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Continuous Integration and Continuous Delivery to Facilitate Web Service Testing

By using Jenkins, LISA and Maven, QA organizations can simplify and modernize the process of testing web services across their disparate and distributed enterprises.

Executive Summary

Web services have evolved to provide platform independence. Increased flexibility has enabled most web services to be consumed by systems built on any language.

As the number of web services in application development grow and become more complex to execute, there is a corresponding increase in demand for testing. And with this demand comes significant technological challenges, which can be overcome with modern quality assurance tools and methodologies.

This white paper focuses on key web-service challenges, such as validation. Moreover, it proposes a solution based on continuous integration (CI) and continuous delivery (CD) methodologies derived from DevOps that require a handshake between tools such as Jenkins, LISA and Maven to trigger automated test scripts (Jenkins), virtualize web services and invoke work objects (LISA) and validate the application (Maven).

The primary challenge requires an automated test suite capability that can be run after code deployment, invoke virtualized web services and validate the web service application flow.

WEB SERVICE TESTING CHALLENGES

Given the complex nature of web services, validating and automating such services is never easy. The primary challenge requires an automated test suite capability that can be run after code deployment, invoke virtualized web services and validate the web service application flow. Compared to other application development tasks, web service testing challenges are unique in the following ways:

- There is no user interface to test a web service, unless it is consumed or integrated with a front-end application at a later stage of the software development lifecycle (SDLC).
- All elements of a service need to be validated correctly no matter which application uses them or how often they might be invoked.
- Underlying security parameters of the service must be validated (e.g., what is expected by the consuming application).
- Connection to services is made through different communication protocols (e.g., SOAP, REST, MQ, etc.).
- Multiple channels calling a service simultaneously leads to performance and scalability issues.
- Each parameter in the service should be explicitly defined: A field expected to hold one specific indicator but that sends a different one can make the application behave very differently.
- The data-type of each field should be defined and validated correctly.
- The availability of both internal and external (third-party) services is involved.
- The same service can respond differently based on the input parameters passed in the request. All such variations in the response must be validated.

MITIGATION OF WEB SERVICE TESTING CHALLENGES

Most of the above challenges can be mitigated by introducing effective CI, service virtualization and continuous automation. This can be accomplished with the following measures:

- CI/CD technique through Jenkins can drastically reduce the risk of product failure with automated deployment and automated triggering of validation scripts, all in real time.
- Virtualizing all web services and having the ability to invoke a work object via LISA can save hard dollars and act as a fall-back to unstable and unavailable live services.
- Validating the application using Maven.

Design Test Cases Using Cucumber & Gherkin

For starters, we suggest the following tools:

- Cucumber helps to design test cases in the Gherkin language to validate web service functionality and business logic validation in language understandable to business users.

CI/CD in Web Service Validation

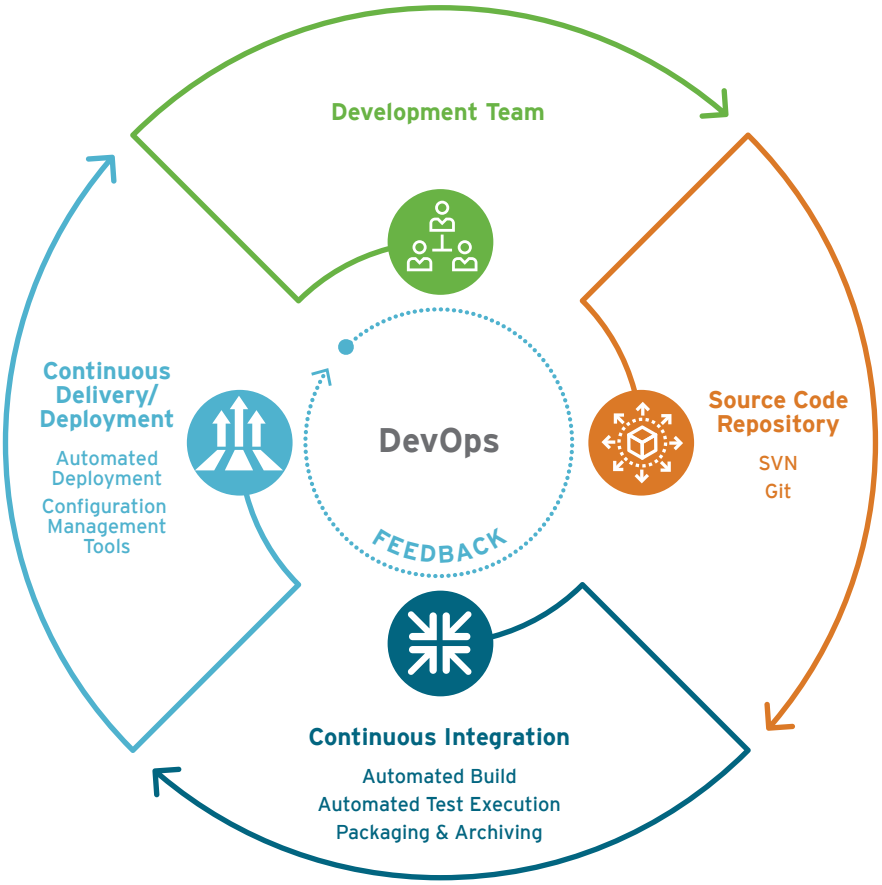

Figure 1

- Categorize and execute test cases as a smoke test to validate for Web Services Description Language (WSDL) structure, endpoint URL, functional test cases to functional business requirements and a regression test to run web service core business functionality using Cucumber's annotation feature.
- Cucumber and Gherkin support business-process-driven development and offer Agile teams the flexibility to bridge the gap between business users and software developers.
- Feature file and Gherkin language help automate the use of test cases from business-analyst-driven story cards, or vice versa.
- Use Cucumber's standard and detailed reporting features to provide scenario level and annotation level reports.

Automation Test Management Using Maven

- Store automated test cases in a Maven test folder and store test data file and other dependency files in a resource folder.
- There is easy readability and maintainability of web service scripts with Maven project structure.
- Related jar installation and automatic configuration is possible, using Maven dependency.
- Reuse existing web service class, function and object of code by class or variable reference.
- Store and retrieve code from GIT and SVN DevOps' repositories, in a push and pull manner.

Continuous Integration in Action

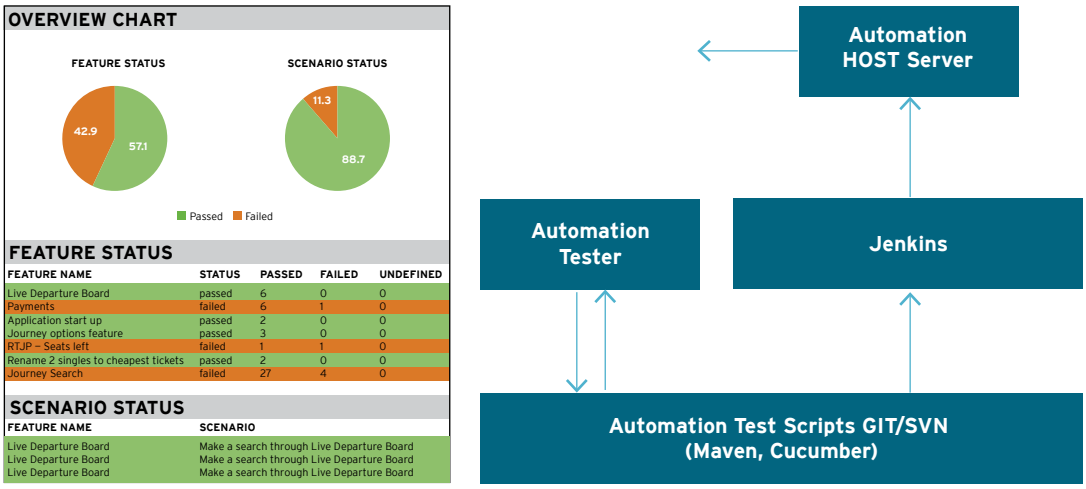

Figure 2

Continuous Integration Using Jenkins

- In an Agile environment, frequency of code deployment is higher and each deployment consumes an adequate amount of effort and time.
- Jenkins can be customized to automate the code deployment process and systematically trigger the web service validation scripts once the code deployment is completed.
- Its e-mail reporting feature notifies the list of users with the results of the web service validation suite.

Role of LISA in Virtualization & Web Service Automation

There are many instances where the application so designed invokes numerous services hosted inside or maintained by third-party vendors. This leads to situations where there is a huge dependency on all such services. Here is a simple example of how costly these dependencies can be, in terms of money and time to market.

- A global credit card company has a legacy application that uses more than 50-plus web services in various protocols.
- The company had been spending millions of dollars to expand into markets but was still lagging competitors due to its inability to adapt to diverse market regulations and to rapidly launch products to these markets.
- To reposition itself as a market leader, the company decided to make a globalized platform migrating from the legacy platform which would address its challenges (e.g., easy customization based on market regulations and faster launch dates to market).
- The plan was laid out architecturally to roll out a globalized application that could be tested without impacting quality, timelines and cost considering the huge volume of web services used. With the increased volume of third-party-managed services, the company bore the cost for each hit.

Service Virtualization: Before & After

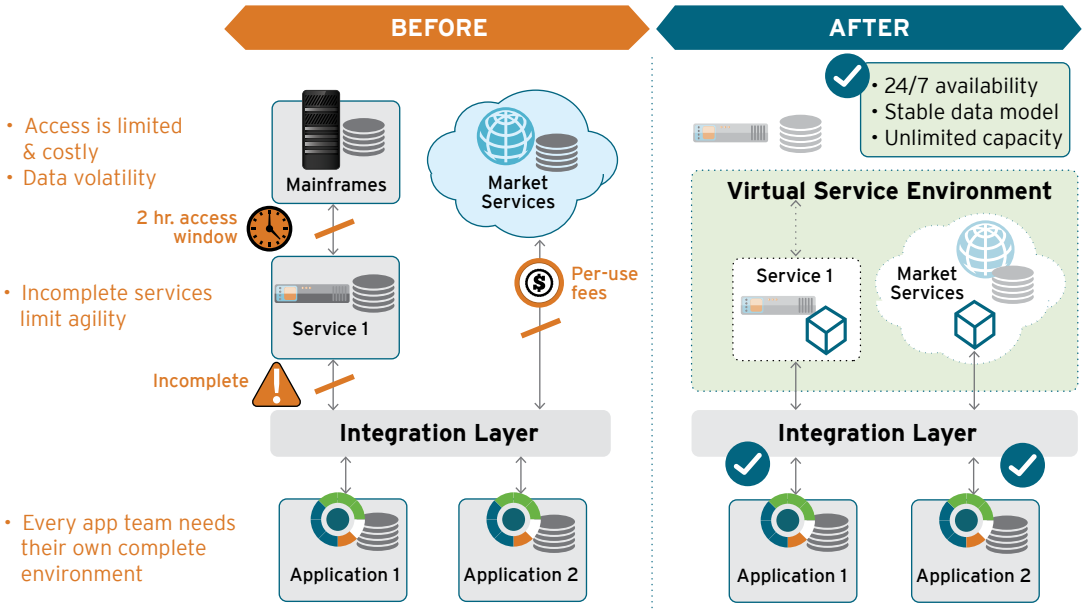

Figure 3

- Each web service, notwithstanding the protocol type, was virtualized so they could invoke virtual services and save a significant amount of time and money, estimated at $12K for two projects in a 12-week release period (see Figure 3).
- Once the services were virtualized, the invocation of the initial web service to trigger a work object can also be achieved through LISA.

LOOKING AHEAD

Our proposed solution can achieve an E2E web service automation wherein the automated test scripts can be executed independently after any code build through Jenkins; this invokes LISA, where all the virtualized web services reside, and also is the starting point of service validation by triggering the work object.

Thereafter, the control passes to Maven to validate the steps in the test script. This ensures the Agile web service application is thoroughly validated. Also the complex services have zero dependency on infrastructure and reduce cost by being virtualized as they are integrated.

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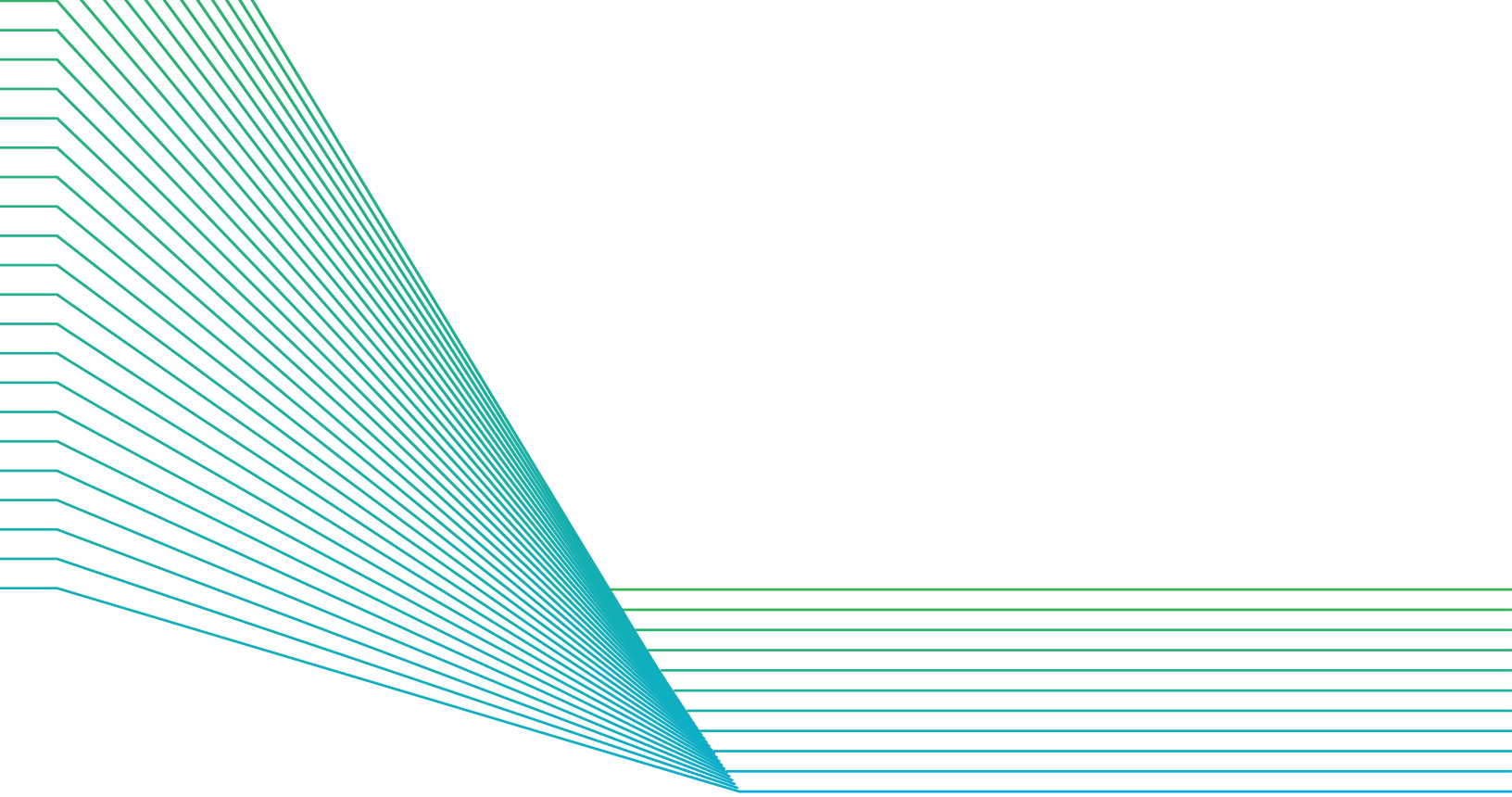

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