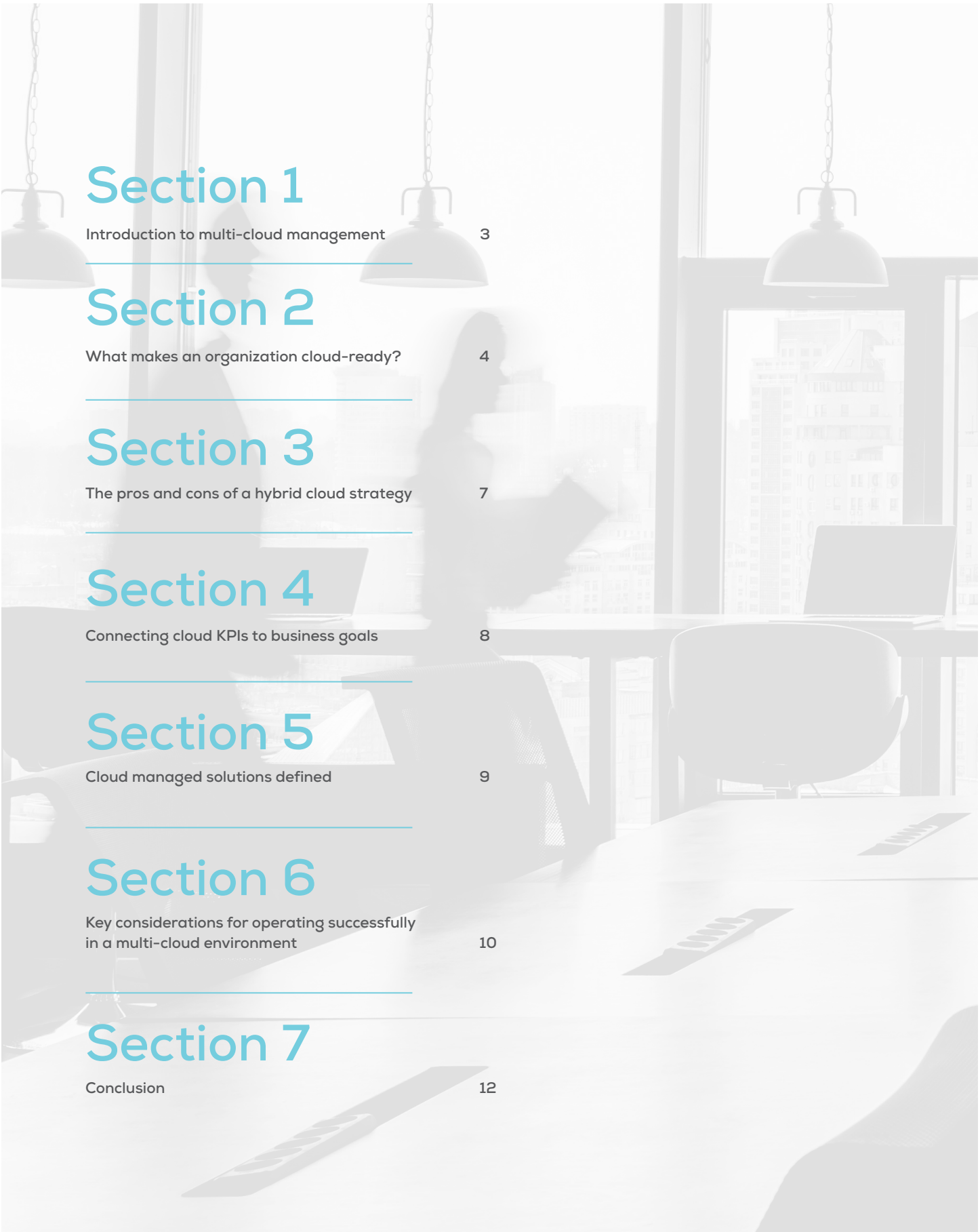
MULTI-CLOUD MANAGEMENT
WHITE PAPER

THE DEFINITIVE GUIDE TO MULTI-CLOUD MANAGEMENT

DECODING "THE CLOUD"



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SECTION 1

INTRODUCTION TO MULTI-CLOUD MANAGEMENT

The concept of "The Cloud" and its many forms and use cases can be nebulous—and executives may wonder if it lives up to the hype. This white paper will decode how and why a multi-cloud strategy—several clouds being used in tandem by one organization—can transform business operations and, ultimately, benefit the bottom line.

THE VALUE OF THE CLOUD

According to RightScale's 2018 State of the Cloud Report, 81% of enterprises have some form of multi-cloud strategy in place. On average, large businesses are running applications on about five different clouds.

Multi-cloud implementation and management is unique to every organization, but there are themes and best practices that extend across industry sectors. One common denominator is the need to evaluate existing cloud infrastructure to ensure it integrates well with other platforms and can scale to meet future needs.

Developing a cloud strategy that aligns with a company's unique situation takes time. One core value proposition of Cloud Managed Solutions is that it enables a company's IT personnel to focus on driving strategic, revenue generating initiatives. Given the IT skills shortage organizations are facing, outsourcing to a managed services provider like Frontier means easier and lower-cost implementation of computing resources, 24/7 support and, ultimately, a measurable return on investment

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SECTION 2

WHAT MAKES AN ORGANIZATION CLOUD-READY?

To determine if your organization is cloud-ready, it's important to first understand the basics of cloud computing—and the various formats that are most common.

The term "cloud computing" refers to the use of remote networks for servers, storage, databases and software applications. Organizations of all sizes can benefit from cloud services. Using the cloud enables a company to lower its operating costs by replacing on-site hardware and software with online infrastructure. Companies only pay for the storage and bandwidth they need, and workloads can be optimized for cost and performance.

What's more, cloud systems can support integrations with emerging technologies that may fuel further innovation. They can be customized by integrating artificial intelligence (AI) algorithms, machine learning (ML) capabilities and Internet of Things (IoT) connectivity.

The use of multi-cloud environments means better performance from a pool of secure servers that are regularly updated and maintained. Companies trade high-overhead internal infrastructure for faster, more reliable remote services in the cloud. What's more, redundant cloud networks ensure business continuity in the event of a disaster or system outage.

USE CASE: ACCELERATING INNOVATION

Big companies with significant resources are finding that AI development platforms facilitated by the cloud can accelerate innovation. Samsung Heavy Industries, for instance, is using the public cloud to develop autonomous cargo vessels and the services needed to manage them. Software companies are also integrating AI capabilities into cloud-based enterprise solutions: Salesforce has integrated an AI-enabled business intelligence tool into the cloud, and SAP has done the same with its cloud-based Enterprise Resource Planning (ERP) system.

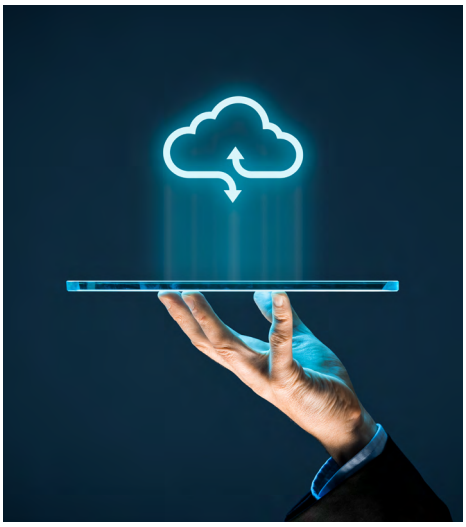
—Deloitte, "Artificial Intelligence: From Expert-Only to Everywhere"

PUBLIC, PRIVATE AND HYBRID CLOUDS

According to the RightScale report, 51% of enterprises with cloud solutions are using hybrid clouds, 21% use multiple public clouds and 10% rely on multiple private clouds. The remainder rely upon either a single private or a single public cloud—and a small percentage have no cloud plan in place.

"Frontier's Cloud Managed Solutions enable companies to outsource day-to-day operational tasks so their IT personnel can be redeployed to support strategic innovation. The bulk of Frontier's customers are using hybrid clouds—often combining both public and private clouds."

—Marcelo Oliveira, Vice President of Commercial New Products, Frontier Commmunications



PUBLIC CLOUDS

These are third-party solutions from vendors such as Amazon Web Services (AWS), Microsoft and Google. Public cloud vendors provide companies with remote access to shared servers and storage. The cloud provider manages everything from hardware and software updates to back-ups and infrastructure maintenance. Users can easily access public clouds via web browser.

PRIVATE CLOUDS

Private clouds are remote computing solutions used exclusively by a single enterprise. Some companies maintain private cloud servers in an on-site data center, while others contract with a third-party vendor to host a dedicated cloud solution. In-house private cloud infrastructure must be maintained much like a traditional network, while an outsourced solution will shift the responsibility for infrastructure maintenance to an outside partner.

HYBRID CLOUDS

As the name implies, hybrid clouds combine the use of public and private cloud solutions. Enterprises using hybrid clouds typically enable data and applications to be shared among various cloud servers. The hybrid approach can provide greater flexibility, control and security.

"A cloud-first strategy should extend beyond the purview of the IT organization. It must be understood and embraced by the whole organization. Thus, IT organizations must focus on more than just the technical steps required to implement a cloud-first strategy. They must evangelize the merits of cloud to business leaders to help them develop and extract business benefits that will yield a competitive edge and greater profitability."

– Smarter with Gartner "6 Steps for Planning a Cloud Strategy"

GETTING STRATEGIC

To begin determining if an organization is cloud-ready, conduct a strategic analysis. This should include an assessment of the internal IT functions that will need to be outsourced, a roadmap for how legacy business applications will integrate with the cloud, and insights into how the new system will facilitate agility and innovation. It's also important to align stakeholder interests with business objectives and specific solutions.

A strategic audit should include a cloud migration strategy that is supported by a clear cost-benefit analysis. It's also important to carefully consider compliance and security requirements. These are the minimum requirements that will need to be met by one or more public or private cloud solution providers.

Another important requirement for optimizing a cloud-based solution: Ensure it's connected to a local network that supports user access to cloud-based servers and applications. An integrated network must be capable of seamlessly connecting devices between the local environment and the cloud.

Once your company is ready to migrate to the cloud, it must ensure its in-house IT experts have the experience to effectively work with the cloud provider. They'll be in charge of working collaboratively to handle the migration and ensure optimal ongoing connectivity.

"Frontier has developed well-established standards for auditing everything from migration costs to security processes. Our priority is to give every customer the peace of mind that their data center, cloud connections and cloud partners are following best practices when it comes to safeguarding their data and communications."

–Marcelo Oliveira, Vice President of Commercial New Products, Frontier Communications

SECTION 3

THE PROS AND CONS OF A HYBRID CLOUD STRATEGY

A hybrid cloud strategy enables an enterprise to partition workloads across a scalable mix of public and private cloud servers, as well as with dedicated on-site servers. According to the Cisco report "5 Imperative Must Haves for Your Cloud Strategy":

"Hybrid is resonating with customers as they balance the benefits of private and public cloud services to meet their unique business requirements. ... Organizations with a mature cloud strategy expect to be able to choose from multiple cloud providers based on location, policies and governance needs. Companies using a multi-cloud strategy are also more likely to practice DevOps, use micro-services architectures and containers—such as Docker—in their cloud architecture, and deploy cloud-based IoT applications."

Implementing a combination of public and private cloud solutions ensures greater uptime. For example, if an organization's IT infrastructure has an availability of 99% today and the cloud increases that to 99.98%, the company has gained 86 hours of productivity a year. Hybrid solutions also provide risk mitigation in the event one vendor experiences systems outages or malicious breaches of their network.

ACCESS TO THE BEST AVAILABLE TECHNOLOGY

Cloud service providers introduce hundreds of new features, functions and upgrades throughout the year. According to Deloitte's report "The Cloud Is Here: Embrace the Transition," a multi-cloud strategy gives enterprises access to the best available technology—such as automation, AI/ML and IoT integration.

Outsourcing infrastructure responsibilities enables companies to be more competitive by focusing less on operations and more on developing capabilities in areas such as AI and IoT. Cloud solution providers like Frontier offer 24/7 access to IT specialists who can handle the complexities of deployment and management. This reduces the burden on companies when it comes to hiring and retaining network engineers in-house.

The ability to deploy new computing resources will be particularly important as the new 5G wireless standard comes online over the next few years. Enterprises will need to think about bringing more computing resources to the edge of their networks to handle evolving data-processing demands and to facilitate the use of an increasing number of connected devices.

Looking ahead, the IBM report "Cloud at the Edge" notes that companies should consider implementing multi-access edge computing. This new solution combines cloud computing capabilities with an IT service environment at the edge of the network. The goal is to reduce network latency and congestion, as well as to facilitate better connectivity and app performance.

Another challenge is ensuring that multiple cloud solutions integrate with each other, as well as with a company's local network. Depending on the mix of systems and the volume of use, a multi-cloud solution may actually increase operating costs. In this sense, moving to the cloud can reduce capital costs related to in-house infrastructure, but increase operating expenses.

3 STEPS TO MANAGE THE COST OF MULTI-CLOUD INITIATIVES:

1. Deploy intuitive, self-service cloud management tools across all public and private cloud environments.
2. Look for platforms that include tagging resources, an insights dashboard that gives visibility into spend and use, and reporting capabilities.
3. Use scalable API-driven and SaaS platforms that enable users to adjust their use based on shifting projects, use cases and cloud combinations.

SECTION 4

CONNECTING CLOUD KPIS TO BUSINESS GOALS

Identifying and tracking key performance indicators (KPIs) is essential for determining how well various networks are performing within a multi-cloud environment.

"Accelerating technological innovation, intensifying competitive pressure and increasing customer expectations are forcing business leaders to rethink how they use KPIs to lead and manage the enterprise," according to the MIT Sloan Management Review report "Leading With Next-Generation Key Performance Indicators."

> **"There is no one-size-fits-all KPI list, so users must narrow the field of possibilities to find their most relevant technical and business parameters,"**
>
> –TechTarget

> **"The only KPIs for the success of moving to the cloud are how well it achieved your reason for moving to the cloud in the first place. Many companies make the mistake of only measuring hard cost savings associated with the cloud, which frequently leads to misaligned expectations during the implementation phase."**
>
> –CIO, **"20 Ways to Measure the Success of Your Growing Cloud Investment"**

AUTOMATED KPI DASHBOARDS

The ability for companies to create and design automated dashboards to help monitor KPIs is on the horizon. As the MIT report observes, rapid advances in machine learning (ML)—a computer's ability to learn and improve based on past performance—are poised to transform how executives use KPIs to monitor and facilitate growth.

The integration of predictive algorithms into business processes related to cloud networks promises to transform next-generation digital dashboards. "KPIs will consequently offer predictive and prescriptive indicators, not just rearview-mirror reviews," the MIT report predicts. "Data-driven companies that leverage these advances by re-conceiving their KPIs will enjoy distinct competitive advantages.

DEFINING ROI BENCHMARKS

Establishing benchmarks for multi-cloud performance requires each company to define its own targets for return on investment—this is a prerequisite for developing meaningful KPIs. While costs should be a consideration, they must be evaluated in the context of a company's overall strategy to meet performance goals.

Companies also need to go beyond operational cost analysis and measure the impact of a cloud strategy on customer experiences and, ultimately, overall revenue. That means understanding how a multi-cloud strategy is facilitating greater agility and responsiveness, as well as increasing a company's overall competitive ability in the marketplace.

There are a wide range of KPIs that an organization should consider monitoring in conjunction with a multi-cloud strategy.

MEASURING IMPACT

Measuring the impact of a cloud migration is essential. KPIs should naturally feed into service-level agreements (SLAs) an enterprise has with cloud providers. KPIs will also help define success or failure in the context of each SLA.

According to TechTarget, after migration, it's important to assess how the cloud is adding value to business operations. The four key metrics for monitoring user satisfaction and ROI are service reliability, operational costs, infrastructure costs and customer experience.

TECHTARGET RECOMMENDS TRACKING:

- Service KPIs
- Customer/User KPIs
- Cost KPIs
- Infrastructure KPIs

SECTION 5

CLOUD MANAGED SOLUTIONS DEFINED

Managed cloud solutions provide peace of mind when it comes to common IT pain points like security monitoring and platform support.

A multi-cloud strategy needs be supported 24/7 to ensure network uptime and access to mission-critical data and applications. Moreover, users must have secure, on-demand access to cloud-based information resources, from anywhere and at any time. So it's important to work with cloud providers who can support an organization's ability to deploy customized virtualization services.

Five types of virtualization services are widely used as part of integrated cloud technology stacks:

INFRASTRUCTURE AS A SERVICE

IaaS is the most familiar virtualization option. A company accesses IT infrastructure –such as servers, storage and operating systems–from a third-party provider on a pay-as-they-go basis.

PLATFORM AS A SERVICE

Companies use PaaS deployments for on-demand access to a network of servers and databases. These solutions are particularly well-suited for developing and deploying software applications.

SOFTWARE AS A SERVICE

One of the fastest-growing cloud solutions is SaaS, which provides on-demand access to software applications on a subscription basis. This enables enterprises to outsource software maintenance and upgrades to cloud providers in much the same way network infrastructure is outsourced.

SERVERLESS COMPUTING

Organizations often use serverless computing for development of app functionality. This gives the company flexibility to focus its resources on development while using only the cloud-based resources required to manage a specific function or project. Serverless computing is also elastic and easily scalable on demand.

BUSINESS CONTINUITY AS A SERVICE

Finally, BCaaS can help optimize system back-ups and ongoing monitoring of cloud instances. According to TechTarget, BCaaS solutions are particularly beneficial for businesses that lack in-house recovery infrastructure and resources. BCaaS is often part of an integrated multi-cloud strategy, because it's designed to facilitate continuity by moving mission-critical back-ups to recovery destinations in the cloud.

SECTION 6

KEY CONSIDERATIONS FOR OPERATING SUCCESSFULLY IN A MULTI-CLOUD ENVIRONMENT

Every enterprise will have different cloud requirements that need to be aligned with short- and long-term goals. As part of the planning process, it's essential to compare potential vendor costs, formulate budgets and determine what resources will be required to integrate a cloud solution with a company's IT infrastructure.

CLOUD CENTER OF EXCELLENCE

One method for defining and implementing a cloud-based strategy is to develop a cloud center of excellence. Milin Patel, co-founder of Rearc and former head of DevOps for Dow Jones, says using a cloud center of excellence helped Dow Jones optimize its cloud-first strategy.

"We figured we had to move away from infrastructure-driven projects with huge capital costs and slow delivery cycles to a nimble, software engineering-driven, cloud-first approach that would allow us to iterate quickly, without the fear of failure and financial risk," Patel says.

> **"The best strategy is a combination of solutions based on the required degrees of cross-platform consistency and platform-specific functionality. In all cases, organizations should prioritize the use of the cloud platform's native toolset, augmenting that where needed with third-party cloud management platforms, cloud management point tools, DIY solutions and outsourcing."**
>
> – Smarter with Gartner ,
> "6 Steps for Planning a Cloud Strategy"

Public cloud adoption was the most important part of the Dow Jones solution. As Patel notes, "It required us to experiment, fail fast and move on to the next experiment until we found the right answer. The cloud abstracted away the undifferentiated heavy lifting so that we could focus on our internal customers."

It's essential to compare potential vendor costs, formulate budgets and determine what resources will be required to integrate a cloud solution with a company's IT infrastructure.

BUILD CUSTOM, CLOUD-NATIVE APPLICATIONS

Companies might also consider developing customized and cloud-native applications. As the "What Is Cloud Computing" report by Microsoft notes, companies implementing a multi-cloud strategy must have the ability to quickly build, deploy and scale applications—such as web, mobile and API. They also need to take advantage of cloud-native technologies and approaches, such as containers, micro-services architecture, API-driven communication and DevOps.

SECURITY AND BACK-UP PROTOCOLS

The RightScale survey found that almost all of its 997 respondents identified security as a challenge, with 29% indicating that it posed "a significant challenge."

Security is a particularly pressing concern for companies implementing a cloud strategy for the first time. "For all the advantages of storing data in the cloud, it is equally important to understand and mitigate risks related to moving corporate data out of a carefully built and secure on premise environment," Deloitte warns.

The Deloitte report recommends taking proactive preventative measures, including the use of strong data encryption, continuous monitoring, and careful evaluation of each cloud provider's security and privacy operating models.

USE CASE: CENTRALIZED CLOUD SECURITY

A global investment bank implemented a consolidated, centrally managed cloud security and privacy solution. The move enabled the bank to offer secure business services to customers across the globe. It empowered them to serve a diverse client base more simply and cost-effectively.

–Deloitte, "The Cloud is Here: Embrace the Transition"

KEY TAKEAWAY

Implementing a strong back-up protocol, too, is essential for ensuring the integrity of a multi-cloud network. Enterprises have to protect their data cost-efficiently–and at massive scale. This requires the ability for ongoing data transfer over the internet to offsite cloud storage systems that are accessible from any location and device.

"As companies deploy highly distributed cloud-based solutions, it is imperative that they monitor every user connection to proactively protect against security threats and vulnerabilities. Customers operating in a multi-cloud environment need a holistic security approach that includes their entire network, from data center to the cloud to the edge. At Frontier, we adapt our infrastructure to our customers' needs, not the other way around, and help take their business from operational to transformational."

–Marcelo Oliveira, Vice President of Commercial New Products, Frontier Communications

SECTION 7

CONCLUSION

Implementing a multi-cloud strategy reduces capital and overhead costs while ensuring access to the most reliable network infrastructure and software. One of the most significant advantages of a multi-cloud network is that it provides redundancy to protect against downtime or lost data in the event of adverse scenarios.

The cloud also enables companies to benefit from the most advanced security protection. Business continuity requires the ability to stay one step ahead of hackers, viruses, malware and cybersecurity threats. Safeguarding financial records, private emails and the personal information of employees and customers is paramount.

The use of managed IT services enables an enterprise to focus on its core business needs while outsourcing many of the complexities related to IT management. Fully managed cloud services also reduce a company's equipment expenses and incremental, unplanned implementation and operational costs, which makes it easier to budget and manage cash flow.

Ultimately, a multi-cloud strategy can provide growing companies with flexibility, scalability, improved efficiency, security and, most important, peace of mind.

Frontier's suite of managed services supports multiple cloud connections that are flexible, secure, fast and reliable. Frontier's Cloud Managed Solutions provide companies with transparent and predictable pricing, customized solutions and a single provider to facilitate always-on cloud connectivity.

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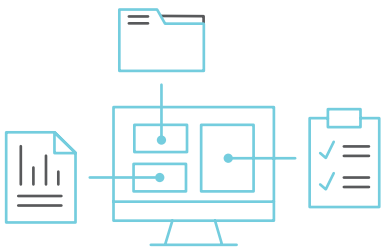

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