The Forrester Wave™: Modern Application Functional Test Automation Tools, Q2 2015

by Diego Lo Giudice, April 17, 2015

KEY TAKEAWAYS

Enterprises Have Solid Choices For FTA Solutions

Among the nine FTA solution vendors Forrester evaluated -- Borland, CA Technologies, HP, IBM, Microsoft, Parasoft, SmartBear, TestPlant and Tricentis -- we found two Leaders, and seven Strong Performers.

Faster Delivery Depends On Frictionless Testing

AD&D leaders don't have to choose between speed and quality any more. Agile testing practices used with modern FTA tools enable faster testing without compromising quality. Modern FTA tools enable the shift of test automation focus away from UI and toward API. This increases the amount of automation of overall tests.

Developer And DevOps Focused Testing Solutions Are Key Differentiators

As more digital transformation happens, more systems of engagement are developed and systems of records modernized. Those that tightly link business, testing, and development; that integrate FTA tools with developers IDEs; that provide full API testability; and enable continuous testing for DevOps will dictate who will lead the pack.

Access The Forrester Wave Model And Schedule An Inquiry For Deeper Insight

Use the detailed Forrester Wave model to view every piece of data used to score the vendors. Access the report online and download the Excel tool using the link in the right-hand column under "Tools & Templates." Schedule an inquiry with the analyst to discuss your specific needs. Alter Forrester's weightings to tailor the model to your specifications.

The Forrester Wave™: Modern Application Functional Test Automation Tools, Q2 2015

Ensure Quality Of Enterprise, Mobile, And Web Applications Without Sacrificing Delivery Speed

by Diego Lo Giudice
with Mike Gualtieri, Kurt Bittner, Randy Heffner, and Sophia Christakis

WHY READ THIS REPORT

Fast application development and delivery (AD&D) is a must. But, so is quality. The growing architectural complexity of modern applications makes functional test automation (FTA) tools an essential component of the application development life cycle. But don't make the mistake of thinking that FTA tools are just about testing user interfaces (UIs). Modern FTA tools must also provide testing of application programming interfaces (APIs). In Forrester's 40-criteria evaluation of FTA vendors, we identified tools from nine vendors: Borland, CA Technologies, HP, IBM, Microsoft, Parasoft, SmartBear, TestPlant and Tricentis. This report details our findings about how well each vendor fulfills our criteria and where they stand in relation to each other to help AD&D professionals select the right FTA tool.

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Notes & Resources

Forrester performed nine lab-based evaluations in January 2015, conducted interviews with 23 referenced clients, and briefed with eight non-Forrester Wave vendors: Cigniti, Grid-Tools, Magenic, Original Software, Qualitia, Sahi Pro, Tech Mahindra, and ThoughtWorks.

Related Research Documents

Brief: Offshore Testing Services Must Reinvent Themselves With Automation

Five Must-Do's For Testing Quality At Speed

The Forrester Wave™: Service Virtualization And Testing Solutions, Q1 2014
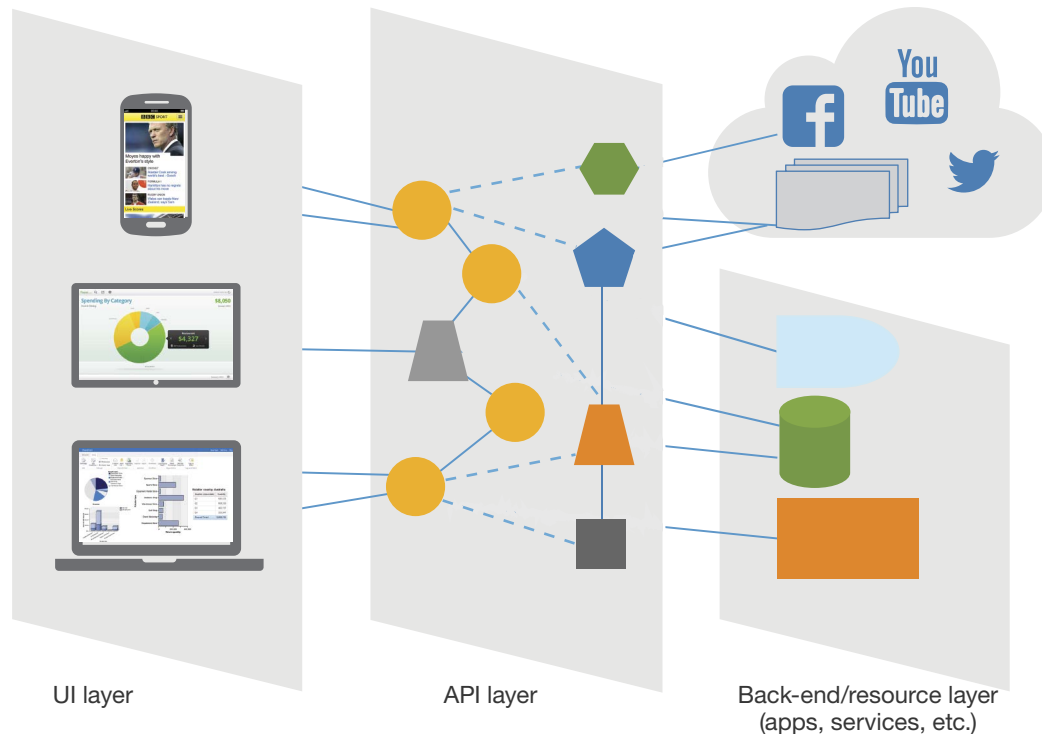
AUTOMATE YOUR FUNCTIONAL TESTS TO GET FASTER

Software delivery is a strategic business enabler, not an operational accessory. It is increasingly a differentiating business asset that must be deployed faster. Conventional wisdom puts quality on a counter-balance with speed, with the assumption that to obtain more quality, more testing needs to be done — leading to longer delivery cycles. A new mindset is needed. Testing must become a practice similar to that of Formula 1 racing teams: Test everything continuously in order to bring pit stop time down to 3 seconds to change four wheels and add fuel![1] Modern functional test automation tools are the application delivery equivalent to achieve faster delivery without sacrificing quality. Forrester defines modern application FTA tools as:

> *Testing software that provides testers and developers with the ability to define an unlimited number of arbitrary test cases for both UI and APIs that can be run continuously throughout the application development lifecycle to minimize business risk.*

Modern Application Delivery Demands Both UI And API Functional Testing

In order to support continuous quality and faster development, especially for those on an Agile and DevOps journey, testing must shift from a UI-only approach to a UI-and-API approach because (see Figure 1):

- **Modern applications are composed with APIs and services.** Modern applications require a layered and decoupled architecture approach where web, mobile, connected devices (IoT), cloud and third-party services impose a multitier architecture.[2] Manual UI tests and UI FTA cannot easily orchestrate tests that need to verify functional paths and back-end APIs and services, some of which might be connected dynamically and not included in the initial planned test cases that are very typical of multitier architectures.

- **Fast feedback loops frequently break UI-only test suites.** Agile development encourages change. When developing in short iterations, the automated UI-based test suites often break as soon as change happens, even for simple graphical user interface (GUI) layout feedback change or unexpected behavior change of the back-end services. Rapid iterations driven by feedback can create a lot of rework, invalidating the dependent automation work, sometimes even when automation is well-designed and traced. Good design depends on the technology and programming languages used, typical job of technical testers and developers. FTA tools have a key role to play as well.

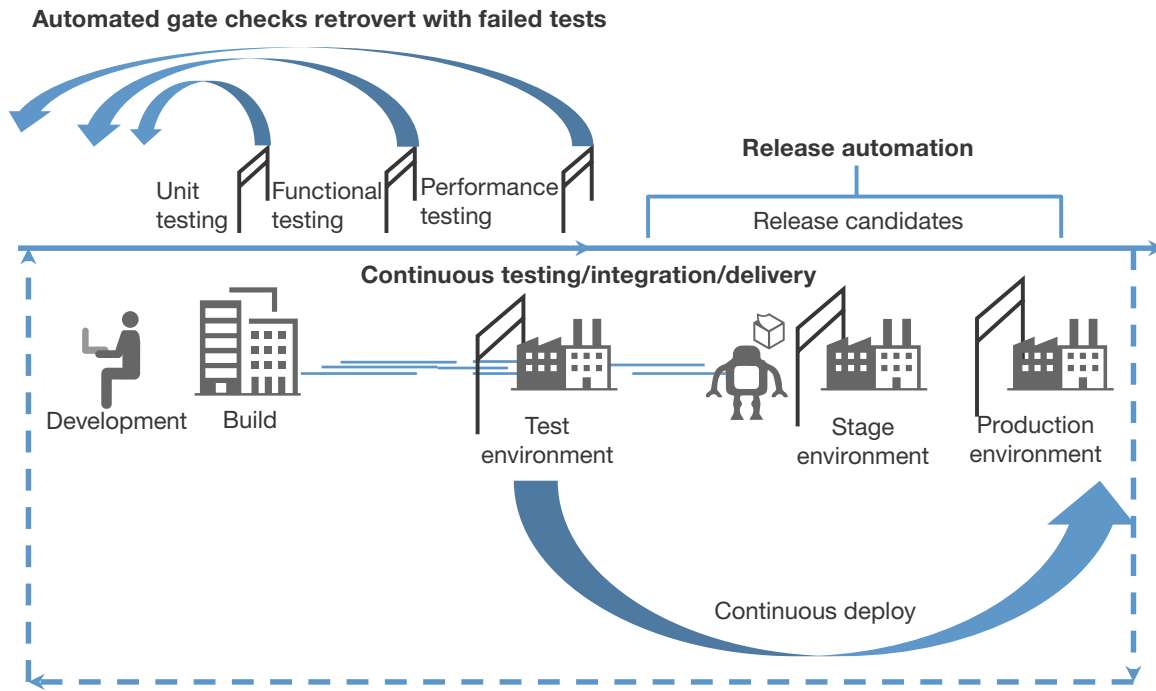*Figure 1* Test Beyond The GUI To Verify And Validate Business And Technical Services

UI layer

API layer

Back-end/resource layer
(apps, services, etc.)

FTA Is An Essential Enabler Of Continuous Delivery

Successful Agile and DevOps teams implement a continuous delivery pipeline to define an automation strategy that executes multiple levels of automation testing. They typically:

- **Target 80% FTA and 20% manual testing.** To reach around 80% of FTA, Agile teams test at the API level. This usually requires a tool that supports API testing and technical skills at the developer level to design and code the tests. Eighty percent is a rule of thumb many experts agree on, which in some cases you might have to increase and in other decrease, there is no predetermined right level and variations depend on the complexity of the automation, the technologies involved, and the costs.

- **Ratchet down UI test automation in favor of API test automation.** Modern applications require a shift of the current 80% UI automation down to 5% to 10% approximately, shifting about 80% of that test automation to be replaced by API test automation. UI test automation will remain slightly higher on simple, well-known user experiences on web apps. The same will be true for mobile testing where finger gestures, resolution, and usability experience might still require a higher UI test automation, on top of API testing.

- **Use exploratory testing to double-check high risk areas.** Manual testing will not and should not go away. Most manual testing will be done in an exploratory testing approach that focuses on high business and technical risk areas. Forrester estimates manual exploratory testing should be contained in the range of 5% to 10% of overall testing and FTA tools should provide specific features to enable and encourage exploratory testing.

- **Automate 100% regressed user acceptance testing (UAT).** Once business has manually tested their UAT the first time, these tests become candidate regression UAT tests that can be fully automated so that business users can focus on testing in each iteration the newly developed features and not the old ones over and over.

- **Automate most non-functional testing.** Automation should not be limited to unit and functional testing but should also be extended to integration testing, which is now enabled through new testing simulation tools Forrester calls service virtualization and testing (SVT). Thanks to SVT and API testing more performance and load testing can be automated too.[3]

- **Integrate FTA into the continuous delivery pipeline.** Automation is not the only goal. Faster delivery is also essential. Teams need to integrate unit test automation, as well as the FTA and any non-functional test automation, with continuous integration (CI) servers so that all testing can be performed automatically every time code is committed and built (see Figure 2). When the tests fail, the CI tools will automatically revert failed tests back to developers to be resolved. If they all pass, the build is automatically promoted to the next stage.

Figure 2 Automate Functional Test Automation With Continuous Integration

Automated gate checks retrovert with failed tests

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Market Overview: FTA Tools Can Be Integrated With Complementary Solutions

Testing is going from a phased approach with UI automation testing primarily, to an activity-based approach with API automation testing. The tools in the Wave, at varying degrees, are on that journey too. In addition, all of them have added to their existing FTA solution a mobile focus, besides the usual desktop and web. Furthermore, besides the commercial vendors we identified and scored in the Wave evaluation, a broader landscape for FTA tools exists, offering complementary functional automation support. These tools in many cases can actually be integrated with the Forrester Wave solutions, realizing a "one plus one is greater than two" strategy. We categorized these functional test automation tools as:

- **Open source functional testing tools.** Operational support systems (OSSes) in the testing world are highly established and there is no lack of choice.[4] Tools exist in all testing segments from test management to functional test automation to non-functional test automation. However, leveraging open source requires high-technical skills and willingness to fill gaps, to custom glue the OSS tools with existing tool chains, and to be patient with imperfections. Not all organizations have the skills and governance in place to leverage OSS tools.[5]

Specifically in the FTA space, at least two OSS categories dominate. The first category contains cross-browser testing tools like the very popular Selenium and Watir (both based on WebDriver).[6] The less popular, but making some in-roads in the market, Sahi would also fall in this category.[7] The second category is made up of high-level descriptive specification language based tools (or DSLs) that focus on behavior specification and are better known as behavior-driven development (BDD), which have the ambition of providing a requirements testing language for both business and developers. Tools like ThoughtWorks Gauge, a lightweight open source cross platform test automation tool, allow developers to write automation code in their language and integrated development environment (IDE) of choice, providing traceability from one view to the other. Test-driven development (TDD) could not miss the OSS category, with the very popular Cucumber with Gerkhin language being widely accepted in many organizations shifting to Agile testing.[8]

- **Tools that augment and optimize FTA.** These are vendors developing interesting technology for optimization of test cases creation and minimizing automation efforts for non-necessary test cases. Their goal is to help optimize the number of test cases, drastically reducing duplicates, blind roads, and non-business-relevant test cases, but guaranteeing an increase in requirements coverage at the same time! This is a good practice before automation activities take place and helps minimize waste, which is a sane Lean principle.

  Grid-Tools is the vendor worth mentioning in this space. The FTA tool they offer is called Agile Designer, which lets testers build an optimized set of test cases, but also makes sure that if functionality changes, a new set of test cases is created in seconds, retaining 100% coverage. Agile Designer becomes a test automation execution tool when linked to its sister product Javelin-TMX. Three vendors of this FTA Wave, CA Technologies, HP, and Parasoft, integrate Agile Designer to optimize test creation for FTA. Grid-Tools did not make the Forrester Wave since Javelin-TMX was not generally available in time for the Wave cut-off date.

- **Powerful UI-only tools focused on traditional web or packaged apps.** A number of tools were not evaluated in this Forrester Wave because their market focus is not centered on Agile and DevOps, their focus is specifically on packaged apps and systems of record testing, or they simply do not meet the inclusion criteria of the Forrester Wave.

  Original Software commercializes TestDrive, a code-free UI automation for functional and regression testing. This tool is definitely worth considering if you need to automate testing in more traditional environments. Qualitia, a young but cool company, offers an FTA tool (Qualitia) for businesses and testers. Qualitia is an innovative script-less test automation platform for multiple test automation tools and application technologies (e.g., Selenium). Following an object -oriented approach, it provides constructors/actions for every event a test would require to perform. Users simply focus on simulating the workflows using already available events, which is extremely simple and fast. A cool vendor, Applitools, offers a very innovative product that allows automated visual testing only, with sophisticated and flexible handling of visual differences without causing test failures.

MODERN APPLICATION FUNCTIONAL TEST AUTOMATION EVALUATION OVERVIEW

To assess the state of the FTA market and see how the vendors stack up against each other, Forrester evaluated the strengths and weaknesses of top FTA vendors.

Evaluation Criteria Focus On Vendors' Current Offering, Strategy, And Market Presence

After examining past research, user-need assessments, and vendor and expert interviews, we developed a comprehensive set of evaluation criteria. We evaluated vendors against 40 criteria, which we grouped into three high-level buckets:

- **Current offering.** We evaluated each tool's operating environment (including mobile, non-mobile, and browsers), automation creation focusing more on API testing than on GUI, and automation execution within continuous delivery pipelines, integration, and scalability.

- **Strategy.** We reviewed each vendor's strategy to assess how they plan to meet current and near future customer demands for enterprise testing in Agile and DevOps contexts. Core evaluation criteria included product road map, ability to execute, partners and global support.

- **Market presence.** To determine each vendor's market presence we evaluated: installed base, reference accounts, financial strength (including market reach) and pricing strategy.

Evaluated Vendors Offer Varying Degrees Of Automated UI And API Testing

Forrester included nine vendors in the assessment: Borland, CA Technologies, HP, IBM, Microsoft, Parasoft, SmartBear, TestPlant, and Tricentis. Each of these vendors has (see Figure 3):

- **Cross-browser FTA and mobile testing capabilities.** All tools enable functional automation testing across at least three of the popular industry browsers: Internet Explorer, Google Chrome, Firefox, and Safari. Additionally, they can execute automation on mobile iOS, Android and/or Windows phones.

- **Both UI and API FTA capabilities.** One of the crucial aspects we evaluated is the ability of the tools to create and execute API and web services testing, besides support for UI. This would allow testers and developers to test functionality of systems of engagement over distributed architectures where varied services span web, mobile device, third-party services, and cloud.

- **Customer references.** All of the participating modern application delivery FTA vendors provided contact information for at least two customers that agreed to speak to Forrester about their use of the FTA tools.

- **Sparked client inquiries and/or has a tool that put them on Forrester's radar.** Forrester clients often discuss these vendors and platforms through inquiries; alternatively, the vendor may, in Forrester's judgment, warrant inclusion or exclusion in this evaluation because of technology trends or their market presence.

Figure 3 Evaluated Vendors: Vendor Information And Selection Criteria

Vendor	Product	Version
Borland	Silk Mobile	15.5
	Silk Test	15.5
CA Technologies	CA Application Test	8.0
HP	HP Unified Functional Testing	12.02
	HP Business Process Testing	12.02
IBM	IBM Rational Test Workbench	8.6
Microsoft	Visual Studio	2013 Update 4
	Visual Studio Test Professional	2013
	Visual Studio Online	
Parasoft	Parasoft Development Testing Platform	5.1.1
	Parasoft SOA Test	9.8
SmartBear	TestComplete	10.5
	Ready! API	1.1
TestPlant	eggPlant Functional	15
Tricentis	Tosca Testsuit	8.3

Vendor selection criteria

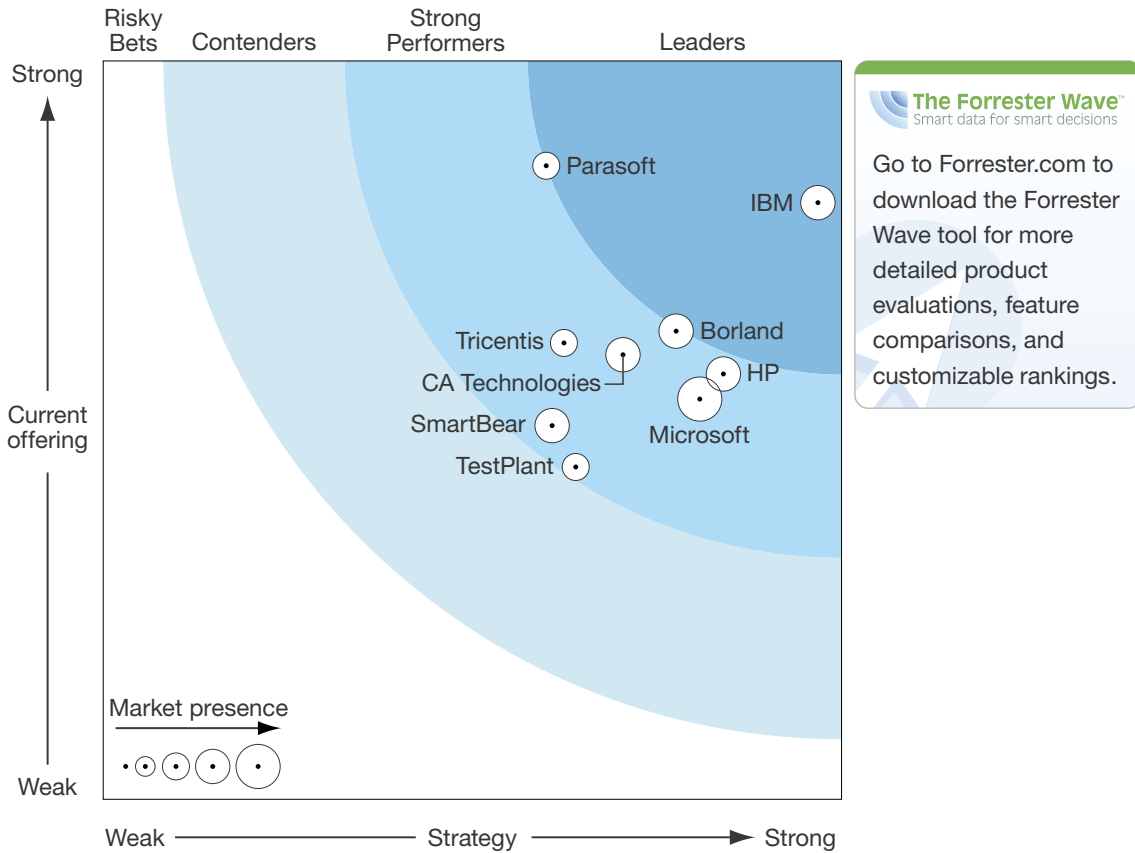| |
|---|
| The solution focus must be on functional test automation over desktops, web, and mobile. |
| The solution must support both the creation and execution of functional tests and of their automation |
| The solution must support testing in a continuous testing environment. |
| The vendor has generated over $10 million in revenue. |
| The tools part of the FTA solution had to be generally available (GA) on December 10, 2014 |

SEASONED TESTING VENDORS LEAD THE PACK, BUT HEAT IS ON BEHIND THEM

The evaluation uncovered a market in which (see Figure 4):

- **IBM and Parasoft lead the pack.** The Leaders in this modern application functional test automation tools Forrester Wave evaluation are IBM and Parasoft. The Leaders have high scores in all the key evaluation areas: operating environments, automation creation, and specifically, API automation testing, automation execution, and integration with life-cycle integration tools. These are mature platforms. The vendors have the resources and vision to take advantage of the increased adoption of FTA in the Agile and DevOps world.

- **Borland, CA Technologies, HP, Microsoft, SmartBear, TestPlant, and Tricentis are Strong Performers with competitive options.** The Strong Performers offer robust testing creation functionality, but a few have weaknesses in the API testing space. Borland is connecting the business tester focus of Silk with the traditional Borland developer focus well; CA Technologies scored well considering that the CA Application Test is a newcomer to the testing market; HP is working hard in the right direction of making a leaner FTA product and moving away from the old QuickTest Professional (QTP); Tricentis has a very strong model-based automation; Microsoft has strong qualities in the .NET world; TestPlant thrives as a UI image testing based tool; and SmartBear is leveraging its strong open source SoapUI solution through the commercial duo of FTA TestComplete and Ready API.

This evaluation of the FTA market is intended to be a starting point only. We encourage clients to view detailed product evaluations and adapt criteria weightings to fit their individual needs through the Forrester Wave Excel-based vendor comparison tool and/or schedule an inquiry.

Figure 4 Forrester Wave™: Modern Application Functional Test Automation, Q2 '15

Figure 4 Forrester Wave™: Modern Application Functional Test Automation, Q2 '15 (Cont.)

	Forrester's weighting	Borland	CA Technologies	HP	IBM	Microsoft	Parasoft	SmartBear	TestPlant	Tricentis
CURRENT OFFERING	50%	3.17	3.01	2.88	4.04	2.71	4.29	2.53	2.25	3.09
Operating environment	10%	3.60	4.00	2.80	5.00	2.50	4.50	2.30	3.70	2.30
Automation creation	40%	3.09	2.65	2.73	4.00	2.43	4.29	2.96	1.59	3.48
Automation execution	25%	3.60	3.50	3.40	4.10	3.30	3.90	1.90	2.40	2.70
Integration	20%	2.65	2.65	2.55	3.80	2.55	5.00	2.95	2.45	3.20
Scalability	5%	3.00	3.00	3.00	3.00	3.00	3.00	1.00	3.00	3.00
STRATEGY	50%	3.88	3.52	4.20	4.84	4.04	3.00	3.04	3.20	3.12
Product road map	30%	3.00	1.00	3.00	5.00	3.00	3.00	3.00	3.00	3.00
Ability to execute	30%	5.00	5.00	5.00	5.00	5.00	3.00	3.00	3.00	3.00
Partners	20%	2.40	3.60	4.00	4.20	3.20	3.00	3.20	4.00	3.60
Global support	20%	5.00	5.00	5.00	5.00	5.00	3.00	3.00	3.00	3.00
MARKET PRESENCE	0%	3.18	3.30	3.30	3.70	4.06	2.36	3.16	2.70	2.58
Installed base/growth	40%	3.00	3.00	3.00	4.00	4.00	2.00	4.00	3.00	3.00
Reference accounts	0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Financial strength	60%	3.30	3.50	3.50	3.50	4.10	2.60	2.60	2.50	2.30
Pricing strategy	0%	2.50	0.50	2.00	3.00	2.00	3.00	0.50	1.50	4.00

All scores are based on a scale of 0 (weak) to 5 (strong).

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VENDOR PROFILES

Leaders

■ **IBM Rational Test Workbench provides industrial strength UI and API test automation.**
IBM's leadership relies on the comprehensiveness of strong features offered in both the UI-based automation features and especially in the API testing space. IBM's commitment to API testing is well-known, given its strong presence in the service virtualization and testing market.[9] It outpaces competition in the number of platforms and browsers test automation can be implemented and executed on, has strong support for APIs automation, test creation, and orchestration executions options. IBM shared a continuous innovation experiment-driven road map approach: data fabrication, impact analysis and test execution optimization, and more extensive dark launching are some of the key focus areas of the Rational Test Workbench product road map.[10]

- **Parasoft's API testing roots and comprehensive integrations pays off.** Parasoft has a very strong product offering. Solid features in UI automation and very comprehensive functional API testing automation features and key integrations with Grid-Tools, version control tools, Agile project management (PM) and test management tools make the solution stand out. Parasoft also scored as a Leader in our qualities criteria for change management and reuse. Parasoft's strong vision on the use of analytics to drive greater testing performance, implemented in its current products and road map, make it a key player in the continuous delivery world allowing developers to promote low-risk, quality-release candidates in delivery pipelines.

Strong Performers

- **HP UFT vision will appeal to developers.** UFT has strong test environment recreation features, reporting/analytics through the integration with Quality Center, and high reuse enablement of test cases and scripts. HP keeps carrying a legacy through its strong captive market presence, which on one side can represent a competitive advantage given the strong client relationships but on the other slows down its innovation road map. HP's vision and three-year road map is anchored on LeanFT, which, if executed in a timely fashion, will appeal to testers and developers. In fact, LeanFT will be the bridge from UFT to the future with increased focus on Agile developers, flexible licensing, better cross-browser testing, mobile testing, and IoT testing as further key elements of the road map.

- **Borland Silk Test gives broad options to developers.** Borland lets developers choose from a broad list of automation languages going from Java, .NET, VB.Net Python, Perl, Ruby and others to create test scripts. Both Eclipse and Microsoft Visual Studio IDE are supported. Strong reporting and analytics are available through its tight integration with Silk Central, but also through Team Foundation Server (TFS) and CI tools. Borland also received top scores for UI automation record and playback features, and has significant coverage of browser technologies and mobile. Future versions of Silk Test will improve test creation through keyword testing and better UAT support by building automation from manual tests.

- **Microsoft focuses on exploratory, user acceptance, and unit testing.** Developers will appreciate Microsoft's smart unit tests generated with IntelliTest to increase code coverage and extensions to support TDD, BDD and code/test refactoring. Microsoft's API testing is focused on web services descriptive language (WSDL) and Windows Communication Foundation. Microsoft scored strong on reuse since it allows reuse at a fine level of granularity and is very comprehensive across GUI test cases, steps, actions, objects, and scripts. Its focus on DevOps allows it to execute diverse sets of tests: unit, Selenium and coded UI, functional non-UI, and load and performance as part of its build/release automation workflow. Microsoft's strategy is focused on mobile-first and cloud-first (soon Microsoft test tools will be fully Azure enabled). New product features will be tested and pivoted as part of Microsoft product innovation cycle, so that when the innovation works it gets productized, if not pivoted.

- **CA Technologies' focus is on automating the automation.** Thanks to a strong integration strategy with CI, DevOps, and other CA Technologies tools, CA Technologies offers an extensive automation platform that allows exceptional test execution orchestration: Selenium GUI automated tests, API automated tests, and manual testing can all be executed in the same automation workflow. CA Application Test is packaged to provide growing functionality; it offers decent functionality to create UI, mobile and APIs, which can be enhanced for speed when used with the rest of the CA Technologies family of tools like CA Continuous Application Insights for example. CA Technologies also integrates and distributes both Datamaker and Agile Designer of Grid-Tools. CA Technologies' product road map will allow it to catch up with the remaining testing tools that have been on the market longer.

- **Tricentis stands out for its model-based test automation.** Tricentis Tosca Testsuite clearly stands out for its model-based automation approach, with strong test automation design capabilities and sophisticated test assets reuse capabilities. In fact, high levels of reuse are guaranteed since the source of the testing truth is kept in one place: a model from where changes can be propagated to all the dependent automation implementations. Tricentis scored high for its Test Case Design capability, and its graphical, wizard-based scripting environment (which is not a programming language) that can be used by technical testers and to some extent by developers. Another unique aspect of Tosca is its risk-based approach, which allows levels of risk to specified by business and applied to all automation scenarios including API testing. TestSuite provides effective built-in wizards for automating synthetic test data generation.

- **SmartBear's Ready API attracts API developers.** SmartBear TestComplete and Ready API together complement each other, with one focusing more on traditional GUI testing and the other offering a lean approach to functional API testing. Ready API appeals to developers in the same way SmartBear's open source API testing tool SoapUI does. It includes more sophisticated, but not over bloated, Service Virtualization features. SmartBear scored quite high for the types of APIs it supports and does a good job in combining manual with automated GUI or automated UI in the same testing workflow. The full integration of TestComplete with Ready API will make more than the sum of the two.

- **TestPlant's UI-image-based testing is cool.** eggPlant has a strong UI testing solution with a unique capability of doing it fully image-based, using also optical character recognition (OCR) technology, and providing enough flexibility in testing UIs that change (test suites do not break at the change of UI layouts and more). TestPlant did not score well in the API testing, which it clearly is not addressing with its own tool, but is delegating to partners. That's where the potential of TestPlant resides! When the application we tested requires it, using it with the right partner tool can complement its weak API focus.

SUPPLEMENTAL MATERIAL

Online Resource

The online version of Figure 4 is an Excel-based vendor comparison tool that provides detailed product evaluations and customizable rankings.

Data Sources Used In This Forrester Wave

Forrester used a combination of three data sources to assess the strengths and weaknesses of each solution:

- **Vendor surveys.** Forrester surveyed vendors on their capabilities as they relate to the evaluation criteria. Once we analyzed the completed vendor surveys, we conducted vendor calls or had email checks where necessary to gather details of vendor qualifications.

- **Hands-on lab evaluations.** Vendors spent a half day with Forrester and performed a hands-on evaluation of the product using a scenario-based testing methodology. We evaluated each product using the same scenario(s), creating a level playing field by evaluating every product on the same criteria.

- **Customer reference calls.** To validate product and vendor qualifications, Forrester also conducted reference calls with at least two of each vendor's current customers.

The Forrester Wave Methodology

We conduct primary research to develop a list of vendors that meet our criteria to be evaluated in this market. From that initial pool of vendors, we then narrow our final list. We choose these vendors based on: 1) product fit; 2) customer success; and 3) Forrester client demand. We eliminate vendors that have limited customer references and products that don't fit the scope of our evaluation.

After examining past research, user need assessments, and vendor and expert interviews, we develop the initial evaluation criteria. To evaluate the vendors and their products against our set of criteria, we gather details of product qualifications through a combination of lab evaluations, questionnaires, demos, and/or discussions with client references. We send evaluations to the vendors for their review, and we adjust the evaluations to provide the most accurate view of vendor offerings and strategies.

We set default weightings to reflect our analysis of the needs of large user companies — and/or other scenarios as outlined in the Forrester Wave document — and then score the vendors based on a clearly defined scale. These default weightings are intended only as a starting point, and we encourage readers to adapt the weightings to fit their individual needs through the Excel-based tool. The final scores generate the graphical depiction of the market based on current offering, strategy, and market presence. Forrester intends to update vendor evaluations regularly as product

capabilities and vendor strategies evolve. For more information on the methodology that every Forrester Wave follows, go to http://www.forrester.com/marketing/policies/forrester-wave-methodology.html.

Integrity Policy

All of Forrester's research, including Waves, is conducted according to our Integrity Policy. For more information, go to http://www.forrester.com/marketing/policies/integrity-policy.html.

ENDNOTES

[1] For more on how to achieve speed with quality, see the "Five Must-Do's For Testing Quality At Speed" Forrester report.

[2] This brief summarizes the trap that many organizations find themselves in — tightly coupled application architectures and accompanying complex processes — and identifies the principles of and first steps toward loosely-coupled application architectures. For more information, see the "Brief: Software Innovation Requires A Loosely-Coupled Application Architecture" Forrester report.

[3] Service virtualization and testing (SVT) solutions provide developers and testers with tools to quickly simulate the services of a complex production environment, mainly for automating regression, integration, and performance tests. In doing so, SVT enables companies to define complex test scenarios, provision more consistent production-like test labs more quickly, and test in fast-paced Agile environments to improve testing speed and product quality. In Forrester's 15-criteria evaluation of service virtualization and testing vendors, we evaluated five solutions. This report details our findings about how well each vendor fulfills our criteria and where they stand in relation to each other to help application development and testing professionals select the right SVT solution. For more information, see the "The Forrester Wave™: Service Virtualization And Testing Solutions, Q1 2014" Forrester report.

[4] As your developers shift to Agile practices, they will invariably perform more testing themselves. So where does that leave your quality assurance (QA) professionals? They need to adapt by getting deeply involved in the daily operations of the development team. These shifts in testing practices also change how development teams select testing tools. This report details how Agile teams are revamping their testing tool strategy to work well in an Agile development context. For more information, see the "Navigating The Agile Testing Tool Landscape" Forrester report.

[5] Open source software (OSS) is increasingly ubiquitous as application development professionals look to trim enterprise software costs while simultaneously creating new, modern applications. OSS seeps into development shops through a variety of channels, whether managers know it or not. Unchecked tactical adoption of OSS creates unmanaged risk and unrealized returns, and application development professionals should not tolerate it when a proactive OSS adoption strategy can increase its benefits. The first step in moving from a tactical mess to a strategic plan is to specify the conditions under which OSS is permissible in your development shop. To learn more, see the "Best Practices: Adopt Open Source Software To Improve Development Effectiveness" Forrester report.

[6] To learn more about Selenium and Watir, visit their website. Source: SeleniumHQ (www.seleniumhq.org).

[7] Sahi Pro is the commercial version of Sahi. Source: Sahi (www.sahipro.com).

[8] To learn more about ThoughtWorks Gauge and Cucumber, visit the following links. Source: ThoughtWorks (www.thoughtworks.com), Gauge (http://getgauge.io), and "cucumber/website," GitHub (https://github.com/cucumber/website).

[9] Service virtualization and testing (SVT) solutions provide developers and testers with tools to quickly simulate the services of a complex production environment, mainly for automating regression, integration, and performance tests. In doing so, SVT enables companies to define complex test scenarios, provision more consistent production-like test labs more quickly, and test in fast-paced Agile environments to improve testing speed and product quality. In Forrester's 15-criteria evaluation of service virtualization and testing vendors, we evaluated five solutions. This report details our findings about how well each vendor fulfills our criteria and where they stand in relation to each other to help application development and testing professionals select the right SVT solution. For more information, see the "The Forrester Wave™: Service Virtualization And Testing Solutions, Q1 2014" Forrester report.

[10] Dark launch is a progressive rollout in production under feature flag, or alternatively pushing to subset of clients by getting them on a certain release node.

About Forrester

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