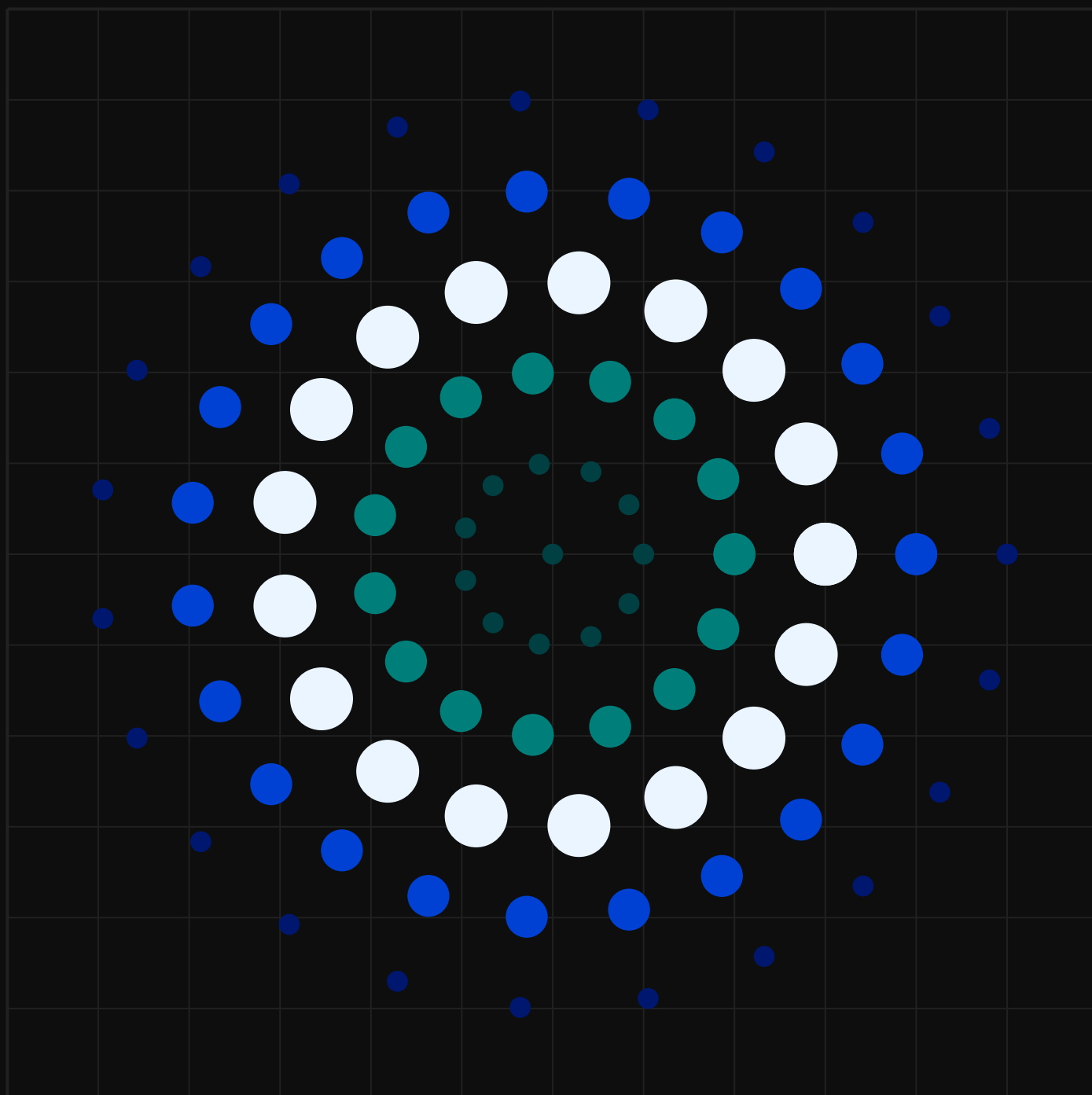


Serverless in the enterprise, 2021:

Building the next generation of efficient, flexible, cost-effective cloud native applications

Results from research conducted by
IBM Market Development & Insights



ABOUT THE RESEARCH

The IBM Market Development & Insights (MD&I) team conducted a series of surveys that recorded the perceptions and real-world experiences of more than 1,200 IT executives, developer executives and developers from large and midmarket companies. Respondents represented a range of experience with a serverless computing approach, including those currently using one as well as nonusers who are exploring or planning to adopt this approach in the near future. The results offer insight into the real-world opportunities and challenges for implementing a services development approach that includes serverless.

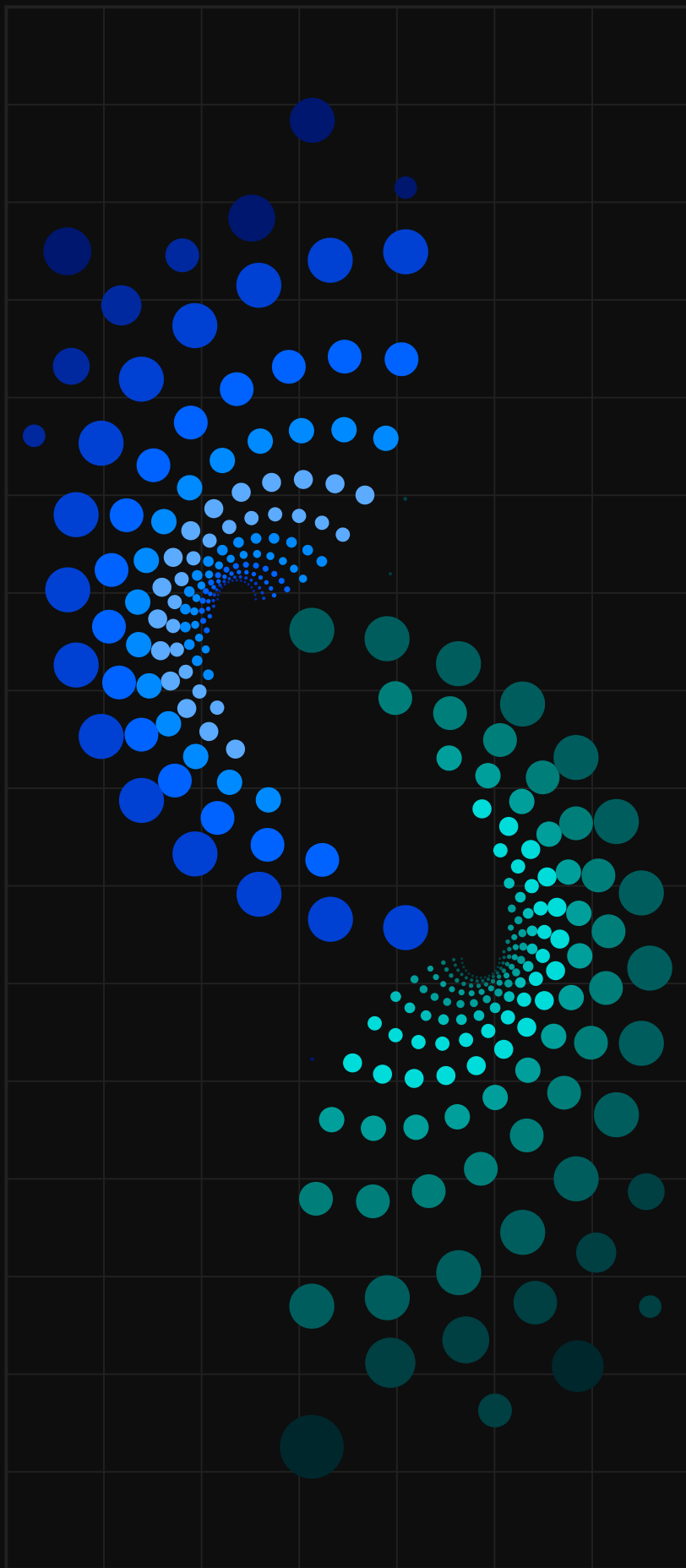
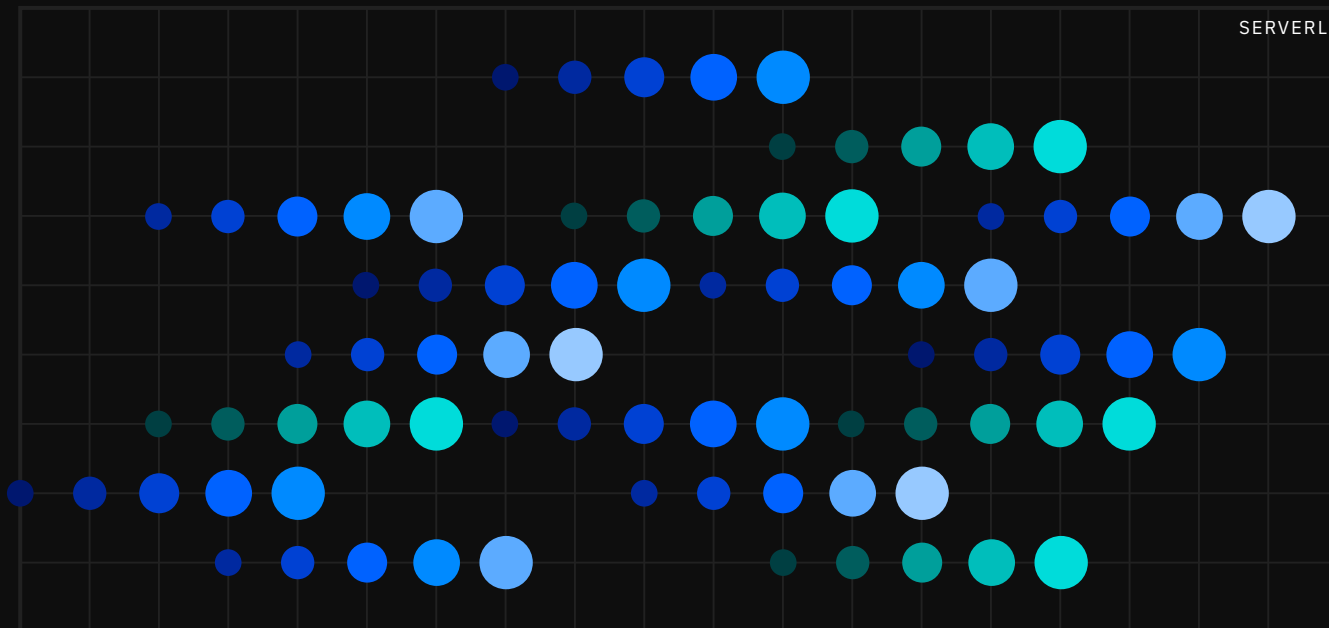


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Greater business value and speed, less administration

In constant pursuit of faster, simpler and more cost-effective ways to deliver application functionality and service development, organizations are turning to microservices, containers and serverless computing. These modern approaches help them efficiently build and run applications in hybrid cloud environments, gaining speed to market and seizing competitive advantage.

Serverless computing offers extremely high performance and flexibility at scale while shifting all of the burdens of server administration to cloud providers. Freed from these tasks, engineers can focus on optimizing code and adding features and functionality for their applications instead of managing infrastructure.

Serverless automatically spins up instances of functions and the infrastructure to run them as they are needed, scales them on demand in response to increased traffic, and scales them to zero—no instances—when they're no longer called. Because serverless is a pay-per-use consumption model, it can dramatically reduce the cost of running many applications.



Benefits beyond cost

Survey results overview

Organizations across industries credit serverless for delivering real-world benefits for application development and the business overall. Reducing costs was among the most important benefits for all users of a serverless approach, regardless of role. Beyond that commonality, however, roles in services development and the business experience different key benefits from serverless.

Most important benefits for development

- *Reduced operational costs*
- *Improved application quality and performance*
- *Greater flexibility to scale up or down*
- *Faster application deployment or rollout of new features*

Most important business benefits

- *Better security of company and customer data*
- *Lower overall costs*
- *Improved employee productivity*
- *Faster time to market or response to marketplace changes*

At the same time, significant concerns remain. When asked to share their top challenges, serverless users included these issues:

- *Security concerns*
- *Costs for apps with long-running processes*
- *Uncertainty regarding the time and costs involved in building serverless applications*

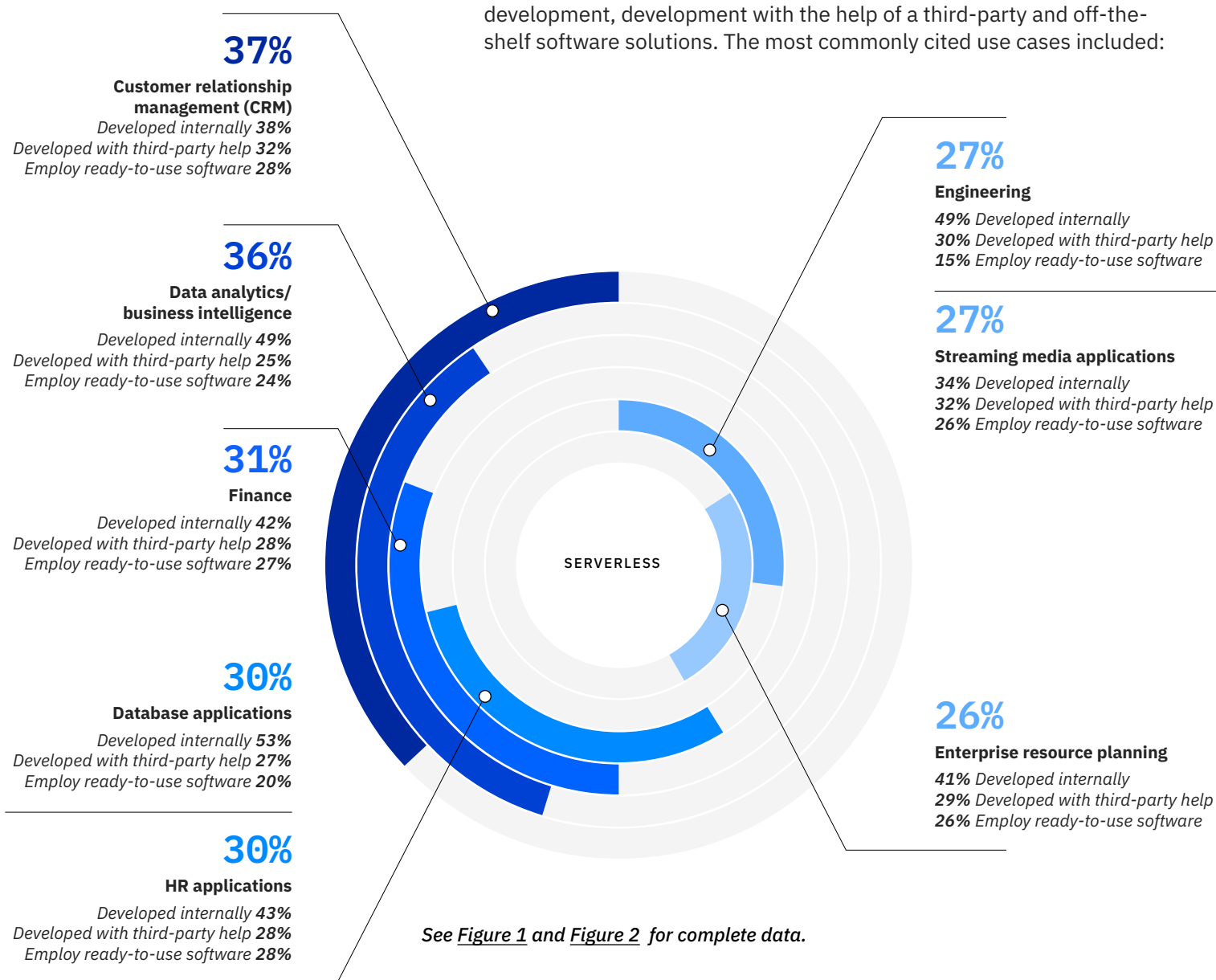
While acknowledging these challenges, **85 percent** of respondents said they either agree or agree completely that the effort and expense of adoption is worth it.

Serverless in action

Enterprises are turning to serverless for many types of applications, both internally and with help from third-party providers. In addition, ready-to-use third-party software solutions make up a sizeable share of these applications in use.

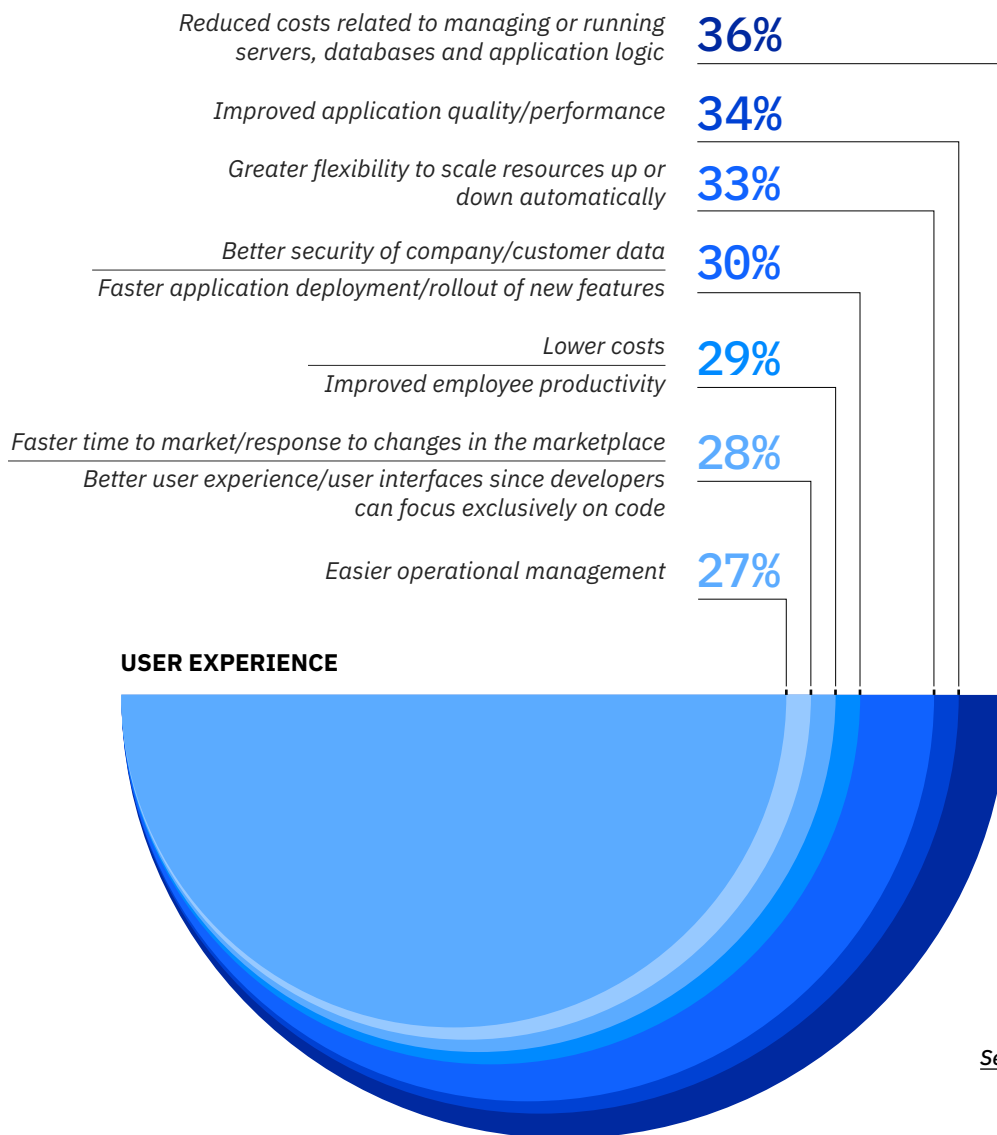
How serverless is being used

More than a dozen common current use cases for serverless applications were identified by survey respondents. These organizations employed a variety of means for implementing serverless applications—in-house development, development with the help of a third-party and off-the-shelf software solutions. The most commonly cited use cases included:



What users experience

Users said that serverless is delivering significant benefits across many areas of the business. Benefits identified as most important included:



KEY TAKEAWAYS

Current users of a serverless application development approach are realizing significant, ongoing benefits that span many areas of the business, with cost, scalability and security named as the primary benefits.

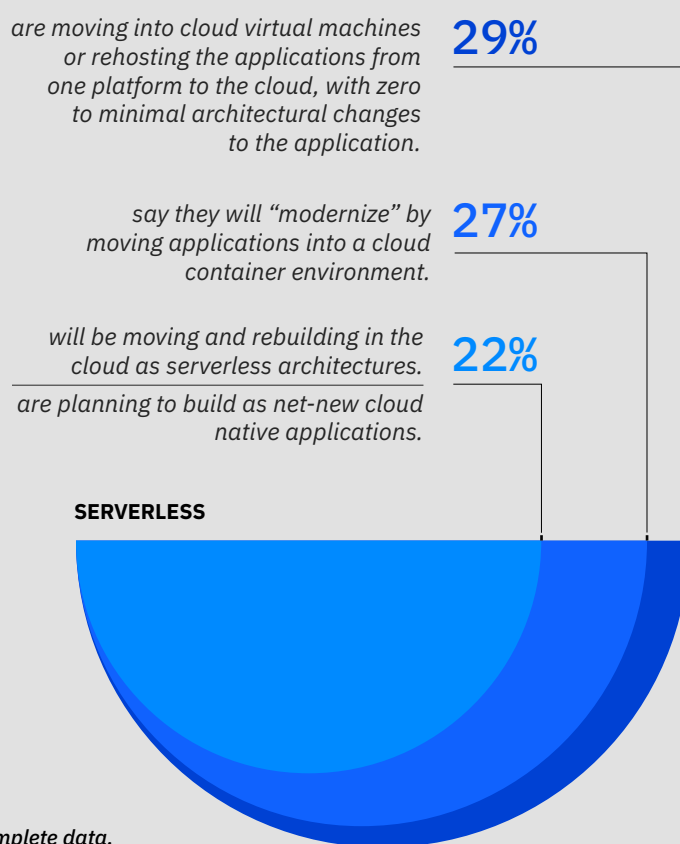
Application types suited for a serverless approach

Successful implementation of serverless computing begins with assessing the best application choices for modernization. Serverless offers outstanding support for a wide range of use cases, including:

- Microservices
- Data and event processing
- Sensor data for the Internet of Things
- Massively parallel compute operations
- Mobile back-end processes

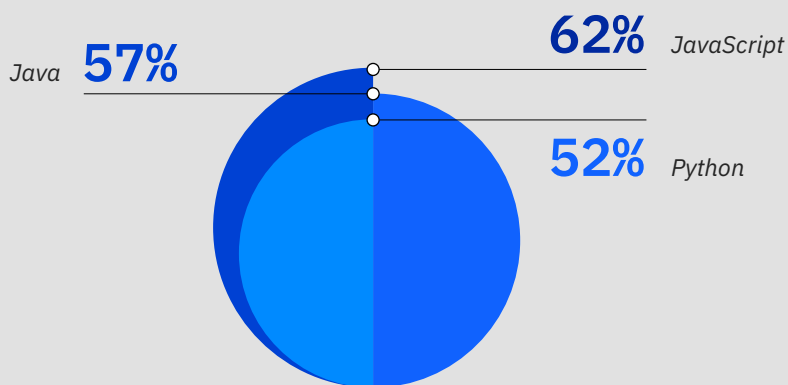
Until recently, serverless was not considered the best approach for stable or predictable workloads, larger processing payloads, or applications that require frequent cold starts. However, that has been changing as best-in-class serverless platforms continue their evolution, delivering new and expanded functionality and broadening their suitability for a greater variety of applications and workloads.

With this in mind, we asked current users of serverless about their organization's cloud strategy and what applications they were most likely to migrate—and through what approach—in the next two years.



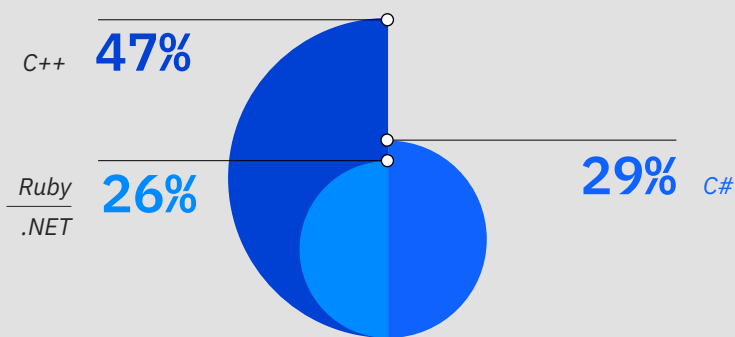
See Figure 4 for complete data.

We also asked users about the type of runtime languages most commonly employed for serverless applications. JavaScript, Java and Python were cited by more than 50 percent of the survey respondents:



See Figure 5 for complete data.

Other languages were less popular:

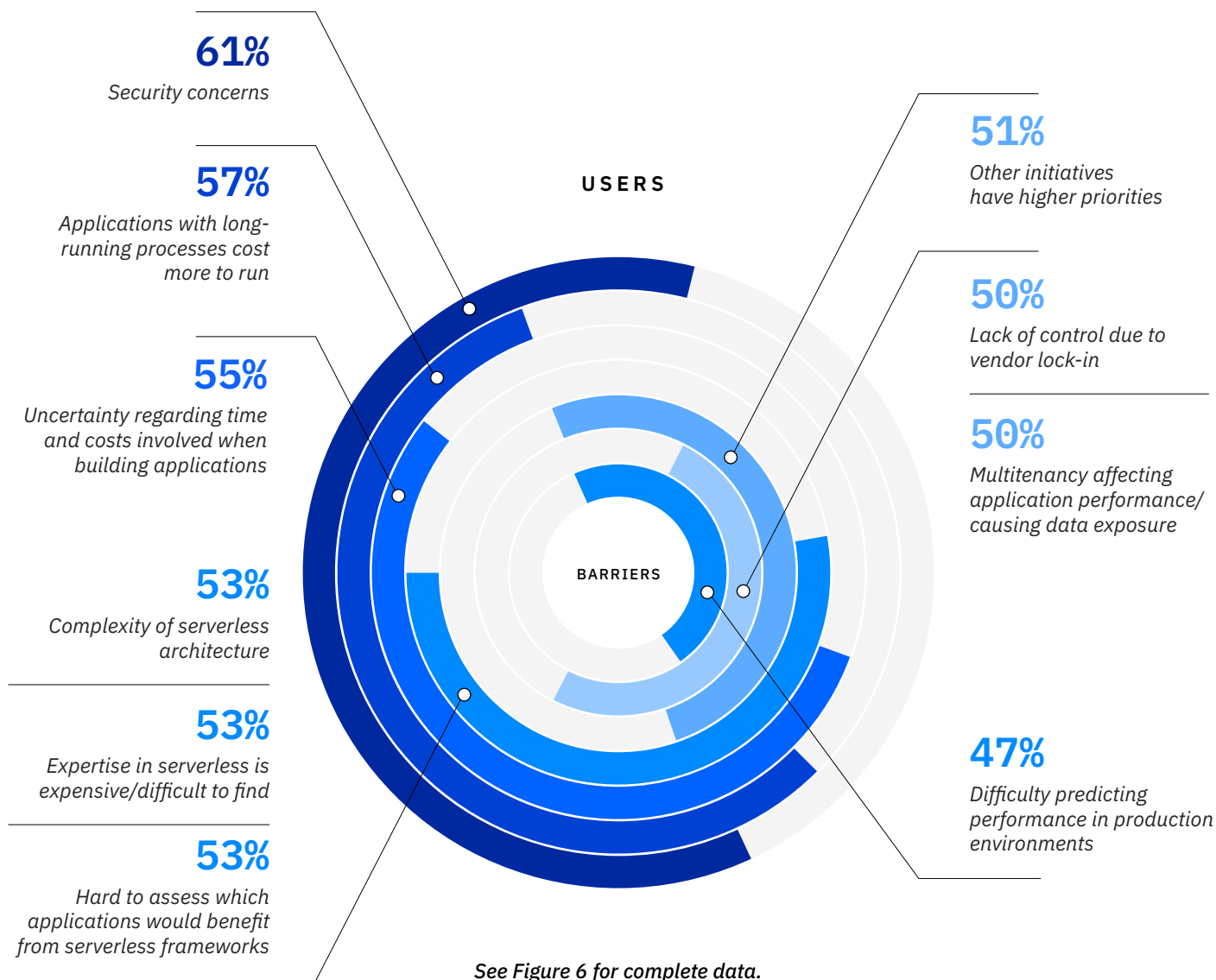


No other programming language was reported to be used by more than 22 percent of respondents.

Each runtime language has characteristics that can offer advantages or disadvantages depending on the system or workload, such as faster spin-up times, extensive and tested libraries, or excellent third-party or community support. Developers increasingly have strong options for their choice of language, which is important for enterprises because it expands the available talent pool for application developers.

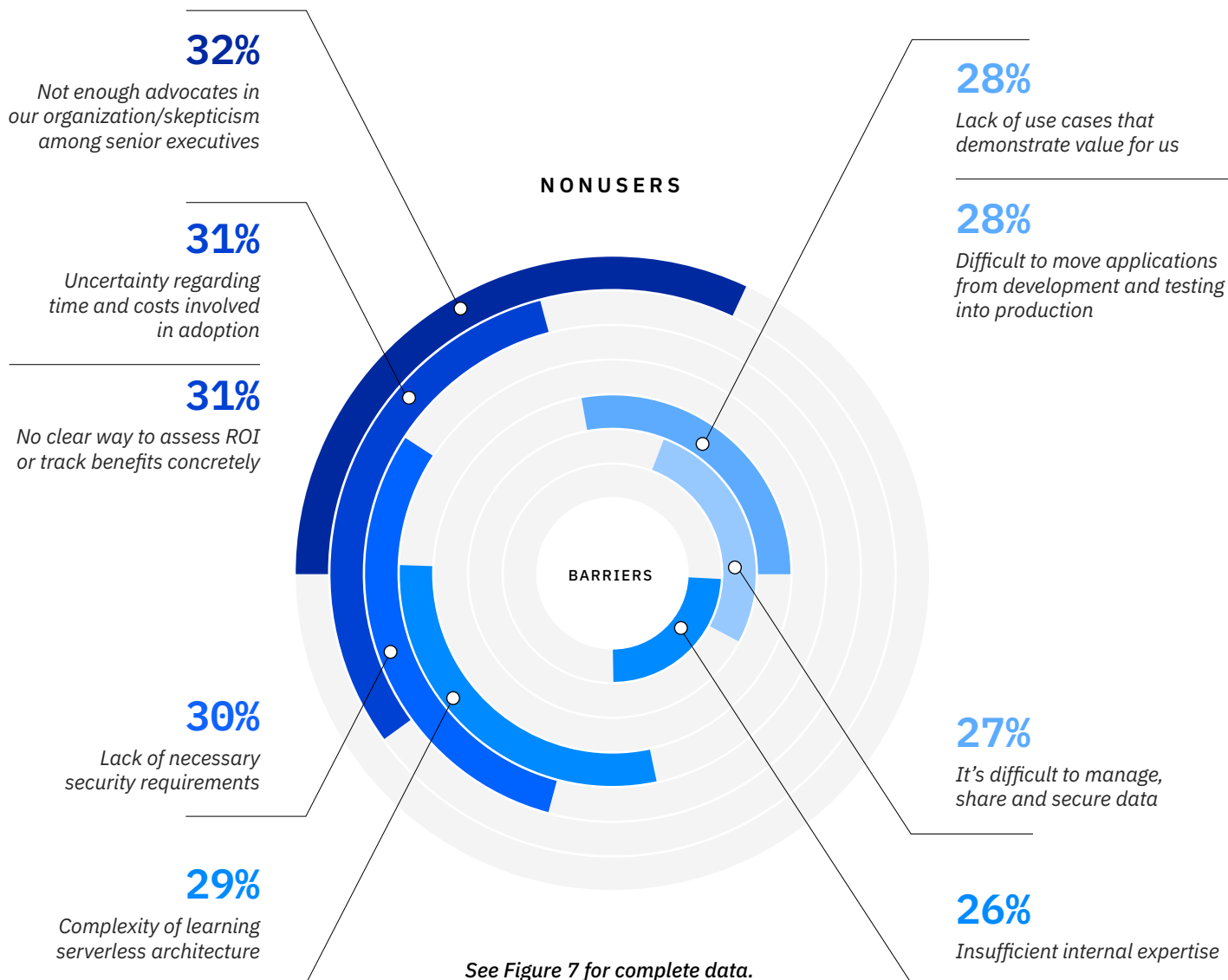
Identifying challenges

Our survey participants report that, although serverless offers many ongoing benefits for application development and deployment, real challenges remain. Asked about barriers to adoption or expansion of serverless computing within their organizations, current users named several areas a challenge, including:



While the challenges are real, only a small percentage ($\leq 25\%$) of those in roles we surveyed—developers, developer executives and IT executives—called any of them a significant challenge.

We asked nonusers about their own barriers to adoption. Here are their responses:



KEY TAKEAWAYS

- Many concerns raised—the lack of experienced talent, security concerns and understanding which applications are right for transition to a serverless architecture approach—can be mitigated by bringing in the right talent.
- For current nonusers, primary concerns center around a lack of clarity about how to move forward—finding relevant use cases, where to get executive support, attracting talent and needing tactical insights into the process.

PERCEPTION VERSUS REALITY: serverless security

Our research reveals that serverless security remains an area of concern for some respondents while being hailed as a strength by others.

Most anxiety around serverless security boils down to a lack of transparency into operational control. Will my function spin up in a secure environment? Can I control the level of isolation? How do I ensure compliance? Will connections remain open after the function scales to zero?

The answers lie in learning the levels and ranges of protection that cloud providers offer for serverless and their relative costs.

For example, a cloud provider may offer compute isolation ranging from container-level isolation, where your functions run in isolated containers running on a shared virtual machine (VM); VM-level isolation, where your containers run on a single-tenant VM; and hypervisor-level isolation. Providers may offer similar ranges of network and storage isolation options. If available, a confidential computing environment—where your data and code are encrypted and isolated at rest, in motion and during computation—provides the ultimate in isolation. The more isolation you chose, the higher the cost; the more granular your options, the better you can balance cost and security.

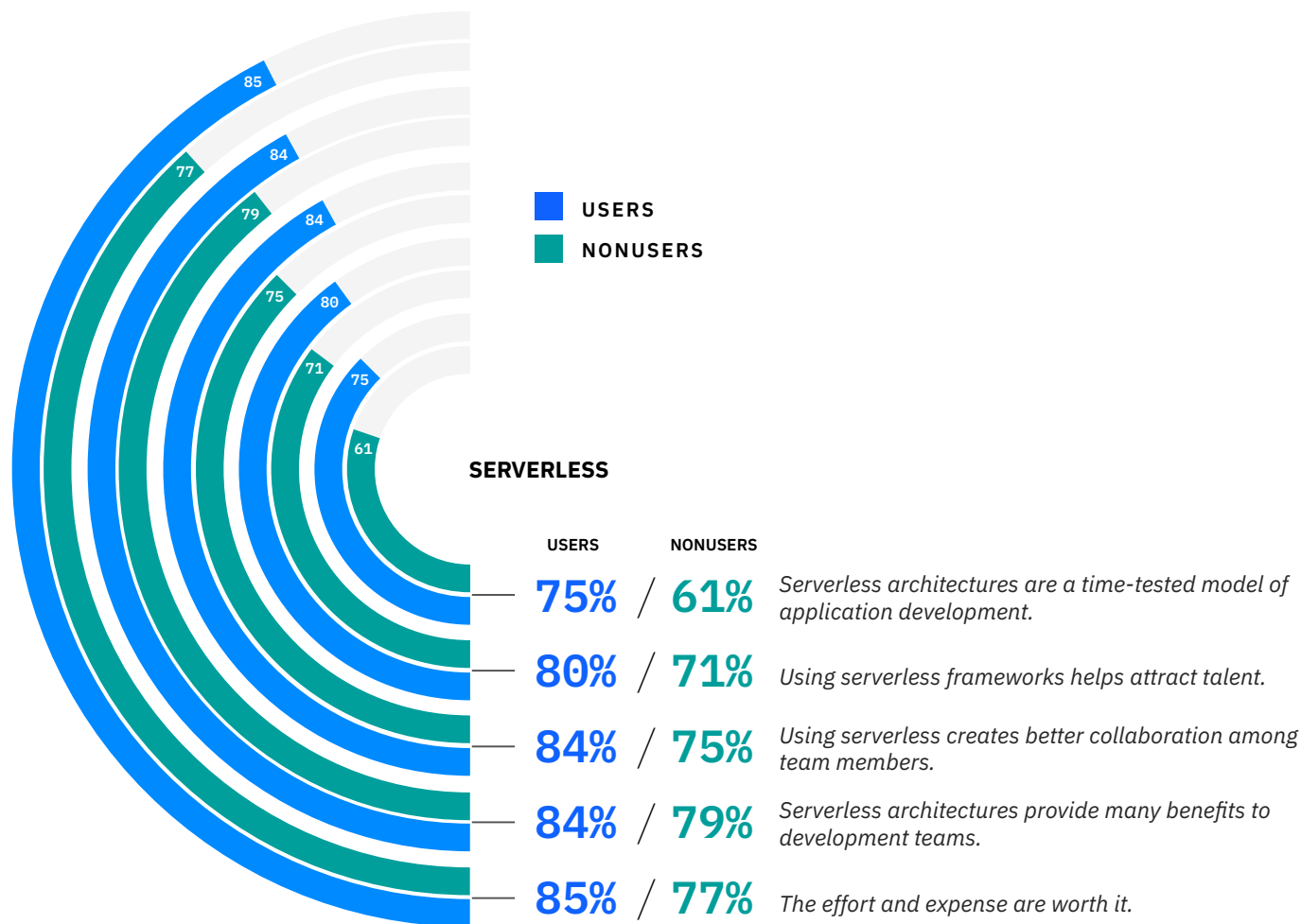
Providers also offer services managed for various levels of regulatory compliance, spanning base-level compliance; common regulations such as the Sarbanes-Oxley Act (SOX) or the Health Insurance Portability and Accountability Act (HIPAA); and extremely demanding, industry- or government-specific regulations such as financial standards or the Federal Risk and Authorization Management Program (FedRAMP). Again, the more demanding the level of compliance, the higher the cost.

As always, adhering to best practices can help further mitigate your security risks. Practice sound connection management—use HTTPS by default, enable function-to-function communication over private networks only and configure connections to close whenever functions scale to zero. Runtime protection, application programming interface (API) gateways and tightly controlled access and permissions will further tighten security and reduce your exposure.

An approach that works

Current users and nonusers of serverless architectures report that they believe the approach offers significant benefits. Further, both groups say that their organizations are planning to increase their use of serverless application development in the next two years.

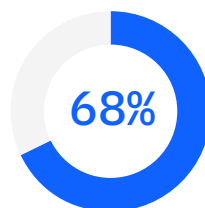
Current users and nonusers agreed or agreed completely with the following statements about a serverless architecture approach:



See [Figure 8](#), [Figure 9](#) and [Figure 10](#) for complete data.

Adoption is increasing

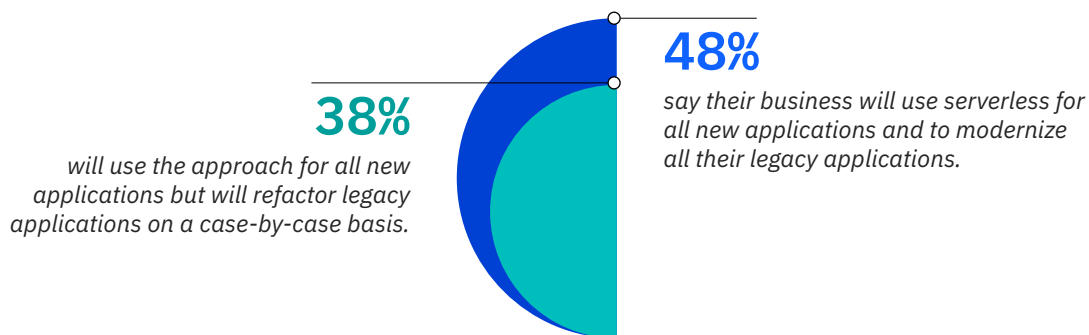
Given these potential benefits, most current nonusers are planning to adopt a serverless architecture approach.



say they are very likely or likely to adopt a serverless approach in the next two years.

See Figure 11 for complete data.

Current users of serverless architectures see the approach growing in popularity in their organization.



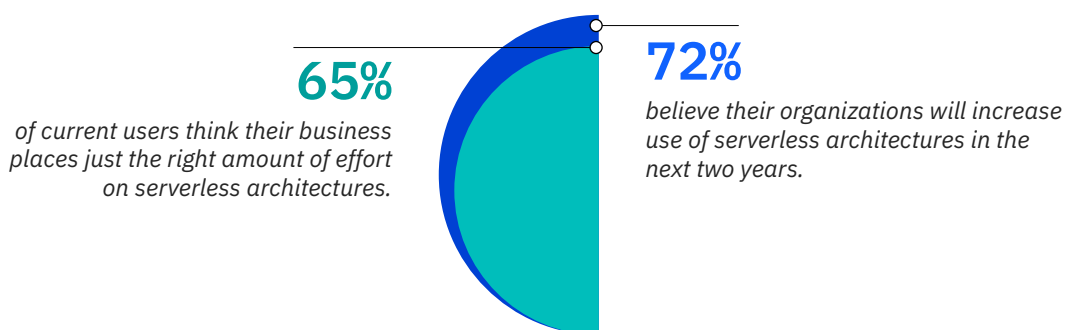
38%

will use the approach for all new applications but will refactor legacy applications on a case-by-case basis.

48%

say their business will use serverless for all new applications and to modernize all their legacy applications.

See Figure 12 for complete data.



65%

of current users think their business places just the right amount of effort on serverless architectures.

72%

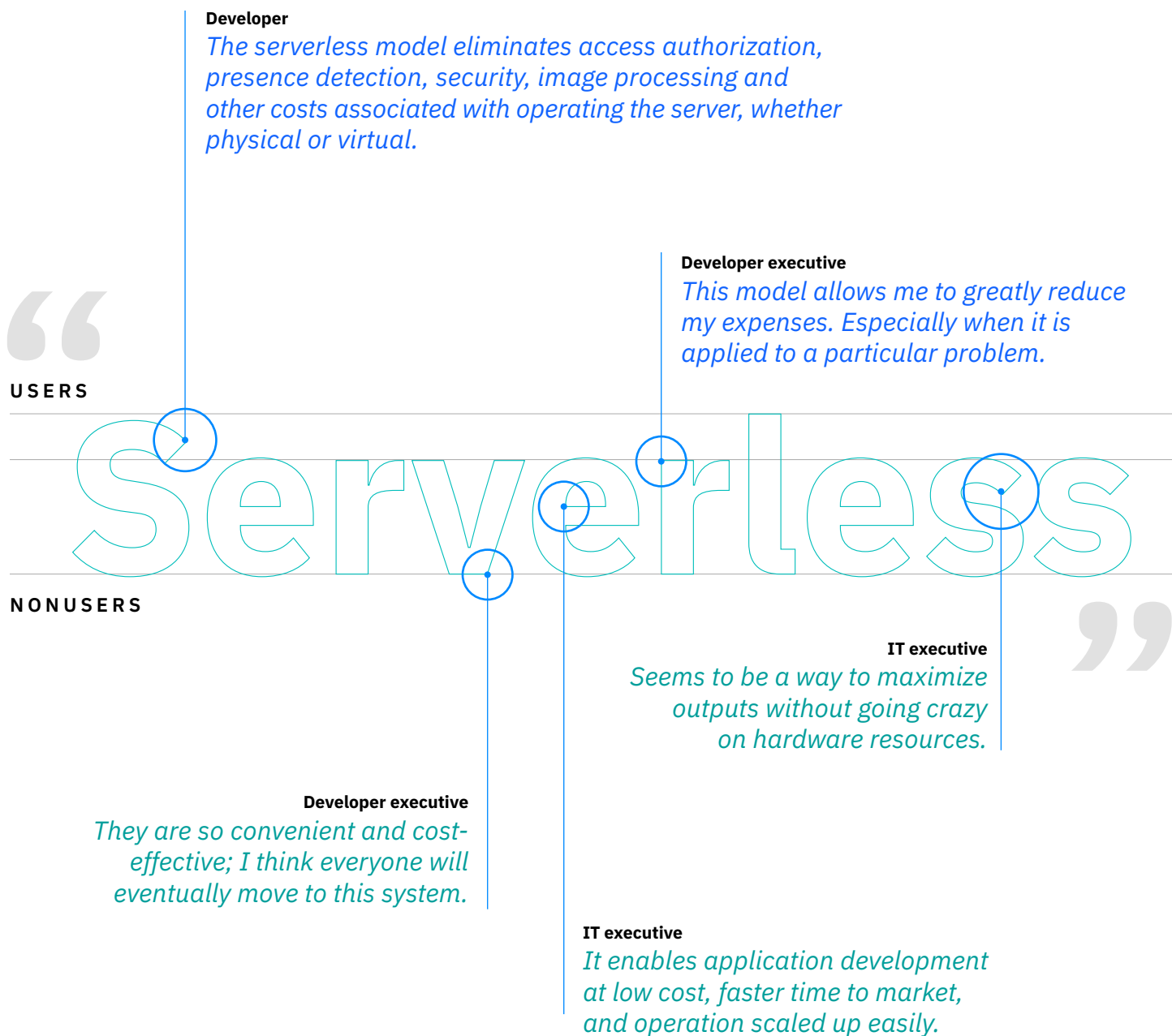
believe their organizations will increase use of serverless architectures in the next two years.

See Figure 13 for complete data.

Current users believe that, in the next two years, **a greater percentage of applications will be developed using a serverless approach (57% mean) than were developed in the previous two years (47% mean).**

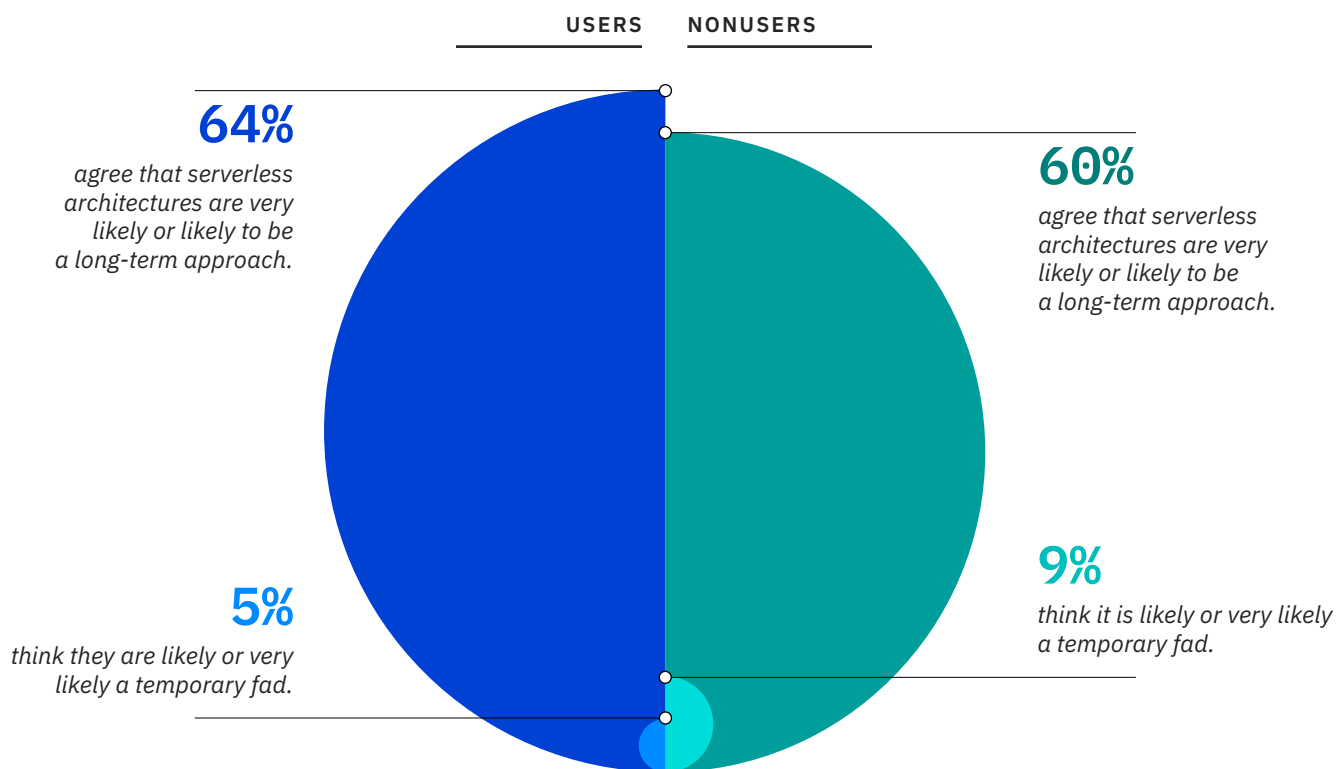
See Figure 14 for complete data.

What people said



A long-term play

Asked if they believed that serverless architectures were a long-term approach to application development and management or simply a fad, both current users and nonusers agreed—serverless is no fad.



See [Figure 15](#) and [Figure 16](#) for complete data.

KEY TAKEAWAYS

Current users and nonusers are excited about what serverless architectures can do for their organizations, and both groups believe that the future is bright for the approach.

Serverless belongs in your application development strategy

As enterprises continue to modernize their infrastructure and increasingly embrace a cloud-first strategy, it's clear that implementing serverless architectures will be a vital part of the mix. Our research shows that taking a serverless approach offers real advantages for many workloads and that the perceived challenges, while not insignificant, can be managed—and that the results are worth the effort. It's worth it because serverless architectures remove the burden of server management from the shoulders of enterprise engineers, freeing them to spend their time on innovation, bringing richly featured applications to the marketplace faster at a lower cost, driving new revenue and increasing customer satisfaction.



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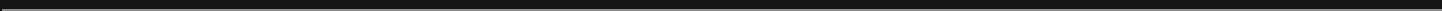
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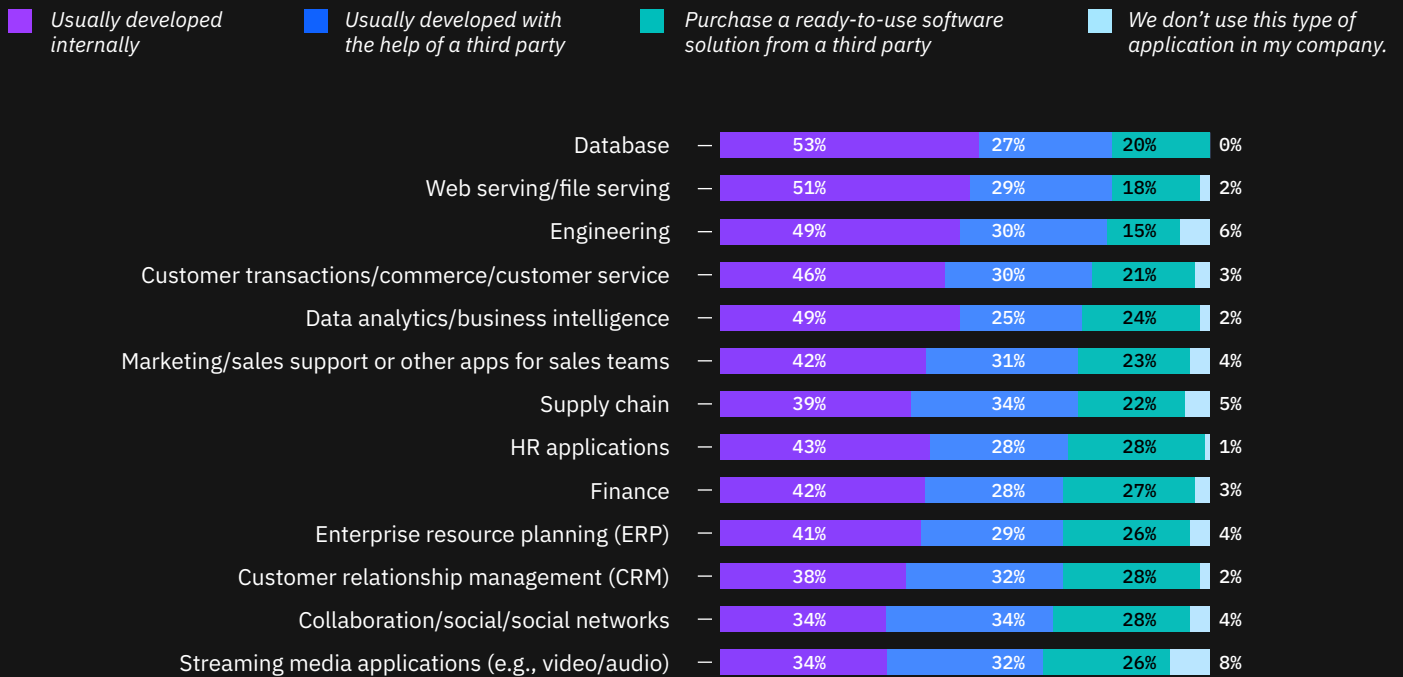
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APPENDIX



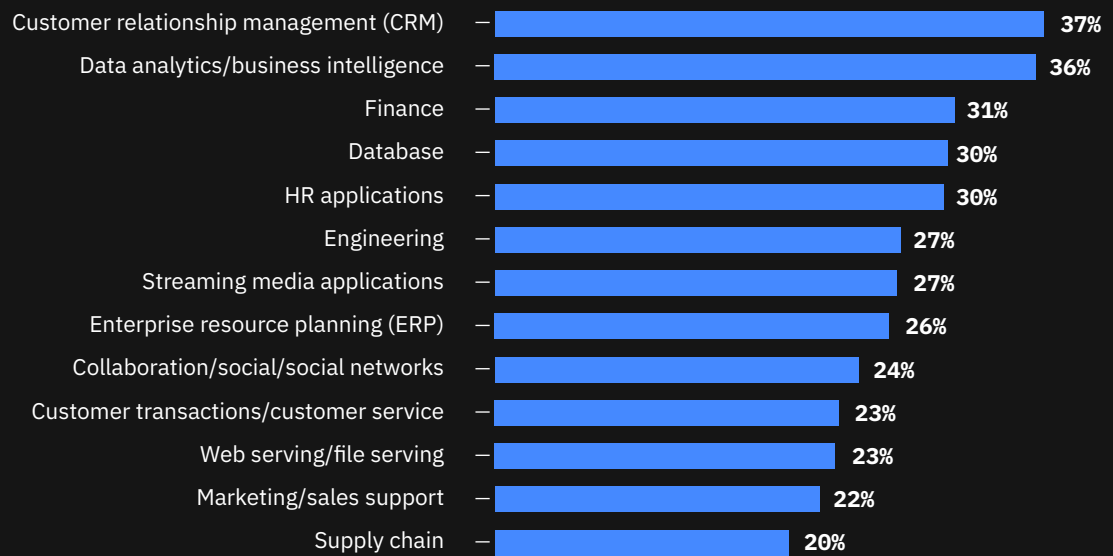
Usual development mode by application type (User, n=391)



P6. For each of the application types below, please indicate if your company usually develops them internally (e.g., developed by internal software developers/developer teams), if they are developed with the help of an external provider or if your company usually buys a ready-to-use software solution from a third party.

Figure 1

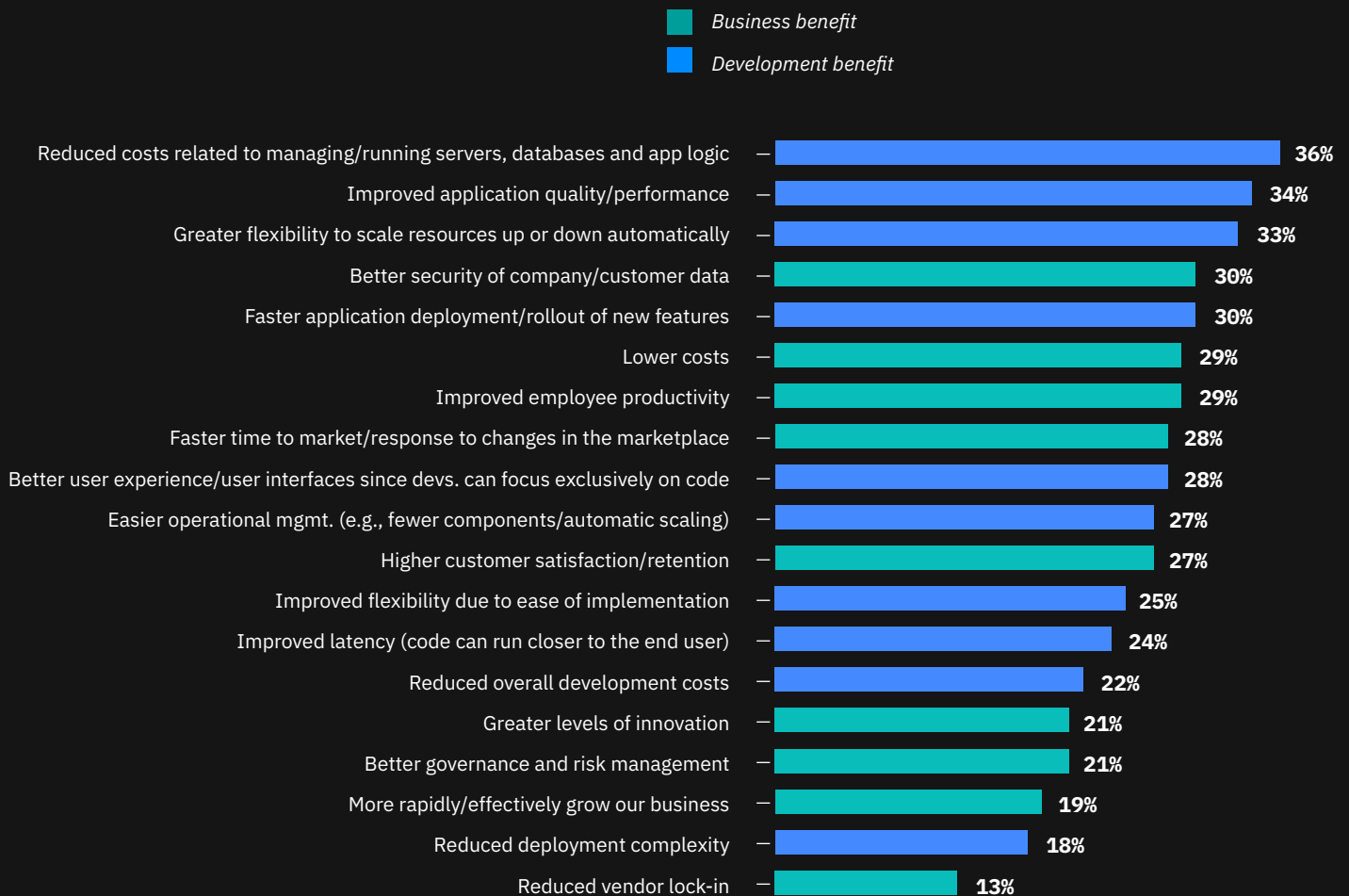
Applications using serverless
(Users developing apps internally/with help of third party, n=385)



P7. You indicated that the following applications are usually developed internally or with the help of an external provider. Which of these applications use serverless?

Figure 2

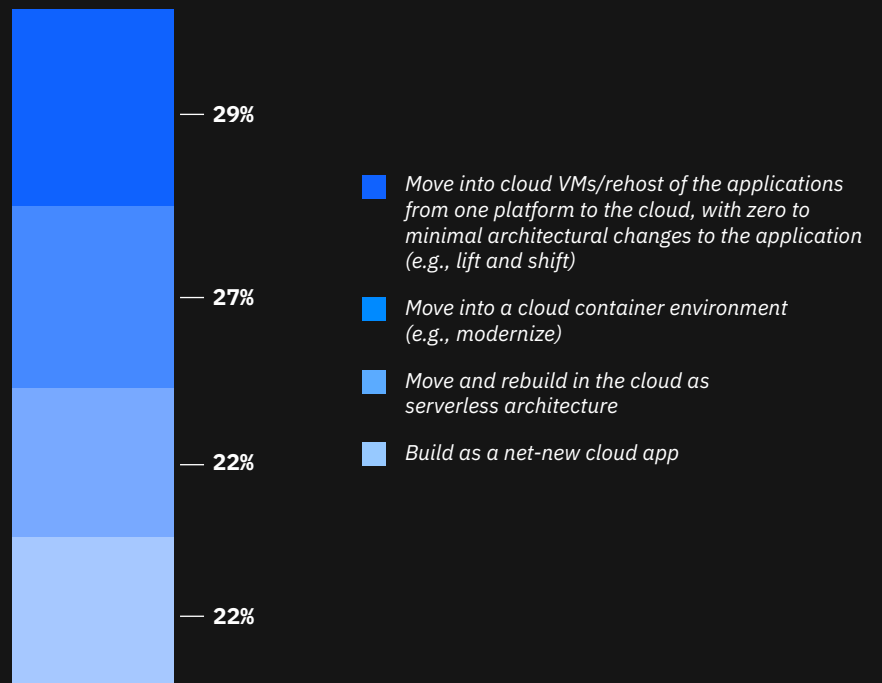
Most important benefits experienced from using serverless architecture
 (% of users ranking benefit in top 5 most important , n=387)



P15. Shown below are the benefits you identified as experienced by your company as a result of using serverless architecture. Which of these benefits are most important to you and your company?

Figure 3

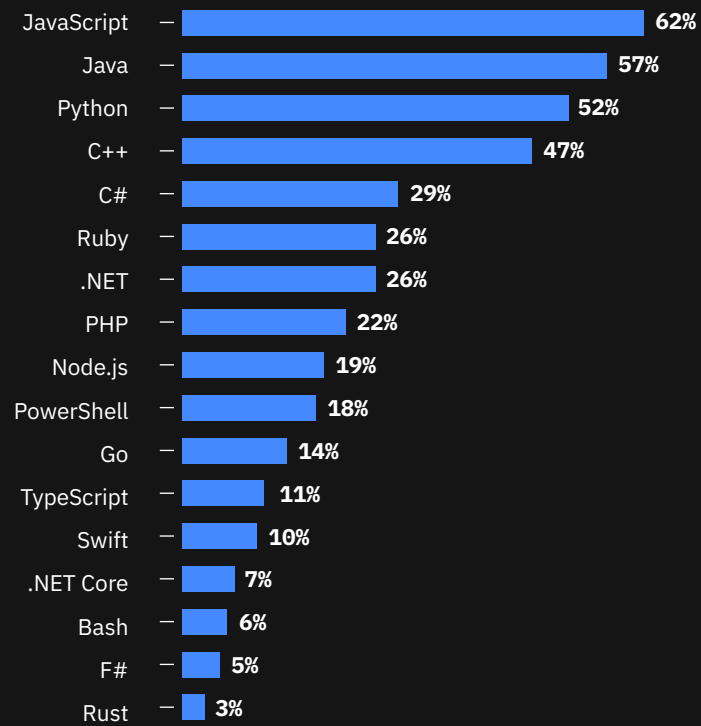
Expected cloud environment categories two years from now (Users, n=196)



P9. You indicated that some applications currently running in a noncloud environment will be moved to a cloud environment in the next two years. Approximately, what percentage of these applications do you expect to fall under each of the following categories two years from now?

Figure 4

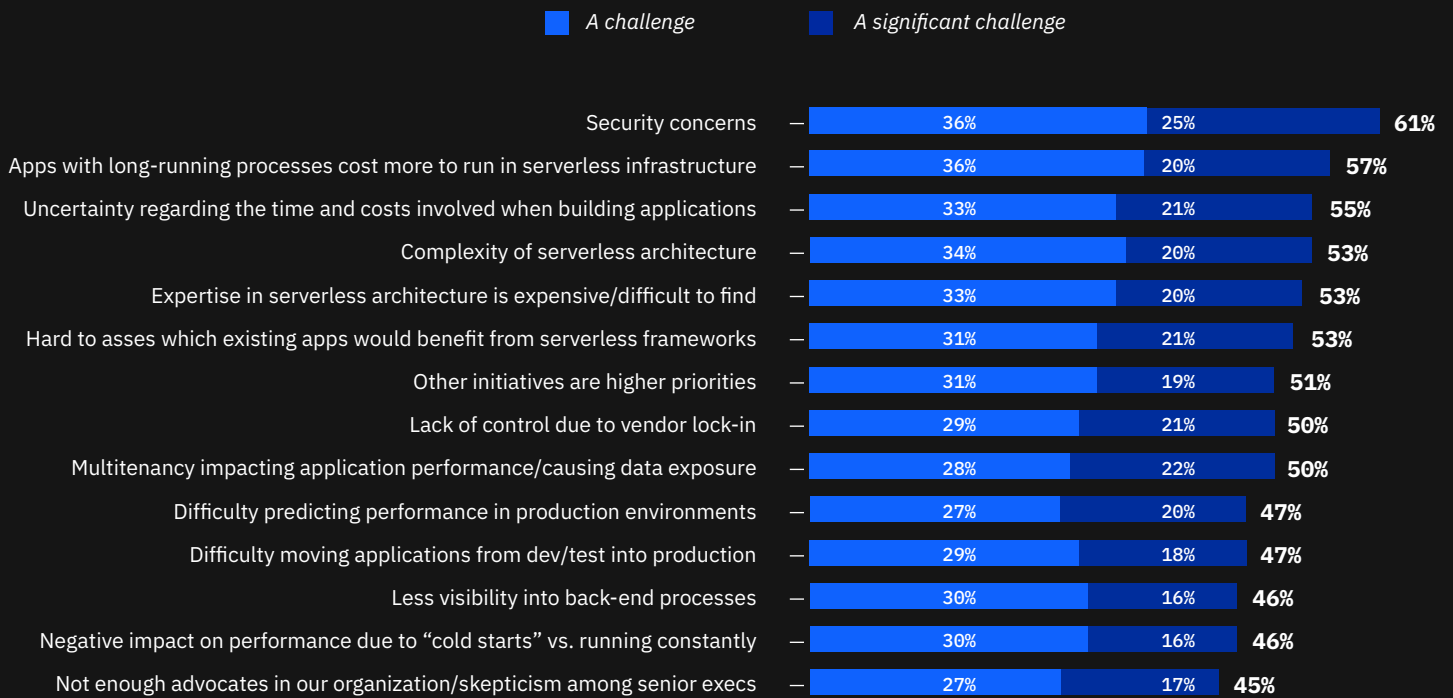
Programming languages used for serverless code (Users, n=391; multiple selection)



P19. Which programming language(s) do you use for serverless code?

Figure 5

Challenges to adoption or expansion of serverless architectures (% users rating 4 or 5 in significance of challenge on a 1–5 scale, n=391)



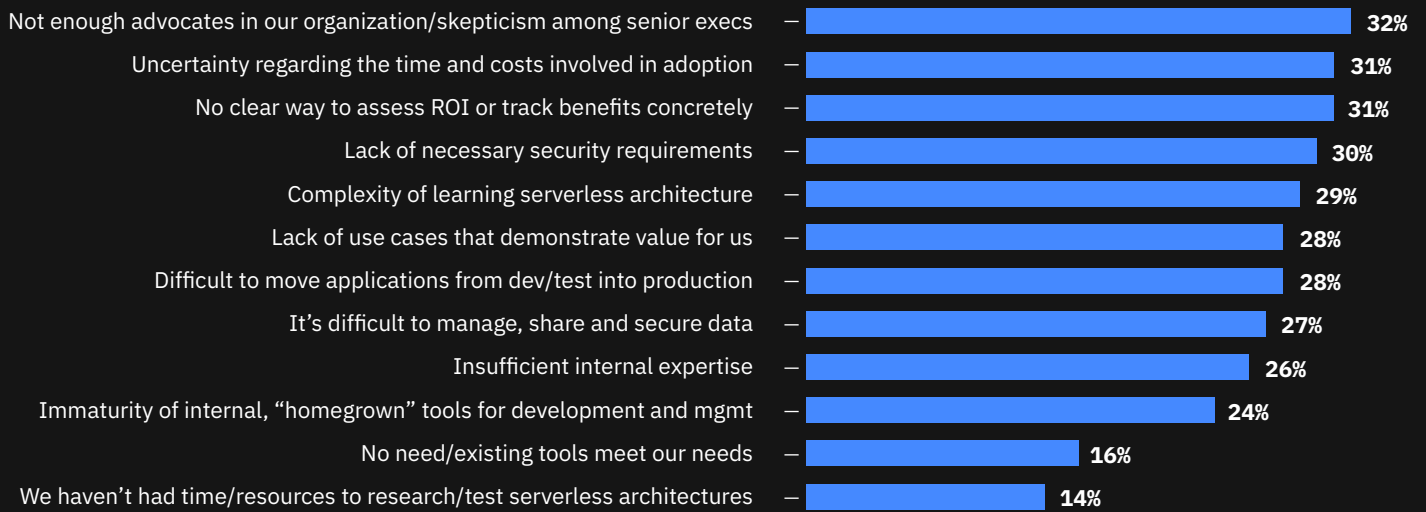
P16. Please rate the degree to which each of the following has been a significant challenge in successfully adopting or expanding the use of serverless architectures/functions in your company.

Figure 6

Reasons why not using or planning to use serverless

(Nonusers, n=208)

(% selected, multiple response)



P2. Why is your company not developing or planning to develop applications using serverless architectures?

Figure 7

Serverless architecture perceptions (Users and nonusers, n=599)



P18. How much do you agree or disagree with the following statements related to serverless architectures?

Figure 8

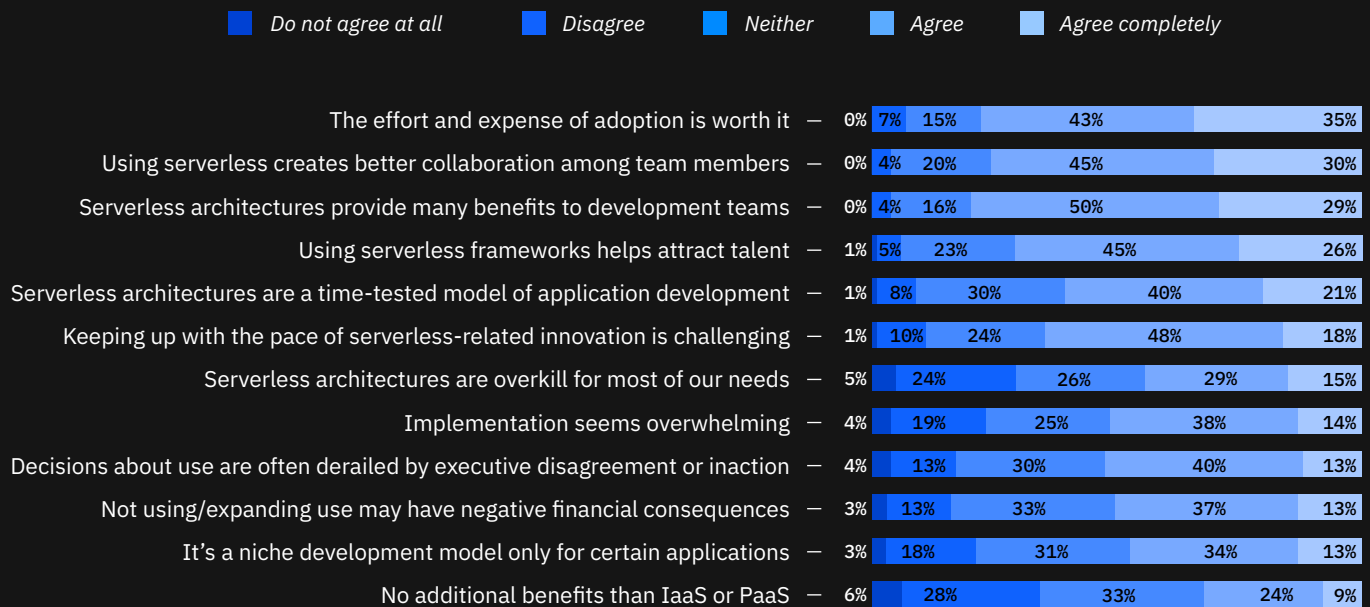
Serverless architecture perceptions (Users, n=391)



P18. How much do you agree or disagree with the following statements related to serverless architectures?

Figure 9

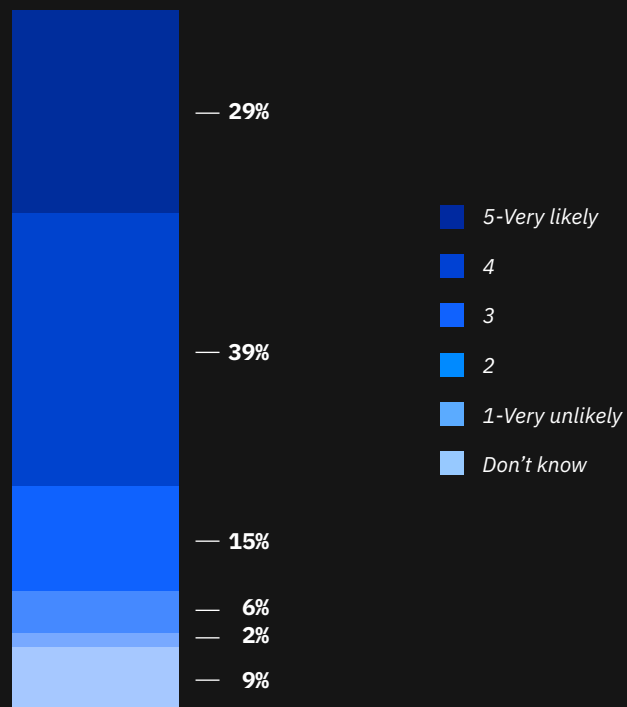
Serverless architecture perceptions (Nonusers, n=208)



P18. How much do you agree or disagree with the following statements related to serverless architectures?

Figure 10

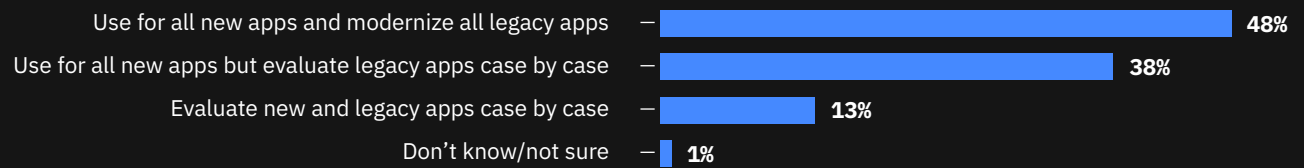
Likelihood to develop serverless applications in the next 2 years
(Nonusers, n=208)



P3. How likely is your company to develop serverless applications in the next two years?
Please explain your answer.

Figure 11

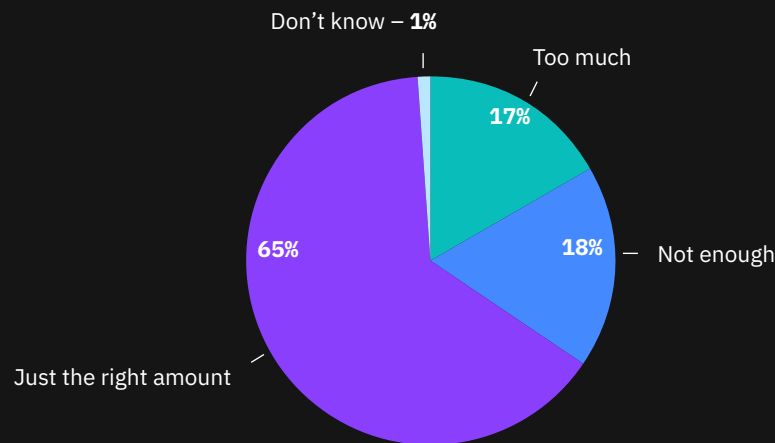
Serverless usage strategy (Users, n=391)



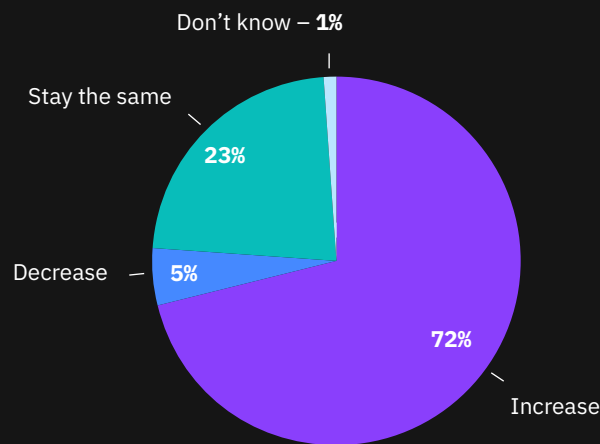
P10. How would you define your company's strategy with regard to the use of serverless architecture?

Figure 12

Amount of money/time/effort around serverless is ...
(Users, n=391)



Money/time/effort around serverless will likely ...
(Users, n=391)

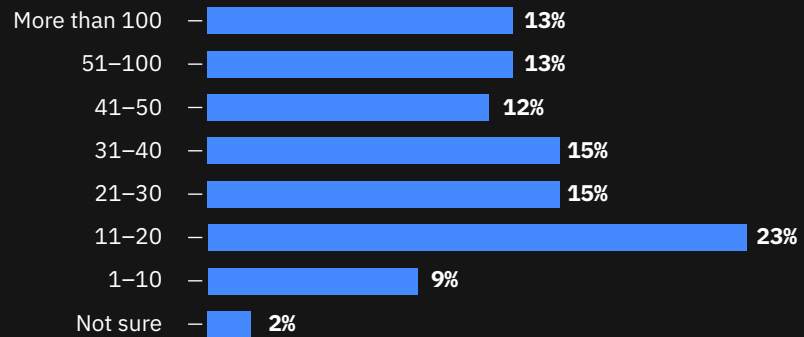


P11. Considering the approximate amount of money, time and effort your business is placing around serverless architecture during the application development process, do you believe the amount is ...

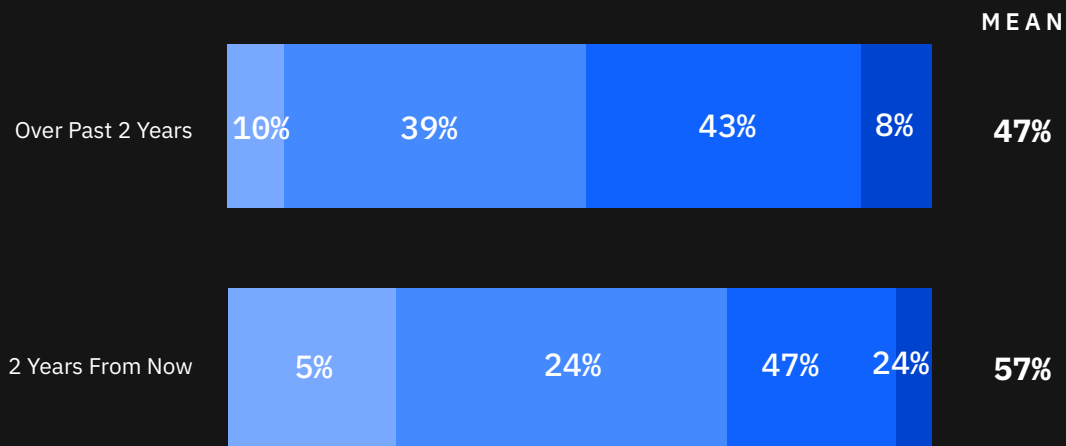
P12. And will this amount of money/time/effort on serverless applications likely increase, decrease or remain the same in the next two years?

Figure 13

Number of new applications developed over past two years
(Users, n=391)



Percentage of applications developed using serverless architecture
(Users who have developed 1+ app in past two years, n=385)

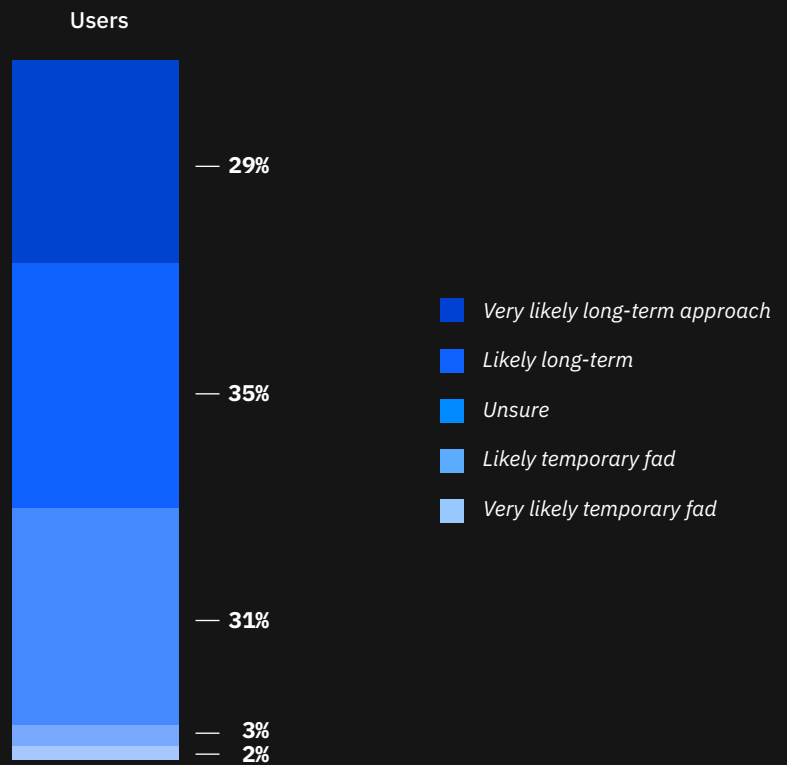


P4a. *Approximately how many new applications has your company developed over the past two years, either internally or through a third party?*

P4b. *[Ask question if P4a answer > 0] What percentage of these applications are serverless? What percentage of your future applications two years from now do you expect to be serverless?*

Figure 14

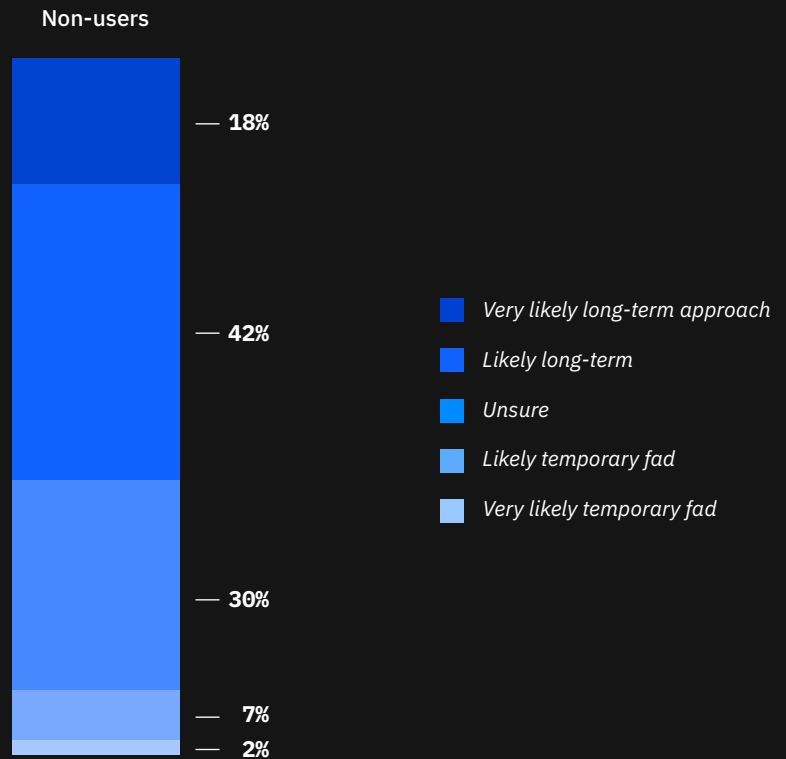
Long-term perception of serverless architectures (Users, n=391)



17a. To what extent do you think serverless architectures will be a long-term approach to application development and management or a temporary “fad”?

Figure 15

Long-term perception of serverless architectures (Nonusers, n=208)



17a. To what extent do you think serverless architectures will be a long-term approach to application development and management or a temporary “fad”?

Figure 16