Research Issues for Software Testing in the Cloud

Leah Muthoni Riungu, Ossi Taipale, and Kari Smolander
Software Engineering Laboratory
Lappeenranta University of Technology
Outline

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Motivation

- Online delivery of IT services
  - IT/software products and services moving to the cloud
    - Testing methods, techniques, tools and concepts should also change
  - Testing in the cloud is seen as an arena of cloud computing that is easy to break into – J. Foley (2009)
    - IBM, Skytap, Utest
- Earlier study, ”Software testing as an online service: Observations from practice”
  - Cloud computing is becoming the means for developing and delivering online services.
Cloud Computing

• “A model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, application and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” - US National Institute of Standards and Technology (NIST)

• Essential characteristics
  • on-demand self-service, broad network access, resource pooling, rapid elasticity and measured service

• Service models
  • Software as a service (SaaS), Infrastructure as a Service (IaaS), Platform as a service (PaaS)
  • Human as a Service (HaaS) – (A. Lenk et al, 2009).
    • Crowdsourcing e.g. uTest

• Deployment models
  • Private clouds, community clouds, public clouds and hybrid clouds
Testing in the Cloud

- A model of software testing used to test an application as a service provided to customers across the internet – (L.V.D Aalst, 2009).
  - It enables daily operation, maintenance and testing support through web-based browsers, testing frameworks and servers

Facets of testing in the cloud

3. Testing the cloud

2. Testing environments in the cloud

1a. SaaS software

1b. Non-SaaS software
Testing in the Cloud - Examples

• D-cloud: An environment for testing large-scale technology systems for parallel and distributed processing as well as fault tolerance capabilities (*T. Hanawa et al.*, 2010)

• The York Extensible Testing Infrastructure (YETI): An automated random testing tool with the ability to test programs written in different programming languages (*M. Oriol, F. Ullah*, 2010)

• Large-scale performance testing of a Network Management System (NMS) for a Voice-over-IP (VoIP) telephony switching system (*Z. Ganon, I.E. Zilberstein*, 2009)

• Cloud9: a software testing service that enables parallel symbolic execution of computer clusters operating on public cloud infrastructures such as Amazon EC2 and clusters running cloud software like Eucalyptus (*L. Ciortea et al.*, 2009)

• Remote network labs (RNL): An on-demand network cloud that enables users to build virtual test laboratories (*S. Gaisbauer et al.*, 2008)
Research Process

- Question: “In your opinion, is there a specific area that you think should be the focus of STaaS research?”

- Data collection: Face-to-face interviews
  - 11 organizations (6 providers, 5 customers)

- Grounded theory approach – makes use of collected and analyzed data to create a theory.
  - Open coding – deduction of initial categories guided by the research question
  - Axial coding - identify similarities, relations and causal conditions amongst categories
  - Selective coding – define a central category
  - Suitable for discovering new issues and concepts

- Issues
  - Application, management, legal and financial issues
Application Issues (1)

- Applications suitable for online software testing.
  - The types of testing in the cloud that would be most productive
  - Cloud based SaaS software vs non-SaaS software
  - Mission critical systems e.g. banking
  - Parveen and Tilley (2010) suggest:
    - Characteristics of application under test e.g. test case dependency
    - Type of testing to be done e.g. unit and performance testing

- Ready-made online performance testing package for any customer
  - The cloud and other systems need to be tested for performance
  - One fits all performance testing package
Application Issues (2)

- Quality checks for applications that have been tested in the cloud
  - High quality is becoming more and more important
  - Do we need new quality metrics?

- Harmonization of the test processes across multiple players
  - Integration between different testing systems in the cloud

- Online testing solutions for e-business applications
  - E-business systems are based heavily on XML
  - Testing systems based on standards might be easier
  - Testing in the cloud may have the potential to enhance e-business models
  - Private clouds may be an option
Management Issues

• Pool of testers
  • How to fulfil the promise of 24/7 availability
  • Cloud computing avails the means to perform testing, but human effort is still required
  • Crowdsourcing e.g. uTest

• Effects on the customer’s business
  • Critical for independent testing vendors
  • Knowledge and skills to advice customers appropriately
  • Follow customer and adapt to customer trends
Legal and Financial Issues

• Test data
  • In order for effective testing to take place, some testing tasks depend highly on the actual customer or production data
  • How to deal with confidential or production data especially across different regulations
  • Development of new models or algorithms that would generate almost “identical” test data to facilitate productive testing results.
  • The generated test data should produce the similar quality of test results that would have been achieved if real data had been used

• Pricing models and service descriptions for testing services
  • Elaborate and transparent pricing models
  • What is the customer paying for?
Conclusion

• Continuous need for organizations to improve their testing processes

• Cloud computing provides large business and technical benefits to software testing

• Shift to the cloud > need for testing in and of the cloud

• Pilot projects and proof of concepts e.g.
  • Open Cirrus (TM) - an open cloud-computing research testbed aimed at supporting research in various aspects of cloud computing e.g. design and management of services.

• Various research approaches
  • Action research, surveys, grounded theory
  • Collaboration between the industry and researchers
Conclusion

• Work-in-progress:
  • How different software organizations adopt to new methods and concepts, specifically within their testing processes.

• Future works
  • How cloud software development and testing will affect quality requirements in the future – addressing the interdependency of cloud software development, cloud testing and overall quality assurance.