Enhancing Grid Infrastructures with
Virtualization and Cloud Technologies

Release of Cloud-like Management of Grid Services and Resources 2.0 Beta

Milestone MS15 (V1.2)
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Abstract

StratusLab 2.0 release incorporates a set of advanced capabilities for a Cloud in order to manage services (including Grid services) and resources. These advanced features involve i) interoperability of APIs and application definitions, ii) a service management layer on top of the virtual infrastructure management layer, iii) networking capabilities, iv) storage management, v) service monitoring and accounting and vi) federation by the inter-Cloud connector.

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Document History

Version	Date	Comment
0.1	1 Mar. 2012	Skeleton of milestone.
0.2	9 Mar. 2012	Service Manager, Monitoring, Inter-Cloud
0.3	12 Mar. 2012	Network and Storage Manager
0.4	13 Mar. 2012	Accounting
0.5	13 Mar. 2012	Revision
1.2	16 Mar. 2012	Final version

1 Introduction

Grid applications deployed over IaaS clouds can benefit from a set of features that StratusLab provides in the its release 2.0: i) interoperability of APIs and application definitions, ii) a service management layer on top of the Virtual Infrastructure Management layer, iii) networking capabilities, iv) storage management, v) monitoring the application and accounting and vi) federation by the inter-Cloud connector.

2 Release of Cloud-like Management of Grid Services and Resources

The following sections deal with the main work done for the StratusLab release of Cloud-like Management of Grid Services and Resources in the second year of the StratusLab project.

2.1 Interoperability

Interoperability allows users to access different sites uniformly and to reuse running virtual images. StratusLab is focused on the use of Cloud-like API and Virtual Appliance (Service) Language Definition. The Cloud-like APIs in StratusLab contain the TCloud API for the Service Manager and monitoring, OCCI for VM, network and image management, Deltacloud for VM and image management, and jClouds for VM management. The Open Virtualization Format is the standard chosen for the virtual appliance language with a set of extensions to cover StratusLab requirements, like scalability and load balancing.

2.2 Service Manager

The Service Manager that has been integrated in StratusLab is named Claudia. Claudia acts as a middleware for IaaS clouds that will enable the following capabilities:

Service-level provisioning The basic unit for provision is the service to be deployed. A service is a set of VMs playing different roles, with their specific needs for storage and connectivity. Note the special use of the term *service* in this context, not to be confused with its common meaning as a piece of server software (e.g. a Unix system service).

Automated deployments This is achieved with the deployment of VMs by the VM Manager and the contextualization by StratusLab contextualization.

Scalability The use of resources is optimized by scaling up/down the service applying elasticity rules at the service level. New Scalability policies have been included to cover Grid site deployments

Monitoring Scalability is driven by the KPIs which are stored in the monitoring

systems. The Service Manager is integrated with the monitoring systems to obtain those KPIs.

2.3 Network Manager

StratusLab incorporates the abstraction needed to extend the VM lifecycle model to add networking aspects. This generic approach allows the management component of StratusLab, OpenNebula, to interact with any networking fabric. This functionality is provided through OpenNebula network drivers, that perform configuration operations before the VM is launched, after it is booted and when it is destroyed. The StratusLab distribution includes drivers to interact with common switching facilities: IEEE 802.1Q and Open vSwitch.

Additionally StratusLab provides support for enabling simple firewalling rules to allow a regular user to filter TCP, UDP or ICMP traffic. This firewall rules are set up on-the-fly, outside the VM, so it does not require any intervention of the user or special firewalling software to be installed in the VM.

2.4 Storage Manager

StratusLab features multiple components to manage storage, namely: the Marketplace, the Persistent Disk Service, and specialized drivers to integrate these components with OpenNebula.

The storage capabilities of OpenNebula have also been improved in StratusLab, with the addition of the Datastore abstraction. A datastore is an abstraction of any storage medium for VM disk images. Datastores operate at site-level and can help administrators to scale storage better (by adding new datastores when needed), to improve performance (e.g. to balance traffic between datastores) and to implement different SLA policies (e.g. backup or realiability) for different types of users.

Datastores are distributed to the hosts with specific transfer (TM) drivers, e.g. shared or ssh. This allows a single host to include multiple datastores of different types. Moreover the temporal disk images or copies are placed in a special datastore, the system datastore, that can be also distributed among the hosts with different transfer drivers.

OpenNebula will include several datastore types: file-system based, VMware or qcow. In addition, the Marketplace and the Persistent Disk Service could be integrated using datastores (instead of using transfer drivers). Finally, there will be a datastore for Amazon S3 providing hybrid cloud storage.

2.5 Monitoring and Accounting

StratusLab provides monitoring systems to to constantly check the performance of the system. This monitoring systems are able to collect metrics about hardware, software and service, which are used later for scalability. The monitoring systems are based on probes (collectd software) introduced in the VM by contextualization, a collector and aggregator of this monitoring information, a database which stores

all the data and an API.

For resource accounting, StratusLab relies on the underlying capabilities of OpenNebula. By querying the accounting database administrators can retrieve information regarding resource usage per user and can easily correlate it with the hosted services running inside the virtualized resources (e.g. a grid site on a StratusLab based cloud).

2.6 Inter-Cloud Connector

StratusLab provides the Inter-cloud Connector, which allows the Multi-Cloud scenario, where multiple external and internal cloud computing services are deployed and managed to match business needs. The Inter-cloud Connector allows instantiation of VMs on public clouds (like Amazon EC2 or Flexiscale) as well as partner clouds (like other StratusLab sites). The component abstracts the external clouds APIs by providing a common interface to them that can be plugged into the VM Manager component allowing a hybrid cloud approach (where the VM Manager decides to outsource computation to another cloud) or the Service Manager component with a cloud brokering approach (when the VM is deployed in different cloud providers according to users policies).

3 Steps towards the release

In order for all previous topics to become part of the StratusLab v2.0 release, some additional steps are needed.

1. All of these developments must be integrated as part of the StratusLab distribution (git repositories, hudson jobs, production of RPM packages etc.).
2. Some command line client tools must be developed for the automatic configuration and installation of these components as part of the StratusLab distribution.
3. Automatic tests must be added to Hudson to complete the continuous-integration cycle.
4. Some use cases (part of WP2) have been deployed by the StratusLab distribution to demonstrate the functionality.

The following table shows the status of the Management of Grid Services and Resources towards the release 2.0.

Table 3.1: *Topics and Status*

Topic	Description	WP6 Development	StratusLab Distribution	StratusLab Tools	Automatic Tests	Demonstration
Cloud-like APIs	TCloud	yes	yes	in progress	in progress	
	OCCI	yes	in progress	TBD	TBD	
	Deltacloud	yes	in progress	TBD	TBD	
	jClouds	in progress	TBD	TBD	TBD	
Language definition	OVF	yes	yes	yes	in progress	commercial use case
Scalability	Claudia scaling policies	yes	yes	yes	in progress	commercial use case
Networking	Configuration, isolation and firewalling	yes	yes	in progress	in progress	commercial use case
Storage	Image and volume management	yes	in progress	TBD	TBD	
Monitoring	Service monitoring	yes	yes	yes	in progress	commercial use case
Accounting	Resource accounting	yes	in progress	TBD	TBD	
Inter-Cloud	Cloud Bursting	in progress	TBD	TBD	TBD	commercial use case
	Cloud Federation	in progress	TBD	TBD	TBD	commercial use case
	Cloud Brokering	in progress	TBD	TBD	TBD	commercial use case