SWITCH

Software Workbench for Interactive,
Time Critical and Highly self-adaptive cloud applications

The **SWITCH project (Software Workbench for Interactive, Time Critical and Highly self-adaptive Cloud applications)** addresses the urgent industrial need for developing and executing time critical applications in Clouds. SWITCH addresses these problems by providing an interactive and flexible software workbench that can provide the necessary tools to control the lifecycle for rapid development, deployment, management and dynamic reconfiguration of complex distributed time-critical Cloud applications.

AT A GLANCE

Project title:
SWITCH: Software Workbench for Interactive, Time Critical and Highly self-adaptive cloud applications

Projects coordinator
University of Amsterdam (NL)
Prof. dr. Cees de Laat and Dr. Zhiming Zhao

Partners from:
Cardiff University (UK)
University of Ljubljana (SL)
Wellness Telecom (ES)
BEIA Consult (RO)
 MOG Technologies (PT)

Duration: 36 months

Total cost: 2,922,500 EUR

EC Contribution: 2,922,500 EUR

Programme: ICT-09-2014
Software tools and methods for large, complex and data-intensive systems

Further information:
www.switch-project.eu

Context and motivation

Many industrial applications have highly time-critical requirements for their performance in order to maintain their business value, for instance the application may address Quality of Service (QoS) (e.g. tsunami emergency response time) or quality of experience (QoE) (e.g. delivery of ultra-high definition television, or collaborative business interactions) issues. These applications are often called time critical applications. The SWITCH project addresses the entire life-cycle of time-critical, self-adaptive Cloud applications by developing new middleware and front-end tools to enable users to specify their time-critical requirements for an application interactively using a direct manipulation user interface, deploy their applications and adapt the infrastructure to changing requirements either automatically (using the specified requirements) or by human intervention if desired.

Challenge

Time critical applications often involve distributed components, and intensive data communication, for instance applications which address disaster warning issues often include remotely

deployed sensors, and many live event television broadcast scenarios require direction of multiple multi outdoor video sources. The development of such applications is usually difficult and costly, because of the high requirements for the runtime environment, and in particular the sophisticated optimisation mechanisms needed for developing and integrating the system components. In the meantime, a Cloud environment provides virtualised, elastic, controllable and quality on demand services for supporting systems like time critical applications. In 2012, Cloud computing was strategically recommended by the European Commission (EC) for boosting productivity in all economy sectors in Europe . However, the engineering method and software tools for developing, deploying and executing classical time critical applications have not yet included the programmability and controllability provided by the Clouds; and the time critical applications cannot yet get the full potential benefits which Cloud technologies could provide.

Solution

The SWITCH project addresses these problems by providing an interactive and flexible software workbench that, by using discovery tools at the networking level and QoS requirements from the application level, can provide the tools necessary to control the lifecycle for rapid development, deployment, management and dynamic reconfiguration of complex distributed time-critical cloud applications. In particular, SWITCH provides novel support for defining, optimising and controlling time-critical constraints in programming, testing, deploying and executing the applications. Using a fully responsive web based interface and backend components for coordinating the data flows across the networking infrastructure, the SWITCH workbench can define dynamic application level mappings for the time critical control rules and strategies to be employed on an application-by-application basis.

At the core idea of the SWITCH environment, a new development and execution model, an application-infrastructure co-programming and control model, will be developed for time-critical Cloud applications. The new model brings together the application

composition, execution environment customisation, and runtime control, which are normally treated in separated processes, into one optimisation loop based on the time critical requirements.

Expected impact

The programming and control model, and the software tools developed in the SWITCH project, will make considerable impact on

1) Improving development productivity of time critical Cloud applications. 2) Upgrading industrial technologies of time critical applications to use Cloud infrastructure. 3) Improving deployment efficiency of time critical applications. 4) Reducing operational cost of time critical services. Operating cost for time critical services such as disaster early warning is, on average, 40% of the total system cost, and sometimes can rise to more than 80% in extreme cases. 5) Promoting business competitiveness of Clouds. By 2020, the Clouds technologies will contribute 1% of GDP to the entire EU, about 160 billion euro , of which Software as a Service will be 30-40 billion euro.
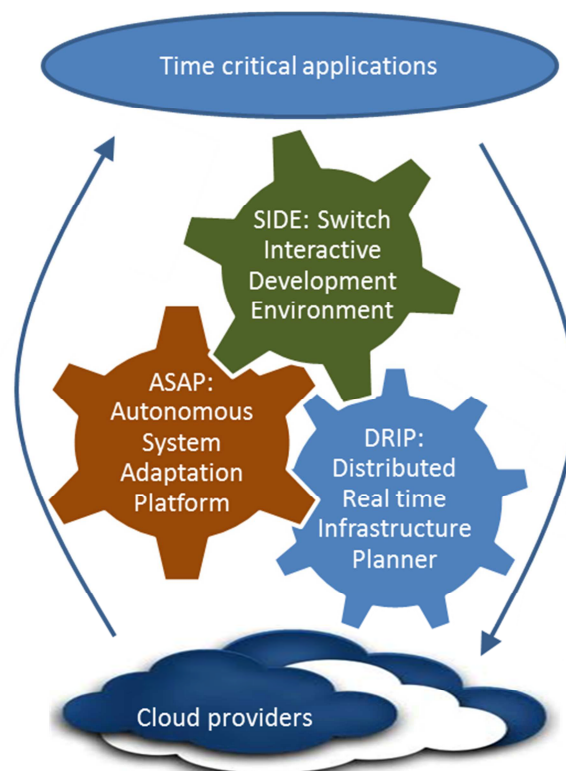
SWITCH application-infrastructure co-programming and control model