



Research Insights

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Application modernization on the mainframe

Expanding the value
of cloud transformation

IBM Institute for
Business Value

IBM

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Key takeaways

Mainframe in the modern world

The pandemic has further hastened the trend toward all things digital, including cloud. What does this increasingly cloud-focused world mean for the mainframe—and for the industry powerhouses that rely on it for their most critical applications? Executives tell us the mainframe remains central to their strategies—and plays an important role in digital transformation.

Mainframe or cloud? The answer is... yes.

Transformation is not an “either-or” process. Executives expect increases in both mainframe- and cloud-based operations. And the vast majority recognize the need to rapidly transform and modernize mainframe-based applications. Modernized systems and applications—connected to new applications through a hybrid cloud environment—open the door to increased agility and innovation.

The foundation for transformation

Hybrid cloud offers foundational support for end-to-end transformation. Some systems require mainframe’s power, reliability, and security features; others are better suited for cloud. Hybrid cloud enables the alignment of workloads with the most appropriate environment, optimizing performance. Blending mainframe power into the cloud landscape enables the cutting-edge capabilities required today.

Introduction

A vast majority of executives tell us their businesses accelerated transformation efforts last year in the face of rapidly changing market environments. Even more say the pandemic has eliminated long-term barriers to transformation including cultural roadblocks.¹ Dual imperatives of remote working and rapid fluctuations in scale and scope have reconfirmed the centrality of cloud computing. In short, virtually all the traditions of business have been turned on their head over the past 18 months. But how much of an impact has all the upheaval really had on the fundamentals of IT infrastructure? Do legacy applications have a role in the new digital order? Is there still a place for mainframe?

Results from a recent IBM Institute for Business Value (IBV) survey indicate the unequivocal answer is yes. Technology and business leaders say the mainframe not only remains an important part of their organizations’ IT platforms, it also plays a central motivating role in accelerating their digital transformations. Executives from some of the largest and most successful businesses assert that mainframe and cloud are not either-or propositions. They are seamlessly intertwined in delivering cutting-edge enterprise-wide agility and capability. And together they help secure operations, reduce latency, and drive legacy processes to levels of dynamic innovation previously only possible for born in the cloud insurgents.



71%

of executives say mainframe-based applications are central to their business strategy.



In three years, the percentage of organizations leveraging mainframe assets in a hybrid cloud environment is expected to increase by more than

2x.



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executives say their organizations need to rapidly transform to keep up with competition, which includes modernizing mainframe-based apps and adopting a more open approach.

Mainframe and cloud in context

For more than 60 years, mainframe computers have powered mission-critical applications for industries central to the continuing operation of the global economy. Today, 45 of the top 50 banks, 4 of the top 5 airlines, 7 of the top 10 global retailers, and 67 of the Fortune 100 companies leverage the mainframe as their core platform.² Mainframes handle almost 70% of the world's production IT workloads.³ And 90% percent of IT and business executives from a recent survey view their mainframe as a growth platform, with more than half reporting an increase in transaction volumes over the past 12 months.⁴

What these executives are highlighting is not the mainframe of old. IT leaders are integrating and extending mainframe capabilities to support agility and new business innovation. Digital transformation strategies motivate modernization of underlying systems and, more importantly, the applications that reside therein. The challenge, as usual, is deciding which applications to modernize, determining how to modernize, and identifying the destination for modernized applications. Successful IT leaders with a vision for these elements are rapidly executing and capturing new value.

But some organizations are falling behind. Their leaders urgently need to ask themselves a crucial question: How do I extract more value from my mainframe investment—an investment that supports almost three quarters of my organization's processing power and the applications that house and operate its core functionality?

To answer these and other questions, the IBV in collaboration with Oxford Economics surveyed 200 top IT executives across industries in North America about both their mainframe systems and transformation strategies and the intersectionality between them. The businesses represented comprise almost 30% of the S&P 500 and drive almost 40% of economic activity in North America—estimated to be more than \$9,000 billion in 2021.⁵ (For more on the research, see the *Study approach and methodology* section at the end of the report.)

Major companies rely on mainframe for some of their most critical applications: 93% use mainframe for financial management and 73% for customer transaction systems.

Our research reveals that as they transform operations and systems, these organizations seek more comprehensive solutions that integrate disparate sources of data across internal and external processes and systems. Executives we surveyed realize the advantages afforded by modern mainframe systems and the need to modernize the applications that run on these systems for peak agility, flexibility, and performance.

Utilizing their insights and analysis, this report offers guidance on how to extract even more value from mainframe assets. We examine why modernizing mainframe-based applications is a critical element in successful hybrid cloud strategies and, ultimately, how both mainframe and cloud underpin holistic digital transformation and innovation realization.

Mainframe's role in the digital world

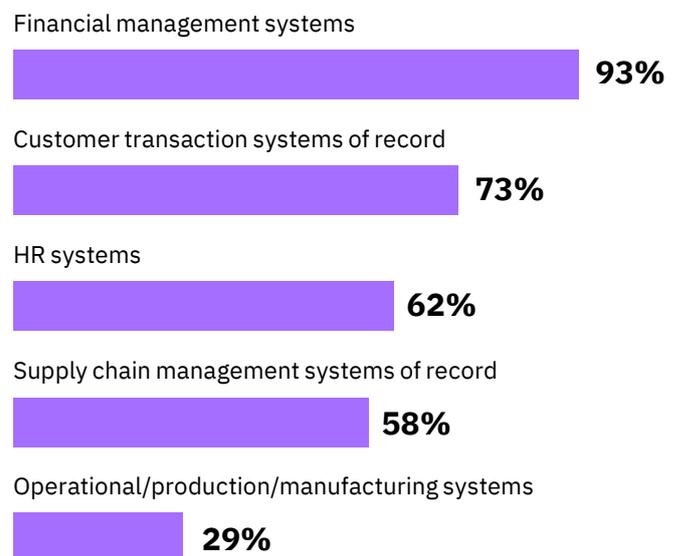
The past decade has seen organizations move away from an on-premise and owned data-center-based strategy to a more flexible subscription cloud-based one. While this approach yields benefits to lines of business in terms of flexibility, recent IBV benchmarking data suggests some executives are less than satisfied with the returns from their cloud-related investments. In early 2021, approximately 30% of executives surveyed were underwhelmed by their public and private cloud investments from a functional and financial perspective.⁶ This percentage will likely continue growing due to the disparate nature of one-off cloud projects that often don't include core systems or workloads.

At the other end of the spectrum, IBV research suggests that even as recently as 2019, up to 80% of enterprise workloads still occurred on mainframe computers, especially among businesses in more regulated industries.⁷ Whether they recognize it or not, major businesses continue to rely on the mainframe for applications across the enterprise, many of them critical. Our 2021 mainframe survey confirms this trend. 93% of executives tell us their enterprise financial management systems remain on mainframe. And roughly three quarters rely on mainframe power to operate their customer data and transaction processing systems (see Figure 1).

Figure 1

Tapping mainframe's power

Mainframes are responsible for business-critical applications across the enterprise.



Question: Indicate whether the following applications run on mainframe.

Given that a multiplicity of cloud-based solutions has now been available for two decades, an interesting question emerges. Why do so many critical workloads continue to remain on the mainframe in the presence of lower-cost and flexible cloud options? Executives point to several reasons. Enhanced data security remains a crucial driver and, as evidenced by the recent compromises of several enterprises, is perhaps even more front of mind.⁸

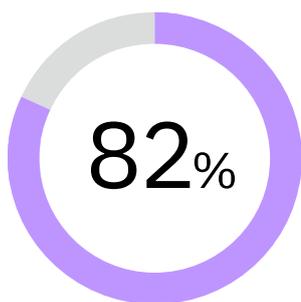
IT leaders also cite faster and higher-volume data processing among their most valued mainframe advantages, as well as reliability and improved scale of operations. This is echoed by Peter Rutten, a research director at market research outfit IDC, who says, “There is no platform that can conduct the same number of transactions per second with the high availability and security that mainframe supplies.”⁹

While not necessarily the topic of headline-grabbing business press, mainframe continues to play a central role in enterprise strategy and performance. And the executives we surveyed bear this out (see Figure 2).

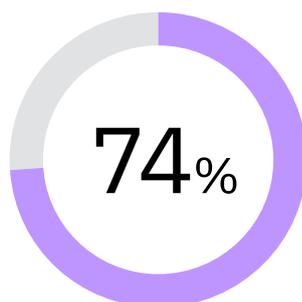
Figure 2

A core element for the future

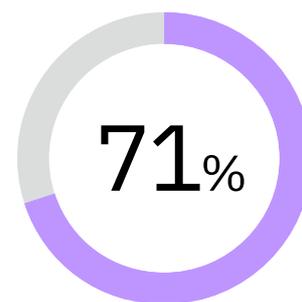
The mainframe remains closely tied to the heart of the enterprise.



82% of executives agree their **business case supports mainframe-based applications**



74% say mainframe-based applications are **central to their technology strategy**



71% tell us mainframe-based applications are **central to their business strategy**

Question: To what extent do you agree with the following statements? (Percentages represent “completely agree” and “partially agree” responses combined.)

While the mainframe itself has continued to evolve, legacy applications weren't designed to support modern requirements.

Recognizing the need for ongoing innovation, 86% of executives tell us their organizations need to accelerate digital transformation to stay ahead of changing customer expectations. And optimizing the value of existing mainframe assets is a cornerstone of this continuous digital transformation journey. Part of that journey is the process of mainframe modernization.

The mainframe computer itself has come a long way. Small and agile, modern mainframe machines offer even greater processing power, enhanced security and reliability features, and the ability to support advanced technologies.

Legacy mainframe applications, on the other hand, have not fared as well. Typically created using waterfall development processes, they often were not designed to support the agility, adaptability, and innovation required today. And they can be difficult to update and expensive to scale. Executives we surveyed confirm that modernizing these mainframe-based applications—and connecting them with new applications through a hybrid cloud environment—is crucial to keep pace with ever-changing business needs. This is evidenced, time and again, through our client engagement experiences as well.

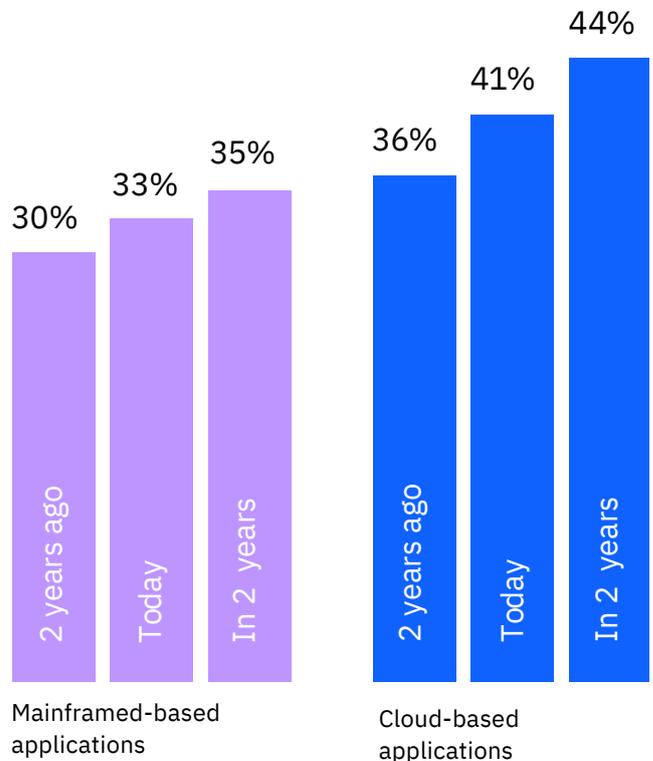
Paths to digital transformation

Enterprise digital transformation comprises much more than cloud migration. It is not an either/or proposition with mutually exclusive solutions. Executives we surveyed expect use of both mainframe and cloud-based applications to grow (see Figure 3). They have a clear focus on a fit-for-purpose digital strategy, pointing to the need for enterprise-wide transformation that facilitates integration and optimization of both environments.

Figure 3

Growth for both

Executives plan to up their usage of both mainframe- and cloud-based applications as part of their comprehensive transformation plans.



Question: What proportion of application workloads across your organization operate on mainframes versus other architectures?

Executives tell us they want to leverage a hybrid cloud environment to optimize and extend the value of existing assets.

Organizations with mainframes need to craft a forward-focused strategy to achieve this aim. We see three potential paths:

1. *Maintain status quo*: Going with a static approach—keeping the mainframe separate by using legacy tools and processes—might be perceived as the cheapest option. However, organizations that choose this path face the very real risk of watching the competition sprint ahead while they jog in place, losing revenue and market share.
2. *Rearchitect infrastructure*: This expensive option requires great time and effort, which could result in lost market share or revenue. It also puts mission critical applications at risk.

3. *Optimize assets through modernization*: In this scenario, mainframe assets, both existing systems as well as applications, are leveraged through modernization and by building new cloud-based applications as part of a holistic digital transformation strategy across the mainframe and cloud.

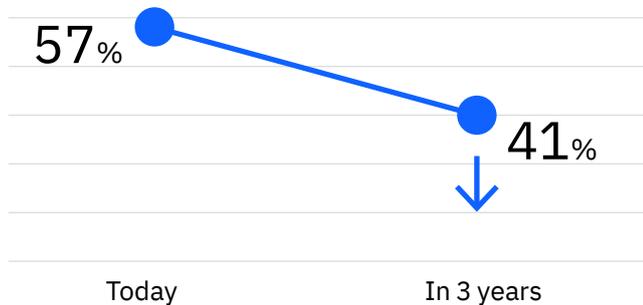
Survey results suggest that IT leaders are trending toward the third option of modernization. As a consequence, the percentage of organizations leveraging mainframe assets in a hybrid cloud environment is expected to more than double in three years (see Figure 4). Understandably these organizations are prioritizing the optimization of existing investments along with an acceleration of their overall IT innovation.

Figure 4
Transformation includes modernization

Organizations are moving toward a hybrid cloud environment that includes modernized applications for extended mainframe value.

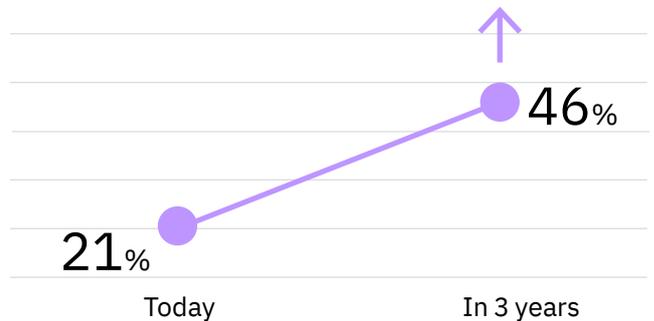
Rearchitecting the entire infrastructure:

Expensive and requires great time and effort, which could lead to lost market share/revenue



Leveraging existing mainframe assets:

Connecting existing assets with modern applications can accelerate transformation



Question: Which of the following is most consistent with your organization's digital presence/transformation?

Best of both worlds: Hybrid solution

Some systems and applications, particularly core ones, are better suited for the processing power, security features, and reliability benefits of the mainframe, while others clearly work best in a cloud environment, reaping benefits in areas such as cost, collaboration, flexibility, and scalability. In three years, close to 70% of leading organizations expect their operations will include unique configurations of data and computing environments, such as on-premise data center, mainframe, private cloud, public cloud, and edge computing.¹⁰

Executives agree that reaching this state of operations will require substantial change. Four out of five from our survey recognize the need to rapidly transform, adopt a more open systems and operations approach, and modernize mainframe-based applications to integrate with other critical applications.

The remaining challenge is how to integrate mainframe operations with cloud-based and other applications and processes in a way that allows them all to share data and operate at peak performance. Modernizing mainframe-based applications allows deployment of cloud-native applications on the mainframe—and should be part of a comprehensive hybrid cloud strategy. (See *Perspective: The hybrid cloud solution.*)

Perspective: The hybrid cloud solution

A hybrid cloud environment integrates traditional computing platforms with private, public, and managed cloud services. In essence, a hybrid cloud becomes a virtual computing environment that aligns workloads and interfaces with the most appropriate computing platform. All these services should be managed as though they were designed to behave as a single unified environment. A hybrid cloud strategy involves prioritizing each workload with an optimal platform—traditional, private cloud, or public cloud—so that each workload is in the right place and each of the various environments is handling what it does best.

Dillard's: Enhancing customer experience with tailored fit pricing¹¹

US-based Dillard's, among the nation's largest fashion retailers, sought a way to better manage the IT costs associated with extreme surges in transaction volumes. Like most retailers, the company experiences large spikes in both online and in-store traffic during holidays and clearance sales event, making it difficult to balance IT costs with customer service.

The company unlocked greater agility by modernizing its systems with a new tailored fit pricing model. Leveraging this consumption-based pricing model, Dillard's can dynamically flex its IT resources while keeping costs predictable. In addition, stable and consistent IT services translate to a more consistent shopping experience for customers.

Hybrid cloud: A foundation for modernization

Almost 70% of the executives from our mainframe survey plan to leverage hybrid cloud to improve the integration and effectiveness of legacy systems. And our most recent IBV cloud survey reveals that 83% of executives anticipate that their organizations will need a cloud orchestrator/management platform to coordinate workloads in multiple environments within the next 10 years.¹²

Hybrid cloud serves as the “*secret sauce*,” delivering the foundation to support comprehensive transformation. Enabling platform integration, a hybrid cloud environment facilitates the alignment of workloads and interfaces with their most appropriate environment from a technical, strategic, and regulatory perspective.

Reaping the benefits of modernization

Executives tell us one of their biggest mainframe-related challenges is cost management. Modernization of mainframe-based applications can help alleviate some cost challenges but, more importantly, it can help drive better business outcomes through improved agility and reduced risk. Some clients are utilizing open source and the open ecosystem on the mainframe, while others are leveraging tailored fit pricing for more of a pay-as-you-go cost model (see *Dillard's: Enhancing customer experience with tailored fit pricing*).

In addition, some enterprises are upgrading software for better functionality, such as AIOps for proactive incident management, hence helping reduce cost, or they are consolidating and modernizing hardware for a more efficient compute. Others are optimizing utilization and eliminating peak constraints.

“The modernization project improves our understanding of and control over services running on our enterprise systems.”

Abdelhakim Loumassine, Head of the Mainframe Division, BNP Paribas

Investing in modern mainframe tools and technology can bring new function and capabilities that not only lower total cost of ownership, but also drive improvements in other areas. For example, adopting DevOps and agile practices that integrate traditional mainframe systems with new cloud-based systems and practices can drive improved agility and innovation. Also, organizations can integrate mainframe applications with new systems of engagement through APIs. And refactoring applications for a microservices architecture can help an organization optimize its portfolio and mitigate risk.

The talent conundrum

A retiring baby boomer workforce has resulted in a mainframe skills gap, creating another key concern for executives. Executives cite difficulty obtaining mainframe talent as one of their top mainframe challenges. But IT leaders and organizations can take positive steps to redress skills challenges.

For example, a group of employers in Cincinnati that needed mainframe-skilled employees formed an ecosystem that includes the local community and other organizations that can assist in identifying and training new hires. As part of this initiative, IBM joined forces with Per Scholas, a non-profit focused on opening doors to transformative technology careers for people from often overlooked communities, to both address job market needs and help members of under-served communities play a greater role in the economy.¹³

In addition to focusing on skills initiatives, organizations are leveraging the latest capabilities on the mainframe, developing mixed-language application components, adopting modern languages and processes, and creating an open development environment that can help them attract new talent (see *BNP Paribas: Transforming the development environment*). Additionally, adopting modern practices and capabilities, like APIs, microservices, containers, analytics, hybrid cloud, DevOps, and agile methods, can also help accelerate market delivery, positively impact costs, and enhance interoperability between mainframe and cloud technology.

BNP Paribas: Transforming the development environment¹⁴

Among the world’s largest banks, BNP Paribas embarked on a major modernization project, overhauling software development for its core IBM Z mainframe systems. The bank, which offers both retail and investment banking services, discovered that its developers faced challenges relating to capacity constraints and outdated tools.

To improve quality and efficiency—and enable more rapid product development—BNP Paribas deployed an integrated development environment backed by open-source tools. Driving both cost and quality improvements, the modern environment enables more efficient development and testing, which also helps attract new developers. It also boosts developer engagement and code quality by offering greater autonomy and tool standardization.

By building a strong foundation with agile, modern development practices and services, BNP Paribas adds business value by seamlessly using the business-critical data and transactions on its modern mainframe systems within its hybrid cloud strategy.

“The modernization project improves our understanding of and control over services running on our enterprise systems,” says Abdelhakim Loumassine, Head of the Mainframe Division at BNP Paribas. “The more we can expose applications and business logic running on IBM Z, the more value we can add to the business and to our clients.”

Action guide

Application modernization on the mainframe

Mainframes play a crucial role in their organizations' digital transformation strategies, offering the reliability, enhanced security, and increased resiliency required for many workloads and processes, particularly core ones. IT leaders and organizations are finding that cloud solutions are not a replacement for mainframe operations. Rather, the two can coexist as part of a holistic transformation strategy that includes modernized mainframe applications and integrated systems supported by a hybrid cloud architecture.

As you develop your mainframe application modernization strategy, embrace the following:

- **Adopt an iterative approach.** As part of your plan to integrate new and existing environments, factor in your industry and workload attributes to co-create a business case and road map designed to meet your strategic goals. Adopt an incremental and adoptive approach to modernization as compared to a big bang. Leverage techniques such as coexistence architecture to gradually make the transition to the integrated hybrid architecture.
- **Assess your portfolio and build your roadmap.** To understand your desired future state, first assess your current state. Examine the capabilities that define the role of the mainframe in your enterprise today and how those capabilities tie into the greater hybrid cloud technology ecosystem. In addition, take stock of your existing talent and resources and determine any potential gaps.
- **Leverage multiple modernization strategies.** Enable easy access to existing mainframe applications and data by using APIs. Provide a common developer experience by integrating open-source tools and a streamlined process for agility. Develop cloud native applications on the mainframe and containerize applications.

Study approach and methodology

In cooperation with Oxford Economics, the IBM Institute for Business Value (IBV) surveyed 200 IT executives (for example, CIOs, Chief Enterprise architects) in North America across more than 7 industries in April 2021. These executives represented organizations that comprise almost 30% of the S&P 500 and drive almost 40% of economic activity in North America, estimated to be more than \$9,000 billion in 2021. Additionally, all respondents are involved with, or responsible for, the development/management of mainframe-based applications as part of their primary role in their organizations. All participants were asked a range of questions about mainframe adoption, relevance to core strategy, key sources of value, workload distribution, and modernization strategy.

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Notes and sources

- 1 “COVID-19 and the future of business: Executive epiphanies reveal post-pandemic opportunities.” IBM Institute for Business Value. September 2020. ibm.co/covid-19-future-business
- 2 IBM research and analysis.
- 3 Hoover, Evelyn. “IBM Infrastructure’s Role in Cloud, AI and Security.” TechChannel. March 1, 2019. <https://techchannel.com/IT-Strategy/03/2019/ibm-infrastructure-cloud-security>
- 4 “2020 BMC Mainframe Survey results.” BMC press release. October 1, 2020. <https://newsroom.bmc.com/news-releases/news-release-details/2020-bmc-mainframe-survey-results>
- 5 IBM Institute for Business Value calculation based on survey respondent data and data from: “GDP (current US\$)—North America.” The World Bank. <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=XU>
- 6 IT application development, maintenance, and operations performance survey data. IBM Institute for Business Value Performance Data and Benchmarking Program. 2021.
- 7 Keverian, Ken, Arvind Krishna, Steve Robinson, and Anthony Marshall. “Next-generation hybrid cloud powers next-generation business.” IBM Institute for Business Value. August 2019. ibm.co/hybrid-cloud
- 8 “Beyond Airports, TSA Also Manages Pipeline Security. That Could Be A Problem.” NPR. May 19, 2021. <https://www.npr.org/2021/05/19/997958344/beyond-airports-tsa-also-manages-pipeline-security-that-could-be-a-problem>
- 9 “Mainframe 2020: A catalyst for transformation.” MIT Technology Review. 2020. <https://www.ibm.com/downloads/cas/LNRYXGJ4>
- 10 IBM Institute for Business Value Smarter Supply Chain Study. 2020.
- 11 Berthiaume, Dan. “Dillard’s scales IT resources to meet customer demand.” Chain Store Age. May 16, 2019. <https://chainstoreage.com/technology/dillards-scales-it-resources-to-meet-customer-demand>
- 12 IBM 2020 Cloud survey. IBM Institute for Business Value.
- 13 “Talent for IBM Z.” IBM case study, IBM website (accessed July 7, 2021). <https://www.ibm.com/case-studies/ibm-academic-initiative-systems-hardware-mainframe-skills>
- 14 “BNP Paribas.” IBM case study, IBM website (accessed July 7, 2021). <https://www.ibm.com/case-studies/bnp-paribas-systems-software-z>

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July 2021

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