IBM **Turbonomic**

IBM

2022
state of multicloud

Technology choices are never made without tradeoffs. In this fourth installment of this annual report, we continue our efforts to capture the current state of multicloud, as well as the motivations. We believe that aiming to understand the broader aspirations of where we collectively want to be, gives us the context to better understand why people make the choices they make. However, if in 2022 we are talking about where we want to be without an understanding of the environmental impact of the technologies we use to do it—often overuse, if we're being honest with ourselves—then we continue to miss our existential tradeoff.

We are a mere eight years away from when current estimates predict that global carbon emissions must be halved by 2030 to limit warming to 1.5°C and avoid catastrophic climate change. New to the report this year is the extent to which sustainable IT is being prioritized and executed upon. The good news is that most organizations are indeed recognizing environmental sustainability and climate resiliency as important, and nearly half are doing something real about it. In the coming years we will expand our analysis and trending on this subject because our ongoing digital transformations must have line of sight to its lasting impacts on future generations—those that will never use your new app or service, but who will build the things we can only begin to imagine today.

Last year, we noted that constraints are a reality, but resigning ourselves to the status quo need not be. Pushing through barriers, however incrementally, and solving the hard problems—that requires imagination from all of us. This year we amend that: it also requires action. If we're not convinced by the increasing number of conscientious consumers and investors, as well as governments and regulatory agencies leaning in, then consider the increased frequency and severity of the weather right outside our doors.

IT is in a unique position to lead and have a real impact. Let's seize it together.

Highlights

78% **of organizations overall—including 89% of leaders—recognize that environmental sustainability and climate resiliency is important.**

45% of organizations overall—including 57% of leaders—are executing against a sustainability and climate resiliency strategy today.

Labor and skills shortage is the leading challenge for organizations aspiring to continuously assure application performance.

74% of organizations overall—and 88% of leaders—are implementing or exploring AIOps.

Lift-and-shift is the leading approach to application modernization; among leaders it ties with replatforming.

Highlights

Overall **guaranteeing availability continues to grow as the primary driver for multicloud**, but for leaders it's still all about leveraging different apps and services.

2022 sees a reversal of opinion: organizations are prioritizing business differentiation over no vendor lock-in.

60% **of organizations are running production workloads in a public cloud; among leaders that jumps to 75%.**

Only 15% of respondents have 3 or more clouds, down from 30% the previous year, largely due to a drop in private cloud.

For 65% of organizations containerization will play a strategic role within 18 months, up from 61% in 2021.

Our Lens on Leaders

Throughout this report we analyze the data by comparing "leaders" versus those "on par with the majority" versus "laggards." We asked respondents to self-identify based on the question: "When it comes to leveraging new technologies to advance business goals, my organization is:" Viewing the data through this lens allows us to see what's important for leaders and should perhaps be considered by their peers.

Leaders
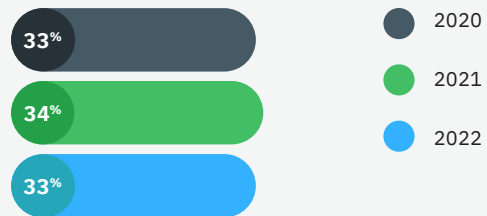
33%	2020
34%	2021
33%	2022

On par with the majority

51%

53%

52%

Laggards

15%

13%

15%

Table of Contents

Methodology & Demographics

We conducted our survey from December 2021 to January 2022 and garnered responses from 669 participants. Of these, 39% were in an Infrastructure/ Operations function, the remaining 61% were a mix of Applications (11%), Development (11%), Architecture (11%), Line-of-Business/Non-IT (10%), Security/ Compliance (9%), DevOps (8%), and Container Platforms (2%). The participants represent the full range of company sizes: Over 5000 (24%), 1,000-4,999 (27%), 200-999 (25%), 1-199 (22%), and Self-employed (3%). In terms of industry, respondents were in Technology (23%), Education (13%), Service Provider (11%), Healthcare (11%), Financial Services (10%), Retail/E-Commerce (9%), Government (5%), Media & Entertainment (3%), and Other (15%). Role distribution was mix of Individual Contributors (40%), Director/Managers (49%), and Executives (11%). Throughout this report results from previous years are shown. The number of survey participants for each of those years is as follows: 2019 – n = 846, 2020 – n = 938, 2021 – n= 819.

669
Participants

01-5000+
Company size range

21%
**Technology:
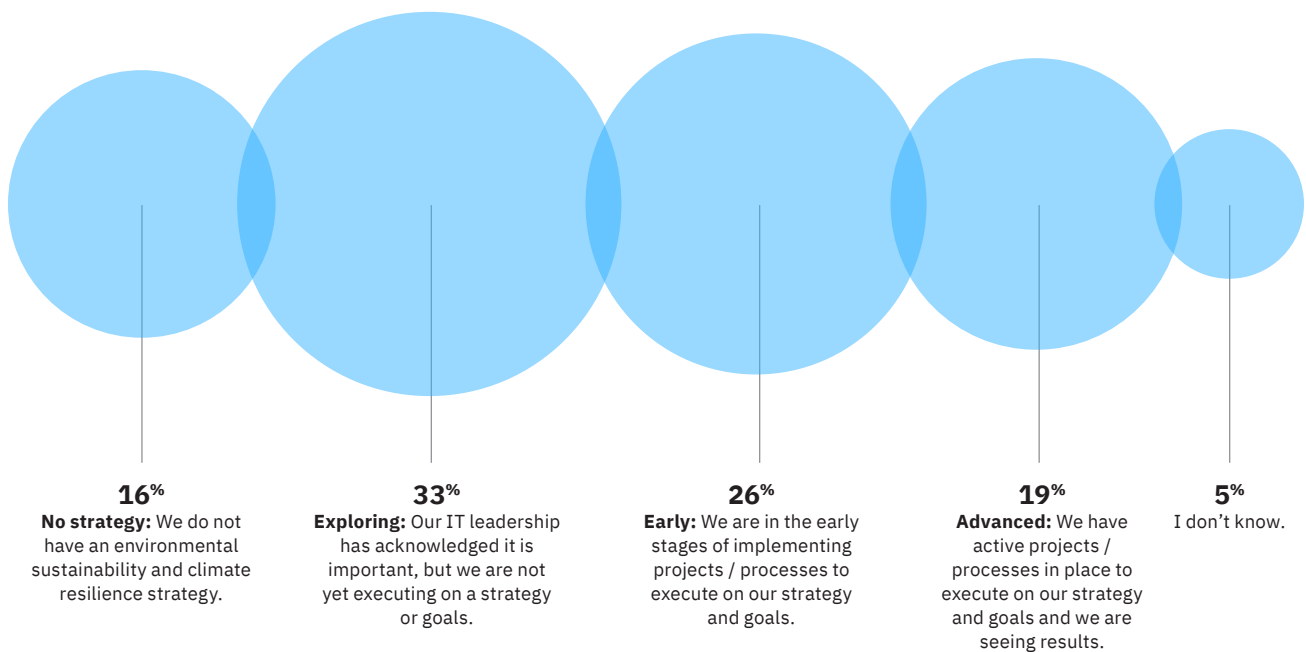most common industry**

01

Sustainability

78% of organizations overall—and 89% of leaders—recognize that environmental sustainability and climate resiliency is important.

Overall, 78% of organizations recognize that environmental sustainability and climate resiliency is important, with 45% executing against a strategy and goals. Among leaders, these numbers jump up to 89% and 57% respectively.

Question: What is your IT organization's environmental sustainability and climate resiliency strategy?

Overall: 2022

16%
No strategy: We do not have an environmental sustainability and climate resilience strategy.

33%
Exploring: Our IT leadership has acknowledged it is important, but we are not yet executing on a strategy or goals.

26%
Early: We are in the early stages of implementing projects / processes to execute on our strategy and goals.

19%
Advanced: We have active projects / processes in place to execute on our strategy and goals and we are seeing results.

5%
I don't know.

It is difficult to ignore impact of climate change as increasingly severe weather patterns disrupt our daily lives more frequently. The pressure on businesses to operate in a more environmentally sustainable way is increasing across multiple stakeholders: consumers, investors, shareholders, board members, and governments. Consumers arguable play the most important role, their preferences shaping markets and governments. A recent study by IBM found that 80% of consumers indicate sustainability is important to them and 60% are willing to change their shopping habits to reduce environmental impact.[1] Due to this pressure, 62% of executives consider having a sustainability strategy essential to be competitive in the future and another 22% think it will be a requirement.[2]

Leaders vs. Laggards: 2022

- **No strategy:** We do not have an environmental sustainability and climate resilience strategy.
- **Exploring:** Our IT leadership has acknowledged it is important, but we are not yet executing on a strategy or goals.
- **Early:** We are in the early stages of implementing projects / processes to execute on our strategy and goals.
- **Advanced:** We have active projects / processes in place to execute on our strategy and goals and we are seeing results.
- I don't know.

Laggards					On par with the majority					Leaders				
30%	35%	21%	10%	5%	18%	34%	28%	13%	7%	8%	32%	25%	32%	4%
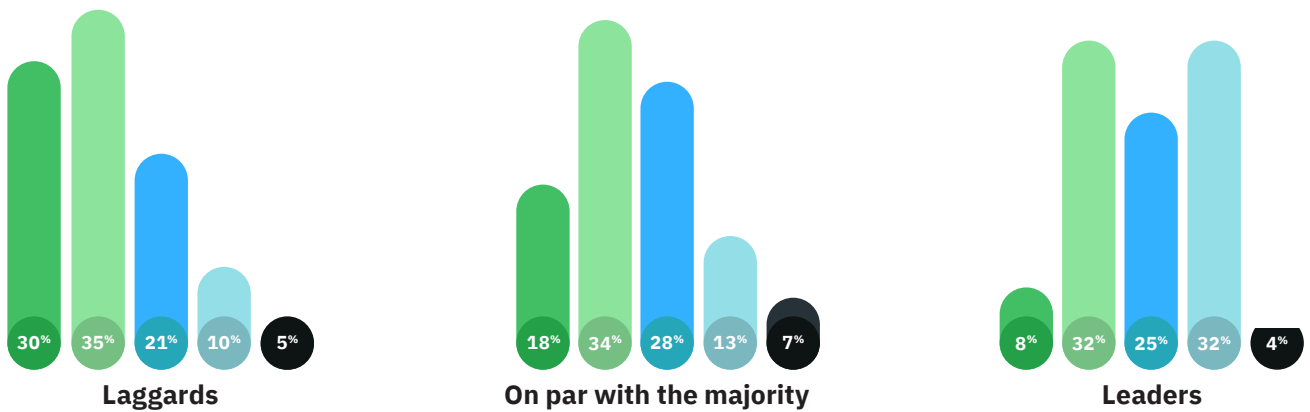
Leaders vs. Laggards: 2022—Executing against an environmental sustainability and climate resiliency strategy.

Calculated by the sum of those in Early and Advanced stages.

31%	42%	57%
Laggards	On par with the majority	Leaders
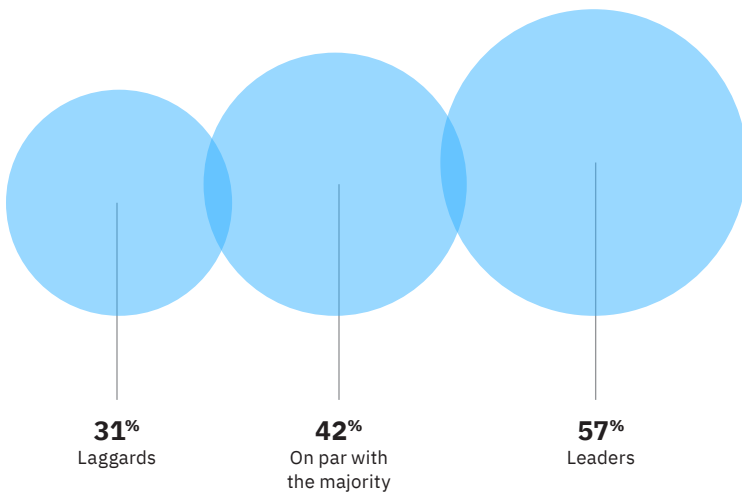
57% of leaders are executing against a sustainability and climate resiliency strategy.

The percentage of organizations that acknowledge the importance of sustainability but are still only exploring how to develop and execute on a strategy is fairly consistent across laggards (35%), those on par with the majority (34%), and leaders (32%). The differences come to light when looking at whether these types of organizations are executing against a strategy and goals.

1   Rise of the Sustainable Enterprise
2   Rise of the Sustainable Enterprise

IT has a critical role to play as organizations strategize, plan, and execute on their sustainability goals. According to Gartner's 2020 Sustainability Survey, 80% of business leaders whose organizations have a sustainability strategy cite that their CIO plays a critical role in sustainability, most often as either a sustainable business enabler or technology innovator. CIOs and their IT organizations are important in part due to the vast quantities of data that is often available to them. Through greater transparency, data can be infused into business processes and decision making and drive improved environmental outcomes.[3] With massive amounts of structured and unstructured data available to CIO's – often in real time – their organizations can tap into unprecedented levels of actionable insight for transformation and innovation.[4]

There are a multitude of strategies that IT organizations can implement to run cleaner and leaner, but among the most immediately impactful is to achieve operational excellence, continuously ensuring that applications get exactly the resources they need when they need them. To learn more about how IT can play a greater part in reducing environmental impact, read: IT Best Practices for Accelerating the Journey to Carbon Neutrality.

3   Rise of the Sustainable Enterprise | IBM Institute for Business Value
4   Rise of the Sustainable Enterprise | IBM Institute for Business Value
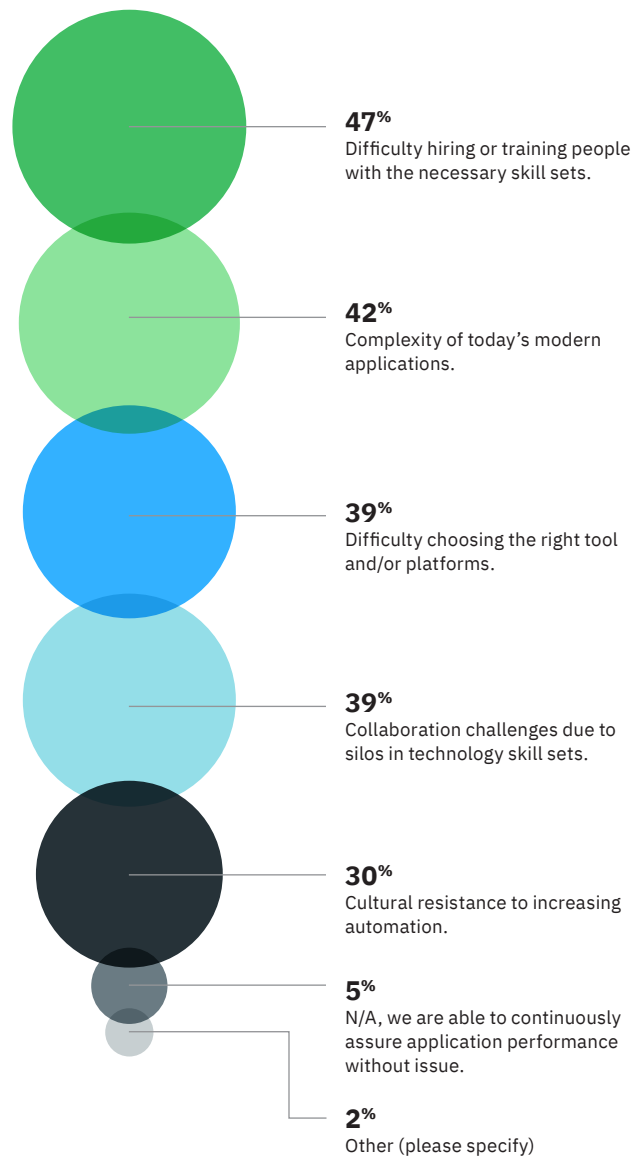
02
Labor Shortage

Difficulty hiring is the leading challenge for organizations aspiring to continuously assure application performance.

47% of organizations cited "difficulty hiring or training people with the necessary skill sets" as a top challenge to continuously assuring application performance. The complexity of modern applications came in second at 42% and choosing the right tools and/or platforms came in third at 39%.
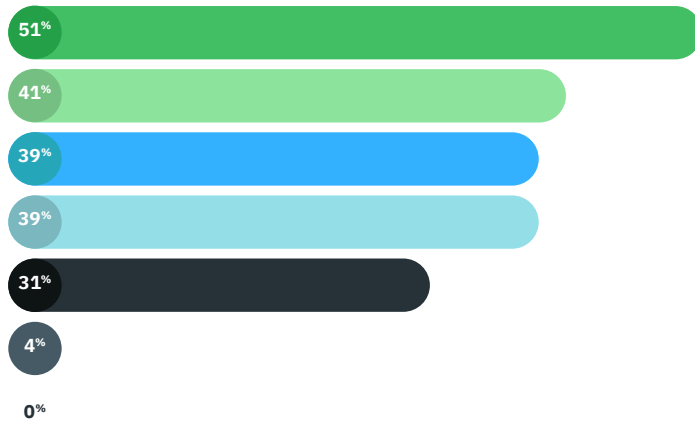
This data reflects the convergence of a historic labor shortage at a time when the work that needs to be done—digital transformation—needs skilled and talented workers more than ever. The Coronavirus Pandemic accelerated the need to launch or improve digital applications and services, which requires that an organization have the skills and resources to implement modern cloud and cloud native technologies. Yet we are in the midst of "The Great Resignation" in which 4 million Americans quit their jobs in July 2021; the tech industry has been the hardest hit, closely followed by healthcare.[5] Simply put, the demand is greater than the supply.

Question: My organization's top challenge(s) to continuously assuring application performance are: (Select up to 3)

Overall: 2022

47%
Difficulty hiring or training people with the necessary skill sets.

42%
Complexity of today's modern applications.

39%
Difficulty choosing the right tool and/or platforms.

39%
Collaboration challenges due to silos in technology skill sets.

30%
Cultural resistance to increasing automation.

5%
N/A, we are able to continuously assure application performance without issue.

2%
Other (please specify)

5   "Who Is Driving the Great Resignation?" by Ian Cook, Harvard Business Review | https://hbr.org/2021/09/who-is-driving-the-great-resignation
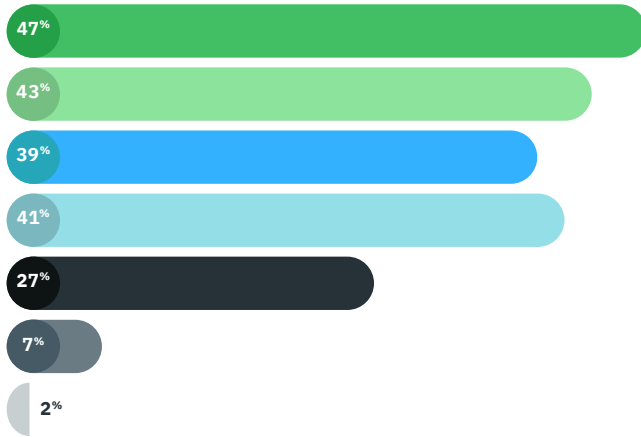
Leaders

- 51%
- 41%
- 39%
- 39%
- 31%
- 4%
- 0%

Leaders vs. Laggards: 2022

- Difficulty hiring or training people with the necessary skill sets.
- Complexity of today's modern applications.
- Difficulty choosing the right tool and/or platforms.
- Collaboration challenges due to silos in technology skill sets.
- Cultural resistance to increasing automation.
- N/A, we are able to continuously assure application performance without issue.
- Other (please specify)

On par with the majority

- 47%
- 43%
- 39%
- 41%
- 27%
- 7%
- 2%

Laggards

- 37%
- 44%
- 39%
- 31%
- 36%
- 3%
- 7%
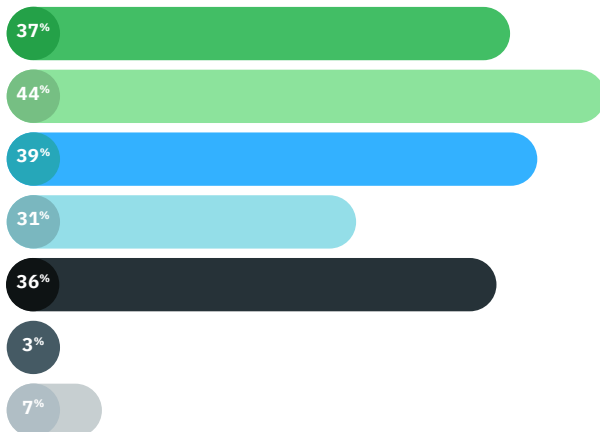
74% of organizations overall—and 88% of leaders—are implementing or exploring AIOps.

The labor shortage is a compelling reason for organizations to rethink the extent to which they leverage automation and/or AIOps to augment their workforce. While there are operational efficiency gains to be had from automation and AIOps, it also allows teams to focus on innovation and higher value work. For the individual this also means more gratifying work thus reducing the risk of burnout.
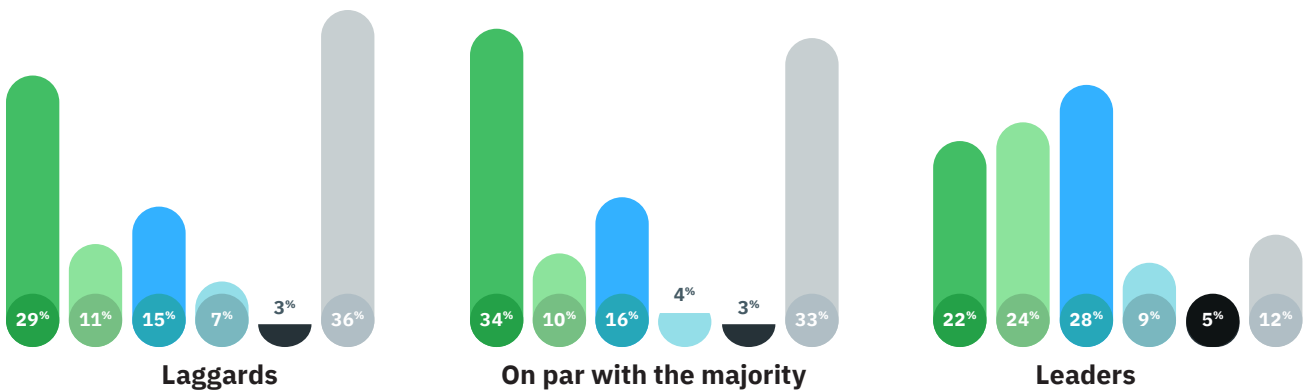
Question: How would you describe your organization's current level of AIOps maturity?

Exploring: We have identified use cases for the implementation of AIOps.

Active: We've implemented AIOps as a proof of concept.

Operational: We leverage AIOps in Production and see measurable value.

Systemic: AIOps is pervasive; it is requiring organizational / operational change.

Transformational: We have integrated AIOps across our processes, products, and services, achieving humans and AI synergy.

N/A: AIOps is not strategic for our organization.

Overall: 2022

29% 15% 20% 6% 4% 26%

Leaders vs. Laggards: 2022

Laggards: 29% 11% 15% 7% 3% 36%

On par with the majority: 34% 10% 16% 4% 3% 33%

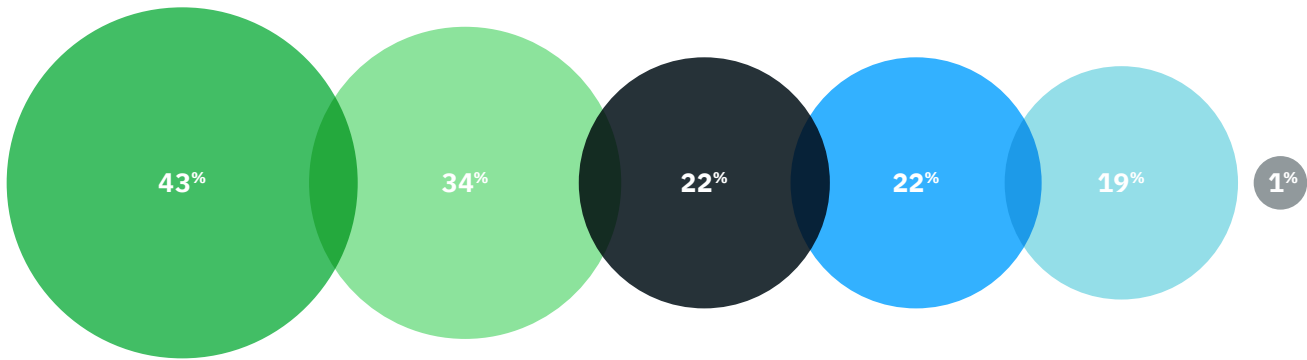**Leaders:** 22% 24% 28% 9% 5% 12%

DevSecOps is a strategic focus for organizations implementing automation, reflecting the growing requirement that security is not an afterthought.
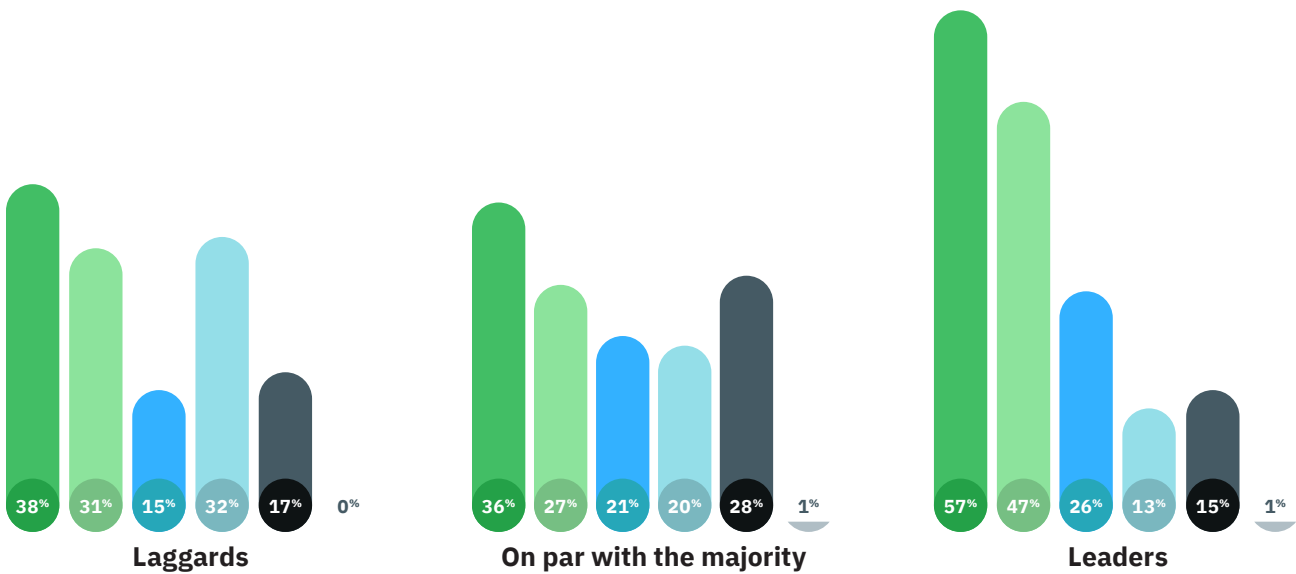
Question: Which of these automation practices will be strategic to your organization achieving its goals this year? (Select all that apply)

- DevSecOps
- Infrastructure-as-Code (IaC)
- GitOps
- None, automation is not strategic to our organization.
- I don't know
- Other (please specify)

Overall: 2022

43% — 34% — 22% — 22% — 19% — 1%

Leaders vs. Laggards: 2022

Laggards: 38% — 31% — 15% — 32% — 17% — 0%

On par with the majority: 36% — 27% — 21% — 20% — 28% — 1%

Leaders: 57% — 47% — 26% — 13% — 15% — 1%

03

Application Modernization

Lift-and-shift is the leading approach to application modernization; among leaders it ties with replatforming.
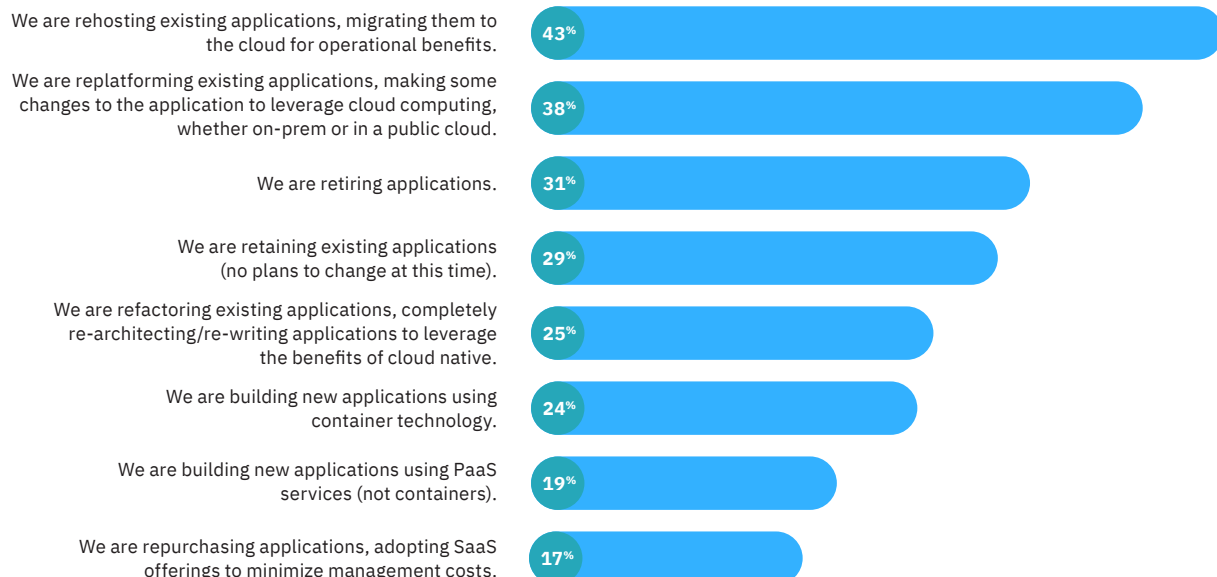
Rehosting applications aka "lift and shift" remains a viable strategy for many organizations, even leaders. The data suggests that they are more concerned with getting out of the business of managing data centers than incurring costs by not first replatforming or refactoring applications. As noted in a Turbonomic blog, "...picking and choosing your battles is the key to being successful. Rehosting a business application not only helps mitigate risk due to financial concerns, but it's one step in the right direction to optimizing your environment. Plus, it could be a huge morale booster or be the motivation your DevOps team needs by upping their skills on cloud while simultaneously helping them realize the benefits."[6] Of course, every

organization has unique business constraints to navigate, but this data suggests that most organizations are recognizing the need to go fast in the generally right direction versus aspiring for perfection, getting there slowly and methodically.
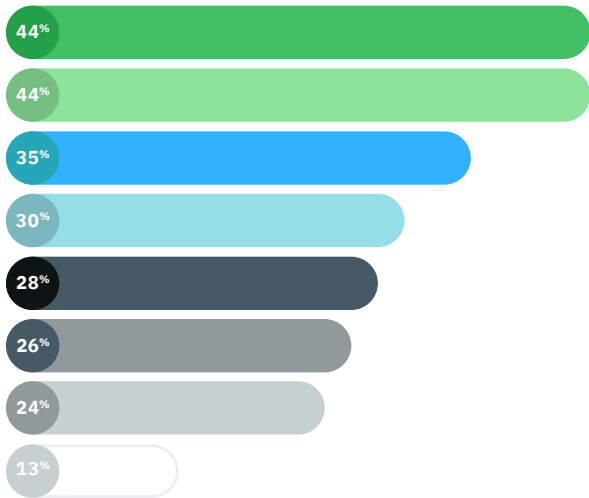
Lastly, with nearly 30% retaining existing applications, it is clear that there remain many applications where the investment required to refactor or repurchase as a SaaS offering is too great. Application modernization is not an easy undertaking; the returns on such an endeavor should be evaluated on a case-by-case basis.

Question: Which approaches to application modernization is your organization taking today? (Select all that apply)
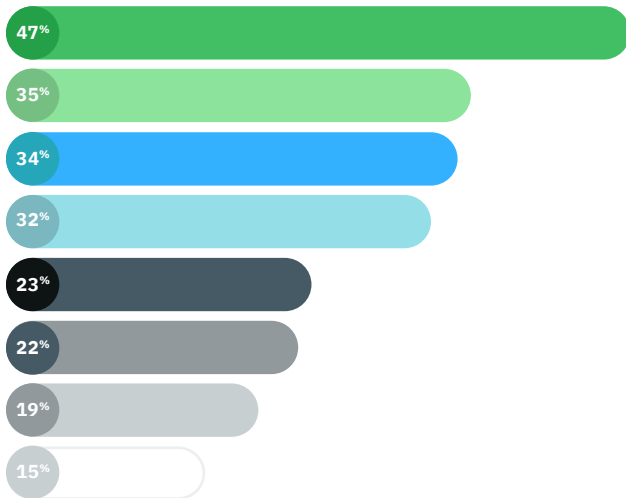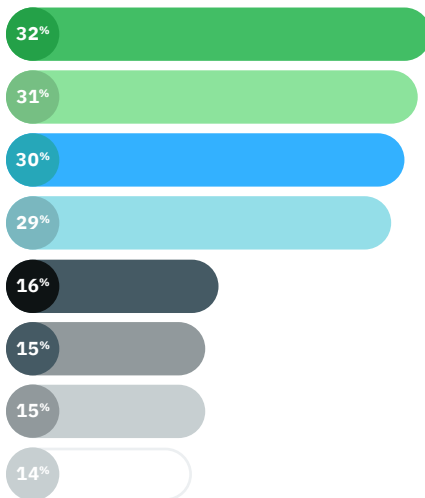
Overall: 2022

Approach	Percentage
We are rehosting existing applications, migrating them to the cloud for operational benefits.	43%
We are replatforming existing applications, making some changes to the application to leverage cloud computing, whether on-prem or in a public cloud.	38%
We are retiring applications.	31%
We are retaining existing applications (no plans to change at this time).	29%
We are refactoring existing applications, completely re-architecting/re-writing applications to leverage the benefits of cloud native.	25%
We are building new applications using container technology.	24%
We are building new applications using PaaS services (not containers).	19%
We are repurchasing applications, adopting SaaS offerings to minimize management costs.	17%

Leaders

- 44%
- 44%
- 35%
- 30%
- 28%
- 26%
- 24%
- 13%

On par with majority

- 47%
- 35%
- 34%
- 32%
- 23%
- 22%
- 19%
- 15%

Laggards
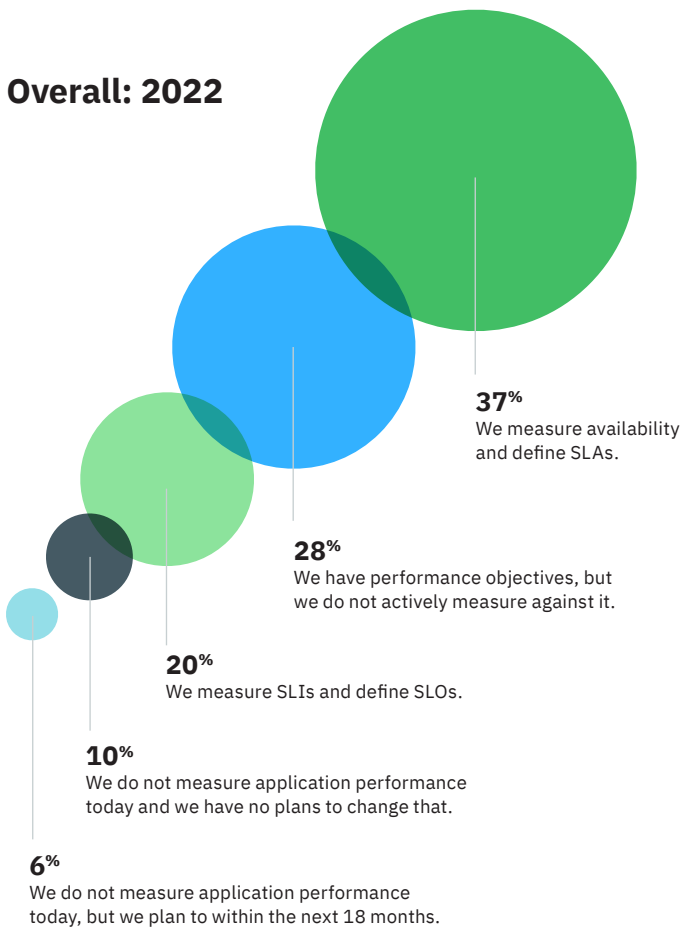
- 32%
- 31%
- 30%
- 29%
- 16%
- 15%
- 15%
- 14%

Leaders vs. Laggards: 2022

- We are hosting existing applications, migrating them to the cloud for operational benefits.

- We are replatforming existing applications, making some changes to the application to leverage cloud computing, whether on-prem or in a public cloud.

- We are refactoring existing applications, completely re-architecting/re-writing applications to leverage the benefits of cloud native.

- We are building new applications using container technology.

- We are retiring applications.

- We are building new applications using PaaS services (not containers).

- We are retaining existing applications (no plans to change at this time).

- We are repurchasing applications, adopting SaaS offerings to minimize management costs.

67% of leaders measure application performance, a stark contrast to only 44% of laggards doing the same.
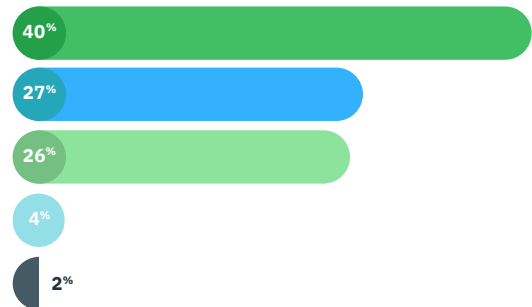
Question: How does your organization measure application performance?
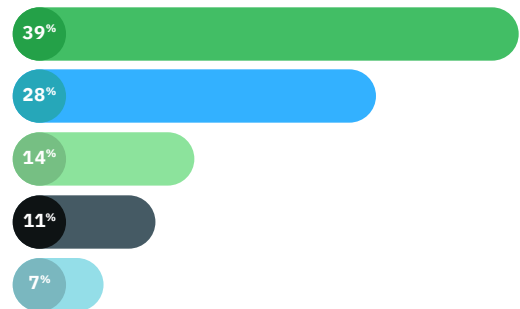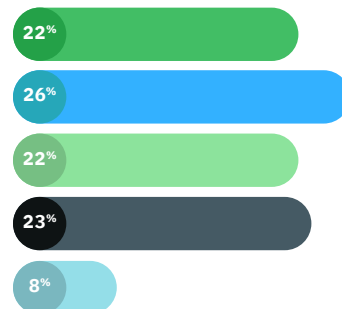
Overall: 2022

37%
We measure availability and define SLAs.

28%
We have performance objectives, but we do not actively measure against it.

20%
We measure SLIs and define SLOs.

10%
We do not measure application performance today and we have no plans to change that.

6%
We do not measure application performance today, but we plan to within the next 18 months.

Leaders vs. Laggards: 2022

Leaders

40%
27%
26%
4%
2%

On par with the majority

39%
28%
14%
11%
7%

Laggards

22%
26%
22%
23%
8%

61% of organizations use response time or throughput to measure application performance; 23% go so far as to measure revenue generated by the app.

Applications are the business. IDC notes that, "focusing on managing systems and applications to optimize the end-user experience is a major priority as fast performance and 100% uptime are table stakes for digital business success."[7] The data suggests that organizations understand the importance of using performance metrics that indicate the end-user experience and/or contribution to the business.

Question: What metrics does your organization use to measure application performance? (Select all that apply)

- Response time / throughput.
- Customer feedback (ex. support tickets opened against app, resources requests, etc.)
- Business transactional information (initiate, complete, abandon).
- Resource utilization metrics.
- Revenue generated by the app.
- Other (please specify)

Overall: 2022

Leaders vs. Laggards: 2022

47% 57% 27% 21% 21% 2%	66% 58% 29% 36% 21% 2%	61% 60% 40% 26% 28% 1%
Laggards	**On par with the majority**	**Leaders**
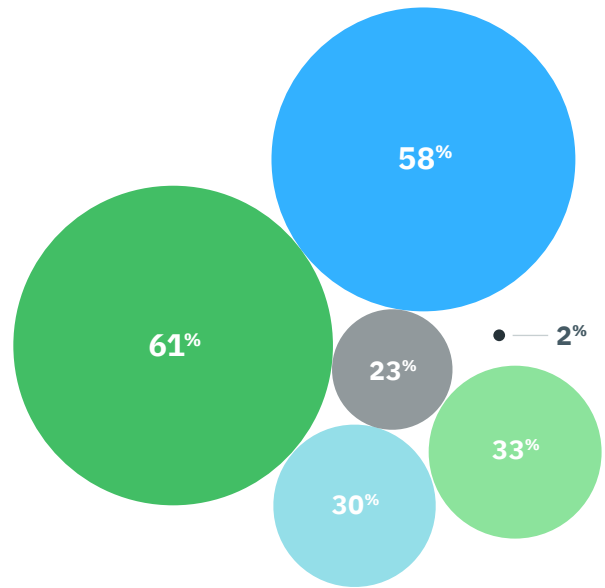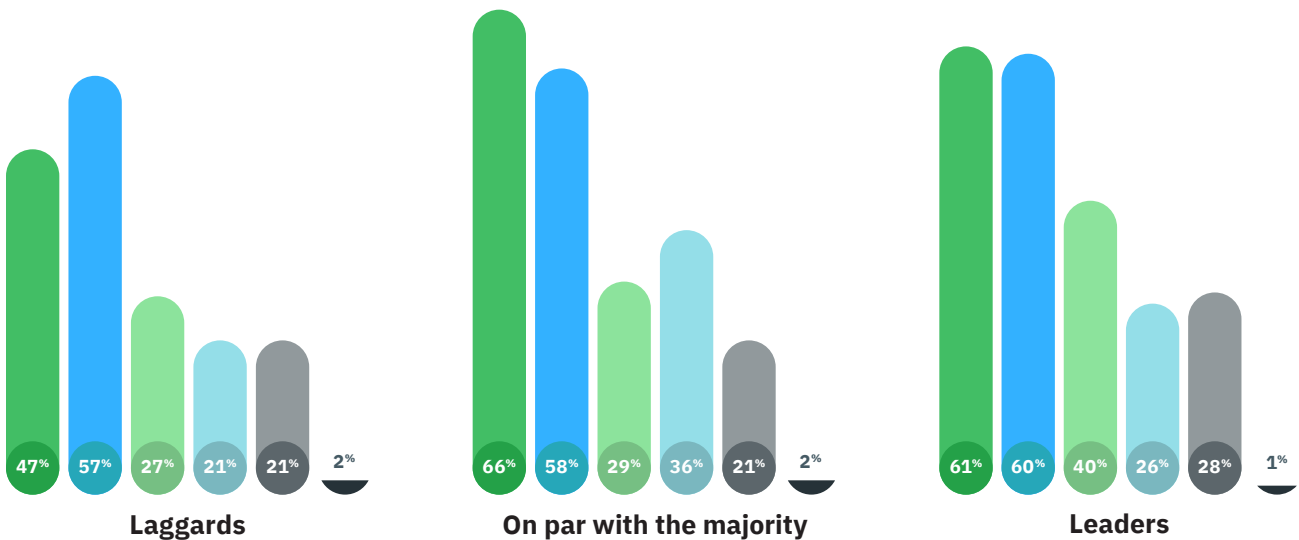
7   Worldwide Application Performance Management Software Market Shares, 2020 | June 2021, IDC #US47989021
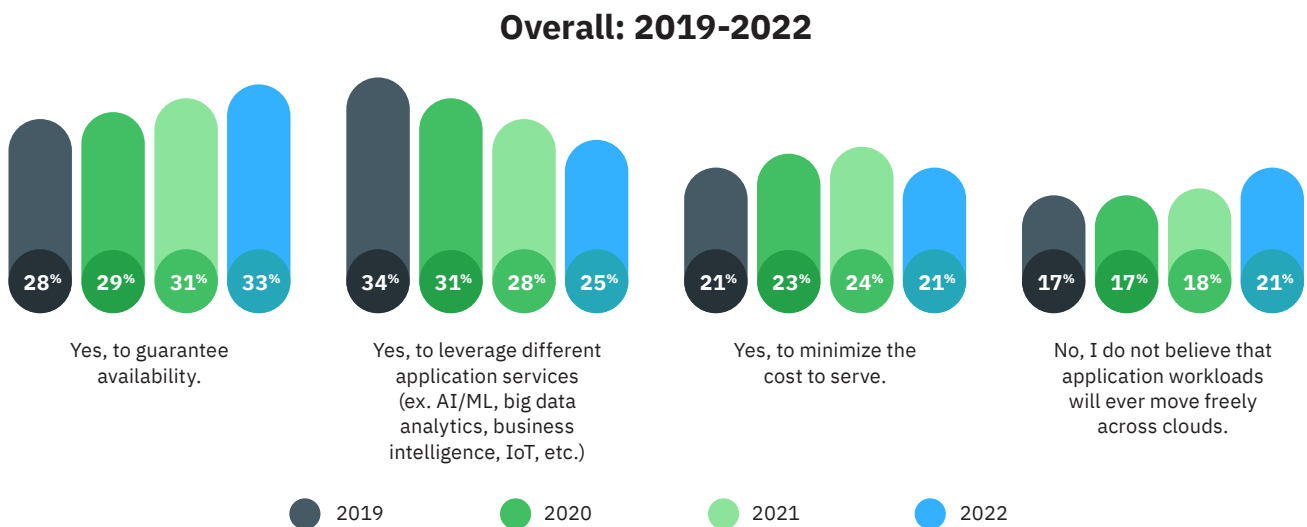
04

Multicloud Motivations

Overall guaranteeing availability continues to grow as the primary driver for multicloud, but for leaders it's still all about leveraging different apps and services.

Over the last four years organizations overall have gradually and consistently shifted opinion—once believing that leveraging different application services from multiple cloud providers would be the primary driver for the hypothetical world in which workloads move freely across clouds. It makes sense. Cloud providers, most recently AWS, are not immune to outages.[8] Application downtime is business downtime. In 2020, the cost of outages ranged from $100,000 to

$1 million with 16% of outages costing more than $1 million.[9] That said, leaders have been consistent about the primary driver being applications and services. It's also likely that leaders are architecting their applications for resiliency, mitigating risk when an outage does occur and allowing them to focus on the applications and services that they can leverage to differentiate their

business.

Question: Do you believe that one day application workloads will move freely across clouds? If so, what will be the primary driver?
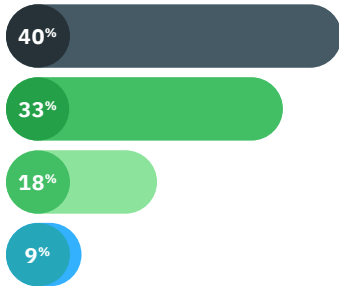
Overall: 2019-2022

	Yes, to guarantee availability.	Yes, to leverage different application services (ex. AI/ML, big data analytics, business intelligence, IoT, etc.)	Yes, to minimize the cost to serve.	No, I do not believe that application workloads will ever move freely across clouds.
2019	28%	34%	21%	17%
2020	29%	31%	23%	17%
2021	31%	28%	24%	18%
2022	33%	25%	21%	21%

8   Amazon's Devoted Cloud Customers Face A Decision After Outages: Leave, Stay Or Diversify?
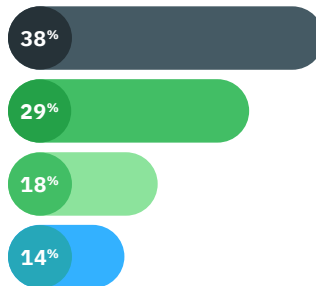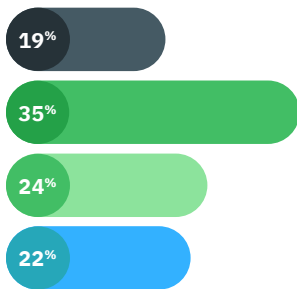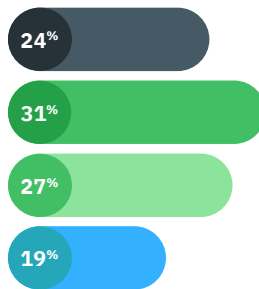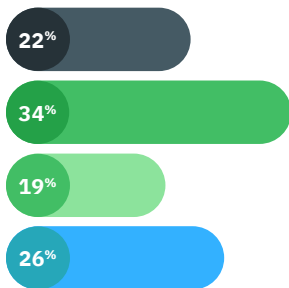9   Barclays Equity Research | Green Data Centers: Beyond Net Zero, September 2021

Leaders vs. Laggards: 2022

Leaders

- **40%**
- **33%**
- **18%**
- **9%**

On par with the majority

- **19%**
- **35%**
- **24%**
- **22%**

Laggards

- **22%**
- **34%**
- **19%**
- **26%**

Leaders vs. Laggards: 2021

Leaders

- **38%**
- **29%**
- **18%**
- **14%**

On par with the majority

- **24%**
- **31%**
- **27%**
- **19%**

Laggards

- **17%**
- **32%**
- **28%**
- **23%**

Legend:

- Yes, to leverage different application services (ex. AI/ML, big data analytics, business intelligence, IoT, etc.)
- Yes, to guarantee availability.
- Yes, to minimize the cost to serve.
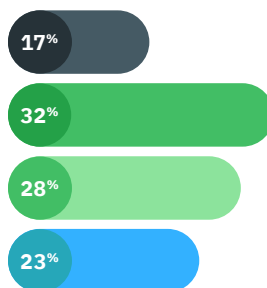- No, I do not believe that application workloads will ever move freely across clouds.

The primary barrier to freely moving workloads continues to be the ability for application components to be fully portable.

We're a long way off—if ever—from freely moving workloads. But while today's application components are not fully portable, advancements in technology have given us more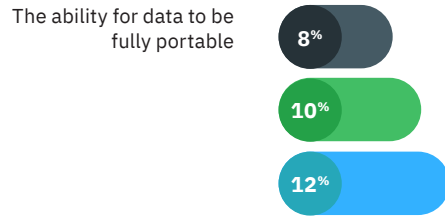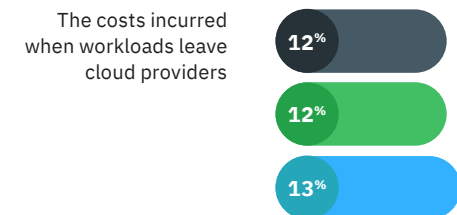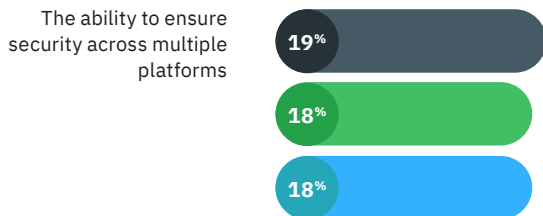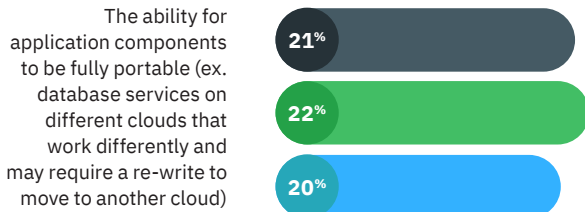 flexibility (and leverage). Consider J.B.Hunt, which migrated their Kubernetes workloads to Google Cloud in 35 business days without downtime.[10]

Question: What do you believe is the greatest barrier to applications workloads moving freely across deployment platforms (data centers, clouds, edge computing, etc.)?

- 2020
- 2021
- 2022
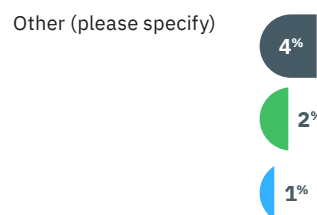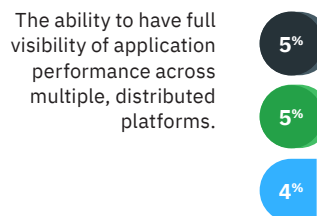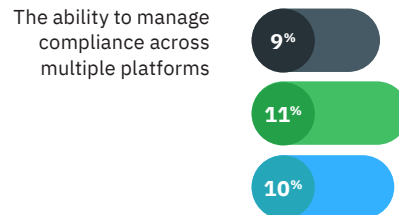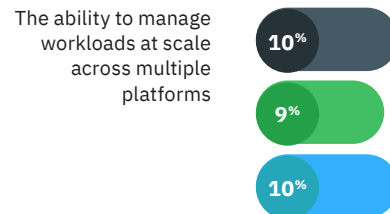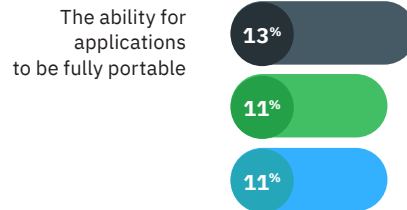
Overall: 2020-2022

The ability for application components to be fully portable (ex. database services on different clouds that work differently and may require a re-write to move to another cloud)
- 21%
- 22%
- 20%

The ability to ensure security across multiple platforms
- 19%
- 18%
- 18%

The costs incurred when workloads leave cloud providers
- 12%
- 12%
- 13%

The ability for data to be fully portable
- 8%
- 10%
- 12%

The ability for applications to be fully portable
- 13%
- 11%
- 11%

The ability to manage workloads at scale across multiple platforms
- 10%
- 9%
- 10%

The ability to manage compliance across multiple platforms
- 9%
- 11%
- 10%

The ability to have full visibility of application performance across multiple, distributed platforms.
- 5%
- 5%
- 4%

Other (please specify)
- 4%
- 2%
- 1%

Leaders vs. Laggards: 2020-2022

Leaders

27%
17%
12%
11%
10%
9%
9%
4%
1%

On par with the majority

15%
20%
9%
14%
15%
9%
13%
4%
1%

Laggards

20%
16%
8%
16%
8%
14%
13%
6%
0%

● The ability for application components to be fully portable (ex. database services on different clouds that work differently and may require a re-write to move to another cloud)

● The ability to ensure security across multiple platforms

● The ability to manage workloads at scale across multiple platforms

● The costs incurred when workloads leave cloud providers

● The ability for data to be fully portable

● The ability to manage compliance across multiple platforms

● The ability for applications to be fully portable

● The ability to have full visibility of application performance across multiple, distributed platforms.
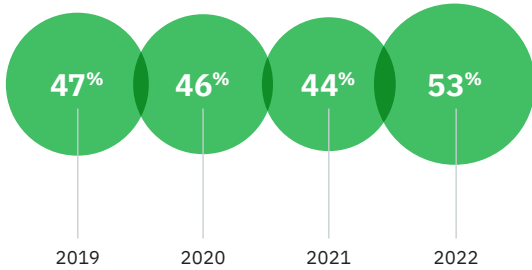
● Other (please specify)

2022 sees a reversal of opinion: organizations are prioritizing business differentiation over no vendor lock-in.

Here is yet more data pointing to the growing prioritization to move fast and focus on what differentiates the business. It is especially true of leaders. No doubt the urgency to adapt to new realities accelerated by the pandemic has driven much of this attitude shift. Every major cloud provider is seizing the opportunity, continuously working to improve the quantity and quality of the services they provide to their customers as they modernize in the cloud—that is how they compete and grow a healthy, satisfied customer base. But the tradeoff still exists for customers: instrumenting applications to leverage specific cloud services naturally creates lock-in. While this year people are more immune to the fear of lock-in, it's not going away. Maintaining leverage is a business reality; it's just a question of the tradeoffs you're willing to make.
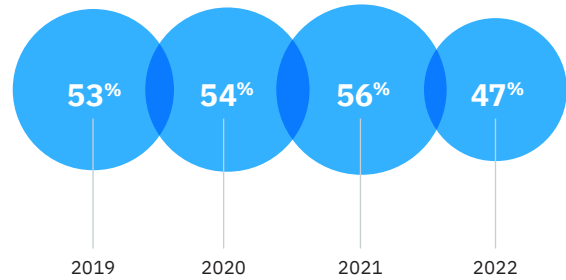
Question: What's more important to you?

Overall: 2019-2022

**Truly abstracted infrastructure
(No patching, updating, etc.)**

47%	46%	44%	53%
2019	2020	2021	2022

No vendor lock-in

53%	54%	56%	47%
2019	2020	2021	2022

Leaders vs. Laggards: 2020-2022

2022

Leaders

65%
35%

On par with the majority

44%
56%

Laggards

53%
47%

2021

Leaders

46%
54%

On par with the majority

43%
57%

Laggards

43%
57%

2020

Leaders

54%
46%

On par with the majority

42%
58%

Laggards

40%
60%

05
Cloud Adoption

60% of organizations are running production workloads in a public cloud; among leaders that jumps to 75%.

Question: Where is your organization in its journey to business transformation in the public cloud?

Note: Numbers in these graphs have been rounded to the nearest whole number. When you add up the unrounded percentages for Early Production, Advanced Production, and Business Transformation the sum is 60% for the 'overall' results and 75% for leaders.
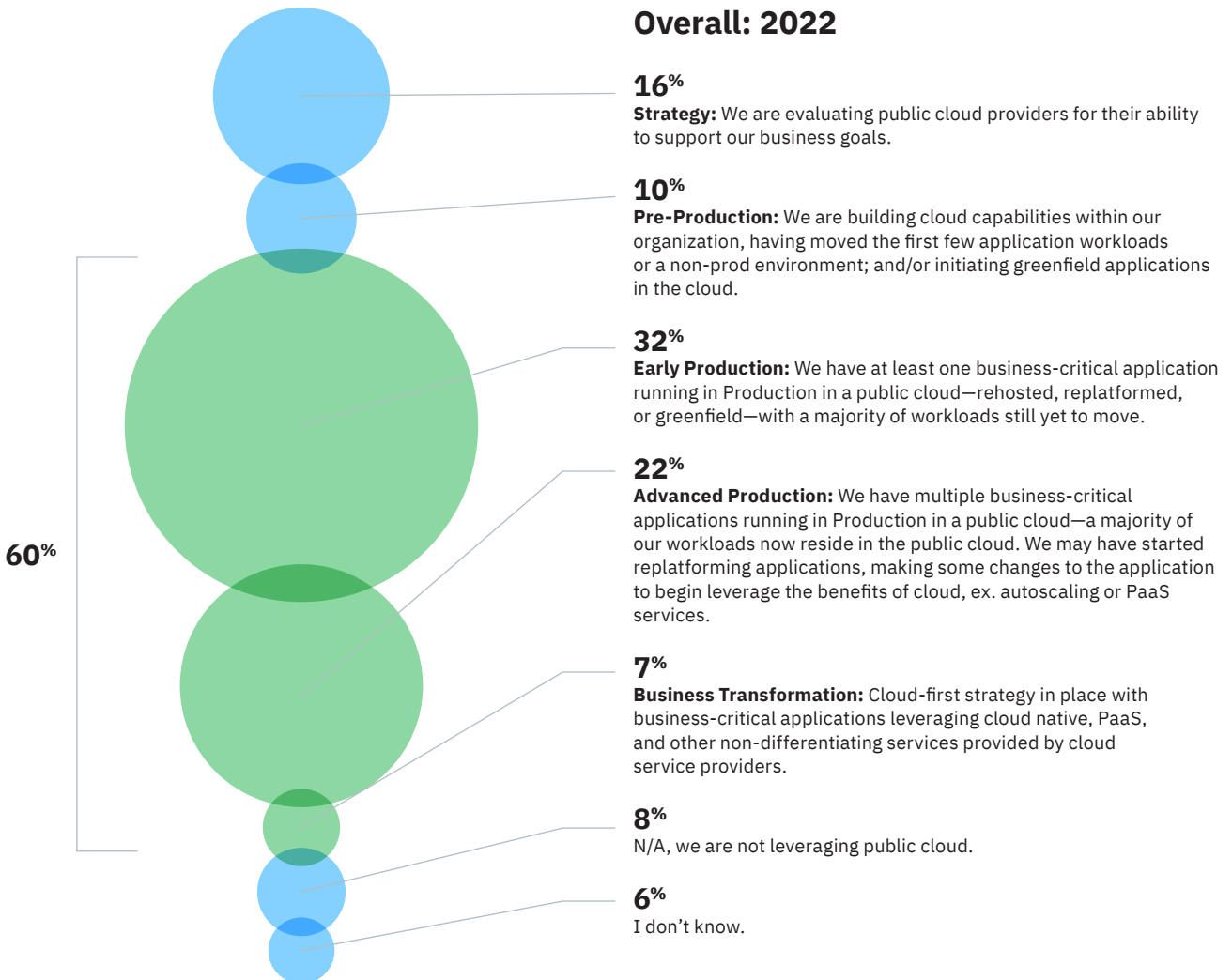
Overall: 2022

16%
Strategy: We are evaluating public cloud providers for their ability to support our business goals.

10%
Pre-Production: We are building cloud capabilities within our organization, having moved the first few application workloads or a non-prod environment; and/or initiating greenfield applications in the cloud.

32%
Early Production: We have at least one business-critical application running in Production in a public cloud—rehosted, replatformed, or greenfield—with a majority of workloads still yet to move.

22%
Advanced Production: We have multiple business-critical applications running in Production in a public cloud—a majority of our workloads now reside in the public cloud. We may have started replatforming applications, making some changes to the application to begin leverage the benefits of cloud, ex. autoscaling or PaaS services.

7%
Business Transformation: Cloud-first strategy in place with business-critical applications leveraging cloud native, PaaS, and other non-differentiating services provided by cloud service providers.
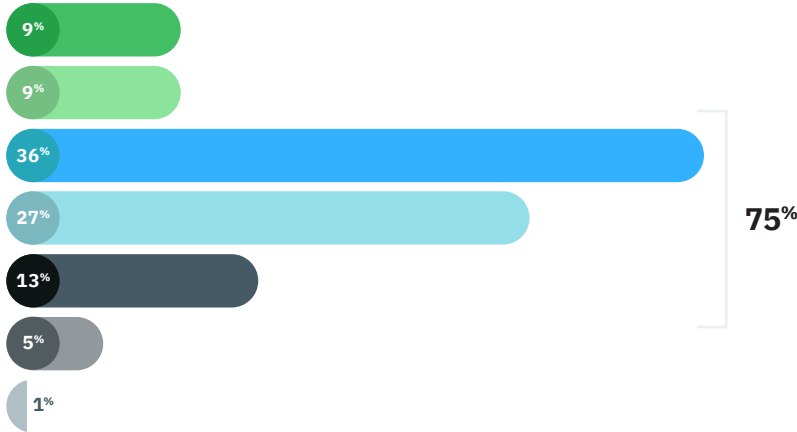
8%
N/A, we are not leveraging public cloud.

6%
I don't know.

60%

Leaders vs. Laggards: 2022

Leaders

- 9%
- 9%
- 36%
- 27%
- 13%
- 5%
- 1%

75%

On par with the majority

- 21%
- 10%
- 29%
- 21%
- 4%
- 8%
- 8%

Laggards

- 19%
- 13%
- 33%
- 12%
- 5%
- 13%
- 6%

Strategy: We are evaluating public cloud providers for their ability to support our business goals.

Pre-Production: We are building cloud capabilities within our organization, having moved the first few application workloads or a non-prod environment; and/or initiating greenfield applications in the cloud.

Early Production: We have at least one business-critical application running in Production in a public cloud—rehosted, replatformed, or greenfield—with a majority of workloads still yet to move.

Advanced Production: We have multiple business-critical applications running in Production in a public cloud—a majority of our workloads now reside in the public cloud. We may have started replatforming applications, making some changes to the application to begin leverage the benefits of cloud, ex. autoscaling or PaaS services.

Business Transformation: Cloud-first strategy in place with business-critical applications leveraging cloud native, PaaS, and other non-differentiating services provided by cloud service providers.
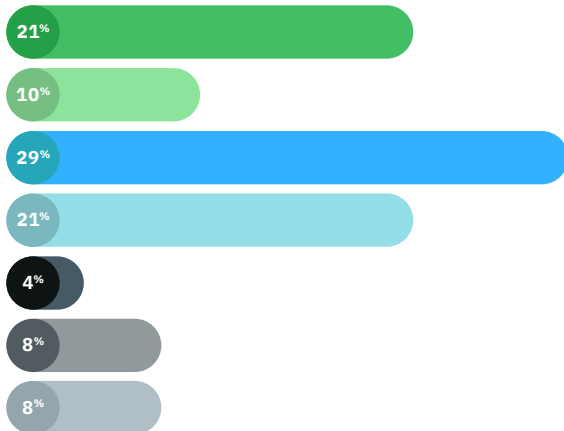
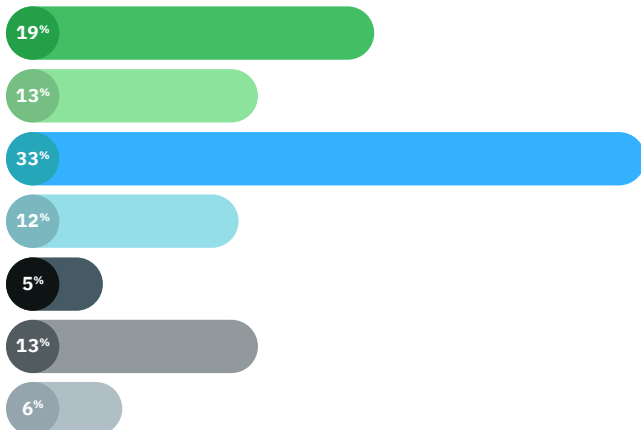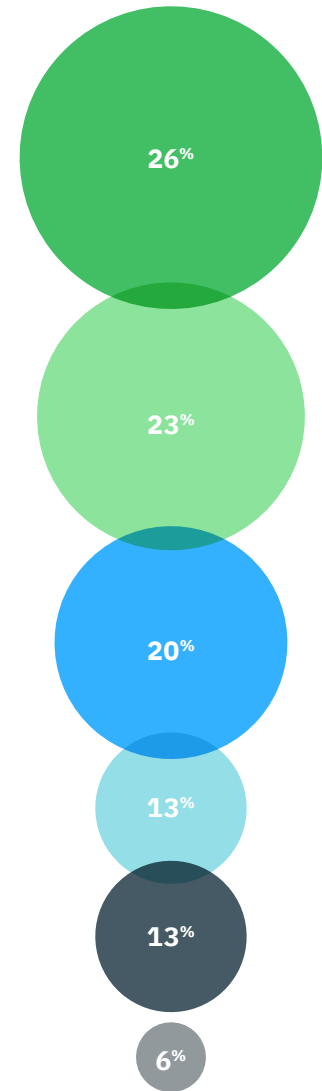N/A, we are not leveraging public cloud.

I don't know.

Migrating more workloads is the most important cloud initiative overall; among leaders, optimizing existing cloud resources and modernizing applications in the cloud are more important.

Leaders are less focused on migration, having moved most or all the applications they plan to move to the cloud—remember 75% of leaders are running public cloud applications in production.
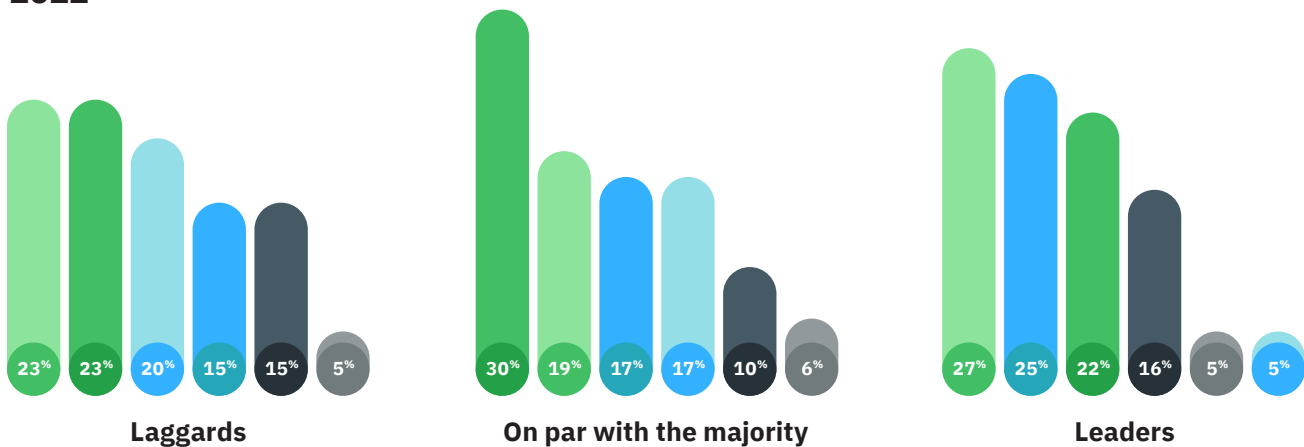
Across leaders and their peers, the top three initiatives are optimize, modernize, and migrate. What's interesting is that laggards are prioritizing cloud optimization as much as migration, suggesting perhaps that they are taking lessons from those that went to the cloud before them. Many organizations in the cloud today were hit hard by fact that you cannot financially benefit from the cloud's pay-as-you-go OpEx model if you do not continuously optimize consumption to the real needs of the application. As we've noted earlier, there are very good reasons to simply get up to the cloud as quickly as possible, as those on par with the majority are doing: they are significantly more focused on cloud migration (30%) than other cloud initiatives. Just know that continuous cloud optimization is a must-have for achieving cloud elasticity and reaping the benefits of an OpEx spend model.[11] Best not to wait too long to do it.

- 🟢 Migrate more workloads to public cloud.
- 🟢 Optimize existing cloud resources for performance and cost.
- 🔵 Modernize applications using public cloud containers and/or PaaS.
- 🔵 N/A, we are not adopting public cloud.
- ⬛ Implement CI/CD in public cloud.
- ⚫ Automate governance/compliance in public cloud.

Overall: 2022

26%
23%
20%
13%
13%
6%

Leaders vs. Laggards: 2022

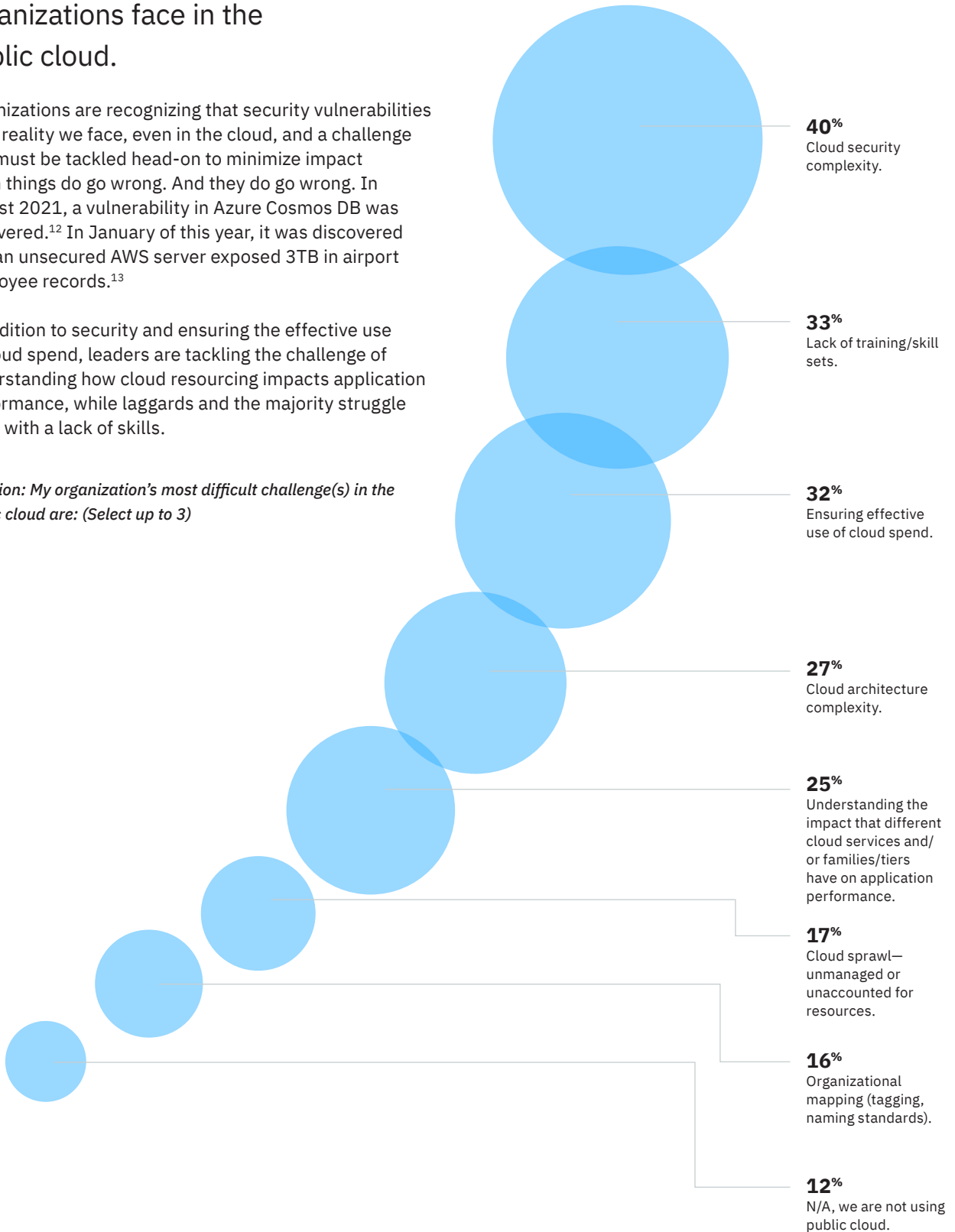| Laggards	On par with the majority	Leaders
23% 23% 20% 15% 15% 5%	30% 19% 17% 17% 10% 6%	27% 25% 22% 16% 5% 5%

The complexity of cloud security is the most difficult challenge organizations face in the public cloud.

Organizations are recognizing that security vulnerabilities are a reality we face, even in the cloud, and a challenge that must be tackled head-on to minimize impact when things do go wrong. And they do go wrong. In August 2021, a vulnerability in Azure Cosmos DB was uncovered.[12] In January of this year, it was discovered that an unsecured AWS server exposed 3TB in airport employee records.[13]

In addition to security and ensuring the effective use of cloud spend, leaders are tackling the challenge of understanding how cloud resourcing impacts application performance, while laggards and the majority struggle more with a lack of skills.

Question: My organization's most difficult challenge(s) in the public cloud are: (Select up to 3)

Overall: 2022

40%
Cloud security complexity.

33%
Lack of training/skill sets.

32%
Ensuring effective use of cloud spend.

27%
Cloud architecture complexity.

25%
Understanding the impact that different cloud services and/or families/tiers have on application performance.

17%
Cloud sprawl—unmanaged or unaccounted for resources.

16%
Organizational mapping (tagging, naming standards).
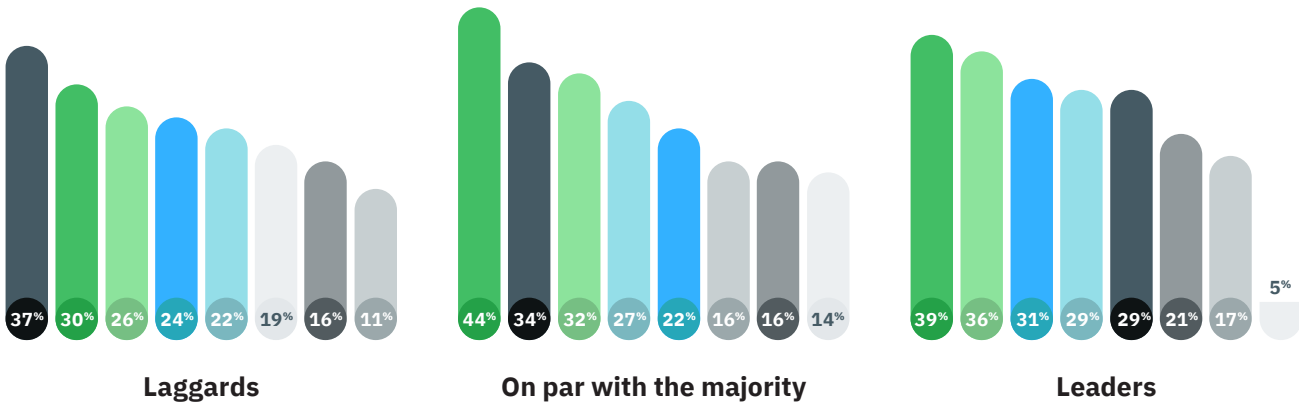
12%
N/A, we are not using public cloud.

12   Critical Cosmos Database Flaw Affected Thousands of Microsoft Azure Customers | The Hacker News, August 2021
13   Unsecured AWS server exposed 3TB in airport employee records | ZD Net, January 2022

Leaders vs. Laggards: 2022

Laggards
37% | 30% | 26% | 24% | 22% | 19% | 16% | 11%

On par with the majority
44% | 34% | 32% | 27% | 22% | 16% | 16% | 14%

Leaders
39% | 36% | 31% | 29% | 29% | 21% | 17% | 5%

- Cloud security complexity.
- Ensuring effective use of cloud spend.
- Understanding the impact that different cloud services and/or families/tiers have on application performance.
- Cloud architecture complexity.
- Lack of training/skill sets.
- Cloud sprawl—unmanaged or unaccounted for resources.
- Organizational mapping (tagging, naming standards).
- N/A, we are not using public cloud.

The skills gap and ensuring the effective use of cloud spend tie for second place for top challenges in the cloud.

As much as the public cloud offers agility, elasticity, and the tools to focus on business differentiation, they introduce significant complexity. AWS and Azure each have over 200 cloud services. It requires significant knowledge and skills building to effectively navigate, evaluate, and leverage these services. Also consider the complexity of the ever-expanding cloud native technology landscape: in a December 2021 EMA Research Report the authors note, "Based on the CNCF classification of cloud-native software products, the cloud-native application stack consists of 936 products in seven categories and 27 subcategories. Following the assumption that development teams can freely combine products from all 27 subcategories into one application stack, there's a very high number of permutations: 1.17E+37 (this is the scientific notation for a number consisting of 38 digits)."[14] Only leaders feel they have overcome the skills gap challenge, instead turning their focus on understanding the impact that different cloud services and/or families/tiers have on application performance.

In 2022, only 17% of organizations have a private cloud, down from 34% in 2021 and 45% in 2019.

To see private cloud implementations drop by half in a single year is surprising. The decline is significant across leaders versus their peers, but certainly more so among leaders and those on par with the majority: in 2021, 36% of leaders and 34% of those on par with the majority had private cloud; in 2022 those numbers drop to 18% and 17%, respectively. Laggards saw a drop from 27% to 17%.

In 2019, Gartner predicted that 80% of organizations will have shut down their traditional data centers by 2025.[15]

The pandemic has accelerated digital transformation across industries. Our survey data suggests that as part of this transformation, organizations have more rapidly moved away from do-it-yourself cloud solutions than anticipated. It's also possible that as organizations have moved more workloads to the public cloud, their definition of what cloud is evolves, perhaps realizing that what they were previously calling a private cloud was not truly private cloud but hosted virtualized workloads. We will continue to keep a close eye on these trends in the coming years.

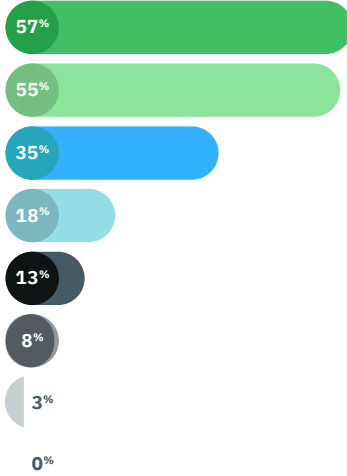*Question: Which clouds are you using today? (Select all that apply)*
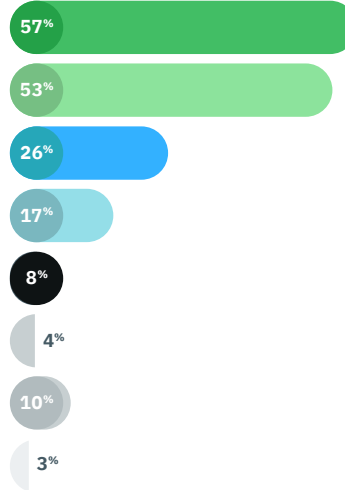
Overall: 2019-2022
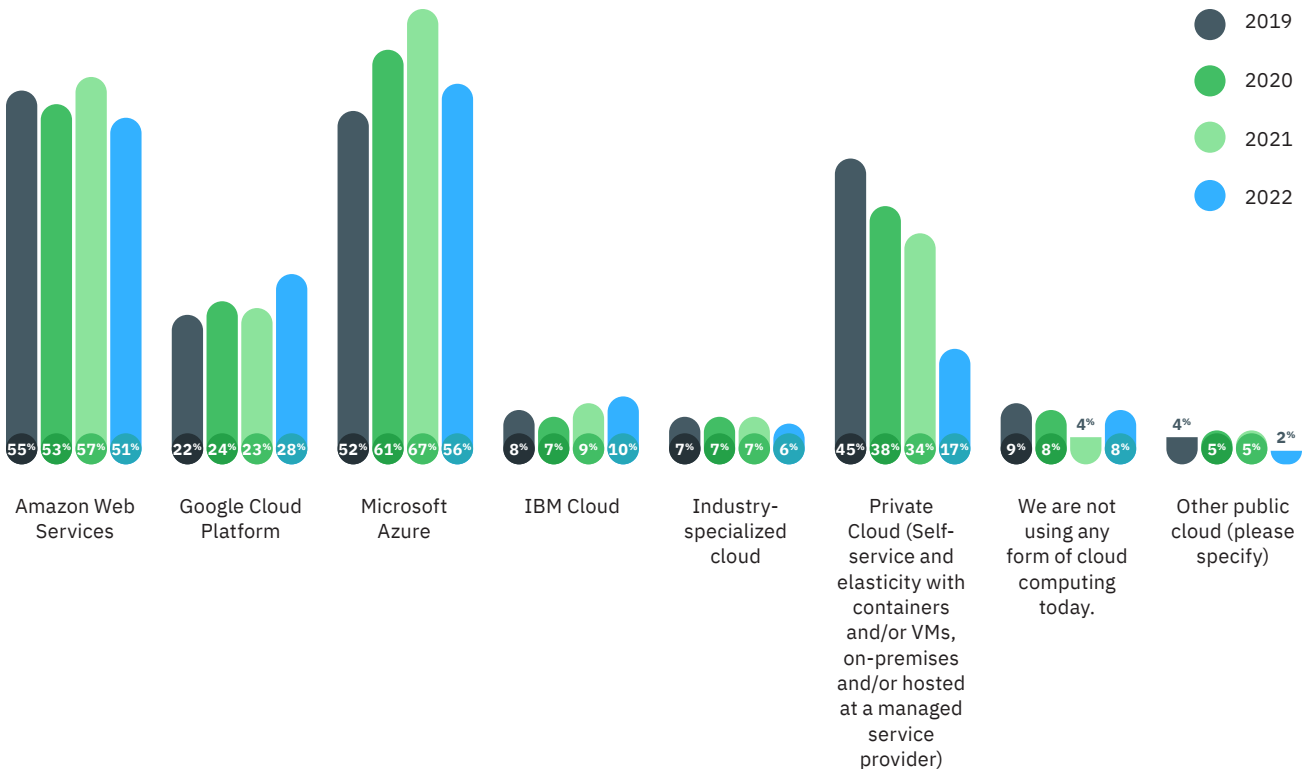
Note: Respondents to our survey tend to work at larger organizations, which is why we see higher use of Microsoft Azure—more common among the enterprise—over Amazon Web Services, which is the leading cloud provider by market share.
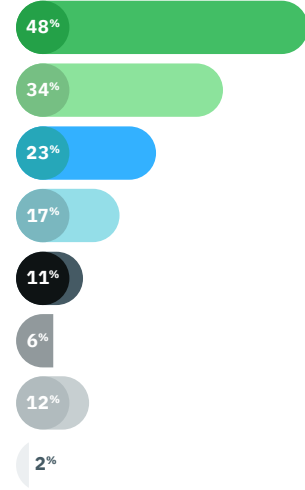
Leaders vs. Laggards: 2022

Leaders

- 57%
- 55%
- 35%
- 18%
- 13%
- 8%
- 3%
- 0%

On par with the majority

- 57%
- 53%
- 26%
- 17%
- 8%
- 4%
- 10%
- 3%

Laggards

- 48%
- 34%
- 23%
- 17%
- 11%
- 6%
- 12%
- 2%

Leaders vs. Laggards: 2021

Leaders

- 70%
- 64%
- 36%
- 26%
- 12%
- 6%
- 3%
- 5%

On par with the majority

- 68%
- 57%
- 34%
- 22%
- 7%
- 7%
- 3%
- 5%

Laggards

- 53%
- 43%
- 27%
- 19%
- 9%
- 7%
- 9%
- 4%

Legend:
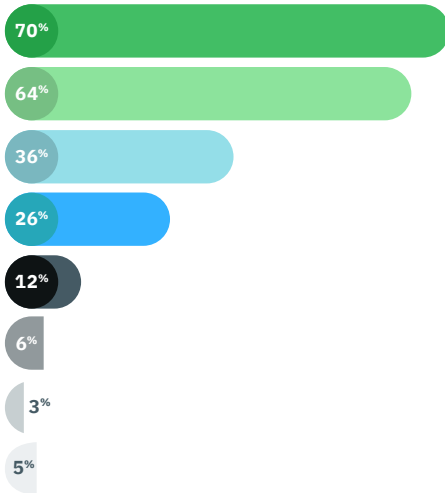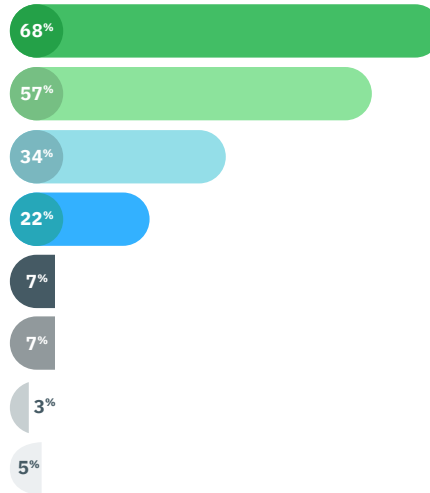
- Microsoft Azure
- Amazon Web Services
- Google Cloud Platform
- Private Cloud (Self-service and elasticity with containers and/or VMs, on-premises and/ or hosted at a managed service provider)
- IBM Cloud
- Industry-specialized cloud
- We are not using any form of cloud computing today.
- Other public cloud (please specify)

In 2022, only 13% of organizations are hybrid cloud down from 28% the previous year.

Overall: 2022

17%
Private Cloud

13%
Hybrid Cloud
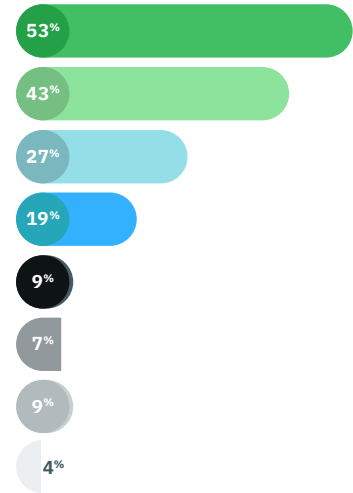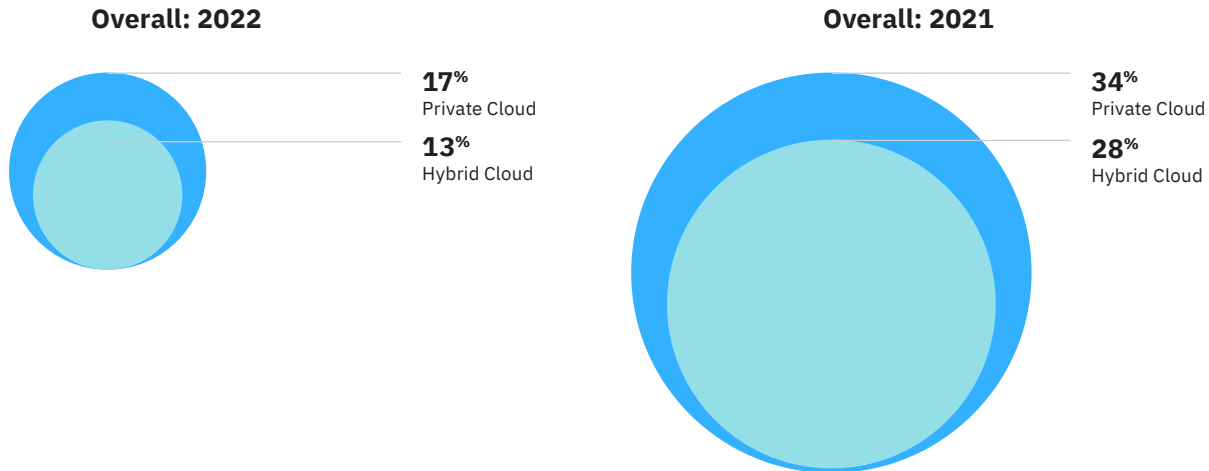
Overall: 2021

34%
Private Cloud

28%
Hybrid Cloud

One hundred and sixteen of the 669 respondents (17%) noted that they had a private cloud; 88 (13%) had a private cloud with some mix of public clouds i.e. hybrid cloud. Last year, 278 of 819 respondents (34%) noted that they had a private cloud; 233 (28%) had a private cloud with some mix of public clouds i.e. hybrid cloud. Looked at another way, in 2022, 591 respondents (88%) indicated that they only use public cloud solutions. In 2021, just 62% indicated the same.

Public Cloud Only

Only 15% of respondents have 3 or more clouds, down from 30% the previous year.

Given the shift away from private cloud this decline in the total number of cloud providers being used does not surprise us. When we look at the data for leaders versus laggards, however, 20% of leaders have three or more clouds compared to only 9% of laggards. We expect that as organizations become savvier in managing public cloud they will consume services from more cloud providers; at that point the business need outweighs the complexity of managing multiple cloud providers—as we are already seeing on a larger scale among leaders.

62% 2021

88% 2022

Distribution of the Number of Cloud Providers (Including Private Cloud)

Overall: 2019-2022

Legend:
- 2019
- 2020
- 2021
- 2022

	0 Cloud Providers	1 Cloud Provider	2 Cloud Providers	3 Cloud Providers	4 Cloud Providers	5+ Cloud Providers
2019	9%	30%	32%	20%	7%	2%
2020	7%	33%	30%	20%	6%	3%
2021	4%	35%	30%	22%	6%	2%
2022	6%	34%	27%	11%	3%	2%
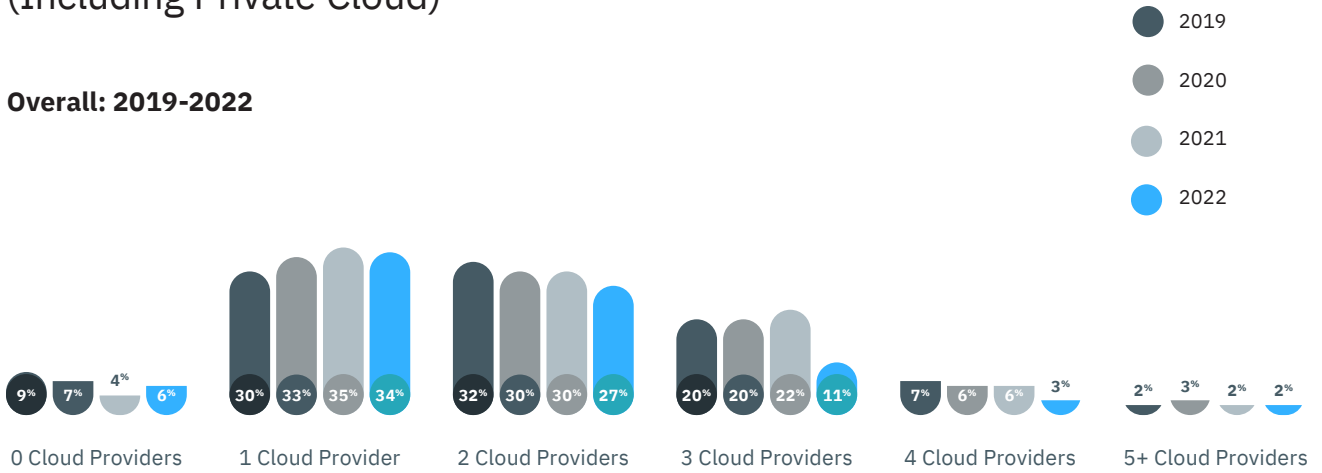
Leaders and Laggards: 2022

Legend:
- Leaders
- Laggards

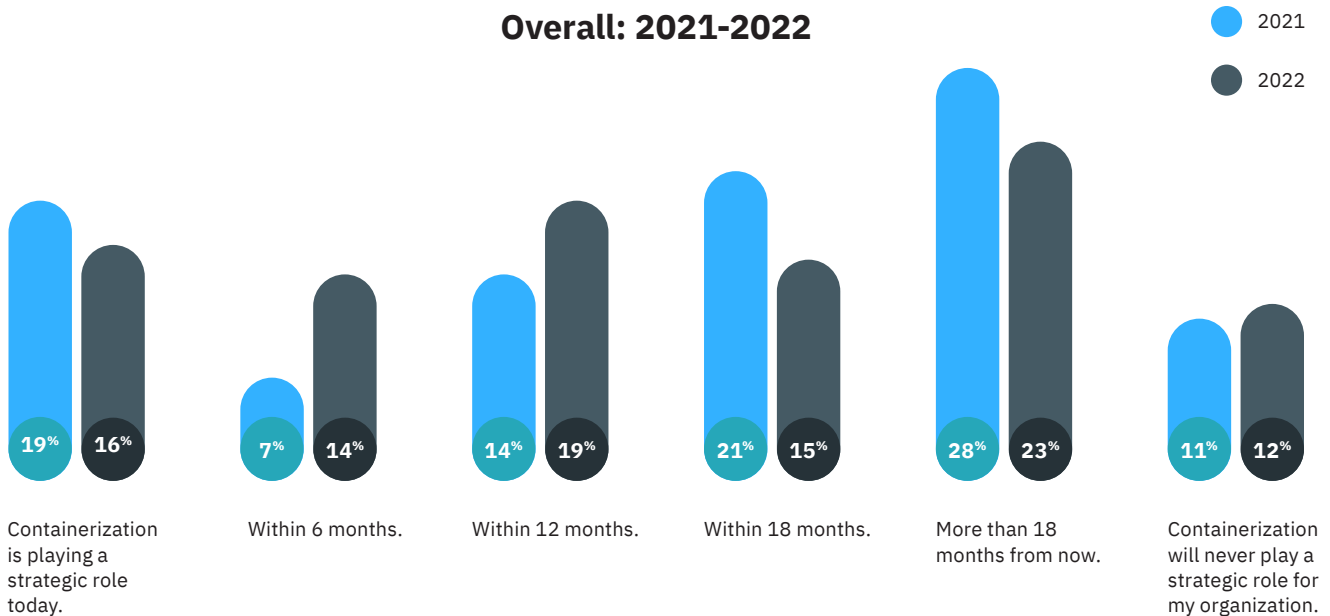|	0 Cloud Providers	1 Cloud Provider	2 Cloud Providers	3 Cloud Providers	4 Cloud Providers	5+ Cloud Providers
Leaders	3%	41%	37%	12%	4%	4%
Laggards	12%	47%	33%	8%	1%	0%
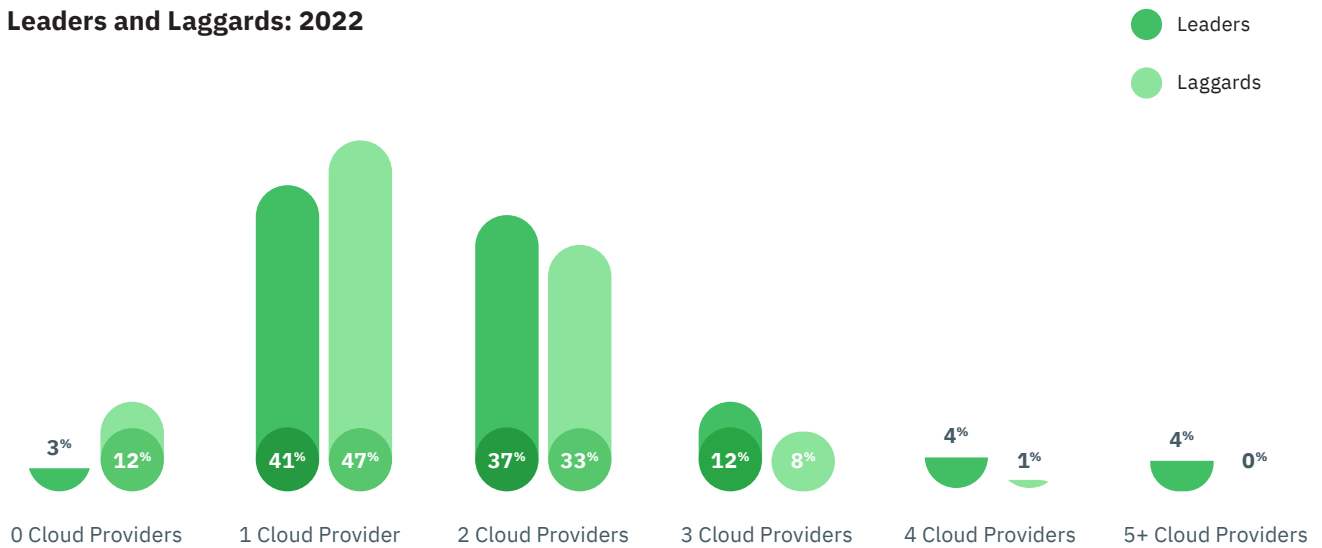
Container Adoption

For 65% of organizations containerization will play a strategic role within 18 months, up from 61% in 2021.

Containers are the building blocks of the modern application. Lightweight and ready for business in minutes, they promise developer speed and elasticity. And their portability is considered a key enabler to implementing multicloud. It should come as no surprise then that organizations are making a strategic investment in containerization.

The typical container adoption curve starts with at least one containerized application. As the benefits are proven out, more applications and lines-of-business are onboarded to the platform. Anticipation for the strategic role that containers will play within 6 months, doubled from 7% in 2021 to 14%, suggesting a broad transition from proof-of-concept to production.

Question: By when do you expect containerization will play a strategic role for your organization?

Overall: 2021-2022

- 🔵 2021
- ⬛ 2022

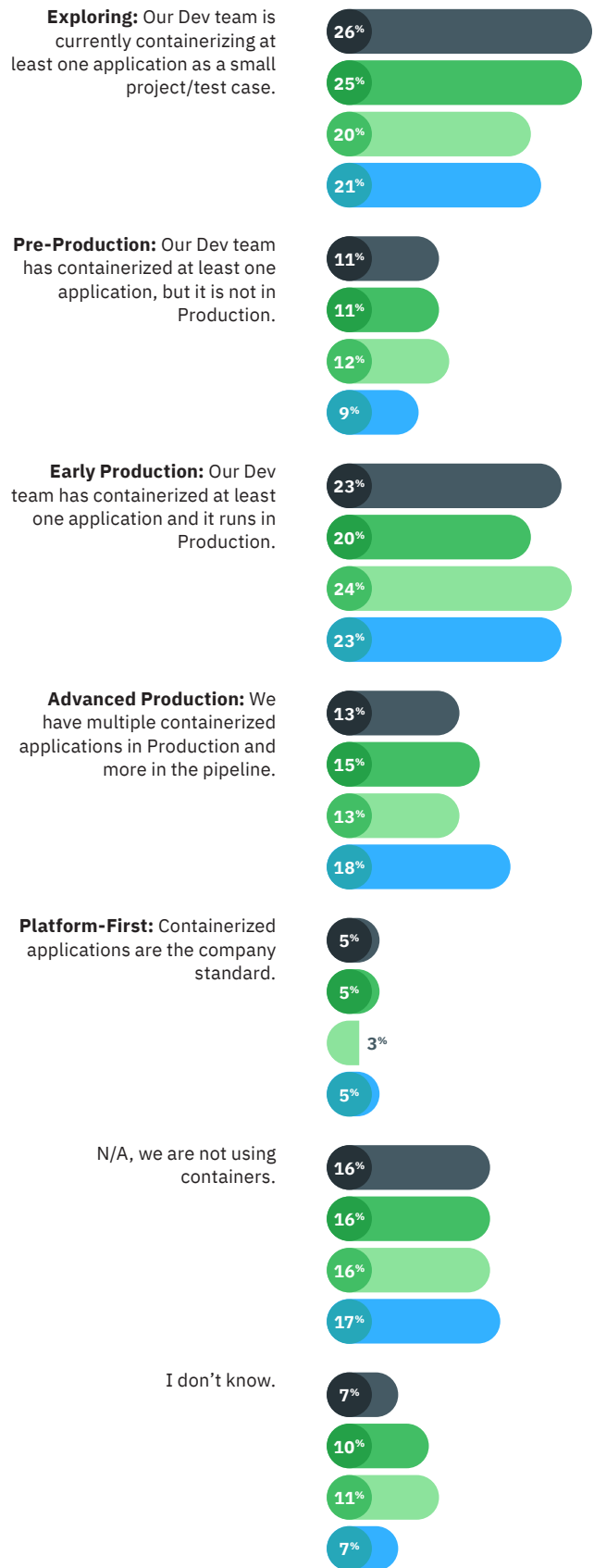|	2021	2022
Containerization is playing a strategic role today.	19%	16%
Within 6 months.	7%	14%
Within 12 months.	14%	19%
Within 18 months.	21%	15%
More than 18 months from now.	28%	23%
Containerization will never play a strategic role for my organization.	11%	12%

In 2022, 46% of organizations overall—and 60% of leaders—are running containers in production.

Additionally, we see, the percent of organizations in Advanced Production increase to 18%, up from 13% last year. It is a positive sign that more organizations are overcoming the well-known challenges around managing the complexity of containerized applications.
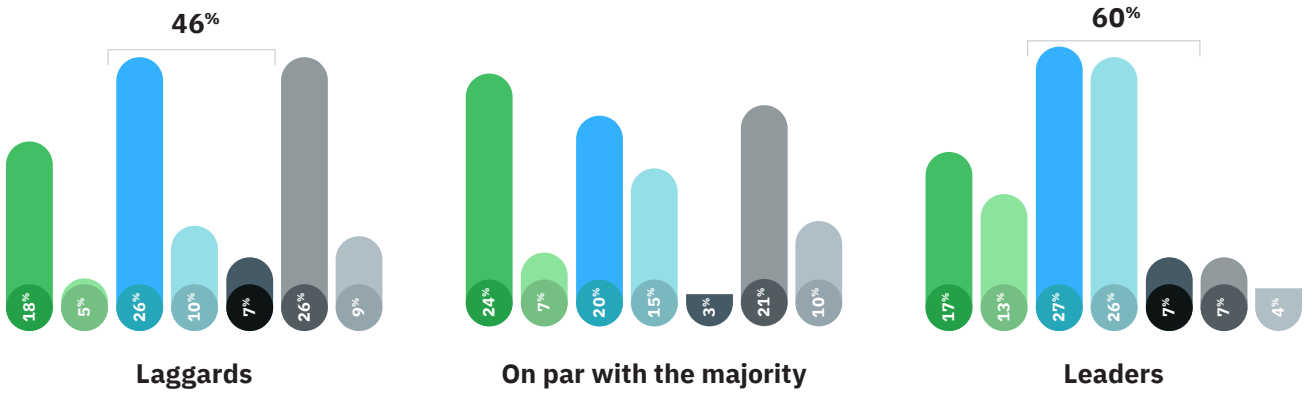
Question: Where is your organization in its journey to containers/cloud native?

- 2019
- 2020
- 2021
- 2022

Overall: 2019-2022

Exploring: Our Dev team is currently containerizing at least one application as a small project/test case.
- 26%
- 25%
- 20%
- 21%

Pre-Production: Our Dev team has containerized at least one application, but it is not in Production.
- 11%
- 11%
- 12%
- 9%

Early Production: Our Dev team has containerized at least one application and it runs in Production.
- 23%
- 20%
- 24%
- 23%

Advanced Production: We have multiple containerized applications in Production and more in the pipeline.
- 13%
- 15%
- 13%
- 18%

Platform-First: Containerized applications are the company standard.
- 5%
- 5%
- 3%
- 5%

N/A, we are not using containers.
- 16%
- 16%
- 16%
- 17%

I don't know.
- 7%
- 10%
- 11%
- 7%

Leaders vs. Laggards: 2022

46% Laggards: 18%, 5%, 26%, 10%, 7%, 26%, 9%

On par with the majority: 24%, 7%, 20%, 15%, 3%, 21%, 10%
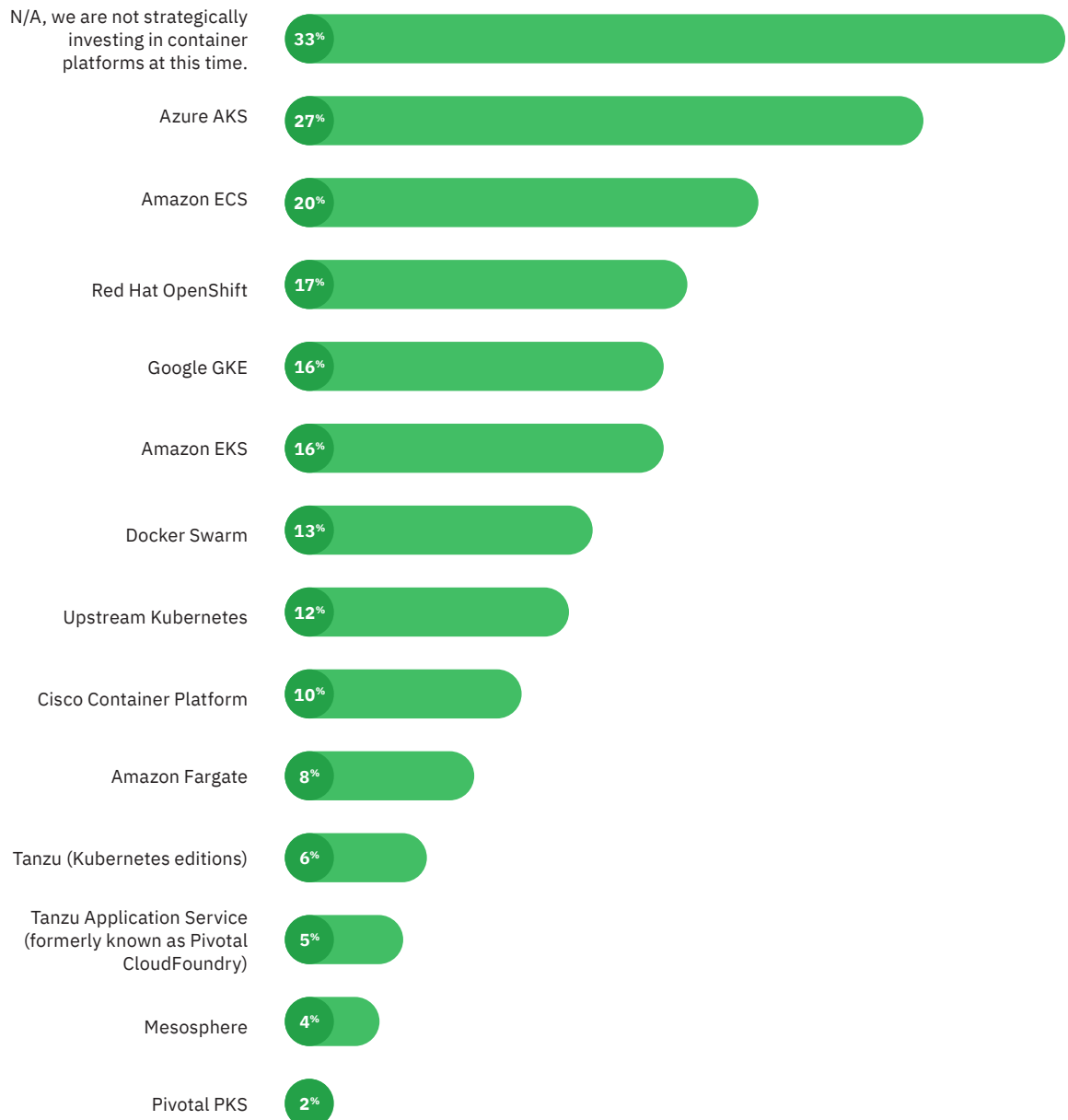
60% Leaders: 17%, 13%, 27%, 26%, 7%, 7%, 4%

Exploring: Our Dev team is currently containerizing at least one application as a small project/test case.

Pre-Production: Our Dev team has containerized at least one application, but it is not in Production.

Early Production: Our Dev team has containerized at least one application and it runs in Production.

Advanced Production: We have multiple containerized applications in Production and more in the pipeline.

Platform-First: Containerized applications are the company standard.

N/A, we are not using containers.

I don't know.

Azure AKS is the most adopted container platform, followed by Amazon ECS and Red Hat OpenShift; among leaders, Google GKE is the second most adopted container platform.

Question: Is your organization making a strategic investment in any of the following container platforms? (Select all that apply)

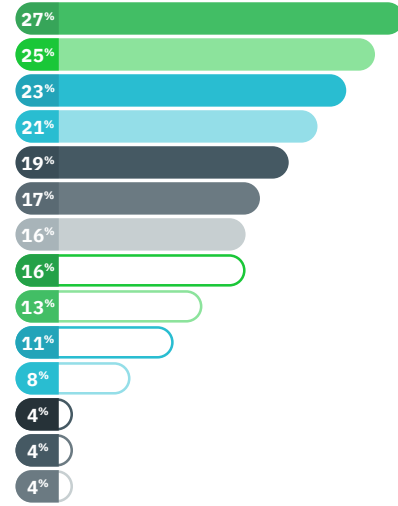*Note: Respondents to our survey tend to work at larger organizations.*
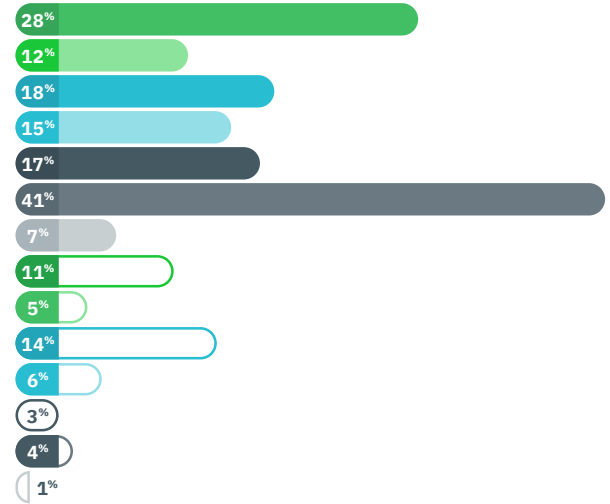
Overall: 2022

Platform	Percentage
N/A, we are not strategically investing in container platforms at this time.	33%
Azure AKS	27%
Amazon ECS	20%
Red Hat OpenShift	17%
Google GKE	16%
Amazon EKS	16%
Docker Swarm	13%
Upstream Kubernetes	12%
Cisco Container Platform	10%
Amazon Fargate	8%
Tanzu (Kubernetes editions)	6%
Tanzu Application Service (formerly known as Pivotal CloudFoundry)	5%
Mesosphere	4%
Pivotal PKS	2%

- 🟢 Azure AKS
- 🟢 Google GKE
- 🔵 Amazon ECS
- 🔵 Amazon EKS
- ⬛ Red Hat OpenShift
- ⬤ N/A, we are not strategically investing in container platfrms at this time.
- ⬤ Cisco Container Platform
- ⭕ Docker Swarm
- ⭕ Amazon Fargate
- ⭕ Upstream Kubernetes
- ⭕ Tanzu (Kubernetes editions)
- ⭕ Mesosphere
- ⭕ Tanzu Application Service (formerly known as Pivotal CloudFoundry)
- ⭕ Pivotal PKS

Leaders vs. Laggards: 2022

Leaders

- 27%
- 25%
- 23%
- 21%
- 19%
- 17%
- 16%
- 16%
- 13%
- 11%
- 8%
- 4%
- 4%
- 4%

On par with majority

- 28%
- 12%
- 18%
- 15%
- 17%
- 41%
- 7%
- 11%
- 5%
- 14%
- 6%
- 3%
- 4%
- 1%

Laggards

- 24%
- 11%
- 16%
- 9%
- 10%
- 42%
- 6%
- 11%
- 7%
- 8%
- 2%
- 8%
- 7%
- 3%

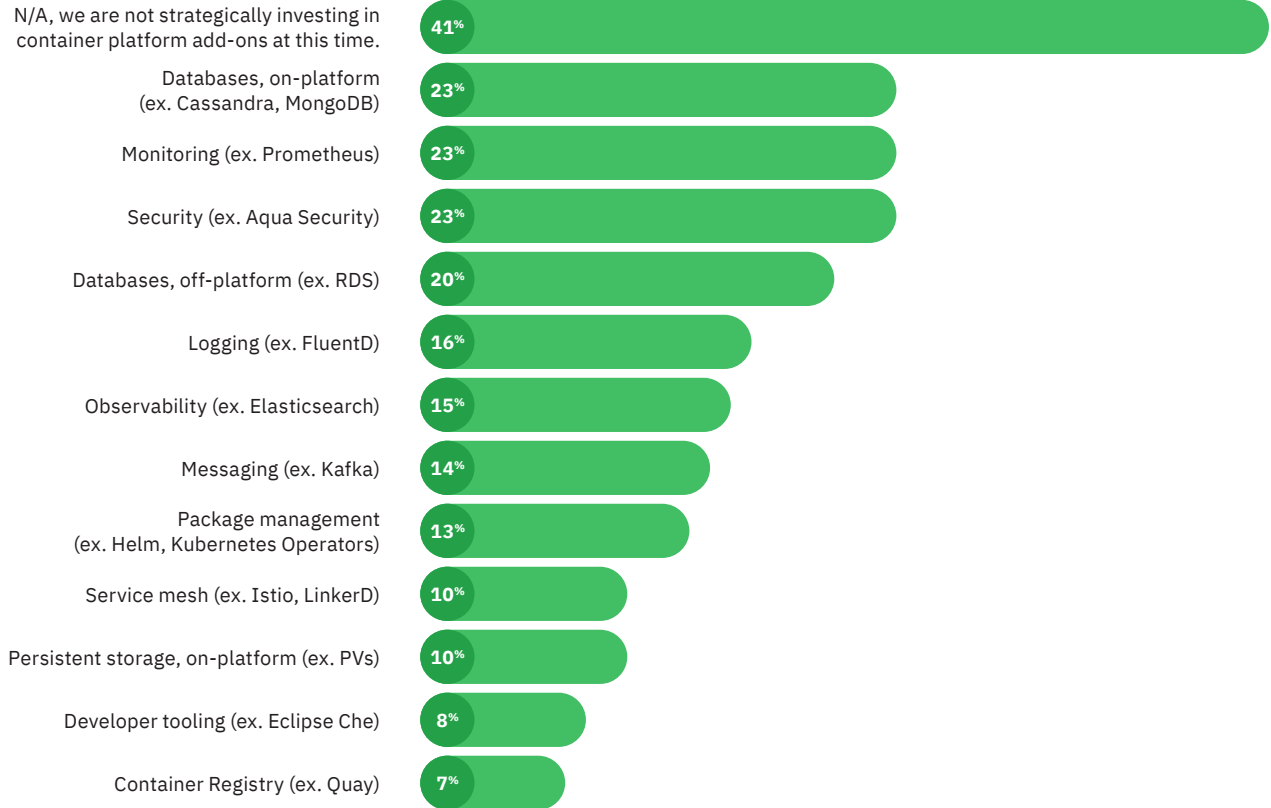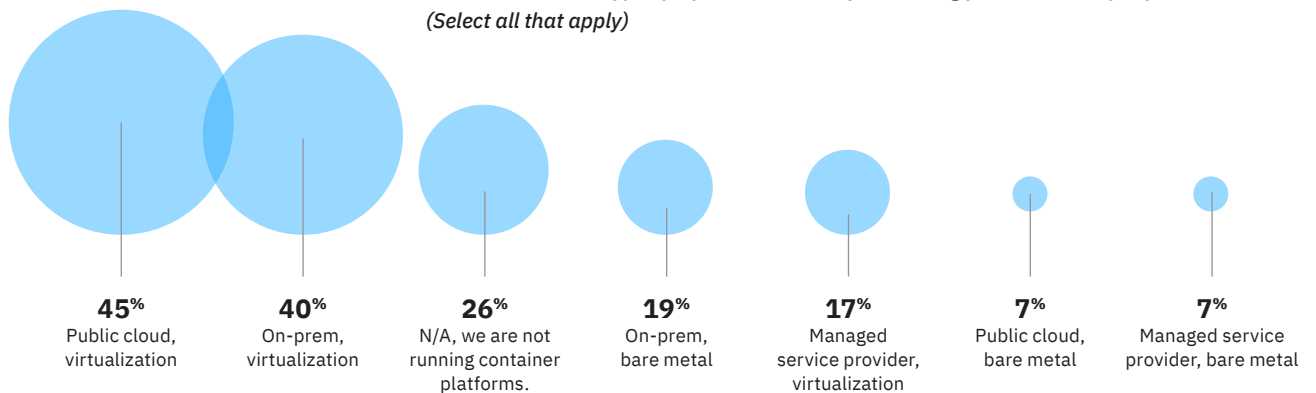## On-platform databases, monitoring, and security tie for top container platform add-ons.

Overall: 2022

Question: Is your organization making a strategic investment in any of the following container platform add-ons? (Select all that apply)

Category	%
N/A, we are not strategically investing in container platform add-ons at this time.	41%
Databases, on-platform (ex. Cassandra, MongoDB)	23%
Monitoring (ex. Prometheus)	23%
Security (ex. Aqua Security)	23%
Databases, off-platform (ex. RDS)	20%
Logging (ex. FluentD)	16%
Observability (ex. Elasticsearch)	15%
Messaging (ex. Kafka)	14%
Package management (ex. Helm, Kubernetes Operators)	13%
Service mesh (ex. Istio, LinkerD)	10%
Persistent storage, on-platform (ex. PVs)	10%
Developer tooling (ex. Eclipse Che)	8%
Container Registry (ex. Quay)	7%

Public cloud is the preferred infrastructure for running containerized applications.

Overall: 2022

Question: On what type of infrastructure are you running your container platform(s)? (Select all that apply)
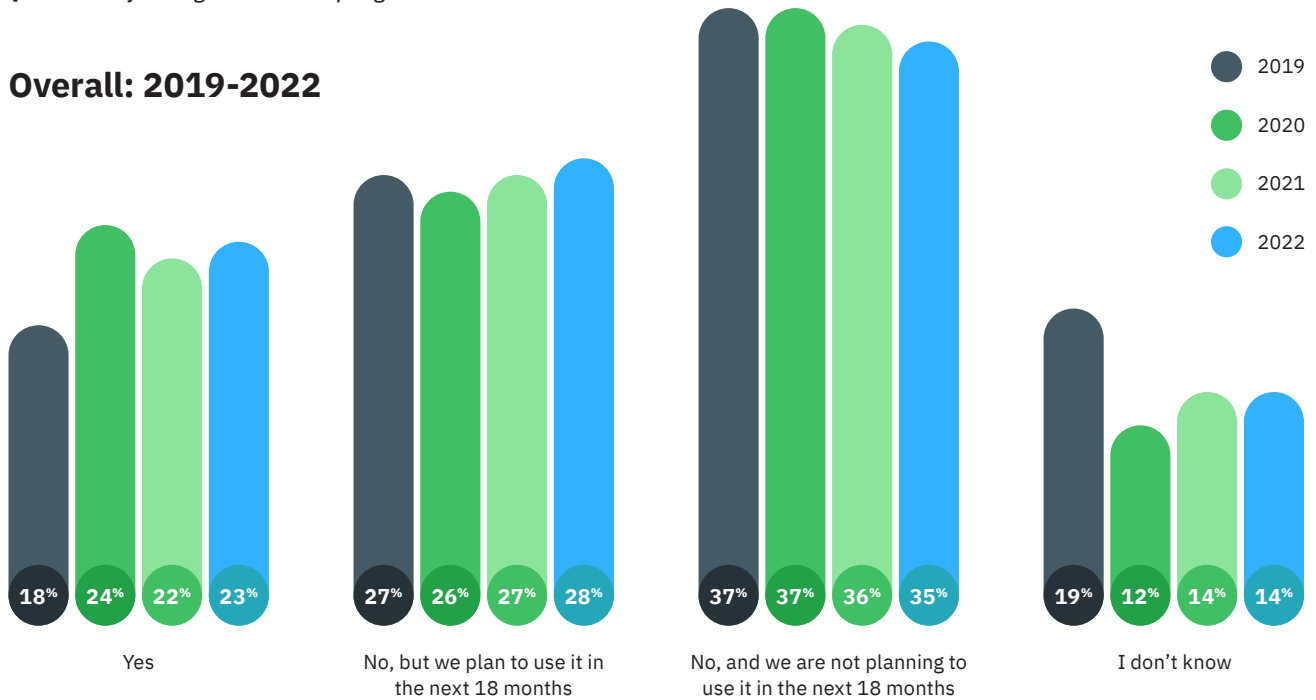
%	Description
45%	Public cloud, virtualization
40%	On-prem, virtualization
26%	N/A, we are not running container platforms.
19%	On-prem, bare metal
17%	Managed service provider, virtualization
7%	Public cloud, bare metal
7%	Managed service provider, bare metal

Serverless adoption remains flat at 23%.

Question: Is your organization adopting serverless?

Overall: 2019-2022

Legend:
- 2019
- 2020
- 2021
- 2022

Yes
- 18%
- 24%
- 22%
- 23%

No, but we plan to use it in the next 18 months
- 27%
- 26%
- 27%
- 28%

No, and we are not planning to use it in the next 18 months
- 37%
- 37%
- 36%
- 35%

I don't know
- 19%
- 12%
- 14%
- 14%

There is no clear leader when it comes to serverless offerings.

Question: Is your organization making a strategic investment in any of the following FaaS/serverless offerings or open-source projects? (Select all that apply)

- **40%** N/A, we are not strategically investing in FaaS/serverless
- **27%** AWS Lambda
- **29%** Azure Functions
- **4%** Knative
- **25%** Google Cloud Functions
- **0%** Other
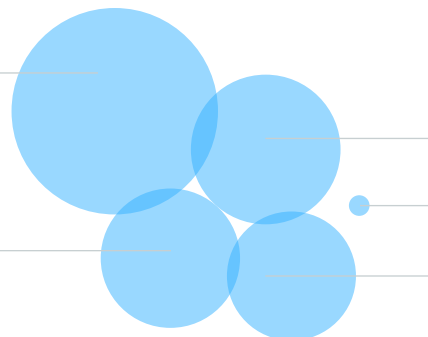
Minimizing cost / platform sprawl is the top benefit to using serverless; leaders are more likely to value the developer experience.

Question: What would prompt you to use serverless?

- Minimize cost / platform sprawl.
- No need to manage a platform.
- Easier for developers.
- We have no reason to use serverless.
- I don't know.

Overall: 2022

31%

27%

15%

14%

13%

Leaders vs. Laggards: 2022

Laggards

27% 29% 11% 16% 18%

On par with the majority

34% 24% 11% 16% 16%

Leaders

30% 30% 23% 10% 8%
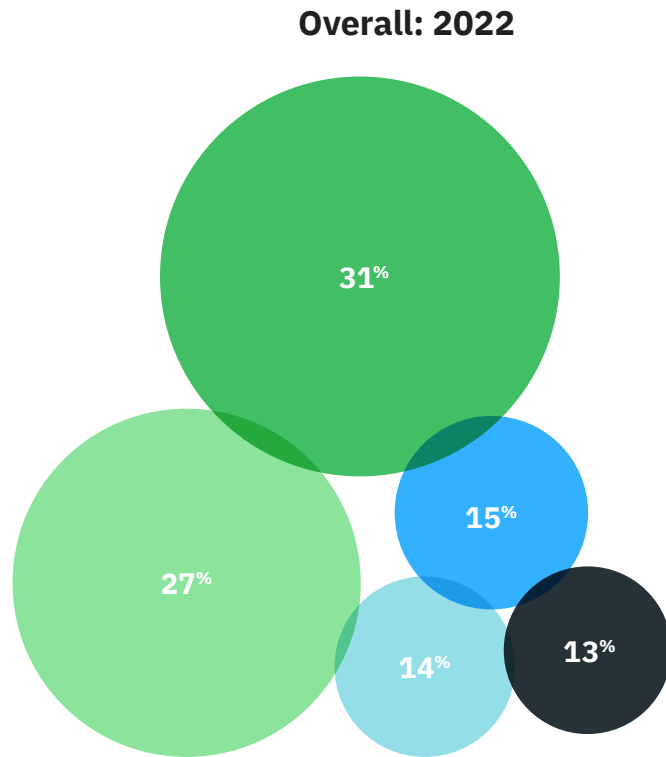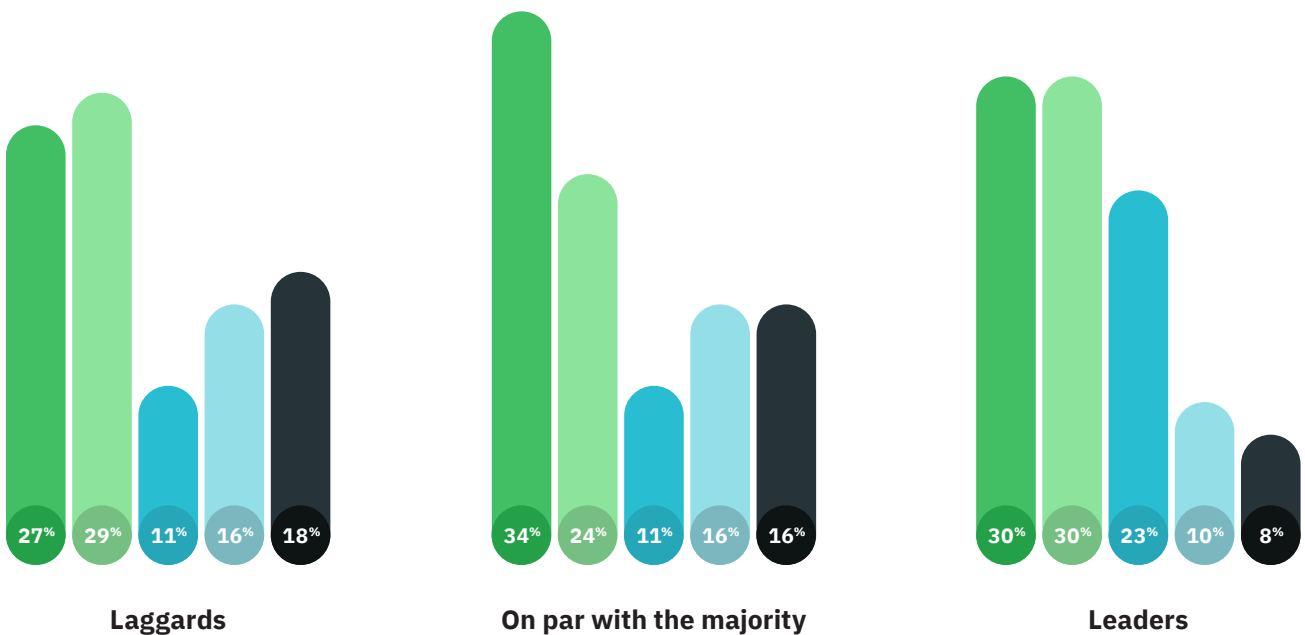
The biggest barrier to adopting serverless—especially among leaders—is applications requiring integration with other cloud services that are not ready.

Question: What are the biggest barriers to adopting serverless?

- ● Our application(s) require(s) integration with other cloud services that are not there yet.
- ● We just don't have a business use case for it.
- ● Our application is too complex.
- ● I don't know.

Overall: 2022

35%	29%	19%	17%

Leaders vs. Laggards: 2022

Laggards

32%	13%	37%	19%

On par with the majority

29%	18%	33%	19%
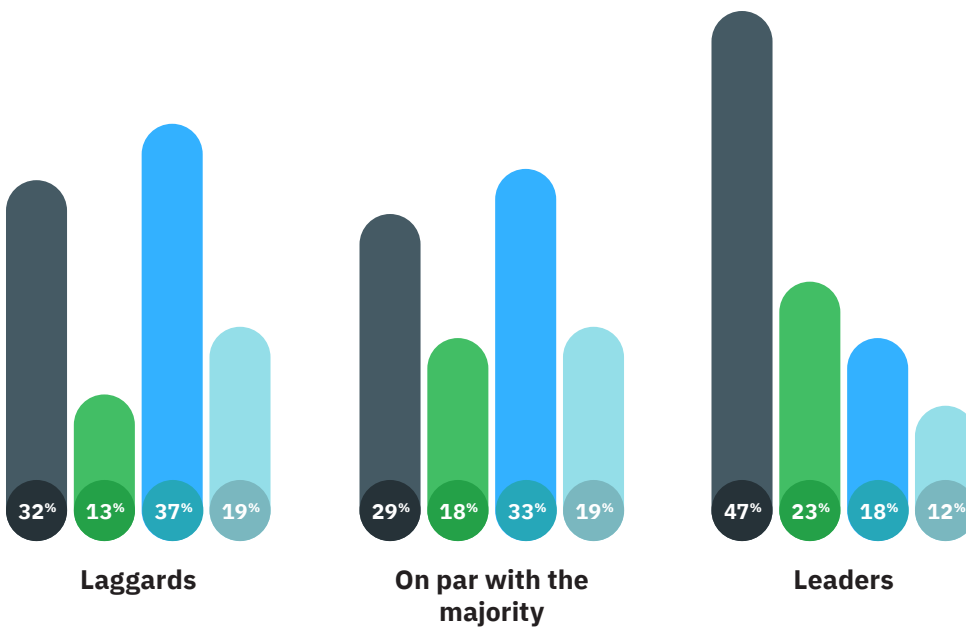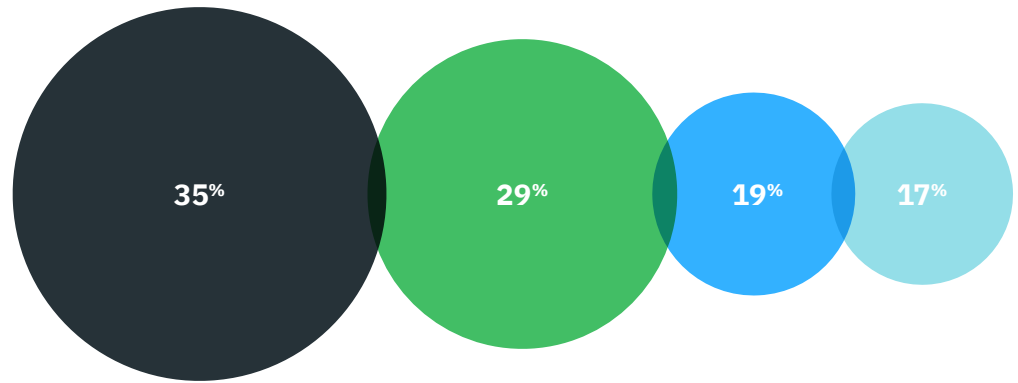
Leaders

47%	23%	18%	12%

ABOUT THE AUTHOR

Asena Hertz

VP, Product Marketing at Turbonomic, an IBM Company

Asena leads product marketing at Turbonomic, bringing more than a decade of experience marketing disruptive technologies that span application resource management, energy and resource analytics, developer tools, clean tech, and more. She is passionate about the transformative impact that cloud and cloud native technologies are having today, as well as the opportunities for automation to change people's lives and climate for the better.