Secure Infrastructure Migration to AWS

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Abstract

Cloud services offer flexible, cost-effective, and easily accessible resources over the internet, impacting various aspects of daily work. While these services bring numerous benefits, migrating on-premise websites to the cloud poses specific challenges. Key challenges include data migration, system integration, security, cost management, potential downtime, skill gaps, provider selection, and data governance. Addressing these challenges is essential for successful migration and realizing the cloud's advantages.

Our research focuses on the opportunities and challenges of cloud migration, with a spotlight on the EC2, RDS, 6Rs strategy and Amazon S3's versatile storage classes. These cloud solutions enhance performance, scalability, and cost-efficiency, aligning businesses with modern standards.

Amazon Web Services (AWS), a leader in cloud computing, offers a comprehensive suite of services, renowned for its reliability, scalability, and affordability.

As cloud services continue to grow, they simplify the delivery of essential applications and data. The availability of migration tools for on-premise to cloud transitions has expanded significantly.

Keywords: Data Migration, Cloud, EC2, RDS, 6R, S3 and AWS

Introduction

Organizations increasingly leverage cloud services to deploy their software systems, in contrast to traditional applications that were conventionally deployed on-premises. Cloud computing has become a focal point in the realm of computing, garnering attention from academia, industry, and research initiatives. Despite this shift, many organizations continue to rely on legacy systems and software that have evolved over the years. Some software applications are unsuitable for migration to a cloud-based environment, while others may not significantly benefit from such a transition. On the other hand, some applications are purpose-built to operate efficiently in a cloud environment. Our primary focus is on the process of migrating legacy on- premises software to the intended cloud environment.
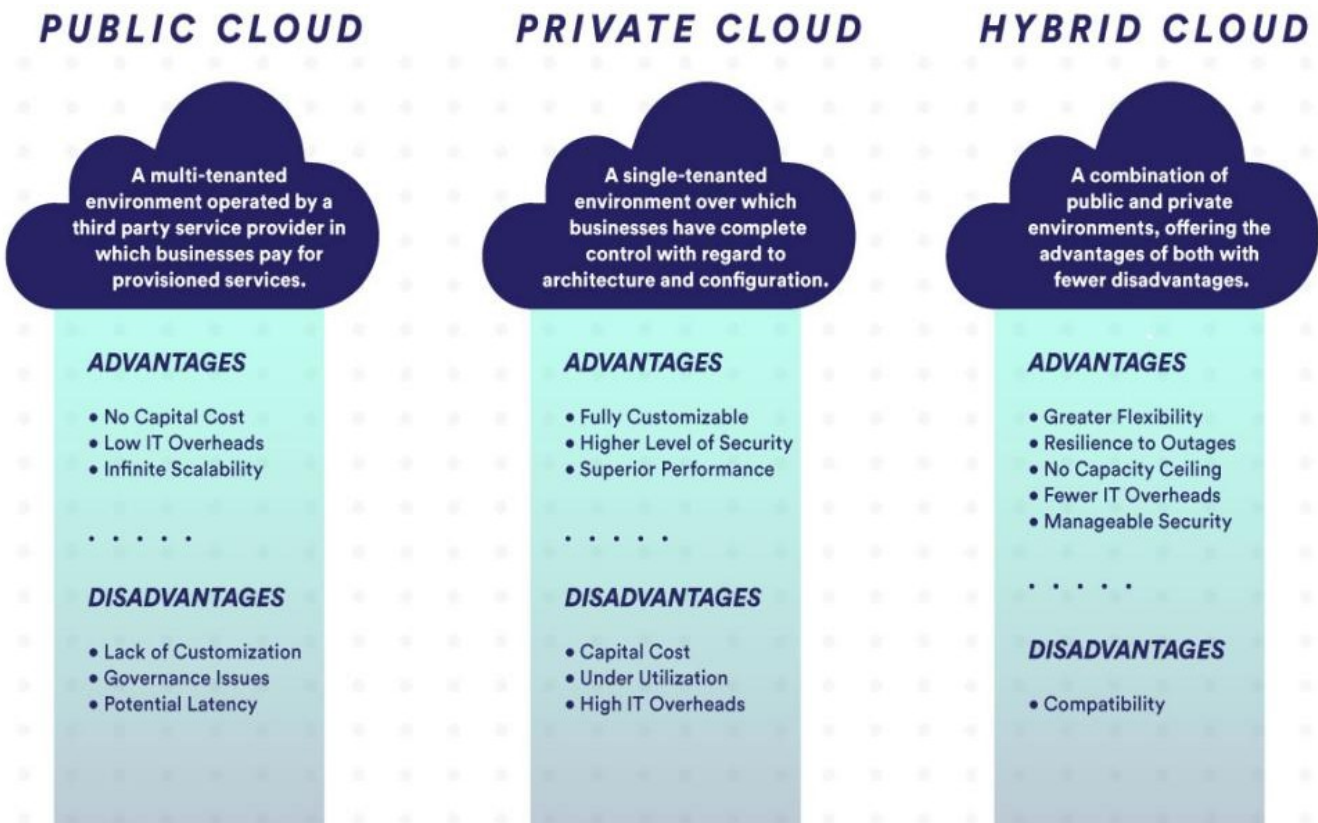
Cloud migration encompasses the movement of digital assets, including data, workloads, IT resources, and applications, to cloud infrastructure. This process generally involves transferring tools and data from outdated legacy infrastructure or on-premises data centers to cloud-based platforms.

Types of Cloud
Public Cloud: Public cloud refers to cloud resources owned and operated by third-party cloud service providers. It offers users access to resources such as servers, software, and storage over the internet.

Private Cloud: Private cloud involves cloud resources exclusively used within a single organization. A private cloud can be located within an organization's on-site data center or hosted by a third-party service provider.

Hybrid Cloud: Hybrid cloud, as the name suggests, is a combination of both private and public clouds, interconnected with technology that enables the sharing of data and applications between them.
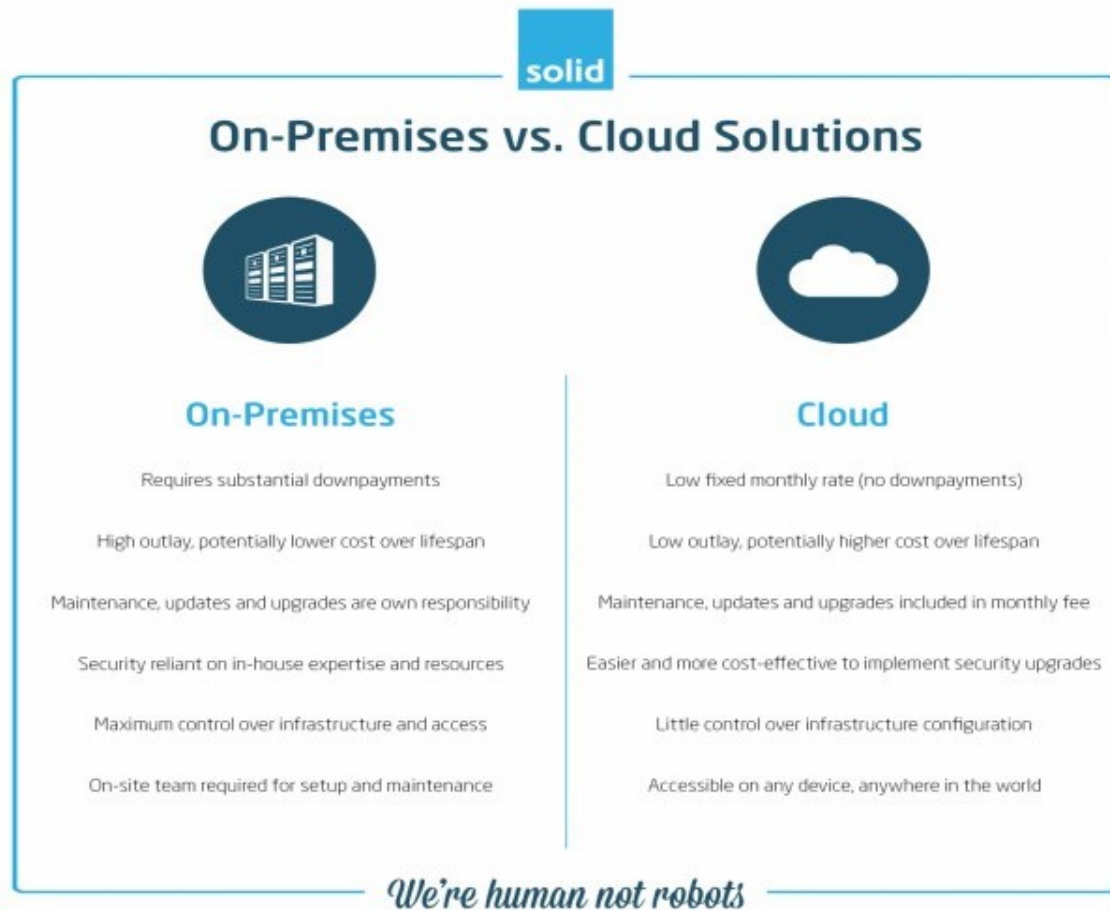
PUBLIC CLOUD

A multi-tenanted environment operated by a third party service provider in which businesses pay for provisioned services.

ADVANTAGES

- No Capital Cost
- Low IT Overheads
- Infinite Scalability

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DISADVANTAGES

- Lack of Customization
- Governance Issues
- Potential Latency

PRIVATE CLOUD

A single-tenanted environment over which businesses have complete control with regard to architecture and configuration.

ADVANTAGES

- Fully Customizable
- Higher Level of Security
- Superior Performance

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DISADVANTAGES

- Capital Cost
- Under Utilization
- High IT Overheads

HYBRID CLOUD

A combination of public and private environments, offering the advantages of both with fewer disadvantages.

ADVANTAGES

- Greater Flexibility
- Resilience to Outages
- No Capacity Ceiling
- Fewer IT Overheads
- Manageable Security

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DISADVANTAGES

- Compatibility

Methodology
Motivated by the numerous benefits of cloud computing environments, there has been substantial research conducted on cloud-enabled software and the migration of on-premise software to the cloud.

This research approach primarily focuses on methods, techniques, processes, and frameworks to facilitate the decision-making process for cloud migration. The core questions driving this research include understanding the motivations behind migrating to the cloud, identifying the methods and techniques that enable the transition from on-premise software, and exploring the reasons for choosing AWS for both startups and enterprises.

On-premise vs Cloud: On-premise software requires an enterprise to purchase a license or a copy of software to use it. While on cloud a company host everything in house.

On-Premises vs. Cloud Solutions

On-Premises	Cloud
Requires substantial downpayments	Low fixed monthly rate (no downpayments)
High outlay, potentially lower cost over lifespan	Low outlay, potentially higher cost over lifespan
Maintenance, updates and upgrades are own responsibility	Maintenance, updates and upgrades included in monthly fee
Security reliant on in-house expertise and resources	Easier and more cost-effective to implement security upgrades
Maximum control over infrastructure and access	Little control over infrastructure configuration
On-site team required for setup and maintenance	Accessible on any device, anywhere in the world

We're human not robots

A cloud migration is when a company moves some or all of its data center capabilities into the cloud these usually runs on cloud-based infrastructure provided by a cloud service provider such as AWS, Google Cloud, Or Azure. As more and more companies have transitioned to the cloud, cloud migration is increasingly taking place in the cloud. Here are some benefits of cloud which migrate their resource to public cloud

Scalability: The architecture is made scalable through the process of virtualization unlike the physical machines in which the performance and resources are set, virtual machines are used. These VMs are easy to scale and can be move to different servers or can be host on different server at once. Third party cloud providers also have vast amount of hardware and software in place for rapid scaling.

Cost: Traditional companies must spend on capital cost (servers, software, licensing hardware etc.) Operational cost (servers, network infrastructure storage datacenter etc.) indirect business cost (unplanned and planned downtime). While cloud have only direct cost (hardware, software) and indirect costs such as loss of productivity etc. The company in cloud can devote themselves into innovating and developing new product or improving the existing product.

Performance: Cloud has faster product development and deployment also it has automatic scaling and load balancing it's also encourages standardization which increases the performance of the application or website.

Digital Experience: The cloud provides an omni channel for customer experience, its reduces the waiting time and it can react with the customer 24×7.

Modeling & Analysis

Brief about AWS: Amazon Web Services (AWS) is a renowned cloud computing platform that offers a wide array of services such as storage, servers, security, and networking to its users. While AWS provides numerous products, three key offerings stand out: EC2, a cost-effective cloud storage solution, Amazon Virtual Machine Service, and S3. In the second quarter of 2023, Amazon reported a staggering $24.2 billion in sales. With 114 availability zones where their servers are located, AWS serves customers in approximately 245 countries. AWS maintains a dominant market share of around 33%, followed by Azure at 23%, and Google Cloud at approximately 11%.

Developing a comprehensive migration strategy is a complex process, typically commencing with a planning phase that identifies elements in the potential migration environment, interdependencies, and what will migrate versus what will remain. This is commonly referred to as the '6Rs of Migration'.

Retire: This stage involves assessing all application workloads to determine which are suitable for migration to the cloud and which should be phased out. This process helps in making cost- effective decisions by retiring elements that no longer serve a purpose.

Retain: Some applications may not be suitable for cloud migration due to factors like design constraints, regulatory compliance, or unsupported operating systems in the target cloud environment. These applications should be retained on-premises.

Rehost: Rehosting, often referred to as the 'lift and shift' method, involves moving an organization's application to the cloud platform in its existing state. While the core infrastructure remains the same, the cloud offers benefits like consumption- based pricing. This migration approach typically results in cost reductions of up to 20% for organizations..

Re-platform: Re-platforming is a migration approach that lies between the two strategies mentioned earlier. Like rehosting, it entails transferring an application to the cloud. However, re- platforming involves making adjustments to the application to fully utilize the capabilities of the cloud infrastructure. This includes optimizing the application for improved scalability and making use of reserved cloud resources with minimal alterations to the existing code.

Figure 1: A Sample Line Graph using Colors which Contrast Well Both on Screen and on a Black-and-White Hardcopy
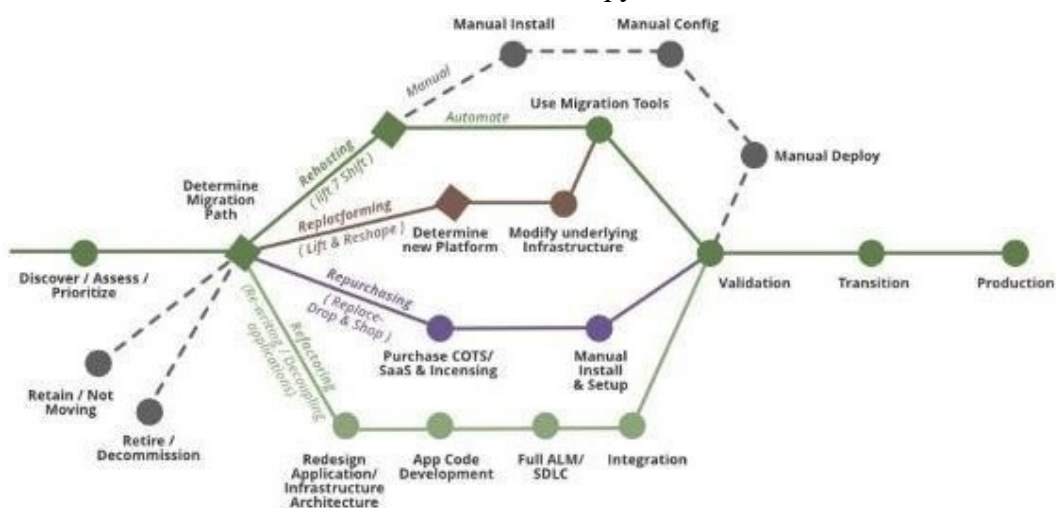
Repurchase: When an application is outdated, organizations can acquire a modern application framework from the AWS Marketplace, which offers a range of Software as a Service (SaaS) products. Repurchasing streamlines the migration process, saving time and effort.
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Refactor & Re-Architect: Refactoring involves rewriting application components to effectively use cloud services, making the code more maintainable. Re-architecting redesigns the application to take full advantage of cloud-native capabilities. This approach requires a deep understanding of both the application and cloud platform but offers long-term benefits..

Challenges in Migration

Migrating an on-premise website to the cloud presents several challenges:

1. **Data Transfer and Integration:** Transferring large volumes of data from on-premise servers to the cloud can be time-consuming and bandwidth- intensive. Integrating on-premise data with cloud services requires careful planning.
2. **Security and Compliance:** Ensuring the security of sensitive data during migration and after it resides in the cloud is paramount. Meeting compliance requirements and regulatory standards may add complexity.
3. **Downtime and Availability:** Minimizing website downtime during migration is challenging. Maintaining high availability and performance is crucial for businesses.
4. **Cost Management:** Cloud costs can escalate if not managed properly. Understanding pricing models and optimizing resource usage is essential.
5. **Resource Compatibility:** Compatibility issues may arise when moving applications or databases to the cloud. Some software may not function optimally in a cloud environment.
6. **Skills and Training:** Teams may need training to manage cloud resources effectively, potentially increasing operational costs.
7. **Data Transfer Speed:** The speed of data transfer to the cloud depends on network bandwidth, which may limit migration efficiency.
8. **Vendor Lock-In:** Switching cloud providers post-migration can be complex, leading to vendor lock-in concerns.
9. **Performance Monitoring:** Monitoring performance in the cloud is different from on-premise environments, necessitating adjustments.
10. **Strategic Planning:** Lack of a clear cloud migration strategy can result in inefficiencies and complications.

Result

Enterprises must conduct comprehensive research and testing to select, tailor, and implement the most suitable cloud services to maximize available opportunities. They need to assess the impact of transitioning to the cloud on their business processes and make informed decisions regarding what should be migrated, when, and what should remain on-premises. Cloud migration strategies should be aligned with the organization's current state in terms of culture, politics, sponsorship, and future IT objectives. Examining current trends, it's evident that broader adoption of cloud computing is the way forward.

Amazon EC2 is a web service providing resizable virtual servers in the cloud, identified by unique ID numbers. Users can launch and manage instances to run applications on various operating systems.

Amazon RDS is a web service offering managed relational databases in the cloud, with each instance identified by a unique ID number. It allows users to focus on application development while handling database hosting and maintenance.

Conclusion

Advantages of Amazon EC2 (Elastic Compute Cloud):

1. **Scalability:** EC2 allows users to scale compute capacity up or down based on demand, ensuring optimal performance without over-provisioning.
2. **Flexibility:** Users can choose from a variety of instance types, each optimized for different workloads, operating systems, and applications.
3. **Customization:** EC2 instances can be configured with specific hardware, storage, and network configurations, allowing users to tailor resources to their application requirements.
4. **Global Reach:** With multiple data center locations worldwide, EC2 enables users to deploy applications close to their end-users for reduced latency and improved performance.
5. **Cost Control:** EC2 follows a pay-as-you-go pricing model, allowing users to pay only for the compute capacity they consume, with options for reserved instances to reduce costs further.
6. **Integration:** Seamless integration with other AWS services allows for easy collaboration and utilization of additional features like load balancing, auto-scaling, and security services.

Advantages of Amazon RDS (Relational Database Service):

1. **Managed Service:** RDS simplifies database administration tasks such as patching, backups, and monitoring, allowing users to focus on application development rather than database maintenance.
2. **Scalability:** RDS provides options for automatic scaling of compute and storage resources, ensuring databases can handle growing workloads without manual intervention.
3. **Multi-AZ Deployments:** RDS supports multi-Availability Zone (AZ) deployments for high availability and fault tolerance, minimizing downtime in case of infrastructure failures.
4. **Security:** RDS offers built-in security features, including encryption at rest and in transit, automated backups, and support for Virtual Private Cloud (VPC) network isolation.
5. **Database Engine Options:** RDS supports various popular relational database engines, such as MySQL, PostgreSQL, Oracle, SQL Server, and MariaDB, giving users flexibility in choosing the right database for their application.
6. **Automated Backups and Point-in-Time Recovery:** RDS automates regular backups and allows users to restore databases to any point in time within a specified retention period, enhancing data protection and recovery capabilities.
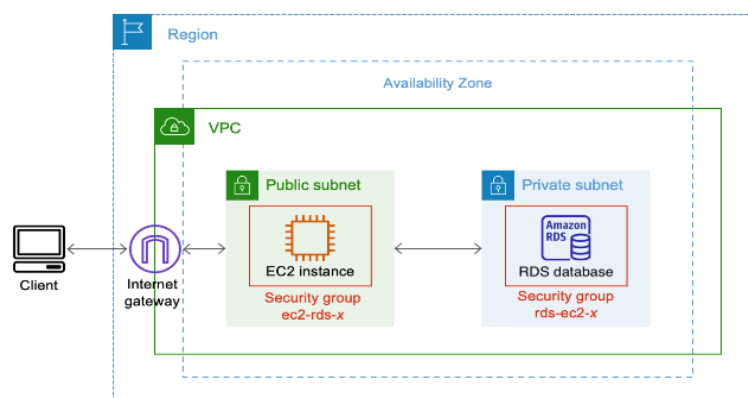
The adoption of cloud technology has become the new standard, with companies of all sizes recognizing its numerous advantages. Our exploration of the 6Rs in cloud migration, including retire, retain, rehost, re-platform, repurchase, and refactor & rearchitect, coupled with our examination of Amazon EC2 and its instances, as well as Amazon RDS and its database options, has shed light on the process of migrating on-premise applications to the cloud. This migration not only enhances the overall experience but also provides a better understanding of your applications, improved scalability, and cost-efficiency. It equips businesses to embrace new strategies and align their applications with the latest industry standards.

As the availability of cloud services continues to grow, cloud applications will play an increasingly integral role in our daily lives. Whether an organization chooses to expand its existing on-premises software deployments or transition to the cloud, these services will simplify how essential applications and data are delivered to users. It's worth noting that there is now a wide array of tools available for migrating from on-premise to the cloud, representing a significant advancement compared to previous years.

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