

ICREON

WHITEPAPER

# THE ICREON GUIDE TO CLOUD MIGRATION

Cloud Platforms Enabling Digital Transformation



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# INTRODUCTION TO CLOUD SOLUTIONS



**Cloud migration may be the most important thing an organization can do to keep up with security, innovation, reliability, computing costs, and operational management.**



Werner Vogels, AWS CTO

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Cloud solutions are defined by the replacement of on-premise data center facilities by **hyperscale hardware** owned and operated by a third-party company. Three major public cloud companies dominate the marketplace: Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP). Competition between public cloud companies is very strong, representing the latest developments in Information Technology (IT) released by corporations with **over \$1 trillion in market capitalization**. Apple, IBM, Facebook, Oracle, Ali Baba, Twitter, Netflix, VMware, and thousands of other companies compete in the cloud sector with products that are designed for managed data center use.

## The CIO's Dilemma - CapEx Vs OpEx Consideration for Cloud Adoption:

- 1 Cloud Migration: How to offset CapEx investment with cloud adoption and OpEx investment?
- 2 What are the advantages of using flexible OpEx Cloud strategies vs. long-term CapEx commitments?
- 3 AWS Cost Explorer: How to generate efficient cost savings with a multi-year cloud commitment?
- 4 Experimentation with Cloud Adoption: How can we test & verify critical Proof of Concepts (PoC)?
- 5 Infrastructure as Code (IaC): How to save costs, improve security, & protect against Trojan attacks?



This guide will provide an overview of the different requirements in **cloud migration strategies** for enterprise organizations, web/mobile startup companies, and small businesses. The most common need for large business groups is legacy software modernization. By focusing on legacy database and software modernization, businesses can transform to cloud solutions that save significant time, money, and effort for IT teams. This guide will discuss organizational alignment with industry best practices by adopting a cloud migration strategy that is specifically tailored to the active IT resources of any business. This process includes adopting Agile software management and DevOps techniques as a primary solution. We also offer the ability to transform applications to run on event-driven architecture for real-time streaming data analytics across any organization, web/mobile application, or platform.

Cloud migration can include the optimization of IT resources in a hybrid or multi-cloud strategy. Data-driven organizations increasingly demand integration with Artificial Intelligence (AI) and Machine Learning (ML) platforms for analytics or providing custom content. Digital Experience Platforms (DXPs) are increasingly being used to create custom websites and mobile applications based on legacy CMS or CRM data that personalize the digital journey of a user. Businesses of any size can access software development tools on public cloud platforms that allow them to transform their apps by introducing new features. Many companies use multi-cloud software to enhance daily worker productivity. A key aspect of cloud web server systems is their ability to scale elastically according to the demands of variable user traffic rates.

The elastic scalability of IT resources is one of the main reasons that businesses choose cloud migration strategies and opens up a network of DevOps techniques for software performance optimization, including real-time metrics based on platform data. Event-driven architecture built on Apache Kafka and Pulsar powers over **80% of Fortune 100 companies**. Microservices and APIs are used by Agile software development teams to modernize legacy databases and mainframe applications to run in the cloud through container virtualization. This guide will discuss managing IT resources at scale with AWS EC2 and **Kubernetes** for elastic hardware and database support. In summary, business owners should consider investing in the re-programming of legacy applications based on new cloud technologies for long-term product support. **Icreon** is a trusted partner in managing the cloud migration process.



# CLOUD PLATFORMS: THE MAIN TYPES OF CLOUD ARCHITECTURE

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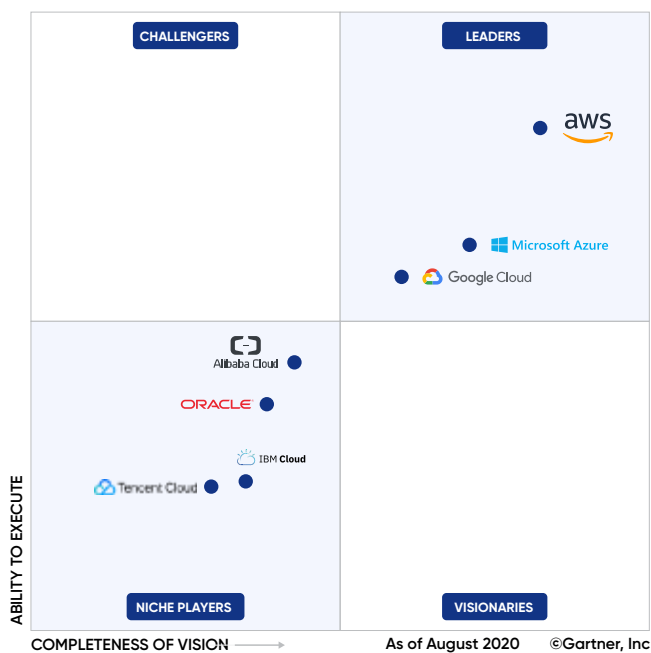
The main types of cloud architecture are public, private, hybrid, and multi-cloud. The definition of public cloud was first popularly detailed by Luiz Andre Barroso and Urs Holzle of Google in their research paper: "The Datacenter as a Computer: An Introduction to the Design of Warehouse-Scale Machines." (2009) This publication illustrated the advantages and primary design components of "warehouse-scale data centers" in comparison to the traditional usage of a web server as a single hardware unit. With Virtual Machines (VMs), hypervisors like vSphere, ESXi, KVM, and Hyper-V allow the kernel of an operating system to be shared across partitions with isolated security. Hyperscale public cloud infrastructure separates the computation, database, storage, and routing capacities of a network to different hardware units using Software-Defined Networking (SDN) rather than relying on the vertical installation of all software components on a single unit. The addition of a service mesh allows public cloud services to scale elastically with load balancing across more than one server, providing software support for millions of users at a time, i.e. through AWS EC2, OpenStack, Kubernetes, etc. solutions.

Private cloud represents the transformation of the on-premises data center with elastic scalability and virtualization, including improved load balancing and hardware efficiency. The advantage of a private cloud is that the hardware is locally owned and operated, to be physically managed by authorized employees only. Enterprise companies use software solutions like VMware, Nutanix, Mirantis, Red Hat OpenShift, etc. to manage their private cloud architecture, where there is increasingly a transition to adopting Kubernetes solutions. VMware is the market leader in private cloud orchestration, where virtual machines (VMs) with any operating system can be managed in synchronization across data center hardware through a unified control panel. Other companies prefer to run **Microsoft Azure** Stack as a private cloud solution for greater ease in auditing or web/mobile software support. **AWS Outposts** offers companies the ability to run AWS EC2, ECS, EKS, etc. in a private cloud, functioning similarly to the **Google Anthos** system. IaaS platforms like Red Hat OpenShift, SUSE CaaS, and VMware Tanzu show the increasing use of Kubernetes in a private cloud for industrial manufacturing, HPC, & other requirements.

Functional shifts in private cloud data center management routines have been implemented to facilitate integrated and secure hybrid cloud operations. In a hybrid cloud, some of the database, web server, and storage files are maintained in an on-premise data center, using public cloud or



edge servers for other aspects of the operation. **Software-Defined Networking (SDN)** allows network administrators to create hybrid cloud architecture that spans public and private cloud resources. With multi-cloud constructs, hardware products and software services from multiple public cloud or SaaS companies are used under a unified organizational security policy. Not all multi-cloud policies include private cloud functionality like a hybrid cloud. Many companies use multiple public cloud data centers and Content Delivery Networks (CDNs) to complete their cloud orchestration requirements. The use of Function-as-a-Service (FaaS) or "Serverless" platforms like **AWS Lambda** as well as AI/ML integration for custom software processing also falls under the categorization of hybrid or multi-cloud computing.



Gartner's market quadrant report for **Cloud Service Providers (CSPs)** shows the clear market dominance of Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP). **lcreon** has assembled a team of software developers, web/mobile application programmers, DevOps engineers, and data center technicians to manage the complete software pipeline during cloud migrations to these platforms. The Seven Migration Strategies defined below need to be incorporated to specify the best fit for the business under consideration, i.e. to take advantage

of PaaS products like programming language utilities, SQL/NoSQL DBaaS products, elastic hardware automation, SDN for international data centers, audited compliance on hardware, load balancing on network traffic, or other options for cloud software runtime optimization. This includes an analysis of where cost savings can be implemented in operations.



# CLOUD ADOPTION: COMMON MYTHS & MISCONCEPTIONS



**Cost efficiency must be defined broadly to account for all the significant components of cost, including hosting-facility capital and operational expenses (which include power provisioning and energy costs), hardware, software, management personnel, and repairs.**



Barroso & Holzle (2009)

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The most common **myth about cloud adoption** is that it is easy for businesses to migrate their existing IT resources to a new plan on a public cloud host. Cloud migration is often more about adopting new technologies, platforms, and standards than preserving old systems. Legacy software must be modernized for cloud runtimes in containers. Businesses may need to hire new, expert staff to support the latest web/mobile programming languages and adopt Agile software development methods with DevOps methodologies to be successful. For example, some companies adopt cloud solutions like **Amazon Redshift** to use the same database on their applications as Amazon.com uses in production, i.e. for better speed and performance at scale. To accomplish this, the website or mobile application must be re-coded to the specifications of the database. It is not a trivial operation to transfer a MySQL application to run on AWS EC2 or Kubernetes with elastic scale. Nor is it easy to meet all of the geo-location routing requirements for GDPR compliance in an audited manner for banking, finance, social networking, and ecommerce applications. Businesses build the most benefit by cloud optimization, i.e. using a solution like **Amazon Aurora** to run MySQL apps in AWS EC2 architecture at elastic scale or a CDN to meet the requirements of reactive systems, where the development costs must often be balanced against intangibles like introducing new software application features or refactoring applications for speed, metrics, security, and performance improvements.



To dispel myths and misconceptions around the usage of "the cloud" as a terminology, it is helpful to use three primary classifications for products and solutions:

## **SOFTWARE-AS-A-SERVICE (SAAS)**

Over 90% of all enterprise companies already use SaaS applications as part of their daily workflow. Software-as-a-Service (SaaS) includes email applications like Gmail or Outlook; word processing and spreadsheet apps like Microsoft Office, Apple Pages, or Google Docs; Image, Video, & Animation applications; CRMs; Ecommerce applications; Web Building software; etc. all of which is hosted at scale by cloud web servers.

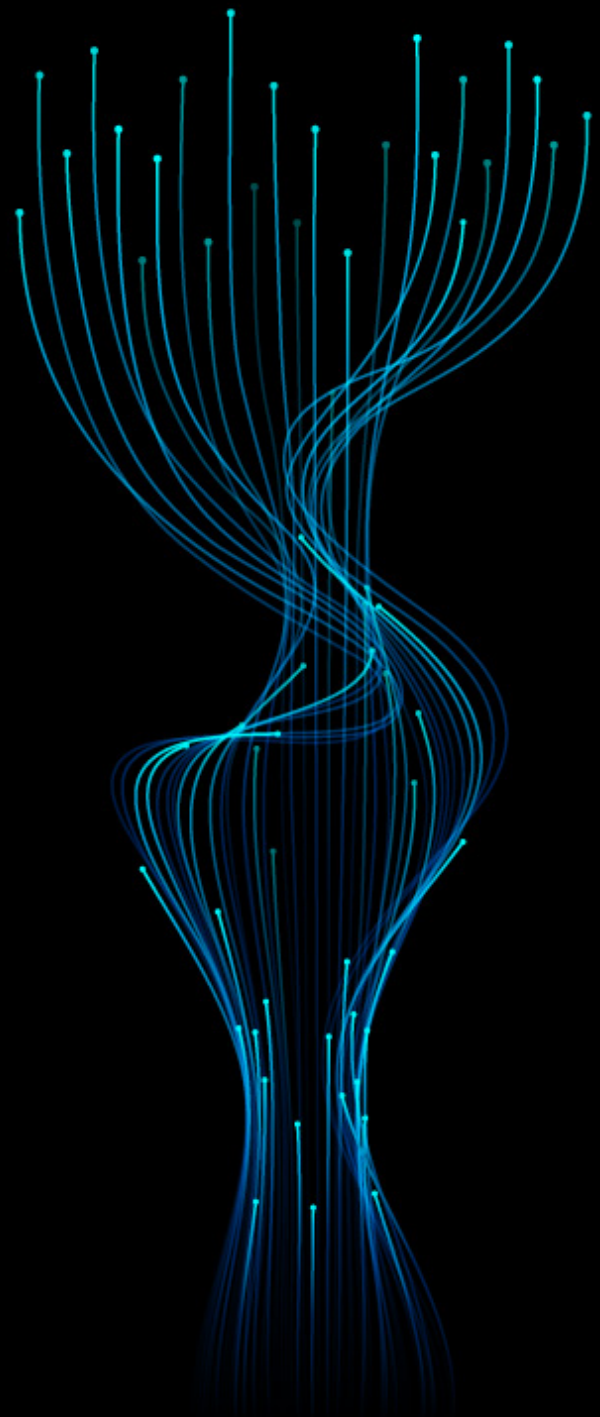
## **PLATFORM-AS-A-SERVICE (PAAS)**

Public cloud hosts and third-party startup companies make PaaS products available in many different varieties, where the primary goal is access to a set of tools related to web and mobile application development that facilitates operations. Managed cloud hosting platforms allow programmers access to pre-configured environments for web/mobile application development that includes server, database, and programming language tools.

## **INFRASTRUCTURE-AS-A-SERVICE (IAAS)**

Companies that need to replace entire on-premise data center facilities with cloud hardware can choose IaaS specialist companies for access to cloud hardware at commodity rates. IaaS companies usually

provide "bare metal" hardware at a scale that can be configured to any runtime operating system, programming language, and database as required. Some IaaS companies offer Containers-as-a-Service (CaaS) solutions with Kubernetes servers, others offer pre-installed Azure Stack hardware, OpenStack, VMware, etc.





The use of the SaaS, PaaS, and IaaS terminology helps to eliminate confusion in IT planning when discussing cloud solutions. Each product in these categories has unique security challenges and risks that must be assessed by the company following internal policies. Similarly, every company will build a unique configuration of cloud products for their daily workflow that will depend on IT management strategy, requirements of employees, dependencies of software, and other factors. Using this terminology also assists IT managers to identify where they can cut costs or optimize relationships.

Common terminology for the cloud includes Database-as-a-Service (DBaaS) and Containers-as-a-Service (CaaS) classification. For companies with requirements for **reactive architecture**, i.e. where the hardware/software stack must be able to scale from 10 to 10 million users seamlessly in production, there is a growing ecosystem of third-party utilities for programming, development, and data center management that can facilitate operations grouped under DevOps categorization. In programming, **Microservices** refer to API-driven functionality on distributed cloud hardware that is used to replace legacy monolithic applications or mainframe databases. Virtualization is primarily related to Virtual Machines (VMs), Virtual Private Servers (VPS), and Container systems like **Docker, Kata, LCX/LCD**, etc. The public cloud hosting companies each offer hundreds of different products aimed at businesses of all sizes under both "pay as you go" and monthly subscription plans. The use of precise terminology assists the audit of IT resources.



# IT AUDITING: **BUILDING VERIFIED DIGITAL NATIVE BRANDS AND SERVICES**

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The world's largest Fortune 500 companies spend hundreds of millions of dollars per year on a public cloud host to replace their internal data centers and run public-facing software at enterprise scale. Companies like **Netflix** can represent over 10% of total internet bandwidth per hour, all managed with **open source software** on AWS. Entire web hosting companies like GoDaddy or WPengine run their operations on public cloud hardware. Since there is no technical limit other than budget to the scale of a public cloud host, the main challenge for businesses now is to optimize their cloud spend per annum through better data analytics, staffing, and organization. This may also involve legacy software applications or database modernization for cloud runtimes. Many companies are choosing reactive systems and **event-driven architecture** for streaming, real-time data analytics across an organization. Traditional brands can learn from Digital Native strategies in cloud adoption and adopt Agile software development methods in project management to bring new features to market more quickly. After the categorization of cloud products is standardized, it is possible to do a complete audit of a business organization's IT

resources for network analytics, legal compliance, and future planning. To prepare an overall cloud migration strategy, we have to include cross-vendor comparisons of the SaaS, PaaS, and IaaS resources available. In developing a cloud migration strategy for any organization, Icreon utilizes a combination of the "GRADIENT" approach, which can be operated as a complete guide to the BPO contracting process. The Seven Migration Strategies guide our project management work with clients.



Icreon utilizes the **GRADIENT** framework to plan cloud migration for our clients:

<b>G</b>	Goal Definition	Requirements for the project defined by the consultation process.
<b>R</b>	Role Crafting	Establishing a specific role for each member of the Icreon team.
<b>A</b>	Actionable Process	Identifying the software elements to be modernized or upgraded.
<b>D</b>	Digital Strategy	Establishing the choice of database, programming language, OS, etc.
<b>I</b>	Information Architecture	Installing & provisioning public cloud hardware for runtimes.
<b>E</b>	Execution Strategy	The plan for the Agile software development team to port the app.
<b>N</b>	Nuanced Tuning	Optimizing the cloud runtime with load balancing, CDNs, caching, etc.
<b>T</b>	Test and Improve	Maintaining sandbox test environments for new features & updates.

The IT audit should include a complete map of all resources in a business organization that can be used in developing event-driven architecture solutions. The network topology allows IT managers to estimate the scale of resources required at every level of the supply chain. Because each business has different technical requirements and organizational structure, a specific IT plan, and cloud strategy is required to be developed to optimize operations. In enterprise organizations, data analytics can assist cloud resource optimization. The IT audit can also

include quality assessment of domain assets like websites and mobile applications to determine where they can be improved or made more efficient in runtime. **Reactive systems** should load every page in under 1 second. The auditing of desktop and manufacturing resources by vertical can assist cloud migration through cost reductions in software licensing, hardware over-provisioning, or the addition of Serverless & AI/ML solutions. The network topology map will also allow businesses to establish a service mesh for unified security



Serverless & AI/ML solutions. The network topology map will also allow businesses to establish a service mesh for unified security policy implementation in multi-cloud management. The open-source Apache Kafka and Pulsar software can be used for event-driven architecture.

### **Icreon recommends the use of Seven Migration Strategies as a guide to the process:**

- 01** | Implementing a Cloud Adoption task force or a steering committee with the partner.
- 02** | Defining the overall goals of the Cloud Migration strategy with the specific roles for Icreon.
- 03** | Establishing the controls required by hardware/software auditing & compliance in cloud governance in the project, as well as infrastructure planning for data analytics & metrics.
- 04** | In Opportunity Evaluation, Icreon builds a PoC report to show how businesses can calculate Opportunity Cost, taking into account running business processes while migrating to the cloud.
- 05** | Through Portfolio Discovery and Planning, Icreon will customize the cloud migration plan to the unique software requirements of the project for public cloud runtime optimization.
- 06** | We then consult with the partner to discuss the final choice of the cloud platform for migration.
- 07** | Finally, the data residency options are orchestrated using the choice of public cloud CSP.

These Seven Migration Strategies are required for very large and complex organizations with multiple stakeholders, as well as for mid-size, SMBs whose cloud governance would be defined as cross-functional coordination at the senior executive level. The Seven Migration Strategies align organizations with cloud best practices for software runtimes through cost commitment from financial leadership, hardware/software audited for legal compliance, data analytics customized for sales & marketing teams, and the cloud security metric definition advanced with adherence from the CIO office.



# Mapping of On-Premises Security Controls vs Major Cloud Providers

ON-PREMISES	aws	Microsoft Azure	Google Cloud	ORACLE®	IBM Cloud	Alibaba Cloud
Firewall & ACLs	Security Groups AWS Network ACLs	Network Security Groups Azure Firewall	Cloud Armor VPC Virtual	VCN Security List	Cloud Security Groups	NAT Gateway
IPS/IDS	3 <sup>rd</sup> Party Only	3 <sup>rd</sup> Party Only	3 <sup>rd</sup> Party Only	3 <sup>rd</sup> Party Only	3 <sup>rd</sup> Party Only	Anti-Bot Service Website Threat Inspector
Web Application Firewall (WAF)	AWS WAF AWS Firewall Manager	Application Gateway	Cloud Armor	Oracle Dyn WAF	Cloud Internet Servicez	Web Application Firewall
SIEM & Log Analytics	AWS Security Hub Amazon GuardDuty	Azure Sentinel Azure Monitor	Stackdriver Monitoring Stackdriver Logging	Oracle Security Monitoring & Analytics	IBM Log Analysis Cloud Activity Tracker	ActionTrail
Antimalware	3 <sup>rd</sup> Party Only	Microsoft Antimalware / Azure Security Center	3 <sup>rd</sup> Party Only	3 <sup>rd</sup> Party Only	3 <sup>rd</sup> Party Only	Server Guard
Data Loss Prevention (DLP)	Amazon Macie	Information Protection (AIP)	Cloud Data Loss Prevention API	3 <sup>rd</sup> Party Only	3 <sup>rd</sup> Party Only	Web Application Firewall
Key Management	Key Management Service (KMS)	Key Vault	Cloud Key Management Service	Cloud Infrastructure Key Management	Key Protect Cloud Security	Key Management Service
Encryption At Rest	EBS/EFS Volume Encryption, S3 SSE	Storage Encryption for Data at Rest	Part of Google Ioud Platform	Cloud Infrastructure Block Volume	Hyper Protect Crypto Services	Object Storage Service
DDoS Protection	AWS Shield	Built-in DDoS defense	Cloud Armor	Built-in DDoS defense	Cloud Internet Services	Anti-DDoS
Email Protection	3 <sup>rd</sup> Party Only	Office Advanced Threat Protection	Various controls embedded in G-Suite	3 <sup>rd</sup> Party Only	3 <sup>rd</sup> Party Only	3 <sup>rd</sup> Party Only
SSL Decryption Reverse Proxy	Application Load Balancer	Application Gateway	HTTPS Load Balancing	3 <sup>rd</sup> Party Only	Cloud Load Blancer	Server Load Balancer (SLB)
Endpoint Protection	3 <sup>rd</sup> Party Only	Microsoft Defender ATP	3 <sup>rd</sup> Party Only	3 <sup>rd</sup> Party Only	3 <sup>rd</sup> Party Only	Server Guard
Certificate Management	AWS Certificate Manager	Key Vault	3 <sup>rd</sup> Party Only	3 <sup>rd</sup> Party Only	Certificate Manager	Cloud SSL Certificates Service
Container Security	Amazon EC2 Container Service (ECS)	Azure Container Service (ACS)	Kubernetes Engine	Oracle Container Services	Container - Trusted Compute	Container Registry
Identify and Access Management	Identity and Access Management (IAM)	Azure Active Directory	Cloud Identity Cloud IAM	Oracle Cloud Infrastructure IAM	Cloud IAM App ID	Resource Access Management
Privileged Access Management (PAM)	3 <sup>rd</sup> Party Only	Azure AD Privileged Identity Management	3 <sup>rd</sup> Party Only	3 <sup>rd</sup> Party Only	3 <sup>rd</sup> Party Only	3 <sup>rd</sup> Party Only
Multi-Factor Authentication (MFA)	AWS MFA (part of AWS IAM)	Azure Avtice Directory	Security Key Enforcement	Oracle Cloud Infrastructure IAM	App ID	Resource Access Management
Centralized Logging / Auditing	CloudWatch / S3 bucket	Azure Audit Logs	VPC Flow Logs Access Transparency	Oracle Cloud Infrastructure Audit	Log Analysis with LogDNA	Log Service
Load Balancer	Application Load Balancer Classic Load Balancer	Azure Load Balancer	Cloud Load Balancing HTTPS Load Balancing	Cloud Infrastructure Load Balancing	Cloud Loader Balancer	Server Load Balancer
LAN	Virtual Private Cloud (VPN)	Virtual Network	Virtual Private Cloud Network (VPC)	Virtual Cloud Network (VCN)	VLANs	Virtual Private Cloud (VPC)
WAN	Direct Connect	ExpressRoute	Dedicated Interconnect	FastConnect	Direct Link	VPN Gateway Express Connect
VPN	VPC Customer Gateway AWS Transit Gateway	Virtual Network SSTP	Google VPN	Dynamic Routing Gateway (DRG)	IPSec VPN Secure Gateway	VPN Gateway
Governance Risk and Compliance Monitoring	AWS CloudTrail AWS Compliance Center	Azure Policy	Cloud Security Command Center	3 <sup>rd</sup> Party Only	3 <sup>rd</sup> Party Only	ActionTrail
Backup and Recovery	AWS Backup Amazon S3 Glacier	Azure Backup Azure Site Recovery	Object Versioning Cloud Storage Nearline	Archive Storage	IBM Cloud Backup	Hybrid Backup Recovery
Vulnerability Assessment	Amazon Inspector AWS Trusted Advisor	Azure Security Center	Cloud Security Scanner	Security Vulnerability Assessment Service	Cloud Security Advisor Vulnerability Advisor	Server Guard Website Threat Inspector
Pacth Management	AWS System Manager	Update Management	3 <sup>rd</sup> Party Only	3 <sup>rd</sup> Party Only	IBM Cloud Orchestrator	3 <sup>rd</sup> Party Only
Change Management	AWS Config	Azure Automation (Change Tracking)	3 <sup>rd</sup> Party Only	3 <sup>rd</sup> Party Only	3 <sup>rd</sup> Party Only	Application Configuration Management (ACM)



# CLOUD METRICS: DATA ANALYTICS FOR HARDWARE & SOFTWARE

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After the cloud audit, business organizations can build better data analytics and metrics functionality into their software to improve results. Businesses that adopt data-driven solutions will have the most advanced platform analytics and use it as a tool for DXP customization using machine learning. On the cloud servers, technology like **DataDog**, **Grafana**, **Prometheus**, and **Tableau** can be used for network user analytics. For product and media recommendations driven by machine learning, an event-driven architecture can be implemented to record user preferences. Companies like **Salesforce** provide CRM capabilities that can be used to customize DXP websites for unique user journeys or displays. For machine learning requirements, Google's Cloud TPU platform based on **TensorFlow** and **AWS SageMaker** compete with **Azure ML** on features, pricing, and notebook functionality. The world's most innovative IT companies are using machine learning with event-driven architecture. Businesses can also use event or message data to build customized analytics displays for sales & marketing teams or platform analytics.

Under the current paradigm, ML-driven data analytics should be operating at every level of the service mesh to provide optimal load balancing on running software and

databases with integrated security, anti-virus, and DDoS protection on all cloud software applications. Products like **OpenStack**, and **Redis** are popular cloud solutions due to their load balancing capabilities. **DataDog**, **New Relic**, **Nagios**, **Dynatrace**, and similar software can provide detailed information on the network traffic across domains and apps. Salesforce recently acquired Tableau for custom data analytics displays, where many startup companies offer similar services as open-source utilities. The world's most innovative companies are using an event-driven architecture with Apache Kafka and Pulsar for real-time streaming analytics across their websites, mobile applications, or logistical supply chain. The advantage of these solutions is that they can be customized to the particular needs of a business organization. The data can also be warehoused with services like **Snowflake**, **AWS S3**, or **Salesforce** and used in machine learning applications for the product or content recommendations. Data analytics are now the most important aspect of cloud optimization with many companies refactoring their software to enhance this functionality for improved operational efficiency across verticals, brands, and domain properties.



# CLOUD MIGRATION: SOFTWARE DEVELOPMENT & DIGITAL TRANSFORMATION

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With cloud migration, businesses need to build upon the information in the IT resource audit and pre-determine a data analytics, user metrics, and security system for each layer of the stack. Cloud security is complex and based on several inter-woven factors. Data analytics and security need to be coded into the software application according to verified systems as a primary requirement. Then the business needs to choose the most appropriate means of migrating the software application code and database to the cloud. At Iceon, we recommend following [Cisco's "Six-Rs" system](#) which involves a choice of:

## 01 Rehosting:

The easiest of all the cloud migration strategies, where the code and database are simply transferred from one public cloud platform to another ("lift and shift"). For companies modernizing legacy software applications and databases, this is considered as a straight port of the private cloud runtime stack software to the public cloud host with no compatibility issues.

## 02 Replatforming:

When the legacy software application and database need modification to be hosted in the cloud, the replatforming strategy is required. Replatforming can be based around container runtimes or involve more complex code conversion to change database support. Legacy database code can be converted to MySQL, NoSQL, Redshift, etc. as required.

## 03 Repurchasing:

If the company has poorly coded or archaic software to be ported, repurchasing can be a viable option. Similar to replatforming, the company makes a decision to use a company like Salesforce, eBay, Shopify, Adobe, SiteCore, Intuit, etc. for the software and simply imports the legacy data through .csv and web files, or starts over with a new customer database.



## 04 Refactoring:

The most complex option for cloud migration is refactoring, where the software application is specifically re-coded in a new programming language or database format to be cloud-native with better performance. The development team ports data between the legacy application and the new system, allowing it to be customized for future use as required.

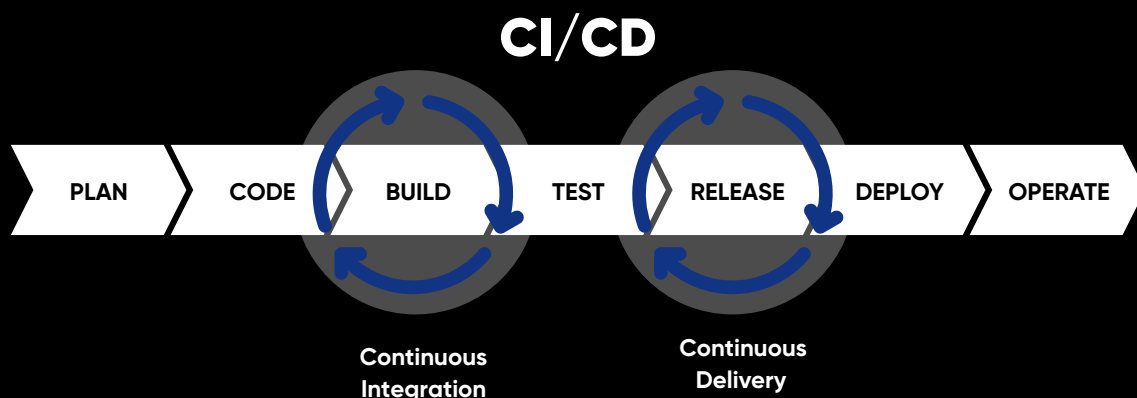
## 05 Retiring:

When one of the first four approaches has been accomplished, the business can consider retiring the legacy application completely as an "End of Life" (EoL) product. The code and database information can be archived for historical reference, but this must be done with a distinct security plan in place, such as local storage in protected facilities, to prevent data loss.

## 06 Retaining:

When a software application is live and running but the organization decides it is not ready for cloud migration, or not required, it is known as retaining in the "Six R's" system. Many companies choose to retain local use of software due to existing licensing agreements or employee work requirements. Small businesses may be able to save money by retaining shared Linux hosting or using a VPS with open source software like WordPress or Drupal & a free CDN.

By following the "Six-Rs" strategy, the goal of the cloud migration process is to operate the software with "four-nine" (99.99%) uptime guarantees. Building on the results of the initial IT audit, the "Six-Rs" strategy allows businesses to apply the latest Agile project management methods for programming teams to innovate more quickly. This process also brings the code and database under contemporary best practices for version control, allowing security updates and new features to be added in rolling updates without downtime. The IT audit also allows these rules to be applied under the size and scale of existing operations, with planning for elastic scalability and expansion of resources.





# CLOUD MIGRATION: RESOURCE PLANNING & TRANSITION MANAGEMENT

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Business owners with legacy applications or active websites need to consider resource planning and transition management as part of the cloud migration process. In the case of event-driven architecture, the use of serverless functions, or the requirement of machine learning processing, the cost is determined not only by the cloud platform but also by the programming and support teams. When a website and mobile application is migrated to the cloud through the "Six R's" process, the guarantee is a fully optimized, cloud-native application with the addition of better metrics, data analytics, and performance speeds. Optionally, businesses can choose to adopt event-driven architecture across their organization for real-time, streaming data analytics. The choice is largely based on whether an organization is developing a system-wide corporate change or focusing on a single application upgrade.

At **lcreon**, our framework to plan for cloud migration involves a process where we:



Define  
Goals



Define  
Roles



Assess the  
Current State



Prioritize  
and Plan

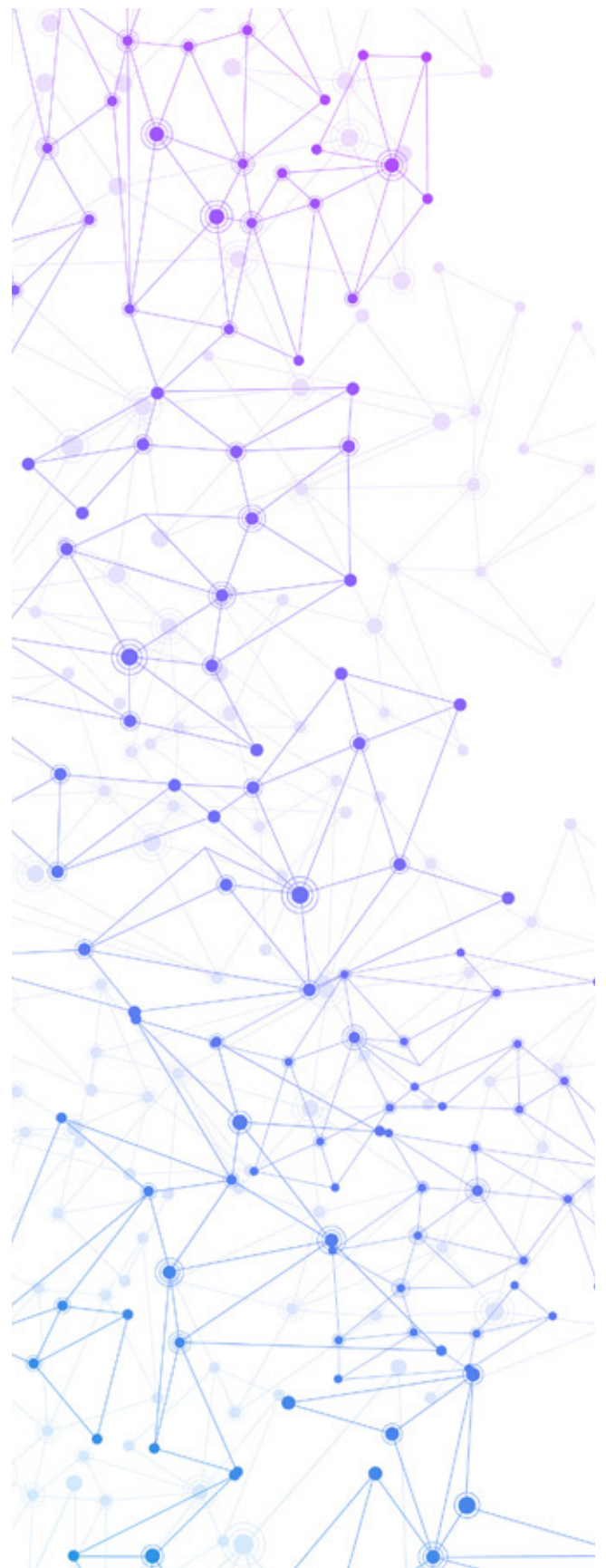


Execute

Although every business has unique requirements for cloud migration, we can apply the strategy outlined above equally to all of our clients as an integration specialist. **lcreon** uses Agile project management techniques to assemble a unique team of experts for each business individually. When a business defines the goals of the process, we determine how best to implement data analytics and platform metrics across the application. This includes decision-making on the adoption of event-driven architecture, machine learning, or elastic scalability. Through a meeting and negotiation process, we define the roles necessary to complete the project according to the agreed-upon requirements.



Our IT audit allows us to assess the current state of the legacy application to be migrated to the cloud. After the initial plan, our team will upgrade the code and database using a team of programming experts working under Agile fundamentals. We specialize in porting archaic legacy code to the public cloud platforms of AWS, GCP, and Microsoft Azure. We prioritize areas where PaaS tools specific to each public cloud can optimize the functionality of the application or provide needed stability over time for data warehousing. We build automation using containerized code for running in Kubernetes or AWS EC2 in elastic hardware frameworks. We plan for DevOps and hire team experts to execute the cloud migration with full management of the code and database under CI/CD protocols for version control.



# CLOUD MIGRATION: **COMMON FRAMEWORKS & BEST PRACTICES**

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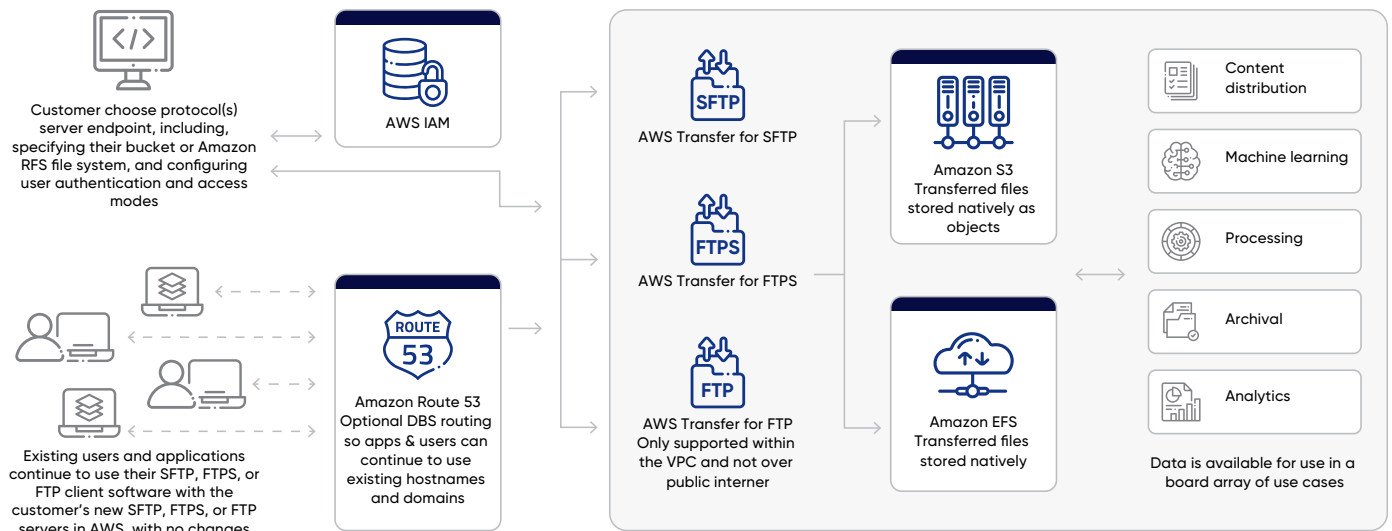
All of the public cloud companies have proprietary tools for migrating applications to their platforms. The efficacy of each depends on the compatibility of the platforms and the scope or dynamics of the project involved. AWS offers prescriptive guidance, a migration evaluator, the cloud adoption readiness tool (CART), and migration hub as their primary utilities for **cloud migration**. Most companies are going to need a trusted partner like **Icreon** to assist the process. AWS has assisted thousands of companies in migrating to their platform, including GE, Coca-Cola, Samsung, & BP. The ability to transfer web/mobile applications and databases is relatively easy with VMware. There are also cloud migration tools for popular enterprise software from SAP, Oracle, IBM, and Microsoft that can assist AWS transitions. Many companies are looking to refactor their applications to make use of AWS products like AWS EC2, EKS/ECS, Redshift, Aurora, Lambda, and SageMaker. Contact **Icreon** to provide managed cloud migration services that include full-stack optimization for web/mobile application runtimes.

Microsoft Azure's **cloud migration** utilities include SMART, the Strategic Migration Assessment and Readiness Tool. The company has tools for IT managers to calculate cost savings vs. other public cloud platforms, but most of the resources are oriented to developers and programmers. Azure does provide easy migration tools for SQL-based databases, as well as containerized web/mobile application support through both VMs and Kubernetes. VMware installations will transfer easily but many apps still require refactoring for cloud runtimes. Many companies are interested in optimizing their existing applications for Microsoft Azure or using the blob storage service as a long-term data warehouse. **Azure Migrate** has one of the most extensive and secure cloud migration solutions available for "big data" requirements. One of **Microsoft Azure's** main suggestions is to "engage a cloud migration partner... Work with a managed service provider that offers support through the entire migration process and beyond."

**Google Cloud Platform (GCP)** has one of the largest set of resources for cloud migration with tools available for applications, databases, and entire data centers. The company has recently released the **Anthos platform** with integrated cloud migration tools. As with other public cloud providers, most clients are looking for greater optimization of their applications to take advantage of the GCP toolset. Icreon functions as a trusted partner for **Google Cloud** app and database migrations. This includes support for VMware installations as well as containerization with refactoring for Kubernetes hosting with DevOps & CI/CD management.



## Foundation Toolkit can be used on GCP to accelerate the transition process for "big data" requirements.



**Migrating applications to AWS by using the rehosting (lift and shift) approach doesn't automatically give you the benefits of the elasticity, resiliency, ease of deployment and management, and flexibility that AWS offers. Nor does it automatically modernize your culture and processes to enable high-performing software development. Modernization means taking your application environment in the form that it's in today (most likely, legacy and monolithic) and transforming it into something that is more agile, elastic, and highly available. In doing so, you can transform your business into a modern enterprise."**



Vijay Thumma (AWS, 2020)

AWS has some advanced options for "big data" cloud migration requirements that include the **Snow Family** of devices. Where Snowcone and Snowball allow companies to transfer terabytes worth of data securely and physically to AWS data centers, the company also provides the Snowmobile, a semi-truck configured to transfer over 100 petabytes of data at a time. Otherwise, developers can use tools from **AWS Transfer Family** to migrate data using SFTP, FTPS, and FTP. Command-line, FXP, and version control tools like Git are the most common methods for data transfer to the public cloud hosting platforms.



# CLOUD MIGRATION: CASE STUDIES OF COMPANIES BY SIZE

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Business owners have many different reasons for cloud migration, all of which can be addressed by the "Six R's" process proposed by Cisco and the GRADIENT steps utilized by **lcreon**. Case studies focus on the best practices in the industry which other businesses seek to emulate and illustrate the depth of IT issues involved with different organizations. Most organizations are seeking greater innovation, lower costs, higher performance, elastic scalability, automation of services, and integration with DevOps tools for code management in production. Many companies have ported their internal productivity and manufacturing software applications to the cloud, as well as public-facing websites and mobile apps. The unique nature of every organization's IT structure makes case studies an important way to learn how the world's leading companies are transforming their business organizations through cloud migration.

## Some examples of cloud migration include:



successfully moved 33 applications, 26 services, and eight support tools to AWS Cloud.



migrated to Google Cloud to take advantage of services to boost fan engagement.



shifted support for over 800 million tax returns and 10,000 offices to Azure Cloud.



migrated over 700 web servers and 350 apps to Microsoft Azure for better scale



Although these represent just a small number of companies, the case studies illustrate the power of public cloud platforms to scale operations for the world's largest companies with the highest levels of security. The case studies also show how companies are refactoring their legacy software applications to optimize for the particular tools like databases or server orchestration frameworks offered by the public cloud platforms. Finally, the case studies can be viewed as examples of the competitive pricing and cost savings that enterprise companies are seeking when making a major cloud migration. **lcreon** can assist with simplifying these cloud migration processes for businesses of any size as a trusted partner and certified integration specialist for the public cloud. We can also assist with adding new features such as data analytics, machine learning, pub/sub messaging, serverless functions, etc. to apps as an upgrade.



***In 2021, we will see new business models emerge that facilitate the deployment of edge, efforts by cloud platforms to compete, and AI and 5G facilitating the expansion of edge use cases... Over the next three years, buyers will shift their cloud strategies toward the edge to capture all this innovation and become more connected.***

-Forrester Research, "Predictions 2021" Report



# CONCLUSION: MANAGED CLOUD MIGRATION

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Cloud platforms like AWS, GCP, & Microsoft Azure enable the digital transformation of businesses of any size or in any sector of operations. Cloud migration can be as simple as adopting a new platform like Salesforce and building your custom web/mobile applications for brands using CRM data and Tableau for data analytics. Companies like **Acquia** provide a cloud solution for Drupal that competes in the DXP marketplace with **Adobe Experience Cloud** and other third parties to be the leading force for migrating legacy websites and mobile applications. The use of **DXP code** gives Agile development teams the tools required to build web/mobile applications with customized user journeys and integrated ML data analysis for content/product recommendations. **DXP software** is also hosted on elastic cloud architecture that is managed by industry experts, potentially saving money over custom-coded solutions.

**Icreon** has developed a team of experienced programmers and data center engineers to function as a specialist in cloud migration to AWS, GCP, and Microsoft Azure platforms. Our consultation process includes a discussion of the use of third-party vs. self-hosted solutions depending on the requirements of the project. We work remotely with business, non-profit,

and government clients worldwide as a cloud integration specialist company to offer services like:

01 Omnichannel Commerce

02 Managed Services

03 Data Integration/AI

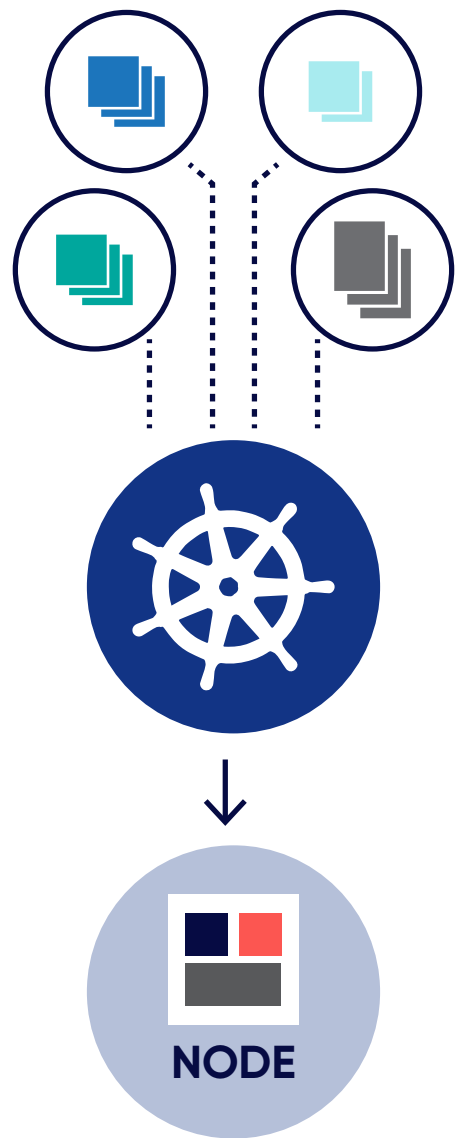
04 Microservices and API

05 Cloud and DevOps

06 Staff Augmentation



There is high demand across enterprise brands to update their website and mobile applications to include DXP functionality. The use of "big data" analytics in complex business organizations is being more widely adopted by SMEs, as is event-driven architecture. Enterprise companies in the Fortune 500 largely seek to emulate the public cloud IT companies in operating their websites and mobile apps at the scale of Twitter, Pinterest, or other high traffic websites with millions of users. Enterprise companies are using the public cloud hardware in manufacturing, publishing, logistics, etc., and are the largest clients in the sector. SMEs seek to adopt and emulate the best practices of industry leaders to stay competitive. Startups challenge the public cloud companies by offering SaaS products to enterprise that save businesses money on software development or cloud hosting. The IT audit can help any business to implement cloud optimization across their web/mobile applications or identify where legacy applications need to be modernized.





# ABOUT ICREON

Founded in 2000, Icreon has been collaborating with businesses of all sizes to make a new meaningful impact in a new age of digital maturity, resulting in more efficient and powerful brands. We help businesses define the future of their customer experiences and then develop personalized solutions for them by merging technology engineering solutions and the power of digital. These digital-first solutions not only result in commerce transactions, but also enrich our ongoing relationships with our clients.

Headquartered in New York City, Icreon's global capabilities expand across North America, Europe, and Asia. With a dedicated team of over 400 technology specialists across the globe, our team supports clients at companies such as GSK, Novartis, Jazz Pharmaceuticals, New York Road Runners, and Lincoln among others. We blend the art of digital transformation and engineering solutions to generate ROI for brands for "what comes next."

[\*\*Let's Get Started\*\*](#)