Evaluating the performance of Seagate Kinetic Drives Technology and its integration with the CERN EOS storage system

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The Project Goal

Motivation
- Scalability (individual drives abstracted by larger clusters)
- Simplicity (reduced API and deployment model)
- Performance (optimized for streaming access)
- Cost efficiency

Goal
- Evaluating the performance of the Seagate Kinetic Drives as a promising storage solution for CERN
Seagate Kinetic Platform

 › Directly Attached Storage (DAS) vs Ethernet Drive Technology

 › What is Seagate Kinetic Platform?
   • Key/Value Store
   • Swift OpenStack Object Storage protocol
   • Kinetic Drive API
Integration with EOS

› Kinetic IO Plug-in - communication between the Kinetic Drives and EOS

› Allows arbitrary Reed-Solomon encoding using Intel ISA library with cauchy matrix and CRC32 block checksumming

› \((32,4)\) - one can lose 4 drives without data loss with 12.5% of space overhead

› \((10,2)\) - one can lose 2 drives without data loss with 20% of space overhead
Test deployment

- Two kinetic configurations (32,4 and 10,2) via 10Gb gateway
- One conventional configuration (eos dev) with directly attached disks and 2 replicas
- Client machines (1GE,10GE)
- Storage server
Write performance

› **Sequential upload**
  Writing on the three instances with 1GE and 10GE clients using the xrdcopy utility
  File size (4k to 4Gb)
  Each file is uploaded 10 times

› **Expected single drive performance**
  Sequential write 50MB/s for kinetic drive
  ~100MB/s for conventional drive
Write performance for 1GE client

Write performance benchmark for 10GE client
Write performance

- Confirmed high performance (using a single client)
- Usually not concerned about max performance on a single drive but about the aggregated speed to many clients
Read performance

› Using ROOT benchmark

› Reading an ATLAS file, accessed by single client

› Sequential and sparse accesses (100% and 50% entries)

› Measuring the CPU time, Real time and CPU ratio
Read performance – single client

Read performance with 1 client - 5 runs

100 percentage of entries

50 percentage of entries

Real time
CPU Time

"EOS-DEV"  "EOS-KINETIC-10:2"  "EOS-KINETIC-32:4"

"EOS-DEV"  "EOS-KINETIC-10:2"  "EOS-KINETIC-32:4"
The kinetic drives need to read blocks of 1MB from each drive. If only a fraction of data is read, the kinetic plugin still reads all data while the dev drives read only the requested bytes.
Summary

› Promising solution for future

› Expected performance was confirmed

› Next step
Study the results for multiple-clients by measuring the aggregated throughput with sequential and sparse access