Enterprise Strategy Group™
by TechTarget

ECONOMIC VALIDATION

Maximizing Economic Advantages by Migrating to AWS Cloud Infrastructure

Reduce Compute, Networking, and Storage Costs by up to 66% by Migrating On-premises Workloads to AWS Cloud Infrastructure

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Introduction

This Economic Validation from TechTarget's Enterprise Strategy Group focused on the quantitative and qualitative benefits organizations can expect by migrating their on-premises compute, networking, and storage workloads to AWS Cloud Infrastructure. Enterprise Strategy Group validated that organizations reduced compute, networking, and storage costs by up to 66% by migrating from on premises to AWS Cloud Infrastructure. By moving to AWS, these organizations experienced reduced costs, increased performance, improved operational efficiency, faster time to value, and improved business agility. This report demonstrates how AWS Cloud Infrastructure services provide a cost-optimized and flexible foundation for a modern data architecture as well as a comprehensive analysis focused on how AWS Cloud Infrastructure helps organizations unlock the value of their data with a proven, secure, and scalable end-to-end cloud infrastructure. AWS helps customers maximize economic and operational advantages by continuously innovating across every service and solution area to improve performance while maximizing savings for their customers.

Challenges

To better support their rapidly changing business requirements, organizations are looking to transform from on-premises IT operations to modern cloud and hybrid strategies. The benefits of migrating to the cloud go beyond simplifying operations, increasing resource utilization, shifting to a pay-as-you-go model, and reducing or eliminating traditional on-premises infrastructure (servers, network, and storage hardware). Evolving opportunities and workloads generate increasingly significant volumes of data at a faster speed and across a wider variety of formats than ever before. We are seeing this often in analytics with artificial intelligence (AI) and machine learning (ML) workloads that generate insights to power new business or revenue streams. Organizations understand the value that data adds to their products, operations, customers, and overall business. And the value of that data is only increasing. Enterprise Strategy Group research shows most organizations have become data driven, with 21% reporting that their core products and services rely completely on data (information-based), 44% reporting that data helps to support the business (tangible products and services), and the remaining 35% reporting that they offer a mix of both information-based and tangible products and services.[1]

Traditional on-premises infrastructure and applications are complex and costly to deploy, manage, maintain, and scale. Most on-premises data centers are forced to overprovision to accommodate peak workloads, rigid purchasing cycles, supply chain issues, and IT workflows, limiting business agility and speed. In times of uncertainty, including rising energy prices and the high cost, complexity, and heavy operational burden associated with managing and maintaining on-premises infrastructure, organizations must seriously consider adopting the cloud. The cloud enables organizations to truly transform their business and unlock the value of their data in a more flexible and cost-efficient manner, while always using the latest technology.

Modern business services and cloud-native applications help to power data-driven businesses. This is only possible with a robust and scalable compute, networking, and storage infrastructure that powers and optimizes new data services. Data must be collected, transformed, and made available to advanced analytics, AI, and ML capabilities. Data used to power real-time business insights can help improve customer experiences, increase revenue, lead to more informed decision-making, and increase operational efficiency.

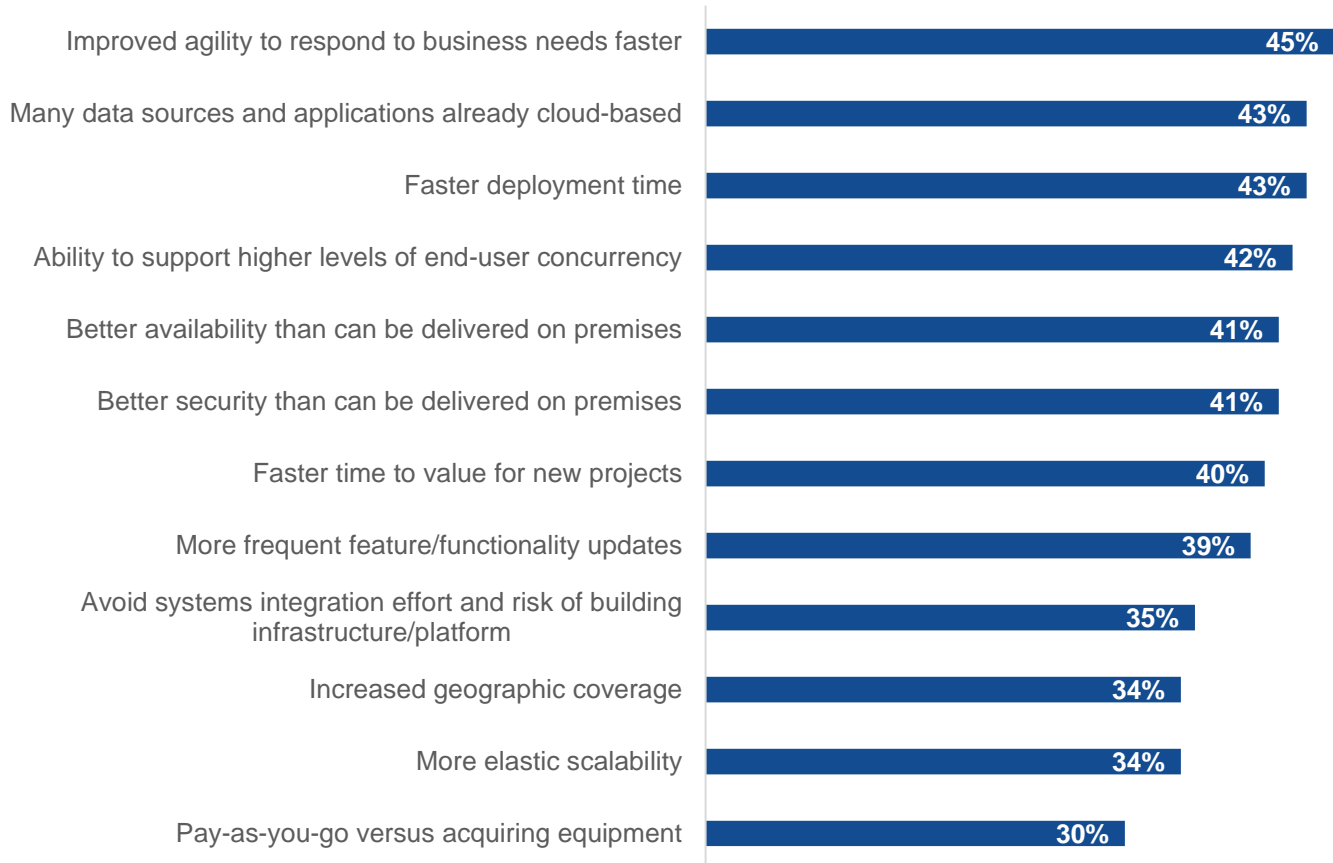For these reasons, many organizations are turning to cloud infrastructure to transform their business and optimize costs. Enterprise Strategy Group research finds that some of the top benefits of leveraging cloud services to support data initiatives include reduced costs, the agility to respond to business needs faster, integration with cloud-

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[1] Source: Enterprise Strategy Group Brief, *Data Is the Business*, April 2022.

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based data sources and applications, faster deployment time, higher levels of end-user concurrency, and improved availability and security, amongst many other important benefits. These benefits are shown in Figure 1.[2]

Figure 1. Top Benefits of Leveraging the Cloud to Support Data Initiatives

Which of the following do you consider to be benefits of leveraging public cloud to support data initiatives? (Percent of respondents, N=338, multiple responses accepted)

Benefit	Percent
Improved agility to respond to business needs faster	45%
Many data sources and applications already cloud-based	43%
Faster deployment time	43%
Ability to support higher levels of end-user concurrency	42%
Better availability than can be delivered on premises	41%
Better security than can be delivered on premises	41%
Faster time to value for new projects	40%
More frequent feature/functionality updates	39%
Avoid systems integration effort and risk of building infrastructure/platform	35%
Increased geographic coverage	34%
More elastic scalability	34%
Pay-as-you-go versus acquiring equipment	30%

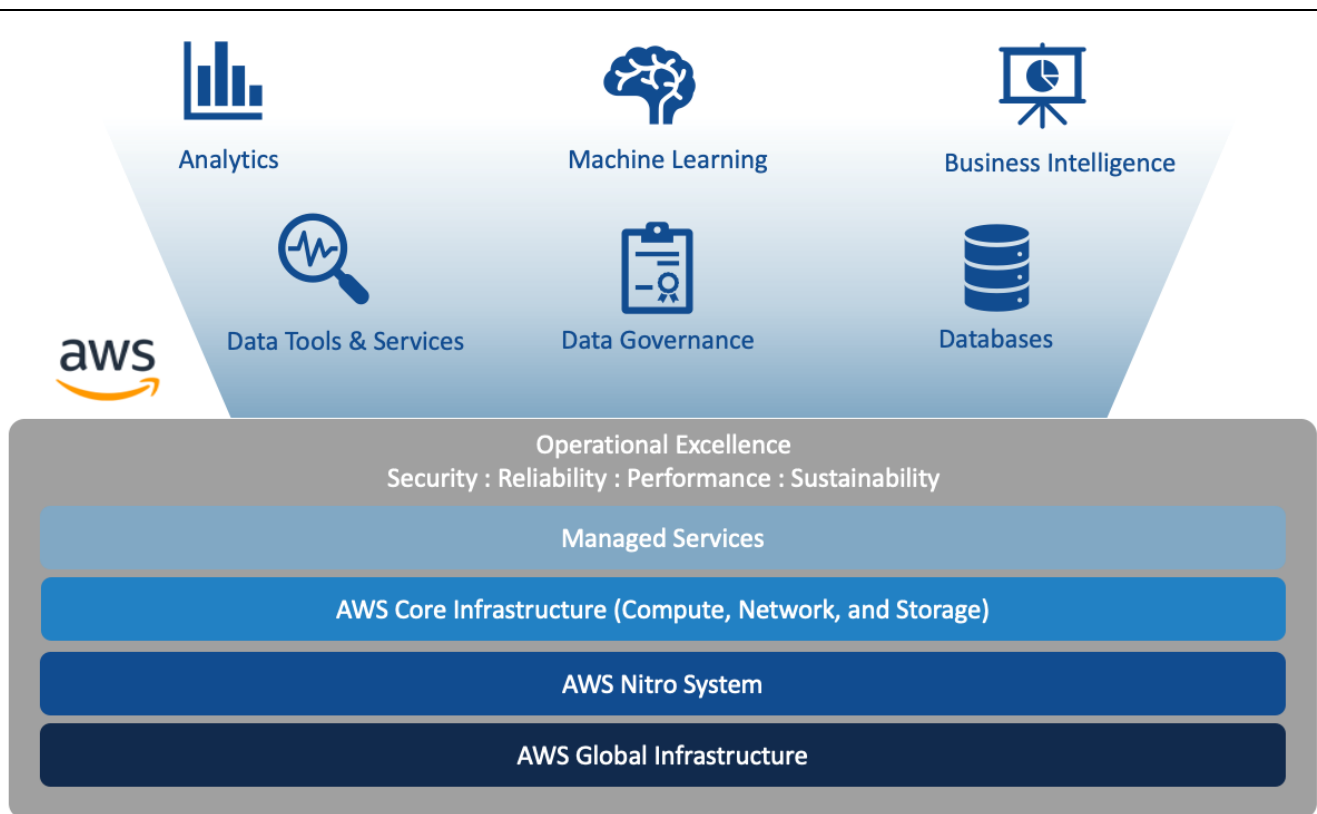*Source: Enterprise Strategy Group, a division of TechTarget, Inc.*

Migrating on-premises data-centric workloads to the cloud provides organizations with modern business agility, more efficient use of resources, cost optimization, scalability, and improved availability and security. Choosing the right cloud provider to partner with is a critical factor in the long-term success of any organization. While migrating on-premises infrastructure to cloud infrastructure-as-a-service offerings can optimize performance and cost savings, many organizations are seeing that the greater business value of cloud-based end-to-end infrastructure is in its ability to simplify and optimize data ingestion and storage and decrease the time to analyze, visualize, and generate insights that unlock new data-driven opportunities. This means partnering with a cloud provider that provides the tools, services, support, education, and innovation to facilitate optimal availability, data governance, and access to data services across the organization. The ideal cloud provider should offer compute, networking, and storage services built upon optimized infrastructure, continually accelerating its pace of innovation to deliver unique and differentiated capabilities and technologies that organizations can use to transform their business.

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[2] Source: Enterprise Strategy Group Research Report, *Cloud Analytics Trends*, March 2022

The Solution: AWS Cloud Infrastructure

AWS Cloud Infrastructure offers modern, purpose-built compute, networking, and storage services that provide increased flexibility, scalability, security, reliability, and performance. AWS has engineered innovation into the chip and system levels and designed its own cloud infrastructure from the ground up to cost-effectively deliver the highest levels of performance, scalability, availability, reliability, and security to power an organization's business forward. The AWS Global Infrastructure is a secure, extensive, and reliable cloud infrastructure, offering over 200 fully featured services from data centers globally. Whether an organization needs to deploy its application workloads across the globe in a single click or wants to build and deploy specific applications closer to its end users with single-digit millisecond latency, AWS provides the organization with the cloud infrastructure where and when it needs it. Millions of customers—including the fastest-growing startups, largest enterprises, and leading government agencies—are using AWS to lower costs, become more agile, and innovate faster.

Figure 2. Data Services Powered by AWS Cloud Infrastructure

Source: Enterprise Strategy Group, a division of TechTarget, Inc.

Benefits

Some of the key benefits that AWS customers can expect from AWS Cloud Infrastructure services are:

- **Agility:** Easy access to a broad range of technologies to innovate faster and build nearly anything customers can imagine. Customers can deploy technology services in minutes and go from idea to implementation faster by several orders of magnitude.

- **Elasticity:** Organizations don't need to over-provision resources up front to handle peak levels of business activity in the future. Instead, customers only provision the number of resources needed. They can scale these resources instantly up or down to grow and shrink capacity as their business needs change.

- **Cost-effectiveness:** Organizations pay only for the compute, networking, and storage resources they use, with no long-term contracts or up-front commitments. They can analyze and optimize deployments for cost, tailor their choice of compute to their applications, and save with purchasing models such as Amazon Elastic Cloud Compute (EC2) Spot Instances and Savings Plans. Organizations can move file-based workloads to Amazon FSx without changing their workflows, and they can migrate and synchronize data from on premises to AWS and make it immediately available to a broad set of integrated AWS services. They can choose the optimal storage classes based on access patterns and cost requirements, and they can choose the optimal volume type based on price-performance requirements of their workloads. They can also use intelligent tiering capabilities with Amazon Simple Storage Service (S3) and Amazon Elastic File System (EFS) to automate savings.

- **Fast Deployments:** AWS Core Infrastructure services are available worldwide, enabling organizations to deploy their applications in multiple physical locations with just a few clicks. Putting applications closer to end users reduces latency and improves their experience. For instance, AWS DataSync and AWS Snow Family can speed up data migrations to AWS to help customers realize savings faster.

- **Security and Data Protection:** AWS provides an end-to-end approach to secure and harden infrastructure, including physical, operational, and software measures. AWS also offers broad data protection and resiliency capabilities to help customers meet their business continuity goals.

Enterprise Strategy Group Economic Validation

Enterprise Strategy Group completed a qualitative and quantitative economic analysis of how organizations have been able to implement the foundation of their modern data architecture by migrating on-premises workloads to AWS Cloud Infrastructure. Enterprise Strategy Group's Economic Validation process is a proven method for understanding, validating, quantifying, and modeling the economic value propositions of a product or solution. The process leverages Enterprise Strategy Group's competencies in market and industry analysis, technical and economic validation, and forward-looking research. We conducted in-depth interviews with end users to better understand the challenges customers experience related to their on-premises environments and to learn how AWS has provided savings and benefits to their organizations. We used the qualitative and quantitative findings as the basis for a conservative economic model, illustrating the range of savings and benefits that might be achieved by an organization.

AWS Cloud Infrastructure Economic Overview

Enterprise Strategy Group's economic analysis revealed that by migrating their on-premises workloads and data to AWS, customers realized significant savings and benefits in the following categories:

- **Cost Optimization and Improved Operational Efficiency**
- **Faster Time to Value and Improved Business Agility**
- **Reduced Risk to the Organization**

Cost Optimization and Improved Operational Efficiency

AWS offers the broadest and deepest set of services to help organizations create operational efficiencies and become more agile in delivering new products and experiences faster. By moving on-premises operations to AWS Cloud infrastructure and streamlining data operations, organizations are able to remove much of the complexity and burden placed on IT infrastructure teams and decision makers. This frees these teams to spend more of their time focusing on business innovation instead of managing hardware and enabling application, development, and data service teams to be more productive and foster innovation across the company.

- **Simplified administration and management of resources** – By moving to AWS Cloud Infrastructure, organizations eliminated physical infrastructure, including racks of servers, networking equipment, and storage arrays. Teams no longer had to spend time racking, cabling, and configuring physical infrastructure. They eliminated the time spent managing, provisioning, optimizing, and maintaining this infrastructure. They no longer had to spend time on interoperability issues; managing inventory and expensive maintenance contracts; deploying servers, networking hardware, and storage resources; setting up services; patching and updating software; tuning and optimizing resources; ensuring security; backing up and recovering systems; or performing refreshes and forklift upgrades. Customers reported time savings of 60% to 70% by being able to automate and simplify most of the tasks that they performed for their on-premises infrastructure. Once they migrated from on premises to AWS Cloud Infrastructure, customers also required far fewer support tickets and needed much less time for tuning or troubleshooting systems. Many of the services they used on AWS were already fine-tuned and load-balanced. Those that were not had the visibility and resource flexibility to troubleshoot and resolve performance, connectivity, or functionality issues quickly and easily. Customers benefitted using AWS through single-pane-of-glass management, automation, orchestration, guided wizards, up-to-date documentation, educational tutorials, and tailored support plans. In addition, customers benefitted by working with the AWS Partner Network (APN), a global community of trusted cloud partners with diverse expertise. The robust AWS Partner community features over 100,000 partners from more than 150 countries. This network of partners helps customers deliver greater value for their business, increase agility, and lower costs.

  > **"Our R&D workload is demanding and inconsistent; if we stayed on premises, we could only do it if we overprovisioned heavily, knowing that the systems would sit idle at other times."**

- **Designed for best price-performance** – AWS has invested years designing custom silicon optimized for the cloud to help deliver the best price-performance for a wide range of applications and workloads, starting with the AWS Nitro System in 2013, the underlying platform for modern Amazon EC2 instances. The Nitro System enables AWS to further reduce costs for customers by delivering practically all of the resources of a server to their instances, making applications more efficient and providing added benefits such as increased security and new instance types. AWS Graviton processors are designed by AWS to deliver the best performance at the lowest cost for cloud workloads running on Amazon EC2. AWS Trainium is the ML accelerator purpose-built by AWS for high performance training of generative AI models. AWS Inferentia accelerators were designed by AWS to deliver high performance inference at the lowest cost in Amazon EC2 for ML inference applications.

- **Financial flexibility, predictability, and visibility** – Customers were able to shift from up-front capital investments to a transparent monthly bill that made it easier to perform cost-benefit analyses on IT services. AWS provides the flexibility for customers to choose to pay on demand or save with up-front reservations and leverage other cost optimization best practices and tools like AWS Cost Explorer, AWS Compute Optimizer, AWS Instance Scheduler, AWS Operations Conductor, and Amazon S3 Storage Lens to gain visibility into resource utilization and identify cost savings opportunities. AWS also offers flexible, cost-effective purchase models, such as AWS On-Demand Instances, Spot Instances, and Savings Plans, so that customers can meet their infrastructure needs while keeping within their budget. One customer shared that they saved 52% compared to their previous spending by provisioning using Savings Plans and Amazon Relational Database Service (RDS) Reserved Instances. Others experienced a 20% cost reduction per On-Demand Instance and more than 70% saved in compute costs with Spot Instances. Another AWS customer commented that Amazon EC2 G5 Instances powered by Graviton2 processors offered them anywhere between 15% and 40% better price-performance compared with the previous generation of GPU-based instances. This financial flexibility and

  > **" AWS Cloud Infrastructure offers us unmatched flexibility that was not possible with on-premises infrastructure. We can choose how we run our simulations. For example, sometimes we run higher-performance instance types on certain days of the week and slower instance types on the weekend. We can balance costs against turnaround time."**

visibility enable customers to provision resources with precision, thereby proactively reducing their infrastructure costs.

- **Managed services** – Maintaining effective technology policies is at the heart of IT transformation initiatives. Data must be ingested, stored, protected, and made available to users, services, and applications across the globe. The data management burden is often so enormous on legacy on-premises storage teams that they are overwhelmed by the challenges of supporting infrastructure across data silos with manual processes, causing unintended workflow bottlenecks and limiting the agility of the entire organization. Once companies have their data on AWS Cloud Infrastructure, internal teams became business enablers rather than bottlenecks. With AWS, customers can focus on business innovation rather than on infrastructure.

  In addition to freeing up time and improving the operational efficiency of existing staff, AWS also provides organizations of all sizes with a way to scale operations and expertise using AWS managed services. AWS customers minimize the total cost of ownership (TCO) with serverless and fully managed services that eliminate infrastructure maintenance. AWS managed services reduce infrastructure administrative burden with various offerings for monitoring, incident detection, management, security functions, patching, backups, and cost optimization based on how frequently data is accessed. Customers have commented that since using AWS managed services, their developers can focus on business logic rather than on infrastructure maintenance, which accelerates time to market and helps maintain security. AWS managed services enable organizations to focus on delivering world-class data services on day one instead of worrying about hiring, training, and building experience for resources first. In addition, the APN's global community of partners leverages programs, expertise, and resources to build, market, and sell customer offerings.

  > **"AWS Cloud Infrastructure is about more than just the hardware itself. It's also about the layer of managed services that allow us to be leaner in terms of staff and still achieve the same results."**

- **Improved environmental sustainability** – Meeting environmental, social, and governance goals is becoming a top priority for companies today. As organizations take responsibility for their impact on the environment, many benefit from the AWS Global Infrastructure to lower their carbon footprint by moving from on-premises infrastructure to AWS Cloud Infrastructure. They can significantly reduce carbon emissions as AWS data centers offer environmental economies of scale. Organizations dramatically reduce their electricity consumption by eliminating on-premises hardware, saving tens or even hundreds of thousands of dollars monthly in power and cooling costs. AWS is working to power 100% of their operations with renewable energy by 2025, with a goal of generating net-zero carbon by 2040. This can help companies reach their own sustainability goals.

Faster Time to Value and Improved Business Agility

Change can be difficult for any IT organization. This is especially true for large enterprises that have made significant investments in on-premises technology and struggle with standardization of organizational structure and adoption of best practices. Taking the first step toward infrastructure modernization can be intimidating. Customers must address different data requirements and technologies across many divisions of their organizations. AWS has proven that it can help organizations through a successful transition from on-premises environments to the cloud quickly and safely while significantly improving business agility and delivering business outcomes that were not previously possible.

- **Faster time to migration** – Migrating on-premises workloads to AWS Cloud Infrastructure allows organizations to immediately take advantage of proven modern end-to-end data architectures to store, protect, analyze, visualize, and extract valuable insights from their data. A customer shared that they migrated their business applications to AWS in a single weekend. The migration involved over 200,000 business customers and 400 internal users in three global locations. AWS offers organizations of all sizes and from all industries a broad range of services and more features within those services than any other cloud provider, making it faster, easier, safer, and more cost-effective to move customers' existing applications, whether rehosting workloads or moving the entire data center to the cloud, helping organizations build nearly anything they can imagine. Customers can migrate confidently and take advantage of AWS Migration solutions, including a proven phased method to guide them through assessment and mobilization. Customers can choose from a broad array of AWS and third-party migration tools and a marketplace-provided software catalog that allows them to find customized solutions designed and specialized for their particular workloads. Organizations that prefer more guidance or wish to accelerate migration further along the way can leverage the AWS Migration Acceleration Program or choose to use AWS Professional Services or work with AWS Migration Competency Partners.

> **"Trying to do on-premises compared to what we are doing now on AWS, we would be at least a year behind and running with a much larger team. We would have to over-provision a costly IT environment, not to mention maintenance, refreshes, and updates."**

- **Accelerated path to modernization and continuous innovation** – AWS delivers unique capabilities and technologies to its customers so they can experiment and innovate quickly and reshape their businesses. AWS Cloud Infrastructure helps customers benefit from continuous innovation in modern compute, networking, and storage technologies as soon as they are available, without having to perform forklift refreshes with on-premises technologies. The AWS Nitro System was purpose built to ensure customers can always run on infrastructure optimized to deliver the highest available levels of security, performance, cost, and pace of innovation. This includes the design of the infrastructure, security chips, and hypervisor. Amazon FSx for Lustre provides a high-speed, fully-managed file system that delivers sub-millisecond latencies, up to hundreds of GBs/s of throughput, and millions of IOPS. FSx for Lustre's low-latency, high-throughput characteristics are ideal for high performance computing (HPC) workloads and ML model training. FSx for Lustre accelerates Amazon SageMaker large language model training and reduces inference times. Additionally, FSx for Lustre optimizes price and performance with a range of deployment options, including storage type, performance tier, automatic data compression, and replication level. AWS customers reported that it was easier for them to modernize or re-platform applications using new technologies like containerization, modernize and accelerate application development and delivery, and expand operations to take advantage of edge computing solutions and other technologies. AWS gave them the ability to deliver modern cloud-native applications by connecting containers and microservices with application-level networking and secure API gateways.

- **Expedited data delivery and insights** – The AWS Global Infrastructure helps organizations deliver their data, applications, and services to regions and customers across the globe while meeting SLAs, ensuring secure and reliable operations. A customer commented that the main benefit for their business and services was the secure, extensive, and reliable global cloud infrastructure of AWS. Customers that migrated applications and existing data, generated new data, or streamed data from various sources into AWS could leverage their choice of object, file, and block storage that best fit their application's format, performance, and cost requirements. Customers use AWS Direct Connect to run applications that use on-premises and cloud resources without sacrificing performance. These private, physical connections to the AWS network bypass the internet to increase security, while MACsec or Site-to-Site VPN encryption options provide additional security while data is in transit. They took advantage of tools and services in AWS to transform,

> **"Running on AWS Cloud Infrastructure makes us more agile. We are able to produce much better results in a shorter time, which would not have been possible had we stayed on premises. We were able to produce a much faster, better, and safer car than before."**

enrich, and make data available to more applications and people and for AI, ML, HPC, and business intelligence (BI) workloads to power real-time dashboards and extract valuable insights. Customers brought data-driven services to more functions across their organization. Remote workers could access data services through AWS Client VPN and AWS Verified Access. They are now able to run high-performance applications at the edge through the Amazon CloudFront content delivery network (CDN), Amazon Route 53 managed DNS, and AWS Global Accelerator networking services. A customer that used Amazon CloudFront, a low-latency CDN, shared that their customers could download game content 50% faster compared to using its previous on-premises servers.

- **Improved scalability and business agility** – After migrating to AWS, customers can quickly and easily scale up and down compute, networking, and storage resources whenever needed to meet the changing demands of their business. With minimal planning, customers can provision additional compute, networking, and storage resources in minutes rather than the weeks or months that would be required on premises. Customers use AWS Auto Scaling to monitor applications and automatically adjust resource capacity, maintaining predictable, steady performance at the lowest possible price. A customer mentioned that Amazon EC2 Auto Scaling saved their developers about 40 hours in manual infrastructure maintenance and scaling. Customers can use AWS intelligent optimization tools to provision resources precisely, proactively reducing infrastructure costs. They have the flexibility to match their workload needs and budget and move between any of the 600 compute instances that best meet the complex requirements of their workloads. Customers can decide whether to run their applications on VMs, containers, or serverless services. Applications can be deployed in the cloud, across geographic regions, in the data center, or at the edge.

Reduced Risk to the Organization

Security is a top priority for most organizations. When it comes to data, businesses must be extremely cautious and diligent in ensuring that both their systems and data are protected against service interruptions, data corruption, non-compliance with regulations, and malicious intent. Earning customer trust is at the foundation of the AWS business. Security is the top priority at AWS and is a critical pillar in the design of the AWS Global Infrastructure. Custom-built for the cloud and designed to meet the most stringent security requirements, AWS Global Infrastructure is monitored 24/7 to help protect the confidentiality, integrity, and availability of customer data. AWS secures the infrastructure that runs all the services used for their customers' cloud applications. This infrastructure is protected at all levels: physical security of the data center premises using security cameras, guards, and surveillance; infrastructure security through restricted access and regular maintenance; a secured network backbone to protect data while in transit; and data security with rigorous access controls, encryption, retention, and auditing to meet compliance requirements. AWS customers benefit from AWS data centers and a network architected to protect their information, identities, applications, and devices. AWS is committed to keeping its customers' workloads secure and confidential with continued investments in security technologies and operational best practices.

- **Shared responsibility model** – Security and compliance is a shared responsibility between AWS and the customer. This shared model can help relieve the customer's operational burden as AWS operates, manages, and controls the components from the host operating system and virtualization layer down to the physical security of the facilities in which the service operates. The customer assumes responsibility and management of the guest operating system, other associated application software, as well as the configuration of the AWS provided security group firewall. Customers should carefully consider the services they choose as their responsibilities vary depending on the services used, the integration of those services into their IT environment, and applicable laws and regulations. The nature of this shared responsibility also provides the flexibility and customer control that permits the deployment.

- **Data protection and security –** AWS offers data protection and resiliency features and solutions to help you meet your business continuity goals and deliver disaster recovery during data loss events, across recovery point and time objectives (RPO/RTO). AWS has built-in security to protect customers' information, identities, applications, devices, and data. The AWS Nitro system has security built-in at the chip level. The Nitro System provides enhanced security that continuously monitors, protects, and verifies the instance hardware and firmware. Virtualization resources are offloaded to dedicated hardware and software, minimizing the attack surface. Finally, Nitro System's security model is locked down and prohibits administrative access, dramatically reducing the possibility of human error and tampering. AWS designs security products and services that prevent, detect, respond to, and remediate issues in customer AWS environments in near-real time. Customers also have options to design for data resiliency by creating known good rollback points with snapshots, versioning, and full backup and recovery solutions across their data, accounts, and AWS Regions. Customers can create their own recovery scenarios without the on-premises overhead of buying and maintaining separate dedicated infrastructure for recovery purposes. For AWS customers, this can reduce the load on dedicated data protection, general IT, and security teams to protect on-premises and cloud environments and provides the tools to operate more efficiently and effectively.

> **"We can sleep much better at night knowing our data is protected and secured by experienced professionals—both on our side and on AWS."**

- **Secure access control and operations** – AWS customers have the tools to secure access to their AWS environments, such as an easy-to-manage firewall with centralized management and controlling access to data through AWS Identity and Access Management, Amazon S3 Object Ownership, Amazon S3 Block Public Access, Amazon Elastic Block Storage (EBS) and Amazon EFS encryption, and more. Customers can protect the integrity of their data through features like Amazon S3 Object Lock to prevent deletion until a specified date, data integrity validation with checksums, Amazon S3 Replication, and Amazon S3 Versioning. They can protect web apps from exploits with AWS Web Application Firewall (WAF), guard applications against DDoS events with AWS Shield, encryption of data in transit and at rest, and a write once, read many (WORM) model with immutable data. AWS also provides tight integration with a marketplace full of AWS partner security solutions.

- **Improved compliance** – AWS customers receive the tools and visibility required to demonstrate compliance locally and regionally. A customer commented that AWS CloudTrail protects their organization from being penalized for regulatory non-compliance. On-premises environments would require a full-time team of network engineers to achieve this level of standards on site.

- **Data sovereignty and privacy** – Organizations have control over where their data is stored, how it is secured, and the users and applications that can access their data. With access controls built in to storage services, customers can plan their own data protection strategy around where the primary data is, where the recovery copies are, and who or what can access both (including the physical location of the authorized recovery team). AWS will not replicate or move content outside the customer's chosen AWS Region(s) unless otherwise agreed upon. AWS is committed to confidential computing, using specialized hardware and firmware to protect its customers' code and data from outside access. The AWS Nitro System architecture restricts any operator access to customer data within an Amazon EC2 instance.

> **"We are true partners in a shared responsibility model between our team and AWS. This ensures availability, security, compliance, and privacy"**

Enterprise Strategy Group Analysis

Why This Matters

Providing scalable infrastructure services that meet modern business requirements with traditional on-premises infrastructure is costly, complex, and a barrier to business agility.

Enterprise Strategy Group validated that AWS Cloud Infrastructure delivers modern business agility and data services to drive business transformation while reducing the expected total cost of infrastructure operations by 66%.

Enterprise Strategy Group leveraged the information collected through vendor-provided material, public and industry knowledge of economics and technologies, and the results of existing case studies and our own customer interviews to create a three-year TCO/ROI model that compares the costs and benefits of running workloads on traditional on-premises infrastructure (server, networking, and storage) versus running the same workloads on AWS Cloud Infrastructure. Our research and interviews with customers who have migrated workloads to AWS, combined with experience and expertise in economic modeling and technical validation of server, network, and storage technologies helped to form the basis for our modeled scenario.

The scenario that Enterprise Strategy Group modeled assumed that a customer currently runs the following workloads in their on-premises data center:

- **50 high-performance servers** running production databases sized to scale to meet the worst-case need for an extremely heavy end-of-year spike in workload while delivering a good customer experience and timely business intelligence services. Each 32-core server was configured with 128GB of RAM and an average of 2TB of storage capacity provided by a traditional all-flash SAN block storage array.

- **Application and dev/test VMs** running across 11 virtualized servers sized to handle the expected 3-year growth from 105 to 206 VMs. Each VM required 2 vCPUs, 8GB of RAM, and 600GB of storage capacity provided by a traditional HDD-based SAN block storage array.

- **File services and legacy business applications** provided by 31 small servers sized to provide for a growing organization. The minimal server requirements for these applications could be satisfied with a single CPU, 4GB of RAM, and up to 5TB of NFS/SMB storage capacity provided by a traditional HDD-based file storage array.

- **A private cloud environment** serving a mix of modern internal and customer-facing applications and services running on nine powerful virtualization servers with 32 cores and 128GB of RAM. Object storage services were provided by a modern storage array that supports object storage protocols.

Compute

Enterprise Strategy Group started by modelling the expected hardware and software costs of acquisition, support and maintenance, power, cooling, floor space, and server and OS administration. We then assumed that only 10 high-performance servers were required to be running year-round to handle all but the year-end seasonal workload. We sized Amazon EC2 c7g.4xlarge instances powered by the latest Graviton3 processors to run 24/7 operations. Our model also considered the ability to reduce costs by autoscaling to 50 instances only when needed to handle the end-of-year spike in workload. The 10 base servers benefitted from a Savings Plans discount through a 3-year hourly spending commitment. We then sized the application, file services, and dev/test VMs with the assumptions that these requirements would grow 40% each year as the organization grew. By deploying these instances as needed, the organization could save with Spot Instances for dev/test VMs when needed and benefit from Savings Plans pricing for application and file services VMs. Savings Plans automatically and simultaneously apply to eligible AWS usage and enable customers to innovate faster by leveraging the newest instances, families, generations, and AWS Regions while staying on the same plan. Cloud applications and services were run on AWS Lamba, a

serverless, event-driven compute service, avoiding the need to manage instances. We then modeled an expected 41% savings for server administrators expected by not having to deploy, manage, and maintain on-premises server infrastructure. As shown in Figure 3, Enterprise Strategy Group's models predicted that AWS could save organizations 63% on compute services over three years.

**Figure 3.** Three-year Expected Cost of Compute/Servers
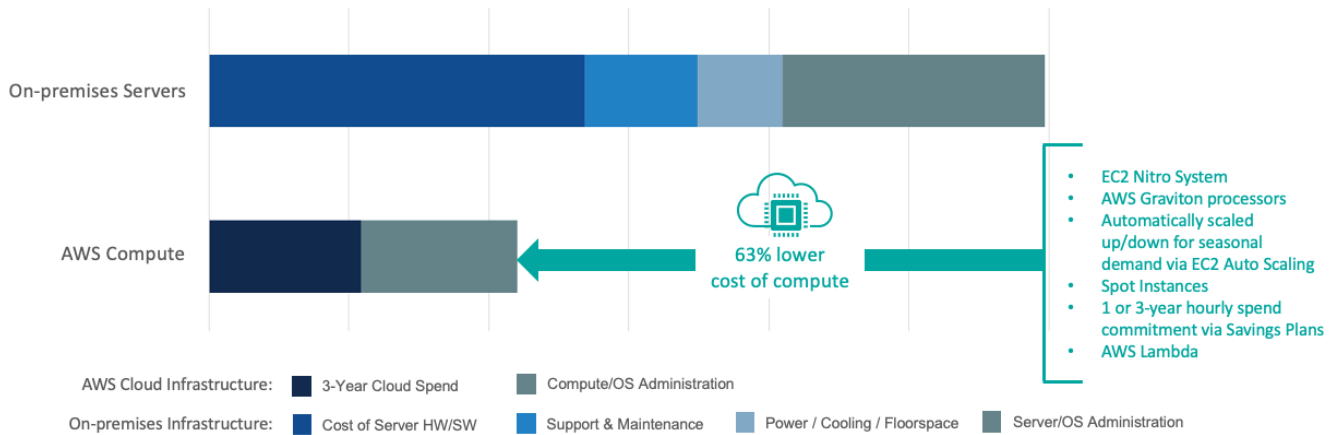
Source: Enterprise Strategy Group, a division of TechTarget, Inc.

Networking

Enterprise Strategy Group then worked with AWS to estimate the costs related to networking, including the cost of data centers, dedicated connectivity, networking hardware and software, and network administration. This model assumed an existing network made up of three data centers (two in the US and one in Europe) located within colocation facilities with multiple dedicated 1 Gbps connections. We considered the associated hardware (routers, switches, firewalls, etc.) and software costs, including ongoing support and maintenance. We also assumed that a network operations team was responsible for configuring and maintaining the network, including troubleshooting and remediating any disruptions in service. As shown in Figure 4, moving to a cloud-based network reduced costs by 66% by eliminating costly data center networking infrastructure and connectivity.

**Figure 4.** Three-year Expected Cost of Networking Services
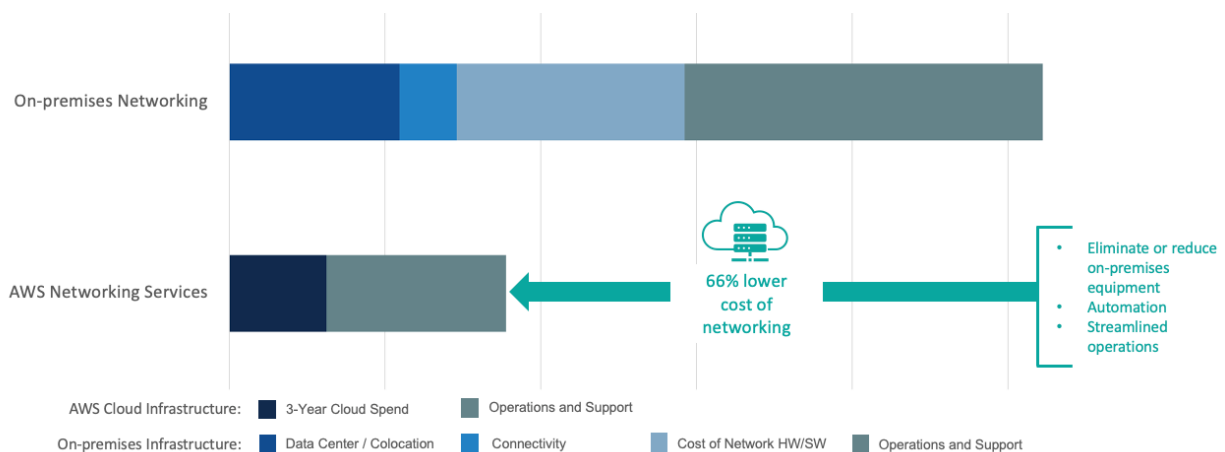
Source: Enterprise Strategy Group, a division of TechTarget, Inc.

Storage

Next, Enterprise Strategy Group modeled the expected storage-related costs. Our storage models were used to calculate the expected costs to purchase, operate, and administer the four storage arrays required to provide a total of 588TB of usable object, file, and block storage capacity. The various on-premises storage arrays also had to provide some overhead (20%-45%) for possible growth, as well as raid and system overhead and to ensure that performance SLAs were not impacted. We then modeled the expected costs to deliver the same set of storage requirements with object storage on Amazon S3, file server workloads on Amazon EFS, and the high-performance computing servers and application and dev/test VMs on Amazon EBS. Substantial savings were provided by delaying provisioning of storage for growth on demand until it was needed in later years and using Amazon S3 Intelligent-Tiering and Amazon EFS lifecycle management to provide cost savings by automating the movement of less frequently used data to more cost-effective tiers of storage. Figure 5 shows the expected savings provided by AWS Storage services.
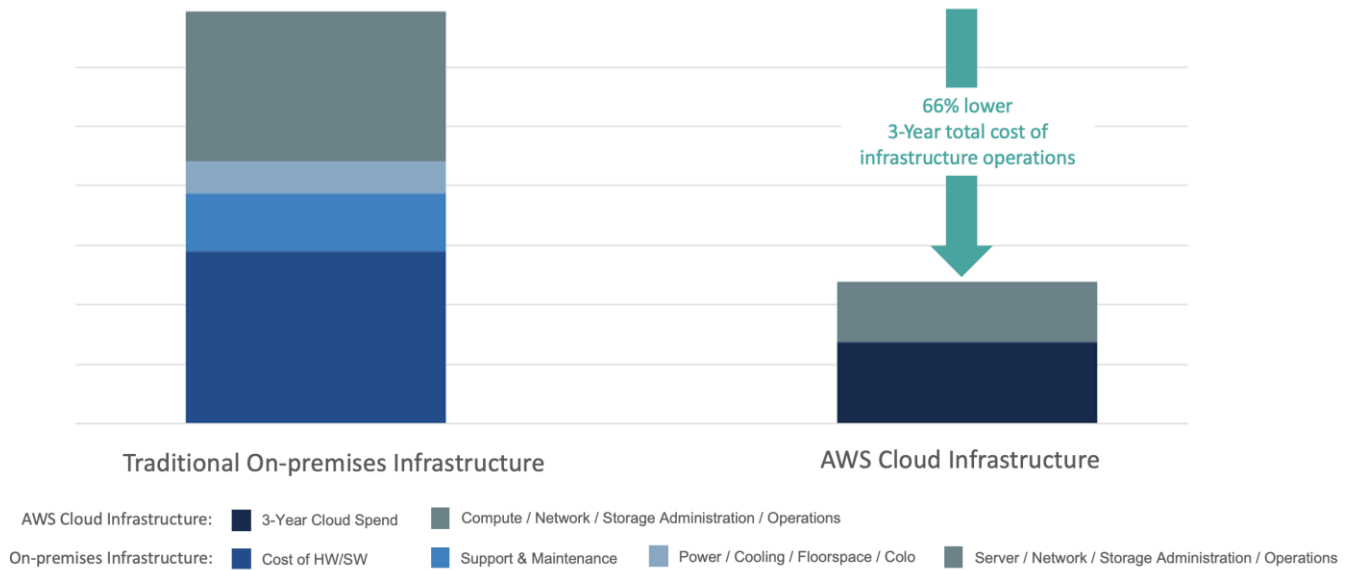
Figure 5. Three-year Expected Cost of Storage
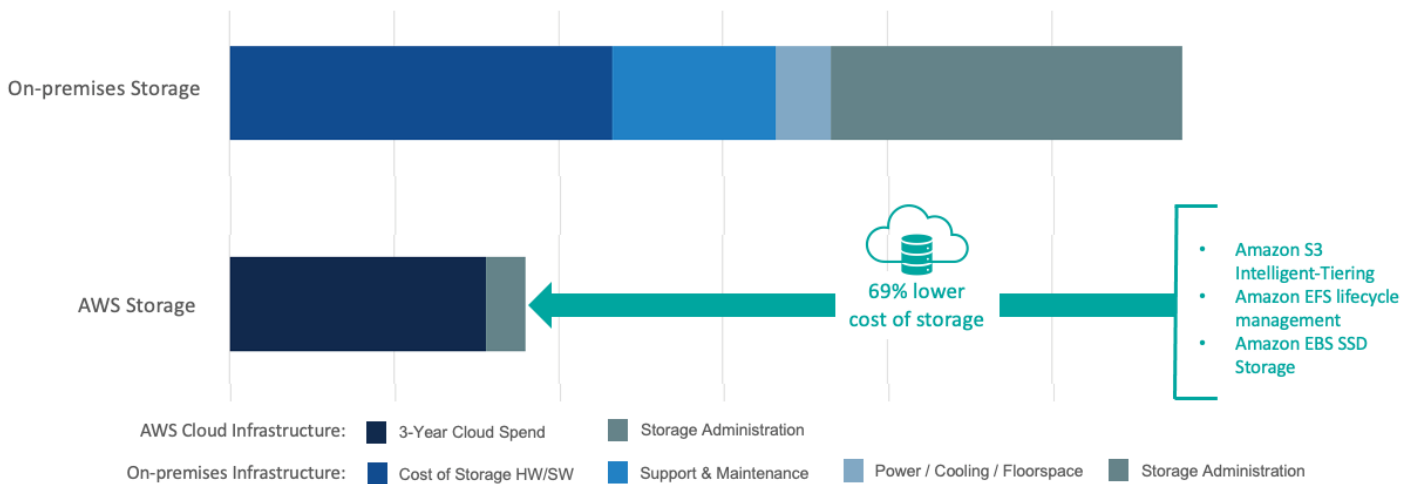
Source: *Enterprise Strategy Group, a division of TechTarget, Inc.*

Putting all three compute, networking, and storage models together, Enterprise Strategy Group predicted that by moving on-premises workloads to AWS Cloud Infrastructure, our modeled organization could lower their three-year total cost of infrastructure operations by 66%. Figure 6 shows the expected TCO savings.

Figure 6. Expected Three-year Total Cost of Infrastructure Operations

66% lower
3-Year total cost of
infrastructure operations

Traditional On-premises Infrastructure

AWS Cloud Infrastructure

AWS Cloud Infrastructure: ■ 3-Year Cloud Spend ■ Compute / Network / Storage Administration / Operations

On-premises Infrastructure: ■ Cost of HW/SW ■ Support & Maintenance ■ Power / Cooling / Floorspace / Colo ■ Server / Network / Storage Administration / Operations

Source: Enterprise Strategy Group, a division of TechTarget, Inc.

Additional Considerations

While models by Enterprise Strategy Group are built in good faith upon conservative, credible, and validated assumptions, no single modeled scenario will ever represent every potential environment or engagement. Enterprise Strategy Group recommends that you perform your own analysis and consult with your AWS representative to understand and discuss the options and potential possibilities proven through your own proof-of-concept testing.

Conclusion

For modern organizations, data is a valuable asset that is central to operations and a primary source of significant business insights. The more data-rich companies are, the better positioned they will be, given that they can accelerate data collection from more sources and make this data available to more parts of the organization. Almost every business will greatly benefit from the insights derived from a modern data infrastructure: improved operational effectiveness, more targeted business opportunities, improved product capabilities and qualities, faster development and innovation, etc. Trying to solve these issues with on-premises infrastructure is costly and complex, and many larger organizations are frozen with paralysis when it comes to taking the first step in making a modern data architecture a reality by migrating infrastructure, workloads, applications, and data to the cloud. Organizations that moved to the cloud are delighted they did, as they are now benefiting from the results of having embarked on an an innovative data journey that helps them constantly improve their business. To simplify and accelerate their migration to the cloud and ensure a successful transition to a comprehensive global modern data architecture, organizations need to choose their cloud partner wisely.

Enterprise Strategy Group validated that AWS helps organizations achieve this vision as a trusted and reliable partner. AWS has helped at each step along the cloud journey, starting with its migration acceleration program, then supporting each step from rehosting legacy applications, operating powerful hybrid environments, and finally modernizing to deliver world-class data services across the organization. AWS helps customers gain an economic and operational advantage by continuously innovating across every service and solution area to improve

performance while maximizing savings for their customers. One customer shared that **"As a CIO for the past 20 years, I've worked with every major technology company you can imagine, and none of them have innovated as a partner as well as AWS."**

Migrating data operations to AWS is the first step of many additional, ongoing benefits to the business. Once an organization's data is in AWS, the complete AWS portfolio of services and tools becomes available across the enterprise. Often, customers rapidly realize the breadth of the AWS portfolio unlocks greater possibilities than they had initially envisioned. They then are able to realize long-term efficiencies, optimize resources, and improve business agility by modernizing and maturing to take advantage of even more AWS Cloud Infrastructure solutions. As their cloud infrastructure becomes a reality, applications became more scalable, available, secure, durable, higher performing, and less complex to manage.

AWS has more than 17 years of experience building and delivering data services on its trusted, reliable, and scalable AWS Global Infrastructure. Customers around the world strongly agree that AWS offers them a broad set of capabilities that can best meet the needs of all of their data types and workloads, which would not have been possible had they stayed on premises. Since these companies moved to AWS, they can now connect their data to more people and services while ensuring better performance, security, data protection, and compliance. With AWS, customers can leverage the latest technologies to experiment and innovate more quickly. AWS is continually accelerating their pace of innovation to deliver unique capabilities and technologies that customers can use to transform their business. If your organization is looking for a cloud provider to help you unlock the value of your data across your organization with a proven, secure, and scalable end-to-end cloud infrastructure, Enterprise Strategy Group recommends you consider building on AWS Cloud Infrastructure and begin the journey to maximize your economic advantages.

Appendix

AWS Cloud Infrastructure is comprised of the following three infrastructure resources:

AWS Compute – AWS offers 600+ instances (virtual machines), containers, and serverless computing for any workload across edge and hybrid deployments with effective cost and capacity management tools to help organizations best match the needs of their workload and budget, even as requirements change. Amazon EC2 offers customers control for managing their infrastructure with the choice of processors, storage, networking, and flexible purchase models. Amazon EC2 has over a decade of innovation in silicon to push the envelope on delivering price-performance for customers, including AWS-designed processors, ML accelerators, and high-performance storage products.

AWS container services offer a wide selection and flexibility of services to run containers (Amazon Elastic Container [ECS], Amazon Elastic Kubernetes [EKS], etc.). Serverless technologies enable customers to run code without thinking about the infrastructure requirements. Customers can run their applications from the cloud to the edge with AWS Outposts, AWS Wavelength, and other services. AWS Compute offers cost flexibility and optimization tools (Amazon EC2 Spot Instances, Savings Plans, AWS Compute Optimizer, Amazon EC2 Auto Scaling, Amazon Elastic Load Balancing [ELB], etc.). AWS is continuously innovating to improve price-performance for its customers, offering compute instances based on the latest processors, as well as its extensive experience, building its own silicon.

- The AWS Nitro System is the underlying technology for all modern Amazon EC2 instances. This provides the ability for AWS to innovate faster, further reduce costs for customers, and deliver added benefits like security, performance, and new instance types.

- AWS Graviton processors are custom-designed by AWS to enable the best price-performance for workloads running in Amazon EC2.

- AWS Inferentia and AWS Trainium accelerators are purpose built by AWS to push the price-performance envelope for deep learning applications.

- AWS Nitro SSDs build on the AWS Nitro System and are custom-designed to deliver the best storage performance with low latency for organization's I/O-intensive applications running in Amazon EC2.

AWS Networking and Content Delivery – AWS customers can run traditional networking operations and applications across edge and hybrid networks while providing security, compliance, and the highest availability levels. This allows customers to have consistent and high-performance network operations across the largest global footprint of any provider. Foundational AWS network services include Amazon Virtual Private Cloud (VPC), AWS Transit Gateway, and AWS PrivateLink. Amazon Elastic Load Balancer and Amazon VPC Lattice are available for application networking. For edge networking, AWS offers Amazon CloudFront, Amazon Route 53, and AWS Global Accelerator. It provides AWS Direct Connect, AWS VPN, and AWS Cloud WAN for hybrid and wide-area connectivity. It also offers AWS Shield, AWS WAF, and AWS Network Firewall for network security.

- Built on the Nitro System, the Elastic Network Adaptor Express (ENA Express) delivers an enhanced networking experience through higher single flow bandwidth and lower tail latency for network traffic between EC2 instances.

AWS Storage – AWS provides a broad portfolio of storage solutions with in-depth functionality for storing, accessing, protecting, and analyzing data. AWS Storage is comprised of object, file, and block-based storage and data protection, movement, and management services that support objectives such as application migration and modernization, data protection for business continuity, backup and archive to and in the cloud, media archival, processing of data at edge locations, data lakes to power analytics and AI/ML, and compute-intensive workloads such as HPC. AWS provides a complete set of data-services offerings, such as hybrid cloud storage, data migration, managed file transfer, and disaster recovery solutions.

The AWS Storage portfolio offers Amazon S3 for object storage. Amazon S3 is a fully managed, elastic service that is used by customers of all sizes and industries to store and protect any amount of data for virtually any use case, such as data lakes, cloud-native applications, and mobile apps. Amazon S3 offers a range of S3 storage classes that customers can choose from based on the data access, resiliency, and cost requirements of their workloads, including Amazon S3 Intelligent-Tiering, which delivers automatic storage cost savings when data access patterns change, without performance impact or operational overhead. Amazon S3 storage classes are purpose-built to provide the lowest cost storage for different access patterns:

- The Amazon S3 Intelligent-Tiering storage class is designed to optimize storage costs by automatically moving data to the most cost-effective access tier for when data access patterns are unknown, changing, or unpredictable. Customers can use S3 Intelligent-Tiering as the default storage class for virtually any workload to start experiencing automatic cost savings.

- For long-term data stored over 90 days, customers can consider S3's low-cost archive storage options. The Amazon S3 Glacier storage classes (Amazon S3 Glacier Instant Retrieval, Amazon S3 Glacier Flexible Retrieval, and Amazon S3 Glacier Deep Archive) are purpose-built for colder data, providing customers with the most retrieval flexibility and the lowest cost archive storage in the cloud.

- Amazon S3 Storage Lens delivers organization-wide visibility into object storage usage and activity trends and provides automated alarms and anomaly detection to gain deeper cost optimization insights. The S3 Storage Lens interactive dashboard experience is auto-configured for all customers and offers visualizations that help customers look across their organization to optimize versioning retention, reduce storage of incomplete multi-part uploads, and check for adherence to lifecycle rule policies.

- Amazon S3 lifecycle policies can be configured to automate transitions to infrequent access or archive storage classes so customers can store data cost effectively throughout its lifecycle.

AWS offers the industry's widest portfolio of fully managed file storage with Amazon EFS and the Amazon FSx family of file systems, including Amazon FSx for NetApp ONTAP, Amazon FSx for OpenZFS, Amazon FSx for Windows File Server, and Amazon FSx for Lustre. Amazon EFS provides serverless, fully elastic file storage that automatically scales as needed so customers pay only for the storage and resources they use. Amazon FSx supports a broad spectrum of use cases from compute-intensive workloads to NAS migrations and support storage efficiency and cost-savings features that can automatically reduce file system storage consumption typically by up to 50–65% for general-purpose workloads.

- Amazon EFS Intelligent-Tiering uses Lifecycle Management to monitor workload access patterns and is designed to optimize storage costs automatically. Customers can set their Lifecycle policy based upon access patterns to move files from EFS Standard or EFS One Zone storage classes to their corresponding cost-effective Infrequent Access (IA) storage class. This helps to take advantage of infrequent access storage pricing that is up to 92% lower than the EFS Standard or EFS One Zone file storage pricing for workloads with changing access patterns.

- Amazon FSx makes it easy and cost effective to launch, run, and scale feature-rich, high-performance file systems in the cloud. It supports a wide range of workloads with its reliability, security, scalability, and broad set of capabilities. Amazon FSx is built on the latest AWS compute, networking, and disk technologies to provide high performance and lower TCO. And as a fully managed service, it handles hardware provisioning, patching, and backups, freeing customers up to focus on their applications, end users, and business. Amazon FSx makes it easy to do more with data. Organizations can migrate and synchronize data from on premises to AWS and make it immediately available to a broad set of integrated AWS services. Customers can choose between four widely used file systems: NetApp ONTAP, OpenZFS, Windows File Server, and Lustre. Amazon File Cache is a fully managed, high-speed cache for data sets stored on premises or in the cloud. File cache cost optimizes and augments compute by accelerating cloud bursting workloads using cache storage designed to deliver sub-millisecond latencies, up to hundreds of GB/s of throughput, and millions of IOPS.

Customers can use Amazon EBS for block storage. Amazon EBS provides multiple volume types that allow customers to optimize storage performance and cost for a broad range of applications. Customers generally start with gp2, which is a balanced SSD-based EBS volume type that increases in performance as it increases in size. When customers want to scale performance and throughput independent of storage capacity, they can seamlessly migrate to gp3, a newer generation of general-purpose volumes that provides 20% lower price per GB than the gp2 volumes.

- Amazon EBS Elastic Volumes is a free service that gives customers the flexibility to change volume type, storage, and performance of their EBS volumes at any time, independently, without any downtime. This allows customers to optimize costs efficiently as needed for their workload, without worrying about overprovisioning performance when not needed.

- Amazon EBS Snapshots are incremental, point-in-time copies of block storage data, storing only the changes since the last snapshot, making them cost-effective and ideal for frequent backups. Customers can use tools such as AWS Cost Explorer to track snapshot usage and spending and further optimize storage costs as needed. Customers can save up to 75% in snapshot storage costs by using Amazon EBS Snapshots Archive for the long-term retention (over 90 days) of seldom-accessed snapshots.

- AWS further simplifies the lifecycle management of EBS Snapshots through integration with Amazon Data Lifecycle Manager, which allows customers to create policies to automate the creation, deletion, retention, and sharing of snapshots. This reduces the operational burden of snapshot management and also helps reduce storage costs, as Data Lifecycle Manager automatically deletes outdated backups or moves seldom-accessed snapshots to EBS Snapshots Archive based on specified policies.

AWS also offers AWS DataSync which is an online data transfer and discovery service that simplifies, automates, and accelerates copying file and object data to and from AWS. This fully managed online data transfer and discovery service seamlessly scales as data loads increase, streamlining migration planning and eliminating on-premises data movement costs. AWS DataSync Discovery is a feature of AWS DataSync that helps customers simplify migration planning and accelerate their data migration to AWS by providing visibility into on-premises storage performance and utilization and providing recommendations for migrating data to AWS Storage services in a fast, cost-effective manner.

Additionally, using AWS Backup, many customers are reducing backup operational costs. AWS Backup helps protect application resources, including AWS storage, database, and compute services as well as hybrid workloads like VMware. AWS Backup supports the following capabilities for all its supported services and third-party applications: automated backup scheduling and retention management, centralized data protection monitoring, AWS Key Management Service-integrated backup encryption, cross-account management with AWS Organizations, data protection auditing and compliance reporting with AWS Backup Audit Manager and WORM with AWS Backup Vault Lock.