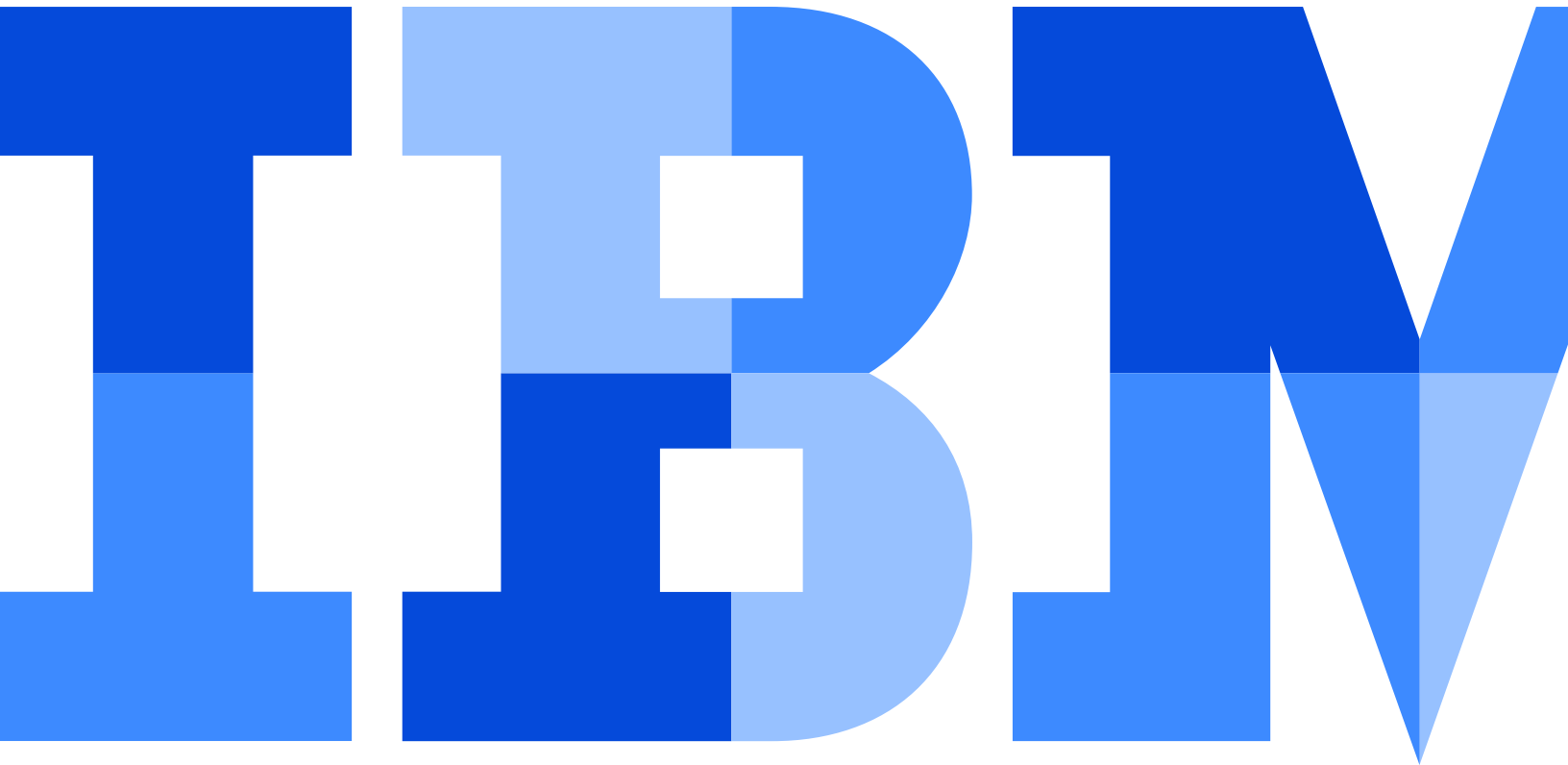


# Enterprise digital transformation with cloud



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## The foundations of the digital enterprise

Digital transformation is not a new concept for most IT leaders. It’s a journey they have been on for 5–10 years, driven by the need to better serve clients, improve competitive advantage and accelerate growth. That journey, though, is unique for each enterprise. It’s also specific to the various factors that define an organization: the industry, business model, regulatory environment, processes and culture.

While each journey is different, there are consistent patterns across large to midsize enterprises:

- Cloud is strategic to virtually every digital transformation journey because it provides rapid access to new technologies from a limitless range of sources, helping speed innovation and time to market.
- Data of all kinds—weather, social, Internet of Things (IoT), patient, partner—is at the heart of every transformation. It fuels the insights needed to help automate business processes, make informed decisions and personalize client experiences.
- The blend of hybrid cloud—public and private clouds used together, and multicloud—adoption of multiple public clouds—is making hybrid multicloud environments the new normal.

This first chapter in digital transformation can be characterized as borderless and heterogeneous, embracing technologies and data, on premises and off, from many providers.

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*“Multicloud is no longer a matter of ‘if’—it’s a matter of ‘when’. Multicloud computing lowers the risk of cloud provider lock-in, and can provide service resiliency and migration opportunities, in addition to the core cloud benefits of agility, scalability and elasticity.”*

—Santhosh Rao, Senior Director Analyst, Gartner

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### The new hybrid multicloud reality

While heterogenous environments are not new, the need for visibility and control across a growing number of external providers, proprietary tools and technologies is a key difference.

In fact, 94 percent of enterprises today have a mix of cloud models—public, dedicated, private and hybrid. Sixty-seven percent of enterprises are using multiple public clouds, mixing software, infrastructure and platform services from different providers. While only 20 percent of core business applications and workloads have moved to the cloud, with 80 percent still residing on premises in data centers.

This new hybrid and multicloud reality brings with it new considerations for IT leaders who must continue to operate business as usual, while embracing greater complexity. In an IBM study, 82 percent of IT leaders expressed concerns about how they’ll connect traditional IT with these clouds to address their specific use cases. Seventy-three percent needed better ways to move apps, workloads and data

between clouds so they can adapt to change, optimize costs, and minimize lock-in risk. Sixty-seven percent worried about how they’ll manage this new mix of cloud environments in a consistent way, across vendors, without impacting service quality, security and compliance.

Fundamentally, this shift from traditional on-premises environments to hybrid, multicloud environments brings with it very real architectural considerations.

### Designing for a hybrid multicloud world

Hybrid cloud allows for a mix of cloud environments—public, dedicated, private—all working together on and off premises. Multicloud enables choice of cloud-based technologies—artificial intelligence(AI), blockchain, IoT, analytics, infrastructure and platform as a service (PaaS) from more sources. This is where the unique nature of every digital transformation journey gets interesting, as it dictates the range and specificity of use cases you need to address as an enterprise.

Let’s explore some common hybrid and multicloud use cases:

- **Data and AI.** Enterprises are embracing more data sources on the cloud, combining it with existing data on premises, and applying analytics and AI on cloud to drive new insights.
- **SaaS integration.** As more workloads move to software as a service (SaaS), it’s become critical to connect them to other SaaS or existing apps and data on public, private or traditional IT in a consistent and repeatable way.
- **Enhance legacy.** With 80 percent of applications still on premises, many enterprises use public cloud services, like natural language processing (NLP), image recognition and short message service (SMS) to create new mobile-friendly front ends that deliver new capabilities quickly to clients.
- **Cloud scaling.** To accommodate peaks in demand, such as seasonal and holiday traffic to websites, enterprises are using public cloud compute on demand to scale on-premises private clouds and traditional IT.

- **Disaster recovery.** To manage risk from disruptive events, organizations are implementing complete failover sites on public and private clouds that can accommodate outages of core business systems—whether they’re on premises, on public or traditional IT.
- **Hybrid DevOps.** As the need for rapid innovation increases, developers are embracing public cloud infrastructure as a service (IaaS) and PaaS for speed, often in a follow-the-sun approach, as well as deploying on premises to meet security, compliance and business needs.
- **Composite multicloud.** With increased competition and new technologies available from more cloud sources, enterprises are building differentiating composite applications using the best microservices from different vendors and across on-premises and off-premises cloud environments.
- **Optimization.** As business needs change, organizations are optimizing for cost, performance or compliance by moving workloads to the lowest-cost provider, best-performing or most-compliant cloud model, for example, private cloud.
- **Edge computing.** With data being generated in mass scale from IoT, organizations are managing the cost and performance of applications that rely on this distributed data by using edge computing to process and send back less data in a hybrid model.

While not all use cases apply to every organization, understanding your requirements will make it easier to determine the best-fit approach to hybrid for your organization.

### Hybrid monocloud and hybrid multicloud

Gartner defines two types of hybrid cloud: hybrid monocloud and hybrid multicloud. These types are loosely defined as follows, but the specific implementation can vary depending on the provider.

**Hybrid monocloud** is a like-for-like model in which a cloud provider offers the same consistent, proprietary software and hardware stack running on premises as what’s available on its public cloud. The two environments are tethered to each other to form a hybrid environment, which is typically managed from the public cloud using public cloud management capabilities. In essence, the hybrid model is an extension of the public cloud to on premises.

If you have a cloud strategy that embraces infrastructure, platform, and SaaS from a single vendor, there are real advantages to a hybrid monocloud approach. You have a single vendor to procure, bill and support with a consistent approach to develop, integrate, deploy, secure and manage applications and data, enabling greater efficiencies across your staff and potentially greater economies of scale overall.

**Hybrid multicloud** is an open standards-based software stack, typically based on Kubernetes, that can be deployed across virtually any public cloud infrastructure and on premises. These two environments are tethered to form a hybrid environment, so management can be done on premises or off premises, but also across multiple cloud providers using the same management tools. A hybrid multicloud environment is, therefore, agnostic to the cloud provider and infrastructure.

If you have multiple cloud providers today, then a hybrid multicloud approach offers distinct advantages. You can address more use cases while mitigating the risks associated with a single vendor approach, such as vendor lock in or a single point of failure. Like hybrid monocloud environments, you can develop, integrate, deploy, secure and manage consistently. However, this method extends across all your cloud vendors, granting you access to new cloud technologies and data from more sources. Plus, you have the ability to move workloads between clouds and vendors as needed to optimize for performance, costs, security or compliance needs.

### The advantages of cloud-native development

When we think about the term cloud native, we’re talking about designing applications optimized to run in the cloud. Microservices represent the cloud-native approach of choice for developing new applications, but also for modernizing existing applications. Microservices allow developers to quickly iterate and deploy enhancements to an application’s code on a continuous basis, without having to touch or simultaneously modernize other parts of the application. In essence, update only what you need, using whatever programming language you want, and deploy new value to clients quickly and continuously without waiting one to two years for a major release. Further, each microservice can be scaled or replicated independently, allowing for a much better use and allocation of infrastructure resources.

Modernization can be done without containers, but containers can offer a strategic advantage in the short and long term. Unlike virtual machines (VMs), which each requires its own operating system, containers are lighter weight and allow enterprises to compartmentalize microservices with dedicated resources. Furthermore, they deploy without the added expense, performance impact or space consumed by replicating the operating system for each microservice you want to replicate or scale. On an enterprise-wide scale, the return on investment (ROI) implications are significant.

Perhaps the biggest benefit of a cloud-native approach based on microservices and containers is the least well known. Yes, speed and continuous delivery of enhancements to microservices is critical, but it doesn't represent the potential long-term strategic advantage at an enterprise level. If you can containerize microservices, you can now build applications that live in a distributed state essentially anywhere, on almost any environment. This versatility means that some applications can reside on premises—close to sensitive data—while some data can reside on a public cloud, anywhere around the globe, closer to your end user. At the same time, others can live on the edge, a critical component of IoT. So, now you can mix and match cutting-edge technologies from different cloud vendors—AI, blockchain, IoT, analytics, security—sourcing the best and latest technology innovations to build truly differentiating client experiences. You can also drive greater insights from a mix of data sources from virtually any data, anywhere, in the cloud or not. In contrast, single-vendor application innovation doesn't compare.

Cloud-native development and modernization practices also bring opportunities to radically rethink and improve security practices for building, deploying and managing enterprise applications. Traditional perimeter-based security controls and infrastructure practices are shifting to data and workload-centric cloud security policies, technologies and practices. As application teams are empowered with greater security responsibility and accountability within DevOps process, it's fostering new DevSecOps practices that enable stronger continuous security.

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*“It’s not just about getting closer to the people we serve and understanding them, it’s also about driving an agenda that lets us source in the business and technology capabilities that we need to serve them as well as possible.”*

— Claus Jensen., CTO, CVS Health

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## **The next chapter in digital transformation**

### **Build once. Deploy anywhere**

The first chapter of enterprise digital transformation was characterized by rapid adoption of cloud-based technologies and data from more sources to better serve clients, improve competitive advantage and accelerate growth. Yet today, only 20 percent of workloads have moved to the cloud. The next chapter in digital transformation aims to modernize and bring the value of cloud to the 80 percent of applications and workloads that remain on premises. This shift requires a better approach for developing and deploying across a hybrid and multicloud world—an approach that offers choice, without sacrificing visibility and control.

Fundamental to success is the consistency enabled by open standards, such as container orchestration platforms like Kubernetes. With it, enterprises can modernize application and data architectures consistently regardless of where they reside. Developers can build applications once and move them freely across clouds and vendors. Because the approach is standardized, visibility and control are achievable everywhere, making it possible to create composite applications using the latest technology from essentially any vendor. By design, open standards democratize how enterprises approach digital transformation.

### Open source leads the way

Most public cloud providers offer a proprietary, monocloud platform to develop applications, with a choice of infrastructure limited to one vendor. Open source ecosystems, however, can accelerate innovation by bringing together the expertise and collective power of many to advance consistent platforms for all enterprises.

In fact, today Linux, an early open source project, is the number one development platform, with 54 percent of all applications developed on Linux, and 79 percent of container hosts on it. Red Hat Enterprise Linux is the leader in Linux, available on all public cloud platforms. Red Hat is also a top two contributor to Kubernetes open source, which forms the foundation for Red Hat OpenShift, the leading hybrid cloud, container, and Kubernetes application platform. Its broad accessibility makes it easy to consistently build and deploy not only on essentially any public cloud, but on premises, as well. As such, it's broadly adopted and used by enterprises, including 100 percent of the Fortune Global 500 airlines, telcos, commercial banks, healthcare organizations, and the US executive government.

### The IBM hybrid multicloud platform

IBM believes that to address the needs of every enterprise, its approach to cloud must be grounded in five key principles that reflect the current reality IT leaders deal with every day:

- **Hybrid.** Enable enterprises to work across public, private and traditional environments.
- **Multicloud.** Manage other vendors' clouds, acknowledging the reality that client environments are heterogeneous.
- **Open.** Build capabilities that are open by design, enabling client flexibility and reducing vendor lock in.
- **Security.** Provide reliability and continuous security across our client's complete environment.
- **Management.** Offer consistent service-level support, logging, management and delivery across cloud environments.

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*“IBM Cloud allowed us to avoid any security or regulatory issues by keeping customer data on premises. That was key for us.”*

— Leo Frey, Head of Digital Platforms, Allianz Taiwan Life Insurance Co. Ltd.

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### Red Hat is the foundation

The foundation of the [IBM hybrid multicloud platform](#) is an infrastructure-independent common operating environment that runs virtually anywhere—from essentially any data center to multiple clouds to the edge. It lets you select the best architecture and approach to address the most critical application, data and workload requirements of your business. The foundation consists of Red Hat Enterprise Linux to build virtually anywhere, and Red Hat OpenShift for application, workload and data portability.

Developers can access languages, databases and tooling they already use, including public cloud services through the service broker. Common services enable self-service deployment, monitoring, logging and security. Standardized workflows, support for multiple environments, continuous integration and release management, help you simplify management of the development lifecycle. Multicloud management lets you visualize all your distributed application components.

This Red Hat foundation enables you to realize greater agility, speed of innovation and economies of scale across your vendors and clouds. With it, enterprises like UPS and BBVA cut development time for new applications down from months to mere weeks, reduced platform deployments to hours, and cut application build costs by up to 60 percent.

## Deutsche Bank streamlines development platform, democratizes IT

### Overview:

As a leading bank, serving private, corporate and fiduciary clients, Deutsche Bank has embraced digital transformation. The bank wanted to improve the experience of its banking customers and users of its back-end technology, including employees and external providers and developers who use the platform to build and run applications. Using Red Hat solutions, Deutsche Bank built an open source PaaS to simplify DevOps collaboration, optimize capacity and increase efficiency, cutting end-to-end application development time from 6–9 months to 2–3 weeks.

### Challenge:

Deutsche Bank wanted to shorten development cycles to get products to market faster. But its restrictive infrastructure made integration difficult and application development slow. Managing thousands of servers and databases hindered growth and the adoption of emerging technology. “Many operating systems were being used across multiple data centers,” said Emma Perkins, PaaS portfolio manager at Deutsche Bank. The bank also wanted to replace its traditional waterfall processes with a DevOps approach. To meet these needs, Deutsche Bank sought to establish a PaaS that would streamline development and management, reduce risk and scale easily to support more agile work across its business.

### Solution:

Deutsche Bank chose Red Hat to help build Fabric, a containerized, microservices-based application development platform. Fabric hosts systems and tools and offers on-demand compute for every application development team at the bank. “Red Hat offered that combination of open source with vendor support, patching and management—all of the things that we need in a regulated enterprise,” said Tom Gilbert, managing director, global head of cloud, application, and integration platforms with Deutsche Bank. “The shift from virtual machines to containers, and traditional applications to microservices, is a big one. We needed a partner that could help us build our deployment capabilities and train our global developer base so we could get maximum value from our investment.”

### Results:

Fabric provides faster resource access, helping developers work more efficiently and speeding time to market. Instead of 6–9 months, applications now go from proof of concept to production in 2–3 weeks. “What we’ve set out to do with Fabric and OpenShift is to democratize IT,” said Gilbert. “We’ve given access to powerful technologies to every developer at the bank.” In addition, Deutsche Bank simplified DevOps collaboration with flexible integration and an agile approach. The bank also streamlined resource access, optimizing its use of data center and cloud capacity, saving time, money and resources. “We’re running a global platform that’s supporting thousands of applications with a single operating model and a large number of workloads on a small portion of infrastructure,” said Gilbert. “It’s efficient from both a utilization and cost point of view.”

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*“We’ve never provided capabilities across so many infrastructure providers or capabilities for developers to actually develop with the platform we’re providing. All of this happened because we started using Red Hat OpenShift Container Platform. It’s setting us apart from competitors because we’re able to make changes quickly, effectively, and efficiently.”*

— Emma Perkins, PaaS Portfolio Manager, Deutsche Bank

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### Hybrid middleware optimizes DevSecOps

On top of the Red Hat foundation, the IBM hybrid multi-cloud platform offers containerized middleware and DevSecOps tools, known as IBM Cloud™ Paks, to create hybrid environments and composite applications using the latest technologies from essentially any source.

They include the following:

- **IBM Cloud Pak™ for Applications** helps you modernize, build, deploy and run your applications. It reduces development time by up to 84 percent.<sup>1</sup>
- **IBM Cloud Pak for Data** helps simplify and automate how you deliver insights from all your data sources. It's tailored to your unique data landscape with an open and extensible architecture on virtually any cloud. It can help virtualize essentially all data for AI up to 500 percent faster.<sup>2</sup>
- **IBM Cloud Pak for Integration** helps you integrate your apps, data, cloud services and application programming interfaces (APIs). It eliminates up to 33 percent of integration costs.<sup>3</sup>
- **IBM Cloud Pak for Automation** helps you to transform your business processes, decisions and content. It reduces manual processes by up to 80 percent.<sup>4</sup>
- **IBM Cloud Pak for Multicloud Management** provides you with multicloud visibility, governance and automation. It reduces operational expenses by up to 75 percent.<sup>5</sup>

### Putting the “Sec” in DevSecOps

Enterprises today require an end-to-end approach to security that achieves three core objectives in managing risk and compliance through structured security practices:

- Manage access with network protection, and identity and access management.
- Protect data with increased customer control and fortify workloads.
- Achieve continuous security and compliance, and manage threats.

IBM offers a complete and scalable suite of cloud security technologies enriched through pervasive encryption, AI plus automation and integration to address these three fundamental requirements. Further, with IBM as a partner, you gain access not only to a full stack of IBM Cloud security, but also to an IBM security team supporting more than 12,000 customers in 133 countries. No matter which service you subscribe to, your content is protected by IBM's world-renowned security leadership. Every IBM Cloud service is designed, developed and managed according to IBM's own

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*“We can manage all of our clouds consistently. Configuration consistently. Our deployment pipeline is consistent across all our clouds. Multicloud management is a game changer for us.”*

— Arun Sharma, Senior IT Leader, General Motors

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strict security policies and implementation guidelines, provided under the binding commitments of the IBM Data Security and Privacy Principles.

### The IBM public cloud

#### Advanced services on the most open and secure public cloud for business

IBM public cloud is optimized to build, run and manage services using the Red Hat Enterprise Linux and [Red Hat OpenShift](#) enterprise Kubernetes application platform, which is at the core of IBM's next-generation hybrid multicloud platform.

[IBM's public cloud](#), offers trusted, secure solutions delivered via an upgraded and award-winning user experience:

- **Open innovation and the best public cloud for Red Hat OpenShift.** Build and run applications using cloud native services or deploy on managed Red Hat OpenShift on our public cloud. IBM is a leader of running Kubernetes production workloads—more than 14,000 production clusters, processing billions of transactions per day. Automated deployment of IBM Cloud Paks allows an out-of-box, easy-to-consume cloud experience.
- **Security leadership with market-leading data protection.** Our public cloud has been designed with the demands of the world's largest and most complex organizations in mind. It uses the same state-of-art cryptographic technology that financial institutions rely on. The data you store on our cloud is yours and yours alone. We allow you to bring your own key—that no one but you can see—not even us. Build and run your core business applications and workloads with certified compliance, single dashboard visibility and multiplatform portability.



- **Enterprise-grade for reliable and robust workloads.** Span classic enterprise multi-architecture lift-and-shift, broad VMware migration to cloud-native leadership with broad support for Kubernetes, Knative, Istio and Cloud Foundry. We have the #1 public cloud for VMware, and provide cloud migration for Power AIX, IBMi, Z, SAP and all of your mission critical applications. Whether it is bare metal, GPU or dedicated virtual compute, IBM's compute choices and configurable auto-scaling allow you to optimize for dynamic, demanding, sensitive and secure workloads.

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### The IBM Advantage:

- **Innovate anywhere** with the latest technologies from any vendor.
- **Modernize once** and deploy anywhere, without recoding.
- **Improve ROI** on existing clouds while maintaining full visibility and control.
- **Optimize on the right cloud** model and meet unique workload requirements.
- **Speed innovation** with advanced public cloud services from IBM or virtually any cloud.
- **Realize a fast, secure journey** with unmatched industry expertise.

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Being the most open public cloud doesn't mean light on security. It has been designed with the exacting demands of the world's largest and most complex organizations in mind and uses the same state-of-the-art cryptographic technology that financial institutions rely on. The data you store on the IBM Cloud is yours and yours alone: you bring your own key—that no one but you can see—not even IBM. The IBM public cloud lets you build and run your core business applications and workloads with continuous compliance, single dashboard visibility and multiplatform portability.

### Expertise when you need it

IBM helps make it easier to move more to the cloud today, without compromising visibility or control. When you need it, IBM has a methodology and services built on deep industry, security and cloud expertise that meets you where you are in your journey. In fact, IBM has helped thousands of clients realize a faster, more secure and cost-effective journey to cloud. Key entry points include:

**Cloud strategy.** Find the right cloud adoption strategy for your organization's needs. IBM can advise on workload, application and DevOps transformation, along with various operating and disposition models. Business case and ROI projections help determine which cloud models make sense for your business.

**Cloud migration.** Get more out of your existing app investments. IBM knows you may be dealing with complex interdependencies, inflexible architectures, redundancy and out-of-date technology. It can help you with a plan to migrate and modernize so you can take advantage of the cloud infrastructure, unlock potential business value and improve business agility.

**Cloud development.** Quickly develop and release apps with minimal incidents. Boost your agility, speed, scalability and operational efficiency. Employ cloud-native development using microservices and API constructs that are built on containers or Cloud Foundry-based platforms.

**Cloud management.** Manage your public, private and multicloud environments at virtually any scale. Smoothly transition and manage your application portfolios with integrated service-level management and a scalable, agile DevOps platform of cloud and security services. With these optimized workloads, you can reduce costs and improve operational reliability, productivity and response times.

All these advantages are delivered through the IBM Garage™ Method, an end-to-end services methodology that defines a reliable, repeatable, security-rich path for IBM clients to embark and succeed on their cloud journeys. This approach better enables businesses to migrate, modernize and build applications for the optimal destination cloud—public, private and hybrid—and then to manage them efficiently. With the [IBM Garage](#), you gain purposeful innovation and transformational change with the speed of a startup at the scale of an enterprise.

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*“IBM is helping us implement our vision of our ideal operating model. We're fostering an environment that removes barriers and drives innovation.”*

— Jeremy Hubbard, Head of Digital and Technology, UBank

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- 1 Responses from the organizations surveyed and Ovum’s own data indicate that the speed to market can be reduced by as much as 84%, depending on which market is being evaluated. Figure 1 shows the reduction in time to market in the fintech sector achieved using IBM Cloud Private, which was on average a drop from 180 days to 15 days. Sources: [ibm.biz/Ovum-WP](http://ibm.biz/Ovum-WP) (Page 6)
- 2 Average speed gain from performance testing of data virtualization vs. federation for access to data from relational databases, data warehouses, and Hive data sources using the TPC-DS benchmark. Testing conducted on May 2019 by the Data & AI development team at IBM Silicon Valley Labs. For additional information, please contact Mukta Singh, Offering Manager, Hybrid Data Management.
- 3 “This can help companies cut the time and cost of integration by 1/3, while staying within their unique requirements for security and compliance.” Substantiation: Our customer Aetna has shared their results with us which is where this initially came from. In addition, the Cloud Integration Platform includes API Connect. We have a published Forrester TEI that includes the following statements on development savings “A 30% improvement in time-to-market for internal development of data and analytics projects” “A 35% improvement in time-to-market projects by public developers consuming APIs” This includes a breakdown to cost savings specifically that is much higher than what we are claiming here.
- 4 “With the Operational Decision Manager, the bank was able to set up workflows that enable faster approval of 80% of all loan requests. “Some loan approval processes were taking days, sometimes four to 10 days depending on the exceptions; now 80% of our loan applications flow straight through and are done in seconds.” Source – [ibm.com/downloads/cas/O5A0BD4R](http://ibm.com/downloads/cas/O5A0BD4R)
- 5 Reducing the operational expense of supporting large-scale dynamic cloud-native environments is a key value proposition of container management platforms. The survey discovered that, on average, organizations achieved a 75% reduction in operational overhead in managing the cloud-native environment. This operational efficiency gain comes in three main areas identified by the survey where using a container management platform approach to cloud-native management yields savings



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