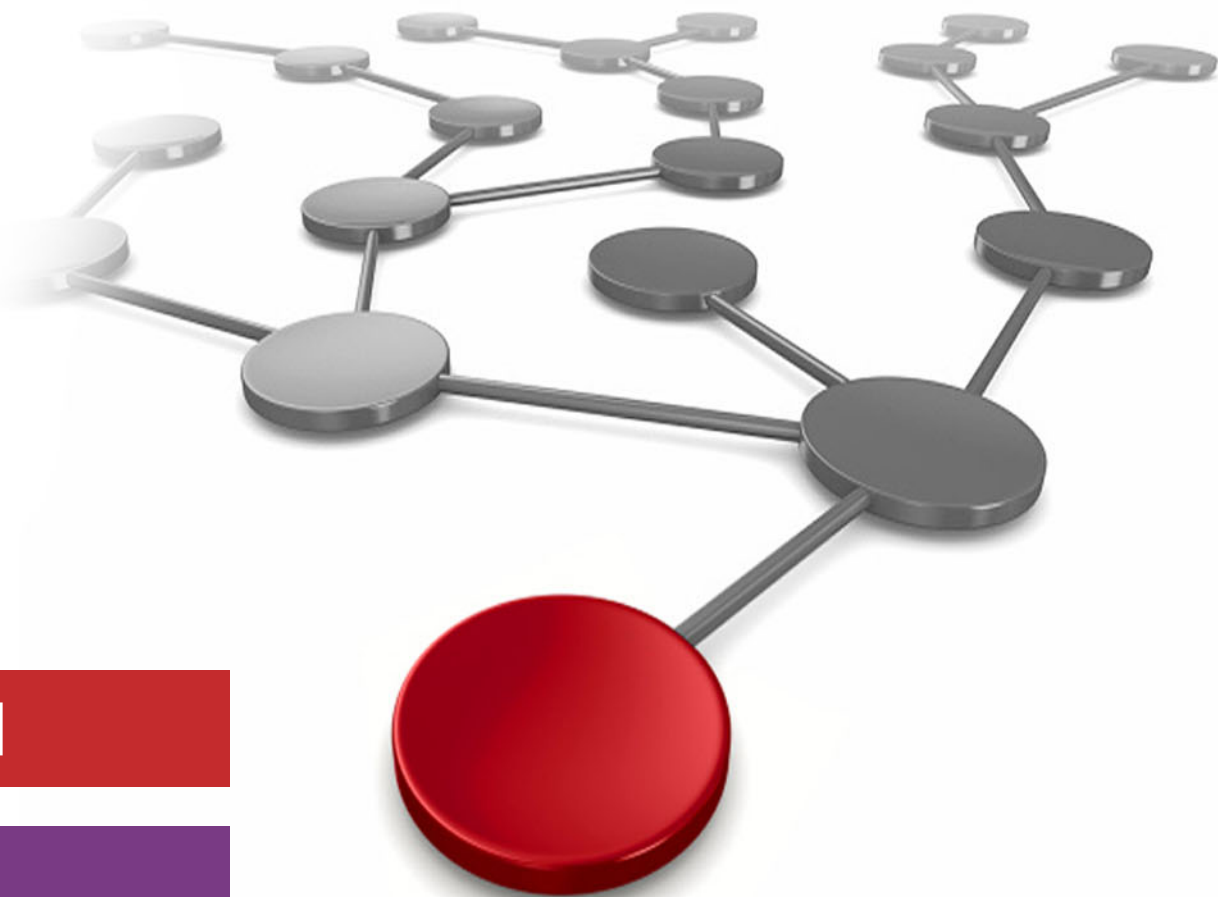


Why IBM Hybrid Cloud for Your Journey to the Cloud?

Dino Quintero

Madison Lee



 **Cloud**

Cloud



Introduction to cloud

Cloud is a method of computing. In an age where everything relies on data, from the digital drive of a single person to the confidential data of a large bank, the internet age requires that this data is transported rapidly, efficiently, and securely always, sometimes globally.

Before cloud computing, which started to become mainstream only in the late 1990s, each company, no matter how small or large, arranged their own private data center to store their data. However, data centers must be well-kept, constantly maintained, and regionally located to supply data fast; therefore, not only was this method arduous and time-consuming for companies, but maintaining another space was risky, expensive, and in many instances, negligent.

Cloud computing, where data of a company is maintained by an established cloud service provider that has branches globally, is the key to completing the digital transformation for any business.

Similar to many other cloud service providers in the market, IBM® Hybrid Cloud supplies customers with cloud computing capabilities. That is, the hybrid cloud features make disaster recovery, data backup, and business continuity easier and less expensive because the data can be mirrored across multiple sites globally, and hosted by the cloud provider.

With the acquisition of Red Hat in 2018 and the major IBM shift in focus to Artificial Intelligence (AI) and Hybrid Cloud, IBM has now positioned itself as one of the leading contenders for open, hybrid cloud provider of our times.

This IBM Redpaper® publication was created to provide customers and IBM teams with the necessary background knowledge about cloud, the cloud provider market, and IBM Hybrid Cloud. The goal is to deliver a general understanding about the different aspects of cloud computing, and most importantly, what makes IBM Hybrid Cloud unique.

Definitions

Cloud computing is the on-demand access (by way of the internet) to computing resources, including servers, storage, databases, networking, software, analytics, and intelligence. This access typically is made possible over the internet (the cloud) and hosted at a remote data center that is managed by a cloud service provider (CSP) to offer faster innovation, flexible resources, and economies of scale.

Five essential characteristics of cloud computing

Cloud computing features the following essential characteristics:

- ▶ On-demand self-service
- ▶ Broad network access
- ▶ Resource pooling
- ▶ Rapid elasticity
- ▶ Measured service

Cloud computing services

This section describes the following types of cloud computing services that are offered by cloud providers:

- ▶ Software as a Service (SaaS)

Application software that is hosted in the cloud and that you access and use by way of a web browser, a dedicated desktop client, or an API that integrates with your desktop or mobile operating system. This service is sometimes referred to as *on-demand software*.

- ▶ Platform as a Service (PaaS)

Provides software developers with an on-demand platform that is the hardware and software tools for running, developing, and managing applications without the cost, complexity, and inflexibility of maintaining that platform on-premises.

- ▶ Infrastructure as a service (IaaS)

Provides on-demand access to fundamental computing resources (physical and virtual servers, networking, storage, and data center space) without the need to manage or operate them.

- ▶ Serverless Computing (serverless)

Cloud computing model that offloads all of the back-end infrastructure management tasks to the cloud provider, which frees developers to focus all their time and effort on the code and business logic to their applications.

- ▶ Functions as a Service (FaaS)

Subset of serverless, allows developers to run portions of application code (called *functions*) in response to specific events.

Types of cloud computing

The following types of cloud computing are available:

- ▶ Public cloud

Type of cloud computing in which cloud services are used over the open internet on hardware that is owned by the cloud provider, but its usage is shared by other companies.

- ▶ Private cloud

Type of cloud environment in which all cloud infrastructure and computing resources are dedicated to, and accessible by, one single organization. This cloud can run on-premises or it can be owned, managed, and operated by a service provider.

- ▶ Hybrid cloud

Connects public and private cloud environments into a single, flexible infrastructure for running workloads and applications.

- ▶ Multicloud

Use of two or more clouds from two or more different cloud providers, which often means companies use multiple cloud services (including SaaS, PaaS, and IaaS services) from two or more of the leading cloud providers.

Organizations choose multicloud to avoid vendor lock-in to have more services to choose from, and to access more innovation. However, the more clouds that are used (each with its own set of management tools, data transmission rates, and security protocols), the more difficult it can be to manage your environment.

- ▶ Hybrid multicloud

The use of two or more public clouds together with a private cloud environment.

Definitions

The following definitions are useful to help understand general cloud concepts:

- ▶ Virtualization

Uses software to create an abstraction layer over computer hardware that allows the hardware elements of a single computer (processors, memory, storage, and more) to be divided into multiple virtual computers, commonly called *virtual machines* (VMs).

- ▶ Virtual machine

A visual representation, or emulation, of a physical computer. Often, they are referred to as a *guest* while the physical machine they run on is referred to as the *host*.

- ▶ On-premises

Software that is installed and runs on computers that are in the building of the person or organization that uses the software rather than at a remote facility, such as a server farm or cloud.

- ▶ Kubernetes

Container orchestration platform for scheduling and automating the deployment, management, and scaling of containerized applications. Red Hat uses Linux, cloud, container, and Kubernetes technologies to supply their enterprise open source solutions.

- ▶ Containers

Executable unit of software in which an application is packaged with libraries and dependencies in common way so that it can be run anywhere on the desktop, traditional IT, or the cloud.

- Availability zones (AZs)

In the context of cloud computing, AZs are isolated locations within data center regions from which public cloud services originate and operate. *Regions* are geographic locations where public cloud service providers' data centers reside. Businesses often choose one or multiple worldwide availability zones for their services, depending on their needs.

Different cloud providers

The cloud industry is expanding rapidly, with Gartner forecasting worldwide public cloud user spending to grow 23% to a total of \$332.3 billion in 2021¹ up from \$270 billion in 2020. As a result, billions of dollars are being invested in cloud migration and the cloud service providing market remains competitive.

Today, the two leaders in cloud computing are Amazon and Microsoft, followed by Google, Alibaba, and IBM.

This section summarizes the top cloud computing providers.

Amazon Web Services

Amazon Web Services (AWS), a subsidiary of Amazon and one of the first to enter the cloud computing market space, has a commanding advantage as the most popular, broadly adopted public and hybrid cloud service provider. It offers an extensive range of infrastructure and platform services globally to businesses on a metered pay-as-you-go basis.

AWS cloud provides a range of products, services, and solutions, including compute, DevOps, data analytics, Internet of Things (IoT), machine learning, networking, content delivery, robotics, and serverless computing, in 81 availability zones. Amazon Cloud markets themselves as a way of assisting customers to become more agile more quickly and cheaply than building physical server farms.

Microsoft Azure

Microsoft Azure is the second most popular cloud service. It provides a flexible hybrid cloud platform for building, testing, deploying, and managing applications and services through Microsoft-managed data centers.

Because of their 200+ data centers being spread out in many regions, Azure provides a global reach with a local presence. Azure provides Software, Platform, and Infrastructure services that support programming languages, tools, and frameworks, including Microsoft-specific and third-party software and systems.

Microsoft markets themselves as the intelligent cloud for on-premises, hybrid, or multicloud access, and are cheaper than their biggest competitor, AWS. A key advantage for Azure is their long Microsoft relationships with large enterprises.

¹ <https://www.gartner.com/en/newsroom/press-releases/2021-04-21-gartner-forecasts-worldwide-public-cloud-end-user-spending-to-grow-23-percent-in-2021>

Google Cloud

Google Cloud Platform (GCP) is a suite of cloud computing services that provides Infrastructure, Platform, and Serverless computing environments. It is a newer yet competitive cloud service provider.

Google uses GCP internally for their user products, such as Google Search and YouTube.

The company markets themselves as an open source, multicloud, and hybrid cloud environment that provides advanced data analytic capabilities, all on a net carbon-neutral cloud because electricity that is used to run Google Cloud products and services is matched 100% with renewable energy.

As a result of entering the cloud computing market late, Google, like IBM, is playing catch-up; however, their primary advantages are their easy to use UI and leading tech, considering that they created Kubernetes.

Alibaba Cloud

Although relatively new, Alibaba Cloud became the largest Chinese cloud computing provider, and delivers a comprehensive suite of global cloud computing services to power customer online businesses and their own e-commerce ecosystem.

Along with their cloud offerings, the company offers a host of products and services, such as compute, network, storage, security, monitoring and managing, communication, analytics, IoT, application development, data migration, and web hosting.

Alibaba markets themselves as possessing an all-inclusive approach to technology, with significant sector knowledge and powerful insight analytics. Because of their unique e-commerce-based business model, support services for customer satisfaction, sensitivity to lucrative business opportunity, and ecosystem, Alibaba made themselves a key player in the e-commerce and cloud industry.

IBM Hybrid Cloud

IBM Hybrid Cloud is a full stack cloud platform that spans public, private, and hybrid environments with products and services covering compute, network, storage, management, security, DevOps, and databases.

Some of their prominent offerings include their bare metal servers, VMware, Cloud Paks for Application Modernization, Virtual Private Cloud, and the suite of emerging, popular technologies, such as AI, IoT, Blockchain, Data, and Analytics. IBM has been a cloud service provider since 2011, but only recently began offering Open Hybrid Cloud after the acquisition of Red Hat in 2018.

Note: IBM Cloud offering portfolio includes IBM Z®, Power Systems, and x86 cloud capabilities and no other cloud provider currently meets IBM in this space. Thus, the growth of competitors is based on the markets that they are facing off to. Although IBM is newer to the cloud-providing industry, IBM is in a different marketplace. Moreover, the cloud computing games have only just begun.

Reference architecture

A *reference architecture* is a proven template solution for architecture within a domain (in this case, the cloud computing domain). A reference architecture is important because it offers the following benefits:

- ▶ Delivers best practices in a standardized, methodical way.
- ▶ Ensures consistency and quality across the development and delivery processes.
- ▶ Mitigates risk by taking an asset-based approach to solution development.

Cloud Computing Reference Architecture (CCRA) is an IBM-defined reference architecture for the cloud computing domain, as shown in Figure 1 on page 6. It is an evolving architecture that is based on real-world input from many cloud implementations around the globe and was submitted to the Open Group Cloud Architecture Project.

The IBM CCRA is designed around a set of architectural principles that establish the framework within which architectural decisions are made. CCRA includes the following architectural principles:

- ▶ Design for cloud-scale efficiencies.
- ▶ Support lean service management.
- ▶ Identify and use commonalities.
- ▶ Define and manage cloud services generically during their lifecycle.

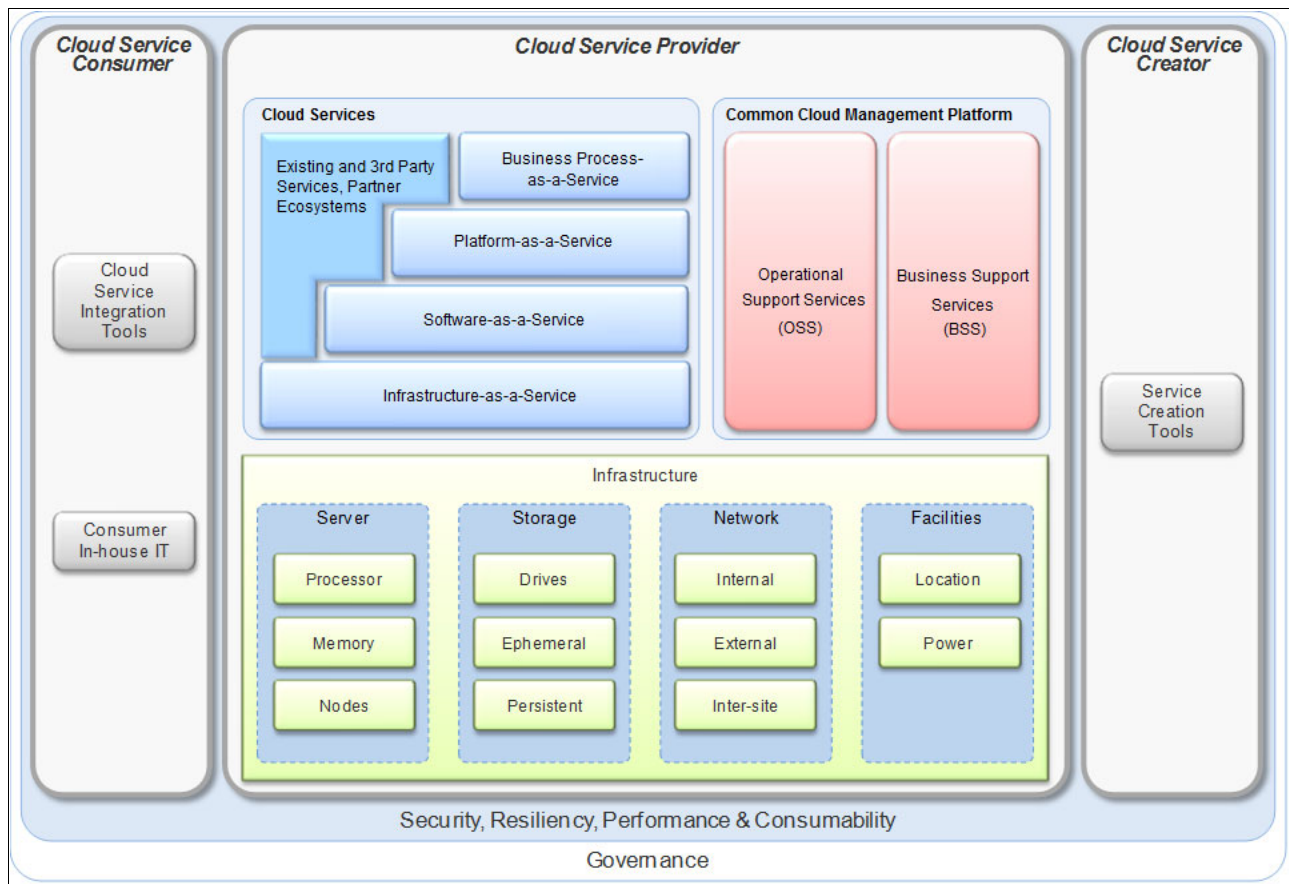


Figure 1 IBM Cloud Computing Reference Architecture (CCRA)

What differentiates IBM Cloud?

This section describes characteristics that deliver key advantages for the use of IBM Cloud for your cloud computing workloads and cloud application modernization.

Scalability

Being the leading enterprise Kubernetes platform, Red Hat OpenShift accelerates the hybrid cloud adoption process by helping customers to truly shift their business applications to the cloud.

Although 81% of enterprises use cloud as of 2020, only 50% of all corporate data is stored in the cloud². As businesses begin or continue the next chapter of their digital reinventions and modernize workloads, IBM Hybrid Cloud that is built on Red Hat OpenShift provides them with open, flexible technology to manage their hybrid multicloud environment.

Hybrid cloud allows businesses to move their workload to the cloud and use cloud services anywhere, whether that means on- or off-premises.

The Red Hat acquisition was and still proves to be a game changer for IBM Hybrid Cloud, which makes IBM one of the top hybrid cloud providers in the emerging \$1 trillion growth cloud market.

Although Red Hat maintains their open source innovation tradition, the acquisition brought together the best-in-class hybrid cloud providers, which enabled companies to securely move all business applications to the cloud.

With IBM and Red Hat conjoint assistance, customers can use the cloud services that they purchased to their maximum capability. Developers can then work on applications with any language or tool and deploy efficiently and rapidly with a click of a button.

Location access

IBM Cloud Kubernetes Services are available to deploy workloads resiliently in over 60 data centers worldwide, which customers can deploy locally and scale globally and maximize choice and control.

The location access of IBM Hybrid Cloud is a huge differentiating factor because other cloud providers have less data center locations and as a result, are less secure regarding disaster recovery.

Moreover, although other cloud providers experienced outages over the years, such as the AWS outage in 2018 that caused many of the largest platforms to shutdown and the Microsoft Azure hour-long outage in 2021, IBM has *never* experienced such an outage.

IBM Cloud features three tiers of regions:

- Multi-zone regions (MZR)

MZR is composed of three or more zones that are independent from each other to ensure that single failure events affect only a single zone. This configuration ensures that customer workloads are secure if a singular malfunction occurs. MZR also provides low latency and high bandwidth connectivity across zones.

² Cloud Computing Trends: 2021 State of the Cloud Report:
<https://www.flexera.com/blog/cloud/cloud-computing-trends-2021-state-of-the-cloud-report/>

- ▶ Single-zone regions (SZR)

SZR are available to deploy on, but they cannot spread across zones.

- ▶ data centers

Data centers host the power, cooling, compute, network, and storage resources that are used for services and applications.

[IBM Cloud Satellite™](#), allows customers to use a single API to create an IBM Cloud Satellite location and then, add host machines from any cloud, their on-premises data center, or [edge computing](#). They can then use IBM Cloud services anywhere they need them, and consistently deploy, manage, and control workloads across these environments.

Cloud security

IBM has a long-standing history as a leading cloud security provider. Often, customers are concerned about placing their workloads on the cloud, especially the public cloud, because of security breaches.

However, IBM ensures that customers are always in control with the [IBM Cloud data protection](#) program, making sure that customers are the only party that governs their private data.

IBM does not provide customer data to a government agency under any surveillance program that involves the bulk collection of content or metadata. A shared responsibility for security exists between IBM and customers, which enables collaborative management and transparency.

Data Encryption is a tool that protects data across environments, addresses compliance requirements, and reduces administrative efforts so businesses can remain secure. [IBM Security™ Guardium® Data Encryption](#) encrypts files, databases, and applications; addresses data security and privacy regulations; and controls encryption keys for cloud-based data for customers.

The [IBM Cloud for Financial Services™](#) is a cloud that is built to enable transparency, trust, compliance, and resiliency that financial institutions need. By using this public cloud, companies can confidently host their critical applications in the cloud and transact quickly and efficiently.

With IBM Cloud Security and Compliance Center, customers also can use a unified dashboard to monitor security and compliance controls directly with IBM Cloud. Because the cost of a data breach is detrimental for businesses, IBM Cloud provides a single platform to view and manage security with configuration rules, predefined profiles, custom profiles, insights, reports, and custom tools.

Long-lasting relationship

IBM works with customers throughout the duration of their cloud transition, from beginning to end, providing abundant support. To assist with the move, customers can use a database of published documentation about cloud-related questions, a large community of cloud peers and experts, constant assistance from outside developers, and IBM expertise.

The use IBM Hybrid Cloud means that businesses never have to go through their cloud journey alone.

IBM Garage™ brings together designers, architects, developers, and data scientists to envision, scale, and execute new plans with businesses. IBM Garage provides customers with tailored solutions and accommodation, whether that means responding to a quick disruption or guiding customers one-on-one in a full-scale transformation.

IBM recognizes that one cloud size does not fit all; therefore, IBM is available to accompany customers throughout their experience.

Beyond the unique IBM Garage methodology, which was proven to accelerate digital transformation across enterprises, the unfaltering goal for IBM is to always create long-lasting, functional relationships with not only each customer, but with the entire ecosystem. Rather than simply dump solutions and leave each customer alone, IBM seeks to co-create, co-execute, and cooperate to build a successful MVP, solution, and partnership with every customer.

Leveraging innovation

A major differentiating factor for IBM is the services that are offered alongside IBM Hybrid Cloud, as shown in Figure 2.

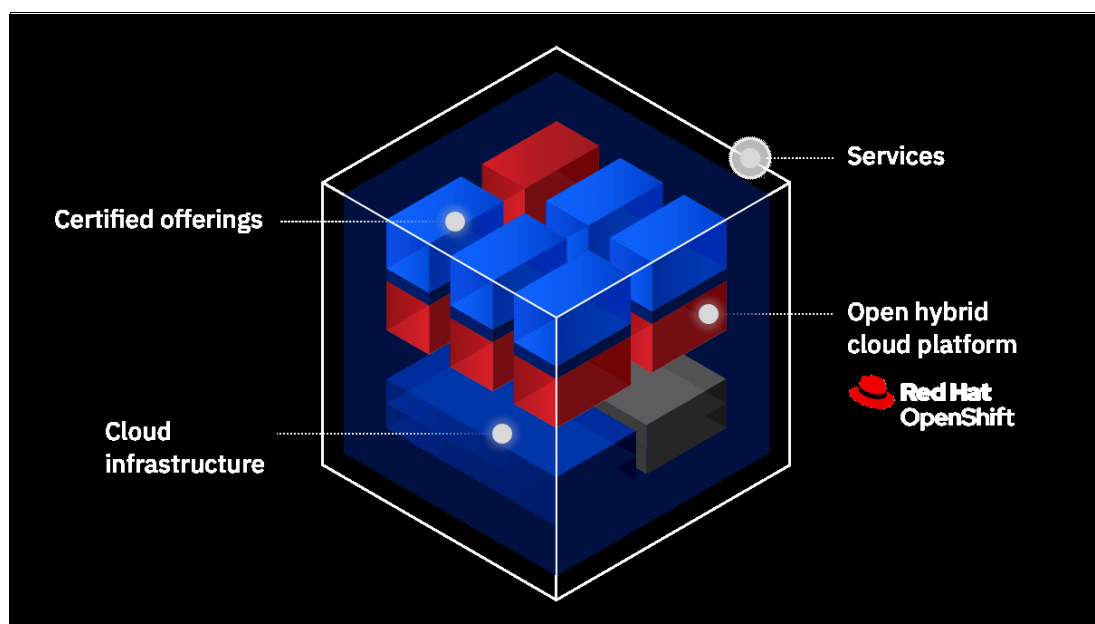


Figure 2 IBM wide range of portfolio offerings

With IBM and Red Hat solutions conjoined, customers can accelerate development and reduce processing time.

Along with the tailored assistance to shift onto hybrid cloud, IBM offers different Cloud Paks to streamline digital business development and resiliency. Cloud Paks help enterprises do more. IBM Cloud Paks are AI-powered software that help organizations build, modernize, and manage applications securely across any cloud. The following types of Cloud Paks are available:

- ▶ [Business Automation](#)
- ▶ [Watson AIOps](#)
- ▶ [Integration](#)
- ▶ [Network Automation](#)

- [Security](#)
- [Data](#)

All of these Cloud Pak types include pre-certified, containerized software and services that provide common operations and integration framework.

IBM offers over 350 services, software, and consulting products that are available for customers to customize and build the solutions that are tailored for their business. A popular choice with IBM Hybrid Cloud is integrating AI into workflow, by using the trusted and reliable IBM data foundation for artificial intelligence. Most AI failures are the result of failures in data collection and organization, not the AI models themselves; therefore, by using scalable data infrastructure, customers can gain flexibility, extract insights, and unify tools from complex, unstructured big data.

Solutions for IBM Watson® and IBM Security are secure. They help customers minimize risk by using AI and protect data by complying with regulatory and data privacy obligations.

Multicloud and open source flexibility

IBM supports multicloud strategies for application development, migration, modernization, and management with a range of cloud migration and integration technologies, services, and consulting offerings.

Customers can choose deployment options that are tuned for specific business needs on any cloud (IBM, AWS, Azure, or Google Cloud platforms) and any system (x86, Power Systems, or IBM Z). Each cloud provider has their own set of management tools, data transmission rates, and security protocols, so at times the multicloud approach lacks visibility; however, IBM works with customers and competitors to provide seamless cloud integration, interoperability and portability, latency, and privacy regulations.

A few other cloud providers partake in the multicloud approach, which makes the collaboration seamless. However, by using the IBM Garage methodology, IBM not only co-collaborates with customers and other cloud providers, but invests in their ecosystem to benefit the customer, their partners, and the IBM company.

Along with the no vendor lock-in benefit, the Hybrid Multicloud Platform is built on open source technologies to provide flexibility, portability, and cloud services by way of open APIs. By nature, [open source is a benefit for all](#), enabling anyone to look for and fix security flaws, which creates a much more secure and transparent platform for businesses and consumers.

IBM is invested in open cloud, where one of the foundations of the partnership between IBM and Red Hat is Kubernetes, the open source application container orchestration software that makes it easier to configure, deploy, and manage containerized applications. Through Red Hat OpenShift, IBM can provide the cloud platform where developers can build for hybrid cloud in open source.

Price

IBM offers flexible cloud billing options for every business by way of three different account types: Lite, Pay-as-you-go, and Subscription. Each account type offers different features and are billable on varying levels.

Lite

The no-cost lite version of IBM hybrid cloud provides access to over 40 services, including IBM Watson APIs. To access features beyond the lite account, customers can upgrade to Pay-as-you-go in which they receive a USD 200 credit that is valid for 30 days.

Pay-as-you-go

The Pay-as-you-go purchase model allows access to the full IBM Cloud catalog. Customers also can create multiple resources groups, but customers pay for only what they use with no long-term commitments.

Subscription

The subscription account offers many of the same benefits as Pay-as-you-go, but includes discounts for platform services and support and more consistent billing through subscription. To get a better idea of how much this model costs, see this [IBM Cloud Docs web page](#).

If you are skeptical about IBM Hybrid Cloud because of the price, consider the value of the product at-hand, which ultimately saves them money by streamlining data, [preventing breaches](#), and modernizing workloads.

To estimate how much a firm can save, customers can use the [IBM Cloud cost estimator](#). Also, along with the IBM Hybrid Cloud services, customers gain IBM expertise, and focus efforts on specialized application tasks, workloads, security requirements, along with specific industry and customer needs, and build a successful partnership.

Use cases

This section discusses the following IBM Cloud use cases:

- [Walmart Stores](#): Retail industry

Walmart adopted the agile development method. However, to support their developers in their new agile approach, Walmart sought to quickly distribute computer resources to them.

By using IBM Cloud Platform, Walmart created a cloud platform that is driven by APIs to give developers on-demand access to the resources they need and help the business scale to meet unpredictable spikes in demand. The collaboration resulted in a 99% decrease in time that is needed to deliver resources to developers (from 5 days to 10 seconds).

- [Deutsche Bank](#): Financial services

Deutsche Bank had a goal of improving the experience of banking customers and users of their back-end technology, being employees and external providers and developers who use the platform to build and run applications.

By using Red Hat solutions, Deutsche Bank then built an open source PaaS to simplify DevOps collaboration, optimize capacity, and grow efficiency. As a result, they cut the end-to-end application development time from 6 - 9 months to 2 - 3 weeks.

- [Aetna](#): Healthcare services

A CVS Health business, Aetna approached IBM with the goal of digitally transforming their business, specifically to improve transparency and interoperability within healthcare.

By using the cloud-based IBM Blockchain Platform, Aetna and IBM collaborated to design and create a blockchain network to enable healthcare companies to build, share, and deploy solutions in a highly secure, shared environment.

► **The Weather Company:** Computer services

With millions of people relying on the Weather Company website daily, especially in extreme weather times and usage peaks, the site must remain at their fastest and most reliable to provide the information that people need to stay safe.

Thus, to optimize elasticity in handling extreme spikes in demand, the Weather Company worked with IBM to quickly migrate to the IBM Cloud from its existing cloud provider. The results unlocked significant cost savings, used containerization services with Kubernetes, and expanded their global reach with access to more data centers.

► **Fox Sports:** Media and Entertainment industry.

Fox Sports sought to create a highly efficient, cutting-edge workflow that used their infrastructure to support live event production anywhere in the world, a revolutionary task for events of their scale.

By using IBM Aspera® Streaming technology, Fox Sports integrated to Telestream Vantage and Lightspeed systems to deliver broadcast-quality feeds of every World Cup match to remote production teams in near real time, over unmanaged IP networks. The results created captivating HD content, greatly reduced costs of production, and delivered 2 petabytes of HD and UHD content from Russia to the US over unmanaged IP networks.

Note: For more information about how IBM Cloud helped to transform businesses, such as Intel, MongoDB, ExxonMobil, and State Farm, see this [web page](#).

Summary

IBM Cloud entered the cloud service market in 2011, years later than most of their competitors, which made the race for the largest market share appear skewed.

Although AWS, Google Cloud, and Microsoft Azure continue to dominate the cloud market, IBM made great progress to become another leading cloud service provider and robust competitor, who further challenges and advances the cloud computing game.

With cloud computing becoming the go-to model for IT, especially after the COVID-19 pandemic triggered the move to remote work, cloud providers are continuously trying to remain competitive with the rapidly growing market. The data acquisition game is ultimately about having an edge, whether that edge is providing multicloud, hybrid cloud, or differentiating oneself with Artificial Intelligence, analytics, IoT, and edge computing or serverless and managed services.

According to the validation of 30 spanning companies, the value that is derived from a full hybrid, multicloud platform technology and operating model at scale is 2.5 times the value that is derived from a single platform, single cloud vendor approach³.

Only IBM offers a hybrid cloud, multicloud service, that is facilitated by the acquisition of Red Hat in 2018, and their unique, tailored Cloud Paks along with AI-infused software and Garage methodology, all of which enable businesses to transform their businesses.

³ The Hybrid Cloud Platform Advantage:
<https://www.ibm.com/thought-leadership/institute-business-value/report/hybrid-cloud-platform>

The next chapter of the cloud requires businesses that are about to embark on their cloud journey to invest in hybrid multicloud platform strategies and capabilities. They also must use the cloud service providers that address their exact needs at an accelerated yet efficient deployment pace and care to foster a long-lasting, trusting, and supportive relationship with their business.

Note: For more information about the pricing of IBM Hybrid Cloud with Red Hat OpenShift, see this [IBM Cloud Pricing web page](#).

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