

Winning in the Digital Marketplace

Assuring Software Quality in a Fast-Moving DevOps World



Contents

03 Introduction:

DevOps and the Digital Marketplace

By Siva Ganesan, Vice President and
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05 The Rise of DevOps: Four Driving Factors

#1: Surging Customer Experience Expectations

#2: The Faster Pace of Innovation

#3: Ubiquity of Digital Devices

#4: Need to Reduce Cost & Eliminate Waste
and Error

14 Five Key Assurance Challenges Created by DevOps

#1: Changing the Organisational Structure

#2: Changing the Mindset

#3: Changing the SDLC Process

#4: Applying the Right Metrics

#5: Learning New Skills, Tools and Technologies

DevOps Journey with Woolworths Australia

DevOps Journey with Comcast Cable Corporation

32 The Future is DevOps

34 About TCS Assurance Services Unit

“Adopting DevOps methods will likely result in a productivity surge as large, or larger, than the manufacturing revolution 30 years ago, making this one of the most important and urgent business problems of our age.”¹

Gene Kim, author of The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win

Introduction: DevOps and the Digital Marketplace

We are living in a world where default is digital - where anything that can be digitised is being turned into software.

Today, if you want to call a cab, read a book, listen to music, buy groceries, unlock your car, look through old photos, check train timings, turn up your air conditioning, pay your childminder, watch a TV show, or chat with a friend, you use software.

As consumers, we have become used to living in this slick, always-on world, where apps are there for our convenience, they 'just work', and they magically update as our needs evolve.

We have started to expect this at work, too. We want accounting systems, HR systems and CRM systems to be 'appified', so we can use them on our smartphones and they are continuously updated with useful new functionality.

Traditional companies across all industry sectors are under pressure

The flipside is we now avoid services that aren't digitised, don't feel slick or convenient, and don't update as our needs change. This has devastating effects on traditional companies across all kinds of industries.

Mired in slow, old-fashioned processes, these companies are being disrupted by super-agile digital entrants.

Business leaders polled by the International Institute for Management Development (IMD) Switzerland in 2015 believe that four out of the 10 top-ranked companies in their sector will be gone by 2020; plunged into irrelevance by fast-moving competitors with new, digital business models.

“4/10 top-ranked companies in 12 industry sectors will disappear by 2020.”²

Source: IMD, The Digital Vortex, June 2015, survey of 941 business leaders in 12 industries and 13 countries

DevOps is key to surviving the digital storm

Traditional firms can accept this fate, or they can choose to change. One way is to adopt the same approach to software development and delivery as the disruptors. In many cases, as this report will reveal, this is the 'DevOps' way; where software development, QA and IT operations teams work together to continuously develop, test, deliver, deploy, monitor and update digital services in line with users' needs.

DevOps represents a major change in the way software is delivered. In an environment where speed is of the essence – and quality must be top-notch – it's becoming the only way forward.

Key lessons from those who have made the transition to DevOps

This report explores how digitisation is turning industries upside down; how the smartest companies are adopting DevOps to retain their competitive edge; and the challenges these companies faced in making the transition to a world where it's common to deploy top-quality new services multiple times per day.

It includes in-depth interviews with software testing and QA leaders at organizations from two distinct parts of the globe who have embarked on the DevOps journey: Comcast in the US, and Woolworths in Australia.

Finally, it provides a brief view of TCS Assurance Services Unit's unique capabilities that can help support and accelerate DevOps at your organisation.

We hope you will find it an inspiring and stimulating read, and look forward to a more in-depth, customized discussion on the 'how' bit of this all-important journey.



Siva Ganesan
Vice President and Global Head
Assurance Services Unit
Tata Consultancy Services

51% of individuals worldwide owned a mobile device in 2015

(SOURCE: GSMA)

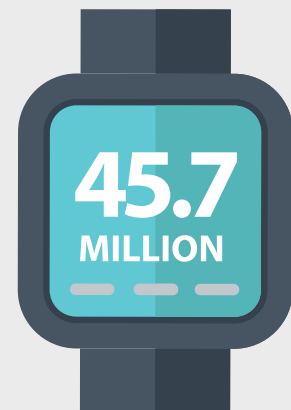


1.37 billion 4G LTE (Fourth Generation / Long Term Evolution) subscribers worldwide by year-end 2015

(SOURCE: ABI RESEARCH)

45.7 million wearable devices to ship in 2015

(SOURCE: IDC)



1 in 5 mobile communications will be M2M by 2020

(SOURCE: GSMA)

The Rise of DevOps: Four Driving Factors

DevOps is a modern solution to a set of four, very modern business needs and challenges.

1. Firstly, it's a response to **surging customer expectations** regarding the service delivery experience. In the consumer world, digital innovators have made it super-easy to buy, consume and return products. It's now effortless to find information or call a taxi, and activities like music discovery and purchase have been revolutionised.

Digital services like these aren't just convenient. They are also enjoyable to use, continuously updated, free or low-cost, and built to work on mobile devices. As consumers get used to this kind of experience, they expect it everywhere – shunning any service that's slow or difficult, or requires effort. Businesses must evolve to meet customer expectations, and maintain competitive advantage, or eventually perish.

2. Related to this is the **accelerating pace of innovation**. Successful disruptors don't just revolutionise things once; they keep on revolutionising, often at an incredible pace – and simultaneously increasing quality, rather than compromising it. Innovation has become a relentless race, with no time to stand still, rest on one's laurels or spend months perfecting a new system that will be obsolete before it's even deployed.

3. A third factor is the **ubiquity of digital devices** and the relentless advance of mobile connectivity. Digital is now default, so today's services must work seamlessly on a huge range of devices.

Developers must also keep a continuous eye on emerging devices and platforms, which are rapidly proliferating beyond smartphones and tablets into wearable tech, virtual/augmented reality, and machine-to-machine (M2M) communications.

“The most successful disruptors employ ‘combinatorial disruption,’ in which multiple sources of value – cost, experience and platform – are fused to create disruptive new business models and exponential gains.”

IMD, The Digital Vortex, June 2015

4. Lastly, DevOps is driven by a need to **reduce cost and eliminate waste and error across** the entire development cycle. All enterprises aim to operate as efficiently as possible; a goal that has previously led to radical new methodologies like Lean and Six Sigma for manufacturing and Agile and Continuous Integration for software development.

DevOps builds on these concepts to create a culture in which continuous software updates can be deployed extremely quickly, with any defects ironed out early in the cycle.

“High-performing IT teams deploy code 30 times more frequently than their peers, and 200 times faster.”

Puppet Labs, State of DevOps Report, 2015

DevOps is enabling companies to continuously innovate and deliver new digital services, faster, at lower cost, and 'first-time-right', to meet increasing customer expectations. Surveys show DevOps is on the rise, fuelled not just by the need to adapt to new business realities, but also by the increasing availability of tools, technologies and knowledge to make it work.

DevOps Adoption in 2015

“By 2016, DevOps will evolve from a niche to a mainstream strategy employed by 25 percent of Global 2000 organizations.”³

Gartner

In the next section, we'll look deeper into these four factors driving the rise of DevOps, and at the companies using it to pioneer new models and gain leadership positions in their respective industries.

³ Gartner Press Release, "Gartner Says By 2016, DevOps Will Evolve From a Niche to a Mainstream Strategy Employed by 25 Percent of Global 2000 Organizations", 5 March 2015, <http://www.gartner.com/newsroom/id/2999017>

Trend #1: Surging Customer Experience Expectations

Owing to the online service delivery revolution, people have started to expect the same levels of digitised service everywhere. Forrester calls this new landscape the 'Age of the Customer', explaining that:

"Empowered customers are shaping business strategy. Simply put, customers expect consistent and high-value in-person and digital experiences. They don't care if building these experiences is hard or requires a complex, multifunction approach from across your business. They want immediate value and will go elsewhere if you can't provide it."⁴

The Age of the Customer is prompting a wholesale change in the way businesses view and manage IT. The focus is shifting to enabling seamless customer service over multiple digital channels, with new services and features delivered daily in response to consumer feedback.

The risk of not doing this is so great that in 2015, Forrester found that improving the customer experience had overtaken revenue growth for the first time on business leaders' priority lists.⁵

Achieving this is only possible through a total re-imagining of the way the IT function is organised.

Business Leader's
Priorities in 2015:

**76% Improve
the experience
of customers**

73% Grow revenues

*Computerworld UK, Cutting Through
the DevOps Noise, June 2015*

Traditional 'waterfall' methods of software delivery are too slow, and, many development teams already use Agile to speed up the software development process. However, in order to deliver the kind of digital experience customers want, IT functions are seeking firstly to adopt Agile development principles (if these are not in use already), and then extend those principles into QA and IT operations, to create a 'DevOps' culture, in which requirements gathering, design, development, testing, deployment and monitoring are conducted continuously, iteratively and collaboratively.

**DevOps: the digital disruptors'
'secret sauce'**

DevOps started out as the 'secret sauce' that enabled fast-moving digital disruptors to swipe huge chunks of market share from traditional incumbents.

But it's now being adopted by those incumbents too, in an effort to keep up with – and even get ahead of – the disruptors.

In the financial services sector, where traditional firms are threatened by everything from peer-to-peer lending to mobile payments, incumbents are turning to DevOps to stay in the game. Jonathan Fletcher, lead for technology, platform and DevOps at UK insurer Hiscox, wrote in July 2015: "The journey of DevOps adoption at Hiscox was inspired by a need to increase the pace of change. The business is growing fast, the market changes rapidly and it's important as an IT function that we can respond to those demands."⁶

The same feeling is evident in all sectors where customers demand smooth, rapid and convenient digital services.

As IMD's Digital Vortex report notes: "Digital disruptors are particularly dangerous because they grow enormous user bases seemingly overnight, and then are agile enough to convert those users into business models that threaten incumbents in multiple markets. [For example, in] addition to free text messaging, WhatsApp now allows users to make free mobile voice calls."⁷

“Empowered customers are shaping business strategy. They want immediate value and will go elsewhere if you can’t provide it.”

Forrester Research, The Age of the Customer



Trend #2: The Faster Pace of Innovation

The pace of change and innovation across industries is so fast that companies can't afford to innovate once, and then rest on their laurels. They must engage in a process of continuous innovation, of continuous experimentation, of continuous deployment, and continuous refinement. Pausing for breath will only allow other firms to jump ahead.

As Forrester analyst Steven Peltzman has noted:

“If you can't innovate easily on your major internal platforms – weeks or days, not months for moderately/small-sized innovations – digital disruptors and likely your direct competitors will both have a significant leg up on you.”⁸

It's an approach that has paid off for Wealthfront (formerly kaChing) - a new breed of financial services businesses. Wealthfront has organised itself to be able to respond extremely quickly to user feedback about its digital services, and seeks to disrupt the status quo by (in its own words) “building an automated investment service from the ground up to put the client first”⁹

This is the kind of responsiveness that many traditional businesses can only dream of, mired as they are in legacy systems, siloed IT teams, and waterfall-style software development processes. But while businesses like Wealthfront make it look easy to deploy updated services in minutes, behind the scenes it requires a disciplined focus on cross-team collaboration and a highly automated approach to testing, release and deployment.

It may be of some comfort to more traditional IT organisations that even the disruptors struggle to deliver high-quality software at this kind of pace, particularly as they experience hyper-growth in their markets and operations. At Airbnb, for example, testers struggled to prevent defective code being released to users.

Airbnb processes huge volumes of transactions in dozens of different currencies across a wide array of payments processors every day, and a small undetected bug could have a huge impact on guests and hosts. A candid blog post by engineering manager Lou Kosak acknowledges that deployments were harrowing, and verifying that a change wasn't introducing regressions was often a matter of manual testing and stats watching.¹⁰

“A small undetected bug could have a huge impact on our guests and hosts. Deploys used to be harrowing for us; verifying that a change wasn't introducing regressions was often a matter of manual testing and stats watching.”

Lou Kosak, Engineering Manager, Airbnb

Netflix, too, struggled with quality and security as it grew. “The IT environment was starting to get quite big and the company was moving fast,” recalls Jason Chan, Netflix's director of engineering in cloud security, in a June 2015 interview with the Wall Street Journal. “The only realistic way of maintaining security in an environment that grows so rapidly and changes so quickly is to make it automation first. When you move faster, it's just logical that the ability for humans to operate effectively diminishes.”¹¹



“DevOps is a faster and smarter way of doing things. But [...] without effective glue that binds the two, there could well be chaos in production. [That glue is] continuous and contiguous assurance.”

Siva Ganesan, Vice President and Global Head - Assurance Services Unit, Tata Consultancy Services

The need to innovate continuously is driving a culture in which new code is deployed to customer-facing systems multiple times per day. That situation comes with the major corollary that the code either has to work first time, or has to be fixable before customers notice anything is wrong. A combination of development, QA and operations teams working together, using appropriate tools, tests and automation, is the only way to achieve it.

As TCS Assurance Services Unit's Siva Ganesan notes, “DevOps is a faster and smarter way of doing things. But [...] without effective glue that binds the two, there could well be chaos in production. [That glue is] continuous and contiguous assurance. Continuity is the need to quickly implement high

velocity changes, while contiguous assurance calls for early involvement across all phases of the product life cycle. The continuity and contiguous combination for assurance enables businesses to quickly churn out features and functionality in line with ever-evolving customer expectations.”¹²

When that happens, the potential for rapid continuous innovation can be realised. Puppet Labs' 2015 State of DevOps report found that high-performing IT teams achieve far better stability than lower-performing peers, with 60 percent fewer failed deployments and a mean time to recover (MTTR) that's 168 times faster. The report concludes that “it's their use of DevOps practices that sets these top performers apart from the pack.”¹³

That level of performance is exemplified by arch-innovator Amazon, where “moving from physical to virtual servers allowed a complete DevOps transformation in which individual engineers could push out new updates an average of every 11.7 seconds on weekdays. Despite this rapid pace, the number of failures and their duration shrank dramatically as well.”¹⁴

¹² <http://sites.tcs.com/blogs/Think-Assurance/perfectly-orchestrated-assurance-symphony/>

¹³ <https://puppetlabs.com/blog/reducing-cost-release-97-devops>

¹⁴ <http://servicevirtualization.com/how-amazon-made-the-leap-to-a-devops-culture/>

A TCS survey of 795 large companies conducted in 2015 found that nearly half of the companies are using IoT technologies today to monitor their supply chains (45%), and 47% track customers via apps.

TCS Global Trend Study 2015, Internet of Things: The Complete Reimaginative Force¹⁵



Trend #3: Ubiquity of Digital Devices

We saw earlier that the move to DevOps is being driven by rising customer expectations of digital service delivery. But those expectations aren't rising in a vacuum; they're at least partly driven by the continuous introduction of new devices, networks and operating systems through which digital services can be delivered.

In particular, they're being driven by advances in mobile devices, mobile network connectivity, wearable devices, and machine to machine (M2M) communications, aka the Internet of Things.

Today, armed with a smartphone, an unlimited data plan and reliable access to a high-speed mobile network, people can reasonably expect to be able to use any digital service, anywhere, at any time. They no longer need to be at a desktop computer or connected to a LAN or Wi-Fi network to do things like use apps, shop, email, play games, watch TV shows, videoconference with colleagues, or update work systems.

That ubiquitous connectivity is driving up expectations of seamless, anywhere-anytime service delivery, and if it fails to materialise, consumers have no qualms in complaining about it on social media.

“The explosion of mobile devices has created a testing nightmare. Massive fragmentation has resulted in over 24,000 distinct Android devices that all run on different versions of the Android OS, plus the several variations of iOS devices currently in use.”¹⁶

***Ori Bendet, Inbound Product Manager
HP Software***

All of this is ratcheting up the pressure for software delivery teams, who not only have to keep up with consumers' expectations of smooth, slick, anytime-anywhere digital services, but also have to deliver them – in full working order and without bugs – across literally thousands of different mobile platforms, operating system versions, OEMs and form factors.

And that's just smartphones, and just today. While still keeping up with today's fragmented mobile device landscape, software delivery teams are also having to plan for an array of wearable devices, including smartwatches and augmented reality headsets, as well as virtual reality platforms and devices like Oculus Rift and Google Cardboard.

IHS (Information Handling Services) predicts that 171 million wearable tech devices will ship in 2016, up from 14 million in 2011¹⁷ – creating opportunities and challenges alike for software teams.

At the same time, for many apps, the user interface is disappearing entirely as the Internet of Things (IoT) evolves: in which devices collect data, act upon it, and share it with other devices with no human intervention or supervision.

This is a world that truly requires continuous delivery of error-free software updates: a world in which development, testing and delivery can no longer be siloed or a manual activity, and in which automation and continuous monitoring and feedback are essential to keep up with the fragmenting landscape and the pace of global innovation.

If an environment is ripe for DevOps – with an emphasis on continuous testing – it's this.

¹⁵ TCS, [Internet of Things: The Complete Re-imaginative Force](#), Global Trend Study 2015
¹⁶ <http://techbeacon.com/software-testing-devops-how-one-qa-team-sets-pace?beta=1>
¹⁷ <http://press.ihs.com/press-release/design-supply-chain/wearable-technology-market-suited-rapid-growth>

A photograph of two men in business attire (blue and white striped shirts) working together at a desk. One man is seated and looking down at a document, while the other stands behind him, also looking down. They are both holding pens. A laptop is visible on the desk to the left. The background is a plain, light-colored wall. A semi-transparent white box with green text is overlaid on the lower half of the image.

“When you apply lean management and continuous delivery practices to software delivery, you get higher quality, shorter cycle times with quicker feedback loops, and lower costs.”

Puppet Labs, State of DevOps Report, 2015

Trend #4: Need to Reduce Cost & Eliminate Waste and Error

Finally, DevOps is driven by a need to reduce cost and eliminate waste and error across the entire development cycle. While all businesses aim to operate as efficiently as possible, very often they are able to do so only in silos.

For example, it's of little use accelerating manufacturing output if you can't also speed up transportation of the manufactured items to their destinations. The same holds true in software development: it's of limited use applying Agile or Continuous Integration (CI) to develop fast and iterative code if the operations team isn't geared to deploy the updated code on a regular basis.

While Agile and CI have their uses, exponential speed and efficiency gains only come when those methodologies are extended across the entire operational cycle. In an IT function where there is seamless collaboration between developers, testers and operations; processes that enable rapid development, testing and deployment; and the right choice of tools to achieve the right results, the gains can be enormous. Puppet Labs' State of DevOps 2015 report observes:

"Manufacturing was revolutionized by the application of lean principles. Today, it's IT's turn. When you apply lean management and continuous delivery practices to software delivery, you get the same results — higher quality, shorter cycle times with quicker feedback loops, and lower costs. And the benefits don't stop there: These practices also contribute to creating a culture of learning and continuous improvement, lower levels of burnout, and higher organizational performance overall."

This isn't just theory, but a fact proven by dedicated adopters of DevOps. In an interview with Amazon's former Lead Engineer John Jenkins, Service Virtualization reports that: "As a result of this transition to more agile, DevOps transition [sic], Amazon is saving millions of dollars using the flexible capacity of the cloud, and gaining new revenues because the site is down less often."¹⁸

And in the entertainment industry, Warner Music reports that its move to integrated 'software factories' has enabled new applications and updates to be delivered 400% faster, with a \$1.1m saving per application update delivered.¹⁹

Quality Assurance is a Critical Element of DevOps

Organisations however, should be wary not to focus too much on the 'dev' and 'ops' elements of DevOps. Despite being absent from the 'DevOps' title, testing (or Quality Assurance) is a critical element of continuous, lean software delivery, and the key to eliminating defects prior to deployment. Without properly integrated and automated testing, DevOps teams risk continuously deploying defective code, something that would almost immediately squander any speed and cost advantage. And, as we are all well aware, seizing a major bug during development costs exponentially less than it does during testing, and further lesser than it does during release.

Despite being absent from the 'DevOps' title, testing (or Quality Assurance) is a critical element of continuous, lean software delivery, and the key to eliminating defects prior to deployment.

¹⁸ <http://servicevirtualization.com/how-amazon-made-the-leap-to-a-devops-culture/>
¹⁹ <http://www.slideshare.net/cdavisafc/ic3-testingmonitoring-and-dev-ops>

Five Key Assurance Challenges Created by DevOps

In the previous section we reviewed four macro trends driving the uptake of DevOps, with a look at how different organisations in different industries are responding to them.

A common thread running through those responses is the critical role played by testing and quality assurance in the continuous delivery of software in a DevOps world. For DevOps to be effective, assurance organizations must look beyond defect detection and affirming conformance to requirements, to become the guardians of customer experience. They must bridge the gaps between development and operations teams and enable IT teams to deliver on business needs.

But embedding testing and QA into a DevOps culture isn't an overnight task. It requires a considerable re-organisation of the way software delivery is managed, and presents five inter-related challenges around the classical organisational pillars of People, Process and Technology:

1. Organisational change

DevOps requires a significant change in the way IT functions are organised. The function must move away from siloed teams, linear processes and top-down decision making. Development, QA and operations teams must be fully integrated, fully empowered and often self-organising – a far cry from the way many IT functions work today.

2. Mindset change

DevOps requires a major mindset shift, in which development, QA and operations teams commit to working together on a continuous stream of small software deployments, rather than one monolithic application that may take months or years to 'complete'. This means accepting and embracing new and initially unfamiliar ways of working, and committing to learning new skills.

3. Process change

One of the biggest challenges of DevOps is to implement the operational shift from a linear process to one that emphasises continuous iteration in short stages, with development, QA and operations teams collaborating throughout. Such a transformation also demands change in other established processes across the organisation, which will have to be tackled with the same amount of attention and rigor.

4. Applying the right metrics

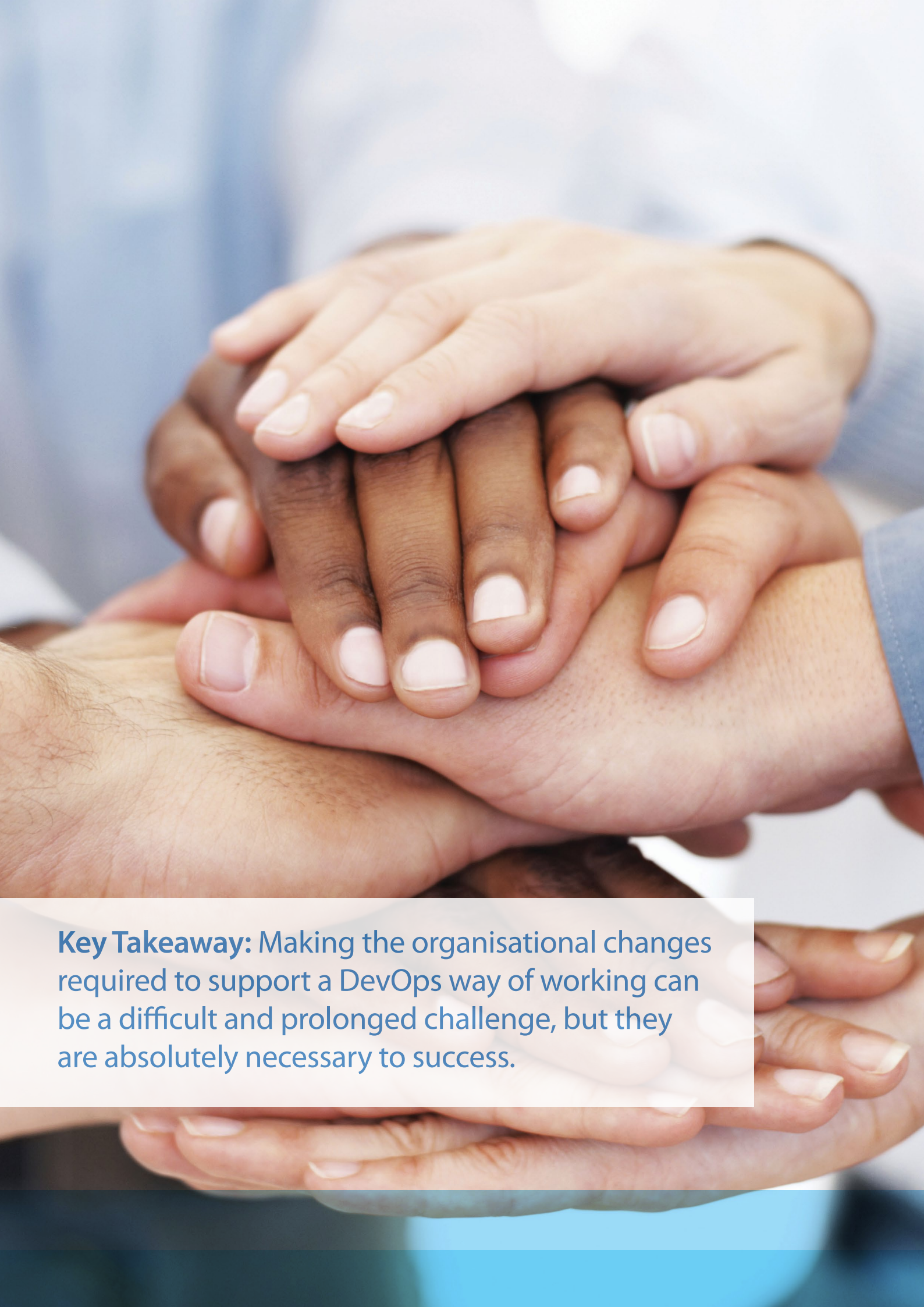
The metrics that were applied to testing in a traditional development world almost certainly no longer apply in a DevOps culture, and trying to bring them over to the new environment may be counter-productive. Establishing a shared vision and goals, and finding the right metrics to measure performance against them is essential to ensuring the team as a whole delivers high-quality software that meets the objectives of the organisation.

5. Learning new skills, tools and technologies

DevOps requires QA professionals to learn a raft of new skills. Since they must work alongside their dev and ops colleagues, they must develop knowledge and expertise in these two functions. And they must also learn to use new tools for everything from test automation to service virtualization and cloud configuration management.

The following sections delve into each of these challenges in turn, illustrated with anecdotes and experiences from organisations that have tackled them – including in-depth interviews with testing and QA leaders at Woolworths and Comcast.





Key Takeaway: Making the organisational changes required to support a DevOps way of working can be a difficult and prolonged challenge, but they are absolutely necessary to success.

Challenge #1: Changing the Organisational Structure

DevOps requires a significant change in the way IT functions are organised; away from siloed teams, linear processes and top-down decision making.

A siloed organisation is too slow and too manual in its operation to support continuous digital service delivery in the age of the customer. In its Digital Vortex Report, IMD notes that even if this approach has worked well in the past, it can't work in the new, always-on world.

"[Incumbent firms] must challenge the assumptions that have underpinned prior success, and stress-test the ways in which they deliver value to customers," the report notes. "It means changing the organization itself, including its operations, culture, revenue model, and more – in fundamental ways, and perpetually."²⁰

In practice, that means not just breaking down barriers between traditional development, QA and operations silos, it also means empowering the resulting cross-functional teams to make their own decisions in real time. In a DevOps world, cross-functional teams work iteratively in short sprints to get software updates delivered, tested and deployed fast. There is no time to escalate issues or queries to senior management and wait for a response – decisions must be made quickly.

This requires a fundamental culture shift, in which less senior staff must be empowered and trusted to make high-risk decisions. Traditional IT organizations may find this hard to stomach at first, even if they like the DevOps message in theory. In a 2015 report, Gartner Research Director Laurie Wurster observes that:

"The overall DevOps message is compelling, because many enterprise IT organizations want to achieve the scale-out and economies of scale achieved by world-class cloud providers."

“However, culture is not easily or quickly changed. And key to the culture within DevOps is the notion of becoming more agile and changing behaviour to support it – a perspective that has not been widely pursued within classical IT operations.”²¹

It's hardly surprising that CIOs are reluctant to let go of top-down decision-making when the stakes are so high. Airbnb's test blog vividly describes the seat-of-the-pants nature of early code deploys at their organisation, when software was released to production with little in the way of quality assurance.

The blog shares that in the early days of Airbnb, as at many startups, most commits were pushed directly to master.

With deploys going out many times a day, this resulted in a lot of questionable code hitting our production servers, and uptime suffered for it.²²

Fortunately, the theory and practice of DevOps have come a long way since Airbnb's early forays, and a whole raft of organisations have proved the viability (indeed utter necessity) of the model, as we have seen earlier in this report.

But wholesale organisational change is still hard to achieve. Interviewed for this report, Richard Lewis, Quality Assurance Manager at Australian retail group Woolworths, says it took his organisation 12-18 months to transition to a new, DevOps style of working – particularly when it came to involving QA and testing in the equation.

For Woolworths, success finally came as a result of adopting proven collaboration models from Woolworths' outsourced test partner, and as a result of QA professionals sitting with development and operations personnel to evangelise and demonstrate the role of QA throughout the lifecycle. (Read the full interview with Richard on p.18)

²⁰ IMD, The Digital Vortex, June 2015

²¹ Gartner Press Release, "Gartner Says By 2016, DevOps Will Evolve From a Niche to a Mainstream Strategy Employed by 25 Percent of Global 2000 Organizations", 5 March 2015, <http://www.gartner.com/newsroom/id/2999017>

²² <http://nerds.airbnb.com/testing-at-airbnb/>

DevOps Journey: An Interview with Woolworths Australia



Richard Lewis
Quality Assurance Manager,
Woolworths

Richard Lewis is responsible for Testing Services across all IT change projects within Woolworths, one of Australia's largest retail groups. He talks about the challenges Woolworths encountered in moving to DevOps, and the benefits they have seen as a result of it.

Which drivers have prompted Woolworths to speed up software delivery?

Customer expectations, improving our customers' shopping experience, and ensuring that we are always seen as industry leaders, several steps ahead of our competitors. A lot of our business is done online and through our apps, and customers have changing expectations around the functionality and look and feel of those. We also need to be able to roll out online offers and promotions fast, and that's why we wanted to make things quicker.

Which methodologies have you adopted to help you achieve this?

We use a bit of everything. When we started out we went for pure Agile. Then we moved to DevOps in some areas, and we do Waterfall rather well in other areas. Every organisation is different, so we have tried to pick the pieces that work best for Woolworths.

“DevOps is not one-size-fits-all. You have to find the way that works for you.”

Has the move to Agile and DevOps created any challenges for you as a test team?

Yes it has in two ways. With Agile, we talked about making the whole lifecycle Agile, but we ended up just targeting testing, which didn't particularly work. It was the same with DevOps. This impacted the way we operated because not everybody was on the same trip as us.

Then there's the perception that people have about our role. Even though everybody is working together with DevOps, our system owners are used to seeing us as the Testing team, so we still got separated a bit. Location is part of that. We have an onshore/offshore model, so how one structures the team around it really matters.

How have you addressed these challenges?

With the onshore/offshore component, we asked TCS (our Quality Assurance & Testing partner) for examples of where they have worked successfully elsewhere, and how they transitioned to DevOps with that model. We then used those as models for ourselves, and to show others here how it can be done well.

It was also making sure our testers work with everybody else, to make them aware of what our team can bring. In some areas that was pretty quick, in others it was 12-18 months before the proper role of the testing team was really understood. It wasn't a quick fix, but we got there in the end.

What results have you seen since adopting a DevOps way of working?


In our online sites, we have been able to roll out functionality and offers ahead of our competitors. We can deliver little pieces more quickly, and that makes a difference. I don't think we could have done that before; we would have chunked them all up into one release and put it out every six months.

We also have vastly less quality issues. I would like to say it's because of the testing, but actually we don't find nearly as many problems as we did before. They are picked up early, when they should be – back in the actual development phase, before they get into proper testing. When it gets to us for the final part of the test we find minimal issues, so the outcome is pretty good.

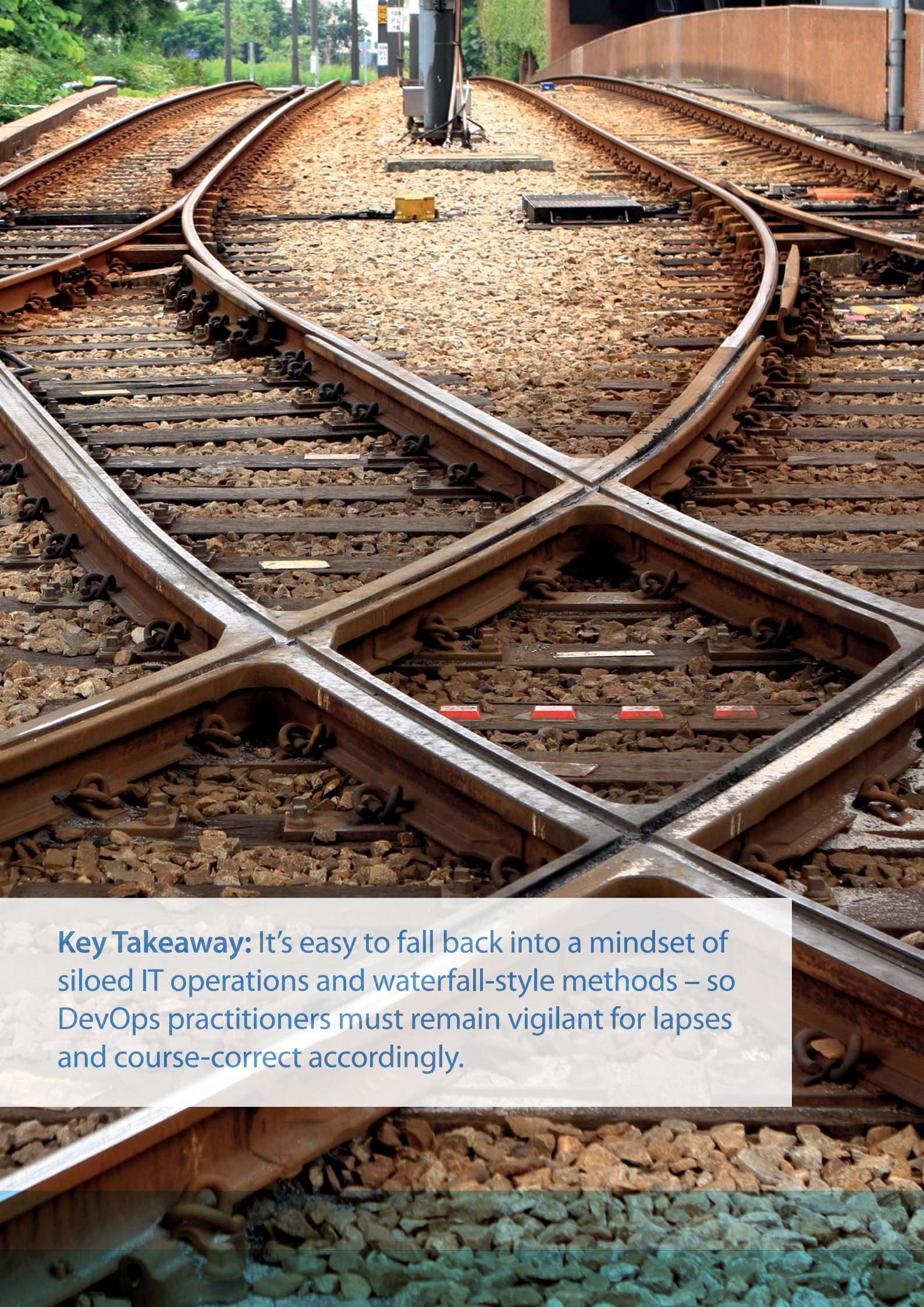
What advice do you have for other organisations considering a move to DevOps?

Firstly, DevOps is not one-size-fits-all. You have to find the way that works for you. When we started, we didn't take advice from anyone. We thought we knew better. Once we took advice from some experienced experts and they helped us find what suits us best in particular, we realised that's where we should have started. So don't just read a textbook and think that's how it's going to work.

And secondly, it's very important that anyone who is going to work in these teams, whether they're a tester or a developer, is trained on exactly what it's going to be. It doesn't have to be formal training but everybody has to have an idea of what DevOps is – or, if you're going to do Agile, what Agile is – so everybody gets taken on that journey, not just the important people!

A photograph of a person's hands in a grocery store. The person is holding a clear plastic package of white chopsticks in their left hand and a black smartphone in their right hand, as if scanning the package. The background is filled with various fresh vegetables like red and yellow bell peppers, and a price tag with the number '5.99' is visible in the foreground.

“We have vastly less quality issues. We don't find nearly as many problems as we did before. They are picked up early, when they should be – back in the actual development phase.”



Key Takeaway: It's easy to fall back into a mindset of siloed IT operations and waterfall-style methods – so DevOps practitioners must remain vigilant for lapses and course-correct accordingly.

Challenge #2: Changing the Mindset

Organising a change in organisational structure links to a change in mindset among IT leaders, developers, testers and operations teams about the way in which software is developed and deployed.

In the old world, an application or service was worked upon until 'finished', then passed to QA for testing, then thrown over the wall to operations to deploy and manage. It was a linear process with a start point, a finish point, and clear delineations between tasks. Even in the Shift Left world, while testing started early in the lifecycle, the siloed approach of 'handing over' to Quality Assurance still persisted.

In DevOps, by contrast, the emphasis is on everyone working together to ensure continuous delivery of software that is continuously updated. The entire notion of a 'finished' product gets outdated. This requires a major mindset shift, towards one in which development, QA and operations teams work side by side on a continuous stream of small software deployments, rather than one monolithic application that may take months or years to 'complete'.

For IT professionals trained in a certain way and used to working in a certain way, it can be a difficult shift to make, and many have struggled to make the necessary adjustments. Interviewed in Network World, for example, Michael Rembetsky, VP of Technical Operations at Etsy, describes the online craft retailer's own experience:

"We had some underlying engineering issues that made it hard to get things out the door. Deploys were often very painful. We had a traditional mindset of, developers write the code and ops deploys it. And that doesn't really scale."²³

Another online retailer, BJ's Wholesale Club, is adopting a DevOps culture in some areas such as mobile app development and e-commerce, and has encountered similar hurdles. Despite being fully committed to DevOps, their tendency to think in waterfall terms is very strong, and has to be actively resisted. In a roundtable discussion organised by Enterprise Project, BJ's Wholesale Club enterprise architect Pete Buonora shared that there exist conflicts between the processes already in place and the DevOps mentality, as it was easy to fall back into a waterfall mindset.²⁴

Falling back into a waterfall mindset when trying to work in a DevOps fashion is such a widespread occurrence that in 2011 Forrester gave it a nickname: 'Waterscrumfall'. Let's examine how a 'Waterscrumfall' situation comes about. Software is developed and tested in an Agile fashion, without involvement of operations. Upstream activities are executed using Waterfall methods, and requirements are then traditionally thrown over the fence to the delivery team. Finally, these delivery teams start working in a time-boxed, iterative manner, which is more Scrum-like.

This example highlights how thinking in terms of discrete, linear tasks (develop-test-deploy) is the enemy of efficiency and productivity in a DevOps world. The mindset needs to change to one in which development, testing and deployment are everyone's responsibility, and everyone works in concert to get high-quality code deployed as quickly as possible.

Interestingly, in a DevOps world, that doesn't always mean testing every unit of code and every integration until it's 'right' (although this should always be the goal of quality assurance). It also means creating an environment in which code can be pulled quickly from servers if a bug is spotted, and the production environment temporarily rolled back to an earlier version that worked. That can only happen when developers, tester and operations work together continuously, in an atmosphere of mutual trust, support and empowerment.

²³ <http://www.networkworld.com/article/2886672/software/how-etsy-makes-devops-work.html>
²⁴ <https://enterpriseproject.com/article/devops-roundtable-part-1-demand-for-devops>

Challenge #3: Changing the SDLC Process

Perhaps the biggest challenge of DevOps is successfully implementing the operational shift from a linear process to one that emphasises continuous iteration in short stages, with high levels of automation, and with development, QA and operations teams collaborating throughout the SDLC.

A common mistake is to over-focus on uniting dev and ops, with testing and QA treated as something of an afterthought. It helps to think of the SDLC as a supply chain, in which every moving part depends on the other. To ensure quality from end to end, assurance must be viewed as a protective umbrella enveloping the whole chain. A holistic approach to product and solution development is the only way to ensure error-free products that conform to requirements as they progress to the production-ready stage.

In this approach, rather than acting as the 'last line of defense', assurance plays a proactive role. It provides continuous visibility and feedback on the quality, accuracy and conformity of not just the business requirements, product and solution design, but also the development process.

This shift requires a phased approach – a move from the traditional design-develop-test process to concurrent testing integrated with all phases of the lifecycle.

But as we saw in the previous section, embedding testing into every stage of the SDLC – and instituting assurance as a protective umbrella over the whole cycle – is a challenging task. That's partly due to the pervasiveness of the develop-test-deploy mindset. In an article for TechBeacon, Stephen Frein, Senior Director of Quality Assurance at cable giant Comcast, describes how on many agile teams, testers end up working in waterfall fashion, waiting for the hand off of a user story from developers before beginning the bulk of their work. This approach creates the same pitfalls as in traditional projects: hurried test efforts, incomplete testing, slow feedback cycles, and a fragmented sense of quality ownership.²⁵

The proper DevOps approach is to have testers and developers sitting and working together, to unit-test user stories as they're developed. But Frein notes that this doesn't eliminate all the risks:


"If developers and testers work more closely together and the notion of a hand off disappears, developers will feel less pressure to get stories ready for QA consumption. They'll scale back their own quality-focused efforts, assuming the tester will make up for any needed diligence in the new, blended testing model."

Another challenge when seeking to integrate testing with development and operations arises when teams work in different physical locations. At one large bank that TCS Assurance Services Unit worked with, the collaboration challenge between onsite and offshore QA teams could have slowed down software delivery. The problem was avoided by using communications tools like video conferencing as well as collaboration tools like JIRA and Confluence, to bring the teams together.

Shift left, and right.

'Shift Left' inaccurately describes the entire process change required; a DevOps approach also necessitates a 'Shift Right' to ensure that software is also continuously monitored and tested after it has been released into production.

TCS Assurance Services Unit's Siva Ganesan, for example, sees an equally critical role for QA in production, writing in a January 2015 article for Test Magazine that "In production, usually after User Acceptance Testing has been completed, the QA teams need to certify the go/no go decision, and to be sure that, once the last set of fixes has been applied, the last set of results are not invalidated."²⁶



Key Takeaway: In a DevOps world, QA must be the guardian of quality throughout the software delivery lifecycle, often necessitating both a 'shift left' and a 'shift right' from its traditional position in the SDLC.

Adopting these shifts and DevOps practices influences changes for other processes of the organisation, and finally also has implications for process maturity models such as CMMI which now must evolve to be part of the DevOps journey.

It's a view confirmed by Anant Subramanian, Senior Director of eBusiness Services at Comcast. The DevOps journey at Comcast has required both a shift left and shift right for QA professionals, he says, in order to influence quality throughout the software development lifecycle.

“At Comcast we have been trying to evolve the function in such a way that the mindset and the capabilities of assurance are focused on influencing quality early on in the cycle. To not only look at the code, and perform Quality Assurance functions on the code, but also, if need be, pull down the code and deploy it into the different environments and whatnot. It's a bit of shift left, and a bit of shift right – that's been the journey.”

Anant Subramanian, Senior Director eBusiness Services at Comcast

DevOps Journey: An Interview with Comcast Cable Corporation

Anant Subramanian
Senior Director
eBusiness Services at Comcast



Anant Subramanian is Senior Director, eBusiness Services at Comcast, the world's largest broadcasting and cable company. He talks about the organizational and cultural impact that the journey to DevOps is having on the QA function at Comcast.

Which drivers have prompted Comcast to speed up software delivery?

Our key focus is on improving the customer experience. We have different customer experience scores that we're tracking towards, so our number one objective is that we are able to deliver not just a better, more reliable quality of product, but something that wows the customer. The other driver is competitive advantage. We have different products and services and we're trying to keep up with what our customers find valuable – a landscape that's changing so fast, all the time. And we want to deliver it before our competitors do, obviously.

Which methodologies have you adopted to help you achieve this?

We continue to be a mixed bag of methodologies. Agile is probably most dominant across the organisation, albeit with different flavours of Agile being used. Then, because of our dependency on some of our external vendors, we still have the old-school approach in certain pockets.

Now, in order for us to continue to evolve, we are looking at bringing DevOps into the culture. For us, DevOps is more of a journey than a destination.

We don't see it as a title – 'now we are DevOps complete' – it is more of a culture. It's about making sure we communicate and collaborate a lot more efficiently than in the past. So it's not a case of 'either we do Agile or DevOps'. It's more that while doing Agile, we are looking to become more DevOps-centric. That's been our journey, all the while keeping in mind the end goal: to provide a better quality customer experience.

What impact has the move to Agile and DevOps had on the QA function?

The evolution of the function is the key here.

“The days of pure play anything are behind us. There is no pure play developer, or pure play publisher, or pure play tester any more. We have to evolve to the next generation of methodology and culture, and with the advent of DevOps this is even more pertinent.”

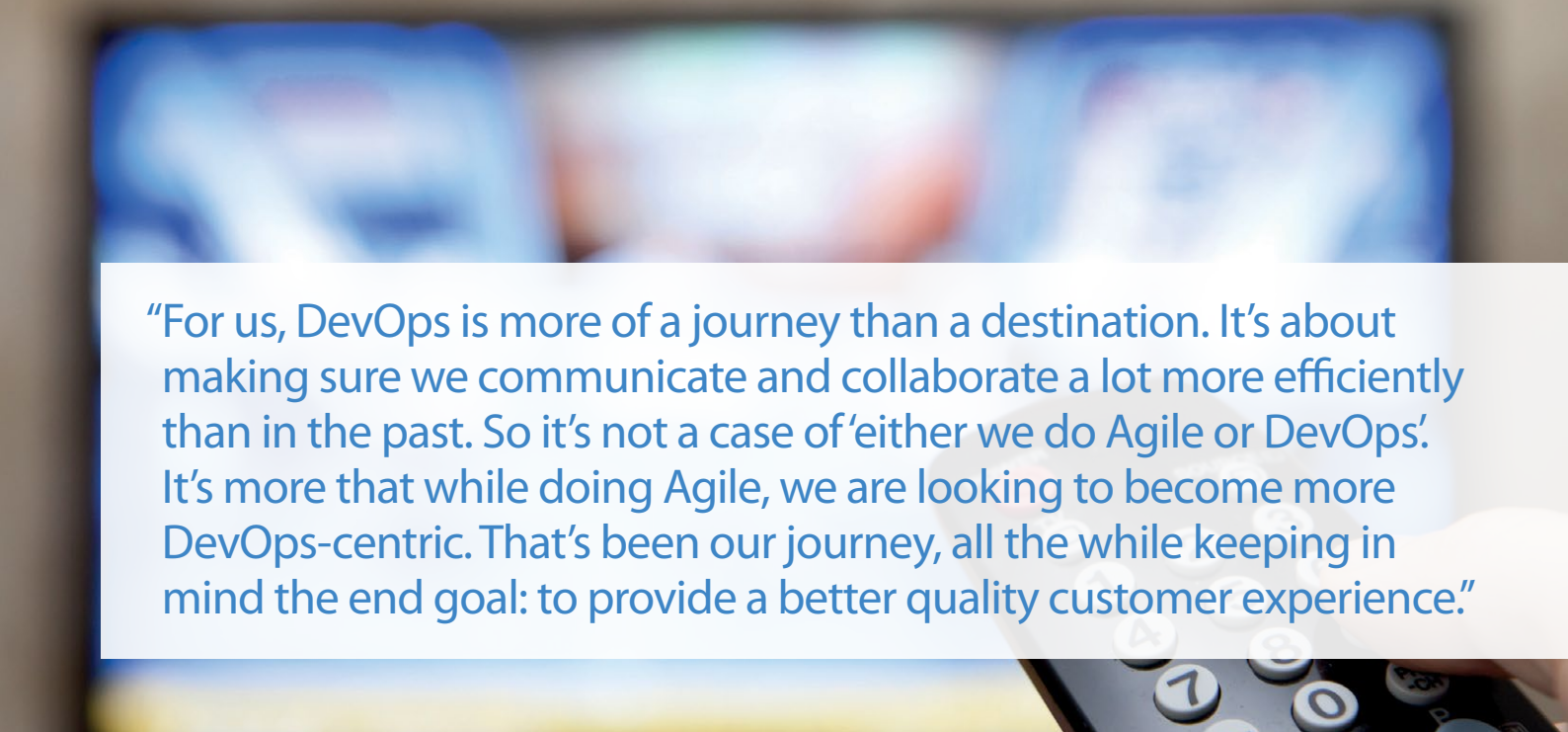
The Quality Assurance function itself has to lend itself to this change, this evolution.

At Comcast we have been trying to evolve the function in such a way that the mindset and the capabilities of assurance are focused on influencing quality early on in the cycle.

To not only look at the code, and perform Quality Assurance functions on the code, but also, if need be, pull down the code and deploy it into the different environments and whatnot. It's a bit of shift left, and a bit of shift right – that's been the journey.

What changes have you had to make in terms of people, processes and tools?

Any time there's change, leaders always evaluate attitude and aptitude. Do we have the right folks who can take us to the next level? Sometimes we are able to re-tool people, and in some cases – due to personal choices, or attitude or aptitude reasons – we might have to replace some. So as the function has evolved, some of the people associated with that function have been swapped out for people with a slightly different skillset.



“For us, DevOps is more of a journey than a destination. It’s about making sure we communicate and collaborate a lot more efficiently than in the past. So it’s not a case of ‘either we do Agile or DevOps’. It’s more that while doing Agile, we are looking to become more DevOps-centric. That’s been our journey, all the while keeping in mind the end goal: to provide a better quality customer experience.”

Another area of focus has been upstream and downstream, on our counterparts in development and operations. I believe that everybody should be responsible for quality. So I don’t just look at the skillset of the QA engineers, but I also encourage my peers to look at the development counterparts. Are those folks quality-centric? Are operations personnel making sure the quality of operations is buttoned-down? So it’s not just managing our own internal housekeeping, but also influencing our immediate near neighbours so that quality is consistently distributed across the value stream.

To do that we have also introduced some new roles. We have been experimenting with an intermediary role, one that sits between the classic tester-versus-developer, who does both functions. That person can influence some of those quality influences and help the development team and some of the other organisations have a better approach in terms of the tools, techniques that they use.

We have had to upgrade skillsets in terms of processes, tools and techniques. We are increasing skills in some of the continuous integration/continuous development tools, as well as doing a lot more quality engineering work. This means getting testers to possess more scripting and development knowledge so they can partner closely with developers to influence quality throughout the lifecycle.

What results have you seen since adopting a DevOps way of working?

The jury’s still out in terms of the larger impact, but the short-term impact is a definite improvement in quality.

“We are beginning to have a better quality cycle, resulting in fewer issues surfacing in production.”

We still don’t have the volume data to accurately say this is all working as planned, and we’re still tweaking things as we go along, but we’re definitely trending in the right direction.

What advice do you have for other organisations considering a move to DevOps?

Wherever you are on your DevOps journey, there is no one universal solution. So ask around, get some objective data points from other folks who have implemented, and then do some proofs of concept, to see what might work for you.

Another is in terms of managing the culture, because the natural tendency for any organisation is to resist change. So it’s always good to have some data-backed history to be able to say “so-and-so was able to leverage this and implement such-and-such and see an uptick in sales numbers or CSAT (or customer satisfaction) scores by x%”.

The last thing is managing the management. Sometimes political barriers come into play, so everybody has to do a thorough evaluation to see how big or how broad they need to go, in order to set themselves up for success. And there’s always got to be some evangelising of what you’re trying to do so people aren’t mystified by it. The more you keep it transparent and the more you evangelise, the more people will understand and sign up for that.



Key Takeaway: Establishing a shared vision and goals, and finding the right metrics to measure performance against them is essential to ensuring the team as a whole delivers high-quality software that meets the objectives of the organisation.



Challenge #4: Applying the Right Metrics

The fourth major challenge in moving successfully to a DevOps world is knowing what to measure, and measuring it effectively. The approach to the DevOps style of working is so different, that many metrics applied to testing in a traditional world almost certainly no longer apply, and trying to bring them over to the new environment may even be counter-productive.

Since the assurance function has to assure quality across the development lifecycle, several metrics for DevOps will encompass the shift left and shift right approaches while others cover purely testing aspects. The concept of joint ownership of metrics would also need to be introduced along with requisite changes in the data collection mechanisms, reporting formats and ensuing analytics.

Some examples of metrics recommended for DevOps culture are:

Number of successful or unsuccessful changes per release

This metric helps analyse the impact on a release based on the number of changes that went in. If a change was unsuccessful, a root cause analysis is done to identify the source entity. For instance a missed scenario in an integration test environment will point to inadequate test coverage.

Cost impact due to changes per release:

This measure is linked to the changes per release metric and calculates the total costs incurred due to actual changes made in a release.

Lead time to deployment:

This is essentially the time taken between development or writing one new line of code and this new code now being put into use by live users in production. This time will also include the assurance function's turnaround time including first time test, defect retest and regression test.

Mean time to repair:

This is the mean time from the occurrence of an incident to the restoration of service, or the average time taken to repair a configuration item or IT service after a failure. This metric must also include the time taken to test an incident fix.

Defect escape ratio:

This metric measures the defects escaping or defect leakage from system test (or system integration or end to end testing) into production. This metric is important in DevOps cultures as it indicates the testing effectiveness. This also takes into account the number of unsuccessful changes in a release where a testing miss further leads to defects in production.

Defect rejection ratio:

This metric measures the percentage of all the invalid defects. These are defects that are rejected by the Dev team. This metric provides valuable information about the quality and effectiveness of testing performed to its stakeholders. A large number of invalid defects will, in turn, induce a larger lead time to deployment taking into account the time for defect documentation and also analysis for root cause identification.

Regression automation effectiveness:

This measures the incremental automation in previous release. It is calculated as:

= Total automated regression test execution time in the release

÷ Total regression test execution time in the release (automated and manual)

In-release automation effectiveness:

This metric gives the measure of the incremental automation in current release. It is calculated as:

= Total automated in-release test execution time in the release.

÷ Total test execution time in the release (automated and manual).

Build failures:

This metric measures the failed builds and is used to analyze the causes of the build failure. Build failure can be measured once it is deployed in testing environment where preferably test automation tools run the test suite on the build. The analysis of failure can also be carried out by tools and build can be reverted back to the development environment.

Challenge #5: Learning New Skills, Tools and Technologies

Re-organising a linear process and siloed teams into a continuous process and single organisation are key to achieving DevOps, but the challenges do not stop there.

DevOps is a fundamentally different way of working, and requires all the professionals involved in it to learn a raft of new skills, tools and technologies. And that applies to testers and QA professionals as much as to their dev and ops colleagues.

Anant Subramanian of Comcast highlights the difference when he says that in a DevOps world, “the days of pure-play anything are behind us. There are no pure-play developers, no pure-play testers anymore.”

Learning about each other’s roles is essential to a successful DevOps journey. Another client of TCS Assurance Services Unit, a global banking organisation, was struggling with their transition to a DevOps culture due to a lack of knowledge sharing between development, QA and operations teams. The TCS team worked with the bank to institute a rotation of responsibilities, enabling all functions to build their knowledge, work productively together and also build trust and understanding.

In addition to understanding and developing expertise in colleagues’ roles, Prasad MK, Practice Director - North America, at TCS Assurance Services Unit highlights another new requirement for QA professionals:

“Know your customer and their business objectives. It is becoming more and more important for assurance organizations to appreciate and understand the entire value chain or business and correlate the right tools and technologies to it”²⁷

New tools for manual testing, test automation and more

Apart from learning new disciplines, testers must also get to grips with the myriad new tools and technologies that support DevOps working – like JIRA/Rally for agile planning, Jenkins for continuous integration, UFT/Selenium/Cucumber/Ruby for test automation, Puppet/Chef for environment configuration management and Splunk for predictive analysis.

There’s a huge amount to learn here, but one significant area of upskilling is around test automation. Traditionally, the bulk of enterprise software testing has been done manually. But a continuous integration and deployment environment puts very high pressure on test teams, making it easy to miss critical scenarios, create unwanted bottlenecks or not test sufficiently due to lack of time.

To avoid these issues, QA teams will need to acquaint themselves with new approaches to automation and tooling, across the whole gamut of functional testing - performance, security, usability, and compatibility.

“Continuous delivery demands continuous assurance, which touches all aspects – from bug-fixes, minor releases, to new functionality and features, ensuring that everything that is released, is continuously tested, regressed, and certified. Instrumentation plays a key role here, facilitating high velocity, assembly-line certification with the right automation and testing tools.”²⁸

Siva Ganesan, Vice President and Global Head - Assurance Services Unit, Tata Consultancy Services

But automation and tooling are just part of the picture, as testers must also understand the wealth of new tools and environments being used by their colleagues to deploy, configure and scale software in fast-moving cloud environments. That means the testing community has to obtain proficiency in a raft of new tools for everything from service virtualization and release automation to continuous integration, static code analysis and configuration management.



Key Takeaway: Rapidly up-skilling is no easy task, particularly if not all of the skills required by the DevOps teams are present in the IT organisation. There's a clear case for working with an experienced external provider to learn the required skills, either as a discrete project or as part of a partnership approach to implementing a DevOps culture.

Lionel Paillet, General Manager for Europe at Nest Labs, shares his views on bringing Big Data and the Internet of Things into our homes via smart thermostats, fire alarms and security cameras. He explains: "Yesterday I used a switch to operate devices in my home. Today I can use my smart phone. But does that really make my life any better? The home has to be thoughtful and understand your habits."²⁹

However he also admits that skill partnerships are essential for success:

"No company can create every product and consumers demand choice when creating their own version of the thoughtful home. At Nest, our open API has enabled us to work with more than 9,000 developers across the world to help bring the thoughtful home to life."³⁰

Questions CIOs Should Ask Before Embarking on the DevOps Journey

- Which parts of our software delivery will benefit from DevOps?
- What will a DevOps way of working look like in our organisation?
- Have we included QA and testing in our DevOps vision?
- Does everyone have a clear and common understanding of our vision and our goal?
- Are our development, QA and operations people bought into the DevOps vision?
- Do we have the right skills to make the transition?
- Do we have the right people in the right places to be able to make the transition?
- Do we have the right tools to enable a DevOps way of working?
- Do we have metrics in place to measure quality and success in a DevOps world?
- Have we enlisted the right partners to help with any of the above?



The Future is DevOps

The digital marketplace is forcing organisations to completely rethink the way they deliver services. As Cornelia Davis, Director of Platform Engineering at CloudFoundry succinctly put it in a 2014 presentation:

“You are either building a software business, or losing to someone who is.”³¹

The level of digital disruption is so rife that James Macaulay, author of IMD’s report *The Digital Vortex*, notes that not just lone companies, but entire industries are being side-swiped by these effects.³²

For companies that want to survive the digital revolution and thrive in a new world where the default is digital, the only solution is to bring development, QA and operations together to form a single community dedicated to continuously delivering high-quality digital services. DevOps seems to have almost become a *fait accompli* for enterprises!

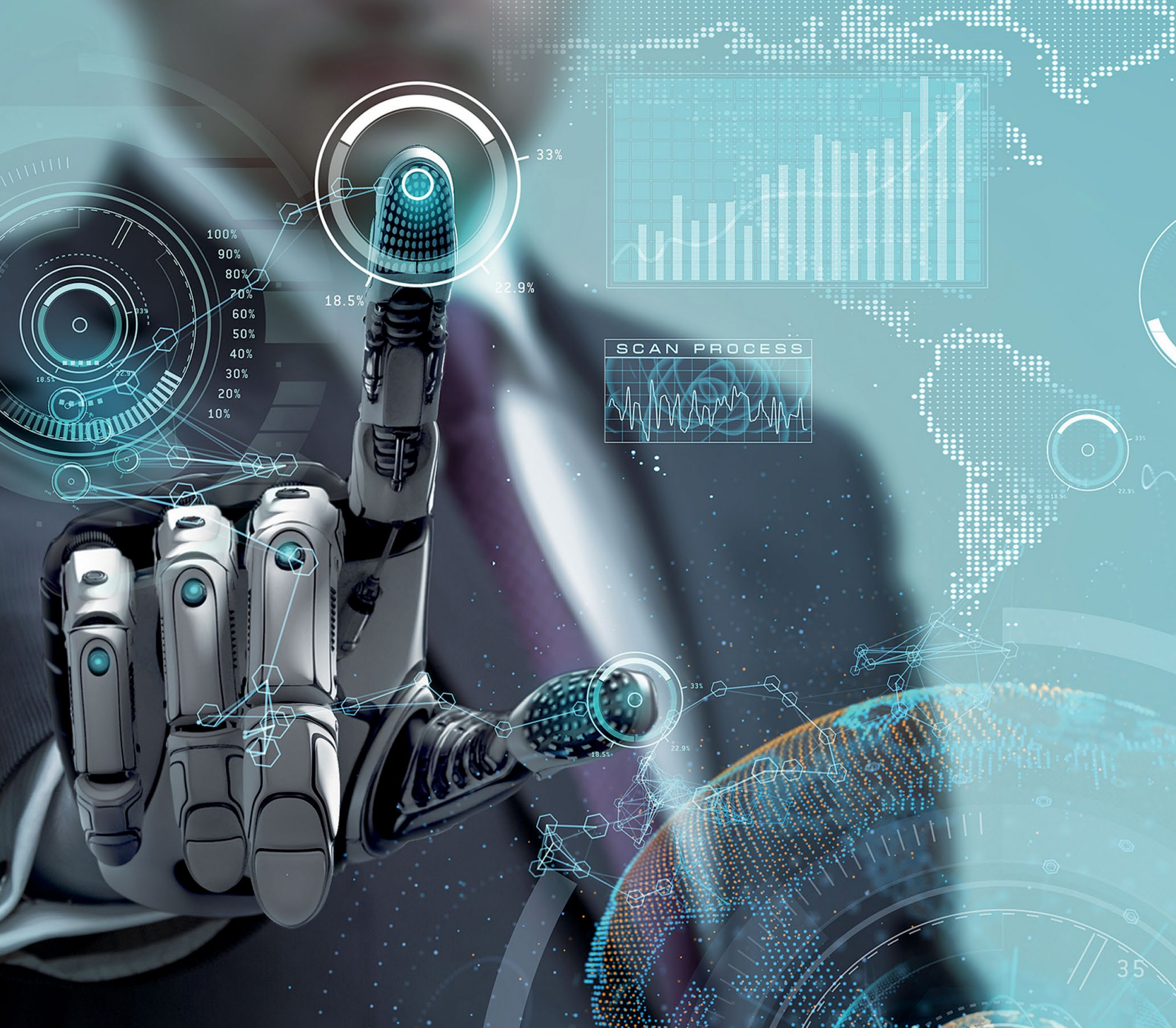
And getting there is not going to be an easy task. It will require a different organisational structure, an open and collaborative mindset, new ways of working, new metrics, new skills, and new tools. There will also be other challenges unique to your organization.

It’s not something that will happen overnight. Jonathan Fletcher, Enterprise Architect at UK insurance company Hiscox, hits the nail on the head when he says:

“Trying to effect process, people, technology and cultural changes across the entire application portfolio, in a globally dispersed team and with a lot of associated technical debt, is an epic challenge.”³³

When facing a challenge of these proportions, it’s prudent to seek help, advice and inspiration from organisations that have already navigated it successfully. The many real experiences cited in this report together provide a wealth of advice and insight into the challenges and how individual organisations have tackled them, but there’s no substitute for having an expert – or team of experts – on tap when you need them.





This report has shown how DevOps is critical to an organisation's success today. We have also examined how traditional approaches are falling short in a fast-moving, multi-channel, multi-platform, multi-device world. In the next section, we'll outline how TCS Assurance Services Unit is uniquely equipped with the expertise you need to make a successful transition to DevOps.

About TCS Assurance Services Unit

DevOps isn't merely an implementation; it is an evolution. In some organizations, perhaps even a revolution! Thus, of all the questions that CIOs must ask before they steer their organisations towards the DevOps journey, perhaps the ones that are most critical are, "Have we enlisted the right partner?" and "What are the essential attributes of a right DevOps partner?"

Holistic set of skills and consultants

TCS teams consist of Quality Assurance and Testing experts, Business Process and Change Management consultants, Organisational Development experts, Technology leaders and Learning facilitators – providing you with unparalleled expertise in business model and technological innovations. This holistic approach addresses both business and quality challenges for global clients as they embark on their DevOps journey.

Independent market validation

TCS has been recognized by Gartner, Inc. as a 'Leader' in its 'Magic Quadrant for Application Testing Services, Worldwide' report.³⁴ And that is not all. TCS is the only IT firm to be positioned as 'Leader' by all major analysts including Gartner, Everest, IDC, Nelson Hall, and Ovum (Gartner and Everest for two consecutive years).

Market leadership

TCS' position as a Leader is a result of a global client base; track record of complex global engagements that support business transformation; and well-balanced business, process, and industry consulting, implementation and service management capabilities, supported by rigorous tools and methodologies.

World-class tools

TCS' key strengths include the quality of our consultants; our Global Network Delivery Model™; and robust tools and automation solutions including TCS MasterCraft, TCS NETRA (which facilitates continuous integration and continuous deployment), and TCS' artificial intelligence product, ignio™.

Industry recognition

TCS further demonstrated its leadership in Quality Assurance (QA) and Testing services at The European Software Testing Awards, 2015.³⁵ The awards, organized by TEST Magazine, the UK's leading software testing magazine, celebrate excellence, best practice and innovation in the UK & European software testing and QA community. TCS was recognized in key areas including:

- **Best Agile Project** in partnership with Aviva - Awarded to the project which has demonstrated the best use of an agile approach in software testing.
- **Best Mobile Project** in partnership with the Avis Budget Group - Awarded to the project which has made the most innovative use of technology and testing in a mobile application.

- **Leading Vendor** – Awarded to the outstanding vendor with a commitment to deliver high-quality innovative products and services with a focus on excellent customer service.

Proven experience in DevOps

TCS has successfully partnered with many customers to transform their DevOps assurance model. Here are two examples. The first is an information services company who moved entirely from print to digital. In this transformation, the assurance group took a lead role because they knew the business, they knew the value chain, and hence they were able to architect a robust assurance strategy, which was flawless and covered end-to-end on all the nodes, i.e. social media, mobility, or web channels, etc. A great shift was witnessed in translating the business requirements to IT requirements through various levers brought in by the assurance team.



Analysts such as NelsonHall have noted that TCS continues its IP approach, focusing on DevOps and taking a full lifecycle testing approach. This automation approach plays well in DevOps. According to NelsonHall, NETRA is not an offering, an off-the-shelf product, but a journey, taking a best-of-breed approach and reintegrating all tools and software. In so doing, TCS brings experience and repeatability to its clients.³⁶

The second example is a telecommunications company, which was adopting agile and iterative development as well as continuous integration. The company chose to adopt the DevOps route as their immediate goal was to establish continuous delivery. Here too, the assurance team brought in the right tool sets to perform configuration management, release automation along with including code quality analysis and build verification to move from continuous integration to continuous delivery.

In summary, TCS has the proven credentials, experience, capabilities and flexibility to help businesses deliver high-quality IT systems and services faster, more smoothly and more cost-effectively than ever before. Implementing DevOps at an enterprise level, with multiple programs each supported by multiple teams, is not an easy journey. But whether it is a one-off testing project, setting up agile testing practices, development of a full-scale test centre of excellence for the entire organisation or a transformation journey towards DevOps, we at TCS have the skills, resources and expertise to provide businesses with a world-class solution.

³⁴ http://www.tcs.com/news_events/press_releases/Pages/TCS-recognized-leader-application-testing-services-Gartner.aspx

³⁵ http://www.tcs.com/news_events/press_releases/Pages/TCS-wins-european-software-testing-awards-2015.aspx

³⁶ http://www.tcs.com/news_events/analyst_reports/Pages/DevOps-testing-TCS-IP-way.aspx

Contact

To learn more about how TCS Assurance Services Unit can help you undertake a successful journey to DevOps:

Visit: <http://www.tcs.com/assurance>

Email: global.assurance@tcs.com

Blog: <http://sites.tcs.com/blogs/Think-Assurance/>

About Tata Consultancy Services Limited (TCS)

Tata Consultancy Services is an IT services, consulting and business solutions organization that delivers real results to global business, ensuring a level of certainty no other firm can match. TCS offers a consulting-led, integrated portfolio of IT and IT-enabled infrastructure, engineering TM and assurance services. This is delivered through its unique Global Network Delivery Model, recognized as the benchmark of excellence in software development. A part of the Tata Group, India's largest industrial conglomerate, TCS has a global footprint and is listed on the National Stock Exchange and Bombay Stock Exchange in India.

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