Architecture of Job Management System Framework Leveraging Software Defined Networking

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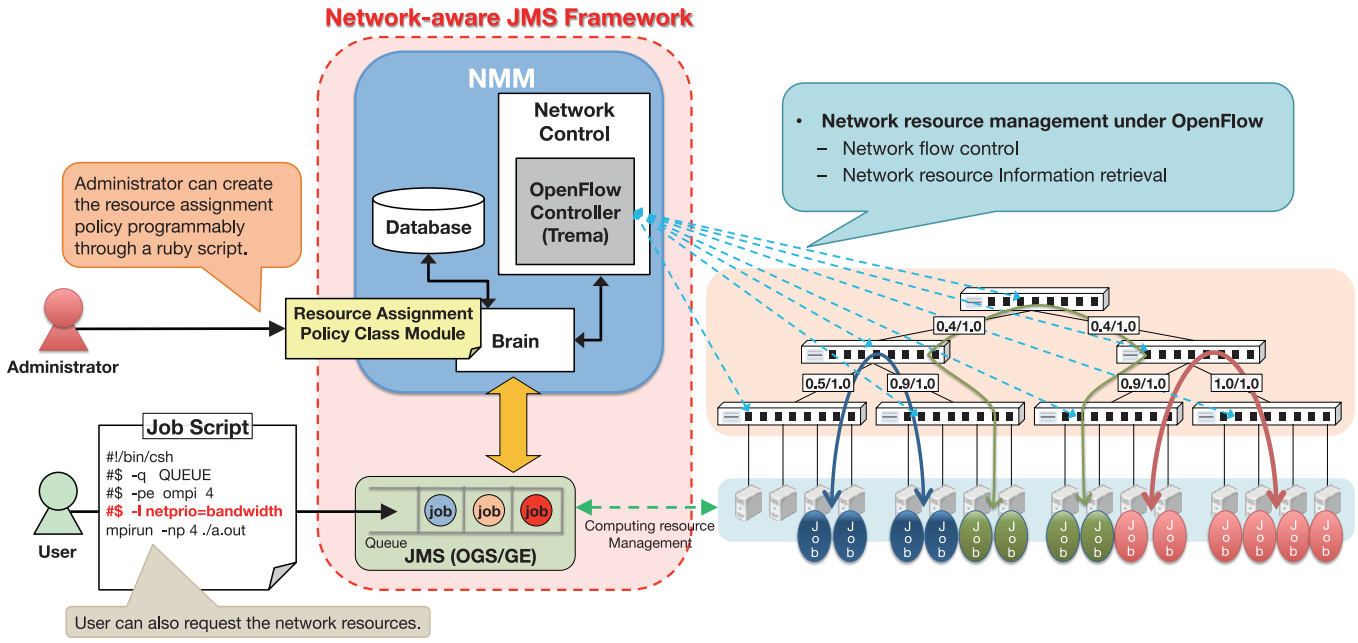
Motivation and Objectives

Network communication performance in high-performance computing environment such as cluster systems plays more important role due to a fact that parallel computation executes on the distributed multiple computing hosts. Since the resources of such computing environment are shared by multiple user jobs, efficient allocation of both network and computing resources to each job is necessary. However, most Job Management Systems (JMSs) available today, which determine the resource allocation to jobs on the computing environment, are not designed to consider status information on network resources. Therefore, we aim to realize network-aware JMS framework that can design the rule of resource allocation for both network and computing resources.

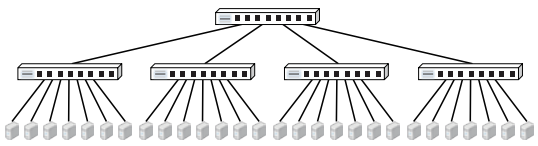
Proposed Network-aware Job Management System Framework

In order to realize a novel network-aware JMS Framework, we take advantage of ***Software Defined Networking (SDN)*** concept, which can dynamically administer an entire network in a centralized manner. The mechanisms to manage the network resources are designed and implemented as *Network Management module (NMM)* leveraging OpenFlow, which is an implementation of the SDN concept. A function to create a rule of resource allocation is provided by *Resource Assignment Policy Class Module.*



Evaluation

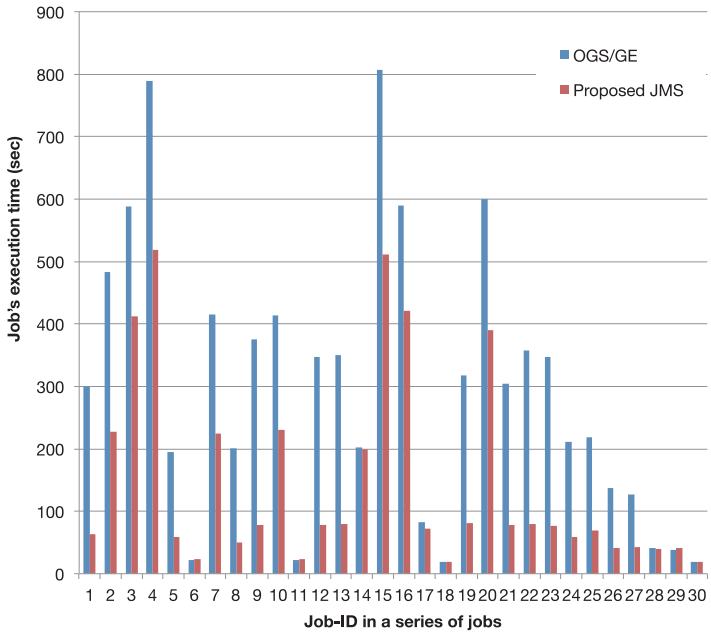
We conducted a measurement experiment to compare job's execution time in each jobs on a cluster system. In this experiment, we submitted a series of network-intensive jobs with the number of processes such as the following table. The resource assignment policy selected a set of computing hosts in which the total number of hops between each computing hosts is smallest. In the experimental result, our proposed network-aware JMS Framework succeeded in reducing the job's execution time by 44.8 percent on the average.



Cluster system configuration:
Each link are connected on a Gigabit Ethernet LAN.

The number of processes in each job.

Job-ID	1	2	3	4	5	6	7	8	9	10
Process	6	10	12	14	6	2	10	4	8	10
Job-ID	11	12	13	14	15	16	17	18	19	20
Process	2	8	8	4	14	12	4	2	8	12
Job-ID	21	22	23	24	25	26	27	28	29	30
Process	8	8	8	6	6	4	4	4	4	2



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