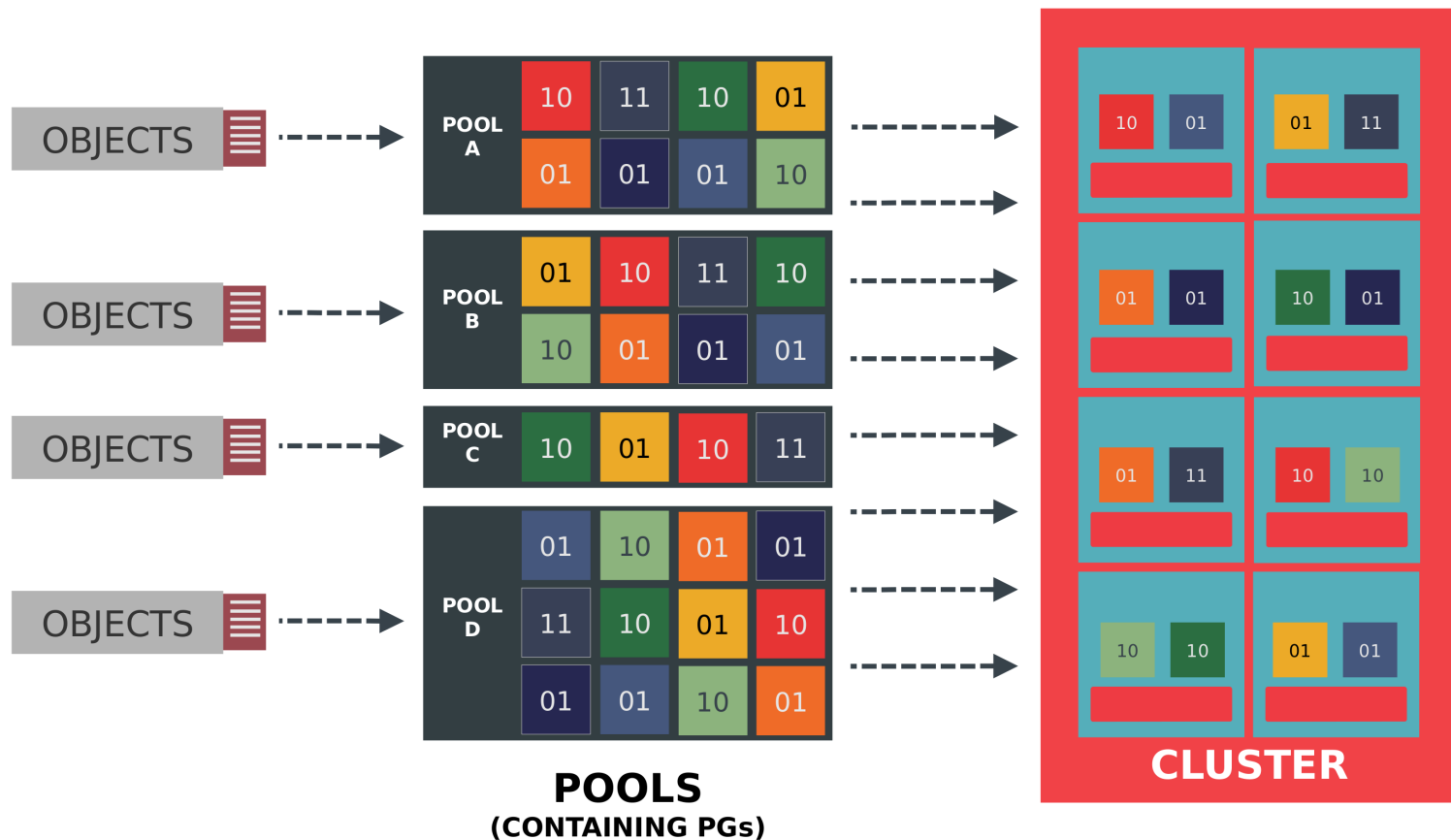


Components

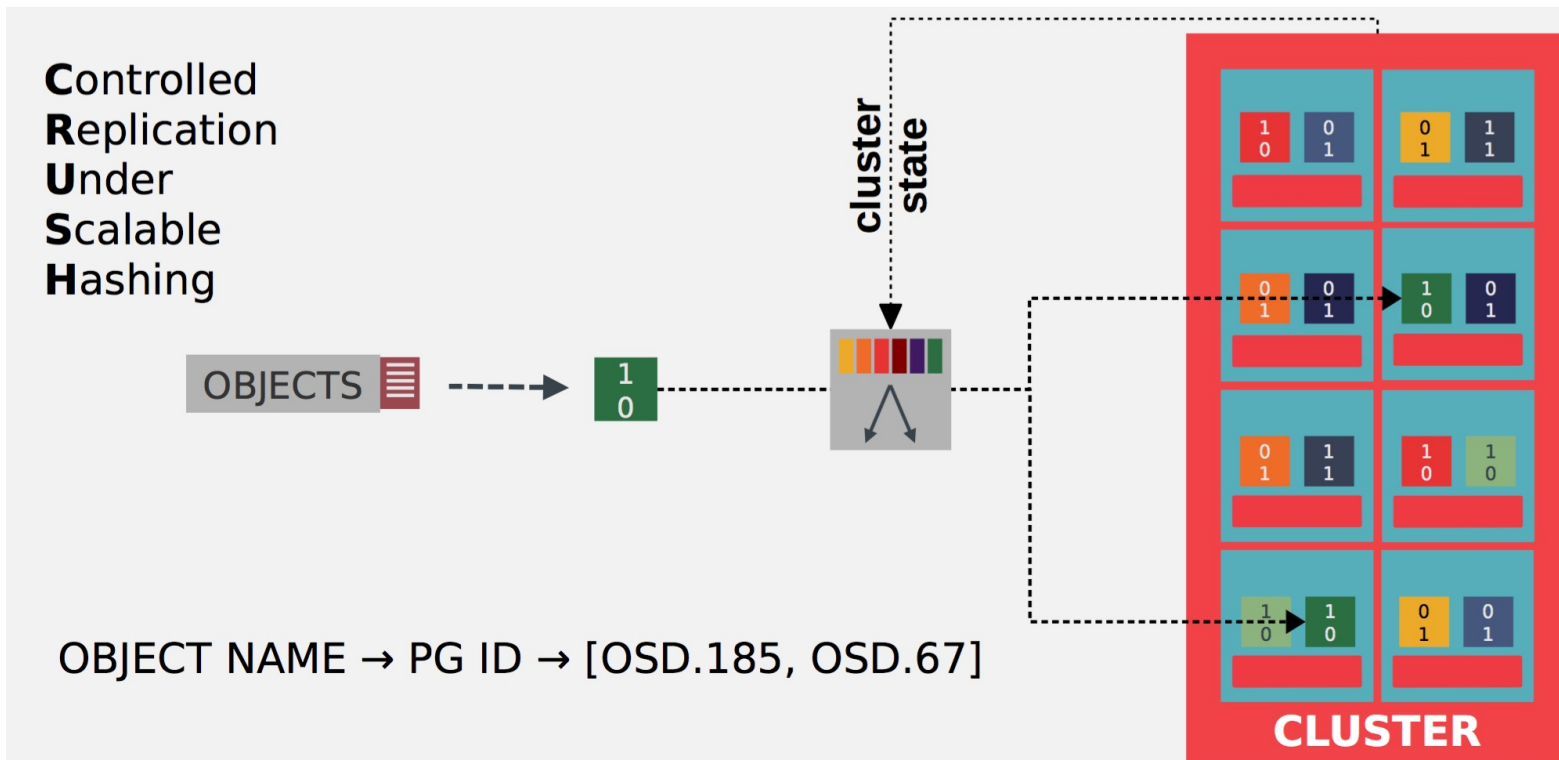
- Object Storage Daemon (OSD)
 - Exposes underlying storage to clients
 - Objects with data and KV metadata
 - One per disk
 - Faster devices can be used for metadata / WAL
 - Handles data replication and recovery
- Monitor
 - Provide consensus on cluster state



Ceph Placement



Ceph Placement



Replication

- Client determines PG and corresponding OSDs
 - Sends object I/O to primary OSD
 - Writes acknowledged only after writing to all replicas
- Pools can be replicated or erasure coded
 - User-specified redundancy levels and failure domains
- Private OSD network used for replication traffic



Failure Handling

- Monitors and OSDs check state of other OSDs
 - Following outage, PG is assigned to a new node
 - Backfill from peers
- Periodic scrubbing of data and metadata





CephFS

- POSIX compatible clustered filesystem atop RADOS
- MDSes manage filesystem namespace
 - Active/Passive or Active/Active redundancy
- Linux kernel and user-space clients
- Snapshots
- Directory to pool mappings



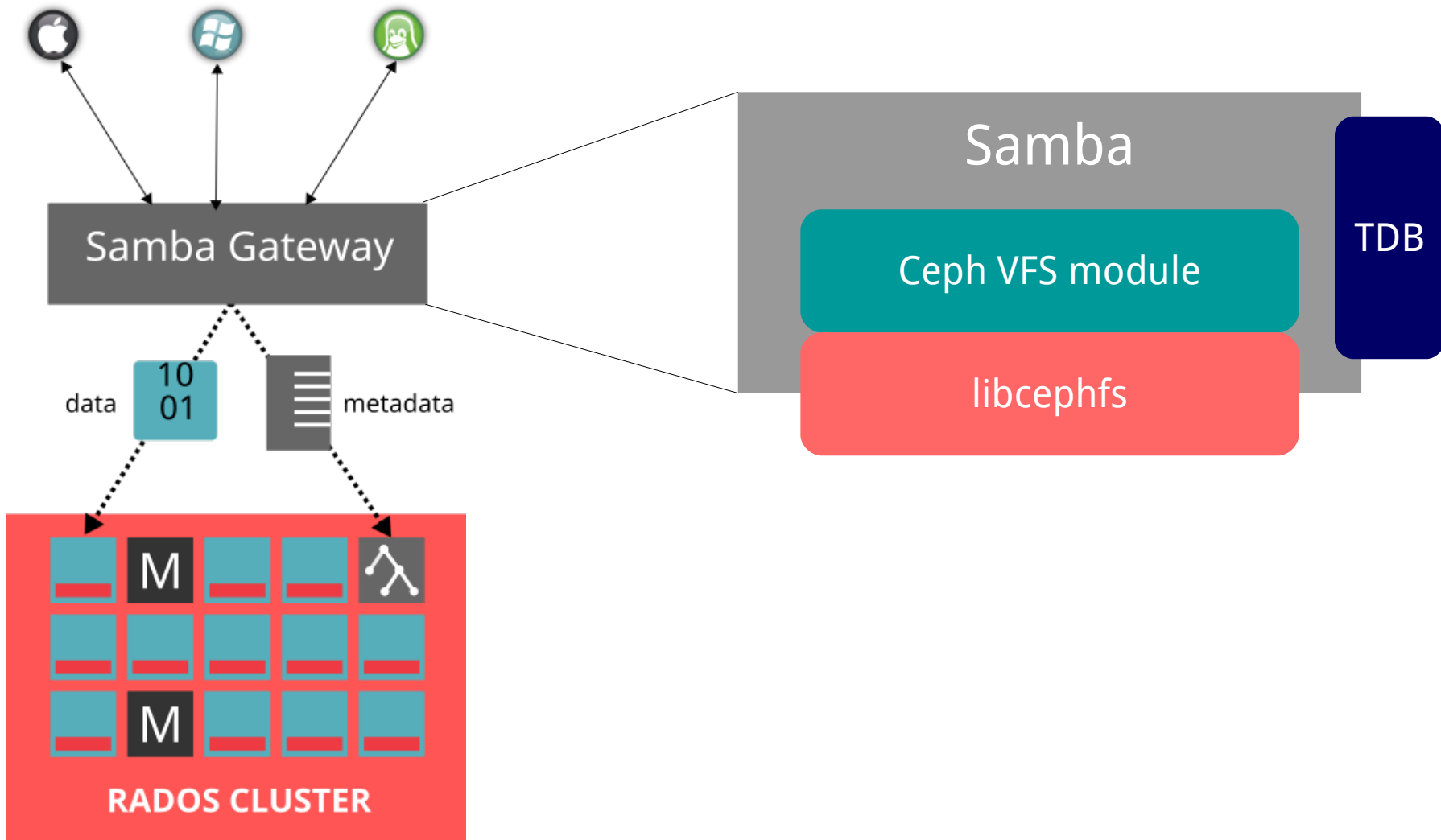
CephFS

- Basic quotas
- Client caching
 - Fine grained
 - Capabilities granted and revoked by MDS



Samba Integration

The background features abstract geometric shapes in two shades of green. On the left, a large teal shape with a pointed right side contains the title. To its right, a lighter green shape with a pointed left side is partially visible. The overall design is modern and minimalist.



Samba Ceph Integration

- CephFS module for Samba: *vfs_ceph*
 - Added in 2013 by Inktank
 - Maps SMB file and directory I/O to libcephfs API calls
- Static cephx credentials
 - Regardless of Samba authenticated user
 - User configurable via *smb.conf*
- POSIX ACLs



Samba Ceph Integration

- RADOS clustered mutex helper for CTDB
 - Removes recovery lock mount dependency
- Ceph librados service integration (*coming soon*)
 - Register service with manager daemon



Testing

- Ceph *vstart*
 - Deploy mock cluster from source
- Samba smbtorure
- cifs.ko fstests





Performance

Performance: Samba vs CephFS

- Preliminary results!
- Environment:
 - Ceph Version 12.2.2
 - Samba 4.6.9
 - Three Samba gateways
 - *vfs_ceph*
 - Non-overlapping share paths
 - Linux cifs.ko client
 - 4.4 kernel with many backports
 - SMB 3.0 mount

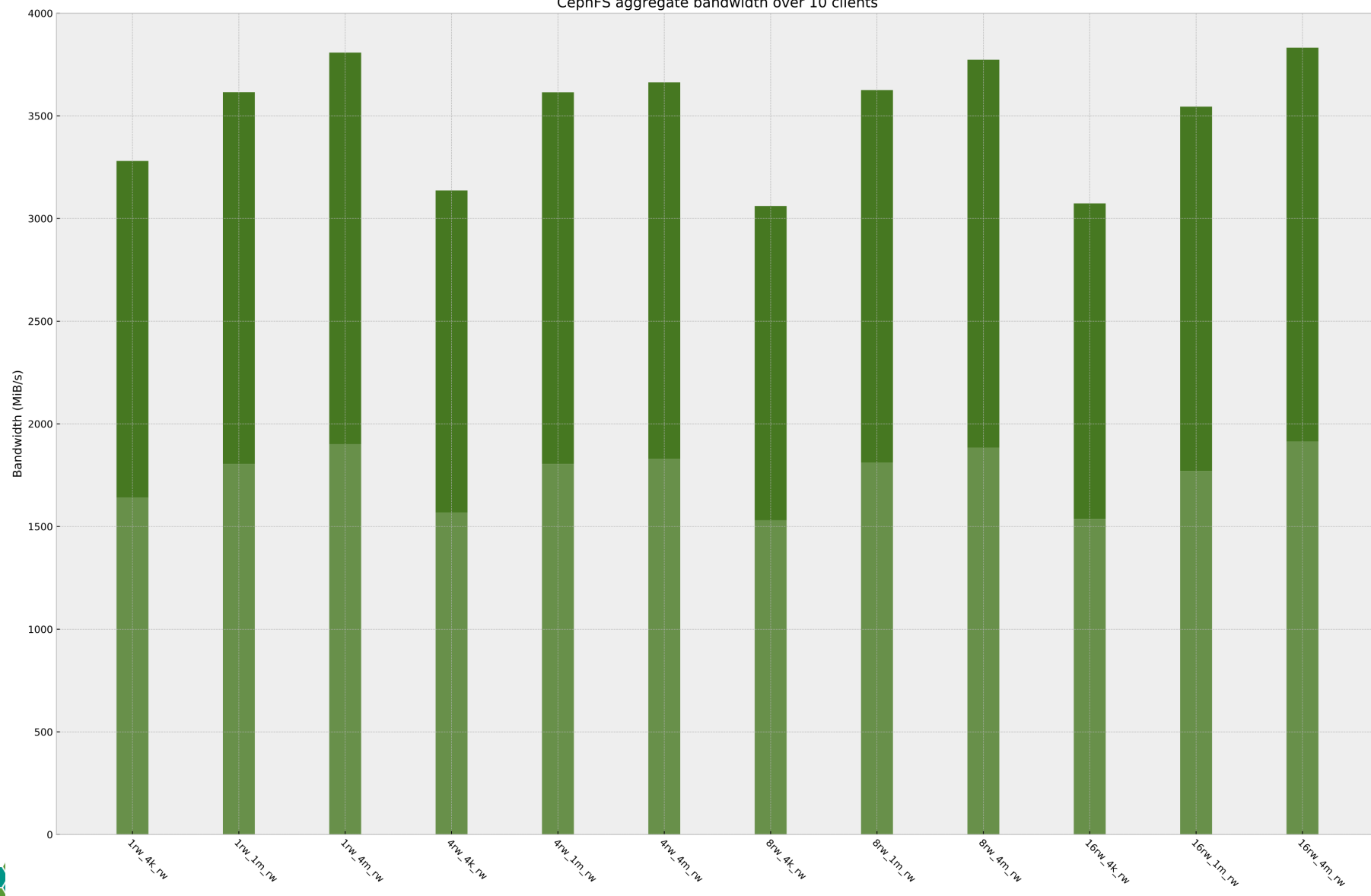


Hardware

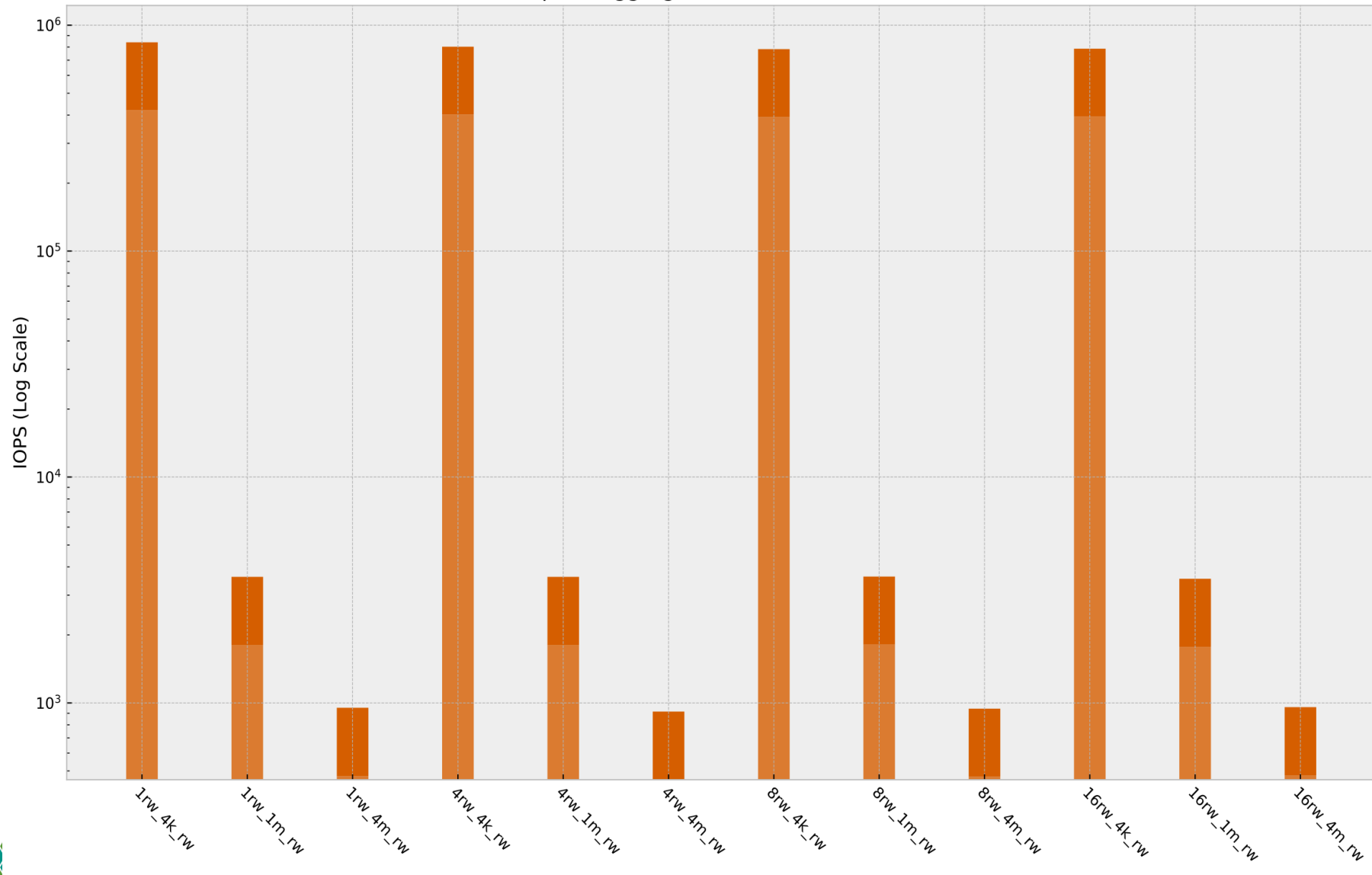
- Ceph setup on 8 nodes
 - 5 OSD nodes – 24 cores – 128 GB RAM
 - 3 MON/MDS nodes – 24 cores – 128 GB RAM
 - 6 OSD daemons per node – Bluestore – SSD/NVME journals
- 10 client nodes
 - 16 cores – 16 GB RAM
- Network interconnect
 - Public network 10Gbit/s
 - Cluster network 100Gbit/s



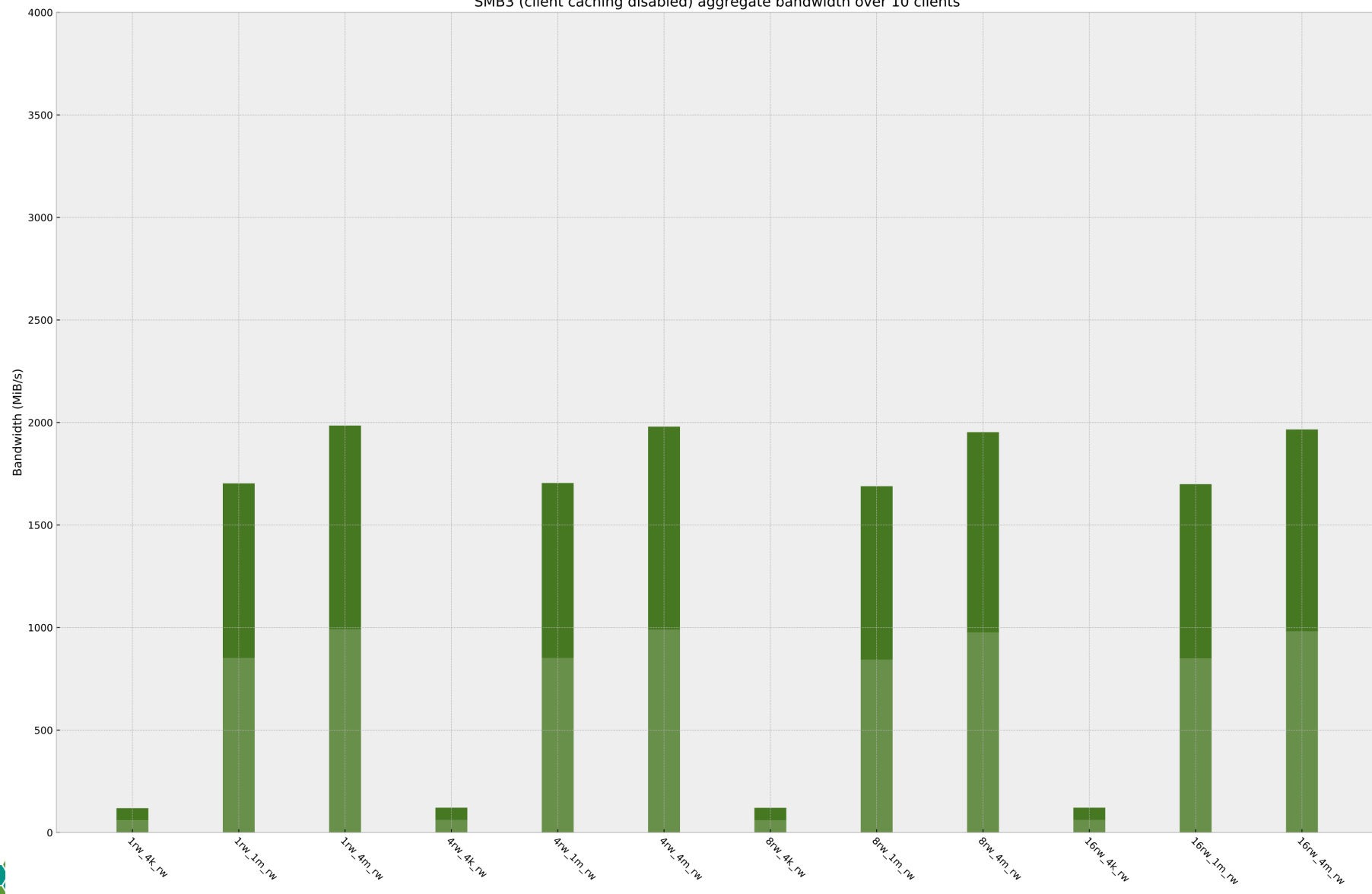
CephFS aggregate bandwidth over 10 clients



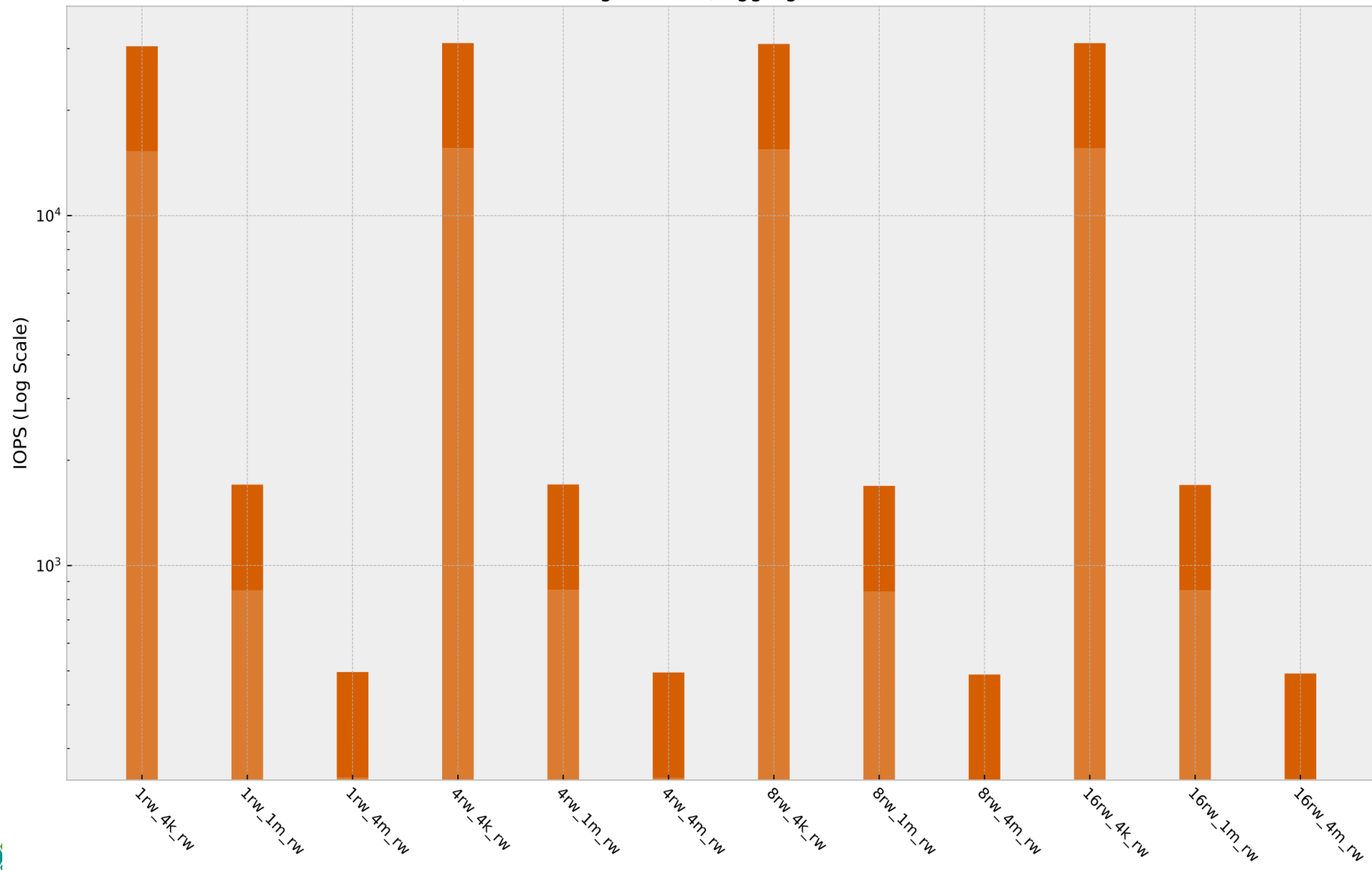
CephFS aggregate IOPS over 10 clients



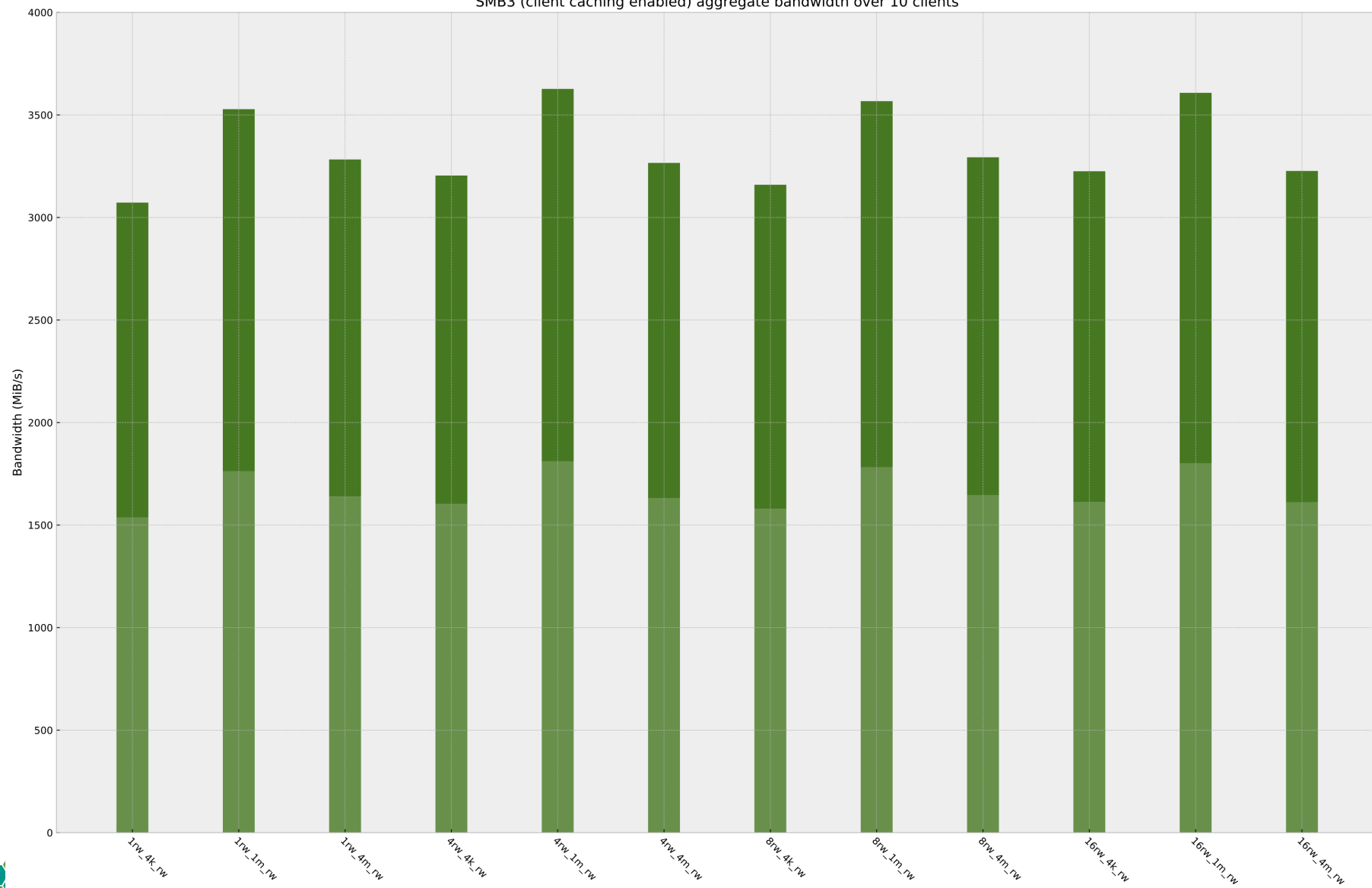
SMB3 (client caching disabled) aggregate bandwidth over 10 clients



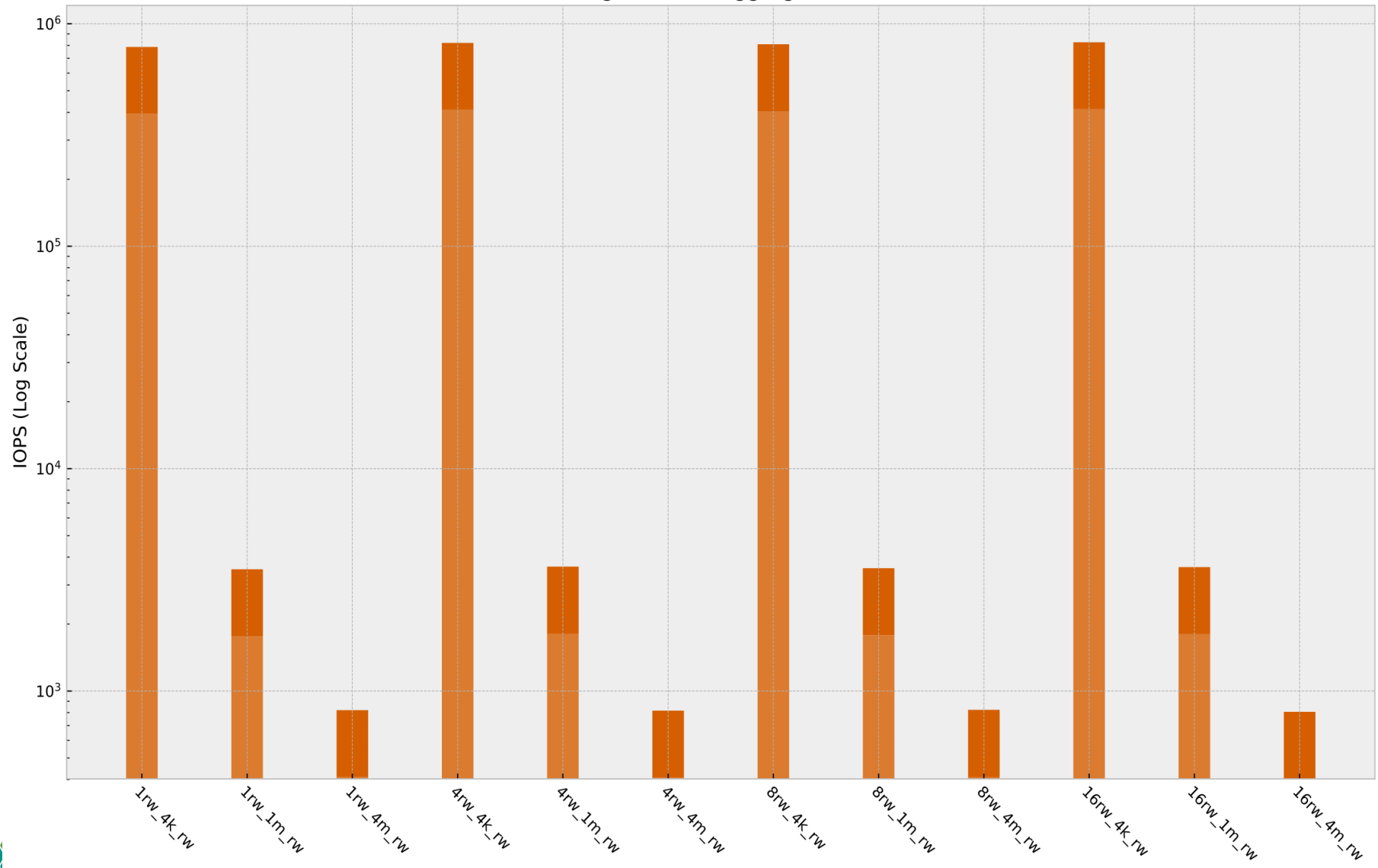
SMB3 (client caching disabled) aggregate IOPS over 10 clients



SMB3 (client caching enabled) aggregate bandwidth over 10 clients



SMB3 (client caching enabled) aggregate IOPS over 10 clients



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Challenges and Future

Challenges

- Cross-protocol client support
 - Coherent client caching
 - Map leases to CephFS *FILE* and *AUTH* capabilities
 - New libcephfs delegations API
 - Shared (NFS, CephFS) ACL model
- Unified authentication and user mapping
 - Use Kerberos / AD for Samba gateway and cephx



Challenges

- libcephfs asynchronous I/O
- Multichannel support
 - Experimental in upstream Samba
 - Not integrated with CTDB
- Automated deployment



Challenges

- Witness protocol
 - Continuous availability of SMB shares
 - Advertise Samba cluster state to clients
 - Transparent client failover
 - Load balancing



Samba: Future

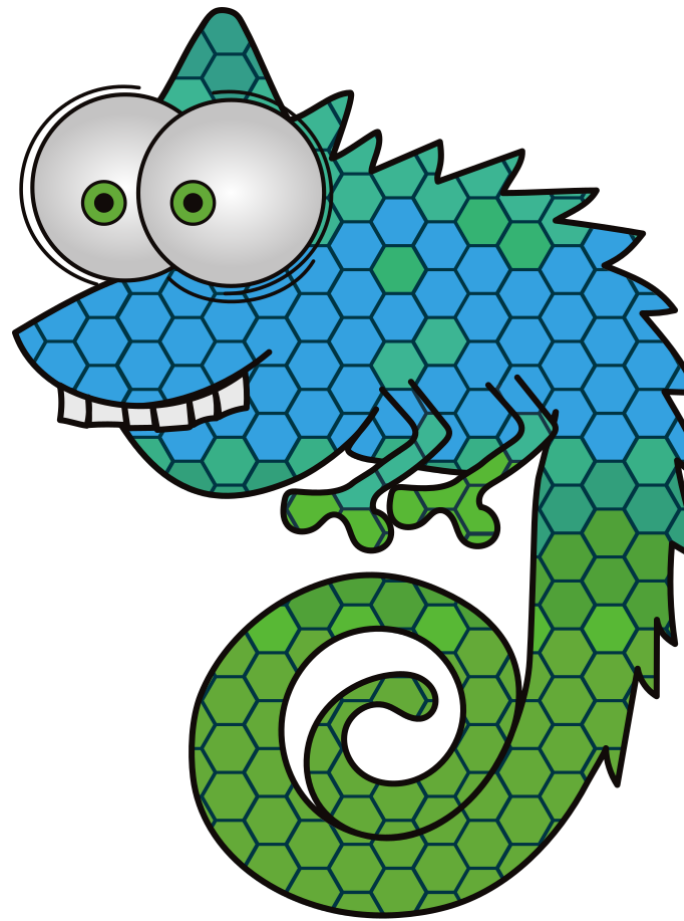
- Ceph backed key-value store for Samba
- Replace or modify CTDB
 - Rocksdb?
 - Samba database API demanding
 - Multiple processes and writers
 - Record locking and transactions



References

- Samba: <https://samba.org/>
- CTDB: <https://ctdb.samba.org/>
- SMB 3.1.1 encryption: [https://technet.microsoft.com/en-us/library/dn551363\(v=ws.11\).aspx](https://technet.microsoft.com/en-us/library/dn551363(v=ws.11).aspx)
- Multichannel deployment: [https://technet.microsoft.com/en-us/library/dn610980\(v=ws.11\).aspx](https://technet.microsoft.com/en-us/library/dn610980(v=ws.11).aspx)
- Witness Protocol:
http://www.sambaxp.org/archive_data/SambaXP2015-SLIDES/wed/track1/sambaxp2015-wed-track1-Guenther_Deschner-ImplementingTheWitnessProtocolInSamba.pdf
- Samba Multichannel Blocker Bug: https://bugzilla.samba.org/show_bug.cgi?id=11897
- CephFS cache flags: <https://jtlayton.wordpress.com/2016/09/01/cephfs-and-the-nfsv4-change-attribute/>
- Greg Farnum: Intro to Ceph, The Distributed Storage System
- Placement diagrams: <http://yauuu.me/ride-around-ceph-crush-map.html>





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