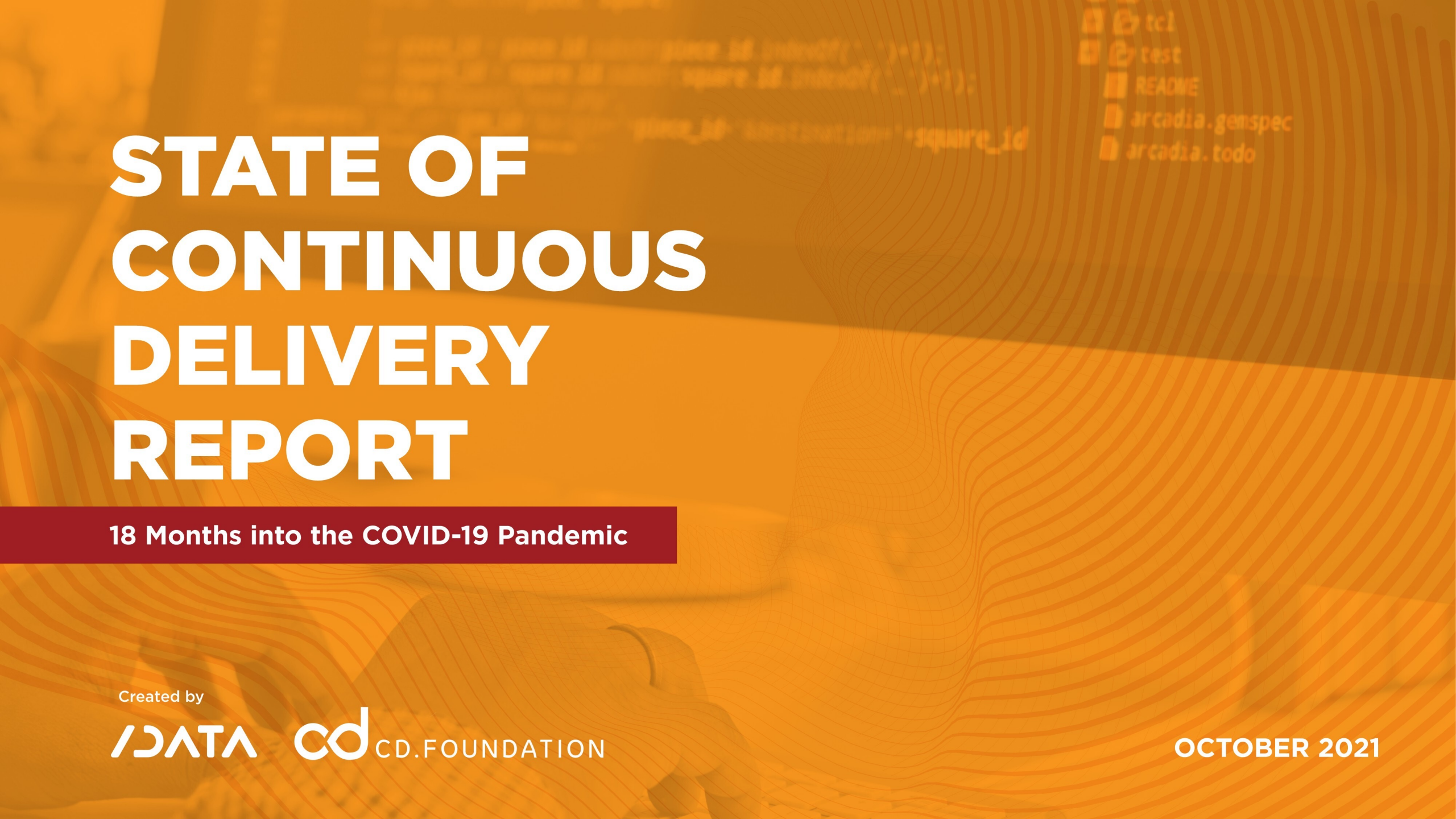

# STATE OF CONTINUOUS DELIVERY REPORT

## 18 Months into the COVID-19 Pandemic

Created by

/DATA CD.FOUNDATION

OCTOBER 2021

# ABOUT THE CONTINUOUS DELIVERY FOUNDATION

The Continuous Delivery Foundation is an open source foundation that seeks to improve the world's capacity to deliver software with security and speed. We help you figure out your best path to becoming a high performing software delivery organization while leveraging open source. The open source projects we nurture are used by millions of developers worldwide.  For more information on the Continuous Delivery Foundation or our projects please visit: https://cd.foundation/






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The analyst of the developer economy | formerly known as VisionMobile

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# 1. Introduction

# 1. INTRODUCTION

Continuous delivery (CD) is a software development practice that enables developers to release small but frequent software updates reliably and safely. Closely linked to the broader DevOps cultural movement, CD consists of a set of practices that aim to automate and streamline the software delivery process. These practices, in turn, allow developer teams to innovate faster by collecting regular user feedback and prioritising the product features and fixes that matter. But to what extent, really, have developers embraced continuous delivery practices and the DevOps culture to increase the effectiveness of their software development and release process?

In this report, commissioned by the Continuous Delivery Foundation (CDF) and authored by SlashData, we explore the current state of the CD developer ecosystem and how this has evolved over the past year. We will look at how many developers are involved in the broader DevOps space and how many work with continuous delivery technologies in particular. Moreover, we will see how developers' software delivery performance has changed over time and which developer segments have experienced the greatest shifts. Finally, we will see which factors contribute the most to superior software delivery performance.

The findings in this report are based on data from SlashData's past three Developer Nation surveys, which reached more than 55,000 respondents worldwide over 12 months, from Q3 2020 to Q3 2021.

# KEY TAKEAWAYS

- As of Q3 2021, only about a fourth (26%) of developers are not involved in DevOps-related activities, which speaks of the broad adoption of lean software delivery practices.
- We're still in the early stages of the transition from phased development approaches to fully streamlined software delivery pipelines: 44% of developers use either continuous integration or deployment, but less than one in five (18%) use both practices to automate all steps of software delivery.
- DevOps practices are broadly adopted in all sectors of the software economy, not just in internet-centric applications.
- DevOps is widespread in organisations of all sizes, with at least 80% of professional developers who work for companies of two or more employees being involved in the space.
- Excellence in software delivery throughput - as measured by the lead time for code changes and deployment frequency metrics - is not very common yet; for only 14% of developers it takes, on average, less than one day to go from code checked-in to having that code successfully running in production.
- Similarly, just over one in ten report that they routinely deploy code to production, i.e. they perform multiple deployments per day.
- There are also no signs that industry velocity is increasing. If anything, the proportion of top performers in terms of lead time for code changes dropped slightly, from 17% in Q3 2020 to 14% in Q3 2021.

# KEY TAKEAWAYS

- Software delivery stability - as measured by the time it takes to restore service following a user-impacting incident - shows similar deceleration; the proportion of top performers dropped from 17% to 13% in 12 months.

- Software delivery speed and stability actually go hand-in-hand. Close to 30% of top performers in lead time for code changes are also top performers in software delivery stability. On the contrary, only 6% of low performers in software delivery throughput are top performers in stability.

- Experience in software development plays a key role in increasing the effectiveness of the software delivery process, both in terms of speed and reliability.

- The areas that have the highest concentration of top performers in software delivery speed are extensions for third-party ecosystems, such as e-commerce platforms, backend services, and web applications.

# 2. WHO IS INTO DEVOPS?

# 2. WHO IS INTO DEVOPS?

For the third consecutive time in SlashData's biannual Developer Nation surveys, we asked developers whether they are involved in any of the activities that commonly fall under the DevOps spectrum, such as continuous integration (CI), continuous delivery (CD), and infrastructure monitoring. In the 12 months between Q3 2020 and Q3 2021, we've hardly seen any shifts in the popularity of the various DevOps activities tracked in the surveys.

As of Q3 2021, only about a fourth (26%) of developers are not involved in DevOps-related activities, which speaks of the broad adoption of lean software delivery practices - no matter how effective these are at the moment. Taking a separate view of engagement with DevOps in our survey, just 5% of developers describe their role as "DevOps engineer/specialist". This signals that there's a large portion of the developer population that have already adopted DevOps practices but do not necessarily self-identify with the term.

Continuous integration is currently the most popular DevOps-related activity, practiced by 32% of developers. 29% use continuous deployment to automate their code deployments. 44% of developers use either continuous integration or deployment, but less than one in five (18%) use both practices to automate all steps between committing code changes to seeing them running successfully in production. Therefore, we're still in the early stages of the transition from phased development approaches to fully streamlined software delivery pipelines. This is also evident by the fact that nearly one in three (31%) developers manually approve code deployments to production.

Application and infrastructure monitoring, performed by 32% of developers, is one of the most common development practices, but not so much infrastructure provisioning and management (23%), which, according to our data, is still the realm of IT managers and DevOps specialists. Similarly, creating automated tests (20%) is a rather specialised task, carried out predominantly by quality assurance and site reliability engineers.

# 2. WHO IS INTO DEVOPS?

DevOps practices are broadly adopted in all sectors of the software economy. It's clear from the data that it's not only developers of internet-centric applications or complex distributed systems that embrace DevOps approaches. For example, those working on embedded software projects are as likely as backend developers to engage in DevOps activities. Even in the sector with the lowest concentration of DevOps practitioners, games development, two  thirds of developers are involved in DevOps in one way or another.

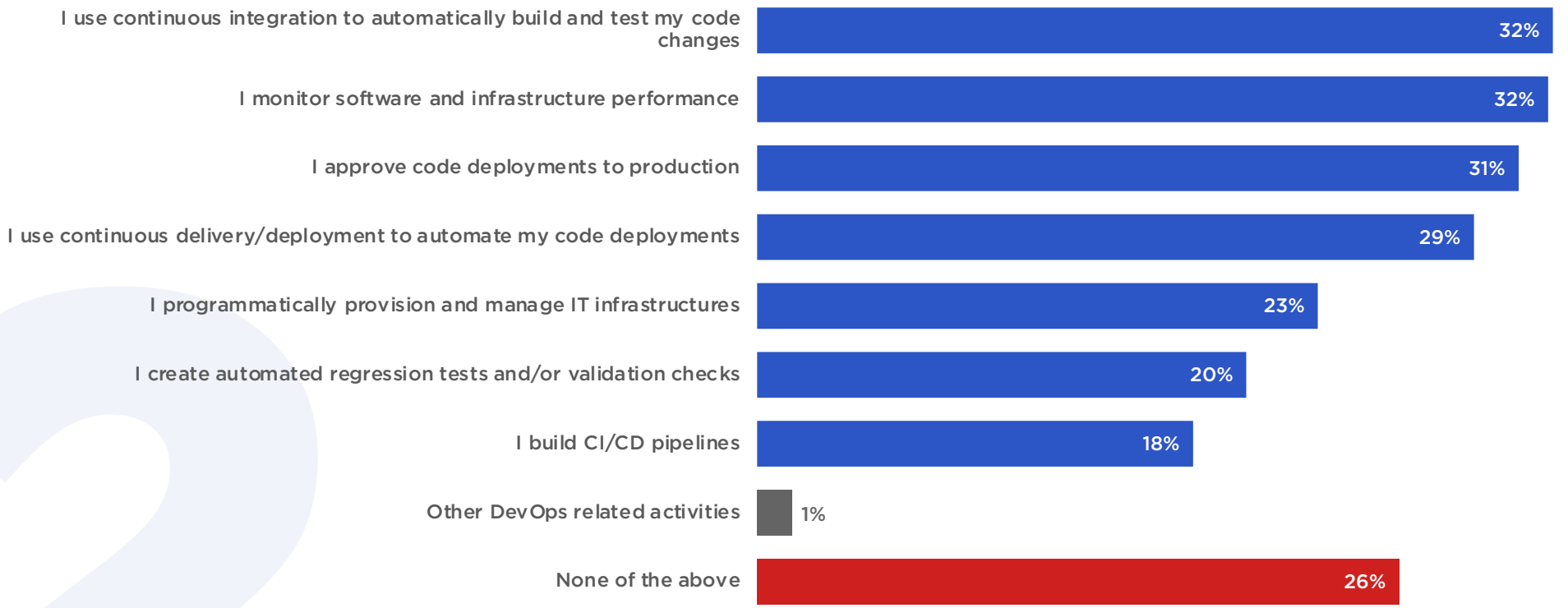
Furthermore, DevOps is widespread in organisations of all sizes, with at least 80% of professional developers who work for companies of two or more employees being involved in the space. By comparison, about 70% of freelancers report being engaged with DevOps. What sets companies of different sizes apart, though, is the extent to which they've adopted specific development practices. For instance, our data shows that nearly 60% of enterprise developers use CI/CD in their workflow, as opposed to 48% of developers working in small businesses and only 42% of freelancers.

## 2. WHO IS INTO DEVOPS?

# The vast majority of developers are involved in DevOps in one way or another

% of developers (Q3 2021 n=18,092)

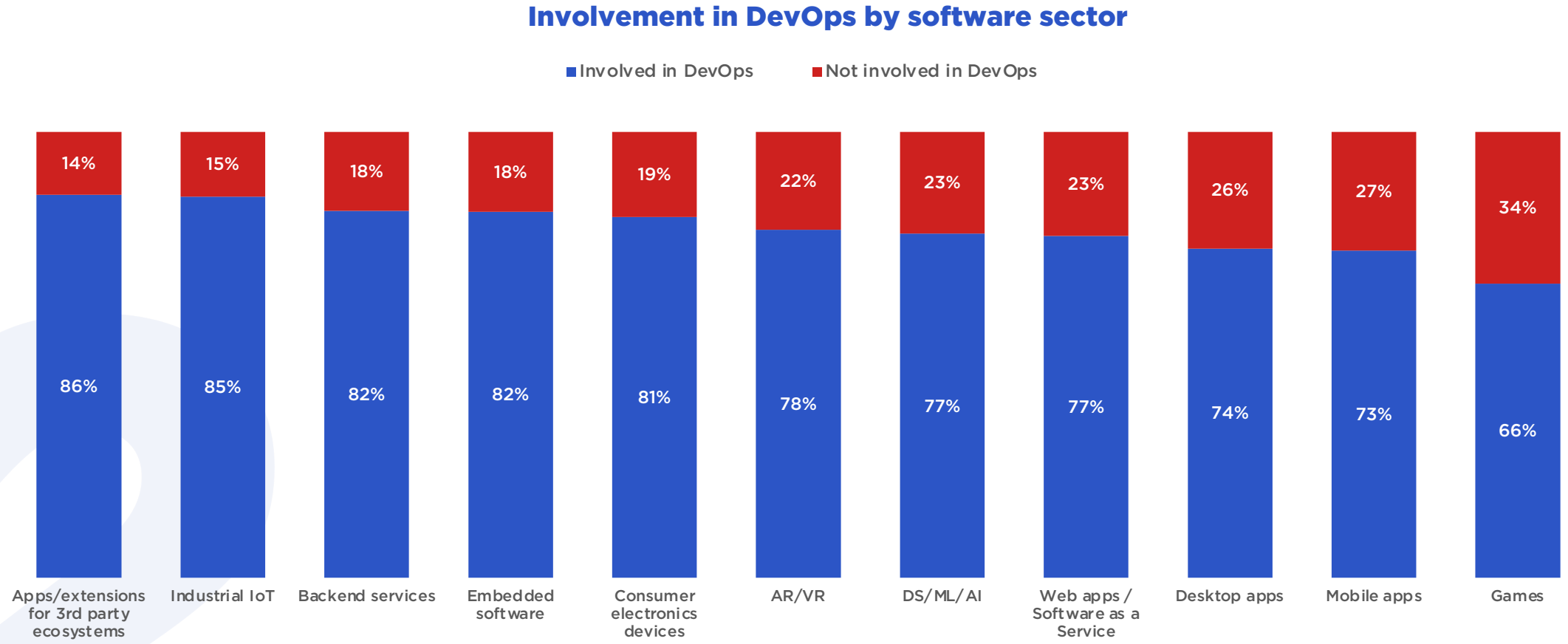
**Which of the following development activities are you involved in?**



## 2. WHO IS INTO DEVOPS?

# DevOps practices are widely adopted in all sectors of the software economy

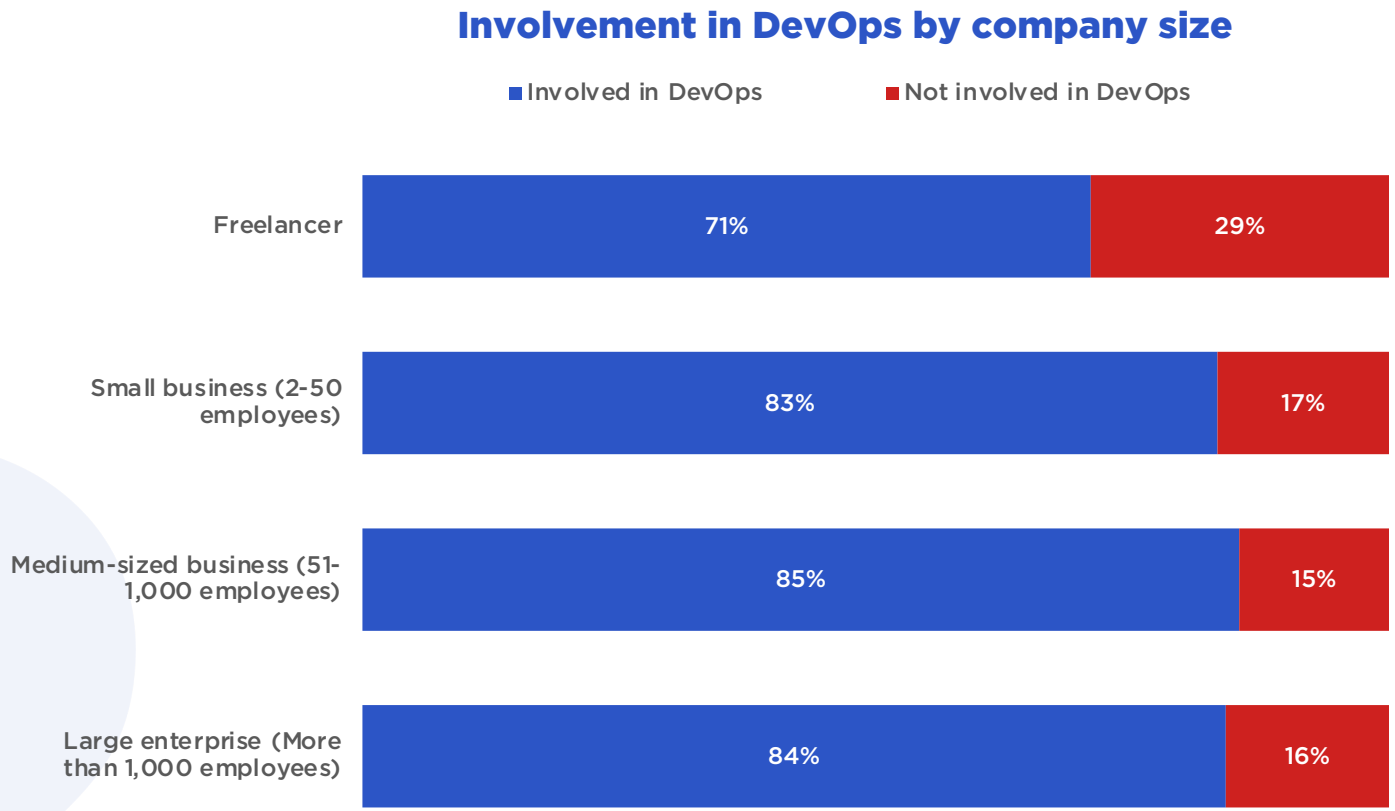
% of developers involved in DevOps activities by software sector (Q3 2021 n=18,092)



## 2. WHO IS INTO DEVOPS?

# More than 80% of developers working for companies of all sizes are involved in DevOps

% of professional developers involved in DevOps activities by company size (Q3 2021 n=12,736)



# 3. HOW HAS SOFTWARE DELIVERY PERFORMANCE EVOLVED OVER TIME?

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For individuals and organisations to be able to measure the effectiveness of their continuous delivery efforts, they need a set of robust performance metrics to track their progress against. Research by Nicole Forsgren et al.[1] has identified four key metrics that are used to measure software delivery performance and are also predictive of organisational performance. In our survey, we ask questions related to three of these, namely lead time for changes, deployment frequency, and time to restore service.

According to our data, excellence in software delivery throughput - as measured by the lead time for code changes and deployment frequency metrics - is not very common yet. As of Q3 2021, for only 14% of developers it takes, on average, less than one day to go from code checked-in to having that code successfully running in production. Similarly, just over one in ten report that they routinely deploy code to production, i.e. they perform multiple deployments per day. There are also no signs that industry velocity has increased over the past year. If anything, the proportion of top performers in terms of lead time for code changes dropped slightly, from 17% in Q3 2020 to 14% in Q3 2021.

The growing scale and complexity of software projects may be a contributing factor to the deceleration of software delivery performance. In large enterprises - where most of the large-scale projects are expected to take place - we observe the largest shift in the proportion of top performers: only 13% of enterprise developers reported lead times for changes of less than a day in Q3 2021, down from 18% a year earlier. In comparison, during the same period, the share of top performers in medium-sized businesses dropped from 16% to 14% and in small businesses from 19% to 17%.

[1] Forsgren, N., Humble, J., Kim, G. 2018. Accelerate: The Science of Lean Software and DevOps: Building and Scaling High Performing Technology Organizations. IT Revolution Press.

# 3. HOW HAS SOFTWARE DELIVERY PERFORMANCE EVOLVED OVER TIME?

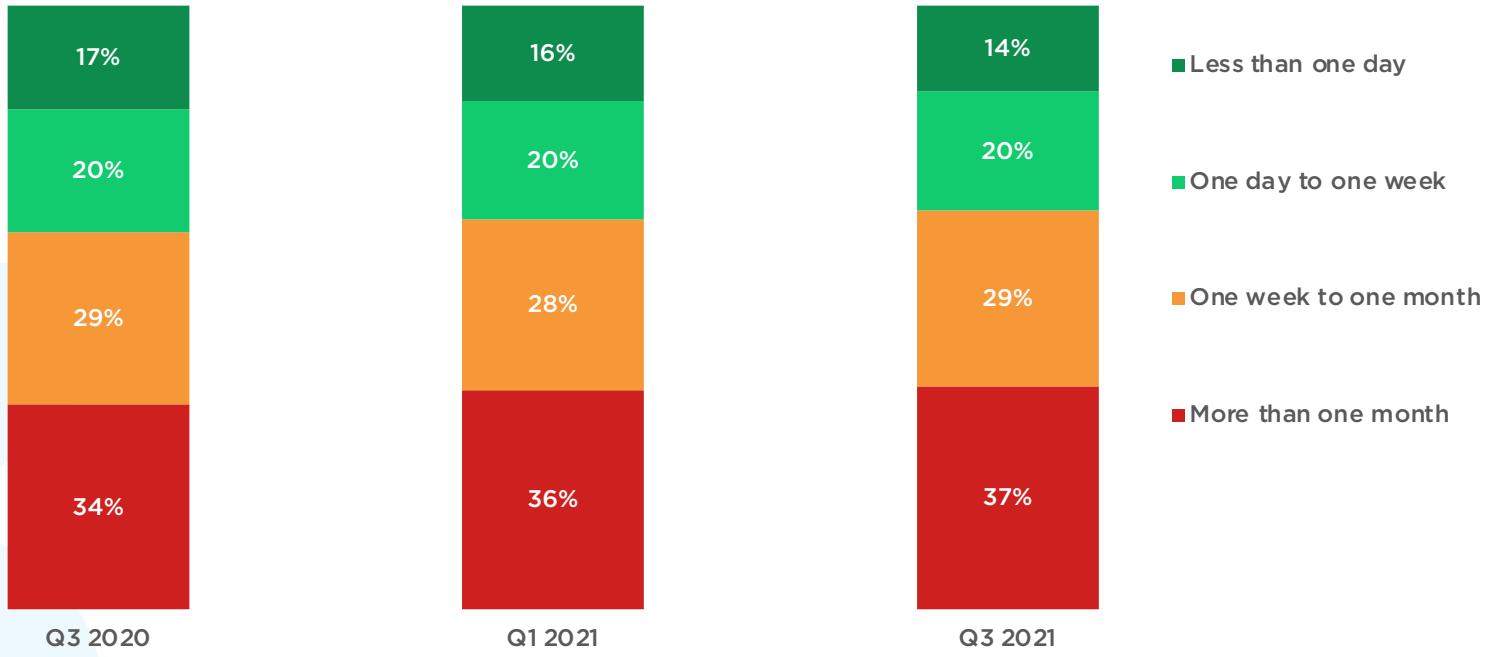
Software delivery stability - as measured by the time it takes to restore service following a user-impacting incident - shows similar deceleration; the proportion of top performers (those who need less than one hour to restore service from an unplanned outage) dropped from 17% to 13% in 12 months. For this metric, the greatest drop in performance was experienced by developers who work for medium-sized businesses. Even so, high performance in software delivery stability is quite frequent, with nearly half of developers (47%) reporting time-to-restore durations of up to one day.

There's a common misconception that the speed and stability metrics represent a set of trade-offs, in the sense that increasing throughput will negatively impact the reliability of the software delivery process. However, our research suggests quite the contrary: speed and stability actually go hand-in-hand. Close to 30% of top performers in lead time for code changes are also top performers in software delivery stability, while only 6% of low performers in software delivery throughput are top performers in stability.

# The proportion of top performers in lead time for code changes decreased slightly in the last 12 months

% of DevOps practitioners (Q3 2020 n=10,252 | Q1 2021 n=8,572 | Q3 2021 n=8,784)

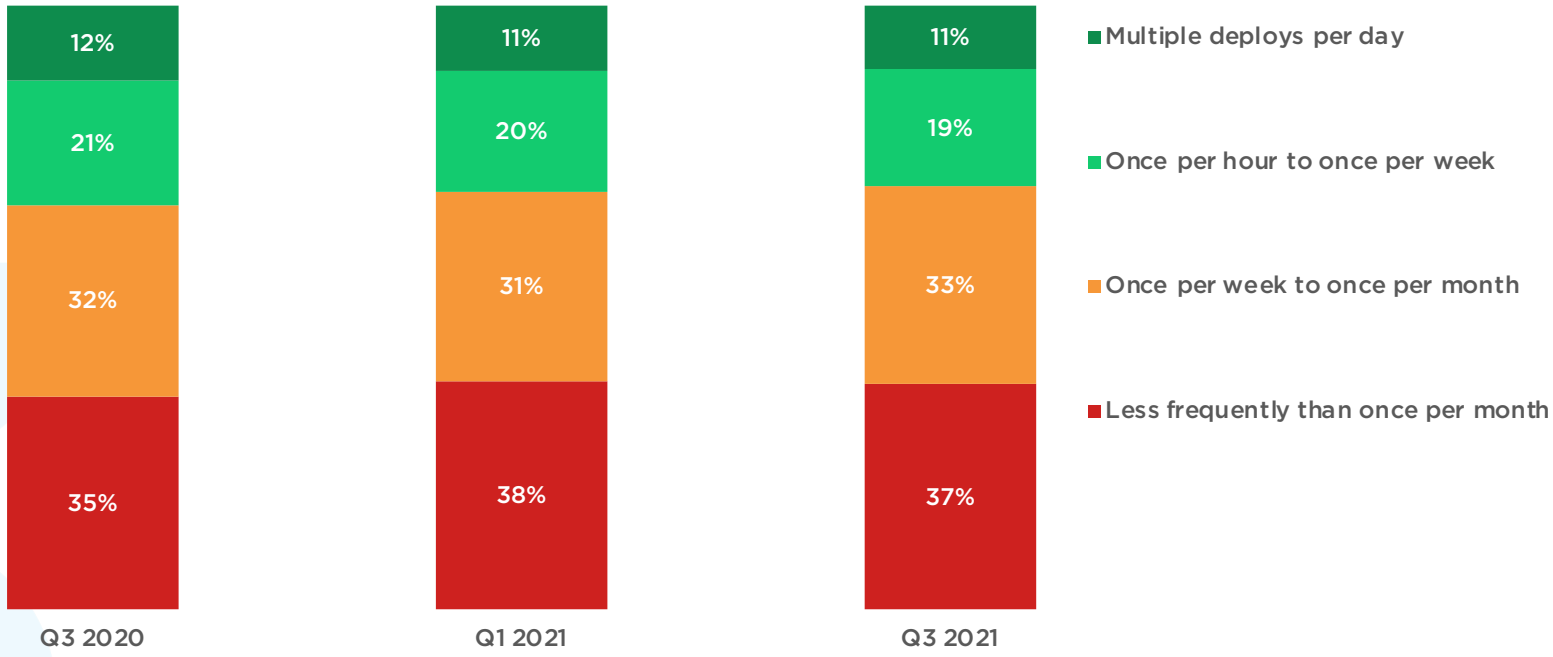
**Evolution of software delivery performance - Lead time for code changes**



# The proportion of developers who perform multiple deploys per day has remained stable over the past year

% of DevOps practitioners (Q3 2020 n=10,119 | Q1 2021 n=8,354 | Q3 2021 n=8,619)

**Evolution of software delivery performance - Deployment frequency**

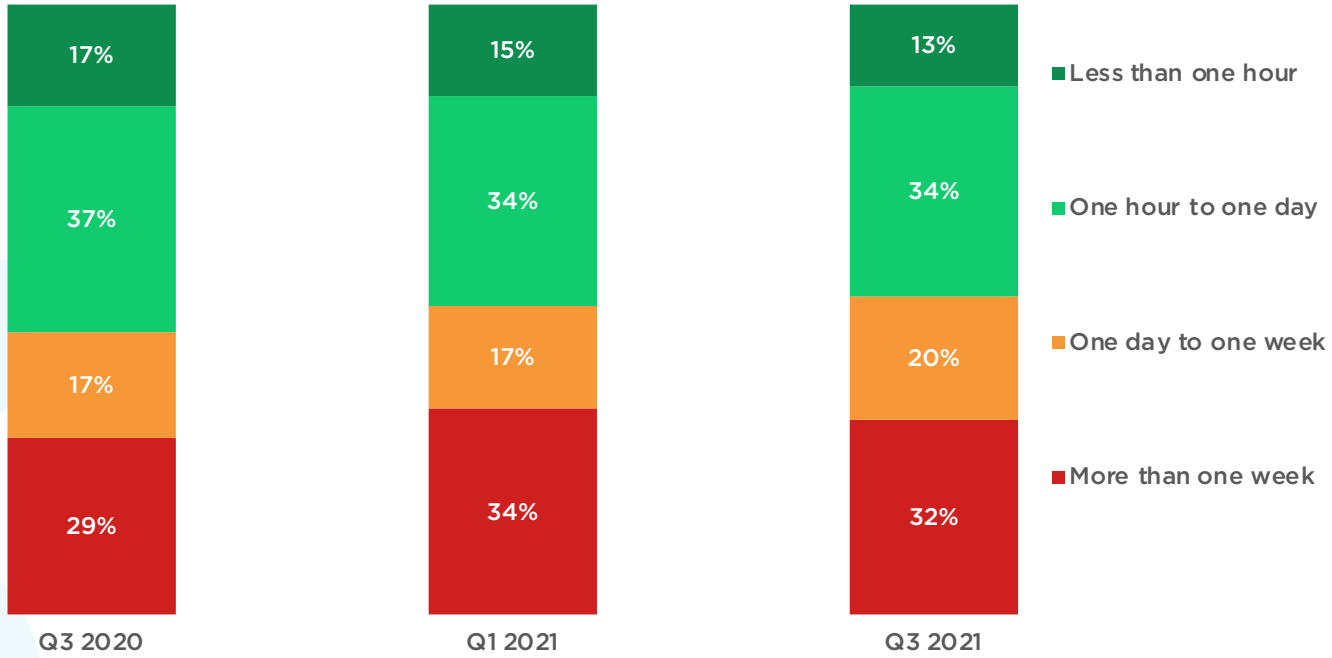


## 3. HOW HAS SOFTWARE DELIVERY PERFORMANCE EVOLVED OVER TIME?

# For nearly half of developers, it takes up to one day to restore service from an unplanned outage

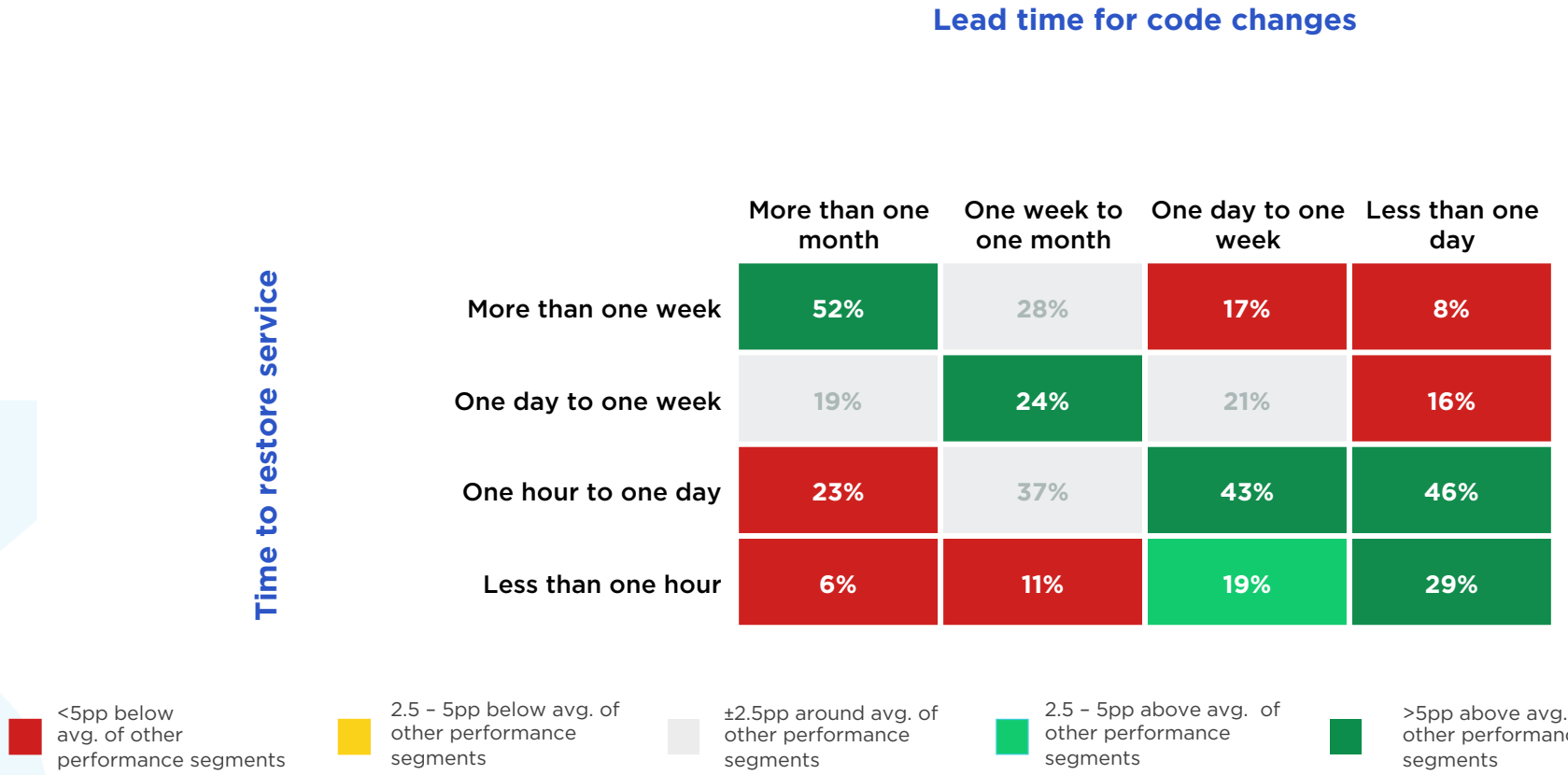
% of DevOps practitioners (Q3 2020 n=9,349 | Q1 2021 n=7,941 | Q3 2021 n=8,126)

**Evolution of software delivery performance - Time to restore service**



# Speed and stability of software delivery go hand-in-hand

% of DevOps practitioners reporting each duration to restore service by lead time for code changes (Q3 2021 n=7,695)



# 4. WHAT DRIVES SOFTWARE DELIVERY PERFORMANCE?

# 4. WHAT DRIVES SOFTWARE DELIVERY PERFORMANCE?

To understand which factors have the greatest impact on software delivery performance, we used statistical models to identify the most important differentiators between top and low performance. As it turns out, two of the strongest predictors of superior software delivery performance are the areas that developers are involved in as well as their experience level in software development.

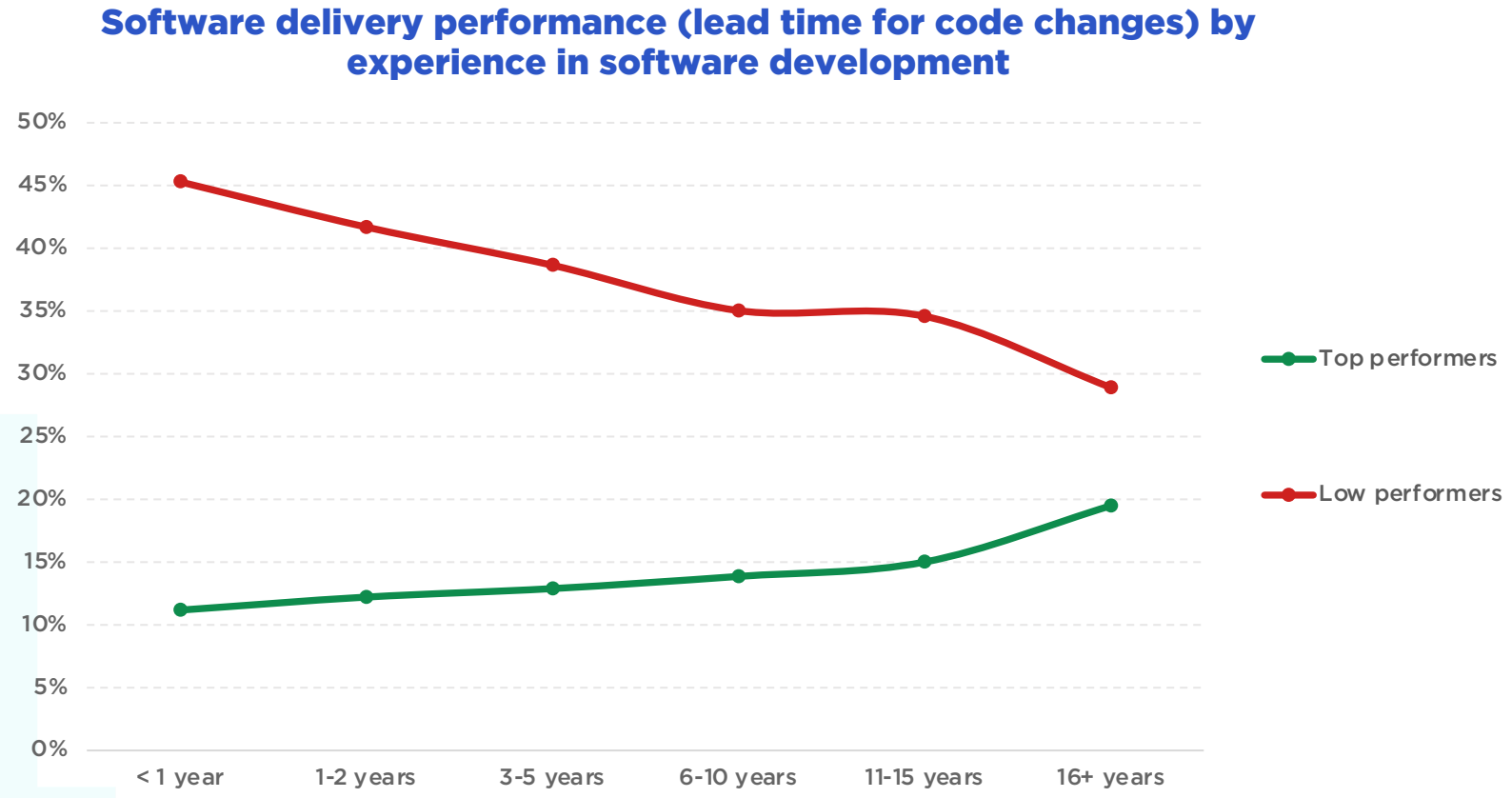
Experience plays a key role in increasing the effectiveness of the software delivery process, both in terms of speed and reliability. Seasoned developers with more than 16 years of experience under their belt are nearly twice as likely as beginners to be top performers in terms of lead time for code changes (19% vs 11%). At the same time, the proportion of low performers drops sharply with experience. The share of top performers in deployment frequency doesn't increase that much with experience, but the proportion of low performers drops significantly. In terms of software delivery stability, the effect of experience on performance is even stronger, with the likelihood of being a low performer dropping from 54% among beginners to only 10% among experts.

The areas that have the highest concentration of top performers in software delivery speed are extensions for third-party ecosystems (such as e-commerce platforms), backend services, and web applications. These are all internet-centric sectors with broad use of cloud technologies that favour the adoption of continuous delivery best practices. At the other end of scale, we find application areas where developers are less likely to leverage the capabilities of the cloud, such as games and embedded software. In these sectors, upwards of 40% of developers are still classified as low performers.

Finally, we find no evidence that the industries that developers are active in has an impact on software delivery performance, at least not a significant one. That being said, the retail industry appears to have a slight lead in terms of delivery speed - but also stability - which likely suggests that retailers are aiming to maximise their operational efficiency in a highly complex and competitive environment.

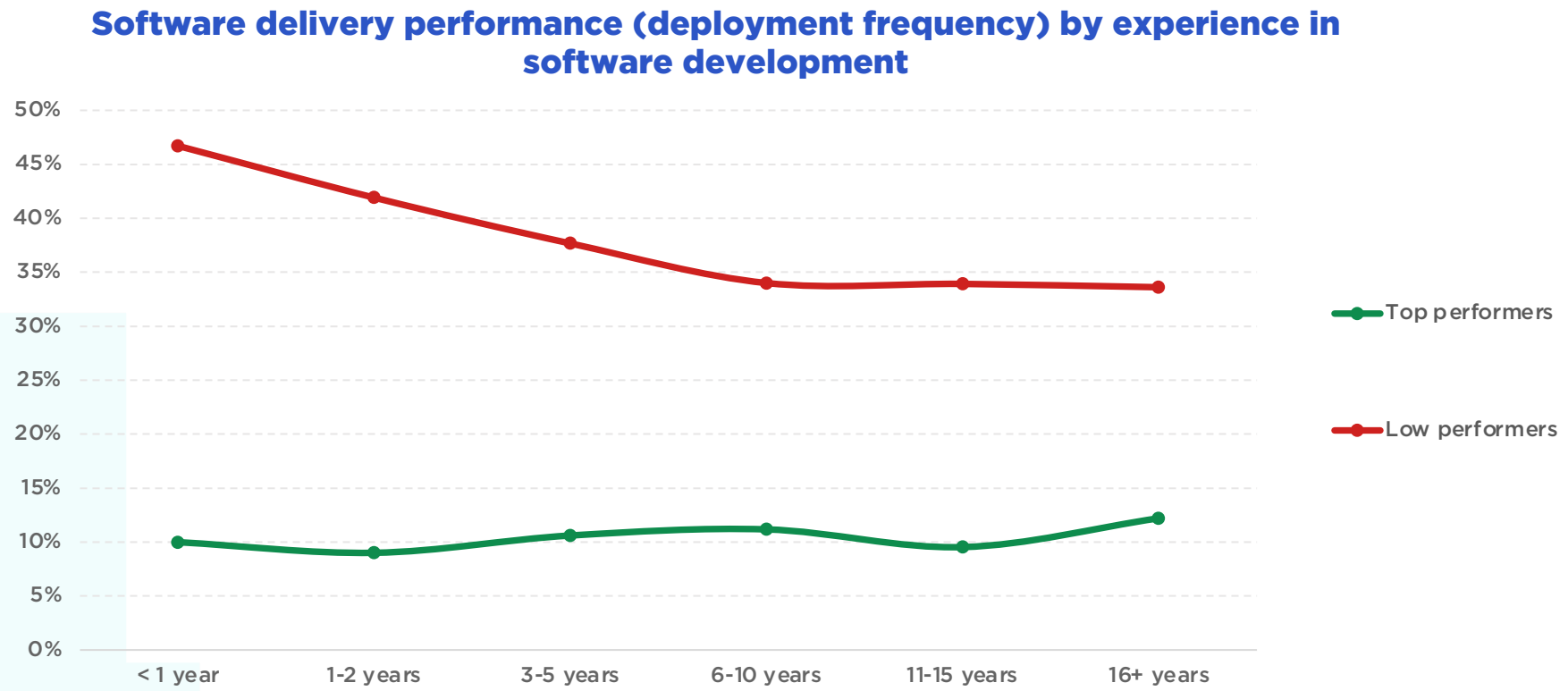
# Experts are nearly twice as likely as beginners to be top performers in lead time for code changes

% of top and low performers in lead time for code changes by experience in software development (Q3 2021 n=8,782)



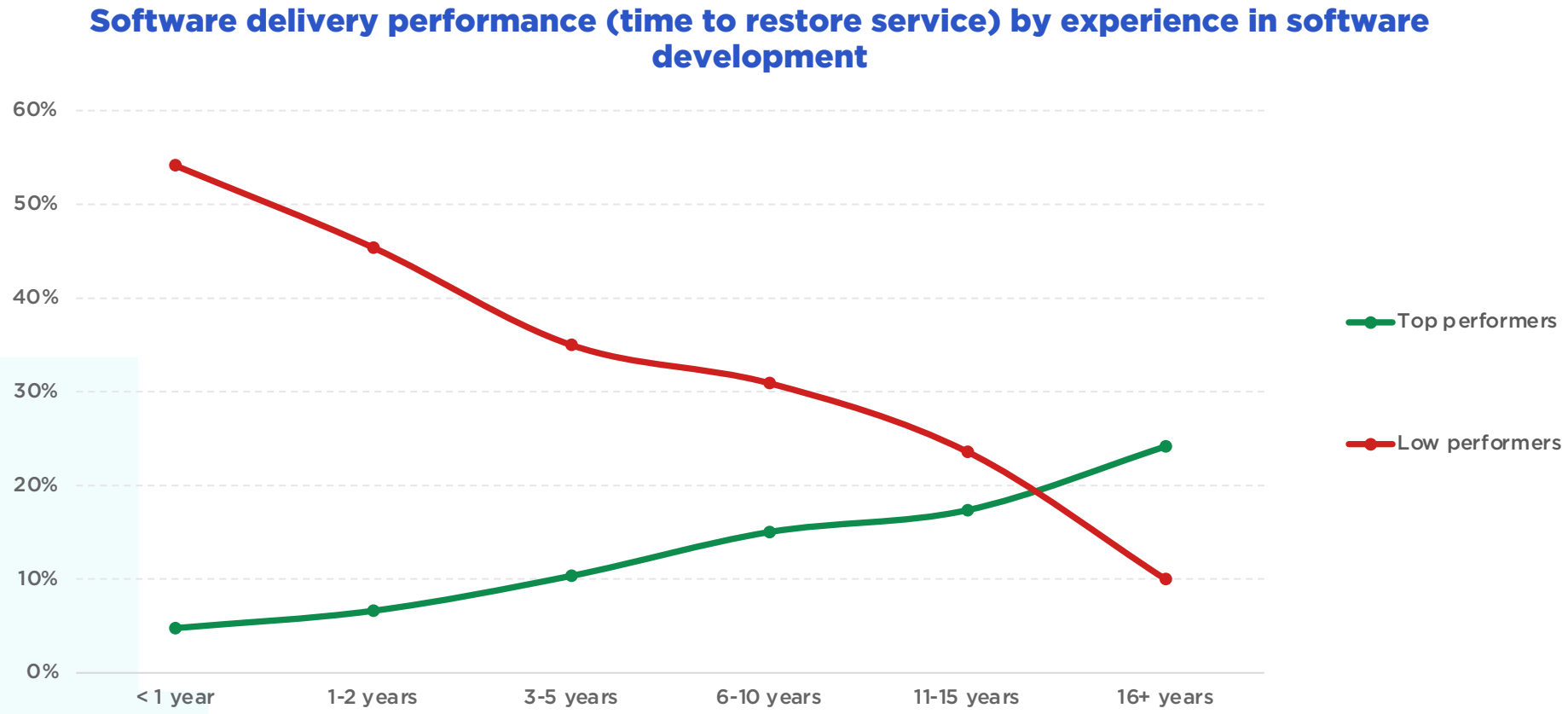
# The share of top performers in deployment frequency does not vary significantly with experience, but that of low performers does

% of top and low performers in deployment frequency by experience in software development (Q3 2021 n=8,617)



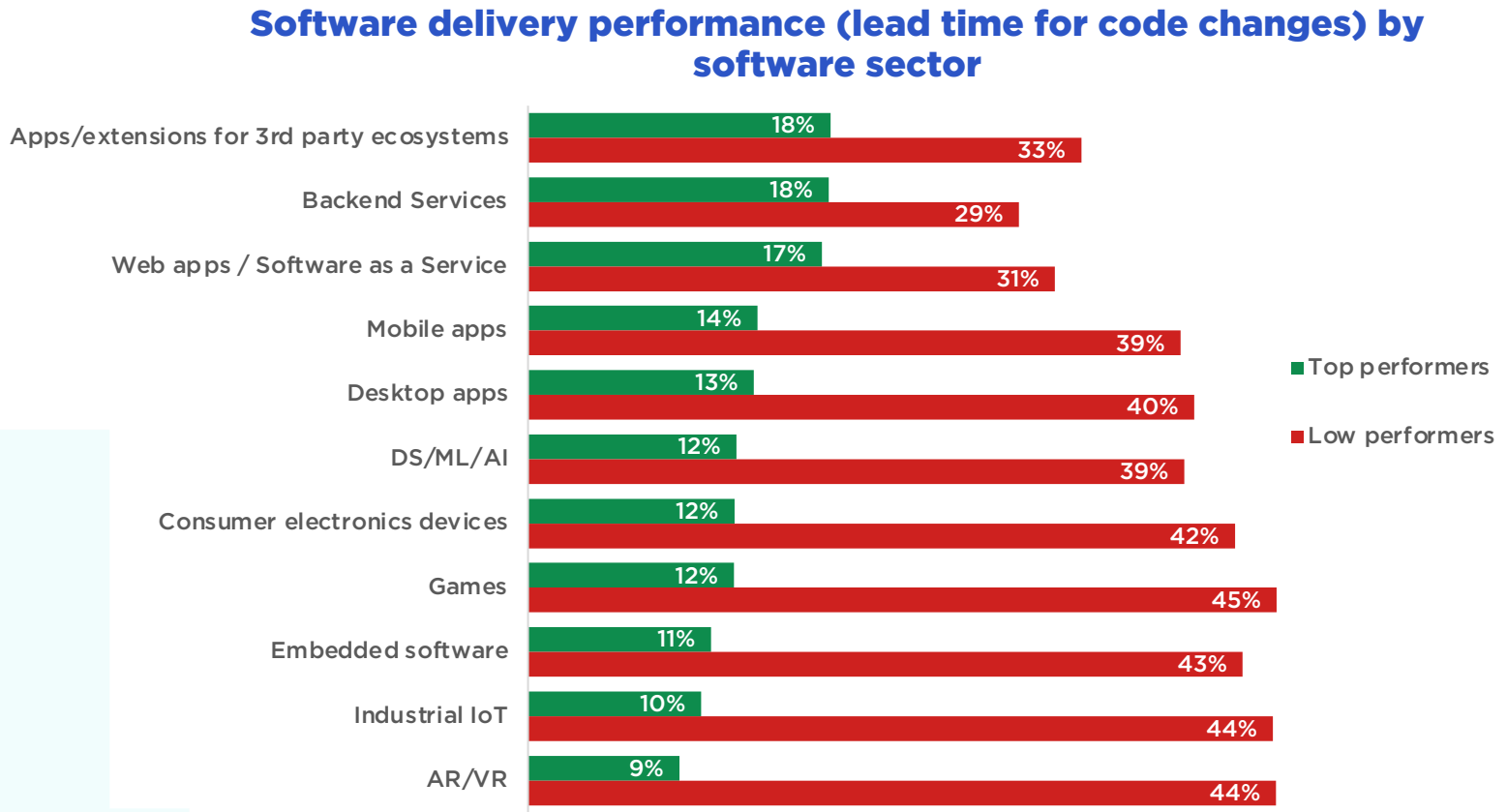
# Experience is highly predictive of strong performance in software delivery stability

% of top and low performers in time to restore service by experience in software development (Q3 2021 n=8,124)



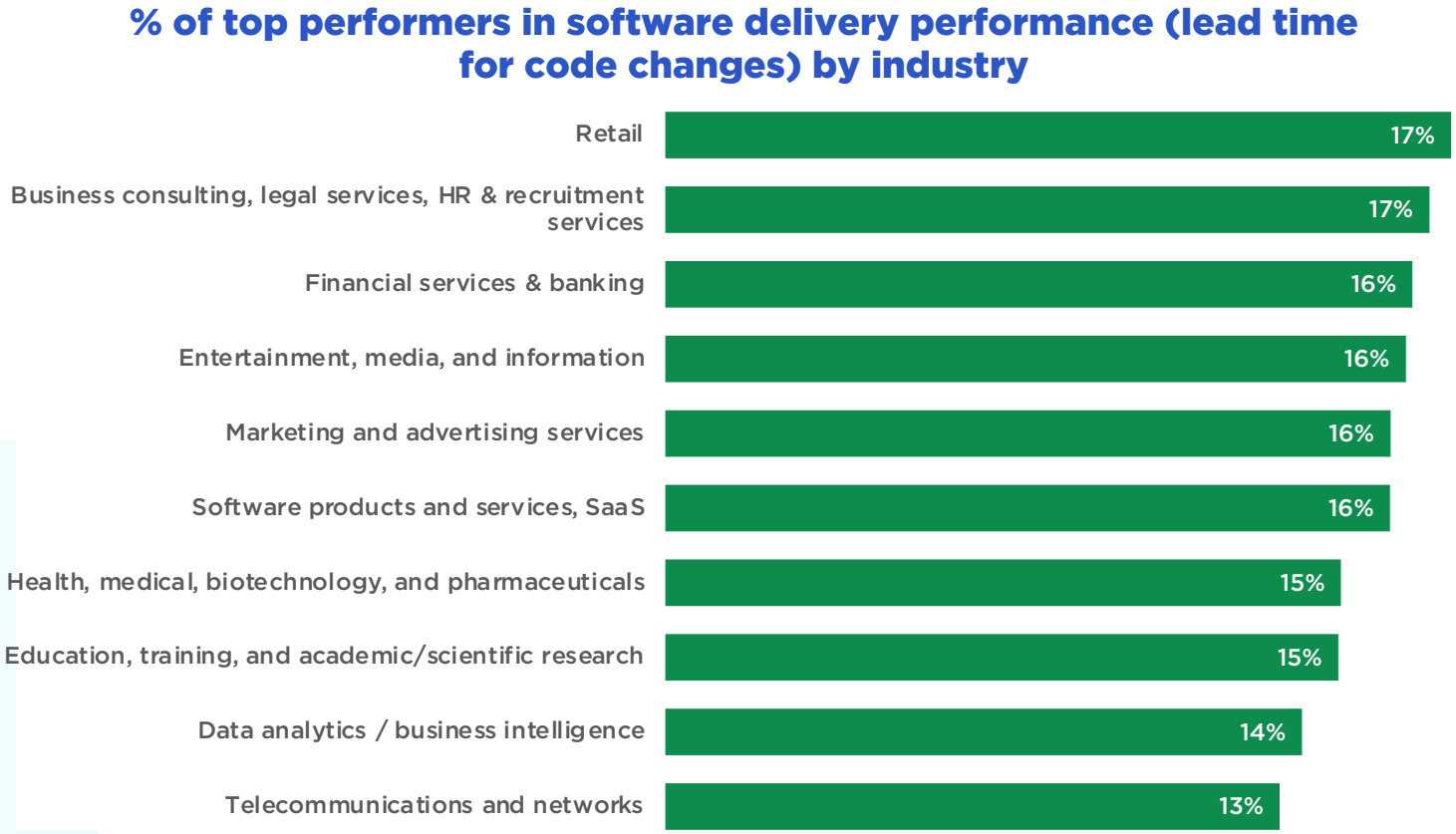
# Internet-centric software sectors, such as web and backend, have the highest concentration of top performers

% of top and low performers in lead time for code changes by software sector (Q3 2021 n=8,784)



# The retail industry is at the forefront of innovation in terms of software delivery speed, other industries follow closely

% of top performers in deployment frequency by industry (Q3 2021 n=7,097)



# METHODOLOGY

## The Developer Economics Survey

The 21st edition of the Developer Nation survey reached 19,000+ respondents from 168 countries around the world. As such, the Developer Nation series of surveys continues to be the most global independent research on mobile, desktop, industrial IoT, consumer electronics, embedded, third-party app ecosystems, cloud, web, game, augmented and virtual reality, and machine learning developers and data scientists combined, ever conducted. The report is based on a large-scale, online developer survey designed, produced, and carried out by SlashData over a period of nine weeks between June and August 2021.

Respondents to the online survey came from 168 countries, including major app and machine learning development hotspots such as the US, China, India, Israel, the UK, and Russia, even stretching all the way to Kenya, Brazil, and Jordan. The geographic reach of this survey is truly reflective of the global scale of the developer economy. The online survey was translated into eight languages in addition to English, namely simplified Chinese, traditional Chinese, Spanish, Portuguese, Vietnamese, Russian, Japanese, and Korean, and was promoted by nearly 60 leading community and media partners within the software development industry.

To eliminate the effect of regional sampling biases, we weighted the regional distribution across nine regions by a factor that was determined by the regional distribution and growth trends identified in our Developer Nation research. Each of the separate branches: mobile, desktop, Industrial IoT, consumer electronics, embedded software, third-party app ecosystems, cloud, web, games, augmented and virtual reality, and data science and machine learning were weighted independently and then combined.

To minimise other important sampling biases across our outreach channels, we weighted the responses to derive a representative distribution for technologies used and developer segments. Using ensemble modelling methods, we derived a weighted distribution based on data from independent, representative channels, excluding the channels of our research partners, to eliminate sampling bias due to respondents who were recruited via these channels. Again, this was performed separately for each of mobile, industrial IoT, consumer electronics, embedded software, third-party app ecosystems, desktop, cloud, web, games, augmented and virtual reality, and data science and machine learning.

For more information on our methodology please visit https://www.slashdata.co/methodology.

/DATA

# We help the world understand developers

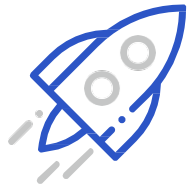
We survey 30,000+ developers annually – across web, mobile, IoT, cloud, Machine Learning, AR/VR, games and desktop – to help companies understand who developers are, what they buy and where they are going next.

## WHO DEVELOPERS ARE

Developer population sizing
Developer segmentation

## WHAT THEY BUY

Why developers are adopting competitor products – and how you can fix that



## WHERE THEY ARE GOING

Emerging platforms – augmented & virtual reality, machine learning

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## We help you understand Developers.

If you could speak to 30,000+ developers what would you ask them?


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