Providing large-scale disk storage

Herve Rousseau | on behalf of CERN IT Storage group
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EOS

Optimizing resource usage

Miscellaneous
CentOS7

How to upgrade ~1300 machines with minimal disruption?

Automation is key

- Rundeck: IT Operations management platform
- Leveraged components of CERN’s “Agile” infrastructure
- Only raise attention when stuck

~30 machines per day ⇒ 2 months
CentOS7

Upgrade between major OS releases (SLC6 to Centos7)

This workflow will pick machines not matching `operatingsystemmajorrelease` in PuppetDB and upgrade them.

**Prepare and Run...**

**Definition**

- **instance**
  - EOS instance name (without leading "eos")

- **Log level**
  - Normal
  - Debug
  - Debug level produces more output

Run Job Now
Namespace

Service grows faster than available hardware

Scale-up limitations

- Routine maintenance becomes a burden
- Boot time skyrockets

QuarkDB

“A highly available datastore with a Redis-like interface”
Namespace

See A. Manzi’s talk right after¹

¹https://indico.cern.ch/event/587955/contributions/2936873/
WLCG Accounting

EOS now generates SRR\(^2\) compatible JSON

```
{
  "numberoffiles" : 35551,
  "path" : [ "/eos/opstest/fts/tbtest/" ],
  "timestamp" : 1530540012,
  "totalsize" : 3000000000000,
  "usedsize" : 2928224959894,
  "vos" : [ "dteam" ]
}
```

\(^2\)Storage Resource Reporting:
https://indico.cern.ch/event/587955/contributions/2936951/
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EOS

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BEER (Batch on EOS Extra Resources)

See D. Smith’s talk$^3$

$^3$https://indico.cern.ch/event/587955/contributions/2937728/
“Monster” machines

Goal: Lower the server overhead

• EOS also has a lifecycle/workflow engine
• EOS has Erasure Coding support
• Target is cold-er data
“Monster” machines

Storage node

- Compute node
- 10 (or 40) Gbit/s network interface
- 4× SAS expander

Storage array (8x)

- Dummy SAS array
- 24× 12TB drives
Fault-detection

EOS data transfers

- Diskserver to diskserver traffic
- Users see strange errors on write() or close()

“It’s always the network!”
Fault-detection

Consul: distributed key-value store (and service catalog)

- Was meant for some internal experiment
- Nodes monitor each other
- Ended up identifying possible network problems

<table>
<thead>
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<th>Health Checks</th>
<th>Services</th>
<th>Round Trip Time</th>
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<tbody>
<tr>
<td>Minimum</td>
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<td></td>
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<tr>
<td>Median</td>
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<tr>
<td>Maximum</td>
<td>0.94ms</td>
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</table>

The diagram illustrates the distribution of round trip times with values ranging from 0.23ms to 0.94ms.
Fault-detection

2018/07/02 14:41:57 [WARN] memberlist: Was able to connect to lxfsrf16b03.cern.ch
but other probes failed, network may be misconfigured
2018/07/02 15:06:32 [WARN] memberlist: Was able to connect to lxfsrf16b03.cern.ch
but other probes failed, network may be misconfigured
2018/07/02 15:25:35 [WARN] memberlist: Was able to connect to lxfsrf16b03.cern.ch
but other probes failed, network may be misconfigured
2018/07/02 15:43:41 [WARN] memberlist: Was able to connect to lxfsrf16b03.cern.ch
but other probes failed, network may be misconfigured
2018/07/02 16:03:21 [WARN] memberlist: Was able to connect to lxfsrf16b03.cern.ch
but other probes failed, network may be misconfigured
<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>0.51ms</td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>0.72ms</td>
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<tr>
<td>Maximum</td>
<td>21.90ms</td>
<td></td>
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</table>

Circle diagram with radii indicating round trip times: 5.47ms, 10.95ms, 16.42ms, 21.90ms.
CASTOR: Still going strong
S3: Simple Storage Service

HTTP-based object store (AWS S3-like) based on Ceph

- Became an official service this year\(^a\)
- Pre-signed URLs, lifecycle policies, static websites
- \(~1\) PB using Erasure Coding

\(^a\)Mainly for disaster recovery use cases
NFS

Virtual NFS filer service

Currently

- Labour-intensive creation of new filers
- Performance doesn’t scale horizontally

Evolving to Openstack-based self-service using CephFS
HPC

See “CephFS for HPC” talk in 45 minutes

\[^4\text{https://indico.cern.ch/event/587955/contributions/2936868/}\]
Thank you!