**ESG RESEARCH INSIGHTS PAPER**

# Survey: Today's Top 3 IT Challenges with Modern Application Environments

Meeting Security and Agility Goals while Managing Complex Hybrid Multi-cloud Environments

By Scott Sinclair, ESG Senior Analyst
and Monya Keane, ESG Senior Research Analyst

March 2021

# Contents

## Executive Summary

It is difficult to overstate the importance of IT to modern businesses, including the essential role that Linux plays in providing a foundation for business-critical workloads. According to ESG research, 98% of organizations now report being in some phase of digital transformation. Their goals for these projects range from becoming more operationally efficient (cited by 56%) to providing a better and more differentiated customer experience (40%), and even developing entirely new business models (25%).[1]

Often, Linux provides the foundation for business-critical workloads that power digital-business initiatives. Managing Linux distributions and updates thus plays a significant role in how well IT organizations secure their environment, manage cloud migrations, and accelerate their SLAs.

## Research Objectives

This ESG research study surveyed 300 IT administrators, security administrators, database administrators, and developers who have purchasing influence over their organizations' data center infrastructure, cloud, server virtualization, cybersecurity, or enterprise application environments. The respondents were all knowledgeable about their organizations' business-critical workloads, run business-critical workloads on Linux today, and were employed at enterprise-sized firms (i.e., those which employ 1,000+ individuals).

The focus of the project involved:

- Investigating the goals, characteristics, and needs of enterprise Linux operating system environments.

- Understanding the existing challenges of managing business-critical workloads and their impact on administrators' workloads.

- Investigating the requirements and considerations for virtualized and cloud environments.

## Highlights from Research Findings

- **Cybersecurity is the top challenge, but achieving it is a constant struggle**—Increased security was identified as a top IT goal by more than half of the participants (52%), representing a higher percentage than reducing costs (42%), which ranked fifth. However, despite security's prioritization, it still takes most organizations average of about 4.5 months (or ~134 days) to apply security patches for Linux distributions in use to all relevant servers.

- **Complexity of environments hinders agility objectives, as multi-cloud is the application environment of choice**— Among organizations that run business-critical workloads on Linux, 85% run those workloads on public cloud infrastructure today and nearly four-fifths (79%) use more than one public cloud provider to run business-critical applications.  Over the next 18 months, ESG expects the percentage of organizations using more than three public cloud providers to increase by 64%.

- **Challenges in accelerating IT initiatives while delivering availability and performance** —Ninety-four percent of the respondents said their SLAs have necessitated faster application and service deployment, and 60% said their deployment-time requirements have become at least 50% shorter. Meanwhile, 73% of respondents agreed that the cost of a major downtime event would far outweigh any IT spending to prevent it.
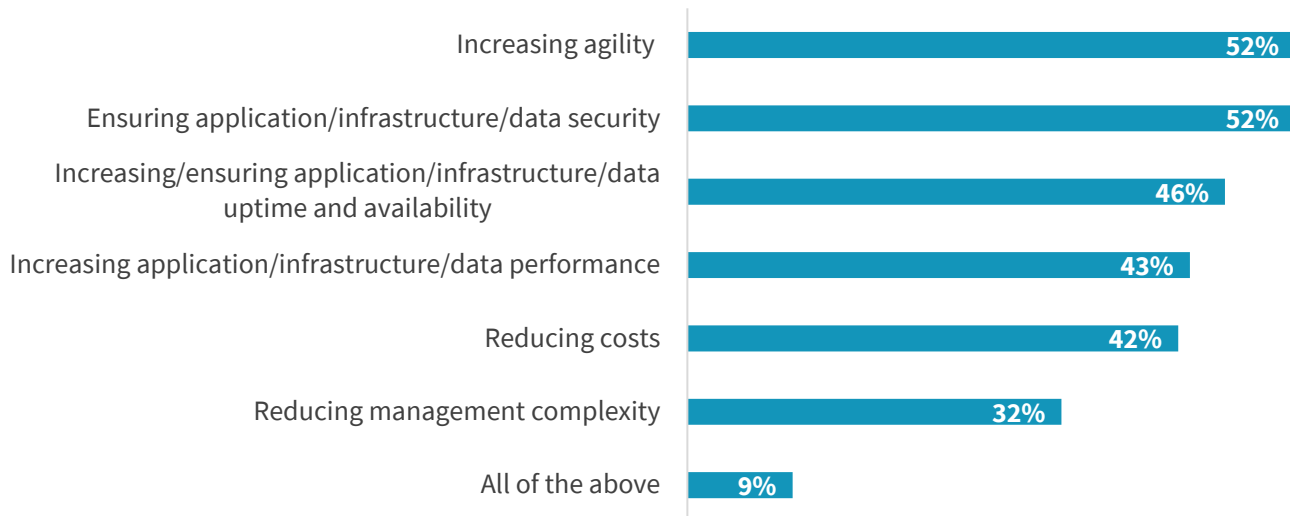
---

[1] Source: ESG Research Report, _2021 Technology Spending Intentions Survey_, January 2021.

## Security and Agility are Top IT Goals

The requirement for multi-cloud IT is likely contributing to the fact that agility capabilities have joined security capabilities as a top IT goal for 2021 (see Figure 1). It appears that although lowering costs is important, ensuring the right infrastructure for business-critical application is often a higher priority now.

Figure 1.

**What are the top goals your organization/team is focusing on for the next year?**
**(Percent of respondents, N=300, multiple responses accepted)**

| Goal | Percent |
|---|---|
| Increasing agility | 52% |
| Ensuring application/infrastructure/data security | 52% |
| Increasing/ensuring application/infrastructure/data uptime and availability | 46% |
| Increasing application/infrastructure/data performance | 43% |
| Reducing costs | 42% |
| Reducing management complexity | 32% |
| All of the above | 9% |

*Source: Enterprise Strategy Group*

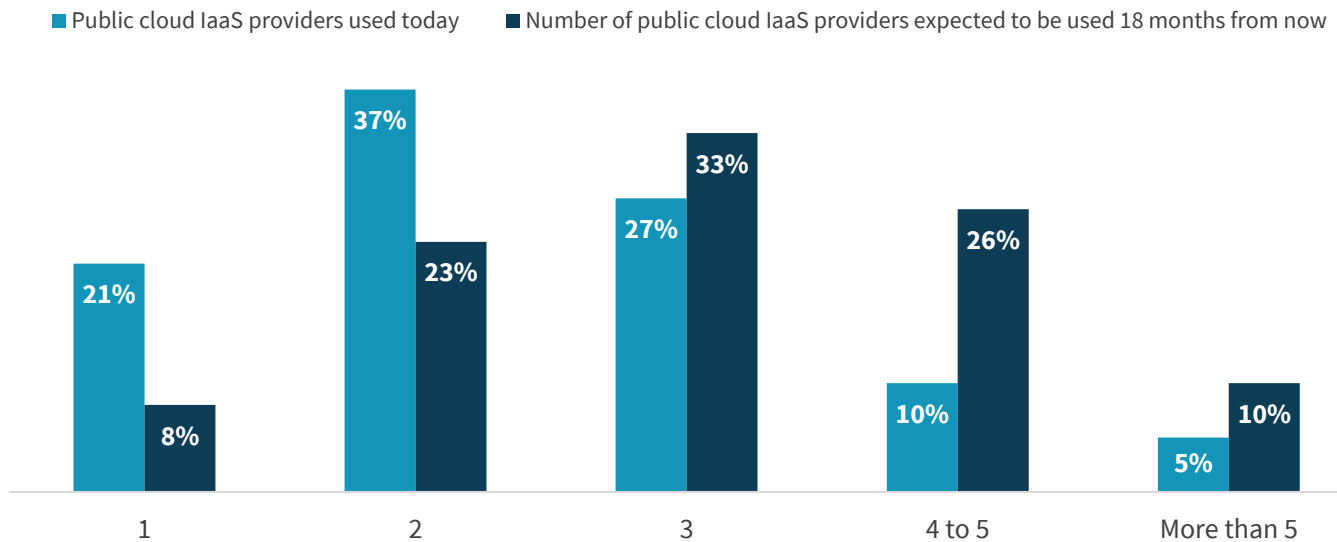## Application Environments are Increasingly Linux-based and Multi-cloud

ESG research into organizations' top goals for their enterprise environments when architecting and optimizing an infrastructure for business-critical workloads reveals that use of Linux-based environments has become important and prevalent. Nearly eight in ten (78%) respondents beginning the survey report their organization has business-critical workloads running on Linux. Among those that do, the de facto environment for business-critical applications is, and will continue to be, hybrid with 89% of organizations expecting to run workloads both on-premises and on public cloud infrastructure in five years.

As the data in Figure 2 shows, these environments will become increasingly multi-cloud.

- Already, a combined 79% of cloud users use more than one public cloud provider.

- And over the next 18 months, the percentage of organizations using three or more public cloud providers is expected to increase by 64%—from 42% to 69%.

**Figure 2.**

**Approximately how many unique public cloud providers does your organization currently use for your business-critical workloads? How many do you expect to use 18 months from now? (Percent of respondents, N=291)**

■ Public cloud IaaS providers used today    ■ Number of public cloud IaaS providers expected to be used 18 months from now

| | 1 | 2 | 3 | 4 to 5 | More than 5 |
|---|---|---|---|---|---|
| Public cloud IaaS providers used today | 21% | 37% | 27% | 10% | 5% |
| Expected 18 months from now | 8% | 23% | 33% | 26% | 10% |

*Source: Enterprise Strategy Group*

## Top Three Common IT Challenges

Securing, managing, and migrating these modern business-critical application environments—while accelerating operations and maintaining performance and availability—comes with challenges. According to ESG's *2021 Technology Spending Intentions Survey*, 75% of IT decision makers believe that IT has become more complex in the last two years.[2]

Part of the reason behind that complexity relates to the difficulty IT organizations have in recruiting and retaining skilled IT specialists. Three of the four most commonly identified problematic skill shortages within IT organizations are cybersecurity (48%), cloud architecture and planning (36%), and IT architecture/planning (34%).[3]

### 1.  Cybersecurity Is the Top Challenge

Security is obviously essential for business-critical workloads, which makes it all the more unfortunate that chronic skill shortages exist in that area. It is not surprising, therefore, that:

*   Strengthening cybersecurity was the most commonly identified business initiative that will drive the most technology spending in 2021 (cited by 47% of respondents).

*   Two-thirds of IT organizations (66%) expect to increase their spending on cybersecurity over what they spent in the prior year.[4]

A deeper dive into security challenges associated with business-critical application environments reveals how essential strong cybersecurity (and strong cybersecurity practices) have become to organizations (see Figure 3). Forty-five percent of

---

[2] Source: ESG Research Report, *2021 Technology Spending Intentions Survey*, January 2021.
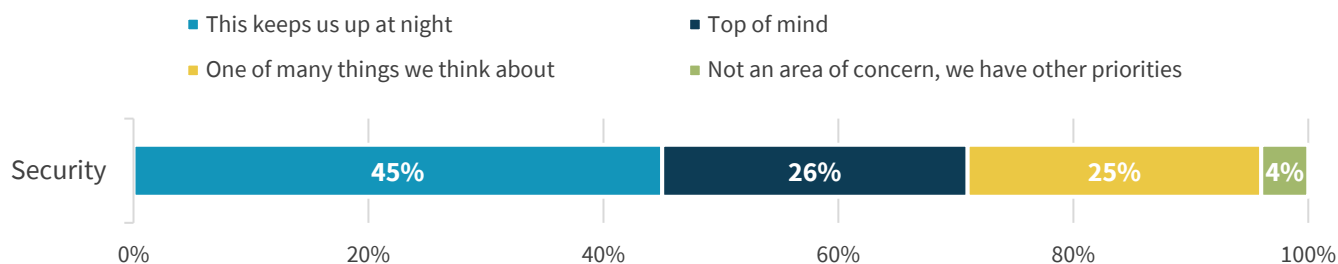[3] Source: ESG Master Survey Results, *2021 Technology Spending Intentions Survey*, December 2020.
[4] Source: ESG Research Report, *2021 Technology Spending Intentions Survey*, January 2021.

respondents said security concerns keep them up at night, and an additional 26% said that security is "top of mind." Only 4% reported that they are not concerned about their organization's cybersecurity position. Interestingly, 60% believe that a major company in their industry will go bankrupt in the next 24 months due to a security incident.

Figure 3.

**When you think of your organization's business-critical applications, what best classifies your organization's perspective? (Percent of respondents, N=300)**

- This keeps us up at night
- Top of mind
- One of many things we think about
- Not an area of concern, we have other priorities



Source: Enterprise Strategy Group

## Delays in Deploying Security Patches Hinder Enterprise Security Efforts

These IT decision makers may be worried in part because of the specific delays and challenges that come with applying patches to Linux environments. It can take a long time—on average, organizations take roughly 134 days to apply security patches to all relevant Linux servers.
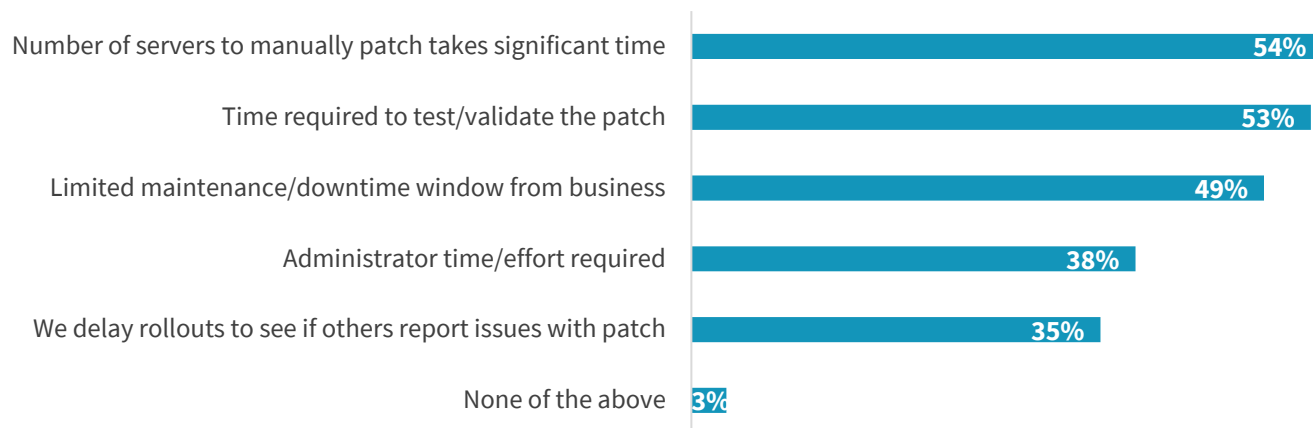
Part of the problem is that many organizations do not distinguish between urgent security patches and routine updates. ESG research shows that nearly three-fifths (59%) of organizations do not distinguish between urgent security-related and routine patch updates. This lack of distinction can make an organization vulnerable—86% of organizations with a uniform patching policy take longer than a month to apply patches of any type.

Organizations that do prioritize installing urgent security patches are still exposed to a degree, but their window of vulnerability is much smaller. On average, these organizations still take an estimated ~63 days to apply urgent security patches to relevant servers, with 53% applying urgent security patches in less than a month.

Figure 4 identifies the common reasons behind the delays enterprises experience when patching Linux distributions across their environments. At many organizations, manual processes and requisite testing slow down patching efforts.

**Figure 4.**

**Which of the following do you believe are impacting the speed with which your organization can apply Linux patches? (Percent of respondents, N=257, multiple responses accepted)**

| | |
|---|---|
| Number of servers to manually patch takes significant time | 54% |
| Time required to test/validate the patch | 53% |
| Limited maintenance/downtime window from business | 49% |
| Administrator time/effort required | 38% |
| We delay rollouts to see if others report issues with patch | 35% |
| None of the above | 3% |

*Source: Enterprise Strategy Group*

## Opportunities to Address the Security Challenge

Fortunately, opportunities do exist to address these challenges. For example, Oracle technology comes with Ksplice automated live patching, including kernel, user space, and hypervisor patching. Importantly, Oracle Ksplice updates an Oracle Linux installation with all important security patches *but without the need to reboot servers*. That means no downtime is required. Applications continue running, container or virtual machine workloads are not disrupted, and systems are up to date and secure.

Oracle is in a good position to provide this offering. It has an established history of commitment to supporting the latest open-source Linux security software, including KATA Containers, libvirt, QEMU, and OpenID Connect tokens based on OAuth 2.0. Oracle also offers Secure Boot, and data encryption both in-flight and at-rest. Using Oracle Ksplice, IT teams can apply patches easily, and they even have the option to automate patching to help address zero-day exploits. Another feature of Ksplice is Known Exploit Detection. When you patch your system with Ksplice, not only is the security vulnerability closed, but tripwires are also laid down for privilege escalation vulnerabilities. If an attacker attempts to exploit a CVE you've patched, Ksplice notifies you. Ksplice both protects your system and alerts you to suspicious activity. Oracle also offers Autonomous Linux, which runs on Oracle Cloud Infrastructure (OCI).

According to Oracle, organizations have successfully deployed millions of patches with the help of Oracle Ksplice.

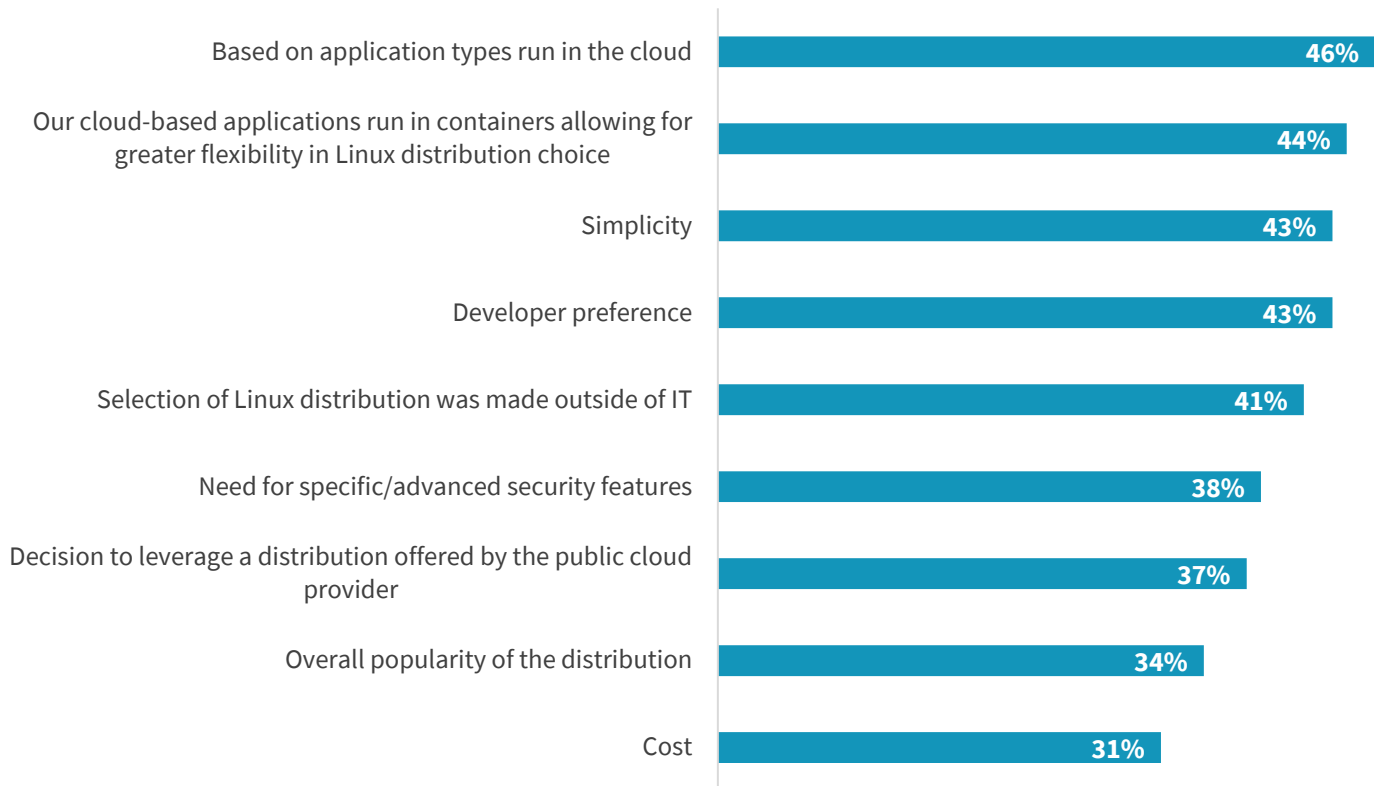## 2.   Complexity of Environments Hinders Agility Objectives

As mentioned, achieving IT agility is now a major goal for modern multi-cloud environments—that includes maintaining agility when managing multiple, diverse Linux-based application environments across the multi-cloud ecosystem. Consider that 85% of organizations surveyed by ESG run Linux-based business-critical workloads on a public cloud infrastructure today, and 84% of organizations use more than one distribution of Linux.

### Cloud Adoption Increases Use of Multiple Linux Distributions

Leveraging cloud resources can increase the variety of Linux distributions that an organization uses, as 78% of organizations run different Linux distributions in the public cloud than what they run on-premises. Figure 5 explains why these organizations leverage different Linux distributions in the cloud.

Figure 5.

**You identified that your organization runs different Linux distributions in the cloud than what is run on-premises. What rationale/factors have led to the deployment of different Linux distributions in the cloud? (Percent of respondents, N=193, multiple responses accepted)**

| | |
|---|---|
| Based on application types run in the cloud | 46% |
| Our cloud-based applications run in containers allowing for greater flexibility in Linux distribution choice | 44% |
| Simplicity | 43% |
| Developer preference | 43% |
| Selection of Linux distribution was made outside of IT | 41% |
| Need for specific/advanced security features | 38% |
| Decision to leverage a distribution offered by the public cloud provider | 37% |
| Overall popularity of the distribution | 34% |
| Cost | 31% |

*Source: Enterprise Strategy Group*

Basically, different distributions offer different advantages. The application type has a big effect, according to 46% of respondents. The rise of containers also has made it easier to choose different versions for simplicity or in accordance with developers' preferences. However, these increases in the number of distributions in use increase IT complexity as well.

## Enterprise Application Environments Become More Diverse and More Complex

The desire for choice in Linux distributions is not likely to diminish anytime soon, and it may accelerate due to growing interest in containers and in virtualization environments such as KVM. The trend toward technology diversity will fuel complexity if left unchecked.

For example, container usage is poised to increase in the coming years, as:

- 72% of organizations are currently using or plan to use containers for their business-critical applications.

- On-premises business-critical workloads on Linux span multiple environments. Currently, on average, 54% reside in VMs, 35% reside on bare metal, and 12% reside in containers.

Looking forward, surveyed organizations believe that, on average, 58% of their business-critical applications will be containerized in three years.

Similarly, virtualized environments are becoming more diversified. Nearly half (45%) of surveyed organizations identified VMware as their primary server virtualization/ hypervisor vendor.

Among those users, VMware comprises a significant portion of their IT budgets. Nearly half (47%) identified VMware as the vendor they spend the most with, and an additional 41% identified VMware as a top-five vendor in terms of spending. Likely influenced by this relatively high spending, 60% of organizations indicated that they are interested in, planning for, or conducting a proof-of-concept for deploying KVM for virtualization.

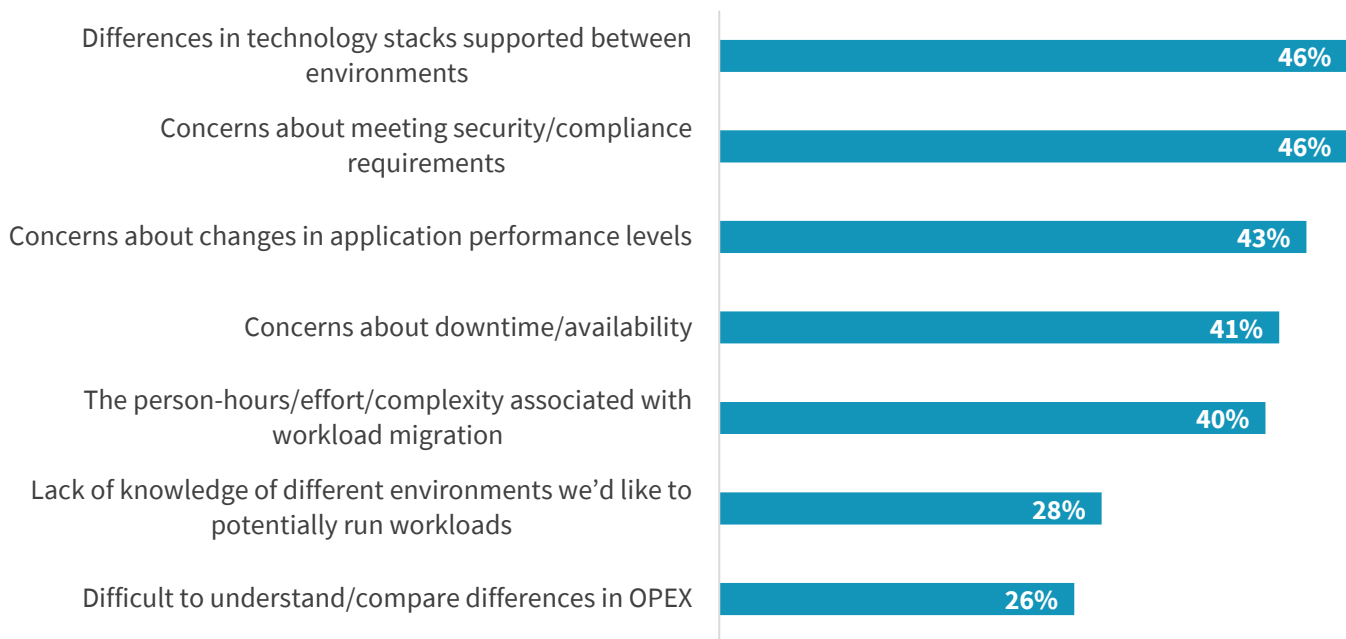## Cloud Migrations and Agility Become More Complex

The hybrid and multi-cloud requirements of business-critical Linux environments drive a need for application agility and portability—both are top IT goals. However, the growing diversity of application environments and Linux deployments, along with concerns about security and inconsistencies in infrastructure, create challenges when migrating Linux-based workloads to the cloud.

Linux-based workloads are dynamic: 68% of respondents said their organizations regularly migrate workloads between on-prem and cloud environments, and 62% said their organizations regularly migrate workloads between public clouds.

A significant 95% of organizations see a need to make those Linux-based workload migrations more flexible, particularly the migrations occurring between on-prem and cloud environments. The data in Figure 6 depicts the complexities inherent in current workload migrations, highlighting trends previously discussed, such as differences in technology stacks (46%) and concerns about meeting security/compliance requirements (46%). Organizations are also feeling held back because they are concerned about achieving the necessary application performance (43%), worried about downtime/availability (41%), and troubled by the person-hours/effort/complexity that is invariably involved (40%).

**Figure 6.**

**What is holding your organization back when it comes to Linux-based workload migrations? (Percent of respondents, N=237, multiple responses accepted)**

| | |
|---|---|
| Differences in technology stacks supported between environments | 46% |
| Concerns about meeting security/compliance requirements | 46% |
| Concerns about changes in application performance levels | 43% |
| Concerns about downtime/availability | 41% |
| The person-hours/effort/complexity associated with workload migration | 40% |
| Lack of knowledge of different environments we'd like to potentially run workloads | 28% |
| Difficult to understand/compare differences in OPEX | 26% |

*Source: Enterprise Strategy Group*

## Opportunities to Address the Challenges of Hybrid Multi-cloud Agility

It is imperative for IT industry vendors to help address organizations' need for hybrid and multi-cloud agility, and Oracle boasts differentiation in this space.

Oracle Linux offers the same operating system on-premises and in the cloud. Also consider that all applications developed on Oracle Linux will also run—without modification—on industry standard x86 and Arm-based servers, Oracle Exadata, Oracle Exadata Cloud at Customer, Oracle Database Appliance, Oracle Private Cloud Appliance, Oracle Private Cloud at Customer, Oracle Cloud Infrastructure, and other major public clouds such as AWS and Azure. Oracle Linux offers 100% application binary compatibility with Red Hat Enterprise Linux. Basically, Oracle Linux is designed to ensure compatibility across environments and across distributions.

In fact, Oracle treats any and all incompatibilities as if they were bugs. According to Oracle, in all the years of distributing Oracle Linux (since 2006), there has never been an incompatibility bug filed.

That is reassuring because consistency is essential for agility. To put the point into a real-world context, Oracle Linux provides developers with the confidence they need to "develop once and run everywhere."

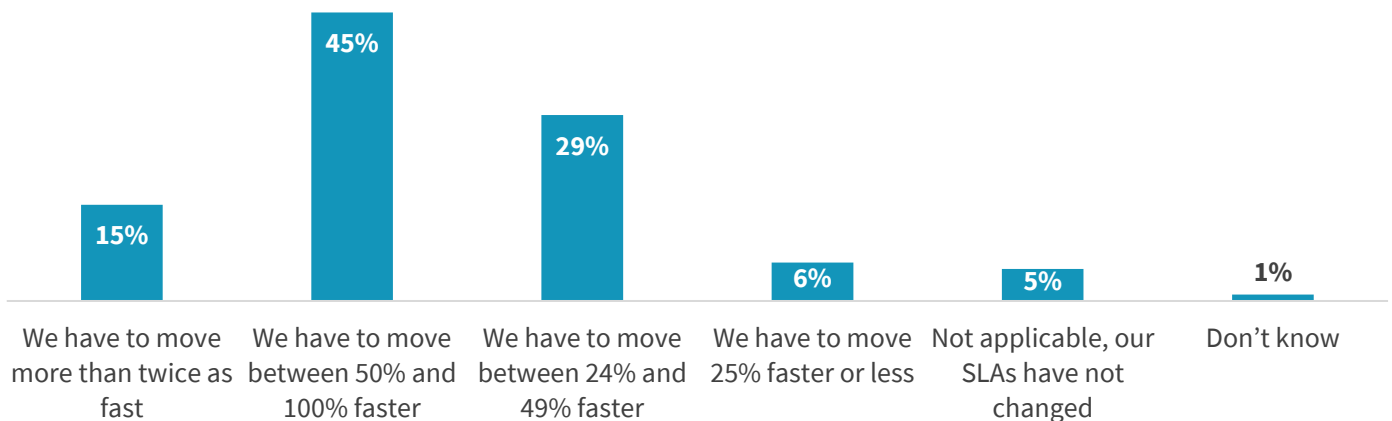## 3.    Challenges in Accelerating IT Initiatives While Delivering Availability and Performance

Another challenge relates to the trouble IT organizations have in accelerating their service-level agreements (SLAs) with their line-of-business end-users—specifically, continuing to maintain the availability and performance of their business-critical applications.

### Businesses Require Faster Deployments

As mentioned, 94% of respondents reported that their stringent SLAs have necessitated faster app and service deployment. Specifically, 60% said their deployment times are now more than 50% shorter than in past years (see Figure 7).

**Figure 7.**

**When you think of SLAs your organization has to adhere to today compared with three years ago, how much faster (if at all) does your team need to deploy applications and services? (Percent of respondents, N=300)**
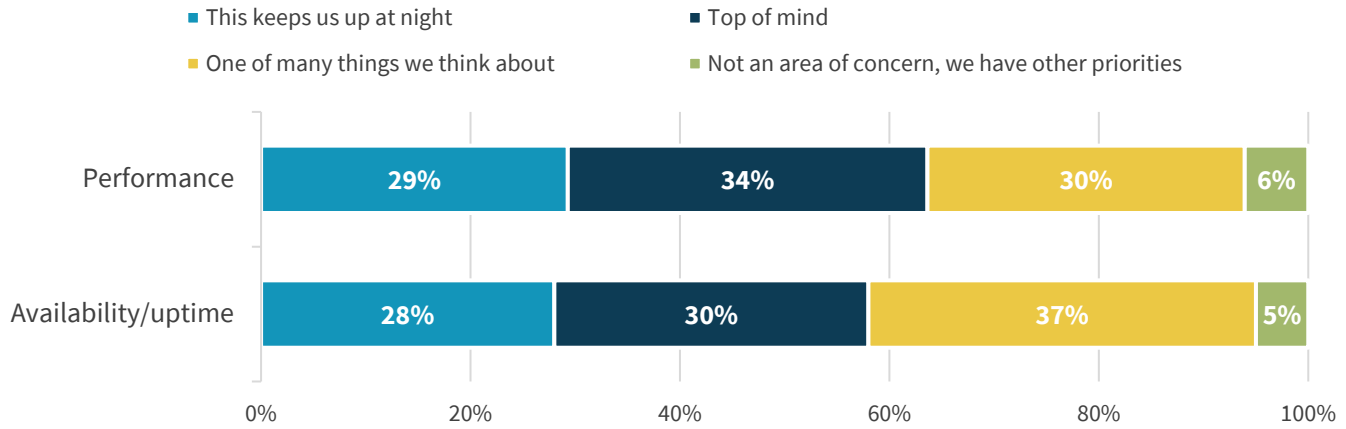


| We have to move more than twice as fast | We have to move between 50% and 100% faster | We have to move between 24% and 49% faster | We have to move 25% faster or less | Not applicable, our SLAs have not changed | Don't know |
|---|---|---|---|---|---|
| 15% | 45% | 29% | 6% | 5% | 1% |

*Source: Enterprise Strategy Group*

### Ensuring Application Performance and Availability Become More Complex as the Number of Vendors Increase

The need to accelerate SLAs does not diminish the need to provide superior ongoing performance and availability to support business-critical applications. Most respondents rated performance (cited by 63%) and reliability (58%) of their business-critical apps as being top of mind (see Figure 8). And again, 73% agreed that the cost of a major downtime event would far outweigh preventative IT spending.

**Figure 8.**

**When you think of your organization's business-critical applications, what best classifies your organization's perspective? (Percent of respondents, N=300)**

- ■ This keeps us up at night
- ■ Top of mind
- ■ One of many things we think about
- ■ Not an area of concern, we have other priorities

| | This keeps us up at night | Top of mind | One of many things we think about | Not an area of concern |
|---|---|---|---|---|
| Performance | 29% | 34% | 30% | 6% |
| Availability/uptime | 28% | 30% | 37% | 5% |

*Source: Enterprise Strategy Group*

On average, organizations are using 7.3 different independent software vendors (ISVs) to support their business-critical workload stacks. And ESG found that, on average, 59% of support issues require the involvement of multiple ISVs.
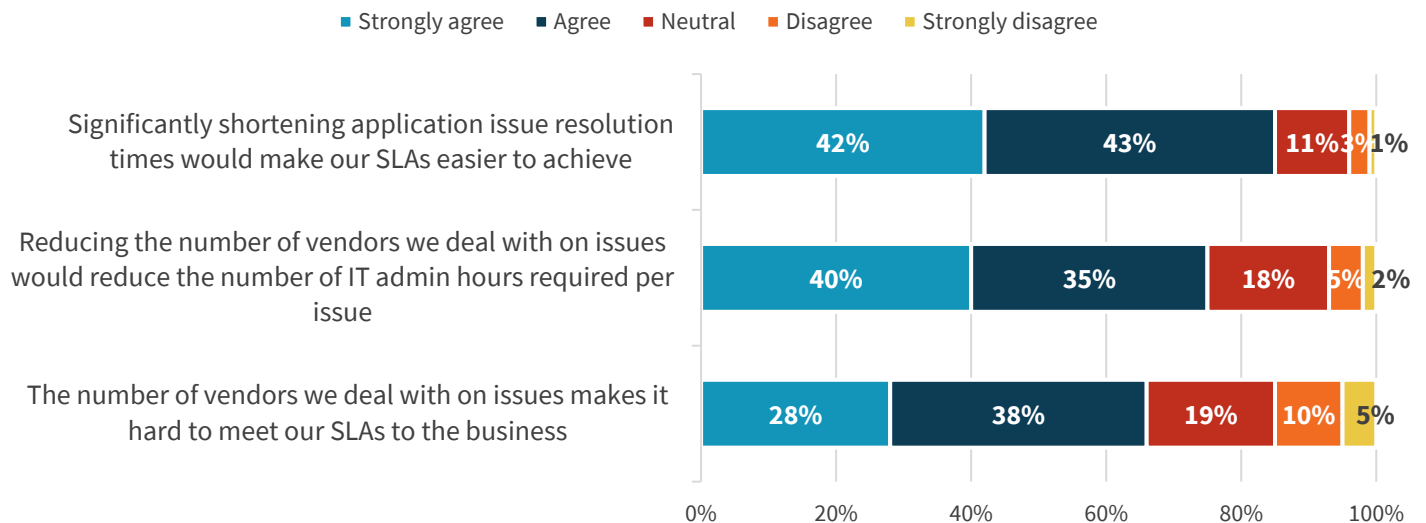
As the number of vendor solutions being used increases, an application environment becomes harder to manage. That, in turn, increases the time to deploy enhancements and diagnose issues, which limits the IT group's ability to ensure availability and performance and makes it harder for them to meet the accelerated SLAs demanded by the business.

## Opportunities to Accelerate SLAs and Ensure Availability and Performance

As Figure 9 shows, 75% of survey respondents said that dealing with fewer vendors would result in fewer person-hours per issue, and 85% agreed that shortening application resolution times would make their SLAs easier to meet.

**Figure 9.**

**Please rate your level of agreement with the following statements. (Percent of respondents, N=300)**

- ■ Strongly agree
- ■ Agree
- ■ Neutral
- ■ Disagree
- ■ Strongly disagree

| | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| Significantly shortening application issue resolution times would make our SLAs easier to achieve | 42% | 43% | 11% | 3% | 1% |
| Reducing the number of vendors we deal with on issues would reduce the number of IT admin hours required per issue | 40% | 35% | 18% | 5% | 2% |
| The number of vendors we deal with on issues makes it hard to meet our SLAs to the business | 28% | 38% | 19% | 10% | 5% |

*Source: Enterprise Strategy Group*

The question, therefore, is how can an organization reduce the number of vendors across its stack?

Oracle's strength is well-known in business-critical application environments—83% of surveyed organizations use Oracle databases and/or applications in their business-critical application stacks. And, on average, 56% of business-critical workloads within those organizations include Oracle databases or apps.

Leveraging Oracle Linux within the environment can minimize the number of vendors involved in a solution, while maintaining the open source benefits and avoiding lock-in.

Here is a selection of some capabilities Oracle Linux provides to help reduce the number of vendors needed for business-critical solutions, thus accelerating deployment of new services and speeding up issue resolution:

- **To accelerate deployment**, Oracle Linux offers templates with pre-installed and pre-configured Oracle software images to help automate deployment processes.

- **To proactively reduce issues**, Oracle offers DTrace, a comprehensive dynamic tracing framework enabling administrators, developers, and service personnel to concisely answer arbitrary questions about the behavior of the Linux OS and user programs in real time. As a result, organizations can quickly discern expected behavior— simplifying root-cause analysis, troubleshooting, and resolution.

- **Optimized for Oracle workloads,** Oracle Linux includes the [Unbreakable Enterprise Kernel (UEK)](#), which is specifically optimized for the best performance of Oracle software. The Oracle Database and Oracle Linux development teams collaborate on UEK performance enhancements, tuning system calls and C library interfaces that accelerate applications and query processing times. Oracle engineers extensively test the optimized UEK across Oracle's database, middleware, and application tiers as well as on Oracle servers and engineered systems. UEK is also subject to incremental and widespread testing across IT development systems running the family of Oracle Database products.

- **For performance**, Oracle applications are developed on Oracle Linux. As a result, Linux performance optimization for Oracle applications is a key design tenet for Oracle. For example, Oracle Linux seeks to better locate processes near memory to accelerate an application's performance. Oracle Linux also accelerates performance for slower block storage devices with its bcache capability, which simplifies the use of lower-latency storage technology such as storage-class memory (SCM) or NVME-based SSDs to serve as a block cache.

- **Database Smart Flash Cache** Since many OLTP workloads are read-intensive, Oracle Database engineers developed Database Smart Flash Cache, an innovative solution on Oracle Linux to accelerate I/Os for read-mostly database workloads. This functionality allows the database buffer cache to expand beyond the System Global Area (SGA) in main memory to a second-level cache that resides on a flash device. Because flash memory is an order of magnitude faster for read operations (e.g., 4ms disk reads vs. 0.4 ms flash reads), this feature significantly accelerates database performance without any additional cost, beyond the cost of the secondary flash.

- Additionally, Oracle has introduced a new technology called **Reliable Datagram Sockets** (RDS) to help address issues that can arise when traditional inter-process communication (IPC) mechanisms are subject to heavy loads. RDS is designed to provide a low-latency, connectionless protocol for delivering datagrams reliably—with the ability to scale to thousands of endpoints. As a result, RDS significantly reduces the number of retransmissions, and that enhancement can significantly increase performance during peak usage. Oracle has contributed its RDS code to the open-source community, and it is currently part of the Linux kernel.

## Conclusion

Multi-cloud Linux has been and continues to be the dominant environment of choice for business-critical applications. While enterprise-grade security, performance, and availability have always been priorities for these application environments, the increased demands of today's digital enterprises have simply raised the stakes.

Small inefficiencies and time-stealing complexities quickly add up as application demands mount, not only increasing the cost and risk to the business but also impeding growth initiatives. In the digital era of business, often a firm can only grow as quickly as its technology will allow.

It is in these business-critical, multi-cloud Linux environments that Oracle and Oracle Linux shine. With advanced security performance optimizations, Oracle Linux effectively and efficiently supports demands while reducing business risk. And with the ability to accelerate new application deployment, automated live patching, and proactive issue resolution, Oracle eliminates unnecessary administrator burden, freeing up resources for high-value activities. With these capabilities, Oracle Linux needs to be a part of any enterprise business-critical application environment.

## Research Methodology and Parameters

This study—fielded between October 30, 2020 and November 16, 2020—covered IT administrators, security administrators, database administrators, and developers who have influence over their organization's data center infrastructure, cloud, server virtualization, cybersecurity, or enterprise application environment purchasing decisions. All respondents in the study work for enterprise organizations of 1,000 employees or more and are knowledgeable about their organization's business-critical applications.

After applying data quality control best practices and screening the remaining completed responses (on several criteria) for data integrity, a final sample of 300 respondents remained. All respondents were provided an incentive to complete the survey in the form of cash awards and/or cash equivalents.

The following figures detail the respondent base's demographics and firmographics (descriptive attributes of their organizations). Please note that totals in figures and tables throughout this report may not add up to 100% due to rounding.

### Respondent Demographics

The research encompassed 300 IT decision makers in enterprise organizations in the U.S. and Canada (see Figures 10 through 12).
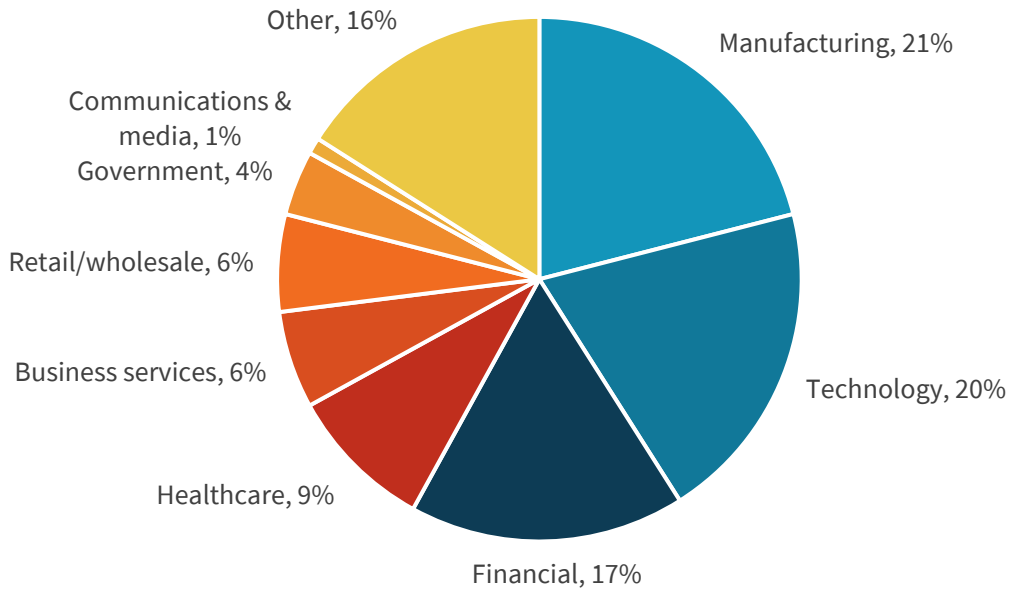
Figure 10.

**How many total employees does your company have worldwide? (Percent of respondents, N=300)**



20,000 or more, 10%
10,000 to 19,999, 12%
1,000 to 2,499, 24%
5,000 to 9,999, 23%
2,500 to 4,999, 31%
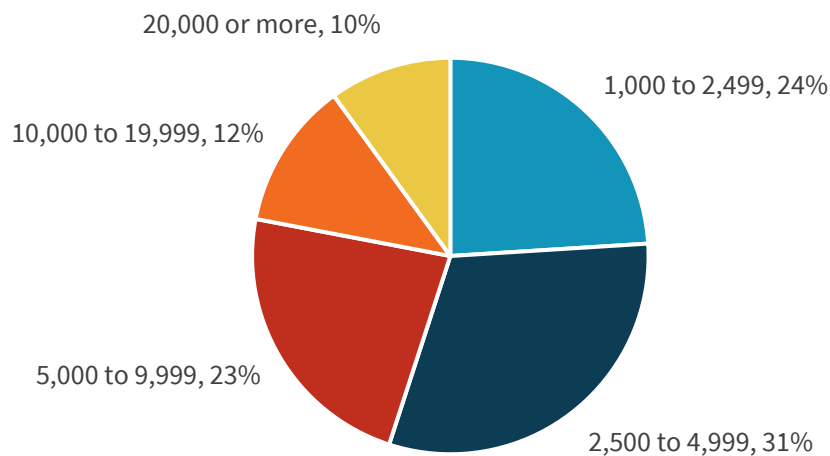
*Source: Enterprise Strategy Group*
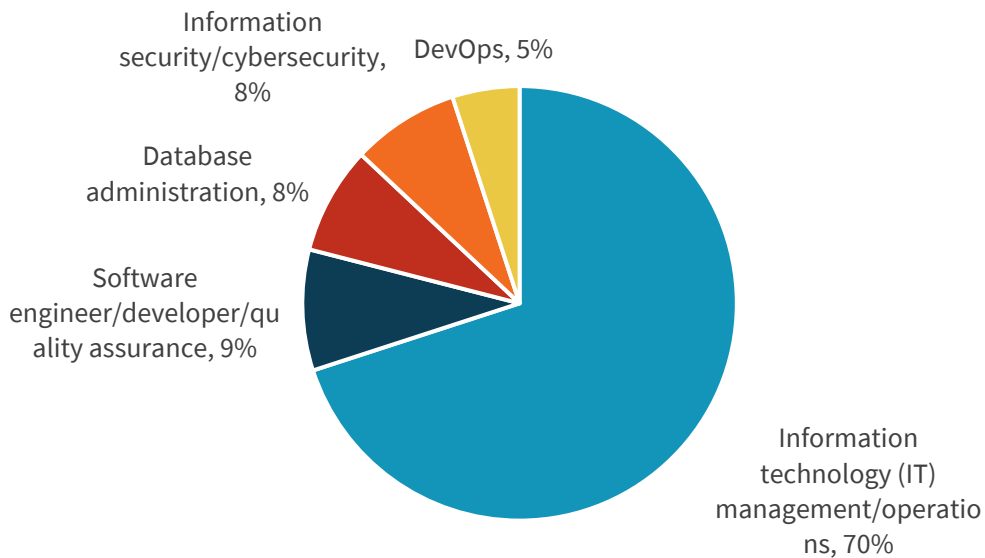
**Figure 11.**

### What is your company's primary industry? (Percent of respondents, N=300)



*Source: Enterprise Strategy Group*

**Figure 12.**

### Which of the following best describes your current job function? (Percent of respondents, N=300)



*Source: Enterprise Strategy Group*

**Enterprise Strategy Group** is an IT analyst, research, validation, and strategy firm that provides market intelligence and actionable insight to the global IT community.

www.esg-global.com          contact@esg-global.com          508.482.0188