

Traditional on-premises infrastructure can no longer effectively support the flexibility and responsiveness needed in today's world. An IT infrastructure with resilience, flexibility, and instantaneous scalability is critical to remain competitive in this rapidly changing environment.

Infrastructure as a Service: The Foundation for Hybrid and Multicloud IT

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The Time to Move to Cloud Is Now

Traditional on-premises infrastructure with high up-front costs and weeks-long scaling lead times is no longer sufficient to effectively support today's needs and required responsiveness. IT is increasingly moving to a direct revenue-supporting position within the enterprise. Applications may be required to scale from hundreds to tens of thousands of users or go from one geographic location to multiple locations in a matter of days.

Not being able to do this has direct revenue impact. Responding to this high velocity of change requires an IT infrastructure layer with comparable flexibility and scalability. Likewise, built-in resilience at the IT infrastructure layer is a basic necessity to move forward confidently with the digital transformation of the business.

Cloud infrastructure, or infrastructure as a service (IaaS), is designed to deliver scalable, automated, and utility-like financial model capabilities. IaaS services are consumed on a pay-as-you-go basis, with no up-front costs, and on-demand scalability. In addition, IaaS services from the major providers are delivered from a globally distributed set of datacenters and designed for immediate availability, resilience, and lower up-front investment.

AT A GLANCE

KEY TAKEAWAYS

- » IaaS offers enterprises a secure and resilient foundation to rapidly deliver and modify IT solutions for the business.

KEY STATS

- » Spend on public cloud IaaS has doubled in the past three years and is expected to double again in the next three years.

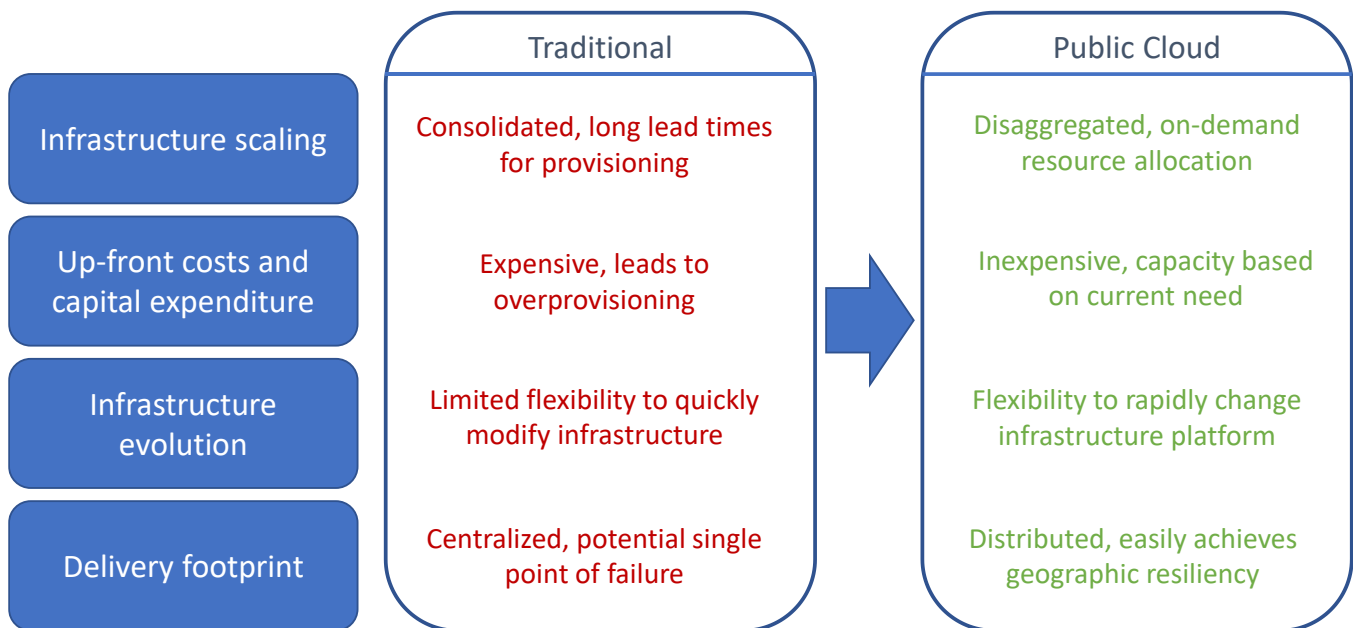
WHAT'S IMPORTANT

- » Cloud IaaS is the foundation to enabling agility in the enterprise's IT backbone and to enabling the responsiveness and scalability needed for today's pace of business operations.
- » Building on a secure and resilient IaaS and gaining access to a rich cloud ecosystem of higher layer services and partners can accelerate enterprise digital transformation.

From a broader perspective, IaaS and cloud technologies offer enterprises three key capabilities (see Figure 1):

- » **Low up-front investments.** Organizations can get started on initiatives at no cost and in turn achieve faster launch and faster time to market for new initiatives. This is important as organizations ramp up their digital assets and experiment with the best ways to leverage technologies — shifting away from a costly capex model to a more beneficial opex model.
- » **Rapid scaling and resilience.** From a capacity perspective and a geographic footprint perspective, cloud technologies allow successful initiatives to be quickly scaled up and replicated across physical locations as needed, enabling solutions to address availability, expansion, and scaling needs at any time without customer disruptions.
- » **Access to a broad ecosystem of higher-layer services and partners.** This includes access to faster and more cost-effective development tools and databases, advanced analytics capabilities, and technologies such as artificial intelligence/machine learning (AI/ML). These capabilities can jump-start projects and lead to faster application development and deployments and enable organizations to avoid up-front investment to build these platform capabilities in-house.

FIGURE 1: *IaaS Introduces a Paradigm Shift in Infrastructure*



Source: IDC, 2021

Most Common Entry Points and Use Cases for Cloud Infrastructure

With the increase in familiarity and acceptance, cloud IaaS is gaining adoption across nearly all types of enterprise IT use cases and organizations are moving applications to cloud through a variety of the following paths and entry points:

- » **Datacenter consolidation and expansion.** Legacy technology infrastructure can be rigid and limited in use and management. Often, older infrastructure requires manual input and resources to maintain applications and services and does not scale quickly or easily to suit business needs without major expenditures and potential downtime. Cloud technology offers increased agility, automation, and intelligent services to all aspects of the datacenter. It enables quick scalability, reducing resource demands and costs, and can improve ROI by expanding services on a global scale.
- » **Business continuity and disaster recovery.** Improving IT resiliency and maintaining business continuity are more important than ever for any enterprise. The flexibility and agility of cloud make it an optimal solution to mitigate risks and maintain business continuity. In fact, the cloud often improves the uptime, performance, and availability of applications, data, and workloads from traditional on-premises environments. In the cloud, organizations are able to recover applications, data, and workloads completely and quickly.
- » **Application modernization and migration.** Another approach is the application modernization and migration path to cloud, where an application is first re-architected to take advantage of the native capabilities available on cloud, such as containers, scale-out capability, and other readily available services. The specific path selected is typically determined by the workload itself and the level of technical capability available to move that workload to cloud.
- » **Virtual machine migration.** One commonly seen path to cloud adoption of enterprise applications is the "lift and shift" migration of virtual machines (VMs) into cloud environments. This involves moving the applications on a VM into an identical or nearly identical VM in an IaaS environment. While this may still require minor configuration changes in the application or deployment scripts, it reduces the rework required on the application before moving it to cloud.
- » **Regulated workloads.** With the maturity of cloud services and the expansion of cloud capabilities, cloud infrastructure is also seeing adoption for regulated workloads and highly secure sensitive workloads. Specific capabilities such as dedicated bare metal services and built-in security enable these workloads to run in the cloud.

Key Takeaways

- » Infrastructure as a service (IaaS) provides an optimal foundation for digital transformation, both to support a cost-effective platform for iterations of initiatives and to deliver resilience and agility for applications in production.
- » Common use cases among enterprise IT customers include datacenter consolidation and expansion, business continuity and disaster recovery and, more recently, regulated workloads.

Security Concerns, Skill Sets, and Migration Are Top Challenges with Cloud

While cloud IaaS is gaining traction across enterprises, cloud adoption is not without its own challenges. Security continues to be one of the key challenges with cloud adoption. Security concerns can be broadly broken into the following three areas:

- » **The ability of the cloud provider to secure its platform sufficiently.** The past decade has helped demonstrate to the enterprise IT world that cloud providers' investments in security often exceed what enterprises can afford and that public cloud IaaS offers security that is comparable to and often better than what is possible on-premises.
- » **The ability of the customer to secure its application running on the cloud platform.** This is critical given the shared security model of public cloud. Cloud providers are responsible for the security of the infrastructure stack, while customers need to be responsible for the security of their applications that run on the cloud platform. This often includes use of proprietary tools from the cloud provider and a good understanding of the platform's security framework. Protecting applications and data by using the cloud provider's security framework correctly continues to be a challenge for enterprises. With increased familiarity and skill set availability, this challenge will be resolved in time.
- » **Resource limitations.** Cloud adoption can bring forward resource limitations, including the lack of availability of cloud skill sets, the lack of clarity around cloud adoption planning, and the absence of execution of application transformation and migration. The typical workaround, seen particularly among large enterprises with IT applications that are designed to support thousands of users, is to engage managed services or professional services to assist in this adoption. Availability of a strong service partner with an extensive ecosystem of experts and partners has emerged as an important enabler for organizations looking to migrate and transform their businesses in the cloud.

Key Takeaways

- » Key capabilities driving cloud adoption are the resilience and scalability that cloud offers, enabling faster business responsiveness.
- » The inability to effectively protect customer workloads and data is an inhibitor of broader cloud usage; other challenges include skill sets access and the need for assistance in planning and executing on adoption. With the right service provider, these challenges can be mitigated.
- » Enterprises often rely on professional or managed services to assist in their cloud adoption efforts.

Advantages of Infrastructure as a Service and Cloud Adoption

IaaS empowers IT organizations with a foundation for agility — the ability to make IT changes easily, quickly, and cost effectively — in its infrastructure layer. Early adopters are seeing benefits in business metrics such as operational efficiency and customer retention. Some of the key business benefits customers report are as follows:

- » **Business agility** — enabled by the rapid scalability of IaaS. Organizations can easily scale their IT footprint depending on business needs. IaaS enables faster time to launch for initiatives, swift time to market for new offerings, and rapid iterations to stay current with market needs.

- » **Improved customer experience** — delivered by high-availability architectures built on a resilient public cloud IaaS platform. Organizations that build their services on the cloud are able to maintain availability through critical phases such as outages or periods of growth or high utilization of services, thus increasing customer satisfaction and loyalty with the solution. This leads to smooth customer base expansion during growth periods.
- » **Total cost of ownership (TCO) benefits** — possible because the "pay as you use" cost model for infrastructure minimizes the need for large up-front investments and overprovisioning. IaaS compute, storage, and networking resources can be provisioned and used within minutes when needed and terminated when not needed, allowing instantaneous on-demand access to resources.
- » **Geographic reach** — enabled by the globally distributed set of datacenters, all of which deliver a consistent infrastructure environment close to the respective geographies. A solution that is successful initially in one region can be easily replicated on the IaaS service in other geographies with minimal additional qualification or contract renegotiation, allowing shorter lead times for regional expansion. This allows a cloud-based solution to rapidly expand beyond physical boundaries and reach customers and markets across the globe as needed.
- » **Easy access to new technologies and services** — through the cloud ecosystem of higher-layer services and partners. This broader cloud ecosystem has emerged as a major source of benefits for IaaS customers. Nearly a third of the respondents to IDC's 2020 *IaaSView Survey* indicated that this ecosystem is a top driver of their decision to adopt cloud.

Key Takeaways

- » Business agility, improved customer experience, TCO optimization, and access to new technologies and services are top business benefits reported as a result of IaaS adoption.
- » The agility and cost savings result in broader benefits to the enterprise, often eventually translating to observable business metrics such as customer retention and revenue.

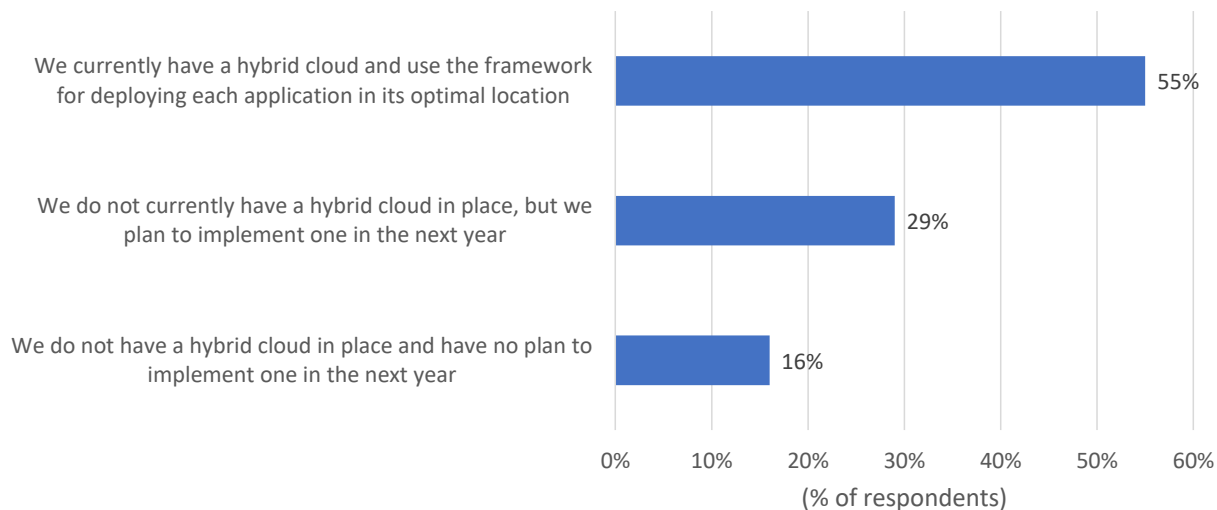
Recent Trends in Enterprise IaaS Usage: Multicloud and Hybrid Cloud Patterns

Two popular cloud adoption strategies in enterprise IT today are "multicloud" and "hybrid cloud" deployments:

- » **Hybrid cloud.** IDC defines hybrid cloud as the usage of IT services (including IaaS, PaaS, SaaS apps, and SaaS-SIS cloud services) across one or more deployment models using a unified framework. The cloud services used leverage more than one cloud deployment model — across public cloud and private cloud deployments. Customers sometimes also include cloud and noncloud combinations when they describe an environment as hybrid cloud (sometimes also referred to as hybrid IT).

This model is rapidly gaining adoption among enterprise IT organizations (see Figure 2). Factors driving the adoption of hybrid cloud include the desire to retain a higher level of control on certain data sets or workloads as well as proximity and latency requirements that call for certain workloads to stay on-premises.

According to IDC's 2020 *IaaSView Survey*, 55% of enterprise cloud customers were in some form of hybrid cloud environment in 2020, up from 52% in 2019 and 36% in 2018.

FIGURE 2: **Growth of Hybrid Cloud****Q How would you describe your organization's adoption of hybrid cloud?**

n = 1,500

Source: IDC's IaaSView Survey, 2020

» **Multicloud.** IDC defines multicloud as an organizational strategy or the architectural approach to the design of a complex digital service (or IT environment) that involves consumption of cloud services from more than one cloud service provider. These may be directly competing cloud services such as hosted private cloud versus public cloud compute services, public object storage from more than one public cloud service provider, or IaaS and SaaS from one or more cloud service providers. Multicloud encompasses a larger universe than hybrid cloud.

The use of multicloud is being driven by organic reasons such as independent projects scaling in different parts of the organizations on different cloud platforms as well as intentional reasons such as a desire to leverage specific cloud platforms for specific unique capabilities. A major factor gating the adoption of multicloud more broadly is the cost/complexity associated with enabling consistent management/governance of many different cloud options.

According to IDC's 2020 IaaSView Survey, 62% of enterprise cloud customers were using multiple public cloud IaaS services in 2020, up from 61% in 2019 and 57% in 2018.

Considering IBM Cloud IaaS: Benefits and Differentiators

IBM Cloud Infrastructure as a Service (IaaS) forms the foundation layer of the IBM Cloud portfolio and delivers the compute, storage, and network functionality, as well as the required virtualization, for customers to build their IT infrastructure environments on these services. The customer continues to be responsible for management of the higher layers of the stack operated on the IaaS platform.

IBM Cloud IaaS and the broader IBM Cloud ecosystem provide customers with all the previously mentioned business benefits of cloud IaaS adoption. These benefits are delivered through a combination of IBM's global datacenter footprint

and resilient, scalable, and broad IaaS portfolio. IBM's global datacenters and IaaS portfolio are complemented by the rich ecosystem of cloud services and partners, including access to the latest technology capabilities such as artificial intelligence and quantum computing. In addition, IBM is in a unique position as a trusted longtime enterprise technology partner and offers the following differentiated strengths and capabilities to businesses:

- » **Security and trust.** IBM Cloud is built to deliver security across all its services, integrated through the service and delivered as a service. This security includes audit compliance and ability to support standards such as PCI 3.0, HIPAA, and GDPR, which are often challenging and expensive for enterprises to meet in-house with on-premises infrastructure. This also includes specific security capabilities such as the IBM Cloud Pak for Security, IBM Data Security Services, and IBM Cloud Hyper Protect Crypto Services (FIPS 140-2 Level 4 compliant) with built-in data-in-motion, data-in-use, and data-at-rest protection as well as Keep Your Own Key (KYOK) capability for the most security-sensitive use cases. Bare metal environments benefit from Intel Software Guard Extensions (SGX), which run code and data in a protected memory space. These capabilities are further enhanced by IBM's long track record as a security-conscious technology company and a trusted partner to enterprises, alleviating concerns of misuse of customer data. These have been instrumental in recent large customer wins in the United States from some of the largest and most well-known enterprise brands.
- » **Differentiated bare metal servers with the latest Intel Xeon technology.** Bare metal servers are the workhorses of infrastructure. With IBM Cloud Bare Metal Servers, clients choose from over 11 million dedicated, single-tenant bare metal server configurations. This level of customization means clients can use IBM Cloud Bare Metal Servers — with their known security, stability, speed, and performance — for cloud banking, regulated, game hosting, and application development workloads, among others. IBM Cloud is built with the latest Intel technology, including Intel Optane and Intel Xeon, to easily blend with today's leading enterprise virtualization and software solutions.
- » **Offerings for other enterprise needs, such as SAP and VMware.** IBM public cloud is designed to make it easier for global enterprises to modernize and build new business applications in the cloud. IBM Cloud offerings consist of a broad portfolio of SAP-certified infrastructure as well as SAP-certified VMware environments and SAP-certified Power Systems Virtual Servers. In addition, IBM Cloud and VMware make it simple for organizations to migrate their VMware workloads to the cloud while using their existing, dedicated bare metal environments, tools, and applications, reducing the need for refactoring.

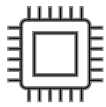
IBM Cloud Differentiators for Enterprise IT

- » **Security** — built to deliver integrated security, a broad set of compliance certifications, and dedicated security and privacy features
- » **Trust** — building on IBM's decades-long history as a trusted enterprise IT partner
- » **Offerings for enterprise workloads** — including specialized offerings for SAP, VMware, and a range of Intel Xeon-based bare metal services
- » **Access to services and expertise** — spanning more than 1,000 experts and partners to assist customers through their cloud journey
- » **Hybrid cloud and multicloud** — enabled by open source technologies based on Red Hat OpenShift and IBM Cloud Paks
- » **Virtual private cloud (VPC)** — quickly provision virtual server instances using multiple VPCs in globally available multizone regions for highly scalable and performant infrastructure

- » **Access to services and expertise across the globe.** The rapid adoption of cloud has outpaced the evolution of skill sets. IBM's Global Business Services division and validated global business partners can address the most stringent industry needs, acting as an effective delivery arm for IBM's technology offerings and assisting customers with cloud adoption and capability building. These services provide customers with professional expertise across containerization, microservices, DevOps, Agile principles, and enterprise IT transformation and can accelerate the initial ramp to a cloud-centric IT model.
- » **Hybrid cloud and multicloud enablers.** The 2019 acquisition of Red Hat brought to IBM Cloud a strong suite of cloud-native software, including the Red Hat OpenShift platform, a cloud-native platform that could be delivered both on customer premises and on multiple public clouds. The OpenShift platform complements the Cloud Paks product portfolio at IBM, which is also designed to deliver a consistent experience for specific enterprise use cases on customer premises and public cloud platforms. IBM Cloud Paks and the IBM Red Hat OpenShift platform are designed with the intent of offering a unified customer experience across public cloud and customer premises infrastructure. IBM Cloud Paks and the IBM Red Hat OpenShift platform address one of the top challenges reported by enterprise using cloud today — that the lack of consistency across clouds and across premises limits their ability to effectively build a multicloud or hybrid cloud environment. The Red Hat OpenShift platform also offers open source compatibility with open source frameworks such as Kubernetes and Knative, allowing portability and reducing risk of lock-in for customers. These recent additions and evolutions to the portfolio are complemented by IBM's long track record of building and operating complex private cloud platforms for enterprise customers.

Figure 3 shows the eight key areas in which IBM has invested specifically to meet organizations where they are in their cloud journeys, leveraging IBM's deep familiarity with enterprise workload portfolios and infrastructure requirements.

FIGURE 3: *IBM Cloud IaaS — Eight Areas of Differentiation*



Bare metal server options

Over 11M different configuration options, including the newest generations of Intel Xeon Processors.



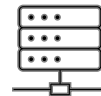
Multi-platform support

Support for AIX, IBMi, Linux, and LinuxONE across system Z and P infrastructure.



VPC network performance

Fast, security-rich network that supports the creation of multiple virtual private clouds in multizone regions — available globally.



VPC virtual servers

Accelerated deployment of virtual server profiles across a pod-less network orchestration layer for highly scalable capacity.



No-cost bandwidth

Up to 20TB of cost-free bandwidth per bare metal server, and no-cost network backbone.



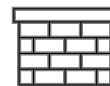
Certified software, applications

Broad portfolio of SAP-certified infrastructure and VMware solutions.



Leading SLA

99.99% SLA for workloads deployed in HA and non-HA setups.



Enterprise-grade security

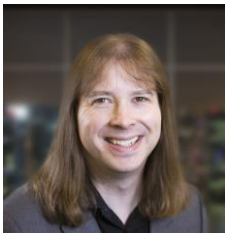
Zero trust, confidential computing support with KYOK, encryption, and regulated compliance support. Highest level of FIPS certification, 140-2 Level 4.

Source: IBM, 2021

Conclusion

The cloud value propositions of flexibility and scalability were ideally suited for the initial use cases that deployed on cloud IaaS, such as start-up and hobbyist/shadow IT workloads. While these value propositions continue to be important, enterprise use cases require more from their IT stack. These requirements include end-to-end security, flexibility to operate across multiple premises and platforms, and partners to support the enterprise's vertical-specific needs. IBM Cloud offers an expansive global cloud infrastructure service inclusive of open hybrid cloud and multicloud enablers and the broad IBM ecosystem of technology and service partners designed to address these needs. With these capabilities and a strong technology portfolio, IBM is well poised to be a trusted cloud partner to enterprises as they transition their IT to the cloud.

About the Analyst



Dave McCarthy, Vice President, Cloud and Edge Infrastructure Services

Dave McCarthy is a Vice President within IDC's worldwide infrastructure practice, where he leads a team of analysts covering shared (public) cloud, dedicated (private) cloud, and edge strategies. Benefitting both technology suppliers and IT decision makers, Dave's insights delve into how hybrid cloud platforms provide the foundation for next-generation workloads, enabling organizations to innovate faster, automate operations, and achieve digital resiliency.

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