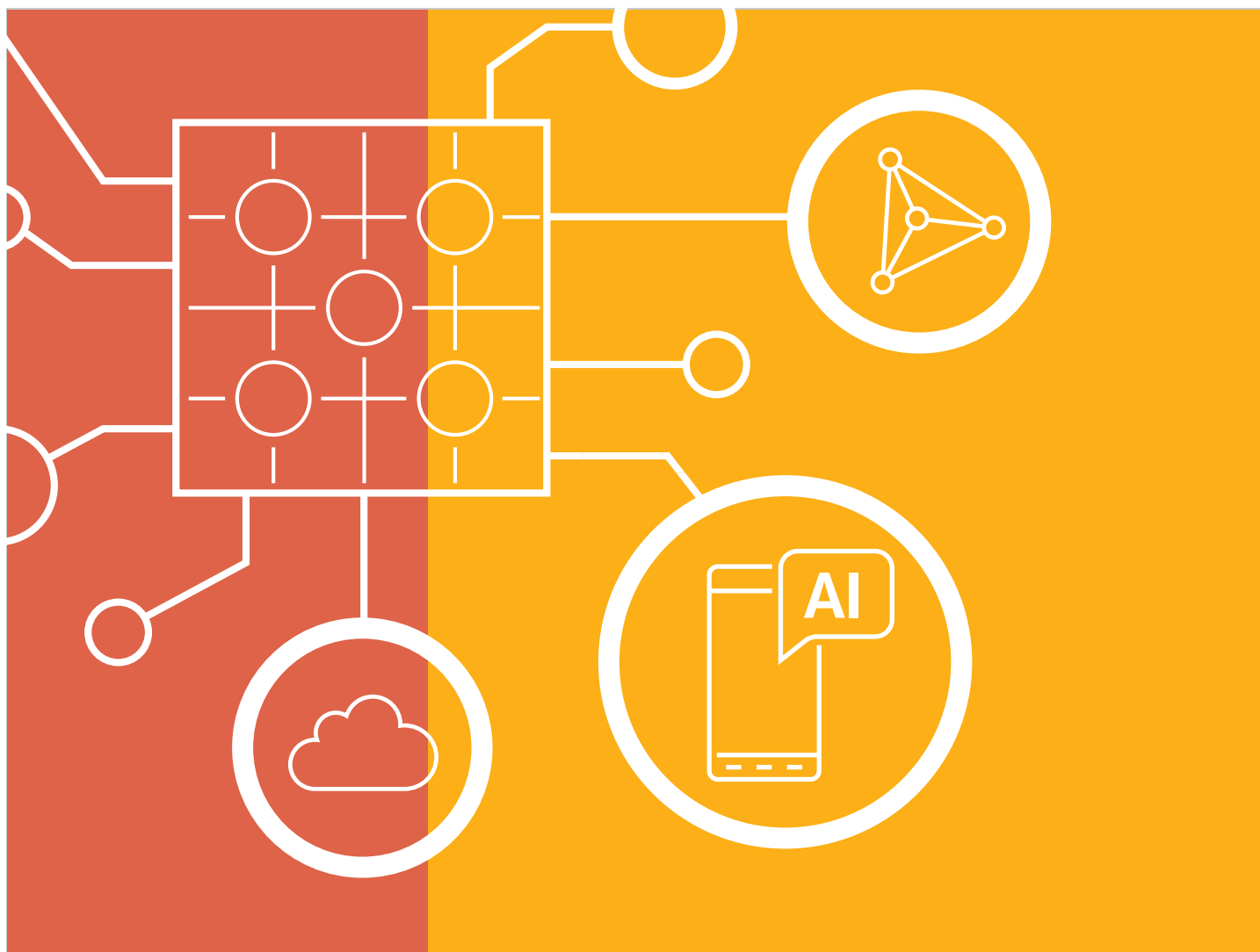
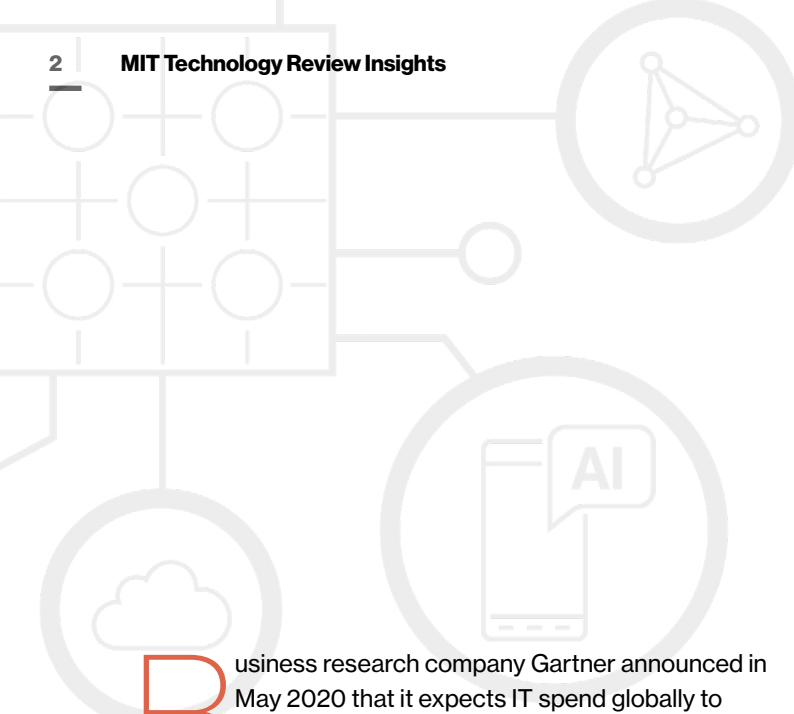

How an agile, robust, and flexible IT infrastructure can make
or break digital transformation

Intelligent infrastructure





Business research company Gartner announced in May 2020 that it expects IT spend globally to decline for the first time in a decade, shrinking by 8% to \$3.4 trillion this year.¹ Enterprise IT investments are always under cost pressure as leaders constantly look to reduce infrastructure spend and use IT as a tool to squeeze operational costs and increase efficiency elsewhere in the organization. As 2020 unfolds, these trends will be compounded by what is likely to be a significant, pandemic-driven economic downturn.

Industry observers expect IT belt-tightening to accelerate certain technology trends, particularly cloud migration efforts, as firms look to make the transition to more dispersed, hybrid IT models to lower costs and increase flexibility. Yet digital transformation projects intended to reduce cost and complexity can often increase both, as IT portfolios expand and diversify, and initiatives are steered around technical and organizational roadblocks.

Mitigating this risk and promoting a truly digital-first business environment will increasingly require integrating applications, data, and management across all cloud providers and locations. IDC estimates 70% of enterprises will integrate applications and data across public and private cloud providers and resources into unified hybrid management capabilities.²

Adaptability is a core business infrastructure requirement

Technology executives interviewed for this report indicate that most key strategic technology initiatives are driven by the need to grow with greater agility, and adapt to rapidly changing commercial, environmental, and regulatory conditions. Often, they also strive to achieve many objectives at the same time. “One of the big challenges for

Key takeaways

1 Intelligent infrastructure provides a platform for business agility. In a highly competitive global environment, further strained by an unprecedented pandemic, businesses are increasingly looking to data and analytics to resolve operational dilemmas, highlight avenues for growth, and increase the productivity of far-flung employees. Digital transformation is well underway at many organizations, but opportunities remain. Whether it is 5G, migrating to hybrid cloud, or moving toward the edge, technology leaders are deploying network infrastructures that are reliable, scalable, and flexible.

2 IT infrastructure needs to be robust and dynamic. There is no one-size-fits-all, and IT leaders must balance cost and complexity while also monitoring risk and compliance. The infrastructure needs to be architected in a way that enables business leaders to respond to new challenges and opportunities.

3 The edge provides analytical fuel for innovation. Edge computing allows businesses to get closer to their customers and suppliers and make faster decisions. New use cases abound: AI for recognizing a customer's pet, IoT networks that assess bushfire risk, real-time patient interactions through mobile apps, and blockchain-secured supplier tracing for palm oil commodities. Edge computing capabilities provide the backbone for innovation—allowing organizations to accelerate their quest for real-time analytics and insight.

us is to reduce the footprint of the warehouses” says the director of innovation at one of the world's largest consumer health-care product manufacturers. “With more technology in our decision-making processes, we achieve better inventory management, smaller warehouses, and less energy consumption. Sustainability and economics in most cases go very well together.”

Within health-care organizations, technology frequently helps to meet a diverse range of objectives. Where doctors are swamped with expanded workloads and administrative responsibilities that eat into time that could be spent with patients, process automation and AI are proving useful. A 2019 survey of 900 health-care executives in North America and the UK found that 82% of respondents already use AI to manage operational and administrative activities, and over 40% use AI image recognition and detection analysis tools to support clinical assessments.³

Driven by competition, compliance, and the need to manage risk, the financial services industry is becoming one of world's most digitally advanced sectors. Competitiveness is important, as the ability to innovate and launch new offerings quickly increasingly sets financial services firms apart. According to Rambabu Gotur, chief technology officer of US-based Wells Fargo's Wholesale, Capital Markets, Wealth and Innovation Technology division, "A bank always has significant new workflows from new products which have to be introduced frequently to maintain competitive advantages."

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Director of Innovation, Global health care and pharmaceutical company

For all three of these industries, efforts to build resilient and flexible IT infrastructure cannot be "once and done." Perpetually changing trends demand both constant vigilance and continuous flexibility.

Covid-19: a business and economic turning point?



In recent years, trying to define the future of work has been a major theme for organizations worldwide. Has the answer now been thrust upon them?

Across numerous initiatives, human resources leaders and workplace strategists have explored maximizing productivity and employee satisfaction by encouraging mobility, telecommuting, and flexible schedules. Yet for all the strategic mindshare that remote working has occupied, the actual impact on infrastructure and environments has been modest. According to one estimate, in 2018 only 5 million employees worked remotely on a full-time basis—just 3.6% of the nation's workforce.⁴ Similar research in the UK estimated that around 6% of employees regularly worked from home.⁵ During the coronavirus pandemic, MIT Technology Review's Global Panel members said that most businesses had 80% or more staff working remotely.

This sudden change looks set to become permanent for many: Twitter recently announced that most of its employees will work from home even after restrictions are

lifted. Miao Song, global chief information officer at Mars Petcare, says the company has preserved productivity through the crisis thanks to its digital initiative. "Systems in our manufacturing capabilities are separated from office-based work," she says. "In China, our associates use POKA, a mobile app to support on-the-floor communication and training. By February 10th, the Shanghai plant was 100% operational and one of the first qualified factories to get back to work."

The current crisis has also shown how technology can allow organizations to exploit unplanned opportunities. At Chicago's Rush University Medical Center, Chief Information Officer Dr. Shafiq Rab describes how MyRush (an app launched in 2019, allowing patients to access their medical information, schedule appointments, and check any symptoms) has become an essential download for hospital patients. The event "brought the criticality of real-time data into focus for us, and the importance of managing large volumes of unstructured, patient-delivered data from outside the managed enterprise environment," says Rab.

A rush to the edge

Digital transformation projects aimed at reducing cost and complexity can often increase both, as IT portfolios expand and initiatives are steered around technical and organizational roadblocks. Mitigating these risks and promoting a true digital-first business environment increasingly demands integrating applications, data, and management across all cloud providers and locations. IDC estimates 70% of enterprises will integrate applications and data across public and private cloud providers and resources into unified hybrid management capabilities.⁶

As organizations become faster and more integrated with customers, suppliers, and other third parties, real-time data and analytics are key to eliminating process bottlenecks and increasing responsiveness. This requires deploying IT services at the edge, bringing data and processing power closer to devices. IDC estimates that by 2023 over 50% of new enterprise infrastructure deployed will be at the edge,

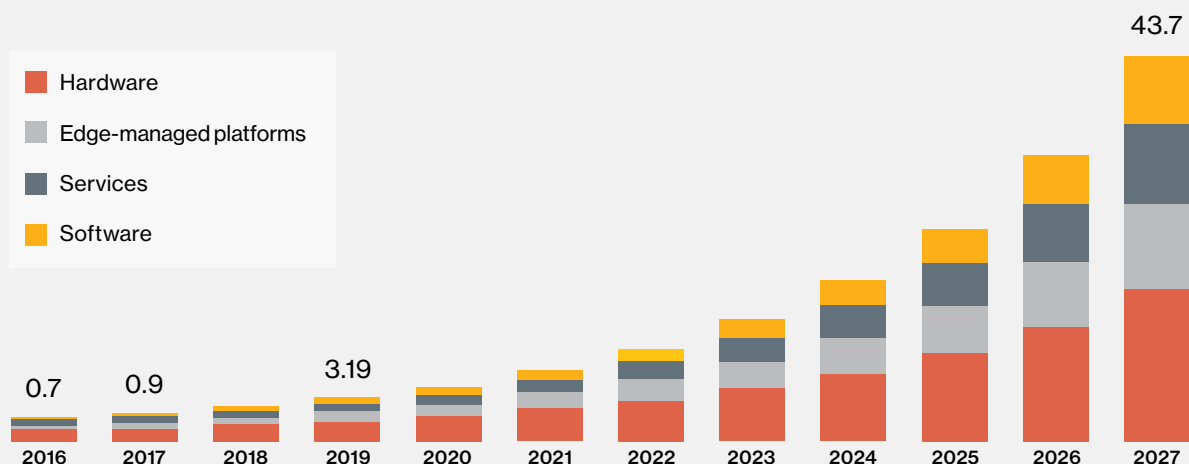
rather than in corporate data centers—today it is less than 10%.⁷ Grandview Research estimates that edge computing infrastructure spending in the US will grow nearly tenfold through 2027, to total \$43.7 billion (See Figure 1).⁸

While the concept of Industry 4.0—successive waves of mechanization and technological advancement culminating in automated production systems, widespread IoT networks, and ubiquitous AI and robotics—is now well understood, research shows that for many businesses these advances are still mostly aspirational. Even within manufacturing firms, a 2020 survey by IoT Analytics into Industry 4.0 and smart manufacturing adoption trends shows that only 30% of producers are using any of these solutions extensively.

Many components are still needed: connected IoT infrastructure and 5G will form the backbone of the intelligent edge networks that will drive truly digitally

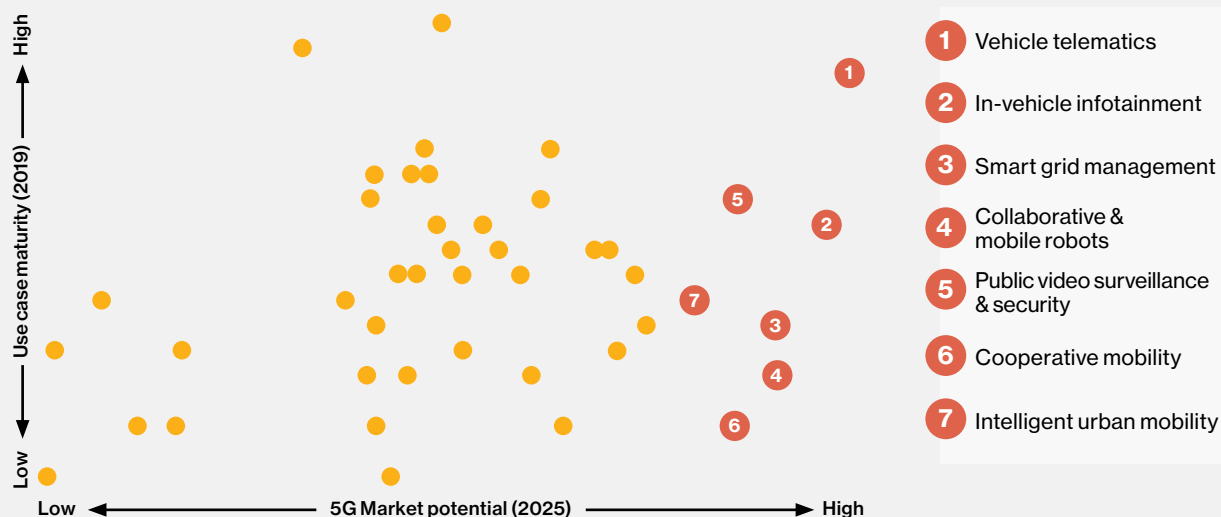
Accelerating the speed of business increasingly means pushing data, processing power, and analytics out to the edge. IDC estimates that by 2023 over 50% of new enterprise infrastructure deployed will be at the edge rather than corporate data centers—today it is less than 10%.

Figure 1: US edge computing market size, by component, 2016-2027 (USD billion)



Source: MIT Technology Review Insights, based on data from Grandview Research, 2020

Figure 2: Leading IoT use cases, 2019-25



Source: IoT Analytics, August 2019

transformation. IoT will be prevalent across all sectors, but particularly in complex, decision-driven industries such as manufacturing and health care. Even before the covid-19 pandemic that will undoubtedly boost many sectors of the health-care industry, analysts are bullish about the wearables, sensors, and intelligent devices market, with compound annual growth forecasts ranging from 20-35% between 2019 and 2025.⁹

Edge-connected intelligent assets allow health-care institutions and professionals to provide more accurate diagnostics and sustainable care regimes today and, over time, develop more proactive preventative care solutions. Deploying more integrated solutions across the medical supply chain also enables health operators to create business value far beyond their own physical operations. For example, Rochester International Airport in Minnesota is owned and managed by the city's renowned health-care operator Mayo Clinic. The clinic sees efficient management of the city's transport infrastructure as an essential extension of its own business.

Rush University Medical Center's MyRush app is also an example of an edge-based transformation. It uses an API to integrate patient-provided data with the hospital's electronic health records and Medicare databases. The center's chief information officer, Dr. Shafiq Rab, describes it as "edge computing without calling it edge computing.

We are empowering our patients and all of our ecosystem's end users: doctors are happy, nurses are happy, case management is happy, and the insurance companies are happy." Yet the app's growing user base, along with the hospital's increasing need for real-time analytics, means traditional broadband infrastructure is becoming insufficient. "The number one thing that stops us from going forward is the speed of the internet," he says. In response, Rush has been experimenting with ultra-wideband solutions and was the first facility in Chicago to have a 5G base station.

The quest for real-time insight

While the mass deployment of real-time analytics, IoT networks, and automation has been a slow burn for many organizations, there is strong belief that the next decade will see such applications gain momentum: McKinsey forecasts that over the next decade, nearly 450 million 5G-enabled IoT units will be deployed by manufacturers, city planners, health-care providers, and others. 5G will accelerate many IoT use cases including vehicle telematics, mobile robots, and smart grid management (see Figure 2).

Indeed, case studies of digital infrastructure harnessing internal production data for process efficiency are emerging. The director of innovation at a global consumer health-care manufacturer describes how the company is

using digital twins to optimize health and beauty product manufacturing processes, establishing virtual production lines to simulate and test alternate configurations. “How do the stirrer geometries of a blending process differ between a 3,000-liter vessel and a 10,000-liter vessel?” he says, illustrating an engineering question using the digital double. “Digital twins will allow us to determine standardized processes, increase their robustness, and translate them into smooth, fast rollouts, whether they are in Thailand, the US, or Italy.”

For Insurance Australia Group (IAG), intelligent infrastructure in the form of IoT sensor networks to capture meteorological data are adding substantial value, says chief digital officer Mark Drasutis, increasing the “fidelity of the data” they have on insured cars, properties, or homes. “In a market where bushfires and hailstones the size of golf balls are common, Australia is the one market where insurance actually counts.” In the future, these data will provide real-time information to property owners, helping them to mitigate risk of personal injury or damage to assets.

5G’s potential to enable low-latency computing environments will “probably be one of the biggest disruptive technologies the insurance industry,” Drasutis

says. “Currently, many operational processes are not really automated because of the last-mile challenge of connectivity in rural or remote areas.” A 5G-connected world will also, he believes, pave the way for future business models, such as use-based insurance where providers “understand the impact of events on people or assets in the real world, assess risk on a much more granular level using those signals, and price the risk of insurance cover accordingly.”

Rethinking cloud strategies

While cloud is a central pillar in a digital transformation strategy, there is no one-size-fits-all approach. Miao Song, global chief information officer at Mars Petcare, believes that hyperscale hybrid cloud resources deployed along the edges of the company’s growing business are essential for the future. Its veterinary hospitals and pet wellness services are underpinned by predictive analytic tools that leverage data from multiple sites and external sources. “Eventually, we will put DNA data, scientific and nutrition information, and pet electronic medical records into a single cloud-based digital platform,” she says. The scalable cloud approach also supports the company’s acquisition strategy. Swiftly integrating numerous, disparate pet-care businesses is “one of the largest digital transformation projects we’ve taken on.”



“5G is probably one of the biggest disruptive technologies in the insurance industry, [allowing us to] understand the impact of events on people or assets in the real world, assess risk on a much more granular level using those signals, and price the risk of insurance cover accordingly.”

Mark Drasutis
Chief Digital Officer, IAG



With any decisions regarding cloud having a potential impact on customer experience, business analytics, software-as-a-service applications, and AI, “the entire business has to be at the table. All of these have become embedded as part of our cloud strategy now.”

Rambabu Gotur

Chief Technology Officer, Wells Fargo Wholesale, Capital Markets, and Wealth

Drasutis points out that a multi-site, multi-region cloud strategy can bring other advantages in highly regulated industries such as financial services. “If we have all our cloud capabilities hosted by a single provider, the regulator may say that’s not a good outcome, because you’re unable to fail over to another cloud provider,” should there be a service outage. A hybrid cloud strategy may help a firm maintain compliance to appease regulators, but at the same time, “it adds a lot of complexity in how our data and workloads move to the cloud, and makes it challenging to generate a single view of their infrastructure assets,” he says.

A risk in deploying enterprise edge networks is recreating the challenges of complexity and capacity management that led enterprises to pursue digital transformation strategies in the first place. Hybrid IT environments, consisting of storage and applications hosted both on and off the cloud, and with data resources managed on and off premises, do offer greater speed of deployment and flexibility, yet they create new challenges for managing consistent service levels. A recent survey suggests that nearly 42% of technology decision-makers are considering a hybrid cloud deployment.¹⁰

Well Fargo’s Gotur sees cloud migration as an ongoing organizational challenge—his team’s cloud strategy is

already in its third iteration. “The first two generations were more about application migration to gain ‘cloud leverage’ in application life cycle management.” In the third generation, the bank is bringing all other primary stakeholders into its cloud development strategy. “The entire business has to be at the table,” he says, because the cloud represents much more of the entire business’s capability: customer experience tools and business analytics environments, and software-as-a-service solutions, often enhanced with AI. “All of these have become embedded as part of our cloud strategy now.”

“The globally dispersed data centers and internal hybrid cloud environment give our business a technical solution—but also creates many operational challenges for even simple things, like syncing our ‘master clock’ so we can synchronize upgrades worldwide between patches,” Gotur explains. But the central challenge in maintaining effective edge infrastructure at scale “is making compromises between computing or storage resource, which often compete with each other.” One example is from home lending businesses, “which requires a lot of external data scraping—geospatial data and credit information—for which a lot of computation is required” and takes resources and effort away from “hooking up the data we already have.” To manage this, Gotur’s team uses a virtualized layer to dynamically shift

between computing and storage and reduce capacity conflicts across resources.

The larger an operation's footprint, the more complex management becomes—particularly for a financial services firm with high throughput and high volumes. In such environments, the visibility needed for decision-making is often lacking. “You need a subway map,” Gotur says, “which allows you to plan and route the traffic to data centers where in-memory infrastructure and databases sits.” Machine learning tools can then automate how routing is evolving and should be explored as part of a broader visibility effort.

The next digital frontier

Facing continued uncertainty, technology departments will be under sustained pressure to deliver business value in the years ahead, providing the tools and technologies that enable end users to make smarter decisions, drive down costs, and satisfy customers.

The director of innovation at a global consumer health-care product manufacturer will continue to use production data analytics to improve manufacturing processes for environmental sustainability. “We are looking for smart solutions that leverage data, strategies that increase proximity to the customer, how ultimately we can ship without packaging at all.” This may lead to a new and sustainable production process,

using standardized containers for goods and medicines that are mailed to customers in a seamless factory-to-consumer supply chain.

Rab at Rush University Medical Center believes that intelligent infrastructure will drive innovation for health-care providers. Hospitals might become smaller and more specialized, harnessing specific cuts of data and focusing on the needs of more precise communities—at the same time as their overall service portfolios broaden. “In the future, we may see clinics and hospitals follow patients through their entire health-care journey: book their tickets, get their hotels, and find them the right doctor,” he says.

Advances in broadband access technologies, cloud computing, and analytics are converging to make an IT infrastructure more intelligent, sentient, and able to extract business insight not only from the confines of the firm's own operations, but from the edges that connect with customers, suppliers, and ecosystem partners.

Whether it is 5G, cloud computing, or moving toward the edge, senior technology leaders face complex systems and myriad options. They are deploying physical network infrastructures that are reliable, scalable, and flexible—their choices creating the foundations for a digital transformation that meets customer expectations, delivers operational efficiencies, and leads to lasting return on investment.

"Intelligent infrastructure: How an agile, robust, and flexible IT infrastructure can make or break digital transformation" is an executive briefing paper by MIT Technology Review Insights. It is based on research and interviews conducted in March and April 2020. We would like to thank all participants as well as the sponsor, Panduit. MIT Technology Review Insights has collected and reported on all findings contained in this paper independently, regardless of participation or sponsorship. Claire Beatty was the editor of this report and Nicola Crepaldi was the producer.

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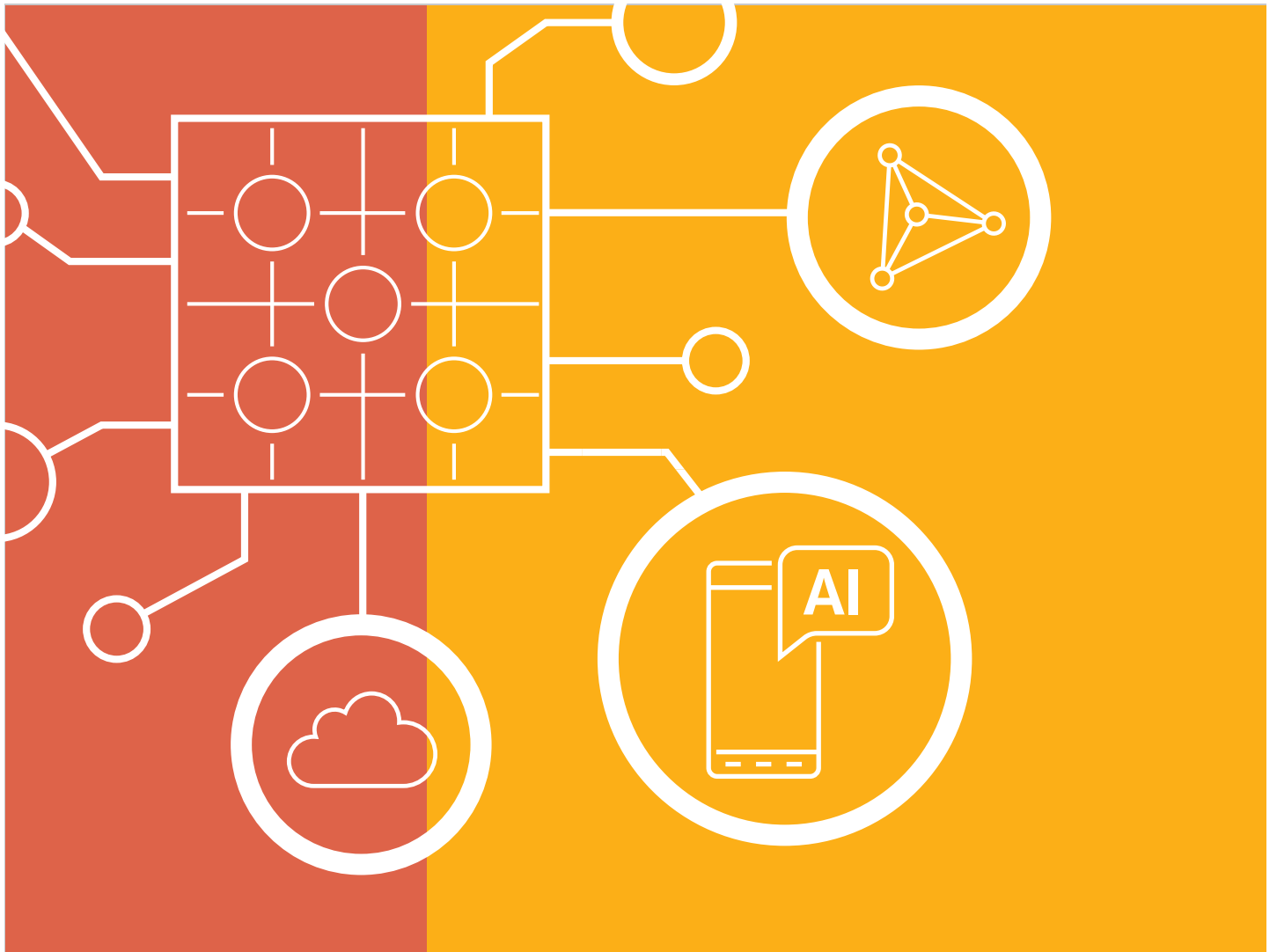
Footnotes

- 1 "Gartner says global IT spending to decline 8% in 2020 due to impact of covid19," Gartner, 13 May 2020
- 2 "IDC FutureScape Outlines the Impact "Digital Supremacy" Will Have on Enterprise Transformation and the IT Industry," IDC, 29 October 2020
- 3 "The AI effect: How artificial intelligence is making health care more human," MIT Technology Review Insights, December 2019 (pdf, p. 3, 6)
- 4 Global Workplace Analytics analysis of 2018 American Community Service data, September 2019
- 5 "Megatrends Flexible Working," CIPD, January 2019 (PDF pg. 11)
- 6 "IDC FutureScape Outlines the Impact "Digital Supremacy" Will Have on Enterprise Transformation and the IT Industry", IDC, 29 October 2019
- 7 "IDC FutureScape Outlines the Impact "Digital Supremacy" Will Have on Enterprise Transformation and the IT Industry", IDC, 29 October 2019
- 8 "Edge Computing Market Size, Share & Trends Analysis Report", Grandview Research, March 2020, IDC, 29 October 2019
- 9 "For example, see "Wearable Medical Devices Market," Global Market Insights, June 2019, and "Wearable Device Market Size Industry Report 2027," Grand View Research, 2019
- 10 "Global Cloud Survey 2020," Denodo, 28 April 2020, (pdf, p. 9)

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