

TRENDS

# IBM Research Bolsters IBM Hybrid Cloud

**A Strong Innovation Pipeline Can Make a Difference  
for IBM Hybrid Cloud—and for IBM**



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# INTRODUCTION

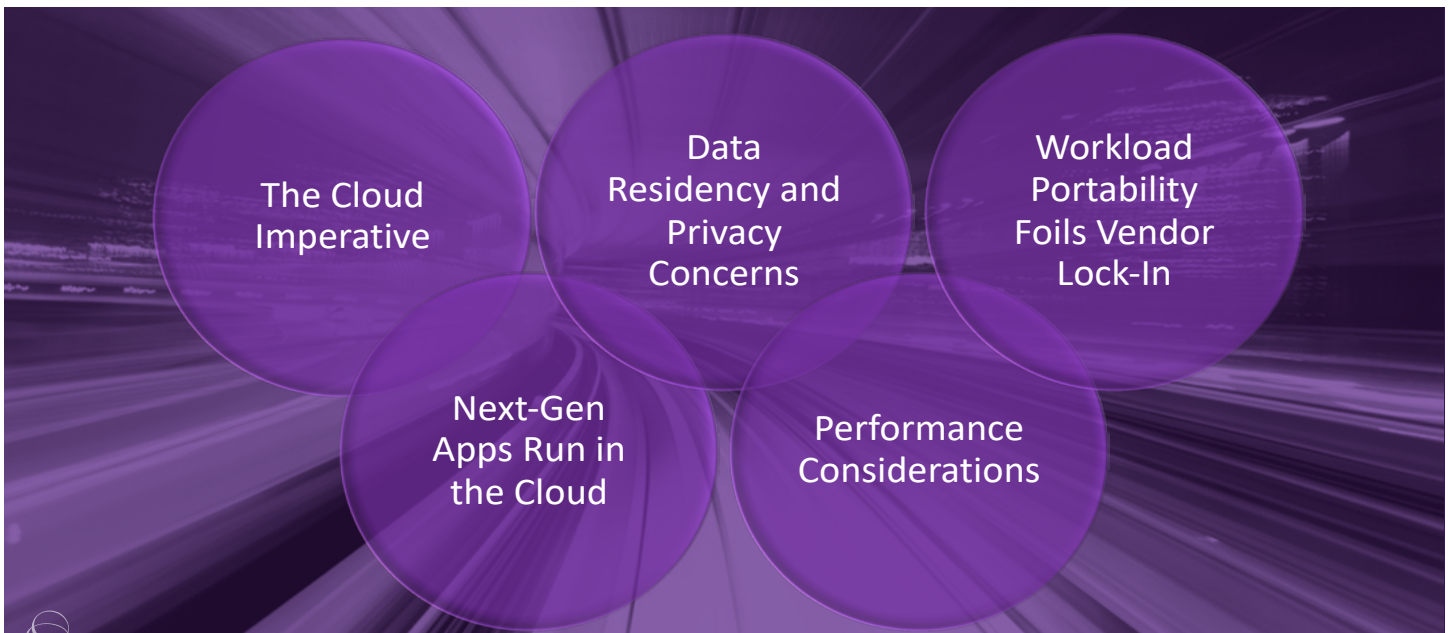
In a webcast February 17, 2021, IBM shared several innovations that are underway with IBM Research. In their joint presentation, IBM's Talia Gershon, director, Hybrid Cloud Infrastructure Research, and Mukesh Khare, vice president, Hybrid Cloud Research, revealed a number of promising developments that may help IBM increase the attractiveness of IBM Hybrid Cloud to enterprises.

This blog post explains what IBM shared and explores which innovations are most promising for enterprises and may set IBM apart from its competitors in the market and concludes with actionable recommendations for CxOs.

## WHAT ARE THE KEY TRENDS?

Enterprises need to move to the cloud to leverage Infinite Computing and build next-generation applications. They need freedom of deployment for these next-generation applications and require choices and flexibility from cloud vendors to provide them with that portability. Five key drivers determine the need for next-generation computing platforms (see Figure 1):

**Figure 1. Five Drivers for Cloud Powering Next-Generation Applications**



Source: Constellation Research

- 1. Cloud moves from nice-to-have to must-have imperative.** The cloud provides the Infinite Computing platform that enterprises need to turn capex into opex and tie their IT costs in a more elastic way to their business performance: If business is up, enterprises can afford to pay more for IT; if business is down, they pay less.
- 2. Next-gen apps run in the cloud.** Next-generation applications are characterized by their need to run on Infinite Computing platforms to operate artificial intelligence (AI), machine learning (ML), big data, conversational interfaces, and so forth.
- 3. Data residency and privacy concerns proliferate.** The regulation tsunami is only getting stronger. Enterprises see themselves forced to account for data residency requirements that are growing at an alarming rate. At the same time, geopolitical concerns make some regions skeptical in regard to allowing data access from different national jurisdictions (e.g., Europe versus the United States).
- 4. Performance considerations impact business models.** Even though information can travel through network cables at the speed of light, inefficient networks, numerous intermediate layers, firewalls, and so forth take a big chunk out of that speed. Accessing a server on the “other hemisphere” introduces substantial performance penalties. So, enterprises want to be able to offer a better customer and employee experience to their constituents by putting data center loads in geographical proximity to them.
- 5. Workload portability foils vendor lock-in.** In the evolution of cloud architecture, enterprises can achieve workload portability across clouds with a number of platforms (e.g., IBM Red Hat OpenShift and VMware) and architectural mechanisms (e.g., Kubernetes). This trend allows CxOs to avoid getting locked into a single cloud provider.

## IBM RESEARCH REINVIGORATES IBM HYBRID CLOUD

IBM has a long tradition in fundamental and basic research, having for many decades led corporations around the world in the number of patents filed. It is no surprise that IBM researchers are also working on the cloud in general, and hybrid cloud more specifically, given IBM is betting the future of the company on the cloud.

IBM Research is contributing to IBM Hybrid Cloud in the following four areas (see Figure 2):

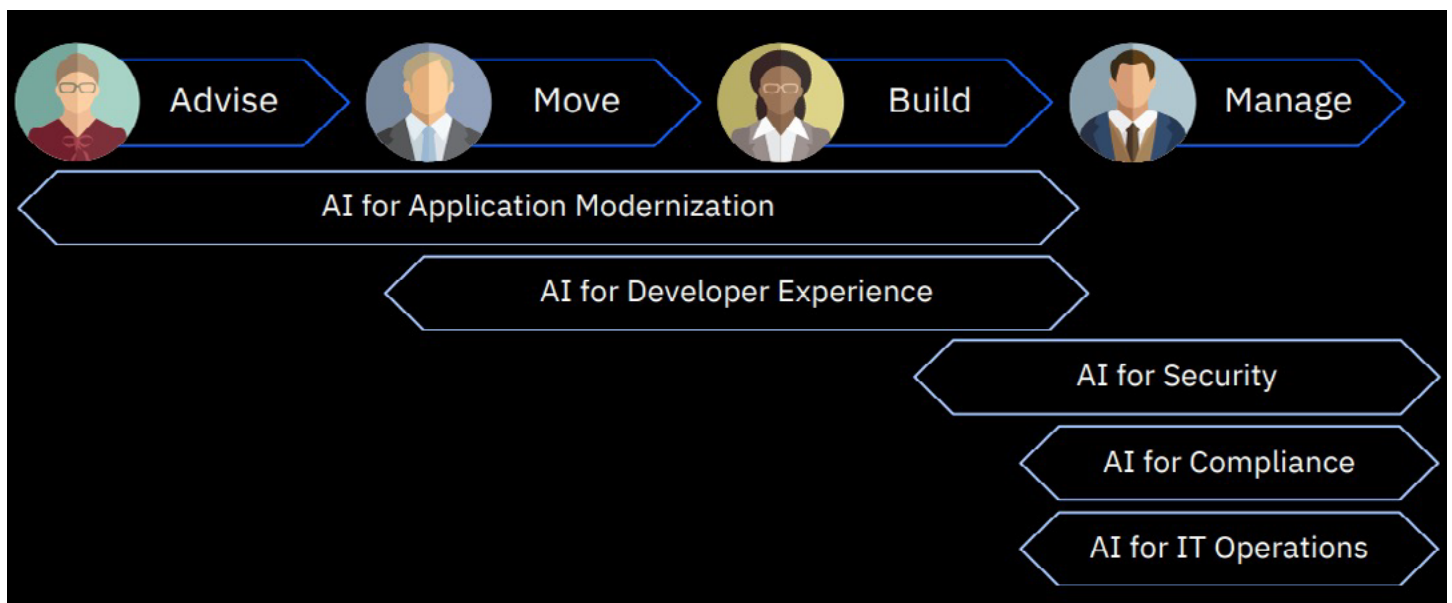
## 1. Agility via AI Automation

IBM Research has been working on infusing AI across the overall value chain of the enterprise journey to the cloud, from advice related to what workloads to move when and where, to the operational move of these workloads, to the building of next-generation applications in the cloud, and finally to overall management of the new operations.

More specifically, IBM Research sees the following areas of AI application:

- **AI modernizes applications.** It is hard for enterprises to keep their applications up to date. AI can help them understand what code is really used, analyzing runtimes and understanding partition communication patterns, and with that can help recommend how to partition the application into microservices most effectively during the modernization. The partition knowledge can enable a new microservices architecture, eliminating the no-longer-used “dead” code.

Figure 2. How IBM Wants to Infuse AI Across the Journey to the Cloud



Source: IBM

- **AI powers operations.** It is not easy for enterprises to keep applications up and running. Using AI to help software reliability engineers (SREs) become more effective in their work has tremendous upsides. IBM already launched Watson AIOps in 2020—an offering that came from a joint collaboration between IBM Research and the Watson business unit. The upside is tremendous in reducing outages and enabling a higher uptime for enterprise software.
- **AI enables security.** Security is a rising priority for enterprises, particularly with the increased vulnerability caused by millions of employees working from home. IBM Research prototyped an AI service that enables the discovery of vulnerability via active learning algorithms, gleaned knowledge from IBM’s security experts.

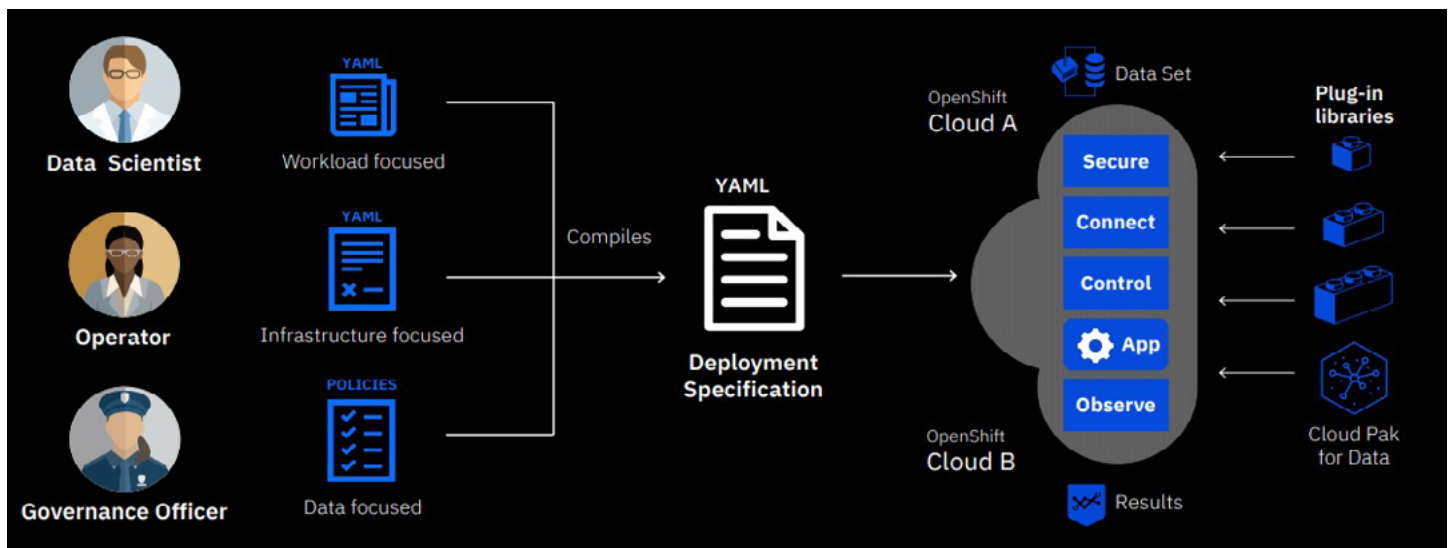
## 2. Seamless Hybrid Cloud Computing

IBM recently released IBM Cloud Satellite, which allows enterprises to run services to where they want across on-premises, the edge, and different cloud platforms. IBM Research now wants to tackle a major problem in hybrid cloud computing—data fragmentation—with what the company calls a mesh for data (see Figure 3).

IBM’s goal is to create a data fabric that allows uniform access to data that is governed in line with data residency and privacy requirements. IBM Research aims to govern not only the access to data, but also the continued usage of data, while creating minimal friction for enterprise data operations.

Practically, IBM Research is working on a sidecar model that is deployed alongside the application and manages the data access and policy rules required. In proof of concepts, IBM Research has shown that the mesh for data works—for instance, with information that is governed by data residency, needs to be encrypted, cannot leave a jurisdiction, and therefore enables cached instances of data for data workers outside of the jurisdiction.

Figure 3. The IBM Mesh for Data



Source: IBM Research

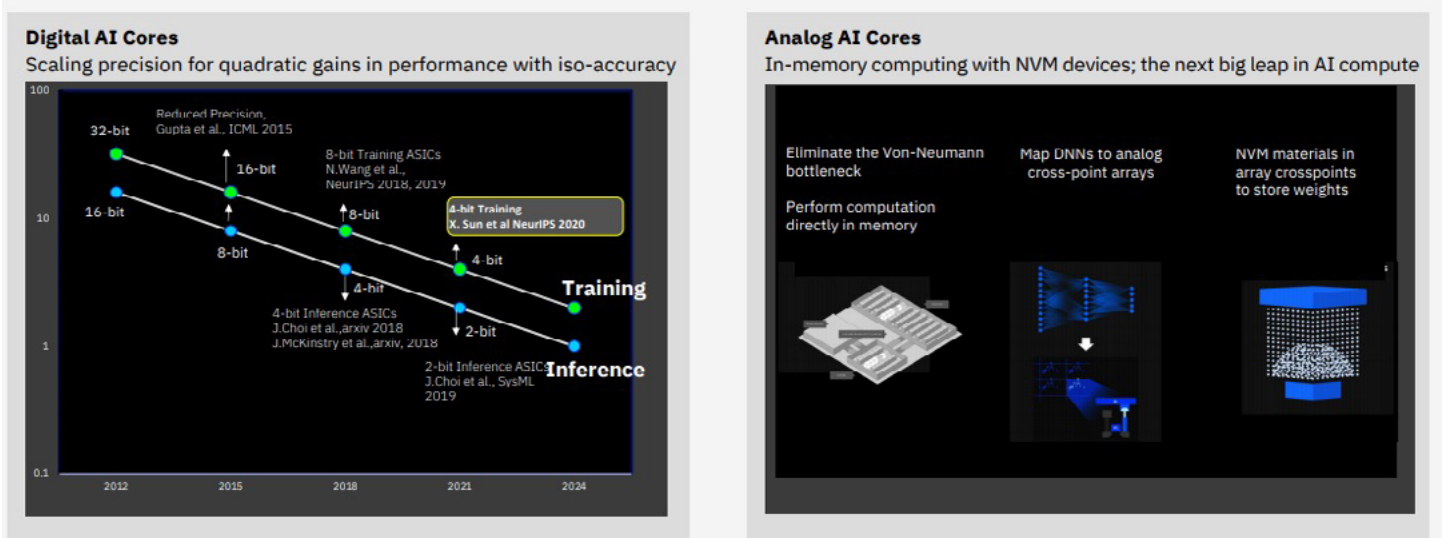
### 3. Flexible, Composable Computing

High-performance computing (HPC) and AI workloads are moving to the cloud, and are increasingly becoming intertwined, with HPC use cases leveraging AI, ML, and big data capabilities. Drug discovery and Monte Carlo simulations are popular use cases for HPC today that are modernizing, leveraging the hybrid cloud, and leveraging AI and ML.

IBM Research is incubating use cases today for the future of HPC and the future of AI. On the AI side, the focus is on low-precision computing, aiming for the use of fewer bits for training and inference to improve performance of AI processes (see Figure 4). The remarkable part of the research is that the reduction of bits involved in the AI processes is not reducing the accuracy of the work.

Another area of research is focused on analog AI cores, because weighting in neural networks can be expressed more efficiently with the help of analog devices. The result is faster, cheaper, and/or better AI compute results.

Figure 4. IBM Research AI Hardware Center Projects



Source: IBM

#### 4. Quantum Computing

One of the most successful IBM Research projects has been quantum computing, where IBM has been delivering tangible quantum platforms to enterprises via the cloud since 2016.

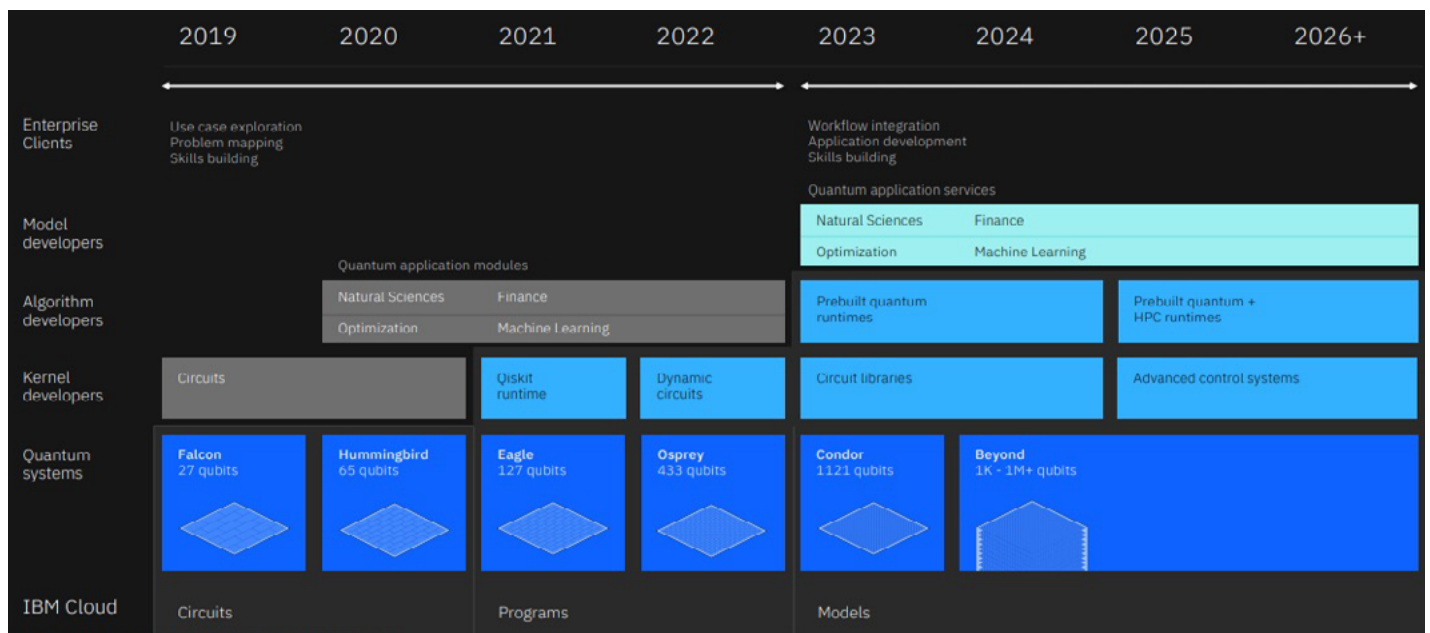
The main focus of quantum research for IBM at the moment is to increase the quality, improve the variety, and increase the capacity and speed of quantum circuits. IBM has momentum in these regards, adding 1.5B hardware circuits daily and having accumulated a total of 760B hardware circuits to date.

Another sign of the fast-paced maturation of IBM Research efforts in this area is the recent publication of a five-year road map that includes both software and hardware plans for IBM’s quantum offering (see Figure 5).

Next to the expected but impressive hardware progress, IBM is advancing its quantum platform for kernel developers. The company plans to ship prebuilt quantum libraries to algorithm developers in 2023 and to support model developers better with application services in the same year.



Figure 5. IBM's Quantum Computing Development Road Map



Source: IBM

As Constellation stated in 2016, quantum computing will be the first computing platform that is available to enterprises from the cloud (and not on-premises). IBM is actively working on integrating its quantum systems into the hybrid cloud, with OpenShift running the IBM Qiskit runtime as well as the quantum nodes that confer with the execution kernel. IBM Research expects 10x to 100x improvement in end-to-end latency from this architecture. Today, IBM has provided more quantum computing capacity via the cloud than any other vendor in the market.

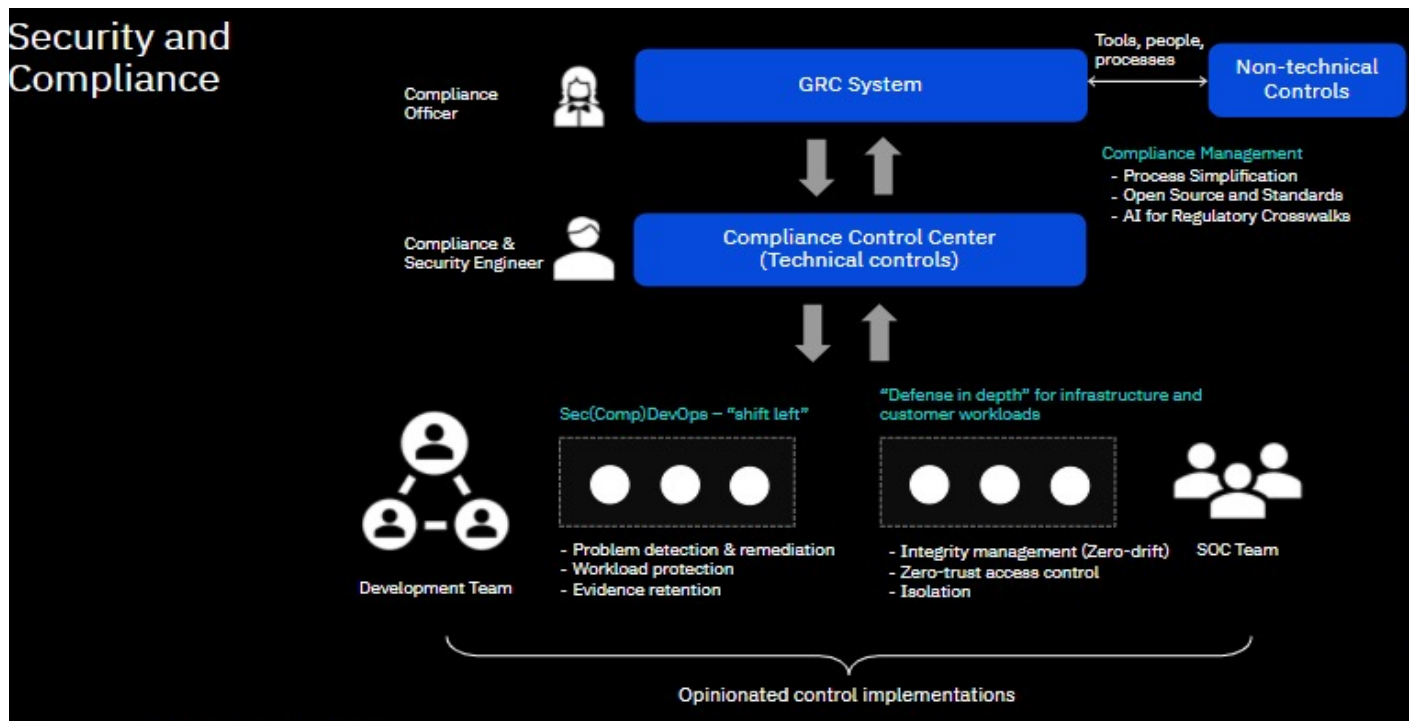
## SECURITY, COMPLIANCE, AND RELIABILITY

The security and compliance landscape is getting more complex for enterprises by the day. At the same time, enterprises need to improve the reliability of their systems and applications.

IBM Research brings together development and compliance teams with the help of the IBM Cloud Security and Compliance Center (product launched in 2020), to which IBM Research was a major contributor, which helps compliance and security engineers assess compliance with technical security controls (see Figure 6).



Figure 6. IBM Research Security and Compliance Architecture



Source: IBM Research

IBM Research also developed Code Risk Analyzer, delivered as a feature of IBM Continuous Delivery, which provides predeployment checks on application artifacts: packages, configuration files, infrastructure as code templates, etc. IBM Cloud Security and Compliance Center can monitor the status of preventative compliance and security controls defined in DevOps and of reactive controls monitored in a deployed system.

Not surprisingly, IBM wants to use AI to harmonize security controls—detecting compliance contradictions (e.g., different password lengths requested by different systems) and then harmonizing these and automating them in a consistent and compliant operation.

## WHY DOES IT MATTER?

Figure 7 illustrates the six market trends that characterize the management of computing infrastructure. The following three trends are the most relevant to this report:

Figure 7. Six Market Trends Defining a Next-Gen Computing Platform



Source: Constellation Research

## Heterogenous Computing Demands

CxOs are confronted with rapidly changing computing demands. Barely having satisfied the business need for big data, CIOs also now must answer to computing requirements that stretch from support for ML to speech recognition for internal and external digital assistant/chatbot solutions all the way to the edge of the enterprise. New computing platforms have entered the data center—for instance, with the advent of large GPU racks to run ML. A never-before-seen platform diversity manifests itself at the edge of the enterprise to support the Internet of Things (IoT). And the pace of change is not slowing down, as shown by new demands for additional workforce support (e.g., augmented/mixed/virtual reality) and new user experience support (e.g., holographic displays).

## The Need for a Single Control Pane

The era of CxOs simply accepting that new products bring a new control pane is gone. CxOs operating next-generation applications<sup>1</sup> must run them as efficiently as possible, via a single control

pane. This not only allows for more efficiency for managing infrastructure but also is the best way to manage a heterogenous landscape effectively. Ramping down and ramping up resources as demand requires cannot be done from a “zoo” of instrumentation. At the same time, the automation of resource scaling is essential, so humans can focus on oversight instead of spending time and energy on operational tasks.

## Rising Complexity of IT Operations

The cloud has not fulfilled its promise to simplify IT for most organizations because they are operating on a fluid automation pane that includes the public cloud and on-premises computing resources. Business priorities, timing, and write-down cycles all determine the specific time a load may be moved to the public cloud or whether it should remain on-premises. Changes in executive management often result in a shifting workload mix—for instance, due to software-as-a-service (SaaS) portfolio changes—that affects the overall computing mix. A greater diversity in workloads and new next-gen application use cases create more heterogeneity and increase the complexity of IT operations.

IBM addresses these three key trends with IBM’s hybrid cloud strategy to a large extent, but IBM Research literally bolsters these capabilities. The availability of the IBM mesh for data will address key demands of enterprises when it comes to successfully operating in a heterogenous computing landscape, typically characterized by data fragmentation. Although the need for single control pane largely has been addressed, the combined processes that intertwine with the control pane and that aid its operators are still new potential for automation. IBM fills this potential by applying AI to IT operations, the IBM Cloud Security and Compliance Center, and so forth. And finally, IBM Research helps to reduce the complexity of IT operations, not only with the infusion of AI but also by prebuilding interfaces for new platforms such as its quantum computing offerings.

## ADVICE FOR CXOS

Constellation has the following recommendations for CxOs regarding IBM’s cloud strategy:

- 1. Accept the automation imperative.** Enterprises must consider automation to increase their productivity and efficiency. The shift from specialized operations to self-driving software is in full

swing, and IBM can help enterprises move to a more autonomous enterprise with its focus on AI offerings.

- 2. More-supported platforms are always better.** IBM via RedHat OpenShift and IBM Cloud Satellite is offering the broadest support for different public cloud platforms as well as for on-premises platforms. The flexibility is advantageous for enterprises and merits the short-listing of IBM for those selecting cloud platforms.
- 3. Cloud services commoditize fast—so look for differentiation.** As with most things, cloud services are affected by commoditization: Imitators come along quickly, and the race to the bottom is real. Enterprises want to see continued investment and regular innovation to help drive value. IBM's massive commitment to research is an encouraging factor that signals continued innovation to its cloud offerings.
- 4. If quantum computing matters, evaluate IBM Cloud.** IBM is one of the leading quantum computing vendors in the market, and there is no indication that will change. If quantum computing matters to an enterprise, IBM is a vendor to short-list.
- 5. IBM has a long tradition in research.** Can that make more of a difference for enterprises? The next years will be critical for IBM and IBM Hybrid Cloud. The big tradition and impressive track record in research need to show value for enterprises using IBM Cloud. Both the focus and urgency are there for IBM, so high expectations are there as well. Now, we will see if IBM can deliver on them.

## RECOMMENDATIONS

Technology vendor selection is always tricky and selecting the right cloud platform is even more important for the future of an enterprise, given the importance of the cloud for next-generation applications. There are several by-now-aborted cloud offerings from the traditional IT vendors, and enterprises that trusted them have had to pay the price by migrating to newer offerings.

IBM is one of the few vendors offering a competitive cloud solution in the 2020s that also has been a traditional IT leader and supplier for more than 50 years. Obviously, IBM has been doing something

right to remain competitive, and its commitment to fundamental research via IBM Research has been an important cornerstone for that continuity. Constellation now sees that IBM is pulling its scientists out of the fabled ivory tower and bringing them closer to customer conversations. That trend can only be good for enterprises, because scientists are confronted with the “real world” sooner in their research, and research artifacts will find themselves sooner in the hands of enterprises.

IBM’s current focus to increase differentiation and attraction for IBM’s hybrid cloud centers on attractive trends and solutions: The practice of infusing AI into every aspect of the cloud journey and operations is broadly validated, and it’s practically a race now to see which cloud provider does it best. Enabling that infusion with specific hardware is the right strategy, and IBM is pursuing that approach with promising progress. Solving data access across data silos fragmented across multiple clouds and on-premises systems is very high on the agenda of CxOs who need to enable insight to action and maybe even deep learning for their enterprise. IBM’s quantum computing offering is one of the leading offerings in the market, and quantum computing needs to be made available and operated together with public cloud. And last but not least, IBM has shown innovative practices for security and compliance, which is a never-ending priority item for CxOs.

The next quarters and years will show how well IBM Research has been able to help IBM Hybrid Cloud become more differentiated and more attractive for enterprises. IBM is off to a promising start.

## RELATED RESEARCH

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For the Market Overview, see: Holger Mueller, “Next-Gen Computing: The Enterprise Computing Model for the 2020s,” Constellation Research, September 14, 2018. <https://www.constellationr.com/research/next-gen-computing-enterprise-computing-model-2020s>

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For a Constellation ShortList™ on IaaS vendors, see: Holger Mueller, “Constellation ShortList Global IaaS for Next-Gen Applications,” Constellation Research, August 15, 2018. <https://www.constellationr.com/research/constellation-shortlist-global-iaas-next-gen-applications-1>

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For more on Infinite Computing, see: Holger Mueller, “The Era of Infinite Computing Triggers Next-Generation Applications,” June 1, 2018. <https://www.constellationr.com/research/era-infinite-computing-triggers-next-generation-applications>

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For the people-leader perspective on the skills shortage and the need for enterprise acceleration, see: Holger Mueller, “Why People Leaders Must Embrace Enterprise Acceleration,” Constellation Research, July 3, 2018. <https://www.constellationr.com/research/why-people-leaders-must-embrace-enterprise-acceleration>

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For more best-practice considerations for PaaS offerings, see: Holger Mueller, “As PaaS Turns Strategic, So Do Implementation Considerations,” Constellation Research, May 9, 2018. <https://www.constellationr.com/research/paas-turns-strategic-so-do-implementation-considerations>

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For more on next-gen applications and PaaS offerings, see: Holger Mueller, “Why Next-Gen Apps Start With a Next-Gen Platform as a Service,” April 5, 2018. <https://www.constellationr.com/research/why-next-gen-apps-start-next-gen-platform-service>

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Also, for more on PaaS tool suites, see: Holger Mueller, “Constellation ShortList PaaS Tool Suites for Next-Gen Apps,” Constellation Research, February 10, 2021. <https://www.constellationr.com/research/constellation-shortlist-paas-tool-suites-next-gen-apps-4>

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For additional IaaS and PaaS selection criteria, see: R “Ray” Wang and Holger Mueller, “Key Questions for Every Public Cloud IaaS/PaaS Decision Matrix,” Constellation Research, January 24, 2018. <https://www.constellationr.com/research/key-questions-every-public-cloud-iaaspaas-decision-matrix>

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For an example of digital transformation, see: Holger Mueller, “Lufthansa Digitally Transforms the Workplace for Flight Managers,” Constellation Research, February 27, 2018. <https://www.constellationr.com/research/lufthansa-digitally-transforms-workplace-flight-managers>

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Finally, check the Constellation Research website at [www.constellationr.com](http://www.constellationr.com) for more Offering Overviews for the vendors covered in “Market Overview—Next-Gen Computing: The Enterprise Computing Model for the 2020s.”

## RELATED RESEARCH CONTINUED

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For information on Enterprise Application Platforms (EAP), see: Holger Mueller, “Constellation ShortList Enterprise Application Platforms,” Constellation Research, February 10, 2021. <https://www.constellationr.com/research/constellation-shortlist-enterprise-application-platforms>

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For more on next-gen databases, see: Holger Mueller, “Constellation ShortList Next-Gen Databases: RDBMS for On-Premises,” Constellation Research, February 10, 2021. <https://www.constellationr.com/research/constellation-shortlist-next-gen-databases-rdbms-premises-4>

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For more on next-gen computing platforms, see: Holger Mueller, “Constellation ShortList Next-Generation Computing Platforms,” Constellation Research, February 10, 2021. <https://www.constellationr.com/research/constellation-shortlist-next-generation-computing-platforms-2>

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For more on logging and observability, see: Holger Mueller, “Oracle Brings Holistic Observability to the Enterprise,” Constellation Research, November 19, 2020. <https://www.constellationr.com/research/oracle-brings-holistic-observability-enterprise>

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For more on Oracle Exadata Cloud Service, see: Holger Mueller, “Oracle Exadata Cloud Service X8M Brings Leading Elasticity to Enterprise Needs,” Constellation Research, October 19, 2020. <https://www.constellationr.com/research/oracle-exadata-cloud-service-x8m-brings-leading-elasticity-enterprise-needs>

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On Oracle Dedicated Region and Oracle Autonomous Database, see: Holger Mueller, “Oracle Raises the Stakes in the Next-Gen Compute Platform Market,” Constellation Research, July 22, 2020. <https://www.constellationr.com/research/oracle-raises-stakes-next-gen-compute-platform-market>



## ENDNOTES

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<sup>1</sup> Holger Mueller, "The Era of Infinite Computing Triggers Next-Generation Applications," Constellation Research, June 1, 2018. <https://www.constellationr.com/research/era-infinite-computing-triggers-next-generation-applications>

## ANALYST BIO

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Vice President and Principal Analyst

Holger Mueller is vice president and principal analyst at Constellation Research, providing guidance for the fundamental enablers of the cloud, IaaS, and PaaS, with forays up the tech stack into big data, analytics, and SaaS. Mueller provides strategy and counsel to key clients, including chief information officers (CIOs), chief technology officers (CTOs), chief product officers (CPOs), investment analysts, venture capitalists, sell-side firms, and technology buyers.

Prior to joining Constellation Research, Mueller was VP of products for NorthgateArinso, a KKR company. He led the transformation of products to the cloud and laid the foundation for new business-process-as-a-service (BPaaS) capabilities. Previously, he was the chief application architect with SAP and was also VP of products for FICO. Before that, he worked for Oracle in various management functions—on both the application development (CRM, Fusion) and business development sides. Mueller started his career with Kiefer & Veitinger, which he helped grow from a startup to Europe's largest CRM vendor from 1995 onward. Mueller has a Diplom-Kaufmann from the University of Mannheim, with a focus on information science, marketing, international management, and chemical technology. A native European, Mueller speaks six languages.

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