A Reactive Architecture for Cloud-Based System Engineering

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Introduction

The complexity of the systems we are building now and will be building in the near future is the main challenge for the engineering community. Even though this increase in complexity is mainly driven by the market needs, there are other contributing factors such as regulations and standards. This calls for development and deployment of the advanced system and software processes that will assist all of the stakeholders in creating systems that are critical and dependable. These system processes will need to incorporate different steps, technologies, tools and services to meet the ever-changing needs of stakeholders.

Approach

The development and deployment of advanced system engineering processes that will assist all of the stakeholders in creating systems that are dynamic (requirements gathering, tool interoperability), and captured by a dependable architecture.

Cloud-Based Architecture: Reactive Middleware
- Reactive Middleware
- Shared Artefacts Repository and Toolbox
- Teamwork Support
- Dependability (Cloud Dependability Method)

Cloud Computing

Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort. It offers benefits such as:
- Scalability (Horizontal and Vertical)
- Multi-user access (Teamwork)
- Interoperability (Web Services)
- Dependability (Availability, Reliability, etc.)

Figure 1: High-Level Representation of the Cloud-Based Reactive Architecture [1]

Reactive Middleware

The reactive middleware supports change management and traceability of system engineering artefacts. It links the artefacts with the tools/development steps in which they are either produced or used. The reactive middleware is made up of two sub-systems that interact with clients (actors) and the shared artefacts repository:
- Publish/Subscribe System, and
- Artefacts Monitoring System (OSLC [2]).

ToolBox System

Figure 3: Theorem Provers Toolbox on Cloud (Proof) [3]

Cloud Dependability Method

- Modular and system level dependability (availability and reliability) components.
- These two sets of metrics (from architecture and cloud’s Service Level Agreements) compliment each other for coverage and to ensure greater dependability.

Figure 2: Overview of Reactive Middleware

Research Aim and Questions

Aim: To design, develop and evaluate a reactive and dependable cloud-based architecture to support system engineering. We formulate the following broad research questions:

- RQ1: How can the reactive middleware guide system engineering process improvements to ensure the continual tight linkage of stakeholders’ requirements and system engineering processes?
- RQ2: Can a cloud dependability method be used to meaningfully assure availability and reliability of a deployed system/architecture, relative to the cloud platform’s service level agreement (SLA)?

Future Work

- Support for a Formal Decomposition Protocol.
- Dependability of Reactive Architecture and an accountable cloud platform.
- Evaluation (Scenario-based techniques).

References