CloudCom 2014 Tutorial Proposal: Programming Elasticity in the Cloud

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1 Tutorial Overview
Elasticity is seen as one of the main characteristics of Cloud Computing today. But elasticity is often viewed as scaling in/out computational resources, which basically means resource elasticity. In fact, elasticity is a multi-dimensional perspective in which elasticity can be based on resource, quality and cost/benefit dimensions, each of them can be further divided into several sub-dimensions. In this tutorial we will present the concept of multi-dimensional elasticity, the main principles of elasticity and how these principles play a role in the development and integration of software services, people, and things into native cloud applications/systems, which can be modeled, programmed, and deployed on a large scale in multiples of cloud infrastructures.

Based on these principles, we need to understand and develop techniques to address main challenges in programming, controlling and monitoring native elastic cloud software systems. We will present techniques to program and engineer elasticity features in dynamic lifecycle development and execution of native software-defined elastic systems (SESs) constructed from diverse types of cloud service units. We will show state-of-the-art techniques to program multidimensional elasticity, in which a complex cloud system will be elastic based on resource, cost, and quality at different levels of abstraction, such as single service units, cloud system patterns/topologies and the entire SES. We will lecture designs and features of main core services in platform-as-a-services for monitoring, control, deployment, and testing of SES and how to integrate these services for achieving multi-dimensional elasticity in state-of-the-art cloud infrastructures and technologies.

2 Tentative Contents
- **Part 1 - Elastic Computing - Principles, Models, and Algorithms for Software Services, Things, and People on the Cloud (1 hour):** in this part, we will lecture the concept of multi-dimensional elasticity, covering resource elasticity, quality elasticity and cost elasticity as well as principles of elasticity for complex services integrating software services, people and things.
- **Part 2 - Techniques for Programming and Engineering Elasticity for Native Cloud Systems/Applications (1 hour):** in this part, we will lecture foundation building blocks, basic techniques and core PaaS services for elasticity control, monitoring, configuration, deployment and testing of cloud systems.
- **Part 3 - Hands-on exercises with COMOT – A Toolset for programming Elasticity (1 hour):** in this part, we will carry out hands-on practices on programming elasticity by using our COMOT toolset for real-world applications executed in different research and industrial cloud infrastructures.
3 Targeting Audience and Lecturers
The expected audience are graduate students, researchers and practitioners. The tutorial will be given by Profs. Schahram Dustdar and Hong-Linh Truong from the Distributed Systems Group, Vienna University of Technology, Austria.

Schahram Dustdar is Full Professor of Computer Science (Informatics) with a focus on Internet Technologies heading the Distributed Systems Group. From 2004-2010 he was Honorary Professor of Information Systems at the Department of Computing Science at the University of Groningen (RuG), The Netherlands. He is a member of the Academia Europaea: The Academy of Europe, Informatics Section (since 2013). He is recipient of the ACM Distinguished Scientist award (2009) and the IBM Faculty Award (2012). He is an Associate Editor of IEEE Transactions on Services Computing, ACM Transactions on the Web, and ACM Transactions on Internet Technology and on the editorial board of IEEE Internet Computing. He is the Editor-in-Chief of Computing (an SCI-ranked journal of Springer). More information is available at http://dsg.tuwien.ac.at/staff/sd/.

Hong-Linh Truong is an assistant professor for Service Engineering Analytics at the Distributed Systems Group, TU Wien. He received a PhD degree, in 2005, and a Habilitation, in 2013, both from Vienna University of Technology, Austria. His research contributes to numerous national and international projects funded by, e.g., European Commission (EU), FWF, WWTF, and ESA (European Space Agency). His research interests focus on understanding of interaction, performance, context, and data quality metrics associated with large-scale, complex distributed and parallel applications and systems through monitoring and analysis, and on utilizing these metrics for the design, adaptation and optimization of these applications and systems. His research has been applied to Monitoring, Analysis and Optimization Techniques for Programs, Data and Systems; Parallel, Grid, and Cloud Computing; Service and Data Management and Integration; Context-aware Computing; Socio-technical Services Engineering; Sustainable Computing; and Elastic Computing. He has published more than 100 refereed papers in books, conferences/workshops and journals. He receives an outstanding paper award, three best paper awards, one best paper run-up award, and one best poster award. More information is available at http://dsg.tuwien.ac.at/staff/truong

4 Available Materials
• Relevant Publications and keynote talks
  o http://dsg.tuwien.ac.at/research/viecom/publications.html
• Software prototypes
  o Programming Elasticity: https://github.com/tuwiendsg/COMOT/
  o Elasticity Control: http://www.infosys.tuwien.ac.at/research/viecom/SYBL/
  o Elasticity Analysis: http://www.infosys.tuwien.ac.at/research/viecom/mela/
  o Elasticity Service Recommendation: http://tuwiendsg.github.io/QUELLE/
  o Elasticity Deployment and Configuration: https://github.com/tuwiendsg/SALSA
  o Testing Elasticity: http://dsg.tuwien.ac.at/autocles/