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MAKING **WAVES** WITH **IMMERSIVE** TECHNOLOGIES

BY MATT KAPKO

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cover story

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COVER ART BY DANIEL HERTZBERG

Keeping it real

"After decades of buzz and expectations, augmented and virtual reality is starting to make inroads – or at least show potential – in business."

We know that most of you aren't yet immersed in augmented or virtual reality (AR/VR). In fact, in the 2017 State of the CIO survey when we asked which three technology initiatives will drive the most IT investment at your organization, only 2 percent of respondents identified augmented and virtual reality. (If you're curious, big data/business analytics, mobile technologies, cloud computing, application modernization/legacy systems migration, security/risk management topped the list, ranging from 33 percent to 23 percent.)

However, don't let that 2 percent fool you. The buzz around AR/VR is steady and growing. Of course, that buzz dates to the 1980s (see our little photo tribute to VR 80s-style), so forgive grizzled technology writers and editors like me for flashing our cynical smirks. But this time it's real, and it's not just for fun and games.

In the coming months and years, look for companies with customer-facing apps and businesses needing to foster engagement to turn to AR/VR. For example, we expect to see AR particularly in areas such as employee collaboration for remote workforces and virtual employees given the rise of the gig economy, in training and in niche markets like telemedicine. In general, vertical markets, such as manufacturing and design, healthcare, transportation and retail stand to benefit the most.

And the numbers bear out that momentum. IDC earlier this year reported that shipments of AR/VR headset devices will reach 99.4 million units in 2021, up nearly 10-fold from the 10.1 million units shipped in 2016 and the enterprise plays a big role in that. "AR and VR is expected to raise productivity, allowing workers to see and interact with data, like a building blueprint or the organs of a human being, instead of viewing a static image on a screen. Changes and procedures can be mapped out ahead of time before moving on to the actual work, saving companies two precious resources: time and cost."

CIO.com has been writing about enterprise use of AR/VR for the past year, discussing how it is being used everywhere from Formula One racetracks to hospital operating rooms. In this issue's cover story, senior writer Matt Kapko immerses himself deeper in the topic, gleaning insights from CIOs and industry analysts.

We've been waiting for AR/VR to be viable business technologies for decades, but Brian Blau, research vice president at Gartner, warns IT leaders to move cautiously still. "A CIO kind of has a special role ... They are built-in skeptics and I think rightfully so," he tells Kapko. "[CIOs] need to make their teams prove to the business that these technologies are worth investing in."

–Dan Muse, editor in chief, cio.com

IMAGES COURTESY OF NASA

Immigration policies bring new challenges

"No matter how much planning you do, new policies on the use of foreign labor could affect your operations."

If you want something done well, do it yourself. Right? Well, not all the time.

While that quote, attributed to Napoleon Bonaparte, may be appropriate for a French leader focused on European domination and revolution, it isn't a fit for 21st century IT leaders who are focusing on operational efficiency and innovative ways to apply technology to real-world solutions.

The goal today is get the work done on time, under budget and with the least number of headaches. And for many organizations, that means outsourced and nearshore solutions. Roughly 10.6 percent of IT budgets in 2016 were dedicated to outsourcing activities, which marks a slight increase over the previous year, according to a Computer Economics report on IT outsourcing.

Applications development remains the most outsourced function, while IT security is increasing at the fastest rate, with some 59 percent of IT executives polled by Computer Economics reporting that they have plans to ramp up activities.

All in all, strategies to shift inside activities to resources on the outside seemed to be the way to go until President Donald Trump signed an executive order mandating more restrictive immigration policies. The concern for many IT leaders is that such actions will create roadblocks for companies that rely on IT professionals who work within the U.S. on H-1B visas, and might even impact outsourcing efforts. Most seem to be exploring strategies that could mitigate problems.

For example, a recent roundtable discussion hosted by the CIO Executive Council, revealed that many companies have reached out to outsourcing partners to set up contingency plans to mitigate any problems arising from stricter regulations. At the very least, this involves proactively applying for visa extensions and backfilling any existing H-1B positions.

Companies are also looking for ways to "rebalance" their workforce portfolios. One option, of course, is actively pulling outsourced programs back inside and expanding their permanent U.S. staffs. Other possibilities include launching "nearshoring" relationships with IT services providers in countries such as Canada that are closer to the U.S., or at least moving foreign resources to countries that are less likely to be in the crosshairs of the new administration, such as the Czech Republic.

But no matter how much planning you do, new policies on immigration and the use of foreign labor could affect your operations. For example, U.S. mandates may force IT service providers to spend more time and money maneuvering through red tape, and the outsourcers could pass those costs along to their U.S. customers.

Let me know your take on the shifting sands of immigration policy and outsourcing.

– Tim Scannell, Director of Strategic Content

Insurers turn to IoT to calculate climate data

The internet of things offers insurance companies a way to collect better data and create new business models to engage consumers – and reduce exposure to the financial risks of climate change.

BY THOR OLAVSRUD

Insurers have always been data-driven companies: Their business is built on understanding data and making judgments on data. But with climate patterns shifting, forecasts that property insurers built on historical data are becoming less reliable.

The Intergovernmental Panel on Climate Change (IPCC), a scientific and intergovernmental body under the auspices of the United Nations, has developed several scenarios to project how climate change

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will affect natural hazards and risks.

In many regions of the earth's temperate zone, extreme heat and drought will put pressure on agriculture and forestry, limit the amount of water that can be used to generate electricity and increase the risk of wildfires.

Other areas are likely to see intense rainfall, leading to more frequent flooding. One of IPCC's scenarios projects that the number of people exposed to a once-in-100-years flood event (as measured in the 20th century) will increase 14-fold. Thunderstorms and tropical cyclones are expected to increase in frequency and severity, and rising sea levels are expected to threaten coastal cities.

For insurance companies, especially those in the property and casualty segments of the industry, this means that there are more (and greater) risks to contend with, but the ability to accurately forecast these risks is declining.

"We're seeing insurance companies realize that the IoT is going to be **massively disruptive** for them."

– **KEVIN MEAGHER**, SENIOR VICE PRESIDENT OF BUSINESS DEVELOPMENT, ROC-CONNECT

The role of IoT

The internet of things (IoT) can help insurers collect data and provide services. But perhaps more importantly, says Kevin Meagher, senior vice president of business development at ROC-Connect, a supplier of smart home technologies as a service to retailers, insurance companies, manufacturers and service providers, IoT systems could allow insurers to completely transform their business models and go to market in a new way.

At their most basic, IoT sensors could detect when a frozen pipe has burst (or is just leaking) and trigger systems that shut off the water supply and notify the homeowner. A smoke detector in a laundry room could detect smoke and shut off the dryer, and a service could predict the path of a sudden hail storm and warn you to get your car under cover.

"We're seeing insurance companies realize that the IoT is going to be massively disruptive for them," Meagher says. "If somebody gets better data than you get, more intelligent information, they'll be able to price better."

Only smart homes need apply

Because of that potential competition, Meagher says that insurers must do more than give customers incentives to hook up sensors and deploy smart home systems.

Instead, savvy insurers will use IoT and smart home technologies to overhaul their business models.

"In my view, in 10 to 15 years, you won't get home insurance unless you have a smart home," Meagher says. "You're already starting to see a bunch of interesting new business models sprouting up: Companies that don't sell insurance, they sell a smart home monthly subscription. The insurance is bundled in with the smart home services. They know if you have all these services, you're a low-risk customer."

You're collecting what?

Ultimately, he says, that business model depends upon open engagement with customers. Insurers need to be explicit about what data their sensors are collecting and what they will do with that data.

"If I pass your data to an insurance provider, I will only do that with your permission and I'll be very explicit: Data from this sensor, this sensor and this sensor," Meagher says. "I need to help the customer understand, 'What's in it for me?' For example, that might be: 'If you let me tell your insurance provider that the battery in your smoke detector is working, I'll give you a 15 percent discount.'"

"In the age of the IoT, data and digital relationships," he adds, "insurance companies can do a lot more to engage with you as a consumer and be seen to be helping you with the very thing you've come to them to buy." ♦

> "In my view, in 10 to 15 years, **you won't get home insurance** unless you have a smart home."
>
> – **KEVIN MEAGHER**

Thor Olavsrud is a senior writer at CIO.com.

Website testing enters a new era

In what they describe as a 'first-of-its-kind initiative,' researchers at the Neuro Business Solutions Center at Drexel University developed an objective, holistic approach to assessing the usability of websites.

BY RAJNEESH SURI AND SIDDHARTH BHATT

Websites not only serve as the face of a company, they can also be the company's primary product.

As the chief component of a company's digital supply chain, websites serve as platforms for companies to reach their customers and for customers to find out more information about the products and services offered by a company. Therefore, designing web platforms that provide smooth and pleasant experiences to customers is critical. No wonder billions of dollars are spent on creating and maintaining websites.

According to IBISWorld, a leading industry research company, the web design services market stood at $26.4 billion in 2016. However, while big money is being invested in creating websites, the methods and tools used to assess the performance of websites remain rudimentary. For the most part, assessment involves asking users about their views of the site's performance.

Such measures are subjective and prone to biases. Often, the users involved in testing may provide favorable reviews of a site during the pilot phase, but then a

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plethora of issues surface when the site is launched. This happens because the responses obtained via the user-feedback approach lack detail and specificity, and oftentimes people are simply unable to accurately articulate what they want to convey. In light of these issues, practitioners have long felt the need for more objective and rigorous measures of website usability testing.

A holistic approach to measuring web usability

The Neuro Business Solutions Center at Drexel University recently evaluated a "neuro ergonomics" method of testing websites. In a first-of-its-kind initiative, researchers at the center came up with a rigorous, objective and holistic method for assessing website usability. In a multimetric approach, the researchers employed behavioral, performance and neuro-physiological measures to evaluate a new investment

While **big money** is being invested in creating websites, the **methods and tools** used to assess the performance of websites **remain rudimentary.**

website for SEI Investments Co., a leading global provider of wealth management services.

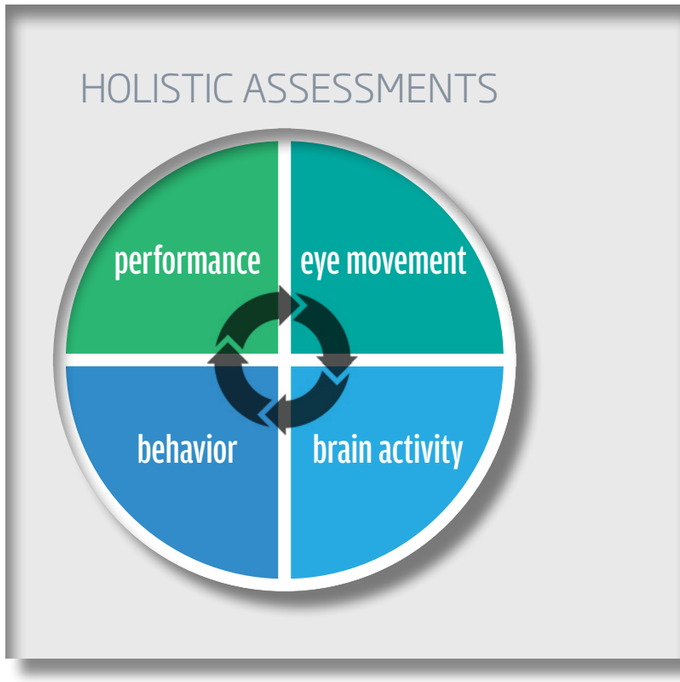
The website was scored on three major criteria: function, aesthetics and affect. Function refers to the website's operational capabilities, aesthetics concern the platform's visual and auditory properties, and affect addresses the emotions and feelings that a website can induce in the user.

Together, these metrics provide a comprehensive assessment. However, measuring each of these in ways that are not prone to the biases and flaws of self-reporting approaches remained a challenge.

That's where the advanced research tools at Drexel's Neuro Business Solutions Center provided an innovative solution.

To test the new approach, consumers were observed as they used the company's new web-based platform to manage their portfolios. As they engaged in various activities, their performance and behavior were monitored using a set of objective measures. Simultaneously, their brains were imaged by a non-invasive optical brain imaging technique called functional near-infrared spectroscopy (fNIR) and their eye movements were tracked.

The eye-tracking data revealed that several parts of the website did not receive much attention even though they contained important content. Neural correlates data from devices was used to generate a metric of inter-hemispheric activity and measure the users' neurobehavioral efficiency to arrive at important conclusions



about how users approached their portfolio-management tasks.

Taken together, these metrics provided critical insights that surveys collecting self-reported user

feedback could not. For instance, findings based on user feedback did not reveal any instances of failure in accessing a particular feature of the website. However, analysis of eye-movement data revealed that some of the icons that were used to represent important functions (such as settings and accounts) were pictorially inappropriate and several users overlooked them.

A similar scenario played out in assessments of a section of the website designated for monitoring the performance of investors' portfolios. In their surveys, investors rated this section as the third-best of five website sections. However, brain data revealed that completing the tasks on this portion of the site demanded the greatest mental effort. This became apparent through an examination of the neurobehavioral efficiency measures developed by Drexel researchers.

Insights such as those helped the company improve the usability of sections of its site that had been shown to be problematic for users.

"With more **objective measures**, such as data on brain activity and eye movements, and by assessing users' actual activities on their websites, financial companies can now get a **richer understanding** of how their customers will interact with their web-based resources.

Old vs. new

The evaluation of the new site also involved a comparison of the new web platform with the existing platform across all four modalities: performance, behavior, eye movements and brain activity. This comparison indicated that the new platform was better than the old platform on both subjective and objective measures of usability, giving the company greater confidence in its decision to replace the old platform.

Finally, the brain activity of investors in this study was benchmarked with data from other studies. The results showed that the new web platform was relatively easy to use and required only a modest amount of mental exertion.

Overall, it was evident that user surveys are deficient in portraying a complete picture of a web platform's usability. With more objective measures, such as data on brain activity and eye movements, and by assessing users' actual activities on their websites, financial companies can now get a richer understanding of how their customers will interact with their web-based resources.

The methods developed at Drexel's Neuro Business Solutions Center are versatile and could be more broadly applied across a wide range of industries and platforms. All in all, they represent a major leap toward a more objective way to assess websites. ♦

Rajneesh Suri is a professor of marketing and associate dean of research at Drexel University's LeBow College of Business. Siddharth Bhatt is a Ph.D. candidate at LeBow College of Business. Hasan Ayaz and Atahan Agrali also contributed to this article. Ayaz is an associate research professor and Agrali is a research associate at Drexel University's School of Biomedical Engineering, Sciences and Health Systems.

Insurer invests in digital expertise

Nationwide IT aims to transform the customer experience by modernizing and standardizing its business-focused technology initiatives.

BY BRENDAN McGOWAN

One of Nationwide Mutual Insurance's core assets is trustworthiness. (It is, after all, the company that says it's "on your side.") Its insurance and investment products support some of the most sensitive and significant milestones of the human experience, so it needs to earn its customers' trust.

But earning your customers' trust is often contingent upon demonstrating corporate stability and consistency — a concern that might seem to be at odds with Nationwide's current focus: a dynamic drive to transform the digital customer experience.

The Fortune 100 company

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spends upwards of $500 million per year on IT projects, says Guru Vasudeva, Nationwide's senior vice president and CIO of program and application services. More than half of that goes to transformational business initiatives.

> "The [technologies] we are currently focused on are obviously digital technology, data analytics, artificial intelligence and machine learning, cybersecurity, legacy modernization and the cloud."
>
> – **GURU VASUDEVA**, SENIOR VICE PRESIDENT AND CIO OF PROGRAM AND APPLICATION SERVICES, NATIONWIDE

Laying the groundwork

In recent years, Vasudeva has focused on streamlining IT business offerings, something that he views as groundwork for making further transformational moves.

As an example, IT has been instrumental in standardizing several insurance policy administration systems, some of which were developed decades ago. A major focus has been "standardizing products across brands, making them all one brand, making them consistent, making them more modern [while] deploying them on a modern technology package-based implementation," he says.

Strategic alignment with colleagues throughout the organization is paramount to the success of this effort. "A lot of the heavy lifting has to happen on the business side to standardize process, to standardize products across regions and distribution channels," Vasudeva says.

Building expertise

To better understand its customers' needs, Nationwide has assembled a cross-functional team that includes representatives of IT, marketing and business units responsible for driving digital capabilities. The team's diversity allows for multiple data points to be collected and synthesized.

For example, Nationwide marketing professionals collaborate with peers at other companies inside and outside the insurance industry to better understand customer behavior. Meanwhile, the digital team on the business side keeps careful track of consumer technology adoption, supported "by substantial data from our various websites and mobile sites that we track analytics around," according to Vasudeva.

For IT to drive change, he says, it must continually assess current and potential business needs. In recent years, IT leaders have identified a shortlist of key technology drivers that they view as integral to Nationwide's digital future. "The ones that we are currently focused on," Vasudeva says, "are obviously

digital technology, data analytics, artificial intelligence and machine learning, cybersecurity, legacy modernization and the cloud."

"We have working teams established to really get better at these technologies," he adds. "The way we are organized allows us to build deep expertise in these technical domains and then make sure we have the appropriate skills and/or partnerships to make sure we can support those business initiatives."

Gaining momentum

About a decade ago, Nationwide was weighing whether the IT department would be able to build out its digital ecosystem using internal resources, or if it should move to a more outsourced model. The company decided to focus primarily on "in-house capability, because we thought that would help us develop better solutions for the business," Vasudeva says.

"We decided to bring together a few agile teams under one organization, and we told that team we would like to build our own internal development center using agile capabilities," he says. "What we noticed is these agile teams, with the right kind of leadership, were producing better results compared to our traditional waterfall methods." The company has expanded its agile workforce from three or four teams a decade ago to approximately 70 teams last year.

Because Nationwide spends hundreds of millions of dollars on technology each year, Vasudeva emphasizes that it's imperative for IT to be clear with its business partners about "the orders of magnitude of investment that is needed and the [amount] of time [projects are] going to take." Without business alignment, he says, IT projects can grind to a halt before they're fully implemented.

He is steadfastly focused on effective investment — of time, capital and talent — and clear communication to avoid costly snags.

Finally, Vasudeva says it's critical to broaden the team's talent and expertise. He prioritizes the development of technical competencies that translate across business units, to help support execution at scale. And he has seen the strategic value in maintaining skill sets that overlap and intersect in ways that drive the business.

For example, he says, "if you have a center of excellence around the web, you can leverage the same set of skills to really get better at mobile or digital. You can build on that." ♦

"If you have a center of **excellence** around the web, you can **leverage** the same set of skills to really get better at mobile or digital." – **GURU VASUDEVA**

Brendan McGowan is global media bureau and client research manager at the CIO Executive Council.

MAKING WAVES WITH IMMERSIVE TECHNOLOGIES

Immersive technologies, including augmented reality, virtual reality and mixed reality, don't easily fit at most businesses today. But some early successes prove opportunity does exist in enterprise.

BY MATT KAPKO

For City of Los Angeles CIO Ted Ross, immersive technology offers a unique way to promote tourism and to engage with the city's 4 million residents. "We're known for Hollywood. We're known for entertainment. We're known as a tourist destination. Virtual reality gives us an opportunity to be able to share some of that experience," he says. »»»

ILLUSTRATION BY DANIEL HERTZBERG

"From an **INTERNAL IT CONTEXT**, I don't see any obvious use cases for VR or AR that can help us drive growth." –GREG MEYERS, CIO, MOTOROLA SOLUTIONS,

One example of the way the city has put virtual reality (VR) technology to use is the "Los Angeles River VR Experience," which was created to generate interest in the city's plans to revitalize the river so it can become a more natural urban ecosystem. "It's a mechanism to create civic engagement" and encourage residents to think of the river as something more than a concrete storm water disposal system, Ross says.

"We're a government," he says. "We want to engage people, we want to connect them with their government, we want to connect them with resources and our elected officials." But he also notes that reprioritizing resources for research and development can be difficult when organizations are just dabbling in new technologies. And developing capabilities to leverage a technology like VR and finding good uses for it are consistent challenges.

A SLOW START

Greg Meyers, CIO at Motorola Solutions, says he's excited about the prospects for immersive technology, and he has a team researching how it can help emergency responders collaborate more efficiently with command centers. However, from his perspective, VR and augmented reality (AR) don't rise to the same level of interest as other emerging technologies.

"From an internal IT context, I don't see any obvious use cases for VR or AR that can help us drive growth," he says. "Sure, I can think of some kitschy things like workplace facilities and having more effective meetings. But in a world where we need to make priorities, I'd rather put time, money and attention on how artificial intelligence (AI) can help us make better decisions faster as a company."

Indeed, immersive technologies are barely on the radar for most CIOs. In CIO.com's 2017 "State of the CIO" study, only 2 percent of respondents listed AR and VR as one of their top three areas for investment in the coming year.

But interest is growing, and more businesses are experimenting with the technology — or at least investigating how an immersive experience might improve outcomes or solve challenges. Worldwide spending on hardware and services associated with AR and VR is projected to increase 130.5 percent year over year to $13.9 billion in 2017, according to research firm IDC. Enterprises are expected to spend $7.7 billion globally this year, but manufacturing and retail are likely to be the only two industries spending more than $1 billion on AR or VR systems in 2017, according to IDC's latest projections.

IT involvement in AR and VR ranges from pure experimentation to production deployments, but relatively few businesses are mature in their use of immersive

technologies, says Brian Blau, an analyst at Gartner. This cautious approach makes sense because finding the right use cases isn't always easy.

"VR and AR are not necessarily appropriate for every CIO," says J.P. Gownder, an analyst at Forrester Research. "You need to make sure that you are dealing with a very specific business problem." Enterprises should consider these technologies as a method to improve operations and training for employees, engage customers of highly configurable goods or deliver new experiences to consumers, Gownder says.

Those CIOs who are interested in AR and VR are largely attracted to its potential to disrupt the work process and enrich environments. However, many IT leaders are taking a technology evaluation approach and that doesn't work for AR and VR, because IT typically doesn't focus on user experience as part of that process, Blau warns.

FINDING THE SWEET SPOT

Experiential training for complex and dangerous environments is a key industrial use case for VR, according to 451 Research analyst Ian Hughes. "Placing an engineer in a convincing plant environment but also feeding that visual model with realistic machine performance data extracted from a live digital twin of a production environment is compelling," he says.

Total immersion is also a good fit for entertainment, says Hughes. And City of Los Angeles CIO Ross has found a benefit in the immersive experience offered by VR. "We love this idea of getting people to try different trails in Griffith Park, we love the idea of having them get to know our observatory," he says.

HOLOLENS FINDS A HOME IN HEALTHCARE

Medical equipment maker taps Microsoft's mixed-reality headset to show customers what its medical equipment will look like in operating rooms.

BY CLINT BOULTON

Microsoft's HoloLens is breathing new life into what has been spotty deployment of immersive digital solutions in enterprises.

Medical equipment maker Stryker is using the mixed-reality headset-based system to help show customers how its surgical tables, light fixtures and displays will look in their operating rooms. Serving as a planning and design tool for sales pitches, HoloLens gives Stryker an easier and less expensive way to demonstrate its wares.

"We have a diverse base of individuals interested in how that operating room is going to look and operate," says Andy Pierce, Stryker's president of global endoscopy. "HoloLens enables [us] to reach that stakeholder base to demonstrate options for customers and do it cost-effectively."

ADOPTING IMMERSION TECH

Virtual reality products such as Oculus Rift immerse people in a digital world, and augmented reality applications such as Pokemon Go overlay digital information onto the physical world. HoloLens is perhaps the most prominent example of mixed reality, in which you interact with digital and real-world objects, typically holograms, while maintaining your presence in the physical world.

Corporate adoption of immersion technologies has remained low, »»

But Hughes points out that for most workplace applications, "the principle of shutting people off to engage in the experience does not fit with how people need to operate." And AR provides a "wider range of options to integrate data and information into the physical world and still be present and aware of surroundings and colleagues."

Blau adds that "while there's a lot to be said for putting people in a completely simulated work environment, for most work tasks having that blend of real and virtual would be better. It keeps people grounded in reality and it relates to something real about their work environment," he says. "The technology is extending the real world versus replacing it, and for a lot of situations that is the sweet spot."

> "The technology is **EXTENDING THE REAL WORLD** versus replacing it, and for a lot of situations that is the sweet spot."
>
> –BRIAN BLAU, ANALYST, GARTNER

At Rent-A-Center, CIO Angela Yochem says AR commands greater attention for her organization because implementations are already in play that don't require specialized hardware. "We are just beginning to experiment with use cases and differentiating augmented reality solutions in our labs, but we

as executives search for systems that will make a significant impact for their businesses. But Gartner expects that to change and predicts that 20 percent of large enterprises will be using such technologies by 2020.

You can count Stryker, which began exploring HoloLens with Microsoft in 2015, among the early adopters.

The company's equipment, tools and lighting systems must be customized and set up in certain configurations for each surgical discipline. Stryker typically begins the sales process by providing customers with two-dimensional demos on computers or tablets and then builds mock operating rooms to show what its equipment will look like after installation. The latter approach is particularly expensive and inefficient, in part because it requires prospective customers to travel.

Stryker executives first saw the potential for using HoloLens to design operating rooms virtually in a 2015 meeting with Microsoft executives, says Shaun Braun, group CIO of Stryker's MedSurge and neurotechnology businesses. They were struck by the idea that Stryker sales teams and clients could use HoloLens headsets to plan the layout and configuration of surgical equipment.

Stryker began a HoloLens pilot in 2016, integrating Microsoft's technology with its By Design planning application. It works like this: Stryker sales representatives and prospective customers don HoloLens headsets, whose interfaces feature an operating room blueprint created in By Design. Participants can then map out the room together in real time, using hand gestures to move, turn and manipulate lighting fixtures and equipment booms around the virtual room.

"You really feel like you're standing in the OR with multiple folks interacting with it and looking at each other," Braun says. "You're standing in a mixed reality of your future OR." »»»

> "One of the reasons **AR IS SO PROMISING** is that we have an increasing number of **SELF-AWARE DEVICES** out in the world." —ANGELA YOCHEM, CIO, RENT-A-CENTER

anticipate AR being additive not just to the customer's experience in our retail stores and online channels, but also essential to many existing business processes, such as those related to co-worker training and service center efficiencies," she says.

As Yochem implies, AR and mixed reality also benefit from an increasingly connected workforce and user base. "One of the reasons AR is so promising is that we have an increasing number of self-aware devices out in the world," says Gownder. "Augmented reality, being able to superimpose information over your field of view, gives you all that access to that detail. Smartglasses is the best way to do this because it's hands-free, but tablets are used far more commonly in enterprise contexts today."

While AR is already proving to be practical and highly beneficial in manufacturing, healthcare and warehouse logistics, CIOs should be evaluating the potential capabilities and applications for each scenario as it pertains to their business, says Brian Solis, an analyst at Altimeter Group. "The best approach is to discuss

WHY HOLOLENS RESONATES

Stryker's HoloLens presentations may resonate with customers because they make the sales process more of an "emotional experience" rather than a dry business engagement, says Gartner analyst Marty Resnick. "You're bringing a new experience and presence into the sales cycle that you wouldn't typically do," he adds, pointing out that adding that new dimension could help Stryker close more sales.

At $3,000 a pop, HoloLens makes for a pricey sales tool. And like any emerging technology, it has pluses and minuses and takes some getting used to. For example, although its view plane is more limited than those of virtual reality products, HoloLens doesn't induce nausea, as users have reported some VR systems doing.

Braun says HoloLens works fine for Stryker's specific purposes. He says the decision to adopt HoloLens was made after he and his team demonstrated it to Stryker's C-suite and board of directors last year.

Eventually, Stryker hopes to integrate price quotes into By Design, and it could use HoloLens in medical education and sales enablement functions.

Stryker is the latest in a line of companies that have found business uses for HoloLens. CIO.com reported in October that Volvo, Lowe's, Japan Airlines and ThyssenKrupp are testing the technology for tasks such as sales, customer service, maintenance and flight crew training.

More recently, software maker Adobe announced that it is testing HoloLens in retail settings. One Adobe app allows retail managers to view store floor plans overlaid with augmented data showing shoppers' traffic patterns throughout the premises.

Clint Boulton is a senior writer at CIO.com.

options and opportunities with experts, developers and integrators to assess real-world, scalable solutions," he says. "In some cases, AR or VR may not be the best solution for now. From a technology standpoint, I do see AR beating VR to enterprise implementation simply because the technology, expertise and integration opportunities are a bit more mature."

CHALLENGES AHEAD

Solis reminds CIOs to recognize and acknowledge the gap between the hype of immersive technology and realistic enterprise applications. "Technology companies are exceptional at marketing, and geeks too are thrilled over the early capabilities of many initial applications," Solis says. "But CIOs have to see benefits and [return on investment] versus the wow factor. . . . CIOs make decisions about future technologies largely based on legacy models and mindsets. This means that AR and VR require a more forward-looking perspective and an innovation mindset that breaks away from traditional IT management processes."

The user experiences and nomenclature for AR will evolve around common gestures, voice commands and object iconography, but advances will come slowly, says Hughes of 451 Research. "All these systems have a physical barrier to entry," he says. "Headsets or wearables are impacted by cultural acceptance, but in industrial use, a hard hat, visor or safety goggles are a requirement, so they can more easily be instrumented and augmented, which is where the core developments are focused."

At present, AR and VR are also lacking security and management features that would be considered enterprise class, according to Gownder. Many vendors have also been resistant to classify any of their products as specific to the enterprise, and Blau argues that AR and VR systems are not robust enough for enterprises, meaning

TIPS FOR GETTING STARTED WITH IMMERSIVE SYSTEMS

GET AHEAD OF THE BUSINESS. Be open to considering AR as a capability that can drive business value, even if the broader business community isn't asking for it yet, says Rent-A-Center CIO Angela Yochem. "Start with an experiment around a solution that could potentially add great value, either by streamlining a process or by enhancing the customer experience, to build excitement and interest within your organization," she says. "The simpler the better: The capability needs to be easy to understand and communicate across teams."

EMPHASIZE COLLABORATION. A slow-start strategy may not scale quickly, but it gives IT professionals a chance to test capabilities and receive feedback from peers, Yochem says. "Collaboration is key to innovation," she says, "and leveraging the knowledge and experiences of others will be vital to successfully innovating with these technologies."

DON'T UNDERESTIMATE THE POWER OF DABBLING. Los Angeles CIO Ted Ross also says he believes in starting small and inexpensively. "A small project will give you a much better understanding of what will work and what doesn't," he says. "Like with any new technology, dibbling and dabbling has a very powerful effect of making sure you know if there's a 'there' there and making sure you can talk the talk." *–M.K.*

"Internally, we can help **SHIFT CO-WORKER THINKING** by exposing them to what is possible through our innovation labs." –ANGELA YOCHEM, CIO, RENT-A-CENTER

they also lack back-end integration, data translation, education, training and design processes.

Regardless of what the technology can achieve and how good it is today, CIOs need to consider how it can be used in their businesses, how much they need to invest and what they are going to achieve as a result, Blau says. "That's the thing that's a real unknown," he says, "and I think IT is going to struggle to find an answer to that."

Rent-A-Center's Yochem says she and other CIOs are also challenged by slow consumer adoption. However, she says that issue will resolve itself once AR-enabled interactions in the workforce multiply, and she's trying to drive those changes among employees and customers in different ways.

"Internally, we can help shift co-worker thinking by exposing them to what is possible through our innovation labs," she says. "Externally, we can start to introduce information augmentation as part of our regular communications with customers, allowing the customer community to engage at their own pace as our solutions evolve over time."

CIO AS 'EXPERIENCE ARCHITECT'

With so much in flux and technology advances coming quickly, the advent of AR and VR presents a unique opportunity for CIOs to rethink their role, says Solis. CIOs and IT professionals should "shed their perceptions and assumptions of what their role in VR or AR would be and instead approach applications from that of an 'experience architect,'" he says, adding that this means finding "problems or opportunities that will benefit from AR or VR."

"This sounds commonsensical," he acknowledges, "but IT over the years has historically demonstrated technology-first approaches, and with a young and still-evolving sector, it's wise to seek areas where investment in time, resources and technology helps companies improve productivity either through iteration or innovation or both."

Gownder points out that "there is a wide array of scenarios [for immersive technology] but you have to really work to find the business value rather than sort of thinking of this as the next platform that everyone's going to use, because it's unclear that that's the case." Real value is being created in pockets, but many of the enterprise efforts are still in the piloting and troubleshooting phases, he adds.

If CIOs focus on making great business decisions about using AR or VR, their organizations will be better off than if they try to pigeonhole the technology into a process that doesn't fit, says Blau. "A CIO kind of has a special role. . . . They are built-in skeptics, and I think rightfully so — they should be skeptical," he says. "[CIOs] need to make their teams prove to the business that these technologies are worth investing in." ♦

Matt Kapko is a senior writer at CIO.com.

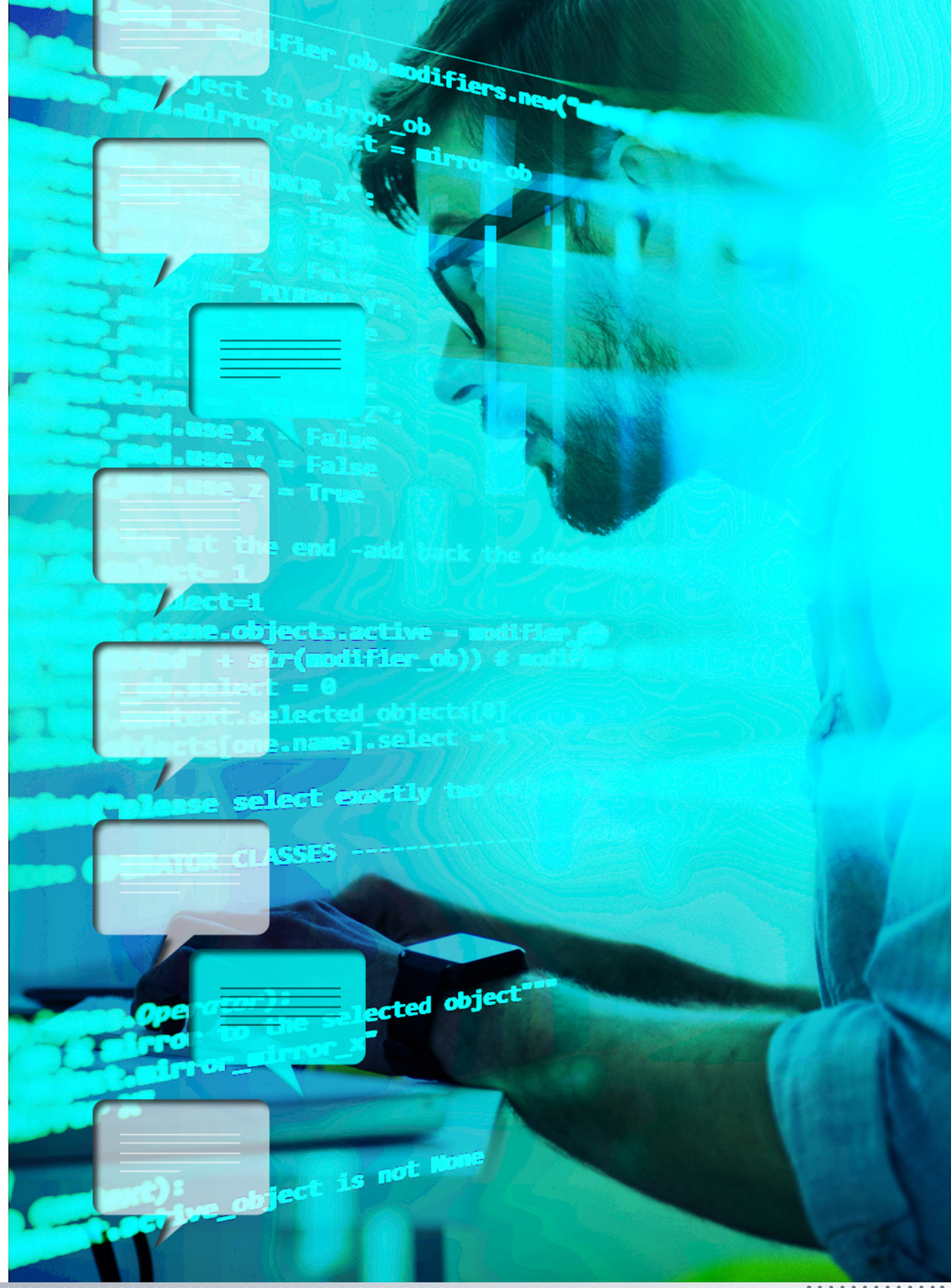
Virtual assistants move into DevOps

DevOps practices are fueling adoption of chatbots and voicebots to automate IT operations.

BY CLINT BOULTON

Companies embracing DevOps practices are turning to chat-based and voice-guided virtual assistants to monitor applications, provision virtual machines and perform other operations. Such tools help keep developers and IT operations staff on the same page as they prioritize speedier software deployment.

"The problem you run into in DevOps is that teams are distributed," says Milan Hanson, an analyst at Forrester Research. "You can have the bot automate activities, address it in the chat like it's another



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person, and it will perform what you've asked it to do and bring the result back into the chat channel where everyone can see it. In a crisis, when people put together a war room or a SWAT team, being able to do that virtually through chat is a huge advantage."

Speed, collaboration and automation are critical in DevOps environments, where software engineers and IT operations professionals buddy up to build, test and ship software. DevOps teams rely on automation tools to write, test and rewrite code, quickly launching new features and scaling them back if they don't work.

Chatbots and voicebots are particularly useful in detecting and resolving problems in a DevOps environment. For example, software engineers investigating application performance problems can query virtual assistants to find out who made the last code check-in rather than bothering team members or searching through logs.

Speed, **collaboration** and **automation** are critical in DevOps environments, where software engineers and IT operations professionals buddy up to build, test and ship software.

Ask Davis

Application performance monitoring software provider Dynatrace has launched Davis, a virtual assistant that answers questions about the health of corporate software without requiring IT workers to scour dashboards. Such automation is critical as IT departments are struggling with managing the millions or even billions of application interdependencies in their organizations, says Alois Reitbauer, Dynatrace's chief technology strategist.

You can open a dialog with Davis through Amazon.com's Alexa or by chatting with it via Slack to elicit answers to questions such as these: What performance problems impacted my revenue today? Can you tell me about user activity levels? Are there any capacity issues? While the Davis Slack chatbot is intended for IT, Reitbauer says the Alexa-enabled version of Davis is targeted toward executives who wish to request more basic performance reports.

Using the Davis Slack chatbot is "just like talking to another human IT team member, except a person would never be able to detect and bring to the surface root causes with such speed and precision," says Jeppe Lindberg, an applica-

tion performance manager at Denmark retail giant COOP, which was among the first organizations to test Davis.

Davis is based on artificial intelligence technology Dynatrace built to make its core platform smarter in an era of cloud and microservices deployment, both key attributes of DevOps programs. "We realized a lot of our customers were already using Slack," Reitbauer says. "We thought we would bring the monitoring tools to where people were actually working rather than make them switch [between Slack and Dynatrace]."

A bot for managing VMs

Tintri, a maker of storage appliances and software for managing virtual machines (VM), is using Slack and Alexa to automate data center and cloud capabilities. Within Slack, you can order the "Tintribot" to spin up 500 test VMs and gather terabytes of production data on them. Using Alexa, an engineer can provision VMs, take snapshots, apply quality-of-service attributes and provide real-time production information.

A cloud service provider in Japan created a Slack bot using Tintri's APIs to manage VMs for its customers, says Chuck Dubuque, vice president of product and solution marketing at Tintri. Developers can conduct person-to-person interactions or query the bot to check the performance of VMs or retrieve status updates on the latest code drops.

"If you want to know who made the decision to spin up 100 VMs at midnight, why they did it and what the result was, it's all captured within the transcript with real people going back and forth talking about the decision, and then the [bot] telling you, 'Here's the command, here's what happened, what do you want to do next?" Dubuque says.

Hanson says if you want to start using chatbots or voicebots, you should pick a small team, preferably made up of people from IT, to assess the options and conduct trials before incorporating staff from other departments. ♦

> "[Using the Davis Slack chatbot is] just like talking to another human . . . except a person would never be able to detect and bring to the surface root causes with such speed and precision."
>
> - **JEPPE LINDBERG**, APPLICATION PERFORMANCE MANAGER, COOP

Clint Boulton is a senior writer at CIO.com.

You aren't thinking of changing your ERP system, are you?

There's a good reason why CIOs look panicked when 'ERP' and 'upgrade' are used in the same sentence.

BY AARON POLIKAITIS AND MICKEY NORTH RIZZA

ERP software has a bad reputation. Over the years, many organizations have initiated massive ERP implementations and upgrades, only to find themselves behind schedule, way over budget and using only portions of the system's functionality. Some upgrades are abandoned midproject; others end in litigation.

You don't have to look far for examples of ERP projects gone wrong. A $100 million lawsuit filed in March by Miller Coors against HCL is one. In 2013, Miller hired HCL to customize its SAP ERP system, with visions of "driving efficiencies, innovation and growth . . . by adopting a common set of best practice business processes." After encountering software defects and dealing with a series of delays, Miller terminated its contract and filed suit.

Though it was one of the more highly publicized ERP debacles, the Miller-HCL situation was hardly an isolated incident. So it's with good reason that CIOs may blanch if asked to make improvements to their ERP systems.

Despite all this, the enterprise

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software industry is growing at a record pace. Older on-premises ERP systems are being replaced by cloud-based "intelligent ERP" applications that use machine learning, advanced analytics and curated data sets to simplify and automate complex tasks once performed by highly skilled ERP software experts.

What is intelligent ERP?

Intelligent ERP (i-ERP) systems are ERP applications or suites that use machine learning and advanced analytics with curated data sets to manage resources and business processes. They feature an assistive and conversational user experience and automate a set of high-volume repeatable tasks and augment (via human-machine interaction) the performance of less frequent, more novel tasks. Intelligent systems and applications are capable of processing, analyzing and acting on massive volumes of data in real time, using in-memory computing (IMC) technologies.

Why intelligent ERP?

Businesses want i-ERP for three reasons:

- **To optimize** resources across people, processes and technology and remove complexity, bring efficiency and increase revenue, cash flow and profitability.
- **To reduce** operating costs by simplifying routine tasks, eliminating human errors, automating basic business processes and removing additional drill-downs, data extraction and analysis.
- **To facilitate** real-time analysis and decision-making by leveraging advanced reporting to analyze unstructured data and structured related data.

Prepare for dual sourcing

As new i-ERP applications become available, innovative line-of-business leaders are identifying layers of legacy ERP functionality that are no longer useful and are investing in new tools to handle the same tasks. At the same time, IT organizations saddled with maintaining legacy ERP applications are consolidating and upgrading them — at great expense to the enterprise. As a result, enterprise systems are being divided into two silos.

> Many organizations have initiated **massive ERP implementations** and upgrades, only to find themselves behind schedule, over budget and using only portions of the system's functionality.

These ERP silos are often separated by solid communication barriers. Innovation teams that are evaluating cloud-based i-ERP options for different functional areas and are not connected to the crews that keep the business operating on the legacy ERP technology. Furthermore, companies' vendor sourcing organizations are typically aligned with the legacy operations and focus on maximizing savings on legacy technology renewals.

In these cases, new relationships with i-ERP vendors are formed without much, if any, regard for existing contractual relationships with the vendors of legacy ERP technology. Similarly, deals with legacy ERP vendors are renewed

IDC predicts that over **70 percent** of such siloed digital transformation initiatives **will ultimately fail** because of insufficient collaboration, integration, sourcing or project management.

without regard for the innovation occurring across the business. These siloed activities are wasting money and time. And more important, companies aren't getting the full value of the new i-ERP systems: Lacking access to the business intelligence at their disposal, they're missing out on valuable real-time insights. That all adds up to lost profitability and lost revenue opportunities.

IDC predicts that over 70 percent of such siloed digital transformation initiatives will ultimately fail because of insufficient collaboration, integration, sourcing or project management.

Sourcing in three dimensions

Mature organizations think strategically to identify the advances in ERP and associated functional technology that best align with the line-of-business requirements. They embrace innovation by identifying digital transformation drivers and owners, and they integrate vendor sourcing and management executives into their teams and incorporate the skill sets necessary to source third-platform technologies (social, mobile, cloud and big data). That approach radically improves business results while also optimizing the resources of people, process and technology across the entire organization. ♦

Practical advice for technology leaders

Transition strategies	Develop comprehensive transition strategies that cover legacy ERP as well as innovation.
Existing obligations	Identify, document and communicate contractual obligations with legacy ERP vendors.
License terms	Understand the impact of license terms and the restrictions affecting legacy ERP applications.
RFPs	Replace outdated and cumbersome RFP templates and processes.
Buyer behavior	Buyers are fairly well educated about vendor offerings even before an RFP is issued. Understand and leverage all sources of information, including blogs, social media, buying guides, technical forums, analysts, webcasts, podcasts and virtual events.
Unique requirements	Assess any unique requirements to determine whether they are consistent with industry best practices.

Aaron Polikaitis is vice president of IDC's IT Executive Programs (IEP) Vendor Sourcing and Management practice. Mickey North Rizza is program vice president for IDC's Enterprise Applications and Digital Commerce research practice.

Why balance is the key to dashboards

If they aren't both easy to use and credible, dashboards will be ignored or produce lousy visualizations.

BY MURUGAN ANANDARAJAN AND DIANA JONES

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Ford's iconic Mustang is revered for having an ideal blend of luxury and power. The release of a redesigned model in the late 1990s caused consumers to question the power of the vehicle, even though the new version was built to have more muscle than its predecessors. Subsequent studies conducted by Ford concluded that power was actually something drivers experienced viscerally — through the appearance of the car, its vibrations and the sound of its engine.

For Ford, identifying the right mix of horsepower and sensory experience made all the difference for its customers. Finding balance in data visualization is just as important.

People are wild for the beauty and benefits of data visualization — and rightfully so. Using a visual landscape of information, organizations can collect insight and influence change. From QVC's use of dashboards for leveraging real-time consumer data through its Data Analytics Response Technology (DART) to Uber's use of an open-source data visualization tool for improved insights, more companies are investing in visual techniques to monitor performance.

To achieve the impact on decision-making they're looking for,

People are wild for the beauty and benefits of data visualization – and rightfully so.

organizations must have the capability to optimize dashboard performance. The best results are achieved when there's a balance between the dashboard's usability and the credibility of its data sources.

Three dimensions of source credibility

Several decades ago, David K. Berlo, James B. Lemert and Robert J. Mertz published a report describing three dimensions of source credibility that can persuade a user to accept a message. The components they identified — trust, expertise and dynamism — can also be applied to data and analytics:

1. Trust: The perceived integrity of the data source. Is the data from an objective source? Can it be trusted?

2. Expertise: The authority or experience of the source. Is the data from a reputable source? Does the source use a validated methodology?

3. Dynamism: The newness of the data. Is it relevant and timely?

Three dimensions of dashboard usability

Successful implementation of a dashboard also depends on its usability. Usability involves three dimensions: aesthetics, navigation and intuitiveness.

1. Aesthetics: The visual appeal of the dashboard's components, such as tabs, text, font and color.

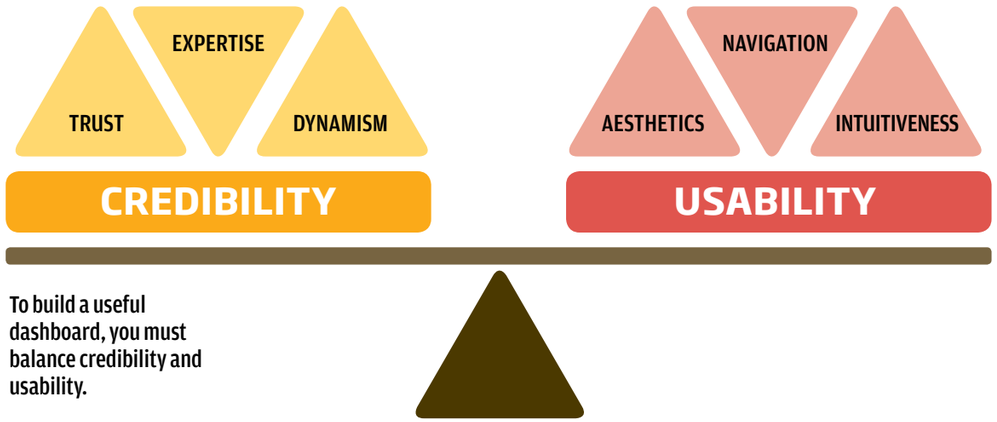
2. Navigation: The ease with which users can drill down, up or across the dashboard.

3. Intuitiveness: The ease with which users can find information.

A dashboard with strong source credibility will still not be used if it is visually unappealing and difficult to navigate. Similarly, an intuitive dashboard that proves easy to use but lacks source credibility will be misused.

Without both credibility and usability, a dashboard will fail: It will either be ignored or unhelpful, producing poor visualizations that lead to ineffective decisions.

Successful dashboards — those that contribute to improved decision-making and organizational performance — use the right data at the right time to make the right decisions. ♦



To build a useful dashboard, you must balance credibility and usability.

Murugan Anandarajan, Ph.D., is department head of Decision Sciences and MIS at Drexel University. Diana Jones is assistant director, Dornsife Office for Experiential Learning, LeBow College of Business, Drexel University.

What it takes to be a chief information officer

How do you land and succeed in the hottest roles in IT? This month, we look at the unique combination of skills a CIO needs.

BY SHARON FLORENTINE

Lawrence Williams has spent 25 years in IT management, and he currently holds the title that many of his colleagues in the profession aspire to: chief information officer. He has worked his way up the ladder, but he will be the first to admit that he didn't get this far on his own: He had mentors who helped to inspire, motivate and drive him along the way. For example, as a project manager in Chicago early in his career, he looked up to the CTO of the Chicago Board of Trade, who inspired him to further his education.

"I saw that my mentor had an MBA and a Ph.D. in computer science. I looked at what he'd accomplished and started to 'roadmap' how to get to that place, and that meant pursuing my own MBA and a Ph.D.," says Williams, who's now CIO at Simmons College of Kentucky.

He went on to earn a Ph.D. in information technology and an MBA in project management, both from Capella University, but he says some of the most

Chief Information Officer

ROLES	CIO
MINIMUM EDUCATION	Bachelor's degree, master's degree, MBA and/or Ph.D.
RELEVANT AREAS OF STUDY	Communications, analytics, statistics, sales, economics, marketing, computer science, programming, software development
TECHNOLOGY SKILLS	Software development, project management, business, strategic analysis, software engineering
POTENTIAL EMPLOYERS	Organizations of all sizes in fields like healthcare, government, education, consumer products, software and technology
SALARY	National median pay **$151,331**

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important skills he brings to the job of CIO have nothing to do with hard technology — and that's something other would-be CIOs should keep in mind.

To be successful, a CIO needs to be able to align an organization's IT needs with its business needs, says Jennifer Selden, regional recruiting director at Randstad Technologies. They also must be excellent communicators, relationship-builders and business leaders with strong organizational skills.

> **"[CIOs need] executive presence, confidence and a strategic mindset. They must also serve as educators."**
>
> – **JENNIFER SELDEN**, REGIONAL RECRUITING DIRECTOR, RANDSTAD TECHNOLOGIES

An eye for trends

"The things I learned from my Ph.D. that have been most important, I think, are critical thinking, in-depth organizational analysis and being able to develop really solid future-proof IT strategies that are in line with where technology is going," Williams says. At Simmons, for example, he proposed investing in SmarTV technology for classrooms to facilitate streaming video and interactive learning instead of pursuing a more conventional, but more costly and time-intensive, infrastructure buildup.

"The internet of things is allowing us access to bandwidth and devices that can deliver the same type of technology and experience within the constraints of what we already have," Williams says. "So I'm in the process of contacting our ISP to ensure we have the bandwidth; that's part of using new technology aligned with business constraints and our strategic initiatives."

'Executive presence'

These days, many CIOs sit on their employers' executive boards, and therefore they need "executive presence, confidence and a strategic mindset," says Selden, adding that "they must also serve as educators, providing guidance on the business value and the risks technology systems can bring to an organization."

One attribute that's especially important to a CIO is emotional intelligence, says Kate Bezrukova, an associate professor of organization and human resources at the University at Buffalo School of Management. "You need to be really good at leadership and negotiation, especially with people who are different from you," she says. "You have to be able to create a great environment and maintain great relationships with your peers, your direct reports and your superiors without stepping on toes or hurting people's feelings and at the same time be able to influence people."

Bezrukova adds that leadership skills, emotional intelligence and the ability to influence others don't always come naturally, which is why many people who want to become CIOs find it helpful to earn MBAs or executive MBAs. She says the University at Buffalo's MBA program aims to hone those skills in stu-

dents with a curriculum that includes courses in organizational behavior, business strategy and organizational psychology, along with courses in marketing, sales, technology skills and general business strategy.

Empathy is key

Williams says he always thought he understood the importance of empathy and emotional intelligence in a C-level role, but it was brought home to him by an exchange he had with a supervisor shortly after his father passed away. "I was teaching at a university; it was the end of the semester and the academic year, and I was supposed to be finishing up grading," he recalls. "Of course, my father had died, and I was trying to cope with that and juggle all the academic and professional responsibilities. So I emailed my students, my peers and my supervisors and explained the situation and asked for a little more time to handle everything. One particular person replied, 'Keep your chin up. So, when exactly can I expect those grades?' and I was floored — shocked at the lack of empathy and the lack of any kind of support or offer to help. I realized then that was not the kind of leader I wanted to be."

Williams says he takes the opposite of a cold, efficient, "win at all costs" approach in leadership roles, and he believes his teams respect him more and are more productive because of it.

"What you have to understand is that people work so that they can live — they are doing this work to support themselves and their families, and they have lives outside of the job. You shouldn't live to work; it's not healthy," he says. "If there's a challenge, personal or professional, I want to know about it so we can fix it."

"I looked at what [my mentor had] accomplished and started to 'roadmap' how to get to that place, and that meant pursuing my own MBA and a Ph.D."

– **LAWRENCE WILLIAMS**, CIO, SIMMONS COLLEGE OF KENTUCKY

A unique combination

The combination of technical expertise, leadership and management abilities, and an aptitude for communication, relationship-building and other soft skills along with years of proven experience is difficult to find. That's why CIOs are in high demand, and why the CIO job market will always be strong, says Selden.

Williams advises IT professionals who aspire to become CIOs to seek out relationships with mentors — plural. He has had many over the years, including mentors who help him keep his technical skills sharp, mentors who help him maintain his soft skills and others who help him plan for the next stages of his career.

"It takes a village to 'raise' an executive," Williams says. "Don't feel like you can only have one mentor; find and cultivate as many relationships as you need, from all walks of life and from as many different perspectives as you can find." ♦

Sharon Florentine is a senior writer at CIO.com.