Best-of-breed test design automation

Introduction

It is not immediately clear what the space we are discussing should be called. *"Test case generation"*, perhaps with an added *"automation"* might be appropriate, if long-winded. However, while the tools evaluated here certainly automate the generation of test cases, some of them do so in only a limited fashion while many of them do rather more than that. We have therefore opted for the rather more nebulous *"test design automation"*. Moreover, we have restricted ourselves to those products that we consider to be best-of-breed since there are a great many tools and products that we might have included in this Market Update. For example, *www.pairwise.org* lists 42 pairwise testing tools and this is not even a complete list (for instance, CA Agile Requirements Designer offers pairwise coverage but is not listed in the pairwise.org site). Rather than even attempt to evaluate all these pairwise products, we have focused, in this case, on Hexawise, because we believe that Hexawise is the best-of-breed supplier in the pairwise space (though, in practice, Hexawise is much more than just a pairwise tool). We have taken a similar approach within other categories of product so that, in practice, all the products discussed in this Market Update can be considered best-of-breed tools.

Two potential categories of product have been omitted from this report. Firstly, tools that we believe to have been left behind by emerging market trends (see later). For example, we regard keyword-based approaches to generating test cases as table stakes. That isn't to say that we have completely ignored keyword-based products (Micro Focus' Silk Central, for example) but what we are generally looking for is more advanced capabilities, especially those that are model-based. Secondly, we have omitted products that focus on testing within systems (engineering) environments as opposed to those that concentrate on software development.

Market trends

The trends in test design automation are impacted by wider trends in the DevOps market and, more precisely, in what we might describe as the TestOps arena.

To begin with, we should note that the bulk of testing remains manual. We deplore this fact.

It is expensive, wasteful and unnecessary. However, we do believe that this is changing, if not as fast as we would like. The drivers behind this change are multiple. Perhaps of most importance from a technical perspective is a greater acceptance of agile development methods (including behaviour and test driven development) while, from a commercial viewpoint, most (but not all) of the tools in the testing space are now available via a subscription model. Historically, hiring testers was an operating expense but licensing software was a capital expense: now that both are available as operating expenses the advantages of automation can be deployed without the need for budgetary approval for capital expenditure.

Figure 1: The highest scoring companies are nearest the centre. The analyst then defines a benchmark score for a domain leading company from their overall ratings and all those above that are in the champions segment. Those that remain are placed in the Innovator segment if their innovation rating is over 2.5 and Challenger if it is less than 2.5. The exact position in each segment is calculated based on their combined innovation and overall score. It is important to note that colour coded products have been scored relative to other products with the same colour coding.

Key: products are colour coded to ensure that readers do not compare apples with pears. Note that all vendors in this Bullseye are consider best-of-breed.

One further trend within the wider market that impacts on test design automation is the rise of challengers to HPE ALM and associated products. HPE has been a dominant vendor in the test management market for some years. However, it is increasingly being challenged and users are moving away from HPE. There are a number of companies (see *http://www.softwaretestinghelp.com/15-best-test-management-tools-for-software-testers/*), mostly start-ups, that are encroaching on HPE's space. As an aside, we agree with the author's assertion in the article quoted that qTest from QA Symphony is probably the leading challenger. In any case, HPE ALM is clearly losing traction in the marketplace. This has a knock-on effect for companies in the test design space because a) some vendors have products that used to specifically rely on HPE ALM and b) even where that was not the case, products were not designed to work with and integrate to, the range of test management products that are now available. The companies covered in this Market Update have been busy integrating their products more broadly and taking away any reliance on HPE products, although integrating with HPE ALM remains a significant requirement. Readers will no doubt be aware that HPE is being acquired by Micro Focus but we think it is too late to stop this drift away from ALM and its sister products. They will, no doubt, remain a significant force within the market, but the days of the HPE hegemony are over.

Following on from the previous paragraph, it is worth commenting that most testing environments are extremely diverse. Test management, requirements definition and management, user story and test case generation, automated testing frameworks, defect management, test data management and service virtualisation, amongst others, are all key elements within a testing environment. In general, organisations use multiple tools from multiple sources. Even in environments where a vendor like CA dominates (with Agile Requirements Designer, Test Data Manager, AppTest, Rally and so on) there is still probably going to be Selenium or Ranorex in place, and Atlassian JIRA. It is therefore incumbent upon all vendors to have products that will work with, and integrate to, pre-existing test environments and tools.

The impact of requirements definition and management on test design automation is also emerging. It is clear from our research that many organisations are still at a relatively immature stage when it comes to requirements. Two of the vendors included in this Market Update reported to us that they had very little demand for integration with requirements management

tools from their user base. Again, we are not happy that this is the case. But it appears to be that a majority of organisations are, at best, capturing requirements in Word documents and/or Excel spreadsheets. While there are certainly tools discussed in this paper that can capture such requirements and use these to help to generate test cases, we regard such an approach as unsophisticated. In our opinion, the market is evolving (and must evolve) towards the use of model-driven requirements: either captured in a test design tool or imported from a business process modelling environment or even created within Microsoft Visio and then imported. We believe in the adage that a picture is worth a thousand words and, in this case, models not only aid efficiency but also collaboration across the various stakeholders involved: developers, testers and business analysts.

It is further worth commenting with respect to requirements management that some companies that take this seriously as a necessity for systems of record are not so inclined to do so when it comes to web-based or mobile applications. This is a false economy. For example, after the Royal Bank of Scotland's website crashed in 2012 many customers were unable to access their accounts. This not only caused reputational damage to the bank but it also resulted in a subsequent fine of £56 million. It is also noteworthy that privacy regulations such as the EU's GDPR (general data protection regulation) directly impact on both web and mobile applications, with breaches of the regulations subject to fines of up to 4% of global revenues. We do not recommend taking requirements lightly.

Once it comes to the test design process itself perhaps the biggest emerging issue is with respect to risk-based coverage. Different vendors are taking very different approaches to this, to the extent that you could argue that they are almost different things. For example, if you are using the Tricentis Tosca TestSuite then you assess risk prior to the generation of your test cases. This is a good thing to think about. On the other hand, various other products only start to utilise the concept of risk after you have run some initial tests and have identified defects. The problem with almost all methods is that ultimately the assessment of risk is very subjective. Some vendors, notably CA, are being more analytic and more objective about this than others but in our opinion risk-based coverage is more a sales tool than a real technical advantage at present. This may change over time but the capabilities offered currently are limited.

The vendors

From a vendor standpoint, this market has two types of supplier: major players such as Micro Focus and CA, plus various independent suppliers that specialise specifically in testing. In the former category, we had thought to include IBM but although the company has strong offerings for requirements management (DOORS) and test management (Rational Quality Manager) it does not offer the sort of automation with respect to tests, that we are looking for. Leaving IBM aside, there is a typical split between stack vendors and pure players.

From a market change perspective, the most significant has been the growing number of companies being acquired by CA, most notably both Rally Software and Grid-Tools during the course of 2015. There have also been various changes in the partnership landscape. Of vendors discussed in this market update, Tricentis has formed a partnership with Conformiq, Blueprint Software has formed a partnership with QASymphony and Turnkey Solutions, now that it is a partner of CA (and Grid-Tools before that) is actively expanding its portfolio beyond HP ALM. HPE, of course, represents the other major forthcoming change with its transition to Micro Focus. It is too early to be definitive about how this will impact on either company's products but it is clear that there is significant overlap between HPE's and Micro Focus' products in the testing space. How that plays out in practice remains to be seen.

The vendors and their products discussed in this Market Update are:

● **Blueprint Enterprise (Blueprint and Storyteller).** Blueprint is an enterprise level requirements management suite, while Storyteller is a tool that assists in the generation of user stories. Blueprint's primary selling point is that it facilitates collaboration and communication around a requirement or set of requirements while maintaining traceability and a complete audit trail. In particular, Blueprint can be fully synchronized with external tools so that communication can continue across any platform. Storyteller's main feature is the ability to automatically generate user stories from a requirements model. Content accelerators are available that provide pre-packaged libraries of regulations and standards that can be used as business rules or non-functional requirements, and an impact analysis tool is available that visually displays the impact of any changes that are made to the model. Blueprint Enterprise supports both Agile and Waterfall environments, but is

particularly suited to assist in the adoption of Agile development across an entire company. It is available both in-cloud and on-premises.

● **CA Agile Requirements Designer.** CA Agile Requirements Designer is a tool for capturing, designing and modelling requirements (or changes thereto) in a flowchart, from which test cases, test scripts and test data are generated automatically. The product provides a simple and reusable approach towards the creation of the tests themselves, which can be run or rerun as test automation artefacts. Furthermore, existing test cases can be folded into the CA Agile Requirements Designer environment and there are specific test case management capabilities built into the product. When generating test cases, the product supports several different types of coverage and will generate the minimum number of test cases needed to provide the coverage requested by the user. The nature of the product means that traceability is preserved between test cases and the requirements that drive those test cases, and similarly, any changes to the requirements will prompt an impact analysis that will create or repair test cases to maintain the same level of coverage. You can import requirements models developed using Visio, BPMN or XPD and the product also integrates with various other tools, including CA Test Data Manager; CA Service Virtualisation, and lifecycle management and test automation frameworks from a variety of suppliers, including both CA and third parties. CA Agile Requirements Designer supports both Agile and Waterfall approaches, has a license based purchase model, and is available on-premises.

● **Cognizant ADPART.** Cognizant ADPART is an automated test case generation tool that is based around a requirements model. ADPART stands for Activity Diagram Path Analysis Regression Testing where the Activity Diagram is a flowchart (the aforementioned requirements model), path analysis applies to test case generation and coverage and regression testing refers to the ability to compare different versions of the same project. The latter allows you to compare versions and automatically detect and highlight any differences. When generating test cases, the product offers options for complete coverage, risk-based coverage and minimum path coverage and will generate the minimal number of tests needed to satisfy the chosen option. Impact analysis is also supported, to assist in change management. Cognizant

ADPART integrates with Atlassian JIRA amongst other third party tools; and Visio and BPMN-based models may be imported. For test data management you can use either Delphix or TDMaxim (a joint Cognizant/Informatica development). It can be licensed as a stand-alone tool, as a part of Cognizant QA Hub Suite, or as part of Cognizant's broader service offering, Cognizant One DevOps. It supports Agile and Waterfall and is currently available as a client/server application.

- **Conformiq Creator and Transformer.** Conformiq Creator is a test generation tool that automatically creates test cases based on a model of the system under test, represented by an activity diagram. This activity diagram may be created either manually or automatically by reverse engineering existing assets such as test cases Gherkin user stories and so on. It can also be synchronized with requirements brought in from third party requirements management products or via BPMN-based models. When generating tests, you can select from a variety of coverage options. The tests generated by Conformiq Creator can then be exported to and executed in either Conformiq Transformer, a test execution framework, or other third party test frameworks. Conformiq's stand-out feature is its extensive support for third party testing and development environments and associated products. Conformiq supports both Agile and Waterfall development and is available either on-premises or in-cloud via Conformiq Grid, a cloud-based offering that runs across multiple CPUs to support test generation in Conformiq Creator. Conformiq Grid moves test generation into the cloud while providing significant performance advantages for complex models.

- **Hexawise.** Hexawise is, in principle, a pairwise testing tool. However, it has much broader capabilities than just pairwise testing, including capabilities such as constraining inputs, analysing testing coverage, ensuring coverage of additional required scenarios, supporting requirements traceability, generating sets of tests for different coverage strengths (pairwise, every possible "triplet," every possible 4, 5 and 6-way combination), allowing users to generate risk-based test sets, enabling team-wide collaboration, facilitating reuse of data dictionaries and other test assets, and automatically generating not just input combinations but actual test scripts. Hexawise is broadly applicable to almost all kinds of software testing including functional testing, systems integration testing, end-to-end testing, and user acceptance testing. Hexawise is also widely used in both Waterfall and Agile projects and for manual as well as automated testing. It's available in-cloud via a subscription license.

- **Micro Focus Silk Central.** Micro Focus Silk Central Silk Central is a test management suite that centralizes your testing by unifying all of your test assets into a single planning and execution hub. The product can import rich text from a variety of different sources to use as requirements. Several requirements products are supported out of the box and the integration is extensible to include any additional tools that you might be using. These requirements can then be assigned tests and tagged with properties (for instance, high risk) that drive quality goals. It supports the creation of a wide variety of tests, including manual tests, keyword tests and Selenium tests. In addition, manual tests can be automatically converted into keyword scripts. These scripts are driven by Silk Test with test data taken from Excel files via DataExpress. Silk Central will also drive your test execution, allowing you to set up a testing cycle that either runs automated tests or schedules manual ones according to a test plan. It supports both Waterfall and Agile development, can be used for anything from small projects to the enterprise level, and is available on-premises with a server installation and a web-based front-end application.

- **Tricentis Tosca TestSuite.** This is an enterprise-level end-to-end testing suite focused primarily on helping to enable continuous integration and automated testing. Its stand-out features are a comprehensive risk-based approach to test coverage (based on assessments of frequency and severity) and an impressively easy to use and code-free 'module' system for automating tests. We especially like the latter. Although the product is model-based the model is not exposed visually to users. Requirements can be imported from third party environments to generate test cases but requirements are not supported if defined visually as, for example, when using BPMN (business process model and notation) though you can use Conformiq – a partner of Tricentis – if you prefer working with a visual model. While continuous testing has obvious application in agile environments, the product is also suitable for use in supporting waterfall developments. Tosca TestSuite is available both in-cloud and on-premises, and has a license based purchase model.

- **Turnkey Solutions cFactory.** cFactory is an enterprise-level application-aware, script-less automated testing solution. It offers an easy to use and code-free 'component' system for automating tests that uses Turnkey's patented Evergreen Automation to monitor your application and automatically keep your tests and related data up-to-date. Content accelerator packages provide a wealth of pre-built functionality that greatly reduces the number of tests that need to be created, and this number is further reduced by the data-driven nature of cFactory. Test creation and execution rely on HPE Application Lifecycle Management and bi-directional integration with CA Agile Requirements Designer and CA Test Data Manager is also supported. cFactory is suitable for supporting both Agile and Waterfall development projects.

Conclusion

One of the problems with this space is that some tools are as much complementary as they are competitive. And even where they are competitive you may be able to use them in conjunction. For example, Tricentis and Conformiq have a partnership even though they might otherwise appear to offer overlapping capabilities. The same is potentially true of, for example, CA Agile Requirements Designer or Cognizant ADPART and Blueprint. And, of course, Turnkey Solutions specifically resells CA products. The key, therefore, will be to establish your priorities. We believe that the first of these should be automation – and we have focused on that in this report – and the second should be collaboration, enabling business users to work alongside developers and testers. These two factors, to our minds, will be the dominant forces in making testing environments more productive.

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