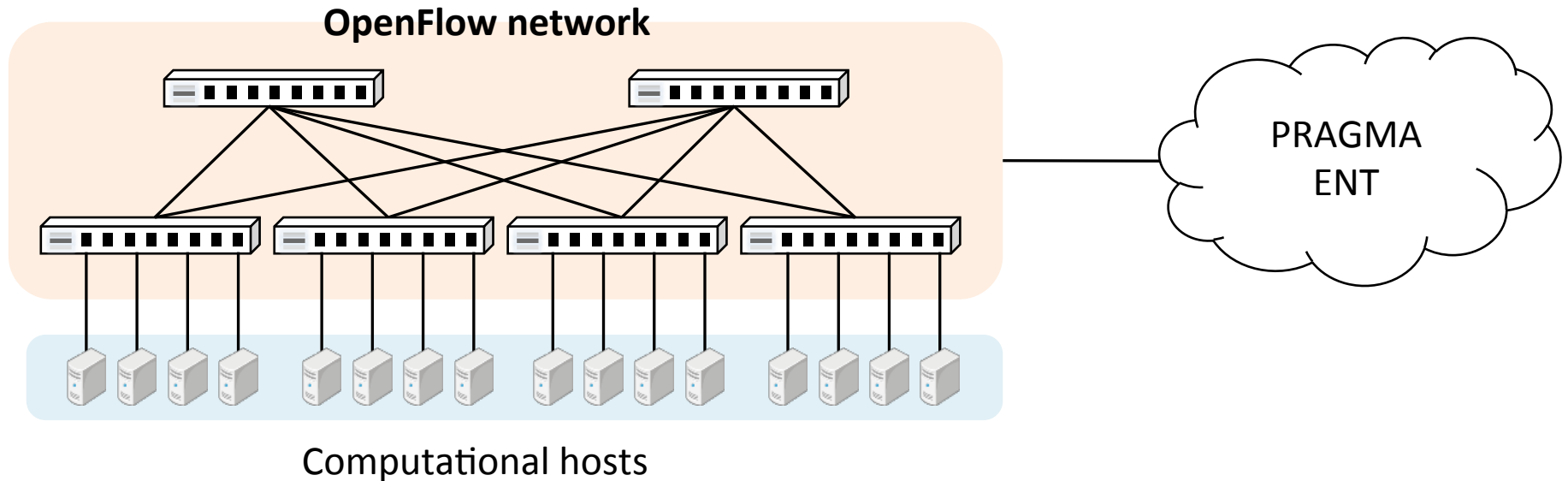# A Network-aware Job Management System Leveraging Software Defined Networking

Yasuhiro Watashiba
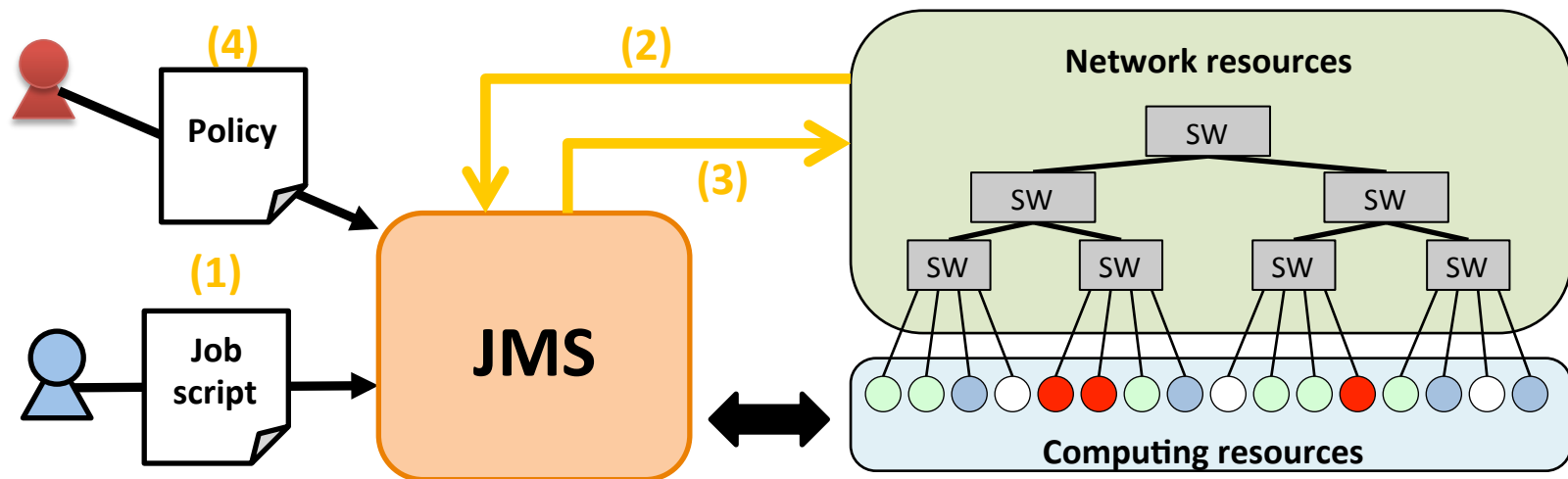
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Cluster system with OpenFlow network

- Interconnect in the cluster system will be constructed as OpenFlow network.
  - OpenFlow switches : HP 2920-24G
  - Topology of the interconnect has multi paths.

OpenFlow network

PRAGMA ENT

Computational hosts
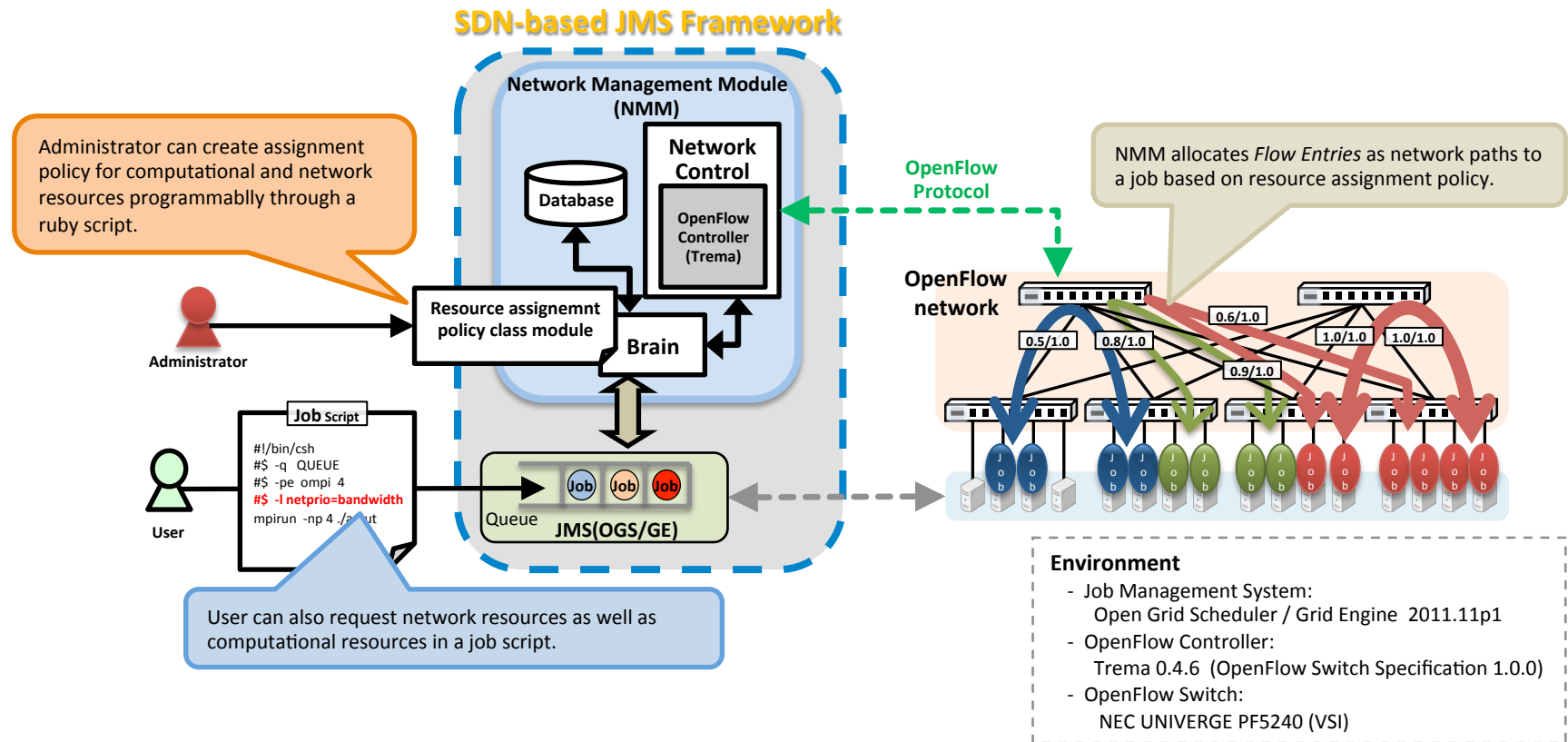
Network Resource Management

(1) **User interface to request network resources**

(2) **Monitoring and managing status of network resources**

(3) **Allocation control for network resources**

(4) **Policy to determine appropriate allocation of resources**

Application for resource management

Leveraging Software Defined Networking / OpenFlow

- Retrieving information of network resources
- Managing and allocating network flows on each job

SDN-based JMS Framework

Network Management Module (NMM)

Network Control

Database

OpenFlow Controller (Trema)

Administrator can create assignment policy for computational and network resources programmablly through a ruby script.

Administrator

Resource assignemnt policy class module

Brain

OpenFlow Protocol

NMM allocates *Flow Entries* as network paths to a job based on resource assignment policy.

OpenFlow network

0.5/1.0   0.8/1.0   0.6/1.0   1.0/1.0   1.0/1.0   0.9/1.0

Job Script
```
#!/bin/csh
#$ -q  QUEUE
#$ -pe  ompi  4
#$ -l netprio=bandwidth
mpirun -np 4 ./a.out
```

User

User can also request network resources as well as computational resources in a job script.

Queue   **JMS(OGS/GE)**

Environment
- Job Management System:
  Open Grid Scheduler / Grid Engine 2011.11p1
- OpenFlow Controller:
  Trema 0.4.6 (OpenFlow Switch Specification 1.0.0)
- OpenFlow Switch:
  NEC UNIVERGE PF5240 (VSI)

[1] Y. Watashiba, Y. Kido, S. Date, H. Abe, K. Ichikawa, H. Yamanaka, E. Kawai, H. Takemura, "Prototyping and Evaluation of a Network-aware Job Management System on a Cluster System Leveraging OpenFlow", The 19th IEEE International Conference On Networks (ICON 2013), Dec. 2013.