Lustre in Practice

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Topics

- Buildling
- Configuring

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Pre-built rpms

- We provide pre-built rpms
  - For 1.6, RHEL4/5 & SLES9/10
  - For 1.8, RHEL5 & SLES10/11
  - For 2.0 (alpha version) RHEL5, SLES10, SLES11 (soon) & RHEL6 (when available)
    - subject to change
- Include OFED & TCP support
- Rebuilding rpms is needed if:
  - Need support for another interconnect (Myrinet, ...)
  - Need to apply kernel or lustre patches

Building lustre (server side)

- Kernel patches needed
  - Re-add journal callback support in jbd
  - Jbd fixes & statistics
  - scsi disk statistics
    - could be removed if blktrace enabled
  - Export some symbols used by lustre
  - API for setting block device read-only
  - ...
- First step is to apply those patches & build the patched kernel
  - Use quilt to manage patches
  - Patch series available in lustre/kernel_patches/series
  - Quilt setup /path/to/series, quilt push -a
  - kernel config files in lustre/kernel_patches/kernel_configs

Building lustre (server side)

- Once the kernel is built, we are ready to build the lustre rpms:
  - Get the lustre source
  - ./configure --with-linux=/path/to/kernel ..
  - make rpms
- This produces serveral rpms:
  - lustre-modules: the lustre kernel module
  - lustre-ldiskfs: ext3+patches
  - lustre-$version: utils (mkfs.lustre, mount.lustre, ...)
- Install the patched kernel + lustre/ldiskfs rpms on the servers (OSSs/MDSs)

Building lustre (client side)

- No kernel patches needed
  - except for RHEL4/SLES9
  - You can run the patched kernel on the clients if you wish
- Get the lustre source
  - ./configure --with-linux=/path/to/kernel --disable-server ..
  - make rpms
- Build the lustre rpms as previously:
  - ./configure --with-linux=/path/to/kernel
    --disable-server ..
  - Generate rpms with client only support
- Install the lustre rpms on the client nodes

Building lustre with DMU support

- No change
- ldiskfs rpm replaces by kDMU rpm
- kDMU integrated in lustre source
  - > built as part of lustre, like ldiskfs today
  - > only needed on OSS/MDS (again as ldiskfs)

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Supported Networks

- Any network running TCP
- Quadrics
  - Qsnet I & II
- Myrinet
  - gm & mx
- Infiniband
  - Old stacks: Topspin, infiniserv, OpenIB gen 1, Voltaire
  - OFED
- Seastar network
- Routing is supported via lnet gatweway
- Mutliple NIC support

Management node (MGS)

- By default just uses the MDT
  - Can be a different node
  - Can be failover
- Functionality
  - Supply configuration information to clients
  - Receive new nodes into the cluster
  - Notify other nodes that some configuration has changed
    - E.g. Dynamic addition of servers

Setting up a lustre filesystem

- mkfs.lustre & mount
- MDS – on mds1 node format

```
mkfs.lustre --mdt --mgs --fsname=scratch $dev
mount -t lustre $dev /mnt/mdt
```

- OSS

```
mkfs.lustre --ost --fsname=scratch --mgsnid=mds1@vib
  $dev
mount -t lustre $dev /mnt/ost1
```

- Clients

```
mount -t lustre mds1@vib:/scratch /scratch
```

Example: failover

- MDS – on mds1 node format:

```
mkfs.lustre --mdt --mgs --fsname=swgfs --param
  lov.stripecount=4 \
--param lov.stripesize=4194304 --failnode=mds2@vib $dev
```

  The failover software will execute a mount command like:

```
mount -t lustre $dev /mnt/mdt
```

- OSS

```
mkfs.lustre --ost --fsname=swgfs --failnode=ossY@vib \
--mgsnid=mds[1-2]@vib $dev
mount -t lustre $dev /mnt/ost1
```

- Clients

```
mount -t lustre mds[1-2]@vib:/swgfs /mnt/lustre
```

lfs stripe commands

- Default striping policy set with *mkfs.lustre*
- Files are striped at *creation time*
  - Until we have a data migrator, you can't change it post-creation
- lfs *setstripe* can adjust it on a per-directory basis
  - That becomes the default for new files in that directory
  - Some admins create /lustre/parallel for massive single-file I/O
    - With a stripe count of -1(all OSTs)
- *lfs setstripe* can also create individual files
- Can specify a specific OST pool
- Query with *lfs getstripe*

Adding an OST

- Format & mount
- QoS introduced in 1.6
  - Qos will fill empty OST's first
  - We will stripe cleverly, avoiding multiple stripes on one OSS etc.
- No automatic rebalancing yet

Dealing with a failed OST

```
mount -v   -o exclude=fsname-OST000N -t lustre mgs:/fsname
  /mnt/lustre
```

- This uses the server partition label
- The client will immediately return errors when trying to contact this OST
- This has the same effect as issuing

```
lctl --device N deactivate
```

- Here N is the OSC device on the client find it with

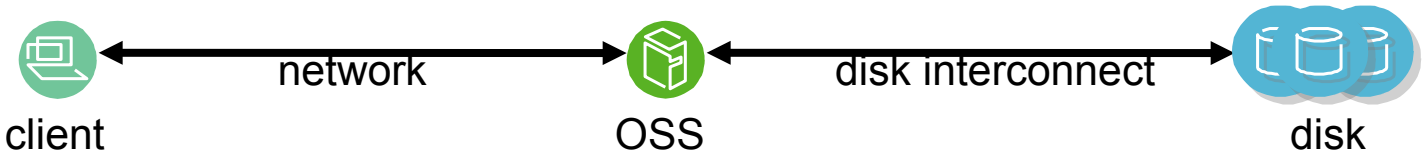
```
lctl dl
```

Stopping servers

- Umount
  - Unmount, keep failover state
  - Client can reconnect and continue after a remount
- Umount -f
  - Unmount, disconnect clients, cleanup failover state
  - Reconnecting clients are evicted
  - This is like NFS server reboots
  - Can sometimes give application errors

I/O Performance Pipeline

- Keep the entire pipeline balanced:



- Network BW should be equal to disk BW
- We reach benchmark rates of 85-90% of raw I/O
- Bus transfers – don't forget about them!
  - The client has one – memory to network
  - The OSS has two – network to memory, memory to SAN/controller