

A black and white photograph of the Golden Gate Bridge, viewed from a low angle looking up at the suspension tower and cables. The bridge spans across the frame. Three colored dots are placed on the bridge: a red dot on the top of the left tower, a yellow dot on the top of the right tower, and a blue dot on the right side of the right tower.

State of Quality Edition One

Investigation report:
The evolution of Testing into
Quality Engineering and Assurance





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Foreword

From a humble caterpillar to a beautiful butterfly

Welcome to the first edition of our quality report!

This report is meant to be a reality check on the state of quality. Over the last decade, fueled by the need to go digital, global organizations have been involved in a race to transform themselves into technology-driven organizations. This has led to an overhaul of brick and mortar processes with “digitized/digitalized” processes. This has required the adoption of new paradigms and technologies within. In order to keep up with this new paradigm, software testing has been through considerable transformation as well. From the reactive testing it once was, it is now a proactive 'Quality Engineering and Assurance' discipline. It has gone from being a humble caterpillar to a beautiful butterfly.

The butterfly analogy is more than realistic. Today, a tiny deterioration in quality can have an immediate and substantial effect on time-to-market, cost of development, user experience and market share. This is probably what mathematician Edward Lorenz termed the Butterfly Effect. In other words, you don't want to play dice when it comes to quality.

This report captures patterns within quality adoption across the globe. It does this by analyzing an unprecedented 1,500+ QA projects across 400+ global organizations, data from 1000+ RFPs, customer, analyst and expert interactions spread across Banking, Financial Services & Insurance (BFSI), Retail & Consumer, Healthcare & Life Sciences, Hi-Tech & Manufacturing, Media & Telecom and Energy & Utilities (Refer to the section on Data Sources & Methodology for more details). All of this makes it a factual and unbiased report by design. Testing specialists will readily agree that the unique and intriguing snapshots presented in this report will help focus and strengthen the expertise of your testing team.



Arun Kumar Melkote

Global Head -
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When we analyzed the data, patterns began to present themselves to us. These were vivid pictures about how automation, non-functional testing, test data & environment management – which are the most fundamental building blocks of quality – were seen and approached.

The result has been interesting and insightful. Quality Engineering and Assurance, Cognitive Computing and the shift from mere solutions to platforms to ecosystems – there is enough and more for the discerning in this report. And, as the report findings state, the need to surface patterns and ponder over the stories these patterns narrate is important. We have looked for patterns across automation, non-functional testing, test data & environment management.

I invite you to examine these patterns for yourself. They will certainly help you understand where your organization stands. More importantly, the next few pages will help shift the kind of questions you ask with regard to quality. Instead of saying, “We have completed 90% of test execution” and look pleased about it, you will ask, “What does 90% test execution mean in terms of time, cost and what is the real value we deliver? Have I spent too much on quality or too little? If too much, how much should I cut back without affecting quality? What are my options?” If you ask those questions, I believe this report will have served its purpose.

This report is the work of Team Wipro that has cross-industry experience in quality testing. I am confident that their effort shines a unique light on the state of quality that we can benefit from.

Introduction and summary

S3 – Looking at the facets of quality

One of the fundamental drivers of digital transformation within large organizations is the mass consumerization of technology. In the brave new “connected” world, organizations are being forced to adopt new technologies across functions in order to keep pace with the fast-moving digital world. This has led to technologies such as Digital, Cloud, Data, Analytics and Mobile in addition to every kind of device making its way into business.

Today, applications are working, behaving and interacting with people, networks and each other in entirely new environments and in completely new ways. As a consequence, testing has also been through considerable transformation. There are critical and positive changes in the speed, structure and skills – what we call S3 – around the science of testing.

The change in testing is somewhat similar to the ‘pit stop paradigm’ in Formula One racing. In the 1950s, a typical pit stop would be messy and time consuming, taking over 60 seconds. In the next 40 to 50 years the racing community began to look at the pit stop as a ‘speed breaker’, responsible for slowing things down. However, they also recognized it as a necessity. Over the years, support teams have worked to make the modern pit stop a fascinating choreography of technology, people, execution and efficiency. Today, a pit stop is a few seconds. It can separate the winners from the losers.

Speed:

Digital transformation has caused QA and testing to evolve. Strategically interleaving the right test solutions at the appropriate points in the lifecycle of a product can enhance speed of delivery as well as the superiority of the software to enhance customer experience.

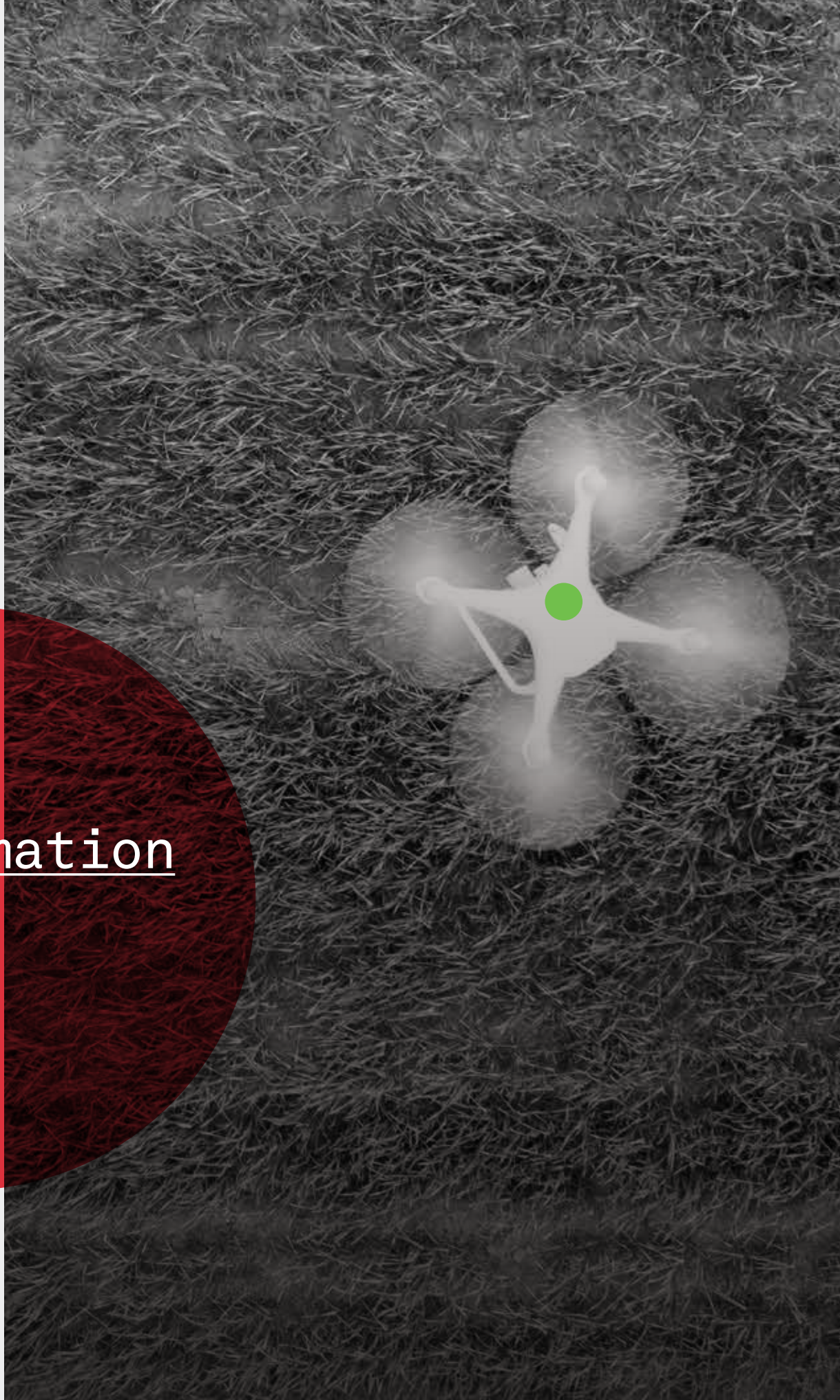
Structure:

We have also noticed the need to centralize the test organization to bring uniformity across projects that would otherwise exhibit uneven levels of quality. On the other hand, with disruptive processes such as Agile and DevOps becoming popular, the luxury of a separate test window is becoming rare, tilting the scales towards decentralized and hybrid states. In other words, there is no dependable one-size-fits-all approach. The balance is somewhere in between, with the central test organization acting as a friend, philosopher and guide leaving enough elbow room for the testing teams. Industries such as Financial Services, Retail & Consumer, Media & Telecom and Healthcare have been through the centralization cycle and are now moving towards decentralization. Think of it like this: you could (and should) toggle between testing as a centralized function and a decentralized one as your needs change between new value creation (centralized) and efficiency from implementation (decentralized). When one is achieved, you switch to the other. It is a continuous step-by-step process of transformation.

Skills:

Digital transformation has driven the adoption of Agile and DevOps growth within projects. In fact, the adoption, as a percentage of total projects, hit the 20% mark across testing engagements. Agile, DevOps and Continuous Delivery methodologies are forcing a transformation in the skills owned by the test function. Today, the need is for multi-disciplinary skills - programmers need to be skilled at testing and testers need to be skilled at programming. This is giving rise to the demand for Quality Engineering (QE). The shift toward QE has been swift. With QE, the role of tester has broadened in scope and the skill sets required for a quality engineer are beyond the traditional skills of functional testing and automation. For a leading US-based manufacturing company, which runs on a DevOps delivery model, we have quality engineers who are trained on programming skills. These engineers, who along with developers, engineer the quality for code and perform continuous testing (unit testing, component testing and integrating testing levels), blend development, testing and operations, leading to continuous deployment. In summary, S3 (speed, structure and skills) has become central to QA. This is where the most immediate battle for superior quality is going to be won and lost. We hope the insights in this report will help you win that battle.

Automation



Bringing bots to the test party

Digital organizations are by definition required to be nimble. They need to deliver data quickly. They must also have flexibility to pivot as required. One reason Agile, Scrum and Continuous Delivery are making headlines is, because every organization function that is touched by digital transformation is keen to deliver more business value faster. The test organization, too, is in the game. How can it improve on its goals of efficiency and faster code release? Automation holds the key. With its never-tiring bots, automation focuses on regression for repeatability, helps maintain agility and pushes down costs. Initial investments in automation can look high, but over a period of time the ROI is strikingly good. For example, automation can cut down two weeks of manual testing to less than a week. The time and resources saved can be ploughed back into the test function making it self-funding. Open-source is also making automation more accessible. Organizations are realizing that the ability to gain a large asymmetrical advantage with automation is within grasp.

Trending #automation

Automation footprint has increased by 85% over the last two years (from 18% to 34%)

Automation is not a new phenomenon. It has been used for decades to control and reduce costs. Now, three remarkable developments have turned automation into a trending topic. The first is the new wave of accessible open-source automation tool options. The second is the growth in maturity levels of technology and customers. And the third is the urgent need for continuous deployment to enable reduced time-to-market.

Digital transformation initiatives and Agile projects have had visible influence in introducing automation to the Retail and Consumer Goods, Financial Services and Manufacturing/Hi-Tech industries

(see Fact File 1: Increase in test automation footprint). These industries have been motivated by the need to reduce time-to-market. On the other hand, the Energy and Healthcare industries are embracing automation with cost take out as the primary goal.

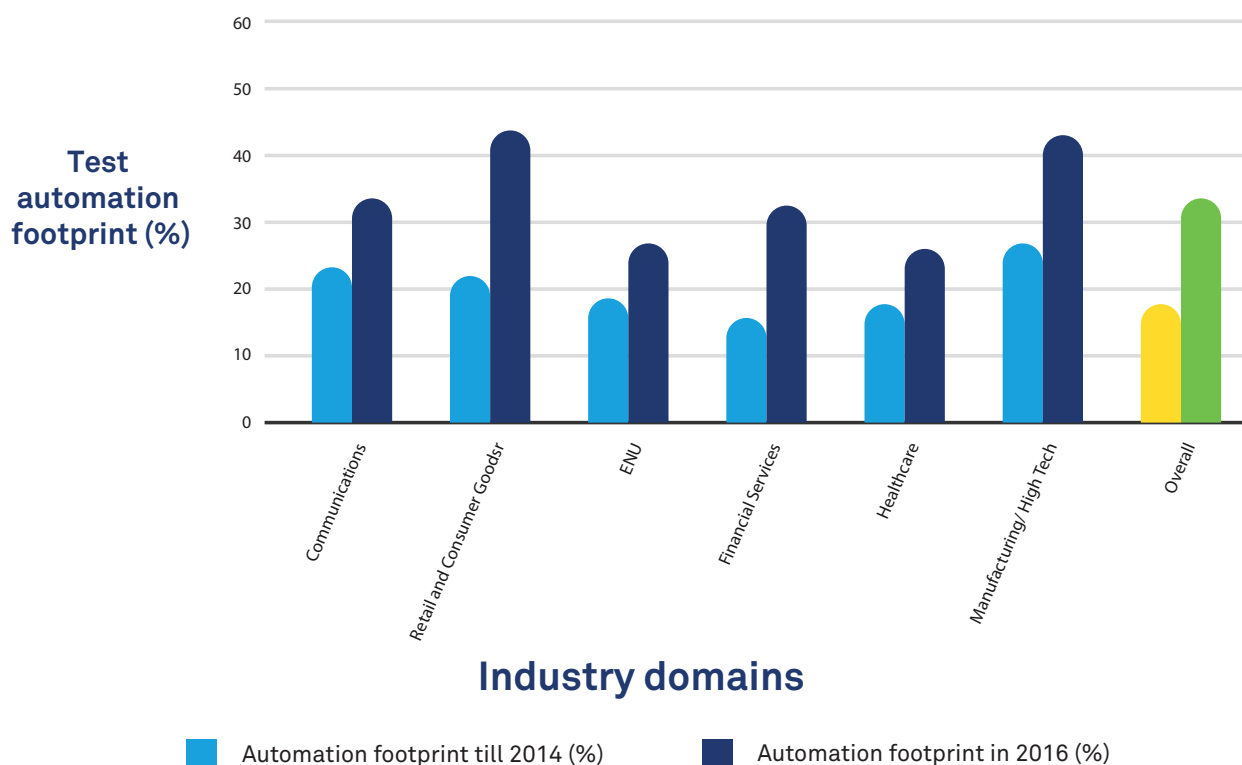
Regardless of industry, with 85% of test cases being automated, it is safe to assume that aside from cost take out, enhanced test coverage – and by implication, improved quality – is a major benefit.

Fact File 01

Increase in test automation footprint

- Retail and consumer goods
96.4% (from 22% to 44%)
- Financial services:
110.2 % (from 15.7% to 33%)
- Manufacturing/Hi-Tech:
50% (from 28% to 43%)

Growth in test automation across industries



Open-source claims the future

Open-source tool demand has increased over commercial tools by 116% over last two years

Tools are a battlefield between the old and the new. And this is turning out to be an uneven fight. Open-source tools have a 56% demand and are turning out to be the winners. This is also an indicator of the digital and Agile trends sweeping Consumer Goods, Financial Services, Manufacturing/Hi-Tech and Retail. The number of commercial tools in use is shrinking. With just 44% usage, the low percentage is a reflection of their inability to

adapt to emerging technological demands and deliver cost benefits.

Despite this, some commercial tools continue to fight and remain winners in areas of non-functional performance testing

Their demand can be attributed to the needs of bi-modal IT where low-end performance testing such as memory leaks can be done with new tools while there is still a lack of mature Open-source tools for high-end performance testing such as stress testing. Commercial tools continue to fill that gap.

Fact File 02

Demand for open-source v/s commercial tools



ready. The advantage is that organizations get to stay ahead on defect detection. This allows everyone to keep pursuing the Holy Grail of development – which is faster code release.

A high-value advantage of Progressive Automation is often missed. It can guide the code team and influence the end product. Our data shows that of the 55% projects that could opt for Progressive Automation, 96% had been automated. Factors that include application instability, test data, test environment and requirement volatility are the key villains in suppressing automation percentages. On the other hand, the key drivers for automation, were Agile projects (see Fact File 03: The Sway of Automation) with Retail, Financial Services and Hi-Tech industries being the leading adopters.

The age of API is here

Next-generation automation like API, Agile automation has climbed up by 17% in the last year

In the new digital world of connected devices, APIs are now the primary interface to applications. This has two implications. Both are, thankfully, simple to appreciate: testing APIs becomes important as they are critical to application performance. Equally important is testing applications against the entire spectrum of API responses. API test automation is also vital because it aids in achieving higher Progressive Automation.

On paper, Progressive Automation appears to be a no-brainer. In Progressive Automation, test scripts are written as code is developed, automating test cases to validate new functionality. Basically, this means we don't wait to test until the complete application is

Fact File 03

The Sway of Automation

- API automation, Continuous Testing and Behavior Driven Development (BDD) automation is in hype curve with API automation leading with **5.1%** improvement in share
- Progressive / in-sprint automation has a **12%** increase in share
- **75%** of Agile projects have adopted
- **25%** of Waterfall projects have adopted Progressive Automation

Performance
engineering

Are you on shaky ground?

Ideally, Performance Testing should have a singular goal: to provide you with the knowledge of how your system will behave under varying conditions. What kind of stress can it withstand? Are those stress levels within the projections of your business plan? Will your systems keep pace with your growth? How stable are your systems? And do they continue to meet user expectations even while there are massive technology changes recasting your IT landscape? In other words, are your IT investments behaving as required? To get to the bottom of the truth, you begin to look at the tools, processes and people used by your organization to ascertain the quality of the applications. But there are no readily available benchmarks for the maturity of these three components — tools, processes and people. We set out to find one.

Thumbs up for conventional tools

Licensed, incumbent, conventional performance testing tools remain the preferred choice

Organizations prefer conventional tools for performance testing. They are expensive but are well entrenched in the universe of testing. Unlike automation where open-source has practically claimed the future, and is helping lower costs, there is no such trend in performance testing. Reason: conventional tools are rugged and reliable. Large organizations don't feel the pain of the cost as sharing justifies the expense. These tools have an "early mover advantage" – being early in the game, they have found a place in testing, from an economic perspective as well, and are difficult to wedge out.

Web services demand most performance testing

Web architecture dominates the platforms that undergo performance testing

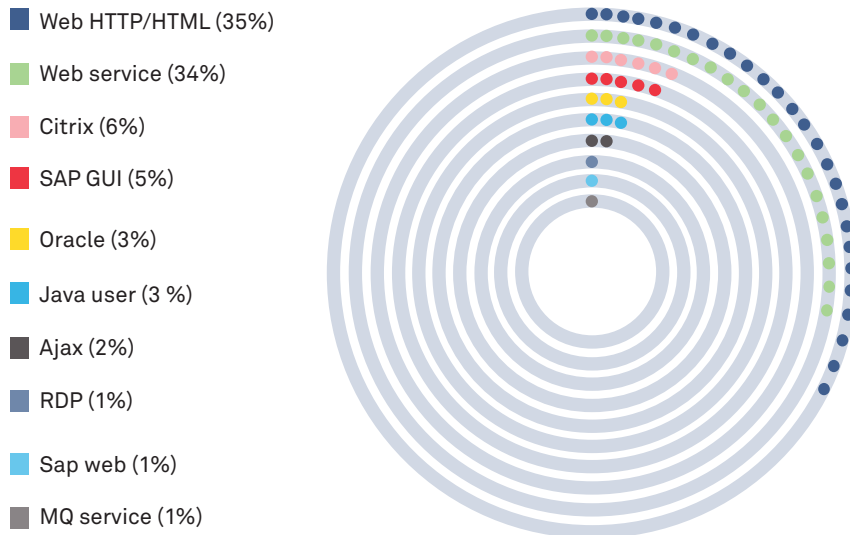
We have more devices, larger screens, endless data and better networks today. For users, this is good. And they want more. Naturally, websites are getting bigger web pages, more forms, dynamic content and all kinds of interactive bells and whistles. Behavioral research has also brought home the fact that a web page which loads even one second faster can dramatically improve conversions, productivity and customer satisfaction. Led by this, it is hardly surprising that 73% of performance testing is focused around web applications and/or web services (see Fact File 04: Platforms dominated by web applications and services) while only 11% involves SAP/ERP. A miniscule 5% is for "other" types of applications – a category for which business does not think performance is critical.

The skew indicates that the web is vital for business and end users. This is why all the new tools for performance testing are focused around web technologies. But, contrary to expectations, we observe that the acceptance of these new tools is low.

Cloud applications continue to escape the scrutiny of performance testing. This could be because of the extraordinary "promise" held by the cloud. Users have come to believe that availability and scalability are the responsibilities of the cloud provider. They believe the cloud provider will deliver on these promises. Budgets are therefore in favor of functional testing even in cloud environments. In a related observation, new players and start-ups have no budgets for performance testing in cloud – and this could spell a new business opportunity for cloud providers with a unique business model aimed at low-budget customers.

Fact File 04

Platforms dominated by web applications and services



- 73% involve web applications and web services
- 11% involve SAP/ ERP
- 5% involve “others”

Performance engineering: sluggish adoption

Organizations exhibit a low hunger for performance engineering

The need for 'quality at speed' in digital organizations has led to the need for performance engineering. Performance engineering is a balance of preventive science and people-dependent art. It addresses non-functional requirements and has the ability to influence code design before it is written or deployed. Despite the sound logic behind performance engineering, the overall hunger for the practice remains at a low 30%.

The key element of performance engineering is the ability to diagnose issues. Application Performance Management (APM) tools facilitate this. But having the tools does not suffice. It is somewhat akin to owning a sonography machine, but not being able to exploit the technique because of a lack of skilled and trained talent.

Only 25% of organizations have APM tools. The figure is a reflection of low IT maturity within organizations, the generally low appetite for risk, and the high cost of APM tools.

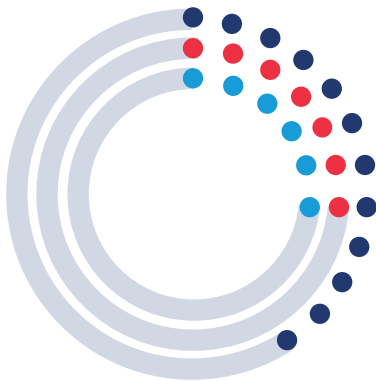
More importantly, only 30% organizations have the talent to realize the benefits of APM tools. The remaining 70% have no appetite for performance engineering (see Fact File 05: Need expressed for performance engineering across organizations).

Performance testing is introduced late in development cycles for 79% of projects. This means performance engineering is not possible (or may not be deemed necessary) in these projects. As a consequence, non-functional requirements don't get a head start. But here is an encouraging development: 10% projects opt for engineering in the development phase – the trend has arrived and appears set to pick up steam in the coming months.

Fact File 05

Need expressed for performance engineering across organizations

- High interest
- Aware, but no inclination
- No mention



- **46%** want performance engineering
- **27%** mention performance engineering (showing awareness of the need)
- **27%** don't mention performance engineering

Performance testing needs more weightage

One performance defect 'costs' eight test executions

On average, 62% of test executions are successful. This means 1.6 times test executions are required for a test to get completed. If a defect is raised, more testing is required to debug for resolution and validate the closure of the defect. This amounts to an additional 25% testing.

Test failures can be attributed to the following top issues:

- Test environment stability
- Constraints due to a shared environment
- Test data incorrectness/validity

Performance testing suffers because the emphasis is always on functionality, with the practice routinely taking a tick box approach: If a feature is slow – say a login takes longer than expected – it is attributed to the test environment or even after knowing the issues, the inability to resolve it is because of inadequate tooling / data validation. The general thinking is, “This is a test environment, and things can go wrong here. Our production environment is better. At the moment, the feature is working and that is what matters. Once the application is rolled out in production, the feature (in this example the login) will perform faster.” Fundamentally, everyone just hope that the results of the performance test will not hurt business. This is why a release is rarely held up when a performance test exposes defects (For what actually happens, see Fact File 06: The shock in operations/SDLC).

Here is a simple way to calculate the cost of a performance defect. On an average, 0.25 defects are found per test execution. Combining this with the test execution and defect ratio tells us we need to execute 6.5 tests to have one performance defect. And then we need a further 1.6 tests to resolve/validate the defect. Thus the cost of one performance defect is eight test executions.

Fact File 06

The shock in operations/SDLC

- In **15%** engagements the performance testing team has visibility and/or availability of production performance (post the test execution)
- In **85%** engagements there is no feedback mechanism. When production incidents occur, operations/SDLC is 'shocked' and the performance testing team is held responsible

Need to engage with business and production

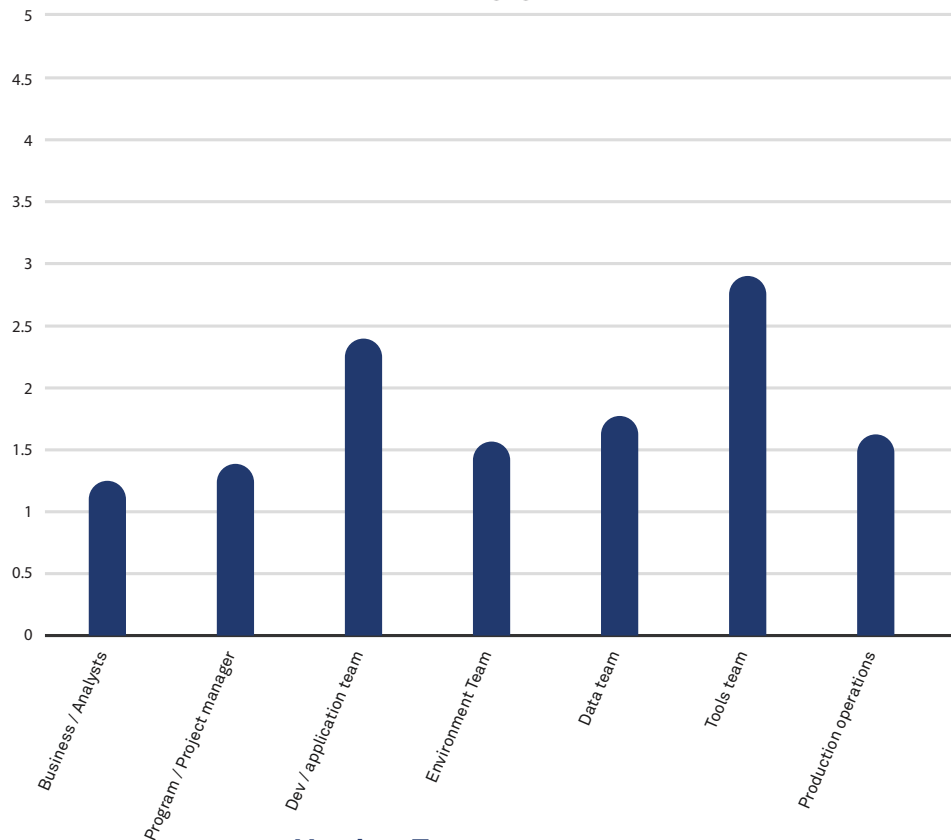
Engagements are focused on getting the execution done and not on the objective of performance testing

The maximum engagement and interactions across projects are with the Tools team, followed by interactions with the Application Development team, chiefly for flow navigation, scripting and problem-reporting (see Fact File 07: Engagement support from the ecosystem). There is minimal engagement with Business and Production teams. Better engagement levels with these two teams can result in reference points for expected business volumes, projected growth, along with technical challenges in production that help correlate the objectives of performance testing with what the organization's customers/users find acceptable.

Fact File 07

Engagement support from the ecosystem
Maximum level of engagement - 5

Y axis -
Level
of
engagement



X axis - Ecosystem teams

Engagement- Support from the Eco- system



End customer experience

Make customer experience your superpower

Mass consumerization has led to digital organizations adopting an omnichannel strategy. However, to ensure customer satisfaction, digital organizations also need to work on seamless customer experience across digital channels to connect, engage and transact with customers. Smart phones perhaps hold the best example of what is happening in the world of mobile applications. From having just a few non-critical applications such as Facebook and photo editing a few years ago, they now bristle with all kinds of applications: office mail, business expense management, instant messaging, shopping, taxi hailing, banking, fitness, home appliance controller, video and virtual reality viewers. Today there are 2.2 million apps available for Android users, 2 million for iOS users and another 0.6 million for Windows users. Even more dramatic is the frequency with which these apps respond to a volatile technology landscape with routine updates. Mobile applications are no more “good to have”. They spell everyday convenience and improved productivity. But in meeting after meeting with customers, we notice developers obsessing over features in their apps; disappointingly, end customer experience rarely comes up for discussion.

Even for digital organizations that believe they know mobile app development, there is a good reason to get behind the idea of examining a “no-compromise end customer experience” — because it can make or break a business. Take Sidecar for an example, after four years of operations, Sidecar was edged out in late 2015 by competition from Uber and Lyft. Poor user experience was a major contributing factor for the failure. No product or service is safe from the wrath of the user. Raw, unfiltered and potentially destructive sentiments will make their way to Facebook, get RT’d on Twitter, and filter their way into mainstream media. Fortunately, mobile apps have a rich culture of user ratings and feedback. It is possible to read customer sentiment, do a qualitative evaluation, segment app defects by severity and see what affects customer experience.

Our analysis of mobile testing trends is confined to the Retail and Banking sectors in North America and Europe. It nevertheless hints at what lies ahead for other industries too.

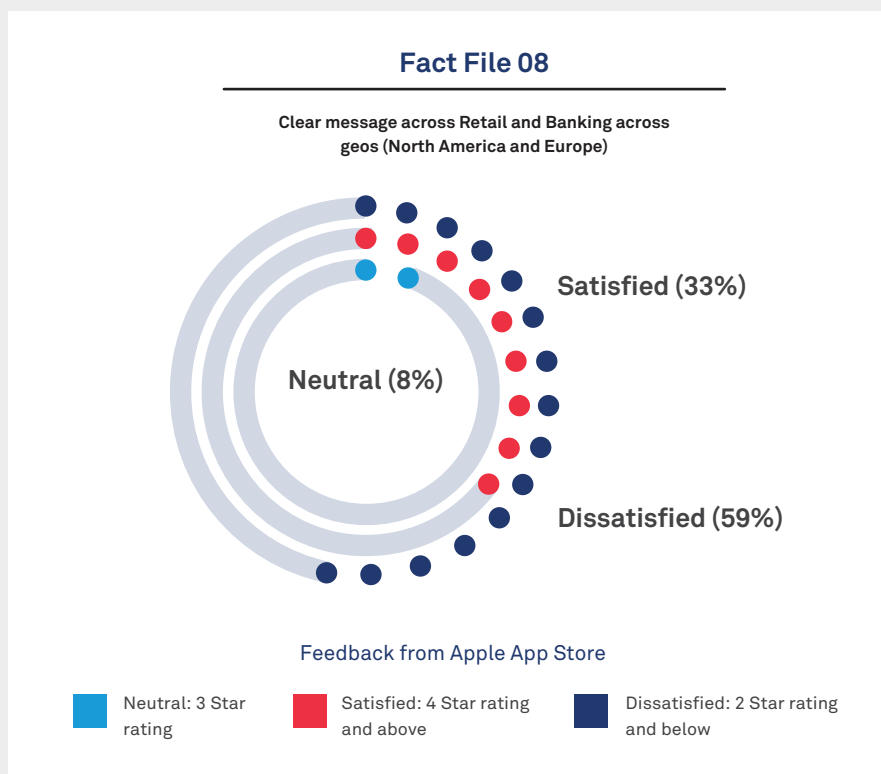
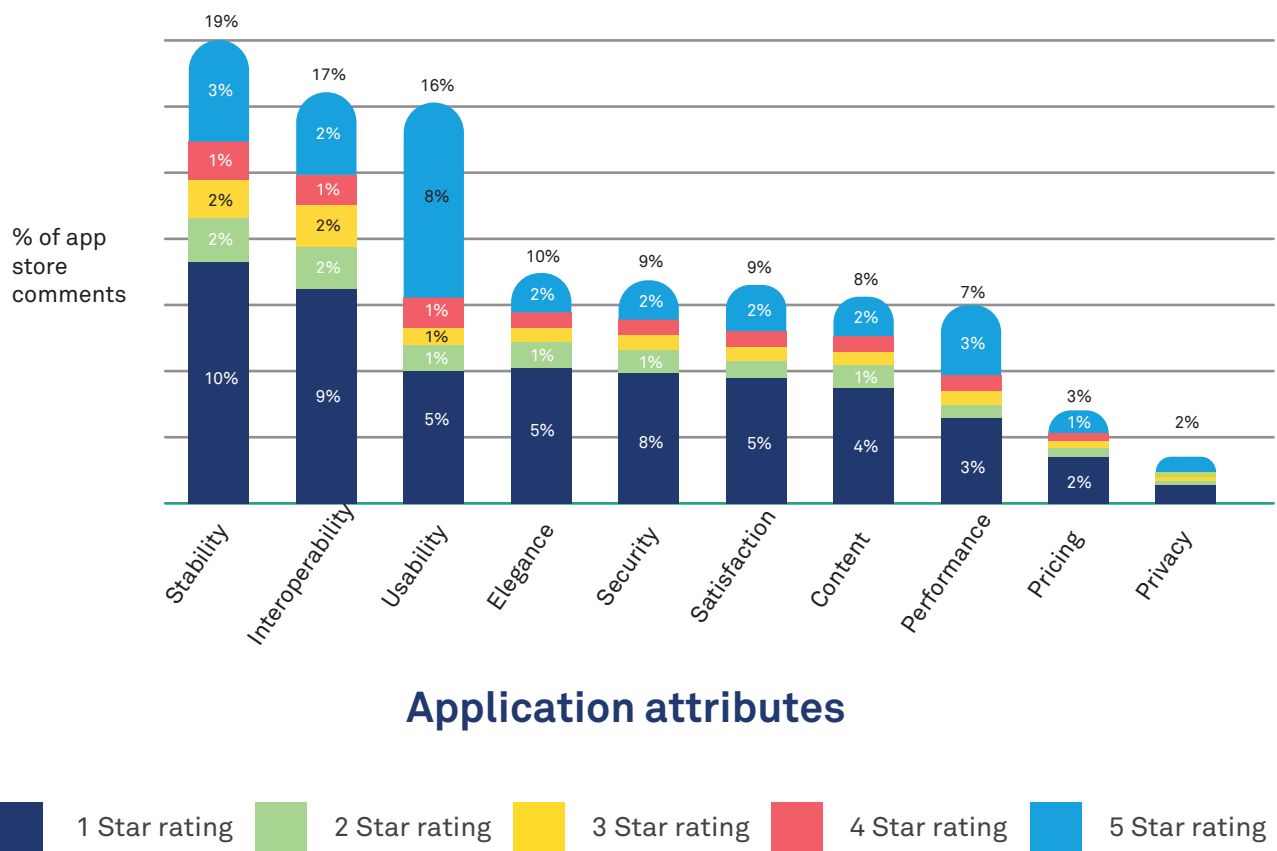


Fig 02: % mention of application attributes across ratings



Test for functionality in real world conditions

Stability and interoperability are the prime concerns for applications, followed by usability across domains and geography

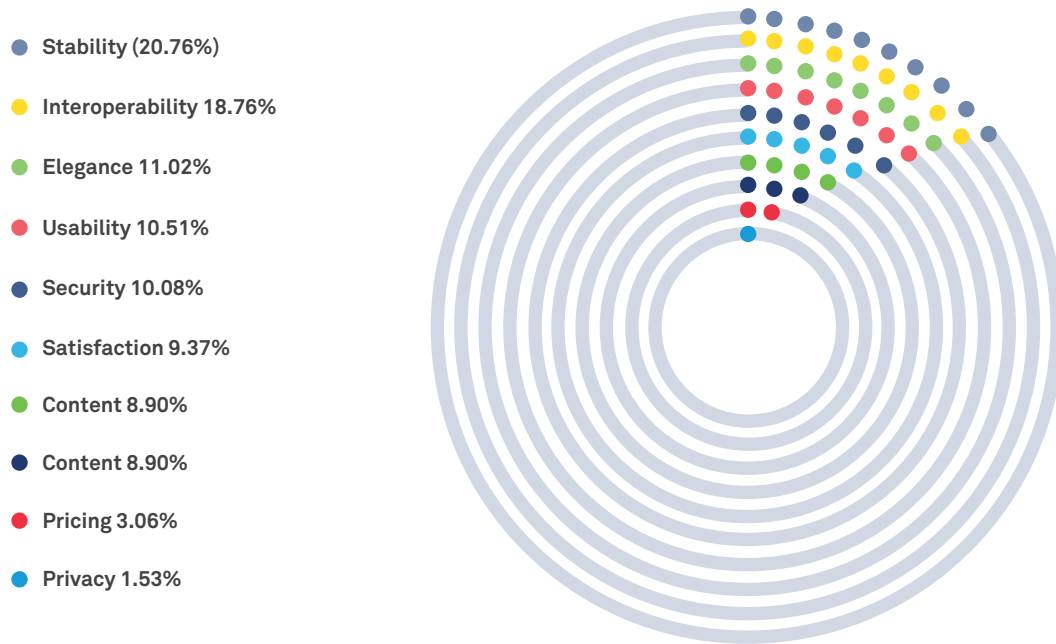
The numbers are non-trivial: All three parameters—stability, interoperability and usability—are at 11% or above (see Fact File 08: Clear message across Retail and Banking). While

functional issues such as slow load times, etc., must be examined, they don't necessarily throw up defects in the app. Functional issues are often device-related or influenced by network types and conditions. Functionality needs to be, therefore, tested in real world conditions. Stability, interoperability and usability, which affect customer experience and need closer attention, don't necessarily need real world conditions for testing.

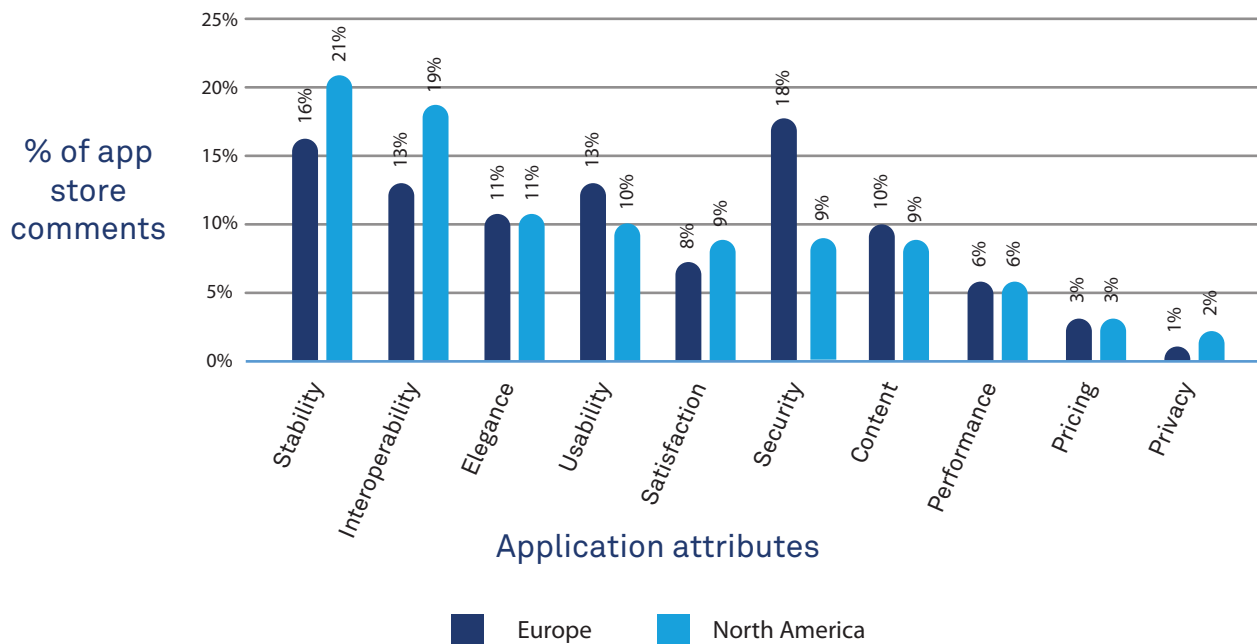
Fact File 09

Content needs improvement (North America and Europe)

Application attributes Banking and Retail clients are dissatisfied with (North America and Europe)



Comparison of pain points between Banking and Retail applications (North America and Europe)



Stay customer-focused

There is sizeable room for improvement in customer satisfaction

This is a worrying aspect of mobile testing. Only 33% customers across domains and geos expressed satisfaction with their mobile apps (see Fact File 08: Clear message across Retail and Banking). It is therefore important to have a qualitative understanding of what customers expect and meet those expectations.

Content should be king

Content is an area of major concern

Overall, 9% users across geographies think that the content delivered by applications needs improvement (Fact File 09: Content needs improvement). Of these, 52% were bank app users and 48% were retail app users. In Europe, banks accounted for all of the 10% of concerns around content. Retail fared extremely well, with not a single mention. Clearly, everyone is happy with retail mobile applications in Europe and there may be a lesson to learn here for retail application developers. In North America, 7.6% of bank app users had concerns around content compared to 10.6% of retail app users.

Content has many layers and each needs to be examined individually. It must be made relevant (offers and product/ service updates), personalized, engaging, contextualized, timely and actionable. Organizations must investigate what matters most to their customers and align their content strategy accordingly.

Banking apps in Europe need urgent attention

In Europe, Banking is a major concern across all parameters (compared to Retail)

Banking customers in Europe are unhappy about everything in their mobile applications at least when compared to Retail (see Fact File 10: Banking is Europe's problem child).

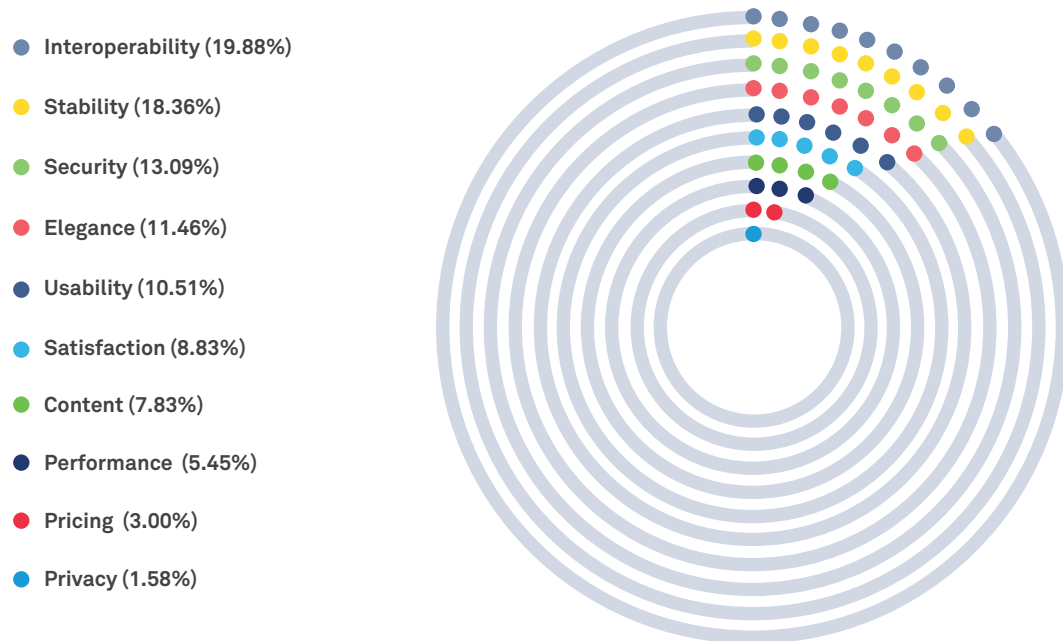
While the trends were near identical across Europe and North America for the parameters scrutinized, one major difference cropped up with regard to security. In Europe, security concerns accounted for 19%, while in North America, it accounted for only 12%.

In both cases, testing practices around security need to be strengthened.

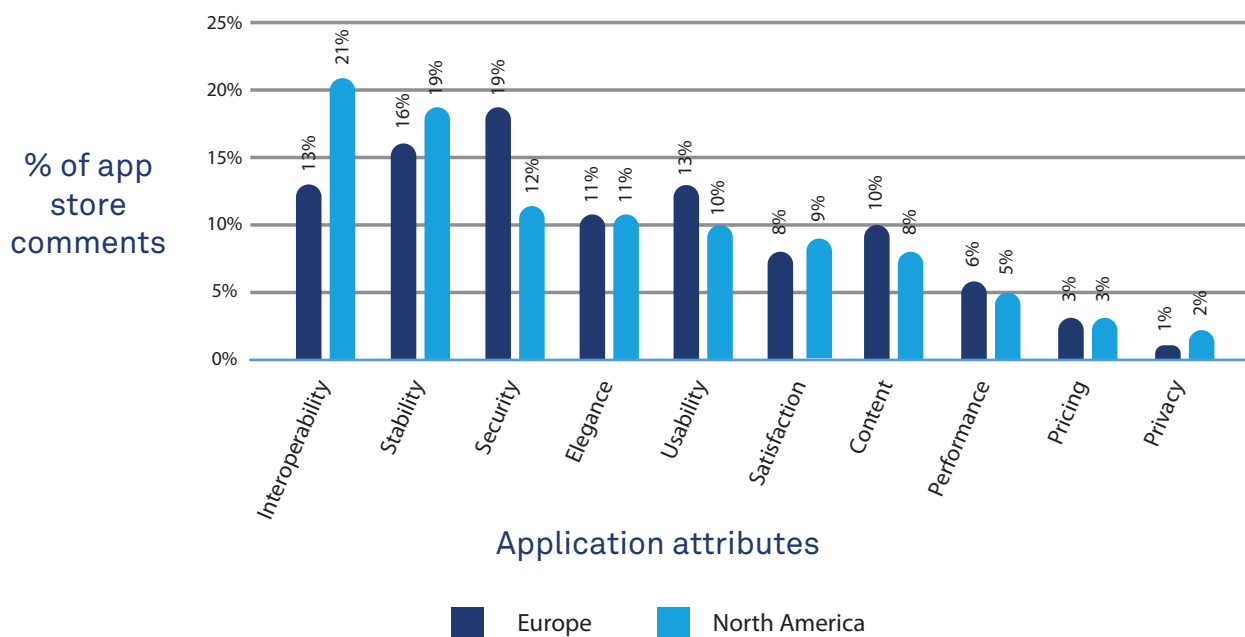
Fact File 10

Banking is Europe's problem child

Banking application attributes clients are dissatisfied with (North America and Europe)



Comparison of Banking applications pain points between Europe and North America





Test data and environment management

Are there real-world hacks for TEM/TDM?

The practice of Test Environment Management (TEM) and Test Data Management (TDM) has had a difficult history. Just when the right test environment is achieved, the technology changes. Virtualization, mobile and cloud are just some of the technologies that have affected TEM/TDM in the last decade. Then, when the technology alignment is achieved, business requirements change. We live in an Agile world where code must be released every two or three weeks, the testing function is left scrambling to create a stable and available test environment together with the right assets and documentation. Today, testing teams spend an inordinate amount of time on TEM, taking away the pin-point focus required on actual testing. This is an avoidable waste of time, money and resources.

The pursuit of quality needs to be rigorous but it doesn't need to be harrowing. Ideally, organizations should be able to walk in with their test cases and walk out with the test execution results.

Are there real-world hacks to perfect TEM/TDM so that you launch new products faster? An analysis of our testing engagements holds some answers to getting TEM right.

Test environments need attention

13% of the total defects are due to environment issues, taking 28% of the team's effort to fix the issues

Environment availability is the key to on-time test execution and defect management. Environment design – this includes the requirements for test data, the database, application versions, operating systems and their configuration – takes time to update and impedes the ability of the test team to work at

peak potential (see Fact File 11: How dependable is your test environment). In real terms, just one minor defect requiring re-validating and re-loading data can take away five days to a week of the QA team. Test environment defects impact release timelines, add to costs and in extreme cases result in loss of revenue and/or competitive advantage.

Fact File 11

How dependable is your test environment?

- Around **35%** of the environment defects are due to requirement errors and configuration settings
- At least **20%** of testers' time is taken up in coordinating and supporting test environment issues
- Around **20%** of test environment issues are due to the lack of monitoring and health checks of test environments

Data quality can reduce test time

6% of the defects are due to test data, taking away 12% of the testing team's efforts

Data is problematic, especially in large organizations with complex data environments. In such enterprises, with everyone working in siloes, data mismatch is invariably a problem of epidemic proportions. But, either an organization has complete, consistent and accurate data sets or not. If not, all test cases won't get executed (see Fact File 12:

How dependable is your test data?), test cycles will get prolonged, costs will begin to pile up, release dates will get postponed and opportunities will be lost. With the right tools selection and automation, non-production test data can be provisioned, resulting in reduced test time.

Fact File 12

How dependable is your test data?

- **4-5%** of testing effort is spent on test data preparation
- At least **20%** of test cases are not able to execute due to test data unavailability

Stepping up environment configuration

10% of the high severity defects are due to the test environment, of which 8% are due to test environment configuration

There are far too many OS upgrades, database tweaks and application versions, patches and the like, to take a chance with environment configuration. Given that a little over a fifth of the test team's efforts go into environment configuration (see Fact File 13: How dependable is your environment configuration?), sanitizing the environment should be taken more seriously than it is.

There is only one way to ensure this: by getting the environment management team to sit with the database and development teams and document the required environment with the aim of getting a sign off on versions and parameters.

Competent test environment configuration and disallowing duplication can reduce issues and effort; it can increase stability, efficiency and control by improving visibility and tracking. Finally, the test environment requires continuous monitoring, tracking and correction of improper configurations to prevent a negative impact on testing.

Fact File 13

How dependable is your environment configuration?

- **21%** of the test team's effort is used for test environment configuration
- **30%** of test environment issues are related to wrong configurations and versions
- **35%** of test environments are under-utilized due to the lack of environment tagging and tracking mechanism (configuration management)

Focus on data quality

90% of organizations reported that generating test data is an area of concern

Successful testing depends on the relevance of the data to what is being tested. A scaled down subset of the data is required – one that reflects the diversity and distribution of production data. Manual methods of extracting data are slow and error prone, particularly when records go back several years and the organization may have revised its data management methodology multiple times over those years. Production data can also contain sensitive personal information. Handling it may require special processes to meet regulatory norms. Creating test data can be time consuming (see Fact File 14: Is your data

management a time consuming monster?). But a well-designed test data generation solution that address both data manufacturing and data mining can greatly reduce test cycles and ensure greater control on deployment and release management process.

Often, when complete data is not available, organizations are forced to manufacture the data. The science of manufacturing data along with its tools is still picking up and will take time to mature. However, given that data quality is tightly linked to domain expertise, organizations may want to ensure that in such circumstances, their consultants have the appropriate background.

Fig 03: Top challenges faced in Test Data Management



Fact File 14

Is your data management a time-sucking monster?

- Up to **40%** of testing effort goes in planning, identifying and creating test data
- **20%** of testing time is wasted with testers creating either redundant data or incorrect data

Reduce data-related defects

90% of customers reported a lack of data integrity across multiple interfaces leading to incomplete test coverage and higher production defects

Today's organization architecture is distributed. Data is not synchronized across systems. Therefore, finding complete, consistent/standardized and accurate data is hard to come by. Testing is the direct casualty.

Sourcing and creating the 'right data' (and ensuring data integrity) leads to 100% test coverage, a qualitative improvement in system integration testing, meaningful business operations, User Acceptance Testing (UAT) and and less than 5% data-related defects in production. Identifying the right data continues to be a problem (see Fact File 15: Where is the right data?).

Sensitive data: Handle with care

Close to 73% of customers reported their inability to consistently mask sensitive information for testing

Organizations are severely challenged when it comes to anonymizing and masking data for testing (see Fact File 16: Is your data correctly

Fact File 15

Where is the right data?

- **50%** of data-related production defects are not exposed in testing due to unavailability of 'right data'
- Chances of discovering critical defects increase by 50% if data anonymization solutions are in place

anonymized?). With the growth in regulatory oversight in several industries, such as payments/banking and healthcare, sensitive data must be handled with care. Not being able to mask it also affects the organization's ability to send the data offshore for testing.

A good TDM solution ensures regulatory and compliance norms are taken care of and the data retains a meaningful format that can be used in test scenarios even after it is anonymized. One of the biggest upsides of effective masking is greater penetration of test execution and therefore the ability to discover and expose critical defects.

Fact File 16

Is your data correctly anonymized?

- **25 to 30%** of test scenarios remain untested in the absence of comprehensive data masking solution
- Chances of discovering critical defects increase by 50% if data anonymization solutions are in place

Quality
engineering

Is testing on its last leg?

Testing, as we know it, could be on its last leg. With the rapid adoption of Agile, DevOps and Continuous Delivery methodologies in digital, or, soon-to-be digital organizations, who has the time to wait for an application to be fully written before testing it? Digital organizations today want their applications rolled out quickly and they are constantly changing application architecture to accommodate user feedback for new releases. Sometimes, they don't even have all the requirements clearly enumerated ahead of the development of the application. So, waiting for a 'finished' app to test may not be realistic. Today, quality is no longer about validating work post-facto. It is about enabling quality during development, right from Day 1. It is therefore safe to say that as a consequence of digital transformation, there is a shift from QA to Quality Engineering (QE), and that testing, as we know it, is on its last leg, and perhaps even already dead.

The shift from QA to QE – in the digital way of developing software – requires an automation-first methodology (that's good news because without automation there is no Agile or DevOps either). In this new software development paradigm, testers need to have development skills while developers need to have testing skills. That is one reason we hear of an increasing demand for Software Development Engineer in Test (SDET). QE responds to today's need for speed. That is the singular reason why you can't avoid embracing it.

Process: The (positive) impact of Agile

100% of all organizations that have a multi/omnichannel digital strategy use Agile methodologies to create software

This is a stronger indicator of the trend towards internal and external digital transformation that is underway. Digital is essential to stay in the multi/omnichannel game. These organizations must use Agile to keep pace with the dynamic needs of creating applications (see Fact File 18: Agile and Continuous Integration). Data also shows that organizations that are developing mobile apps are more likely to use Continuous Integration (CI). This means finding and fixing defects must be much faster – and it helps immeasurably if QE is used to reduce the likelihood of defects to begin with.

Fact File 17

Agile and Continuous Integration

- 2 out of 3 organizations implementing Agile have reported benefits of using Continuous Integration along with Agile

People: Blurring lines between testers and developers

The traditional role of developers and testers is evolving and broadening

Only 1 in 3 organizations implementing Agile use manual testing in addition to developers that test (SDET). Interpreted another way, the role of testing is evolving and broadening. We now have small teams with multiple responsibilities. In this environment, testers have to learn to create the infrastructure to test in an automated fashion with QE replacing the traditional role of testers. In one of our US-based manufacturing engagements that leverages DevOps, we have quality engineers trained in programming skills along with developers who are skilled at continuous testing (unit testing, component testing and integrating testing levels) leading to continuous integration. Quality engineers create the automation script code which is stored in a central code hosting tool (Git/CVS/SVN) along with the application code. The automation script code undergoes review by the developers who use code review tools such as Crucible. This streamlined QE process where quality engineers and developers work closely has helped in achieving speed to market with very little manual intervention.

Using the right tool sets with seamless integration is the key

One of the key levers for achieving speed to market in a DevOps delivery model is to have the right set of testing tools used across the lifecycle. However, at the moment, the maturity levels of tools are low and there is considerable churn in the market.

Given the circumstances, it is not surprising to see that open-source tools are becoming chartbusters. The last two years has seen a 116% increase in demand for open-source tools over commercial tools. The key reason for the top status that open-source occupies in the tools space (see Fact File 18: Shift towards Open Source tools) is that these tools integrate and fit into the DevOps delivery tool chain. Factors like

ease of use (no licenses to worry about), customizations, regular release of plug-ins that support technologies beyond Java, and the extensive support forums have led to higher comfort levels with open-source tools.

Secondly, automation frameworks have to meet the requirements of Progressive Automation. A key framework in this space is the BDD (Behavior Driven Development) framework which is largely driven by open-source tools like Selenium and Cucumber, which in turn integrate with the open-source-based code management, continuous integration and deployment toolsets.

The bottom line is that open-source tools are costless and allow the SDET community to be more creative, experimental and self-driven, leading to better testing solutions. Importantly, open-source is enriching the QE practice by making it more vibrant, dependable and innovative — thereby making it more desirable as part of testing.

Fact File 18

Shift towards open-source tools

- 2 in 3 organizations are using open-source tools for Continuous Delivery
- Jenkins used by 80% of projects for Continuous Integration



Looking
ahead

Keep a finger on the pulse of IT

One aspect of testing and QA becomes self-evident from this report. It is important for organizations to begin drawing out the patterns within their testing practice. The wisdom in making investments in analytical tools and expertise, therefore, should not be undermined.

Today's organizations are rich in the data surrounding their QA and testing practice. There is a wealth of information and insight within that data. Analytics can help surface that insight and drive QA into a consultative and advisory role, helping shape applications that are aligned with today's Agile and DevOps environment. This will result in the faster delivery of stable and reliable products.

Analytics will also help organizations understand trends and surface vulnerabilities that are typical to the organization. This is a bit like maintaining your wellness by attending to the minor coughs, colds and headaches, using timely diagnostics and a healthy lifestyle, thereby preventing the need for major hospitalization. QA analytics works in a similar manner. It is a simple way to keep a finger on the pulse and wellness of your IT estate. Do it and organizations can be sure they will not be taken by surprise.



Data sources and methodology

Keep a finger on the pulse of IT

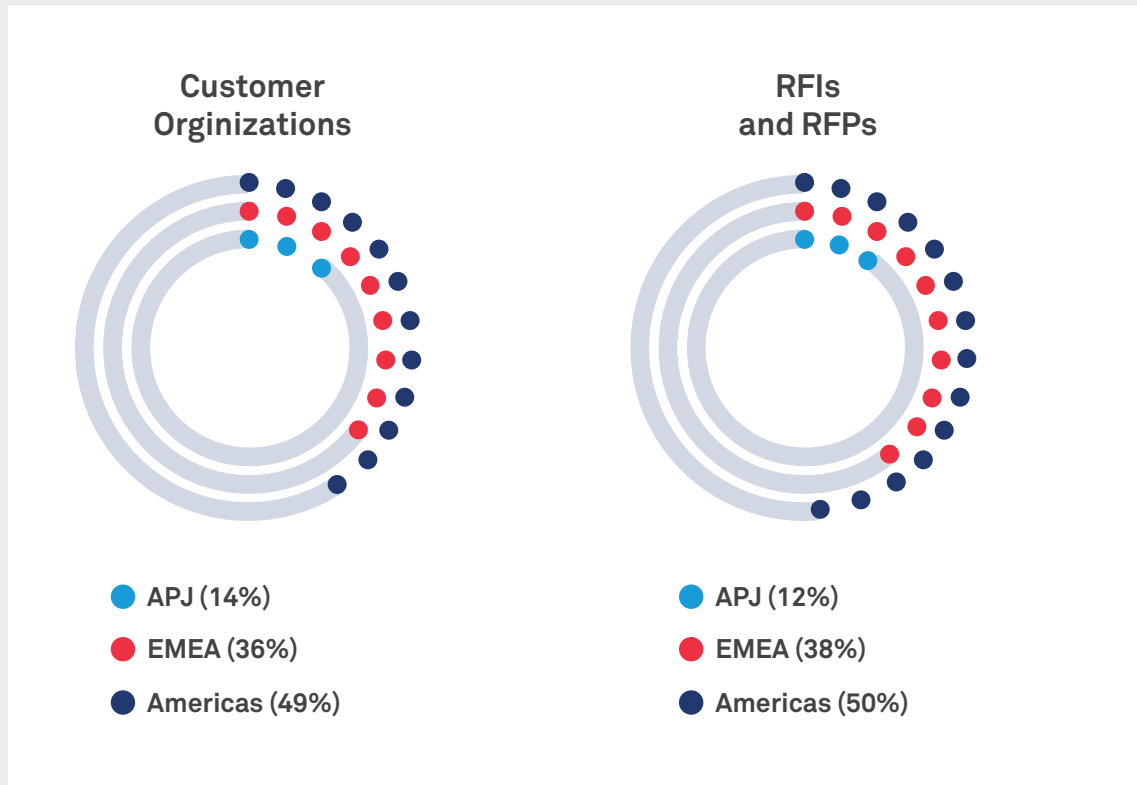
During Q1 2016, Wipro analysed data from over 1,500 QA projects across 400+ global organizations based in USA & Canada, Europe and Asia spread across different industries. These included Banking, Financial Services and Insurance (BFSI), Retail & Consumer, Healthcare & Life Sciences, Hi-Tech & Manufacturing, Media & Telecom and Utilities. The findings were corroborated by several other sources, such as customer feedback from Apple App Store for 40+ consumer & retail and financial services apps in North America and Europe.

Data and insights were also included from

- 50+ advisory and consulting engagements
- 1000+ RFPs and RFIs
- Analysts and thought leader briefings
- Customer interactions by Wipro's senior leadership and the sales teams

Wipro's intent was to make the report factual and unbiased by design. The analytics exercise began with the creation of a master data template by Wipro's subject matter experts, under the guidance of business leaders. The master template was further split into several sub-sections, customized for best capturing data from the various sources listed above. The fields to be populated in the template spanned across several critical areas pertaining to Quality Engineering and Assurance. The topics ranged from functional to test automation, from performance engineering, through to Test Data and Environment Management, to Quality Engineering. It was ensured that they collectively drilled down to the nitty-gritties, so as to tap into the full potential of the analytics engine. The majority of data was collected from our accounts globally, followed by RFP/Is, topped up with analyst and thought leader views. The data once collected was fed into Wipro's proprietary intelligent quality platform, IntelliAssure, which churned out various insights, forming the basis of the report. While we have looked at the data, we had to limit ourselves to certain patterns that looked fundamental today.

Demographics



Customer experience

The methodology for deriving insights specific to this section is unique in many ways. The data source for this section was the social media feedback from Apple App Store for the applications selected from US and Europe

region. Keywords used most commonly by the users are correlated to application attributes, which in turn have been dotted back to the root cause of the malfunction or defect. A total of 10 application attributes were focussed upon, and used to mould the findings.



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Customer Experience

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Notes

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