ERCIM "Alain Bensoussan" Fellowship Scientific Report

Fellow: Jorge Alberto Fox Lozano
Visited Location : CNR, Pisa
Duration of Visit: 9 months
Scientific coordinator: Prof. Stefania Gnesi

I - Scientific activity

Work for the second stage of the Fellowship focused on the subject of Cloud Computing. The lines of work are explained in the following.

Cloud computing is a promising new type of parallel and distributed system which offers the opportunity to achieve almost unlimited scalability of the IT infrastructure and improvement of IT-Services. However, broad acceptance of this technology is curbed by legitimate questions regarding security, performance, and reliability, among others. A critical aspect of Cloud Computing lies in the fact that use of a cloud service requires a company to trust the service to comply with given Service-level Agreements (SLA). In order to foster broader acceptance of the Cloud, we propose a framework for preservation of Quality of Service (QoS) levels supported by product line engineering.
The problem identified lies on coupling the abstraction capabilities of product line approaches and SLA's for monitoring, control and enforcement of QoS parameters.

Two project proposals were discussed and planned during the first stage of the Fellowship. The first proposal for the EU Future and Emerging Technologies in the concept Challenging Current Thinking was completed with the following partners: NTNU, CNR, Technical University of Dortmund, Aalto University Helsinky, Melbourne University, and Chiang Mai University, Thailand. The abstract follows in Section II.

For the second proposal meant to be submitted under the EU Objective 1.2 Cloud Computing, I organized a consortium meeting in October 2011. Due to the lack of an industrial partner the submission and further work on this second proposal was stopped.

In the area of dynamic adaptation, joint work with the University of Florence was established following the lines in the paper "A formal orchestration model for dynamically adaptable services with COWS". We chose to advance the time construct for the language COWS and explain this with a new case study. The case study selected comes from previous work on "The Common Component Modelling Example" (CoCoME). This work is underway.

Furthermore, as part of community involvement activities, two reviews were done, one for Oxford's Computer Journal and the second one for Mathematical Structures in Computer Science (MSCS).

II- Publication(s) during your fellowship

1. A Formal Orchestration Model for Dynamically Adaptable Services with COWS. The Third International Conference on Adaptive and Self-Adaptive Systems and Applications (ADAPTIVE 2011). Rome, Italy, September 25-29, 2011.

Abstract: The growing complexity of software systems, as well as, changing conditions in their operating environment demand systems that are more flexible, adaptable and dependable. In many domains, adaptations may occur dynamically and in real time. In addition, services from heterogeneous, possibly unknown sources may be used. This motivates a need to ensure the correct behaviour of the adapted systems, and its continuing compliance to time bounds and other Quality of Service properties. The complexity of Dynamic Adaptation is significant, but currently not well understood or formally specified. This paper elaborates a well-founded model of dynamic adaptation, introducing formalisms written using the process algebra COWS.
The model provides the foundation for exploring dynamic adaptation and assessing it against predefined specifications.
We consider it a contribution for the design of new models and methodologies for system adaptability.

2. Dynamic Variability in Families of Clouds, in review

Abstract: Cloud computing, a promising new type of parallel and distributed system offers the opportunity to achieve almost unlimited scalability of the IT infrastructure and improvement of IT-Services.
However, broad acceptance of this technology is curbed by legitimate questions regarding security, performance, and reliability, among others.
A critical aspect of Cloud Computing lies in the fact that use of a cloud service requires a company to trust the service to comply with given Service-level Agreements (SLA). In order to foster broader acceptance of the Cloud, we propose a framework for preservation of Quality of Service (QoS) levels supported by product line engineering. We argue that coupling the abstraction capabilities of product line approaches and SLA's
offers enhanced support for monitoring, control and enforcement of QoS parameters.
In the long run, our work aims to provide a generic framework for non-functional requirements enforcement in Cloud Computing.

3. FET Proposal “Cloud Risk Safe Sphere”, under consideration

FET Proposal Abstract: In the past, the future of computing and knowledge was believed to reside in the personal computer. We now know that knowledge growth occurs primarily within a community of participants regardless of their scale. This growth works best in a trusted environment. Cloud computing can provide a trusted virtual environment to support physical infrastructure, offering the opportunity to develop IT Services, achieving virtually unlimited scalability of the IT infrastructure. While proven technologies for the provisioning of services in the Cloud are within reach, a comprehensive infrastructure for risk detection and management of legal regulations is still an open issue. The need for enhanced security management strategies has its roots on the ample attack planes offered in this environment.
For addressing the risks imposed on this new type of environment, this project introduces the concept of a safe Cloud Sphere, a novel concept that coupled with advanced risk detection and assessment mechanisms guarantees preservation of security specifications. The Cloud Sphere is intended to act as a self-regulating entity encapsulating User sensitive

information. The cloud sphere will continuously monitor the environment in which the information is being used, and deny or grant access to it based on the corresponding risk level and legal constraints associated to the application environment

Based on novel risk detection mechanisms and automatic adjustment of process instances, the platform protects security specifications, sensitive data, and regulatory concerns, as information transits within the heterogeneous environments in which Clouds operate.

As a result, this work represents a substantially original design methodology to security management and regulations compliance in the Cloud Computing ecosystem. The proposed cloud safe sphere and risk management strategies create superior levels of support to cope with these challenges in Cloud Computing.

III -Attended Seminars, Workshops, and Conferences

1. Third International Conference on Adaptive and Self-Adaptive Systems and Applications (ADAPTIVE 2011). Rome, Italy, September 25-29, 2011.

IV – Research Exchange Programme (12 month scheme)

Please identify the name(s), date(s) and place(s) of your Research Exchanges during your fellowship period and detail them .

Not applicable