A Software Workbench for Developing, Deploying and Controlling Time-critical Cloud Applications

George Suciu[a], Victor Suciu[a], Elisa Morón López[b], Carlos Rubia Marcos[b], J. M. Perez Cerpa[b], Alexandre Ulisses[c]
[a]BEIA Consult International SRL, Romania
[b]Wellness Telecom SL, Spain
[c]MOG Technologies SA, Portugal

1. What is SWITCH?

The software workbench for interactive, time-critical and highly self-adaptive cloud applications (SWITCH) [1] is a **Horizon 2020 project** that will provide tools for managing the complete lifecycle of time-critical applications within the Cloud, explicitly linking user-level QoS with programmable infrastructure and autonomous runtime monitoring and control.

2. Background

Time-critical applications are required to respond immediately to a range of events that may occur at runtime. Often the quality of service (QoS) given directly impacts business value (e.g. for multimedia platforms) or public safety (e.g. for disaster response). Many such applications are distributed and highly demanding. Cloud environments provide on-demand virtualized infrastructure that could support such applications, but there is a lack of tools for exerting fine-grained control over software-defined infrastructure and applications at runtime.

3. The SWITCH approach

The SWITCH workbench will provide tools for developing, deploying and controlling the execution of time-critical applications, supporting every stage of the application lifecycle. It will realise an application-infrastructure co-programming and control model that relates application logic, QoS constraints, and developments in programmable infrastructure.
The workbench has three subsystems, as presented in Fig. 1:
1. The SWITCH Interactive Development Environment (SIDE), to specify applications for deployment on Cloud.
2. The Dynamic Real-time Infrastructure Planner (DRIP), to plan and provision applications on virtual infrastructure.
3. The Autonomous System Adaptation Platform (ASAP), to monitor and intercede in the execution of applications.

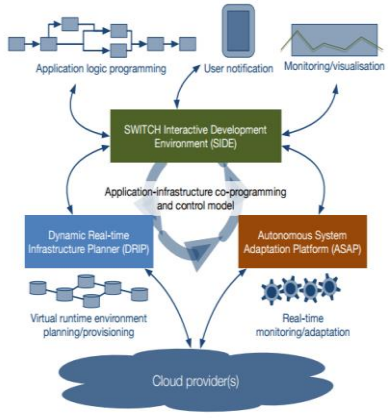

Fig. 1. SWITCH subsystems

The modularity of SWITCH allows components to be replaced as new Cloud standards and technologies come into existence.
The SWITCH application lifecycle is split into a number of interlinked phases, as presented in Fig. 2.

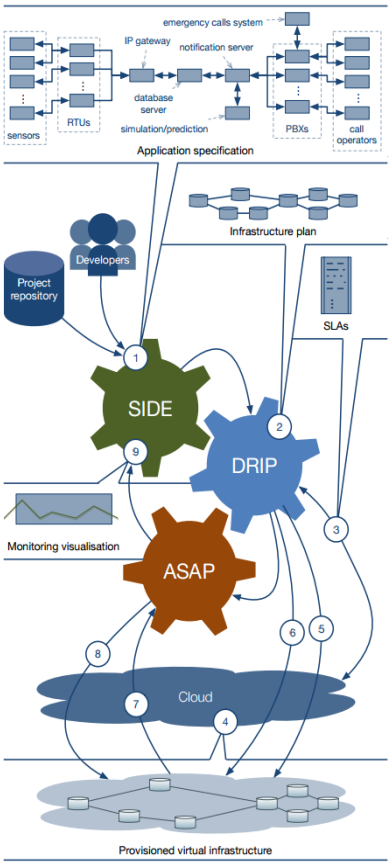

Fig. 2. SWITCH applications lifecycle

The following phases are followed during the lifecycle of an application:
1. Application composition and verification.
2. Resource selection and infrastructure planning.
3. SLA negotiation.
4. Infrastructure provisioning.
5. Application deployment.
6. Application execution and runtime management.
7. Runtime monitoring and diagnosis.
8. Runtime adaptation.
9. Runtime visualisation and feedback.

4. Time critical application cases and requirements

SWITCH has three pilot cases, each with different time-critical requirements and business case for moving into the Cloud:

- **A collaborative business communication platform (Wellness Telecom)** that provides browser-based real-time communication and collaboration that scales to demand while minimising costs;
- **An elastic disaster early warning system (BEIA Consult)** that continuously monitors a sensor network, identifies events in progress, and upscales facilities in anticipation of user demands;
- **A cloud studio for directing and broadcasting live events (MOG Technologies)** that manages the streaming of video feeds and the production of the broadcast stream virtually rather than on-site.

4.1 A collaborative business communication platform

Real-time communication plays an increasingly important role for many business applications, videoconferences, cooperative working environment, and remote diagnosis (Fig. 3).

Fig. 3. Critical time constraints in collaborative business collaborative platforms

4.2 An elastic disaster early warning system

Early warning for natural disasters is an important challenge for many countries. An early warning system often collects data from real-time sensors, processes the information using tools such as predictive simulation, and provides warning services or interactive facilities for the public to obtain more information (Fig. 4).

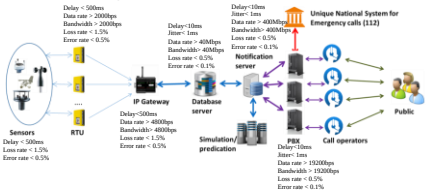

Fig. 4. Basic scenario of disaster earlier warning and the critical time constraints

4.3 A cloud studio for directing and broadcasting live events

In a live event, the broadcaster or production company has to deploy a large number of personnel and many items of equipment to fully cover it. Multiple cameras are placed around the event venue to cover all the different angles that the director considers relevant.

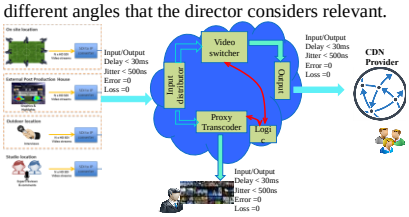

Fig. 5. The basic scenario for live event broadcasting and the quality constraints

5. Impact of SWITCH

The SWITCH project will make an impact on:

- Improving the development productivity of time critical Cloud applications;
- Upgrading industrial technologies of time critical applications to use Cloud infrastructure;
- Improving deployment efficiency of time critical applications;
- Reducing operational cost of time critical services;
- Promoting business competitiveness of Clouds.

References

[1] Z. Zhao, P. Martin, J. Wang, A. Taal, A. Jones, I. Taylor, V. Stankovski, I. G. Vega, G. Suciu, A. Ulisses et al., "Developing and operating time critical applications in clouds: The state of the art and the SWITCH approach," Procedia Computer Science, vol. 68, pp. 17–28, 2015

Acknowledgements

This research has received funding from the European Union's Horizon 2020 research and innovation program under grant agreements 643963 (SWITCH project).