Sequoia and the ZFS OSD

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Christopher Morrone

Lawrence Livermore National Laboratory

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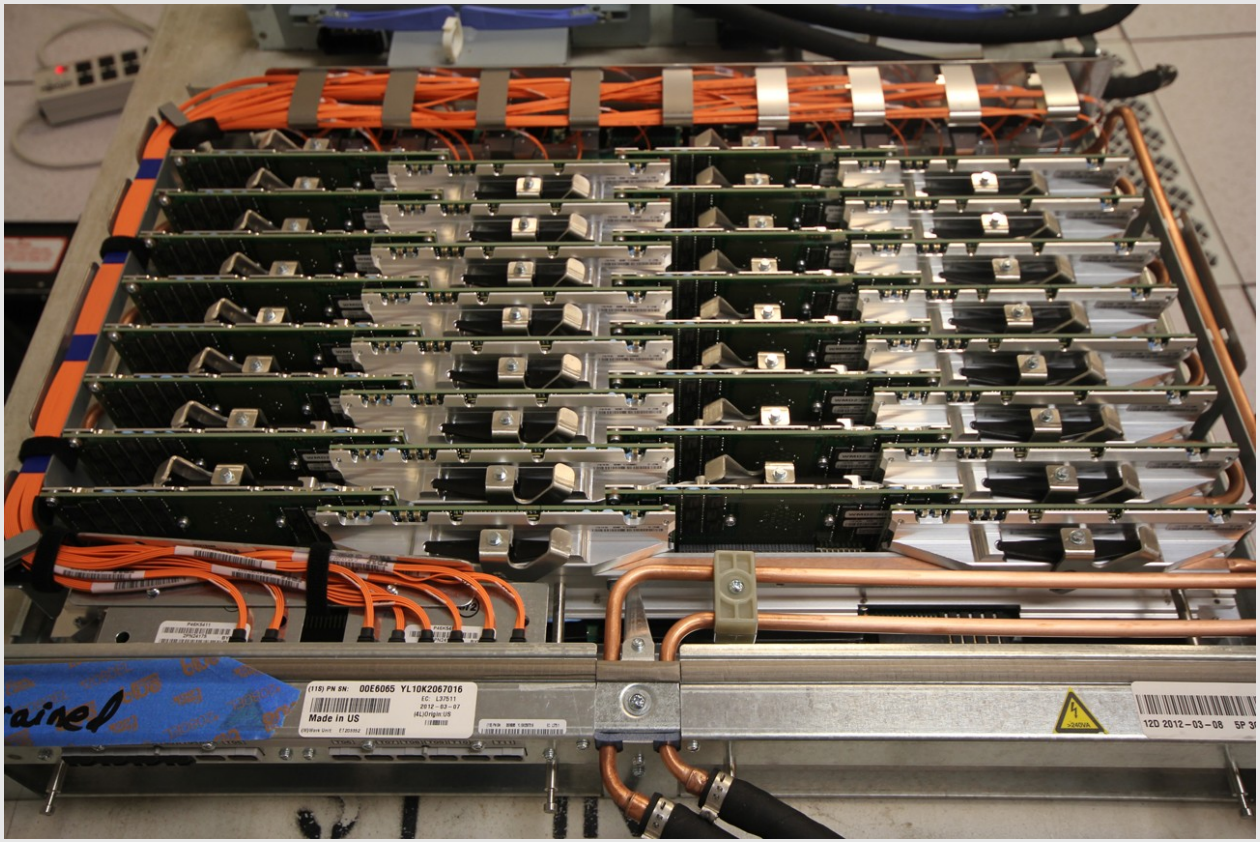
Sequoia – IBM BG/Q

Sequoia
1,572,864 Compute Cores

- 96 racks
- 1024 nodes per rack
- 16 compute cores per node

32 Compute Nodes on Node Card



Sequoia Naked

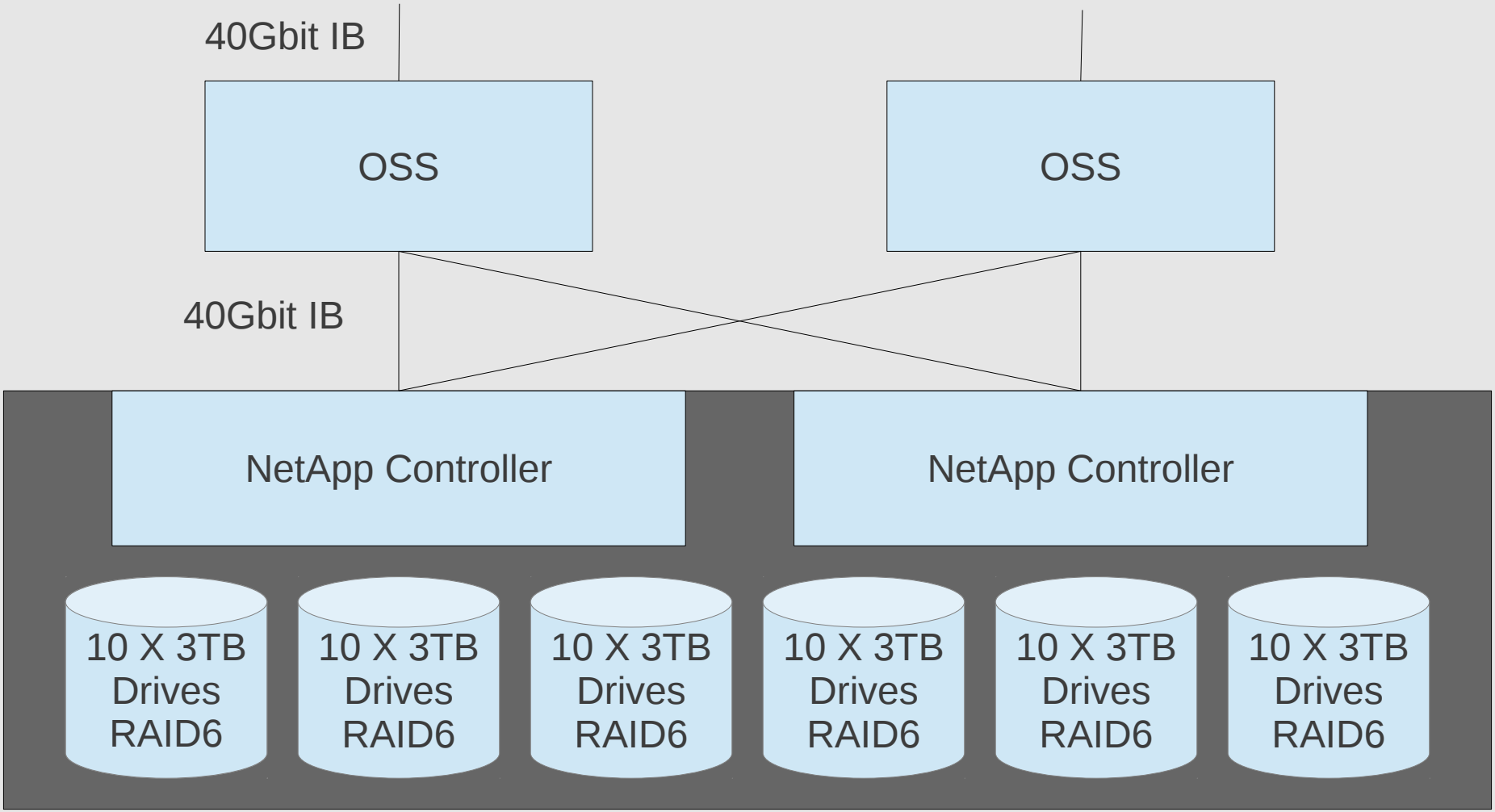
Sequoia Clothed

Lustre Client on I/O Nodes (IONs)

Sequoia Filesystem Stats

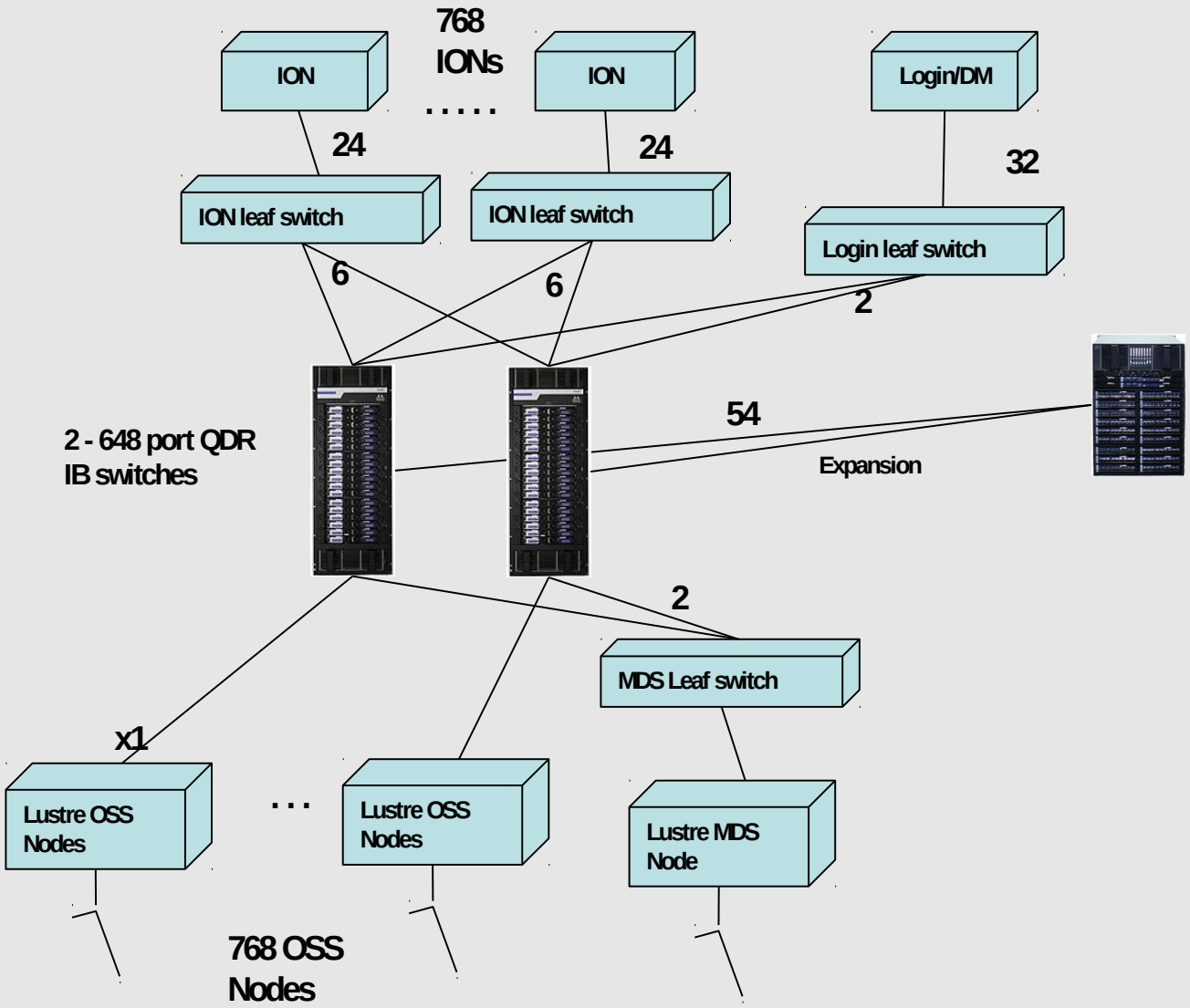
- 55 Petabytes
- 850 GB/s measured sustained write throughput
- 768 OSS & OST
- Each OST is 72 Terabytes

Filesystem building block
NetApp E5460 + 2 OSS



Sequoia's Filesystem Hardware

Sequoia's Filesystem Network



Lustre OSD and OSD-ZFS in 2.4!

- Lustre OSD & ZFS planning began in 2007
- LLNL contracted w/ Whamcloud to complete

OSD is not just for ZFS!

- Address long-existing technical debt
- Provides foundation for DNE, and other features

ZFS Benefits

- Copy-on-write sequentializes random write
- Single volume size limit of 16 EiB
- Zero off-line fsck time
  - Online data integrity checking and error handling
- Scalable directory contents
  - LLNL tested 1.5+ million files in one directory

ZFS Additional Benefits

- Compression – Average 1.7:1 on Sequoia
- Snapshots
  - Great for investigating Lustre problem!
- Multiple filesystems in same pool
  - E.G. test Lustre FS with less danger to production FS
- Other ideas
  - zfs send/recv for backups or copies
  - Snapshot entire Lustre filesystem

Sequoia Filesystem Status

- Lustre OST over ZFS
  - Stability: good
  - Performance: good
- Lustre MDT over ZFS
  - Stability: good
  - Performance: could be better
- Lustre Client
  - Stability: acceptable
  - Performance: needs work

ZFS Packaging

- Arch Linux
- Debian
- Fedora
- Funtoo
- Generic DEBs
- Generis RPMs
- RHEL / CentOS / SL
- Sabayon
- SprezzOS
- Ubntu

Lustre+ZFS Installation is easy!

- http://zfsonlinux.org/lustre.html
- RHEL example:
  - sudo yum localinstall –nogpgcheck http://archive.zfsonlinux.org/epel/zfs-release-1-2.el6.noarch.rpm
    - Adds /etc/yum.repo.d/zfs.repo and signing keys
  - sudo yum install lustre

http://zfsonlinux.org

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