Toward Multi-site Virtual Cluster toolkit

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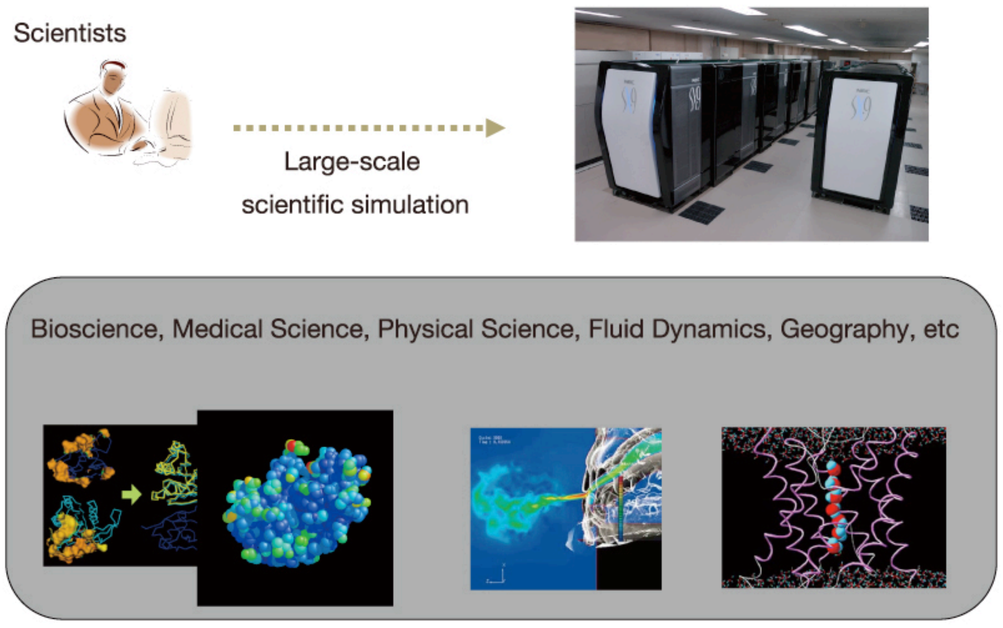

Background

Recently, virtual cluster technology, which allows scientists to build their private computational environments that can be customized as they like, has attracted attention. However, although it is becoming relatively easy to build a virtual cluster on a single physical cluster, building and managing a virtual cluster spanned over multiple physical clusters on multiple sites is hard despite that it is expected to be useful for in various computational scientific fields.

A reason can be explained from the fact that each physical node composing the virtual cluster can be, in general, isolated by the Firewalls or NATs deployed based on organizational administrative policies. Also, it causes the situation that virtual machines deployed on different physical nodes cannot be connected directly with each other.

To tackle the problem, we propose a solution that allows scientists to build a virtual cluster spanned over multiple physical clusters easily, by seamlessly integrating virtual machine technology and overlay network technology.

Proposed Method for Deploying Multi-site Virtual Clusters

In our solution, each virtual machine composing a virtual cluster automatically establishes an overlay network for dedicated and secure use of it, irrespective of the underlying physical network structure. For the functionality of the overlay network, N2N, which provides an encrypted P2P based L2 virtual network solution, is utilized. The P2P based virtual network enables to build an unified network over multiple sites, regardless of the deployed policies of Firewalls and NATs.

Leveraging the N2N, we have been developing Multi-site Virtual Cluster (MVC) Toolkit. The toolkit realizes virtual clusters on multiple Rocks-based physical clusters which are ready to accommodate virtual machines composing virtual clusters. Rocks is exploited to automate the construction of virtual clusters on the N2N network.

Technology for realizing a multi-site virtual cluster

Rocks cluster toolkit: Cluster management tool

- Installing and managing clusters
- By PXE boot, setting up clusters automatically
- Clusters are customizable by Rolls
- Xen roll is available to deploy virtual clusters based on Xen hypervisor

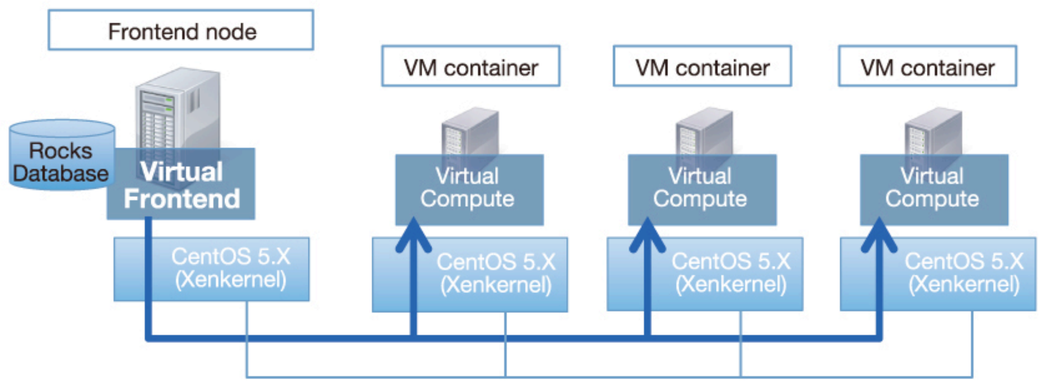

Figure1. Architecture of Rocks cluster toolkit

N2N: Layer 2 overlay networking software

- A secure Layer 2 network
- NAT traversal
- Decentralzed overlay network
- Isolated each overlay network

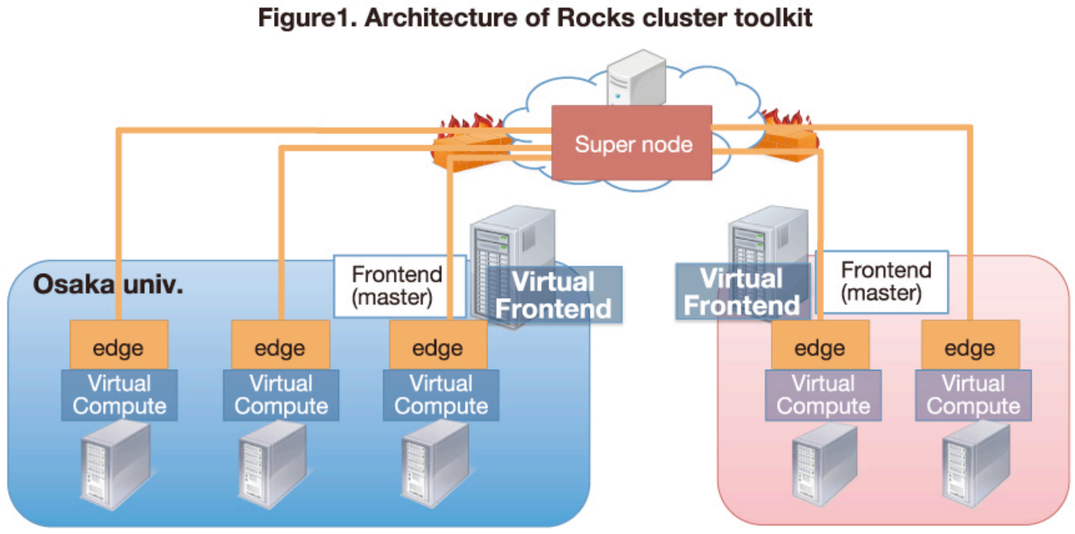

Figure2. Architecture of N2N

How to deploy a multi-site virtual cluster

1. Request a virtual cluster deployment
2. Select virtual machines from each domains
3. Register the selected virtual machine to the MVC database
4. Establish the overlay network among the virtual machines
5. Install OS and Software requested
6. Login the depolyed virtual clusterFeatures Features

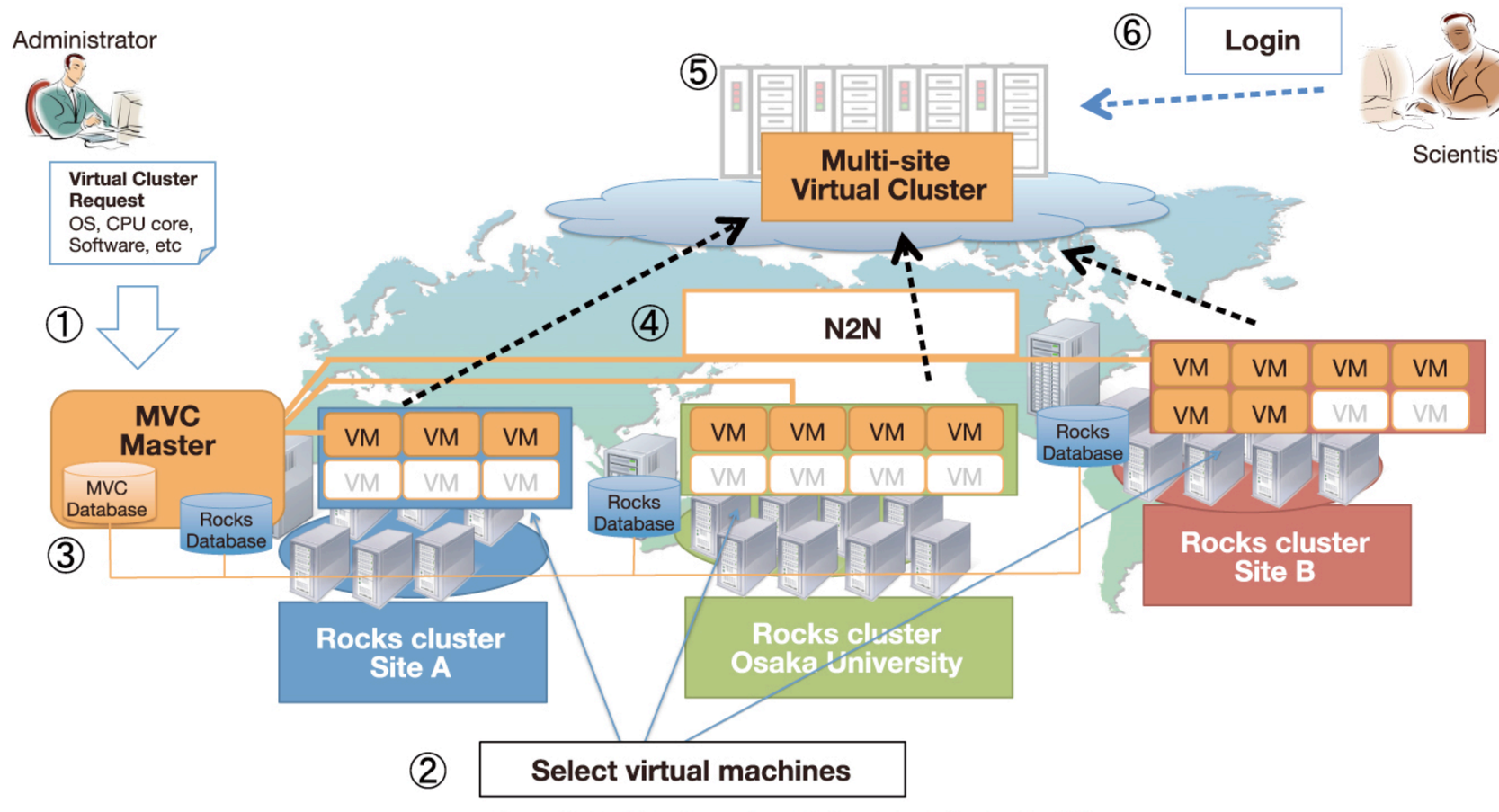

Figure3. Architecture of multisite virtual cluster toolkit

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