Going to Light Speed with DataWarp
An Administrators Perspective

Tina Declarck and Dave Paul
CUG 2016 – May 10, 2016
Hardware Description

- Hardware – 144 nodes
  - 2 SSDs per node
    - 4 devices - nvme
    - Intel P3608
  - Ability to increase endurance (DWPD)
    - Decreases available space
    - NERSC configured with 10 DWPD – default 3 DWPD
DataWarp configuration

- Uses DVS to project to compute nodes
  - Each DW node is a DVS server
  - Limits access to GPFS in CLE 5.2
- DW scheduler daemon
  - Runs on sdb
- ReSTful API – gunicorn
  - Runs on mom/login node
  - Uses nginx as the http server
User access

• Assigned 2 ways
  – Per job
  – Persistent
• #DW directives in job scripts
  – Private mode
  – Striped
  – Type: currently only scratch supported
  – How much space needed
• Pools define a set of DataWarp nodes with a specific configuration
• DataWarp supports multiple pools
  – Native SLURM does NOT
• Granularity is configured at the node and pool levels
  – Pool granularity defines the smallest unit that can be allocated per node
Sessions, Instances, and Fragments

• Session
  – Equates to a job ID

• Instance
  – DataWarp space allocated to a job or persistent over many jobs

• Fragment
  – Portions of the instance on each node allocated to it
But wait, there’s more…

• Configuration
  – Defines how a DW instance is used

• Namespace
  – A configuration can have 0 or more namespaces
  – Basically a directory or folder in a scratch configuration
We’re not done yet…

• Registration
  – Binds a session with a configuration
  – Maintains information for stage-in/stage-out

• Activation
  – An available instance configuration on a set of nodes
Putting it all together

96 node job
DW striped
Type=scratch

8 node job
Type=private

Type=scratch
persistent
striped

POOL
### General problem solving - dwstat

<table>
<thead>
<tr>
<th>sess state</th>
<th>token</th>
<th>creator</th>
<th>owner</th>
<th>created</th>
<th>expiration</th>
<th>nodes</th>
<th>confs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2520</td>
<td>CA----</td>
<td>myBBname</td>
<td>CLI 3333</td>
<td>2016-02-19T13:45:33</td>
<td>never</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>3041</strong></td>
<td>CA----</td>
<td>u1_bb1</td>
<td>CLI 11111</td>
<td>2016-03-02T15:01:01</td>
<td>never</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>6185</td>
<td>CA----</td>
<td></td>
<td>SLURM 55555</td>
<td>2016-05-09T07:13:58</td>
<td>never</td>
<td>96</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>inst state</th>
<th>sess</th>
<th>bytes</th>
<th>nodes</th>
<th>created</th>
<th>expiration</th>
<th>intact</th>
<th>label</th>
<th>public</th>
<th>confs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2234</td>
<td>CA---</td>
<td>2520 212.91GiB</td>
<td>1</td>
<td>2016-02-19T13:45:33</td>
<td>never</td>
<td>true</td>
<td>myBBname</td>
<td>true</td>
<td>1</td>
</tr>
<tr>
<td><strong>2550</strong></td>
<td>CA---</td>
<td><strong>3041</strong> 1.04TiB</td>
<td>5</td>
<td>2016-03-02T15:01:02</td>
<td>never</td>
<td>true</td>
<td>u1_bb1</td>
<td>true</td>
<td>1</td>
</tr>
<tr>
<td>5534</td>
<td>CA---</td>
<td>6185 1.87TiB</td>
<td>9</td>
<td>2016-05-09T07:13:58</td>
<td>never</td>
<td>true</td>
<td>l6185-0</td>
<td>false</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>conf state</th>
<th>inst</th>
<th>type</th>
<th>access_type</th>
<th>activs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2505</td>
<td>CA---</td>
<td>2234</td>
<td>scratch</td>
<td>stripe</td>
</tr>
<tr>
<td><strong>2821</strong></td>
<td>CA---</td>
<td><strong>2550</strong></td>
<td>scratch</td>
<td>stripe</td>
</tr>
<tr>
<td>5811</td>
<td>CA---</td>
<td>5534</td>
<td>scratch</td>
<td>stripe</td>
</tr>
</tbody>
</table>
• reg state sess conf wait
  • 5877 CA--- 6114 5764 true
  • 5890 CA--- 6131 5773 true
  • 5943 CA--- 6185 5811 true

• activ state sess conf nodes mount
  • 5732 CA--- 6185 5811  96 /var/opt/cray/dws/mounts/batch/2128492/ss

• frag state inst capacity gran node
  • 61382 CA-- 2234 212.91GiB 4MiB nid00457
  • 73696 CA-- 2550 212.91GiB 4MiB nid02249
  • 73697 CA-- 2550 212.91GiB 4MiB nid00205
  • 73698 CA-- 2550 212.91GiB 4MiB nid01801
  • 73699 CA-- 2550 212.91GiB 4MiB nid00014
  • 73700 CA-- 2550 212.91GiB 4MiB nid01169
  • 165142 CA-- 5487 425.81GiB 4MiB nid01418
• ns state conf frag span
• 49200 CA-- 2505 61382 1
• 52607 CA-- 2821 73696 5
• 59484 CA-- 5764 165142 129

• States
  – Goal: C – create or D – destroy
  – Setup: A – actualized or – non-actualized
  – Condition: F – fuse blown or – fuse intact
  – Status: T – transitioning or – stable or blocked
  – Spectrum: M- mixed or – not delayed
Name=cray DefaultPool=wlm_pool Granularity=218016M TotalSpace=872936064M UsedSpace=234803232M StageInTimeout=86400 StageOutTimeout=86400 Flags=EnablePersistent,TeardownFailure GetSysState=/opt/cray/dw_wlm/default/bin/dw_wlm_cli

Allocated Buffers:
- Name=u1_bb1 CreateTime=2016-03-02T15:01:01 Size=1090080M State=allocated UserID=user1(11111)
- Name=u2_space CreateTime=2016-05-09T11:00:43 Size=1090080M State=allocated UserID=user2(22222)
- Name=myBBname CreateTime=2016-02-19T13:45:33 Size=218016M State=allocated UserID=user3(33333)
- Name=u4_Test2 CreateTime=2016-05-05T18:31:36 Size=654048M State=allocated UserID=user4(44444)
- Name=u4_Test CreateTime=2016-05-05T16:01:02 Size=654048M State=allocated UserID=user4(44444)
- Name=u5_30TB CreateTime=2016-05-05T14:31:08 Size=31612320M State=allocated UserID=user5(55555)

Per User Buffer Use:
- UserID=user1(11111) Used=1090080M
- UserID=user2(22222) Used=1090080M
- UserID=user3(33333) Used=218016M
- UserID=user4(44444) Used=1962144M
- UserID=user5(55555) Used=31612320M
Job hung with processes in ‘D’ state

- Node stuck completing (most likely admindown if using Alps)
  - With SLURM log into the node to see what the problem is
  - Process hung in ‘D’ state on a DW instance
  - Get the job information and look at:
    - ‘dwstat sessions’ to find the session id
    - ‘dwstat instance’ to find the instance id
    - ‘dwstat fragments’ | grep <instance id>
  - Find the MDS node
    - Drain the node and reboot to clear the issue
DW server crash

• Dwstat shows a ‘D’estroy indicator that doesn’t clear
• “scontrol show burst” (SLURM) where “allocation” size=0 or state=teardown.
• Once the DW-server is rebooted most recovery issues are handled by the DWS software without need for further intervention.
Problem w/ size=0

- Silent problem
- Registration stuck in ‘D’ state and either T or M
- Dwcli rm activation - wait to see if that clears the issue
- Dwcli update registration - -id <num> - -no-wait
  - Can cause data loss if all data isn’t staged out
Log Files

• SMW – log per dw node + log for sdb
  – /var/opt/cray/log/p0-current/dws
  – /var/opt/cray/log/p0-current/console & message
    • Grep dw and xfs to see information
• On mom/login nodes
  – /var/log/nginx
Important Notes

- To create or destroy a persistent instance a compute node must be allocated
- Existing issues
  - Symbolic links don’t work
  - If there is an empty directory in the stage-in directory the stage-in will fail
- If max writes/day is reached the node will be set to read-only (ro)
- Check status of an SSD with xtcheckssd
This work was supported by the Director, Office of Science, Office of Advanced Scientific Computing Research of the U.S. Department of Energy under contract No. DEAC02-05CH11231.