



Cloud-TM

Specific Targeted Research Project (STReP)

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D5.4: 1st Year Collaboration Activity Report

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1 Introduction

This document reports on the collaboration activities that were carried out during the first reporting year with other FP7 projects under the Work Programme 2009/2010 Objective “Internet of Services, Software and Virtualization”.

As already highlighted in deliverable D5.3, Initial Collaboration Plan, three main potential collaboration areas have been identified:

1. Standardized APIs for resource provisioning from Cloud infrastructures
2. QoS specification, negotiation and monitoring
3. Storage and data management platforms for the Cloud

The structure of this deliverable is the following. We start, in Section 2, by elaborating on the motivations and on the potential benefits achievable by pursuing collaborations in these research areas. In Section 3 we report participation to open workshops/meetings aimed at fostering collaboration activities at a pan-European level. Section 4 discusses participation of Cloud-TM to IoS Working Groups. Finally, in Section 5 we report on the specific collaboration activities carried out so far with FP7 projects from Call 1/Call 5, and define a work plan for the following months.

1.1 Relationship with other deliverables

The collaboration activities reported in this document represent the materialization of the collaboration plan defined in deliverable D5.3, “Initial Collaboration Plan”. Section 2, in which we discuss the general areas of collaborations identified up to date, is largely based on the corresponding Section of deliverable D5.3 (as the areas and reasons for collaborations have not changed significantly over the last six months). We decided to include such a discussion also in this deliverable, for self-containment and to frame the specific collaboration activities reported in the remainder of this document.

2 Main Areas of Collaboration

Based on the analysis of the research results and goals of Call 1 and Call 5 projects active in the area of Cloud computing and Service Oriented Architecture, we were able to identify three main areas of collaboration between Cloud-TM and other EU funded projects.

- **Standardized APIs for resource provisioning from Cloud infrastructures:** over the last year, we have witnessed the proliferation of a number of competing standardization efforts on the area of provisioning for Cloud platforms, driven from both academy and industry, such as OpenNebula's XML-RPC, OCCI, and TCloud.

Unfortunately, the lack of a universally standard in the IaaS area hampers the portability of Cloud applications, as well as of middleware solutions aimed at automating resource provisioning in the Cloud. On the other, elastic scaling is one of the key objectives aimed at by Cloud-TM and by many of the currently active EU funded projects in the area of QoS management and Cloud computing.

While defining new standards for resource provisioning is out of the scope of the Cloud-TM project, we are willing to collaborate with EU funded projects active in this area by providing use cases and applications exploiting such APIs (for instance, the Cloud-TM's Autonomic Manager, see Deliverable D2.1). We believe that this will be useful both for Cloud-TM, which will benefit from a higher portability, and for other EU projects directly working in this area, which will be provided with (additional) real use cases/applications to validate the effectiveness of the proposed standards.

- **QoS specification, negotiation and monitoring:** automating the provisioning of resources from the underlying Cloud infrastructure to ensure applications' SLAs is a key goal that Cloud-TM shares with several currently active EU projects in the areas of QoS and Cloud computing. While these projects typically target different kind of applications (for instance, in Cloud-TM we target a middleware for transactional data manipulations), all of them will have to face the issue of developing tools for QoS specification, negotiation and monitoring.

Also in this case, unfortunately, there are still no universally recognized standards in the area. This represents a significant hurdle as it forces practically each project in the area of Cloud computing to reinvent their own wheel, re-implementing analogous, but proprietary, solutions that end up being incompatible and often not easily comparable.

For a small scale project like Cloud-TM, whose focus is on other research topics (such as transactional data management and self-optimization mechanisms), the availability of standardized, open tools for QoS specification, negotiation and monitoring would be extremely beneficial as it would allow to concentrate the efforts on the key challenges addressed by the project. We have been and will be involved in efforts aimed at cooperatively developing such tools with other projects working in this area, and at reusing existing results developed by older projects working in this area.

- **Storage and data management platforms for the Cloud:** several Call 5 projects (e.g. Contrail, Vision Cloud, TClouds) focus on the issue of developing innovative storage solutions for the Cloud, addressing problems such as data security and Cloud providers federation. While these research directions do not represent the main focus of the Cloud-TM project, an important issue that we intend to address is related to how to integrate the Cloud-TM transactional data platform with heterogeneous Cloud storage platforms. Our approach will be based on a modular, plug-in based architecture whose goal is to minimize the cost of porting the Cloud-TM middleware to persist its state on top of heterogeneous storage platforms.

We will be therefore closely monitoring the advances of EU projects in the area, making available our data platform's use cases and pilot applications. We will also evaluate the possibility of developing plug-ins to integrate the Cloud-TM data platform with innovative storage solutions developed by any of these projects providing features of particular relevance for our project.

3 Participation to Collaboration/Networking Events

During the first reporting period Cloud-TM had representatives involved in three main open events aimed at fostering collaboration/networking among EU projects.

- The Collaboration Meeting held in Bruxelles on the 19th and 20th of October 2010, which brought together representatives of nearly all projects in the IoS area from Call 1 and Call 5.
- The Euro-TM Cost Action 1st plenary meeting held in Paris, on May 19-20 2011, which brought together representatives from a number of EU funded projects active in the area of transactional memories (such as Velox) and programming paradigms for parallel computing (such as Teraflux).
- The 2nd Workshop on Services (WoSS), held in Timisoara, Romania, on the 6-9 of June 2010, which brought together representatives of a large majority of projects on Cloud Computing from Call 5, as well as a number of representatives of companies and universities from new member states.

These events served to exchange preliminary research results, identify and catalyse collaboration opportunities that were then pursued via face-to-face meetings, email exchanges and conference calls.

4 Participation to IoS Working Groups

The Cloud-TM project is currently collaborating in the following three IoS working groups:

- Virtualized Service Platforms

- Quality of Service & Service Level Agreements
- Service Engineering

Up to date, Cloud-TM has participated to all the initiatives (e.g. teleconferences, mailing list-based discussions) organized by these WPs, which served as useful means to identify collaboration opportunities and establish links among projects.

An interesting initiative organized by the Virtualized Service Platforms WG, and to which Cloud-TM is actively participating, is the preparation of a publication collecting joint use cases highlighting the use of a virtualized service platform, as well as a gap analysis based on today's technologies. These use cases will be submitted to S-CUBE and to an international conference. The planned deadline for contributions is the 15th of July 2011.

5 Specific Collaboration Activities with Call 1/Call 5 Projects

We now report on the performed collaboration activities carried out with Call 1 and Call 5 EU projects, grouping them according to the thematic areas identified in Section 2.

5.1 Standardized APIs for resource provisioning from Cloud infrastructures

In this area, discussions were activated with representatives of a number of FP7 projects on Cloud, including TClouds, Reservoir, Optimis, Contrail and mOSAIC. The point is that, at current stage, there is not yet unanimous consensus on a universally accepted standard in the area of provisioning from IaaS providers. In fact, many projects had a very hard time even in reaching an internal agreement on the reference IaaS APIs to be chosen. Trying to reach an inter-project agreement on this did not seem therefore a realistic goal.

In Cloud-TM, it was ultimately taken the choice to use openNebula as reference API, namely the reference IaaS solution output by the RESERVOIR Call 1 project, while adopting the δ -cloud abstraction layer (at current date an Apache foundation incubator project) to avoid locking-in to this specific API.

Further, a face-to-face meeting was organized in Rome, hosted by CINI, on the 20 of April 2011 between representatives of Cloud-TM (namely, Dr. Paolo Romano, Prof. Bruno Ciciani, Pierangelo Di Sanzo and Roberto Palmieri) and mOSAIC (namely, Prof. Beniamino Di Martino, Massimiliano Rak and Massimo Ficco). One of the possible collaboration opportunities identified during this meeting consists in letting Cloud-TM use the abstraction layer that mOSAIC will build to hide the heterogeneity of current IaaS providers' APIs.

This seems in principle relatively easy to do, given that in Cloud-TM we are already planning to use an abstraction layer (δ -cloud) that will use a REST-based API similar

in spirit to that planned by mOSAIC. We plan to have a proof of concept implementation of this integration by month 28 of Cloud-TM, when mOSAIC APIs should have reached a sufficient maturity and stability.

5.2 QoS specification, negotiation and monitoring

On this front, in addition to taking actively part to the “Quality of Service & Service Level Agreement Working Group”, we have activated collaborations with the following projects.

- **SLA@SOI**, whose deliverables describing the SLA establishment and management process have been studied and analysed.
- **SMARTLM**, whose JAVA based implementation of WS-Agreement has been chosen as reference implementation for our project.
- **mOSAIC**, in particular with Prof. Di Martino and Prof. Rak (from the 2nd University of Naples, Italy), with whom it has been decided to meet, during the second year of the project (in a date to be still defined), to discuss a common framework for mechanisms for specifying application-dependant QoS/cost requirements.
- **Optimis**, in particular with Prof. Johan Tordsonn (from the Umea University, Sweden), with whom we have discussed possible collaborations aimed at integrating the work done so far on self-tuning replication schemes (in WP3 of Cloud-TM) with the control-theory based provisioning mechanisms that his group has been developing in the context of the Optimis project. We have scheduled a meeting in Lisbon during the third week of September.

5.3 Storage and data management platforms for the Cloud

The design of our platform relies on a modular plug-in based architecture that allows using a number of heterogeneous storage platforms. It appears therefore relatively easy to develop additional plug-ins allowing interoperability with the storage platforms that are going to be developed by several of the Call 5 projects in the area of Cloud computing.

Of course, due to resource constraints, it is not realistic to conceive to develop plug-ins for all of them. Another concern (and possible roadblock) is related to the fact that most of the projects that aim at developing innovative storage solutions for the Cloud are expected to deliver stable prototype relatively late, considering that Cloud-TM has started earlier than most of these projects.

On the other hand, after having consulted representatives of several projects, it has been decided to investigate the possibility to develop a plug-in to interface the Cloud-TM platform with the dependable storage system that is being developed in TClouds, for which a preliminary prototype has been already presented in the EuroSys 2011 symposium. The fact that two research units (INESC-ID and University of Lisbon) involved in the Cloud-TM and TClouds projects are both located in Lisbon is in fact

going to simplify the coordination of activities and maximize the chances of a fruitful collaboration.

Dr. Paolo Romano, coordinator of Cloud-TM, and Dr. Alyson Bessani, one of the key researchers of the University of Lisbon involved in TClouds, have already met face-to-face in several occasions and defined a preliminary plan of integration. A preliminary version of a Cloud-TM plug-in capable of persisting its state to the TClouds storage system is expected to be developed at the end of the 2nd year.