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## Exploitation and Sustainability First Plan

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Enhancing Grid Infrastructures with  
Virtualization and Cloud Technologies

## **Exploitation and Sustainability First Plan**

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### **Abstract**

This document describes StratusLab's plans for exploitation and sustainability during the second year of the project and beyond. The plans cover commercial exploitation, primarily through commercial integration and support; and non-commercial exploitation, through use in national and international research e-infrastructures: for operating grid resources on private clouds, and for running research-oriented community clouds. In addition, we plan exploitation through projects such as OpenNebula and EGI, and through training and future research. Sustainability is driven by a desire to support critical infrastructures and as a basis for future research. Public funding, private funding and community contributions will play a role in sustainability through promotion, community development, support of cloud strategies, national cloud infrastructures, and cloud research.



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# 1 Executive Summary

This document describes the plans to exploit the project results and to ensure their sustainability beyond the project lifetime.

The plans cover both commercial and non-commercial exploitation. Commercial exploitation will take the form of integration and support: several specific examples related to project partners are described, including SixSq and SlipStream, and the Telefónica I+D Global Cloud Initiative.

Non-commercial exploitation will include use of StratusLab within national and international research e-Infrastructures: private clouds for service deployment – particularly for grid services – as well as public clouds for research communities. For systems administrators, StratusLab will provide a convenient approach for testbed deployment.

OpenNebula, as well as providing a core component of the StratusLab software, offers a key point of exploitation, as StratusLab-originated innovations are provided to its user community.

Collaborating projects, particularly from the Distributed Computing Infrastructure sphere, will provide another channel of exploitation.

Finally, StratusLab project results will be exploited to provide opportunities for future cloud research, and for training and e-Learning.

With respect to sustainability, the project has identified drivers for sustainability, most notably the continuation of critical infrastructures and future research opportunities. Support for sustainability actions will be sought through public funding from national and international sources, private funding from commercial activities, and community contributions from the existing project partners and from the wider StratusLab user community.

The approaches to sustainability that will be used by StratusLab include direct promotion of the project results, continuous improvement of development processes, evolving the user and developer community, influencing and harnessing national and international cloud strategies, pursuing research funding for further technological development, and integration of StratusLab within national and international infrastructures.

The document describes the current and future work for exploitation and sustainability with a focus on the current project partners. The plan will be updated before the end of the project, with the intention to expand the exploitation and sustainability beyond the consortium members.

## **2 Introduction**

Cloud computing is revolutionising the way we procure and consume computing, storage and networking resources, as well as the way these resources are managed at the infrastructure level. StratusLab offers an open source cloud distribution, targeted particularly at the e-science community.

### **2.1 Purpose**

The purpose of this document is to provide a first version of the exploitation and sustainability plan for the StratusLab project. This document describes the plans to exploit the project results and to ensure the sustainability of the products beyond the project lifetime. The plan will be updated before the end of the project.

### **2.2 Organization**

This document contains chapters on Exploitation and Sustainability and finishes with Conclusions. The Exploitation and Sustainability chapters draw on plans provided by each partner and the Conclusions include a summary of exploitation and sustainability strategies that cut across the project as a whole.



## 3 Exploitation

As described in further detail below each partner is already taking positive advantage from StratusLab and is expected to continue doing so in the near future but also beyond the project lifetime.

The project hopes that its work will be rewarded by a wide adoption by grid sites and infrastructure providers around Europe and beyond our frontiers. This exploitation should also generate feedback and requests for further improvements. Further, as the distribution is deployed and used, a larger set of virtual machines and datasets will be produced and maintained using StratusLab software.

During the second year of the project the exploitation plan will be executed and subsequently revised to serve as a plan for the future.

### 3.1 Commercial exploitation

Commercial exploitation of project results comes in several forms, including integration with commercial products and commercial support work.

#### 3.1.1 SixSq and SlipStream

Beyond its ability to change how we access computer resources, cloud computing has an equally disrupting potential for improving software engineering practices. It is this aspect of cloud computing that **SixSq Sàrl** is exploiting with its flagship product and service called SlipStream.

SlipStream is an automated engine for creating multi-machine runtime environments, using cloud computing as a backend. SlipStream also integrates a virtual machine factory service. This means that SlipStream customers can reduce their time to market and improve their release cycle significantly, while improving software quality. In this context, StratusLab is instrumental, since it enables SixSq to deliver and deploy its solutions on existing and private customer resources.

Until now, SlipStream was deployed only on the Amazon EC2 cloud service. This limitation was significant, as it made it impossible for a significant number of companies to use SlipStream due to reasons ranging from legal to cultural. SixSq added StratusLab support to SlipStream earlier this year, feeding back and sharing the knowledge gained and lessons learned with the project partners.

### 3.1.2 Telefónica I+D Global Cloud Initiative

Telefónica I+D (TID, <http://www.tid.es/>), which is a 100% subsidiary of Telefónica S.A., works on research and development activities in order to identify those factors that are going to shape the future of telecommunications and the development of Telefónica's businesses. TID is in charge of providing new and innovative products and solutions, which solve customer needs, and can be commercialized by Telefónica's operators (LATAM, Spain, O2 Europe, etc.).

In the context of the 2009–2012 Strategic Plan, Telefónica is performing the Cloud global business project to address Cloud Computing in Telefónica, where outcomes will be available to all of Telefónica's business. The Global Telefónica Cloud initiative comprises three main architecture areas:

- **Global IaaS Architecture.** This is the common architecture where the Global Cloud Services will be integrated and delivered to customers. It supports a federation of TEF's Global Cloud sites located in different countries.
- **Global Cloud Services.** Services will be created once but commercialized many times, under a multi-business approach and deployed on the Global IaaS platform. These services can be not only computing and storage services (IaaS and DaaS) but Telefónica applications (PaaS) and services (SaaS).
- **Local Infrastructures.** The marketing of Global Cloud Services requires integration with the local infrastructure (Service Platforms and Access Network) of each Telefónica Operator Business and, optionally, connection also from/to Customer's Data centres.

Due to this, Telefónica I+D has established the Cloud Computing Area where an IaaS Cloud Product Line is under development. TID is developing new production components in StratusLab. The results will be exploited in the IaaS Cloud Product Line. In order to quantify the return of investment, the TEF Cloud budget for the 2010–2012 period is 30 million euros.

From StratusLab results, TID is interested in:

- **Claudia Platform:** some of functionalities identified during the R&D and Service Provision at StratusLab have been added to the Claudia Platform. StratusLab has provided a way of distributing Claudia with a set of tools and documentation.
- **TCloud API as Claudia API** has been sent to the DMTF for standardization.

In addition, TID is using StratusLab results to continue researching through the in-progress 4CaaS, VISION, NUBA & FI-Ware PPP-Core Platform projects. The Claudia distribution in StratusLab together the RPM packaging, StratusLab installation tools and manual instructions are used as the basis for distributing Claudia software.

The main TID result in StratusLab is the service manager called Claudia. Claudia is a key element in several initiatives inside the Cloud Area in TID, and Claudia is evolving continuously thanks to requirements coming from business lines and research projects.

The results from StratusLab are used as a basis for other national and European initiatives. The webpage on the StratusLab wiki<sup>1</sup> is used for distributing Claudia software and documentation among the different projects.

### 3.1.3 Commercial Integration and Support

**SixSq** predicts that its business pipeline from SlipStream service and product will come in significant proportion from deploying private services inside customers' infrastructure. Since SlipStream targets StratusLab as its preferred private cloud solution, in turn, SixSq will be investing some of this revenue in the maintenance and evolution of the StratusLab solution.

Lately, as cloud computing is becoming more widely accepted, several organisations and industries have been looking for open source, yet robust and well supported IaaS private cloud solutions. **SixSq**, with its strong expertise in the StratusLab stack and virtualisation technologies is well positioned to provide commercial support to future StratusLab customers.

As a University research group, **UCM**'s aim is to perform applied research and to transfer the results to the industry and the scientific community. So, although our primary aim is not to commercially exploit the results, UCM offers value-added services around OpenNebula through the University Office of Technology Transfer.

Additionally, **C12G Labs**, a UCM spin-off created to manage the OpenNebula open-source project and to provide support subscription and value-added services for OpenNebula, will support and maintain the StratusLab extensions incorporated into the main OpenNebula distribution.

### 3.1.4 Other commercial exploitation

Preliminary discussions surrounding the **CNRS** persistent storage service have already been held with **Huawei**. This opens the door for possible commercial exploitation of the StratusLab distribution and potentially may provide revenue for continued support and development.

## 3.2 Exploitation in e-Infrastructures and user communities

User communities – and in particular the community of research e-infrastructures – offer important opportunities for the exploitation of the StratusLab project results.

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<sup>1</sup><http://stratuslab.eu/doku.php/claudia>

## 3.2.1 Computing sites

Individual computing sites, initially those related to the project partners, are already seeing benefits from exploiting the StratusLab software locally.

### 3.2.1.1 CNRS

The CNRS laboratories involved in StratusLab are already exploiting the StratusLab software to provide services to system administrators, engineers, and scientists. Both **LAL** and **IBCP** plan to further their use of the StratusLab cloud technologies in the near future and are participating in planning at the national level to provide cloud services via existing and new generic computing infrastructures.

At **LAL**, the computing services department has already deployed a **private StratusLab cloud infrastructure** to support the rapid testing and deployment of laboratory services. This has helped to streamline upgrades of existing services and identified problems with newer versions before their deployment in production. This also supports the numerous developers within the service by allowing (virtual) machines to be quickly deployed without direct system administrator intervention and without the need to provision or to redeploy physical hardware. Feedback from users of this cloud deployment has helped improve the StratusLab distribution.

**LAL** is a major partner of the regional grid infrastructure, **GRIF**, which participates in the European Grid Infrastructure (**EGI**). The system administrators have already done early tests on **running grid Worker Nodes (WNs) within the StratusLab cloud** and attaching them to **LAL's** standard, production grid resources. Once the StratusLab 1.0 release is available, the administrators will progressively migrate the **WNs** of the grid infrastructure to virtual machines running within a StratusLab cloud. Initially the current generic computing environment will be provided to all users; eventually, customized environments for different scientific communities (Virtual Organizations) will be created. Participation in **EGI** is a long term commitment of the laboratory and consequently use of virtualization technologies, in particular StratusLab, will be a long term activity.

In parallel with the virtualization of the grid **WNs**, **LAL** will also deploy a **public cloud service**. The infrastructure has already been deployed with the existing beta releases of the StratusLab distribution and some local users are taking advantage of those resources. The service has not yet been opened for wider use because of the lack of a registration service to ensure that cloud users accept responsibility for the actions of their virtual machines and because the currently allocated storage is insufficient. Once those issues are resolved, this service will open for wider use and will be maintained through the end of the project and beyond.

**IBCP** is already using virtualization heavily for the provision of local services and of grid services within **EGI**. They have been closely involved in the testing of the StratusLab distribution and will take advantage of it to simplify and to consolidate their local deployment. Their experience will also be critical in the potential **use of StratusLab by the national bioinformatics infrastructure, RENABI GRISBI**.

Both laboratories have already benefitted from their existing StratusLab deployments through the better use of existing hardware and improved (easier, faster, and more flexible) provisioning of resources to administrators and users. These improvements have positively impacted both general laboratory services and scientific analyses.

### 3.2.1.2 TCD

TCD has begun to make use of StratusLab as a **testbed platform**. This is used for testing new releases of software, new grid and other services, and to perform initial installation of hardware before it is integrated into production at TCD or at other Grid-Ireland sites. A system based on StratusLab will eventually supplant the ad-hoc ‘TestGrid’ system that relies on a somewhat more manual approach to allocating test hardware.

As a grid resource provider and Computer Science research group, **TCD** will evaluate StratusLab as a platform for conventional grid worker nodes, for **GP-GPU worker nodes**, and for **community-specific services**: in particular, ‘bridge’ services that may be needed to provide public access to grid storage resources in a form suitable for the community.

## 3.2.2 National infrastructures

### 3.2.2.1 France

There is a growing realization in **CNRS** and in France that cloud services provide a more flexible and dynamic computing infrastructure than is currently available with existing infrastructures. Taking more advantage of these technologies would allow the infrastructure to appeal to a wider scientific community and thus allow consolidation and better use of computing and human resources. Consequently, France-Grilles, the French partner of EGI and RENABI GRISBI, the French distributed bioinformatics infrastructure, both are investigating use of StratusLab and providing cloud-like services to their user communities. These investigations also include studies of possible national funding models while taking advantage of the administrative and support services which already exist within France-Grilles and RENABI GRISBI.

The support of a **Quattor-based installation for StratusLab** also makes it easier for the majority of sites in France-Grilles, who use Quattor, to adopt the StratusLab cloud distribution. Wider use makes it easier to justify the necessary human resources to maintain and to evolve the CNRS components of the distribution after the end of StratusLab.

### 3.2.2.2 Greece

**GRNET** is a major provider of e-infrastructure for the Greek Academic community. Among others, the company has been leading the Grid computing activities in the past years, mainly through its strong participation in leading European projects like EGEE, SEE-GRID and recently EGI-InSPIRE and EMI.

For the immediate future GRNET wishes to capitalize on StratusLab’s findings

and **move the existing national grid infrastructure on to virtualized resources**. This effort has already started with the initial deployment of a production grid site (HG-07-StratusLab) which was carried out in the context of StratusLab WP5 activity.

The positive results obtained from this experience have led GRNET to start planning the migration of a larger portion of resources used for grid services, to **cloud infrastructures running the StratusLab distribution**.

In the context of national funding for cloud services, GRNET is planning to exploit part or whole of StratusLab results and integrate them with the rest of cloud services being developed within the company.

### 3.2.2.3 Ireland

**TCD** anticipates that the cloud approach offered by StratusLab may be attractive to potential resource providers and users for whom grid computing did not appear suitable.

As a grid operations centre with responsibility for maintaining Grid-Ireland, the Irish national grid infrastructure, TCD is already an intensive user of virtualization technology for testing and deployment. At a high level, TCD will exploit StratusLab to provide a simpler **private cloud** approach for server deployment.

TCD runs a set of Xen hosts for national services, but VMs are statically allocated. TCD plans to use of StratusLab to **simplify the deployment** of these services. TCD currently deploys grid gateways to Grid-Ireland sites around Ireland. Each gateway hosts a number of Xen virtual machines for various grid services. TCD will evaluate the use of StratusLab to deploy these systems in future.

### 3.2.3 OpenNebula

As a core component of the StratusLab distribution, **UCM** is extending the OpenNebula open-source toolkit to address the requirements of the Grid computing community that have been identified in the project. These extensions are incorporated into the main OpenNebula distribution and so they are available for all users of the toolkit and not only for the users of the StratusLab distribution.

OpenNebula serves as an excellent vehicle to transfer the technology and the innovation created in the project because it is used as a cloud management tool in thousands of deployments around the world and across different industries, such as hosting, telecom, HPC, and eGovernment. Moreover OpenNebula is being used in many EU-funded projects as a tool for innovation and interoperability. This technology transfer is a valuable mechanism by which industry can accelerate its innovation activities and gain competitive advantage through cloud computing.

### 3.2.4 Collaborating projects

The existing StratusLab infrastructures also enable exploitation and collaboration with other regional and European projects. For instance at **LAL**, the local infrastructure supports collaboration with the European project **EDGI** and also will be used as a platform for gathering data for a **university-supported green computing**

## **project.**

The **European Grid Infrastructure** (EGI) has expressed a clear interest in using virtualization technology. **TCD**, **GRNET** and **CNRS** participate in EGI and are likely to take part in the EGI transition to virtualized grid resources, based on StratusLab technology. As mentioned above, **GRNET** and **CNRS** have already begun evaluating StratusLab as a virtual platform for EGI grid sites with positive results.

Within the context of the **FP7 Mantychore** project, **TCD** expects to deploy StratusLab-based computing resources to a number of Grid-Ireland sites as part of a use-case for next-generation dynamic networking. This will form the basis for research in network-level federation of cloud resources, resource migration, load distribution, and comparison with ‘static’ non-cloud grid resources.

### **3.2.5 Training and e-Learning**

**TCD** has a strong interest in e-Learning technology, and StratusLab provides the ability to host e-learning testbeds. StratusLab also will appear as a subject of e-Learning material.

## **3.3 Summary**

The project has identified several examples of and approaches to commercial exploitation originating with the project partners:

- SixSq and SlipStream
- Telefónica I+D Global Cloud Initiative
- Commercial Integration and Support
- Other commercial exploitation – Huawei

Exploitation of the project results within research e-Infrastructure and by other user communities has also been identified:

- Computing sites – CNRS, GRNET, TCD
  - Private clouds for test and production service deployment
  - Grid resources in StratusLab clouds
  - Public clouds
- National infrastructures – in France, Greece and Ireland
- OpenNebula – bringing StratusLab developments to all its users
- Collaborating projects – including EDGI, EGI and Mantychore
- Training and e-Learning
- Future research – a basis for cloud technology investigation and development

## 4 Sustainability

As the number of resources managed by StratusLab in data-centers increases, scalability and management issues are likely to arise, which will also require attention from engineers, developers and system administrators knowledgeable in StratusLab. Further, this exploitation must also be put in the wider cloud context, where innovation will challenge current thinking with new solutions. This will require careful evaluation and evolution of cloud infrastructures.

### 4.1 Reasons for sustainability

To promote the sustainability of the project, there are a number of aspects that serve as incentives.

#### 4.1.1 Continuation of critical infrastructure

Organizations including the project partners, NGIs, collaborating projects and other organizations have an incentive to maintain the software on which their critical infrastructure is (or will be) built.

Because StratusLab and other cloud technologies are the key enablers for convergence of computing infrastructure, it will be critical that they are supported and maintained throughout and after the project. As they are critical, **CNRS**, for instance, will continue to support and to evolve the parts of the StratusLab distribution that it has developed (e.g. authentication infrastructure, registration service, persistent storage service, and Quattor-based installation) with the existing personnel.

Some parts of the project results and the actors who have an incentive to sustain the parts in question are set out below:

- OpenNebula and core StratusLab toolkit – operation centres, e.g. CERN, LAL
- Marketplace – research infrastructure provider, e.g. EGI
- Appliance repositories and appliances – virtual research communities, e.g. IBCP

The lists of interested actors are not exclusive. For instance, UCM and many others have a strong incentive to sustain OpenNebula.



EGI is interested in the virtual appliance repository and Marketplace services (led by **TCD** within StratusLab). Under the MoU between EGI and StratusLab, EGI will assist in finding a sustainable future for the marketplace. One possibility is that the marketplace will be hosted by an NGI, for example Grid-Ireland / TCD.

In general, EGI views StratusLab as a technology provider and if the technology sees significant uptake amongst EGI resource providers, EGI will have a keen interest in sustaining the software and it may be possible for this effort to be delegated to an NGI or other partner.

### **4.1.2 Future research opportunities**

The project results will present opportunities for future research and development, which in turn will promote the sustainability of the project components. Possible areas of future evolution include:

- Scheduling and advanced placement heuristics
- Messaging service for extensibility and scalability
- Scalable storage integration
- Virtual machine translation service

The possibility of future research on a solid basis will appeal to academic and other research organizations, including the existing project consortium partners.

In the EGI model, appliance repositories will be widely deployed by virtual organizations using a variety of storage technology: with this in mind future work could investigate accessing appliance images stored in grid storage systems such as the Logical File Catalogue.

## **4.2 Paths to sustainability**

Several paths must be explored to ensure the required sustainability of the Stratus-Lab results. Partners have already identified promising paths, which we can group as: public funding, private funding, and community contributions.

### **4.2.1 Public funding**

Public funding could come from European sources, such as for example FP7, or national funding, via the respective partners' national funding bodies.

**GRNET** has secured national funds for developing a comprehensive cloud solution with the aim to provide cloud services to academic users.

The government of Ireland has declared an interest in supporting cloud computing as a source of growth for employment and the economy. It is to be hoped that this will translate into support for existing and future efforts in cloud computing research and deployment of the kind pursued by **TCD** and Grid-Ireland at present.

## 4.2.2 Private funding

Private funding is perhaps more speculative and directly linked to our commercial partners' ability to integrate StratusLab into new and existing business lines.

It is hoped that maintenance contracts – from commercial and institutional users – could contribute to ensuring that receiving partners are able to dedicate the required resources to the maintenance and enhancement of the distribution.

**SixSq** predicts that its business pipeline from SlipStream service and product will come in significant proportion from deploying private services inside customers' infrastructure. Since SlipStream targets StratusLab as its preferred private cloud solution, in turn, SixSq will be investing some of this revenue in the maintenance and evolution of the StratusLab solution.

As mentioned above, **UCM** offers value-added services around OpenNebula through the University Office of Technology Transfer. This funding is used to maintain and evolve the OpenNebula project.

## 4.2.3 Community contributions

It is envisaged that 'large users' may engage with the StratusLab development community and invest effort into the distribution.

Several partners have also pledged to contribute unfunded efforts towards maintenance of the project results. For instance, **TCD** is likely to make significant use of StratusLab software in future. In the case where dedicated funded effort for development is not available, TCD would still expect to contribute in the form of bug reports, patches and improvements as part of the StratusLab open source community.

In order to attract and retain early adopters of the StratusLab results, and secure their commitment, a public **open source plan** would help in showing the project's longer term vision.

## 4.3 Approaches to sustainability

### 4.3.1 Promotion of project results

It is clearly important to promote the project results in order to create a climate where sustainability is possible.

**SixSq** will continue its effort to promote StratusLab as the best open source cloud solution currently available on the market, which in turn will hopefully generate revenue, as well as attract new contributors to StratusLab open source project.

In general, the plans for project dissemination are described in WP3 deliverables [1] and [2].

### 4.3.2 Community and process development

The community of users and developers around StratusLab must be nurtured to ensure sustainability. This includes support for the development processes used.

The long-term sustainability of **UCM's** contributions is ensured through its

contribution to the OpenNebula open-source toolkit. The OpenNebula project receives funding from several public grants and private sponsors.

The OpenNebula open-source project could also contribute to the long-term sustainability of the StratusLab distribution by hosting the new software in its ecosystem and providing the infrastructure instruments to support its evolution and maintenance as an open-source community.

**SixSq** has put a significant effort in shaping and leading the **agile development processes** used to produce the StratusLab distribution and service. Without a strong process, efficiency diminishes, as well as the ability for the project to remain ahead of competition. SixSq is willing to remain involved, not only on the development, integration and testing front, but also in continuing to improve the StratusLab processes.

A key point for community-led sustainability is to support the **open-source community** around StratusLab to allow interested developers to get involved more easily.

### 4.3.3 Cloud strategy

At present, many organizations and governments are devising strategies and setting priorities related to cloud computing. Partners will aim to have StratusLab considered as an important part of such strategies in which they are involved.

Cloud computing technologies have become a priority in development agenda of **GRNET**. At **LAL**, **IBCP**, and within France, a push for the convergence of existing computing infrastructures based on cloud technologies is already evident. This convergence promises to reduce the costs associated with running a computing infrastructure while simultaneously making it useful for a wider community.

### 4.3.4 Research funding

**GRNET** is seeking opportunities to continue the activities taking place within StratusLab with the focus to further evolve those that the company directly is involved with (i.e. provision of production-level cloud services) but also additional ones including core development and technology evolution. A primary avenue for funding this effort will be through future EC project calls, optimally with the same consortium, but also in the context of other collaborations and with an extended research and development agenda.

**TCD**'s involvement in StratusLab and other projects, and the related infrastructure deployment provides great expertise and a degree of leverage for future research and development work. TCD is highly interested in participating in future consortia that would continue development of the StratusLab project outputs. Within Ireland, TCD is exploring links with research centres towards future national cloud computing research. TCD would intend to make use of StratusLab in these collaborations also.

### 4.3.5 National infrastructure funding

For GRNET It is safe to assume that a significant portion of the existing StratusLab activities will continue to be supported by national funding allocated for the provision of academic and government applications over the cloud.

Existing national computing infrastructures linked to CNRS in France have already starting discussing how cloud technologies can be incorporated in existing computing infrastructures. Funding would be used to expand the available resources, but more critically, also provide manpower for the continued evolution of the cloud software to take advantage of new virtualization capabilities.

## 4.4 Summary

The project has identified a number of incentives for sustainability from within the partners and beyond:

- Continuation of critical infrastructure – for organizations, infrastructures and virtual research communities
- Future research opportunities – for academic, community and commercial researchers

The sustainability of the StratusLab results and project will be pursued along a number of funding paths:

- Public funding – from national and international sources
- Private funding – from commercial support and services
- Community contributions – from user communities and project partners

Further, the project has identified a variety of approaches to ensuring sustainability

- Promotion of project results – through dissemination and commercial activities
- Community and process improvement – for users and developers
- Influencing cloud strategy – harnessing widespread support for deployment and development of cloud technology
- Research funding – international and national
- National infrastructure support – in France, Greece and Ireland

## 5 Conclusions

This document illustrates and describes several avenues for exploration, based on the knowledge accumulated thus far by the project as a whole and by individual partners in particular.

The project has identified key approaches and areas of exploitation as follows:

- Commercial integration and support, by project partners including SMEs and large corporations.
- e-Infrastructure deployment for cloud and grid infrastructures
- National infrastructures that are migrating towards a cloud model
- OpenNebula, as a means to bring StratusLab developments to all its users
- Collaborating projects including EDGI, EGI and Mantychore FP7 projects
- Training and e-Learning, and future cloud research

The project has identified a number of incentives for sustainability from within the partners and beyond, namely, continuation of critical infrastructure and future research opportunities. The sustainability of the StratusLab results and project will be pursued through public funding, private funding and community contributions.

The approaches to ensuring sustainability include

- Promotion of project results through dissemination and commercial activities
- Community and process improvement for users and developers
- Influencing cloud strategy to harness widespread support for deployment and development of cloud technology
- Funding of further development based on StratusLab from international and national sources
- Support for and from national infrastructures

This document provides an early plan for the exploitation and sustainability of the StratusLab project results. This report will be updated during the second year of the project, with the release of 'D3.5 Exploitation and Sustainability Final Plan' in PM24.

## 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
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)

## References

- [1] D. O'Callaghan and K. Cassidy. Initial plan for dissemination, collaboration and standardization activities, October 2010. D3.1.
- [2] D. O'Callaghan and K. Cassidy. Report on dissemination, collaboration and standardization activities, June 2011. D3.2.