Diskless Computing

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Background:

The purpose of a high performance computing cluster is to achieve the highest level of performance possible. In order to achieve this goal the number of components in most modern computer clusters has greatly increased resulting in lower reliability. Today, in an effort to increase reliability and reduce costs most extreme computing clusters are being built without hard drives. Removing the hard drives from a cluster creates an interesting problem since the nodes usually boot from the hard drive. In order to overcome this obstacle cluster administrators are using diskless management solutions to create a bootable image that is then used to provision the nodes. There are several competing diskless management solutions currently available for cluster administrators to use when building these diskless computing clusters. The two most popular diskless cluster management systems currently in use are Perceus and XCAT2.

Diskfull Cluster

A diskfull cluster is a cluster that boots each node from its hard drive. This means that any configuration changes must be done on each node making a disk full installation much harder to manage than a diskless installation.

Perceus Diskless Cluster

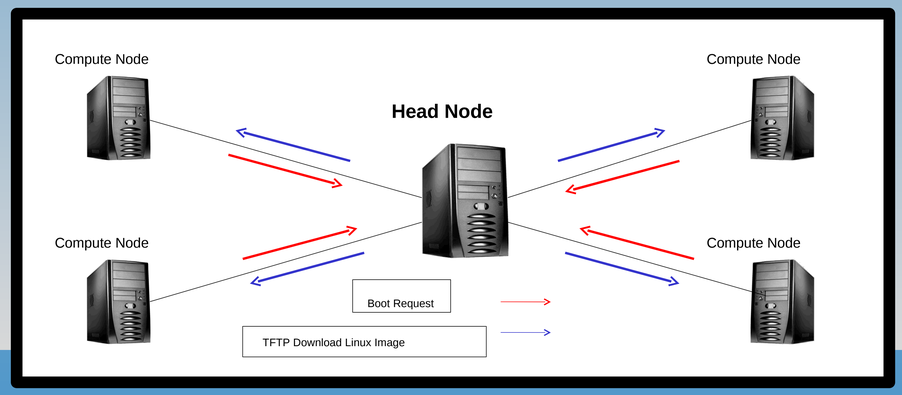
Perceus is a competing cluster management solution that can be used to create a diskless cluster. Perceus uses DHCP and PXEBoot to provision the node with their images. A major issue we faced with Perceus is that it did not support our hardware. In order to overcome this issue we had to use a modified kernel.

XCAT2 Diskless Cluster

XCAT2 is also a competing cluster management solution that can be used to create a diskless cluster. XCAT2 is the diskless management solution that is currently being used to manage the IBM Roadrunner.

Gluster File System

Gluster is a cluster file system that combines several storage systems via Infiniband or TCP/IP into one large parallel network file system. It requires disks; however the disks are solely used as storage, similar to a RAID system. On our cluster, the head node was the only that had a complete and fully functional operating system. Upon booting, the compute nodes simply load a small image of CentOS operating system using the Perseus diskless infrastructure.



Our Ratings:

Feature Comparison	Perceus	XCAT2	Disk Full
Documentation	7	5	9
Hard Drive Required	No	No	Yes
Node Installation Method	PXE Boot	PXE Boot	Kickstart
Reliability	8	8	6
Hardware Compatibility	5	7	10
Personal Preference	8	7	8
Time Required	6	7	4
Scalability	5	7	8
Feature Rating	39	41	45

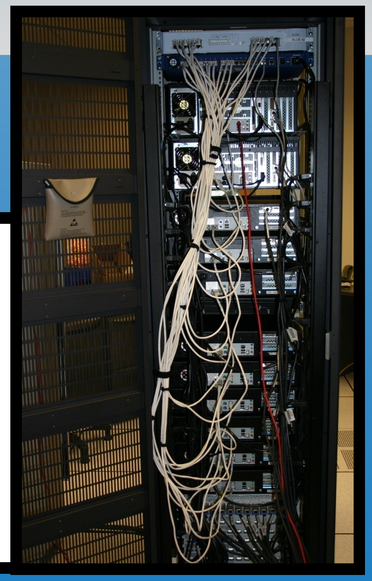
Scale: 1 = Poor 10 = Excellent

Difficulty of :	Perceus	XCAT2	Disk Full
System Installation	8	7	8
System Interface	9	5	8
Adding Nodes	10	7	7
Replacing Nodes	7	7	6
Node Configuration	9	7	6
Changing Node Image	9	7	6
Scheduler Implementation	3	6	7
Infiniband Installation	7	7	7
MPI Job Execution	8	8	8
Difficulty Rating	70	61	63
Overall Rating	109	102	108

Scale: 1 = Difficult 10 = Easy

Conclusion:

After setting up and comparing a diskfull cluster, a diskless cluster using Perceus and a diskless cluster using XCAT2 we found the best system management tool to be Perceus. Although we found that Perceus was the best solution for the cluster we built, this does not mean that it is the best solution for all clusters. From our experience Perceus is fairly easy to set up and will work well if you are building a simple cluster that you need to get running quickly. If you are building a larger more complicated cluster such as Roadrunner, Perceus will probably not work as well. In this type of cluster XCAT2 would be the preferable management tool. XCAT2 is more complicated to set up than Perceus, however it offers more flexibility when designing and implementing large clusters.



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