Experiences with 10 Months HP SFS / Lustre in HPC Production

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Outline

» Status

» Problems

» Positive aspects

» Troubleshooting

» Performance of OSS components
HP SFS on SSCK's HP XC6000

120 Itanium clients

MDS and Admin for 
$HOME$ and $WORK$

- Allows > 50 million files

$HOME$
- 3.8 TB storage

$WORK$
- 7.6 TB storage

Legend

Admin: Administration Server
MDS: Metadata Server
OSS: Object Storage Server
EVA: EVA5000 storage array
C: Client
Status of HP SFS at SSCK (1)

» Production started in January 2005
  - HP SFS was used for home directories from the beginning
    • This was a good decision!

» HP SFS software version is still 1.1-1
  - Over time, 5 patches were installed
    • see following slides
  - SFS version 2.0 was not installed because of XC version 2.1 dependency
    • Waiting for XC version 3 in order to do migration install from XC version 2.0
    • Different SFS versions on client and server are currently not supported

» A lot of storage hardware had to be replaced
  - 15 FC disks and 3 EVA controllers
    • This is much more than expected by the MTBF
Status of HP SFS at SSCK (2)

» Interconnect adapter on servers is single point of failure
  - Heartbeat between server pairs uses shared storage
    • Room for improvement in future SFS version

» Both file systems were heavily used
  - One user group was doing most of the IO
    • Parts of their applications now use local disks
    • This means more bandwidth is available for other users

» Problem management system at www.itrc.hp.com is bad
  - Updates are not sorted by date
  - Information is manually copied between 2 different systems
    • QuIX and WFM
    • This causes delay or information to be lost

» HP SFS is pretty stable and stability has improved
Problems with HP SFS version 1.1-1 (1)

» MDS stopped working and had to be manually rebooted
   ➢ Bugs in LDLM locking caused all ll_mdt threads to become hung
     • Fixed with patch SFSV1.1-1-153-26-70

» OSS dumped frequently
   ➢ LBUG in filter_grant_sanity_check()
     • Fixed with patch SFSV1.1-1-1000233568

» Filesystem hangs because server lost Quadrics connection
   ➢ Installed new Quadrics driver to further investigate problem
     • Problem happened 3 times

» File system did not start after reboot of server pair
   ➢ Bugs in hpls-clumanager and hpls-db
     • Fixed with patch SFSV1.1-1-1000240369
Problems with HP SFS version 1.1-1 (2)

» HP SFS logging did not work
  ➢ Lots of harmless error messages filled up eventlog
    • Fixed with patch SFSV1.1-1-1000243131
  ➢ 2 GB limit of eventlog

» Sometimes EVA controller failover did not work
  ➢ This caused IO errors in applications
  ➢ New FC drivers were installed
    • Fixed with patch SFSV1.1-1-1000279279-290319
  ➢ After storage problems OST luns might be mounted read-only

» Patch installation decreased HP SFS throughput by 30 %
  ➢ Problem is still under investigation
Positive aspects

» Pretty long periods without major problems
  ➢ Until summer one month, now up to 3 months
    • OSS failover usually after few weeks
    • Failover usually worked
  ➢ Only 3 of the 7 problems were really critical
    • MDS hangs, Quadrics adapter failure, and failing EVA controller failover

» Most problems simply caused file system and applications to hang
  ➢ Time limit of some batch jobs had to be extended
  ➢ Most times only $WORK file system was affected

» High level support was good
  ➢ Was able to fix all main problems
Troubleshooting HP SFS (1)

» Check for SFS server errors during the last 4 days
  ➢ evlview -m -f 'age < 4' | grep -i LustreError
    • If no errors are reported everything works fine
    • Otherwise error messages can be critical or insignificant

» Check if SFS services are balanced
  ➢ echo "show server" | sfsmgr

» Check status of services
  ➢ echo "show filesystem" | sfsmgr

» Check if enough local disk space is available on south4
  ➢ ssh south4 df /var/log/dump
    • Filesystem /local on OSS is hidden

» Check for Lustre error messages on a XC client
  ➢ grep -i LustreError /var/log/`hostname`
Troubleshooting HP SFS (2)

» Check on client if file system throughput is normal
  ➢ time dd if=/dev/zero of=testfile bs=1M count=10000

» Explanation of some Lustre error messages:
  ➢ Sep 14 01:35:54 xc1-ls3-adm kernel: LustreError: 4147:0:
    (filter_io_24.c:172:filter_direct_io()) **short write**? expected 524288, wrote –5
    • Writes are failing, i.e. you might have a critical problem with your storage
  ➢ Sep 14 01:35:57 xc1-ls3-adm kernel: Lustre: 4144:0:
    (debug.c:244:portals_run_upcall()) Invoked portals_upcall /
    usr/opt/hpls/bin/hpls_upcall *LBUG*,filter_io_24.c,filter_commitrw_write,343
    • An LBUG triggers a failover, i.e. the server will probably go down
  ➢ Oct 27 08:40:51 xc1-ls7-adm kernel: LustreError: 3348:0:
    (ldlm_lockd.c:318:ldlm_failed_ast()) ### **blocking AST failed** (-107): evicting
    client c7774_data_e03790ea4e@NET_0x166_UUID NID 0x166 (0:358) …
    • Client with Quadrics node id 358 fails to relinquish a lock in time
    • Possible reason is client shutdown without unmounting cleanly
Performance of OSS components

» Quadrics Elan4
  - Internally about 1300 MB/s
  - Only PCI-X adapters exist

» PCI-X bus on servers
  - About 900 MB/s

» Dual-ported FC adapter
  - About 195 MB/s
  - Actually only 1 port is used

» EVA5000 storage array
  - About 120 MB/s for writes
  - Nearly 500 MB/s for reads

![Bar chart showing throughput for different components.](chart.png)
Summary

» It’s not easy to understand Lustre messages
  ➢ Better documentation of error messages is necessary

» Advantages of HP SFS compared to free Lustre:
  ➢ Additional software for failover and ease of administration
  ➢ Good support

» Performance is sufficient for our current applications
  ➢ Performance monitoring can help to improve applications
    • It can also help to identify system problems

» Stability of HP SFS was good and seems to be improving
  ➢ We had expected to run into more problems

» We can recommend HP SFS!