Leveraging Cloud for Software Assurance
Issues & Challenges

T S Mohan, PhD

Principal Researcher, E&R

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Overview

Software Assurance & the Cloud

- Testing the Cloud
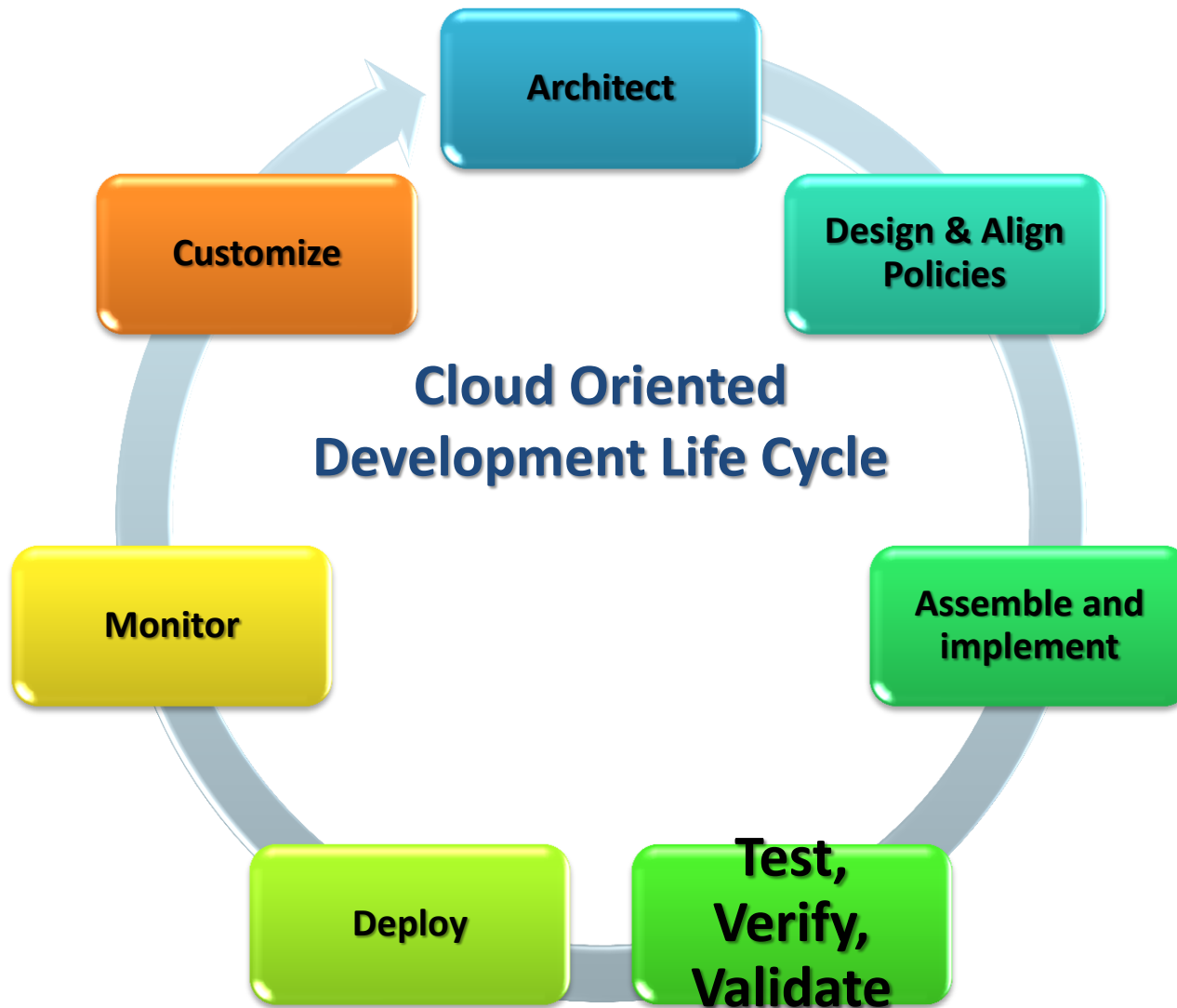- Testing on the Cloud

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?

Architect

Design & Align Policies

Customize

Cloud Oriented Development Life Cycle

Monitor

Assemble and implement

Deploy

Test, Verify, Validate

The Cloud Computing Eco-Systems.... Convergence!

CONVERGENCE

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

Client Smart Devices + Firmware (Android etc)

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

**Testing and Validation
For
Complexity?
Usage?
Collaborations?**

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Testing the Cloud

Testing for
Functional Requirements
And
Non-Functional Requirements
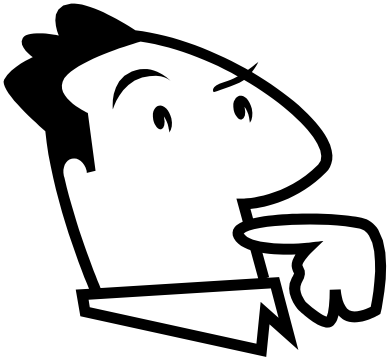
**Infrastructure
as a Service**
*Amazon AWS Microsoft
Azure
Eucalyptus etc*

**Client Smart Devices
+ Firmware
(Android etc)**

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

**Platform
as a Service**
*Microsoft Azure,
Google GAE, etc*

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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**

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Architecting for Testability and NFRs ....

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?

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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)

Indirect Data Mining and Analytics

The misuse by many Public Cloud Vendors!!

A Case of NFR Testing for Security – Various Dimensions

1) **Cloud Architecture – IaaS, PaaS, SaaS**
2) **Governance & Enterprise Risk Mgmt**
3) **Legal & Electronic Discovery**
4) **Compliance and Audit**
5) **Information Lifecycle management**
6) **Portability and Interoperability**
7) **Traditional Security, Biz Continuity, Disaster recovery**
8) **Data center operations**
9) **Incident response, notification and remediation**
10) **Application Security**
11) **Encryption and key management**
12) **Identity and access management**
13) **Virtualization**

From CloudSecurityAlliance….

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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

3. Cloud Governance

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

Consulting

Proof-Of-Concepts

Deployments

Implementations

2. Cloud Architecture and Enablement

- Private Cloud architecture & setup
- SOA and application remediation for Cloud
- Testing services for Cloud
- Security architecture for Cloud

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

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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!