



# **DIGITAL HEALTH TECH VISION 2018**

**Intelligent Enterprise  
Unleashed**



**Accenture Consulting**

# THE WORLD HAS REACHED A POINT

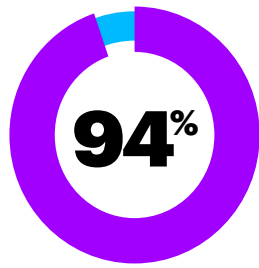
**where technology is deeply embedded in our lives—and the lines between business and personal are blurred more than ever.**

Healthcare organizations are increasingly unleashing the power of intelligent technologies, using them to deliver personalized, efficient and informed care. However, with such innovation comes responsibility. For people to get the full benefits of digitally enabled healthcare services, providers and health plans must prioritize trust and responsibility.

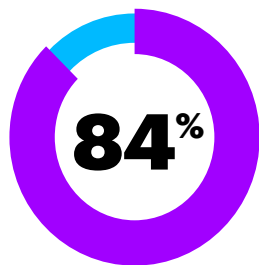
**The Accenture Digital Health Technology Vision 2018** explores five trends that underscore the importance of building a foundation of trust as technology has a greater impact on our lives: *Citizen AI*, *Extended Reality*, *Data Veracity*, *Frictionless Business* and *Internet of Thinking*.

We see these trends in two categories—the enablers of an intelligent healthcare enterprise, and the consequences. The technology enablers *Extended Reality*, *Frictionless Business* and *Internet of Thinking* demonstrate how integration and personalization can help people in new ways. *Citizen AI* and *Data Veracity* reveal the consequences when technology is deeply intertwined in our lives and in our care.

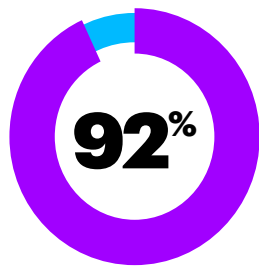
Healthcare leaders have great potential to apply emerging technologies to create deeper, more meaningful relationships with people—but there are choices to be made on that journey. How will we apply technology, govern it and ensure that it does no harm? Now more than ever, these choices must be made with great caution and care.



**94%** of health executives believe that treating customers as partners is important or very important to gain consumer trust.



**84%** of health executives agree that through technology, businesses are weaving themselves seamlessly into the fabric of how people live today.



**92%** of health executives believe that ensuring the security of consumer data is important or very important to gain trust of customers.

### More on this topic

[Meet Today's Healthcare Team: Patients + Doctors + Machines](#)

[In Hot Pursuit of Healthcare Innovation](#)

[Find Out What Our Health Leaders Think](#)

## Trend 1

# CITIZEN AI

## Raising AI to Benefit Providers, Plans and Patients

**Artificial intelligence (AI) now has a deeper touch in healthcare. It is much more than a technological tool—it is part of the workforce.**

AI is using algorithms to [diagnose patient wounds via smartphone](#).<sup>1</sup> It is allowing caretakers and doctors to [remotely monitor the elderly](#) so that they may safely live independently.<sup>2</sup> AI is helping health systems to [digitally verify a patient's insurance information](#).<sup>3</sup>

More and more, AI touches the end-to-end care experience—and it will only grow in scale. A majority of health executives (85 percent) surveyed agree that every human will be directly impacted on a daily basis by an AI-based decision within the next three years.

Meanwhile, AI is growing up. Just as a child begins to learn to be responsible on his or her own, AI is gaining knowledge without simply being

programmed. Learning-based AIs build models based on vast amounts of training data. They spot patterns and self-check against test data for success across a variety of factors. And the more data an AI is given, the better its predictions become.

The power of AI in healthcare is both awesome and alarming, considering the potential implications of one bad decision. Healthcare organizations must recognize this impact and build AI with responsibility, fairness and transparency—but many aren't there yet. Eighty-one percent of health executives agree that organizations are not prepared to face the societal and liability issues that will require them to explain their AI-based actions and decisions, should issues arise.

## Raising it right

When AI is “raised” successfully, it can begin to do more to help the healthcare enterprise. For instance, AI might support human decision making in a wider variety of areas, such as providing a recommended treatment plan or accepting or rejecting medical claims. In healthcare, this is life or death business.

Healthcare leaders must ensure that the data used to inform AI solutions are created without any embedded bias. Bias can be harmful to people. For instance, if a healthcare organization builds a model around heart disease detection, and the model is full of data about older white males, it may yield incorrect results such as a denied claim, or cause harm such as an inaccurate diagnosis, for a young African American.

For this reason, companies using AI must be very mindful of what is in the data used to train their AI. They must continuously test for and mitigate biases to minimize risk, error and potential harm. [See Decoding AI.]

## DECODING AI

### Explainable AI

In healthcare, being able to explain the process used to arrive at a decision can be critical to trust, safety and compliance. Given that an AI system is fundamentally designed to collaborate with people, healthcare organizations must build and train their AIs to provide clear explanations for the actions the AI systems decide to take, in a format that people understand.

### Responsible AI

Healthcare organizations must raise AI systems to act responsibly as AI represents the business in every action that it takes. Companies using the technology must think carefully about the responsibility and liability of the actions their AI takes on their behalf.



## Lack of trust. Lack of adoption.

Raising explainable and responsible AI is essential to earning trust with those interacting with the technology. And trust is the only way to foster adoption. For healthcare to realize AI's full potential, each organization must be transparent about its motives for using data, as well as consistent with the motives of consumers. That means understanding what the consumer believes the business has the right to do with their information.

Health plans likely have more trust-related issues to overcome than providers. For instance, consumers perceive medical information shared by health plans to be biased. An Accenture survey found that when researching treatments, [69 percent of consumers believe health plan sources are steering them in a preferred direction.](#)<sup>4</sup>

As health plans start to use AI to augment employees for core transaction processing, such as claims processing, this insight and path to decisions must be transparent so that it is explainable to consumers—not hidden in a black box. What's more, regulators are often involved in reviewing a consumer appeal or grievance on a claim denial and expect a clear and explainable answer for a determination.

Organizations might consider being abundantly clear about how they will use patient data by sharing a public statement around responsible and explainable AI and AI governance.

In addition to earning trust with consumers, clinicians must trust AI to adopt it. When clinicians are using AI to make decisions, they need to believe the technology is trustworthy and dependable. But how dependable must the technology be before making it available to clinicians? As reliable as a medical student? A nurse? A physician's assistant?

Proving outcomes is one way to earn clinicians' trust in AI. [Jvion](#) is using an Eigen-based cognitive computing engine to help healthcare organizations identify patient-specific risk of adverse events and recommend individualized actions to help mitigate those risks. By using Jvion's solution to reduce readmissions, [Health First](#) has avoided more than 800 unnecessary inpatient length of stay days and realized about \$2 million in material savings.



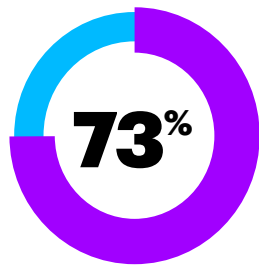
New solutions will allow healthcare organizations to be more transparent in how AI models make decisions, thus providing the evidence that analytical thinkers, such as doctors and regulators, are seeking to validate decisions and eliminate bias. For example, [Pegasystems](#) created a customer decision hub that has a “T-Switch” feature which allows an organization to set transparency thresholds for AI. This gives customers a choice: Some models are opaque and some are more transparent and,

therefore, explainable. Such solutions allow users—whether clinicians, administrators or consumers—to see the inner workings of an AI model, including contributing factors to why a decision was made. With the T-switch, AI becomes a consultative companion for decision making. A feature like this is especially important for compliant AI in light of the European Union’s General Data Protection Regulation, which includes the “right to explanation of decisions made by automated systems.”

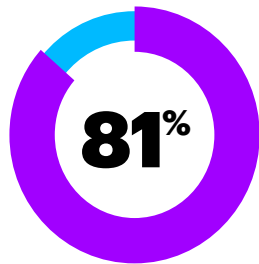


## Keeping up with AI

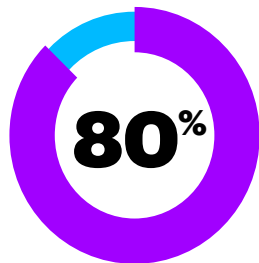
AI is changing every day—and health executives (80 percent) believe it is advancing faster than their organization's pace of adoption. As AI capabilities in healthcare continue to evolve, leaders must quickly take on the challenge of raising AI in a way that acknowledges its new roles and impact in healthcare.



**73%** of health executives are planning to develop internal ethical standards related to the use of AI to ensure their AI systems are designed to act responsibly.



**81%** of health executives agree that organizations are not prepared to face the societal and liability issues that will require them to explain their AI-based actions and decisions, should issues arise.



**80%** of health executives agree that within the next two years, AI will work next to humans in their organization, as a coworker, collaborator and trusted advisor.



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# DEEPER INSIGHT INTO DISEASE PREDICTIONS

**Researchers at New York's Icahn School of Medicine at Mt. Sinai have a unique collaborator in the hospital: their in-house AI system, affectionately known as Deep Patient.**

Armed with an analysis of electronic health records from 700,000 patients, Deep Patient taught itself to predict risk factors for 78 different diseases—and doctors now turn to the system to aid in diagnoses.

Deep Patient may not be a person, but it's more than just a program. Artificially intelligent systems learn, make autonomous decisions, and have grown from a technological tool to a partner among people, coordinating and collaborating with humans in the workforce and society. With increasing autonomy and sophisticated capabilities, AI now often has as much influence as the people putting it to use.

## More on this topic

[Meet Today's Healthcare Team: Patients + Doctors + Machines](#)

[Healthcare: Walking the AI Talk](#)

[AI Explained: A Guide for Executives](#)

## Trend 2

# EXTENDED REALITY

## The End of Distance

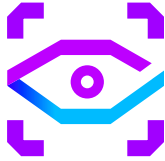
### Extended reality technologies provide a bridge that connects people, places and information.

And as the technology evolves, it has greater potential to close the gaps of distance, addressing significant pain points in health and healthcare, transforming the ways people work and live.

Virtual and augmented reality technologies comprise “extended reality” or XR—which blurs the lines across physical and simulated worlds. XR technology makes immersive experiences commonplace, it solves for distance, minimizing its relevance. In healthcare, this has important implications.

Imagine an elderly patient in a rural setting has a consult with a world-class expert without ever leaving his or her own home. A surgical resident practices surgery in a virtual setting at home, rather than operating on cadavers in a medical facility. A nurse uses a [vein finder](#) to insert an IV on the first try. A war veteran rebounds from PTSD through cognitive therapy in a virtual environment.





### **Virtual Reality (VR)**

VR visually takes the user out of their real-world environment and into a virtual environment, typically using a headset for viewing coupled with hand-held controllers to navigate virtual space.



### **Augmented Reality (AR)**

AR overlays digital objects (information, graphics, sounds) on the real world, allowing the user to experience the relationship between digital and physical worlds.



### **Extended Reality (XR)**

XR refers to the spectrum of experiences that blurs the line between real world and the simulated world. The technology immerses the user through visuals, audio, and potentially olfactory and haptic cues. The two major types of XR are virtual reality and augmented reality.

Physical actions in healthcare require quick access to information. XR brings it all closer together, such as overlaying digital information during a physical task like surgery. In fact, 82 percent of health executives agree that extended reality is removing the hurdle of distance in access to people, information and experiences.

## **Distance to people**

XR has tremendous potential to close gaps between employees, patients and providers. For employees, XR allows training scenarios to be set up anywhere, run, replicated and adjusted to give a firsthand experience of a variety of situations. To close distance for patients, [Florida Hospital Tampa](#) is using virtual reality models to allow neurosurgeons, patients and their

families to see inside the anatomy of a patient's brain tumor or aneurysm. Patients can better understand their situation and make more informed medical decisions, and [doctors can create detailed surgical plans](#) and share those models so that other clinicians may learn these complex procedures.<sup>5</sup>

XR can close the distance between concept and practice for healthcare providers and their students. For instance, a world-renowned sub-specialist can be training a medical resident in another country on a new technique. XR will also help businesses address the largest workforce challenge they face: the distance between themselves and the talent they need to grow. XR allows access to an [on-demand workforce](#), which enables healthcare organizations to tap expertise in thousands of skills from anywhere in the world.

With the help of XR, patients can enjoy the removal of distance when it comes to their care. Most health executives (82 percent) agree that extended reality solutions enable organizations to close the distance gap in offering services to customers. For instance, distance may make it such that a patient can only see a non-specialist to treat a condition. XR can bring a specialized physician right to the patient in an immersive experience.

## Distance to information

XR is helping to eliminate the distance between consumers and clinicians—and also the information providers need to get work done. It places a rich level of detail at a clinician's fingertips, removing potential barriers to decisions. For instance, a surgeon can wear XR glasses to see real-time digital content overlaid on the physical world without their attention being drawn away from the patient on the operating table. When information is superimposed on top of a physical action, doctors may have better precision and achieve outcomes that weren't possible in the past.

XR is not only closing the distance to information, but also the distance to new insights. Emerging XR tools express data in 3D environments, closer to the way humans actually see and imagine

scenarios. This clears the way for new types of visualizations—and new discoveries in healthcare.

For instance, [surgeons in Texas are using 3D mapping and imagery](#) as a “GPS system” to better navigate complex anatomy, making surgical procedures more precise. Doctors recently used the technology to perform a minimally invasive sinus procedure. The system records the surgery and the surgical planning, which can be used to train other surgeons on this complex procedure.<sup>6</sup> [The Body VR](#) creates interactive 3D builds of traditionally 2D medical imaging, like CT scans and MRIs, to provide a more intuitive view of medical conditions.<sup>7</sup> Similarly, [Oxford researchers have created VR models of genetic data](#) to better visualize what happens within living cells.<sup>8</sup>

Consumers can be more closely connected to information through XR to help improve their lives. Accenture has developed an AI-powered solution, called Drishti, to [help the visually impaired improve the way they experience the world around them](#) and enhance their productivity in the workplace. Via a smartphone, the solution tells the user about the number of people in a room, their ages, genders and even emotions based on facial expressions. It can also be used to narrate text from books and documents, and identify obstructions, such as glass doors, to help with safety.<sup>9</sup>

## Distance to experiences

Perhaps the greatest potential for XR-based disruption is through delivering shared and collaborative healthcare experiences. Clinicians cannot live the experiences of their patients, but they can try to better understand conditions—even gain empathy—through XR. For instance, [Embodied Labs](#) creates virtual reality labs that allow workforce training for aging services. The “We Are Alfred” lab shows young medical students how it feels to be a 74-year-old with audio and visual impairments. “The Beatriz” lab takes users on a journey of progressive Alzheimer’s disease.<sup>10</sup>

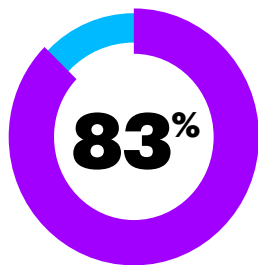
XR allows clinicians to understand the struggle of diseases such as mental illness, and also allows those struggling to get the care they need. For instance, researchers have seen compelling results using VR therapy to address post-traumatic stress disorder in military veterans, letting patients confront triggering stressors while talking through their responses with therapists in real time.

In collaboration with the US government, the [Institute for Creative Technologies at the University of Southern California](#) created [Bravemind](#), a virtual reality-based exposure therapy tool that puts psychologically scarred veterans in environments that allow them to face the triggers, or cues, that cause trauma. They found that stress symptoms, including depression, decreased by as much as 80 percent after the treatments.<sup>11</sup>

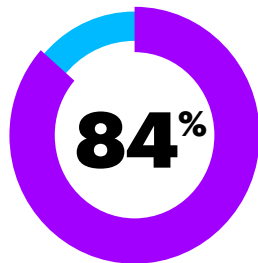


Extended reality technologies can also help even the youngest of patients. Hospitals are using XR to distract kids from painful experiences, such as injections or dressing changes. The young child about to have an IV inserted can [leave the sterile hospital room and head underwater to a virtual ocean](#).<sup>12</sup> Nicklaus Children's Hospital in Miami developed immersive VR content [to train medical professionals on proper CPR techniques](#).<sup>13</sup>

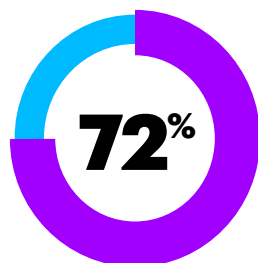
XR is pushing industry leaders to not only think differently about what is possible, but also to create new solutions that bypass the distance-based challenges they face today—a clear advantage for those that embrace it. Many (79 percent) health executives believe it's important for their organization to be a pioneer in extended reality solutions.



**83%** of health executives agree that extended reality will create a new foundation for interaction, communication and information.



**84%** of health executives believe it's important for their organization to leverage extended reality solutions to close the gap of physical distance when engaging with employees or customers.



**72%** of health executives agree that extended reality will be widespread and impact virtually every industry over the next five years.



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# IMMERSIVE MEDICAL EDUCATION

**The Cleveland Clinic is transitioning its current traditional, cadaver-based anatomy curriculum to a multi-platform digital experience that allows healthcare students worldwide to learn human anatomy concepts in an interactive virtual digital environment.**

The multi-platform digital solution features anatomy content based on Cleveland Clinic's own medical school syllabus of clinically based learning modules. The organization is partnering with Zygote, a company that brings digital skills and insights, along with 360-degree views of 3D models of human anatomy that can be shared globally via the cloud for accessible group learning. The intellectual property, clinical skills and technical skills of these two organizations combined is setting a new standard in digital medical education.

## **More on this topic**

[Voting for Virtual Health](#)

[Meet Today's Healthcare Team: Patients + Doctors + Machines](#)

[Fjord Trends 2018: Physical Fights Back](#)

## Trend 3

# DATA VERACITY

## The Importance of Trust



### Healthcare is more data-driven than ever.

And autonomous, data-driven decision-making is increasing as the industry uses more AI for administrative and clinical functions. However, AI is only as good as the data used to train it. Without establishing the veracity, or accuracy, of data, organizations leave themselves vulnerable.

Inaccurate data leads to corrupted insights and skewed decisions. Nearly one quarter (24 percent) of health executives say their organizations have been the target of adversarial AI (such as bot fraud, spoofed sensor or IoT data and falsified location data) multiple times.

In healthcare, these vulnerabilities can do great harm because data underpins medical decisions, treatment plans and even whether an insurance claim is accepted or denied. Bad data in a patient's electronic medical record could put them at risk for not getting the right diagnosis or treatment.

Incomplete or compromised public health data could lead to misidentifying the source of a disease outbreak.

Unfortunately, many [health plans and providers are not ready to protect themselves](#).<sup>14</sup> Health executives surveyed (77 percent) say they are not prepared to confront the impending waves of corrupted insights as falsified data starts to infiltrate their data-driven information systems. Meanwhile, they are already feeling the effects of vulnerability. A national survey reveals [83 percent of physicians surveyed already have experienced a cyber attack](#),<sup>15</sup> and this has been a [significant issue for health plans](#)<sup>16</sup> as well.

To address the challenge, companies must follow a dual mandate to maximize veracity and minimize opportunities for data manipulation.

## Fewer threats, more truth

In a world of data manipulation, as illustrated by fake news, no one knows where the next threat lies—and the scariest breach is the one you don't know about. Healthcare organizations should seek to mitigate future vulnerabilities at the outset by establishing provenance, or verifying the history of data from its origin throughout its life cycle; context, or considering the circumstances around its use; and integrity, or securing and maintaining data.

Most healthcare providers (84 percent) and many health plans (68 percent) agree that automated systems create new risks including fake data and data

manipulation. Yet only 14 percent of providers and 6 percent of health plans surveyed say they validate data sources extensively and are “very confident” in the quality of their organization's data.

Validation must be built in to ensure a data output that users can trust. Uncovering processes that inadvertently incentivize deceit is essential to improving the truth in data across a system. Incentivizing truth will allow companies to reduce noise in data, so that real threats stand out. Ultimately, it will help ensure the data is trustworthy enough to drive critical decisions in the future.

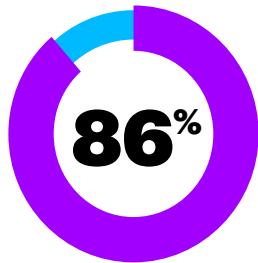
## Improving data intelligence capabilities

Healthcare organizations aiming to achieve data veracity must ramp up existing efforts, embedding and enforcing data provenance, context, integrity and security throughout the organization. Existing investments in cybersecurity and data science may need to be adapted to address the data veracity issue because data quality is critical to having inputs users can trust to make both business and clinical decisions. For instance, technologies such as blockchain can be used to ensure data provenance throughout its lifecycle and prove the data was not tampered with.

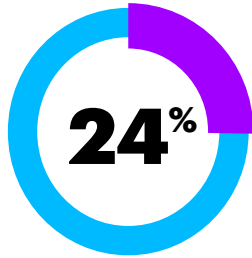
Companies must build a data intelligence capability. By using technology tools to track behavior as data is recorded, used and maintained, cybersecurity and risk management systems have a baseline of expected behavior around data. For example, [Aetna](#) has eliminated 10 billion instances of social security numbers in the company's core processing capabilities in the past three years. Rather than using SSNs as a unique identifier and authenticator, the company has implemented continuous behavior-based authentication that offers real-time authentication using

many behavioral attributes available through web and mobile applications. This approach embeds authentication into electronic interactions on a continual basis. Aetna uses between 30-60 attributes that feed a risk

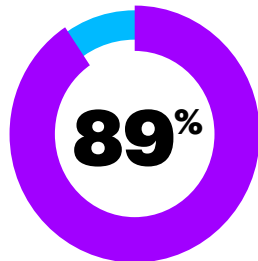
engine used to calculate a risk score. That score is fed to the mobile or web application in real time, and the application determines how much access to provide to the consumer.



**86%** of health executives agree that their organizations are basing their most critical systems and strategies on data, yet many have not invested in the capabilities to verify the truth within it.



**24%** of health executives state their organizations have been the target of adversarial AI multiple times.



**89%** of health executives agree that as organizations rely on data-driven decisions, the issue of data integrity will grow exponentially.



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# USING BLOCKCHAIN TO SECURE THE PHARMACEUTICAL SUPPLY CHAIN

Logistics company [DHL](#) joined with Accenture to create a blockchain-based serialization prototype to track pharmaceuticals across the supply chain.

The ledger allows enterprises to accommodate legal and regulatory requirements, and address mischief—all while preserving cryptographic features. The ledger that tracks medicines can be shared with stakeholders, including manufacturers, warehouses, distributors, pharmacies, hospitals and doctors. Prototype simulations showed that blockchain could handle more than 7 billion unique serial numbers and 1,500 transactions per second.

## More on this topic

[Perspectives: Securing the Healthcare Enterprise](#)

[Losing the Cybersecurity Culture War](#)

[Fjord Trends 2018: Ethics Economy](#)

## Trend 4

# FRictionLESS BUSINESS

## Built to Partner at Scale

**Now more than ever, strategic partnerships are essential to business growth for healthcare organizations.**

As lines between industries blur, unexpected partners are collaborating in nontraditional ways and creating experiences that bridge worlds. Those leading the industry worldwide show that technology is now at the root of partnerships.

Partnerships that are technology-based allow networks to grow faster and into more ecosystems than ever before. However, healthcare legacy systems weren't built to

support this kind of rapid and robust expansion. Soon enough, these legacy systems will become major hindrances to future growth.

Healthcare organizations must rethink how to make technology-based partnerships work to position themselves for sustainable differentiation and growth. Two technologies have the potential to solve these challenges: microservices and blockchain.

### NEW TECHNOLOGY TO HELP SUPPORT TECHNOLOGY-BASED PARTNERSHIPS:



**Microservices** break applications down to their simplest component functions. Each function is treated as a separate service with its own API.



**Blockchain** information is replicated across a network of nodes delivering information and transactions that are secure, unalterable, and verifiable.



Microservices is not a single piece of technology, but rather an approach to architecture. A microservices approach will foster agility as applications become more modular, enabling rapid integration with many new partners. Such collaboration has become increasingly important for businesses to differentiate and grow in a [world of ecosystem power plays](#). And as a healthcare organization's portfolio of partnerships grows, the ways in which businesses transact with each other becomes more complex. Blockchain is a distributed ledger system that stores groups of transactions. The technology helps create, scale and manage those

relationships through its ability to hold partners accountable without the need to first build trust.

Healthcare entities that adopt microservices architectures, use blockchain and store self-executing smart contracts on the blockchain will build a strong foundation for technology-based partnerships to support future differentiation and growth. Those that invest in these changes today will redefine how businesses transact in the future.



## Breaking down the parts to build up partnerships

Microservices allow a business to transcend industry boundaries, collaborating with other third parties to bring solutions faster to market. In health, microservices make it easier for organizations to adapt quickly to changing customer experience expectations. It uses a suite of tools such as application programming interfaces (APIs), containers and the cloud to break applications into simple, discrete services. Every feature becomes its own service versus being combined into a single monolithic application.

A microservices architecture provides a foundation for companies to forge partnerships quickly and easily, seamlessly integrating services while minimizing friction for partners or customers.

Consider the US pharmacy, [Walgreens](#). The company rebuilt its “healthy choice” rewards program with a goal of expanding partnerships via microservices. The APIs built during their microservices transformation were shared with [third-party developers](#), who could integrate Walgreens’ rewards into their own apps, [offering points to customers for activities like running, testing blood pressure, and even quitting tobacco](#).<sup>17</sup> Walgreens reports that building these partnerships now takes only a few hours, as opposed to the months-long process of the past. They now work with more than 275 partners, and [their prescription API fills one prescription per second](#).<sup>18</sup>

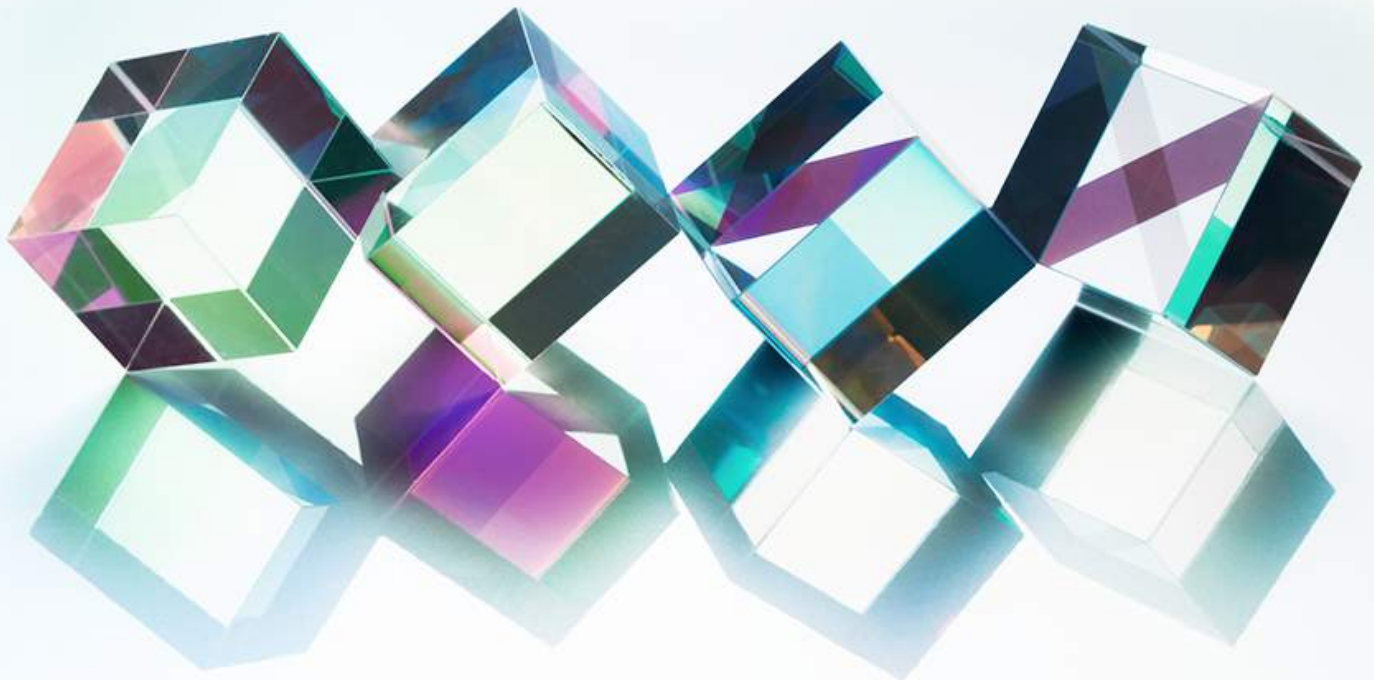
While 88 percent of healthcare executives expect their organization’s use of microservices to increase over the next year, it is still a nascent approach to technology architecture among providers and health plans. However, a small group of luminaries is leading the pack, actively pursuing microservices architectures as part of their strategies. Some healthcare enterprises are using third-party integration layers that sit on top of systems of record to extract information for use by systems of engagement. Companies like [Sansoro Health](#) are advancing microservices adoption, offering solutions that simplify API integration across multiple EMR platforms. Third-party applications connect into the platform for secure, seamless data exchange to swiftly scale, reduce integration efforts and deliver value rapidly.<sup>19</sup>

Industry leaders are using an API layer to minimize the integration complexity across multiple core administration systems. The microservices architecture helps enable them to adapt to new systems of engagement such as smartphones, wearable devices and voice-activated speakers. [They are building Alexa skills](#),<sup>20</sup> and developing mobile apps that quickly integrate among partners to deliver a unified experience for members.

## Managing partners though blockchain

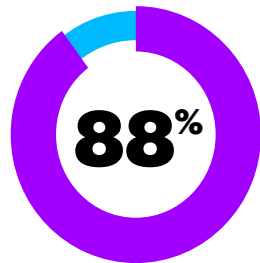
Healthcare organizations grappling with managing a wide network of partners can look to blockchain to simplify their collection and reconciliation of disparate healthcare and financial data. Imagine the magnitude of disconnected data from providers, hospitals, health plans and other partners. Blockchain provides the potential to connect these highly segmented data silos, adding a layer of trust through cryptographic proofs of the data's provenance. No single organization owns the blockchain, therefore all participants have equal access to the information they have permission to interact with.

Delegating trust to a blockchain means that businesses can pursue broader networks, onboard new partners or enter new ecosystems with ease. With blockchain-based smart contracts, businesses can capture computable terms of a given relationship, and automatically trigger transactions for any partner meeting those terms. Most health executives (78 percent) agree that smart contracts will dramatically evolve our transactional methods and enable digital trust.

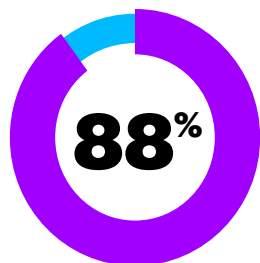


Healthcare is in an early experimentation phase with blockchain trailing industry sectors like financial services. Still, executives are recognizing its [potential](#).<sup>21</sup> When asked, “When do you expect that blockchain will be integrated into your organization’s systems?” 32 percent of healthcare providers and 48 percent of health plans said one to two years.

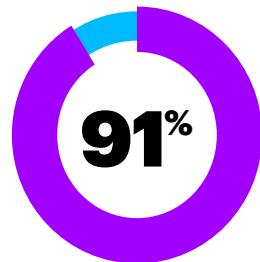
The future is becoming abundantly clear as partnerships take hold: If microservices and APIs are the keys to scaling and integrating partnerships, blockchain will be critical to creating trust in the authenticity and accuracy of what is being shared.



**88%** of health executives anticipate the volume of data exchanged with ecosystem partners will increase over the next two years.



**88%** of health executives agree that microservices are critical for scaling and integrating ecosystem partnerships.



**91%** of health executives believe blockchain and smart contracts will be critical for their organization over the next three years.

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# A PLATFORM FOR BETTER HEALTH ENGAGEMENT

[Anthem](#), in partnership with [Castlight Health](#), launched Engage, a next-generation health engagement platform and digital experience designed to drive better health for consumers—and better healthcare decisions. The new platform establishes a single hub for an employer's health and wellness programs and will drive all of the capabilities together, personalizing the programs offered to each user. It also uses a microservices layer to seamlessly connect to data from third-party health and wellness apps as well as health plan tools such as telehealth services, virtual nursing and fitness tracker-powered wellness programs. For example, the platform alerts a condition management nurse to connect with a user based on their medical or lifestyle needs and can help users follow their doctors' plan of care, flagging missed lab tests and providing additional educational resources.

"Engage is enabled using the microservices and event-driven architecture that helps with easy transfer of data and actions when needed. The use of microservices and APIs for Anthem Engage and other internal apps creates a seamless integration pattern," says Anil Bhatt, vice president of digital technologies.

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# INTERNET OF THINKING

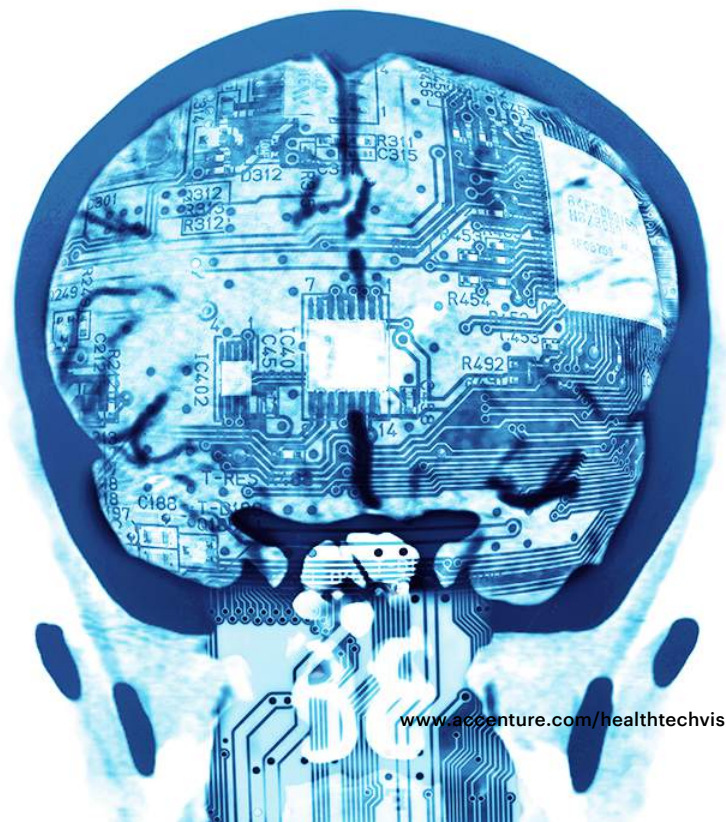
## Creating Intelligent Distributed Systems

**From ICU hospital rooms that automatically manage patient fluids, to self-maintaining equipment, more healthcare organizations are developing intelligent environments that include a mix of robotics, extended reality, artificial intelligence and connected devices.**

However, the technical infrastructure to support this new hyperconnected environment has not evolved at the same pace.

The enterprise infrastructures that are common today in healthcare aren't built to support the instant insights and actions needed to create intelligent solutions at scale. Current infrastructures are designed around a few basic assumptions: there is enough bandwidth to support any remote application, there is infinite

storage available in the cloud and hardware will continue to have enough computing power. But the demand for immediate response times—especially in healthcare's physical world—defies this approach.





## Companies can no longer make the same assumptions around bandwidth, remote storage and compute.

BANDWIDTH	STORAGE	COMPUTE
<b>Assumption:</b> AI techniques will be the primary method of significant discoveries in life sciences.	<b>Assumption:</b> The cloud provides unlimited, cheap storage.	<b>Assumption:</b> Hardware will continue to get increasingly more powerful.
<b>Reality:</b> As companies depend on more, and larger, amounts of data, bandwidth is becoming a hard limit, particularly while waiting for 5G.	<b>Reality:</b> Storing data is cheap, but creating it is even cheaper. An autonomous car is expected to create 3.6TB of data for every hour of driving, or 1 GB per second.	<b>Reality:</b> Shrinking transistors are reaching physical limits. Performance is still increasing, but how companies achieve it is changing.

The future demands an overhaul of existing infrastructures. To overcome the challenges, healthcare organizations can pursue three strategies: embed intelligent tools everywhere, balance the cloud versus the edge and leverage custom hardware. Reimagining enterprise infrastructure unleashes new opportunities for healthcare organizations willing to see “the edge” as a strategic asset in delivering intelligent environments. Embedding a business into the surrounding world begins with an IT architecture transformation—building the capabilities to power intelligent actions everywhere.

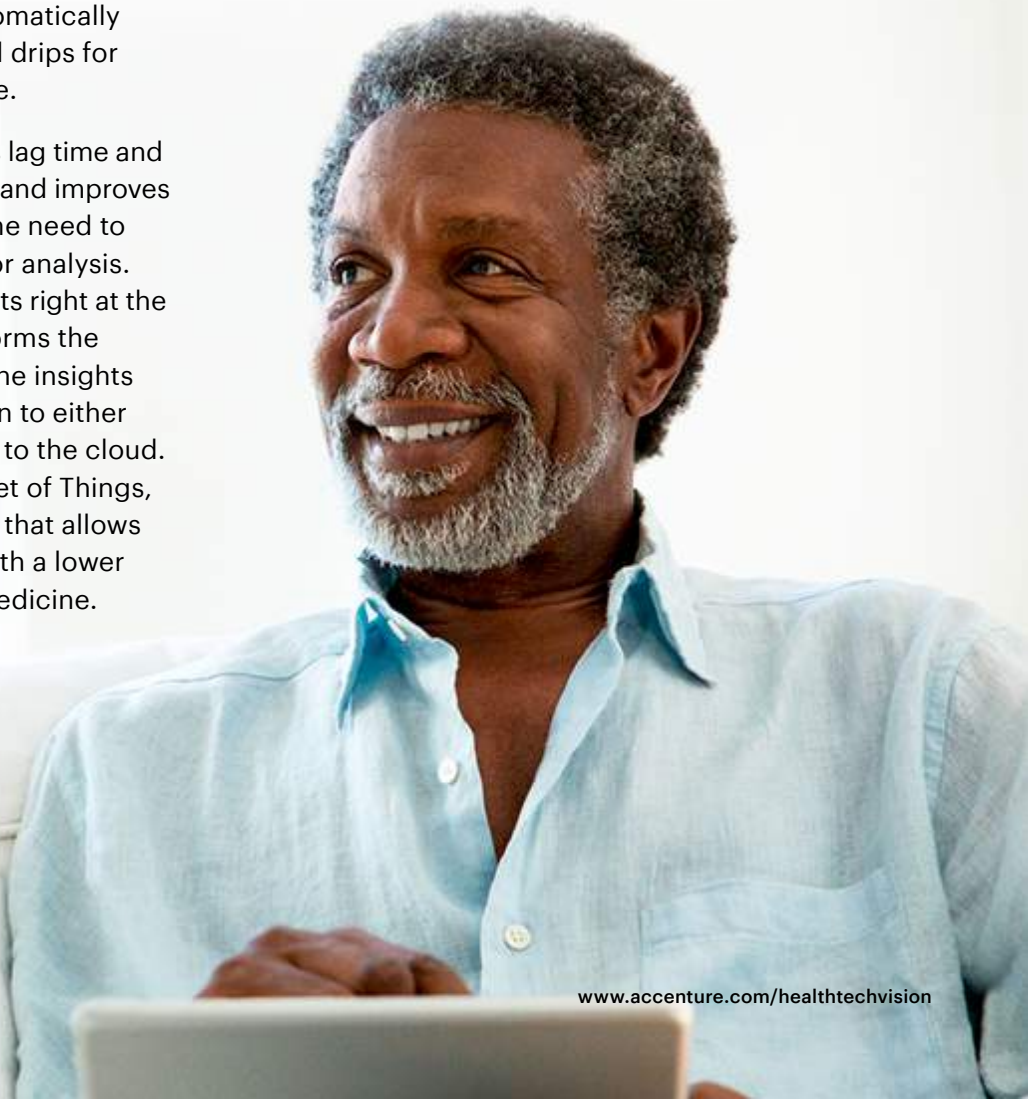
## Healthcare on the edge

To deliver intelligence everywhere, healthcare organizations must be able to analyze and act on data where it is generated. There isn't time to wait for connectivity or the cloud—decisions must be made in an instant. This means bringing processing to the edge. Many health executives (82 percent) agree that edge architecture will speed the maturity of many technologies.

Edge solutions process and store data “nearby” on devices. For instance, [Autonomous Healthcare](#) (formerly AreteX Systems) uses machine learning tools housed on medical equipment and devices to monitor patient vital signs to automatically dispense and adjust fluid drips for individuals in critical care.

Edge computing reduces lag time and bandwidth requirements and improves security by minimizing the need to send data to the cloud for analysis. Analytics generate insights right at the source. The device performs the analytics and based on the insights yielded, makes a decision to either discard data or upload it to the cloud. It's essentially the Internet of Things, but with software on top that allows processing to happen with a lower failure rate—critical in medicine.

Consider the impact the edge can have on improving quality of life and independence for the elderly. Connected homes with smart sensors, coupled with wearable technology for health monitoring, can perform passive sensing and active coaching. For instance, an [Alexa-like device](#)<sup>22</sup> could alert a patient of an elevated heart rate (detected on a wearable) and advise them to sit down and rest. In more acute cases, the technology would alert a caretaker or healthcare provider to intervene. The technology is liberating for the patient, and potentially lifesaving.



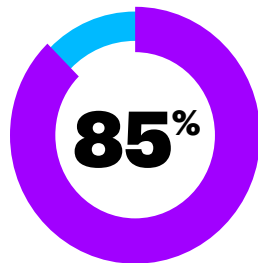
## Getting to the edge

Digital and physical worlds continue to blur in healthcare, emphasizing the need for a stronger, more flexible backbone: extended infrastructure. Extending does not mean ripping and replacing. Moreover, it's adapting the infrastructure so that healthcare businesses can seize the full potential of AI, robotics and other emerging technologies without overburdening bandwidth.

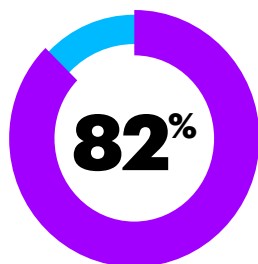
Improvements in processing power and energy efficiency at the edge make instant actions possible, which

can save lives in healthcare. The edge allows organizations to implement the technologies they want and need because they have the right level of processing power on hand.

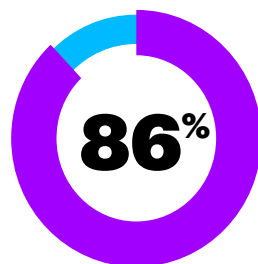
In the next wave of healthcare innovation, the edge will become a critical part of infrastructure. Companies must determine what should be processed and stored at the edge. Businesses will find their unique balance for dividing processing tasks among the cloud and the edge, and everywhere in between.



**85%** of health executives agree that generating real-time insights from the volumes of data expected in the future will require computing at the edge, where data is generated.



**82%** of health executives agree that to support real-time insights and actions, organizations need a renewed focus on custom hardware and hardware accelerators.



**86%** of health executives agree that enterprises must balance cloud and edge computing to maximize technology infrastructure agility and enable intelligence everywhere.

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# INFORMATION AND ACTION IN AN INSTANT

**Imagine a seizure patient with an implanted device that does real-time analytics on her brainwaves, monitoring for unusual activity.**

Within milliseconds of sensing the beginning of a seizure, the device delivers pulses designed to stop it—without needing to consult an external system about what it should do, or waiting for any input from the patient. In fact, the patient doesn't even know it's happening. All of the action happens on the device itself. This isn't a hypothetical scenario, but a real treatment option in use today. After [NeuroPace's](#) neurostimulation device is surgically implanted in a patient's skull, it invisibly and autonomously monitors for and prevents seizures, [reducing incidence by 44 percent after just the first year.](#)<sup>23</sup> This real-time management of a critical medical condition is an example of what's possible with intelligent environments: combinations of real-time sensing and computing that deliver instant action.

## More on this topic

[Invest Today to Grow Tomorrow: Accenture 2017 Internet of Health Things Survey](#)

[Healthcare's Future Arrives Early at HealthTech Innovation Challenge](#)

[Perspectives: In Hot Pursuit of Innovation](#)

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