StratusLab

Enhancing Grid Infrastructures with
Virtualization and Cloud Technologies

Project Periodic Report

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1 Publishable Summary

1.1 Project Context and Objectives

The StratusLab project is aimed at service provisioning, networking, and research of technologies that will bridge cloud and grid infrastructures to simplify and optimize the use and operation of existing distributed computing infrastructures (e.g. European Grid Infrastructure) and to provide a more flexible, dynamic computing environment for scientists.

The European production grid infrastructure has had many notable successes. It has allowed scientists from all over Europe and indeed from all over the world to federate their computing resources to advance their scientific aims. More importantly, the infrastructure allows them to federate their data and expertise to accomplish more than they would be able to do singlehandedly. Common APIs and service interfaces make it possible to take advantage of these distributed resources without having to modify applications for each site.

Despite its success, the grid also has its limitations. The uniformity of service interfaces unfortunately does not extend to the underlying computing resources, where users are exposed to significant heterogeneities in the computing environment, complicating applications and increasing failure rates. Passive calculations are handled well by the grid, but many applications require active services to coordinate the distributed analyses. Either scientists must provide their own resources for such services or negotiate with a particular site to provide them. This reduces the speed at which new calculations can be done.

Virtualization technologies provide a mechanism for offering customized, uniform environments for users with negligible performance degradation. Using grid technologies combined with virtualization allows the grid to provide users with a homogeneous computing environment, simplifying applications and reducing failures. Emerging cloud technologies allow users to dynamically allocate computing resources (often in less than a minute) and to specify the characteristics for the allocated resources. The fusion of cloud and grid technologies provides a more dynamic and flexible computing environment for grid application developers.

Cloud and virtualization technologies also offer other benefits to administrators of resource centers, such as the migration of live services for load balancing or the deployment of redundant servers. Reduced costs for managing resources immediately benefit users by freeing money for additional computing resources or by having better user support from administrators.

A combined computing infrastructure that uses grid technology's strengths for federating resources, virtualization's strengths in providing custom, uniform environments, and the cloud's strengths in dynamic resource allocation, maximizes the utility of European distributed computing resources to scientists.

The StratusLab project creates an complete, coherent, open-source private cloud distribution to allow administrators of grid resources centers to take advantage of virtualization and cloud technologies. It provides new ways of using existing distributed computing resources to make the infrastructure more adaptable and more useful for scientists.

1.2 Summary of Work Performed and Achievements

In the first quarter of the project, the participants have successfully laid the foundations for creating a stable, comprehensive, open-source cloud platform. The project management, in cooperation with all of the activities, has put in place the collaborative tools necessary for a successful software development project, including mailing lists, issue trackers, code repositories, and the like. Using these tools, the project members have made significant progress in collecting use cases, defining the StratusLab architecture, creating a base release, and testing it on the project's cloud infrastructure.

In the second quarter, the project has successfully created the first public release of the StratusLab cloud distribution. To complement the release, the project participants have provided user support, deployed a reference infrastructure for outside users, and increased awareness of the release and the project. High-level features, including advanced service management features, have been defined and will be progressively added to the series of public releases leading to the v1.0 release due at the end of the first year.

In the third quarter, the project has built on the first public release (v0.1), providing additional functionality leading up to the 1.0 production release expected at the end of Q4. An additional public, preview release (v0.2) was produced and a subsequent release (v0.3) is expected just after the close of Q3. The releases are progressing well, with v0.3 expected to be nearly feature-complete, lacking only storage functionalities.

In the fourth quarter, two beta releases of the StratusLab cloud distribution were made and deployed on the project's reference cloud infrastructure. The v1.0 production release is expected just after the close of Q4 due to the scheduling of the project's development sprints. The project continues to operate a production grid service over the StratusLab cloud distribution, demonstrating its functionality and stability. The project has also demonstrated the deployment of a grid site with the Claudia service manager with some autoscaling features. Detailed achievements are given below.

1.3 Final Results and Potential Impact and Use

Most scientific and engineering research requires significant computing resources. Distributed computing infrastructures have brought unprecedented computational power to a wide range of scientific domains. Although, these architectures and the related software tools have been considerably improved over the years, they exhibit several difficulties, mainly due to limitations of physical platforms, which discourage adoption of grid technologies. StratusLab has the potential to profoundly change existing grid infrastructures.

1.3.1 Improved Interdisciplinary Scientific Collaboration

Cloud technologies are expected to have significant impact, both immediate and long-term, in the way scientific research is carried out. Grid infrastructures have provided a remarkable advantage over the past years offering access to vast amount of computing power and storage space, and most importantly by offering a sustainable platform for scientific collaboration enabling the sharing of computing resources and scientific data. Cloud computing is expected to take this one step further by facilitating the easy deployment of customized grid infrastructures. These infrastructures are expected to have further positive impact on the way interdisciplinary scientific research is taking place.

StratusLab focuses on the provision of scientific infrastructures over cloud computing, investigating in particular the provision of customized Virtual Machine images. This customization will be done on the user side, which means that the user can have more immediate influence on the infrastructure itself. In this way the infrastructure will adapt to the user requirements and not vice-versa. By easing the management of grid sites and the configuration of hosting services we expect to attract a broader number of scientific communities and further facilitate their collaboration.

1.3.2 Impact on DCI Evolution

Currently, there is a big shift in all e-Infrastructure projects, and related efforts in Europe, to expand their activities in order to include cloud computing technologies. StratusLab will play a key role in this landscape by providing a focused environment for development, deployment and experimentation of cloud computing services.

The projects proposal reflects an evolutionary path from the existing large-scale monolithic grid e-Infrastructures to novel, beyond the state-of-the-art, cloud-based, grid-enabled ones. Through its expected collaborations with other projects, StratusLab will disseminate its findings and drive direct impact on the way e-Infrastructure provision is currently done.

1.3.3 Improved Usability of DCI Platforms

Virtualization is the cornerstone of cloud computing and a key for achieving optimal usability of DCI platforms. Moreover, virtualized environments have the

Table 1.1: StratusLab Information and Support

Website	http://stratuslab.eu/
RSS Feed	feed://stratuslab.eu/feed.php?ns=news&linkto=page
Twitter	@StratusLab
YouTube	http://www.youtube.com/user/StratusLab
Support	support@stratuslab.eu

ability to adapt to different hardware platforms enabling a quick transition from one environment to another.

StratusLab operates such a virtualized platform on a variety of hardware environments. By offering customized machine images, users will be able to set-up an environment that better suits their application requirements. This will dramatically improve the current situation where current infrastructures are forced to offer a common configuration–a common denominator–that tries to do its best to satisfy many users with different runtime requirements. Another aspect where StratusLab will contribute is on power consumption efficiency (Green Computing) and the increase reliability by incorporating failover mechanisms using virtual machine snapshots and migration.

1.4 Contact Information

More information about the StratusLab project can be obtained from the sources listed in Table 1.1. Individual partners can also be contacted to obtain more specific information about their contributions to the project. Table 1.2 contains the list of StratusLab partners and relevant contacts.

Table 1.2: *StratusLab Partners*

CNRS	Centre National de la Recherche Scientifique	Charles LOOMIS loomis@lal.in2p3.fr
UCM	Universidad Complutense de Madrid	Ignacio LLORENTE llorente@dacya.ucm.es
GRNET	Greek Research and Technology Network S.A.	Evangelos FLOROS efloros@grnet.gr
SIXSQ	SixSq Sàrl	Marc-Elian BEGIN meb@sixsq.com
TID	Telefónica Investigación y Desarrollo SA	Henar MUÑOZ henar@tid.es
TCD	The Provost Fellows and Scholars of the College of the Holy and Undivided Trinity of Queen Elizabeth Near Dublin	David O'Callaghan david.ocallaghan@cs.tcd.ie

2 Project Objectives for the Period

2.1 Objectives

The primary objective of the project is to provide a software distribution that brings together cloud and grid technologies to benefit both grid resource center administrators and scientists. In order to achieve this main objective, we have defined a set of interrelated objectives to be addressed in the project. The objectives are organized, for clarity of exposition, into three groups of objectives, corresponding to networking, service and research activities (see Figure 2.1):

- The first group represents coordination and networking with users and other stakeholders in the grid and cloud ecosystems. The project will work directly with scientists using the grid to ensure that the distribution satisfies real needs; and will collaborate with related projects and contribute to standards bodies.
- The second group represents infrastructure related services to the scientific community. The project will integrate and maintain a software distribution to bring cloud to existing and new grid sites and will ensure the production quality of the distribution by running two production sites with the distribution.
- The last group represents innovation and exploration of new cloud and virtualization technologies to enhance grid infrastructures. The project will develop innovative technology for cloud-like management of grid services and resources that will be incorporated into the software distribution.

These objectives are presented by work package below. Similarly, the work program is built around these objectives. There is a one-one correspondence between objectives and activities, so facilitating an easy cross-reference between objectives and activities throughout this document, and their verification during the project execution. The activity on project coordination has not been included here.

2.1.1 WP2: Interaction with Users and Related Communities

StratusLab targets two distinct communities: resource providers and end-users. The StratusLab software will simplify grid site administration and improve the reliability of the site. Later releases in the second phase of the project will provide

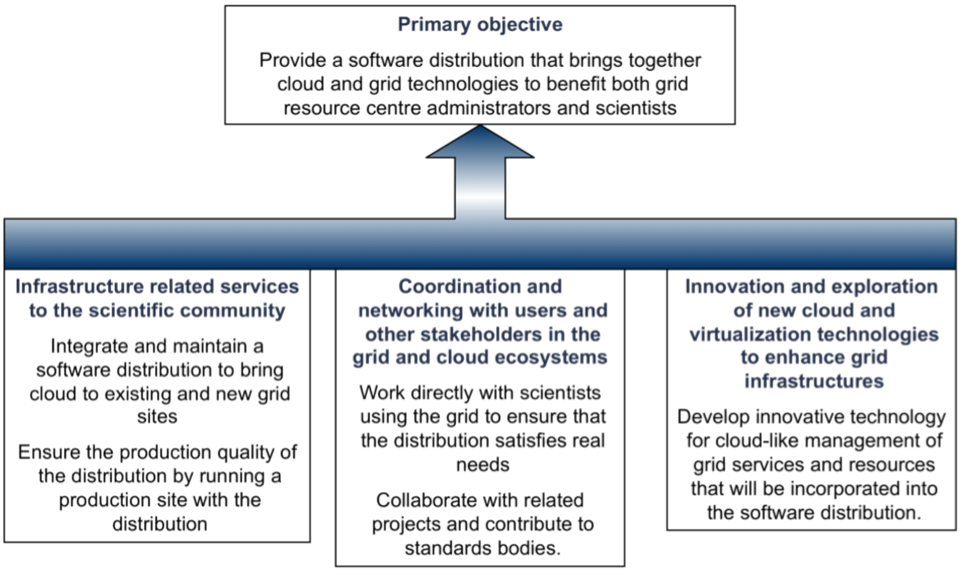

Figure 2.1: *Primary and supporting objectives*

direct cloud APIs that will be attractive for scientists porting applications to the grid. The communications between these communities and the project must be managed to ensure the project fully addresses their needs and any problems that arise. One community will work directly with the project to evaluate early releases of the software. Results of the project must be disseminated as widely as possible to those two communities as well as the general public. Scope of the objective.

- Manage communication with resource providers regarding their needs concerning virtualization and cloud technologies and their feedback on StratusLab software.
- Manage communication with end-users regarding their use of resources running StratusLab software and their needs for direct access to virtualization and cloud features.
- Training sessions will be organized to encourage dissemination of technical information and adoption of the StratusLab software.
- Evaluate early versions of StratusLab software from a users perspective with respect to utility and stability.

2.1.2 WP3: Dissemination

A large number of projects, companies, and standards bodies currently focus on cloud and virtualization technologies because of their promise and growing adoption. StratusLab must actively engage with those entities to ensure that the projects results are well represented, that we are aware of others advances, and that we drive standardization in a direction consistent with our vision. Scope of the objective.

- Disseminate results of the project to resource providers, end-users, and the general public.
- Identify project contributions to standards bodies and standardization efforts.
- Coordinate interactions with related projects, develop-ing Memoranda of Understanding between projects where appropriate.

2.1.3 WP4: Integration, Distribution and Support of Open-Source Cloud Distribution

StratusLab will integrate and support an open-source cloud distribution enabling grid site virtualization and dynamic scaling to remote clouds. This distribution will address the specific requirements of the grid resource providers and enable the deployment of science clouds, as well as addressing infrastructure cloud-like access demands from user communities, including industrial users. Scope of the objective. StratusLab will address the following topics:

- Selection of software components, from best of breed in open source software, to compose a robust and industry grade open source StratusLab toolkit. This distribution will integrate with typical administration tools in grid infrastructures and fabric management. This process will be driven by real needs and constraints in production infrastructures.
- Integration and management of open-source distribution, definition and maintenance of reference configurations and sustainability in the context of EGI and its official middleware distribution. The StratusLab toolkit will integrate the innovation developed in the research activity.
- Technical support for installation and configuration of the distribution, following industrial practices in term of quality, maintainability, testability and usability
- Definition of a process for automatic configuration of the virtual appliances

2.1.4 WP5: Operation of a Production Grid Site Running StratusLab

StratusLab will engage two resource centers that will be responsible for the deployment of middleware and tools developed in the project. One the main tasks of these resource centers will be the operation of two production grid sites running StratusLab toolkit. The sites should be able to pass the certification procedures imposed by EGI. The activity will demonstrate the security, performance, reliability and scalability of the distribution, and will provide support for the creation of the virtual appliances for different user communities. The activity will also investigate the feasibility of offering a repository of reference images for cloud users, with demonstrated interoperability among the supported cloud infrastructures (including the private cloud deployed in the re-source centers, as well as a selected number of public clouds). Scope of the objective. StratusLab will address the following topics:

- Deployment and operation of virtualized grid sites
- Testbed for the StratusLab toolkit
- Support for the creation of virtual appliances for different user communities.

2.1.5 WP6: Innovative Cloud-like Management of Grid Services and Resources

StratusLab will conduct research on grid service automatic deployment and dynamic provision, including automatic elasticity mechanisms for scaling up and down to meet performance goals (typically defined by SLAs). StratusLab will also conduct research on novel infrastructure cloud-like resource provisioning paradigms, and dynamic and scalable management of virtualized infrastructures for grid services. The research will be performed to address technology gaps defined by the service activities according to user requirements collected by the networking activities. Scope of the objective. StratusLab will address the following topics:

- Framework for grid service elasticity and dynamic pro-vision of grid services
- Grid specific virtual machine management techniques
- Infrastructure cloud interfaces for grid sites and its integration with existing Grid services

2.2 Detailed Objectives by Quarter

2.2.1 Quarter 1

In this first quarter, the primary objective was to prepare the foundations for a successful project. In more detail this involved:

- Deployment of collaborative software development tools,
- Starting dialog between StratusLab and targeted communities,
- Make the project visible to targeted communities and general public,
- Put in place the software development processes and policies,
- Define the initial architecture for the StratusLab software, and

- Deploy the initial project infrastructure.

Within this quarter all of these have been obtained providing a solid basis for the first public release of the StratusLab software in Q2 with additional features appearing rapidly afterwards.

2.2.2 Quarter 2

In the second quarter, the emphasis was on making the first public release of the StratusLab cloud distribution. Detailed objectives were:

- Increase project visibility particularly at the EGI Technical Forum,
- Initial public release of StratusLab cloud distribution,
- Reference infrastructure available to outside users,
- Support provided for release, and
- Initial design of advanced management services.

All of these objectives have been met, allowing the project to build a feature-complete release during the next quarter.

2.2.3 Quarter 3

In the third quarter, the primary objective was to provide a feature-complete release and demonstrate its utility for running grid services. The detailed objectives were:

- Continued dialog with and support of targeted communities,
- Increasing visibility of project by targeted communities,
- Regular public releases concluding with functionally complete beta,
- Production grid site running over a stable StratusLab cloud, and
- Integration of the service manager into the distribution.

Nearly all of these objectives have been achieved with the StratusLab v0.3 release at the end of the quarter. One highlight is the certification of a production grid site running over the StratusLab distribution. The v0.3 release is nearly functionally-complete, missing only a solution for storage. This will be developed early in Q4.

2.2.4 Quarter 4

In the fourth quarter, the preparation and release of the StratusLab 1.0 Cloud Distribution was the primary focus of the project. The detailed objectives were oriented around this goal:

- In depth evaluation of the StratusLab v1.0 distribution,

- Increasing visibility of project by targeted communities and evaluation of our dissemination strategy,
- Continued public, preview releases culminating with the StratusLab v1.0 distribution,
- Continued operation of reference infrastructure and production grid site, and
- Complete integration and use of the service manager in the v1.0 release.

The preparations for the StratusLab 1.0 are very advanced and it is expected that the 1.0 release will be made at the end of Sprint 14 that will conclude just after the close of Quarter 4. With this release, the focus will shift to improving the existing services and providing more advanced functionality like hybrid clouds and deployments of predefined systems (e.g. hadoop).

2.3 Review Recommendations

Not yet applicable.

3 Progress and Achievements

3.1 Quarter 1

In the first quarter of the project, the participants have successfully laid the foundations for creating a stable, comprehensive, open-source cloud platform. The project management, in cooperation with all of the activities, has put in place the collaborative tools necessary for a successful software development project, including mailing lists, issue trackers, code repositories, and the like. Using these tools, the project members have made significant progress in collecting use cases, defining the StratusLab architecture, creating a base release, and testing it on the project's cloud infrastructure.

Project Visibility A project web site was setup to increase the visibility of the project within our targeted communities and the general public. The web site includes general information about the project as well as detailed information about the project's technical work. An initial press release and numerous technical presentations helped increase the visibility of the project. All members of the project have contributed material to ensure a visible presence at the upcoming EGI Technical Forum.

Dialog with Targeted Communities Two surveys, one for end-users and another for system administrators, were developed and used to collect feedback from those likely to deploy and use the StratusLab software. The document "Review of the Use of Cloud and Virtualization Technologies in Grid Infrastructures" (D2.1) provides a set of 25 requirements and recommendations based on the survey responses. These guided the development of the StratusLab architecture.

Agile Software Processes The project has adopted scrum, an agile software development process, for managing the production of the StratusLab software releases. This is an iterative method that begins with a sprint planning meeting, three weeks of work on the defined tasks (with daily 15-minute, "standup" meetings), and finishes with a sprint demonstration meeting and an updated StratusLab distribution. The technical coordination group reviews progress between sprints. The first few sprints have already produced a StratusLab distribution that can be easily installed manually or automatically.

Initial Architecture An initial architecture that takes into account the feedback from the targeted communities and the partners' experience with virtualization and cloud technologies has been defined. Various aspects of this initial architecture and choices for implementations (e.g. OpenNebula as a virtual machine manager, Apache for an appliance repository, etc.) have already been verified with early developments of the project.

Initial Project Infrastructure The early StratusLab distributions have been deployed on the project's physical infrastructure provided by GRNET and CNRS. Moreover, the distributions have been extensively tested using this infrastructure to reveal a significant number of bugs and issues that are being corrected before a public release. Moreover, grid services have been deployed over the StratusLab to verify the applicability of cloud resources to these services.

This foundation provides a solid basis for the first public release of the StratusLab software expected Q2 with additional features appearing rapidly afterwards.

3.2 Quarter 2

In the second quarter, the project has successfully created the first public release of the StratusLab cloud distribution. To complement the release, the project participants have provided user support, deployed a reference infrastructure for outside users, and increased awareness of the release and the project. High-level features, including advanced service management features, have been defined and will be progressively added to the series of public releases leading to the v1.0 release due at the end of the first year.

Initial Public Release The project released v0.1 of the StratusLab cloud distribution. This release provides a minimal cloud distribution that allows remote access to the cloud, easy access to base images (ttylinux, Ubuntu, and CentOS) stored in the StratusLab appliance repository, contextualization of those images, and management of the full virtual machine lifecycle.

Reference Infrastructure The v0.1 release of the StratusLab cloud distribution has been installed on dedicated hardware at GRNET to provide a reference cloud infrastructure. This infrastructure has been opened to external users to allow them to easily test drive the StratusLab release and to provide feedback. In parallel with the deployment of the infrastructure, security policies and user management procedures have been put in place.

User Support To ensure that users receive the appropriate support and have the means to provide feedback, a support mailing list was created, backed by a first-line support team consisting of people from the user support, integration, and operations activities. All project participants will provide second-line support as needed. An online tutorial and video version of it help users understand the features in the release and how to use them.

Increased Visibility The project made a concerted effort to increase the visibility of the project, particularly at the EGI Technical Forum in Amsterdam. Several high-profile presentations were given and the project manned a booth showing the first results of the project. The dissemination activity has diversified the means that people can find out about the project using, for example, Twitter and YouTube. It has also improved the website with better integration with social media and better targeted RSS feeds. It also developed a release dissemination strategy for the v0.1 release that will be used (and improved) for each of the upcoming StratusLab releases.

Improved Software Processes The successful public release of the StratusLab distribution early in the project's life is a direct result of the agile/scrum software development processes used by the project. Significant work was done to expand testing of the StratusLab software and to automate both the testing and generation of the release.

Service Manager The overall architecture of the StratusLab distribution was extended with a "service manager" that will allow ensembles of machines (complete "services") to be specified and controlled as a block. Moreover, the service manager will allow the dynamic allocation or reallocation of resources based on service load. Claudia, a development from TID, was selected as the basis for the service manager.

The successful initial public release of the StratusLab cloud distribution and associated supporting activities demonstrates the consortium's ability to create a useful open-source cloud distribution with a potentially high positive impact on European e-Infrastructures. Q3 will see this release evolve into a feature-complete beta release of the StratusLab cloud distribution.

3.3 Quarter 3

In the third quarter, the project has built on the first public release (v0.1), providing additional functionality leading up to the 1.0 production release expected at the end of Q4. An additional public, preview release (v0.2) was produced and a subsequent release (v0.3) is expected just after the close of Q3. The releases are progressing well, with v0.3 expected to be nearly feature-complete, lacking only storage functionalities.

Increased Visibility Interest in the project continues to increase through the efforts of all partners. A number of researchers have contacted the project and are trying out the StratusLab software via the reference infrastructure. Two particularly interesting collaborations have been with the maintainer of the ttylinux distribution to make it more cloud-friendly and with the HEPiX Virtualization Working Group concerning the Marketplace.

Marketplace Sharing machine and disk images is critical for the adoption of cloud technologies on shared, distributed infrastructures. The project has redesigned the appliance repository concept, resulting in the StratusLab Marketplace–a repository of machine and disk image metadata–and a set of associated tools. The tools allow site policies to be applied to requested images and conveniently downloaded. Eventually, cloud-based storage will be used for storing and sharing images. A prototype version of the Marketplace is currently available (MS10).

Specialized Appliances Specialized appliances have been created for bioinformatic applications (MS3) and for grid services. The bioinformatics appliance will free researchers from the drudgery of installing by hand the large number of required applications for their research, thus streamlining their use of the cloud and research. Similarly, the grid images will make it easier for sites to create a working grid resource center, avoiding all of the usual pitfalls involved in deploying grid services by hand.

Certified Grid Site The grid appliances have been used to deploy a standard grid site. This site has been integrated with EGI and is subject to the same operations checks as for other sites. This site has passed all of the certification criteria and is now a recognized, certified site within EGI. The number of accepted VOs is currently limited, but will expand as we build confidence in the site.

Agile Processes The Scrum philosophy adopted by the project for development and integration is now an integral part of the project, with regular cycles of planning meetings, daily standup meetings, and demonstrations taking place. A much improved continuous integration server (reconstructed after a crash) more fully tests the StratusLab components and facilitates the public releases.

Usability Improvements Numerous improvements have been added to the latest release (v0.3) based on user feedback. These include a more robust and easier to use client, quarantine of virtual machine images for forensic analysis of potentially compromised machines, new authentication modules supporting a wide range of different credentials, and automated creation of new machine images from existing ones.

Claudia Integration The build of the Claudia service manager has been integrated with the standard build procedures of the project. Packages generated via the automated integration procedures have been tested and installed and will appear in the v0.3 release which will occur just after the close of Q3.

OpenNebula Improvements During Q3 several new features has been developed in OpenNebula to address some of the requirements identified in this period, namely: integration with cluster monitoring systems (e.g. Ganglia) and new fault tolerance capabilities to recover from physical host or virtual machine failures. This features can be previewed in v0.3 and will be fully integrated in upcoming releases.

The project's cloud distribution continues to develop largely according to the foreseen plan. The only critical functionality missing from the distribution at the end of Q3 is a solution for cloud storage. This will be a focus of upcoming sprints to ensure that the 1.0 release in May 2011 will be truly complete.

3.4 Quarter 4

In the fourth quarter, two beta releases of the StratusLab cloud distribution were made and deployed on the project's reference cloud infrastructure. The v1.0 production release is expected just after the close of Q4 due to the scheduling of the project's development sprints. The project continues to operate a production grid service over the StratusLab cloud distribution, demonstrating its functionality and stability. The project has also demonstrated the deployment of a grid site with the Claudia service manager with some autoscaling features. Detailed achievements are given below.

EGI User Forum The project booked an exhibition booth at EGI User Forum 2011, which was held in Vilnius, Lithuania from 2011-04-11 to 2011-04-14. Seven posters were displayed covering the topics *Agile Development*, *Bioinformatics*, *Grid-Cloud Integration*, *Marketplace*, *SlipStream Integration*, *Cloud Storage* and *Reference Infrastructure*. Flyers were also printed and distributed as well as t-shirts. The StratusLab tutorial video and other demonstration videos were played on a screen in the booth during the event. The StratusLab booth received the "Best Exhibition" award. A StratusLab Tutorial was also scheduled at the EGI User Forum. It was extremely well attended, with 54 participants in total, 24 of whom tried and succeeded in installing and running the StratusLab client.

Increased Contacts The project has continued to increase the number of contacts with individuals, groups, and projects through presentations of StratusLab and via direct interaction. Notably in this quarter there have been discussions with the HPC Cloud (Amsterdam), NIIF (Budapest), and the Mantychore project concerning possible collaborations on development and deployment. Additionally, a collaboration with HEPiX Virtualization Working Group concerning the design of the Marketplace has taken place in this period.

MoUs More formally, Memoranda of Understanding have been signed with EGI and with the EDGI project, defining the goals, tasks, and timelines for collaboration between the projects. The negotiations of an MoU with VENUS-C have concluded, but the MoU is not yet signed. MoUs with EMI and IGE are still being negotiated.

Base and Customized Appliances The project has increased the number of base (operating system) images that are made available in the Appliance Repository and Marketplace. All of these images have been updated to conform to the new contextualization recipe required by the latest StratusLab releases. In addition, two customized bioinformatics images have been created to validate the image creation procedure and to provide useful test VMs for this community.

Improved Build Processes The Scrum process keeps on improving, with more effective planning meetings and demos. In addition, a number of jobs have been added to the continuous integration server to test a wider range of services and a large number of defined use cases. The state of jobs in the Hudson integration server is now a discussion item in the daily stand-up. This follows a decision by

WP4 to introduce a 'stop-the-line' culture, where all development and integration activities are stop as soon as a failed job occurs in Hudson. This has lead to improved quality of the StratusLab releases.

StratusLab Releases This quarter has seen two beta releases (v0.3 and v0.4) of the StratusLab distribution, leading up to the v1.0 release expected in mid-June. The release v0.4 introduced a change in the database used by OpenNebula, from SQLite to MySQL, which increases the performance and scalability of the system. Migration scripts were created that allowed existing StratusLab deployments to be migrated without loss of information. The underlying operating system was also changed from CentOS 5.5 to Fedora 14 to take advantage of newer features in the KVM hypervisor and to avoid needing to work around limitations stemming from the older kernel in CentOS 5.5.

Evaluation of Current Release The project has evaluated the current release in terms of the initial requirements identified by the project and also with respect to the requirements identified in the EGI VIrtualization Workshop. This has identified gaps in functionality and important points to be included in the Y2 roadmap.

Marketplace This quarter has seen the continued design and implementation of the Marketplace, a registry for shared machine and disk images. A reference implementation of the Marketplace has been made available for use in testing and for development of the client tools. The Marketplace implementation has been extended to include new features such as SPARQL querying of the metadata, new search functionality, and browser-based upload of metadata files. A test deployment of the Marketplace has also been deployed to support tests by the HEPiX Virtualization Working Group.

Test of Parallel File Systems Operational experience has shown that NFS lacks the performance attributes required for the delivery of efficient cloud services. Ceph and GlusterFS have been investigated to see if they offer better scalability and performance. Unfortunately, neither provides an adequate replacement and NFS has been retained while further investigations continue.

Persistent Disk Service An important requirement coming from the users is the need for persistent storage. A prototype persistent disk service and been developed and integrated to satisfy this requirement. This prototype will need to evolve to become an efficient and scalable solution following the feedback from this prototype.

Grid and Cloud Services The project has continued to provide a reference cloud infrastructure over which a production grid site within EGI is being run. Experience garnered from this has lead to the production of a technical note available from the project's web site providing feedback to StratusLab developers and recommendations to those running grid services over a cloud.

Grid Site Deployment via Claudia A grid site has been deployed in the test infrastructure by using Claudia, which has been fully integrated into the standard StratusLab distribution. Component scalability has been carried out considering virtual hardware resources (e.g. VM CPU) and some work in being done towards the scalability driven by Key Performance Indicators (KPI) such as the number of queued jobs.

OpenNebula Adaptations Work has been done in order to adapt OpenNebula to the typical operations of a grid site, like virtual resource placement heuristics, cloud-aware image management techniques, and management of cloud-aware networks. Other enhancements like improvements to the OpenNebula OCCI implementation and group/role support for authentication will be taken advantage of in future releases.

Exploitation and Sustainability Plan The first Exploitation and Sustainability Plan was written and delivered in this quarter. This document outlines the plans for exploitation of the project's results by each of the StratusLab partners and provides a first plan on sustainability of the StratusLab distribution after the project ends in May 2012. This document will be updated and refined in the second year of the project.

The official release of v1.0 will occur early in Q5, followed by an updated architecture which will be used to define the roadmap for Y2 and release 2.0 of the StratusLab cloud distribution.

3.5 WP2: Interaction with Targeted Communities

3.5.1 Summary

3.5.1.1 Quarter 1

The major achievements of this activity include the analysis of two surveys and the development of a set of application benchmarks. The surveys targeted end-users of the StratusLab distribution and system administrators who will install it. They provided extensive feedback and requirements that will be used to guide the development of the StratusLab distribution. The application benchmarks cover a wide range of real-world analysis patterns and will be used to validate the StratusLab distribution and to provide concrete performance metrics.

3.5.1.2 Quarter 2

In parallel with the first public release of the StratusLab cloud distribution, WP2 has worked to expand the number of people (and communities) aware of the distribution, solicited feedback on its installation and use, and provided support to our first users. Strong interactions continue with the bioinformatics community and researchers from ATLAS (high-energy physics experiment) at LAL. Initial contacts with the developers of OpenMole, a task management framework, and the EDGI project promise to diversify our user community. A strong effort has been made on tutorials as a means of providing support and increasing awareness of the StratusLab distribution. WP2 has a self-guided tutorial linked from the release page, a 5-minute screencast version of it, and live tutorials at several scientific meetings. WP2 coordinates and contributes to the support team and collects feedback from users and administrators. The WP2 partners continue to evaluate the latest versions of the StratusLab distribution and to fill functionality gaps: for example, authentication of virtual machine metadata and support for grid certificate authentication.

3.5.1.3 Quarter 3

The number of researchers and groups who express interest in the StratusLab distribution continues to increase through the efforts of the WP2 activity. Most of these researchers have requested access to the project's reference infrastructure and are using that platform for porting their applications to a cloud-based infrastructure. Q4 will see a formal evaluation of the StratusLab distribution based on the experiences of those using the reference infrastructure now. In addition to scientific and commercial users, there has also been a productive collaboration with the maintainer of the ttylinux distribution in order to make it more useful in a cloud setting. WP2 has contributed significantly to the design of the StratusLab Marketplace for shared machine and disk images along with developing tools to allow site policy enforcement and download of those images. The activity continues to promote collaboration with the HEPiX Virtualization Working Group to ensure that the StratusLab distribution can meet their needs and increase the chance of adoption of StratusLab at grid resource centers.

3.5.1.4 Quarter 4

The WP2 activity has continued to expand the number of people, groups, and projects they have contacted about the StratusLab distribution. There is significant interest in evaluating and using project's software. However after the release of the StratusLab 1.0 distribution, the activity will have to make a more concerted and systematic effort in getting feedback from the contacted people, groups, and projects to ensure that the project continues to meet the requirements of our users. Similarly, the activity will need to more systematically review and improve the documentation with each release.

The activity has begun developing customized appliances, specifically two appliances for the bioinformatics community. The activity has also developed a prototype persistent disk service to satisfy a need expressed by many user communities. The appliances and the prototype service will need to evolve according to users' needs in upcoming releases of the StratusLab distribution.

3.5.2 Task 2.1: Interactions with Resource Providers and End-users

3.5.2.1 Quarter 1

User and Administrator Surveys A major component of the work plan for the previous quarter was the creation, deployment, and analysis of two surveys: one for end-users and another for system administrators. IBCP has used its expertise and connections with the bioinformatics community to solicit responses to the User and Administrators surveys. Announcements of these surveys were sent to the scientific and technological lists and contacts in France and also in Europe. The results of these surveys are presented in the deliverable "Review of the Use of Cloud and Virtualization Technologies in Grid Infrastructures" (D2.1). They have provided valuable feedback for the development activities of the project and have allowed the project to build the initial lists of end-users and system administrators interested in announcement of StratusLab releases.

Contacts with ATLAS Scientists Following a presentation at the Seillac conference for LAL employees, two people from the ATLAS experiment approached us concerning use of virtualization and cloud technologies. With our help, they developed a virtual machine that contained the commercial software required for their research and successfully ran instances of that machine on LAL's OpenNebula installation. The software uses a token-based licensing system that worked without problems with the multiple virtual machine instances.

Contacts with French Bioinformatics Community Members of IBCP have participated in meetings in collaboration with the French RENABI GRISBI community. This is designed to foster acceptance and deployment of the StratusLab Toolkit within this community and to gather their requirements.

Bioinformatics Appliance IBCP has defined what will be the first bioinformatics virtual appliance of the project. This virtual machine will be based on the grid worker node distribution, will have selected bioinformatics applications preinstalled, and will be connected to the biological databases repository of the bioinformatics grid site. This thematic appliance will be available from the project's appliance repository.

3.5.2.2 Quarter 2

ATLAS Experiment CNRS/LAL continues to work with people within the laboratory from the ATLAS experiment. We have helped them develop a virtual machine image containing commercial software for the design and testing of custom integrated circuits. This application uses license tokens and is a good example of the integration of commercial applications on a cloud infrastructure. (GRNET in WP5 has also discussed with people from MathWorks about providing a MATLAB appliance compatible with StratusLab.)

EDGI Project CNRS/LAL has discussed with the EDGI project at both the managerial and technical levels on how EDGI can use virtualization technologies to provide better quality of service on desktop grid systems. A formal Memorandum of Understanding (MoU) will likely be developed between the projects to define the collaboration. At a technical level, participants in EDGI from CNRS/LAL and INRIA have asked for support for creating machine images and deploying them on the LAL preproduction cloud service.

OpenMole CNRS/LAL has discussed with the author of the OpenMole system (a workflow/task management system) about how resources within a StratusLab cloud could be used. Although in the early stages, the authors are very interested in collaborating with the project and initial support for the use of cloud resources through OpenMole is expected in the next quarter.

Bioinformatics Community CNRS/IBCP has contributed to several events involving the French bioinformatics community and has organized meetings with the French RENABI GRISBI community. It regularly presents the StratusLab project and results at these meetings to raise awareness of the project and to promote collaboration. In particular, StratusLab was presented at the national GRISBI scientific school (27 September, 40 attendees, Roscoff, France) and at the regional scientific workshop (10 November, Lyon, France) of PRABI (Rhone-Alps Bioinformatics Platform). CNRS/IBCP has initiated a collaboration with the French bioinformatics platform GenOuest about the deployment and usage of StratusLab distribution for bioinformatics applications. A first workshop took place at IBCP on 18-19 October 2010. These workshops and meetings were used to collect use cases and requirements.

Contacts with System Administrators CNRS/LAL has discussed with system administrators at BELNET (Belgium) and at RAL (UK) about the StratusLab distribution. Both have installed the public release via Quattor and have provided feedback to the project. CNRS/IBCP has organized meetings with the French RENABI GRISBI administrators who provide resources to the French bioinformatics community.

User Tutorial CNRS/LAL has prepared a self-guided user tutorial that is available from the StratusLab web site. In addition, a 5-minute "screencast" of the tutorial has been prepared. It is also available from the release page on the StratusLab website as well as on on YouTube (thanks to WP3). CNRS/IBCP has presented tutorials about how cloud technologies could meet the needs of bioinformatics users. These tutorials were based on OpenNebula and the StratusLab distribution; they included a detailed description of the StratusLab project, its goals, current releases, and functionality interesting for bioinformatics applications. These tutorials took place at the national GRISBI scientific school (1 October 2010, 22 students, Roscoff, France) and at the RENABI GRISBI steering committee meeting (19 November, 12 attendees, Toulouse, France).

3.5.2.3 Quarter 3

TID internal Cloud testbed A new testbed, constituted with open source technologies, is being created inside TID infrastructure for Cloud tools education. StratusLab distribution is going to be used to install and configure Claudia and OpenNebula software. TID people are aware of the StratusLab value due to some internal demos and presentations.

Spain super computation centers Claudia and OpenNebula have been installed inside the CESGA http://www.cesga.es/index.php?lang=en super computation center in Santiago (Spain) by using StratusLab distribution. In next weeks, it is planned to install them also in Calendula datacenter, the computation center in Castilla Leon region http://www.fcsc.es/index.php?option=com_content&view=frontpage&Itemid=1&lang=es. Although this work is part of the NUBA project, since NUBA use cases are deploying in both data centers, this activity is providing visibility to StratusLab. In the NUBA consortium there are data centers partners as CESGA and Calendula, SMEs XERIDIA and CATON and large enterprises as ATOS and TID. It seems to be an important forum to disseminate StratusLab results.

Virtual Spain Claudia from the StratusLab distribution in being used in the Spain-funded Virtual Spain project (CENIT research programme), where TID is collaborating.

Fiware TID was presenting Claudia and TCloud in the Fiware kickoff-meeting. TID pointed to StratusLab tools as the way to install and configure those assets.

Virtual Spain TID is contacting the Spain-funded Virtual Spain project (CENIT research programme), which aims at enriching interactive multimedia services with geographical data (satellite images, digital terrain models, etc). TID attended the project's Technical Committee in early December. The grid-related part of the project researches the adaptation of geospatial data processing flows to massive computation platforms based on cloud computing. The project is aware of Stratus-lab and the potential of the software being developed.

LAPP The Laboratoire d'Annecy-le-Vieux de Physique des Particules (LAPP) is a CNRS particle physics laboratory located in Annecy, France. They had proposed a cloud-based infrastructure for the laboratory and the surrounding university campus, which was unfortunately not directly funded. However, they view cloud technologies as a natural complement of their existing grid infrastructures and wish to continue to work towards such an infrastructure on a best-effort basis. LAL has discussed in detail how they could take advantage of the StratusLab distribution to simplify their grid administration and to provide cloud-based resources to their users. LAPP already has extensive experience with VMware and is willing to test the StratusLab distribution over VMware. This would help the project in providing direct feedback on another underlying virtualization technology.

ASSYST Meeting on Cloud Computing Following a presentation of StratusLab at the ASSYST Meeting on Cloud Computing in Paris, we have been contacted by a Portuguese researcher who is interested in porting his master/worker calculation framework, Conillion, to the cloud. WP2 will help him to do this porting using the reference infrastructure.

ttylinux The ttylinux distributions are small, but fully functional, linux distributions that are typically used for embedded systems. Images based on these distributions are extremely useful for testing the StratusLab cloud and for training. Scientists may also be interested in these images because of their extremely fast start-up times. LAL had a strong collaboration with the maintainer of the ttylinux distributions in order to make it more appropriate for use in a cloud. Essentially all of the customization that StratusLab had been doing for making cloud ttylinux images have been adopted by the maintainer and now appear in the standard ttylinux distributions. This makes it easier for the project (and others) to keep pace with the new ttylinux releases. StratusLab will prepare new images based on the updated ttylinux distributions in Q4.

HEPiX Virtualization Working Group Significant work in Q3 was related to the collaboration with the HEPiX Virtualization Working Group concerning the Marketplace and trusting of machine images through signed metadata. There are ongoing discussions with this group to allow for interoperable metadata descriptions between various services. There is an interest on their part to use the StratusLab Marketplace if it can fulfill their requirements.

IIT Vietnam An engineer from the Institute of Information Technology in Vietnam visited LAL for a week to learn about the StratusLab distribution. During this week, this engineer learned how to use the StratusLab reference infrastructure, how to create new machine images, how to upload them to the image repository, how to deploy grid services within the cloud, and how to install a StratusLab cloud. In addition, the engineer also started porting a drug-discovery scientific application based on the WISDOM platform. This collaboration is continuing after his return to Vietnam; other scientists from his institute will come for training in Q4.

NIIF The National Information Infrastructure Development (NIIF) Program is the framework for the national research network in Hungary. They have already developed a working cloud prototype for their users. In particular, they have based their image repository infrastructure around iSCSI technologies. LAL discussed various points for collaboration, in particular around using these storage technologies in the StratusLab distribution. Providing storage services will be a major focus for Q4, so it is expected that technical collaboration will begin then.

NUBA TID is contacting the Spanish NUBA project (Avanza research program), which aims to develop a multi-vendor federated IaaS platform for corporations. The project team takes into consideration the use of the Stratuslab tools to deploy their testbed.

TID Private Cloud TID is discussing with the in-house Private Cloud project on how the Service Manager can benefit from the tasks that are being carried out in StratusLab. Although in the early stages, the development team is very interested in collaborating and expressed their interest in areas such as monitoring and scalability applied to the use cases of grid services.

French Bioinformatics RENABI IBCP has created two customized machine images for the bioinformatics community: "biological databases repository" and "bioinformatics compute node". The "biodata repo" VM aims to provide users with access from any cloud node to international reference databases recording biological resources such as protein or gene sequences and associated data, protein structures, or complete genomes. This appliance acts as an proxy between the internet where all the reference databases are published and the cloud internal virtual nodes that will compute the bioinformatics analyses. The "biocompute node" VM has pre-installed bioinformatics software such as ClustalW, BLAST, FastA and SSearch. Because these methods require access to reference data for processing, this appliance is linked via an NFS mount to the "biodata repo" appliance.

ELIXIR IBCP has participated to an ELIXIR workshop about Bioinformatics Infrastructures. StratusLab was presented as a possible solution for bioinformatics distributed infratructures, especially for the web services and portal interfaces deployed by IBCP and for the French distributed infrastructure set-up by RENABI GRISBI. Attendees are very interested in StratusLab. Contact with institutes Germany (Rost Lab, Munich), Denmark (CBS, Copenhagen) and Netherlands (CMBI, Nijmegen) has been made. One member of the Rost Lab who is in charge of cloud evaluation has already requested for an account on the StratusLab Reference Infrastructure.

3.5.2.4 Quarter 4

TID internal Cloud testbed A new testbed, using with open source technologies, is being created inside the TID educational infrastructure for cloud tools. The StratusLab distribution is going to be used to install and configure Claudia and

OpenNebula software on this testbed. TID personnel are aware of the value of StratusLab due to some internal demonstrations and presentations.

Spanish Supercomputing Centers Claudia and OpenNebula have been installed inside the CESGA[1] supercomputing center in Santiago (Spain) by using StratusLab distribution. In the coming weeks, it is planned to install them also in Calendula data center, the computation center in Castilla Leon region[2]. Although this work is part of the NUBA project, this activity is providing visibility to StratusLab. In the NUBA consortium there are data center partners (CESGA and Calendula), SMEs (XERIDIA and CATON), and large enterprises (ATOS and TID). It seems to be an important forum to disseminate StratusLab results.

Virtual Spain Claudia from the StratusLab distribution in being used in the nationally-funded Virtual Spain project (CENIT research programme), in which TID is collaborating.

Fiware TID was presenting Claudia and TCloud in the Fiware kickoff-meeting. TID pointed to StratusLab tools as the way to install and configure those assets.

Contacts with Other Projects The project has made contact with other projects such as HPC Cloud (Amsterdam), NIIF (Budapest), and the Mantychore project. Initial discussions to collaborate on development, deployment, and standards took place which will need to be followed up in the following quarter. Some topics for collaboration are a user-level graphical user interface, storage implementations, efficient caching of VM images, and API standards such as OCCI, TCloud, and CDMI.

Appliances for the Bioinformatics Community CNRS IBCP has created two customized machine images for the bioinformatics community: “biological databases repository” and “bioinformatics compute node”. The “biodata repo” VM aims to provide users with access from any cloud node to international reference databases recording biological resources such as protein or gene sequences and associated data, protein structures, or complete genomes. This appliance acts as an proxy between the internet where all the reference databases are published and the cloud internal virtual nodes that will compute the bioinformatics analyses. The “bio-compute node” VM has pre-installed bioinformatics software such as ClustalW, BLAST, FastA and SSearch. Because these methods require access to reference data for processing, this appliance is linked via an NFS mount to the “biodata repo” appliance. This work has been reported in detail in the Milestone MS3 “Creation of Virtual Appliances for Bioinformatics Community”. A poster has been presented at the EGI User Forum in Vilnius. Another poster has been submitted and accepted to the French annual Bioinformatics conference JOBIM 2011.

Persistent Disk Service An important requirement coming from the users is the need for persistent storage. The activity has created and integrated a proto-

[1] http://www.cesga.es/index.php?lang=en

[2] http://www.fcsc.es/index.php?option=com_content&view=frontpage&Itemid=1&lang=es

type persistent disk service to satisfy this requirement. This prototype will need to evolve to become an efficient and scalable solution following the feedback from this prototype.

EGI User Forum LAL played a leading role in the development of the user tutorial presented at the EGI User Forum in Vilnius, Lithuania. It was extremely well attended with 54 participants in total with 24 who tried to install the StratusLab client. All 24 succeeded in using the Reference Infrastructure provided by WP5. It was also instrumental in preparing the posters displayed in the project's booth.

3.5.3 Task 2.2: Intensive Evaluation of StratusLab Products

3.5.3.1 Quarter 1

Application Benchmarks The core development of this work package has been the creation of a set of application-level benchmarks. These benchmarks cover CPU-intensive, IO-intensive, workflow, and parallel applications. These will be used to validate StratusLab releases and to measure the performance of the system for real scientific applications. These benchmarks are packaged and made available as part of the StratusLab releases.

Debugging During the installation and use of the OpenNebula deployments, numerous bugs and features requests were generated. All of these issues have been put into the project's issue tracker (JIRA) and will be followed up in future sprints. Issues related to the use of the StratusLab utilities for deploying machines, creating machines, etc. have similarly been put into JIRA and reported to the developers.

3.5.3.2 Quarter 2

Image Metadata Sharing of virtual machine images will require a standard format for the image metadata and a method of signing that metadata to ensure its authenticity. CNRS/LAL has developed tools for signing and validating metadata information in XML files using XML Digital Signature API. Grid Certificates or DSA/RSA keys can be used to sign the metadata. When grid certificates are used, the identity of the signer is extracted and printed during the metadata validation.

Application Benchmarks The application benchmarks have been included as a part of the first public StratusLab release. These are available to both end-users and system administrators. They will eventually be used by the project to evaluate the efficiency of different deployment scenarios.

Grid Certificate Authentication Integration with EGI will require the support of the grid authentication mechanisms. CNRS/LAL had developed a proxy server that allows authentication based on grid certificates. This initial prototype proxies the OpenNebula XMLRPC interface. This proxy service will evolve as the project moves towards the OCCI interface. Full support of grid identities, groups, and roles will require modifications to OpenNebula itself.

Quattor Configuration CNRS/IBCP has evaluated the StratusLab installation with Quattor by deploying a front-end and nodes on their local resources in Lyon, following the online "Quattor Installation Guide".

Bioinformatics Appliance CNRS/IBCP has worked on the definition of a bioinformatics appliances consisting of a gLite Worker Node with pre-installed bioinformatics applications and NFS mounts of biological data. A first instance was integrated in the grid site IBCP-GBIO and is under evaluation.

3.5.3.3 Quarter 3

Claudia Documentation A wiki page has been created to document Claudia http://stratuslab.eu/doku.php/claudia, installation instructions, packages, its usage and so on.

Documentation The activity lead the effort to restructure on the online documentation of StratusLab and will continue to work to keep it up to date with the project's preview releases.

Semi-Production Use of StratusLab LAL has deployed a StratusLab cloud for use by the computer services section of the laboratory. This is used to test and to deploy laboratory services to gauge how well the cloud paradigm works in a production setting. Several bugs have been found and corrected (e.g. incorrect reporting of the number of virtual CPUs). Also several feature requests have come out of this work: need for group machine management, "tags" of virtual machines to easily identify them, and finer control over the resource allocations for a particular machine instance.

Evaluation of StratusLab Manual Installation IBCP is deploying a StratusLab cloud for use by the bioinformatics section of the laboratory. The manual installation procedure is used in order to be strongly evaluated. In case of deployment of StratusLab clouds in other bioinformatics Labs such as the French RENABI ones, there will be no expertise about Quattor usage. Then the manual installation will be very probably the most used one in the Bioinformatics community, at least for the first times. Several bugs have been found and most were fixed, e.g. the daemons httpd and oned were not configured to start at boot time (chkconfig on), misconfiguration of the passwords between the different files (jetty-7 login.properties, oned one_auth) or problem in the configuration file ('app_repo_use_ldap' in stratuslab.cfg).

Marketplace As part of the collaboration with the HEPiX Virtualization Working Group, LAL has contributed extensively to the design and development of the StratusLab Marketplace. The design has been captured in the Marketplace technical note. LAL has also created scripts to allow for policy enforcement and downloading of images based on image metadata. These will be critical for the integration of the Marketplace into the distribution and allowing cloud administrators better control over the images running on their infrastructure.

3.5.3.4 Quarter 4

Claudia Documentation A wiki page has been created to document Claudia[3], including installation instructions, packages, and its usage.

Use Cases in Hudson An important contribution to the testing and stability of the StratusLab software has been the inclusion of jobs within the hudson continuous integration server that test specific use cases and benchmarks. These are executed automatically when changes to the code are made. Failures are followed up immediately by the integration activity to ensure that the project's software distribution continues to satisfy the primary use cases. The jobs test the complete VM lifecycle, the Marketplace, the Registration Service, and the benchmarks.

Manual Installation in Bioinformatics Laboratory CNRS IBCP has evaluated the manual installation of the StratusLab framework to deploy a cloud site devoted to Bioinformatics. Several issues have been identified and reported to the project's developers, who have corrected them. Manual installation is potentially the most realistic way of deploying the StratusLab system in bioinformatics laboratories that do not have system administrators who are experts with the Quattor system. The main goal of this evaluation was to fix bugs and to confirm the reliability of this procedure.

Evaluation of Reference Cloud with Bioinformatics Appliances CNRS IBCP has used their two virtual appliances, "Biological databases repository" and "Bioinformatics compute node" to evaluate the reference cloud deployed in GRNET. This work has been reported in details in the Milestone MS11 "Operation of Site Running StratusLab toolkit".

Evaluation of Current Release The activity has evaluated the current release in terms of the initial requirements identified by the project (D2.1) and also with respect to the requirements identified in the EGI Virtualization Workshop. This evaluation is contained in the deliverable D2.2.

3.5.4 Issues and Corrective Actions

No major issues related to WP2 have arisen in Q1.

No major issues related to WP2 have arisen in Q2.

No major issues related to the WP2 work plan have arisen in Q3.

More Followup The activity has made contact with a large number of individuals, groups, and projects over the course of the first year. However, the level of feedback and interactions has been moderate. With the release of the StratusLab 1.0 release, a more concerted effort will need to be made to follow up on these contacts and to solicit actively relevant feedback. The survey planned for Q5 will be a start, but more direct personal contact will be needed as well.

Improved Documentation The activity has been rather lax in keeping the documentation on the web site consistent with the current release. Embedding jobs

[3] http://stratuslab.eu/doku.php/claudia

in hudson for the primary use cases will help flag changes needed in the documentation and tutorials. Nonetheless, more systematic review and update of the documentation needs to be done by the activity.

3.6 WP3: Dissemination

3.6.1 Summary

3.6.1.1 Quarter 1

The focus in the first quarter has been on promoting the project and its objectives to a variety of audiences. This was achieved through a launch press release, the project website, visible online presence and technical presentations. The EGI Technical Forum 2010 has been chosen as a high-profile event to promote the project to key target groups.

Looking forward to the rest of the first year, the project is developing its initials plans for dissemination, collaboration and standardization activities, and it has established initial aims for collaboration with related projects.

3.6.1.2 Quarter 2

StratusLab began its second quarter dissemination and collaboration activities with a strong presence at the EGI Technical Forum 2010, in Amsterdam. StratusLab prepared for its first software release–and the associated dissemination activities–in early November. The release was announced through a number of online outlets and a tutorial video produced in WP2 was published on YouTube. Prior to the software release, the website was updated to support social network sharing and to allow better analysis of visitor/download patterns.

At the EGI Technical Forum, ICT 2010, the 8th e-Infrastructure Concertation meeting, and other events, StratusLab partners had the opportunity to develop connections and collaborations with other projects and potential users. Collaborations with DCI projects are under way with the expectation that these will be formalized through Memoranda of Understanding in the coming quarter.

3.6.1.3 Quarter 3

The project continued to increase its visibility among European projects. The dissemination effort has been primarily concerned with announcing development releases of the software, and with preparing for the EGI User Forum 2011. Project partners continue to give talks to promote and explain StratusLab.

Collaboration activity has increased through involvement with SIENA, EGI-InSPIRE and other DCI projects, and Memoranda of Understanding are in the preparation or exploration phases in some cases.

3.6.1.4 Quarter 4

The project continued to increase its visibility among European projects. The dissemination effort focused largely on the participation in the EGI User Forum 2011. Project partners continue to give talks to promote and explain StratusLab and participated in several workshops where the StratusLab project was presented during discussion sessions.

Collaboration activity has increased with Memoranda of Understanding (MoU) now signed with the EGI and EDGI projects. Other MoUs are being explored (e.g. EMI and IGE); an MoU will not be pursued with ERINA+ because of a large amount of additional effort required in StratusLab and an incompatibility with the timelines. Involvement with SIENA has also continued with StratusLab participating in the *Cloudscape III* meeting.

The Exploitation and Sustainability First Plan (D3.3) was written and delivered in this quarter.

3.6.2 Task 3.1: Dissemination

3.6.2.1 Quarter 1

Press Release The dissemination activities began with a press release announcing the launch of the project, which was picked up by relevant online media reaching resource providers, end-users, and the technical and general public.

Website The project website was set up (http://www.stratuslab.eu) and some plans have been made for future developments. A Twitter account (*StratusLab*) has been created to allow the project to develop a social network.

Presentations Project members have given presentations that describe or mention StratusLab, such as at the XtreemOS Summer School, Günzberg, Germany and at the CSIC graduate course on Grid and e-Science, Valencia, Spain both in July 2010. In addition, keynotes or invited talks with slides about StratusLab were given at EuroPar 2010, Ischia; CERN, Geneva; HPC 2010, Cetraro; SWSTE 2010, Herzlia; and First European Summit on Future Internet, Luxembourg.

EGI Technical Forum 2010 The project has booked an exhibition booth at EGI Technical Forum 2010 and is preparing posters, demonstrations and other dissemination material for this event.

3.6.2.2 Quarter 2

Release Dissemination In preparation for the first software development release (version 0.1) on 9 November 2010, a *release dissemination plan* was created that covered the main dissemination targets for the release. For the initial release we wanted plenty of awareness of the software and the project, but with the focus on those groups who would be most interested in testing a version of the software that was not ready for full production use. With this in mind, the release was disseminated to our opt-in announcements list and relevant online media.

The release dissemination plan will be revised as necessary for future public releases. The project plans to make public, development releases every six weeks.

Media & Publications A press release was prepared for the first software development release and distributed to a number of outlets that had been interested previously in our work. This was picked up by *HPCwire*, *Sys-Con*, *CloudExpo News*, *DSA Research Blog*, and *OpenNebula Blog*. In addition, an announcement appeared in *International Science Grid This Week* on 14 November 2010.

Work continued on an article in *International Science Grid This Week* (http:

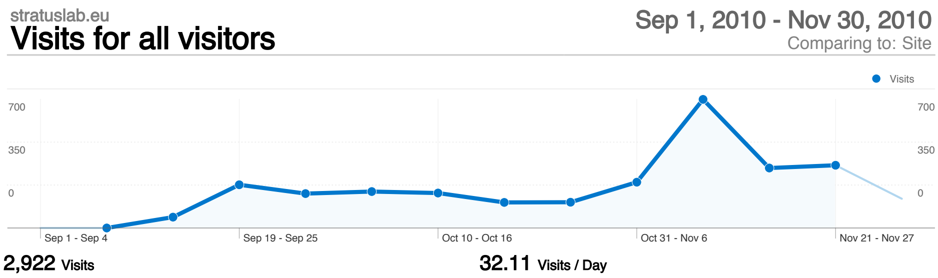

Figure 3.1: *Visits for Q2 showing the increase in traffic around the first software release.*

//isgtw.net/) covering the results of the StratusLab surveys carried out by WP2 in Q1 and the recent software release. This was published on 24 November 2010. StratusLab was also mentioned in the e-ScienceTalk *Grid Briefing* entitled *Mapping the e-Infrastructure Landscape* published in November 2010.

Website The project website (http://www.stratuslab.eu) was updated to include some social media features, such as a link to the project Twitter account (*@StratusLab*) and social bookmarking / messaging tools, allowing visitors to post links to Twitter, Facebook, Digg and others. The website RSS feed was modified to show project news rather than wiki changes, making it more useful for outside users.

Website monitoring was improved to give the project better visibility of the number of visitors and software downloads. Google Analytics gives a clear view of website traffic and, for instance, allows us to visualize spikes in traffic caused by media exposure (See Figure 3.1). AWStats (running locally on the web server) can provide in-depth statistics for non-web files, including software downloads.

EGI Technical Forum 2010 The project booked an exhibition booth at EGI Technical Forum 2010 and presented posters, demonstrations and other dissemination material. StratusLab had a very visible presence at the event. Project members gave a number of high-profile presentations, listed in Table 3.1.

StratusLab members participated in the session *Enabling Clouds for e-Science*, which brought together a number of international cloud computing projects.

Talks A brief list of talks describing the project delivered during Q1-Q2 is given in Table 3.1. Details and links, where available, are given on the project website at http://stratuslab.eu/doku.php?id=presentations.

3.6.2.3 Quarter 3

Release Dissemination The release dissemination plan devised for the first software development release in the previous quarter was updated for version 0.2 and 0.3. Preparation has begun for the release of version 0.3, due early in Q4.

Media & Publications The StratusLab grant is acknowledged in a book chapter “Architectures for Enhancing Grid Infrastructures with Cloud Computing” by

Table 3.1: *Talks in Q1-Q2*

Title / Event	Date
EuroPar 2010	31 August – 3 September 2010
Integrating Cloud Monitoring and Accounting with Grid Operational Tools	14 September 2010
Operational Considerations From Running Grid Services on Cloud Resources	14 September 2010
StratusLab Accounting Requirements, EGI Technical Forum 2010	15 September 2010
Cloud Challenges, EGI Technical Forum 2010	16 September 2010
ICT 2010, Brussels, Belgium	27–29 September 2010
GRISBI Bioinformatics School, Roscoff, France	1 October 2010
OGF30/Grid2010	25–28 October 2010
CloudComp 2010	26–28 October 2010
ISC Cloud 2010	28–29 October 2010
HP Labs Seminar	November 2010
7th International Cloud Computing Expo	1 November 2010
SlipStream and StratusLab, Cloud & ICT 2.0 Summit, Geneva	18 November 2010
OW2 Annual Conference	24–25 November 2010

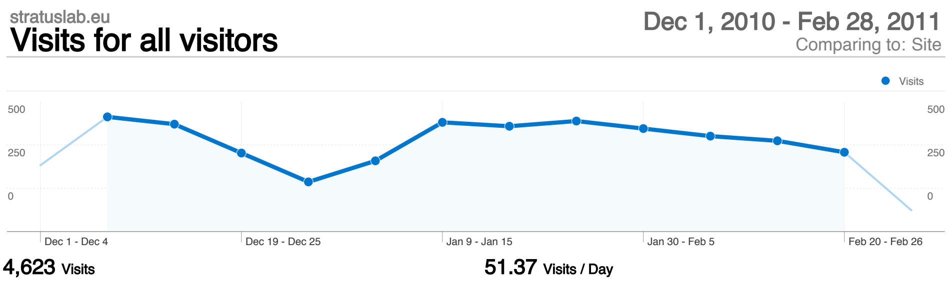

Figure 3.2: *Visits for Q3.*

Eduardo Huedo, Rafael Moreno-Vozmediano, Ruben S. Montero and Ignacio M. Llorente (of StratusLab participant UCM) in *Grids, Clouds and Virtualization* (Springer, 2011). An initial, internal draft of an academic position paper on StratusLab was prepared.

Website The project website (http://www.stratuslab.eu) was updated to allow visitors to provide comments. This will be used initially to solicit feedback on the project roadmap. The website content management system was also upgraded to get the latest features and security updates. Some design work has begun to improve the appearance and usability of the project website for visitors.

Figure 3.2 shows the number of visits to the website. The number has increased from 2922 in Q2 to 4623 in Q3 (+58%).

Online, the project's Twitter account has been used to announce development progress such as planning meetings, demos and releases.

EGI User Forum 2011 The project has booked an exhibition booth at EGI User Forum 2011 – to be held in Vilnius, Lithuania – and WP3 is coordinating the preparation of dissemination materials for the event including t-shirts, flyers, and demonstrations.

GRNET has submitted an abstract to the conference describing the release infrastructure provided for interested users. LAL will provide training on StratusLab as part of the 'Heavy User Communities' training sessions at the event.

Project partners will participate in the virtualization strand of the conference program.

Talks A brief list of talks describing the project delivered during Q3 is given in Table 3.2. Details and links, where available, are given on the project website at http://stratuslab.eu/doku.php/presentations.

3.6.2.4 Quarter 4

Release Dissemination A release dissemination plan, based on the plans for previous releases, was devised for version 0.4. A larger dissemination effort is planned for the upcoming release 1.0, and the release dissemination plan is being updated for this purpose.

***Table 3.2:** Talks in Q3*

Title / Event	Date
"StratusLab: The European Initiative to Bring Cloud to Grid Infrastructures" (R. S. Montero, UCM) at Spanish NGI meeting, Barcelona, Spain	2010-12-02
"StratusLab : Le projet et sa distribution cloud" (C. Loomis, LAL) at France-Grille Cloud Event in Lyon, France	2010-12-13
UCM talk at France-Grille Cloud Event in Lyon, France	2010-12-13
"Cloud Computing – Anatomy and Practice" (M.-E. Bgin, SixSq) at *Groupe romand des utilisateurs/trices de GNU/Linux et de Logiciels libres*, Morge, Switzerland	2011-01-11
"StratusLab Cloud Distribution" (C. Loomis, LAL) "Opening the Cloud" 2011 ASSYST Meeting on Cloud Computing, Paris, France	2011-01-31
UCM talk at Cloud Expo Europe 2011, London, United Kingdom	2011-02-03
"Bioinformatics distributed infrastructure, services and cloud computing" (C. Blanchet, CNRS IBCP) at *ELIXIR Workshop - Bioinformatics Infrastructures*, Amsterdam, Netherlands	2011-02-22

OpenNebula StratusLab partner UCM were involved in the release and dissemination of OpenNebula 2.2, which is a major component of StratusLab from version 0.3.

Media & Publications The StratusLab version 0.3 release was announced with a release annoucement in iSGTW[4] which ran on 15th March.

CNRS IBCP has submitted a poster to the French annual Bioinformatics conference JOBIM 2011 to be held in Institut Pasteur in Paris in June 2011. The subject is "Virtualisation of Bioinformatics Applications on Cloud Infrastructure". The submission introduces the virtual bioinformatics appliances that have been built by the partner CNRS and the benefit to bioinformatics scientists and engineers of using the cloud service from StratusLab. The poster has been accepted for presentation.

StratusLab also provided input to the SIENA white paper "SIENA European Roadmap on Grid and Cloud Standards for e-Science and Beyond Cloudscape III Use Cases and Position Papers".

Website A significant redesign of the project website[5] was undertaken with a new version expected to go live shortly after the end of Q4, and before the release of version 1.0. The new version has a more appealing design and is easier to navigate. It also gives more visibility on the front page to the news items and the

[4] http://www.isgtw.org/
[5] http://www.stratuslab.eu

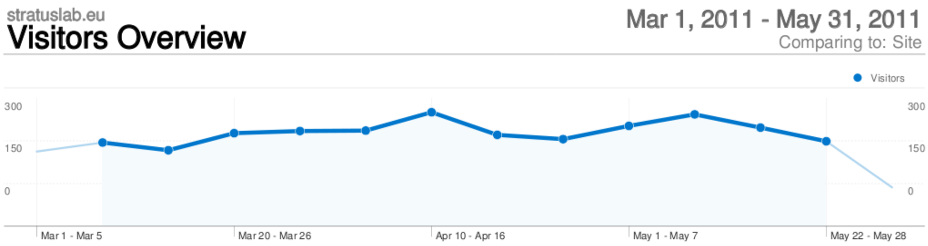

Figure 3.3: *Visits for Q4.*

Twitter feed, in order to ensure that the main content is regularly updated and to increase repeat visits.

A section devoted to Bioinformatics has been created on the project web site. These pages introduce the current context in Bioinformatics and what advantages the scientific community could take from the StratusLab realizations in link with their science. The two bioinformatics appliances developed by CNRS IBCP are also described in terms of what they provide and how to use them on a StratusLab cloud such as the reference infrastructure in GRNET.

Figure 3.3 shows the number of visits to the website. The number for Q4 (4,579 visits) is similar to that for Q3 (4,623 visits).

Online, the project continued to use the Twitter account to announce development progress, releases and participation at events. The StratusLab Twitter feed now has 53 followers.

EGI User Forum 2011 The project booked an exhibition booth at EGI User Forum 2011, which was held in Vilnius, Lithuania from 2011-04-11 to 2011-04-14. Seven posters were displayed covering the topics *Agile Development*, *Bioinformatics*, *Grid-Cloud Integration*, *Marketplace*, *SlipStream Integration*, *Cloud Storage* and *Reference Infrastructure*. Flyers were also printed and distributed as well as t-shirts. The StratusLab tutorial video and other demonstration videos were played on a screen in the booth during the event. The StratusLab booth received the "Best Exhibition" award.

Talks were presented by Charles Loomis (LAL) and Vangelis Floros (GRNET) on "Operating Grid Services on the StratusLab Cloud" and "StratusLab Collaborations".

A StratusLab Tutorial was also scheduled at the EGI User Forum. It was extremely well attended, with 54 participants in total, 24 of whom tried and succeeded in installing and running the StratusLab client.

Workshops CNRS representatives (C. Blanchet and C. Loomis) have participated to the national workshop "RENABI GRISBI, Science and Technology Days" in Lyon (26 May 2011, 49 participants). CNRS IBCP has introduced the StratusLab developments as a reliable perspective for the French Bioinformatics infrastructure RENABI GRISBI. CNRS LAL has presented the project, its goals and the current developments.

GRNET representative Vangelis Floros participated in the e-Infranet Cloud Computing Workshop on 29–30 March in Leuven, Belgium, presenting the StratusLab's point of view in the workshop discussions.

The StratusLab Marketplace was presented at the HEPiX Workshop in Darmstadt, Germany which took place over the period 2–6 May.

Talks A brief list of talks describing the project delivered during Q4 is given in Table 3.3. Details and links, where available, are given on the project website[6].

3.6.3 Task 3.2: Collaboration with Standards Bodies and Related Projects

3.6.3.1 Quarter 1

The project is developing its "Initial Plan for Dissemination, Collaboration and Standardization Activities" (D3.1) to be published shortly. Project members have made contact with related projects (in particular the EC-funded Distributed Computing Infrastructures projects) to establish points of collaboration, via face-to-face and remote meetings. The project has joined with other DCI projects to exchange information on collaboration needs and expectations. Two project members participated in a joint DCI kick-off event in Brussels.

3.6.3.2 Quarter 2

The project published its "Initial Plan for Dissemination, Collaboration and Standardization Activities" (D3.1) early in this quarter.

e-Infrastructure Charles Loomis participated in the 8th e-Infrastructure Concertation Meeting on 4–5 November 2010, CERN in Geneva, Switzerland (http://www.e-sciencetalk.org/e-concertation/).

SIENA At the 1st SIENA Roadmap Event, 27 October 2010, in conjunction with OGF30, Brussels, Juan Caceres represented StratusLab at the Roadmap Editorial Board: a group of national and international distributed computing initiative members, active contributors to standards, and collaborating e-Infrastructure users serve on an editorial board to consolidate the Roadmap's wide input.

Venus-C Project partners participated in several meetings with the Venus-C project about collaboration between both projects.

IGE Project partners met with the IGE project about collaboration between both projects, to deploy Globus middleware and services on StratusLab sites.

EGI-InSPIRE StratusLab will contribute to EGI-InSPIRE deliverable D2.6 on *Integration of Clouds and Virtualization into the European Grid Infrastructure*.

FP7 Proposals StratusLab partners were approached by a number of project consortia interested in future collaborations. The project issued Letters of Support for four projects.

[6] http://stratuslab.eu/doku.php/presentations

Table 3.3: *Talks in Q4*

Title / Event	Date
“Security Management in OpenNebula Cloud Architectures” (Javier Fontn, UCM) at 9th RedIRIS Security Forum on Cloud Computing	2011-03-09
“StratusLab Cloud: Early success stories and community feedback” (V. Floros, GRNET) at CloudScape III, Brussels, Belgium	2011-03-15
“StratusLab: Enhancing Grid Infrastructures with Virtualization and Cloud Technologies” (C. Loomis, LAL) at EU-Canada Future Internet Workshop, Waterloo, Ontario, Canada	2011-03-23
StratusLab Booth at the EGI User Forum, Vilnius, Lithuania	2011-04-11 – 2011-04-14
“Operating Grid Services on the StratusLab Cloud” (V. FLoros, GRNET) at the EGI User Forum, Vilnius, Lithuania	2011-04-11
“StratusLab Tutorial” at the EGI User Forum, Vilnius, Lithuania	2011-04-12
“StratusLab Collaborations” at the ECEE Workshop during the EGI User Forum, Vilnius, Lithuania	2011-04-13
“Sharing Virtual Appliances with the StratusLab Marketplace” at the HEPiX Workshop in Darmstadt, Germany	2011-05-05
“Panel Discussion” sharing knowledge on StratusLab’s experience in applying agile (and Scrum) in academic context and FP7 contracts (Marc-Elian Bgin, SixSq) at XP2011, Madrid, Spain	2011-05-11
“StratusLab use cases” at EGI User Virtualisation Workshop, Amsterdam, Netherlands	2011-05-12
“Cloud Computing & StratusLab” at Journée Grille de production EGI, Lille, France	2011-05-17
“StratusLab: Enhancing Grid Infrastructures with Cloud and Virtualization Technologies” at the TERENA Conference in Prague, Czech Republic	2011-05-19
“StratusLab: Enhancing Grid Infrastructures with Cloud and Virtualization Technologies” at Journes GRISBI in Lyon, France	2011-05-26
“Grid-Ireland Operations Centre / TCD presentation” featuring StratusLab at Lero Cloud Computing seminar Cork, Ireland	2011-05-26

3.6.3.3 Quarter 3

SIENA Project partners prepared for the upcoming *Cloudscape III* meeting (March 15–16) organized by SIENA. Vangelis Floros will represent StratusLab.

TID wrote several sections on the SIENA Initiative (http://www.sienainitiative.eu/) wiki, which has been set up specifically for the writing of the *SIENA European Roadmap on Grid and Cloud Standards for e-Science and Beyond*. The sections aim at disseminating the activities carried out in Stratuslab, and consisted of an introduction to the project, a description of challenges and a description of engagement. In addition to that, deliverable D6.1 was uploaded as a reference document for StratusLab's *Cloud-like management of grid sites design*.

Memoranda of Understanding StratusLab has taken initial steps towards establishing a Memorandum of Understanding with EGI. The project has begun exploring the possibility of MoUs with other projects: namely EGI, IGE, EMI, EDGI, ERINA+.

EGI-InSPIRE StratusLab contributed to and reviewed EGI-InSPIRE deliverable D2.6 on *Integration of Clouds and Virtualization into the European Grid Infrastructure*.

StratusLab was represented at an EGI-InSPIRE Security Policy Group meeting in Amsterdam in January 2011. StratusLab input will be included in a number of security policies which touch on virtualization and cloud computing. StratusLab may be invited to participate formally in the Security Policy Group once the MoU is in place.

EMI Since Q2 Vangelis Floros (GRNET) has engaged an informal interaction with EMI project. This was initiated by two members of EMI, Shahbaz Memon and Bjorn Hagemeier (both from the Julich Supercomputing Center) mainly with the purpose for EMI to keep up to date with the developments of StratusLab integration activities. During the past quarter there have been various communications between the two parties answering questions and clarifying specific technical details about the StratusLab cloud solution. In addition a user account has been created for Shabhaz Memon in GRNET's reference cloud infrastructure providing access to the test installation and tools of StratusLab. This informal collaboration is expected to be formally defined in the coming months in the context of the MoU with EMI which is currently under preparation.

OpenNebula Discussion has begun on promoting new StratusLab features and services (such as enhanced security, and the under-development appliance marketplace) to the OpenNebula community through the mutual project partners.

Venus-C UCM participated in a Venus-C project meeting at Aachen Microsoft Innovation to study integration between both projects.

FP7 Proposals TID was approached by Fraunhofer Fokus (Germany) expressing interested in future collaborations in cloud-related projects. Fraunhofer and TID participated in former project consortia.

3.6.3.4 Quarter 4

Memoranda of Understanding StratusLab has signed two Memoranda of Understanding to date, with the EGI and EDGI projects at the EGI User Forum in Vilnius, Lithuania in March. The MoU with EGI outlines a number of specific areas for collaboration including the development of cloud middleware components based on requirements gathered through the various scientific communities within EGI along with complementary training strategies, cooperation on workshops and technical meetings and development of standards.

The MoU with the EDGI project allows EDGI to take advantage of a cloud infrastructure with StratusLab providing expertise in building virtual appliances as well as supplying base images for EDGI to build their appliances, and grid appliances for their interoperability testing. StratusLab also provides a test infrastructure to EDGI and use of the Marketplace. The EDGI project implements an instantiation of some StratusLab use cases and thus will provide requirements, as well as feedback on their use of the StratusLab tools and infrastructure.

A draft MoU with VENUS-C has been defined covering collaboration in the areas of user requirements and experiences and on sharing expertise on standards, accounting, and OpenNebula (a core component of StratusLab). Furthermore, Stratuslab will investigate the use of the shared storage solution of VENUS-C while VENUS-C will investigate developing high-level APIs for some of the StratusLab benchmarks.

The project is continuing to explore the possibility of MoUs with other projects such as EMI, IGE and Cyfronet.

SIENA Vangelis Floros (GRNET) represented StratusLab at the *Cloudscape III* meeting organized by SIENA, in Brussels, Belgium on 15–16 March, and presented an overview of the project and its progress and success to date.

EGI User Virtualization Workshop StratusLab members from CNRS, GRNET, TCD, UCM participated in the EGI User Virtualization workshop in Amsterdam on 12–13 May to map out the future of EGI as a federated virtualized infrastructure.

SARA HPC Cloud StratusLab members from CNRS, GRNET, TCD, UCM met representatives of the SARA HPC Cloud project in Amsterdam on 11 May to see how StratusLab could work with SARA on future developments of their HPC Cloud service. Mantychore representatives were also present at this meeting and described their project and technology, which appears to have applications for StratusLab.

EMI Informal discussions have continued with the EMI project, with a number of requests and queries coming from EMI. Two members of the EMI Virtualization group have now been given access to the StratusLab reference cloud service.

3.6.4 Task 3.3: Development of Exploitation and sustainability Plan

3.6.4.1 Quarter 1

This task will begin in Q4.

3.6.4.2 Quarter 2

This task will begin in Q4.

3.6.4.3 Quarter 3

This task will begin in Q4.

3.6.4.4 Quarter 4

This task began in PM10. The initial work exploring possible avenues of exploitation and sustainability has been done and the deliverable D3.3 is due concomitantly with this report.

3.6.5 Issues and Corrective Actions

No major issues related to WP3 have arisen in Q1.

No major issues related to WP3 have arisen in Q2.

No major issues related to WP3 have arisen in Q3.

It was expected that a discussion forum would be in place by end of Year 1, and although the project has put in place a discussion mechanism on the website, this has not yet been widely disseminated and usage is low and difficult to measure. The project is revisiting the issue of whether this is the appropriate forum for such discussions. More detail is provided in StratusLab Deliverable 3.2 *Report on Dissemination, Collaboration and Standardization Activities*.

More comprehensive discussion functionality is expected to be launched along side the release of version 1.0.

3.7 WP4: Software Integration and Distribution

3.7.1 Summary

3.7.1.1 Quarter 1

During Q1, WP4 focused on the definition of the StratusLab architecture and produced the deliverable "Reference Architecture for StratusLab Toolkit 1.0" (D4.1). This major effort included an analysis of the current needs of our targeted user communities, based on the information contained in the WP2 surveys and reported in "Review of the Use of Cloud and Virtualization Technologies in Grid Infrastructures" (D2.1).

Originally Tasks 4.2-4 were scheduled to start at M4, however, they were started earlier in order validate key concepts in the architecture and to support the work of other activities. In close cooperation with the other work packages, WP4 has put into place Scrum, an agile software development process. Within Q1 the first sprints (iterations) took place, providing the initial definition of the StratusLab distribution, definition of the contextualization strategy, creation of the initial software packages, and tools for manual and automated installation.

UCM, as part of the WP4 support activities, organized an OpenNebula Tutorial, 20-21 July 2010, and hosted a StratusLab/OpenNebula workshop on the 22 July 2010 in Madrid. These events were important for firming-up the definition of the StratusLab architecture. More generally, WP4 has provided support to the entire project concerning the StratusLab tools and OpenNebula.

3.7.1.2 Quarter 2

During Q2, WP4 focused on the first release of StratusLab distribution: v0.1. This was also the opportunity to assert that our architecture defined during Q1 was sound and able to support the key features planned in StratusLab v0.1. This major effort included the integration, test and certification of a number of tools to ensure that StratusLab would be consistent, easy to install, as well as easy to use.

The agile/scrum process put in place during Q1 was consolidated and worked well in providing feedback from short iterations (i.e. three weeks) and ensuring that all partners are working on a coherent set of objectives and that fluid and constant communication takes place between all.

A significant effort was also deployed in continuing automation efforts (noticeably by CNRS/LAL and SixSq) that had started during QR1 of our build, test and release process.

3.7.1.3 Quarter 3

During Q3, WP4 continued integrating features resulting in the production of StratusLab distributions: v0.2 and v0.3 (although the actual release of v0.3 officially took place early March). During this, we improved the build, test and release procedures. This also included devising an upgrade procedure, such that an infrastructures running a previous versions of StratusLab could be easily upgraded. This work has been performed in tight collaboration with WP5.

The Scrum process adopted in Q1 and improved in Q2 is now fully integrated, as can be seen from the regular sprints, demos and planning meetings that are now taking place, as well as the releases that are being produced on average every two sprints (approximately every six weeks). All the Scrum events are now part of fabric of the project and most partners contribute actively.

The Hudson continuous integration server was considerably improved following a hardware failure that forced us to rebuild it. It now includes machines from GRNET and LAL, including machines being re-imaged at LAL daily, providing clean machines on which to perform automatic tests.

As defined during the Scrum planning meetings, WP4 focused its integration effort on the following services:

- Marketplace
- Authentication proxy
- Claudia
- Automatic image creation
- Policy enforcement (e.g. quota, Marketplace images)
- Quarantine

WP4 also simplified the configuration file required for the manual installation as well as completing the ability for Quattor to manage an entire StratusLab installation.

3.7.1.4 Quarter 4

During Q4, WP4 continued integrating features resulting in the production of StratusLab distributions: v0.3, v0.4 and the preparation for v1.0 (the actual release of v1.0 officially took place mid-June). We further improved the build, test and release procedures. We now have automated Hudson jobs for all major services and components of StratusLab.

The release v0.4 introduced a change in the database used by OpenNebula, from SQLite to MySQL. This required migrating existing SQLite databases to MySQL. Specific upgrade scripts were written, in tight collaboration between WP4 and WP5, such that existing StratusLab deployments can be migrated without loss of information.

To prepare for v0.4, as a candidate release for v1.0, SixSq hosted an integration face-to-face meeting in Geneva. This day and a half meeting was very productive, with all partners and work packages well represented. Several small working groups were spawned running in parallel, presenting and assessing every half day the progress done.

The Scrum process keeps on improving, with more effective planning meetings and demos. A notable improvement during Q4 is the addition of a definition of ‘done’ to each user story accepted for a sprint, and recorded in JIRA. This provides much clearer context for what is expected from each user story such that it can be considered completed. This ‘done’ definition also forms the basis of what is expected to be demoed during the demo meeting for each story.

The state of jobs in the Hudson integration server is now a discussion item in the daily stand-up. This follows a decision by WP4 to introduce a ‘stop-the-line’ culture, where all development and integration activities are stop as soon as a failed job occurs in Hudson. The result was positive with much improved stability of the Hudson jobs in the second half of Q4 and higher confidence in the quality of StratusLab.

A major integration effort completed during Q4 was the transition from CentOS to Fedora 14 as the official operating system for the StratusLab distribution. This means that StratusLab now standardizes on an up-to-date operating system, taking advantages of recent developments, libraries and services. The key decision factor for this transition was the poor support for virtualization technologies from the old Linux kernels such as the one CentOS runs, compared to more recent distributions, such as Fedora 14.

As defined during the Scrum planning meetings, WP4 focused its integration effort on the following services:

- Marketplace
- Registration service
- Claudia
- Automatic image creation
- Policy enforcement (e.g. quota, Marketplace images)
- Quarantine
- Persistent Storage
- On-demand Cluster creation
- SlipStream / StratusLab integration

WP4 also worked on support for SuSE Linux virtual machines, the standard operating system used by the European Space Agency, which has expressed interest in evaluating StratusLab and SlipStream in the context of its operational software procurement.

3.7.2 Task 4.1: Definition of Reference Architecture

3.7.2.1 Quarter 1

The D4.1 document presents the initial architecture of the StratusLab distribution, defining the foundation of StratusLab 1.0. The document is a starting point and the architecture will evolve over the course of the project, as we learn and gather feedback from users and system administrators. The architecture will be formally updated at M15 with the deliverable D4.4. While defining the architecture, sprints have been conducted and user stories selected to validate the main ideas behind StratusLab 1.0.

3.7.2.2 Quarter 2

This task was not active during Q2. Having said that, the architecture of the system is regularly reviewed to ensure that all features required of the StratusLab distribution can be provided effectively. To date, no dramatic changes are required or foreseen in the architecture captured in D4.1 and extended in D6.1.

As part of this ongoing work, the StratusLab roadmap was discussed during the Lyon F2F meeting, with resulting new interfaces identified for future versions of the system. See the planning section for details.

3.7.2.3 Quarter 3

This task was not active during Q3. However, the architecture was revisited to include the proxy service which provides a single point for performing authentication. The Marketplace was also integrated as planned in the architecture. To date, no dramatic changes are required or foreseen in the architecture captured in D4.1 and extended in D6.1.

As part of this ongoing work, the StratusLab roadmap is now published on our website to collect comments from our community.

3.7.2.4 Quarter 4

This task was not active during Q3. However, the architecture was better documented in the form of an 'architectural vision' with a new page on our online documentation server, including all current services. Work has also started in upgrading the current vision for the second year of the project to better guide our work towards StratusLab v2.0.

As part of this ongoing work, the StratusLab roadmap is available on our website to collect comments from our community.

3.7.3 Task 4.2: Integration of Open-source Distribution

3.7.3.1 Quarter 1

Early in the project and in order to support the architectural definition task (Section 3.7.2.1), it was important to validate several assumptions made during the proposal writing stage. To support this work, sprints have been conducted and user stories selected in order to validate the main ideas behind StratusLab 1.0: OpenNebula as the VM Manager, remote Appliance Repository, remote access to the cloud (via the OpenNebula XMLRPC API) and mechanisms (manual and automated) for distribution installation and configuration of the StratusLab software. This validation was successful with the production of an early distribution, which can be easily installed.

This work revealed several technical issues, which have been tracked using the project tracking tool (JIRA/GreenHopper). As the project identifies bugs and issues with the early versions of StratusLab, including OpenNebula, both SixSq and UCM have been active at fixing these bugs and addressing the identified issues.

3.7.3.2 Quarter 2

To support the test, certification and release process, WP4 invested significant efforts in creating an automated and continuous integration system (noticeably CNRS/LAL and SixSq). Using a series of open source tools (e.g. Hudson, Maven, Yum repository). We now have several machines, with the support from GRNET, able to test several possible deployments, including both CentOS and Ubuntu operating systems. This gives us the ability to verify that StratusLab can successfully be configured in different ways to match system administrators requirements.

This automation strategy was also adopted by the OpenNebula team at UCM where integration tests were developed to check the functionality of OpenNebula. A set of functionality tests were also created that manage real virtual machines. All these tests are integrated into a hudson server that runs them every day. Similarly to what SixSq and GRNET created for the StratusLab's integration facilities, UCM set up a private infrastructure to develop StratusLab components with multiple configurations in terms of hypervisors (Xen, KVM and VMware), storage systems (Shared FS, ssh) and installation modes (system wide, installation and runtime directories). This setup was effective at finding new bugs, such as: new remote action management isues, improvements in the OpenNebula packages, support for Xen4 and specific disk drivers and new architecture attribute for OS section of VM templates.

A series of tools and services were integrated, developed and tested in order to deliver the functionality required for StratusLab v0.1. Here are the main features included in the first version of the distribution:

OpenNebula virtual machine management

Web Monitor administrator dashboard for cloud

User CLI Python-based command line tools for remote access to cloud

System Administrator CLI Command line tools to facilitate manual installation and management of the cloud

Automated (Quattor) Installation Templates for automatic installation using the Quattor fabric and configuration management tool

All of these features were selected by the project technical group, defined and tracked using JIRA/GreenHopper.

The Appliance Repository developed during Q1 by TCD was also included in the release, but not officially, since not considered critical. A reference Appliance Repository was deployed by TCD, and a mirror instance was also provided by GRNET for backup.

StratusLab distribution v0.1 was released under the Apache 2.0 license, with copyright owned by the major contributors of each respective tool and/or service.

All technical issues identified, in preparation for each sprint, as well as during, were tracked using the project tracking tool (JIRA/GreenHopper).

In preparation for future features, we have also explored requirements on OpenNebula to better support image creation. For example, qcow could be used to automatically create and use sparse images was identified and could be integrated. Further, in order to better manage user authentication, we should be able to support ldap and (grid) certificates. In OpenNebula, an analysis was performed by UCM and work started to provide such support.

Preparation work also took place for the integration of Claudia, the Service Manager component developed by TID and scheduled for a future release of StratusLab.

3.7.3.3 Quarter 3

As mentioned in the introduction, SixSq, GRNET and LAL have continued to improve the Hudson continuous integration server. The Hudson infrastructure is now composed of over five machines (three at GRNET and two at LAL). The LAL machines are managed by Quattor, which allows us to re-image the machines every day (at 2:00 in the morning), from which an automatic installation, configuration and end-to-end test is conducted. Additionally, the testing infrastructure for the OpenNebula component at UCM has been improved with two new slave nodes and specific test jobs for the development branches. This contributes significantly in building confidence that StratusLab remains functional with each code commit.

Several services and components, such as the command-line client, the proxy and the Marketplace, now include unit tests, which are automatically executed by Hudson on each code commit. The end-to-end smoke tests have also been extended to cover more features and key functionality.

From v0.2, StratusLab includes a new authentication service, referred to as proxy server, which provides a single authentication point for the entire StratusLab distribution. A new OpenNebula driver was developed to disable the OpenNebula authentication feature, removing duplication of configuration information, without compromising security.

A quarantine feature was also developed to quarantine each virtual machine, such that post-mortem forensic can be performed on suspicious instances. This is an important feature to investigate security issues.

Significant work took place in improvements in the monitoring system of the distribution. This included a partial integration of Ganglia with OpenNebula and the installation system. In particular, the host CPU load now takes into account the hypervisor overhead. The VM network metrics (received and transmitted bytes) are now obtained for the KVM hypervisor. Additionally a new system probe to gather the disk free space of each host is now in place and ready for integration and testing.

UCM has setup a git repository that tracks changes in the mainstream source tree of OpenNebula and also includes specific patches and developments for StratusLab. This allows StratusLab to benefit more quickly from improvements and bug fixes to OpenNebula, instead of having to wait for public releases.

Several bugs in OpenNebula were fixed, including: shared file system issues, special OpenNebula configurations and wrong handling of remote action scripts, partial URL encoding and decoding of usernames when using certificates for authentication. In preparation for an elastic-IP like feature, OpenNebula now supports the ability to dynamically add and remove leases from a virtual network. These features could be integrated and leveraged in future versions of the StratusLab distribution.

During this quarter, Claudia (the Service Manager component developed by TID) was integrated in the project's continuous integration system, with the help of CNRS/LAL and SixSq. Claudia's source code was organized to comply with the policies shared by the rest of the components (e.g. using the same version of libraries across components). New jobs were created in Hudson so that compilation, deployment and documentation are automated sharing a common strategy with the rest of the components. Python scripts were written to install, configure and start Claudia services and integrated with the Stratuslab command-line tools.

3.7.3.4 Quarter 4

SixSq, GRNET and LAL have continued to improve the Hudson continuous integration server. The Hudson infrastructure is now composed of over six machines (from GRNET and LAL). The LAL machines are managed by Quattor, which allows us to re-image the machines every day (at 02:00), from which an automatic installation, configuration and end-to-end test is conducted. While this was introduced during Q3, all these machines were upgraded to Fedora 14. We are now also taking advantage of StratusLab by integrating virtual machines managed by GRNET's reference infrastructure, as Hudson slaves. This is giving us increased flexibility since we can more easily duplicate and extend our build and test infrastructure.

Most services, such as the command-line client, the OpenNebula proxy, the Marketplace, the web monitor, registration application, persistence storage, include unit and system tests, which are automatically executed by Hudson after each code commit.

In order to get better support for virtualization from the Linux kernel, without having to upgrade default kernel (which is possible but a very intrusive operation which would invariably cause resistance from the system administers community, for good reasons), we decided to depart from our earlier CentOS operating system baseline. CentOS is an 'old' operating system. Since then, KVM (our default virtualization solution) has been integrated with the Linux kernel. To take advantage of this integration, a recent kernel is required. We therefore, decided to change our operating system baseline to Fedora 14, a more recent operating system that is also RPM-based. This switch also means that we do not need any longer to maintain our own packages for a number of dependencies that StratusLab requires, therefore streamlining its installation and maintenance.

From v0.4, StratusLab includes a new registration web application, which allows users to register with a StratusLab installation, using a clear workflow, confirming their identity via email and their acceptance of StratusLab usage policy.

The quarantine feature was also integrated with the distribution, including automated testing.

A long awaited OpenNebula feature was added at StratusLab's request to add error reporting to the client when failures occur during operations. This means that now users can be informed of the likely source of an error, such that they can take corrective actions, if errors are caused by the user. The command-line tools and web monitor were upgraded to take advantage of this feature.

StratusLab end-users can now attach three types of extra disks: volatile (created on the fly during instantiation), persistent (taking advantage of the persistent service) and read-only (from disk images registered with the Marketplace and Applicances Repostory). The command-line client options to handle extra disk was harmonised to reflect this.

In order to improve performance, StratusLab now ships with MySQL as the default database, replacing SQLite, OpenNebula's default database. This improves significantly the performance of OpenNebula, therefore StratusLab, when scaling deployments.

A computing cluster can now be instantiated using a single command (stratus-run-cluster), taking advantage of StratusLab's ability to deploy several virtual machines. This command was developed leveraging StratusLab's core Python client modules and API.

During this quarter, Claudia (the Service Manager component developed by TID) was further integrated in the project's continuous integration system, with the help of CNRS/LAL and SixSq. This included integrating authentication and connection to a proxy service, such that Claudia follows the same authentication strategy as all StratusLab services. In addition, more packages and configuration parameters have been included in the StratusLab distribution for feeding Claudia with monitoring information coming from OpenNebula and Ganglia. Finally, a significant effort was also put in developing Quattor profiles to install and configure Claudia automatically with Quattor.

3.7.4 Task 4.3: Contextualization of Grid Services

3.7.4.1 Quarter 1

Before grid services can be contextualized, it is important to understand well contextualization itself. In this quarter, we have defined a generic virtual machine contextualization strategy, documented on the project wiki and reviewed by all partners. This mechanism will be included in all base images managed and maintained by the project. This work included the definition of a manifest file describing the images in the appliance repository. From this foundation, specific support for grid service contextualization will be realized as this task progresses.

3.7.4.2 Quarter 2

The generic mechanism devised during Q1 for contextualization was simplified and implemented for production use during this quarter and released as part of StratusLab v0.1. This included the decision to rely on DHCP for public IP address / MAC address assignment, which significantly simplifies the configuration work for the system administrators. Further simplifications are also possible on this topic, for example for private IP assignment.

StratusLab v0.1 was released with three fully contextualized reference images for the Ubuntu, CentOS, and ttylinux operating systems.

The StratusLab contextualization strategy was implemented as a coherent set, using OpenNebula idiomatic setup, configuration and end-user command-line tools.

3.7.4.3 Quarter 3

The generic contextualization mechanism devised during Q1 and improved during Q2 was furthered enhanced during this quarter. From v0.2 onwards, StratusLab supports three network levels: public, local and private. The local network can now be NATed using the StratusLab front-end machines using the manual installation configuration file, making it possible for private system administrators to deploy StratusLab on private resources with no public IPs.

Following the agreed new metadata for describing machine images for the Marketplace, the StratusLab base images we re-created and simplified. These base images can also be used as base images for creating new custom images.

More grid images were created, such that an entire grid site can run on a StratusLab infrastructure. In support to VMs running grid services, instances can be started requesting a specific IP address, such that server certificates remain valid across VM restarts.

3.7.4.4 Quarter 4

The generic contextualization mechanism devised during earlier quarters was further enhanced during this quarter. Integration work with SlipStream provided valuable feedback especially in order to be able to parameterize virtual machine instances. For example, it is now possible, via the standard StratusLab tools, to provide new VMs with scripts to be executed during boot and parameters to change new VM behavior.

The Appliances Repository and Marketplace now contain a richer set of validated virtual machine images.

3.7.5 Task 4.4: Technical Support

3.7.5.1 Quarter 1

WP4 has provided support for the StratusLab tools and OpenNebula to the whole project. This support has been provided via the daily standup meetings, phone calls, Skype, and email.

WP4 has defined a software development procedure based on scrum, an agile software development process. WP4 manages this process by running the daily standup meetings, the sprint demo meetings and the sprint preparation meetings. During Q1, the initial sprints (iterations) took place, putting in motion the process and producing real results. To support this process, WP4 with WP5 has put in place the tools to support continuous integration, like for example, the project's Hudson server (http://hudson.stratuslab.eu:8080/).

As part of its technical support, WP4 has created and maintained several wiki pages providing information on the StratusLab distribution, including installation instructions, conventions and technical notes.

3.7.5.2 Quarter 2

WP4 has provided support for the StratusLab tools and OpenNebula to the whole project. This support has been provided via the daily standup meetings, phone calls, Skype, and email.

WP4 has continued to support and manage our software development procedure based on scrum, an agile software development process. WP4 manages this process by running the daily standup meetings, the sprint demo meetings and the sprint preparation meetings. During Q2, our Scrum process was consolidated, with the addition of effort estimates such that the project can be better managed and scheduling made more reliable.

As the project identifies bugs and issues with each new version of StratusLab, including OpenNebula, both SixSq and UCM have been active at fixing these bugs and addressing the identified issues. When bugs were identified in core components of StratusLab, when possible, patches were created and integrated. In parallel, these patches were sent to the owner of the component for future fix. Once these patches were integrated and released by the provider, the patches were then removed from the StratusLab code-base. This ensured that we were not blocked moving forward. As a result of bug fixes, including ones found by StratusLab partners, UCM will release a maintenance version of OpenNebula (2.0.1) this quarter.

The technical support is now extended to a number of wiki pages on our website, as well as a FAQ page to which WP4 will contribute as recurrent questions and issues are raised by members and users. The previously created wiki pages for internal use have been cleaned-up and updated in order to be made public.

3.7.5.3 Quarter 3

WP4 has provided support for the StratusLab tools and OpenNebula to the whole project. This support has been provided via the daily standup meetings, phone calls, Skype and email. Further, as planned in the program of work, WP5 is taking over more of the first line support, as WP5 gains in operational knowledge in the distribution.

WP4 has continued to support and manage our software development procedure based on Scrum. All main Scrum events are now routinely taking place (daily stand-up, demo and planning meetings), to which the large majority of partners are taking part regularly.

The user-stories and tasks selected during the planning meetings include a balance of bug fixes and new features, such that current versions are maintained, while new versions are being prepared. Several of the patches fixing OpenNebula bugs have been integrated in new versions of OpenNebula, such that these are not required in the StratusLab code-base.

The technical support is now extended to a number of wiki pages on our website, as well as a FAQ page to which WP4 contributes as recurrent questions and issues are raised by members and users. The wiki pages have been maintained and updated prior to each release.

TID provided the project's website (http://stratuslab.eu/doku.php/claudia) with technical support on Claudia (the Service Manager). This information covers the following subjects:

- Claudia Architecture
- How to compile Claudia and to install Claudia Platform
- Install Claudia from deb and rpm packages
- Claudia User Manual

3.7.5.4 Quarter 4

WP4 has provided support for the StratusLab distribution. This support continued to be provided via the daily standup meetings, phone calls, Skype and email. Further, as planned in the program of work, WP5 is taking over more of the first line support, where WP4 intervenes as second line support when and were required, coordinated with WP5.

WP4 has continued to support and manage the software development procedure based on Scrum. All main Scrum events are now routinely taking place (daily stand-up, demo and planning meetings), to which the large majority of partners are taking part regularly.

The user stories and tasks selected during the planning meetings include a balance of bug fixes and new features, such that current versions are maintained, while new versions are being prepared. An important improvement introduced during Sprint 14's planning meeting was to add to each user story an agreement of the definition of 'done'. This is important to ensure that functionality delivered by WP4 to WP5 is meeting expected quality criteria. This definition of done often includes the minimum requirements of having unit and/or system tests written, as well as being integrated with Hudson's continuous integration and test strategy.

3.7.6 Issues and Corrective Actions

No major issues related to WP4 have arisen in Q1.

Following from our first release, during the Lyon face-to-face meeting, a retrospective was conducted. The retrospective is an important event that all agile methods mandate. It is a mechanism that encourages the team, and all its stakeholders, to reflect on its performance. This is an important tenet in the concept of ‘continuous improvement’ that lies at the heart of agile. The two items on which the retrospective focused were:

1. Increasing clarity and priorities on our technical program of work prior, to improve the planning meeting
2. Contrasting views on the effectiveness of the daily meetings

For the first item, we agreed that having the technical group meetings would provide the right platform to discuss ‘medium term strategic’ issues. The technical group had not met as often as it could have. This was felt by all participants as the right forum to address this issue. We also agreed to keep the three weeks sprint as a meeting frequency.

For the second item regarding the daily meetings, since we had different views on the effectiveness of this meeting, we discussed the issue and tried to better understand everybody’s viewpoints. The meetings are managed such that they never exceed 15 minutes (with only one exception since the beginning of the project, with 16 minutes), and normally are over in 10 minutes. The daily meeting take place every day at 10:30 (sharp!), Paris time. For people participating regularly to the daily meetings, they are efficient and useful. Others felt that the stand-ups were too frequent. Alternatives were discussed such as traditional sit-down weekly meetings, but these would reduce the flow of communication, as well as our responsiveness, and would force us to start taking and distributing minutes.

The compromise in the end was that the daily stand-ups will continue with some people participating less frequently, but regularly.

Following a major hard-disk failure, part of the Hudson server was lost for several days. Since this is a critical part of our release procedure, for building and testing each release, we also decided to insert a small two weeks sprint focused on finalizing and testing release 0.3. During that time, the server was rebuilt, which was also an opportunity to considerably improve the system, now including Quattor controlled machines. The new system now includes a backup process.

While our implementation of Scrum already works very well, it would perform even better if all the partners were to take part more regularly to the different events.

Upgrade of the production system (reference architecture) is still laborious and taking longer that expected. This is in part due to the slow frequency at which StratusLab releases. Further, StratusLab’s aggressive development, integration and test schedule means that a significant number of services and components have to be upgraded/installed by WP5 at every release. To mitigate this, the definition of done was improved and made more systematic during the planning meetings, such that WP5 is better able to estimate the maturity of the features integrated in each release. The next item of improvement would be to release more often, putting more effort in automating the upgrade of our production systems, thus reducing the size of the increments and time during which the service is off-line, and minimizing the risk of unexpected side-effects for our users.

3.8 WP5: Infrastructure Operation

3.8.1 Summary

3.8.1.1 Quarter 1

WP5 is responsible for the provision of the computing infrastructure required by the various activities of the project. Since StratusLab is mainly an infrastructure project the smooth execution of WP5 is essential for the unobstructed implementation of the whole project. During the first quarter of the project, work towards many of the initial goals of the work package progressed at a very satisfactory level.

The first priority was the establishment of the physical infrastructure necessary for hosting all the cloud and grid services of the project. Once this was completed, the next step was to start with a preliminary installation and testing of cloud middleware (OpenNebula). Further was the installation of grid services and the first trials of the provision of these services using cloud computing capabilities.

In parallel, WP5 contributed with its infrastructure to the other activities (in particular WP4) by providing the necessary physical resources for hosting various support services (e.g. the Hudson continues integration platform) and for running various trials and testing activities. At the end of the first quarter all the necessary infrastructure is in place: a number of cloud services are already available, which host pre-production grid sites.

3.8.1.2 Quarter 2

During the second quarter of the project, work towards many of the initial goals of the work package progressed satisfactory delivering important results. Among the highlights of the past quarter is the opening for public access of a reference cloud service in parallel with the release of v0.1 of StratusLab distribution. Along with the appliance repository that contains a set of basic VM images, also prepared by WP5, this service plays the role of the technological preview of the results delivered by the project and provides a set of elementary IaaS services to third parties.

Overall, WP5 has deployed a significant number of services, either as production service for public access or private services for testing or support for the development activities of the project. These services utilize the physical infrastructure offered by the project partners. Table 3.5 summarizes the services that currently offer web-based access in the context of WP5.

In the following paragraphs we provide more details about the various achievements of WP5 during Q2, grouped by subtask.

3.8.1.3 Quarter 3

In the third quarter, we achieved noticeable progress with all of the tasks planned by the activity. Among the highlights of the past quarter is the certification of the first virtualized production grid site, the expansion of the cloud infrastructure, the migration to StratusLab release 0.2, the preliminary work on the Marketplace and the provision of first grid and bioinformatic-specific appliances. Table 3.6

summarizes the services that currently offer web-based access in the context of WP5.

3.8.1.4 Quarter 4

Work in WP5 progressed in Q4 with no diversions from the original planned work. The infrastructure operations and support activity continued to serve an extended base of users and to provide a stable set of cloud and grid services. WP5 contributed significantly towards the release of stable version 1.0 expected at the beginning of Y2 of the project by providing input and requirements to the two main R&D activities of the project, namely WP4 and WP6.

Highlights for Q4 include the upgrade of the cloud reference service to StratusLab distribution v0.3, the operation of a stable pre-production Marketplace service, development of a Registration Service, and the compilation of the "Installing and operating a production grid site in the StratusLab cloud" Technical Report which provides recommendations for optimal interoperation of grid and cloud services. The activity also investigated parallel file systems such as Ceph and GlusterFS in an attempt to improve the scalability and performance of the Reference Infrastructure; neither solution was a marked improvement over the current one. Table 3.7 summarizes the services that currently offer web-based access in the context of WP5.

3.8.2 Task 5.1: Deployment and Operation of Virtualized Grid Sites

3.8.2.1 Quarter 1

Commissioning of Physical Infrastructure The first priority was commissioning the physical computing infrastructure that will be required throughout the lifetime of the project, mainly for hosting cloud services on on those deploying a number of grid sites based on EMI's UMD grid middleware distribution. Two project partners have committed to provide the necessary resources–GRNET and CNRS. The resources provided by each partner respectively are summarized in Table 3.4.

Installation of OpenNebula-based Cloud Sites Two cloud sites were installed in GRNET using OpenNebula (v1.4). The first site was installed on top of Ubuntu 10.04 and the second on top of CentOS 5. (Those are the initial platforms supported by the project). Having a deployed instance of OpenNebula on each supported platform is essential for the project's testing activities. The site deployed on CentOS comprises 11 nodes (1 master and 10 hosts) and the site on Ubuntu, 12 nodes (1 master and 11 hosts). The physical nodes of these sites are monitored through Ganglia (http://ganglia.sourceforge.net/ tool.

Deployment of Grid Sites Two minimal grid sites, using the gLite 3.2 middleware, have been deployed on top of the cloud in GRNET's infrastructure. The first site, named GR-42-STRATUSLAB, comprises a CREAM Computing Element (CE), Storage Element (SE), and 2 Worker Nodes (WNs). The second site, named

Table 3.4: *StratusLab Physical Infrastructure*

Resource	GRNET	CNRS	Total
Computing nodes	26	5	31
CPU Cores	208	40	248
Storage	20 TB	5-10 TB	25-30 TB

GR-43-STRATUSLAB comprises of a CREAM CE, SE, and 5 WNs. Both sites are in pre-production phase and are monitored by the Service Availability Monitoring (SAM) tests running in NGI-GRNET (https://sam.athena.hellasgrid.gr). Both sites support MPI. Their small size permits reasonable feasibility tests. At the end of Sprint 1, we were able to demonstrate the stability and elasticity of the grid sites by dynamically adding and removing WNs on the fly.

Quattor Configuration of OpenNebula 2.0b LAL uses the Quattor Toolkit for the automated installation, configuration, and management of machines. To ensure that the cloud test bench at LAL can be similarly managed, LAL has developed Quattor configuration components for OpenNebula (ncm-oned) and for libvirt (ncm-libvirtd). In addition, a complete set of configuration templates have been developed to allow an entire OpenNebula system (front-end and hosts) to be installed automatically from bare metal. Documentation (http://stratuslab.eu/doku.php?id=quattorinstall) on the StratusLab internal wiki explains how to use the configuration as well as the current limitations.

Quattor Deployment of Grid Worker Nodes The Quattor Toolkit bootstraps machine installation via PXE. LAL has verified that PXE images can be started via OpenNebula and that they can be used to install grid Worker Nodes via the standard Quattor installation mechanism. This is a first indication that automated site management tools can be used with little or no modification to control grid services running on a StratusLab cloud infrastructure.

Deployment of LAL Test Bench Using Quattor, LAL has deployed a StratusLab test bench consisting of five physical hosts. This consists of one OpenNebula front-end and four OpenNebula hosts. The front-end is also configured to allow virtual machines to run there. Currently, the test bench uses sqlite as the database implementation and the image repositories are shared via NFS.

3.8.2.2 Quarter 2

Production Cloud Service With the release of StratusLab 0.1 distribution, a reference cloud service was deployed and made available to the public. The StratusLab distribution has been installed in the physical infrastructure allocated by GRNET. Coupled with the Appliance Repository maintained by TCD, this infrastructure will play the role of the production cloud service deployed by the project, allowing people outside the project to test-drive a reference installation of the 0.1 release and the IaaS cloud developed by the project. A total of 11 nodes have

Table 3.5: *WP5 Infrastructure Services*

Production Cloud Service	GRNET	http://cloud-grnet.stratuslab.eu:2633
Preproduction Cloud Service	GRNET	http://node006.one.ypepth.grnet.gr:2633
Project Tools (Hudson Server)	GRNET	hhttp://hudson.stratuslab.eu:8080
Appliance Repository	TCD	http://appliances.stratuslab.eu
App. Repository Mirror	GRNET	http://appmirror-grnet.stratus.eu/images
Test Infrastructure	LAL	https://onehost-2.lal.in2p3.fr:2643/RPC2
Test Infrastructure	GRNET	http://node003.one.ypepth.grnet.gr:2633

been allocated for this purpose offering 160 CPU cores and 528 GB of memory. Depending on the demand more nodes will be added to the reference cloud service.

For what concerns the offered QoS, the StratusLab cloud services are provided on a best-effort basis, with no guarantees about the availability and stability of the service. As the distribution matures the infrastructure is expected to become more stable and reliable. Our goal is to offer, in the coming months, a production cloud service with a high-quality Service Level Agreement.

Detailed instructions for accessing and using the service are available from the project's wiki site at http://www.stratuslab.org/doku.php?id=referenceservices.

Pre-production Services LAL has been discussing this quarter with the Security Officers of IN2P3 to come to a workable solution for the firewall around LAL's preproduction cloud service. An agreement was reached at the end of the quarter that will allow all grid service ports as well as ssh, http(s), and ldap(s) to be accessible from the WAN for running virtual machines. Access to physical machines will have more severe restrictions with ssh access only allowed from within the LAL site. The purchase order for hardware for the preproduction cloud service has been prepared. The hardware should arrive in December 2010 with rapid deployment of the service.

Support Infrastructure GRNET went through a re-organization process of the pre-production infrastructure in order to optimize the resource utilization and plan for future workload demands. Currently this infrastructure is used for hosting project services: the hudson continuous integration service, the appliance repository mirror, and two testing sites installed with the StratusLab distribution.

3.8.2.3 Quarter 3

Production Cloud Service The production cloud service in GRNET evolved and expanded during the reporting quarter attracting at the same time new external users. The service was upgraded to StratusLab 0.2 a few days after this was released. Due to significant changes that this revision introduced, the service had to be re-installed from ground up. In normal cases this would cause a major dis-

Table 3.6: ***WP5 Infrastructure Services***

Reference Cloud Service	GRNET	https://cloud-grnet.stratuslab.eu:2634/RPC2
Pre-production Infrastructure	GRNET	https://62.217.120.158:2634/RPC2
Pre-production Infrastructure	LAL	https://onehost-4.lal.in2p3.fr:2643/RPC2
Project Tools (Hudson Server)	GRNET	http://hudson.stratuslab.eu:8080
Appliance Repository	TCD	http://appliances.stratuslab.eu
App. Repository Mirror	GRNET	http://appmirror-grnet.stratus.eu/images
Prototype Marketplace implementation	TCD	http://appliances.stratuslab.eu/marketplace/
Test Infrastructure	LAL	https://onehost-2.lal.in2p3.fr:2643/RPC2

ruption in the hosting services but since this was still in a very early stage of the project no production services, hosted in running VMs, were impacted. As the project progresses though, and the infrastructure is used for hosting production-level applications and grid sites, it will be imperative to streamline the upgrade progress as much as possible making it transparent to the end users. This requirement has already been conveyed to WP4 and was taken under consideration during the production of release 0.3 expected at the beginning of Q4.

The physical infrastructure hosting the project's reference cloud service, was also expanded significantly during the past quarter, with the addition of 6 more nodes. Thus the total capacity offered is 17 physical nodes (1 frontend and 16 hosting nodes) providing a total of 256 CPU cores and 768 GBytes of total main memory (48 GBytes per node).

For what concerns external users, 10 more user accounts were created in response to requests from people outside the project who got interested in StratusLab and wanted to test-drive the tools integrated by the project. For the time being the reference cloud service still depends on a username/password authentication scheme, but with the advent of 0.3 we plan to adopt the more secure certificate-based authentication mechanism implemented in this latest release.

The project decided to adopt the EGI Acceptable Usage Policy (https://documents.egi.eu/public/ShowDocument?docid=74) which defines the rights and obligations of all StratusLab users related to the usage of the offered cloud services. The web link to the above document is communicated to every new user upon the creation of their account informing them that the usage of the service implies the acceptance of the EGI AUP conditions.

Certification of a production Grid Service During the first six months we experimented extensively with the installation and operation of grid sites on top of cloud services using pre-configured VMs. In this quarter we decided to take this effort one step further and formalize the installation of a virtualized grid site by certifying it within the EGI infrastructure. In parallel we prepared a number of VM appliances for the basic node roles of a gLite-based grid site and namely: the Computing Element, the Storage Element, the Worker Node, the User Interface and the APEL service. All of the above-mentioned images are available from the appliance repository. The appliances follow the evolution of gLite middleware; with every new release a new image snapshot is created and is uploaded on 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 CE and 8 dual-core WNs thus providing a total capacity of 16 cores for job submission. The site also supports submission of MPICH-2 and OpenMPI parallel jobs. Communication among the nodes for MPI execution is supported through ssh host-based authentication. Each WN is configured with 2GB of main memory. The site also comprises a SE that offers a total storage space of 2TB. It should be noted that this storage is configured directly as an NFS mount-point from the local storage server and is not yet virtualized (e.g. it cannot be managed as a EBS service from the StratusLab command line tools).

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 classified and 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 WNs).

The GStat page with all the details of the site as they are reported from the Site-BDII are available at http://gstat-prod.cern.ch/gstat/site/HG-07-StratusLab/.

Pre-production Services LAL has deployed an initial pre-production cloud service which is available to the laboratory's users and system administrators. This service will be opened to the wider community once registration procedures are in place and the StratusLab release provides a mechanism for enforcing site machine image policies.

GRNET has also deployed a pre-production site dedicated for beta-testing and validation of StratusLab releases. The site is comprised of 3 nodes (1 frontend and 2 hosting nodes). Access to the site is granted only to a few system administrators and developers within the project.

Support Infrastructure The Hudson continuous integration service had to be relocated to a new node, within the datacenter, in order to perform required maintenance tasks to the previous hosting node (see "Issues and Corrective Actions" section for more details). Three servers have been allocated to WP4 for development testing. Additionally, two servers have been allocated to WP6 for the Claudia integration tasks.

Table 3.7: *WP5 Infrastructure Services*

Reference Cloud Service	GRNET	https://cloud-grnet.stratuslab.eu
Pre-production Infrastructure	GRNET	https://62.217.120.158
Pre-production Infrastructure	LAL	https://onehost-4.lal.in2p3.fr
Project Tools (Hudson Server)	GRNET	http://hudson.stratuslab.eu:8080
Appliance Repository	TCD	http://appliances.stratuslab.eu
App. Repository Mirror	GRNET	http://appmirror-grnet.stratus.eu/images
App. Marketplace	TCD	http://appliances.stratuslab.eu/marketplace/
Test Infrastructure	LAL	https://onehost-2.lal.in2p3.fr

3.8.2.4 Quarter 4

Production Cloud Service The reference cloud service in GRNET continued to operate on a production basis offering a stable testbed for both internal and external users. Internally the service is used for the provision of the project's production grid site and for various test and development activities. For external users, the reference cloud service offers a showcase of StratusLab distribution capabilities in a real environment.

The number of registered external users continues to grow as more people are becoming aware of the project activities and are interested to try out the developed cloud solutions. The reference cloud service also is a useful tool for collaboration with the other DCI projects and an integral instrument for the MoU's signed with them. The service is also used regularly for demonstrations and tutorials given by the project. For this purpose, a number of temporary demo accounts have been created which are active only for a limited period of time.

During Q4 the service has been upgraded to v0.3 of StratusLab distribution. The base OS still remains CentOS 5.5 although this is planned for change in Q5 with the installation of v0.4.

As of Q4 the service offers three methods of user authorization:

1. Username/password generated internally by WP5
2. Digital certificate
3. VOMS proxy certificate

Username/password still remains the most popular choice due to its simplicity and fast learning curve, despite being less secure. The certificate-based solutions although more secure are still underutilized due to their complexity of usage but also because not everyone is accustomed to PKI technologies.

Table 3.8 provides an overview of the service usage.

Table 3.8: *Reference Cloud Service Usage Statistics*

Number of external users	26
Number of external projects supported	8
Number of countries represented	10
Total number of VMs instantiated by the end of Q4	2432

The number of physical resources has remained unchanged. Nevertheless due to the increasing demand from external users we are currently looking for ways to incorporate more physical nodes and thus expand the capacity of the hosting infrastructure.

Operation of a production Grid Service The operation of the production grid site HG-07-StratusLab continued in Q4 without any problems. The provision of grid service over virtualized resources does not seem to introduce any particular changes in the way they are administered. The underlying middleware has followed the evolution of gLite and the nodes have been kept up to to date with any major releases of the software or special requirements communicated by the EGI operations groups. The respective VM appliances that were used to setup the site are also kept up-to-date with the grid middleware releases and are regularly updated in the Appliance Repository.

The site still offers a minimal set of physical resources and therefore has not been heavily used by real grid applications so far. Nevertheless, the experience we have gained from its deployment and operation has been valuable and has led to compilation of the *Installing and operating a production grid site in the StratusLab cloud* Technical Report [7]. This document summarizes our experience from the installation of the site over the reference cloud service, identifies a number of issues that prohibit optimal exploitation of the underlying cloud resources and offers a set of recommendation to alleviate them. The document has proved also extremely useful for the design of grid elasticity functionality that is currently being developed in the context of WP6.

The GStat page with all the details of the site as they are reported from the Site-BDII is available on the web[8].

Pre-production Services LAL has deployed an initial pre-production cloud service which is available to the laboratory's users and system administrators. This service will be opened to the wider community once registration procedures are in place and the StratusLab release provides a mechanism for enforcing site machine image policies.

[7] http://stratuslab.eu/lib/exe/fetch.php/documents:gridovercloud-v1.0.pdf

[8] http://gstat-prod.cern.ch/gstat/site/HG-07-StratusLab/

Support Infrastructure The Hudson continuous integration service had to be relocated to a new node, within the data center, in order to perform required maintenance tasks to the previous hosting node (see “Issues and Corrective Actions” section for more details). Three servers have been allocated to WP4 for development testing. Additionally, two servers have been allocated to WP6 for the Claudia integration tasks. Two Quattor-controlled machines at LAL have been allocated for cloud deployment and functionality tests through the hudson continuous integration server.

Registration Service A condition from the CNRS-IN2P3 security officers for opening the LAL pre-production service to the public was the registration of users of the service. The registration must collect simple identification information (name, email address, etc.) but must also require that the user agree to the existing EGI Acceptable Use and Security Policies. To satisfy this requirement, a registration service was developed to handle this registration. The information is kept in an LDAP server which is compatible with the StratusLab authentication services, allowing access via username/password pairs and via grid certificates. This has been integrated as part of the standard StratusLab release.

Quattor Configuration LAL has created and maintains a Quattor configuration that allows the installation of a complete StratusLab cloud, similar to that created with the scripted installation with stratus-install. This configuration has evolved with the StratusLab distribution. The most difficult issue encountered has been the switch from CentOS 5.5 to Fedora 14 as the base operating system for the project. Fedora 14 requires many changes in the configuration modules for standard services and for the generated kickstart files. These are generic changes needed within Quattor to support more modern RedHat-based distributions, but the StratusLab effort is pushing this evolution forward rapidly. As for previous releases, the StratusLab 1.0 release should have a complete, working Quattor configuration.

3.8.3 Task 5.2: Testing of the StratusLab Toolkit

3.8.3.1 Quarter 1

Testing of OpenNebula Deployment The LAL test bench has been used test and verify that the contextualization of images works correctly. This test bench was also used to verify the application benchmarks that have been developed within the WP2 activity. Moreover, several grid Worker Nodes were run on the LAL test bench are part of LAL’s production grid infrastructure. No problems were found related to the fact that they were running in a virtualized environment.

Performance Issues The use of NFS appears to cause significant startup delays in machine startup and non-responsive behavior with the OpenNebula daemon. These have been investigated by LAL and also by the OpenNebula developers. Optimized parameters will probably improve the performance; however, LAL has started looking into alternative configurations (using squid caching and LVM) that would remove the need for NFS and provide a more responsive and scalable architecture.

3.8.3.2 Quarter 2

Testing Infrastructure LAL continues to maintain the Quattor configuration for the StratusLab toolkit. The configuration and associated deployment are frequently updated according to feedback from administrators who have installed the StratusLab release.

Verification of StratusLab Release 0.1 During the period that preceded the release of StratusLab v0.1, the distribution went through an intensive testing process. For this purpose a number of nodes were allocated from GRNET's support and pre-production infrastructure. During this testing process a significant number of bugs were identified and fixed, and the overall stability of the distribution was enhanced. This process took place in close collaboration with WP4 developers and focused on mainly two aspects of the StratusLab distribution: the manual installation of the service and remote client access via the command line tools.

In both cases, the online tutorials were used as a guides, namely the "Manual installation tutorial" and the "User tutorial". As a result, this testing and verification process improved the online support material as well as exposed problems with the software.

3.8.3.3 Quarter 3

Testing Infrastructure Work was done to more completely automate the installation of the StratusLab installation with Quattor. This includes a new configuration module for the authentication proxy and an updated module for OpenNebula. With the deployment of the pre-production cloud service at LAL, the test infrastructure will be regularly reinstalled from scratch with the latest software to ensure that the distribution installs and functions correctly.

Validation of StratusLab Releases A validation procedure for new releases of the StratusLab distribution has been defined and reported in project deliverable D5.2 "Infrastructure Tools and Policy Specifications", released in M7. According to this procedure each new candidate release is first tested in the pre-production infrastructure and then, if accepted, is deployed in the reference cloud service. This procedure enforces the close interaction between WP4 and WP5 in order to promptly resolve any issues concerning the stability and validity of new releases. The procedure was applied during the release of StratusLab 0.3 which is due in Q4.

Investigation of Storage Solutions Cloud storage services will be added to the StratusLab distribution shortly. LAL has investigated using iSCSI technologies as a component of those storage services. An iSCSI target (server) was deployed. Disks residing on this server could then be mounted by hosts in the cloud and used as input devices for virtual machines running on the host. No obstacles were encountered to using this as part of the StratusLab cloud storage services.

GRNET also investigated the usage of NFS as a shared storage solution among the frontend and the hosting nodes. The migration to a shared storage solution seems inevitable at the moment since it will allow us to take complete advantage of the physical nodes processing capabilities and also will give us the ability to perform live migration of VM instances among the hosting nodes. The current reference cloud service resides on SSH transfers for sharing images among the hosting nodes. The nodes themselves are limited to a total storage space of 80 GB. Currently all VM images are copied locally in every host before instantiation, this space quickly gets filled, especially when large images are used (e.g. a 10GB CentOS base image currently offered from the appliance repository). The storage server in GRNET infrastructure currently support only NFS so the usage of this protocol is the only solution even though it does not scale very well. Nevertheless, for this size of infrastructure (17 nodes) this approach should be sufficient. For larger infrastructures technologies like iSCSI, currently tested by LAL, should be considered more appropriate.

3.8.3.4 Quarter 4

Testing Infrastructure In addition to the development of the registration service, associated hudson jobs have been created that test the service as well as username/-password and certificate authentication. As for all of the hudson test jobs, these are run automatically when the code base changes and a full re-installation and test is done daily.

Validation of StratusLab Releases Significant effort has been placed this quarter for testing and validation of StratusLab 0.4. For this purpose we relied heavily on the pre-production nodes residing in GRNET datacenter. This update is quite significant since among others requires the migration of the base OS for the physical nodes from CentOS 5.5 to Fedora 14. Our tests spotted a few problems and incompatibilities that where fixed promptly in coordination with WP4. In particular a new build of OpenNebula packages had to be performed on Fedora 14. Also the new version of *libvirt* that comes with Fedora 14 had to be fine tuned in order to allows seamless interoperability with StratusLab distribution.

Investigation of Storage Solutions During the past months we have gathered important experience from the operation of the reference cloud service over a shared NFS file system. This experience showed that NFS lacks the performance attributes required for the delivery of efficient cloud services, or at least this is the case for the setup in GRNET where a centralized EMC storage server is sharing volumes to the rest of the nodes over NFSv3.

For this reason we decided to investigate alternative solutions for distributed and parallel file systems. In particular we chose to test *Ceph* [9] and *GlusterFS* [10] as two of the most popular offerings nowadays. Both file systems were installed in the pre-production service and were used for sharing the images of VM instances managed by OpenNebula (i.e. residing under /var/lib/one folder). Unfortunately, the results we got were not particularly encouraging. Ceph appears to be still very

[9] http://ceph.newdream.net/
[10] http://www.gluster.org/

unstable and in our opinion can not be trusted yet for production-level services. GlusterFS on the other hand did not gave us the expected performance gain. Actually our tests showed that in most cases the system exhibits worse or similar performance with NFS v3. For this reason we decided to retain the existing setup based on NFS but to continue seeking more efficient shared storage solutions.

3.8.4 Task 5.3: Virtual Appliances Creation and Maintenance

3.8.4.1 Quarter 1

Installation of Virtual Appliance Repository A first simple implementation of the virtual appliances repository is available from http://appliances.stratuslab.eu. In this first version the appliance repository is a standard Apache web server, hosted by Trinity College Dublin (TCD). The web server is accessed using WebDAV (Web-based Distributed Authoring and Versioning), with authentication via the StatusLab LDAP server. The repository already offers a number of appliances, which have been created by other members of the project. For example, it contains VM images preconfigured with gLite software for the three basic components of a grid site (CE, SE and WN).

The appliance repository structure is designed to mirror that of a Maven repository. Information about an appliance is stored in an associated XML manifest file. The reason for following the above approach is that in the long term we plan to evaluate the use of tools such as Apache Maven for uploading and downloading of images. Initial tests using Maven have, however, proved unsuccessful with the large file sizes of the appliances currently found in the repository. This will be investigated further in the next quarter.

3.8.4.2 Quarter 2

Appliance Repository The virtual appliance repository is available as a service hosted by TCD. This first version the appliance repository is a standard Apache web server, accessed using WebDAV (Web-based Distributed Authoring and Versioning) with authentication via the StatusLab LDAP server. The focus during this quarter has been on providing a reliable, stable service to support the first release. The main activities have been the following:

- The set of appliances available from the repository has been rationalized. Only images that have been tested, and are known to work with the StratusLab release are included. Currently three reference images are provided for Ubuntu, CentOS, and ttylinux.

- The front-end of the repository has been modified to match the look and feel of the main StratusLab web page. Users can now more easily find the available images, and also obtain information about them. This information is loaded from the metadata files stored with the images.

- A statistics package has been installed on the repository to provide a way of tracking the downloads of images. This is particularly useful to track the impact of the first release.

- The WP4 installation tools have been extended to allow for the installation of a local appliance repository. The tools were used by GRNET to deploy an appliance repository mirror which is intended to serve as a backup in case of a failure of the TCD repository.

Appliance Repository Mirror A mirror of the appliance repository has been installed in GRNET using the automated installation process supported by the project. The service is deployed on a VM running on GRNET's support infrastructure. A total storage of 1 TB has been allocated from the local storage server in order to accommodate VM images. Currently the repository is mirrored from TCD once every day.

Creation of Standard Base Images Three standard base images were created for the first public StratusLab release. These were images for ttylinux 9.5, CentOS 5.5, and Ubuntu 10.04. The procedure for generating these images has also been documented on the StratusLab website as part of the user tutorial. These images are currently available from the appliance repository and can be used to instantiate VMs on the StratusLab reference cloud service.

3.8.4.3 Quarter 3

Appliance Repository During this quarter the initial version of the appliance repository, using a WebDAV enabled Apache web server, has been maintained. The initial set of reference images has been updated as required, and a new set of images has been made available. These include the first *appliances*. Five grid appliances have been provided containing gLite grid middleware: a Computing Element, a Storage Element, a Worker Node, an APEL node and a User Interface. Additionally, in collaboration with WP2 activity a Bioinformatics specific appliance has been created based on a CentOS 5.5 base image.

The operation of the first version of the repository was marked by the delivery of milestone MS10 - "Initial Virtual Appliance Repository", which was prepared during month PM9 as planed.

In this quarter the focus of the task has been on the design, and initial implementation of the next version of the repository, the 'Marketplace'. The Marketplace will serve as a registry for images that can be shared. Rather than providing a centralized storage location, the storage of the actual images will be handled by the owners of the images, allowing them to control access to the images if desired. The Marketplace itself will contain cryptographically-signed metadata about machine and disk images allowing users to find existing images and allowing system administrators to define policies on trusting those images.

A reference implementation of the Marketplace will be made available for testing at the beginning of the next quarter.

Creation of Standard Base Images New base images were made available during this period. After user requests a 10 GB CentOS 5.5 image was generated providing larger storage space on the root file system. Also in response to security issues (see below) related to ttylinyx 9.5 images, a new image based on version 9.7 of the distribution was created fixing the security holes of its predecessor.

3.8.4.4 Quarter 4

Marketplace During this quarter the initial version of the appliance repository, using a WebDAV enabled Apache web server, has been maintained. The initial set of reference images has been updated as required. In collaboration with WP2 activity two Bioinformatics specific appliances have been created based on a CentOS 5.5 base image.

In this quarter the focus of the task has been on the continued design and implementation of the Marketplace. A reference implementation of the Marketplace has been made available for use in testing and for development of the client tools. The Marketplace implementation has been extended to include new features such as SPARQL querying of the metadata, new search functionality, and browser-based upload of metadata files. During the next quarter the existing appliance repository will be phased out, to be replaced by the Marketplace.

Hudson jobs have been created to test the deployment, configuration, and functionality of the Marketplace. These run regularly and flag any errors that have been introduced in the code or the deployment procedures.

In addition, a test server has been deployed for the HEPiX Virtualization Working Group. This will allow them to test how the Marketplace can help them to publish and to share virtual machine images between their grid sites. A concerted testing effort by the HEPiX people is expected to take place in the latter part of June 2011.

Creation of Standard Base Images A new update contextualization recipe has been introduced and will be applied from v0.4 and forward. This requires all images to be re-configured or re-generated in order to be compatible with the cloud services build with StratusLab 0.4 and later. The largest part of this effort is managed by WP4 although members of WP5 have contributed with new versions for a number of appliances.

PXE Support Almost all operating systems provide a mechanism for automated installation via PXE. Reusing this mechanism to automate the production of virtual machine images offers the possibility to document the contents of a particular image (through kickstart or other description files) and to regenerate them easily to incorporate regular security updates of the operating system. LAL has adapted the mechanisms used in Quattor for the automated installation of machines via PXE to provide a similar mechanism for cloud users. In this case, cloud users provide the network boot file and the machine description to create the virtual machine. A prototype of this works, but needs to be integrated into the main StratusLab distribution and command line interface.

3.8.5 Issues and Corrective Actions

No major issues related to WP5 have arisen in Q1.

Reaction to Security Incident During the past quarter we have experienced two security incidents related with vulnerable VM images.

A machine running on the LAL preproduction cloud service was hijacked and used for a password scanning attack on another site. The forensic analysis showed that the method of entry was use of an image with a commonly-known root password. This analysis also highlighted deficiencies in the available logging information. Changes to OpenNebula and the authentication proxy were made to ensure that all necessary tracing information is conveniently available to system administrators. In addition, a quarantine mechanism was implemented that keeps terminated instances for 48 hours (by default) so that detailed forensic analysis can be done afterwards on any image.

A similar incident occurred also in a VM running in the reference cloud service. Again an instance was hijacked using a commonly known username/password combination in the ttylinux 9.5 distribution. The instance was brought offline immediately and the faulty image was removed from the appliance repository.

Both incidents demonstrated the problems of public cloud infrastructures related with the vulnerabilities of VM images. Apart from reacting promptly to such events we believe that the introduction of the Marketplace and the security mechanisms implemented within will improve the overall security of the service. Nevertheless, security will remain one of the critical challenges for the project operations activity and will in our focus for improvement in the coming months.

Disruption of support services The Hudson continuous integration service was disrupted just before the release of StratusLab 0.3 due to a failed hard disk in the hosting node. This delayed the release process since the server had to be reinstalled and configured from scratch. The server employed a RAID-1 mirroring configuration which means that the hosting data were not lost, but due to lack of an on-line back-up procedure, recovering of the information took longer than expected. For this reason it was decided to put in place a backup mechanism in the hudson server which will store daily snapshots of the system data. This way the time to bring the service back on line will be much shorter should a similar incident occur again.

The provisioning of physical infrastructure was impacted during the reported period by a number of unscheduled and particularly long downtimes at the GRNET site. The downtimes were required to perform various maintenance activities of the physical infrastructure. These activities included the recabling of the physical nodes interconnection and the upgrade of the networking infrastructure (routers and switches) in order to deal with some serious firmware bugs affecting the network equipment. These downtimes affected the testing process of the StratusLab distribution and slightly delayed the date of the first official release of the software.

Apparently, these circumstances are rather rare and the corrective actions performed by the datacenter administrators are expected to fix the various problems in the physical setup of the infrastructure. Nevertheless, in order to avoid similar situations in the future, the StratusLab team negotiated with the datacenter the process to be followed in the future. In particular it was agreed that:

- StratusLab will be identified as one of the datacenter's official users and will be notified well beforehand about downtimes. The datacenter support help desk has been notified for this and the GRNET operations team has been included in the relevant mailing lists.

- In case these downtimes can be postponed and if the project's current status demands such a delay, the StratusLab team will prevent the downtimes till the issues imposed by the project are resolved (e.g. planned release of a new version).

- A specific window of maintenance has been set in which the datacenter administration can schedule a downtime. Specifically, there are two windows on Monday and Wednesday morning from 07:00-09:00 CET.

So far the above actions seem to have brought the expected results and the number and length of downtimes have decreased. Obviously these are major issues that will be followed closely in the coming period in order to ensure the provision of envisioned Quality of Service from the project's operations activity.

Quattor Support of Fedora 14 The switch from CentOS 5.5 to Fedora 14 has required more effort than foreseen, pulling effort away from other tasks like the testing of iSCSI as an image store. Despite the need for additional effort, it is expected that a full Quattor configuration will be available for deploying the StratusLab 1.0 release.

Need for Storage Resources for LAL Pre-production Service Local users of the LAL pre-production service have already encountered limitations stemming from the lack of storage capacity. Foreseen funding has unfortunately not appeared, so storage hardware will likely be purchased with StratusLab funds instead. This will mean a reduction in the overall funded human effort, but believe that this will better serve the aims of the project and allow faster evolution of the StratusLab distribution.

3.9 WP6: Innovative Cloud-like Management of Grid Services and Resources

3.9.1 Summary

3.9.1.1 Quarter 1

This Work Package starts on month 4.

3.9.1.2 Quarter 2

WP6 investigates and develops services for the innovative automatic deployment and dynamic provision of grid services as well as scalable cloud-like management of grid site resources. The main result in the second quarter has been the deliverable D6.1 "Cloud-like Management of Grid Sites 1.0 Design Report", where an extension of the initial StratusLab architecture including these innovative services has been defined. This document has established the starting points for development: cloud-like APIs, service definition language and contextualization, scalable cloud frameworks and monitoring and accounting solutions. For scalability, a service manager, Claudia, will be included in the StratusLab distribution; the code has been moved into a StratusLab repository. A set of specific initial uses cases have been identified to test the StratusLab distribution, for example, Torque, Sun Grid Engine (SGE), and a dynamically-managed grid computing element.

3.9.1.3 Quarter 3

WP6 investigates and develops services for the innovative automatic deployment and dynamic provision of grid services as well as scalable cloud-like management of grid site resources. The main result in the third quarter has been the development of new functionalities in the Service Manager (Claudia) and the Virtual Infrastructure Manager (OpenNebula). Claudia has been provided with an extended lifecycle engine and a more flexible rule language. The new rule definition language will allow for improved scalability in the management of grid services. OpenNebula was integrated with a monitoring tool and fault tolerance mechanisms were developed to reduce service downtime.

The work done in Q3 led to the achievement of milestone MS14 *Release of Cloud-like Management of Grid Services and Resources 1.0 Beta*.

3.9.1.4 Quarter 4

WP6 develops advanced technology/features for deployment on existing cloud infrastructures through automatic deployment and dynamic provision of grid services as well as scalable cloud-like management of grid site resources. During this period, a grid site has been deployed in the testbed by using Claudia. Component scalability has been carried out considering virtual hardware resources (e.g. VM CPU) and some work in being done towards the scalability driven by Key Performance Indicators (KPI). On the other hand, some work has been done in order to adapt OpenNebula to the typical operations of a grid site (like virtual resource placement heuristics, cloud-aware image management techniques and management of cloud-aware networks).

3.9.2 T6.1: Dynamic Provision of Grid Services

3.9.2.1 Quarter 1

This Work Package starts on month 4.

3.9.2.2 Quarter 2

Service Manager For the dynamic provision of grid services, WP6 has introduced a layer on top of current IaaS clouds that allows users to manage a service (ensemble of machines) as a single entity. This service manager, Claudia, analyzed in D6.1, has been moved into the StratusLab repository and will appear in upcoming releases. This solution provides a wider range of scalability mechanisms and a broader set of actions that can be undertaken (addition, removal, reconfiguration, federation, etc.) than on a simple IaaS cloud. Claudia can work on top of several different cloud infrastructure providers.

Service Language and Contextualization For the service definition language, Open Virtualization Format (OVF) has been chosen, since it provides a standard way for describing service and virtual machines as well as the networks involved in the service. Furthermore, as virtual machines need contextualization information, (that is, configuration information passed at boot time) some mechanisms from OpenNebula and some OVF recommendations (for instance ISO images) have been introduced.

Cloud-like APIs The usage of standard APIs has been identified as an important point for StratusLab. Thus, TCloud and OCCI are the APIs that will provide access to the Service Manager and Virtual Machine Manager, respectively.

Monitoring and Accounting Regarding monitoring and accounting, the extension of OpenNebula for both monitoring (integration with Ganglia) and accounting has been identified as a better solution.

Identification of Use Cases D6.1 has identified a set of use cases for the WP6 development based on end-user's requirements. Concretely, these are Sun Grid Engine (a service that has already been tested with the service manager and all the required artifacts exist), Torque, and gLite services.

3.9.2.3 Quarter 3

Lifecyle engine Claudia, the Service Manager developed by TID, has now an improved lifecycle engine that supports a broader set of actions over the Virtual Machines.

Rule language Regarding the service definition language, Open Virtualization Format (OVF) was extended with Rule Interchange Format (RIF), a W3C standard, to support complex scalability rules.

Requirements and use case definition Since the project has a grid site officially running and maintained by GRNET, the team is starting a phase for establishing requirements and use cases to be covered in the next quarters.

Integration of the Service Manager Claudia was added to the project's continuous integration system and is ready to be part of the Stratuslab distribution/release. Installation and configuration mechanisms were prepared during this quarter, and more effort on that will be done in the next quarter in order to further automate Claudia's installation and configuration.

3.9.2.4 Quarter 4

Grid Site Specification Formalized in OVF The grid site features has been defined and specified by the OVF format. The OVF is a DMTF standard which provides a portable packaging mechanism to specify the service requirements to be deployed in the cloud. To this end, OVF has been used to define the VMs involved in a grid site (CE, SE, WN, APEL), their hardware resources (CPU, RAM, etc.), and the software installed in each VM together their configuration parameters. In addition, some OVF extensions has been included for scalability issues (to define the scalability rules, the KPI which drives the scalability, and the number of replicas which can scale).

Grid Site Deployment by Using Claudia The grid site, specified in the OVF format, has been deployed in the cloud by using the service manager (Claudia), using the deployment functionality that Claudia provides (following the TCloud specification). Claudia processes the OVF and performs requests via the virtual machine manager (OpenNebula) to deploy networks and virtual machines. The configuration information arrives at the VM by using the contextualization mechanism. By using scripts and contextualization information, all VMs execute the YAIM tool against a set of inferred configuration files. As a result, all the VMs from the grid site have been deployed in the cloud are interconnected by a public network, configured correctly and the grid site is up and running.

Grid Site Contextualization The OVF language can provide a mechanism to provide the contextualization information for the software installed in the VMs. In the OVF, it is possible to specify configuration parameters, certificates needed and so on. The generated file by Claudia (ovf-env.xml) is in the deployed VM. A script, also passed by contextualization, is in charge of configuring each VM.

Grid Site Scalability Grid applications deployed over cloud technologies can benefit from scalability at the service level that Claudia provides; this conceals low level details from the user. This means that the number of WNs can vary depending on the virtual hardware resources (like CPU) and the KPI like job queue utilization.

Probe Development A typical approach to apply grid site elasticity is to vary the number of WNs in the site depending on the job workload at a given moment. This requires the constant monitoring of the number of jobs in the local LRMS queues. During Q4 we experimented with a basic probe module developed in Python that calls the pbsnodes and qstat command line tools of Torque LRMS (which has been installed in HG-07-StratusLab), parses the output and generates the percentage of job queue utilization. This module is currently being evolved to act as a proper demon service that will communicate the the above mentioned KPI value (queue utilization) to the Service Manager using the its REST API.

Load Balancer Support The CE of a grid site has to be aware of all of the WNs to be deployed and un-deployed on the site. To achieve this, close cooperation between the service manager and the load balancer (LB) component that is running as a service on the CE is requried. LB is running constantly waiting for notifications from Claudia. Work on the LB has started in the end of Q4 and is expected to complete in the first weeks of Q5. The LB service is developed with Python using the web.py [11] module.

Static IP Support by Claudia A requirement taken from the grid site is the need for static IP addresses. Some VMs in the grid site require a digital certificate which corresponds to a concrete IP address. This certificate has a duration of a year for the duration of which we have to keep the associated IP addresses. Due to this, Claudia has evolved to manage the static IP for customers and specify a way that the user can utilize it to configure the grid site in the OVF.

Feeding Claudia with Virtual Hardware Monitoring Information OpenNebula provides Virtual Machine hardware monitoring information obtained from Ganglia. Claudia needs to obtain this virtual hardware information to scale grid services. Thus, this monitoring information collected by OpenNebula has to be provided to the Claudia optimization module.

3.9.3 T6.2: Scalable and Elastic Management of Grid Site Infrastructure

3.9.3.1 Quarter 1

This Work Package starts on month 4.

3.9.3.2 Quarter 2

Service-level open-source elasticity frameworks Grid applications deployed over cloud technologies should benefit from scalability at the service level, which conceals low level details from the user. WP6, in Q2, has selected Claudia as a service manager because it fulfills the requirements and to take advantage of TID's experience with it. Claudia is an advanced service management toolkit that allows service providers to dynamically control the service provisioning and scalability in an IaaS Cloud. Claudia manages services as a whole, controlling the configuration of multiple VM components, virtual networks and storage support by optimizing the use of them and by dynamically scaling up/down services applying elasticity rules, SLAs and business rules.

[11] http://webpy.org/

3.9.3.3 Quarter 3

Improved service-level elasticity Service-level elasticity will be brought to grid applications by Claudia, the Service Manager. During this quarter, Claudia went through a series of changes to increase the flexibility of the rule engine and accept complex scalability rules. Rule Interchange Format (RIF) was chosen as the preferred language for rule description. A RIF parser was implemented so that Claudia supports RIF rules embedded in the OVF file. Services that scale up demanding many Virtual Machines benefit from load balancers. For that reason Claudia was integrated with a load balancer to be ready for high load situations.

Monitoring with Ganglia OpenNebula is now able to obtain monitoring information from Ganglia. GRNET and UCM wrote custom Ganglia probes that were installed on each host in order to expose hypervisor information to the Ganglia monitoring tool. Large deployments may benefit from the scalability of Ganglia and use it as the monitoring source both for physical hosts and VMs. Moreover, the administrator is now able to have a real time graphic representation of the resource consumption using the Ganglia Web Frontend.

Fault tolerance Fault tolerance has been improved to automatically trigger recovery actions when a physical host or VM fails. When OpenNebula detects that a host is down, a hook can be triggered to deal with the situation. This can be very useful to limit the downtime of a service due to a hardware failure, since it can redeploy the VMs on another host.

3.9.3.4 Quarter 4

Development of Image Repository for Image Management in OpenNebula The Image Repository system allows OpenNebula administrators and users to set up images, which can be operative systems or data, to be used in VMs easily. These images can be used by several VMs simultaneously, and also shared with other users. Users can manage the image repository from the command line interface with the `oneimage` command.

Support for Multiple Storage Backends to Access Persistent Images in the Image Repository VM disk images can be provisioned using two approaches: block devices and files. The image repository has been architected to support these two approaches and to easily incorporate different technologies in each area.

Evaluation of Additional VLAN Models for Virtual Network Management We are evaluating different alternatives for virtual network management. For example, Open vSwitch[12] or host-managed 802.1Q VLANs. In this case, the OpenNebula network manager creates bridges and tagged interfaces for VMs as needed, when the VM is booted; and remove them upon VM disposal.

Automatic Setup of Simple TCP/UDP Firewall Rules for VMs Each network interface defined in a VM can include simple filter rules based on destination ports.

[12] http://openvswitch.org

This is implemented by dynamically creating iptables rules that captures the FORWARDING packets and setting up custom iptables chains for the VM interfaces.

Using Virtual Network Information and Image Information in VM Contextualization Variables from the image template and virtual network template can now be used in the `CONTEXT` parameter of the VM description file to provide contextualization information to VMs.

3.9.4 T6.3: Cloud-like Interfaces Specific for the Scientific Community

3.9.4.1 Quarter 1

This Work Package starts on month 4.

3.9.4.2 Quarter 2

3.9.4.3 Quarter 3

3.9.4.4 Quarter 4

TCloud as the Claudia API The TCloud API is a RESTful API which allows access to the service manager. The TCloud API has been implemented and released by the `tcloud-server` project, which is a general TCloud API representation and which is bound to an implementation by a set of drivers, for instance, the OpenNebula driver. The tcloud-server plus the drivers are provided as an RPM package `tcloud-server-rpm`, which is configured and installed by using the StratusLab sysadmin tools.

Enhancements in OpenNebula OCCI Implementation The OCCI interface has been enhanced to expose more OpenNebula functionality for image management, virtual network management, as well as for fine grained resource specification.

Authorization Based on Groups and Roles in OpenNebula The authorization system in OpenNebula is being extended to support groups of users and access rules (roles) to manage OpenNebula resources. These groups and roles can be used, for example, to map attributes specified in VOMS certificates.

3.9.5 Issues and Corrective Actions

None.

No major issues related to WP6 have arisen in Q2.

No major issues related to WP6 have arisen in Q3.

No major issues related to WP6 have arisen in Q4.

4 Project Management

4.1 Consortium

The project consortium consisting of six partners (CNRS, UCM, GRNET, SIXSQ, TID, and TCD) has not changed since the start of the project. There have been no changes in the legal status of those partners. The representatives for TCD and TID have changed because of retirements and internal reorganization of activities.

4.2 Management Tasks

Meetings Tables 4.1, 4.2, 4.3, and 4.4 contain a list of the meetings by quarter that have been planned to foster collaboration between the project participants. Not listed are the planning meetings for each development sprint and the daily standup meetings.

Metrics Table 4.5 contains the metrics for the project. The table groups related metrics together. The first group aimed towards dissemination show steady interest in the project; an open question is how to encourage and manage discussion with the community. The second group concerns the integration processes; all of the metrics show good progress, which is reflected in the regular releases of the distribution. The third group concerns the operations and deployments. The metrics show that the quality of the software is good. However, more effort needs to be made by the project in having external users deploy and use the distribution in production. The release of the StratusLab v1.0 release will help improve these metrics. In the fourth group, the resources provided by StratusLab are steady. Storage services have just been added in the v1.0 release, so related metrics can now be collected. The last group shows that the maintained appliances and the Marketplace are well used. Further growth in these metrics are expected in Y2.

Deliverables and Milestones Tables 5.1, 5.2, and 5.3 list all of the documents. In addition, these are available from the project website. Milestones MS8 and MS11 as well as Deliverables D6.2, D2.2, D3.2, D3.3, D4.2, D4.3, D5.3, and D6.3 have been produced in this quarter.

Memoranda of Understanding The project has signed Memoranda of Understanding (MoU) with the EGI and EDGI projects; an MoU with VENUS-C has been concluded but not yet signed. The project has decided not to pursue an MoU with the ERINA+ project because of the large additional effort required by StratusLab and incompatibilities with the timelines. MoUs with EMI and IGE are still under negotiation.

4.3 Issues

Underused Effort The effort numbers for Q4 are very near to the expected values except for WP1 (management) and WP5. The effort for WP1 is about 50% of what was foreseen because the project has been less difficult to manage than expected, although with the year end deliverables and first review the numbers are likely to increase in Q5%. The deficit in WP5 is largely an artifact of GRNET's internal accounting schedule; the actual effort is expected to be compensated in Q5.

Overall, there was significantly less effort provided than planned with a corresponding underspend in the budget for most partners. See the Resources section for complete details concerning this issue. Early in the second year of the project, an updated budget will be prepared to ensure that overall spending is in line with the foreseen budget. As all of the project personnel are now in place, predicting the costs associated with the effort should be much more precise, although there may still need to be shifts in budget between work packages to ensure that all of the project's objectives are met.

4.4 Planning

4.4.1 Objectives for Next Quarter

- Solidify the v1.0 StratusLab cloud distribution through increased testing and hardening of existing services.
- Support for a second operating system to ensure the portability of the distribution.
- Survey of the users and system administrators to see if the requirements have evolved from those already collected in Y1.
- Update and expand the target reference architecture for the distribution.
- Continued dissemination of project results.
- Continued operation of reference infrastructure and support to users and system administrators.
- Expansion of the number of users and sites using StratusLab.

4.4.2 Roadmap

The roadmap remains essentially the same as decided in the Lyon Face-to-Face meeting. The PMB in Q3 gave its formal approval of the following changes to the overall work program:

1. The tasks regarding having a public (user-visible) cloud and an associated cloud API have been moved from Y2 to Y1, largely because of interest from scientific communities and resource centers wanting to provide public clouds.

2. The tasks about hybrid clouds will be expanded to include also cloud federation models. This will be moved to Y2 to balance the change above. Also having a solid release will make these investigations easier.

3. As foreseen in the TA, the appliance repository consists of a single service that contains appliance metadata, appliance storage, and services for changing appliance formats. This has been split into different services. The Marketplace will handle appliance metadata. Storage will take place with normal cloud storage or outside of the cloud. Instead of providing a service for appliance format changes, client tools will be provided instead.

These changes have been made and followed at the technical level for sometime; they are now also agreed at the management level.

The architecture and roadmap will be re-evaluated early in Q5 to define the detailed work plan for the second year of the project.

Table 4.1: *Meetings (Q1)*

Title	Date	Venue	Comments
StratusLab Kick-Off Meeting	14-15/06/2010	Orsay, FR	Kick-off of project. Detailed planning for accomplishing objectives. http://indico.lal.in2p3.fr/conferenceDisplay.py?confId=1129
Technical Meeting	22/07/2010	Madrid, ES	Detailed technical discussions for StratusLab development. http://indico.lal.in2p3.fr/conferenceDisplay.py?confId=1189
Sprint 1 Demo	30/07/2010	Phone/EVO	Sprint 1 demonstration meeting. http://indico.lal.in2p3.fr/conferenceDisplay.py?confId=1191
Sprint 2 Demo	20/08/2010	Phone/EVO	Sprint 2 demonstration meeting. http://indico.lal.in2p3.fr/conferenceDisplay.py?confId=1192

Table 4.2: *Meetings (Q2)*

Title	Date	Venue	Comments
Project Management Board	03/09/2010	Phone	PMB meeting to decide IPR policies. http://indico.lal.in2p3.fr/conferenceDisplay.py?confId=1203
Sprint 3 Demo	10/09/2010	Phone/EVO	Sprint 3 demonstration meeting. http://indico.lal.in2p3.fr/conferenceDisplay.py?confId=1203
Technical Meeting (TSCG)	21/09/2010	Phone/EVO	Shaping StratusLab distribution. http://indico.lal.in2p3.fr/conferenceDisplay.py?confId=1213
WP6 research lines meeting	27/09/2010	Madrid, ES	Discussion about the main gaps identified in WP4 and some technologies to solve them. http://indico2.lal.in2p3.fr/indico/conferenceDisplay.py?confId=1318
WP6 kickoff meeting	07/10/2010	Phone	Presentation of the lines to work on WP6 and distribution of work. http://indico2.lal.in2p3.fr/indico/conferenceDisplay.py?confId=1320
Sprint 4 Demo	08/10/2010	Phone/EVO	Sprint 4 demonstration meeting. http://indico.lal.in2p3.fr/conferenceDisplay.py?confId=1232
WP6 monitoring and accounting	26/10/2010	Phone	Audioconference about monitoring and accounting in StratusLab. http://indico2.lal.in2p3.fr/indico/conferenceDisplay.py?confId=1321
Sprint 5 Demo	08/11/2010	Phone/EVO	Sprint 5 demonstration meeting. http://indico.lal.in2p3.fr/conferenceDisplay.py?confId=1255
Face-to-Face Technical Meeting	15-16/11/2010	IBCP, Lyon, France	Discussion of StratusLab roadmap. http://indico.lal.in2p3.fr/conferenceDisplay.py?confId=1243
Project Management Board	22/11/2010	Phone	Project overview; LoS policy. http://indico.lal.in2p3.fr/conferenceDisplay.py?confId=1263

Table 4.3: *Meetings (Q3)*

Title	Date	Venue	Comments
Sprint 6 Demo	09/12/2010	Phone/EVO	Sprint 6 demonstration meeting. http://indico.lal.in2p3.fr/conferenceDisplay.py?confId=1310
Sprint 7 Demo	17/12/2010	Phone/EVO	Sprint 7 demonstration meeting. http://indico.lal.in2p3.fr/conferenceDisplay.py?confId=1323
Technical Meeting (TSCG)	27/01/2011	Phone/EVO	Feedback from EGI; priorities for distribution. http://indico.lal.in2p3.fr/conferenceDisplay.py?confId=1213
Sprint 8 Demo	31/01/2011	Phone/EVO	Sprint 8 demonstration meeting. http://indico.lal.in2p3.fr/conferenceDisplay.py?confId=1423
Technical Meeting (TSCG)	17/02/2011	Phone/EVO	Error reporting; priorities for next sprint. http://indico.lal.in2p3.fr/conferenceDisplay.py?confId=1213
Sprint 9 Demo	18/02/2011	Phone/EVO	Sprint 9 demonstration meeting. http://indico.lal.in2p3.fr/conferenceDisplay.py?confId=1442
Project Management Board	24/02/2011	Phone	Project status; MoUs; effort utilization; review planning. http://indico.lal.in2p3.fr/conferenceDisplay.py?confId=1440

Table 4.4: *Meetings (Q4)*

Title	Date	Venue	Comments
Sprint 10 Demo	03/03/2011	Phone/EVO	Sprint 10 demonstration meeting. http://indico2.lal.in2p3.fr/indico/conferenceDisplay.py?confId=1448
Technical Meeting (TSCG)	03/03/2011	Phone/EVO	Review of developments and priorities. http://indico2.lal.in2p3.fr/indico/conferenceDisplay.py?confId=1460
Sprint 11 Demo	31/03/2011	Phone/EVO	Sprint 11 demonstration meeting. http://indico2.lal.in2p3.fr/indico/conferenceDisplay.py?confId=1470
Metadata & Marketplace Demo	08/04/2011	EVO	Demo for HEPiX Virtualization Working Group. http://indico2.lal.in2p3.fr/indico/conferenceDisplay.py?confId=1477
Sprint 12 Demo	29/04/2011	Phone/EVO	Sprint 12 demonstration meeting. http://indico2.lal.in2p3.fr/indico/conferenceDisplay.py?confId=1492
Grid site deployment with Claudia (TID, GRNET)	09/05/2011	Phone	Discussion about how to use Claudia for the deployment of a grid site. http://indico2.lal.in2p3.fr/indico/conferenceTimeTable.py?confId=1530#20110509
Technical Meeting (TSCG)	10/05/2011	Phone	Persistent storage and cloud interfaces. http://indico2.lal.in2p3.fr/indico/conferenceDisplay.py?confId=1526
Interproject Collaboration	11/05/2011	Amsterdam	StratusLab, HPC Cloud, and Mantychore discussions. http://indico2.lal.in2p3.fr/indico/conferenceDisplay.py?confId=1510
Sprint 13 Demo	16/05/2011	Phone/EVO	Sprint 13 demonstration meeting. http://indico2.lal.in2p3.fr/indico/conferenceDisplay.py?confId=1513
Integration Meeting	23-24/05/2011	Geneva	F2F meeting for 1.0 release. http://indico2.lal.in2p3.fr/indico/conferenceDisplay.py?confId=1503
Interproject Collaboration	27/05/2011	Phone	Discussion with Contrail project. http://indico2.lal.in2p3.fr/indico/conferenceDisplay.py?confId=1527
Grid site deployment and scalability (TID, GRNET)	27/05/2011	Phone	Discussion to align the work. http://indico2.lal.in2p3.fr/indico/conferenceDisplay.py?confId=1529

Table 4.5: *Metrics*

Metric	Q2	Q3	Q4	Y1 Target	Q5	Q6	Q7	Q8	Y2 Target
No. of people on StratusLab announcement list	67	67	67	25					75
Registered users on StratusLab discussion site	N/A	N/A	N/A [a]	50					100
No. of views of website	2922	4623	4579	–					–
No. of completed sprints	5	5	4	–					–
No. of releases	1	1	1	–					–
No. of open user stories	38	72	101	–					–
No. of implemented user stories	69	40	67	–					–
No. of open bugs	6	15	22	–					–
No. of fixed bugs	7	11	27	–					–
No. of prod. sites running StratusLab dist.	1	1	1	5					10
No. of sites exposing the cloud API	1	1	1	0					5
Availability of sites	N/A	N/A	100%	80%					95%
Reliability of sites	N/A	N/A	100%	80%					95%
No. of VOs served via StratusLab sites	0	1	1	10					30
No. of sci. disciplines served via StratusLab sites	0	0	0	3					7
Delivered CPU	N/A	16 cores	16 cores	–					–
Delivered CPU through cloud API	N/A	256 cores	256 cores	–					–
Storage used	N/A	3 TB	3 TB	–					–
Storage used through cloud API	N/A	N/A	N/A	–					–
No. of sites providing scale-out	N/A	N/A	N/A	–					–
Fraction of resources by scale-out of a site	N/A	N/A	N/A	–					–
No. base machine images	5	7	8	5					10
No. of base machine image downloads	783	2628	7072	–					–
No. appliances	0	6	7	5					15
No. of appliance downloads	0	252	687	–					–

[a] See section 3.6.5

5 Deliverables and Milestones

Tables 5.1 and 5.2 show the deliverables for the first and second years of the project. Table 5.3 lists all of the milestones. All of the deliverables and milestones for the first year of the project have been produced and submitted as foreseen in the project's roadmap. All of these are available from the project's website[1].

Two technical notes have also been produced during the first year: "StratusLab Marketplace" describing the technical specification of the Marketplace and "Installing and operating a production grid site in the StratusLab cloud: Experience and issues" providing feedback to developers and advice to administrators running grid services within a cloud. These notes are also available from the project website.

[1] http://stratuslab.eu/doku.php/deliverables

Table 5.1: *Deliverables (Year 1)*

No.	Title	Version	WP No.	Lead Beneficiary	Nature	Diss. Level	Due Date	Actual Date	Status	Contractual	Comments
D2.1	Review of the Use of Cloud and Virtualization Technologies in Grid Infrastructures	1.2	WP2	CNRS	R	PU	PM2	11/08/2010	Done	Yes	
D4.1	Reference Architecture for StratusLab Toolkit 1.0	1.0	WP4	SIXSQ	R	PU	PM3	14/09/2010	Done	Yes	
D5.1	Infrastructure Specification	1.0	WP5	GRNET	R	PU	PM3	14/09/2010	Done	Yes	
D3.1	Initial Plan for Dissemination, Collaboration and Standardization Activities	1.0	WP3	TCD	R	PU	PM4	18/10/2010	Done	Yes	
D6.1	Cloud-like Management of Grid Sites 1.0 Design Report	1.0	WP6	TID	R	PU	PM5	16/11/2010	Done	Yes	
D5.2	Infrastructure Tool and Policy Specification	1.0	WP5	GRNET	R	PU	PM6	15/12/2010	Done	Yes	
D6.2	Cloud-like Management of Grid Sites 1.0 Software	1.1	WP6	TID	P	PU	PM11	13/05/2011	Done	Yes	
D2.2	Report on Evaluation of StratusLab Products	1.0	WP2	CNRS	R	PU	PM12	15/06/2011	Done	Yes	
D3.2	Report on Dissemination, Collaboration and Standardization Activities	1.1	WP3	TCD	R	PU	PM12	16/06/2011	Done	Yes	
D3.3	Exploitation and Sustainability First Plan	1.1	WP3	TCD	R	PU	PM12	16/06/2011	Done	Yes	
D4.2	StratusLab Toolkit 1.0	1.0	WP4	SIXSQ	P	PU	PM12	15/06/2011	Done	Yes	
D4.3	First Year Software Integration Report	1.0	WP4	SIXSQ	R	PU	PM12	15/06/2011	Done	Yes	
D5.3	First Year Infrastructure Operations Report	1.1	WP5	GRNET	R	PU	PM12	16/06/2011	Done	Yes	
D6.3	First Year Cloud-like Management of Grid Sites Research Report	1.0	WP6	TID	R	PU	PM12	15/06/2011	Done	Yes	

Table 5.2: *Deliverables (Year 2)*

No.	Title	Version	WP No.	Lead Beneficiary	Nature	Diss. Level	Due Date	Actual Date	Status	Contractual	Comments
D2.3	Survey of Targeted Communities Concerning StratusLab		WP2	CNRS	R	PU	PM14				
D4.4	Reference Architecture for StratusLab Toolkit 2.0		WP4	SIXSQ	R	PU	PM15				
D6.4	Cloud-like Management of Grid Sites 2.0 Design Report		WP6	TID	R	PU	PM17				
D5.4	Economic Analysis of Infrastructure Operations		WP5	GRNET	R	PU	PM18				
D6.5	Cloud-like Management of Grid Sites 2.0 Software		WP6	TID	P	PU	PM23				
D2.4	Final Report on StratusLab Adoption		WP2	CNRS	R	PU	PM24				
D2.5	Report on Evaluation of StratusLab Products		WP2	CNRS	R	PU	PM24				
D3.4	Final Review of Dissemination, Collaboration and Standardization Activities		WP3	TCD	R	PU	PM24				
D3.5	Exploitation and Sustainability Final Plan		WP3	TCD	R	PU	PM24				
D4.5	StratusLab Toolkit 2.0		WP4	SIXSQ	P	PU	PM24				
D4.6	Software Integration Final Report		WP4	SIXSQ	R	PU	PM24				
D5.5	Infrastructure Operations Final Report		WP5	GRNET	R	PU	PM24				
D6.6	Cloud-like Management of Grid Sites Research Final Report		WP6	TID	R	PU	PM24				

Table 5.3: Milestones

No.	Title	WP No.	Lead Beneficiary	Due Date	Achieved	Actual Date	Comments
MS1	Establishment of Management Infrastructure and Metrics Definition	WP1	CNRS	PM3	Yes	1/09/2010	
MS6	Website Operational	WP3	TCD	PM3	Yes	6/09/2010	
MS2	Contact Procedures and Supporting Tools for Targeted Communities	WP2	CNRS	PM4	Yes	10/12/2010	
MS7	StratusLab Development, Certification and Release Procedures in Place	WP4	SIXSQ	PM6	Yes	10/12/2010	
MS3	Creation of Virtual Appliances for Bioinformatics Community	WP2	CNRS	PM9	Yes	14/03/2011	
MS10	Initial virtual appliance repository	WP5	GRNET	PM9	Yes	4/03/2011	
MS14	Release of Cloud-like Management of Grid Services and Resources 1.0 Beta	WP6	TID	PM9	Yes	14/03/2011	
MS8	Release of StratusLab 1.0 Beta	WP4	SIXSQ	PM10	Yes	05/04/2011	
MS11	Operation of Site Running StratusLab toolkit v1.0	WP5	GRNET	PM10	Yes	04/04/2011	
MS4	Adoption of StratusLab Software by External Grid Sites	WP2	CNRS	PM14			
MS12	Delivery of Virtual Appliance Repository	WP5	GRNET	PM18			
MS5	Opening of Virtual Appliances Repository to External Application Communities	WP2	CNRS	PM20			
MS15	Release of Cloud-like Management of Grid Services and Resources 2.0 Beta	WP6	TID	PM21			
MS9	Release of StratusLab 2.0 Beta	WP4	SIXSQ	PM22			
MS13	Operation of Site Running StratusLab Toolkit v2.0	WP5	GRNET	PM22			

6 Use of Resources

The effort consumed by partner and by work package are shown in Tables 6.8–6.10. Similarly, the numbers for the Total Cost and Requested Contributions are in Tables 6.11–6.14 and Tables 6.15–6.18, respectively. Effort numbers for UCM include unfunded effort and hence will be larger than claimed in the Form C for reimbursement from the EC.

Overall, there was significantly less effort declared than planned for Y1. This is accounted for by use of permanent staff rather than temporary staff, delayed hiring at the start of the project, and compensation with unfunded effort. Despite the lower effort figures, the project has met all of the planned milestones for Y1 and provided all of the defined deliverables.

For most partners, there was also a significant underspend in the budget compared to the planned budget directly linked to the lower effort numbers. However, two partners, CNRS and SixSq, have used more expensive staff than foreseen initially and hence have overall budgets in line with the plan (-4% and -3% deviations, respectively).

A new set of effort tables and budgets for Y2 will be prepared early in Q6, as the final numbers were not provided by partners until the end of Q5 because of summer holidays. These new tables will be used to track the provided effort and budgets during the second year of the project.

6.1 CNRS

For all of the work packages, the effort provided by CNRS was less than foreseen in the original project planning, although the overall total cost is very close to the planned figure with only a 4% deviation. To compensate for late hiring and to ensure that the objectives of the work plan were met, there was a larger than expected effort from experienced permanent staff. Because the permanent staff is more expensive than temporary personnel, there were fewer person-months of effort delivered for nearly the same budget.

The deviations, however, were not uniform between different work packages. For WP2, there was actually a significant overspend by 18%. This is because all of the temporary staff for this work package was in place from the beginning of the project and significant additional effort was provided by permanent staff. For the dissemination activities (WP3), there was less effort provided than foreseen,

Table 6.1: *Personnel, Subcontracting and Other Major Cost Items for Beneficiary 1 (CNRS/LAL) for the Period*

Work Package	Item Description	Amount (Euro)	Explanations
1,2,3,5	Personnel direct costs	172938.16	Salaries for 5 people working a total of 27.37 PM
1,2,5	Travel costs	13247.56	Travel for personnel to attend StratusLab and EGI meetings; representation of StratusLab at major events, these include Brussels 28/10/2010, 14/3/2011; Geneva 4/11/2010, 8/12/2010, 18/1/2011, 23/5/2011; Lyon 15/11/2010, 4/4/2011; Budapest 20/11/2010; Annecy 27/1/2011; Amsterdam 14/9/2010, 7/4/2011, 11/5/2011; Waterloo (CA) 22/3/2011; Vilnius 10/4/2011; Clermont-Ferrand 30/3/2011; London 10/10/2010
1,2,3,5	Indirect Costs	111711.43	
	TOTAL COSTS	297897.15	

***Table 6.2:** Personnel, Subcontracting and Other Major Cost Items for Beneficiary 2 (UCM) for the Period*

Work Package	Item Description	Amount (Euro)	Explanations
3,4,6	Personnel direct costs	59705.00	Salaries of 7 researchers corresponding to 15.23 funded PMs
6	Remaining Direct Costs	2463.00	Travel: Valencia 9/3/2011, Amsterdam 11/5/2011, Geneva 11/5/2011
3,4,6	Indirect Costs	37301.00	
	TOTAL COSTS	99469.00	

although many of the activities in WP2 (training, posters, tutorials, videos) could be categorized as WP3 rather than WP2. The management of the project took considerably less effort than foreseen, largely because of the use of agile techniques to ensure coordination between work packages. The lower management effort allowed more time to be spent on WP2. The operations (WP5) was the most affected by the delay in hiring personnel at the beginning of the project and the relative unavailability of permanent staff to compensate. As the temporary engineer is in place, effort should be at nearly nominal levels for the second year of the project. CNRS will also work to rebalance the effort from permanent staff to reinforce the WP5 work.

6.2 UCM

UCM reports an important difference (-63%) between planned and declared costs because they could not hire new researchers until the second half of Y1. UCM could not start the hiring process until the signature of the Grant Agreement by the European Commission and the Coordinator, and the process took three months to complete. However there is no such difference (-3.4%) between the planned and the declared effort because UCM has allocated unfunded resources (UCM has not declared the cost of 15.24 PMs of the overall 29.14 PMs) to complete their assigned work in the work plan. UCM will allocate more resources (researchers) to the project to bring our overall spending and funded effort to the figures declared in the technical annex.

Table 6.3: *Personnel, Subcontracting and Other Major Cost Items for Beneficiary 3 (GRNET) for the Period*

Work Package	Item Description	Amount (Euro)	Explanations
1,3	Personnel direct costs	88975.00	Salaries of 5 people providing effort of 1.72PMs in WP3, 16.92PMs in WP5 and 2.05PMs in WP6
2	Travel	8661.48	Travel costs to the project meetings and other conferences linked to StratusLab activities such as kick off meeting in Paris (14/6/2010), EGI tech conference in Amsterdam (14/9/2010), EGI user forum in Vilnius (10/4/2011), StratusLab Integration meeting in Geneva (23/5/2011) etc.
1,6	Indirect Costs	78109.18	Cost Model: Real indirect costs 80%
	TOTAL COSTS	175745.66	

Table 6.4: *Personnel, Subcontracting and Other Major Cost Items for Beneficiary 4 (SixSq) for the Period*

Work Package	Item Description	Amount (Euro)	Explanations
3, 4	Personnel direct costs	189960.00	2 engineers working for 19.17 person months
4	Subcontracting	3162.00	Amazon Web Services for checking interoperability with commercial cloud provider
4	Equipment deprecation	3744.00	Laptops for project participants
4	Travel Costs	3937.00	Kick-off Meeting, Paris (14/6/2010); Technical Meeting, Madrid (20/7/2010); Face-to-face Meeting, Lyon (16/11/2010); EGI Technical Forum, Vilnius (28/2/2011); XP2011, Madrid (11/5/2011)
4	Remaining Direct Costs	1100.00	
3, 4	Indirect Costs	39747.00	
	TOTAL COSTS	237228.00	

Table 6.5: *Personnel, Subcontracting and Other Major Cost Items for Beneficiary 5 (TID) for the Period*

Work Package	Item Description	Amount (Euro)	Explanations
2,3,4,6	Personnel costs	107447.35	10 engineers providing effort in the following work packages: WP2 6.44, WP3 1.83 PM, WP4 8.84 PM, WP6 18.91 PM with costs RTD: 123,882.36; OTHER: 61,791.09; COORD: 55,101.20
2,3	Travel costs	3526.18	CA: Attendance Roadmap Standardization OGF/SIENA Event / Brussels (Belgium) - 26/10/2010 (CACERES EXPOSITO, JUAN ANTONIO) =897,13; Attendance Plenary meeting / LYON (France) - 14/11/2010 (MUNOZ FRUTOS, HENAR) = 1364,58; Attendance General Assembly and PMB StratusLab. / LYON (France) - 14/11/2010 (CACERES EXPOSITO, JUAN ANTONIO) = 1464,47
2,3,4,6	Indirect costs	120133.65	Overhead costs
	TOTAL COSTS	231137.18	

Table 6.6: *Personnel, Subcontracting and Other Major Cost Items for Beneficiary 6 (TCD) for the Period*

Work Package	Item Description	Amount (Euro)	Explanations
3	Personnel direct costs	25046.00	Salary of Research Fellow (5.54 PM, funded by StratusLab)
5	Personnel direct costs	15797.00	Salary of Research Fellow (4.5PM, funded by StratusLab. 1.5PM unfunded to provide 6PM total)
3,5	Travel costs	4230.49	Kick-off, Orsay (14/6/2010); training, Madrid (22/7/2010); EGI TF 2010, Amsterdam (14/9/2010); Face-to-face, Lyon (15/11/2010); HEPiX, Geneva (18/1/2011); EGI UF 2011, Vilnius (11/4/2011); EGI User Virtualization Workshop, Amsterdam (12/5/2011); EC Review, Brussels (4/7/2011)
3	Dissemination	1250.00	EGI TF 2010 Booth, EGI UF 2011 Registration
3,5	Remaining Direct Costs	59.87	Courier
3,5	Indirect Costs	27830.00	
	TOTAL COSTS	74212.36	

Table 6.7: *Declared Y1 Effort (in Person-Months) by Partner and by Work Package*

Partner/WP	WP1	WP2	WP3	WP4	WP5	WP6	TOTAL
CNRS	1.90	16.81	0.95		7.71		27.37
UCM			2.80	12.23		14.11	29.14
GRNET			1.72		16.92	2.05	20.69
SIXSQ			2.00	17.17			19.17
TID		2.56	1.18	3.16		11.09	17.99
TCD			5.54		6.00		11.54
TOTAL	1.90	19.37	14.19	32.56	30.63	27.25	125.90

Table 6.8: *Planned Y1 Effort (in Person-Months) by Partner and by Work Package*

Partner/WP	WP1	WP2	WP3	WP4	WP5	WP6	TOTAL
CNRS	6.00	19.50	3.00		12.00		40.50
UCM			2.50	18.00		12.00	32.50
GRNET			3.00		24.00	2.00	29.00
SIXSQ			1.50	24.00			25.50
TID		4.50	1.50	6.00		12.00	24.00
TCD			6.00		6.00		12.00
TOTAL	6.00	24.00	17.50	48.00	42.00	26.00	163.50

Table 6.9: *Difference Y1 Effort (in Person-Months) by Partner and by Work Package*

Partner/WP	WP1	WP2	WP3	WP4	WP5	WP6	TOTAL
CNRS	-4.1	-2.7	-2.1		-4.3		-13.1
UCM			0.3	-5.8		2.1	-3.4
GRNET			-1.3		-7.1		-8.3
SIXSQ			0.5	-6.8			-6.3
TID		-1.9	-0.3	-2.8		-0.9	-6.0
TCD			-0.5				-0.5
TOTAL	-4.1	-4.6	-3.3	-15.4	-11.4	1.2	-37.6

Table 6.10: *Difference Y1 Effort (percentage) by Partner and by Work Package*

Partner/WP	WP1	WP2	WP3	WP4	WP5	WP6	TOTAL
CNRS	-68.3%	-13.8%	-68.3%		-35.8%		-32.4%
UCM			12.0%	-32.1%		17.6%	-10.3%
GRNET			-42.6%		-29.5%	2.3%	-28.6%
SIXSQ			33.3%	-28.5%			-24.8%
TID		-43.1%	-21.3%	-47.3%		-7.6%	-25.0%
TCD			-7.7%				-3.8%
TOTAL	-68.3%	-19.3%	-18.9%	-32.2%	-27.1%	4.8%	-23.0%

Table 6.11: *Declared Y1 Total Cost by Partner and by Activity Type*

	RTD	Coord.	Mgt.	Other	TOTAL
CNRS		204866	31501	61531	297897
UCM	58403	8556		32539	99498
GRNET	15840	19688		140217	175746
SIXSQ		1804		259712	261516
TID	143658	51054		36645	231357
TCD		47393		26820	74213
TOTAL	217901	333361	31501	557464	1140227

Table 6.12: *Planned Y1 Total Cost by Partner and by Activity Type*

	RTD	Coord.	Mgt.	Other	TOTAL
CNRS		172903	61083	77746	311732
UCM	96480	33800		141120	271400
GRNET	15480	36720		191160	243360
SIXSQ		15300		255354	270654
TID	141691	84067		70799	296556
TCD		60920		50576	111496
TOTAL	253651	403710	61083	786755	1505198

Table 6.13: *Difference Y1 Total Cost by Partner and by Activity Type*

	RTD	Coord.	Mgt.	Other	TOTAL
CNRS		31963	-29582	-16215	-13834
UCM	-38077	-25244		-108581	-171902
GRNET	360	-17032		-50943	-67614
SIXSQ		-13496		4358	-9138
TID	1968	-33013		-34154	-65199
TCD		-13527		-23756	-37283
TOTAL	-35749	-70349	-29582	-229291	-364971

Table 6.14: *Difference Y1 Total Cost by Partner and by Activity Type*

	RTD	Coord.	Mgt.	Other	TOTAL
CNRS		18%	-48%	-21%	-4%
UCM	-39%	-75%		-77%	-63%
GRNET	2%	-46%		-27%	-28%
SIXSQ		-88%		2%	-3%
TID	1%	-39%		-48%	-22%
TCD		-22%		-47%	-33%
TOTAL	-14%	-17%	-48%	-29%	-24%

Table 6.15: *Declared Y1 Requested Contribution by Partner and by Activity Type*

	RTD	Coord.	Mgt.	Other	TOTAL
CNRS		137004	31501	61531	230035
UCM	43792	5720		32539	82051
GRNET	7920	11704		140217	159841
SIXSQ		1609		259712	261321
TID	71829	27580		36645	136054
TCD		31694		26820	58514
TOTAL	123541	215311	31501	557464	927816

Table 6.16: *Planned Y1 Requested Contribution by Partner and by Activity Type*

	RTD	Coord.	Mgt.	Other	TOTAL
CNRS		115629	61083	58310	235022
UCM	72360	22604		105840	200804
GRNET	7740	21828		143370	172938
SIXSQ		13643		255354	268997
TID	70845	49154		35834	155832
TCD		40740		37932	78672
TOTAL	150945	263597	61083	636639	1112264

Table 6.17: *Difference Y1 Requested Contribution by Partner and by Activity Type*

	RTD	Coord.	Mgt.	Other	TOTAL
CNRS		21375	-29582	3221	-4986
UCM	-28568	-16884		-73301	-118752
GRNET	180	-10124		-3153	-13097
SIXSQ		-12034		4358	-7676
TID	984	-21574		811	-19778
TCD		-9046		-11112	-20158
TOTAL	-27404	-48286	-29582	-79175	-184447

Table 6.18: *Difference Y1 Requested Contribution by Partner and by Activity Type*

	RTD	Coord.	Mgt.	Other	TOTAL
CNRS		18%	-48%	6%	-2%
UCM	-39%	-75%		-69%	-59%
GRNET	2%	-46%		-2%	-8%
SIXSQ		-88%		2%	-3%
TID	1%	-44%		2%	-13%
TCD		-22%		-29%	-26%
TOTAL	-18%	-18%	-48%	-12%	-17%

6.3 GRNET

For GRNET, various reasons account for the exhibited budget underspending in Y1. The activities that the partner is involved in had a slow start and thus not much effort could be provided especially during Q1 and half-way through Q2. For example in WP5, managed by GRNET and accounting for most of the planned effort, the actual work of operations (that required day-to-day work and support) reached the expected levels of intense workload after the first stable releases of StratusLab distribution and in particular after release 0.2 which took place around the middle of Q2. Additionally the dissemination (WP3) and RTD (WP6) activities also had a late start, although the late start for WP6 was planned.

Effectively during Q1 only one person was allocated from GRNET to provide effort for the project. Fortunately, the staffing process for the GRNET team was completed at the end of Q1. This issue was resolved in the remaining quarters of Y1; by the end of Y1 a total of 6 people have been providing effort to the various WPs that GRNET is involved.

6.4 SixSq

In view of the technical challenge posed by the project, SixSq decided to dedicate more senior team members than originally envisaged. This resulted in lower effort figures, but equivalent cost figures. Considering the successful contribution to the project by SixSq we believe this was the right course of action, which will continue during the second year of the project.

6.5 TID

When StratusLab started, there was a reorganization in TID which affected the whole enterprise, including the Cloud area. In the Cloud area, where StratusLab belongs, the leader was changed and people were moved among different initiatives. As a consequence, the team working on research projects in Cloud changed, and some time was required to create a new team with new people. This has implied the TID underspending in Y1. This new team is fully involved with the project and with its objectives now, so the underspending will be solved during Y2.

6.6 TCD

The estimated effort was 6PM (0.5PM per month) and actual effort was 5.54PM (0.46 PM per month on average). This deviation from a linear 6PM per year was intentional to allow slightly more effort in Y2. In Y2, TCD's effort in WP3 will increase to 6.48PM (0.54PM) per month.

The Planned Y1 Total Costs for TCD Coordination were 60920. The actual Total Costs were 47393, a difference of -13527. The major components of the deviation are salary (due to non-linear effort, as explained in the section on TCD's WP3 effort deviation), consumables, travel, and indirect costs associated with the above.

With regard to “consumables”, this budget was available for dissemination material in particular. However, several major dissemination costs such as t-shirts were paid out of other budgets available to the partners, reducing the need for TCD to spend on consumables in Y1. The salary deviation will be removed due to change in effort level. The consumable budget will be used in renewed dissemination and exploitation efforts. The indirect costs of these will also be included in Y2.

For WP5 (operations), there was no deviation from the planned effort.

The Planned Y1 Total Costs for TCD Other were stated as 50576. The actual Total Costs were 26820. However, TCD only the 75% portion funded by the EC is recorded as an actual charge to the relevant account. The Planned Y1 Total Costs (75%) were 37932, and the actual costs were 26820, a difference of 11112.

The major components of this difference are an error in salary charged to the account during the period, unspent budget for consumables, equipment and travel, and indirect costs associated with the above. The salary error will be corrected in Y2. The budget for consumables and equipment will be spent as necessary. The indirect costs of these will be included in Y2.

Glossary

APEL	Accounting Processor for Event Logs (EGI accounting tool)
Appliance	Virtual machine containing preconfigured software or services
CDMI	Cloud Data Management Interface (from SNIA)
CE	Computing Element in EGI
DCI	Distributed Computing Infrastructure
DMTF	Distributed Management Task Force
EGEE	Enabling Grids for E-sciencE
EGI	European Grid Infrastructure
EGI-TF	EGI Technical Forum
GPFS	General Parallel File System by IBM
Hybrid Cloud	Cloud infrastructure that federates resources between organizations
IaaS	Infrastructure as a Service
iSGTW	International Science Grid This Week
KPI	Key Performance Indicator
LB	Load Balancer
LRMS	Local Resource Management System
MoU	Memorandum of Understanding
NFS	Network File System
NGI	National Grid Initiative
OCCI	Open Cloud Computing Interface
OVF	Open Virtualization Format
Public Cloud	Cloud infrastructure accessible to people outside of the provider's organization
Private Cloud	Cloud infrastructure accessible only to the provider's users
SE	Storage Element in EGI
SGE	Sun Grid Engine
SNIA	Storage Networking Industry Association
TCloud	Cloud API based on vCloud API from VMware
VM	Virtual Machine
VO	Virtual Organization
VOBOX	Grid element that permits VO-specific service to run at a resource center
Worker Node	Grid node on which jobs are executed

XMLRPC	XML-based Remote Procedure Call
YAIM	YAIM Ain't an Installation Manager (configuration utility for EGI)