Study of Hadoop Deployment on Supercomputing Environment

Jae-Hyuck Kwak, Taesang Huh, Sangwan Kim and Soonwook Hwang*
*Korea Institute of Science and Technology Information, Republic of Korea
E-mail : {jhkwak,tshuh,sangwan,hwang}@kisti.re.kr

1. Introduction

As of today, scientific research is becoming more involved with large-scale data processing. Especially, instrument science such as astronomy, high-energy physics and bioinformatics has been generating tremendous scale of data from the scientific instrument. Hadoop[1] is an open source distributed data processing framework widely used by the enterprise computing to analyze large-scale of business data and to produce valuable business insight. Even though hadoop was designed to be suitable for low-cost commodity clusters, several open source software projects are on the way to use hadoop on supercomputing environment to support data-intensive science application.

In this paper, we have studied two kinds of open-source software, myHadoop[2] from SDSC and HOD[3] from Apache project for hadoop deployment on supercomputing environment. We conclude with thoughts about the prospects for using hadoop on supercomputing environment.

2. Hadoop Overview

Hadoop is a framework that allows for the distributed processing of large data sets across computer clusters using a simple programming model. It can be scaled up to thousands of machines, each offering local computation and storage and delivering a highly-available service on top of that, as shown in Figure 1. From the beginning, hadoop has been widely used by the internet business companies, particularly dependent on web data analytics. However, worldwide recognition of hadoop due to its scalable and fault-tolerant architecture and simple programming model attracted the attention of the data-intensive science communities.

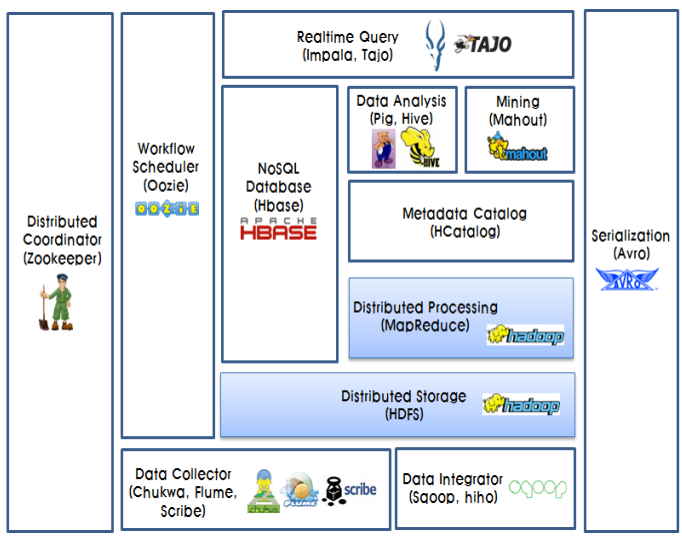

Figure 1. Hadoop Ecosystem

3. Challenges for adopting hadoop on traditional supercomputing environment

Hadoop uses cluster of machines, each offering local computation and storage connected by commodity network. However, this architecture differs from traditional supercomputing architecture. Figure 2 shows architectural comparison between enterprise computing environment and supercomputing environment. Traditional supercomputing environment uses batch queue system for the fair sharing of batch resources among different users and uses parallel distributed filesystem connected by high-performance interconnect for shared storage. This architectural difference makes it challenge hadoop running on supercomputing environment.

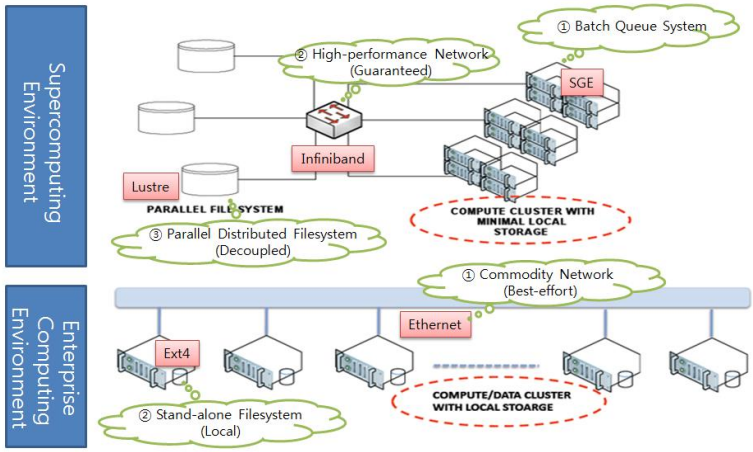

Figure 2. Architectural comparison between enterprise computing environment and supercomputing environment

4. myHadoop and HOD: Comparison and analysis

To run hadoop on supercomputing environment, it is necessary to run hadoop dynamically in the context of batch queue system. myHadoop and HOD are well-known software frameworks to set up hadoop environment dynamically using batch queue scheduler. Table 1 shows technology comparison and analysis of myHadoop and HOD.

[Table 1] Technology comparison between myHadoop and HOD

	myHadoop	HOD (Hadoop on Demand)
agent of development	SDSC	Apache project
batch queue system support	torque, sge, slurm	torque (but extensible)
language	bash	python
components	myhadoop-configure.sh, myhadoop-cleanup.sh (called in job script)	RingMaster(manager), HODRing (agent)
interface	No (called in job script)	CLI
shared filesystem support	Yes	No (external HDFS support)
config file	No (defined in job script)	Yes (hodrc)
log management	Yes (per-user managed)	Yes (collecting to a central location)
lifetime management	No (depends on job script)	Yes (auto-cleanup of unused clusters)

5. Conclusion and Future Plans

In this paper, we addressed challenges for adopting hadoop on traditional supercomputing environment. And then, we compared two well-known software frameworks to run hadoop on supercomputing environment. Enabling hadoop over shared storage is the other thing to consider. Shared parallel distributed filesystems such as Lustre, PVFS, GPFS, etc. are common for supercomputing environment. Related works[4,5] are on the way to enable hadoop over shared parallel distributed filesystem connected by high-performance interconnect.

PLSI (Partnership& Leadership for the nationwide Supercomputing Infrastructure) is the nationwide supercomputing resources infrastructure in Korea, connecting the geographically distributed supercomputing resources. Enabling hadoop on PLSI is our main interest. This might open the door to the potential science communities that uses hadoop as the baseline research infrastructure.

6. References

[1] Hadoop, http://hadoop.apache.org
[2] Krishnan, Sriram, Mahidhar Tatineni, and Chaitanya Baru. “myHadoop-Hadoop-on-Demand on Traditional HPC Resources.” SDSC Technical Report TR-2011-2, University of California, San Diego (2011).
[3] HOD Scheduler documentation, http://hadoop.apache.org/docs/r1.2.1/hod_scheduler.html.
[4] Zhiqi Tao, “Run Hadoop Map Reduce Jobs on Lustre”, LUG 2014, 2014.
[5] Islam, Nusrat S., et al. “High performance RDMA-based design of HDFS over InfiniBand.” Proceedings of the International Conference on High Performance Computing, Networking, Storage and Analysis. IEEE Computer Society Press, 2012.