Q3/Q4 2018

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Special Report

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The future of technology holds great promise, but government needs to get past some pitfalls first.

A Research Report from the Center for Digital Government

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Representing Chief Information Officers of the States

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The Promise of Emerging Te

Intelligence for CIOs

In 2014, the U.S. Coast Guard received repeated distress calls that turned out to be hoaxes. Officials had little to go on and couldn't find the caller's location because the calls were too brief. But when the Coast Guard turned over a snippet of the recorded conversation to a researcher at Carnegie Mellon University, they started to get some information. Rita Singh is a scientist who specializes in voice recognition and has been using artificial intelligence to help identify people from their voices.

The technology Singh used can analyze a voice and help make predictions about a person's physical features, their socio-economic background, even their mental and physical health. In fact, the accuracy of the prediction is so good, the technique has been dubbed a "voice fingerprint." The information about the person behind the voice gave the Coast Guard an accurate profile of the hoaxer and allowed them to identify a suspect.

The combination of AI and voice recognition could prove to be a valuable crime-fighting tool for law enforcement. AI is already helping cops in the San Diego County Sheriff's Department get crucial information while they are in their cruisers. A voice-activated assistant allows officers to pull information, such as criminal backgrounds, from back-end databases in real time.

Identity management, one of the more challenging IT problems in state and local government, could get some help from an unlikely source: blockchain, the system of trust originally developed for cryptocurrencies, but now considered a potentially versatile platform for government. It could be used to trace

The 2018 Public CIO Future of Technology Report

will provide a look at key technology trends, giving CIOs the intelligence they need to strategically plan their operations and investments for the coming year, while providing some insight into technology expectations in the years ahead. By learning about these technologies and the challenges governments face in implementing them, CIOs will be in a position to do a number of important things. First, they can educate government executives, elected leaders and agency heads about the potential impact of new technologies on policies and programs. Next, they can begin to map which technologies to focus on, and figure out what changes they might bring without putting their more stable production systems at risk. Last, they can plan for how these technologies could introduce broader changes going forward.

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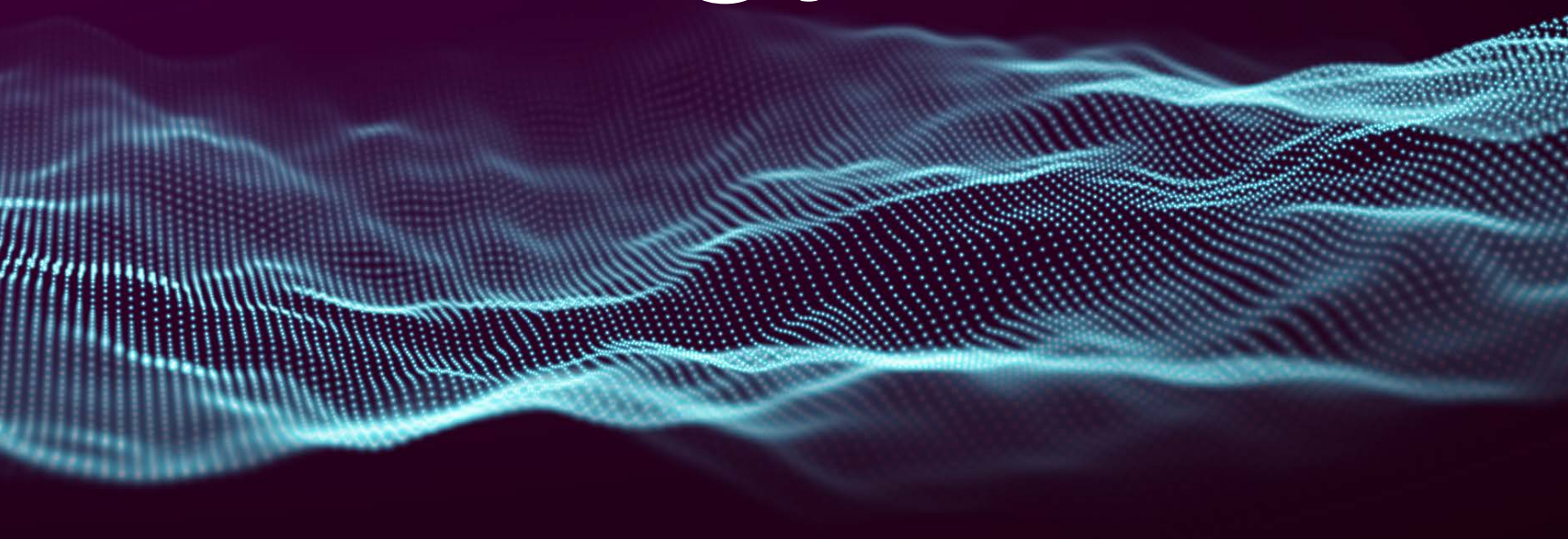

digital assets and identities more conveniently. Overhead, states are using unmanned aerial drones to carry out a wide variety of tasks, from inspecting remote facilities, such as pipelines, to analyzing crop yields, monitoring forest fires and helping with public safety. The Internet of Things continues to be refined for use in the public sector, and with the growth in edge computing, the power of IoT, whether to monitor the environment, improve transportation or foster widespread use of autonomous vehicles, will only get stronger.

It is an amazing time for emerging technologies as the world's economy embraces the latest digital innovations and puts them to use. Market forecasts reflect just how robust new technologies have become. Artificial intelligence is projected to have a $1.2 trillion market value by 2020 and investments are expected to triple by then, according to Forrester Research. By 2023, companies and organizations will be spending nearly $20 billion on blockchain technology, according to ResearchAndMarkets.com. Global spending on IoT varies according to different forecasts, but overall investments are now in the trillions of dollars. Other new tech areas, such as robotics and augmented reality, are growing steadily.

Just as new technologies are changing the way companies do business, they have the potential to disrupt old business models in the public sector as well. Knowing what those technologies are and anticipating their disruption, while taking advantage of the opportunities they offer, is important to public-sector chief information officers and the organizations they serve.

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Key Emerging Technologies and Their Potential

In Johns Creek, Ga., population 84,000, the city has just launched an AI-driven citizen service application that can handle hundreds of questions pertaining to a range of popular issues, including zoning and city finances. Two factors make this project interesting. First, the data behind the virtual assistant comes from the city's open data portal, making it perhaps the first city in the country to have its AI chatbot powered by open data. Second, the city's modest size is indicative of how democratic AI technology has become in a few short years.

Artificial Intelligence

Not so long ago, new technologies were often the exclusive domain of large jurisdictions with similar-sized IT budgets. Consider how long it took 311 and ERP to become affordable for smaller municipalities and counties. But AI applications for government, while still relatively new, are already affordable for modest-sized governments. "AI chatbots are relatively easy to do, not expensive to design and can handle the main sorts of questions that the public requests," said Professor Shannon Tufts of the University of North Carolina School of Government and director of the Center for Public Technology. "Local governments are building chatbot interfaces that can answer a range of questions, such as dates and times for garbage pickup, that sort of thing."

Interest in AI at the state and local level is growing, but enthusiasm for the technology remains modest. In a 2017 survey of state and local public officials, the Center for Digital Government found that less than 30 percent of respondents had a high or very high interest in implementing AI (the Center for Digital Government is part of e.Republic, *Government Technology's* parent company). Less than 16 percent had implemented an AI technology or related process. Compare that number to a rate of 50 percent among top performers in other industries, according to Gartner.

Currently, the AI applications found in state and local government tend to be simple in nature, often involving a virtual assistant that can answer general questions around a specific project. Starting with a basic application is the best way to begin, recommends Dave Fletcher, chief technology officer of Utah, which launched its first AI chatbot to provide information about fishing hot spots in the state. Once the service went online, it generated interest among other state agencies. "Since then, we've done quite a few things with Alexa and Google Assistant, and most are relatively simple and rely on voice recognition," he said.

AI operates on lots of computing power and lots of data. A third factor driving AI is the fact that vendors are making technology like virtual assistants readily available. "Tech vendors are embedding AI into everything," said Fletcher. "It starts with the basics, and as we get better data, we have tremendous opportunities."

While much of AI in government appears to be cropping up in the kinds of chatbots that have gained attention in the media, experts say the real impact of AI will be in less obvious solutions, such as law enforcement, public benefits, human services and Medicaid, "just about anywhere you are, you are already collecting lots of data," said Steve Nichols, Georgia's chief technology officer, in September during a Public CIO Summit in Jackson, Wyo. "Suppliers are going to bring better tools and will sell them to lines of business in government. We're at a tipping point where

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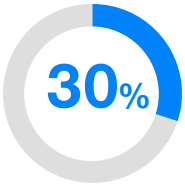
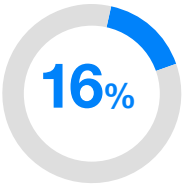
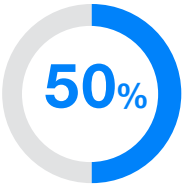
Catching Up



Less than 30 percent of state and local officials report "high" or "very high" interest in implementing artificial intelligence technologies.



Less than 16 percent of state and local officials have implemented AI.



About half of top-performing companies outside of government, according to Gartner, are using AI.

interesting things are happening, now that we have more compute power and data to make AI applications."

The virtual assistants that Utah now uses extensively are proving to be so capable that some cities are viewing the technology as a less complicated and less expensive alternative to 311, which can require dozens of human agents to handle phone queries. Portland, Ore., is one city without the call center service and is considering virtual assistants as a way to move in that direction, according to Dan Bauer, Portland's deputy CTO. So too is Johns Creek, Ga., according to Nick O'Day, the city's chief data officer. With nearly all of the city's data available in an open data format, creating a 311 system powered by AI using voice recognition is a logical — and easy — next step, he said.

For the few jurisdictions that have done more than just sample how AI works with some basic applications, the next stage is to go deeper. Utah uses AI to run analyses to find out what its citizens like and don't like about the state's online services. The state's public safety agencies are running intelligent image recognition applications, for example. Other agencies are using AI and analytics to deal with fraud detection.

Fletcher pointed out that for the areas of IT he is in charge of — the state's enterprise architecture, emerging tech and digital services — the heavy lifting is being done by the tech firms. "We are just utilizing their services," he said. What CTOs like Fletcher have to do is identify the data that can be used for AI and make sure the data streams are available. "The goal is to make the answers to questions citizens have available in real time and to contribute to a more personalized digital government offering."

What does concern public officials about AI is how it makes decisions. While this may not seem like an issue with a virtual assistant that is answering basic service questions, it does matter when those answers involve policy or complex issues, such as eligibility or sentencing guidelines, or risk factors in child welfare cases. These are just some areas where more sophisticated AI has been used and where officials have to trust that the decisions are good.

"It's really a big factor to have trust and transparency around these tools," said Jackie Speedy, associate dean for the School of Public Policy and Management at Carnegie Mellon University's Heinz College of Information Systems and Public Policy. "Government requires a better understanding around ethics and bias screening. These have to be taken into account when civic technologists build these technologies."

These so-called "black box" issues could hold back government from pursuing more ambitious AI projects. Nichols pointed out that decisions made by AI may change on a monthly basis. "But we might not understand why those decisions changed," he said. "And we have data quality problems. How does that affect decisions [made by AI]? Do we have the governance to decide whether it is a good or bad thing?"

Government is not alone on this issue. Concerns about transparency and ethics in AI are mounting in the private sector as well, and that has led cloud service companies to unveil new tools that explain the decision-making behind their AI software, according to *The Wall Street Journal*.

Carnegie Mellon also wants to help demystify how AI works in government in order to build trust and raise the comfort level with the technology, said Speedy. "We now have a public policy program that specializes in training future civic technologists to understand the technology, such as data analytics and the public sector," she said.

"The goal is to make the answers to questions citizens have available in real time and to contribute to a more personalized digital government offering."

Dave Fletcher, CTO, Utah

Taking the Right Cloud Journey for You

Cloud isn't one size fits all for governments. State and local agencies often have distinct budgets, needs and workforces. Solutions that work for some organizations may fail for others. And although the benefits are often similar, not every cloud journey is the same. Some agencies are fully embracing cloud, while others are deploying it alongside on-premises technology.

"Cloud allows agencies to focus on the services that they're delivering rather than the technologies that they're using," says David Smith, national director of state and local government sales at Citrix Public Sector.

However, adopting cloud isn't always easy. "Challenges come when deciding what cloud to use, what applications will or won't live on it, the security of data and where it will be stored," Smith says.

Citrix — a leading cloud provider — leverages cloud's versatility to help its government clients modernize at their own pace and adopt the model that's right for them. This includes taking a hybrid approach, which allows agencies that lack the funding and labor to fully adopt cloud to save energy, time and money by mixing it with existing infrastructures.

Cloud's fluidity and scalability means that agencies can add and subtract applications based on their needs. This lets organizations refine the scope of their tools based on the demands that they're facing. Government IT employees have ultimate control over how they deliver services, which gives them more choices.

Citrix solutions provide government leaders with a single, secure platform to manage their cloud capabilities. This shrinks IT infrastructure costs while protecting data and sculpting cloud services and solutions to meet organizational needs.

"Our biggest differentiator from other cloud platforms is we can provide a common workspace experience for the end user regardless of where their applications and data live," Smith says. "This experience can extend across all types of devices and networks while providing a common management platform to maintain policies across both cloud and on-premises applications."

Citrix also gives government leaders confidence their data is secure with solutions that comply with cybersecurity standards relevant to each level of government and by deploying behavior analytics to mitigate threats and quickly respond to breaches.

"Government organizations have more personal information about us than any other organization," says Smith. "These organizations are always under attack and need to be able to adapt to a changing security landscape."

Citrix envisions the Workspace of the Future where every military, federal, and state & local government employee has a personal, secure digital workspace hosted in government-grade cloud(s) where they would self-provision the apps, data and IT resources necessary to accomplish their role in the mission. Choice. Experience. Security.

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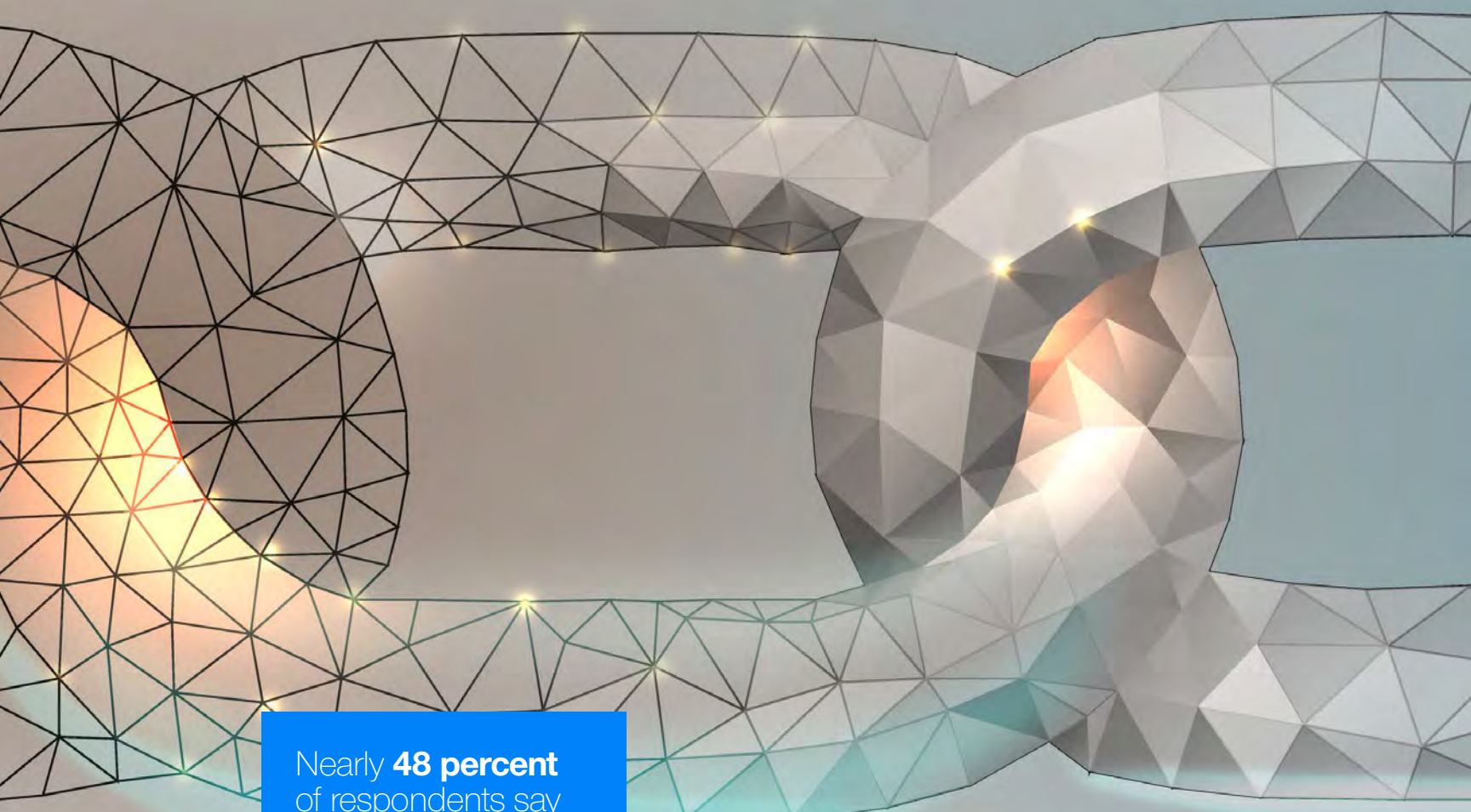
Blockchain



Nearly **48 percent** of respondents say lack of knowledge about blockchain is holding back adoption.

SOURCE: CENTER FOR DIGITAL GOVERNMENT

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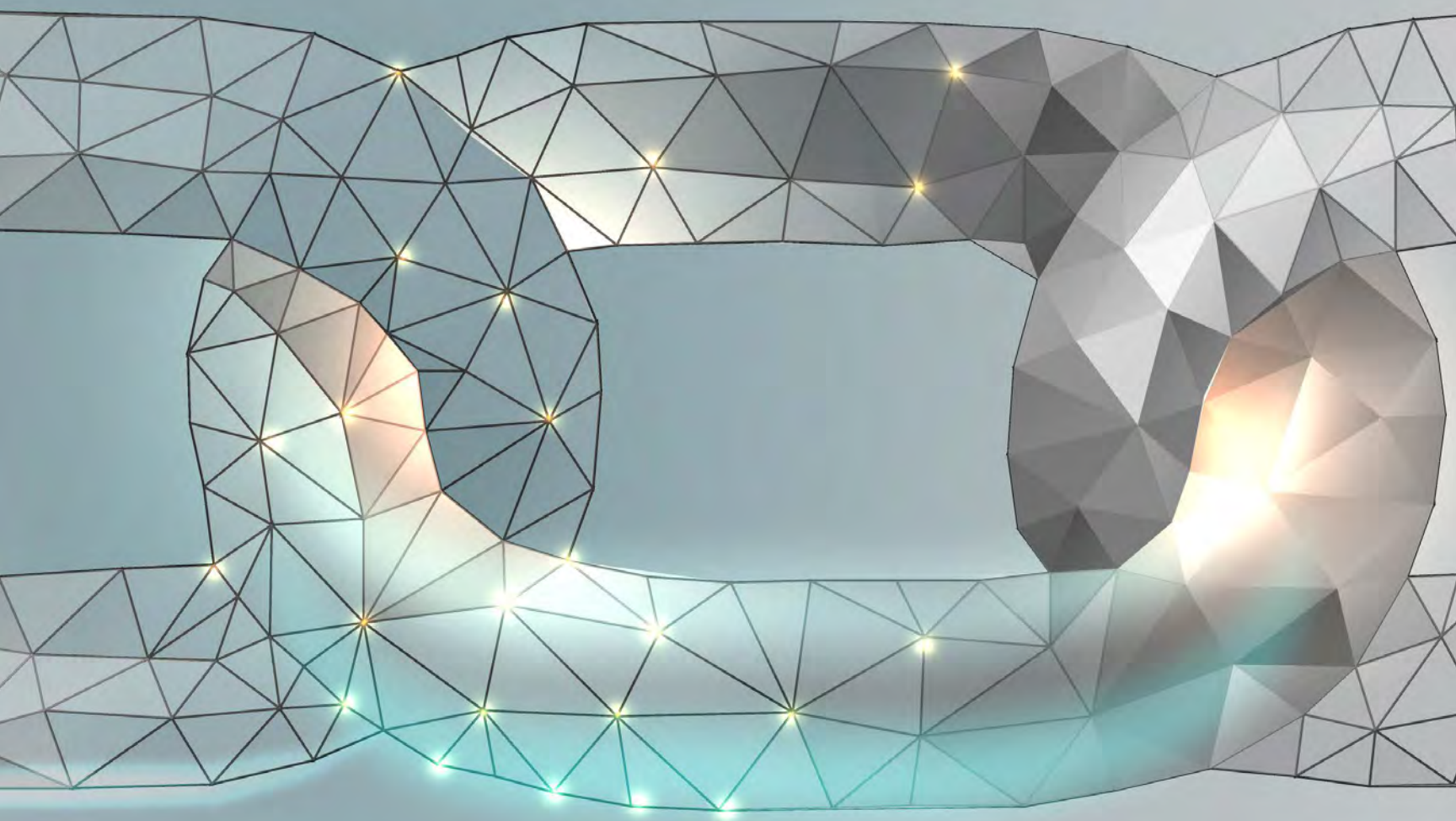
The AI industry is already a trillion-dollar market, one that government is slowly moving toward. Another emerging technology is far smaller in market size, but generates perhaps as much government interest as AI. Blockchain has gained traction thanks to its unique aspect as a decentralized ledger account that provides transparency using time stamps that can securely record transactions between two parties without the need for third-party authorization.

CIOs are looking to see which of government's more common databases can be improved by blockchain to make them simpler to operate, more secure and less costly. Possible uses range from motor vehicle and land record registry transactions to authenticating professional licenses and managing birth and death certificates. Some have even suggested that blockchain could make voting more secure. Already, West Virginia has begun testing whether the technology could work as a way for overseas military voters to cast ballots in state and federal elections.

Most intriguing is the idea that blockchain could give a lift to one of government's more intractable issues: identity management. For some time, state and local governments have lacked a method for establishing user identification. Without a workable system, efforts to increase data sharing between agencies, as well as to take the friction out of online customer services, continue to be stymied. Most government CIOs and CTOs agree it's



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a multilayered problem with no easy fix. A few states — Pennsylvania, Michigan and Utah, for example — have been attacking the problem in different ways.

Utah is beginning to explore how blockchain might solve the identity management riddle. Working with the nonprofit firm Sovrin, the state is exploring how it might build an identity infrastructure for citizens using blockchain, which would provide the platform for multiple identity verifiers, a must for any identity management system. As Fletcher explains, the identity verifiers — a driver's license or vital records database — would be nodes on a blockchain. "Users would have control of their identification and would just refer those who need to validate their identity to the verifiers in the blockchain," he said.

While the concept makes sense, turning it into reality is another matter. "The issue around blockchain is that it requires quite a bit of collaboration and cooperation," said Fletcher. "I don't think it has happened to the degree it would need to, in order to make it viable. It's a chicken-and-egg technology, where the technology has been around for a while, but will require larger adoption before it's accepted."

> "[Blockchain] is a chicken-and-egg technology, where the technology has been around for a while, but will require larger adoption before it's accepted."
>
> *Dave Fletcher, CTO, Utah*

CDG's survey bears out Fletcher's point that government needs greater education on how blockchain works and how it can help before use of it will grow. More than 50 percent of the respondents said they were somewhat or very unfamiliar with the concept of blockchain, while nearly 55 percent said they did not know if there was a level of interest in using blockchain within their agency or department. And more than 90 percent said there were no plans to use blockchain, or they did not know of any plans to use the technology. Finally, nearly 48 percent of respondents said lack of knowledge about blockchain was holding back adoption.

BETTER VISIBILITY AND CONTROL FOR EXPENSES

Reporting and processing expenses all too often requires inefficient, cumbersome, confusing effort. Employees struggle to complete expense reports correctly and track paper invoices and receipts. Approvers can't readily determine expenses align with agency policy. And finance staff can't easily obtain spend data that allows for better monitoring, vendor negotiation and budget planning.

These limitations are particularly true for paper-based processes, but they also exist in older expense-processing software.

A better approach is offered by the cloud-based SAP Concur solutions. Concur Expense, Concur Invoice and Concur Detect by AppZen streamline tasks for employees and approvers and increase transparency, compliance and control for the agency.

SIMPLIFY EXPENSE REPORTING

Concur Expense integrates employee expense data into a single online system for simpler processing and management. Data flows automatically into Concur Expense from credit cards, select suppliers and receipt photos captured by a mobile app. Employees save time by creating and submitting accurate, in-policy expense reports from their smartphones. Managers can review and approve expense reports anywhere, anytime by using the Concur mobile app.

AUTOMATE INVOICE PROCESSING

Concur Invoice offers a single system to approve purchase requests, capture invoices, and automate approval routing and payments. A single dashboard helps the agency better monitor and manage invoices for employee-initiated expenditures.

IMPROVE EXPENSE TRANSPARENCY AND COMPLIANCE

SAP Concur solutions support expense transparency and policy enforcement end-to-end. Employees always know the status of each expense report and approvers know when submitted reports need review. Agency policies can be built into SAP Concur for automatic enforcement when employees submit expense reports and invoices — improving compliance. Utilizing the latest in artificial intelligence (AI) and machine learning, SAP Concur solutions can audit expense reports automatically, reducing expense reporting errors and the potential for fraud, waste and abuse by 66 percent.

Concur Expense also provides visibility into total spending, helping agency managers monitor budgets more effectively and forecast more accurately. Detailed data on spend levels, such as by location or vendor, helps the agency negotiate rates and identify needed policy changes.

MODERNIZE EXPENSE REPORTING AND PROCESSING

Expense reporting, processing and tracking no longer need to involve paperwork, manual activity and limited reports. SAP Concur solutions in the cloud help governments improve expense processing and budget control, while increasing transparency and policy compliance.

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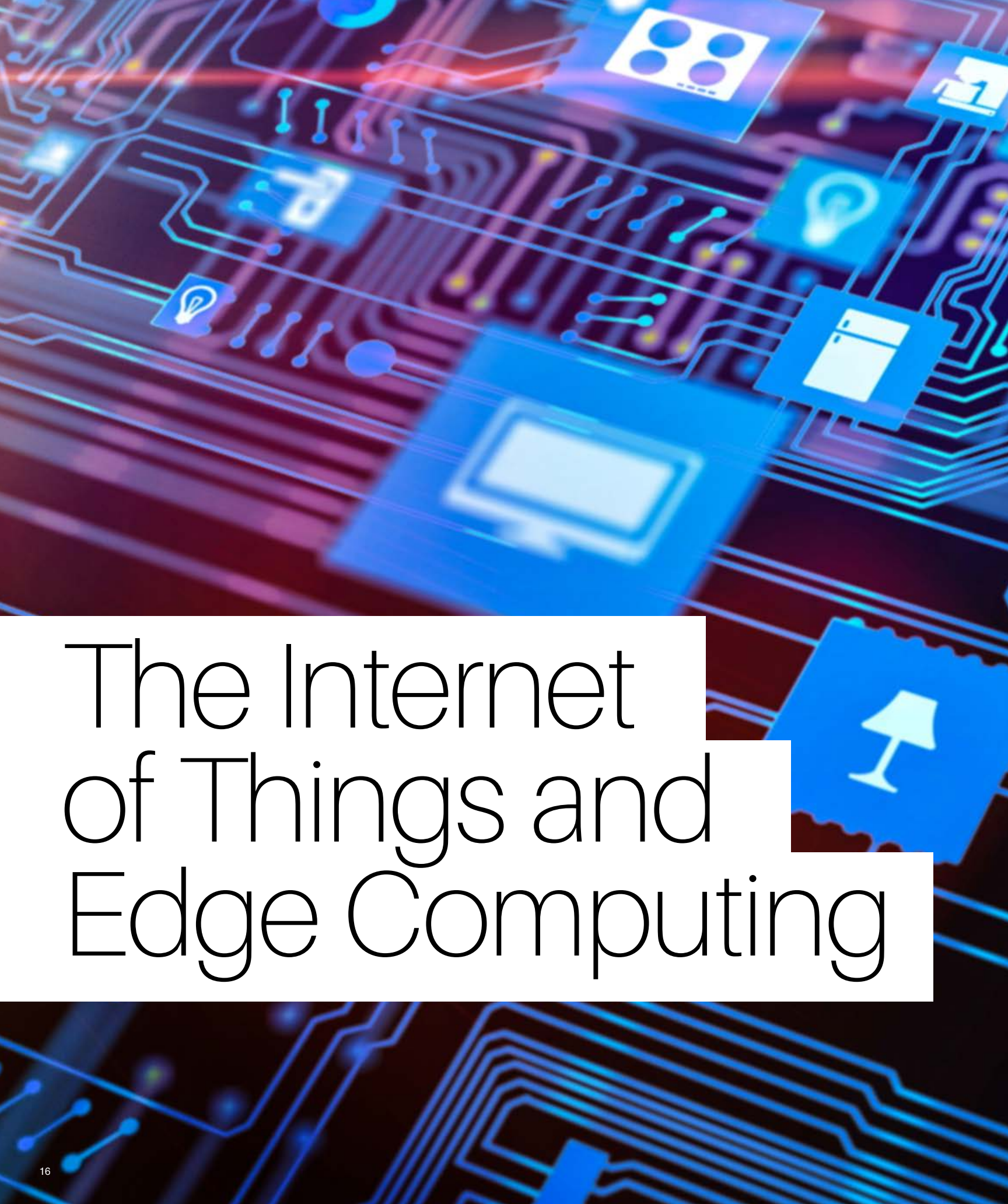
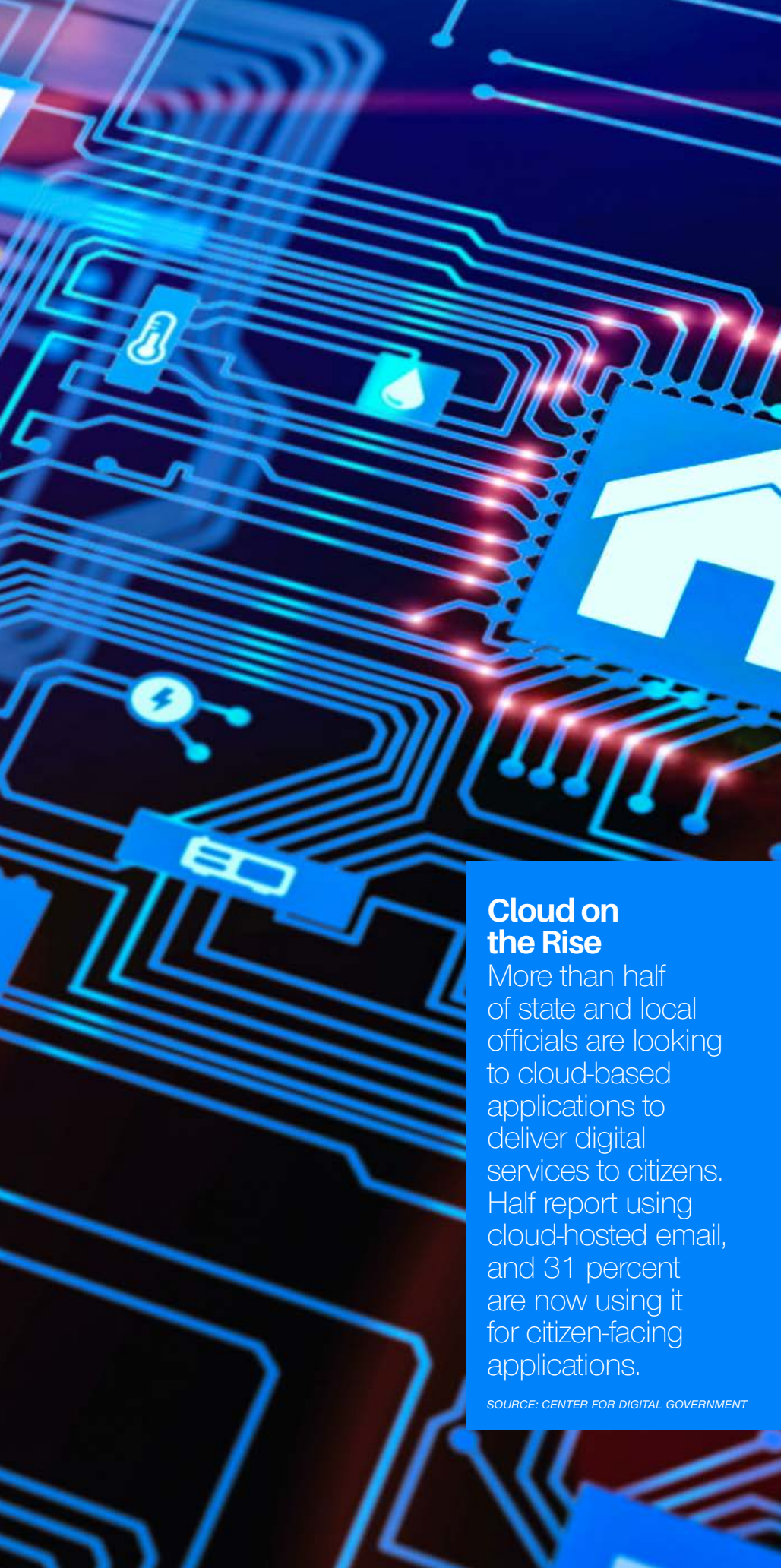


The Internet of Things and Edge Computing



Cloud on the Rise

More than half of state and local officials are looking to cloud-based applications to deliver digital services to citizens. Half report using cloud-hosted email, and 31 percent are now using it for citizen-facing applications.

SOURCE: CENTER FOR DIGITAL GOVERNMENT

In Detroit, a specific crime wave had broken out at the city's gas stations and convenience stores: carjackings. To halt the problem, the Detroit Police Department partnered in 2016 with eight gas stations to install real-time camera connections with the Police Department. Dubbed "Project Green Light" the unique, public-private community partnership has brought safety to the neighborhoods near the stations while promoting the revitalization of the local businesses.

Today, more than 300 businesses are participating in the project. Other types of advanced technology that provide public safety, such as facial recognition tools, are used by the city to fight crime at the edge of the city's network. Detroit is also partnering with a nonprofit to set up a mesh network with sensors that can measure air quality.

Louisville, Ky., also has an air quality problem. With some of the dirtiest air in the country, the city knows it must do something, but it is not easy to pin down when and where the quality is bad, particularly for the city's asthma sufferers, who tend to live in the poorest sections of the city where the air quality is the worst. But a partnership between a medical device company, the city and other organizations hopes to generate more accurate and timely data with use of GPS-enabled inhalers that can generate a burst of data about the time the inhaler is used, the location, the weather at the time and the kind of pollutants in the air.

The wireless inhalers are able to alert users when the air is especially bad and they should stay indoors, and it gives the city useful data about the pollutant triggers in specific neighborhoods.

These are just a handful of examples of the Internet of Things. Most people think of talking refrigerators, home alarm systems and

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the millions of commercially sold virtual assistants now in homes. But IoT is a powerful new technology for state and local government. Besides public safety and air quality, IoT applications can be found in just about every sector of government, including public works (smart garbage bins), digital services (kiosks are back), parking management (smart meters) and virtually all aspects of transportation, from road congestion monitoring to smart buses that can count passengers and manage traffic signals to speed up route travel.

Clark Giles, CTO of Indianapolis and Marion County, cites IoT as one of the key emerging technologies where the city sees an investment opportunity. "We are using it especially in regards to law enforcement and public safety, and we have a project that is similar to Detroit's Project Green Light," he said. The city's other big IoT project involves kiosks that can deliver digital services to citizens who don't want to come downtown to City Hall. "We are trying to look at services that require a visit to the city-county building to see if they can be done online using a kiosk. We don't want people to be bound by space and time limitations," he said.

IoT, including the broad field of smart city projects, has gained traction in large part because of cloud computing. The vast amounts of data captured by cameras, sensors and other devices can now be swept up and stored in the cloud where it can be processed or analyzed, depending on the application. Earlier this year, the Center for Digital Government surveyed state and local officials on what solutions their agencies plan to procure for digital services, and just under 53 percent of respondents said cloud-based applications. And while most public officials (49 percent) listed email as already in the cloud, 31 percent have implemented cloud-based, citizen-facing applications.

> "Cities are not data ATMs for companies. Do citizens understand what they give up when they use an e-scooter with an app?"
>
> *Beth Niblock, CIO, Detroit*

As many jurisdictions wrap their heads around IoT in general, new trends are introducing a more robust version of IoT known as edge computing. Rather than send sensor and other types of remote data, such as video images, to the cloud where it can then be processed, edge allows the analysis to take place at the node where it is located and then sends to analysts only the information that is important. "What's happening now is that we are tracking everything, where people live, how they move through a city and so on. It's very noisy," said Carnegie Mellon's Speedy. "But edge computing cuts through the noise and allows us to find the information we are looking for."

Dave Fletcher called edge computing a "natural evolution" of IoT as it grows and drives up the need for more processing to take place at the edge for real-time response. Until edge computing becomes mature, the state is working on a contracting vehicle that will provide a lower-cost wireless option for IoT devices. "Those devices have to have a way to get their data back to the servers for processing. Wireless makes a lot of sense, but the expense of traditional mobile networks is too high for some IoT applications," he said.

But as states and localities expand their use of IoT, they are running into unforeseen problems that raise the need for better management practices and clear policies on how these devices will operate and what kind of data they will collect. Some cities have begun to inventory the number of IoT projects they have and are surprised by the number already in operation. Without proper management, costs for IoT could escalate. Utah's effort to create a contract vehicle for low-cost mobile service to handle IoT highlights the need to control costs with this new technology.

Then there is the data itself. Private companies have become adept at introducing IoT-related services that appear to be useful for citizens, but at what cost to privacy? some ask. Without data governance, a new service, such as e-scooters, could end up scooping up sensitive data about citizens that they might not realize they are handing over.

"Cities are not data ATMs for companies," said Beth Niblock, CIO of Detroit. Niblock said citizens have long had a rocky relationship with the city when it comes to trust. A poorly managed IoT project involving a third party could do irreparable harm to the trust that city is trying to build. "Do citizens understand what they give up when they use an e-scooter with an app?" she asked at this year's Public CIO Summit. "How do you drive data governance and policy around city objectives, principles, values, enforcement and organizational management? What about consent and data retention rules?"

LENOVO'S 360° APPROACH TO SECURITY

The risk of cyberattacks and the cost of breaches are increasing. According to a 2016 International City/County Management Association nationwide survey of local government cybersecurity, nearly half — 44 percent — of all respondents said they experience cyberattacks at least daily.

Lenovo believes a 360° approach to security is essential. Our philosophy includes a secure approach at all points of the manufacturing and delivery processes, including:

DEVELOPMENT - Development begins with security. Security is always the primary focus as products are conceived, built, designed and tested.

SUPPLIER MANAGEMENT AND CONTROL - Lenovo has enhanced our supplier relationships through a Trusted Supplier Program. The goal of the program is management of customer risk through the implementation of a documented and auditable supply chain security program. Lenovo's work to ensure the security of its products and supply chain has been recognized by Chain Security LLC, one of the leading security firms in the United States.

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SECURE MANUFACTURING - Strong practices and controls manage the security of personnel and physical plants. Major components and subassemblies are tracked electronically, and final products are inspected and tested to confirm they meet security, reliability and functionality requirements.

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Drones and Wearables

The concept of IoT and edge computing extends in many directions for government. Expanding research and development around autonomous vehicles is strongly predicated on the idea of the vehicle as a robot that will rely on edge computing to navigate through our streets without a driver. But AVs remain years away from broad use (many years away, according to some skeptics). Another new robotic device that is already readily available and involved in numerous government applications is the unmanned aerial vehicle or drone.

The market is certainly growing rapidly. By 2021, drone sales are expected to surpass $12 billion, according to Business Insider, up from $8.5 billion in 2016. How much drone activity is taking place within state and local government is unclear, but when *Government Technology* took a look at a program run by the Federal Aviation Administration, it found strong interest and activity across the country, but especially in Huntsville, Ala.; the Washington, D.C.-Northern Virginia area; Denver; and the state of Montana.

Government is acting as both a facilitator for drone applications — New York state just created a $5 million grant to support the state's fledgling drone industry — and as a consumer of drones. Law enforcement agencies have been especially interested in using the technology for surveillance and as a crime-fighting tool. Louisville, Ky., has run a pilot project to find out if drones could be sent as a first response to its ShotSpotter alert system. Other governments, especially at the state level, are using drones for facilities management in remote locations, firefighting surveillance, utility inspections and for agricultural uses.

Concerns about drones focus mainly on security and public safety. Like other types of technology, bad actors will continue to test the cybersecurity of drones and look for ways to hack into the aerial robots, say experts. Most drone users only have a radio transmission connection to their drones, which means there's no connection to the cyberworld. But drones that do connect to the Internet could be hacked. To mitigate the problem, governments will have to view the security of drones as they do any kind of edge computing system, and then develop proper security measures for any IoT network that involves wireless devices.

Drone sales are expected to surpass **$12B** by **2021**

SOURCE: BUSINESS INSIDER

In 2003, the virtual reality game known as Second Life was launched. Unlike other types of role-playing games, it had no built-in conflict. In fact, it had no objective. But people and organizations — including government — found it fascinating. By 2013, Second Life had 1 million regular users, according to Wikipedia. The strange 3-D world filled with avatars soon became a testing ground for trying out new, complex ideas, as well as a recruiting tool in some instances.

Today, few people talk about Second Life, and the game's virtual reality world seems a bit antiquated, but it demonstrated how technology could be used outside the typical confines of business operations. Now, virtual reality has moved from the computer screen to the heads-up display. Even more intriguing is augmented reality, which doesn't replace reality, but overlays it with information and visual elements. Some governments have experimented with augmented reality by overlaying digital information or signs on their real-world parks, statues or bridges, when viewed on a smartphone. Departments of tourism have begun to develop applications that give visitors a richer level of information about historic buildings and locations. The medical field has been exploring how augmented reality m ight improve health care. Firefighters believe the

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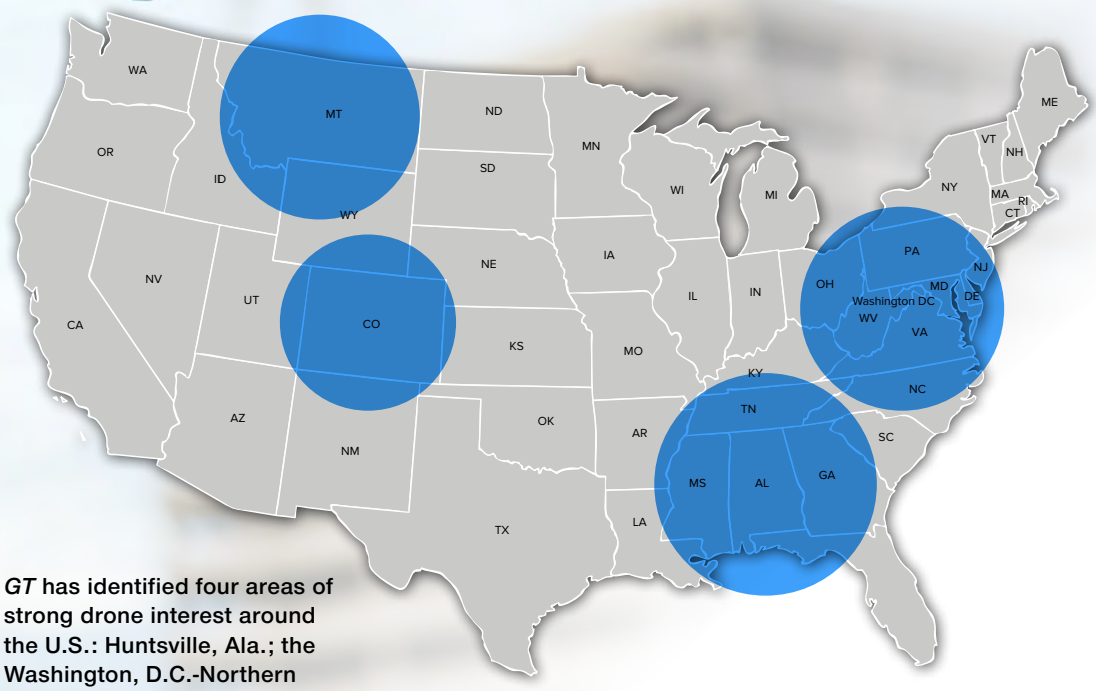
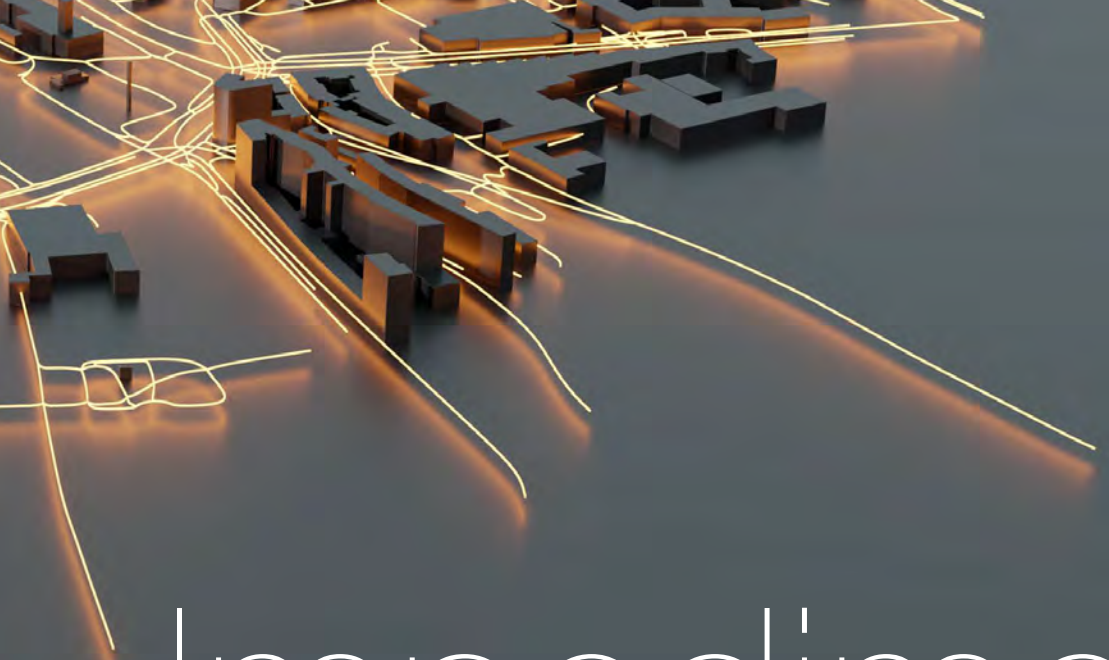
technology could help them better understand dangerous environments during a fire. Transit agencies have experimented with AR tools that can be used by mechanics who have to fix broken complex hardware, such as trains or buses, in the field.

More aptly, public education has turned to AR to teach children in ways that break from traditional learning. One AR teaching tool allows students to point a phone at a picture in the book and it comes alive so that the dinosaur in the picture growls or, in the case of the Anatomy 4D app, lets students study a picture of a heart while it's pumping. While still considered experimental, the possibilities for AR are growing at a rapid clip.



***GT* has identified four areas of strong drone interest around the U.S.: Huntsville, Ala.; the Washington, D.C.-Northern Virginia area; Denver; and the state of Montana.**



Impediments to New Tech Adoption

Culture, workforce and security

For years, state and local governments have been stuck with the dilemma of how to embrace new technology without disrupting the IT systems that maintain so much of government's critical operations. Government by design is meant to be stable in the face of sweeping changes that can ripple through modern society. But that stability can become a liability, especially when technology shifts rapidly, as it has done with cloud computing and now with big data, analytics and artificial intelligence. "The consequences of not maintaining an IT strategy that embraces the new while evolving the legacy environment can be significant," Rick Howard, vice president of research at Gartner, told *Government Technology* in 2016.

State and local governments have a duty to be good stewards of taxpayer dollars, said Shannon Tufts. "They can't be on the leading edge with technology." But she is quick to point out that too many governments view IT as a cost control issue, which means they "don't spend enough securing and upgrading their IT environment to run some of these new systems."

That attitude cuts into a government's ability to invest in the future. "Technology is not a cost issue, but a value-add proposition," said Tufts. "When you invest in technology — and the data bears this out — once you reach the right threshold in terms of investment, you will have leaps and bounds in ROI."

Yet few governments are able to change the traditional mindset to view technology as a line-item cost that needs to be controlled and recognize that IT is now a central part of the business of government. Investing in new technology, in a judicious way, is a strategy, not a problem, according to Tufts. "It's not about nickel and diming every commodity item being bought."

Complicating the situation is that governments have held back on investments in upgrades to their core

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systems for so long that overhauling them so they can work with new technologies has become a task that could prove extremely disruptive, not to mention expensive. “Many public officials would push to go to the next level of technology for the citizens,” said Tufts. “But now you are talking about massively changing the way that government as a business operates. You are talking about people who have been in their jobs for a long time, and are good at what they do, but are not accustomed to the introduction of a massive amount of change.”

Reskilling these workers to handle new technologies is a major challenge, according to CMU’s Jackie Speedy, who points out that career civil servants tend to be the least familiar with new technologies. “One of the problems is getting them to trust the new technologies when it comes to doing their job.” Speedy cited a challenge at the Allegheny County, Pa., Department of Human Services, which has been using an algorithm to assess risk for child abuse. The workers who were asked to use the predictive tool were being told to ignore their own knowledge and experience and to trust in a new technology, which few of them understood.

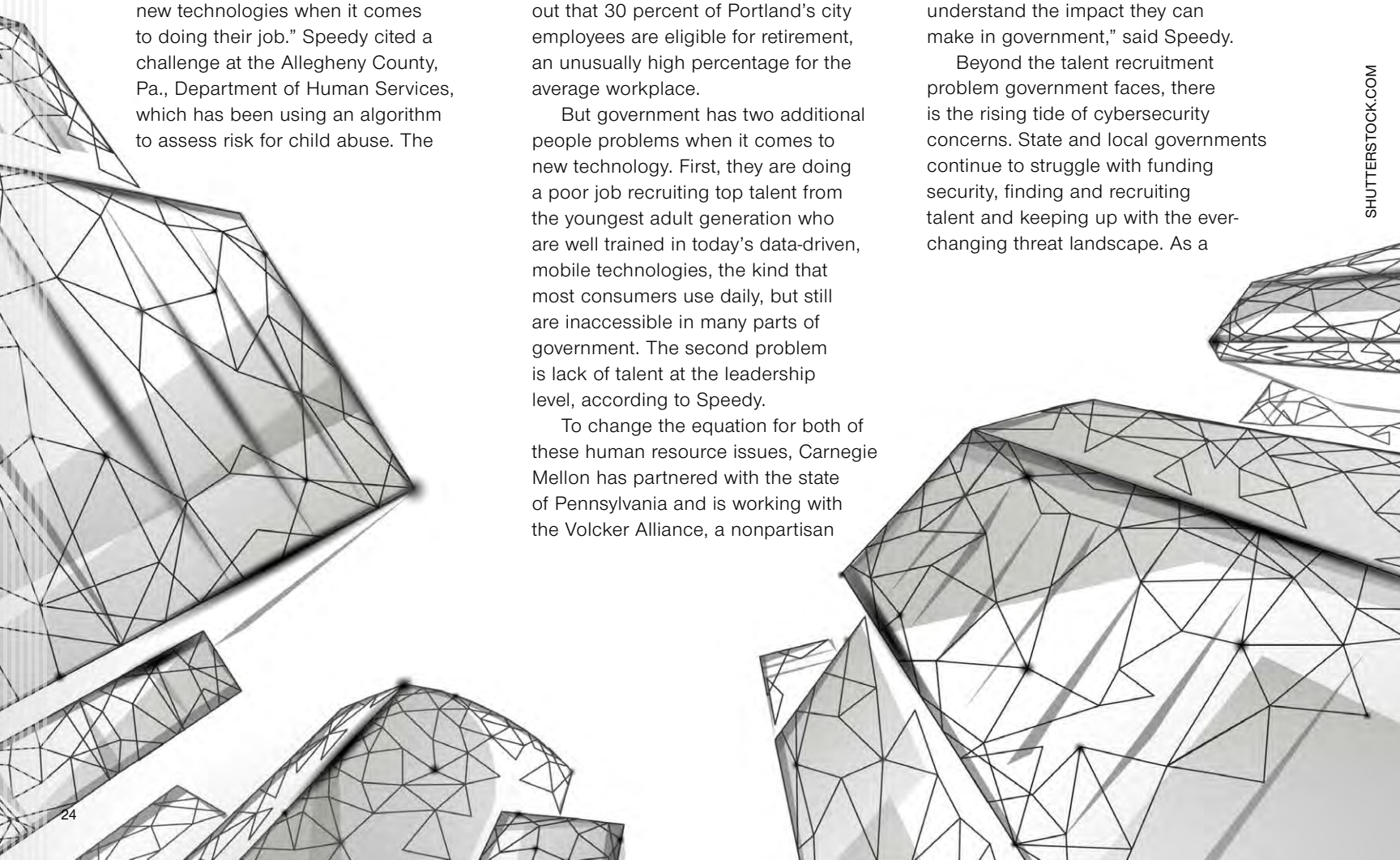
> “Many public officials would push to go to the next level of technology for the citizens. But now you are talking about massively changing the way that government as a business operates.”
>
> *Shannon Tufts, University of North Carolina School of Government professor and director of the Center for Public Technology*

Exacerbating this situation is the fact that government workers are older on average than workers in the private sector. Dan Bauer points out that 30 percent of Portland’s city employees are eligible for retirement, an unusually high percentage for the average workplace.

But government has two additional people problems when it comes to new technology. First, they are doing a poor job recruiting top talent from the youngest adult generation who are well trained in today’s data-driven, mobile technologies, the kind that most consumers use daily, but still are inaccessible in many parts of government. The second problem is lack of talent at the leadership level, according to Speedy.

To change the equation for both of these human resource issues, Carnegie Mellon has partnered with the state of Pennsylvania and is working with the Volcker Alliance, a nonpartisan organization with the objective of strengthening professional education for public service and conducting research on government performance, efficiency and accountability. “The partnership is about attracting this generation of young workers who are more civically minded than past generations, and to help them understand the impact they can make in government,” said Speedy.

Beyond the talent recruitment problem government faces, there is the rising tide of cybersecurity concerns. State and local governments continue to struggle with funding security, finding and recruiting talent and keeping up with the ever-changing threat landscape. As a



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DEMYSTIFYING EMERGING TECHNOLOGY TO MOVE BEYOND THE HYPE

Artificial intelligence (AI), digital twins and bots of every kind have exploded into the discourse of many government technology leaders. It can be enjoyable to discuss the possible benefits of emerging innovations, but how does an organization discern which technologies are more than just buzz? SHI's breadth of resources help IT leaders move beyond the hype and make sure they get the most value out of modernizations.

PROMOTE EMERGING TECHNOLOGY AWARENESS

It's all too easy to get caught up in the excitement around a particular emerging technology – it's more difficult to understand the advantages it could bring your organization. For example, what areas of AI might yield the greatest returns? Are chatbots right for your organization? Will digital twins allow you to be more effective and efficient? The volume of new technology is growing daily and is ever-changing. Most of these technologies rely on a foundation of data currently residing with organizations.

Public sector organizations should formalize a process to promote emerging technology awareness and adoption. As part of this strategy, consider leveraging SHI resources. SHI employs experts who not only understand emerging technologies, but who can also anticipate the challenges public entities will face when they introduce potentially disruptive changes into their environment.

DON'T TRUST THE HYPE, PROVE THE VALUE

After identifying data and emerging technology uses that could be beneficial to your organization, your staff will want to work to prove the value. But running proofs of concept can be time-consuming and costly. SHI's Customer Innovation Center (CIC) allows organizations to test emerging technologies from multiple vendors in a secure environment.

It's necessary to identify specific innovations that will provide the greatest return to your organization. By proving the value ahead of procurement and implementation you can ensure the value proposition for your organization isn't just hype. SHI | can help demystify emerging technology and identify potential value for your organization throu gh our broad expertise and partner relationships.

"We have 46 agencies here, and each acts as a separate organization and they don't really care what the others are doing. So, we have to look for the technology that is useful to at least 80 percent of those agencies, if we're to get the best out of our investment."

Clark Giles, CTO, Indianapolis

result, confidence in IT performance has been declining, according to research conducted by the Ponemon Institute, a think tank specializing in privacy, data protection and information security practices.

Clark Giles called security a big impediment to the adoption of new technologies. It's an issue that is hard to explain to non-tech policymakers and can drain time and resources away from new projects. "You don't know what's out there and what could show up on the radar at any time. It's like watching for a meteorite that could hit at any time."

Robert Huber, chief security officer for Tenable, a cybersecurity firm that works with governments and organizations to reduce their cyberexposure, agrees that states and local governments can be doing more to improve their cyberdefenses. Their challenges include a skills shortage and a lack of budgeting for cybersecurity. The growth in devices, such as those from IoT, has further exacerbated the threat exposure problem government faces.

Another impediment to the adoption of new technologies is the sheer size and scope of most state and local governments, which are federated or decentralized in structure. Trying to pick a winning new technology for 20, 30 or 40 different agencies, each with its own line of business, isn't easy.

"User base adoption is always an issue," said Giles. "We have 46 agencies here, and each acts as a separate organization and they don't really care what the others are doing. So, we have to look for the technology that is useful to at least 80 percent of those agencies, if we're to get the best out of our investment."

Best practices

In theory, testing, adopting and using new technologies, such as AI and IoT, should be easy. Citizens use new technologies every day, so the expectation is there to have the best and easiest services available. Likewise, government is constantly in search of ways to make its business more efficient and effective. Why not look at blockchain or use robotics, such as drones or autonomous vehicles, if they can improve safety while adding value to what government does?

David Ballard, a senior vice president for the public sector at SAP Concur, points out that when an important service is online, mobile and highly automated, it can free up valuable time for the people who use it and for the workers who no longer have to perform tedious, repetitive tasks. Mobile is also highly important. "That's the expectation these days," he said. Building in the flexibility of mobile also appeals to a younger workforce that is "always on."

To enter that kind of data-driven, service-oriented world, which is so prevalent at leading private-sector companies, calls for several factors to come into play. First, government needs to be more agile when it comes to deploying, testing, modifying and replacing old technologies with new ones. "This is what the private sector does to adopt new technology," said CMU's Speedy. But that's a big paradigm shift for many governments, which are used to spending lots of money on one big system, and not factoring in the kind of testing and modifications necessary to ensure there's room for innovation.

Adopting new technologies also needs to happen with the right people talking to each other. Too often, policymakers make decisions without having a technologist at the table. Only after a major policy decision has been made does the talk shift to the role of technology. This is an issue as more unregulated tech firms enter the market, offering services to citizens that are untouched by government until policies finally catch up. That has to change, said Speedy.

Within government itself, the best new ideas for emerging technologies can be found in partnerships between the IT department and the end-user agency they support, said Professor Tufts. "It's a different way of thinking. You are identifying the problem first and then finding a strategic use for technology. We are seeing phenomenal results across the country with that way of thinking."

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Conclusion

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In October, the Massachusetts Institute of Technology announced it is creating a new college devoted entirely to artificial intelligence, backed by an investment of $1 billion. In the same month, IBM, Intel and other tech firms announced plans to fund the launch of a research lab at the University of California, San Diego to study blockchain.

A Google search will turn up similar examples of new investments in IoT, robotics and wearable technology, such as virtual and augmented reality. The global economy is moving rapidly to adopt these new technologies and consumers are happy to use them to get the services they desire. The question that remains is, how will government fit into the next wave of technology trends? Will it be a participant and keep pace with rapid change, or will it allow a technology gap to open up?

Most experts and government CTOs agree: It's important that government not fall too far behind. A tech gap of more than 30 months could impact the trust and confidence citizens have in their government. The good news is that the appetite exists to bring new technologies into the public sector and put them to valuable use.

Security for the Era of Emerging Technologies

Emerging technologies like the Internet of Things (IoT), industrial IoT, industrial control systems (ICS), cloud apps, containers, serverless computing, artificial intelligence (AI) and machine learning (ML) will help governments use data and automate processes to improve operations and deliver services in exciting new ways. But these technologies introduce cybersecurity risks by creating a larger, more dynamic attack surface. It's harder for IT and security teams to fully understand an agency's cyber exposure — and traditional vulnerability management solutions may not provide the needed insights.

Tenable solutions deliver visibility into the entire cyberattack surface, from on-premises IT and operational technology (OT) systems to cloud applications. With complete visibility across their cyber terrain, agencies can better take advantage of the many new opportunities offered by digital transformation.

INTEGRATING SECURITY FOR CRITICAL INFRASTRUCTURE

OT systems that run power delivery systems, pipelines, water systems and other critical public infrastructure increasingly rely on connected digital technology to increase efficiency, reduce costs and automate operations. Yet cybersecurity vulnerabilities in OT systems may not be fully understood, or visible, by IT teams. Tenable solutions help agencies identify, monitor and prioritize vulnerabilities across IT, OT, cloud, virtual and mobile environments. Security leaders gain the visibility they need to reduce the attack surface and risks created by the growing connectedness of government systems.

PROTECTING SENSITIVE DATA

Applying AI and ML to data can yield big improvements inside agency operations and services. Yet these technologies can also create security concerns when they deal with sensitive data such as licenses, tax records, voter registrations and client information, and that data can be accessed through the internet. Tenable provides real-time vulnerability monitoring, active discovery, multiple scanning options and actionable intelligence about current threats, helping agencies protect a full spectrum of citizen data and other information assets.

MAINTAINING CONTINUOUS COMPLIANCE

Compliance with regulatory requirements involves a comprehensive and continuous effort to maintain a strong security posture. Through automatic assessment of security measures, Tenable solutions make it simpler for agency managers to identify the source and nature of compliance gaps.

SECURITY FOR A NEW TECHNOLOGY ERA

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Tod Newcombe

With more than 20 years of experience covering state and local government, Tod previously was the editor of *Public CIO*, e.Republic's award-winning publication for information technology executives in the public sector. He is now a senior editor for *Government Technology*. Tod is also the author of several books on information management.

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Q&A

HOW DATA DRIVES DIGITAL TRANSFORMATION

Several years ago, the state of Indiana made headlines with its focus on outcomes and innovative data-driven approach to tackle problems like the state's high infant mortality rate. Chris Atkins, Director of Indiana's Office of Management and Budget at the time, was on the frontlines of the launch of the state's Management and Performance Hub, which set the bar for statewide data sharing and analysis.

Now the Vice President of Digital Government Transformation at SAP, Atkins shares how he believes data analytics will continue to evolve — and the best practices that will help government leaders fully leverage one of its most critical assets.

Chris Atkins, Vice President, Digital Government Transformation, SAP

Q You were part of the team that helped propel Indiana as a leader in the strategic use of data. What did you achieve with sophisticated analytics technology that you wouldn't have been able to otherwise?

We had persistent — and life-changing — problems we wanted to solve like lowering our infant mortality rate or helping people with opioid use disorder. Well-intentioned people had been trying to solve these issues for a long time. The effort was there, but government has historically been organized in service delivery silos, and separate agencies alone didn't have the resources to tackle these issues.

With analytics technology, we built a platform to sit on top of those silos and provide the data resources that agencies need to gain insight into problems and make those insights actionable. It allowed us to redefine our approach and better collaborate to overcome challenges.

Q What has changed with analytics technology in the last five years and what do you see as some of the biggest opportunities?

The biggest change is the augmented intelligence government employees will have when government agencies deploy emerging technologies like artificial intelligence (AI) across business applications.

People can fear AI because they anticipate it replacing human employees. But I believe the opportunity lies in augmenting the intelligence that our hardworking state and local government employees bring to the job every day. For example, AI can help government human resources (HR) experts focus their time on creating a great workplace culture by automating routine and time-consuming tasks like resume matching.

Q How can government agencies use SAP to accelerate digital transformation?

SAP crafts industry-specific solutions and speaks the language of government when we talk with our public sector customers. For example, we have a public-sector specific analytics solution called Digital Cabinet Room that helps government executives gain the real-time insight they need to manage strategy and public policy development in their day-to-day operations.

We also co-innovate with our customers to enable digital transformation. We help our government customers take a platform approach that accelerates the optimization and transformation of their business processes using the power of data analytics insights. Co-innovation with our customers helps us push the envelope of what is possible.

Q Are there best practices government should adopt moving forward to effectively embrace technologies like data analytics?

First, be relentlessly focused on outcomes. In Indiana, we got so much traction because we were relentlessly focused on infant mortality, and then on opioid use disorder. One of our customers at SAP — the Office of State Revenue in Queensland, Australia — used a data-driven approach to engage more uniquely and empathetically with their taxpayers to help them avoid debt. We are also working with customers on how to use data strategically to reduce recidivism and homelessness.

Technology is a strategy to help you achieve a business outcome — focus on those outcomes.

Second, invest in new skills. This includes new technology skills like data and database management skills, analytics and insight skills, data science skills and enterprise architecture skills. Investing in these types of skills long term is going to be vital for any government that doesn't want to be left behind. On top of technology skills, as government becomes more data-driven, it will be critical for leaders to acquire legal expertise around data governance.

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