



Technology Group

# Automated Software Testing

MARKET OVERVIEW Q4 2022



**Houlihan Lokey**

# Automated Software Testing Market Overview

Dear Clients and Friends,

Houlihan Lokey is pleased to present its Automated Software Testing Market Overview. Our team is keenly aware of the rising demand for automated and AI-augmented testing solutions and has pulled together materials that provide a broad overview of the software testing sector, including key trends, constituents, and investment activity.

We hope you find the materials informative and helpful in monitoring this continually evolving market.

## Market Activity

- Strong M&A activity in the continuous software testing market:
  - **API Testing:** SmartBear/PactFlow (Apr-22) and Sauce Labs/API Fortress (Dec-20).
  - **Web/Cross-Browser Testing:** BrowserStack/Nightwatch.js (Dec-21) and Keysight Technologies/Eggplant (Jun-20).
  - **Mobile Testing:** Worksoft/eureQa (May-22) and Kobiton/Mobile Labs (Nov-20).
  - **UI/Visual Testing:** Thoma Bravo/AppIttools (Mar-21) and Tricentis/testIM (Feb-22).
  - **Error Reporting:** Sauce Labs/Backtrace (Jul-21).
  - **Load Testing:** Perforce/Blazemeter (Sep-21) and Tricentis/Neotys (Mar-21).
  - **Low-Code Testing:** Sauce Labs/AutonomiQ (Feb-21).
- **Private equity involvement:** Private equity engagement in the space led by Accel, Francisco Partners, Insight Partners, TPG, and Vista Equity Partners.
  - Strong capital raise activity in the space with approximately **\$2B raised in 2021** and **\$1.3M raised in 2022**.
  - Notable capital raises include Advent International and General Catalyst's **\$412M investment** in Sonar, K1 Capital's **\$350M investment** in Cyara, and Bond Capital's **\$200M investment** in BrowserStack.
- DevOps leaders such as **Atlassian** (Percept.AI, Mindville), **Microsoft/GitLab** (Opstrace, Unreview), **JFrog** (Upswift, Vdoo), **Progress** (Kemp), **Digital.ai** (Experitest), **Cloudbees** (InfraDNA), **IBM** (Greenhat, Telelogic), and **ServiceNow** (DotWalk, Gekkobrain) have been active in adding new capabilities and supplementing existing ones via acquisition and may play a **major role in future consolidation** of the testing sector.

Regards,



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# Executive Summary

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## General Overview

- **Legacy software testing** solutions have acted as a key **bottleneck in the software development lifecycle (SDLC)**.
- **Increased release velocity of software** has led to the **need for continuous testing**, which transcends the CI/CD process and spans the SDLC.
- The **complexity and cumbersome nature** of today's testing demands are **driving adoption of third-party vendor solutions**.
- The **broader software test market is \$30B today**, with third-party automated vendors projected to increase market share over time from ~20% today.
- **The continuous testing market is fragmented** with many best-of-breed point solutions, but **few full-suite testing platforms exist**.

## Outlook

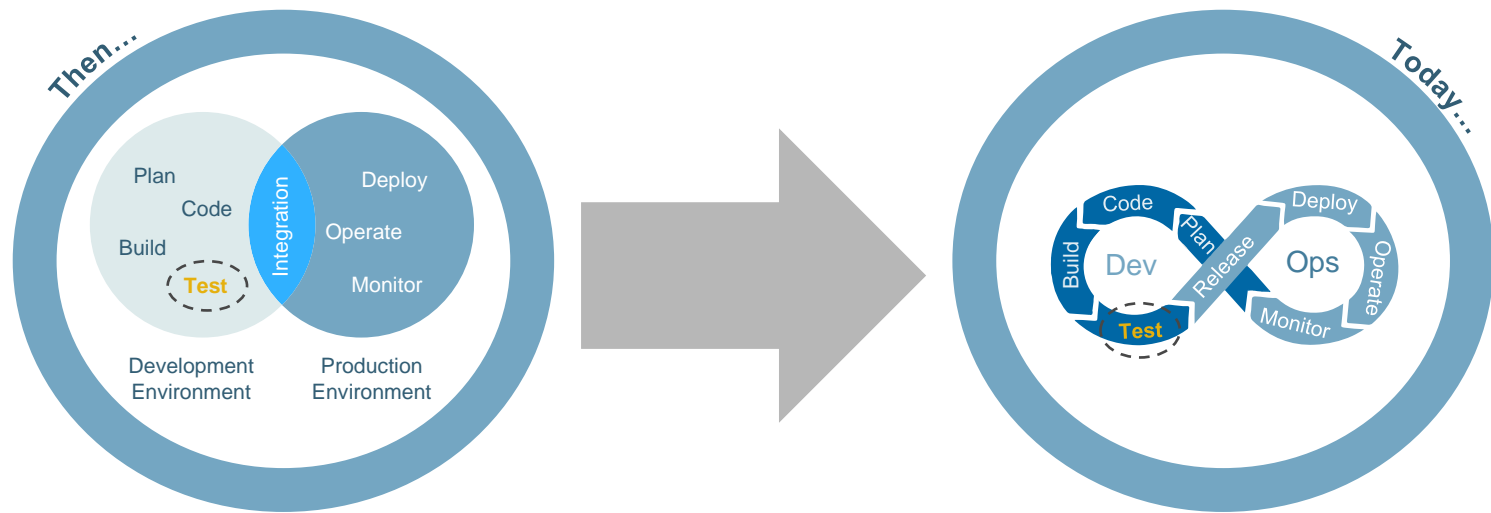
- Sector consolidation by financial backers and strategics will lead to **more comprehensive testing platform solutions**.
- Migration from **open-source/DIY automated testing and outsourced manual testing to third-party solutions** is still in its **early stages**.
- The future of software testing will focus on **leveraging AI/ML frameworks** to perform **automated and customizable testing**.
- The **lines between the traditional testing universe and adjacencies** like security testing will become **increasingly blurred**.

# Legacy Testing Solutions Remain a Bottleneck for Automation

The rapid adoption of DevOps in recent years has exponentially increased software release velocity and caused historical software testing (predominantly manual) approaches to become outdated.

Previously, software release cycles were fragmented, with developers functionally separate from IT professionals.

Today, DevOps is an integrated, collaborative approach, enabling faster time to market, more automation, and an ability to build, test, deploy, and secure applications at every stage of the lifecycle.

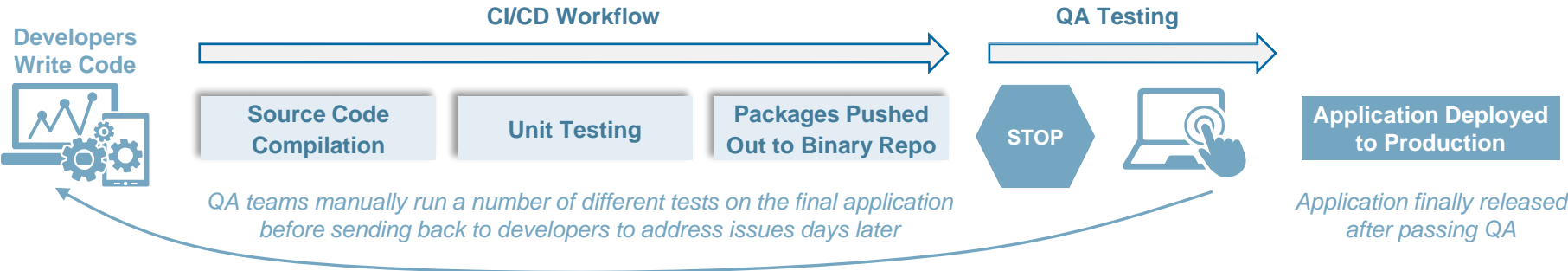


“ For the third year in a row, respondents pointed to testing as the primary reason for release delays. ”

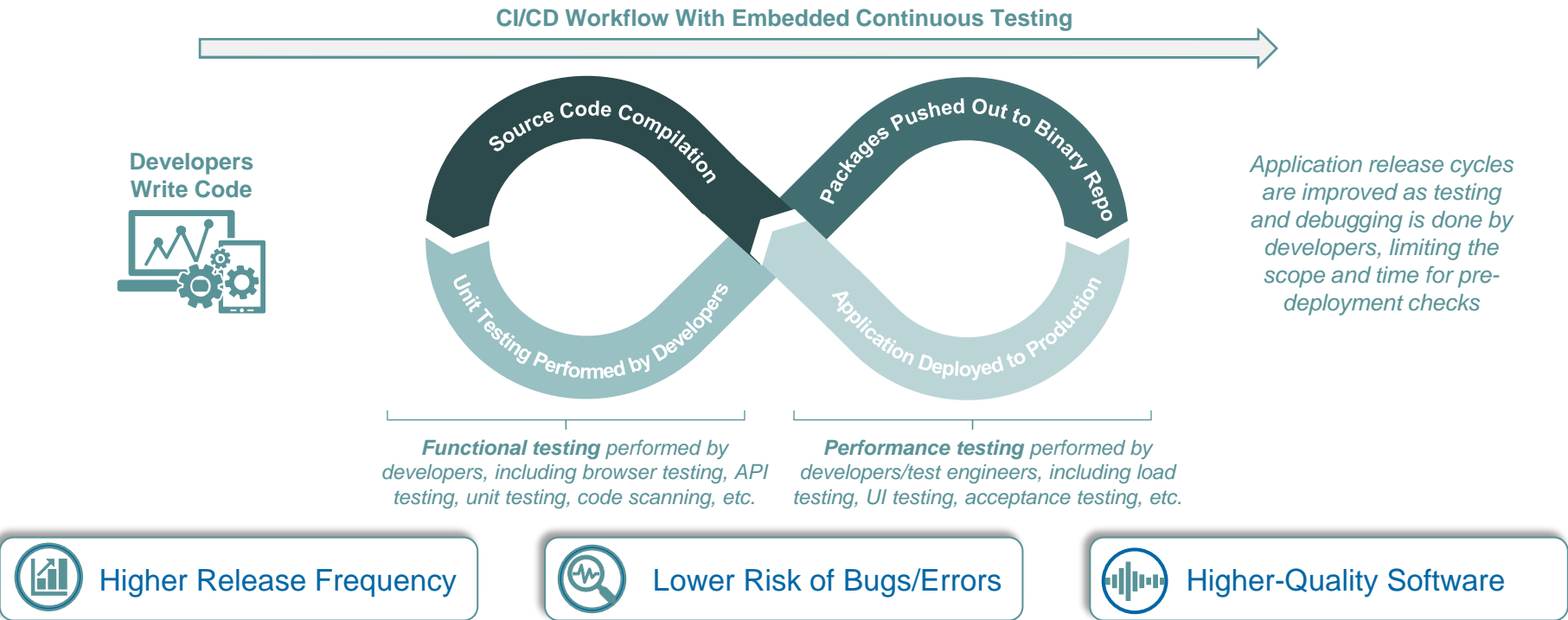
—Gitlab 2021 Global Survey Results

# From Traditional to Continuous

## Traditional Approach: Bespoke, Manual Solutions Designed for a Specific Application and Environment



## Continuous Approach: Continuous, Automated Solutions That Span the SDLC



Source: Wall Street Research.

# From Manual to Automated

Migration to continuous, automated solutions is still in the early innings, with adoption requiring cultural and process changes from developers and organizations alike.

	Manual Solutions		Automated Solutions	
	(In-House or Third-Party)		Open-Source/DIY	Third-Party Automated Vendor
<b>Description</b>	<ul style="list-style-type: none"> <li>Individual testing in a legacy waterfall/ sequential approach.</li> </ul>		<ul style="list-style-type: none"> <li>In-house testing typically utilized due to resource constraints.</li> </ul>	<ul style="list-style-type: none"> <li>Individual teams use third-party SaaS tooling.</li> </ul>
<b>Typical End User</b>	<ul style="list-style-type: none"> <li>Companies in the early stages of their digital transformation journeys where the pace of software release/development is slower/less modern (e.g., no agile/DevOps).</li> </ul>		<ul style="list-style-type: none"> <li>Resource-strapped, nontech organizations with a limited digital footprint.</li> <li>Smaller organizations.</li> </ul>	<ul style="list-style-type: none"> <li>Tech-forward agile organizations that emphasize development velocity.</li> </ul>
<b>Key Benefits</b>	<ul style="list-style-type: none"> <li>Suited for companies in the early stages of their DevOps transformation, as manual testing requires lower complexity and less domain expertise to set up.</li> <li>Effective for complex corner cases where it may be difficult to write automation scripts.</li> </ul>		<ul style="list-style-type: none"> <li>Has value for light testing when scalability is not a key focus.</li> <li>In-house testing infrastructure strategically compliments companies for which software is a core competency.</li> </ul>	<ul style="list-style-type: none"> <li>Highly scalable as customers can spin up resources on demand.</li> <li>Easy to use (dashboards, logs, other metadata).</li> <li>Integrates into CI/CD pipeline.</li> <li>Greater device, browser, and OS coverage (e.g., legacy browsers).</li> </ul>
<b>Key Considerations</b>	<ul style="list-style-type: none"> <li>Can slow down release cycles/velocity of software development.</li> <li>More expensive than automated testing (since it requires repetitive manual human validation).</li> <li>Requires physical devices.</li> </ul>		<ul style="list-style-type: none"> <li>Continuous maintenance costs associated with managing grids/updates.</li> <li>Requires more technically proficient employees.</li> <li>Requires a physical or virtual copy of every device model or browser drivers.</li> </ul>	<ul style="list-style-type: none"> <li>Customer sensitivities around back-end security.</li> <li>Still requires some technical in-house expertise.</li> </ul>
<b>Deployment Ease</b>				
<b>Scalability</b>				
<b>In-House Expertise Need</b>				
<b>Share of Overall Testing Market</b>	~40%		~40%	~20%

Sources: Wall Street Research, market research, EY-P, LEK.

# Open-Source/DIY Automated Solutions Have Limitations

The surging complexity and scale of testing functions have increased the time and effort to use open-source/DIY automated solutions.

## Open-Source/DIY Automated Frameworks Have Limitations Compared to Third-Party Automated Alternatives



Expensive to Maintain



Unable to Scale Across Development Teams



Often Unstable



Minimal Support

- Many third-party vendors sell management and automation tools for these frameworks, with the frameworks themselves serving as lead generation sources for these testing vendors.

## Selected Key Open Source Frameworks

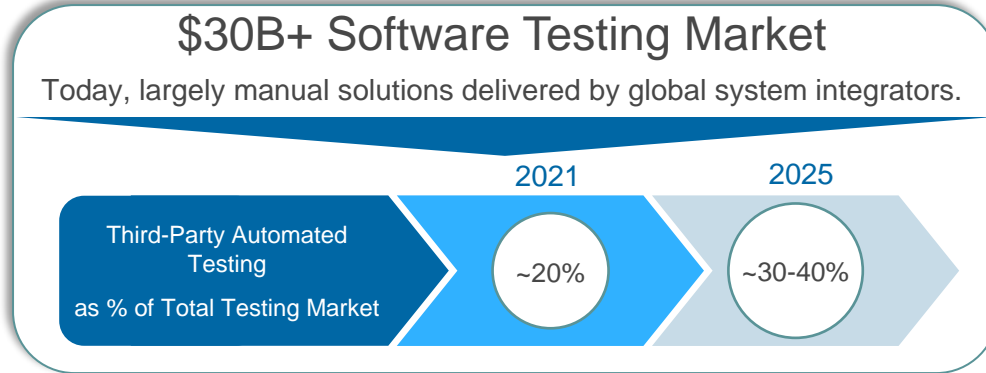


# Third-Party Automated Vendors Projected to Gain Market Share

The larger testing market is ripe for disruption as continuous testing platforms leverage AI/ML to replicate highly manual testing processes and functions.

## Market Size

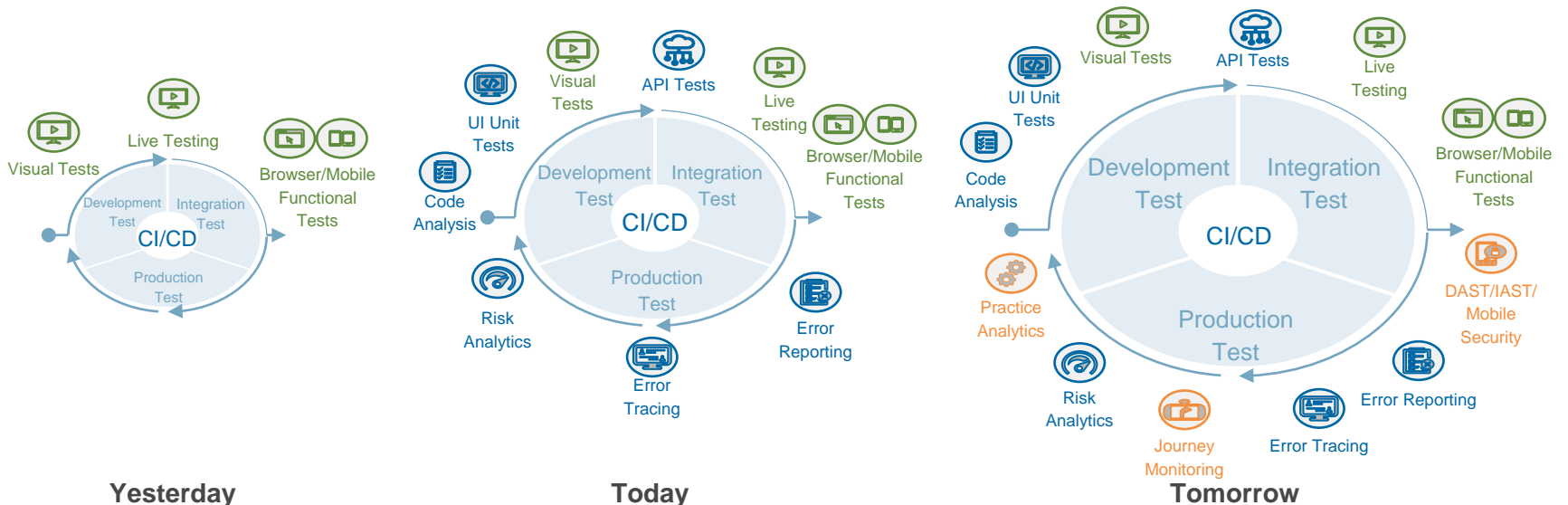
(\$ in billions)



## Trends Driving Increasing Market Share of Continuous, Automated Solutions:

- Increasing number of developers/testers.
- Increasing penetration of commercial third-party tools.
- Increasing number of tools per user.
- Increasing spend per tool.

## Continually Expanding Addressable Market for Continuous, Automated Software Testing





# Trends Driving Continuous Testing Adoption

<b>Software Dependence</b>	<ul style="list-style-type: none"><li>▪ <b>Software is everywhere</b> and the world <b>relies on code</b>, with an increasing number of web and mobile apps emerging.</li><li>▪ Broader <b>digital transformation initiatives</b> have <b>increased developer count</b> at nontech companies, bolstering the broader developer tools market, which now includes testing.</li><li>▪ Growth supported by <b>open standards and components</b>, widely available <b>development resources</b>, and seamless multi-device/connected experiences.</li></ul>
<b>Release Velocity</b>	<ul style="list-style-type: none"><li>▪ Legacy testing solutions <b>remain a key bottleneck</b> and can lead to <b>slow iteration and infrequent releases</b>.</li><li>▪ The desire to <b>continuously deliver better</b> products and rapidly respond to market demand has led to <b>more frequent application updates</b>.</li></ul>
<b>Shift Left/Right</b>	<ul style="list-style-type: none"><li>▪ Testing has <b>shifted left and right</b> in the SDLC toward both <b>developer and product manager</b> functions.</li><li>▪ <b>New frameworks and tools</b> are emerging with testing now considered <b>part of the larger observability and customer experience monitoring</b> markets.</li></ul>
<b>Complexity</b>	<ul style="list-style-type: none"><li>▪ With <b>exponentially more software changes</b> and the <b>expansion of the digital experience</b>, the <b>complexity and number of scenarios</b> to be tested has skyrocketed.</li><li>▪ <b>Increased device diversification</b> and <b>OS/browser fragmentation</b> is driving the need to ensure the <b>functionality</b> of applications <b>across a range of environments</b>.</li><li>▪ Increasing complexity has <b>shifted customers away from in-house, manual tests</b>.</li></ul>
<b>Cost</b>	<ul style="list-style-type: none"><li>▪ Customers expect <b>flawless application behavior</b> with poor experiences leading to <b>lost customers and revenue</b>.</li><li>▪ Significant <b>development and maintenance cost savings</b> associated with automating the <b>manual and cumbersome legacy testing</b> process.</li><li>▪ Escaped bugs can be up to <b>100x more expensive to fix than those caught early</b>.</li></ul>

## Adoption Leads to Benefits at Every Level

### Large Infra/Broader DevOps



Predictable Revenue and Profitability



Business Continuity



Competitive Differentiation

### Technology and B.U. Owners



Reduced Time to Market



Quality and Observability



CI/CD Integration

### Practitioners



Velocity



Coverage and Flexibility



Automation

# Continuous Testing Landscape by Testing Competencies

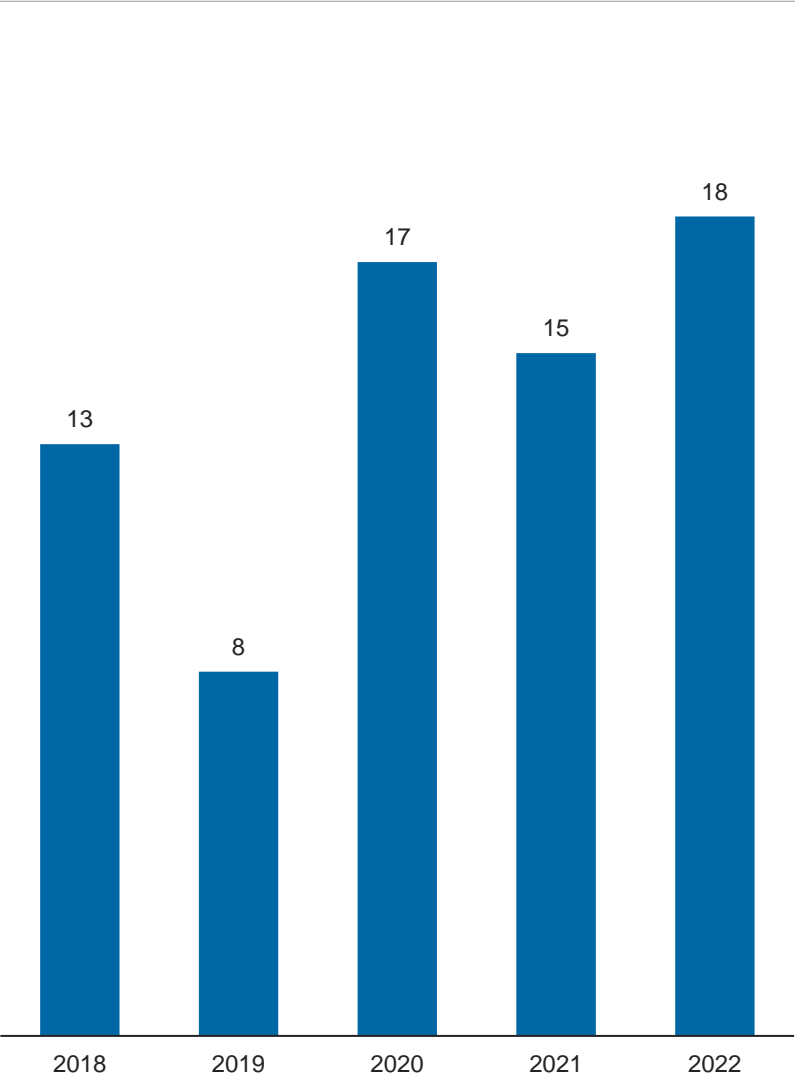
	Description	Key Players
<b>API Testing</b>	<ul style="list-style-type: none"> <li>Tests API directly including its functionality, reliability, and performance.</li> <li>Validates logic of build architecture.</li> </ul>	
<b>Web/Cross-Browser Testing</b>	<ul style="list-style-type: none"> <li>Analyzes how applications function across various devices and tools.</li> <li>Evaluates different browser OS combinations.</li> <li>Ensures consistent functionality and experience across platforms.</li> </ul>	
<b>Mobile Testing</b>	<ul style="list-style-type: none"> <li>Ensures apps work efficiently on all mobile devices and their OS versions.</li> <li>Tests consistency, usability, performance, and compatibility across various platforms and devices.</li> <li>Mobile beta testing.</li> </ul>	
<b>UI/Visual Testing</b>	<ul style="list-style-type: none"> <li>Checks how an application handles user actions and whether visual elements are displayed correctly.</li> <li>Validates user interface per business requirements.</li> </ul>	
<b>No-Code/Low-Code Testing</b>	<ul style="list-style-type: none"> <li>Allows non-technical team members to plan, generate, and execute end-to-end testing.</li> </ul>	
<b>Error Reporting</b>	<ul style="list-style-type: none"> <li>Provides full-stack trace and information when a program encounters unhandled exceptions.</li> </ul>	
<b>Regression Testing</b>	<ul style="list-style-type: none"> <li>Analyzes changes in performance, functionality, or dependencies after errors are corrected in dependent software and the system.</li> </ul>	
<b>Other Testing Types</b>	<ul style="list-style-type: none"> <li>Includes load testing, code review/scanning, resilience/chaos testing, journey monitoring, and unit testing.</li> </ul>	

Note: Market Map is available by contacting Ryan Gillis directly.

Sources: Wall Street Research, company websites, market research.

# Recent Software Testing M&A Activity

## Total M&A Deals



## Select Acquisitions by Sponsors and Strategics

(\$ in millions)

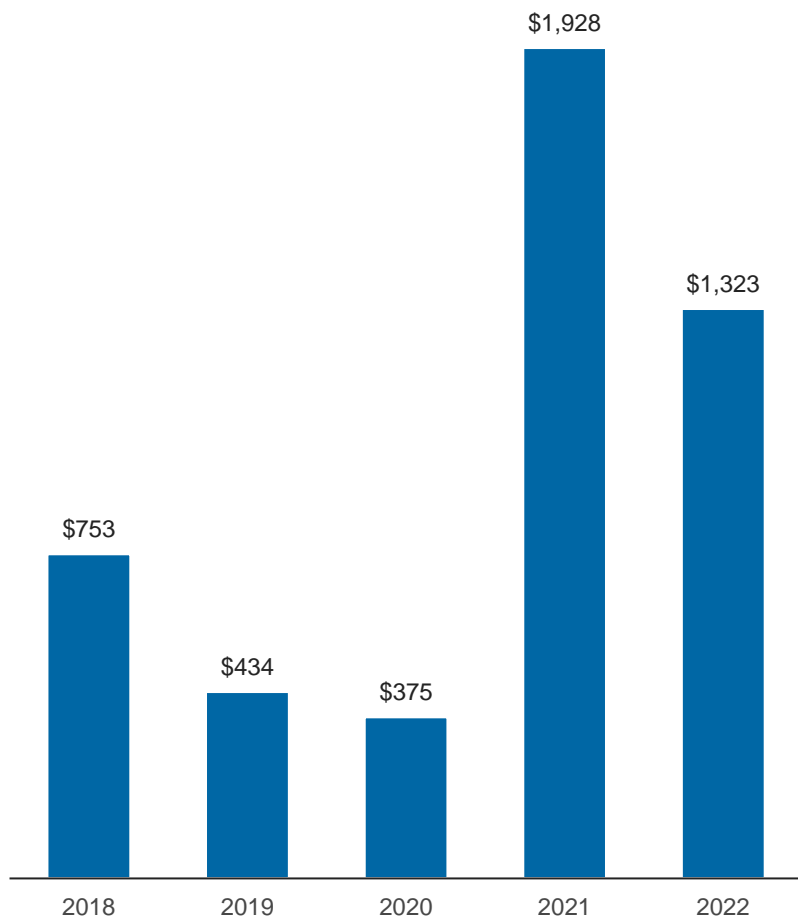
Date	Acquirer	Target
Aug-22	<b>opentext™</b>	<b>MICRO FOCUS</b>
Aug-22	QUALITEST / <b>Bridgepoint</b>	<b>ZENQ</b>
May-22	<b>WORKSOFT.</b> / <b>MARLIN EQUITY PARTNERS</b>	<b>eureQa</b>
May-22	<b>Idera, Inc.</b> / <b>Partners Group</b>	<b>HEXAWISE</b>
Apr-22	<b>CYARA</b>	<b>b...tium</b>
Apr-22	<b>SMARTBEAR</b> / <b>FP VISTA</b>	<b>PACTFLOW</b>
Mar-22	<b>harness</b>	<b>CHAOS NATIVE</b>
Feb-22	<b>Tricentis</b> / <b>INSIGHT PARTNERS</b>	<b>Tx</b>
Feb-22	<b>Tricentis</b> / <b>INSIGHT PARTNERS</b>	<b>testim</b>
Dec-21	<b>BrowserStack</b>	<b>Logwatch</b>
Sep-21	PERFORCE / <b>FP PARTNERS</b>	<b>BlazeMeter</b>
Jul-21	<b>SAUCELABS</b>	<b>Backtrace</b>
Jun-21	<b>COPADO</b>	<b>Qentinel</b>   ROBOTIC SOFTWARE TESTING
May-21	<b>Idera, Inc.</b> / <b>Partners Group</b>	<b>XPORTER XRAY</b>
Mar-21	<b>THOMABRAVO</b>	<b>applitools</b>
Mar-21	<b>SAUCELABS</b>	<b>TestFairy</b>
Mar-21	<b>Tricentis</b> / <b>INSIGHT PARTNERS</b>	<b>Neotys</b>
Feb-21	<b>SAUCELABS</b>	<b>AutonomiQ</b>

Source: 451 Research as of February 7, 2023.

# Recent Software Testing Capital-Raising Activity

## Total Capital Raise Value By Year<sup>(1)</sup>

(\$ in millions)



Source: PitchBook as of February 7, 2023.

(1) Represents all VC stage deals and private equity growth/expansion deals with disclosed values.

(2) Lead investor(s) for round.

## Select Capital Raises (\$25M+)

(\$ in millions)

Date	Company	Investor <sup>(2)</sup>	Deal Type	Amount Raised
Jan-23	ATOMIC JAR	<b>boldstart</b> INSIGHT PARTNERS	Early-Stage VC	\$25.0
Aug-22	fullstory	Undisclosed	Later-Stage VC	25.0
Jun-22	LogRocket	Battery <small>Delta-v Capital</small>	Later-Stage VC	25.0
May-22	Instabug	INSIGHT PARTNERS	Later-Stage VC	46.0
Apr-22	harness	NORWEST	Later-Stage VC	230.0
Apr-22	sonar	Advent International GENERAL CATALYST	PE Growth/Expansion	412.0
Apr-22	LAMBDA TEST	PREMJI INVEST	Later-Stage VC	45.0
Jan-22	CYARA	K1	PE Growth/Expansion	445.0
Nov-21	bitrise	INSIGHT PARTNERS	Later-Stage VC	95.0
Nov-21	mabl	VISTA	Later-Stage VC	40.0
Nov-21	pendo	THOMABRAVO	Secondary Transaction	110.0
Oct-21	Katalon	ELEPHANT	Later-Stage VC	27.0

# Houlihan Lokey Overview

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# Leading Independent, Global Advisory Firm



Houlihan Lokey is the trusted advisor to more top decision-makers than any other independent global investment bank.

**~2,500**  
Employees

**35**  
Locations

**>\$6 Billion**  
Market Cap



**>\$2 Billion**  
Annual Revenue

**~25%**  
Employee-Owned

**No**  
Debt

## Corporate Finance

- No. 1 Global M&A Advisor Under \$1 Billion
- Leading Capital Markets Advisor Raising More Than \$100 Billion in Past Five Years

### 2022 M&A Advisory Rankings Global Transactions Under \$1 Billion

Rank	Advisor	Deals
1	Houlihan Lokey	381
2	Rothschild	369
3	JP Morgan	217

Source: Refinitiv.  
Excludes accounting firms and brokers.

## Financial Restructuring

- No. 1 Global Restructuring Advisor
- \$3.0 Trillion of Aggregate Transaction Value Completed

### 2022 Global Distressed Debt & Bankruptcy Restructuring Advisory Rankings

Rank	Advisor	Deals
1	Houlihan Lokey	58
2	PJT Partners	30
3	Lazard	29

Source: Refinitiv.

## Financial and Valuation Advisory

- No. 1 Global M&A Fairness Opinion Advisor Over the Past 25 Years
- 1,000+ Annual Valuation Engagements

### 1998 to 2022 Global M&A Fairness Advisory Rankings

Rank	Advisor	Deals
1	Houlihan Lokey	1,232
2	JP Morgan	1,030
3	Duff & Phelps, A Kroll Business	938

Source: Refinitiv.  
Announced or completed transactions.

## Financial Sponsors Coverage

- No. 1 Global Advisor to Private Equity Firms
- 1,000+ Sponsors Covered Globally

### 2021 Most Active Global Investment Banks to Private Equity Firms

Rank	Advisor	Deals
1	Houlihan Lokey	323
2	Deloitte	218
3	William Blair	183

Source: PitchBook.

**Houlihan Lokey** +



Houlihan Lokey has agreed to acquire Oakley Advisory, an independent advisory firm that provides a range of services to clients across the digital infrastructure, communications services, and cloud landscape.

With the addition of Oakley, Houlihan Lokey will cover the full spectrum of Digital Infrastructure and Connectivity in the U.S and Europe...

- Broadband & Connectivity
- Towers & Shared Infrastructure
- Data Centers & Managed Services
- Wireless & Spectrum
- Telecom Services
- Telecom Software

# Houlihan Lokey Is the Trusted Advisor to More Top Decision-Makers Than Any Other Independent Global Investment Bank

## 2022 Investment Banking Rankings All Global Technology Transactions

	Advisor	Deals
1	<b>Houlihan Lokey</b>	<b>116</b>
2	Goldman Sachs	106
3	Morgan Stanley	79
4	Rothschild	76
5	JP Morgan	75

Source: Refinitiv. Excludes accounting firms and brokers.

## 2022 M&A Advisory Rankings Global Transactions Under \$1 Billion

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2	Rothschild	369
3	JP Morgan	217
4	Lazard	206
5	Goldman Sachs	203

Source: Refinitiv. Excludes accounting firms and brokers.

# No. 1

Global M&A Advisor  
Under \$1 Billion

# No. 1

Global Restructuring Advisor

# No. 1

Global M&A Fairness Opinion  
Advisor Over the Past 25 Years\*

# Leading

Capital Markets Advisor

# 1,500+

Transactions Completed Valued at  
More Than \$3.0 Trillion Collectively

# 1,000+

Annual Valuation Engagements

# Houlihan Lokey's Tech M&A Team Is No. 1 Globally With Unparalleled Reach

## North America

Atlanta  
**Boston**  
Chicago  
Dallas  
Houston  
**Los Angeles**  
**Miami**  
Minneapolis  
**New York**  
**San Francisco**  
Washington, D.C.

## Europe and Middle East

Amsterdam  
Dubai  
**Frankfurt**  
**London**  
Madrid  
**Manchester**  
**Milan**  
Munich  
**Paris**  
**Stockholm**  
**Tel Aviv**  
Zurich

## Asia-Pacific

Beijing  
Fukuoka  
Gurugram  
Ho Chi Minh City  
Hong Kong SAR  
**Mumbai**  
Nagoya  
Osaka  
Shanghai  
Singapore  
Sydney  
**Tokyo**

**No. 1**

TECH M&A  
ADVISOR\*

**14**

LOCATIONS  
WORLDWIDE

**200+**

TECHNOLOGY  
BANKERS

**40+**

MANAGING  
DIRECTORS

**116+**

TECHNOLOGY  
DEALS IN CY22

Local Technology team

\*According to data provided by Refinitiv.



# How Houlihan Lokey Can Help


Our firm is extremely well equipped to help our clients navigate uncertain times. We respond quickly to challenging situations and are constantly helping clients analyze, structure, negotiate, and execute the best possible solutions from both strategic and financial perspectives.

## What We Offer

1  **Corporate Finance**

- Mergers and Acquisitions
- Capital Markets
- Private Funds Advisory
- Board Advisory Services

We are widely recognized as a leading M&A advisor to the mid-cap and have long-standing relationships with capital providers, including commercial banks and other senior credit providers, insurance funds, asset managers, and mezzanine fund investors. Few other investment banks maintain the breadth of relationships and capital markets intelligence that we do.

2  **Financial Restructuring**

- Company Advisory
- Special Situations
- Distressed M&A
- Liability Management
- Creditor Advisory

We have the largest restructuring practice of any global investment bank. Since 1988, we have advised on more than 1,500 restructuring transactions (with aggregate debt claims in excess of \$3.0 trillion). We served as an advisor in 12 of the largest 15 bankruptcies from 2000 to 2022.

3  **Financial and Valuation Advisory**

- Portfolio Valuation and Fund Advisory
- Transaction Opinions
- Corporate Valuation Advisory Services
- Transaction Advisory Services
- Real Estate Valuation and Advisory
- Dispute Resolution Consulting

Over nearly four decades, we have established ourselves as one of the largest financial and valuation advisory firms. Our transaction expertise and leadership in the field of valuation help inspire confidence in the financial executives, boards of directors, special committees, investors, and business owners we serve.

## Why We're Different



No. 1 for Global Under \$1 Billion and Tech M&A



Significant Experience With Financing Markets



Senior-Level Commitment and Dedication



Deep, Industry-Specific Expertise



Superior Work Product/Technical Abilities



Creativity, Imagination, Tenacity, and Positivity

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Houlihan Lokey

CORPORATE FINANCE  
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