Table of Contents

1 Introduction ................................................................................................................................................................................. 3
2 Continuous Integration and Test ............................................................................................................................................... 3
3 Jenkins ........................................................................................................................................................................................ 4
4 VectorCAST Manage ................................................................................................................................................................ 4
5 A Complete Test Automation Solution ...................................................................................................................................... 5
6 Summary ..................................................................................................................................................................................... 5
1 Introduction
For years, most software development occurred using a process that had three distinct phases: design, code, and test. However, this process has major shortcomings:

- Faults in the design are often only found months later during testing
- Hundreds or thousands of latent bugs are accumulating during development
- The test phase might be two to three times as long as the development phase

The three-phase workflow eventually produced a complete application, but the completion was often significantly behind schedule and significantly over budget.

2 Continuous Integration and Test
Probably the most over-used graphic in the history of software development is the hockey stick graph that shows it costs very little to fix a bug when it is introduced and it costs a fortune to fix after it is deployed to thousands of customers.

Figure 1:

Over the years, there have been many attempts to solve the problem of software quality and time to market, but Continuous Integration (CI) is yielding quantifiable benefits.

The concept of continuous integration is to continually build and test your application every time anyone changes anything. This works well if you have a few hundred lines of application code and a few dozen tests. However, what happens when you have millions of lines of code and thousands of tests?
3 Jenkins

If it takes 10 hours to do an incremental build of your application and your test system takes 2 weeks to run, you cannot possibly build and run tests each time a source change is made. As a result, one of the critical requirements of continuous integration is an optimized and distributed approach to building and testing.

Jenkins solves this problem and is an excellent foundation for a continuous integration system. Jenkins is the leading open-source continuous integration server. Built with Java, Jenkins provides over 400 plugins to support building and testing virtually any project. The simplest way to think of Jenkins is as a “job server”. Jenkins does not care what the “job” is, it can be a “make” command to compile and link an application, a batch script to setup preconditions for a test, or an executable that stimulates a complete simulation environment for an embedded system.

Jenkins provides the following testing infrastructure features:

> The ability to define a list of “nodes” which are physical or virtual machines
> The ability to “tag” a node to indicate the kind of jobs it can run
> The ability to remotely dispatch and balance jobs to a list of nodes
> The ability to e-mail job status when jobs are complete

So all that you need to provide Jenkins as input is a list of jobs to be run and this is exactly what VectorCAST Manage does.

4 VectorCAST Manage

VectorCAST Manage is designed to allow thousands of test cases to be organized into groups that map onto the architecture of your application, and to allow any sub-set of these tests to be run using any available configuration on any available target. For example, you might deploy an embedded application on both PPC and ARM targets, or you might deploy the same native application on both Windows and Linux.

Regardless of the platform however, it is desirable to be able to run the same set of test cases on the same application code. VectorCAST Manage provides the following testing infrastructure features:

> The ability to organize thousands of test cases into logical groups that conform to the structure of your application
> The ability to determine the pass/fail status of each test case
> The ability to determine code coverage on a per function basis
> The ability to run the same test against multiple configurations of the application
> Command Line and Python API interfaces to all of these features
5 A Complete Test Automation Solution

Figure 1 shows a hypothetical use case for VectorCAST Manage with Jenkins. In this example, our project has four Test Suites built into a VectorCAST Manage Project and each of the Test Suites must be run on a different target and/or operating system.

Figure 2:

Let’s also assume that each test suite contains 4,000 individual test cases, each of which takes 5 minutes to run. This means that if we just kicked off the testing without Jenkins, the testing would be done in 20,000 minutes or 2 weeks.

A great feature of VectorCAST Manage is that it allows any level of granularity in running tests and compiling results. This means that we can choose to make each of the 4,000 tests be its own Jenkins “job”.

By configuring multiple “nodes” to execute tests, we can spread the testing work across many machines, and dramatically shorten the total time to test. Taken to an extreme, we could have 4,000 Jenkins Slave virtual machines running, and our testing would be completed in 5 minutes.

6 Summary

Continuous Integration is yielding quantifiable benefits to the problem of software quality and time-to-market, which are both adversely affected by testing applications only after they are developed, not continuously during development. VectorCAST Manage and Jenkins together provide a scalable approach to continuous testing of application software.
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