Enhancing Grid Infrastructures with
Virtualization and Cloud Technologies

# Operation of Site Running StratusLab toolkit v1.0

Milestone MS11 (V1.0)
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## Abstract

This document reports on one of the significant project milestones concerning the operation of a cloud site running StratusLab's cloud distribution (or toolkit). It is currently running v0.3 of the StratusLab distribution–a beta release of the upcoming 1.0 production release. In particular it presents the WP5 reference cloud service, the evolution of the service up to Month 10 of the project, and the way this service has been exploited to date. A major milestone regarding the exploitation has been the deployment of the first virtualized production grid site running on the project's reference cloud service.

## Contributors

| Name | Partner | Sections |
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## Document History

| Version | Date | Comment |
| --- | --- | --- |
| 0.1 | 21 Mar. 2011 | First draft for internal review. |
| 0.2 | 23 Mar. 2011 | Release candidate version |
| 1.0 | 04 Apr. 2011 | Final version |

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# 1 Introduction

The StratusLab project is working on bridging grid and cloud computing technologies. This entails both the provision of grid services on top of IaaS (Infrastructure as a Service) cloud infrastructures as well as the expansion of the cloud access paradigms to incorporate grid computing attributes like collaboration and resource sharing. The main product of this effort is the StratusLab distribution (or toolkit), a cloud middleware that integrates various software tools to provide customized infrastructure deployment capabilities. This middleware needs to be tested and validated in near-production environments to ensure that certain functional and Quality of Service requirements have been met. For this purpose one of the main tasks of WP5 is to setup and operate a reference cloud site using the software integrated by WP4. The operation of this site has been set as one of the main milestones for WP5 and was achieved in the first months of the project. The infrastructure is currently running release v0.3 – a beta release for the upcoming 1.0 production release.

# 2  Reference Cloud Service

## 2.1  Service Deployment Evolution

The reference cloud service follows the evolution of the software distribution provided by WP4. Work on the service started during the early stages of the project, before there was any cloud middleware available, with the installation of a plain OpenNebula site (version 2.0). This site was used for evaluation purposes as well as for demonstrations at the EGI Technical Forum 2010 in Amsterdam. The first publicly accessible site was provided with StratusLab release v0.1. A public announcement was distributed in various dissemination channels and the first requests for user accounts started arriving during the first hours of operations. During the following months the cloud site followed the evolution of StratusLab distribution upgrading to versions 0.2 and to 0.3, which is the latest version of the software and a beta release for the upcoming 1.0 production release. At the end of the first year of the project, the site will migrate to StratusLab v1.0.

## 2.2  Physical Configuration

The reference cloud service is currently hosted in one of GRNET's datacenters. Table 2.1 summarizes the physical resources allocated for the site. All the nodes are co-located in the same physical rack and are interconnected using 10 GigE (Figure 2.1). Storage is provided by a datacenter-wide storage server.

***Table 2.1:*** *Summary of the physical resources of the cloud site.*

| | |
|---|---|
| Number of nodes | 17 (1 Frontend + 16 hosts) |
| Number of cores for VM instantiation | 256 |
| Total memory per physical node | 48 GB |
| Total memory for the site | 768 GB |
| Total storage for hosting VMs | 3.6 TB shared over NFS |
| Number of public IPs available | 120 |
| Range of public IPs available for VMs | 62.217.122.130–250 |
| OS for hosts | CentOS 5.5 |

Connectivity to GEANT     GRNET

1x10GE     1x10GE

1x10GE     StratusLab Resources
(Hosting nodes + Frontend)

1x10GE

Rack 1     Rack 2     Rack 3     Rack 4

32 Servers/rack
3 ethernet/server
1 mgnt/server

stack     stack

1x10GE

1x10GE

1x10GE     1x10GE     1x10GE

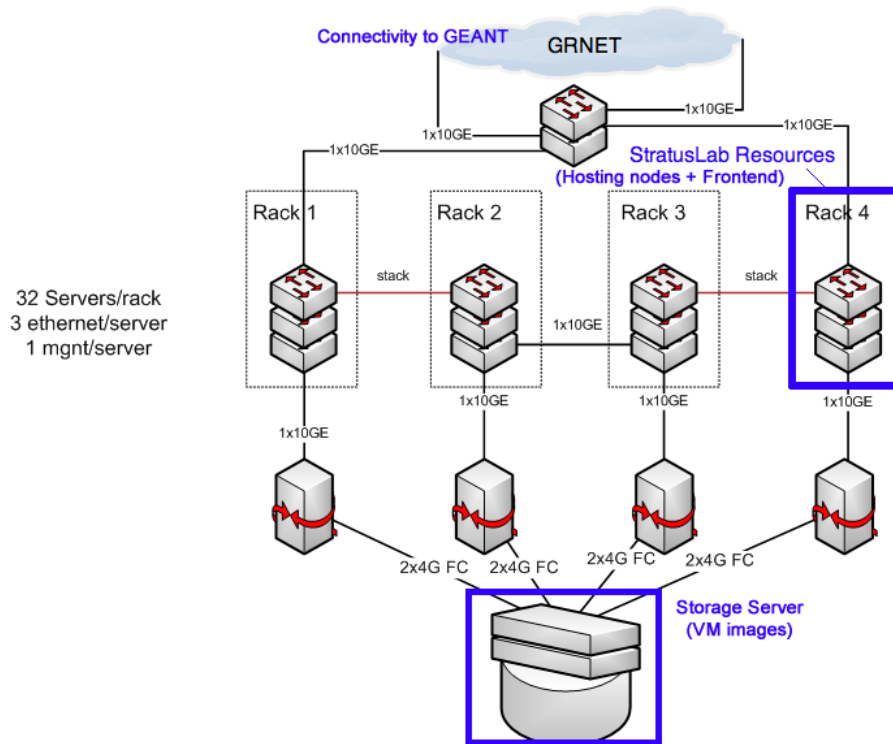2x4G FC     2x4G FC     2x4G FC     2x4G FC

Storage Server
(VM images)

**Figure 2.1:** *StratusLab's physical infrastructure in GRNET's datacenter.*

Connectivity between the nodes and the storage server is achieved through dual 4 Gb/s Fibre Channel links. The above configuration enables the instantiation of a total of 120 VMs with public IP connectivity. Private or local IP interfaces are not yet available but they are planned for future upgrades of the service.

## 2.3  Service Provisioning

The reference cloud service is publicly available to everyone wanting to try out the StratusLab cloud middleware distribution. Users may request access to the service by sending an email to the support email list[1] providing their contact details and some basic information about their reasons for using the cloud. Until version 0.2 of the distribution the only option for accessing the service was with a username/-password pair. As of version 0.3 users can access the cloud site via certificate based authentication. In the latter case, users must provide the DNs of their digital certificates, otherwise StratusLab will generate a username/password pair for them.

In order to access the service the users need to download and install the latest version of the StratusLab python command line tools available from the project's

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[1]support@stratuslab.eu

**StratusLab**

**Enhancing Grid Infrastructures with Virtualization and Cloud Technologies**

**Web Monitor**

Nodes Instances

Enable auto refresh

**List of nodes**

| Id | IP | Total CPU | Free CPU | Total mem | Free mem | Running VMs | State |
|---|---|---|---|---|---|---|---|
| 0 | 62.217.120.155 | 1600 | 1598 | 49449772 | 46846440 | 3 | Monitored |
| 1 | 62.217.120.147 | 1600 | 1600 | 49449772 | 47011480 | 3 | Monitored |
| 2 | 62.217.120.148 | 1600 | 1596 | 49449772 | 47354468 | 2 | Monitored |
| 3 | 62.217.120.149 | 1600 | 1600 | 49449772 | 47250716 | 3 | Monitored |
| 4 | 62.217.120.150 | 1600 | 1598 | 49449772 | 47109348 | 1 | Monitored |
| 6 | 62.217.120.152 | 1600 | 1600 | 49449772 | 47011360 | 3 | Monitored |
| 7 | 62.217.120.153 | 1600 | 1600 | 49449772 | 48440180 | 2 | Monitored |
| 8 | 62.217.120.154 | 1600 | 1600 | 49449772 | 48233480 | 2 | Monitored |
| 9 | 62.217.120.156 | 1600 | 1600 | 49449772 | 48296108 | 2 | Monitored |
| 10 | 62.217.120.138 | 1600 | 1600 | 49449764 | 46574188 | 3 | Monitored |
| 11 | 62.217.120.139 | 1600 | 1598 | 49449764 | 46420368 | 3 | Monitored |
| 12 | 62.217.120.140 | 1600 | 1598 | 49449764 | 45764572 | 4 | Monitored |
| 13 | 62.217.120.141 | 1600 | 1596 | 49449772 | 44729112 | 4 | Monitored |
| 14 | 62.217.120.142 | 1600 | 1598 | 49449764 | 45473688 | 2 | Monitored |
| 15 | 62.217.120.143 | 1600 | 1600 | 49449764 | 46030140 | 3 | Monitored |
| 16 | 62.217.120.151 | 1600 | 1595 | 49449772 | 45717496 | 7 | Monitored |

***Figure 2.2:*** *Web monitoring of cloud site (hosting nodes)*

package repository[2] either in RPM (Red-Hat Package Manager), zip, or tarball formats. Using these tools and the service's endpoint [3], the user has the ability to instantiate new VMs, inspect the status of existing running VMs and kill previously instantiated VMs. Information and a video tutorial for using the cloud service is available from the project web site[4].

## 2.4 Site Monitoring

Two tools are used for monitoring the site. Ganglia[5] has been setup for monitoring all physical hosts provided by GRNET for the purposes of the project. A subset of these hosts have been dedicated for hosting the cloud service and thus monitoring is available from Ganglia.

A web monitoring tool has been developed within the project by WP4 and is installed with every StratusLab cloud. The tool provides access to basic node and VM information. Figure 2.2 provides a snapshot of this tool depicting the total number of hosts that comprise the cloud site and the number of VMs running on them.

## 2.5 Sample Applications

During these months of the site's operations it has been used for various tests and for hosting a number of small and large applications. Most notably the site has

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[2]http://yum.stratuslab.eu

[3]https://cloud-grnet.stratuslab.eu:2634/RPC2

[4]http://www.stratuslab.eu

[5]http://node017.one.ypepth.grnet.gr/ganglia/

been used for deploying a production grid site running gLite middleware [2] and for running Bioinformatics applications. The deployment of the grid site is reported in the next section. The details regarding the bioinformatics application have been reported in MS3 [1]. In brief, two virtual appliances, "Biological databases repository" and "Bioinformatics compute node", have been prepared to provide bioinformaticians with a repository machine maintaining up-to-date international reference databases, then made available through shared filesystem in destination to bioinformatics cloud nodes with pre-installed bioinformatics software.

# 3 Hosting of Grid Services

During the first months we experimented extensively with the installation and operation of grid sites on top of cloud services using pre-configured VMs. At the end of this process we decided to formalize the installation of a virtualized grid site by certifying it within the EGI production infrastructure. In parallel we prepared a number of VM appliances for the basic node types of a gLite-based grid site: the Computing Element, the Storage Element, the Worker Node, the User Interface, and the APEL service. All of these images are available from the appliance repository[1]. The appliances follow the evolution of gLite middleware–with every new release new image snapshots are created and uploaded to the repository.

The certified grid site is named HG-07-StratusLab. The site was certified within the GRNET NGI (the Greek National Grid Initiative) and has joined the national grid infrastructure (HellasGrid). The site offers a Computing Element and 8 dual-core Worker Nodes, thus providing a total capacity of 16 cores for job execution. The site also supports MPICH-2 and OpenMPI parallel applications. Communication among the nodes for MPI execution is supported through SSH host-based authentication. Each WN is configured with 4GB of main memory. Also, the site includes a Storage Element that offers a total storage space of 3TB. This storage is configured directly as an NFS mount-point from the local storage server and is not yet virtualized, as the cloud storage services of StratusLab are not yet available.

The site currently supports the StratusLab VO (vo.stratuslab.eu) as well as the required EGI-wide and local ops (operations) VOs. Obviously the job processing capacity of the site is currently rather limited. In this first phase the site primarily serves as a testbed for grid-cloud interoperability tests and for evaluating the implications of operating grid sites on public cloud services. Already a number of issues have been identified which will be reported in the coming quarter. In the future depending on the workload and potential requests to support additional VOs, it should be rather trivial to expand the workload execution capacity of the site (i.e. number of available cores and/or Worker Nodes).

The GStat page with all the details of the site as they are reported from the Site-BDII are available[2].

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[1]http://appliances.stratuslab.eu
[2]http://gstat-prod.cern.ch/gstat/site/HG-07-StratusLab/

# References

[1] C. Blanchet. Creation of Virtual Appliances for Bioinformatics Community, 2011. StratusLab project milestone MS3.

[2] gLite. Lightweight Middleware for Grid Computing. http://glite.web.cern. ch.