International Symposium on Grids and Clouds (ISGC) 2015

Contribution ID : 31

Building Virtual Scientific Computing Environment with Openstack
Thursday 19 Mar 2015 at 16:20 (00h20')

Content:
Nowadays, scientific computing environment becomes more and more complex with the development of modern scientific research including high energy physics, astrophysics, biomedical and so on. Traditional scientific computing system run jobs on physical machines, and face some problems, such as low utilization of computing resources, single use method of high-performance computing power, legacy application, complex management of remote sites, and so on. So it is the time to change strategy and move to cloud. IHEP launched IHEPCloud project since 2014 aiming at providing common services to different scientific scenarios. IHEPCloud is firstly an IaaS service. User can create and manage their own virtual machines on demand. Then IHEPCloud provides an elastic virtual cluster computing system. When a queue in the job management system is too busy, some jobs will be allocated to the virtual cluster computing system transparently. The virtual cluster computing system has its own job scheduling which will call IHEPCloud API to create and start corresponding virtual machines. When the jobs finished, the virtual machine will be destroyed. The whole procedure is transparent to user who don’t know where his job runs on physical machine or virtual machine. Moreover, IHEPCloud manages the different sites around the country or abroad. A dedicated job management system allocates HEP jobs to different sites and call standard cloud interface OCCI to start or destroy virtual machines on remote sites. So it is easy to build virtual or distributed scientific computing environment on IHEPCloud infrastructure.

IHEPCloud adopts Openstack icehouse release currently. More important thing is that we have to provide specified supports to openstack, mainly including legacy network system, unified authentication, configuration management tool, monitoring system, log analysis service, external block storage, and live migration. Firstly, only the user which is authenticated by email and AFS kererbos has the privilege to use IHEPCloud infrastructure. And when a virtual machine is created by a user or external application, whatever it is long-term or temporary, it is registered automatically to legacy IP database and DNS server. And then the virtual machine is also registered to configuration management tool puppet, monitoring tools – nagios and ganglia, and log analysis services – flume, elasticserach and so on. From this point of view, a virtual machine actually managed like a physical machine in the whole computing environment. We are using CEPH to support glance and nova, and try to use Cinder with
CEPH backing store.
IHEPCloud began to provide public services in Oct. 2014 and will support thousands of virtual machines in 2015. In this paper, we will introduce IHEPCloud project in detail including technical design, implement, usage, management and roadmap.

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**Session classification**: Infrastructure Cloud I

**Track classification**: Infrastructure Clouds and Virtualisation

**Type**: Oral