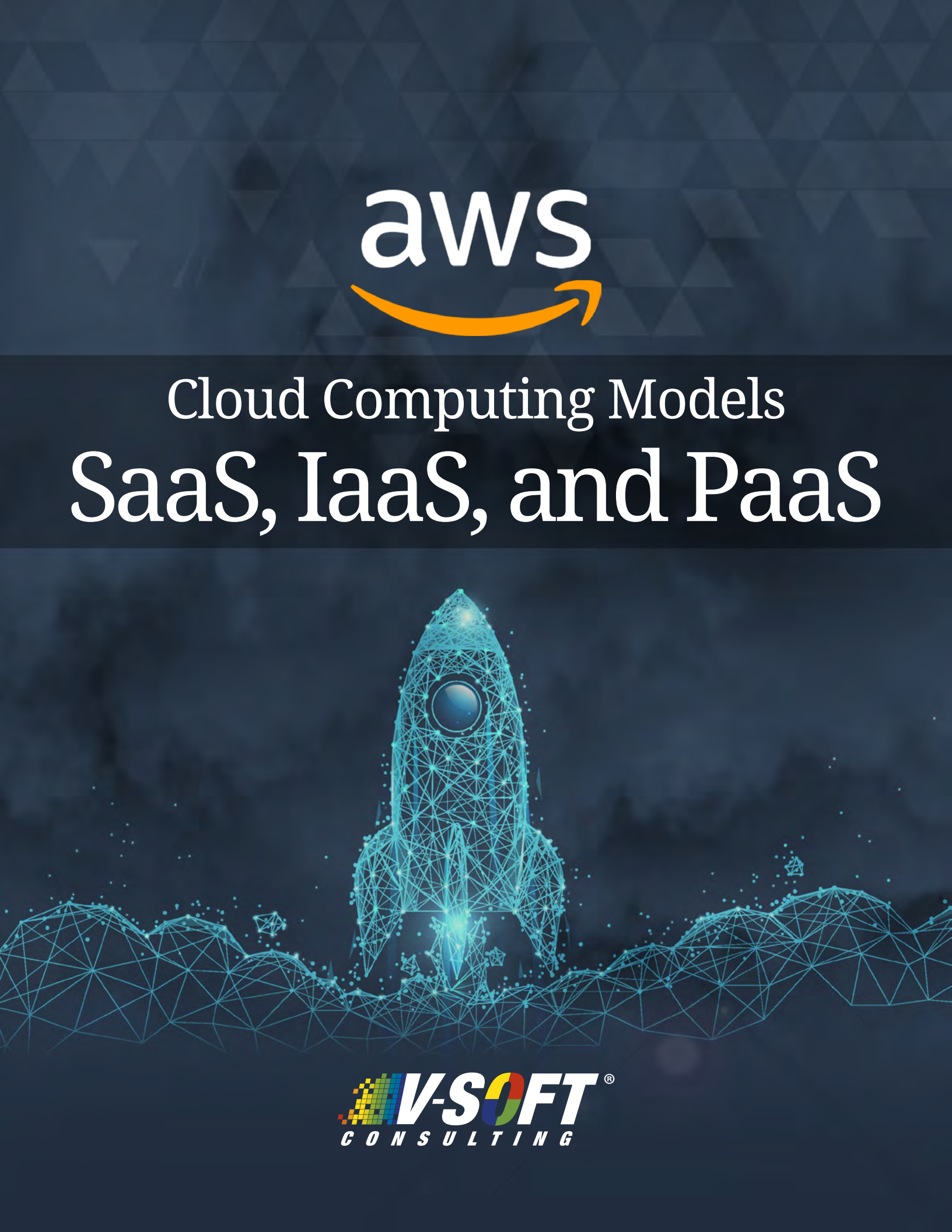
aws
Cloud Computing Models
SaaS, IaaS, and PaaS
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CONSULTING

AWS Cloud Computing Models

SaaS, IaaS, and PaaS

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Introduction

Cloud computing is providing developers and IT departments with the ability to focus on what matters the most and avoid undifferentiated work like procurement, maintenance, and capacity planning. As cloud computing has grown in popularity, several different models and deployment strategies have emerged to help meet the cloud needs of its diverse users. Each type of cloud service and deployment method provides different levels of control, flexibility, and management.

Based on this, cloud models are categorized into: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). Understanding the differences between these three cloud platforms is crucial. It's also important to understand what deployment strategies you can use and what set of services is best suited for your business needs. While there are many cloud players, AWS is the best in the market.

Introduction to AWS Cloud

Cloud strategy is driven by business vision, goals, and interests. It's important that cloud strategy be aligned and mapped to business objectives. This is what Amazon Web Services Cloud Adoption Framework (AWS CAF) solutions do. AWS cloud solutions deliver ready-to-use resources that can be purchased as needed.

Business teams can be spread across cities and even countries making it challenging for team collaboration and IT operations management. Processes should be agile and streamlined with different work streams. The AWS Hybrid Cloud Framework can trace and fix problems hindering the service delivery process. AWS Cloud Framework streamlines dynamic work streams, cross-functional development teams, operations and IT infrastructure. This way businesses can scale up agility and efficiency with robust solutions at optimal costs, reducing the investment, installation, and management of hardware resources. This is why AWS has clients across 190 countries.

On-Premise	Infrastructure as a Service (IaaS)	Platform as a Service (PaaS)	Software as a Service (SaaS)
Applications	Applications	Applications	Applications
Data	Data	Data	Data
Runtime	Runtime	Runtime	Runtime
Middleware	Middleware	Middleware	Middleware
O/S	O/S	O/S	O/S
Virtualization	Virtualization	Virtualization	Virtualization
Servers	Servers	Servers	Servers
Storage	Storage	Storage	Storage
Networking	Networking	Networking	Networking
You Manage		Others Manages	

Efficiency of AWS as an IaaS, SaaS, & PaaS Cloud Computing Model

Understanding the differences between Infrastructure as a Service, Platform as a Service, and Software as a Service, as well as what deployment strategies you can use can help you decide what set of services is right for your needs.

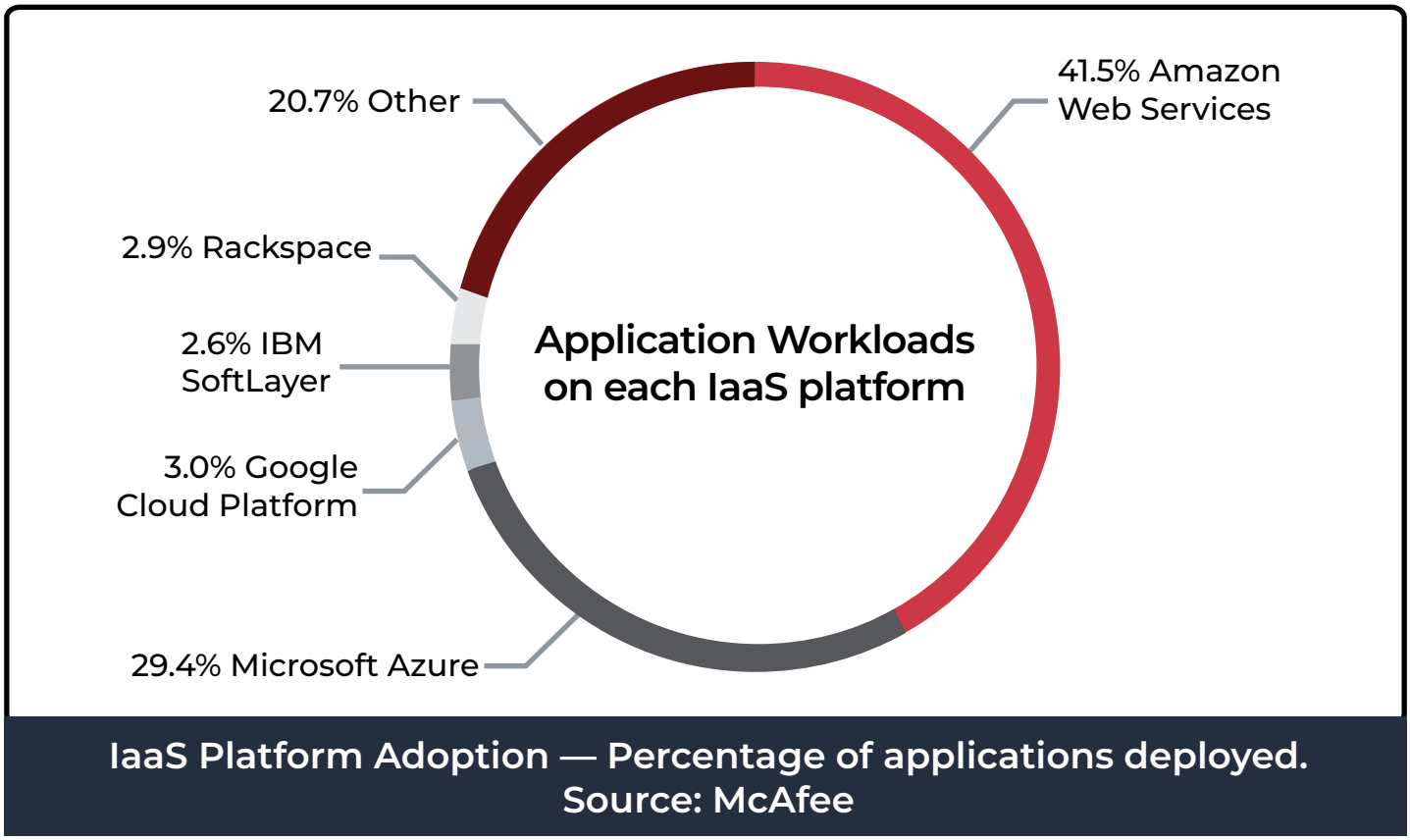
Market Projections of IaaS, PaaS, & SaaS

Worldwide Public Cloud Sevice Revenue Forecast (Billion of U.S. Dollars) - Gartner

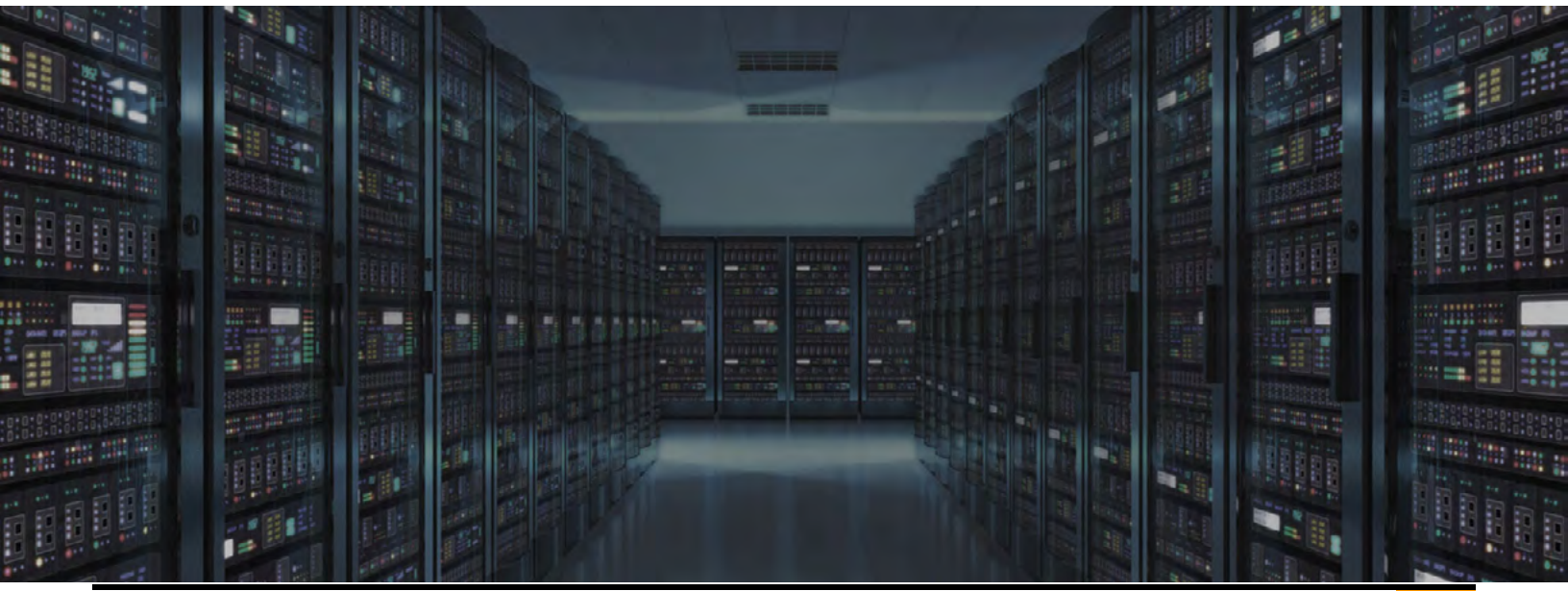
	2017	2018	2019	2020	2021
Cloud Business Process (BPaaS)	42.2	46.6	50.3	54.1	58.1
Cloud Application Infrastructure Services (PaaS)	11.9	15.2	18.8	23.0	27.7
Cloud Application Services (SaaS)	58.8	72.2	85.1	98.9	113.1
Cloud Management and Security Services (CMSs)	8.7	10.7	12.5	14.4	16.3
Cloud System Infrastructure Services (IaaS)	23.6	31.0	39.5	49.9	63.0
Total Market	**145.3**	**175.8**	**206.2**	**240.3**	**278.3**

AWS as Infrastructure as a Service (IaaS)

The Infrastructure-as-a-Service (IaaS) cloud model has transformed the way cloud computing and storage infrastructure services are attained and administered. Because of this, most organizations have migrated their legacy on-premise processes and applications to the public cloud, avoiding the costs and effort that goes into tasks like backup, archiving, and so on. In this space, there are many evolved cloud service providers like AWS, Microsoft, Google, IBM, Alibaba, and Fujitsu.



IaaS Platform Adoption — Percentage of applications deployed.
Source: McAfee



What Services can an IaaS Cloud User Expect?

- Service Functionality
- Enterprise and Hybrid Workload Support
- Support for DevOps
- Cloud Service Availability
- Compliance
- Data Protection
- Cybersecurity

Why AWS is Best Suited for IaaS Cloud Model

AWS has clients in close to 190 countries and has 66 Availability Zones within 21 geographic regions and the company plans to add 12 more. As a provider of IaaS, Amazon Elastic Compute Cloud (AWS EC2) facilitates extremely secure, cost-effective, flexible, and scalable cloud infrastructure and computing capacity. As an IaaS enabler, AWS makes it easier for cloud developers to auto-scale resources and makes web-scale cloud computing easier. The web service interface allows businesses to gain full configurability in resource utilization and computing capacities.

Developers are given full control of instances and can manage instances anywhere in the software stack, either to halt or reboot using web APIs at any given point in time while preserving the data. Amazon EC2 provides easy-to-develop tools and applications. Above all, businesses will be charged only for the time and resources used, thereby saving costs.

AWS offers networking services through a virtual private cloud and uses web APIs that offer on-premise connectivity. AWS Elasticsearch is used to handle load balancing during zero downtime or times of operational overheads. Users can deploy cluster clouds with ease and source data from another source using inbuilt APIs of Elasticsearch. Through this service, AWS streamlines all IaaS cloud operations management tasks such as hardware or software facilitation.

To ensure availability of instances and data consistency across all the Availability Zones in the regions, Elasticsearch uses the Amazon RDS Multi-AZ deployments to replicate the data between various Availability Zones within a region, to be highly available. The service also supervises the state of various cloud clusters and replaces the failed instances automatically.

Security is one of the biggest concerns businesses have when migrating to cloud applications. Not only does AWS provide low-cost data centers and robust network architecture, AWS is giving the utmost priority to security by offering full stack security solutions through Amazon Cognito to ensure secure and authenticated access to data and resources across any device or platform. To ensure secure transacting of data between various cloud resources, AWS KMS provides a centralized and managed approach to easily create and control the keys used to encrypt data. By using APIs, users can easily build applications incorporating AWS Encryption SDK with AWS KMS.

To ensure secure access to resources, AWS offers Identity and Access Management (IAM). This allows users to define roles and groups, and provide identity and access permissions. As an added layer of authentication, Multi-Factor Authentication can be enabled for individual users and can apply to AWS service APIs.

Preparation Prior to Adopting IaaS Platform

For successful adoption of IaaS platform, we suggests the following steps:

- Define and align high-level goals for cloud strategy
- Design cloud architecture
- Implement strategy
- Implement ongoing operations, management, and review cloud environment
- Govern the cloud transition strategy and frame of the new IT strategy

AWS as Software as a Service (SaaS)

Cloud strategy is one of the best driving forces of digital transformation. As a part of cloud strategy adoption, businesses are very keen on deploying SaaS models to alter the mode of delivering enterprise solutions faster and more effectively over cloud, even though some architectural challenges exist.

What is SaaS?

> *Software that is owned, delivered and managed remotely by one or more providers. The provider delivers software based on one set of common code and data definitions that is consumed in a one-to-many model by all contracted customers at any time, on a pay-for-use basis or as a subscription based on use metrics.*
>
> **- Gartner**

Example Scenario of SaaS

If you need an HR solution, a SaaS model makes it so you don't need to set up a server or complete system. Instead, HR can go directly to a website and utilize the service in a cloud environment.

Why Businesses Switch to SaaS Model

- Easy integration
- Instant results, rapid prototyping
- No need to invest in infrastructure and its maintenance costs
- Innovative and up-to-date technology
- User-friendly and secure services
- Availability of advanced features
- Best-in-class SLAs
- Only pay for what you use
- Flexibility for users and businesses
- Lower costs in application development ecosystem

Concerns of Cloud-Based SaaS Model Adoption

Research conducted by Transparency Market Research reveals that by 2020 the global market of Software-as-a-Service is expected to reach $164.29 billion. Despite the huge demand for SaaS cloud services, businesses still have doubts about adopting cloud SaaS because of:

Inconsistent Performance

As the third-party cloud service provider regulates and manages the SaaS service, client depend on service providers for security and performance maintenance. Because of this, some businesses are uncertain about issues like unexpected network downtime and service performance delivery. Also, considering the intensity of cyberattacks, businesses are still hesitant to adopt SaaS model despite having SLAs in place.

Less Support to Multi-Cloud

As the enterprise applications require integration with existing cloud applications, designing integration standards can be challenging.

Limited Integration Support

Many organizations require deep integrations with on-premise apps, data, and services. The SaaS vendor may offer limited support in this regard, forcing organizations to invest internal resources in designing and managing integrations. The complexity of integrations can further limit how the SaaS app or other dependent services can be used.

- **Data Security and Compliance**

  Large volumes of data may have to be exchanged to the backend data centers of SaaS apps in order to perform the necessary software functionality. Transferring sensitive business information to public cloud-based SaaS service may compromise security and compliance, as well as incur significant cost in migrating large amounts of data.

- **Limited Customization**

  Even though SaaS models offer ready-to-use solutions, customizing the solutions to suit business requirements is critical in most cases. But, businesses often think that SaaS models offer less customization options compared to on-premise models.

How AWS Serves as a SaaS

As a SaaS service provider, AWS provides its clients with complete solutions that are run and managed by AWS. Businesses don't have to worry about issues like how to maintain the service or essential infrastructure and instead can focus on innovation and business logic. AWS offers networking services for the cloud through a virtual private cloud and uses web APIs that offer on-premise connectivity. AWS Elasticsearch is used to handle load balancing during downtime or at the times of operational overheads.

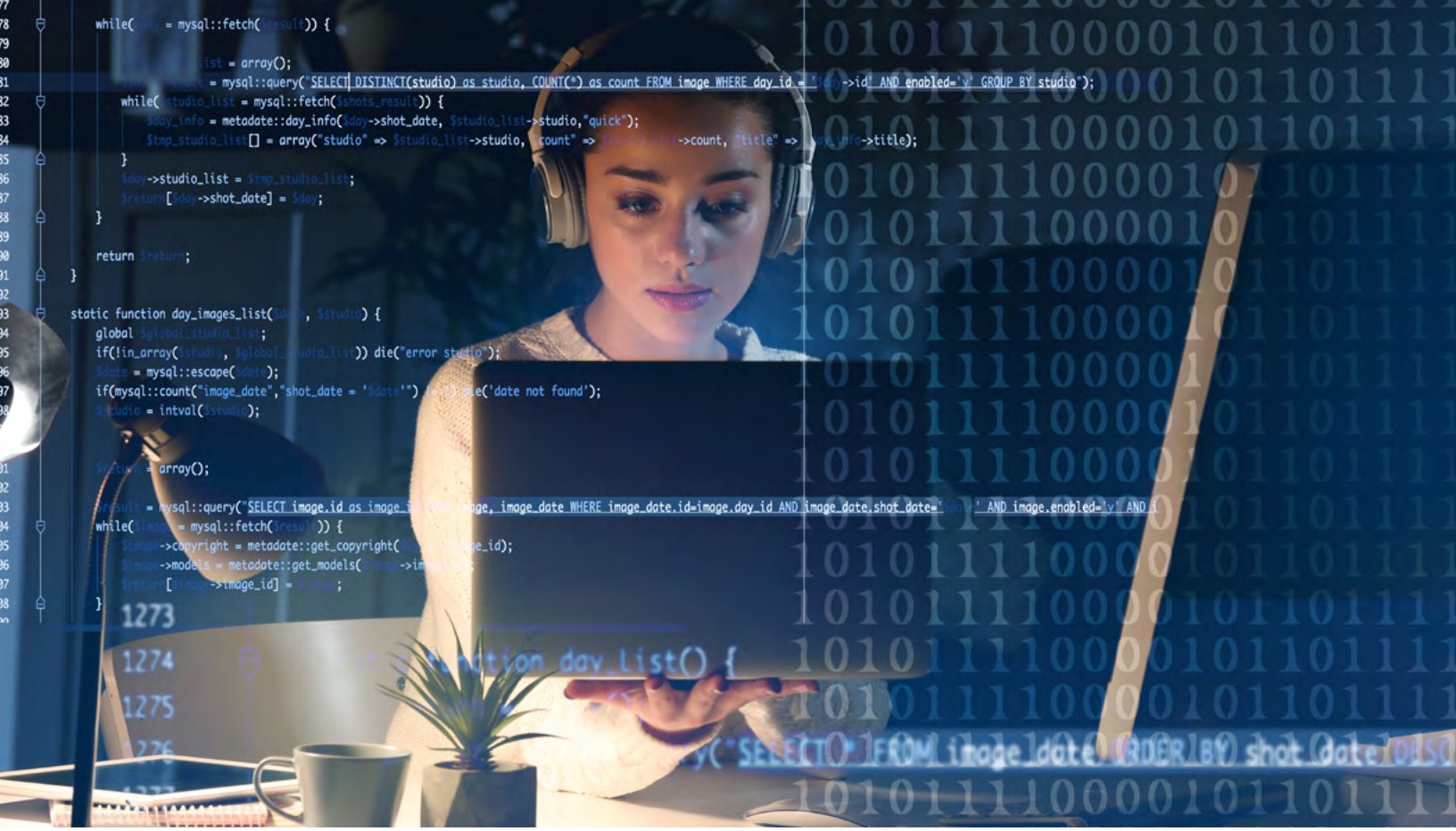
Amazon EC2 provides easy-to-develop tools and applications to configure apps and provide a strong set of APIs to easily integrate with all AWS services. AWS Backup users will have centralized automated backup progression that ensures all changes are saved.

AWS as a SaaS model adopts a multi-tenant strategy to ensure services are on a secured and secluded space. The distinction to client applications and data are allotted at all layers of service delivery with services like Amazon CloudWatch, robust data encryption, and better authentication of user access through Identity and Access Management (IAM). With built-in applications like IDS and IPS, businesses can have robust security and will be well informed in case of any security breaches or intrusions. Through services like Amazon CloudWatch, businesses can complete application and infrastructure management in real time. Integrating with tools like Amazon Kinesis, allows users to get real-time analytics on the vast software service management data (logs, access logs, and so on).

AWS as Platform as a Service (PaaS)

Platforms as a Service (PaaS) removes the need for organizations to manage the underlying infrastructure (usually hardware and operating systems) and allows you to focus on the deployment and management of your applications. This helps you be more efficient as you don't need to worry about resource procurement, capacity planning, software maintenance, patching, or any of the other heavy lifting involved in running your application. PaaS provides the infrastructure and application development platform to easily develop applications over a cloud platform. AWS Lambda is the most robust service that positions as a strong PaaS, enabling developers to utilize all AWS platform services.

> *Based on our experiences, I believe that we can be even more secure in the AWS Cloud than in our data centers.*
>
> **- Tom Soderstone,** CTO-NASA



AWS Lambda Function

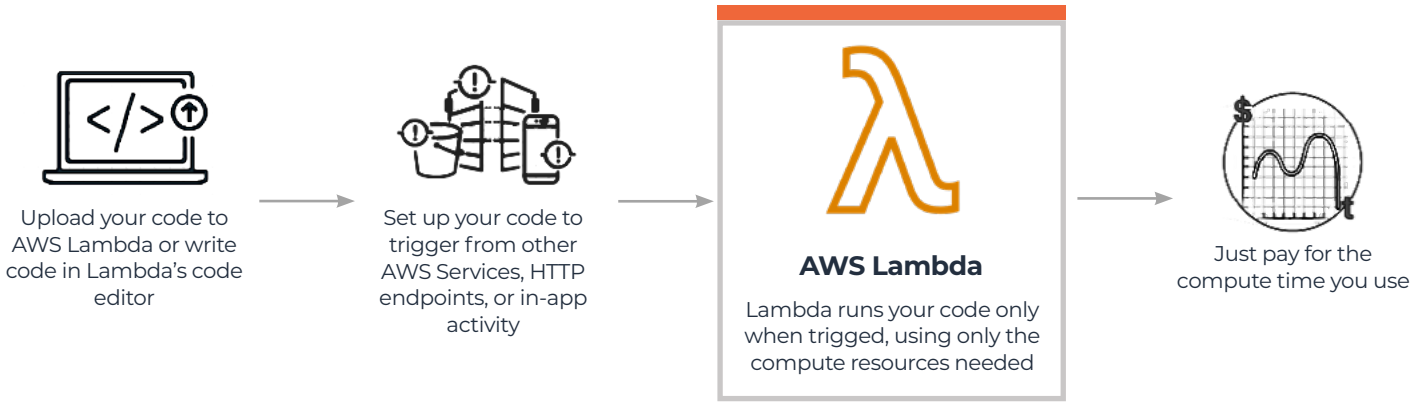
AWS Lambda is a serverless computing service that lets the developers run their code in the standard runtime environment of Lambda without having to worry about server handling with zero supervision. To develop any AWS service or application, creating a Lambda function is a must.

How AWS Lambda Works

Developers can start using Lambda services by uploading the code or coding directly in the Lambda's code editor and mention the condition triggers of the code. The code executed on the Lambda run time environment is called a Lambda function. With Lambda, any event can prompt your function without developers having to handle the server or getting the right type of application or resource - meaning businesses don't have to pay when the code isn't running, thereby saving on server costs.

Once an event triggers the Lambda platform, Lambda runs the associated code by picking resources to execute an event by making use of the best resources available in the infrastructure ecosystem, thereby enabling businesses to intelligently manage IT infrastructure. The Lambda runtime environment's control pane entity consists of APIs that facilitate AWS resources for the application execution. Another key aspect of run time environment is the data pane, this provides APIs to run the functions. Whenever a

function is called to run, the data pane facilitates either a dedicated execution environment or uses the allotted one. This execution environment is never shared with other functions.



Workflow of AWS Lambda

Key Aspects of AWS Lambda

- Users can run an application either from the web or in a mobile platform.
- Lambda makes use of AWS Identity and Access Management (IAM) module to ensure that only the right users or groups get access to the application or function.
- Lambda speeds up the execution process and scales your application or code by executing the events triggering a particular code.
- Developers don't have to focus on infrastructure to run an application, allowing them to focus on business logic.
- Strong APIs enable user applications to easily integrate with innovative AWS services like AI and machine learning to develop intelligent business applications or add intelligence into your applications.

Conclusion

Each cloud service and deployment method delivers diverse levels of control, flexibility, and management. The above discussed three cloud service models are meant for different business application use cases and requirements. So, choosing the right cloud model purely depends on the cloud capabilities your business demands. You can start by picking one cloud computing service model or discover the need for all three models; that rests on the scope and complexity of your business. Whatever cloud computing model your business demands, AWS offers many capacities that can transform your business.

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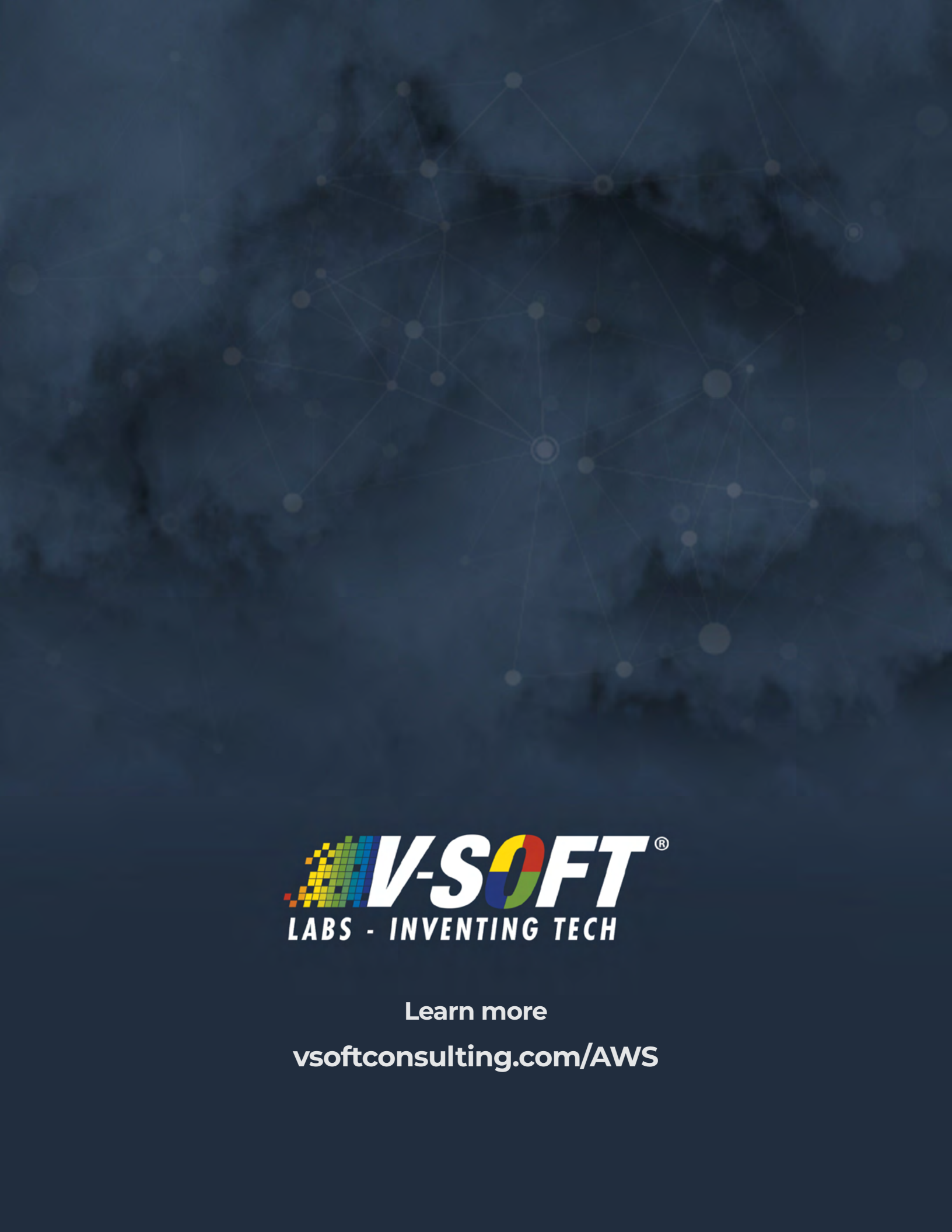

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