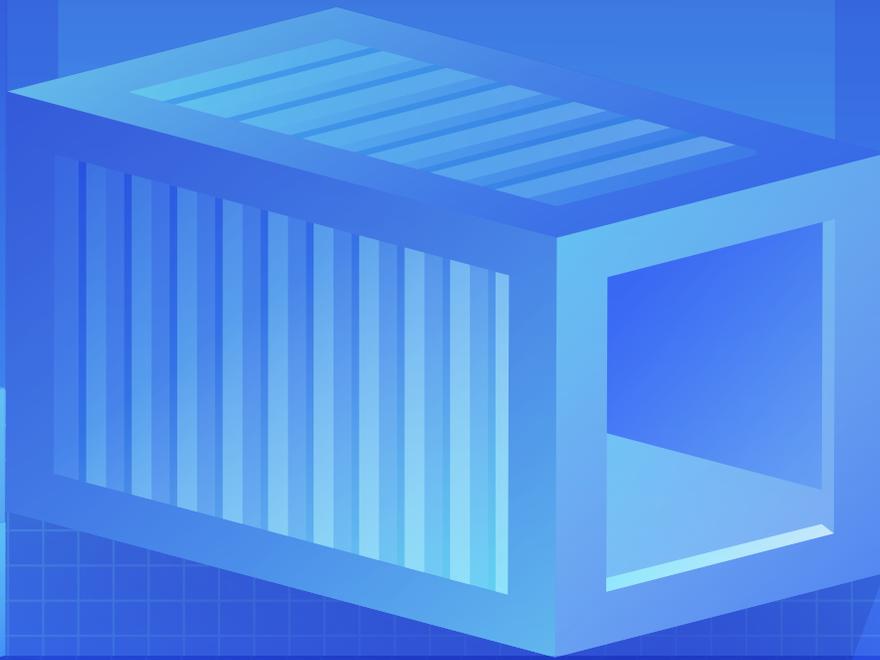




DZONE'S 2019 GUIDE TO

# Containers

ORCHESTRATION AND BEYOND



RESEARCH PARTNER SPOTLIGHT



# Key Research Findings

BY JORDAN BAKER  
CONTENT COORDINATOR, DEVADA

## Demographics

For the 2019 DZone Guide to Containers, we surveyed 559 developers, with a 79% completion rating. Below, we've given a quick demographic breakdown of these respondents.

- Respondents live in three main geographical areas:
  - 35% reside in Europe
  - 26% live in the USA
  - 14% call South Central Asia home
- Respondents, on average, have 18 years of experience in the software/IT industry.
- Most respondents work for enterprise-level organizations:
  - 23% work for organizations with 100-999 employees
  - 22% work for organizations with 1,000-9,999 employees
  - 22% work for organizations with 10,000+ employees
- Respondents reported three main job roles:
  - 29% work as developers/engineers
  - 25% are architects
  - 20% make their living as developer team leads

- Survey-takers reported working on three main types of software development projects:
  - 84% are currently developing web applications/services
  - 52% are working on developing enterprise business applications
  - 30% are developing native mobile apps

## How Orgs Use Containers

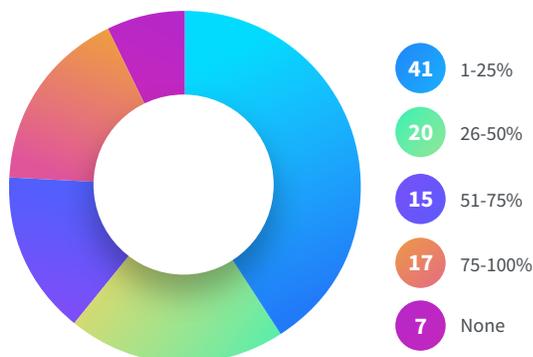
To set a baseline for the rest of the report, let's begin by examining the organizational use of containers, and how it has changed over time. When we asked respondents if their organization currently uses container technologies, 70% answered yes. This is a rather astounding number, as last year, in our 2018 Containers Guide Survey, only 45% of respondents reported that their organization used containers. Additionally, that percentage of respondents who told us that their organizations are not using containers fell from 25% in 2018 to 10% in this year's survey.

Taking a more granular look at these statistics, we find that every department within a typical software company's organizational structure witnessed large increases in container adoption. Among development teams, container adoption rates rose from 83% in 2018 to 89% in 2019; container use among DevOps teams grew from 77% to 82%; QA/Testing teams' adoption of containers went from 46% to 60%; and operations teams' container adoption rates climbed from 38% to 60%. These statistics represent a dramatic shift in the ways in which containers and container technologies are used throughout the SDLC.

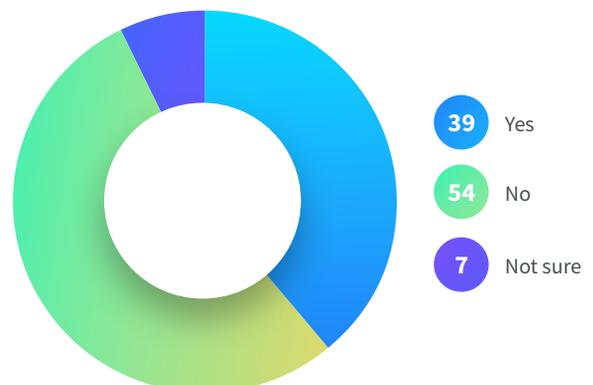
If we zoom in even farther, going from the departmental level to the environmental level, we see the same pattern occurring. In 2018, 87% of respondents reported using containers in development environments; this year, this number rose to 90%. Production/deployment environments saw a 7% percent increase

### SURVEY RESPONSES

What percentage of your organization's workload is containerized?



Do you believe your organization has achieved Continuous Delivery?



in container use over the past year, with 80% of this year’s survey-takers using containers in production/deployment. The containerization rates of QA/Testing environments jumped from 63% in 2018 to 79% in 2019; and staging environments witnessed a similar growth in containerization rates, going from 54% in 2018 to 71% this year.

All this is to say that container adoption has increased dramatically over the past year. This growth was not only reflected in the number of organizations, teams, and projects adopting container technologies but also the number of containers being run by those organizations. In last year’s survey, 61% of respondents reported that their organizations ran 1-100 containers in production; this year, 46% of respondents reported thusly. Interestingly, the growth in larger containerized environments in production was spread out rather evenly among the different sizes. As this type of statistical breakdown does not lend itself to compelling prose, here are the numbers reflecting the year-over-year changes our respondents reported in terms of the number of containers their organization uses in production:

- 2018:
  - 1-100: 61%
  - 101-250: 13%
  - 251-500: 6%
  - 501-1,000: 2%
  - 1,001-5,000: 3%
  - 5,000+: 1%
- 2019:
  - 1-100: 46%
  - 101-250: 16%
  - 251-500: 9%
  - 501-1,000: 6%
  - 1,001-5,000: 4%
  - 5,000+: 4%

## Containers as a DevOps Tool

Not much has changed over the past year in terms of the tools that developers use in their containerization efforts; the field is still dominated by Docker (and its other products like Docker Swarm, Docker Enterprise, and Docker Hub) and Kubernetes. Thus, rather than belabor the point of Docker’s and Kubernetes’s astronomical adoption rates, in this section, we’ll evaluate the role that containers play as a means to achieve a more streamlined development process.

### MICROSERVICES ADOPTION

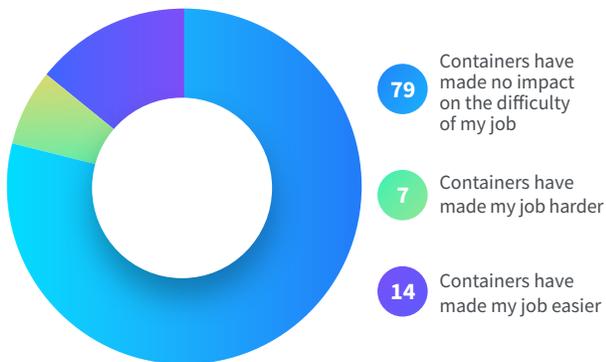
As noted in [DZone’s Guide to DevOps: Implementing Cultural Change](#), microservices have become an important facet of DevOps-based development — so much, in fact, that 58% of respondents to our 2019 DevOps survey reported using microservices in some capacity (either in production or development). In this year’s containers survey, we also found a widespread adoption of microservices among respondents. When we asked survey-takers if their organizations have adopted microservices, 70% responded yes. This was a rather large year-over-year change from our 2018 Containers Guide survey, in which 57% of the respondents reported that their organization had adopted microservices. When we compare this year’s data on microservices adoption to those organizations that are currently using containers, we find that the two are a popular pairing. Among those respondents who work for organizations that use container technology, 60% have adopted microservices. Additionally, only 10% of survey-takers who reported using microservices have not adopted container technologies.

### CI/CD

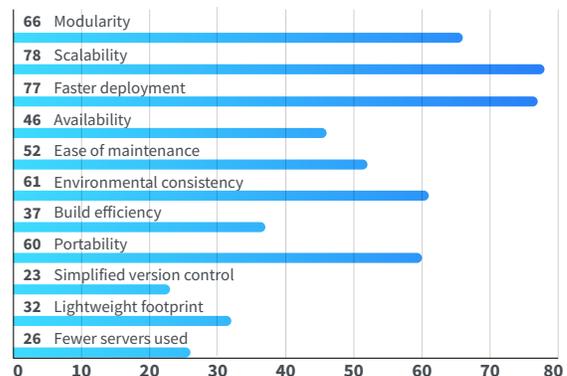
Continuous integration and continuous delivery constitute possibly the most well-known DevOps concepts, and thus seems like a good barometer with which to measure containers’ effects on the DevOps process. When we asked survey takers whether

#### SURVEY RESPONSES

Have containers made your job easier or harder?



What benefits do container technologies offer your organization?



they believe their organization has achieved continuous delivery, 54% said no and 39% responded yes. Interestingly, when we correspond this data to the data on organizational container adoption, we get a different story. Among those respondents whose organizations are using container technologies, 33% reported that their organization has achieved continuous delivery and another 33% reported that their organization has not. Thus, while containers are not the silver bullet for achieving CD, it seems they may alleviate some of the roadblocks along the way.

In terms of continuous integration, we see a similar story. 62% of respondents said that they believe their organization has achieved CI, while 32% told us they have not. Comparing these numbers to our data on organizations that currently use container technologies, we find that the rate of organizations both achieving and not achieving continuous integration fall. Among respondents who work for organizations that use containers, 50% believe their organization has achieved CI, while 16% say they have not achieved CI. Thus, much like in the case of continuous delivery, containers seem to act more as an impediment remover to the CI process than an active agent in CI's success.

**EXPECTATIONS VS. REALITY**

Containers have received a fair amount of hype over the past several years. In an attempt to peer through the buzz, in this section, we'll be using the data we collected from developers on what they expected from containers and what they've actually found working with containers to be like.

We began by simply asking respondents what benefits they were expecting container technologies to offer their organization. The top answers were as follows: scalability (72%), faster deployment (69%), ease of maintenance (54%), environmental consistency (51%), modularity (48%), and portability (42%). Out of all these potential benefits, ease of maintenance (52%) was the only one where expected and actual benefits (more or less) matched up.

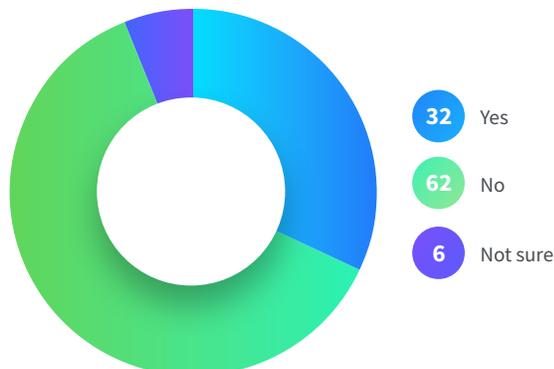
When we asked respondents what benefits containers actually brought to their organization, all the other factors enumerated above exceeded expectations (and, in some cases, by quite a wide margin). The benefits of containers that survey-takers reported actually witnessing in their organization were as follows: scalability (77%), faster deployment (77%), modularity (66%), environmental consistency (61%), and portability (60%). Modularity and portability seem to be the most unforeseen benefits offered by containers, with each garnering an 18% difference between expected and actual benefits.

When it comes to the expected versus actual challenges of containers, we saw equally interesting results. Unlike the potential benefits listed above, respondents only reported four main concerns regarding container adoption: lack of developer experience (80%, up from 71% in 2018), refactoring/re-architecting legacy applications (70%), ensuring application and network security (43%), and application performance monitoring (31%, down from 38% in 2018). Again, much like we saw with the benefits of containers, only one of these challenges actually matched respondents' expectations, with ensuring application and network security reported as a real challenge faced by 46% of respondents. The other three potential challenges proved less daunting than feared. 63% of respondents told us refactoring/re-architecting legacy applications was an obstacle, 58% reported challenges with a lack of developer experience, and 41% said application performance monitoring proved a challenge (up from 33% in 2018). Out of these four main road blocks, however, only two were reported as a primary reason why organizations opted against container adoption: lack of developer (41%) experience and refactoring/re-architecting legacy applications (21%).

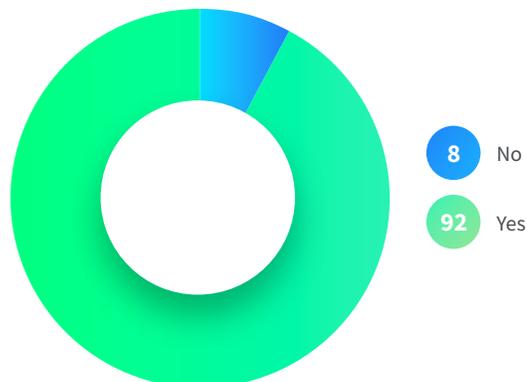
All in all, the benefits of container adoption seem to outweigh the negatives, as 79% of respondents told us they feel containers have made their jobs easier (up from 75% in 2018).

**SURVEY RESPONSES**

**Do you believe your organization has achieved Continuous Integration?**



**Is your organization planning to increase the number of containers they use?**



# Diving Deeper Into Containers

## Zones

### Cloud [dzone.com/cloud](https://dzone.com/cloud)

The Cloud Zone covers the host of providers and utilities that make cloud computing possible and push the limits (and savings) with which we can deploy, store, and host applications in a flexible, elastic manner. The Cloud Zone focuses on PaaS, infrastructures, security, scalability, and hosting servers

### Microservices [dzone.com/microservices](https://dzone.com/microservices)

The Microservices Zone will take you through breaking down the monolith step-by-step and designing microservices architecture from scratch. It covers everything from scalability to patterns and anti-patterns. It digs deeper than just containers to give you practical applications and business use cases.

### DevOps [dzone.com/devops](https://dzone.com/devops)

DevOps is a cultural movement, supported by exciting new tools, that is aimed at encouraging close cooperation within cross-disciplinary teams of developers and IT operations. The DevOps Zone is your hot spot for news and resources about Continuous Delivery, Puppet, Chef, Jenkins, and much more.

## Twitter



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[@jessfraz](https://twitter.com/jessfraz)



[@abbyfuller](https://twitter.com/abbyfuller)

## Books

### **The Docker Book: Containerization Is the New Virtualization**

Dive into how to install, deploy, manage, and extend Docker, as well as how to use Docker to build containers and services for your specific needs.

### **Microservices and Containers**

Get an analysis of how Docker containers plus microservices can aid in agile and scalable app development and deployment.

### **Kubernetes Cookbook: Building Cloud-Native Applications**

Learn about successfully using Kubernetes to automate the deployment, scaling, and management of containerized applications.

## Refcardz

### **CI/CD for Containers**

Containers and orchestration tools have often been cited as ways to facilitate continuous delivery and continuous integration. Download this Refcard to learn about the challenges and solutions to utilizing containers in your DevOps pipeline.

### **Java Containerization**

This Refcard focuses on the design, deployment, service discovery, and management of Java applications on the open-source project called Docker so that you can get your Java application up and running inside a Docker-deployed Linux container.

### **Persistent Container Storage**

Containers are great for building applications with ephemeral data. But what if you need your data to persist? Download this Refcard to learn what you need for container storage, discover the benefits of cloud-native storage.

## Podcasts

### **Containerization and Why Everyone Loves Docker So Much**

Learn about what containerization is, containerization software solutions, what the appeal of containers is, and how containerization is used.

### **Tom's Tech Notes: What You Need to Know About Containers**

Get advice from nine industry experts on what you need to know about containers for modern application development.

### **Pod as a Service: Containerization & Container Orchestration**

Learn about prominent container technologies and their benefits, considerations, orchestration, and management.

# Secure the Open Source in Your Containers From Start to Finish

Containers rely heavily on open source components, comprising the vast majority of code in most modern applications today. While providing a powerful building block for our software, these open source components can be used by attackers to exploit your product if they are not protected.

As developers play a greater role in vulnerability management for their applications, we have a responsibility to make sure the open source components in our containers are secure and compliant.

The challenge that many developers face in working securely is achieving sufficient visibility into the multiple layers of their containers, lacking the control to guard against risky components. It is hard to stay protected if you can't see what you're working with.

Responding to the need to ensure security coverage, WhiteSource for Containers offers teams a holistic solution for the entire container development lifecycle from building your container registries and even all the way to Kubernetes with real-time alerts and policy enforcement so developers can focus on building great products.

Providing support for over 200 programming languages, [WhiteSource for Containers](#) offers native integration to all environments along the way, including all CI servers, container registries, and container orchestration tools like Kubernetes.

View all the relevant information pertaining to containers with easy to navigate dashboards to produce container vulnerability reports, manage policies, and track the security status of deployed containers.

Containers are a powerful tool that help teams reach deployment faster. However, in order to reap their benefits, you need to take control of your vulnerability management. [WhiteSource for Containers](#) allows developers to code with confidence without compromising on security.



**WRITTEN BY RAMI SASS**  
CEO & CO-FOUNDER, WHITESOURCE

## PARTNER SPOTLIGHT

## WhiteSource for Containers

WhiteSource for Containers provides continuous and automated open source security throughout the container lifecycle.



**Category** Container Security | Application Security | Software Composition Analysis | DevOps | Secure Coding

**New Release** Continuous

**Open Source?** Yes

### Case Study

Due to the sensitive regulatory environment Siemens Healthineers works in, Siemens H. needed assurance that they are remaining compliant and secure in their use of open source components.

“With open source software, usually the source code is available for all to see, including hackers,” explained Code Clinic Lead, Neil Langmead. In order to avoid costly mistakes that can result from vulnerable or risky open source components being added to their products, Siemens Healthineers turned to WhiteSource.

“We chose WhiteSource because of its ease of use, its excellent data, and for the in-depth security vulnerability information that comes with the reporting engine.” With WhiteSource, Siemens was offered the widest coverage of plugins and languages that they needed, as well as the continuous monitoring and policy enforcement safeguards they required in order to allow their team to code with confidence. [Read more here](#)

### Strengths

- **Automated workflow:** Enforce policies automatically at all stages of the container lifecycle
- **Native integrations to container registries:** Track vulnerabilities in images automatically
- **Kubernetes deployment:** Automatically scans any image deployed to production
- **Comprehensive coverage:** Supports 200+ programming languages and many Linux distributions
- **Pinpoint accuracy:** Proprietary algorithms guarantee no false positives

### Notable Customers

- Microsoft
- Comcast
- EllieMae
- IGT
- Spotify

### Website

[whitesourcesoftware.com](https://whitesourcesoftware.com)

### Twitter

[@WhiteSourceSoft](https://twitter.com/WhiteSourceSoft)

### Blog

[resources.whitesourcesoftware.com](https://resources.whitesourcesoftware.com)

# Secure Your Open Source Components in Your Containers

**FIND OUT HOW**

