Leveraging Cloud for Software Assurance

Issues & Challenges

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Overview

Software Assurance & the Cloud
- Testing the Cloud
- Testing on the Cloud

Software Assurance
- Challenges, Issues and Trends

Research in Infosys
- Testing the Cloud
- Testing on the Cloud
Cloud Computing – Software Development Lifecycle
For the Cloud and On the Cloud?

Cloud Oriented Development Life Cycle

- Architect
- Design & Align Policies
- Assemble and implement
- Test, Verify, Validate
- Deploy
- Monitor
- Customize
The Cloud Computing Eco-Systems.... Convergence!

**CONVERGENCE**

Cloud - Private, Hybrid, Public
Mobility & Smart Devices
Business Analytics
Collaborative Business Processes

Cloud Services
Public, Private, Hybrid
Azure, Google App Engine, Amazon,
Salesforce.com, Force.com etc

Client Smart Devices
+ Firmware (Android etc)

Testing and Validation
For Complexity?
Usage?
Collaborations?
Testing the Cloud

Testing for Functional Requirements And Non-Functional Requirements

Client Smart Devices
+ Firmware (Android etc)

Infrastructure as a Service
Amazon AWS Microsoft Azure Eucalyptus etc

Software as a Service
Salesforce.com, Force.com etc

Platform as a Service
Microsoft Azure, Google GAE, etc
What is the Difference?

Testing Applications on the Cloud

VS

Testing the Cloud Services along with the applications

Testing NFRs
- Cloudonomics
- Security – Data, Processes, Vulnerabilities
- Availability – Under various loads and SLAs, Policies
- Interoperability and Integrations
- Hybrid Deployments
- Migrations
NFRs and Testability in Enterprise Software is typically an Afterthought.

How Do We Architect the multiple dimensions of NFRs and Testing from the early phases of Software Lifecycle?
Testing on the Cloud - Issues, Challenges

- Testability Challenges
  - controllability: Controlling Components
  - observability: Observing test results.
  - isolateability: Component Isolation
  - separation of concerns: Focusing on the component under test
  - automatability: component test automation?
  - heterogeneity: component test heterogeneity capability

- Domain Specific Testing
  - Insecure APIs and User Interfaces
  - Shared Technology Challenges
  - Shared Data Loss and Leakages
  - Black box and White Box testing in the Cloud

- Domain Independent Testing
  - Verification and Validation
  - Stress Tests
  - Fault Injection Testing
  - Volume and Load Tests
  - Environmental Tests
  - All-Pairs Testing (Combinatorial Testing)
Misuse of Proprietary Test Data on the Cloud

Indirect Data Mining and Analytics

The misuse by many Public Cloud Vendors!!
### A Case of NFR Testing for Security – Various Dimensions

<table>
<thead>
<tr>
<th>No.</th>
<th>Dimension</th>
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<tbody>
<tr>
<td>1</td>
<td>Cloud Architecture – IaaS, PaaS, SaaS</td>
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<tr>
<td>2</td>
<td>Governance &amp; Enterprise Risk Mgmt</td>
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<td>Legal &amp; Electronic Discovery</td>
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<td>Compliance and Audit</td>
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<td>Information Lifecycle management</td>
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<td>Portability and Interoperability</td>
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<td>7</td>
<td>Traditional Security, Biz Continuity, Disaster recovery</td>
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<td>Data center operations</td>
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<td>Incident response, notification and remediation</td>
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<td>Application Security</td>
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<td>Encryption and key management</td>
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<td>12</td>
<td>Identity and access management</td>
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<td>13</td>
<td>Virtualization</td>
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From CloudSecurityAlliance....
A Comprehensive Suite of Cloud Services

1. Enterprise Cloud Adoption
   - Enterprise 'Cloud Readiness' assessment – Infrastructure, Application, Security
   - Business case & ROI
   - Enterprise Cloud roadmap & strategy – Public / Private Cloud

2. Cloud Architecture and Enablement
   - Private Cloud architecture & setup
   - SOA and application remediation for Cloud
   - Testing services for Cloud
   - Security architecture for Cloud

3. Cloud Governance
   - Dynamic IT services/assets provisioning, monitoring and governance
   - Policy enforcement & standardization
   - Metering and charge-back models
   - Green IT Compliance Advisory

4. Cloud QoS Assurance
   - Application performance monitoring, diagnostics & optimization on Cloud
   - Infrastructure & application availability
   - Security audit & compliance
   - SLA-driven service management

Application Data and Migration Services
   - Microsoft BPOS Migrations
   - Google Apps Migrations
   - Amazon AWS Migrations

   - Application / data migration to private/public clouds such as MS Azure, Google App Engine & Amazon EC2 platforms
Research Projects Underway at Infosys – Cloud & Testing

- Leveraging ACTs
- Automation of Testing – Domain Specific and Vertical Specific
- Test cases generation and cross leveraging
- Testing Frameworks and Methodologies
  - Static and Dynamic Analysis
  - Verification approaches
  - Formal Methods

- Where do we go from here?...
THANK YOU!