The Forrester Wave™: Modern Application Functional Test Automation Tools, Q4 2016

The 11 Providers That Matter Most And How They Stack Up

by Diego Lo Giudice

December 5, 2016

Why Read This Report

In our 33-criteria evaluation of functional test automation (FTA) providers, we identified the 11 most significant ones — Conformiq, Hewlett Packard Enterprise (HPE), IBM, LogiGear, Micro Focus, Microsoft, Original Software, Parasoft, SmartBear, TestPlant, and Tricentis — and researched, analyzed, and scored them. This report shows how each provider measures up and helps application development and delivery (AD&D) and software testing professionals make the right choice.

Key Takeaways

Parasoft, IBM, Tricentis, And Hewlett Packard Enterprise Lead The Pack

Forrester's research illuminated a market in which Parasoft, IBM, Tricentis, and HPE lead the pack. Microsoft, Micro Focus, TestPlant, and SmartBear offer competitive options. Conformiq, LogiGear, and Original Software lag behind.

AD&D Pros Are Looking For Ruthless Test Automation

The FTA market is thriving because more AD&D pros see test automation as a way to address one of their top challenges to delivering better software faster. AD&D pros are increasingly adopting Agile, DevOps, and continuous delivery practices to shorten delivery cycles; these techniques require dev teams to reduce manual testing in favor of highly automated tests.

End-To-End Automation And API Testing Are Key Differentiators

As organizations shift to continuous testing, older approaches entirely focused on user interface (UI) testing become less effective. Going beyond the UI and testing APIs is crucial to avoiding brittle test suites and increasing test coverage. AD&D cannot achieve ruthless automation by focusing solely on test execution automation; it also requires automating test design and process orchestration. The vendors that best address all those needs lead the pack.

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by Diego Lo Giudice
with Christopher Mines and Sara Sjoblom
December 5, 2016

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Forrester evaluated the products of 11 vendors and interviewed 36 vendor and user companies. Vendors evaluated include Conformiq, Hewlett Packard Enterprise, IBM, LogiGear, Micro Focus, Microsoft, Original Software, Parasoft, SmartBear, TestPlant, and Tricentis.

Related Research Documents

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

Market Update: Service Virtualization And Testing Solutions

TechRadar™: Continuous Software Delivery, Q3 2016

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Continuous Delivery Needs Continuous Testing

Customer-obsessed organizations are under pressure to innovate quickly, and their software delivery teams feel that pressure every day. In response, AD&D leaders are upgrading their practices and technology by increasingly adopting Agile and DevOps models and delivering software via a continuous delivery (CD) life cycle.[1] In this modern development environment, testing also becomes continuous and pervasive throughout the CD life cycle (see Figure 1). Our Agile adoption research shows that 54% of expert Agile firms — those that are more successful with Agile — use continuous testing, while just 30% of Agile neophytes do.[2] Forrester defines continuous testing as:

> *A core capability in Agile and DevOps where all testing activities run continuously in an integrated fashion with development and delivery. Immediate bug fixing is enabled, test environments are provisioned instantly, and unit, functional, and nonfunctional tests are run in an automated way, orchestrated by continuous integration and continuous delivery tools.*

It's straightforward to see that because continuous integration (CI) and CD are highly automated, continuous testing must be too (see Figure 2).

FIGURE 1 Testing Is Pervasive In The Continuous Delivery Life Cycle

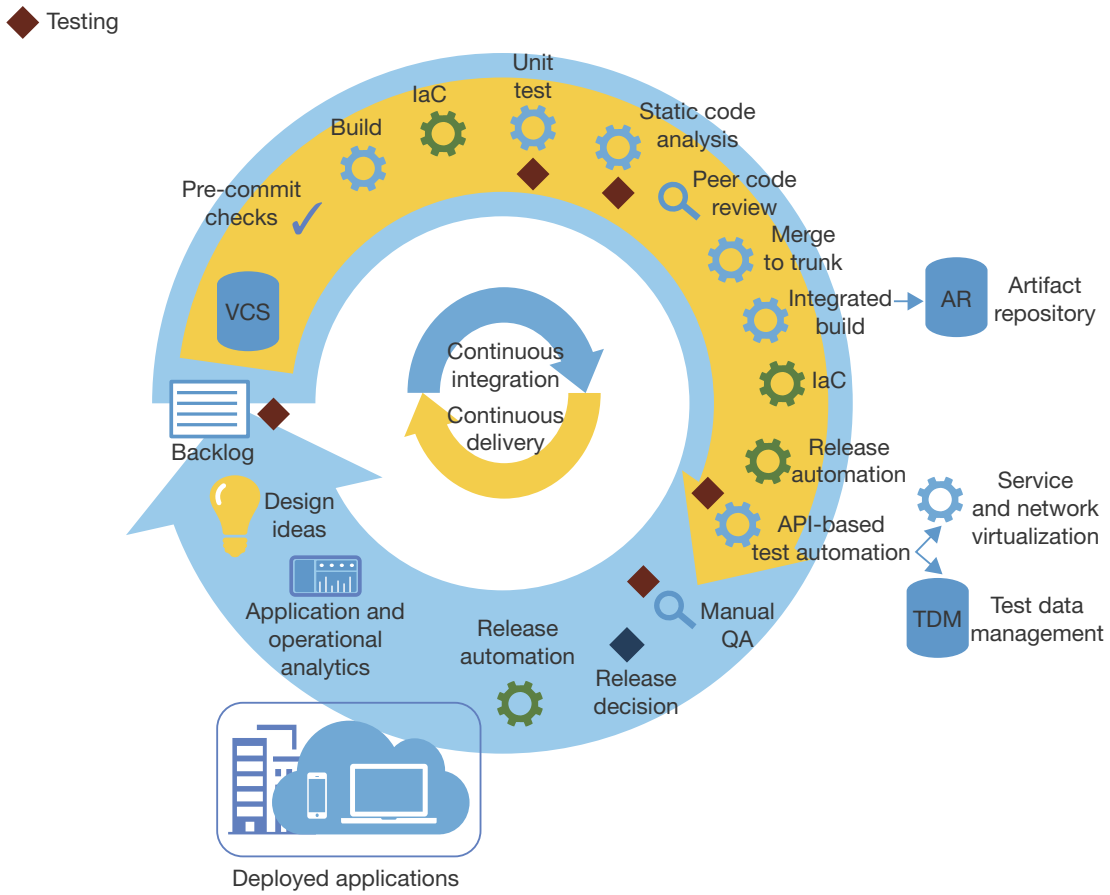
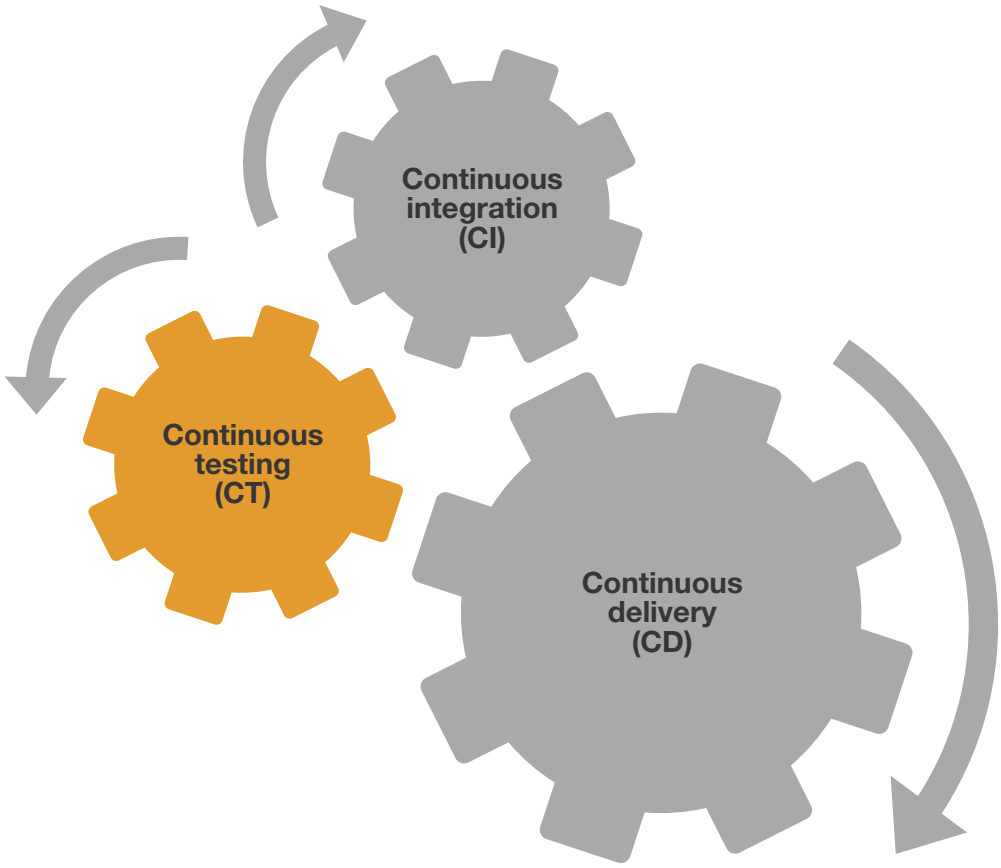


FIGURE 2 Continuous Testing Is The Linchpin Of Automated Continuous Integration And Continuous Delivery



Functional Testers, The Pressure Is On

Functional testing is one of the most crucial, time-consuming, and expensive steps in continuous testing — so it's necessary to automate this testing, and to automate it at higher levels than most Agile teams achieve today. In fact, our Agile survey shows FTA adoption levels between 42% and 45%, and we know that automation is lower in the general development market.[3] On the other side, developers are getting more involved with FTA; 16% say that they use UI and API functional test automation.[4] Too much manual testing or insufficient automation quickly becomes the enemy of continuous delivery as teams struggle to:

› **Find time for manual tests in short delivery cycles.** Ideation, design, development, integration, and testing all need to happen in two weeks or less. So the heat is on testers to reduce the 20% to 30% share of the software development life cycle that testing typically takes up. As a rule of thumb, manual testing should account for less than 20% of the overall testing activity; automated testing should account for more than 80%.

- **Get more quality, not less.** Dev teams are rediscovering service-oriented architectures in the form of microservices and are delivering smaller batches of software that third-party development teams then reuse as services. Any components or services of poor quality will have a ripple effect on all products using them — so automated API testing takes center stage as teams implement functionality and features on microservice architectures.
- **Keep up with modern delivery cadences.** Developers and testers need to keep up with all the automation surrounding them: Builds, integration, and release candidate decisions and deployments are all automated. To keep pace with the rest of the pipeline, firms must automate and optimize functional testing from beginning to end, from the design and automation of test cases to their execution in the overall testing process — all integrated within the broader CI/CD automation process.

Testing Tools Adopt Open Source, Adapt To Agile/DevOps, And Consolidate

As testing processes change due to Agile and DevOps adoption, the market for testing tools will not stand still. Options for open source testing tools are expanding in specific FTA use cases, and FTA vendors are opening up to new opportunities:

- **Cross-browser testing technology is open source.** The testing market is increasingly populated by open source tools that are gaining broad adoption. The most popular open source software tools are Selenium for cross-browser testing and Appium for mobile UI testing.[5] They are attractive to developers because they are de facto standards, they're cheap, and they get the job done. The popularity of these frameworks drives FTA vendors to integrate or base their commercial FTA tools on them.
- **TDD, BDD, and ATDD speak open source too.** Practices like behavior-driven development (BDD) and test-driven development (TDD) are becoming more popular; 16% of our survey respondents use BDD and 39% use TDD.[6] Open source tools like Cucumber/Gherkin and SpecFlow/Gherkin (for .NET) are raising their profile in parallel, driven by the trend of using specification languages that increase collaboration between business testers, expert testers, and developers.[7] As Agile gains traction, acceptance test-driven development (ATDD) practices are getting more popular and Fit/Fitness is becoming the go-to open source tool.
- **Test optimization helps users avoid the "automate everything" syndrome.** While it is important to increase the level of test automation to speed up delivery, dev teams face the risk of trying to automate too much. Automation isn't free; the tools cost money, as do testing pros with automation engineering skills. The goal of test optimization is to reduce test cases while increasing coverage, thereby saving both automation creation and execution time and effort. CA Technologies is working furiously to integrate Agile Requirements Designer into a test optimization solution as part of its CA Application Test FTA tool. However, this solution is still a work in progress, so we did not include CA in this Forrester Wave™ evaluation.

› **Functional automation and load performance testing converges.** Driven by mobile, the internet of things, and the need for speed, dev teams want to use their functional test cases not only for user acceptance testing (UAT) and automated regression testing, but also for testing load performance — and they want do more of it. Performance testing is shifting left, meaning that teams test load performance early and locally so they can fix their designs sooner rather than later. They also want to leverage feedback from monitoring tools so that when alerts happen in production they can feed load performance profiles and create early performance tests. CA Technologies is pursuing this strategy through its recent acquisition of performance testing vendor BlazeMeter; it intends to facilitate the convergence and enable the shift left of performance testing. Convergence is also part of IBM's and HPE's road maps.

Modern Application FTA Tools Evaluation Overview

To assess the state of the modern application FTA market and see how the vendors stack up against each other, Forrester evaluated the strengths and weaknesses of top FTA vendors. After examining past research, user needs assessments, and vendor and expert interviews, we developed a comprehensive set of evaluation criteria. We evaluated vendors against 33 criteria, which we grouped into three high-level buckets:

› **Current offering.** We evaluated each tool's operating environment (including mobile, nonmobile, cloud, and browsers) and its design and execution automation; we placed the heaviest emphasis on API testing, some on UI testing, and to a lesser degree on packaged-app testing. We also evaluated automation execution and orchestration in continuous delivery pipelines, tool qualities, and third-party integrations with nonfunctional testing tools and Agile project management (PM) tools.

› **Strategy.** We reviewed each vendor's product road map to assess how it plans to differentiate its tools in the competitive continuous testing market supporting Agile and DevOps operating models. Other evaluation criteria included pricing strategies, number of partners with deployments in the field, and number of resellers.

› **Market presence.** To determine each vendor's market presence, we evaluated its product revenue, product growth in the past 12 months, and geographic sales reach.

Evaluated Vendors And Inclusion Criteria

Forrester included 11 vendors in the assessment: Conformiq, Hewlett Packard Enterprise, IBM, LogiGear, Micro Focus, Microsoft, Original Software, Parasoft, SmartBear, TestPlant, and Tricentis. Each of these vendors has (see Figure 3):

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

- **UI and API FTA capabilities.** Besides UI automated testing, one of the crucial aspects we evaluated is the ability of the tools to create and execute API and web services testing. This allows testers and developers to test functionality over typical N-tier distributed architectures where varied services span the web, mobile devices, 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 it 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 its market presence.

Besides UI automated testing, one of the crucial aspects we evaluated is the ability of the tools to create and execute API and web services testing.

FIGURE 3 Evaluated Vendors: Product Information And Selection Criteria

Vendor	Product evaluated	Version evaluated
Conformiq	Conformiq 360° Test Automation (Conformiq Creator and Conformiq Transformer)	Conformiq 360° Test Automation (Conformiq Creator 2.2 plus Conformiq Transformer 1.1)
Hewlett Packard Enterprise	Unified Functional Testing (includes LeanFT and BPT)	12.53
IBM	IBM Rational Test Workbench	9.0
LogiGear	TestArchitect	8.2
Micro Focus	Silk 17.0 Testing Suite	Silk Test 17.0 (functional testing) Silk Central 17.0 (test management) Silk Performer 17.0 (performance testing)
Microsoft	Visual Studio Enterprise	Visual Studio SKU
Original Software	TestDrive Suite	V2016
Parasoft	Parasoft SOAtest	9.9.5
SmartBear	TestComplete, TestLeft, TestServer, Ready! API, Cross Browser Testing	TestComplete 12.0 TestLeft 2.0 Ready! API 1.8.5 TestServer 1.8 Cross Browser Testing
TestPlant	eggPlant Functional eggPlant Manager eggCloud	v16.1.2 (eggPlant Functional) v5.12 (eggPlant Manager) v5.12 (eggCloud)
Tricentis	Tricentis Tosca Testsuite	10

Vendor inclusion criteria

The vendor must have a solution for the creation and execution of functional tests.
The vendor sparked client inquiries and/or has a tool that put them on Forrester's radar.
The vendor has generated more than $5 million in revenue from the tool.
The tool part of the functional test automation solution was generally available as of September 9, 2016.

Vendor Profiles

This evaluation of the modern application functional testing automation 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 ` Excel-based vendor comparison tool (see Figure 4).

FIGURE 4 Forrester Wave™: Modern Application Functional Test Automation, Q4 '16

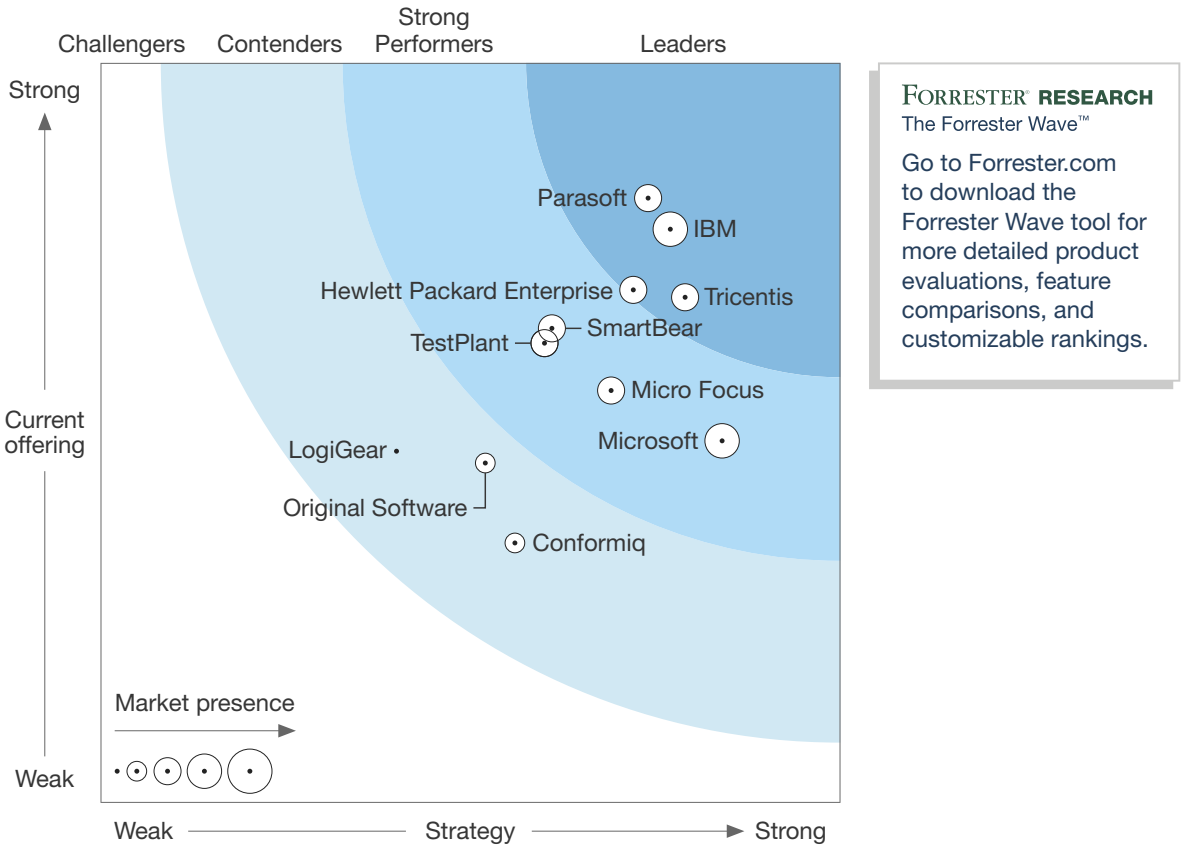


FIGURE 4 Forrester Wave™: Modern Application Functional Test Automation, Q4 '16 (Cont.)

	Forrester's weighting	Conformiq	Hewlett Packard Enterprise	IBM	LogiGear	Micro Focus	Microsoft	Original Software	Parasoft	SmartBear	TestPlant	Tricentis
Current Offering	50%	1.74	3.45	3.86	2.36	2.77	2.43	2.28	4.07	3.19	3.09	3.40
Operating environment	10%	1.30	3.35	3.65	2.65	2.70	1.00	1.00	4.65	3.70	4.30	3.30
GUI automation	10%	1.70	4.65	3.30	3.30	3.70	2.70	3.35	3.30	4.30	4.00	3.30
Test and automation design	15%	3.90	4.10	2.80	1.70	1.00	2.05	1.40	3.70	3.00	3.15	3.15
API test design and automation	20%	1.00	3.50	4.25	1.50	2.75	1.50	1.50	4.50	3.25	1.00	3.75
Packaged application testing	5%	1.00	3.00	3.00	2.00	2.00	1.00	5.00	0.00	0.00	2.00	5.00
Automation execution and continuous testing	20%	0.60	2.20	4.60	3.00	2.60	3.40	3.00	5.00	3.00	4.20	3.00
Qualities	10%	2.50	4.15	3.90	3.75	4.05	3.90	3.50	4.15	3.60	3.15	3.65
Tool integration for end-to-end testing	10%	2.35	3.33	4.34	1.34	4.01	3.34	1.35	4.01	3.33	3.34	3.02
Strategy	50%	2.80	3.60	3.85	2.00	3.45	4.20	2.60	3.70	3.05	3.00	3.95
Product road map	40%	4.00	3.00	4.00	2.00	3.00	3.00	2.00	4.00	2.00	3.00	5.00
Pricing strategy	30%	3.00	3.00	3.00	3.00	5.00	5.00	5.00	5.00	3.00	3.00	3.00
Partner strategy	30%	1.00	5.00	4.50	1.00	2.50	5.00	1.00	2.00	4.50	3.00	3.50
Market Presence	0%	1.80	3.00	3.40	1.00	2.40	3.40	1.80	3.00	2.80	2.80	3.00
Product revenue	40%	1.00	4.00	3.00	1.00	3.00	3.00	1.00	3.00	3.00	3.00	3.00
Product growth	40%	3.00	1.00	3.00	1.00	1.00	3.00	3.00	3.00	3.00	3.00	3.00
Sales reach	20%	1.00	5.00	5.00	1.00	4.00	5.00	1.00	3.00	2.00	2.00	3.00

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

Leaders

› **IBM's Rational Test Workbench (RTW) provides industrial-strength test automation.** IBM's leadership position relies on a comprehensive set of features it offers in the UI-based approach and an even stronger one in API testing. It outpaces the competition in the number of platforms on which teams can execute test automation. RTW also strongly supports API automation across a broad set of protocols and formats and has rich test design creation and programming, test automation reuse, and orchestration execution. It supports developers and specialized testers who build, test, and deploy applications through continuous software delivery pipelines. IBM's product road map includes strengthening the convergence of functional and nonfunctional test automation, providing flexible cloud consumption, and leveraging Watson capabilities to make testing smarter.

IBM recently closed an important strategic product partnership with HCL that transfers the responsibility for developing many its products, including software functional testing tools, to HCL. The success of the deal depends on its execution, but it's undeniable that HCL brings a wealth of testing expertise, a corpus of testing data for Watson-based systems to digest, and a rich portfolio of clients to the table. RTW does have some weaknesses: It lacks cross-browser testing support for devs using Opera, and the continuous feedback loop to leverage monitoring data in tests and vice versa is still manual.

› **Parasoft's focus on developers, API testing, and evolved analytics pays off.** Parasoft has the strongest continuous testing product offering, with a long list of mature features in UI automation and comprehensive functional API testing automation and rich integrations with third-party CI/CD pipeline tools, version control options, integration with Agile PM, and nonfunctional test automation such as integration and security testing. These features plus the solution's performance and service virtualization tools make it stand out. Parasoft's solution also stood out in our assessment of maintenance, reuse, and reporting analytics. The vendor is realizing its vision for using analytics to improve testing performance. Its road map plans to evolve the product to shift testing both left and right and to grow its product API and service virtualization convergence, further enabling FTA beyond the UI. Some Parasoft clients highlighted their satisfaction with not only the technical tool's capabilities and ease of use, but also the vendor's outstanding support.

Parasoft created its product as a testing tool for custom-developed applications. While we see dev teams increasingly using CD practices for packaged apps like SAP or PeopleSoft, Parasoft does not address packaged application testing at all. Another weak area is its low number of service delivery partnerships with large systems integrators.

› **Tricentis' Tosca Testsuite makes automation easy with model-based automation.** Via Tosca Testsuite, Tricentis provides top test automation and optimization design capabilities, test asset reuse, and combined automation. The solution assures a high level of reuse, as it keeps the source of testing truth in one place: a module that can propagate changes to all dependent automation implementations. Tricentis distinguishes itself with a wizard-based, graphical scripting environment

(not a programming language) used by technical testers and to some extent by developers. Tricentis has the ambition to make it easy for manual expert testers to achieve high levels of automation for both UI and API testing. Another unique aspect of Tosca Testsuite is its risk-based approach, which allows the business to specify levels of risk and apply them to all automation scenarios, including API testing. The solution also provides effective built-in wizards for automating synthetic test data generation. The strong points of Tricentis' road map include leveraging artificial intelligence to further design and automate execution and vision testing, provide effortless testing for DevOps and cloud, and right-shift testing with application performance management tools.

Clients praised Tricentis' great service continuity and the productivity benefits of the tool in helping them reach high levels of automation. Among its weaknesses: A rich SDK for testing custom or unknown controls requires training and professional services to automate exceptional or unknown custom cases. Tosca has weak support for continuous and automated feedback loops. While it boasts out-of-the-box integration with GitHub, it offers other version control systems via Tosca Connect, which is powered by a third-party life-cycle integration tool.

› **HPE's UFT and LeanFT address all kinds of test automation needs.** Hewlett Packard Enterprise has realized the goal it had two years ago: to bring a leaner version of Unified Functional Testing (UFT) to market. The result, LeanFT (LFT), has vaulted HPE into a position among the Leaders. LFT features strong object identification, a test object abstraction framework for easy test maintenance, built-in reporting and analytics through integration with ALM Octane, and high reuse enablement of test cases and scripts. It also offers a bridge to Agile developers via more flexible licensing, better cross-browser testing, and Selenium integration. HPE has the double-edged sword of a strong captive market presence; while its strong client relationships provide a competitive advantage, it has also slowed the pace of innovation. Octane ALM, of which both UFT and LFT are a part, is a move to retain existing clients wishing to become more agile with innovative Agile and DevOps products.

UFT, LFT, and Octane are part of the broader business that HPE Software is spinning off and merging with Micro Focus. On paper, that transaction will speed the innovation of HPE's testing products, but Micro Focus has not demonstrated fast execution of its testing product road map. HPE's continuous delivery capabilities will probably benefit from Micro Focus's Serena acquisition. HPE has weak API testing and mediocre coverage of design automation features. One customer lamented the limitations of LFT in running Selenium Grid, as LFT requires installing agent software that prevents a fully automated process.

Strong Performers

› **Microsoft has a broad partner ecosystem; its FTA tools target developers.** Microsoft's Visual Studio SKU Enterprise product is ahead of competitors in partner and pricing strategy. The firm has the broadest reselling and service partner network, and its pricing strategy gets good reviews from customers. From a product offering perspective, developers find an ideal environment to implement TDD, BDD, and code/test refactoring. Microsoft allows the reuse of tests at a fine

level of granularity and is very comprehensive across GUI test cases, steps, actions, objects, and scripts. Testers can also reuse scripts and code unchanged for load performance testing and run the FTA tool on Microsoft's Azure cloud platform. Going forward, Microsoft intends to implement the notion of machine pools to improve parallel and distributed test executions and optimize the DevOps workflow.

Microsoft's API testing focuses exclusively on web services descriptive language and SOAP, which presents a limitation for enterprises with more heterogeneity. Other weaknesses in our evaluation — limited cross-browser testing and poor design automation — are due to the restricted Windows-only platform for all of its products.

› **Micro Focus Silk Test offers rich options to expert testers and developers.** Micro Focus lets developers choose from a broad list of automation languages to create test scripts. Both business testers and testing experts can use a rich keyword scripting environment. Strong reporting and analytics are available through its tight integration with Silk Central, integration with Agile PM tools, and out-of-the-box integration with Jenkins and Atlassian Bamboo CI tools. These make Silk Test among the best choices for integration. Micro Focus is ahead of the competition in terms of its ability to test unknown or custom UI controls for UI automation. Silk's framework version was highly praised by a customer as being an open framework with great programmability, easily leveraged to build comprehensive FTA accelerators.

Micro Focus is executing a very ambitious acquisition strategy, announcing the acquisition of HPE's software division, including its testing tools portfolio. The recent acquisition of Serena also strengthens its DevOps story for continuous delivery. Increasing the focus on mobile, moving to open source (Selenium and Appium), and converging functional and nonfunctional testing are all parts of Micro Focus's future initiatives. We found weaknesses in the design and optimization automation features, the number of API types supported, and support for TDD/BDD testing frameworks in an Agile/DevOps context.

› **SmartBear's FTA family strengthens UI automation while keeping a strong API focus.** SmartBear stretches beyond API testing to offer more and better UI capabilities. In addition to TestComplete and Ready! API, SmartBear now offers TestLeft, TestServer, and cross-browser testing. The tools in the suite complement each other by addressing both business and developer personas in the test automation world. Ready! API appeals to developers and includes service virtualization features. Compatibility with both Selenium and Appium frameworks increases its focus on open source. SmartBear performs well in terms of the extended types of APIs it supports, and its addition of protocols is a welcome change to the prior strategy of focusing only on the SOAP/REST market. The tools do a good job of combining manual and automated UI and different API types in the same testing workflow. Future enhancements will focus on increasing the level of integration of cross-browser testing with UI and API testing tools to create a seamless end-to-end test environment.

The road map SmartBear provided is unambitious; if it stays as is, the vendor's product positioning will not remain competitive. Other weaknesses: Neither the tool nor test automations can easily run on most popular clouds; the tool has minimal design automation capabilities; and the vendor has a limited global field sales structure.

› **TestPlant's image-based testing performs also on non-standard platforms.** eggPlant has a strong UI testing solution with a unique image-based approach using optical character recognition technology; it is quite accurate and sophisticated at catching false positives. For example, the image-based approach allows retail firms to test apps running on specific hardware such as point-of-sale devices. TestPlant has very effective UI extensibility, enabling testers to work on personalized and unknown UI controls efficiently. It also features feedback from production, which partners have successfully used to enable a feedback loop — a key feature in modern CD capabilities. It also performed well for BDD and TDD testing. TestPlant provides API testing through partners or third-party tools, as it focuses specifically on nondevelopers. TestPlant's product road map has three major directions: Become a universal tool suite; improve the productivity of test operations and management; and enable teams to easily achieve desired results with good tests.

While TestPlant intentionally does not provide API testing capabilities, Forrester thinks that this a weak point; it constrains developers by not giving them the chance to switch and combine testing approaches, such as UI and API, in a nice, tightly integrated environment. A consequence of this weakness is that the vendor does not support quick API test automation builds starting from web or API interface descriptions.

Contenders

› **LogiGear's TestArchitect offers a powerful action-based language for test automation.** LogiGear has some enthusiastic clients that enjoy the vendor's customer support and the flexibility and power of TestArchitect's user action keyword language. The solution appeals mostly to expert testers, and to some extent to developers, and has leading functionality for reusing test assets, both within and across teams. LogiGear is above average in most of our criteria, except for API testing, which is on its road map to attract more developers to the tool.

LogiGear's weaknesses are a lack of test design automation and optimization, inability to enable API testing for functional testing, lack of third-party version control integration, and a limited partner strategy with service companies and resellers.

› **Original Software's TestDrive appeals to packaged app testers for functional UAT.** Focused on packaged software, TestDrive is strong in enabling functional UAT for business testers across a number of packages including SAP's R3, Hana, and Fiori; Oracle's business apps; and Salesforce. TestDrive offers a scriptless UI record and replay for business testers that perform UAT mostly via UI-led and test data-driven tests. Given its scriptless approach, the tool is often the only solution possible in some niche or nonstandard application environments. Original Software plans to work on increasing user experience effectiveness.

Original Software's strength in the packaged world and deliberate focus on business testers does not offset its weakness in providing any tools that appeal to developers or supporting efficient CD pipelines, where UAT is also a "continuous must."

› **Conformiq provides pure model-based requirements-driven testing.** Conformiq has a head start on most other vendors in automated test design through its graphical model-based test generation. It offers distinct capabilities for testers to capture requirements and generate tests from graphical models in Conformiq Creator and then automate and execute these tests either with Conformiq Transformer (which is primarily based on Selenium) or with third-party test automation execution tools. The tool also provides strong features to import from requirements or existing tests or to construct models from test plans written in external tools like HP ALM and CA Agile Center and from Gherkin feature files. The tool then converts these into its model-based language and integrates them after test generation with test execution automation tools.

Conformiq's notable strength — its focus on test design automation — is also its weakness when it comes to functional test execution. Most of the other weaknesses we found stem from this root cause. Conformiq focuses on improving, not replacing, execution tools. Having its automation execution engine based primarily on Selenium, for example, limits its execution capabilities and in general impedes a tight integration between the design and execution automation environment. This in turn inhibits tight collaboration between business testers and developers and segregates the two phases of test design creation and test execution automation (e.g., not enabling an effective environment for developers to re-create bugs).

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 four data sources to assess the strengths and weaknesses of each solution. We evaluated the vendors participating in this Forrester Wave, in part, using materials that they provided to us by September 2016.

- **Executive strategy briefings.** We asked vendors to conduct a strategy briefing with executives to collect company strategy and positioning information. We used the information in the briefings to provide insight on the vendor's product background, positioning, value proposition, customer base, and strategic vision.

- **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 where necessary to gather details of vendor qualifications.
- **Product demos.** We asked vendors to conduct demonstrations of their products' functionality. We used findings from these product demos to validate details of each vendor's product capabilities.
- **Customer reference calls and surveys.** To validate product and vendor qualifications, Forrester also conducted reference calls or surveys with two of each vendor's current customers.

Survey Methodology

Forrester's Global Business Technographics® Developer Survey, 2016, was fielded in January 2016. This online survey included 1,867 respondents in Australia, Brazil, Canada, China, France, Germany, India, New Zealand, the UK, and the US.

Forrester's Business Technographics ensures that the final survey population contains only those with significant involvement in the planning, funding, and purchasing of business and technology products and services. ResearchNow fielded this survey on behalf of Forrester. Survey respondent incentives include points redeemable for gift certificates.

Please note that the brand questions included in this survey should not be used to measure market share. The purpose of Forrester's Business Technographics brand questions is to show usage of a brand by a specific target audience at one point in time.

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 do not fit the scope of our evaluation.

After examining past research, user need assessments, any 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 evaluation — and then score the vendors based on a clearly defined scale. We intend these default weightings to serve only as a starting point and 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

We conduct all our research, including Forrester Wave evaluations, in accordance with our Integrity Policy. For more information, go to http://www.forrester.com/marketing/policies/integrity-policy.html.

Endnotes

[1] Continuous delivery technologies are on the high success curve adoption; see the Forrester report "TechRadar™: Continuous Software Delivery, Q3 2016."

[2] For more information, see the Forrester report "Agile Experts Focus On Downstream Delivery."

[3] Source: Forrester's Q2 2015 Global Agile Software Application Development Online Survey.

[4] Source: Forrester's Global Business Technographics Developer Survey, 2016.

[5] For more information, see the Forrester report "The Forrester Wave™: Mobile Front-End Test Automation Tools, Q2 2016."

[6] Source: Forrester's Q2 2015 Global Agile Software Application Development Online Survey.

[7] Source: Forrester's Q2 2015 Global Agile Software Application Development Online Survey.

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