Research Issues for Software Testing in the Cloud

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Outline

- Introduction
  - Motivation
  - Cloud computing
  - Testing in the cloud
- Research process
- Results
- Conclusion

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).
    - Crowdsoucing 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

3. Testing the cloud

2. Testing environments in the cloud

1a. SaaS software

1b. Non-SaaS software
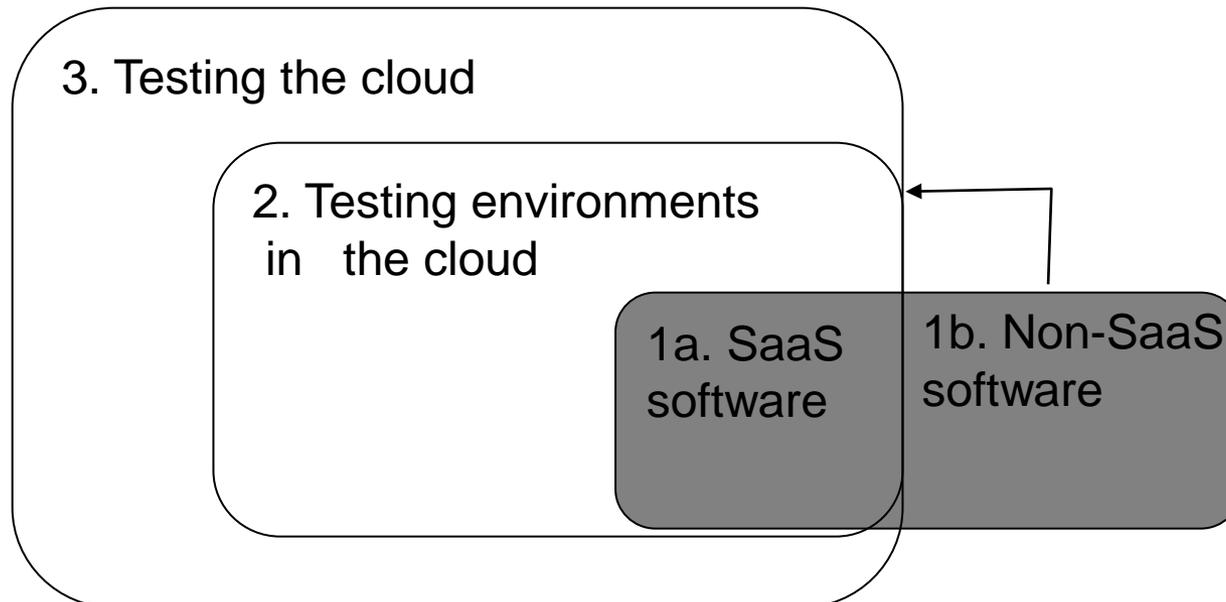
Facets of testing in the cloud

5

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

- Continous 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.