Test and Fix Milestone Completion for the CLIO Simplification Project of the SFS-DEV-004 contract.

Revision History

Date	Revision	Author
15/05/27	Original	R. Henwood
15/05/28	Added figure showing release variability.	R. Henwood
15/06/01	Added in additional measurements	R. Henwood
15/06/01	Added in patch list.	R. Henwood
15/06/03	Added Appendix A: detailed results	R. Henwood
15/06/09	Clarified only means for CLIO mdtest are available.	R. Henwood

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Introduction

The following milestone completion document applies to CLIO Simplification Project recorded in the OpenSFS Lustre Development contract SFS-DEV-004 agreed September 25, 2014.
The CLIO Simplification code is functionally complete and recorded in the Implementation Milestone.
Completion of this milestone requires the following tasks to be executed:

1. Contractor demonstrates the code passing the complement of tests in Contractor's Autotest environment with the code applied to the Lustre Master tree.
2. Contractor demonstrates the code runs successfully at scale (typically completing a 48 hour SWL run on the Hyperion platform at the Lawrence Livermore National Laboratory).
3. Contractor executes performance regression testing, identifying and addressing performance regressions related to the development of the revised code. This performance testing will be run on a system with at least 100 clients and will compare results of IOR, mdtest on builds before and after the implementation of the CLIO Simplification High Level Design. Degradation of more than 5% will be taken as a failure, but small drops will be accepted as within normal variation.

NOTE: This task list includes agreed enhancements in item 3. They are: lnet-selftest has been omitted as redundant. Mdtest has been selected as a better alternative to mdsrate.

Overview of CLIO Simplification.

CLIO Simplification work was completed with six high-level tasks. These are:

- cl_lock re-factoring (simplified and cache-less).
- Liblustre removal.
- Implement function calls and cleanup obsolete OBD methods.
- Remove lov_stripe_md (LSM) direct access beyond LOV layer.
- Remove cfs_ prefixed functions, where appropriate.
- Remove ccc_ layer.

This work has been completed in the following patches:

Change #	Work ticket
11013	LU-3259 clio: get rid of cl_req
10858	LU-3259 clio: cl_lock simplification
10657	LU-2675 build: remove liblustre and libsysio
11772	LU-2675 mgc: remove libmgc.c
11423	LU-2675 build: remove Darwin "support"
11385	LU-2675 build: remove WinNT "support"
13514	LU-5823 llite: Remove access of stripe in ll_setattr_raw
12452	LU-5823 clio: add coo_getstripe interface
12494	LU-5823 clio: add cl_object_find_cbdata()
13422	LU-5823 clio: use CIT_SETATTR for FSFILT_IOC_SETFLAGS
12535	LU-5823 clio: add cl_object_fiemap()
12638	LU-5823 clio: add coo_obd_info_get and coo_data_version
12748	LU-5823 clio: remove IOC_LOV_GETINFO
12639	LU-5823 clio: get rid of lov_stripe_md reference
13426	LU-5814 obd: remove unused LSM parameters
13722	LU-5814 lov: remove LSM from struct lustre_md
12442	LU-5814 lov: remove LL_IOC_RECREATE_{FID,OBJ}

13696 LU-5814 lov: move LSM to LOV layer
12446 LU-5814 echo: remove userspace LSM handling
13737 LU-5814 obd: rename obd_unpackmd() to md_unpackmd()
12445 LU-5814 lov: remove unused {get,set}_info handlers
12447 LU-5418 echo: replace lov_stripe_md with lov_oinfo
12618 LU-5814 llite: remove ll_objects_destroy()
12581 LU-5814 lov: flatten struct lov_stripe_md]
13426 LU-5814 obd: remove unused LSM parameters
13680 LU-5814 lov: add cl_object_layout_get()
13690 LU-5814 llite: replace lli_has_smd with lli_layout_type
13694 LU-5814 llite: add cl_object_maxbytes()
13695 LU-5814 lov: use obd_get_info() to get def/max LOV EA sizes
12592 LU-5971 llite: merge lclient.h into llite/vvp_internal.h
13075 LU-5971 llite: rename ccc_device to vvp_device
13077 LU-5971 llite: rename ccc_object to vvp_object
13086 LU-5971 llite: rename ccc_page to vvp_page
13088 LU-5971 llite: rename ccc_lock to vvp_lock
13351 LU-5971 llite: merge ccc_io and vvp_io
13347 LU-5971 llite: remove struct ll_ra_read
13363 LU-5971 llite: use vui prefix for struct vvp_io members
13376 LU-5971 llite: move vvp_io functions to vvp_io.c
13377 LU-5971 llite: rename ccc_req to vvp_req
13714 LU-5971 llite: rename struct ccc_grouplock to ll_grouplock
13074 LU-6028 Move definition of LDLM_GID_ANY to lustre_dlm.h
13137 LU-6046 audit comments in cl_object.h

1. Autotest results

The complete series of patches are recorded at http://review.whamcloud.com/13737/ and below. This series (patch set 3) successfully passed Autotest on March 27th. This result is recorded here:

- review-zfs
- review-dne-part-1
- review-dne-part-2
- review-ldiskfs

NOTE: since completing these tests, many unrelated patches have landed on master that have obligated a re-base of this patch series.

2. 48hr SWL run on Hyperion

SWL completed a 48 hour run on Hyperion on March 12 with no observed issues. A summary of the test is below:

```
Summary
=======

Start Time: Thu Mar 12 05:59:15 PDT 2015
Job Totals
  Passed:       14346
  Failed:       0
  Terminated:   64
  Unknown:      0
  Total:        14410
  Failure Rate: 0.00%
Run Times
  Wall Clock Run Time:       2253.22 hrs.
  Node Run Time:             14018.81 node-hrs.
  SWL Node Utilization:      145.18%
  SLURM Node Utilization:    n/a
Excessive Run-time Variation Job Count: 0
Overall Job Coverage: 21.7% (138/636)
Passed Job Coverage: 21.5% (137/636)
End Time: Sat Mar 14 06:16:02 PDT 2015
SWL Run Time: 173807 sec. (48.28) hrs.)

                              Failure Mode Summary
 Mode   Count                       Description
====== ======= ============================================================
 129   3431    TBD

                               Failure Mode Breakdown
  Test    Mode   Count                        Description
======== ====== ======= ============================================================
IO        129   3431    TBD

Report generated on Sat Mar 14 06:50:43 PDT 2015
```

NOTE: SWL runs continuously. This test run was ended after 48 hours. Jobs that where running when the test run was completed are recorded as terminated in this summary.

3. Performance tests

This series of tests is designed to verify that the CLIO Simplification project has not negatively affected the performance of the Lustre filesystem. This test was executed on Hyperion. Hyperion runs with 16 threads per single-client tests, and 1600 IOR threads for 100-client tests. The baseline for performance was selected as Lustre 2.6.0. The build with CLIO Patches applied was created from http://review.hpdd.intel.com/13318/ (since merged into http://review.hpdd.intel.com/13714 for landing).

Five consecutive tests were run for each metric. The mean of the five runs was computed. This mean is used to calculate percentage difference against the baseline. The complete result set is recorded in Appendix A. Observed CLIO Simplification performance that is slower than 5% of the baseline is presented in red.

Guidelines for the reader:

- CLIO Simplification patches have been landed into Master over the last 9 months. During this time, 988 patches have landed which may or may not be responsible for changes in performance.
- Variability in performance computing is commonly observed during tests on Hyperion.. It is not unknown to see a 10% variation between consecutive runs of the same code. The figure below illustrates variability in performance over 15 recent consecutive tags. NOTE: for two runs of 2.6.90 on different dates (2.6.90.1 and 2.6.90.2 on the figure below) show significant differences in read performance for otherwise identical Lustre versions.

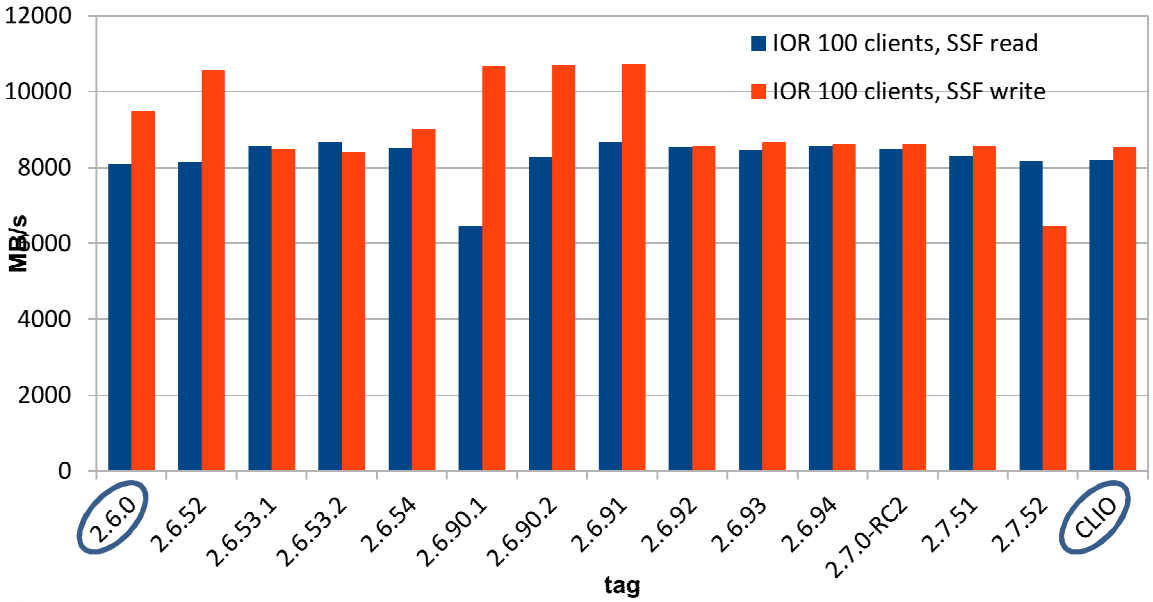

Figure 1: Performance of 15 consecutive tags including 2.6.0 and 2.7.0 releases as well as more recent master tags. Read and write bandwidth of a single shared file with 100 clients is recorded. Significant variability can be observed between any two consecutive tags.

IOR, 100 Clients, Single Shared File (SSF)

	2.6.0 vs CLIO	2.6.53.1 vs CLIO
Read performance difference	101%	97%
Write performance difference	90%	100%

OBSERVATIONS: Figure 1 shows the baseline of 2.6.0 (far left) has write performance that is above the typical performance for 15 recent tags. This unusually high value for the 2.6.0 baseline, means that more typical observations are apparently slow by comparison. Choosing a more common value for 100 client SSF read and write (i.e. tag 2.6.53.1) provides a better baseline value and shows performance within tolerance.

IOR, 100 Clients, File Per Process (FPP)

Read performs: 96%

Write perform: 102%

OBSERVATION: Both observations show CLIO Simplification performance within tolerance.

IOR, Single Client, File Per Process (FPP)

	Hyperion	OpenSFS test 1	OpenSFS test 2
Read performance difference	104%	104%	
Write performance difference	92%	150%	97%

OBSERVATIONS: Write performance was below tolerance during our run on Hyperion on this test. This apparent slow-down was not reproducible over three re-runs on the OpenSFS cluster where between 97% and 150% write performance was observed.

IOR, Single Client, Single Shared File (SSF)

Read performs: 101%

Write perform: 388%

OBSERVATIONS: Observation of the 2.6.0 baseline showed write performance on Hyperion at 340MB/s. The CLIO Simplification client performed at 1400MB/s. Task LU-1669 (out of scope for this contract) is thought to be primarily responsible for the large improvement in write performance between 2.6.0 and the accumulated unrelated CLIO Simplification patches.

mdtest, Single Client

Best FFP tree filestat: 115%
Best SSF tree dircreate: 103%
Worst FFP tree treecreate: 97%
Worst SSF tree rm: 97%

OBSERVATIONS: All 32 observations show CLIO Simplification performance within tolerance. Only the best and the worst are included here.

mdtest, 100 Clients

	Hyperion run 1		Hyperion run 2	
	File per process	Single shared file	File per process	Single shared file
Dir create	108%	104%	88%	98%
Dir stat	96%	100%	100%	100%
Dir rm	110%	98%	95%	96%
File create	181%	235%	201%	168%
File stat	96%	99%	98%	100%
File rm	108%	104%	104%	102%
Tree create	100%	86%	100%	100%
Tree rm	114%	104%	106%	97%

OBSERVATIONS: Out of 32 metrics only two metric are observed out of tolerance for mdtest at 100 clients scale. Out of tolerance observations were not repeated between consecutive runs and they are judged to be due to variability occurring at 100 client scale. A significant performance increase is observed on metrics including 'file create' and 'file rm'.

Conclusion

Functional testing and SWL testing of the CLIO Simplification stack was completed successfully. Performance testing is also complete. Of 49 values presented within the performance testing, four were observed below 5% of the 2.6.0 baseline value. On review, these four observations can be attributed to the challenges of running repeatable tests with low variability at scale. Further tests were run to check whether CLIO Simplification patches introduced these observed regressions, but no evidence was found to support this being the case. We are confident that the CLIO Simplification patches do not introduce regressions and this phase of the project is complete.

Appendix A: Detailed Results

Hyperion and file system setup

Servers:	h-agb[13-24] CPU- 16x Intel(R) Xeon(R) CPU E5-2670 0 @ 2.60GHz 64 GB Ram
Clients:	Dell 6220 or 6100, 16 or 8 CPU
Array:	10 x NetApp E-5460, Disks 10x 60x 3TB, cache block size 32kb
Network:	IB
MDT:	10.9TB RAID 10 VG across 8 discs configured with 128KB segment size
OST:	21.8TB RAID 6 VG across 10 discs configured with a 256KB segment size
ldiskfs setup:	1-2 OSTs per OSS, one OST per LUN
MKFSOPTS	"-t ext4 -J size=2048 -O extents -G 256 -i 69905"

IOR, 100 Clients, Single Shared File (SSF)

2.6.0 mean read: 8817 MB/s

2.6.0 mean write: 9441 MB/s

```
0000: IOR-3.0.0: MPI Coordinated Test of Parallel I/O
0000:
0000: Began: Tue May 19 18:23:17 2015
0000: Command line used: /opt/ior-3.0.0/bin/ior -a POSIX -b 4g -o /p/l_wham/d0.ior.ssf/iorData -t
2m -v -w -r -i 5 -T 4320 -k
0000: Machine: Linux iwc1
0000: Start time skew across all tasks: 0.00 sec
0000:
0000: Test 0 started: Tue May 19 18:23:17 2015
0000: Path: /p/l_wham/d0.ior.ssf
0000: FS: 828.5 TiB   Used FS: 0.0%   Inodes: 6144.0 Mi   Used Inodes: 0.0%
0000: Participating tasks: 1600
0000: Summary:
0000:   api                = POSIX
0000:   test filename      = /p/l_wham/d0.ior.ssf/iorData
0000:   access             = single-shared-file
0000:   pattern            = segmented (1 segment)
0000:   ordering in a file = sequential offsets
0000:   ordering inter file= no tasks offsets
0000:   clients            = 1600 (16 per node)
0000:   repetitions        = 5
0000:   xfersize           = 2 MiB
0000:   blocksize          = 4 GiB
0000:   aggregate filesize = 6400 GiB
0000:
0000: access    bw(MiB/s)  block(KiB) xfer(KiB)  open(s)    wr/rd(s)   close(s)   total(s)   iter
0000: ------    ---------  ---------- ---------  --------   --------   --------   --------   ----
0000: Commencing write performance test: Tue May 19 18:23:17 2015
0000: write     8374       4194304    2048.00    0.159298   782.62     731.95     782.62     0
0000: Commencing read performance test: Tue May 19 18:36:20 2015
0000: read      9336       4194304    2048.00    0.059846   701.94     622.68     701.94     0
0000: Commencing write performance test: Tue May 19 18:48:02 2015
0000: write     8592       4194304    2048.00    0.158557   762.77     612.51     762.77     1
0000: Commencing read performance test: Tue May 19 19:00:45 2015
0000: read      9103       4194304    2048.00    0.063806   719.95     354.02     719.95     1
0000: Commencing write performance test: Tue May 19 19:12:45 2015
0000: write     9768       4194304    2048.00    0.155280   670.90     574.44     670.90     2
0000: Commencing read performance test: Tue May 19 19:23:56 2015
0000: read      8625       4194304    2048.00    0.064690   759.81     430.58     759.81     2
0000: Commencing write performance test: Tue May 19 19:36:36 2015
0000: write     10044      4194304    2048.00    61.10      652.48     521.68     652.48     3
0000: Commencing read performance test: Tue May 19 19:47:29 2015
0000: read      8520       4194304    2048.00    0.060742   769.18     409.43     769.18     3
0000: Commencing write performance test: Tue May 19 20:00:18 2015
0000: write     10430      4194304    2048.00    0.154209   628.34     452.81     628.34     4
0000: Commencing read performance test: Tue May 19 20:10:46 2015
0000: read      8501       4194304    2048.00    0.068666   770.94     404.68     770.94     4
0000:
0000: Max Write: 10430.06 MiB/sec (10936.71 MB/sec)
0000: Max Read:  9336.36 MiB/sec (9789.88 MB/sec)
```

```
0000:
0000: Summary of all tests:
0000: Operation   Max(MiB)   Min(MiB)  Mean(MiB)     StdDev    Mean(s) Test# #Tasks tPN reps fPP
reord reordoff reordrand seed segcnt blksiz xsize aggsize API RefNum
0000: write       10430.06    8373.87    9441.65     813.53  699.42346 0 1600 16 5 0 0 1 0 0 1
4294967296 2097152 6871947673600 POSIX 0
0000: read         9336.36    8500.78    8817.10     339.48  744.36592 0 1600 16 5 0 0 1 0 0 1
4294967296 2097152 6871947673600 POSIX 0
0000:
0000: Finished: Tue May 19 20:23:37 2015
```

CLIO Simplification mean read: 8193
CLIO Simplification mean write: 8538

```
0000: IOR-3.0.0: MPI Coordinated Test of Parallel I/O
0000:
0000: Began: Tue May 19 11:30:05 2015
0000: Command line used: /opt/ior-3.0.0/bin/ior -a POSIX -b 4g -o /p/l_wham/d0.ior.ssf/iorData -t
2m -v -C -w -r -W -i 5 -T 4320 -k
0000: Machine: Linux iwc1
0000: Start time skew across all tasks: 0.00 sec
0000:
0000: Test 0 started: Tue May 19 11:30:05 2015
0000: Path: /p/l_wham/d0.ior.ssf
0000: FS: 828.5 TiB   Used FS: 0.0%   Inodes: 6144.0 Mi   Used Inodes: 0.0%
0000: Participating tasks: 1600
0000: Using reorderTasks '-C' (expecting block, not cyclic, task assignment)
0000: Summary:
0000:   api                = POSIX
0000:   test filename      = /p/l_wham/d0.ior.ssf/iorData
0000:   access             = single-shared-file
0000:   pattern            = segmented (1 segment)
0000:   ordering in a file = sequential offsets
0000:   ordering inter file= constant task offsets = 1
0000:   clients            = 1600 (16 per node)
0000:   repetitions        = 5
0000:   xfersize           = 2 MiB
0000:   blocksize          = 4 GiB
0000:   aggregate filesize = 6400 GiB
0000:
0000: access    bw(MiB/s)  block(KiB) xfer(KiB)  open(s)    wr/rd(s)   close(s)   total(s)   iter
0000: ------    ---------  ---------- ---------  --------   --------   --------   --------   ----
0000: Commencing write performance test: Tue May 19 11:30:05 2015
0000: write     8217       4194304    2048.00    0.167975   797.55     0.009727   797.57     0
0000: Verifying contents of the file(s) just written.
0000: Tue May 19 11:43:23 2015
0000:
0000: Commencing read performance test: Tue May 19 11:56:10 2015
0000: read      8620       4194304    2048.00    0.078238   760.29     0.008840   760.30     0
0000: Commencing write performance test: Tue May 19 12:08:50 2015
0000: write     8585       4194304    2048.00    0.160144   763.37     0.004076   763.37     1
0000: Verifying contents of the file(s) just written.
0000: Tue May 19 12:21:34 2015
0000:
0000: Commencing read performance test: Tue May 19 12:34:57 2015
0000: read      8295       4194304    2048.00    0.077603   790.10     0.004642   790.10     1
0000: Commencing write performance test: Tue May 19 12:48:07 2015
0000: write     8518       4194304    2048.00    0.159648   769.34     0.007866   769.34     2
0000: Verifying contents of the file(s) just written.
0000: Tue May 19 13:00:57 2015
0000:
0000: Commencing read performance test: Tue May 19 13:14:41 2015
0000: read      7959       4194304    2048.00    0.081929   823.36     0.011041   823.37     2
0000: Commencing write performance test: Tue May 19 13:28:25 2015
0000: write     8630       4194304    2048.00    0.164202   759.39     0.004458   759.39     3
0000: Verifying contents of the file(s) just written.
0000: Tue May 19 13:41:04 2015
0000:
0000: Commencing read performance test: Tue May 19 13:54:14 2015
0000: read      8172       4194304    2048.00    0.082267   801.95     0.007892   801.96     3
0000: Commencing write performance test: Tue May 19 14:07:36 2015
0000: write     8740       4194304    2048.00    0.158126   749.82     0.007431   749.83     4
0000: Verifying contents of the file(s) just written.
0000: Tue May 19 14:20:06 2015
0000:
0000: Commencing read performance test: Tue May 19 14:33:39 2015
0000: read      7922       4194304    2048.00    0.081227   827.23     0.009481   827.24     4
```

```
0000:
0000: Max Write: 8740.10 MiB/sec (9164.66 MB/sec)
0000: Max Read:  8619.74 MiB/sec (9038.45 MB/sec)
0000:
0000: Summary of all tests:
0000: Operation   Max(MiB)   Min(MiB)  Mean(MiB)     StdDev    Mean(s) Test# #Tasks tPN reps fPP
reord reordoff reordrand seed segcnt blksiz xsize aggsize API RefNum
0000: write        8740.10    8216.98    8538.12     176.05  767.90222 0 1600 16 5 0 1 1 0 0 1
4294967296 2097152 6871947673600 POSIX 0
0000: read         8619.74    7922.24    8193.61     253.27  800.59516 0 1600 16 5 0 1 1 0 0 1
4294967296 2097152 6871947673600 POSIX 0
0000:
0000: Finished: Tue May 19 14:47:26 2015
```

2.6.53.1: only mean available.
2.6.53.1 read mean: 8578 MB/s
2.6.53.1 write mean: 8482 MB/s

IOR, 100 Clients, File Per Process (FPP)

2.6.0 mean read: 8417

2.6.0 mean write: 8861

```
0000: IOR-3.0.0: MPI Coordinated Test of Parallel I/O
0000:
0000: Began: Tue May 19 16:09:21 2015
0000: Command line used: /opt/ior-3.0.0/bin/ior -a POSIX -b 4g -o /p/l_wham/d0.ior.fpp/iorData -t
2m -v -w -r -i 5 -T 4320 -k -F
0000: Machine: Linux iwc1
0000: Start time skew across all tasks: 0.00 sec
0000:
0000: Test 0 started: Tue May 19 16:09:21 2015
0000: Path: /p/l_wham/d0.ior.fpp
0000: FS: 828.5 TiB   Used FS: 0.0%   Inodes: 6144.0 Mi   Used Inodes: 0.0%
0000: Participating tasks: 1600
0000: Summary:
0000:   api                = POSIX
0000:   test filename      = /p/l_wham/d0.ior.fpp/iorData
0000:   access             = file-per-process
0000:   pattern            = segmented (1 segment)
0000:   ordering in a file = sequential offsets
0000:   ordering inter file= no tasks offsets
0000:   clients            = 1600 (16 per node)
0000:   repetitions        = 5
0000:   xfersize           = 2 MiB
0000:   blocksize          = 4 GiB
0000:   aggregate filesize = 6400 GiB
0000:
0000: access    bw(MiB/s)  block(KiB) xfer(KiB)  open(s)    wr/rd(s)   close(s)   total(s)   iter
0000: ------    ---------  ---------- ---------  --------   --------   --------   --------   ----
0000: Commencing write performance test: Tue May 19 16:09:21 2015
0000: write     8337       4194304    2048.00    0.548709   786.12     352.30     786.13     0
0000: Commencing read performance test: Tue May 19 16:22:27 2015
0000: read      9502       4194304    2048.00    0.016616   689.70     231.00     689.70     0
0000: Commencing write performance test: Tue May 19 16:33:57 2015
0000: write     8283       4194304    2048.00    0.554845   791.16     321.00     791.16     1
0000: Commencing read performance test: Tue May 19 16:47:08 2015
0000: read      8393       4194304    2048.00    0.022216   780.81     293.36     780.82     1
0000: Commencing write performance test: Tue May 19 17:00:10 2015
0000: write     9070       4194304    2048.00    0.536139   722.51     300.54     722.52     2
0000: Commencing read performance test: Tue May 19 17:12:12 2015
0000: read      8133       4194304    2048.00    0.016274   805.82     227.22     805.82     2
0000: Commencing write performance test: Tue May 19 17:25:38 2015
0000: write     9374       4194304    2048.00    0.546189   699.13     290.45     699.14     3
0000: Commencing read performance test: Tue May 19 17:37:17 2015
0000: read      8077       4194304    2048.00    0.018348   811.40     277.54     811.40     3
0000: Commencing write performance test: Tue May 19 17:50:49 2015
0000: write     9244       4194304    2048.00    0.538646   708.96     277.09     708.96     4
0000: Commencing read performance test: Tue May 19 18:02:38 2015
0000: read      7985       4194304    2048.00    0.018073   820.77     250.16     820.77     4
0000:
0000: Max Write: 9373.82 MiB/sec (9829.16 MB/sec)
0000: Max Read:  9502.04 MiB/sec (9963.61 MB/sec)
0000:
```

```
0000: Summary of all tests:
0000: Operation   Max(MiB)   Min(MiB)  Mean(MiB)     StdDev    Mean(s) Test# #Tasks tPN reps fPP
reord reordoff reordrand seed segcnt blksiz xsize aggsize API RefNum
0000: write        9373.82    8283.49    8861.66     460.88  741.58247 0 1600 16 5 1 0 1 0 0 1
4294967296 2097152 6871947673600 POSIX 0
0000: read         9502.04    7984.66    8417.93     558.79  781.70387 0 1600 16 5 1 0 1 0 0 1
4294967296 2097152 6871947673600 POSIX 0
0000:
0000: Finished: Tue May 19 18:16:18 2015
```

CLIO Simplification mean read: 8107
CLIO Simplification mean write: 9082

```
0000: IOR-3.0.0: MPI Coordinated Test of Parallel I/O
0000:
0000: Began: Tue May 19 08:10:04 2015
0000: Command line used: /opt/ior-3.0.0/bin/ior -a POSIX -b 4g -o /p/l_wham/d0.ior.fpp/iorData -t
2m -v -C -w -r -W -i 5 -T 4320 -k -F
0000: Machine: Linux iwc1
0000: Start time skew across all tasks: 0.00 sec
0000:
0000: Test 0 started: Tue May 19 08:10:04 2015
0000: Path: /p/l_wham/d0.ior.fpp
0000: FS: 828.5 TiB   Used FS: 0.0%   Inodes: 6144.0 Mi   Used Inodes: 0.0%
0000: Participating tasks: 1600
0000: Using reorderTasks '-C' (expecting block, not cyclic, task assignment)
0000: Summary:
0000:   api                = POSIX
0000:   test filename      = /p/l_wham/d0.ior.fpp/iorData
0000:   access             = file-per-process
0000:   pattern            = segmented (1 segment)
0000:   ordering in a file = sequential offsets
0000:   ordering inter file= constant task offsets = 1
0000:   clients            = 1600 (16 per node)
0000:   repetitions        = 5
0000:   xfersize           = 2 MiB
0000:   blocksize          = 4 GiB
0000:   aggregate filesize = 6400 GiB
0000:
0000: access    bw(MiB/s)  block(KiB) xfer(KiB)  open(s)    wr/rd(s)   close(s)   total(s)   iter
0000: ------    ---------  ---------- ---------  --------   --------   --------   --------   ----
0000: Commencing write performance test: Tue May 19 08:10:05 2015
0000: write     8196       4194304    2048.00    0.550534   799.63     0.018160   799.65     0
0000: Verifying contents of the file(s) just written.
0000: Tue May 19 08:23:24 2015
0000:
0000: Commencing read performance test: Tue May 19 08:36:02 2015
0000: read      8578       4194304    2048.00    0.033552   763.99     0.030871   764.02     0
0000: Commencing write performance test: Tue May 19 08:48:47 2015
0000: write     9015       4194304    2048.00    2.44       726.96     0.018863   726.98     1
0000: Verifying contents of the file(s) just written.
0000: Tue May 19 09:00:53 2015
0000:
0000: Commencing read performance test: Tue May 19 09:14:13 2015
0000: read      8132       4194304    2048.00    0.031640   805.84     0.033794   805.87     1
0000: Commencing write performance test: Tue May 19 09:27:40 2015
0000: write     9300       4194304    2048.00    0.540365   704.66     0.017112   704.68     2
0000: Verifying contents of the file(s) just written.
0000: Tue May 19 09:39:24 2015
0000:
0000: Commencing read performance test: Tue May 19 09:53:00 2015
0000: read      8006       4194304    2048.00    0.034262   818.51     0.031989   818.54     2
0000: Commencing write performance test: Tue May 19 10:06:39 2015
0000: write     9479       4194304    2048.00    1.29       691.35     0.021143   691.37     3
0000: Verifying contents of the file(s) just written.
0000: Tue May 19 10:18:10 2015
0000:
0000: Commencing read performance test: Tue May 19 10:31:59 2015
0000: read      7835       4194304    2048.00    0.032578   836.43     0.035894   836.46     3
0000: Commencing write performance test: Tue May 19 10:45:56 2015
0000: write     9424       4194304    2048.00    0.549726   695.43     0.016050   695.45     4
0000: Verifying contents of the file(s) just written.
0000: Tue May 19 10:57:31 2015
0000:
0000: Commencing read performance test: Tue May 19 11:11:22 2015
0000: read      7987       4194304    2048.00    0.031731   820.50     0.029160   820.53     4
0000:
```

```
0000: Max Write: 9479.12 MiB/sec (9939.58 MB/sec)
0000: Max Read:  8577.74 MiB/sec (8994.41 MB/sec)
0000:
0000: Summary of all tests:
0000: Operation   Max(MiB)   Min(MiB)  Mean(MiB)     StdDev    Mean(s) Test# #Tasks tPN reps fPP
reord reordoff reordrand seed segcnt blksiz xsize aggsize API RefNum
0000: write        9479.12    8195.57    9082.64     471.63  723.62615 0 1600 16 5 1 1 1 0 0 1
4294967296 2097152 6871947673600 POSIX 0
0000: read         8577.74    7834.90    8107.69     253.29  809.08573 0 1600 16 5 1 1 1 0 0 1
4294967296 2097152 6871947673600 POSIX 0
0000:
0000: Finished: Tue May 19 11:25:02 2015
```

IOR, Single Client, File Per Process (FPP)

2.6.0 mean read: 1843 MB/s

2.6.0 mean write: 2563 MB/s

```
00: IOR-3.0.0: MPI Coordinated Test of Parallel I/O
00:
00: Began: Tue May 19 15:33:42 2015
00: Command line used: /opt/ior-3.0.0/bin/ior -a POSIX -b 4g -o /p/l_wham/d0.ior.fpp/iorData -t
2m -v -w -r -i 5 -T 4320 -k -F
00: Machine: Linux iwc1
00: Start time skew across all tasks: 0.00 sec
00:
00: Test 0 started: Tue May 19 15:33:42 2015
00: Path: /p/l_wham/d0.ior.fpp
00: FS: 828.5 TiB   Used FS: 0.0%   Inodes: 6144.0 Mi   Used Inodes: 0.0%
00: Participating tasks: 16
00: Summary:
00:    api                = POSIX
00:    test filename      = /p/l_wham/d0.ior.fpp/iorData
00:    access             = file-per-process
00:    pattern            = segmented (1 segment)
00:    ordering in a file = sequential offsets
00:    ordering inter file= no tasks offsets
00:    clients            = 16 (16 per node)
00:    repetitions        = 5
00:    xfersize           = 2 MiB
00:    blocksize          = 4 GiB
00:    aggregate filesize = 64 GiB
00:
00: access    bw(MiB/s)  block(KiB) xfer(KiB)  open(s)    wr/rd(s)   close(s)   total(s)   iter
00: ------    ---------  ---------- ---------  --------   --------   --------   --------   ----
00: Commencing write performance test: Tue May 19 15:33:42 2015
00: write     2892.01    4194304    2048.00    0.021270   22.66      2.73       22.66      0
00: Commencing read performance test: Tue May 19 15:34:05 2015
00: read      1734.88    4194304    2048.00    0.034651   37.77      1.84       37.78      0
00: Commencing write performance test: Tue May 19 15:34:43 2015
00: write     2512.79    4194304    2048.00    0.036783   26.08      2.24       26.08      1
00: Commencing read performance test: Tue May 19 15:35:09 2015
00: read      1873.04    4194304    2048.00    0.021823   34.99      2.96       34.99      1
00: Commencing write performance test: Tue May 19 15:35:44 2015
00: write     2484.16    4194304    2048.00    0.038491   26.38      3.81       26.38      2
00: Commencing read performance test: Tue May 19 15:36:10 2015
00: read      1875.19    4194304    2048.00    0.006283   34.95      2.51       34.95      2
00: Commencing write performance test: Tue May 19 15:36:45 2015
00: write     2455.42    4194304    2048.00    0.043362   26.69      4.15       26.69      3
00: Commencing read performance test: Tue May 19 15:37:12 2015
00: read      1872.96    4194304    2048.00    0.006443   34.99      2.00       34.99      3
00: Commencing write performance test: Tue May 19 15:37:47 2015
00: write     2474.11    4194304    2048.00    0.016318   26.49      2.89       26.49      4
00: Commencing read performance test: Tue May 19 15:38:14 2015
00: read      1862.33    4194304    2048.00    0.006630   35.19      1.68       35.19      4
00:
00: Max Write: 2892.01 MiB/sec (3032.49 MB/sec)
00: Max Read:  1875.19 MiB/sec (1966.28 MB/sec)
00:
00: Summary of all tests:
00: Operation   Max(MiB)   Min(MiB)  Mean(MiB)     StdDev    Mean(s) Test# #Tasks tPN reps fPP
reord reordoff reordrand seed segcnt blksiz xsize aggsize API RefNum
00: write        2892.01    2455.42    2563.70     165.20   25.66053 0 16 16 5 1 0 1 0 0 1
4294967296 2097152 68719476736 POSIX 0
00: read         1875.19    1734.88    1843.68      54.59   35.57894 0 16 16 5 1 0 1 0 0 1
4294967296 2097152 68719476736 POSIX 0
```

```
00:
00: Finished: Tue May 19 15:38:49 2015
```

CLIO Simplification mean read: 1972 MB/s (Hyperion)

CLIO Simplification mean write: 2252 MB/s (Hyperion)

```
00: IOR-3.0.0: MPI Coordinated Test of Parallel I/O
00:
00: Began: Tue May 19 07:24:57 2015
00: Command line used: /opt/ior-3.0.0/bin/ior -a POSIX -b 4g -o /p/l_wham/d0.ior.fpp/iorData -t
2m -v -C -w -r -W -i 5 -T 4320 -k -F
00: Machine: Linux iwc1
00: Start time skew across all tasks: 0.00 sec
00:
00: Test 0 started: Tue May 19 07:24:57 2015
00: Path: /p/l_wham/d0.ior.fpp
00: FS: 828.5 TiB   Used FS: 0.0%   Inodes: 6144.0 Mi   Used Inodes: 0.0%
00: Participating tasks: 16
00: Using reorderTasks '-C' (expecting block, not cyclic, task assignment)
00: Summary:
00:    api                = POSIX
00:    test filename      = /p/l_wham/d0.ior.fpp/iorData
00:    access             = file-per-process
00:    pattern            = segmented (1 segment)
00:    ordering in a file = sequential offsets
00:    ordering inter file= constant task offsets = 1
00:    clients            = 16 (16 per node)
00:    repetitions        = 5
00:    xfersize           = 2 MiB
00:    blocksize          = 4 GiB
00:    aggregate filesize = 64 GiB
00:
00: access    bw(MiB/s)  block(KiB) xfer(KiB)  open(s)    wr/rd(s)   close(s)   total(s)   iter
00: ------    ---------  ---------- ---------  --------   --------   --------   --------   ----
00: Commencing write performance test: Tue May 19 07:24:57 2015
00: write     2554.97    4194304    2048.00    0.023868   25.64      0.003177   25.65      0
00: Verifying contents of the file(s) just written.
00: Tue May 19 07:25:23 2015
00:
00: Commencing read performance test: Tue May 19 07:25:55 2015
00: read      1944.18    4194304    2048.00    0.008003   33.70      0.003640   33.71      0
00: Commencing write performance test: Tue May 19 07:26:28 2015
00: write     2207.04    4194304    2048.00    0.017580   29.69      0.003684   29.69      1
00: Verifying contents of the file(s) just written.
00: Tue May 19 07:26:58 2015
00:
00: Commencing read performance test: Tue May 19 07:27:30 2015
00: read      1976.12    4194304    2048.00    0.030359   33.16      0.003031   33.16      1
00: Commencing write performance test: Tue May 19 07:28:03 2015
00: write     2169.67    4194304    2048.00    0.018068   30.20      0.003075   30.21      2
00: Verifying contents of the file(s) just written.
00: Tue May 19 07:28:33 2015
00:
00: Commencing read performance test: Tue May 19 07:29:05 2015
00: read      1959.00    4194304    2048.00    0.039940   33.45      0.003431   33.45      2
00: Commencing write performance test: Tue May 19 07:29:39 2015
00: write     2159.91    4194304    2048.00    0.018403   30.34      0.003539   30.34      3
00: Verifying contents of the file(s) just written.
00: Tue May 19 07:30:09 2015
00:
00: Commencing read performance test: Tue May 19 07:30:41 2015
00: read      2014.43    4194304    2048.00    0.010443   32.53      0.003206   32.53      3
00: Commencing write performance test: Tue May 19 07:31:13 2015
00: write     2169.41    4194304    2048.00    0.021038   30.21      0.003250   30.21      4
00: Verifying contents of the file(s) just written.
00: Tue May 19 07:31:43 2015
00:
00: Commencing read performance test: Tue May 19 07:32:15 2015
00: read      1970.96    4194304    2048.00    0.027161   33.25      0.002772   33.25      4
00:
00: Max Write: 2554.97 MiB/sec (2679.08 MB/sec)
00: Max Read:  2014.43 MiB/sec (2112.28 MB/sec)
00:
00: Summary of all tests:
```

```
00: Operation   Max(MiB)   Min(MiB)  Mean(MiB)     StdDev    Mean(s) Test# #Tasks tPN reps fPP
reord reordoff reordrand seed segcnt blksiz xsize aggsize API RefNum
00: write        2554.97    2159.91    2252.20     152.25   29.22024 0 16 16 5 1 1 1 0 0 1
4294967296 2097152 68719476736 POSIX 0
00: read         2014.43    1944.18    1972.94      23.48   33.22213 0 16 16 5 1 1 1 0 0 1
4294967296 2097152 68719476736 POSIX 0
00:
00: Finished: Tue May 19 07:32:49 2015
```

CLIO Simplification mean read: 1972 MB/s (OpenSFS test 1)

CLIO Simplification mean write: 2252 MB/s (OpenSFS test 1)

```
# mpirun -np 16 --allow-run-as-root src/ior -a POSIX -F -i 5 -b 4g -v -w -r -t 2m -O
"lustreStripeCount=6" -o /lustre/scratch/first_fpp.file
IOR-3.0.1: MPI Coordinated Test of Parallel I/O

Began: Thu Apr  9 21:07:07 2015
Command line used: src/ior -a POSIX -F -i 5 -b 4g -v -w -r -t 2m -O lustreStripeCount=6 -o
/lustre/scratch/first_fpp.file
Machine: Linux c11
Start time skew across all tasks: 0.00 sec

Test 0 started: Thu Apr  9 21:07:07 2015
Path: /lustre/scratch
FS: 3.3 TiB   Used FS: 0.1%   Inodes: 49.4 Mi   Used Inodes: 0.0%
Participating tasks: 16
Summary:
                api                = POSIX
                test filename      = /lustre/scratch/first_fpp.file
                access             = file-per-process
                pattern            = segmented (1 segment)
                ordering in a file = sequential offsets
                ordering inter file= no tasks offsets
                clients            = 16 (16 per node)
                repetitions        = 5
                xfersize           = 2 MiB
                blocksize          = 4 GiB
                aggregate filesize = 64 GiB
                Lustre stripe size = Use default
                      stripe count = 6

access    bw(MiB/s)  block(KiB) xfer(KiB)  open(s)    wr/rd(s)   close(s)   total(s)   iter
------    ---------  ---------- ---------  --------   --------   --------   --------   ----
Commencing write performance test: Thu Apr  9 21:07:07 2015
write     1027.45    4194304    2048.00    0.178993   63.64      1.92       63.79      0
Commencing read performance test: Thu Apr  9 21:08:11 2015
read      1866.69    4194304    2048.00    0.007009   35.11      2.64       35.11      0
remove    -          -          -          -          -          -          0.017267   0
Commencing write performance test: Thu Apr  9 21:08:46 2015
Commencing read performance test: Thu Apr  9 21:10:21 2015
write     686.73     4194304    2048.00    0.037184   95.43      2.39       95.43      1
read      1818.22    4194304    2048.00    0.021382   36.04      3.81       36.04      1
remove    -          -          -          -          -          -          0.011775   1
Commencing write performance test: Thu Apr  9 21:10:57 2015
write     977.80     4194304    2048.00    0.036464   67.02      3.73       67.02      2
Commencing read performance test: Thu Apr  9 21:12:04 2015
read      1808.71    4194304    2048.00    0.022793   36.23      3.30       36.23      2
remove    -          -          -          -          -          -          0.015670   2
Commencing write performance test: Thu Apr  9 21:12:41 2015
Commencing read performance test: Thu Apr  9 21:13:48 2015
write     972.19     4194304    2048.00    0.026325   67.41      2.16       67.41      3
read      1793.69    4194304    2048.00    0.023307   36.54      2.89       36.54      3
remove    -          -          -          -          -          -          0.023530   3
Commencing write performance test: Thu Apr  9 21:14:25 2015
write     970.24     4194304    2048.00    0.033871   67.54      2.95       67.55      4
Commencing read performance test: Thu Apr  9 21:15:32 2015
read      1806.52    4194304    2048.00    0.006800   36.28      3.67       36.28      4
remove    -          -          -          -          -          -          0.016251   4

Max Write: 1027.45 MiB/sec (1077.36 MB/sec)
Max Read:  1866.69 MiB/sec (1957.36 MB/sec)

Summary of all tests:
Operation   Max(MiB)   Min(MiB)  Mean(MiB)     StdDev    Mean(s) Test# #Tasks tPN reps fPP reord
reordoff reordrand seed segcnt blksiz xsize aggsize API RefNum
write        1027.45     686.73     926.88     121.91   72.23965 0 16 16 5 1 0 1 0 0 1 4294967296
```

```
2097152 68719476736 POSIX 0
read         1866.69    1793.69    1818.76      25.21   36.04009 0 16 16 5 1 0 1 0 0 1 4294967296
2097152 68719476736 POSIX 0

Finished: Thu Apr  9 21:16:09 2015
```

2.6.0 write: 2108 MB/s (OpenSFS test 2)

write 2108.54, 2084.76, 2075.78, 2079.94, 2080.44

CLIO Simplification write: 2101 MB/s (OpenSFS test 2)

write 2101.49, 2074.16□, 2083.86□, 2056.66□, 2066.63

IOR, Single Client, Single Shared File (SSF)

2.6.0 mean read: 1977 MB/s

2.6.0 mean write: 337 MB/s

```
00: IOR-3.0.0: MPI Coordinated Test of Parallel I/O
00:
00: Began: Tue May 19 15:44:26 2015
00: Command line used: /opt/ior-3.0.0/bin/ior -a POSIX -b 4g -o /p/l_wham/d0.ior.ssf/iorData -t
2m -v -w -r -i 5 -T 4320 -k
00: Machine: Linux iwc1
00: Start time skew across all tasks: 0.00 sec
00:
00: Test 0 started: Tue May 19 15:44:26 2015
00: Path: /p/l_wham/d0.ior.ssf
00: FS: 828.5 TiB   Used FS: 0.0%   Inodes: 6144.0 Mi   Used Inodes: 0.0%
00: Participating tasks: 16
00: Summary:
00:     api                = POSIX
00:     test filename      = /p/l_wham/d0.ior.ssf/iorData
00:     access             = single-shared-file
00:     pattern            = segmented (1 segment)
00:     ordering in a file = sequential offsets
00:     ordering inter file= no tasks offsets
00:     clients            = 16 (16 per node)
00:     repetitions        = 5
00:     xfersize           = 2 MiB
00:     blocksize          = 4 GiB
00:     aggregate filesize = 64 GiB
00:
00: access    bw(MiB/s)  block(KiB) xfer(KiB)  open(s)    wr/rd(s)   close(s)   total(s)   iter
00: ------    ---------  ---------- ---------  --------   --------   --------   --------   ----
00: Commencing write performance test: Tue May 19 15:44:26 2015
00: write     341.38     4194304    2048.00    0.014077   191.97     56.16      191.97     0
00: Commencing read performance test: Tue May 19 15:47:39 2015
00: read      2014.03    4194304    2048.00    0.007456   32.54      2.37       32.54      0
00: Commencing write performance test: Tue May 19 15:48:11 2015
00: write     336.11     4194304    2048.00    0.012973   194.97     57.19      194.98     1
00: Commencing read performance test: Tue May 19 15:51:26 2015
00: read      2005.08    4194304    2048.00    0.031526   32.68      2.36       32.69      1
00: Commencing write performance test: Tue May 19 15:51:59 2015
00: write     338.41     4194304    2048.00    0.014116   193.66     77.96      193.66     2
00: Commencing read performance test: Tue May 19 15:55:13 2015
00: read      1950.99    4194304    2048.00    0.006631   33.59      3.45       33.59      2
00: Commencing write performance test: Tue May 19 15:55:47 2015
00: write     337.90     4194304    2048.00    0.013124   193.95     77.92      193.95     3
00: Commencing read performance test: Tue May 19 15:59:01 2015
00: read      1940.67    4194304    2048.00    0.041497   33.77      2.07       33.77      3
00: Commencing write performance test: Tue May 19 15:59:35 2015
00: write     334.32     4194304    2048.00    0.012947   196.02     140.82     196.03     4
00: Commencing read performance test: Tue May 19 16:02:51 2015
00: read      1977.61    4194304    2048.00    0.027478   33.14      3.20       33.14      4
00:
00: Max Write: 341.38 MiB/sec (357.97 MB/sec)
00: Max Read:  2014.03 MiB/sec (2111.86 MB/sec)
00:
00: Summary of all tests:
00: Operation   Max(MiB)   Min(MiB)  Mean(MiB)     StdDev    Mean(s) Test# #Tasks tPN reps fPP
```

```
reord reordoff reordrand seed segcnt blksiz xsize aggsize API RefNum
00: write         341.38     334.32     337.63       2.37  194.11815 0 16 16 5 0 0 1 0 0 1
4294967296 2097152 68719476736 POSIX 0
00: read         2014.03    1940.67    1977.67      28.82   33.14497 0 16 16 5 0 0 1 0 0 1
4294967296 2097152 68719476736 POSIX 0
00:
00: Finished: Tue May 19 16:03:24 2015
```

CLIO Simplification mean read: 2003 MB/s

CLIO Simplification mean write: 1307 MB/s

```
00: IOR-3.0.0: MPI Coordinated Test of Parallel I/O
00:
00: Began: Tue May 19 07:55:46 2015
00: Command line used: /opt/ior-3.0.0/bin/ior -a POSIX -b 4g -o /p/l_wham/d0.ior.ssf/iorData -t
2m -v -C -w -r -W -i 5 -T 4320 -k
00: Machine: Linux iwc1
00: Start time skew across all tasks: 0.00 sec
00:
00: Test 0 started: Tue May 19 07:55:46 2015
00: Path: /p/l_wham/d0.ior.ssf
00: FS: 828.5 TiB   Used FS: 0.0%   Inodes: 6144.0 Mi   Used Inodes: 0.0%
00: Participating tasks: 16
00: Using reorderTasks '-C' (expecting block, not cyclic, task assignment)
00: Summary:
00:     api                = POSIX
00:     test filename      = /p/l_wham/d0.ior.ssf/iorData
00:     access             = single-shared-file
00:     pattern            = segmented (1 segment)
00:     ordering in a file = sequential offsets
00:     ordering inter file= constant task offsets = 1
00:     clients            = 16 (16 per node)
00:     repetitions        = 5
00:     xfersize           = 2 MiB
00:     blocksize          = 4 GiB
00:     aggregate filesize = 64 GiB
00:
00: access    bw(MiB/s)  block(KiB) xfer(KiB)  open(s)    wr/rd(s)   close(s)   total(s)   iter
00: ------    ---------  ---------- ---------  --------   --------   --------   --------   ----
00: Commencing write performance test: Tue May 19 07:55:46 2015
00: write     1373.75    4194304    2048.00    0.015149   47.70      0.000593   47.71      0
00: Verifying contents of the file(s) just written.
00: Tue May 19 07:56:33 2015
00:
00: Commencing read performance test: Tue May 19 07:57:06 2015
00: read      1990.14    4194304    2048.00    0.013006   32.93      0.000667   32.93      0
00: Commencing write performance test: Tue May 19 07:57:39 2015
00: write     1255.88    4194304    2048.00    0.029460   52.18      0.000764   52.18      1
00: Verifying contents of the file(s) just written.
00: Tue May 19 07:58:31 2015
00:
00: Commencing read performance test: Tue May 19 07:59:03 2015
00: read      1990.26    4194304    2048.00    0.022508   32.93      0.001009   32.93      1
00: Commencing write performance test: Tue May 19 07:59:36 2015
00: write     1275.14    4194304    2048.00    0.012213   51.39      0.005362   51.40      2
00: Verifying contents of the file(s) just written.
00: Tue May 19 08:00:28 2015
00:
00: Commencing read performance test: Tue May 19 08:01:00 2015
00: read      1998.43    4194304    2048.00    0.012318   32.79      0.000484   32.79      2
00: Commencing write performance test: Tue May 19 08:01:33 2015
00: write     1342.20    4194304    2048.00    0.013019   48.82      0.000821   48.83      3
00: Verifying contents of the file(s) just written.
00: Tue May 19 08:02:21 2015
00:
00: Commencing read performance test: Tue May 19 08:02:54 2015
00: read      2009.70    4194304    2048.00    0.013355   32.61      0.006915   32.61      3
00: Commencing write performance test: Tue May 19 08:03:26 2015
00: write     1290.05    4194304    2048.00    0.049230   50.80      0.000824   50.80      4
00: Verifying contents of the file(s) just written.
00: Tue May 19 08:04:17 2015
00:
00: Commencing read performance test: Tue May 19 08:04:50 2015
00: read      2028.01    4194304    2048.00    0.012455   32.31      0.004848   32.32      4
00:
```

```
00: Max Write: 1373.75 MiB/sec (1440.48 MB/sec)
00: Max Read:  2028.01 MiB/sec (2126.52 MB/sec)
00:
00: Summary of all tests:
00: Operation   Max(MiB)   Min(MiB)  Mean(MiB)     StdDev    Mean(s) Test# #Tasks tPN reps fPP
reord reordoff reordrand seed segcnt blksiz xsize aggsize API RefNum
00: write        1373.75    1255.88    1307.40      43.84   50.18260 0 16 16 5 0 1 1 0 0 1
4294967296 2097152 68719476736 POSIX 0
00: read         2028.01    1990.14    2003.31      14.27   32.71553 0 16 16 5 0 1 1 0 0 1
4294967296 2097152 68719476736 POSIX 0
00:
00: Finished: Tue May 19 08:05:22 2015
```

mdtest, Single Client

2.6.0

```
00: -- started at 05/18/2015 13:42:16 --
00:
00: mdtest-1.8.3 was launched with 16 total task(s) on 1 nodes
00: Command line used: /opt/mdtest-1.8.3/bin/mdtest -d /p/l_wham/d0.mdtest -i 5 -n 50000
00: Path: /p/l_wham
00: FS: 828.5 TiB   Used FS: 0.0%   Inodes: 6144.0 Mi   Used Inodes: 0.0%
00:
00: 16 tasks, 800000 files/directories
00:
00: SUMMARY: (of 5 iterations)
00:    Operation                  Max        Min       Mean    Std Dev
00:    ---------                  ---        ---       ----    -------
00:    Directory creation:   3684.698   3507.675   3578.251     58.828
00:    Directory stat    :   3134.159   3059.594   3105.373     28.390
00:    Directory removal :   3111.133   2930.473   3040.936     64.080
00:    File creation     :   2386.979   2376.579   2380.636      3.645
00:    File stat         :   2899.264   2883.098   2888.189      5.767
00:    File removal      :   2788.136   2742.206   2763.638     15.723
00:    Tree creation     :   3300.330   1901.141   2668.176    468.237
00:    Tree removal      :     37.720     35.154     36.332      0.952
00:
00: -- finished at 05/18/2015 15:59:31 –
```

CLIO Simplification

Only mean values of the test are available:

Test type	Date	Tag/branch	Backfstype	OSTs	Dir create	Dir stat	Dir rm	File create	File stat	File rm	Tree create	Tree rm
File per process	5/18/2015	CLIO	ldiskfs	52	3503	26975	3850	3010	25446	3751	199	14
Single shared file	5/18/2015	CLIO	ldiskfs	52	3703	3090	3026	2373	2845	2773	2661	35

mdtest, 100 Clients

2.6.0

```
0000: -- started at 05/18/2015 18:15:24 --
0000:
0000: mdtest-1.8.3 was launched with 1600 total task(s) on 100 nodes
0000: Command line used: /opt/mdtest-1.8.3/bin/mdtest -d /p/l_wham/d0.mdtest -i 5 -n 500
0000: Path: /p/l_wham
0000: FS: 828.5 TiB   Used FS: 0.0%   Inodes: 6144.0 Mi   Used Inodes: 0.0%
0000:
0000: 1600 tasks, 800000 files/directories
0000:
0000: SUMMARY: (of 5 iterations)
0000:    Operation                  Max        Min       Mean    Std Dev
0000:    ---------                  ---        ---       ----    -------
0000:    Directory creation:  13846.793   9804.456  12160.288   1498.798
0000:    Directory stat    :  56571.641  54919.670  55897.755    749.533
```

```
0000:    Directory removal :  20425.065  15329.699  17601.988   1869.762
0000:    File creation     :  12063.081   6851.853   8626.935   1783.476
0000:    File stat         :  57730.217  57414.048  57578.375    133.341
0000:    File removal      :  21391.639  19822.020  20437.112    592.529
0000:    Tree creation     :    293.169     90.400    245.443     77.746
0000:    Tree removal      :     33.466     29.944     31.918      1.377
0000:
0000: -- finished at 05/18/2015 18:38:26 --
```

CLIO Simplification mean values:

Only mean values of the test are available:

Test type	Date	Tag/branch	Backfstype	OSTs	Dir create	Dir stat	Dir rm	File create	File stat	File rm	Tree create	Tree rm
File per process	5/18/2015	CLIO	Ldiskfs	52	20218	81772	33786	18569	83269	38015	10.9	7
Single shared file	5/18/2015	CLIO	ldiskfs	52	11928	55872	16977	14511	57353	20798	245	30