Research Insights

IBM **Institute for Business Value**

The Virtual Enterprise

The Imperative of Open, Secure Hybrid Cloud and Networks

IBM

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Technology is transforming the business models of enterprises across the globe, creating new opportunities for growth and fresh benchmarks of cost and efficiency. The ability to apply AI, automation, blockchain, the Internet of Things (IoT), 5G, cloud, and quantum computing at scale has made the promise of Cognitive Enterprises real.

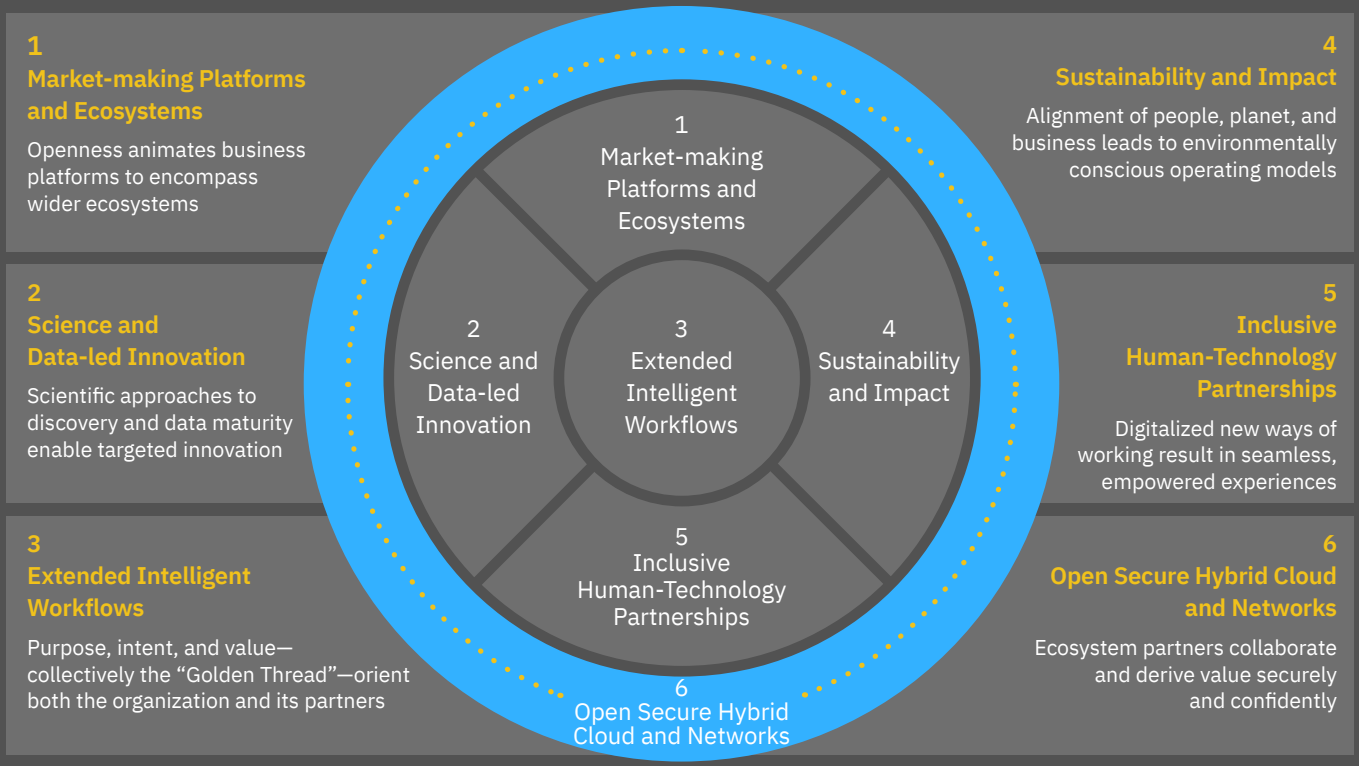
As we place this revolution in the context of an increasingly virtual world, we see even more power arising from the ecosystems, digital workflows, and networked organizations that are made possible. The Virtual Enterprise is emerging, supported by a "Golden Thread" of value that animates the enterprise and binds ecosystem participants (see Figure 1).

As enterprises leverage new technologies and weave them together, we believe that client value will come increasingly from open innovation. That will help enable expanded revenue opportunities with broad ecosystems; more breakthrough ideas and business platforms; faster technology developments; accelerated times to market; and improved productivity, costs, and efficiencies. This requires an open, secure hybrid cloud architecture.

The Virtual Enterprise takes full advantage of the flexibility and nimbleness promised by hybrid cloud architectures. It enables the openness of the enterprise to connect with business partners as well as access the full potential of leading open technologies to drive innovation. The Virtual Enterprise is therefore underpinned by robust networks and secure technology infrastructure, with the right workloads within the right overarching architecture and plug-compatible with the world around. The dual demands of adaptability and resilience are thus prerequisites of the journey to become a Virtual Enterprise—a journey on which many organizations have now embarked.

Figure 1

Building blocks of
the Virtual Enterprise



The Virtual Enterprise makes ecosystems the heart of its strategy to enhance innovation, make markets, and massively enhance capabilities.

How open, secure hybrid cloud and networks drive virtual excellence

In the Virtual Enterprise, the power of the network to bind together the players in a seamless, secure, and real-time manner is critical. The Virtual Enterprise relies on new market-making platforms embedded in new ecosystem relationships, as well as powerful Intelligent Workflows that are being reinvented through science and data-led innovation and bringing wide-ranging sustainable impact. None of this, however, will be possible without a fit-for-purpose application and infrastructure architecture to support it.

The Virtual Enterprise is massively enabled by the modern, open, and secure architecture delivered by hybrid cloud. The recent pandemic triggered a natural acceleration in the use of cloud-based architectures to deliver the flexibility and adaptiveness digital acceleration demands. But more than just "clouds" will underpin the enterprises of the future. Only the right clouds for the right workloads in the right overarching architecture can enable openness and security.

Open-source solutions have a multiplier effect on the collaboration and building of shared capabilities that can release new cross-functional and cross-industry value. Within the enterprise, application islands create silos that limit the reach of Intelligent Workflows, and the emergence of multiple cloud-based solutions has only created new levels of potential disjointedness. Breaking down those silos unleashes new solutions that can draw upon the development and innovation of the crowd. In an open, secure hybrid cloud environment, different contributions arrive with inherent compatibility. This is fundamental to the adaptiveness of the Virtual Enterprise.

What is open, secure hybrid cloud?

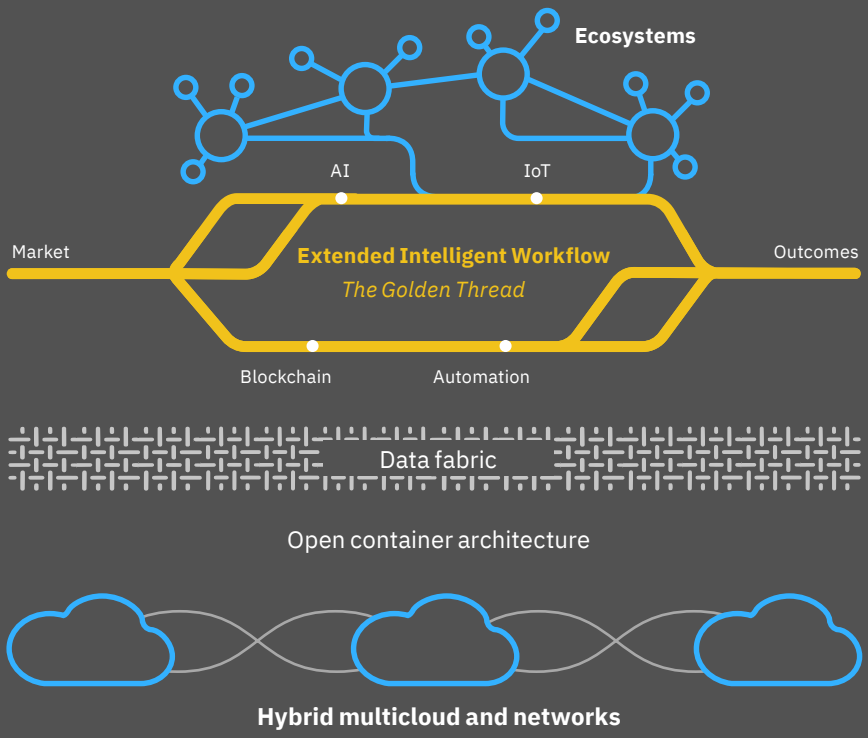
Open, secure hybrid cloud is a technical architecture that straddles on-premise, mainframe, private, and public environments. The "open" element encourages sharing and interoperability. The "secure" element protects both the integrity and the availability of data and information, integrating and translating seamlessly.

Hybrid cloud creates flexibility, fulfilling the need to keep some workloads on premise or in a private cloud while also taking advantage of the speed and available-anywhere capability of the public cloud. Hybrid cloud architecture provides a consistent standards-based approach to development, security, and operations from the core to the edge. And it allows for workload portability, orchestration, and management across multiple environments.

As the Virtual Enterprise extends through the organization and outward to partners and ecosystems, seamless integration and translation become imperative. Hybrid cloud supports that process. Software-defined networks are the adaptive solutions that, together with hybrid cloud technologies, provide the next generation of connectivity and resilience. This is redefining the role of the telco provider and opening up the field to new players and ecosystem partners seeking to provide components in these new network value chains. The openness of the underlying technology architectures is becoming more and more critical.

Figure 2

Open secure hybrid cloud and networks are foundational to the Virtual Enterprise



Open-source architecture and the control planes that accompany it enable more value when they reinforce partner and ecosystem connectivity outside the enterprise. Many of the evolving, new multiplatform ecosystems are benefiting from the plug compatibility that has arisen from open APIs and microservices that can be shared and from data mobility across partners. Open source also has a huge impact on accessing the skills required to build and maintain these new systems.

The CIO and CTO become more important members of the C-suite because the strategic calls made about the technology architecture become the indicators of competitive advantage. The need to make the right decisions with regard to next-generation enterprise systems is key, as are the choices of on-premise, private, and public cloud infrastructures that will support data and security needs. And all of this has to sit within an economic cost envelope that can be flexed in line with business context.

Application modernization in service of the Virtual Enterprise is a complex task, and there is a very real risk of legacy complexity being replaced by digital and cloud complexity. Agile approaches, DevSecOps, and automation can help, but they need guardrails and tracks on which to be organized. Data availability, quality, security, and scalability will be critical for the Virtual Enterprise to flourish, with big implications for the underlying technology architecture (see Figure 2).

Security is already one of the most important factors underpinning the evolution of more technology-enabled business and business models. As the enterprise ecosystem is extended into other partners or platforms, the need to align security along the whole Intelligent Workflow only increases.

Data and information are the raw material of these new workflows, but the value of that data is hugely dependent upon the transparency, trust, and security of these sources. It is an irony of the virtual world that data gravity can matter more than ever. New technologies such as blockchain have the potential to play a fundamentally different and enhanced role in the acceleration of these new models, as they provide certainty of identity, provenance, and activity along the workflow.

All of these opportunities can be advanced by the adoption of open, secure hybrid cloud and networks.

Leveraging cloud technology to accelerate progress

Organizations that choose to evolve toward becoming Virtual Enterprises will need to develop deep cloud capabilities. From ecosystems to Intelligent Workflows, the fundamental building blocks of the Virtual Enterprise rely on open, secure hybrid cloud technology.

Cloud is not simple infrastructure. Unlike roads, railways, and airports, cloud should not be approached as a one-time, single-purpose capital expense. It's insufficient to approach "cloud adoption" as an event that swaps parts of an old system (the data center and conventional IT management) with a plug-and-play new system.

The bigger game today is about getting radically better at designing, developing, and operating software. Leaders across industries are fast becoming software ecosystem companies on the inside, while remaining banks or healthcare or industrial companies on the outside. Leaders understand cloud, applications, data, and networks as core elements of a software-driven enterprise.

There's no way to build an Intelligent Workflow that crosses organizational boundaries with just a private cloud or a public cloud; only hybrid cloud provides the integration and orchestration required. Once viewed as increasing risk, the adoption of cloud brings new opportunities to create a more secure and open digital environment at scale. Cybersecurity and cloud-based digital capabilities complement each other in support of sustainable performance, end-user trust, and reduced exposure to disruption.

Hybrid cloud supports levels of openness and collaboration far beyond what was possible in the past. Coupled with digital and business transformation, that can generate unprecedented strategic and financial benefits for an organization.

What differentiates cloud leaders

What does cloud leadership look like? Leading organizations have a broad and shared vision of the role cloud plays in the Virtual Enterprise. They recognize that hybrid cloud architecture is critical to an Intelligent Workflow. And they understand that applications and data may be running on and through any number of private or public clouds and even via a conventional on-premise data center.

The IBM Institute for Business Value (IBV) analyzed the traits of technology leaders through a wide series of studies and across industries and functions. Increasingly, these organizations prioritize the need to pivot seamlessly between virtual and analog worlds. They operate beyond traditional organizational boundaries, looking to take advantage of the possibilities offered by new technology through an increased engagement with business platforms and ecosystem partnerships. They prioritize open strategies.

We found that successful leadership depends on 4 priorities:[1]

Adoption: Technology adopters had on average a 6 percentage-point revenue growth premium over their peers across 12 industries during the pandemic.

Integration: Integrating multiple cloud environments fuels performance, with hybrid cloud investments generating 2.5 times greater business value than a single cloud platform approach.

Transformation: The revenue impact of cloud investments can be amplified up to 13 times when orchestrated as an end-to-end reinvention of the enterprise. And the more that hybrid and multicloud are tightly coupled with enterprise transformation, the greater the revenue impact of all technology investments to the business.

Commitment: 92% of the revenue potential from cloud is expected to be generated through its interaction with other transformation capabilities.

In the emerging Virtual Enterprise, the democratization of data and the dramatically increased intelligence and insight brought about by open hybrid technology and architecture promise to redefine the economics of business. The Virtual Enterprise embodies the traits necessary for cloud leadership, building a foundation around 3 key concepts:

— Openness

— Continuous modernization

— Culture and productivity

Key insight #1

Openness unlocks opportunity

The openness of the Virtual Enterprise needs to be enabled by open, secure hybrid multicloud technology architectures.

The Virtual Enterprise is founded on openness. And openness requires open, secure, and hybrid cloud technology architectures. It also involves collaboration—sharing applications and data with reduced friction, transaction costs, and risks. That's true whether the applications and data are mainframe based or in a public or private cloud.

The Virtual Enterprise operates on 3 levels: *inside the enterprise*, linking divisions and functions in more collaborative and agile workflows; *outside*, with partners that become ever more critical to deliver the core purpose of the business; and *out there*, with the wider ecosystem that allows true platform economics to play out and the enterprise to take advantage of those that wish or need to connect with its intent.

Connectivity is at the core of this operational matrix. In fact, 53% of organizations cite "transparency and visibility" across workflows as one of their most important competitive advantages in the next 3 years, according to IBV research.[2] Agile, open operating models empower networks of teams through a culture of accountability, alignment with strategic objectives, and constantly evolving expertise.

Yet participants in an Intelligent Workflow—such as those in an ecosystem—may be using many systems, applications, and data. 2 out of 3 executives say that over the next 3 years, their organizations' innovative operations will include unique configurations of data and computing environments, including on-premise data center, mainframe, private cloud, public cloud, and edge computing.[3]

The solution to this multiplicity dilemma: a secure and open hybrid cloud, which allows these services to behave as if in a unified environment, while enhancing overarching security protection. In a recent IBV study, 82% of respondents report they want to adopt more open approaches in their systems and operations. During the pandemic, hybrid cloud emerged as the dominant type of cloud delivery, in part because advanced cloud capabilities are critical to the success of digital transformation (see Figure 3).[4]

Intelligent Workflows are a composition of services. Cloud infrastructure must allow those services to interact and to share data. Vertical integration operating models are migrating to vertical connectivity operating models. The hybrid cloud strategy must embrace the virtual computing environment, aligning workloads and interfaces with the appropriate platform: traditional, private cloud, or public cloud.

Figure 3

As they digitally transform, organizations seek connectivity to integrate data

Source: "Application modernization on the mainframe: Expanding the value of cloud transformation." IBM Institute for Business Value. https://ibm.co/application-modernization-mainframe. Q: To what extent do you agree with the following statements? (Percentages represent "completely agree" and "partially agree" responses combined.)

How ready are you to adopt openness?

Q1 How are you expanding the openness of your systems to enable improved connectivity and value creation?

Q2 How might your current tech infrastructure be limiting opportunity and exposing risk inside the enterprise, with partners, and in wider ecosystems?

Q3 How might an investment in hybrid cloud technology impact organizational costs, adaptability, and transformational potential?

Airtel

Hybrid cloud, AI, and new telco services

Faced with rapidly growing data consumption in India at a compound annual growth rate (CAGR) of over 70% by 2022, Airtel—one of the country's largest integrated telcos—is turning to a modern hybrid cloud architecture. With this platform, Airtel plans to deliver more responsive networks that tap into automation and AI to address growing customer needs and deploy new services at the right location and network tier.

Airtel's open hybrid cloud platform is expected to help enable new revenue streams with the onboarding of third-party services, including gaming, remote media production, and enterprise services. Airtel aims to improve the time-to-market of services and reduce operating and capital expenses. The network cloud also could position ecosystem partners, including B2B and B2C application developers, to create value-added services, including new edge offerings.

Additionally, the network cloud is embedded with AI, designed to facilitate automation in onboarding and improve monitoring and predictive capabilities for different services from network equipment providers.

Key insight #2

Perpetual modernization must be embraced

The new ecosystems and extended Intelligent Workflows require massive application modernization and technology renewal to leverage data access, flexibility, and total cost of ownership.

The Virtual Enterprise is always improving and modernizing; it's always leveraging insights across its Intelligent Workflows. The Virtual Enterprise is never static.

Hybrid cloud is the lubricant in this process, enabling comprehensive, ongoing transformation. 4 of 5 executives say organizations need to rapidly transform to keep up with competition, including modernizing applications and adopting a more open approach, according to recent IBV research.[5] And almost 70% of executives plan to leverage hybrid cloud to improve the integration and effectiveness of current legacy systems.

Digital transformation strategies motivate the modernization of underlying systems and, more important, the applications that reside therein. A hybrid cloud environment facilitates the alignment of workloads and interfaces with their most appropriate environment from technical, strategic, and regulatory perspectives. All of this helps enable continuous modernization and workflow evolution in response to integrated feedback loops (see Figure 4).

Such modernization can take multiple forms. Many enterprises have been taking advantage of cloud platforms to develop "cloud-native" applications, for instance. A cloud-native application is built very differently than a monolithic application—an application that is originally designed to satisfy the functional requirements for a business activity but over time becomes outdated. With a cloud-native application, each chunk of functionality is constructed as a stand-alone microservice using containers, which have become the standard for microservice architecture.

The emergence of control tower approaches to orchestrate the moving parts of the enterprise architecture is another important cloud-based modernization, and we can imagine the extension of this thinking to straddle the end-to-end environments of the ecosystem, powered by open standards. Many executives tell us Intelligent Workflows require a hybrid environment—in fact, only 13% from a recent IBV survey disagree with this assertion.[6]

Cloud-based enterprise resource planning (ERP) solutions can also play an important role in the overall architecture—and are a mainstay for Intelligent Workflows. Through precise integration of cloud-based ERP solutions, differentiated data, and open application platforms, Extended Intelligent Workflows operate together across multiple environments, providing a robust core for the Virtual Enterprise.

Finally, hybrid cloud models enable the Virtual Enterprise to remain on the cutting edge of security protection. An open, secure hybrid cloud network allows organizations to tap into better, more modern solutions, instantly available and continually updating.

Figure 4

Top workflows improved by cloud computing

Source: Previously unpublished data from the 2021 IBM Institute for Business Value Virtual Enterprise Survey.

Do you have the capability to continually modernize?

Q1 Have you created a continuous, perpetual process for modernizing your applications and systems?

Q2 How do you determine which applications to modernize, how do you implement the improvements, and how do you identify the appropriate destination for the new functionality?

Q3 How are you future-proofing the security of your workflows, even as you integrate more partners, networks, and ecosystems?

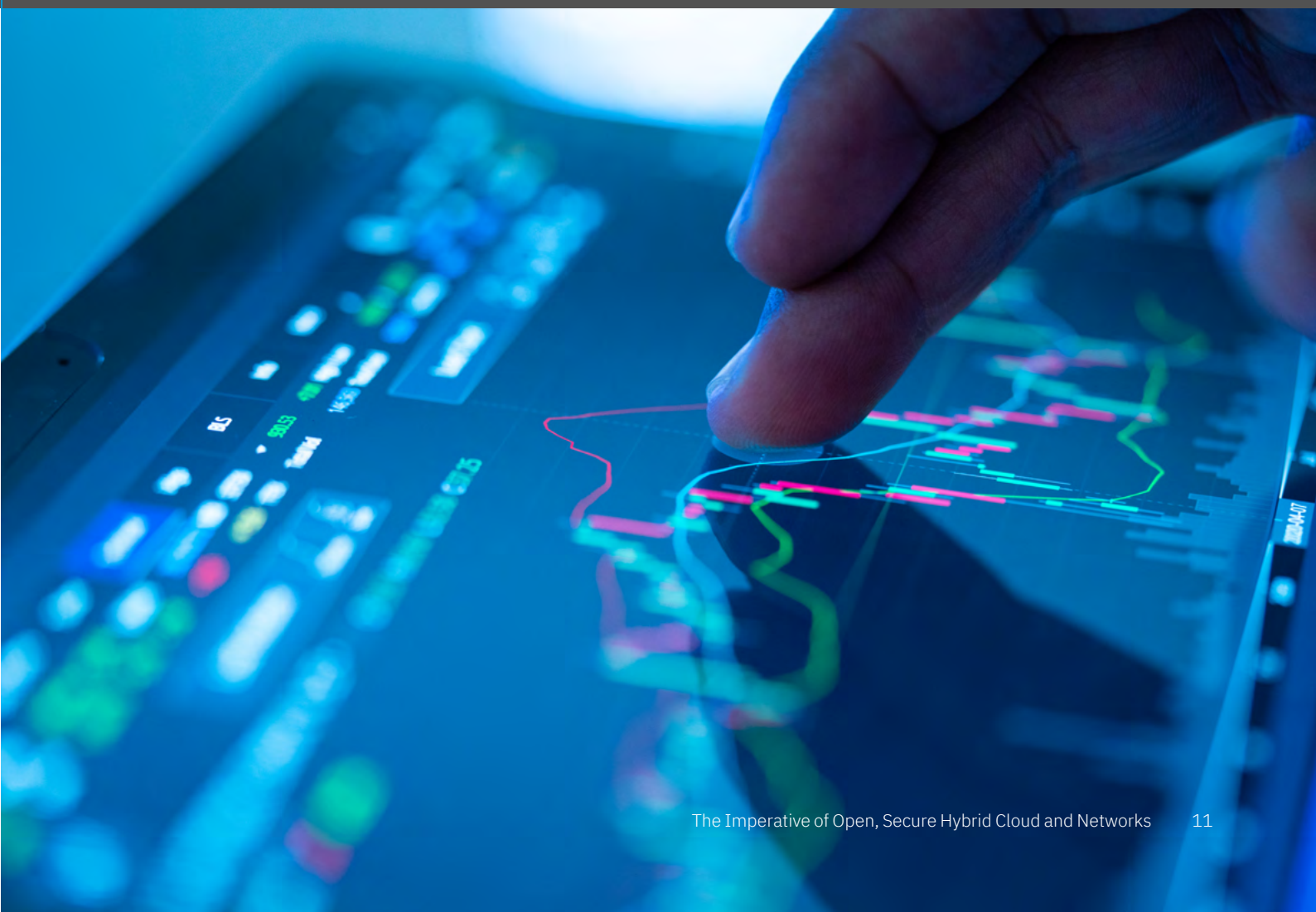
Lumen Technologies

Bringing hybrid cloud to the network edge

Lumen, a US-based multinational technology provider, was looking to offer customers speedier, real-time solutions. Enterprise clients that used Lumen's services for compute-intensive applications, such as financial trading and visual inspection—often deploying AI-fueled analytical models—needed instant results. If Lumen sent information to a data center or external cloud for processing and calculations, a delay would be unacceptable.

Lumen's answer was to implement edge computing networks. But to more effectively enable the technology, Lumen needed to put in place robust hybrid cloud capabilities. Via a security-rich tunnel, Lumen now provides clients with access to a centralized cloud console, through which they can develop, distribute, and manage edge applications across the global enterprise—with the versatility they require.

With the IBM Cloud Satellite integrated into Lumen's network, Lumen's clients can drive innovation more rapidly at the edge—propelling them forward to capitalize on emerging capabilities and exponential opportunities.



Key insight #3

Culture and productivity are linked

Architectural choices and open, secure solutions with fungible skillsets are fundamental to the success of the Virtual Enterprise.

Culture is the organizational glue that holds internal and external actors together, motivating innovation, collaboration, and value creation. It is a critical ingredient in the Virtual Enterprise that connects people, technology, and organizational capabilities in pursuit of transformational outcomes and better business performance.

With hybrid cloud as an open technology foundation to integrate operations, more securely share data, and improve trust among ecosystem participants, organizations can collaborate, co-create, and innovate for increased value delivery (see Figure 5).

Organizations are struggling with the skills reinvention challenge they face with legacy IT workforce as they embark upon their transformation journeys. The more open the underlying solutions and architectures leveraged—and the more they straddle the worlds of mainframe, private cloud, and public cloud—the more fungible and reusable the teams that undertake the work of development and maintenance can be.

According to recent IBV research, 81% of organizations say culture makes a positive contribution to digital transformation. In addition, 3 out of 4 respondents tell us that drawing ecosystems closer together is a key driver for establishing a hybrid cloud.[7]

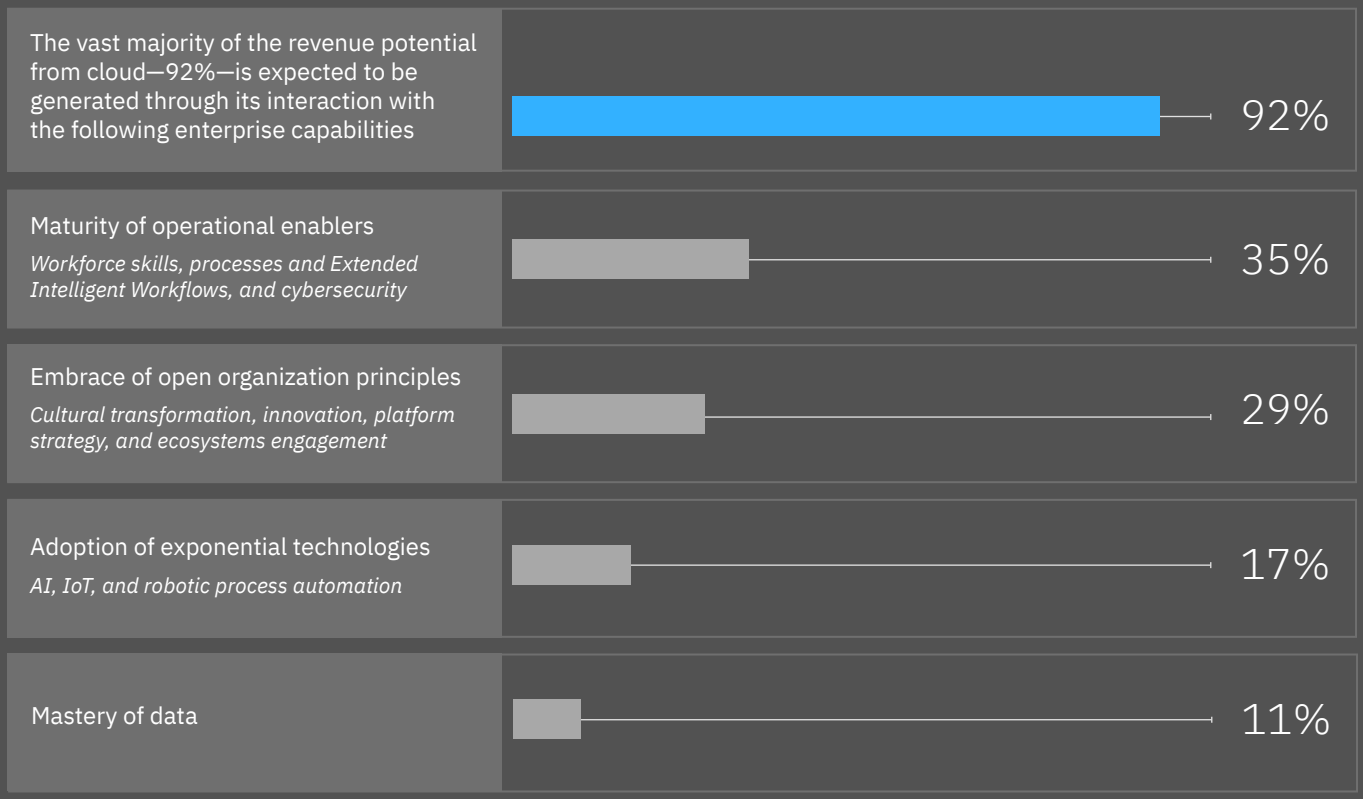
As technology redefines tasks and augments work, employees inevitably need to be reskilled, retrained, and supported as they adapt to new ways of working. An open cloud-enabled organization can harness the skills potential of both its own people and the wider partner ecosystem. Advanced cloud adopters that excel in their ability to develop talent and skills as a learning enterprise realize a 9% higher rate of revenue growth than other advanced cloud adopters, IBV research shows.[8]

Enterprises across industries want to pivot seamlessly between virtual and analog worlds. To unlock new sources of value, they are looking to extend and operate beyond traditional organizational boundaries, through increased engagement with platforms and ecosystem partnerships. As they adopt these strategies, their ability to shift data and workloads between operating environments becomes ever more crucial.

Establishing and maintaining a culture of interoperability and openness through hybrid cloud can bolster both workforce and organizational productivity.

Figure 5

Revenue potential from cloud



Source: Payraudeau, Jean-Stéphane, Anthony Marshall, and Jacob Dencik. "Unlock the business value of hybrid cloud: How the Virtual Enterprise drives revenue growth and innovation." IBM Institute for Business Value. ibm.co/hybrid-cloud-business-value

How will your culture promote productivity?

Q1 How might the complexity of your technology estate complicate the development of a collaborative yet standards-based operating environment across your enterprise, with partners, and within ecosystems?

Q2 How can you best address potential talent gaps as you prepare for future-state operations in more virtualized environments?

Q3 What obstacles exist in upskilling or reskilling your workforce amid ongoing digital transformation?

Delta Air Lines

Modernizing the technology platform

With demand down due to the pandemic, Delta Air Lines recognized a unique opportunity to modernize its digital operations. Delta understands the need to constantly enhance its customer and employee experience, and to improve efficiency across its business. As part of this digital transformation, the company is migrating most of its data and applications to the cloud.

More than 2,000 Delta IT experts are dedicated to application development, security, and cloud deployment. Moving to an open hybrid cloud architecture enables a consistent standards-based approach to operations and improvements. Delta's new cloud architecture will help weave its networks together, increasing agility and unlocking data for use across applications.

Delta expects to have modernized 90% of its applications and databases over the next 3 years via a hybrid cloud environment. The business-value advantage: The airline anticipates a more than 30% improvement in development productivity.

Action guide

Tapping into hybrid cloud to advance the Virtual Enterprise

The Virtual Enterprise affords new opportunities for co-creation, collaboration, and innovation across platforms and ecosystems, relying on Extended Intelligent Workflows, exponential technologies, and new data capabilities. Openness is its defining characteristic, underpinned by cloud.

As multicloud solutions proliferate along the Intelligent Workflows and platforms, the need grows to understand and manage the location of—and the speed to access—the data that fuels them. Cutting-edge security protocols become imperative. Integration unlocks value that transforms business and society. We can envision a wholesale shift in how people will interact with technology along these workflows, driving empathy, productivity, and experience.

By providing near-instant insights in support of an organization's workforce, ecosystems, and fluid work unit teams, open hybrid cloud-based models foster collaboration and enhance opportunity.

Here is a 5-step outline for effectively tapping into hybrid cloud and networks:

Open your organization

- Participate in platforms that can enable your organization to connect with partners, customers, and other stakeholders in new and improved ways.
- Identify the value of cross-system, cross-network collaboration. Modernize your portfolio to connect with other ecosystems and continue to track value.
- Build trust within the organization, with partners, and across ecosystems.

Invest in the right technology mix

- Embrace hybrid cloud as the foundation of integration and connections.
- Modernize to enable the right data to be available to the right location and the right application at the right time by allowing data to flow through a broad "on tap" network.
- Prioritize technologies with the highest compounding value to drive business results.

Develop operational enablers

- Build out and optimize Intelligent Workflows, infused with data and enabled by exponential technologies, to capitalize on the business potential of digital acceleration.
- Enhance cybersecurity capabilities as you engage ecosystem partners to both protect and encourage collaboration, co-creation, and data-sharing.
- Embed learning and continuous reskilling within the enterprise.

Modernize continuously

- Avoid the impulse to look at transformation as an event. Instead, accept ongoing improvement as a never-ending goal and process.
- Explore digital dashboard approaches, cloud orchestrator/management platforms, and cloud-based ERP, software-as-a-service (SaaS), and independent software vendor (ISV) solutions.
- Implement feedback loops that promote learning, best practices, and improved processes.

Drive cultural change

- Foster an open culture that encourages constant experimentation, builds new skills and ways of working, and understands that new ideas can come from anywhere.
- Clarify strategy and establish clear criteria for prioritizing the most valuable ideas.
- Develop and institute performance metrics that value and reward innovation, collaboration, and value creation.

Perspectives from across the field

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