

Peer Research

Insights on Client Computing in the Cloud

Intel's IT Manager Survey on Using Intelligent Clients in a Cloud Environment

Why You Should Read This Document

This report captures key findings from a survey of 200 IT professionals that can help you understand how your peers are approaching client computing in a cloud environment. The report provides benchmarking data that you can use in your own client computing initiatives, including:

- Understanding the range of cloud models in use, including private, hybrid, and public models
- Capturing concerns related to security, performance, manageability, and user experience—and discovering plans to address these concerns
- Understanding current perspectives and concerns about moving applications to the public cloud
- Identifying the appeal of client-awareness capabilities in the cloud

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About This Report

Although cloud computing is no longer a new concept, many IT organizations are still carefully evaluating cloud implementation models. The transition to cloud computing brings a range of security concerns, as well as questions about performance and preserving the user experience. Because the type of clients deployed in a cloud environment can have a significant impact on these issues, we wanted to find out how IT professionals are moving forward with client computing in the cloud.

This survey targeted 200 IT professionals¹ to:

- Understand the range of cloud models in use, including private, hybrid, and public.
- Capture concerns related to security, performance, manageability, and user experience—and discover plans to address these concerns.
- Understand the current perspective on moving applications to the public cloud.
- Identify the appeal of client-awareness capabilities in the cloud.

The aim of this report is to provide benchmarking data you can use in your own client computing initiatives for the cloud.

The goal of this report is to provide benchmarking data about how your peers are approaching client computing in a cloud environment to aid in your own IT planning efforts. For more information about planning a client computing project, or to get advice from colleagues who have already implemented one, visit intel.com/ITCenter.

¹ Survey respondents are IT professionals in organizations of 100 to 1,000-plus employees across a variety of industries. See the Appendix for more information.

Executive Summary

As cloud services and applications continue to evolve, it's important to look at the critical role of clients in a cloud environment. By incorporating the use of intelligent clients into any cloud deployment strategy, IT professionals can better address issues like security, performance, manageability, and user experience—and help ensure the success of cloud initiatives.

This research captures the current landscape of client computing in the cloud from the perspective of 200 IT professionals. Among this group, the individuals surveyed are either already working in the cloud, in the process of implementing cloud computing initiatives, or currently evaluating or planning to evaluate cloud computing initiatives.

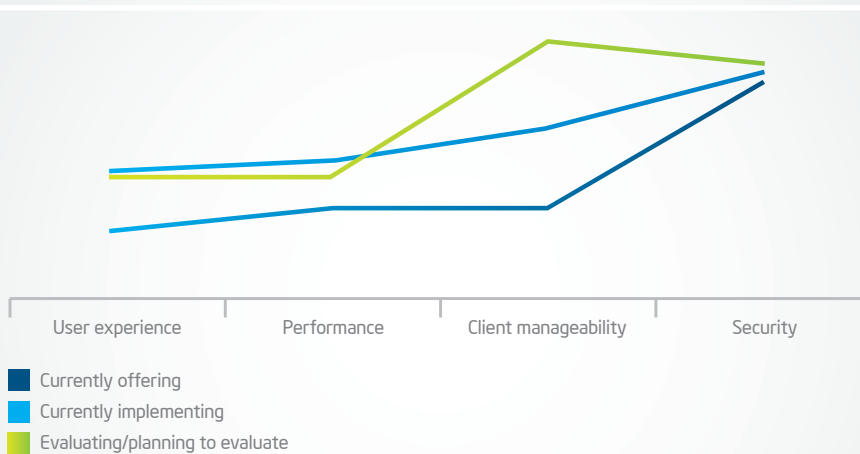
The survey results revealed that the primary concerns of IT professionals vary depending on their cloud computing experience. For example:

- User experience, performance, and client manageability issues in the cloud are of greater concern to those still evaluating cloud computing initiatives, as compared to those already working in the cloud.
- Respondents all rate security as a key concern. This is topped only by concerns about client manageability, which are unique to those still in the planning and evaluation phase.

Key Finding:

Top cloud computing concerns among IT professionals vary based on where they are in evaluating or deploying their own cloud initiatives.

Concern Ratings by Cloud Status (n=200)



Security Concerns Lead the Way

We asked the IT professionals surveyed to rate their level of concern on specific issues: security, user experience, performance, and manageability. The results revealed consistently that those who have experience with cloud computing have less overall concern about each issue. However, security issues in the cloud generate the greatest apprehension among *all* IT professionals—regardless of cloud experience.

- **Data protection is critical.** Maintaining data privacy is the top security issue for IT professionals. Of greatest concern is the ability to maintain security for virtual applications and endpoint devices, such as mobile PCs.
- **Security breaches are the biggest concern for information management.** When asked about information management, 82 percent of IT professionals are concerned about security, with information breaches and hackers at the top of the list.
- **User experience is not a primary concern for most.** Although more than half of IT professionals identify user experience and user acceptance as important to the success of their cloud initiatives, few are very concerned about the impact of performance issues on user experience. Of those that do express concern, data inaccessibility due to service interruptions tops the list of worries.

Other key findings from the survey include the following:

- **Private clouds are most common—at least for now.** More than half of IT professionals are currently working on private cloud initiatives, compared to a hybrid cloud model (24 percent) or a public cloud model (18 percent). However, that trajectory may change: Of those currently working in a private cloud model, many will consider moving to a hybrid cloud (46 percent) or a public cloud (36 percent) within the next 12 months.
- **The public cloud brings apprehension.** When asked about moving applications into the public cloud, more than half of IT professionals cite security concerns. Moreover, these concerns are enough to halt forward progress: One in five IT professionals is unwilling to move applications into the public cloud due to potential security and performance issues.
- **Authentication and encryption are top security measures.** To address security issues in the public cloud, the vast majority of IT professionals focus on two technologies: deploying authentication for cloud-based services and encrypting information being sent to and from the cloud.
- **Client awareness is significant.** A client-aware cloud model is one that leverages the capabilities of the client—such as performance, device security, and optimized user experience—and combines them with cloud attributes for an optimal, balanced compute model. This concept has wide appeal for IT professionals: Three in five consider it very appealing, while 57 percent deem it a key consideration once cloud initiatives are operational.

Deployment Models: Private Clouds Lead the Way

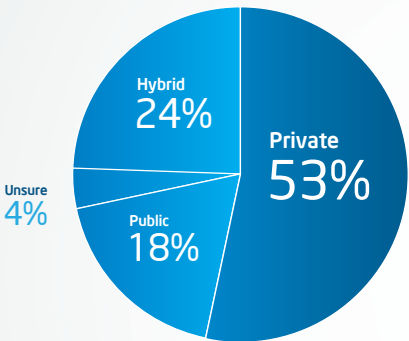
We began by asking IT professionals about which cloud deployment model they are using or most likely to use, including private, public, and hybrid cloud models. Not surprisingly, more than half are using a private cloud model.

Notably, there seems to be a growing interest in hybrid and public cloud models among those currently using or planning to deploy a private cloud model. Within the next 12 months, 46 percent will strongly consider using a hybrid model, and 36 percent will consider a public cloud model.

Key Finding:

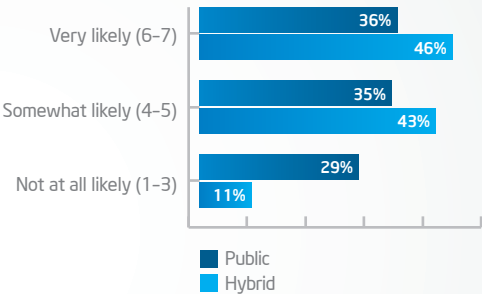
Private clouds continue to dominate as the preferred cloud model—but that may change.

Cloud Deployment Preference (n=200)



Q: Which of the following cloud deployment models is your organization currently using or most likely to use?

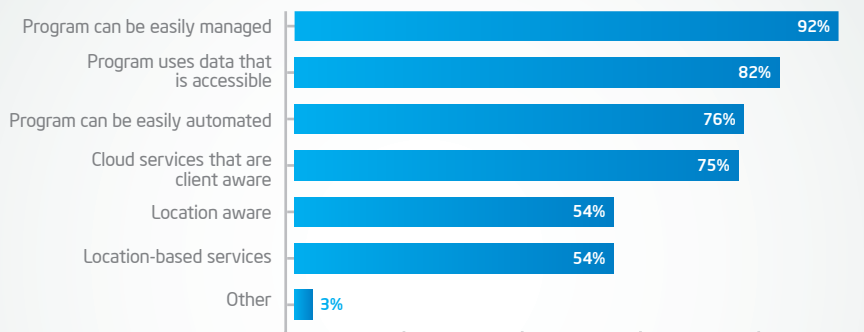
Likelihood to Consider Public/Hybrid Cloud (n=114)



Q: How likely are you to consider the following cloud deployment models in the next 12 months?

Regardless of cloud model preference, IT professionals have very clear priorities for functionality. When asked to look ahead to future cloud implementations, a vast majority are looking for an implementation approach that can be easily managed, uses accessible data, and can be easily automated.

Future Cloud Implementation Priorities (n=200)



Q: Which of the following will be taken into consideration when considering future cloud implementations?

Client-Aware Cloud Architectures

Today, IT departments must support and secure a range of clients for mobile users who have high expectations for performance. For IT to meet these challenges effectively, cloud architectures need to consider the capabilities of the client—in other words, the cloud must become “client aware.”

When a cloud is client aware, solutions delivered over the cloud can make real-time decisions about how to execute a task optimally based on the capabilities of the client. This improves application delivery and provides greater flexibility for IT, while at the same time providing a better experience for users.

Ranking the importance of client awareness in future cloud models garnered a strong response, with 75 percent of IT professionals indicating that it is important to have client-aware cloud services. Interestingly, client-aware cloud services are more important to organizations using or planning to use a public cloud (92 percent) or a hybrid cloud (84 percent) compared to those currently using a private cloud (67 percent).

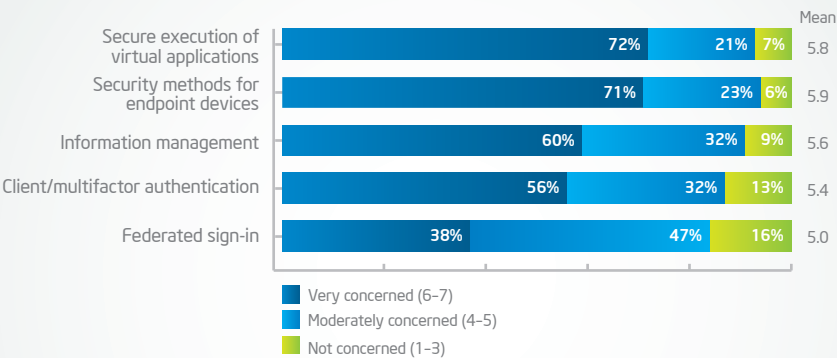
Rating Security, Performance, Manageability, and User Experience

When considering the top issues related to client computing in the cloud—security, performance, manageability, and user experience—the primary concerns of IT professionals vary based on their experience with cloud initiatives. For example, those currently working on cloud initiatives are less concerned about user experience and manageability than those still in the process of planning and evaluating cloud initiatives.

Security Reigns Supreme

Not surprisingly, security concerns are top of mind for IT professionals. The majority expressed concern for nearly every security challenge presented, with securing virtual applications leading the list of concerns, followed closely by securing endpoint devices.

Level of Concern for Cloud Computing Security Issues (n=200)



Q: How concerned are you about each of the following security issues related to client computing in the cloud?

Across the board, IT professionals expressed concern about privacy issues and the threat of hackers, with a slight variance in the category of information management, where data and security breaches rose as the top issue.

The following sections outline the specific security concerns for each category, including:

- Client/multifactor authentication and federated sign-in
- Secure execution of virtual applications
- Security methods for endpoint devices
- Information management

“Breach of security of accessed data would be one of our greatest concerns.”

Client/Multifactor Authentication and Federated Sign-In

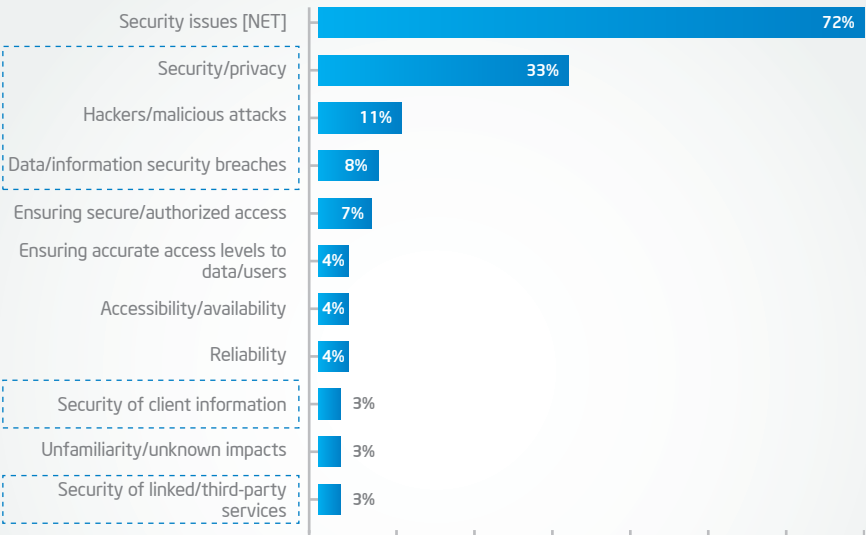
Authentication can become a significant issue in a public or hybrid cloud environment when IT organizations need to ensure that only trusted users and devices can access corporate data and services hosted outside their own four walls.

With the increasing number of mobile workers in today's business environment, combined with a growing risk of malware and screen-scraping techniques, two-factor authentication is critical to protecting passwords and data. Concerns also exist about data access using federated sign-in, by which users can access a multitude of data through Google, Facebook, or another single account.

The large majority of IT professionals cite security issues as their primary concern regarding authentication and federated sign-in, with privacy and the threat of hackers at the top of the list.

"Tamper-proof federated sign-in provides increased security and decreases risk."

Client/Multifactor Authentication and Federated Sign-In Concerns (n=180)



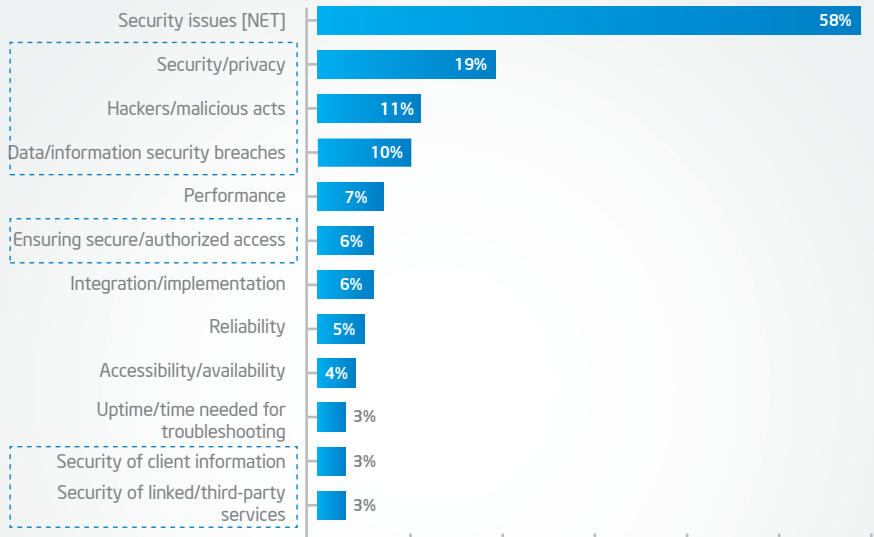
Q: What, specifically, is your biggest concern regarding client/multifactor authentication and/or federated sign-in?

Secure Execution of Virtual Applications

In a cloud computing environment, IT departments must ensure that virtualized applications running on the client can execute in a secure and protected environment. In addition to security, performance and power issues can also arise as issues with virtual applications. Despite these risks, this category generated the least amount of security concern (58 percent) as compared to the others.

“Loss of control of perceived sensitive data is the biggest concern regarding secure execution of virtual applications.”

Concerns about Execution of Virtual Applications (n=187)



Q: What, specifically, is your biggest concern regarding secure execution of virtual applications?

Unlike the other categories, performance was specifically noted as a concern for virtual applications. Although the percentage of IT professionals citing it was very small (7 percent), there is some concern about application failure.

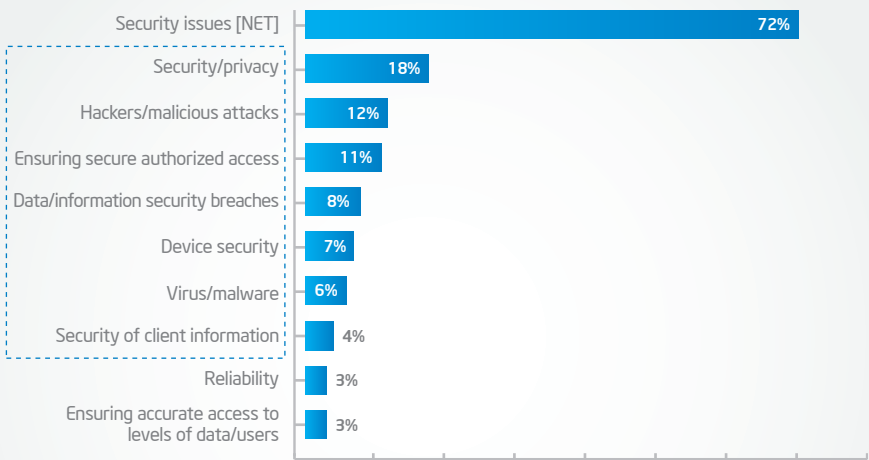
Security Methods for Endpoint Devices

Despite significant advances in security for endpoint devices such as mobile PCs, a sophisticated new threat landscape is bringing more potential for complex security breaches—and putting these devices at even greater risk.

IT professionals are well aware of this risk, with 72 percent worried about security issues. The top specific concern was privacy (18 percent), followed by the threat of hackers (12 percent).

“Endpoints are a major vector for cyberattacks and must withstand relentless assaults from cybercriminals.”

Endpoint Device Security Concerns (n=188)



Q: What, specifically, is your biggest concern regarding security methods for endpoint devices?

Interestingly, IT professionals ranked this on par with security issues regarding authentication, which is also at 72 percent.

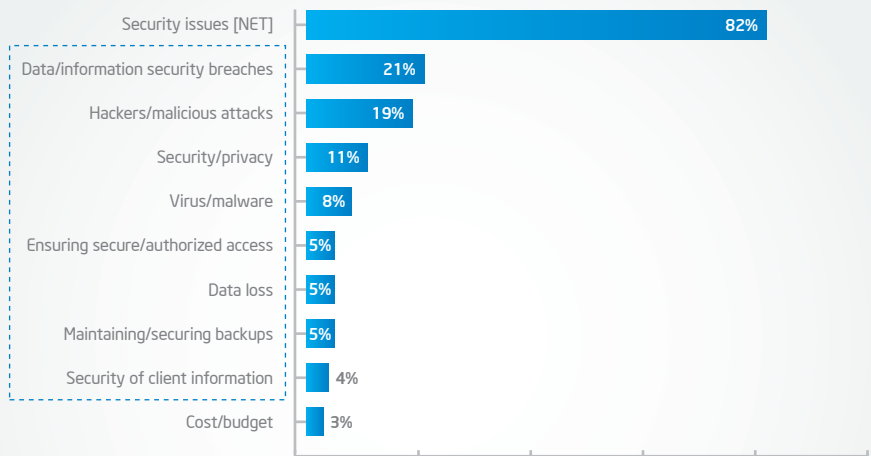
Information Management Security

Protecting sensitive company data and maintaining the integrity of confidential information are at the top of the list of IT security challenges for organizations worldwide. With the growing number of mobile PCs in a cloud-driven computing environment, the risk of data breach and loss is amplified.

The survey results support this fully: 82 percent of IT professionals have security concerns about information management. At the top of the list is data and information security breaches (21 percent), with the threat of hackers following close behind (19 percent).

"We just want to make sure that the hackers do not get access to the information that we consider a premium to our business, and in turn, possibly cause harm to our way of life in our industry."

Information Management Concerns (n=183)

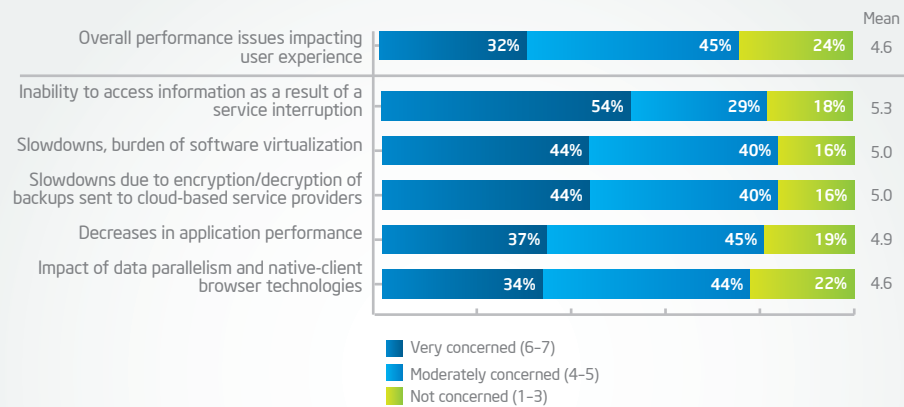


Q: What, specifically, is your biggest concern regarding information management, such as data security and protecting information from accidental or malicious acts?

Snapshot of Performance Concerns

Just 32 percent of IT professionals report being very concerned about performance issues impacting user experience as a result of moving to a cloud environment. However, when queried about specific performance-related issues, more than half expressed concern about the inability to access information due to a service interruption.

Performance Issue Concerns (n=200)



Q: How concerned are you about performance issues impacting the user experience as a result of moving to a cloud environment?

Q: More specifically, how concerned are you about each of the following performance issues impacting the user experience as a result of moving to a cloud environment?

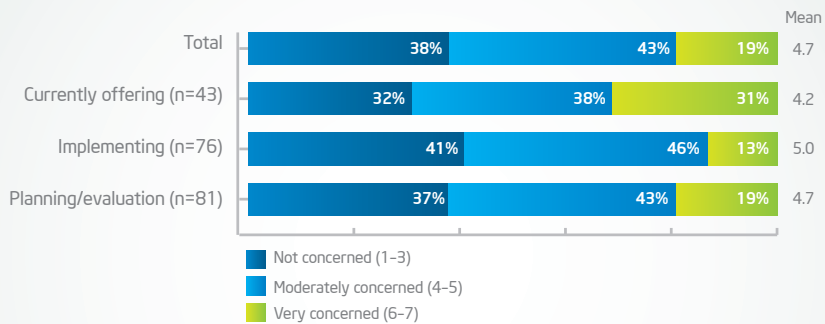
Manageability Issues

Concern about how current and future cloud implementations will affect client manageability varied, based on the IT professional's level of experience working in the cloud. When asked about managing images of operating systems, applications, and user profiles, the biggest concern emerged for those who are still in the process of implementing cloud computing (87 percent).

Key Finding:

A third of IT professionals currently working in the cloud are not concerned about managing images.

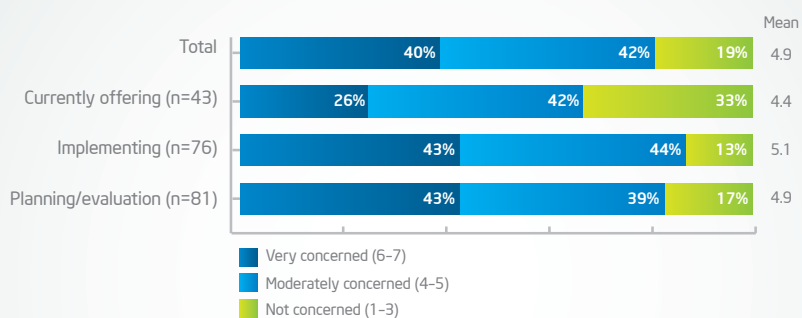
Managing Images of Operating Systems, Apps & User Profiles (n=200)



Q: How concerned are you about how your organization's current/future cloud implementation will affect client manageability for managing images of operating systems, applications, and user profiles?

Organizations currently offering cloud computing are not as concerned about the impact to user experience when delivering service across different client devices, compared to those still in implementation or planning phases.

Delivery Methods & Impact on User Experience (n=200)



Q: How concerned are you about how your organization's current/future cloud implementation will affect client manageability for delivering across different client devices, and the implications of these delivery methods on user experience?

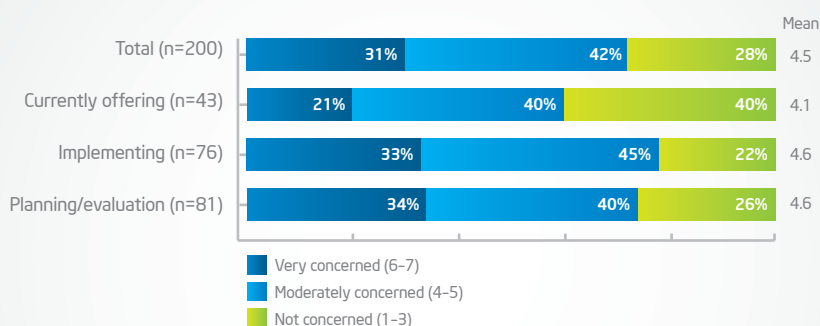
User Experience Concerns Vary with Experience

Surprisingly, only about a third of IT professionals are very concerned about how the user experience will change in the cloud. However, overall concern is greater among those still in the process of implementing, planning, or evaluating cloud initiatives.

Key Finding:

User experience is a concern to 75 percent of IT professionals moving to a public or hybrid cloud within a year.

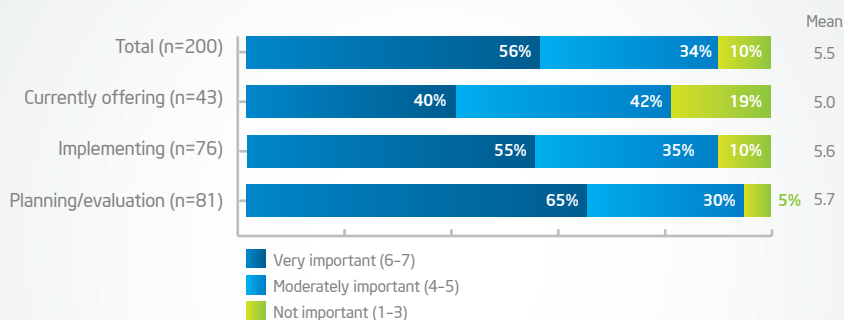
Concern about User Experience (n=200)



Q: How concerned are you, if at all, about how the user experience will change in a cloud environment?

More than half of IT professionals rate user experience and user adoption as very important to the success of their cloud projects. However, concerns seem to diminish as the IT professional's experience with cloud implementation grows.

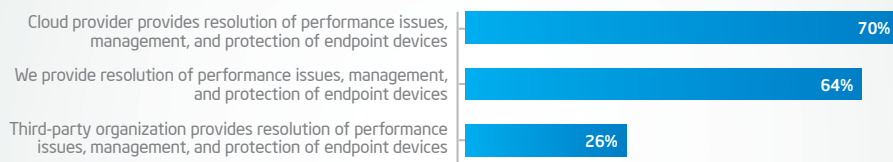
Importance of User Experience & Acceptance (n=200)



Q: How important is user experience and user acceptance to the success of your organization's cloud initiatives?

When cloud computing has a negative impact on user experience and resolution is needed, the majority of IT professionals look to the cloud provider for help. For issues with performance, management, and the protection of endpoint devices, 70 percent believe it is the responsibility of the cloud provider to deliver resolution.

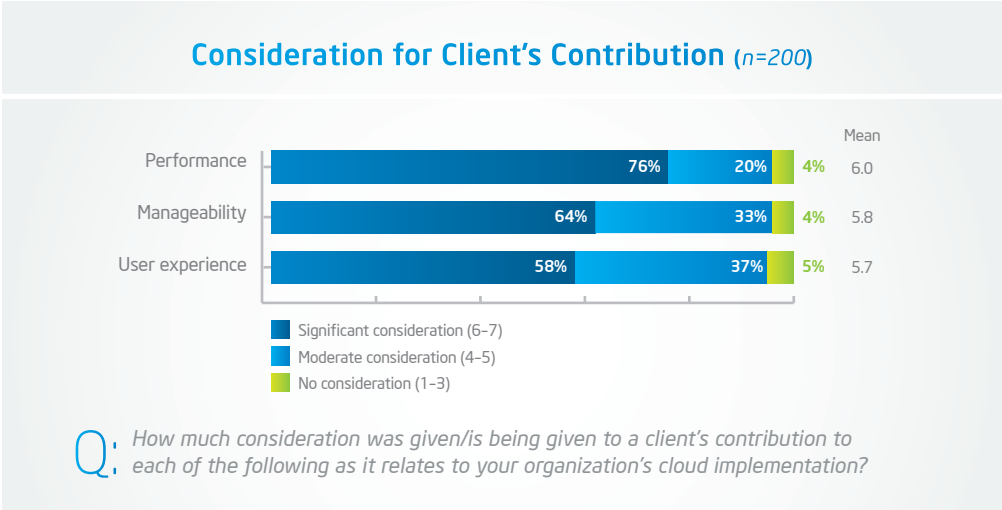
Enhancing User Experience (n=200)



Q: Which of the following strategies have you employed/will you employ to protect or enhance the user experience across clients, such as notebooks, tablets, and home PCs?

The Role of Clients

When IT professionals were asked to rate the level of consideration given to a client’s ability to contribute to performance, manageability, and user experience in a cloud implementation, performance was at the top of the list.



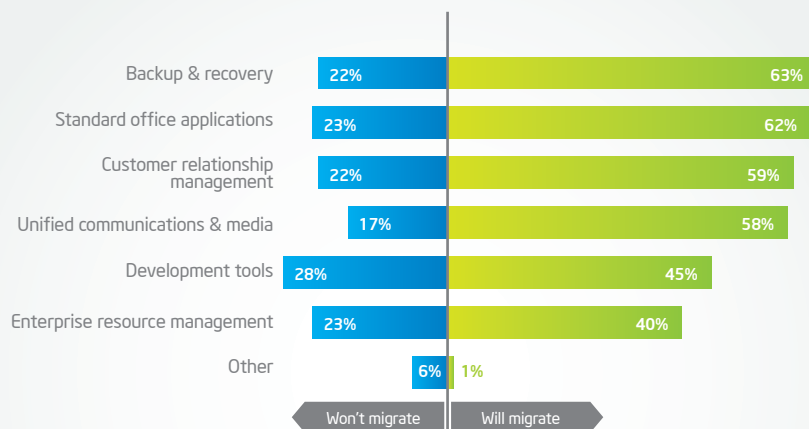
Moving Applications to the Public Cloud

Three aspects of moving applications to a public cloud were explored in this survey: the type of applications to be moved, the potential impact on performance, and concern about security issues. The top four application candidates for movement to a public cloud were backup and recovery, standard office applications, customer relationship management, and unified communications and media.

Key Finding:

One in five IT professionals will not move applications into a public cloud because of security and performance concerns.

Moving Applications to a Public Cloud (n=194)



Q: Which, if any, of the following applications does your organization plan to move into a public cloud?

Q: Which, if any, applications or services will you not move into a public cloud due to concerns over performance or security?

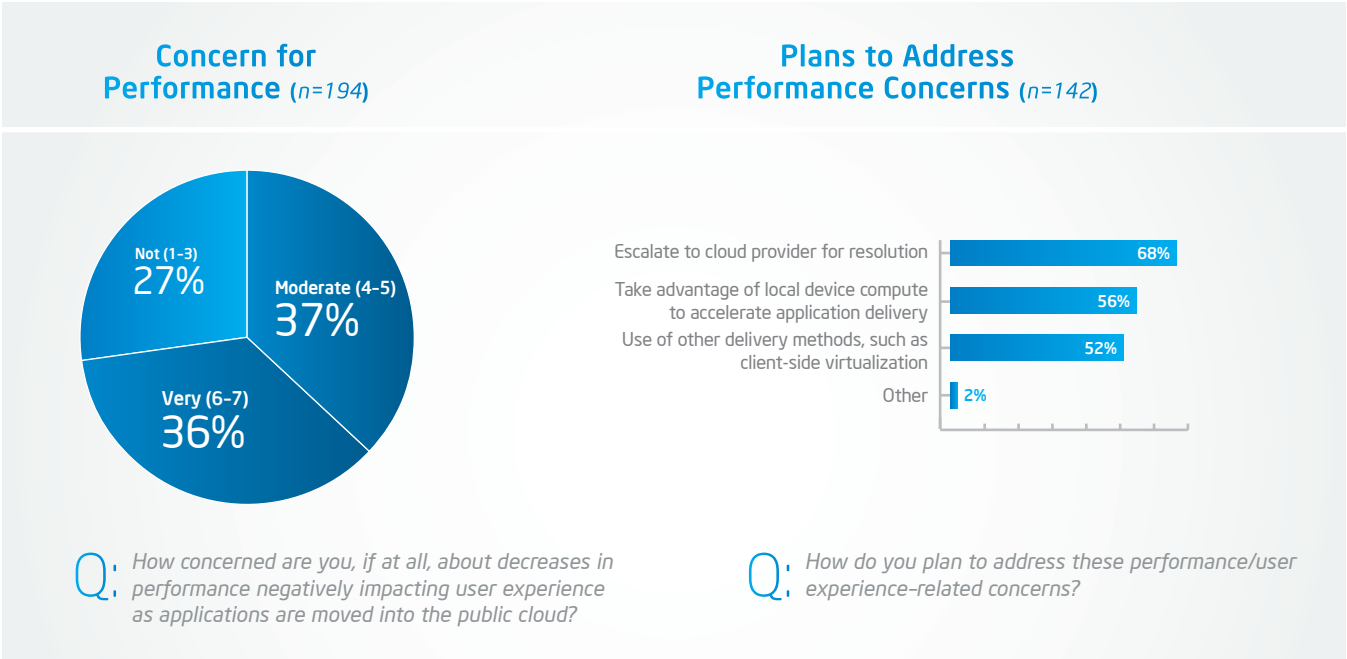
Not surprisingly, standard office applications are more likely to be moved into a public cloud by organizations with half or more of their servers virtualized than those without (71 percent versus 53 percent).

For many IT professionals, however, moving applications to the public cloud is simply too risky. One in five IT professionals will *not* move applications into a public cloud due to concerns about security and performance.

Performance Concerns

Moving applications into a public cloud environment can often compromise the user experience. In a shared cloud, a sudden spike in demand from one set of users may require additional resources, therefore inhibiting the performance of certain applications for other users.

The survey results reflected that risk, with nearly three-quarters of IT professionals expressing concerns about decreased performance having a negative impact on user experience.



If performance issues were to arise, 68 percent would escalate to the cloud provider for resolution. In addition, more than half would leverage local device compute capabilities to accelerate application delivery, or implement alternative delivery methods, such as client-side virtualization.

Security Remains Top of Mind

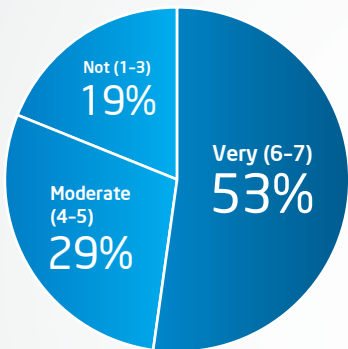
Maintaining security in a public cloud is a primary concern of IT professionals, with 82 percent responding that they are very concerned or moderately concerned about security.

When asked about solutions to address these security concerns, authentication and encryption were the clear front-runners. Seventy-nine percent of IT professionals plan to deploy authentication for cloud services, and 77 percent plan to protect data using encryption.

Key Finding:

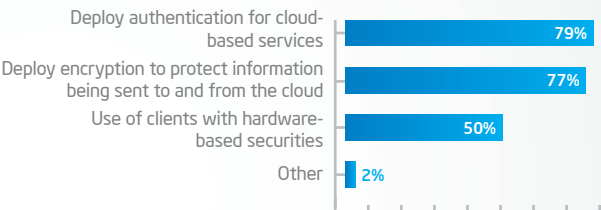
Security is the leading concern in moving applications to the public cloud.

Security Concern
(n=194)



Q: How concerned are you about security as the applications are moved into the cloud?

Plans to Address Security Concerns (n=159)



Q: How do you plan to address these security concerns?

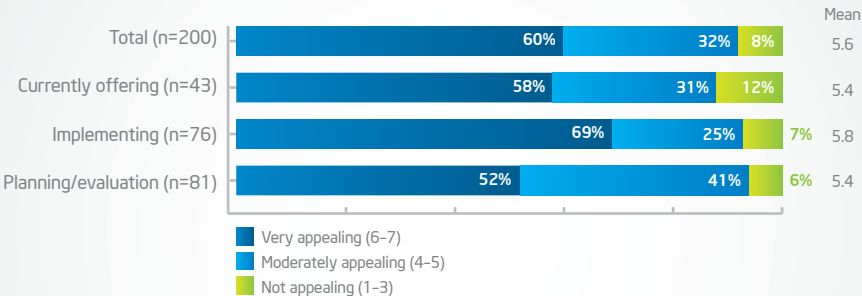
Embracing the Client-Aware Cloud

With a client-aware cloud infrastructure in place, IT organizations can achieve a balanced compute model that capitalizes on the capabilities of the client and the cloud. When introduced to the concept of a client-aware cloud, 92 percent found it very appealing or moderately appealing.

Key Finding:

Data encryption was identified as having the highest appeal when considering a client-aware cloud.

Client-Awareness Appeal (n=200)



Q: How appealing is the concept of a client-aware cloud?

Of those who identified a client-aware cloud as very appealing, encryption of data, client contribution to performance, and the cloud provider's ability to resolve performance and management issues and protect endpoint devices were key considerations.

What Is a Client-Aware Cloud?

Cloud attributes (such as device and location, connectivity awareness, optimized application delivery, and greater flexibility) combined with client capabilities (such as performance, device security, and an optimal user experience) deliver the best of both worlds. By leveraging the attributes of both cloud and client, IT can optimize security, manageability, and user experience in a client-aware cloud environment.

Client-Awareness Considerations

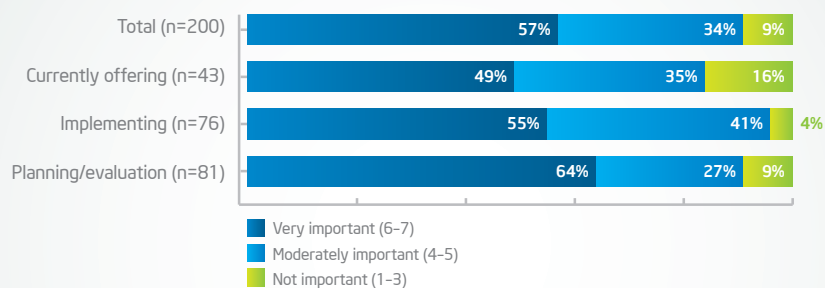
	Very appealing (n=119)	< Very appealing (n=81)
Deploying encryption to protect information being sent to and from the cloud	85 percent	66 percent
Giving significant consideration to client's contribution to performance	83 percent	64 percent
Reliant upon cloud provider to provide resolution of performance issues, management and protection of endpoint devices	81 percent	56 percent
Giving significant consideration to client's contribution to manageability	74 percent	49 percent
Rating user experience and user acceptance very important	71 percent	35 percent
Giving significant consideration to client's contribution to user experience	68 percent	45 percent
Moving unified communications into a public cloud	65 percent	47 percent
Very concerned about the inability to access information as a result of a service interruption	60 percent	46 percent
Very likely to consider hybrid cloud models in the next year	57 percent	31 percent
Moving media development tools into a public cloud	51 percent	35 percent
In an organization with between 25 and 249 virtual servers	51 percent	37 percent
Rating client-aware services very important	50 percent	35 percent
Very concerned about slowdowns due to encryption of backups impacting user experience	50 percent	35 percent
Very likely to consider public cloud models in the next year	46 percent	22 percent
Currently implementing cloud services/computing	44 percent	30 percent
Very concerned about managing images of operating system, applications, and user profiles	43 percent	29 percent

Table 1. Considerations of IT professionals who rate a client-aware cloud as very appealing

Client-Aware Applications

Nearly all IT professionals deemed client awareness an important criterion when selecting applications for their organization, with three in five considering it very important.

Importance of Client Awareness (n=200)



Q: When considering criteria for selecting applications for your organization, how important was/will be client awareness once your cloud initiatives were/are operational?

Conclusion

The landscape of client computing in the cloud is constantly evolving. And while cloud computing is no longer a new concept, many IT professionals are cautious—especially in the public cloud—because of concerns about security and potential data loss. Many who are still in the planning phase of their cloud initiatives have even greater concerns about issues such as performance, manageability, and user experience. These concerns seem to lessen as IT professionals gain experience working with cloud deployments.

By incorporating the use of intelligent clients into cloud computing, IT professionals can effectively balance the demands between the client and the cloud—and address some of these concerns.

For additional information from Intel on client computing in the cloud, see the following resources.

Additional Resources

Planning Guide: Client Computing in the Cloud

Find out more about the essential role of intelligent clients in a cloud environment. This planning guide discusses how intelligent endpoint devices can enhance security, improve performance, and optimize the user experience.

intel.com/content/dam/www/public/us/en/swf/pdfview/it-center/client-computing-cloud/planning-guide/appli.htm

Client Computing: The Next Step toward a Better Cloud

The Intel® IT Center's dedicated site of IT manager resources for client computing in the cloud. Find out how you can improve cloud performance and manageability with intelligent clients.

intel.com/itcenter/cloud/client.htm

Benefits of a Client-Aware Cloud

This white paper captures Intel's Cloud 2015 Vision, which represents an end-to-end model for cloud architecture, including both the data center and a broad range of endpoint client devices.

intel.com/Assets/PDF/general/client_aware.pdf

Cloud Computing Technology (Intel Cloud 2015 Vision)

Intel's dedicated site for cloud computing technology, which includes the Intel Cloud 2015 Vision video.

intel.com/itcenter/topics/cloud/

Cloud Computing: How Client Devices Affect the User Experience

Intel IT, in partnership with the Intel Architecture Group's End-User Platform Integration team, conducted testing and analysis to compare the user experience with different client devices when accessing a range of cloud-based applications.

<http://download.intel.com/it/pdf/Cloud-Computing-How-Client-Devices-Affect-User-Experience.pdf>

Enabling Emerging Enterprise Usages with Client-Aware Technologies

Intel IT is working toward a goal of giving employees seamless and secure access to both corporate and personal services, applications, and data on a wide range of devices. To reach this goal, we are building an enterprise private cloud with client-aware capabilities that can detect device type, capabilities, and other attributes. In parallel, we are also investigating emerging enterprise usages and creating solutions based on Intelligent Desktop Virtualization and client-aware web services delivered through the cloud.

<http://communities.intel.com/docs/DOC-19282>

Applying Client-Aware Technologies for Desktop Virtualization and Cloud Services

As Intel IT develops the private cloud, we are also looking at client-aware technologies that take advantage of endpoint device capabilities. While consumerization is increasing the device choices available to our employees, we believe there will be no best one-size-fits-all approach to delivering services from the cloud. Instead, we envision a private cloud that can recognize and determine the device attributes and user preferences, and deliver the service or information accordingly.

<http://communities.intel.com/docs/DOC-18856>

Appendix: Methodology and Audience

Responses to this survey were gathered via an online questionnaire; 200 responses were received between November 1, 2011, and November 13, 2011. A sample size of 200 has a maximum sampling variability of ± 6.9 percent at the 95 percent confidence level.

Respondents were screened to ensure that they meet the following criteria:

- Work in a company of 100 or more employees
- Perform a wide range of IT-related job functions
- Have deployed, are currently deploying, or are evaluating or planning to evaluate cloud computing
- Are involved in decision making processes and strategic planning for clients in their organization

Being an Intel customer was not a consideration for inclusion in the survey. Quotas for company size and industry were enforced to ensure a representative sample.

Respondent Profile Data

Annual Revenue (n=200)

Less than \$500,000	3 percent
\$500,000-\$0.9M	6 percent
\$1M-\$3.9M	9 percent
\$4M-\$9.9M	13 percent
\$10M-\$49.9M	24 percent
\$50M-\$99.9M	17 percent
\$100M or more	24 percent
Unsure	6 percent

Industry (n=200)

Manufacturing	15 percent
Professional services	15 percent
Financial services	12 percent
Retail	12 percent
Healthcare	8 percent
Computer-related business or service	6 percent
Education	6 percent
Transportation & logistics	4 percent
Government	4 percent
Wholesale & distribution	4 percent
Construction	4 percent
Media & entertainment	3 percent
Telecommunications	2 percent
Utilities	2 percent
Others (1 percent or less)	3 percent

Company Size (n=200)

100-499 employees	34 percent
500-999 employees	26 percent
1,000+ employees	40 percent

Worldwide Locations (n=200)

1 location	14 percent
2-4 locations	20 percent
5-9 locations	26 percent
10-14 locations	20 percent
15-19 locations	20 percent
Unsure	2 percent

Virtual Servers (n=200)

Less than 25	22 percent
25-249	46 percent
250-499	20 percent
500-999	4 percent
1,000+	7 percent
Unsure	2 percent

Percentage of Servers Virtualized (n=200)

Less than 25 percent	12 percent
25 percent to 49 percent	26 percent
50 percent to 74 percent	28 percent
75 percent or more	24 percent
Unsure	11 percent

Job Role (n=200)

IT manager	24 percent
IT director	22 percent
Manager of IT operations	9 percent
Owner/president	9 percent
Senior IT manager	8 percent
Office manager	8 percent
Chief technology officer	7 percent
CIO	6 percent
Vice president of IT	6 percent

Reports To: (multiple mention) (n=200)

CIO	36 percent
Vice president of IT	36 percent
Chief technology officer	26 percent
CEO	4 percent
Owner/president	2 percent
Other	4 percent
None of the above	13 percent

Responsibilities (multiple mention) (n=200)

Participating in strategic technology planning	97 percent
Working with most senior IT management to set the strategic IT direction for the company	84 percent
Vendor selection for key components of cloud technology	90 percent
Planning, implementation, maintenance of cloud technology	94 percent
Leading a team of IT specialists to support business initiatives	86 percent
Hands-on implementation responsibilities	79 percent

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